Errata

Title & Document Type: **1205A/B Dual Trace Oscilloscope Operating and Service Manual**

Manual Part Number: **01205-90001**

Revision Date: **July 1970**

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HP References in this Manual

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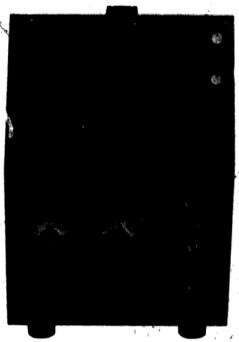
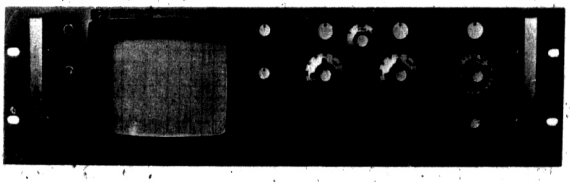
Agilent Technologies

OPERATING AND SERVICE MANUAL

DUAL TRACE OSCILLOSCOPE

1205A/B





HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

MODEL 1205A/B
DUAL TRACE OSCILLOSCOPE

SERIALS PREFIXED: 930–

Refer to Section VII for instruments with other Serial Prefixes.

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

PRINTED: JUL 1970

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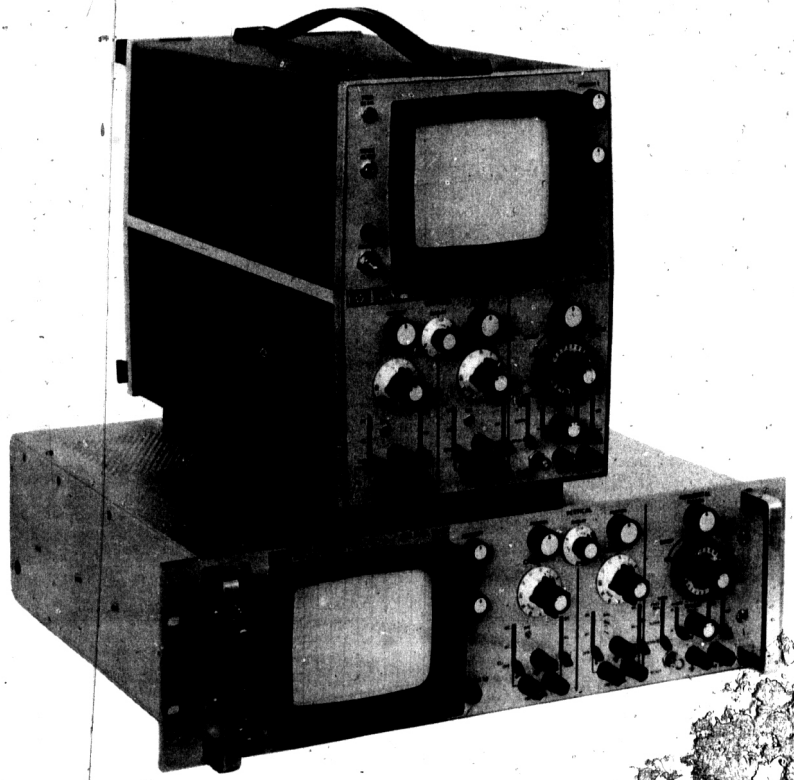


Figure 1-1. Model 1205A/B Dual Trace Oscilloscope

SECTION I

GENERAL INFORMATION

1-1 INTRODUCTION.

1-2. This section contains complete instrument specifications, a description of features, warranty information, and data for manual and instrument identification.

1-3. INSTRUMENT DESCRIPTION.

1-4. In the following paragraphs, key features of the instruments are described, both in general and according to circuit location.

1-5. GENERAL.

1-6. Hewlett-Packard Models 1205A and 1205B Dual Trace Oscilloscopes (shown in Figure 1-1) are electrically identical, general purpose instruments. Model 1205A is a cabinet version with a built-in tilt stand, carrying handle on top, and feet mounted on both bottom and rear for either bench or upright operation. Designed primarily for rack mounting, the Model 1205B uses only 5-1/4 vertical inches of rack space and has front-panel handles for portability.

1-7. Since all circuitry is solid state, power consumption is only about 45 watts, and a cooling fan is not needed. Complete specifications are given in Table 1-1.

1-8. VERTICAL CIRCUITS.

1-9. Each instrument contains two identical vertical amplifiers for single or dual channel operation. Either single-ended or differential signals can be applied with a choice of direct or capacitive coupling. Common-mode rejection for differential input signals is from 50 dB at 5 mV/div to 30 dB at 20 V/div. Maximum safe vertical input potential (dc plus peak ac) is 400 volts.

1-10. Twelve calibrated switch settings provide a deflection factor range of 5 mV/div to 20 V/div in a 1, 2, 5 sequence. A vertical vernier permits continuous adjustment between calibrated steps and extends the least sensitive deflection factor setting to 50 V/div.

1-11. With the dual trace feature, displays can be obtained of either channel alone, both channels together or one channel versus the other for X-Y comparison. Simultaneous display of two signals is possible in either a chop or alternate mode of operation. During chop, channels are switched at about a 100 kHz rate during each sweep. In the alternate mode of operation, the signal applied to each channel is displayed on alternate sweeps. Sweep is triggered by the channel A signal in the A, ALT, and CHOP modes and by the channel B signal in the B mode when using an internal trigger source. In X-Y operation, the signal connected to channel A is applied to the vertical deflection plates, and the channel B signal is applied to the horizontal deflection plates. Since phase shift between channels is less than 1 degree up to 100 kHz, phase differences between the two signals can be measured accurately.

1-12. HORIZONTAL CIRCUITS.

1-13. Vertical input signals can be displayed either versus an internally generated time base or an externally applied horizontal signal. Horizontal amplifier bandwidth is dc to 300 kHz (low frequency cut-off is 1.6 Hz when ac coupled), and maximum safe input is ±350V, dc plus peak ac. Four calibrated sensitivity settings provide a deflection factor range of 0.1 V/div to 1.0 V/div. A vernier permits continuous adjustment between steps and can be used to extend the minimum sensitivity to 2.5 V/div.

1-14. When the time base generator is used, sweep can be synchronized to a vertical display signal, a power-line signal or an external signal up to 1 MHz. Trigger level, slope, coupling and sweep mode are also selectable.

1-15. Sweep speed settings from 1 usec/div to 5 sec/div are available in twenty-one calibrated steps in a 1, 2, 5 sequence. A vernier control provides continuous adjustment between steps and extends the slowest sweep speed to at least 12.5 sec/div. Using the direct readout sweep magnifier, fastest sweep speed can be expanded to 0.1 usec/div.

1-16. By operating in automatic, a bright time base is displayed even in the absence of a trigger input signal. When a trigger signal above 50 Hz is applied, it overrides the automatic circuit and controls the sweep. Free-run operation provides a non-synchronized baseline that is not affected by incoming trigger signals.

1-17. Single sweep operation can be used with any type of display and is particularly useful for viewing or photographing transient waveforms. One sweep is displayed, and then the sweep circuits must be manually reset to operate again. By pressing a pushbutton, the circuits are immediately reset, and the time delay needed for slow sweep to end is eliminated.

1-18. CATHODE-RAY TUBE.

1-19. Both instruments use a mono-accelerator CRT with a non-glare, rectangular faceplate. An internal

graticule is located on the same plane as the display to eliminate parallax errors. The tube has a 3000V accelerating potential, identical vertical and horizontal deflection factors, and eight-vertical by ten-horizontal divisions (one division equals one centimeter) of display.

1-20. A type P31 phosphor is standard, however, other types are optional at no extra cost. Special graticules, no graticule, or external graticules are also available by special order. Refer to Section VII for further information about optional and special order modifications.

NOTE

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

1-21. WARRANTY.

1-22. This instrument is certified and warranted as stated on the inside front cover of this manual. The CRT, however, is covered by a separate warranty located at the rear of the manual. Should the CRT fail within the time specified in the warranty, fill out the failure report form on the reverse side of the warranty statement and return it with the CRT.

1-23. MANUAL IDENTIFICATION AND CHANGES.

1-24. This manual applies directly to Model 1205A and Model 1205B instruments with a serial prefix as shown on the title page. The serial prefix is the first section of the two-section (000-00000) serial number located on a plate at the rear of the instrument. For instruments with a serial prefix other than the one on the title page, refer to either an enclosed Manual Changes sheet or to Section VII for information necessary to make this manual correspond to the instrument.

1-25. Manual printing errors are called Errata and are corrected on an enclosed Manual Changes sheet (if any). Refer any questions regarding the instrument, manual or change sheet to the nearest HP Sales/Service Office listed at the rear of this manual. Be sure to identify the instrument by both model and complete serial number in all correspondence.

1-26. SCOPE OF MANUAL.

1-27. This manual contains complete operating and service information for HP Models 1205A and 1205B Dual Trace Oscilloscopes. All aspects of the instruments are covered in eight sections, each of which can be referred to for specific data by use of the table of contents. Schematics are located at the rear of the manual on fold-out pages to permit reference to the text, and an overall block diagram is in Section IV.

Table 1-1. Specifications

VERTICAL AMPLIFIERS

DEFLECTION FACTOR:

Ranges: From 5 mV/div to 20 V/div (12 positions) 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 50 V/div.

BANDWIDTH: Dc to 500 kHz with a maximum risetime of 0.7 usec. 2 Hz to 500 kHz when ac coupled.

INPUT: Differential or single-ended on all ranges, selectable by front-panel control.

COMMON MODE:

Frequency: Dc to 10 kHz on all ranges.
Rejection Ratio: At least 50 dB with dc input coupling on 5 mV/div to 0.2 V/div ranges. CMRR is at least 30 dB on the 0.5 V/div to 20 V/div ranges.
Signal maximum: ±3V (dc + pk ac) on 5 mV/div to 0.2 V/div ranges; ±300V (dc + pk ac) on all other ranges.

INPUT COUPLING: Front-panel selection of DC, AC, or OFF for both + and − inputs.

INPUT RC: 1 megohm shunted by 45 pF; constant on all ranges.

MAXIMUM INPUT: ±400V (dc + pk ac).

DISPLAY: Channel A. Channel B. Channels A and B (either Chop or Alternate). Channels A and B vs. horizontal input (Chop only). Channel A vs. B (A-vertical, B-horizontal). Chop frequency is approximately 100 kHz.

INTERNAL TRIGGER: By channel A signal for A, Chop, and Alternate displays. Channel B signal for B display.

ISOLATION: Greater than 80 dB between channels at 500 kHz with input connectors shielded.

PHASE SHIFT: (For Channel A vs. B) Less than 1° to 100 kHz (Verniers in calibrated position).

TIME BASE

SWEEP:

Ranges: From 1 usec/div to 5 sec/div (21 positions) in 1, 2, 5 sequence. ±3% accuracy with Vernier in calibrated position.
Vernier: Continuously variable between ranges: extends slowest sweep to at least 12.5 sec/div.

X10 MAGNIFIER: indicates magnified sweep time/division directly with ±5% accuracy.

AUTOMATIC TRIGGERING: Baseline is displayed in absence of an input signal.

Internal: 50 Hz to above 500 kHz on most signals causing 0.5 division or more vertical deflection. Triggering on line frequency also selectable.
External: 50 Hz to above 1 MHz on most signals at least 0.2V p-p.
Trigger Slope: Positive or negative slope on internal, external or line trigger signals.

AMPLITUDE SELECTION TRIGGERING:

Internal: Dc to above 500 kHz on signals causing 0.5 division or more vertical deflection.
External: Dc to 1 MHz on signals at least 0.2V p-p. Input impedance is 1 megohm shunted by approximately 20 pF.
Trigger Level and Slope: Internal, any point on vertical waveform displayed; or continuously variable from + 100V to −100V on either slope of the external trigger signal.
Trigger Coupling: Dc or ac for external, line, or internal triggering. Lower ac cutoff is 1.6 Hz for external; 5 Hz for internal.

SINGLE SWEEP: Selectable by front-panel switch, reset pushbutton with armed indicator light.

FREE RUN: Selectable by front-panel switch.

MAXIMUM INPUT: ±350V (dc + pk ac).

Table 1-1. Specifications (Cont'd)

HORIZONTAL AMPLIFIER

BANDWIDTH: Dc to 300 kHz. With input ac coupled, low frequency cutoff is 1.6 Hz.

DEFLECTION FACTOR:

Ranges: 0.1 V/div, 0.2 V/div 0.5 V/div, and 1 V/div.

Vernier: Continuously variable between ranges; extends maximum deflection factor to at least 2.5 V/div.

INPUT: Single-ended.

INPUT RC: 1 megohm shunted by approximately 20 pF.

MAXIMUM INPUT: ±350V (dc + pk ac).

GENERAL

CATHODE-RAY TUBE.

Type: Mono-accelerator, 3000V accelerating potential; P31 phosphor standard (see Modifications for other phosphors); etched safety glass faceplate reduces glare.

Graticule: 8 x 10 divisions; parallax-free internal graticule; 0.2 subdivision markings on horizontal and vertical major axes, 1 div = 1 cm.

Intensity Modulation: +2V signal blanks trace of normal intensity; +8V signal blanks any intensity. Dc coupled input on rear panel; amplifier risetime approximately 200 ns; input resistance is 5 kilohms.

CALIBRATOR:

Type: Line frequency square wave.

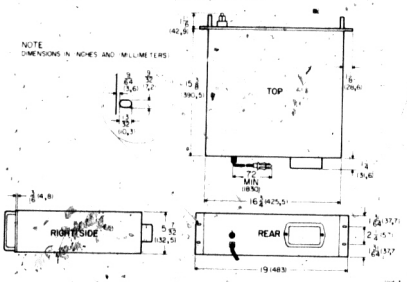
Output: 1V ±1.5%, front-panel connector.

BEAM FINDER: Pushbutton to locate beam on CRT screen regardless of setting of vertical, horizontal, and intensity controls.

DIMENSIONS:

Cabinet: 8-5/16 in. wide x 11-3/4 in. high x 18-11/16 in. deep (211,1 x 298,5 x 374,4 mm).

Rack: Refer to outline drawing.



WEIGHT:

Cabinet: Net, 25 lb (11,3 kg); shipping, 34-1/2 lb (15,6 kg).

Rack: Net, 22-1/2 lb (10,2 kg); shipping, 35 lb (15,8 kg).

POWER: 115 or 230V ±10%; 47 to 440 Hz; approximately 45W.

MODIFICATIONS

CRT PHOSPHORS: (specify by phosphor number): P31 standard. P2, P7 (with amber filter), and P11 available at no extra cost.

OPTIONS AND SPECIALS: Refer to Section VII for further information.

INSTALLATION

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. Information for making a visual and electrical inspection of the instrument, processing a claim, repackaging for shipment and installation procedures are contained in this section.

2-3. INITIAL INSPECTION.

2-4. Inspect the oscilloscope for physical damage such as bent or broken parts and dents or scratches. If a defect is discovered, refer to the claim procedure in this section.

2-5. Check the electrical performance (Section V Performance Check) as soon as possible. This check will indicate whether or not the instrument is operating within the specifications listed in Table 1-1. Initial performance and accuracy of this instrument are certified as stated on the inside front cover of this manual. If operation is not as specified, refer to the claim procedure.

2-6. CLAIMS.

2-7. If either physical damage is found or operation is not within specifications when the instrument is received, notify the carrier and the nearest Hewlett-Packard Sales Service Office immediately. The Sales/Service Office will arrange for repair or replacement of the instrument without waiting for the carrier to settle a claim.

2-8. The warranty statement for all Hewlett-Packard products is on the inside front cover of this manual (Section I for explanation of CRT warranty). Contact the nearest Sales/Service Office about warranty claims.

2-9. REPACKAGING FOR SHIPMENT.

2-10. When shipping an instrument to a Hewlett-Packard Sales/Service Office, attach a tag describing required service, and include model number, serial number and return address.

2-11. Use the original carton and packaging materials for reshipment. If the original material is not available, use the following:

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

b. Heavy paper or sheets of cardboard to protect all instrument surfaces. Use a non-abrasive material such as polyurethane foam, or cushioned paper such as Kimpak, around all projecting parts.

Table 2-1. Shipping Carton Test Strength

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

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

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

2-12. PREPARATION FOR USE.

2-13. In the following paragraphs, additional pre-operational information concerning power requirements, instrument cooling and mounting is presented.

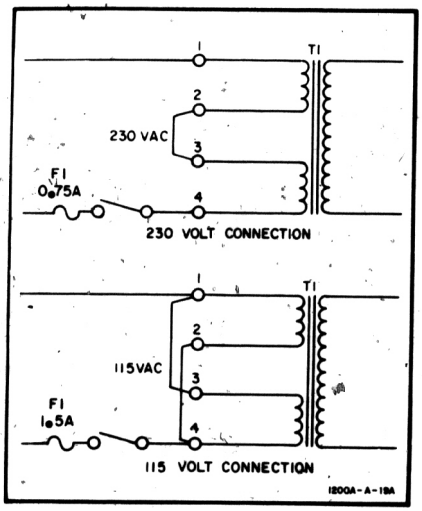


Figure 2-1. Primary Power Connections

2-14. POWER REQUIREMENTS.

2-15. This instrument requires a power source of either 115 or 230 Vac, ±10%, single phase, 47 to 440 Hz that can deliver about 45 watts. The oscilloscope is normally shipped from the factory wired for use with a 115 Vac power source. To convert the instrument for use with a 230 Vac power source, resolder the jumper wires connected across the primary of T1, as shown in Figure 2-1, and replace the 1.5-amp slow-blow fuse with a 0.75-amp slow-blow fuse.

2-16. THREE-CONDUCTOR POWER CABLE.

2-17. For the protection of operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three-conductor power cable that, when plugged into an appropriate receptacle, grounds the instrument through the round offset pin. To preserve this protection feature when operating the instrument from a two-contact outlet, use a three-conductor to two-conductor adapter, and connect the adapter wire to ground at the power outlet.

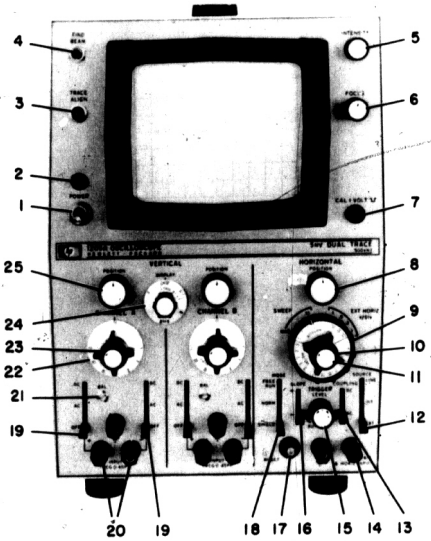
2-18. INSTRUMENT COOLING.

2-19. This instrument does not require forced-air cooling when operated at room temperature. Normal air circulation will maintain a reasonable operating temperature within the instrument when used in a location that provides at least 2 inches of clearance around the top, rear and both sides.

2-20. INSTRUMENT MOUNTING.

2-21. Both the Model 1205A and the Model 1205B, as shipped from the factory, can be used on the bench or in the field. However, the Model 1205B is designed primarily for rack use and does not require any modification.

OPERATION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VERTICAL
HORIZONTAL
1205A-R-8

1. POWER. Applies primary power to instrument.

2. Indicator. Lights when power is applied.

3. TRACE ALIGN. Aligns trace with horizontal axis.

4. FIND BEAM. When pressed, returns offset beam to CRT screen.

5. INTENSITY. Adjusts brightness of CRT display.

6. FOCUS. Adjusts sharpness of display.

7. CAL. Provides 1V pk-pk, line frequency, square wave test signal at front panel jack.

8. POSITION. Adjusts horizontal position of display.

9. SWEEP/EXT HORIZ. In SWEEP, turns on sweep generator and allows magnification of sweep. In EXT HORIZ, determines deflection factor of external signal applied to TRIG & HORIZ INPUT jack.

10. Time/Division. Selects horizontal sweep speed.

11. Horizontal Vernier. Provides continuous adjustment of horizontal deflection factor between ranges of EXT HORIZ switch or of sweep time between ranges of Time/Division switch.

12. SOURCE. Selects origin of trigger signal that starts sweep.

13. COUPLING. In AC position, selected input signal is capacitively coupled. In DC position, input signal is direct coupled.

14. TRIG & HORIZ INPUT. Jack for applying external trigger signals to sweep generator or external horizontal signal to horizontal amplifiers.

15. TRIGGER LEVEL. Selects point on trigger waveform that starts sweep. In AUTO position, automatic triggers are generated at about a 40 Hz rate.

16. SLOPE. Selects positive or negative-going slope of trigger signal to start sweep.

17. RESET. In SINGLE mode, pressing the push-button resets sweep to zero, and releasing it arms circuit preparatory to receipt of trigger. Indicator lamp glows when sweep circuit is armed.

18. MODE. In NORM, sweep is periodically started by incoming trigger signal. In SINGLE, sweep is triggered only once, then must be manually reset. In FREE RUN, sweep cycles continuously and is not affected by trigger signals.

19. Vertical Coupling. Selects capacitive (AC) or direct (DC) coupling of vertical input signals. In OFF, vertical amplifier input circuit is grounded and INPUT jacks disconnected.

20. INPUT. Jacks connect either single-ended or differential input signals to respective vertical amplifiers.

21. BAL. Adjustment to minimize trace shift when changing Volts/Division ranges.

22. Volts/Division. Selects vertical amplifier deflection factor in seventeen calibrated steps.

23. Vertical Vernier. Provides continuous adjustment of vertical deflection factor between calibrated ranges of Volts/Division switch. In CAL detent, vertical deflection is selected by Volts/Division switch position.

24. DISPLAY. Selects single channel, chop, alternate or A vs B CRT display.

25. POSITION. Adjusts vertical position of display.

Figure 3-1. Controls and Connectors.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. Front-panel control operation and typical instrument application instructions are presented in this section. The control and connectors in the Model 1205B are identical to those of the Model 1205A. Only operation of the Model 1205A is discussed in this section.

3-3. CONTROLS AND CONNECTORS.

3-4. Figure 3-1 shows the instrument front panel with a brief description of control and connector applications. Since the channel A and B controls are identical, only those for channel A are described in the figure. For a more detailed explanation of control and connector use, refer to the following paragraphs.

3-5. The TRACE ALIGN screwdriver adjustment is used to position the trace parallel to the horizontal graticule lines. Since external magnetic fields may shift the trace, check alignment each time the instrument is moved to a new location, and readjust when necessary.

3-6. Pressing the FIND BEAM pushbutton increases intensity and reduces amplifier gain enough to return a displaced beam on screen. 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, position controls, or intensity). When centered properly, the beam remains on screen when the pushbutton is released.

NOTE

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

3-7. The CAL 1 volt jack provides a 1V pk-pk square wave signal, at power line frequency, to calibrate vertical deflection or compensate a divider probe. Signal amplitude is accurate to ±1.5%.

3-8. The SWEEP/EXT HORIZ switch is used to select either of two modes of horizontal circuit operation. In the SWEEP X1 or MAG position, a sweep signal is generated to establish a time base reference for vertical signals. Selecting MAG increases horizontal amplifier gain and, sweep speed, by a factor of 10.

NOTE

In either the X1 or MAG position, sweep speed is read directly from the Time/Division dial, and no calculations are required.

3-9. In the EXT HORIZ position, the switch disables the sweep generator and applies external input signals to the horizontal amplifiers. Four switch settings provide calibrated horizontal deflection factors from 0.1 to 1 volt/division when the Horizontal Vernier is in the CAL detent.

3-10. The Time/Division switch controls the time required for one horizontal division of sweep. Sweep speed settings from 1 usec/div to 5 sec/div are available in twenty-one calibrated steps in a 1, 2, 5 sequence. A vernier control provides continuous adjustment between steps and extends the slowest sweep speed to at least 12.5 sec/div. Using the direct readout sweep magnifier, fastest sweep speed can be expanded to 0.1 usec/div.

3-11. The Horizontal Vernier has two uses: one for each function of the SWEEP/EXT HORIZ switch. In the SWEEP mode, the vernier provides continuous adjustment of sweep speed between the calibrated positions of the Time/Division switch and extends the 5 sec/div range to at least 12.5 sec/div. In the EXT HORIZ mode, it provides continuous adjustment of horizontal deflection factor between the calibrated positions of the EXT HORIZ switch and extends the 1 V/div deflection factor to at least 2.5 V/div. When this control is rotated fully clockwise to CAL detent, time per division and horizontal deflection factors are calibrated to the front panel control settings.

3-12. The trigger SOURCE switch selects trigger signal origin. In the LINE position a signal at the frequency of the power line is used for triggering. When the INT setting is selected, the channel A vertical deflection signal triggers the sweep during A, ALT or CHOP display; the channel B signal is the trigger for a B display. To trigger with an external signal, set the switch to the EXT position and apply a trigger to the TRIG & HORIZ INPUT jack.

3-13. The point on a trigger signal that starts the sweep is selected by the LEVEL control. This point can be chosen over a −100V to +100V range when triggering by an external signal or at any point on the displayed waveform when triggering by the internal signal. Set

SLOPE to positive (+) to trigger on the positive-going portion of a signal or negative (–) to trigger on the negative-going portion.

3-14. By setting the LEVEL control to AUTO (fully counterclockwise detent), the instrument is automatically triggered at a 40 Hz rate with no signal applied. In AUTO, however, if a trigger signal greater than about 50 Hz is applied, it overrides the automatic circuitry and triggers the sweep.

3-15. The MODE switch selects the type of sweep operation to be used. In the FREE RUN position, the sweep generator runs free at a rate controlled by the Time/Division switch. In the NORM position, input trigger signals (internal or external) produce a sweep on the CRT. In the SINGLE position, an incoming trigger signal produces one horizontal sweep cycle. The sweep generator must then be manually reset before the next trigger signal will produce another sweep cycle. To reset and arm the sweep generator, press and release the RESET pushbutton. The indicator lamp in the RESET pushbutton will glow when the sweep generator is armed and extinguish when the sweep cycle is completed.

3-16. The + and –INPUT jacks are used to apply an external signal up to ±400V (dc + peak ac) to the vertical deflection circuits. For a single-ended signal, use either connector, depending on the direction of deflection desired. Signals applied to the +INPUT jack are displayed in-phase on the CRT, and signals applied to the –INPUT jack are inverted. Use both connectors to apply a differential input signal. The amplitudes of the two input signals are algebraically subtracted. As a result, one waveform is displayed on the CRT, and common mode (in-phase) components of the signal are rejected.

3-17. The Volts/Division (channel A or B) switch selects the vertical deflection factor of the display in mV/div or V/div. Twelve settings provide calibrated steps from 5 mV/div to 20 V/div in a 1, 2, 5 sequence. When the Vertical Vernier control is in the CAL detent, multiply the number of vertical divisions of deflection by the Volts/Division switch setting to determine input signal peak-to-peak amplitude. If a divider probe is used, multiply this product by the division ratio. For example: if 3.5 vertical divisions are deflected when Volts/Division is set to 20 and a signal is applied to the vertical input connector via a 10:1 divider probe, then 3.5 x 20 x 10 = an input signal of 700V pk-pk.

3-18. When the Vertical Vernier (channel A or B) is set to the fully clockwise CAL detent, vertical deflection is calibrated to the Volts/Division switch. By rotating the Vertical Vernier from the CAL detent, vertical deflection factors are continuously adjustable and the 20 V/div setting can be extended to at least 50 V/div, however, vertical deflection is calibrated to the Volts/Division switch only when the Vertical Vernier is in the CAL detent.

3-19. The five-position DISPLAY switch selects the type of display presented on the CRT. Input signals can be displayed singly or simultaneously, as explained below:

a. Position A: presents a display of the vertical input signal applied to the channel A input jacks.

b. Position B: presents a display of the vertical input signal applied to the channel B input jacks.

c. Position A vs B: presents an X-Y display of the signals applied to the input jacks of both channels. The channel A signal is applied to the vertical deflection plates, and the channel B signal is applied to the horizontal deflection plates.

d. Position ALT: presents a separate display of each channel input signal on alternate sweep cycles. In the INT position of the trigger SOURCE switch, the channel A signal is selected to trigger the sweep generator.

e. Position CHOP: presents a separate display of each channel input signal during each sweep cycle. Channels are switched at about a 100 kHz rate. Sweep is triggered by the channel A signal when the trigger SOURCE switch is set to INT.

3-20. The Z-AXIS INPUT terminal, located on the rear panel, is normally grounded through a shorting link. External intensity modulation signals applied to this terminal are fed directly to the gate amplifier. About +2 volts are required to blank a trace of normal intensity; +8 volts blank a trace of any intensity.

3-21. OPERATING INSTRUCTIONS.

3-22. Before attempting to operate the Model 1205A/B, refer to the following paragraphs for detailed operating instructions.

3-23. APPLYING INPUT SIGNALS.

3-24. For measurements requiring low amplifier deflection factors and high impedance levels, a shielded input connection is desirable. An adapter (Model 10111A) that provides a shielded banana post-to-female-BNC is available for this purpose. For differential input operation, two adapters can be used. Also available is a frequency-compensated divider probe (Model 10001A) to provide a higher input impedance and reduce circuit loading effects.

3-25. TRIGGER SIGNAL REQUIREMENTS.

3-26. Sweep triggering requires application of a signal that will start the sweep at the same point on the displayed waveform during each sweep. Synchronous triggering is necessary to obtain a stable (jitter-free) display of a repetitive waveform. To observe two different waveforms simultaneously, the signals must have time-related repetition rates, otherwise the one not harmonically related

to the trigger signal will be non-synchronous with the display.

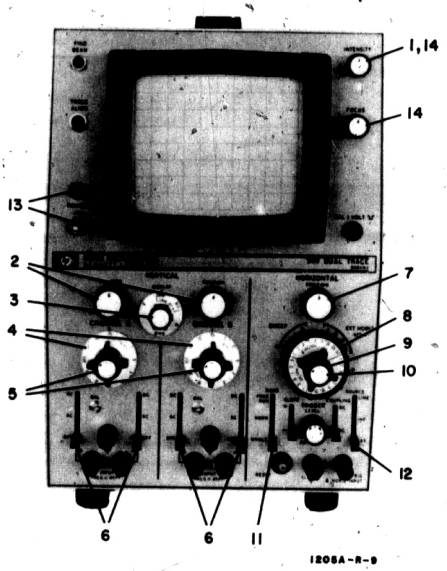
3-27. Table 3-1 shows the trigger signal requirements with various control setting combinations. The table provides frequency range, amplitude required and trigger point information for each possible trigger condition.

3-28. OPERATING PROCEDURES.

3-29. Figures 3-2 thru 3-7 contain step-by-step operating procedures indexed to photographs. Due to the versatility of the instrument, numerous applications exist. However, only the basic operating techniques are explained in the procedures. Most of these can then be modified or combined to fulfill a wide variety of unique requirements.

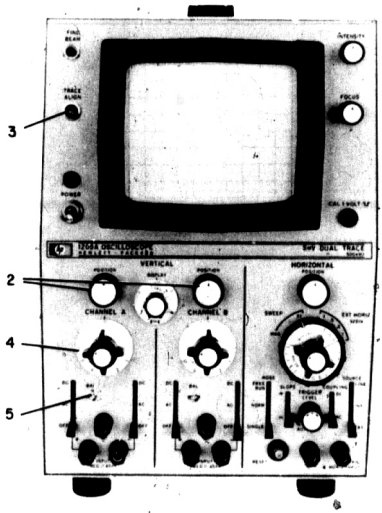
Table 3-1. Trigger Signal Requirements.

Mode	Slope	Source	Trigger Level	Coupling	Required Signal	
					Frequency	Amplitude
NORM or SINGLE		LINE	Selectable	DC or AC	Line Frequency	Internally Connected
			AUTO			
	+ or −	INT	Selectable (Any point that can be displayed.)	DC	DC to 500 kHz	At least 0.5 div of deflection
				AC	5 Hz to 500 kHz	
			AUTO	DC or AC	50 Hz to 500 kHz	
		EXT	Selectable +100V to −100V	DC	DC to 1 MHz	0.2V to 350V pk-pk (dc plus peak ac)
				AC	1.6 Hz to 1 MHz	
			AUTO	DC or AC	50 Hz to 1 MHz	
FREE RUN	Provides a non-synchronous display.					



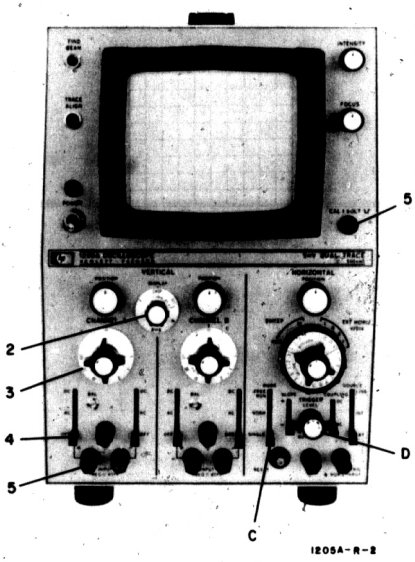
1. Set INTENSITY fully counterclockwise.
2. Set Vertical POSITION (A and B) to midrange.
3. Set DISPLAY to CHOP.
4. Set Volts/Division (A and B) to 20 V/DIV.
5. Set Vertical Vernier (A and B) to CAL detent.
6. Set + and – Vertical Coupling (A and B) to OFF.
7. Set Horizontal POSITION to midrange.
8. Set SWEEP/EXT HORIZ to X1.
9. Set Time/Division to 2 MSEC/DIV.
10. Set Horizontal Vernier to CAL detent.
11. Set MODE to FREE RUN.
12. Set SOURCE to INT.
13. Apply operating power (refer to power requirements paragraph in Section II), turn on POWER switch (note that indicator lights), and allow at least 15 minutes for warm-up.
14. Adjust INTENSITY and FOCUS for two sharp and just visible traces.

Figure 3-2. Initial Turn-on Procedure



1. Do initial turn-on procedure in Figure 3-2.
2. Using Vertical POSITION controls, set traces on horizontal graticule lines.
3. Adjust TRACE ALIGN so that traces are aligned parallel to horizontal graticule lines.
4. Turn channel A Volts/Division switch from 20 V/DIV to .005 V/DIV.
5. If channel A trace shifts, adjust channel A BAL until trace remains stationary when the Volts/Division switch is rotated from .005 V/DIV to 20 V/DIV.
6. Repeat steps 4 and 5 for channel B.

Figure 3-3. Trace Alignment and Amplifier Balance



FREE RUN SWEEP MODE

This procedure explains how to obtain a FREE RUN mode display of the 1V pk-pk calibrator signal on channel A.

1. Do initial turn-on procedure in Figure 3-2.
2. Set DISPLAY to A.
3. Set channel A Volts/Division to 0.2 V/DIV.
4. Set channel A + Vertical Coupling to AC.
5. Connect CAL 1 VOLT signal to channel A +INPUT jack.
6. Note free-running (unsynchronized) display, 5 vertical divisions in amplitude, of calibrator signal.

NORMAL SWEEP MODE

This procedure explains how to obtain a NORMAL mode display of the 1V pk-pk calibrator signal on channel A.

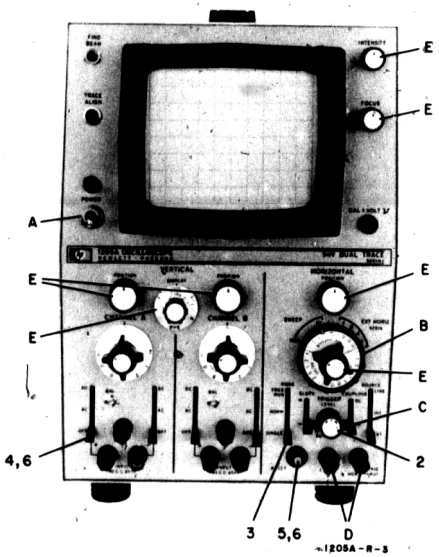
A. Do initial turn-on procedure in Figure 3-2.

B. Repeat steps 2 thru 5 for free run operation.

C. Set MODE to NORM.

D. Adjust trigger LEVEL (or set to AUTO), and note stable display, 5 vertical divisions in amplitude, of calibrator signal.

Figure 3-4. Free Run and Normal Operation



SINGLE SWEEP MODE

1. Do steps A and B of normal sweep mode operation (Figure 3-4).

2. Set trigger LEVEL to midrange.

3. Set MODE to SINGLE.

4. Set channel A + Vertical Coupling to OFF.

5. Press and release RESET pushbutton. Note that RESET indicator lights to signify that sweep circuits are armed.

NOTE

Pressing RESET will immediately reset sweep without normal delay for sweep termination.

6. When sweep is armed, first trigger input (in this case, trigger is applied internally since SOURCE is set to INT) will initiate one sweep cycle. Set + Vertical Coupling to AC and note display. After sweep cycle, indicator goes out until sweep is manually reset again (step 5).

EXT HORIZ INPUT

In this type of operation, the horizontal circuits perform as an amplifier instead of a sweep generator.

A. Turn on POWER, and allow at least 15 minutes for warm-up.

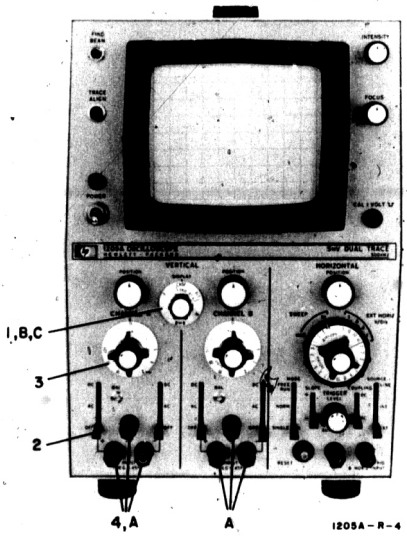
B. Set SWEEP/EXT HORIZ to EXT HORIZ position at desired sensitivity.

C. Set Horizontal COUPLING to either DC (direct) or AC (capacitive).

D. Connect signal to TRIG & HORIZ INPUT jack.

E. Set INTENSITY, FOCUS, DISPLAY, POSITION, and Horizontal Vernier for required display.

Figure 3-5. Single Sweep and Ext Horiz Input Operation



SINGLE CHANNEL OPERATION

1. Do initial turn-on procedure in Figure 3-2, except set DISPLAY to A or B.
2. Set Vertical Coupling to AC (capacitive) or DC (direct).
3. Set Volts/Division for required deflection factor.
4. Connect single-ended input signals between + or −INPUT jack and ground jack (signals applied to +INPUT are displayed in-phase on CRT; signals applied to −INPUT are displayed inverted on CRT). To display differential signal, connect between + and −INPUT jacks (ground jack not used).
5. Adjust other controls to meet specific requirements.

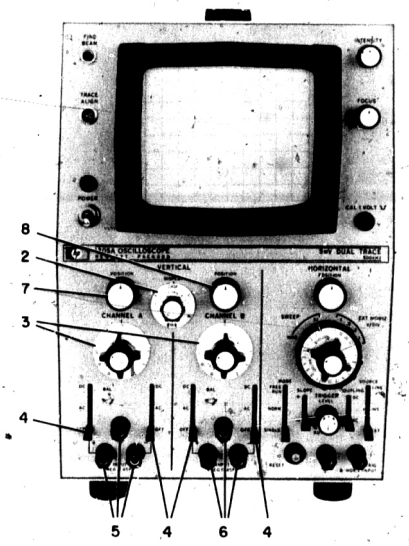
DUAL CHANNEL OPERATION

A. Do steps 1 thru 5 of single channel operation for channel A and B, and connect input signals to both channel A and B INPUT jacks.

B. Set DISPLAY to either CHOP or ALT.

C. ALT operation is preferable for use with fast sweep speeds; slow sweep speeds will make display flicker. CHOP operation is usually best for use with slow sweep speeds; fast sweep speeds will cause dotted trace. Set DISPLAY to CHOP when using EXT HORIZ.

Figure 3-6. Single and Dual Channel Operation



A vs B OPERATION

1. Do initial turn-on procedure in Figure 3-2.
2. Set DISPLAY to A vs B.
3. Set channel A and B Volts/Division as required.
4. Set channel A and B Vertical Coupling (one side ground for single-ended signals) to AC (capacitive) or DC (direct).
5. Connect desired vertical signal to channel A INPUT jacks.
6. Connect desired horizontal signal to channel B INPUT jacks.
7. Adjust channel A POSITION for desired vertical position of display.
8. Adjust channel B POSITION for desired horizontal position of display.

X-Y OPERATION

This method of operation is similar to A vs B, the difference is that in A vs B, the signal applied to one vertical amplifier is displayed against the signal applied to the other vertical amplifier, and in X-Y operation, the signal applied to either or both vertical amplifiers is displayed against the signal applied to the horizontal amplifiers.

A. Set up vertical amplifier(s) for either single or dual channel operation as explained in Figure 3-6.

B. Set up horizontal amplifier for external horizontal input operation as explained in Figure 3-5.

Figure 3-7. A vs B and X-Y Operation

THEORY

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains both an overall and detailed explanation of circuit theory. Refer to the overall block diagram and figures in this section and the schematics in Section VIII while reading the text.

4-3. GENERAL THEORY.

4-4. Following is an overall explanation of circuit operation based on the block diagram in Figure 4-10. This data is presented to create a basic understanding of the instrument in preparation for the detailed theory that follows.

4-5. For simplicity, the block diagram is drawn for function and doesn't necessarily show all details of the schematics.

4-6. This instrument consists of a CRT and seven modules: two independent vertical preamplifiers, a horizontal amplifier/sweep generator, a dual channel output amplifier, a low voltage power supply, and a high voltage regulator and rectifier. These function as follows:

4-7. VERTICAL PREAMPLIFIER MODULES.

4-8. Since operation of the channel A and B vertical preamplifiers is identical, the following text is applicable to either.

4-9. Incoming signals, single-ended or differential, are connected to the front panel jacks and applied to three-position coupling switches for either direct (DC) or capacitive (AC) coupling to the attenuators. A third alternative is to switch to OFF. In this setting, the incoming signal is disconnected internally, and the attenuator input is grounded. This can be done to set a 0-volt reference without removing the incoming signal from the input jack.

4-10. The incoming signal is attenuated before being applied to the preamplifiers when the Volts/Division switch is set to one of the six least sensitive positions (0.5 to 20 V/div). In the remaining six switch settings, the incoming signal is applied without attenuation direct to the preamplifier input.

4-11. In addition to amplifying the incoming signal, the preamplifier rejects common mode signals. Other features include an interstage attenuator controlled by the Volts/Division switch, and a front panel BAL adjustment to keep the CRT trace from shifting when the deflection factor is changed.

4-12. Two signals are taken from the output of the preamplifiers: a single-ended signal is applied, via the DISPLAY switch, to the horizontal preamplifier for use as an internal trigger, and a differential signal is applied to the vertical amplifier in the output module for eventual application to the CRT vertical deflection plates.

4-13. HORIZONTAL MODULE.

4-14. The horizontal module can operate in either of two ways: as a horizontal amplifier or as a sweep generator. Each mode of operation is explained separately in the following paragraphs.

4-15. HORIZONTAL AMPLIFIER. When the SWEEP/EXT HORIZ switch is in one of the four EXT HORIZ positions, the horizontal module acts as an amplifier. In this mode, the SOURCE switch is bypassed, and incoming signals applied to the TRIG & HORIZ INPUT jack are applied to a coupling switch for either direct or capacitive coupling.

4-16. The signal is attenuated on one of four steps determined by the setting of the SWEEP/EXT HORIZ switch and applied to the horizontal amplifier.

4-17. The preamplifier amplifies the incoming signal and then applies it to the first horizontal amplifier stage for further amplification. At this point in the circuitry, a POSITION control is provided to move the CRT beam horizontally.

4-18. The single-ended output signal from the horizontal amplifier is next applied to the output module for further amplification, conversion to a differential signal and, finally, application to the CRT horizontal deflection plates.

4-19. SWEEP GENERATOR. When the SWEEP/EXT HORIZ switch is set to SWEEP, the horizontal module acts as a sweep generator. Two sweep settings can be selected with the SWEEP/EXT HORIZ switch: X1 or MAG. In the MAG setting, sweep rate and length are magnified (increased) by X10; however, in either setting, sweep rate is read directly from the Time/Division switch.

4-20. Sweep can be triggered or it can run-free, depending on the setting of the MODE switch. A negative control voltage is applied to the sweep generator and it runs free at a rate set by the Time/Division switch when FREE RUN is selected. However, the sweep generator must be triggered when the MODE switch is set to NORM or SINGLE.

4-21. A sweep signal is generated each time a trigger signal is applied when NORM is selected. In the SINGLE position of the MODE switch, operation is similar to NORM except that an incoming trigger signal produces only one horizontal sweep cycle. The sweep generator must then be manually reset before the next trigger signal can produce another sweep cycle.

4-22. Three trigger choices can be selected by the SOURCE switch: an external signal applied to the TRIG & HORIZ INPUT jack, a signal taken from the vertical preamplifiers, or a power-line-frequency signal taken from the low voltage power supply.

4-23. A selected trigger signal is coupled, either direct or capacitively, to the horizontal preamplifier and is then amplified and applied to the trigger generator. Upon reception of the incoming signal, the trigger generator produces a fast-rise, negative-going step. This voltage step triggers the sweep generator to produce three output signals: a sweep signal, an unblanking gate, and a trigger for alternate channel display.

4-24. The sweep signal is amplified in the output module and is then applied to the CRT's horizontal deflection plates to set a time-base reference for vertical display signals. The unblanking gate is applied to an amplifier in the high voltage power supply and is used to unblank the CRT during sweep time. In the ALT display mode, the trigger from the sweep generator is used to activate the multivibrator in the output module.

4-25. Controls in the trigger and sweep generator circuits permit selection of either the positive or negative-going slope of the incoming signal for triggering, selection of the voltage level on the incoming signal that will activate the trigger generator, and variable sweep speed calibrated to the CRT graticule.

4-26. When the TRIGGER LEVEL control is set to the AUTO detent, trigger signals are automatically generated at about a 40 Hz rate to present a baseline even in the absence of a trigger input signal. However, if a trigger input signal 50 Hz or greater is applied, it overrides the automatic trigger signals and initiates the sweep cycle.

4-27. OUTPUT MODULE.

4-28. A display switching arrangement in the output module allows presentation of five types of display: channel A signal, channel B signal, channel A and B signals during alternate sweep cycles, channel A and B signals alternately switched on and off at a 100 kHz rate, and channel A signal vertically versus channel B signal horizontally.

4-29. The output module's vertical and horizontal amplifiers are controlled by current sources. When the DISPLAY switch is set to A, a negative voltage is applied to the A side of the multivibrator. The multivibrator then operates as a switch to turn on current source A. As a result, vertical amplifier A is turned on, the channel A signal is amplified, applied to the vertical output amplifier for further amplification, and then applied to the CRT's vertical deflection plates. During this time, a sweep signal is produced by the sweep generator, amplified by the horizontal output circuits, and applied to the CRT's horizontal deflection plates. On the CRT, the channel A signal is then displayed versus a time-base reference.

4-30. When the DISPLAY switch is set to B, operation is identical except that the channel A current source is turned off, and the channel B current source is turned on. Then, only the channel B signal is amplified and applied to the CRT's vertical deflection plates.

4-31. In the A vs. B setting, the multivibrator turns on current source A and vertical amplifier A. In addition, the current source that normally turns on the horizontal amplifier, is coupled through the DISPLAY switch and turns on vertical amplifier B. Thus, the channel A signal from the preamplifier is amplified by vertical amplifier A and the vertical output amplifier and then applied to the CRT's vertical deflection plates. Instead of a sweep signal, the channel B signal is amplified by the horizontal output amplifiers and applied to the CRT's horizontal deflection plates for an X-Y type presentation.

4-32. When the DISPLAY switch is set to ALT, the multivibrator is triggered by a signal from the sweep generator and it operates in a bistable state. The multivibrator then turns on channel A during one sweep cycle and channel B during the next sweep cycle. Switching is at a rate determined by the setting of the Time/Division switch. Thus, the channel A and B signals are alternately applied to the vertical deflection plates while a sweep signal is applied to the horizontal deflection plates. In this way, the CRT display is of a different channel's signal during each successive sweep cycle, and the result is a dual-signal presentation on a time-shared basis.

4-33. A negative voltage applied to both the A and B sides of the multivibrator causes it to become astable when the DISPLAY switch is set to CHOP. In this mode, the multivibrator free-runs at a 100 kHz rate. In turn, the current sources switch on and off at the same rate. The channel A and B signals are amplified and applied to the CRT's vertical deflection plates via the same paths used during ALT operation. However, instead of being displayed separately during alternate sweep cycles, the vertical display is switched between channels at a 100 kHz rate during each sweep cycle.

4-34. Each channel has a POSITION control to vertically position the signal on the CRT, and a Vernier to adjust sensitivity between the calibrated settings of the Volts/Division switch. Pressing the FIND BEAM pushbutton switch reduces the current applied to the vertical and horizontal amplifiers so that an offset display can be located and returned to the viewing area.

4-35. Except when the DISPLAY switch is set to B, the internal trigger signal taken from the vertical preamplifiers and applied to the horizontal module is always the channel A display signal.

4-36. POWER SUPPLY MODULES.

4-37. LOW VOLTAGE POWER SUPPLY. Either 115 or 230 Vac, 47 to 440 Hz, can be applied to the input of the low voltage power supply as operating power. This voltage is then stepped-up or down by a transformer, rectified, filtered, and regulated to produce operating voltages for the various circuits of the instrument. In addition, the low voltage power supply module produces two other voltages. A line sync signal is applied to the horizontal module so that the sweep signal can be synchronized to the power-line frequency, if desired. Also, a 1V pk-pk line frequency square wave is applied to the front panel for use as a calibrating reference.

4-38. HIGH VOLTAGE POWER SUPPLY. An oscillator, controlled by a regulator, and a step-up transformer are used in the high voltage power supply modules to generate high voltage for the CRT. Further, a gate amplifier in the high voltage supply is pulsed to unblank the CRT during sweep time. Chop blanking signals are also applied to the gate amplifier to eliminate switching cross-over, and external signals can be applied, via the Z-AXIS INPUT, to intensity modulate the CRT. The high voltage power supply also contains circuitry to adjust CRT focus, astigmatism, intensity and other characteristics.

4-39. DETAILED CIRCUIT THEORY.

4-40. The following detailed theory is sub-divided according to module type and referenced to fold-out schematics in Section VIII. Each schematic is numbered and indexed in the appropriate text for easy location. Also included is a separate detailed block diagram for each circuit function.

4-41. VERTICAL PREAMPLIFIER MODULES.

4-42. Operation of the channel A and B vertical preamplifiers is identical. Therefore, although the following theory describes only the channel A preamplifier, it is applicable to either channel. Refer to Figure 4-1 and Schematic 1, in Section VIII, while reading the following text.

4-43. ATTENUATORS. Either single-ended or differential signals can be applied to the vertical amplifier's INPUT jacks. A single-ended signal applied between the positive (J3) and ground (J2) input jacks results in an in-phase display on the CRT. Conversely, single-ended signals applied between the negative (J1) and ground (J2) input jacks are displayed inverted on the CRT. To display a differential signal, use only the positive and negative jacks.

4-44. From the input jacks, incoming signals are applied to three-position Coupling switches (A1S1 for signals applied to J1 and A1S2 for signals applied to J3). When DC coupling is selected, both the dc and ac components of the incoming signal are direct coupled to the attenuators. Only the ac signal component is coupled through capacitors A1C1A or A1C1B when AC coupling is selected. A third alternative is to switch A1S1 or A1S2 to OFF. In this setting, the incoming signal is disconnected internally, and the attenuator input is grounded. This can be done to set a 0-volt reference without removing the incoming signal from the input jack.

4-45. Signal attenuation is determined by the Volts/Division switch setting. When the switch is set to any of the six settings from 5 mV/div to 0.2 V/div, the attenuator is bypassed and the incoming signal is applied direct to the preamplifier input. In the six least sensitive settings (0.5 to 20 V/div) of the Volts/Division switch, the incoming signal is attenuated by a ÷100 factor before being applied to the preamplifiers.

4-46. The attenuator network is essentially a frequency compensated voltage divider used to control the input level to the preamplifier. Since the resistance of A1A2R2 approximately equals one-hundreth the total resistance of A1A2R1 plus A1A2R2, the attenuator is a ÷100 voltage divider. However, to maintain a constant 100:1 division ratio over a broad frequency range, capacitors A1A2C2 and A1A2C3 are selected with a capacitive reactance equal to the same proportion as the resistors. Capacitor A1A2C2 is a high frequency compensation capacitor, and it is adjusted for an optimum square wave response (since a square wave is multi-harmonic) to assure a constant attenuation ratio over a wide frequency range. Input capacitance is set by A1A2C1 and A1A2C4.

4-47. INPUT AMPLIFIERS. When the input signal is applied direct to the preamplifier without attenuation, A1A1C1 and A1A1C3 determine the input capacitance. Input resistance is set by A1A1R1 and A1A1R2, and input current is limited by A1A1R3 and A1A1R4 during overload.

4-48. Voltage at the preamplifier input is limited to about ±12V by a diode clamp circuit consisting of A1A1CR1-CR4 and associated components. If the voltage at either input exceeds the voltage at the junction of A1A1R26/R27 or A1A1R28/R29 one of the diodes will become forward biased to bypass the excessive current to ground and limit input voltage.

4-49. The input amplifier is a two-stage feedback amplifier with an emitter follower included in the feedback loop. Field-effect transistor A1A1Q1A/Q1B provides the amplifier with a high input impedance to prevent loading of the circuit under test.

4-50. Gain of the feedback amplifier is determined by the amount of resistance switched into the feedback circuit by interstage attenuator A1A2R5-R10. BAL adjustment A1A2R15 equalizes the dc voltage across the interstage attenuator for all positions of the Volts/Division switch

so that the position of the trace does not shift when the value of the feedback resistance is changed.

4-51. The main current for the amplifier is that which flows through input transistor A1A1Q1A/Q1B and feedback resistors A1A1R15 and A1A1R16. The output voltage is set by A1A1R9A and is equal to the source voltage of the FET plus the voltage drop across the feedback resistor. Vernier balance voltage is set by A1A1R9B.

4-52. The differential signal from emitter followers A1A1 Q4/Q5 is coupled to the vertical amplifier in the output module. Also, a single ended internal trigger signal is coupled from A1A1Q5 to the DISPLAY switch in the output module.

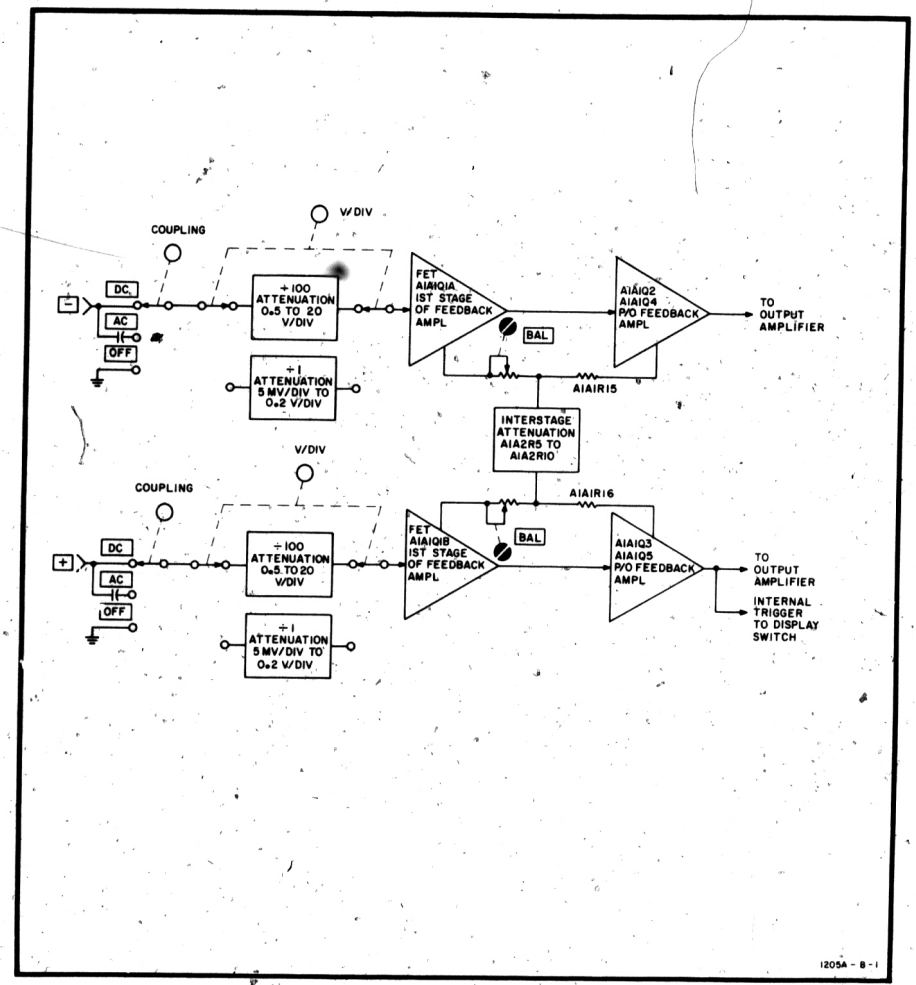


Figure 4-1. Channel A Attenuator and Preamplifier Block Diagram

4-53. HORIZONTAL MODULE.

4-54. Depending on the setting of the SWEEP/EXT HORIZ switch, the horizontal module can operate either as a horizontal amplifier or time-base generator. To simplify the theory, each mode is explained separately, from input to output, in the following text.

4-55. HORIZONTAL AMPLIFIER. See Figure 4-2 and Schematic 5 in Section VIII. The horizontal module serves as an amplifier when SWEEP/EXT HORIZ switch A4A2S1 is in one of the four EXT HORIZ settings (0.1 to 1 V/DIV). SOURCE switch A4S1 is bypassed, and incoming signals connected to the TRIG & HORIZ INPUT jack (J7) are applied to an attenuator network. The attenuator consists of resistors A4R2 and A4A2R1-R4, compensated by capacitors A4C1 and A4A2C2/C3. Total resistance of the divider is about 1 megohm, and signal attenuation is determined by the tap-off point between resistors. For example: when the SWEEP/EXT HORIZ switch is set to 1 V/DIV the combination of A4R2 and A4A2R1-R3 (about 1 megohm) is in series with the incoming signal, and A4A2R4 (10 kilohms) is in parallel. Thus, attenuation ratio is 100:1. Ratio of the voltage divider is 50:1 at 0.5 V/DIV, 20:1 at 0.2 V/DIV and 10:1 at 0.1 V/DIV.

4-56. In addition to being attenuated, the incoming signal can be direct or capacitively coupled. In the AC setting of COUPLING switch A4S2, capacitor A4A2C1 is in series with the attenuator, and the signal is capacitively coupled. When the switch is set to DC, the capacitor is shorted, and the incoming signal is direct coupled to the horizontal preamplifier.

4-57. The horizontal preamplifier consists of a three-stage amplifier and a trigger level control circuit. Two things happen when the SWEEP/EXT HORIZ switch (A4A2S1) is set to the EXT HORIZ position: TRIGGER LEVEL potentiometer A4R3 is disconnected, and the short is removed from the Horizontal Vernier potentiometer.

4-58. Input impedance is high and, if no signal is applied, A4A1Q1 base potential is 0V. Consequently, A4A1Q2 emitter voltage is about −1.2V. Voltage at the emitter of A4A1Q5 is also about −1.2V when vernier balance adjustment A4A1R10A is properly set. Since the voltage on both sides of A4A1R3 and A4A2R5A is equal, no bias current flows through these resistors, and the circuit is balanced. In addition, current passing through the combination of A4A1R2/R4/R5 is sufficient to create a 1.2V drop across A4A1R4. This voltage drop opposes the voltage at the emitter of A4A1Q2 to produce a quiescent output voltage of about 0V. Thus, with no signal applied, the amplifier is balanced and no output is produced.

4-59. Amplifier gain is primarily determined by the ratio of A4A1R4 to the sum of A4A1R3 and A4A2R5A. Horizontal Vernier A4A2R5A adjusts gain to provide continuous adjustment of the horizontal deflection factor between settings of the SWEEP/EXT HORIZ switch. When

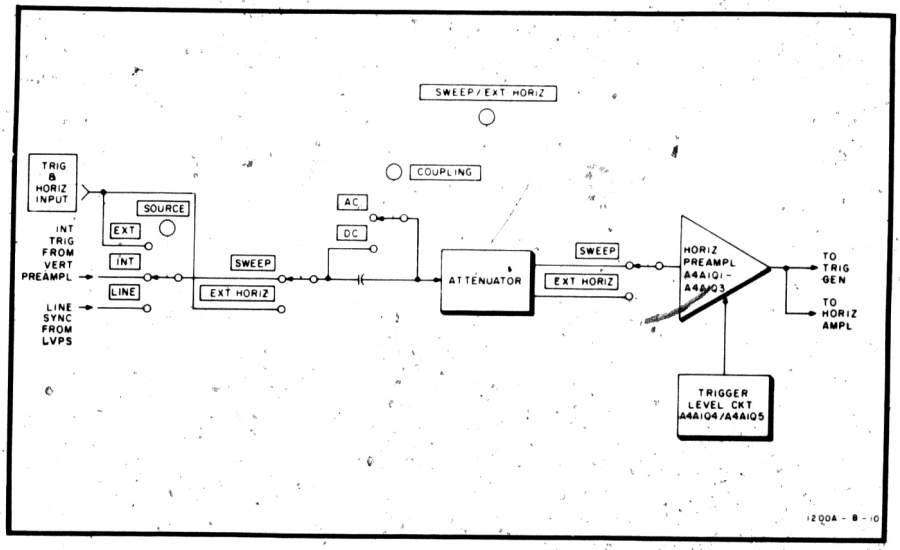


Figure 4-2. Horizontal Preamplifier Block Diagram

the control is set to CAL, or when operating in the sweep mode, the Horizontal Vernier control is shorted. At high frequencies, A4A1C1 provides additional base drive to A4A1Q2. Due to a low A4A1Q1/Q2 base current, dc drift is reduced. Degenerative feedback from the collector of A4A1Q3 to the emitter of A4A1Q2 increases amplifier bandwidth and creates a low output impedance to drive the input of the following stages. Temperature compensation is provided by A4A1Q4/Q5.

4-60. The signal from the preamplifier is next applied through the SWEEP/EXT HORIZ switch (see Figure 4-3 and Schematic 6), A4A2S1, to the horizontal amplifier circuit, A4A1Q10/Q11. Incoming signals are limited to about ±0.6V by diodes A4A1CR5/CR6 at the base of emitter follower A4A1Q10. Dc bias on the base of A4A1Q10 is varied by POSITION control A4R4, via emitter follower A4A2Q1 and the SWEEP/EXT HORIZ switch. A portion of the amplified signal at the collector of A4A1Q11 is applied to the base of A4A1Q10, via A4A1R38, as degenerative feedback. Potentiometer A4A1R36 is used to horizontally center the CRT trace at mid-screen when the POSITION control is at mid-range. The amplified signal at the collector of A4A1Q11 is applied to the output module for further amplification and eventual application to the CRT's horizontal deflection plates.

4-61. TIME BASE GENERATOR. When the SWEEP/EXT HORIZ switch is set to SWEEP, the horizontal module generates a sweep signal to provide a time-base reference on the CRT's horizontal axis.

4-62. Horizontal Preamplifier. See Figure 4-2 and Schematic 5. Input trigger signals can be selected from three sources by A4S1: external (EXT), internal (INT) or power-line (LINE). External trigger signals are applied at the front panel TRIG & HORIZ INPUT jack, internal trigger signals are taken from the vertical preamplifiers, and line trigger signals are power-line frequency signals taken from the low voltage power supply. The SWEEP/EXT HORIZ and SOURCE switches are interconnected so that the selected trigger signal is applied to A4S2, and the two remaining signals are grounded to prevent interference.

4-63. In the sweep mode of operation, the attenuator network is bypassed and the selected trigger signal is capacitively (AC) or direct (DC) coupled by A4S2 to the input of the horizontal preamplifier. Diodes A4A2CR1/CR2 limit the amplitude of the incoming signal to ±0.6V and, thus, permit triggering over an extended range of input signals.

4-64. The horizontal preamplifier consists of a trigger level circuit and a three stage amplifier with a high input impedance, low output impedance and high current gain. Horizontal Vernier A4A2R5A is shorted and TRIGGER LEVEL potentiometer A4R3 is connected in the sweep mode. Transistors A4A1Q4/Q5 provide temperature compensation for the amplifier to limit drift and, in addition, provide a high-input-to-low-output impedance for trigger level current.

4-65. TRIGGER LEVEL potentiometer A4R3 selects the point on the incoming signal that will trigger the sweep. When the potentiometer is varied, so is the amount of current through A4A1Q4/Q5. Level range is determined by voltage divider A4A1R7/R8.

4-66. Due to the differential connection of the trigger level and input amplifier circuits, the output voltage at the collector of A4A1Q3 changes in accordance with the setting of the TRIGGER LEVEL control. This voltage is then applied to the input of the trigger generator circuit as a composite of the level and input signals. A variable hold-off level is also taken from the circuit, at the top of A4A1R7, and applied to the sweep generator circuit.

4-67. Trigger Generator. The trigger generator can either be triggered by the signal from the horizontal preamplifier, or it can operate automatically. Each type of operation is explained separately in the following paragraphs.

4-68. See Figure 4-3 and Schematic 6. When the TRIGGER LEVEL control is not set to the fully counterclockwise AUTO detent, capacitors A4C2 and A4C3 are shorted from the circuit. In this case, the signal from the horizontal preamplifier is applied direct to the SLOPE switch (A4S4). According to the setting of the SLOPE switch, either the positive or negative-going portion of the incoming signal is used to trigger the sweep cycle.

4-69. The base of A4A1Q6 is grounded, and the incoming signal is applied to the base of A4A1Q7 when the positive slope is selected. During the negative alternation of the incoming signal, the base-to-emitter junction of A4A1Q7 is reverse biased, and the transistor is cut-off. However, when the positive-going alternation of the incoming signal reaches sufficient amplitude, A4A1Q7 conducts with a resultant negative-going collector voltage.

4-70. When the SLOPE switch is set to the negative position, the base of A4A1Q7 is grounded, and the incoming signal is applied to the base of A4A1Q6. During the positive alternation of the incoming signal, A4A1Q6 conducts and cuts off A4A1Q7. The result is no output. However, when the negative alternation of the incoming signal reaches a sufficient amplitude, A4A1Q6 cuts off and A4A1Q7 conducts enough to produce a negative-going collector voltage. Thus, either the positive or negative alternation of the incoming signal can be selected by the SLOPE switch to produce an output at the collector of A4A1Q7.

4-71. The negative-going signal at the collector of A4A1Q7 is amplified and inverted by A4A1Q8. Normally, tunnel diode A4A1CR4 is in the low voltage state. However, as the collector of A4A1Q8 rises in a positive

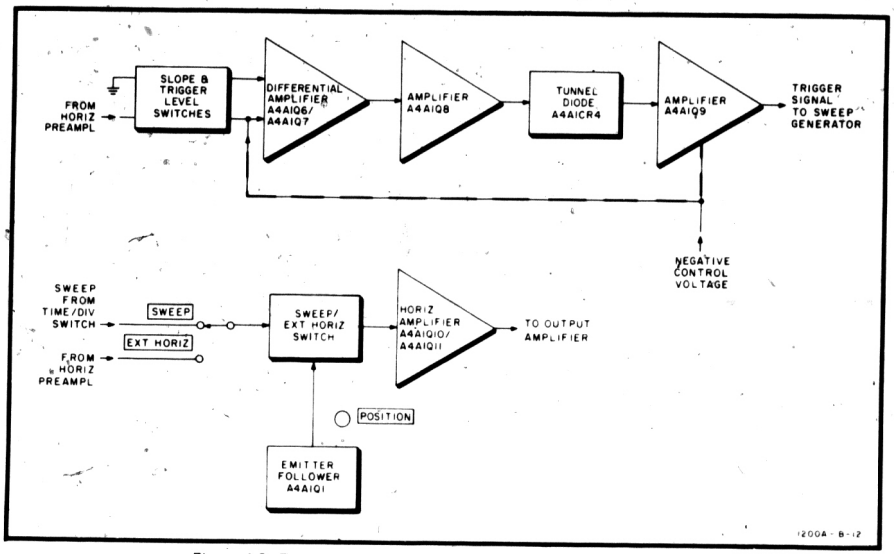


Figure 4-3. Trigger Generator and Horizontal Amplifier Block Diagram

direction, more current flows through the tunnel diode until it finally switches to the high voltage state. This increase in voltage, combined with the pre-bias voltage from the combination of A4A1R25-R28, is sufficient to turn on A4A1Q9. As a result, a fast-rise, negative-going step is produced at the collector of A4A1Q9.

4-72. When the TRIGGER LEVEL control is set fully counterclockwise to the UTO detent, the trigger generator automatically generates triggers at about a 40-Hz rate to present a horizontal time base even in the absence of an incoming horizontal signal. However, incoming signals of the proper amplitude and frequency override the automatic trigger pulses and start the sweep cycle.

4-73. During automatic operation, capacitors A4C2 and A4C3 are switched into the input of the differential amplifier. Thus, the low resistance (ground) dc reference for the bases of A4A1Q6/Q7 is removed. The base of A4A1Q6 is held near ground potential by A4A1R15; but the base of A4A1Q7 is free to follow an auto feedback signal from the collector of A4A1Q9.

4-74. Automatic triggering rate is determined by the RC time constant of A4A1R31/C15 and is about 40 Hz. If an incoming signal of sufficient amplitude and greater than 50 Hz is applied, it will override the automatic operation. Since capacitors A4C2-C3 are inserted in the circuit, the TRIGGER LEVEL control is ineffective, and the voltage level at which overriding signals control the circuit is not selectable.

4-75. Sweep Generator. See Figure 4-4 and Schematic 7. Depending on the setting of the MODE switch (A4S5), the sweep generator can:

a. continuously be triggered to generate sweep signals (normal sweep mode).

b. generate only one sweep when triggered (single sweep mode). The sweep generator must then be manually reset before further trigger signals can produce additional sweep signals.

c. run-free (free-run sweep mode).

4-76. Normal Sweep. Transistors A4A1Q12/Q13 form a complementary trigger Schmitt circuit; that is, both transistors either conduct or don't conduct, simultaneously. The base of A4A1Q12 is armed (set to about 0 volt) by control Schmitt A4A1Q20's emitter when the MODE switch (A4S5) is set to NORM. However, with no input trigger, the trigger Schmitt transistors are cut off.

4-77. When a negative-going trigger signal is applied, it is differentiated by the input resistance/capacitance and applied, via A4A1CR7, to the emitter of A4A1Q12. Transistor A4A1Q12 then conducts, and the voltage drop at the collector turns on A4A1Q13. The voltage at the emitter of A4A1Q13 then turns-on A4A1Q14, and a negative-going voltage pulse is developed at the emitter.

4-78. The negative-going pulse at the emitter of A4A1Q14 is applied to three places:

a. to the multivibrator in the output module for alternate channel switching.

b. to the gate amplifier in the high voltage power supply to unblank the CRT during sweep time.

c. to the emitter of A4A1Q15 and the anode of A4A1CR15.

4-79. Before the negative-going pulse is applied to the emitter of A4A1Q15, the transistor conducts heavily. As a result, a large voltage is dropped across collector load resistor A4A1R52, and the collector becomes positive enough to forward bias diodes A4A1CR9-CR11. The potential at the gate of source follower A4A1Q16 is then about +5.4V. Amplifier A4A1Q16/Q17/Q18 conducts and A4A1Q15/Q23 form a comparator to drive the emitter of A4A1Q18 to about +5.4V. Since both sides of the selected sweep timing capacitor (either A4A2C5 or A4A2C6, depending on the setting of Time/Division) are equal (about +5.4V), the capacitor has no charge.

4-80. When a trigger signal is applied to the input of the sweep generator, a negative-going gate signal is coupled to the emitter of A4A1Q15 and the anode of A4A1CR15. Both of these devices are reverse biased and neither conducts. With no A4A1Q15 current, the collector moves toward the −50V supply potential and reverse biases diodes A4A1CR9-CR11. Timing capacitor A4A2C5 or A4A2C6 then starts to charge via the following long time constant path: through the timing resistance (A4A2R12-R18), A4A2C5/C6, A4A1R58 and emitter follower A4A1Q18. At the same time, A4A1Q17 and A4A1Q18 decrease conduction, and the emitter voltage of A4A1Q18 moves toward the +50V supply potential at a rate determined by the time constant of the sweep timing capacitance and resistance. Since current through the timing capacitor is constant, the linear ramp portion of the sweep signal is produced.

4-81. The rising ramp at the emitter of A4A1Q18 is applied through the Time/Division switch (Schematic 8) to the output module. By changing the sweep charge time and charge potential, ramp slope can be altered for the various sweep speeds. Ramp slope can be varied between settings of the Time/Division switch by Sweep Vernier potentiometer A4A2R58 to allow discrete adjustment of the CRT display. The Time/Division switch settings are calibrated on the front panel only when A4A2R5B is set fully clockwise to the CAL detent. Emitter follower A4A1Q26 is a voltage source for the sweep timing resistors, and A4A1R10B/C/D are sweep timing adjustments.

4-82. See Figure 4-4 and Schematic 7. The rising ramp at the emitter of A4A1Q18 is also applied to the hold-off discharge, ramp control and control Schmitt circuits. As the ramp rises, A4A1Q24 turns on and discharges the hold-off capacitor (A4A2C7-C9, selected by the Time/Division switch). When the ramp voltage rises enough to overcome the forward bias on A4A1Q21, the transistor turns off and consequently turns off A4A1Q20.

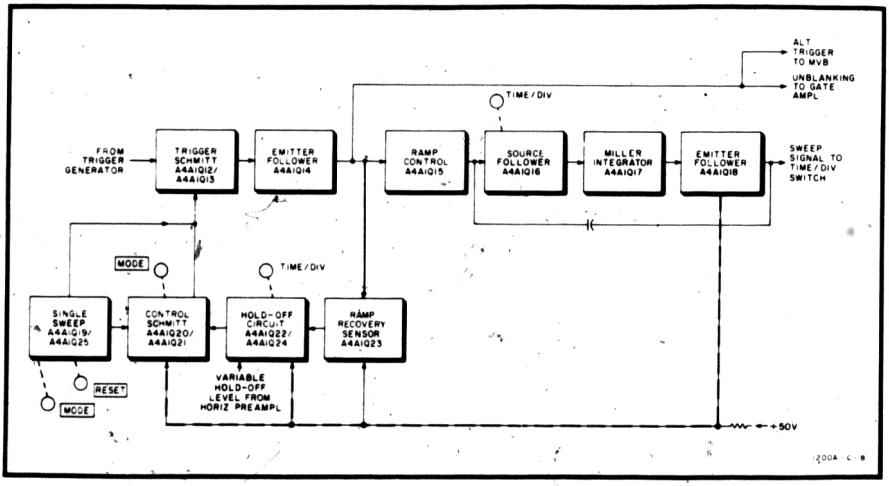


Figure 4-4. Sweep Generator Block Diagram

4-83. When the control Schmitt turns off, it removes the arming voltage applied to the base of A4A1Q12. Emitter follower A4A1Q14 then turns off, and the resulting positive-going voltage step at the emitter is applied to the gate amplifier in the high voltage power supply to blank the CRT. This positive-going voltage step also turns on ramp control transistor A4A1Q15. The ramp control transistor's collector voltage then moves in a positive direction and forward biases diodes A4A1CR9-CR11. Transistors A4A1Q17 and A4A1Q18 then conduct heavily, and the sweep timing capacitor discharges through the relatively fast path consisting of: through A4A1Q18 collector to emitter, A4A1R58, A4A2C5/C6, A4A1CR9-CR11, and into the collector of A4A1Q15. This action generates the flyback portion of the sweep signal.

4-84. The positive-going voltage step applied to the emitter of A4A1Q15 just prior to the timing capacitor's discharge also forward biases A4A1CR15. However, A4A1Q23 is still turned off by the ramp voltage. When the ramp falls to its minimum value, A4A1Q23 turns on and charges the hold-off capacitor (A4A2C7-C9). Hold-off time is defined as the minimum time between the end of the flyback portion of the sweep signal and the beginning of the next ramp. A positive-going hold-off ramp is produced as the hold-off capacitor charges. This ramp is applied to A4A1Q21 by emitter follower A4A1Q22. Also, a trigger level signal is applied to the base of A4A1Q22 to allow stable triggering of complex waveforms.

4-85. When the hold-off ramp potential is sufficient to forward bias A4A1Q21, it conducts and turns on A4A1Q20. Once again the control Schmitt circuit provides an arming voltage to the base of trigger Schmitt A4A1Q12, and it then stands by to initiate another sweep cycle upon reception of a trigger signal from the trigger generator.

4-86. Single Sweep. When the MODE switch is set to the SINGLE position, an incoming trigger signal produces one horizontal sweep cycle. The sweep generator must then be manually reset before the next trigger signal can produce another sweep cycle.

4-87. The main difference between single sweep and normal sweep is that the control Schmitt doesn't re-arm the trigger Schmitt circuit following the completion of a sweep ramp. This makes it impossible to start a new sweep cycle until the RESET (A4S6) pushbutton is pressed.

4-88. When the RESET pushbutton switch is pressed, the voltage across A4A1R81 increases to about +28V. This voltage, applied to the base of A4A1Q21, turns off the control Schmitt regardless of ramp condition. As a result, the trigger Schmitt is not armed, and the sweep is terminated.

4-89. During this time, the ramp recovery and hold-off circuits operate but are unable to turn the control Schmitt back on to arm the trigger Schmitt. Capacitors A4A1C30 and A4A1C31 charge to the +28V potential across A4A1R81, and arming delay transistor A4A1Q25 turns on. Current flowing from A4A1Q25 passes through A4A1R77 and A4A1R43, creating a voltage drop that reverse biases A4A1CR7. This prevents incoming trigger signals from reaching the trigger Schmitt circuit.

4-90. When the RESET pushbutton switch is released, A4A1C30 discharges and maintains the reverse bias on A4A1CR7 for about 0.5 second. Capacitor A4A1C31 discharges through A4A1R81 and A4A1R84, and the voltage drop across A4A1R84 then turns on A4A1Q21. The base of A4A1Q20 then goes positive, and the transistor conducts to provide 0 volt at the base of A4A1Q12 and arm the trigger Schmitt. When the 0.5-second arming delay ends, A4A1Q25 turns off. This removes the reverse bias from A4A1CR7 and allows incoming trigger signals to be applied to the trigger Schmitt. In addition, lamp A4DS1 lights to indicate that the circuit is armed.

4-91. The first incoming trigger signal applied to the trigger Schmitt after the circuit is armed initiates a sweep cycle as previously explained in the normal sweep mode, with the following exception. The control Schmitt circuit senses the maximum ramp voltage, turns off, and terminates the sweep ramp. Both the recovery sense and hold-off circuits function normally but are unable to overcome a fixed bias set by A4A1R84. Therefore, the control Schmitt doesn't turn on and re-arm the trigger Schmitt unless the RESET pushbutton switch is pressed again.

4-92. Free-Run Sweep. When the MODE switch is set to the FREE RUN position, the sweep generator runs free at a rate determined by the Time/Division switch and can't be controlled by an incoming trigger signal.

4-93. Resistor A4A1R77 is connected to the −50V supply by the MODE switch during free-run operation. The voltage drop across A4A1R77 then drives the emitter of A4A1Q12 so far negative that the trigger Schmitt changes state each time it receives an arming signal from the control Schmitt circuit. Thus, an incoming signal from the trigger generator is not needed to start a sweep cycle.

4-94. OUTPUT MODULE.

4-95. The output module consists of multivibrator-switched current sources and vertical and horizontal output amplifiers.

4-96. MULTIVIBRATOR. See Figure 4-5 and Schematic 4. Operation of multivibrator A3Q15/Q16 is set by DISPLAY switch A3S1. The multivibrator is:

a. a switch (one side on and the other off) for A, B, and A vs. B displays.

b. bistable for ALT (alternate) channel displays.

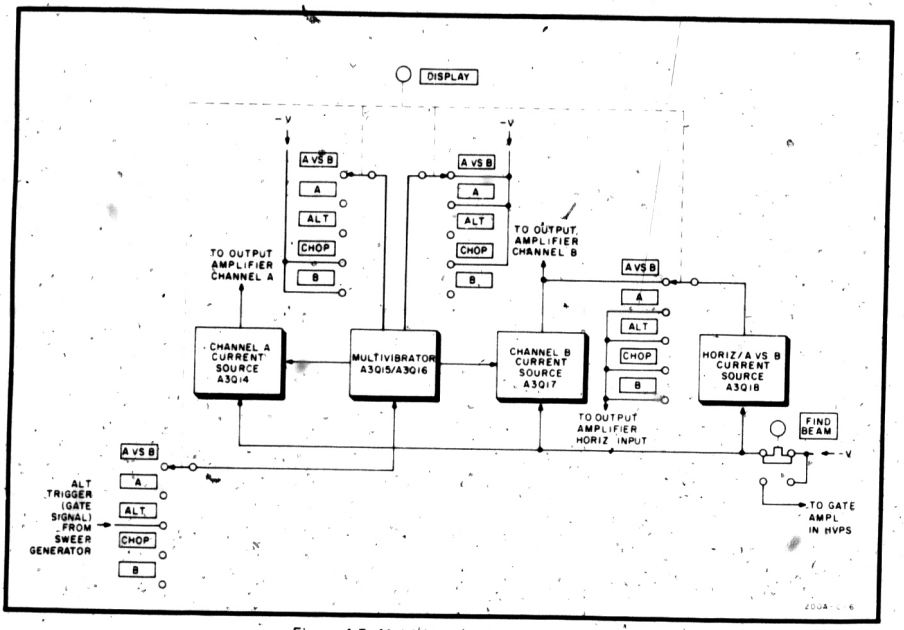


Figure 4-5. Multivibrator Block Diagram

c. astable at about 100 kHz for CHOP (mixed) displays.

4-97. In the A vs. B setting, −50V is applied through the DISPLAY switch (A3S1) and A3R46 to the base of A3Q15. As a result, A3Q15 turns on and the collector moves in a positive direction. This positive-going voltage ensures that A3Q16 won't conduct, and it forward biases the base-to-emitter junction of A3Q14. Current source A3Q14 then conducts to supply current to the channel A vertical amplifier (Schematic 3). When the DISPLAY switch is set to A, operation is the same, and current is again supplied to the channel A vertical amplifier.

4-98. The −50V is disconnected from the base of A3Q15 and applied to the base of A3Q16, via A3R44, when the DISPLAY switch is set to B. Transistor A3Q16 then conducts, ensuring no A3Q15 conduction, and forward biases the base-to-emitter junction of A3Q17. Current source A3Q17 then conducts to supply current to the channel B vertical amplifier.

4-99. When the DISPLAY switch is set to ALT, neither A3R44 or A3R46 is connected to the −50V supply, and the alt trigger (unblanking pulse) from the sweep generator is applied to the anodes of A3CR25 and A3CR26. The multivibrator then operates in a bistable mode, turning current sources A (A3Q14) and B (A3Q17) alternately on and off at the rate of the unblanking pulse. Thus, channel A current is supplied during one sweep and channel B current is supplied during the succeeding sweep.

4-100. The unblanking pulse is disconnected and −50V is applied through A3R44/R46 to the bases of both A3Q15/Q16 when the DISPLAY switch is set to CHOP. In this mode, the multivibrator is astable, and it free-runs at about a 100 kHz rate. When A3Q15 turns on, it turns off A3Q16 and turns on A3Q14 to supply channel A current for the vertical amplifier. Then the cycle reverses. Transistor A3Q16 turns on, turning off A3Q15 and turning on A3Q17 to supply channel B current for the vertical amplifier. Unlike ALT operation, the channels switch independent of the sweep signal at about a 100 kHz rate.

4-101. Current source A3Q18 always conducts. When the DISPLAY switch is set to A vs. B, it supplies current to the channel B vertical amplifier while A3Q14 supplies current to the channel A vertical amplifier. In all other setting of the DISPLAY switch, A3Q18 supplies current to the horizontal amplifier.

4-102. Current is normally supplied to the current sources from the −50V power supply, via the FIND BEAM pushbutton switch (S2) and A3R61. When the FIND BEAM switch is pressed, A3R61 is disconnected. Current is then supplied from the filtered −50V supply, via A3R58. Since the resistance of A3R58 is greater than that of A3R61, the current sources supply less current to the output amplifiers. And, since less current is supplied to the output amplifiers, vertical and horizontal deflection is decreased. The −50V that was connected to A3R61 is now applied to the gate amplifier in the high voltage power supply by the FIND BEAM switch. As a result, the CRT is unblanked. An offset CRT display can thus be returned to the viewing area.

4-103. Emitter follower A3Q13 is used to apply a chop blanking signal to the gate amplifier in the high voltage power supply when CHOP is selected by the DISPLAY

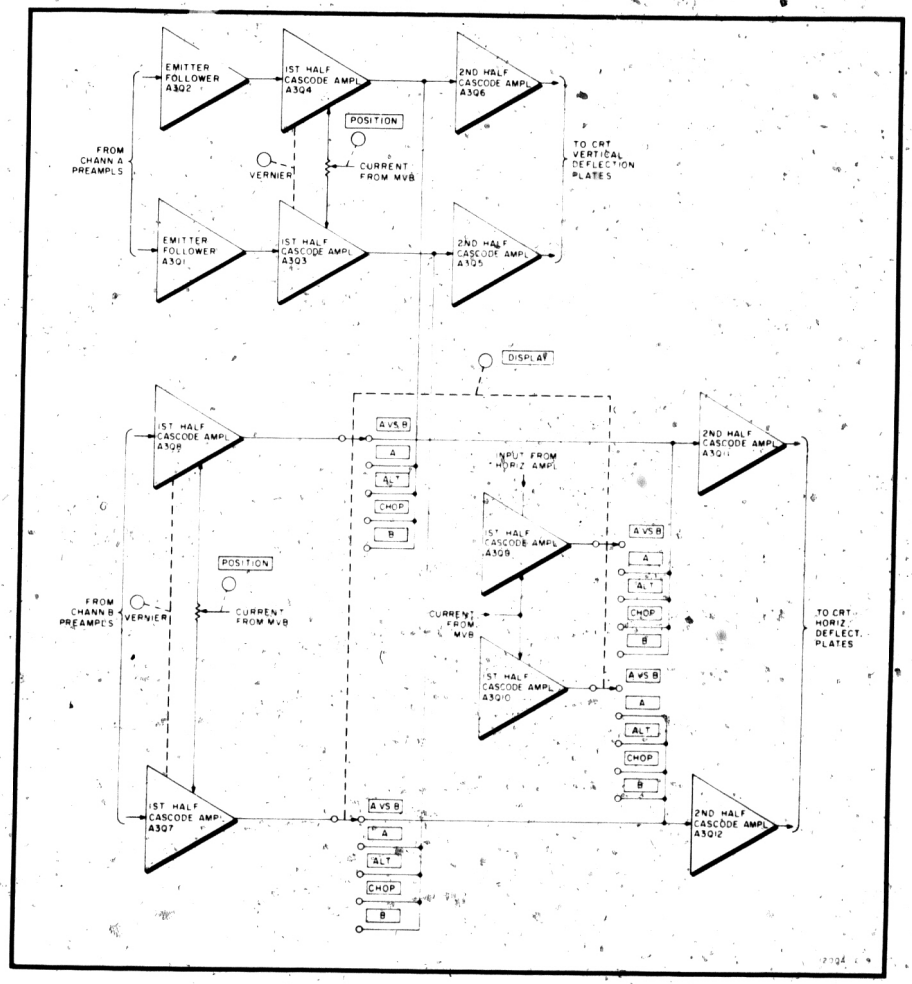


Figure 4-6. Output Amplifier Block Diagram

switch. This signal, taken from the multivibrator, blanks the CRT during switching time between channels.

4-104. Either the channel A or B display signal from the vertical preamplifiers can be applied as an internal trigger signal to the horizontal preamplifier. Except when the DISPLAY switch is set to B, the internal trigger signal is always taken from the channel A preamplifier.

4-105. OUTPUT AMPLIFIER. See Figure 4-6 and Schematic 3. Channel A signals are applied to the bases of A3Q1 and A3Q2 from the vertical preamplifiers. These two emitter followers isolate the preamplifier from chop and alt signals present in the emitters of A3Q3 and A3Q4. This isolation is needed to prevent interaction with the channel A trigger signal.

4-106. The channel B signal is applied to the bases of A3Q7 and A3Q8 from the channel B preamplifier. Isolation transistors are not needed because the channel B signal isn't used for triggering in the chop or alt modes.

4-107. Only operation of the channel A amplifier is explained in detail in the following paragraphs. The channel B and horizontal amplifiers are similar.

4-108. Diodes A3CR3-CR6 allow fast recovery of the amplifiers if they are driven into saturation. Protection diodes A3CR7 and A3CR8 prevent A3Q3 and A3Q4 emitter breakdown if the amplifier is overdriven. The input is neutralized by A3C1 and A3C2 to prevent coupling between channels when both are connected to A3Q5/Q6, as is the case in the alt or chop modes.

4-109. Output amplifier gain is about 40 when Vernier potentiometer A1A2R16 is set to the CAL detent. Since the vertical output stage is a differential cascode amplifier, gain is approximately equal to the ratio of A3R12 or A3R13 to one-half of the resistance between the emitters of A3Q3 and A3Q4.

4-110. Whether the channel A or B amplifiers are turned on or off is determined by the current sources applied to the arm of the POSITION potentiometers (R6 for channel A and R7 for channel B). Either channel (A or B) or both, at a 100 kHz rate (CHOP) or alternating at the sweep rate (ALT), can be applied to the second half of the output cascode amplifier (A3Q5/Q6), depending on the setting of the DISPLAY switch. Output signals are then applied to the CRT's vertical deflection plates.

4-111. Operation of the horizontal output amplifier is similar to that of the vertical output amplifier. The horizontal signal or sweep signal (depending on the SWEEP/EXT HORIZ switch setting) is applied to the base of A3Q9, converted to a differential signal, amplified and then applied to the CRT's horizontal deflection plates.

4-112. Current is supplied to the emitters of A3Q9 and A3Q10 from the multivibrator circuit at all settings of the DISPLAY switch except A vs. B. In this setting, the horizontal signal is disconnected from the second half of the cascode amplifier (A3Q11/Q12), and the channel B signal from the vertical amplifier is applied instead.

4-113. POWER SUPPLY MODULES.

4-114. There are two power supplies in this instrument: a low voltage supply and a high voltage supply. Each is explained separately in the following text.

4-115. LOW VOLTAGE SUPPLY. See Figure 4-8 and Schematic 9. Line voltage is transformed, rectified and filtered into two regulated outputs (+50V and −50V) and one unregulated output (+180V). In addition, 6.3 Vac is applied to the CRT filament, a calibrating signal is generated, and a power-line frequency sync signal is provided for the horizontal circuits.

4-116. Primary Power. Either 115 or 230 Vac (±10%, single phase, 47 to 440 Hz) can be applied as operating power, depending on the jumper wires connected to T1. When POWER switch S1 is turned on, lamp DS1 lights to indicate the presence of primary power, and fuse F1 prevents excessive input current from damaging the instrument. Since the instrument is fully transistorized (except for the CRT), no fan is needed, and cooling is by convection.

4-117. If 115 Vac is used as primary power, one side of the line voltage is applied to pins 1 and 3 of T1, and the other side is connected to pins 2 and 4. Thus, the two primary windings are in parallel. This is done so that primary power is divided between the two windings, and neither is as susceptible to breakdown.

4-118. When T1 is wired to accept 230 Vac, windings 1 to 2 and 3 to 4 are connected in series. This decreases the transformer step-up ratio by a factor of 50% so that secondary voltages remain the same as when 115 Vac is applied.

4-119. Basic Regulated Power Supply. A simplified block diagram of the type regulator used in the low voltage power supply is shown in Figure 4-7. In effect, this circuit

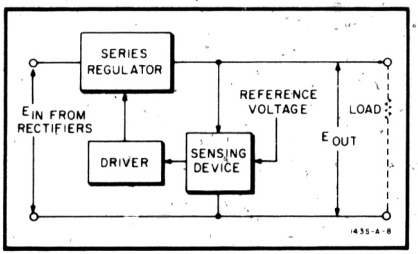


Figure 4-7. Regulated Power Supply Block Diagram

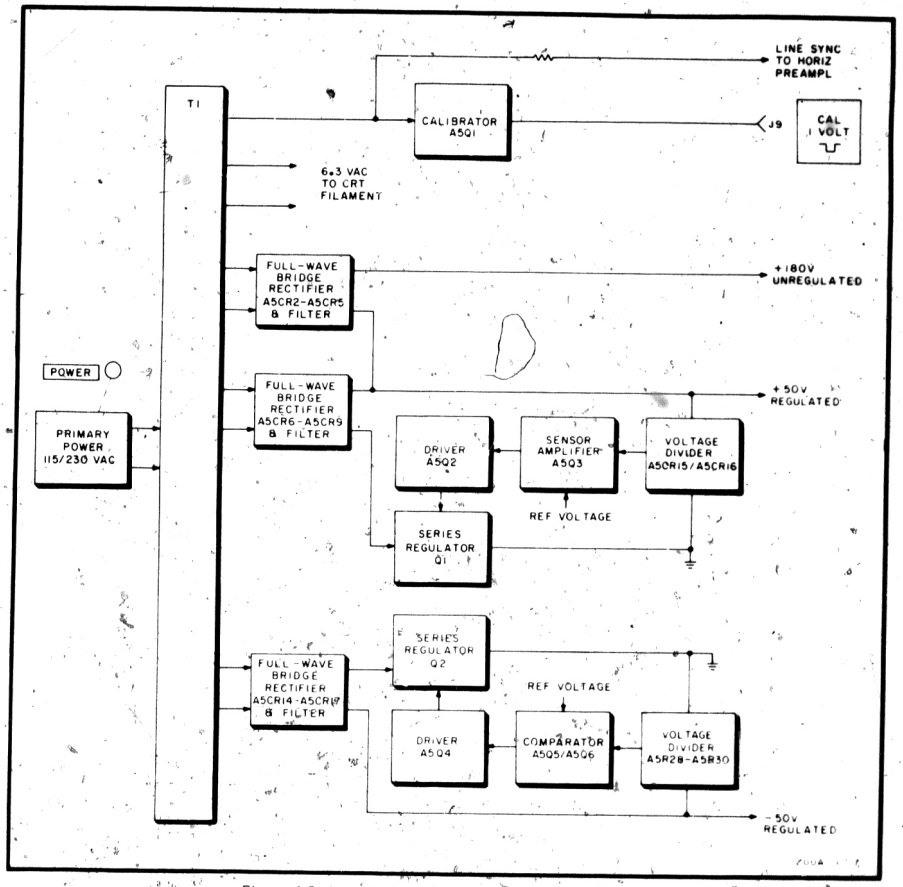


Figure 4-8. Low Voltage Power Supply Block Diagram

is simply a self-adjusting voltage divider. Its purpose is to keep output voltage constant.

4-120. Input voltage, from the rectifiers, is dropped proportionately across the series regulator and the parallel combination of load and sensing device. Changes in output voltage are detected by the sensing device (either a comparator or common emitter amplifier) and are then compared against a reference voltage. If sensor voltage doesn't agree with the reference voltage, a difference voltage is created and applied to the driver.

4-121. The driver, in turn, controls series regulator bias. Since the series regulator acts as a variable resistance, it either increases or decreases conduction. The resulting voltage drop opposes the output voltage change and, thus, output voltage remains at a constant level.

4-122. Secondary Power. AC voltage across each secondary winding (except calibrator and CRT filament voltages) is full-wave rectified by a bridge circuit. The resulting dc voltages are filtered and applied to the following circuits for regulation. Since the −50V supply acts as a reference for the other supplies, it is explained first.

4-123. −50 Volt Supply. From pins 9 and 10 of T1, secondary ac voltage is full-wave bridge rectified by

A5CR14-CR17. The resulting dc voltage, pulsating at 120 Hz, is filtered primarily by A5C5. Resistor A5R18 is a bleeder placed at the input as a protective device to discharge A5C5 if fuse A5F3 opens. Current is limited by A5R17 and, in case A5F3 opens, A5CR21 protects A5C9 from reverse charging.

4-124. Output voltage is sampled at voltage divider A5R28/R29/R30 and applied to the comparator, A5Q5/Q6. This voltage, applied to the base of A5Q6, is compared against a reference voltage set by A5VR4 at the base of A5Q5. A voltage difference is then amplified and applied to the driver, A5Q4. In turn, the driver changes the bias applied to series regulator Q2. This, in effect, changes the resistance of the regulator and keeps output voltage constant.

4-125. In case the −50V supply output is shorted to ground, A5VR3 protects the series regulator by turning on and causing A5Q2 to draw enough current to open fuse A5F3. RC network A5C6 and A5R21 is a high frequency roll-off path for frequencies above 10 kHz, and A5C7 bypasses noise caused by zener diode A5VR4. Diodes A5CR18-CR20 are protection diodes.

4-126. +50 Volt Supply. The +50V supply functions similar to the −50V supply. Sensor amplifier A5Q3 is referenced to the −50V supply. A voltage variation in the +50V supply output is sensed at the base of A5Q3, amplified and applied to the series regulator by driver A5Q2. The series regulator (Q1) then compensates with more or less series resistance and restores output voltage to the original level.

4-127. Bias for the driver is provided by A5VR2, and A5VR1 protects the series regulator. Diodes A5CR11 and A5CR12 are emitter-to-base protection diodes, and A5CR13 protects A5C2 and A5C4 by preventing the supply voltage from going negative. Frequencies above 10 kHz are rolled off by A5C3 and A5R12.

4-128. +180 Volt Supply. This supply consists of an unregulated +130V supply added onto the +50V supply. Input voltage is full-wave rectified by A5CR2-CR5, fused by A5F1, and filtered by A5C1. Resistor A5R6 is a bleeder. Since the supply is not regulated, output voltage may vary with the line voltage or load changes.

4-129. Calibrator. This circuit produces a 1V pk-pk power-line frequency square wave. Transistor A5Q1 operates as a switch. During the negative alternation of the power-line frequency signal taken from T1 pin 6, the transistor saturates, and output voltage at the front panel calibrator jack (J9) is 0V. The transistor cuts off during

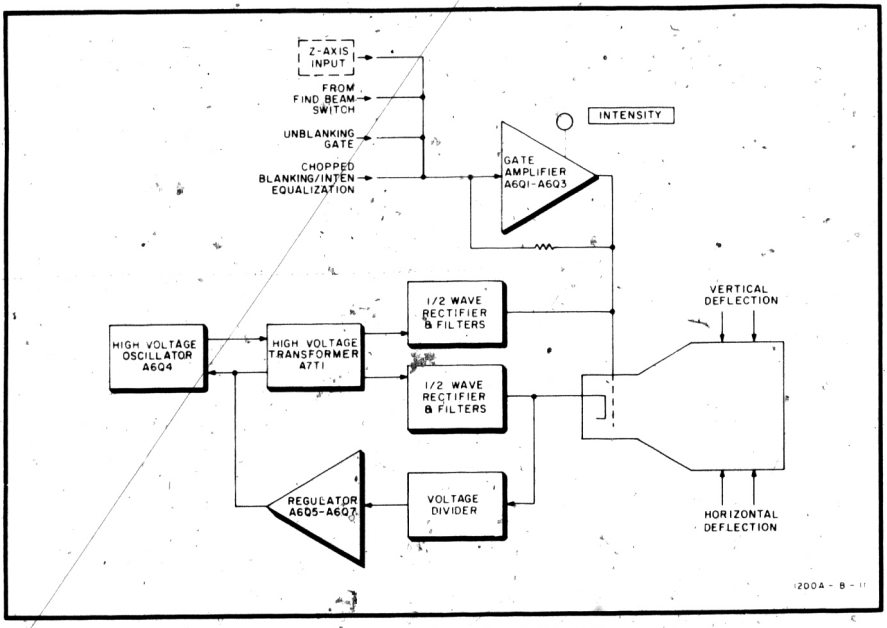


Figure 4-9. High Voltage Power Supply Block Diagram

the positive alternation of the input signal, and output voltage is set to −1V by voltage divider A5R3-R5. The signal that drives the calibrator is also attenuated by A5R1 and applied to the horizontal module for use as a power-line frequency sync signal.

4-130. HIGH VOLTAGE SUPPLY. See Figure 4-9 and Schematic 10. The high voltage power supply consists of three circuits: a high voltage regulator, high voltage rectifiers, and a gate amplifier. Each of these is explained separately, as follows.

4-131. High Voltage Regulator. High voltage oscillator A6Q4 produces a 50 kHz, 100V pk-pk, sine wave. To sustain oscillations, regenerative feedback is coupled from collector to base via the mutual inductance of A7T1. This signal is then stepped up in amplitude by the transformer and later rectified and filtered by the secondary circuits.

4-132. High voltage is regulated as follows. Half-wave rectified and filtered high voltage from A7CR2 is fedback to high-input-impedance field effect transistor A6Q7 by A6R27. In combination with A6R26 and A6R17B, resistor A6R27 forms a 45:1 (approximately) voltage divider. Since the top end of A6R26 is connected to the +50V supply, the gate of A6Q7 is close to ground potential. Bias for A6Q7 is set by A6R17B. Since this adjustment sets the bias of the input transistor, it also controls the conducting levels of A6Q5 and A6Q6 and sets the bias of the high voltage oscillator.

4-133. A variation in feedback voltage at the gate of A6Q7 is amplified by A6Q5-Q7 and applied to the base of A6Q4 to reestablish output voltage.

4-134. High Voltage Rectifiers. CRT cathode voltage is derived from the bottom secondary winding of A7T1. This ac voltage is half-wave rectified by A7CR2 and filtered by a capacitive input pi-filter network. A portion of this high voltage is returned to the high voltage regulator by means of A6R27 to provide a regulated −2915V CRT cathode potential.

4-135. In combination with A6R28-R32, FOCUS control R4 forms a voltage divider connected to the −2915V supply and provides CRT focusing potential.

4-136. CRT grid voltage is developed by the voltage divider string across the top secondary winding of high voltage transformer A7T1. The ac voltage is half-wave rectified by A7CR1 and filtered by A7C1 and A7R1 before it is applied to the voltage divider. Intensity Limit adjustment A6R14 is used to adjust current through the divider and, thus, limit the range of INTENSITY potentiometer R3. Both intensity potentiometers adjust CRT beam intensity by changing the grid-to-cathode bias.

4-137. CRT grid potential is normally about −2955V. Since grid potential is normally about 50V more negative than the cathode, the CRT beam is turned off. Neon bulbs A6VR2 and A6VR3 protect A6CR8. The grid is prevented from becoming excessively positive with respect to the cathode by A6CR8/R37.

4-138. Astigmatism, roundness of the spot, is adjusted by A6R17A, and R2 is used to align the trace with the CRT graticule.

4-139. Gate Amplifier. The gate amplifier, A6Q1-Q3, is a current-fed operational amplifier. Inputs to the base of A6Q1 are from the following sources:

a. INTENSITY potentiometer R3.

b. the unblanking gate from the sweep generator.

c. chopped blanking/intensity equalization from the sweep generator.

d. Z-axis signals from TB1.

e. BEAM FINDER S2.

f. feedback current through A6C3/R12.

4-140. These input currents are summed at the base of A6Q1, converted to a voltage, amplified by A6Q3 and applied to the CRT's grid as bias. Output voltage at the collector of A6Q3 is approximately equal to the current through A6CR3 multiplied by the resistance of A6R12.

4-141. Transistor A6Q2 is a constant current source at low frequencies and an active pull-up at high frequencies. If the current through A6CR3 increases, feedback current through A6C3/R12 increases, and less current is available for A6Q3. The collector voltage of A6Q3 then moves in a positive direction, reducing CRT grid bias and increasing CRT conduction. When a less negative signal is applied to the cathode of A6CR3, feedback current decreases and the current through A6Q3 increases. Thus, the collector of A6Q3 moves in a negative direction to increase CRT bias and decrease CRT conduction.

4-142. Diodes A6CR1/CR2/CR4 prevent the amplifier from being overdriven, and A6CR5 prevents the collectors of A6Q2/Q3 from being more positive than 50.6V. Due to the feedback current, amplifier gain is stable.

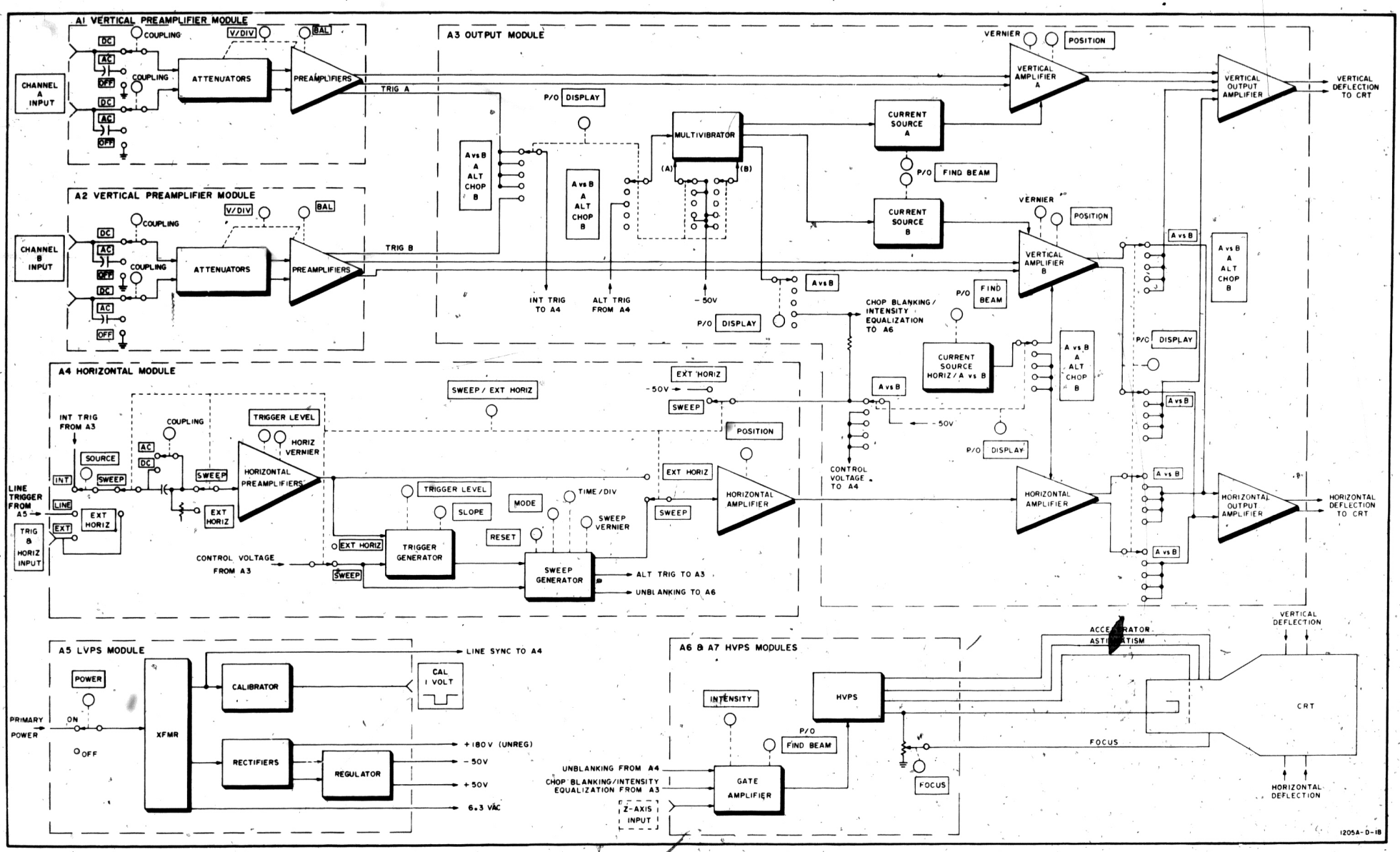


Figure 4-10. Overall Block Diagram

PERFORMANCE CHECK

ADJUSTMENTS

Table 5-1. Recommended Test Equipment

Recommended Instrument		Required Characteristics	Required for
Type	Model		
Voltmeter Calibrator	HP Model 738AR or H01-738BR	0.5 mV to 100 V pk-pk, ±0.2%	Calibrator Check Vert. Ampl. Gain Check Vert. Vernier Check Trig. Point & Slope Check Horiz. Ampl. Gain Check Horiz. Vernier Check Horiz. Ampl. Gain Adj. Output Ampl. Gain Adj.
Oscillator	HP Model 200CD	50 Hz to 500 kHz; up to 8.0V pk-pk at 500 kHz; 20V pk-pk at 10 kHz.	Vert. Positioning Check Vert. Bandwidth Check CMR Check A vs. B Phase Shift Check Channel Isolation Check Trig. Amplitude Check Trig. Point & Slope Check Horiz. Bandwidth Check
Time-mark Generator	Tektronix Type 180A or 184A	markers from 1 usec to 5 sec.	Sweep Time Check Sweep Vernier Check Mag. Sweep Check Single Sweep Check Sweep Time Adj.
Digital DC Voltmeter	HP Model 3439A with Model 3441A	±50V; ±0.05% ±165V; ±0.05%	L.V.P.S. Adj. H.V.P.S. Adj.
High Voltage 100:1 Divider Probe	HP Model 11044A	−3000 Vdc.	H.V.P.S. Adj.
High Voltage Hum Probe	HP Model ET-2227	0.0068 uF; 500 Vdc.	H.V.P.S. Adj.
L-C Meter	Tektronix Type 130 LC	45 pF ±3%	Input Cap Adj. Atten. Comp. Adj.
Square Wave Generator	HP Model 211A	4.5V pk-pk at 1 kHz; risetime approx. 0.5 usec	Horiz. Atten. Comp. Adj. Input Cap Adj. Atten. Comp. Adj.
Frequency Compensated Divider Probe	HP Model 10001A	10:1; dc to 30 MHz; 10 megohms; 10 pF; 2%; 600V.	L.V.P.S. Adj. H.V.P.S. Adj.
Test Oscilloscope	HP Model 1200A/B	100 mV sensitivity; 100 kHz bandwidth	L.V.P.S. Adj. H.V.P.S. Adj.
AC Voltmeter	HP Model 427A	10V; +2% accurate 50 kHz to 500 kHz	Vert. Bandwidth Check Horiz. Bandwidth Check
BNC-to-binding-post adapter quantity: 2	HP Model 1011A	shielded	Channel Isolation Check

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains step-by-step procedures required to check and maintain specified instrument performance. Photographs of all internal adjustments are also included; follow-up troubleshooting information and schematics are in Section VIII.

5-3. TEST EQUIPMENT.

5-4. Recommended test equipment is listed in Table 5-1. Equivalent test equipment may be substituted, provided it has the required characteristics stated in the table. For proper results, use only recently calibrated test equipment.

5-5. PERFORMANCE CHECK.

5-6. The purpose of the performance check is to indicate whether or not the instrument is operating within the specifications stated in Table 1-1. This check can be used as part of an incoming quality assurance inspection, as a periodic operational test, or to check calibration after repairs or adjustments are made. If the result of a performance check is unsatisfactory, refer to the indicated adjustment step (when given). If, after doing the appropriate adjustment, performance is still unsatisfactory, refer to Section VIII for detailed troubleshooting information.

5-7. It is preferable to do the performance check in the given sequence since succeeding steps depend on the control settings and results of earlier steps. However, steps may be done individually or out of sequence by referring to the preliminary control settings and the steps prior to the desired one.

5-8. Enter the results of the initial performance check on the Performance Check Record at the end of the procedure. Then remove the forms from the manual and file them for future reference (be sure to include the instrument serial number for identification).

5-9. PRELIMINARY CONTROL SETTINGS.

a. Set:

INTENSITY	ccw
FOCUS	midrange
Volts/Division (A and B)	20 V/DIV
Vertical Vernier (A and B)	CAL
Vertical POSITION (A and B)	midrange
+Vertical Coupling (A and B)	OFF
−Vertical Coupling (A and B)	OFF
DISPLAY	CHOP
Horizontal POSITION	midrange
SWEEP/EXT HORIZ	X1
Time/Division	1 MSEC/DIV
Horizontal Vernier	CAL
MODE	FREE RUN
SLOPE	+
TRIGGER LEVEL	AUTO
SOURCE	INT
Horizontal COUPLING	DC

b. Apply operating power (refer to power requirements paragraph in Section II), turn on POWER switch and allow at least 15 minutes for warm-up.

5-10. PRELIMINARY CHECK.

5-11. Paragraphs 5-12 through 5-17 contain preliminary operational checks of performance characteristics not specified in Table 1-1. Since these characteristics are not specified, stated results are approximate.

5-12. INTENSITY.

a. Turn INTENSITY control from stop to stop.

b. Note that intensity of traces varies smoothly from extinguished to brighter than normal.

c. Refer to Paragraph 5-43 for adjustment information, if required.

5-13. FOCUS.

a. Adjust INTENSITY for visible traces.

b. Turn FOCUS control from stop to stop.

c. Note that traces are focused when FOCUS is set to approximately midrange.

5-14. TRACE ALIGN.

a. Using POSITION controls, set traces on horizontal graticule lines.

b. Adjust TRACE ALIGN, and note that traces can be aligned parallel to horizontal axis.

5-15. AMPLIFIER BALANCE.

a. Turn channel A Volts/Division from 20 V/DIV to 5 MV/DIV, and adjust front panel BAL (channel A) screwdriver adjustment.

b. Note that channel A trace can be prevented from shifting when turning Volts/Division.

c. Repeat steps a and b for channel B.

5-16. VERTICAL POSITIONING.

a. Set:

+Vertical Coupling (A and B) . . . . . AC
Volts/ Division (A and B) . . . . . 0.1 V/DIV
MODE . . . . . NORM
Time/Division . . . . . 5 USEC/DIV

b. Connect 100-kHz signal from oscillator to channel A +INPUT jack.

c. Adjust oscillator for 8 divisions vertical deflection.

d. Turn channel A Vertical POSITION fully cw.

e. Note that channel A display moves upward until offset from graticule.

f. Turn channel A Vertical POSITION fully ccw.

g. Note that channel A display moves downward until offset from graticule.

h. Repeat steps b through g for channel B.

i. Disconnect oscillator.

5-17. BEAM FINDER.

a. Remove traces from screen by turning vertical and horizontal POSITION controls.

b. Set INTENSITY fully ccw.

c. Press FIND BEAM pushbutton.

d. Note that bright, defocused traces return to screen.

e. Readjust INTENSITY and POSITION controls to return traces to screen.

5-18. CALIBRATOR.

a. Set Time/Division to 5 MSEC/DIV.

b. Connect 400-Hz, 1V pk-pk signal from voltmeter calibrator to channel A +INPUT jack.

c. Set channel A Vertical Vernier for 8 divisions vertical deflection.

d. Disconnect voltmeter calibrator, and connect CAL 1 VOLT signal to channel A +INPUT jack.

e. Note display of 8 vertical divisions ±0.6 minor division.

f. Disconnect CAL 1 VOLT signal.

5-19. VERTICAL AMPLIFIER GAIN.

a. Set:

DISPLAY . . . . . A
+Vertical Coupling (A and B) . . . . . DC
Time/Division . . . . . 1 MSEC/DIV

b. Connect 400-Hz signal from voltmeter calibrator output to channel A +INPUT jack.

c. Set voltmeter calibrator output and channel A Volts/Division according to Table 5-2.

d. Observe vertical deflection specified in Table 5-2.

Table 5-2. Vertical Amplifier Gain

Voltmeter Calibrator Volts (pk-pk)	Volts/Division	Vertical Deflection (divisions)
100V	20V	5 ± 0.15
50V	10V	5 ± 0.15
30V	5V	6 ± 0.18
10V	2V	5 ± 0.15
5V	1V	5 ± 0.15
3V	0.5V	6 ± 0.18
1V	0.2V	5 ± 0.15
0.5V	0.1V	5 ± 0.15
0.3V	50 mV	6 ± 0.18
0.1V	20 mV	5 ± 0.15
50 mV	10 mV	5 ± 0.15
30 mV	5 mV	6 ± 0.18

e. Set:

+Vertical Coupling A . . . . . OFF
−Vertical Coupling A . . . . . DC

f. Connect 400-Hz signal from voltmeter calibrator output to channel A −INPUT jack.

g. Set voltmeter calibrator output and channel A Volts/Division according to Table 5-3.

h. Observe vertical deflection specified in Table 5-3.

Table 5-3. Vertical Amplifier Gain

Voltmeter Calibrator Volts (pk-pk)	Volts/Division	Vertical Deflection (divisions)
3V	0.5V	6 ± 0.18
1V	0.2V	5 ± 0.15

i. Set DISPLAY to B.

j. Repeat steps b through d for channel B.

k. Set:
+Vertical Coupling B . . . . . OFF
−Vertical Coupling B . . . . . DC

l. Repeat steps f through h for channel B.

m. Refer to Paragraph 5-53 for adjustment information.

5-20. VERTICAL VERNIER.

a. Set channel B Volts/Division to 20 V/DIV.

b. Connect 400-Hz, 200V pk-pk signal from voltmeter calibrator output to channel B −INPUT jack.

c. Set channel B Vertical Vernier fully ccw.

d. Note 4 divisions or less vertical deflection.

e. Set DISPLAY to A.

f. Repeat steps a through d for channel A.

g. Disconnect voltmeter calibrator.

5-21. VERTICAL BANDWIDTH.

a. Set:
Vertical Vernier (A and B) . . . . . CAL
Volts/Division (A and B) . . . . . 1 V/DIV

b. Connect 1-kHz signal from oscillator output to channel A −INPUT jack.

c. Monitor oscillator output with ac voltmeter.

d. Adjust oscillator for 8 divisions vertical deflection, and note ac voltmeter indication.

e. Adjust oscillator frequency for 500-kHz signal.

f. Adjust signal amplitude for same voltage indication noted in step d.

g. Note 5.7 or more divisions of vertical deflection.

h. Set:
+Vertical Coupling A . . . . . DC
−Vertical Coupling A . . . . . OFF

i. Connect 1-kHz signal from oscillator to channel A +INPUT jack.

j. Repeat steps c throug g.

k. Set DISPLAY to B.

l. Connect 1-kHz signal from oscillator to channel B −INPUT jack.

m. Repeat steps c through g.

n. Set:
+Vertical Coupling B . . . . . DC
−Vertical Coupling B . . . . . OFF

o. Connect 1-kHz signal from oscillator to channel B +INPUT jack.

p. Repeat steps c through g.

q. Disconnect oscillator and ac voltmeter.

r. Refer to Paragraph 5-54 for adjustment information, if required.

5-22. COMMON MODE REJECTION RATIO.

a. Set:
DISPLAY . . . . . A
+Vertical Coupling (A and B) . . . . . DC
−Vertical Coupling (A and B) . . . . . DC
Volts/Division (A and B) . . . . . 5 MV/DIV

b. Connect 10-kHz, 6V pk-pk signal from oscillator to channel A + and −INPUT jacks (jacks shorted together).

c. Note 3.8 divisions or less vertical deflection.

d. Set DISPLAY to B.

e. Disconnect oscillator from channel A and connect to channel B + and −INPUT jacks (jacks shorted together).

f. Note 3.8 divisions or less vertical deflection.

g. Disconnect oscillator.

5-23. A vs. B PHASE SHIFT.

a. Set:
DISPLAY . . . . . A vs B
Volts/Division (A and B) . . . . . 0.2 V/DIV
−Vertical Coupling (A and B) . . . . . OFF

b. Connect 100-kHz sine wave signal from oscillator output to channel A and B +INPUT jacks.

c. Adjust signal amplitude to obtain 8 divisions vertical deflection.

d. Note that minor diameter of elliptical display (display may appear as straight, diagonal line) is 0.1 division or less.

e. Set Volts/Division (A and B) to 0.5 V/DIV.

f. Repeat steps c and d.

5-24. CHANNEL ISOLATION.

a. Set:

DISPLAY	ALT
Volts/Division A	20 V/DIV
Volts/Division B	5 MV/DIV
+Vertical Coupling (A and B)	DC
−Vertical Coupling (A and B)	DC
Time/Division	1 USEC/DIV

b. Connect shielded BNC-to-binding-post adapters from channel B + and −INPUT jacks to ground jack.

c. Connect 500-kHz signal from oscillator output to channel A + and −INPUT jacks (ground jack not used).

d. Adjust oscillator for 1 division channel A vertical deflection.

e. Note less than 0.4 division of channel B vertical deflection.

f. Set:

Volts/Division A	5 MV/DIV
Volts/Division B	20 V/DIV

g. Repeat steps b through e with signal applied to channel B.

h. Disconnect oscillator and input adapters.

5-25. TRIGGER AMPLITUDE.

a. Set:

DISPLAY	A
+Vertical Coupling A	DC
−Vertical Coupling A	OFF
Volts/Division A	1 V/DIV
Time/Division	5 MSEC/DIV

b. Connect 50-Hz signal from oscillator output to channel A +INPUT jack.

c. Adjust oscillator for 0.5 division vertical deflection.

d. Adjust TRIGGER LEVEL or set to AUTO detent, and note stable display.

e. Set Time/Division to 1 USEC/DIV.

f. Adjust oscillator frequency for 500-kHz signal.

g. Repeat steps c and d.

h. Set:

SOURCE	EXT
Volts/Division A	50 MV/DIV

i. Connect 500-kHz signal from oscillator output to channel A +INPUT and TRIG & HORIZ INPUT jacks.

j. Adjust oscillator for 4 divisions vertical deflection.

k. Adjust TRIGGER LEVEL or set to AUTO detent, and note stable display.

l. Set Time/Division to 5 MSEC/DIV.

m. Adjust oscillator for 50-Hz signal.

n. Repeat steps j and k.

5-26. TRIGGER POINT AND SLOPE.

a. Set SOURCE to INT.

b. Adjust oscillator for 8 divisions vertical deflection.

c. Adjust TRIGGER LEVEL through its range.

d. Note stable display as trigger point moves smoothly along positive slope of waveform.

e. Set SLOPE to −.

f. Adjust TRIGGER LEVEL through its range.

g. Note stable display as trigger point moves smoothly along negative slope of waveform.

h. Disconnect oscillator.

i. Set

Volts/Division A	20 V/DIV
Time/Division	0.5 MSEC/DIV
SOURCE	EXT

j. Connect 400-Hz, pk-pk signal from voltmeter calibrator to channel A +INPUT and TRIG & HORIZ INPUT jacks.

k. Set channel A Vertical Vernier for 8 divisions vertical deflection.

l. Adjust TRIGGER LEVEL through its range.

m. Note stable display as trigger point moves smoothly along negative slope of waveform.

n. Set SLOPE to +.

o. Adjust TRIGGER LEVEL through its range.

p. Note stable display as trigger point moves smoothly along positive slope of waveform.

q. Disconnect voltmeter calibrator.

5-27. SWEEP TIME.

a. Set SLOPE to + and SOURCE to INT.

b. Connect time-mark generator to channel A +INPUT jack.

Table 5-4. Sweep Timing

Time-mark Generator	Time/Division	Time Mark to Check
5 sec	5 SEC/DIV	11
1 sec	2 SEC/DIV	21
1 sec	1 SEC/DIV	11
500 msec	0.5 SEC/DIV	11
100 msec	0.2 SEC/DIV	21
100 msec	0.1 SEC/DIV	11
50 msec	50 MSEC/DIV	11
10 msec	20 MSEC/DIV	21
10 msec	10 MSEC/DIV	11
5 msec	5 MSEC/DIV	11
1 msec	2 MSEC/DIV	21
1 msec	1 MSEC/DIV	11
500 usec	0.5 MSEC/DIV	11
100 usec	0.2 MSEC/DIV	21
100 usec	0.1 MSEC/DIV	11
50 usec	50 USEC/DIV	11
10 usec	20 USEC/DIV	21
10 usec	10 USEC/DIV	11
5 usec	5 USEC/DIV	11
1 usec	2 USEC/DIV	21
1 usec	1 USEC/DIV	11

c. Set time-mark generator and Time/Division according to Table 5-4. Adjust TRIGGER LEVER for stable display, and adjust INTENSITY and channel A Volts/Division as required to obtain 3 to 5 divisions vertical deflection.

d. Adjust Horizontal POSITION to align first marker with left edge of graticule.

e. Note that 11th or 21st marker (according to Table 5-4) is within 0.3 division of right edge of graticule.

f. Refer to Paragraph 5-50 for adjustment information, if required.

5-28. SWEEP VERNIER.

a. Set time-mark generator for 1-msec markers.

b. Set Time/Division to 0.1 MSEC/DIV, and turn Horizontal Vernier fully ccw.

c. Adjust TRIGGER LEVER for stable display.

d. Note that any two markers are displayed in less than 4 horizontal divisions.

5-29. MAGNIFIED SWEEP.

a. Set:
SWEEP/EXT HORIZ . . . . . MAG
Time/Division . . . . . 0.1 MSEC/DIV
Horizontal Vernier . . . . . CAL

b. Adjust TRIGGER LEVEL for stable display.

c. Adjust Horizontal POSITION to align first marker with left edge of graticule.

d. Note that second marker is within 0.5 division of right edge of graticule.

5-30. SINGLE SWEEP.

a. Set:
SWEEP/EXT HORIZ X1
Time/Division . . . . . 0.1 SEC/DIV
MODE . . . . . SINGLE
TRIGGER LEVEL . . . . . AUTO

b. Set time-mark generator for 100-msec markers.

c. Press RESET pushbutton; note that indicator lights, and one sweep cycle is displayed. Indicator goes out at end of sweep cycle.

d. Disconnect time-mark generator.

5-31. HORIZONTAL AMPLIFIER GAIN.

a. Set SWEEP/EXT HORIZ to 1 V/DIV.

b. Connect 400-Hz signal from voltmeter calibrator to TRIG & HORIZ INPUT jack.

c. Set voltmeter calibrator output and EXT HORIZ V/DIV according to Table 5-5.

Table 5-5. Horizontal Gain

Voltmeter Calibrator Volts (pk-pk)	Ext Horiz V/DIV	Horizontal Deflection (divisions)
10V	1V	10 ± 0.3
5V	0.5V	10 ± 0.3
2V	0.2V	10 ± 0.3
1V	0.1V	10 ± 0.3

d. Observe horizontal deflection specified in Table 5-5.

e. Refer to Paragraph 5-44 for adjustment information, if required.

5-32. HORIZONTAL VERNIER.

a. Set EXT HORIZ to 1 V/DIV.

b. Set voltmeter calibrator output for 10V.

c. Set Horizontal Vernier fully ccw.

d. Note 4 or less divisions of horizontal deflection.

e. Disconnect voltmeter calibrator.

5-33. HORIZONTAL BANDWIDTH.

a. Set Horizontal Vernier to CAL detent.

b. Connect 1-kHz signal from oscillator to TRIG & HORIZ INPUT jack.

c. Monitor oscillator output with ac voltmeter.

d. Adjust oscillator for 10 divisions horizontal deflection, and note ac voltmeter indication.

e. Adjust oscillator frequency for 300-kHz signal.

f. Adjust signal amplitude for same voltage indication noted in step c.

g. Note 7 or more divisions horizontal deflection.

h. Disconnect oscillator and ac voltmeter.

i. Refer to Paragraph 5-46 for adjustment information, if required.

PERFORMANCE CHECK RECORD

Serial No. _____

REFERENCE STEP	DESCRIPTION	RESULTS		
		MIN	ACTUAL	MAX
5-12b	INTENSITY	extinguished	_____	brighter than normal
5-13c	FOCUS	focuses at midrange	_____	
5-14b	TRACE ALIGN	horizontal traces	_____	
5-15b, c	AMPLIFIER BALANCE	stationary trace	A _____ B _____	
5-16e, h	VERTICAL POSITIONING	display moves upward off graticule	A _____ B _____	
5-16g, h		display moves downward off graticule	_____ _____	
5-17d	BEAM FINDER	bright defocused traces	_____	
5-18e	CALIBRATOR	7 div + 4.4 minor div.	_____	8 div + 0.6 minor div.

PERFORMANCE CHECK RECORD

Serial No. _____

REFERENCE STEP	DESCRIPTION	RESULTS			
		MIN	ACTUAL		MAX
	VERTICAL AMPLIFIER GAIN		A	B	
5-19d, j	20 V/DIV	4.85 div.	_____	_____	5.15 div.
	10 V/DIV	4.85 div.	_____	_____	5.15 div.
	5 V/DIV	5.82 div.	_____	_____	6.18 div.
	2 V/DIV	4.85 div.	_____	_____	5.15 div.
	1 V/DIV	4.85 div.	_____	_____	5.15 div.
	0.5 V/DIV	5.82 div.	_____	_____	6.18 div.
	0.2 V/DIV	4.85 div.	_____	_____	5.15 div.
	0.1 V/DIV	4.85 div.	_____	_____	5.15 div.
	50 MV/DIV	5.82 div.	_____	_____	6.18 div.
	20 MV/DIV	4.85 div.	_____	_____	5.15 div.
	10 MV/DIV	4.85 div.	_____	_____	5.15 div.
	5 MV/DIV	5.82 div.	_____	_____	6.18 div.
5-19h, l	0.5 V/DIV	5.82 div.	_____	_____	6.18 div.
	0.2 V/DIV	4.85 div.	_____	_____	5.15 div.
	VERTICAL VERNIER		A	B	
5-20d, f			_____	_____	4 div.
	VERTICAL BANDWIDTH		A	B	
5-21g, j, m, p	500-kHz check	5.7 div.	_____	_____	
	COMMON MODE REJECTION RATIO		A	B	
5-22c, f	10-kHz signal		_____	_____	3.8 div.

PERFORMANCE CHECK RECORD

Serial No. _____

REFERENCE STEP	DESCRIPTION	RESULTS		
		MIN	ACTUAL	MAX
	A vs. B PHASE SHIFT			
5-23d	0.2 V/DIV		_____	0.1 div.
5-23f	0.5 V/DIV		_____	0.1 div.
	CHANNEL ISOLATION		A B	
5-24e, g			_____ _____	0.4 div.
	TRIGGER AMPLITUDE			
5-25d	internal; 50-Hz signal	stable display	_____	
5-25g	internal; 500-kHz signal	stable display	_____	
5-25k	external; 500-kHz signal	stable display	_____	
5-25n	external; 50-Hz signal	stable display	_____	
	TRIGGER POINT AND SLOPE			
5-26d	internal; positive slope	stable display	_____	
5-26g	internal; negative slope	stable display	_____	
5-26m	external; negative slope	stable display	_____	
5-26p	external; positive slope	stable display	_____	
	SWEEP TIME			
5-27e	5 SEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	2 SEC/DIV	21 in 9.7 div.	_____	21 in 10.3 div.
	1 SEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	0.5 SEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	0.2 SEC/DIV	21 in 9.7 div.	_____	21 in 10.3 div.
	0.1 SEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	50 MSEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	20 MSEC/DIV	21 in 9.7 div.	_____	21 in 10.3 div.
	10 MSEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	5 MSEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	2 MSEC/DIV	21 in 9.7 div.	_____	21 in 10.3 div.

PERFORMANCE CHECK RECORD

Serial No. _____

REFERENCE STEP	DESCRIPTION	RESULTS		
		MIN	ACTUAL	MAX
	SWEEP TIME (Cont'd.)			
	.1 MSEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	0.5 MSEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	0.2 MSEC/DIV	21 in 9.7 div.	_____	21 in 10.3 div.
	0.1 MSEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	50 USEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	20 USEC/DIV	21 in 9.7 div.	_____	21 in 10.3 div.
	10 USEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	5 USEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
	2 USEC/DIV	21 in 9.7 div.	_____	21 in 10.3 div.
	1 USEC/DIV	11 in 9.7 div.	_____	11 in 10.3 div.
5-28d	SWEEP VERNIER		_____	2 in 4 div.
5-29d	MAGNIFIED SWEEP	2 in 9.5 div.	_____	2 in 10.5 div.
5-30c	SINGLE SWEEP	indicator lights; one sweep cycle; indicator goes out	_____	same as minimum
5-31d	HORIZONTAL AMPLIFIER GAIN			
	1 V/DIV	9.7 div.	_____	10.3 div.
	0.5 V/DIV	9.7 div.	_____	10.3 div.
	0.2 V/DIV	9.7 div.	_____	10.3 div.
	0.1 V/DIV	9.7 div.	_____	10.3 div.
5-32d	HORIZONTAL VERNIER		_____	4 div.
5-33g	HORIZONTAL BANDWIDTH	7 div.	_____	

5-34. ADJUSTMENT PROCEDURE.

5-35. Procedures to calibrate the instrument so that it will perform as specified in Table 1-1 are presented in the following paragraphs. It is preferable to do the adjustment procedure in the given sequence since succeeding steps depend on the control settings and results of earlier steps. However, steps can be done individually by referring to the steps prior to the desired one.

5-36. Physical location of all internal adjustments is shown in Figures 5-1 through 5-5. Only channel A vertical attenuator and preamplifier adjustments are shown in Figure 5-4. To find the corresponding channel B adjustments, change the A1 prefix to A2.

5-37. Use a non-metallic screwdriver and only calibrated test equipment with characteristics as specified in Table 5-1. After adjustments are completed, check operation by doing the performance check in the previous paragraphs.

5-38. PRELIMINARY SETUP.

5-39. Remove side covers (bench instrument) or top and bottom covers (rack instrument). Apply power, and allow at least 15 minutes for warm-up.

5-40. LOW VOLTAGE POWER SUPPLY.

a. Connect digital voltmeter to output of −50V supply (any violet wire on A5).

b. Adjust A5R29 (Figure 5-1) for output of −50V ±25 mV.

NOTE

Only the −50V supply is adjustable. All other supply voltages are dependent on its adjustment.

c. Check power supply output voltages and maximum ripple according to Table 5-6.

Table 5-6. Low Voltage Power Supply Outputs

Supply	Voltage	Ripple
−50V	−50V ± 25 mV	2 mV pk-pk
+50V	+50V ± 1V	2 mV pk-pk
+180V(unreg)	+150V to +200V	150 mV pk-pk

5-41. HIGH VOLTAGE POWER SUPPLY.

a. Connect digital voltmeter via 100:1 divider probe, to output of −50V supply (any violet wire on A5).

b. Note voltage reading.

c. Multiply result of step b by 58.30.

d. Monitor high voltage supply output white-green-gray wire between A6 and A7) with digital voltmeter and divider probe.

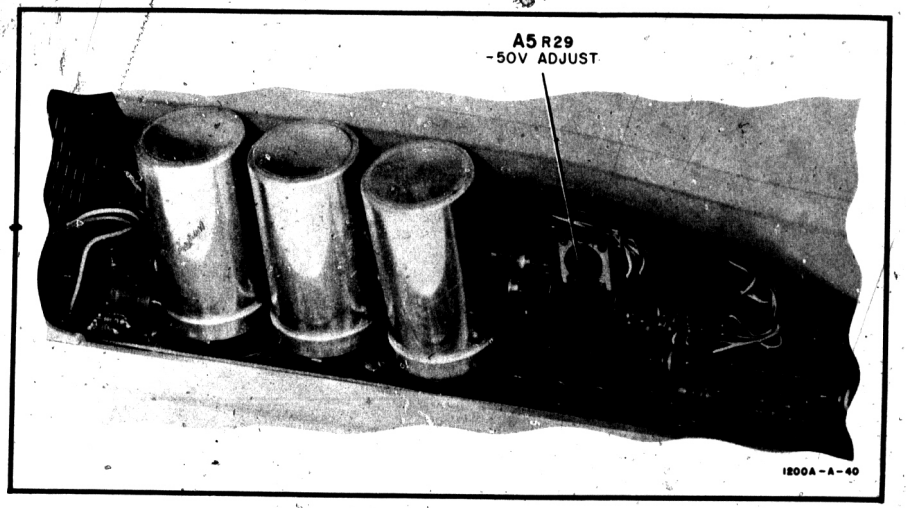


Figure 5-1. Low Voltage Power Supply Adjustment

WARNING

Voltages present in the high voltage power supply are dangerous to life.

e. Adjust A6R17B (Figure 5-2) for same voltage calculated in step c (−2,915V ±5V discounting probe attenuation).

NOTE

Divider probe inaccuracy is eliminated by this procedure.

f. Disconnect digital voltmeter.

g. Monitor high voltage supply output (white-green-gray wire between A6 and A7) with test oscilloscope and high voltage hum probe.

h. Ripple should not exceed 200 mV pk-pk.

i. Disconnect test oscilloscope.

5-42. ASTIGMATISM.

a. Set:

FOCUS	ccw
DISPLAY	A
Volts/Division A	1 V/DIV
SWEEP/EXT HORIZ	1 V/DIV

b. Set INTENSITY and vertical and horizontal POSITION controls to center low intensity dot on CRT graticule.

c. Adjust A6R17A (Figure 5-2) for largest, roundest dot possible.

d. Adjust FOCUS for smallest, sharply focused dot. Astigmatism is properly adjusted if dot remains round when focused.

5-43. INTENSITY LIMIT.

a. Set FOCUS fully ccw.

b. Set INTENSITY to 9 o'clock.

c. Adjust A6R14 (Figure 5-2) until dot just disappears.

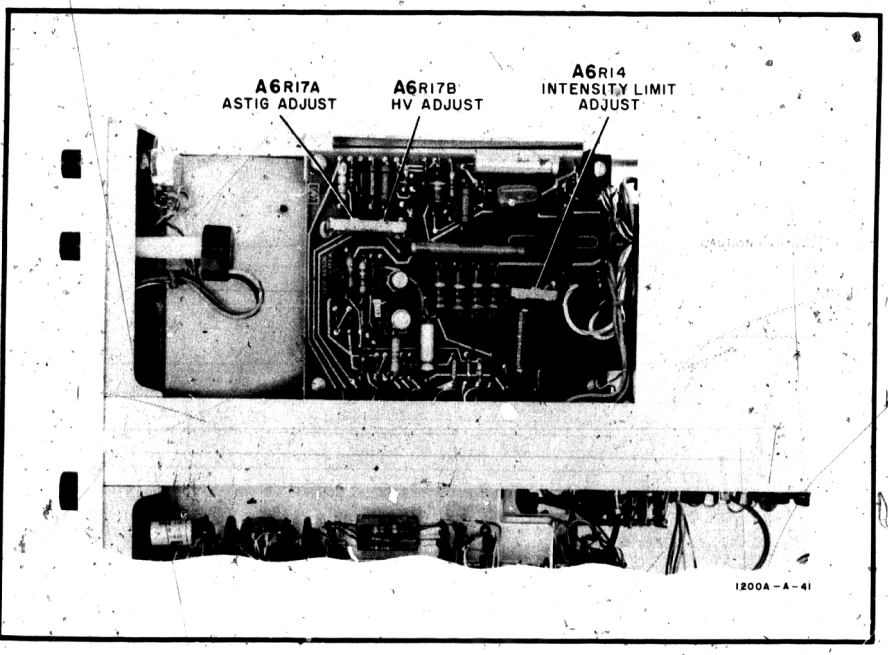


Figure 5-2. High Voltage Power Supply Adjustments

5-44. HORIZONTAL GAIN.

a. Set:
SWEEP/EXT HORIZ ..... 0.1 V/DIV
Horizontal COUPLING ..... DC

b. Connect 400-Hz, 1V pk-pk signal from voltmeter calibrator to TRIG & HORIZ INPUT jacks.

c. Adjust INTENSITY, FOCUS, and vertical and horizontal POSITION controls for midscreen trace.

d. Adjust A3R4D (Figure 5-5) for 10 divisions horizontal deflection.

e. Disconnect voltmeter calibrator.

5-45. HORIZONTAL VERNIER BALANCE.

a. Set Horizontal POSITION to center dot on screen.

b. Set Horizontal Vernier fully ccw.

c. Note horizontal position of dot.

d. Set Horizontal Vernier to CAL detent.

e. Set Horizontal POSITION to move dot to opposite side of center an amount equal to result of step c.

f. Adjust A4A1R10A (Figure 5-3) to center dot on screen.

g. Repeat steps b through f until dot remains stationary when Horizontal Vernier is turned.

5-46. HORIZONTAL ATTENUATOR COMPENSATION.

a. Connect 1-kHz signal from square-wave generator to TRIG & HORIZ INPUT jacks.

b. Set square-wave generator output for 9 divisions horizontal deflection (two dots 9 div apart).

c. Adjust A4C1 (Figure 5-3) for minimum overshoot (observed as two well-defined dots 9 div apart). Be sure that intensity is temporarily increased to observe overshoot.

d. Disconnect square-wave generator.

5-47. AUTO TRIGGERING.

a. Set:
DISPLAY ..... A
+Vertical Coupling A ..... AC
−Vertical Coupling A ..... OFF
Volts/Division A ..... 0.2 V/DIV
TRIGGER LEVEL ..... AUTO
Time/Division ..... 5 MSEC/DIV
Horizontal Vernier ..... CAL
SWEEP/EXT HORIZ X1

b. Connect CAL 1 VOLT signal to channel A +INPUT jacks.

c. Set A4A1R21 (Figure 5-3) to midrange.

d. Adjust A4A1R34B (Figure 5-3) cw until sweep free runs; then adjust it ccw until sweep stops. Center between these points.

e. Set channel A Volts/Division to 20 V/DIV.

f. Adjust A4A1R21 (Figure 5-3) to obtain triggering on both + and −setting of SLOPE switch.

g. Disconnect CAL 1 VOLT signal.

5-48. HORIZONTAL POSITION CENTERING.

a. Set channel A Volts/Division to 1 V/DIV.

b. Adjust A4A1R36 (Figure 5-3) so that beginning and end of trace are equidistant from graticule center when Horizontal POSITION is set fully cw or ccw.

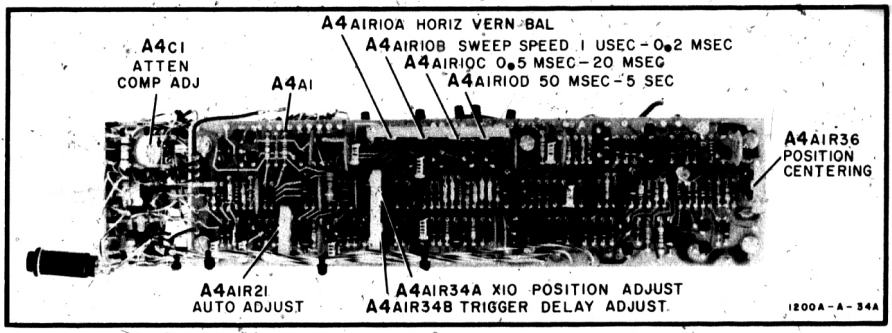


Figure 5-3. Horizontal Module Adjustments

5-49. MAGNIFIER CENTERING.

a. Set Horizontal POSITION to align beginning of trace with graticule center.

b. Set SWEEP/EXT HORIZ to MAG.

c. Adjust A4A1R34A (Figure 5-3) to align beginning of trace with graticule center.

5-50. SWEEP TIME CALIBRATION.

a. Set:

SOURCE	INT
MODE	NORM
Horizontal COUPLING	AC
SLOPE	+
SWEEP/EXT HORIZ	X1
Time/Division	5 USEC/DIV
Horizontal Vernier	CAL

b. Connect 5-usec time marks from time-mark generator to channel A +INPUT jacks.

c. Set TRIGGER LEVEL for stable display.

d. Adjust Horizontal POSITION to align 1st marker with left edge of graticule.

e. Adjust A4A1R10B (Figure 5-3) to obtain one time mark per division.

f. Set Time/Division to 0.5 MSEC/DIV and apply 0.5-msec time marks.

g. Set TRIGGER LEVEL for stable display.

h. Adjust A4A1R10C (Figure 5-3) to obtain one time mark per division.

i. Set Time/Division to 50 MSEC/DIV and apply 50-msec time marks.

j. Set TRIGGER LEVEL for stable display.

k. Adjust A4A1R10D (Figure 5-3) to obtain one time mark per division.

l. Disconnect time-mark generator.

5-51. VERTICAL VERNIER AND VERTICAL AMPLIFIER BALANCE.

a. Set:

DISPLAY	CHOP
Volts/Division (A and B)	5 MV/DIV
+Vertical Coupling (A and B)	OFF
−Vertical Coupling (A and B)	OFF
Vertical Vernier (A and B)	CAL
Time/Division	1 MSEC/DIV
MODE	FREE RUN

b. Set Vertical POSITION A and B to align channel A and B traces with horizontal graticule lines.

c. Turn Vertical Vernier A ccw and check for channel A trace shift.

d. Adjust A1A1R9B (Figure 5-4) until trace remains stationary when Vertical Vernier is turned.

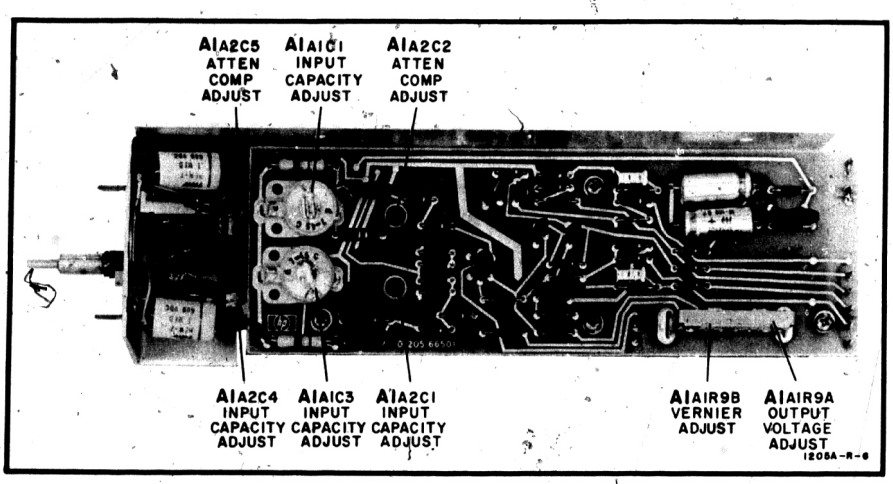


Figure 5-4. Vertical Preamplifier Module Adjustments

e. Set Vertical Vernier A to CAL detent.

f. Repeat steps c through e for channel B, except adjust A2A1R9B (Figure 5-4) for stationary trace.

g. Turn Volts/Division A from 0.2 V/DIV to 5 MV/DIV and check for channel A trace shift.

h. Adjust channel A BAL (front panel) until trace remains stationary when Volts/Division is turned.

5-52. PREAMPLIFIER OUTPUT VOLTAGE.

a. Use DC Voltmeter to monitor output of channel A preamplifier (white wire or green wire on A1A1).

b. Adjust A1A1R9A (Figure 5-4) for Voltmeter indication of 21.5 volts.

c. Repeat steps a and b for channel B, except monitor channel B preamplifier output on A2A1 in step a and adjust A2A1R9A in step b.

5-53. OUTPUT AMPLIFIER GAIN.

a. Set:

DISPLAY	A
Volts/Division (A and B)	1 V/DIV
+Vertical Coupling (A and B)	DC
−Vertical Coupling (A and B)	OFF
Vertical Vernier (A and B)	CAL
Time/Division	1 MSEC/DIV
SLOPE	+
TRIGGER LEVEL	AUTO
Horizontal COUPLING	DC
SOURCE	INT
MODE	NORM

b. Connect 400-Hz, 5V pk-pk signal from voltmeter calibrator to channel A +INPUT jacks.

c. Adjust A3R4A (Figure 5-5) for 5 divisions vertical deflection.

d. Set DISPLAY to A vs. B.

e. Connect 400-Hz, 5V pk-pk signal from voltmeter calibrator to channel B +INPUT jacks.

f. Adjust A3R4B (Figure 5-5) for 5 divisions horizontal deflection.

g. Set DISPLAY to B.

h. Adjust A3R4C (Figure 5-5) for 5 divisions vertical deflection.

i. Disconnect voltmeter calibrator.

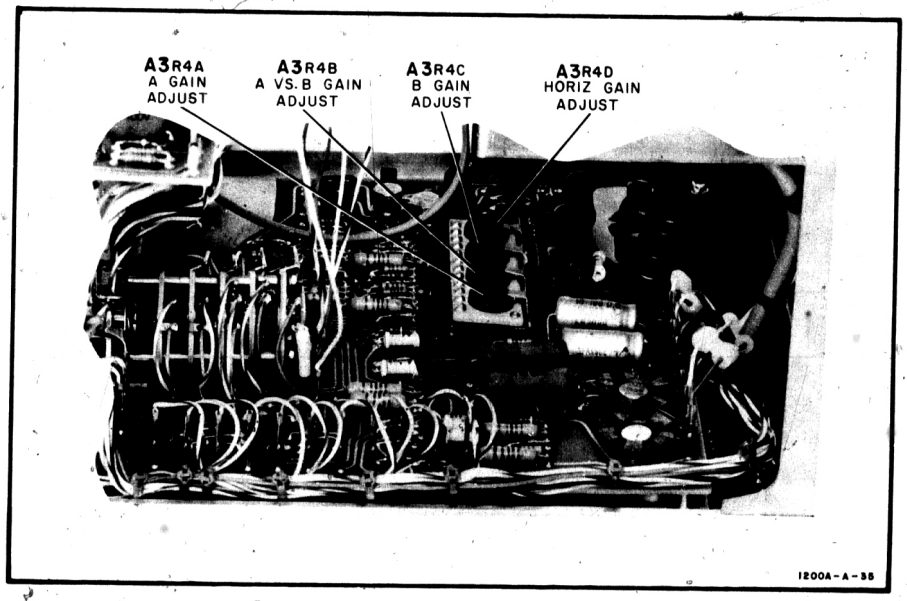


Figure 5-5. Dual Channel Output Amplifier Adjustments

5-54. INPUT CAPACITANCE AND ATTENUATOR COMPENSATION.

a. Set:
DISPLAY . . . . . ALT
Volts/Division (A and B) . . . . . 0.2 V/DIV
Time/Division . . . . . 0.2 MSEC/DIV

b. Connect LC meter between channel A +INPUT and ground jacks.

c. Adjust A1A1C3 (Figure 5-4) for 45-pF indication on LC meter.

d. Set:
+Vertical Coupling A . . . . . OFF
−Vertical Coupling A . . . . . DC

e. Connect LC meter between channel A −INPUT and ground jacks.

f. Adjust A1A1C1 (Figure 5-4) for 45-pF indication on LC meter.

g. Connect LC meter between channel B +INPUT and ground jacks.

h. Adjust A2A2C3 (Figure 5-4) for 45-pF indication on LC meter.

i. Set:
+Vertical Coupling B . . . . . OFF
−Vertical Coupling B . . . . . DC

j. Connect LC meter between channel B −INPUT and ground jacks.

k. Adjust A2A1C1 (Figure 5-4) for 45-pF indication on LC meter.

l. Disconnect LC meter.

m. Set Volts/Division (A and B) to 0.5 V/DIV.

n. Connect 1-kHz signal from square-wave generator to channel A −INPUT jacks.

o. Set square-wave generator for 6 divisions vertical deflection.

p. Adjust A1A2C2 (Figure 5-4) for best square-wave response.

q. Set:
+Vertical Coupling A . . . . . DC
−Vertical Coupling A . . . . . OFF

r. Connect 1-kHz signal from square-wave generator to channel A +INPUT jacks.

s. Adjust A1A2C5 (Figure 5-4) for best square-wave response.

t. Connect 1-kHz signal from square-wave generator to channel B −INPUT jacks.

u. Adjust A2A2C2 (Figure 5-4) for best square-wave response.

v. Set:
+Vertical Coupling B . . . . . DC
−Vertical Coupling B . . . . . OFF

w. Connect 1-kHz signal from square-wave generator to channel B +INPUT jacks.

x. Adjust A2A2C5 (Figure 5-4) for best square-wave response.

y. Disconnect square-wave generator.

z. Connect LC meter between channel A +INPUT and ground jacks.

aa. Adjust A1A2C4 (Figure 5-4) for 45-pF indication on LC meter.

bb. Set:
+Vertical Coupling A . . . . . OFF
−Vertical Coupling A . . . . . DC

cc. Connect LC meter between channel A −INPUT and ground jacks.

dd. Adjust A1A2C1 (Figure 5-4) for 45-pF indication on LC meter.

ee. Connect LC meter between channel B +INPUT and ground jacks.

ff. Adjust A2A2C4 (Figure 5-4) for 45-pF indication on LC meter.

gg. Set:
+Vertical Coupling B . . . . . OFF
−Vertical Coupling B . . . . . DC

hh. Connect LC meter between channel B −INPUT and ground jacks.

ii. Adjust A2A2C1 (Figure 5-4) for 45-pF indication on LC meter.

jj. Disconnect LC meter.

PARTS LIST

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. Table 6-3 lists the parts in order of the HP stock number and includes the manufacturer and manufacturer's part number. Table 6-4 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	OBD	= order by description	SE	= selenium
BP	= bandpass	HZ	= hertz	OH	= oval head	SEC	= second(s)
C	= centi (10^{-2})	IF	= intermediate freq.	OX	= oxide	SECT	= section(s)
CAR	= carbon	IMPG	= impregnated	P	= peak	SI	= silicon
CCW	= counterclockwise	INCD	= incandescent	PC	= printed (etched) circuit(s)	SIL	= silver
CER	= ceramic	INCL	= include(s)	PF	= picofarads	SL	= slide
CMO	= cabinet mount only	INS	= insulation(ed)	PHL	= Phillips	SP	= single pole
COAX	= coaxial	INT	= internal	PIV	= peak inverse voltage(s)	SPL	= special
COEF	= coefficient	K	= kilo (10^{3})	PNP	= positive-negative-positive	ST	= single throw
COMP	= composition	KG	= kilogram	P/O	= part of	STD	= standard
CONN	= connector(s)	LB	= pound(s)	PORC	= porcelain	TA	= tantalum
CRT	= cathode-ray tube	LH	= left hand	POS	= position(s)	TD	= time delay
CW	= clockwise	LIN	= linear taper	POT	= potentiometer(s)	TFL	= teflon
D	= deci (10^{-1})	LOG	= logarithmic taper	P-P	= peak-to-peak	TGL	= toggle
DEPC	= deposited carbon	LPF	= low-pass filter(s)	PRGM	= program	THYR	= thyristor
DP	= double pole	LVR	= lever	PS	= polystyrene	TI	= titanium
DT	= double throw	M	= milli (10^{-3})	PWV	= peak working voltage	TNLDIO	= tunnel diode(s)
ELECT	= electrolytic	MEG	= mega (10^{6})	RECT	= rectifier(s)	TOL	= tolerance
ENCAP	= encapsulated	MET FILM	= metal film	RF	= radio frequency	TRIM	= trimmer
EXT	= external	MET OX	= metal oxide	RFI	= radio frequency interference	U	= micro (10^{-6})
F	= farad(s)	MFR	= manufacturer	RH	= round head or right hand	V	= volts
FET	= field-effect transistor(s)	MINAT	= miniature	RMO	= rack mount only	VAR	= variable
FH	= flat head	MOM	= momentary	RMS	= root mean square	VDCW	= dc working volt(s)
FIL H	= fillister head	MTG	= mounting			W	= watt(s)
FXD	= fixed	MY	= mylar			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 in Reference Designation Order

Reference Designation	Part No.	Description #	Note
A1	01205-63502	A: CHANNEL A PREAMPLIFIER MODULE	
A1A1	01205-66501	A: 5 MV PREAMPLIFIER SUBASSEMBLY	
A1A2	01205-61902	A: 5 MV ATTENUATOR SWITCH ASSEMBLY	
A1C1	0160-0917	C: FXD MY 0.1 UF 20% 600VDCW MATCHED PAIR	
A1MP2	01200-60603	SHIELD:AMPLIFIER	
A1MP3	01200-23704	SHAFT:BAL POT	
A1S1	3100-1376	SWITCH: LEVER (-COUPLING)	
A1S2	3100-1376	SWITCH: LEVER (+ COUPLING)	
A1A1	01205-66501	A: 5 MV PREAMPLIFIER SUB ASSEMBLY	
A1A1C1	0121-0045	C:FXD CER 7-45 PF 500VDCW	
A1A1C2	0150-0012	C:FXD CER 0.01 UF 20% 1000VDCW	
A1A1C3	0121-0045	C:FXD CER 7-45 PF 500VDCW	
A1A1C4	0150-0012	C:FXD CER 0.01 UF 20% 1000VDCW	
A1A1C5	0160-2249	C: FXD CER 4.7 PF 500VDCW	
A1A1C6	0160-2249	C: FXD CER 4.7 PF 500VDCW	
A1A1C7	0180-0091	C:FXD ELECT 10 UF +50-10% 100VDCW	
A1A1C8	0180-0091	C:FXD ELECT 10 UF +50-10% 100VDCW	
A1A1C9	0160-2914	C:FXD CER 0.1 UF +80-20% 50VDCW	
A1A1C10	0160-2914	C:FXD CER 0.1 UF +80-20% 50VDCW	
A1A1CR1	1901-0376	DIODE:SILICON 35V	
A1A1CR2	1901-0376	DIODE:SILICON 35V	
A1A1CR3	1901-0376	DIODE:SILICON 35V	
A1A1CR4	1901-0376	DIODE:SILICON 35V	
A1A1CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1CR6	1901-0040	DIODE:SILICON 30MA 30WV	
A1A1Q1	1855-0085	Q: FET SILICON DUAL	
A1A1Q2	1853-0098	Q:SI PNP	
A1A1Q3	1853-0098	Q:SI PNP	
A1A1Q4	1853-0036	Q:SI PNP	
A1A1Q5	1853-0036	Q:SI PNP	
A1A1R1	0757-0059	R:FXD MET FLM 1 MEGOHM 1% 1/2W	
A1A1R2	0757-0059	R:FXD MET FLM 1 MEGOHM 1% 1/2W	
A1A1R3	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
A1A1R4	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
A1A1R5	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A1A1R6	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A1A1R7	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A1A1R8	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A1A1R9	2100-2577	R:VAR COMP 10K/500 OHM 30% LIN 1/4W	
A1A1R10	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A1A1R11		NOT ASSIGNED	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A1A1R12	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A1A1R13	0684-3311	R:FXD COMP 330 OHM 10% 1/4W	
A1A1R14	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A1A1R15	0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	
A1A1R16	0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	
A1A1R17	0684-2731	R:FXD COMP 27K OHM 10% 1/4W	
A1A1R18	0684-2731	R:FXD COMP 27K OHM 10% 1/4W	
A1A1R19	0684-1031	R:FXD COMP 10K OHM 10% 1/4W	
A1A1R20	0684-1031	R:FXD COMP 10K OHM 10% 1/4W	
A1A1R21	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A1A1R22	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A1A1R23	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A1A1R24	0684-6801	R:FXD COMP 68 OHM 10% 1/4W	
A1A1R25	0684-6801	R:FXD COMP 68 OHM 10% 1/4W	
A1A1R26	0757-0440	R:FXD MET FLM 7.50K 1% 1/8W	
A1A1R27	0757-0435	R:FXD FLM 3920 OHM 1% 1/8W	
A1A1R28	0757-0440	R:FXD MET FLM 7.50K 1% 1/8W	
A1A1R29	0757-0431	R:FXD MET FLM 2.43K OHM 1% 1/8W	
A1A2	01205-61902	A: 5 MV ATTENUATOR SWITCH ASSEMBLY	
A1A2C1	0130-0001	C:VAR CER 7-45PF 500VDCW	
A1A2C2	0130-0003	C:VAR CER 1.5-7 PF NPO	
A1A2C3	0140-0090	C:FXD MICA 200 PF 5%	
A1A2C4	0130-0001	C:VAR CER 7-45PF 500VDCW	
A1A2C5	0130-0003	C:VAR CER 1.5-7 PF NPO	
A1A2C6	0140-0090	C:FXD MICA 200 PF 5%	
A1A2R1	0757-0057	R:FXD MET FLM 990K OHM 1% 1/2W	
A1A2R2	0698-3109	R:FXD MET FLM 10.1K OHM 1% 1/8W	
A1A2R3	0757-0057	R:FXD MET FLM 990K OHM 1% 1/2W	
A1A2R4	0698-3109	R:FXD MET FLM 10.1K OHM 1% 1/8W	
A1A2R5	0698-4492	R:FXD FLM 32.4K OHM 1% 1/8W	
A1A2R6	0698-6742	R:FXD FLM 10.8K OHM 1% 1/8W	
A1A2R7	0698-3155	R:FXD MET FLM 4.64K 1% 1/8W	
A1A2R8	0698-6735	R:FXD FLM 1.71K OHM 1% 1/8W	
A1A2R9	0698-6736	R:FXD FLM 831 OHM 1% 1/8W	
A1A2R10	0698-3122	R:FXD MET FLM 412 OHM 1% 1/8W	
A1A2R11-A1A2R14		NOT ASSIGNED	
A1A2R15	2100-2622	R:VAR COMP 200 OHM 30% LIN 3/10W	
A1A2R16	2100-2617	R:VAR COMP 4K OHM 10% 10 CCLOG 1/4W	
A1A2S1	3100-2524	SWITCH:ROTARY 6 SECT 12 POSITION	
A2	01205-63502	A: CHANNEL B PREAMPLIFIER MODULE	
A2A1	01205-66501	A: 5 MV PREAMPLIFIER SUBASSEMBLY	
A2A2	01205-61902	A: 5 MV ATTENUATOR SWITCH ASSEMBLY	
A2C1	0160-0917	C: FXD MY 0.1 UF 20% 600VDCW MATCHED PAIR	
A2MP1		NOT ASSIGNED	

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A2MP2	01200-60603	SHIELD:AMPLIFIER	
A2MP3	01200-23704	SHAFT:BAL POT	
A2S1	3100-1376	SWITCH: LEVER (-COUPLING)	
A2S2	3100-1376	SWITCH: LEVER (+COUPLING)	
A2A1	01205-66501	A: 5 MV PREAMPLIFIER SUBASSEMBLY	
A2A1C1	0121-0045	C:FXD CER 7-45 PF 500VDCW	
A2A1C2	0150-0012	C:FXD CER 0.01 UF 20% 1000VDCW	
A2A1C3	0121-0045	C:FXD CER 7-45 PF 500VDCW	
A2A1C4	0150-0012	C:FXD CER 0.01 UF 20% 1000VDCW	
A2A1C5	0160-2249	C:FXD CER 4.7-0.25 PF 500VDCW	
A2A1C6	0160-2249	C:FXD CER 4.7-0.25 PF 500VDCW	
A2A1C7	0180-0091	C:FXD ELECT 10 UF +50-10% 100VDCW	
A2A1C8	0180-0091	C:FXD ELECT 10 UF +50-10% 100VDCW	
A2A1C9	0160-2914	C:FXD CER 0.1 UF +80-20% 50VDCW	
A2A1C10	0160-2914	C:FXD CER 0.1 UF +80-20% 50VDCW	
A2A1CR1	1901-0376	DIODE:SILICON 35V	
A2A1CR2	1901-0376	DIODE:SILICON 35V	
A2A1CR3	1901-0376	DIODE:SILICON 35V	
A2A1CR4	1901-0376	DIODE:SILICON 35V	
A2A1CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A2A1CR6	1901-0040	DIODE:SILICON 30MA 30WV	
A2A1Q1	1855-0085	Q: FET SILICON DUAL	
A2A1Q2	1853-0098	Q:SI PNP	
A2A1Q3	1853-0098	Q:SI PNP	
A2A1Q4	1853-0036	Q:SI PNP	
A2A1Q5	1853-0036	Q:SI PNP	
A2A1R1	0757-0059	R:FXD MET FLM 1 MEGOHM 1% 1/2W	
A2A1R2	0757-0059	R:FXD MET FLM 1 MEGOHM 1% 1/2W	
A2A1R3	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
A2A1R4	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
A2A1R5	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A2A1R6	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A2A1R7	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A2A1R8	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A2A1R9	2100-2577	R:VAR COMP 10K/500 OHM 30% LIN 1/4W	
A2A1R10	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A2A1R11		NOT ASSIGNED	
A2A1R12	0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	
A2A1R13	0684-3311	R:FXD COMP 330 OHM 10% 1/4W	
A2A1R14	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A2A1R15	0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	
A2A1R16	0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A2A1R17	0684-2731	R:FXD COMP 27K OHM 10% 1/4W	
A2A1R18	0684-2731	R:FXD COMP 27K OHM 10% 1/4W	
A2A1R19	0684-1031	R:FXD COMP 10K OHM 10% 1/4W	
A2A1R20	0684-1031	R:FXD COMP 10K OHM 10% 1/4W	
A2A1R21	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A2A1R22	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A2A1R23	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A2A1R24	0684-6801	R:FXD COMP 68 OHM 10% 1/4W	
A2A1R25	0684-6801	R:FXD COMP 68 OHM 10% 1/4W	
A2A1R26	0757-0440	R:FXD MET FLM 7.50K 1% 1/8W	
A2A1R27	0757-0435	R:FXD FLM 3920 OHM 1% 1/8W	
A2A1R28	0757-0440	R:FXD MET FLM 7.50K 1% 1/8W	
A2A1R29	0757-0431	R:FXD MET FLM 2.43K OHM 1% 1/8W	
A2A2	01205-61902	A: 5 MV ATTENUATOR SWITCH ASSEMBLY	
A2A2C1	0130-0001	C:VAR CER 7-45PF 500VDCW	
A2A2C2	0130-0003	C:VAR CER 1.5-7 PF NPO	
A2A2C3	0140-0090	C:FXD MICA 200 PF 5%	
A2A2C4	0130-0001	C:VAR CER 7-45PF 500VDCW	
A2A2C5	0130-0003	C:VAR CER 1.5-7 PF NPO	
A2A2C6	0140-0090	C:FXD MICA 200 PF 5%	
A2A2R1	0757-0057	R:FXD MET FLM 990K OHM 1% 1/2W	
A2A2R2	0698-3109	R:FXD MET FLM 10.1K OHM 1% 1/8W	
A2A2R3	0757-0057	R:FXD MET FLM 990K OHM 1% 1/2W	
A2A2R4	0698-3109	R:FXD MET FLM 10.1K OHM 1% 1/8W	
A2A2R5	0698-4492	R:FXD FLM 32.4K OHM 1% 1/8W	
A2A2R6	0698-6742	R:FXD FLM 10.8K OHM 1% 1/8W	
A2A2R7	0698-3155	R:FXD MET FLM 4.64K 1% 1/8W	
A2A2R8	0698-6735	R:FXD FLM 1.71K OHM 1% 1/8W	
A2A2R9	0698-6736	R:FXD FLM 831 OHM 1% 1/8W	
A2A2R10	0698-3122	R:FXD MET FLM 412 OHM 1% 1/8W	
A2A2R11- A2A2R14		NOT ASSIGNED	
A2A2R15	2100-2622	R:VAR COMP 200 OHM 30% LIN 3/10W	
A2A2R16	2100-2617	R:VAR COMP 4K OHM 10% 10 CCLOG 1/4W	
A2A2S1	3100-2524	SWITCH:ROTARY 6 SECT 12 POSITION	
A3	01200-66504	A: DUAL CHANNEL OUTPUT AMPLIFIER	
A3C1	0160-2240	C:FXD CER 2.0 PF 500VDCW	
A3C2	0160-2240	C:FXD CER 2.0 PF 500VDCW	
A3C3	0160-2240	C:FXD CER 2.0 PF 500VDCW	
A3C4	0160-2240	C:FXD CER 2.0 PF 500VDCW	
A3C5	0160-2237	C:FXD CER 1.2 PF 500VDCW	
A3C6	0160-2913	C:FXD CER 0.01 UF +80-20% 500VDCW	
A3C7	0140-0205	C:FXD MICA 62 PF 5%	
A3C8	0140-0206	C:FXD MICA 270 PF 5%	
A3C9	0140-0206	C:FXD MICA 270 PF 5%	
A3C10	0160-2203	C:FXD MICA 91 PF 5%	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A3C11	0160-2203	C:FXD MICA 91 PF 5%	
A3C12	0140-0206	C:FXD MICA 270 PF 5%	
A3C13	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A3C14	0180-0091	C:FXD ELECT 10 UF +50-10% 100VDCW	
A3C15	0180-0091	C:FXD ELECT 10 UF +50-10% 100VDCW	
A3CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR3	1901-0050	DIODE:SILICON 75V	
A3CR4	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR6	1901-0050	DIODE:SILICON 75V	
A3CR7	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR8	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR9	1901-0050	DIODE:SILICON 75V	
A3CR10	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR11	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR12	1901-0050	DIODE:SILICON 75V	
A3CR13	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR14	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR15	1901-0050	DIODE:SILICON 75V	
A3CR16	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR17	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR18	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR19	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR20	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR21	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR22	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR23	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR24	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR25	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR26	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR27	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR28	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR29	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR30	1901-0040	DIODE:SILICON 30MA 30WV	
A3CR31	1901-0040	DIODE:SILICON 30MA 30WV	
A3L1	9140-0137	COIL:FXD RF 1000 UH 5%	
A3L2	9140-0137	COIL:FXD RF 1000 UH 5%	
A3L3	9140-0137	COIL:FXD RF 1000 UH 5%	
A3L4	9140-0137	COIL:FXD RF 1000 UH 5%	
A3MP1	01200-01201	BRACKET: MODE SWITCH MTG.	
A3MP2	1205-0095	HEAT SINK:TRANSISTOR	
A3Q1	1853-0098	Q:SI PNP	
A3Q2	1853-0098	Q:SI PNP	
A3Q3	1854-0215	Q:SI NPN	
A3Q4	1854-0215	Q:SI NPN	
A3Q5	1854-0234	Q:SI NPN	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A3Q6	1854-0234	Q:SI NPN	
A3Q7	1854-0215	Q:SI NPN	
A3Q8	1854-0215	Q:SI NPN	
A3Q9	1854-0215	Q:SI NPN	
A3Q10	1854-0215	Q:SI NPN	
A3Q11	1854-0234	Q:SI NPN	
A3Q12	1854-0234	Q:SI NPN	
A3Q13	1854-0022	Q:SI NPN	
A3Q14	1854-0022	Q:SI NPN	
A3Q15	1853-0049	Q:SI PNP	
A3Q16	1853-0049	Q:SI PNP	
A3Q17	1854-0022	Q:SI NPN	
A3Q18	1854-0022	Q:SI NPN	
A3R1	0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	
A3R2	0684-8221	R:FXD COMP 8200 OHM 10% 1/4W	
A3R3	0698-3447	R:FXD MET FLM 422 OHM 1% 1/8W	
A3R4	2100-2578	R:VAR COMP 4 X 1.5K OHM 30% LIN 1/4W	
A3R5	0684-8221	R:FXD COMP 8200 OHM 10% 1/4W	
A3R6	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A3R7	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A3R8	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A3R9	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A3R10	0757-0822	R:FXD FLM 1.30K OHM 1% 1/2W	
A3R11	0757-0822	R:FXD FLM 1.30K OHM 1% 1/2W	
A3R12	0767-0008	R:FXD MET OX FLM 10K OHM 5% 3W	
A3R13	0767-0008	R:FXD MET OX FLM 10K OHM 5% 3W	
A3R14	0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	
A3R15	0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	
A3R16	0698-3447	R:FXD MET FLM 422 OHM 1% 1/8W	
A3R17	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A3R18	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A3R19	0757-0822	R:FXD FLM 1.30K OHM 1% 1/2W	
A3R20	0757-0822	R:FXD FLM 1.30K OHM 1% 1/2W	
A3R21	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	
A3R22	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A3R23	0757-0274	R:FXD MET FLM 1.21K OHM 1% 1/8W	
A3R24	0757-0274	R:FXD MET FLM 1.21K OHM 1% 1/8W	
A3R25	0757-0445	R:FXD FLM 13K OHM 1% 1/8W	
A3R26	0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	
A3R27	0698-3447	R:FXD MET FLM 422 OHM 1% 1/8W	
A3R28	0757-0822	R:FXD FLM 1.30K OHM 1% 1/2W	
A3R29	0757-0822	R:FXD FLM 1.30K OHM 1% 1/2W	
A3R30	0767-0008	R:FXD MET OX FLM 10K OHM 5% 3W	
A3R31	0767-0008	R:FXD MET OX FLM 10K OHM 5% 3W	
A3R32	0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	
A3R33	0757-0456	R:FXD MET FLM 43.2K OHM 1% 1/8W	
A3R34	0684-1051	R:FXD COMP 1MEGOHM 10% 1/4W	
A3R35	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A3R36	0757-0486	R:FXD MET FLM 750K OHM 1% 1/8W	
A3R37	0698-3457	R:FXD MET FLM 316K OHM 1% 1/8W	
A3R38	0684-1541	R:FXD COMP 150K OHM 10% 1/4W	
A3R39	0757-0433	R:FXD MET FLM 3.32K OHM 1% 1/8W	
A3R40	0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	
A3R41	0757-0438	R:FXD MET FLM 5.11K 1% 1/8W	
A3R42	0757-0433	R:FXD MET FLM 3.32K OHM 1% 1/8W	
A3R43	0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	
A3R44	0757-0467	R:FXD MET FLM 121K OHM 1% 1/8W	
A3R45	0698-5102	R:FXD COMP 1.2 MEGOHM 10% 1/4W	
A3R46	0757-0467	R:FXD MET FLM 121K OHM 1% 1/8W	
A3R47	0698-5102	R:FXD COMP 1.2 MEGOHM 10% 1/4W	
A3R48	0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	
A3R49	0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	
A3R50	0757-0438	R:FXD MET FLM 5.11K 1% 1/8W	
A3R51	0757-0433	R:FXD MET FLM 3.32K OHM 1% 1/8W	
A3R52	0757-0441	R:FXD MET FLM 8.25K 1% 1/8W	
A3R53	0757-0433	R:FXD MET FLM 3.32K OHM 1% 1/8W	
A3R54	0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	
A3R55	0684-1541	R:FXD COMP 150K OHM 10% 1/4W	
A3R56	0757-0414	R:FXD FLM 432 OHM 1% 1/8W	
A3R57	0757-0414	R:FXD FLM 432 OHM 1% 1/8W	
A3R58	0684-4711	R:FXD COMP 470 OHM 10% 1/4W	
A3R59	0698-0085	R:FXD MET FLM 2.61K OHM 1% 1/8W	
A3R60	0757-0289	R:FXD MET FLM 13.3K OHM 1% 1/8W	
A3R61	0757-0394	R:FXD MET FLM 51.1 OHM 1% 1/8W	
A3R62	0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	
A3S1	3100-1377	SWITCH:ROTARY 5 SECTION 5 POSITION	
A3W1	01200-61603	CABLE ASSY:COAX	
A4	01200-63503	A: HORIZONTAL MODULE	
A4A1	01200-66508	A: SWEEP CIRCUIT	
A4A2	01200-61902	A: SWEEP TIME SWITCH	
A4C1	0130-0016	C: VAR CER 5-25 PF NPO	
A4C2	0180-0155	C: FXD ELECT 2.2 UF 20% 20VDCW	
A4C3	0180-0155	C: FXD ELECT 2.2 UF 20% 20VDCW	
A4DS1		DS: NSR P/O A4S6	
A4MP1	01200-60602	SHIELD: SWEEP ASSY	
A4R1	01200-61501	RESISTOR: MODIFIED	
A4R2	0757-0350	R: FXD MET FLM 909K OHM 1% 1/4W	
A4R3	2100-2613	R: VAR CARBON 100K OHM 20% LIN 1/5W	
A4R4	2100-1509	R: VAR 20K OHM 20% LIN 1/3W	
A4S1	3100-1375	SWITCH: LEVER (SOURCE)	
A4S2	3100-1374	SWITCH: LEVER (COUPLING)	
A4S3		SWITCH: (TRIGGER LEVEL) NSR P/O A4R3	
A4S4	3100-1373	SWITCH: LEVER (SLOPE)	
A4S5	3100-1372	SWITCH: LEVER (MODE)	
A4S6	3101-0944	SWITCH: PUSHBUTTON SP ST	
A4W1	01200-61607	LEAD: TWIN OUTPUT	

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A4A1	01200-66508	A: SWEEP CIRCUIT	
A4A1C1	0160-2959	C:FXD CER 1000 PF +100-0% 600VDCW	
A4A1C2	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C3	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C4	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C5	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C6	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C7	0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW	
A4A1C8	0160-2258	C:FXD CER 11 PF 5% 500VDCW	
A4A1C9	0160-2258	C:FXD CER 11 PF 5% 500VDCW	
A4A1C10	0140-0198	C:FXD MICA 200 PF 5%	
A4A1C11	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C12	0160-2258	C:FXD CER 11 PF 5% 500VDCW	
A4A1C13	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C14	0160-2959	C:FXD CER 1000 PF +100-0% 600VDCW	
A4A1C15	0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW	
A4A1C16	0150-0115	C:FXD CER 27 PF 10% 500VDCW	
A4A1C17	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C18	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C19	0160-2258	C:FXD CER 11 PF 5% 500VDCW	
A4A1C20	0160-2258	C:FXD CER 11 PF 5% 500VDCW	
A4A1C21	0140-0198	C:FXD MICA 200 PF 5%	
A4A1C22	0150-0115	C:FXD CER 27 PF 10% 500VDCW	
A4A1C23	0140-0198	C:FXD MICA 200 PF 5%	
A4A1C24	0150-0115	C:FXD CER 27 PF 10% 500VDCW	
A4A1C25	0160-2913	C:FXD CER 0.01 UF +85-20% 500VDCW	
A4A1C26	0140-0198	C:FXD MICA 200 PF 5%	
A4A1C27	0140-0207	C:FXD MICA 330 PF 5%	
A4A1C28	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C29	0140-0207	C:FXD MICA 330 PF 5%	
A4A1C30	0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	
A4A1C31	0160-2913	C:FXD CER 0.01 UF +85-20% 500VDCW	
A4A1C32	0150-0115	C:FXD CER 27 PF 10% 500VDCW	
A4A1CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR4	1912-0009	DIODE TUNNEL:GERMANIUM 1N3712	
A4A1CR5	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR6	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR7	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR8	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR9	1901-0376	DIODE:SILICON 35V	
A4A1CR10	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR11	1901-0040	DIODE:SILICON 30MA 30WV	

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A4A1CR12	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR13	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A4A1CR14	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR15	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR16	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1CR17	1901-0040	DIODE:SILICON 30MA 30WV	
A4A1Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q2	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q3	1853-0036	Q:SI PNP	
A4A1Q4	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q5	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q6	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q7	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q8	1853-0036	Q:SI PNP	
A4A1Q9	1854-0215	Q:SI NPN	
A4A1Q10	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q11	1853-0036	Q:SI PNP	
A4A1Q12	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q13	1853-0036	Q:SI PNP	
A4A1Q14	1853-0036	Q:SI PNP	
A4A1Q15	1853-0036	Q:SI PNP	
A4A1Q16	1855-0090	Q:FET N-CHANNEL	
A4A1Q17	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q18	1853-0036	Q:SI PNP	
A4A1Q19	1853-0036	Q:SI PNP	
A4A1Q20	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q21	1853-0036	Q:SI PNP	
A4A1Q22	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q23	1853-0036	Q:SI PNP	
A4A1Q24	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q25	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A4A1Q26	1853-0036	Q:SI PNP	
A4A1R1	0698-5092	R:FXD FLM 160K OHM 1% 1/8W	
A4A1R2	0757-0976	R:FXD FLM 150K OHM 2% 1/8W	
A4A1R3	0757-0427	R:FXD MET FLM 1.5K 1% 1/8W	
A4A1R4	0757-0289	R:FXD MET FLM 13.3K OHM 1% 1/8W	
A4A1R5	0687-1531	R:FXD COMP 15K OHM 10% 1/2W	
A4A1R6	0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	
A4A1R7	0757-0959	R:FXD FLM 30K OHM 2% 1/8W	
A4A1R8	0757-0914	R:FXD FLM 390 OHM 2% 1/8W	
A4A1R9	0757-0964	R:FXD FLM 47K OHM 2% 1/8W	
A4A1R10	2100-0347	R:VAR COMP 4 X 25K OHM 30% LIN 1/4W	
A4A1R11	0684-2231	R:FXD COMP 22K OHM 10% 1/4W	
A4A1R12	0761-0027	R:FXD MET OX 2700 OHM 5% 1W	
A4A1R13	0684-2201	R:FXD COMP 22 OHM 10% 1/4W	
A4A1R14	0684-2231	R:FXD COMP 22K OHM 10% 1/4W	
A4A1R15	0684-2231	R:FXD COMP 22K OHM 10% 1/4W	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A4A1R16	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A4A1R17	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A4A1R18	0684-4741	R:FXD COMP 470K OHM 10% 1/4W	
A4A1R19	0757-0924	R:FXD MET FLM 1K OHM 2% 1/8W	
A4A1R20	0757-0952	R:FXD FLM 15K OHM 2% 1/8W	
A4A1R21	2100-0940	R:VAR COMP 500 OHM 20% LIN 1/4W	
A4A1R22	0698-6814	R:FXD FLM 10K OHM 2% 1/4W	
A4A1R23	0684-2231	R:FXD COMP 22K OHM 10% 1/4W	
A4A1R24	0757-0935	R:FXD FLM 3K OHM 2% 1/8W	
A4A1R25	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
A4A1R26	0757-0914	R:FXD FLM 390 OHM 2% 1/8W	
A4A1R27	0757-0962	R:FXD FLM 39K OHM 2% 1/8W	
A4A1R28	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A4A1R29	0760-0028	R:FXD METOX 6.2K OHM 2% 1W	
A4A1R30	0757-0928	R:FXD FLM 1.5K OHM 2% 1/8W	
A4A1R31	0684-2231	R:FXD COMP 22K OHM 10% 1/4W	
A4A1R32	0684-2241	R:FXD COMP 220K OHM 10% 1/4W	
A4A1R33	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A4A1R34	2100-2581	R:VAR COMP 2 X 20K OHM 20% LIN 1/4W	
A4A1R35	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A4A1R36	2100-0381	R:VAR COMP 25K OHM 30% LIN 1/4W	
A4A1R37	0757-0972	R:FXD FLM 100K OHM 2% 1/8W	
A4A1R38	0757-0457	R:FXD MET FLM 47.5K OHM 1% 1/8W	
A4A1R39	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
A4A1R40	0684-1041	R:FXD COMP 100K OHM 10% 1/4W	
A4A1R41	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A4A1R42	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
A4A1R43	0757-0928	R:FXD FLM 1.5K OHM 2% 1/8W	
A4A1R44	0757-0972	R:FXD FLM 100K OHM 2% 1/8W	
A4A1R45	0757-0964	R:FXD FLM 47K OHM 2% 1/8W	
A4A1R46	0698-3155	R:FXD MET FLM 4.64K 1% 1/8W	
A4A1R47	0757-0453	R:FXD MET FLM 30.1K OHM 1% 1/8W	
A4A1R48	0757-0449	R:FXD FLM 20K OHM 1% 1/8W	
A4A1R49	0757-0914	R:FXD FLM 390 OHM 2% 1/8W	
A4A1R50	0698-6816	R:FXD FLM 6.2K OHM 2% 1/4W	
A4A1R51	0757-0931	R:FXD MET FLM 2K OHM 2% 1/8W	
A4A1R52	0757-0972	R:FXD FLM 100K OHM 2% 1/8W	
A4A1R53	0757-0952	R:FXD FLM 15K OHM 2% 1/8W	
A4A1R54	0684-4741	R:FXD COMP 470K OHM 10% 1/4W	
A4A1R55	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
A4A1R56	0757-0288	R:FXD MET FLM 9.09K 1% 1/8W	
A4A1R57	0684-2201	R:FXD COMP 22 OHM 10% 1/4W	
A4A1R58	0684-2201	R:FXD COMP 22 OHM 10% 1/4W	
A4A1R59	0757-0924	R:FXD MET FLM 1K OHM 2% 1/8W	
A4A1R60	0684-1041	R:FXD COMP 100K OHM 10% 1/4W	
A4A1R61	0684-1041	R:FXD COMP 100K OHM 10% 1/4W	
A4A1R62	0757-0935	R:FXD FLM 3K OHM 2% 1/8W	
A4A1R63	0757-0972	R:FXD FLM 100K OHM 2% 1/8W	
A4A1R64	0757-0964	R:FXD FLM 47K OHM 2% 1/8W	

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A4A1R65	0757-0757	R:FXD MET FLM 15K OHM 1% 1/4W	
A4A1R66	0757-0281	R:FXD MET FLM 2.74K OHM 1% 1/8W	
A4A1R67	0698-6814	R:FXD FLM 10K OHM 2% 1/4W	
A4A1R68	0757-0944	R:FXD FLM 6.8K OHM 2% 1/8W	
A4A1R69	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W	
A4A1R70	0684-1051	R:FXD COMP 1MEGOHM 10% 1/4W	
A4A1R71	0757-0952	R:FXD FLM 15K OHM 2% 1/8W	
A4A1R72	0757-0289	R:FXD MET FLM 13.3K OHM 1% 1/8W	
A4A1R73	0684-2231	R:FXD COMP 22K OHM 10% 1/4W	
A4A1R74	0757-0976	R:FXD FLM 150K OHM 2% 1/8W	
A4A1R75	0757-0959	R:FXD FLM 30K OHM 2% 1/8W	
A4A1R76	0757-0095	R:FXD MET OX 5100 OHM 2% 1/2W	
A4A1R77	0757-0950	R:FXD FLM 12K OHM 2% 1/8W	
A4A1R78	0757-0928	R:FXD FLM 1.5K OHM 2% 1/8W	
A4A1R79	0757-0930	R:FXD FLM 1.8K OHM 2% 1/8W	
A4A1R80	0698-6815	R:FXD FLM 1.8K OHM 2% 1/4W	
A4A1R81	0757-0944	R:FXD FLM 6.8K OHM 2% 1/8W	
A4A1R82	0757-0940	R:FXD MET FLM 4.7K OHMS 2% 1/8W	
A4A1R83	0757-0956	R:FXD FLM 22K OHM 2% 1/8W	
A4A1R84	0757-0930	R:FXD FLM 1.8K OHM 2% 1/8W	
A4A1R85	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A4A1R86	0698-3155	R:FXD MET FLM 4.64K 1% 1/8W	
A4A1R87	0698-3155	R:FXD MET FLM 4.64K 1% 1/8W	
A4A1VR1	1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	
A4A1VR2	1902-0055	DIODE BREAKDOWN:14.7V 10%	
A4A1VR3	1902-0049	DIODE:BREAKDOWN 6.19V 5%	
A4A2	01200-61902	A: SWEEP TIME SWITCH	
A4A2C1	0170-0022	C:FXD MY 0.1UF 20% 600VDCW	
A4A2C2	0160-2204	C:FXD MICA 100PF 5%	
A4A2C3	0160-2258	C:FXD CER 11 PF 5% 500VDCW	
A4A2C4	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A4A2C5	0160-3133	C:FXD MY 2 UF 10% 100VDCW	
A4A2C6	0170-0063	C:FXD MY 0.02 UF 10% 400VDCW	
A4A2C7	0160-0168	C:FXD MICA 0.1 UF 10% 200VDCW	
A4A2C8	0160-0194	C:FXD MY 0.015 UF 10%	
A4A2C9	0160-0155	C:FXD MY 3300 PF 10%	
A4A2CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A4A2CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A4A2MP1	3130-0038	COUPLER:SWITCH SST U-SHAPED	
A4A2MP2	01200-01203	BRACKET:SWEEP SWITCH MOUNTING	
A4A2Q1	1854-0358	Q:SI NPN	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A4A2R1	0698-4009	R:FXD FLM 50K OHM 1% 1/8W	
A4A2R2	0757-0453	R:FXD MET FLM 30.1K OHM 1% 1/8W	
A4A2R3	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	
A4A2R4	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	
A4A2R5	2100-2616	R:VAR COMP 7K/25K OHM 30/20% LIN	
A4A2R6	0698-5092	R:FXD FLM 160K OHM 1% 1/8W	
A4A2R7	0757-0959	R:FXD FLM 30K OHM 2% 1/8W	
A4A2R8	0757-0124	R:FXD MET FLM 39.2K OHM 1% 1/8W	
A4A2R9	0757-0479	R:FXD MET FLM 392K OHM 1% 1/8W	
A4A2R10	0757-0471	R:FXD MET FLM 182K OHM 1% 1/8W	
A4A2R11	0698-4482	R:FXD FLM 17.4K OHM 1% 1/8W	
A4A2R12	0757-0472	R:FXD MET FLM 200K OHM 1% 1/8W	
A4A2R13	0757-0465	R:FXD MET FLM 100K 1% 1/8W	
A4A2R14	0698-6733	R:FXD FLM 30 MEGOHM 1% 1W	
A4A2R15	0698-7091	R:FXD MET FLM 10 MEGOHM 1% 1/2W	
A4A2R16	0698-7091	R:FXD MET FLM 10 MEGOHM 1% 1/2W	
A4A2R17	0757-0344	R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	
A4A2R18	0757-0344	R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	
A4A2R19	0757-0950	R: FXD MET FLM 12K 2% 1/8W	
A4A2S1	3100-1378	SWITCH:ROTARY DUAL, DETENT	
A4A2W1	01200-61605	CABLE:SWEEP SWITCH	
A5	01200-66514	ASSY:LOW VOLTAGE POWER SUPPLY	
A5C1	0180-2138	C:FXD ELECT 150 UF +50-10% 250VDCW	
A5C2	0180-2159	C:FXD ELECT 300 UF +75-10% 150VDCW	
A5C3	0160-0168	C:FXD MICA 0.1 UF 10% 200VDCW	
A5C4	0180-2134	C:FXD ELECT 20 UF +50-10% 100VDCW	
A5C5	0180-2159	C:FXD ELECT 300 UF +75-10% 150VDCW	
A5C6	0160-0168	C:FXD MICA 0.1 UF 10% 200VDCW	
A5C7	0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW	
A5C8	0180-1731	C:FXD ELECT 4.7 UF 10% 50VDCW	
A5C9	0180-2134	C:FXD ELECT 20 UF +50-10% 100VDCW	
A5CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A5CR2	1901-0028	DIODE:SILICON 0.75A 400PIV	
A5CR3	1901-0028	DIODE:SILICON 0.75A 400PIV	
A5CR4	1901-0028	DIODE:SILICON 0.75A 400PIV	
A5CR5	1901-0028	DIODE:SILICON 0.75A 400PIV	
A5CR6	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR7	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR8	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR9	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR10	1901-0040	DIODE:SILICON 30MA 30WV	
A5CR11	1901-0040	DIODE:SILICON 30MA 30WV	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A5CR12	1901-0040	DIODE:SILICON 30MA 30WV	
A5CR13	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR14	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR15	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR16	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR17	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5CR18	1901-0040	DIODE:SILICON 30MA 30WV	
A5CR19	1901-0040	DIODE:SILICON 30MA 30WV	
A5CR20	1901-0040	DIODE:SILICON 30MA 30WV	
A5CR21	1901-0026	DIODE:SILICON 0.75A 200PIV	
A5F1	2110-0004	FUSE:CARTRIDGE 1/4 AMP 250V	
	2110-0269	CLIP:FUSE 0.250" DIA	
A5F2	2110-0012	FUSE:CARTRIDGE 0.5A(230V OPERATION)	
	2110-0269	CLIP:FUSE 0.250" DIA	
A5F3	2110-0012	FUSE:CARTRIDGE 0.5A(230V OPERATION)	
	2110-0269	CLIP:FUSE 0.250" DIA	
A5Q1	1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	
A5Q2	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q3	1853-0036	Q:SI PNP	
A5Q4	1854-0022	Q:SI NPN	
A5Q5	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5Q6	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A5R1	0684-2251	R:FXD COMP 2.2 MEGOHM 10% 1/4W	
A5R2	0684-1031	R:FXD COMP 10K OHM 10% 1/4W	
A5R3	0698-6734	R:FXD FLM 28.6K OHM 0.5% 1/8W	
A5R4	0698-6218	R:FXD FLM 20K OHM 0.5% 1/8W	
A5R5	0698-4055	R:FXD FLM 1K OHM 0.25% 1/8W	
A5R6	0684-1041	R:FXD COMP 100K OHM 10% 1/4W	
A5R7	0684-1041	R:FXD COMP 100K OHM 10% 1/4W	
A5R8	0698-3605	R:FXD MET OX 15 OHM 5% 2W	
A5R9	0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	
A5R10	0757-0456	R:FXD MET FLM 43.2K OHM 1% 1/8W	
A5R11	0764-0043	R:FXD MET OX 2.7K OHM 5% 2W	
A5R12	0757-0392	R:FXD MET FLM 43.2 OHM 1% 1/8W	
A5R13	0757-0450	R:FXD MET FLM 22.1K OHM 1% 1/8W	
A5R14	0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	
A5R15	0757-0110	R:FXD MET FLM 12.8K OHM 1% 1/4W	
A5R16	0698-7142	R:FXD FLM 12.3K OHM 1% 1/4W	
A5R17	0698-3605	R:FXD MET OX 15 OHM 5% 2W	
A5R18	0684-1041	R:FXD COMP 100K OHM 10% 1/4W	
A5R19	0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	
A5R20	0684-5631	R:FXD COMP 56K OHM 10% 1/4W	
A5R21	0698-3443	R:FXD MET FLM 287 OHM 1% 1/8W	
A5R22	0757-0750	R:FXD MET FLM 6810 OHM 1% 1/4W	
A5R23	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
A5R24	0684-4741	R:FXD COMP 470K OHM 10% 1/4W	
A5R25	0757-0757	R:FXD MET FLM 15K OHM 1% 1/4W	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A5R26	0684-4741	R:FXD COMP 470K OHM 10% 1/4W	
A5R27	0757-0389	R:FXD MET FLM 33.2 OHM 1% 1/8W	
A5R28	0757-0433	R:FXD MET FLM 3.32K OHM 1% 1/8W	
A5R29	2100-0935	R:VAR COMP 1K OHM 20% LIN 1/4W	
A5R30	0698-3264	R:FXD FLM 11.8K OHM 1% 1/8W	
A5R31	0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	
A5VR1	1902-3357	DIODE BREAKDOWN:56.2V 5%	
A5VR2	1902-0034	DIODE:5.76V 10%	
A5VR3	1902-3357	DIODE BREAKDOWN:56.2V 5%	
A5VR4	1902-0018	DIODE BREAKDOWN:11.7V 5%	
A6	01200-66515	BOARD ASSY:HV REGULATOR	
A6C1	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
A6C2	0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	
A6C3	0160-2234	C: FXD CER 0.51 PF 500VDCW	
A6C4	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
A6C5	0180-0109	C:FXD ELECT 18 UF 100VDCW	
A6C6	0160-3008	C:FXD CER 4700 PF 20% 4K VDCW	
A6C7	0160-3008	C:FXD CER 4700 PF 20% 4K VDCW	
A6C8	0160-3007	C:FXD CER 4700 PF 20% 4K VDCW	
A6C9	0160-3007	C:FXD CER 4700 PF 20% 4K VDCW	
A6C10	0160-3007	C:FXD CER 4700 PF 20% 4K VDCW	
A6C11	0160-0165	C:FXD MY 0.056 UF 10% 200VDCW	
A6C12	0160-2056	C:FXD MY 0.22 UF 20% 200VDCW	
A6C13	0160-2403	C:FXD CER 1500 PF 20% 5K VDCW	
A6C14	0160-0165	C:FXD MY 0.056 UF 10% 200VDCW	
A6C15	0180-0091	C:FXD ELECT 10 UF +50-10% 100VDCW	
A6CR1	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR2	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR3	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR4	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR5	1901-0045	DIODE:SILICON 0.75A 100PIV	
A6CR6	1901-0049	DIODE:SILICON 0.75A 50PIV	
A6CR7	1901-0040	DIODE:SILICON 30MA 30WV	
A6CR8	1901-0033	DIODE:SILICON 100MA 180WV	
A6L1	9140-0118	COIL:FXD 500 UH 5%	
A6L2	9140-0179	COIL/CHOKE 22.0 UH 10%	
A6MP1	0340-0451	WASHER:INSULATED, TRANSISTOR	
A6MP2	01200-01101	HEAT SINK: TRANSISTOR (Q4)	
A6Q1	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	
A6Q2	1853-0037	Q:SI PNP	
A6Q3	1854-0022	Q:SI NPN	
A6Q4	1854-0330	Q:SI NPN	
A6Q5	1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
A6Q6	1853-0036	Q:SI PNP	
A6Q7	1855-0057	Q:SI FET N-CHAN	
A6R1	0698-3200	R:FXD FLM 8K OHM 1% 1/8W	
A6R2	0757-0424	R:FXD MET FLM 1.10K OHM 1% 1/8W	
A6R3	0757-0941	R:FXD FLM 5.1K OHM 2% 1/8W	
A6R4	0684-4731	R:FXD COMP 47K OHM 10% 1/4W	
A6R5	0757-0439	R:FXD MET FLM 6.81K OHM 1% 1/8W	
A6R6	0698-3158	R:FXD MET FLM 23.7K OHM 1% 1/8W	
A6R7	0687-1211	R:FXD COMP 120 OHM 10% 1/2W	
A6R8	0757-0831	R:FXD MET FLM 4.32K OHM 1% 1/2W	
A6R9	0757-0832	R:FXD MET FLM 4.75K OHM 1% 1/2W	
A6R10	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A6R11	0757-0757	R:FXD MET FLM 15K OHM 1% 1/4W	
A6R12	0757-0456	R:FXD MET FLM 43.2K OHM 1% 1/8W	
A6R13	0757-0411	R:FXD MET FLM 332 OHM 1% 1/8W	
A6R14	2100-0981	R:VAR COMP 1 MEGOHM 20% LIN 1/4W	
A6R15	0836-0003	R:FXD FLM 29 MEGOHM 10% 1W	
A6R16	0684-1051	R:FXD COMP 1MEGOHM 1% 1/4W	
A6R17	2100-2580	R:VAR COMP 2X100K/250K OHM 30% LIN 1/4W	
A6R18	0687-5631	R:FXD COMP 56K OHM 10% 1/2W	
A6R19	0698-3417	R:FXD MET FLM 23.7K OHM 1% 1/2W	
A6R20	0698-4935	R:FXD MET FLM 41.2K OHM 1% 1/2W	
A6R21	0684-1511	R:FXD COMP 150 OHM 10% 1/4W	
A6R22	0684-2211	R:FXD COMP 220 OHM 10% 1/4W	
A6R23	0757-0465	R:FXD MET FLM 100K 1% 1/8W	
A6R24	0757-0463	R:FXD MET FLM 82.5K 1% 1/8W	
A6R25	0684-1241	R:FXD COMP 120K OHM 10% 1/4W	
A6R26	0727-0832	R:FXD DEPC 619K OHM 1% 1/2W	
A6R27	0698-7182	R:FXD MET FLM 30 MEGOHM 1% 2W	
A6R28	0687-3351	R:FXD COMP 3.3 MEGOHM 10% 1/2W	
A6R29	0693-6851	R:FXD COMP 6.8 MEGOHM 10% 2W	
A6R30	0693-6851	R:FXD COMP 6.8 MEGOHM 10% 2W	
A6R31	0693-6851	R:FXD COMP 6.8 MEGOHM 10% 2W	
A6R32	0693-6851	R:FXD COMP 6.8 MEGOHM 10% 2W	
A6R33	0698-3443	R:FXD MET OX 4.3K OHM 5% 2W	
A6R34	0687-1001	R:FXD COMP 10 OHM 10% 1/2W	
A6R35	0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	
A6R36	0757-0124	R:FXD MET FLM 39.2K OHM 1% 1/8W	
A6R37	0687-2221	R:FXD COMP 2200 OHM 10% 1/2W	
A6VR1	1902-0041	DIODE:BREAKDOWN 5.11V 5%	
A6VR2	2140-0013	VR: NEON	
A6VR3	2140-0013	VR: NEON	
A7	01200-66505	HV RECTIFIER ASSY	
A7C1	0160-3007	C:FXD CER 4700 PF 20% 4K VDCW	
A7C2	0160-3008	C:FXD CER 4700 PF 20% 4K VDCW	
A7CR1	1901-0341	DIODE:SILICON 7000 PIV	
A7CR2	1901-0341	DIODE:SILICON 7000 PIV	
A7R1	0684-2231	R:FXD COMP 22K OHM 10% 1/4W	
A7R2	0684-1531	R:FXD COMP 15K OHM 10% 1/4W	
A7T1	01200-61101	TRANSFORMER:HIGH VOLTAGE	

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
		CHASSIS PARTS	
A1	01205-63502	A: CHANNEL A 5 MV PREAMPLIFIER MODULE	
A2	01205-63502	A: CHANNEL B 5 MV PREAMPLIFIER MODULE	
A3	01200-66504	A: DUAL CHANNEL OUTPUT AMPLIFIER	
A4	01200-63503	A: HORIZONTAL MODULE	
A5	01200-66514	A: LOW VOLTAGE POWER SUPPLY	
A6	01200-66515	A: HIGH VOLTAGE REGULATOR	
A7	01200-66505	A: HIGH VOLTAGE RECTIFIER	
DS1	1450-0048	DS: NEON (POWER INDICATOR)	
F1	2110-0059	FUSE:CARTRIDGE 1-1/2A SLO-BLO (115V OPERATION)	
F1	2110-0080	FUSE:0.75A 125V SLOW-BLOW (230V OPERATION)	
J1	1510-0057	BINDING POST ASSY:RED (CHANNEL A -INPUT)	
J2	1510-0056	BINDING POST ASSY:BLACK (CHANNEL A GROUND)	
J3	1510-0057	BINDING POST ASSY:RED (CHANNEL A +INPUT)	
J4	1510-0057	BINDING POST ASSY:RED (CHANNEL B -INPUT)	
J5	1510-0056	BINDING POST ASSY:BLACK (CHANNEL B GROUND)	
J6	1510-0057	BINDING POST ASSY:RED (CHANNEL B +INPUT)	
J7	1510-0057	BINDING POST ASSY:RED (TRIGGER AND HORIZONTAL INPUT)	
J8	1510-0056	BINDING POST ASSY:BLACK (GROUND)	
J9	1251-0463	CONNECTOR:FEMALE,BANANA TYPE BLACK (CAL 1 VOLT)	
L1	01200-66001	COIL ASSY:ALIGNMENT	
MP1	0340-0424	INSULATOR:BINDING POST, BLACK	
MP2	0340-0425	INSULATOR:BINDING POST, RED	
MP3	0340-0450	WASHER:TRANSISTOR INSULATOR (FOR Q1 AND Q2)	
MP4	0370-0432	KNOB:BLACK LEVER	
MP5	0370-0453	KNOB:W/DUAL INDEX (SWEEP TIME SWITCH)	
MP6	0510-0097	RETAINER:PUSH-ON (POWER INDICATOR)	
MP7	0905-0016	STRIP:FELT FOR CRT	
MP8	1410-0052	BUSHING:POTENTIOMETER (TRACE ALIGNMENT CONTROL)	
MP9	1431-0039	SHAFT:STL 8.187+/-0.03" LG. (DISPLAY SWITCH)	
MP10	1490-0841	COUPLING:SHAFT 0.127" ID (DISPLAY SWITCH)	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
MP11	5020-0476	BEZEL: CRT	
MP12	5020-0510	FILTER:CRT CLEAR	
MP13	5020-0530	FILTER: CRT AMBER (USED ONLY WITH P7 PHOSPHOR)	
MP14	5040-0444	SHIELD:LIGHT BLACK NYLON	
MP15	5040-0453	COVER:POTENTIOMETER (FOCUS CONTROL)	
MP16	00180-01218	BRACKET:ALIGNMENT COIL	
MP17	00180-67402	KNOB: BLACK W/ARROW (INTENSITY/FOCUS CONTROLS)	
MP18	01200-04105	COVER:CRT	
MP19	01200-44701	SUPPORT:CRT	
MP20	01200-44702	SUPPORT:CIRCUIT BOARD	
MP21	01200-44703	SUPPORT:CRT SHIELD	
MP22	01200-44704	SPACER:KNOB (TRIGGER LEVEL CONTROL)	
MP23	01200-60601	SHIELD:CRT	
MP24	01205-67401	ASSY:KNOB (VOLTS/DIVISION SWITCH)	
MP25	01200-67402	ASSY:KNOB (SWEEP TIME SWITCH)	
MP26	01200-67403	ASSY:KNOB (DISPLAY SWITCH)	
MP27	01200-67404	ASSY:KNOB WITH ARROW (POSITION CONTROLS)	
MP28	01821-67401	KNOB: +/01- W/ARROWS (TRIGGER LEVER CONTROL)	
MP29	01821-67403	KNOB:CAL W/ ARROW (VERNIER CONTROLS)	
MP30	0510-1075	FASTENER:PUSH-ON (BALANCE CONTROL) MODEL 1205A ONLY	
MP31	1440-0074	HANDLE:BLACK MODEL 1205A ONLY	
MP32	5040-0447	FOOT:REAR(LONG) MODEL 1205A ONLY	
MP33	01200-00103	DECK:HORIZONTAL MODEL 1205A ONLY	
MP34	01205-00203	PANEL:FRONT MODEL 1205A ONLY	
MP35	01200-00606	SHIELD:HIGH VOLTAGE POWER SUPPLY MODEL 1205A ONLY	
MP36	01200-01205	BRACKET:HIGH VOLTAGE BD. TOP MTG. MODEL 1205A ONLY	
MP37	01200-01206	BRACKET:HIGH VOLTAGE BD. BOTTOM MTG. MODEL 1205A ONLY	
MP38	01200-04103	COVER:TOP MODEL 1205A ONLY	
MP39	01200-04106	COVER:HIGH VOLTAGE POWER SUPPLY MODEL 1205A ONLY	
MP40	1390-0153	FASTENER: PANEL MODEL 1205A ONLY	
MP41		NOT ASSIGNED	
MP42	01200-21701	BUSHING:PANEL(BALANCE CONTROL) MODEL 1205A ONLY	

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
MP43	01200-23702	RAIL:TOP MODEL 1205A ONLY	
MP44	01200-23703	RAIL:SIDE MODEL 1205A ONLY	
MP45	01200-40502	FRAME:REAR MODEL 1205A ONLY	
MP46	01200-40503	FRAME:FRONT MODEL 1205A ONLY	
MP47	01200-42301	RETAINER:HANDLE MODEL 1205A ONLY	
MP48	01200-64104	ASSY:BOTTOM COVER MODEL 1205A ONLY	
MP49	01200-67501	NOT ASSIGNED	
MP50	5020-0522	HANDLE:5-1/4" MODEL 1205B ONLY	
MP51	01205-00201	PANEL:FRONT MODEL 1205B ONLY	
MP52	01200-00604	SHIELD:HIGH VOLTAGE POWER SUPPLY MODEL 1205B ONLY	
MP53	01200-04101	COVER:TOP MODEL 1205B ONLY	
MP54	01200-04102	COVER:BOTTOM MODEL 1205B ONLY	
MP55	01200-60501	ASSY:FRAME MODEL 1205B ONLY	
P1		P:POWER (N.S.R. PART OF W1)	
Q1	5080-0475	Q:SI PNP	
Q2	5080-0476	Q:SI NPN	
R1	0684-4731	R:FXD COMP 47K OHM 10% 1/4W	
R2	2100-0013	R:VAR COMP 50K OHM LIN 1/2W	
R3	2100-2663	R:VAR WW 5K OHM 10% LIN 4W	
R4	2100-2563	R:VAR COMP 5 MEGOHM 20% LIN 1/2W	
R5		NOT ASSIGNED	
R6	2100-2594	R:VAR COMP 2500 OHM 10% LIN 1/2W	
R7	2100-2594	R:VAR COMP 2500 OHM 10% LIN 1/2W	
R8	0684-1041	R:FXD COMP 100K OHM 10% 1/4W	
S1	3101-0036	SWITCH:TOG SPST 3 AMP 250 V (POWER)	
S2	3101-1310	SWITCH:PUSHBUTTON SPDT (FIND BEAM)	
T1	9100-1125	TRANSFORMER:POWER	
TB1	0360-0104	STRIP:TERMINAL SCREW TYPE CATCH (Z AXIS INPUT)	
V1	5083-1853	CATHODE RAY TUBE	
W1	8120-0050	CABLE ASSY:7.5' POWER CORD MODEL 1205B ONLY	

See introduction to this section for ordering information

Table 6-2. Replaceable Parts in Reference Designation Order (Cont'd)

Reference Designation	Part No.	Description #	Note
W1	8120-1202	CABLE ASSY:POWER MODEL 1205A ONLY	
W2	01200-61602	CABLE:MAIN MODEL 1205A ONLY	
W2	01200-61601	CABLE:MAIN MODEL 1205B ONLY	
XF1	1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	
XV1	1200-0037	SOCKET:CRT TUBE	

See introduction to this section for ordering information

Table 6-3. Replaceable Parts in HP Stock Number Order

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0121-0045	C:FXD CER 7-45 PF 500VDCW	72982	503-001-D2P0-33R	4
0130-0001	C:VAR CER 7-45PF 500VDCW	28480	0130-0001	4
0130-0003	C:VAR CER 1.5-7 PF NPO	28480	0130-0003	4
0130-0016	C:VAR CER 5-25 PF NPO	28480	0130-0016	1
0140-0090	C:FXD MICA 200 PF 5%	28480	0140-0090	4
0140-0198	C:FXD MICA 200 PF 5%	72136	RDM15F201J3C	4
0140-0205	C:FXD MICA 62 PF 5%	28480	0140-0205	1
0140-0206	C:FXD MICA 270 PF 5%	72136	RDM15F2715 500V	3
0140-0207	C:FXD MICA 330 PF 5%	28480	0140-0207	2
0150-0012	C:FXD CER 0.01 UF 20% 1000VDCW	56289	29C214A3	4
0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA	1
0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA	2
0150-0115	C:FXD CER 27 PF 10% 500VDCW	72982	301-000-U2J0-270K	4
0160-0155	C:FXD MY 3300 PF 10%	28480	0160-0155	1
0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	56289	192P33392-PTS	1
0160-0165	C:FXD MY 0.056 UF 10% 200VDCW	56289	192P56392-PTS	2
0160-0168	C:FXD MICA 0.1 UF 10% 200VDCW	56289	192P10492-PTS	3
0160-0194	C:FXD MY 0.015 UF 10%	56289	192P15392-PTS	1
0160-0917	C:FXD MY 0.1 UF 20% 600VDCW	28480	0160-0917	2
0160-2056	C:FXD MY 0.22 UF 20% 200VDCW	56289	224P22402	1
0160-2203	C:FXD MICA 91 PF 5%	72136	RDM15F910J3C	2
0160-2204	C:FXD MICA 100PF 5%	72136	RDM15F101J3C	1
0160-2234	C: FXD CER 0.51 PF 500VDCW	72982	301-000-C0K0-518C	1
0160-2237	C: FXD CER 1.2 PF 500VDCW	72982	301-NP0-1.2 PF	1
0160-2240	C: FXD CER 2.0 PF 500VDCW	72982	301-000-C0K0-209C	4
0160-2249	C: FXD CER 4.7 PF 500VDCW	72982	301-NP0-4.7 PF	4
0160-2258	C:FXD CER 11 PF 5% 500VDCW	72982	301-000-G0G0-110J	6
0160-2403	C:FXD CER 1500 PF 20% 5K VDCW	72982	828-025-X5R0-152M	1
0160-2913	C:FXD CER 0.01 UF +85-20% 500VDCW	72982	811-014-Y5U0-103Z	3
0160-2914	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	1233C20-CDH-104Z	4
0160-2917	C:FXD CER 0.05 UF +80-20% 100VDCW	84411	TYPE TA	11
0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA	1
0160-2959	C:FXD CER 1000 PF +100-0% 600VDCW	84411	Y5U	2
0160-3007	C:FXD CER 4700 PF 20% 4K VDCW	72982	3888-024-Y5S0-472M	4
0160-3008	C:FXD CER 4700 PF 20% 4K VDCW	72982	3888-024-Y5S0-472M	3
0160-3133	C:FXD MY 2 UF 10% 100VDCW	84411	663UW	1
0170-0022	C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24	1
0170-0063	C:FXD MY 0.02 UF 10% 400VDCW	56289	148P170A	1
0180-0091	C:FXD ELECT 10 UF +50-10% 'OVDCW	56289	30D106F100DC2-DSM	7
0180-0109	C:FXD ELECT 18 UF 100VDCW	56289	40D186F100DH 6M1	1
0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS	5
0180-1731	C:FXD ELECT 4.7 UF 10% 50VDCW	56289	150D475X9050B2-DYS	1
0180-2134	C:FXD ELECT 20 UF +50-10% 100VDCW	56289	34D206F100EJ4-DSB	2
0180-2138	C:FXD ELECT 150 UF +50-10% 250VDCW	56289	68D-10044-DFP	1
0180-2159	C:FXD ELECT 300 UF +75-10% 150VDCW	56289	68D-D47670-DFP	2
0340-0424	INSULATOR:BINDING POST, BLACK	28480	0340-0424	6
0340-0425	INSULATOR:BINDING POST, RED	28480	0340-0425	10
0340-0450	WASHER:TRANSISTOR INSULATOR	04713	14852600F12	1
0340-0451	WASHER:INSULATED, TRANSISTOR	04713	14852600F03	1
0360-0104	STRIP:TERMINAL, SCREW TYPE CATCH	71785	321-11-02-036	1
0370-0432	KNOB:BLACK LEVER	28480	0370-0432	8
0370-0453	KNOB:W/DUAL INDEX	28480	0370-0453	1
0510-0097	RETAINER:PUSH-ON	78553	C185-014-24D	1
0510-1075	FASTENER:PUSH-ON	78553	24DC-12045-012	1

 # See introduction to this section for ordering information

Table 6-3. Replaceable Parts in HP Stock Number Order (Cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0683-3935	R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935	5
0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021	3
0684-1031	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031	5
0684-1041	R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041	7
0684-1051	R: FXD COMP 1 MEGOHM 10% 1/4W	01121	CB 1051	3
0684-1241	R:FXD COMP 120K OHM 10% 1/4W	01121	CB 1241	1
0684-1511	R:FXD COMP 150 OHM 10% 1/4W	01121	CB 1511	1
0684-1531	R:FXD COMP 15K OHM 10% 1/4W	01121	CB 1531	1
0684-1541	R:FXD COMP 150K OHM 10% 1/4W	01121	CB 1541	2
0684-2201	R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201	3
0684-2211	R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211	16
0684-2231	R:FXD COMP 22K OHM 10% 1/4W	01121	CB 2231	7
0684-2241	R:FXD COMP 220K OHM 10% 1/4W	01121	CB 2241	1
0684-2251	R:FXD COMP 2.2 MEGOHM 10% 1/4W	01121	CB 2251	1
0684-2731	R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731	4
0684-3311	R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311	2
0684-3321	R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321	9
0684-3331	R:FXD COMP 33K OHM 10% 1/4W	01121	CB 3331	5
0684-4711	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711	1
0684-4731	R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731	2
0684-4741	R:FXD COMP 470K OHM 10% 1/4W	01121	CB 4741	4
0684-5631	R:FXD COMP 56K OHM 10% 1/4W	01121	CB 5631	1
0684-6801	R:FXD COMP 68 OHM 10% 1/4W	01121	CB 6801	4
0684-8221	R:FXD COMP 8200 OHM 10% 1/4W	01121	CB 8221	2
0687-1001	R:FXD COMP 1K OHM 10% 1/2W	01121	EB 1001	1
0687-1041	R:FXD COMP 100K OHM 10% 1/2W	01121	EB 1041	4
0687-1211	R:FXD COMP 120 OHM 10% 1/2W	01121	EB 1211	1
0687-1531	R:FXD COMP 15K OHM 10% 1/2W	01121	EB 1531	1
0687-2221	R:FXD COMP 2200 OHM 10% 1/2W	01121	EB 2221	1
0687-3351	R:FXD COMP 3.3 MEGOHM 10% 1/2W	01121	EB 3351	1
0687-5631	R:FXD COMP 56K OHM 10% 1/2W	01121	EB 5631	1
0693-6851	R:FXD COMP 6.8 MEGOHM 10% 2W	01121	HB 6851	4
0698-0085	R:FXD MET FLM 2.61K OHM 1% 1/8W	14674	C4	1
0698-3109	R:FXD MET FLM 10.1K OHM 1% 1/8W	28480	0698-3109	4
0698-3122	R:FXD MET FLM 412 OHM 1% 1/8W	28480	0698-3122	2
0698-3136	R:FXD MET FLM 17.8K OHM 1% 1/8W	14674	C4	4
0698-3155	R:FXD MET FLM 4.64K 1% 1/8W	91637	MFF-1/10-32	5
0698-3158	R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158	1
0698-3200	R:FXD FLM 8K OHM 1% 1/8W	28480	0698-3200	1
0698-3264	R:FXD FLM 11.8K OHM 1% 1/8W	28480	0698-3264	1
0698-3417	R:FXD MET FLM 23.7K OHM 1% 1/2W	28480	0698-3417	1
0698-3443	R:FXD MET FLM 287 OHM 1% 1/8W	91637	MF-1/10-32	1
0698-3447	R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447	3
0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W	28480	0698-3450	1
0698-3457	R:FXD MET FLM 316K OHM 1% 1/8W	28480	0698-3457	1
0698-3605	R:FXD MET OX 15 OHM 5% 2W	28480	0698-3605	2
0698-3643	R:FXD MET OX 4.3K OHM 5% 2W	28480	0698-3643	1
0698-4009	R:FXD FLM 50K OHM 1% 1/8W	28480	0698-4009	1
0698-4055	R:FXD FLM 1K OHM 0.25% 1/8W	28480	0698-4055	1
0698-4482	R:FXD FLM 17.4K OHM 1% 1/8W	28480	0698-4482	1
0698-4492	R:FXD FLM 32.4K OHM 1% 1/8W	28480	0698-4492	2
0698-4935	R:FXD MET FLM 41.2K OHM 1% 1/2W	28480	0698-4935	1
0698-5092	R:FXD FLM 160K OHM 1% 1/8W	28480	0698-5092	2
0698-5102	R:FXD COMP 1.2 MEGOHM 10% 1/4W	01121	CB 1251	2

See introduction to this section for ordering information

Table 6-3. Replaceable Parts in HP Stock Number Order (Cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0698-6218	R:FXD FLM 20K OHM 0.5% 1/8W	28480	0698-6218	1
0698-6733	R:FXD FLM 30 MEGOHM 1% 1W	28480	0698-6733	1
0698-6734	R:FXD FLM 28.6K OHM 0.5% 1/8W	28480	0698-6734	1
0698-6735	R:FXD FLM 1.71K OHM 1% 1/8W	28480	0698-6735	2
0698-6736	R:FXD FLM 831 OHM 1% 1/8W	28480	0698-6736	2
0698-6742	R:FXD FLM 10.8K OHM 1% 1/8W	28480	0698-6742	2
0698-6814	R:FXD FLM 10K OHM 2% 1/4W	28480	0698-6814	2
0698-6815	R:FXD FLM 1.8K OHM 2% 1/4W	28480	0698-6815	1
0698-6816	R:FXD FLM 6.2K OHM 2% 1/4W	28480	0698-6816	1
0698-7091	R:FXD MET FLM 10 MEGOHM 1% 1/2W	28480	0698-7091	2
0698-7142	R:FXD FLM 12.3K OHM 1% 1/4W	28480	0698-7142	1
0698-7182	R:FXD MET FLM 30 MEGOHM 1% 2W	03888	PME-80	1
0727-0832	R:FXD DEPC 619K OHM 1% 1/2W	28480	0727-0832	1
0757-0057	R:FXD MET FLM 990K OHM 1% 1/2W	28480	0757-0057	4
0757-0059	R:FXD MET FLM 1 MEGOHM 1% 1/2W	28480	0757-0059	4
0757-0095	R:FXD MET OX 5100 OHM 2% 1/2W	28480	0757-0095	1
0757-0110	R:FXD MET FLM 12.8K OHM 1% 1/4W	28480	0757-0110	1
0757-0124	R:FXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124	2
0757-0274	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274	2
0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	14674	C4	1
0757-0281	R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281	1
0757-0288	R:FXD MET FLM 9.09K 1% 1/8W	14674	C4	1
0757-0289	R:FXD MET FLM 13.3K OHM 1% 1/8W	28480	0757-0289	3
0757-0344	R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344	2
0757-0350	R:FXD MET FLM 909K OHM 1% 1/4W	28480	0757-0350	1
0757-0389	R:FXD MET FLM 33.2 OHM 1% 1/8W	28480	0757-0389	1
0757-0392	R:FXD MET FLM 43.2 OHM 1% 1/8W	28480	0757-0392	1
0757-0394	R:FXD MET FLM 51.1 OHM 1% 1/8W	14674	C4	1
0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397	1
0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398	2
0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	14674	C4	2
0757-0411	R:FXD MET FLM 332 OHM 1% 1/8W	28480	0757-0411	1
0757-0414	R:FXD FLM 432 OHM 1% 1/8W	28480	0757-0414	2
0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	14674	C4	4
0757-0424	R:FXD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424	1
0757-0427	R:FXD MET FLM 1.5K 1% 1/8W	14674	C4	1
0757-0431	R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431	2
0757-0433	R:FXD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0433	5
0757-0435	R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435	2
0757-0438	R:FXD MET FLM 5.11K 1% 1/8W	14674	C4	2
0757-0439	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439	1
0757-0440	R:FXD MET FLM 7.50K 1% 1/8W	14674	C4	4
0757-0441	R:FXD MET FLM 8.25K 1% 1/8W	14674	C4	1
0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	14674	C4	4
0757-0443	R:FXD MET FLM 11.0K OHM 1% 1/8W	91637	MF-1/10-32	2
0757-0445	R:FXD FLM 13K OHM 1% 1/8W	28480	0757-0445	1
0757-0446	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446	2
0757-0447	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447	4
0757-0449	R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449	1
0757-0450	R:FXD MET FLM 22.1K OHM 1% 1/8W	28480	0757-0450	1
0757-0453	R:FXD MET FLM 30.1K OHM 1% 1/8W	28480	0757-0453	2
0757-0456	R:FXD MET FLM 43.2K OHM 1% 1/8W	28480	0757-0456	3
0757-0457	R:FXD MET FLM 47.5K OHM 1% 1/8W	28480	0757-0457	1
0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	91637	MF-1/10-32	2

See introduction to this section for ordering information

Table 6-3. Replaceable Parts in HP Stock Number Order (Cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0757-0463	R:FXD MET FLM 82.5K 1% 1/8W	14674	C4	1
0757-0465	R:FXD MET FLM 100K 1% 1/8W	14674	C4	2
0757-0467	R:FXD MET FLM 121K OHM 1% 1/8W	28480	0757-0467	2
0757-0471	R:FXD MET FLM 182K OHM 1% 1/8W	28480	0757-0471	1
0757-0472	R:FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472	1
0757-0479	R:FXD MET FLM 392K OHM 1% 1/8W	28480	0757-0479	1
0757-0486	R:FXD MET FLM 750K OHM 1% 1/8W	91637	MFF-1/8	1
0757-0750	R:FXD MET FLM 6810 OHM 1% 1/4W	28480	0757-0750	1
0757-0757	R:FXD MET FLM 15K OHM 1% 1/4W	28480	0757-0757	3
0757-0822	R:FXD FLM 1.30K OHM 1% 1/2W	28480	0757-0822	6
0757-0831	R:FXD MET FLM 4.32K OHM 1% 1/2W	28480	0757-0831	1
0757-0832	R:FXD MET FLM 4.75K OHM 1% 1/2W	28480	0757-0832	1
0757-0914	R:FXD FLM 390 OHM 2% 1/8W	28480	0757-0914	3
0757-0924	R:FXD MET FLM 1K OHM 2% 1/8W	14674	C4	2
0757-0928	R:FXD FLM 1.5K OHM 2% 1/8W	28480	0757-0928	3
0757-0930	R:FXD FLM 1.8K OHM 2% 1/8W	28480	0757-0930	2
0757-0931	R:FXD MET FLM 2K OHM 2% 1/8W	14674	C4	1
0757-0935	R:FXD FLM 3K OHM 2% 1/8W	28480	0757-0935	2
0757-0940	R: FXD MET FLM 4.7K OHM 2% 1/8W	28480	0757-0940	1
0757-0941	R:FXD FLM 5.1K OHM 2% 1/8W	28480	0757-0941	1
0757-0944	R:FXD FLM 6.8K OHM 2% 1/8W	28480	0757-0944	2
0757-0950	R:FXD FLM 12K OHM 2% 1/8W	28480	0757-0950	2
0757-0952	R:FXD FLM 15K OHM 2% 1/8W	28480	0757-0952	3
0757-0956	R:FXD FLM 22K OHM 2% 1/8W	14674	C4	1
0757-0959	R:FXD FLM 30K OHM 2% 1/8W	28480	0757-0959	3
0757-0962	R:FXD FLM 39K OHM 2% 1/8W	28480	0757-0962	1
0757-0964	R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964	3
0757-0972	R:FXD FLM 100K OHM 2% 1/8W	28480	0757-0972	4
0757-0976	R:FXD FLM 150K OHM 2% 1/8W	28480	0757-0976	2
0760-0028	R:FXD METOX 6.2K OHM 2% 1W	28480	0760-0028	1
0761-0027	R:FXD MET OX 2700 OHM 5% 1W	14674	C-32 OBD	1
0764-0043	R:FXD MET OX 2.7K OHM 5% 2W	28480	0764-0043	1
0767-0008	R:FXD MET OX FLM 10K OHM 5% 3W	28480	0767-0008	4
0836-0003	R:FXD FLM 29 MEGOHM 10% 1W	28480	0836-0003	1
09C5-0016	STRIP:FELT FOR CRT	00000	OBD#	1
1200-0037	SOCKET:CRT TUBE	72825	97097	1
12C5-0095	HEAT SINK:TRANSISTOR	13103	22258	4
1251-0463	CONNECTOR:FEMALE,BANANA TYPE BLACK	74970	108-903	1
1390-0153	FASTENER:PANEL MODEL 1205A ONLY	28480	1390-0153	2
1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	79515	342014	1
1410-0052	BUSHING:POTENTIOMETER	28480	1410-0052	1
1431-0039	SHAFT:STL 8.187+/-0.03" LG.	76854	OBD#	1
1440-0074	HANDLE:BLACK	12136	STYLENO 7860	1
1450-0048	LAMP:INDICATOR RED 115V	72765	599-124	1
1490-0841	COUPLING:SHAFT 0.127" ID	28480	1490-0841	1
1510-0056	BINDING POST ASSY:BLACK	28480	1510-0056	3
1510-0057	BINDING POST ASSY:RED	28480	1510-0057	5
1853-0020	Q:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020	1
1853-0036	Q:SI PNP	04713	SPS 3612	17
1853-0037	Q:SI PNP	28480	1853-0037	1
1853-0049	Q:SI PNP	28480	1853-0049	2
1853-0098	Q:SI PNP	04713	2N5086	6
1854-0022	Q:SI NPN	07263	S17843	6
1854-0071	Q:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071	18
1854-0215	Q:SI NPN	04713	SPS3611	7

See introduction to this section for ordering information

Table 6-3. Replaceable Parts in HP Stock Number Order (Cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
1854-0234	Q:SI NPN	02735	2N3440	4
1854-0330	Q:SI NPN	28480	1854-0330	1
1854-0358	Q:SI NPN	28480	1854-0358	1
1855-0057	Q:SI FET N-CHAN	28480	1855-0057	1
1855-0085	Q: FET SILICON DUAL	28480	1855-0085	2
1855-0090	Q:FET N-CHANNEL	28480	1855-0090	1
1901-0026	DIODE:SILICON 0.75A 200PIV	04713	SR1358-8	10
1901-0028	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9	4
1901-0033	DIODE:SILICON 100MA 180WV	07263	FD3369	1
1901-0040	DIODE:SILICON 30MA 30WV	07263	FDG1C88	58
1901-0045	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7	1
1901-0049	DIODE:SILICON 0.75A 50PIV	04713	SR1358-6	1
1901-0050	DIODE:SILICON 75V	14433	S270	5
1901-0341	DIODE:SILICON 7000 PIV	28480	1901-0341	2
1901-0376	DIODE:SILICON 35V	28480	1901-0376	9
1902-0018	DIODE BREAKDOWN:11.7V 5%	04713	1N941	1
1902-0025	DIODE:BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025	1
1902-0034	DIODE:5.76V 10%	28480	1902-0034	1
1902-0041	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98	1
1902-0049	DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122	1
1902-0055	DIODE BREAKDOWN:14.7V 10%	28480	1902-0055	1
1902-3357	DIODE BREAKDOWN:56.2V 5%	28480	1902-3357	2
1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361	1
1912-0009	DIODE TUNNEL:GERMANIUM 1N3712	03508	1N3712 SPEC	1
2100-0013	R:VAR COMP 50K OHM LIN 1/2W	28480	2100-0013	1
2100-0347	R:VAR COMP 4 X 25K OHM 30% LIN 1/4W	28480	2100-0347	1
2100-0381	R:VAR COMP 25K OHM 30% LIN 1/4W	28480	2100-0381	1
2100-0935	R:VAR COMP 1K OHM 20% LIN 1/4W	28480	2100-0935	1
2100-0940	R:VAR COMP 500 OHM 20% LIN 1/4W	28480	2100-0940	1
2100-0981	R:VAR COMP 1 MEGOHM 20% LIN 1/4W	28480	2100-0981	1
2100-1509	R:VAR 20K OHM 20% LIN 1/3W	28480	2100-1509	1
2100-2563	R:VAR COMP 5 MEGOHM 20% LIN 1/2W	28480	2100-2563	1
2100-2577	R:VAR COMP 10K/500 OHM 30% LIN 1/4W	28480	2100-2577	2
2100-2578	R:VAR COMP 4 X 1.5K OHM 30% LIN 1/4W	28480	2100-2578	1
2100-2580	R:VAR COMP 2X100K/250K OHM 30% LIN 1/4W	28480	2100-2580	1
2100-2581	R:VAR COMP 2 X 20K OHM 20% LIN 1/4W	28480	2100-2581	1
2100-2594	R:VAR COMP 2500 OHM 10% LIN 1/2W	28480	2100-2594	2
2100-2613	R:VAR CARBON 100K OHM 20% LIN 1/5W	28480	2100-2613	1
2100-2616	R:VAR COMP 7K/25K OHM 30/20% LIN	28480	2100-2616	1
2100-2617	R:VAR COMP 4K OHM 10% 10 CCLOG 1/4W	28480	2100-2617	2
2100-2622	R:VAR COMP 200 OHM 30% LIN 3/10W	28480	2100-2622	2
2100-2663	R:VAR WW 5K OHM 10% LIN 4W	28480	2100-2663	1
2110-0004	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250	1
2110-0012	FUSE:CARTRIDGE 0.5A(230V OPERATION)	28480	2110-0012	2
2110-0059	FUSE:CARTRIDGE 1-1/2A SLO-BLO	71400	MDL 1.5	1
2110-0080	FUSE:0.75A 125V SLOW-BLOW	75915	313.750	1
2110-0269	CLIP:FUSE 0.250" DIA	91506	6008-32CN	6
2140-0013	LAMP:GLOW 1/25W 65 VAC MAX LG	24455	NE 23 2	2
3100 – 1372	SWITCH: LEVER	28480	3100 – 1372	1
3100 – 1373	SWITCH: LEVER	28480	3100 – 1373	1
3100 – 1374	SWITCH LEVER	28480	3100 – 1374	1
3100 – 1375	SWITCH: LEVER	28480	3100 – 1375	1
3100 – 1376	SWITCH	28480	3100 – 1376	4
3100 – 1377	SWITCH: ROTARY 5 SECTION 5 POSITION	28480	3100 – 1377	1
3100 – 1378	SWITCH: ROTARY DUAL DETENT	28480	3100 – 1378	1
3100 – 2524	SWITCH: ROTARY 6 SECT 12 POSITION	28480	3100 – 2524	2
3101 – 0036	SWITCH: TOG SP ST 3 AMP 250 V	88140	8280K16	1
3101 – 0944	SWITCH: PUSHBUTTON SP ST	81073	40YY2015 – 1	1

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Table 6-3. Replaceable Parts in HP Stock Number Order (Cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
3101-1310	SWITCH:PUSHBUTTON SPDT	82389	12S-1038	1
3130-0038	COUPLER:SWITCH SST U-SHAPED	76854	12276-6	1
5020-0476	BEZEL	28480	5020-0476	1
5020-0510	FILTER:CRT, CLEAR	28480	5020-0510	1
5020-0522	HANDLE:5-1/4"	28480	5020-0522	2
5020-0530	FILTER:AMBER	28480	5020-0530	1
5040-0444	SHIELD:LIGHT BLACK NYLON	28480	5040-0444	1
5040-0447	FOOT:REAR(LONG)	28480	5040-0447	4
5040-0453	COVER:POTENTIOMETER(FOCUS)	28480	5040-0453	1
5080-0475	Q:SI PNP	28480	5080-0475	1
5080-0476	Q:SI NPN	28480	5080-0476	1
5083-1853	CATHODE RAY TUBE	28480	5083-1853	1
8120-0050	CABLE ASSY:7.5' POWER CORD	70903	KH4096	1
8120-1202	CABLE ASSY:POWER	28480	8120-1202	1
9100-1125	TRANSFORMER:POWER	28480	9100-1125	1
9140-0118	COIL:FXD 500 UH 5%	28480	9140-0118	1
9140-0137	COIL:FXD RF 1000 UH 5%	71895	2500-28	4
9140-0179	COIL/CHOKE 22.0 UH 10%	28480	9140-0179	1
00180-01218	BRACKET:ALIGNMENT COIL	28480	00180-01218	2
00180-67402	KNOB	28480	00180-67402	2
01200-00103	DECK:HORIZONTAL	28480	01200-00103	1
01200-00604	SHIELD:HIGH VOLTAGE POWER SUPPLY	28480	01200-00604	1
01200-00606	SHIELD:HIGH VOLTAGE POWER SUPPLY	28480	01200-00606	1
01200-01101	HEAT SINK:TRANSISTOR	28480	01200-01101	1
01200-01203	BRACKET:SWEEP SWITCH MOUNTING	28480	01200-01203	1
01200-01205	BRACKET:HIGH VOLTAGE BD, TOP MTG.	28480	01200-01205	1
01200-01206	BRACKET:HIGH VOLTAGE BD. BOTTOM MTG.	28480	01200-01206	2
01200-04101	COVER:TOP	28480	01200-04101	1
01200-04102	COVER:BOTTOM	28480	01200-04102	1
01200-04103	COVER:TOP	28480	01200-04103	1
01200-04105	COVER:CRT	28480	01200-04105	1
01200-04106	COVER:HIGH VOLTAGE POWER SUPPLY	28480	01200-04106	1
01200-01201	BRACKET: MODE SWITCH MTG	28480	01200-01201	1
01200-21701	BUSHING:PANEL (BALANCE CONTROL)	28480	01200-21701	2
01200-23702	RAIL:TOP	28480	01200-23702	1
01200-23703	RAIL:SIDE	28480	01200-23703	2
01200-23704	SHAFT:BAL POT	28480	01200-23704	2
01200-40502	FRAME:REAR	28480	01200-40502	1
01200-40503	FRAME:FRONT	28480	01200-40503	1
01200-42301	RETAINER:HANDLE	28480	01200-42301	2
01200-44701	SUPPORT:CRT	28480	01200-44701	1
01200-44702	SUPPORT:CIRCUIT BOARD	28480	01200-44702	6
01200-44703	SUPPORT:CRT SHIELD	28480	0120-44703	1
01200-44704	SPACER:KNOB	28480	01200-44704	1
01200-60501	ASSY:FRAME	28480	01200-60501	1
01200-60601	SHIELD:CRT	28480	01200-60601	1
01200-60602	SHIELD:SWEEP ASSY	28480	01200-60602	1
01200-60603	SHIELD:AMPLIFIER	28480	01200-60603	2
01200-61101	TRANSFORMER:HIGH VOLTAGE	28480	0120-61101	1
01200-61501	RESISTOR:MODIFIED	28480	01200-61501	1
01200-61601	CABLE:MAIN	28480	01200-61601	1
01200-61602	CABLE:MAIN	28480	01200-61602	1

See introduction to this section for ordering information

Table 6-3. Replaceable Parts in HP Stock Number Order (Cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
01200-61603	CABLE ASSY:COAX	28480	01200-61603	1
01200-61605	CABLE:SWEEP SWITCH	28480	01200-61605	1
01200-61607	LEAD:TWIN OUTPUT	28480	01200-61607	1
01200-61902	SWITCH ASSY:SWEEP	28480	01200-61902	1
01200-63503	MODULE-SWEEP ASSY	28480	01200-63503	1
01200-64104	ASSY:BOTTOM COVER	28480	01200-64104	1
01200-66001	COIL ASSY:ALIGNMENT	28480	01200-66001	1
01200-66504	ASSY: DUAL CHANNEL OUTPUT AMPLIFIER	28480	01200-66504	1
01200-66505	HV RECTIFIER ASSY	28480	01200-66505	1
01200-66508	BOARD ASSY:SWEEP	28480	01200-66508	1
01200-66514	ASSY:LOW VOLTAGE POWER SUPPLY	28480	01200-66514	1
01200-66515	BOARD ASSY:HV REGULATOR	28480	01200-66515	1
01200-67402	ASSY:KNOB	28480	01200-67402	1
01200-67403	ASSY:KNOB	28480	01200-67403	1
01200-67404	ASSY:KNOB WITH ARROW	28480	01200-67404	3
01205-00201	PANEL:FRONT	28480	01205-00201	1
01205-00203	PANEL:FRONT	28480	01205-00203	1
01205-61902	SWITCH ASSY:ATTENUATOR	28480	01205-61902	2
01205-63502	MODULE-AMPLIFIER ASSY	28480	01205-63502	2
01205-66501	BOARD ASSY:5 MV	28480	01205-66501	2
01205-67401	ASSY:KNOB	28480	01205-67401	2
01821-67401	KNOB: +/01- W/ARROWS	28480	01821-67401	1
01821-67403	KNOB:CAL W/ ARROW	28480	01821-67403	3

See introduction to this section for ordering information

Table 6-4. List of Manufacturers' Codes

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

Code No.	Manufacturer	Address
00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp	Rochester, N.Y.
00287	Comco Inc	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Microtron Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc	Cherry Hill, N.J.
00656	Aerovox Corp	New Bedford, Mass.
00779	Amp Inc	Harrisburg, Pa.
00781	Aircraft Radio Corp	Boonton, N.J.
00809	Craven Ltd	Whitby, Ontario Canada
00815	Northern Engineering Laboratories, Inc	Burlington, Wis
00853	Sangamo Electric Co Pickens Div	Pickens, S.C.
00866	Gow Engineering Co	City of Industry, Cal.
00891	Carl E. Holmes Corp	Los Angeles, Calif.
00929	Mictrolab Inc	Livingston, N.J.
01002	General Electric Co Capacitor Dept	Hudson Falls, N.Y.
01009	Alden Products Co	Brockton, Mass.
01121	Allen Bradley Co	Milwaukee, Wis.
01255	Litton Industries, Inc	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc	Lawndale, Calif.
01295	Texas Instruments, Inc Transistor Products Div	Dallas, Texas
01349	The Alliance Mfg. Co	Alliance, Ohio
01538	Smar Parts Inc	Los Angeles, Calif.
01589	Pacific Relays, Inc	Van Nuys, Calif.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferrocube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02736	Radio Corp. of America, Semiconductor and Materials Div	Somerville, N.J.
02771	Vocaline Co. of America Inc	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
02875	Hudson Tool & Die Co	Newark, N.J.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co	Dayton, Ohio
03797	Eldema Corp	Compton, Calif.
03818	Parker Seal Co	Los Angeles, Calif.
03877	Transitron Electric Corp	Wakefield, Mass.
03888	Pyrofilm Resistor Co. Inc	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div Finderne Plant	Somerville, N.J.
04009	Arrow Hart and Hegeman Elect Co	Hartford, Conn.
04013	Taurus Corp	Lambertville, N.J.
04062	Arco Electronic Inc	Great Neck, N.Y.
04217	Essex Wire	Los Angeles, Calif.
04222	HVD Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co	Palo Alto, Calif.
04651	Sylvania Electric Products Microwave Device Div	Mountain View, Calif.
04673	Dakota Engr. Inc	Culver City, Calif.
04713	Motorola Inc Semiconductor Prod. Div	Phoenix, Arizona
04732	Filtron Co. Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co	Northlake, Ill.
04796	Sequoia Wire Co	Redwood City, Calif.
04811	Precision Coil Spring Co	El Monte, Calif.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc	Los Angeles, Calif.
05245	Components Corp	Chicago, Ill.
05277	Westinghouse Electric Corp Semi-Conductor Dept	Youngwood, Pa.
05347	Ultronix, Inc	San Mateo, Calif.
05397	Union Carbide Corp Elect. Div.	New York, N.Y.
05574	Viking Ind Inc	Canoga Park, Calif.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Calif.
05616	Cosmo Plastic Ic o Electrical Spec. Co.	Cleveland, Ohio
05624	Barber Colman Co	Rockford, Ill.
05728	Tiffett Optical Co	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp	Westbury, N.Y.
05783	Stewart Engineering Co	Santa Cruz, Calif.
05820	Wakefield Engineering Inc	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp	Bridgeport, Conn.
06090	Raychem Corp	Redwood City, Calif.
06175	Bausch and Lomb Optical Co	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co Inc	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co Inc	Penacook, N.H.
06666	General Devices Co. Inc	Indianapolis, Ind.
06751	Components Inc. Ariz. Div	Phoenix, Ariz.
06812	Torrington Mfg. Co. West Div	Van Nuys, Calif.
06980	Varian Assoc. Eimac Div	San Carlos, Calif.
07088	Kelvin Electric Co	Van Nuys, Calif.
07126	Digitran Co	Pasadena, Calif.
07137	Transistor Electronics Corp	Minneapolis, Minn.
07138	Westinghouse Electric Corp Electronic Tube Div	Elmira, N.Y.
07149	Pamotor Corp	New York, N.Y.
07233	Cinch Graphik Co	City of Industry, Calif.
07256	Sprague Transistor Corp	Carle Place, N.Y.
07261	Avnet Corp	Culver City, Calif.
07263	Fairchild Camera & Inst Corp Semiconductor Div	Mountain View, Calif.
07322	Minnesota Rubber Co	Minneapolis, Minn.
07387	Britcher Corp The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc	Mt. View Operations Mountain View, Calif.
07700	Technical Wire Products Inc	Cranford, N.J.
07829	Bodine Elect. Co	Chicago, Ill.
07910	Continental Device Corp	Hawthorne, Calif.
07933	Raytheon Mfg. Co Semiconductor Div	Mountain View, Calif.
07980	Hewlett-Packard Co. Boonton Radio Div	Rockaway, N.J.
08145	U.S. Engineering Co	Los Angeles, Calif.
08269	Bivin, Delbert Co	Pomona, Calif.
08358	Burgess Battery Co	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp	Los Angeles, Calif.
08664	Bristol Co. The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc Phoenix Div	Phoenix, Ariz.
08727	National Radio Lab Inc	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div. of C.B.S. Inc	Lowell, Mass.
08806	General Electric Co. Miniat. Lamp Dept	Cleveland, Ohio
08984	Mec-Rann	Indianapolis, Ind.
09626	Babcock Relays Div	Costa Mesa, Calif.
09134	Texas Capacitor Co	Houston, Texas
09145	Tech Ind. Inc. Atohm Elect.	Burbank, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09922	Burndy Corp	Norwalk, Conn.
10214	General Transistor Western Corp	Los Angeles, Calif.
10411	Ti-Tal Inc	Berkeley, Calif.
10646	Carborundum Co	Niagara Falls, N.Y.
11236	CTS of Berne Inc	Berne, Ind.
11237	Chicago Telephone of California, Inc	So. Pasadena, Calif.
11242	Bay State Electronics Corp	Waltham, Mass.
11312	Teledyne Inc. Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11453	Precision Connector Corp	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp Semiconductor Div., Products Group	Newark, N.J.
11716	Imperial Electronic, Inc	Buena Park, Calif.
11870	Melabs, Inc	Palo Alto, Calif.
12040	National Semiconductor	Danbury, Conn.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc	Shady Grove, Pa.
12574	Gulton Ind. Inc. Data System Div	Albuquerque, N.M.
12697	Clarostat Mfg. Co	Dover, N.H.
12728	Elmar Filter Corp	W. Haven, Conn.
12859	Nippon Electric Co., Ltd	Tokyo, Japan
12881	Metex Electronics Corp	Clark, N.J.
12930	Delta Semiconductor Inc	Newport Beach, Calif.
12954	Dickson Electronics Corp	Scottsdale, Arizona
13014	Aero Supply Mfg. Co.	Arkansas Kansas
13103	Thermoloy	Dallas, Texas
13396	Telefunken GmbH	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc	Kansas City, Kansas
14099	Sen-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp	Santa Monica, Calif.
14298	American Components, Inc	Conshohocken, Pa.
14483	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell-Dubilier Electric Corp	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc	San Gabriel, Calif.
14936	Williams Mfg. Co	San Jose, Calif.
15238	The Spring Co. Inc	East Paris, N.Y.
15207	Webster Electronics Co	New York, N.Y.
15287	Scionics Corp	Northridge, Calif.
15291	Adjustable Bushing Co	N. Hollywood, Calif.
15558	Micron Electronics Garden City, Long Island, N.Y.	
15566	Amphobe Inst. Corp	Lyndbrook, N.Y.
15631	Cabletronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co	Santa Clara, Calif.
15801	Eeuwal Elect. Inc	Framingham, Mass.
15818	Ametca Inc	Mt. View, Calif.
16037	Spruce Pine Mica Co	Spruce Pine, N.C.
16179	Omni-Spectra Inc.,	Farmington, Mich.
16352	Computer Diode Corp	Lodi, N.J.
16585	Boots Aircraft Nut Corp	Pasadena, Calif.
16688	Ideal Prec. Meter Co Inc De Jur Meter Div	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp	Kokomo, Ind.
17109	Thermonetics Inc	Canoga Park, Calif.
17474	Tranex Company	Mountain View, Calif.
17554	Components Inc	Biddeford, Me.
17675	Hamlin Metal Products Corp	Akron, Ohio
17745	Angstrohm Prec. Inc	No. Hollywood, Calif.
17856	Siliconix Inc	Sunnyvale, Calif.

From FSC Handbook Supplements

Table 6-4. List of Manufacturers' Codes (Cont'd)

Code No.	Manufacturer	Address
17870	McGraw Edison Co	Manchester N H
18042	Power Design Pacific Inc	Palo Alto Calif
18083	Crevite Corp Semiconductor Div	Palo Alto Calif
18324	Signetics Corp	Sunnyvale Calif
18476	Ty Car Mfg Co Inc	Holliston Mass
18486	TRW Elect Comp Div	Des Plaines Ill
18583	Curtis Instrument Inc	Mt Kisco N Y
18612	Vishay Instruments Inc	Malvern Pa
18873	E I DuPont and Co Inc	Wilmington Del
18911	Durant Mfg Co	Milwaukee Wis
19315	The Bendix Corp Navigation & Control Div	Teterboro N J
19500	Thomas A Edison Industries Div of McGraw Edison Co	West Orange N J
19589	Concoa	Baldwin Park Calif
19644	LRC Electronics	Horseheads N Y
19701	Electra Mfg Co	Independence Kansas
20183	General Atronics Corp	Philadelphia Pa
21226	Executone Inc	Long Island City N Y
21335	Fafnir Bearing Co The	New Britain Conn
21520	Fansteel Metallurgical Corp	N Chicago Ill
23042	Terscan Corp	Indianapolis Ind
23783	British Radio Electronics Ltd	Washington D C
24455	G E Lamp Division	Nela Park Cleveland Ohio
24655	General Radio Co	West Concord Mass
24681	Memcor Inc Comp Div	Huntington Ind
24796	Piezo Inc	San Juan Capistrano Calif
26365	Gries Reproducer Corp	New Rochelle N Y
26462	Grobet File Co of America Inc	Carlstadt N J
26851	Compac Hollister Co	Hollister Calif
26992	Hamilton Watch Co	Lancaster Pa
27251	Specialties Mfg Co Inc	Stratford Conn
28480	Hewlett Packard Co	Palo Alto Calif
28520	Heyman Mfg Co	Kenilworth N J
30817	Instrument Specialties Co Inc	Little Falls N J
33173	G E Receiving Tube Dept	Owensboro Ky
35434	Lectrohm Inc	Chicago Ill
36199	Stanwyck Coil Products Ltd	Hawkesbury Ontario Canada
36267	Cunningham W H & Hill Ltd	Toronto Ontario Canada
37942	P R Mallory & Co Inc	Indianapolis Ind
39543	Mechanical Industries Prod Co	Akron Ohio
40920	Miniature Precision Bearings Inc	Keene N H
41502	Muter Co	Chicago Ill
43990	C A Norgren Co	Englewood Colo
44655	Ohmite Mfg Co	Skokie Ill
46384	Penn Eng & Mfg Corp	Doylestown Pa
47904	Polaroid Corp	Cambridge Mass
48620	Precision Thermometer & Inst Co	Southampton Pa
49956	Multiwave & Power Tube Div	Waltham Mass
52090	Rowan Controller Co	Westminster Md
52983	Sanborn Company	Waltham Mass
54294	Shakeproof Mfg Co	Shelby N C
55026	Simpson Electric Co	Chicago Ill
55933	Sonotone Corp	Elmsford N Y
55938	Raytheon Co Commercial Apparatus & Systems Div	So Norwalk Conn
56137	Scaulding Fibre Co Inc	Tonawanda N Y
56289	Sprague Electric Co	North Adams Mass
59446	Telex Corp	Telex Iowa
59730	Thomas & Betts Co	Elizabeth N J
60741	Turnett Electrical Inst Co	Bluffton Ohio
61775	Union Switch and Signal Div of Westinghouse Air Brake Co	Pittsburgh Pa
62119	Universal Electric Co	Owosso Mich
63743	Ward Leonard Electric Co	Mt Vernon N Y
64959	Western Electric Co Inc	New York N Y
65092	Weston Inst Inc Weston Newark	Newark N J
66295	Zierick Mfg Co	Chicago Ill
66346	Minnesota Mining & Mfg Co	Revere Muncoin Div St Paul Minn
70276	Allen Mfg Co	Hartford Conn
70485	Allied Control	New York N Y
70485	Almetal Screw Product Co Inc	Garden City N Y
70485	Amphex Div of Sprague Corp	Detroit Mich
70485	Atlantic India Rubber Works Inc	Chicago Ill
70563	Amperite Co Inc	Union City N J
70674	ADC Products Inc	Minneapolis Minn
70903	Belden Mfg Co	Chicago Ill
70998	Bird Electronic Corp	Cleveland Ohio
71002	Birnbach Radio Co	New York N Y
71248	Bliley Electric Co Inc	Erie Pa
71261	Boston Gear Works Div of Murray Co of Texas	Quincy Mass
71279	Cambridge Thermionics Corp	Cambridge Mass
71286	Cannon Electric Co	Paramus N J
71313	Cardwell Condenser Co	
71400	Bussmann Mfg Div of McGraw Edison Co	St Louis Mo
71436	Chicago Condenser Corp	Chicago Ill
71447	Clark Springs Inc	Palos Riveras Calif
71450	CTS of Inc	Elkhart Ind
71468	ITT Cannon Electric Inc	Los Angeles Calif
71479	Cinch Graphic Div Arvin Industries	Burbank Calif
71482	C P Clare & Co	Chicago Ill
71590	Centralab Div of Globe-Union Inc	Milwaukee Wis
[illegible]	[illegible]	Franklin Ky
[illegible]	[illegible]	Chicago Ill
[illegible]	[illegible]	Newark N Y
[illegible]	[illegible]	Chicago Ill
[illegible]	[illegible]	Milford Mich
[illegible]	[illegible]	Attleboro Mass
[illegible]	[illegible]	Hudson N Y
[illegible]	[illegible]	Keasbey N J
[illegible]	[illegible]	Hackensack N J
[illegible]	[illegible]	Philadelphia Pa
[illegible]	[illegible]	Hagerstown Md
[illegible]	[illegible]	Union N J
[illegible]	[illegible]	Los Angeles Calif
[illegible]	[illegible]	Erie Pa
[illegible]	[illegible]	Princeton Ind
[illegible]	[illegible]	Chicago Ill
[illegible]	[illegible]	Evanston Ill
[illegible]	[illegible]	Hartford Conn
[illegible]	[illegible]	Trenton N J
[illegible]	[illegible]	Philadelphia Pa
73734	Federal Screw Works	Chicago Ill
73743	Fischer Special Mfg Co	Cincinnati Ohio
73793	General Instrument Corp Of The	Elgin Ill
73842	Gudeman Stamping & Tool Co	Goshen Ind
73899	JFD Electronics Corp	Brooklyn N Y
73905	Jennings Radio Mfg Corp	San Jose Calif
73957	Groov-Pin Corp	Ridgefield N J
74276	Signalite Inc	Neptune N J
74455	J H Allen and Sons	Winchester Mass
74868	Industrial Cuppenser Corp	Chicago Ill
74868	R F D Products Division of Amphenol-Borg Electronics Corp	Danbury Conn
74970	E F Johnson Co	Waseca Minn
75042	International Resistance Co	Philadelphia Pa
75263	Keystone Carbon Co Inc	St Marys Pa
75378	C T S Knights Inc	Sandwich Ill
75382	Kulka Electric Corporation	Mt Vernon N Y
75818	Lenz Electric Mfg Co	Chicago Ill
75915	Littlefuse Inc	Des Plaines Ill
76005	Lord Mfg Co	Erie Pa
76200	C W Marwedel	San Francisco Calif
76433	General Instrument Corp Micamold Division	Newark N J
76487	James Millen Mfg Co Inc	Malden Mass
76493	J W Miller Co	Los Angeles Calif
76531	Cinch Monadnock Div of United Carr Fastener Corp	San Leandro Calif
76545	Mueller Electric Co	Cleveland Ohio
76703	National Union	Newark N J
76854	Oak Manufacturing Co	Crystal Lake Ill
76868	The Bendix Corp Electrodynamics Div	N Hollywood Calif
77055	Pacific Metals Co	San Francisco Calif
77221	Phaostron Instrument and Electronic Co	South Pasadena Calif
77252	Philadelphia Steel and Wire Corp	Philadelphia Pa
77342	American Machine & Foundry Co Potter & Brumfield Div	Princeton Ind
77630	TRW Electronic Components Div	Camden N J
77638	General Instrument Corp Rectifier Div	Brooklyn N Y
77764	Resistance Products Co	Harrisburg Pa
77968	Rubbercraft Corp of Calif	Torrance Calif
78189	Stanford Division of Illinois Tool Works	Elgin Ill
78277	Sigma	So Braintree Mass
78283	Sigma Instruments Inc	New York N Y
78426	Struthers Dunn Inc	Pitman N J
78452	Specialty Transformer Corp Co	Newark N J
78488	Stackpole Carbon Co	St Marys Pa
78493	Thomas & Skinner Steel Products Co	Chicago Ill
78526	Triad Mfg Co	San Francisco Calif
78633	Stackpole Carbon Co	St Marys Pa
78749	Standard Precision Corp	Waltham Mass
78553	Tinnerman Products Inc	Cleveland Ohio
78779	Trak Microwave Corp	Tampa Fla
78790	Transformer Engineers	San Gabriel Calif
78947	Uniclite Inc	Newtonville Mass
79136	Waldes Kohinoor Inc	Long Island City N Y
79142	Veeder Root Inc	Hartford Conn
79251	Weed Mfg Co	Chicago Ill
79307	Component Art Electronics Corp	Philadelphia Pa
79963	Zierick Mfg Corp	New Rochelle N Y
80031	Mepco Division of Sessions Clock Co	Morristown N J
80120	Schnitzer Alloy Products Co	Elizabeth N J
80131	Electronic Industries Association	Any brand
	Tentative EIA Standards	Washington DC
80207	Ideal Electronics Inc Mason Electronics Corp	Wallingford Conn
80223	United Transformer Corp	New York N Y
80294	Oxford Electric Corp	Chicago Ill
80294	Bourns Inc	Riverside Calif
80411	Acro Div of Robertshaw Controls Co	Columbus Ohio

Table 6-4. List of Manufacturers' Codes (Cont'd)

Code No.	Manufacturer	Address
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Calif.
80583	Hamarlund Co., Inc.	Mars Hill, N.C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80813	Dimco Gray Co.	Dayton, Ohio
81030	International Instruments Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	
81483	International Rectifier Corp.	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Paramus, N.J.
82209	Magnetic Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
82768	Phillips Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83014	Hartwell Corp.	Los Angeles, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp. Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Calif.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp. Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Rosan Inc.	Newport Beach, Calif.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisade's Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Calif.
85474	R.M. Bracamonte & Co.	San Francisco, Calif.
85660	Coiled Cords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Calif.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	San Francisco, Calif.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89665	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	US Rubber Co. Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90763	United-Carr Fastener Corp.	Chicago, Ill.
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect. Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K.F. Development Co.	Redwood City, Calif.
91886	Malco Mfg. Co., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co. Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury Long Island, N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93637	Waters Mfg. Co.	Culver City, Calif.
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94142	Phelps Dodge	Yonkers, N.Y.
94144	Raytheon Co. Comp. Div. Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp. Tung-Sol Div.	Newark, N.J.
94197	Curtiss Wright Corp. Electronics Div.	East Paterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94682	Worcester-Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95236	Aries Products Corp.	Dania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Symon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West Inc.	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96306	Microsw itch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
96508	Krohn-Hite Inc.	Orchard Park, N.Y.
96733	San Fernando Elect. Mfg. Co.	San Fernando, Calif.
96881	Thomson Ind. Inc.	Long Is., N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Tronics, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.,	Gardena, Calif.
98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98376	Zero Mfg. Co.	Burbank, Calif.
98410	Etc Inc.	Cleveland, Ohio
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind. Capac-tor Div.	Monrovia, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Branson Corp.	Whippany, N.J.
99934	Renbrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK

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

From FSC Handbook Supplements

BACK DATING MANUAL CHANGES

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information about manual changes, optional modifications and special instruments.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to all standard Model 1205A/B Dual Trace Oscilloscopes with a serial prefix (refer to Section 1 for explanation) as listed on the title page. If the instrument serial prefix isn't the same, check Table 7-1 for backdating changes or, if it isn't listed in the table, refer to an enclosed Manual Changes sheet for updating information. Also, if a Manual Changes sheet is supplied, make all errata corrections in the manual.

Table 7-1. Manual Changes

Serial Prefix	Make Changes
808–	1 thru 7
839–	2 thru 7
843–	3 thru 7
846–	4 thru 7
849–	5 thru 7
913–	6 & 7
916–	7
930–	7

CHANGE 1

Table 6-2, Replaceable Parts,
Q1: Change to A5Q2: Si pnp; HP Part No. 1853-0079.
Q2: Change to A5Q6: Si npn; HP Part No. 1854-0320.
A5: Change HP Part No. to 01200-66502.
A5Q2: Change reference designator to A5Q3.
A5Q3: Change reference designator to A5Q4.
A5Q4: Change reference designator to A5Q5.
A5Q5: Change reference designator to A5Q7.
A5Q6: Change reference designator to A5Q8.
A5R12: Change HP Part No. to 0757-0280; R: fxd metflm 1 kilohm 1% 1/8W.
Page 8-27, Figure 8-41,
Delete: replace with Figure 7-1.
Page 8-27, Figure 8-42,
Q1, Q2: Delete wire colors.
Q1: Change to A5Q2.
Q2: Change to A5Q6.
A5Q2: Change to A5Q3.
A5Q3: Change to A5Q4.
A5Q4: Change to A5Q5.
A5Q5: Change to A5Q7.
A5Q6: Change to A5Q8.
A5R12: Change value to 1 kilohm.

CHANGE 2

Page 1-4, Table 1-1,
Change intensity modulation specification as follows: +5V signal blanks trace of normal intensity; +12V signal blanks any intensity. DC-coupled input on rear panel; amplifier risetime approx. 200 ns; input resistance is 10 kilohms.
Table 6-2, Replaceable Parts,
A6R3: Change to R: fxd comp 10 kilohms 10% 1/4W; HP Part No. 0684-1031.
Page 8-29/8-30, Figure 8-46,
A6R3: Change value to 10 kilohms.

CHANGE 3

Rack instruments in this category are identified on the front panel as Model 1205AR. In all other respects, Model 1205AR is identical to Model 1205B.

CHANGE 4

Table 6-2, Replaceable Parts,
A6L2: Delete.
A6R35: Delete.
Page 8-29/8-30, Figure 8-46,
A6L2: Delete.
A6R35: Delete.

CHANGE 5

Table 6-2, Replaceable Parts,
A6R36: Delete.
Page 8-15, Figure 8-22,
Change: −50V to −50 VF at top of A3R25.
Page 8-29/8-30, Figure 8-46,
A6R36: Delete.

CHANGE 6

Table 6-2, Replaceable Parts,
MP46: Change HP Part No. to 01200-40501.

CHANGE 7

Table 6-2, Replaceable Parts,
A6: Change HP Part No. to 01200-66506.
Delete: A6CR8, A6R37, A6VR2 and A6VR3.
Page 8-28, Figure 8-44,
Delete: replace with Figure 7-2.
Page 8-29/8-30, Figure 8-46,
Delete: A6CR8, A6R37, A6VR2 and A6VR3.

7-5. STANDARD OPTIONS.

7-6. Nine standard options are available at present. These are Model 1205A/B instruments with standard modifications installed at the factory.

OPTION 001

The instrument is wired for 230 Vac operation as shown in Figure 2-1, and HP Part No. 2110-0080, listed in Table 6-2, is the standard fuse for F1.

OPTION 002

Table 6-2, Replaceable Parts,
V1: Change HP Part No. to 5083-1823. CRT, P2 phosphor, non-aluminized, internal graticule.

OPTION 006

This standard option is available only for Model 1205B. Two three-pin, circular connectors (HP Part No. 1251-0038) have been mounted on the rear panel; one each is in parallel with the channel A and B front panel input jacks. Also, a BNC connector (HP Part No. 1250-0083) has been mounted on the rear panel in parallel with the front panel TRIG & HORIZ INPUT jacks.

OPTION 007

Table 6-2, Replaceable Parts,
V1: Change HP Part No. to 5083-1833; CRT, P7 phosphor, non-aluminized, internal graticule.
Add: Filter: amber, CRT; HP Part No. 5020-0530.

OPTION 011

Table 6-2, Replaceable Parts,
V1: Change HP Part No. to 5083-1842; CRT, P11 phosphor, aluminized, internal graticule.

OPTION 602

Table 6-2, Replaceable Parts
V1: Change HP Part No. to 5083-1820; CRT, P2 phosphor, non-aluminized, no graticule

OPTION 607

Table 6-2, Replaceable Parts,
V1: Change HP Part No. to 5083-1830; CRT, P7 phosphor, non-aluminized, no graticule.
Add: Filter: amber, CRT; HP Part No. 5020-0530.

OPTION 611

Table 6-2, Replaceable Parts,
V1: Change HP Part No. to 5083-1841; CRT, P11 phosphor, aluminized, no graticule.

OPTION 631

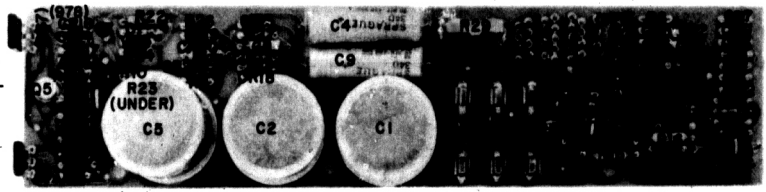
Table 6-2, Replaceable Parts,
V1: Change HP Part No. to 5083-1850; CRT, P31 phosphor, non-aluminized, no graticule.

7-7. SPECIAL OPTIONS.

7-8. Special options are standard Model 1205A/B instruments that are modified at the factory according to customer specifications. These instruments are identified by a letter-number combination (such as C05-) in addition to the standard model number. A tag, adjacent to the serial number tag, is used for identification.

7-9. A separate insert sheet containing all modification information that affects the manual is included with each special-option instrument. Revise the manual according to the insert sheet for proper instrument coverage. If an insert sheet isn't included, modifications don't affect the manual.

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						

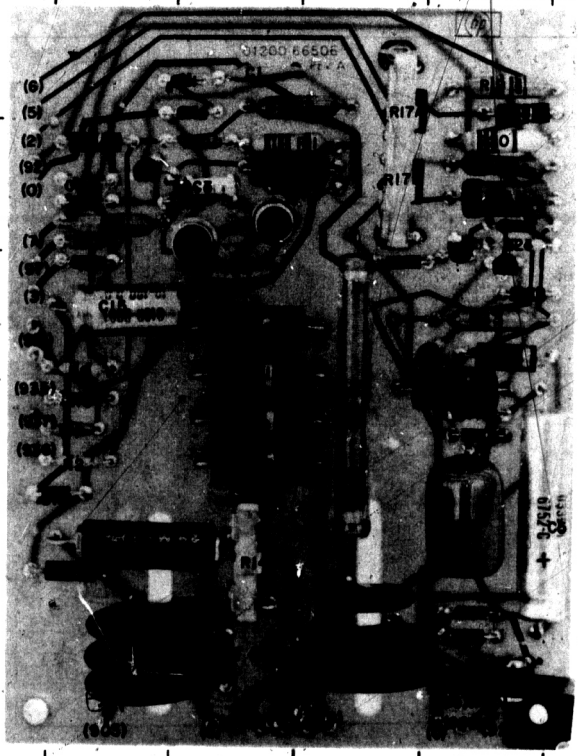


REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	CR6	F-2	CR18	C-2	Q7	A-2	R12	F-3	R24	B-2
C2	C-3	CR6	F-2	CR19	B-2	Q8	A-2	R13	F-3	R25	B-2
C3	F-3	CR7	F-2	CR20	B-2	R1	F-2	R14	E-3	R26	B-2
C4	C-2	CR8	F-2	CR21	B-2	R2	F-3	R15	E-3	R27	C-2
C5	B-3	CR9	F-2	F1	D-3	R3	F-3	R16	F-3	R28	B-2
C6	A-3	CR10	A-3	F2	E-3	R4	F-3	R17	A-3	R29	D-2
C7	B-2	CR11	E-3	F3	D-3	R5	F-3	R18	A-2	R30	C-2
C8	C-2	CR12	E-3	Q1	F-3	R6	F-2	R19	A-3	R31	F-2
C9	C-2	CR13	C-2	Q2	A-3	R7	F-2	R20	A-2	VR1	A-3
CR1	F-3	CR14	A-2	Q3	E-2	R8	F-3	R21	A-3	VR2	E-3
CR2	F-2	CR15	A-2	Q4	E-3	R9	B-2	R22	B-2	VR3	A-3
CR3	F-2	CR16	A-2	Q5	A-3	R10	B-2	R23	B-3	VR4	B-2
CR4	F-2	CR17	A-2	Q6	A-2	R11	E-3				

Note: For complete reference designation, prefix component designators with A5.

1200A-A-4

Figure 7-1. Low Voltage Power Supply, A5, 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	C-1	C12	E-5	L1	E-3	R4	B-2	R15	B-5	R25	D-3
C2	C-2	C13	D-5	Q1	B-2	R5	B-4	R16	C-6	R26	E-2
C3	C-2	C14	E-2	Q2	C-2	R6	B-3	R17A	D-1	R27	D-4
C4	C-3	C15	B-3	Q3	C-2	R7	B-5	R17B	D-2	R28	D-6
C5	F-5	CR1	C-1	Q4	E-6	R8	D-1	R18	E-1	R29	C-4
C6	D-6	CR2	C-1	Q5	E-3	R9	B-2	R19	E-1	R30	C-4
C7	D-6	CR3	B-2	Q6	E-3	R10	C-2	R20	E-2	R31	C-3
C8	B-5	CR4	B-2	Q7	E-3	R11	D-2	R21	E-3	R32	C-3
C9	C-6	CR5	B-4	R1	B-4	R12	C-2	R22	E-4	R33	E-3
C10	B-6	CR6	E-5	R2	B-4	R13	D-2	R23	E-2	R34	B-2
C11	E-4	CR7	E-5	R3	B-3	R14	C-5	R24	E-2	VR1	E-4

Note: For complete reference designation, prefix component designators with A6.

1200A-A-5

Figure 7-2. High Voltage Regulator, A6, Component Identification

SCHEMATIC DIAGRAMS TROUBLE-SHOOTING

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematics and component location photographs along with troubleshooting, repair and replacement information.

8-3. SCHEMATICS.

8-4. All schematics are on fold-out pages to allow reference to the text and figures in other sections. To find one by circuit name, refer to the List of Illustrations at the front of the manual. The schematics are drawn to show electronic function, and any one may include all or part of several different physical assemblies. Symbols and conventions are defined in Table 8-2.

8-5. For ready reference, a block diagram of each schematic is on the adjacent page. An overall block diagram of the entire instrument is in Section IV.

8-6. Each schematic is identified by a circled number in the lower right-hand corner. These numbers make it easy to find a point of reference. For example, the trigger signal from A1A1Q5 on Schematic 1 is referred to A3S1 on Schematic 4. On Schematic 4, the trigger input signal to A3S1 is referred back to A1A1Q5 on Schematic 1.

8-7. To find a component on the schematics, first check the reference designation boxes. These are located in the lower right-hand corner whenever compatible with circuit layout and indicate which components are on a particular schematic.

8-8. Components within the shaded areas of the schematics are physically located on an etched circuit board. Subassembly components, other than those on a circuit board, are shown within a shaded border for better distinction.

8-9. All component reference designators are complete on the schematics. Do not add any additional prefixes to these designators.

8-10. COMPONENT LOCATION.

8-11. All adjustments are shown in Section V, and mechanical parts are shown on exploded-view drawings in this section. For ready reference, assembly photographs are given adjacent to the appropriate schematics.

8-12. Circuit board assembly photographs are subdivided by a grid, and components within each subdivision are indexed to a table below the photograph. Thus, a component can be easily found on the photograph by first referring to the table. However, reference designators are not complete on assembly photographs. For the complete reference designator, add the assembly number (and subassembly number, if any) stated in the photograph to each component designator.

8-13. TROUBLESHOOTING.

8-14. Troubleshooting is easier if more than one symptom of a trouble is evident. Observe the instrument, and note all indications of faulty operation. If symptoms indicate more than one trouble, treat each problem individually and locate one trouble at a time. Don't waste time making random checks. Follow the procedure presented here, and refer to other areas of information in this manual if necessary.

8-15. FRONT-PANEL CONTROLS.

8-16. Equipment troubles are frequently due simply to improper front-panel control settings. Refer to the operating instructions in Section III for a complete explanation of each control's function along with typical operating instructions if in doubt. Use the controls as a guide to help isolate a trouble to a specific area of the instrument.

8-17. PERFORMANCE CHECK.

8-18. Make a thorough check of instrument performance. A complete procedure is given in Section V, and forms are included to record results. A trouble, such as incorrect vertical gain or sweep speed, may be due to lack of calibration. If a performance check result can be adjusted, the last step of the check refers to the appropriate adjustment procedure.

8-19. TROUBLESHOOTING TABLE.

8-20. Troubleshooting tips are given in Table 8-1. The table is not intended as a fool-proof tool for pin-pointing every possible trouble; only some of the most common symptoms and probable faults are given. Before doing the checks, be sure that the symptom is valid by checking control settings. For example, what may at first appear as no display may really be a no sweep problem.

8-21. To check the vertical circuits for an unbalance, measure the vertical preamplifier output voltages (white and green wires at module rear).

8-22. The unbalance is in the output amplifier if these voltages are equal. If the voltages are unequal, either the preamplifier or output amplifier may be defective.

8-23. To further isolate the trouble source, disconnect the preamplifier output leads, and measure the voltages again. Check the preamplifier for an unbalance if the voltages are unequal; check the output amplifier for an unbalance if the voltages are equal.

8-24. Measure the dc voltage at symmetrical points on each half of the differential amplifiers to detect a defective stage. Voltages should be the same, as indicated on the schematics.

8-25. The vertical preamplifier modules can also be checked by exchanging output connections. If the inoperative channel is then O.K., the module originally connected to that channel is defective.

8-26. VISUAL CHECKS.

8-27. After localizing a trouble to a specific area of the instrument, make a good visual check of that area. Check for burned or broken components, loose wires or circuit board connections, faulty switch contacts, or any similar condition suggesting a source of trouble. If everything appears normal, proceed to the next step.

8-28. WAVEFORMS AND VOLTAGES.

8-29. Let the instrument warm up for about 15 minutes before taking any measurements. Conditions for measuring waveforms and dc voltages are stated adjacent to each schematic. These conditions must be observed to obtain the proper results.

8-30. A triangle with an enclosed number is shown at key locations throughout the schematics. These are waveform measurement points and are referenced to the waveform photographs adjacent to each schematic.

8-31. Waveforms can be used to measure gain, locate a differential amplifier unbalance, or pin-point a defective stage.

8-32. DC voltages are shown on the schematics near active components such as transistors. As an aid to locating measurement points, a small dot is etched on the circuit boards near the emitter of transistors, source of field-effect transistors, cathode of diodes and positive lead of electrolytic capacitors. Use a needle-tip probe to avoid creating a short circuit.

8-33. FINAL CHECKS.

8-34. Read the theory of operation in Section IV to learn how a circuit should operate. With the aid of this information, it will be easier to discover why a defective circuit is inoperative. Finally, make resistance checks to uncover a faulty component. If it appears necessary to calibrate the instrument, refer to Section V for the correct procedures.

8-35. REPAIR AND REPLACEMENT.

8-36. The following paragraphs contain recommended procedures for repair and replacement of defective components. A complete list of components, with Hewlett-Packard part numbers and ordering information, is in Section VI. Contact the nearest HP Sales/Service Office listed at the rear of this manual if satisfactory repair or operation cannot be achieved.

8-37. SERVICING ETCHED CIRCUIT BOARDS.

8-38. Circuit boards in this instrument have plated-through holes with conductive surfaces on both sides. Components can be removed or replaced by unsoldering from either side of a board. When removing a large component, such as a potentiometer, rotate the soldering iron from lead-to-lead while pulling upward on the part. The following extract from HP Service Note M-20E contains further etched circuit board repair information:

a. Don't apply excessive heat. Use a 37- to 48-watt soldering iron.

b. Clip the leads of the damaged component. Remove the component, and then unsolder the leads from the board.

c. Use a toothpick or other pointed object to clean the circuit board holes while heating with a soldering iron.

d. Shape the leads of replacement components to fit the circuit board holes. Don't use force.

e. If the metal-plated conductive surface lifts from the board, cement it back with a small amount of quick-drying, acetate-base cement with good insulating properties. Or, solder a wire along the damaged area.

8-39. SEMICONDUCTOR REPLACEMENT.

8-40. Semiconductor devices are available in a wide variety of shapes and sizes. This can make it confusing to identify the leads. Examples of some of the most common configurations are shown in Figure 8-1.

8-41. When removing a semiconductor, use a pair of long nose pliers as a heat sink between the device and the soldering iron. And, when replacing a semiconductor, ensure sufficient lead length to dissipate soldering heat by using the same length of exposed lead as used for the original part.

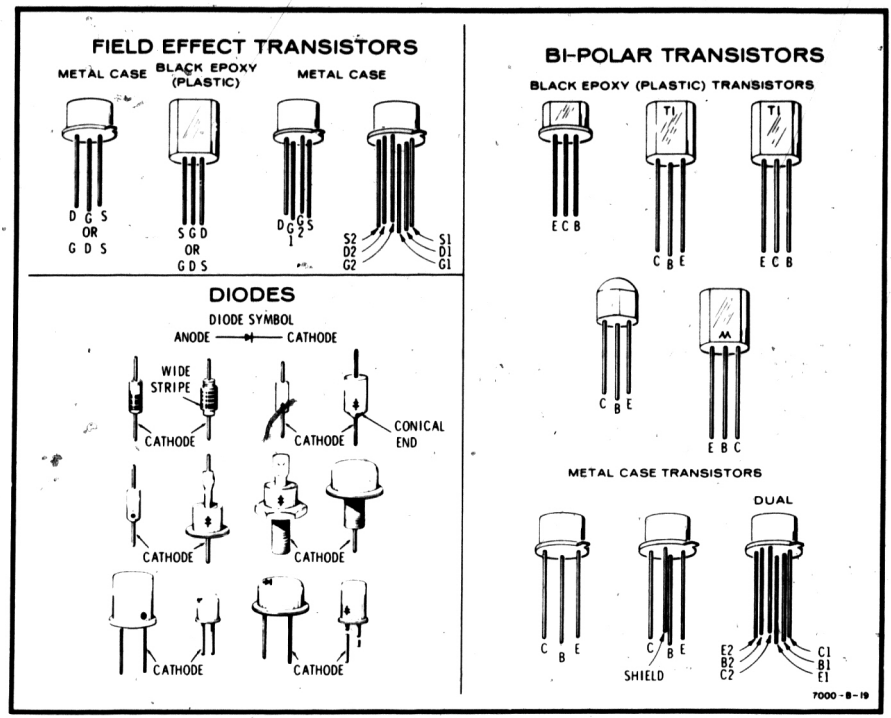


Figure 8-1. Semiconductor Identification

8-42. CRT REMOVAL AND REPLACEMENT.

8-43. Remove the CRT as follows:

WARNING

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

a. Remove Model 1205A top cover by loosening the two captive screws; remove Model 1205B bottom cover by first removing four retaining screws.

b. Remove rear-panel CRT socket cover by first removing two retaining screws.

c. Remove front-panel CRT light shield by squeezing at mid-point, top and bottom.

d. Remove CRT bezel by first removing four retaining screws.

e. Carefully remove CRT socket.

f. Loosen screw at bottom of CRT clamp (an access hole is provided at rear of Model 1205B side panel).

g. Put one hand on CRT face; use other hand to slide CRT forward and out of instrument.

8-44. To install a CRT, do the reverse of the above procedure. If a new CRT is installed, also do the adjustment procedure given in Section V.

8-45. VERTICAL PREAMPLIFIER MODULE REMOVAL AND REPLACEMENT.

8-46. Remove the vertical preamplifier modules as follows (see Figures 8-5 and 8-6 for exploded-view drawings):

NOTE

To remove the Model 1205B channel A preamplifier module, first remove the channel B module to provide clearance.

a. Remove knobs from Vertical Vernier, Volts/Division, and + and −Vertical Coupling switches (lever-switch knobs pull off).

b. Remove nut from attenuator shaft.

c. Disconnect wires from square-pin connectors (note locations for replacement).

d. Slide module about 1/4 inch to rear, and lift out.

8-47. To install the module, do the reverse of the above procedure. Wire colors are shown in the appropriate component identification photograph in this section. When sliding the module forward, be sure that the bottom slots catch on the retaining clips.

8-48. HORIZONTAL MODULE REMOVAL AND REPLACEMENT.

8-49. Remove the horizontal module as follows (see Figures 8-5 and 8-6 for exploded-view drawings):

a. Remove all knobs from horizontal section of front panel (lever-switch knobs pull off).

b. Remove nut from SWEEP/EXT HORIZ switch shaft and RESET lamp mounting nut.

c. Disconnect wires from square-pin connectors (note locations for replacement). A yellow coaxial cable connected between module and dual channel output board cannot be disconnected until module is partially removed.

d. Slide module about 1/4 inch to rear, and lift out.

8-50. To install the module, do the reverse of the above procedure. Wire colors are shown in the appropriate component identification photograph in this section. When sliding the module forward, be sure that the bottom slots catch on the retaining clips.

8-51. DUAL CHANNEL OUTPUT BOARD REMOVAL AND REPLACEMENT.

8-52. Remove the dual channel output board as follows (see Figures 8-5 and 8-6 for exploded-view drawings):

a. Remove four power transformer screws, and temporarily move transformer to gain access to board.

b. Disconnect wires from square-pin connectors (note locations for replacement).

c. Remove DISPLAY switch coupler shaft. To do this, slightly spread vertical preamplifier modules, and insert a long Allen driver. Loosen two Allen set screws on either end of shaft, turning DISPLAY switch as required to reach screws.

CAUTION

To avoid damaging the instrument, spread the vertical preamplifier modules only enough to insert the Allen driver.

d. Remove three support screws from board.

e. Slide board toward rear of instrument, and lift out.

8-53. To install the board, do the reverse of the above procedure. Wire colors are shown in the appropriate component identification photograph in this section.

Table 8-1. Troubleshooting Tree

Symptom	Check
No display, both channels	1. Press FIND BEAM. 2. If display returns: adjust INTENSITY, POSITION controls, and BAL. Check vertical and horizontal amplifiers for an unbalance (refer to paragraphs 8-21 thru 8-25). 3. If display doesn't return check: gate amplifier, low and high voltages, and CRT.
No display, one channel	1. Adjust vertical POSITION and BAL of defective channel. 2. Select another mode of vertical coupling to check input path (switch could also be defective). 3. Turn Volts/Division through its range. 4. If no display only from 0.5V to 20 V/DIV, check ÷100 attenuator path. 5. If no display only from 5 MV to 0.2 V/DIV, check unattenuated attenuator path. 6. Check current source A3Q14 or A3Q17 for, respectively, no channel A or B display. 7. Check vertical preamplifier and amplifiers of defective channel for an unbalance (refer to paragraphs 8-21 thru 8-25).
No alt display	1. Check alt trigger from sweep generator to multivibrator. 2. Check A3S1, A3Q15 and A3Q16.
No chop display	1. Check A3S1, A3Q15 and A3Q16.
No A vs. B display	1. Check A3S1 and A3Q18.
Unstable display	1. Check horiz. preamplifier. 2. Check trigger generator. 3. Check hold-off circuit. 4. If no LINE triggering, check signal from L.V.P.S. to horiz. preampl. 5. If no INT triggering, check signal from vert. preampl. to horiz. preampl. 6. If no EXT triggering, check signal from J7 to horiz. preampl.

Table 8-1. Troubleshooting Tips (Con't)

Symptom	Check
Poor CMRR	1. Check vertical preamplifier. 2. Check for unsymmetrical gain on each side of vertical differential amplifiers.
No sweep	1. Set SWEEP/EXT HORIZ to EXT HORIZ. and apply signal to J7. 2. If no horizontal deflection, check horiz. preamplifier and amplifiers. 3. If horizontal deflection, check trigger and sweep generators.
No norm sweep	1. Check input signal from input of horiz. preampl. to trigger generator (A4A1Q6/Q7). 2. Check A4S5.
No auto sweep	1. Check feedback loop from A4A1Q9 collector to A4A1Q7 base. 2. Check A4S3, A4C2 and A4C3.
No single sweep	1. Check A4S5. 2. Check A4S6. 3. Check A4A1Q25 and associated components.
No free run sweep	1. Check A4S5, −50V applied to A4S5, and A4A1R77.
No magnified sweep	1. Check A4A2S1. 2. Check A4A2Q1 and associated components.

Table 8-2. 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

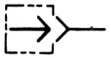
P/O = Part of

CW = Clockwise end of variable resistor

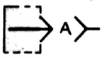
NC = No connection

= Waveform test point (with number)

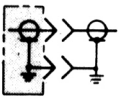
= Common electrical point (with letter) not necessarily ground



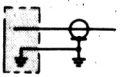
= Single-pin connector on board



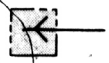
= Pin of a plug-in board (with letter or number)



= 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

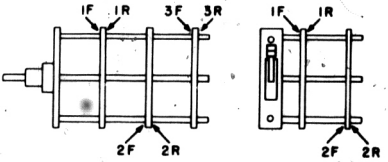
= Step-recovery diode

= 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

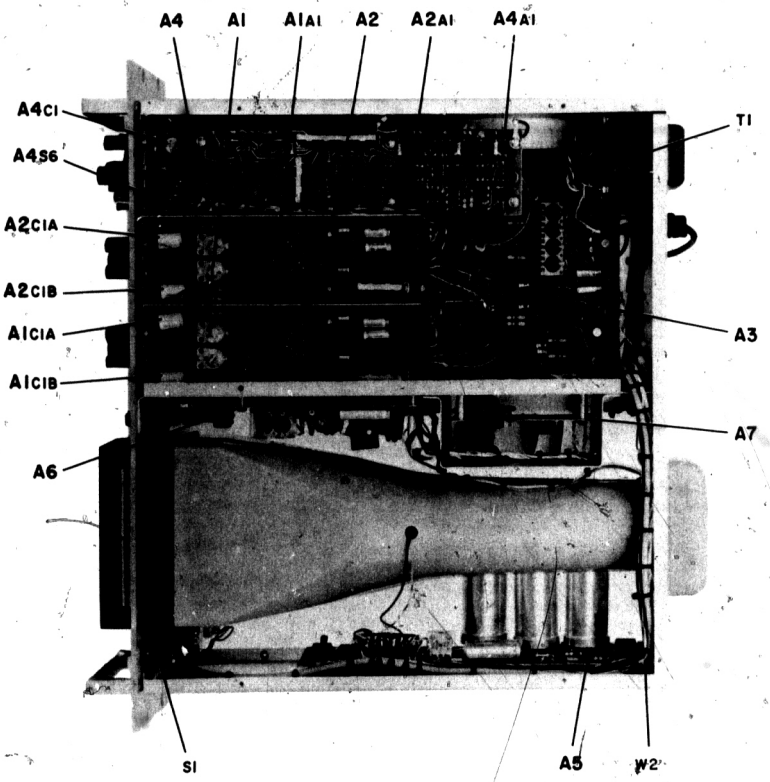


Figure 8-2. Model 1205B Bottom View

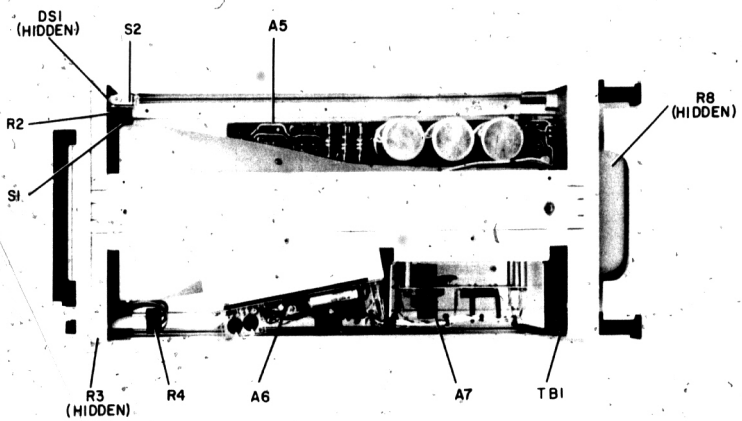


Figure 8-3. Model 1205A Top View

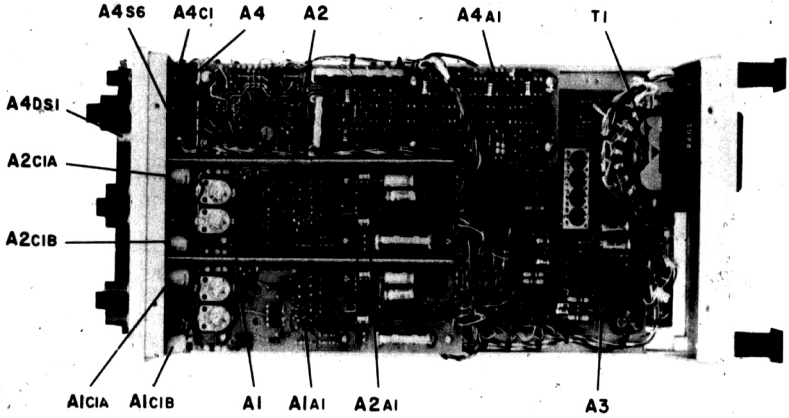


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Figure 8-4. Model 1205A Bottom View.

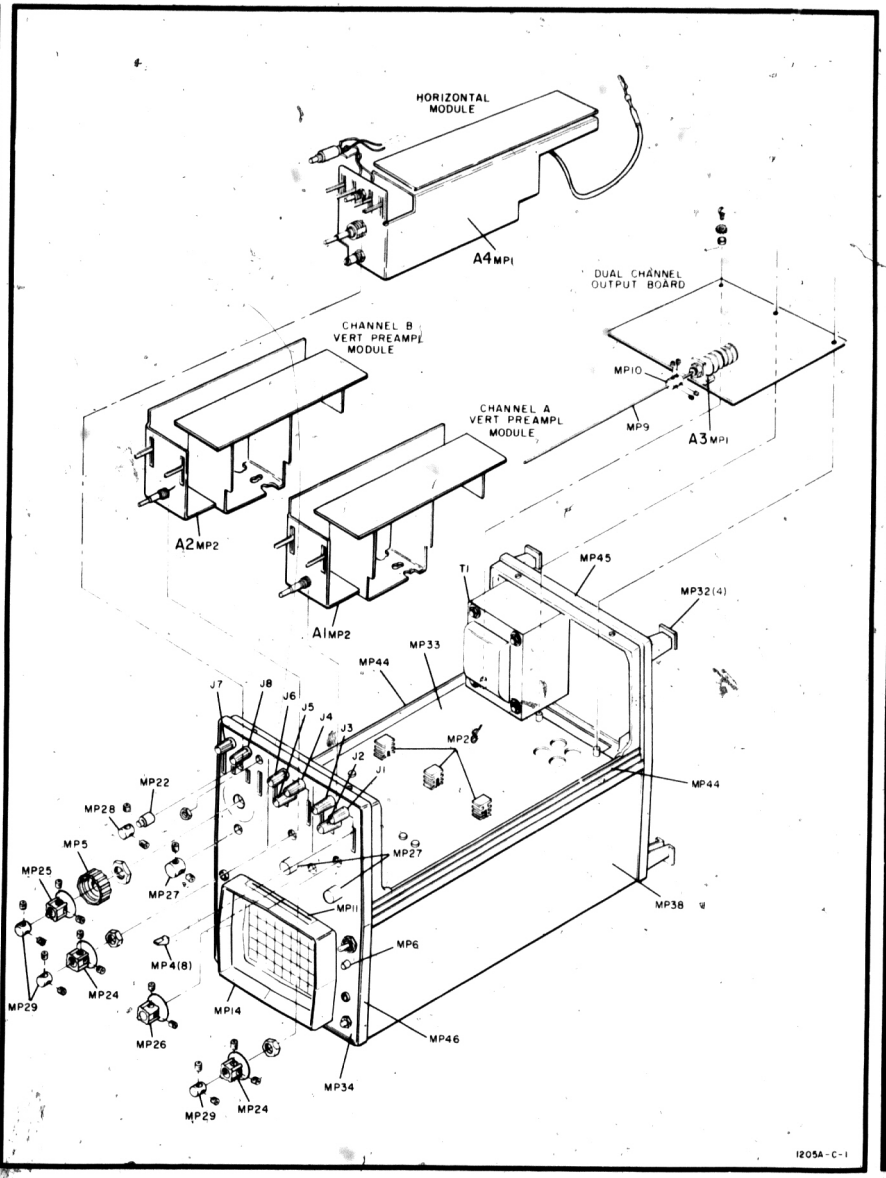


Figure 8-5. Model 1205A Exploded View

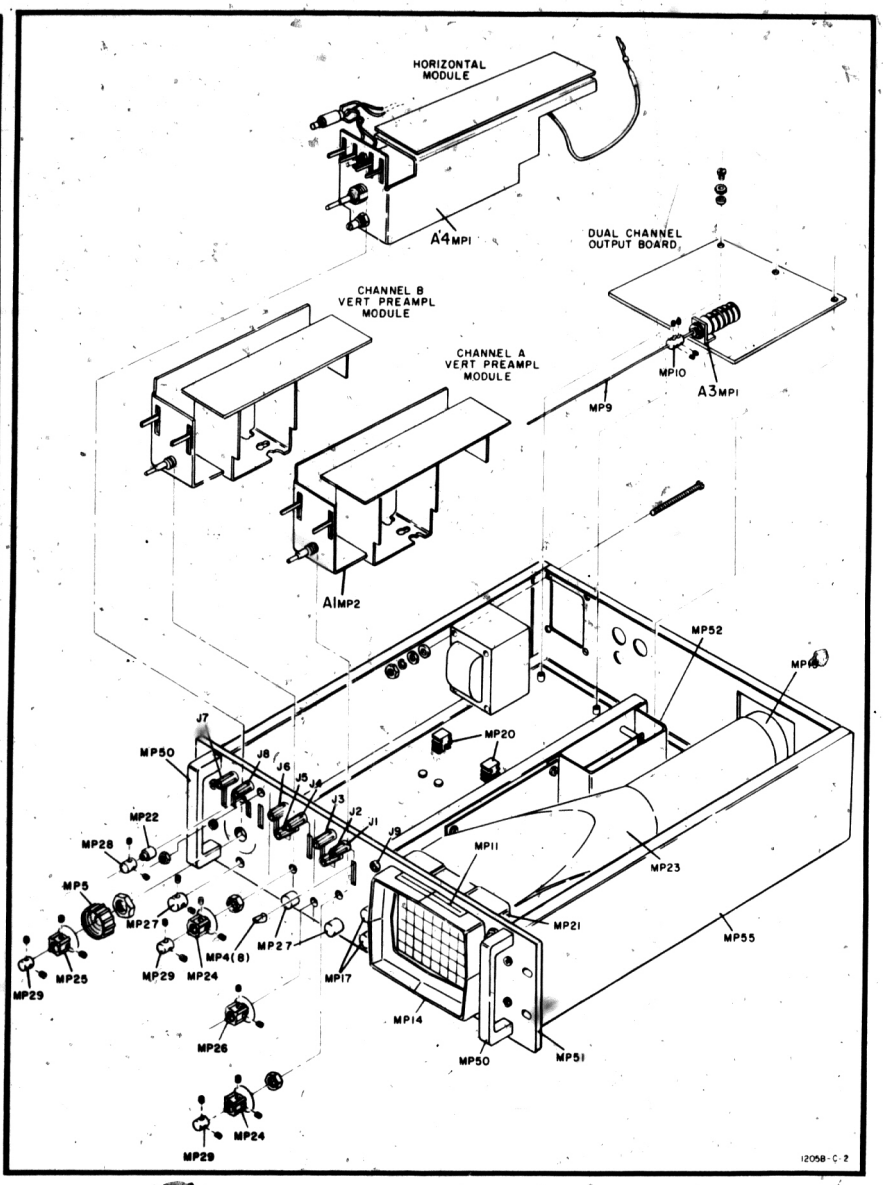


Figure 8-6. Model 1205B Exploded View

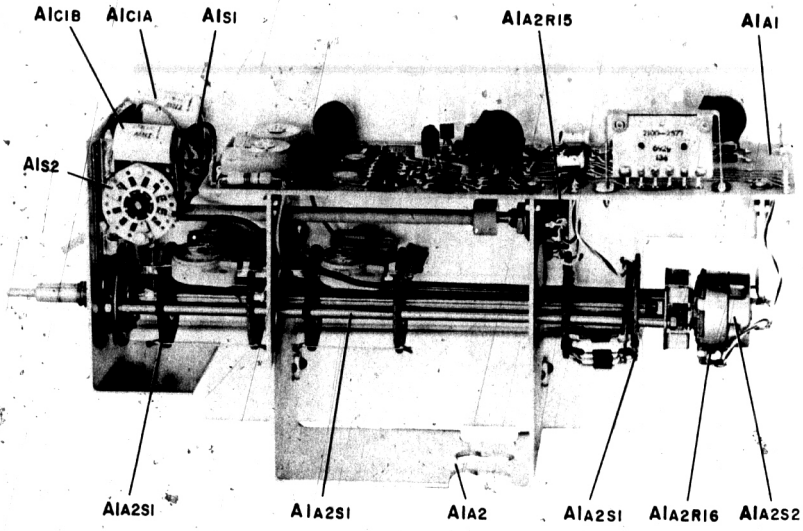


Figure 8-7. 5 mV Preamplifier Module, A1 Component Identification

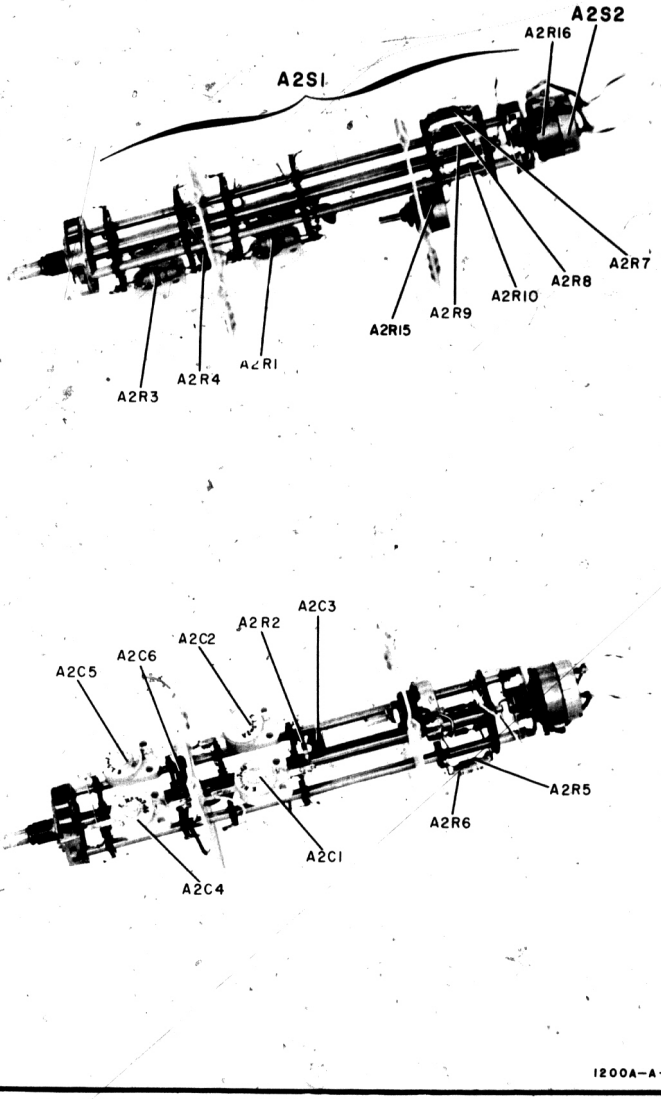
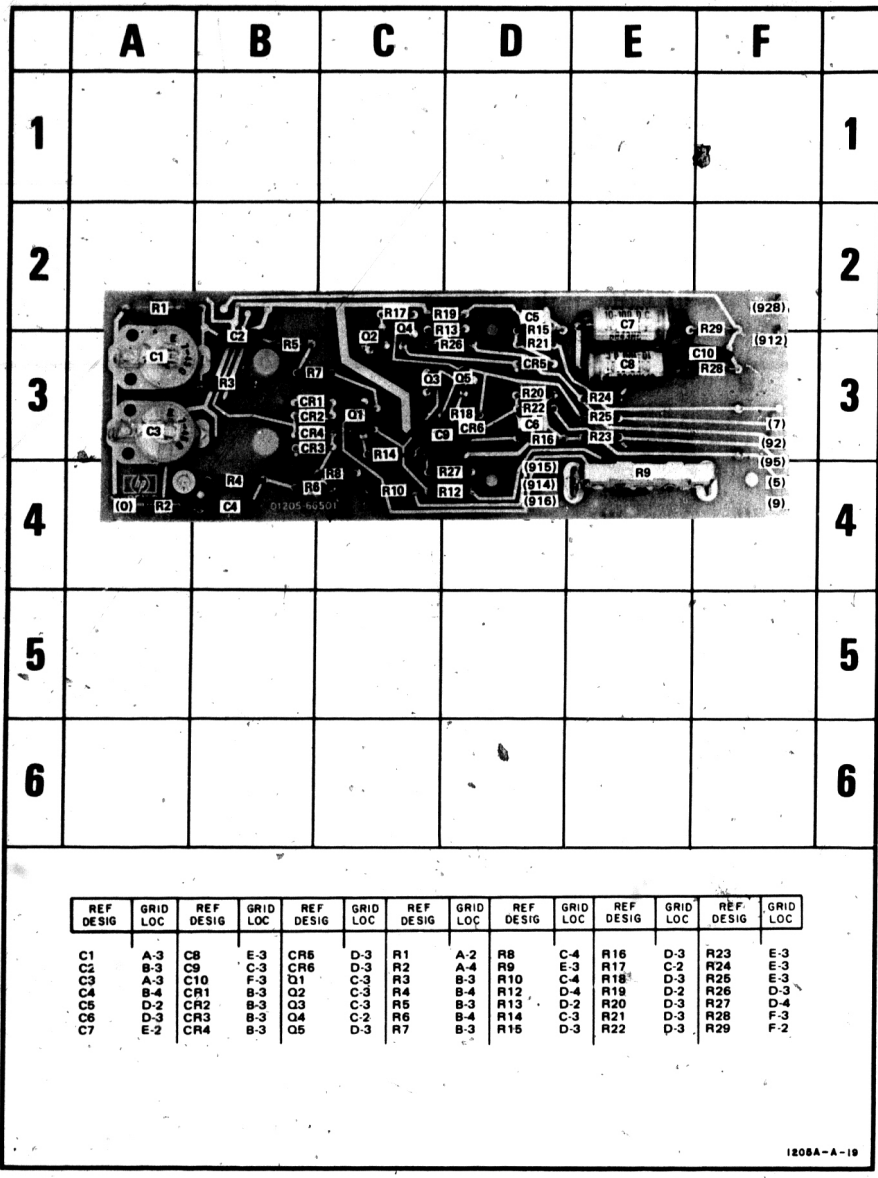


Figure 8-8. Volts/Division Switch A1A2, Component Identification



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
C1	A-3	C8	E-3	CR5	D-3	R1	A-2	R8	C-4	R16	D-3	R23	E-3
C2	B-3	C9	C-3	CR6	D-3	R2	A-4	R9	E-3	R17	C-2	R24	E-3
C3	A-3	C10	F-3	Q1	C-3	R3	B-3	R10	C-4	R18	D-3	R25	E-3
C4	B-4	CR1	B-3	Q2	C-3	R4	B-4	R12	D-4	R19	D-2	R26	D-3
C5	D-2	CR2	B-3	Q3	C-3	R5	B-3	R13	D-2	R20	D-3	R27	D-4
C6	D-3	CR3	B-3	Q4	C-2	R6	B-4	R14	C-3	R21	D-3	R28	F-3
C7	E-2	CR4	B-3	Q5	D-3	R7	B-3	R15	D-3	R22	D-3	R29	F-2

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Figure 8-9. Vertical Preamplifier, A1A1, Component Identification

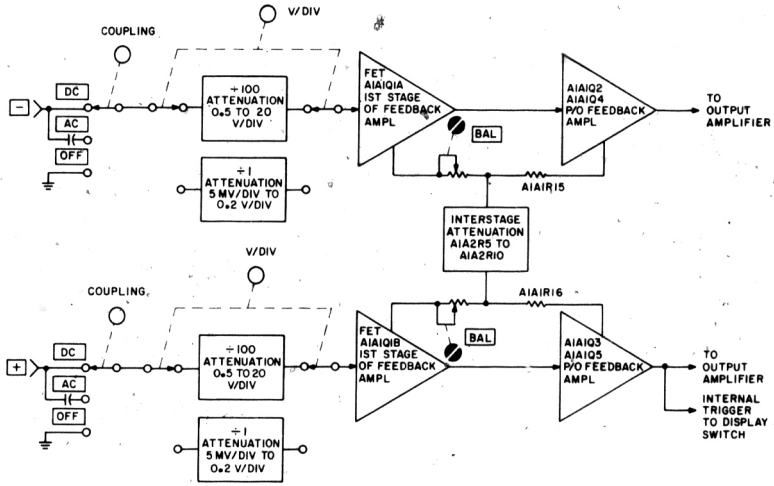

Figure 8-10. Channel A Attenuator and Preamplifier Block Diagram

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   - Volts/Division A . . . . . 1 V/DIV
   - +Vertical Coupling A . . . . . OFF
   - −Vertical Coupling A . . . . . OFF

2. Voltages are referenced to chassis ground. All indications are approximate and may vary slightly from instrument to instrument.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   - Volts/Division A . . . . . 1 V/DIV
   - +Vertical Coupling A . . . . . AC
   - −Vertical Coupling A . . . . . OFF

2. Connect a 5V pk-pk, 1 kHz sine wave to channel A +INPUT jack.

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

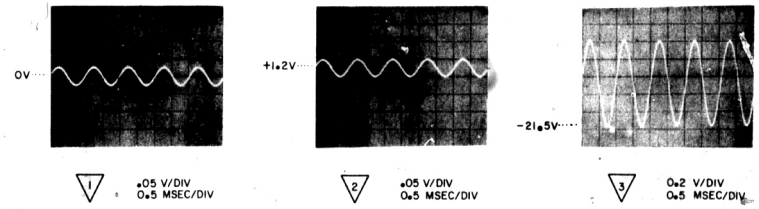

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Figure 8-11. Channel A Preamplifier Module Measurement Conditions and Waveforms

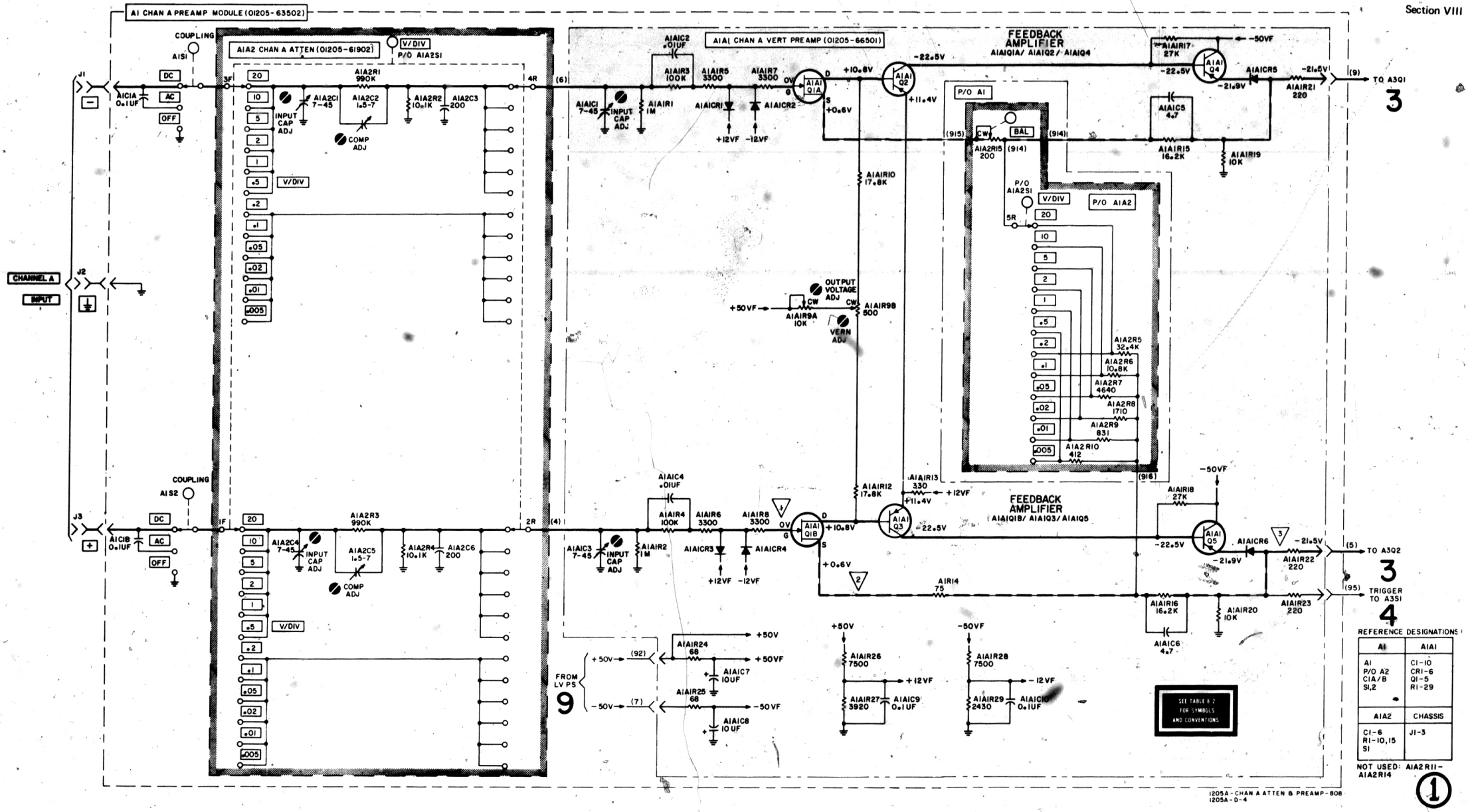

Figure 8-12.
Channel A Preamplifier Module Schematic

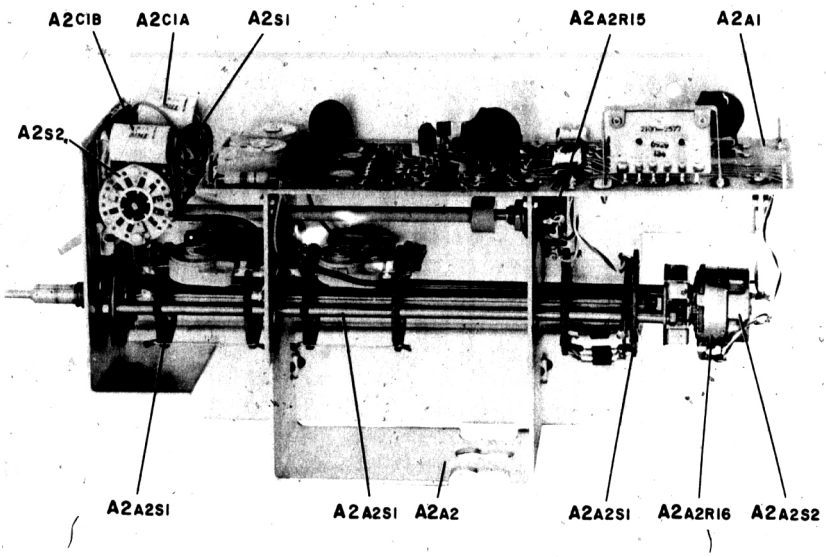

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Figure 8-13. 5 mV Preamplifier Module, A2, Component Identification

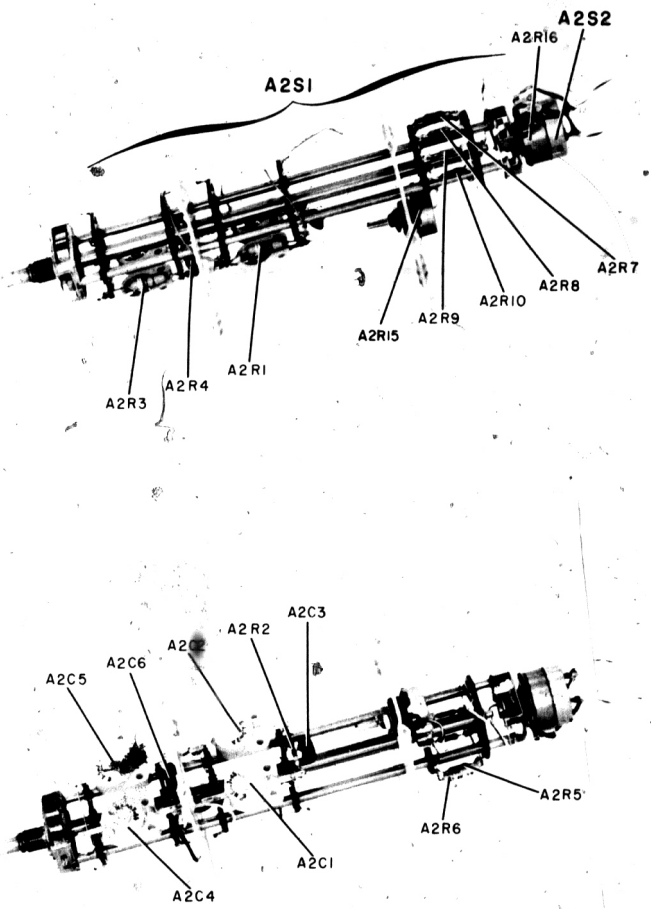
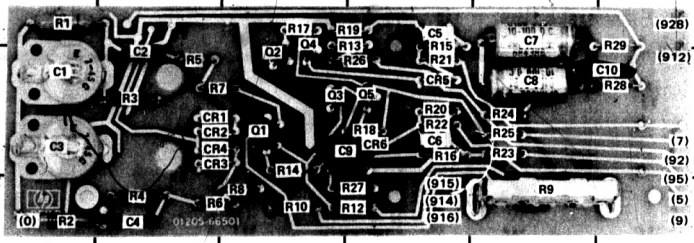


Figure 8-14. Volts/Division Switch, A2A2, Component Identification



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
C1	A-3	C8	E-3	CR5	D-3	R1	A-2	R8	C-4	R16	D-3	R23	E-3
C2	B-3	C9	C-3	CR6	D-3	R2	A-4	R9	E-3	R17	C-2	R24	E-3
C3	A-3	C10	F-3	Q1	C-3	R3	B-3	R10	C-4	R18	D-3	R25	E-3
C4	B-4	CR1	B-3	Q2	C-3	R4	B-4	R12	D-4	R19	D-2	R26	D-3
C5	D-2	CR2	B-3	Q3	C-3	R5	B-3	R13	D-2	R20	D-3	R27	D-4
C6	D-3	CR3	B-3	Q4	C-2	R6	B-4	R14	C-3	R21	D-3	R28	F-3
C7	E-2	CR4	B-3	Q5	D-3	R7	B-3	R15	D-3	R22	D-3	R29	F-2

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Figure 8-15. Vertical Preamplifier, A2A1, Component Identification

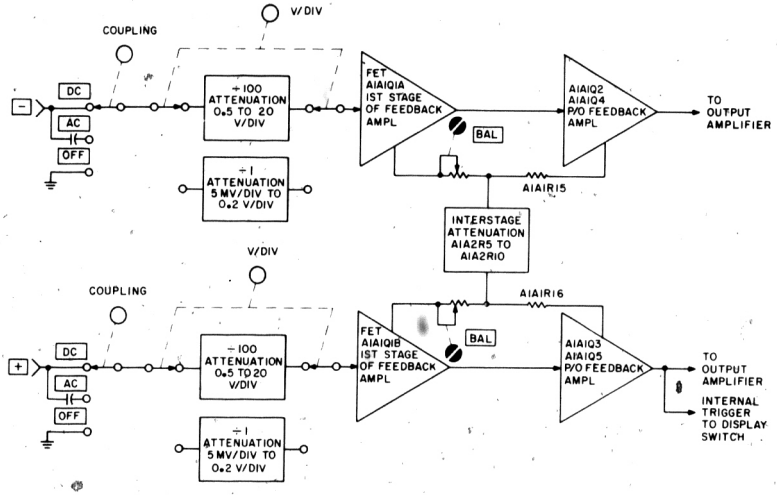

Figure 8-16. Channel B Attenuator and Preamplifier Block Diagram

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   - Volts/Division B . . . . . 1 V/DIV
   - +Vertical Coupling B . . . . . OFF
   - –Vertical Coupling B . . . . . OFF

2. Voltages are referenced to chassis ground. All indications are approximate and may vary slightly from instrument to instrument.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   - Volts/Division B . . . . . 1 V/DIV
   - +Vertical Coupling B . . . . . AC
   - –Vertical Coupling B . . . . . OFF

2. Connect a 5V pk-pk, 1 kHz sine wave to channel B +INPUT jack.

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

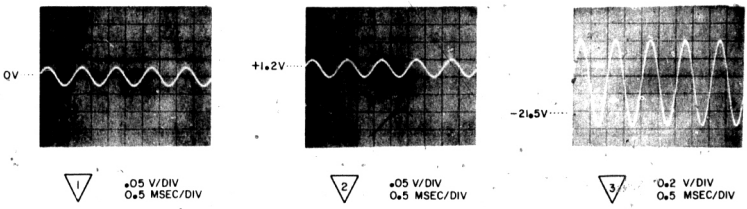

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Figure 8-17. Channel B Preamplifier Module Measurement Conditions and Waveforms

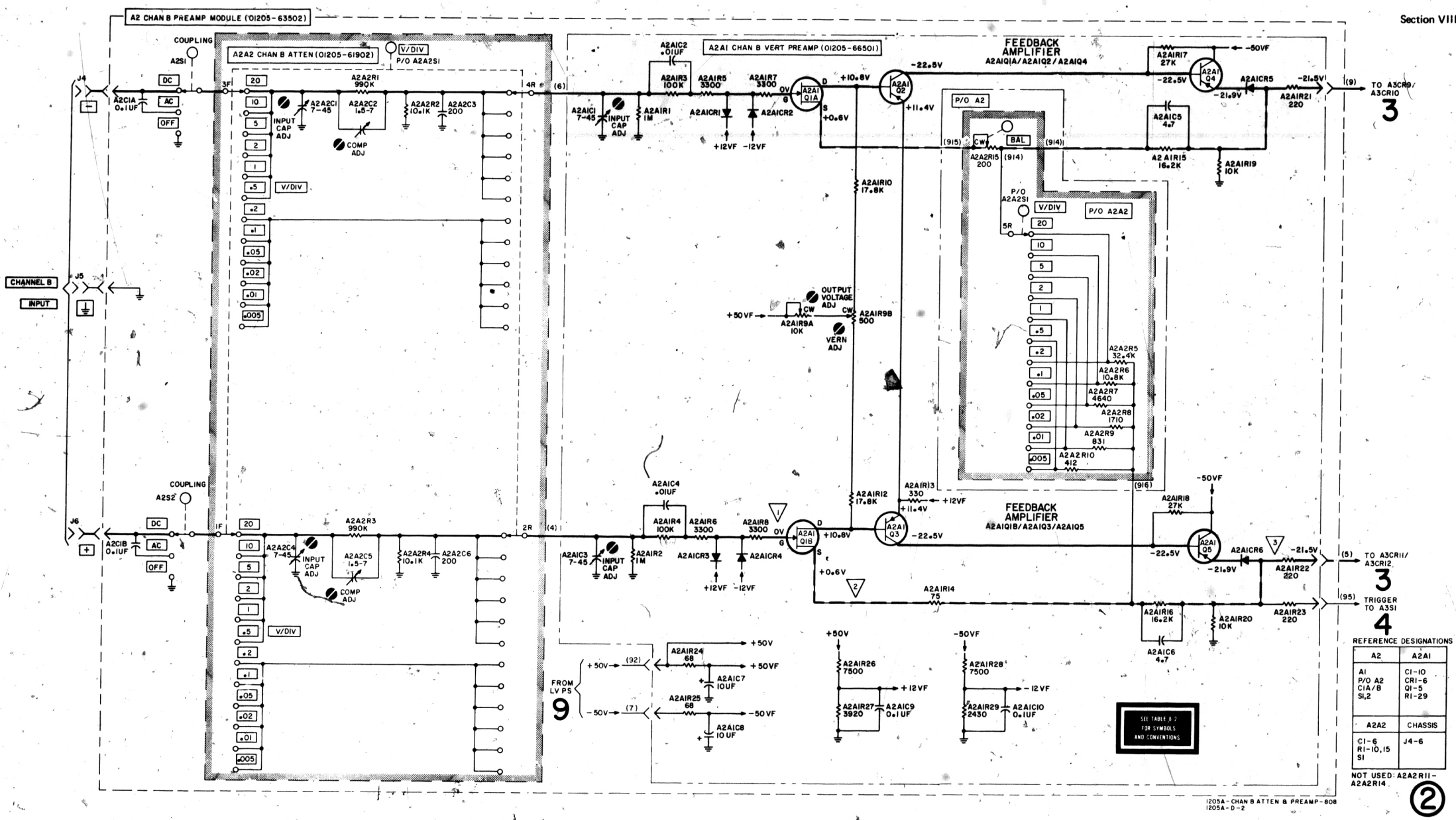
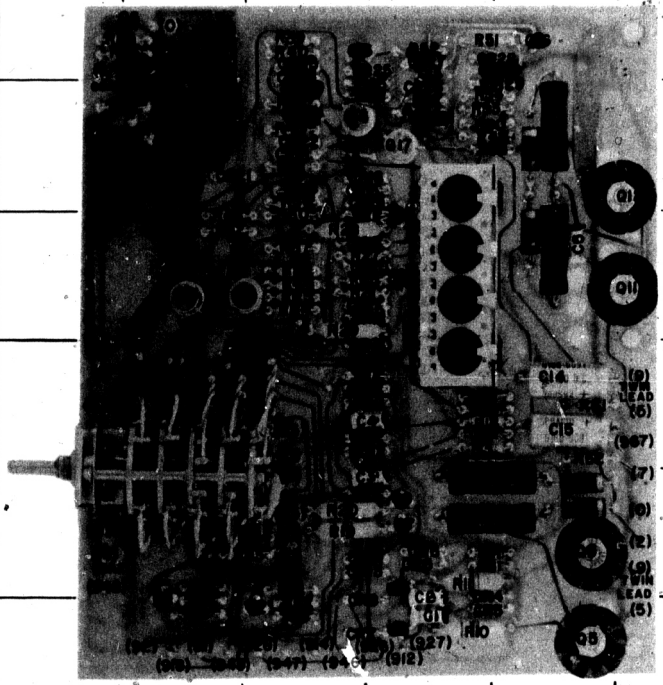


Figure 8-18.
Channel B Preamplifier Module Schematic



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C1	D-6	CR3	D-6	CR20	C-3	Q2	C-6	R1	D-4	R15	D-4	R32	B-3	R48	B-2
C2	D-5	CR4	D-5	CR21	B-2	Q3	D-6	R2	B-6	R16	D-4	R33	C-5	R49	D-2
C3	C-5	CR5	D-5	CR22	C-2	Q4	D-5	R3	D-4	R17	C-4	R34	C-5	R50	D-2
C4	C-4	CR6	D-5	CR23	C-1	Q5	E-6	R4A	D-4	R18	C-5	R35	A-1	R51	D-1
C5	E-3	CR7	C-6	CR24	C-1	Q6	E-5	R4B	D-3	R19	C-5	R36	A-1	R52	D-1
C6	B-1	CR8	C-6	CR25	C-1	Q7	D-5	R4C	D-3	R20	C-5	R37	A-2	R53	D-2
C7	B-1	CR9	C-4	CR26	D-2	Q8	D-5	R4D	D-2	R21	C-3	R38	D-2	R54	D-2
C8	B-1	CR10	C-4	CR27	D-1	Q9	D-3	R5	C-5	R22	C-3	R39	C-1	R55	D-2
C9	C-2	CR11	C-4	CR28	D-1	Q10	D-3	R6	B-5	R23	C-3	R40	C-1	R56	C-2
C10	C-2	CR12	C-4	CR29	E-1	Q11	F-3	R7	C-6	R24	C-3	R41	C-2	R57	C-3
C11	D-2	CR13	C-5	CR30	C-4	Q12	F-2	R8	D-5	R25	C-3	R42	C-2	R58	C-2
C12	E-1	CR14	C-5	CR31	C-2	Q13	B-3	R9	D-5	R26	C-3	R43	C-2	R59	C-3
C13	D-1	CR15	C-3	L1	E-5	Q14	C-2	R10	D-6	R27	C-3	R44	G-3	R60	C-2
C14	E-4	CR16	C-2	L2	E-5	Q15	C-1	R11	D-5	R28	C-3	R45	D-1	R61	E-4
C15	E-4	CR17	C-3	L3	E-3	Q16	E-1	R12	D-5	R29	C-3	R46	D-2	R62	E-4
CR1	B-6	CR18	C-3	L4	E-2	Q17	D-2	R13	D-5	R30	E-3	R47	D-2	S1	A-4
CR2	C-6	CR19	C-2	Q1	B-5	Q18	B-3	R14	D-4	R31	E-2				

1209A-A-6

Figure 8-19. Dual Channel Output Amplifier, A3, Component Identification

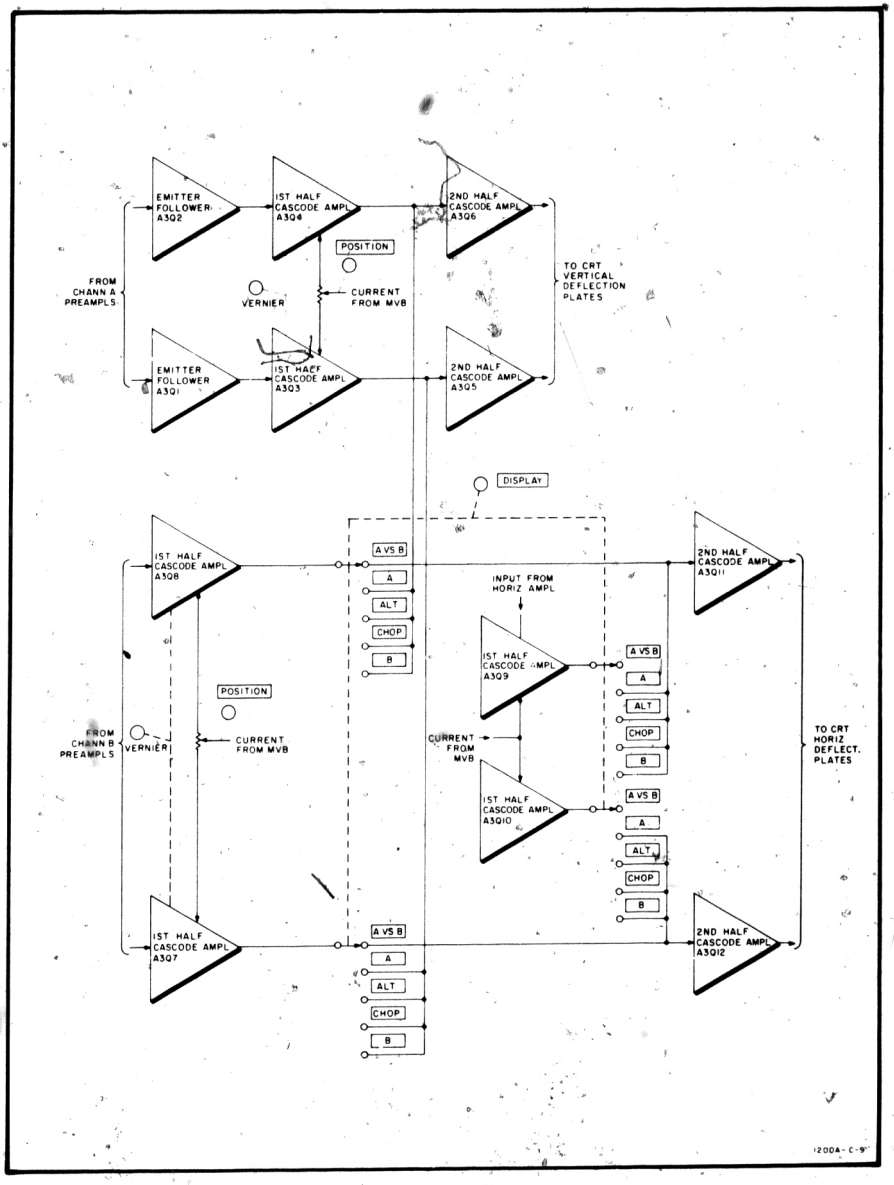


Figure 8-20. Dual Channel Output Amplifier Block Diagram

Table 8-3. Dual Channel Output Amplifier Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   - DISPLAY ..... A
   - Vertical POSITION (A and B) ..... midrange
   - Vertical Vernier (A and B) ..... CAL
   - Volts/Division (A and B) ..... 1 V/DIV
   - +Vertical Coupling (A and B) ..... OFF
   - −Vertical Coupling (A and B) ..... OFF
   - Horizontal POSITION ..... midrange
   - SWEEP/EXT HORIZ ..... 1 V/DIV

2. Voltages are referenced to chassis ground. All indications are approximate and may vary slightly from instrument to instrument.

3. *To measure voltages with an asterisk, set DISPLAY to A vs B.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:
   - DISPLAY ..... A
   - Vertical POSITION (A and B) ..... midrange
   - Volts/Division (A and B) ..... 1 V/DIV
   - Vertical Vernier (A and B) ..... CAL
   - +Vertical Coupling A ..... AC
   - −Vertical Coupling A ..... OFF
   - +Vertical Coupling B ..... AC
   - −Vertical Coupling B ..... OFF
   - Horizontal POSITION ..... midrange
   - SWEEP/EXT HORIZ x1
   - Time/Division ..... 0.2 MSEC/DIV
   - Horizontal Vernier ..... CAL
   - SLOPE ..... +
   - MODE ..... NORM
   - TRIGGER LEVEL ..... AUTO
   - Horizontal COUPLING ..... DC
   - SOURCE ..... INT

2. Connect a 5V pk-pk, 1 kHz sine wave to channel A +INPUT jack.

3. ▽ To measure these waveforms, connect a 5V pk-pk, 1 kHz sine wave to both channel A and B +INPUT jacks. Set the controls as indicated in step 1, except set DISPLAY to A vs B.

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

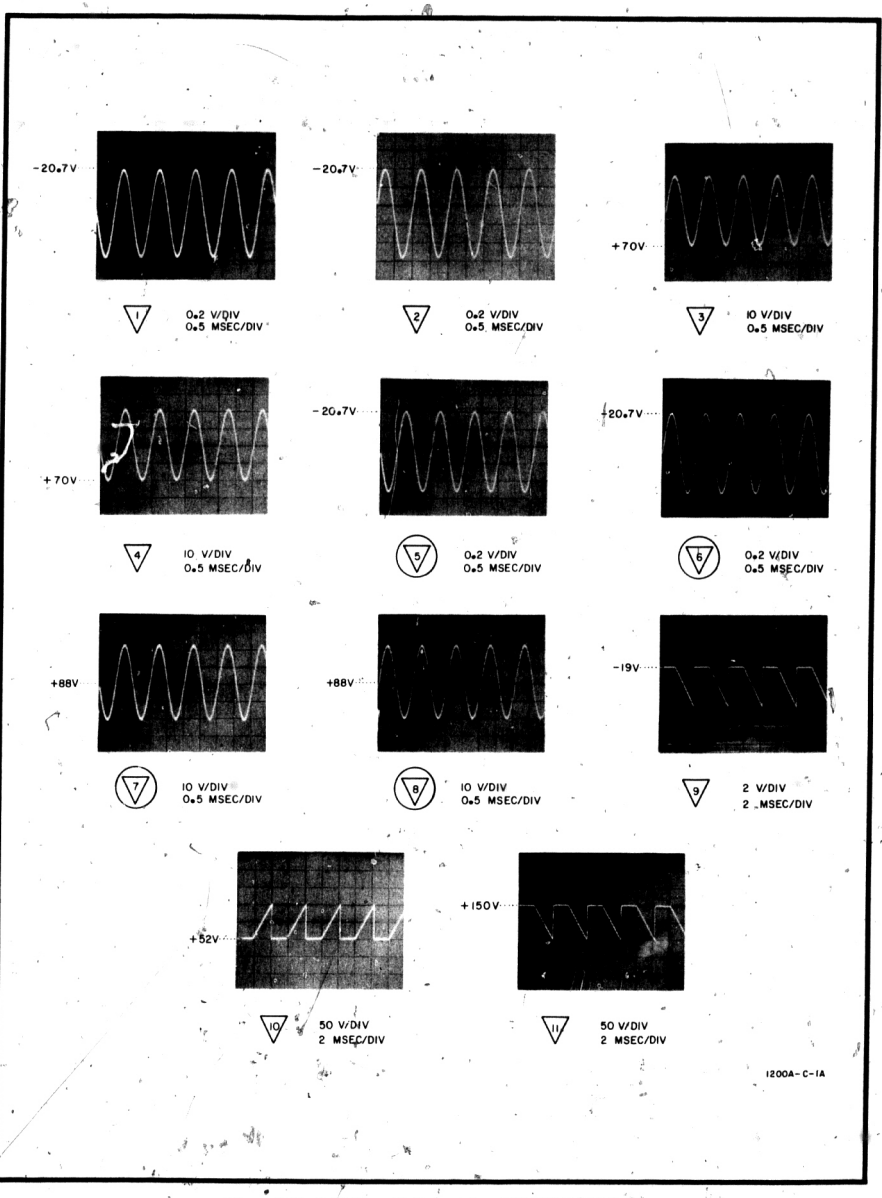


Figure 8-21. Dual Channel Output Amplifier Waveforms

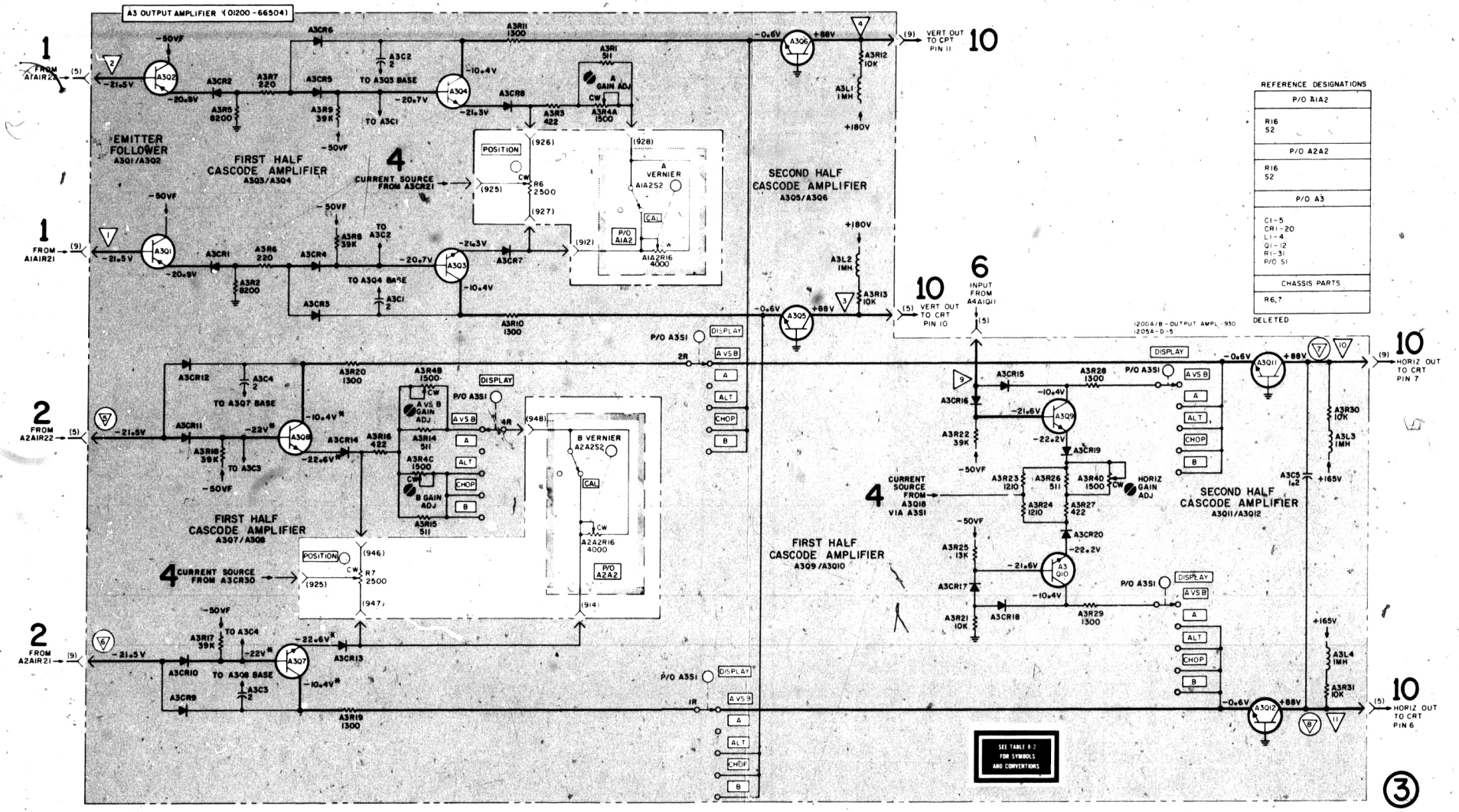
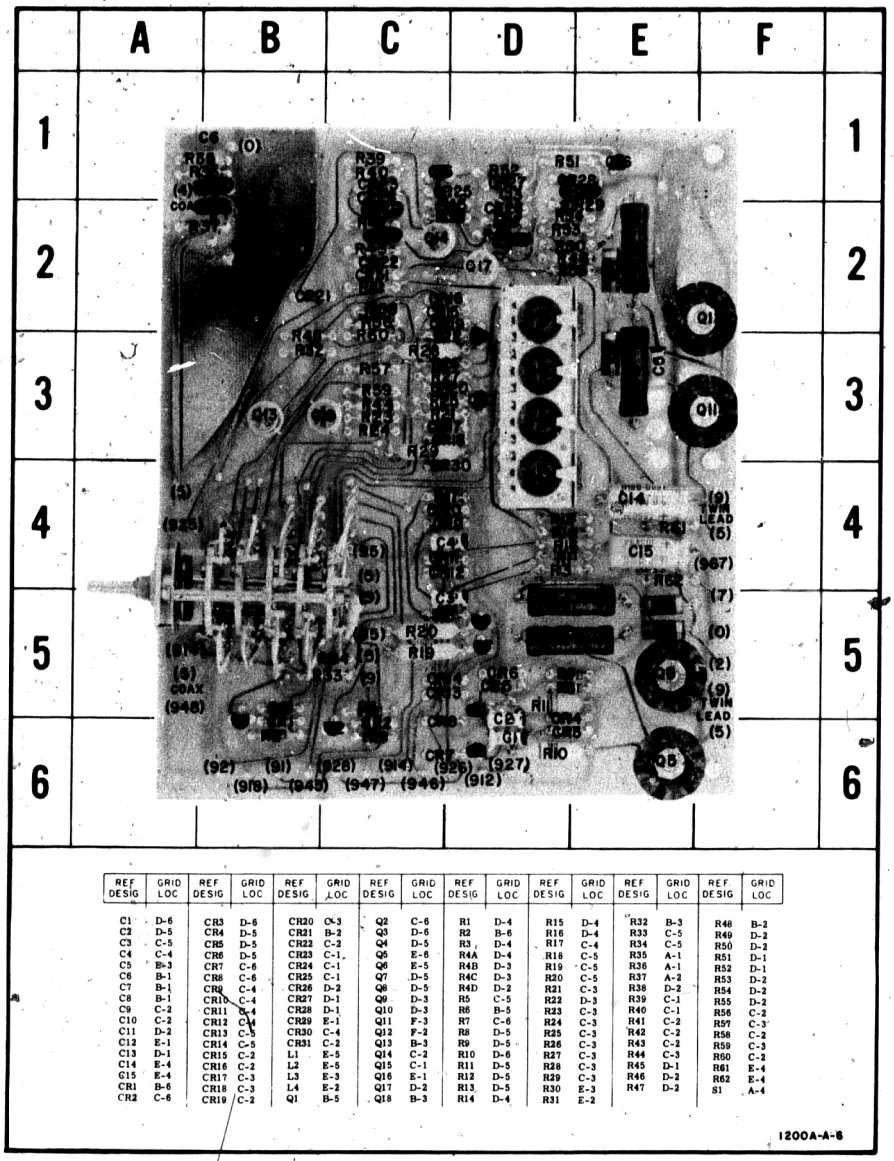


Figure 8-22.
Dual Channel Output Amplifier Schematic



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C2	D-5	CR4	D-5	CR21	B-2	Q3	D-6	R2	B-6	R16	D-4	R33	C-5	R49	D-2
C3	C-5	CR5	D-5	CR22	C-2	Q4	D-5	R3	D-4	R17	C-4	R34	C-5	R50	D-2
C4	C-4	CR6	D-5	CR23	C-1	Q5	E-6	R4A	D-4	R18	C-5	R35	A-1	R51	D-1
C5	B-3	CR7	C-6	CR24	C-1	Q6	E-5	R4B	D-3	R19	C-5	R36	A-1	R52	D-1
C6	B-1	CR8	C-6	CR25	C-1	Q7	D-5	R4C	D-3	R20	C-5	R37	A-2	R53	D-2
C7	B-1	CR9	C-4	CR26	D-2	Q8	D-5	R4D	D-2	R21	C-3	R38	D-2	R54	D-2
C8	B-1	CR10	C-4	CR27	D-1	Q9	D-3	R5	C-5	R22	D-3	R39	C-1	R55	D-2
C9	C-2	CR11	C-4	CR28	D-1	Q10	D-3	R6	B-5	R23	C-3	R40	C-1	R56	C-2
C10	C-2	CR12	C-4	CR29	E-1	Q11	F-3	R7	C-6	R24	C-3	R41	C-2	R57	C-3
C11	D-2	CR13	C-5	CR30	C-4	Q12	F-2	R8	D-5	R25	C-3	R42	C-2	R58	C-2
C12	E-1	CR14	C-5	CR31	C-2	Q13	B-3	R9	D-5	R26	C-3	R43	C-2	R59	C-3
C13	D-1	CR15	C-2	L1	E-5	Q14	C-2	R10	D-6	R27	C-3	R44	C-3	R60	C-2
C14	E-4	CR16	C-2	L2	E-5	Q15	C-1	R11	D-5	R28	C-3	R45	D-1	R61	E-4
C15	E-4	CR17	C-3	L3	E-3	Q16	E-1	R12	D-5	R29	C-3	R46	D-2	R62	E-4
CR1	B-6	CR18	C-3	L4	E-2	Q17	D-2	R13	D-5	R30	E-3	R47	D-2	S1	A-4
CR2	C-6	CR19	C-2	Q1	B-5	Q18	B-3	R14	D-4	R31	E-2				

1200A-A-6

Figure 8-23. Multivibrator, A3, Component Identification

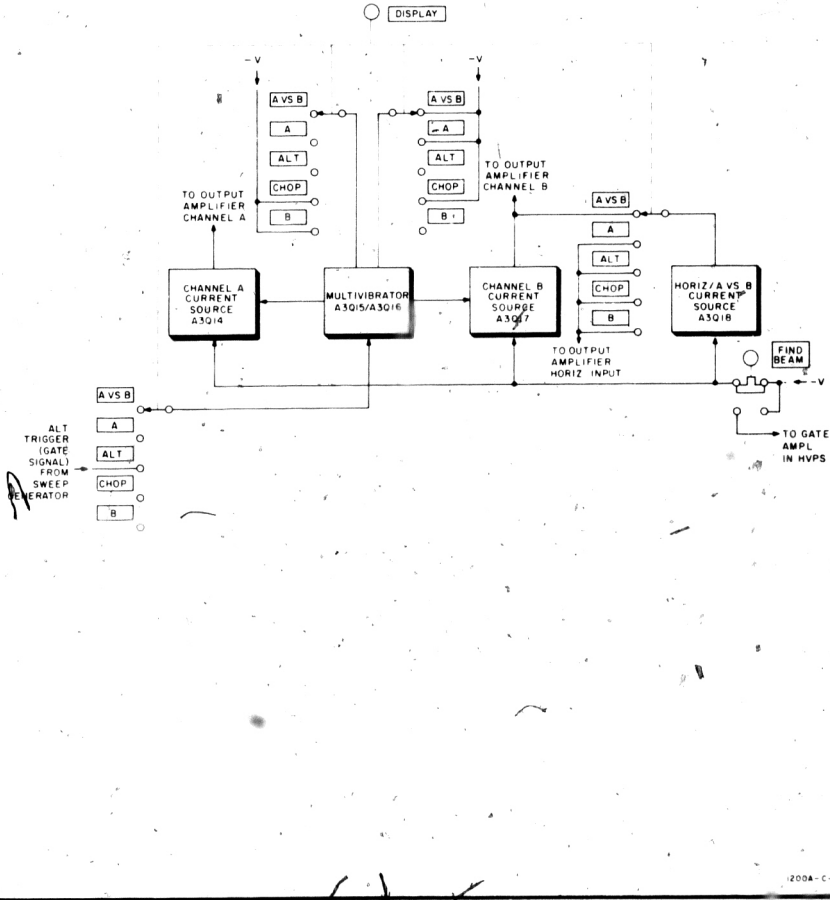


Figure 8-24. Multivibrator Block Diagram

Table 8-4. Multivibrator Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:

DISPLAY	A
Vertical POSITION (A and B)	midrange
Horizontal POSITION	midrange

2. Voltages are referenced to chassis ground. All indications are approximate and may vary slightly from instrument to instrument.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:

DISPLAY	CHOP
Vertical POSITION (A and B)	midrange
Horizontal POSITION	midrange

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

SCHEMATIC DIAGRAMS

CON'T

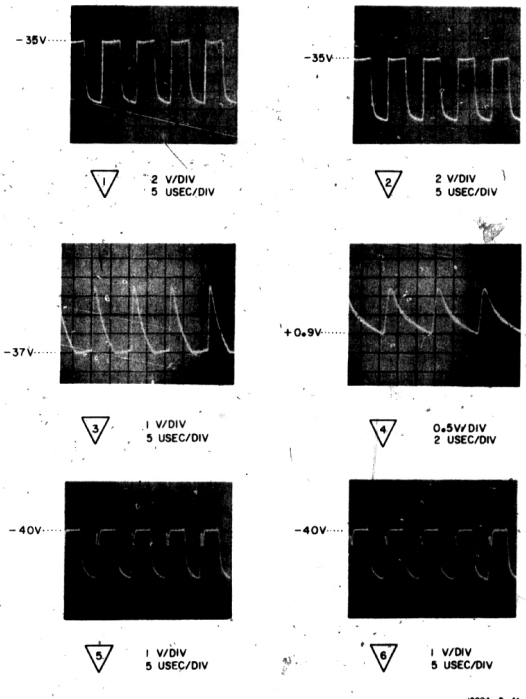


Figure 8-25. Multivibrator Waveforms

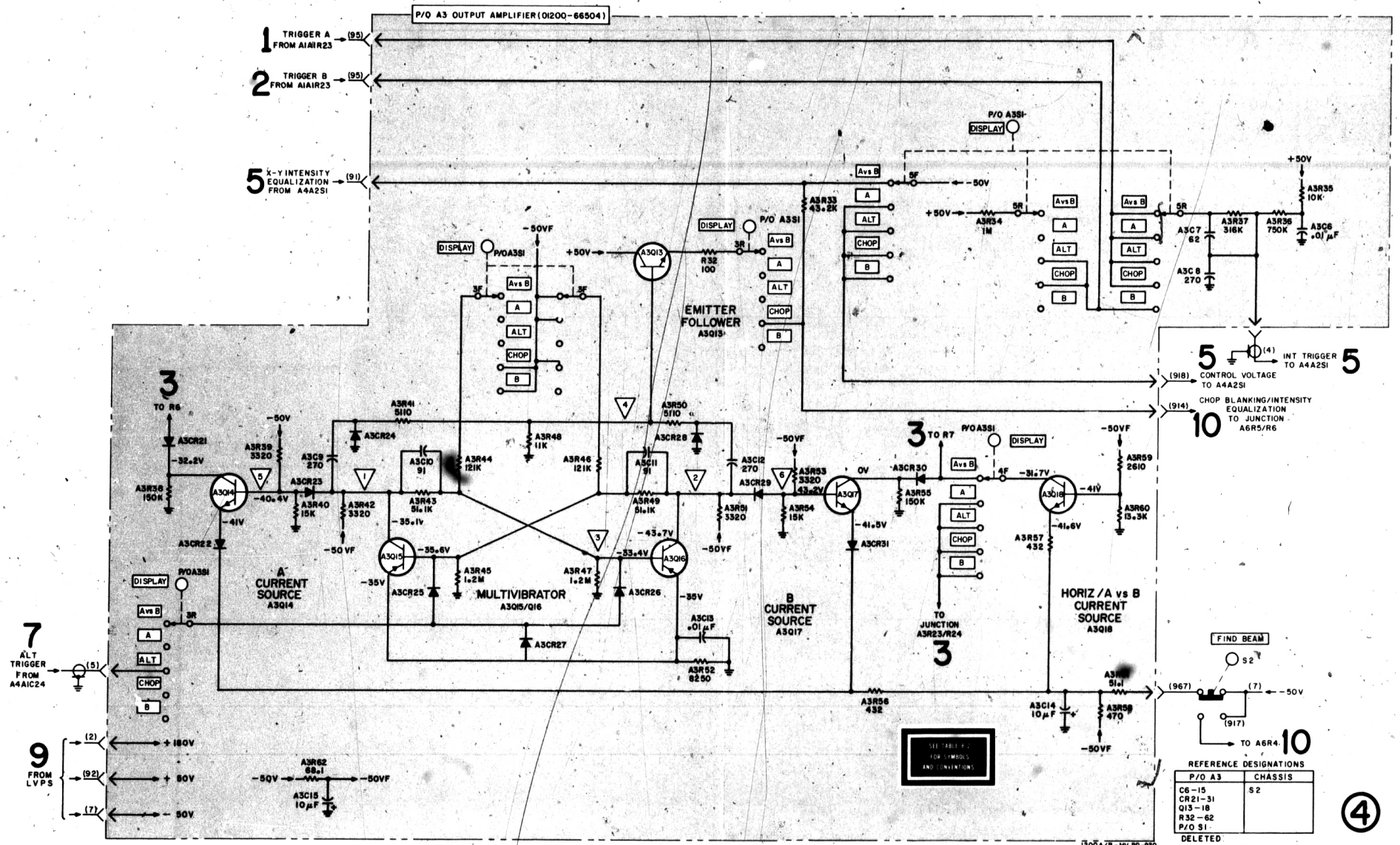
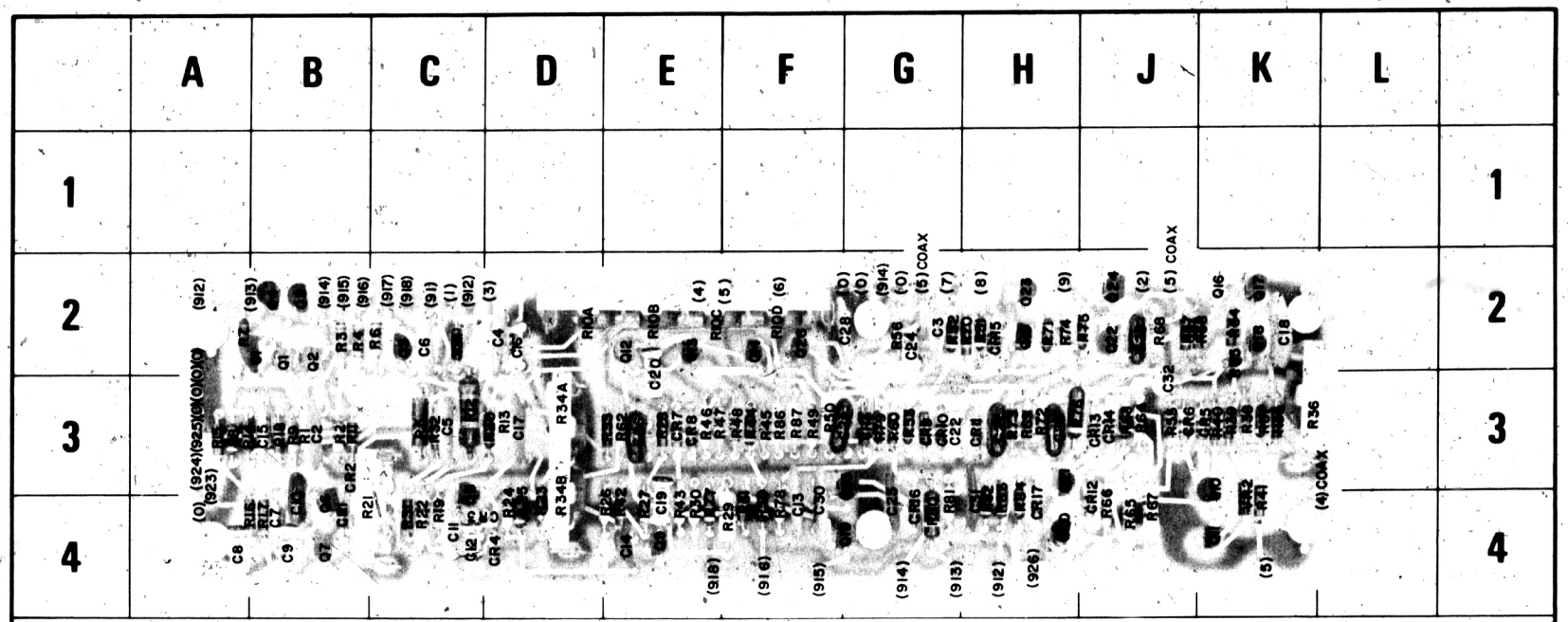


Figure 8-26.
Multivibrator Schematic



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	H-2	C23	J-2	CR12	J-4	Q16	K-2	R10B	E-2	R29	F-4	R49	F-3	R70	H-2
C2	H-3	C24	G-2	CR13	J-3	Q17	K-2	R10C	E-2	R30	E-4	R50	F-3	R71	H-2
C3	G-2	C25	G-4	CR14	J-3	Q18	K-2	R10D	F-2	R31	C-4	R51	H-2	R72	H-3
C4	D-2	C26	F-3	CR15	H-2	Q19	J-4	R11	B-3	R32	C-3	R52	G-2	R73	H-3
C5	F-3	C27	H-3	CR16	G-4	Q20	H-4	R12	C-3	R33	E-3	R53	G-3	R74	H-2
C6	C-2	C28	G-2	CR17	H-4	Q21	H-3	R13	D-3	R34A	D-3	R54	K-2	R75	J-2
C7	H-4	C29	H-3	Q1	B-2	Q22	J-2	R14	A-3	R34B	D-4	R55	J-3	R76	H-3
C8	A-4	C30	F-4	Q2	B-2	Q23	H-2	R15	A-3	R35	K-3	R56	G-2	R77	E-4
C9	B-4	C31	H-2	Q3	C-2	Q24	J-2	R16	A-4	R36	K-3	R57	J-2	R78	F-4
C10	B-4	C32	J-3	Q4	B-2	Q25	G-3	R17	B-4	R37	K-3	R58	K-2	R79	G-3
C11	C-4	CR1	B-4	Q5	B-2	Q26	F-2	R18	B-3	R38	K-3	R59	F-4	R80	G-4
C12	C-3	CR2	B-2	Q6	B-4	Q27	H-4	R19	C-4	R39	K-3	R60	G-3	R81	G-4
C13	F-4	CR3	B-3	Q7	B-4	R1	B-3	R20	D-3	R40	K-3	R61	F-4	R82	H-4
C14	F-4	CR4	B-4	Q8	C-3	R2	B-2	R21	B-4	R41	K-4	R62	E-3	R83	H-4
C15	B-3	CR5	K-3	Q9	E-4	R3	B-2	R22	C-4	R42	E-4	R63	J-3	R84	H-4
C16	B-2	CR6	J-3	Q10	K-4	R4	B-2	R23	D-4	R43	F-4	R64	J-3	R85	K-3
C17	D-3	CR7	F-3	Q11	K-4	R5	C-3	R24	D-4	R44	F-3	R65	J-4	R86	F-3
C18	K-2	CR8	G-3	Q12	J-2	R6	C-2	R25	D-4	R45	F-3	R66	J-4	R87	F-3
C19	F-4	CR9	G-3	Q13	J-2	R7	A-2	R26	D-4	R46	E-3	R67	J-4	VR1	C-2
C20	F-3	CR10	G-3	Q14	F-2	R8	A-3	R27	F-4	R47	F-3	R68	J-2	VR2	K-4
C21	F-3	CR11	H-4	Q15	H-2	R9	B-3	R28	F-3	R48	F-3	R69	H-3	VR3	G-3
C22	G-3					R10A	D-2								

Note: For complete reference designation, prefix component designators with A4A1.

1200A-8-2

Figure 8-27. Horizontal Circuits, A4A1, Component Identification

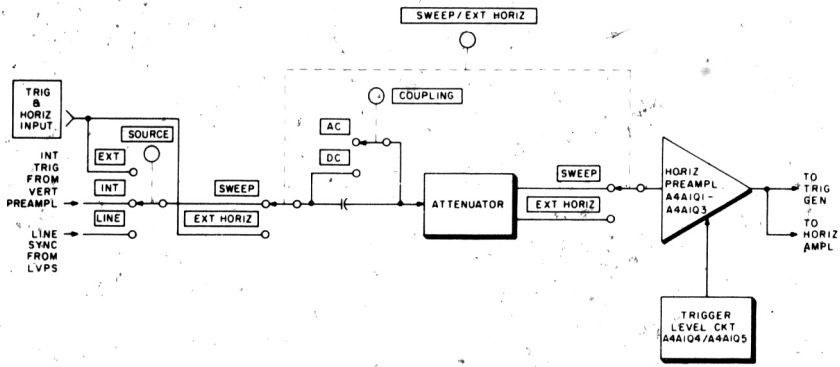


Figure 8-28. Horizontal Preamplifier Block Diagram

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
   a. Condition 1 (for trigger circuit testing).

SWEEP/EXT HORIZ	X1
Horizontal VERNIER	CAL
TRIGGER LEVEL	AUTO
SOURCE	INT
Horizontal COUPLING	DC
SLOPE	+
MODE	NORM
No signal applied	

   b. Condition 2 (for horizontal amplifier testing).

SWEEP/EXT HORIZ	1 V/DIV
Horizontal VERNIER	CAL
Horizontal POSITION	midrange
No signal applied	

2. Voltages are referenced to chassis ground. All indications are approximate and may vary slightly from instrument to instrument.

3. Voltages in parenthesis are for Condition 2.

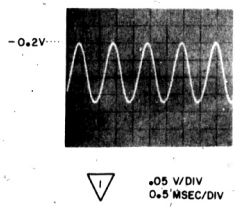
WAVEFORM MEASUREMENT CONDITIONS

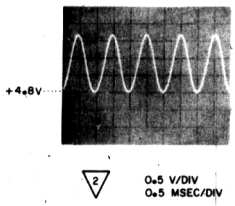
1. Set:

DISPLAY	A
Vertical POSITION A	midrange
Volts/Division A	1 V/DIV
Vertical Vernier A	CAL
+Vertical Coupling A	AC
−Vertical Coupling A	OFF
Horizontal POSITION	midrange
SWEEP/EXT HORIZ	X1
Time/Division	0.2 MSEC/DIV
Horizontal Vernier	CAL
SLOPE	+
MODE	NORM
TRIGGER LEVEL	AUTO
Horizontal COUPLING	DC
SOURCE	INT

2. Connect a 5V pk-pk, 1 kHz sine wave to channel A +INPUT jack.

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





1200A-B-6A

Figure 8-29. Horizontal Preamplifier Measurement Conditions and Waveforms

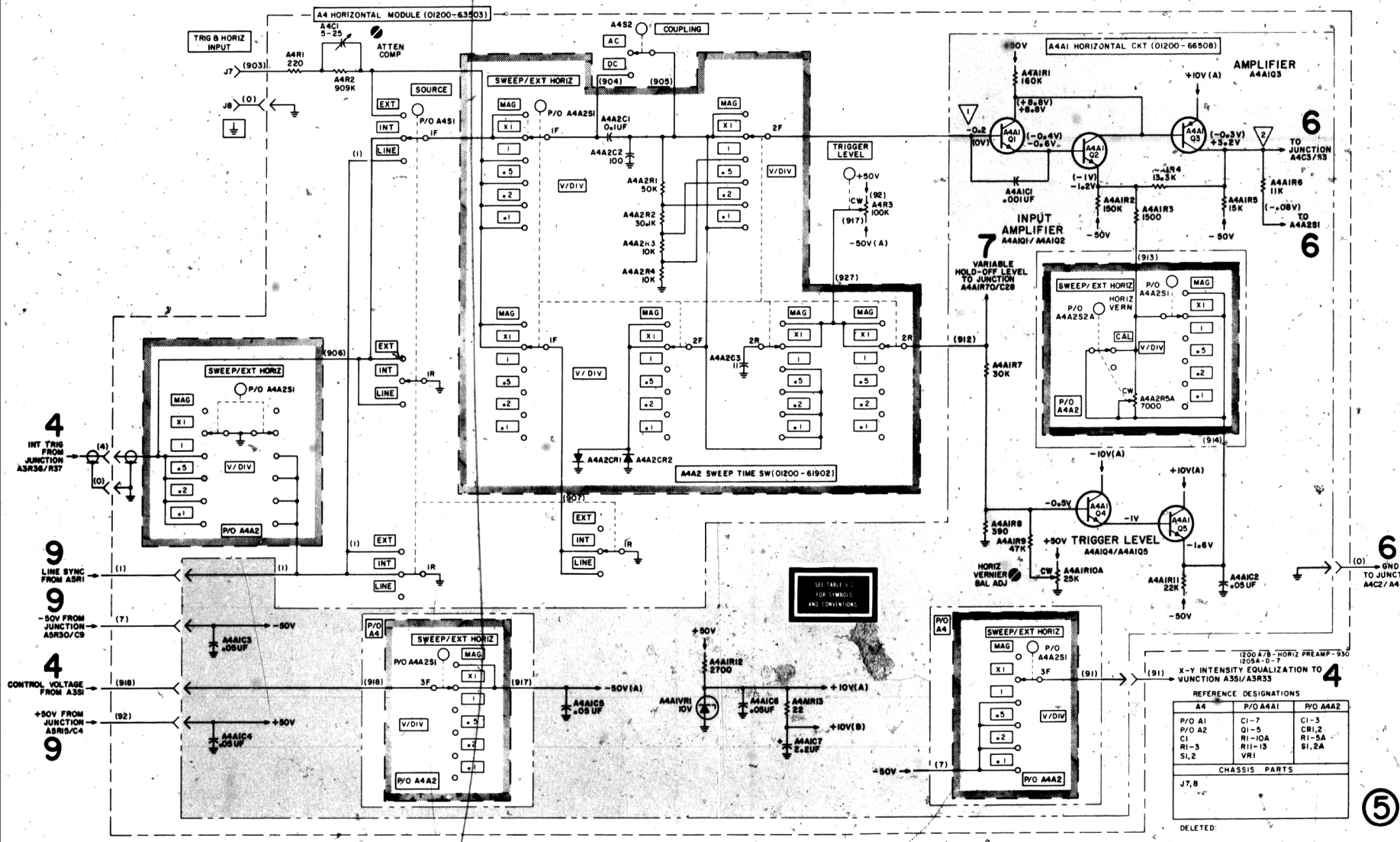


Figure 8-30.
Horizontal Preamplifier Schematic

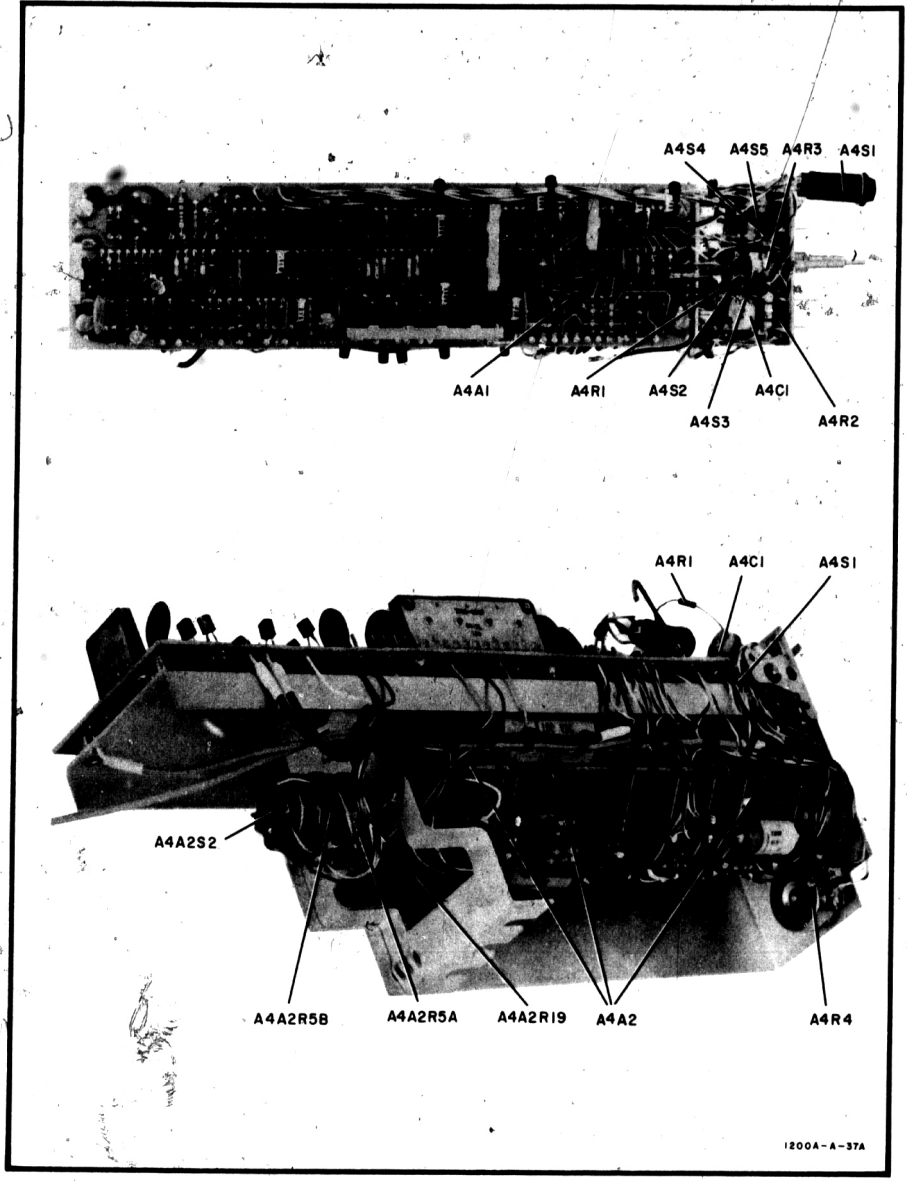


Figure 8-31. Horizontal Module, A4, Component Identification

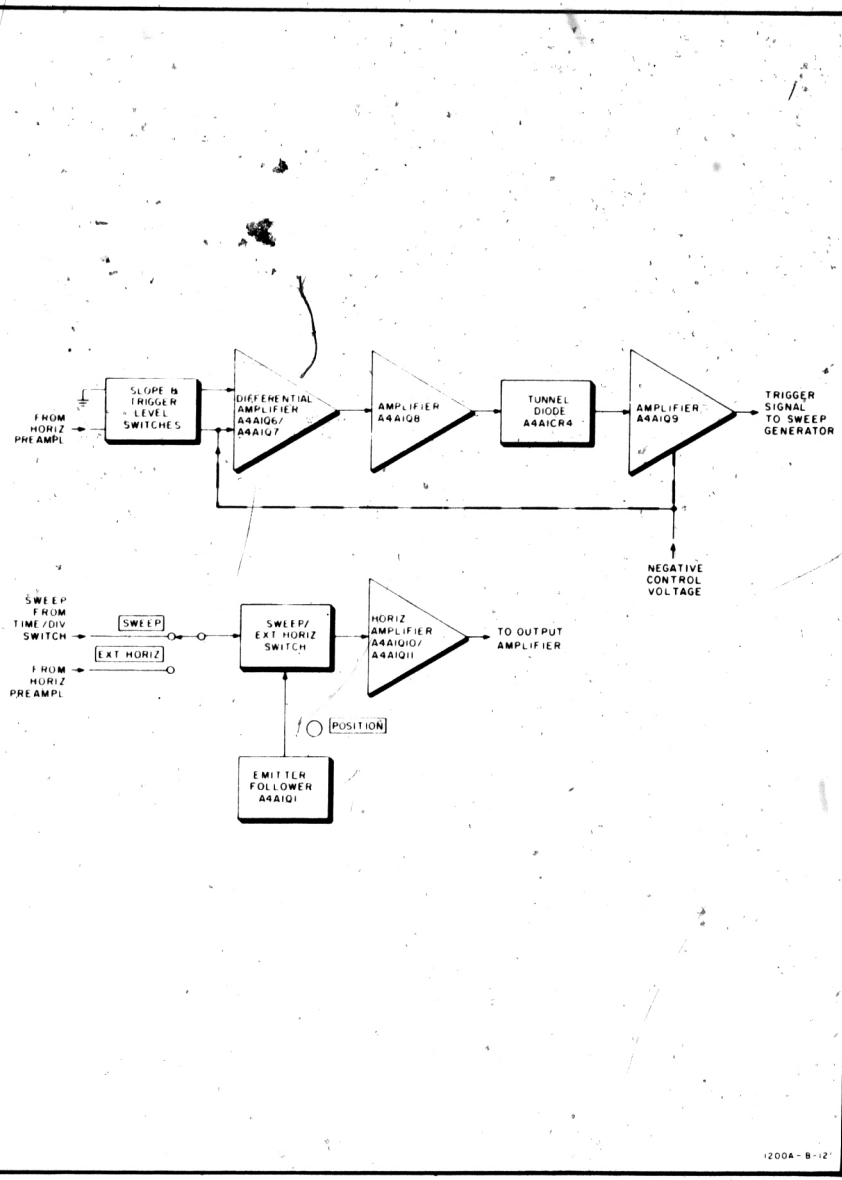


Figure 8-32. Trigger Generator and Horizontal Amplifier Block Diagram

Table 8-5. Trigger Generator and Horizontal Amplifier Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:

a. Condition 1 (for trigger circuit testing).

SWEEP/EXT HORIZ	X1
Horizontal VERNIER	CAL
TRIGGER LEVEL	AUTO
SOURCE	INT
Horizontal COUPLING	DC
SLOPE	+
MODE	NORM
No signal applied	

b. Condition 2 (for horizontal amplifier testing).

SWEEP/EXT HORIZ	1 V/DIV
Horizontal VERNIER	CAL
Horizontal POSITION	midrange
No signal applied	

2. Voltages are referenced to chassis ground. All indications are approximate and may vary slightly from instrument to instrument.

3. Voltages in parenthesis are for Condition 2.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:

DISPLAY	A
Vertical POSITION A	midrange
Volts/Division A	1 V/DIV
Vertical Vernier A	CAL
+Vertical Coupling A	AC
−Vertical Coupling A	OFF
Horizontal POSITION	midrange
SWEEP/EXT HORIZ	X1
Time/Division	0.2 MSEC/DIV
Horizontal Vernier	CAL
SLOPE	+
MODE	NORM
TRIGGER LEVEL	AUTO
Horizontal COUPLING	DC
SOURCE	INT

2. Connect a 5V pk-pk, 1 kHz sine wave to channel A +INPUT jack.

3. ⓥ To measure this waveform, connect a 5V pk-pk, 1 kHz sine wave to the TRIG & HORIZ INPUT jack. Set the controls as indicated in step 1, except set SWEEP/EXT HORIZ to 0.5 V/DIV.

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

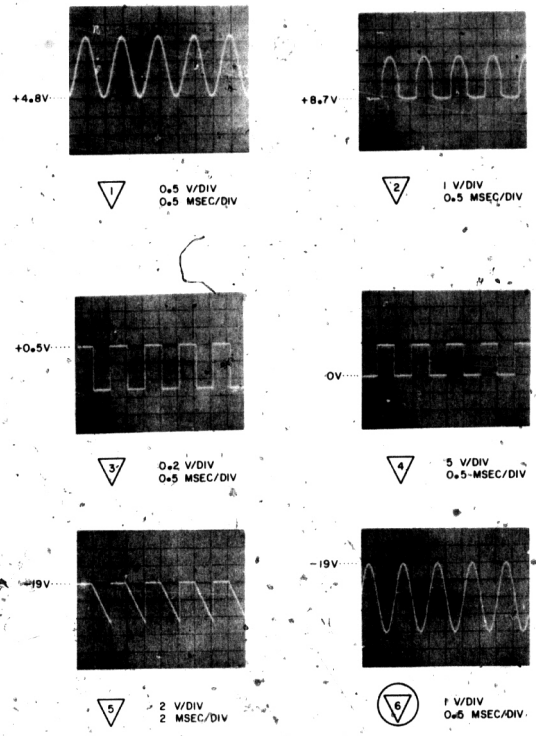


Figure 8-33. Trigger Generator and Horizontal Amplifier Waveforms

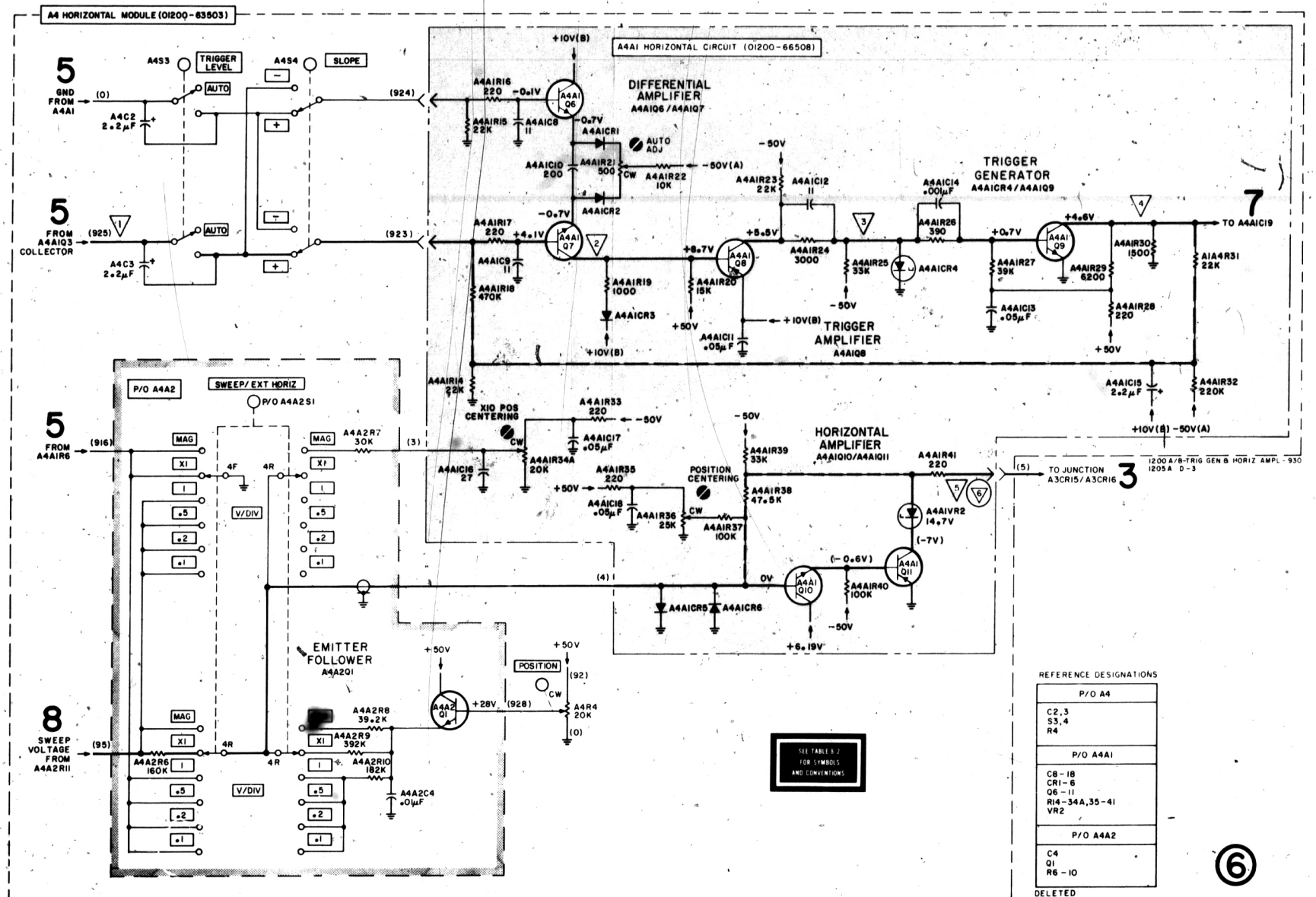


Figure 8-34.
Trigger Generator and Horizontal Amplifier Schematic

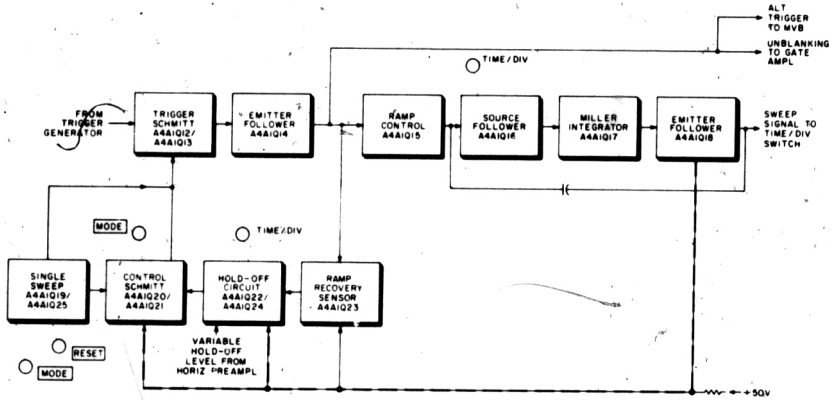


Figure 8-35. Sweep Generator Block Diagram

Table 8-6. Sweep Generator Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:

Horizontal POSITION	midrange
SWEEP/EXT HORIZ	x1
Time/Division	0.2 MSEC/DIV
Horizontal Vernier	CAL
MODE	SINGLE
SLOPE	+
TRIGGER LEVEL	ccw (not in AUTO)
SOURCE	INT
RESET	armed (light on)*

2. *Measure voltages in parenthesis with RESET pressed. Measure all other voltages with the sweep generator armed (light on).

3. Voltages are referenced to chassis ground. All indications are approximate and may vary slightly from instrument to instrument.

WAVEFORM MEASUREMENT CONDITIONS

1. Set:

DISPLAY	A
Vertical POSITION A	midrange
Volts/Division A	1 V/DIV
Vertical Vernier A	CAL
+Vertical Coupling A	AC
−Vertical Coupling A	OFF
Horizontal POSITION	midrange
SWEEP/EXT HORIZ	x1
Time/Division	0.2 MSEC/DIV
Horizontal Vernier	CAL
SLOPE	+
MODE	NORM
TRIGGER LEVEL	AUTO
Horizontal COUPLING	DC
SOURCE	INT

2. Connect a 5V pk-pk, 1 kHz sine wave to channel A +INPUT jack.

3. ⓥ To measure this waveform, change the vertical input frequency to 50 kHz.

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

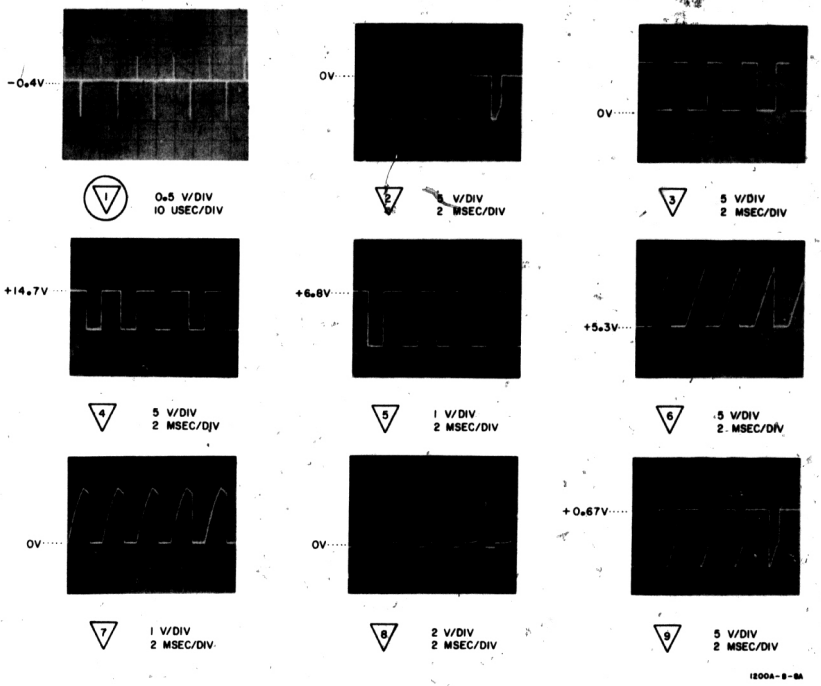
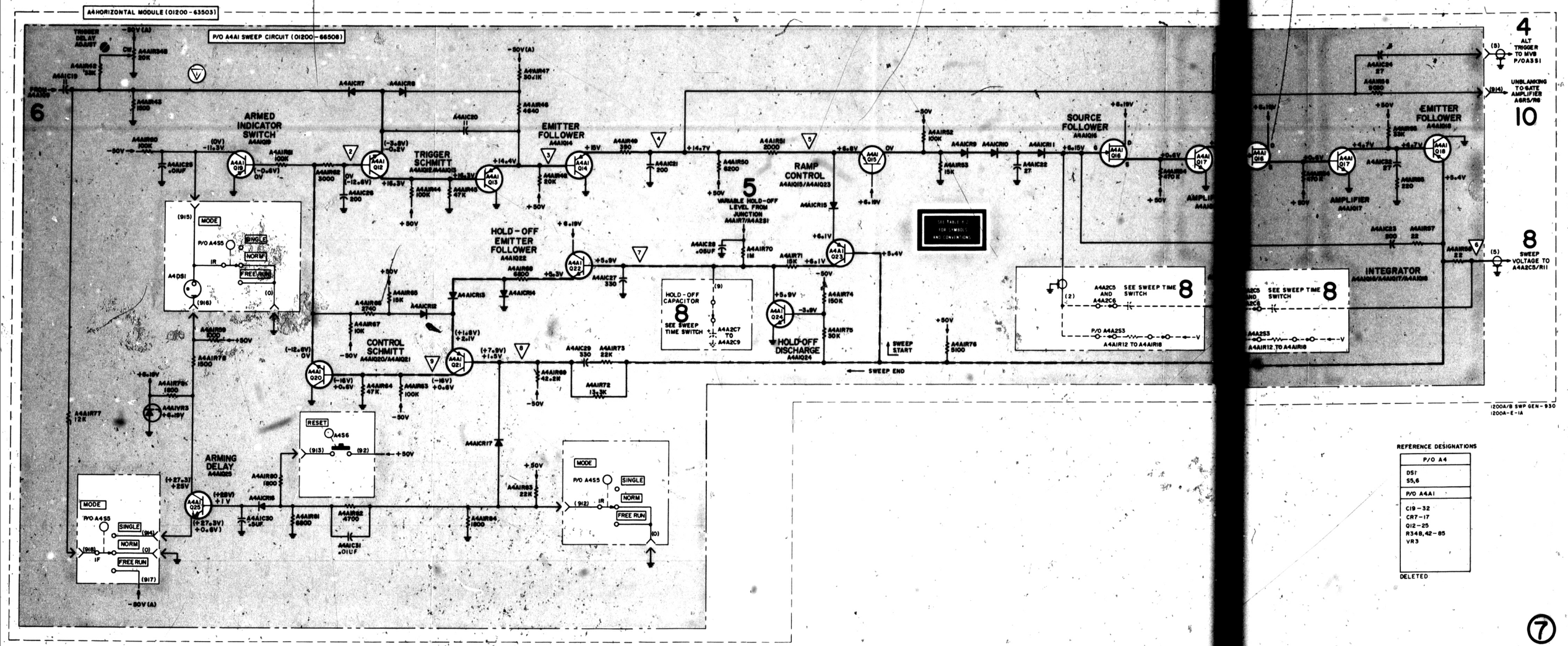


Figure 8-36. Sweep Generator Waveforms

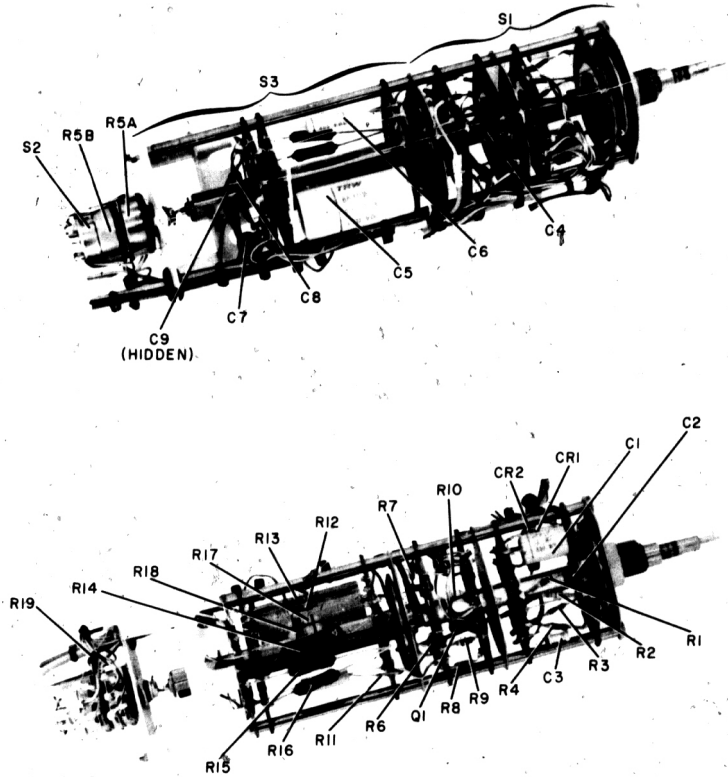


REFERENCE DESIGNATIONS

P/O A4
DS1
S5,6
P/O A4A1
C19-32
CR7-17
Q12-25
R348,42-85
VR3

DELETED

Figure 8-37.
Sweep Generator Schematic
8-23/8-24



Note: For complete reference designation, prefix component designators with A4A2.

1201A-A-15

Figure 8-38. Time/Division Switch, A4A2, Component Identification

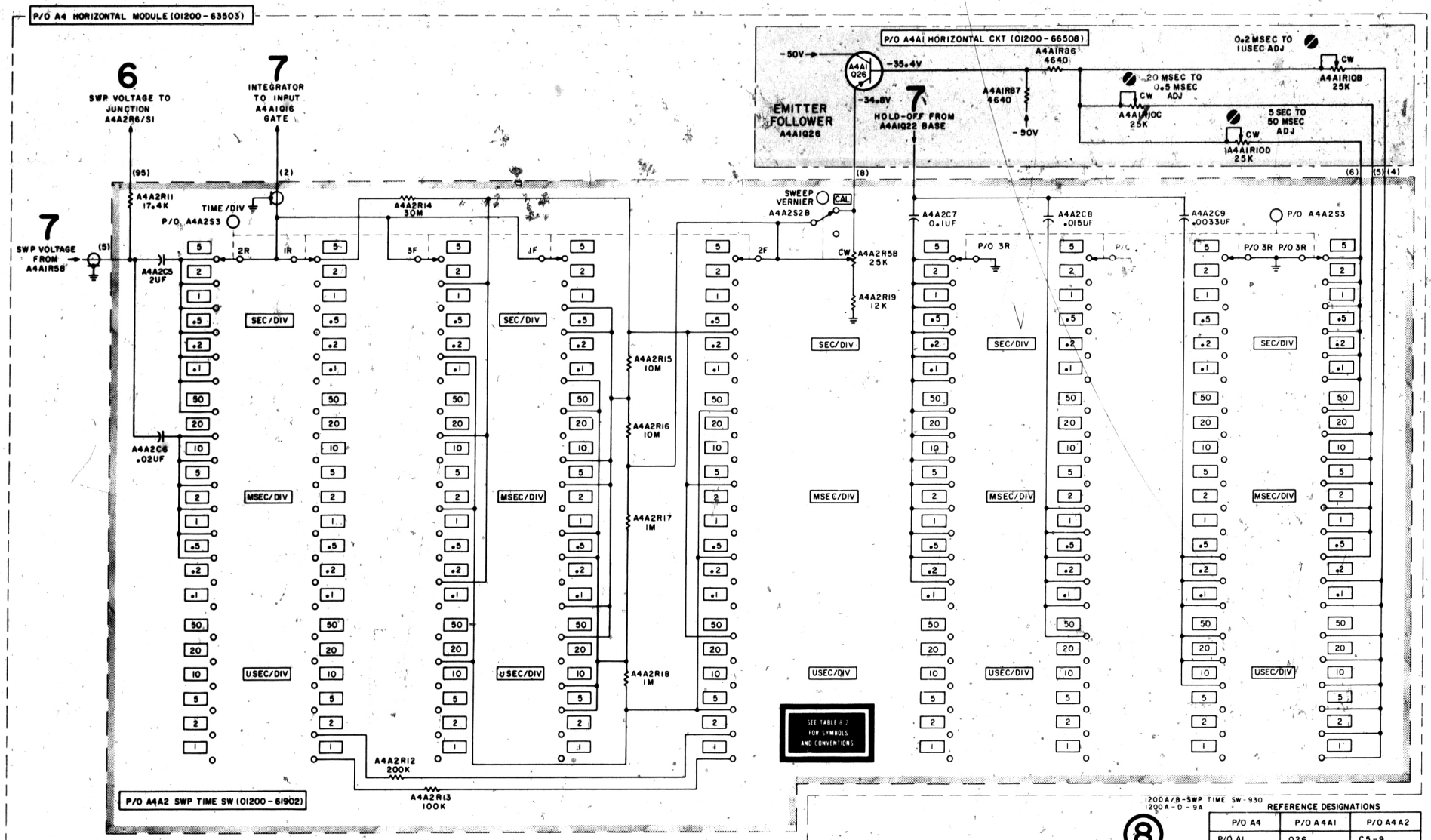


Figure 8-39.
Time/Division Switch Schematic

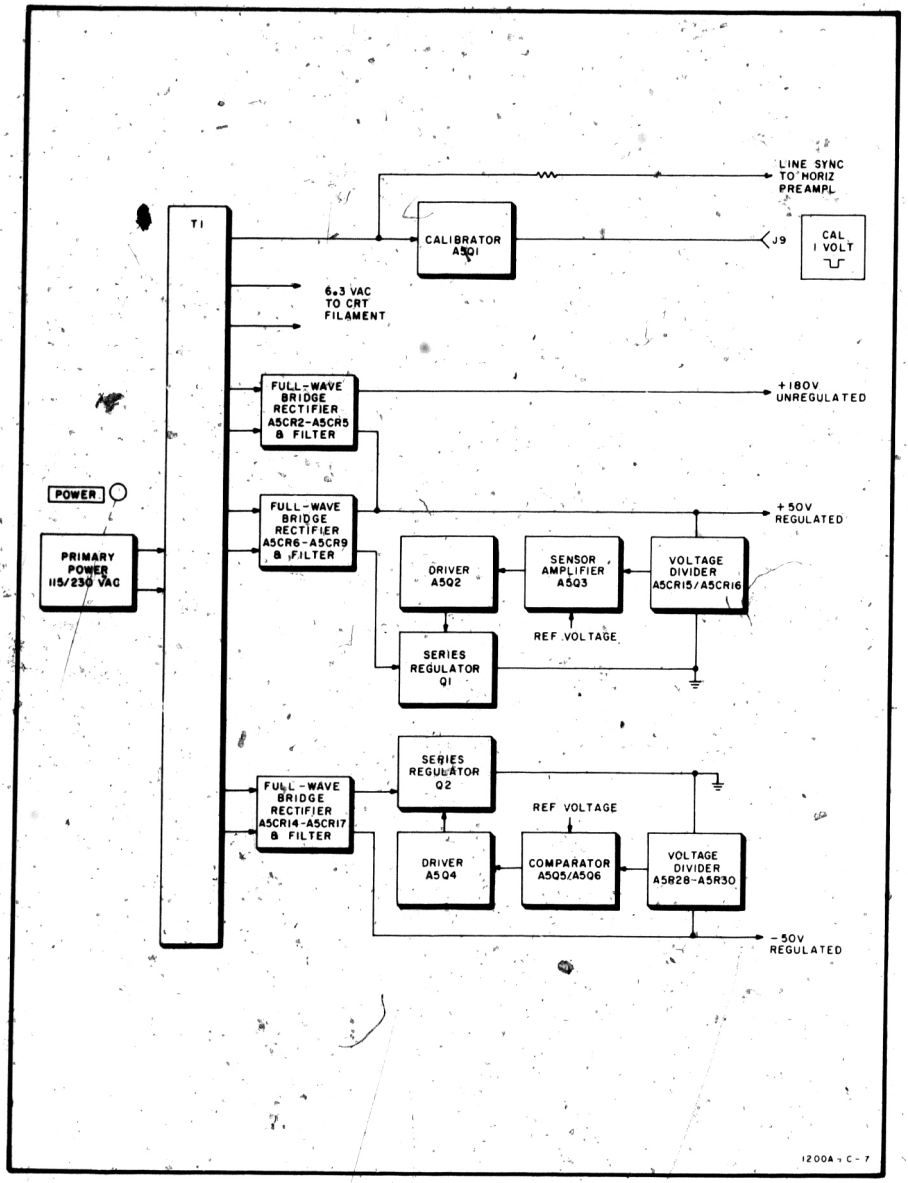
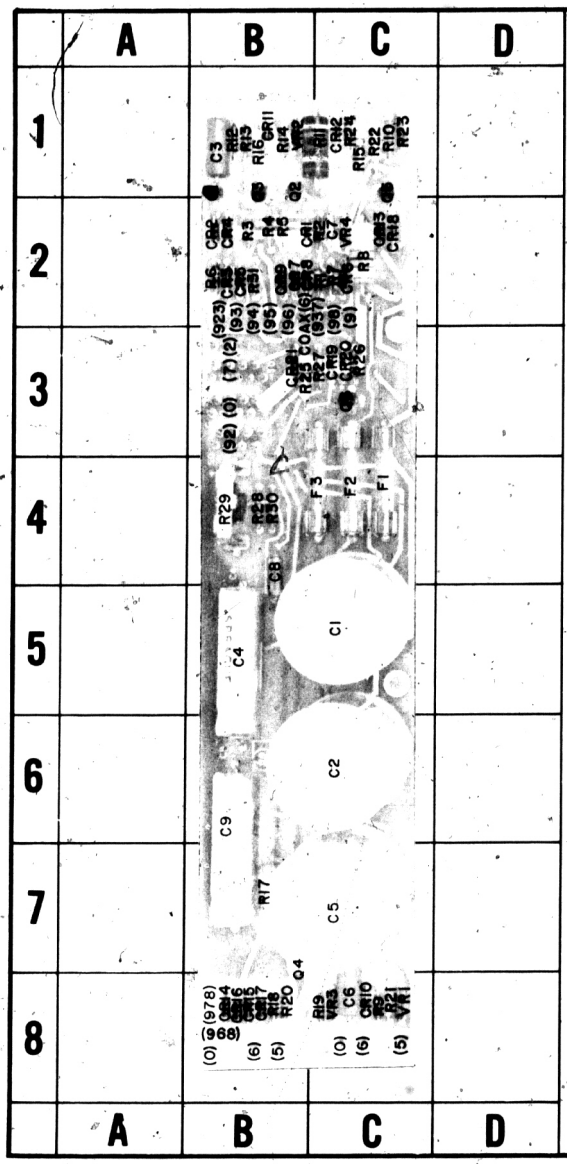


Figure 8-40. Low Voltage Power Supply Block Diagram



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-5	Q5	C-1
C2	C-6	Q6	C-3
C3	B-1	R1	C-2
C4	B-5	R2	C-2
C5	C-7	R3	B-2
C6	C-8	R4	B-2
C7	C-2	R5	B-2
C8	B-4	R6	B-2
C9	B-6	R7	C-2
CR1	B-2	R8	C-2
CR2	B-2	R9	C-8
CR3	B-2	R10	C-1
CR4	B-2	R11	C-1
CR5	B-2	R12	B-1
CR6	C-2	R13	B-1
CR7	B-2	R14	B-1
CR8	B-2	R15	C-1
CR9	B-2	R16	B-1
CR10	C-8	R17	B-7
CR11	B-1	R18	B-8
CR12	C-1	R19	C-8
CR13	C-2	R20	B-8
CR14	B-8	R21	C-8
CR15	B-8	R22	C-1
CR16	B-8	R23	C-1
CR17	B-8	R24	C-1
CR18	C-2	R25	B-3
CR19	C-3	R26	C-3
CR20	C-3	R27	C-3
CR21	B-3	R28	B-4
F1	C-4	R29	B-4
F2	C-4	R30	B-4
F3	C-4	R31	B-2
Q1	B-1	VR1	C-8
Q2	B-1	VR2	B-1
Q3	B-1	VR3	C-8
Q4	B-7	VR4	C-2

Note: For complete reference designation prefix component designators with A5.

1200A-A-33A

Figure 8-41. Low Voltage Power Supply, A5, Component Identification

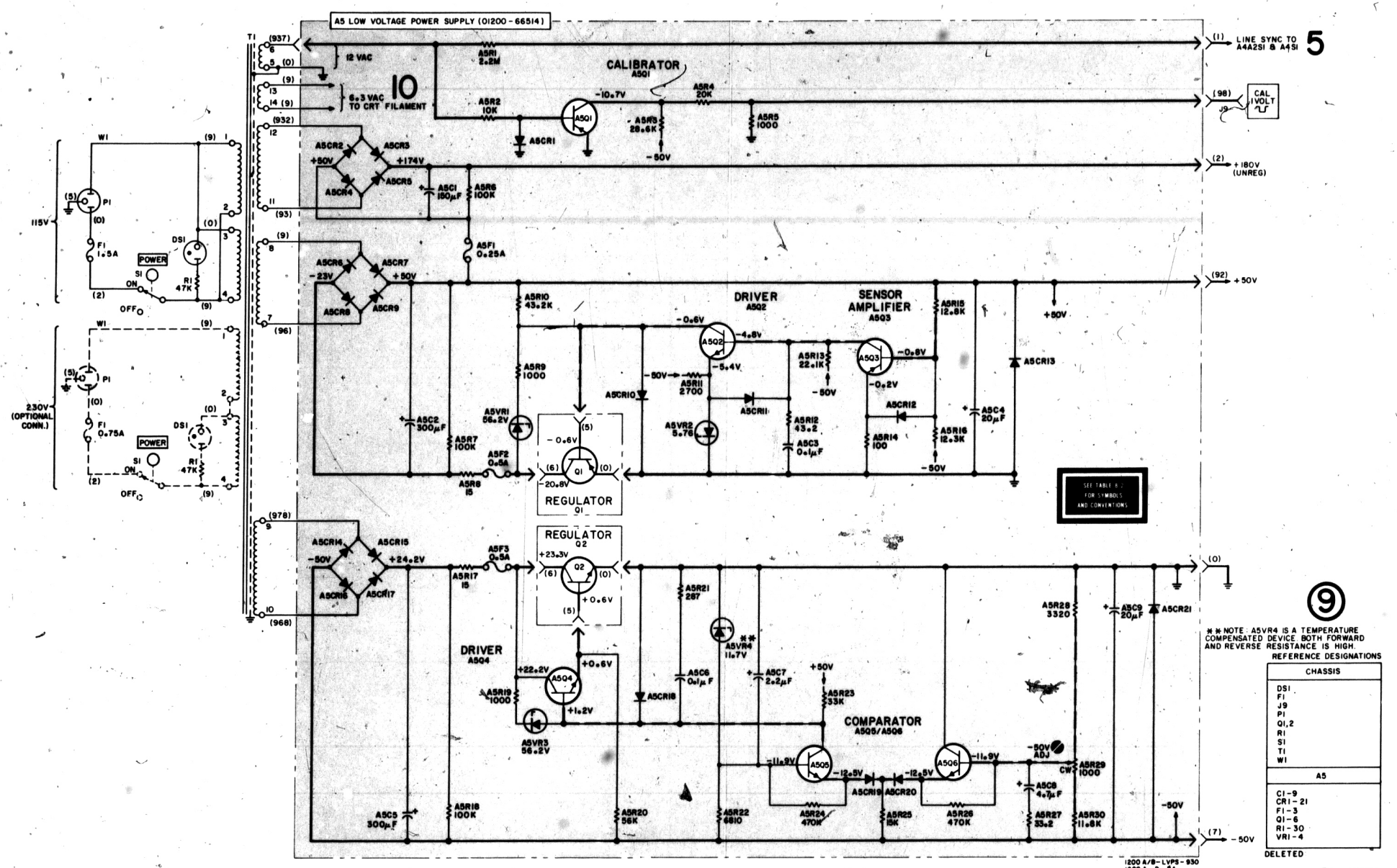
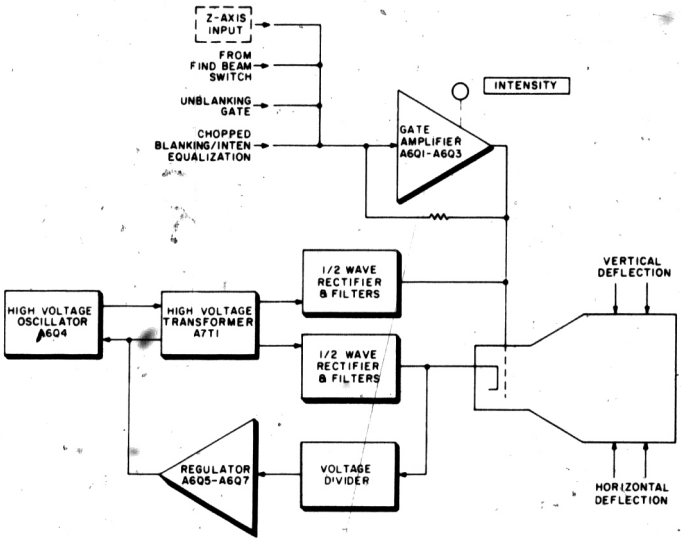
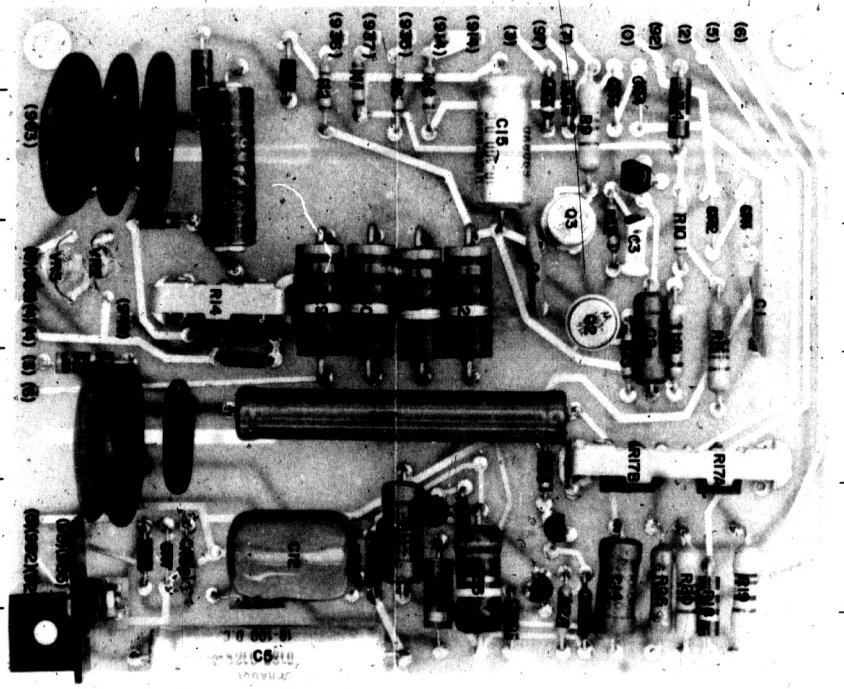


Figure 8-42.
Low Voltage Power Supply Schematic



1200A-8-11

Figure 8-43. High Voltage Power Supply Block Diagram

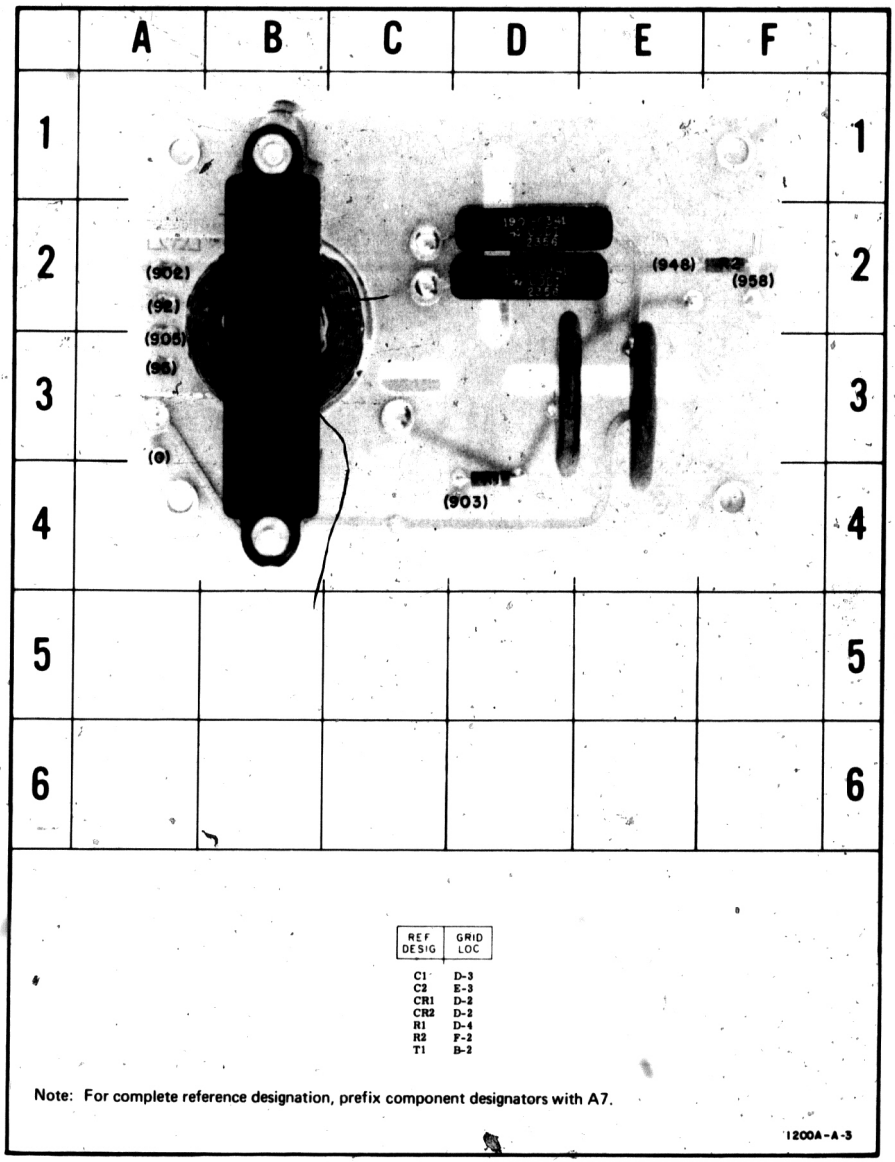


REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	J-3	C11	G-5	CR5	F-1	Q6	H-5	R8	I-3	R17A	I-4	R25	H-4	R34	I-2
C2	I-3	C12	F-5	CR6	E-5	Q7	H-5	R9	H-2	R17B	I-4	R26	I-5	R35	G-5
C3	I-3	C13	E-4	CR7	E-5	R1	F-1	R10	I-2	R18	I-5	R27	G-4	R36	E-5
C4	H-3	C14	I-5	CR8	F-4	R2	F-1	R11	I-3	R19	J-5	R28	D-4	R37	E-3
C5	F-6	C15	H-2	Q1	I-2	R3	H-1	R12	H-2	R20	I-5	R29	F-3	L1	G-5
C6	E-4	CR1	J-2	Q2	H-3	R4	H-1	R13	I-3	R21	H-6	R30	G-3	L2	F-5
C7	D-4	CR2	I-2	Q3	H-3	R5	G-1	R14	E-3	R22	F-5	R31	G-3	VR1	G-5
C8	E-2	CR3	I-1	Q4	D-5	R6	G-1	R15	E-2	R23	H-5	R32	G-3	VR2	D-3
C9	E-2	CR4	I-1	Q5	G-5	R7	E-1	R16	E-2	R24	H-5	R33	G-5	VR3	D-3
C10	D-2														

Note: For complete reference designation, prefix component designators with A6.

1200A-8-12

Figure 8-44. High Voltage Regulator, A6, Component Identification



REF DESIG	GRID LOC
C1	D-3
C2	E-3
CR1	D-2
CR2	D-2
R1	D-4
R2	F-2
T1	B-2

Note: For complete reference designation, prefix component designators with A7.

1200A-A-3

Figure 8-45. High Voltage Rectifier, A7, Component Identification

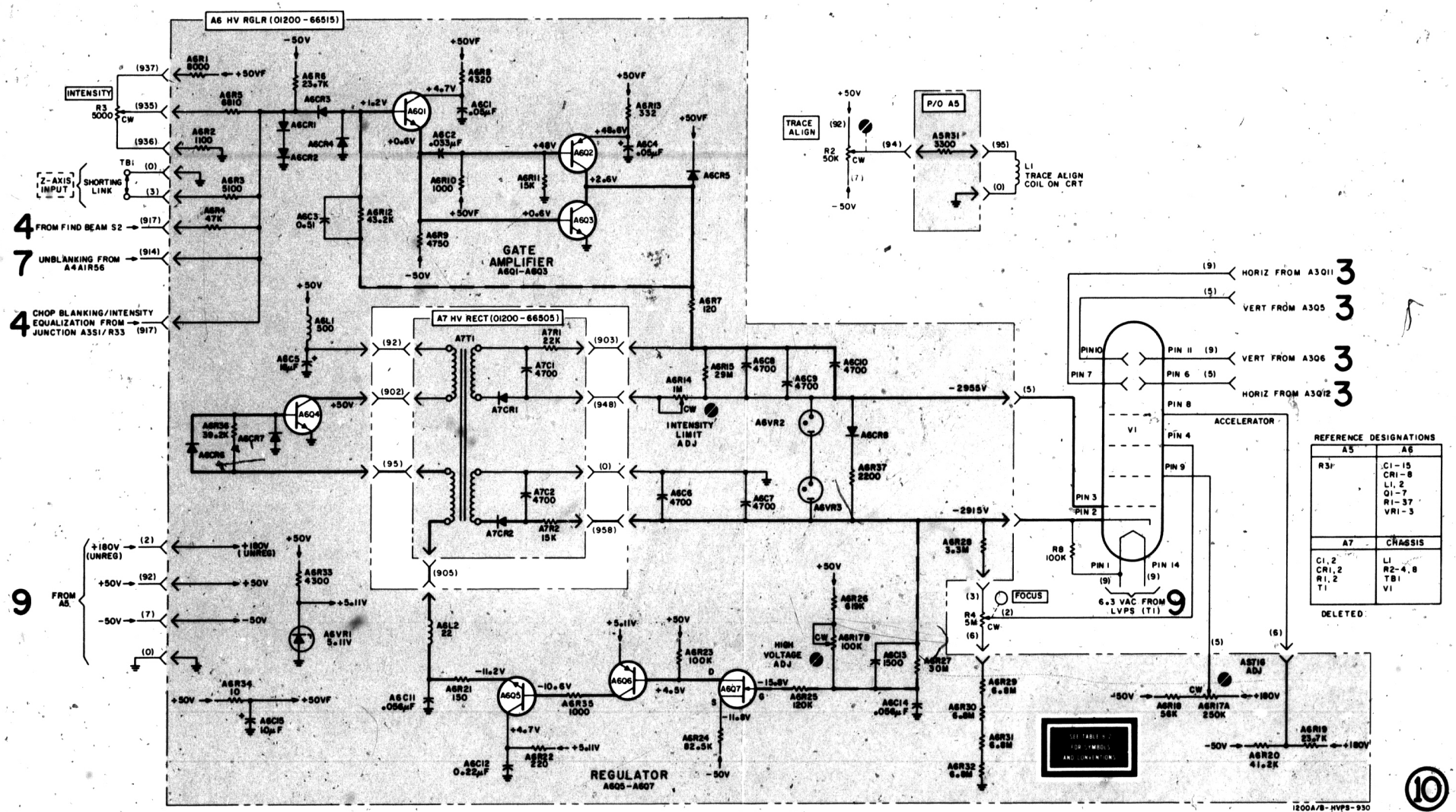


Figure 8-46.
High Voltage Power Supply Schematic
8-29/8-30

HEWLETT hp PACKARD

CATHODE-RAY TUBE WARRANTY

The cathode-ray tube (CRT) supplied in your Hewlett-Packard Oscilloscope and replacement CRT's purchased from hp are warranted by the Hewlett-Packard Company against electrical failure for a period of one year from the date of sale. Broken tubes and tubes with phosphor or mesh burns are not included under this warranty. If the CRT is broken when received, a claim should be made with the responsible carrier. All warranty claims with Hewlett-Packard should be processed through your nearest Hewlett-Packard Sales/Service Office (listed at rear of instrument manual).

We would like to evaluate every defective CRT. This engineering evaluation helps us to provide a better product for you. Please fill out the CRT Failure Report on the reverse side of this sheet and return it with the defective CRT to:

Hewlett-Packard Company
1900 Garden of the Gods Road
Colorado Springs, Colorado 80907

Attention: CRT QA

To avoid damage to the tube while in shipment, please follow the shipping instructions below; warranty credit is not allowed on broken tubes.

SHIPPING INSTRUCTIONS

It is preferable that the defective CRT be returned in the replacement CRT carton. If the carton or packaging material is not available, pack the CRT according to the instructions below:

1. Carefully wrap the tube in 1/4 inch thick cotton batting or other soft padding material.
2. Wrap the above in heavy kraft paper.
3. Pack wrapped tube in a rigid container which is at least 4 inches larger than the tube in each dimension.
4. Surround the tube with at least 4 inches of packed excelsior or similiar shock absorbing material; be sure the packing is tight all around the tube.

Thank you,

CRT Department

5950-7124

CATHODE-RAY TUBE FAILURE REPORT

DATE _____

FROM:

NAME _____

COMPANY _____

ADDRESS _____

1. hp INSTRUMENT MODEL NO. _____
2. hp INSTRUMENT SERIAL NO. _____
3. CRT SERIAL NO. _____
4. Please describe the failure and, if possible, show the trouble on the appropriate CRT face below.

_____

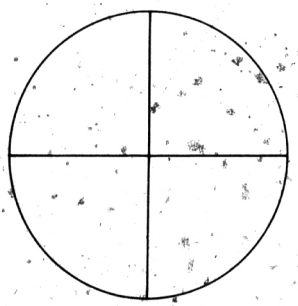
_____

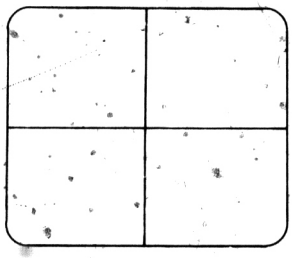
_____

_____

_____

CUT ALONG DOTTED LINE





5. Is the CRT within warranty? Yes_____ No_____
6. hp Sales/Service Office _____ Repair Order No. _____

02537-4

MANUAL CHANGES

MANUAL CHANGES

MODEL 1205A/B

DUAL TRACE OSCILLOSCOPE

Manual Serials Prefixed: 930–
Manual Printed: JULY 1970

Make all changes listed below as Errata. Check the following table for your instrument serial prefix and/or serial number and make listed change(s) to the manual:

Serial Prefix or Number	Make Changes
1045A (1205A only)	1
931– (1205B only)	1
1129A (1205A only)	1, 2
1127A (1205B only)	1, 2

Serial Prefix or Number	Make Changes
1152A (1205B only)	1, 2, 3
1202A (1205A only)	1, 2, 3

ERRATA

Add the following cautionary statement after the last paragraph in Section III:

CAUTION

This instrument is fitted with a plexiglass CRT safety faceplate (HP Part No. 5020-8728) for operator protection. To clean the CRT faceplate, use a soft cloth or tissue. Never use coarse or abrasive tissues because these will scratch the plexiglass.

Page 4-4, Figure 4-1,
Change: BAL resistor to FET A1A1Q1B stage to a fixed resistor. Delete the word BAL and the screwdriver adjust symbol.

Δ Page 5-7, Table 5-6,
150 mV pk-pk: Change to 1500 mV pk-pk in Ripple column.

Table 6-2,
A1A2R1: Change HP Part No. to 0698-8502.
A1A2R3: Change HP Part No. to 0698-8502.
A2A2R1: Change HP Part No. to 0698-8502.
A2A2R3: Change HP Part No. to 0698-8502.
A3R39: Change to HP Part No. 0757-0428, R:FXD MET FLM 1.62K OHM 1% 1/8W.
A3R40: Change to HP Part No. 0757-0751, R:FXD MET FLM 7.5K OHM 1% 1/4W.
A3R53: Change to HP Part No. 0757-0428, R:FXD MET FLM 1.62K OHM 1% 1/8W.
A3R54: Change to HP Part No. 0757-0751, R:FXD MET FLM 7.5K OHM 1% 1/4W.
A3R56: Change to HP Part No. 0757-0413, R:FXD MET FLM 392 OHM 1% 1/8W.
A4A1Q1, A4A1Q2, A4A1Q4, A4A1Q5: Change to HP Part No. 1854-0538.

Table 6-2 (Cont'd),
A4A1R12: Change to HP Part No. 0698-3640, R:FXD METOX 1800 OHM 5% 2W.
A4A2W1: Change HP Part No. and Mfr Part No. to 01200-61628.
A6MP2: Change to HP Part No. 01201-01101.
A6R14: Change to HP Part No. 2100-2692, R:VAR CERMET 1 MEGOHM 20% TYPE V 1/2W.
A6R26: Change to HP Part No. 0757-0791, R:FXD MET FLM 6.19K OHM 1% 1/4W.
A7CR1: Change to HP Part No. 1901-0683, DIODE: SILICON HV 10KV 5 MA.
A7CR2: Change to HP Part No. 1901-0683, DIODE: SILICON HV 10kV 5 MA.
F1 (2110-0080): Change to HP Part No. 2110-0020, FUSE: 0.8A 250V SLOW-BLOW (230V OPERATION).
MP49: Change to HP Part No. 01200-66521, TERMINAL BOARD: TRANSFORMER.
Add: MP56, HP Part No. 01200-64104, COVER: BOTTOM (1205A ONLY).
Add: MP 57, HP Part No. 01710-04103, COVER: TRANSFORMER.
Q1: Change HP Part No. to 1853-0079.
Q2: Change HP Part No. to 1854-0320.
Add: XQ1 and XQ2, HP Part No. 5060-0585, CABLE:TSTR Q1 AND Q2.
W2: (1205A only): Change to HP Part No. 01200-61626.

20 March 1975
Δ = Latest additions to this change sheet.
This change sheet supersedes all prior change sheets for this manual.

Supplement A for
01205-90902

ERRATA (Cont'd)

Page 7-1, Table 7-1,
Delete: Reference to Serial Prefix 930-.

Page 7-2, Paragraph 7-5, Option 006.
Replace entire paragraph with the following:
This standard option is available for Model 1205B only. Three rear panel connectors are added in parallel to front panel inputs: one each for CHANNEL A and CHANNEL B INPUTS, and one for TRIG & HORIZ INPUT. The input impedance specification is changed as follows: VERTICAL: 1 megohm shunted by approximately 100 pF for all ranges; HORIZONTAL: 1 megohm shunted by approximately 75 pF. Replaceable parts for Option 006 are listed in table 1 and schematic connections are shown in figure 3.

Page 8-11, Figure 8-12,
Change: A1R14 to A1A1R14.

Page 8-17, Figure 8-26,
A3R39: Change value to 1620.
A3R40: Change value to 7500.
A3R53: Change value to 1620.
A3R54: Change value to 7500.
A3R56: Change value to 392.

Page 8-19, Figure 8-30,
A4A1R12: Change value to 1800.

Page 8-21, Figure 8-34,
Add: A4A1R18 470K in line between top of A4A1R14 and top of A4A1R28.

Page 8-23/8-24, Figure 8-37,
Change: Value of A4A1C30 to .05 UF.

Page 8-29/8-30, Figure 8-46,
Add: A6R16 1M in line between bottom of A6R15 and bottom of A6C8.

CHANGE 1

Page 1-2, NOTE,
Change last line of note to read: have the beam finder intensification feature.
Page 1-4, Table 1-1, BEAM FINDER,
Insert after last line. The beam finder intensification feature has been disabled in instruments having a CRT with a P11 phosphor.
Page 2-1, Figure 2-1,
Replace with Figure 1, attached.
Page 3-1, NOTE,
Change last line of note to read: have the beam finder intensification feature.
Page 5-2, Paragraph 5-17, BEAM FINDER,
Add: The beam finder intensification feature has been disabled in instruments having a CRT with P11 phosphor.
Page 5-6a, Performance Check Record,
Insert in REFERENCE STEP 5-17d. P11 phosphor-defocused spot.
Table 6-2,
W1: (1205A only) Change HP Part No. to 8120-1538.
Table 6-2 (Cont'd),
W1: (1205B only) Change HP Part No. to 8120-1538.
MP45: Change HP Part No. to 01200-20502.
MP55: Change HP Part No. to 01200-60503.
Add: J10: Connector; Power HP Part No. 1251-2357. S3: Switch; Slide; DPDT HP Part No. 3101-1234.
Page 7-2, Option 011,
Add: A6. Change HP Part No. to 01200-66519: High Voltage Regulator Assembly.
A6R4: Delete HP Part No. 0684-4731: R: FXD COMP 47K OHMS 10% 1/4W. The intensification feature of the beam finder is disabled in this option.
Page 7-2, Option 611,
Add: A6: Change HP Part No. to 01200-66519: High Voltage Regulator Assembly.
A6R4: Delete HP Part No. 0684-4731: R: FXD COMP 47K OHM 10% 1/4W. The intensification feature of the beam finder is disabled in this option.
Page 8-27, Figure 8-42,
Replace T1 primary circuits with Figure 2, attached.

CHANGE 2

Page 6-17, Table 6-2,
DS1: Change to HP Part No. 1450-0419.

CHANGE 3

Table 6-2,
Δ MP18: Change to HP Part No. 01701-04108.
MP34: Change to HP Part No. 01205-00205.
Table 6-2 (Cont'd),
MP38: Change to HP Part No. 01200-04114.
MP51: Change to HP Part No. 01205-00206.
MP56: Change to HP Part No. 01200-64105.

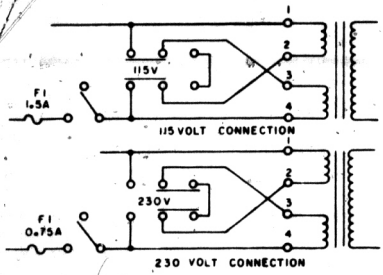


Figure 1. Primary Power Connections

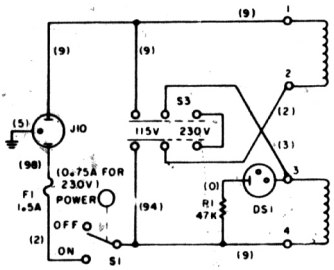


Figure 2. T1 Connections

Revision A

Table 1. Option 006 Replaceable Parts

Item	HP Part No.	TQ	Description
1.	1250-0063	2	Connector Hood, RF
2.	1250-0083	1	BNC Connector, female (HORIZ rear panel connector)
3.*	1251-0038	2	Connector, 3-pin, male
4.	1251-0039	2	Connector, 3-pin, female (VERT A and VERT B rear panel connectors)
5.*	1251-0040	2	Clamp
6.	8120-0093		Cable, red coax, 60-ohm
7.	8120-0094		Cable, green coax, 60-ohm
8.	8120-0095		Cable, white coax, 60-ohm
9.	01200-61621		Cable assembly, VERT A (includes items 1, 4, 6, and 8)
10.	01200-61622		Cable assembly, VERT B (includes items 1, 4, 7, and 8)

*Items 3 and 5 are external cabling mating connector hardware for item 4.

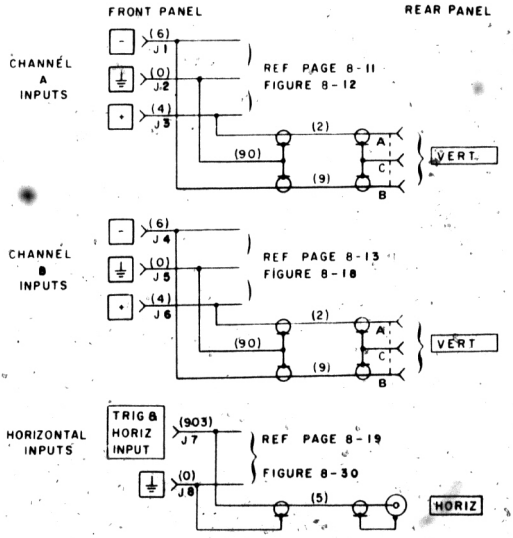


Figure 3. Option 006 Schematic Connections

SERVICE NOTES

SERVICE NOTE

Supersedes:

None

HP MODEL 1205A/B OSCILLOSCOPES

1205A Serial Numbers Below 1045A-00946
1205B Serial Numbers Below 0931A-00841

Increased Protection for Input Preamplifier Boards When Making Power Measurements

Ground for the front panel input terminal is connected thru a printed circuit strip on the preamplifier board to chassis ground. When making power measurements, it is possible to connect the hot line to the ground jack. The resulting excessive current will cause the printed circuit strip on the preamp. board to burn up and allow possible damage to the preamp. board circuitry.

To prevent this occurence, the ground lead from the input select switch is now being connected to chassis ground by using a ground lug at the stand-off terminal on the preamp. board.

Installation Procedure

1. Remove preamplifier assembly from chassis.

2. Install ground lug on stand-off at front of P. C. board.

3. Remove black wire connecting positive input select switch to preamp. board square pin.

   Replace this wire with a 2 1/2" black wire connecting input select switch to solder lug installed in step 2.

No changes are required in the adjustment procedure.

GR/bw/WO

5/71-08

HEWLETT hp PACKARD

For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181 West (213) 877-1282. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, 1217 Meyrin-Geneva

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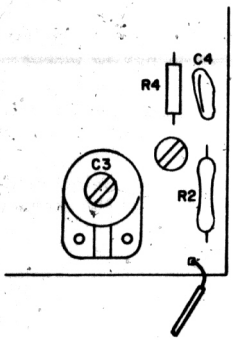
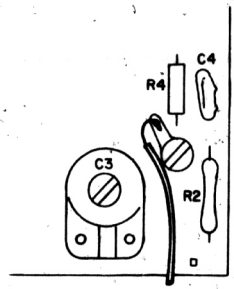
Original Configuration



New Configuration



Solder lug P/N 0360-0042

SERVICE NOTE

Supersedes:

None

HP MODEL 1205A/B OSCILLOSCOPE

All Serial Prefixes

PREFERRED REPLACEMENT FOR A6Q4

Preferred replacement for A6Q4, high voltage oscillator, is HP Part No. 1854-0582. This replacement will reduce the possibility of double-moding.

Lead configuration changes from ECB to EBC.

DB/mh/WN

10/73-08

HEWLETT hp PACKARD

For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181 • West (213) 877-1281. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, Post Office Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan, Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

Printed in U.S.A.

SERVICE NOTE

Supersedes:

None

HP MODEL 1205A/B OSCILLOSCOPES

All Serial Prefixes

NUT ADAPTER FOR INTENSITY POT

When ordering intensity pot, HP Part No. 2100-2663, also order the nut adapter, HP Part No. 1530-1340.

This replacement intensity pot is smaller than the old one and requires this adapter for proper fit.

RS/mh/WO

11/73-08

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