Errata

Title & Document Type: **1703A Oscilloscope Operating and Service Manual**

Manual Part Number: **01703-90908**

Revision Date: **May 1976**

About this Manual

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

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

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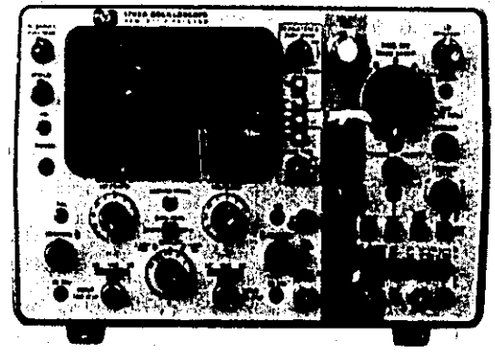
Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

OPERATING AND SERVICE MANUAL

MODEL 1703A OSCILLOSCOPE



HEWLETT hp PACKARD

HP 1703A

CERTIFICATION

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

WARRANTY AND ASSISTANCE

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

Service contracts or customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

CWSA 5/77

OPERATING AND SERVICE MANUAL

MODEL 1703A
OSCILLOSCOPE

SERIALS PREFIXED: 1542A

Refer to Section VII for instruments with the following serial prefix numbers: 1150A, 1226A, 1230A, 1232A, 1325A, 1331A, 1342A, 1402A, 1422A, 1509A, 1517A.

Refer to Section VII for instruments with the following standard options: 001, 002.

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

Manual Part Number 01703-90908
Microfiche Part Number 01703-90808

PRINTED: MAY 1976

SAFETY SUMMARY

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

GROUND THE INSTRUMENT.

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

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

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

KEEP AWAY FROM LIVE CIRCUITS.

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

DO NOT SERVICE OR ADJUST ALONE.

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

USE CAUTION WHEN EXPOSING OR HANDLING THE CRT.

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

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

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

DANGEROUS PROCEDURE WARNINGS.

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

WARNING

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

SS-2-1/76

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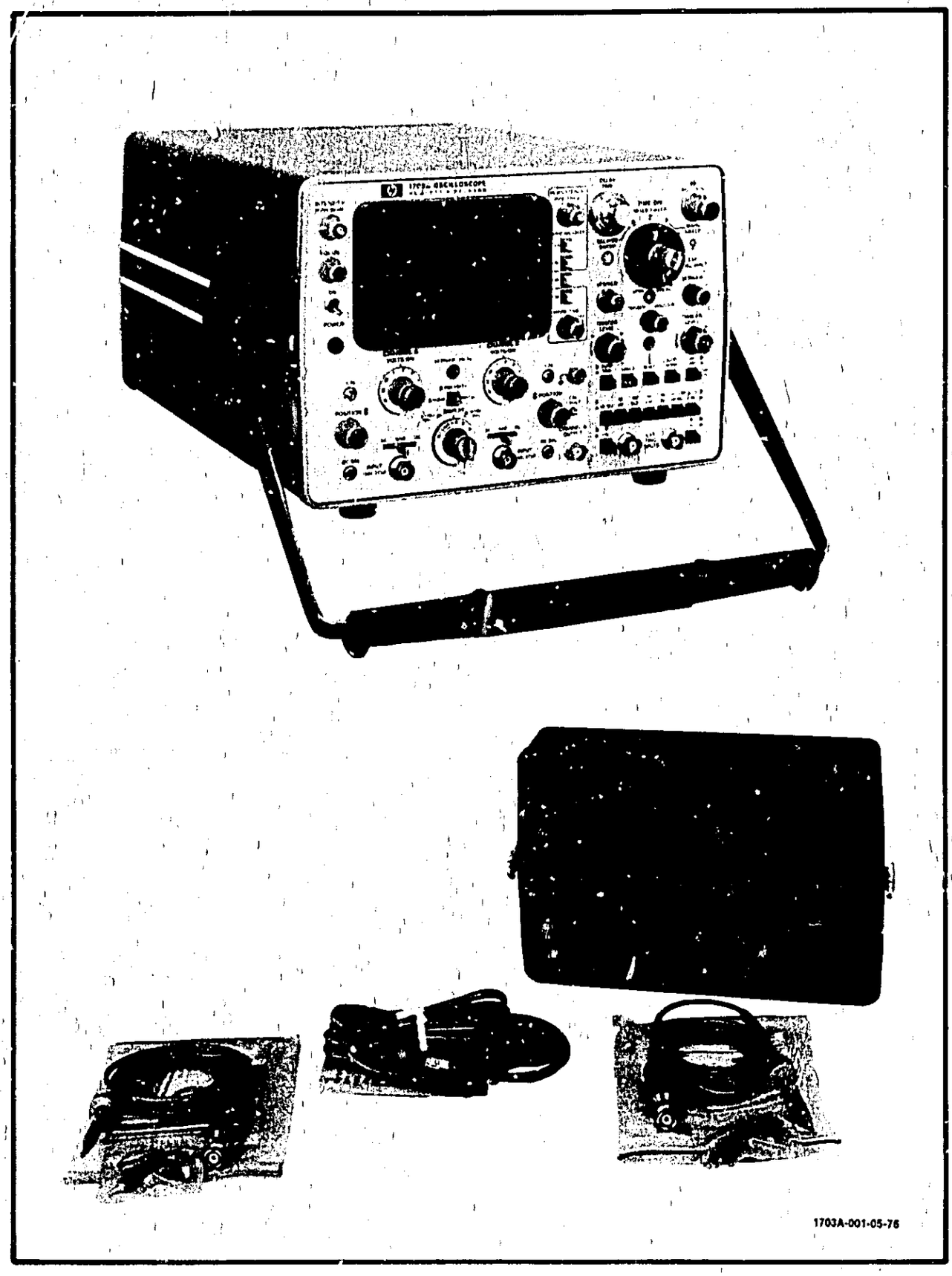


Figure 1-1. Model 1703A Oscilloscope

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and service information for the Hewlett-Packard Model 1703A Oscilloscope (figure 1-1). This 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. A removable instruction card is located at the rear of this manual. The card is designed to fit the inside lid of the storage cover.

Note

Throughout the text of the manual, the Hewlett-Packard Model 1703A Oscilloscope shall be called the Model 1703A.

1-3. This section contains a description of the Model 1703A. The instrument specifications are listed in table 1-2. Table 7-2 lists the options available for the Model 1703A.

1-4. DESCRIPTION.

1-5. INTRODUCTION.

1-6. The Model 1703A is a general-purpose, wideband, variable-persistence storage oscilloscope designed for bench or field service. The Model 1703A operates from an ac line, dc line or optional battery pack. The optional, rechargable, nickle-cadmium battery provides up to 4 hours of operation and requires a recharge time of approximately 16 hours. A carrying handle provides ease of transportation and is adjustable, allowing the Model 1703A to be placed at an angle for viewing the CRT. The CRT dimensions are 6 by 10 divisions.

1-7. The variable persistence capability is especially useful for viewing slow-speed signals. Adjustment of persistence time can provide viewing of a complete trace with fading sufficient to prevent interference with the next trace. The display persistence can readily be adjusted to eliminate flicker and provide high resolution. The storage feature can be used to store single-sweep occurrences for later viewing or photographing. The comparision of waveforms can be accomplished by storing several separate occurrences and later viewing them simultaneously.

1-8. VERTICAL CIRCUITS.

1-9. The vertical bandwidth is 35 MHz with a rise-time less than 10 ns. The vertical deflection factor is 10 mV/div on single channel and 1 mV/div with channel A cascaded into channel B.

1-10. The Model 1703A 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.

1-11. 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.

1-12. With the dual-trace feature (channel A, channel B), displays can be obtained on either channel A or B, channels A and B together, 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 approximately 400-kHz rate during each sweep. In the alternate mode of operation the signal applied to each channel is displayed on alternate sweeps. Triggering is selectable from either A ONLY TRIG or NORM TRIG position. In the NORM TRIG position, the instrument triggers on the displayed signal. In the A ONLY TRIG position, the instrument triggers on the signal applied to channel A.

1-13. HORIZONTAL CIRCUITS.

1-14. The horizontal circuits provide four types of sweep displays. The displays are: main sweep, mixed sweep, delayed sweep and external horizontal input.

1-15. Operation of the delayed sweep while in the main sweep mode provides for trace intensification. The amount of intensification width depends on the delayed front panel settings. In the delayed mode, the intensified portion is displayed across the entire CRT.

1-16. Sweep speed settings from 0.1 usec/div to 2 sec/div (main sweep) and 0.1 usec/div to 0.2 sec/div

(delayed sweep) are available in a 1, 2, 5 sequence. Vernier controls allow continuous adjustment between steps and extend the slowest sweep to 5 sec/div (main sweep) and 0.5 sec/div (delayed sweep). Using the SWP MAG X10 function, the fastest sweep speed can be expanded to 10 ns/div.

1-17. The mixed sweep function provides for simultaneous display of an input waveform and an expanded portion of the waveform. The delayed circuits are calibrated to allow accurate time difference measurements to be made. The external horizontal input function allows the CRT horizontal plates to be driven by an external signal.

1-18. The main and delayed trigger circuits have provisions for either internal or external operation. Choice of trigger coupling is provided; choices are ac/dc, high frequency reject and low frequency reject. The delayed trigger circuit does not have low frequency reject trigger coupling.

1-19. CATHODE-RAY TUBE.

1-20. The Model 1703A uses a post-accelerator CRT with a nonglare, rectangular faceplate. An internal graticule is located on the same plane as the display to eliminate parallax errors. The tube has a 7500-volt accelerating potential, and 6 vertical by 10 horizontal divisions.

1-21. A type P31 phosphor is used in the standard CRT. Special graticules (or no graticule) are also available by special order. Refer to Section VII for further information about optional and special order modifications.

Table 1-1. Model 1703A Accessories Available

Accessory No.	Description
HP Model 10102A	RFI Contrast Screen
HP Model 10103A	Battery Pack
HP Model 10104A	Viewing Hood (collapsible)
HP Model 10105A	Testmobile Adapter
HP Model 10106A	Camera Adapter
HP Part No. 01701-68701	Service Kit; contains three extender boards and one board puller.
HP Model 10036A	Probe Adapter Kit; probe tips contained in this kit are designed for use with the probes supplied with 1700-series oscilloscopes.
HP Part No. 1251-2614	DC Power Plug

1-22. WARRANTY.

1-23. The instrument (except the CRT) is certified and warranted as stated in the front of this manual. The CRT is covered by a separate warranty. The CRT warranty and warranty claim form is 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 mutilate serial number tag.

1-24. ACCESSORIES FURNISHED.

1-25. Accessories furnished are listed in table 1-2.

1-26. ACCESSORIES AVAILABLE.

1-27. Table 1-1 lists the accessories available for the Model 1703A. The service kit (figure 1-3) is recommended to maintain the Model 1703A.

1-28. INSTRUMENT AND MANUAL IDENTIFICATION.

1-29. This manual applies directly to the Model 1703A 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.

1-30. 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.

1-31. Technical corrections (if any) are contained in an enclosed MANUAL CHANGES sheet.

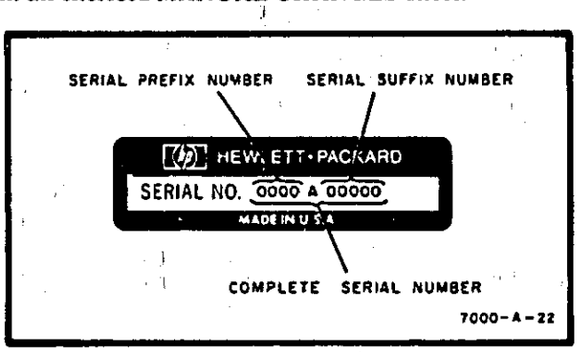


Figure 1-2. Instrument Serial Number

1-32. INQUIRIES.

133. Refer any questions regarding the manual, the replacement pages or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name and complete serial number in all correspondence. Refer to the rear of the manual for a world-wide listing of HP Sales/Service Offices.

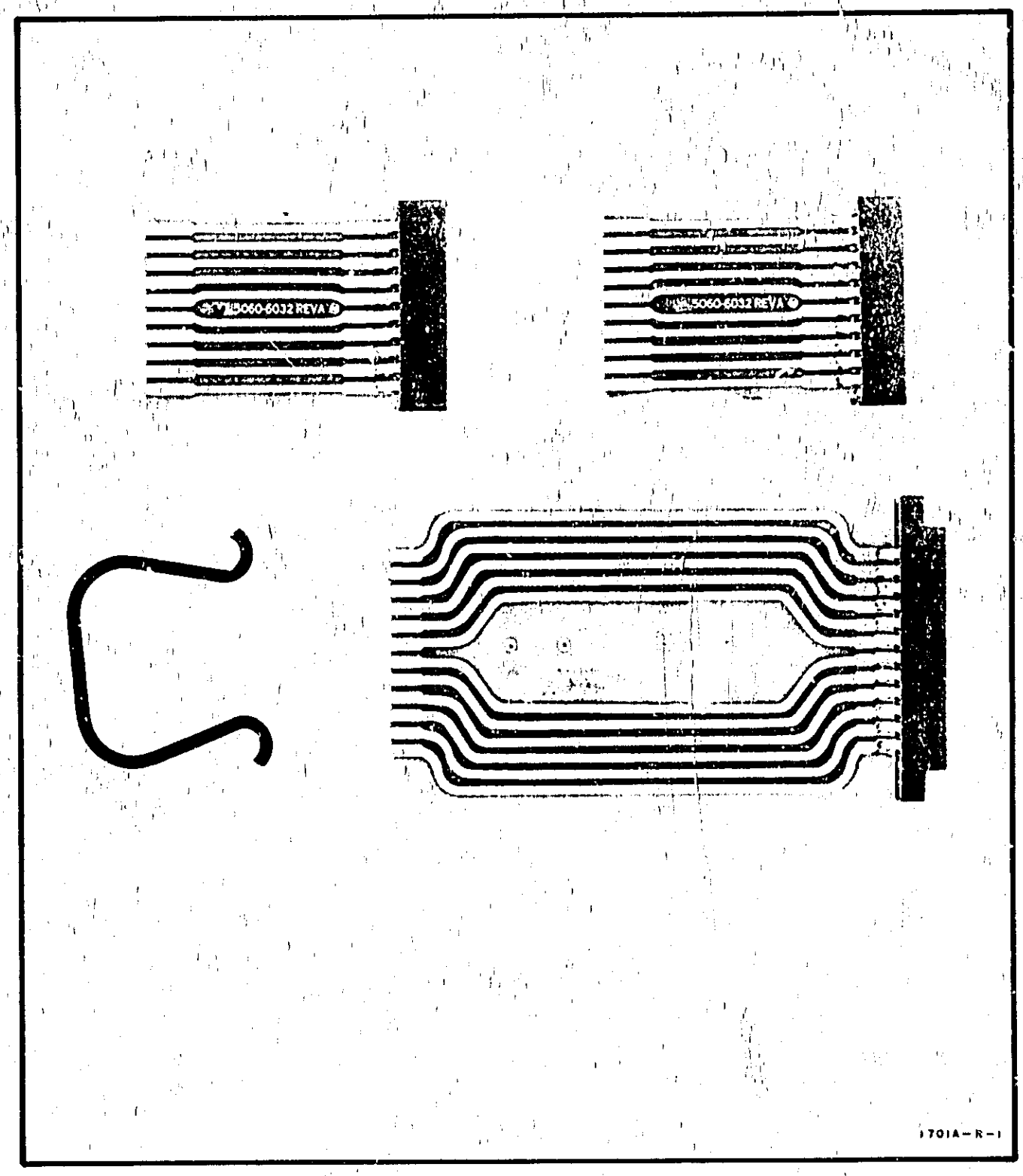


Figure 1-3. Service Kit for 1700-series Oscilloscopes

Table 1-2. Specifications

VERTICAL AMPLIFIERS

MODES OF OPERATION: channel A; channel B; channels A and B displayed alternately on successive sweeps (alt); channels A and B displayed by switching between channels at approx 400-kHz rate with blanking during switching (chop); channel A + channel B (algebraic addition).

EACH CHANNEL (2)

Bandwidth; (Direct or with Model 10006B probe, 3-dB down from 50-kHz, 6-div reference signal from terminated 50-ohm source.)

DC-COUPLED: dc to 35 MHz.
AC-COUPLED: lower limit is approx 10 Hz.

Risetime: <10 ns. Direct or with Model 10006B probe, 10% to 90% points with 6-div input step from terminated 50-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.
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 27 pF.
Input Coupling: AC, DC or Ground selectable. Ground position disconnects signal input and grounds amplifier input.

MAXIMUM INPUT

AC-coupled: ±600V (dc + pk 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 10 div.

TRIGGERING

Source (applies to all five modes of operation).
NORM TRIG: on displayed signal.
A ONLY TRIG: on signal from channel A.

CHANNEL A OUTPUT

Channel A output for obtaining 1 mV/div vertical sensitivity.

Amplitude: 100 mV/div.
Cascaded Bandwidth: dc to 3 MHz (use HP Model 10121A BNC Cable to connect channel A to channel B).
Coupling: dc.
Vertical Output DC Level: Approx 0V.
Vertical Output Resistance: Approx 200 ohms.

MAIN TIME BASE

SWEEP

Ranges: from 0.1 usec/div to 2 sec/div (23 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 5 sec/div. Vernier uncalibrated light indicates when vernier is not in CAL position.
Magnifier: expands all sweeps by factor of 10 and extends fastest sweep to 10 ns/div. Accuracy ±5% (including 3% accuracy of time base).

SWEEP MODE

Normal: sweep is triggered by internal or external signal.
Automatic: bright baseline displayed in absence of input signal. Triggering is same as normal above 40 Hz.
Single: 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.

Table 1-2. Specifications (Cont'd)

TRIGGERING

Internal: dc to 35 MHz on signals causing 0.5 div or more vertical deflection in all display modes except chop; dc to 400 kHz in chop mode. Triggering on line frequency also selectable.

External: dc to 35 MHz on signals 50 mV p-p or more.

External Input RC: approx 1 megohm shunted by approx 27 pF.

Level and Slope

INTERNAL: variable over either slope of form displayed.
EXTERNAL: continuously variable from +1.2V to —1.2V on either slope of trigger signal. Maximum input, ±100V.

Coupling: AC, DC, LF REJ, or HF 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 steps continuously variable.

DELAYED TIME BASE

TRACE INTENSIFICATION: intensifies that part of main time base to be expanded to full screen in delayed time base mode. Rotating time base switch from OFF position activates intensified mode.

SWEEP

Ranges: 0.1 usec/div to 0.2 sec/div (20 ranges) in 1, 2, 5 sequence. ±3% with vernier in calibrated position.
Vernier: continuously variable between all ranges, extends slowest sweep to 0.5 sec/div.
Magnifier: expands all sweeps by a factor of 10 and extends fastest sweep to 10 ns/div. Accuracy is ±5% (including 3% accuracy of time base).

SWEEP MODE

Trigger: delayed sweep is armed at end of delay period.
Auto: delayed sweep is automatically triggered at end of delay period.

TRIGGERING

Internal: same as main time base.
External: same as main time base. Input RC is approx 1 megohm shunted by approx 27 pF.

Level and Slope

INTERNAL: variable over either slope of form displayed.
EXTERNAL: continuously variable from +1.2V to —1.2V on either slope of trigger signal.

Coupling: selectable, AC DC or HF REJ. AC attenuates signals below approx 20 Hz. HF REJ attenuates signals above approx 30 kHz.

DELAY (Before start of delayed sweep.)

Time: continuously variable from 0.1 usec to 2 sec.
Time Jitter: <0.005% (1 part in 20,000) of maximum delay in each sweep.
Calibrated Delay Accuracy: ±1%; linearity, ±0.2%.

MIXED SWEEP

Combines main and delayed sweeps into one display. Sweep is started by main time base and is completed by faster delayed time base.

EXTERNAL HORIZONTAL INPUT

BANDWIDTH: dc to 1 MHz.
COUPLING: dc.
DEFLECTION FACTOR: X1; 1 V/div.
X10; 0.1 V/div.
VERNIER: 10:1 vernier provides continuous adjustment between ranges.
DYNAMIC RANGE: beam may be positioned to left edge of CRT with 0 to —5V input.
MAXIMUM INPUT: ±100V.
INPUT RC: 1 megohm shunted by approx 30 pF.

STORAGE/VARIABLE-PERSISTENCE CRT

TYPE: post-accelerator, ≈7.5-kV accelerating potential, aluminized, P31 phosphor.

GRATICULE: 6 X 10 div internal graticule; each major division consists of 5 subdivisions on both horizontal and vertical axes. 1 div = 0.85 cm. Rear panel adjustments for trace alignment and astigmatism.

Table 1-2. Specifications (Cont'd)

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

INTENSITY MODULATION: +4V, dc to 1 MHz blanks trace of any intensity. Input R, 1000 ohms ±10%. Maximum input, ±10V (dc + pk ac).

PERSISTENCE

Conventional: natural persistence of P31 phosphor (approx 40 usec).
Variable: from <0.2 sec to >1 min.

STORAGE WRITING SPEED

Standard Mode: >100 div/ms over central 5x9 division.
Fast Mode: >1000 div/ms over central 5x9 divisions.
Brightness: ≈100 foot lamberts.
Storage Time: from std mode to store, traces may be stored at reduced intensity for >1 hr. With STORE TIME fully ccw, traces may be viewed at normal intensity for >1 min. From fast mode to store, traces may be stored at reduced intensity for >5 min. With STORE TIME fully ccw, traces may be viewed at normal intensity for >15 sec.
Erase: manual pushbutton erasure takes approx 400 ms.

GENERAL

CALIBRATOR

Type: 1 kHz ±10% square wave.

Voltage: 1V p-p ±1%.

POWER REQUIREMENTS

AC Line: 115V or 230V ±20%, 48 to 440 Hz., 60 VA max.

DC Line: 11.5V to 36V, 40 VA max.

Battery (optional)

OPERATING TIME: up to 4 hours in Model 1703A.
RECHARGE TIME: 14 hr maximum, with power switch off, if not operated after power indicator flashes.
LOW BATTERY INDICATOR: power light flashes to indicate that batteries are discharged and further operation may damage battery.
RECHARGING: batteries are recharging whenever POWER MODE switch is set to AC with power applied. With POWER switch off, full charge is applied. With POWER switch ON, trickle charge is applied.

WEIGHT

Without Panel Cover: net, 24 lb (11 kg); shipping, 35 lb (15,9 kg).

With Panel Cover and Accessories: net, 27 lb (12,3 kg); shipping, 38 lb (17,2 kg).

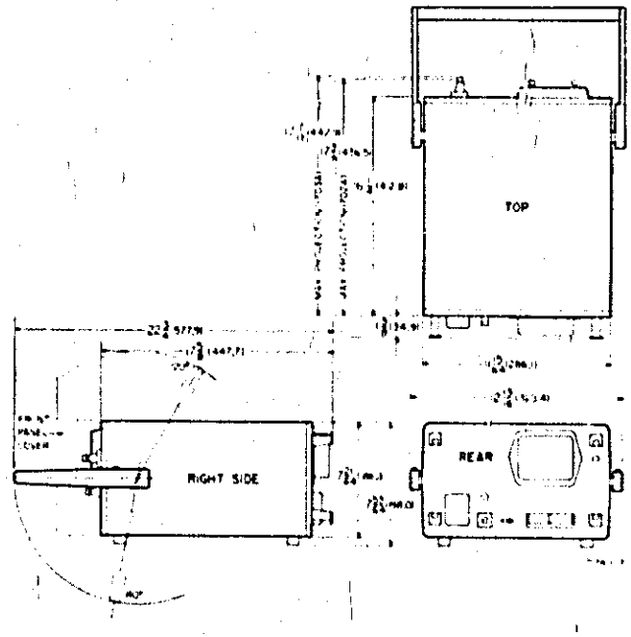
With Panel Cover, Accessories, and Battery Pack: net, 35 lb (16 kg); shipping, 46 lb (20,9 kg).

DIMENSIONS: refer to outline drawing.

ENVIRONMENT (Oscilloscope operates within specifications over following ranges):

temperature 0°C to +55°C; humidity, to 90% relative humidity to 40°C; altitude, to 15,000 ft; vibration, vibrated in three planes for 15 min each with 0.010-inch excursion, 10 to 55 Hz.

ACCESSORIES FURNISHED: blue contrast filter, Model 10115A; two Model 10006D probes; one ac power cord with right-angle plug.



SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for performing an initial inspection of the Model 1703A. 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 in the front 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-ON switch is off and ac power cord connected.

2-6. PREPARATION FOR USE.

2-7. POWER REQUIREMENTS.

2-8. The Model 1703A can operate either from an ac or dc power source. For ac operation, the Model 1703A requires 115- or 230-volt ±20%, single phase, 48 to 440-Hz source that can deliver 60 volt-amperes.

2-9. A removable jumper board in the power line input module (A1) provides selection of the line voltage to be used (figure 2-1).

CAUTION

Before placing this instrument in operation, ensure that the operating voltage visible in the power module window (figure 2-1) agrees with the line voltage being used. The power supplies may be damaged if the line voltage selection is incorrect.

2-10. For dc operation, the Model 1703A requires from 11.5 to 36 volts, 40 VA maximum. The 2A fuse (F1) must be replaced with a 3A fuse for dc operation. 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. To change the POWER MODE switch setting proceed as follows:

CAUTION

Do not change the POWER MODE switch setting with the instrument on or with ac or dc power applied to the rear panel.

a. Turn instrument power off.

b. Disconnect ac or dc power cord from rear panel.

c. Set POWER MODE switch to desired position.

d. Connect ac or dc power cord if desired.

e. Turn instrument power on.

2-11. THREE-CONDUCTOR AC POWER CABLE.

2-12. 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

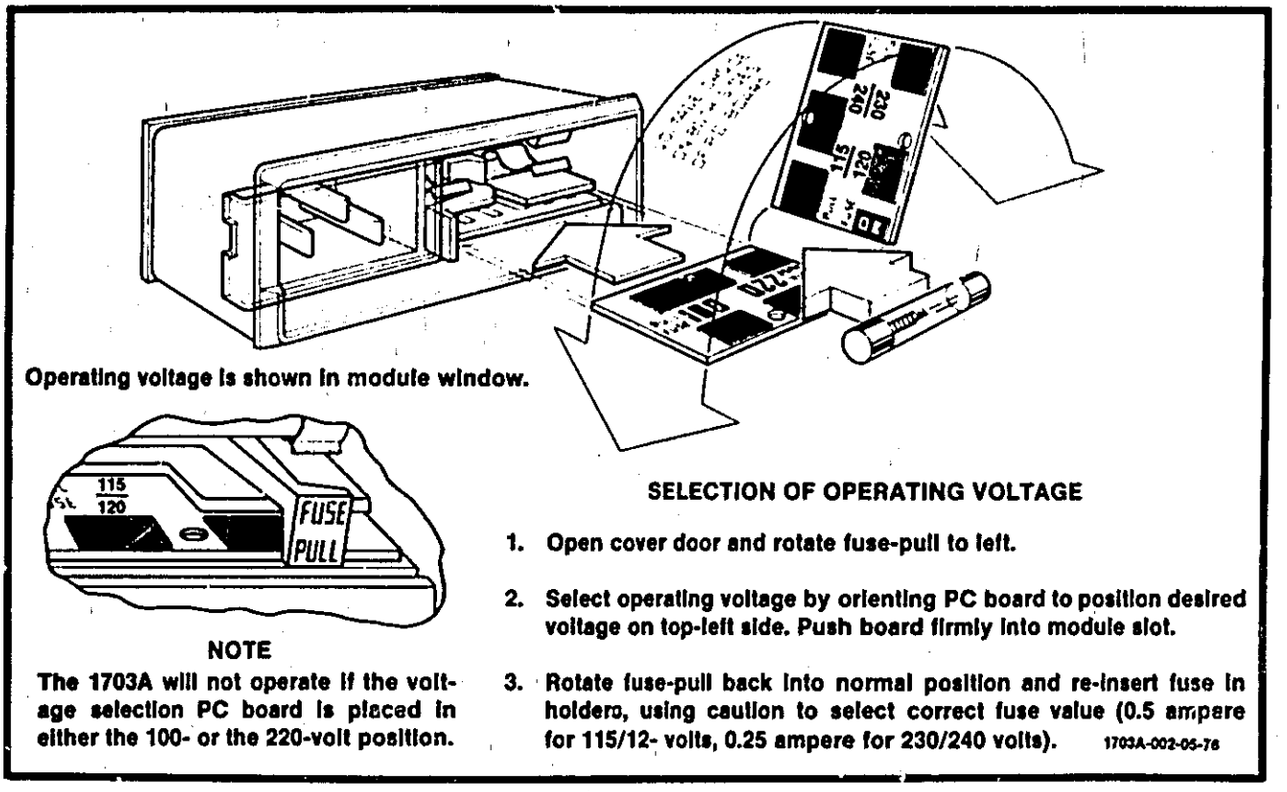


Figure 2-1. Rear Panel Power Module

cord meet International Electro-technical 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.

2-13. DC PLUG.

2-14. A dc plug (HP Part No. 1251-2614) is available and may be ordered separately. This plug is used to operate the Model 1703A from a dc source. Cable used for the dc power cord must be able to carry 2.5A of current with a voltage loss of less than 1V.

2-15. BATTERY INSTALLATION.

2-16. To install the battery pack in the Model 1703A, proceed as follows:

CAUTION

Read operating note on battery pack before installation.

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

b. Move POWER MODE switch to INTERNAL BATTERY position.

c. Turn instrument on its top and loosen fasteners holding bottom cover.

d. Remove bottom cover.

e. Place battery pack in instrument as shown in figure 2-2.

f. Tighten battery screws in place (figure 2-2).

g. Connect P1 to battery J1 as shown in figure 2-2.

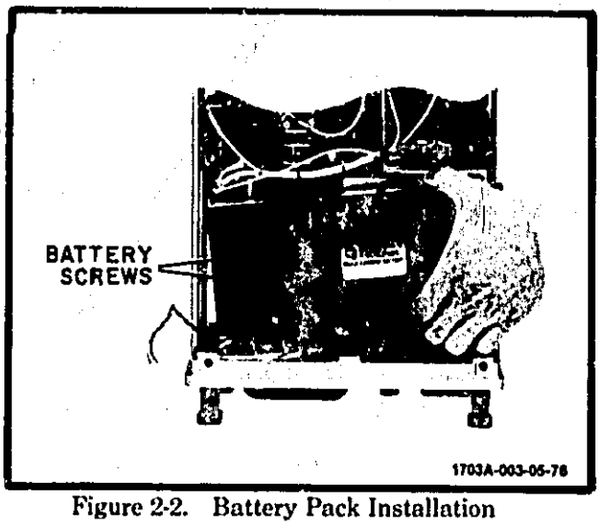


Figure 2-2. Battery Pack Installation

h. Replace bottom cover and tighten fasteners.

i. Turn instrument right side up.

j. Turn instrument on and observe power light. If power light is on, resume normal operation.

CAUTION

If power light is flashing, battery is discharged. Damage to the battery may result if operated in this condition. Refer to Section III for battery recharging operation.

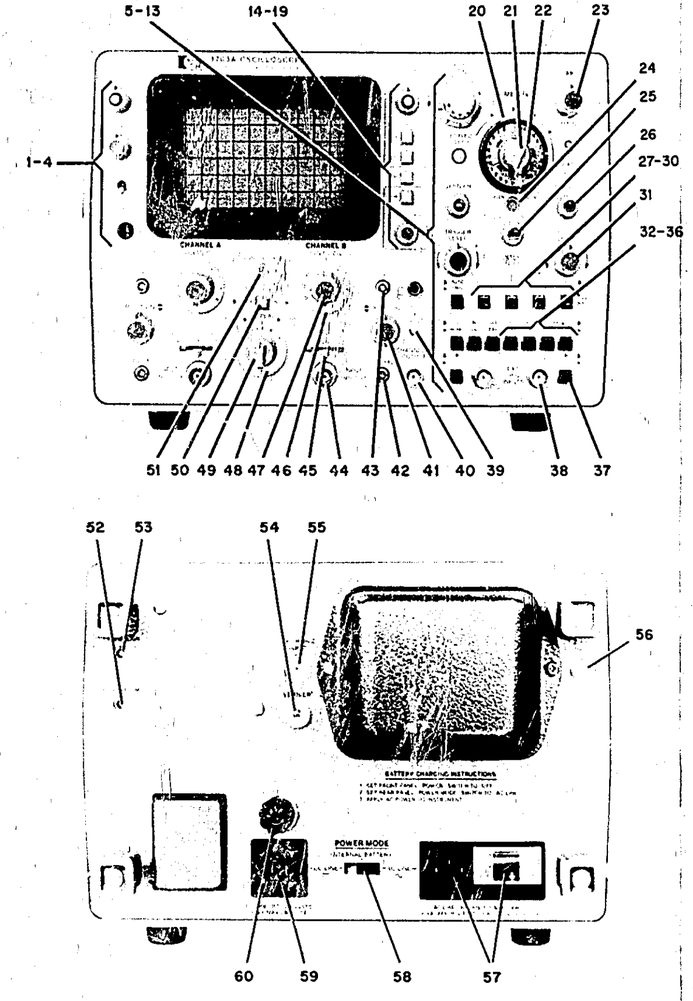
2-17. CLAIMS.

2-18. The warranty statement applicable to this instrument is printed in the front of this manual. 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.

2-19. REPACKING FOR SHIPMENT.

2-20. If the Model 1703A 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.



1. INTENSITY. Controls brightness of display.

2. PUSH:BEAM. Returns display to viewing area.

3. FOCUS. Controls sharpness of display.

4. POWER-ON. Toggle switch with indicator light for turning oscilloscope off and on. Light flashes when optional battery is discharged.

5. DELAY TIME. Calibrated control that selects time delay between start of main sweep and start of delayed sweep.

6. delayed VERNIER. Provides continuous control of sweep time between calibrated positions of delayed TIME/DIV control.

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

8. delayed AUTO/TRIG.

   a. AUTO. Delayed sweep starts automatically at end of delay time.

   b. TRIG. Delayed sweep arms at end of delay time and triggers on next trigger signal.

9. delayed HF REJ. Attenuates delayed trigger signals above 30 kHz.

10. delayed AC/DC. Selects delayed trigger signal coupling.

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

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

13. delayed EXT TRIG INPUT. Delayed external trigger input.

14. PERSISTENCE. Controls endurance time of displayed signal.

15. PUSH:ERASE. Removes stored or written displays.

16. WRITING SPEED. Selects,

   a. STD. Operates CRT at normal writing rate with variable persistence.

   b. FAST. Operates CRT at maximum writing rate with variable persistence.

17. CONV. Selects operation as standard oscilloscope. Note intensity level (paragraph 3-25).

18. STORE. Retains displayed signal at reduced intensity.

19. STORE TIME. Determines length of time that signal can be stored.

20. delayed TIME/DIV. Controls delayed sweep time in DELAYED SWEEP. Controls intensified portion of sweep in MAIN SWEEP.

21. sweep display. Select horizontal sweep mode: EXT HORIZ INPUT, MAIN SWEEP, MIXED SWEEP and DELAYED SWEEP.

22. main TIME/DIV. Controls main sweep time.

23. HORIZONTAL POSITION. Controls course and fine horizontal position of display.

24. VERNIER UNCAL. Lights when either main or delayed VERNIER is not in CAL position.

25. TRIGGER HOLDOFF (NORM). Provides continuous control of time between sweeps. NORM holdoff time is minimum.

26. main VERNIER. Provides continuous control of sweep time between calibrated positions of main TIME/DIV control.

27. SINGLE. Selects single sweep operation.

28. RESET. Resets sweep in SINGLE sweep mode.

29. main AUTO/NORM.

   a. AUTO. Automatic sweep in absence of trigger signal or triggered sweep by applying trigger signal above 40 Hz.

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

30. SWP MAG. In X10 position, sweep is magnified 10 times.

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

32. main INT/EXT. Selects main trigger internal sweep triggering.

33. main AC/DC. Selects main trigger signal coupling.

34. main HF REJ. Attenuates main trigger signals above 30 kHz.

35. main LF REJ. Attenuates main trigger signals below 15 kHz.

36. main LINE. Instrument triggers internally on line frequency.

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

38. main EXT TRIG INPUT. Main external trigger input.

39. CAL 1 VOLT. Calibrator 1-kHz, 1-volt ±1% signal.

40. CHANNEL A OUTPUT. Channel A output jack.

41. channel B POSITION. Controls vertical position of display.

42. channel B DC BAL. Adjust to minimize vertical shift of trace when channel B vernier is rotated.

43. channel B CAL. Adjust to calibrate amplifier with CHANNEL B VOLTS/DIV settings.

44. channel B INPUT. BNC input connector.

45. channel B coupling (AC-GND-DC). Selects capacitive (AC) or direct (DC) coupling of input signal, or grounds input amplifier stage while disconnecting input.

46. CHANNEL B VOLTS/DIV. Selects vertical deflection factor necessary for calibrated measurements.

47. channel B vernier (CAL). Provides continuous adjustment of VOLTS/DIV between calibrated positions of CHANNEL B VOLTS/DIV control.

48. DISPLAY. Selects type of display; either single channel, dual channel, alternate or chop mode.

49. trig. Selects internal triggering mode.

   a. A ONLY TRIG. Instrument triggers on signal applied to channel A.

   b. NORM TRIG. Instrument triggers on displayed signal except in DISPLAY ALT mode. In DISPLAY ALT mode, instrument should trigger on composite sync and LF REJ trigger coupling should be used to ensure proper trigger coupling.

50. B POLARITY. Selects polarity of channel B display (NORM/INVT).

51. VERNIER UNCAL. Lights when either channel A or channel B vernier is not in CAL position.

52. ASTIGMATISM. Adjusts roundness of writing spot.

53. TRACE ALIGN. Adjust to align trace with horizontal graticule line.

54. ext horiz VERNIER. Permits 10:1 horizontal amplifier.

55. EXT HORIZ INPUT. Input to external horizontal amplifier.

56. Z-AXIS INPUT. Z-axis input connector.

57. AC LINE. Power input from ac line. Power module contains ac line fuse (0.50 AT for 115V operation; 0.25 AT for 230V operation) and line selector switch.

58. POWER MODE. Selects DC LINE, INTERNAL battery or AC LINE operation.

59. DC LINE. Power input for dc line operation.

60. fuse. 2-amp, slow-blow fuse in circuit for ac and internal battery modes of operation. Use 3-amp, slow-blow fuse for dc line mode of operation.

1703A-R-31

Figure 3-1. Controls and Connectors

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section provides general operating instructions and applications information for the Model 1703A. Front and rear-panel controls and connectors are identified and briefly described in figure 3-1. General operating instructions are provided in figures 3-3 through 3-9 and operational adjustments are detailed in figure 3-10. Delayed operations are detailed in figure 3-11.

3-3. SPECIAL OPERATING CONSIDERATIONS.

3-4. Prior to operating the Model 1703A, the operator must have a thorough understanding of instrument operation and control functions. This section should be read in its entirety before attempting to operate the instrument.

CAUTION

This instrument contains a new burn-resistant CRT. While CRT burns are greatly reduced, high intensity settings while in the conventional mode will burn CRT. Observe all operating cautions.

3-5. The following are steps that must be taken prior to applying power to the Model 1703A:

a. Set WRITING SPEED to STD.

b. Set PERSISTENCE control fully ccw.

c. Set INTENSITY control fully ccw.

d. Apply power to Model 1703A.

e. After 3 min, entire CRT viewing area should be evenly flooded green.

Note

If there is no green illumination, turn instrument off and check all CRT connections.

3-6. CONTROLS AND CONNECTORS.

3-7. The location of operating controls and connectors are shown in figure 3-1 together with a brief explanation of their functions. Additional information regarding some of these controls and connectors is provided below.

3-8. FOCUS.

3-9. This control provides uniform focus of the trace over the entire CRT screen. To adjust:

a. Set WRITING SPEED to STD.

b. Center low-intensity spot on CRT screen.

c. Adjust FOCUS control for small, round, sharply focused spot.

3-10. PUSH:BEAM.

3-11. Pressing this pushbutton reduces amplifier gain enough to return the beam to the viewing area. This enables the operator to locate the beam and determine the action necessary to center a display (examples: reduce input signal amplitude; change coupling; adjust deflection factor, trigger level, dc balance or position controls). When centered properly, the beam remains on the CRT when the pushbutton is released.

Note

The beam find function is dependent on the setting of the INTENSITY. If no beam is visible when the PUSH: BEAM control is engage, increase the INTENSITY setting until a beam is observed.

3-12. TRACE ALIGN.

3-13. The TRACE ALIGN adjustment compensates for external magnetic fields that may affect 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.

3-14. CAL 1 VOLT.

3-15. The 1-volt, 1-kHz calibrator square-wave output can be used for vertical sensitivity calibration and for divider probe compensation. The amplitude accuracy is ±1% and frequency accuracy is ±10%.

3-16. COUPLING.

3-17. This lever switch selects either capacitive (AC) or direct (DC) coupling of the input signal to the vertical amplifiers, or it grounds (GND) the vertical 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 amplifier input and at the same time ground the amplifier input. The GND position can be used to establish a reference.

3-18. DISPLAY.

3-19. This control selects the type of vertical display. Input signals may be displayed either singly or simultaneously as explained below.

3-20. Position A displays channel A input signal.

3-21. Position B displays channel B input signal.

3-22. Position A + B (A — B with B POLARITY INVT engaged) displays algebraic sum of channel A and channel B input signals.

3-23. Position CHOP presents separate display of each input. Both inputs are displayed during same sweep by switching between each channel at 400-kHz rate. This mode should be used to display low frequency signals.

3-24. Position ALT displays each channel on alternate sweeps. This mode should be used to display high frequency signals.

3-25. PERSISTENCE AND INTENSITY.

3-26. These controls determine the viewing time of a signal being displayed. The INTENSITY control sets the trace brightness as it is written. The PERSISTENCE control is used to establish the desired duration of signal viewing without rewriting. It accomplishes this by varying the rate that the displayed signal is erased.

3-27. FAST.

3-28. Operation in this mode provides a more rapid buildup display of fast, single-sweep signals. Since the background illumination also increases more rapidly, the CRT contrast level and storage time are reduced.

3-29. CONV.

3-30. Selection of this operating mode disables the variable persistence and storage features of the instrument. It will now function as a conventional, general-purpose oscilloscope. The PERSISTENCE control does not function in this mode. Always adjust the INTENSITY in std mode, with minimum persistence, for no blooming; then switch to conv. Do not increase intensity beyond this level while in the conv mode.

3-31. STORE.

3-32. In order to retain whatever is visible on the CRT, engage the STORE pushbutton. The signal will be stored at reduced intensity, resulting in a storage time greater than 1 hr. The INTENSITY, PERSISTENCE, FOCUS, PUSH:ERASE, and HORIZONTAL POSITION controls do not affect the presentaion in the store mode.

3-33. In some applications, it may be desired to show overlapping traces. This is possible through proper manipulation of the PERSISTENCE and INTENSITY controls. Simply obtain the desired multiple trace display in the std mode; then engage the STORE pushbutton.

3-34. STORE TIME.

3-35. To observe a previously stored display, turn the STORE TIME control slowly ccw until the display is observed. The STORE TIME control will intensify the brightness level selected during the std mode. Again, the INTENSITY, PERSISTENCE, FOCUS, PUSH:ERASE and HORIZONTAL POSITION controls do not affect the display.

3-36. PUSH:ERASE.

3-37. This control removes stored or written displays.

3-38. TRIG.

3-39. This control selects the signal to be used as the internal sync signal. In NORM TRIG position, the signal displayed on the CRT is used as the internal sync signal, except in alt operation. In the alt mode of operation, the instrument triggers on the composite sync signal; to ensure proper triggering, LF REJ trigger coupling must be used.

3-40. B POLARITY.

3-41. This control inverts the channel B display 180 degrees and can be used to present an A — B display. To operate in the A — B mode, proceed as follows:

a. Set DISPLAY to A + B mode.

b. Set B POLARITY to INVT.

c. Display observed is A — B.

3-42. SWEEP DISPLAY.

3-43. This switch, mounted concentric to the main and delayed TIME/DIV controls, determines the horizontal sweep display modes. Modes are EXT HORIZ INPUT, MAIN SWEEP, MIXED SWEEP and DELAYED SWEEP. The function of each mode is as follows:

3-44. Ext Horiz Input. In this mode, the CRT horizontal plates are driven by an external source.

3-45. 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.

3-46. Mixed Sweep. In this mode, the first portion of signal is referenced to the main time base and the expanded portion is referenced to the delayed time base. Turning the DELAY TIME control varies the amount of display controlled by the delayed time base.

3-47. Delayed Sweep. Main sweep is not displayed in this mode. The sweep speed is controlled by delayed TIME/DIV.

3-48. TIME/DIV.

3-49. 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 23 ranges from 0.1 usec/div to 2 sec/div. Twenty ranges of delayed sweep speeds from 0.1 usec/div to 0.2 sec/div are provided by delayed TIME/DIV. Also, by switching SWP MAG to X10, a display can be expanded up to 10 times, increasing the fastest sweep to 10 ns/div.

3-50. VERNIER.

3-51. Sweep speed is calibrated to the TIME/DIV control when both the main and delayed VERNIER controls are set fully cw to CAL detent position. As the VERNIER controls are turned, the VERNIER UNCAL indicator lights and sweep speeds decrease. The main VERNIER control extends the slowest sweep to at least 5 sec/div.

3-52. The delayed VERNIER control extends the slowest sweep to at least 0.5 sec/div. The vernier controls are useful for making continuous adjustments of sweep speed, however TIME/DIV readings are uncalibrated.

3-53. TRIGGER LEVEL.

3-54. 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 +1.2V to —1.2V along the sync signal. Delayed TRIGGER LEVEL has no function when delayed AUTO/TRIG is set to AUTO.

3-55. TRIGGER HOLDOFF.

3-56. 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 holdoff and allows the instrument to synchronize on complex waveforms.

3-57. SWEEP MODE.

3-58. This group of controls selects the type of main and delayed sweep triggering. Main sweep free-runs in auto, giving a bright baseline in the absence of a sync signal. However, if a sync signal of 40 Hz or greater is applied, the sync signal overrides free-run operation and triggers the sweep. Due to the presence of a baseline, the auto sweep mode can be used for most applications.

3-59. Use norm mode if the sync signal is erratic or is less than 40 Hz. The sync input signal is always needed in norm mode to generate a sweep. When the SINGLE pushbutton is engaged, the sweep is generated only once. To sweep again, press the RESET pushbutton and release it. This arms the sweep circuit. This feature is particularly useful for viewing or photographing single, transient waveforms.

3-60. When the delayed AUTO/TRIG is set to AUTO, the delayed sweep starts at the end of the delay time. When the delayed AUTO/TRIG is set to TRIG, the delayed sweep is started by the first sync signal after the delay time.

3-61. TRIGGER.

3-62. Main and delayed trigger source is selected by this group of controls. In the INT position, sweep is synchronized to the vertical deflection signal. When EXT is selected, the sweep is triggered by sync signals applied to the main or delayed EXT TRIG INPUT connector.

3-63. The trigger coupling 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. The LF REJ control attenuates signals below approximately 15 kHz and is used, for instance, to prevent power line or other low frequency signals from triggering the sweep. The delayed trigger circuits do not have an LF REJ control. The HF REJ control attenuates signals above approximately 30 kHz and can be used to prevent high frequency noise from triggering the sweep.

3-64. SLOPE.

3-65. These controls determine whether the sweep triggers on the positive-going (+) or negative-going (—) portion of the sync signal. When the delayed AUTO/TRIG is set to AUTO, the delayed slope control has no function.

3-66. MAGNETIC INTERFERENCE.

3-67. The CRT is provided with a mu-metal shield for protection against magnetic fields. Due to the sensitivity of the CRT, it is possible that strong magnetic fields from nearby motors, ac line transformers, etc., may still result in noticeable beam deflection. In this event, reorient or relocate the instrument with respect to the interfering device.

3-68. OPERATING CONSIDERATIONS.

3-69. DEFINITIONS.

3-70. Several words and phrases, the definition of which may vary slightly from common usage, are used to describe the operation of the Model 1703A. The definitions of these words and phrases which apply to the Model 1703A are as follows.

3-71. Persistence. The length of time a written display remains visible on the CRT screen.

3-72. Write. To transform an input signal into a visible display on the CRT screen.

3-73. Store. To retain, at reduced intensity, a display that has been on the CRT screen.

3-74. Conv. Operation of the oscilloscope in the conventional, nonstorage mode.

3-75. Erase. To remove all displays and blooms that have been stored or written with persistence on the CRT screen.

3-76. Intensity. The brightness of a display as it is written on the CRT screen.

3-77. Bloom. A visible, nonsymmetrical expansion of a display written on the CRT screen.

3-78. Fade Positive. Display obscured by slow blooming. See figure 3-2A.

3-79. Background Illumination. A green cloud of illumination visible on the CRT screen. See figure 3-2B.

3-80. OPERATING TIPS.

3-81. This information is provided to aid the operator in becoming familiar with the Model 1703A controls and their functions, and to serve as a guide for obtaining the desired CRT display.

3-82. Normal Persistence Operation. To operate in the normal persistence mode, proceed as follows:

a. Set WRITING SPEED to STD.

b. Turn PERSISTENCE control fully ccw.

c. Slowly rotate INTENSITY control to point where no trace blooming occurs.

d. Engage CONV pushbutton; do not increase INTENSITY while in conv mode.

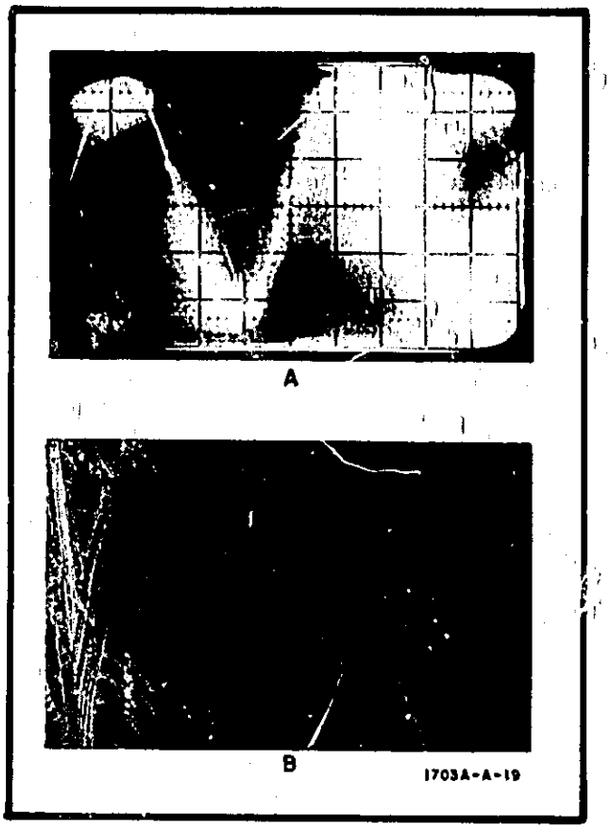


Figure 3-2. Fade Positive and Background Illumination

e. If sweep speed is changed, always check for proper intensity by using steps a through d.

CAUTION

When not actively using the Model 1703A, switch to store operation, thus turning off the write gun and eliminating the possibility of burning the storage mesh When in the std, fast, or conv mode, any visible trace may cause permanent damage to the CRT if the display is left for prolonged periods of time. To prevent this from happening, periodically erase the display or switch to store mode if the image is to be retained.

3-83. Variable Persistence Operation. To operate in the variable persistence mode, proceed as follows:

a. Set WRITING SPEED to STD.

b. Set minimum INTENSITY and maximum PERSISTENCE compatible with display.

3-84. Store Operation. To operate in the store mode, proceed as follows:

a. Set WRITING SPEED to STD.

b. Adjust INTENSITY and PERSISTENCE controls for desired display.

c. Engage STORE pushbutton.

d. Adjust STORE TIME control to set time display will be stored.

3-85. If more than one display is to be stored, proceed as follows:

a. Set WRITING SPEED to STD.

b. Set PERSISTENCE control fully cw.

c. Set INTENSITY control as required.

d. Allow first display to be written on CRT.

e. Set INTENSITY control fully ccw.

f. Connect second signal to be stored.

g. Reset vertical position if second display is not to be superimposed on first.

h. Adjust INTENSITY control until second signal appears on CRT.

i. Engage STORE pushbutton.

3-86. Erase Operation. To erase all persistence or stored displays, proceed as follows:

a. Set WRITING SPEED to STD.

b. Engage PUSH:ERASE control for approximately 2 sec.

3-87. Std/Store and Fast/Store Operation. These two modes of operation are useful when it is desireable to write and store a signal that might occur at an unknown time or at more infrequent intervals than the view time of the store mode (i. e. 15 sec in fast mode and 1 min in std mode. In the std/store or fast/store modes, the flood guns are turned off which prevents the CRT from fading positive, eliminating the need to periodically erase the CRT. An example of std/store operation is given below.

a. Obtain baseline (figure 3-3).

b. Set trig to A ONLY TRIG or NORM TRIG as desired.

c. Apply signal to channel A INPUT.

d. Set main TIME/DIV to desired position.

e. Set main AUTO/NORM to NORM.

f. Engage SINGLE pushbutton.

g. Set PERSISTENCE fully cw to MAX.

h. Engage STD and STORE pushbuttons at same time.

i. Press and release PUSH:ERASE control.

j. Press and release RESET pushbutton. Sweep should occur and signal should be stored but will not be visible.

k. Press STORE pushbutton and adjust STORE TIME until trace is visible.

Note

If trace is not completely stored, turn INTENSITY up slightly, and repeat steps h through k.

l. If FAST/STORE operation is desired, engage FAST and STORE pushbutton at same time for step i.

Note

In the std/store and fast/store modes of operation, the flood guns are turned off. Because the flood guns are off, the

vertical and horizontal sensitivity will be reduced approximately 3%. If accurate measurements are required, readjust the front panel vertical cal adjust (paragraph 3-99) and internal X1 gain adjust (paragraph 5-177) until gain is correct.

3-88. *Single-Sweep Operation.* To write or store single-sweep signals, a trial setting of the FOCUS and INTENSITY controls is the best approach. The signal amplitude and sweep time required to display the signal will affect the persistence. For example: with maximum persistence and the same intensity setting, a single-sweep straight line may bloom. A signal with amplitude variations may not bloom. To determine the best FOCUS and INTENSITY settings, proceed as follows:

a. Connect signal, which approximates sweep time and amplitude of single-sweep signal, to Model 1703A channel A INPUT.

b. Set PERSISTENCE control fully ccw.

c. Press and release RESET control periodically.

f. Adjust FOCUS and INTENSITY controls for best defined trace without blooming while repeating step e.

3-89. Single-sweep signals that require a sweep time faster than 20 usec/div can be written with more brightness by switching to the fast mode. The screen will be unevenly illuminated after erasing when in fast mode, figure 3-2B; however, intensity can be set high enough to make the display visible through the illumination. A display written in the fast mode will be more rapidly obscured by positive fading than a signal written in the conv mode. Single-sweep signals that require a sweep time between 20 usec/div and 200 usec/div may have low brightness at the center of the screen. If center screen brightness is low, wait from 1 to 3 min for the low brightness area to become brighter. If the entire display brightness appears below a visable level, or the display is not visible at all, wait from 1 to 5 min for the display to appear.

3-90. BATTERY RECHARGE OPERATION.

3-91. To recharge Model 10103A Battery Pack, proceed as follows:

a. Set front-panel POWER-ON switch to off.

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

c. Connect ac power to instrument. This sends 400 milliamperes of charge current to battery. Recharge time is approximately 14 hours.

3-92. PREOPERATIONAL ADJUSTMENTS.

3-93. INITIAL TURN-ON.

3-94. To place the Model 1703A into operation, perform the following steps:

a. Perform steps in paragraph 3-5.

b. Set INTENSITY fully ccw.

c. Set channel A and channel B POSITION controls to midrange.

d. Set DISPLAY to CHOP.

e. Set CHANNEL A VOLTS/DIV to 5.

f. Set channel A and channel B verniers to CAL detent.

g. Set B POLARITY to NORM.

h. Set channel A and B coupling to GND.

i. Set HORIZONTAL POSITION to midrange.

j. Set main TIME/DIV to 1 mSEC.

k. Set delayed TIME/DIV to OFF.

l. Set main and delayed VERNIER to CAL detent.

m. Set main AUTO/NORM to AUTO.

n. Set main INT/EXT to INT.

CAUTION

Verify proper position of the POWER MODE switch located on the rear panel. Do not change the POWER MODE switch setting with the instrument on or with power connected to the rear panel. Refer to Section II for procedure to change POWER MODE switch setting.

o. Apply operating power and allow 15-min warm-up time.

3-95. TRACE ALIGN ADJUST.

3-96. To align the trace, proceed as follows:

Note

If there is no green illumination, turn instrument off, and check all CRT connections.

a. Obtain baseline (figure 3-3).

b. Adjust channel A POSITION until baseline is on center graticule line.

c. Adjust TRACE ALIGN until baseline is parallel with graticule line.

3-97. FOCUS and ASTIGMATISM ADJUST.

3-98. To adjust focus and astigmatism, proceed as follows:

a. Set all pushbuttons out.

b. Set channel A controls as follows:

DISPLAY..... A
channel A POSITION..... center trace on CRT

c. Set main AUTO/NORM to NORM.

d. Set main TIME/DIV to 2 SEC.

e. Turn main VERNIER fully ccw.

f. Set INTENSITY to observe dot.

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

3-99. CAL ADJUST.

3-100. To calibrate the front-panel vertical sensitivity, proceed as follows:

a. Set DISPLAY to A.

b. Connect CAL 1 VOLT to channel A INPUT with test lead.

c. Set CHANNEL A VOLTS/DIV to .2.

d. Adjust channel A CAL for 5-div display.

e. Set DISPLAY to B.

f. Connect CAL 1 VOLT to channel B INPUT.

g. Set CHANNEL B VOLTS/DIV to .2.

h. Adjust channel B CAL for 5-div display

3-101. OPERATING PROCEDURES.

3-102. Figures 3-3 through 3-11 are operating plates containing step-by-step operating procedures indexed to photographs.

3-103. OPERATORS PERFORMANCE CHECK.

3-104. The operation of the Model 1703A 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 display modes and 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 midsequence, because succeeding steps depend on control settings and results of previous steps. If any of the results are unobtainable, refer to Section V, Performance Check and Adjustments, or Section VIII, Schematics and Troubleshooting.

a. Set Model 1703A controls as follows:

PERSISTENCE..... fully ccw
INTENSITY..... as required
WRITING SPEED..... STD

CHANNEL A VOLTS/DIV..... .02
channel A coupling..... A
channel A vernier..... CAL
channel A POSITION..... as required
DISPLAY..... A
trig..... A ONLY TRIG

CHANNEL B VOLTS/DIV..... N/A
channel B coupling..... N/A
channel B vernier..... N/A
channel B POSITION..... N/A
P POLARITY..... NORM

HORIZONTAL POSITION.... as required
main VERNIER..... CAL
delayed VERNIER..... CAL
sweep display..... MAIN SWEEP
main TIME/DIV..... .5 mSEC
delayed TIME/DIV..... OFF
main AUTO/NORM..... AUTO
delayed AUTO/TRIG..... AUTO
main INT/EXT..... INT
delayed INT/EXT..... INT
delayed slope..... +

main slope..... +
main TRIGGER LEVEL..... as required
delayed TRIGGER LEVEL..... N/A
TRIGGER HOLDOFF ..... NORM
SWP MAG..... X1

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

c. Connect CAL 1 VOLT output to channel A INPUT with X10 probe.

d. Adjust main TRIGGER LEVEL for stable display. Observe five positive-going pulses with an amplitide of 5 divisions.

e. Set delayed TIME/DIV to .2 mSEC. Observe intensified portion of sweep.

Note

Intensified portion should cover 4 to 5 divisions.

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

g. Set sweep display 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 dial. Observe that intensified portion moves smoothly along display.

j. Set delayed AUTO/TRIG control to TRIG.

k. Adjust delayed TRIGGER LEVEL for stable intensified portion of trace.

l. Vary DELAY TIME dial. 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.

q. Set main TRIGGER LEVEL fully cw.

r. Set main AUTO/NORM to NORM.

s. Select SINGLE operation.

t. Press RESET pushbutton. Reset light should light. Observe no sweep.

u. Rotate main TRIGGER LEVEL fully ccw. Observe one sweep and reset light goes off after sweep.

v. Set main AUTO/NORM to AUTO.

w. Press RESET pushbutton. Observe one sweep.

3-105. OPERATING INFORMATION.

3-106. The following paragraphs provide additional information concerning the use of one specific function over another.

3-107. AUTO VERSUS NORM.

3-108. In auto operation, there will always be a baseline. A trigger signal 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 more, norm operation may be used. A trigger signal is always needed in norm operation to generate a sweep.

3-109. AUTO VERSUS TRIG.

3-110. Auto delayed sweep is achieved when delayed AUTO/TRIG pushbutton is out. This causes the delayed sweep to start at the end of the delay time as set by the DELAY TIME dial.

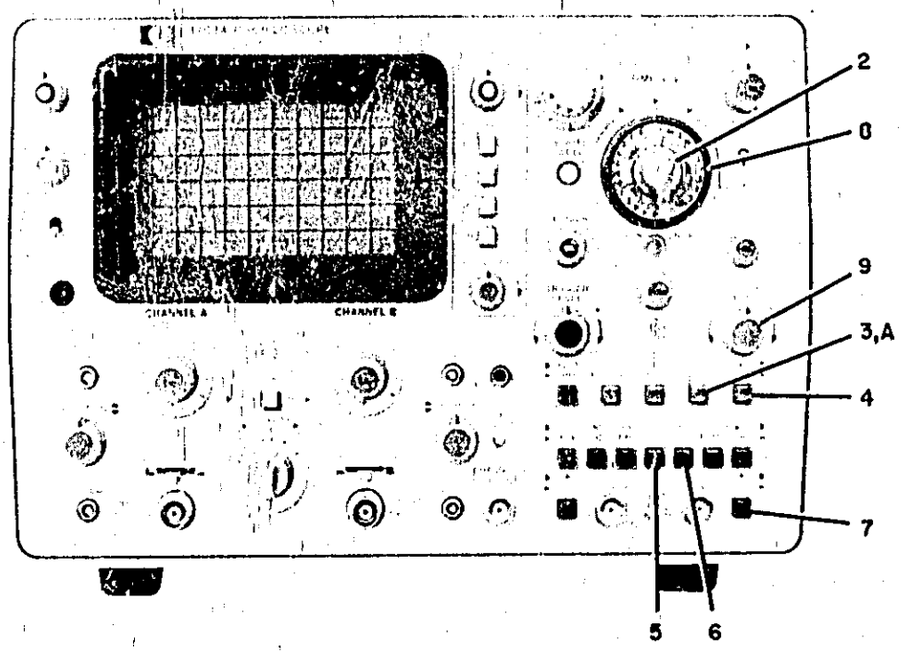
3-111. AC VERSUS DC.

3-112. Ac coupling removes the dc level of trigger signals. Use of the LF REJ control prevents low frequency noise from triggering the sweep.

3-113. DELAYED SWEEP.

3-114. Any signal can be displayed at 100 ns/div with 3% accuracy. Displays can also be expanded up to 10 ns/div (X10 magnification) with 5% accuracy. This expansion permits viewing of critical risetime or signal shapes with increased resolution. The portion to ge expanded is selectable by the DELAY TIME dial 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 indepandent, the main VERNIER may be out of CAL position while the delayed sweep is still calibrated.

3-115. 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.



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

AUTO OPERATION

1. Adjust vertical controls for desired display, and connect vertical input signal.
2. Set sweep display to MAIN SWEEP.
3. Set main AUTO/NORM to AUTO.
4. Set SWP MAG to X1.
5. Set main INT/EXT to desired trigger source. If EXT trigger is selected, connect trigger signal to main EXT TRIG INPUT jack.
6. Set main AC/DC 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. Set main AUTO/NORM to NORM.

B. Perform steps 2 and 4 through 9 for AUTO operation.

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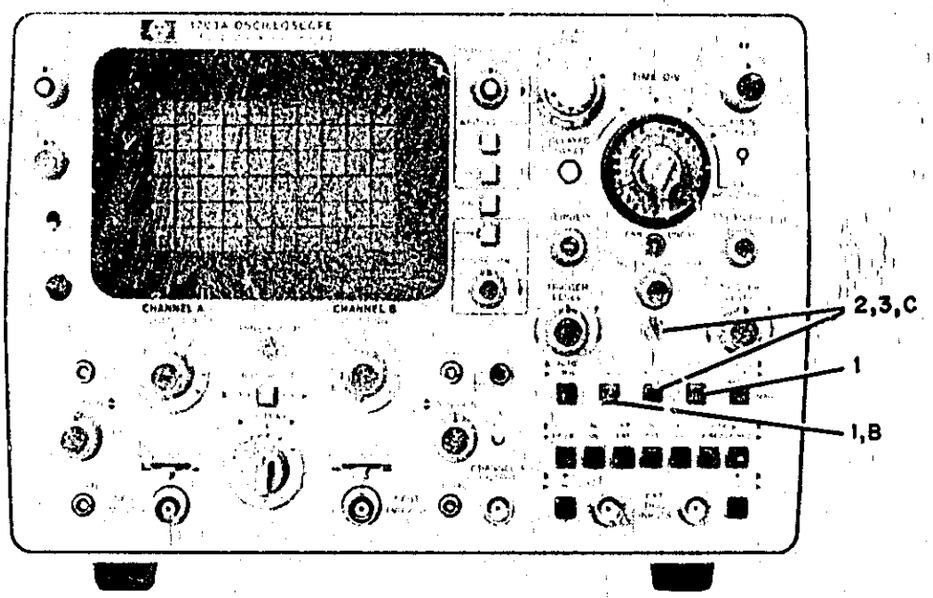
Figure 3-3. Auto and Norm Operation



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

SINGLE (RESET) NORM OPERATION

1. Obtain baseline (figure 3-3), except engage SINGLE pushbutton and set main AUTO/NORM to NORM.
2. Press and release RESET pushbutton. RESET indicator lamp will light to indicate sweep circuit is armed.
3. When sweep is armed, first trigger input will initiate sweep cycle. RESET lamp will go out at completion of cycle, and circuit must be rearmed for next cycle.

SINGLE (RESET) AUTO OPERATION

A. Obtain baseline (figure 3-3).

B. Engage 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.

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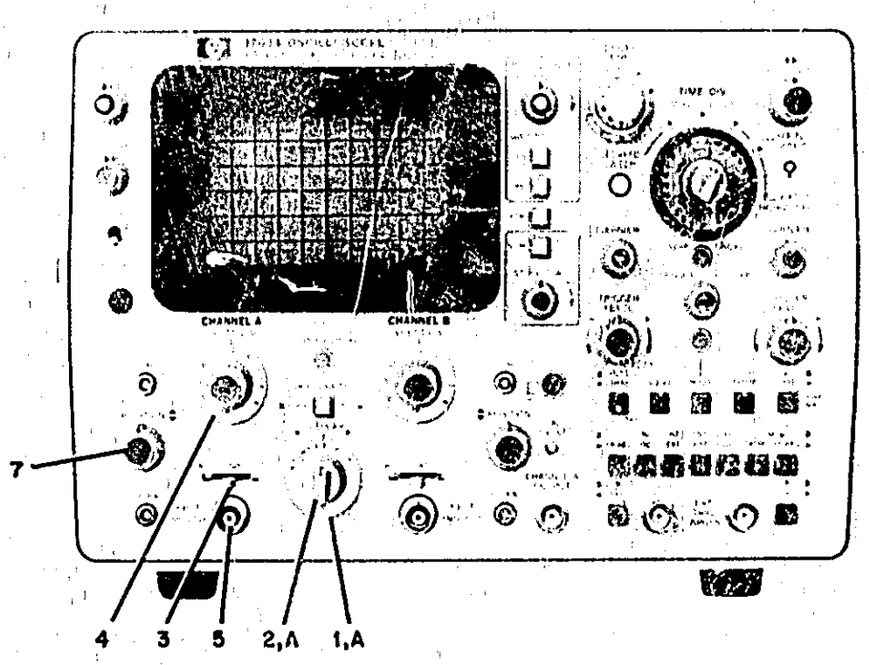
Figure 3-4. Single Sweep Operation



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

A or B, SINGLE CHANNEL OPERATION

1. Set DISPLAY to A or B, and perform following steps for selected channel.
2. Set trig to NORM TRIG.
3. Set channel A or channel B coupling to AC or DC.
4. Set CHANNEL A VOLTS/DIV or CHANNEL B VOLTS/DIV to desired range.
5. Connect input signal to channel A or channel B INPUT connector.
6. Obtain baseline on CRT (figure 3-3).
7. Adjust channel A POSITION or channel B POSITION for desired vertical position of display.

CHOPPED or ALTERNATE, DUAL CHANNEL

A. Set DISPLAY to CHOP or ALT position.

Note

For CHOP operation, use A ONLY TRIG. The NORM TRIG position is undefined in CHOP mode.

B. Perform steps 2 through 7 (A or B, single channel) for both vertical channels.

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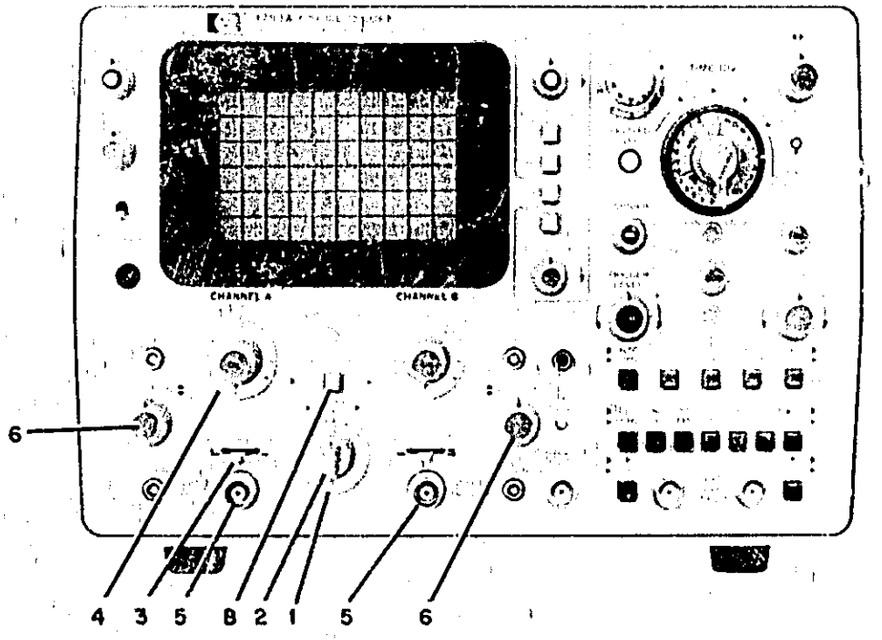
Figure 3-5. Single and Dual Channel Operation



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

A + B OPERATION

1. Set DISPLAY to A + B.
2. Set trig to NORM TRIG or A ONLY TRIG as desired.
3. Set channel A coupling to AC or DC.
4. Set CHANNEL A VOLTS/DIV to desired range.
5. Connect desired vertical signals to channel A and channel B INPUT connectors.
6. 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. Set B POLARITY pushbutton to INVT.

C. Repeat steps 3 through 6 of A + B operation.

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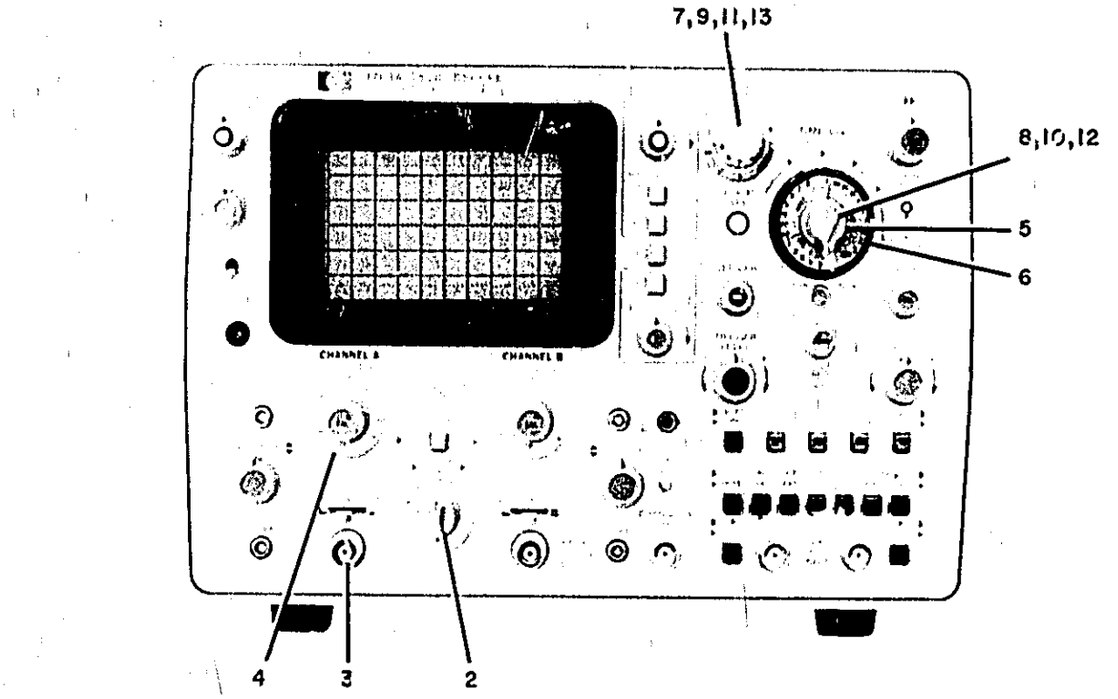
Figure 3-6. A + B and A — B Operation



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

1. Obtain baseline (figure 3-3).
2. Set trig to A ONLY TRIG or NORM TRIG as desired.
3. Apply signal to channel A INPUT.
4. Set CHANNEL A VOLTS/DIV to desired display.
5. Set main TIME/DIV for desired display.
6. Set delayed TIME/DIV to 5 μSEC.
7. Adjust DELAY TIME dial to intensify first point of interest on waveform (figure A).
8. Set sweep display to DELAYED SWEEP.
9. Adjust DELAY TIME dial to set point of interest on center vertical graticule (figure B). Note DELAY TIME dial setting.
10. Set sweep display to MAIN SWEEP.
11. Adjust DELAY TIME dial to intensify second point of interest on waveform (figure C).
12. Set sweep display to DELAYED SWEEP.
13. Adjust DELAY TIME dial to set point of interest on center vertical graticule (figure D). Note DELAY TIME dial setting.
14. To obtain time between two points, multiply main TIME/DIV setting by difference between DELAY TIME dial setting in steps 9 and 13.

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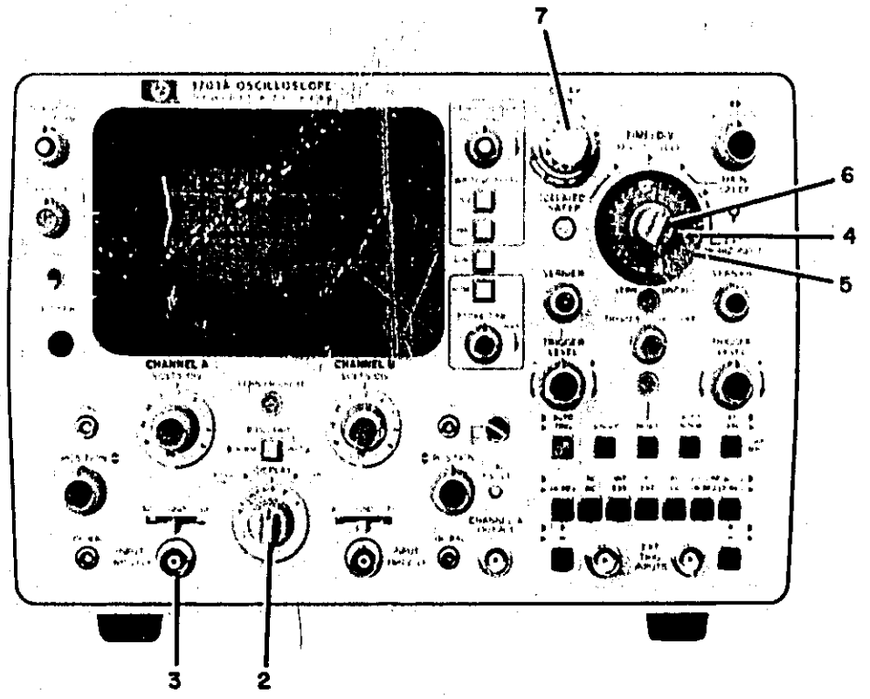
Figure 3-7. Time Difference Measurements



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument tc operate in CONV for extended periods of time.

1. Obtain baseline (figure 3-3).
2. Set trig to A ONLY TRIG or NORM TRIG as desired.
3. Apply signal to channel A INPUT.
4. Set main TIME/DIV to desired sweep speed.
5. Set delayed TIME/DIV to desired sweep speed.
6. Set sweep display to MIXED SWEEP.
7. Adjust DELAY TIME dial until desired waveform portion is displayed on screen.

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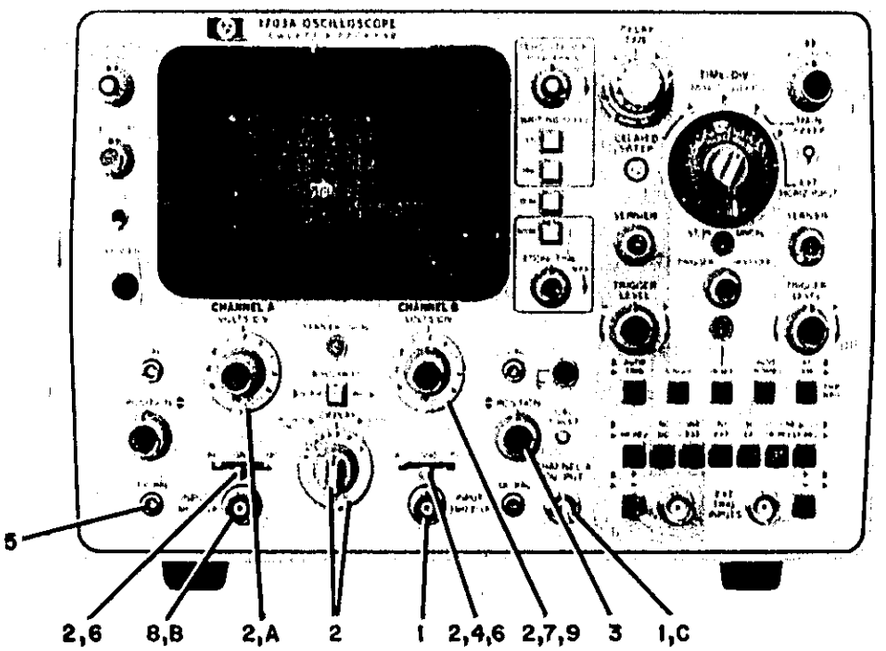
Figure 3-8. Mixed Sweep Operation



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

CASCADED OPERATION, CHANNEL A OUTPUT

1. Connect CHANNEL A OUTPUT to channel B INPUT with BNC cable.
2. Set vertical controls as follows:

DISPLAY	B
CHANNEL A VOLTS/DIV	.01
CHANNEL B VOLTS/DIV	.01
channel A coupling	GND
channel B coupling	GND
trig	NORM TRIG

3. Center trace with channel B POSITION control.
4. Set channel B coupling to DC.
5. Center trace with channel A DC BAL control.
6. Set channel A and channel B coupling to desired position.
7. Set CHANNEL B VOLTS/DIV to desired range.
8. Connect signal to channel A INPUT.
9. Sensitivity of vertical amplifier (as read on CHANNEL B VOLTS/DIV switch) will be increased by factor of 10.

INDEPENDENT OPERATION, CHANNEL A OUTPUT

A. Set CHANNEL A VOLTS/DIV to desired range.

B. Connect desired signal to channel A INPUT.

C. Take amplified signal from CHANNEL A OUTPUT.

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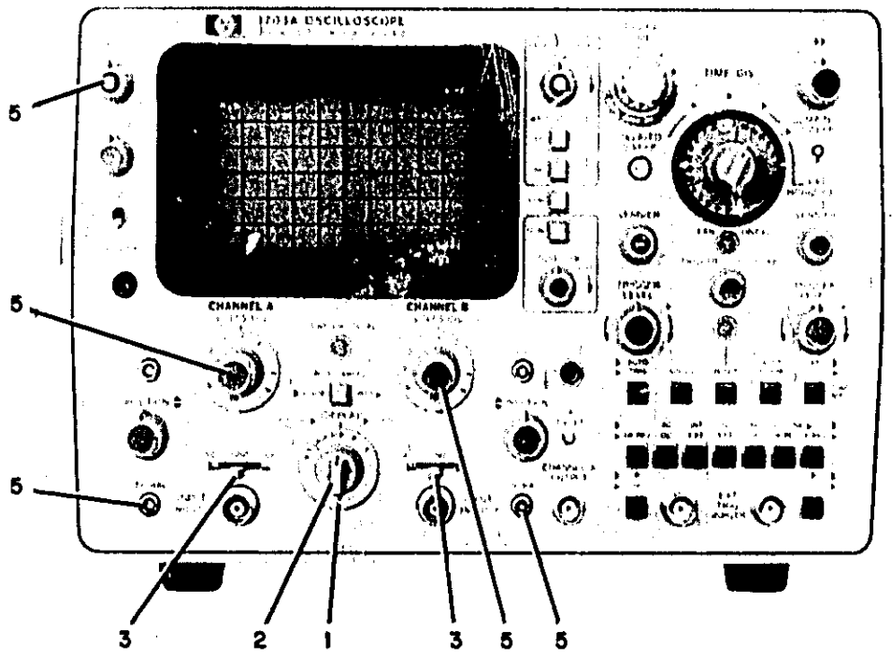
Figure 3-9. Channel A Cascaded and Independent Operation



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

DC BALANCE ADJUST

1. Set DISPLAY to A.
2. Set channel A coupling to GND.
3. Obtain baseline per figure 3-3, AUTO operation.
4. Adjust channel A DC BAL until vertical trace does not shift when turning channel A vernier from CAL to maximum attenuation.

Note

If trace is not on CRT screen, depress PUSH:BEAM pushbutton and adjust channel A DC BAL until trace remains on screen.

5. Repeat steps 1 through 4 for channel B.

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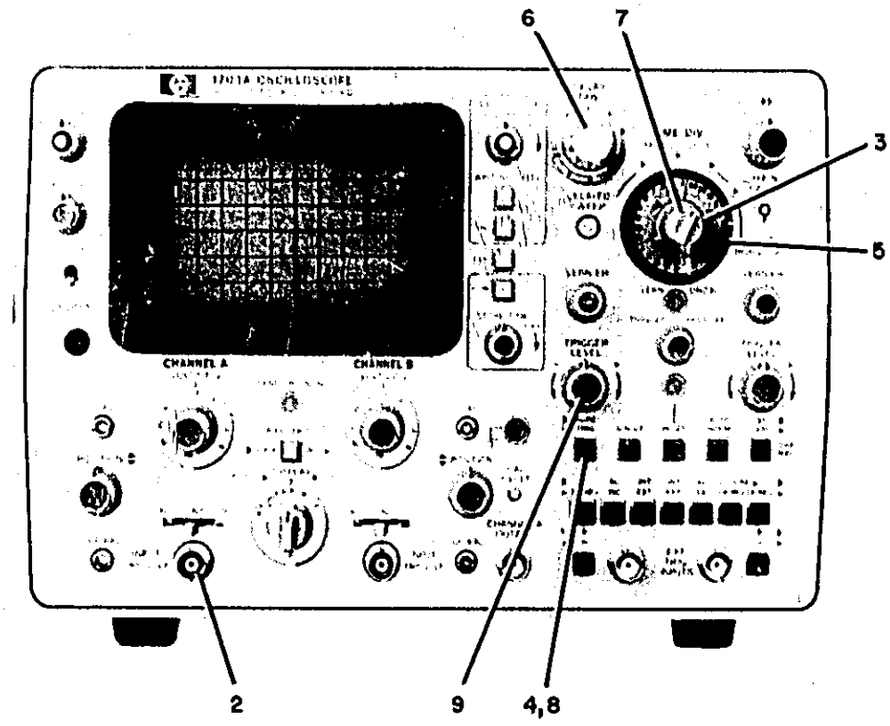
Figure 3-10. Amplifier Balance Adjust



CAUTION

Do not allow trace to bloom. Do not allow unattended instrument to operate in CONV for extended periods of time.

1. Obtain baseline (figure 3-3).
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. Set sweep display to DELAYED SWEEP. Intensified poriton 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 instrument to trigger on signal of interest and reduces jitter.
9. Adjust delayed TRIGGER LEVEL for stable display.

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Figure 3-11. Delayed Sweep Operation

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains an overall explanation of circuit theory. Refer to the overall block diagram in Section VIII while reading the theory.

4-3. VARIABLE PERSISTENCE AND STORAGE.

4-4. This section deals with basic theory of operation to aid in the understanding of storage concepts.

4-5. The storage CRT consists mainly of a conventional write gun with associated deflection plates and an aluminized phosphor viewing screen. In addition, it contains flood guns, flood beam shaping and accelerating grids, a collector mesh, and storage mesh. A schematic drawing of this CRT is shown in figure 4-1. The write gun functions as a conventional, electrostatic deflection gun. Elements which provide storage and variable persistance are located between the write gun and phosphor.

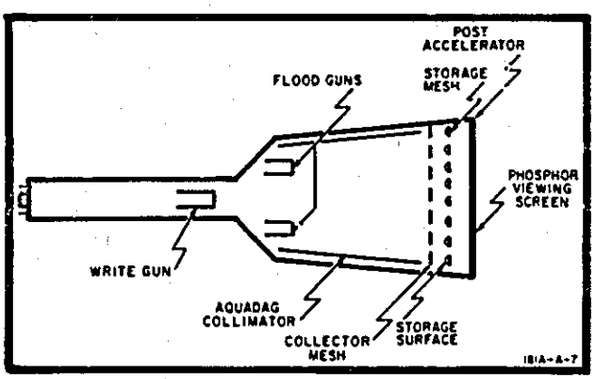


Figure 4-1. Simplified CRT Construction

4-6. The flood guns are located physically just outside the horizontal deflection plates and emit a cloud of electrons from their cathodes. This cloud of electrons is shaped and accelerated toward the viewing area by the collimator (the coating on the inside of the funnel section of the glass) and the collector mesh. The potential on the storage mesh and storage surface exerts further control on the flood of electrons as they arrive at the storage surface, where storage of information takes place.

4-7. The secondary emission ratio curve shown in figure 4-2 is the basis for storage of information on the storage surface. The point where the number of

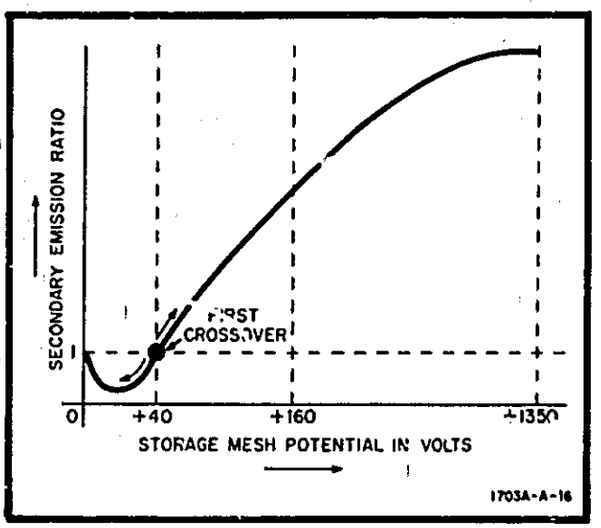


Figure 4-2. Secondary Emission Ratio

electrons leaving the storage surface is the same as the number of electrons arriving is called "first crossover" point. When more electrons are leaving than arriving, the storage surface potential rises; when more electrons are arriving then leaving, the storage surface potential decreases.

4-8. Figure 4-3 graphically presents the action of the storage mesh and storage surface potentials during the erase cycle. When the PUSH:ERASE control is pressed, the storage mesh and storage surface are brought to the same potential as the collector mesh, +160 volts. When the PUSH:ERASE control is released, both storage mesh and storage surface are decreased to a potential of approximately +10 volts and held there for about 350 ms.

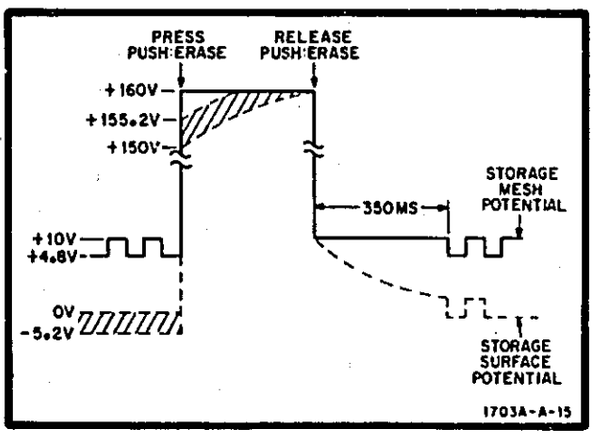


Figure 4-3. Erase Cycle

4-9. Flood gun electrons that have a potential close to 0 volt will be attracted to the +10 volts. These flood gun electrons then discharge the storage surface, because the potential is below first crossover (figure 4-2), and bring the entire storage surface to 0 volt. At the end of 350 ms, the storage mesh potential is decreased to +4.8 volts. The storage surface will follow, due to capacitive coupling, and becomes —5.2 volts.

4-10. Write gun electrons (with much higher than first crossover energy) charge the storage surface in a positive direction only in areas where they strike the storage surface. Flood gun electrons pass through these areas and are pulled to the viewing areas by the high post-accelerator potential.

4-11. The method of obtaining variable persistence is represented in figure 4-4. After the erase cycle, the unwritten storage surface is approximately —5.2 volts. Those areas of the storage surface struck by the write gun electrons become charged to near 0 volt. The written areas are clamped near 0 volt by flood gun electrons. When erase pulses are applied to the storage mesh, the storage surface is capacitively increased to 5.2 volts for the duration of the pulse. While at this potential, the storage surface written areas (about 5.2 volts) attract and capture flood gun electrons. This tends to lower the potnetial of written areas because it discharges the capacitor (created by the dielectric material) toward 0 volt. When the storage mesh returns to its normal level, the storage surface drops to 5.2 volts. The unwritten areas of the storage surface return to the —5.2 volt potential and written areas return to a slightly negative potential, somewhat lower (more negative) then their initial value. This decrease in potential reduces the ability of the post-accelerator potential to reach through and capture flood gun electrons, and trace brightness is slightly reduced.

4-12. A train of erase pulses gradually erases the written trace as shown in figure 4-4. The repetition rate of the erase pulses varies the persistence of the written trace. While the storage mesh is pulsed positive, flood gun electrons are allowed through to the phosphor viewing screen at all areas on the storage surface, causing a light background glow under some conditions.

4-13. When the storage mesh potential is reduced to about —40 volts, in the conv mode, it acts as a control grid to flood gun electrons, repelling them from the phosphor. It has little effect on the write gun electrons, allowing them to pass through to the viewing area.

4-14. However, some of the write gun electrons strike the storage surface and drive it in a positive direction. At high intensity settings, this change in potential is very rapid. The energy from this sudden change is converted into heat in the storage sufrace and may burn the dielectric material. In storage modes of operation, this burning action is visible as trace blooming. However, trace blooming is not visible during conv operation. Therefore the intensity level should be set just below the blooming point in the std mode before switching to the conv mode of operation.

4-15. Fade positive of the storage surface (causing the entire viewing area to be illuminated) limits the viewing time of a persisting trace. This effect is caused primarily by flood gun electrons ionizing the residual gas molecules. Fade positive is reduced by turning off the flood gun, except for a brief period during use in the storage mode. These turn-on periods occur frequently at the minimum end of the STORE TIME control (fully ccw) and produce a trace near normal intensity. No turn-on periods occur on the maximum end of the STORE TIME control (fully cw) and the trace is not visible.

4-16. GENERAL THEORY.

4-17. An overall explanation of circuit operation based on block diagrams (schematics 1 and 2) is pre-

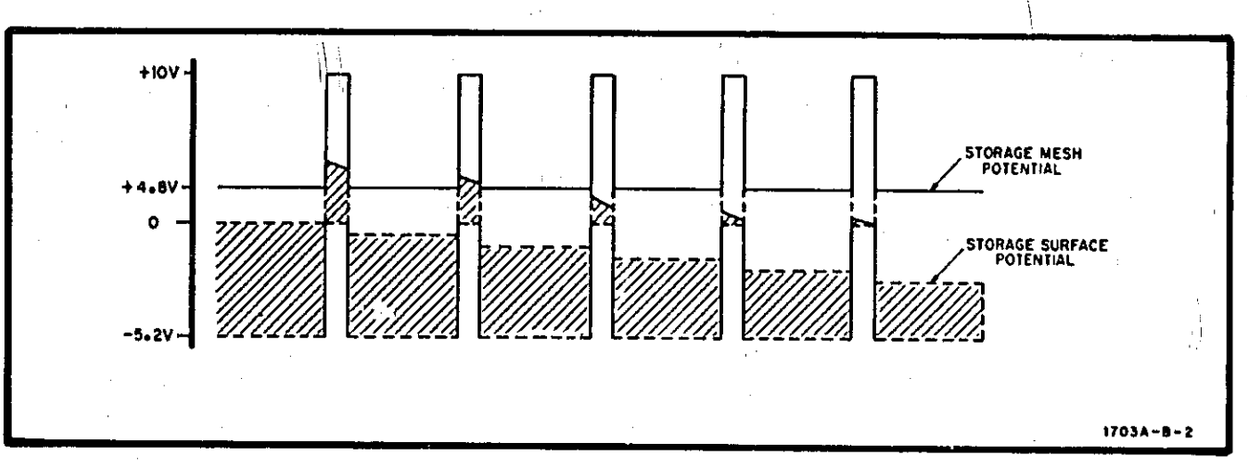


Figure 4-4. Variable Persistence Accomplished through Pulse Erase

sented to generate a basic understanding of the instrument. 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 logic low (0) is less positive voltage.

4-18. This instrument consists of a CRT, storage circuit, line rectifier, gate assembly, external horizontal amplifier, and three modules. The modules are as follows: (1) vertical amplifier module containing attenuators, vertical preamplifier, delay line, vertical output amplifier, and channel A output amplifier; (2) a horizontal amplifier module containing trigger assembly, horizontal mother board, main and delayed intergrators, main and delayed sweep time assemblies, holdoff and comparator assembly, horizontal mode assembly, horizontal preamplifier, and horizontal output amplifier; and (3) power supply module containing low voltage mother board, low voltage converter, low voltage rectifier and filter, high voltage oscillator, and high voltage multiplier.

4-19. INPUT ATTENUATOR. (See schematic 1.)

4-20. The attenuators are compensated voltage-divider types. They provide division ratios of 1, 2, 5 10 and 100, giving nine separate sensitivities. Each decade 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.

4-21. VERTICAL PREAMPLIFIER.

4-22. 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 vertical preamplifier (schematic 7).

4-23. DELAY LINE.

4-24. 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 that the event caused by the trigger can be observed on the fastest sweep.

4-25. VERTICAL OUTPUT AMPLIFIER.

4-26. The vertical output amplifier provides drive to the CRT vertical deflection plates.

4-27. CHANNEL A OUTPUT AMPLIFIER.

4-28. The channel A output amplifier provides a gain of 10 to the channel A signal. With the CHANNEL A OUTPUT connected to the channel B INPUT, the Model 1703A vertical sensitivity can be extended to 1 mV/div.

4-29. TRIGGER CIRCUITS.

4-30. The trigger assembly provides the main and delayed trigger signals to the integrators. Trigger modes are selectable in this assembly. The main trigger circuit provides two outputs to the main integrator (schematic 1). One output is the main trigger that is generated by the current switch. The output of the current switch is controlled by the inputs to the set-trigger gates. One input to the set-trigger gate is the trigger signal and other input is the reset signal from the main integrator. When the reset signal is high, the set-trigger gates are inoperative and no trigger signal is generated. When the reset signal is low, the set-trigger gates are operational and a trigger signal will be generated if there is an internal or external trigger input. The other output is the bright-line auto level which is provided only in the auto mode. The delayed trigger circuit functions indentically to the main trigger circuit and provides a trigger signal to the delayed integrator (schematic 13).

4-31. MAIN INTEGRATOR.

4-32. 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 12). 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.

4-33. 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 holdoff 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 holdoff amplifier determines the holdoff time of the circuits and sets the trigger set-trigger gates to a logic low (0) for a new sweep.

4-34. When the bright-line auto circuit is used, the set-reset multivibrator provides a ground for the bright-line auto level and terminates the sweep. This allows the sweep signal to return to its starting point.

4-35. At the same time that the main ramp is generated, the alt amplifier provides an output to the vertical preamplifier J-K flip-flop for alt operation.

4-36. HOLDOFF AND COMPARATOR.

4-37. The holdoff and comparator establishes the time interval between trigger points. The time interval is adjusted by the TRIGGER HOLDOFF control. A signal from the main integrator set-reset multivibrator activates the holdoff circuit. When the holdoff is activated, a ramp, determined by the holdoff amplifier RC circuits and the TRIGGER HOLDOFF 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 new sweep.

4-38. The main horizontal sweep ramp from the Miller integrator also drives the comparator in the holdoff and comparator assembly. The main sweep is compared to a voltage set by the DELAY TIME dial. 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.

4-39. DELAYED INTEGRATOR.

4-40. 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.

4-41. 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.

4-42. TIMING SEQUENCE.

4-43. Figure 4-5 is an illustration representing the time relationship between the trigger and sweep timing circuits. Waveform A represents the input signal to the vertical circuits and the internal sync signal. Waveform B represents the main integrator set-reset multivibrator output. Waveform C represents the

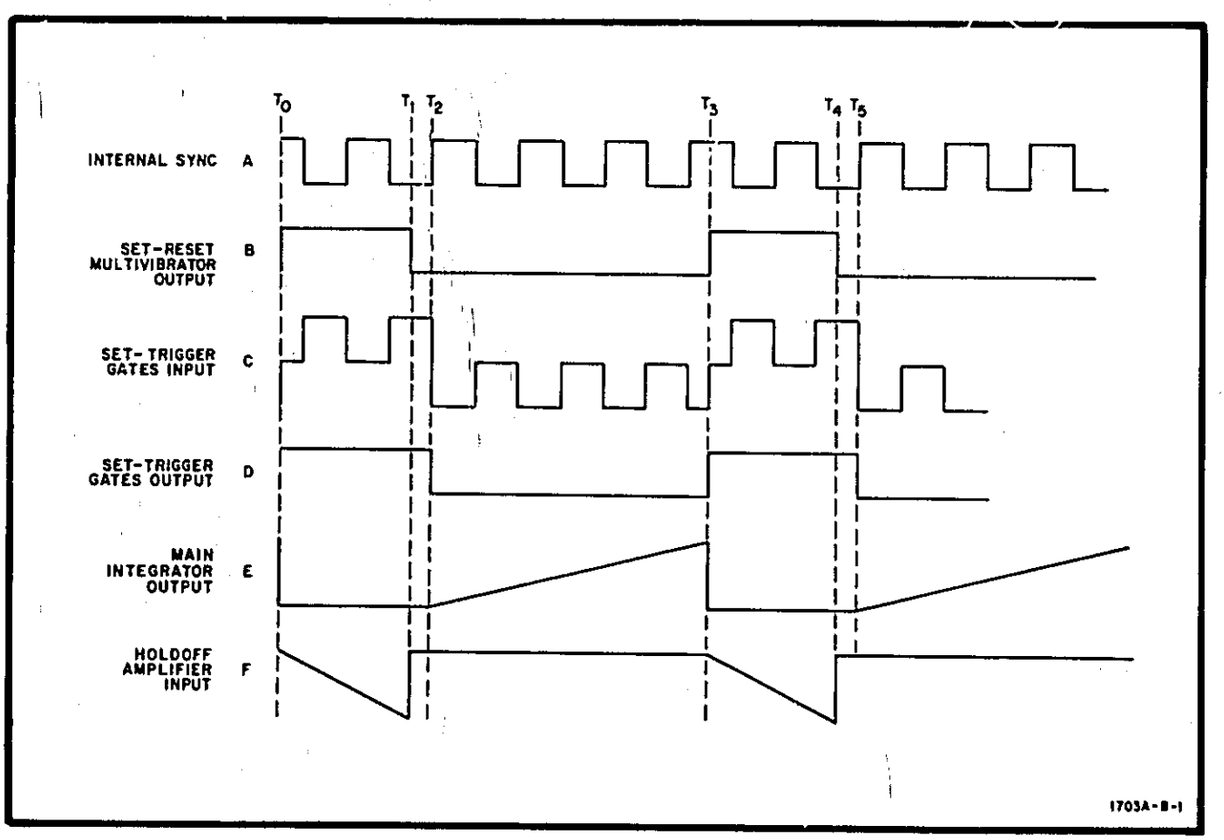


Figure 4-5. Timing Sequence

input to the trigger set-trigger gates and waveform D represents the output. Waveform E represents the input to the holdoff and amplifier.

4-44. At T_0, the multivibrator output is high, holding the set-trigger gates high, preventing a sweep signal. At T_1, the holdoff time is completed and the multivibrator output goes low, activating the set-trigger gates. At T_2, the trigger signal goes positive and the set-trigger gates output goes low, activating the main integrator which produces a horizontal sweep signal.

4-45. At T_3, the sweep is terminated and the set-reset multivibrator output goes high. When the set-reset multivibrator goes high, the holdoff time signal starts and the set-trigger gates are locked high, preventing a sweep. At the completion of holdoff time, the sequence is repeated.

4-46. HORIZONTAL MODE ASSEMBLY.

4-47. This assembly controls main sweep, mixed sweep, delayed sweep, external horizontal input and the trace intensity in these modes. A switch selects the type of sweep signal to be displayed.

4-48. The blanking circuit blanks the trace in the main sweep, delayed sweep and mixed sweep modes. The blanking signal is applied to the gate assembly (schematic 2) which controls the high voltage oscillator assembly.

4-49. The blanking circuit also intensifies the delayed portion of the sweep in the main sweep and mixed sweep mode. When the delayed TIME/DIV switch is set to some position other than OFF, the main sweep intensity is reduced and the delayed sweep intensity is held at a normal level, providing trace intensification.

4-50. LOW VOLTAGE POWER SUPPLY. (See schematic 2.)

4-51. 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.

4-52. 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.

4-53. The voltage regulator output is applied to the low voltage converter. This stage converts the input dc power to useable 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.

4-54. 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.

4-55. The filtered voltages from the low voltage mother board are coupled to the gate board. The gate board provides filtering, fuse protection and distribution of the low voltage supplies to the rest of the Model 1703A circuits.

4-56. HIGH VOLTAGE POWER SUPPLY.

4-57. The high voltage power supply consists of the high voltage oscillator, power transformer, rectifying networks, and high voltage multiplier. When the instrument is turn 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 filaments of the CRT. The secondary voltage at pin 7 is connected through a rectifying diode to the control grid of the CRT. Pin 8 of the secondary is connected through a rectifying diode to the cathode. A correction voltage is coupled from this diode back through a resistive divider network, controlling 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.

4-58. 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 1.875-kV peak-to-peak voltage is present at pin 9 of the high voltage transformer. This voltage is applied to the high voltage multiplier circuit where it is multiplied by 4. The +7.5-kV output is applied to the post-accelerator on the CRT.

4-59. GATE AMPLIFIER.

4-60. The gate amplifier has four inputs: one input is from the INTENSITY control, another input is the horizontal mode blanking input, a third input is the vertical preamplifier chop blanking input and fourth input is from the Z-AXIS INPUT. All of these inputs control the intensity or Z-axis of the CRT. The output

from the gate amplifier to the CRT grid increases or decreases the intensity of the display.

4-61. STORAGE CIRCUITS.

4-62. Store Operation. During store operation, the blanking circuit and the 30-usec, one-shot multivibrator are activated. The blanking circuit output is coupled to the gate amplifier, turning the CRT write gun off. The 30-usec, one-shot multivibrator output is applied to the flood gun anode driver. This signal turns the flood gun anode driver on and off. When the flood gun anode driver is off, the flood gun is positive and accelerates the flood gun electrons to the CRT, allowing a stored display to be viewed.

4-63. Conv Operation. In this mode, the conv amplifier turns on, pulling the storage mesh driver output to —40 volts. This voltage causes the storage mesh to act as a control grid to the flood gun electrons and prevents the electrons from reaching the CRT phosphor. Under this condition, the CRT acts as a conventional CRT.

4-64. Std/fast Operation. In the std mode of operation, the max/write memory circuit is activated. The max write pulse amplifier is turned off and the write pulse amplifier is turned on, saturating the amplifier. In the fast mode, the write pulse amplifier is turned off and the max write pulse amplifier is turned on, saturating the amplifier. The amplifier controls the bias of the storage mesh driver, controlling how positive the storage mesh will be pulsed.

4-65. In the std and fast operating modes, the current source supplies between 0 mA (maximum persistence) and 0.5 mA (minimum persistence) to the unijunction oscillator. This current activates the unijunction oscillator which provides negative pulses to the 30-usec, one-shot multivibrator. The more current supplied to the unijunction oscillator, the higher the output frequency of the 30-usec, one-shot multivibrator. The 30-usec, one-shot multivibrator output is applied to the persistence control circuit that turns the pulse amplifier on and off. When the pulse amplifier is off, the storage mesh driver input is clamped. When the pulse amplifier is on, the storage mesh driver bias voltage is established. The difference between on and off status of the pulse amplifier provides a storage mesh driver pulse output between +4.8 volts and +10 volts. The frequency of the erase pulses determines the display persistence and the pulse amplitude determines the erase depth.

4-66. Erase Operation. When the PUSH:ERASE control is engaged, +160 volts is applied to the storage mesh, bringing the storage mesh to the same potential as the collector mesh. During this time, the erase control circuit is activated, turning the persistence control circuit off. With the persistence control circuit off, persistence pulses are prevented from being applied to the storage mesh driver.

4-67. During this time, the 100-Hz, astable multivibrator is activated, turning the collimator switches on and off at 100-Hz rate. The collimator switches turn the collimator output amplifier on and off. The collimator amplifier output changes the focusing of the flood gun electrons to help erase the CRT more completely.

4-68. When the PUSH:ERASE control is released, the erase control circuit turns off and the persistence control circuit turns on. There is a 350-ms delay between the time the PUSH:ERASE control is released and the time the erase control circuit turns off.

4-69. DETAILED CIRCUIT THEORY.

4-70. 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 text for easy location.

4-71. INPUT ATTENUATORS.

4-72. The 35-MHz attenuators, A5A1 and A5A2, (schematic 3) 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 division ratios of 1, 10, and 100. The rear section provides division ratios of 1, 2, and 5.

4-73. A5A1S1 provides choice of coupling. Choices are AC, DC, or GND. A5A1C1 provides a cutoff frequency of 10 Hz in the AC position.

4-74. A5A1C7 and A5A1C8 provide attenuator compensation for the front portion of the attenuator. These two components are adjusted for best frequency response. A5A1C2 and A5A1C3 provide input capacitance adjustment. These two components standardize the attenuator input capacitance so that when a compensated probe is used, its compensation remains constant as the attenuator ranges are switched. A5A1C17 and A5A1C18 provide attenuator compensation for the attenuator rear section. A5A1C11 and A5A1C12 provide input capacitance adjustment. RC networks A5C1/A5R1 and A5C2/A5R2 protect the input FETs (schematic 4) from high input voltages if the attenuator is set to a high sensitivity range.

4-75. VERTICAL PREAMPLIFIER.

4-76. 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.

e. Trigger selection.

4-77. Front-panel controls to the vertical preamplifier determine dc balance, position, calibrated amplification of the amplifiers, choice of display, and internal trigger selection.

4-78. Schematic 4. 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.

4-79. A5A4C1 sets oscilloscope input capacitance to approximately 27 pF. A5A4CR1, A5A4CR2, A5A4CR5, and A5A4CR6 form an over-voltage protection circuit. If the attenuator input voltage exceeds 1.2 volts, these diodes conduct, limiting the voltage applied to the input FET (A5A4Q1). The stray capacitance and A5A4R15 form an RC network which insures that the input impedance of A5A4Q1 is always positive and prevents oscillations if an inductive source is connected to the amplifier. A5A4Q1 and A5A4Q2 are matched FETs connected in a source-follower configuration. A5A4Q1 and A5A4Q2 offer high input impedance thus preventing loading of circuits under test. A5A4Q1 provides impedance matching, and A5A4Q2 provides dc balance for the channel A amplifiers.

4-80. Emitter followers, A5A4Q5 and A5A4Q6, provide low impedance drive to the remaining active circuits. A5R5 is the gain vernier control. When A5R5 is set to the CAL position, all of the signal is coupled from A5A4Q5 to the base of A5A4Q9. If A5A4R5 is moved from the CAL position fully ccw, approximately 33% of the signal gets through, providing the 3:1 vernier range.

4-81. The collector current of A5A4Q5 initiates the channel A sync output. This current is fed to the channel A sync amplifier A5A4Q13, A5A4Q14, and A5A4Q15 (schematic 5). Between A5A4Q9 and A5A4Q10 is the position centering adjust (A5A4R40) which compensates for mismatches in transistors. Also connected between these two transistors is the CAL control, A5R12. A5R12 sets amplifier gain with a known input voltage. Also connected to the emitters of A5A4Q9 and A5A4Q10 are the position controls A5R17A and B, which vary the vertical position display on the CRT. The signal outputs from the collector of A5A4Q9 and A5A4Q10 are fed to channel switches (A5A4Q18 or A5A4Q19) on schematic 5.

4-82. Schematic 5. Channel switches A5A4Q18 and A5A4Q19 are controlled by A5A4Q16. A5A4Q16 is controlled by J-K flip-flop A5A4U2 (schematic 7). A5A4U2 is controlled by the DISPLAY switch. If the channel A display is not used, the base of A5A4Q16 goes high, forward biasing A5A4Q16. This forward biases A5A4CR10 and A5A4CR11. When A5A4CR10 and A5A4CR11 are turned on, A5A4Q18 and A5A4Q19 are turned off, preventing a display on this channel.

4-83. The channel switches for channel B operate in the same manner except there are two sets of

transistors. A5A4Q20 and A5A4Q23 are used for the B POLARITY NORM display. A5A4Q21 and A5A4-Q22 are used for the B POLARITY INVT display. The two transistor groups are controlled by the position of B POLARITY switch A5S1. Depending upon the position of A5S1, +5 volts is applied to the base of the appropriate transistors. The two displays are summed at the collectors of A5A4Q18 and A5A4Q19 and applied to feedback amplifiers A5A4Q24 and A5A4Q25. The A + B bal (A5A4R60) is adjusted for maximum dynamic range of A5A4Q24 and A5A4-Q25 when operated in the A + B mode. Feedback from the collectors of A5A4Q24 and A5A4Q25, through A5A4R66 and A5A4R67, compensates for the collector-to-base capacitance of the transistors. This provides for better frequency response.

4-84. A5A4Q13 sums the current from A5A4Q5 and the channel A sync zero control, A5A4R50. A5A4-Q14 provides a gain of 10. This gain provides 100 mV of signal for each division of display deflection. Emitter follower, A5A4Q15 provides low impedance drive to the trigger circuit (schematic 9).

4-85. The signals from A5A4Q24 and A5A4Q25 are applied to the delay line driver A5A4Q30 and A5A4-Q31 (schematic 6). The RC networks in the emitters of A5A4Q30 and A5A4Q31 provide for delay line compensation.

4-86. Schematic 6. A5A4Q26 and A5A4Q27 are the composite sync take-off transistors. The collector output of A5A4Q26 is fed to shunt feedback amplifier A5A4Q28. Feedback is from collector to base. Emitter follower A5A4Q29 provides low impedance output to drive the trigger circuit. Composite sync adjust, A5A4-R80, controls the output from A5A4Q26 and A5A4-Q27. A5A4R80 is adjusted for a zero-volt output from the composite sync amplifier with zero volts in.

4-87. 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.

4-88. The delay line output signals drive A5A5Q1 and A5A5Q2. Complementary current from A5A5Q1 and A5A5Q2 drives shunt feedback amplifiers A5A5Q3 and A5A5Q4. High frequency adjustment A5A5C3, in the emitters of A5A5Q1 and A5A5Q2, is set for optimum pulse response shaping. Feedback in A5A5Q3 and A5A5Q4 corrects pulse response due to collector-to-base capacitance. The shunt amplifier outputs drive cascode amplifiers consisting of A5A5Q5, A5A5Q6, A5A5Q7 and A5A5Q8. High frequency adjustment, A5A5C9 adjusts the output for optimum pulse response.

4-89. The beam finder (PUSH:BEAM) circuit is applied to A5A5Q5 and A5A5Q6. When the PUSH:BEAM pushbutton is pressed, less current is available to A5A5Q5 and A5A5Q6. With reduced current, the amplification range of the cascode amplifiers is restricted and insures that the signal will always be on the CRT viewing area.

4-90. Schematic 7. The circuits shown on schematic 7 control the channel switch controls (schematic 5), generate chop blanking, and select the internal trigger signal.

4-91. A5A4U1 controls the channel controls and chop blanking. Astable multivibrator A5A4Q32/A5A4Q33 is activated when the base of A5A4Q32 is high. It free-runs at approximately 800 kHz. When the base is low the multivibrator is turned off. A5A4Q34 controls the channel A switch control (schematic 5) and A5A4Q35 controls the channel B switch control.

4-92. Flip-flop A5A4U2 has two outputs and three inputs. When C is high (open) and S is low (ground), A5A4U2 acts as an asynchronous flip-flop and the $\overline{Q}$ output is high. When S is high and C is low, A5A4U2 functions as before and the Q output is high. When both C and S are low, the $\overline{Q}$ and Q outputs are high. When both C and S are high, A5A4U2 functions as a toggled flip-flop and a negative going transition on T will cause the flip-flop to change states.

4-93. A5A4U2 is driven by A5A4U1C and A5A4U1D. In the A, B, and A + B positions of the DISPLAY switch, the A5A4U2 T input is held high because A5A4U1D pin 9 is grounded (held low) by the rear section of A5S1.

4-94. In the A position, the A5A4U2 S input is grounded by the front section of A5S1 and A5A4Q34 is turned on. In the B position, the C input is grounded by the rear section of A5S1 and A5A4Q35 is turned on. In the A + B position, both the S and C inputs are grounded and both A5A4Q34 and A5A4Q35 are turned on.

4-95. In the A + B position of the DISPLAY switch, the rear section of the switch connects +15 volts to the A + B bal adj control A5A4R60 (schematic 5). This permits correction of any dc unbalance caused by turning on the channel A and channel B switches together.

4-96. The astable multivibrator is driven by A5A4-U1A and A5A4U1B. In all positions of the DISPLAY switch (except CHOP), the astable multivibrator is turned off because A5A4U1A is grounded (held low) by the front section of A5S1. In the CHOP position, the ground is removed and pin 2 goes high. During the sweep time the alt trigger is high. Because both inputs are now high, the output (pin 3) is low. With this low, the A5A4U1B output, pin 6, is high and the astable multivibrator is activated.

4-97. In the CHOP and ALT positions, the A5A4U2 S and C inputs are ungrounded and go high. A5A4U1D pin 9 is also ungrounded and goes high. With this condition, changes at pin 10 of A5A4U1D controls the state of A5A4U2.

4-98. In the CHOP position, the astable multivibrator is operating and part of the output is applied to A5A4U1C pin 12. During the time the alt trigger is present, the astable multivibrator output caused A5A4U2 to change state on each negative transition. The net result being that the channel switch controls (schematic 5) change between channel A and channel B at a 400-kHz rate. The astable multivibrator chop blanking output is coupled to the blanking circuits (schematic 19) to blank the CRT during channel switching.

4-99. In the ALT position, the astable multivibrator is again disabled and A5A4U1C is held high. Each negative going transition of the alt trigger causes A5A4U2 to change states. The net result being that the channel switch controls (schematic 5) alternate, at the sweep rate, between channel A and channel B.

4-100. The trig switch A5S2 selects either the channel A trigger (schematic 5) or the composite trigger (schematic 6). The selected trigger is applied to the trigger circuits (schematic 9).

4-101. CHANNEL A OUTPUT AMPLIFIER.

4-102. The amplifier (schematic 8) consists of two paralleled operational amplifiers with common inputs, common feedback resistor (A5A6R8) and a common output. A5A6U1 is an integrated circuit (IC) direct-coupled operational amplifier that provides the required amplification for dc and very low frequency input signals. A5A6Q1-A5A6Q4 is a capacitive coupled operational amplifier that provides amplification for higher frequency signals. A5A6R13 permits precise gain adjustment.

4-103. TRIGGER ASSEMBLY.

4-104. The trigger assembly (schematics 9 and 10) consists of the main and delayed trigger circuits. The main trigger has choice of trigger coupling. Choices are INT/EXT, AC/DC, HF REJ, and LF REJ. The delayed trigger is triggered internally or externally and has choice of AC or DC coupling.

4-105. The main trigger provides two outputs to the main integrator (schematic 11). One output is the main trigger signal and the other is the bright line auto level. The delayed trigger provides a trigger to the delayed integrator (schematic 13).

4-106. Schematic 9. Input to the main trigger circuits is from the vertical preamplifier (schematic 7) in the INT position, and from EXT TRIG INPUT, J5 in EXT position. A6A2S2 provides AC or DC coupling. LF REJ switch, A6A2S3, is used to reject trigger frequency components below 15 kHz. HF REJ switch, A6A2S8, is used to reject trigger frequency components above 30 kHz.

4-107. Network A6A2R2 and A6A2C2 protects FET A6A2Q1 and A6A2Q2 from being over-driven. Diode array A6A2CR1 through A6A2CR4 protects A6A2Q1 or A6A2Q2 from over voltage. These diodes turn on at 1.5 volts, clamping the input signal.

4-108. One half of the trigger circuit amplifies the signal and the other half determines the triggering point set by main TRIGGER LEVEL A6R1. A6A2S4 (main slope) determines which half of the trigger circuit amplifies the signal and which half provides the trigger point. A6A2Q1 and A6A2Q2 are connected in a source-follower configuration, providing high input impedance. A6A2Q3 and A6A2Q4 provide low impedance drive to the rest of the active components. A6A2Q5 and A6A2Q6 provide differential drive to A6A2Q7 and A6A2Q8. The differential drive removes common-mode noise from the signal waveform, A6A2Q7 and A6A2Q8 provide differential drive and pulse shaping to current steering switches A6A2Q17 and A6A2Q18.

4-109. The current steering switches, set-trigger gates and the trigger outputs for the main and delayed triggers are nearly identical so only the main circuits will be discussed. The bright line auto circuit will be explained separately.

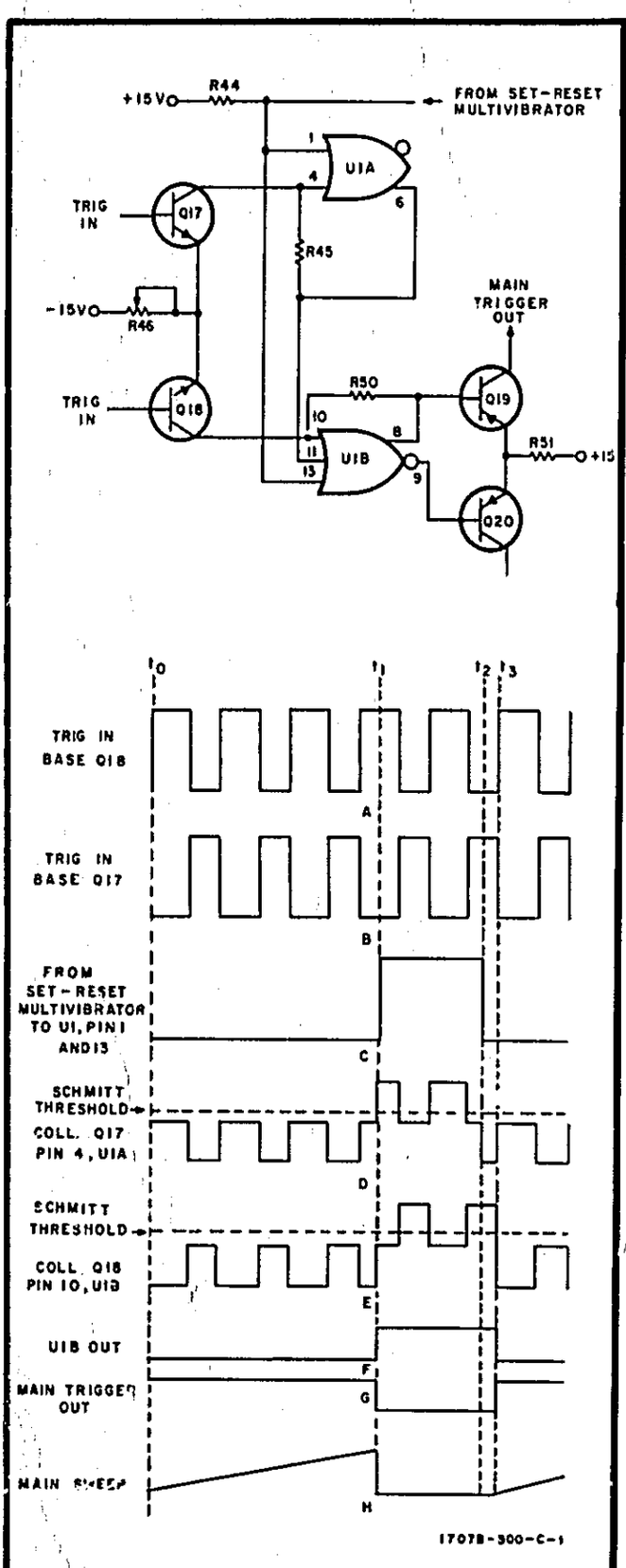
4-110. Schematic 10. The current steering switches, A6A2Q17 and A6A2Q18, are a differentially driven differential amplifier whose static dc level is closely controlled.

4-111. The set-trigger gates, A6A2U1A and A6A2U1B, consists of two OR circuits with biasing and feedback. A step-by-step explanation of the set-trigger gates is given in figure 4-6. The set-trigger gates have two functions; to generate a signal to initiate the sweep upon receipt of a trigger, and to prohibit further triggering during sweep and holdoff. The set-trigger threshold voltage is set by main trigger sensitivity adj A6A2R46.

4-112. The bright line auto circuit consists of A6A2Q21 through A6A2Q24 and Schmitt trigger A6A2Q25 and A6A2Q26.

4-113. When A6A2U1B pin 8 goes low and A6A2Q19 turns on, pin 9 goes high and A2A2Q20 turns off. A6A2Q21 turns on and saturates. If no further trigger signals are applied, A6A2Q21 turns off and the A6A2Q21 collector voltage decays through an RC network consisting of A6A2R54, A6A2C11 and A6A2R55. When the voltage decays to approximately —16 volts, A6A2CR12 turns on. A6A2Q23 and A6A2Q24 turn on and Schmitt trigger A6A2Q25/A6A2Q26 turn on. When the Schmitt trigger turns on, +15 volts is applied through to the main integrator A6A3Q1 (schematic 11).

4-114. The delayed functions are identical to the main trigger except it has no bright line auto circuit. The trigger signal is coupled through A6A2Q29 to delayed integrator A6A4Q1 (schematic 13).



RULES FOR OR GATES

1. If any input is HI, output is HI.
2. If all inputs are LO, output is LO.

SWEEP PERIOD (t_0 to t_1)

1. Main sweep begins (t_0).
2. Trigger inputs (waveforms A and B) from Q17 and Q18 are latched below the threshold (waveforms D and E).
3. All inputs to U1A and U1B are LO.
4. Main trigger output is HI (waveform G).

HOLDOFF PERIOD (t_1 to t_2)

1. The sweep ends (t_1) and the sweep comparator (schematic 11) resets the set-reset multivibrator. Holdoff begins.
2. Pins 1 and 13 of U1 follow the reset level HI.
3. Pins 6 and 8 of U1 go HI (rule 1). This causes:
   a. Q19 turns off, main trigger output (waveform G) goes LO, and the integrator (schematic 11) is disabled.
   b. Pins 4 and 10 of U1 are unlatched. Their levels may now go above and below the threshold level as the trigger input changes (waveforms D and E).

ARMED PERIOD (t_2 to t_3)

1. After holdoff ends, the set-reset multivibrator sets LO.
2. The next LO (from Q17) on the arming input (pin 4) causes the output of U1A to go LO (rule 2) and latch.
3. U1B now has two LO inputs. The next LO from Q18 will cause the output of U1B to go LO (rule 2) and latch.
4. When U1B goes LO (waveform F), the main trigger goes HI (waveform G) and the integrator turns on to reinitiate the entire process.

NOTES

1. Latching occurs whenever the output of an OR gate goes LO. The LO is coupled through R45 (or R50) to the collector of Q17 (or Q18). This assures that the output of the transistor will never rise to the threshold voltage as it varies with the trigger input. Conversely, the circuit unlatches when the output of the OR circuit goes HI. This permits the positive excursions of the trigger waveform to rise above the threshold level.
2. The threshold level of this circuit is critical to proper operation. R3 permits adjustment of the threshold level.

Figure 4-6. Step-by-step Operation of the Set-trigger Gates

4-115. MAIN INTEGRATOR.

4-116. The main integrator (schematic 11) in conjunction with the main sweep time assembly (schematic 12) generates the main sweep applied to the horizontal circuits (schematic 16), provides main blanking to the horizontal mode assembly (schematic 16), 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 first, and sets the set-trigger gates (schematic 10) low to arm for a new trigger.

4-117. A6A3Q1 has two inputs: one is the main trigger through pin K, and the other input is the bright line auto level through A6A3CR1 and A6A3CR2. either input will turn A6A3Q1 on. When A6A3Q1 turns on, the sweep is activated. When A6A3Q1 turns off, the sweep is terminated. When A6A3Q1 turns off (sweep terminated), A6A3Q4 turns on, providing a ground to the vertical preamplifier flip-flop (schematic 7). This ground connection causes the flip-flop to change state, alternating the channel being displayed.

4-118. Main blanking is also controlled when A6A3Q1 turns on. When A6A3Q1 is on, a ground is provided through A6A3CR5 turning the horizontal mode blanking circuit off (schematic 16). This allows the trace to be seen on the CRT. When A6A3Q1 is off, the blanking circuit is on, blanking the CRT.

4-119. When A6A3Q1 is on, current is drawn through A6A3CR9 turning A6A3Q6 off. With A6A3Q6 off, the Miller integrator (A6A3Q7 and A6A3Q8) in conjunction with the main sweep timing components (schematic 12) generates a +12-volt positive-going ramp. The ramp is applied through A6A3Q9 to the horizontal mode assembly (schematic 16).

4-120. The ramp is also coupled back to comparator A6A3Q2 and A6A3Q5. This circuit sets the ramp limits from +2 volts to +12 volts. The 2-volt limit is set by current flow through A6A3R9, A6A3CR12 and A6A3Q5 to ground. The 12-volt limit is set as follows. When the ramp applied to A6A3Q5 reaches 12 volts, A6A3Q5 turns off, allowing A6A3Q2 to turn on. The current flow turns A6A3Q3 on, which applies a low to pin 5 of set-reset multivibrator A6A3U1. When pin 5 goes low, A6A3U1 changes state, making pin 6 go high. This high is applied back to the trigger set-trigger gates A6A2U1A and A6A2U1B (schematic 10). When A6A2U1B (pin 8) goes high, the sweep is terminated by turning A6A3Q1 off.

4-121. If the bright line auto level is operating, the following action will occur. When the ramp reaches 12 volts, A6A3U1 changes state, making A6A3U1A pin 12 go low, forward biasing A6A3CR3. This provides a ground, removing the bright line auto signal from A6A3Q1, terminating the sweep.

4-122. The holdoff time signal is also applied to the set-reset multivibrator. While the holdoff time is in process, pin 1 of A6A3U1A is high. This high causes A6A3U1B, pin 6 output to remain high, locking set-trigger gates A6A2U1A/B high, preventing a sweep. At the completion of holdoff time, A6A3U1A pin 1 goes low, forward biasing A6A2CR9 which applies a low to the set-trigger gates, allowing the trigger circuit to function on the next trigger signal.

4-123. Light driver, A6A1Q1, turns off RESET light A6DS2 when the output from A6A3U1B is high (sweep off).

4-124. MAIN SWEEP TIME ASSEMBLY.

4-125. The main sweep timing components (schematic 12) are tied to the main sweep Miller integrator. Except for the five fastest sweep speeds (0.1 usec through 2 usec) the RC timing is determined by the main sweep time assembly. The capacitor for the five fastest sweep speeds on the main integrator board is A6A3C8 (schematic 11).

4-126. The operational amplifier, A6A5Q1A/B, A6A5Q2 and A6A5Q3, 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 11). Feedback for the amplifier is provided by A6A5R10.

4-127. When main 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.

4-128. DELAYED INTEGRATOR.

4-129. The delayed integrator (schematic 13) in conjunction with the delayed sweep time assembly (schematic 14) generates the delayed sweep applied to the horizontal circuits (schematic 16), and provides delayed blanking to the horizontal mode assembly (schematic 16).

4-130. The set-reset multivibrator terminates the delayed sweep, and starts the armed condition for the delayed set-trigger gates necessary before generation of a new trigger.

4-131. A6A4Q1 has two inputs: one is the delayed trigger through pin K and the other is +15 volts for AUTO operation through A6A4CR1 and A6A4CR2. Either input will turn A6A4Q1 on. Delayed blanking is controlled when A6A4Q1 turns on. With A6A4Q1 on, a ground is provided through A6A4CR5, turning the horizontal mode blanking circuit off (schematic 16).

This allows the trace to be seen on the CRT. When A6A4Q1 is off, the blanking circuit is on, blanking the CRT.

4-132. When A6A4Q1 is on, current is drawn through A6A4CR9 turning off A6A4Q6. With A6A4Q6 off, the Miller integrator (A6A4Q7 and A6A4Q8) in conjunction with the delayed timing components (schematic 14), generates a positive going ramp. The ramp is amplified by A6A4Q9 and applied to the horizontal mode assembly (schematic 16).

4-133. The ramp is also coupled back to comparator A6A4Q2 and A6A4Q5. This circuit sets the ramp limits from +2 volts to +12 volts. The 2-volt limit is set by current flow through A6A4R9, A6A4CR12 and A6A4Q5 to ground. The +12-volt limit is set as follows. When the ramp applied to A6A4Q5 reaches 12 volts, current through A6A4R8 turns on A6A4Q2 which is referenced to +12 volts. This action turns A6A4Q3 on, applying a low to set-reset multivibrator A6A4U1 pin 5. When pin 5 goes low, pin 6 goes high. This high is applied back to A6A2 set-trigger gates A6A2U2A and A6A2U2B (schematic 10). When A6A2U2B (pin 6) goes high, the sweep is terminated by turning A6A4Q1 off.

4-134. In AUTO operation the following action will occur: when the ramp reaches 12 volts, pin 6 of A6A4U1B goes high. This high is applied to pin 2 of A6A4U1A. A6A4U1A pin 12 goes low forward biasing A6A4CR3. This provides a ground, removing the +15V drive to A6A4Q1, terminating the sweep.

4-135. The delayed set-reset multivibrator is controlled by two other inputs. One input is from the comparator Schmitt trigger (schematic 15) and the other from the main integrator set-reset multivibrator (schematic 11). 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 removes the ground path for the +15 volts to A6A4Q1 in the AUTO mode and sets the set-trigger gates (schematic 10) for a new sweep in the TRIG mode.

4-136. The main integrator input terminates the delayed sweep if the main sweep terminates before the comparator Schmitt trigger is activated. A6A4U1B pin 4 goes low and pin 6 goes high resetting the set-trigger gates high for a new sweep. With the trigger gates high, delay integrator A6A4Q1 turns off terminating the sweep.

4-137. DELAYED SWEEP TIME ASSEMBLY.

4-138. The delayed sweep timing components (schematic 14) are tied to the delayed sweep Miller integrator (schematic 13). Except for the two fastest sweep speeds (0.1 and 0.2 usec) the RC timing is determined by the delayed sweep time assembly. The capacitor for the two fastest sweep speeds on the delayed integrator board is A6A4C8 (schematic 13).

4-139. The operation amplifier, A6A6Q1A/B, A6A6Q2 and A6A6Q3, 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 13). Feedback for the amplifier is provided by A6A6R10.

4-140. When delayed 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.

4-141. HOLDOFF AND COMPARATOR.

4-142. The holdoff and comparator assembly (schematic 15) determines the holdoff time between sweeps. The output from the holdoff amplifier is connected to the main integrator set-reset multivibrator. The set-reset multivibrator prevents the trigger gates (schematic 10) and main integrator (schematic 11) from functioning during holdoff time.

4-143. 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, activating the delayed sweep circuits.

4-144. 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 expotential ramp is generated at the collector of A6A7Q4. This ramp is determined by A6A7C5, A6A7C6, A6A7C7, A6A7C10, A6A7C11, A6A7C12, A6A7R13 and TRIGGER HOLDOFF control A6R7. A6A7C5 through A6A7C7 and A6A7C10 through A6A7C12 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 holdoff amplifier A6A7Q7.

4-145. 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.

4-146. Ramp comparator A6A7Q2 and A6A7Q3 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 Schmitt trigger A6A7U1. When A6A7U1 turns on, pin 12 goes from a high to a low state. This output pulse is differentiated by A6A7C9 and A6A7R15 and sent to the delayed integrator set-reset multivibrator as a start pulse

(the start pulse goes from a high to a low and returns to a high state). This start pulse allows the delayed integrator to activate and generate the delayed ramp.

4-147. HORIZONTAL MODE ASSY.

4-148. The horizontal mode assembly (schematic 16) determines the type of display (delayed, mixed or main display) and provides the various blanking signals to the gate assembly (schematic 19).

4-149. Sweep display switch A6A8S1F provides selection of the main sweep, delayed sweep, mixed sweep or external horizontal input to be applied to the horizontal preamplifier assembly. A6A8CR1 prevents the delayed sweep signal from being fed back into the main integrator in the mixed sweep mode. A6A8CR2 and A6A8CR3 prevent the main sweep signal from being fed back into the delayed integrator in the mixed sweep mode.

4-150. The blanking circuit provides main blanking, delayed blanking, mixed blanking and trace intensification to the gate assembly. Inputs from the main and delayed integrators determine the output of the gate assembly. Inputs to this circuit at pins 8 and J are such that when the sweep is off, a high is applied to the input and when the sweep is on, a low is applied.

4-151. Main Sweep Blanking. When the main sweep is off, a high is applied to pin 8 from A6A3Q1 in the main integrator. This high reverse biases A6A8CR4 and blanking current flows through A6A8CR5 to the gate assembly. A ground is provided by sweep display switch A6A8S1R to the anodes of A6A8CR6 and A6A8CR7, preventing the delay blanking circuit from functioning in the main sweep mode.

4-152. Mixed Sweep Blanking. Blanking current in the mixed sweep mode is turned off by the main time base and turned on by the delayed time base. When the main sweep is on, a low is applied to pin 8. This low forward biases A6A8CR4 and main blanking current is shunted to the main integrator. This low also turns A6A8Q1 off, which applies a low to A6A8U1A pin 2, causing pins 10 and 11 to go high. The high potential at pins 10 and 11 cause pin 8 of A6A8U1B to go high. This high turns A6A8Q2 on, applying a ground potential to the anodes of A6A8CR6 and A6A8CR7 preventing delayed blanking current to the gate assembly.

4-153. When the delayed sweep turns on, a low is applied to pin J. This low is differentiated by A6A8C3 and A6A8R9. The low is then applied to A6A8U1C pins 3 and 4. With pin 5 of A6A8U1C high and pins 3 and 4 of A6A8U1C low, pin 6 goes high. This high is applied to pin 9 of A6A8U1B. With pins 10 and 11 high, and pin 9 of A6A8U1B high, pin 8 of A6A8U1B goes low, turning A6A8Q2 off. When A6A8Q2 turns off, A6A8CR6 is forward biased and the blanking current is shunted to the delayed integrator.

4-154. When the delayed sweep terminates, a high is applied to pin J and A6A8CR6 is reverse biased. Blanking current then flows through A6A8CR7 to the gate assembly, blanking the CRT. When the main sweep terminates, a high is applied to pin 8 This reverse biases A6A8CR4 and main blanking current flows to the gate circuit.

4-155. This high also turns A6A8Q1 on. When A6A8Q1 turns on, a high is applied to pins 2 and 13 of A6A8U1A. This high causes pin 12 of A6A8U1A to go low taking pins 10 and 11 of A6A8U1B low. When pins 10 and 11 go low, pin 8 of A6A8U1B goes high turning on A6A8Q2. When A6A8Q2 turns on, A6A8CR6 and A6A8CR7 are reverse biased removing the delayed sweep blanking current.

4-156. Delayed Sweep Blanking. In the delayed sweep mode, sweep display switch A6A8S1R applies a low to pin 1 of A6A8U1A. Pins 2 and 13 of A6A8U1A are low because the main sweep input has turned A6A8Q1 on. This condition causes pin 12 of A6A8U1A to go high, which takes pins 10 and 11 of A6A8U1B high. With pins 10 and 11 high, pin 8 goes low turning A6A8Q2 off. With A6A8Q2 off A6A8CR6 is forward biased and the delayed blanking current is shunted to the delayed integrator. When the delayed sweep terminates, A6A8CR6 is reverse biased and blanking current flows through to the gate circuit.

4-157. Trace Intensification. Trace intensification is provided when the delayed TIME/DIV switch is moved from the OFF position while in MAIN SWEEP mode. A6A8CR10 is normally on in the OFF position. When the delayed TIME/DIV switch is moved from the OFF position, A6A8CR10 turns off. Current flows through A6A8R11 and A6A8CR9 to the gate assembly. This current dims the trace but is insufficient to blank the trace. When delayed sweep turns on, the increase in current flow goes through A6A8CR8 to the delayed integrator circuit, and the trace intensity returns to a normal level which is trace intensification.

4-158. HORIZONTAL PREAMPLIFIER ASSEMBLY.

4-159. The horizontal preamplifier assembly (schematic 17) amplifies the sweep signal, provides sweep length adjustments, and controls the trace horizontal position. Trace magnification (X10) and trace centering is also provided by this circuit. Pins D through U of A6A9XA1 and pin D through U of A6A9XA2 (schematic 17) are shorted together. These connections provide voltage distribution to the rest of the horizontal circuits and electrical connections between trigger assembly A6A2 and the horizontal circuits.

4-160. The sweep signal is applied to the input of A6A9Q1. A6A9Q1 is balanced by temperature compensation amplifier A6A9Q2. Differential amplifier A6A9Q3/A6A9Q4 provides drive to the horizontal output amplifier. When the SWP MAG switch is set to X10, the gain of the differential amplifier is increased by a

factor of 10. A6A9R21 (X10 gain adj) is set for a gain increase of exactly 10. Mag adj, A6A9R2 is used to center the X10 display. When the PUSH:BEAM switch is engaged, less current is supplied to the differential amplifier, reducing its gain and assuring that the beam is not deflected off screen.

4-161. The horizontal output amplifier (schematic 17) is a class B amplifier used to drive the CRT horizontal plates. 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.

4-162. EXTERNAL HORIZONTAL AMPLIFIER.

4-163. The amplifier (schematic 18) consists of three cascaded differential amplifiers, a controlled current source and a single-ended emitter follower output stage. The input of the first stage, FET differential amplifier A9Q1/A9Q2, is driven single-ended from the output of a compensated voltage divider consisting of A9R1, A9C1, A9R2 and A9C2. The input circuit provides the required high impedance and voltage step-down. A9CR1 and A9CR2 limit the voltage on the gate of A9Q1 between +15-volts and —15-volts.

4-164. Differential amplifiers A9Q3/A9Q4 and A9Q5/A9Q6 are driven differentially from the output of A9Q1/A9Q2. The differential drive removes common mode noise from the signal waveforms and increases the amplifier bandpass.

4-165. Controlled current sources A9U1 provides temperature compensation for the amplifier by maintaining equal currents into the two inputs. Normally, a change of current in A9Q3 will cause an opposite change in current in A9Q5 which, in turn, causes a change in the output voltage. When the current into A9U1 changes, the current at A9U1 pin 8 changes a like amount and direction by action of the controlled current source. This change opposes the change in A9Q5 and thus provides compensation.

4-166. A9Q5 drives emitter follower A9Q7 which provides the required single-ended low impedance output. Amplifier gain is adjusted by varying cal adj A9R15. A 10:1 ratio gain vernier is provided by ext horiz VERNIER R6.

4-167. GATE ASSEMBLY.

4-168. The gate assembly (schematic 19) circuit sums current signals from five sources and develops 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 blanking current from the storage circuits.

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

4-170. 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 (A4Q3 through A4Q6). The output amplifiers amplify the input signal to the CRT control grid controlling the CRT trace intensity. A positive-going level will increase the conduction of the CRT and brighten the display.

4-171. Emitter-coupled multivibrator A4Q7 and A4Q8 provide a 1-kHz, 1-volt square wave calibration output. A4Q9 amplifies the square wave. Cal ampl adj A4R22, provides amplitude adjustment of the calibration output signal.

4-172. STORAGE CIRCUITS.

4-173. Pulse Generator A8U7. Integrated circuit A8U7 generates a pulse of fixed amplitude and width. The pulse repetition rate is a function of the RC time constant of A8R1, A8R2, and A8C1. A8U7 generates a pulse when pin 6 reaches approximately 2/3 of the voltage at pin 8. The pulse cuts off when pin 6 drops to approximately 1/3 of the voltage at pin 8.

4-174. The pulse repetition rate of A8U7 is controlled by the front panel STORE TIME or PERSISTENCE controls. With the STD or FAST mode switches pressed, PERSISTENCE controls the pulse repetition rate. With the STORE pushbutton pressed, STORE TIME controls the pulse repetition rate. Each pulse performs an erasing function on the storage mesh. Decreasing pulse repetition rate increases display time. At control settings below 10V, A6A11VR1 or A6A11VR2 cuts off, connecting the associated resistor in series with the control voltage to further reduce pulse repetition rate (increasing display persistence). With the CONV pushbutton pressed, A8U7 is disconnected from any control source, and the pulse generator cuts off.

4-175. Flood Gun Driver. Logic gates A8U5B, A8U5A, and A8U3A couple the pulse train from A8U7 to amplifier A8Q13/A8Q16 during the store mode of operation. The three logic gates stop the pulse train in the other storage switch settings and during the erase cycle. In all modes except store, A8Q13 is off. Current through A8R4, A8R5, an

A8R6 establishes a bias voltage on the base of A8Q16. This voltage provides normal electron flood. Emitter follower A8Q16 presents a low impedance to the flood gun anode.

4-176. In the store mode, pulses from A8U7 turn A8Q13 on and off. This varies the potential on the flood gun anode and turns the flood guns on and off. By reducing the on-time of the flood guns, brightness of the stored trace is reduced but the time that a trace will be stored before fade-positive occurs is increased.

4-177. Storage Mesh Driver. When the CONV switch is open, pin 11 is at +5V through A8R40. This +5V turns on A8Q6 which turns on A8Q7. The current through A8Q7 divides between A8CR1 and A8CR2. The current through A8CR2 establishes a voltage across A8R19 which is applied to the storage mesh. With A8Q7 off, the storage mesh receives —50V through A8R23, stopping flood gun electrons and causing the CRT to operate as a conventional, nonstorage oscilloscope. With increasing positive voltage on the storage mesh, persistence or storage time increases within the CRT. Diodes A8CR3 through A8CR6 are protective diodes for A8Q10 and A8Q9.

4-178. The current through A8CR2 is varied according to the current through A8CR1. The drain through A8CR1 is controlled as follows: A8U4C and A8U4D form a flip-flop memory circuit. When the STD or FAST pushbutton is pressed, the flip-flop will turn on either A8Q3 or A8Q4 to enable control by one of the two erase potentiometers (A8R15 or A8R16). Pulses from A8U7 are applied through A8U1C and A8U1B to switch A8Q5 on and off. When on, A8Q5 absorbs all current through A8CR1. When A8Q5 is off, current through A8CR1 is controlled by adjustment of the selected erase potentiometer. The selected erase potentiometer (A8R15 or A8R16) is adjusted to give the proper storage mesh potential for the operating mode selected.

4-179. Collimator Drive. A8Q11 is forward biased by A8R37 and A8CR8. Current from A8R38 flows through A8Q11 and divides between A8R36 and the low output side of flip-flop A8U4D/A8U4C, depending on whether STD or FAST mode is selected. The voltage on the collector of A8Q11 is applied to the collimator through emitter follower A8Q12. Potentiometers A8R29 and A8R30 are adjusted in their respective modes for proper collimation (even spread of flood gun electrons over the surface of the CRT). Astable multivibrator A8U6B/A8U6C is cut off; it only operates during the erase cycle.

4-180. Blanking Circuit. Amplifier A8Q14/A8Q15 supplies current to the gate amplifier. Depending on the conditions applied to the logic circuits, current from A8Q14/A8Q15 will either enable the gate circuit for control by the oscilloscope sweep circuitry, or disable the gate circuit to blank the CRT regardless of the other gate inputs. When A8U1A gets a low at any one of its inputs (CONV, STD, or FAST pressed), its output is high. This high is applied to one input of A8U4A. If the other input of A8U4A is high (erase cycle not in progress), the output of A8U4A is low. The low is inverted by A8U4B, turning on A8Q14 and turning off A8Q15. The negative voltage through A8R53 enables the gate circuit. When STORE is selected or during the erase cycle, A8Q14 is cut off, A8Q15 is turned on, and the collector current from A8Q15 disables the gate circuit.

4-181. Erase Circuits. In FAST or STD operation, the PUSH:ERASE pushbutton may be pressed to erase the CRT. Normally A8Q1 and A8Q2 are conducting and the output of A8U3B is high. When PUSH:ERASE is pressed, A8Q1 is turned off for a time determined by the time constant of A8R42 and A8C11. This supplies positive voltage to turn on A8Q8. When A8Q8 turns on, A8Q9 saturates, supplying +160V to prime the storage mesh for even erasure.

4-182. When A8Q1 switches off, A8U3B output switches low. This low is inverted by A8U6A and enables astable multivibrator A8U6B/A8U6C. The output of the multivibrator varies current through A8Q11, defocusing the collimator to aid in obtaining even erasure of the CRT.

4-183. The low from A8U3B also disables A8U1C to stop storage mesh control pulses, and disables A8U4A to blank the CRT write gun. A8U5A and A8U5D are required only when erasing during STD-STORE or FAST-STORE operations (two buttons pressed at the same time). The low to A8U5A cuts off the pulses from A8U7 to the flood gun anode. In the other writing modes, the pulses are cut off by the high applied to A8U3A. In the store mode, the PUSH:ERASE pushbutton is disabled. The low from A8U3B forces A8U5D to cut off storage mesh pulses through A8U1B. In other modes, these pulses are cut off through A8U1C.

4-184. When A8Q1 turns on again, A8Q2 is cut off to extend the erasure low on A8U3B for the time constant of A8R45 and A8C12. A8Q8 and A8Q9 turn off, allowing A8Q10 output to be set by A8R15 or A8R16 and erase all information on the storage mesh.

4-185. +5V Power Circuit. When operating power is turned off, A8CR7 and A8C6 slow the turn-off of all +5V circuits on assembly A8. This controlled turn-off is done to prevent generating an erase cycle when the oscilloscope power is turned off.

4-186. OPERATING MODES.

4-187. Store. In the store mode, the flood gun anode is pulsed to view the stored display. A8Q5 is forward biased and the storage mesh potential is held low because the current from A8Q7 is divided between A8R17 and A8R19. The CRT write gun is disabled.

4-188. Conv. In the conventional, nonstorage mode, A8Q6 and A8Q7 are cut off and the storage mesh potential goes to —50V through A8R23, eliminating the storage capability. All drive is disconnected from A8U7, stopping its pulse train. The CRT write gun is enabled.

4-189. STD. In the standard writing mode, the flood gun is turned on. The storage mesh potential is controlled according to adjustment of A8R15 and PERSISTENCE potentiometer R8. The collimator controls flood beam shape according to the adjustment of A8R30. The gate circuit is enabled.

4-190. Fast. In the fast writing mode, all circuits function the same as in standard writing except that the storage mesh potential is governed by adjustment of A8R16 and collimation potential is set by adjustment of A8R29.

4-191. HIGH VOLTAGE POWER SUPPLY.

4-192. The high voltage power supply (schematic 22) 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.

4-193. 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 A3Q1, turning A3Q1 on harder. The signal developed on pins 1 and 2 is stepped up by A3A4A1T1, rectified and filtered.

4-194. Dc 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 —1350 volts to the cathode. Feedback is coupled through RC network A3A4R5, A3A4R4, R2 (FOCUS), A3A4R3 and A3A4C2 to the base of A3A4Q1. A3A4R1, A3A4R2, R2 and A3A4R3 form a reference network. Any variation in feedback voltage level is amplified by Darlington amplifier A3A4Q1 and A3A4Q2 and applied to the base of A3A4Q3 to re-establish the proper voltage level of —1350 volts.

4-195. 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 A3A4Q1 and A3A4Q2. 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 and A3A4C4 provide high frequency roll-off compensation.

4-196. A3A4CR7 and associated circuitry provide —1400 volts to the CRT control grid. Blanking is provided to the CRT control grid 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.

4-197. 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 1750 volts between pins 9 and 5. This signal is applied to high voltage multiplier circuit A5, which is a quadrupler circuit. The multiplier assembly rectifies the input voltage, inverts it, and multiplies it to approximately +7000 volts to drive the CRT post accelerator.

4-198. LOW VOLTAGE POWER SUPPLY.

4-199. Schematic 23 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 1703A. 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.

4-200. 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.

4-201. Z1 rectifies the incoming signal. A2C1 and A2C2 are ripple filter capacitors. A2R1 and A2CR1 provides a trickle charge of 40 milliamperes to the battery in AC LINE operation. A2R3, A2R4 and A2C3 provide the line sync signal.

4-202. 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 and A3A1R3 form a ripple filter. A3A1R5 and A3A1CR2 form the full charge circuit for the battery. When the instru-

ment is off, approximately 400 milliamperes is applied to charge 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.

4-203. 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. J4 provides for DC LINE input. This input should be limited between 11.5 to 36 volts, 18 watts maximum.

4-204. 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 A4R30, A4CR12 and 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. DS1, A4R29 and A4C13 form a relaxation oscillator which causes DS1 to flash. This is an indication that the battery is discharged and further operation may damage the battery.

4-205. Schematic 24 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 reverse.

4-206. The A3A2 low voltage converter changes the input dc voltage to usable dc voltages of different levels. The low voltage converter assembly also contains the regulator network which controls the converter output.

4-207. 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 23) opens. If a dc input over 40 volts is connected, A3A1CR3 conducts which turns on A3A1SCR1 and opens F1 (schematic 23).

4-208. If the regulated +15-volt supply goes above approximately 20 volts, bidirectional diode A3A1CR5 turns on. A3A1CR5, A3A1C2 and A3A1R9 form a relaxation oscillator whose output is coupled across A3A1T1, rectified by A3A1CR4 and filtered by A3A1C3. This rectified voltage turns A3A1SCR1 on, opening line fuse F1.

4-209. A3A2Q2 with associated circuitry form the low voltage converter. This circuit changes the incoming dc voltage to useable dc voltages of different magnitudes. A3A2R2 and A3A2VR2 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 A3A2Q2. This current turns on A3A2Q2 allowing current to flow in the primary windings of A3A2T1 and A3A3T1 (schematic 25). As the current in these windings increases, primary winding 1 and 2 (A3A2T1) induces voltage into pins 3 and 4 such that A3A2Q2 conducts 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 A3A2Q2 turns off, an open circuit condition on pins 1 and 2 of A3A3T1 (schematic 25) exists and the energy stored in the primary windings of A3-A3T1 causes a fly back voltage to appear on the secondaries of A3A3T1. This allows the secondary circuits to conduct, charging the capacitors to the required dc voltages.

4-210. 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.

4-211. A3A2VR3 is a protection diode protecting A3A2Q2 from emitter-to-collector breakdown. A3A2-C1 and A3A2C2 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.

4-212. 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 of 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 low voltage rectifier and filter network.

4-213. 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 and A3A2-R4. The different current, which results in a small voltage variation, is applied to operational amplifier A3-A2U1 which is connected in the inverting 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.

4-214. If +15 volts decreases, the voltage applied to pin 2 decreases causing an increase at the output of A3A2U1. 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.

4-215. A3A2CR1 and A3A2CR2 protect A3A2U1 input. A3A2C10, A3A2R13 and A3A2C12 provides frequency compensation. A3A2U1 operates open loop dc and closed loop ac. The closed loop feedback is provided by A3A2C13 and A3A2R14.

4-216. Schematic 25 contains the low voltage rectifier and filter networks, the low voltage mother board filter networks and the fuse protection circuits for the low voltage power supply.

4-217. A3A3CR1 through A3A3CR8 provides rectification of the input signal from the low voltage converter (schematic 24). A3A3C1 through A3A3C10 provide appropriate filtering.

4-218. A3A1C4 through A3A1C6 and A3A1C8 A3A1C11 provide further filtering to the low voltage power supplies. A3A1R10 through A3A1R18 and A3-A1R20 are bleeder resistors that discharge the capacitors on the low voltage rectifier and filter and the low voltage mother board.

4-219. The A4 gate assembly provides fuse protection, filtering, and distribution of the low voltage to the horizontal module and the vertical module.

Table 5-1. Recommended Test Equipment

Instrument Type	Recommended Model	Required Characteristics	Required For
Voltmeter Calibrator	HP Model 745A	Voltage: 5 mV to 100V Accuracy: to 0.1%	P,A
Oscillator	HP Model 204C	Frequency: 100 kHz Voltage Output: 15 mV	A
Time-mark Generator	HP Model 226A	Time Marks: 0.1 usec to 2 sec in 1, 2, 5 sequence	P, A
Square-wave Generator	HP Model 211B	Frequency: 100 kHz Risetime: <5 ns	P
Multifunction Digital Voltmeter	HP Model 3465A	Voltage Range: 1000V Accuracy: ±0.1% Resistance Range: 10 megohms Accuracy: ±0.1%	P, A, T
Constant-amplitude Signal Generator	Customer's Choice	Frequency: 50 kHz to 75 MHz Voltage Output: 50 mV to 5V p-p	P
LC Meter	Customer's Choice	Range: 30 pF	A
50-ohm Feedthrough Termination	HP Model 10100C	Resistance: 50 ohms	P, A
50-ohm BNC Cable (1)	RG 213	50-ohms	P, A
BNC Cable (2)	HP Model 10501A Cable Assembly	44 in.	P, A
BNC Cable (2)	HP Model 10502A Cable Assembly	9 in.	P, A
Banana Jack to BNC Adapter	HP Model 10110A	Banana Jack to BNC	P, A
BNC to Binding Post Adapter	HP Model 10111A	BNC to Binding Post	P, A
Test Leads	HP Model 11002A	Test Leads	P, A, T
RF Voltmeter	HP Model 3406A	Range: 35 mV Accuracy: ±3%	P
10:1 Divider Probe	HP Model 10006D	Divide Ratio: 10:1	A
1000:1 Divider Probe	HP Model K05-3440A	Divide Ratio: 1000:1	A
Monitor Oscilloscope	HP Model 1740A	Bandwidth: 50 MHz	A,T
50-ohm Sampling Tee	HP Model 11063A		P
Service Kit	HP Part No. 01701-68701	Extender Boards and Board Puller	P, A, T

7000-A-19A

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

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains step-by-step procedures for checking the instrument specifications as given in table 1-1 of this manual. The performance check procedure gives troubleshooting suggestions in case the instrument fails to meet any specification tested. A table (performance check record) is provided at the end of the performance check for recording the measurements obtained in the first running of the procedure. This record may be used to compare measurements taken at later dates with the original. The procedures for making all internal adjustments are covered in paragraphs 5-128 through 5-239. A photograph showing the locations of all internal adjustments controls is presented in figure 5-22.

5-3. TEST EQUIPMENT.

5-4. Test equipment required for procedures in this section is listed in table 5-1. Test equipment equivalent to that recommended may be substituted, provided it meets the required characteristics listed in the table. For best results, use recently calibrated test equipment.

5-5. PERFORMANCE CHECK.

5-6. The following subparagraphs describe procedure to determine whether or not the instrument is operating within the specifications of table 1-1. This check can be used as part of an incoming inspection, as a periodic operational test, or to check calibration after repairs or adjustments have been made. Any one of the following checks can be made separately if desired.

5-7. The first time the performance check is made, enter the results on the performance check record at the end of the procedure. Remove the record from the manual and file it for future reference. Be sure to include the instrument serial number on the record for identification.

5-8. FRONT PANEL ADJUSTMENTS.

5-9. Set the instrument up and perform initial adjustments outlined in Section III before proceeding with the performance checks or adjustment procedures.

5-10. FRONT PANEL SETTINGS.

5-11. Begin each performance test and adjustment procedures with the control settings listed below. 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 settings.

PERSISTENCE	fully ccw
INTENSITY	fully ccw
WRITING SPEED	STD
CHANNEL A VOLTS/DIV	.01
channel A coupling	AC
channel A vernier	CAL
channel A POSITION	as required
DISPLAY	A
trig	NORM TRIG
CHANNEL B VOLTS/DIV	.01
channel B coupling	AC
channel B vernier	CAL
channel B POSITION	as required
B POLARITY	NORM
HORIZONTAL POSITION	as required
main VERNIER	CAL
delayed VERNIER	CAL
sweep display	MAIN SWEEP
main TIME/DIV	5 uSEC
delayed TIME/DIV	OFF
main AUTO/NORM	AUTO
delayed AUTO/TRIG	AUTO
main INT/EXT	INT
delayed INT/EXT	INT
main AC/DC	DC
delayed AC/DC	DC
main slope	+
delayed slope	+
main TRIGGER LEVEL	as required
delayed TRIGGER LEVEL	as required
TRIGGER HOLDOFF	NORM
SWP MAG	X1

5-12. PERFORMANCE TESTS.

5-13. DEFLECTION FACTOR.

5-14. Specification. Ranges: from 10mV/div to 5 V/DIV (9 ranges) in 1, 2, 5 sequence. Accuracy: ±3% with vernier in CAL position. Vernier: continuously variable between all ranges, extends maximum deflection factor to at least 12.5 volts/div. VERNIER UNCAL light indicates when vernier is not in CAL position.

5-15. Description. The deflection factor is checked by applying a 400-Hz, voltage-calibrated signal to the input. The display signal is compared against the voltage standard.

5-16. Equipment.

a. Voltmeter Calibrator.

b. Banana Jack to BNC Adapter.

c. BNC Cable, 44 in.

5-17. Procedure.

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

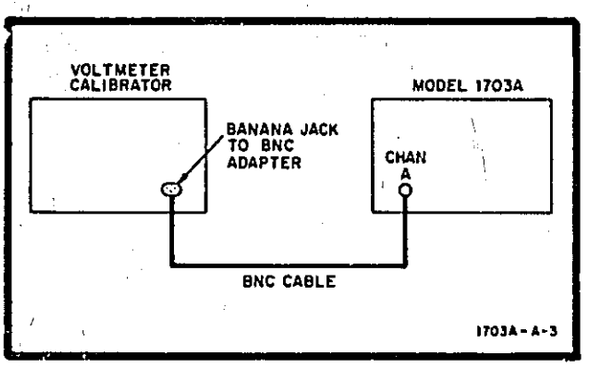


Figure 5-1. Deflection Factor Test Setup

b. Set Model 1703A main TIME/DIV to .5 mSEC.

c. Set voltmeter calibrator controls for 50-mV p-p output signal.

d. Observe CRT. Display should be 5 vertical div ±3%

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

f. Set voltmeter calibrator output for 30V.

g. Set CHANNEL A VOLTS/DIV to 5.

h. Rotate channel A vernier control fully ccw. VERNIER UNCAL light turns on. Display reduction should be equal to or less than 2.4 div.

i. Rotate channel A vernier control fully cw into CAL detent.

j. Connect voltmeter calibrator output to channel B INPUT.

k. Set DISPLAY to B.

l. Repeat steps b through i for channel B.

m. Remove test equipment.

Table 5-2. Deflection Factor Accuracy

Voltmeter Calibrator Settings (Volts p-p)	VOLTS/DIV Settings	Vertical Display (Div)
0.1	.02	5 ±0.15
0.3	.05	6 ±0.18
0.5	.1	5 ±0.15
1	.2	5 ±0.15
3	.5	6 ±0.18
5	1	5 ±0.15
10	2	5 ±0.15
30	5	6 ±0.18

n. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A and B VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC

o. Refer to schematic 3 if any deflection factor is not within specifications.

5-18. CALIBRATOR

5-19. Specification. Type: 1-kHz ±10% square wave. Voltage: 1V p-p ±1%.

5-20. Description. The frequency is checked by the Model 1703A. The calibrator amplitude is checked by comparing the calibrator amplitude against a known 0.1%, 1V p-p signal.

5-21. Equipment.

a. Voltmeter Calibrator.

b. Banana Jack to BNC Adapter.

c. BNC Cable, 44 in.

d. Test Lead.

5-22. Procedure.

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

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV 1
channel A coupling ..... DC
main TIME/DIV..... .2 mSEC

c. Set voltmeter calibrator controls for 1V p-p output signal.

d. Adjust channel A vernier so display is exactly 6 div of vertical amplitude.

e. Disconnect voltmeter calibrator.

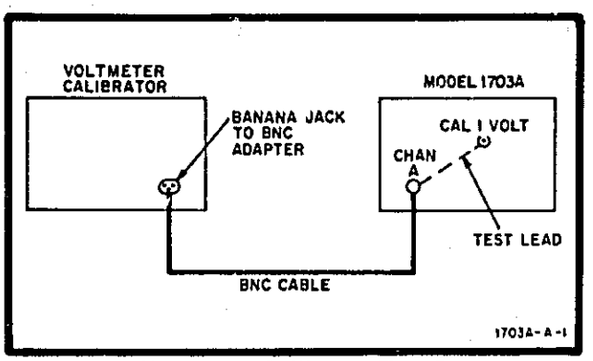


Figure 5-2. Calibrator Test Setup

f. Connect CAL 1 VOLT output to channel A INPUT with test lead. Display should be 6 div of vertical amplitude ±0.06 div and 1 kHz ±10%.

g. Remove test lead.

h. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
channel A vernier..... CAL
main TIME/DIV..... 5 uSEC

i. Refer to paragraph 5-206 and schematic 19 if test limits are incorrect.

5-23. RISETIME.

5-24. Specification. Risetime is less than 10 ns; direct or with 10:1 divider probe. Risetime is measured from 10% to 90% with 6-div input step from a terminated 50-ohm source.

5-25. Description. A 100-kHz signal, with a risetime of less than 5 ns, is applied to the vertical input of the input. The risetime displayed on the CRT is then checked to see that it is less than 10 ns. This measurement is made direct or with 10:1 divider probe.

5-26. Equipment.

a. Square-wave Generator.

b. 50-ohm Feedthrough Termination.

c. BNC Cable, 44 in.

5-27. Procedure.

a. Connect instruments as shown in figure 5-3.

b. Set main TIME/DIV to .1 uSEC.

c. Set square-wave generator controls for 60-mV, 100-kHz output signal.

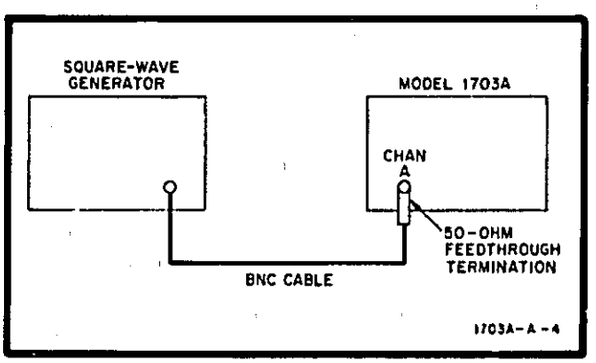


Figure 5-3. Risetime Test Setup

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

e. Set SWP MAG to X10.

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

g. Connect square-wave generator output to channel B INPUT.

h. Set DISPLAY to B.

i. Repeat steps b through f for channel B risetime.

j. Remove test equipment.

k. To return to initial settings, set Model 1703A controls as follows:

DISPLAY..... A
main TIME/DIV..... 5 uSEC
SWP MAG..... X1

l. Refer to paragraph 5-221 and schematic 3, 4, 5 and 6 if risetime specification is not met.

5-28. BANDWIDTH.

5-29. Specification. (Direct or with 10:1 divider probe, 3 dB down from 50-kHz, 6-div reference signal from a terminated 50-ohm source.) DC coupled: dc to 35 MHz, AC coupled: 10 Hz to 35 MHz.

5-30. Description. To check bandwidth, a constant-ampltiude signal generator is used to apply a 6-div, 50-kHz reference signal to the Model 1703A input. The constant-amplitude signal generator frequency is increased to 35 MHz. The signal amplitude displayed on the CRT must always be equal to or greater than 4.3 div to meet bandwidth specifications. This measurement is made direct but may be made with 10:1 divider probe.

5-31. Equipment.

a. Constant-amplitude Signal Generator.

b. RG 213 Cable.

c. 50-ohm Feedthrough Termination.

5-32. Procedure.

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

b. Set constant-amplitude signal generator controls for 60-mV, 50-kHz output signal.

c. Adjust main TRIGGER LEVEL for stable display.

d. Adjust constant-amplitude signal generator voltage vernier for 6-div vertical display.

e. Set constant-amplitude signal generator controls for frequency output of 35 MHz. Vertical display on CRT should be equal to or greater than 4.3 div.

f. Connect constant-amplitude signal generator to channel B.

g. Set DISPLAY to B.

h. Repeat steps b through e for channel B.

i. Remove test equipment.

j. To return to initial settings, set DISPLAY to A.

k. Refer to schematics 3 through 7 if either channel does not meet bandwidth specification.

5-33. INPUT RESISTANCE.

5-34. Specification. The input is 1 megohm ±2% shunted by approximately 27 pF.

5-35. Description. The input resistance is measured with an ohmeter to verify resistance.

5-36. Equipment.

a. Multifunction Digital Voltmeter.

b. BNC Cable, 44 in.

c. Banana Jack to BNC Adapter.

5-37. Procedure.

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

b. Set Model 1703A controls as follows:

channel A coupling	DC
channel B coupling	DC

c. Set multifunction digital voltmeter controls to measure 10 megohms.

d. Connect BNC cable to channel A INPUT. Multifunction digital voltmeter should indicate 1 megohm ±2%.

e. Check all CHANNEL A VOLTS/DIV ranges per table 5-3.

f. Move BNC cable from channel A to channel B. Multifunction digital voltmeter should indicate 1 megohm ±2%.

g. Check all CHANNEL B VOLTS/DIV ranges per table 5-3.

h. Remove test equipment.

i. To return to initial settings, set Model 1703A controls as follows:

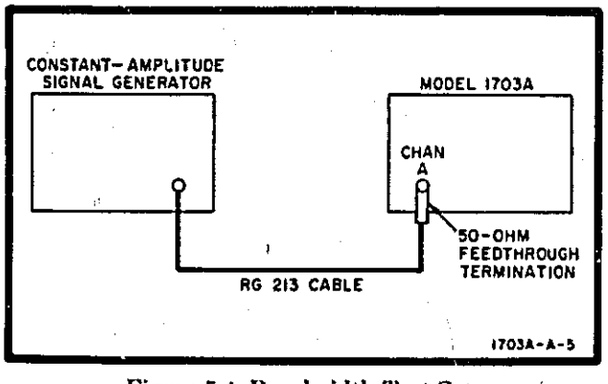


Figure 5-4. Bandwidth Test Setup

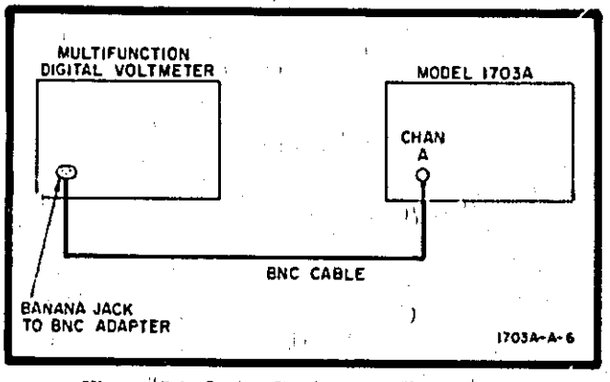


Figure 5-5. Input Resistance Test Setup

CHANNEL A VOLTS/DIV ..... .01
CHANNEL B VOLTS/DIV ..... .01
channel A coupling ..... AC
channel B coupling ..... AC

j. Refer to schematic 3 and 4 if input resistance specification is not met.

Table 5-3. Input Resistance

VOLTS/DIV Setting	Resistance		
	Min	Actual	Max
.02	0.98 megohm		1.02 megohm
.05	0.98 megohm		1.02 megohm
.1	0.98 megohm		1.02 megohm
.2	0.98 megohm		1.02 megohm
.5	0.98 megohm		1.02 megohm
1	0.98 megohm		1.02 megohm
2	0.98 megohm		1.02 megohm
5	0.98 megohm		1.02 megohm

5-38. COMMON MODE REJECTION RATIO (CMRR).

5-39. Specification. Frequency: dc to 1 MHz. CMRR: 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 div.

5-40. Description. This measurement is made by applying identical signals to channel A and channel B and operating in the A — B (B POLARITY INVT) mode. The signal display on the CRT will be the common mode signal.

5-41. Equipment.

a. Constant-amplitude Signal Generator.

b. BNC Cable, 9 in.

c. BNC Tee.

d. RG 213 Cable.

e. 50-ohm Feedthrough Termination.

5-42. Procedure.

a. Connect instruments as shown in figure 5-6.

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .05
main TIME/DIV..... 5 uSEC

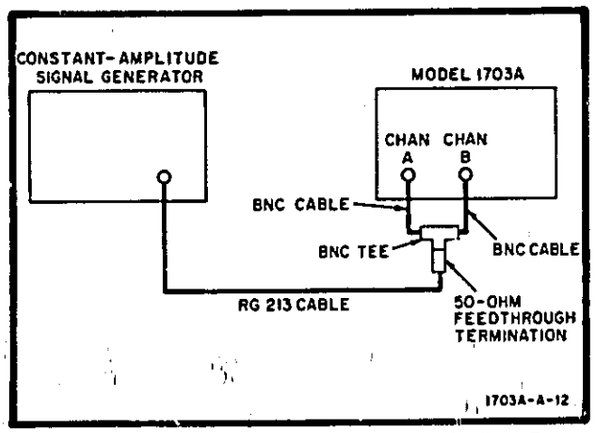


Figure 5-6. Common Mode Rejection Ratio Test Setup

c. Set constant-amplitude signal generator controls for 50-kHz, 0.3V p-p signal as viewed on Model 1703A CRT.

d. Set DISPLAY switch to A + B.

e. Set CHANNEL A VOLTS/DIV to .01.

f. Set B POLARITY to INVT. Display should be less than 0.3 div.

g. Increase constant-amplitude signal generator frequency to 1 MHz. Display should be less than 0.3 div. For all other vertical sensitivity ranges (VOLTS/DIV), 30 div of signal at 1 MHz applied to channel A and channel B INPUT will result in a deflection factor equal to or less than 3 div. Deflection factor is with channel A and channel B verniers adjusted for optimum CMRR.

h. Remove test equipment.

i. To return to initial settings, set Model 1703A controls as follows:

DISPLAY..... A
B POLARITY..... NORM
channel A vernier..... CAL
channel B vernier..... CAL

j. Refer to schematics 3 through 6 if CMRR specification is not met.

5-43. CASCADED AMPLIFIER GAIN.

5-44. Specification. Amplifier gain shall be 10 ±3%.

5-45. Description. Gain is checked by connecting CHANNEL A OUTPUT to channel B INPUT, inserting a known amplitude, 400-Hz signal into channel A INPUT and observing CRT deflection.

5-46. Equipment.

a. Voltmeter Calibrator.

b. BNC Cable, 44 in.

c. BNC Cable, 9 in.

5-47. Procedure.

a. Set instruments up as shown in figure 5-7.

b. Set Model 1703A controls as follows:

DISPLAY..... B
main TIME/DIV..... To observe convenient number of cycles

c. Set voltmeter calibrator controls for 5-mV signal.

d. Observe CRT. Vertical deflection shall be 5 div ±0.15 div.

e. Remove test equipment.

f. To return to initial settings, set Model 1703A controls as follows:

main TIME/DIV..... 5 uSEC
DISPLAY..... A

g. Refer to paragraph 5-226 and schematic 8 if specification is not met.

5-48. CASCADED AMPLIFIER BANDWIDTH.

5-49. Specification. Cascaded bandwidth shall be 3 MHz.

5-50. Description. Bandwidth is checked by inserting first a 50-kHz signal, and then a 3-MHz signal into channel A INPUT and comparing output deflections on the CRT.

5-51. Equipment.

a. Constant-amplitude Signal Generator.

b. RG 213 Cable.

c. 50-ohm Feedthrough Termination.

d. BNC Cable, 9 in.

5-52. Procedure.

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

b. Set Model 1703A controls as follows:

DISPLAY..... B
CHANNEL B VOLTS/DIV 1
main TIME/DIV..... To observe convenient number of cycles

c. Set constant-amplitude signal generator controls for 50-kHz output signal.

d. Adjust constant-amplitude signal generator output amplitude for 6 div of trace deflection.

e. Change constant-amplitude signal generator frequency to 3 MHz. Observe CRT; deflection shall be 4.3 div or greater.

f. Remove test equipment.

g. To return to initial settings, set Model 1703A controls as follows:

DISPLAY..... A
CHANNEL B VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC

h. Refer to schematic 8 if specification is not met.

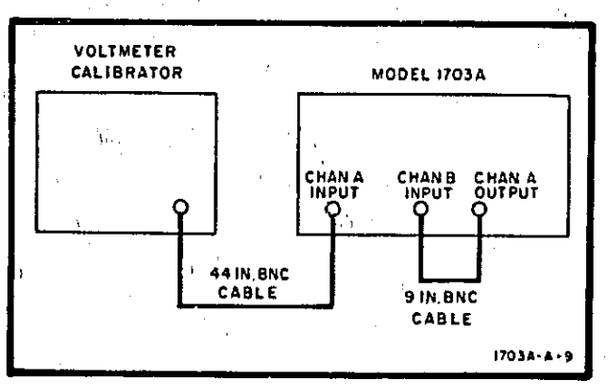


Figure 5-7. Cascaded Amplifier Gain Test Setup

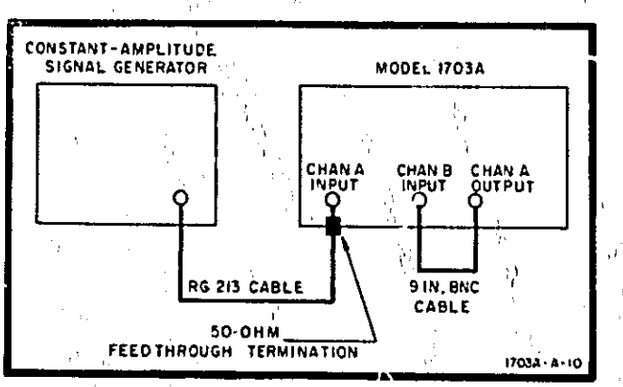


Figure 5-8. Cascaded Amplifier Bandwidth Test Setup

5-53. MAIN SWEEP TIME.

5-54. Specification. Range: From 0.1 usec/div to 2 sec/div (23 ranges) in 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%, includes ±3% accuracy of time base.

5-55. Description. The instrument time base is compared against a time-mark generator to verify specifications.

5-56. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-57. Procedure.

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

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... as required
main TIME/DIV..... .1 uSEC

c. Set time-mark generator controls for 0.1-usec time-mark output.

d. Adjust HORIZONTAL POSITION control so first marker is aligned with first left-hand vertical graticule. Eleven markers should be present on CRT.

e. Check rest of main TIME/DIV settings using table 5-4.

f. Set main TIME/DIV switch to 1 uSEC.

g. Set time-mark generator for 5-usec time-mark output.

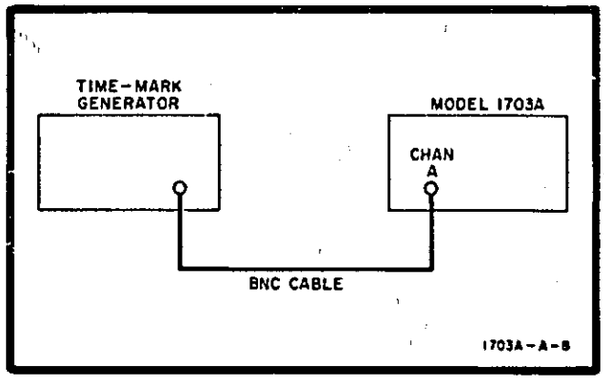


Figure 5-9. Main Sweep Time Test Setup

Table 5-4. Main Sweep Performance Check

Time-mark Generator	Main TIME/DIV	Time Marks to Check
0.1 usec	.1 uSEC	11 in 10 div ±0.3 div
0.2 usec	.2 uSEC	
0.5 usec	.5 uSEC	
1 usec	1 uSEC	
2 usec	2 uSEC	
5 usec	5 uSEC	
10 usec	10 uSEC	
20 usec	20 uSEC	
50 usec	50 uSEC	
0.1 ms	.1 mSEC	
0.2 ms	.2 mSEC	
0.5 ms	.5 mSEC	
1 ms	1 mSEC	
2 ms	2 mSEC	
5 ms	5 mSEC	
10 ms	10 mSEC	
20 ms	20 mSEC	
50 ms	50 mSEC	
0.1 sec	.1 SEC	
0.2 sec	.2 SEC	
0.5 sec	.5 SEC	
1 sec	1 SEC	
2 sec	2 SEC	

h. Adjust HORIZONTAL POSITION control so three time marks appear on CRT.

i. Rotate main VERNIER fully ccw, VERNIER UNCAL light should be on. Time period between time marks should be less than 2 div.

j. Return main VERNIER to CAL position.

k. Set time-mark generator for 1-usec time-mark output. Eleven time marks should appear on CRT.

l. Set SWP MAG to X10.

m. Adjust HORIZONTAL POSITION control until two time marks appear. Time marks should be 10 div apart ±0.5 div.

n. Remove test equipment.

o. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC
SWP MAG..... X1

p. Refer to following paragraphs and schematics if any of these test fail:

(1). Sweep ranges: paragraph 5-181; schematics 11 and 12.

(2). Vernier check: paragraph 5-181; schematics 11 and 12.

(3). SWP MAG (X10) check: paragraph 5-191; schematic 16.

5-58. DELAYED SWEEP TIME.

5-59. Specification. Ranges: From 0.1 usec/div to 0.2 sec/div (20 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 0.5 sec/div. VERNIER UNCAL light indicates when VERNIER is not in CAL position.

5-60. Description. The delayed time base is compared against a time-mark generator to verify specifications.

5-61. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-62. Procedure.

a. Connect instruments as shown in figure 5-10.

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... as required for comfortable display
delayed TIME/DIV ..... .1 uSEC
sweep display ..... DELAYED SWEEP
main TIME/DIV ..... .2 uSEC

c. Set time-mark generator controls for 0.1-usec time-mark output.

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

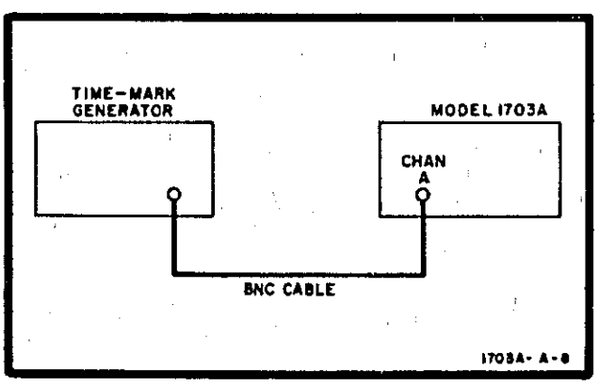


Figure 5-10. Delayed Sweep Time Test Setup

e. Check rest of delayed TIME/DIV settings using table 5-5. Main TIME/DIV control should be one sweep speed slower than delayed TIME/DIV.

f. Set delayed TIME/DIV switch to 1 mSEC.

g. Set time-mark generator for 5-ms time-mark output.

h. Adjust DELAY TIME until three time marks appear on CRT.

i. Rotate delayed VERNIER fully ccw. VERNIER UNCAL light should be on. Time period should be equal to or less than 2 div.

Note

Sweep length decreases as delayed VERNIER is turned ccw.

j. Return delayed VERNIER to CAL position.

k. Remove all test equipment.

l. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
delayed TIME/DIV ..... OFF
sweep display ..... MAIN SWEEP
main TIME/DIV ..... 5 uSEC

m. Refer to paragraph 5-186 and schematics 14 and 15 if any tests fail.

Table 5-5. Delayed Sweep Performance

Time-mark Generator	Delayed TIME/DIV	Time Marks to Check
0.1 usec	.1 uSEC	11 in 10 div ±0.3 div
0.2 usec	.2 uSEC	
0.5 usec	.5 uSEC	
1 usec	1 uSEC	
2	2 uSEC	
5 usec	5 uSEC	
10 usec	10 uSEC	
20 usec	20 uSEC	
50 usec	50 uSEC	
0.1 ms	.1 mSEC	
0.2 ms	.2 mSEC	
0.5 ms	.5 mSEC	
1 ms	1 mSEC	
2 ms	2 mSEC	
5 ms	5 mSEC	
10 ms	10 mSEC	
20 ms	20 mSEC	
50 ms	50 mSEC	
0.1 sec	.1 SEC	
0.2 sec	.2 SEC	

5-63. DELAYED TIME ACCURACY.

5-64. Specification. Accuracy: ±1%.

5-65. Description. The delay time accuracy is checked against a calibrated standard to verify accuracy.

5-66. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-67. Procedure.

a. Set instruments up as shown in figure 5-11.

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV . as required for comfortable display
main TIME/DIV..... 1 mSEC
delayed TIME/DIV ..... 10 uSEC

c. Set time-mark generator for 1-ms time-mark output.

d. Adjust DELAY TIME dial to intensity second time mark from left.

e. Set sweep display to DELAYED SWEEP.

f. Adjust DELAY TIME dial to center visible time mark on center vertical graticule line. Note DELAY TIME dial setting.

DELAY TIME dial _____

g. Set sweep display to MAIN SWEEP.

h. Adjust DELAY TIME dial to intensity 10th time mark from left.

i. Set sweep display to DELAYED SWEEP.

j. Adjust DELAY TIME dial to center visible time mark on center vertical graticule line. Note DELAY TIME dial setting.

DELAY TIME dial _____

k. Subtract setting in step f from step j. Difference should be 8.00 ±0.8.

l. Disconnect test equipment.

m. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
sweep display..... MAIN SWEEP
main TIME/DIV..... 5 uSEC

n. Refer to schematic 15 if specification is not met.

5-68. DELAY TIME LINEARITY.

5-69. Specification. Linearity: ±0.2%.

5-70. Description. The linearity of the DELAY TIME dial is checked against a calibrated standard to verify linearity.

5-71. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-72. Procedure.

a. Set instruments up as shown in figure 5-12.

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ... as required for comfortable display
sweep display..... DELAY SWEEP
main TIME/DIV..... 1 mSEC
delay TIME/DIV ..... 1 uSEC

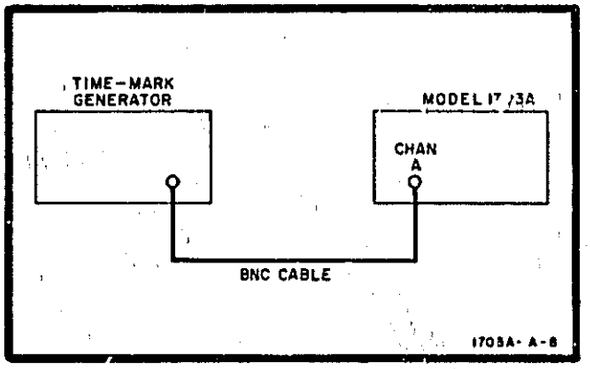


Figure 5-11. Delay Time Accuracy Test Setup

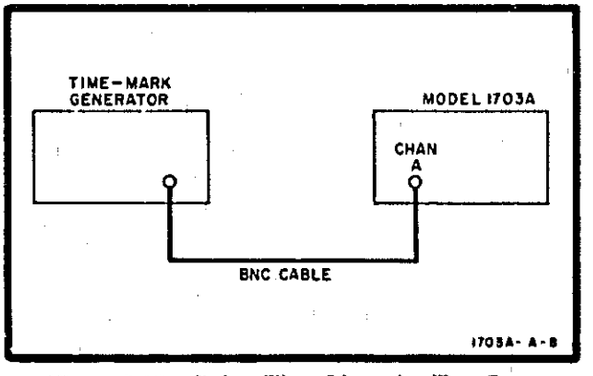


Figure 5-12. Delay Time Linearity Test Setup

c. Set time-mark generator for 1-ms time-mark output.

d. Rotate DELAY TIME dial cw until first marker is centered on center graticule line. Note DELAY TIME dial setting.

(A) DELAY TIME dial _____

e. Adjust DELAY TIME dial cw until fifth marker is centered on center vertical graticule line. Note DELAY TIME dial setting.

(B) DELAY TIME dial _____

f. Adjust DELAY TIME dial cw until ninth marker is centered on center vertical graticule line. Note DELAY TIME dial setting.

(C) DELAY TIME dial _____

g. Perform mathematics given below. Note result of 0.00 ±0.02.

A = step d setting.

B = step e setting.

C = step f setting.

$$\frac{A + (\frac{C - A}{2}) - B}{2} = 0.00 \pm 0.02$$

h. Disconnect test equipment.

i. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
sweep display ..... MAIN SWEEP
delayed TIME/DIV ..... OFF
main TIME/DIV ..... 5 uSEC

j. Refer to schematics 11 through 15 if specification is not met.

5-73. DELAY JITTER.

5-74. Specification. Delay jitter should be less than 0.005%.

5-75. Description. The delay jitter is checked by expanding the sweep 20 000 and visually monitoring the jitter.

5-76. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-77. Procedure.

a. Connect instruments as shown in figure 5-13.

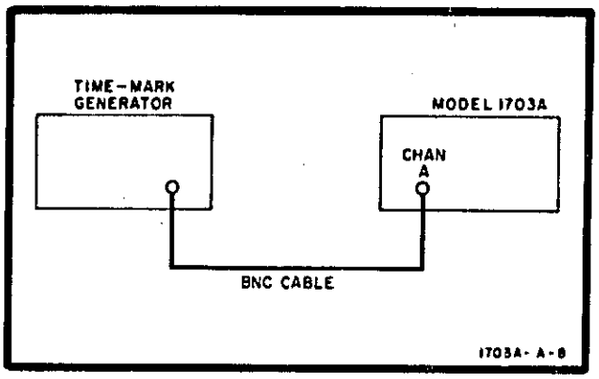


Figure 5-13. Delay Jitter Test Setup

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... as required for comfortable display
main TIME/DIV ..... 1 mSEC
delayed TIME/DIV ..... .5 uSEC

c. Set time-mark generator controls for 1-ms time-mark output.

d. Adjust DELAY TIME dial so intensified portion of sweep is at 11th graticule line.

e. Set sweep display to DELAYED SWEEP.

f. Adjust DELAY TIME dial so display is centered. Delay jitter should be less than 1 div which is less than .005%.

Note

Disregard slow drift.

g. Remove test equipment.

h. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV ..... 5 uSEC
delayed TIME/DIV ..... OFF
sweep display ..... MAIN SWEEP
DELAY TIME dial 0.00

i. Refer to schematics 9 through 15 if specification is not met.

5-78. MAIN TRIGGERING.

5-79. Specification. Dc to 35 MHz on signals causing 0.5 div of vertical deflection in all disp'ay modes except chop; dc to 400 kHz in chop mode. External: dc to 35 MHz on signals 50 mV p-p or more.

5-80. Description. The main triggering is checked with known input signals to ensure proper triggering.

5-81. Equipment.

a. Constant-amplitude Signal Generator.

b. RF Voltmeter.

c. BNC Tee.

d. BNC Cable, 9 in. (2)

e. RG 213 Cable.

f. 50-ohm Feedthrough Termination.

g. 50-ohm Sampling Tee.

5-82. Procedure.

a. Connect instruments as shown in figure 5-14.

b. Set Model 1703A controls as follows:

SWP MAG X10
CHANNEL A VOLTS/DIV 1
main TIME/DIV ..... .1 uSEC

c. Set constant-amplitude signal generator controls for 35-MHz, 0.5-div display.

d. Adjust main TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

e. Set trig to A ONLY TRIG and repeat steps b through d.

f. Set main INT/EXT to EXT.

g. Set constant-amplitude signal generator controls for 35-MHz, 17.5-mV rms (50-mV p-p) signal as read on RF voltmeter.

h. Adjust main TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

i. Set main INT/EXT to INT.

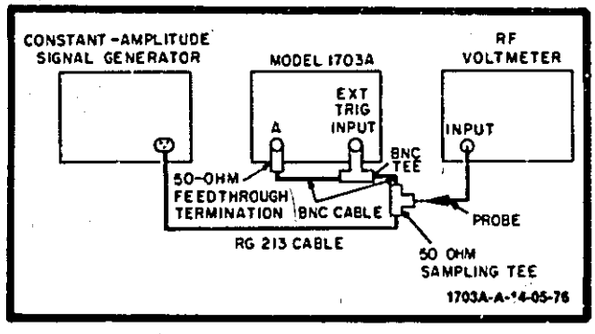


Figure 5-14. Main Triggering Test Setup

j. Set SWP MAG to X1.

k. Set DISPLAY to CHOP.

l. Set main TIME/DIV control to 2 uSEC.

m. Set constant-amplitude signal generator controls for 400-kHz, 0.5 div display.

n. Adjust main TRIGGER LEVEL for stable display. A segmented display should be observed. This is normal display.

o. Remove test equipment.

p. Connect 10:1 divider probe from channel A OUTPUT to ac line voltage source.

q. Set Model 1703A controls as follows:

DISPLAY ..... A
main LF REJ ..... engaged
main HF REJ ..... engaged
CHANNEL A VOLTS/DIV 5
channel A vernier ..... ccw
main TIME/DIV ..... 2 mSEC

r. Adjust main TRIGGER LEVEL to obtain stable display. If stable display is obtained instrument is triggering properly on line signal.

s. To return to initial settings set Model 1703A controls as follows:

channel A vernier ..... CAL
CHANNEL A VOLTS/DIV ..... .01
trig ..... NORM TRIG
main TIME/DIV ..... 5 uSEC
main LF REJ ..... disengaged
main HF REJ ..... disengaged

t. Refer to paragraphs 5-167 thru 5-172 and schematics 9 and 10 if any triggering specifications are not met.

5-83. DELAYED TRIGGERING.

5-84. Specification. DC to 35 MHz on signals causing 0.5 div of vertical deflection in all display modes except chop; dc to 400 kHz in chop mode. External: dc to 35 MHz on signals 50 mV p-p or more.

5-85. Description. The delayed triggering is checked with known input signals to ensure proper triggering.

5-86. Equipment.

a. Constant-amplitude Signal Generator.

b. RF Voltmeter.

c. BNC Tee.

d. BNC Cable, 9 in.

e. 50-ohm Feedthrough Termination.

f. RG 213 Cable.

g. 50-ohm Sampling Tee.

5-87. Procedure.

a. Connect instruments as shown in figure 5-15.

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV 1
delayed TIME/DIV ..... .1 uSEC
main TIME/DIV..... .2 uSEC
SWP MAG..... X10
delayed AUTO/TRIG ..... TRIG

c. Set constant-amplitude signal generator controls for 35-MHz, 0.5-div display output signal.

d. Adjust main TRIGGER LEVEL for stable display.

e. Set sweep display to DELAYED SWEEP.

f. Adjust delayed TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

g. Set delayed INT/EXT to EXT.

h. Set sweep display to MAIN SWEEP.

i. Set constant-amplitude signal generator controls for 35-MHz, 17.5-mV rms (50-mV p-p) signal as read on RF millivoltmeter.

j. Adjust main TRIGGER LEVEL for stable display.

k. Set sweep display to DELAYED SWEEP.

l. Adjust delayed TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

m. Remove test equipment.

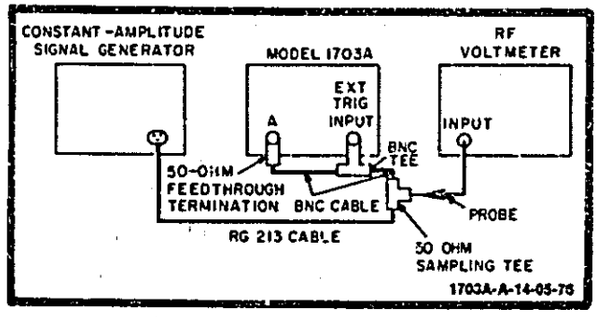


Figure 5-15. Delayed Triggering Test Setup

n. To return to initial settings, set Model 1703A controls as follows:

delayed INT/EXT..... INT
sweep display..... MAIN SWEEP
CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC
delayed TIME/DIV ..... OFF
SWP MAG..... X1

o. Refer to schematic 9 and 10 if any triggering specifications are not met.

5-88. MAIN TRIGGEP LEVEL RANGE AND POLARITY.

5-89. Specification. Variable over either slope of displayed waveform. In ext mode, the trigger level should adjust from —1.2V to +1.2.

5-90. Description. The trigger level range and polarity are checked against a calibrated input to ensure that the instrument triggers on both negative and positive slopes of the input signal.

5-91. Equipment.

a. Voltmeter Calibrator.

b. BNC Cable, 44 in.

c. BNC Cable, 9 in. (2).

d. BNC Tee.

e. Banana Jack to BNC Adapter.

5-92. Procedure.

a. Connect instruments as shown in figure 5-16.

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV 5
main TIME/DIV..... .5 mSEC
main HF REJ.....engaged

c. Set voltmeter calibrator controls for 5V output signal.

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

e. Set main slope to (—).

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

g. Set main INT/EXT to EXT.

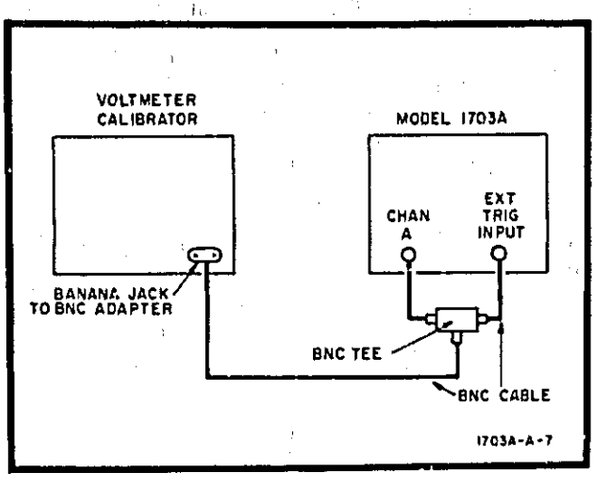


Figure 5-16. Main Trigger Level Range and Polarity Test Setup

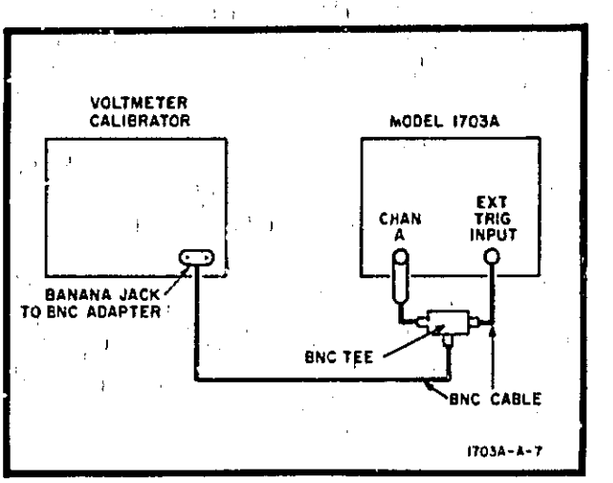


Figure 5-17. Delayed Trigger Level Range and Polarity Test Setup

h. Repeat steps a through f in EXT position. Triggering in EXT for both positive and negative slopw should operate smoothly from —1.2V to +1.2V.

i. Remove main INT/EXT to EXT.

j. To return to initial settings, set Model 103A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC
main INT/EXT .....INT
main slope.....+
main HF REJ.....disengaged

k. Refer to paragraph 5-167 and schematic 9 if any specifications are not met.

5-93. DELAYED TRIGGER LEVEL RANGE AND POLARITY.

5-94. Specification. Variable over either slope of display waveform. In ext mode, triggering should adjust from —1.2V to +1.2V.

5-95. 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 siganl.

5-96. Equipment.

a. Voltmeter Calibrator.

b. BNC Cable, 44 in.

c. BNV Tee.

d. Banana Jack to BNC Adapter.

e. BNC Cable 9 in. (2).

5-97. Procedure.

a. Connect instruments as shown in figure 5-17.

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV 5
main TIME/DIV..... .5 mSEC
main HF REJ..... engaged
delayed TIME/DIV ..... .1 mSEC

c. Set voltmeter calibrator controls for 5V output signal.

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

e. Set delayed slope to (—).

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

g. Set delayed INT/EXT to EXT.

h. Repeat steps a through f in EXT position. Triggering in EXT for both positive and negative slope should operate smoothly from —1.2V to +1.2V.

i. Remove test equipment.

j. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
delayed INT/EXT..... INT
delayed slope ..... ↑
delayed TIME/DIV ..... OFF
main TIME/DIV..... 5 uSEC
sweep display..... MAIN SWEEP

k. Refer to schematic 9 if any specifications are not met.

5-98. EXT HORIZONTAL BANDWIDTH.

5-99. Specification. dc to 1 MHz.

5-100. Descr ption. Bandwidth is checked by applying 50-Hz and 1-MHz signals to the EXT HORIZ INPUT and measuring the difference in trace deflection.

5-101. Equipment.

a. Constant-amplitude Signal Generator.

b. RG 213 Cable.

c. 50-ohm Feedthrough Termination.

5-102. Procedure.

a. Set instruments up as shown in figure 5-18.

b. Set Model 1703A controls as follows:

sweep display..... EXT HORIZ INPUT
SWP MAG..... X10
SINGLE..... engaged

c. Set constant-amplitude signal generator controls for 1V, 50-kHz output signal.

d. Adjust constant-amplitude signal generator output to obtain exactly 10 div of horizontal deflection.

e. Adjust constant-amplitude signal generator frequency to obtain 1-MHz output signal. Horizontal deflection shall be equal to or greater than 7.2 div.

f. Disconnect test equipment.

g. To return to intial settings, set Model 1703A controls as follows:

sweep display..... MAIN SWEEP
SWP MAG..... X1
SINGLE..... disengaged

h. Refer to schematic 18 if specification is not met.

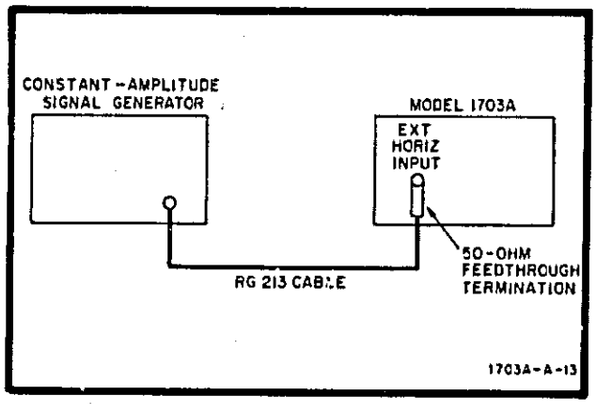


Figure 5-18. Ext Horizontal Bandwidth Test Setup

5-103. EXT HORIZONTAL DEFLECTION FACTOR.

5-104. Specification. SWP MAG (X1), 1 V/div; SWP MAG (X10), 0.1 V/div. Accuracy: ±5%.

5-105. Description. A voltmeter calibrator signal (1V or 10V at 400 Hz) is applied to the EXT HORIZ INPUT and horizontal deflection is measured to vertical deflection factor.

5-106. Equipment.

a. Voltmeter Calibrator

b. BNC Cable, 44 in.

5-107. Procedure.

a. Set instruments up as shown in figure 5-19.

b. Set Model 1703A controls as follows:

sweep display..... EXT HORIZ INPUT
SINGLE..... engaged

c. Set voltmeter calibrator controls for 10V output signal.

d. In SWP MAG X1 position, horizontal deflection should be 10 div ±0.5 div.

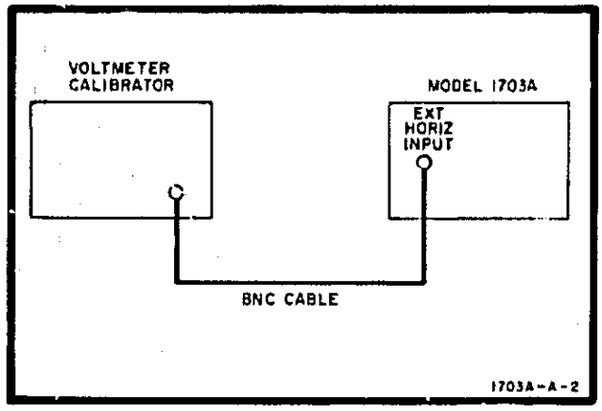


Figure 5-19. Ext Horizontal Deflection Factor Test Setup

e. Set voltmeter calibrator output for 1V.

f. Set SWP MAG to X10. Horizontal deflection should be 10 div ±0.5 div.

g. Rotate rear panel ext horiz VERNIER out of CAL position fully cw. Horizontal deflection should decrease to less than 1 div.

h. Return ext horiz VERNIER to CAL position.

i. Disconnect test equipment.

j. To return to initial settings, set Model 1703A controls as follows:

sweep display ..... MAIN SWEEP
SWP MAG X1
SINGLE ..... disengaged

k. Refer to paragraph 5-216 and schematic 18 if specification is not met.

5-108. VARIABLE PERSISTENCE.

5-109. Specification. Persistence shall be continuously variable from less than 0.2 sec to greater than 1 min.

5-110. Description. The variable persistence is checked by timing the trace persistence.

5-111. Procedure.

a. Set main TIME/DIV to .2 SEC.

b. Adjust INTENSITY control until spot just appears on CRT.

c. Observe tail (figure 5-20) on spot. Tail should be equal to or less than 1 div (minimum persistence) anywhere on CRT.

d. Turn PERSISTENCE control cw. Length of tail shall increase as persistence increases.

e. Turn PERSISTENCE control fully cw.

f. Turn INTENSITY control fully ccw. Display shall remain visible for at least 1 min (maximum persistence).

g. Set main TIME/DIV to 5 uSEC.

h. Refer to paragraph 5-236 and schematics 16, 20 and 21 in event above specification is not met.

5-112. STANDARD WRITING SPEED.

5-113. Specification. In standard writing mode, storage writing speed shall be greater than 20 div/ms within a 5-div by 9-div area of the CRT.

5-114. Description. Standard writing speed is measured by timing the trace persistence.

5-115. Procedure.

a. Set Model 1703A controls as follows:

main TIME/DIV ..... 50 uSEC
SINGLE ..... engaged
PERSISTENCE ..... full cw

b. Turn INTENSITY fully cw.

CAUTION

Do not disengage SINGLE pushbutton while INTENSITY is fully cw. Damage to storage mesh may occur.

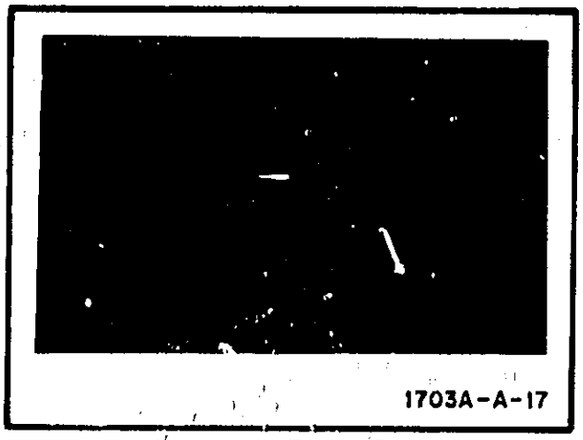


Figure 5-20. Tail on Spot.

c. Press and release PUSH:ERASE control.

d. Press and release RESET control to trigger single sweep.

Note

If bright spot occurs at beginning of trace, reduce INTENSITY setting and repeat steps c and d.

e. Repeat steps c and d and adjust FOCUS control as necessary for sharpest trace.

f. Observe trace; trace shall remain visible for at least 1 min.

g. To return to initial settings, set Model 1703A controls as follows:

INTENSITY	fully ccw
main TIME/DIV	5 uSEC
PERSISTENCE	fully ccw
SINGLE	disengage

h. Refer to paragraph 5-236 and schematics 20 and 21 if above specification is not met.

5-116. STANDARD STORE TIME.

5-117. Specification. A trace written in the standard writing mode and immediately stored shall be viewable after 1 hour.

5-118. Description. Standard store time is measured by timing the persistence of the stored display.

5-119. Procedure.

a. Set Model 1703A controls as follows:

main TIME/DIV	50 uSEC
SINGLE	engaged
STORE TIME	MAX
PERSISTENCE	fully cw

b. Turn INTENSITY fully cw.

c. Press and release PUSH:ERASE control.

d. Press and release RESET control to trigger single sweep.

e. Immediately engage STORE pushbutton.

f. Turn STORE TIME ccw and verify presence of trace.

h. Turn STORE TIME fully cw to MAX.

h. After 1 hr, turn STORE TIME fully ccw. Trace should still be visible.

i. To return to initial settings, set Model 1703A controls as follows:

INTENSITY	fully ccw
main time/DIV	5 uSEC
SINGLE	disengaged

j. Refer to paragraph 5-236 and schematics 20 and 21 if above specification is not met.

5-120. FAST WRITING SPEED.

5-121. Specification. In fast writing mode, storage writing speed shall be greater than 1000 div/ms within a 5-div by 9-div area of the CRT.

5-122. Description. Fast writing speed is measured by timing the trace persistence.

5-123. Procedure.

a. Set Model 1703A controls as follows:

main TIME/DIV	1 uSEC
SINGLE	engaged
PERSISTENCE	fully cw
WRITING SPEED	FAST

b. Turn INTENSITY fully cw.

CAUTION

Do not disengage SINGLE pushbutton while INTENSITY is fully cw. Damage to storage mesh may occur.

c. Press and release PUSH:ERASE.

d. Press and release RESET control to trigger single sweep.

Note

If bright spot occurs at beginning of trace, reduce INTENSITY setting and repeat steps c and d.

e. Repeat steps c and d and adjust FOCUS control as necessary for sharpest trace.

f. Observe trace; trace shall remain visible for at least 15 sec.

g. To return to initial settings, set Model 1703A controls as follows:

INTENSITY	fully ccw
main TIME/DIV	5 uSEC
PERSISTENCE	fully ccw
SINGLE	disengage
WRITING SPEED	STD

h. Refer to paragraph 5-36 and schematics 20 and 21 if above specification is not met.

5-124. MAX STORE TIME.

5-125. Specification. A trace written in the fast writing mode, and immediately stored, shall be viewed after 5 min.

5-126. Description. Max store time is measured by timing the persistence of the stored signal.

5-127. Procedure.

a. Set Model 1703A controls as follows:

main TIME/DIV	1 uSEC
SINGLE	engaged
STORE TIME	MAX
WRITING SPEED	FAST
PERSISTENCE	fully cw

b. Turn INTENSITY fully cw.

CAUTION

Do not disengage SINGLE pushbutton while INTENSITY is fully cw. Damage to storage mesh may occur.

c. Press and release PUSH:ERASE.

d. Press and release RESET control to trigger single sweep.

e. Immediately engage STORE pushbutton.

f. After 5 min, rotate STORE TIME fully ccw. Trace should still be visible.

g. To return to initial settings, set Model 1703A controls as follows:

INTENSITY	fully ccw
main TIME/DIV	5 uSEC
SINGLE	disengage
WRITING SPEED	STD
PERSISTENCE	fully ccw

h. Refer to paragraph 5-236 and schematics 20 and 21 if above specification is not met.

PERFORMANCE CHECK RECORD
Model 1703A

Instrument Serial Number _____ Date _____

Check	Specification	Measured
DEFLECTION FACTOR		
.01 VOLTS/DIV	5 div ±0.15 div	_____
.02 VOLTS/DIV	5 div ±0.15 div	_____
.05 VOLTS/DIV	6 div ±0.18 div	_____
.1 VOLTS/DIV	5 div ±0.15 div	_____
.2 VOLTS/DIV	5 div ±0.15 div	_____
.5 VOLTS/DIV	6 div ±0.18 div	_____
1 VOLTS/DIV	5 div ±0.15 div	_____
2 VOLTS/DIV	5 div ±0.15 div	_____
5 VOLTS/DIV	6 div ±0.18 div	_____
Channel A Vernier	< 2.4 div	_____
Channel B Vernier	< 2.4 div	_____
CALIBRATOR		
Calibrator Amplitude	6 div ±0.06 div	_____
Calibrator Frequency	1 kHz ±10%	_____
RISETIME		
Channel A Risetime	< 10 ns	_____
Channel B Risetime	< 10 ns	_____
BANDWIDTH		
Channel A Bandwidth	> 4.3 div	_____
Channel B Bandwidth	> 4.3 div	_____
INPUT RESISTANCE		
Channel A Resistance		
.01 VOLTS/DIV	1 ±0.02 megohm	_____
.02 VOLTS/DIV	1 ±0.02 megohm	_____
.05 VOLTS/DIV	1 ±0.02 megohm	_____
.1 VOLTS/DIV	1 ±0.02 megohm	_____
.2 VOLTS/DIV	1 ±0.02 megohm	_____
.5 VOLTS/DIV	1 ±0.02 megohm	_____
1 VOLTS/DIV	1 ±0.02 megohm	_____
2 VOLTS/DIV	1 ±0.02 megohm	_____
5 VOLTS/DIV	1 ±0.02 megohm	_____

PERFORMANCE CHECK RECORD(Cont'd)
Model 1703A

Instrument Serial Number _____ Date _____

Check	Specification	Measured
Channel B Resistance		
.01 VOLTS/DIV	1 ±0.02 megohm	
.02 VOLTS/DIV	1 ±0.02 megohm	
.5 VOLTS/DIV	1 ±0.02 megohm	
.1 VOLTS/DIV	1 ±0.02 megohm	
.2 VOLTS/DIV	1 ±0.02 megohm	
.5 VOLTS/DIV	1 ±0.02 megohm	
1 VOLTS/DIV	1 ±0.02 megohm	
2 VOLTS/DIV	1 ±0.02 megohm	
5 VOLTS/DIV	1 ±0.02 megohm	
COMMON MODE REJECTION RATIO (CMRR)		
CMRR (50 kHz/0.01 volts/div)	< 0.3 div	
CMRR (1 MHz/0.01 volts/div)	< 0.3 div	
CASCADED AMPLIFIER GAIN		
Vertical Deflection	.5 div ±0.15 div	
CASCADED AMPLIFIER BANDWIDTH		
Cascaded Bandwidth	≥4.3 div	
MAIN SWEEP TIME		
.1 uSEC	11 in 10 div ±0.3 div	
.2 uSEC	11 in 10 div ±0.3 div	
.5 uSEC	11 in 10 div ±0.3 div	
1 uSEC	11 in 10 div ±0.3 div	
2 uSEC	11 in 10 div ±0.3 div	
5 uSEC	11 in 10 div ±0.3 div	
10 uSEC	11 in 10 div ±0.3 div	
20 uSEC	11 in 10 div ±0.3 div	
50 uSEC	11 in 10 div ±0.3 div	
.1 mSEC	11 in 10 div ±0.3 div	
.2 mSEC	11 in 10 div ±0.3 div	
.5 mSEC	11 in 10 div ±0.3 div	
1 mSEC	11 in 10 div ±0.3 div	
2 mSEC	11 in 10 div ±0.3 div	
5 mSEC	11 in 10 div ±0.3 div	
10 mSEC	11 in 10 div ±0.3 div	
20 mSEC	11 in 10 div ±0.3 div	
50 mSEC	11 in 10 div ±0.3 div	

PERFORMANCE CHECK RECORD(Cont'd)
Model 1703A

Instrument Serial Number _____ Date _____

Check	Specification	Measured
.1 SEC	11 in 10 div ±0.3 div	_____
.2 SEC	11 in 10 div ±0.3 div	_____
.5 SEC	11 in 10 div ±0.3 div	_____
1 SEC	11 in 10 div ±0.3 div	_____
2 SEC	11 in 10 div ±0.3 div	_____
Main Vernier Check	<2 div	_____
SWP MAG (X 10) Check	10 div ±0.5 div	_____
DELAYED SWEEP TIME		
.1 uSEC	11 in 10 div ±0.3 div	_____
.2 uSEC	11 in 10 div ±0.3 div	_____
.5 uSEC	11 in 10 div ±0.3 div	_____
1 uSEC	11 in 10 div ±0.3 div	_____
2 uSEC	11 in 10 div ±0.3 div	_____
5 uSEC	11 in 10 div ±0.3 div	_____
10 uSEC	11 in 10 div ±0.3 div	_____
20 uSEC	11 in 10 div ±0.3 div	_____
50 uSEC	11 in 10 div ±0.3 div	_____
.1 mSEC	11 in 10 div ±0.3 div	_____
.2 mSEC	11 in 10 div ±0.3 div	_____
.5 mSEC	11 in 10 div ±0.3 div	_____
1 mSEC	11 in 10 div ±0.3 div	_____
2 mSEC	11 in 10 div ±0.3 div	_____
5 mSEC	11 in 10 div ±0.3 div	_____
10 mSEC	11 in 10 div ±0.3 div	_____
20 mSEC	11 in 10 div ±0.3 div	_____
50 mSEC	11 in 10 div ±0.3 div	_____
.1 SEC	11 in 10 div ±0.3 div	_____
.2 SEC	11 in 10 div ±0.3 div	_____
Delayed Vernier Check	< 2 div	_____
DELAY TIME ACCURACY		
Difference	8.00 ±0.8	_____
DELAY TIME LINEARITY		
Result	±0.02	_____
DELAY JITTER		
Delay Jitter	< 1 div	_____

PERFORMANCE CHECK RECORD (Cont'd)
Model 1703A

Instrument Serial Number _____ Date _____

Check	Specification	Measured
MAIN TRIGGERING		
Internal Triggering (35 MHz)	✓	_____
Chop Triggering (400 kHz)	✓	_____
Line Triggering	✓	_____
DELAYED TRIGGERING		
Internal Triggering (35 MHz)	✓	_____
External Triggering (35 MHz)	✓	_____
MAIN TRIGGER LEVEL RANGE AND POLARITY		
Int Trigger Level (+)	✓	_____
Int Trigger Level (—)	✓	_____
Ext Trigger Level (+)	—1.2V to +1.2V	_____
Ext Trigger Level (—)	—1.2V to +1.2V	_____
DELAYED TRIGGER LEVEL RANGE AND POLARITY		
Int Trigger Level (+)	✓	_____
Int Trigger Level (—)	✓	_____
Ext Trigger Level (+)	—1.2V to +1.2V	_____
Ext Trigger Level (—)	—1.2V to +1.2V	_____
EXT HORIZONTAL BANDWIDTH		
Ext Horizontal Bandwidth	>7.2 div	_____
EXT HORIZONTAL DEFLECTION FACTOR		
Mag X1 Deflection Factor	10 div ±0.5 div	_____
Mag X10 Deflection Factor	10 div ±0.5 div	_____
Vernier Deflection	< 1 div	_____
VARIABLE PERSISTENCE		
Minimum Persistence	< 1 div	_____
Maximum Persistence	> 1 min	_____

PERFORMANCE CHECK RECORD(Cont'd)
Model 1703A

Instrument Serial Number _____ Date _____

Check	Specification	Measured
STANDARD WRITING SPEED		
Visible Trace	> 1 min	_____
STANDARD STORE TIME		
Visible Trace	> 1 hr	_____
FAST WRITING SPEED		
Visible Trace	> 15 SEC	_____
MAX STORE TIME		
Visible Trace	> 5 min	_____

5-128. ADJUSTMENTS.

5-129. The following paragraphs describe procedures to calibrate the instrument so that it will perform as specified in table 1-1. The entire adjustment procedure can be done in sequence, or any separate adjustment can be calibrated by following the steps outlined in the appropriate paragraph. The locations of adjustment controls are shown in a photograph included at the end of the section of a foldout page.

5-130. Use a nonmetallic screwdriver and recently calibrated test equipment with characteristics as specified in table 5-1. After adjustments are complete, check instrument performance by doing the performance check procedure at the beginning of this section.

5-131. Set Model 1703A front panel controls to those positions given in paragraph 5-10. Remove top and bottom covers.

5-132. ADJUSTMENT PROCEDURES.

5-133. LOW VOLTAGE POWER SUPPLY ADJUST.

5-134. Reference. Schematics 23, 24 and 25, figures 5-22, 8-55, 8-56 and 8-57.

5-135. 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.

5-136. Equipment.

a. Digital Voltmeter.

b. Test Leads.

5-137. Procedure.

a. Connect digital voltmeter to XA4 (gate) pin 6.

WARNING

Power is present in the line rectifier assembly (A2) and low voltage mother board (A3A1) when POWER-ON switch is off.

b. Turn instrument ON.

c. Adjust A3A2R3, LOW VOLTAGE ADJ, for voltmeter indication of +15V ±10 mV.

d. Check rest of low voltage power supply output voltages as shown in table 5-6.

e. Turn instrument off.

f. If any voltage measurement is inaccurate, refer to schematics 23, 24 and 25.

5-138. HIGH VOLTAGE POWER SUPPLY ADJUST.

5-139. Reference. Schematic 22, figures 5-22 and 8-53.

5-140. Description. The high voltage is adjusted to —1350V by comparing it against a known calibrated voltage standard.

5-141. Equipment.

a. Digital Voltmeter.

b. Voltmeter Calibrator.

c. 1000:1 Divider Probe.

5-142. Procedure.

a. Turn power off.

b. Remove A3 power supply module cover.

Table 5-6. Power Supply Voltage Limits

Supply	Test Point	Limits	
+15V	XA4 Pin 6	+14.99V	+15.01V
—15V	XA4 Pin 8	—14.5V	—15.75V
+5V	XA4 Pin 10	+5.1V	5.9V
+50V	XA4 Pin 3	+47V	+52V
—50V	XA4 Pin 12	—47V	—52V
+80V	XA4 Pin 5	+80V	+90V
+160V	XA4 Pin 2	+150V	+180V

c. Turn instrument on.

d. Connect digital voltmeter through 1000:1 divider probe to voltmeter calibrator.

e. Set voltmeter calibrator to —100-volt output.

f. Note voltmeter indication.

g. Multiply indication in step f by 13.5.

h. Monitor high voltage on red wire (2) from A3A4 using 1000:1 divider probe and digital voltmeter.

i. Adjust A3A4R15, HIGH VOLTAGE ADJ, for value calculated in step g.

j. Turn instrument off.

k. Disconnect test equipment and replace A3 power supply module cover.

l. Check high voltage power supply circuits on schematic 22 if adjustment cannot be made.

5-143. INTENSITY LIMIT ADJUST.

5-144. Reference. Schematics 19 and 22, figures 5-22 and 8-53.

5-145. Description. The intensity limit adjustment is set so the front panel INTENSITY control has complete range. This range is from extinguished to complete brightness.

5-146. Equipment.

a. Monitor Oscilloscope.

b. 10:1 Divider Probe.

5-147. Procedure.

a. Set Model 1703A main TIME/DIV to 1 mSEC.

b. Obtain free-running trace (figure 3-5).

c. Connect monitor oscilloscope controls to gate output (wire color 1) with 10:1 divider probe.

d. Set monitor oscilloscope controls to view 10V signal.

e. Set INTENSITY control for 10V p-p signal as viewed on monitor oscilloscope.

f. Adjust A3A4R1, INTENSITY LIMIT ADJ, until trace is just extinguished.

g. Turn INTENSITY control ccw and verify trace is visible.

h. Disconnect test equipment.

i. Set Model 1703A main TIME/DIV to 5 mSEC.

j. Check high voltage power supply circuit on schematic 22 if adjustment cannot be made.

5-148. Y-AXIS ALIGNMENT.

5-149. Reference. Schematic 22, figures 5-22 and 8-46.

5-150. Description. The internal orth adjust is set to align the trace on the Y-axis.

5-151. Equipment.

a. Oscillator.

b. BNC cable, 44 in.

Note

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

5-152. Procedure.

a. Connect oscillator set for 10-kHz, 6-div output to channel A INPUT.

b. Set sweep display to EXT HORIZ INPUT.

c. Adjust HORIZONTAL POSITION until vertical line is centered on CRT screen.

d. Adjust A4R25, orth adjust, until vertical line is aligned on major Y-axis graticule.

e. Disconnect oscillator.

f. Set sweep display to MAIN SWEEP.

g. Refer to schematic 22 if adjustment cannot be made.

5-153. PATTERN ADJUST.

5-154. Reference. Schematic 22, figures 5-22 and 8-46.

5-155. Description. The CRT geometry is set for minimum barrelling or pincushioning.

5-156. Equipment.

a. Oscillator

b. BNC cable, 44 in.

5-157. Procedure.

Note

Make sure trace align (paragraph 3-95) is properly set before performing this adjustment.

a. Set Model 1703A controls as follows:

PERSISTENCE ..... ccw
main TIME/DIV ..... 1 mSEC
CHANNEL A VOLT/DIV 1

b. Connect oscillator output to channel A INPUT.

c. Set oscillator controls for 100-kHz output signal.

d. Adjust oscillator amplitude control for 5.8-div display on CRT.

e. Adjust INTENSITY control for normal viewing level.

f. Engage CONV pushbutton.

g. Adjust A4R27, for best compromise between distortion of vertical and horizontal edges of CRT display.

h. Disconnect test equipment.

i. To return to initial setting, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV ..... 5 uSEC

j. Refer to schematic 22 if adjustment cannot be made.

5-158. GATE AMPLIFIER RESPONSE ADJUST.

5-159. Reference. Schematic 19, figures 5-22 and 8-46.

5-160. Description. The gate amplifier is adjusted for optimum response.

5-161. Equipment.

a. Monitor Oscilloscope.

b. 10:1 Divider Probe.

5-162. Procedure.

a. Set main TIME/DIV to 1 uSEC.

b. Connect 10:1 divider probe from monitor oscilloscope to wire (1) on A4 gate assy.

c. Set monitor oscilloscope controls as follows:

coupling ..... DC
all others ..... normal display

d. Adjust INTENSITY control for 20V amplitude pulse as displayed on oscilloscope.

e. Adjust A4C8 gate response adj, for fastest risetime and flatest pulse of positive-going signal.

f. Disconnect test equipment.

g. Set main TIME/DIV to 5 uSEC.

h. Set channel A coupling to AC.

i. Refer to schematic 19 if adjustment cannot be made.

5-163. POSITION CENTERING ADJUST.

5-164. Reference. Schematics 4, 5, 6, and 7, figures 5-22 and 8-12.

5-165. Description. Internal controls are adjusted to center the display. This adjustment varies the amplifier dc reference, thus establishing position.

Note

Be sure channel A and channel B DC are properly adjusted (figure 3-10).

5-166. Procedure.

a. Set DISPLAY to B.

b. Center channel B POSITION control.

c. Adjust A5A4R43, B pol bal adj, for no vertical trace shift as B POLARITY switch is changed from NORM to INVT.

d. Adjust A5A4R108, B pos centering adj, to center trace vertically.

e. Set DISPLAY to A.

f. Center channel A POSITION control.

g. Adjust A5A4R40, A pos centering adj, to center trace vertically.

h. Set DISPLAY to A + B.

i. Adjust A5A4R60 A + B bal, to center trace.

j. To return to initial settings, set DISPLAY to A.

k. Refer to schematics 4, 5, 6 and 7 if th adjustment cannot be made.

5-167. TRIGGER AMPLIFIER BALANCE AND DC LEVEL ADJUST.

5-168. Reference. Schematics 4 and 5, figures 5-22 and 8-12.

5-169. Description. The composite sync adj, and channel A sync adj. are set so the instrument triggers at the same point on all signals.

5-170. Equipment.

a. Oscillator.

b. BNC Cable, 44 in.

5-171. Procedure.

a. Connect oscillator to channel A INPUT.

b. Set CHANNEL A VOLTS/DIV to .1.

c. Set oscillator to 50-kHz, 6-div output.

d. Set main TIME/DIV switch to 5 uSEC.

e. Adjust channel A POSITION to center display.

f. Adjust main TRIGGER LEVEL until sweep triggers at center graticule.

g. Set main trigger coupling pushbutton switch to DC.

h. Adjust A5A4R80, composite sync adj, until sweep triggers at same point as in step f.

i. Set trig to A ONLY TRIG.

j. Adjust A5A4R50, channel A sync zero adj, until sweep triggers at same point as in step f.

k. Disconnect test equipment.

l. To return to initial settings, set Model 1703A controls as follows:

trig	NORM TRIG
CHANNEL A VOLTS/DIV	.01

m. Refer to schematics 4 and 5 if adjustment cannot be made.

5-172. TRIGGER SENSITIVITY ADJUST.

5-173. Reference. Schematic 10, figures 5-22 and 8-23.

5-174. Description. Trigger sensitivity is adjusted with a calibrated input to optimize triggering across the entire specified frequency range.

5-175. Equipment.

a. Oscillator.

b. BNC Cable, 44 in.

5-176. Procedure.

a. Set Model 1703A controls as follows:

trig	A ONLY TRIG
CHANNEL A VOLTS/DIV	0.2
main TIME/DIV	.5 mSEC
main HF REJ	engaged
delayed HF REJ	engaged
delayed AUTO/TRIG	TRIG

b. Connect oscillator output to channel A INPUT.

c. Set oscillator controls for 500-Hz, 4-div display output signal as viewed on Model 1703A CRT.

d. Adjust main TRIGGER LEVEL and A6A2R46, trigger sensitivity adj, until stable trigger is obtained on entire range of positive slope without double triggering.

Note

There is a small, allowable range of rotation for A6A2R46 where step d is satisfied. If optimum high frequency trigger sensitivity is desired, rotate A6A2R46 to the most ccw position within the allowable range. If optimum low frequency trigger stability is desired, rotate A6A2R46 to the most cw position within the allowable range. The trigger sensitivity is set at the factory for optimum high frequency trigger sensitivity and (farthest ccw within the allowable range).

e. Recheck performance in accordance with paragraph 5-78. Readjust A6R2R46 if necessary.

f. Set main TIME/DIV to 1 mSEC.

g. Set delayed TIME/DIV to .5 mSEC.

h. Adjust main TRIGGER LEVEL for stable display.

i. Set sweep display to DELAYED SWEEP.

j. Adjust delayed TRIGGER LEVEL and A6A2R63, trigger sensitivity adj, until stable display is obtained.

k. After stable display is obtained, adjust delayed TRIGGER LEVEL and A6A2R63 until instrument triggers across entire range of positive slope without double triggering.

Note

There is a small allowable range of rotation for A6A2R63 where step k is satisfied. If optimum high frequency trigger sensitivity is desired, rotate A6A2R63 to the most cw position within allowable range. If optimum low frequency trigger stability is desired, rotate A6A2R63 to most ccw position within allowable range. The trigger sensitivity is set at factory for optimum high frequency trigger sensitivity (farthest cw within allowable range).

l. Recheck performance in accordance with paragraph 5-83. Readjust A6A2R63 if necessary.

m. Disconnect test equipment.

n. To return to initial settings, set Model 1703A controls as follows:

delayed TIME/DIV	OFF
main TIME/DIV	5 uSEC
delayed AUTO/TRIG	AUTO
sweep display	MAIN SWEEP
CHANNEL A VOLTS/DIV	.01
trig	NORM TRIG
main HF REJ	disengaged
delayed HF REJ	disengaged

o. Refer to schematics 8 and 9 if adjustment cannot be made.

5-177. SWEEP LENGTH ADJUST.

5-178. Reference. Schematics 11 and 17, figures 5-22 and 8-40.

5-179. Description. The horizontal preamplifier X1 gain adjust is set to calibrate the 1.00 and 9.00 positions on the DELAY TIME dial.

5-180. Procedure.

a. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV	as required for comfortable display
main TIME/DIV	1 mSEC
delayed TIME/DIV	1 uSEC

b. Adjust INTENSITY so bright dot is visible on trace.

c. Set DELAY TIME dial to 1.00.

d. Adjust HORIZONTAL POSITION until bright dot is on second vertical graticule line from left.

e. Set DELAY TIME dial to 9.00.

f. Adjust A6A9R1, X1 gain adj, until bright dot is on 10th vertical graticule line from left.

g. Repeat steps c through f until bright dots are exactly 8 divisions apart when DELAY TIME dial is moved from 1.00 to 9.00.

h. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV	.01
main TIME/DIV	5 uSEC
delayed TIME/DIV	OFF

i. Refer to schematics 11 and 17 if adjustment cannot be made.

5-181. MAIN SWEEP TIMING ADJUST.

5-182. Reference. Schematics 11, 12, and 17, figures 5-22, 8-27 and 8-30.

5-183. Description. The main sweep time adjustments are made with a known time reference input to provide a calibrated sweep.

5-184. Equipment.

a. Time-mark Generator.

b. BNC Cable.

5-185. Procedure.

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

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV	as required
main TIME/DIV	1 uSEC
delayed TIME/DIV	.1 uSEC

c. Set time-mark generator for 1-usec time-mark output.

d. Adjust DELAY TIME dial to intensify second time mark from left.

e. Set sweep display to DELAYED SWEEP.

f. Adjust DELAY TIME dial to place time mark on center vertical graticule line. Note DELAY TIME dial setting.

DELAY TIME dial

g. Set sweep display to MAIN SWEEP.

h. Advance DELAY TIME dial to intensify 10th marker from left.

i. Set sweep display to DELAYED SWEEP.

j. Set DELAY TIME dial to 8.00 above dial setting noted in step f.

k. Adjust A6A5R16, cal adj 50 ms/div - 2 sec/div, to align 10th time mark with center vertical graticule line.

l. Repeat steps d through k until no further adjustment is required as DELAY TIME dial is varied to intensify second and 10th time mark.

m. Make main sweep time adjustment in table 5-7 using procedures in steps b through l.

n. Disconnect test equipment.

o. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC
delayed TIME/DIV ..... OFF
DELAY TIME dial..... 0.00

5-186. DELAYED SWEEP TIME ADJUST.

5-187. Reference. Schematics 13 and 14, figures 5-22, 8-32 and 8-34.

5-188. Description. The delayed sweep time adjustments are made with a known time reference input to provide a calibrated sweep.

5-189. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-190. Procedure.

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

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ... as required for comfortable display
main TIME/DIV..... .2 uSEC
delayed TIME/DIV ..... .1 uSEC
sweep display..... DELAYED SWEEP

c. Set time-mark generator for 0.1-usec time-mark output.

Table 5-7. Main Sweep Time Adjustments

Time Marks	Main TIME/DIV	Delayed TIME/DIV	Adjustment
1 usec	1 uSEC	.1 uSEC	A6A5R16
.1 ms	.1 mSEC	1 uSEC	A6A5R15
5 ms	5 mSEC	50 uSEC	A6A5R14
.1 sec	.1 SEC	1 mSEC	A6A5R13

d. Adjust A6A6R16, cal adjust 0.1 usec/div - 0.2 usec/div, for 11 marks in 10 divisions.

e. Complete rest of sweep time adjustments per table 5-8. Main TIME/DIV control should be one step slower than delayed TIME/DIV.

f. Disconnect test equipment.

g. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC
delayed TIME/DIV ..... OFF
sweep display..... MAIN SWEEP

h. Refer to schematics 13 and 14 if adjustment cannot be made.

5-191. X10 GAIN ADJUST.

5-192. Reference. Schematic 17, figures 5-22 and 8-40.

5-193. Description. The horizontal preamplifier circuit X10 gain adjust is adjusted in the expand mode for X10 magnification.

5-194. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-195. Procedure.

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

b. Set Model 1703A controls as follows:

main TIME/DIV..... 1 mSEC
CHANNEL A VOLTS/DIV ... as required
for comfortable display

c. Set time-mark generator controls for 0.1-ms time-mark output.

d. Set SWP MAG to X10.

e. Adjust A6A9R21, X10 gain adj, for 1 div between time marks.

f. Disconnect test equipment.

g. To return to initial settings, set Model 1703A controls as follows:

SWP MAG..... X1
main TIME/DIV..... 5 uSEC
CHANNEL A VOLTS/DIV ..... .01

h. Refer to schematic 17 if adjustment cannot be made.

5-196. MAG CENTERING ADJUST.

5-197. Reference. Schematic 17, figures 5-22 and 8-40.

5-198. Description. The mag adjust is set so the display is expanded around center screen.

5-199. Equipment.

a. Time-mark Generator.

b. BNC Cable, 44 in.

5-200. Procedure.

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

b. Set Model 1703A controls as follows:

main TIME/DIV..... .2 mSEC
CHANNEL A VOLTS/DIV ... as required
for comfortable display

c. Set time-mark generator controls for 1-ms time-mark output.

d. Adjust HORIZONTAL POSITION so middle time mark is on center graticule.

e. Set SWP MAG to X10.

f. Adjust A6A9R2, mag adj, to recenter middle time mark.

Table 5-8. Delayed Sweep Time Adjustments

Time-mark Generator	delayed TIME/DIV	Adjustment	Time Mark
0.1 usec	.1 uSEC	A6A6R16	11 in 10 div
1 usec	1 uSEC	A6A6R15	
0.1 ms	1 uSEC	A6A6R14	
10 ms	10 mSEC	A6A6R13	

g. Disconnect test equipment.

h. To return to initial settings, Set Model 1703A controls as follows:

main TIME/DIV..... 5 uSEC
SWP MAG..... X1
CHANNEL A VOLTS/DIV ..... .01

i. Refer to schematic 17 if adjustment cannot be made.

5-201. HORIZONTAL LINEARITY ADJUST.

5-202. Reference. Schematic 17, figures 5-22 and 8-41.

5-203. Description: The horizontal output amplifier response is adjusted to give the best high frequency linearity and timing accuracy.

5-204. Equipment.

a. Time-mark Generator.

b. 50-ohm Feedthrough Termination.

5-205. Procedure.

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

b. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ... as required for comfortable display
main TIME/DIV..... .1 uSEC

c. Set time-mark generator controls for 50-ns time-mark output.

d. Set SWP MAG to X10. Setting provides sweep length of about 110 divisions.

e. Adjust A6A10C1, HF adj 1, and A6A10C4, HF adj 2, for best overall linearity and timing on center 80 divisions of available display.

Note

Use HORIZONTAL POSITION control to view left, middle and right portions of sweep display. Best linearity wil usually be obtained with both A6A10C1 and A6A10C4 adjusted in or out the same amount.

f. Remove test equipment.

g. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
main TIME/DIV..... 5 uSEC
SWP MAG..... 1

h. Refer to schematic 7 if adjustment cannot be made.

5-206. CALIBRATOR ADJUST.

5-207. Reference. Schematic 19, figures 5-22 and 8-45.

5-208. Description. The calibrator output is compared against a voltmeter calibrator standard to accurately set the calibrator amplitude.

5-209. Equipment.

a. Voltmeter Calibrator.

b. Test Leads.

c. BNC Cable, 44 in.

5-210. Procedure.

a. Set CHANNEL A VOLTS/DIV to .1.

b. Set channel A coupling to DC.

c. Connect voltmeter calibrator to channel A INPUT.

d. Set voltmeter calibrator to 1V p-p output signal.

e. Adjust channel A vernier for display of 6 div.

f. Disconnect voltmeter calibrator.

g. Connect CAL 1 VOLT output to channel A INPUT with test lead.

h. Adjust A4R22, cal ampl adj, for 6-div display.

i. Disconnect CAL 1 VOLT output from channel A.

j. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
channel A vernier..... CAL
channel A coupling ..... AC

k. Refer to schematic 19 if adjustment cannot be made.

5-211. EXT HORIZ INPUT COMPENSATION

5-212. Reference. Schematic 18, figures 5-22 and 8-43.

5-213. Description. A square-wave generator is used to adjust input compensation. A 5V, 1-kHz signal from the square-wave generator is applied to EXT HORIZ INPUT and input comp, A9C1, is adjusted for minimum overshoot and undershoot.

5-214. Equipment.

a. Square-wave Generator.

b. BNC Cable, 44 in.

5-215. Procedure.

a. Connect square-wave generator output to EXT HORIZ INPUT.

b. Set Model 1703A controls as follows:

sweep display..... EXT HORIZ INPUT
ext horiz VERNIER..... CAL
SINGLE..... engaged

c. Set square-wave generator controls for 5V, 1-kHz output signal.

d. Adjust A9C1, input comp, for minimum overshoot or undershoot.

Note

Overshoot is characterized by a dim extenion of the trace on the right side of CRT. Undershoot is characterized by an intensified portion of the trace on the right side of CRT. The best adjustment of A9C1 is when the intensified portion of the trace and the dim extension of the trace have disappeared.

e. Remove test equipment.

f. To return to initial settings, set Model 1703A controls as follows:

sweep display..... MAIN SWEEP
SINGLE..... disengaged

g. Refer to schematic 18 if adjustment cannot be made.

5-216. EXT HORIZ GAIN ADJUST.

5-217. Reference. Schematic 18 and figures 5-22 and 8-43.

5-218. Description. The gain of the external horizontal amplifier is set by applying a 10V, 400-Hz signal from a voltmeter calibrator and adjusting cal adj, A9R15 for exactly 10 div of horizontal deflection.

5-219. Equipment.

a. Voltmeter Calibrator.

b. BNC Cable, 44 in.

5-220. Procedure.

a. Connect voltmeter calibrator output to EXT HORIZ INPUT.

b. Set Model 1703A controls as follows:

sweep display..... EXT HORIZ INPUT
SINGLE..... engaged

c. Set voltmeter calibrator controls for 10V output signal.

d. Adjust A9R15 cal adj, to obtain exactly 10 div of horizontal deflection.

e. Disconnect test equipment.

f. To return to initial settings, set Model 1703A controls as follows:

sweep display..... MAIN SWEEP
SINGLE..... disengaged

g. Refer to schematic 18 if adjustment cannot be made.

5-221. INPUT CAPACITANCE AND ATTENUATOR COMPENSATION ADJUST.

5-222. Reference. Schematics 3 and 4, figures 5-22 and 8-10.

5-223. Description. The input capacitance is adjusted to 27 pF using an LC meter. The attenuator compensation adjustment is made with a square-wave input to provide optimum pulse response.

5-224. Equipment.

a. LC Meter.

b. Square-wave Generator.

c. BNC Cable, 44 in.

d. BNC Tee.

e. BNC Cable, 9 in.

5-225. *Procedure.*

a. Connect LC meter to channel A INPUT.

b. Set Model 1703A controls as follows:

DISPLAY..... ALT
main TIME/DIV..... 20 uSEC
channel A coupling ..... DC
channel B coupling ..... DC

c. Adjust A5A4C1, input cap, for 27-pF indication on LC meter.

d. Connect LC meter to channel B INPUT.

e. Adjust A5A4C2, input cap, for a 27-pF indication on LC meter.

f. Disconnect LC meter.

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

h. Set square-wave generator for 10-kHz output.

i. Adjust square-wave generator amplitude control for 4-div display.

j. Perform adjustments in table 5-9 for best square-wave response.

k. Disconnect square-wave generator.

l. Connect LC meter to appropriate channel as listed in table 5-10 and adjust appropriate component for 27-pF indication.

m. Disconnect test equipment.

n. To return to initial settings set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV ..... .01
CHANNEL B VOLTS/DIV ..... .01
DISPLAY..... A
main TIME/DIV..... 5 uSEC

Table 5-9. Square-wave Adjustment

VOLTS/DIV	CHANNEL A	CHANNEL B
.02	A5A1C17	A5A2C17
.05	A5A1C18	A5A2C18
.1	A5A1C7	A5A2C7
.2	A5A1C11	A5A2C11
.5	A5A1C12	A5A2C12
1.0	A5A1C8	A5A2C8

channel A coupling ..... AC
channel B coupling ..... AC

o. Refer to schematics 3 and 4 if adjustments cannot be made.

5-226. CASCADE AMPLIFIER GAIN ADJUST.

5-227. *Reference.* Schematic 8 and figures 5-22 and 8-21.

5-228. *Description.* Gain is adjusted by connecting CHANNEL A OUTPUT to channel B INPUT, inserting a known amplitude, 400-Hz signal into channel A INPUT and adjusting A5A6R13 to obtain the desired deflection on the CRT.

5-229. *Equipment.*

a. Voltmeter Calibrator.

b. BNC Cable, 44 in.

c. BNC Cable, 8 in.

5-230. *Procedure.*

a. Remove bottom cover.

b. Set Model 1703A controls as follows:

DISPLAY..... B
main TIME/DIV..... To observe convenient number of cycles

c. Using 8-in. BNC cable, connect CHANNEL A OUTPUT to channel B INPUT.

d. Connect 5-mV signal from voltmeter calibrator to channel A INPUT.

e. Observe CRT. Adjust A5A6R13, gain adj, to obtain exactly 5-div deflection on CRT.

f. Remove test equipment.

g. To return to initial settings, set Model 1703A controls as follows:

DISPLAY..... A
main TIME/DIV..... 5 uSEC

h. Refer to schematic 8 if adjustment cannot be made.

Table 5-10. Capacitance Adjustment

VOLTS/DIV	CHANNEL A	CHANNEL B
0.1	A5A1C2	A5A2C2
1.0	A5A1C3	A5A2C3

5-231. PULSE RESPONSE ADJUST.

5-232. Reference. Schematic 6, figures 5-22 and 8-17.

5-233. Description. The vertical output amplifier high frequency compensation capacitors are adjusted for optimum pulse response.

5-234. Equipment.

a. Square-wave Generator.

b. 50-ohm Feedthrough Termination.

5-235. Procedure.

a. Connect square-wave generator output through 50-ohm feedthrough termination to channel A INPUT.

b. Set Model 1703A controls as follows:

main TIME/DIV	.1 uSEC
SWP MAG	X10

c. Set square-wave generator controls for 100-kHz, 6-div display.

d. Adjust A5A4C32, CHAN A LEADING EDGE, HF Adj 1, A5A5C9, HF Adj 3, and A5A5R11, HF Adj 2, for best pulse response with risetime of less than 10 ns. A5A5C9 and A5A5R11 affect high frequency corner. A5A4C32 affects only first 10 ns of leading edge of pulse.

e. Connect square-wave generator to channel B INPUT.

f. Set DISPLAY to B.

g. Observe pulse response of channel B with B POLARITY in NORM and INVT position.

h. Adjust A5A4C33, CHAN B LEADING EDGE, for best response in first 10 ns of pulse.

i. Readjust A5A5C9 and A5A5R11 if necessary to obtain optimum pulse response for both polarities and both channels with risetime of less than 10 ns

j. Disconnect test equipment.

k. To return to initial settings, set Model 1703A controls as follows:

DISPLAY	A
main TIME/DIV	5 uSEC

l. Refer to schematic 6 if adjustment cannot be made.

5-236. STORAGE CIRCUIT ADJUSTMENTS.

5-237. Reference. Schematics 20 and 21, figures 5-21, 5-22 and 8-47.

5-238. Description. The storage circuit adjustments are set to optimize the performance of the storage CRT.

5-239. Equipment.

a. Oscillator.

b. BNC Cable, 44 in.

5-240. Procedure.

a. Set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV	2
main TIME/DIV	10 mSEC
INTENSITY	normal
PERSISTENCE	fully ccw

Note

Reduce intensity setting of unwanted blanking occurs at start of trace.

b. Set A8R15, STD ERASE, fully ccw.

c. Set A8R16, FAST ERASE, fully ccw.

d. Press and release PUSH:ERASE control.

e. Adjust A8R30, STD COLL, to bring background illumination just inside aluminum ring (figure 5-21a).

f. Adjust A8R8, FG GRID, for maximum height of background illumination.

g. Readjust A8R30, STD COLL, until background illumination just fills CRT viewing area (figure 5-21b).

h. Set PERSISTENCE control full cw (MAX).

i. Press and release PUSH:ERASE control.

j. Adjust A8R15, STD ERASE, cw in small increments, erasing after each adjustment, until background just erases completely.

Note

If CRT cannot be made to erase completely, rotate A8R30, STD COLL, slightly ccw and repeat step j.

k. Connect oscillator to channel A INPUT.

l. Set oscillator controls for 80-Hz output.

m. Set PERSISTENCE control fully ccw.

n. Set oscillator amplitude controls for 4-div CRT display.

o. Set CHANNEL A VOLTS/DIV to .1 (80-div display).

p. Engage SINGLE pushbutton.

q. Set PERSISTENCE control fully cw (MAX).

r. Set INTENSITY fully cw.

s. Press and release PUSH:ERASE control.

t. Press and release RESET control to trigger single sweep. Observe trace inside 5-div by 9-div rectangle for 60 sec (figure 5-21c).

Note

Repeat steps s and t and adjust FOCUS control as necessary for sharpest trace.

u. Set Model 1703A controls as follows:

main TIME/DIV	.2 mSEC
INTENSITY	fully ccw
WRITING SPEED	FAST
PERSISTENCE	ccw

v. Adjust A8R29, FAST COLL, until background illumination just fills CRT viewing area (figure 5-21b).

w. Set PERSISTENCE control fully cw (MAX).

x. Press and release PUSH:ERASE control.

y. Adjust A8R16, FAST ERASE, cw in small increments, erasing after each adjustment, until good compromise between no light and saturated brightness is obtained on CRT after erasing (figure 5-21d).

z. Set oscillator controls for 4-kHz output.

aa. Set INTENSITY fully cw.

bb. Press and release PUSH:ERASE control.

cc. Press and release RESET control to trigger single sweep.

Note

Repeat steps bb and cc and adjust FOCUS control as necessary for sharpest trace (paragraph 3-88).

dd. Observe trace inside 5-div by 9-div rectangle for 15 sec (figure 5-21e).

Note

If display fades positive too fast, adjust A8R16, FAST ERASE, cw slightly and repeat steps aa through dd. If display is not stored over entire area, adjust A8R16, FAST ERASE, ccw slightly and repeat steps aa through dd.

ee. Remove test equipment.

ff. To return to initial settings, set Model 1703A controls as follows:

CHANNEL A VOLTS/DIV	.01
main TIME/DIV	5 uSEC
WRITING SPEED	STD

gg. Refer to schematics 20 and 21 if adjustment cannot be made.

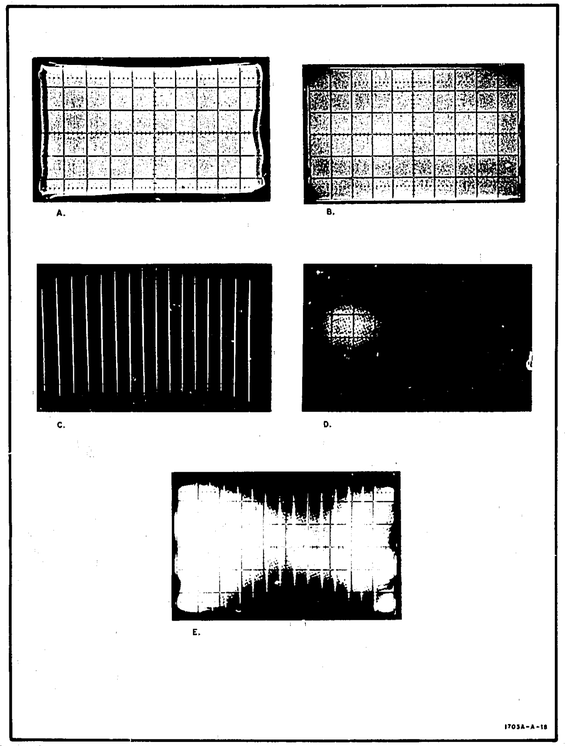
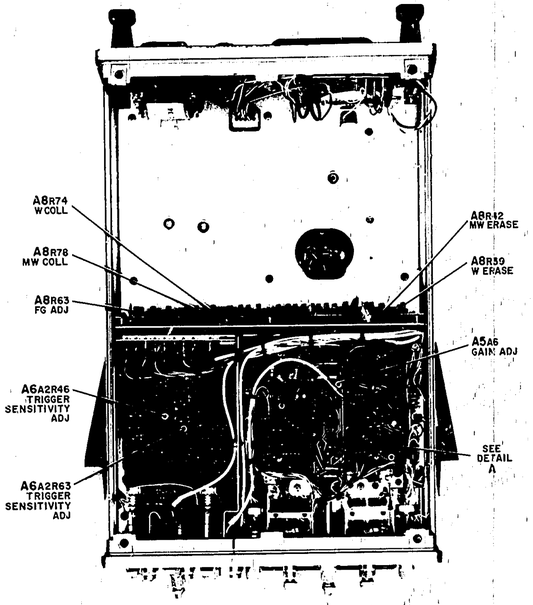
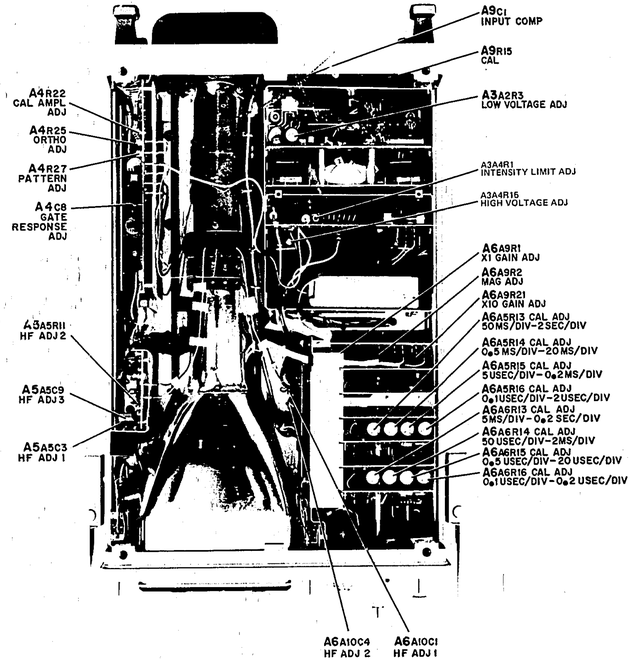


Figure 5-21. Typical CRT Displays





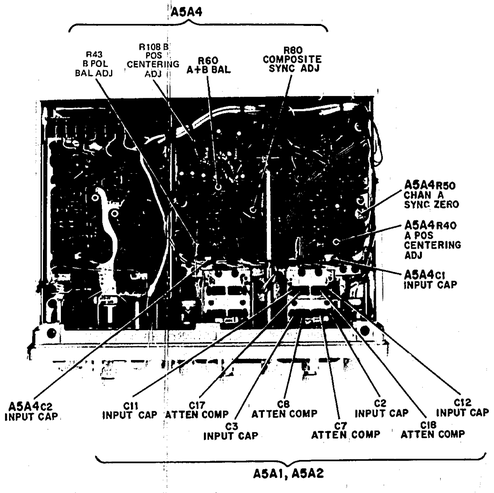


Figure 5-22.
Adjustments Locations

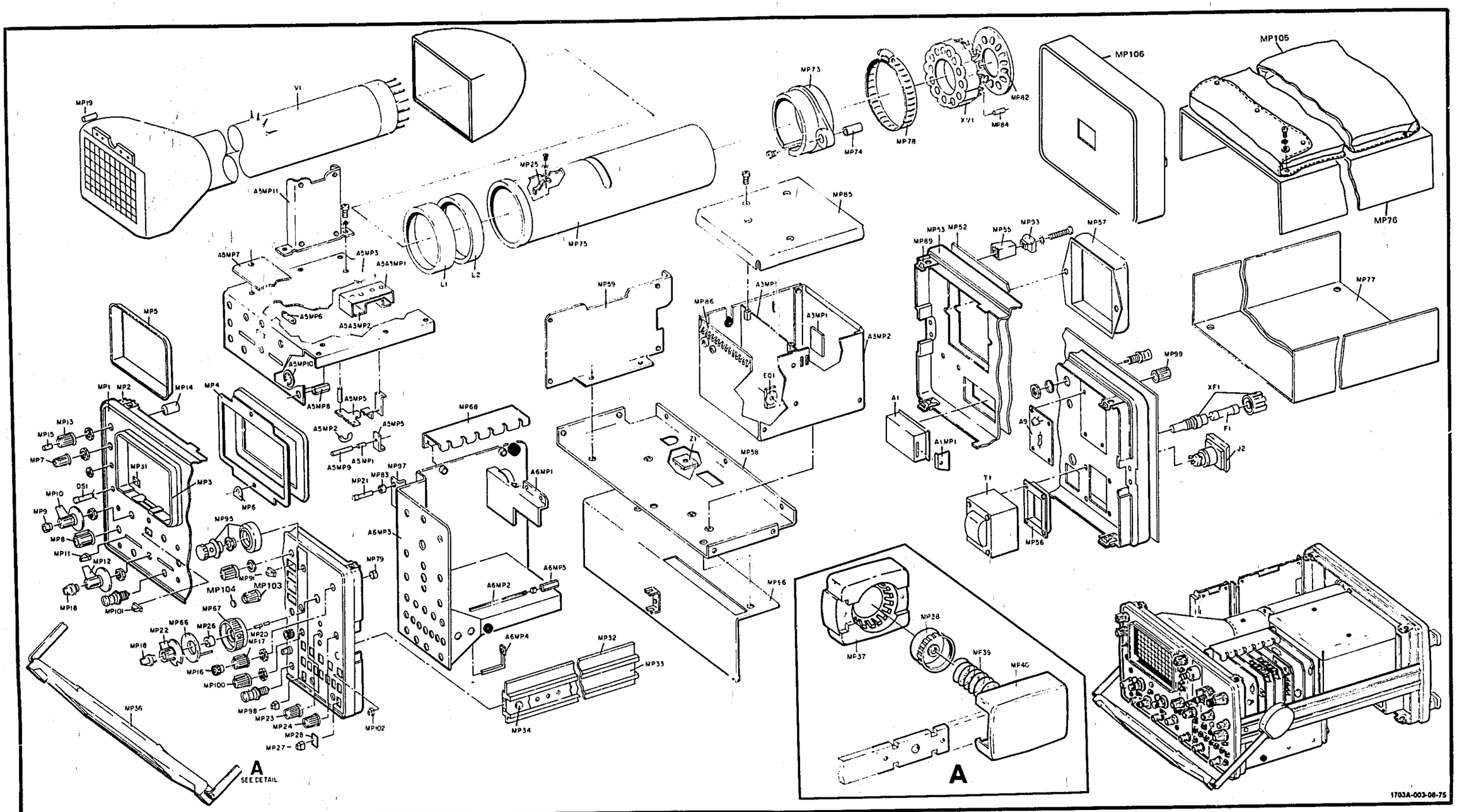


Figure 6-1. Parts Identification

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

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	0960-0444	1	POWER LINE INPUT ASSY	28480	0960-0444
A2	01701-66553	1	BOARD ASSY: LINE RECT	28480	01701-66553
A3	01703-61101	1	POWER SUPPLY MODULE	28480	01703-61101
A3A1	01703-66502	1	BOARD ASSY: LOW VOLTAGE MOTHER	28480	01703-66502
A3A2	01701-66554	1	BOARD ASSY: LOW VOLTAGE CONVERTER	28480	01701-66554
A3A3	01701-66537	1	BOARD ASSY: RECT AND FILTER	28480	01701-66537
A3A4	01703-66503	1	BOARD ASSY: HIGH VOLTAGE OSCILLATOR	28480	01703-66503
A3A5	01703-61106	1	ASSY: HIGH VOLTAGE MULTIPLIER	28480	01703-61106
A4	01703-66501	1	BOARD ASSY: GATE	28480	01703-66501
A5	01701-65815	1	VERTICAL AMPLIFIER MODULE	28480	01701-65815
A5A1	01701-63401	2	ATTENUATOR ASSY	28480	01701-63401
A5A2	01701-63401		ATTENUATOR ASSY	28480	01701-63401
A5A3	01703-61103	1	ASSY: HIGH VOLTAGE MULTIPLIER	28480	01703-61103
A5A4	01701-66541	1	BOARD ASSY: VERTICAL PREAMPL	28480	01701-66541
A5A5	01703-66507	1	BOARD ASSY: VERTICAL OUTPUT	28480	01703-66507
A5A6	01707-66503	1	BOARD ASSY: CHANNEL A OUTPUT	28480	01707-66503
A6	01703-65804	1	HORIZONTAL AMPLIFIER MODULE	28480	01703-65804
A6A1	01701-66558	1	BOARD ASSY: HORIZONTAL MOTHER	28480	01701-66558
A6A2	01701-66552	1	BOARD ASSY: TRIGGER	28480	01701-66552
A6A3	01701-66514	2	BOARD ASSY: INTEGRATOR MAIN	28480	01701-66514
A6A4	01701-66514		BOARD ASSY: INTEGRATOR DELAYED	28480	01701-66514
A6A5	01701-66551	1	BOARD ASSY: SWEEP TIME MAIN	28480	01701-66551
A6A6	01701-66515	1	BOARD ASSY: SWEEP TIME DELAYED	28480	01701-66515
A6A7	01701-66550	1	BOARD ASSY: HOLDOFF AND COMPARATOR	28480	01701-66550
A6A8	01701-66565	1	BOARD ASSY: HORIZONTAL MODE	28480	01701-66565
A6A9	01703-66508		BOARD ASSY: HORIZONTAL PREAMPL	28480	01703-66508
A6A10	01703-66510		BOARD ASSY: HORIZONTAL OUTPUT	28480	01703-66510
A6A11	01703-66511		STORAGE SWITCH	28480	01703-66511
A7			NOT ASSIGNED		
A8	01703-66512	1	BOARD ASSY: STORAGE	28480	01703-66512
A9	01701-66524	1	BOARD ASSY: EXT HORIZONTAL	28480	01701-66524
A10	01703-61608	1	CONNECTOR ASSY: HIGH VOLTAGE	28480	01703-61608
BT1	1251-2510	1	BODY:R & P CONNECTOR 2 MALE CONTACT	27264	1545 P1
BT1MP1	1251-2599	15	CONTACT:R & P CONNECTOR MALE	27264	1380T
DS1	1450-0709	1	LIGHT:INDICATOR 90 VDC	72765	6140-6004-503
F1	2110-0002	1	FUSE:CARTRIDGE 2 AMP 3 AG (FOR AC OPERATION)	75915	312.002
F1	2110-0003	1	FUSE: CARDRIDGE 3 AMP 3 AG (FOR DC OPERATION)	75915	312 003
J1	1250-0118	7	CONNECTOR:BNC	24931	28JR 124-1
J2	1250-0118		CONNECTOR:BNC	24931	28JR 124-1
J3	1250-0118		CONNECTOR:BNC	24931	28JR 124-1
J4	01701-67602	1	CONNECTOR ASSY:DC POWER	28480	01701-67602
J5	1250-0118		CONNECTOR:BNC	24931	28JR 124-1
J6	1250-0118		CONNECTOR:BNC	24931	28JR 124-1
J7	1250-0118		CONNECTOR:BNC	24931	28JR 124-1
J8	1250-0118		CONNECTOR:BNC	24931	28JR 124-1
L1	01701-66001	2	COIL ASSY:ALIGNMENT	28480	01701-66001
L2	01701-66001		COIL ASSY:ALIGNMENT	28480	01701-66001
MP1	01703-00205	1	PANEL:FRONT	28480	01703-00205
MP2	01701-20504	1	FRAME:FRONT	28480	01701-20504
MP3	01701-24702	1	SUPPORT:CRT-CAMERA	28480	01701-24702
MP4	01703-07101	1	MASK:CRT	28480	01703-07101
MP5	5040-0814	1	BEZEL:DRIVE, BLACK	28480	5040-0814
MP6	01701-09103	2	SPRING:FILTER CONTRAST	28480	01701-09103
MP7	0370-2611	2	KNOB:JADE GRAY (FOCUS)	28480	0370-2611
MP8	0370-1099	3	KNOB:JADE GRAY POSTION/TRIGGER LEVEL	28480	0370-1099
MP9	0370-0962	2	KNOB ASSY: VOLTS/DIV DIV/CAL	28480	0370-0962
MP10	0370-0966	2	KNOB ASSY:VOLTS/DIV	28480	0370-0966
MP11	0370-0929	2	KNOB:LEVER, JADE GRAY COUPLING	28480	0370-0929
MP12	0370-2167	1	KNOB ASSY:DISPLAY	28480	0370-2167
MP13	01703-67401	2	KNOB ASSY	28480	01703-67401
MP14	5040-7545	1	COVER: HIGH VOLTAGE POT (FOCUS)	28480	5040-7545
MP15	0370-2610	1	KNOB: ROUND	28480	0370-2610
MP16	0370-0963	1	KNOB:HORIZONTAL POSITION - FINE	28480	0370-0963
MP17	0370-1100	1	KNOB:JADE GRAY HORIZONTAL POSITION	28480	0370-1100
MP18	01707-67406	1	KNOB:BAR TRIG/SWEEP DISPLAY	28480	01707-67406
MP19	1520-0079	4	MOUNT: SHOCK	00000	OBD
MP20	01701-63705	1	SHAFT ASSY: SWEEP TIME	28480	01701-63705
MP21	01703-63702	1	SHAFT ASSY: PUSHBUTTON	28480	01703-63702
MP22	0370-2173	1	KNOB:ROUND	28480	0370-2173
MP23	0370-0957	1	KNOB ASSY (NORM)	28480	0370-0957
MP24	01700-67407	3	KNOB ASSY (CAL)	28480	01700-67407
MP25	01701-09104	2	SPRING:CONTACT	28480	01701-09104
MP26	01701-23203	1	COLLAR:ANTI-ROTATION	28480	01701-23203
MP27	0370-2610	10	KNOB ASSY:BLANK	28480	0270-2610
MP28	0370-0606	19	BEZEL:PUSHBUTTON KNOB, JADE GRAY	28480	0370-0606
MP30	1510-0038	1	BINDING POST	28480	1510-0038
MP31	0610-0097	1	RETAINER:PUSH-ON	78553	C185-014-24D
MP32	01703-23703	2	RAIL:SIDE	28480	01703-23703
MP33	01710-64101	2	COVER:RAIL REAR	28480	01710-64101
MP34	01707-04104	2	COVER ASSY:RAIL FRONT	28480	01707-04104
MP35			NOT ASSIGNED		
MP36	5040-0515	1	GRIP:HANDLE	28480	5040-0515

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
MP37	5020-8734		GEAR:RING HANDLE	28480	5020-8734
MP38	5020-8735		GEAR:HUB HANDLE	28480	5020-8735
MP39	1460-0604		SPRING:COMPRESSION		1460-0604
MP40	5040-0611		CAP:TRIM HANDLE	28480	5040-0611
MP41			NOT ASSIGNED		
MP42					
MP43					
MP45					
MP46					
MP47					
MP48					
MP49					
MP50					
MP51					
MP52	01703-00203	1	PANEL:REAR	28480	01703-00203
MP53	5001-1060	1	FRAME:REAR	28480	5001-1060
MP54			NOT ASSIGNED		
MP55	5040-5861	4	FOOT:BASE	28480	5040-5861
MP56	01701-04109	1	COVER:TRANSFORMER	28480	01701-04109
MP57	01701-04108	1	COVER:CRT	28480	01701-04108
MP58	01703-00101	1	DECK:BATTERY	28480	01703-00101
MP59	01703-00603	1	SHIELD:GATE	28480	01703-00603
MP66	0370-2397	1	CORE:FLOATING	28480	0370-2397
MP67	01707-67404	1	KNOB ASSY	28480	01707-67404
MP68	01701-02303	1	KEEPER:PC BOARDS	28480	01701-02303
MP73	1400-0798	1	CLAMP:CRT, OLIVE	28480	1400-0798
MP74	0380-1019	2	STANDOFF:CRT	28480	0380-1019
MP75	01703-60602	1	SHIELD:CRT	28480	01703-60602
MP76	01703-04106	1	COVER:TOP	28480	01703-04106
MP77	01703-04102	1	COVER:BOTTOM	28480	01703-04102
MP78	1400-0026	1	CLAMP:HOSE	66295	36H
MP79	1500-0364	1	COLLAR:PRECISION SST	28480	1500-0364
MP82	1200-0408	1	COVER:CRT SOCKET	28480	1200-0408
MP85	01703-04103	1	COVER:POWER SUPPLY	28480	01703-04103
MP86	0363-0068	2	CONTACT GROUND	28480	0363-0068
MP89	1390-0084	8	RECEPTACLE	28480	1390-0084
MP90	0370-0684	1	KNOB:PUSHBUTTON FAST	28480	0370-0684
MP91	0370-0684	1	KNOB:PUSHBUTTON STD	28480	0370-0684
MP92	0370-0684	1	KNOB:PUSHBUTTON STORE	28480	0370-0684
MP93	5040-5862	4	CAP:FOOT	28480	5040-5862
MP94	0370-0684	1	KNOB:PUSHBUTTON CONV	28480	0370-0684
MP95	1140-0036	1	DIAL-TURNS COUNTING	28480	1140-0036
MP96	01703-01201	1	BRACKET:STORAGE SWITCH	28480	01703-01201
MP97	01703-01202	1	BRACKET:STORAGE SWITCH/PUSH ERASE	28480	01703-01202
MP98	01701-67416	5	KNOB:PUSHBUTTON	28480	01701-67416
MP99	01701-67419	1	KNOB ASSY (CAL)	28480	01701-67419
MP100	01701-67420	1	KNOB ASSY:DELAYED TRIGGER LEVEL	28480	01701-67420
MP101	0370-0604	1	PUSHBUTTON B POLARITY	28480	0370-0604
MP102	0370-0671	4	PUSHBUTTON BLANK	28480	0370-0671
MP103	0370-2611		KNOB STORE TIME (MP 104 MUST BE ORDERED FOR THIS PART)	28480	0370-2611
MP104	0360-0083		DECAL: HARVEST GOLD FOR MP103		
				06987	WC 86
MP105	1540-0292	1	COVER, FRONT PANEL	28480	1540-0292
MP106	5040-0516	1	CASE, ACCESSORY	28480	5040-0516
XV1	1200-0037	1	SOCKET:CRT TUBE	72825	97097
P1	1251-2412	1	BODYER 6 P CONNECTOR 15 MALE CONTACT	27264	16625-15P
P2			NOT ASSIGNED		
R1	2100-3209	1	REVAR COMP 5K OHM (INTENSITY)	28480	2100-3209
R2	2100-0683	1	R VAR COMP 2.5 MEGOHM 10% LIN 1/2W	12697	382VX
R3	0684-1011		FIXED COMP 100 OHM 10% 1/4W	01121	CB 1011
R4	2100-0428	1	REVAR COMP 20K OHM LIN 20% 0.2W (TRACE ALIGN)	28480	2100-0428
R5	2100-3191	1	REVAR CER 100K OHM 0% LIN 1/2W (ASTIGMATISM)	28480	2100-3191
R6	2100-2588	1	REVAR COMP 5K OHM 10% 10 CLOG 1/4W (EXT HORIZ VERNIER)	28480	2100-2588
R7	2100-3189	1	REVAR COMP 50K OHM 20% LIN 1/2W (STORE TIME)	28480	2100-3189
R8	2100-3190	1	REVAR CER 50K OHM 20% LIN 1/2W (PERSISTENCE)	28480	2100-3190
S1	3101-0540	1	SWITCH:TOGGLE DPDT (POWER)	28480	3101-0540
S2	3101-1391	1	SWITCH (P/O REAR PANEL, SEE MP52) POWER MODE	28480	3101-1391
S3	3101-0044	1	SWITCH:PUSHBUTTON SPST	81073	301NO
T1	01703-61106	1	TRANSFORMER	28480	01703-61106
V1	5083-3452	1	CRT:P31 PHOSPHOR	28480	5083-3400
W1	01703-61615	1	CABLE ASSY: INT SYNC (VERT PREAMPL TO TRIGGER)	28480	01703-61615
W2	01703-61609	2	CABLE ASSY: TWIN LEAD (VERT TO CRT)	28480	01703-61609
W3	01703-61609	1	CABLE ASSY: TWIN LEAD (HORIZONTAL TO CRT)	28480	01703-61609
W4	01703-61603	1	CABLE ASSY: CHOP BLANKING (VERT PREAMPL TO GATE)	28480	01703-61603
W5	01703-61604	1	CABLE ASSY: BLANKING (HORIZ PREAMPL TO GATE)	28480	01703-61604
W6	01701-61609	1	CABLE ASSY: ALT TRIGGER (HORIZ PREAMPL TO VERTICAL PREAMPL)	28480	01701-61609
W7	01703-61602	1	CABLE ASSY: CAL 1 VOLT	28480	01703-61602

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
W8	01703-61606	1	CABLE ASSY: EXT HORIZ INPUT (EXT HORIZ AMPL TO HORIZ PREAMPL)	28480	01703-61606
W9	01703-61605	1	CABLE ASSY: Z AXIS INPUT	28480	01703-61605
W10	01701-61620	1	CABLE ASSY: CHANNEL A OUTPUT	28480	01701-61620
W11	8120-1521	1	CABLE ASSY: POWER CARD 7.5 FT	70903	KH 7147
W12	01703-61610	1	CABLE ASSY: LINE SYNC (LINE RECTIFIER TO TRIGGER)	28480	01703-61610
W13	01703-61607	1	CABLE ASSY: POWER INPUT	28480	01703-61607
W14	01703-61613	1	CABLE ASSY: MAIN	28480	01703-61613
XF1	1400-0084	1	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
Z1	1901-0526	1	DIODE ASSY:SI 100V	14099	SCA J1
MISC.	10101B	1	COVER: STORAGE	28480	10101B
A1	0960-0444	1	POWER LINE INPUT ASSY	28480	0960-0444
A1F1	2110-0006	1	FUSE:3.50AMP 125V SLOW-BLOW (FOR 230 VOLT OPERATION)	71400	MDL 1/2
A1F1	2110-0018	1	FUSE:CARTRIDGE 0.25 AMP SLOW BLOW (FOR 115 VOLT OPERATION)	75915	313.250
A1MP1	5000-5085	2	CLIP: MOUNTING	28480	5000-5085
A2	01701-66553		BOARD ASSY:LINE RECT	28480	01701-66553
A2C1	0160-3453	38	C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L5U5C525-2DY4
A2C2	0180-2351	1	C:FXD ELECT 2000 UF +75-10% 50VDCW	56289	390243
A2C3	0150-3084	7	C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A2CR1	1901-0045	6	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A2MP1	1400-0533	1	COMPONENT CLIP, BLACK VINYL	00000	7-9
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
A2R3	0684-1041	20	R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A2R4	0684-1521		R:FXD COMP 1500 OHM 10% 1/4W	01121	CB 1521
A3	01703-61101		POWER SUPPLY MODULE	28480	01703-61101
A3MP1	01700-00600	1	SHIELD, TRANSFORMER	28480	01700-00600
A3MP2	01703-05501	1	BOX: POWER	28480	01703-05501
A3MP3	01703-04701	1	GUSSET: POWER BOX	28480	01703-04701
A3EQ1	1200-0077	1	WASHER: INSULATOR	04713	14B52600F12
A3EQ2	5080-0476	1	INSULATOR: TRANSISTOR MICA	16037	#112
A3Q1	1854-0309	1	TRANSISTOR: SI NPN PD = 83.5W FT = 4MHZ	04713	SJE874
A3Q2	1854-0063	1	TST:RESI NPN	80131	2N3055
A3W1	01703-61612	1	CABLE:HIGH VOLTAGE	28480	01703-61612
A3XQ1	5060-0585		CABLE: Q1 CONNECTOR	28480	5060-0585
A3A1	01703-66502		BOARD ASSY: LOW VOLTAGE MOTHER	28480	01703-66502
A3A1C1	0180-1819	1	C:FXD ELECT 100 UF +75-10% 50VDCW	28480	0180-1819
A3A1C2	0160-0302	28	C:FXD MY 0.018 UF 200VDCW	56289	192P13392 PTS
A3A1C3	0180-2148	3	C:FXD ELECT 0.47 UF 20% 50VDCW	56289	1500474X005A2 DYS
A3A1C4	0150-0091	4	C:FXD ELECT 10 UF +50-10% 100VDCW	56289	500106F100DC2-DSM
A3A1C5	0180-0091		C:FXD ELECT 10 UF +50-10% 100VDCW	56289	500106F100DC2-DSM
A3A1C6	0160-0058	12	C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A3A1C7			DELETED		
A3A1C8	0160-0159	4	C:FXD ELECT 220 UF 20% 10VDCW	28480	0160-0159
A3A1C9	0180-0159		C:FXD ELECT 220 UF 20% 10VDCW	28480	0180-0159
A3A1C10	0180-0367	1	C:FXD ELECT 20 UF 10% 200VDCW	56289	34D206F200JM4 DBS
A3A1C11	0180-0098		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A3A1C12	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A3A1C13	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A3A1CR1	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3A1CR2	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3A1CR3	1901-0416	1	DIODE:SILICON 400PIV 1N5000	04713	1N5000
A3A1CR4	1901-0040	46	DIODE:SILICON 30MA 30MV	07263	FDG1003
A3A1CR5	1884-0094	1	THYRISTOR:BILATERAL SWITCH	04713	SPT-12
A3A1CR6			NOT ASSIGNED		
A3A1CR7	1901-0045		DIODE: SILICON 100V 750MA	28480	1901-0045
A3A1J1	1251-2409	1	CONNECTOR & P CONNECTOR 15 FEMALE CONTACT	27264	16-15-1
A3A1L1	9100-3139	15	COIL:75 UH	28480	9100-3139
A3A1L2	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L3	9140-0210		COIL: CHOKE 100 UH 5%	82142	15-1315-123
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
A3A1L10	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L11	9100-3139		COIL:75 UH	28480	9100-3139
A3A1MP1	1400-0475	3	BRACKET:COMPONENT CLIP	03877	721-0004
A3A1Q1	1854-0090	1	TST:RESI NPN(SIMILAR TO 2N3053)	28480	1854-0090
A3A1Q2	1884-0082	1	THYRISTOR: SCR JEDEC TYPE 2N4441	04713	SR1350-7
A3A1R1	0761-0015	1	R:FXD MET FX 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	46	R:FXD COMP 110 OHM 10% 1/4W	01121	CB 1011
A3A1R4	0687-2201	1	R:FXD COMP 22 OHM 10% 1/2W	01121	EB 2201
A3A1R5	0811-1670	1	R:FXD WW 2.2 OHM 5% 2W	28480	0811-1670
A3A1R6	0812-0047	1	R:FXD WW 5 OHM 5% 5W	28480	0812-0047
A3A1R7	0757-0908	2	R:FXD MET FLM 220 OHM 2% 1/8W	28480	0757-0908
A3A1R8	0684-4711	1	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A3A1R9	0698-4306		R:FXD FLM 150K OHM 5% 1/8W	28480	0698-4306
A3A1R10	0684-1041		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	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R13	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1R14	0684-1031	17	RESISTOR COMP 10K OHM 10% 1/4W	01121	CB 1031
A3A1R15	0684-2731		RESISTOR COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R16	0684-2731		RESISTOR COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R17	0757-0989	1	RESISTOR MET FLM 16.2 OHM 1% 1/2W	28480	0757-0989
A3A1R18	0684-1051	3	RESISTOR COMP 1MEGOHM 10% 1/4W	01121	CB 1051
A3A1R19	0683-2705		RESISTOR COMP 27 OHM 5% 1/4W	01121	CB 2705
A3A1R20	0684-1041		RESISTOR COMP 100K OHM 10% 1/4W	01121	CB 1041
A3A1T1	01701-61104	1	TOROID:FERRITE	28480	01701-61104
A3A1VR1	1902-3302	1	DIODE BREAKDOWN:4.64V 2% 400 MW	28480	1902-3302
A3A1VR2	1902-3059	1	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A3A1VR3	1902-3316	1	DIODE BREAKDOWN:39.2V 2% 400 MW	28480	1902-3316
A3A1VR4	1902-3002	1	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A3A1XA2	1251-1968	3	CONNECTOR:PC 10 TUNING FORK TYPE CON	02660	143-010-07-1158
A3A1XA3	1251-1968		CONNECTOR:PC 10 TUNING FORK TYPE CON	02660	143-010-07-1158
A3A1XA4	1251-1968		CONNECTOR:PC 10 TUNING FORK TYPE CON	02660	143-010-07-1158
A3A1XQ1	1200-0186	1	SOCKET:INTEGRATED CIRCUIT 8 PIN	91506	8068-1G45
A3A2	01701-66554		BOARD ASSY:LOW VOLTAGE CONVERTER	28480	01701-66554
A3A2C1	0160-0168		CAPFXD MY 0.1 UF 10% 200VDCW	56289	192P-10492 PTS
A3A2C2	0160-0168		CAPFXD MY 0.1 UF 10% 200VDCW	56289	192P-10492 PTS
A3A2C3	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
A3A2C4	0180-1832	1	CAPFXD AL ELECT 150 UF +75-10% 40VDCW	56289	39D157G040EJ4-DSB
A3A2C5	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
A3A2C6	0180-1780	1	CAPFXD ELECT 500 UF +75-10% 10VDCW	28480	0180-1780
A3A2C7	0150-0084	4	CAPFXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A3A2C8	0160-0380	3	CAPFXD MY 0.22 UF 10% 200VDCW	28480	0160-0380
A3A2C9	0150-0084		CAPFXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A3A2C10	0160-3451		CAPFXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A3A2C11	0150-0084		CAPFXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A3A2C12	0160-2141	1	CAPFXD CER 640 PF 60/20% 1000VDCW	91418	TYPE B
A3A2C13	0160-0168		CAPFXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3A2C14	0150-0084		CAPFXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A3A2CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A2CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3A2CR3	1901-0049	4	DIODE:SILICON 50PIV	28480	1901-0049
A3A2CR4	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
A3A2CR5	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A3A2E1	01700-00606	1	SHIELD TRANSFORMER	28480	01700-00606
A3A2L1	9140-0128	1	COIL:FXD RF 22 UH	28480	9140-0128
A3A2MP1	1205-0227		HEAT DISSIPATOR:SEMICONDUCTOR	28480	1205-0227
A3A2Q1	1855-0010	2	TST:FET:SI	80131	2N2646
A3A2Q2	1854-0476	1	TST:FET:SI NPN	02735	2N3879
A3A2Q3	1854-0039	1	TST:FET:SI NPN	80131	2N3053
A3A2Q4	1853-0027	1	TST:FET:SI PNP	07263	S15545
A3A2R1	0684-1221	8	RESISTOR COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A3A2R2	0684-2721	2	RESISTOR COMP 2700 OHM 10% 1/4W	01121	CB 2721
A3A2R3	2100-1760	2	RESVAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A3A2R4	0757-0199	1	RESISTOR MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A3A2R5	0757-0442	11	RESISTOR MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3A2R6	0684-4721	12	RESISTOR COMP 4700 OHM 10% 1/4W	01121	CB 4721
A3A2R7	0684-1011		RESISTOR COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R8	0684-1011		RESISTOR COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R9	0684-1011		RESISTOR COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R10	0684-1011		RESISTOR COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A2R11	0698-3159	1	RESISTOR MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A3A2R12	0757-0401	14	RESISTOR MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3A2R13	0684-1521		RESISTOR COMP 1500 OHM 10% 1/4W	01121	CB 1521
A3A2R14	0684-1041		RESISTOR COMP 100K OHM 10% 1/4W	01121	CB 1041
A3A2R15	0684-2211	12	RESISTOR COMP 220 OHM 10% 1/4W	01121	CB 2211
A3A2R16	0813-0050	1	RESISTOR WW 100 OHM 5% 3W	28480	0813-0050
A3A2T1	9100-3152	1	TRANSFORMER	28480	9100-3152
A3A2U1	1820-0058	1	IC:LIN, OP, AMP, 15K MIN, (TO-99)	07263	U5B7709398
A3A2VR1	1902-0033	2	DIODE:BREAKDOWN 6.2V	04713	1N8.3
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
A3A2XQ2	1205-0227	1	HEAT DISSIPATOR:SEMICONDUCTOR	28480	1205-0227
A3A2XU1	1200-0763	1	SOCKET:IC 8-PIN, FOR TO-5 CASE	71785	133-98-92-061
A3A3	01701-66537		BOARD ASSY:RECT FILTER	28480	01701-66537
A3A3C1	0180-0091		CAPFXD ELECT 10 UF +50-10% 100VDCW	56289	30D106F100DC2-DSM
A3A3C2	0180-2344	4	CAPFXD AL ELECT 150 UF +75-10% 75VDCW	56289	39D157G075FJ4-DSB
A3A3C3	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
A3A3C4	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
A3A3C5	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
A3A3C6	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
A3A3C7	0180-2344		CAPFXD AL ELECT 150 UF +75-10% 75VDCW	56289	39D157G075FJ4-DSB
A3A3C8	0180-0159		CAPFXD ELECT 220 UF 20% 10VDCW	28480	0180-0159
A3A3C9	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
A3A3C10	0180-0098		CAPFXD ELECT 100 UF 20% 20VDCW	56289	150D107X002052-DYS
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

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
A3A3L1	9100-3139		COIL:75 UH	28480	9100-3139
A3A3L2	9100-3139		COIL:75 UH	28480	9100-3139
A3A3MP1	0403-0175	1	BUMPER:RUBBER 0.75"H DIA	77068	6057
A3A3MP2	1400-0475		BRACKET:COMPONENT CLIP	03877	721-0004
A3A3T1	9100-3235	1	TRANSFORMER:TOROID & SEC.	28480	9100-3235
A3A4	01703-66503		BOARD ASSY:HIGH VOLTAGE	28480	01703-66503
A3A4A1	01703 61104		TRANSFORMER ASSY: HIGH VOLTAGE	28480	01703 61104
A3A4C1	0160-3443	6	C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A3A4C2	0160-2403	2	C:FXD CER 1500 PF 20% 5K VDCW	72982	828-025-X5R0-152M
A3A4C3	0180-1746	2	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3A4C4	0180-0791	2	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A3A4C5	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3A4C6	0160-0161	2	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-P15
A3A4C7	0160-3801	17	C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C8	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C9	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C10	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C11	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C12	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C13			NOT ASSIGNED		
A3A4C14	0160-2403		C:FXD CER 1500 PF 20% 5K VDCW	72982	828 025 X5R0 15210
A3A4C15	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C16	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C17	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C18	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C19	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C20	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C21	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C22	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C23	0160-3801		C:FXD CER 5000 PF 20% 3K VDCW	56289	44C148A1
A3A4C24	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A3A4CR1	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A3A4CR2	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A3A4CR3	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A3A4CR4	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A3A4CR5	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
A3A4CR6	1901-0049		DIODE:SILICON 50PIV	28480	1901-0049
A3A4CR7	1901-1022	4	DIODE:SI RECTIFIER HV, 10 MA	28480	1901-1022
A3A4CR8	1901-1022		DIODE:SI RECTIFIER HV, 10 MA	28480	1901-1022
A3A4CR9	1901 0669		DIODE:SILICON 200-1A	28480	1901 0669
A3A4CR10	1901-0040		DIODE:SILICON 50MA 30WV	07263	FDG1088
A3A4DS1	2140-0018	2	LAMP:GLOW 1.0 MILLIAMPS 0.1W	08806	49A-CENE-2E11
A3A4DS2	2140-0018		LAMP:GLOW 1.0 MILLIAMPS 0.1W	08806	49A-CENE-2E11
A3A4F1	2110-0031	1	FUSE:1 AMP 250V	75915	312001.
A3A4L1	9140-0179	1	COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A3A4MP1	5040-0402	1	MOUNT:TRANSFORMER	28480	5040-0402
A3A4MP2	5040-0430	1	MOUNT:TRANSFORMER	28480	5040-0430
A3A4MP3	2200-0125	2	SCREW:SST PAN HD POZI DR 4-40X1.500"LG	00000	OBD
A3A4MP4	2260-0001	2	NUT:HEX SSTL 4-40X1/4X3/32	80120	280*
A3A4Q1	1854-0023	1	TST:SI NPN:SELECTED FROM 2N2946A	28480	1854-0023
A3A4Q2	1854-0215	49	TST:SI NPN	80131	2N3904
A3A4Q3	1853-0001	1	TST:SI PNP:SELECTED FROM 2N1320	28480	1853-0001
A3A4R1	2100-2514	3	R:VAR CERMET 20% OHM 10% LIN 1/2W	28480	2100-2514
A3A4R2	0757 0470	1	R: FXD MET FLM 162K OHM 1% 1/8W	28480	0757 0470
A3A4R3	0698-7807	1	R:FXD MET FLM 845 MEGOHM 1% 1/8W	28480	0698-7807
A3A4R4	0698-5922	2	R:FXD MET FLM 1.62 MEGOHM 1.0% 1/2W	28480	0698-5922
A3A4R5	0698-5922		R:FXD MET FLM 1.62 MEGOHM 1.0% 1/2W	28480	0698-5922
A3A4R6	0686-1021	26	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A3A4R7	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A3A4R8			NOT ASSIGNED		
A3A4R9	0684-4731	3	R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A3A4R10	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A3A4R11	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A3A4R12	0687-5611	1	R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611
A3A4R13	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3A4R14	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3A4R15	2100-3350	1	R:VAR CERMET 2 MEGOHM 20% LIN 1/2W	73138	72XR2M
A3A4R16	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A3A4R17	0698-8719	1	R:FXD CAR FILM 29 MEGOHM 10% 1W	28480	0698 8719
A3A4R18	0684-1051		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1051
A3A4R19	0698 5185	1	R:FXD COMP 15K OHM 10% 1/8W	28480	0698 5185
A3A4T1	01703-61104	1	TRANSFORMER ASSY:HIGH VOLTAGE	28480	01703-61104
A3A4XF1	2110-0369	12	FUSEHOLDER 0.25" DIA	91506	B3D3-32CA
A3A5	01703 61106		ASSY: HIGH VOLTAGE MULTIPLIER	28480	01703 61106
A3A5E1	01701-26508	1	BOARD:ETCHED	28480	01701-26508

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
A4	01703-66501		BOARD ASSEMBLY	28480	01703-66501
A4C1	0160-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A4C2	0160-3452	3	C:FXD DISC CER 0.02 UF 20% 100VDCW	56289	C023B101H203MS25-CDH
A4C3	0160-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A4C4	0160-0084		C:FXD CER 0.1 UF +80-20% 100 VDCW	72982	8131-100-651-104Z
A4C5			NOT ASSIGNED		
A4C6	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A4C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A4C8	0121-0168	3	C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A4C9	0180-0104	1	C:FXD ELECT 2.2 UF +75-10% 15VDCW	56289	30D227G015DF4-DS4
A4C10	0160-2432	7	C:FXD POLY 0.1 UF 5% 100VDCW	84411	663T
A4C11	0160-3452		C:FXD DISC CER 0.02 UF 20% 100VDCW	56289	C023B101H203MS25-CDH
A4C12	0160-0104		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C13	0150-0084		C:FXD CER 0.1 UF +80-20% 100VDCW	72982	8131-100-651-104Z
A4C14	0180-0091		C:FXD ELECT 10 UF +50-10% 100VDCW	56289	30D106F100DC2-DS4
A4C15	0180-2344		C:FXD AL ELECT 150 UF +75-10% 75VDCW	56289	39D157G075FJ4-DS8
A4C16	0180-0096		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A4C17	0180-0096		C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A4C18	0180-2344		C:FXD AL ELECT 150 UF +75-10% 75VDCW	56289	39D157G075FJ4-DS8
A4C19	0180-0155		C:FXD ELECT 220 UF 20% 10VDCW	2P480	0180-0159
A4CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG103H
A4CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4CR10	1901-0043		DIODE:SILICON 0.75A 100PIV	04713	SR1353-7
A4CR11			NOT ASSIGNED		
A4CR12	1901-0043		DIODE:SILICON 0.75A 100PIV	04713	SR1353-7
A4CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG108B
A4F1	2110-0004	3	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A4F2	2110-0004		FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A4F3	2110-0012	3	FUSE:0.5 AMP 250V	75915	312.500
A4F4	2110-0012		FUSE:0.5 AMP 250V	75915	312.500
A4F5	2110-0004		FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A4F6	2110-0012		FUSE:0.5 AMP 250V	75915	312.500
A4L1	9100-3139		COIL:75 UH	28480	9100-3139
A4L	9100-3139		COIL:75 UH	28480	9100-3139
A4L3	9100-3139		COIL:75 UH	28480	9100-3139
A4MP1	1500-0475		BRACKET:COMPONENT CLIP	03877	721-0004
A4Q1	1854-0215	1	TSTR:SI NPN	80131	2N3904
A4Q2	1853-0063	1	TSTR:SI PNP	80131	2N4898
A4Q3	1853-0036	26	TSTR:SI PNP	80131	2N3906
A4Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A4Q5	1853-0232	1	TSTR:SI PNP	28480	1853-0232
A4Q6	1854-0419		TSTR:SI NPN	04713	S5657
A4Q7	1854-0215		TSTR:SI NPN	80131	2N3904
A4Q8	1854-0215		TSTR:SI NPN	80131	2N3904
A4Q9	1853-0036		TSTR:SI PNP	80131	2N3906
A4Q10	1854-0215		TSTR:SI NPN	80131	2N3904
A4R1	0684-1021		RES:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A4R2	0698-3152	1	RES:FXD MET FLM 2.46K OHM 1% 1/8W	28480	0698-3152
A4R3			NOT ASSIGNED		
A4R4	0684-1021		RES:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A4R5	0684-4721		RES:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R6	0757-0416	3	RES:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A4R7	0757-0273	13	RES:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A4R8	0684-1011		RES:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R9	0757-0457	1	RES:FXD MET FLM 47.5K OHM 1% 1/8W	28480	0757-0457
A4R10	0684-4721		RES:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A4R11	0684-1011		RES:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R12	0684-4701		RES:FXD COMP 47 OHM 10% 1/4W	01121	CB 4701
A4R13	0757-0760	4	RES:FXD FLM 20K OHM 1% 1/4W	28480	0757-0760
A4R14	0684-1011		RES:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R15	0757-0442		RES:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R16	0757-0438	5	RES:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A4R17	0684-6811	1	RES:FXD COMP 680 OHM 10% 1/4W	01121	CB 6811
A4R18	0684-2721		RES:FXD COMP 2700 OHM 10% 1/4W	01121	CB 2721
A4R19	0757-0453	3	RES:FXD MET FLM 30.1K OHM 1% 1/8W	28480	0757-0453
A4R20	0684-1011		RES:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A4R21	0757-0454	4	RES:FXD MET FLM 33.2K OHM 1% 1/8W	28480	0757-0454
A4R22	2100-1766	1	RES:VAR FLM 500 OHM 10% LIN 1/2W	28480	2100-1766
A4R23	0757-0421	1	RES:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A4R24	0757-0407	4	RES:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A4R25	2100-2010	2	RES:VAR FLM 20K OHM 10% LIN 1/2W	28480	2100-2010
A4R26	0684-1001	12	RES:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A4R27	2100-2655	1	RES:VAR FLM 100K OHM 10% LIN 1/2W	28480	2100-2655
A4R28	0698-3154	1	RES:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A4R29	0684-1051		RES:FXD COMP 1MEGOHM 10 1/4W	01121	CB 1051

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
A4R30	0684-5631	6	R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A4R31	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A4R32	0684-4721	4	R:FXD COMP 4700 OHM 10% 1/4	01121	CB4721
A4R33	0757-0440	6	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A4VR1	1902-0033		DIODE:BREAKDOWN 6.2V	04713	1N821
A4VR2	1902-0052	1	DIODE BREAKDOWN:6.81V	28480	1902-0052
A4XA4	1251-0334	1	CONN: PC 36 (2x18) CONTACTS	07233	251-18-30-261
A4XF1	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4XF2	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4XF3	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4XF4	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4XF5	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4XF6	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4XQ5	1206-0073		HEAT SINK: DUAL	13103	2210B
A5	01701-66815		VERTICAL AMPLIFIER MODULE	28480	01701-66815
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	0160-0153	1	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PFS
A5DS1	1450-0709	3	LIGHT:INDICATOR 90 VDC	72765	6140-000-603
A5MP1	1400-0841	2	COUPLER	28480	1400-0841
A5MP2			NOT ASSIGNED		
A5MP3	01701-00608	1	SHIELD: VERTICAL MODULE	28480	01701-00608
A5MP4	01701-01204	2	BRACKET: POT	28480	01701-01204
A5MP5	01701-01211	1	BRACKET: VERTICAL	28480	01701-01211
A5MP6	01701-04106	2	PLATE: NUT	28480	01701-04106
A5MP7	01701-04107	1	PLATE: ATTEN COVER	28480	01701-04107
A5MP8	01701-21701	4	BUSHING: POT	28480	01701-21701
A5MP9	01701-23701	2	SHAFT: POT EXTENSION	28480	01701-23701
A5MP10	01701-24701	1	SPACER: BNC	28480	01701-24701
A5MP11	01703-00604	1	SHIELD: VERT OUTPUT	28480	01703-00604
A5MP12	01701-01213	1	BRACKET:SWITCH	28480	01701-01213
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	2	R:VAR COMP 50K OHM 10% 10 CCLOG 1/4W	28480	2100-3007
A5R4	2100-3007		R:VAR COMP 50K OHM 10% 10 CCLOG 1/4W	28480	2100-3007
A5R5			NOT ASSIGNED	28480	2100-3008
A5R6	0757-0394	6	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A5R7			NOT ASSIGNED	28480	2100-3008
A5R8	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A5R9	0684-3901	65	R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5R10	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5R11	0757-0394		R:FXD MET FLM 51.1OHM 1% 1/8W	28480	0757-0394
A5R12	2100-2762	2	R:VAR CERMET 100 OHM 20% LIN 2W	28480	2100-2762
A5R13	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A5R14	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A5R15	2100-2762		R:VAR CERMET 100 OHM 20% LIN 2W	28480	2100-2762
A5R16	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A5R17	2100-3016	2	R:VAR CERMET 50K OHM 20% LIN DUAL	28480	2100-3016
A5R18	2100-3016		R:VAR CERMET 50K OHM 20% LIN DUAL	28480	2100-3016
A5R19			NOT ASSIGNED		
A5R20	0757-0422	7	R:FXD MET FLM 909 OHM 1% 1.8W	28480	0757-0422
A5R21	0757-0422		R:FXD MET FLM 909 OHM 1% 1.8W	28480	0757-0422
A5S1	3101-1396	1	SWITCH:PUSHBUTTON 2 POLE 1 STABLE	28480	3101-1396
A5S2	01701-61902	1	SWITCH ASSY	28480	01701-61902
A5A1	01701-63401		ATTENUATOR ASSY	28480	01701-63401
A5A1C1	0170-0043	2	C:FXD MY 0.022UF 10% 400VDCW	24446	64FDA223
A5A1C2	0121-0483	16	C:VAR TRIMMER 0.5-3.0PF	72982	2536-016
A5A1C3	0121-0483		C:VAR TRIMMER 0.5-3.0PF	72982	2536-016
A5A1C4	0160-2261	5	C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A5A1C5	0160-2261		C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A5A1C6	0160-2257	8	C:FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A5A1C7	0121-0407		C:VAR TRIMMER 0.7-3.0PF	72982	536-016
A5A1C8	0121-0407		C:VAR TRIMMER 0.7-3.0PF	72982	536-016
A5A1C9	0140-0130	2	C:FXD MICA 220 PF 5% 500VDCW	72982	654-014(CB11R0221J)
A5A1C10	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A5A1C11	0121-0483		C:VAR TRIMMER 0.5-3.0PF	72982	2536-016
A5A1C12	0121-0483		C:VAR TRIMMER 0.5-3.0PF	72982	2536-016
A5A1C13	0160-0214	2	C:FXD CER 10PF 5% 500V	71590	TYPE CA
A5A1C14	0160-2249	2	C:FXD CER 4.7 PF 500VDCW	72982	301-NPO-4.7 PF
A5A1C15	0160-2256	2	C:FXD CER 9.1 PF 500VDCW	72982	301-000-COK0-919C
A5A1C16	0160-2258	2	C:FXD CER 11 PF 5% 500VDCW	72982	301-000-COG0-110J
A5A1C17	0121-0407		C:VAR TRIMMER 0.7-3.0PF	72982	536-016
A5A1C18	0121-0407		C:VAR TRIMMER 0.7-3.0PF	72982	536-016
A5A1MP1	3130-0038		COUPLER,SWITCH	76854	22766
A5A1R1	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001

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	0698-6400	2	RESISTOR: FXD FLM 900K OHM 1.0% 1/4W	28480	0698-6400
A5A1R3	0698-6634	2	RESISTOR: FXD FLM 950K OHM 1.0% 1/4W	28480	0698-6634
A5A1R4	0698-3109	2	RESISTOR: MET FLM 10.1K OHM 1% 1/8W	28480	0698-3109
A5A1R5	0698-5470	2	RESISTOR: FXD FLM 111K OHM 1% 1/8W	28480	0698-5470
A5A1R6	0684-2201	4	RESISTOR: FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A5A1R7	0684-1001		RESISTOR: FXD COMP 10 OHM 10% 1/4W	01121	CB1001
A5A1R8	0684-1001		RESISTOR: FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A1R9	0698-3263	2	RESISTOR: FXD MET FLM 500K OHM 1% 1/8W	28480	0698-3263
A5A1R10	0698-6654	3	RESISTOR: FXD MET FLM 800K OHM 1% 1/4W	28480	0698-6654
A5A1R11	0757-0344	4	RESISTOR: FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A5A1R12	0698-4011	2	RESISTOR: FXD FLM 250K OHM 1% 1/8W	28480	0698-4011
A5A1R13	0684-2201		RESISTOR: FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A5A1R14	0757-0344		RESISTOR: FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A5A1R15	2100-3008	2	RESISTOR: VAR COMP 100 OHM 20% LIN	28480	2100-3008
A5A1S1	3100-2683	2	SWITCH: ROTARY 3 SECTION 9 POSITION	28480	3100-2683
A5A2			SAME AS A5A1, USE PREFIX A5A2		
A5A3	01701-61616		COIL: DELAY LINE	28480	01701-61616
A5A4	01701-66541		BOARD ASSY: VERTICAL PREAMP	28480	01701-66541
A5A4C1	0121-0138	2	CAPVAR TRIMMER 1.3-6.7 PF	74970	189-502-5
A5A4C2	0121-0138		CAPVAR TRIMMER 1.3-6.7 PF	74970	189-502-5
A5A4C3	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C4	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C5	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C6	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C7	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C8	0160-3451		CAPFXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A5A4C9	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C10	0160-3451		CAPFXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A5A4C11	0180-0230		CAPFXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A5A4C12	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C13	0160-3451		CAPFXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A5A4C14	0160-3451		CAPFXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A5A4C15	0160-2246	2	CAPFXD CER 3.6+/-0.25 PF 500VDCW	72982	301-000-COJJ-369C
A5A4C16	0160-2246		CAPFXD CER 3.6+/-0.25 PF 500VDCW	72982	301-000-COJJ-369C
A5A4C17	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C18	0180-0229		CAPFXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A5A4C19	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C20	0180-0229		CAPFXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A5A4C21	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C22	0160-3453		CAPFXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A5A4C23	0140-0206	2	CAPFXD MICA 270 PF 5%	72136	RDM15F271J 300V
A5A4C24	0160-3451		CAPFXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A5A4C25	0160-2220	1	CAPFXD MICA 1200 PF 5% 300 V	28480	0160-2220
A5A4C26	0160-3451		CAPFXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A5A4C27	0140-0191	2	CAPFXD MICA 56 PF 5% 300VDCW	19701	RDM15E560J 300V
A5A4C28	0140-0191		CAPFXD MICA 56 PF 5% 300VDCW	19701	RDM15E560J 300V
A5A4C29	0180-0197	9	CAPFXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5A4C30	0160-3466	2	CAPFXD CER 100 PF 10% 250VDCW	56289	C157F251F101K522-CDH
A5A4C31	0160-3466		CAPFXD CER 100 PF 10% 250VDCW	56289	C157F251F101K522-CDH
A5A4C32	0121-0445	2	CAPVAR CER 4.5-20 PF 160 VDCW	28480	0121-0445
A5A4C33	0121-0445		CAPVAR CER 4.5-20 PF 160 VDCW	28480	0121-0445
A5A4C34	0160-3451		CAPFXD CER 0.01 UF +80-20% 100 VDCW	56289	C023B101F103Z525-CDH
A5A4C35	0160-3622	1	CAPFXD CER 0.1 UF 100 VDCW	28480	0160-3622
A5A4CR1	1901-0376	6	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	01701-66541		COIL: FXD 10UH	28480	01701-66541
A5A4Q1	1855-0085	8	TST: FET (MATCHED PAIR)	28480	1855-0085
A5A4Q2	1855-0085		TST: FET (MATCHED PAIR)	28480	1855-0085
A5A4Q3	1855-0085		TST: FET (MATCHED PAIR)	28480	1855-0085
A5A4Q4	1855-0085		TST: FET (MATCHED PAIR)	28480	1855-0085
A5A4Q5	1854-0296	20	TST: SI NPN	28480	1854-0296
A5A4Q6	1854-0296		TST: SI NPN	28480	1854-0296
A5A4Q7	1854-0296		TST: SI NPN	28480	1854-0296
A5A4Q8	1854-0296		TST: SI NPN	28480	1854-0296
A5A4Q9	1854-0296		TST: SI NPN	28480	1854-0296
A5A4Q10	1854-0296		TST: SI NPN	28480	1854-0296
A5A4Q11	1854-0296		TST: SI NPN	28480	1854-0296
A5A4Q12	1854-0296		TST: SI NPN	28480	1854-0296
A5A4Q13	1853-0203	7	TST: SI PNP	28480	1853-0203

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
A5A4Q14	1853-0015	10	TSTRESI PNP	80131	2N3640
A5A4Q15	1854-0215		TSTRESI NPN	80131	2N3904
A5A4Q16	1854-0215		TSTRESI NPN	80131	2N3904
A5A4Q17	1854-0215		TSTRESI NPN	80131	2N3904
A5A4Q18	1854-0009	6	TSTRESI NPN	80131	2N709
A5A4Q19	1854-0009		TSTRESI NPN	80131	2N709
A5A4Q20	1854-0039		TSTRESI NPN	80131	2N709
A5A4Q21	1854-0009		TSTRESI NPN	80131	2N709
A5A4Q22	1854-0039		TSTRESI NPN	80131	2N709
A5A4Q23	1854-0009		TSTRESI NPN	80131	2N709
A5A4Q24	1854-0019	4	TSTRESI NPN	28480	1854-0019
A5A4Q25	1854-0019		TSTRESI NPN	28480	1854-0019
A5A4Q26	1853-0015		TSTRESI PNP	80131	2N3640
A5A4Q27	1853-0015		TSTRESI PNP	80131	2N3640
A5A4Q28	1853-0015		TSTRESI PNP	80131	2N3640
A5A4Q29	1854-0215		TSTRESI NPN	80131	2N3904
A5A4Q30	1853-0203		TSTRESI PNP	28480	1853-0203
A5A4Q31	1853-0203		TSTRESI PNP	28480	1853-0203
A5A4Q32	1854-0052	9	TSTRESI NPN	80131	2N3563
A5A4Q33	1854-0052		TSTRESI NPN	80131	2N3563
A5A4Q34	1854-0215		TSTRESI NPN	80131	2N3904
A5A4Q35	1854-0215		TSTRESI NPN	80131	2N3904
A5A4R1	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R2	0684-1041		RESCOMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R3	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R4	0684-1041		RESCOMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R5	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R6	0684-1041		RESCOMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R7	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R8	0684-1041		RESCOMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R9	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R10	0757-0469	2	RESFXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A5A4R11	0684-1041		RESCOMP 100K OHM 10% 1/4W	01121	CB 1041
A5A4R12	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R13	0757-0469		RESFXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A5A4R14	0684-1011		RESCOMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R15	0684-1521		RESCOMP 1500 OHM 10% 1/4W	01121	CB 1521
A5A4R16	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R17	0684-1011		RESCOMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R18	0757-0274	2	RESFXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A5A4R19	0684-1011		RESCOMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R20	0684-1521		RESCOMP 1500 OHM 10% 1/4W	01121	CB 1521
A5A4R21	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R22	0684-1011		RESCOMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R23	0757-0274		RESFXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A5A4R24	0757-0442		RESFXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5A4R25	0757-0442		RESFXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5A4R26	0757-0442		RESFXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5A4R27	0757-0442		RESFXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5A4R28	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R29	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R30	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R31	0684-3901		RESCOMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R32	0757-0273		RESFXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A5A4R33	0757-0273		RESFXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A5A4R34	0684-1001		RESFXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A4R35	0757-0273		RESFXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A5A4R36	0757-0273		RESFXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A5A4R37	0684-3901		RESFXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R38	0684-3901		RESFXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R39	0757-0290	6	RESFXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A4R40	2100-2497	3	RESVAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A5A4R41	0757-0290		RESFXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A4R42	0757-0290		RESFXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A4R43	2100-2497		RESVAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A5A4R44	0757-0290		RESFXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A4R45	0757-0124	5	RESFXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A5A4R46	0757-0124		RESFXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A5A4R47	0757-0124		RESFXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A5A4R48	0757-0124		RESFXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A5A4R50	2100-1773	1	RESVAR WW 1K OHM 5% TYPE H 1W	28480	2100-1773
A5A4R51	0757-0280		RESFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5A4R52	0684-2211		RESFXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R53	0684-2211		RESFXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R54	0684-3901		RESFXD COMP 39 OHM 10% 1/4W	01121	CB 3901

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
A5A4R55	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R56	0757-0283	7	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A5A4R57	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A5A4R58	0684-3321	8	R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A5A4R59	0757-0437	3	R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A5A4R60	2100-2497		R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2497
A5A4R61	0757-0437		R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A5A4R62	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R63	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R64	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R65	0757-1094	2	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A5A4R66	0757-0410	5	R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A5A4R67	0757-0410		R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A5A4R68	0757-1094		R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A5A4R69	0757-0282	1	R:FXD MET FLM 221 OHM 1% 1/8W	28480	0757-0282
A5A4R70	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R71	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R72	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R73	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R74	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R75	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R76	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R77	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A5A4R78	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R79	0698-3136	1	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A5A4R80	2100-2030		R:VAR FLM 20K OHM 10% LIN 1/2W	28480	2100-2030
A5A4R81	0757-0413	3	R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A5A4R82	0757-0452	1	R:FXD MET FLM 27.4K OHM 1% 1/8W	28480	0757-0452
A5A4R83	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A4R84	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A5A4R85	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A5A4R86	0757-0419	1	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A5A4R87	0757-0417	1	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A5A4R88	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A4R89	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R90	0757-0434	2	R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A5A4R91	0757-0402		R:FXD MET FLM 110 OHM 1% 1/8W	28480	0757-0402
A5A4R92	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A4R93	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A5A4R94	0757-0400	5	R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A4R95	0684 1231		R:FXD COMP 12K OHM 10% 1 W	01121	CB1231
A5A4R96	0683-5115	1	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A5A4R97	0684 1831		R:FXD COMP 18K OHM 10% 1 4W	01121	CB1831
A5A4R98	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A5A4R99	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A5A4R100	0683- 125	1	R:FXD COMP 1100 OHM 5% 1/4W	01121	CB 1125
A5A4R101	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R102	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A5A4R103	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A4R104	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A5A4R105	0757-0437		R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A5A4R106	0684-5621	7	R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A5A4R107	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A5A4R108	2100-2061	2	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2061
A5A4R109	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A4U1	1820-0094	1	IC:DTL QUAD 2-INPUT GATE	04713	SC6903PK
A5A4U2	1820-0308	1	IC:DTL CLOCKED FF RL106	07263	U6A994559X
A5A4VR1	1902-3048	1	DIODE BREAKDOWN:SILICON 3.48V 5%	28480	1902-3048
A5A4XU1	1200-0768	9	SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A5A4XU2	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A5A5	01703-66507		BOARD ASSY:VERTICAL OUTPUT	28480	01703-66507
A5A5C1	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-C0H
A5A5C2	0160-2236	2	C:FXD CER 1.0PF 500VDCW	72982	301-000-C0K0-109C
A5A5C3			NOT ASSIGNED		
A5A5C4	0140-0193	3	C:FXD MICA 82 PF 5%	28480	0140-0193
A5A5C5	0160-0166	1	C:FXD MY 0.056 UF 10% 200VDCW	56289	192P68392-PTS
A5A5C6	0160-2236		C:FXD CER 1.0PF 500VDCW	72982	301-000-C0K0-109C
A5A5C7	0160-2261		C:FXD CER 15 PF 5% 500VDCW	72982	301-N20-15 PF
A5A5C8	0160-2203	1	C:FXD MICA 91 PF 5% (FACTORY SELECTED)	72136	DM15F 910J3C
A5A5C9	0121-0166		C:VAR AIR 2.4-24.5 PF 350VDCW	28480	0121-0166
A5A5C10	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-C0H
A5A5C11	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-C0H
A5A5C12			NOT ASSIGNED		
A5A5C13	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-C0H
A5A5C14	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-C0H

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A5Q1	1853-0203		TSTR:SI PNP	28480	1853-0203
A5A5Q2	1853-0203		TSTR:SI PNP	28480	1853-0203
A5A5Q3	1853-0015		TSTR:SI PNP	80131	2N3640
A5A5Q4	1853-0015		TSTR:SI PNP	80131	2N3640
A5A5Q5	1854-0233	4	TSTR:SI NPN	80131	2N3866
A5A5Q6	1854-0233		TSTR:SI NPN	80131	2N3866
A5A5Q7	1854-0233		TSTR:SI NPN	80131	2N3866
A5A5Q8	1854-0233		TSTR:SI NPN	80131	2N3866
A5A5R1	0684-1031		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A5R2	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A5R3	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB1001
A5A5R4	0757-0418	3	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A5A5R5	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB1001
A5A5R6	0757-0732	2	R:FXD MET FLM 909 OHM 1% 1/4W	28480	0757-0732
A5A5R7	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A5R8	0757-0817	4	R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A5A5R9	0757-0817		R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A5A5R10	0757-0420	1	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5A5R11	2100-1984	1	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-1984
A5A5R12	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A5R13	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A5R14	0698-3430	2	R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A5A5R15	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A5R16	0757-0799	1	R:FXD MET FLM 121 OHM 1% 1/2W	28480	0757-0799
A5A5R17	0757-0334	1	R:FXD MET FLM 301 OHM 1% 1/4W	28480	0757-0334
A5A5R18	0698-3430		R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A5A5R19	0757-0413		R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A5A5R20	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A5A5R21	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A5R22	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5A5R23	0757-0400		R:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A5A5R24			NOT ASSIGNED		
A5A5R25	0757-0418		R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A5A5R26			NOT ASSIGNED		
A5A5R27	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A5R28	0757-0817		R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A5A5R29	0757-0817		R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A5A5R30	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A5R31	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5A5R32	0757-0732		R:FXD MET FLM 909 OHM 1% 1/4W	28480	0757-0732
A5A5VR1	1902-0041	3	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A5A5VR2	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A5A6	01707 66503		BOARD ASSY:CHANNEL A OUTPUT	28480	01707 66503
A5A6C1	0180-0374	3	C:FXD TANT, 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A5A6C2	0180-0374		C:FXD TANT, 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A5A6C3	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A6C4	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A5A6Q1	1855-0085		TSTR:FET (MATCHED PAIR)	28480	1855-0085
A5A6Q2	1855-0085		TSTR:FET (MATCHED PAIR)	28480	1855-0085
A5A6Q3	1853-0036		TSTR:SI PNP	80131	2N3906
A5A6Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A5A6R1	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5A6R2	0684-2711		R:FXD COMP 270 OHM 10% 1/4W	01121	CB2711
A5A6R3	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5A6R4	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5A6R5	0757-0454		R:FXD MET FLM 33.2K OHM 1% 1/8W	28480	0757-0454
A5A6R6	0757-0444	9	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A5A6R7	0684-2231	38	R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A5A6R8	0757-0444		R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A5A6R9	0684-1541	4	R:FXD COMP 150K OHM 10% 1/4W	01121	CB 1541
A5A6R10	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A5A6R11	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A5A6R12	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB1011
A5A6R13	2100-2061		R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2061
A5A6R14	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5A6R15	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A5A6R16	0684-6831		R:FXD COMP 68K OHMS 10% 1/4W	01121	CB6831
A5A6R17	2100-2031		R:VAR 50K OHM 10% LIN 1/2W	28480	2100-2031
A5A6U1	1820-0216	1	IC:OP. AMP. AVOL=50K MIN.	28480	1820-0216
A5A6VR1	1902-3171		DIODE:BREAKDOWN 11.0V 5%	28480	1902-3171
A5A6VR2	1902-3171		DIODE:BREAKDOWN 11.0V 5%	28480	1902-3171
A6	01703-65802	1	HORIZONTAL AMPLIFIER MODULE	28480	01703-65302
A6DS1	1450-0709		LIGHT:INDICATOR 90 VDC	72765	6140-000-603
A6DS2	1450-0709		LIGHT:INDICATOR 90 VDC	7276	6140-000-603

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
A6MP1	01701-00612	1	SHIELD: HOLDOFF	28480	01701-00612
A6MP2	01701-23706	1	SHAFT: SWITCH EXTENSION	28480	01701-23706
A6MP3	01701-60602	1	SHIELD ASSY: HORIZ	28480	01701-60602
A6MP4	01701-63703	2	SHAFT ASSY: PUSHBUTTON EXTENSION	28480	01701-63703
A6MP5	01830-23201	1	COUPLER: SWITCH EXTENSION	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- 32	1	R:VAR 10-TURN WW 2K OHM 3% LIN 2W (DELAY TIME)	28480	2100-3082
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	2100-3014	1	R:VAR COMP DUAL 20K OHM 20% LIN	28480	2100-3014
A6R7	2100-3015	1	R:VAR COMP 200K OHM 20% 2/10W	28480	2100-3015
A6R8	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6R9	0757-0273	4	R:FXD MET FLM 301K OHM 1% 1/8W	28480	0757-0273
A6R10	0757-0273		R:FXD MET FLM 301K OHM 1% 1/8W	28480	0757-0273
A6R11	0757-0273		R:FXD MET FLM 301K OHM 1% 1/8W	28480	0757-0273
A6R12	0757-0273		R:FXD MET FLM 301K OHM 1% 1/8W	28480	0757-0273
A6W1	01701-61606	1	CABLE ASSY: COAX	28480	01701-61608
A6W2	01701-61610	1	CABLE ASSY: COAX	28480	01701-61610
A6A1	01701-66558		BOARD ASSY:HMZ MOTHER	28480	01701-66558
A6A1C1	0160-2207	1	C:FXD MICA 300 PF 5%	28480	0160-2207
A6A1C2			NOT ASSIGNED		
A6A1C3	0180-0094	1	C:FXD ELECT 100 UF +75-10% 25VDCW	56289	30D107G025002-DSM
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			NOT ASSIGNED		
A6A1R6	0757-0413		R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A6A1R7	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A1R8	0684-3331		R:FXD COMP 33K OHM 10% 1/4W	01121	CB 3331
A6A1R9	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A6A1R10	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A1R11	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB2231
A6A1R12	0757-0273		R:FXD MET FLM 3010 OHM 1% 1/8W	28480	0757-0273
A6A1R13	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB1021
A6A1S1	3101-1399	1	SWITCH:PUSHBUTTON 2 POLE 4 STATION	28480	3101-1399
A6A1S2			NSR: (P/O S1)		
A6A1S3			NSR: (P/O S1)		
A6A1S4	3101-1400	3	SWITCH:PUSHBUTTON DPDT	71590	PB-1
A6A1S5			NSR: (P/O S1)		
A6A1VR1	1902-0041		DIODE:BREAKDOWN 6.11V 5% 400MW	04713	SZ-10939-98
A6A1XA3	1251-1626	6	CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1XA4	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1XA5	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1XA6	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1XA7	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A1XA8	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A6A2	01701-66552		BOARD ASSY:TRIGGER	28480	01701-66552
A6A2C1	0150-0070	2	C:FXD CER 0.02 UF 20% 500VDCW	72982	821-000-Z5U 203M
A6A2C2	0140-0203	4	C:FXD MICA 10 PF 5%	28480	0140-0203
A6A2C3	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A2C4	0160-3462	1	C:DISC CER 0.02 UF 20% 100VDCW	56289	C023B101N203MS25 CD
A6A2C5	0140-0203		C:FXD MICA 10 PF 5%	28480	0140-0203
A6A2C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A2C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C8	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C9	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C10	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C11	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6A2C12	0160-2204		C:FXD MICA 100 PF 5%	72136	RDM15F101J3C
A6A2C13	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C14	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C15	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C16	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A2C17	0160-2914		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	1233C20 CDH-1042
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
A6A2CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A2Q1	1855-0085		TSTR:FET (MATCHED PAIR)	28480	1855-0085
A6A2Q2			NSR (P/O Q1)		

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
A6A203	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A204	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A205	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A206	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A207	1853-0015		TSTR:SI PNP	80131	2N3640
A6A208	1853-0015		TSTR:SI PNP	80131	2N3640
A6A209	1855-0065		TSTR: FET (MATCHED PAIR)	28480	1855-0065
A6A2010	1855-0065		NSR: P/O A6A209		
A6A2011	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2012	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2013	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2014	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2015	1853-0015		TSTR:SI PNP	80131	2N3640
A6A2016	1853-0015		TSTR:SI PNP	80131	2N3640
A6A2017	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2018	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2019	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2020	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2021	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2022	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2023	1854-0215		TSTR:SI NPN	80131	2N3904
A6A2024	1853-0049	5	TSTR:SI PNP	28480	1853-0049
A6A2025	1853-0049		TSTR:SI PNP	28480	1853-0049
A6A2026	1853-0049		TSTR:SI PNP	28480	1853-0049
A6A2027	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2028	1854-0296		TSTR:SI NPN	28480	1854-0296
A6A2029	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2030	1853-0036		TSTR:SI PNP	80131	2N3906
A6A2R1	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A2R2	0757-0367	2	R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A6A2R3	0757-0488	3	R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A6A2R4	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R5	0757-0442		R:FXD MET FLM 100K OHM 1% 1/8W FACTORY SELECTED, NOMINAL VALUE SHOWN	28480	0757-0442
A6A2R6	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R7	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R8	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R9	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A6A2R10	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R11	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R12	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R13	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A2R14	0757-0410		R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A6A2R15	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R16	0757-0442		R:FXD MET FLM 100K OHM 1% 1/8W FACTORY SELECTED, NOMINAL VALUE SHOWN	28480	0757-0442
A6A2R17	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R18	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R19	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R20	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R21	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R22	0757-0367		R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A6A2R23	0757-0488		R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A6A2R24	0698-4130	2	R:FXD COMP 39 OHM 5% 1/8W	28480	0698-4130
A6A2R25	0757-0442		R:FXD MET FLM 100K OHM 1% 1/8W FACTORY SELECTED, NOMINAL VALUE SHOWN	28480	0757-0442
A6A2R26	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R27	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R28	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R29	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A6A2R30	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R31	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R32	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R33	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A6A2R34	0757-0410		R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A6A2R35	0698-4130		R:FXD COMP 39 OHM 5% 1/8W	28480	0698-4130
A6A2R36	0757-0442		R:FXD MET FLM 100K OHM 1% 1/8W FACTORY SELECTED, NOMINAL VALUE SHOWN	28480	0757-0442
A6A2R37	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R38	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R39	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
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	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R43	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R44	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Q.	Description	Mfr Code	Mfr Part Number
A6A2R45	0757-0401		RESISTOR: FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R46	2100-2216	2	RESISTOR: VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2216
A6A2R47	0757-0429	2	RESISTOR: FXD MET FLM 1.82K OHM 1% 1/8W	28480	0757-0429
A6A2R48	0684-3901		RESISTOR: FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R49	0684-3901		RESISTOR: FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R50	0757-0401		RESISTOR: FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R51	0757-0438		RESISTOR: FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6A2R52	0684-2231		RESISTOR: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A2R53	0684-1531		RESISTOR: FXD COMP 15K OHM 10% 1/4W	01121	CB 1531
A6A2R54	0684-3341	1	RESISTOR: FXD COMP 330K OHM 10% 1/4W	28480	0684-3341
A6A2R55	0684-2221		RESISTOR: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R56	0757-0465	5	RESISTOR: FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A2R57	0684-1031		RESISTOR: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R58	0684-1011		RESISTOR: FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A2R59	0684-1031		RESISTOR: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A2R60	0684-3321		RESISTOR: FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A6A2R61	0684-2221		RESISTOR: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A6A2R62	0757-0401		RESISTOR: FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R63	2100-2216		RESISTOR: VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2216
A6A2R64	0757-0429		RESISTOR: FXD MET FLM 1.82K OHM 1% 1/8W	28480	0757-0429
A6A2R65	0757-0401		RESISTOR: FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2R66	0757-0438		RESISTOR: FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6A2R67	0684-1001		RESISTOR: FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6A2R68	0684-1001		RESISTOR: FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A6A2R69	0684-3901		RESISTOR: FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R70	0684-3901		RESISTOR: FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A2R71			NOT ASSIGNED		
A6A2R72	0684-1041		RESISTOR: FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A2R73	0684-1041		RESISTOR: FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A2R74	0757-0401	1	RESISTOR: FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A2S1	3101-1705	7	SWITCH: PUSHBUTTON 7 STATION EA. DPDT	71590	PB-10
A6A2S2			NSR P/O A2S1		
A6A2S3			NSR P/O A2S1		
A6A2S4	3101-1400		SWITCH: PUSHBUTTON DPDT	71590	PB-1
A6A2S5			NSR P/O A2S1		
A6A2S6			NSR P/O A2S1		
A6A2S7	3101-1400		SWITCH: PUSHBUTTON DPDT	71590	PB-1
A6A2S8			NSR P/O A2S1		
A6A2S9			NSR P/O A2S1		
A6A2U1	1820-0142	2	INTEGRATED CIRCUIT: 4 INPUT, 2-OR/NOR	04713	MC1004P
A6A2U2	1820-0142		INTEGRATED CIRCUIT: 4 INPUT, 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		BOARD ASSY: INTEGRATOR MAIN	28480	01701-66514
A6A3C1	0180-0230		CAPACITOR: FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C2	0180-0230		CAPACITOR: FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C3	0180-0230		CAPACITOR: FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C4	0180-0230		CAPACITOR: FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A3C5	0160-3451		CAPACITOR: FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A3C6	0160-3451		CAPACITOR: FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A3C7	0160-3448	2	CAPACITOR: FXD CER 1000 PF 10% 1000VDCW	56289	C067B251F102K525-CDH
A6A3C8	0160-2264	2	CAPACITOR: FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A6A3C9	0160-3451		CAPACITOR: FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A3C10	0160-2257		CAPACITOR: FXD CER 10 PF 5% 500VDCW	72982	301-000-C0G0-100J
A6A3C11	0160-2257		CAPACITOR: FXD CER 10 PF 5% 500VDCW	72982	301-000-C0G0-100J
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	1901-0635	1	DIODE: HYBRID HOT CARRIER	28480	1901-0635
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

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A3CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A3Q1	1854-0092		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	2	TSTR:SI PNP	28480	1853-0276
A6A3Q7	1855-0057	2	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		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R2	0684-3901		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R3	0684-3901		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R4	0684-3901		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R5	0684-1221		RESD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A3R6	0684-1221		RESD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A3R7	0684-1031		RESD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A3R8	0684-2231		RESD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A3R9	0757-0446		RESD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A3R10	0684-1021		RESD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A6A3R11	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A3R12	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A3R13	0684-2231		RESD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A3R14	0684-1221		RESD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A3R15	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A3R16	0684-1031		RESD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A3R17	0684-2211		RESD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A3R18	0684-3901		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A3R19	0684-1031		RESD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A3R20	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011

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
A6A3U1	1820-0068	4	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6A3XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A6A4	01701-66514		BOARD ASSY: INTEGRATOR DELAYED	28480	01701-66514
A6A4C1	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A4C2	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A4C3	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A4C4	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A4C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A4C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A4C7	0160-3448		C:FXD CER 1000 PF 10% 100VDCW	56289	C0678251F102K525-CDH
A6A4C8	0160-2264		C:FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A6A4C9	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A4C10	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A6A4C11	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A6A4CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR4	1901 0635	1	DIODE: HYBRID: HOT CARRIER	28480	1901 0635
A6A4CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4CR14	1901 0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A4Q1	1854-0092		TST:SI NPN	80131	2N3563
A6A4Q2	1853-0036		TST:SI PNP	80131	2N3906
A6A4Q3	1854-0092		TST:SI NPN	80131	2N3563
A6A4Q4	1854-0092		TST:SI NPN	80131	2N3563
A6A4Q5	1853-0036		TST:SI PNP	80131	2N3906
A6A4Q6	1853-0276		TST:SI PNP	28480	1853-0276
A6A4Q7	1855-0057		TST:SI FET N-CHANNEL	28480	1855-0057
A6A4Q8	1854-0215		TST:SI NPN	80131	2N3904
A6A4Q9	1854-0215		TST:SI NPN	80131	2N3904
A6A4R1	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A4R2	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A4R3	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A4R4	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A4R5	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A4R6	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A4R7	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A4R8	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A4R9	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A4R10	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A6A4R11	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A4R12	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A4R13	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A6A4R14	0684-1221		R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A6A4R15	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A4R16	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A4R17	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A6A4R18	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A6A4R19	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A4R20	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A4U1	1820-0068		IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6A4XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG5D-3R
A6A5	01701 66663		BOARD ASSY: SWEEP TIME MAIN	28480	01701 66663
A6A5C1	0160-3359	1	C:FXD POLY 10 UF +5-15% 100VDCW	84411	HEW 247
A6A5C2	0160-2432		C:FXD POLY 0.1 UF 5% 100VDCW	84411	863T
A6A5C3	0160-2218	2	C:FXD MICA 1000 PF 5%	28480	0160-2218
A6A5C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A5C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A5C6	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A6A5C7	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A6A5MP1	0510-1101	4	SPRING:RETAINER(PC SWITCH)	28480	0510-1101
A6A5MP2	1460-1148	4	SPRING:TORSION	00000	OBD
A6A5MP3	01840 22502	1	ROLLER: DETENT	28480	01840 22502
A6A5Q1	1854-0221	2	TST:SI NPN(REPL.BY 2N4044)	28480	1854-0221
A6A5Q2	1853-0086	3	TST:SI PNP	80131	2N5087
A6A5Q3	1853-0049		TST:SI PNP	28480	1853-0049
A6A5R1	0757-0156	8	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A5R2	0757-0779	9	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

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
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	0698-8131	2	R:FXD MET FLM 150K OHM 0.1% 1/4W	28480	0698-8131
A6A5R7	0687-1231	2	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	0698-8131		R:FXD MET FLM 150K OHM 0.1% 1/4W	28480	0698-8131
A6A5R10	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A5R11	0757-0460	2	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A6A5R12	0757-0462	2	R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462
A6A5R13	2100-1762	4	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		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
A6A5R19	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A5R20	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A5S1MP1	3130-0355	2	ROTOR ASSY:FEMALE	28480	3130-0355
A6A5S1MP2	3130-0354	2	ROTOR ASSY:MALE	28480	3130-0354
A6A6	01701-66515		BOARD ASSY: SWEEP TIME DELAYED	28480	01701-66515
A6A6C1	0160-3324	1	C:FXD MET POLY 1.0 UF 5% 100VDCW	84411	HEW-249
A6A6C2	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A6C3	0140-0193		C:FXD MICA 82 PF 5%	28480	0140-0193
A6A6C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A6C5	0160-3541	1	C:FXD POLY 0.01 UF 5% 100VDCW	84411	HEW-192
A6A6MP1	0510-1101		SPRING:RETAINER(PC SWITCH)	28480	0510-1101
A6A6MP2	1460-1148		SPRING:TORSION	00000	OBD
A6A6MP3	01840-22502	3	ROLLER:DETENT	28480	01840-22502
A6A6Q1	1854-0221		TSTR:SI NPN(REPL.BY 2N4044)	28480	1854-0221
A6A6Q2	1853-0086		TSTR:SI PNP	80131	2N5087
A6A6Q3	1853-0049		TSTR:SI PNP	28480	1853-0049
A6A6R1	0757-0156		R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A6R2	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A6R3	0757-0156		R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A6R4	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A6R5	0757-0156		R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A6R6	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A6R7	0687-1231		R:FXD COMP 12K OHM 10% 1/2W	01121	EB 1231
A6A6R8	0757-0156		R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A6A6R9	0757-0779		R:FXD MET FLM 150K OHM 1% 1/4W	28480	0757-0779
A6A6R10	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6A6R11	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A6A6R12	0757-0462		R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462
A6A6R13	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A6R14	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A6R15	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A6R16	2100-1762		R:VAR WW 20K 5% 1W	75042	CT-106-4
A6A6R17	0684-1541		R:FXD COMP 150K OHM 10% 1/4W	01121	CB 1541
A6A6R18	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A6A6S1	3130-0355		ROTOR ASSY:FEMALE	28480	3130-0355
A6A6S1	3130-0354		ROTOR ASSY:MALE	28480	3130-0354
A6A7	01701-66550		BOARD ASSY: HOLDOFF AND COMPARATOR	28480	01701-66550
A6A7C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A7C2	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
A6A7C3	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6A7C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A7C5	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A6A7C6	0180-1743	1	C:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A6A7C7	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6A7C8	0140-0203		C:FXD MICA 30 PF 5%	28480	0140-0203
A6A7C9	0140-0203		C:FXD MICA 30 PF 5%	28480	0140-0203
A6A7C10	0160-0153 8		C:FXD MICA .001 UF 5% 5%	28480	0160-0153
A6A7C11	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A6A7C12	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
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	OBD
A6A7MP3	01840-22502		ROLLER:DETENT	28480	01840-22502
A6A7Q1	1854-0215		TSTR:SI NPN	80131	2N3904

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
A6A7Q2	1853-0203		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	1820-0088		IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6A7XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG50-3R
A6A8	01701-66565		BOARD ASSY: HORIZ MODE	28480	01701-66565
A6A8C1	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6A8C2	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6A8C3	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A6A8CR1	1901-0535	5	DIODE:HYBRID HOT CARRIER	28480	1901-0535
A6A8CR2	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A6A8CR3	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A6A8CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A8CR11	1901-0040		DIODE SILICON 30MA 30WV	07263	FDG1088
A6A8Q1	1854-0215		TSTR:SI NPN	80131	2N3904
A6A8Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A6A8Q3	1853-0036		TSTR:SI PNP	80131	2N3906
A6A8R1	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A8R2	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A8R3	0757-0431	2	R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A6A8R4	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A8R5	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A6A8R6	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A6A8R7	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A6A8R8	0684-5631		R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A6A8R9	0684-5631		R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A6A8R10	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A6A8R11	0757-0288	1	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A6A8R12	0698-3156	1	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A6A8R13	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A6A8R14	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB1031
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
A6A8S1MP1	3130-0360	1	ROTOR ASSY:FEMALE	28480	3130-0360
A6A8S1MP2	01701-61903	1	ROTOR ASSY:MALE	28480	01701-61903
A6A8U1	1820-0088		IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A6A8XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG50-3R
A6A9	01703-66508		BOARD ASSY: HORIZONTAL PREAMP	28480	01703-66508
A6A9C1	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A9C2	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A9C3	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A9C4	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A9C5	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CDH
A6A9C6	0180-0230		C:FXD ELECT 1.0 UF 20% 50VDCW	56289	150D105X0050A2-DYS
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	C023B101F103Z525-CDH
A6A9C9	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A9C10	0140-0236		C:FXD MICA 270 PF 5%	72136	RDM15F271J 500V
A6A9CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A9CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088

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
A6A9CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A9CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A9CR5	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A6A9CR6	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A6A9CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6A9XA1	1251-1604	2	CONNECTOR:PC EDGE 1 ROW 22 CONTACT	71785	252-22-30-310
A6A9XA2	1251-1604		CONNECTOR:PC EDGE 1 ROW 22 CONTACT	71785	252-22-30-310
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	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
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	4	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 0436		R:FXD MET FLM 3920 OHM 1% 1.8W	28480	0757 0436
A6A9R10	0757 0436		R:FXD MET FLM 3920 OHM 1% 1.8W	28480	0757 0436
A6A9R11	0757-0458	3	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
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	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A9R15	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A6A9R16	0757-0427	1	R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A6A9R17	0757-0753	2	R:FXD MET FLM 9.09K OHM 1% 1/4W	28480	0757-0753
A6A9R18	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A6A9R19			NOT ASSIGNED		
A6A9R20	0757-0753		R:FXD MET FLM 9.09K OHM 1% 1/4W	28480	0757-0753
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	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6A10	01703 66510		BOARD ASSY:HORIZONTAL OUTPUT	28480	01703 66510
A6A10C1	0121-0168		C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A6A10C2	0160 3670		C:FXD CER 0.1 UF 20% 200VDCW	72982	8131 M200 651 104M
A6A10C3	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L5032525-CDH
A6A10C4	0121-0168		C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A6A10C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103Z525-CDH
A6A10C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103, 525-CDH
A6A10C7	0160 3665		C:FXD CER 0.01 UF +80-20% 500VDCW	56289	C023A501J103Z52 CDH
A6A10C8	0160 3665		C:FXD CER 0.01 UF +80-20% 500VDCW	56289	C023A501J103Z525 CDH
A6A10C9	0160 3670		C:FXD CER 0.1 UF 20% 200VDCW	72982	8131 M200 651 104M
A6A10C10	0160 3670		C:FXD CER 0.1 UF 20% 200VDCW	72982	8131 M200 681 104M
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	2	TSTR:SI NPN	28480	1854-0271
A6A10Q6	1854-0271		TSTR:SI NPN	28480	1854-0271
A6A10Q7	1853-0037	2	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	0684-3931		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
A6A10R16	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A10VR1	1902 0041		DIODE: BREAKDOWN 5.11V 5%	04713	SZ10939-98
A6A10XQ7	1205 0095	2	HEAT SINK: TRANSISTOR	13103	22268
A6A11	01703 66511	1	BOARD ASSY: STRG SWITCH	28480	01703 66511
A6A11R1	0757 0476		R: FXD MET FLM 301K OHM 1% 1/8W	28480	0757 0476
A6A11R2	0757 0487		R: FXD MET FLM 825K OHM 1% 1/8W	28480	0757 0487
A6A11R3	0698 3451		R: FXD MET FLM 133K OHM 1% 1/8W	28480	0698 3451
A6A11S1	3101 1372		SWITCH: PUSHBUTTON 4 STATION	28480	3101 1372
A6A11VR1	1902 0025		DIODE: BREAKDOWN 10.0V 5% 400 MW	28480	1902 0025
A6A11VR2	1902 0025		DIODE: BREAKDOWN 10.0V 5% 400 MW	28480	1902 0025
A7			NOT ASSIGNED		
A8	01703 66512		BOARD ASSY: STORAGE	28480	01703 66512
A8C1	0160 3451		C: FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F1032S25 CD
A8C2	0160 3448		C: FXD CER 1000 PF 10% 1000VDCW	56289	C067B251F102K525 CD
A8C3	0160 2306		C: FXD MICA 27 PF 5%	28480	0160 2306
A8C4	0140 0206		C: FXD MICA 270 PF 5%	72136	RDM15F271J 500V
A8C5	0160 3452		C: FXD DISC CER 0.02 UF 20% 100VDCW	56289	C023B101H203MS25 CD
A8C6	0180 1988		C: FXD AL ELECT 2600 UF +75-10% 15VDCW	56289	30D268G015JJ4 DSB
A8C7	0180 0260		C: FXD ELECT 3.0 UF +50-10% 150VDCW	56289	30D105F150BA2 DSM
A8C8	0160 0155		C: FXD MY 3300 PF 10% 200VDCW	56289	192P33292-PTS
A8C9	0160 3443		C: FXD CER 0.1 UF +80-20% 500VDCW	72982	B131 050 661 104Z
A8C10	0160 3443		C: FXD CER 0.1 UF +80-20% 500VDCW	72982	B131 050 661 104Z
A8C11	0180 1745		C: FXD ELECT 1.5 UF 10% 20VDCW	28480	0180 1745
A8C12	0180 0100		C: FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2 DYS
A8C13	0180 0116		C: FXD ELECT 6.8 UF 10% 35VDCW	56289	150D686X9035B2 DYS
A8CR1	1901 0028		DIODE: SILICON 0.75A 400 PIV	04713	SR1358 0
A8CR2	1901 0028		DIODE: SILICON 0.75A 400 PIV	04713	SR1358 0
A8CR3	1901 0028		DIODE: SILICON 0.75A 400 PIV	04713	SR1358 0
A8CR4	1901 0028		DIODE: SILICON 0.75A 400 PIV	04713	SR1358 0
A8CR5	1901 0028		DIODE: SILICON 0.75A 400 PIV	04713	SR1358 0
A8CR6	1901 0028		DIODE: SILICON 0.75A 400 PIV	04713	SR1358 0
A8CR7	1901 0028		DIODE: SILICON 0.75A 400 PIV	04713	SR1358 0
A8CR8	1901 0040		DIODE: SILICON 30 MA 30 WV	07263	FDG 1088
A8CR9	1901 0040		DIODE: SILICON 30 MA 30 WV	07263	FDG 1088
A8CR10	1901 0040		DIODE: SILICON 30 MA 30 WV	07263	FDG 1088
A8Q1	1854 0215		TSTR: SI NPN	80131	2N3904
A8Q2	1854 0215		TSTR: SI NPN	80131	2N3904
A8Q3	1854 0215		TSTR: SI NPN	80131	2N3904
A8Q4	1854 0215		TSTR: SI NPN	80131	2N3904
A8Q5	1854 0215		TSTR: SI NPN	80131	2N3904
A8Q6	1854 0215		TSTR: SI NPN	80131	2N3904
A8Q7	1853 0240		TSTR: SI PNP	04713	SS1139K
A8Q8	1854 0232		TSTR: SI NPN (SELECTED FROM 2N3440)	28480	1854 0232
A8Q9	1853 0240		TSTR: SI PNP	04713	SS1139K
A8Q10	1854 0232		TSTR: SI NPN (SELECTED FROM 2N3440)	28480	1854 0232
A8Q11	1854 0232		TSTR: SI NPN (SELECTED FROM 2N3440)	28480	1854 0232
A8Q12	1854 0232		TSTR: SI NPN (SELECTED FROM 2N3440)	28480	1854 0232
A8Q13	1854 0358		TSTR: SI NPN	28480	1854 0358
A8Q14	1854 0215		TSTR: SI NPN	80131	2N3904
A8Q15	1853 0036		TSTR: SI PNP	80131	2N3906
A8Q16	1854 0232		TSTR: SI NPN (SELECTED FROM 2N3440)	28480	1854 0232
A8R1	0757 0449		R: FXD FLM 20K OHM 1% 1/8W	28480	0757 0449
A8R2	0757 1094		R: FXD MET FLM 1470 OHM 1% 1.8W	28480	0757 1094
A8R3	0684 2231		R: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R4	0757 0469		R: FXD FLM 150K OHM 1% 1/8W	28480	0757 0469
A8R5	0757 0458		R: FXD MET FLM 51.1K OHM 1% 1.8W	28480	0757 0458
A8R6	0757 0472		R: FXD MET FLM 200K OHM 1% 1.8W	28480	0757 0472
A8R7	0684 5631		R: FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R8	2100 3355		R: VAR CER MET 100K OHM 1/2W	73138	72XR104
A8R9	0684 2231		R: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R10	0684 2231		R: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R11	0684 2231		R: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R12	0684 2231		R: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R13	0684 5631		R: FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R14	0684 5631		R: FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R15	2100 3353		R: VAR CER MET 20K OHM 1/2W	73138	72XR20K
A8R16	2100 3353		R: VAR CER MET 20K OHM 1/2W	73138	72XR20K
A8R17	0757 0426		R: FXD FLM 1300 OHM 1% 1.8W	28480	0757 0426
A8R18	0698 3155		R: FXD MET FLM 4640 OHM 1% 1/8W	28480	0698 3155
A8R19	0687 1041		R: FXD COMP 100K OHM 10% 1/2W	01121	EB 1041
A8R20	0684 5631		R: FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R21	0684 2231		R: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231

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
A8R22	0684-1541		R: FXD COMP 150K OHM 10% 1/4W	01121	CB 1541
A8R23	0684 8231		R: FXD COMP 82K OHM 10% 1/4W	01121	CB 8231
A8R24	0684-2221		R: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R25	0684-2221		R: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R26	0684-2221		R: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R27	0684-2221		R: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R28	0684 2221		R: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R29	2100-3353		R: VAR CER MET 20K OHM 1/2W	73138	72XR20K
A8R30	2100-3353		R: VAR CER MET 20K OHM 1/2W	73138	72XR20K
A8R31	0757-0200		R: FXD MET FLM 5620 OHM 1% 1/8W	28480	0757 0200
A8R32	0757 0200		R: FXD MET FLM 5620 OHM 1% 1/8W	28480	0757 0200
A8R33	0684-1031		R: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A8R34	0684-1031		R: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A8R35	0698-3449		R: FXD MET FLM 28.7K OHM 1% 1/8W	28480	0698-3449
A8R36	0757-0443		R: FXD MET FLM 11K OHM 1% 1/8W	28480	0757 0443
A8R37	0684-2231		R: FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R38	0684-1041		R: FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A8R39	0684-1021		R: FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R40	0684-2221		R: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R41	0684-1031		R: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A8R42	0684-1041		R: FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A8R43	0684-1031		R: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A8R44	0684 5621		R: FXD COMP 5600 OHM 10% 1/4W	01121	CB 5621
A8R45	0684-1541		R: FXD COMP 150K OHM 10% 1/4W	01121	CB 1541
A8R46	0684-1031		R: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A8R47	0684 5621		R: FXD COMP 5600 OHM 10% 1/4W	01121	CB 5621
A8R48	0684 5631		R: FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R49	0684-5631		R: FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R50	0684 5631		R: FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R51	0684-2221		R: FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R52	0684-1031		R: FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A8R53	0684-1041		R: FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A8U1	1820-0587		IC: TTL LP TRIPLE 3-INPT NAND GATE	12040	DM74L10N
A8U2	1820-0584		IC: TTL LP QUAD 2-INPT NOR GATE	12040	DM74L02N
A8U2	1820-0584		IC: TTL LP QUAD 2-INPT NOR GATE	12040	DM74L02N
A8U4	1820-0583		IC: TTL LP QUAD 2-INPT NAND GATE	12040	DM74L00N
A8U5	1020-0583		IC: TTL LP QUAD 2-INPT NAND GATE	12040	DM74L00N
A8U6	1820-0583		IC: TTL LP QUAD 2-INPT NAND GATE	12040	DM74L00N
A8U7	1826-0119		IC: LIN TIMER W/TRIGGER AND RESET	18324	CF 901T
A8XU1 6	1200-0441	6	SOCKET: IC 14-PIN MINIATURE	28480	1200-0441
A8XU7	1200 0763	1	SOCKET: IC 8-PIN, FOR TO-5 CASE	71785	133 98 92 061
A9	01701 66524		BOARD ASSY: EXT HORIZONTAL	28480	01701 66524
A9C1	0121 0069	1	C:VAR CER 2-8 PF	28480	0121 0069
A9C2	0140 0202	1	C: FXD MICA 15 PF 5% 500VDCW	28480	0140 0202
A9C3	0180-0197		C: FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2 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
A9C4	0180-0197		CAPACITOR-FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A9CR1	1901-0376		DIODE-SILICON 35V	28480	1901-0376
A9CR2	1901-0376		DIODE-SILICON 35V	28480	1901-0376
A9CR3	1901-0040		DIODE-SILICON 30MA 30WV	07263	FDG1088
A9CR4	1901-0040		DIODE-SILICON 30MA 30WV	07263	FDG1088
A9Q1	5080-0493	2	Q:FET(MATCHED PAIR)	28480	5080-0493
A9Q2	5080-0498		Q:FET(MATCHED PAIR)	28480	5080-0498
A9Q3	1854-0215		TSTR-SI NPN	80131	2N3904
A9Q4	1854-0215		TSTR-SI NPN	80131	2N3904
A9Q5	1853-0036		TSTR-SI PNP	80131	2N3906
A9Q6	1853-0036		TSTR-SI PNP	80131	2N3906
A9Q7	1854-0215		TSTR-SI NPN	80131	2N3904
A9R1	0698-6654		RESD MET FLM 800K OHM 1% 1/4W	28480	0698-6654
A9R2	0757-0472		RESD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A9R3	0684-3901		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A9R4	0684-3901		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A9R5	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R6	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R7	0757-0440		RESD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A9R8	0757-0414	1	RESD FLM 432 OHM 1% 1/8W	28480	0757-0414
A9R9	0757-0440		RESD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A9R10	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R11	0757-0440		RESD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A9R12	0757-0283		RESD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A9R13	0757-0440		RESD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A9R14	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R15	2100-2521	1	RESVAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A9R16	0757-0435	1	RESD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A9R17	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R18	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R19	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R20	0684-3321		RESD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A9R21	0684-1011		RESD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R22	0684-3901		RESD COMP 39 OHM 10% 1/4W	01121	CB 3901
A9U1	1821-0002	1	TRANSISTOR ARRAY:SI NPN	02735	CA3045
A9XU1	1200-0768		SOCKET:INTEGRATED CIRCUIT 14 CONTACT	91506	314-AG50-3R
A10	01703-61608		CONNECTOR ASSY: HIGH VOLTAGE	28480	01703-61608

See introduction to this section for ordering information

Table 6-3. List of Manufacturers' Codes

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
00000	U.S.A. COMMON	ANY SUPPLIER OF U.S.A.	
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
02735	RCA SOLID STATE & RECEIVING TUBE DIV.	SOMERVILLE, N.J.	08876
03877	TRANSITRON ELECTRONIC CORP.	WAKEFIELD, MASS.	01880
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
08806	G.E. CO. MINIATURE LAMP DEPT.	CLEVELAND, OHIO	44112
12040	NATIONAL SEMICONDUCTOR CORP.	DANBURY, CONN.	06810
13103	THERMALLOY CO.	DALLAS, TEX.	75247
14032	SPRUCE PINE MICA CO.	SPRUCE PINE, N.C.	28777
14701	ELECTRA/MIDLAND CORP.	MINERAL WELLS, TEX.	76067
24446	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
24931	SPECIALTY CONNECTOR CO. INC.	INDIANAPOLIS, IND.	46227
27264	MOLEX PROD. CO.	DOWNERS GROVE, ILL.	60515
28480	HEWLETT-PACKARD COMPANY	PALO ALTO, CALIF.	94304
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
66295	WIEFK MFG. CO.	CHICAGO, ILL.	60623
70903	BELDEN CORP.	CHICAGO, ILL.	60644
71400	BUSSMANN MFG. DIV. MC GRAW-EDISON CO.	ST. LOUIS, MO.	63017
71590	GLOBE UNION INC. CENTRALAB DIV.	MILWAUKEE, WISC.	53201
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72765	DRAKE MFG. CO.	HARWOOD HEIGHTS, ILL.	60656
72825	EBY HUGH H. INC.	PHILADELPHIA, PA.	19144
72962	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
74970	JOHNSON E.F. CO.	WASECA, MINN.	56093
75042	INTERNATIONAL RESISTANCE CO. INC.	PHILADELPHIA, PA.	19108
75915	LITTELFUSE INC.	DES PLAINES, ILL.	60016
77068	RUBERCRAFT CORP. OF CALIF. LTD.	TORRANCE, CALIF.	90507
78553	TINNERMAN PROD. INC.	CLEVELAND, OHIO	44129
79136	WALDES KOHINOOR INC.	LONG IS. CITY, N.Y.	11101
80120	SCHNITZER ALLOY PROD. CO.	ELIZABETH N.J.	07206
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
82142	AINCO SPEER FLECT. COMP.	DU BOIS, PA.	15801
84411	TRW CAPACITOR DIV.	OGALLALA, NEBR.	69153
91418	RADIO MATERIALS CO.	CHICAGO, ILL.	60646
91506	AUGAT INC.	ATTLEBURO, MASS.	02703

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 the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, find your serial prefix in table 7-1 and make the changes to the manual that are listed for that serial prefix. When making changes listed in table 7-1, make the change with the highest number first. Example: If backdating changes 1, 2, and 3 are required for your serial prefix, do change 3 first, then change 2, and finally change 1. If the serial prefix of the instrument is not listed either on the title page or in table 7-1, refer to the Manual Changes (Supplement A) included with this manual.

Table 7-1. Manual Changes

Serial Prefix	Make Changes
1517A	1
1509A	2, 1
1422A	3, 2, 1
1402A	4 thru 1
1342A	4 thru 1
1331A	5 thru 1
1325A	5 thru 1
1232A	6 thru 1
1230A	7 thru 1
1226A	8 thru 1
1150A	8 thru 1

CHANGE 1

Page 1-6, table 1-2,
ACCESSORIES FURNISHED: Add front panel storage cover (Model 10101B), and one dc power plug for assembling dc power cord (HP Part No. 1251-2614).
Table 6-2,
MP18: Change HP Part No. and Mfr Part No. to 0370-1129.
MP32: Use part listed in table 7-3 and shown in figure 7-6.
MP33: Use part listed in table 7-3 and shown in figure 7-6.
MP34: Change HP Part No. and Mfr Part No. to 01707-04102.
MP35: Use part listed in table 7-3 and shown in figure 7-6.
MP36: Use part listed in table 7-3 and shown in figure 7-6.
Add: MP36H1 as listed in table 7-3 and shown in figure 7-6.
MP37: Use part listed in table 7-3 and shown in figure 7-6.
MP38: Use part listed in table 7-3 and shown in figure 7-6.
Delete: MP39.
MP40: Use part listed in table 7-3 and shown in figure 7-6.
Add: MP41 as listed in table 7-3 and shown in figure 7-6.
Add: MP42 as listed in table 7-3 and shown in figure 7-6.
Add: MP43 as listed in table 7-3 and shown in figure 7-6.
Add: MP44, NOT ASSIGNED.
Add: MP45 as listed in table 7- and shown in figure 7-6.
Add: MP46 as listed in table 7-3 and shown in figure 7-6.
Add: MP47 as listed in table 7-3 and shown in figure 7-6.
Add: MP48 as listed in table 7-3 and shown in figure 7-6.
Add: MP49 as listed in table 7-3 and shown in figure 7-6.
Add: MP50 as listed in table 7-3 and shown in figure 7-6.
Add: MP51 as listed in table 7-3 and shown in figure 7-6.
MP76: Use part listed in table 7-3 and shown in figure 7-6.
Schematic 19,
Delete: A4R3.
Delete: A4CR11.

CHANGE 2

Page 6-3, table 6-2,
MP53: Change HP Part No. and Mfr Part No. to 01703-20502.
Page 6-4, table 6-2,
W14: Change HP Part No. and Mfr Part No. to 01703-61611.
Schematic 23,
S2: Connect wire from pin 14 to junction pin 10 and BT1P1. Disconnect wire color (2) from pin 14 to S1 pin 3.

CHANGE 3

Page 6-6, table 6-2,
A3A5: Change HP Part No. and Mfr Part No. to 01703-61103.
Schematic 22,
A3A5R1: Change value to 29M.
A3A5R2: Delete.
A3A5C5: Delete.

CHANGE 4

Page 6-4, table 6-2,
A3A1C2: Change to HP Part No. 0160-3451, C: FXD CER 0.01 UF +80-20% 100 VDCW, Mfr Code 56289, Mfr Part No. C023B101F103ZS25-CDH.
A3A1C3: Change to HP Part No. 0180-0229, C: FXD ELECT 33 UF 10% 10 VDCW, Mfr Code 28480, Mfr Part No. 0180-0229.
Add: A3A1C7, HP Part No. 0180-0230, C: FXD ELECT 1.0 UF 20% 50 VDCW, Mfr Code 56289, Mfr Part No. 150D105X0050A2-DYS.
Delete: A3A1C12, A3A1C13.
Delete: A3A1CR7.
A3A1R7: Change to HP Part No. 0684-4701, R: FXD COMP 47 OHMS 10% 1/4W, Mfr Code 01121, Mfr Part No. CB-4701.
A3A1R9: Change to HP Part No. 0687-4711, R: FXD COMP 470 OHMS 10% 1/2W, Mfr Code 01121, Mfr Part No. EB-4711.
A3A1R19: Change to HP Part No. 0684-1011, R: FXD COMP 100 OHMS, 10% 1/4W, Mfr Code 01121, Mfr Part No. CB-2705.
Page 6-8, table 6-2,
A5R20, A5R21: Change to HP Part No. 0757-0280, R: FXD METFLM 1K OHMS 1% 1/8W, Mfr Code 28480, Mfr Part No. 0757-0280.
Page 8-27, schematic 8,
A5R20, A5R21: Change value to 1000 ohms.
Page 8-55, schematic 23,
CR7: Delete.
Page 8-57, schematic 24,
Replace schematic for part of A3A1 with figure 7-5.
Page 8-59/8-60, schematic 25,
A3A1C12 and A3A1C13: Delete.

CHANGE 5

Page 6-0, figure 6-1,
Use figure 7-6 from this section for handle assy parts identification.
Page 6-2, 6-3, 6-4, 6-21, and 6-22,
Replace with table 7-3 from this section.

CHANGE 6

Table 6-2,
W14: Change HP and Mfr Part No. to 01703-61601.
A3W1: Delete.
Pages 6-21 and 6-22: Replace with table 7-3 from this section.
Figure 8-47 through 8-53,
Replace with figures 7-1 through 7-4 from this section.
Tables 7-4 and 7-5 provide test measurement information for the associated schematics in this section.

CHANGE 7

Page 6-2,
A6A10: Change to HP Part No. 01701-66544, Qty 1, Board Assy: Horizontal Output; Mfr Code 28480, Mfr Part No. 01701-66544.
Page 6-20,
A6A10: Change to HP Part No. 01701-66544; Qty 1; Board Assy: Horizontal Output, Mfr Code 28480, Mfr Part No. 01701-66544.
A6A10C1: Change to HP Part No. 0121-0168, Qty 2, C: VAR TEFLON 0.25-1.5 PF, Mfr Code 28480, Mfr Part No. 0121-0168.
A6A10C4: Change to HP Part No. 0121-0168, C: VAR TEFLON 0.25-1.5 PF, Mfr Code 28480, Mfr Part No. 0121-0168.

CHANGE 8

Page 6-2, table 6-2,
MP8: Change Qty to 4.
MP18: Change to HP Part No. 0370-1099, Qty 1, KNOB, JADE GRAY, Mfr Code 28480, Mfr Part No. 0370-1099.
MP24: Change Qty to 2.
MP27: Change Qty to 12.
Page 6-3, table 6-2,
MP98: Delete.
MP99: Delete.
MP100: Delete.
Page 8-55, figure 8-54,
Change: post-accelerator voltage to 7500 V.

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 supplement are provided with each special option instrument. The operating and service manual contains information about the standard instrument. The manual supplement 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 supplement information (and manual change pages, 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 supplement 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. Table 7-2 lists the Model 1703A standard options.

Table 7-2. Model 1703A Standard Options

Option	Description	HP Part No.
001	Instrument set at factory for 230V operation: Fuse, .25 ASB for 230-volt operation.	Fuse: 2110-0018
012	Standard Model 1703A with Model 10103B Battery Pack.	Model 10103B Battery Pack

Table 7-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	5061-1196	1	POWER LINE INPUT ASSY	28480	5060 1196
A2	01701 66553	1	BOARD ASSY: LINE RECT	28480	01701 66553
A3	01703 61101	1	POWER SUPPLY MODULE	28480	01703 61101
A3A1	01703 66502	1	BOARD ASSY: LOW VOLTAGE MOTHER	28480	01703 66502
A3A2	01701 66554	1	BOARD ASSY: LOW VOLTAGE CONVERTER	28480	01701 66554
A3A3	01701 66537	1	BOARD ASSY: RECT AND FILTER	28480	01701 66537
A3A4	01703 66503	1	BOARD ASSY: HIGH VOLTAGE OSCILLATOR	28480	01703 66503
A3A5	01703 66509	1	BOARD ASSY: HIGH VOLTAGE MULTIPLIER	28480	01703 66509
A4	01703 66501	1	BOARD ASSY: GATE	28480	01703 66501
A5	01703 65801	1	VERTICAL AMPLIFIER MODULE	28480	01703 65801
A5A1	01701 63401	2	ATTENUATOR ASSY	28480	01701 63401
A5A2	01701 63401		ATTENUATOR ASSY	28480	01701 63401
A5A3	01703 61103	1	ASSY: HIGH VOLTAGE MULTIPLIER	28480	01703 61103
A5A4	01701 66541	1	BOARD ASSY: VERTICAL PREAMPL	28480	01701 66541
A5A5	01703 66507	1	BOARD ASSY: VERTICAL OUTPUT	28480	01703 66507
A5A6	01701 66526	1	BOARD ASSY: CHANNEL A OUTPUT	28480	01701 66526
A6	01703 65802	1	HORIZONTAL AMPLIFIER MODULE	28480	01703 65802
A6A1	01701 66558	1	BOARD ASSY: HORIZONTAL MOTHER	28480	01701 66558
A6A2	01701 66552	1	BOARD ASSY: TRIGGER	28480	01701 66552
A6A3	01701 66514	2	BOARD ASSY: INTEGRATOR MAIN	28480	01701 66514
A6A4	01701 66514		BOARD ASSY: INTEGRATOR DELAYED	28480	01701 66514
A6A5	01701 66551	1	BOARD ASSY: SWEEP TIME MAIN	28480	01701 66551
A6A6	01701 66515	1	BOARD ASSY: SWEEP TIME DELAYED	28480	01701 66515
A6A7	01701 66550	1	BOARD ASSY: HOLDOFF AND COMPARATOR	28480	01701 66550
A6A8	01701 66532	1	BOARD ASSY: HORIZONTAL MODE	28480	01701 66532
A6A9	01703 66508	1	BOARD ASSY: HORIZONTAL PREAMPL	28480	01703 66508
A6A10	01701 66544	1	BOARD ASSY: HORIZONTAL OUTPUT	28480	01701 66544
A7	01703 66506	1	STORAGE SWITCH	28480	01703 66506
A8	01703 66505	1	BOARD ASSY: STORAGE	28480	01703 66505
A9	01701 66524	1	BOARD ASSY: EXT HORIZONTAL	28480	01701 66524
A10	01703 61608	1	CONNECTOR ASSY: HIGH VOLTAGE	28480	01703 61608
BT1	1251-2510	1	BODY:R & P CONNECTOR 2 MALE CONTACT	27264	1545 P1
BT1MP1	1251-2599	15	CONTACT:R & P CONNECTOR MALE	27264	13801
DS1	1450-0710	1	LIGHT INDICATOR 90 VDC	72765	6140-600 603
F1	2110-0002	1	FUSE CARTRIDGE 2 AMP 3 AG (FOR AC OPERATION)	75915	312002
F1	2110 0003	1	FUSE: CARDRIDGE 3 AMP 3 AG (FOR DC OPERATION)	75915	312 003
J1	1250-0118	7	CONNECTOR:BNC	24931	2438 122-1
J2	1250-0118		CONNECTOR:BNC	24931	2438 122-1
J3	1250-0118		CONNECTOR:BNC	24931	2438 122-1
J4	01701-67602	1	CONNECTOR ASSY:ELL POWER	28480	01701-67602
J5	1250-0118		CONNECTOR:BNC	24931	2438 122-1
J6	1250-0118		CONNECTOR:BNC	24931	2438 122-1
J7	1250-0118		CONNECTOR:BNC	24931	2438 122-1
J8	1250-0118		CONNECTOR:BNC	24931	2438 122-1
L1	01701-66001	2	COIL ASSY:ALIGNMENT	28480	01701-66001
L2	01701-66001		COIL ASSY:ALIGNMENT	28480	01701-66001
MP1	01703-00201	1	PANEL:FRONT	28480	01703-00201
MP2	01701-20504	1	FRAME:FRONT	28480	01701-20504
MP3	01701-24702	1	SUPPORT:CRT-CAMERA	28480	01701-24702
MP4	01703-07101	1	MASK:CRT	28480	01703-07101
MP5	5040-0814	1	BEZEL:DISPLAY, BLACK	28480	5040-0814
MP6	01701-09103	2	SPRING:FILTER, CONTRAST	28480	01701-09103
MP7	0370-1005	2	KNOB:JADE GRAY (FOCUS)	28480	0370-1005
MP8	0370-1099	3	KNOB:JADE GRAY POSITION/TRIGGER LEVEL	28480	0370-1099
MP9	0370-0962	2	KNOB ASSY: VOLTS/DIV DIV/CAL	28480	0370-0962
MP10	0370-0966	2	KNOB ASSY:VOLTS/DIV	28480	0370-0966
MP11	0370-0329	2	KNOB:LEVER, JADE GRAY COUPLING	28480	0370-0329
MP12	0370 2046	1	KNOB ASSY:DISPLAY	28480	0370-0965 0370 2046
MP13	01703 67401	2	KNOB ASSY	28480	01703 67401
MP14	5040 7545	1	COVER: HIGH VOLTAGE POT (FOCUS)	28480	5040 7545
MP15	0370 2171	1	KNOB: ROUND	28480	0370 2171
MP16	0370 0963	1	KNOB:HORIZONTAL POSITION - FINE	28480	0370 0963
MP17	0370-1100	1	KNOB:JADE GRAY HORIZONTAL POSITION	28480	0370 1100
MP18	0370 2452	2	KNOB:BAR TRIG/SWEEP DISPLAY	28480	0370 2452
MP19	1520 0079	4	MOUNT: SHOCK	00000	OBD
MP20	01701 63705	1	SHAFT ASSY: SWEEP TIME	28480	01701 63705
MP21	01703 63701	1	SHAFT ASSY: PUSHBUTTON	28480	01703 63701
MP22	0370 2173	1	KNOB:ROUND	28480	0370 2173
MP23	0370 0957	1	KNOB ASSY (NORM)	28480	0370 0957
MP24	0370 0958	3	KNOB ASSY (CAL)	28480	0370 0958
MP25	01701 09104	2	SPRING:CONTACT	28480	01701 09104
MP26	01701 23203	1	COLLAR:ANTI-ROTATION	28480	01701 23203
MP27	01701 67415	10	KNOB ASSY:BLANK	28480	01701 67415
MP28	0370 0914	19	BEZEL:PUSHBUTTON KNOB, JADE GRAY	28480	0370 0914
MP30	1510 0038	1	BINDING POST	28480	1510 0038
MP31	0510 0097	1	RETAINER:PUSH-ON	78553	C185 014 24D
MP32	01703 23701	2	RAIL:SIDE	28480	01703 23701
MP33	01703 04104	2	COVER:RAIL REAR	28480	01703 04104
MP34	01701 64101	2	COVER ASSY:RAIL FRONT	28480	01701 64101
MP35	0050 1757	2	GEAR:SUPPORT	28480	0050 1757
MP36	01701 25002	1	HANDLE:ARM, RIGHT	28480	01701 25002

See introduction to this section for ordering information

Table 7-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP36H1	01701-23707	1	SHAFT:PAWL	28480	
MP37	01701-25001	1	HANDLE:ARM, LEFT	28480	01701-25001
MP38	01701 64901	1	HANDLE ASSY	28480	01701 64901
MP40	7120-1254	1	NAMEPLATE	28480	7120-1254
MP41	01701 07201	2	INSERT:HANDLE FRONT	28480	01701 07201
MP42	01701 07202	2	INSERT:HANDLE REAR	28480	01701 07202
MP43	01701-27401	2	BUTTON	28480	01701-27401
MP45	0510-0091	2	RING:RETAINING STL EXTERNAL	79136	5103-25 S MD
MP46	3050-0253	4	WASHER:SPRING	28480	3050-0253
MP47	0510-0956	2	RING:RETAINING 0.188" SHAFT	79136	5133-18 MD
MP48	0050-1758	2	PAWL	28480	0050-1758
MP49	2190-0924	1	WASHER:WAVE SPRING	28480	2190-0924
MP50	0050-1756	2	GEAR:HANDLE	28480	0050-1756
MP51	1460-0295	2	SPRING:COMPRESSION	00000	OBD
MP52	01703-00203	1	PANEL:REAR	28480	01703-00203
MP53	01703-20502	1	FRAME:REAR	28480	01703-20502
MP55	5040-5861	4	FOOT:BASE	28480	5040-5861
MP56	01701-04109	1	COVER:TRANSFORMER	28480	01701-04109
MP57	01701-04108	1	COVER:CRT	28480	01701-04108
MP58	01703-00101	1	DECK:BATTERY	28480	01703-00101
MP59	01703-00603	1	SHIELD:GATE	28480	01703-00603
MP66	0370-2397	1	CORE:FLOATING	28480	0370-2397
MP67	01701-67414	1	KNOB ASSY	28480	01703-002
MP68	01701-02303	1	KEEPER:PC BOARDS	28480	01701-02303
MP73	1400-0798	1	CLAMP:CRT, OLIVE	28480	1400-0798
MP74	0380-1019	2	STANDOFF:CRT	28480	0380-1019
MP75	01703-60602	1	SHIELD CRT	28480	01703-60602
MP76	01703-04101	1	COVER:TOP	28480	01703-04101
MP77	01703-04102	1	COVER:BOTTOM	28480	01703-04102
MP78	1400-0026	1	CLAMP:HOSE	66295	36H
MP79	1500-0364	1	COLLAR:PRECISION SST	28480	1500-0364
MP82	1200-0408	1	COVER:CRT SOCKET	28480	1200-0408
MP85	01703-04103	1	COVER:POWER SUPPLY	28480	01703-04103
MP86	0363-0068	2	CONTACT GROUND	28480	0363-0068
MP89	1390-0084	8	RECEPTACLE	28480	1390-0084
MP90	01703-67402	1	KNOB:PUSHBUTTON FAST	28480	01703-67402
MP91	01703-67403	1	KNOB:PUSHBUTTON STD	28480	01703-67403
MP92	01703-67404	1	KNOB:PUSHBUTTON STORE	28480	01703-67404
MP93	5040-5862	4	CAP:FOOT	28480	5040-5862
MP94	0370-2392	1	KNOB:PUSHBUTTON CONV	28480	0370-2392
MP95	1140-0036	1	DIAL-TURNS COUNTING	28480	1140-0036
MP96	01703-01201	1	BRACKET:STORAGE SWITCH	28480	01703-01201
MP97	01703-01202	1	BRACKET:STORAGE SWITCH/PUSH ERASE	28480	01703-01202
MP98	01701-67416	5	KNOB:PUSHBUTTON	28480	01701-67416
MP99	01701-67417	1	KNOB ASSY (CAL)	28480	01701-67417
MP100	01701-67418	1	KNOB ASSY:DELAYED TRIGGER LEVEL	28480	01701-67418
XV1	1200-0037	1	SOCKET:CRT TUBE	72825	97097
P1	1251-2412	1	BODYER & P CONNECTOR 15 MALE CONTACT	27264	1625-15P
P2	1251-2614	1	CONNECTOR:JONES TYPE 2 FEMALE CONTACT	71785	5-302-CCT
R1	2100-3209	1	REVAR COMP 5K OHM (INTENSITY)	28480	2100-3209
R2	2100-3188	1	REVAR COMP 2.5 MEGOHM 20% LIN	28480	2100-3188
R3	0684-1011		FIXED COMP 100 OHM 10% 1/4W	01121	CB 1011
R4	2100-0428	1	REVAR COMP 20K OHM LIN 20% 0.2W (TRACE ALIGN)	28480	2100-0428
R5	2100-3191	1	REVAR CER 100K OHM 20% LIN 1/2W (ASTIGMATISM)	28480	2100-3191
R6	2100-2588	1	REVAR COMP 5K OHM 10% 10 CLOS 1/4W (EXT HORIZ VERNIER)	28480	2100-2588
R7	2100-3189	1	REVAR COMP 50K OHM 20% LIN 1/2W (STORE TIME)	28480	2100-3189
R8	2100-3190	1	REVAR CER 50K OHM 20% LIN 1/2W (PERSISTENCE)	28480	2100-3190
S1	3101-0940	1	SWITCH:TOGGLE DPDT (POWER)	28480	3101-0940
S2	3101-1391	1	SWITCH (P/O REAR PANEL, SEE MP52) POWER MODE	28480	3101-1391
S3	3101-0044	1	SWITCH:PUSHBUTTON SPST	81073	391 N.O.
T1	01703-61105	1	TRANSFORMER	28480	01703-61105
V1	5083-3452	1	CRT:P31 PHOSPHOR	28480	5083-3400
W1	01701-61610	1	CABLE ASSY: INT SYNC (VERT PREAMPL TO TRIGGER)	28480	01701-61610
W2	01703-61609	2	CABLE ASSY: TWIN LEAD (VERT TO CRT)	28480	01703-61609
W3	01703-61609	1	CABLE ASSY: TWIN LEAD (HORIZONTAL TO CRT)	28480	01703-61600
W4	01703-61603	1	CABLE ASSY: CHOP BLANKING (VERT PREAMPL TO GATE)	28480	01703-61603
W5	01703-61604	1	CABLE ASSY: BLANKING (HORIZ PREAMPL TO GATE)	28480	01703-61604
W6	01701-61609	1	CABLE ASSY: ALT TRIGGER (HORIZ PREAMPL TO VERTICAL PREAMPL)	28480	01701-61609
W7	01703-61602	1	CABLE ASSY: CAL 1 VOLT	28480	01703-61602

See Introduction to this section for ordering information

Table 7-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
W8	01703-61606	1	CABLE ASSY: EXT HORIZ INPUT (EXT HORIZ AMPL TO HORIZ PREAMPL)	28480	01703-61608
W9	01703-61605	1	CABLE ASSY: Z-AXIS INPUT	28480	01703-61605
W10	01701-61620	1	CABLE ASSY: CHANNEL A OUTPUT	28480	01701-61620
W11	8120-1521	1	CABLE ASSY: POWER CARD 7.5 FT	70903	KH 7147
W12	01703-61610	1	CABLE ASSY: LINE SYNC (LINE RECTIFIER TO TRIGGER)	28480	01703-61610
W13	01703-61607	1	CABLE ASSY: POWER INPUT	28480	01703-61607
XF1	1400-0084	1	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
Z1	1901-0526	1	DIODE ASSY:SI 100V	14099	SCA J1
MISC.	10101B	1	COVER: STORAGE	28480	10101B
A1	5060-1196		POWER LINE INPUT ASSY	28480	5060-1196
A1F1	2110-0008	1	FUSE:0.50AMP 125V SLOW-BLOW (FOR 230 VOLT OPERATION)	71400	MDL 1/2
A1F1	2110-0018	1	FUSE:CARTRIDGE 0.25 AMP SLOW BLOW (FOR 115 VOLT OPERATION)	75915	313.250
A1MP1	5000-5085	2	CLIP: MOUNTING	28480	5000-5085
A2	01701-66553		BOARD ASSY:LINE RECT	28480	01701-66553
A2C1	0160-3453	38	CAPACITOR:FXD CER 0.05 UF +80-20% 100VDCW	56289	[illegible]
A2C2	0180-2351	1	CAPACITOR:FXD ELECT 2000 UF +75-10% 50VDCW	56289	390243
A2C3	0150-0084	7	CAPACITOR:FXD CER 0.1 UF +80-20% 100VDCW	72982	[illegible]
A2CR1	1901-0045	6	DIODE:SILICON 0.75A 100PIV	04713	[illegible]
A2MP1	1400-3781	1	COMPONENT CLIP: BLACK VINYL	00000	[illegible]
A2R1	0811-1204	1	RESISTOR:WW 200 OHM 5% 5W	28480	0811-1204
A2R2	0687-1031	1	RESISTOR:COMP 10K OHM 10% 1/2W	01121	EB 1031
A2R3	0684-1041	20	RESISTOR:COMP 100K OHM 10% 1/4W	01121	CB 1041
A2R4	0684-1521		RESISTOR:COMP 1500 OHM 10% 1/4W	01121	CB 1521
A3	01703-61101		POWER SUPPLY MODULE	28480	01703-61101
A3MP1	01700-00600	1	SHIELD: TRANSFORMER	28480	01700-00600
A3MP2	01703-06501	1	BOX: POWER	28480	01703-06501
A3MP3	01703-04701	1	GUSSET: POWER BOX	28480	01703-04701
A3EQ1	1200-0077	1	WASHER: INSULATOR	04713	14852600F12
A3EQ2	5080-0476	1	INSULATOR: TRANSISTOR MICA	16037	#112
A3Q1	5080-0476	1	TRANSISTOR ASSY:FET NPN	28480	5080-0476
A3Q2	1854-0063	1	TST:FET NPN	80131	2N3055
A3A1	01703-66502		BOARD ASSY:LOW VOLTAGE MOTHER	28480	01703-66502
A3A1C1	0180-1819	1	CAPACITOR:FXD ELECT 100 UF +75-10% 50VDCW	28480	0180-1819
A3A1C2	0160-3451	28	CAPACITOR:FXD CER 0.01 UF +80-20% 100VDCW	56289	[illegible]
A3A1C3	0180-0229	3	CAPACITOR:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A3A1C4	0180-0091	4	CAPACITOR:FXD ELECT 10 UF +50-10% 100VDCW	56289	[illegible]
A3A1C5	0180-0091		CAPACITOR:FXD ELECT 10 UF +50 10% 100VDCW	56289	[illegible]
A3A1C6	0180-0058	12	CAPACITOR:FXD ELECT 100 UF 20% 20VDCW	56289	[illegible]
A3A1C7	0180-0210	13	CAPACITOR:FXD ELECT 1.0 UF 20% 50VDCW	56289	[illegible]
A3A1C8	0180-0159	4	CAPACITOR:FXD ELECT 220 UF 20% 10VDCW	28480	0180-0159
A3A1C9	0180-0159		CAPACITOR:FXD ELECT 220 UF 20% 10VDCW	28480	0180-0159
A3A1C10	0180-0367	1	CAPACITOR:FXD ELECT 20 UF 10% 200VDCW	56289	34D206F200FJ4 DBS
A3A1C11	0180-0098		CAPACITOR:FXD ELECT 100 UF 20% 20VDCW	56289	[illegible]
A3A1CR1	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	[illegible]
A3A1CR2	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	[illegible]
A3A1CR3	1901-0418	1	DIODE:SILICON 400PIV 1N5000	04713	[illegible]
A3A1CR4	1901-0040	96	DIODE:SILICON 30MA 30MW	07263	FDG1302
A3A1CR5	1884-0094	1	THYRISTOR:BILATERAL SWITCH	04713	SPT-12
A3A1CR6	1884-0082	1	THYRISTOR:SCR JEDEC TYPE 2N4441	04713	2N4441
A3A1J1	1251-2409	1	COVER & P CONNECTOR 15 FEMALE CONTACT	27264	[illegible]
A3A1L1	9100-3139	15	COIL:75 UH	28480	9100-3139
A3A1L2	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L3	9140-0210		COIL: CHOKE 100 UH 5%	82142	15-1315-123
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
A3A1L10	9100-3139		COIL:75 UH	28480	9100-3139
A3A1L11	9100-3139		COIL:75 UH	28480	9100-3139
A3A1MP1	1400-0475	5	BRACKET:COMPONENT CLIP	03877	721-0004
A3A1Q1	1854-0090	1	TST:FET NPN(SIMILAR TO 2N3053)	28480	1854-0090
A3A1R1	0761-0015	1	RESISTOR:MET OX 1500 OHM 5% 1W	28480	0761-0015
A3A1R2	0687-4711	2	RESISTOR:COMP 470 OHM 10% 1/2W	01121	EB 4711
A3A1R3	0684-1011	46	RESISTOR:COMP 100 OHM 10% 1/4W	01121	CB 1011
A3A1R4	0687-2201	1	RESISTOR:COMP 2K OHM 10% 1/2W	01121	EB 2201
A3A1R5	0811-1675	1	RESISTOR:WW 3.9 OHM 5% 2W	28480	0811-1675
A3A1R6	0812-0047	1	RESISTOR:WW 5 OHM 5% 5W	28480	0812-0047
A3A1R7	0684-4701	2	RESISTOR:COMP 47 OHM 10% 1/4W	01121	CB 4701
A3A1R8	0684-4711	1	RESISTOR:COMP 470 OHM 10% 1/4W	01121	CB 4711
A3A1R9	0687-4711		RESISTOR:COMP 470 OHM 10% 1/2W	01121	EB 4711
A3A1R10	0684-1041		RESISTOR:COMP 100K OHM 10% 1/4W	01121	CB 1041
A3A1R11	0684-2731	4	RESISTOR:COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R12	0684-2731		RESISTOR:COMP 27K OHM 10% 1/4W	01121	CB 2731
A3A1R13	0684-1041		RESISTOR:COMP 100K OHM 10% 1/4W	01121	CB 1041

See introduction to this section for ordering information

Table 7-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A10VR1	1902 0041		DIODE BREAKDOWN 5.11V 5%	04713	SZ10039 88
A6A10XQ7	1206 0095	2	HEAT SINK/TRANSISTOR	13103	2225B
A6A11	01703 66506		BOARD ASSY STORAGE SWITCH	[illegible]480	01703-66506
A6A11R1	0757 0453		R FXD MET FLM 30.1K OHM 1% 1/8W	28480	0757-0453
A6A11R2	0757 0453	1	R FXD MET FLM 30.1K OHM 1% 1/8W	28480	0757-0453
A6A11S1	3101 1372		SWITCH PUSHBUTTON 4 STATIONS	28480	3101-1372
A6A11S2			NSR P/O A7S1		
A6A11S3			NSR P/O A7S1		
A6A11S4			NSR P/O A7S1		
A7			NOT ASSIGNED		
A8	01703-66505	1	BOARD ASSY:STORAGE	28480	01703-66505
A8C1	0160-0156	1	C:FXD MY 0.0033 UF 10% 200VDCW	56289	192P39292-PTS
A8C2	0140-0199	1	C:FXD MICA 240 PF 5%	28480	0140-0199
A8C3	0180 0374	1	C FXD ELECT 10 UF 10% 20VDCW	56289	160D106X002082076
A8C4	0160-0303	1	C:FXD MYLAR .15 UF 10% 200VDCW	28480	0160-0303
A8C5	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A8C6	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A8C7	0180 0160		C FXD ELECT 60 UF 20% 6VDCW	28480	0180 0160
A8C8	0160-2215	1	C:FXD MICA 750 PF 5%	28480	0160-2215
A8C9	0160-0380		C:FXD MY 0.22 UF 10% 200VDCW	28480	0160-0380
A8C10	0160-0380		C:FXD MY 0.22 UF 10% 200VDCW	28480	0160-0380
A8C11	0160-3452		C:FXD DISC CER 0.02 UF 20% 100VDCW	56289	C023B101M203MSP5-CDN
A8C12	0180-1544	1	C:FXD AL ELECT 2600 UF +75-10% 15VDCW	56289	390268G015JJ4-CSS
A8C13	0160 2012		C:FXD MICA 330 PF ±5%	72136	RDM15F331J5S
A8CR1	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR2	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR3	1901-0026	4	DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A8CR4	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A8CR5	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A8CR6	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR7	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR8	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR9	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR10	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR11	1901-0040		DIODE:SILICON 30MA 30mV	07263	FDG1088
A8CR12	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A8Q1	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q2	1853-0036		TSTR:SI PNP	80131	2N3906
A8Q3	1854-0010		TSTR:SI	80131	2N2646
A8Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q5	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q6	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q7	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q8	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q9	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q10	1853-0036		TSTR:SI PNP	80131	2N3906
A8Q11	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q12	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q13	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q14	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q15	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q16	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q17	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q18	1853-0036		TSTR:SI PNP	80131	2N3906
A8Q19	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q20			NOT ASSIGNED		
A8Q21	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q22	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q23	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q24	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q25	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q26	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q27	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q28	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q29			NOT ASSIGNED		
A8Q30			NOT ASSIGNED		
A8Q31	1853-0036		TSTR:SI PNP	80131	2N3906
A8Q32	1853-0086		TSTR:SI PNP	80131	2N5087
A8Q33	1854-0022	3	TSTR:SI NPN	07263	S17843
A8Q34	1854-0022		TSTR:SI NPN	07263	S17843
A8Q35	1854-0022		TSTR:SI NPN	07263	S17843
A8Q36	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q37	1854-0215		TSTR:SI NPN	80131	2N3904
A8Q38	1854-0234	3	TSTR:SI NPN	80131	2N3440
A8Q39	1854-0234		TSTR:SI NPN	80131	2N3440
A8Q40	1854-0234		TSTR:SI NPN	80131	2N3440
A8R1	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R2	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A8R3	0757-0124		R:FXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A8R4	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A8R5	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R6	0684-5631		R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631

See introduction to this section for ordering information

Table 7-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R7	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R8	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R9	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R10	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R11	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A8R12	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R13	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R14	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R15	0684-5631		R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R17	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R18	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R19	0757-0472		R:FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A8R20	0757-0479	1	R:FXD MET FLM 392K OHM 1% 1/8W	28480	0757-0479
A8R21	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R22	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R23	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R24	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R25	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R26	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R27	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R28	0684 2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R29	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A8R30	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A8R31	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R32	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R33	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R34	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A8R35	0757-0760		R:FXD FLM 20K OHM 1% 1/4W	28480	0757-0760
A8R36	0684-1541		R:FXD COMP 150K OHM 10% 1/4W	01121	CB 1541
A8R37	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A8R38	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R39	2100-2514		R:VAR CERMET 20K OHM 10% LIN 1/2W	28480	2100-2514
A8R40	0757-0760		R:FXD FLM 20K OHM 1% 1/4W	28480	0757-0760
A8R41	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R42	2100-2514		R:VAR CERMET 20K OHM 10% LIN 1/2W	28480	2100-2514
A8R43	0757 0440		R:FXD FLM 20K OHM 1% 1/4W	28480	0757 0440
A8R44	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R45	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R46	0757 0430		R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757 0430
A8R47	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R48			NOT ASSIGNED		
A8R49			NOT ASSIGNED		
A8R50	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R51	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R52	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R53	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A8R54	0684-5631		R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631
A8R55	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R56	0684-5621		R:FXD COMP 5.6K OHM 10% 1/4W	01121	CB 5621
A8R57	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R58	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R59	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R60	0684 1021		R:FXD COMP 1000 OHMS 10% 1/4W	01121	CB1021
A8R61	0686 6825		R:FXD COMP 6800 OHMS 5% 1 2W	01121	EB6825
A8R62	0757 0479	1	R:FXD MET FLM 392K OHM 1% 1 8W	28480	0757 0479
A8R63	2100-2516	1	R:VAR CERMET 100K OHM 10% LIN 1/2W	28480	2100-2516
A8R64	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R65	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R66	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R67	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A8R68	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R69	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A8R70	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R71	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R72	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R73	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R74	2100-2644	2	R:VAR CERMET 500K OHM 10% LIN 1/2W	28480	2100-2644
A8R75	0757-0472		R:FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A8R76	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A8R77	0684-2231		R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231
A8R78	2100-2644		R:VAR CERMET 500K OHM 10% LIN 1/2W	28480	2100-2644
A8R79	0757-0488		R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A8R80	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A8R81	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A8R82	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A8R83	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A8XA8	1251-3163	1	CONNECTOR PC 21 PIN	22284	09 01 2211
A9	01703-66524		BOARD ASSY:EXT HORIZONTAL	28480	01703-66524
A9C1	0121-0454	1	C:VAR AIR 1.7-11 0PF 250VDCW	74970	187 0160-105
A9C2	0140-0202	1	C:FXD MICA 15 PF 5% 500 VDCW	28480	0140-0202
A9C3	0180-0197		C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2 DYS

See introduction to this section for ordering information

Table 7-4. Storage Circuit Measurement Conditions and Waveforms

WAVEFORM MEASUREMENT CONDITIONS

	STD	FAST	CONV	STORE	ERASE
1	+1.0V, +0.2V	+1.0V, +0.2V	+0.2V	+1.0V, +0.2V	+1.0V, +0.2V
2	+4V, 0V	+4V, 0V	+4V	+4V	+4V, 0V; PUSH ERASE DEPRESSED; PUSH ERASE RELEASED; 400MS
3	+9.5V*, +4.8V; * AMPLITUDE DEPENDS ON STD ERASE DEPTH ADJ.	+7.5V*, +4.8V; * AMPLITUDE DEPENDS ON FAST ERASE DEPTH ADJ.	-38V	+4.8V	ERASE RELEASED; +160V; 400MS; +4.8V

ITEMS 1 2 AND 3 WITH MONITOR OSCILLOSCOPE TIME/DIV SET TO 10MSEC/DIV

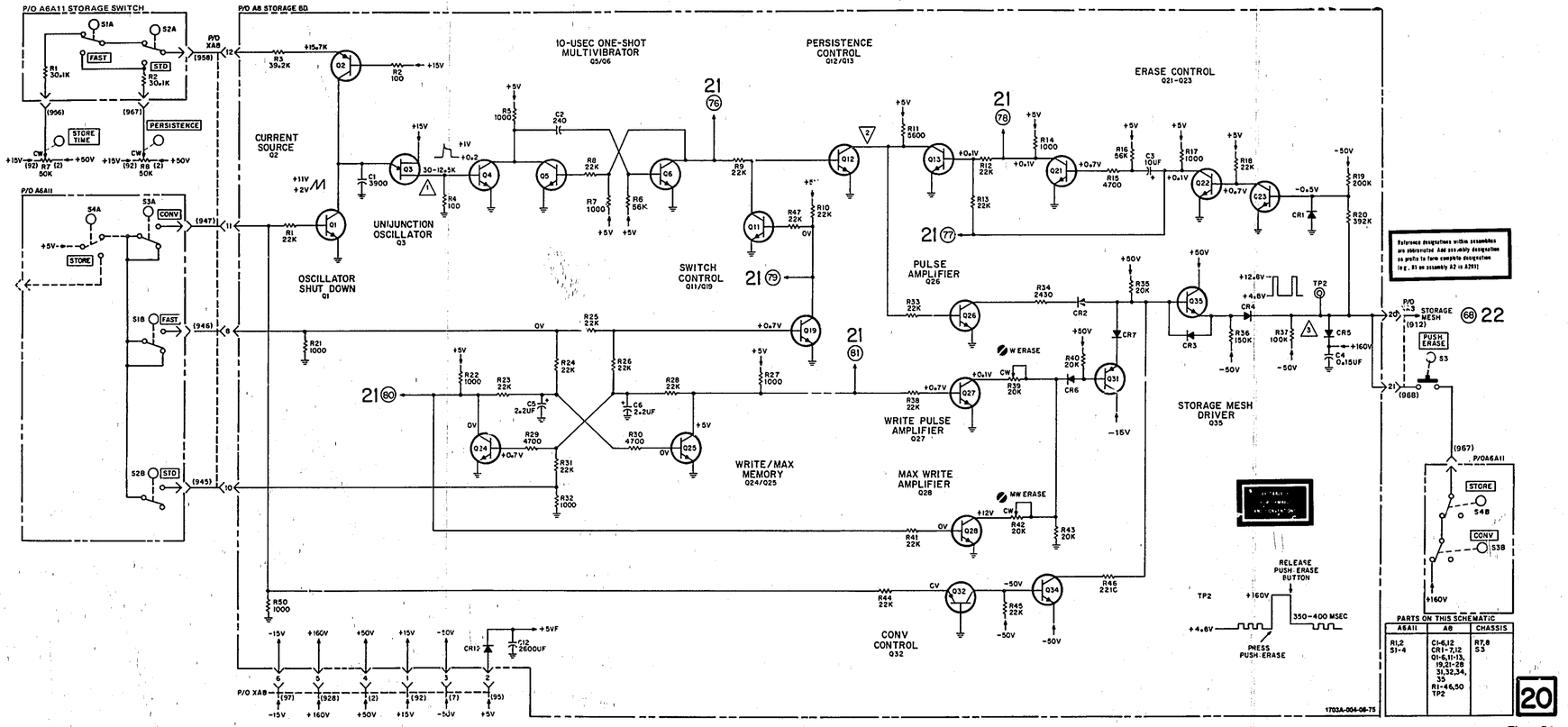
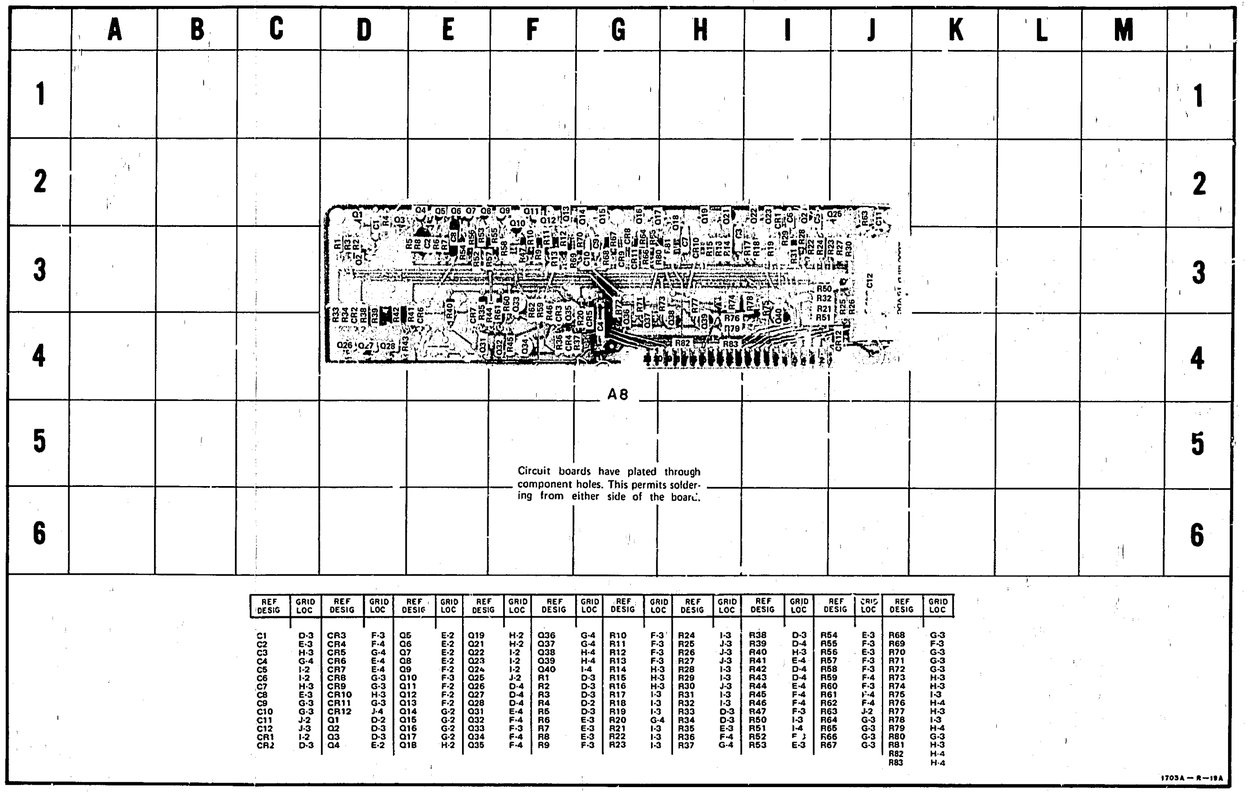


Figure 7-1.
Storage Circuit A8 Schematic
(1 of 2)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	CR3	F-3	Q5	E-2	Q19	H-2	Q36	G-4	R10	F-3	R24	I-3	R38	D-3	R54	E-3	R68	G-3
C2	E-3	CR4	F-4	Q6	E-2	Q21	H-2	Q37	G-4	R11	F-3	R25	J-3	R39	D-4	R55	F-3	R69	F-3
C3	H-3	CR5	G-4	Q7	E-2	Q22	I-2	Q38	H-4	R12	F-3	R26	J-3	R40	H-3	R56	E-3	R70	G-3
C4	G-4	CR6	E-4	Q8	E-2	Q23	I-2	Q39	H-4	R13	F-3	R27	J-3	R41	E-4	R57	F-3	R71	G-3
C5	I-2	CR7	E-4	Q9	F-2	Q24	I-2	Q40	I-4	R14	H-3	R28	I-3	R42	D-4	R58	F-3	R72	G-3
C6	I-2	CR8	G-3	Q10	F-3	Q25	J-2	R1	D-3	R15	H-3	R29	I-3	R43	D-4	R59	F-4	R73	H-3
C7	H-3	CR9	G-3	Q11	F-2	Q26	D-4	R2	D-3	R16	H-3	R30	J-3	R44	E-4	R60	F-3	R74	H-3
C8	E-3	CR10	H-3	Q12	F-2	Q27	D-4	R3	D-3	R17	I-3	R31	I-3	R45	F-4	R61	F-4	R75	J-3
C9	G-3	CR11	G-3	Q13	F-2	Q28	D-4	R4	D-2	R18	I-3	R32	I-3	R46	F-4	R62	F-4	R76	H-4
C10	G-3	CR12	J-4	Q14	G-2	Q31	E-4	R5	D-3	R19	I-3	R33	D-3	R47	F-3	R63	J-2	R77	H-3
C11	J-2	Q1	D-2	Q15	G-2	Q32	F-4	R6	E-3	R20	G-4	R34	D-3	R50	I-3	R64	G-3	R78	I-3
C12	J-3	Q2	D-3	Q16	G-2	Q33	F-3	R7	E-3	R21	I-3	R35	E-3	R51	I-4	R65	G-3	R79	H-4
CR1	I-2	Q3	D-3	Q17	G-2	Q34	F-4	R8	E-3	R22	I-3	R36	F-4	R52	F-3	R66	G-3	R80	G-3
CR2	D-3	Q4	E-2	Q18	H-2	Q35	F-4	R9	F-3	R23	I-3	R37	G-4	R53	E-3	R67	G-3	R81	H-3
																		R82	H-4
																		R83	H-4

Figure 7-2. Storage Circuit, A8, Component Identification

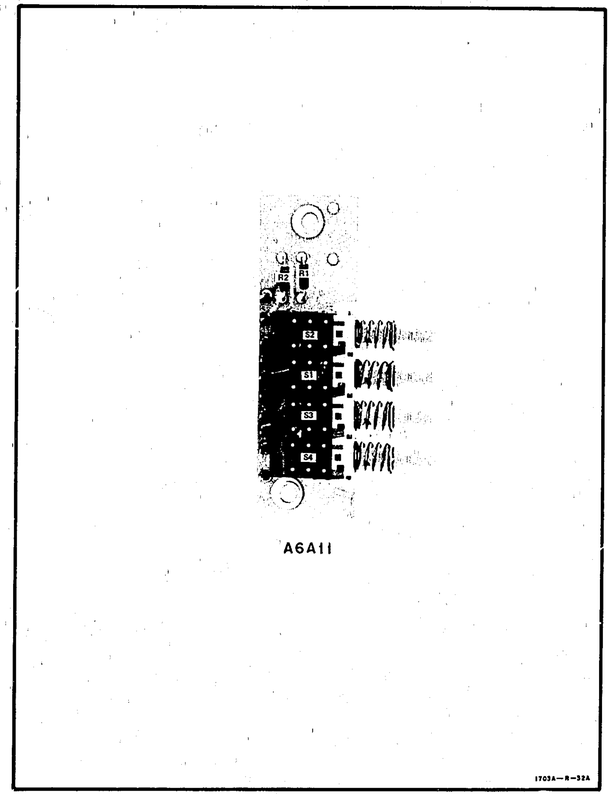


Figure 7-3. Storage Switch, A6A11, Component Identification

Table 7-5. Storage Circuit Measurement Conditions and Waveforms

WAVEFORM MEASUREMENT CONDITIONS

	STD	FAST	CONV	STORF	ERASE
4	+32V	+32V	+32V	+32V, -6.0V	NO CHANGE FROM PREVIOUS MODE SELECTED
5	≅ +62V	≅ +53V	≅ +53V – +62V. LEVEL WILL BE SAME AS FAST OR STD, WHICH EVER WAS USED LAST	≅ +53V – +62V. LEVEL WILL BE SAME AS FAST OR STD, WHICH EVER WAS USED LAST	ERASE DEPRESSED, 400MS AFTER ERASE IS RELEASED, +125V, DURING ERASE, * +53V – +62V. * LEVEL DEPENDS ON SETTING OF W COLL ADJ R74 OR MW COLL ADJ R78
6	≅ 0V WITH INTENSITY CCW, ≅ -0.8V WITH INTENSITY CW	≅ 0V WITH INTENSITY CCW, ≅ -0.8V WITH INTENSITY CW	≅ 0V WITH INTENSITY CCW, ≅ -0.8V WITH INTENSITY CW	+0.7V	ERASE DEPRESSED, ≅ 1.2SEC, +0.7V, 0V / -0.8V (SEE STD), ERASE RELEASED

ITEM 4 WITH MONITOR OSCILLOSCOPE TIME/DIV SET TO 20USEC/DIV

ITEM 5 WITH MONITOR OSCILLOSCOPE TIME/DIV SET TO 5USEC/DIV

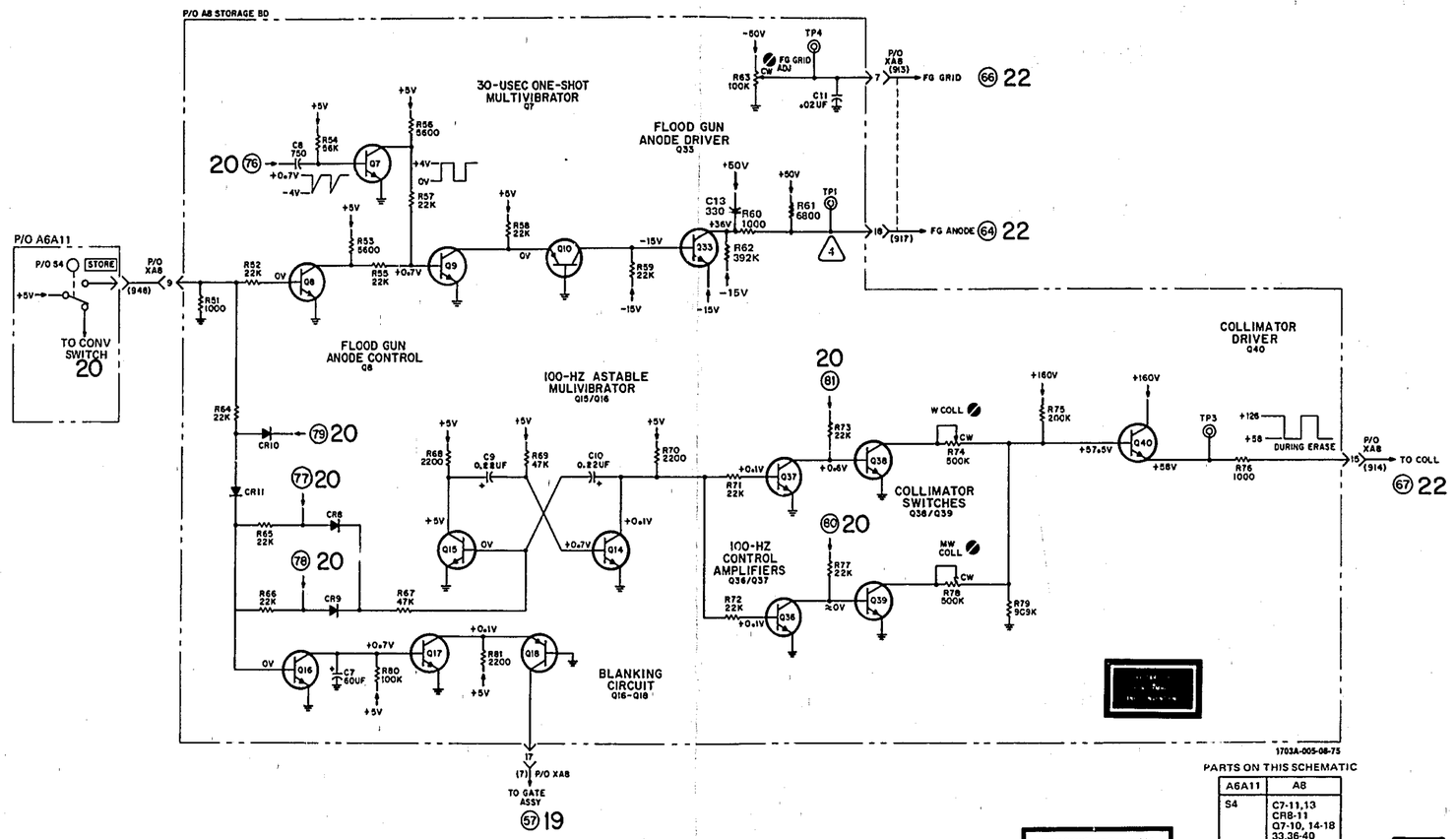


Figure 7-4.
Storage Circuit A8 Schematic
(2 of 2)
7-11

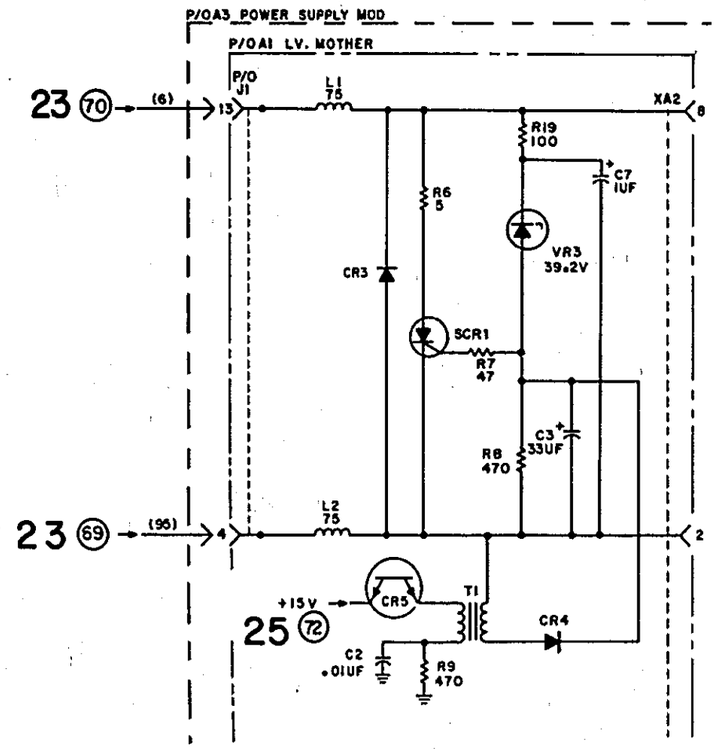


Figure 7-5. LV Converter Protection Circuit

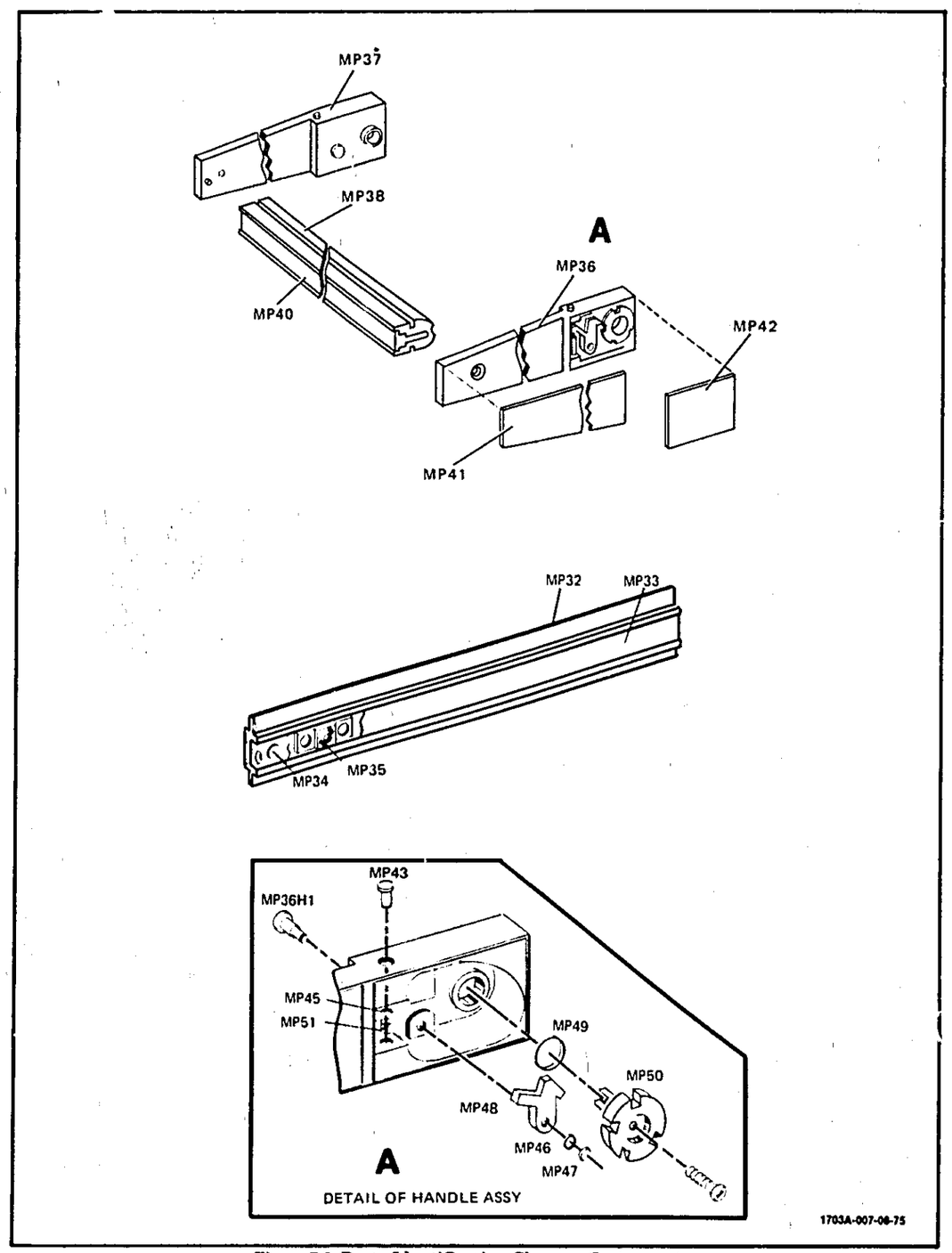


Figure 7-6. Parts Identification Changes (Instruments with Serial Number Prefixed 1150A thru 1331A)

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 procedure for removing the CRT and instrument modules for repair and replacement is also contained in this section.

8-3. SCHEMATICS.

8-4. Schematics are printed on foldout pages for easy reference to the text and figures in other sections. The schematics are drawn to show the electronic function of the circuits. Any one schematic may include all or part of several different physical assemblies. Non MIL-standard symbols and conventions used in the schematics are defined in table 8-3.

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 the schematics. At each circuit breaking point, a number in a circle is shown, followed by another number in bold type. The circled number indicates the signal or circuit and the bold number indicates the associated schematic that contains the source or destination of the signal. To find the source or destination of the signal, turn to the indicated schematic and find the circled number in question.

8-6. A table on each schematic lists all components shown on the schematic by reference designation. Component reference designators that have been deleted from the schematic are listed below the table.

8-7. All components within the broken outlines are physically located on etched circuit boards. Components not physically located on an etched circuit board are outside the broken etched circuit board lines.

8-8. REFERENCE DESIGNATIONS.

8-9. The unit system of reference designations used in this manual is in accordance with the provisions of USA Standard Y32.16-1968, Reference designations for Electrical and Electronics Parts and Equipments, dated March 1, 1968. Minor variations from the standard, due to design and manufacturing practices, may be noted.

8-10. Each electrical component is assigned a class letter and a number. This letter-number combination is the basic reference designation. Components which are part of an assembly have, in addition to the basic designation, a prefix designation indicating the assembly of which the component is a part. For instance, resistor R23 on assembly A1 is called A1R23.

8-11. Assemblies are numbered consecutively. If an assembly reference designation is assigned and later deleted, that number is not reused.

8-12. COMPONENT LOCATIONS.

8-13. Locations of components on assemblies and subassemblies are illustrated on photographs 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 photograph is printed next to the schematic that shows most of the circuitry on the assembly. In some cases, a particular component-location photograph may appear adjacent to more than one schematic.

8-14. Components located on the chassis are identified in figures 8-4 and 8-5. The locations of all adjustments are shown in Section V.

8-15. PREVENTIVE MAINTENANCE.

8-16. Preventive maintenance consists of periodic performance checks, calibration, mechanical inspection, lubrication, and other services designed to prevent breakdown and failure. Performance checks and calibration are covered in Section V of this manual. The other preventive maintenance services are covered in the following paragraphs.

8-17. MECHANICAL INSPECTION.

8-18. Periodically inspect the instrument for damaged components, excess grease, dirt, and corrosion. Look for loose and misaligned assemblies. Ensure that all screws and fasteners are tight and serviceable.

8-19. Refer to the paragraphs in this section on repair and replacement for instructions on replacing damaged components.

8-20. Painted surfaces can be cleaned with a commercial, spray-type, window cleaner or with a mild soap and water solution. Excess grease can be removed with a degreaser such as M-180 FREON TF DEGREASER produced by Miller-Stevenson Company.

8-21. Corroded spots are best removed with soap and water. Stubborn residues can be removed with a fine abrasive. When using abrasives, be careful that fine particules do not fall into the instrument. Such areas should be protected from further corrosion by an application of a silicone resin such as GE DRI-FILM 88.

8-22. SWITCH MAINTENANCE.

8-23. The pushbutton switches used in this instrument have been designed for long, trouble-free service. In the event that one of these switches becomes defective, replacement rather than repair is recommended.

8-24. The rotary switches in this instrument can easily be serviced after removal of the assembly on which the switch is mounted. In the case of the TIME/DIV switch, the TIME/DIV switch shaft must be removed. Refer to the paragraphs on repair and replacement in this section for instructions on disassembly of the modules in the instrument.

8-25. Conventional rotary switches are serviced by cleaning the contacts with a degreaser such as MS-180 FREON TF DEGREASER produced by Miller-Stevenson Chemical Company. The contact surfaces are then lubricated with a lubricant comparable to LUBRIPLATE FML produced by the Fiske Brothers Refining Company. LUBRIPLATE FML is available from the Hewlett-Packard Company. Order HP Part No. 6040-0305.

8-26. The switches on the main sweep time assembly, delayed sweep time assembly, horizontal mode assembly and holdoff and comparator assembly can be serviced as follows:

a. Remove TIME/DIV knob and shaft (paragraph 8-39).

b. Remove printed circuit board keeper from top of assemblies.

c. Remove assembly or assemblies to be serviced. See figure 8-5 for assembly locations.

d. Note orientation of open part of rotor section.

Note

The following steps use the main sweep time assembly (figure 8-30) as an example.

e. Remove retainer ring MP1.

f. Separate two rotor sections, S1MP1 and S1MP2, from etched circuit board.

g. Check contact area of etched circuit board. If contact area shows excessive wear, replace etched circuit board.

h. Check contacts on two rotor sections. If contacts show excessive wear, replace rotor.

i. Clean and lubricate contacts on etched circuit board and rotors as described in paragraph 8-25.

j. Place rotor sections on etched circuit board and reinstall retainer ring MP1.

k. Position open part of rotor section as noted in step d.

l. Reinstall TIME/DIV shaft and knob assembly.

8-27. REPAIR AND REPLACEMENT.

8-28. The following paragraphs provide procedures for removal and replacement of assemblies, subassemblies, and components. Special servicing instructions for the etched circuit boards are provided in paragraph 8-54. Section VI provides a detailed parts list for use in ordering replecement parts. Refer to table 8-2 for the location of a particular assembly.

8-29. CRT REMOVAL AND REPLACEMENT.

WARNING

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

8-30. To remove and replace the CRT, proceed as follows:

a. Remove instrument top and bottom covers.

b. Remove rear panel CRT socket cover.

c. Remove two screws from rear of CRT shield.

d. Remove CRT socket.

e. Remove CRT shock mounting screws.

f. Remove CRT clamp.

g. Remove leads from CRT neck.

h. Remove two screws holding vertical output amplifier shield and tilt to one side.

i. Remove two screws holding A10 high voltage connector assembly.

j. Remove flexible leads from A10 high voltage connector assembly.

k. Unplug snap on CRT.

l. Rotate shock mount 45 degrees and remove.

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

n. Remove CRT from CRT shield.

o. To reinstall, reverse removal procedure.

8-31. VERTICAL AMPLIFIER MODULE REMOVAL AND REPLACEMENT.

8-32. To remove the vertical amplifier module, proceed as follows:

a. Using allen wrench, loosen allen screws in POSITION, VOLTS/DIV, and DISPLAY control knobs.

b. Remove control knobs.

c. Pull plastic covers from coupling switches.

d. Remove top and bottom covers from instrument.

e. Disconnect main harness wires from vertical preamplifier assembly.

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

g. Remove two screws holding vertical output amplifier to 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 amplifier module, reverse removal procedure.

8-33. DELAY LINE REMOVAL AND REPLACEMENT.

8-34. To remove the delay line from the vertical amplifier module, proceed as follows:

a. Remove vertical amplifier module as described in paragraph 8-31.

b. Unsolder two wires (red, blue) from end of delay line to vertical preamplifier assembly. Mark locations of wires to facilitate correct reassembly.

c. Remove two center screws from bottom side of vertical module (C, figure 8-1).

d. Rotate delay line slightly and remove.

Note

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

e. To reinstall delay line, reverse removal procedure.

8-35. ATTENUATOR REMOVAL AND REPLACEMENT

3-36. To remove the attenuator assemblies from the vertical amplifier module, proceed as follows:

a. Remove vertical amplifier module as described in paragraph 8-31.

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

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

d. Remove delay line as described in paragraph 8-33.

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 attenuators, reverse removal procedure.

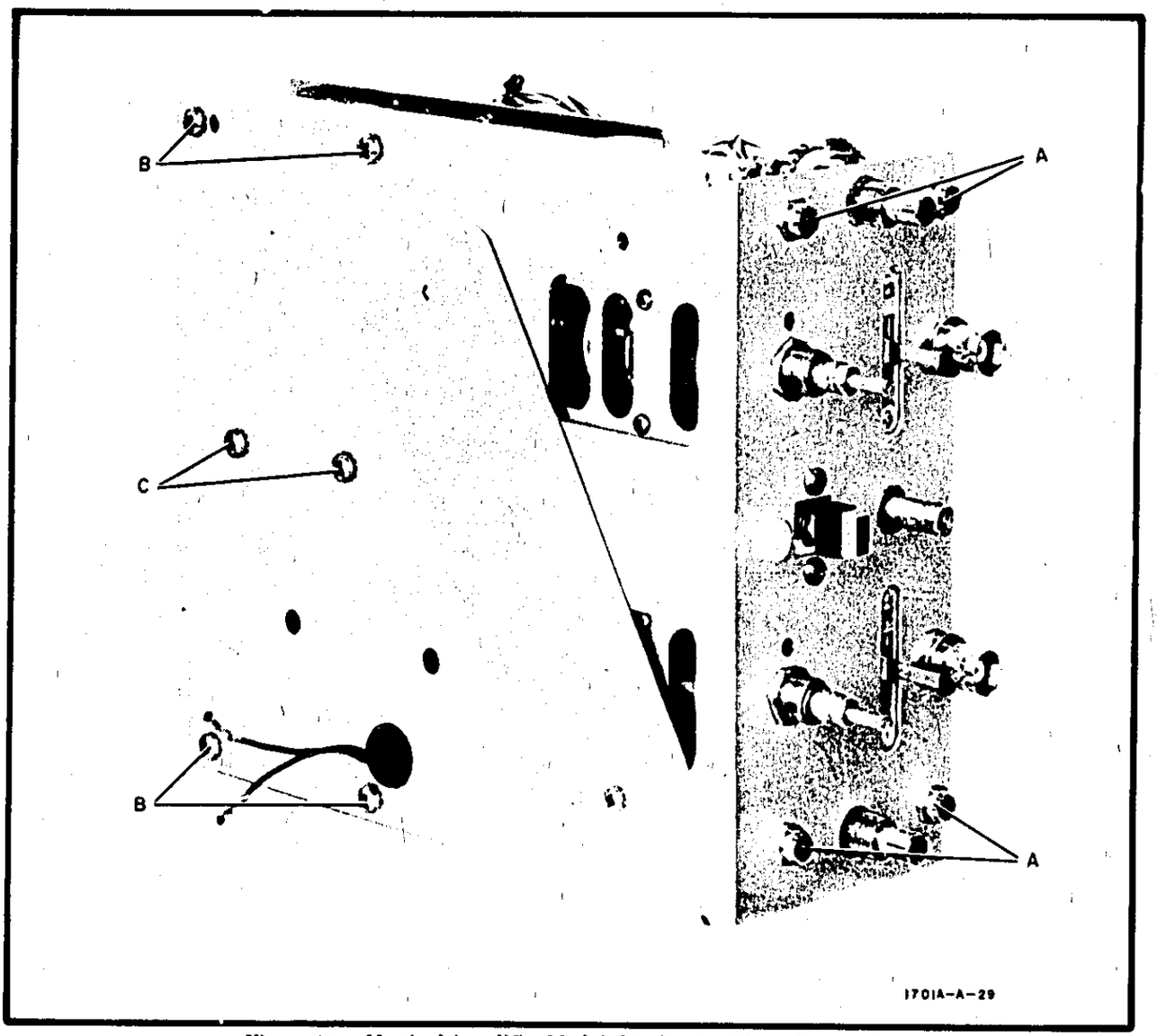


Figure 8-1. Vertical Amplifier Module Mechanical Parts Removal

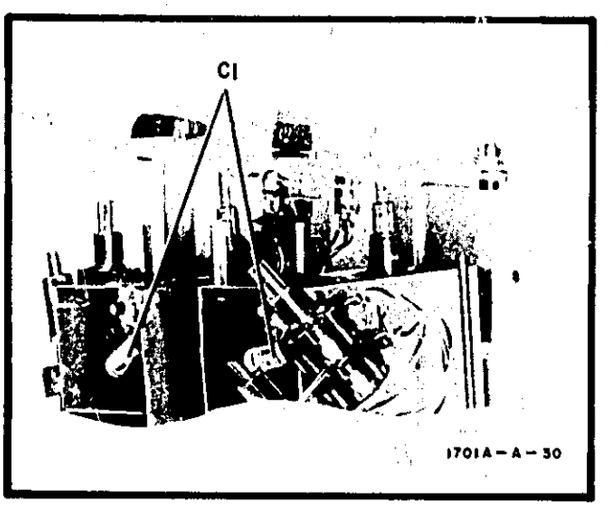


Figure 8-2. Attenuator Removal

8-37. REMOVAL AND REPLACEMENT OF ASSEMBLIES IN HORIZONTAL AMPLIFIER MODULE.

8-38. The following paragraphs provide information required to remove and replace the various assemblies in the horizontal amplifier module.

8-39. *TIME/DIV Switch Removal and Replacement.* To remove the TIME/DIV switch, proceed as follows:

a. Set TIME/DIV controls as follows:

sweep display ..... DELAYED SWEEP
main TIME/DIV ..... .2 SEC
delayed TIME/DIV ..... 10 uSEC

b. Loosen locking collar setscrew on inside front panel of instrument.

c. Pull TIME/DIV shaft out.

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

8-40. Plug-in Assemblies Removal and Replacement. After removal of the TIME/DIV shaft, the five plug-in assemblies in the horizontal amplifier module can be removed as follows:

a. Remove etched circuit board keeper from top of assemblies.

b. Gently rock assemblies from side to side while pulling upward to remove from sockets.

c. To reinstall assemblies, reverse removal procedure.

8-41. Trigger Assembly and Horizontal Mother Board Removal and Replacement. To remove the trigger assembly and horizontal mother board, proceed as follows:

a. Remove TIME/DIV shaft as described in paragraph 8-39.

b. Remove five assemblies as described in paragraph 8-40.

c. Disconnect wires (top and bottom) to horizontal preamplifier board.

d. Remove two screws from horizontal preamplifier board.

e. Disconnect wires to trigger assembly.

f. Separate horizontal amplifier from trigger assembly and horizontal mother board.

g. Remove horizontal preamplifier board.

h. Hold trigger assembly and remove four screws that hold assembly.

i. Carefully remove trigger assembly.

j. Horizontal mother board can be removed by disconnecting wires connected to it.

k. To reinstall, reverse removal procedure.

8-42. POWER SUPPLY MODULE REMOVAL AND REPLACEMENT.

8-43. To remove power supply module from instrument, proceed as follows:

a. Turn instrument off and remove power cord.

b. Remove top and bottom covers.

c. Unplug 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 12.

f. Unplug A3J1 connecting power supply to main cable.

g. Using #1 Pozidrive screwdriver, remove two flathead screws directly in front of power transformer T1.

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

8-44. POWER SUPPLY MODULE DISASSEMBLY AND REASSEMBLY.

8-45. To disassemble power supply module, proceed as follows:

a. Remove power box cover.

b. Using board puller furnished with service kit, hook on inside of stand-offs between two low voltage boards and pull straight out.

c. Disconnect Q2 from low voltage mother board.

d. Disconnect Q1 leads from high voltage oscillator.

e. Remove high voltage oscillator.

f. Turn instrument over.

g. Remove four screws holding power supply module to battery deck.

h. Turn instrument over.

i. Remove high voltage oscillator shield.

j. Remove two screws holding low voltage mother board.

k. Remove low voltage mother board.

l. To reinstall, reverse removal procedure.

8-46. SEMICONDUCTOR REMOVAL AND REPLACEMENT.

8-47. Figure 8-3 is included to help identify the leads on the common shapes and sizes of semiconductor devices. When removing a semiconductor, use long-

nosed pliers as a heat sink between the device and the soldering iron. When replacing a semiconductor, ensure sufficient lead length to dissipate the soldering heat by using the same length of exposed lead as used for the original part.

8-48. ATTENUATOR SERVICING.

8-49. A metal plate provides access to the attenuators. The plate is located under the front of the CRT. Service for the attenuators is accomplished by removing the CRT (paragraph 8-29) and metal plate. After the attenuators have been serviced, replace the metal plate and CRT.

8-50. CIRCUIT BOARDS.

8-51. The following paragraphs provide information regarding servicing procedures for etched circuit boards, use of heat sinks, and special soldering considerations.

8-52. BOARD CONNECTIONS.

8-53. Square-pin connectors are identified on circuit boards by the color code of the connecting wire. Connector pins on plugs and jacks are identified by either a numeral or a letter. The letters G, I, O, and Q have been omitted. Table 8-3 shows the types of board connections used in the instrument.

8-54. SERVICING ETCHED CIRCUIT BOARDS.

8-55. This instrument uses etched circuit boards with plated-through component holes. This allows components to be removed or replaced by unsoldering or soldering from either side of the board. When removing large components, such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part to lift it from the board. HP Service Note M-20E contains additional information of repair of etched circuit boards.

8-56. INTEGRATED CIRCUIT REPLACEMENT.

8-57. The integrated circuits in this instrument are of two general configurations, plug-in types and those soldered in place. Remove a plug-in integrated circuit with a straight pull away from the board. Soldered integrated circuits can be removed with soldering irons which simultaneously heat all connections. These irons are available from various manufacturers. Soldering irons with built-in desoldering tools also facilitate quick removal.

CAUTION

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

Table 8-1. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 37-5 Tip Temp: 750-800 degrees	Ungar #775 handle with Ungar #1237 Heating Unit
Soldering Tip	Soldering	Shape: chisel	Ungar #PL 113
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

8-58. Use the following procedure for removing an integrated circuit with a standard soldering iron.

a. Heat lead solder joint. Use small tip such as on Weller No. PT-H7 iron.

b. When solder is fluid, remove with desoldering tool such as deluxe Model Soldapullt manufactured by Edsyn Company of California.

c. Repeat steps a and b for each lead until all leads are free.

d. Grasp each lead with long-nosed pliers and check that it is mechanically free from circuit board.

e. When all leads are free, carefully remove integrated circuit. Dual in-line type can be removed by gently gripping top and bottom with long-nosed pliers and rolling integrated circuit out.

f. Use desoldering tool or toothpick to remove all remaining solder from circuit board holes.

g. Insert replacement integrated circuit into circuit board and solder in place.

CAUTION

Be careful not to damage the integrated circuit with excessive heat. Work quickly.

8-59. When replacing an integrated circuit, note the mark or notch used for orientation. The component-identification photographs and the integrated circuit pin-location diagrams in this manual show the correct orientation.

8-60. SERVICE KIT.

8-61. The service kit (refer to Section I) consists of three extender boards and a board puller. The extenders can be used with the plug-in etched circuit boards. They permit a circuit board to remain connected to the instrument, yet raised to a convenient level for circuit checks and adjustments. The board puller is used to remove the low voltage converter assembly A3A2 and the low voltage rectifier and filter assembly A3A3. Connect the hook portion of the board puller around the metal standoffs that connect the two assemblies and pull the assemblies out.

8-62. SOLDERING TOOL, SOLDER, AND AIDS.

8-63. Table 8-1 contains a list of soldering tools, solder, and soldering aids. These items or equivalents should be used to obtain the very best results when repairing and replacing soldered-in components on etched circuit boards.

8-64. HEAT SINK REMOVAL.

8-65. There are two types of transistor heat sinks used in this instrument; the friction type and the

Table 8-2. Model 1703A Assembly Locations

Assembly	Description	Schematic Number	Photo Figure No.
A1	Power Module	23	8-4
A2	Line Rectifier	23	8-4, 8-5, 8-55
A3	Power Supply Assembly	22, 23, 24, 25	8-5
A3A1	Low Voltage Mother Board	23, 24, 25	8-5, 8-56
A3A2	Low Voltage Converter	24	8-5, 8-60
A3A3	Line Rectifier and Filter	25	8-5, 8-62
A3A4	High Voltage Oscillator	22	8-5, 8-53
A4	Gate	19, 22, 23, 25	8-5, 8-46
A5	Vertical Amplifier Module	3, 4, 5, 6, 7, 8	8-5
A5A1	Attenuator (channel A)	3	8-5, 8-11
A5A2	Attenuator (channel B)	3	8-5, 8-11
A5A3	Delay Line	6	8-5
A5A4	Vertical Preamplifier	4, 5, 6, 7	8-5, 8-12
A5A5	Vertical Output Amplifier	6	8-5, 8-17
A5A6	Channel A Output Amplifier	8	8-5, 8-21
A6	Horizontal Amplifier Module	9, 10, 11, 12, 13, 14, 15, 16, 17,	8-5
A6A1	Horizontal Mother Board	11, 12, 13, 14, 15, 16	8-5, 8-28
A6A2	Trigger	9, 10	8-5, 8-23
A6A3	Main Integrator	11	8-5, 8-27
A6A4	Delayed Integrator	13	8-5, 8-32
A6A5	Main Sweep Time	12	8-5, 8-30
A6A6	Delayed Sweep Time	14	8-5, 8-34
A6A7	Holdoff and Comparator	15	8-5, 8-36
A6A8	Horizontal Mode	16	8-5, 8-38
A6A9	Horizontal Preamplifier	17	8-5, 8-40
A6A10	Horizontal Output Amplifier	17	8-5, 8-41
A6A11	Storage Switch	20/21	8-5, 8-47
A8	Storage Circuit	20/21	8-5, 8-48
A9	External Horizontal Amplifier	18	8-5, 8-43
A10	High Voltage Connector Assy	22	8-5

screw-on type. The friction type can be removed by carefully pulling them off. To remove the screw-on type, proceed as follows:

a. Remove transistor from circuit board.

b. Grasp cooling fins with taped pliers.

c. Remove nut with ½-inch wrench.

CAUTION

When replacing heat sinks, especially friction type, support the bottom of the transistors to avoid lead damage caused by downward pressure.

8-66. TROUBLESHOOTING.

8-67. The most important prerequisite for successful troubleshooting is understanding how the instrument is designed to operate and correct use of front panel controls. Improper control settings or circuit connections can cause apparent malfunctions. Read Section III (operating procedure) for an explanation of controls and connectors and general operating considerations. Read Section IV (Principles of operation) for explanations of circuit theory.

8-68. 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 instrument. Prior to any extensive troubleshooting, also check the external power sources.

8-69. DC VOLTAGES.

8-70. On some of the schematics, dc voltages are indicated for active components (transistors, etc.). Conditions for making these voltage measurements are

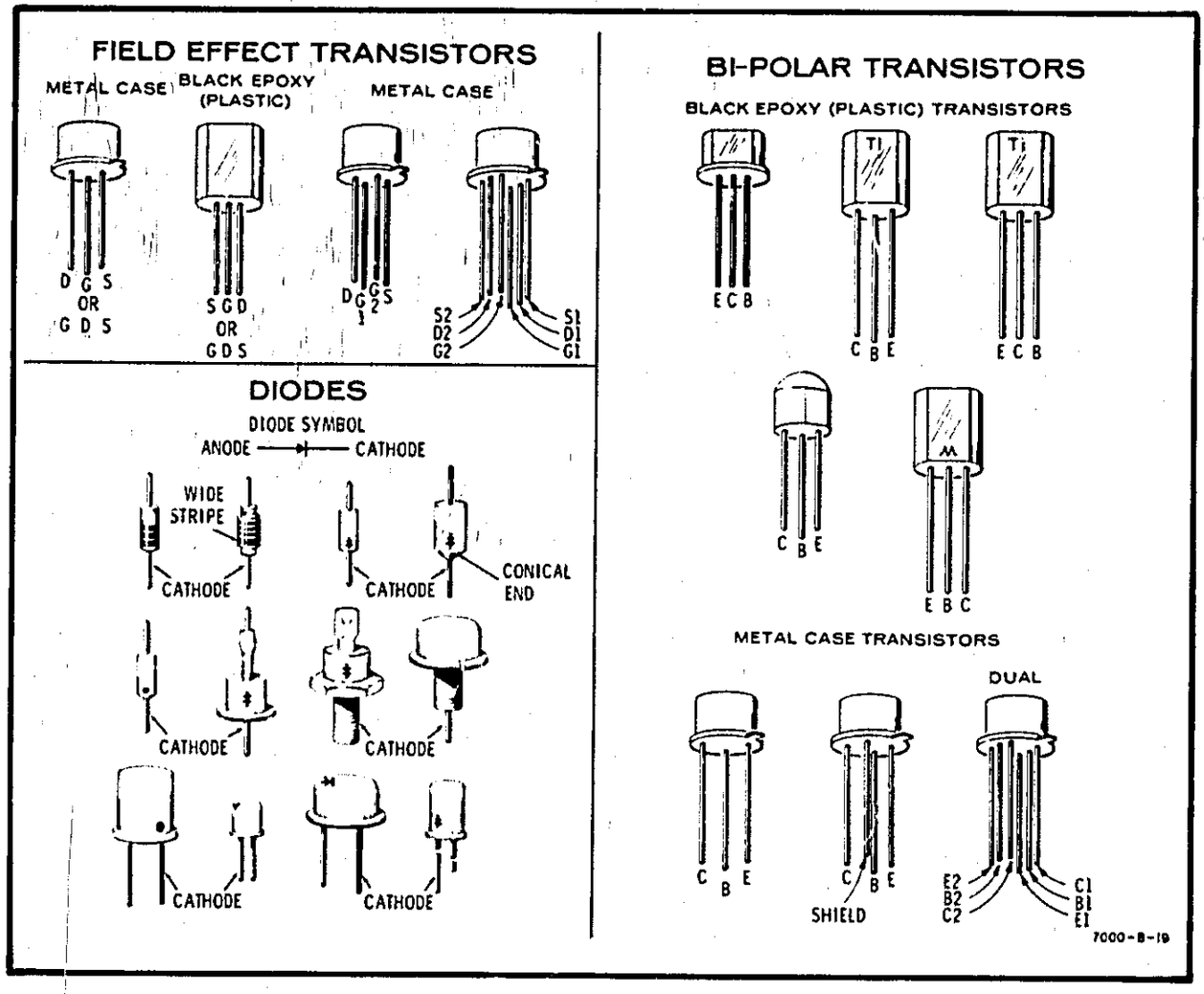


Figure 8-3. Example of Diode and Transistor Marking Methods

listed adjacent to the schematics. Since the conditions for making the measurements may differ from one circuit to another, always check the specific condition listed adjacent to the schematic.

8-71. WAVEFORMS.

8-72. Waveform measurement points (▽ with a numeral inclosed) 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. Line the dc voltage measurement conditions, waveform measurement conditions may vary from one circuit to another.

8-73. TEST POINTS.

8-74. Test points are shown on schematics with this symbol (◎). Test points correspond to pins protruding from etched circuit boards and do not necessarily correspond to waveform measurement points.

8-75. CIRCUIT CHECKING.

8-76. The block diagrams (schematics 1 and 2) have been provided to enable rapid isolation of a malfunction to a particular circuit group. This is accomplished by observing the indicated waveforms and voltages shown on the block diagrams until a block is found whose inputs are normal but whose outputs are abnormal. Once this point is reached, the input and output to the block is located on the appropriate schematic and progressive troubleshooting techniques (waveform analysis, voltage measurement, resistance measurement, and substitution) are employed between the two points to isolate the malfunction to a particular component(s).

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

= Waveform test point (with number)

= Common electrical point (with letter) not necessarily ground

= Single-pin connector on board

= 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

= Field-effect transistor (P-type base)

= Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

= Step-recovery diode

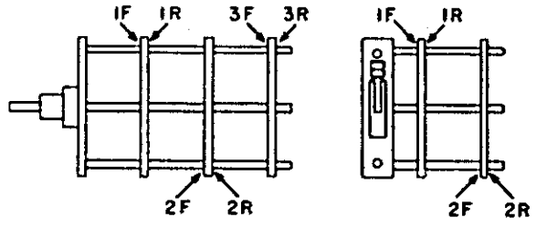
= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

(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

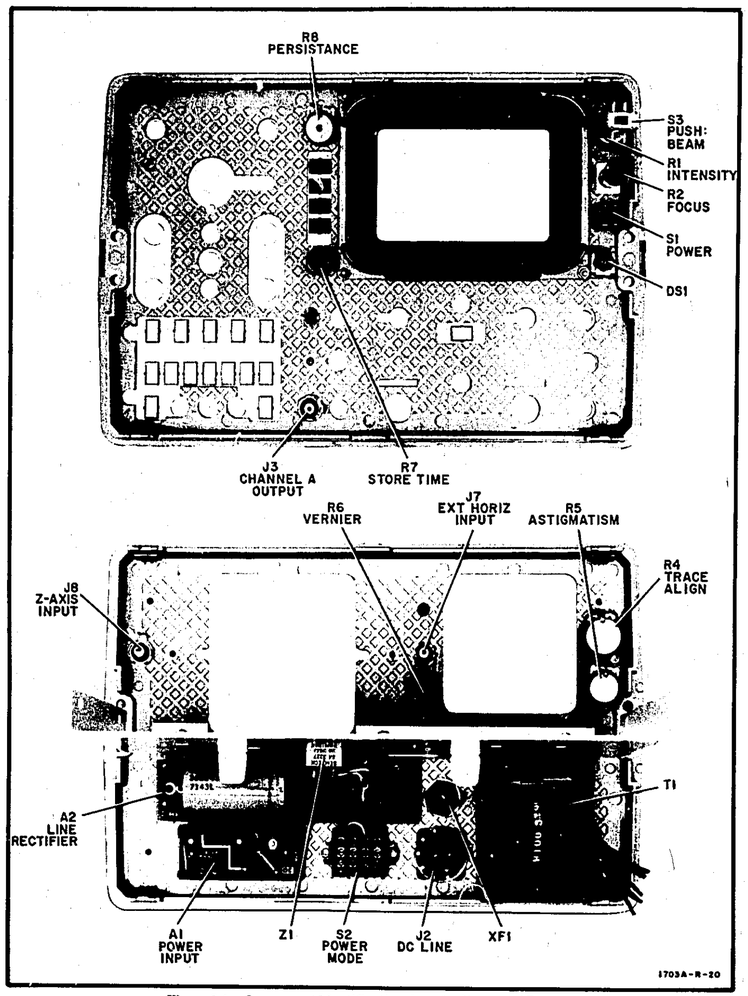


Figure 8-4. Component Identification, Interior Front and Rear Panel

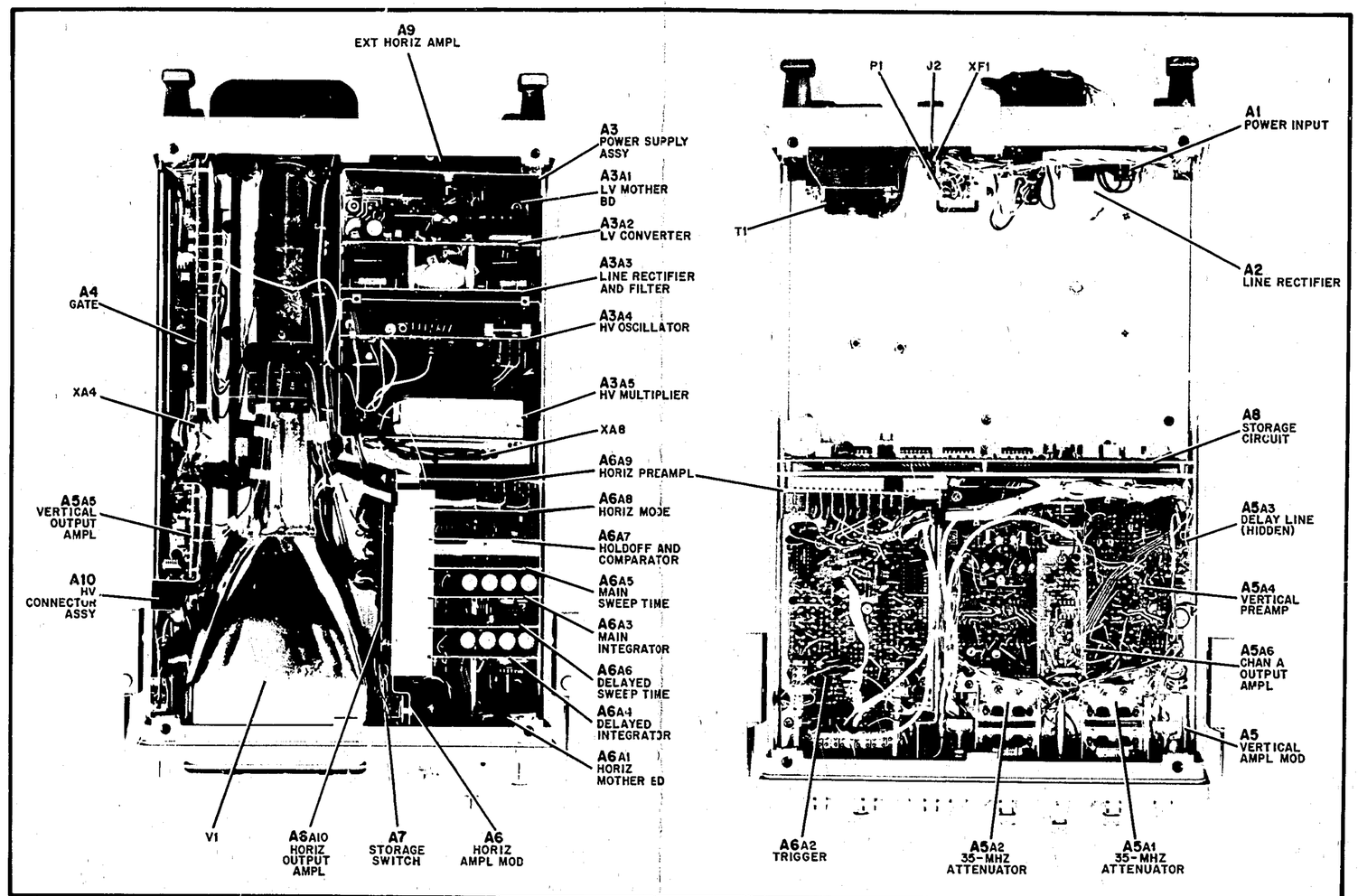


Figure 8-5
Component and Assembly Locations

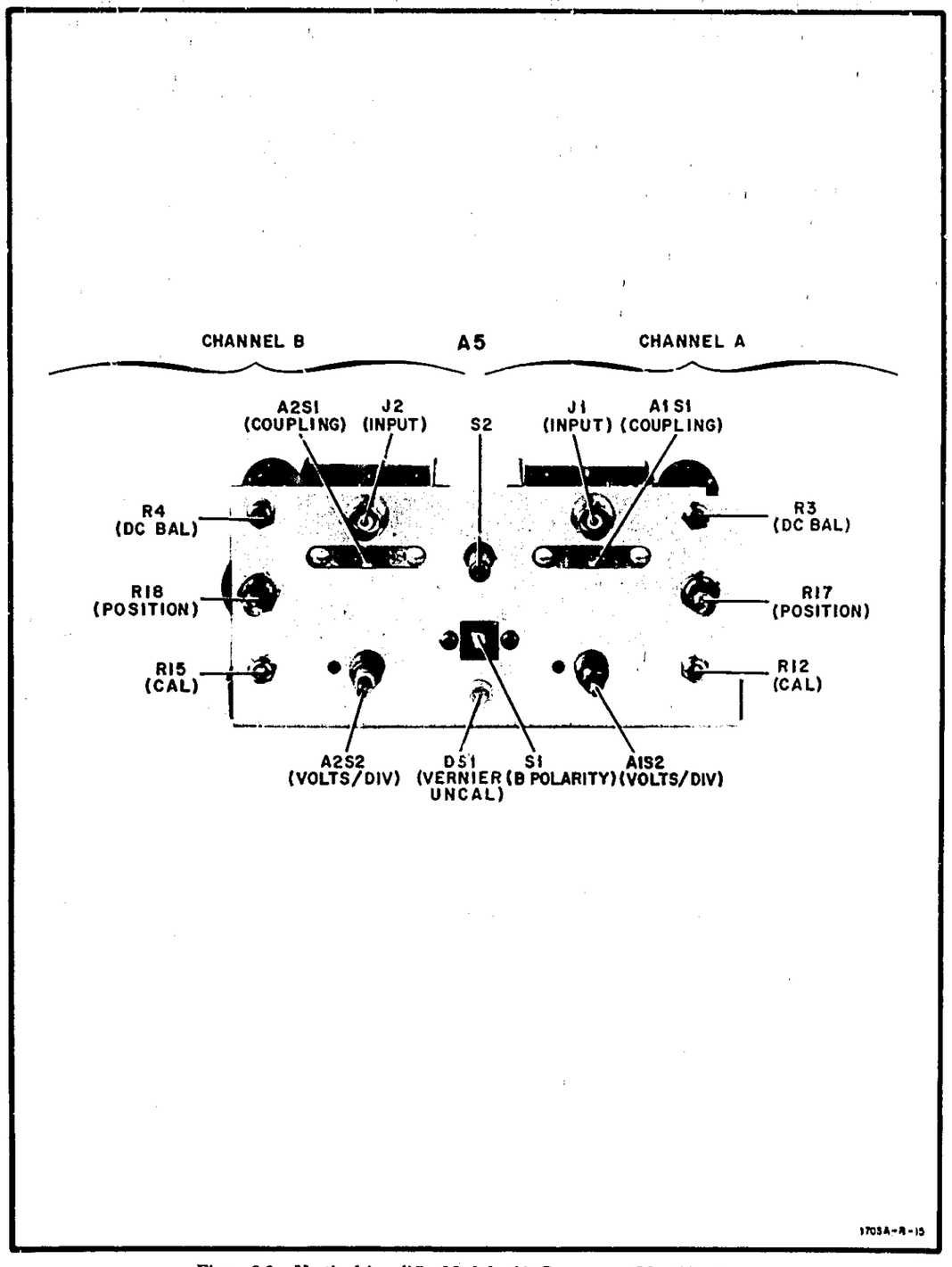


Figure 8-6. Vertical Amplifier Module, A5, Component Identification

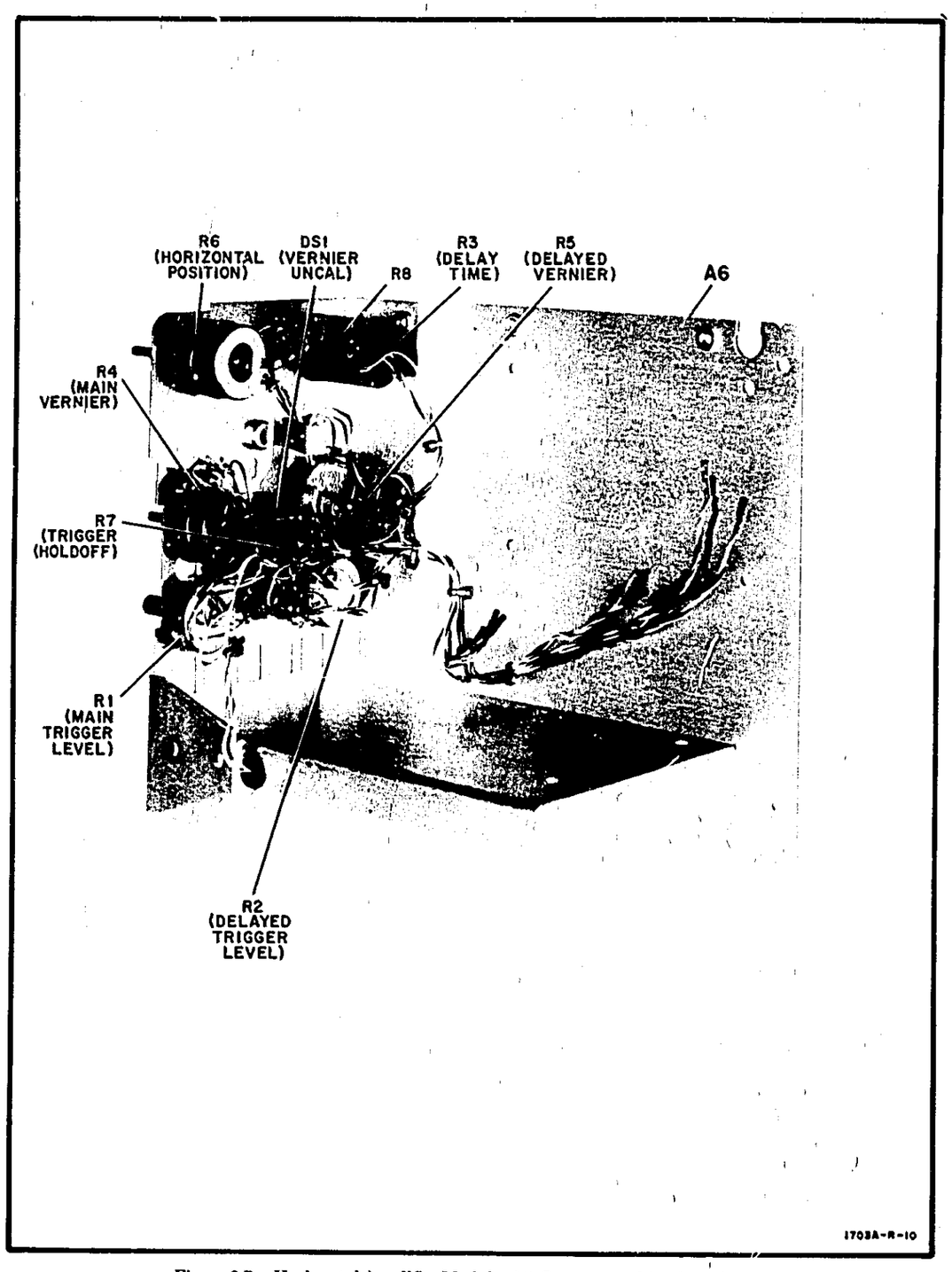


Figure 8-7. Horizontal Amplifier Module, A6, Component Identification

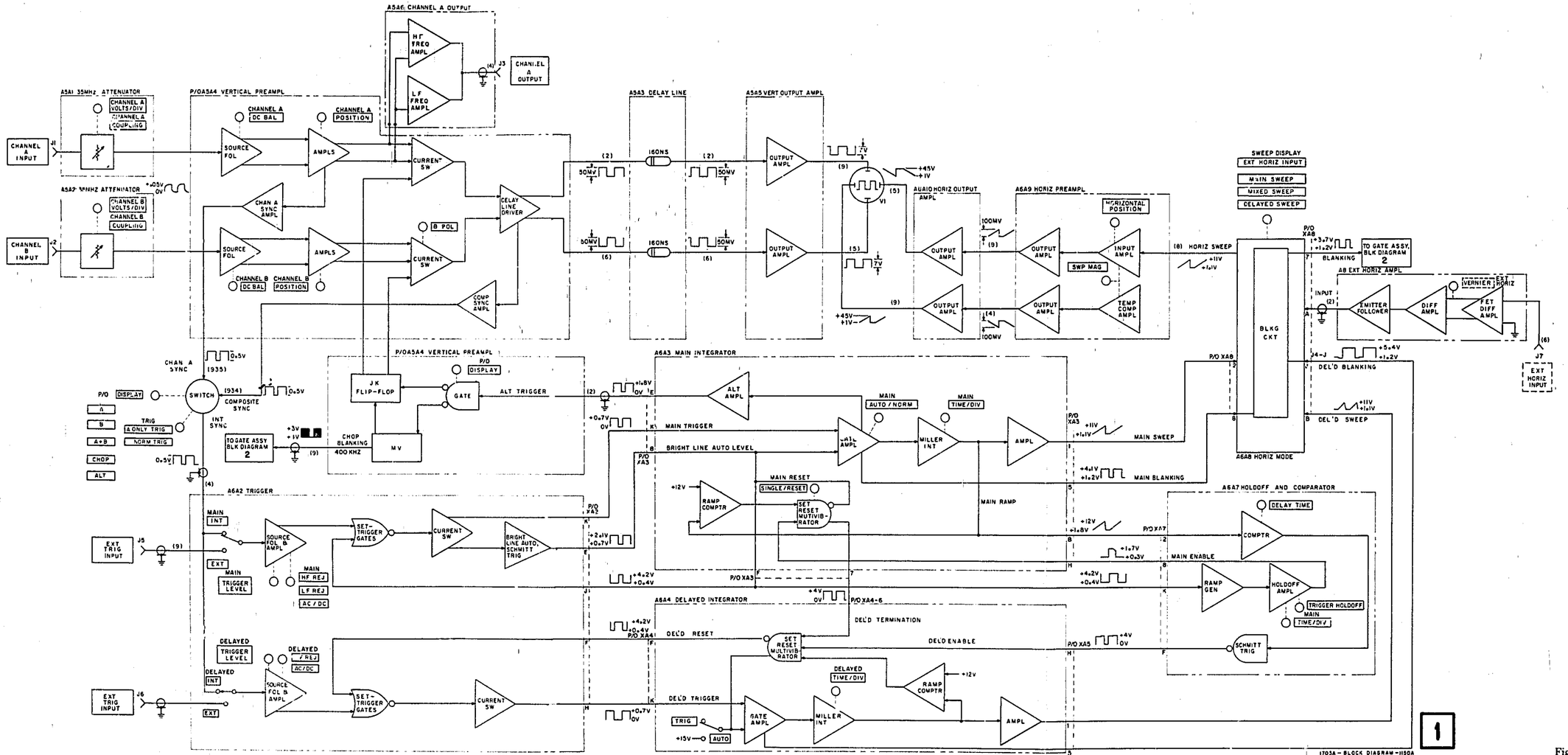
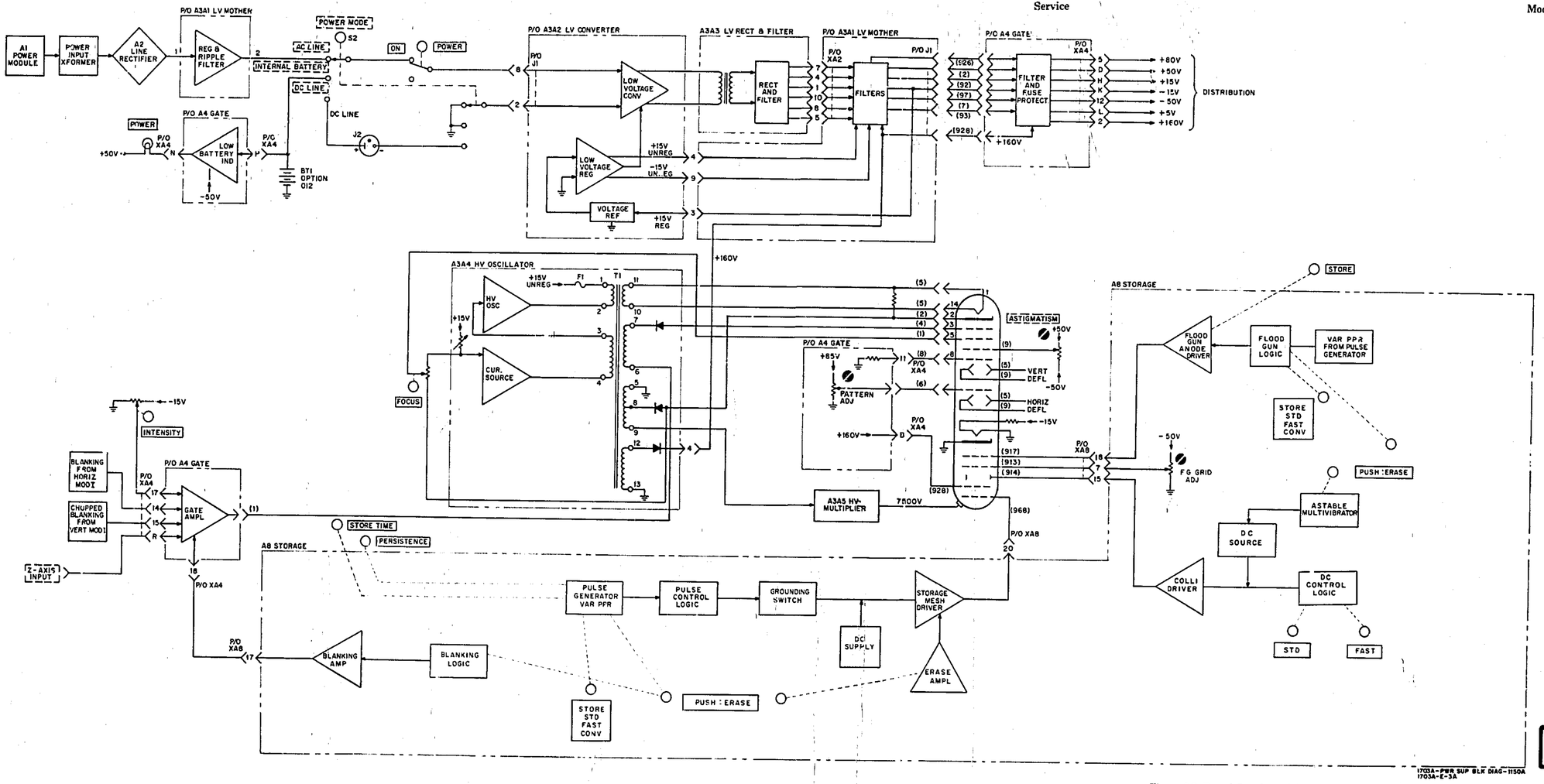
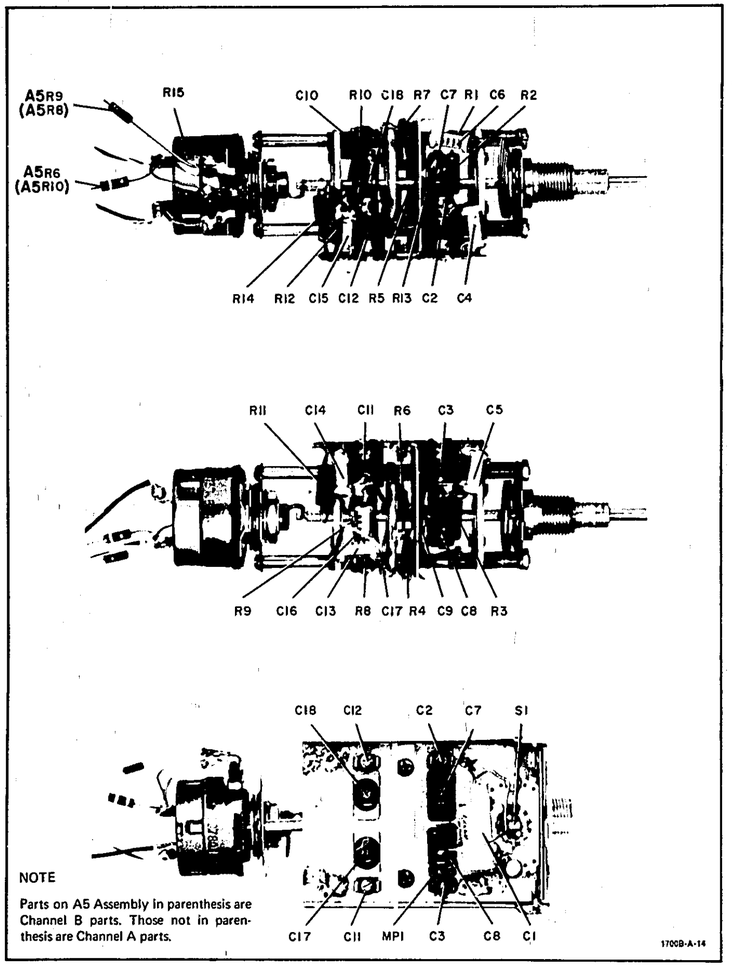


Figure 8-8.
Main Block Diagram



2

Figure 8-9. Power Supply and Storage Circuit Block Diagram



NOTE

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

Figure 8-10. 35-MHz Attenuator Component Identification

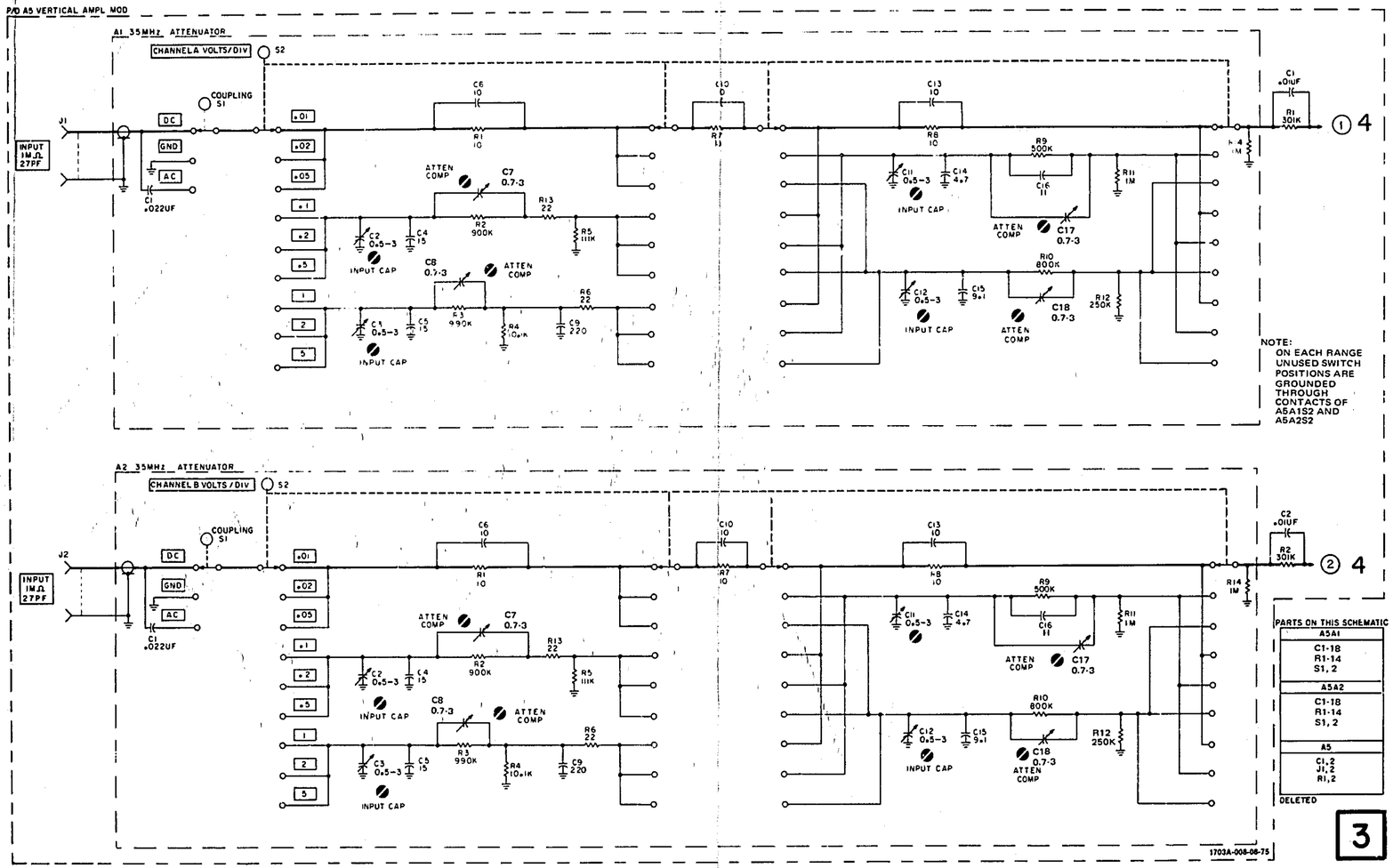
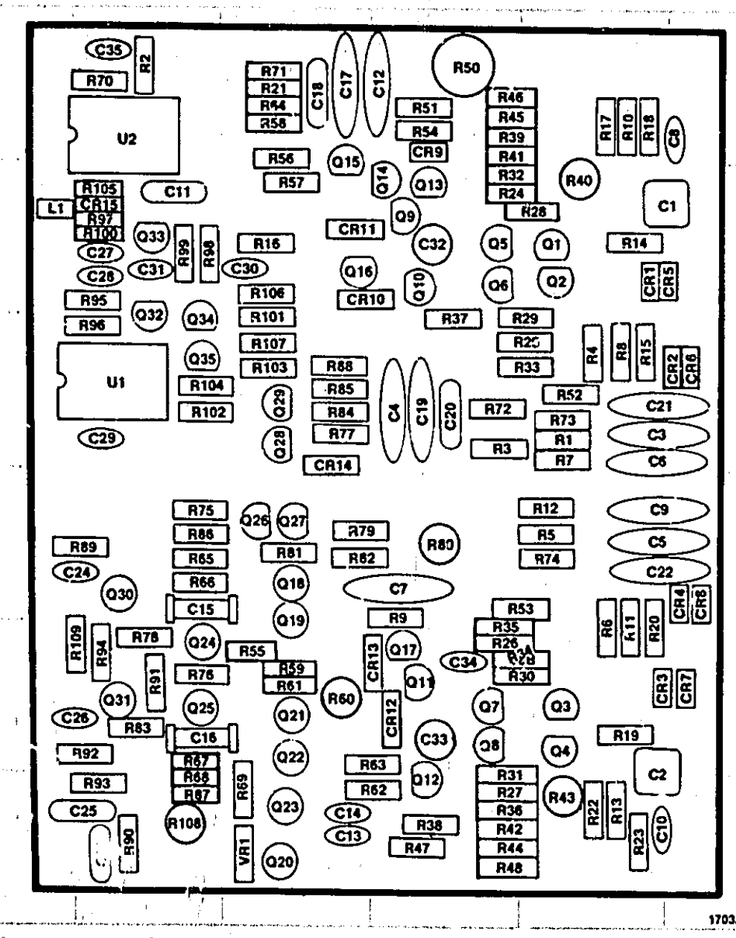


Figure 8-11.
Attenuator Schematic



A B C D F F

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-2	C26	A-5	L1	A-2	Q24	B-5	R[illegible]	E-2	R38	D-6	R64	C-1	R88	C-3
C2	E-5	C27	B-2	Q1	E-2	Q25	B-5	R[illegible]5	E-3	R39	D-1	R65	B-4	R89	B-4
C3	E-3	C28	B-2	Q2	E-2	Q26	C-4	R16	C-2	R40	E-2	R66	B-4	R90	B-6
C4	D-3	C29	B-3	Q3	E-6	Q27	C-4	R17	E-1	R41	D-2	R67	B-5	R91	B-5
C5	E-4	C30	C-2	Q4	E-6	Q28	C-[illegible]	R18	E-1	R42	D-5	R68	B-6	R92	B-5
C6	E-3	C31	B-2	Q5	D-2	Q29	C-3	R19	E-5	R43	E-6	R69	C-6	R93	B-6
C7	D-4	C32	D-2	Q6	D-2	Q30	B-4	R20	E-5	R44	D-6	R70	B-1	R94	B-5
C8	E-1	C33	D-5	Q7	D-5	Q31	B-5	R21	C-1	R45	D-1	R71	C-1	R95	B-2
C9	E-4	C34	D-5	Q8	D-5	Q32	B-3	R22	E-6	R46	D-1	R72	D-3	R96	B-3
C10	E-6	C35	B-1	Q9	D-2	Q33	B-2	R23	E-6	R47	D-6	R73	E-3	R97	B-2
C11	B-2	CR1	E-2	Q10	D-2	Q34	B-3	R24	D-2	R48	D-6	R74	E-4	R98	B-2
C12	D-1	CR2	F-3	Q11	D-5	Q35	B-3	R25	E-3	R50	D-1	R75	B-4	R99	B-2
C13	C-6	CR3	E-5	Q12	D-6	R1	E-3	R26	D-5	R51	D-1	R76	B-5	R100	B-2
C14	C-6	CR4	F-4	Q13	D-2	R2	B-1	R27	D-6	R52	E-3	R77	C-3	R101	C-3
C15	B-4	CR5	E-2	Q14	D-2	R3	D-3	R28	E-2	R53	D-4	R78	B-5	R102	B-3
C16	B-5	CR6	F-3	Q15	C-2	R4	E-3	R29	E-3	R54	D-1	R79	C-4	R103	C-3
C17	C-1	CR7	F-5	Q16	C-2	R5	E-4	R30	D-5	R55	C-5	R80	D-4	R104	B-3
C18	C-1	CR8	F-4	Q17	D-5	R6	[illegible]-5	R31	D-6	R56	C-2	R81	C-4	R105	B-2
C19	D-3	CR9	D-1	Q18	C-4	R7	[illegible]-3	R32	D-2	R57	C-2	R82	C-4	R106	C-2
C20	D-3	CR10	C-2	Q19	C-5	R8	E-3	R33	E-3	R58	C-1	R83	B-5	R107	C-3
C21	E-3	CR11	C-2	Q20	C-6	R9	D-5	R34	D-5	R59	C-5	R84	C-3	R108	B-6
C22	E-4	CR12	D-5	Q21	C-5	R10	E-1	R35	D-5	R60	C-5	R85	C-3	R109	B-5
C23	B-6	CR13	D-5	Q22	C-5	R11	E-5	R36	D-6	R61	C-5	R86	B-4	U1	B-3
C24	A-4	CR14	C-4	Q23	C-6	R12	E-4	R37	D-3	R62	C-5	R87	B-6	U2	B-1
C25	B-6	CR15	B-2			R13	E-5			R63	C-5			VR1	C-5

Figure 8-12. Vertical Preamplifier, A5A4, Component Identification

Table 8-4. Vertical Amplifier Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

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

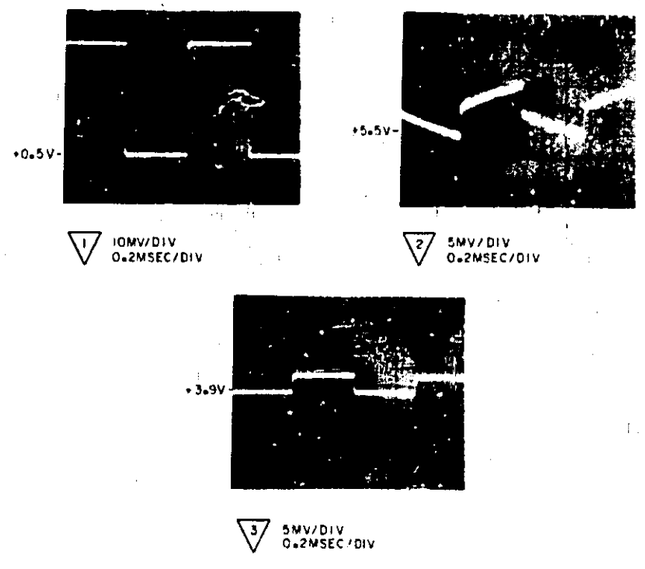
2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   DISPLAY ..... A
   POSITION (A and B) ..... midrange
   Vernier (A and B) ..... CAL
   VOLTS/DIV (A and B) 2
   Coupling (A) ..... AC
   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.



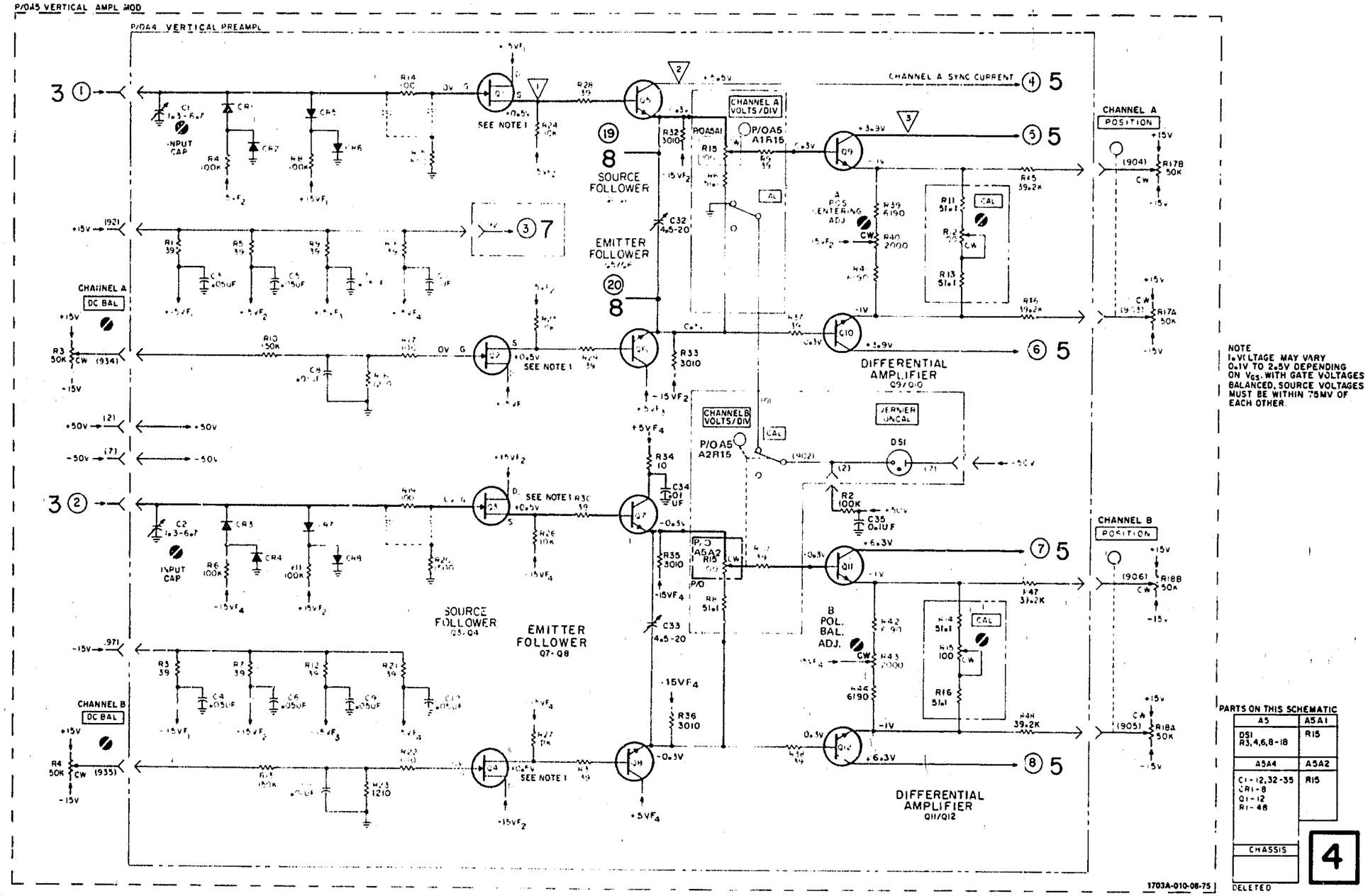


Figure 8-13.
Vertical Preamplifier A5A4 Schematic (Sheet 1 of 4)

Table 8-5. Channel A Preamplifier Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
DISPLAY..... A
channel A POSITION..... midrange
channel A vernier..... CAL
channel A VOLTS/DIV..... .2
channel A coupling ..... GND

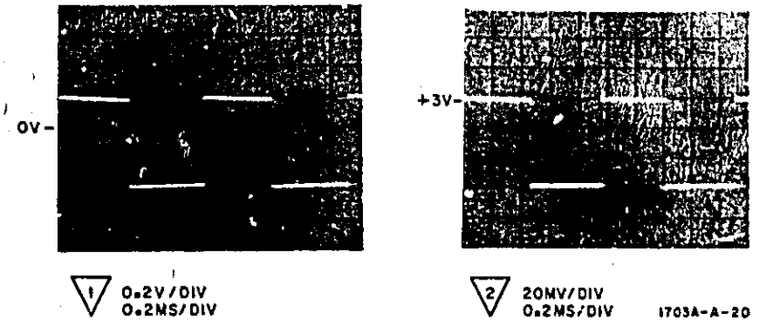
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
DISPLAY..... A
channel A POSITION..... midrange
channel A vernier..... CAL
channel A VOLTS/DIV..... .2
channel A coupling ..... AC

B. Connect CAL 1 VOLT to channel A INPUT.

C. 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 on each waveform photograph.



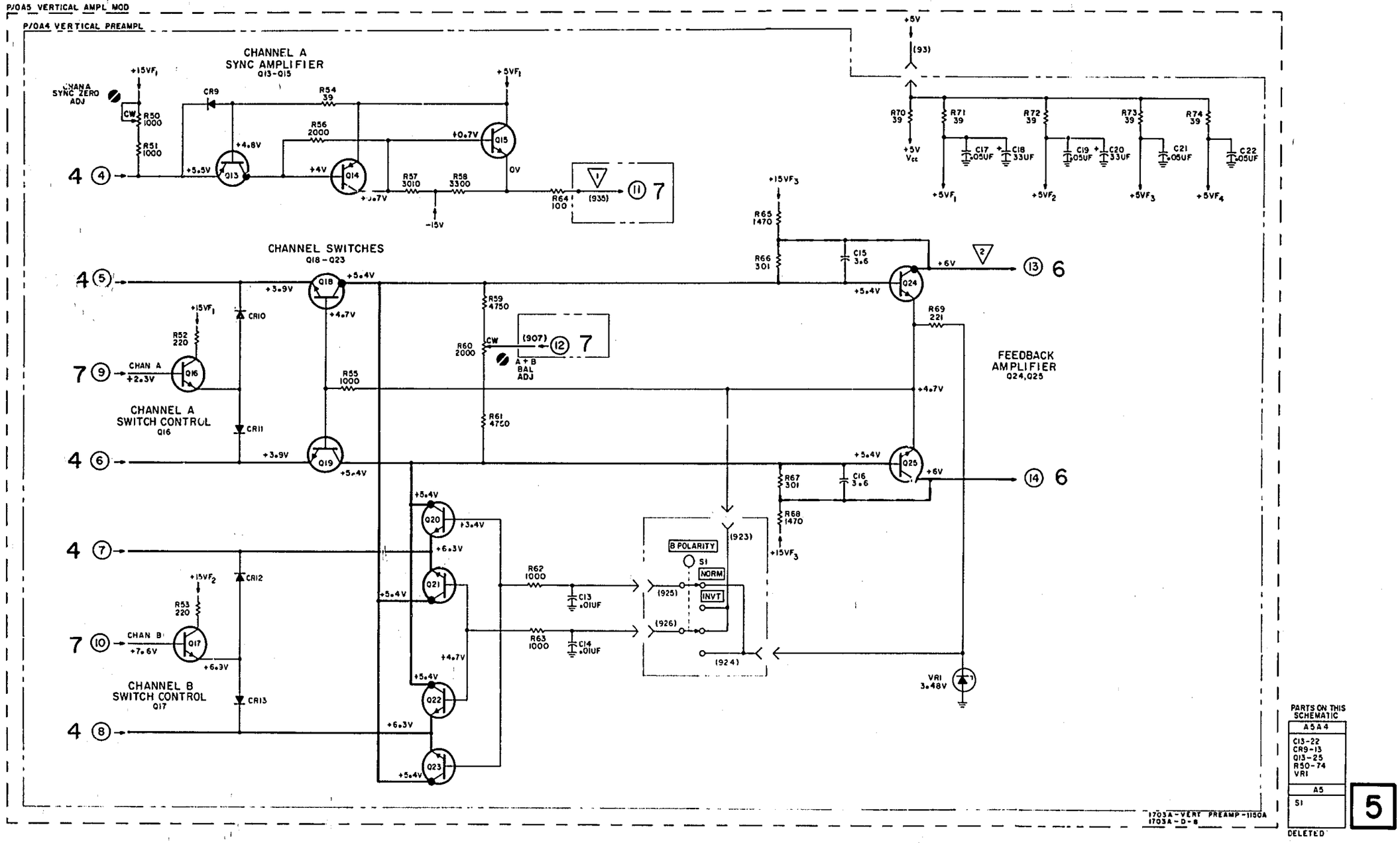
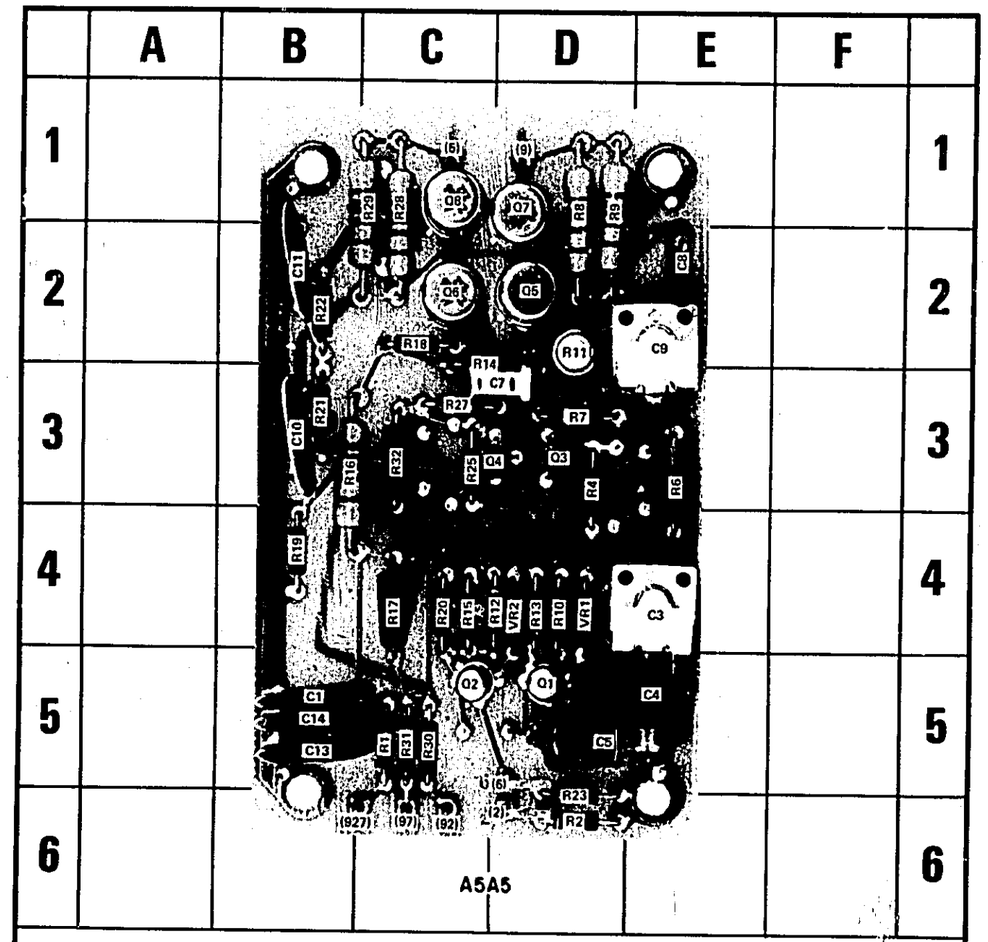


Figure 8-14.
Vertical Amplifier A5A4 Schematic (Sheet 2 of 4)



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-5	C10	B-3	Q4	D-3	R4	D-3	R12	D-4	R19	B-4	R28	C-1
C3	E-4	C11	B-2	Q5	D-2	R6	E-3	R13	D-4	R20	C-4	R29	C-1
C4	E-5	C13	B-5	Q6	C-2	R7	D-3	R14	C-2	R21	B-3	R30	C-5
C5	D-5	C14	B-5	Q7	D-1	R8	D-1	R15	C-4	R22	B-2	R31	C-5
C7	D-3	Q1	D-5	Q8	C-1	R9	D-1	R16	B-3	R23	D-6	R32	C-3
C8	E-2	Q2	C-5	R1	C-5	R10	D-4	R17	C-4	R25	C-3	VR1	D-4
C9	E-2	Q3	D-3	R2	D-6	R11	D-2	R18	C-2	R27	C-3	VR2	D-4

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

1703A-R-16

Figure 8-15. Vertical Output Amplifier, A5A5, Component Identification

Table 8-6. Vertical Preamplifier and Output Amplifier Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
DISPLAY..... A
channel A POSITION..... midrange
channel A vernier..... CAL
channel A VOLTS/DIV..... .2
channel A coupling ..... GND

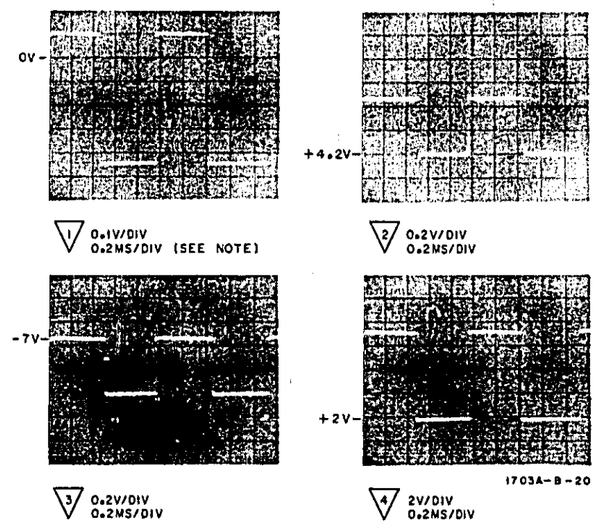
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
DISPLAY..... A
channel A POSITION..... midrange
channel A vernier..... CAL
channel A VOLTS/DIV..... .2
channel A coupling ..... AC

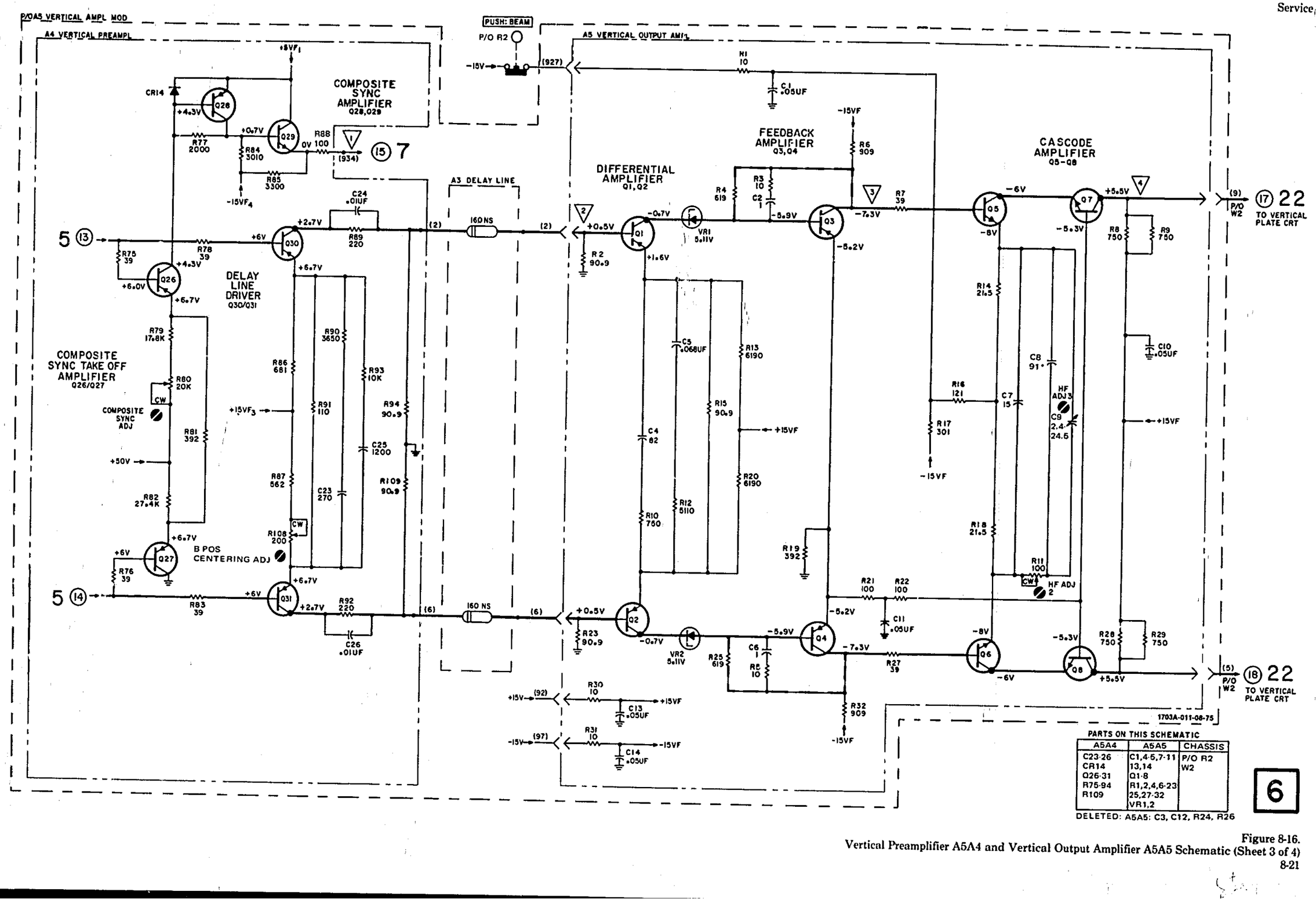
B. Connect CAL 1 VOLT to channel A INPUT.

C. 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 on each waveform photograph.



1 0.1V/DIV 0.2MS/DIV (SEE NOTE)
2 0.2V/DIV 0.2MS/DIV
3 0.2V/DIV 0.2MS/DIV
4 2V/DIV 0.2MS/DIV

NOTE: WAVEFORM POSITIONS WILL VARY WITH SETTING OF POSITION CONTROLS AND COUPLING SETTING.



PARTS ON THIS SCHEMATIC

A5A4	A5A5	CHASSIS
C23-26	C1,4-5,7-11	P/O R2
CR14	13,14	W2
Q26-31	Q1-8	
R75-94	R1,2,4,6-23	
R109	25,27-32	
	VR1,2	

DELETED: A5A5: C3, C12, R24, R26

6

Figure 8-16.
Vertical Preamplifier A5A4 and Vertical Output Amplifier A5A5 Schematic (Sheet 3 of 4)

Table 8-7. Vertical Preamplifier Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
DISPLAY..... A
channel A POSITION..... midrange
channel A vernier..... CAL
channel A VOLTS/DIV..... .2
channel A coupling ..... GND

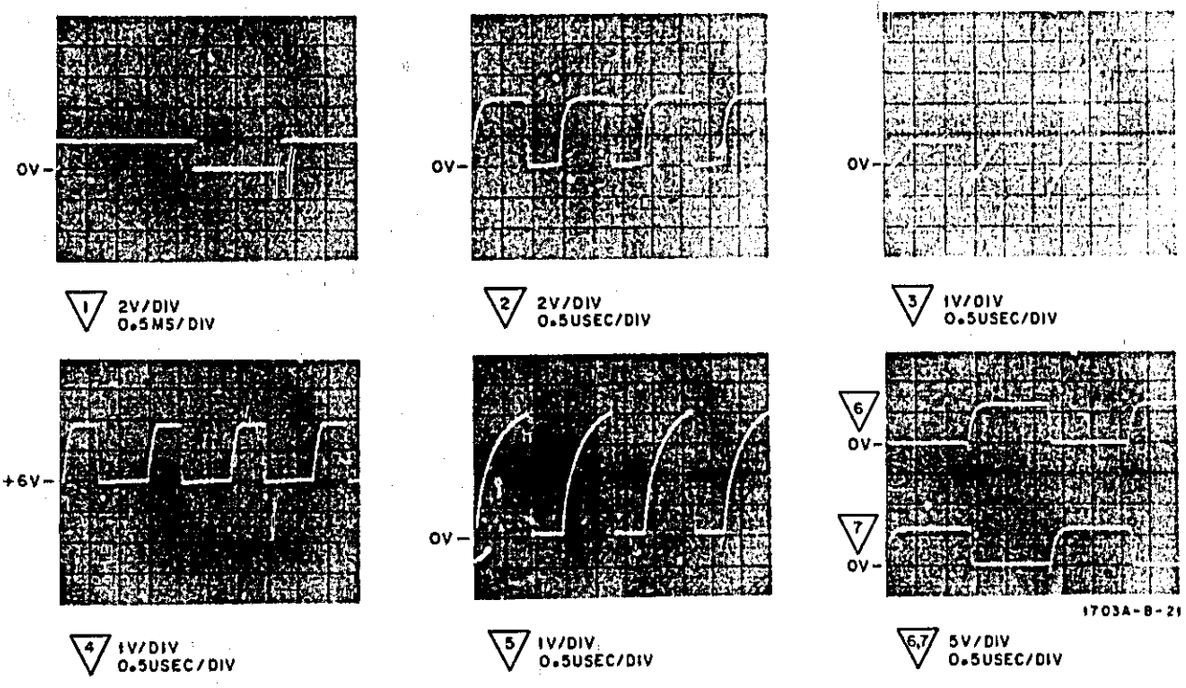
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
DISPLAY..... CHOP
channel A POSITION..... midrange
channel A vernier..... CAL
channel A VOLTS/DIV..... .2
channel A coupling ..... AC
main INT/EXT..... INT
main TIME/DIV..... .2 mSEC
main AUTO/NORM ..... AUTO

B. Connect CAL 1 VOLT to channel A INPUT.

C. 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 on each waveform photograph.



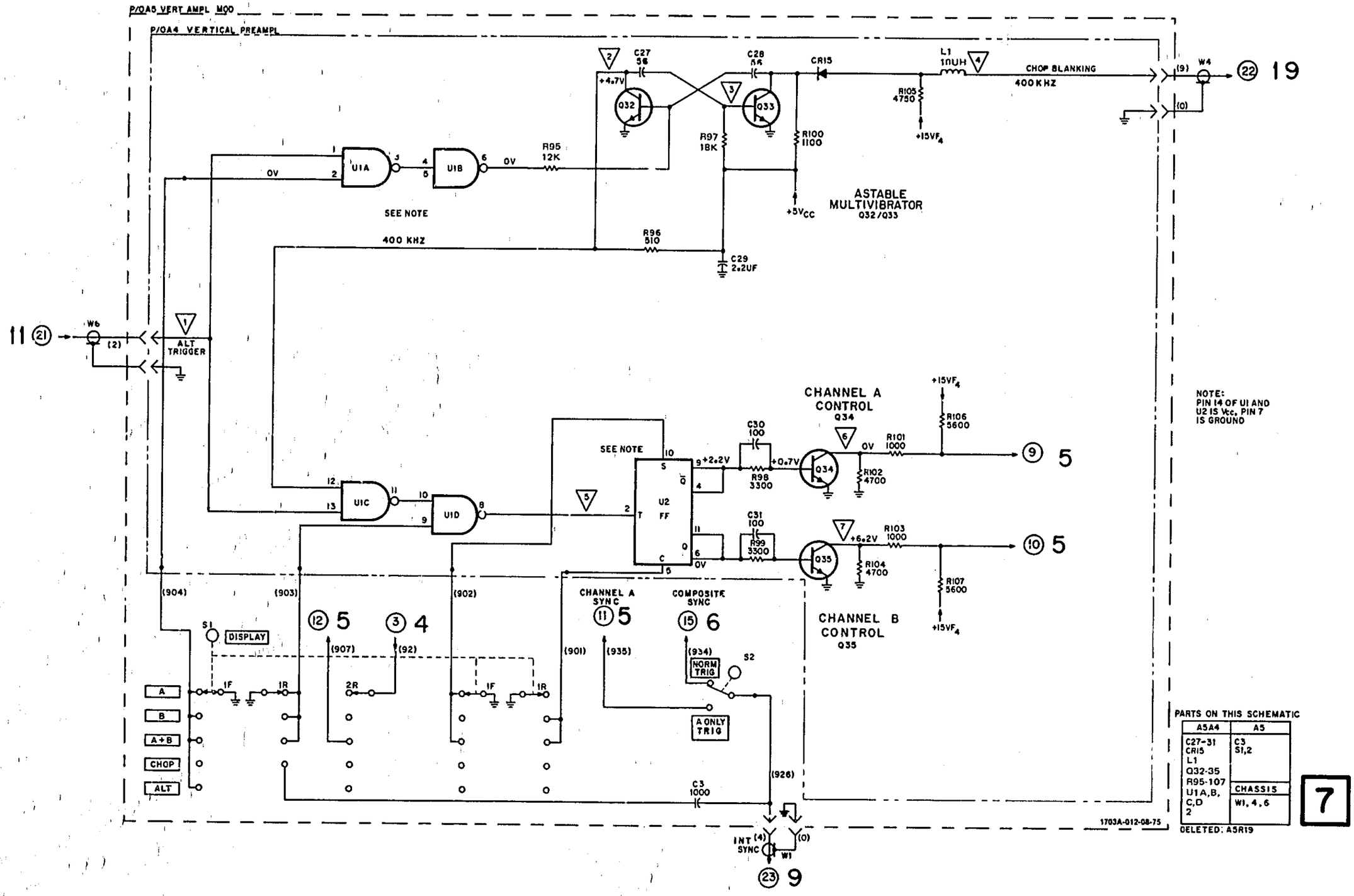
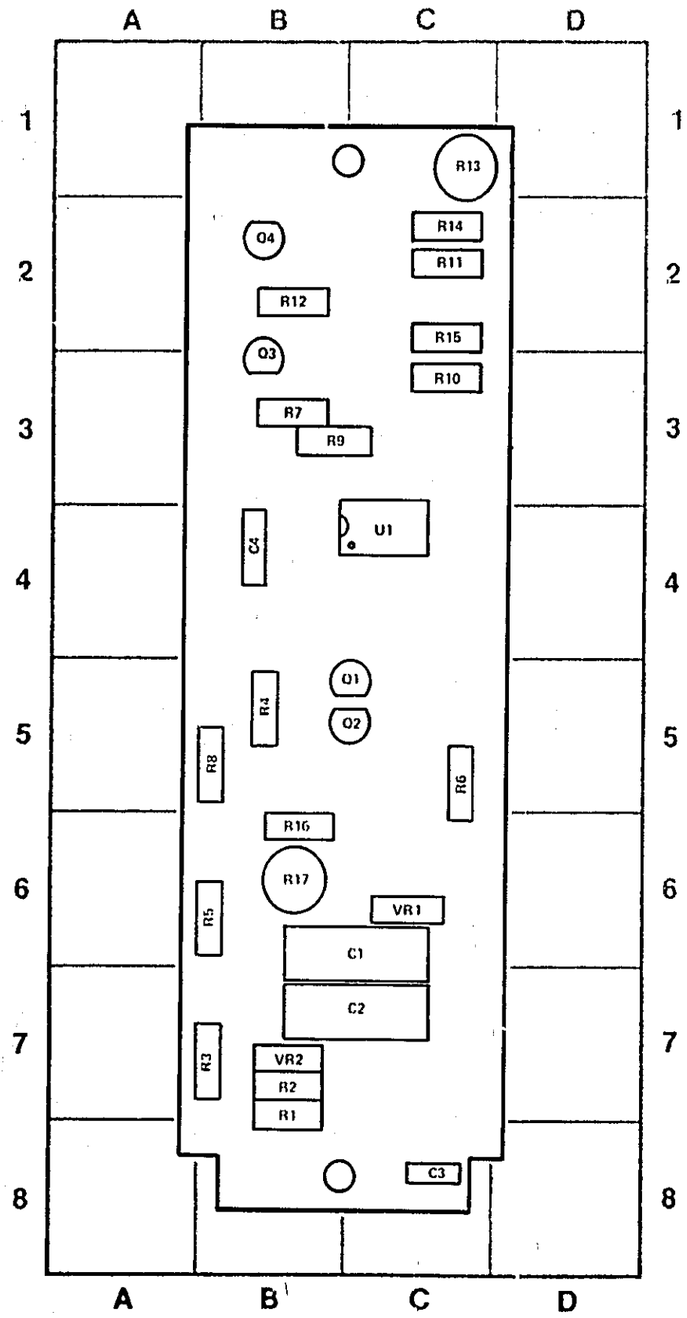


Figure 8-17.
Vertical Preamplifier A5A4 Schematic (Sheet 4 of 4)



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-6	R7	B-3
C2	C-7	R8	B-5
C3	C-8	R9	B-3
C4	B-4	R10	C-3
Q1	C-5	R11	C-2
Q2	C-5	R12	B-2
Q3	B-2	R13	C-1
Q4	B-2	R14	C-2
R1	B-7	R15	C-2
R2	B-7	R16	B-5
R3	B-7	R17	B-6
R4	B-5	U1	C-4
R5	B-6	VR1	C-6
R6	C-5	VR2	B-7

1703A-013-08-75

Figure 8-18. Channel A Output Amplifier, A5A6 Component Identification

Table 8-8. Channel A Output Amplifier Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
DISPLAY ..... B
channel A POSITION ..... midrange
channel B POSITION ..... midrange
channel A vernier ..... CAL
channel B vernier ..... CAL
channel A VOLTS/DIV ..... .01
channel B VOLTS/DIV ..... .01
channel A coupling ..... GND
channel B coupling ..... DC

B. Connect CHANNEL A OUTPUT to channel B INPUT.

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

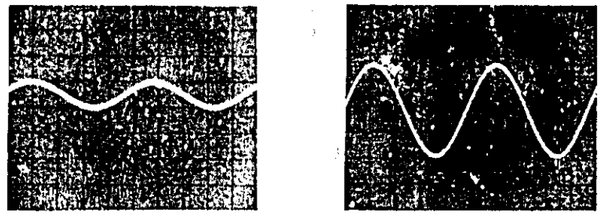
WAVEFORM MEASUREMENT CONDITIONS

A. Set:
DISPLAY ..... B
channel A POSITION ..... midrange
channel B POSITION ..... midrange
channel A vernier ..... CAL
channel B vernier ..... CAL
channel A VOLTS/DIV ..... .01
channel B VOLTS/DIV ..... .01
channel A coupling ..... AC
channel B coupling ..... AC

B. Connect CHANNEL A OUTPUT to channel B INPUT.

C. Connect 5 mV p-p, 400-Hz sine wave to channel A INPUT.

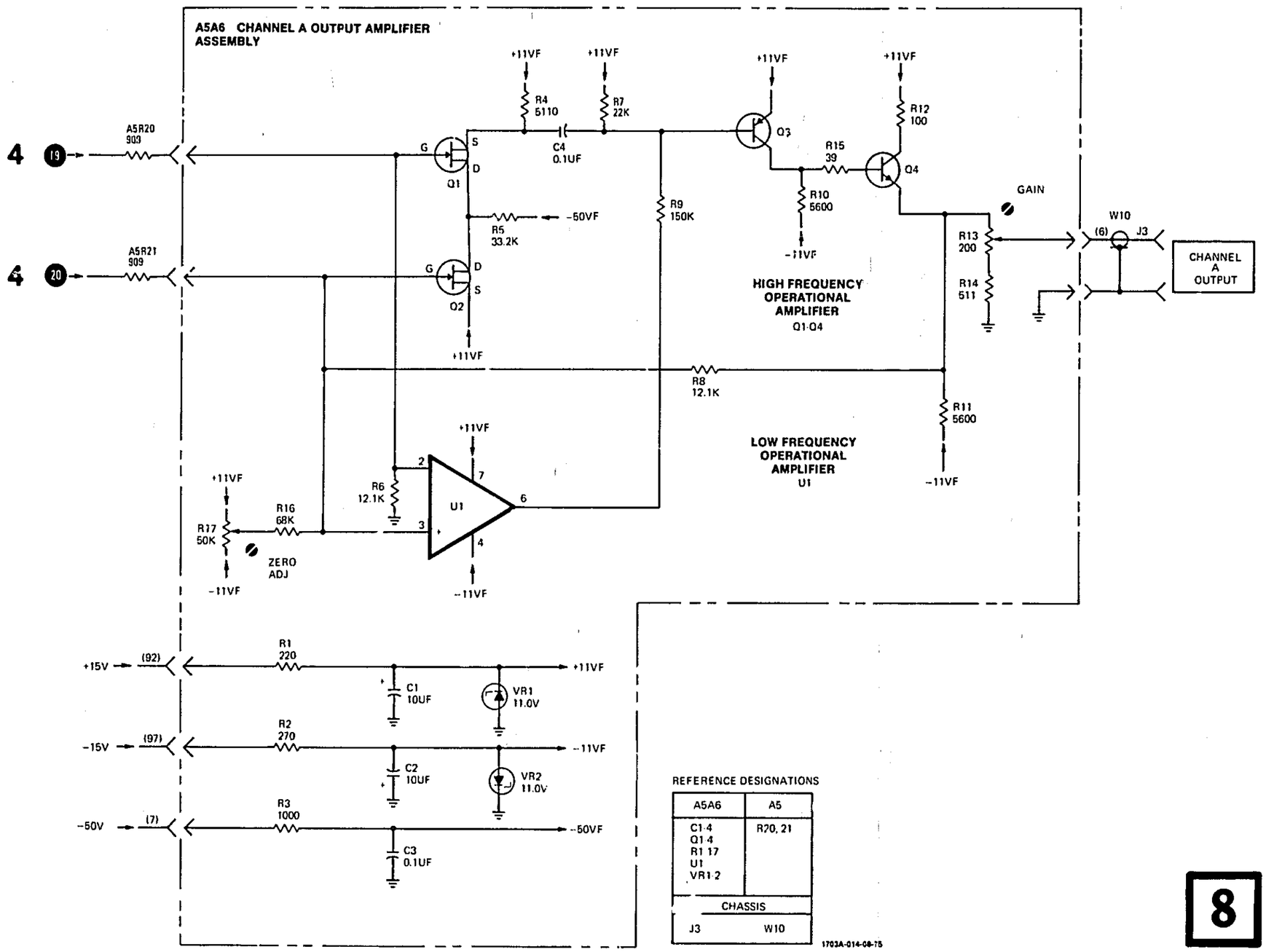
D. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below on each waveform photograph.



1703A-A-21

1 5MV/DIV 0.5MS/DIV

2 20MV/DIV 0.5MS/DIV



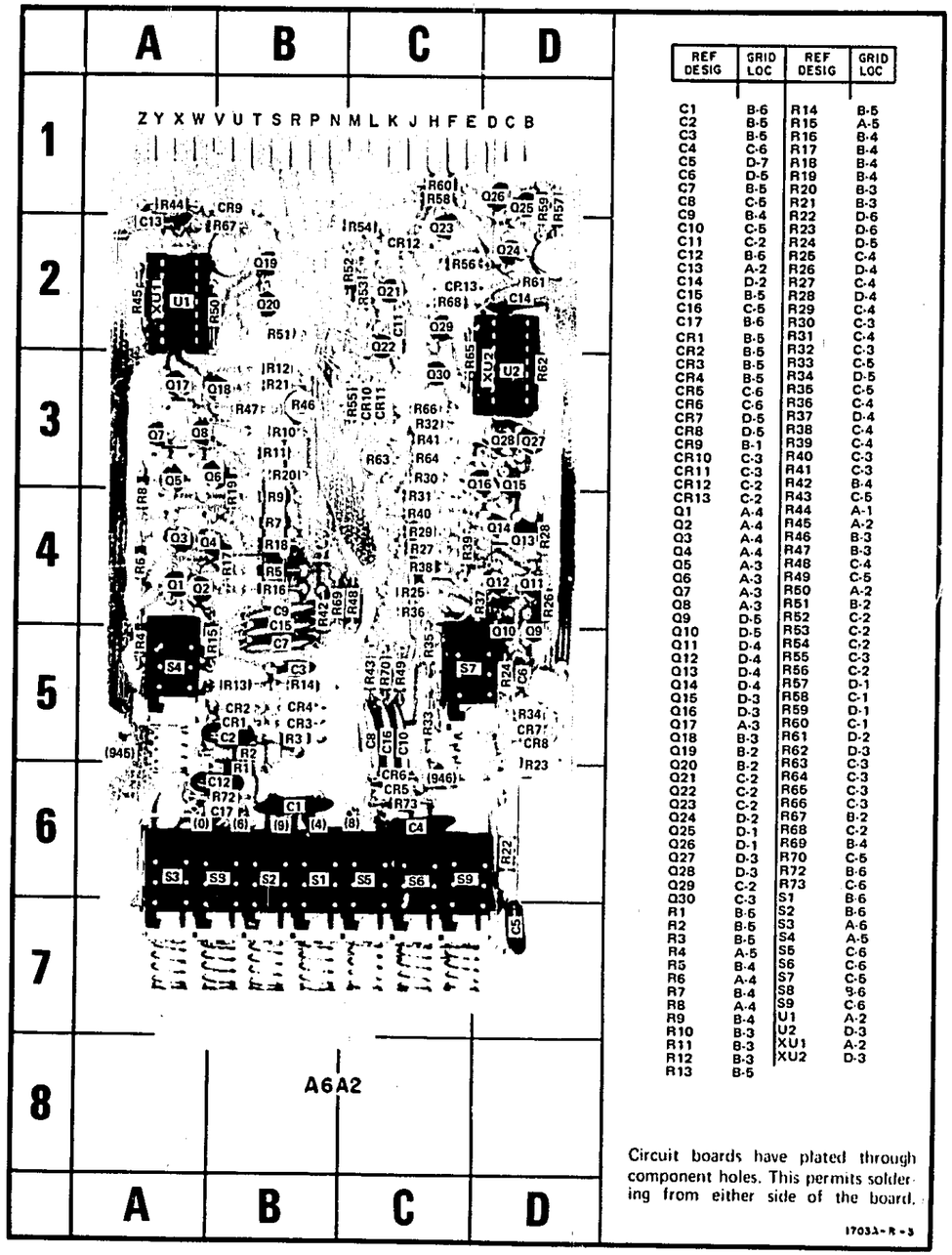
REFERENCE DESIGNATIONS

A5A6	A5
C1-4 Q1-4 R1-17 U1 VR1-2	R20, 21
CHASSIS	
J3	W10

1703A-014-08-75

8

Figure 8-19.
Channel A Output Amplifier 45A6 Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-6	R14	B-5
C2	B-5	R15	A-5
C3	B-5	R16	B-4
C4	C-6	R17	B-4
C5	D-7	R18	B-4
C6	D-5	R19	B-4
C7	B-5	R20	B-3
C8	C-5	R21	B-3
C9	B-4	R22	D-6
C10	C-5	R23	D-6
C11	C-2	R24	D-5
C12	B-6	R25	C-4
C13	A-2	R26	D-4
C14	D-2	R27	C-4
C15	B-5	R28	D-4
C16	C-5	R29	C-4
C17	B-6	R30	C-3
CR1	B-5	R31	C-4
CR2	B-5	R32	C-3
CR3	B-5	R33	C-5
CR4	B-5	R34	D-5
CR5	C-6	R35	C-5
CR6	C-6	R36	C-4
CR7	D-5	R37	D-4
CR8	D-5	R38	C-4
CR9	B-1	R39	C-4
CR10	C-3	R40	C-3
CR11	C-3	R41	C-3
CR12	C-2	R42	B-4
CR13	C-2	R43	C-5
Q1	A-4	R44	A-1
Q2	A-4	R45	A-2
Q3	A-4	R46	B-3
Q4	A-4	R47	B-3
Q5	A-3	R48	C-4
Q6	A-3	R49	C-5
Q7	A-3	R50	A-2
Q8	A-3	R51	B-2
Q9	D-5	R52	C-2
Q10	D-5	R53	C-2
Q11	D-4	R54	C-2
Q12	D-4	R55	C-3
Q13	D-4	R56	C-2
Q14	D-4	R57	D-1
Q15	D-3	R58	C-1
Q16	D-3	R59	D-1
Q17	A-3	R60	C-1
Q18	B-3	R61	D-2
Q19	B-2	R62	D-3
Q20	B-2	R63	C-3
Q21	C-2	R64	C-3
Q22	C-2	R65	C-3
Q23	C-2	R66	C-3
Q24	D-2	R67	B-2
Q25	D-1	R68	C-2
Q26	D-1	R69	B-4
Q27	D-3	R70	C-5
Q28	D-3	R72	B-6
Q29	C-2	R73	C-6
Q30	C-3	S1	B-6
R1	B-6	S2	B-6
R2	B-5	S3	A-6
R3	B-5	S4	A-5
R4	A-5	S5	C-6
R5	B-4	S6	C-6
R6	A-4	S7	C-5
R7	B-4	S8	C-6
R8	A-4	S9	C-6
R9	B-4	U1	A-2
R10	B-3	U2	D-3
R11	B-3	XU1	A-2
R12	B-3	XU2	D-3
R13	B-5		

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

1703A-R-3

Figure 8-20. Trigger A6A2, Component Identification

Table 8-9. Trigger Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
SINGLE ..... engaged
SWP MAG X1
main INT/EXT ..... INT
main TRIGGER LEVEL ..... cw
main slope ..... +
delayed TRIGGER LEVEL ..... cw
sweep display ..... MAIN SWEEP

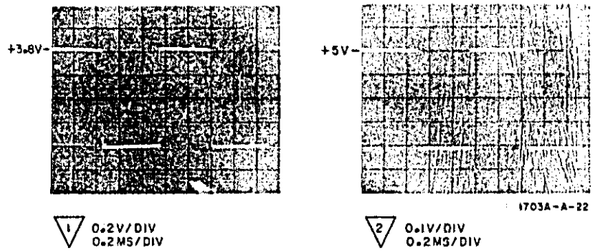
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

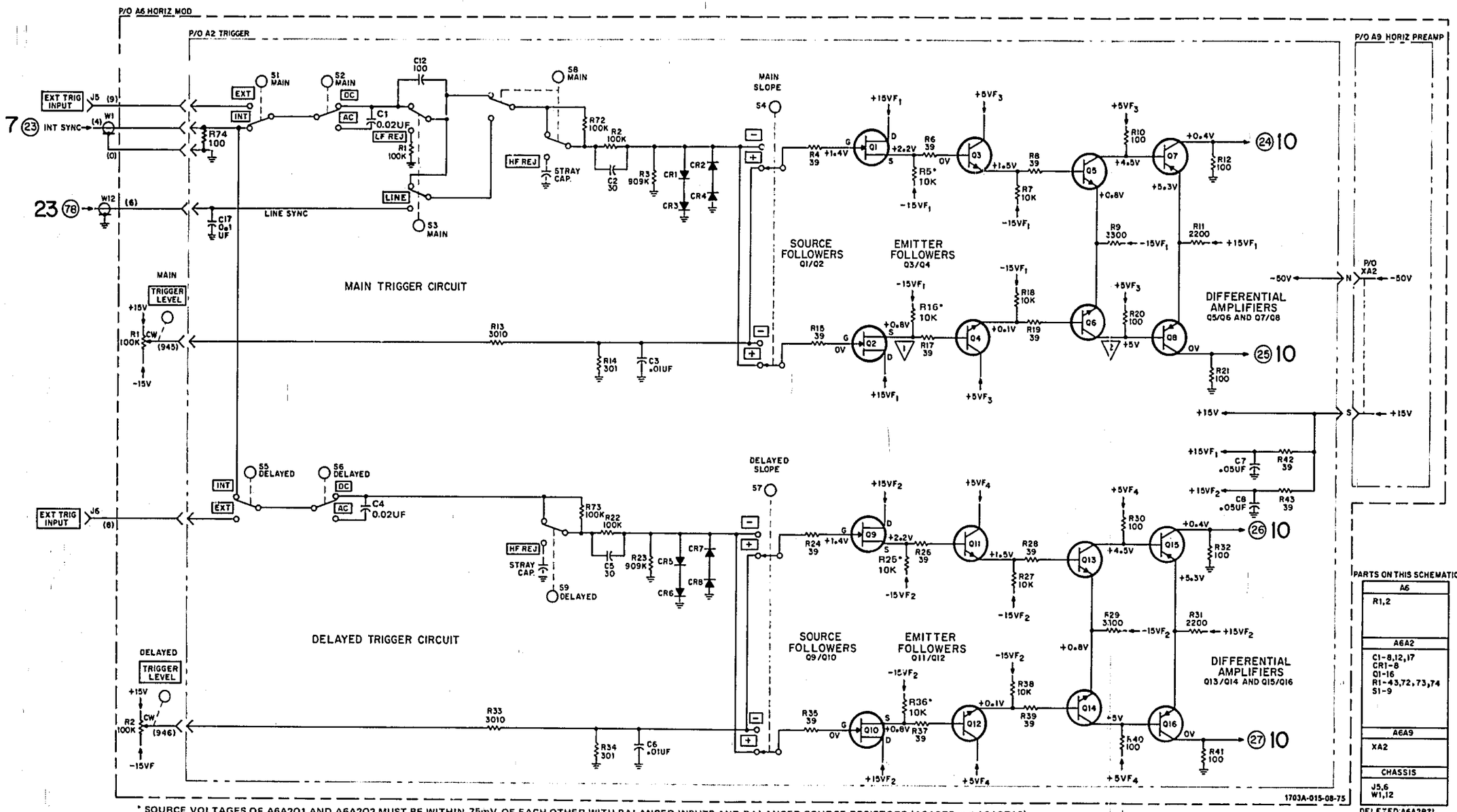
WAVEFORM MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
SWP MAG X1
main INT/EXT ..... EXT
sweep display ..... MAIN SWEEP
main slope ..... +
main TIME/DIV ..... .2 mSEC
main TRIGGER LEVEL ..... 12 o'clock position

B. Connect CAL 1 VOLT signal to EXT TRIG INPUT.

C. 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.





* SOURCE VOLTAGES OF A6A2Q1 AND A6A2Q2 MUST BE WITHIN 75mV OF EACH OTHER WITH BALANCED INPUTS AND BALANCED SOURCE RESISTORS (A6A2R5 and A6A2R16). WHEN BALANCED WITH ZERO INPUT VOLTAGES, THE SOURCE VOLTAGES MAY BE BETWEEN 0.1 AND 2.5 VOLTS (V_S TO GROUND). THIS SAME CIRCUIT REQUIREMENT IS TRUE FOR A6A2Q9 AND A6A2Q10 WITH SOURCE RESISTORS A6A2 R25 AND A6A2R36. PAIRS OF SOURCE RESISTORS ARE SELECTED TO OBTAIN THE LESS THAN 75mV DIFFERENCE.

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Figure 8-21.
Trigger A6A2 Schematic (1 of 2)

Table 8-10. Trigger Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
main INT/EXT ..... INT
sweep display ..... MAIN SWEEP
main TRIGGER LEVEL ..... cw
delayed TRIGGER LEVEL ..... cw
main AUTO/NORM ..... AUTO
main slope ..... +
SINGLE ..... engaged

B. Voltages in ( ) are measured with waveform measurement conditions below except main AUTO/NORM set to NORM and disengage SINGLE pushbutton.

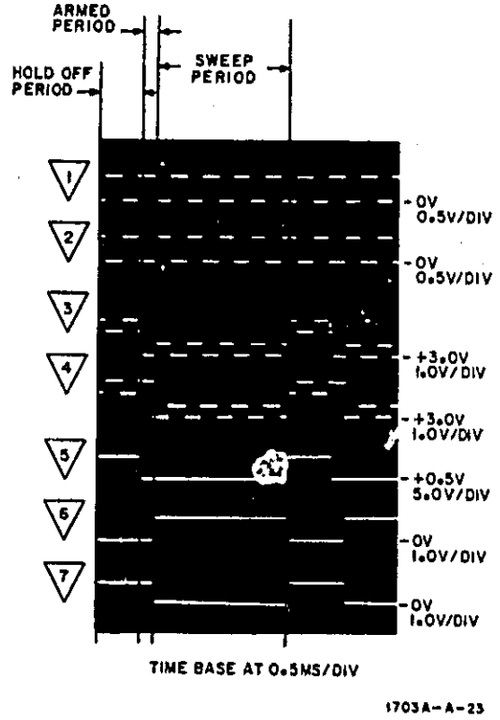
C. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main INT/EXT ..... EXT
sweep display ..... MAIN SWEEP
main slope ..... +
main TIME/DIV ..... .2 mSEC
main TRIGGER LEVEL ..... 12 o'clock position

B. Connect CAL 1 VOLT to EXT TRIG INPUT.

C. 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 on each waveform photograph.



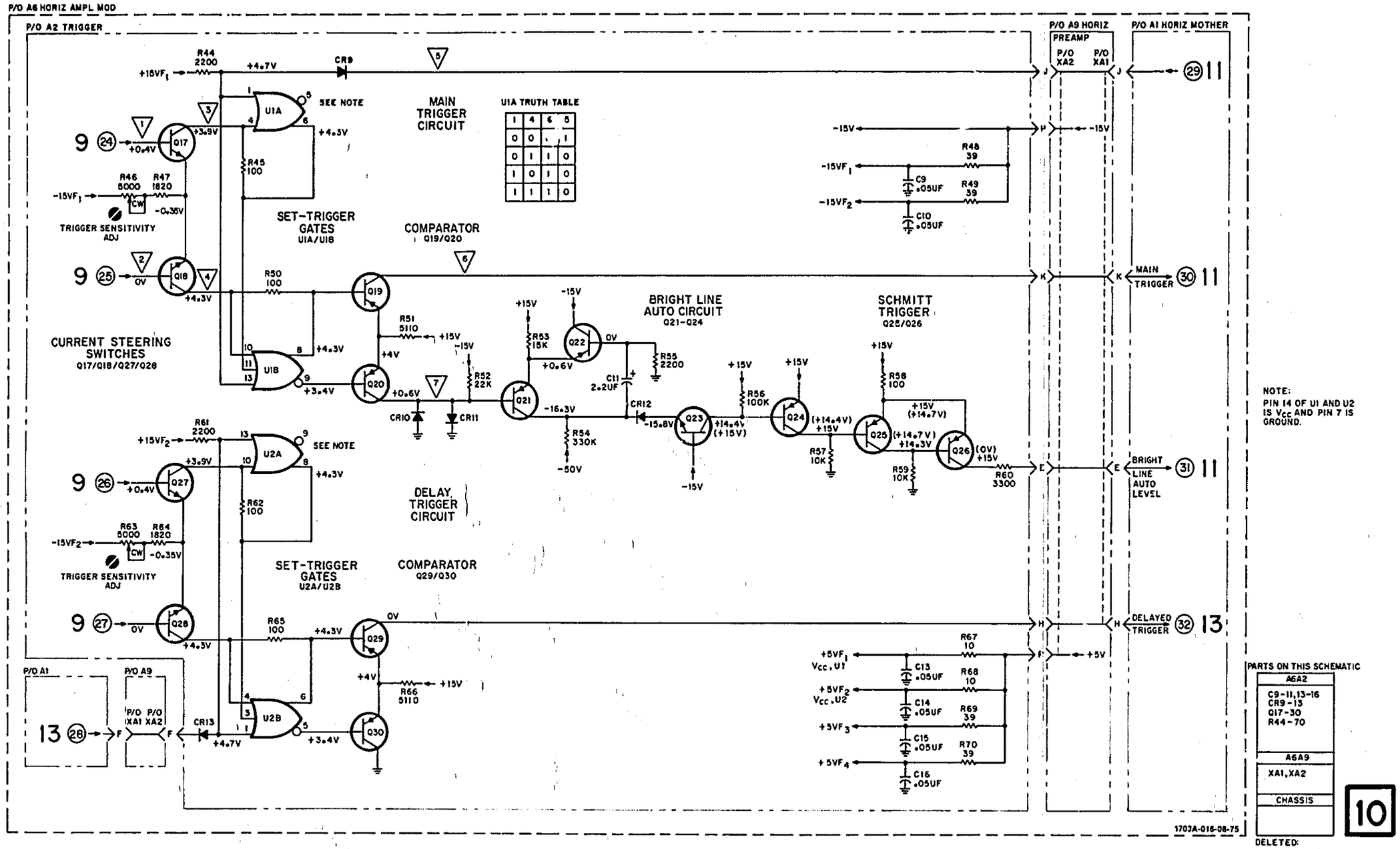
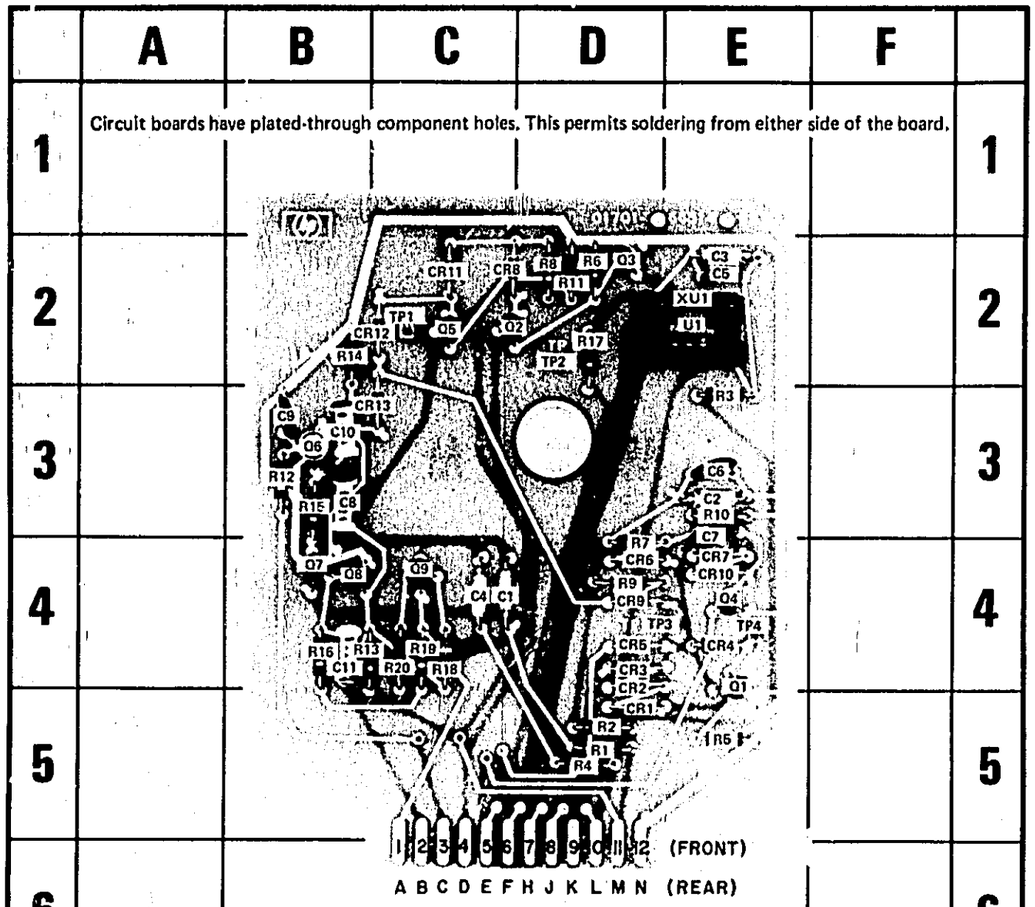


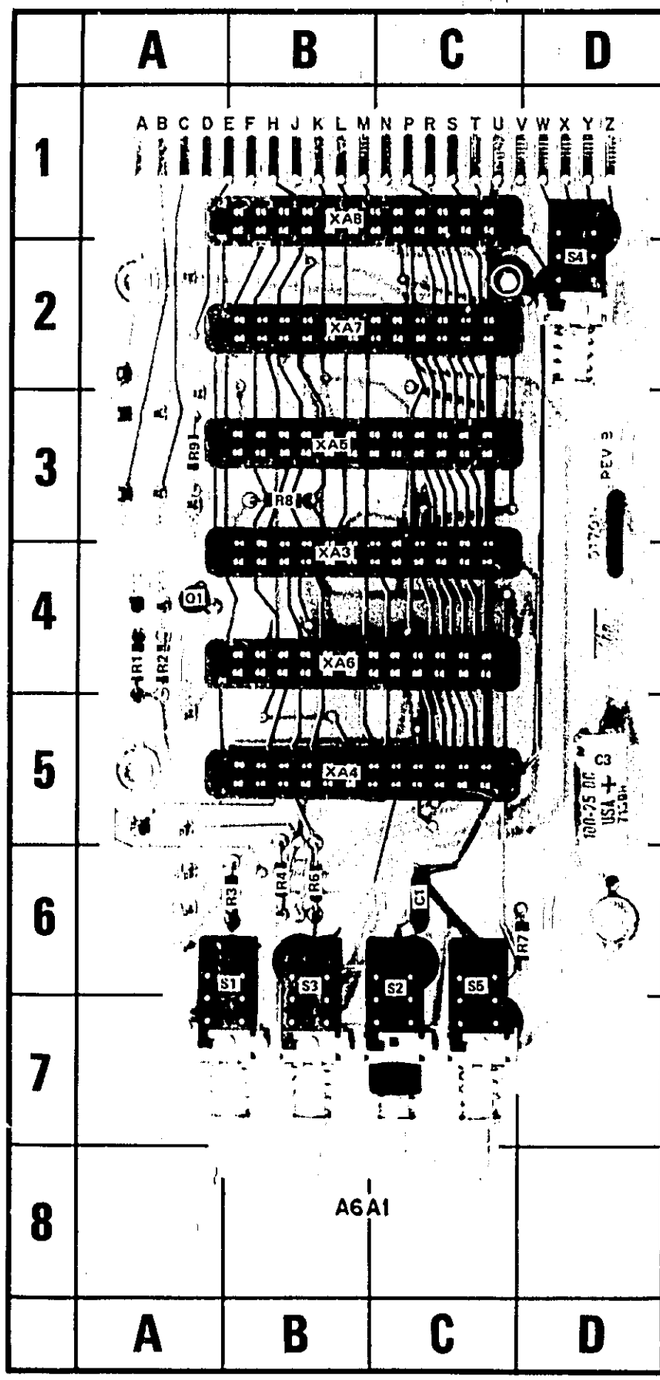
Figure 8-22.
Trigger A6A2 Schematic
(2 of 2)



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

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

Figure 8-23. Main Integrator, A6A3, Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-6	S2	C-6
C3	D-5	S3	B-6
R1	A-4	S4	D-2
R2	A-4	S5	C-6
R3	B-6	XA3	B-4
R4	B-6	XA4	B-5
R6	B-6	XA5	B-3
R7	D-6	XA6	B-4
R8	B-3	XA7	B-2
R9	A-3	XAB	B-1
S1	B-6		

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

Figure 8-24. Horizontal Mother Board, A6A1, Component Identification

Table 8-11. Main Integrator Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main INT/EXT ..... INT
sweep display ..... MAIN SWEEP
main TRIGGER LEVEL ..... cw
delayed TRIGGER LEVEL ..... cw
SINGLE ..... engaged

B. Voltages in ( ) are measured with main AUTO/NORM set to NORM and SINGLE disengaged.

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

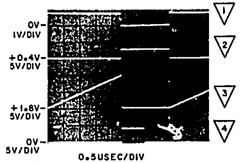
WAVEFORM MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... NORM
main INT/EXT ..... EXT
sweep display ..... MAIN SWEEP
main slope ..... +
main TIME/DIV ..... .2 mSEC

B. Connect CAL 1 VOLT to EXT TRIG INPUT.

C. 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 on each waveform photograph.

D. All waveforms are time related.



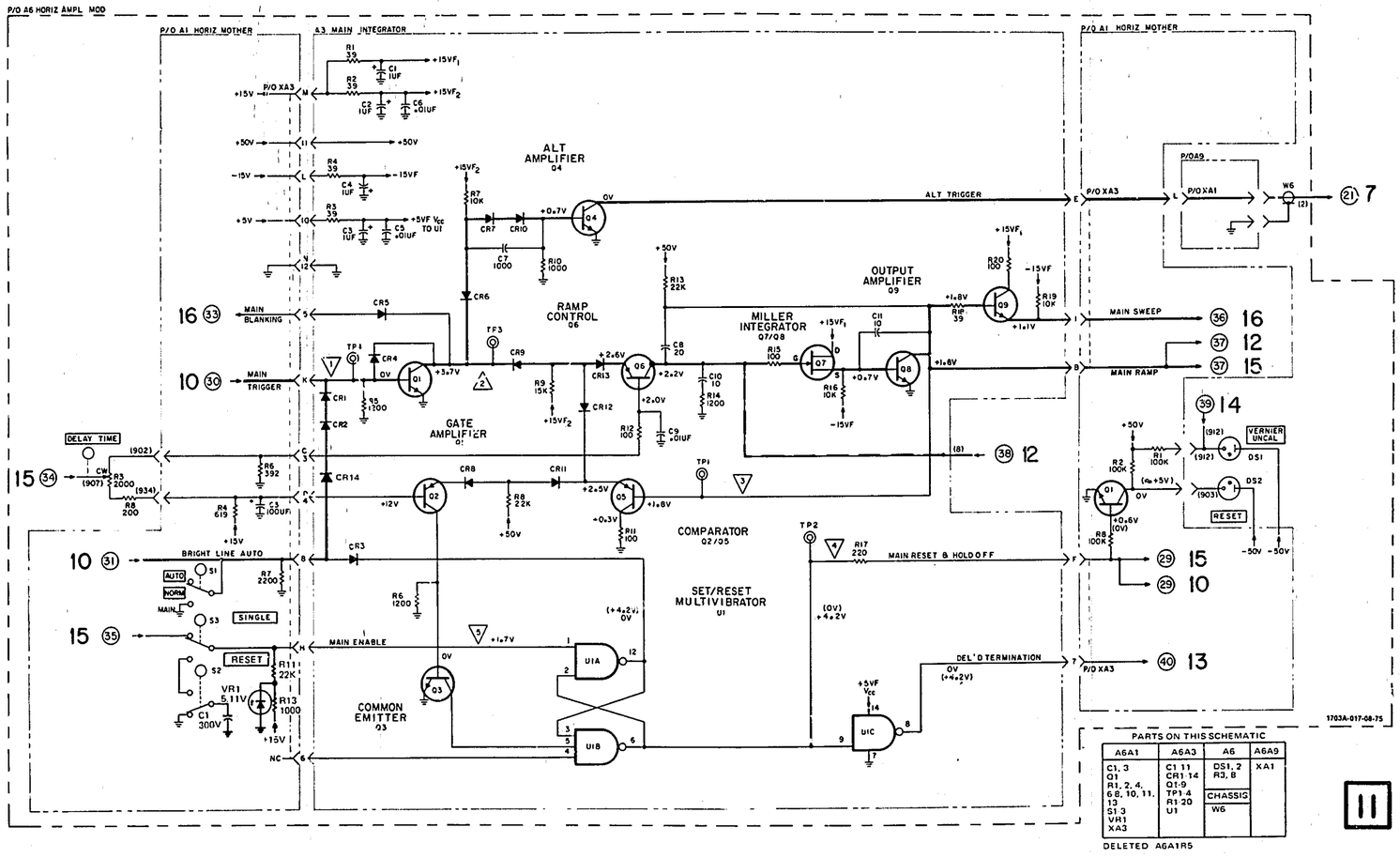
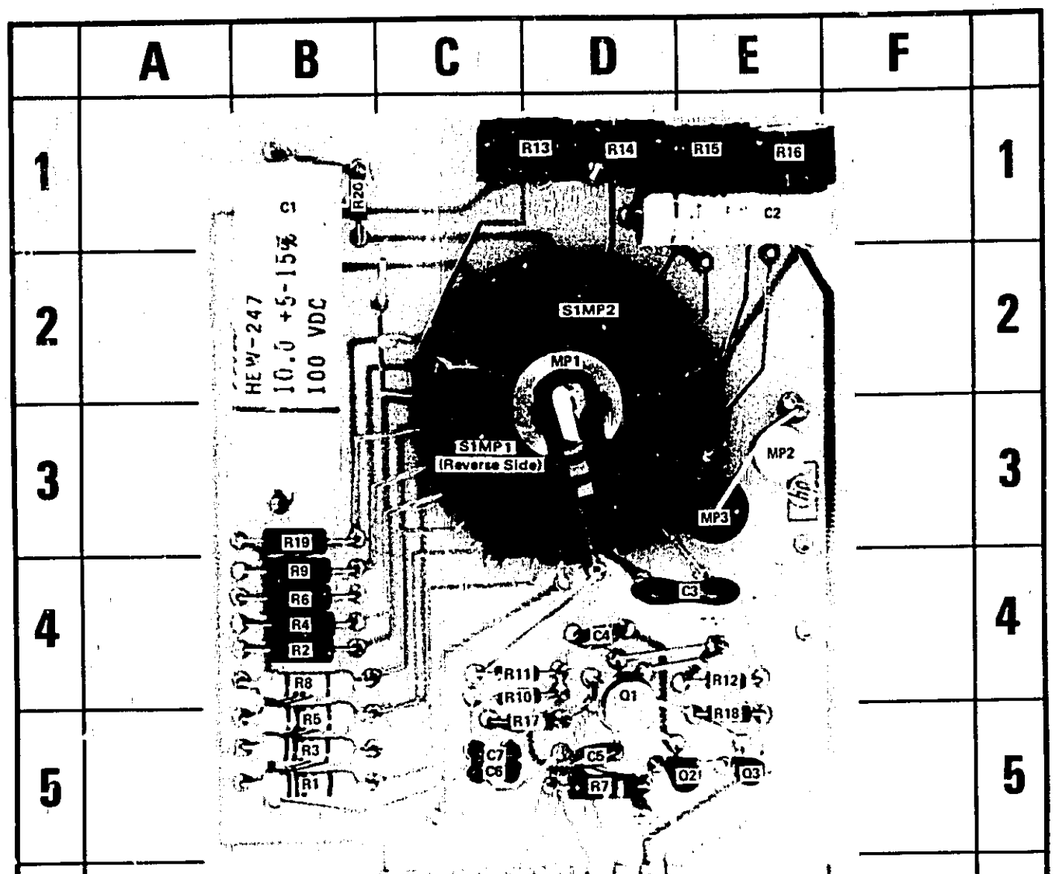


Figure 8-25.
Main Integrator A6A3 Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-1	MP1	D-2	R2	B-4	R9	B-4	R16	E-1
C2	E-1	MP2	E-3	R3	B-5	R10	C-4	R17	C-5
C3	E-4	MP3	E-3	R4	B-4	R11	C-4	R18	E-5
C4	D-4	Q1	D-4	R5	B-5	R12	E-4	R19	B-3
C5	D-5	Q2	E-5	R6	B-4	R13	D-1	R20	B-1
C6	C-5	Q3	E-5	R7	D-5	R14	D-1	S1MP1	C-3
C7	C-5	R1	B-5	R8	B-4	R15	E-1	S1MP2	D-2

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

1703A-R-1

Figure 8-26. Main Sweep Time, A6A5, Component Identification

Table 8-12. Main Sweep Time Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main INT/EXT ..... INT
sweep display ..... MAIN SWEEP

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

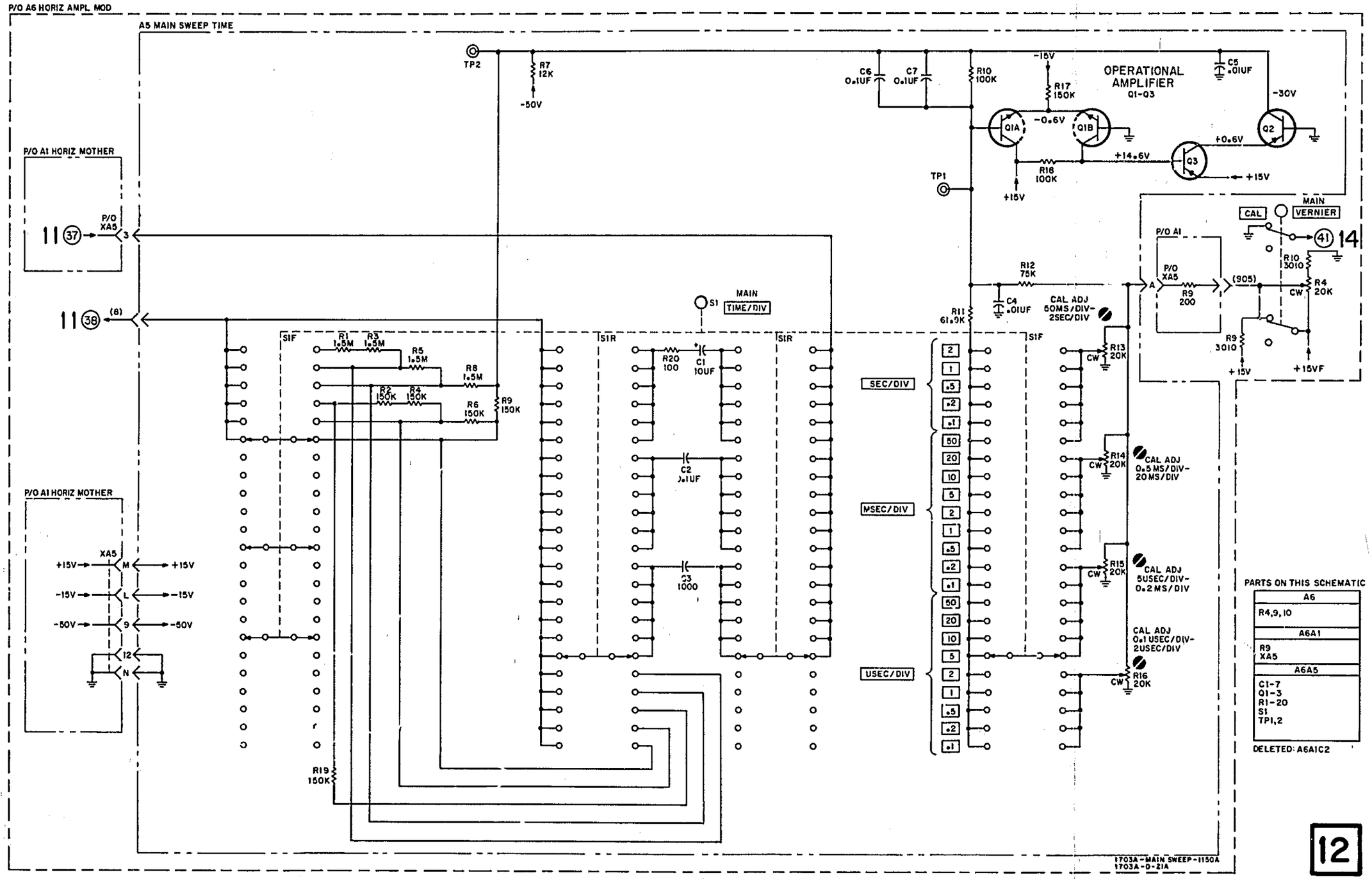
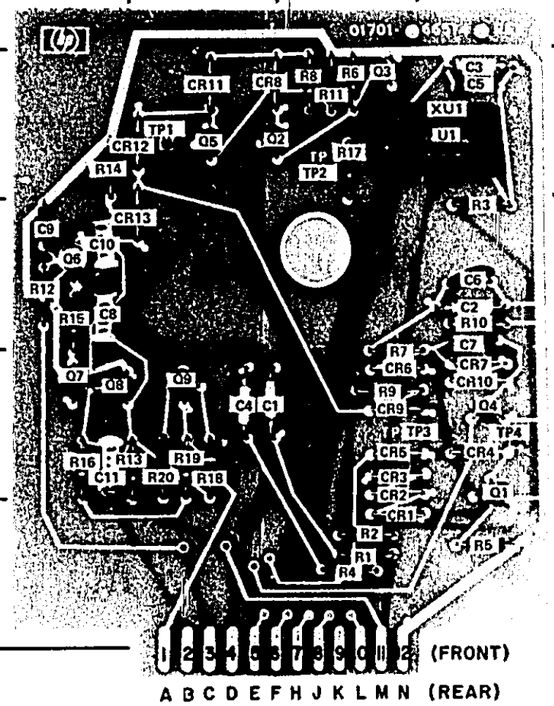


Figure 8-27.
Main Sweep Time A6A5 Schematic



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

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

1701A-A-12

Figure 8-28. Delayed Integrator, A6A4, Component Identification

Table 8-13. Delayed Integrator Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main INT/EXT ..... INT
sweep display ..... MAIN SWEEP
SINGLE ..... engaged
delayed TIME/DIV ..... .1 mSEC

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

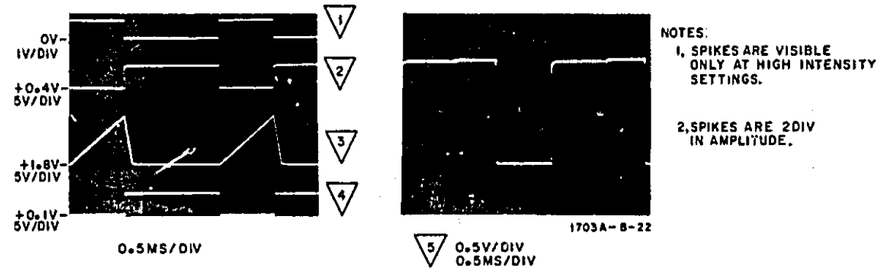
WAVEFORM MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main INT/EXT ..... EXT
sweep display ..... MAIN SWEEP
main slope ..... +
main TIME/DIV ..... .2 mSEC
delayed TIME/DIV ..... .1 mSEC

B. Connect CAL 1 VOLT to EXT TRIG INPUT.

C. 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 on each waveform photograph.

D. All waveforms are time related.



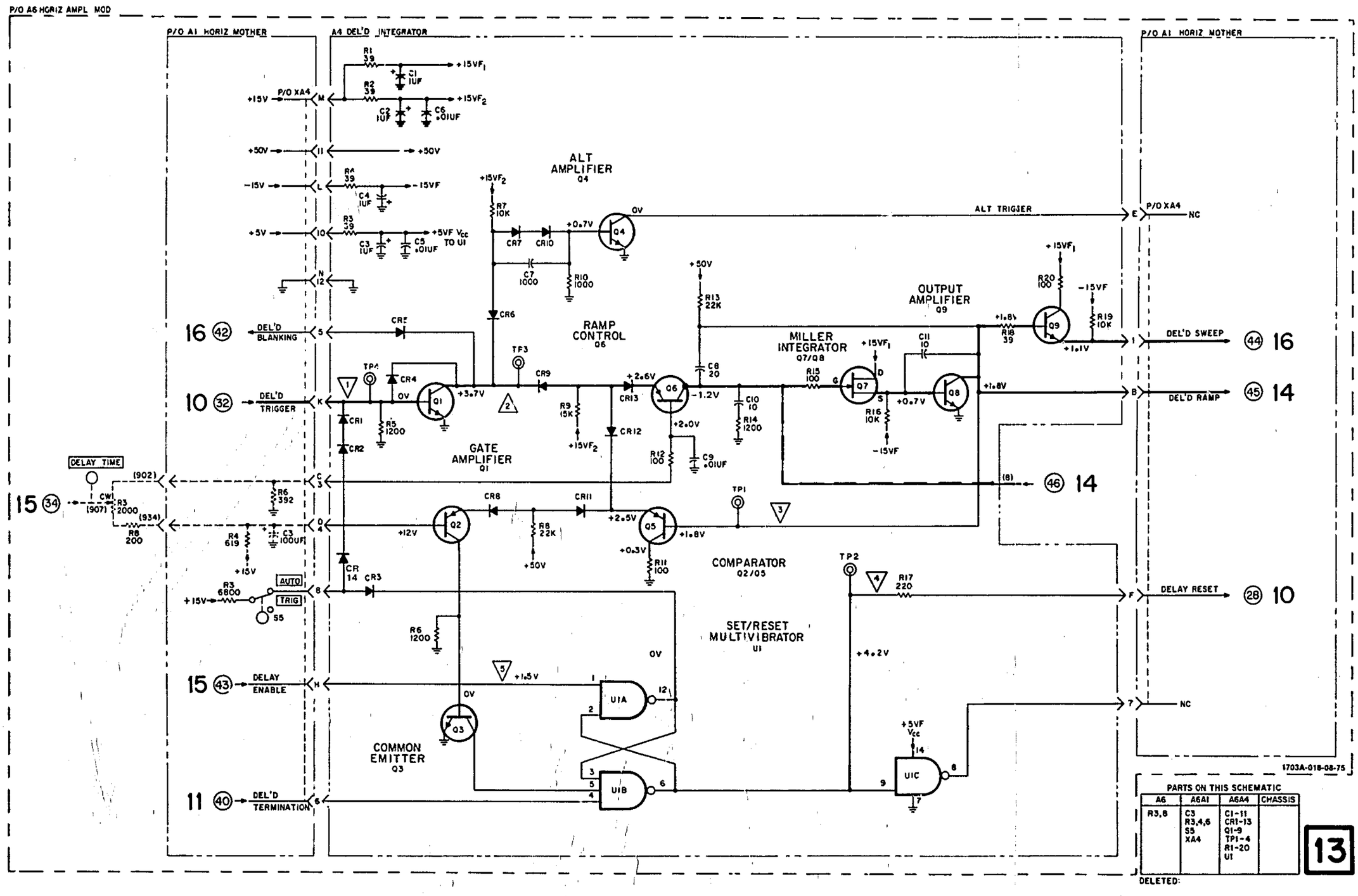
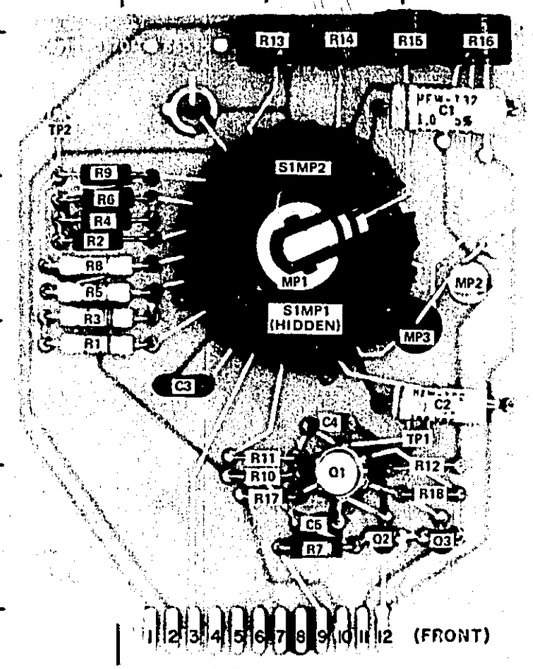


Figure 8-29.
Delayed Integrator A6A4 Schematic

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	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 8-30. Delayed Sweep Time, A6A6, Component Identification

Table 8-14. Delayed Sweep Time Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main INT/EXT ..... INT
sweep display ..... MAIN SWEEP
main TIME/DIV ..... .2 uSEC
delayed TIME/DIV ..... .1 uSEC

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

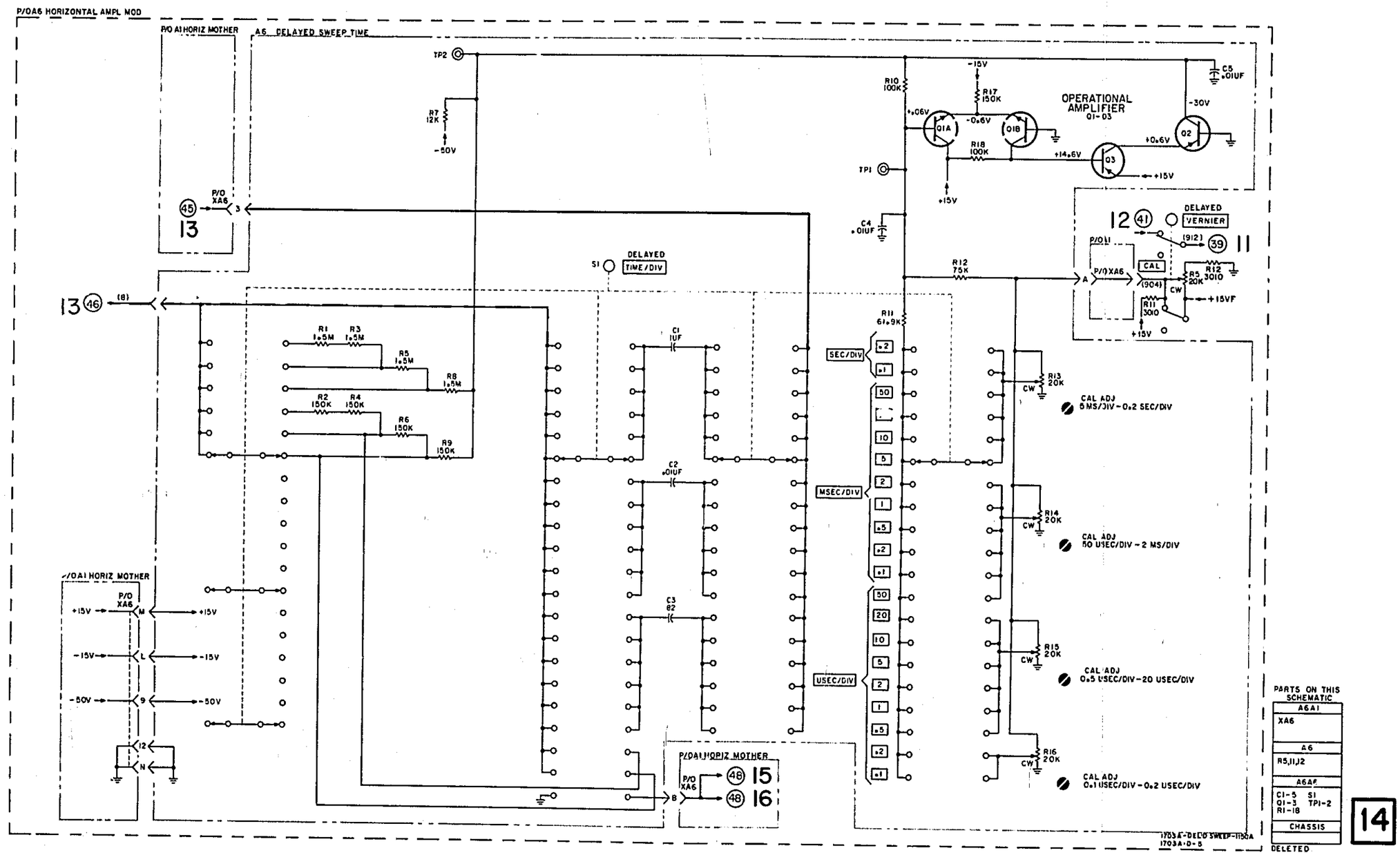
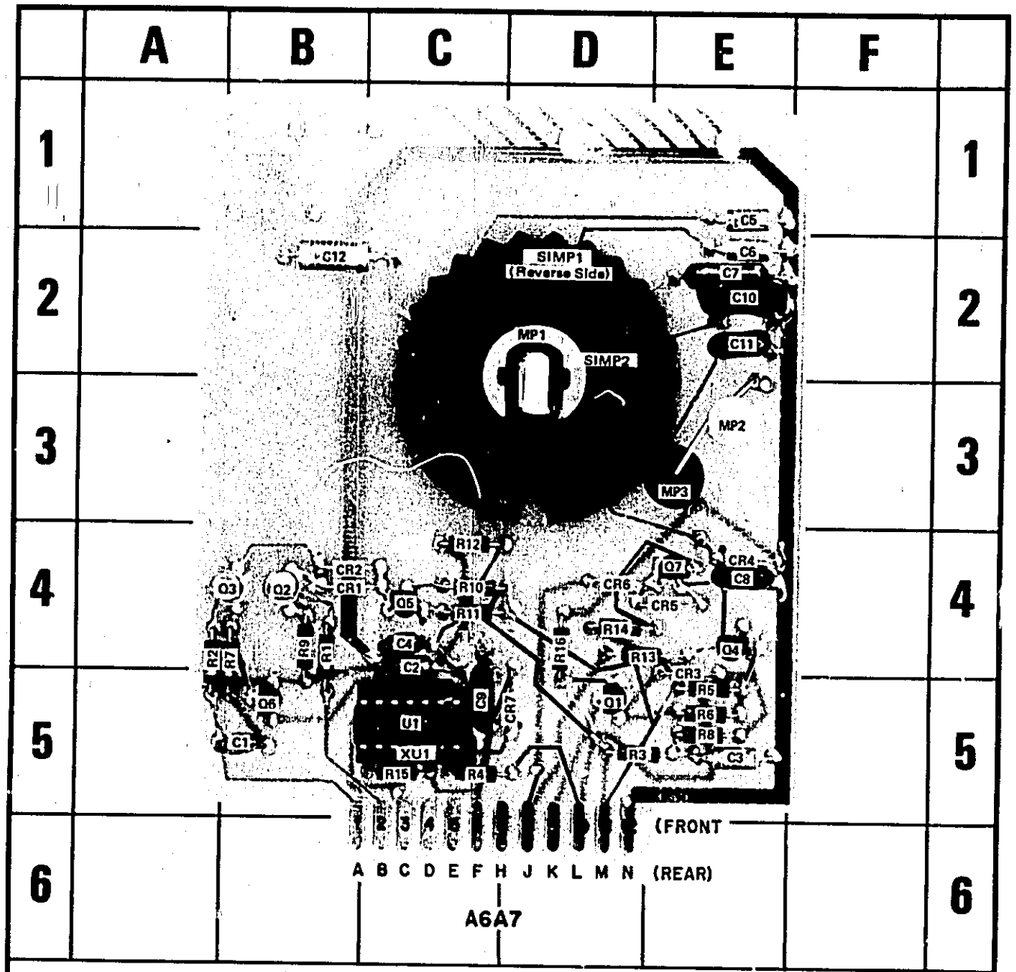


Figure 8-31.
Delayed Sweep Time A6A6 Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-5	C9	C-5	CR5	E-3	Q3	B-4	R4	C-5	R12	C-4
C2	C-4	C10	E-2	CR6	D-4	Q4	B-4	R5	E-5	R13	D-4
C3	E-5	C11	E-2	CR7	D-5	Q5	C-4	R6	E-5	R14	D-4
C4	C-4	C12	B-2	MP1	D-2	Q6	B-5	R7	B-4	R15	C-5
C5	E-1	CR1	B-4	MP2	E-3	Q7	E-3	R8	E-5	R16	D-4
C6	E-2	CR2	B-4	MP3	E-3	R1	B-4	R9	B-4	SIMP1	D-2
C7	E-2	CR3	E-4	Q1	D-5	R2	A-4	R10	C-4	S1MP2	D-2
C8	F-3	CR4	E-3	Q2	B-4	R3	D-5	R11	C-4	U1	C-7
										XU1	C-5

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

1703A-R-6

Figure 8-32. Holdoff and Comparator, A6A7, Component Identification

Table 8-15. Holdoff and Comparator Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main INT/EXT ..... INT
sweep display ..... MAIN SWEEP
SINGLE ..... engaged
main TIME/DIV ..... .2 uSEC
delayed TIME/DIV ..... .1 uSEC

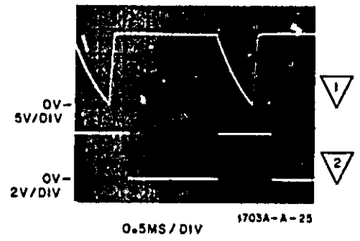
B. Voltage in ( ) are measured with main AUTO/NORM set to NORM and SINGLE disengaged.

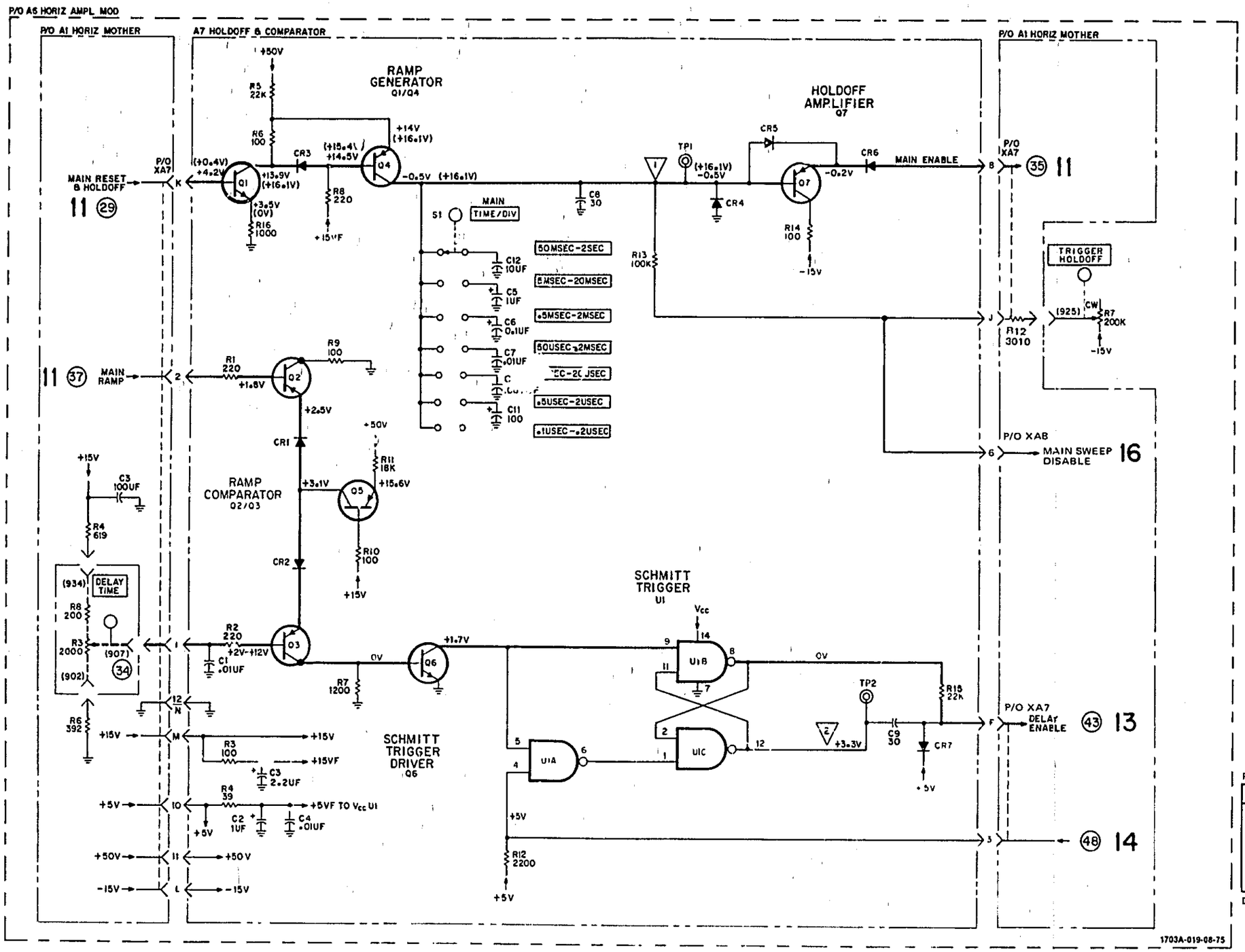
C. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
main TIME/DIV ..... .2 mSEC
delayed TIME/DIV ..... .1 mSEC
DELAY TIME 2.00

B. 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 on each waveform photograph.





PARTS ON THIS SCHEMATIC

A6A1	A6A7	A6
C3 R4,6,12 XA7 XA8	C1-12 CR1-7 Q1-7 R1-16 S1 TP1,2 U1	R3,7,8

DELETED: A6A1R5

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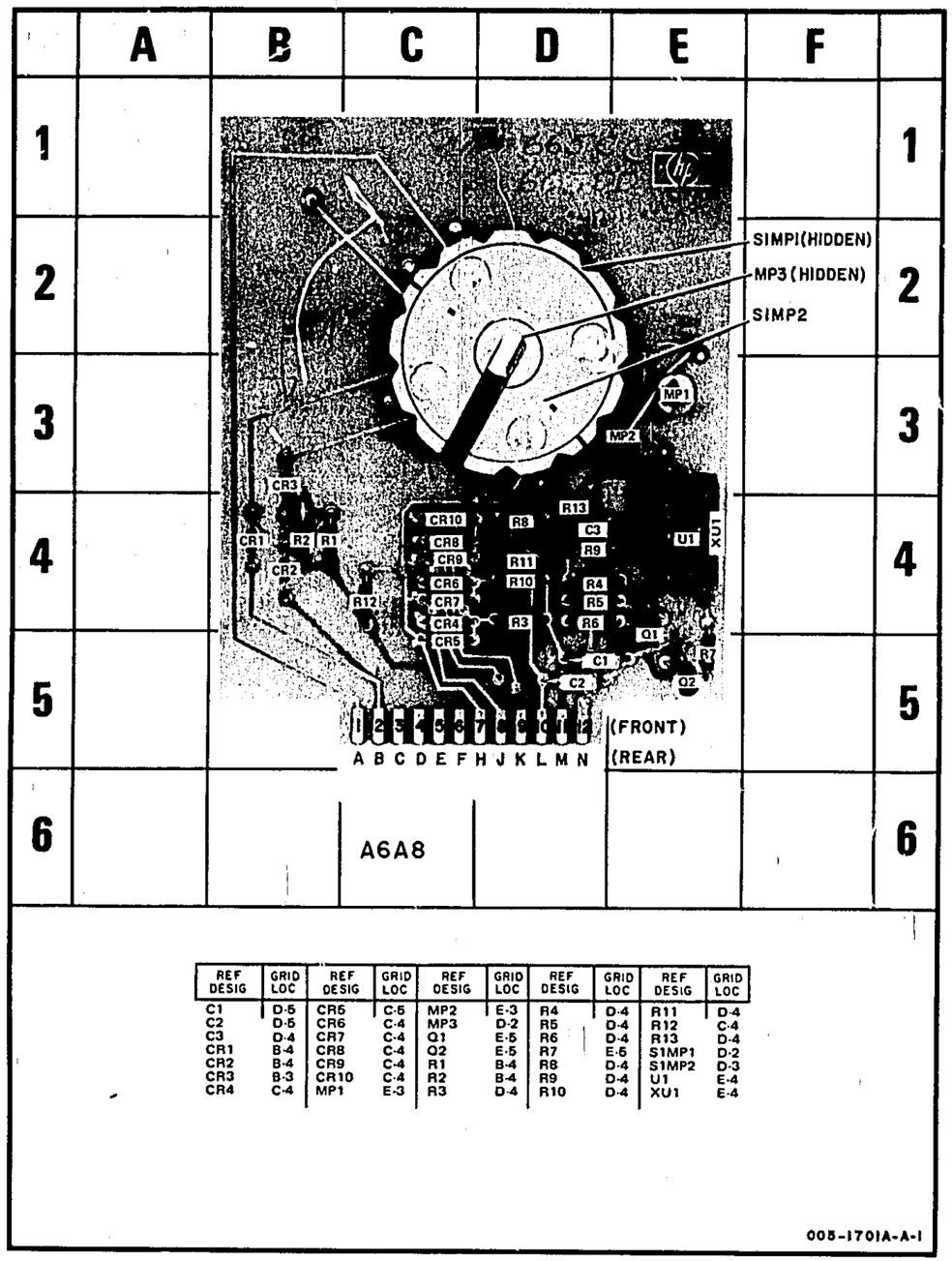
Figure 8-33.
Holdoff and Comparator A6A7 Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-5	CR5	C-5	MP2	E-3	R4	D-4	R11	D-4
C2	D-5	CR6	C-4	MP3	D-2	R5	D-4	R12	C-4
C3	D-4	CR7	C-4	Q1	E-5	R6	D-4	R13	D-4
CR1	B-4	CR8	C-4	Q2	E-5	R7	E-5	S1MP1	D-2
CR2	B-4	CR9	C-4	R1	B-4	R8	D-4	S1MP2	D-3
CR3	B-3	CR10	C-4	R2	B-4	R9	D-4	U1	E-4
CR4	C-4	MP1	E-3	R3	D-4	R10	D-4	XU1	E-4

005-1701A-A-1

Figure 8-34. Horizontal Mode, A6A8, Component Identification

Table 8-16. Horizontal Mode Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

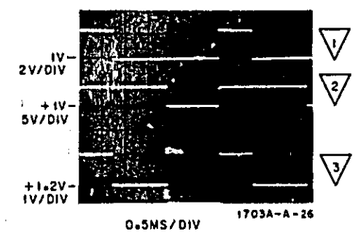
A. Set:
SINGLE ..... engaged
sweep display .... MAIN SWEEP

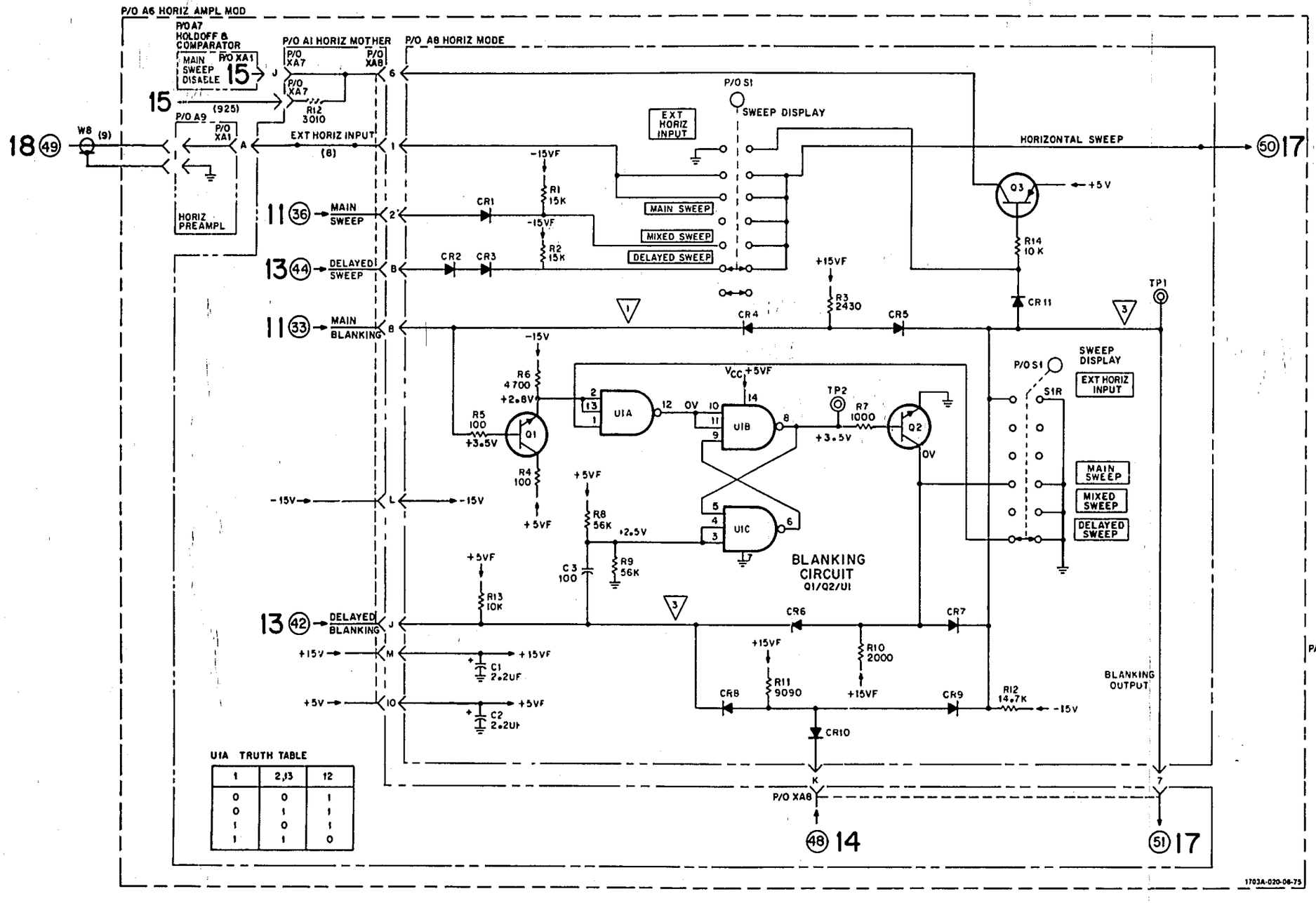
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
main AUTO/NORM ..... AUTO
sweep display .... MAIN SWEEP
main TIME/DIV..... .2 mSEC
delayed TIME/DIV .... .1 mSEC
DELAY TIME 5.00
INTENSITY ..... 9:00 o'clock position

B. 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.





U1A TRUTH TABLE

1	2,13	12
0	0	1
0	1	1
1	0	1
1	1	0

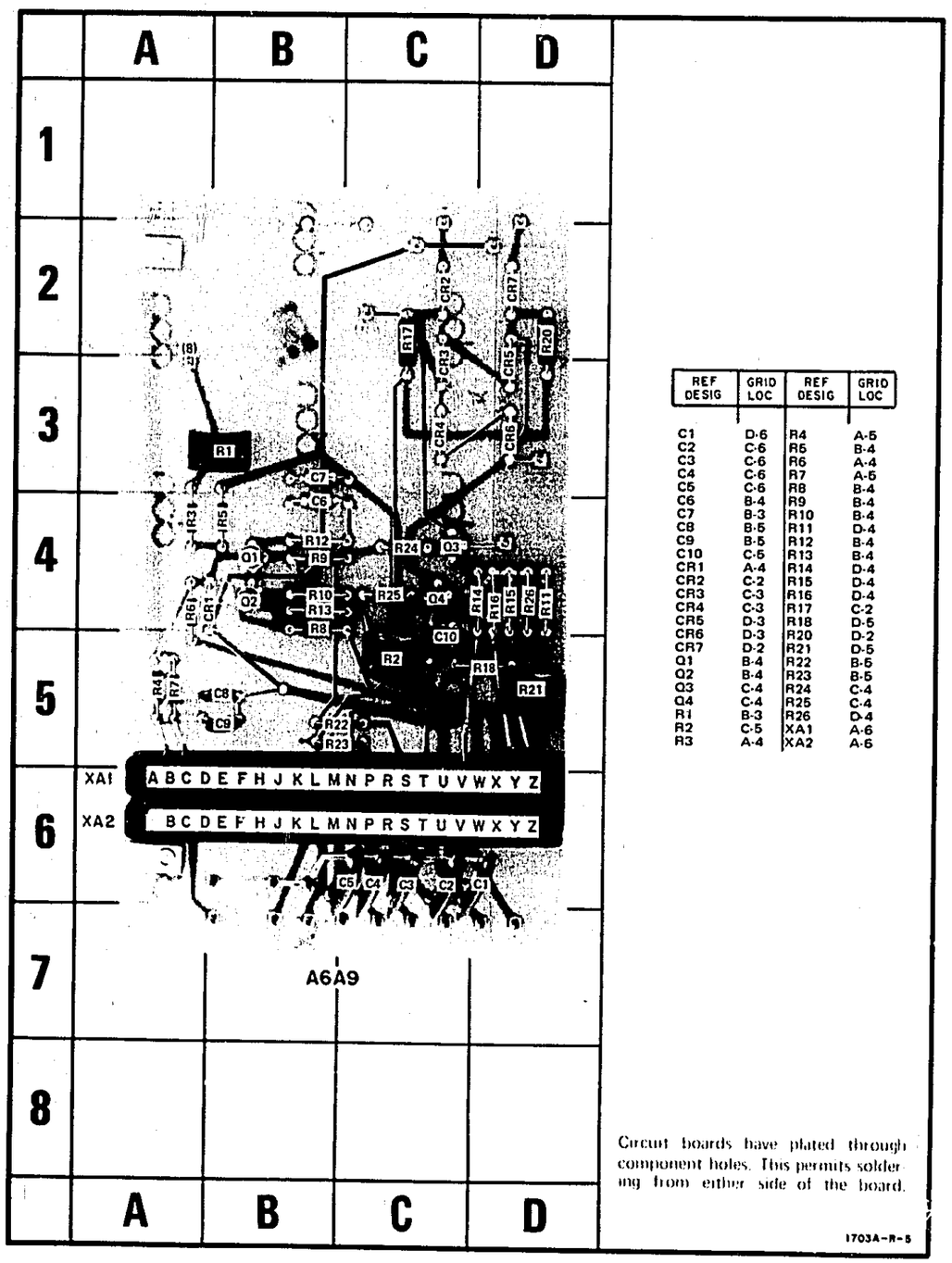
PARTS ON THIS SCHEMATIC

A6A8	A6A7
C1-3 CR1-11 Q1,2,3 R1-14 U1	XA1
A6A1	
R12 XA7, XA8	
A6A9	
XA1	
CHASSIS	
W8	

DELETED:

16

Figure 8-35.
Horizontal Mode, A6A8, Schematic

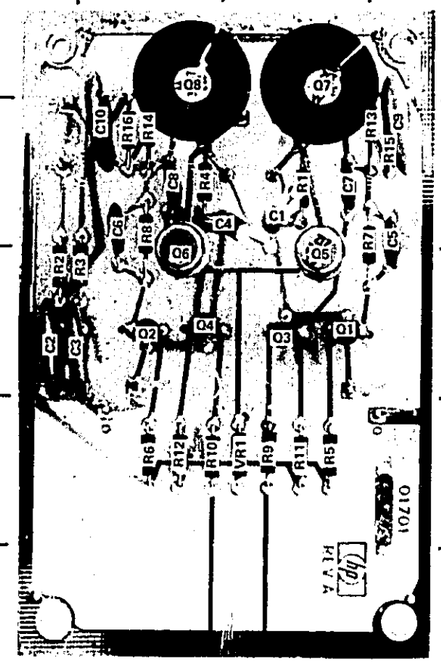


REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-6	R4	A-5
C2	C-6	R5	B-4
C3	C-6	R6	A-4
C4	C-6	R7	A-5
C5	C-6	R8	B-4
C6	B-4	R9	B-4
C7	B-3	R10	B-4
C8	B-5	R11	D-4
C9	B-5	R12	B-4
C10	C-5	R13	B-4
CR1	A-4	R14	D-4
CR2	C-2	R15	D-4
CR3	C-3	R16	D-4
CR4	C-3	R17	C-2
CR5	D-3	R18	D-5
CR6	D-3	R20	D-2
CR7	D-2	R21	D-5
Q1	B-4	R22	B-5
Q2	B-4	R23	B-5
Q3	C-4	R24	C-4
Q4	C-4	R25	C-4
R1	B-3	R26	D-4
R2	C-5	XA1	A-6
R3	A-4	XA2	A-6

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

1703A-R-5

Figure 8-36. Horizontal Preamplifier, A6A9, Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-2	C8	C-2	Q5	D-3	R4	C-2	R11	D-4
C2	B-3	C9	E-2	Q6	C-3	R5	D-4	R12	C-4
C3	C-3	C10	C-2	Q7	D-1	R6	C-4	R13	E-2
C4	D-2	Q1	D-3	Q8	C-1	R7	E-2	R14	C-2
C5	E-2	Q2	C-3	R1	D-2	R8	C-2	R15	E-2
C6	C-2	Q3	D-3	R2	B-3	R9	D-4	R16	C-2
C7	D-2	Q4	C-3	R3	C-3	R10	C-4	VR1	D-4

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

1703A-R-11

Figure 8-37. Horizontal Output Amplifier, A6A10, Component Identification

Table 8-17. Horiz Preamp and Output Ampl Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:

main AUTO/NORM	AUTO
main INT/EXT	INT
sweep display	MAIN SWEEP
SINGLE	engaged
main TIME/DIV	.2 mSEC
HORIZONTAL POSITION	centered

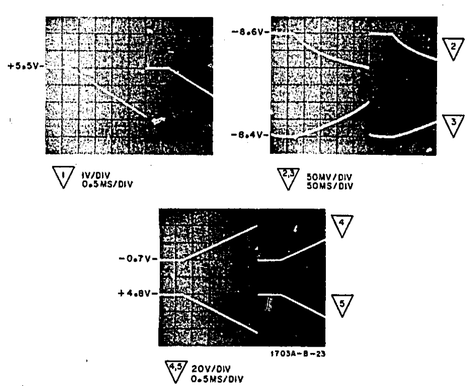
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:

main AUTO/NORM	AUTO
main INT/EXT	INT
sweep display	MAIN SWEEP
main slope	+
main TIME/DIV	.2 mSEC
HORIZONTAL POSITION	centered

B. 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 on each waveform photograph.



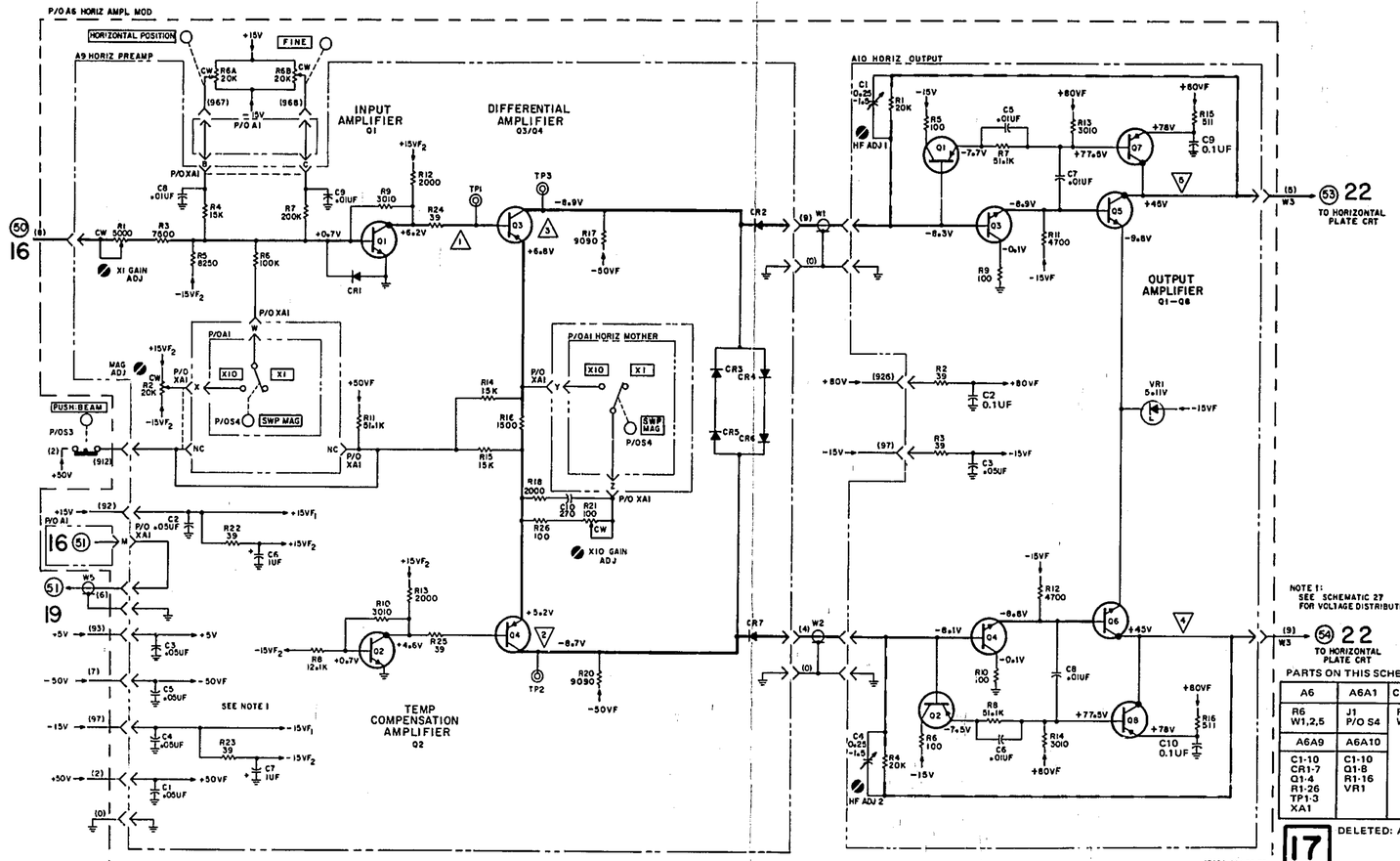
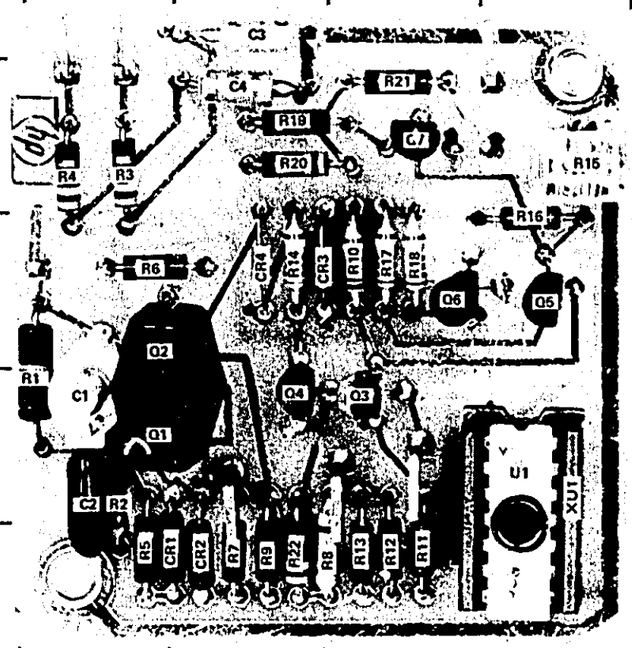


Figure 8-38.
Horizontal Preamplifier A6A9 and
Horizontal Output Amplifier A6A10 Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-4	Q1	B-4	R2	B-4	R10	D-3	R18	D-3
C2	B-4	Q2	B-3	R3	B-2	R11	D-5	R19	C-2
C3	C-1	Q3	D-4	R4	B-2	R12	D-5	R20	C-2
C4	C-2	Q4	C-4	R5	B-5	R13	D-5	R21	D-2
CR1	C-5	Q5	E-3	R6	B-3	R14	C-3	R22	C-5
CR2	C-5	Q6	D-3	R7	C-5	R15	E-2	U1	E-4
CR3	C-3	Q7	D-2	R8	D-5	R16	E-3	XU1	E-4
CR4	C-3	R1	B-4	R9	C-5	R17	D-3		

008-1701A-A-3

Figure 8-39. External Horizontal Amplifier, A9, Component Identification

Table 8-18. External Horizontal Amplifier Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A Set:
SINGLE ..... engaged
sweep display ..... EXT HORIZ INPUT

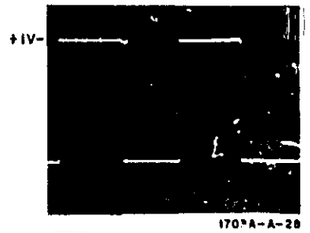
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
SINGLE ..... engaged
sweep display ..... EXT HORIZ INPUT

B. Connect CAL 1 VOLT to EXT HORIZ INPUT.

C. 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 on each waveform photograph.



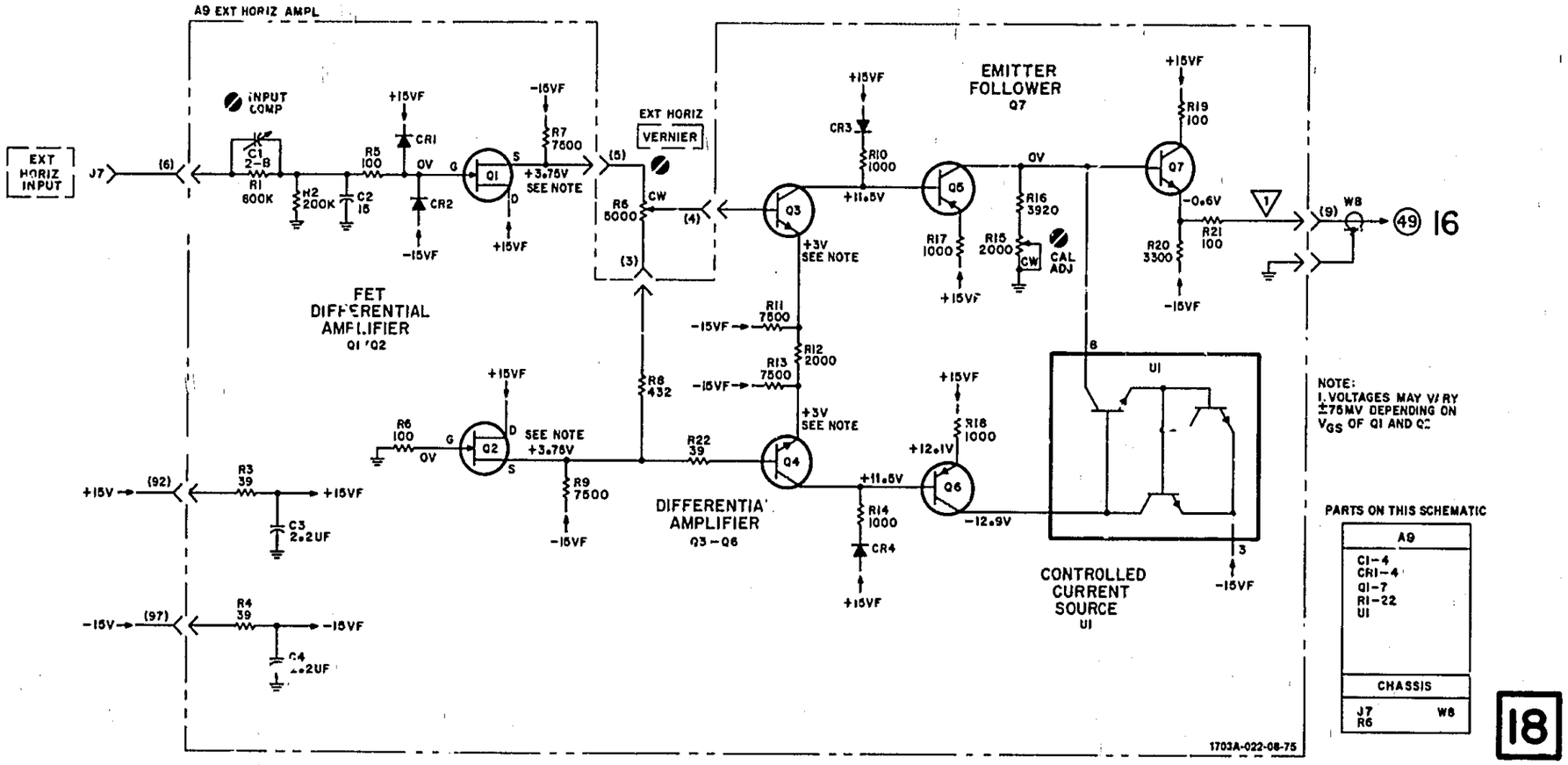
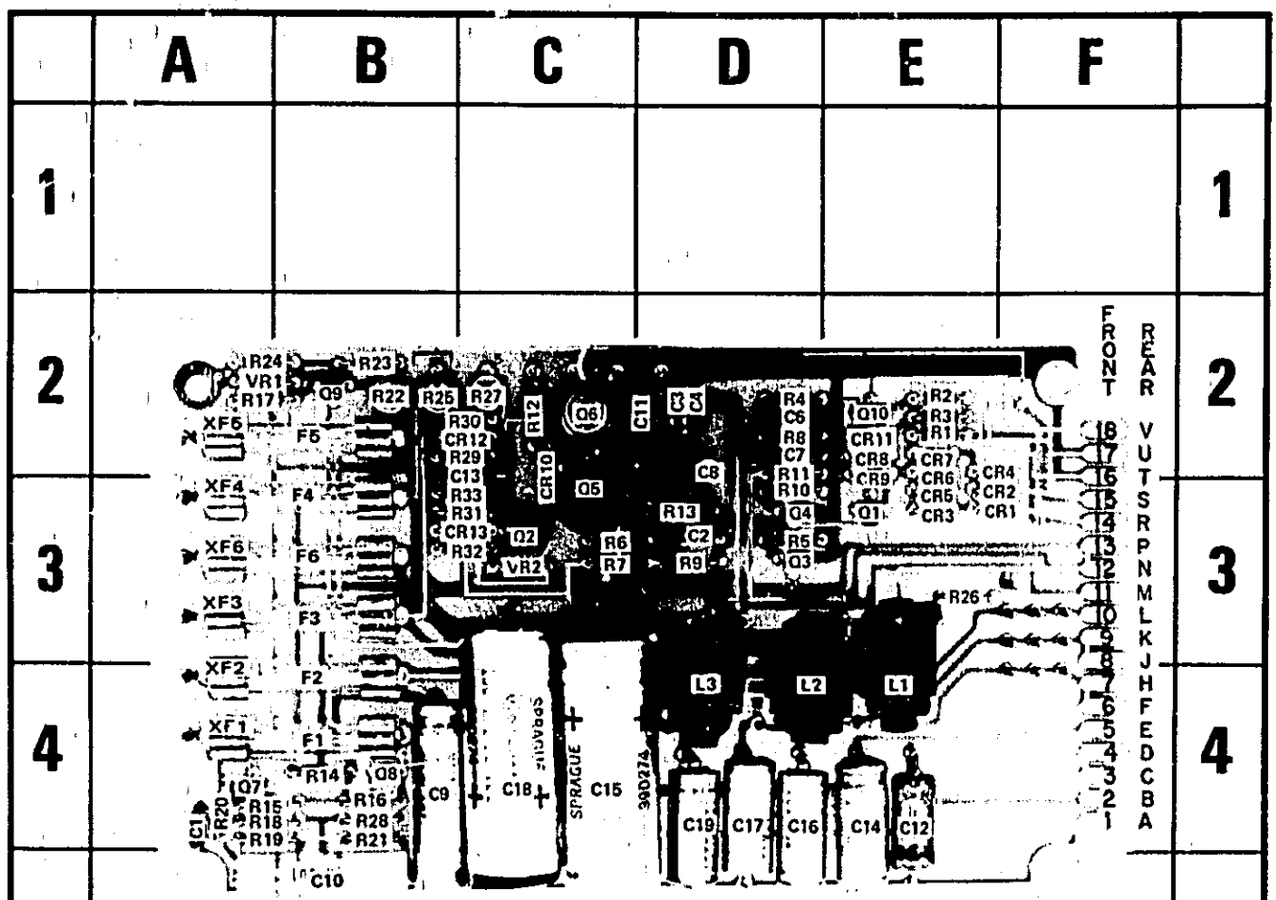


Figure 8-40.
External Horizontal Amplifier A9 Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	A-4	C14	E-4	CR7	E-2	F6	B-3	Q9	B-2	R11	D-2	R23	B-2	VR2	C-3
C2	D-3	C15	C-4	CR8	E-2	L1	E-4	Q10	E-2	R12	C-2	R24	A-2	XF1	A-4
C3	D-2	C16	D-4	CR9	E-3	L2	D-4	R1	E-2	R13	D-3	R25	B-2	XF2	A-4
C4	D-2	C17	D-4	CR10	C-2	L3	D-4	R2	E-2	R14	B-4	R26	E-3	XF3	A-3
C6	D-2	C18	C-4	CR11	E-2	Q1	E-3	R3	E-2	R15	A-4	R27	C-2	XF4	A-3
C7	D-2	C19	D-4	CR12	C-2	Q2	C-3	R4	D-2	R16	B-4	R28	B-4	XF5	A-2
C8	D-2	CR1	F-3	CR13	C-3	Q3	D-3	R5	D-3	R17	A-2	R29	C-2	XF6	A-3
C9	B-4	CR2	F-3	F1	B-4	Q4	D-3	R6	C-3	R18	A-4	R30	C-2		
C10	B-5	CR3	E-3	F2	B-4	Q5	C-3	R7	C-3	R19	A-4	R31	C-3		
C11	D-2	CR4	F-2	F3	B-3	Q6	C-2	R8	D-2	R20	A-4	R32	C-3		
C12	E-4	CR5	E-3	F4	B-3	Q7	A-4	R9	D-3	R21	B-4	R33	C-2		
C13	C-2	CR6	E-3	F5	B-2	Q8	B-4	R10	D-3	R22	B-2	VR1	A-2		

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

1703A-R-8

Figure 8-41. Gate, A4, Component Identification

Table 8-19. Gate Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

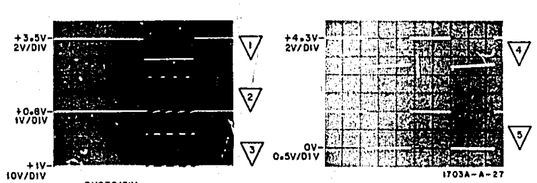
A. Set:
SINGLE ..... engaged
INTENSITY ..... normal

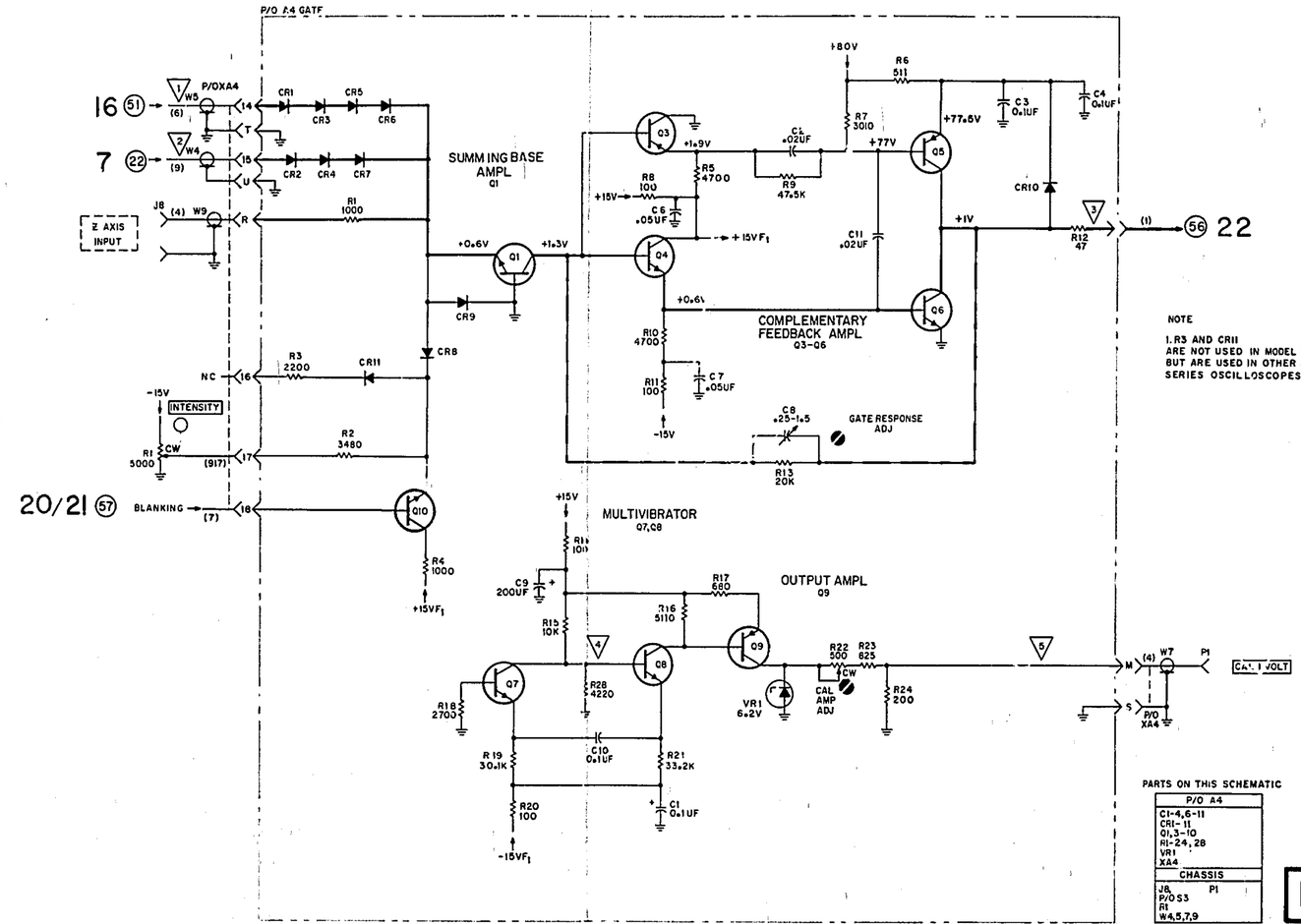
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
DISPLAY ..... CHOP
main AUTO/NORM ..... AUTO
INTENSITY ..... normal
main TIME/DIV ..... .5 uSEC

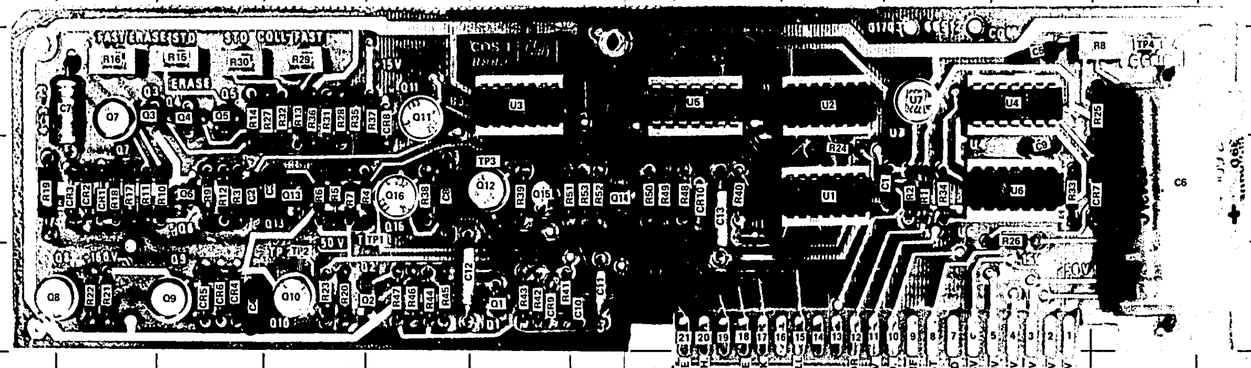
B. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below on each waveform photograph.





19

Figure 8-42.
Gate A4 Schematic



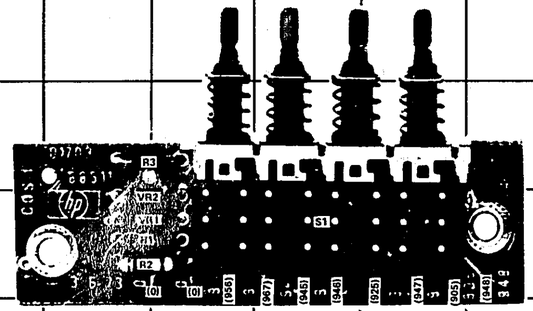
CIRCUIT BOARDS HAVE PLATED THROUGH COMPONENT HOLES. THIS PERMITS SOLDERING FROM EITHER SIDE OF THE BOARD.

A8

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	J-3	C11	G-4	CR8	E-2	Q8	A-4	R2	J-3	R12	C-3	R22	B-4	R32	D-2	R43	F-4	TP1	E-3
C2	C-3	C12	E-4	CR9	F-4	Q9	C-4	R3	C-3	R13	D-2	R23	D-4	R33	K-3	R44	E-4	TP2	D-4
C3	D-3	C13	H-3	CR10	H-3	Q10	D-4	R4	D-3	R14	C-2	R24	I-3	R34	J-3	R45	E-4	TP3	F-3
C4	C-4	CR1	B-3	Q1	F 4	Q11	E-2	R5	D-3	R15	C-2	R25	L-2	R35	D-2	R46	E-4	TP4	L-2
C5	K-2	CR2	B-3	Q2	D-4	Q12	F-3	R6	D-3	R16	B-2	R26	K-4	R36	D-2	R47	E-4	U1	I-3
C6	L-3	CR3	B-3	Q3	B-2	Q13	D-3	R7	D-3	R17	B-3	R27	D-2	R37	E-2	R48	H-3	U2	I-2
C7	B-2	CR4	C-4	Q4	C-2	Q14	G-3	R8	L-2	R18	B-3	R28	D-2	R38	E-3	R49	G-3	U3	F-2
C8	E-3	CR5	C-4	Q5	C-2	Q15	F-3	R9	C-3	R19	A-3	R29	D-2	R39	F-3	R50	G-3	U4	K-2
C9	K-3	CR6	C-4	Q6	C-3	Q16	E-3	R10	C-3	R20	D-4	R30	C-2	R40	H-3	R51	G-3	U5	H-2
C10	G-4	CR7	K-3	Q7	B-2	R1	J-3	R11	B-3	R21	B-4	R31	D-2	R41	F-4	R52	G-3	U6	K-3
														R42	F-4	R53	G-3	U7	J-2

2-P-001

Figure 8-43 Storage Circuit, A8, Component Identification



A6A11

CIRCUIT BOARDS HAVE PLATED THROUGH COMPONENT HOLES. THIS PERMITS SOLDERING FROM EITHER SIDE OF THE BOARD.

REF DESIG	GRID LOC
R1	B-4
R2	B-4
R3	B-3
S1	D-4
VR1	B-4
VR2	B-4

2-P-002

Figure 8-44. Storage Switch A6A11, Component Identification

Table 8-20 and 8-21. Storage Circuit Measurement Conditions and Waveforms

WAVEFORM TEST POINT	STD	FAST	CONV	STORE	ERASE
1	+50V level	+50V dc level	+50V dc level	 Frequency depends on setting of store time pot R7	No change from previous mode selected.
2	Level depends on setting of Std Erase pot R15  Frequency depends on setting of Persistence pot 8.	Level depends on setting of Fast Erase pot R16 	−50V dc level	+2.4V dc level	Level depends on setting of Std or Fast Erase pots.  Occurs in std or Fast mode only, otherwise no change from previous mode selected
3	+21V dc level approx.	+74V dc level approx.	+21V dc or +74V dc level approx. Depends on whether Std or Fast was used last.	+21V dc or +74V dc level approx. Depends on whether Std or Fast was used last.	Occurs in Std or Fast Mode only, otherwise no change from previous mode selected.  Level depends on whether Std or Fast was used last.
4	−1.4V dc level	−1.4V dc level	−1.4V dc level	+0.8V dc level	+0.8V dc level in STD or FAST only. Otherwise no change from previous mode selected.

Table 8-20 and 8-21. Storage Circuit Measurement Conditions and Waveforms (Cont'd)

WAVEFORM TEST POINT	STD	FAST	CONV	STORE	ERASE
5	 Frequency depends on PERSISTENCE setting.	Same as STD mode.	+4.3V dc level	 Frequency depends on STORE TIME setting.	No change from mode selected.
6	+0.8V dc level	+0.8V dc level	+0.8V dc level	+0.8V dc level	 Occurs in Std or Fast mode only. Otherwise no change from previous mode selected.

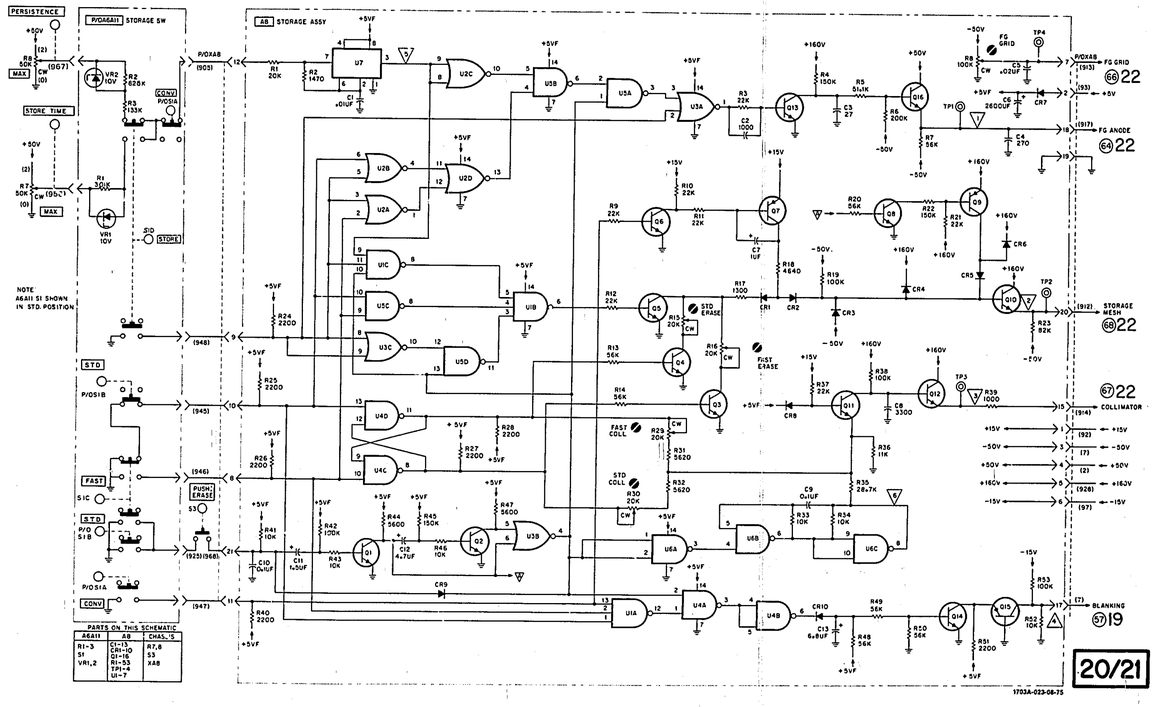
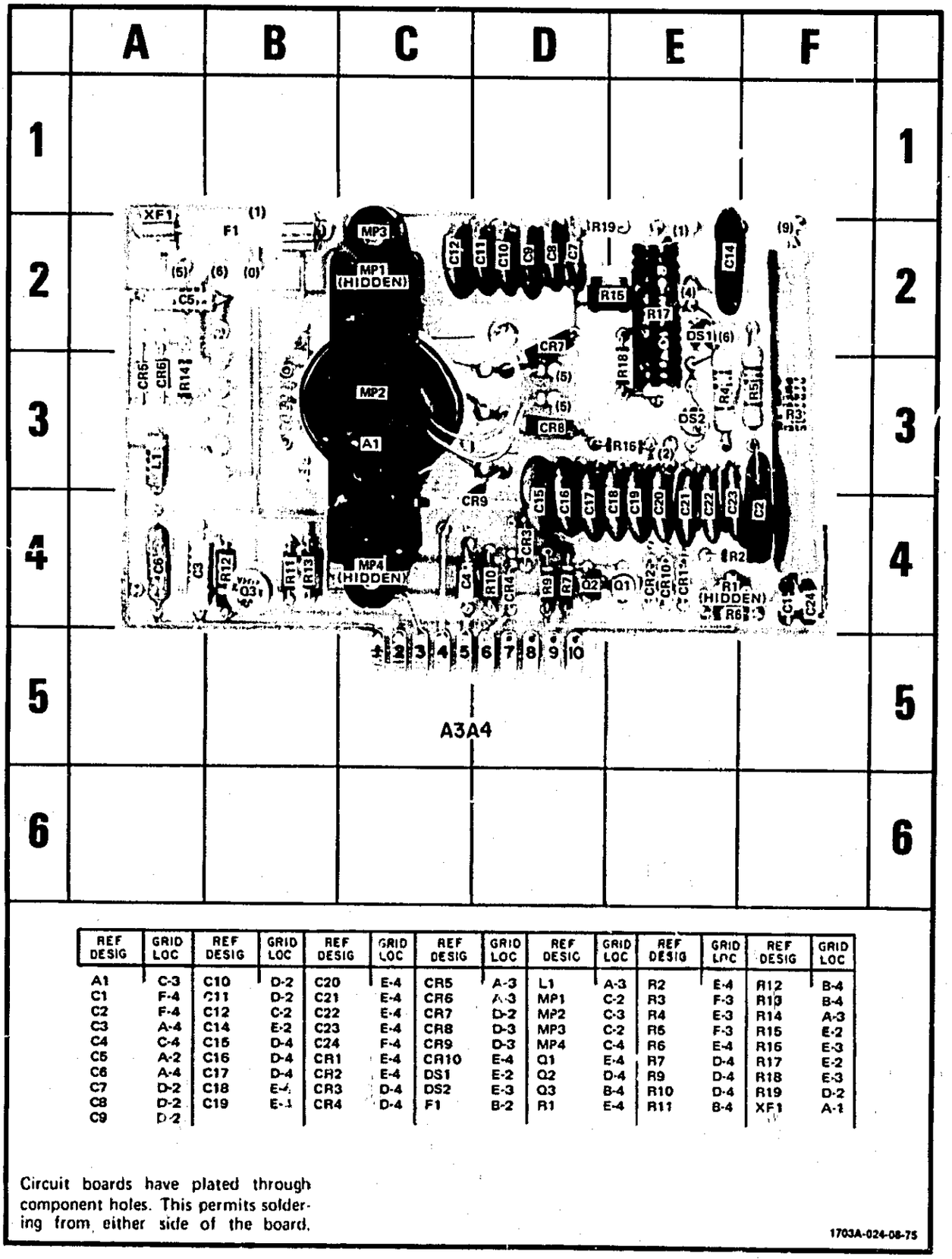


Figure 8-45.
Storage Circuit A8 Schematic
8-49



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A1	C-3	C10	D-2	C20	E-4	CR5	A-3	L1	A-3	R2	E-4	R12	B-4
C1	F-4	C11	D-2	C21	E-4	CR6	A-3	MP1	C-2	R3	F-3	R13	B-4
C2	F-4	C12	C-2	C22	E-4	CR7	D-2	MP2	C-3	R4	E-3	R14	A-3
C3	A-4	C14	E-2	C23	E-4	CR8	D-3	MP3	C-2	R5	F-3	R15	E-2
C4	C-4	C15	D-4	C24	F-4	CR9	D-3	MP4	C-4	R6	E-4	R16	E-3
C5	A-2	C16	D-4	CR1	E-4	CR10	E-4	Q1	E-4	R7	D-4	R17	E-2
C6	A-4	C17	D-4	CR2	E-4	DS1	E-2	Q2	D-4	R9	D-4	R18	E-3
C7	D-2	C18	E-4	CR3	D-4	DS2	E-3	Q3	B-4	R10	D-4	R19	D-2
C8	D-2	C19	E-4	CR4	D-4	F1	B-2	R1	E-4	R11	B-4	XF1	A-1
C9	D-2												

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

1703A-024-08-75

Figure 8-46. High Voltage Oscillator A3A4, Component Identification

Table 8-22. High Voltage Oscillator Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

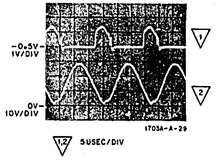
A. Set:
POWER ..... ON
INTENSITY ..... ccw

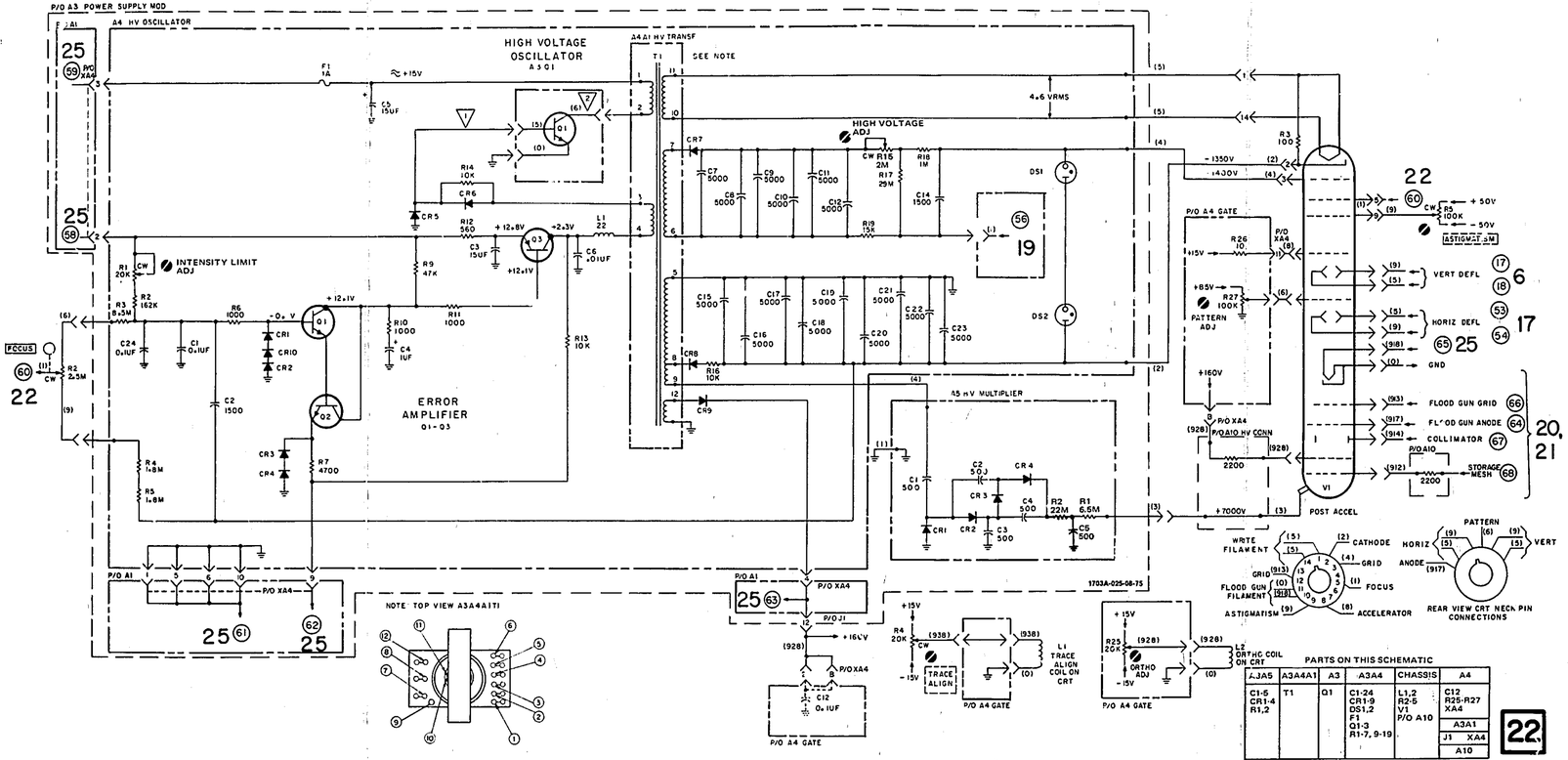
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
POWER ..... ON
INTENSITY ..... ccw

B. 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 on each waveform photograph.



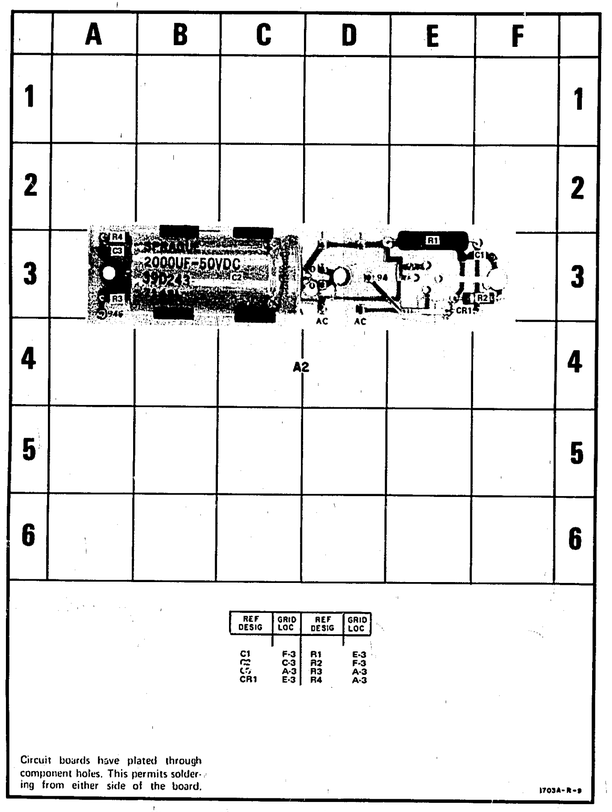


PARTS ON THIS SCHEMATIC

A3A5	A3A4A1	A3	A3A4	CHASSIS	A4
C1-5 CR1-4 R1,2	T1	Q1	C1-24 CR1-9 DS1,2 F1 Q1-3 R1-7, 9-19	L1,2 R2-5 V1 P/O A10	C12 R25-R27 XA4 A3A1 J1 XA4 A10

DELETED: A3A4C13, A3A4R8

Figure 8-47.
High Voltage Oscillator A3A4 Schematic

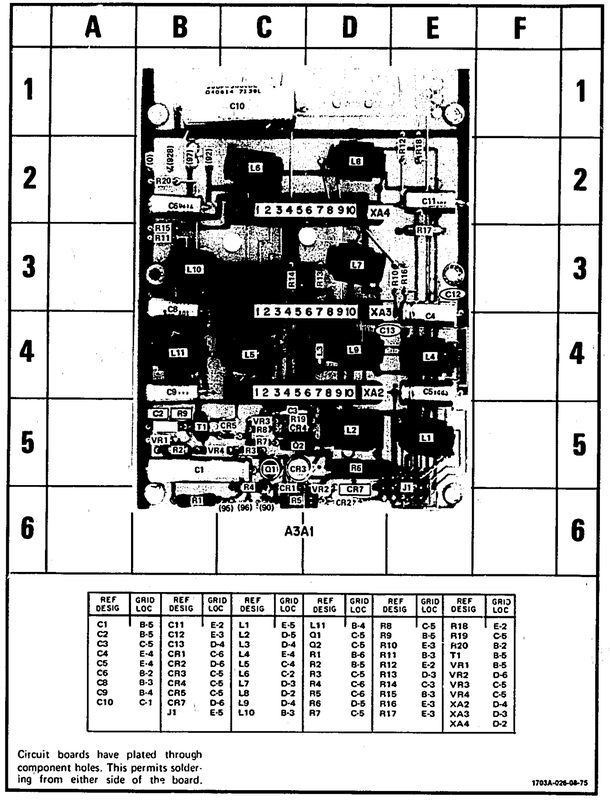


REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	F-3	R1	E-3
C2	C-3	R2	F-3
C3	A-3	R3	A-3
CR1	E-3	R4	A-3

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

1703A-R-9

Figure 8-48. Line Rectifier, A2, Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-5	C11	E-2	L1	E-5	L11	B-4	R8	C-5	R18	E-2
C2	B-5	C12	E-3	L2	D-5	Q1	C-5	R9	B-5	R19	C-5
C3	C-5	C13	D-4	L3	D-4	Q2	C-5	R10	E-3	R20	B-2
C4	E-4	CR1	C-6	L4	E-4	R1	B-5	R11	B-3	T1	B-5
C5	E-4	CR2	D-6	L5	C-4	R2	B-5	R12	E-2	VR1	B-5
C6	B-2	CR3	C-5	L6	C-2	R3	C-5	R13	D-3	VR2	D-6
C8	B-3	CR4	C-5	L7	D-3	R4	C-6	R14	C-3	VR3	C-5
C9	B-4	CR5	C-5	L8	D-2	R5	C-6	R15	B-3	VR4	C-5
C10	C-1	CR7	D-6	L9	D-4	R6	D-5	R16	E-3	XA2	D-4
		J1	E-5	L10	B-3	R7	C-5	R17	E-3	XA3	D-3
										XA4	D-2

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

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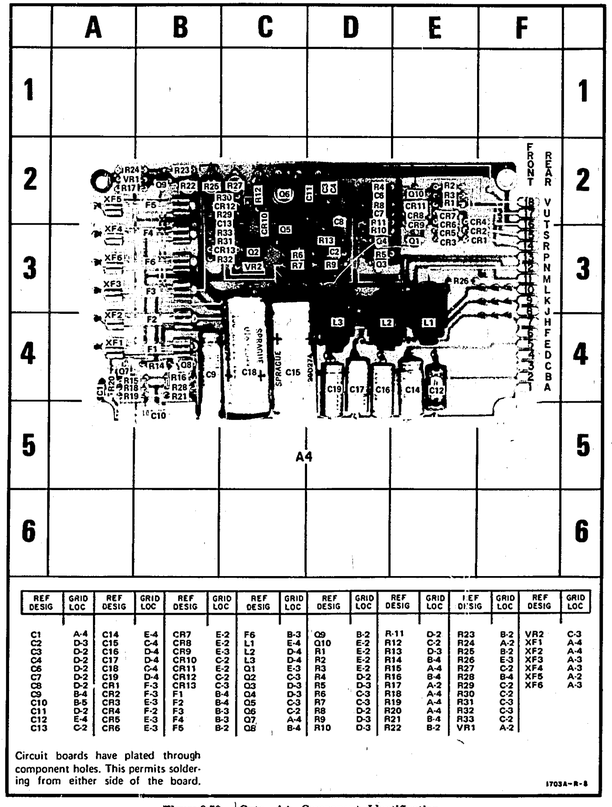
Figure 8-49. Low Voltage Mother Board, A3A1, Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	A-4	C14	E-4	CR7	E-2	F6	B-3	Q9	B-2	R-11	D-2	R23	B-2	VR2	C-3
C2	D-3	C15	C-4	CR8	E-2	L1	E-4	Q10	E-2	R12	C-2	R24	A-2	XF1	A-4
C3	D-2	C16	D-4	CR9	E-2	L2	D-4	R1	E-2	R13	D-3	R25	B-2	XF2	A-4
C4	D-2	C17	D-4	CR10	C-2	L3	D-4	R2	E-2	R14	B-4	R26	E-3	XF3	A-3
C5	D-2	C18	D-4	CR11	E-2	Q1	E-3	R3	E-2	R15	B-4	R27	E-2	XF4	A-3
C6	D-2	C19	D-4	CR12	C-2	Q2	C-3	R4	D-2	R16	B-4	R28	B-4	XF5	A-2
C7	D-2	CR1	F-3	CR13	C-3	Q3	D-3	R5	D-3	R17	A-2	R29	A-2	XF6	A-3
C8	D-2	CR2	F-3	F1	B-4	Q4	D-3	R6	C-3	R18	A-4	R30	C-2		
C9	B-4	CR3	E-3	F2	B-4	Q5	C-3	R7	C-3	R19	A-4	R31	C-3		
C10	B-5	CR4	F-2	F3	B-3	Q6	C-2	R8	D-2	R20	A-4	R32	C-3		
C11	D-2	CR5	E-3	F4	B-3	Q7	A-4	R9	D-3	R21	B-4	R33	C-2		
C12	E-4	CR6	E-3	F5	B-2	Q8	B-4	R10	D-3	R22	B-2	VR1	A-2		
C13	C-2														

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

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Figure 8-50. Gate, A4, Component Identification

Table 8-23. Low Voltage Power Supply Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
POWER MODE..... AC LINE
POWER ..... ON

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

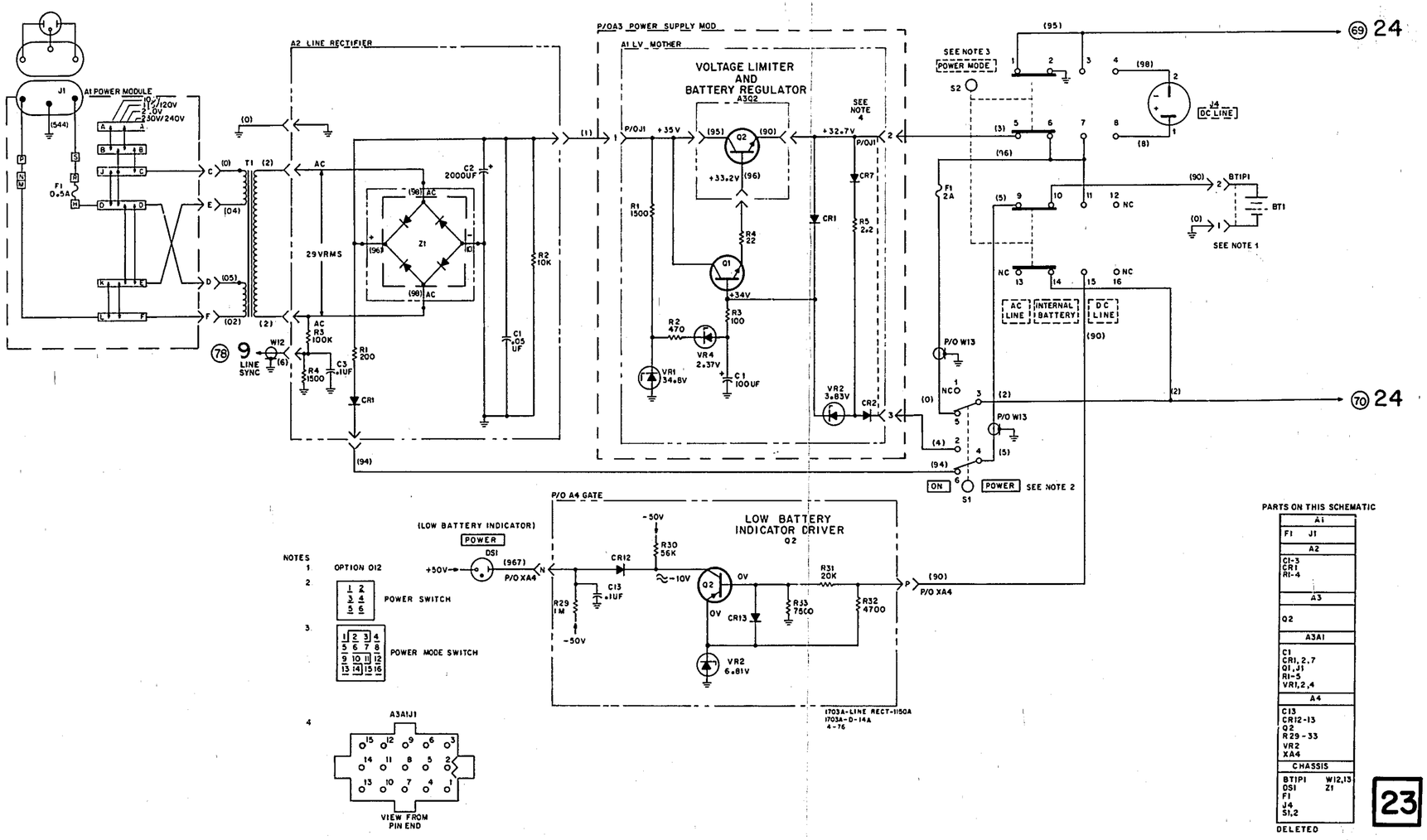
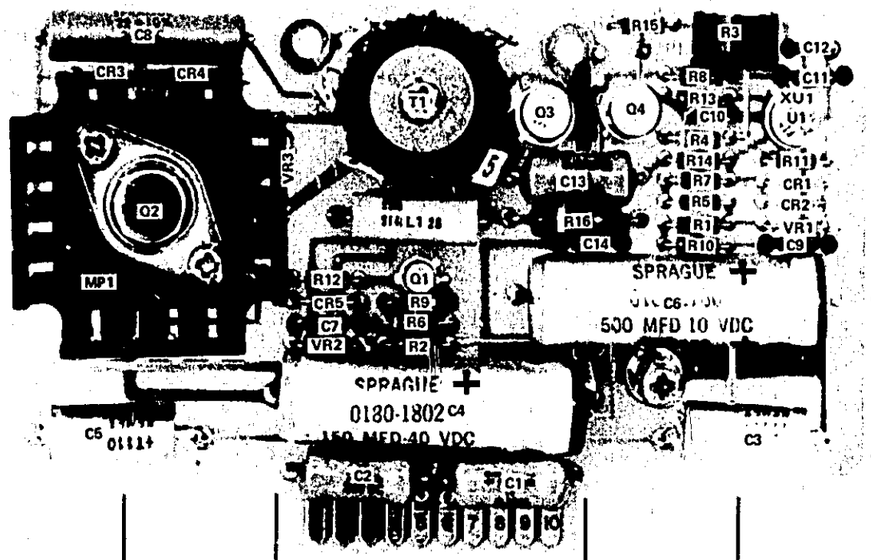


Figure 8-51.
Power Input and Line Rectifier



A3A2

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-4	C9	F-2	CR3	A-1	Q3	D-1	R7	E-2	R15	E-1
C2	C-4	C10	E-1	CR4	B-1	Q4	E-1	R8	E-1	R16	D-2
C3	F-3	C11	F-1	CR5	C-3	R1	E-2	R9	C-3	U1	F-1
C4	D-3	C12	F-1	E1	C-5	R2	C-3	R10	E-2	T1	C-1
C5	A-3	C13	D-2	L1	C-2	R3	E-1	R11	F-2	VR1	F-2
C6	E-3	C14	E-2	MP1	A-2	R4	E-1	R12	C-2	VR2	C-3
C7	C-3	CR1	F-2	Q1	C-2	R5	E-2	R13	E-1	VR3	C-2
C8	B-1	CR2	F-2	Q2	B-2	R6	C-3	R14	E-2	XU1	F-1

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

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Figure 8-52. Low Voltage Connector, A3A2, Component Identification

Table 8-24. Low Voltage Converter Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

A. Set:
POWER ..... ON
POWER MODE ..... DC LINE

B. Connect:
DC LINE ..... 36 Vdc

Measure (1)

C. Connect:
DC LINE ..... 24 Vdc

Measure (2)

D. Connect:
DC LINE ..... 11.5 Vdc

Measure (3)

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

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
POWER ..... ON
POWER MODE ..... DC LINE

B. Connect:
DC LINE ..... 36 Vdc

Measure ▽1

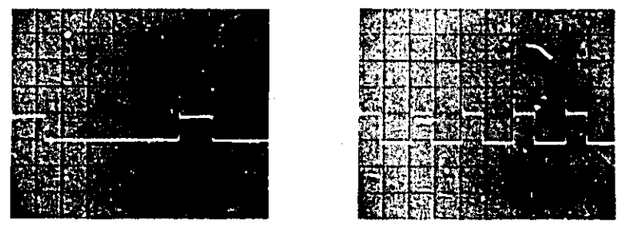
C. Connect:
DC LINE ..... 24 Vdc

Measure ▽2

D. Connect:
DC LINE ..... 11.5 Vdc

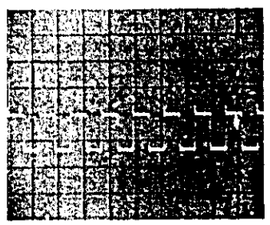
Measure ▽3

E. 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 on each waveform photograph.



▽1 50V/DIV 10USEC/DIV

▽2 50V/DIV 10USEC/DIV



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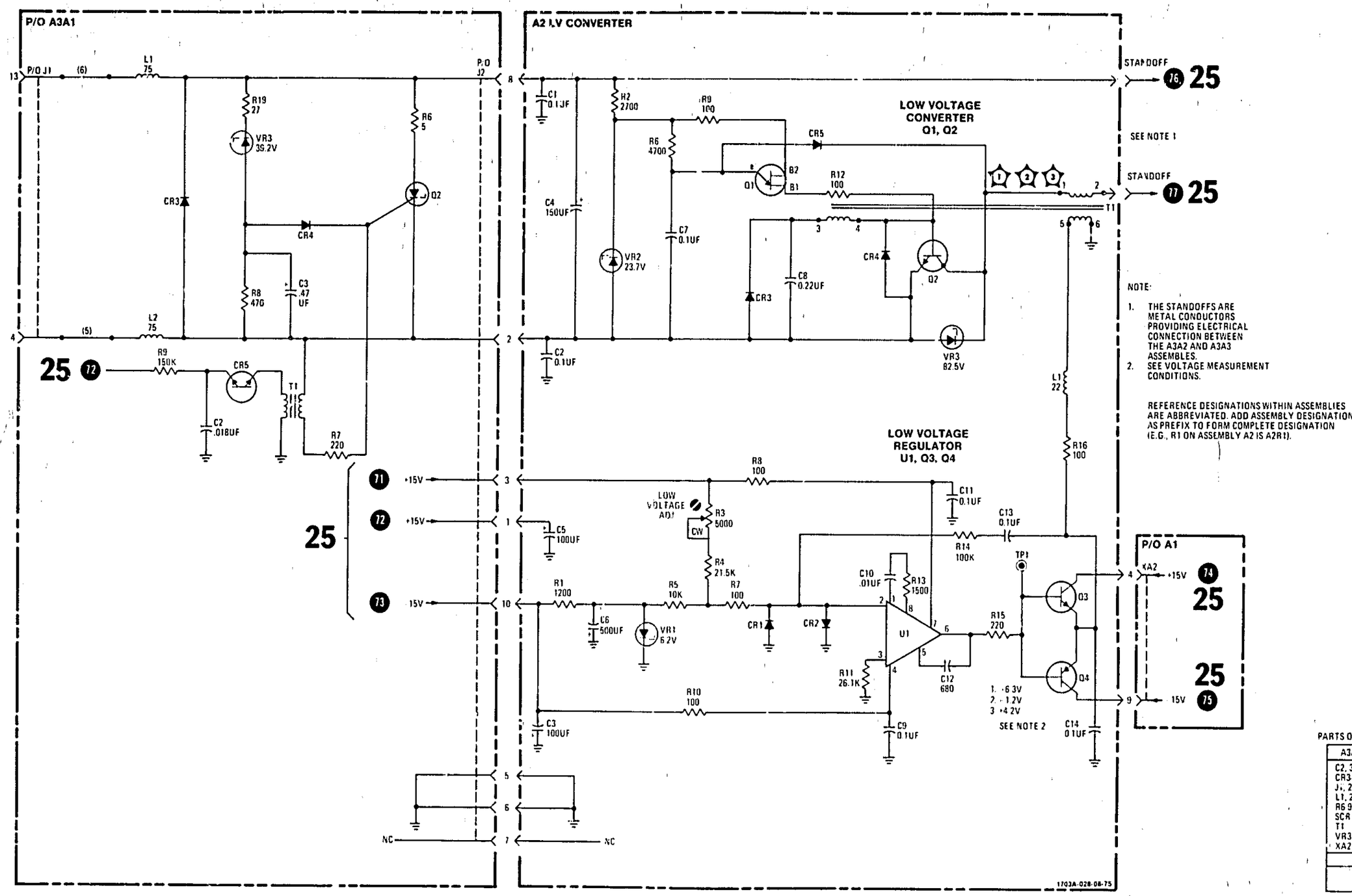
▽3 50V/DIV 10USEC/DIV



PARTS ON THIS SCHEMATIC

A3A1	A3A2
C2, 3	C1-14
CR3-5, 7	CR1-5
J1, 2	L1
L1, 2	Q1-4
R6-9, 19	R1-16
SCR1	T1
T1	TP1
VR3	U1
XA2	VR1-3
CHASSIS	

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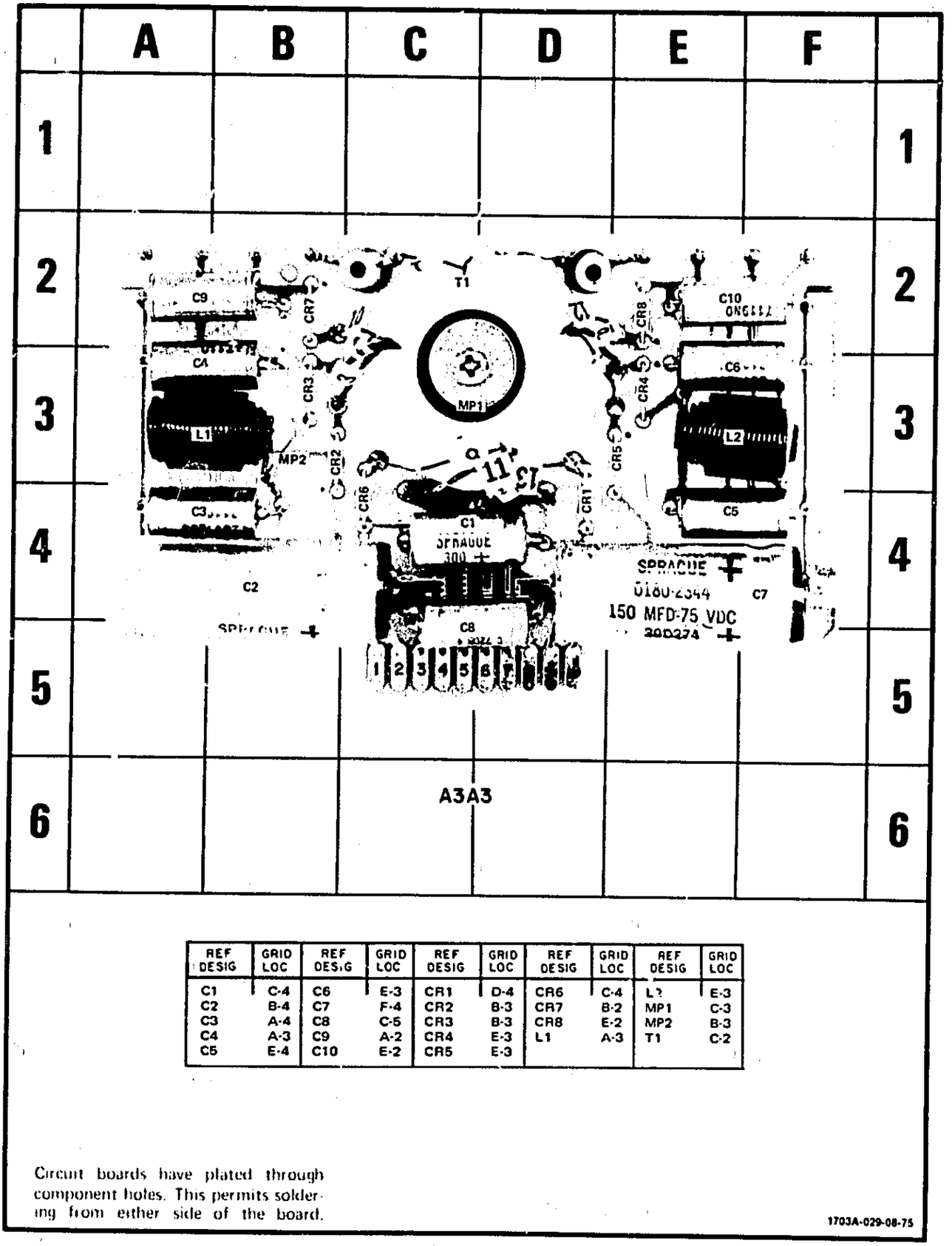
Figure 8-53.
Low Voltage Converter, A3A4, Schematic



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-4	C6	E-3	CR1	D-4	CR6	C-4	L2	E-3
C2	B-4	C7	F-4	CR2	B-3	CR7	B-2	MP1	C-3
C3	A-4	C8	C-5	CR3	B-3	CR8	E-2	MP2	B-3
C4	A-3	C9	A-2	CR4	E-3	L1	A-3	T1	C-2
C5	E-4	C10	E-2	CR5	E-3				

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

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Figure 8-54. Line Rectifier and Filter, A3A3, Component Identification

Table 8-25. Gate Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

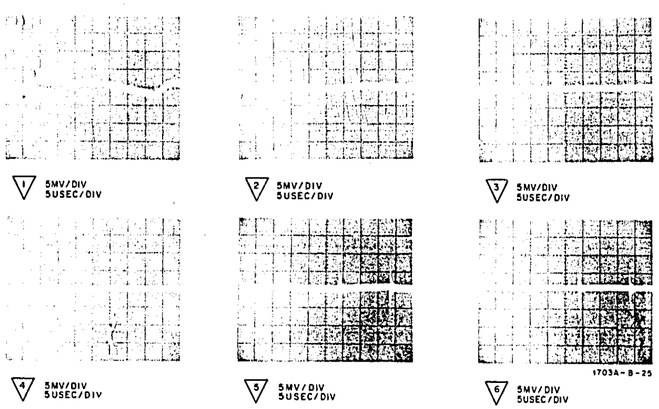
A. Set:
POWER ..... ON

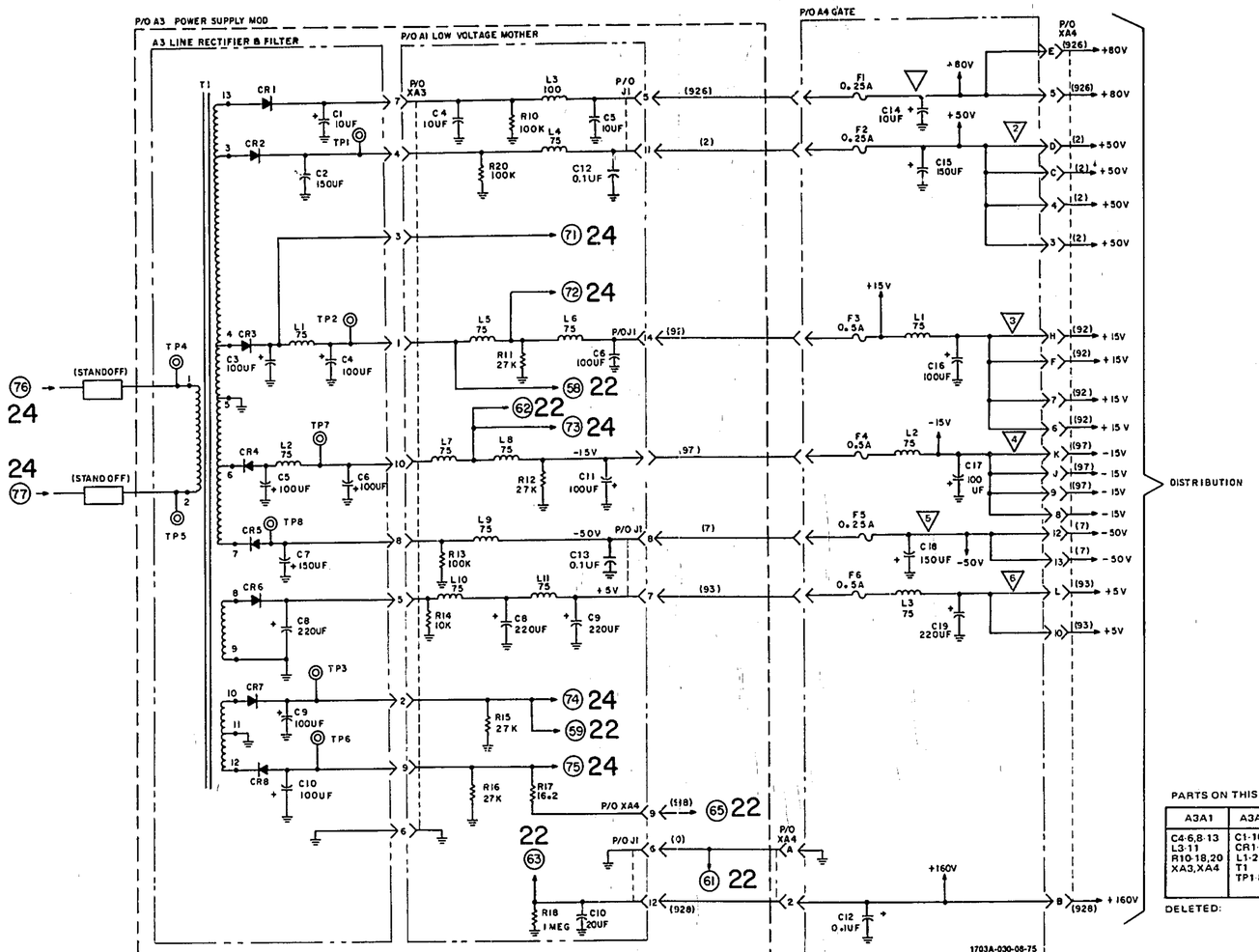
B. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

A. Set:
POWER ..... ON
SINGLE ..... engaged

B. 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 on each waveform photograph.





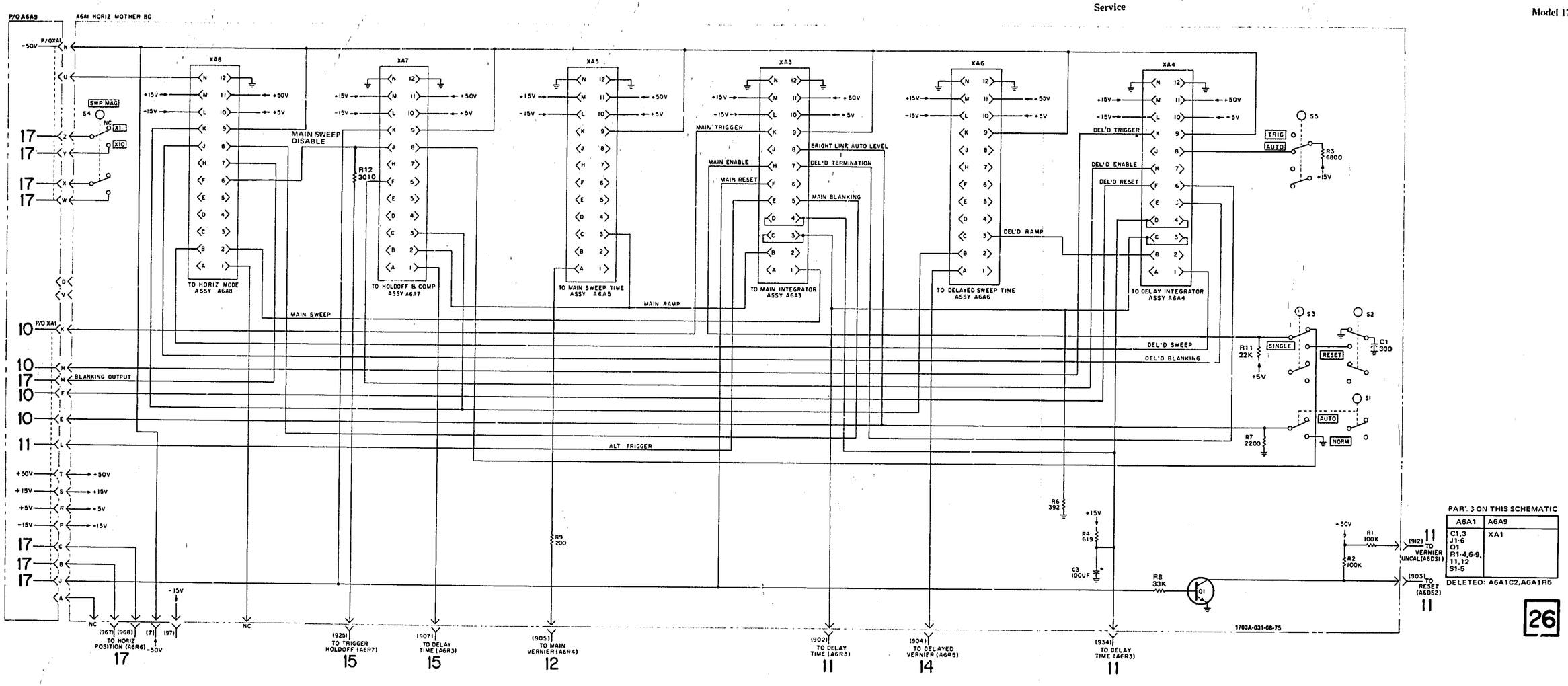
PARTS ON THIS SCHEMATIC

A3A1	A3A3	A4
C4-6,8-13 L3-11 R10-18,20 XA3,XA4	C1-10 CR1-8 L1-2 T1 TP1-8	C14-19 F1-6 L1-3 XA4

DELETED:

25

Figure 8-55.
Line Rectifier and Filter A3A3 Schematic



PARTS ON THIS SCHEMATIC

A6A1	A6A9
C1,3 J1-6 Q1 R1-4,6-9, 11,12 S1-5	XA1

DELETED: A6A1C2, A6A1R5

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Figure 8-56. Horizontal Mother Board, A6A1, Schematic

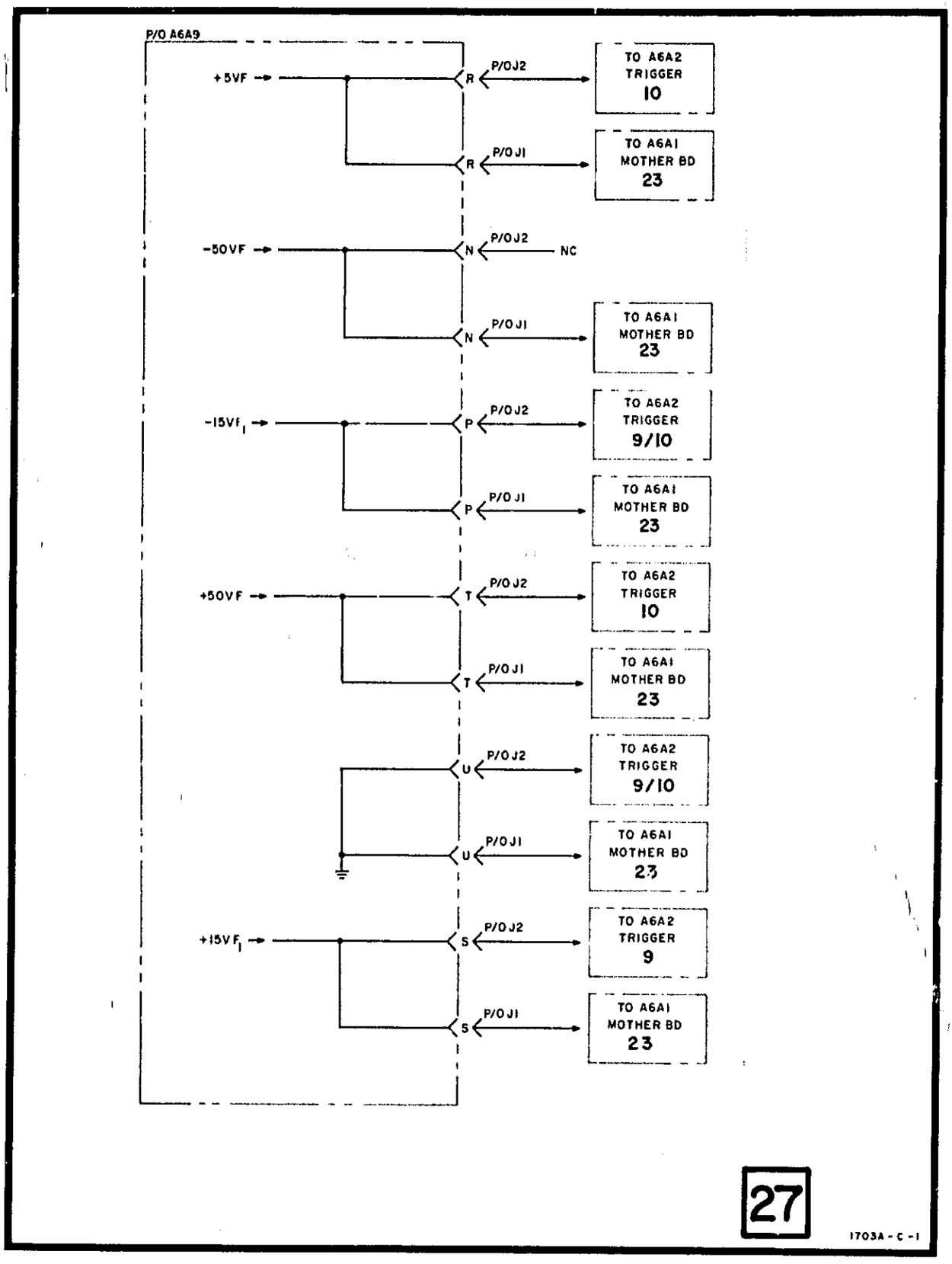

Figure 8-57. Horizontal Preamplifier, A6A9, Voltage Distributor Schematic