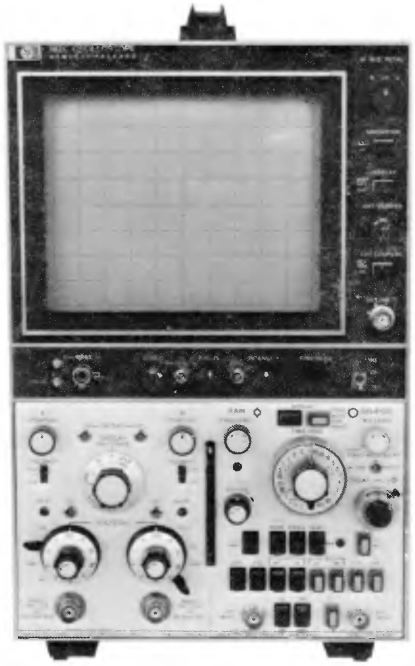
OPERATING AND SERVICE MANUAL

OSCILLOSCOPE

182C



HEWLETT hp PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

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

OPERATING AND SERVICE MANUAL

MODEL 182C
OSCILLOSCOPE

SERIALS PREFIXED: 1342A

Refer to Section VII for instruments with the following serial prefix numbers: **1311A, 1248A, 1241A, 1240A.**

Refer to Section VII for instruments with the following standard options: **001, 002, 003, 007, 010, 011, 013, 807, X95.**

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

Manual Part Number 00182-90906.
Microfiche Part Number 00182-90806.

PRINTED: FEB 1974

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

LIST OF ILLUSTRATIONS

LIST OF TABLES

Figure 1-1. Model 182C Oscilloscope

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and servicing information for the Hewlett-Packard Model 182C Oscilloscope. The manual is divided into eight sections, each covering a specific topic or aspect of the instrument. All schematics are located at the rear of the manual and can be unfolded and used for reference while reading any part of the manual.

1-3. This section contains complete instrument specifications (Table 1-1), a description of features, warranty information, data for manual and instrument identification, and information regarding accessories available for use with the instrument. Table 1-2 lists and describes the abbreviations used in this manual.

1-4. INSTRUMENT DESCRIPTION.

1-5. The Model 182C (Figure 1-1) is a solid-state, lightweight laboratory and general-purpose oscilloscope with plug-in capabilities. It is designed to display complex high frequency waveforms and to measure alternating- and direct-current voltages. Complete specifications are given in Table 1-1.

1-6. The Model 182C is a cabinet type instrument with a built-in tilt stand, convenient carrying handle on top, and feet mounted on both bottom and rear for either bench or upright operation. Controls are arranged and located to simplify operation.

1-7. For minimum size and weight with maximum reliability, the Model 182C has solid-state circuitry throughout except for the CRT. Power consumption, with plug-ins, is less than 120 watts at normal line voltage. The instrument is convection cooled and designed to operate within specifications at temperatures between 0° C and 55° C with up to 95% relative humidity at 40° C.

1-8. All power supplies, a dual output calibrator, a horizontal amplifier, a gate amplifier and the CRT are contained in this instrument. Operation at either 115V or 230V ac is selectable by a switch located on the rear panel of the oscilloscope. Located on the rear panel are connectors for main and delayed gate, and main and delayed sweep output signals. Connection for input of an external signal for intensity modulation (Z-axis input) is provided at the rear panel. An input signal of approximately +2V having a pulse width of greater than about 50 ns will blank a trace of normal intensity.

1-9. The Model 182C is designed to operate with a number of different plug-in vertical amplifiers and time bases. Presently available plug-ins provide a wide choice of operating capabilities such as wide bandwidth, sensitivities, dual or four-channel operation, single or delayed sweeps, sampling and time-domain reflectometer operation.

1-10. Modular type construction has been used throughout the instrument. This makes it easy and simple to remove units for quick maintenance. Assemblies are constructed with interconnecting plugs and jacks and each assembly can be removed without unsoldering connections.

1-11. A calibrator provides a square-wave signal of approximately 1 kHz with a risetime of less than 3 μsec. The calibrator output is available at the front panel at amplitudes of 250 mV and 10V p-p with an accuracy of ±1%. The signal may be used to check horizontal and vertical deflection factors and to compensate divider probes.

1-12. The oscilloscope horizontal amplifier accepts sweep signals from the time base plug-in or an external signal. Bandwidth is dc to 5 MHz, dc-coupled, and 5 Hz to 5 MHz with capacitive coupling. Two deflection factor ranges are front panel selectable: 1 V/div (X1), and 0.1 V/div ±5% (X10). In addition, a vernier control provides continuous adjustment between ranges. The maximum external input level is 300 Vdc, ac-coupled, with a dynamic range of ±20V.

1-13. A beam finder pushbutton control assists the operator in rapidly bringing a displaced beam on screen. Its use increases intensity and reduces vertical and horizontal amplifier gain to quickly locate trace position.

1-14. CATHODE-RAY TUBE.

1-15. The Model 182C uses a post-accelerator aluminized CRT with a large eight by ten division display area of 133 cm^2. Each division is 1.29 cm with 0.2-div subdivisions provided on the major axes. The graticule is internal to the CRT, eliminating display parallax. Option 011 instruments are provided with a P11 phosphor CRT. The display intensity will not increase when FIND BEAM is depressed. This prevents phosphor burn.

1-16. The standard CRT supplied with this instrument has a P31 aluminized phosphor. P2, P7 and P11 phosphors are also available as options.

1-17. WARRANTY.

1-18. This instrument is certified and warranted as stated on the inside front cover of this manual. The CRT is covered by a separate warranty. The CRT warranty and warranty claim form are located at the rear of this manual. Should the CRT fail within the time specified on the warranty, fill out the failure report form on the reverse side of the warranty statement and return it with the CRT. In all correspondence with a Hewlett-Packard Sales/Service Office concerning an instrument, reference the complete serial number and model of the instrument.

1-19. INSTRUMENT IDENTIFICATION.

1-20. Hewlett-Packard uses a two-section serial number for instrument identification (Figure 1-2). The first numerical group is the serial prefix number. It identifies a series of instruments. The last numerical group identifies a particular instrument in the series. The serial number appears on a plate located on the rear panel.

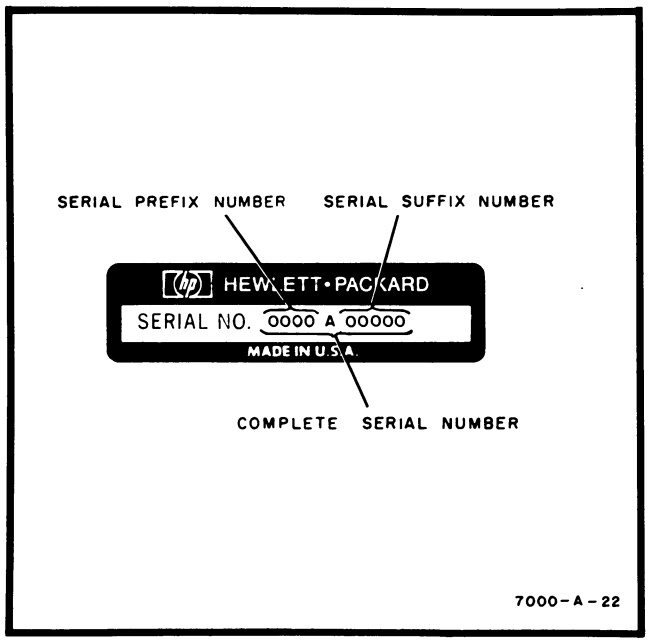


Figure 1-2. Instrument Identification

1-21. MANUAL IDENTIFICATION AND CHANGES.

1-22. This manual provides operating and service information for the HP Model 182C. Information in this manual applies directly to instruments (as manufactured) with a serial prefix as indicated on the title page. If the serial prefix of your instrument is different from that on the title page, a MANUAL CHANGES insert sheet, or Section VII of this manual will describe the changes necessary to adapt this manual to provide correct information.

1-23. Technical corrections (if any) to this manual due to known errors in print are called Errata and are shown on the manual changes sheet. For information on manual coverage of any HP instrument, contact the nearest HP Sales/Service Office (addresses are listed at the rear of this manual).

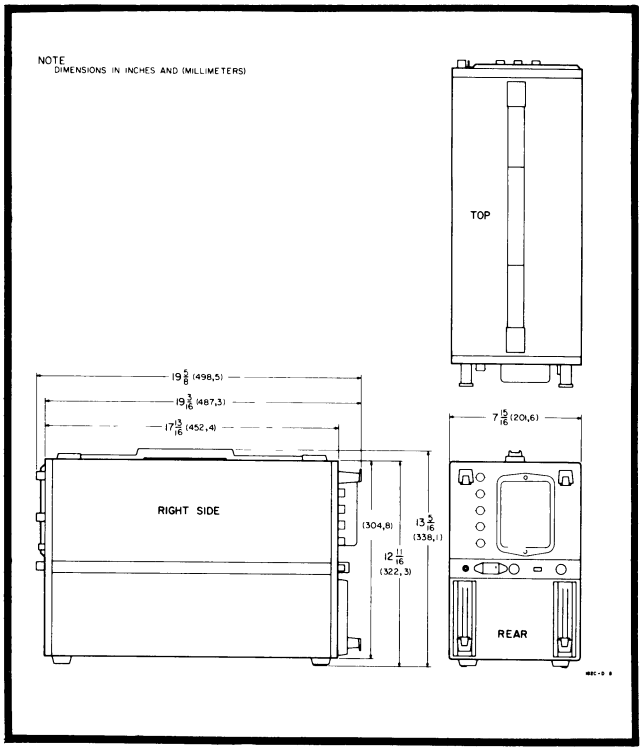


Figure 1-3. Model 182C Outline Dimensions

1-24. ACCESSORIES FURNISHED.

1-25. The Model 182C is equipped with a blue plexiglas contrast filter which provides improved viewing and greater contrast under ambient light conditions. The filter slides into place in the CRT bezel and may be removed if preferred.

1-26. A detachable power cord is supplied with each instrument. The three-conductor power cord and instrument receptacle conform to International Electrotechnical Commission (IEC) safety standards.

1-27. AVAILABLE ACCESSORIES.

1-28. A series of mobile test stands is available for the Model 182C. The Model 1118A is a portable tripod testmobile which provides adjustable height, tilt and rotation. It is also equipped with locking wheels and is readily collapsible for transport. The 1119-series testmobiles are general-purpose test stands designed for maximum utility while requiring a minimum of floor space. These testmobiles allow the instrument to be tilted at least 40 degrees above and below horizontal in 10-degree steps.

1-29. The Model 10172A cover, made of flexible material, covers the entire instrument. The cover top is slotted for access to the carrying handle.

Table 1-1. Specifications

CATHODE-RAY TUBE AND CONTROLS

TYPE:

Post-accelerator, 22 kV accelerating potential: aluminized P31 phosphor (other phosphors available, refer to Options).

GRATICULE:

8 x 10 div graticule. 0.2-div sub-div on major axes. 1 div = 1.29 cm. Front panel recessed screwdriver adjustment aligns trace with graticule. Scale control illuminates graticule for viewing with hood or taking photographs.

BEAM FINDER:

Returns trace to CRT screen regardless of setting of horizontal, vertical or intensity controls.

INTENSITY MODULATION:

Approx +2V, $\geqslant$ 50ns width ($\leqslant$ 10 MHz CW) will blank trace of normal intensity. Input R, approx 5k ohms. Maximum input voltage, ±20V (dc + pk ac).

CALIBRATOR

TYPE:

Approx 1 kHz square wave, $<$ 3 μsec risetime.

VOLTAGE:

Two outputs, 250 mV p-p and 10V p-p; accuracy, ±1%.

HORIZONTAL AMPLIFIER

EXTERNAL INPUT:

BANDWIDTH: DC-coupled, dc to 5 MHz; AC-coupled, 5 Hz to 5 MHz;

DEFLECTION FACTOR: X1, 1 V/div; X10, 0.1 V/div. Vernier provides continuous adjustment between ranges. Accuracy, ±5%.

DYNAMIC RANGE: ±20V.

MAXIMUM INPUT: 300V (dc + pk ac).

INPUT RC: 1 megohm shunted by approx 30 pF.

INTERNAL SWEEP:

SWEEP MAGNIFIER: X10; accuracy ±5%.

OUTPUTS

Four emitter follower outputs on rear for main and delayed gates, main and delayed sweeps, or vertical and horizontal outputs when used with sampling plug-ins; maximum current available, ±3 mA; outputs will drive impedances down to 1000 ohms without distortion.

GENERAL

WEIGHT:

(without plug-ins) net, 26 1/2 lb (12,02 kg); shipping, 38 1/2 lb (17,46 kg).

DIMENSIONS:

See outline drawing (figure 1-3).

ENVIRONMENT:

Temperature: 0° C to 55° C.

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

Altitude: Up to 15,000 ft.

Vibration: Vibrated in three planes for 15 minutes each with 0.010 inch excursion, 10 to 55 Hz.

POWER:

115V or 230V ±10%, 48 to 440 Hz. Approx 120 watts with plug-ins at normal line, 200 VA max.

ACCESSORIES FURNISHED:

Blue plexiglas contrast filter; power cord.

OPTIONS

Refer to Section VII for listing of options.

1-30. Waveform photography of the Model 182C display can be accomplished with the Model 10367A Camera Adapter. The adapter fits into the Model 182C bezel, replacing the contrast filter, for use with the Model 195A and Model 197A Oscilloscope Cameras.

1-31. A Horizontal Gain Calibrator, HP Model 10411A, facilitates rapid and accurate calibration of the horizontal deflection factor of the Model 182C. Also available is a Service Extender, HP Model 10133A, which is useful for troubleshooting the complete power supply module when removed from the oscilloscope mainframe.

1-32. For ease of calibration and maintenance, the HP Model 10407A Plug-in Extender can be obtained. It provides for removal of the vertical and time base plug-ins from the oscilloscope mainframe and exposes components and adjustments of the plug-ins for servicing.

1-33. Blank plug-ins are available for use with the Model 182C. These units fit into the oscilloscope vertical and time base compartments and provide the necessary interface connections and operating power for user designed vertical amplifier and/or time base circuitry. Refer to Section IV for the operating power available from the oscilloscope mainframe. The following units are available: HP Model 10408A Vertical Blank Plug-in, HP Model 10409A Horizontal Blank Plug-in, and HP Model 10410A Dual Blank Plug-in.

1-34. A metallic mesh contrast filter which functions as an RFI shield is available for the Model 182C. The mesh filter, HP Part No. 00182-62701, is directly interchangable with the standard blue plexiglas filter. When installed, the metallic mesh filter is electrically grounded to the oscilloscope chassis, thereby furnishing RFI shielding.

1-35. Cameras, probes, viewing hoods, terminations and other accessory items are available for specialized requirements. Information on these and the above described accessories may be obtained from HP Sales/Service Offices listed in the rear of this manual.

Table 1-2. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	= assembly	E	= misc. electrical part	P	= plug	U	= integrated circuit (unrepairable)
AT	= attenuator, resistive termination	F	= fuse	PS	= power supply	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor, fan	FL	= filter	Q	= transistor	VR	= voltage regulator (diode)
BT	= battery	H	= hardware	R	= resistor	W	= cable
C	= capacitor	J	= Jack	RT	= thermistor	X	= socket
CP	= coupling	K	= relay	S	= switch	Y	= crystal
CR	= diode	L	= inductor	T	= transformer	Z	= network
DL	= delay line	LS	= speaker	TB	= terminal board		
DS	= device signaling (lamp)	M	= meter	TP	= test point		
		MP	= mechanical part				

ABBREVIATIONS

A	= ampere(s)	FET	= field-effect transistor(s)	n	= nano (10^{-9})	rfi	= radio frequency interference
ampl	= amplifier(s)			nc	= normally closed		
assy	= assembly			no.	= normally open	rms	= root mean square
ampltd	= amplitude			npn	= negative-positive-negative	rwv	= reverse working voltage
		G	= giga (10^{9})				
bd	= board(s)	gnd	= ground(ed)	ns	= nanosecond		
bp	= bandpass					SCR	= silicon controlled rectifier
		H	= henry(ies)				
c	= centi (10^{-2})	hr	= hour(s)	p	= pico (10^{-12})	sec	= second(s)
C	= carbon	HP	= Hewlett-Packard	pc	= printed (etched) circuit(s)	std	= standard
ccw	= counterclockwise	Hz	= hertz				
coax.	= coaxial			pk	= peak	trmr	= trimmer
coef	= coefficient	if.	= intermediate freq.	pnp	= positive-negative-positive		
com	= common	intl	= internal	p/o	= part of	u	= micro (10^{-6})
CRT	= cathode-ray tube			p-p	= peak-to-peak	usec	= microsecond
cw	= clockwise	k	= kilo (10^{3})	prgm	= program		
				prv	= peak inverse voltage(s)	V	= volts
d	= deci (10^{-1})	lb	= pound(s)			var	= variable
dB	= decibel	lpf	= low-pass filter(s)	ps	= picosecond		
						w/	= with
ext	= external	m	= milli (10^{-3})	pwv	= peak working voltage	w/o	= without
		M	= mega (10^{6})			wiv	= working inverse voltage
F	= farad(s)	ms	= millisecond	rf	= radio frequency		

3/70

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section of the manual contains inspection and installation procedures for the Model 182C Oscilloscope. In addition, packing and claims procedures are discussed in the event damage occurs during shipment.

2-3. INITIAL INSPECTION.

2-4. The instrument was carefully inspected, mechanically and electrically, prior to shipment. On receipt, inspect it for any mechanical damage which may have occurred during shipment and test the electrical performance.

2-5. Check for physical damage such as bent or broken parts and dents or scratches. If damage is found, refer to the recommended claims procedure. Retain the packaging material for future use.

2-6. Check the electrical performance of the instrument as soon as possible after receipt. The performance check is contained in Section V of this manual. This check will verify that the instrument is operating to the specifications listed in Table 1-1.

2-7. The initial performance and accuracy of this instrument are certified as stated in the warranty on the inside front cover of this manual. If the instrument does not operate as specified, refer to the recommended claims procedure.

2-8. CLAIMS.

2-9. If physical damage is found or if the instrument is not within specifications when 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 a claim to be settled with the carrier.

2-10. The warranty statement for this Hewlett-Packard instrument is on the inside front cover of this manual. Contact the nearest Sales/Service Office for information and assistance with warranty claims.

2-11. REPACKING FOR SHIPMENT.

2-12. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag to it showing owner's name and address, instrument model number, and serial number, and a description of service required.

2-13. Use the original shipping carton and packaging materials for reshipment. If they are not available, repackage the instrument with the following materials:

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

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

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

d. Heavy-duty shipping tape to secure outside of carton.

Table 2-1. Shipping Carton Test Strength

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

2-14. PREPARATION FOR USE.

2-15. POWER REQUIREMENTS.

2-16. The standard Model 182C requires a 115 or 230 Vac ±10%, single phase, 48 to 440 Hz power source capable of supplying 200 VA maximum. It requires approximately 120 watts at normal line voltage with the plug-ins installed.

2-17. 115 VAC OPERATION. This instrument, as shipped, is ready for operation on 115 Vac. Before applying power, check the rear-panel slide switch, labeled SELECTOR, for proper position. Positioning it so that the legend 115 is visible connects the power transformer primary windings in parallel for 115 Vac operation. This also selects the proper fuse for this voltage.

2-18. 230 VAC OPERATION. If the instrument is to be operated from a 230 Vac power source, set the rear-panel SELECTOR slide switch to 230. This connects the

power transformer primary windings in series for 230 Vac operation and selects the proper fuse for 230 Vac.

2-19. THREE-CONDUCTOR POWER CABLE.

2-20. The National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded to protect operating personnel. The Model 182C is provided with a detachable three-conductor power cord which, when plugged into an appropriate outlet, grounds the instrument. The oscilloscope mainframe power jack and the mating plug of the power cord conform to International Electrotechnical Commission (IEC) safety standards.

2-21. When operating the Model 182C from a two-contact power outlet use a three-conductor to two-conductor adapter. Preserve the safety feature by grounding the adapter flexible (third) lead. A suitable three- to two-pin adapter is available from Hewlett-Packard. Order HP Part No. 1251-0048.

2-22. INSTRUMENT MOUNTING.

2-23. The Model 182C is intended for bench use. It has a built-in tilt stand and feet mounted on both bottom and rear for bench or upright operation.

2-24. To use the tilt stand, lift the front of the instrument or place it vertically on the rear feet. The tilt stand is folded and locked into place against the cabinet bottom cover. Hold the instrument steady and squeeze the two tilt stand legs together to release them from the lock. Pull the stand toward the front of the instrument. When fully forward, release the legs and they will lock into position. The tilt stand will support the instrument with the front elevated.

2-25. INSTRUMENT COOLING.

2-26. This instrument does not require forced-air cooling when operated at room temperature or between 0 to +55 degrees centigrade. Normal air circulation will maintain a reasonable operating temperature within the instrument.

2-27. Perforations in the two covers provide for the required air flow. Do not obstruct them. Provide several inches of clearance around the top, rear and sides. Adequate airflow from the bottom of the instrument is provided by the mounting feet.

2-28. CONTRAST FILTER.

2-29. The contrast filter is designed to be easily removed from the CRT bezel. Use of the light blue contrast filter provides comfortable viewing when the instrument is operated in normal and high ambient light.

2-30. To remove the contrast filter, as is desirable for photographing the display, grasp the top portion of the bezel frame and pull straight up. Remove the filter by lifting it straight up and out of the bezel. Figure 2-1 shows the filter being removed from the instrument.

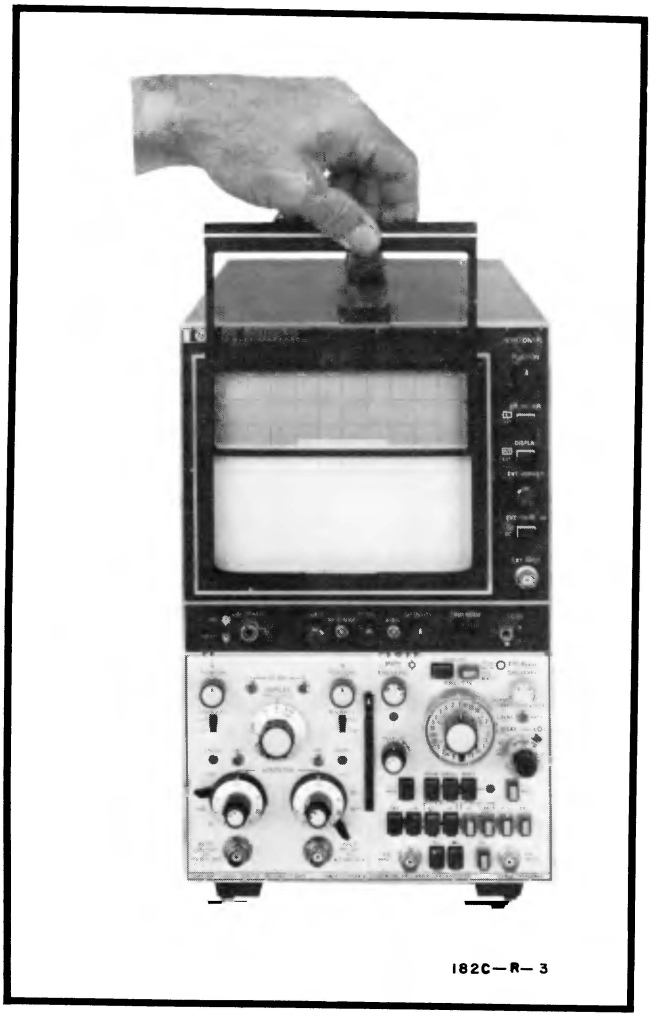


Figure 2-1. Contrast Filter Removal

2-31. CLEANING CRT FACEPLATE.

2-32. When the contrast filter has been removed, the CRT faceplate can be cleaned using a soft cloth or tissue. Never use coarse or abrasive tissues; these will scratch the plastic CRT faceplate.

2-33. INSTRUMENT COMPATIBILITY.

2-34. The Model 182C Oscilloscope is designed to operate with a wide variety of time base and vertical plug-ins. Table 3-1 lists the plug-ins currently available.

Note

Plug-ins specifically designed for use with the 500 MHz Model 183A/B Oscilloscope will not fit into or operate in the Model 182C. A mechanical interlock is provided on these plug-ins which prevents their full insertion into the Model 182C. Additionally, the Model 182C does not supply the required operating power.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section of the manual presents information on the operation, function and capabilities of the instrument controls. Information regarding control turn-on procedures and front panel adjustments is explained to assist the operator in properly setting up and using the Model 182C.

3-3. GENERAL.

3-4. The Model 182C is designed to operate with plug-in time bases, and vertical amplifiers or sampling and time domain reflectometers. These plug-ins are accommodated in the lower portion of the instrument. The required operating power is obtained from the oscilloscope mainframe. Time base and vertical amplifier units must be locked together before being installed in the mainframe.

3-5. The vertical amplifier is always installed in the left-hand side and the time base on the right-hand side of the mainframe compartment. Refer to the plug-in operating and service manuals for mating and installation instructions.

3-6. PUSHBUTTON SWITCHES.

3-7. Three switches are of the two position push-push type. These are: MAGNIFIER, DISPLAY and EXT COUPLING. The pushbuttons for these functions are color coded to indicate the function selected. When the released position is selected, the white skirt of the pushbutton is exposed. This corresponds to the control function on the panel outlined in white. For example: if MAGNIFIER is depressed, only the black portion of the pushbutton is visible. Magnification is therefore X10. When MAGNIFIER is released, the white skirt of the pushbutton can be seen and magnification is X1.

3-8. FRONT PANEL CONTROLS AND CONNECTORS.

3-9. All operating controls and front panel adjustments are identified and described in Figure 3-1. The information presented gives the operator a quick reference regarding the operating function of each. Additional information regarding some of these is explained below in greater detail.

3-10. CALIBRATOR.

3-11. The calibrator has two outputs, 10V and 250 mV peak-to-peak, negative-going from ground, with an amplitude accuracy of ±1%. The output is a square wave at a frequency of approximately 1 kHz. Risetime of the signal is less than 3 microseconds. These outputs are useful for checking vertical and horizontal sensitivity calibration, and divider probe calibration. A 3-way binding post provides a convenient ground connection point and may be used with banana plug, wire or spade lug connection.

3-12. SCALE.

3-13. This control adjusts the overall brightness of the CRT graticule. It should be adjusted for good contrast between the background and the graticule. The SCALE control is useful when using a hood to view the display or when photographing waveforms. Rotate the SCALE control counterclockwise to OFF when graticule illumination is not needed.

3-14. TRACE ALIGN.

3-15. This screwdriver adjustment is used to compensate for external magnetic fields that may affect alignment of the horizontal trace with the graticule. Use it to position the trace parallel to the graticule horizontal lines. The alignment should be checked when the instrument is moved to a new location and adjustment made whenever necessary.

3-16. FOCUS AND ASTIGMATISM.

3-17. These controls are used to obtain a display of uniform focus. Adjust both controls for the sharpest display possible.

3-18. FIND BEAM.

3-19. Occasionally the CRT beam may be driven off-screen by large dc input levels or improper control settings. Pressing the pushbutton increases intensity and reduces horizontal and vertical amplifier gains enough to always return a displaced beam to the viewing area. This enables the operator to determine the action necessary to center the display. All operating controls function while the FIND BEAM control is depressed. Obtaining a centered display may require adjustment of the deflection factor, horizontal and vertical position, coupling, trigger level or intensity for example. If the controls are properly set, the display will remain visible when FIND BEAM is released.

Note

Option 011 instruments do not increase intensity when FIND BEAM is pressed. Use the INTENSITY control to set intensity to viewing level.

3-20. LINE POWER SWITCH.

3-21. This toggle switch applies or removes ac line input power to the instrument. When ON, an indicator lamp, located immediately above the switch, is illuminated. Power for the lamp is obtained from the low voltage power supply. Both sides of the ac power line input are interrupted when switched to OFF.

3-22. HORIZONTAL EXTERNAL COUPLING.

3-23. An external input signal may be connected to the horizontal amplifier via the EXT INPUT BNC connector when DISPLAY is set to EXT. The EXT COUPLING switch is used to select ac coupling (capacitive coupling) to the amplifier for alternating voltages or dc coupling.

3-24. HORIZONTAL MAGNIFIER.

3-25. This pushbutton switch controls the gain of the horizontal amplifier. When switched from X1 to X10, the gain is increased ten times. For example, one volt into the horizontal amplifier EXT INPUT jack produces 1 division of deflection in X1 and 10 divisions of deflection in X10.

3-26. HORIZONTAL DISPLAY.

3-27. Either of two modes of operation can be selected with this switch. It selects the origin of the input signal applied to the horizontal amplifier. When INT is selected, the input signal to the horizontal amplifier is obtained from the time base plug-in. With the switch in EXT, the sweep signal input from the plug in is disconnected, and input to the horizontal amplifier is obtained from the EXT INPUT connector located on the front panel.

3-28. EXTERNAL VERNIER.

3-29. The deflection factor of an external input signal can be continuously varied to decrease deflection by a factor of approximately 10 by using this control. When the vernier is in the maximum clockwise position (CAL detent), the horizontal amplifier is calibrated to provide 1.0 V/div deflection in the X1 magnifier range and 0.1 V/div in the X10 range.

3-30. REAR PANEL CONTROLS AND CONNECTORS.

3-31. Rear panel controls and connectors are identified and described in Figure 3-1. Additional information regarding these is explained below in greater detail.

3-32. OUTPUTS.

3-33. Four BNC connectors on the rear panel of the Model 182C are provided to supply signals from the time base or sampling plug-in to external equipment. The low impedance outputs are isolated from the high impedance input signals. The period of the signal output is directly related to the main and delayed sweep speed selected for the time base plug-in or the vertical and horizontal outputs when used with sampling plug-ins. Refer to the Operating and Service Manual for the plug-in to determine signal identification.

3-34. The output of the MAIN SWEEP OUTPUT and the DELAYED SWEEP OUTPUT is a positive-going ramp of about 6 volts amplitude. The output of the MAIN GATE OUTPUT and the DELAYED GATE OUTPUT is a negative-going pulse of about 3 volts amplitude. These outputs can supply 3 mA and will drive impedances as low as 1000 ohms without distortion.

3-35. Z-AXIS INPUT.

3-36. An external signal can be utilized to control the CRT intensity. The intensity modulation signal is applied directly to the CRT intensity gate amplifier. A pulse of approximately +2V amplitude and a width of at least 50 nanoseconds or a +2V continuous wave (cw) input of 10 MHz or lower will blank a trace of normal intensity. Input of a negative signal can be used for display intensification.

3-37. AC LINE INPUT.

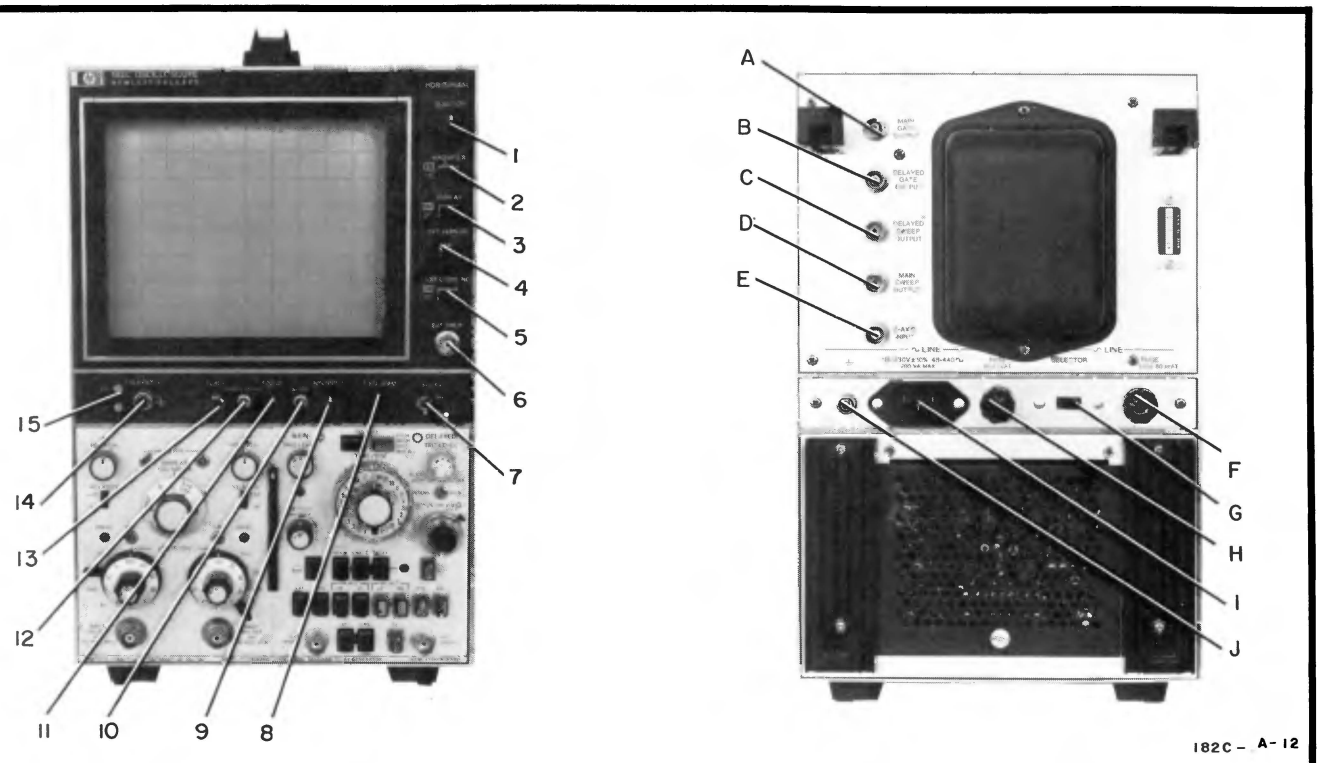
3-38. A three-conductor ac power cord is provided for ac input. A power line ground is obtained through the power cord. Also located on the rear panel is the SELECTOR line slide switch, which allows operation from either 115V or 230V ac power line. Fuses are provided for both 115V and 230V operation.

3-39. PHASE/BANDWIDTH SWITCH.

3-40. A PHASE/BANDWIDTH switch is located within the instrument on the horizontal amplifier assembly. The instrument top cover must be removed for access to this switch. Positioning the PHASE/BANDWIDTH switch to PHASE causes the horizontal input signal to be delayed the same amount of time as the vertical input signal. This delay allows the Model 182C to be used for phase measurement. The switch should always be in the BANDWIDTH position unless the instrument is being used for phase measurement.

3-41. PHASE MEASUREMENT.

3-42. Channel A of multi-channel vertical plug-ins should be used when making phase measurements. When a different channel (other than A) is to be used, the oscilloscope horizontal amplifier should be properly adjusted for that channel. Section V of this manual contains the adjustment procedure. Accurate phase measurements may be made at frequencies up to 100 kHz.



1. POSITION. Single knob provides coarse and fine adjustment of display's horizontal position.
2. MAGNIFIER. Determines gain of horizontal amplifier.
3. DISPLAY. Selects source of horizontal input signal.
4. EXT VERNIER. Provides continuous adjustment of deflection factor for external horizontal input signals. In CAL detent position, deflection factor is selected by Magnifier switch position.
5. EXT COUPLING. Selects AC or DC coupling for external horizontal input signal.
6. EXT INPUT. BNC connector for coupling an external horizontal input signal to horizontal amplifier.
7. LINE. Toggle switch with indicator light for turning oscilloscope on and off.
8. FIND BEAM. Intensifies trace and always returns display to on-screen.
9. INTENSITY. Controls brightness of display.
10. ASTIG. Adjusts roundness of writing beam.
11. FOCUS. Adjusts writing beam for sharpest trace.
12. TRACE ALIGN. Rotates trace around longitudinal axis of CRT.
13. SCALE. Controls graticule illumination.
14. Ground Connector. Provides a chassis ground connection point.
15. CALIBRATOR. Provides a 1-kHz square wave at two amplitudes: 250 mV and 10V p-p.

A. MAIN GATE OUTPUT. BNC connector for main gate signal to external equipment.

B. DELAYED GATE OUTPUT. BNC connector for output of delayed gate signal to external equipment.

C. DELAYED SWEEP OUTPUT. BNC connector for output of delayed sweep signal to external equipment.

D. MAIN SWEEP OUTPUT. BNC connector for output of main sweep signal to external equipment.

E. Z-AXIS INPUT. BNC connector for input of CRT intensification or blanking signal.

F. FUSE. 230V operation ac line fuse.

G. SELECTOR. Provides for external selection of line operating voltage.

H. FUSE. 115V operation ac line fuse.

I. Power Connector. 3-wire ac power line input.

J. Ground Connector. Provides a chassis ground connection point.

Figure 3-1. Front and Rear Controls and Connectors

3-43. To measure phase, set the internal PHASE/ BANDWIDTH switch to PHASE and connect the input signals to the vertical amplifier Channel A input and the oscilloscope HORIZONTAL EXT INPUT. Set the HORIZONTAL DISPLAY to EXT. A display similar to Figure 3-2 will be observed. The size of the opening of the display is a relative indication of the phase difference of the input signals.

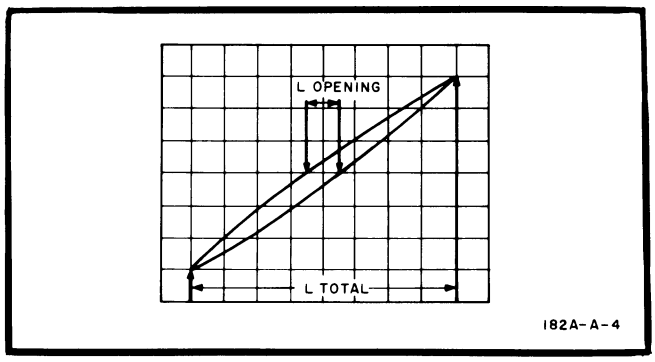


Figure 3-2. Phase Measurement

3-44. To obtain a more exact measurement of the phase difference, center the display in the X-axis and Y-axis. Increased measurement accuracy will be obtained by using horizontal and vertical deflection factors which result in maximum display size. The phase shift in degrees is determined by the following:

$$\emptyset = \sin^{-1}\left(\frac{L\ \text{opening}}{L\ \text{total}}\right)$$

As an example, assume that L total is 8 divisions. If L opening is 1 division, the phase shift is approximately 7 degrees.

Note

Make certain that the switch is returned to BANDWIDTH position after making phase measurements. This will allow normal operation.

3-45. PLUG-IN UNITS.

3-46. The Model 182C Oscilloscope requires time base and vertical or sampling plug-in units. The deflection sensitivity of the CRT may vary slightly with different units. Vertical plug-ins should be calibrated when first installed or when shifted between oscilloscopes. The time base and vertical plug-ins must be locked together prior to insertion into the Model 182C. Consult the respective plug-in Operating and Service Manuals for operation and capability information. Table 3-1 lists the plug-ins currently available.

Table 3-1. Available Plugins

Vertical Plug-ins								Sampling (Vertical Section)		
Model No.	**1801A**	**1803A**	**1804A**	**1805A**	**1806A**	**1807A**	**1808A**	**1810A**	**1815A/B**	**1811A**
Bandwidth MHz	50	40 (30)	50	100	0.5	35	75	1 GHz	4 or 12.4 GHz	4 or 18 GHz
Min. deflection factor/div	5 mV (500 uV opt 001 cascaded)	10 mV (1 mV cascaded)	20 mV	5 mV	100 uV	10 mV	5 mV	2 mV	5 mV	2 mV
Channels	2 (opt 001, 1 cascaded)	1 diff	4	2 (1 cascaded)	2 (both diff)	2	2	2	1	2
Input RC	1 MΩ/ 25 pF	1 MΩ/ 27 pF	1 MΩ/ 25 pF	1 MΩ/ 13 pF or 50Ω	1 MΩ/ 45 pF	1 MΩ/ 27 pF	1 MΩ/ 12 pF or 50Ω	50Ω	50Ω	50Ω
Differential input	yes	yes (with dc offset)	no	yes	yes	yes	yes	yes	no	yes

Time Base Plug-ins					Sampling (Time Base Section)			TDR	
Model No.	**1820C**	**1821A**	**1824A**	**1825A**	**1810A**	**1815A/B**	**1811A**	**1818A**	**1815A/B**
Ext Trig Freq. (MHz)	150	100	150	150	<1 GHz	18 GHz with trigger countdown	18 GHz with trigger countdown	<160 ps risetime	<35 ps risetime
Int Trig Freq.	Determined by Vertical Amplifier Plug-in				1 GHz			TDR System	TDR
Sweep Speeds/div	5 ns* 1 sec	10 ns* 1 sec	5 ns* 1 sec	5 ns* 1 sec	100 ps (expanded) - 50 usec	10 ps - 1 usec	10 ps (expanded) - 1 usec	Calibrated in feet, meters, and nanoseconds	1815A calibrated in feet, 1815B calibrated in meters.
Delayed and mixed sweep	No	Yes	Expanded X100	Yes	No	No	No		

*Includes X10 mainframe magnification.

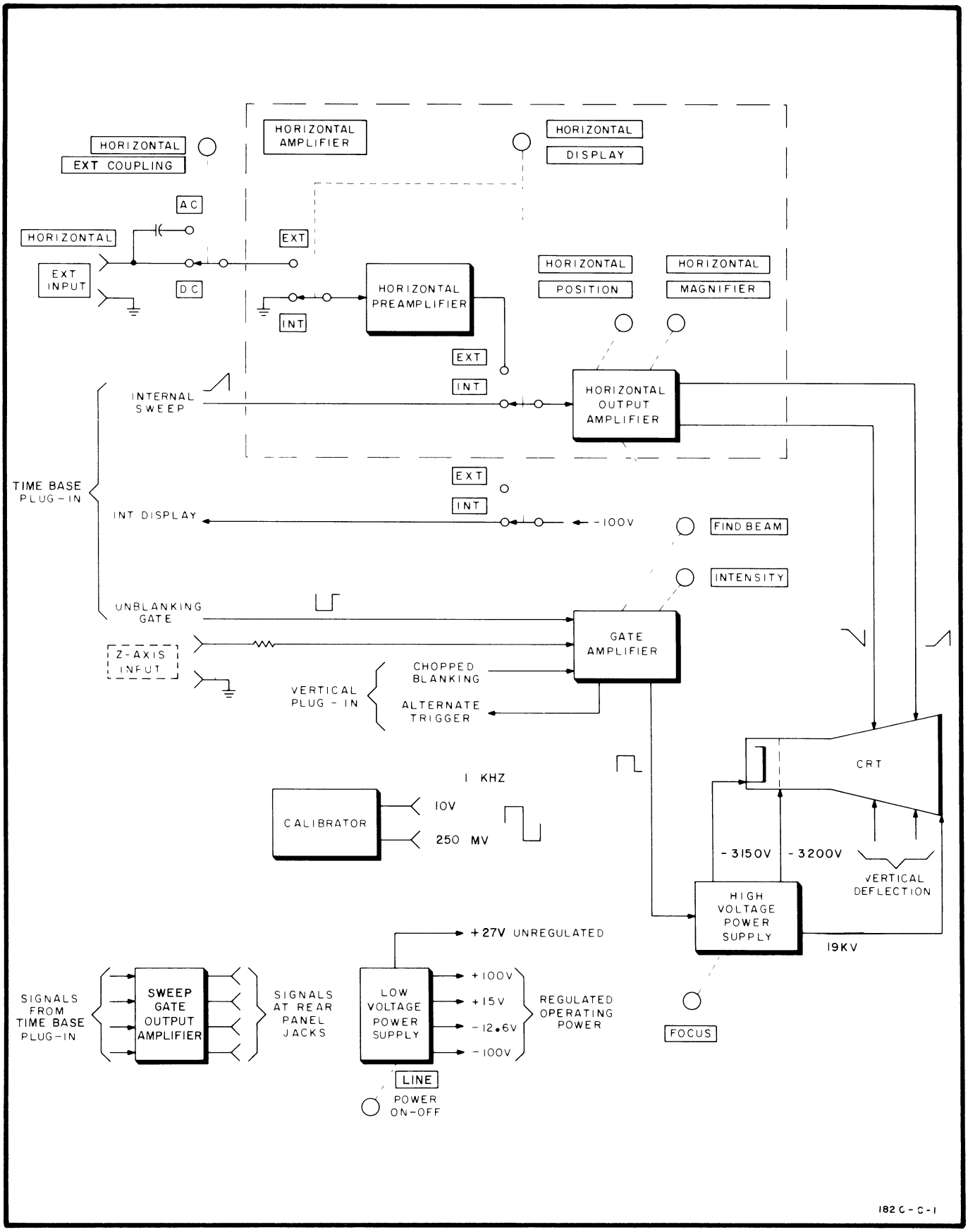


Figure 4-1. Overall Block Diagram

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section provides information about the circuits used in the Model 182C and how they operate. Refer to the overall block diagram (Figure 4-1) and the schematics in Section VIII while reading the text.

4-3. GENERAL DESCRIPTION.

4-4. The Model 182C is an X-Y axis display instrument designed to be used with a plug-in vertical amplifier and a plug-in time base generator. The instrument contains the CRT and its controls, low voltage and high voltage regulated power supplies, a horizontal amplifier, and a gate amplifier. A sweep-gate output amplifier and a calibrator are also included.

4-5. To obtain a useful display on the CRT, three signals are necessary: vertical deflection, horizontal deflection and intensity. The signal required for vertical deflection (Y-axis) of the CRT is supplied from a plug-in vertical amplifier. This signal is connected directly to the CRT vertical deflection plates. The horizontal (X-axis) deflection signal is generated by the time base plug-in. It is further amplified by the oscilloscope horizontal amplifier before being applied to the CRT horizontal deflection plates.

4-6. The signal for CRT intensification must be time coincident with the horizontal deflection signal to increase the CRT brightness as the beam is swept through the CRT display area. This intensity determining signal is called the unblanking gate. It is developed in the time base plug-in and amplified by the gate amplifier for application to the CRT control grid.

4-7. Signals for horizontal deflection and intensity modulation may also be applied to the oscilloscope from external sources other than the plug-in units. External input jacks are provided for this purpose.

4-8. INPUT POWER.

4-9. Either 115V or 230V ac (±10%) single phase, 48 to 440 Hz, can be applied as operating power. A rear-panel SELECTOR switch allows operation from either input line voltage. This switch connects two windings of the instrument power transformer in parallel for 115V operation. The SELECTOR switch also selects the proper size fuse for 115V or 230V operation. It is not necessary to change fuses.

4-10. With power applied to the power transformer primary windings, several secondary voltages are produced. Rectified, filtered and regulated as required, they are used as the source of power for the various circuits of the oscilloscope and for operation of the vertical and time base plug-ins.

4-11. HORIZONTAL DEFLECTION.

4-12. The horizontal amplifier may be used with either internal or external deflection signal sources. Positioning the HORIZONTAL DISPLAY switch to INT arranges the circuitry to operate from signals supplied from the time base plug-in. In this condition the –100V power is applied to the plug-in, allowing it to operate and produce both a sweep signal and an unblanking gate signal.

4-13. The sweep signal from the time base plug-in is coupled to the oscilloscope horizontal output amplifier. Here it is converted to a differential signal, amplified and applied to the CRT horizontal deflection plates.

4-14. Horizontal position of the X-axis sweep signal is controlled at the input to the first stage of the horizontal output amplifier. A two section potentiometer, mechanically interconnected, is used to provide both fine and coarse positioning controls from a single knob.

4-15. Horizontal amplifier gain is controlled by the MAGNIFIER switch. Two settings can be selected: X1 or X10. With X1 selected, the sweep speed corresponds to the selected time base plug-in sweep speed. In X10 operation the sweep speed is ten times that selected at the time base plug-in.

4-16. The unblanking gate from the time base plug-in is coupled to the gate amplifier where it is summed with the Z-axis input and chopped blanking signals (if they are applied). The resulting signal is amplified and coupled through the high voltage supply to the CRT control grid to set the intensity of the displayed signals.

4-17. At the end of each unblanking gate the gate amplifier produces an alternate trigger signal. This signal is coupled to the vertical plug-in and is a negative-going pulse. The alternate trigger is used by the vertical plug-in to synchronize the channel switching of multichannel vertical plug-ins.

4-18. With the HORIZONTAL DISPLAY switch set to EXT, operating power (-100V) is removed from the time base plug-in. Without this –100V, the time base plug-in does not produce an internal sweep signal or an unblanking gate.

4-19. An externally applied signal for horizontal deflection may be connected to the EXT INPUT jack. The EXT VERNIER controls the externally applied signal and provides a variable gain adjustment for setting the X-axis display size. The EXT COUPLING switch provides for either direct (DC) or capacitive (AC) coupling of the external input signal. The external signal is then coupled to a preamplifier, differentially amplified by the output amplifier and applied to the CRT for horizontal deflection. Positioning and horizontal gain controls also function with external input signals.

4-20. CIRCUIT DETAILS.

4-21. INPUT POWER.

4-22. Input line power is supplied by a detachable three conductor power cord. This cord has a standard plug for wall outlet connection providing an electrical ground. Instrument power input is via a rear-panel IEC connector. Both sides of the line power are filtered immediately at the power input connector.

4-23. The line power transformer has two primary windings. SELECTOR switch A4S1 connects these windings in parallel for 115V operation and in series for 230V operation. When set for use with a 115V source of line power, fuse A4F1 protects against excessive input current. When operated on 230V line power, fuse A4F2 is also placed in the primary power circuit. With the front panel LINE toggle switch A2S1 in the ON position, power is applied to the low voltage power supply transformer and LINE lamp A2DS1 lights.

4-24. LOW VOLTAGE POWER SUPPLY.

4-25. The low voltage supply produces four regulated voltages for use throughout the oscilloscope and the plug-ins: +100V, −100V, +15V and −12.6V. Each supply is referenced to the +100V supply for regulation purposes, with the +100V supply referenced to a 9-volt temperature compensated zener diode A1A2VR2. The +100V and −100V supplies are also foldback current limited, providing short-circuit protection.

4-26. A simplified block diagram of a typical low voltage power supply is shown in Figure 4-2. Unregulated alternating power is supplied by the transformer, bridge rectified and filtered. Changes in output voltage caused by input voltage variation or load changes are detected by the voltage sensor. Compared against a voltage reference, changes in output voltage are detected and applied as feedback to the driver which controls the series regulator. The series regulator acts as a variable resistance, and operates to increase its series resistance if the output voltage is high or decreases resistance when the output voltage is low. The action of the series regulator is to maintain output voltage at a constant level.

4-27. Current sensing takes place simultaneously with voltage sensing. If the load current increases above a pre-set level, the current sensor detects the increased voltage drop across the series resistor. This increased voltage causes the driver to bias the series regulator off.

4-28. +100-VOLT SUPPLY. The +100V supply is used throughout the LVPS as a reference for the other supplies. It is both voltage and current regulated. Refer to the LVPS schematic while reading the following explanation.

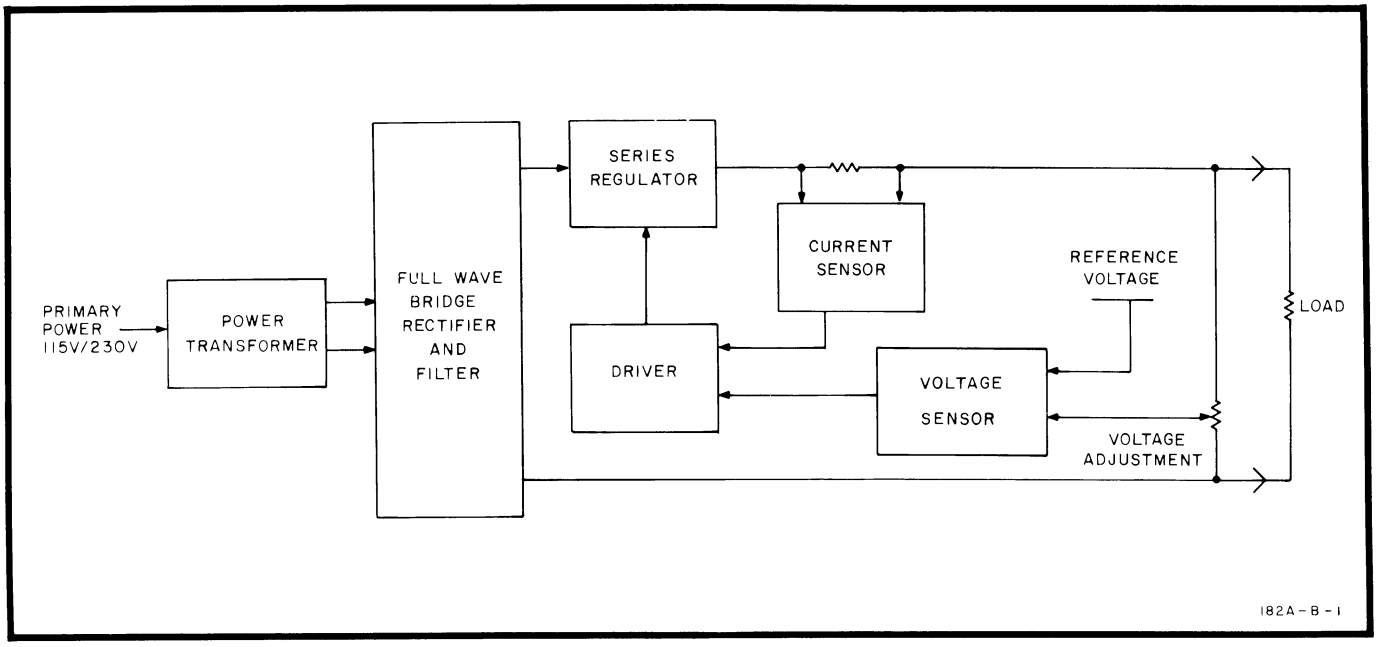


Figure 4-2. Simplified Low Voltage Power Supply

4-29. One of the secondary outputs of A1T1 is coupled to a full-wave bridge rectifier consisting of A1A1 CR5-CR8. The rectified voltage is filtered by A1C1, and applied through fuse A1F1 to the regulator assembly. Fusing protects the rectifiers and transformer if a regulator malfunction results in excessive current flow. The regulator supplies sufficient current to the load to keep the output voltage at a constant +100 volts. Series regulator A1Q1 controls load current in order to maintain the output voltage at +100V. Variations in output voltage due to changes in load or input line voltage are sensed by differential comparator A1A2Q3 and Q4. If the output of the +100V supply changes, the full amount of the voltage change is applied to A1A2Q3 by A1A2VR2, and A1A2Q4 senses only a small part of the change in output voltage. The +100V adjustment potentiometer A1A2R11 sets the operating point of A1A2Q4. The output of the differential comparator is coupled to driver A1A2Q1, amplified and used to control series regulator A1Q1.

4-30. A current limiting function is also part of the +100V supply operation. All current furnished by the supply flows through A1A2R4. The voltage drop across this resistor depends on the amount of current required. As the current requirements increase to the limit of the supply capability, the voltage drop across A1A2R4 is used to set A1A2Q2 into conduction. Since the collector of this transistor and the output of differential comparator A1A2Q2 and Q4 are coupled to drive A1A2Q1, the amount of current flowing as well as voltage variations control the operation of series regulator A1Q1.

4-31. Resistors A1A2R2 and R3 are used in conjunction with A1A2R4 to set up a condition for current foldback operation. In this type of operating condition, fully regulated voltage will be provided to the limit of the supply capability. When current exceeds capability, the output voltage will begin to drop and the load will receive less current. If the output of the supply is short-circuited, the output current will be limited to considerably less than the current available at full loading.

4-32. The +100V supply is protected for turn-on and turn-off voltage transients. Diodes A1A2CR1 and A1A2CR2 provide transient protection for the differential amplifier, A1A2Q3 and A1A2Q4. To prevent the +100V supply from going negative in the event of an accidental short circuit (during troubleshooting, for example), diode A1A2CR3 provides reverse voltage protection.

4-33. A separate supply is used to obtain voltage for the +100V regulator. This supply is used only within the LVPS regulator. The ac voltage from pins 11 and 12 of A1T1 is bridge rectified by A1A1CR1-CR4 and filtered by A1A1C1. The supply produces about +10V which is added to the +100V supply to provide a reference source for the +100V regulator. Zener diode A1A2VR1 stabilizes the collector voltage for A1A2Q3.

4-34. +15-VOLT SUPPLY. This supply provides three voltages. Approximately 30Vac p-p is furnished for time base line synchronization; an unregulated +27V is furnished for operation of the HV oscillator; and a regulated +15V is produced for use in the mainframe and plug-ins.

4-35. The secondary voltage developed by the power transformer at pins 13 and 14 is rectified by full-wave bridge A1A2CR9-A1A2CR12 and filtered by A1C2. Diode A1A1CR21 provides reverse voltage protection. Series regulator A1Q2 controls the amount of load current in order to maintain the output voltage at +15V. Variations in output voltage are sensed by differential comparator A1A2Q7 and A1A2Q8. A reference voltage derived from the +100V regulated supply is applied to A1A2Q7, while A1A2Q8 samples any change in output voltage due to load changes. The +15V adjustment potentiometer A1A2R20 sets the operating point of A1A2Q8. The output of the differential amplifier is coupled to driver A1A2Q5 and used to control the series regulator.

4-36. Load current flows through A1A2R13. The voltage drop across this resistor is used to control the conduction of A1A2Q6, which has its collector coupled to driver A1A2Q5. Thus, both current variations sensed by A1A2Q6 and voltage changes sensed by the differential amplifier are coupled to the driver A1A2Q5 to control series regulator A1Q2. Protection from turn-on or turn-off transients is provided by A1A2CR4. Fuse A1F2 protects the +15V rectifier and transformer in the event of a regulator short circuit.

4-37. −12.6-VOLT SUPPLY. This supply operates in a manner similar to the +15V supply. Changes in output voltage are sensed by differential comparator A1A2Q11 and A1A2Q12 and coupled to driver A1A2Q9 which controls the conduction of series regulator A1Q3. Current limiting action is provided by A1A2R22 and A1A2Q10. Fuse A1F3 protects against damage due to regulator failure and A1A2CR5 is used for voltage transient protection.

4-38. −100-VOLT SUPPLY. Operation of the −100V supply is similar to the +100V supply. A1A2Q15 and A1A2Q16 operate as a differential comparator, with A1A2Q16 sensing any change in output voltage. Transistor A1A2Q14 with A1A2R33 provides current limiting. Current foldback operation reduces the current output in the event of a short circuited load. Voltage and current variations are coupled to driver A1A2Q13 which controls the conduction of series regulator A1Q4. Adjustment of the supply output voltage is accomplished with potentiometer A1A2R40. Voltage transient protection is furnished by A1A2CR6, while A1A2CR7 provides reverse voltage protection.

4-39. SUPPLY CURRENT AVAILABLE. The oscilloscope power supplies may be used to furnish operating power for vertical or time base plug-ins designed by the

user. Table 4-1 lists the maximum current available from each power supply to the plug-in compartment of the oscilloscope. There is no minimum current requirement for any supply.

Table 4-1. LVPS Current Capabilities

Power Supply	Maximum Safe Current Available
+100 VDC	160 mA
+ 15 VDC	750 mA
− 12.6 VDC	750 mA
−100 VDC	80 mA

4-40. GATE AMPLIFIER.

4-41. The inputs to the gate amplifier are an unblanking gate from the time base plug-in, a chopped blanking signal from the vertical amplifier plug-in and an externally input Z-axis signal. These three signals may be present singly or simultaneously, depending on control settings and signals applied.

4-42. The unblanking gate is first applied as a current to A7Q1, a common base amplifier, then combined in the low impedance emitter circuit of A7Q5 with a current established by the INTENSITY, FIND BEAM, and EXT DISPLAY front-panel controls. Depressing FIND BEAM shunts the adjustable INTENSITY potentiometer to increase emitter current and produce an intensified beam. Setting the HORIZONTAL DISPLAY to EXT supplies additional current from the −100V supply. This establishes an unblanking current level to compensate for removal of the internal unblanking signal from the time base plug-in, and establishes a nominal brightness level.

Note

The intensification function of the FIND BEAM switch is removed on instruments with a P11 phosphor CRT (Option 011). Additional information is provided in Section VII.

4-43. The output voltage of A7Q5 is coupled through emitter follower A7Q6 to complimentary amplifier A7Q7 and A7Q8. Diodes A7CR1 through A7CR4 provide a clamping action to prevent overdriving the amplifier.

4-44. A large negative feedback from the collectors of A7Q7 and A7Q8 ensures that the amplifier gain in very stable. Capacitors A7C6 and A7C8 provide for adjustment of the high frequency feedback and gain. Decreasing the capacitance of A7C6 decreases the high frequency feedback and increases gain, while decreasing the capacitance of A7C8 increases high frequency feedback and decreases gain. Amplifier voltage gain is approximately 10 for Z-axis signals. The gate amplifier output is approximately:

$$\Delta E_{Q8\ \text{collector}} \cong (\Delta I_{CR4})\ (R21 + R22)$$

4-45. The gate amplifier output unblanking signal is added to the -3200V output of the high voltage power supply and applied to the CRT control grid. Voltage level changes of the unblanking signal cause corresponding changes to the CRT control grid voltage. Diodes A7CR6 through A7CR9 provide isolation protection from high voltage transients from the CRT control grid.

4-46. An alternate trigger signal is used by multi-channel vertical amplifier plug-ins to initiate channel switching action. Transistors A7Q2 and A7Q3 function as a fast acting switch. With A7Q2 normally conducting and A7Q3 non-conducting, the unblanking gate trailing edge causes A7Q3 to conduct and A7Q2 to cease conducting. The switching output is differentiated and applied to A7Q4, providing a negative-going voltage pulse for vertical amplifier channel switching.

4-47. Z-AXIS INPUT. The input impedance to the Z-axis input is approximately 5100 ohms. An input signal of approximately +2 volts amplitude is adequate to blank a trace of normal viewing intensity, while an input signal of --2 volts will provide unblanking. Since the gate amplifier has a voltage gain of about 10, a 2-volt input will result in a 20-volt change at the CRT grid.

4-48. HIGH VOLTAGE POWER SUPPLY (HVPS).

4-49. The HVPS generates three regulated voltages. These are applied to the cathode (-3150V), control grid (-3200V) and post-accelerator (+19kV) of the CRT to provide the accelerating potential required to produce excitation of the CRT phosphor for a visible trace. All three voltages are regulated by sampling the -3150-volt supply. The HVPS is shown in simplified form in Figure 4-3. Refer to this figure, and to the schematic in Section VIII while reading the following explanation of HVPS operation.

4-50. HIGH VOLTAGE OSCILLATOR. Chassis mounted transistor Q1 and transformer A6A1T1 form an oscillator which generates approximately 26 Vac at 40 kHz. A feedback winding on the transformer provides the regenerative coupling to sustain oscillation. Operating power is provided by the unregulated +27V supply. The supply source is fused and decoupled.

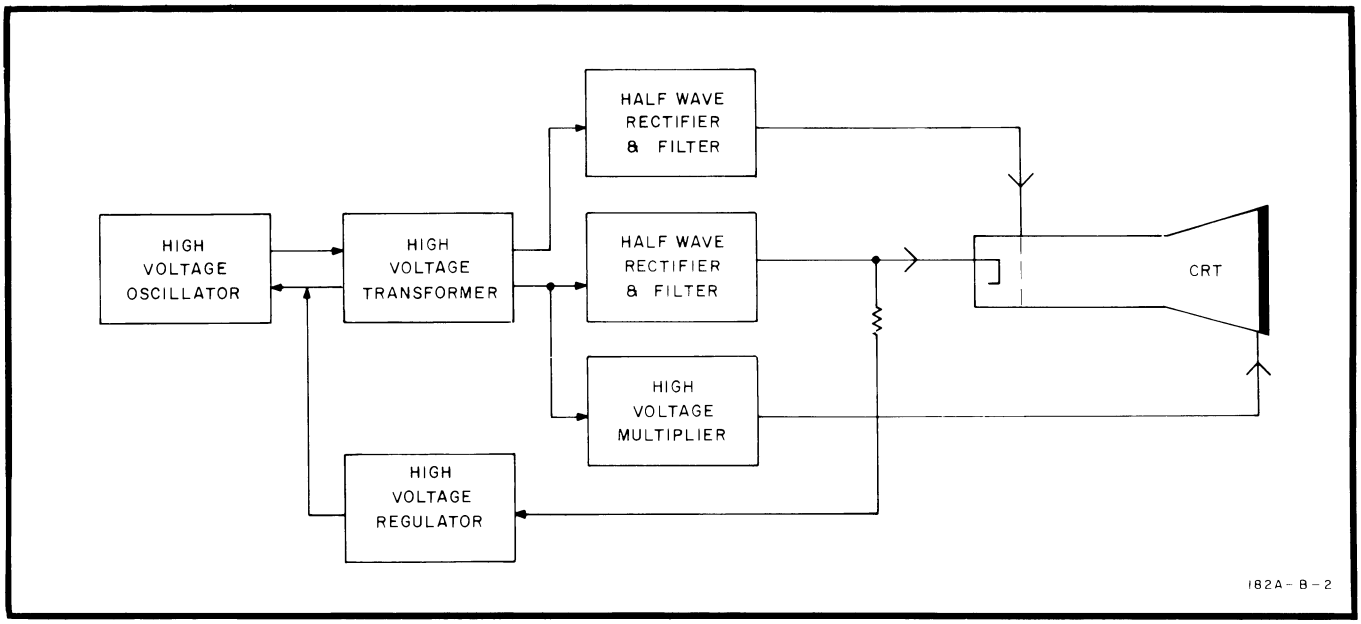


Figure 4-3. High Voltage Power Supply Block Diagram

4-51. HV RECTIFIERS. The 40-kHz oscillator output is stepped up by the secondary windings of A6T1. Two half-wave rectifiers and a voltage multiplier are used to develop the high voltages necessary for CRT operation.

4-52. The CRT grid voltage, approximately -3200V, is developed by half-wave rectifier A6CR1 and filter A6C1, A6C2, and A6R1 through A6R5. The display intensity lower limit, determined by the CRT grid voltage level, is adjusted by A6R2. The CRT cathode voltage, approximately -3150V, and the focusing voltage, approximately -2270V, are developed by half-wave rectifier A6CR4 and filter A6C3, A6C4 and A6R7. Resister A6R8 is part of a voltage divider which drops the -3150V to -2270V for focus control. Diodes A6CR5 and CR6 prevent the CRT grid from becoming positive with respect to the cathode. The CRT post-accelerator voltage, approximately 19 kV, is developed by high voltage multiplier assembly A11.

4-53. HV REGULATION. Variations in high voltage output are fed back to the high voltage regulator circuitry consisting of A10Q1, A10Q2, A10Q3, and associated components. The regulator controls the high voltage oscillator bias to maintain high voltage at a constant level. If, for example, the CRT cathode voltage tends to decrease (go more positive), a positive-going signal is applied through the regulator to the base of oscillator Q1. The oscillator then conducts for a greater period of time, causing a larger voltage change at the primary of A6T1. This increases the secondary voltage to restore cathode voltage to the desired level.

4-54. The high voltage regulator monitors CRT cathode voltage through coupling network A6R9 and A6C5. Resistors A10R3 and A10R4 form a voltage divider between +100V and the coupling network output. A10R3 adjusts the operating level of FET A10Q1. High voltage fluctuations are sensed by A10Q1 and amplified by A10Q2 and A10Q3. Diodes A10CR4 and A10CR5 provide clamping action to prevent overdriving the high voltage oscillator. The regulator output is applied through the regenerative winding of A6T1 as bias to the base of Q1, thereby controlling high voltage oscillator drive.

4-55. CALIBRATOR.

4-56. The calibrator uses a 1-kHz free-running multivibrator. A voltage divider provides the output at two amplitudes: 10 volts and 250 millivolts. The calibrator output is a negative-going waveform.

4-57. Transistors A2Q1 and A2Q2 oscillate at a rate determined by the time constant of associated RC components. A2CR1 disconnects the collector of A2Q2 from the negative discharge of A2C3 and A2Q2 cuts off, and provides a faster risetime. Diodes A2CR2 and A2CR3 protect the transistors from voltage breakdown. A filter network, A2L1 and A2C4, isolates the multivibrator from the −100V supply.

4-58. With A2Q2 conducting, the voltage divider consisting of A2R17, A2R18 and A2R19 effectively divides the −100V supply voltage. The values selected for these resistors permit the output of 10V and 250 mV. These two outputs are available at the instrument front panel and may be used for probe compensation adjustment and horizontal or vertical sensitivity calibration checks.

4-59. SWEEP GATE OUTPUT AMPLIFIERS.

4-60. The output amplifiers are four emitter followers, A8Q1-A8Q4. They provide isolated outputs of time base sampling or TDR generated signals to rear-panel connectors. The Operating and Service Manual for the plug-in will provide information on the characteristics of the output signals.

4-61. The four time base signal inputs to these amplifiers are the main sweep, delayed sweep, main gate and delayed gate. The emitter-followers convert the high impedance inputs to low impedance outputs and isolate the time base signals from external equipment.

4-62. HORIZONTAL AMPLIFIER.

4-63. The inputs to the horizontal amplifier are an internal sweep signal from the horizontal plug-in or an external signal applied to the HORIZONTAL EXT INPUT jack. Positioning the HORIZONTAL DISPLAY to INT grounds the input of the preamplifier and disconnects the external signal preamplifier from the output amplifier. The internal sweep signal is connected through the HORIZONTAL DISPLAY switch to the output amplifier.

4-64. Selecting HORIZONTAL DISPLAY EXT disconnects the internal sweep signal and connects the external signal through the preamplifier to the output amplifier. With EXT selected, the amplitude of the signal from the preamplifier is adjustable by rotating the EXT VERNIER control. When the control is in the CAL detent position the output amplitude of the preamplifier is determined by the input amplitude.

4-65. The selected signal is applied to the output amplifier and summed with a current established by the HORIZONTAL POSITION control. A HORIZONTAL MAGNIFIER allows the gain to be increased by a factor of 10 (X10) or to be directly related to the amplitude of the input signal (X1). The resulting current is converted to a differential signal, amplified, and applied to the horizontal deflection plates of the CRT.

4-66. Refer to the schematic of the horizontal amplifier for the more detailed explanation which follows.

4-67. An external signal applied to the preamplifier is coupled through a 3:1 divider composed of A5R5 and A5R6 to A5Q1. The output of A5Q2 is coupled through the HORIZONTAL EXT VERNIER and the HORIZONTAL DISPLAY switch. The high input impedance of A5Q1 in conjunction with the voltage divider and A5R4 provides a 1 megohm load to the external circuit. Transistor A5Q2 is an emitter follower. It supplies a current to A5Q3 which is determined by A5R15 and the EXT VERNIER control.

4-68. The bandwidth of the preamplifier is decreased when the Phase/Bandwidth switch is placed in the Phase position. This is accomplished by connecting A5C11 and A5C12 into the circuit. The decreased bandwidth and phase shift compensates for the signal time delay in the vertical amplifier plug-in. This allows more accurate X-Y phase measurements to be made.

4-69. A vernier balance adjustment A5R11 is used to establish a zero input voltage reference level. This eliminates horizontal dc shift as the EXT VERNIER control is rotated. The EXT VERNIER provides a range of control of the deflection factor when an EXT INPUT signal is used for horizontal deflection. It has sufficient range to change the deflection factor by at least 10.

4-70. The input signal to A5Q3 is summed in the low impedance emitter circuit with a current established by the HORIZONTAL POSITION controls. A fine and coarse positioning is provided. Both controls operate from a single control, and are mechanically interconnected. Rotating the control first provides fine positioning. When the limit of available rotation of the fine position potentiometer has been reached, the coarse positioning potentiometer becomes effective.

4-71. The output of A5Q3 is coupled through emitter-follower A5Q4 to differential amplifier A5Q5 and A5Q7. The low impedance necessary to drive A5Q5 is provided by A5Q4, and A5Q6 maintains a similar low impedance voltage source for A5Q7.

4-72. The position of the MAGNIFIER switch A5S4 selects either of two values of emitter degeneration between A5Q5 and A5Q7 and controls the gain. As degeneration decreases, gain increases. Two gain levels are provided, X1 and X10. Each has an adjustable element to provide for calibration of the gain. With X1 magnification selected, A5R46 is used to set the gain. With X10 magnification selected A5R44 sets the gain. The emitter potentials of A5Q5 and A5Q7 are balanced by A5R49. This prevents horizontal dc shift as the MAGNIFIER control is switched between ranges.

4-73. The differential signal at the collectors of A5Q5 and A5Q7 is applied to current-fed operational amplifiers A5Q11/A5Q12/A5Q13 and A5Q8/A5Q9/A5Q10. The amplifier low frequency gain is very stable because of the large negative feedback employed, and the high frequency feedback for each side of the amplifier is separately adjustable. High frequency feedback from the collectors of A5Q12/A5Q13 to the base of A5Q11 is controlled by A5C28; high frequency feedback from the collectors of A5Q9/A5Q10 to the base of A5Q8 is controlled by A5C21. Capacitor A5C24 adjusts the ratio of feedback for each side of the amplifier. The output of the amplifiers is a voltage which is connected to the horizontal deflection plates of the CRT.

4-74. Diodes A5CR9/A5CR10 and A5CR4/A5CR5 limit the output to the deflection plates to prevent overdriving. Diodes A5CR8 and A5CR3 prevent A5Q5 and A5Q7, respectively, from saturating.

4-75. Depressing the FIND BEAM control disables diode limiter A5CR4/A5CR5 and blocks the signal to A5Q8. The differential gain is effectively cut in half, and the horizontal deflection of the beam is confined to the limits of the CRT.

4-76. POWER SUPPLY DECOUPLING.

4-77. Decoupling networks are used on each etched circuit assembly for the supply voltages. The use of decoupling is important to prevent extraneous signals or noise from being introduced into circuitry from the power supplies or supply leads. Decoupling also prevents transients originating in other circuits from being introduced.

Table 5-1. Recommended Test Equipment

Instrument		Required Characteristics	Required For
Type	Model		
Voltmeter Calibrator	HP 738AR, 6920B, or E02-738BR	1V and 10V p-p ±0.2%	Calibrator Check Horizontal Magnifier Check
Monitor Oscilloscope	HP 180A/AR w/1801A and 1820A plug-ins	Sensitivity 1 V/div Sweep speed <3 μsec Sweep output	Calibrator Check Gate Amplifier Response Adjustment Transient Response Adjustment
50:1 Divider Probe	HP 10002A	±3%	Gate Amplifier Response Adjustment
Constant Amplitude Signal Generator	Tektronix Type 190B/191	50 kHz-50MHz, 10V p-p	Horizontal Bandwidth Check Horizontal Linearity Adjustment
Digital Voltmeter	HP 3440A w/3441A or 3444A plug-in	±100 Vdc ±0.05%	Low Voltage Power Supply Adjustment High Voltage Power Supply Adjustment
1000:1 Divider Probe	HP K05-3440A	Combined voltmeter/divider Input impedance of >1 gigohm	High Voltage Power Supply Adjustment
Square Wave Generator	HP 211A/B	200 kHz, 1V p-p, risetime ≤ 30 ns	Transient Response Adjustment
Oscillator	HP 200CD	10 kHz-100 kHz, 10V p-p	Phase Adjustment Trace Alignment Adjustment
Horizontal Gain Calibrator	HP 10411A	No substitute	Gain Adjustment
Resistor: 40k ohms	HP Part No. 0698-6101	1/10%, 1/2W	Gain Adjustment (Alternate Procedure)
Time Mark Generator	HP 226A	1-ms markers	Gain Adjustment (Alternate Procedure)

7000-A-19

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section provides a performance check procedure to determine if the Model 182C is operating within specifications and a procedure for adjustment and calibration. Physical location of the adjustments is shown in the fold-out photograph at the end of this section.

5-3. TEST EQUIPMENT.

5-4. Recommended test equipment is listed in Table 5-1. Test equipment having the required characteristics may be substituted. Use recently calibrated equipment to ensure proper results.

5-5. PERFORMANCE CHECK.

5-6. The purpose of the performance check is to determine if the instrument is operating within the specifications listed in Table 1-1. This check may also be used as part of an incoming quality assurance inspection, as a periodic operational check or to verify operation after repairs or adjustments have been made.

5-7. It is desirable to do the performance check in the sequence given since succeeding steps depend on control settings and results of previous steps. If desired, the checks may be accomplished individually by referring to the preliminary control settings and the preceding steps.

5-8. A Performance Check Record is included at the end of these checks. As the initial performance check is accomplished, the actual readings should be entered on the form. The form may be removed from the manual and filed for future reference. Readings taken at a later date can be compared with the original performance check results.

5-9. PRELIMINARY SETUP.

5-10. Set the line voltage SELECTOR switch, located on rear panel, to desired power line operating voltage (115V or 230V ac). Connect instrument to line power source and apply power by turning LINE power switch ON. Allow fifteen minutes for warm-up. Do not install plug-ins.

5-11. CALIBRATOR CHECK.

a. Set controls as follows:

MAGNIFIER X10
DISPLAY . . . . . EXT
EXT COUPLING . . . . . AC

b. Connect a 10V p-p signal from Voltmeter Calibrator to EXT INPUT.

c. Obtain a horizontal trace by adjusting INTENSITY, FOCUS and POSITION controls.

d. Adjust EXT VERNIER to obtain displayed trace of exactly 10 divisions.

e. Disconnect Voltmeter Calibrator from EXT INPUT. Do not disturb EXT VERNIER setting.

f. Connect CALIBRATOR 10V output to EXT INPUT.

g. Note displayed trace of 10 ±0.1 divisions.

h. Disconnect CALIBRATOR 10V output from EXT INPUT.

i. Observe CALIBRATOR 10V output using Monitor Oscilloscope.

j. Risetime of calibrator waveform (leading edge) should be 3 μsec or less. Risetime is measured at 10% to 90% amplitude points.

k. Disconnect CALIBRATOR from EXT INPUT.

5-12. HORIZONTAL MAGNIFIER CHECK.

a. Set controls as follows:

MAGNIFIER X1
DISPLAY . . . . . EXT
EXT VERNIER . . . . . CAL

b. Connect 10V p-p signal from Voltmeter Calibrator output to EXT INPUT.

c. Note displayed trace of 10 ±0.5 divisions.

d. Set Voltmeter Calibrator for output of 1V p-p.

e. Set MAGNIFIER to X10.

f. Note displayed trace of 10 ±0.5 divisions.

5-13. HORIZONTAL BANDWIDTH CHECK.

a. Connect 50 kHz signal from Constant Amplitude Signal Generator to EXT INPUT.

b. Set MAGNIFIER to X1.

c. Adjust output of Constant Amplitude Signal Generator to obtain displayed trace of exactly 10 divisions.

d. Set Constant Amplitude Signal Generator for output frequency of 5 MHz.

e. Note displayed trace of 7.1 divisions or greater. (If displayed trace is approximately 2 divisions, check position of Phase/Bandwidth switch located in horizontal amplifier. It should be in Bandwidth position.)

f. Set MAGNIFIER to X10.

g. Set Constant Amplitude Signal Generator for output frequency of 50 kHz.

h. Adjust output of Constant Amplitude Signal Generator to obtain displayed trace of exactly 10 divisions.

i. Set Constant Amplitude Signal Generator for output frequency of 5 MHz.

j. Note displayed trace of 7.1 divisions or greater.

k. Disconnect Constant Amplitude Signal Generator.

5-14. BEAMFINDER CHECK.

a. Set controls as follows:

INTENSITY . . . . . fully ccw
POSITION . . . . . fully ccw

b. Depress FIND BEAM pushbutton.

c. Note that intensified beam is displayed.

Note

Option 011 instruments are provided with P11 phosphor CRT. The display intensity will not increase when FIND BEAM is depressed. This eliminates phosphor burn. Use INTENSITY control to set intensity to viewing level.

5-15. This completes the Performance Check. If the instrument does not meet Model 182C specifications, the Adjustment Procedure which follows should be done. If this does not result in satisfactory instrument performance refer to Section VIII of this manual for troubleshooting and maintenance information.

HP MODEL 182C

PERFORMANCE CHECK RECORD

Serial Number: _____ Date: _____

CHECK	Minimum	Reading	Maximum
CALIBRATOR			
amplitude	9.9 div	_____	10.1 div
risetime	none	_____	3 μsec
MAGNIFIER			
X1	9.5 div	_____	10.5 div
X10	9.5 div	_____	10.5 div
BANDWIDTH			
50 kHz		set to 10 div	
5 MHz	7.1 div	_____	none
FIND BEAM	Intensified beam on-screen	_____	yes or no

5-16. ADJUSTMENT PROCEDURE.

5-17. The following paragraphs outline the procedure for accomplishing the adjustments required for the Model 182C. Use the equipment recommended in Table 5-1 or similar equipment having at least equivalent capability. Use only a non-metallic adjustment tool.

5-18. The adjustment procedures should be performed in the sequence listed, since some adjustments are dependent on control settings and results of previous steps. The adjustments may be accomplished individually, if desired, by referring to the preliminary control settings and the steps before the desired procedure.

5-19. COVER REMOVAL.

5-20. To gain access to the adjustments, top and bottom covers and the rear LVPS access panel must be removed. See Figure 5-1. Remove the covers as follows:

a. Ensure that LINE power switch is OFF and disconnect power plug from ac power source.

b. Set oscilloscope on rear end.

c. Release 3 quarter-turn fasteners on each side of the instrument. Cover retainers will be completely free.

d. Loosen 2 captive screws located on handle ends.

e. Remove top cover by expanding open end slightly and pulling away from instrument.

f. Remove bottom cover by extending tilt stand, expanding open end of cover and pulling away from instrument.

g. Return instrument to horizontal position and remove rear access cover by releasing single quarter-turn fastener.

5-21. PRELIMINARY SETUP.

5-22. Install vertical and time base plug-ins in Model 182C. Set line voltage SELECTOR switch, located on rear panel, to desired power line operating voltage 115V or 230V ac. Connect instrument to line power source and apply power by turning LINE power switch ON. Allow fifteen minutes for warm-up. Check that Phase/Bandwidth switch is in Bandwidth position.

5-23. Adjustment locations are identified in the photographs at the end of this section. The page may be folded out for easy reference while performing the adjustments.

5-24. There are several adjustments which directly affect the final accuracy of the horizontal sweep. These must be made accurately and to the test limits specified to ensure that sweep accuracy will be maintained as time base plug-ins are interchanged. The adjustments given for the Low Voltage Power Supply, High Voltage Power Supply, and Horizontal Amplifier, are particularly important in this respect.

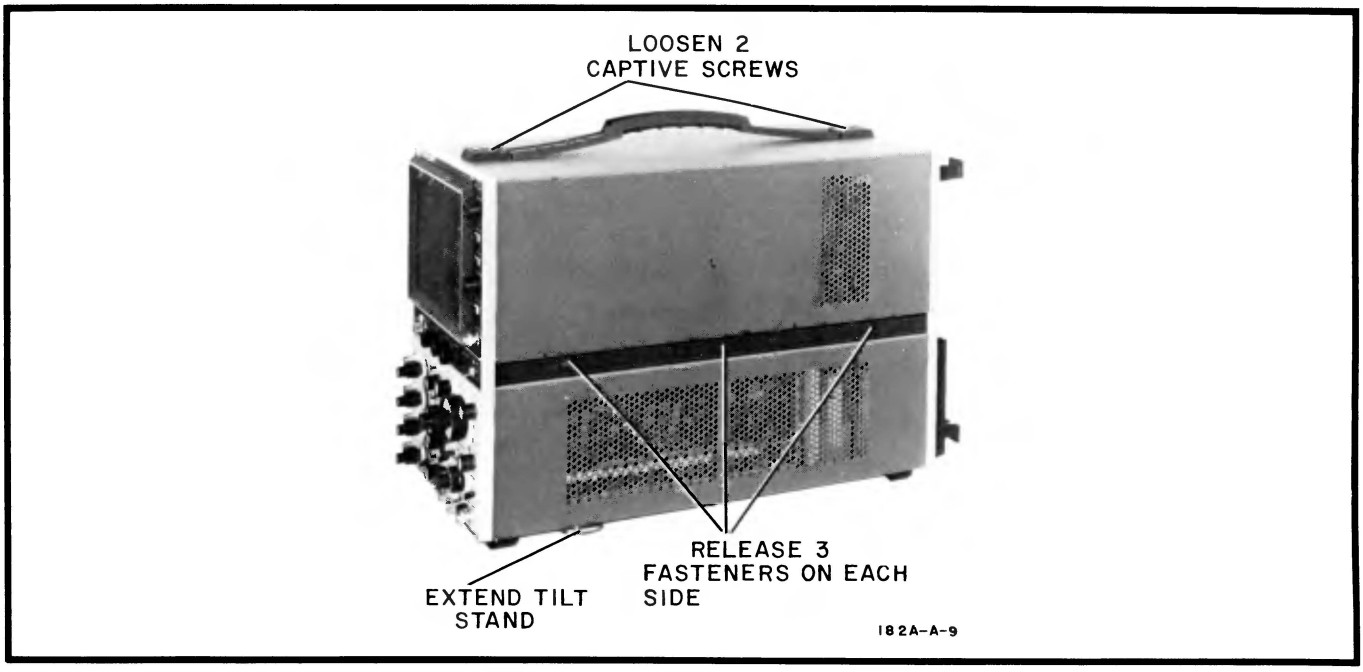


Figure 5-1. Cover Removal

5-25. LOW VOLTAGE POWER SUPPLY.

a. Connect Digital Voltmeter to +100V testpoint A1A2TP1 (Figure 5-2).

b. Set +100V adjust A1A2R11 to obtain a reading of +100V ±0.1V.

c. Connect Digital Voltmeter to +15V testpoint A1A2 TP2.

d. Set +15V adjust A1A2R20 to obtain a reading of +15V ±0.1V.

e. Connect Digital Voltmeter to −12.6V testpoint A1A2 TP3.

f. Set −12.6V adjust A1A2R29 to obtain a reading of −12.6V ±0.1V.

g. Connect Digital Voltmeter to −100V testpoint A1A2TP4.

h. Set −100V adjust A1A2R40 to obtain a reading of −100V ±0.1V.

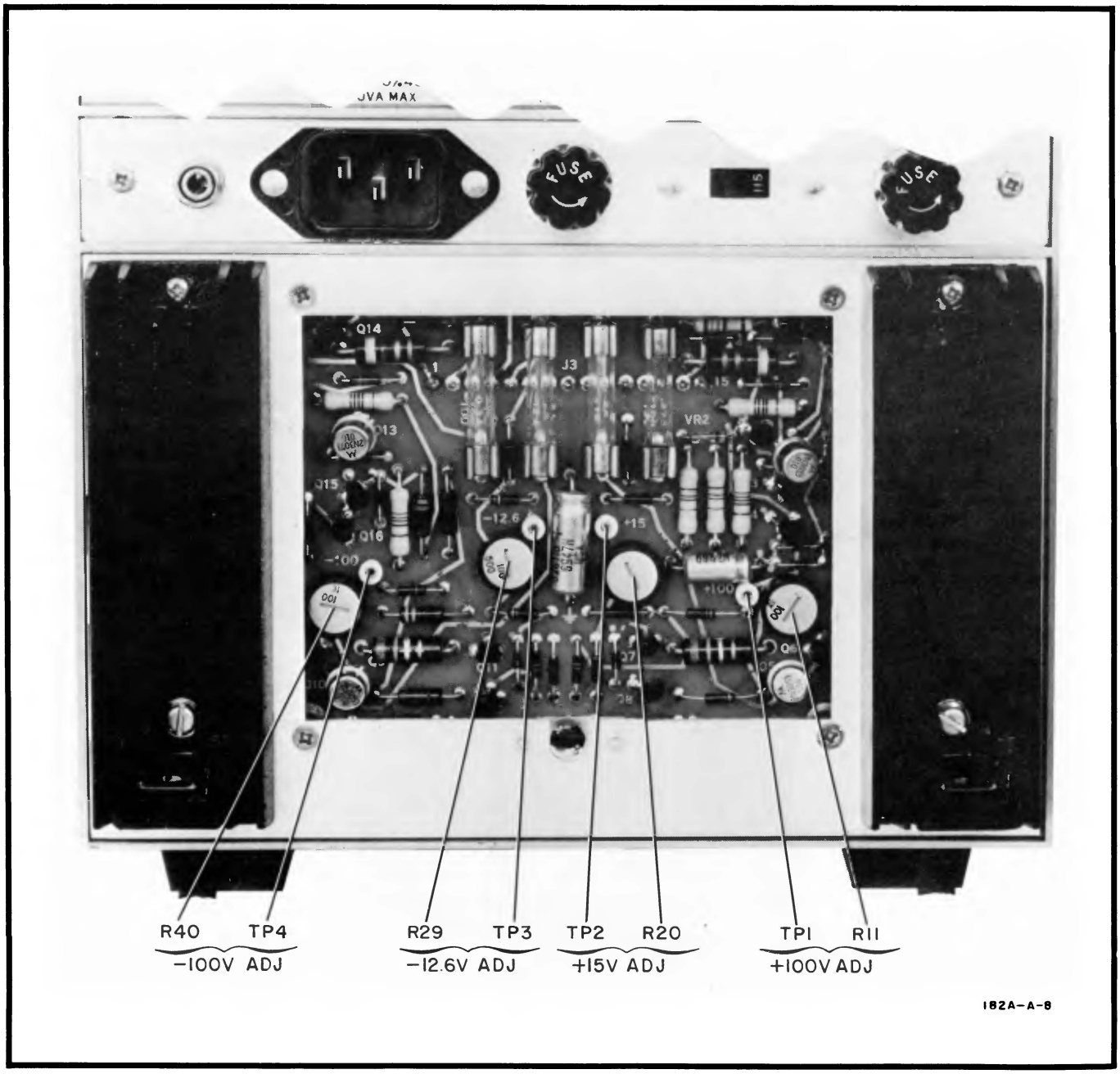


Figure 5-2. Low Voltage Power Supply Adjustments

5-26. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT.

a. The required high voltage output of the supply is −3150V ±0.5%.

b. Using 1000:1 Divider Probe, monitor voltage at −100V test point A1A2TP4 with Digital Voltmeter.

c. Note voltage reading which will be approximately −0.100V. Accuracy in noting the voltage is essential for proper adjustment.

d. Multiply reading obtained in step c by 31.50.

WARNING

This voltage is dangerous to life.

e. Using 1000:1 Divider Probe, monitor high voltage at −3150V test point A6TP1 with Digital Voltmeter.

f. Set High Voltage adj A10R3 to obtain reading exactly equivalent to result obtained in step d (approximately −3.150V).

5-27. INTENSITY LIMIT ADJUSTMENT.

a. Set DISPLAY to EXT.

b. Set INTENSITY control to center (12 o'clock) position.

c. Adjust Intensity Limit Adj A6R2 to just extinguish spot.

5-28. ASTIGMATISM ADJUSTMENT.

a. Set DISPLAY to EXT.

b. Center low intensity spot with HORIZONTAL and Vertical POSITION controls.

c. Adjust FOCUS and ASTIG front-panel screwdriver adjustment for smallest round spot.

5-29. FLOOD GUN ADJUSTMENT.

a. Set INTENSITY fully ccw.

b. Set SCALE fully cw.

c. Adjust SCALE PATTERN ADJ A2R4 for uniform illumination intensity.

d. Slowly rotate SCALE control while adjusting SCALE PATTERN ADJ A2R4 as necessary to maintain uniform illumination intensity throughout entire range of SCALE.

5-30. TRACE ALIGNMENT ADJUSTMENT.

a. Set MAGNIFIER to X1.

b. Set EXT COUPLING to AC.

c. Connect Oscillator 400 Hz 10V output to EXT INPUT.

d. Position trace on center horizontal graticule line.

e. Set INTENSITY and FOCUS to view sharply defined trace.

f. Adjust TRACE ALIGN front-panel screwdriver adjustment A2R23 to align trace parallel to horizontal graticule line.

g. Connect Oscillator 400 Hz 10V output to Vertical plug-in.

h. Set Vertical plug-in controls to obtain vertical trace.

i. Adjust Y ALIGN adj A5R61 to align vertical trace parallel to vertical graticule line.

Note

Exact adjustment is very important if repeatable risetimes are to be obtained in both +UP and −UP operation.

j. Disconnect Oscillator from Vertical plug-in input.

5-31. GATE AMPLIFIER RESPONSE ADJUSTMENT.

a. Set following controls as applicable:

DISPLAY	INT
Main Time/Div	0.1 μsec
Main Vernier	CAL
Sweep Mode	AUTO
Sweep Display	MAIN
Delayed Time/Div	OFF

b. Set Monitor Oscilloscope controls as follows:

Volts/Div	.2
Time/Div	0.1 μsec
Trigger Source	INT
Slope	+
Coupling	DC

c. Using 50:1 Divider Probe and Monitor Oscilloscope, observe signal at collector of A7Q8.

d. Rotate INTENSITY control cw for a gate amplitude of 6 divisions (approximately 60V).

e. Adjust Gate Resp Adj No. 2 A7C6 and Gate Resp Adj No. 1 A7C8 for optimum fast risetime and pulse flat-top response.

f. Disconnect Monitor Oscilloscope.

5-32. DC BALANCE.

a. Set MAGNIFIER to X10.

b. Set DISPLAY to EXT.

c. Center spot with POSITION control.

d. Set MAGNIFIER to X1.

e. Adjust DC Bal adj A5R49 to recenter spot.

f. Repeat steps a through e until spot does not shift from center while switching MAGNIFIER from X1 to X10.

5-33. VERNIER BALANCE.

a. Set MAGNIFIER to X1.

b. Rotate EXT VERNIER from CAL position to fully ccw.

c. Center spot with POSITION control.

d. Set EXT VERNIER to CAL.

e. Adjust Vern Bal adj A5R11 to recenter spot.

f. Repeat steps b through e until spot does not shift from center when EXT VERNIER is rotated.

5-34. GAIN ADJUSTMENT.

Note

This adjustment is critical if Time Base interchangeability is desired without recalibration. Critical adjustment is achieved by injecting a precise current into the emitter-base junction of A5Q3 and adjusting for the specified deflection. An alternate method not requiring use of HP Model 10411A Horizontal Gain Calibrator is provided.

a. Set controls as follows:

DISPLAY . . . . . EXT
MAGNIFIER X1
EXT VERNIER . . . . . CAL

b. Check +100-volt supply for +100V ±0.1V.

Note

The calibrating accuracy of the Model 10411A Horizontal Gain Calibrator used for this adjustment procedure is determined by the accuracy of the +100V supply. If the power supply is not +100V ±0.1V, the gain adjustment will be out of tolerance.

c. Connect Horizontal Gain Calibrator as follows:

1. Black lead: connect to chassis (power supply ground).

2. Yellow lead: connect to emitter of A5Q3.

3. Red lead: connect to +100 volt supply.

d. Set Horizontal Gain Calibrator magnifier switch to X1.

e. Display should be a bright spot near each side of the display. Adjust HORIZONTAL POSITION to center left-hand spot exactly on left-hand (first) vertical graticule line.

f. Set INTENSITY and FOCUS to obtain low intensity sharply focused spots.

g. Adjust X1 Gain Adj A5R46 for exactly 10 divisions of separation between spots (Figure 5-3).

h. Set MAGNIFIER to X10 and Horizontal Gain Calibrator magnifier switch to X10.

i. Adjust X10 Gain adj A5R44 for exactly 10 divisions of separation between spots.

j. Disconnect Horizontal Gain Calibrator.

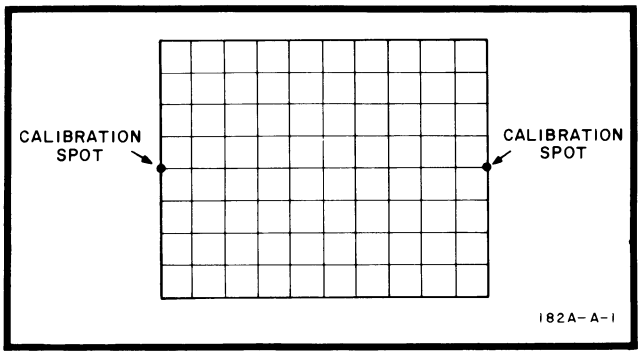


Figure 5-3. Calibration Display

5-35. GAIN ADJUSTMENT (ALTERNATE PROCEDURE).

a. Set controls as follows:

HORIZONTAL DISPLAY . . . . . EXT
HORIZONTAL MAGNIFIER. X1
EXT VERNIER . . . . . CAL

b. Check +100V supply for +100V ±0.1V.

c. Alternately connect and disconnect 40-kilohm 0.1% 1/2W resistor between +100V supply and emitter of A5Q3. Keep connection lead length short as possible to avoid stray pick-up or oscillations.

CAUTION

With resistor disconnected, +100V is present at open lead of resistor. Do not leave resistor connected throughout adjustment as thermal rise will shift current reference.

d. Adjust HORIZONTAL POSITION to center left-hand spot exactly on left-hand (first) vertical graticule line.

e. While alternately connecting and disconnecting resistor to emitter of A5Q3, adjust X1 Gain adj A5R46 for exactly 10 major divisions of separation between spot positions.

f. Set HORIZONTAL DISPLAY to INT and Time Base for 1 msec/div sweep speed.

g. Apply 1 msec markers from Time Mark Generator to Vertical input.

h. Adjust Time Base 1 msec calibration adjustment to obtain display of eleven markers in 10 divisions. Second marker should be on 2nd graticule line and 10th marker on 10th graticule line.

i. Set HORIZONTAL MAGNIFIER to X10.

j. Adjust X10 Gain adj A5R44 to obtain a display of exactly 1 marker for 10 divisions.

k. Disconnect Time Mark Generator.

5-36. PHASE ADJUSTMENT.

a. Set controls as follows:

Phase/Bandwidth Switch . . . . . Phase
HORIZONTAL MAGNIFIER. X1
HORIZONTAL DISPLAY . . . . . EXT
EXT VERNIER . . . . . CAL

b. Connect 10 kHz sine wave output of Oscillator to HORIZONTAL EXT INPUT and to Vertical plug-in Channel A input (Figure 5-4).

Note

Channel A of a multi-channel Vertical plug-in is normally used for phase measurement. If another channel must be used connect Oscillator to that channel instead of Channel A.

c. Adjust Oscillator output to obtain a 8-div display.

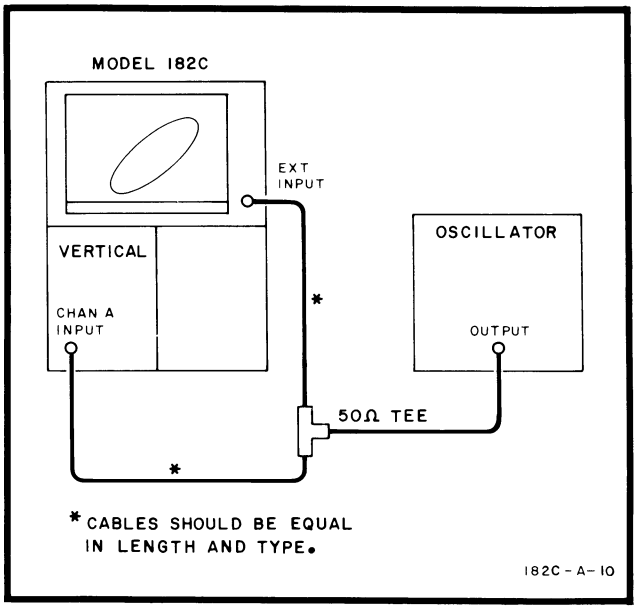


Figure 5-4. Phase Adjustment Test Setup

d. Adjust Input Comp adj A5C9 for display of a single diagonal line (no phase shift).

e. Set Oscillator for an output of 100 kHz sine wave.

f. Adjust Phase adj A5C12 for display of a single diagonal line (no phase shift).

g. Repeat steps b through f until no phase shift occurs for either frequency.

h. Disconnect Oscillator.

i. Return Phase/Bandwidth switch to Bandwidth position.

5-37. TRANSIENT RESPONSE ADJUSTMENT.

Note

Omit this adjustment procedure for normal calibration and perform the Horizontal Linearity Adjustment. This procedure should only be used if major repairs or complete module replacement has been made.

a. Set DISPLAY to EXT.

b. Connect 1V p-p square wave at 200 kHz repetition rate from Square Wave Generator to HORIZONTAL EXT INPUT and to Monitor Oscilloscope Vertical input.

c. Set Monitor Oscilloscope time base to operate at sweep of 1 μsec/div and synchronize Monitor Oscilloscope with 200 kHz signal.

d. Connect 1 μsec/div sweep signal from Monitor Oscilloscope rear-panel Main Sweep Output to Channel A input of Model 182C. See Figure 5-5.

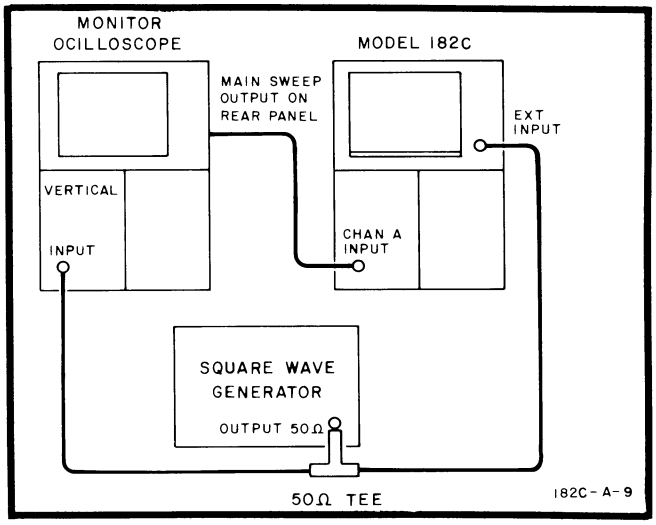


Figure 5-5. Transient Response Adjustment Test Setup

e. Adjust Vertical plug-in VOLTS/DIV and Vernier controls to obtain an 8-div display.

f. Observe displayed waveform. At this stage of adjustment waveform will typically exhibit 5% (approximately 0.5 div) overshoot. If overshoot is greater, adjust HF Adj No. 1 A5C21, HF Adj No. 2 A5C24, and HF Adj No. 3 A5C28 to obtain flat-top response with approximately 5% overshoot on lower right-hand corner of displayed pulse.

Note

Capacitors for HF Adj No. 1 and HF Adj No. 3 should be adjusted so their slugs are almost equally extended.

g. Disconnect Monitor Oscilloscope.

5-38. HORIZONTAL LINEARITY ADJUSTMENT.

Note

Ensure that Time Base has been properly calibrated before proceeding with this adjustment.

a. Set HORIZONTAL DISPLAY to INT.

b. Connect 4V p-p 50 MHz sinewave output from Constant Amplitude Signal Generator to Vertical plug-in Channel A input.

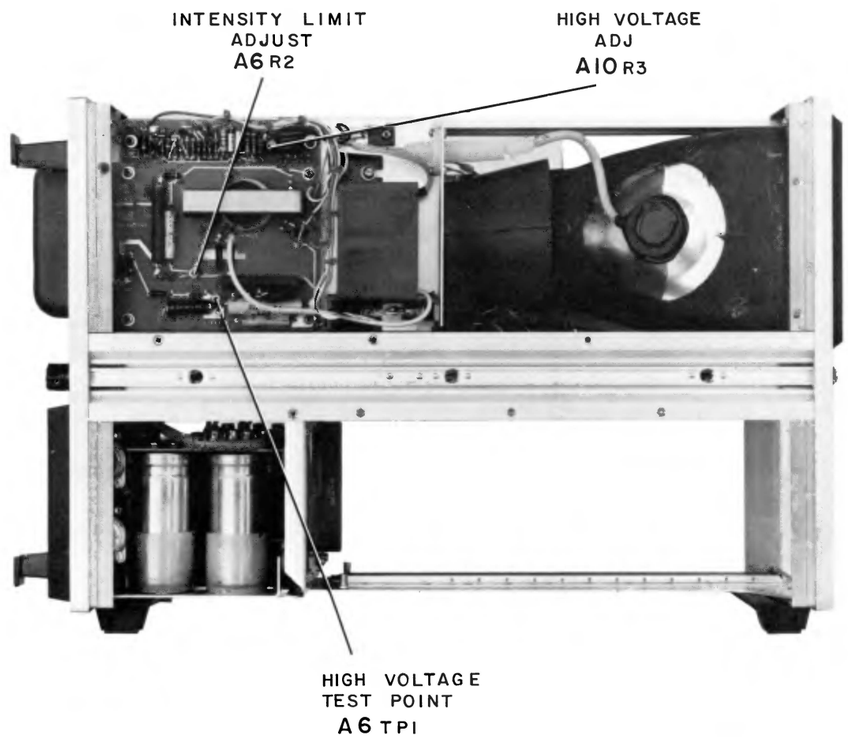
c. Set HORIZONTAL MAGNIFIER to X10.

d. Select fastest sweep speed (.05 or .1 μsec/div) and obtain a display.

e. Adjust HF Adjust No. 1, No. 2 and No. 3 for best overall linearity of center 80 divisions of available display. Use HORIZONTAL POSITION control to permit viewing the right, center and left portions of the display. HF Adj No. 1 affects the right portion, HF Adj No. 2 the center portion and HF Adj No. 3 the left portion of the sweep.

f. Disconnect Constant Amplitude Signal Generator.

5-39 This completes the adjustment procedure. If desired, the instrument performance may be tested to Model 182C specifications using the Performance Check procedure. If satisfactory adjustment or instrument performance is not obtained refer to Section VIII of this manual for troubleshooting information.



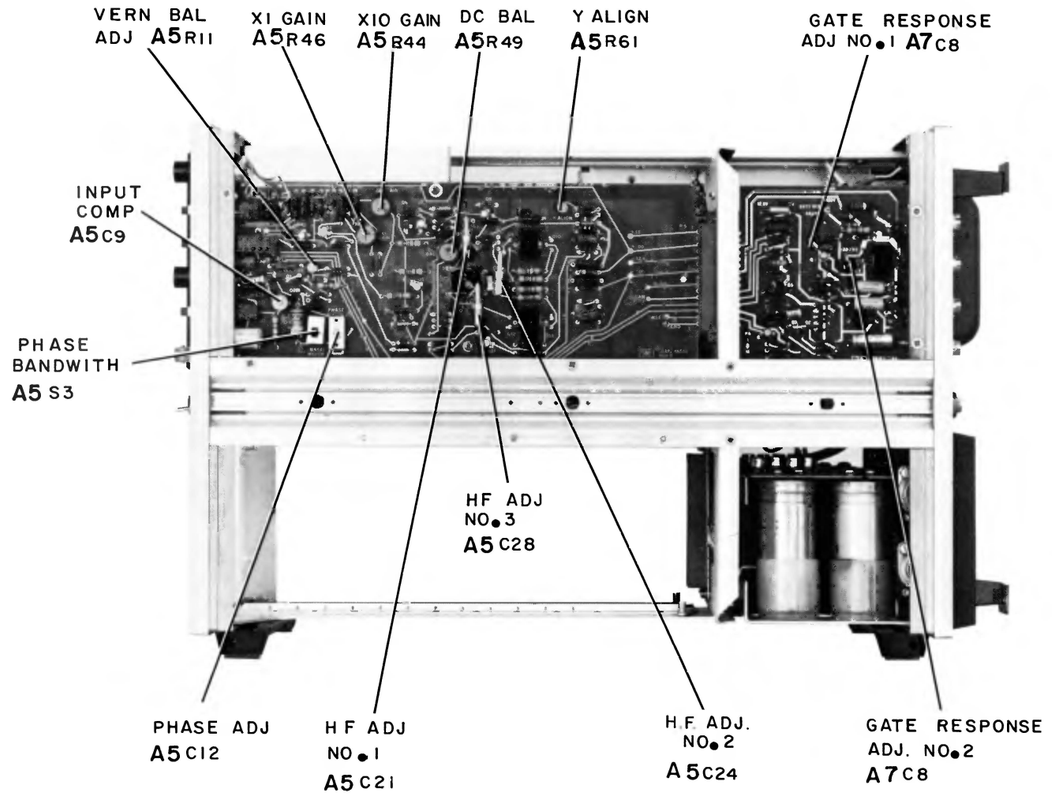


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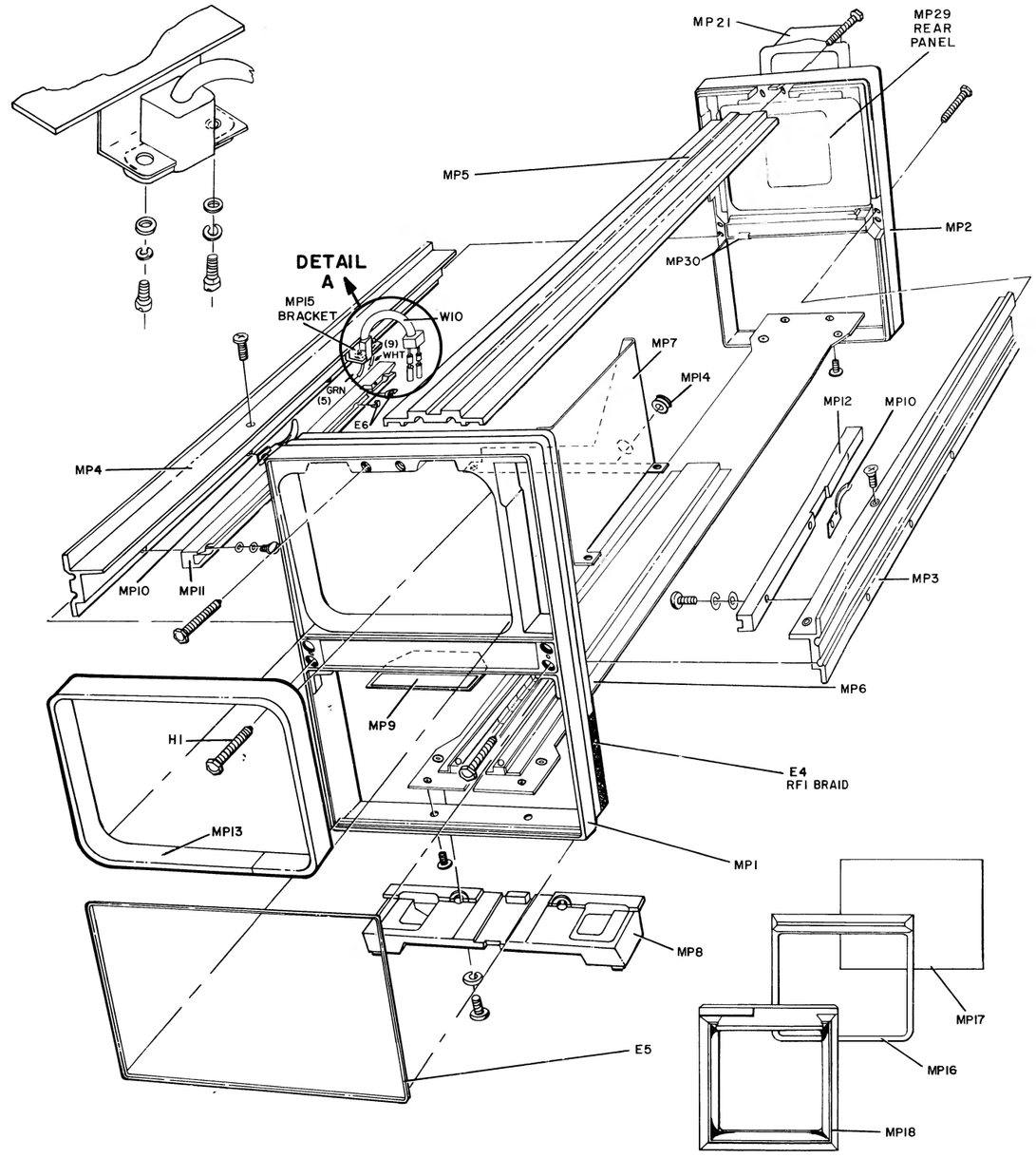
Figure 5-6.
Adjustment Locations



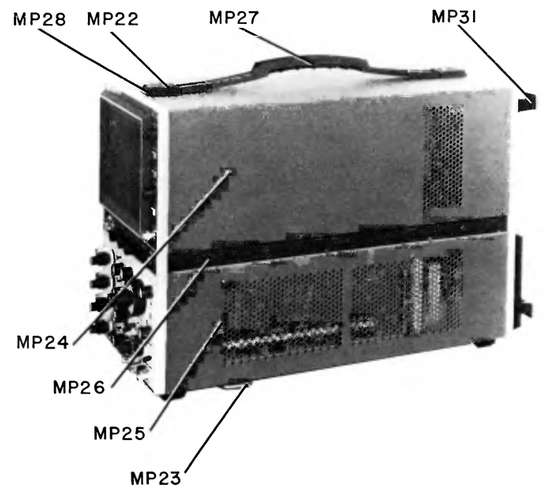


Figure 6-1. Model 182C Mechanical Parts

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

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

6-3. ORDERING INFORMATION.

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

a. Instrument model and serial number.

b. HP part number of items(s).

c. Quanity 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. Quanity desired.

Table 6-1. Abbreviations for Replaceable Parts List

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

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS & MISCELLANEOUS		
A1	00182-60034		ASSY:LOW VOLTAGE POWER MODULE	28480	00182-60034
A2	00182-60030		ASSY:CONTROL MODULE	28480	00182-60030
A3	00182-60021		ASSY:INTERCONNECT MODULE	28480	00182-60021
A4	00182-60004		ASSY:AC POWER	28480	00182-60004
A5	00182-60035		ASSY:HORIZONTAL AMPLIFIER MODULE	28480	00182-60035
A6	00182-61102		ASSY:H.V. OSC. RECTIFIER BOARD	28480	00182-61102
A7	00182-66515		ASSY:GATE AMPLIFIER BOARD	28480	00182-66515
A8	00181-66508		ASSY:SWEEP GATE OUTPUT BOARD	28480	00181-66508
A9	00182-60029		ASSY:CRT MODULE	28480	00182-60029
A10	00182-66513		ASSY:H.V. REGULATOR BOARD	28480	00182-66513
A11	0960-0117	1	ASSY:H.V. MULTIPLIER(NOT REPAIRABLE)	28480	0960-0117
A12	00182-60023		MODULE:HIGH VOLTAGE (INCLUDES A6, A10, A11, E1, E7, E8, F3, MP20, Q1, AND W7)	28480	00182-60023
E1	0362-0227	4	TERMINATION:CRIMP LUG	27264	2125
E2	0362-0227		TERMINATION:CRIMP LUG	27264	2125
E3	0362-0277		TERMINATION:CRIMP LUG	27264	2125
E4	8160-0204	1	BRAID:MONEL-NEOPRENE SPONGE STRIP	12881	01-06-01-1756
E5	4320-0231	2	RUBBER:RFI	00000	ORD#
E6	0363-0006	1	CONTACT:CONNECTOR SWITCH	28480	0363-0006
E7	0340-0450	1	WASHER:TRANSISTOR INSULATOR	04713	14B52600F12
E8	0340-0451	1	WASHER:INSULATED, TRANSISTOR	04713	14B52600F03
F3	2110-0033	1	FUSE:0.75A 250V	75915	F02GR750A
F4	2110-0004	1	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
H1	0624-0234	12	SCREW:TAPPING 8-18 THREAD 1.000" LG	00000	ORD
H2			NOT ASSIGNED		
H3	2200-0165	2	SCREW:FLAT HD POZI DR 4-40 X 1/4"	00000	ORD
J1	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J2	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J3	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J4	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J5	1250-0083		CONNECTOR:BNC	02660	31-221-1020
MP1	00182-22001	1	FRAME:FRONT	28480	00182-22001
MP2	00182-22004	1	FRAME:REAR	28480	00182-22004
MP3	00182-23701	1	SIDE RAIL:RIGHT	28480	00182-23701
MP4	00182-23702	1	SIDE RAIL:LEFT	28480	00182-23702
MP5	00182-63701	1	RAIL ASSY:TOP	28480	00182-63701
MP6	00182-64101	1	PLATE:BOTTOM	28480	00182-64101
MP7	00182-01201	1	BRACKET:SHIELD	28480	00182-01201
MP8	5040-0445	2	FOOT:BOTTOM	28480	5040-0445
MP9	00182-00604	1	SHIELD:FOCUS	28480	00182-00604
MP10	00180-09104	2	CLIP:GROUND	28480	00180-09140
MP11	0403-0128	1	GUIDE:PC BD PLUG-IN(LEFT)	28480	0403-0128
MP12	0403-0129	1	GUIDE:PC BD PLUG-IN(RIGHT)	28480	0403-0129
MP13	0460-0778	1	TAPE:GRAY 0.750" WIDE	00000	ORD
MP14	0400-0010	1	GROMMET:VINYL 0.250" ID	00000	ORD#
MP15	00182-01212	1	BRACKET:VERTICAL CABLE	28480	00182-01212
MP16	00182-60501	1	FRAME:ADAPTER	28480	00182-60501
MP17	5060-0547	1	KIT:CONTRAST FILTER, BLUE	28480	5060-0547
MP18	00182-60026	1	BEZEL ASSY	28480	00182-60026
MP19	00182-60025	1	H.V. COVER ASSY	28480	00182-60025
MP20	00182-01211	1	BRACKET:H.V.	28480	00182-01211
MP21	01701-04108		COVER:CRT	28480	01701 04108
MP22	1390-0153	2	PANEL FASTENER	00000	ORD
MP23	1490-0710	1	STAND:TILT	28480	1490-0710
MP24	00182-04105	1	COVER:TOP, OLIVE GRAY	28480	00182-04105
MP25	00182-04106	1	COVER:BOTTOM, OLIVE GRAY	28480	00182-04106
MP26	00182-23705	2	COVER:RETAINER	28480	00182-23705
MP27	00182-24901	1	HANDLE	28480	00182-24901
MP28	01200-42301	2	RETAINER:HANDLE	28480	01200-42301
MP29	00182-00215	1	PANEL:REAR, TOP	28480	00182-00215
MP30	00182-01205	2	BRACKET:LOW VOLTAGE POWER SUPPLY	28480	00182-01205
MP31	5040-0447	1	FOOT:REAR(LONG)	28480	5040-0447
MP32	00182-24101	1	FACEPLATE:CRT	28480	00182 24101
MP33	00182-24702	2	SPACER:CRT CLAMP	28480	00182-24702
MP34	00182-62701	1	FILTER ASSY:CONTRAST	28480	00182-62701
MP35	00182-00206	1	PANEL: ACCESS TO A1	28480	00182-00206
Q1	00182-62902	1	TRANSISTOR ASSY:H.V. OSCILLATOR	28480	00182-62902
R1	0683-1045	1	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
V1	5083-3952	1	CRT:P31 ALUM.	28480	5083-3952
W1	8120-1538	1	CABLE ASSY:POWER 7.5 FT.	28480	8120-1538
W2	00182-61614	1	CABLE ASSY:CRT (INCL. R1, E1, E2, XV1)	28480	00182-61614
W3	00182-61611	1	CABLE:COAX Z-AXIS(INCL. E2)	28480	00182 61611
W4	00182-61613	1	CABLE ASSY:COAX	28480	00182-61613
W5	00182-61615	1	CABLE ASSY:REG.	28480	00182 61615
W6	00182-61617	1	CABLE:CRT VERTICAL	28480	00182-61617
W7	00182-61612	1	CABLE ASSY: H.V	28480	00182 61612
W8	00182-61616	1	CABLE ASSY:CRT TO A2	28480	00182-61616
XV1	1200-0037	1	SOCKET:CRT TUBE, and	72825	97097
	1200-0050	1	CONTACT:CRT SOCKET, and	72825	9553-1
	1200-0408	1	COVER:CRT SOCKET	28480	1200-0408

See introduction to this section for ordering information

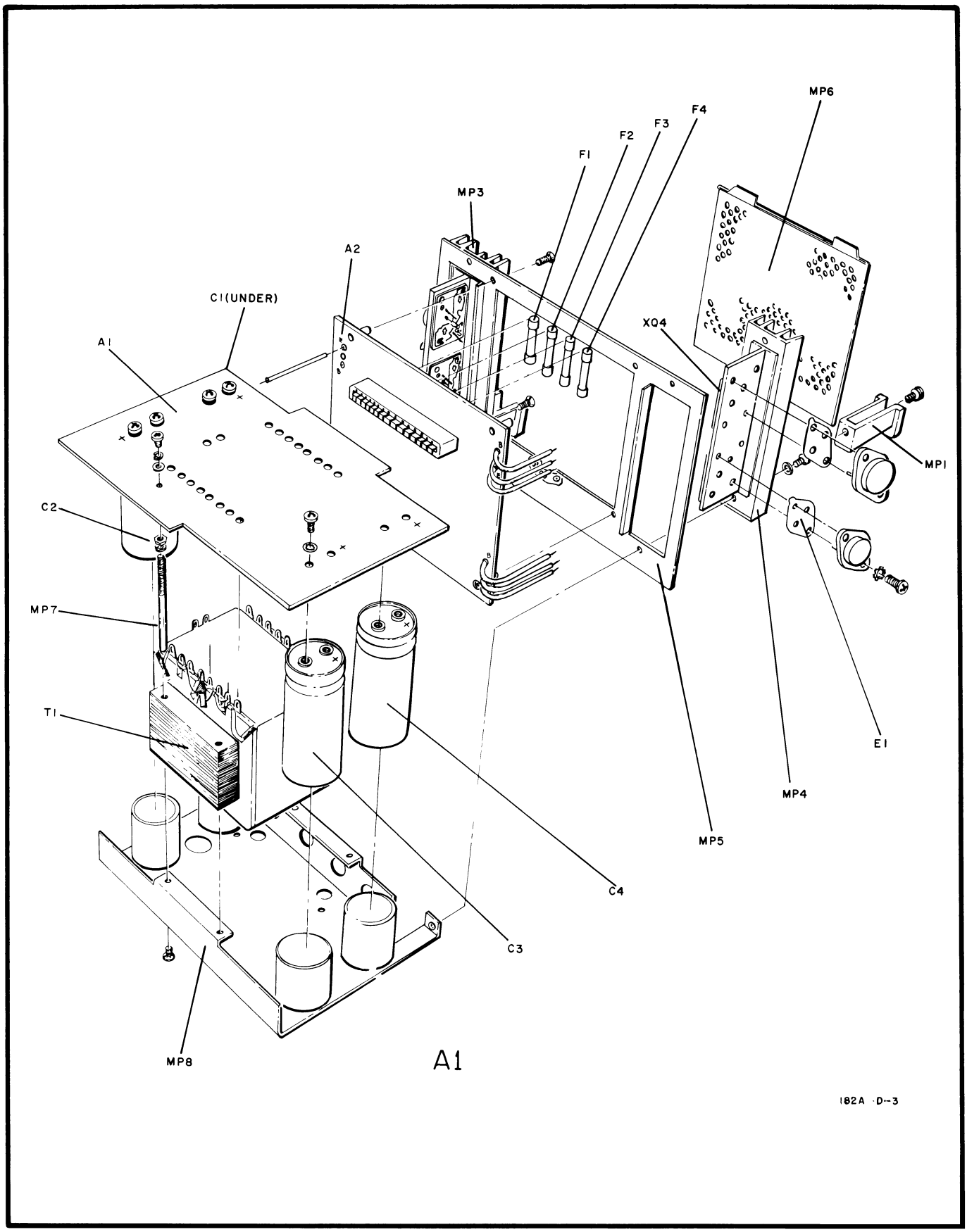


Figure 6-2.
Low Voltage Power Module Exploded View

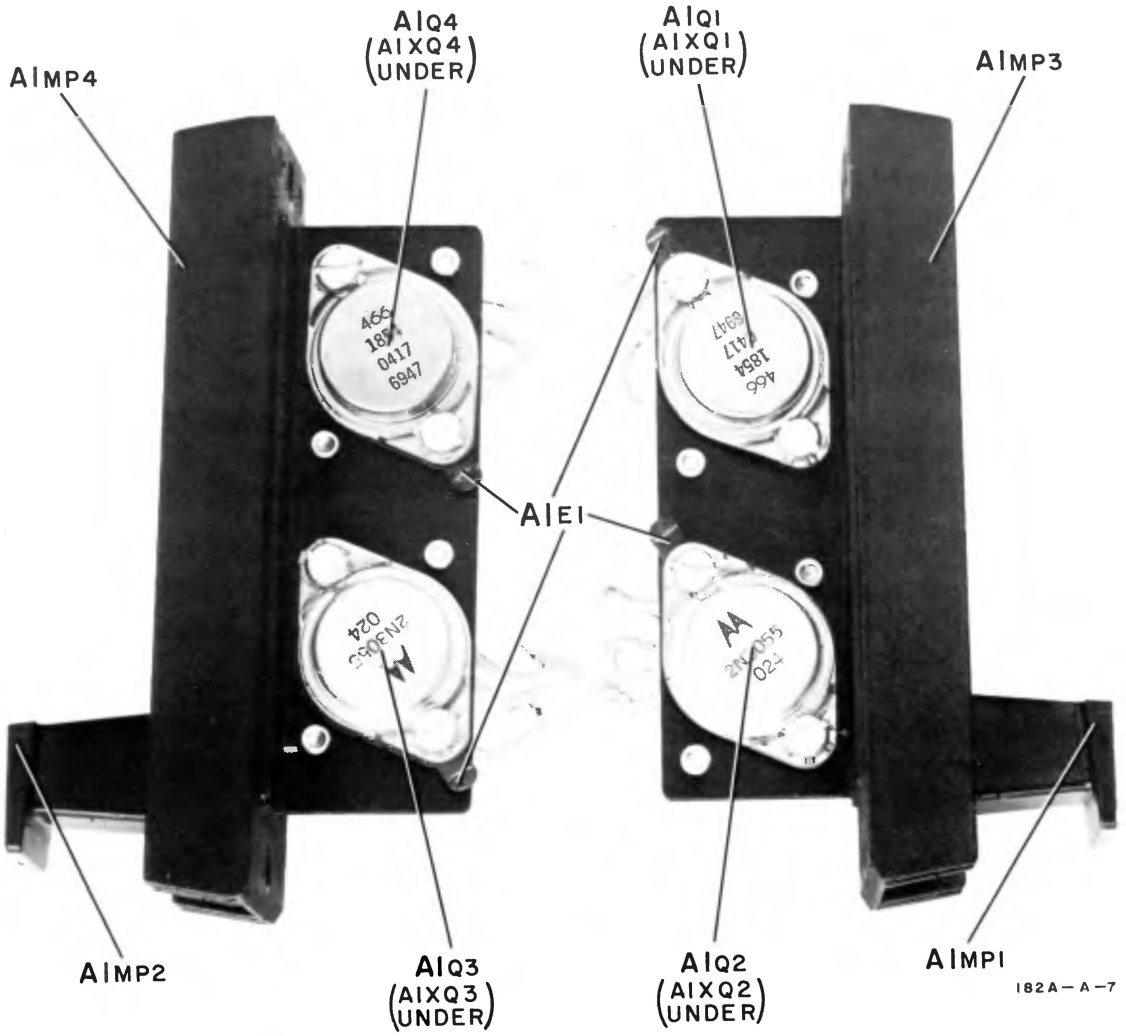


Figure 6-3. Series Regulator Parts Identification

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	00182-60034	1	ASSY:LOW VOLTAGE POWER MODULE	28480	00182-60034
A1C1	0180-1807	2	C:FXD ELECT 290 UF +50-10% 200VDCW	56289	32D291F200AB2A-DQB
A1C2	0180-1865	1	C:FXD ELECT 2100 UF +75-10% 40VDCW	56289	32D212G040AB2A-DQB
A1C3	0180-1809	1	C:FXD ELECT 3400 UF +75-10% 25VDCW	56289	32D342G025AB2A-DQB
A1C4	0180-1807		C:FXD ELECT 290 UF +50-10% 200VDCW	56289	32D291F200AB2A-DQB
A1E1	1200-0043	1	INSULATOR:TSTR MOUNTING(TO-3)	71785	293011
A1F1	2110-0065	2	FUSE:0.375A 250V	75915	312.375
A1F2	2110-0002	2	FUSE:CARTRIDGE 2 AMP 3 AG	75915	312.002
A1F3	2110-0002		FUSE:CARTRIDGE 2 AMP 3 AG	75915	312.002
A1F4	2110-0065		FUSE:0.375A 250V	75915	312.375
A1MP1	5040-0446	2	FOOT:REAR, SHORT, NON-FILTERED	28480	5040-0446
A1MP2	5040-0446		FOOT:REAR, SHORT, NON-FILTERED	28480	5040-0446
A1MP3	00180-61103	1	TRANSISTOR:HEAT SINK RH	28480	00180-61103
A1MP4	00180-61104	1	TRANSISTOR:HEAT SINK LH	28480	00180-61104
A1MP5	00182-00205	1	PANEL:REAR, LVPS	28480	00182-00205
A1MP6	00182-00206	1	PANEL:ACCESS	28480	00182-00206
A1MP7	00182-24701	4	SPACER:LVPS	28480	00182-24701
A1MP8	00182-61201	1	BRACKET ASSY:TRANSFORMER	28480	00182-61201
A1Q1	1854-0417	2	TSTR:SI NPN	28480	1854-0417
A1Q2	1854-0063	2	TSTR:SI NPN	80131	2N3055
A1Q3	1854-0063		TSTR:SI NPN	80131	2N3055
A1Q4	1854-0417		TSTR:SI NPN	28480	1854-0417
A1T1	9100-1129	1	TRANSFORMER:POWER	28480	9100-3401
A1XQ1	1200-0041	4	SOCKET:TRANSISTOR	71785	133-32-10-013
A1XQ2	1200-0041		SOCKET:TRANSISTOR	71785	133-32-10-013
A1XQ3	1200-0041		SOCKET:TRANSISTOR	71785	133-32-10-013
A1XQ4	1200-0041		SOCKET:TRANSISTOR	71785	133-32-10-013
A1A1	00184-66511	1	ASSY:LOW VOLTAGE RECTIFIER BOARD	28480	00184-66511
A1A1C1	0180-0091	1	C: FXD ELECT 10 UF +50–10% 100 VDCW	56289	30D106F100DC2-USM
A1A1CR1	1901-0028	4	DIODE: SILICON 0.75A 400PIV	04713 04713	SR 1358-9
A1A1CR2	1901-0028		DIODE: SILICON 0.75A 400PIV	04713	SR 1358-9
A1A1CR3	1901-0028		DIODE: SILICON 0.75A 400PIV	04713	SR 1358-9
A1A1CR4	1901-0028		DIODE: SILICON 0.75A 400PIV	28480	SR 1358-9
A1A1CR5	1901-0028	8	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR6	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR7	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR8	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR9	1901-0415	8	DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR10	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR11	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR12	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR13	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR14	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR15	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR16	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR17	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR18	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR19	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR20	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR21	1901-0045	4	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A1A1CR22	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A1A1R1	0757-0342	2	R:FXD MET FLM 100K OHM 1% 1/4W	28480	0757-0342
A1A1R2	0757-0342		R:FXD MET FLM 100K OHM 1% 1/4W	28480	0757-0342
A1A1R3	0760-0016		R: FXD MET OX 2700 OHM 2% 1W	28480	0760-0016
A1A1R4	0757-0060		R: FXD MET FLM 24.3K OHM 1% 1/2W	28480	0757-0060
A1A1VR1	1902-0597		DIODE: BREAKDOWN 56.2V 5% 1W	28480	1902-0597
A1A2	00184-66509	1	ASSY:LOW VOLTAGE REGULATOR BOARD	28480	00184-66509
A1A2C1	0140-0176	1	C: FXD MICA 100 PF 2%	28480	0140-0176
A1A2C2	0180-0269	1	C:FXD ELECT 1.0 UF +50-10% 150VDCW	56289	30D105F150BA2-DSM
A1A2C3	0180-0089	4	C:FXD AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150DD2-DSM
A1A2C4	0160-0161	3	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A1A2C5	0180-0058	2	C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A1A2C6	0170-0040	3	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A1A2C7	0180-0058		C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A1A2C8	0180-0089		C: FXD AL ELECT 50 UF +50–10% 150VDCW	56289	30D106F150DD2-DSM
A1A2CR1	1901-0040	18	DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR3	1901-0026	6	DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A1A2CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR7	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A1A2E1-E8	2110-0269	9	CLIP:FUSE 0.250" DIA	91506	6008-32CN
A1A2J3	1251-1633	1	CONNECTOR:PC(1 X 15) 15 CONTACT	71785	252-15-30-310
A1A2Q1	1854-0234	4	TSTR: SI NPN	80131	2N3440
A1A2Q2	1854-0071	15	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071

See introduction to this section for ordering information

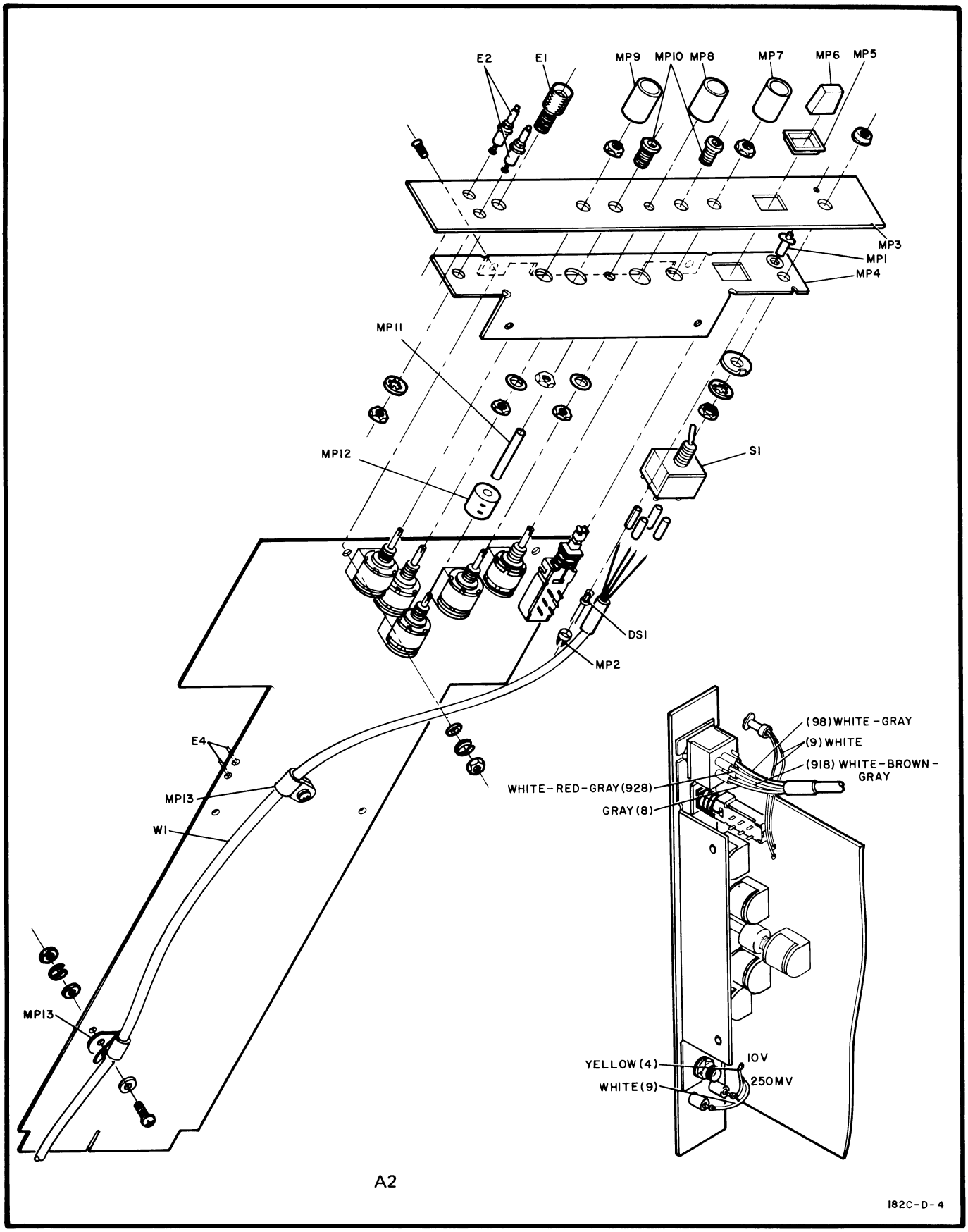


Figure 6-4. Control Module Mechanical Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A2Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q5	1854-0039		TSTR:SI NPN	80131	2N3053
A1A2Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q9	1854-0039		TSTR:SI NPN	80131	2N3053
A1A2Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q11	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q13	1854-0039		TSTR:SI NPN	80131	2N3053
A1A2Q14	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q15	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q16	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2R1	0757-0713	1	R:FXD FLM 110 OHM 1% 1/4W	28480	0757-0713
A1A2R2	0757-0281	6	R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A1A2R3	0757-0465	2	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A1A2R4	0812-0058	2	R:FXD WW 8.2 OHM 5% 2W	28480	0812-0058
A1A2R5	0757-0060	2	R:FXD MET FLM 24.3K OHM 1% 1/2W	28480	0757-0060
A1A2R6	0757-0060		R:FXD MET FLM 24.3K OHM 1% 1/2W	28480	0757-0060
A1A2R7	0757-0435	3	R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A1A2R8	0757-0438	9	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1A2R9	0757-0044	3	R:FXD MET FLM 33.2K OHM 1% 1/2W	28480	0757-0044
A1A2R10	0757-0435		R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A1A2R11	2100-1773	2	R:VAR WW 1K OHM 5% TYPE H 1W	28480	2100-1773
A1A2R12	0757-0767	4	R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A1A2R13	0811-1746	2	R:FXD WW 0.36 OHM 5% 2W	28480	0811-1746
A1A2R14	0757-0767		R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A1A2R15	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1A2R16	0757-0767		R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A1A2R17	0757-0431	4	R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A1A2R18	0757-0273	1	R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A1A2R19	0757-0283	5	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1A2R20	2100-1772	2	R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A1A2R21	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1A2R22	0811-1746		R:FXD WW 0.36 OHM 5% 2W	28480	0811-1746
A1A2R23	0757-0769	4	R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A1A2R24	0757-0436	3	R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A1A2R25	0757-0430	1	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A1A2R26	0757-0769		R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A1A2R27	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A1A2R28	0757-0428	1	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A1A2R29	2100-1772		R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A1A2R30	0757-0435		R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A1A2R31	0757-0367	3	R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A1A2R32	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A1A2R33	0812-0058		R:FXD WW 8.2 OHM 5% 2W	28480	0812-0058
A1A2R34	0757-0769		R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A1A2R35	0757-0768	2	R:FXD FLM 47.5K OHM 1% 1/4W	28480	0757-0768
A1A2R36	0757-0044		R:FXD MET FLM 33.2K OHM 1% 1/2W	28480	0757-0044
A1A2R37	0757-0367		R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A1A2R38	0757-0450	1	R:FXD MET FLM 22.1K OHM 1% 1/8W	28480	0757-0450
A1A2R39	0757-0280	5	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1A2R40	2100-1774	1	R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A1A2R41	0757-0768		R:FXD FLM 47.5K OHM 1% 1/4W	28480	0757-0768
A1A2R42	0687-5611	2	R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611
A1A2TP1	1251-0206	5	CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2TP2	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2TP3	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2TP4	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2VR1	1902-3096	1	DIODE BREAKDOWN:5.23V 5% 400 MW	28480	1902-3096
A1A2VR2	1902-0767	1	DIODE:T.C. REFERENCE 1N938	04713	1N938
A2	00182-60030	1	ASSY:CONTROL MODULE	28480	00182-60030
A2C1	0180-0155	3	C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS
A2C2	0160-2961	2	C:FXD MICA 5825 PF 2% 300VDCW	04062	RDM20F(5825)G3C
A2C3	0160-2961		C:FXD MICA 5825 PF 2% 300VDCW	04062	RDM20F(5825)G3C
A2C4	0180-0069		C:FXD AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150DD2-DSM
A2C5	0180 0094		C: FXD ELECT 100 UF +75-10% 25 VDCW	56289	30D107G025DD2 DSM
A2C6	0180 0094		C: FXD ELECT 100 UF +75-10% 25 VDCW	56289	30D107G025DD2 DSM
A2C7	0160 4079		C: FXD MY 1500 PF 4K VDCW	56289	430P152040
A2CR1	1901-0096	4	DIODE:SILICON 120V	01295	UG-888
A2CR2	1901-0096		DIODE:SILICON 120V	01295	UG-888
A2CR3	1901-0096		DIODE:SILICON 120V	01295	UG-888
A2CR4	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A2CR5	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A2DS1	2140-0346	1	LAMP:INCANDESCENT 5V	71744	7210
A2E1	1510-0038	2	BINDING POST	28480	1510-0038
A2E2	0360-1646	1	TERMINAL:SOLDER STUD	17117	4338-67-0
A2E3	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN

See introduction to this section for ordering information

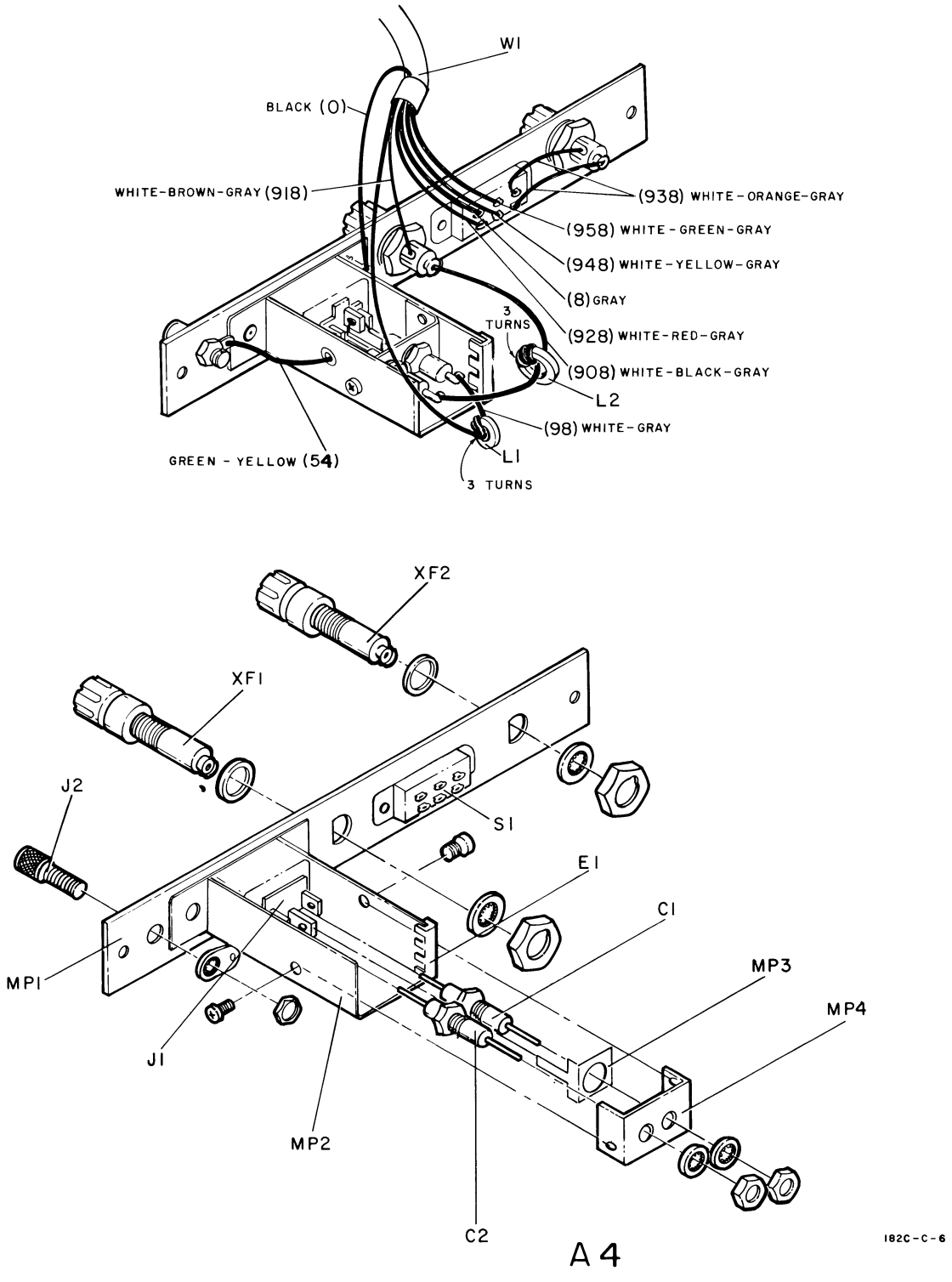


Figure 6-5. AC Power Module Parts Identification

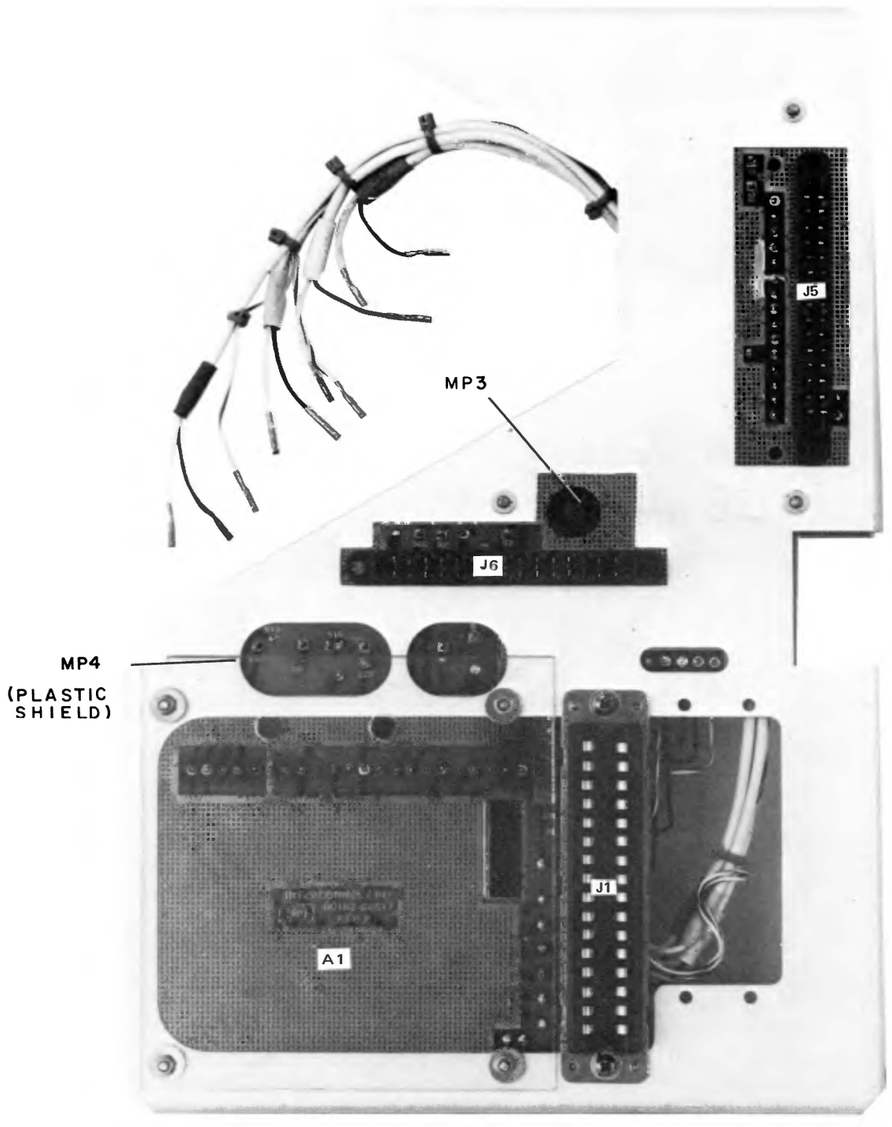
Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2E4	0360-1653	14	TERMINAL:PIN (CDA 260)	00000	OBD
A2E5	0362-0063	12	TERMINATION:CRIMP LUG FOR 0.046SQ PIN	00000	OBD
A2E6	0362-0264	3	TERMINATION:CRIMP LUG	91886	2611225-14
A2L1	9140-0115	1	COIL:FXD RF 22 UH 10%	99800	2150-32
A2MP1	1450-0404	1	LENS:CLEAR	28480	1450-0404
A2MP2	00183-67701	1	BASE:PILOT LIGHT	28480	00183-67701
A2MP3	00182-60203	1	PANEL:FRONT CONTROL	28480	00182-60203
A2MP3			(INCLUDES A2E2)		
A2MP4	00182-01210	1	BRACKET:CONTROL	28480	00182-01210
A2MP5	0370-0451	4	BEZEL:PUSHBUTTON KNOB BLK NYLON	28480	0370-0451
A2MP6	0370-0450	1	KNOB:PUSHBUTTON SWITCH, BLK	71590	J52305
A2MP7	00182-67401	3	KNOB ASSY:ARROW	28480	00182-67401
A2MP8	00182-67401		KNOB ASSY:ARROW	28480	00182-67401
A2MP9	00182-67403	1	KNOB ASSY:OFF	28480	00182-67403
A2MP10	1490-0968	1	BUSHING:POTENTIOMETER 1/4-32 EXT THRD	00000	OBD
A2MP11	00182-23706	1	SHAFT:EXTENDER	28480	00182-23706
A2MP12	1490-0841	1	COUPLING:SHAFT 0.127" ID	28480	1490-0841
A2MP13	1400-0024	3	CLAMP,CABLE NYLON 1/4 DIA	71616	CPC-1953-4A
A2Q1	1854-0234	2	TSTR:SI NPN	80131	2N3440
A2Q2	1854-0234		TSTR:SI NPN	80131	2N3440
A2Q3	1854-0053	1	TSTR:SI NPN	80131	2N2218
A2R1	0757-0453	1	R:FXD MET FLM 30.1K OHM 1% 1/8W	28480	0757-0453
A2R2	2100-2917	1	R:VAR WW 50K OHM 20% 1/2W	28480	2100-2917
A2R3	0698-3158	2	R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A2R4	2100-2031	1	R:VAR 50K OHM 10% LIN 1/2W	28480	2100-2031
A2R5	0757-0454	1	R:FXD MET FLM 33.2K OHM 1% 1/8W	28480	0757-0454
A2R6	0757-0460	1	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R7	0757-0456	1	R:FXD MET FLM 43.2K OHM 1% 1/8W	28480	0757-0456
A2R8	2100-3002	2	R:VAR 10K OHM	28480	2100-3002
A2R9	0757-0468	4	R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A2R10	0683-0275	4	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A2R11	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A2R12	0757-0407	6	R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A2R13	0757-0190	1	R:FXD MET FLM 20K OHM 1% 1/2W	28480	0757-0190
A2R14	0761-0006	1	R:FXD MET OX 10K OHM 5% 1W	28480	0761-0006
A2R15	0757-0468		R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A2R16	0757-0468		R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A2R17	0698-5421	1	R:FXD MET FLM 17.82K OHM 0.1% 1/2W	28480	0698-5421
A2R18	0698-5419	1	R:FXD FLM 1.95K OHM 0.1% 1/8W	28480	0698-5419
A2R19	0698-5418	1	R:FXD FLM 50 OHM 0.1% 1/8W	28480	0698-5418
A2R20	2100-3002		R:VAR 10K OHM	28480	2100-3002
A2R21	2100-3001	1	R:VAR 5 MEGOHM	28480	2100-3001
A2R22	0698-5678	1	R:FXD FLM 16.25 MEGOHM 5% 1W	28480	0698-5678
A2R23	2100-3003	1	R:VAR 5K OHM	28480	2100-3003
A2R24	0757-0281		R: FXD MET FLM 2740 OHM 1% 1/8W	28480	0757-0281
A2R25	0684-3901	1	R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A2S1	3101-1508	1	SWITCH:TOGGLE DPDT	09353	7318I
A2S2	3101-1374	1	SWITCH:PUSHBUTTON DPDT	28480	3101-1374
A2W1	00182-61605	1	CABLE ASSY:	28480	00182-61605
			(INCLUDES E5 AND E6)		
A3	00182-60021	1	ASSY:INTERCONNECT MODULE	28480	00182-60021
A3E1	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A3A1	00182-66517	1	ASSY:MOTHER BOARD	28480	00182-66517
A3J1	1251-0137	1	CONNECTOR:PC 32 CONTACT	02660	26-4200-32S
A3J2	1251-2572	1	CONNECTOR:PC EDGE 22 FORK CONTACT	95354	91-6922-0702-00
A3J4	1251-0213	3	CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3J5	1251-0213		CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3J6	1251-0213		CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3MP1	00182-01204	1	BRACKET:MOTHER BOARD	28480	00182-01204
A3MP2	1400-0024		CLAMP,CABLE NYLON 1/4 DIA	71616	CPC-1953-4A
A3MP3	0400-0010	1	GROMMET:VINYL 0.250" I.D.	00000	OBD
A3MP4	00182-00605	1	SHIELD:A.C.	28480	00182-00605
A3W1	00182-61609	1	CABLE ASSY:COAX	28480	00182-61609
A3W2	00180-61650	1	CABLE ASSY:SWEEP OUT	28480	00180-61650
A4	00182-60004	1	ASSY:AC POWER	28480	00182-60004
A4C1	0160-3484	2	C:FXD CER FEED-THRU 1000 PF 20% 1000V	72982	2432-009 X5U 102M
A4C2	0160-3484		C:FXD CER FEED-THRU 1000 PF 20% 1000V	72982	2432-009 X5U 102M
A4E1	0400-0018	1	GROMMET:CHANNEL U-SHAPED	95987	WG-101
A4E2	0362-0063		TERMINATION:CRIMP LUG FOR 0.046SQ PIN	00000	OBD
A4F1	2110-0005	1	FUSE:CARTRIDGE 1.6 AMP 125V	71400	MDL 1.6
A4F2	2110-0020	1	FUSE:0.8A 250V SLOW-BLOW	75915	313.800S
A4J1	1251-2357	1	SOCKET:3-PIN MALE POWER RECEPTACLE	82389	EAC-301
A4J2	1510-0038		BINDING POST	28480	1510-0038
A4L1	9170-0013	1	COIL:CORE, TOROID, GREEN	72656	CF-102-H
A4MP1	00182-60201	1	PANEL ASSY:REAR	28480	00182-60201
A4MP2	00182-00601	1	SHIELD:LINE FILTER	28480	00182-00601
A4MP3	00180-01246	2	BRACKET:GROUND LINE FILTER	28480	00180-01246

See introduction to this section for ordering information

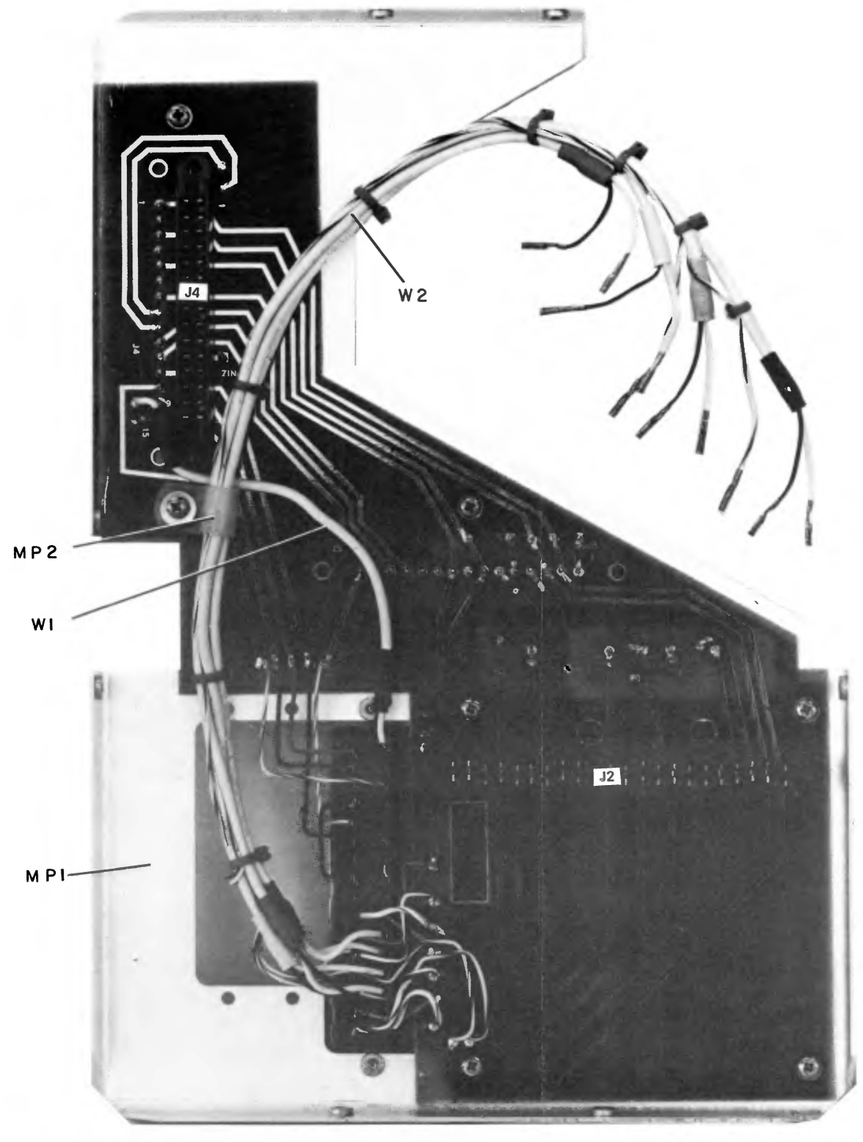
Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4MP4	00182-01209	1	BRACKET:LINE FILTER	28480	00182-01209
A4S1	3101-1237	1	SWITCH:SLIDE DPDT	82389	11A-1243
A4W1	00182-61604	1	CABLE ASSY:LINE 1	28480	00182-61604
A4XF1	1400-0084	2	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
A4XF2	1400-0084		FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
A5	00182-60035	1	ASSY HORIZONTAL AMPLIFIER MODULE (See figure 6-7.)	28480	00182-60035
A5A1	00182-66518	1	ASSY:HORIZONTAL AMPLIFIER (See figure 6-7 for A5 parts not included with A5A1).	28480	00182-66518
A5C1	0160-0162	10	C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C2	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C3	0180-0197	4	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C5	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C6	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A5C7	0160-0168	3	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A5C8	0170-0022	1	C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24
A5C9	0121-0060	1	C:VAR CER 2-8 PF NPO	72982	538-011 A 2-8
A5C10	0160-2250	1	C:FXD CER 5.1 PF 500VDCW	72982	301-000-COHO-519E
A5C11	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A5C12	0131-0004	1	C:VAR MICA 16-150 PF 175VDCW	72136	T51410-3
A5C13	0160-2020	2	C:FXD MICA 910 PF 5% 100VDCW	00853	RDM15F911J1S
A5C14	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C15	0160-2020		C:FXD MICA 910 PF 5% 100VDCW	00853	RDM15F911J1S
A5C16	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C17	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C18	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C19	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C20			NOT ASSIGNED		
A5C21	0132-0007	3	C:VAR POLY 0.7 TO 3.0 PF 350VDCW	72982	535-033-4R
A5C22	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C23	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A5C24	0132-0007		C:VAR POLY 0.7 TO 3.0 PF 350VDCW	72982	535-033-4R
A5C25	0160-2235	1	C:FXD CER 0.75 PF 500VDCW	72982	301-000-COKO-758C
A5C26	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A5C27	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C28	0132-0007		C:VAR POLY 0.7 TO 3.0 PF 350VDCW	72982	535-033-4R
A5CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR4	5080-0464	4	DIODE:SILICON 30 200M	28480	5080-0464
A5CR5	5080-0464		DIODE:SILICON 30 200M	28480	5080-0464
A5CR6			NOT ASSIGNED		
A5CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR9	5080-0464		DIODE:SILICON 30 200M	28480	5080-0464
A5CR10	5080-0464		DIODE:SILICON 30 200M	28480	5080-0464
A5CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5E1	1251-2039	2	CONNECTOR:TEST POINT, CORD JACK	28480	1251-2039
A5E2	0360-1788		TERMINAL:PIN	28480	0360-1788
A5J1	1250-0083	6	CONNECTOR:BNC	02660	31-221-1020
A5L1	9140-0179	6	COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5L3	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5L4	9170-0029	2	CORE:FERRITE BEAD	02114	56-590-65A2/4A
A5MP1	00182-00201	1	PANEL:FRONT, HORIZONTAL	28480	00182-00201
A5MP2	00182-01202	1	BRACKET:HORIZONTAL	28480	00182-01202
A5MP3	00182-67401		KNOB ASSY:ARROW	28480	00182-67401
A5MP4	00182-67404	1	KNOB ASSY:CAL	28480	00182-67404
A5MP5	00182-67405	3	KNOB ASSY:PUSHBUTTON	28480	00182-67405
A5MP6	0370-0451		BEZEL:PUSHBUTTON KNOB BLK NYLON	28480	0370-0451
A5MP7	1400-0325	1	CLAMP:CABLE 0.125" DIA	00000	OBD
A5MP8	1205-0063	3	HEAT SINK:SEMICONDUCTOR	05820	224-CB
A5Q1	1855-0062	1	TSTR:SI FET 30V	01295	2N1595
A5Q2	1854-0215	3	TSTR:SI NPN	80131	2N3904
A5Q3	1850-0158	1	TSTR:GE PNP	80131	2N2635
A5Q4	1854-0019	5	TSTR:SI NPN	28480	1854-0019
A5Q5	1854-0019		TSTR:SI NPN	28480	1854-0019
A5Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q7	1854-0019		TSTR:SI NPN	28480	1854-0019
A5Q8	1853-0009	2	TSTR:SI PNP	28480	1853-0009
A5Q9	1854-0419	2	TSTR:SI NPN	04713	SS657
A5Q10	1853-0038	3	TSTR:SI PNP	28480	1853-0038
A5Q11	1853-0009		TSTR:SI PNP	28480	1853-0009
A5Q12	1854-0419		TSTR:SI NPN	04713	SS657
A5Q13	1853-0038		TSTR:SI PNP	28480	1853-0038
A5R1	0684-1011	2	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R2	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A5R3	0757-0388	1	R:FXD FLM 30.1 OHM 1% 1/8W	28480	0757-0388



FRONT VIEW

A3



REAR VIEW

182C-A-6

Figure 6-6.
Interconnect Module Parts Identification

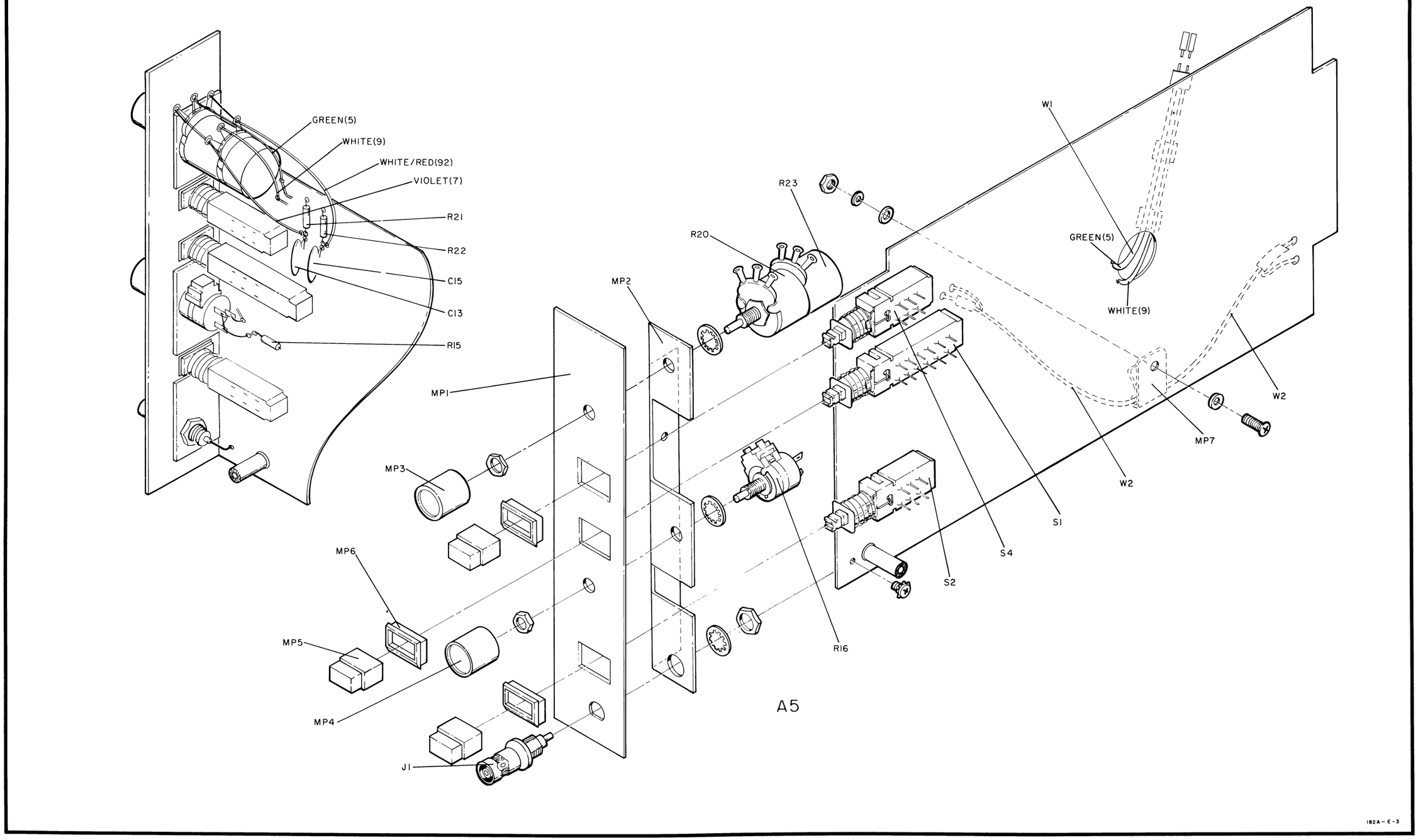


Figure 6-7. Horizontal Amplifier Module Mechanical Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5R4	0757-0156	1	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A5R5	0727-0287	1	R:FXD CARBON 2 MEGOHM 1% 1/2W	28480	0727-0287
A5R6	0757-0344	2	R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A5R7	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R8	0757-0367		R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A5R9	0757-0416	4	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5R10	0757-0434	3	R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A5R11	2100-2030	2	R:VAR FLM 20K OHM 10% LIN 1/2W	28480	2100-2030
A5R12	0757-0447	1	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A5R13	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A5R14	0698-3647	1	R:FXD MET CX 15K OHM 5% 2W	28480	0698-3647
A5R15	0757-0426	2	R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A5R16	2100-2922	1	R:VAR COMP 15K OHM 20% 5 CCLOG 1/4W	28480	2100-2922
A5R17	0757-0774	1	R:FXD FLM 82.5K OHM 1% 1/4W	28480	0757-0774
A5R18	0757-0401	9	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R19	0757-0792	1	R:FXD MET FLM 681K OHM 1% 1/4W	28480	0757-0792
A5R20	2100-2998	2	R:VAR CERMET 2 X 100K OHM 20% LIN	28480	2100-2998
A5R21	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R22	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R23	2100-2998		R:VAR CERMET 2 X 100K OHM 20% LIN	28480	2100-2998
A5R24	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R25	0757-0771	1	R:FXD FLM 61.9K OHM 1% 1/4W	28480	0757-0771
A5R26	0757-0441	1	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A5R27	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A5R28	0757-0044		R:FXD MET FLM 33.2K OHM 1% 1/2W	28480	0757-0044
A5R29	0757-0741	2	R:FXD MET FLM 2.43K OHM 1%/1/4W	28480	0757-0741
A5R30	0757-0468		R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A5R31	0757-0440	1	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A5R32	0757-0427	2	R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A5R33	0757-0741		R:FXD MET FLM 2.43K OHM 1%/1/4W	28480	0757-0741
A5R34	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A5R35			NOT ASSIGNED		
A5R36	0757-0443	2	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A5R37	0757-0434		R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A5R38	0757-0846	2	R:FXD MET FLM 22.1K OHM 1.0% 1/2W	28480	0757-0846
A5R39	0757-0413	2	R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A5R40	0757-0736	2	R:FXD MET FLM 1.50K OHM 1% 1/4W	28480	0757-0736
A5R42	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A5R43	0757-0841	2	R:FXD MET FLM 12.1K OHM 1% 1/2W	28480	0757-0841
A5R44	2100-1770	1	R:VAR WW 100 OHM 5% TYPE H 1W	28480	2100-1770
A5R45	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A5R46	2100-1773		R:VAR WW 1K OHM 5% TYPE H 1W	28480	2100-1773
A5R47	0757-0284	1	R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5R48	0698-3416	2	R:FXD MET FLM 21.5K OHM 1% 1/2W	28480	0698-3416
A5R49	2100-1775	1	R:VAR WW 5K OHM 5% TYPE H 1W	28480	2100-1775
A5R50	0698-3416		R:FXD MET FLM 21.5K OHM 1% 1/2W	28480	0698-3416
A5R51	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A5R52	0757-0443		R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A5R53	0757-0434		R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A5R54	0757-0413		R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A5R55	0757-0846		R:FXD MET FLM 22.1K OHM 1.0% 1/2W	28480	0757-0846
A5R56	0757-0736		R:FXD MET FLM 1.50K OHM 1% 1/4W	28480	0757-0736
A5R57	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A5R58	0757-0448	1	R:FXD MET FLM 18.2K OHM 1% 1/8W	28480	0757-0448
A5R59	0757-0841		R:FXD MET FLM 12.1K OHM 1% 1/2W	28480	0757-0841
A5R60	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5R61	2100-2030		R:VAR FLM 20K OHM 10% LIN 1/2W	28480	2100-2030
A5R62	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5R63	0757-0426		R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A5S1	3101-1241	1	SWITCH:PUSHBUTTON 4PDT	71590	P8 1
A5S2	3101-0535	2	SWITCH:PUSHBUTTON 2P SINGLE STATION	71590	PB-1
A5S3	3101-0982	1	SWITCH:SLIDE SPST 0.5A 125V	79727	GF124-0007
A5S4	3101-0535		SWITCH:PUSHBUTTON 2P SINGLE STATION	71590	PB-1
A5W1	00181-61606	1	CABLE ASSY:HORIZONTAL (INCL. E1 AND E2)	28480	00181-61606
A5W2	00182-61606	1	CABLE ASSY:COAX	28480	00182-61606
A6	00182-61102	1	ASSY:H.V. OSC. RECTIFIER BOARD	28480	00182-61102
A6C1	0160-0543	2	C:FXD CER 4700 PF 20% 4K VDCW	28480	0160-0543
A6C2	0160-0544	2	C:FXD CER 0.022 UF 20% 4K VDCW	28480	0160-0544
A6C3	0160-0543		C:FXD CER 4700 PF 20% 4K VDCW	28480	0160-0543
A6C4	0160-0544		C:FXD CER 0.022 UF 20% 4K VDCW	28480	0160-0544
A6C5	0160-2403	1	C:FXD CER 1500 PF 20% 5K VDCW	72982	828-025-X5R0-152M
A6C6	0160-2906		C: FXD CER 0.02 UF 20% 500VDCW	72982	821-519-X5V-203M
A6CR1	1901-0683	2	DIODE:SI HV	28480	1901-0683
A6CR2	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A6CR3	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A6CR4	1901-0683		DIODE:SI HV	28480	1901-0683

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6CR5	1901-0490	1	DIODE:SI 3000 PIV	28480	1901-0490
A6CR6	1901-0096		DIODE:SILICON 120V	01295	UG-888
A6E1	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A6R1	0687-2231	1	R:FXD COMP 22K OHM 10% 1/2W	01121	EB 2231
A6R2	2100-1618	1	R:VAR FLM 1 MEGOHM 20% LIN 1/2W	28480	2100-1618
A6R3	0757-0145	1	R:FXD MET FLM 750K OHM 1% 1/4W	28480	0757-0145
A6R4	0698-8018	2	R:FXD FLM 30 MEGOHM 1% 3W	28480	0698-8018
A6R5	0757-0344		R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A6R6	0687-2221	1	R:FXD COMP 2200 OHM 10% 1/2W	01121	EB 2221
A6R7	0687-1531	1	R:FXD COMP 15K OHM 10% 1/2W	01121	EB 1531
A6R8	0698-5677	1	R:FXD FLM 8.25 MEGOHM 5% 1W	28480	0698-5677
A6R9	0698-8018		R:FXD FLM 30 MEGOHM 1% 3W	28480	0698-8018
A6T1			N.S.R. PART OF A6		
A6TP1	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A7	00182-66515	1	ASSY:GATE AMPLIFIER BOARD	28480	00182-66515
A7C1	0160-0207	1	C:FXD MYLAR 0.01UF 5% 200VDCW	28480	0160-0207
A7C2	0160-2261	1	C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A7C3	0150-0093	1	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A7C4	0160-2200	1	C:FXD MICA 43 PF 5%	72136	RDM15E430J3C
A7C5	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A7C6	0121-0407	1	C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A7C7	0150-0029	1	C:FXD TI 1 PF 10% 500VDCW	78488	TYPE GA
A7C8	0121-0168	1	C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A7C9	0150-0029	1	C: FXD TI 1 PF 10% 500VDCW	78488	TYPE GA
A7C10	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A7C11	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A7C12	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A7C13	0180-0089		C:FXD AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150DD2-DSM
A7C14	0180-0161	1	C:FXD ELECT 3.3 UF 20% 35VDCW	56289	150D335X0035B2-DYS
A7C15	0140-0204	1	C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A7CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR4	1901-0535	1	DIODE: HYBRID HOT CARRIER	28480	1901-0535
A7CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR6	1901-0029	2	DIODE:SILICON 600 PIV	28480	1901-0029
A7CR7	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A7CR8	1901-0436	2	DIODE:SILICON 1600 PIV	28480	1901-0436
A7CR9	1901-0436		DIODE:SILICON 1600 PIV	28480	1901-0436
A7E1	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A7L1	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A7L2	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A7MP1	1205-0063		HEAT SINK:SEMICONDUCTOR	05820	224-CB
A7Q1	1854-0019		TSTR:SI NPN	28480	1854-0019
A7Q2	1853-0049	2	TSTR:SI PNP	28480	1853-0049
A7Q3	1853-0049		TSTR:SI PNP	28480	1853-0049
A7Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q5	1854-0092	1	TSTR:SI NPN	80131	2N3563
A7Q6	1854-0019		TSTR:SI NPN	28480	1854-0019
A7Q7	1853-0038		TSTR:SI PNP	28480	1853-0038
A7Q8	1854-0271	1	TSTR:SI NPN	28480	1854-0271
A7R1	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R2	0757-0769		R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A7R3	0757-0433	1	R:FXD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0433
A7R4	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R5	0757-0442	1	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R6	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A7R7	0757-0274	1	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A7R8	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R9	0757-0419	1	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A7R10	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R11	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A7R12	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R13	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A7R14	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A7R15	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A7R16	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A7R17	0757-0437	1	R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A7R18	0757-0461	1	R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A7R19	0757-0724	1	R:FXD FLM 392 OHM 1% 1/4W	28480	0757-0724
A7R20	0757-0727	1	R:FXD MET FLM 562 OHM 1% 1/4W	28480	0757-0727
A7R21	0757-0767		R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A7R22	0757-0840	1	R:FXD MET FLM 11.0K OHM 1% 1/2W	28480	0757-0840
A7R23	0757-0472	1	R: FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A7R24			NOT ASSIGNED		

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R25	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R26	0757-0760	1	R:FXD FLM 20K OHM 1% 1/4W	28480	0757-0760
A7R27	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R28	0683-1015	1	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A7R29	0761-0083	1	R:FXD MET OX 69K OHM 5% 1W	28480	0761-0083
A7R30	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R31	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R32	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A8	00181-66508	1	ASSY:SWEEP GATE OUTPUT BOARD	28480	00181-66508
A8C1	0180-0155		C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS
A8C2	0180-0155		C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS
A8E1	5020-0495	12	PIN:SQUARE(TEST POINTS)	28480	5020-0495
A8L1	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A8L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A8Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q3	1853-0016	2	TSTR:SI PNP	80131	2N3638
A8Q4	1853-0016		TSTR:SI PNP	80131	2N3638
A8R1	0757-0451	2	R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A8R2	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R3	0757-0436		R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A8R4	0757-0451		R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A8R5	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R6	0757-0436		R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A8R7	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A8R8	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A8R9	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R10	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A8R11	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A8R12	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R13	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A8R14	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A8R15	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A9	00182-60029	1	ASSY:CRT MODULE	28480	00182-60029
A9E1	0360-0227	1			
A9L1	5060-0553	1	COIL:ALIGNMENT, ORTHOGONALITY "Y"	28480	5060-0553
A9L2	5060-0435	1	COIL:ALIGNMENT Z AXIS	28480	5060-0435
A9MP1	00182-60602	1	SHIELD ASSY:CRT	28480	00182-60602
A9MP2	0400-0009		GROMMET:VINYL, FOR 1/4" DIA HOLE	01538	6250
A9MP3	7120-0538		LABEL	28480	7120-0538
A9MP4	1400-0798		CLAMP:CRT OLIVE	28480	1400-0798
A9MP5	1400-0026		CLAMP:HOSE	66295	36H
A9MP6	0380-1019		SPACER	00000	OBD
A9MP7	0380-1019		SPACER	00000	OBD
A10	00182-66513	1	ASSY:H.V. REGULATOR BOARD	28480	00182-66513
A10C1	0180-0097	1	C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A10C2	0160-3453	2	C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A10C3	0180-0100	2	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10C4	0160-2903	1	C:FXD CER 0.05 UF 20% 500VDCW	56289	1233C24A2-CDH
A10C5	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A10C6	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A10C8	0160-3452	2	C: FXD CER 0.02 UF 20% 100VDCW	56289	C03B101H203MS25-CO
A10CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR4	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A10CR5	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A10E1	1251-0513	1	CONNECTOR:R & P, 5 MALE POST CONTACT	28480	1251-0513
A10E2	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A10Q1	1855-0057	1	TSTR:SI FET N-CHANNEL	28480	1855-0057
A10Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A10Q3	1853-0034	1	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0034
A10R1	0811-1671	1	R:FXD WW 2.7 OHM 5% 2W	28480	0811-1671
A10R2	0699-0002	2	R:FXD COMP 6.8 OHM 10% 1/2W	01121	EB 68G1
A10R3	2100-2650	1	R:VAR FLM 200K OHM 10% LIN 1/2W	28480	2100-2650
A10R4	0757-0138	1	R:FXD MET FLM 909K OHM 2% 1/2W	28480	0757-0138
A10R5	0684-2731	3	R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A10R6	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A10R7	0684-2721	1	R:FXD COMP 2700 OHM 10% 1/4W	01121	CB 2721
A10R8	0684-4721	1	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A10R9	0687-5611		R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611
A10R10	0699-0002		R:FXD COMP 6.8 OHM 10% 1/2W	01121	EB 68G1
A10R11	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A10R12	0687-1011	1	R:FXD COMP 100 OHM 10% 1/2W	01121	EB 1011
A10R13	0684-1021	1	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021

See introduction to this section for ordering information

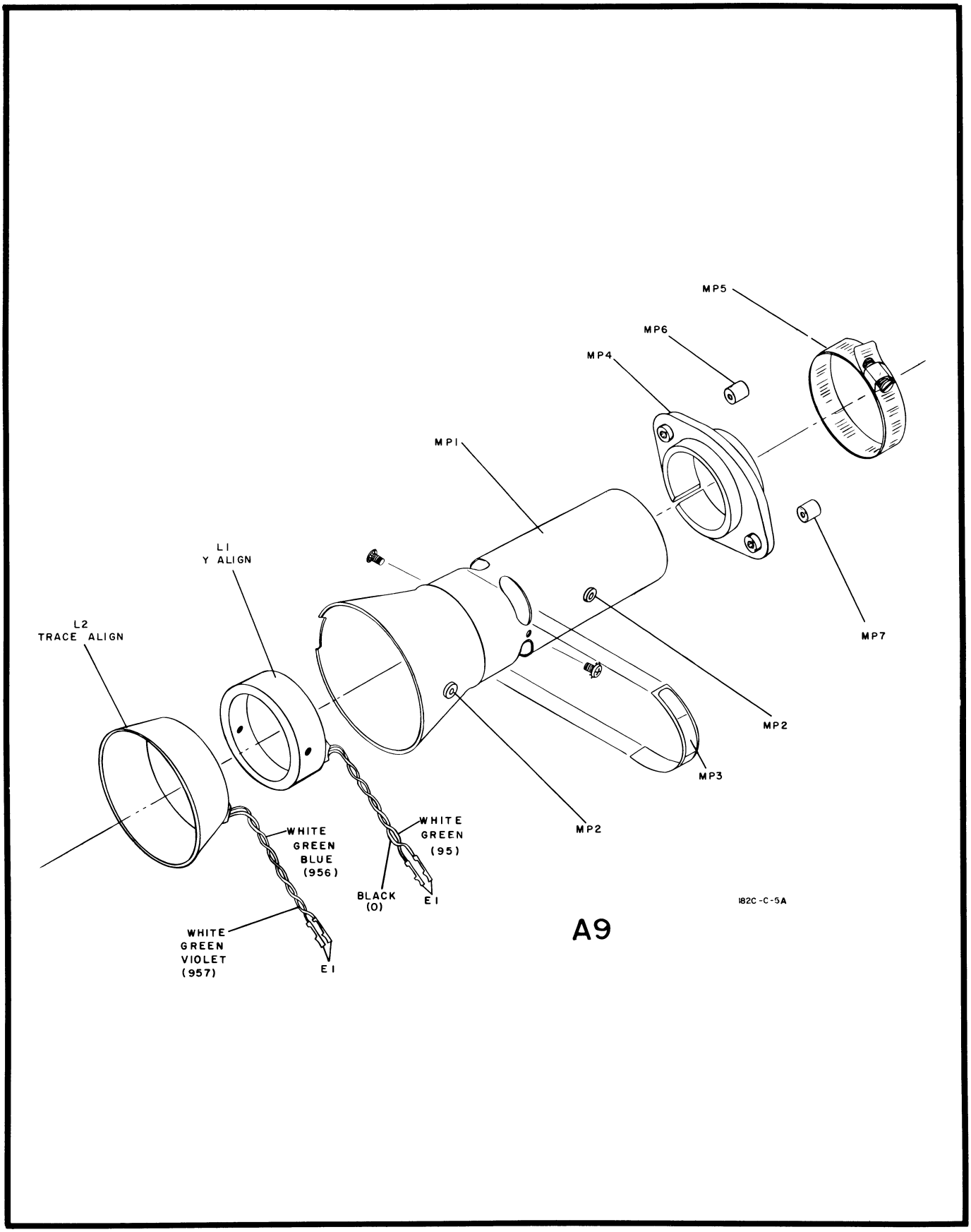


Figure 6-8. CRT Module Parts Identification

Table 6-3. List of Manufacturers' Codes

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	U.S.A. COMMON	ANY SUPPLIER OF U.S.A.	
00853	SANGAMO ELECTRIC CO.PICKENS DIV.	PICKENS, S.C.	29671
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
01538	SMALL PARTS INC.	COSTA MESA, CALIF.	92626
02114	FERROXCUBE CORP.	SAUGERTIES, N.Y.	12477
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
05820	WAKEFIELD ENGINEERING INC.	WAKEFIELD, MASS.	01880
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
08717	SLOAN CO. THE	SUN VALLEY, CALIF.	91352
09134	TEXAS CAPACITOR CO. INC.	HOUSTON, TEX.	77042
09353	C & K COMPONENTS INC.	NEWTON, MASS.	02158
12881	METEX CORP.	EDISON, N.J.	08817
14655	CORNELL DUBLIER ELECT. DIV.FEDERAL PACIFIC ELECT. CO.	NEWARK, N.J.	07105
17117	ELECTRONIC MOLDING CORP.	PAWTUCKET, R.I.	02860
27264	MOLEX PROD. CO.	DOWNERS GROVE, ILL.	60515
28480	HEWLETT-PACKARD CO. CORPORATE HQ	YOUR NEAREST HP OFFICE	
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
59730	THOMAS & BETTS CO. THE	ELIZABETH, N.J.	07207
66295	WITTEK MFG. CO.	CHICAGO, ILL.	60623
71400	BUSSMANN MFG. DIV. MC GRAW-EDISON CO.	ST. LOUIS, MO.	63017
71590	GLOBE UNION INC. CENTRALAB DIV.	MILWAUKEE, WISC.	53201
71616	COMMERCIAL PLASTICS CO.	MUNDELEIN, ILL.	60060
71744	CHICAGO MINIATURE LAMP WORKS	CHICAGO, ILL.	60640
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72656	INDIANA GENERAL CORP. ELECTRONIC DIV.	KEASBEY, N.J.	08832
72825	EBY HUGH H. INC.	PHILADELPHIA, PA.	19144
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
75915	LITTELFUSE INC.	DES PLAINES, ILL.	60016
78488	STACKPOLE CARBON CO.	ST. MARYS, PA.	15857
79727	CONTINENTAL-WIRT ELECTRONICS CORP.	WARMINSTER, PA.	18974
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
82389	SWITCHCRAFT INC.	CHICAGO, ILL.	60630
91506	AUGAT INC.	ATTLEBORO, MASS.	02703
91886	MALCO MFG. CO. INC.	CHICAGO, ILL.	60650
95354	METHODE MFG. CO.	ROLLING MEADOWS, ILL.	60008
95987	WECKESSER CO. INC.	CHICAGO, ILL.	60641
98291	SEALECTRO CORP.	MAMARONECK, N.Y.	10544
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052

See introduction to this section for ordering information

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information required to backdate or update this manual for a specific instrument. Descriptions of special options and standard options are also in this section.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having a serial prefix as shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, refer to Table 7-1 for changes necessary to backdate the manual to the instrument. When making changes from Table 7-1, make the change with the highest number first.

Table 7-1. Manual Changes

Serial Prefix	Make Changes
1240A, 1241A	3 thru 1
1248A	3 and 2
1311A	3

CHANGE 1

Table 6-2,

A1 (on pages 6-2 and 6-5): Change HP and Mfr. Part No. to 00182-60018.

A1T1: Change HP and Mfr. Part Nos. to 9100-1129.

A1A1: Change HP and Mfr. Part Nos. to 00182-66505.

A1A1C1: Change to HP Part No. 0180-1811; C: FXD ELECT 100 UF +75V −10% VDCW; Mfr. Code 56289; Mfr. Part No. 600D107G0200D4.

A1A1CR1 through A1A1CR4: Change to HP Part No. 1909-0049; DIODE: SILICON 50 PIV Mfr. Code 28480; Mfr. Part No. 1901-0049.

A1A1R3: Delete.

A1A1R4: Delete.

A1A1VR1: Delete.

A1A2: Change HP and Mfr. Part Nos. to 00182-66514.

A1A2C1: Change to HP Part No. 0160-2204; C: FXD MICA 100 PF 5% Mfr. Code 72136; Mfr. Part No. RDM 15F101J3C.

A1A2Q1: Change to HP Part No. 1854-0039; TSTR: SI NPN; Mfr. Code 80131; Mfr. Part No. 2N3053.

A7CR1 through A7CR3: Change to HP Part No. 1901-0535; DIODE: HOT CARRIER; Mfr. Code 28480; Mfr. Part No. 1901-0535.

Page 7-4, Table 7-2, Option 807 Replaceable Parts.

A5: Delete.

Page 8-12, Figure 8-6: Delete. Replace with Figure 7-6.

Page 8-14, Figure 8-7: Delete. Replace with Figure 7-7.

Page 8-15, Figure 8-8: Delete. Replace with Figure 7-8.

CHANGE 2

Table 6-2,

A5 (on pages 6-2 and 6-10): Change HP and Mfr. Part No. to 00182-60003.

A5A1: Change HP and Mfr. Part No. to 00182-66510.

Table 7-2,

Add: A5, 00182-66518, Assy: horizontal amplifier module.

A8: Change HP and Mfr. Part No. to 00180-66548, Board assy: auxiliary.

Delete: A8C1.

CHANGE 3

Table 6-2,

Delete: A2C7.

Page 8-23, Figure 8-16,

Delete: A2C7.

7-5. SPECIAL OPTIONS.

7-6. Most customer special application requirements and/or specifications can be met by factory modification of a standard instrument. A standard instrument modified in this way will carry a special option number, such as Model 0000A/Option C01.

7-7. An operating and service manual and a manual insert are provided with each special option instrument. The operating and service manual contains information about the standard instrument. The manual insert for the special option describes the factory modifications required to produce the special option instrument. Amend the operating and service manual by changing it to include all manual insert information. When these changes are made, the operating and service manual will apply to the special option instrument.

7-8. If you have ordered a special option instrument and the manual insert is missing, notify the nearest Hewlett-Packard Sales/Service Office. Be sure to give a full description of the instrument, including the complete serial number and special option number.

7-9. STANDARD OPTIONS.

7-10. Standard options are modifications installed on HP instruments at the factory and are available on request. Contact the nearest Hewlett-Packard Sales/Service Office for information concerning standard options.

7-11. Table 7-2 lists the available options for the Model 182C.

Table 7-2. Model 182C Options

OPTION	DESCRIPTION
001	230-Vac operation set at factory.
002	Standard CRT (V1) is replaced by P2 phosphor CRT, HP Part No. 5083-3922.
003	Instrument is set at factory for operation from power source of 100 or 200 Vac ±10%, 48 to 440 Hz, 200 VA maximum. Make the following changes to Table 6-2, Replaceable Parts, for Option 003: A1: Change HP and Mfr. Part Nos. to 00182-60014. A1T1: Change HP and Mfr. Part Nos. to 9100-3249. MP29: Change HP and Mfr. Part Nos. to 00182-00217.
007	Standard CRT (V1) is replaced by P7 phosphor CRT, HP Part No. 5083-3932.
010	Oscilloscope mainframe without rear panel MAIN GATE OUTPUT, DELAYED GATE OUTPUT, DELAYED SWEEP OUTPUT, or MAIN SWEEP OUTPUT connectors. Make the following changes to Table 6-2, Replaceable Parts, for Option 010: A3: Change HP Part No. to 00182-60020. A3MP2: Delete. A3W2: Delete. A8: Delete. J2-J5: Delete. W3: Change HP Part No. to 00182-61611. Add: RESISTOR, FXD MET FLM 5110 1% 1/8W, HP Part No. 0757-0438, to replace A8R15 on schematic 4. Add: TERMINAL BOARD, HP Part No. 0360-0013 to support added resistor.
011	Standard CRT (V1) is replaced by P11 phosphor CRT, HP Part No. 5083-3942. The intensification function of the FIND BEAM switch is deleted on Option 011 instruments equipped with P11 phosphor CRT to eliminate phosphor burn. Figure 7-1 shows the change to the schematic for the Control Module, A2. Figure 7-2 illustrates the location of the jumper wire to be removed. If the CRT is replaced with a standard P31 phosphor CRT, the FIND BEAM intensification capability may be restored by replacing the jumper wire.
013	Instrument is set at factory for operation from power source of 100 or 200 Vac ±10%, 48 to 440 Hz, 200 VA maximum. Oscilloscope mainframe is supplied without rear panel MAIN GATE OUTPUT, DELAYED GATE OUTPUT, DELAYED SWEEP OUTPUT, or MAIN SWEEP OUTPUT connectors. Make the following changes to table 6-2, Replaceable Parts, for Option 013: A1: Change HP and Mfr Part Nos. to 00182-60014 (pages 6-2 and 6-5). A3: Change HP and Mfr Part Nos. to 00182-60020 (pages 6-2 and 6-9). Delete: A8 (pages 6-2 and 6-15). Delete: J2 through J5. MP29: Change HP and Mfr Part Nos. to 00182-00218. Add: MP29R1, HP Part No. 0757-0438, R: FXD MET FLM 5110 OHM 1% 1/8W, Mfr Code 28480, Mfr Part No. 0757-0438 to replace A8R15 on schematic 4. Add: MP29MP1, HP Part No. 0360-0013, TERMINAL BOARD, Mfr Code 28480, Mfr Part No. 0360-0013 to support MP29R1. W3: Change HP and Mfr Part Nos. to 00182-61611. A1T1: Change HP and Mfr Part Nos. to 9100-3249. Delete: A3MP2 and A3W2.

Table 7-2. Model 182C Options (Cont'd)

<table>
<tr><th>OPTION</th><th>DESCRIPTION</th></tr>
<tr><td>807</td><td>
Factory modification for application, with spectrum analyzer plug-in units. Standard CRT (V1) is replaced by P7 phosphor, CRT, Standard Sweep Gate Output board (A8) is replaced by an Auxiliary Output board, and the rear panel labeling is changed to identify auxiliary outputs. Make the following changes for Option 807: Table 1-1, Specifications, change OUTPUTS to:
Four rear-panel BNC jacks provide recorder outputs for use with spectrum analyzer plug ins. (Refer to the plug-in operating and service manual for information about the use of these outputs). These outputs should not be used when a standard 1800-series time base plug-in is installed in the oscilloscope. The calibrated performance of the time base will be degraded due to loading.

NOTE

The signals present at the auxiliary output jacks are directly related to the plug-in installed. Refer to the plug-in operating and service manual for additional information.

Change CATHODE-RAY TUBE to:
Post-accelerator, 22-kV accelerating potential, alumized, P7 phosphor, internal graticule.

Table 6-2 Replaceable Parts. Change Table 6-2 as indicated for the listed components.
<table>
<tr><th>Ref. Desig.</th><th>HP Part No.</th><th>Description</th></tr>
<tr><td>A3</td><td>00182-60019</td><td>Assy: interconnect module</td></tr>
<tr><td>A3W2</td><td>00182-61807</td><td>Cable assy: auxiliary</td></tr>
<tr><td>A8</td><td>00180-66551</td><td>Board assy: auxiliary</td></tr>
<tr><td>A8C1</td><td>0160-3446</td><td>C: fxd cer 220 pF 10% 1K Vdc</td></tr>
<tr><td>A8E1</td><td>0360-1514</td><td>Terminal: pin</td></tr>
<tr><td>A8R1</td><td>0757-0438</td><td>R: fxd 5110 ohm 1% 1/8W</td></tr>
<tr><td>A8R2</td><td>0757-0438</td><td>R: fxd 5110 ohm 1% 1/8W</td></tr>
<tr><td>A8R3</td><td>0757-0438</td><td>R: fxd 5110 ohm 1% 1/8W</td></tr>
<tr><td>MP29</td><td>00182-60024</td><td>Panel: rear display, top</td></tr>
<tr><td>MP32</td><td>00182-62701</td><td>Filter assy: contrast</td></tr>
<tr><td>V1</td><td>5083-3932</td><td>CRT: P7, internal graticule</td></tr>
</table>
Note: Delete all other entries beginning with reference designation A8.

Page 8-16, Figure 8-9,
Replace Figure 8-9 with Figure 7-3.
Page 8-17, Figure 8-10,
Replace Schematic 3 with Figure 7-4.
</td></tr>
<tr><td>X95</td><td>
Mainframe with blue-gray covers. Make the following changes to Table 6-2, Replaceable parts, for Option X95:
MP24: Change to HP Part No. 00182-04102; COVER:
Top, BLUE-GRAY; Mfr. Code 28480; Mfr. Part No. 00182-04102.
MP25: Change to HP Part No. 00182-04103; COVER: BOTTOM,
BLUE-GRAY; Mfr. Code 28480; Mfr. Part No. 00182-04103.
</td></tr>
</table>

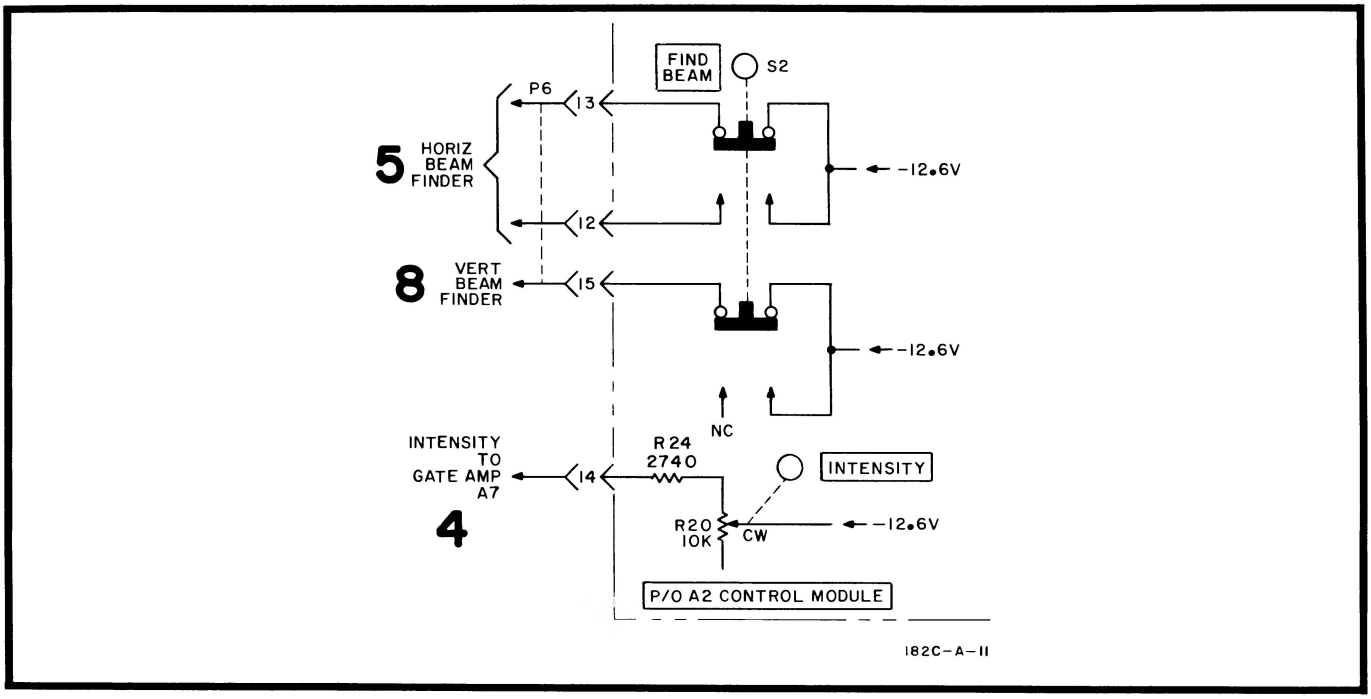


Figure 7-1. Option 011 Beam Finder Schematic

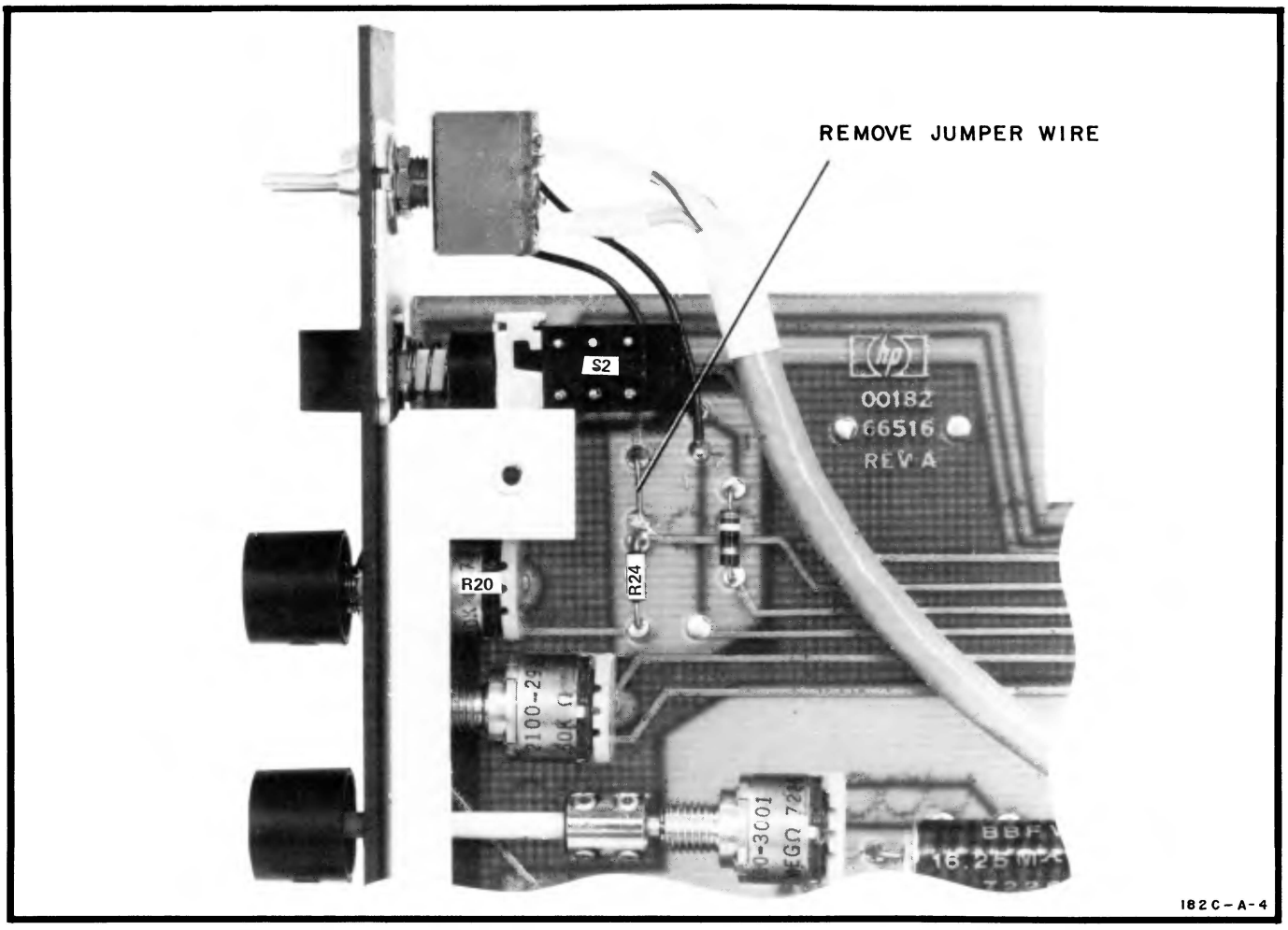


Figure 7-2. Location of Option 011 Circuit Change

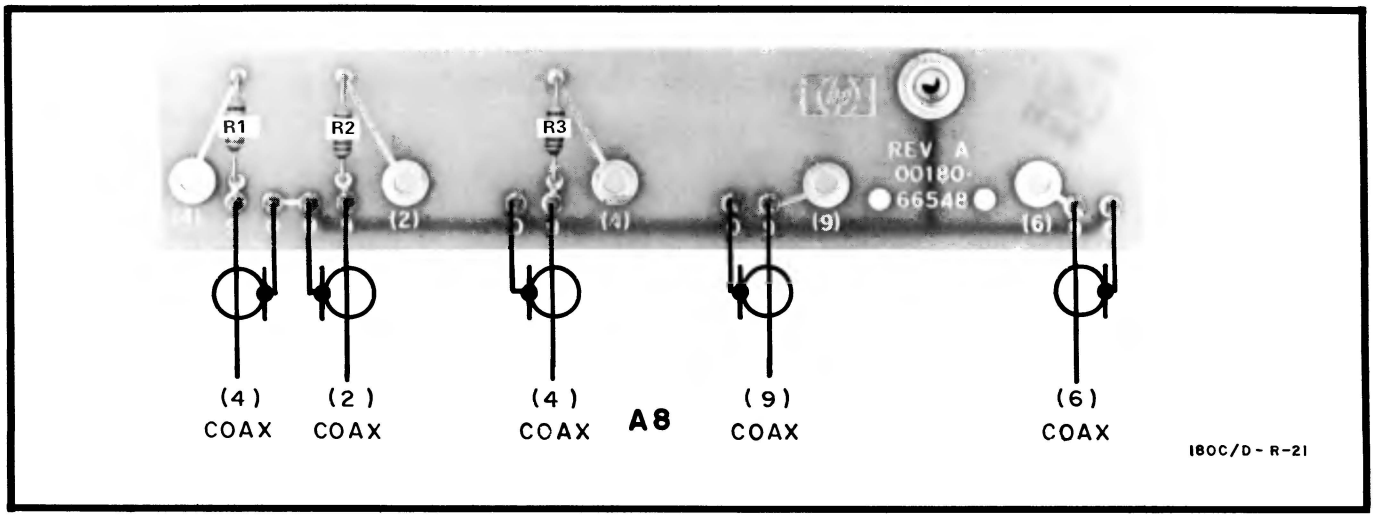


Figure 7-3. Auxiliary Output Board Component and Connection Identification

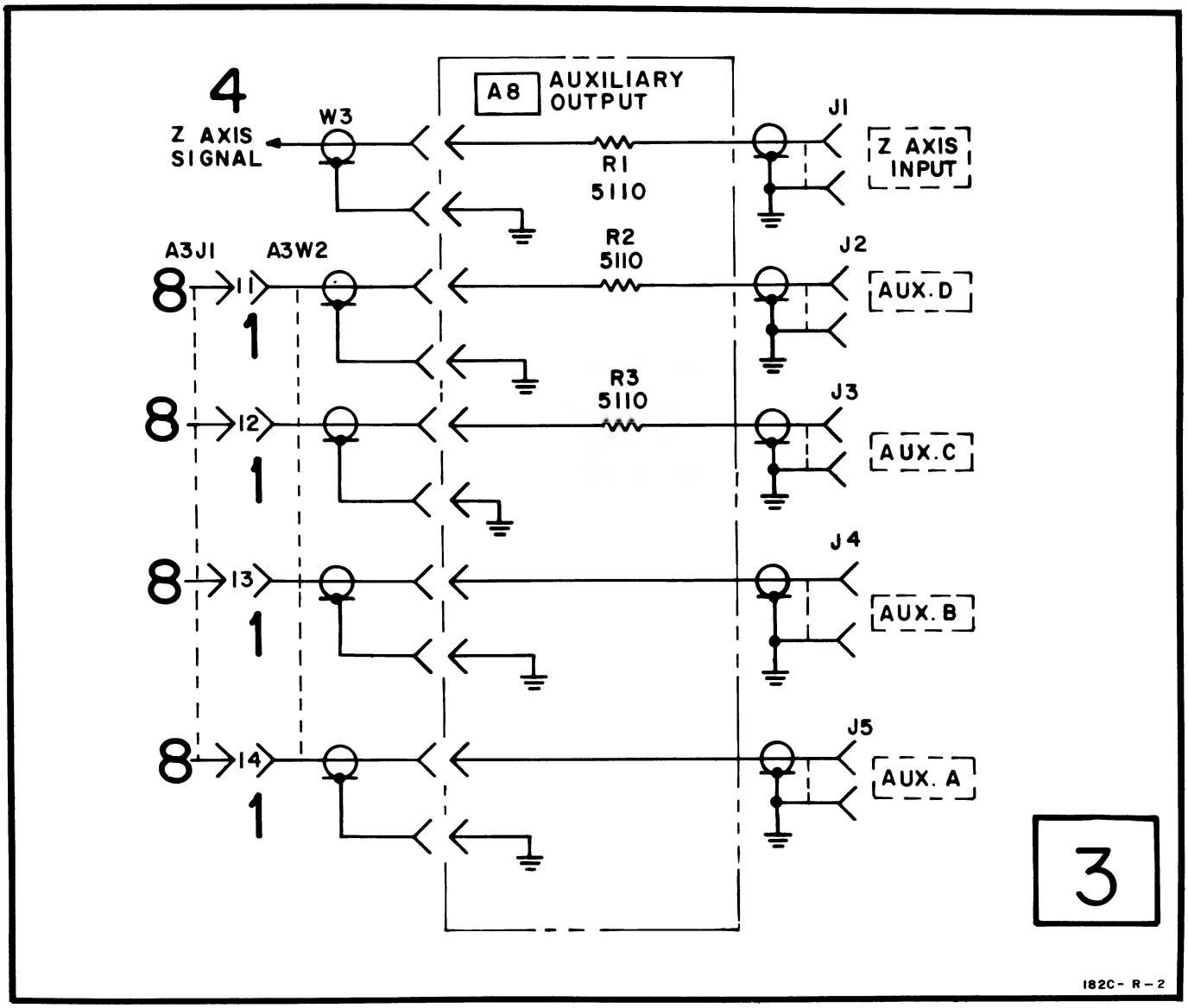
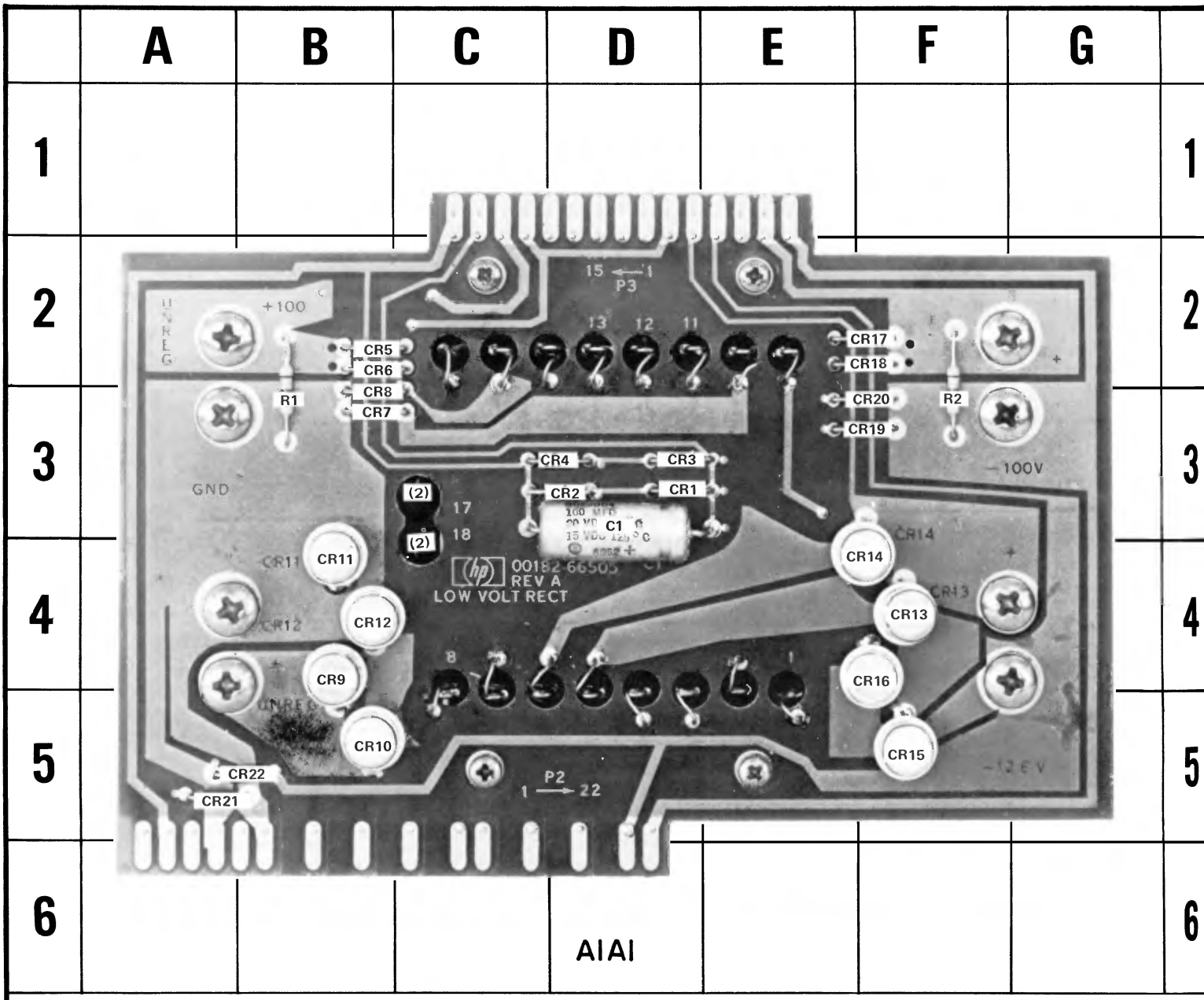


Figure 7-4. Auxiliary Output Schematic

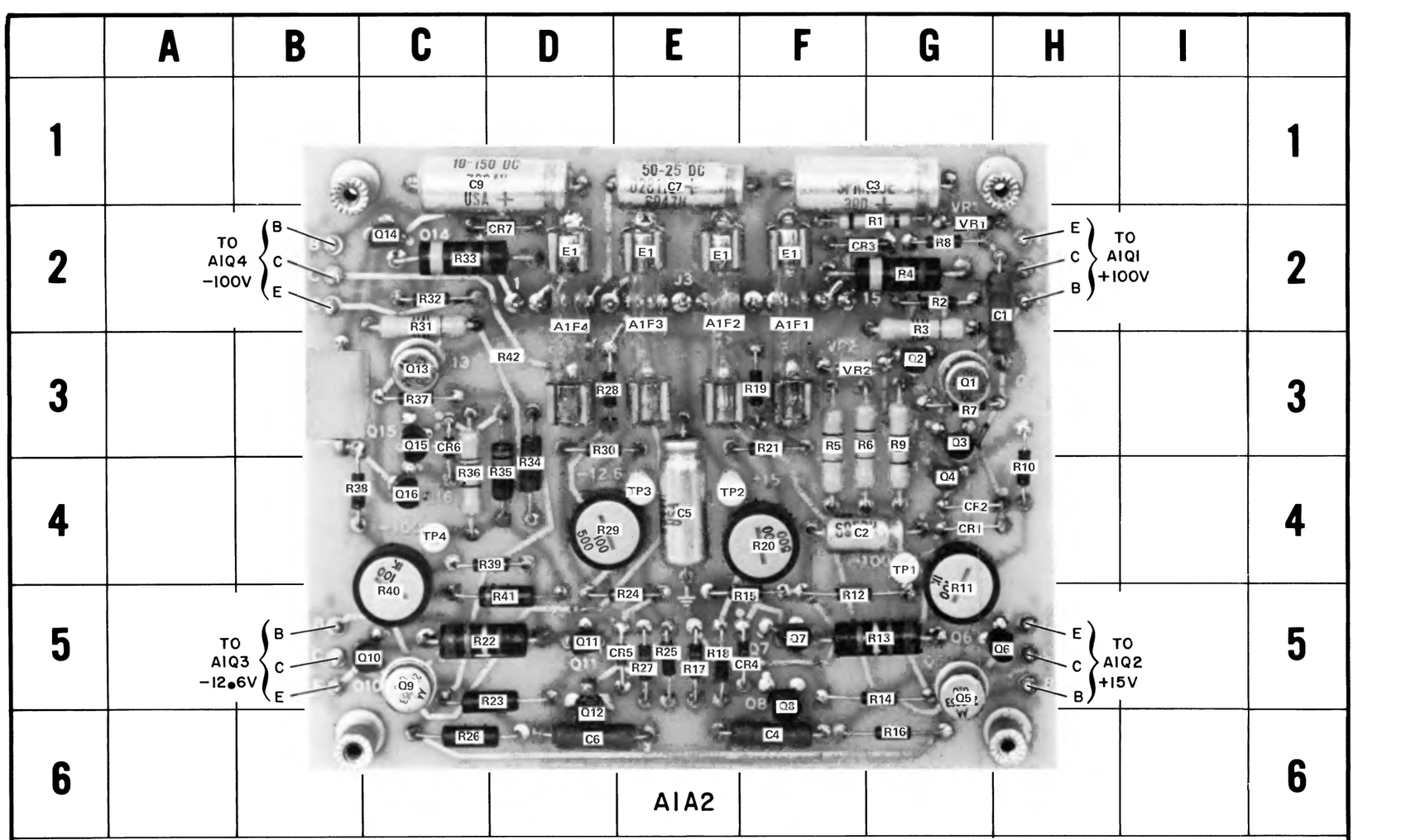


Note: Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	CR5	B-2	CR10	B-5	CR15	F-5	CR20	F-3
CR1	D-3	CR6	B-2	CR11	B-4	CR16	F-4	CR21	A-5
CR2	D-3	CR7	B-3	CR12	B-4	CR17	F-2	CR22	B-5
CR3	D-3	CR8	B-3	CR13	F-4	CR18	F-2	R1	B-3
CR4	D-3	CR9	B-4	CR14	F-4	CR19	F-3	R2	F-3

182A-8-

Figure 7-5. Low Voltage Rectifier (A1A1) Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A1F1	F-2	C1	H-2	CR4	E-5	Q5	G-5	R1	G-2	R13	G-5	R25	E-5	R37	C-3
A1F2	E-2	C2	F-4	CR5	E-5	Q6	H-5	R2	G-2	R14	G-5	R26	C-6	R38	B-4
A1F3	E-2	C3	G-1	CR6	C-3	Q7	F-5	R3	G-2	R15	F-5	R27	E-5	R39	D-4
A1F4	D-2	C4	F-6	CR7	D-2	Q8	F-5	R4	G-2	R16	G-6	R28	D-3	R40	C-5
		C5	E-4	E1	D-2	Q9	C-5	R5	F-3	R17	E-5	R29	D-4	R41	D-5
		C6	D-6	E1	E-2	Q10	C-5	R6	F-3	R18	E-5	R30	D-3	R42	D-3
		C7	E-1	E1	E-2	Q11	D-5	R7	G-3	R19	F-3	R31	C-2	TP1	G-4
		C9	D-1	E1	F-2	Q12	D-6	R8	G-2	R20	F-4	R32	C-2	TP2	E-4
		CR1	G-4	Q1	G-3	Q13	C-3	R9	G-3	R21	F-3	R33	C-2	TP3	E-4
		CR2	G-4	Q2	G-3	Q14	C-2	R10	H-4	R22	C-5	R34	D-4	TP4	C-4
		CR3	F-2	Q3	G-3	Q15	C-3	R11	G-5	R23	D-5	R35	D-4	VR1	G-2
				Q4	G-4	Q16	C-4	R12	F-5	R24	E-5	R36	C-4	VR2	F-3

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

182A-8-4A

Figure 7-6. Low Voltage Regulator (A1A2) Component Identification

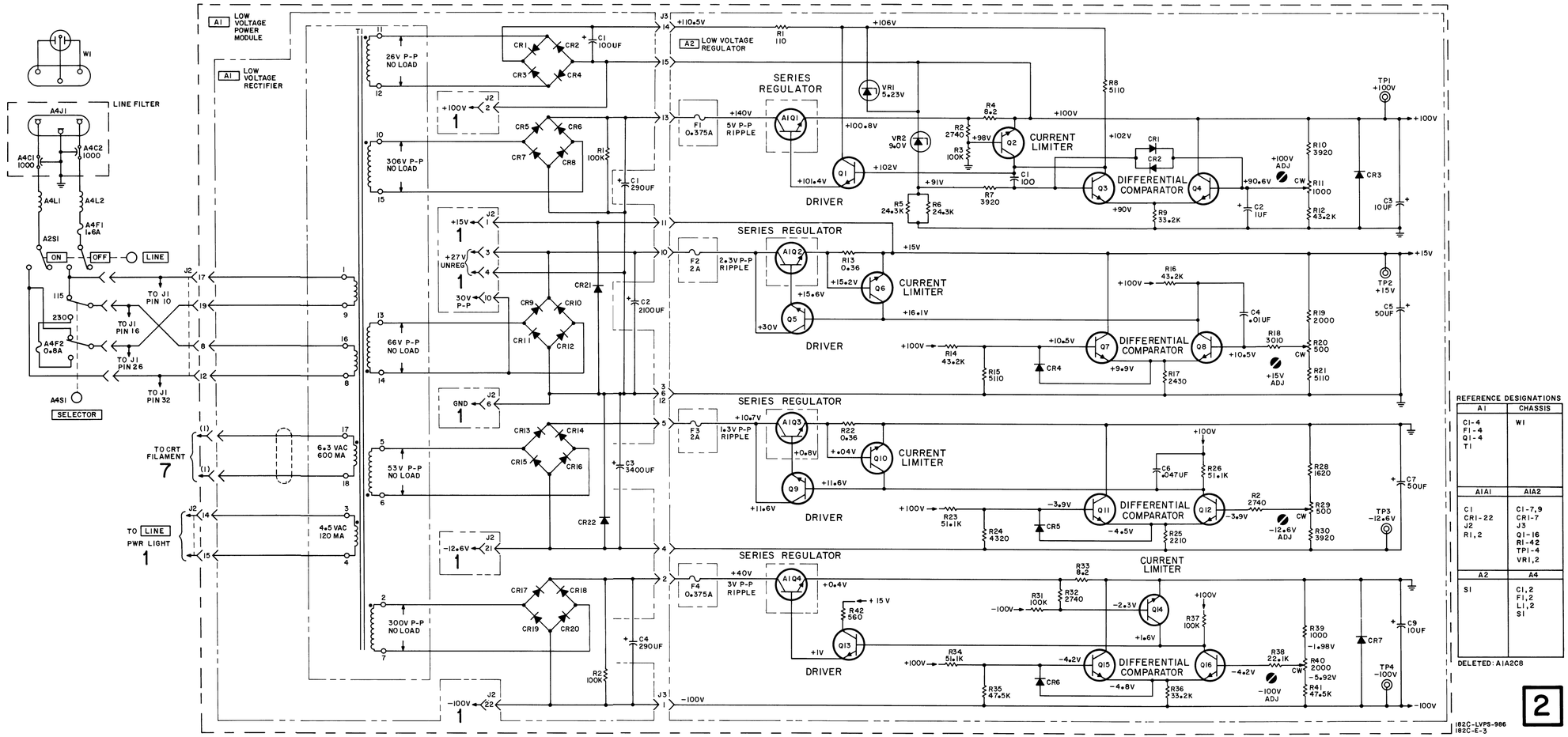


Figure 7-7
Low Voltage Power Supply (A1) Schematic 2

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematics, repair and replacement information, component identification illustrations, and troubleshooting and repair information. Table 8-1 defines symbols and conventions used on the schematics. The overall block diagram is located in Section IV.

8-3. SCHEMATICS.

8-4. Schematic diagrams appear on right hand pages that unfold outside the right edge of the manual. This allows viewing the schematics while referring to text and figures in another section of the manual.

8-5. The schematics are drawn primarily to show the electronic function of the circuit and instrument. A given schematic may include all or part of several assemblies. Schematics also include dc voltages and waveforms at helpful points. Information explaining the symbols and conventions used in these schematics is provided by Table 8-1. Voltage measurement conditions applicable to each schematic are shown next to the schematic.

8-6. Each schematic is identified by a code number. The number of the schematic is located in the lower right hand corner near the figure number and title. These numbers are used to make it easy to trace a circuit that begins on one schematic and is continued on another. When a circuit leaves a schematic it is identified with the code number of the schematic on which it is continued. Both schematics have the same circuit identification information such as voltage, function or circuit connection

8-7. REFERENCE DESIGNATIONS.

8-8. The unit system of reference designations used in this manual is in accordance with provisions of the USA Standard Reference Designations for Electrical and Electronic Parts and Equipments dated March 1, 1968. Minor variations due to design and manufacturing practices not specifically covered by the standard may be noted.

8-9. Each electrical component is identified by a class letter and number. This letter-number combination is the basic designation for each component. Components that are separately replaceable and are part of an assembly have, in addition to the basic designation, a prefix designation indicating the assembly on which the component is physically located. Components not located on an assembly will have only the basic designation and are listed in the replaceable parts list (Section VI) under chassis parts.

8-10. All components within the shaded areas on the schematics are physically located on an etched circuit board and should be prefixed with the assembly number assigned to the board (e.g. resistor R23 on assembly A3 is referred to as A3R23). There may also be an R23 on several other assemblies, but the assembly designation will always be different (A2R23, A1R23, etc.).

8-11. COMPONENT LOCATION.

8-12. All adjustments are shown in Section V, and mechanical and miscellaneous electrical parts are shown on exploded view drawings in Section VI. For ready reference, circuit assembly photographs are placed adjacent to the associated schematics.

8-13. Circuit assembly photographs are subdivided by a grid, and components within each subdivision are indexed to a location table below the photograph. A component can be easily located on the photograph by first referring to the table. However, reference designators are not complete on the assembly photographs. For the complete reference designator, prefix the assembly designation given in the photograph to each component designator.

8-14. TROUBLESHOOTING.

8-15. The most important prerequisite for successful troubleshooting is understanding how the instrument operates and correct usage of 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. 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.

8-18. 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.

8-19. PRELIMINARY CHECKOUT.

8-20. To help isolate malfunctions, perform the following checkout procedure:

a. Check for improper control settings (refer to Section III).

b. Check for proper operation of accessory equipment.

c. Visually inspect instrument for loose wire and cable connections. Check wiring to all board assemblies for proper connections.

d. Visually inspect for burned, broken or chafed wires; charred or discolored components; and any other indication of physical damage.

e. Check for proper power supply voltages and determine that fuses are not open.

8-21. DETAILED CHECKOUT.

8-22. If the trouble cannot be located using the preliminary checkout procedures, a detailed check of the circuits will be necessary. Troubleshooting charts, waveforms, and voltages are provided to help in locating problem areas and components. The troubleshooting charts and waveforms are to be used to isolate the problem to a specific area. The voltages can then be used to locate the faulty component within the problem area.

CAUTION

When taking waveform or dc voltage measurements, use extreme care to avoid shorting supply voltages or components.

8-23. Dc voltages are shown on the schematics near active components such as transistors. Waveforms are also placed on the schematics at points which will assist in determining proper circuit operation. As an aid to locating measurement points, a small dot is etched on the circuit board next to the emitter lead of each transistor, the source lead of FET's, the cathode end of diodes and the positive end of electrolytic capacitors. Use these points to assist in voltage and resistance measurement tests and as guidance in properly replacing components.

8-24. TROUBLESHOOTING TABLES.

8-25. Troubleshooting tips are given in several tables. The tables are 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.

8-26. REPAIR AND REPLACEMENT.

8-27. 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.

8-28. SERVICING ETCHED CIRCUIT BOARDS.

8-29. Etched circuit boards in this instrument have components mounted on one side of the board, conductive surfaces on both sides, and plated-through component mounting holes. Hewlett-Packard Service Note M-20E contains useful information on servicing etched circuit boards. Some important considerations are as follows:

a. Use a 37 to 47.5 watt chisel tip soldering iron with a tip diameter of 1/16 to 1/8 inch, and a small diameter rosin core solder.

b. Components may be removed by placing the soldering iron on the component leads on either side of the board and pulling the component straight away from the board. If heat is applied to the component side of the board, greater care is required to avoid damage to the components, especially semi-conductors. Heat damage may be minimized by gripping the lead with long nose pliers between the soldering iron and the component, thereby forming a heat sink.

c. If a component is obviously damaged or faulty, clip the leads close to the component and then unsolder the leads from the board.

d. Large components, such as potentiometers, may be removed by rotating the soldering iron from lead to lead and applying steady pressure to lift the part free. The alternative is to clip the leads of the damaged part and remove them individually.

e. Excessive heat or force will destroy the laminate bond between the metal plated surface (conductor) and the board. If this problem should occur, the lifted conductor may be cemented down with a small amount of quick-drying acetate-base cement having good insulating properties. Another method of repair is to solder a section of good conducting wire along the damaged area.

f. Before replacing a component, heat the remaining solder in the component hole and clean it out with a toothpick or "solder sucker". Sharp pointed metallic tools are not recommended since they may loosen eyelets in boards or remove plating from the inside of holes on plated-through etched circuit boards.

g. Tin and shape replacement component leads to fit existing holes.

h. Install the replacement component in the same position as the original.

8-30. SEMICONDUCTOR REPLACEMENT.

8-31. 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.

8-32. 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.

8-33. DETAILED TROUBLESHOOTING.

8-34. The following troubleshooting tips are categorized according to the various areas of the instrument. These tips can be helpful only after a trouble is localized to one of these areas. Read the theory of operation in Section IV to learn how a circuit should operate. With the aid of this information, it is easier to discover why a defective circuit is inoperative. Finally, make resistance checks to uncover the faulty component. If it appears necessary to calibrate the instrument, refer to Section V for the proper procedures.

8-35. LOW VOLTAGE POWER SUPPLY.

8-36. Fuses, test points for measuring regulated output voltages and voltage adjustment controls are located on the low voltage regulator assembly. Access to the assembly is obtained by removing the instrument rear panel. Each low voltage supply is fused. The fuses are in series with the regulator transistors, and all regulated output power flows through the fuse for the respective supply.

8-37. Since the +100V and −100V supplies are current fold-back limited, and the +15V and −12.6V supplies are current limited, an open fuse generally indicates that trouble exists in the regulator portion of the supply. If a fuse is open, check the series regulator transistor, driver transistor and comparator.

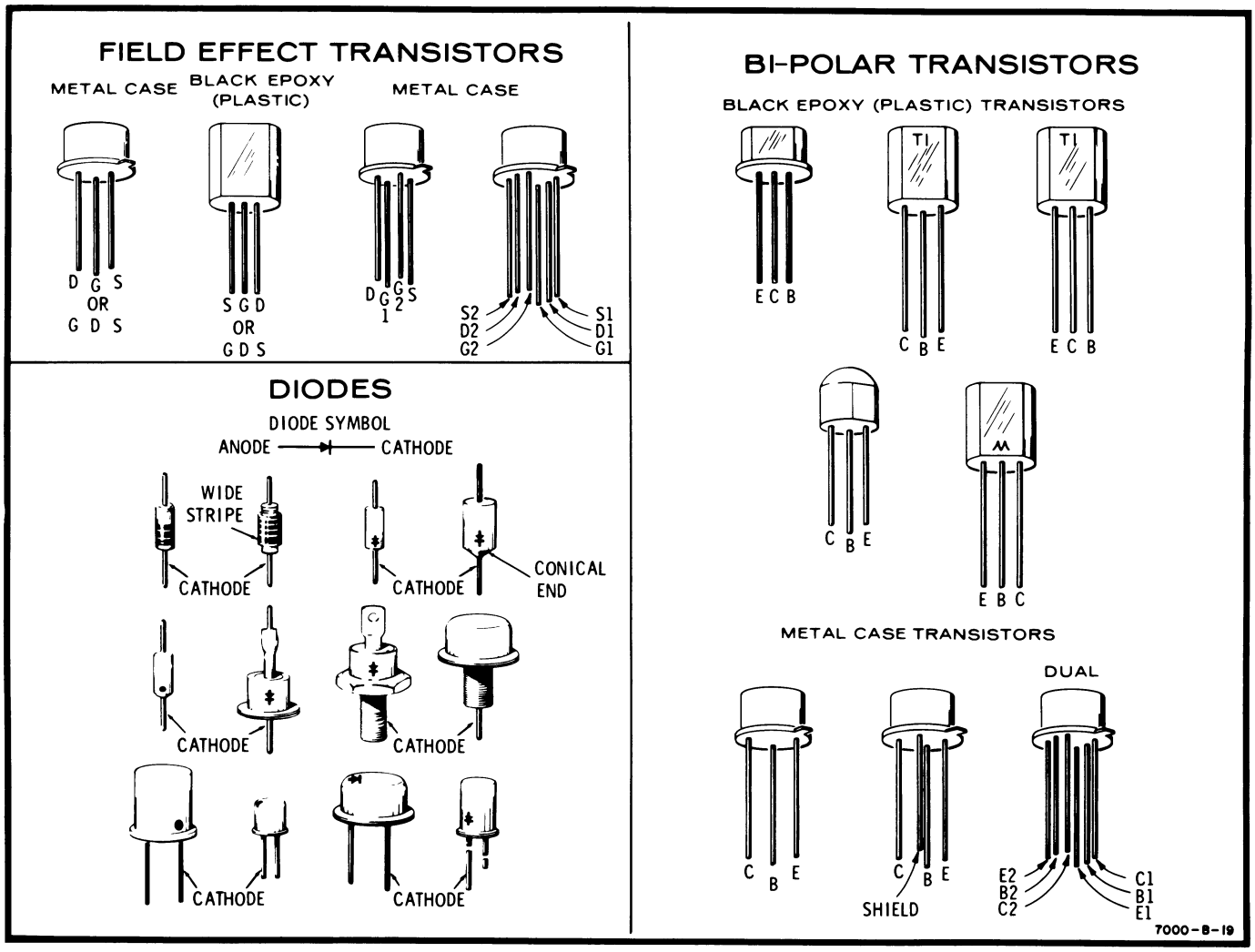


Figure 8-1. Semiconductor Identification

8-38. Troubleshooting the low voltage supply is facilitated by removing the power supply from the oscilloscope. This will provide access to the power transformer, rectifiers and filters. Removing the module also disconnects the power supply from all other circuits of the oscilloscope, thus confining the troubleshooting effort to the low voltage supply. The procedure for removing the power supply module is explained later in this section of the manual.

WARNING

Lethal voltages are exposed when the power supply module is operated outside the oscilloscope mainframe.

8-39. The low voltage power module can be powered from the oscilloscope mainframe by using the Model 10133A Service Extender. This provides line voltage power to the module while continuing to control it by the front-panel power LINE switch. The extender does not connect dc operating power to the oscilloscope mainframe. This permits troubleshooting the low voltage supplies with no external circuit loads.

8-40. The +100V supply should be checked first, since all other supplies use it as a reference. Unregulated operation of all of the other supplies may be the result of a defective +100V supply. Use the convenient test points to monitor the regulated output of a supply. If the +100V supply is defective, verify operation of the reference supply which is regulated by the 9-volt zener diode.

8-41. HIGH VOLTAGE POWER SUPPLY AND REGULATOR.

WARNING

Lethal voltages are exposed when the oscilloscope is turned on with the high voltage power supply cover removed.

8-42. High-voltage power supply problems are usually indicated by no display, a display that is too bright, an arcing sound, slow trace shift or blooming or sudden shifts in display intensity. Regulator problems may result in no high-voltage or excessive high-voltage.

8-43. If only one high voltage output is missing, check the appropriate rectifier and filter circuit. If high voltage is present but not properly adjustable, refer to the high voltage troubleshooting tables (Tables 8-7 and 8-8).

WARNING

The CRT post accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

WARNING

The CRT post accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

8-44. If no high voltage is present, check the high voltage oscillator circuitry. The oscillator supply voltage, unregulated +27V, is fused by F3 on the Regulator assembly. The oscillator frequency is approximately 40kHz. With the High Voltage Multiplier output disconnected, (by disconnecting the CRT post-accelerator lead), the oscillator frequency should increase to approximately 50 kHz.

8-45. The CRT cathode and grid high voltage leads can be disconnected by removing the CRT socket. This will further isolate the trouble. If it is determined that the H.V. Multiplier is faulty, it must be replaced as a complete unit, since it is a sealed assembly.

8-46. DISASSEMBLY INFORMATION.

8-47. If it is necessary to remove an assembly for servicing or replacement, the following information will provide guidance in accomplishing this in a manner to prevent damage and facilitate removal and replacement.

8-48. The instrument has been designed to readily permit disassembly for component removal, troubleshooting or replacement. Each module is a plug-in type, and may be removed without unsoldering any connections. Single or multi-contact connectors are used throughout for signal, control and operating power connections.

8-49. COVER REMOVAL.

8-50. The instrument has a two-piece cover. Remove the covers as follows:

a. Ensure that LINE power switch is OFF and disconnect power plug from line power source.

b. Set oscilloscope on rear end.

c. Release the 3 quarter-turn fasteners located on each side of the instrument. The cover retainers will be completely free. Figure 8-2 shows the location of the fasteners.

d. Loosen 2 captive screws located on handle ends.

e. Remove top cover by expanding slightly and pulling away from instrument.

f. Remove bottom cover by extending tilt stand, expanding and pulling away from instrument.

g. Return instrument to horizontal position and remove rear access cover by releasing single quarter turn fastener.

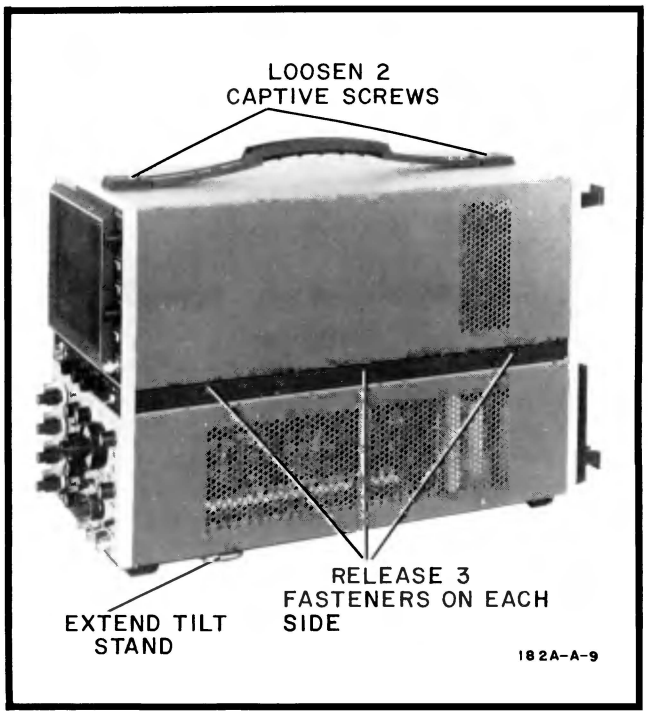


Figure 8-2. Cover Removal

8-51. POWER MODULE REMOVAL.

8-52. The low voltage power module includes the power transformer, low voltage rectifier assembly, low voltage regulator assembly, and the series regulators. The entire module is removable as a unit which can be further disassembled if desired.

8-53. To remove the power module, disconnect ac power input, remove the covers and proceed as follows:

a. Set the instrument on rear end.

b. Remove 4 screws located on bottom rear of instrument.

c. Return instrument to horizontal position and remove 2 rear screws. One screw is located on top of each series regulator heat sink. Do not remove screws holding rear feet to heat sink or screws located below rear feet.

d. Disconnect CRT filament lead connectors (brown wires) from rectifier assembly using long-nosed pliers and lifting straight up. (CRT filament leads may also be disconnected later, refer to step e.)

WARNING

Filament leads operate at -3150 Volts when power is on.

e. Remove module by grasping filter capacitors on each side and pressing toward rear of instrument. If CRT filament leads were not disconnected previously, be careful to pull module only partially free. Then disconnect filament leads and remove module.

8-54. CONTROL ASSEMBLY REMOVAL.

8-55. This assembly includes the calibrator, CRT controls, and LINE power switch.

8-56. To remove the Controls assembly, disconnect ac power input, remove the covers, and proceed as follows:

a. Disconnect 5 square-pin connections between cable, located on the underside of the assembly, and the Interconnect assembly circuit board.

b. Disconnect 8 square-pin connections located on the top side of the assembly. Use a long-nosed pliers and pull connections straight off to remove. These consist of: CRT focus (2 right-angle connections), trace alignment (2 connections), CRT flood gun (2 connections), CRT mesh, (1 connection), and ground (1 connection).

c. Remove 4 screws from underside of Control assembly. Two screws hold the assembly to the front casting frame and also hold the focus high voltage shield in place. The other 2 screws are located approximately at the center of the assembly.

d. Grasp the assembly internal to the instrument and remove with a straight pull toward the front of the instrument. Do not remove by pulling on knobs. Be careful that square-pins located on top of the assembly do not catch on front casting frame.

8-57. AC POWER INPUT MODULE REMOVAL.

8-58. The power input module contains the line power jack, line filter, fuse holders and LINE SELECTOR switch. It may be partially removed for servicing or completely removed if necessary.

8-59. Partial removal is possible since the cable carrying ac line power is long enough to expose the components without disconnecting the cable. To release the module, disconnect ac power input and remove the 2 screws holding the panel in place. Pull the module to the rear of the instrument.

8-60. If complete removal is desired, either remove the low voltage power module or open the upper rear panel. This exposes the ac line power cable connections to the Interconnect assembly. Then disconnect 6 square-pin connections from the cable to the Interconnect assembly circuit board. The module can now be completely removed from the oscilloscope.

8-61. SWEEP-GATE ASSEMBLY REMOVAL.

8-62. The Sweep-gate amplifier is located on the upper rear panel of the instrument. It is exposed for servicing by removing 4 screws holding the rear panel to the rear casting frame. (Do not remove rear feet from panel.) If complete removal is desired, disconnect 12 square-pin connections to the assembly. Five BNC connectors and one screw hold the circuit board to the rear panel.

8-63. GATE AMPLIFIER ASSEMBLY REMOVAL.

8-64. Disconnect ac power input and remove the instrument top cover. Then proceed as follows:
held in place by 4 screws. (Do not remove rear feet.) Then proceed as follows:

a. Disconnect Gate Out coaxial cable (2 square-pin connections) from rear of Gate Amplifier.

b. Remove 2 screws from rear casting frame.

c. Remove by pulling assembly back and pivoting connector end out of mainframe.

8-65. HORIZONTAL MODULE REMOVAL.

8-66. To remove the Horizontal module, use the following procedure:

a. Disconnect ac power input and remove the instrument top cover.

b. Disconnect 2 horizontal deflection cable pin connections from CRT neck.

c. Remove 2 screws holding bottom of circuit board to oscilloscope frame and 1 screw located at top center of circuit board.

d. Remove 1 screw from front casting frame.

e. Slide module toward front of instrument to disconnect module and turn rear of module to outside of oscilloscope mainframe.

f. Bend horizontal deflection cable forward and flat against rear of module.

g. Carefully slide module toward front of instrument for removal.

h. When reinstalling, be certain that horizontal deflection cable is placed toward front of module before installing. After module is inserted, bend cable toward rear before making connection to oscilloscope connector.

8-67. CRT REMOVAL.

8-68. Remove the CRT as follows:

WARNING

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

a. Disconnect ac power input and remove covers from instrument.

b. Disconnect CRT post-accelerator lead at connector mounted on H.V. module. Cable is permanently fastened to CRT. Completely discharge CRT and H.V. Multiplier connections by grounding both plug and jack.

WARNING

The CRT post accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

c. Remove 2 screws holding CRT socket cover to rear panel.

d. Carefully remove CRT socket by gently prying it loose. If desired, the instrument top rear panel may be removed to facilitate socket removal.

e. Disconnect 8 CRT neck pin connections. (See Figure 8-20 for connection identifications.)

f. Remove 4 screws which hold the front bezel in place. These screws are removed from the rear of front casting frame and are located near each corner of the CRT.

g. Loosen circular clamp securing CRT shield to CRT neck.

Note

If the standard P31 phosphor CRT is replaced with a P11 phosphor CRT, circuit modification is required. The increase in intensity from use of the FIND BEAM switch can cause phosphor burn. Refer to Section VII for information about the circuit change required.

h. Slide CRT forward out of shield to remove. Keep one hand on front face of CRT while using other to slide forward. Exercise care to prevent damage to neck pin connections.

8-69. HIGH VOLTAGE MODULE REMOVAL.

8-70. Assemblies in the H.V. module are separately removable. However, if it is desired to remove the module, first remove the CRT. Then proceed as follows:

WARNING

The CRT post-accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

a. Disconnect CRT post-accelerator lead at connector mounted on H.V. module. Cable is permanently fastened to CRT. Completely discharge CRT and H.V. Multiplier connections by grounding both plug and jack.

b. Remove cover from module by removing two screws.

c. Disconnect four square-pin connections, Gate Coax, Focus, Grid, and Cathode leads, located on rear of H. V. Oscillator and Recifier assembly.

d. Disconnect five-pin connector located on rear of H. V. Regulator assembly.

e. Remove six screws holding module to mainframe top and side struts.

Table 8-1. 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

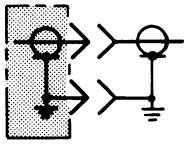
NC = No connection

= Waveform test point (with number)

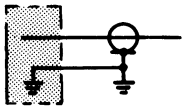
= Common electrical point (with letter) not necessarily ground

= 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

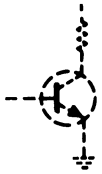
= Field-effect transistor (P-type base)

= Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

= Step-recovery diode

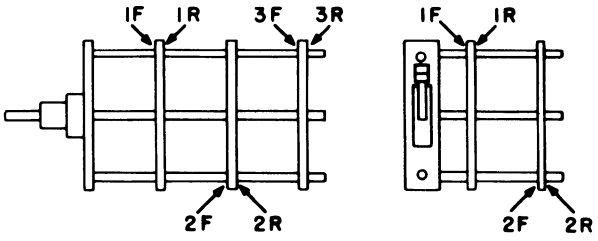


= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

(925) = Wire colors are given by numbers in parentheses using the resistor color code [(925) is wht-red-grn].

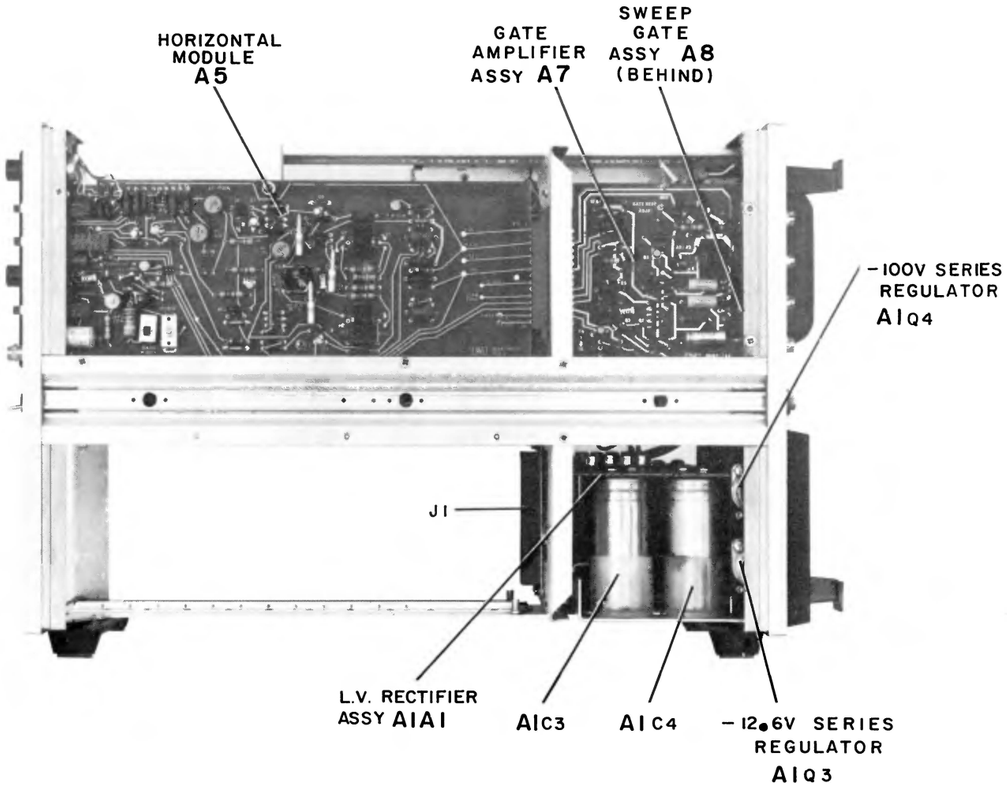
0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

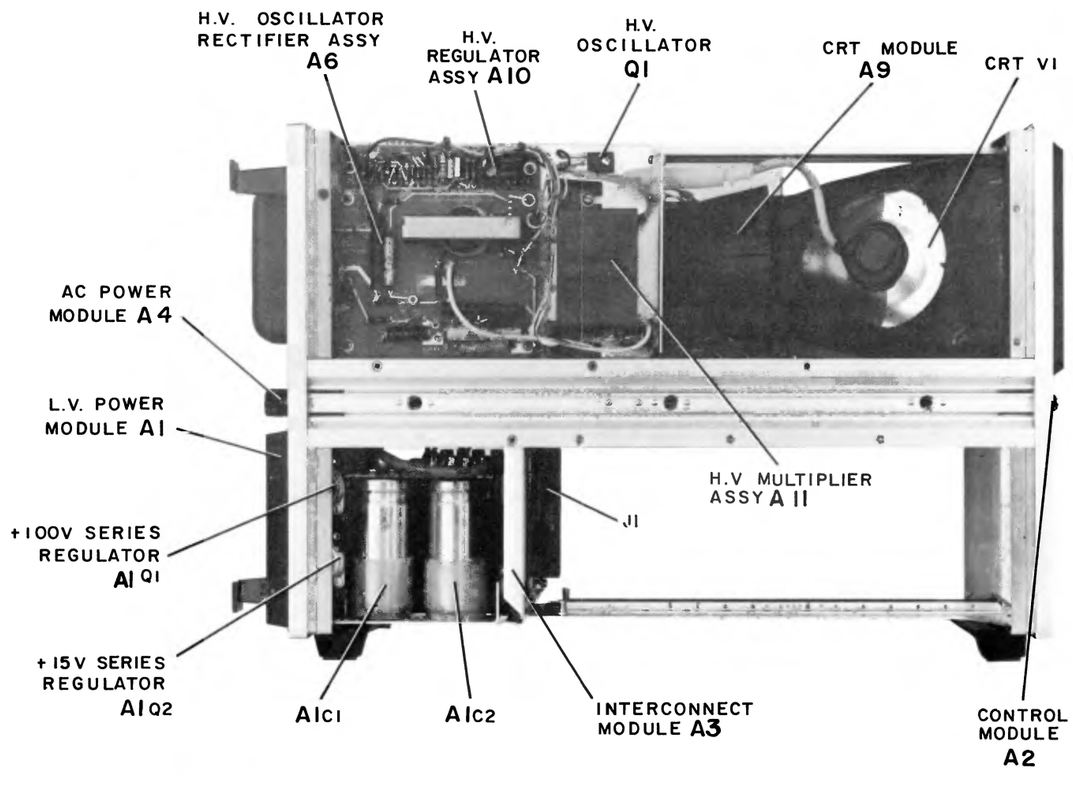
Switch wafers are identified as follows:



* = Optimum value selected at factory, typical value shown; part may have been omitted.

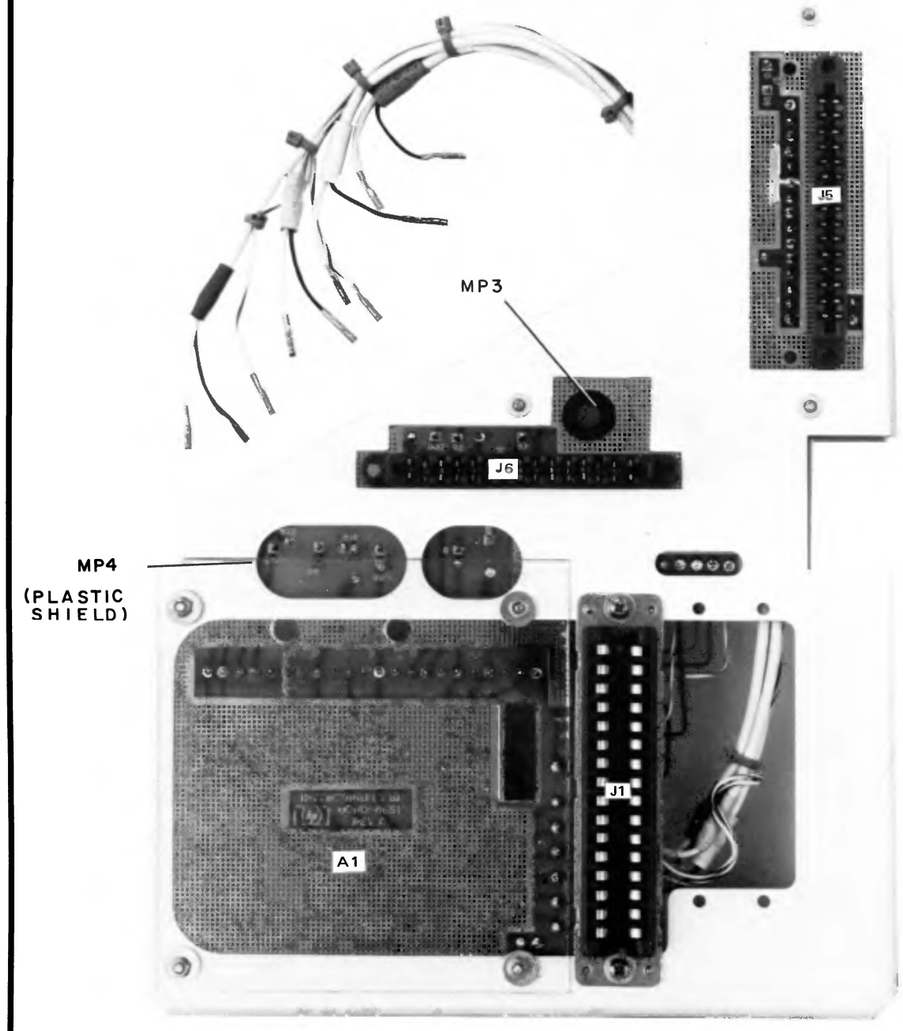
Unless otherwise indicated:
resistance in ohms
capacitance in picofarads
inductance in microhenries





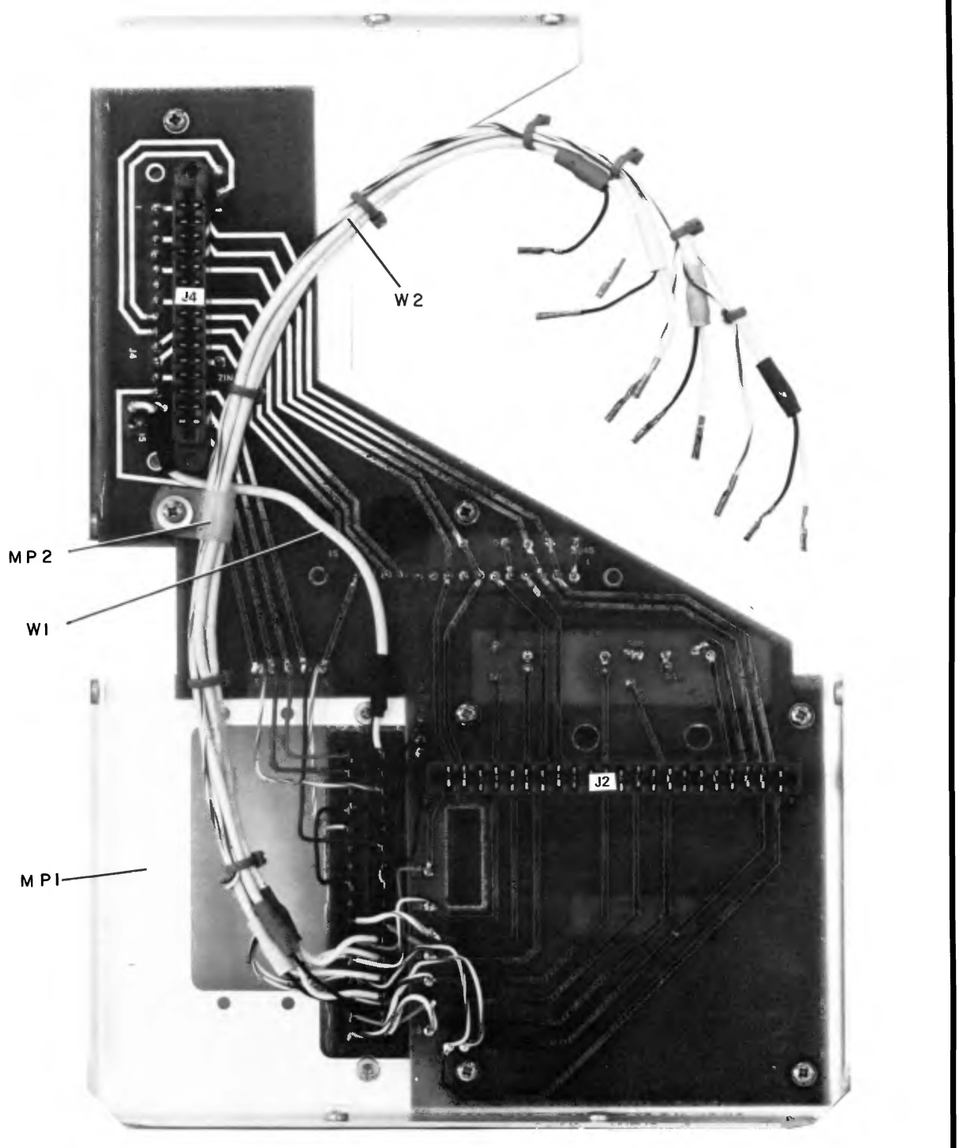
182C-A-7

Figure 8-3.
Mainframe Component Identification



FRONT VIEW

A3



REAR VIEW

182C-A-6

Figure 8-4. Interconnect Assembly (A3) Component Identification

Table 8-2. Miscellaneous Troubleshooting Tips

Symptom	Suggested Checks
Intermittent deflection	Check for loose or corroded connections to CRT neck pins. Check for intermittent open in deflection leads. (Refer to note for additional tips.)
Intensity variation causes trace shift (either axis).	Check for open deflection lead in axis affected. If trouble is vertical axis, check vertical plug-in connector and mating connector in oscilloscope.
No output from Gate or Sweep output jacks.	Check emitter-follower for output affected. Check circuit interconnections (cables, connectors).
Improper Z-axis modulation.	Check normal operation with plug-ins installed. If OK, check connections and check in-puts. (Refer to note for additional tips.)
CRT trace develops distortion over long period.	Instrument may have been subjected to high magnetic field, magnetizing CRT elements. Possible CRT malfunction.
Improper deflection	If symptom is apparent in both vertical and horizontal axes, check High Voltage. If H.V. is low, expanded display results. If H.V. is high, causes contracted display. Vertical axis only: check vertical plug-in, deflection leads and connectors. Horizontal axis only: check with replacement time base plug-in. If OK, problem is in time base plug-in, otherwise check oscilloscope horizontal amplifier, deflection leads and connectors.

NOTE

It may be helpful to isolate the Gate amplifier from the H.V. supply to isolate the problem. Disconnect the Gate Out cable connection from the High Voltage supply and ground the High Voltage Gate Coax connection. This will eliminate the Gate amplifier as a source of H.V. intensity trouble. In this mode, CRT intensity will only be controlled by the INT LIMIT adjustment. This potentiometer is located on the H.V. Osc & Rectifier Assembly, A6.

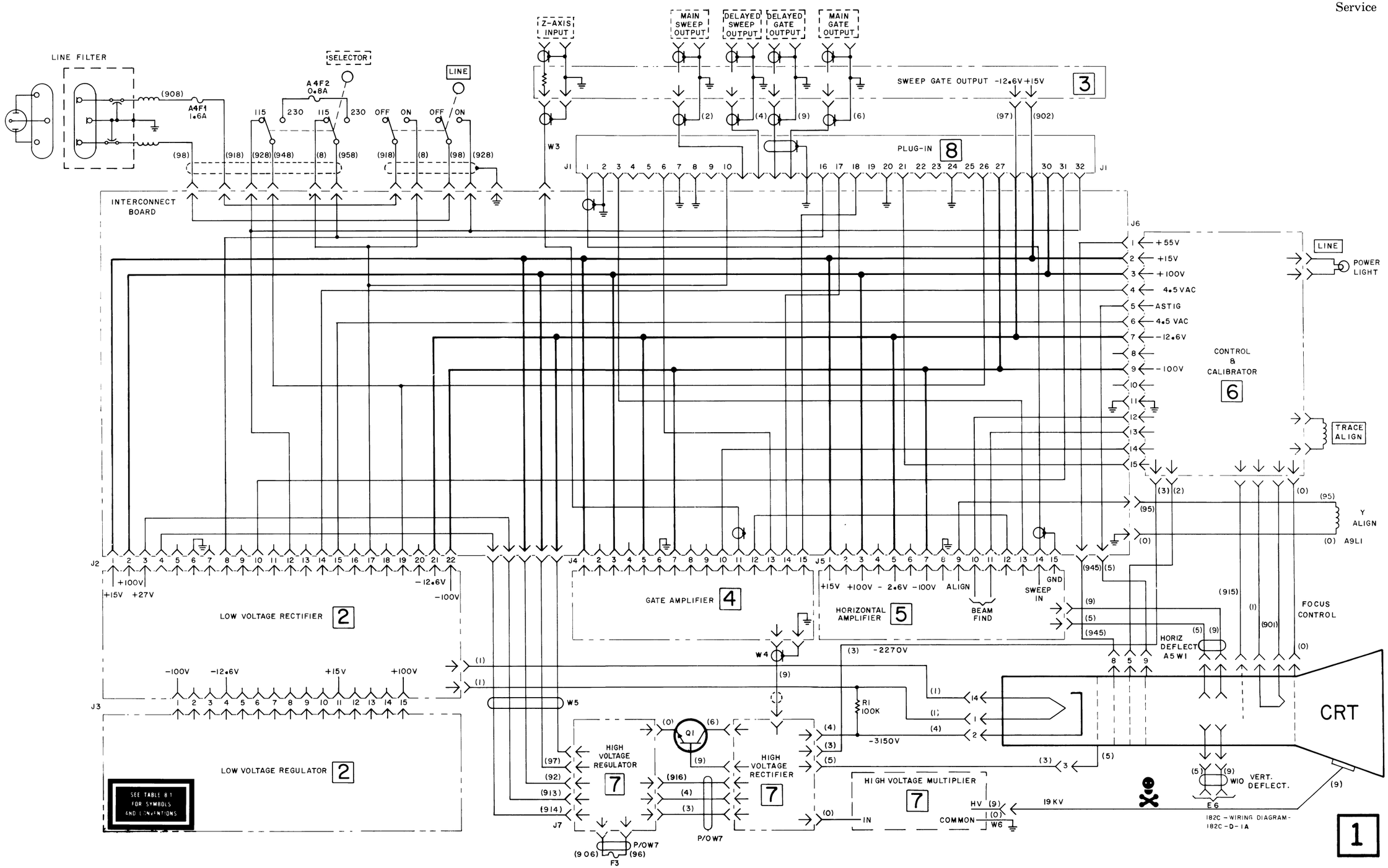
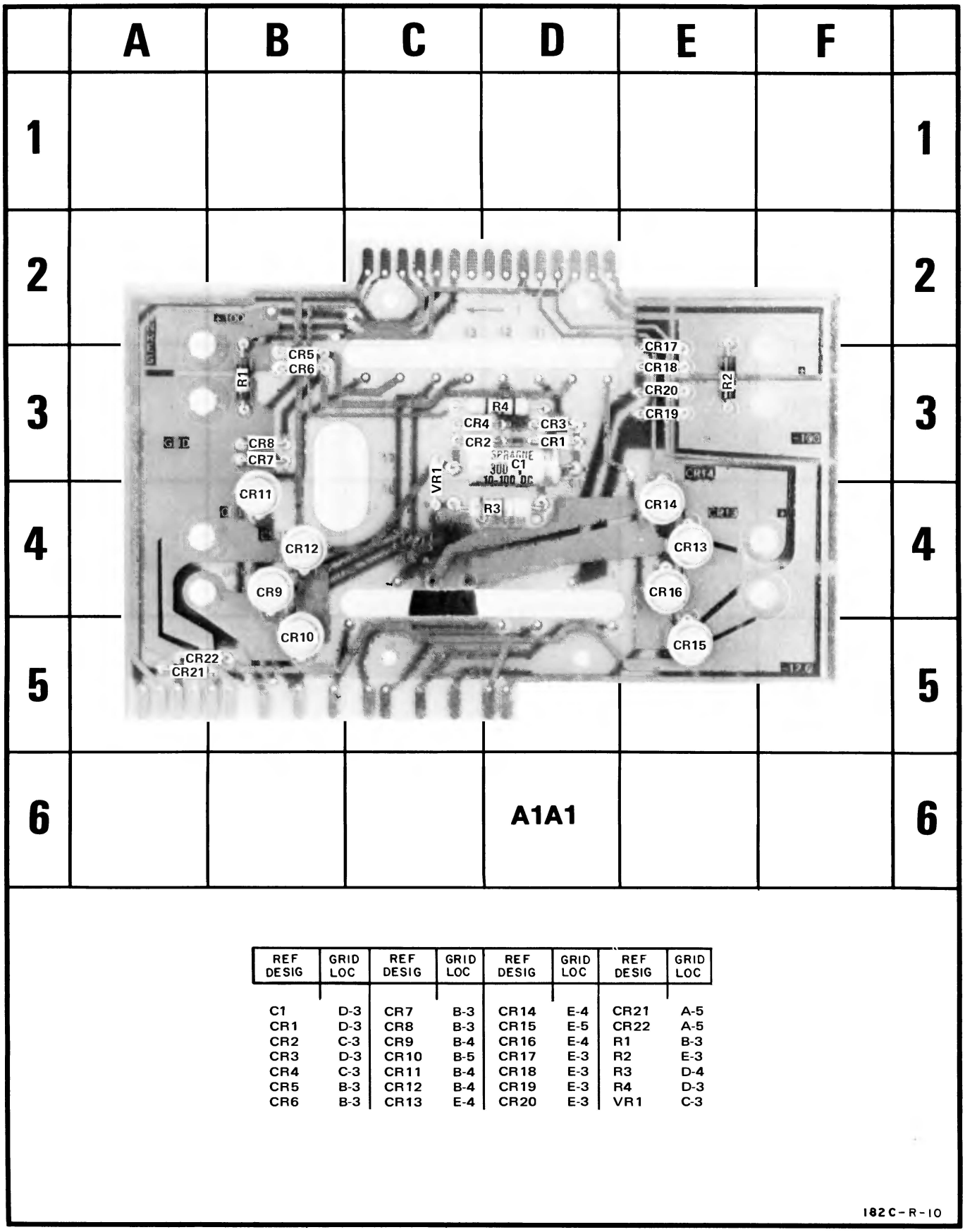
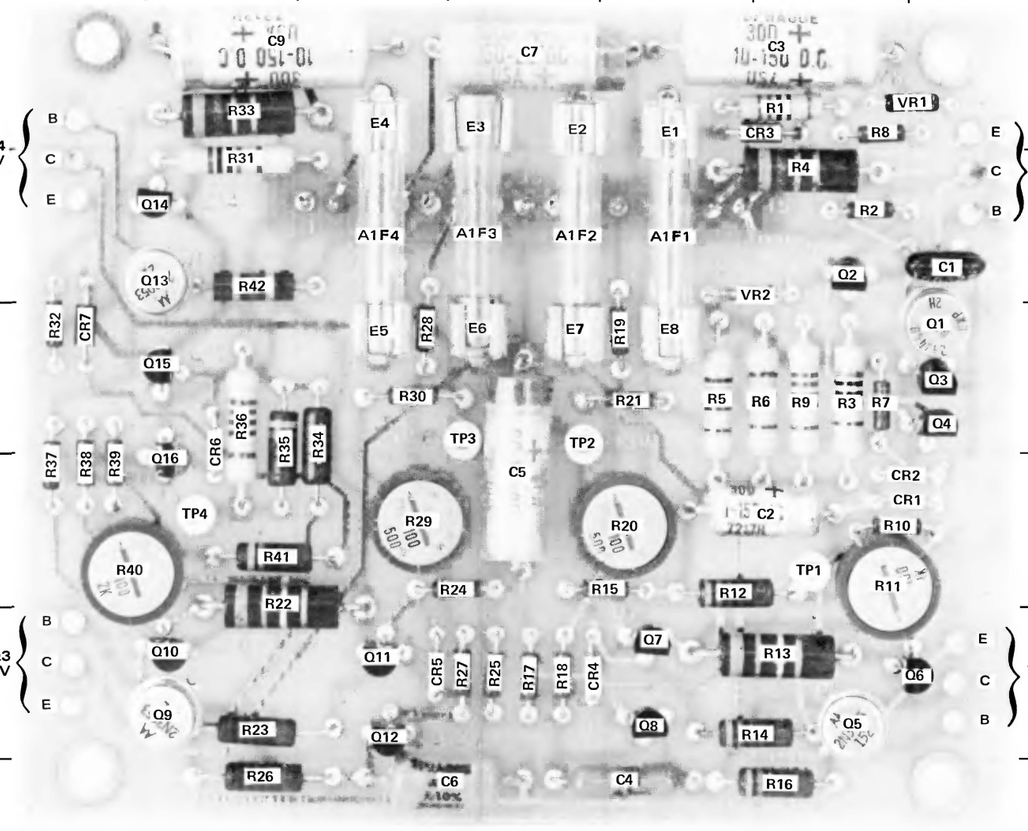


Figure 8-5.
Mainframe Wiring Diagram, Schematic 1



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	CR7	B-3	CR14	E-4	CR21	A-5
CR1	D-3	CR8	B-3	CR15	E-5	CR22	A-5
CR2	C-3	CR9	B-4	CR16	E-4	R1	B-3
CR3	D-3	CR10	B-5	CR17	E-3	R2	E-3
CR4	C-3	CR11	B-4	CR18	E-3	R3	D-4
CR5	B-3	CR12	B-4	CR19	E-3	R4	D-3
CR6	B-3	CR13	E-4	CR20	E-3	VR1	C-3

Figure 8-6. Low Voltage Rectifier (A1A1) Component Identification



A1A2

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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	J-2	CR4	G-5	E-7	G-3	Q5	I-5	Q15	E-3	R9	I-3	R19	H-3	R29	F-4	R39	D-4
C2	I-4	CR5	F-5	E-8	H-3	Q6	J-5	Q16	E-4	R10	I-4	R20	H-4	R30	F-3	R40	D-4
C3	I-1	CR6	E-4	A1F1	H-1	Q7	H-4	R1	I-1	R11	I-4	R21	H-3	R31	E-2	R41	E-4
C4	H-6	CR7	D-3	A1F2	G-2	Q8	H-4	R2	I-2	R12	H-4	R22	E-4	R32	D-3	R42	E-2
C5	G-4	E1	H-1	A1F3	G-2	Q9	E-5	R3	I-3	R13	I-5	R23	E-5	R33	E-1	TP1	I-4
C6	F-6	E-2	G-1	A1F4	F-2	Q10	E-5	R4	I-2	R14	H-5	R24	F-4	R34	F-3	TP2	G-3
C7	G-1	E-3	G-1	Q1	J-3	Q11	F-5	R5	H-3	R15	G-4	R25	G-5	R35	E-3	TP3	G-3
C9	E-1	E-4	F-1	Q2	I-2	Q12	F-5	R6	I-3	R16	I-6	R26	E-6	R36	E-3	TP4	E-4
CR1	I-4	E-5	F-3	Q3	J-3	Q13	E-2	R7	I-3	R17	G-5	R27	G-5	R37	D-4	VR1	J-1
CR2	I-4	E-6	G-3	Q4	J-3	Q14	E-2	R8	I-2	R18	G-5	R28	F-3	R38	D-4	VR2	H-2
CR3	I-1																

184A/B – A – 16

Figure 8-7. Low Voltage Regulator (A1A2) Component Identification

Table 8-3. Low Voltage Power Supply Troubleshooting Tips

Symptom	Suggested Checks *Most common fault.
All supplies low or high and unregulated.	Check ac input line voltage and position of rear-panel SELECTOR switch (115 or 230V) *Check + 100V supply and A1A2VR2. (+100V supply is used as reference for −100V, +15V, −12.6V supplies and A1A2VR2 provides reference voltage for +100V supply).
One supply high and unregulated with high ripple.	Check comparator and series regulator.
One supply low.	Check for excessive current drain. *Check comparator.
No output from one supply.	Check fuse. Check regulator. (Supplies are current limited. Fuse will not open due to shorted load.)
Open line fuse.	Check ac line voltage and position of rear-panel SELECTOR switch. *Check rectifier diodes. Check filter capacitors. Check power transformer.

Table 8-4. Low Voltage Power Supply Measurement Conditions

1. Set controls as follows:

   LINE power ON.

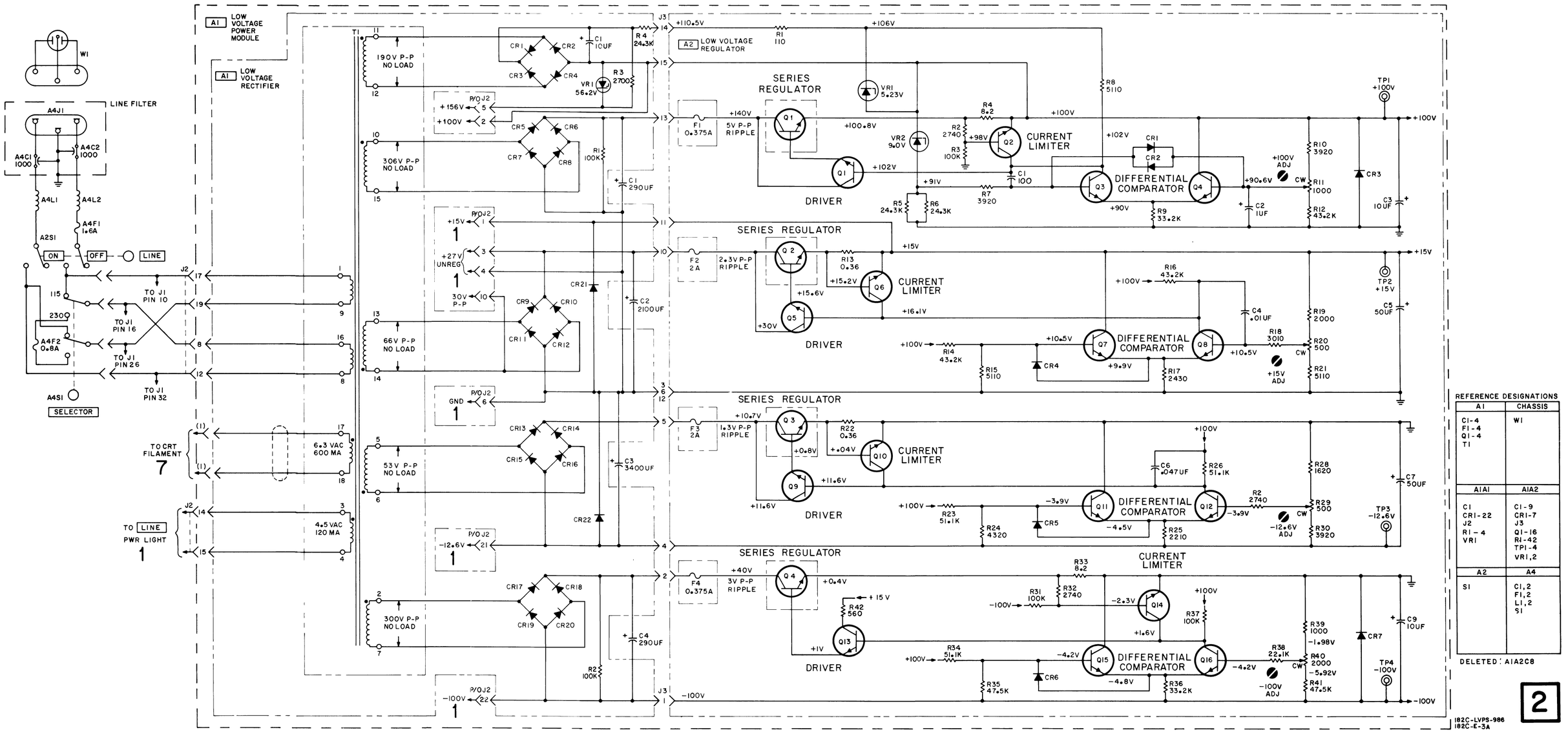
   Plug-ins not installed.

   Line voltage 115 Vac.

2. All dc voltages are referenced to ground.

3. All dc voltages measured with HP Model 1414A Auto Voltmeter. (100 MΩ input impedance).

4. Voltages indicated on schematic remain approximately as indicated when power supply is operated with HP Model 10133A Service Extender.



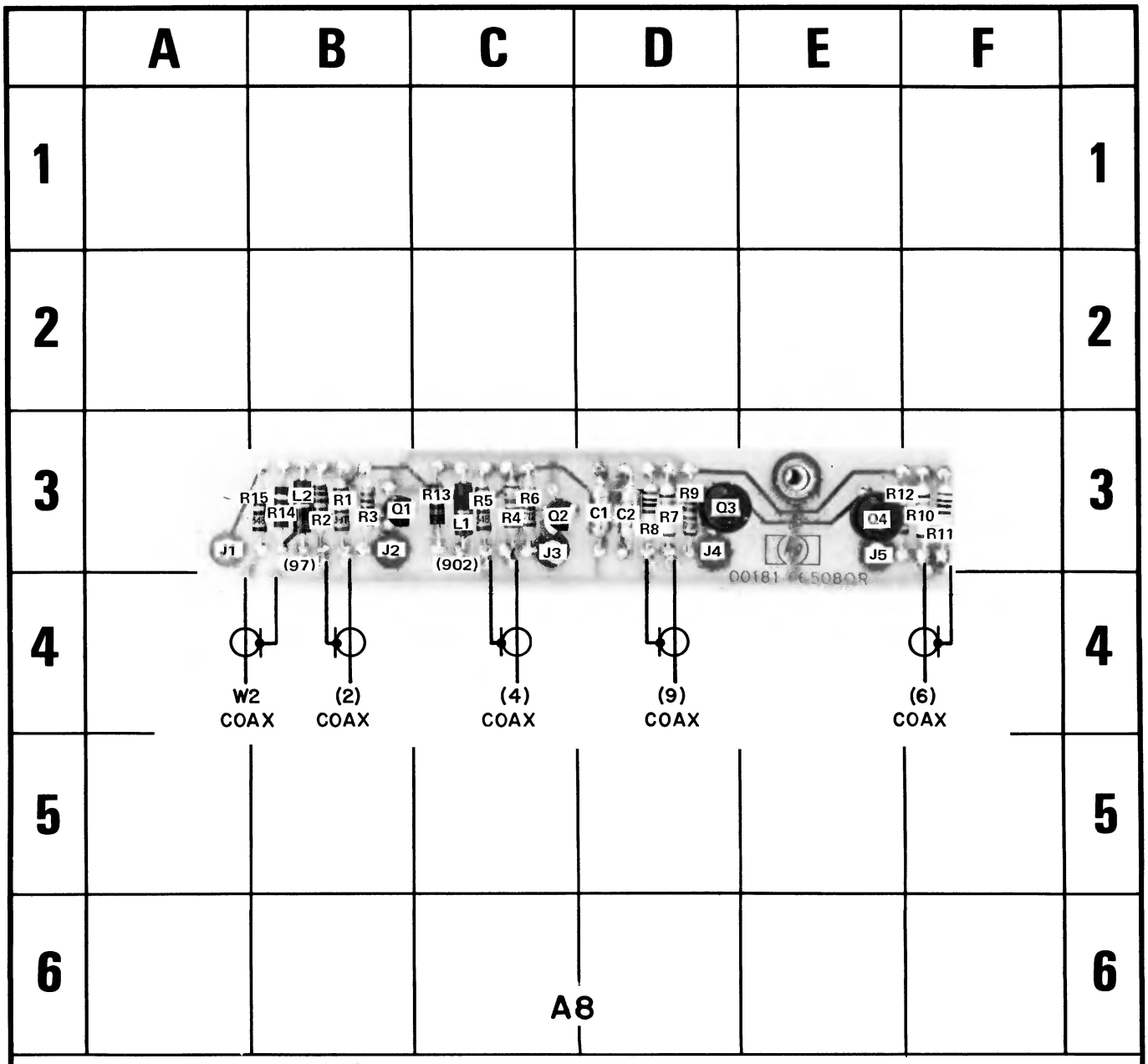
REFERENCE DESIGNATIONS

A1	CHASSIS
C1-4 F1-4 Q1-4 T1	W1
A1A1	**A1A2**
C1 CR1-22 J2 R1-4 VR1	C1-9 CR1-7 J3 Q1-16 R1-42 TP1-4 VR1,2
A2	**A4**
S1	C1,2 F1,2 L1,2 S1

DELETED: A1A2C8

2

Figure 8-8.
Low Voltage Power Supply (A1) Schematic 2
8-13/8-14

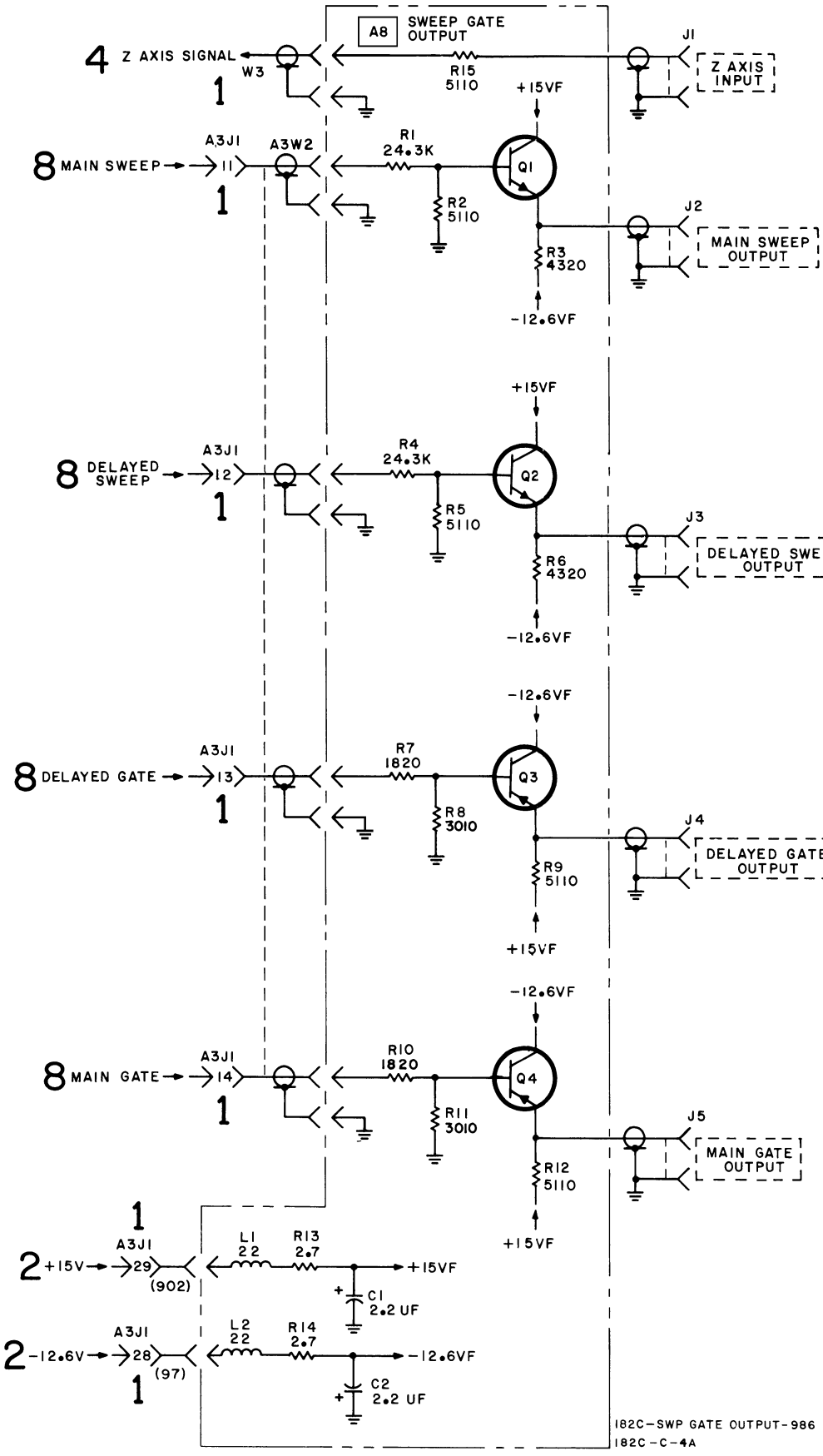


Etched circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	L1	C-3	R6	C-3	R13	C-3
C2	D-3	L2	B-3	R7	D-3	R14	B-3
J1	A-3	R1	B-3	R8	D-3	R15	B-3
J2	B-3	R2	B-3	R9	D-3	Q1	B-3
J3	C-3	R3	B-3	R10	F-3	Q2	C-3
J4	D-3	R4	C-3	R11	F-3	Q3	D-3
J5	E-3	R5	C-3	R12	F-3	Q4	E-3

182A-A-11

Figure 8-9. Sweep-Gate Amplifier (A8) Component Identification



REFERENCE DESIGNATIONS

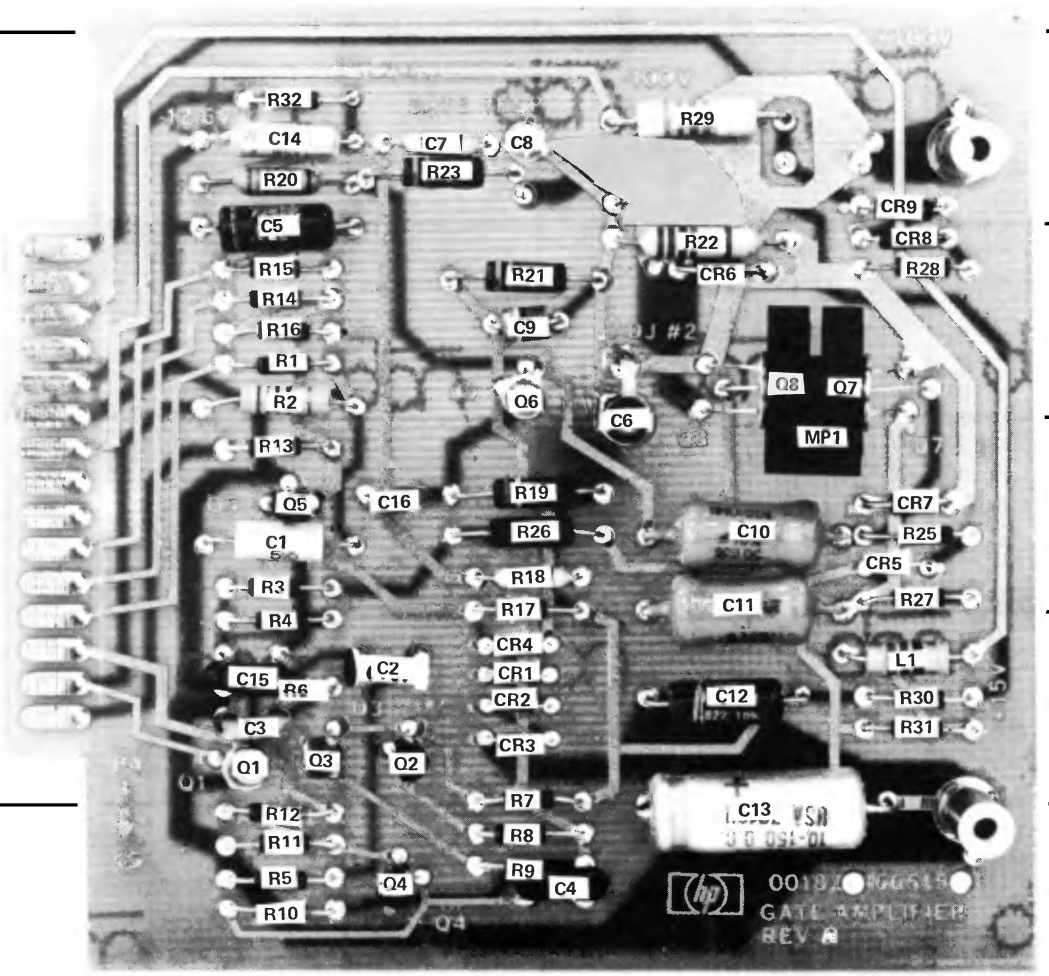
A8	CHASSIS
C1,2 L1,2 Q1-4 R1-15	J1-5

DELETED:

3

Figure 8-10.
Sweep-Gate Output Amplifier (A8) Schematic 3

	A	B	C	D	E	F	
1	Circuit boards have plated through component holes. This permits soldering from either side of the board.			A7			1
2							2
3							3
4							4
5							5
6							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	B-4	C11	E-4	CR6	D-3	Q7	E-3	R10	B-6	R21	C-3
C2	C-5	C12	D-5	CR7	E-4	Q8	E-3	R11	B-6	R22	D-3
C3	B-5	C13	D-6	CR8	E-3	R1	B-3	R12	B-6	R23	C-2
C4	D-6	C14	B-2	CR9	E-2	R2	B-3	R13	B-4	R25	E-4
C5	B-3	C15	B-5	L1	E-5	R3	B-4	R14	B-3	R26	C-4
C6	D-4	C16	C-4	Q1	B-5	R4	B-5	R15	B-3	R27	E-4
C7	C-2	CR1	C-5	Q2	C-5	R5	B-6	R16	B-3	R28	E-3
C8	C-2	CR2	C-5	Q3	B-5	R6	B-5	R17	C-4	R29	D-2
C9	C-3	CR3	C-5	Q4	C-6	R7	C-5	R18	C-4	R30	E-5
C10	E-4	CR4	C-5	Q5	B-4	R8	C-6	R19	C-4	R31	E-5
		CR5	E-4	Q6	C-3	R9	C-6	R20	B-2	R32	B-2

182C-R-7

Figure 8-11. Gate Amplifier (A7) Component Identification

Table 8-5. Gate Amplifier Voltage Measurement Conditions

1. Set controls as follows:

   LINE power ON.

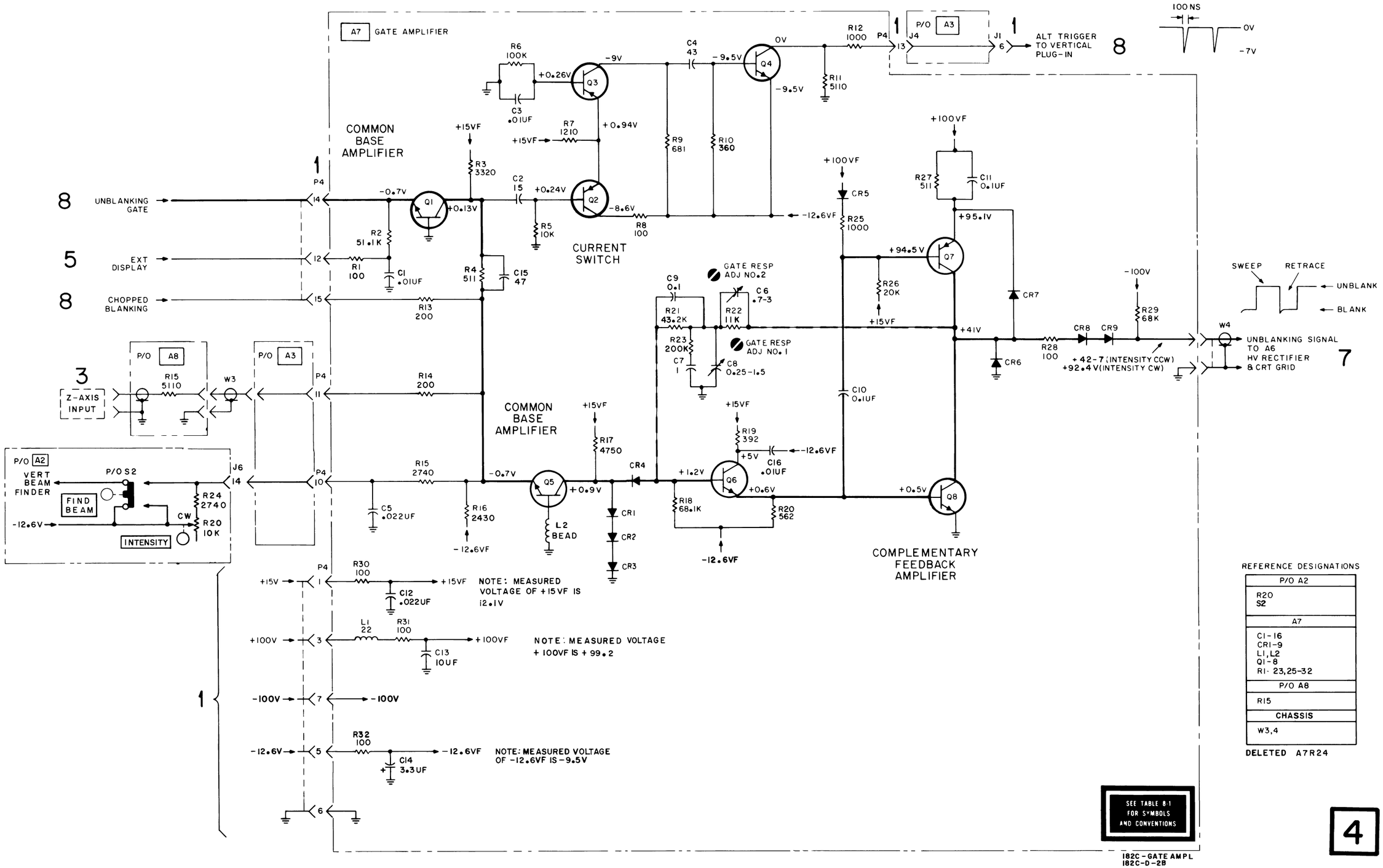
   Plug-ins not installed.

   No signal input.

INT	fully CCW
SCALE	fully CCW
FOCUS	fully CW
POSITION	centered
EXT VERNIER	CAL
DISPLAY	EXT
MAGNIFIER	X1

2. All voltages are referenced to ground.

3. All voltages measured with HP Model 414A Auto Voltmeter. (100 MΩ input impedance).



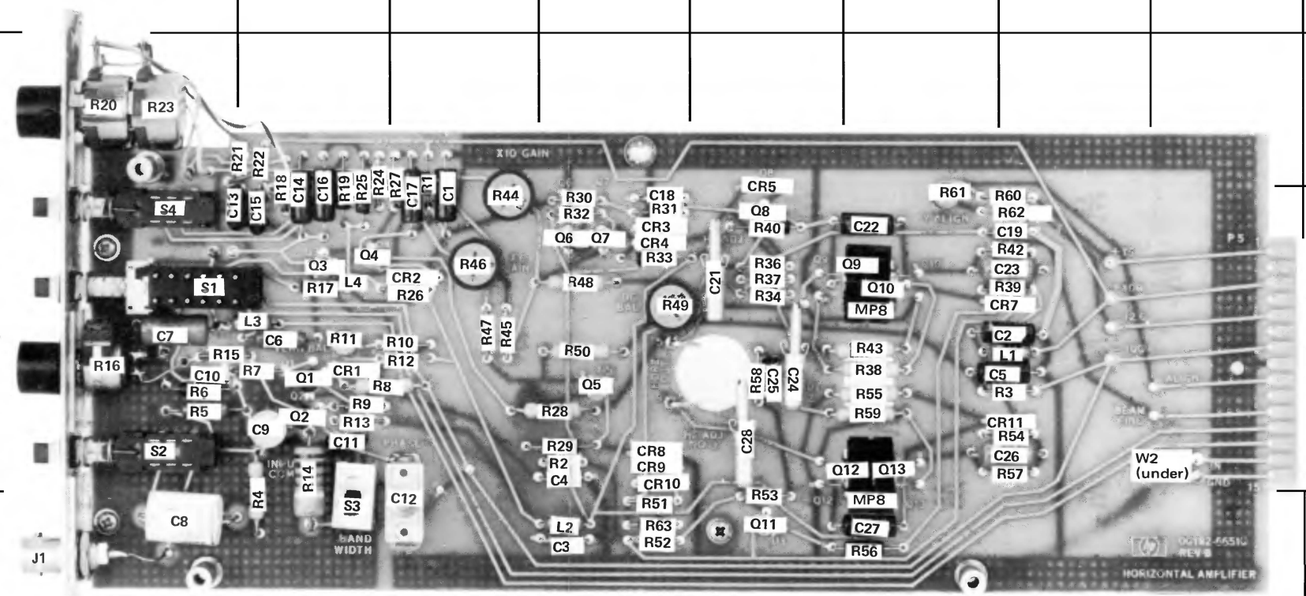
REFERENCE DESIGNATIONS

P/O A2
R20 S2
A7
C1-16 CR1-9 L1,L2 Q1-8 R1-23,25-32
P/O A8
R15
CHASSIS
W3,4

DELETED A7R24

4

Figure 8-12.
Gate Amplifier (A7) Schematic 4
8-17



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

A5

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	F-3	C14	E-3	C28	H-4	L2	G-5	Q9	I-3	R8	E-4	R20	D-2	R32	G-3	R46	F-3	R58	H-4
C2	J-3	C15	E-3	CR1	E-4	L3	E-3	Q10	I-3	R9	E-4	R21	E-2	R33	G-3	R47	F-3	R59	I-4
C3	G-5	C16	E-3	CR2	F-3	L4	E-3	Q11	H-5	R10	F-4	R22	E-2	R34	H-3	R48	G-3	R60	J-3
C4	G-4	C17	F-3	CR3	G-3	MP8	I-3	Q12	I-4	R11	E-4	R23	D-2	R36	H-3	R49	G-3	R61	I-3
C5	J-4	C18	G-3	CR4	G-3	Q1	E-4	Q13	I-4	R12	F-4	R24	E-3	R37	H-3	R50	G-4	R62	J-3
C6	E-4	C19	J-3	CR5	H-2	Q2	E-4	R1	F-3	R13	E-4	R25	E-3	R38	I-4	R51	G-5	R63	G-5
C7	D-3	C21	H-3	CR7	J-3	Q3	E-3	R2	G-4	R14	E-4	R26	F-3	R39	J-3	R52	G-5	S1	D-3
C8	D-5	C22	I-3	CR8	G-4	Q4	E-3	R3	J-4	R15	D-4	R27	F-2	R40	H-3	R53	H-5	S2	D-4
C9	E-4	C23	J-3	CR9	G-4	Q5	G-4	R4	E-5	R16	D-4	R28	G-4	R42	J-3	R54	J-4	S3	E-5
C10	D-4	C24	H-4	CR10	G-4	Q6	G-3	R5	D-4	R17	E-3	R29	G-4	R43	I-4	R55	I-4	S4	D-3
C11	E-4	C25	H-4	CR11	J-4	Q7	G-3	R6	D-4	R18	E-3	R30	G-3	R44	F-3	R56	I-5	W2	K-4
C12	F-5	C26	J-4	J1	C-5	Q8	H-3	R7	E-4	R19	E-3	R31	G-3	R45	F-3	R57	J-4		
C13	D-3	C27	I-5	L1	J-4														

182C-8-1

Figure 8-13. Horizontal Amplifier (A5) Component Identification

Table 8-6. Horizontal Amplifier Voltage Measurement Conditions

1. Set controls as follows:

   LINE power ON.

   Plug-ins not installed.

   No signal input.

INT	fully CCW
SCALE	fully CCW
FOCUS	fully CW
POSITION	centered
EXT VERNIER	CAL
DISPLAY	EXT
MAGNIFIER	X1

2. All voltages are referenced to ground.

3. All voltages measured with HP Model 414A Auto Voltmeter (100 MΩ input impedance).

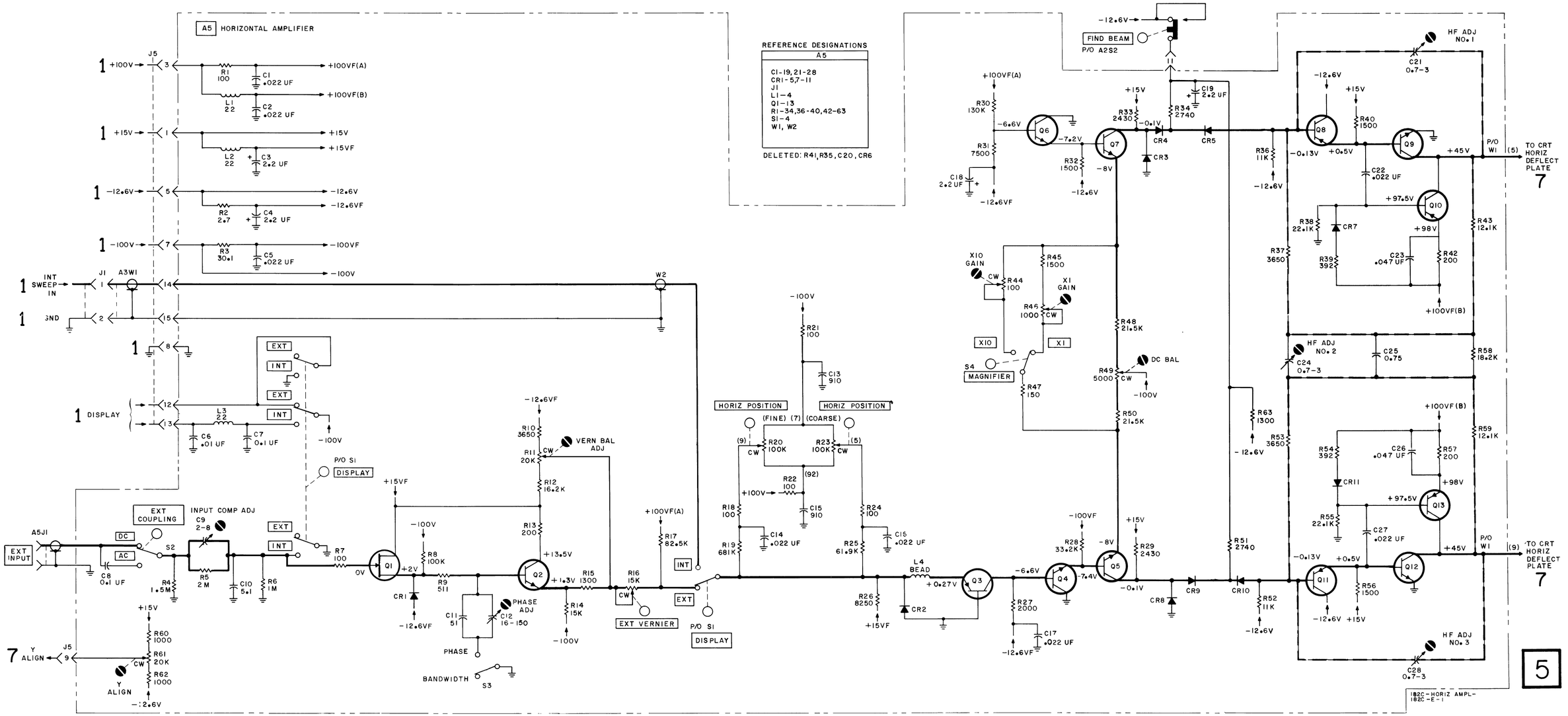
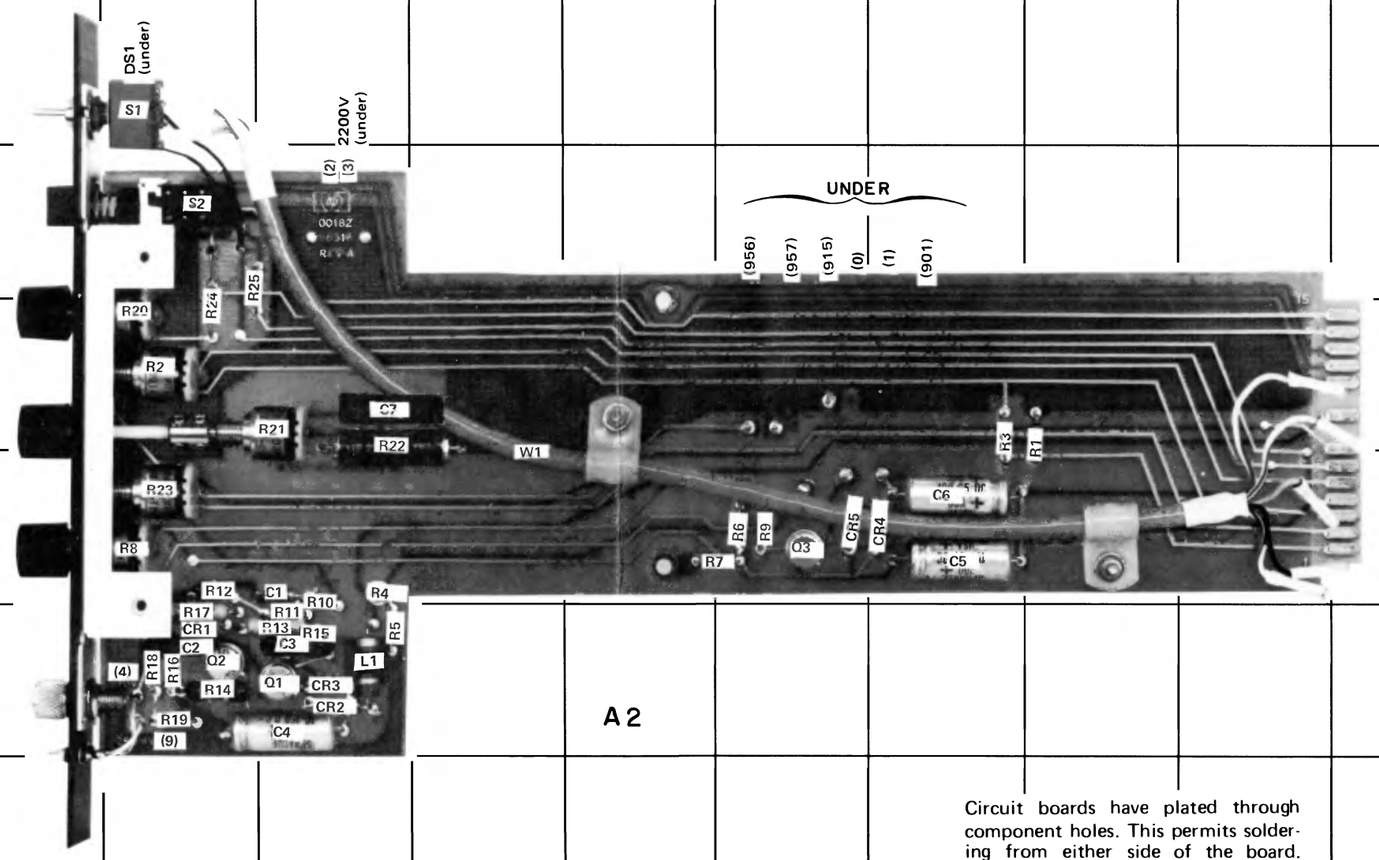


Figure 8-14.
Horizontal Amplifier (A5) Schematic 5



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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-4	DS1	D-1	R7	H-4	R18	D-5
C2	D-5	L1	E-5	R8	D-4	R19	D-5
C3	E-5	Q1	E-5	R9	H-4	R20	D-3
C4	E-5	Q2	D-5	R10	E-4	R21	E-3
C5	I-4	Q3	H-4	R11	E-5	R22	E-3
C6	I-4	R1	J-3	R12	D-4	R23	D-4
C7	E-3	R2	D-2	R13	E-5	R24	D-3
CR1	D-5	R3	I-3	R14	D-5	R25	D-2
CR2	D-5	R4	E-4	R15	D-5	S1	D-1
CR3	E-5	R5	E-5	R16	D-5	S2	D-2
CR4	I-4	R6	H-4	R17	D-5	W1	F-3
CR5	H-4						

182C-B-2A

Figure 8-15. Control Module (A2) Component Identification

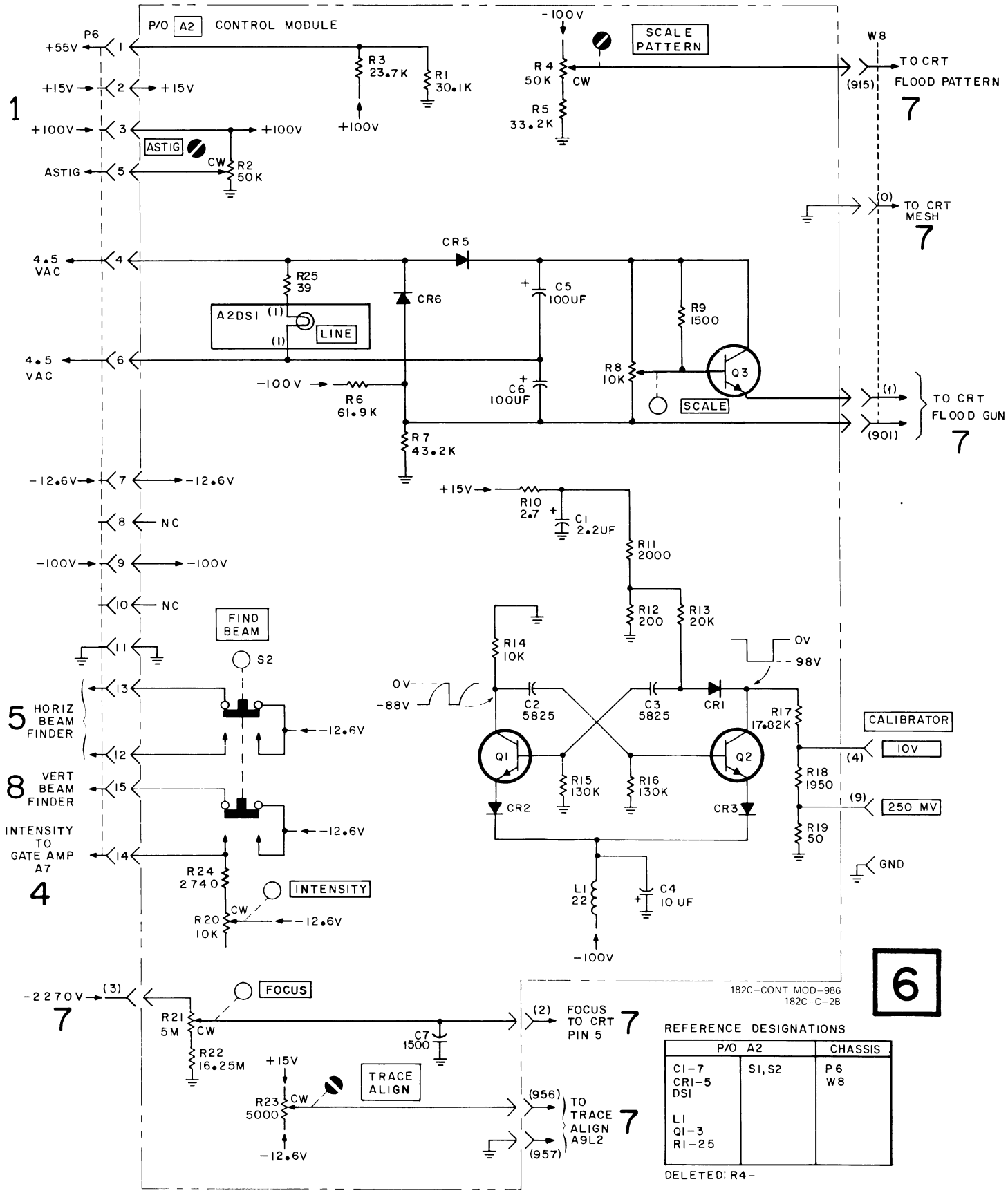
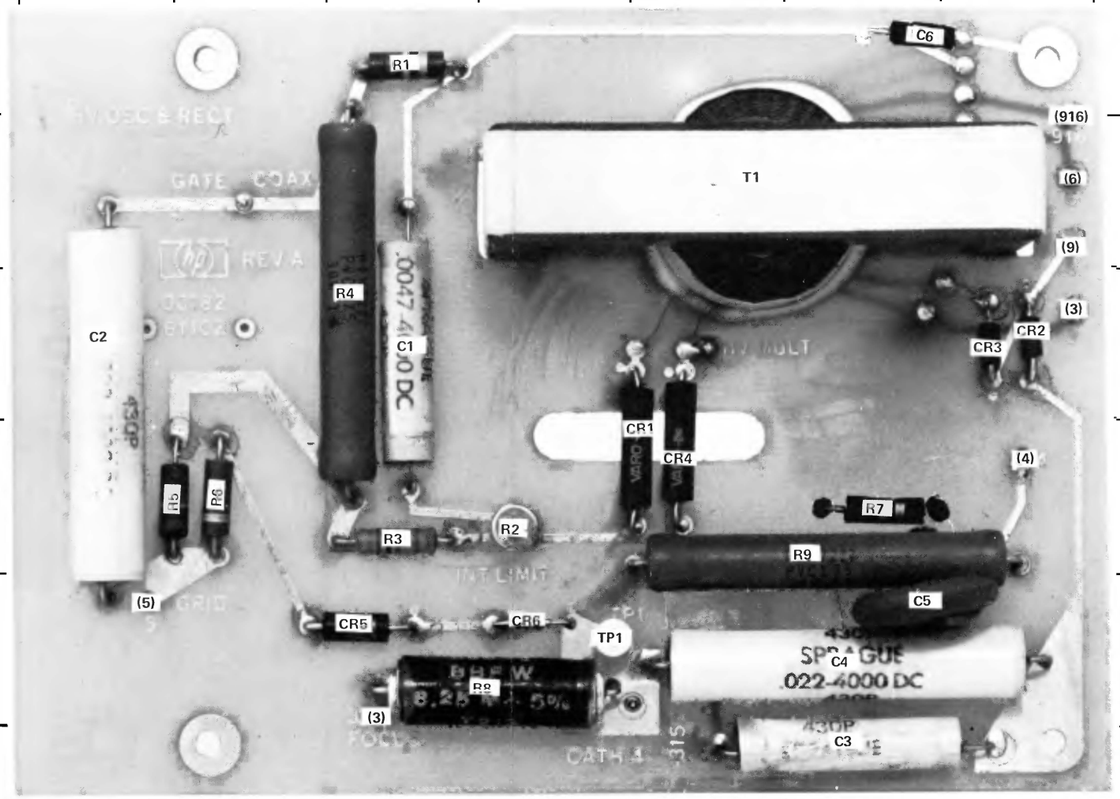


Figure 8-16.
Control Module (A2) Schematic 6



A6

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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	F-3	CR3	J-3	R5	E-4
C2	D-3	CR4	H-4	R6	E-4
C3	I-6	CR5	F-5	R7	I-4
C4	I-5	CR6	G-5	R8	G-5
C5	I-5	R1	F-1	R9	I-4
C6	I-1	R2	G-4	T1	H-2
CR1	H-4	R3	F-4	TP1	G-5
CR2	J-3	R4	F-3		

182C–B–3A

Figure 8-17. H.V. Oscillator & Rectifier (A6) Component Identification

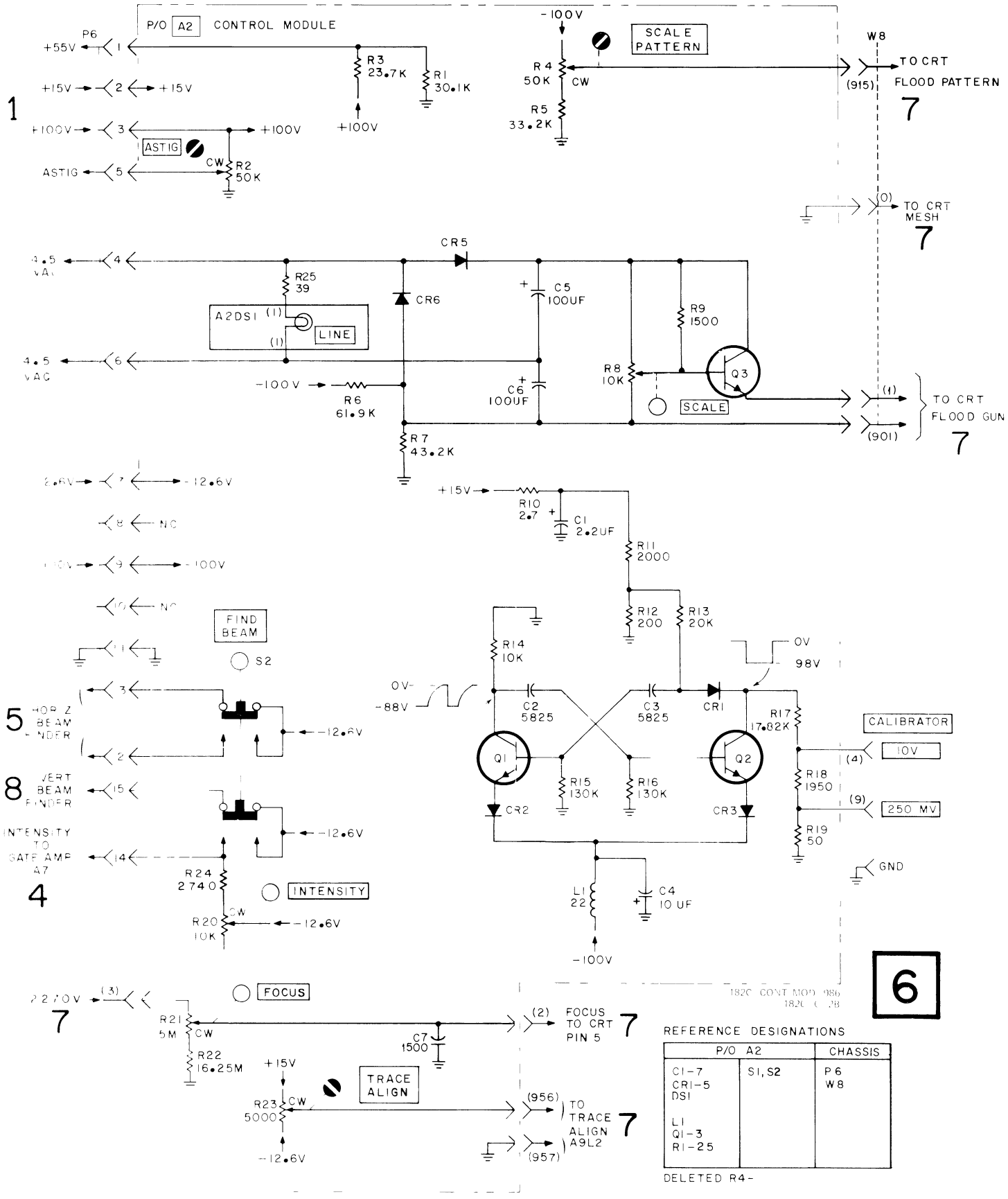


Figure 8-16
Control Module (A2) Schematic 6

Table 8-7. High Voltage Power Supply Troubleshooting Tips

Symptom	Suggested Checks
No high voltage.	*Most common fault. *Check oscillator power supply fuse located on H.V. Regulator Assembly. Check oscillator components: transistor, H.V. transformer, diodes, etc.
Voltage too high.	Check H.V. Adjust. Check regulator components and feedback loop. *Typical case is increased resistance in regulator feedback loop.
Voltage too low.	Check H.V. Adjust. Check regulator components and feedback loop. Typical case is decreased resistance in regulator feedback loop or CRT loading supply.
NOTE Refer to CRT Intensity Troubleshooting Tips for additional checks.	

Figure 8-18.
H. V. Multiplier

Table 8-8. CRT Intensity Troubleshooting Tips

Symptom	Suggested Checks
Low intensity	*Most common fault. Check Intensity Limit Adj. Check low voltage supplies. Check High Voltage Supply. Check Gate Amplifier and gate connection to H.V. Oscillator & Rectifier assembly. *Check CRT. (See Notes for additional tips.)
High intensity	Make checks listed for low intensity. *Check H.V. power supply diodes. Check CRT for grid-cathode leakage. Check CRT for open grid circuit. (See Notes for additional tips.)
Flickering intensity	Check High Voltage supply for arcing. Check High Voltage leads for arcing. Check CRT for loose connections to pins. Check CRT for possible intermittent internal connection. Check High Voltage regulator for intermittent components or connections. Check High Voltage Supply for intermittent components or connections. Check oscillator connections. (See Notes for additional tips.)

NOTE 1

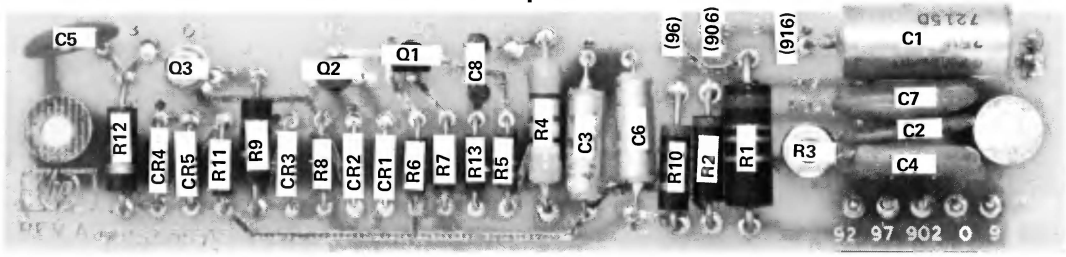
When troubleshooting the High Voltage Power Supply or CRT it is helpful to isolate the CRT. Do this by disconnecting CRT base socket and Post Accelerator High Voltage connection. With CRT disconnected, the High Voltage circuit is not loaded by the CRT if it is at fault, and the CRT is protected if the High Voltage supply is faulty.

NOTE 2

The CRT may be checked to determine if grid-cathode voltage is correct. Use a high-impedance voltmeter (VTVM) which has isolated input terminals to measure grid-cathode voltage. (Voltmeter input terminals must be isolated from ground, i.e.: floating, since grid and cathode are at high voltage in relation to ground.) With INTENSITY control set for maximum intensity (fully cw), grid should be more negative than cathode by about 20V. With control set for minimum intensity (fully CCW) grid should be more negative than cathode by about 60V.

NOTE 3

In checking for cause of excessive high voltage, remember that increased resistance in the feedback regulator loop will result in increasing the H. V. oscillator output. High Voltage output from the supply will therefore be increased. Conversely, low output from the High Voltage supply will result if the feedback loop resistance is lower than normal. Low voltage can also be the result of increased loading.



A10

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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-3	CR3	B-3	R5	C-3
C2	E-3	CR4	B-3	R6	C-3
C3	D-3	CR5	B-3	R7	C-3
C4	E-3	Q1	C-3	R8	B-3
C5	A-2	Q2	B-3	R9	B-3
C6	D-3	Q3	B-3	R10	D-3
C7	E-3	R1	E-3	R11	B-3
C8	C-3	R2	D-3	R12	A-3
CR1	C-3	R3	E-3	R13	C-3
CR2	C-3	R4	D-3		

182C - A-3

Figure 8-19. H.V. Regulator (A10) Component Identification

Table 8-9. H.V. Power Supply Voltage Measurement Conditions

1. Set controls as follows:

   LINE power ON.

   Plug-ins not installed.

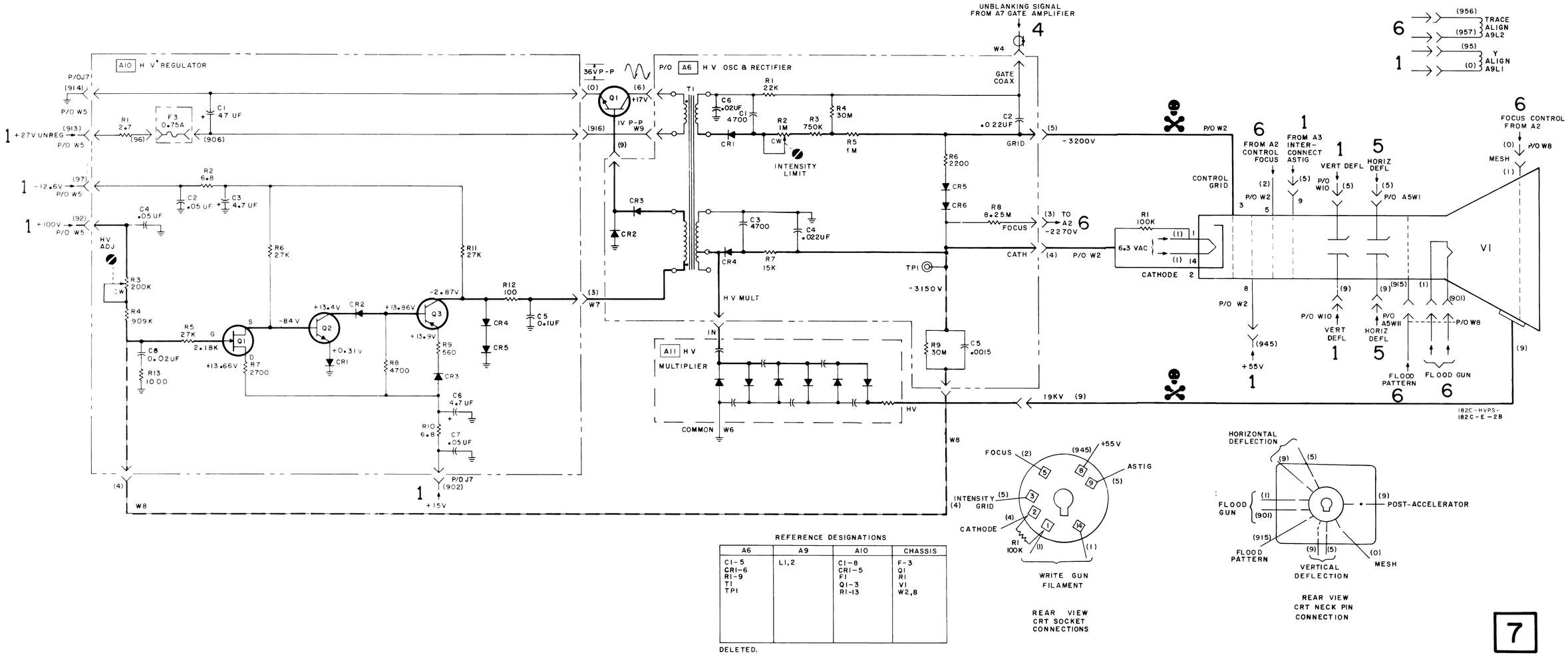
   No signal input

   INT . . . . . fully CCW
   SCALE . . . . . fully CCW
   FOCUS . . . . . fully CCW

2. All voltages are referenced to ground.

3. Low voltages measured with HP Model 414A Auto Voltmeter (100 MΩ input impedance).

4. To measure high voltages use HP Model K05-3440A 1000:1 Divider Probe and HP Model 3440A Digital Voltmeter with HP Model 3441A or 3444A plug-in.



REFERENCE DESIGNATIONS

A6	A9	A10	CHASSIS
C1-5 CR1-6 R1-9 T1 TP1	L1,2	C1-8 CR1-5 F1 Q1-3 R1-13	F-3 Q1 R1 V1 W2,8

DELETED.

Figure 8-20.
High Voltage Power Supply Schematic 7
8-25

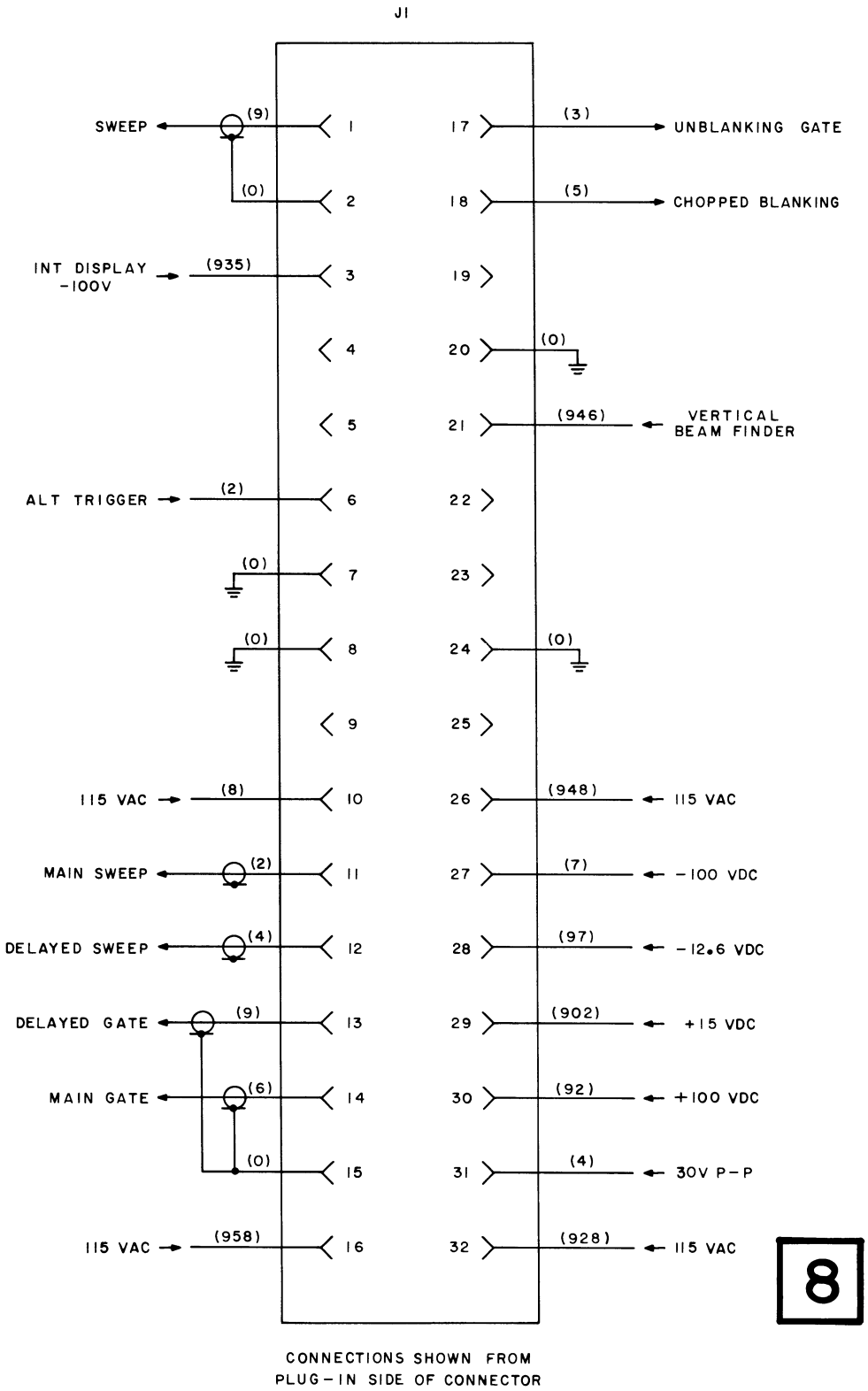


Figure 8-21. Horizontal Plug-in Connections, Schematic 8

HEWLETT hp PACKARD

CATHODE-RAY TUBE WARRANTY

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

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

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

Attention: CRT QA

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

SHIPPING INSTRUCTIONS

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

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

Thank you,

CRT Department

5950-7124

HEWLETT hp PACKARD

CATHODE-RAY TUBE FAILURE REPORT

DATE _____

FROM:

NAME _____

COMPANY _____

ADDRESS _____

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

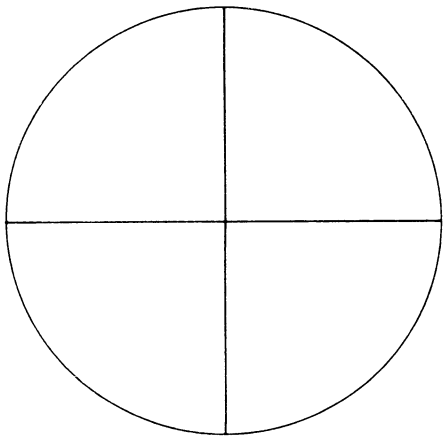
_____

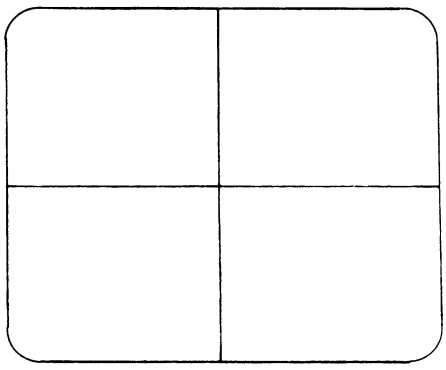
_____

_____

_____

_____





5. Warranty claimed ? Yes _____ No _____
6. HP Sales/Service Office _____ Repair Order No. _____

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UNITED STATES

ALABAMA
8290 Whitesburg Dr S E
P O Box 4207
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

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2336 E Magnolia St
Phoenix 85034
Tel (602) 244-1361
TWX 910-951-1330

5737 East Broadway
Tucson 85711
Tel (602) 298 2313
TWX 910 952 1162

(Effective Dec 15 1973)
2424 East Aragon Rd
Tucson 85706
Tel (602) 889 4661

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1430 East Orangethorpe Ave
Fullerton 92631
Tel (714) 870 1000
TWX 910 592 1288

3939 Lankershim Boulevard
North Hollywood 91604
Tel (213) 877-1282
TWX 910 499 2170

6305 Arizona Place
Los Angeles 90045
Tel (213) 649-2511
TWX 910-328 6148

1101 Embarcadero Road
Palo Alto 94303
Tel (415) 327 6500
TWX 910 373 1280

2220 Watt Ave
Sacramento 95825
Tel (916) 482-1463
TWX 910 367 2092

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P O Box 23333
San Diego 92123
Tel (714) 279-3200
TWX 910-335 2000

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7965 East Prentice
Englewood 80110
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12 Lunar Drive
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TWX 710 465 2029

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TWX 510-955 4099

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TWX 710 862 9157

20010 Century Blvd
Germantown 20767
Tel (31) 428 0700

P O Box 1648
2 Choke Cherry Road
Rockville 20850
Tel (301) 948-6370
TWX 710-828-9684

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Lexington 02173
Tel (617) 861-8960
TWX 710 326 6904

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23855 Research Drive
Farmington 48024
Tel (313) 476-6400
TWX 810-242-2900

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St. Paul 55114
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TWX 910-771 2087

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TWX 910-764-0830

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TWX 710-892-4945

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TWX 710-990-4951

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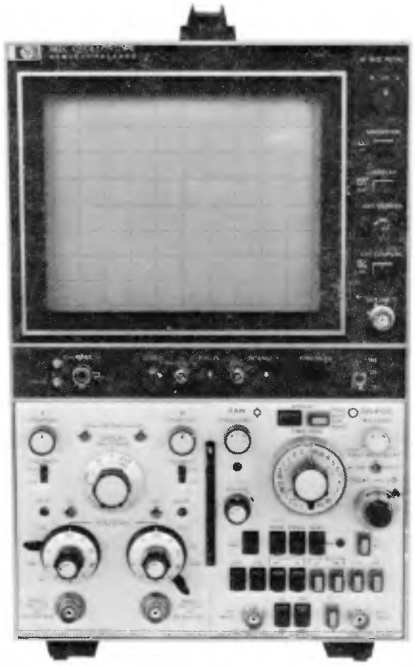
PRINTED IN U.S.A.

OPERATING AND SERVICE MANUAL

OSCILLOSCOPE

182C



HEWLETT hp PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

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

OPERATING AND SERVICE MANUAL

MODEL 182C
OSCILLOSCOPE

SERIALS PREFIXED: 1342A

Refer to Section VII for instruments with the following serial prefix numbers: **1311A, 1248A, 1241A, 1240A.**

Refer to Section VII for instruments with the following standard options: **001, 002, 003, 007, 010, 011, 013, 807, X95.**

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

Manual Part Number 00182-90906.
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PRINTED: FEB 1974

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

LIST OF ILLUSTRATIONS

LIST OF TABLES

Figure 1-1. Model 182C Oscilloscope

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and servicing information for the Hewlett-Packard Model 182C Oscilloscope. The manual is divided into eight sections, each covering a specific topic or aspect of the instrument. All schematics are located at the rear of the manual and can be unfolded and used for reference while reading any part of the manual.

1-3. This section contains complete instrument specifications (Table 1-1), a description of features, warranty information, data for manual and instrument identification, and information regarding accessories available for use with the instrument. Table 1-2 lists and describes the abbreviations used in this manual.

1-4. INSTRUMENT DESCRIPTION.

1-5. The Model 182C (Figure 1-1) is a solid-state, lightweight laboratory and general-purpose oscilloscope with plug-in capabilities. It is designed to display complex high frequency waveforms and to measure alternating- and direct-current voltages. Complete specifications are given in Table 1-1.

1-6. The Model 182C is a cabinet type instrument with a built-in tilt stand, convenient carrying handle on top, and feet mounted on both bottom and rear for either bench or upright operation. Controls are arranged and located to simplify operation.

1-7. For minimum size and weight with maximum reliability, the Model 182C has solid-state circuitry throughout except for the CRT. Power consumption, with plug-ins, is less than 120 watts at normal line voltage. The instrument is convection cooled and designed to operate within specifications at temperatures between 0° C and 55° C with up to 95% relative humidity at 40° C.

1-8. All power supplies, a dual output calibrator, a horizontal amplifier, a gate amplifier and the CRT are contained in this instrument. Operation at either 115V or 230V ac is selectable by a switch located on the rear panel of the oscilloscope. Located on the rear panel are connectors for main and delayed gate, and main and delayed sweep output signals. Connection for input of an external signal for intensity modulation (Z-axis input) is provided at the rear panel. An input signal of approximately +2V having a pulse width of greater than about 50 ns will blank a trace of normal intensity.

1-9. The Model 182C is designed to operate with a number of different plug-in vertical amplifiers and time bases. Presently available plug-ins provide a wide choice of operating capabilities such as wide bandwidth, sensitivities, dual or four-channel operation, single or delayed sweeps, sampling and time-domain reflectometer operation.

1-10. Modular type construction has been used throughout the instrument. This makes it easy and simple to remove units for quick maintenance. Assemblies are constructed with interconnecting plugs and jacks and each assembly can be removed without unsoldering connections.

1-11. A calibrator provides a square-wave signal of approximately 1 kHz with a risetime of less than 3 μsec. The calibrator output is available at the front panel at amplitudes of 250 mV and 10V p-p with an accuracy of ±1%. The signal may be used to check horizontal and vertical deflection factors and to compensate divider probes.

1-12. The oscilloscope horizontal amplifier accepts sweep signals from the time base plug-in or an external signal. Bandwidth is dc to 5 MHz, dc-coupled, and 5 Hz to 5 MHz with capacitive coupling. Two deflection factor ranges are front panel selectable: 1 V/div (X1), and 0.1 V/div ±5% (X10). In addition, a vernier control provides continuous adjustment between ranges. The maximum external input level is 300 Vdc, ac-coupled, with a dynamic range of ±20V.

1-13. A beam finder pushbutton control assists the operator in rapidly bringing a displaced beam on screen. Its use increases intensity and reduces vertical and horizontal amplifier gain to quickly locate trace position.

1-14. CATHODE-RAY TUBE.

1-15. The Model 182C uses a post-accelerator aluminized CRT with a large eight by ten division display area of 133 cm^2. Each division is 1.29 cm with 0.2-div subdivisions provided on the major axes. The graticule is internal to the CRT, eliminating display parallax. Option 011 instruments are provided with a P11 phosphor CRT. The display intensity will not increase when FIND BEAM is depressed. This prevents phosphor burn.

1-16. The standard CRT supplied with this instrument has a P31 aluminized phosphor. P2, P7 and P11 phosphors are also available as options.

1-17. WARRANTY.

1-18. This instrument is certified and warranted as stated on the inside front cover of this manual. The CRT is covered by a separate warranty. The CRT warranty and warranty claim form are located at the rear of this manual. Should the CRT fail within the time specified on the warranty, fill out the failure report form on the reverse side of the warranty statement and return it with the CRT. In all correspondence with a Hewlett-Packard Sales/Service Office concerning an instrument, reference the complete serial number and model of the instrument.

1-19. INSTRUMENT IDENTIFICATION.

1-20. Hewlett-Packard uses a two-section serial number for instrument identification (Figure 1-2). The first numerical group is the serial prefix number. It identifies a series of instruments. The last numerical group identifies a particular instrument in the series. The serial number appears on a plate located on the rear panel.

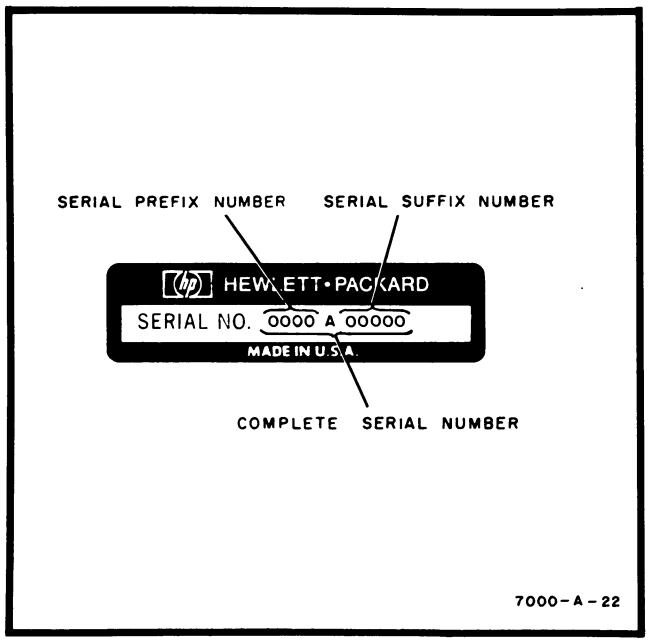


Figure 1-2. Instrument Identification

1-21. MANUAL IDENTIFICATION AND CHANGES.

1-22. This manual provides operating and service information for the HP Model 182C. Information in this manual applies directly to instruments (as manufactured) with a serial prefix as indicated on the title page. If the serial prefix of your instrument is different from that on the title page, a MANUAL CHANGES insert sheet, or Section VII of this manual will describe the changes necessary to adapt this manual to provide correct information.

1-23. Technical corrections (if any) to this manual due to known errors in print are called Errata and are shown on the manual changes sheet. For information on manual coverage of any HP instrument, contact the nearest HP Sales/Service Office (addresses are listed at the rear of this manual).

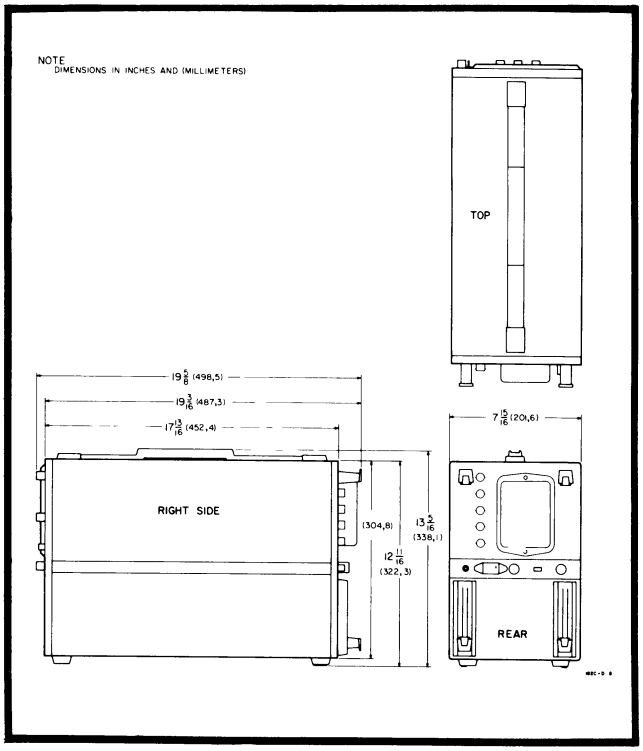


Figure 1-3. Model 182C Outline Dimensions

1-24. ACCESSORIES FURNISHED.

1-25. The Model 182C is equipped with a blue plexiglas contrast filter which provides improved viewing and greater contrast under ambient light conditions. The filter slides into place in the CRT bezel and may be removed if preferred.

1-26. A detachable power cord is supplied with each instrument. The three-conductor power cord and instrument receptacle conform to International Electrotechnical Commission (IEC) safety standards.

1-27. AVAILABLE ACCESSORIES.

1-28. A series of mobile test stands is available for the Model 182C. The Model 1118A is a portable tripod testmobile which provides adjustable height, tilt and rotation. It is also equipped with locking wheels and is readily collapsible for transport. The 1119-series testmobiles are general-purpose test stands designed for maximum utility while requiring a minimum of floor space. These testmobiles allow the instrument to be tilted at least 40 degrees above and below horizontal in 10-degree steps.

1-29. The Model 10172A cover, made of flexible material, covers the entire instrument. The cover top is slotted for access to the carrying handle.

Table 1-1. Specifications

CATHODE-RAY TUBE AND CONTROLS

TYPE:

Post-accelerator, 22 kV accelerating potential: aluminized P31 phosphor (other phosphors available, refer to Options).

GRATICULE:

8 x 10 div graticule. 0.2-div sub-div on major axes. 1 div = 1.29 cm. Front panel recessed screwdriver adjustment aligns trace with graticule. Scale control illuminates graticule for viewing with hood or taking photographs.

BEAM FINDER:

Returns trace to CRT screen regardless of setting of horizontal, vertical or intensity controls.

INTENSITY MODULATION:

Approx +2V, $\geqslant$ 50ns width ($\leqslant$ 10 MHz CW) will blank trace of normal intensity. Input R, approx 5k ohms. Maximum input voltage, ±20V (dc + pk ac).

CALIBRATOR

TYPE:

Approx 1 kHz square wave, $<$ 3 μsec risetime.

VOLTAGE:

Two outputs, 250 mV p-p and 10V p-p; accuracy, ±1%.

HORIZONTAL AMPLIFIER

EXTERNAL INPUT:

BANDWIDTH: DC-coupled, dc to 5 MHz; AC-coupled, 5 Hz to 5 MHz;

DEFLECTION FACTOR: X1, 1 V/div; X10, 0.1 V/div. Vernier provides continuous adjustment between ranges. Accuracy, ±5%.

DYNAMIC RANGE: ±20V.

MAXIMUM INPUT: 300V (dc + pk ac).

INPUT RC: 1 megohm shunted by approx 30 pF.

INTERNAL SWEEP:

SWEEP MAGNIFIER: X10; accuracy ±5%.

OUTPUTS

Four emitter follower outputs on rear for main and delayed gates, main and delayed sweeps, or vertical and horizontal outputs when used with sampling plug-ins; maximum current available, ±3 mA; outputs will drive impedances down to 1000 ohms without distortion.

GENERAL

WEIGHT:

(without plug-ins) net, 26 1/2 lb (12,02 kg); shipping, 38 1/2 lb (17,46 kg).

DIMENSIONS:

See outline drawing (figure 1-3).

ENVIRONMENT:

Temperature: 0° C to 55° C.

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

Altitude: Up to 15,000 ft.

Vibration: Vibrated in three planes for 15 minutes each with 0.010 inch excursion, 10 to 55 Hz.

POWER:

115V or 230V ±10%, 48 to 440 Hz. Approx 120 watts with plug-ins at normal line, 200 VA max.

ACCESSORIES FURNISHED:

Blue plexiglas contrast filter; power cord.

OPTIONS

Refer to Section VII for listing of options.

1-30. Waveform photography of the Model 182C display can be accomplished with the Model 10367A Camera Adapter. The adapter fits into the Model 182C bezel, replacing the contrast filter, for use with the Model 195A and Model 197A Oscilloscope Cameras.

1-31. A Horizontal Gain Calibrator, HP Model 10411A, facilitates rapid and accurate calibration of the horizontal deflection factor of the Model 182C. Also available is a Service Extender, HP Model 10133A, which is useful for troubleshooting the complete power supply module when removed from the oscilloscope mainframe.

1-32. For ease of calibration and maintenance, the HP Model 10407A Plug-in Extender can be obtained. It provides for removal of the vertical and time base plug-ins from the oscilloscope mainframe and exposes components and adjustments of the plug-ins for servicing.

1-33. Blank plug-ins are available for use with the Model 182C. These units fit into the oscilloscope vertical and time base compartments and provide the necessary interface connections and operating power for user designed vertical amplifier and/or time base circuitry. Refer to Section IV for the operating power available from the oscilloscope mainframe. The following units are available: HP Model 10408A Vertical Blank Plug-in, HP Model 10409A Horizontal Blank Plug-in, and HP Model 10410A Dual Blank Plug-in.

1-34. A metallic mesh contrast filter which functions as an RFI shield is available for the Model 182C. The mesh filter, HP Part No. 00182-62701, is directly interchangable with the standard blue plexiglas filter. When installed, the metallic mesh filter is electrically grounded to the oscilloscope chassis, thereby furnishing RFI shielding.

1-35. Cameras, probes, viewing hoods, terminations and other accessory items are available for specialized requirements. Information on these and the above described accessories may be obtained from HP Sales/Service Offices listed in the rear of this manual.

Table 1-2. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	= assembly	E	= misc. electrical part	P	= plug	U	= integrated circuit (unrepairable)
AT	= attenuator, resistive termination	F	= fuse	PS	= power supply	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor, fan	FL	= filter	Q	= transistor	VR	= voltage regulator (diode)
BT	= battery	H	= hardware	R	= resistor	W	= cable
C	= capacitor	J	= Jack	RT	= thermistor	X	= socket
CP	= coupling	K	= relay	S	= switch	Y	= crystal
CR	= diode	L	= inductor	T	= transformer	Z	= network
DL	= delay line	LS	= speaker	TB	= terminal board		
DS	= device signaling (lamp)	M	= meter	TP	= test point		
		MP	= mechanical part				

ABBREVIATIONS

A	= ampere(s)	FET	= field-effect transistor(s)	n	= nano (10^{-9})	rfi	= radio frequency interference
ampl	= amplifier(s)			nc	= normally closed		
assy	= assembly			no.	= normally open	rms	= root mean square
ampltd	= amplitude			npn	= negative-positive-negative	rwv	= reverse working voltage
		G	= giga (10^{9})				
bd	= board(s)	gnd	= ground(ed)	ns	= nanosecond		
bp	= bandpass					SCR	= silicon controlled rectifier
		H	= henry(ies)				
c	= centi (10^{-2})	hr	= hour(s)	p	= pico (10^{-12})	sec	= second(s)
C	= carbon	HP	= Hewlett-Packard	pc	= printed (etched) circuit(s)	std	= standard
ccw	= counterclockwise	Hz	= hertz				
coax.	= coaxial			pk	= peak	trmr	= trimmer
coef	= coefficient	if.	= intermediate freq.	pnp	= positive-negative-positive		
com	= common	intl	= internal	p/o	= part of	u	= micro (10^{-6})
CRT	= cathode-ray tube			p-p	= peak-to-peak	usec	= microsecond
cw	= clockwise	k	= kilo (10^{3})	prgm	= program		
				prv	= peak inverse voltage(s)	V	= volts
d	= deci (10^{-1})	lb	= pound(s)			var	= variable
dB	= decibel	lpf	= low-pass filter(s)	ps	= picosecond		
						w/	= with
ext	= external	m	= milli (10^{-3})	pwv	= peak working voltage	w/o	= without
		M	= mega (10^{6})			wiv	= working inverse voltage
F	= farad(s)	ms	= millisecond	rf	= radio frequency		

3/70

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section of the manual contains inspection and installation procedures for the Model 182C Oscilloscope. In addition, packing and claims procedures are discussed in the event damage occurs during shipment.

2-3. INITIAL INSPECTION.

2-4. The instrument was carefully inspected, mechanically and electrically, prior to shipment. On receipt, inspect it for any mechanical damage which may have occurred during shipment and test the electrical performance.

2-5. Check for physical damage such as bent or broken parts and dents or scratches. If damage is found, refer to the recommended claims procedure. Retain the packaging material for future use.

2-6. Check the electrical performance of the instrument as soon as possible after receipt. The performance check is contained in Section V of this manual. This check will verify that the instrument is operating to the specifications listed in Table 1-1.

2-7. The initial performance and accuracy of this instrument are certified as stated in the warranty on the inside front cover of this manual. If the instrument does not operate as specified, refer to the recommended claims procedure.

2-8. CLAIMS.

2-9. If physical damage is found or if the instrument is not within specifications when 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 a claim to be settled with the carrier.

2-10. The warranty statement for this Hewlett-Packard instrument is on the inside front cover of this manual. Contact the nearest Sales/Service Office for information and assistance with warranty claims.

2-11. REPACKING FOR SHIPMENT.

2-12. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag to it showing owner's name and address, instrument model number, and serial number, and a description of service required.

2-13. Use the original shipping carton and packaging materials for reshipment. If they are not available, repackage the instrument with the following materials:

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

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

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

d. Heavy-duty shipping tape to secure outside of carton.

Table 2-1. Shipping Carton Test Strength

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

2-14. PREPARATION FOR USE.

2-15. POWER REQUIREMENTS.

2-16. The standard Model 182C requires a 115 or 230 Vac ±10%, single phase, 48 to 440 Hz power source capable of supplying 200 VA maximum. It requires approximately 120 watts at normal line voltage with the plug-ins installed.

2-17. 115 VAC OPERATION. This instrument, as shipped, is ready for operation on 115 Vac. Before applying power, check the rear-panel slide switch, labeled SELECTOR, for proper position. Positioning it so that the legend 115 is visible connects the power transformer primary windings in parallel for 115 Vac operation. This also selects the proper fuse for this voltage.

2-18. 230 VAC OPERATION. If the instrument is to be operated from a 230 Vac power source, set the rear-panel SELECTOR slide switch to 230. This connects the

power transformer primary windings in series for 230 Vac operation and selects the proper fuse for 230 Vac.

2-19. THREE-CONDUCTOR POWER CABLE.

2-20. The National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded to protect operating personnel. The Model 182C is provided with a detachable three-conductor power cord which, when plugged into an appropriate outlet, grounds the instrument. The oscilloscope mainframe power jack and the mating plug of the power cord conform to International Electrotechnical Commission (IEC) safety standards.

2-21. When operating the Model 182C from a two-contact power outlet use a three-conductor to two-conductor adapter. Preserve the safety feature by grounding the adapter flexible (third) lead. A suitable three- to two-pin adapter is available from Hewlett-Packard. Order HP Part No. 1251-0048.

2-22. INSTRUMENT MOUNTING.

2-23. The Model 182C is intended for bench use. It has a built-in tilt stand and feet mounted on both bottom and rear for bench or upright operation.

2-24. To use the tilt stand, lift the front of the instrument or place it vertically on the rear feet. The tilt stand is folded and locked into place against the cabinet bottom cover. Hold the instrument steady and squeeze the two tilt stand legs together to release them from the lock. Pull the stand toward the front of the instrument. When fully forward, release the legs and they will lock into position. The tilt stand will support the instrument with the front elevated.

2-25. INSTRUMENT COOLING.

2-26. This instrument does not require forced-air cooling when operated at room temperature or between 0 to +55 degrees centigrade. Normal air circulation will maintain a reasonable operating temperature within the instrument.

2-27. Perforations in the two covers provide for the required air flow. Do not obstruct them. Provide several inches of clearance around the top, rear and sides. Adequate airflow from the bottom of the instrument is provided by the mounting feet.

2-28. CONTRAST FILTER.

2-29. The contrast filter is designed to be easily removed from the CRT bezel. Use of the light blue contrast filter provides comfortable viewing when the instrument is operated in normal and high ambient light.

2-30. To remove the contrast filter, as is desirable for photographing the display, grasp the top portion of the bezel frame and pull straight up. Remove the filter by lifting it straight up and out of the bezel. Figure 2-1 shows the filter being removed from the instrument.

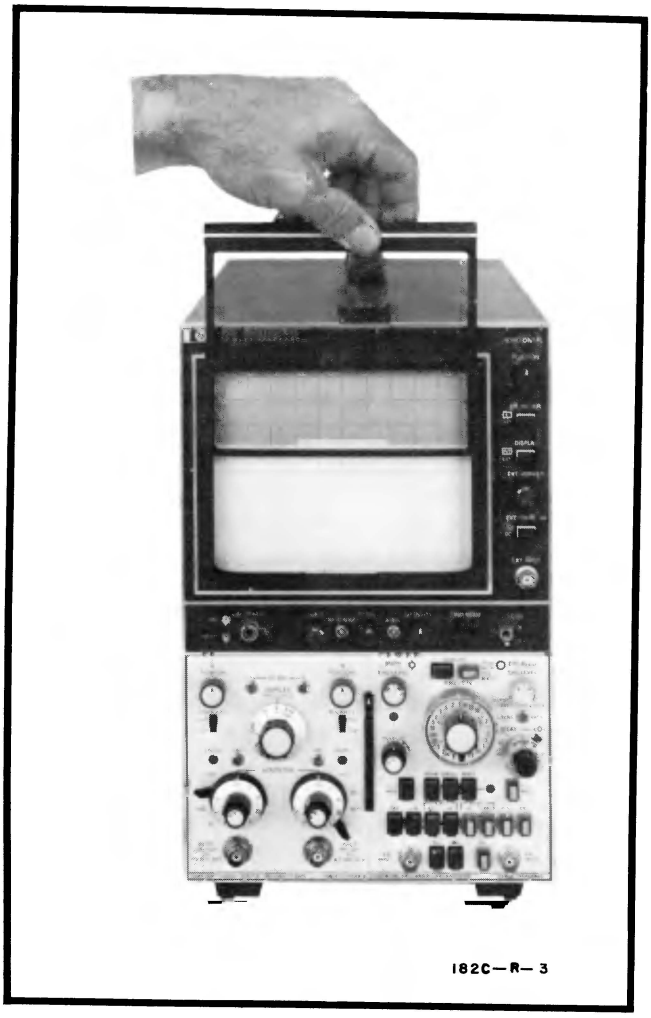


Figure 2-1. Contrast Filter Removal

2-31. CLEANING CRT FACEPLATE.

2-32. When the contrast filter has been removed, the CRT faceplate can be cleaned using a soft cloth or tissue. Never use coarse or abrasive tissues; these will scratch the plastic CRT faceplate.

2-33. INSTRUMENT COMPATIBILITY.

2-34. The Model 182C Oscilloscope is designed to operate with a wide variety of time base and vertical plug-ins. Table 3-1 lists the plug-ins currently available.

Note

Plug-ins specifically designed for use with the 500 MHz Model 183A/B Oscilloscope will not fit into or operate in the Model 182C. A mechanical interlock is provided on these plug-ins which prevents their full insertion into the Model 182C. Additionally, the Model 182C does not supply the required operating power.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section of the manual presents information on the operation, function and capabilities of the instrument controls. Information regarding control turn-on procedures and front panel adjustments is explained to assist the operator in properly setting up and using the Model 182C.

3-3. GENERAL.

3-4. The Model 182C is designed to operate with plug-in time bases, and vertical amplifiers or sampling and time domain reflectometers. These plug-ins are accommodated in the lower portion of the instrument. The required operating power is obtained from the oscilloscope mainframe. Time base and vertical amplifier units must be locked together before being installed in the mainframe.

3-5. The vertical amplifier is always installed in the left-hand side and the time base on the right-hand side of the mainframe compartment. Refer to the plug-in operating and service manuals for mating and installation instructions.

3-6. PUSHBUTTON SWITCHES.

3-7. Three switches are of the two position push-push type. These are: MAGNIFIER, DISPLAY and EXT COUPLING. The pushbuttons for these functions are color coded to indicate the function selected. When the released position is selected, the white skirt of the pushbutton is exposed. This corresponds to the control function on the panel outlined in white. For example: if MAGNIFIER is depressed, only the black portion of the pushbutton is visible. Magnification is therefore X10. When MAGNIFIER is released, the white skirt of the pushbutton can be seen and magnification is X1.

3-8. FRONT PANEL CONTROLS AND CONNECTORS.

3-9. All operating controls and front panel adjustments are identified and described in Figure 3-1. The information presented gives the operator a quick reference regarding the operating function of each. Additional information regarding some of these is explained below in greater detail.

3-10. CALIBRATOR.

3-11. The calibrator has two outputs, 10V and 250 mV peak-to-peak, negative-going from ground, with an amplitude accuracy of ±1%. The output is a square wave at a frequency of approximately 1 kHz. Risetime of the signal is less than 3 microseconds. These outputs are useful for checking vertical and horizontal sensitivity calibration, and divider probe calibration. A 3-way binding post provides a convenient ground connection point and may be used with banana plug, wire or spade lug connection.

3-12. SCALE.

3-13. This control adjusts the overall brightness of the CRT graticule. It should be adjusted for good contrast between the background and the graticule. The SCALE control is useful when using a hood to view the display or when photographing waveforms. Rotate the SCALE control counterclockwise to OFF when graticule illumination is not needed.

3-14. TRACE ALIGN.

3-15. This screwdriver adjustment is used to compensate for external magnetic fields that may affect alignment of the horizontal trace with the graticule. Use it to position the trace parallel to the graticule horizontal lines. The alignment should be checked when the instrument is moved to a new location and adjustment made whenever necessary.

3-16. FOCUS AND ASTIGMATISM.

3-17. These controls are used to obtain a display of uniform focus. Adjust both controls for the sharpest display possible.

3-18. FIND BEAM.

3-19. Occasionally the CRT beam may be driven off-screen by large dc input levels or improper control settings. Pressing the pushbutton increases intensity and reduces horizontal and vertical amplifier gains enough to always return a displaced beam to the viewing area. This enables the operator to determine the action necessary to center the display. All operating controls function while the FIND BEAM control is depressed. Obtaining a centered display may require adjustment of the deflection factor, horizontal and vertical position, coupling, trigger level or intensity for example. If the controls are properly set, the display will remain visible when FIND BEAM is released.

Note

Option 011 instruments do not increase intensity when FIND BEAM is pressed. Use the INTENSITY control to set intensity to viewing level.

3-20. LINE POWER SWITCH.

3-21. This toggle switch applies or removes ac line input power to the instrument. When ON, an indicator lamp, located immediately above the switch, is illuminated. Power for the lamp is obtained from the low voltage power supply. Both sides of the ac power line input are interrupted when switched to OFF.

3-22. HORIZONTAL EXTERNAL COUPLING.

3-23. An external input signal may be connected to the horizontal amplifier via the EXT INPUT BNC connector when DISPLAY is set to EXT. The EXT COUPLING switch is used to select ac coupling (capacitive coupling) to the amplifier for alternating voltages or dc coupling.

3-24. HORIZONTAL MAGNIFIER.

3-25. This pushbutton switch controls the gain of the horizontal amplifier. When switched from X1 to X10, the gain is increased ten times. For example, one volt into the horizontal amplifier EXT INPUT jack produces 1 division of deflection in X1 and 10 divisions of deflection in X10.

3-26. HORIZONTAL DISPLAY.

3-27. Either of two modes of operation can be selected with this switch. It selects the origin of the input signal applied to the horizontal amplifier. When INT is selected, the input signal to the horizontal amplifier is obtained from the time base plug-in. With the switch in EXT, the sweep signal input from the plug in is disconnected, and input to the horizontal amplifier is obtained from the EXT INPUT connector located on the front panel.

3-28. EXTERNAL VERNIER.

3-29. The deflection factor of an external input signal can be continuously varied to decrease deflection by a factor of approximately 10 by using this control. When the vernier is in the maximum clockwise position (CAL detent), the horizontal amplifier is calibrated to provide 1.0 V/div deflection in the X1 magnifier range and 0.1 V/div in the X10 range.

3-30. REAR PANEL CONTROLS AND CONNECTORS.

3-31. Rear panel controls and connectors are identified and described in Figure 3-1. Additional information regarding these is explained below in greater detail.

3-32. OUTPUTS.

3-33. Four BNC connectors on the rear panel of the Model 182C are provided to supply signals from the time base or sampling plug-in to external equipment. The low impedance outputs are isolated from the high impedance input signals. The period of the signal output is directly related to the main and delayed sweep speed selected for the time base plug-in or the vertical and horizontal outputs when used with sampling plug-ins. Refer to the Operating and Service Manual for the plug-in to determine signal identification.

3-34. The output of the MAIN SWEEP OUTPUT and the DELAYED SWEEP OUTPUT is a positive-going ramp of about 6 volts amplitude. The output of the MAIN GATE OUTPUT and the DELAYED GATE OUTPUT is a negative-going pulse of about 3 volts amplitude. These outputs can supply 3 mA and will drive impedances as low as 1000 ohms without distortion.

3-35. Z-AXIS INPUT.

3-36. An external signal can be utilized to control the CRT intensity. The intensity modulation signal is applied directly to the CRT intensity gate amplifier. A pulse of approximately +2V amplitude and a width of at least 50 nanoseconds or a +2V continuous wave (cw) input of 10 MHz or lower will blank a trace of normal intensity. Input of a negative signal can be used for display intensification.

3-37. AC LINE INPUT.

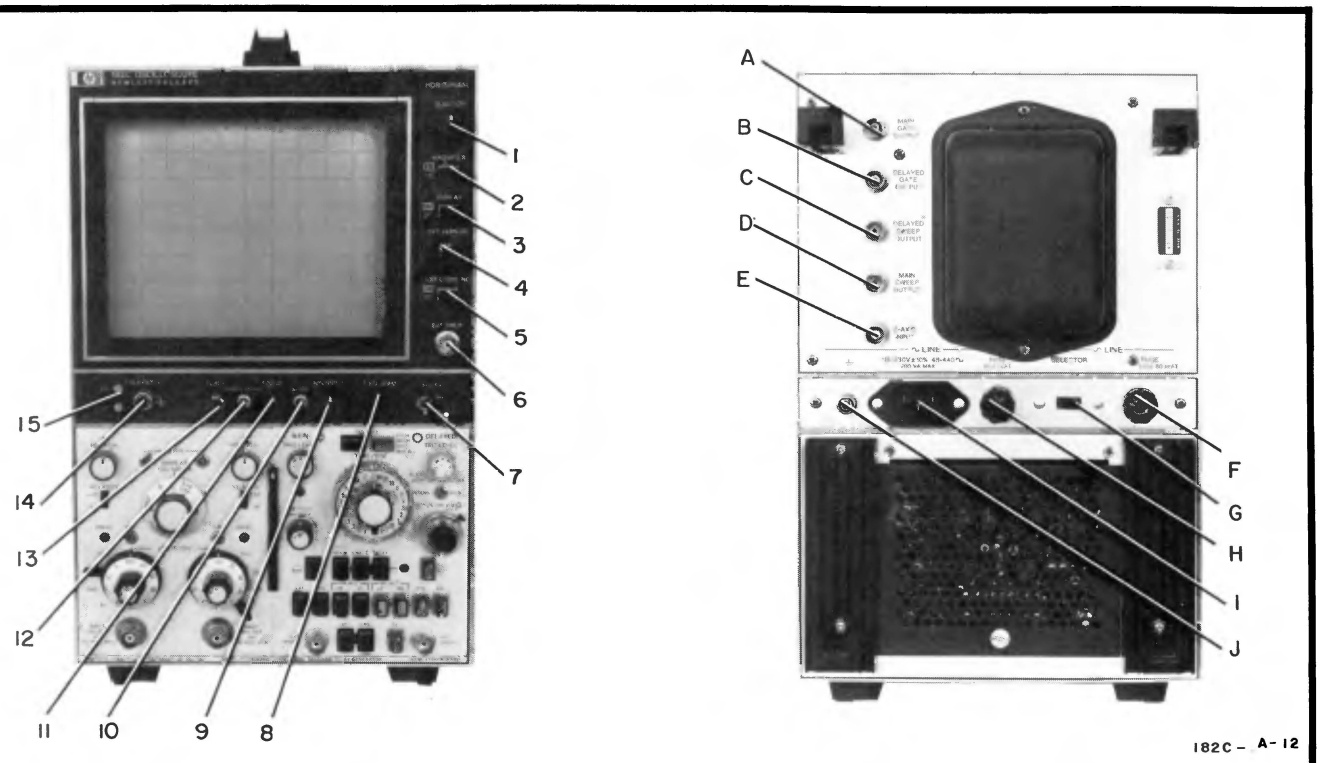
3-38. A three-conductor ac power cord is provided for ac input. A power line ground is obtained through the power cord. Also located on the rear panel is the SELECTOR line slide switch, which allows operation from either 115V or 230V ac power line. Fuses are provided for both 115V and 230V operation.

3-39. PHASE/BANDWIDTH SWITCH.

3-40. A PHASE/BANDWIDTH switch is located within the instrument on the horizontal amplifier assembly. The instrument top cover must be removed for access to this switch. Positioning the PHASE/BANDWIDTH switch to PHASE causes the horizontal input signal to be delayed the same amount of time as the vertical input signal. This delay allows the Model 182C to be used for phase measurement. The switch should always be in the BANDWIDTH position unless the instrument is being used for phase measurement.

3-41. PHASE MEASUREMENT.

3-42. Channel A of multi-channel vertical plug-ins should be used when making phase measurements. When a different channel (other than A) is to be used, the oscilloscope horizontal amplifier should be properly adjusted for that channel. Section V of this manual contains the adjustment procedure. Accurate phase measurements may be made at frequencies up to 100 kHz.



1. POSITION. Single knob provides coarse and fine adjustment of display's horizontal position.
2. MAGNIFIER. Determines gain of horizontal amplifier.
3. DISPLAY. Selects source of horizontal input signal.
4. EXT VERNIER. Provides continuous adjustment of deflection factor for external horizontal input signals. In CAL detent position, deflection factor is selected by Magnifier switch position.
5. EXT COUPLING. Selects AC or DC coupling for external horizontal input signal.
6. EXT INPUT. BNC connector for coupling an external horizontal input signal to horizontal amplifier.
7. LINE. Toggle switch with indicator light for turning oscilloscope on and off.
8. FIND BEAM. Intensifies trace and always returns display to on-screen.
9. INTENSITY. Controls brightness of display.
10. ASTIG. Adjusts roundness of writing beam.
11. FOCUS. Adjusts writing beam for sharpest trace.
12. TRACE ALIGN. Rotates trace around longitudinal axis of CRT.
13. SCALE. Controls graticule illumination.
14. Ground Connector. Provides a chassis ground connection point.
15. CALIBRATOR. Provides a 1-kHz square wave at two amplitudes: 250 mV and 10V p-p.

A. MAIN GATE OUTPUT. BNC connector for main gate signal to external equipment.

B. DELAYED GATE OUTPUT. BNC connector for output of delayed gate signal to external equipment.

C. DELAYED SWEEP OUTPUT. BNC connector for output of delayed sweep signal to external equipment.

D. MAIN SWEEP OUTPUT. BNC connector for output of main sweep signal to external equipment.

E. Z-AXIS INPUT. BNC connector for input of CRT intensification or blanking signal.

F. FUSE. 230V operation ac line fuse.

G. SELECTOR. Provides for external selection of line operating voltage.

H. FUSE. 115V operation ac line fuse.

I. Power Connector. 3-wire ac power line input.

J. Ground Connector. Provides a chassis ground connection point.

Figure 3-1. Front and Rear Controls and Connectors

3-43. To measure phase, set the internal PHASE/ BANDWIDTH switch to PHASE and connect the input signals to the vertical amplifier Channel A input and the oscilloscope HORIZONTAL EXT INPUT. Set the HORIZONTAL DISPLAY to EXT. A display similar to Figure 3-2 will be observed. The size of the opening of the display is a relative indication of the phase difference of the input signals.

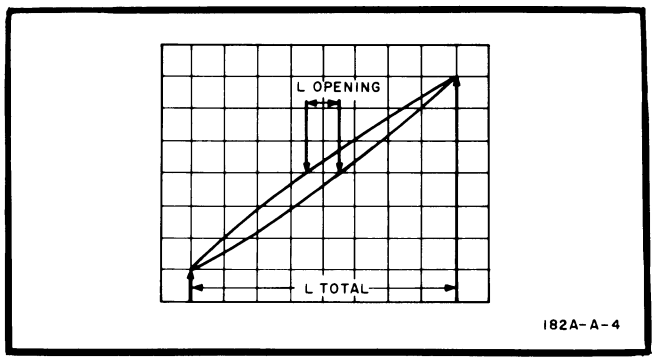


Figure 3-2. Phase Measurement

3-44. To obtain a more exact measurement of the phase difference, center the display in the X-axis and Y-axis. Increased measurement accuracy will be obtained by using horizontal and vertical deflection factors which result in maximum display size. The phase shift in degrees is determined by the following:

$$\emptyset = \sin^{-1}\left(\frac{L\ \text{opening}}{L\ \text{total}}\right)$$

As an example, assume that L total is 8 divisions. If L opening is 1 division, the phase shift is approximately 7 degrees.

Note

Make certain that the switch is returned to BANDWIDTH position after making phase measurements. This will allow normal operation.

3-45. PLUG-IN UNITS.

3-46. The Model 182C Oscilloscope requires time base and vertical or sampling plug-in units. The deflection sensitivity of the CRT may vary slightly with different units. Vertical plug-ins should be calibrated when first installed or when shifted between oscilloscopes. The time base and vertical plug-ins must be locked together prior to insertion into the Model 182C. Consult the respective plug-in Operating and Service Manuals for operation and capability information. Table 3-1 lists the plug-ins currently available.

Table 3-1. Available Plugins

Vertical Plug-ins								Sampling (Vertical Section)		
Model No.	**1801A**	**1803A**	**1804A**	**1805A**	**1806A**	**1807A**	**1808A**	**1810A**	**1815A/B**	**1811A**
Bandwidth MHz	50	40 (30)	50	100	0.5	35	75	1 GHz	4 or 12.4 GHz	4 or 18 GHz
Min. deflection factor/div	5 mV (500 uV opt 001 cascaded)	10 mV (1 mV cascaded)	20 mV	5 mV	100 uV	10 mV	5 mV	2 mV	5 mV	2 mV
Channels	2 (opt 001, 1 cascaded)	1 diff	4	2 (1 cascaded)	2 (both diff)	2	2	2	1	2
Input RC	1 MΩ/ 25 pF	1 MΩ/ 27 pF	1 MΩ/ 25 pF	1 MΩ/ 13 pF or 50Ω	1 MΩ/ 45 pF	1 MΩ/ 27 pF	1 MΩ/ 12 pF or 50Ω	50Ω	50Ω	50Ω
Differential input	yes	yes (with dc offset)	no	yes	yes	yes	yes	yes	no	yes

Time Base Plug-ins					Sampling (Time Base Section)			TDR	
Model No.	**1820C**	**1821A**	**1824A**	**1825A**	**1810A**	**1815A/B**	**1811A**	**1818A**	**1815A/B**
Ext Trig Freq. (MHz)	150	100	150	150	<1 GHz	18 GHz with trigger countdown	18 GHz with trigger countdown	<160 ps risetime	<35 ps risetime
Int Trig Freq.	Determined by Vertical Amplifier Plug-in				1 GHz			TDR System	TDR
Sweep Speeds/div	5 ns* 1 sec	10 ns* 1 sec	5 ns* 1 sec	5 ns* 1 sec	100 ps (expanded) - 50 usec	10 ps - 1 usec	10 ps (expanded) - 1 usec	Calibrated in feet, meters, and nanoseconds	1815A calibrated in feet, 1815B calibrated in meters.
Delayed and mixed sweep	No	Yes	Expanded X100	Yes	No	No	No		

*Includes X10 mainframe magnification.

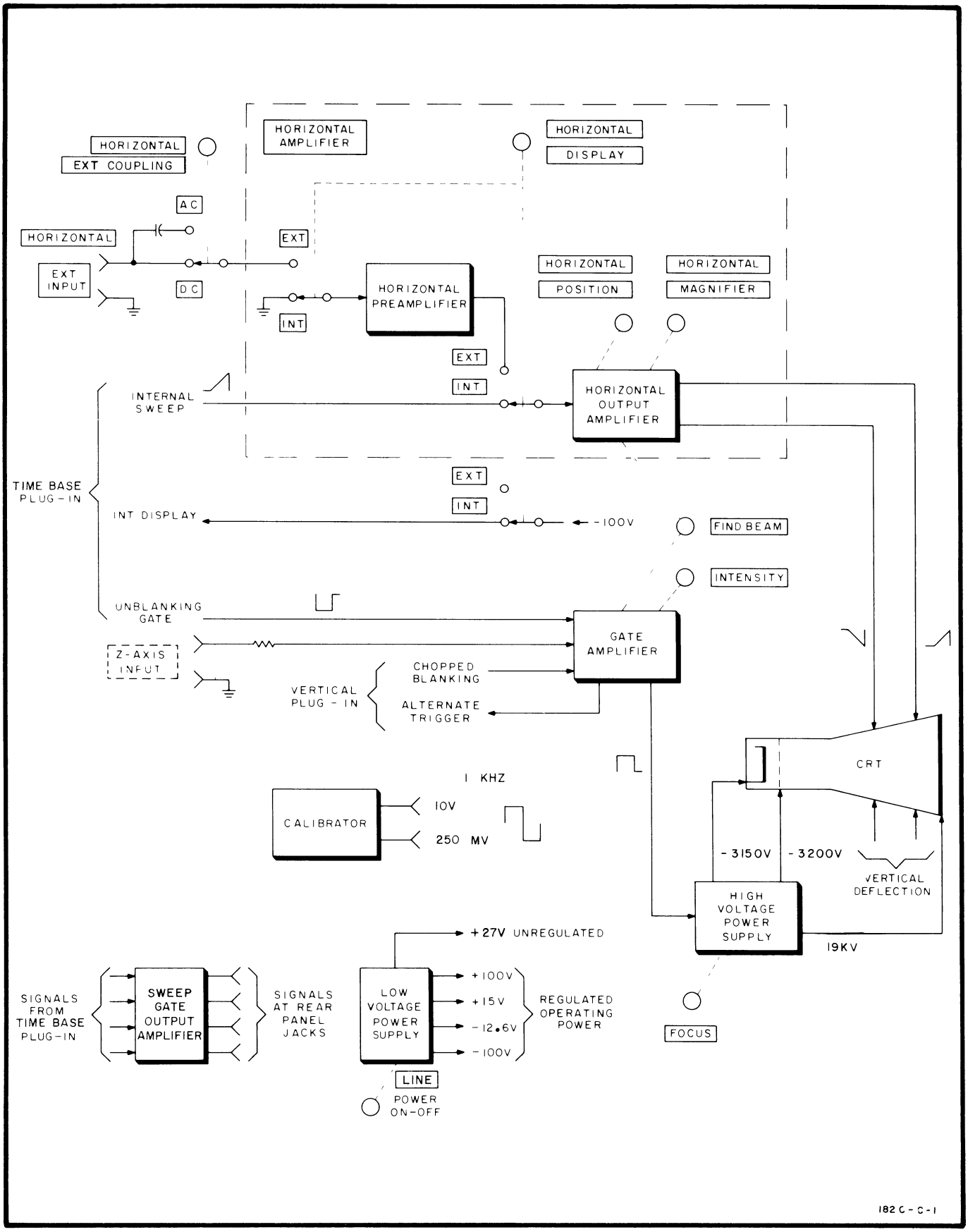


Figure 4-1. Overall Block Diagram

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section provides information about the circuits used in the Model 182C and how they operate. Refer to the overall block diagram (Figure 4-1) and the schematics in Section VIII while reading the text.

4-3. GENERAL DESCRIPTION.

4-4. The Model 182C is an X-Y axis display instrument designed to be used with a plug-in vertical amplifier and a plug-in time base generator. The instrument contains the CRT and its controls, low voltage and high voltage regulated power supplies, a horizontal amplifier, and a gate amplifier. A sweep-gate output amplifier and a calibrator are also included.

4-5. To obtain a useful display on the CRT, three signals are necessary: vertical deflection, horizontal deflection and intensity. The signal required for vertical deflection (Y-axis) of the CRT is supplied from a plug-in vertical amplifier. This signal is connected directly to the CRT vertical deflection plates. The horizontal (X-axis) deflection signal is generated by the time base plug-in. It is further amplified by the oscilloscope horizontal amplifier before being applied to the CRT horizontal deflection plates.

4-6. The signal for CRT intensification must be time coincident with the horizontal deflection signal to increase the CRT brightness as the beam is swept through the CRT display area. This intensity determining signal is called the unblanking gate. It is developed in the time base plug-in and amplified by the gate amplifier for application to the CRT control grid.

4-7. Signals for horizontal deflection and intensity modulation may also be applied to the oscilloscope from external sources other than the plug-in units. External input jacks are provided for this purpose.

4-8. INPUT POWER.

4-9. Either 115V or 230V ac (±10%) single phase, 48 to 440 Hz, can be applied as operating power. A rear-panel SELECTOR switch allows operation from either input line voltage. This switch connects two windings of the instrument power transformer in parallel for 115V operation. The SELECTOR switch also selects the proper size fuse for 115V or 230V operation. It is not necessary to change fuses.

4-10. With power applied to the power transformer primary windings, several secondary voltages are produced. Rectified, filtered and regulated as required, they are used as the source of power for the various circuits of the oscilloscope and for operation of the vertical and time base plug-ins.

4-11. HORIZONTAL DEFLECTION.

4-12. The horizontal amplifier may be used with either internal or external deflection signal sources. Positioning the HORIZONTAL DISPLAY switch to INT arranges the circuitry to operate from signals supplied from the time base plug-in. In this condition the –100V power is applied to the plug-in, allowing it to operate and produce both a sweep signal and an unblanking gate signal.

4-13. The sweep signal from the time base plug-in is coupled to the oscilloscope horizontal output amplifier. Here it is converted to a differential signal, amplified and applied to the CRT horizontal deflection plates.

4-14. Horizontal position of the X-axis sweep signal is controlled at the input to the first stage of the horizontal output amplifier. A two section potentiometer, mechanically interconnected, is used to provide both fine and coarse positioning controls from a single knob.

4-15. Horizontal amplifier gain is controlled by the MAGNIFIER switch. Two settings can be selected: X1 or X10. With X1 selected, the sweep speed corresponds to the selected time base plug-in sweep speed. In X10 operation the sweep speed is ten times that selected at the time base plug-in.

4-16. The unblanking gate from the time base plug-in is coupled to the gate amplifier where it is summed with the Z-axis input and chopped blanking signals (if they are applied). The resulting signal is amplified and coupled through the high voltage supply to the CRT control grid to set the intensity of the displayed signals.

4-17. At the end of each unblanking gate the gate amplifier produces an alternate trigger signal. This signal is coupled to the vertical plug-in and is a negative-going pulse. The alternate trigger is used by the vertical plug-in to synchronize the channel switching of multichannel vertical plug-ins.

4-18. With the HORIZONTAL DISPLAY switch set to EXT, operating power (-100V) is removed from the time base plug-in. Without this –100V, the time base plug-in does not produce an internal sweep signal or an unblanking gate.

4-19. An externally applied signal for horizontal deflection may be connected to the EXT INPUT jack. The EXT VERNIER controls the externally applied signal and provides a variable gain adjustment for setting the X-axis display size. The EXT COUPLING switch provides for either direct (DC) or capacitive (AC) coupling of the external input signal. The external signal is then coupled to a preamplifier, differentially amplified by the output amplifier and applied to the CRT for horizontal deflection. Positioning and horizontal gain controls also function with external input signals.

4-20. CIRCUIT DETAILS.

4-21. INPUT POWER.

4-22. Input line power is supplied by a detachable three conductor power cord. This cord has a standard plug for wall outlet connection providing an electrical ground. Instrument power input is via a rear-panel IEC connector. Both sides of the line power are filtered immediately at the power input connector.

4-23. The line power transformer has two primary windings. SELECTOR switch A4S1 connects these windings in parallel for 115V operation and in series for 230V operation. When set for use with a 115V source of line power, fuse A4F1 protects against excessive input current. When operated on 230V line power, fuse A4F2 is also placed in the primary power circuit. With the front panel LINE toggle switch A2S1 in the ON position, power is applied to the low voltage power supply transformer and LINE lamp A2DS1 lights.

4-24. LOW VOLTAGE POWER SUPPLY.

4-25. The low voltage supply produces four regulated voltages for use throughout the oscilloscope and the plug-ins: +100V, −100V, +15V and −12.6V. Each supply is referenced to the +100V supply for regulation purposes, with the +100V supply referenced to a 9-volt temperature compensated zener diode A1A2VR2. The +100V and −100V supplies are also foldback current limited, providing short-circuit protection.

4-26. A simplified block diagram of a typical low voltage power supply is shown in Figure 4-2. Unregulated alternating power is supplied by the transformer, bridge rectified and filtered. Changes in output voltage caused by input voltage variation or load changes are detected by the voltage sensor. Compared against a voltage reference, changes in output voltage are detected and applied as feedback to the driver which controls the series regulator. The series regulator acts as a variable resistance, and operates to increase its series resistance if the output voltage is high or decreases resistance when the output voltage is low. The action of the series regulator is to maintain output voltage at a constant level.

4-27. Current sensing takes place simultaneously with voltage sensing. If the load current increases above a pre-set level, the current sensor detects the increased voltage drop across the series resistor. This increased voltage causes the driver to bias the series regulator off.

4-28. +100-VOLT SUPPLY. The +100V supply is used throughout the LVPS as a reference for the other supplies. It is both voltage and current regulated. Refer to the LVPS schematic while reading the following explanation.

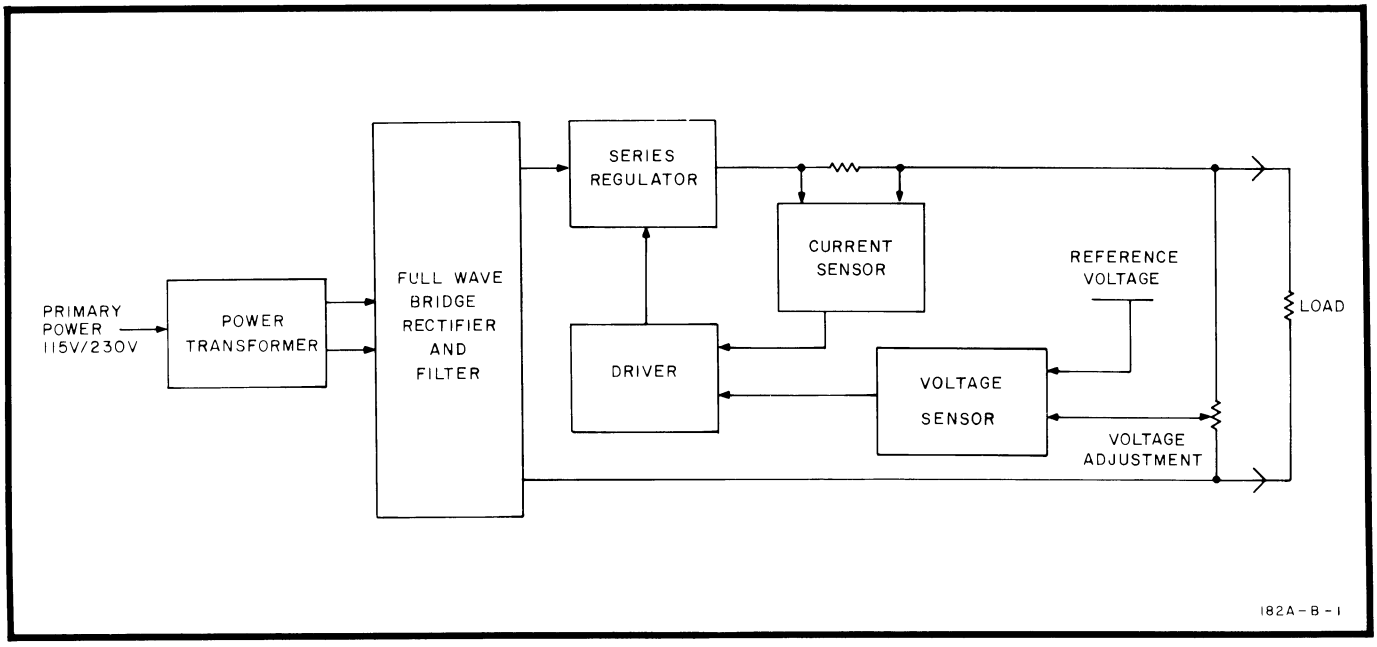


Figure 4-2. Simplified Low Voltage Power Supply

4-29. One of the secondary outputs of A1T1 is coupled to a full-wave bridge rectifier consisting of A1A1 CR5-CR8. The rectified voltage is filtered by A1C1, and applied through fuse A1F1 to the regulator assembly. Fusing protects the rectifiers and transformer if a regulator malfunction results in excessive current flow. The regulator supplies sufficient current to the load to keep the output voltage at a constant +100 volts. Series regulator A1Q1 controls load current in order to maintain the output voltage at +100V. Variations in output voltage due to changes in load or input line voltage are sensed by differential comparator A1A2Q3 and Q4. If the output of the +100V supply changes, the full amount of the voltage change is applied to A1A2Q3 by A1A2VR2, and A1A2Q4 senses only a small part of the change in output voltage. The +100V adjustment potentiometer A1A2R11 sets the operating point of A1A2Q4. The output of the differential comparator is coupled to driver A1A2Q1, amplified and used to control series regulator A1Q1.

4-30. A current limiting function is also part of the +100V supply operation. All current furnished by the supply flows through A1A2R4. The voltage drop across this resistor depends on the amount of current required. As the current requirements increase to the limit of the supply capability, the voltage drop across A1A2R4 is used to set A1A2Q2 into conduction. Since the collector of this transistor and the output of differential comparator A1A2Q2 and Q4 are coupled to drive A1A2Q1, the amount of current flowing as well as voltage variations control the operation of series regulator A1Q1.

4-31. Resistors A1A2R2 and R3 are used in conjunction with A1A2R4 to set up a condition for current foldback operation. In this type of operating condition, fully regulated voltage will be provided to the limit of the supply capability. When current exceeds capability, the output voltage will begin to drop and the load will receive less current. If the output of the supply is short-circuited, the output current will be limited to considerably less than the current available at full loading.

4-32. The +100V supply is protected for turn-on and turn-off voltage transients. Diodes A1A2CR1 and A1A2CR2 provide transient protection for the differential amplifier, A1A2Q3 and A1A2Q4. To prevent the +100V supply from going negative in the event of an accidental short circuit (during troubleshooting, for example), diode A1A2CR3 provides reverse voltage protection.

4-33. A separate supply is used to obtain voltage for the +100V regulator. This supply is used only within the LVPS regulator. The ac voltage from pins 11 and 12 of A1T1 is bridge rectified by A1A1CR1-CR4 and filtered by A1A1C1. The supply produces about +10V which is added to the +100V supply to provide a reference source for the +100V regulator. Zener diode A1A2VR1 stabilizes the collector voltage for A1A2Q3.

4-34. +15-VOLT SUPPLY. This supply provides three voltages. Approximately 30Vac p-p is furnished for time base line synchronization; an unregulated +27V is furnished for operation of the HV oscillator; and a regulated +15V is produced for use in the mainframe and plug-ins.

4-35. The secondary voltage developed by the power transformer at pins 13 and 14 is rectified by full-wave bridge A1A2CR9-A1A2CR12 and filtered by A1C2. Diode A1A1CR21 provides reverse voltage protection. Series regulator A1Q2 controls the amount of load current in order to maintain the output voltage at +15V. Variations in output voltage are sensed by differential comparator A1A2Q7 and A1A2Q8. A reference voltage derived from the +100V regulated supply is applied to A1A2Q7, while A1A2Q8 samples any change in output voltage due to load changes. The +15V adjustment potentiometer A1A2R20 sets the operating point of A1A2Q8. The output of the differential amplifier is coupled to driver A1A2Q5 and used to control the series regulator.

4-36. Load current flows through A1A2R13. The voltage drop across this resistor is used to control the conduction of A1A2Q6, which has its collector coupled to driver A1A2Q5. Thus, both current variations sensed by A1A2Q6 and voltage changes sensed by the differential amplifier are coupled to the driver A1A2Q5 to control series regulator A1Q2. Protection from turn-on or turn-off transients is provided by A1A2CR4. Fuse A1F2 protects the +15V rectifier and transformer in the event of a regulator short circuit.

4-37. −12.6-VOLT SUPPLY. This supply operates in a manner similar to the +15V supply. Changes in output voltage are sensed by differential comparator A1A2Q11 and A1A2Q12 and coupled to driver A1A2Q9 which controls the conduction of series regulator A1Q3. Current limiting action is provided by A1A2R22 and A1A2Q10. Fuse A1F3 protects against damage due to regulator failure and A1A2CR5 is used for voltage transient protection.

4-38. −100-VOLT SUPPLY. Operation of the −100V supply is similar to the +100V supply. A1A2Q15 and A1A2Q16 operate as a differential comparator, with A1A2Q16 sensing any change in output voltage. Transistor A1A2Q14 with A1A2R33 provides current limiting. Current foldback operation reduces the current output in the event of a short circuited load. Voltage and current variations are coupled to driver A1A2Q13 which controls the conduction of series regulator A1Q4. Adjustment of the supply output voltage is accomplished with potentiometer A1A2R40. Voltage transient protection is furnished by A1A2CR6, while A1A2CR7 provides reverse voltage protection.

4-39. SUPPLY CURRENT AVAILABLE. The oscilloscope power supplies may be used to furnish operating power for vertical or time base plug-ins designed by the

user. Table 4-1 lists the maximum current available from each power supply to the plug-in compartment of the oscilloscope. There is no minimum current requirement for any supply.

Table 4-1. LVPS Current Capabilities

Power Supply	Maximum Safe Current Available
+100 VDC	160 mA
+ 15 VDC	750 mA
− 12.6 VDC	750 mA
−100 VDC	80 mA

4-40. GATE AMPLIFIER.

4-41. The inputs to the gate amplifier are an unblanking gate from the time base plug-in, a chopped blanking signal from the vertical amplifier plug-in and an externally input Z-axis signal. These three signals may be present singly or simultaneously, depending on control settings and signals applied.

4-42. The unblanking gate is first applied as a current to A7Q1, a common base amplifier, then combined in the low impedance emitter circuit of A7Q5 with a current established by the INTENSITY, FIND BEAM, and EXT DISPLAY front-panel controls. Depressing FIND BEAM shunts the adjustable INTENSITY potentiometer to increase emitter current and produce an intensified beam. Setting the HORIZONTAL DISPLAY to EXT supplies additional current from the −100V supply. This establishes an unblanking current level to compensate for removal of the internal unblanking signal from the time base plug-in, and establishes a nominal brightness level.

Note

The intensification function of the FIND BEAM switch is removed on instruments with a P11 phosphor CRT (Option 011). Additional information is provided in Section VII.

4-43. The output voltage of A7Q5 is coupled through emitter follower A7Q6 to complimentary amplifier A7Q7 and A7Q8. Diodes A7CR1 through A7CR4 provide a clamping action to prevent overdriving the amplifier.

4-44. A large negative feedback from the collectors of A7Q7 and A7Q8 ensures that the amplifier gain in very stable. Capacitors A7C6 and A7C8 provide for adjustment of the high frequency feedback and gain. Decreasing the capacitance of A7C6 decreases the high frequency feedback and increases gain, while decreasing the capacitance of A7C8 increases high frequency feedback and decreases gain. Amplifier voltage gain is approximately 10 for Z-axis signals. The gate amplifier output is approximately:

$$\Delta E_{Q8\ \text{collector}} \cong (\Delta I_{CR4})\ (R21 + R22)$$

4-45. The gate amplifier output unblanking signal is added to the -3200V output of the high voltage power supply and applied to the CRT control grid. Voltage level changes of the unblanking signal cause corresponding changes to the CRT control grid voltage. Diodes A7CR6 through A7CR9 provide isolation protection from high voltage transients from the CRT control grid.

4-46. An alternate trigger signal is used by multi-channel vertical amplifier plug-ins to initiate channel switching action. Transistors A7Q2 and A7Q3 function as a fast acting switch. With A7Q2 normally conducting and A7Q3 non-conducting, the unblanking gate trailing edge causes A7Q3 to conduct and A7Q2 to cease conducting. The switching output is differentiated and applied to A7Q4, providing a negative-going voltage pulse for vertical amplifier channel switching.

4-47. Z-AXIS INPUT. The input impedance to the Z-axis input is approximately 5100 ohms. An input signal of approximately +2 volts amplitude is adequate to blank a trace of normal viewing intensity, while an input signal of --2 volts will provide unblanking. Since the gate amplifier has a voltage gain of about 10, a 2-volt input will result in a 20-volt change at the CRT grid.

4-48. HIGH VOLTAGE POWER SUPPLY (HVPS).

4-49. The HVPS generates three regulated voltages. These are applied to the cathode (-3150V), control grid (-3200V) and post-accelerator (+19kV) of the CRT to provide the accelerating potential required to produce excitation of the CRT phosphor for a visible trace. All three voltages are regulated by sampling the -3150-volt supply. The HVPS is shown in simplified form in Figure 4-3. Refer to this figure, and to the schematic in Section VIII while reading the following explanation of HVPS operation.

4-50. HIGH VOLTAGE OSCILLATOR. Chassis mounted transistor Q1 and transformer A6A1T1 form an oscillator which generates approximately 26 Vac at 40 kHz. A feedback winding on the transformer provides the regenerative coupling to sustain oscillation. Operating power is provided by the unregulated +27V supply. The supply source is fused and decoupled.

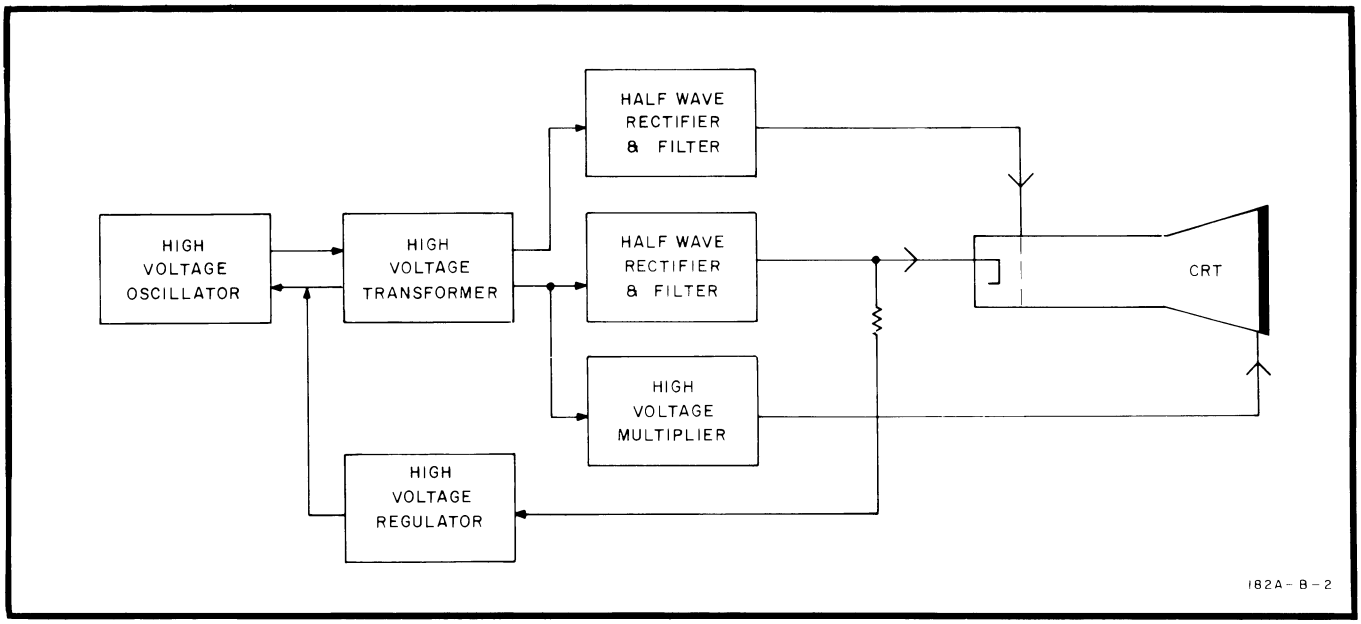


Figure 4-3. High Voltage Power Supply Block Diagram

4-51. HV RECTIFIERS. The 40-kHz oscillator output is stepped up by the secondary windings of A6T1. Two half-wave rectifiers and a voltage multiplier are used to develop the high voltages necessary for CRT operation.

4-52. The CRT grid voltage, approximately -3200V, is developed by half-wave rectifier A6CR1 and filter A6C1, A6C2, and A6R1 through A6R5. The display intensity lower limit, determined by the CRT grid voltage level, is adjusted by A6R2. The CRT cathode voltage, approximately -3150V, and the focusing voltage, approximately -2270V, are developed by half-wave rectifier A6CR4 and filter A6C3, A6C4 and A6R7. Resister A6R8 is part of a voltage divider which drops the -3150V to -2270V for focus control. Diodes A6CR5 and CR6 prevent the CRT grid from becoming positive with respect to the cathode. The CRT post-accelerator voltage, approximately 19 kV, is developed by high voltage multiplier assembly A11.

4-53. HV REGULATION. Variations in high voltage output are fed back to the high voltage regulator circuitry consisting of A10Q1, A10Q2, A10Q3, and associated components. The regulator controls the high voltage oscillator bias to maintain high voltage at a constant level. If, for example, the CRT cathode voltage tends to decrease (go more positive), a positive-going signal is applied through the regulator to the base of oscillator Q1. The oscillator then conducts for a greater period of time, causing a larger voltage change at the primary of A6T1. This increases the secondary voltage to restore cathode voltage to the desired level.

4-54. The high voltage regulator monitors CRT cathode voltage through coupling network A6R9 and A6C5. Resistors A10R3 and A10R4 form a voltage divider between +100V and the coupling network output. A10R3 adjusts the operating level of FET A10Q1. High voltage fluctuations are sensed by A10Q1 and amplified by A10Q2 and A10Q3. Diodes A10CR4 and A10CR5 provide clamping action to prevent overdriving the high voltage oscillator. The regulator output is applied through the regenerative winding of A6T1 as bias to the base of Q1, thereby controlling high voltage oscillator drive.

4-55. CALIBRATOR.

4-56. The calibrator uses a 1-kHz free-running multivibrator. A voltage divider provides the output at two amplitudes: 10 volts and 250 millivolts. The calibrator output is a negative-going waveform.

4-57. Transistors A2Q1 and A2Q2 oscillate at a rate determined by the time constant of associated RC components. A2CR1 disconnects the collector of A2Q2 from the negative discharge of A2C3 and A2Q2 cuts off, and provides a faster risetime. Diodes A2CR2 and A2CR3 protect the transistors from voltage breakdown. A filter network, A2L1 and A2C4, isolates the multivibrator from the −100V supply.

4-58. With A2Q2 conducting, the voltage divider consisting of A2R17, A2R18 and A2R19 effectively divides the −100V supply voltage. The values selected for these resistors permit the output of 10V and 250 mV. These two outputs are available at the instrument front panel and may be used for probe compensation adjustment and horizontal or vertical sensitivity calibration checks.

4-59. SWEEP GATE OUTPUT AMPLIFIERS.

4-60. The output amplifiers are four emitter followers, A8Q1-A8Q4. They provide isolated outputs of time base sampling or TDR generated signals to rear-panel connectors. The Operating and Service Manual for the plug-in will provide information on the characteristics of the output signals.

4-61. The four time base signal inputs to these amplifiers are the main sweep, delayed sweep, main gate and delayed gate. The emitter-followers convert the high impedance inputs to low impedance outputs and isolate the time base signals from external equipment.

4-62. HORIZONTAL AMPLIFIER.

4-63. The inputs to the horizontal amplifier are an internal sweep signal from the horizontal plug-in or an external signal applied to the HORIZONTAL EXT INPUT jack. Positioning the HORIZONTAL DISPLAY to INT grounds the input of the preamplifier and disconnects the external signal preamplifier from the output amplifier. The internal sweep signal is connected through the HORIZONTAL DISPLAY switch to the output amplifier.

4-64. Selecting HORIZONTAL DISPLAY EXT disconnects the internal sweep signal and connects the external signal through the preamplifier to the output amplifier. With EXT selected, the amplitude of the signal from the preamplifier is adjustable by rotating the EXT VERNIER control. When the control is in the CAL detent position the output amplitude of the preamplifier is determined by the input amplitude.

4-65. The selected signal is applied to the output amplifier and summed with a current established by the HORIZONTAL POSITION control. A HORIZONTAL MAGNIFIER allows the gain to be increased by a factor of 10 (X10) or to be directly related to the amplitude of the input signal (X1). The resulting current is converted to a differential signal, amplified, and applied to the horizontal deflection plates of the CRT.

4-66. Refer to the schematic of the horizontal amplifier for the more detailed explanation which follows.

4-67. An external signal applied to the preamplifier is coupled through a 3:1 divider composed of A5R5 and A5R6 to A5Q1. The output of A5Q2 is coupled through the HORIZONTAL EXT VERNIER and the HORIZONTAL DISPLAY switch. The high input impedance of A5Q1 in conjunction with the voltage divider and A5R4 provides a 1 megohm load to the external circuit. Transistor A5Q2 is an emitter follower. It supplies a current to A5Q3 which is determined by A5R15 and the EXT VERNIER control.

4-68. The bandwidth of the preamplifier is decreased when the Phase/Bandwidth switch is placed in the Phase position. This is accomplished by connecting A5C11 and A5C12 into the circuit. The decreased bandwidth and phase shift compensates for the signal time delay in the vertical amplifier plug-in. This allows more accurate X-Y phase measurements to be made.

4-69. A vernier balance adjustment A5R11 is used to establish a zero input voltage reference level. This eliminates horizontal dc shift as the EXT VERNIER control is rotated. The EXT VERNIER provides a range of control of the deflection factor when an EXT INPUT signal is used for horizontal deflection. It has sufficient range to change the deflection factor by at least 10.

4-70. The input signal to A5Q3 is summed in the low impedance emitter circuit with a current established by the HORIZONTAL POSITION controls. A fine and coarse positioning is provided. Both controls operate from a single control, and are mechanically interconnected. Rotating the control first provides fine positioning. When the limit of available rotation of the fine position potentiometer has been reached, the coarse positioning potentiometer becomes effective.

4-71. The output of A5Q3 is coupled through emitter-follower A5Q4 to differential amplifier A5Q5 and A5Q7. The low impedance necessary to drive A5Q5 is provided by A5Q4, and A5Q6 maintains a similar low impedance voltage source for A5Q7.

4-72. The position of the MAGNIFIER switch A5S4 selects either of two values of emitter degeneration between A5Q5 and A5Q7 and controls the gain. As degeneration decreases, gain increases. Two gain levels are provided, X1 and X10. Each has an adjustable element to provide for calibration of the gain. With X1 magnification selected, A5R46 is used to set the gain. With X10 magnification selected A5R44 sets the gain. The emitter potentials of A5Q5 and A5Q7 are balanced by A5R49. This prevents horizontal dc shift as the MAGNIFIER control is switched between ranges.

4-73. The differential signal at the collectors of A5Q5 and A5Q7 is applied to current-fed operational amplifiers A5Q11/A5Q12/A5Q13 and A5Q8/A5Q9/A5Q10. The amplifier low frequency gain is very stable because of the large negative feedback employed, and the high frequency feedback for each side of the amplifier is separately adjustable. High frequency feedback from the collectors of A5Q12/A5Q13 to the base of A5Q11 is controlled by A5C28; high frequency feedback from the collectors of A5Q9/A5Q10 to the base of A5Q8 is controlled by A5C21. Capacitor A5C24 adjusts the ratio of feedback for each side of the amplifier. The output of the amplifiers is a voltage which is connected to the horizontal deflection plates of the CRT.

4-74. Diodes A5CR9/A5CR10 and A5CR4/A5CR5 limit the output to the deflection plates to prevent overdriving. Diodes A5CR8 and A5CR3 prevent A5Q5 and A5Q7, respectively, from saturating.

4-75. Depressing the FIND BEAM control disables diode limiter A5CR4/A5CR5 and blocks the signal to A5Q8. The differential gain is effectively cut in half, and the horizontal deflection of the beam is confined to the limits of the CRT.

4-76. POWER SUPPLY DECOUPLING.

4-77. Decoupling networks are used on each etched circuit assembly for the supply voltages. The use of decoupling is important to prevent extraneous signals or noise from being introduced into circuitry from the power supplies or supply leads. Decoupling also prevents transients originating in other circuits from being introduced.

Table 5-1. Recommended Test Equipment

Instrument		Required Characteristics	Required For
Type	Model		
Voltmeter Calibrator	HP 738AR, 6920B, or E02-738BR	1V and 10V p-p ±0.2%	Calibrator Check Horizontal Magnifier Check
Monitor Oscilloscope	HP 180A/AR w/1801A and 1820A plug-ins	Sensitivity 1 V/div Sweep speed <3 μsec Sweep output	Calibrator Check Gate Amplifier Response Adjustment Transient Response Adjustment
50:1 Divider Probe	HP 10002A	±3%	Gate Amplifier Response Adjustment
Constant Amplitude Signal Generator	Tektronix Type 190B/191	50 kHz-50MHz, 10V p-p	Horizontal Bandwidth Check Horizontal Linearity Adjustment
Digital Voltmeter	HP 3440A w/3441A or 3444A plug-in	±100 Vdc ±0.05%	Low Voltage Power Supply Adjustment High Voltage Power Supply Adjustment
1000:1 Divider Probe	HP K05-3440A	Combined voltmeter/divider Input impedance of >1 gigohm	High Voltage Power Supply Adjustment
Square Wave Generator	HP 211A/B	200 kHz, 1V p-p, risetime ≤ 30 ns	Transient Response Adjustment
Oscillator	HP 200CD	10 kHz-100 kHz, 10V p-p	Phase Adjustment Trace Alignment Adjustment
Horizontal Gain Calibrator	HP 10411A	No substitute	Gain Adjustment
Resistor: 40k ohms	HP Part No. 0698-6101	1/10%, 1/2W	Gain Adjustment (Alternate Procedure)
Time Mark Generator	HP 226A	1-ms markers	Gain Adjustment (Alternate Procedure)

7000-A-19

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section provides a performance check procedure to determine if the Model 182C is operating within specifications and a procedure for adjustment and calibration. Physical location of the adjustments is shown in the fold-out photograph at the end of this section.

5-3. TEST EQUIPMENT.

5-4. Recommended test equipment is listed in Table 5-1. Test equipment having the required characteristics may be substituted. Use recently calibrated equipment to ensure proper results.

5-5. PERFORMANCE CHECK.

5-6. The purpose of the performance check is to determine if the instrument is operating within the specifications listed in Table 1-1. This check may also be used as part of an incoming quality assurance inspection, as a periodic operational check or to verify operation after repairs or adjustments have been made.

5-7. It is desirable to do the performance check in the sequence given since succeeding steps depend on control settings and results of previous steps. If desired, the checks may be accomplished individually by referring to the preliminary control settings and the preceding steps.

5-8. A Performance Check Record is included at the end of these checks. As the initial performance check is accomplished, the actual readings should be entered on the form. The form may be removed from the manual and filed for future reference. Readings taken at a later date can be compared with the original performance check results.

5-9. PRELIMINARY SETUP.

5-10. Set the line voltage SELECTOR switch, located on rear panel, to desired power line operating voltage (115V or 230V ac). Connect instrument to line power source and apply power by turning LINE power switch ON. Allow fifteen minutes for warm-up. Do not install plug-ins.

5-11. CALIBRATOR CHECK.

a. Set controls as follows:

MAGNIFIER X10
DISPLAY . . . . . EXT
EXT COUPLING . . . . . AC

b. Connect a 10V p-p signal from Voltmeter Calibrator to EXT INPUT.

c. Obtain a horizontal trace by adjusting INTENSITY, FOCUS and POSITION controls.

d. Adjust EXT VERNIER to obtain displayed trace of exactly 10 divisions.

e. Disconnect Voltmeter Calibrator from EXT INPUT. Do not disturb EXT VERNIER setting.

f. Connect CALIBRATOR 10V output to EXT INPUT.

g. Note displayed trace of 10 ±0.1 divisions.

h. Disconnect CALIBRATOR 10V output from EXT INPUT.

i. Observe CALIBRATOR 10V output using Monitor Oscilloscope.

j. Risetime of calibrator waveform (leading edge) should be 3 μsec or less. Risetime is measured at 10% to 90% amplitude points.

k. Disconnect CALIBRATOR from EXT INPUT.

5-12. HORIZONTAL MAGNIFIER CHECK.

a. Set controls as follows:

MAGNIFIER X1
DISPLAY . . . . . EXT
EXT VERNIER . . . . . CAL

b. Connect 10V p-p signal from Voltmeter Calibrator output to EXT INPUT.

c. Note displayed trace of 10 ±0.5 divisions.

d. Set Voltmeter Calibrator for output of 1V p-p.

e. Set MAGNIFIER to X10.

f. Note displayed trace of 10 ±0.5 divisions.

5-13. HORIZONTAL BANDWIDTH CHECK.

a. Connect 50 kHz signal from Constant Amplitude Signal Generator to EXT INPUT.

b. Set MAGNIFIER to X1.

c. Adjust output of Constant Amplitude Signal Generator to obtain displayed trace of exactly 10 divisions.

d. Set Constant Amplitude Signal Generator for output frequency of 5 MHz.

e. Note displayed trace of 7.1 divisions or greater. (If displayed trace is approximately 2 divisions, check position of Phase/Bandwidth switch located in horizontal amplifier. It should be in Bandwidth position.)

f. Set MAGNIFIER to X10.

g. Set Constant Amplitude Signal Generator for output frequency of 50 kHz.

h. Adjust output of Constant Amplitude Signal Generator to obtain displayed trace of exactly 10 divisions.

i. Set Constant Amplitude Signal Generator for output frequency of 5 MHz.

j. Note displayed trace of 7.1 divisions or greater.

k. Disconnect Constant Amplitude Signal Generator.

5-14. BEAMFINDER CHECK.

a. Set controls as follows:

INTENSITY . . . . . fully ccw
POSITION . . . . . fully ccw

b. Depress FIND BEAM pushbutton.

c. Note that intensified beam is displayed.

Note

Option 011 instruments are provided with P11 phosphor CRT. The display intensity will not increase when FIND BEAM is depressed. This eliminates phosphor burn. Use INTENSITY control to set intensity to viewing level.

5-15. This completes the Performance Check. If the instrument does not meet Model 182C specifications, the Adjustment Procedure which follows should be done. If this does not result in satisfactory instrument performance refer to Section VIII of this manual for troubleshooting and maintenance information.

HP MODEL 182C

PERFORMANCE CHECK RECORD

Serial Number: _____ Date: _____

CHECK	Minimum	Reading	Maximum
CALIBRATOR			
amplitude	9.9 div	_____	10.1 div
risetime	none	_____	3 μsec
MAGNIFIER			
X1	9.5 div	_____	10.5 div
X10	9.5 div	_____	10.5 div
BANDWIDTH			
50 kHz		set to 10 div	
5 MHz	7.1 div	_____	none
FIND BEAM	Intensified beam on-screen	_____	yes or no

5-16. ADJUSTMENT PROCEDURE.

5-17. The following paragraphs outline the procedure for accomplishing the adjustments required for the Model 182C. Use the equipment recommended in Table 5-1 or similar equipment having at least equivalent capability. Use only a non-metallic adjustment tool.

5-18. The adjustment procedures should be performed in the sequence listed, since some adjustments are dependent on control settings and results of previous steps. The adjustments may be accomplished individually, if desired, by referring to the preliminary control settings and the steps before the desired procedure.

5-19. COVER REMOVAL.

5-20. To gain access to the adjustments, top and bottom covers and the rear LVPS access panel must be removed. See Figure 5-1. Remove the covers as follows:

a. Ensure that LINE power switch is OFF and disconnect power plug from ac power source.

b. Set oscilloscope on rear end.

c. Release 3 quarter-turn fasteners on each side of the instrument. Cover retainers will be completely free.

d. Loosen 2 captive screws located on handle ends.

e. Remove top cover by expanding open end slightly and pulling away from instrument.

f. Remove bottom cover by extending tilt stand, expanding open end of cover and pulling away from instrument.

g. Return instrument to horizontal position and remove rear access cover by releasing single quarter-turn fastener.

5-21. PRELIMINARY SETUP.

5-22. Install vertical and time base plug-ins in Model 182C. Set line voltage SELECTOR switch, located on rear panel, to desired power line operating voltage 115V or 230V ac. Connect instrument to line power source and apply power by turning LINE power switch ON. Allow fifteen minutes for warm-up. Check that Phase/Bandwidth switch is in Bandwidth position.

5-23. Adjustment locations are identified in the photographs at the end of this section. The page may be folded out for easy reference while performing the adjustments.

5-24. There are several adjustments which directly affect the final accuracy of the horizontal sweep. These must be made accurately and to the test limits specified to ensure that sweep accuracy will be maintained as time base plug-ins are interchanged. The adjustments given for the Low Voltage Power Supply, High Voltage Power Supply, and Horizontal Amplifier, are particularly important in this respect.

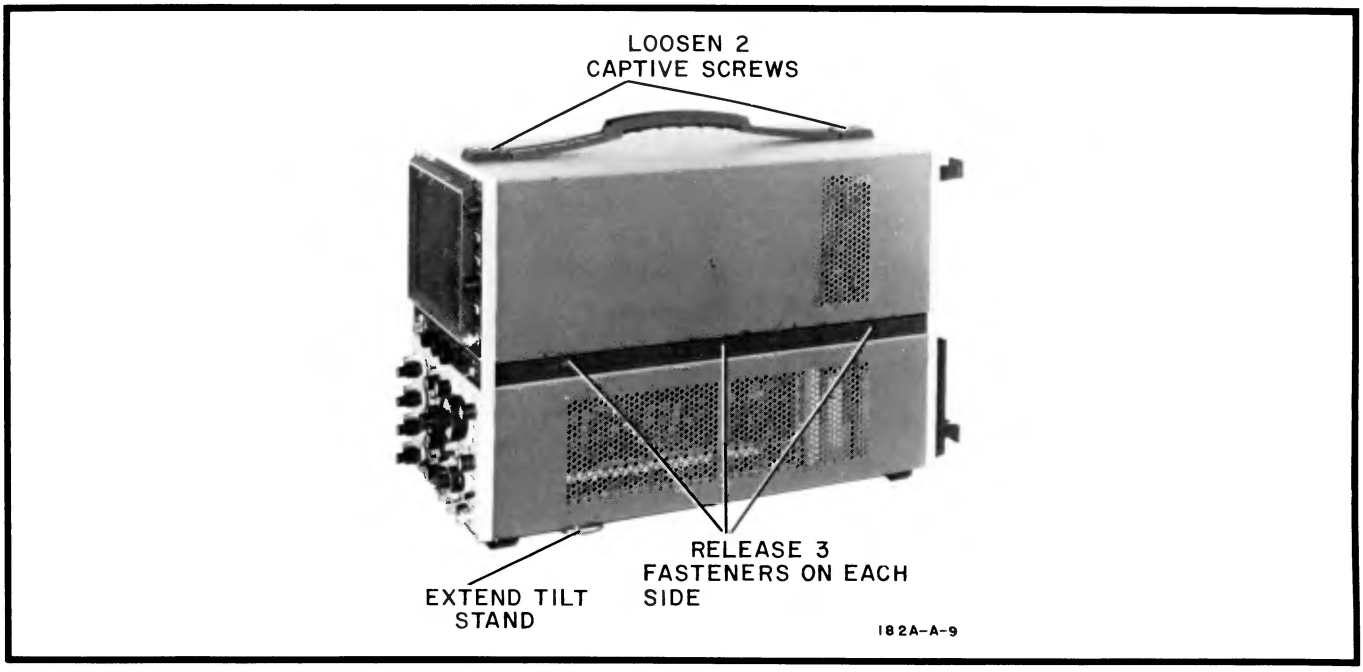


Figure 5-1. Cover Removal

5-25. LOW VOLTAGE POWER SUPPLY.

a. Connect Digital Voltmeter to +100V testpoint A1A2TP1 (Figure 5-2).

b. Set +100V adjust A1A2R11 to obtain a reading of +100V ±0.1V.

c. Connect Digital Voltmeter to +15V testpoint A1A2 TP2.

d. Set +15V adjust A1A2R20 to obtain a reading of +15V ±0.1V.

e. Connect Digital Voltmeter to −12.6V testpoint A1A2 TP3.

f. Set −12.6V adjust A1A2R29 to obtain a reading of −12.6V ±0.1V.

g. Connect Digital Voltmeter to −100V testpoint A1A2TP4.

h. Set −100V adjust A1A2R40 to obtain a reading of −100V ±0.1V.

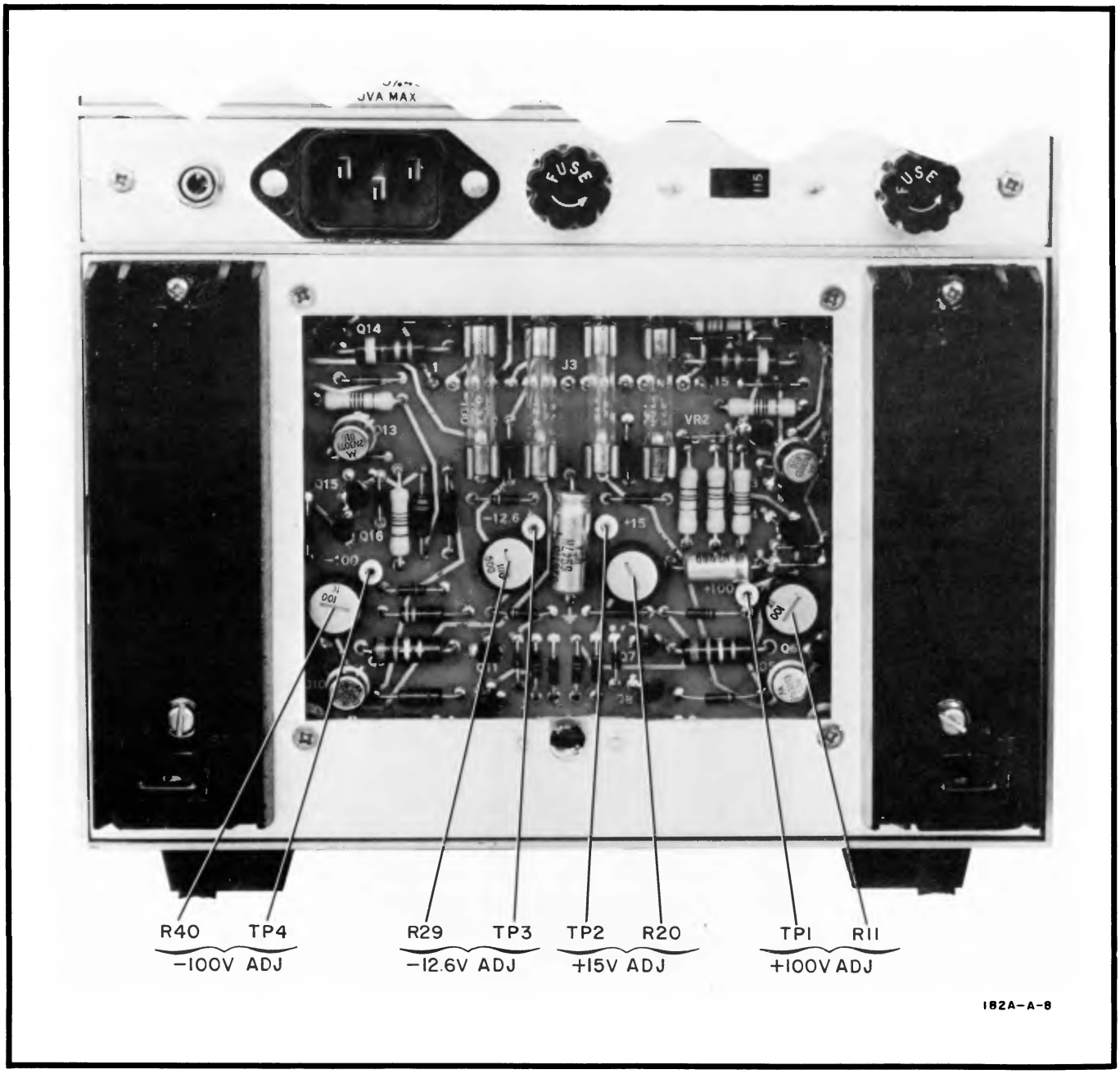


Figure 5-2. Low Voltage Power Supply Adjustments

5-26. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT.

a. The required high voltage output of the supply is −3150V ±0.5%.

b. Using 1000:1 Divider Probe, monitor voltage at −100V test point A1A2TP4 with Digital Voltmeter.

c. Note voltage reading which will be approximately −0.100V. Accuracy in noting the voltage is essential for proper adjustment.

d. Multiply reading obtained in step c by 31.50.

WARNING

This voltage is dangerous to life.

e. Using 1000:1 Divider Probe, monitor high voltage at −3150V test point A6TP1 with Digital Voltmeter.

f. Set High Voltage adj A10R3 to obtain reading exactly equivalent to result obtained in step d (approximately −3.150V).

5-27. INTENSITY LIMIT ADJUSTMENT.

a. Set DISPLAY to EXT.

b. Set INTENSITY control to center (12 o'clock) position.

c. Adjust Intensity Limit Adj A6R2 to just extinguish spot.

5-28. ASTIGMATISM ADJUSTMENT.

a. Set DISPLAY to EXT.

b. Center low intensity spot with HORIZONTAL and Vertical POSITION controls.

c. Adjust FOCUS and ASTIG front-panel screwdriver adjustment for smallest round spot.

5-29. FLOOD GUN ADJUSTMENT.

a. Set INTENSITY fully ccw.

b. Set SCALE fully cw.

c. Adjust SCALE PATTERN ADJ A2R4 for uniform illumination intensity.

d. Slowly rotate SCALE control while adjusting SCALE PATTERN ADJ A2R4 as necessary to maintain uniform illumination intensity throughout entire range of SCALE.

5-30. TRACE ALIGNMENT ADJUSTMENT.

a. Set MAGNIFIER to X1.

b. Set EXT COUPLING to AC.

c. Connect Oscillator 400 Hz 10V output to EXT INPUT.

d. Position trace on center horizontal graticule line.

e. Set INTENSITY and FOCUS to view sharply defined trace.

f. Adjust TRACE ALIGN front-panel screwdriver adjustment A2R23 to align trace parallel to horizontal graticule line.

g. Connect Oscillator 400 Hz 10V output to Vertical plug-in.

h. Set Vertical plug-in controls to obtain vertical trace.

i. Adjust Y ALIGN adj A5R61 to align vertical trace parallel to vertical graticule line.

Note

Exact adjustment is very important if repeatable risetimes are to be obtained in both +UP and −UP operation.

j. Disconnect Oscillator from Vertical plug-in input.

5-31. GATE AMPLIFIER RESPONSE ADJUSTMENT.

a. Set following controls as applicable:

DISPLAY	INT
Main Time/Div	0.1 μsec
Main Vernier	CAL
Sweep Mode	AUTO
Sweep Display	MAIN
Delayed Time/Div	OFF

b. Set Monitor Oscilloscope controls as follows:

Volts/Div	.2
Time/Div	0.1 μsec
Trigger Source	INT
Slope	+
Coupling	DC

c. Using 50:1 Divider Probe and Monitor Oscilloscope, observe signal at collector of A7Q8.

d. Rotate INTENSITY control cw for a gate amplitude of 6 divisions (approximately 60V).

e. Adjust Gate Resp Adj No. 2 A7C6 and Gate Resp Adj No. 1 A7C8 for optimum fast risetime and pulse flat-top response.

f. Disconnect Monitor Oscilloscope.

5-32. DC BALANCE.

a. Set MAGNIFIER to X10.

b. Set DISPLAY to EXT.

c. Center spot with POSITION control.

d. Set MAGNIFIER to X1.

e. Adjust DC Bal adj A5R49 to recenter spot.

f. Repeat steps a through e until spot does not shift from center while switching MAGNIFIER from X1 to X10.

5-33. VERNIER BALANCE.

a. Set MAGNIFIER to X1.

b. Rotate EXT VERNIER from CAL position to fully ccw.

c. Center spot with POSITION control.

d. Set EXT VERNIER to CAL.

e. Adjust Vern Bal adj A5R11 to recenter spot.

f. Repeat steps b through e until spot does not shift from center when EXT VERNIER is rotated.

5-34. GAIN ADJUSTMENT.

Note

This adjustment is critical if Time Base interchangeability is desired without recalibration. Critical adjustment is achieved by injecting a precise current into the emitter-base junction of A5Q3 and adjusting for the specified deflection. An alternate method not requiring use of HP Model 10411A Horizontal Gain Calibrator is provided.

a. Set controls as follows:

DISPLAY . . . . . EXT
MAGNIFIER X1
EXT VERNIER . . . . . CAL

b. Check +100-volt supply for +100V ±0.1V.

Note

The calibrating accuracy of the Model 10411A Horizontal Gain Calibrator used for this adjustment procedure is determined by the accuracy of the +100V supply. If the power supply is not +100V ±0.1V, the gain adjustment will be out of tolerance.

c. Connect Horizontal Gain Calibrator as follows:

1. Black lead: connect to chassis (power supply ground).

2. Yellow lead: connect to emitter of A5Q3.

3. Red lead: connect to +100 volt supply.

d. Set Horizontal Gain Calibrator magnifier switch to X1.

e. Display should be a bright spot near each side of the display. Adjust HORIZONTAL POSITION to center left-hand spot exactly on left-hand (first) vertical graticule line.

f. Set INTENSITY and FOCUS to obtain low intensity sharply focused spots.

g. Adjust X1 Gain Adj A5R46 for exactly 10 divisions of separation between spots (Figure 5-3).

h. Set MAGNIFIER to X10 and Horizontal Gain Calibrator magnifier switch to X10.

i. Adjust X10 Gain adj A5R44 for exactly 10 divisions of separation between spots.

j. Disconnect Horizontal Gain Calibrator.

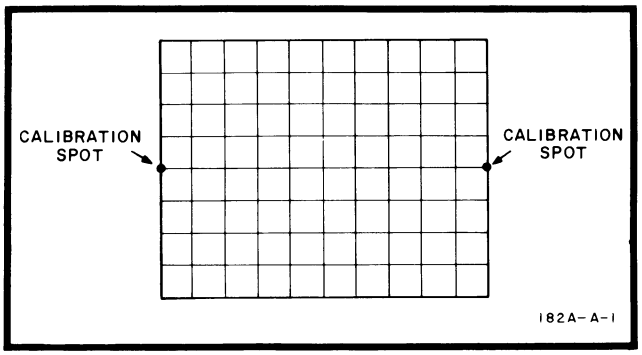


Figure 5-3. Calibration Display

5-35. GAIN ADJUSTMENT (ALTERNATE PROCEDURE).

a. Set controls as follows:

HORIZONTAL DISPLAY . . . . . EXT
HORIZONTAL MAGNIFIER. X1
EXT VERNIER . . . . . CAL

b. Check +100V supply for +100V ±0.1V.

c. Alternately connect and disconnect 40-kilohm 0.1% 1/2W resistor between +100V supply and emitter of A5Q3. Keep connection lead length short as possible to avoid stray pick-up or oscillations.

CAUTION

With resistor disconnected, +100V is present at open lead of resistor. Do not leave resistor connected throughout adjustment as thermal rise will shift current reference.

d. Adjust HORIZONTAL POSITION to center left-hand spot exactly on left-hand (first) vertical graticule line.

e. While alternately connecting and disconnecting resistor to emitter of A5Q3, adjust X1 Gain adj A5R46 for exactly 10 major divisions of separation between spot positions.

f. Set HORIZONTAL DISPLAY to INT and Time Base for 1 msec/div sweep speed.

g. Apply 1 msec markers from Time Mark Generator to Vertical input.

h. Adjust Time Base 1 msec calibration adjustment to obtain display of eleven markers in 10 divisions. Second marker should be on 2nd graticule line and 10th marker on 10th graticule line.

i. Set HORIZONTAL MAGNIFIER to X10.

j. Adjust X10 Gain adj A5R44 to obtain a display of exactly 1 marker for 10 divisions.

k. Disconnect Time Mark Generator.

5-36. PHASE ADJUSTMENT.

a. Set controls as follows:

Phase/Bandwidth Switch . . . . . Phase
HORIZONTAL MAGNIFIER. X1
HORIZONTAL DISPLAY . . . . . EXT
EXT VERNIER . . . . . CAL

b. Connect 10 kHz sine wave output of Oscillator to HORIZONTAL EXT INPUT and to Vertical plug-in Channel A input (Figure 5-4).

Note

Channel A of a multi-channel Vertical plug-in is normally used for phase measurement. If another channel must be used connect Oscillator to that channel instead of Channel A.

c. Adjust Oscillator output to obtain a 8-div display.

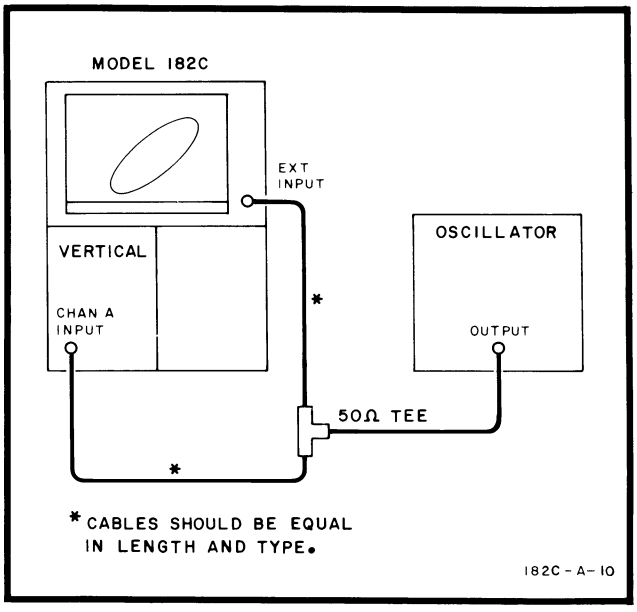


Figure 5-4. Phase Adjustment Test Setup

d. Adjust Input Comp adj A5C9 for display of a single diagonal line (no phase shift).

e. Set Oscillator for an output of 100 kHz sine wave.

f. Adjust Phase adj A5C12 for display of a single diagonal line (no phase shift).

g. Repeat steps b through f until no phase shift occurs for either frequency.

h. Disconnect Oscillator.

i. Return Phase/Bandwidth switch to Bandwidth position.

5-37. TRANSIENT RESPONSE ADJUSTMENT.

Note

Omit this adjustment procedure for normal calibration and perform the Horizontal Linearity Adjustment. This procedure should only be used if major repairs or complete module replacement has been made.

a. Set DISPLAY to EXT.

b. Connect 1V p-p square wave at 200 kHz repetition rate from Square Wave Generator to HORIZONTAL EXT INPUT and to Monitor Oscilloscope Vertical input.

c. Set Monitor Oscilloscope time base to operate at sweep of 1 μsec/div and synchronize Monitor Oscilloscope with 200 kHz signal.

d. Connect 1 μsec/div sweep signal from Monitor Oscilloscope rear-panel Main Sweep Output to Channel A input of Model 182C. See Figure 5-5.

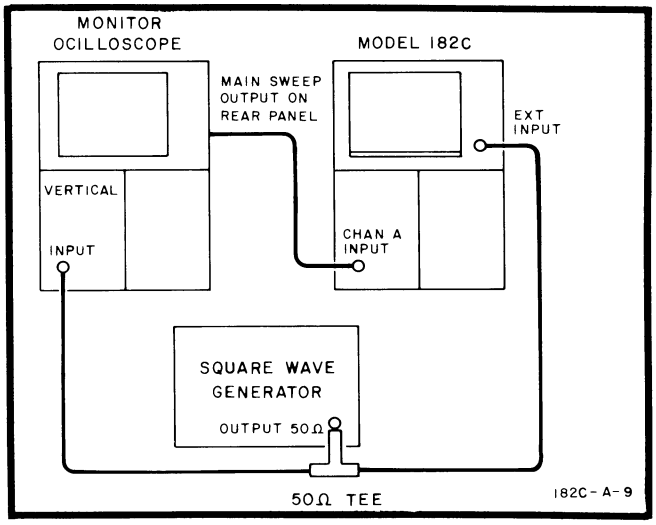


Figure 5-5. Transient Response Adjustment Test Setup

e. Adjust Vertical plug-in VOLTS/DIV and Vernier controls to obtain an 8-div display.

f. Observe displayed waveform. At this stage of adjustment waveform will typically exhibit 5% (approximately 0.5 div) overshoot. If overshoot is greater, adjust HF Adj No. 1 A5C21, HF Adj No. 2 A5C24, and HF Adj No. 3 A5C28 to obtain flat-top response with approximately 5% overshoot on lower right-hand corner of displayed pulse.

Note

Capacitors for HF Adj No. 1 and HF Adj No. 3 should be adjusted so their slugs are almost equally extended.

g. Disconnect Monitor Oscilloscope.

5-38. HORIZONTAL LINEARITY ADJUSTMENT.

Note

Ensure that Time Base has been properly calibrated before proceeding with this adjustment.

a. Set HORIZONTAL DISPLAY to INT.

b. Connect 4V p-p 50 MHz sinewave output from Constant Amplitude Signal Generator to Vertical plug-in Channel A input.

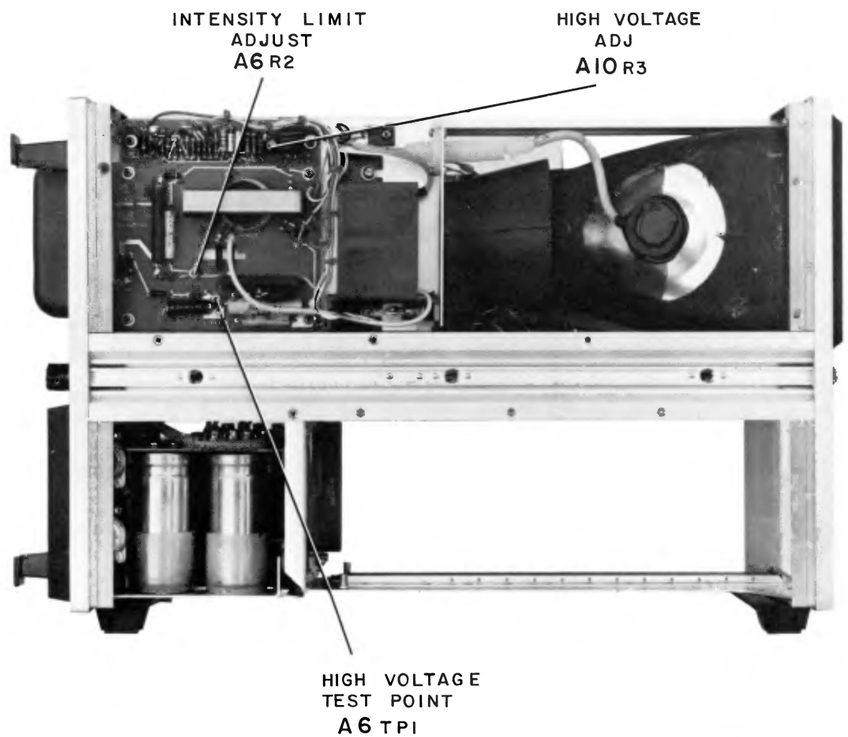
c. Set HORIZONTAL MAGNIFIER to X10.

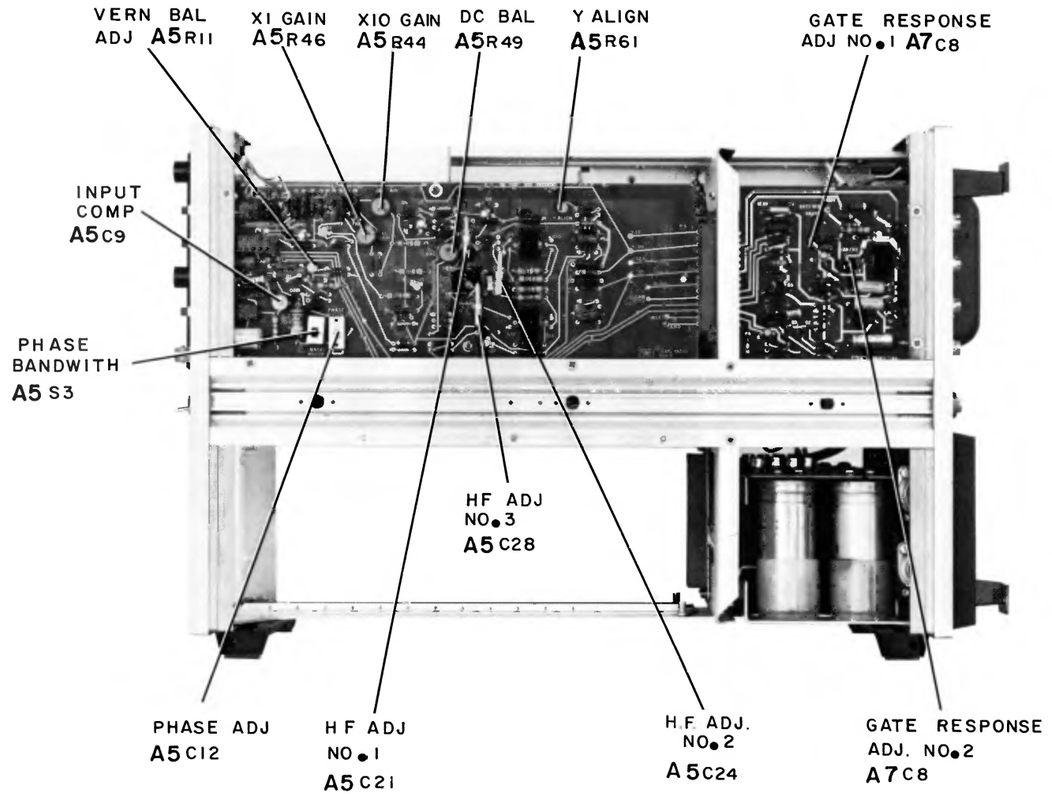
d. Select fastest sweep speed (.05 or .1 μsec/div) and obtain a display.

e. Adjust HF Adjust No. 1, No. 2 and No. 3 for best overall linearity of center 80 divisions of available display. Use HORIZONTAL POSITION control to permit viewing the right, center and left portions of the display. HF Adj No. 1 affects the right portion, HF Adj No. 2 the center portion and HF Adj No. 3 the left portion of the sweep.

f. Disconnect Constant Amplitude Signal Generator.

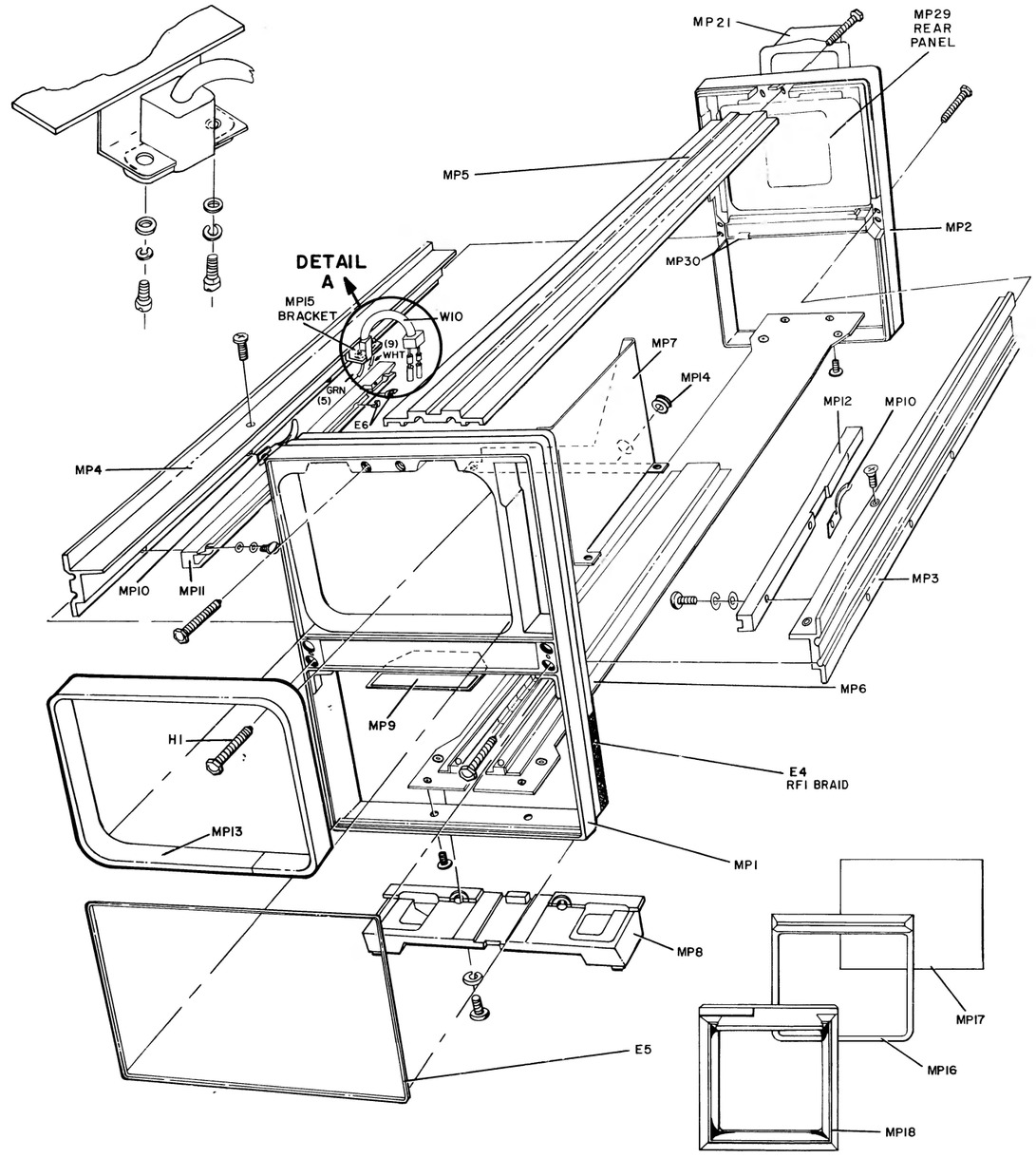
5-39 This completes the adjustment procedure. If desired, the instrument performance may be tested to Model 182C specifications using the Performance Check procedure. If satisfactory adjustment or instrument performance is not obtained refer to Section VIII of this manual for troubleshooting information.





182C-A-8

Figure 5-6.
Adjustment Locations



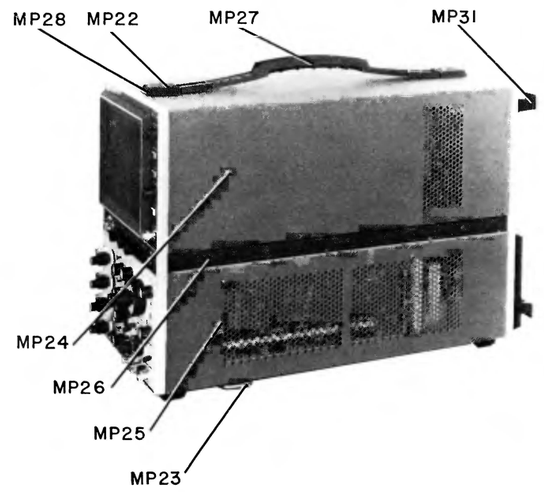


Figure 6-1. Model 182C Mechanical Parts

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

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

6-3. ORDERING INFORMATION.

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

a. Instrument model and serial number.

b. HP part number of items(s).

c. Quanity 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. Quanity desired.

Table 6-1. Abbreviations for Replaceable Parts List

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

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS & MISCELLANEOUS		
A1	00182-60034		ASSY:LOW VOLTAGE POWER MODULE	28480	00182-60034
A2	00182-60030		ASSY:CONTROL MODULE	28480	00182-60030
A3	00182-60021		ASSY:INTERCONNECT MODULE	28480	00182-60021
A4	00182-60004		ASSY:AC POWER	28480	00182-60004
A5	00182-60035		ASSY:HORIZONTAL AMPLIFIER MODULE	28480	00182-60035
A6	00182-61102		ASSY:H.V. OSC. RECTIFIER BOARD	28480	00182-61102
A7	00182-66515		ASSY:GATE AMPLIFIER BOARD	28480	00182-66515
A8	00181-66508		ASSY:SWEEP GATE OUTPUT BOARD	28480	00181-66508
A9	00182-60029		ASSY:CRT MODULE	28480	00182-60029
A10	00182-66513		ASSY:H.V. REGULATOR BOARD	28480	00182-66513
A11	0960-0117	1	ASSY:H.V. MULTIPLIER(NOT REPAIRABLE)	28480	0960-0117
A12	00182-60023		MODULE:HIGH VOLTAGE (INCLUDES A6, A10, A11, E1, E7, E8, F3, MP20, Q1, AND W7)	28480	00182-60023
E1	0362-0227	4	TERMINATION:CRIMP LUG	27264	2125
E2	0362-0227		TERMINATION:CRIMP LUG	27264	2125
E3	0362-0277		TERMINATION:CRIMP LUG	27264	2125
E4	8160-0204	1	BRAID:MONEL-NEOPRENE SPONGE STRIP	12881	01-06-01-1756
E5	4320-0231	2	RUBBER:RFI	00000	ORD#
E6	0363-0006	1	CONTACT:CONNECTOR SWITCH	28480	0363-0006
E7	0340-0450	1	WASHER:TRANSISTOR INSULATOR	04713	14B52600F12
E8	0340-0451	1	WASHER:INSULATED, TRANSISTOR	04713	14B52600F03
F3	2110-0033	1	FUSE:0.75A 250V	75915	F02GR750A
F4	2110-0004	1	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
H1	0624-0234	12	SCREW:TAPPING 8-18 THREAD 1.000" LG	00000	ORD
H2			NOT ASSIGNED		
H3	2200-0165	2	SCREW:FLAT HD POZI DR 4-40 X 1/4"	00000	ORD
J1	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J2	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J3	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J4	1250-0083		CONNECTOR:BNC	02660	31-221-1020
J5	1250-0083		CONNECTOR:BNC	02660	31-221-1020
MP1	00182-22001	1	FRAME:FRONT	28480	00182-22001
MP2	00182-22004	1	FRAME:REAR	28480	00182-22004
MP3	00182-23701	1	SIDE RAIL:RIGHT	28480	00182-23701
MP4	00182-23702	1	SIDE RAIL:LEFT	28480	00182-23702
MP5	00182-63701	1	RAIL ASSY:TOP	28480	00182-63701
MP6	00182-64101	1	PLATE:BOTTOM	28480	00182-64101
MP7	00182-01201	1	BRACKET:SHIELD	28480	00182-01201
MP8	5040-0445	2	FOOT:BOTTOM	28480	5040-0445
MP9	00182-00604	1	SHIELD:FOCUS	28480	00182-00604
MP10	00180-09104	2	CLIP:GROUND	28480	00180-09140
MP11	0403-0128	1	GUIDE:PC BD PLUG-IN(LEFT)	28480	0403-0128
MP12	0403-0129	1	GUIDE:PC BD PLUG-IN(RIGHT)	28480	0403-0129
MP13	0460-0778	1	TAPE:GRAY 0.750" WIDE	00000	ORD
MP14	0400-0010	1	GROMMET:VINYL 0.250" ID	00000	ORD#
MP15	00182-01212	1	BRACKET:VERTICAL CABLE	28480	00182-01212
MP16	00182-60501	1	FRAME:ADAPTER	28480	00182-60501
MP17	5060-0547	1	KIT:CONTRAST FILTER, BLUE	28480	5060-0547
MP18	00182-60026	1	BEZEL ASSY	28480	00182-60026
MP19	00182-60025	1	H.V. COVER ASSY	28480	00182-60025
MP20	00182-01211	1	BRACKET:H.V.	28480	00182-01211
MP21	01701-04108		COVER:CRT	28480	01701 04108
MP22	1390-0153	2	PANEL FASTENER	00000	ORD
MP23	1490-0710	1	STAND:TILT	28480	1490-0710
MP24	00182-04105	1	COVER:TOP, OLIVE GRAY	28480	00182-04105
MP25	00182-04106	1	COVER:BOTTOM, OLIVE GRAY	28480	00182-04106
MP26	00182-23705	2	COVER:RETAINER	28480	00182-23705
MP27	00182-24901	1	HANDLE	28480	00182-24901
MP28	01200-42301	2	RETAINER:HANDLE	28480	01200-42301
MP29	00182-00215	1	PANEL:REAR, TOP	28480	00182-00215
MP30	00182-01205	2	BRACKET:LOW VOLTAGE POWER SUPPLY	28480	00182-01205
MP31	5040-0447	1	FOOT:REAR(LONG)	28480	5040-0447
MP32	00182-24101	1	FACEPLATE:CRT	28480	00182 24101
MP33	00182-24702	2	SPACER:CRT CLAMP	28480	00182-24702
MP34	00182-62701	1	FILTER ASSY:CONTRAST	28480	00182-62701
MP35	00182-00206	1	PANEL: ACCESS TO A1	28480	00182-00206
Q1	00182-62902	1	TRANSISTOR ASSY:H.V. OSCILLATOR	28480	00182-62902
R1	0683-1045	1	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
V1	5083-3952	1	CRT:P31 ALUM.	28480	5083-3952
W1	8120-1538	1	CABLE ASSY:POWER 7.5 FT.	28480	8120-1538
W2	00182-61614	1	CABLE ASSY:CRT (INCL. R1, E1, E2, XV1)	28480	00182-61614
W3	00182-61611	1	CABLE:COAX Z-AXIS(INCL. E2)	28480	00182 61611
W4	00182-61613	1	CABLE ASSY:COAX	28480	00182-61613
W5	00182-61615	1	CABLE ASSY:REG.	28480	00182 61615
W6	00182-61617	1	CABLE:CRT VERTICAL	28480	00182-61617
W7	00182-61612	1	CABLE ASSY: H.V	28480	00182 61612
W8	00182-61616	1	CABLE ASSY:CRT TO A2	28480	00182-61616
XV1	1200-0037	1	SOCKET:CRT TUBE, and	72825	97097
	1200-0050	1	CONTACT:CRT SOCKET, and	72825	9553-1
	1200-0408	1	COVER:CRT SOCKET	28480	1200-0408

See introduction to this section for ordering information

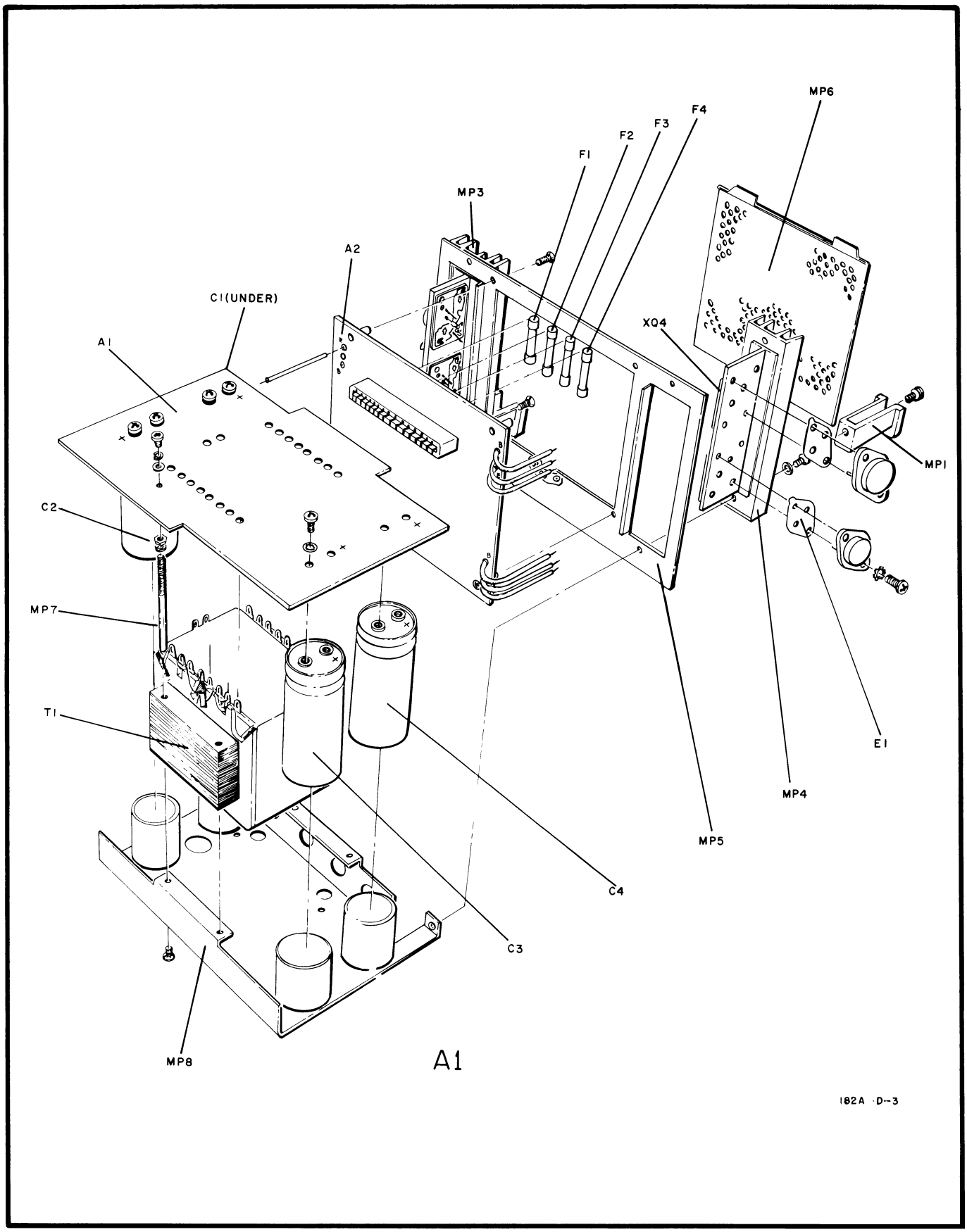


Figure 6-2.
Low Voltage Power Module Exploded View

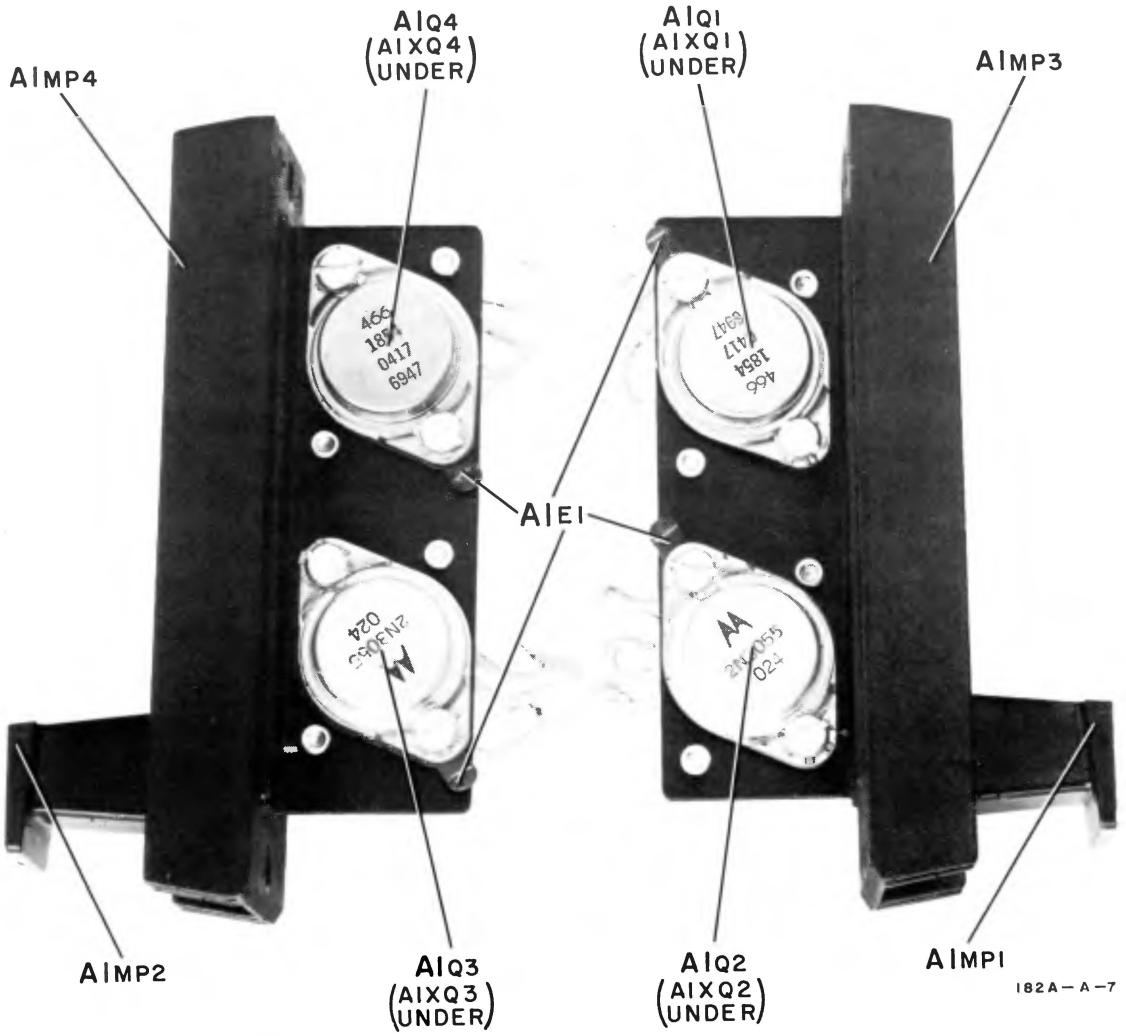


Figure 6-3. Series Regulator Parts Identification

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	00182-60034	1	ASSY:LOW VOLTAGE POWER MODULE	28480	00182-60034
A1C1	0180-1807	2	C:FXD ELECT 290 UF +50-10% 200VDCW	56289	32D291F200AB2A-DQB
A1C2	0180-1865	1	C:FXD ELECT 2100 UF +75-10% 40VDCW	56289	32D212G040AB2A-DQB
A1C3	0180-1809	1	C:FXD ELECT 3400 UF +75-10% 25VDCW	56289	32D342G025AB2A-DQB
A1C4	0180-1807		C:FXD ELECT 290 UF +50-10% 200VDCW	56289	32D291F200AB2A-DQB
A1E1	1200-0043	1	INSULATOR:TSTR MOUNTING(TO-3)	71785	293011
A1F1	2110-0065	2	FUSE:0.375A 250V	75915	312.375
A1F2	2110-0002	2	FUSE:CARTRIDGE 2 AMP 3 AG	75915	312.002
A1F3	2110-0002		FUSE:CARTRIDGE 2 AMP 3 AG	75915	312.002
A1F4	2110-0065		FUSE:0.375A 250V	75915	312.375
A1MP1	5040-0446	2	FOOT:REAR, SHORT, NON-FILTERED	28480	5040-0446
A1MP2	5040-0446		FOOT:REAR, SHORT, NON-FILTERED	28480	5040-0446
A1MP3	00180-61103	1	TRANSISTOR:HEAT SINK RH	28480	00180-61103
A1MP4	00180-61104	1	TRANSISTOR:HEAT SINK LH	28480	00180-61104
A1MP5	00182-00205	1	PANEL:REAR, LVPS	28480	00182-00205
A1MP6	00182-00206	1	PANEL:ACCESS	28480	00182-00206
A1MP7	00182-24701	4	SPACER:LVPS	28480	00182-24701
A1MP8	00182-61201	1	BRACKET ASSY:TRANSFORMER	28480	00182-61201
A1Q1	1854-0417	2	TSTR:SI NPN	28480	1854-0417
A1Q2	1854-0063	2	TSTR:SI NPN	80131	2N3055
A1Q3	1854-0063		TSTR:SI NPN	80131	2N3055
A1Q4	1854-0417		TSTR:SI NPN	28480	1854-0417
A1T1	9100-1129	1	TRANSFORMER:POWER	28480	9100-3401
A1XQ1	1200-0041	4	SOCKET:TRANSISTOR	71785	133-32-10-013
A1XQ2	1200-0041		SOCKET:TRANSISTOR	71785	133-32-10-013
A1XQ3	1200-0041		SOCKET:TRANSISTOR	71785	133-32-10-013
A1XQ4	1200-0041		SOCKET:TRANSISTOR	71785	133-32-10-013
A1A1	00184-66511	1	ASSY:LOW VOLTAGE RECTIFIER BOARD	28480	00184-66511
A1A1C1	0180-0091	1	C: FXD ELECT 10 UF +50–10% 100 VDCW	56289	30D106F100DC2-USM
A1A1CR1	1901-0028	4	DIODE: SILICON 0.75A 400PIV	04713 04713	SR 1358-9
A1A1CR2	1901-0028		DIODE: SILICON 0.75A 400PIV	04713	SR 1358-9
A1A1CR3	1901-0028		DIODE: SILICON 0.75A 400PIV	04713	SR 1358-9
A1A1CR4	1901-0028		DIODE: SILICON 0.75A 400PIV	28480	SR 1358-9
A1A1CR5	1901-0028	8	DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR6	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR7	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR8	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR9	1901-0415	8	DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR10	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR11	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR12	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR13	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR14	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR15	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR16	1901-0415		DIODE:SILICON 50 PIV 3A	28480	1901-0415
A1A1CR17	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR18	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR19	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR20	1901-0028		DIODE:SILICON 0.75A 400PIV	04713	SR1358-9
A1A1CR21	1901-0045	4	DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A1A1CR22	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A1A1R1	0757-0342	2	R:FXD MET FLM 100K OHM 1% 1/4W	28480	0757-0342
A1A1R2	0757-0342		R:FXD MET FLM 100K OHM 1% 1/4W	28480	0757-0342
A1A1R3	0760-0016		R: FXD MET OX 2700 OHM 2% 1W	28480	0760-0016
A1A1R4	0757-0060		R: FXD MET FLM 24.3K OHM 1% 1/2W	28480	0757-0060
A1A1VR1	1902-0597		DIODE: BREAKDOWN 56.2V 5% 1W	28480	1902-0597
A1A2	00184-66509	1	ASSY:LOW VOLTAGE REGULATOR BOARD	28480	00184-66509
A1A2C1	0140-0176	1	C: FXD MICA 100 PF 2%	28480	0140-0176
A1A2C2	0180-0269	1	C:FXD ELECT 1.0 UF +50-10% 150VDCW	56289	30D105F150BA2-DSM
A1A2C3	0180-0089	4	C:FXD AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150DD2-DSM
A1A2C4	0160-0161	3	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A1A2C5	0180-0058	2	C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A1A2C6	0170-0040	3	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A1A2C7	0180-0058		C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A1A2C8	0180-0089		C: FXD AL ELECT 50 UF +50–10% 150VDCW	56289	30D106F150DD2-DSM
A1A2CR1	1901-0040	18	DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR3	1901-0026	6	DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A1A2CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR7	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A1A2E1-E8	2110-0269	9	CLIP:FUSE 0.250" DIA	91506	6008-32CN
A1A2J3	1251-1633	1	CONNECTOR:PC(1 X 15) 15 CONTACT	71785	252-15-30-310
A1A2Q1	1854-0234	4	TSTR: SI NPN	80131	2N3440
A1A2Q2	1854-0071	15	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071

See introduction to this section for ordering information

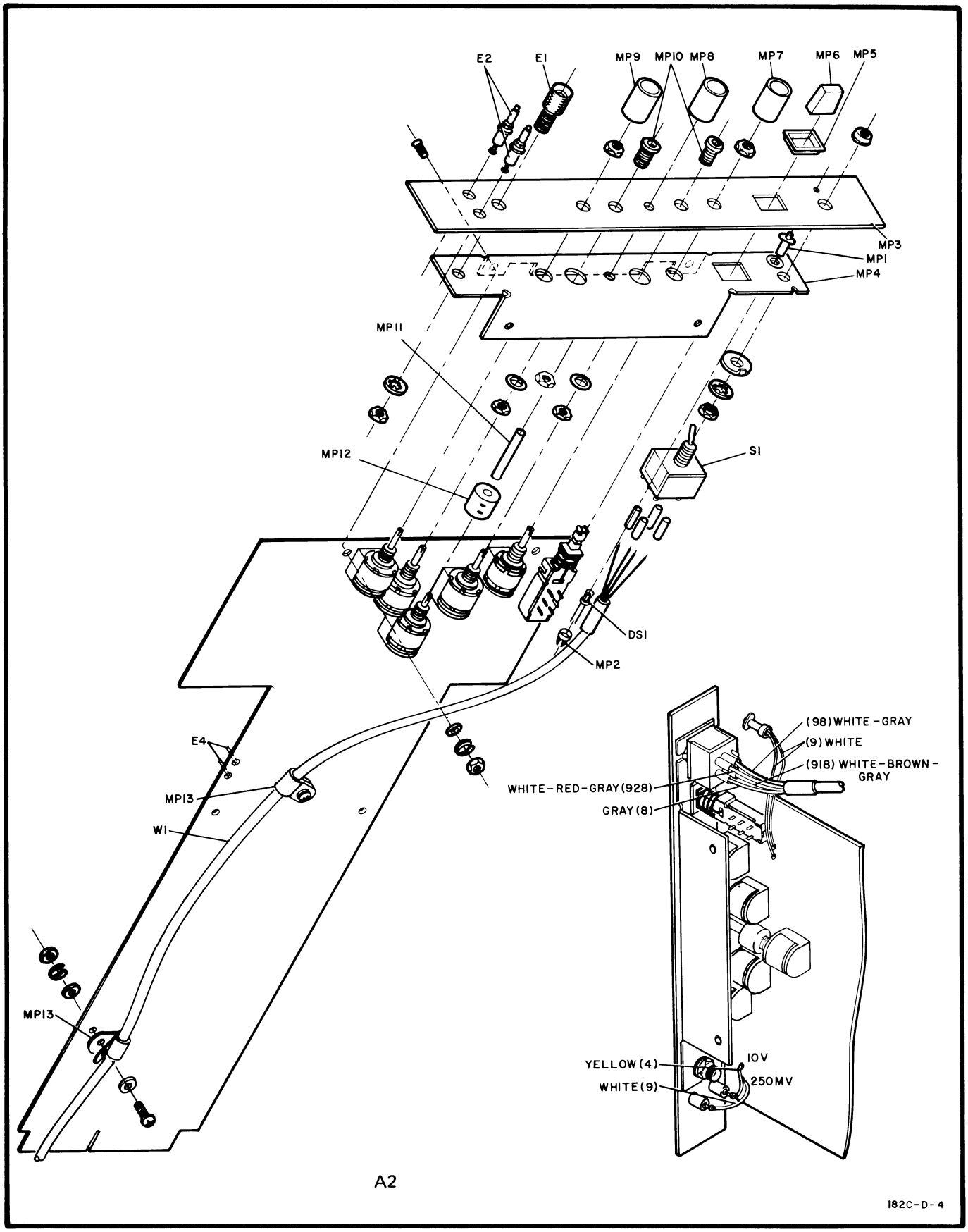


Figure 6-4. Control Module Mechanical Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A2Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q5	1854-0039		TSTR:SI NPN	80131	2N3053
A1A2Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q9	1854-0039		TSTR:SI NPN	80131	2N3053
A1A2Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q11	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q13	1854-0039		TSTR:SI NPN	80131	2N3053
A1A2Q14	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q15	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2Q16	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1A2R1	0757-0713	1	R:FXD FLM 110 OHM 1% 1/4W	28480	0757-0713
A1A2R2	0757-0281	6	R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A1A2R3	0757-0465	2	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A1A2R4	0812-0058	2	R:FXD WW 8.2 OHM 5% 2W	28480	0812-0058
A1A2R5	0757-0060	2	R:FXD MET FLM 24.3K OHM 1% 1/2W	28480	0757-0060
A1A2R6	0757-0060		R:FXD MET FLM 24.3K OHM 1% 1/2W	28480	0757-0060
A1A2R7	0757-0435	3	R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A1A2R8	0757-0438	9	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1A2R9	0757-0044	3	R:FXD MET FLM 33.2K OHM 1% 1/2W	28480	0757-0044
A1A2R10	0757-0435		R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A1A2R11	2100-1773	2	R:VAR WW 1K OHM 5% TYPE H 1W	28480	2100-1773
A1A2R12	0757-0767	4	R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A1A2R13	0811-1746	2	R:FXD WW 0.36 OHM 5% 2W	28480	0811-1746
A1A2R14	0757-0767		R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A1A2R15	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1A2R16	0757-0767		R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A1A2R17	0757-0431	4	R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A1A2R18	0757-0273	1	R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A1A2R19	0757-0283	5	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1A2R20	2100-1772	2	R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A1A2R21	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1A2R22	0811-1746		R:FXD WW 0.36 OHM 5% 2W	28480	0811-1746
A1A2R23	0757-0769	4	R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A1A2R24	0757-0436	3	R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A1A2R25	0757-0430	1	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430
A1A2R26	0757-0769		R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A1A2R27	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A1A2R28	0757-0428	1	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A1A2R29	2100-1772		R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A1A2R30	0757-0435		R:FXD FLM 3920 OHM 1% 1/8W	28480	0757-0435
A1A2R31	0757-0367	3	R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A1A2R32	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A1A2R33	0812-0058		R:FXD WW 8.2 OHM 5% 2W	28480	0812-0058
A1A2R34	0757-0769		R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A1A2R35	0757-0768	2	R:FXD FLM 47.5K OHM 1% 1/4W	28480	0757-0768
A1A2R36	0757-0044		R:FXD MET FLM 33.2K OHM 1% 1/2W	28480	0757-0044
A1A2R37	0757-0367		R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A1A2R38	0757-0450	1	R:FXD MET FLM 22.1K OHM 1% 1/8W	28480	0757-0450
A1A2R39	0757-0280	5	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1A2R40	2100-1774	1	R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A1A2R41	0757-0768		R:FXD FLM 47.5K OHM 1% 1/4W	28480	0757-0768
A1A2R42	0687-5611	2	R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611
A1A2TP1	1251-0206	5	CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2TP2	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2TP3	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2TP4	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A1A2VR1	1902-3096	1	DIODE BREAKDOWN:5.23V 5% 400 MW	28480	1902-3096
A1A2VR2	1902-0767	1	DIODE:T.C. REFERENCE 1N938	04713	1N938
A2	00182-60030	1	ASSY:CONTROL MODULE	28480	00182-60030
A2C1	0180-0155	3	C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS
A2C2	0160-2961	2	C:FXD MICA 5825 PF 2% 300VDCW	04062	RDM20F(5825)G3C
A2C3	0160-2961		C:FXD MICA 5825 PF 2% 300VDCW	04062	RDM20F(5825)G3C
A2C4	0180-0069		C:FXD AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150DD2-DSM
A2C5	0180 0094		C: FXD ELECT 100 UF +75-10% 25 VDCW	56289	30D107G025DD2 DSM
A2C6	0180 0094		C: FXD ELECT 100 UF +75-10% 25 VDCW	56289	30D107G025DD2 DSM
A2C7	0160 4079		C: FXD MY 1500 PF 4K VDCW	56289	430P152040
A2CR1	1901-0096	4	DIODE:SILICON 120V	01295	UG-888
A2CR2	1901-0096		DIODE:SILICON 120V	01295	UG-888
A2CR3	1901-0096		DIODE:SILICON 120V	01295	UG-888
A2CR4	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A2CR5	1901-0045		DIODE:SILICON 0.75A 100PIV	04713	SR1358-7
A2DS1	2140-0346	1	LAMP:INCANDESCENT 5V	71744	7210
A2E1	1510-0038	2	BINDING POST	28480	1510-0038
A2E2	0360-1646	1	TERMINAL:SOLDER STUD	17117	4338-67-0
A2E3	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN

See introduction to this section for ordering information

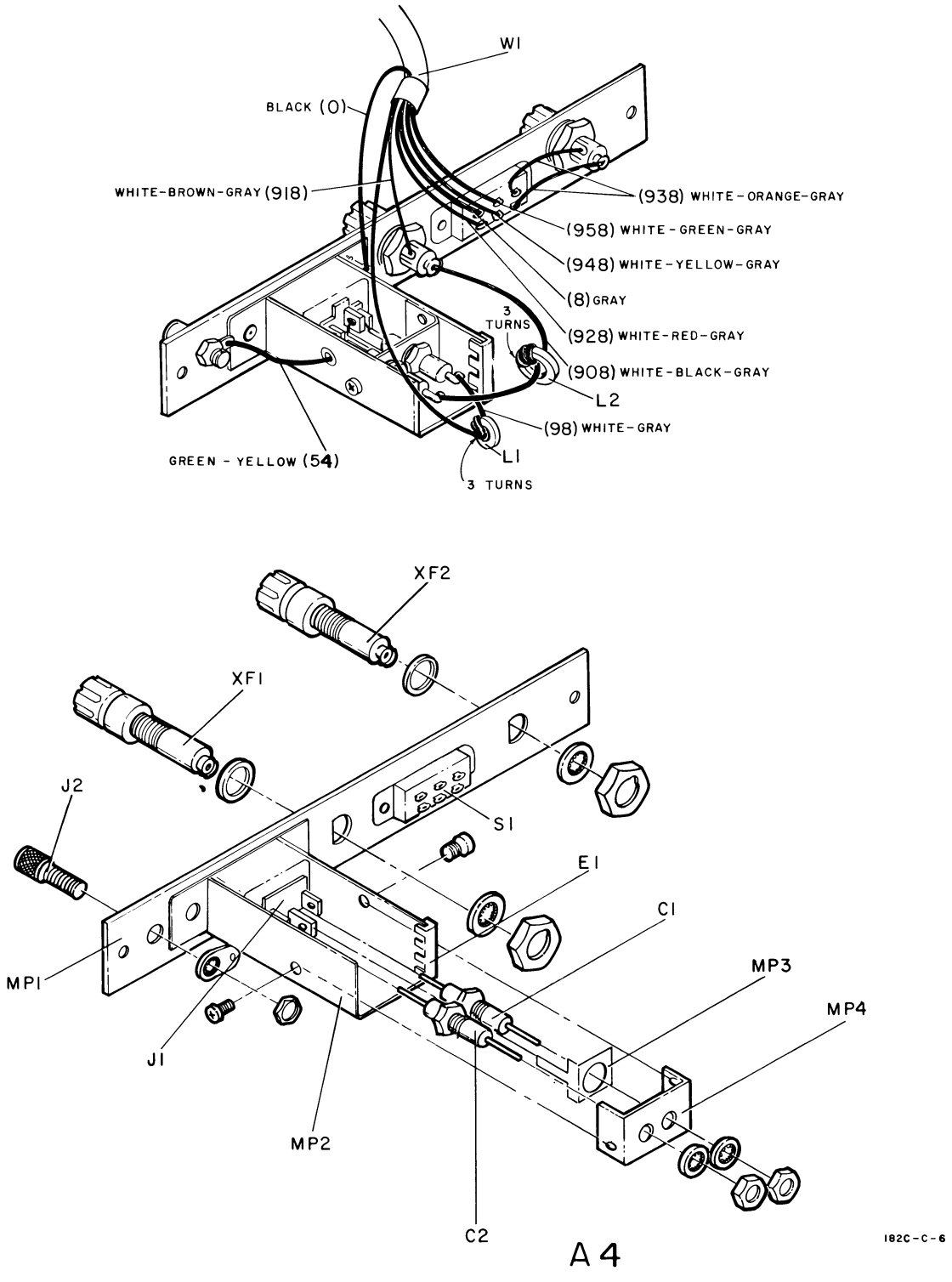


Figure 6-5. AC Power Module Parts Identification

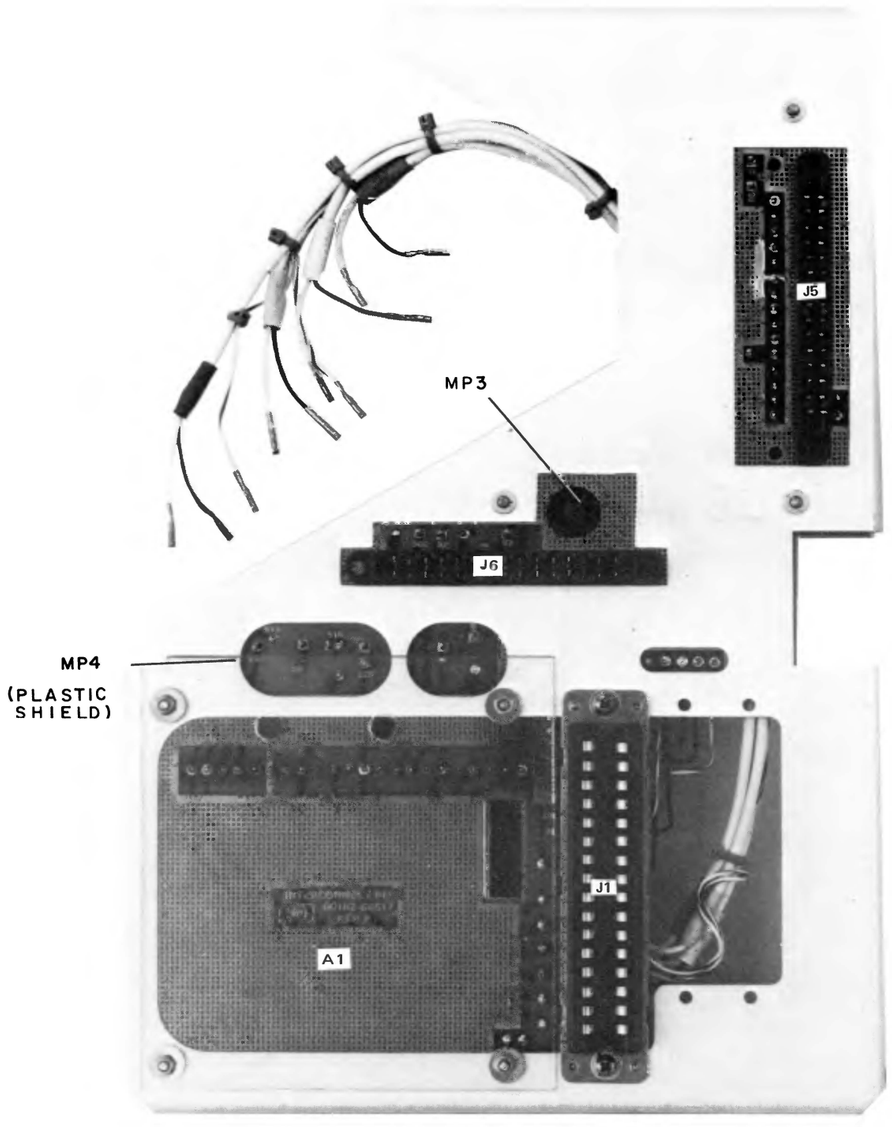
Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2E4	0360-1653	14	TERMINAL:PIN (CDA 260)	00000	OBD
A2E5	0362-0063	12	TERMINATION:CRIMP LUG FOR 0.046SQ PIN	00000	OBD
A2E6	0362-0264	3	TERMINATION:CRIMP LUG	91886	2611225-14
A2L1	9140-0115	1	COIL:FXD RF 22 UH 10%	99800	2150-32
A2MP1	1450-0404	1	LENS:CLEAR	28480	1450-0404
A2MP2	00183-67701	1	BASE:PILOT LIGHT	28480	00183-67701
A2MP3	00182-60203	1	PANEL:FRONT CONTROL	28480	00182-60203
A2MP3			(INCLUDES A2E2)		
A2MP4	00182-01210	1	BRACKET:CONTROL	28480	00182-01210
A2MP5	0370-0451	4	BEZEL:PUSHBUTTON KNOB BLK NYLON	28480	0370-0451
A2MP6	0370-0450	1	KNOB:PUSHBUTTON SWITCH, BLK	71590	J52305
A2MP7	00182-67401	3	KNOB ASSY:ARROW	28480	00182-67401
A2MP8	00182-67401		KNOB ASSY:ARROW	28480	00182-67401
A2MP9	00182-67403	1	KNOB ASSY:OFF	28480	00182-67403
A2MP10	1490-0968	1	BUSHING:POTENTIOMETER 1/4-32 EXT THRD	00000	OBD
A2MP11	00182-23706	1	SHAFT:EXTENDER	28480	00182-23706
A2MP12	1490-0841	1	COUPLING:SHAFT 0.127" ID	28480	1490-0841
A2MP13	1400-0024	3	CLAMP,CABLE NYLON 1/4 DIA	71616	CPC-1953-4A
A2Q1	1854-0234	2	TSTR:SI NPN	80131	2N3440
A2Q2	1854-0234		TSTR:SI NPN	80131	2N3440
A2Q3	1854-0053	1	TSTR:SI NPN	80131	2N2218
A2R1	0757-0453	1	R:FXD MET FLM 30.1K OHM 1% 1/8W	28480	0757-0453
A2R2	2100-2917	1	R:VAR WW 50K OHM 20% 1/2W	28480	2100-2917
A2R3	0698-3158	2	R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A2R4	2100-2031	1	R:VAR 50K OHM 10% LIN 1/2W	28480	2100-2031
A2R5	0757-0454	1	R:FXD MET FLM 33.2K OHM 1% 1/8W	28480	0757-0454
A2R6	0757-0460	1	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A2R7	0757-0456	1	R:FXD MET FLM 43.2K OHM 1% 1/8W	28480	0757-0456
A2R8	2100-3002	2	R:VAR 10K OHM	28480	2100-3002
A2R9	0757-0468	4	R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A2R10	0683-0275	4	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A2R11	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A2R12	0757-0407	6	R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A2R13	0757-0190	1	R:FXD MET FLM 20K OHM 1% 1/2W	28480	0757-0190
A2R14	0761-0006	1	R:FXD MET OX 10K OHM 5% 1W	28480	0761-0006
A2R15	0757-0468		R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A2R16	0757-0468		R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A2R17	0698-5421	1	R:FXD MET FLM 17.82K OHM 0.1% 1/2W	28480	0698-5421
A2R18	0698-5419	1	R:FXD FLM 1.95K OHM 0.1% 1/8W	28480	0698-5419
A2R19	0698-5418	1	R:FXD FLM 50 OHM 0.1% 1/8W	28480	0698-5418
A2R20	2100-3002		R:VAR 10K OHM	28480	2100-3002
A2R21	2100-3001	1	R:VAR 5 MEGOHM	28480	2100-3001
A2R22	0698-5678	1	R:FXD FLM 16.25 MEGOHM 5% 1W	28480	0698-5678
A2R23	2100-3003	1	R:VAR 5K OHM	28480	2100-3003
A2R24	0757-0281		R: FXD MET FLM 2740 OHM 1% 1/8W	28480	0757-0281
A2R25	0684-3901	1	R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A2S1	3101-1508	1	SWITCH:TOGGLE DPDT	09353	7318I
A2S2	3101-1374	1	SWITCH:PUSHBUTTON DPDT	28480	3101-1374
A2W1	00182-61605	1	CABLE ASSY:	28480	00182-61605
			(INCLUDES E5 AND E6)		
A3	00182-60021	1	ASSY:INTERCONNECT MODULE	28480	00182-60021
A3E1	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A3A1	00182-66517	1	ASSY:MOTHER BOARD	28480	00182-66517
A3J1	1251-0137	1	CONNECTOR:PC 32 CONTACT	02660	26-4200-32S
A3J2	1251-2572	1	CONNECTOR:PC EDGE 22 FORK CONTACT	95354	91-6922-0702-00
A3J4	1251-0213	3	CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3J5	1251-0213		CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3J6	1251-0213		CONNECTOR:PC EDGE 15 CONTACT	95354	91-6915-1700-00
A3MP1	00182-01204	1	BRACKET:MOTHER BOARD	28480	00182-01204
A3MP2	1400-0024		CLAMP,CABLE NYLON 1/4 DIA	71616	CPC-1953-4A
A3MP3	0400-0010	1	GROMMET:VINYL 0.250" I.D.	00000	OBD
A3MP4	00182-00605	1	SHIELD:A.C.	28480	00182-00605
A3W1	00182-61609	1	CABLE ASSY:COAX	28480	00182-61609
A3W2	00180-61650	1	CABLE ASSY:SWEEP OUT	28480	00180-61650
A4	00182-60004	1	ASSY:AC POWER	28480	00182-60004
A4C1	0160-3484	2	C:FXD CER FEED-THRU 1000 PF 20% 1000V	72982	2432-009 X5U 102M
A4C2	0160-3484		C:FXD CER FEED-THRU 1000 PF 20% 1000V	72982	2432-009 X5U 102M
A4E1	0400-0018	1	GROMMET:CHANNEL U-SHAPED	95987	WG-101
A4E2	0362-0063		TERMINATION:CRIMP LUG FOR 0.046SQ PIN	00000	OBD
A4F1	2110-0005	1	FUSE:CARTRIDGE 1.6 AMP 125V	71400	MDL 1.6
A4F2	2110-0020	1	FUSE:0.8A 250V SLOW-BLOW	75915	313.800S
A4J1	1251-2357	1	SOCKET:3-PIN MALE POWER RECEPTACLE	82389	EAC-301
A4J2	1510-0038		BINDING POST	28480	1510-0038
A4L1	9170-0013	1	COIL:CORE, TOROID, GREEN	72656	CF-102-H
A4MP1	00182-60201	1	PANEL ASSY:REAR	28480	00182-60201
A4MP2	00182-00601	1	SHIELD:LINE FILTER	28480	00182-00601
A4MP3	00180-01246	2	BRACKET:GROUND LINE FILTER	28480	00180-01246

See introduction to this section for ordering information

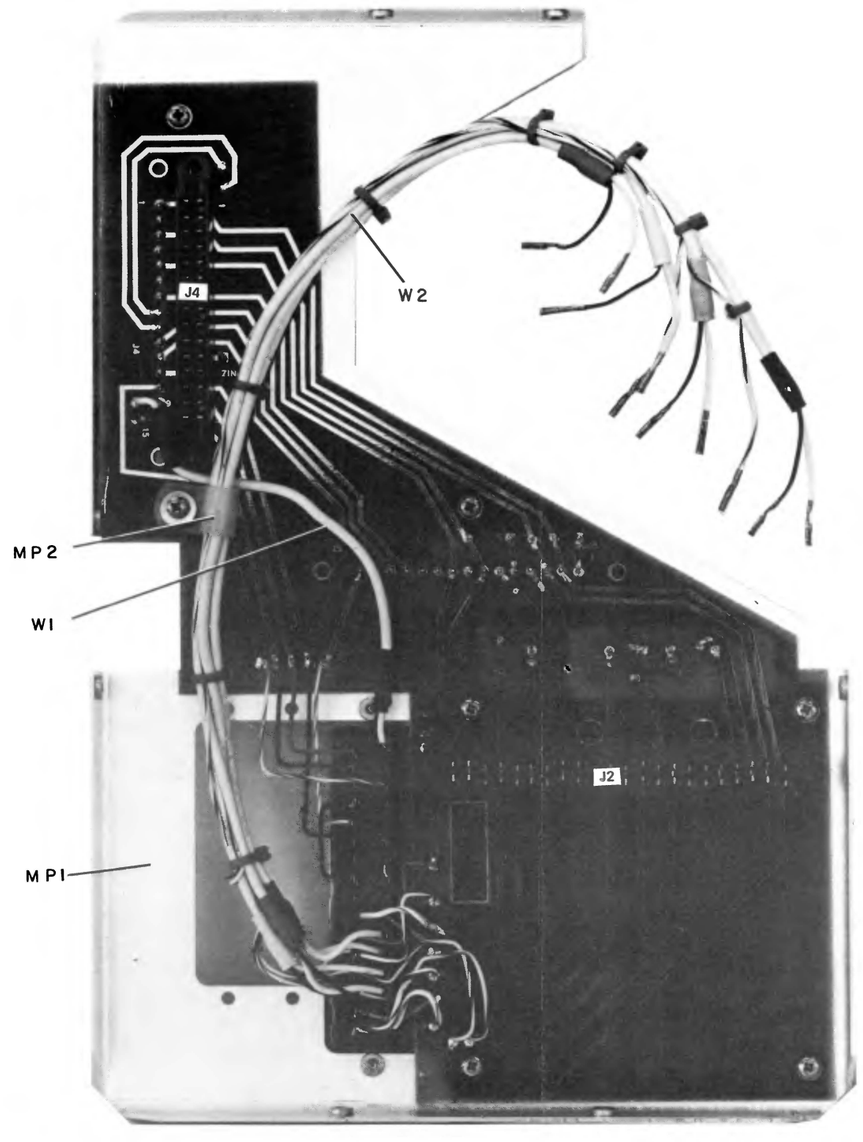
Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4MP4	00182-01209	1	BRACKET:LINE FILTER	28480	00182-01209
A4S1	3101-1237	1	SWITCH:SLIDE DPDT	82389	11A-1243
A4W1	00182-61604	1	CABLE ASSY:LINE 1	28480	00182-61604
A4XF1	1400-0084	2	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
A4XF2	1400-0084		FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
A5	00182-60035	1	ASSY HORIZONTAL AMPLIFIER MODULE (See figure 6-7.)	28480	00182-60035
A5A1	00182-66518	1	ASSY:HORIZONTAL AMPLIFIER (See figure 6-7 for A5 parts not included with A5A1).	28480	00182-66518
A5C1	0160-0162	10	C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C2	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C3	0180-0197	4	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C5	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C6	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A5C7	0160-0168	3	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A5C8	0170-0022	1	C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24
A5C9	0121-0060	1	C:VAR CER 2-8 PF NPO	72982	538-011 A 2-8
A5C10	0160-2250	1	C:FXD CER 5.1 PF 500VDCW	72982	301-000-COHO-519E
A5C11	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A5C12	0131-0004	1	C:VAR MICA 16-150 PF 175VDCW	72136	T51410-3
A5C13	0160-2020	2	C:FXD MICA 910 PF 5% 100VDCW	00853	RDM15F911J1S
A5C14	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C15	0160-2020		C:FXD MICA 910 PF 5% 100VDCW	00853	RDM15F911J1S
A5C16	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C17	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C18	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C19	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C20			NOT ASSIGNED		
A5C21	0132-0007	3	C:VAR POLY 0.7 TO 3.0 PF 350VDCW	72982	535-033-4R
A5C22	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C23	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A5C24	0132-0007		C:VAR POLY 0.7 TO 3.0 PF 350VDCW	72982	535-033-4R
A5C25	0160-2235	1	C:FXD CER 0.75 PF 500VDCW	72982	301-000-COKO-758C
A5C26	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A5C27	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A5C28	0132-0007		C:VAR POLY 0.7 TO 3.0 PF 350VDCW	72982	535-033-4R
A5CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR4	5080-0464	4	DIODE:SILICON 30 200M	28480	5080-0464
A5CR5	5080-0464		DIODE:SILICON 30 200M	28480	5080-0464
A5CR6			NOT ASSIGNED		
A5CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR9	5080-0464		DIODE:SILICON 30 200M	28480	5080-0464
A5CR10	5080-0464		DIODE:SILICON 30 200M	28480	5080-0464
A5CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5E1	1251-2039	2	CONNECTOR:TEST POINT, CORD JACK	28480	1251-2039
A5E2	0360-1788		TERMINAL:PIN	28480	0360-1788
A5J1	1250-0083	6	CONNECTOR:BNC	02660	31-221-1020
A5L1	9140-0179	6	COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5L3	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A5L4	9170-0029	2	CORE:FERRITE BEAD	02114	56-590-65A2/4A
A5MP1	00182-00201	1	PANEL:FRONT, HORIZONTAL	28480	00182-00201
A5MP2	00182-01202	1	BRACKET:HORIZONTAL	28480	00182-01202
A5MP3	00182-67401		KNOB ASSY:ARROW	28480	00182-67401
A5MP4	00182-67404	1	KNOB ASSY:CAL	28480	00182-67404
A5MP5	00182-67405	3	KNOB ASSY:PUSHBUTTON	28480	00182-67405
A5MP6	0370-0451		BEZEL:PUSHBUTTON KNOB BLK NYLON	28480	0370-0451
A5MP7	1400-0325	1	CLAMP:CABLE 0.125" DIA	00000	OBD
A5MP8	1205-0063	3	HEAT SINK:SEMICONDUCTOR	05820	224-CB
A5Q1	1855-0062	1	TSTR:SI FET 30V	01295	2N1595
A5Q2	1854-0215	3	TSTR:SI NPN	80131	2N3904
A5Q3	1850-0158	1	TSTR:GE PNP	80131	2N2635
A5Q4	1854-0019	5	TSTR:SI NPN	28480	1854-0019
A5Q5	1854-0019		TSTR:SI NPN	28480	1854-0019
A5Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q7	1854-0019		TSTR:SI NPN	28480	1854-0019
A5Q8	1853-0009	2	TSTR:SI PNP	28480	1853-0009
A5Q9	1854-0419	2	TSTR:SI NPN	04713	SS657
A5Q10	1853-0038	3	TSTR:SI PNP	28480	1853-0038
A5Q11	1853-0009		TSTR:SI PNP	28480	1853-0009
A5Q12	1854-0419		TSTR:SI NPN	04713	SS657
A5Q13	1853-0038		TSTR:SI PNP	28480	1853-0038
A5R1	0684-1011	2	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R2	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A5R3	0757-0388	1	R:FXD FLM 30.1 OHM 1% 1/8W	28480	0757-0388



FRONT VIEW

A3



REAR VIEW

182C-A-6

Figure 6-6.
Interconnect Module Parts Identification

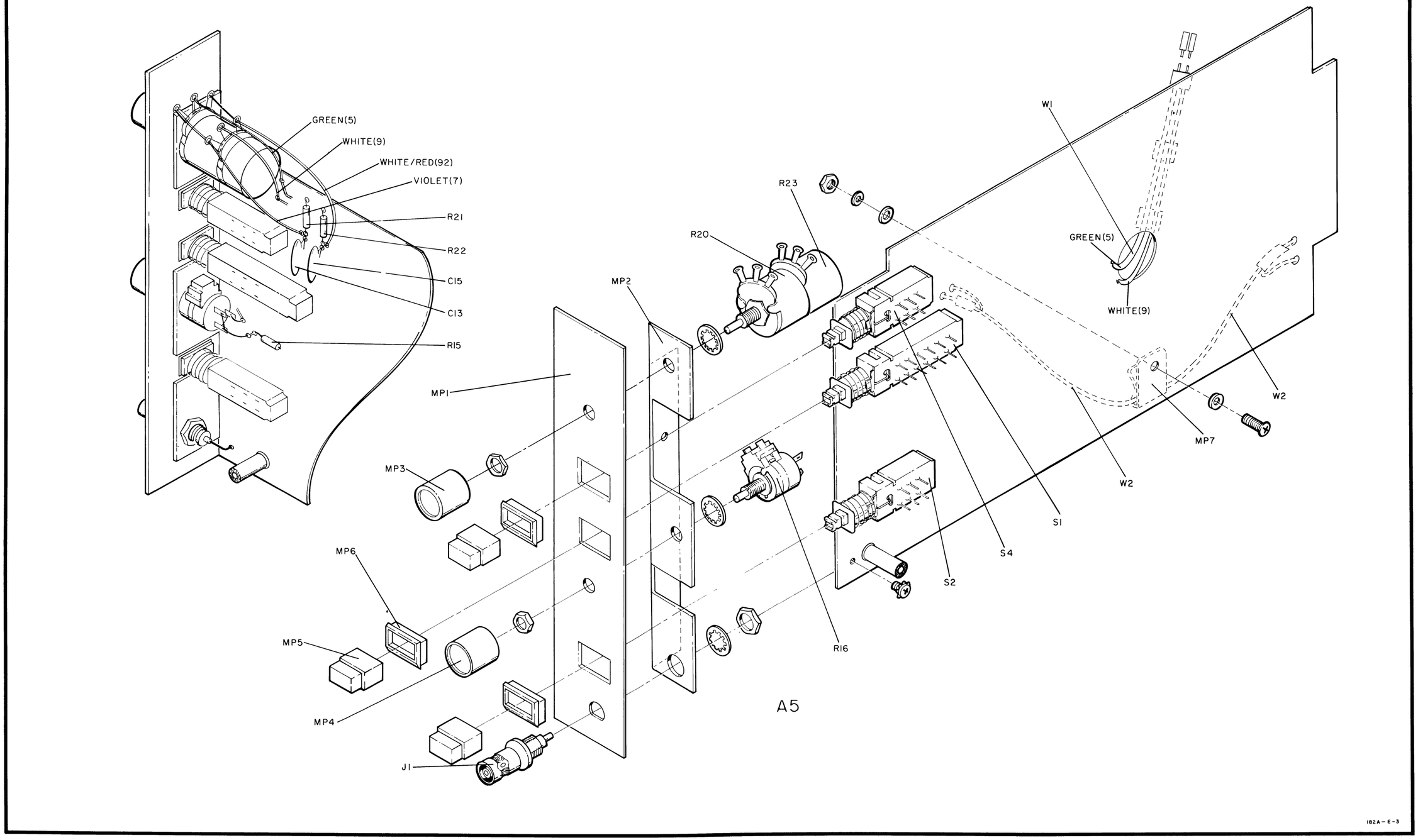


Figure 6-7. Horizontal Amplifier Module Mechanical Parts

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5R4	0757-0156	1	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156
A5R5	0727-0287	1	R:FXD CARBON 2 MEGOHM 1% 1/2W	28480	0727-0287
A5R6	0757-0344	2	R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A5R7	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R8	0757-0367		R:FXD MET FLM 100K OHM 1% 1/2W	28480	0757-0367
A5R9	0757-0416	4	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5R10	0757-0434	3	R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A5R11	2100-2030	2	R:VAR FLM 20K OHM 10% LIN 1/2W	28480	2100-2030
A5R12	0757-0447	1	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A5R13	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A5R14	0698-3647	1	R:FXD MET CX 15K OHM 5% 2W	28480	0698-3647
A5R15	0757-0426	2	R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A5R16	2100-2922	1	R:VAR COMP 15K OHM 20% 5 CCLOG 1/4W	28480	2100-2922
A5R17	0757-0774	1	R:FXD FLM 82.5K OHM 1% 1/4W	28480	0757-0774
A5R18	0757-0401	9	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R19	0757-0792	1	R:FXD MET FLM 681K OHM 1% 1/4W	28480	0757-0792
A5R20	2100-2998	2	R:VAR CERMET 2 X 100K OHM 20% LIN	28480	2100-2998
A5R21	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R22	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R23	2100-2998		R:VAR CERMET 2 X 100K OHM 20% LIN	28480	2100-2998
A5R24	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A5R25	0757-0771	1	R:FXD FLM 61.9K OHM 1% 1/4W	28480	0757-0771
A5R26	0757-0441	1	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A5R27	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A5R28	0757-0044		R:FXD MET FLM 33.2K OHM 1% 1/2W	28480	0757-0044
A5R29	0757-0741	2	R:FXD MET FLM 2.43K OHM 1%/1/4W	28480	0757-0741
A5R30	0757-0468		R:FXD FLM 130K OHM 1% 1/8W	28480	0757-0468
A5R31	0757-0440	1	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A5R32	0757-0427	2	R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A5R33	0757-0741		R:FXD MET FLM 2.43K OHM 1%/1/4W	28480	0757-0741
A5R34	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A5R35			NOT ASSIGNED		
A5R36	0757-0443	2	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A5R37	0757-0434		R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A5R38	0757-0846	2	R:FXD MET FLM 22.1K OHM 1.0% 1/2W	28480	0757-0846
A5R39	0757-0413	2	R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A5R40	0757-0736	2	R:FXD MET FLM 1.50K OHM 1% 1/4W	28480	0757-0736
A5R42	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A5R43	0757-0841	2	R:FXD MET FLM 12.1K OHM 1% 1/2W	28480	0757-0841
A5R44	2100-1770	1	R:VAR WW 100 OHM 5% TYPE H 1W	28480	2100-1770
A5R45	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A5R46	2100-1773		R:VAR WW 1K OHM 5% TYPE H 1W	28480	2100-1773
A5R47	0757-0284	1	R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5R48	0698-3416	2	R:FXD MET FLM 21.5K OHM 1% 1/2W	28480	0698-3416
A5R49	2100-1775	1	R:VAR WW 5K OHM 5% TYPE H 1W	28480	2100-1775
A5R50	0698-3416		R:FXD MET FLM 21.5K OHM 1% 1/2W	28480	0698-3416
A5R51	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A5R52	0757-0443		R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A5R53	0757-0434		R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A5R54	0757-0413		R:FXD MET FLM 392 OHM 1% 1/8W	28480	0757-0413
A5R55	0757-0846		R:FXD MET FLM 22.1K OHM 1.0% 1/2W	28480	0757-0846
A5R56	0757-0736		R:FXD MET FLM 1.50K OHM 1% 1/4W	28480	0757-0736
A5R57	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A5R58	0757-0448	1	R:FXD MET FLM 18.2K OHM 1% 1/8W	28480	0757-0448
A5R59	0757-0841		R:FXD MET FLM 12.1K OHM 1% 1/2W	28480	0757-0841
A5R60	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5R61	2100-2030		R:VAR FLM 20K OHM 10% LIN 1/2W	28480	2100-2030
A5R62	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5R63	0757-0426		R:FXD FLM 1.3K OHM 1% 1/8W	28480	0757-0426
A5S1	3101-1241	1	SWITCH:PUSHBUTTON 4PDT	71590	P8 1
A5S2	3101-0535	2	SWITCH:PUSHBUTTON 2P SINGLE STATION	71590	PB-1
A5S3	3101-0982	1	SWITCH:SLIDE SPST 0.5A 125V	79727	GF124-0007
A5S4	3101-0535		SWITCH:PUSHBUTTON 2P SINGLE STATION	71590	PB-1
A5W1	00181-61606	1	CABLE ASSY:HORIZONTAL (INCL. E1 AND E2)	28480	00181-61606
A5W2	00182-61606	1	CABLE ASSY:COAX	28480	00182-61606
A6	00182-61102	1	ASSY:H.V. OSC. RECTIFIER BOARD	28480	00182-61102
A6C1	0160-0543	2	C:FXD CER 4700 PF 20% 4K VDCW	28480	0160-0543
A6C2	0160-0544	2	C:FXD CER 0.022 UF 20% 4K VDCW	28480	0160-0544
A6C3	0160-0543		C:FXD CER 4700 PF 20% 4K VDCW	28480	0160-0543
A6C4	0160-0544		C:FXD CER 0.022 UF 20% 4K VDCW	28480	0160-0544
A6C5	0160-2403	1	C:FXD CER 1500 PF 20% 5K VDCW	72982	828-025-X5R0-152M
A6C6	0160-2906		C: FXD CER 0.02 UF 20% 500VDCW	72982	821-519-X5V-203M
A6CR1	1901-0683	2	DIODE:SI HV	28480	1901-0683
A6CR2	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A6CR3	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A6CR4	1901-0683		DIODE:SI HV	28480	1901-0683

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6CR5	1901-0490	1	DIODE:SI 3000 PIV	28480	1901-0490
A6CR6	1901-0096		DIODE:SILICON 120V	01295	UG-888
A6E1	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A6R1	0687-2231	1	R:FXD COMP 22K OHM 10% 1/2W	01121	EB 2231
A6R2	2100-1618	1	R:VAR FLM 1 MEGOHM 20% LIN 1/2W	28480	2100-1618
A6R3	0757-0145	1	R:FXD MET FLM 750K OHM 1% 1/4W	28480	0757-0145
A6R4	0698-8018	2	R:FXD FLM 30 MEGOHM 1% 3W	28480	0698-8018
A6R5	0757-0344		R:FXD MET FLM 1.00 MEGOHM 1% 1/4W	28480	0757-0344
A6R6	0687-2221	1	R:FXD COMP 2200 OHM 10% 1/2W	01121	EB 2221
A6R7	0687-1531	1	R:FXD COMP 15K OHM 10% 1/2W	01121	EB 1531
A6R8	0698-5677	1	R:FXD FLM 8.25 MEGOHM 5% 1W	28480	0698-5677
A6R9	0698-8018		R:FXD FLM 30 MEGOHM 1% 3W	28480	0698-8018
A6T1			N.S.R. PART OF A6		
A6TP1	1251-0206		CONNECTOR:SOCKET 0.15 BDY DIA TEFLON	98291	SKT-400
A7	00182-66515	1	ASSY:GATE AMPLIFIER BOARD	28480	00182-66515
A7C1	0160-0207	1	C:FXD MYLAR 0.01UF 5% 200VDCW	28480	0160-0207
A7C2	0160-2261	1	C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A7C3	0150-0093	1	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A7C4	0160-2200	1	C:FXD MICA 43 PF 5%	72136	RDM15E430J3C
A7C5	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A7C6	0121-0407	1	C:VAR TRIMMER 0.7-3.0 PF	72982	536-016
A7C7	0150-0029	1	C:FXD TI 1 PF 10% 500VDCW	78488	TYPE GA
A7C8	0121-0168	1	C:VAR TEFLON 0.25-1.50 PF 600VDCW	28480	0121-0168
A7C9	0150-0029	1	C: FXD TI 1 PF 10% 500VDCW	78488	TYPE GA
A7C10	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A7C11	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A7C12	0160-0162		C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A7C13	0180-0089		C:FXD AL ELECT 10 UF +50-10% 150VDCW	56289	30D106F150DD2-DSM
A7C14	0180-0161	1	C:FXD ELECT 3.3 UF 20% 35VDCW	56289	150D335X0035B2-DYS
A7C15	0140-0204	1	C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A7CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR4	1901-0535	1	DIODE: HYBRID HOT CARRIER	28480	1901-0535
A7CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A7CR6	1901-0029	2	DIODE:SILICON 600 PIV	28480	1901-0029
A7CR7	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A7CR8	1901-0436	2	DIODE:SILICON 1600 PIV	28480	1901-0436
A7CR9	1901-0436		DIODE:SILICON 1600 PIV	28480	1901-0436
A7E1	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A7L1	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A7L2	9170-0029		CORE:FERRITE BEAD	02114	56-590-65A2/4A
A7MP1	1205-0063		HEAT SINK:SEMICONDUCTOR	05820	224-CB
A7Q1	1854-0019		TSTR:SI NPN	28480	1854-0019
A7Q2	1853-0049	2	TSTR:SI PNP	28480	1853-0049
A7Q3	1853-0049		TSTR:SI PNP	28480	1853-0049
A7Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q5	1854-0092	1	TSTR:SI NPN	80131	2N3563
A7Q6	1854-0019		TSTR:SI NPN	28480	1854-0019
A7Q7	1853-0038		TSTR:SI PNP	28480	1853-0038
A7Q8	1854-0271	1	TSTR:SI NPN	28480	1854-0271
A7R1	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R2	0757-0769		R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A7R3	0757-0433	1	R:FXD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0433
A7R4	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R5	0757-0442	1	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R6	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A7R7	0757-0274	1	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A7R8	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R9	0757-0419	1	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A7R10	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R11	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A7R12	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R13	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A7R14	0757-0407		R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A7R15	0757-0281		R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A7R16	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A7R17	0757-0437	1	R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A7R18	0757-0461	1	R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A7R19	0757-0724	1	R:FXD FLM 392 OHM 1% 1/4W	28480	0757-0724
A7R20	0757-0727	1	R:FXD MET FLM 562 OHM 1% 1/4W	28480	0757-0727
A7R21	0757-0767		R:FXD FLM 43.2K OHM 1% 1/4W	28480	0757-0767
A7R22	0757-0840	1	R:FXD MET FLM 11.0K OHM 1% 1/2W	28480	0757-0840
A7R23	0757-0472	1	R: FXD MET FLM 200K OHM 1% 1/8W	28480	0757-0472
A7R24			NOT ASSIGNED		

See introduction to this section for ordering information

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

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R25	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R26	0757-0760	1	R:FXD FLM 20K OHM 1% 1/4W	28480	0757-0760
A7R27	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R28	0683-1015	1	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A7R29	0761-0083	1	R:FXD MET OX 69K OHM 5% 1W	28480	0761-0083
A7R30	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R31	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R32	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A8	00181-66508	1	ASSY:SWEEP GATE OUTPUT BOARD	28480	00181-66508
A8C1	0180-0155		C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS
A8C2	0180-0155		C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS
A8E1	5020-0495	12	PIN:SQUARE(TEST POINTS)	28480	5020-0495
A8L1	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A8L2	9140-0179		COIL/CHOKE 22.0 UH 10%	28480	9140-0179
A8Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q3	1853-0016	2	TSTR:SI PNP	80131	2N3638
A8Q4	1853-0016		TSTR:SI PNP	80131	2N3638
A8R1	0757-0451	2	R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A8R2	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R3	0757-0436		R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A8R4	0757-0451		R:FXD MET FLM 24.3K OHM 1% 1/8W	28480	0757-0451
A8R5	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R6	0757-0436		R:FXD MET FLM 4.32K OHM 1% 1/8W	28480	0757-0436
A8R7	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A8R8	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A8R9	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R10	0757-0431		R:FXD MET FLM 2.43K OHM 1% 1/8W	28480	0757-0431
A8R11	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A8R12	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R13	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A8R14	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A8R15	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A9	00182-60029	1	ASSY:CRT MODULE	28480	00182-60029
A9E1	0360-0227	1			
A9L1	5060-0553	1	COIL:ALIGNMENT, ORTHOGONALITY "Y"	28480	5060-0553
A9L2	5060-0435	1	COIL:ALIGNMENT Z AXIS	28480	5060-0435
A9MP1	00182-60602	1	SHIELD ASSY:CRT	28480	00182-60602
A9MP2	0400-0009		GROMMET:VINYL, FOR 1/4" DIA HOLE	01538	6250
A9MP3	7120-0538		LABEL	28480	7120-0538
A9MP4	1400-0798		CLAMP:CRT OLIVE	28480	1400-0798
A9MP5	1400-0026		CLAMP:HOSE	66295	36H
A9MP6	0380-1019		SPACER	00000	OBD
A9MP7	0380-1019		SPACER	00000	OBD
A10	00182-66513	1	ASSY:H.V. REGULATOR BOARD	28480	00182-66513
A10C1	0180-0097	1	C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A10C2	0160-3453	2	C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A10C3	0180-0100	2	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10C4	0160-2903	1	C:FXD CER 0.05 UF 20% 500VDCW	56289	1233C24A2-CDH
A10C5	0160-3443		C:FXD CER 0.1 UF +80-20% 50VDCW	72982	8131-050-651-104Z
A10C6	0180-0100		C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A10C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CDH
A10C8	0160-3452	2	C: FXD CER 0.02 UF 20% 100VDCW	56289	C03B101H203MS25-CO
A10CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A10CR4	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A10CR5	1901-0026		DIODE:SILICON 0.75A 200PIV	04713	SR1358-8
A10E1	1251-0513	1	CONNECTOR:R & P, 5 MALE POST CONTACT	28480	1251-0513
A10E2	0360-1653		TERMINAL:PIN (CDA 260)	00000	OBD
A10Q1	1855-0057	1	TSTR:SI FET N-CHANNEL	28480	1855-0057
A10Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A10Q3	1853-0034	1	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0034
A10R1	0811-1671	1	R:FXD WW 2.7 OHM 5% 2W	28480	0811-1671
A10R2	0699-0002	2	R:FXD COMP 6.8 OHM 10% 1/2W	01121	EB 68G1
A10R3	2100-2650	1	R:VAR FLM 200K OHM 10% LIN 1/2W	28480	2100-2650
A10R4	0757-0138	1	R:FXD MET FLM 909K OHM 2% 1/2W	28480	0757-0138
A10R5	0684-2731	3	R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A10R6	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A10R7	0684-2721	1	R:FXD COMP 2700 OHM 10% 1/4W	01121	CB 2721
A10R8	0684-4721	1	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A10R9	0687-5611		R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611
A10R10	0699-0002		R:FXD COMP 6.8 OHM 10% 1/2W	01121	EB 68G1
A10R11	0684-2731		R:FXD COMP 27K OHM 10% 1/4W	01121	CB 2731
A10R12	0687-1011	1	R:FXD COMP 100 OHM 10% 1/2W	01121	EB 1011
A10R13	0684-1021	1	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021

See introduction to this section for ordering information

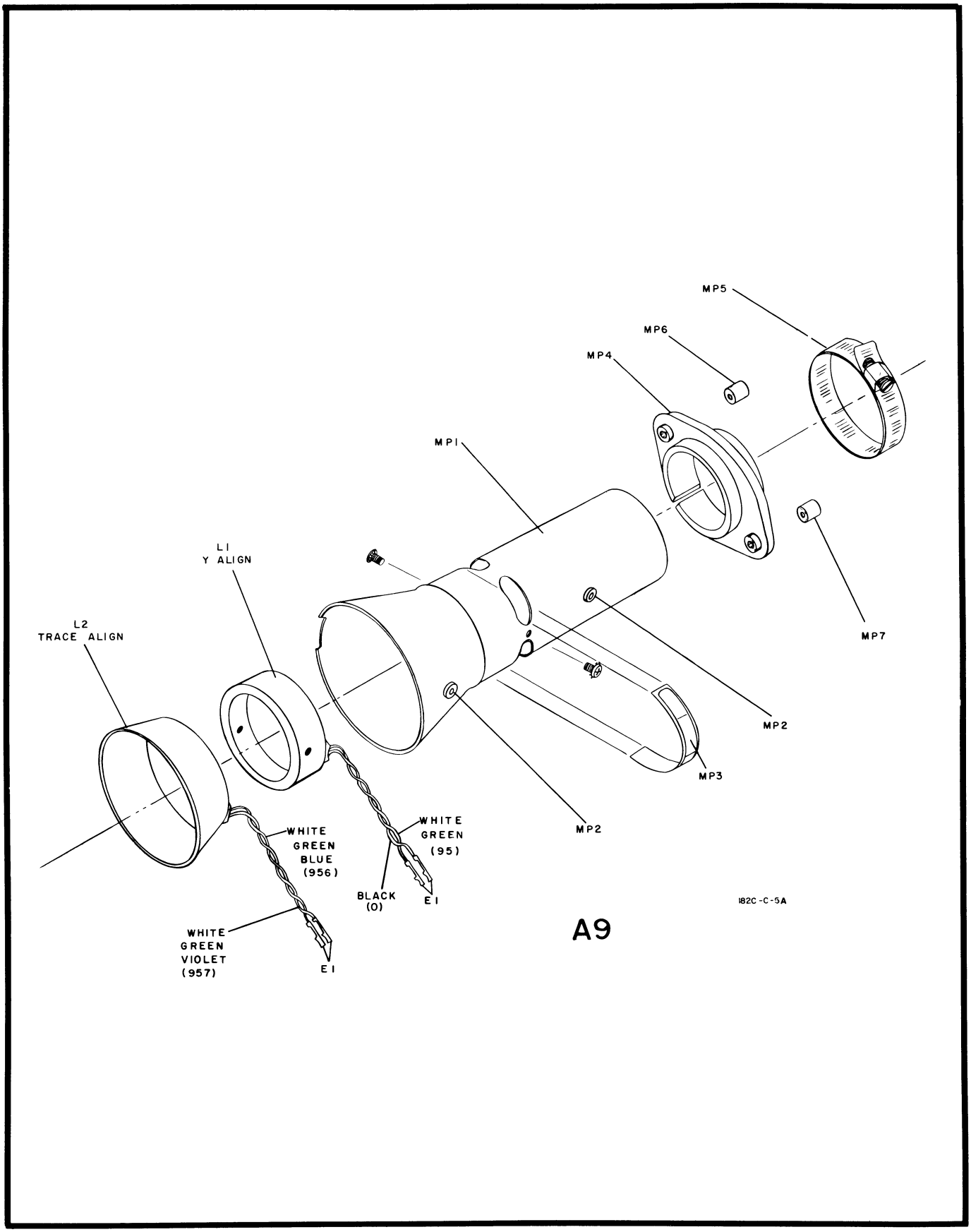


Figure 6-8. CRT Module Parts Identification

Table 6-3. List of Manufacturers' Codes

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	U.S.A. COMMON	ANY SUPPLIER OF U.S.A.	
00853	SANGAMO ELECTRIC CO.PICKENS DIV.	PICKENS, S.C.	29671
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
01538	SMALL PARTS INC.	COSTA MESA, CALIF.	92626
02114	FERROXCUBE CORP.	SAUGERTIES, N.Y.	12477
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
05820	WAKEFIELD ENGINEERING INC.	WAKEFIELD, MASS.	01880
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
08717	SLOAN CO. THE	SUN VALLEY, CALIF.	91352
09134	TEXAS CAPACITOR CO. INC.	HOUSTON, TEX.	77042
09353	C & K COMPONENTS INC.	NEWTON, MASS.	02158
12881	METEX CORP.	EDISON, N.J.	08817
14655	CORNELL DUBLIER ELECT. DIV.FEDERAL PACIFIC ELECT. CO.	NEWARK, N.J.	07105
17117	ELECTRONIC MOLDING CORP.	PAWTUCKET, R.I.	02860
27264	MOLEX PROD. CO.	DOWNERS GROVE, ILL.	60515
28480	HEWLETT-PACKARD CO. CORPORATE HQ	YOUR NEAREST HP OFFICE	
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
59730	THOMAS & BETTS CO. THE	ELIZABETH, N.J.	07207
66295	WITTEK MFG. CO.	CHICAGO, ILL.	60623
71400	BUSSMANN MFG. DIV. MC GRAW-EDISON CO.	ST. LOUIS, MO.	63017
71590	GLOBE UNION INC. CENTRALAB DIV.	MILWAUKEE, WISC.	53201
71616	COMMERCIAL PLASTICS CO.	MUNDELEIN, ILL.	60060
71744	CHICAGO MINIATURE LAMP WORKS	CHICAGO, ILL.	60640
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72656	INDIANA GENERAL CORP. ELECTRONIC DIV.	KEASBEY, N.J.	08832
72825	EBY HUGH H. INC.	PHILADELPHIA, PA.	19144
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
75915	LITTELFUSE INC.	DES PLAINES, ILL.	60016
78488	STACKPOLE CARBON CO.	ST. MARYS, PA.	15857
79727	CONTINENTAL-WIRT ELECTRONICS CORP.	WARMINSTER, PA.	18974
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
82389	SWITCHCRAFT INC.	CHICAGO, ILL.	60630
91506	AUGAT INC.	ATTLEBORO, MASS.	02703
91886	MALCO MFG. CO. INC.	CHICAGO, ILL.	60650
95354	METHODE MFG. CO.	ROLLING MEADOWS, ILL.	60008
95987	WECKESSER CO. INC.	CHICAGO, ILL.	60641
98291	SEALECTRO CORP.	MAMARONECK, N.Y.	10544
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052

See introduction to this section for ordering information

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information required to backdate or update this manual for a specific instrument. Descriptions of special options and standard options are also in this section.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having a serial prefix as shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, refer to Table 7-1 for changes necessary to backdate the manual to the instrument. When making changes from Table 7-1, make the change with the highest number first.

Table 7-1. Manual Changes

Serial Prefix	Make Changes
1240A, 1241A	3 thru 1
1248A	3 and 2
1311A	3

CHANGE 1

Table 6-2,

A1 (on pages 6-2 and 6-5): Change HP and Mfr. Part No. to 00182-60018.

A1T1: Change HP and Mfr. Part Nos. to 9100-1129.

A1A1: Change HP and Mfr. Part Nos. to 00182-66505.

A1A1C1: Change to HP Part No. 0180-1811; C: FXD ELECT 100 UF +75V −10% VDCW; Mfr. Code 56289; Mfr. Part No. 600D107G0200D4.

A1A1CR1 through A1A1CR4: Change to HP Part No. 1909-0049; DIODE: SILICON 50 PIV Mfr. Code 28480; Mfr. Part No. 1901-0049.

A1A1R3: Delete.

A1A1R4: Delete.

A1A1VR1: Delete.

A1A2: Change HP and Mfr. Part Nos. to 00182-66514.

A1A2C1: Change to HP Part No. 0160-2204; C: FXD MICA 100 PF 5% Mfr. Code 72136; Mfr. Part No. RDM 15F101J3C.

A1A2Q1: Change to HP Part No. 1854-0039; TSTR: SI NPN; Mfr. Code 80131; Mfr. Part No. 2N3053.

A7CR1 through A7CR3: Change to HP Part No. 1901-0535; DIODE: HOT CARRIER; Mfr. Code 28480; Mfr. Part No. 1901-0535.

Page 7-4, Table 7-2, Option 807 Replaceable Parts.

A5: Delete.

Page 8-12, Figure 8-6: Delete. Replace with Figure 7-6.

Page 8-14, Figure 8-7: Delete. Replace with Figure 7-7.

Page 8-15, Figure 8-8: Delete. Replace with Figure 7-8.

CHANGE 2

Table 6-2,

A5 (on pages 6-2 and 6-10): Change HP and Mfr. Part No. to 00182-60003.

A5A1: Change HP and Mfr. Part No. to 00182-66510.

Table 7-2,

Add: A5, 00182-66518, Assy: horizontal amplifier module.

A8: Change HP and Mfr. Part No. to 00180-66548, Board assy: auxiliary.

Delete: A8C1.

CHANGE 3

Table 6-2,

Delete: A2C7.

Page 8-23, Figure 8-16,

Delete: A2C7.

7-5. SPECIAL OPTIONS.

7-6. Most customer special application requirements and/or specifications can be met by factory modification of a standard instrument. A standard instrument modified in this way will carry a special option number, such as Model 0000A/Option C01.

7-7. An operating and service manual and a manual insert are provided with each special option instrument. The operating and service manual contains information about the standard instrument. The manual insert for the special option describes the factory modifications required to produce the special option instrument. Amend the operating and service manual by changing it to include all manual insert information. When these changes are made, the operating and service manual will apply to the special option instrument.

7-8. If you have ordered a special option instrument and the manual insert is missing, notify the nearest Hewlett-Packard Sales/Service Office. Be sure to give a full description of the instrument, including the complete serial number and special option number.

7-9. STANDARD OPTIONS.

7-10. Standard options are modifications installed on HP instruments at the factory and are available on request. Contact the nearest Hewlett-Packard Sales/Service Office for information concerning standard options.

7-11. Table 7-2 lists the available options for the Model 182C.

Table 7-2. Model 182C Options

OPTION	DESCRIPTION
001	230-Vac operation set at factory.
002	Standard CRT (V1) is replaced by P2 phosphor CRT, HP Part No. 5083-3922.
003	Instrument is set at factory for operation from power source of 100 or 200 Vac ±10%, 48 to 440 Hz, 200 VA maximum. Make the following changes to Table 6-2, Replaceable Parts, for Option 003: A1: Change HP and Mfr. Part Nos. to 00182-60014. A1T1: Change HP and Mfr. Part Nos. to 9100-3249. MP29: Change HP and Mfr. Part Nos. to 00182-00217.
007	Standard CRT (V1) is replaced by P7 phosphor CRT, HP Part No. 5083-3932.
010	Oscilloscope mainframe without rear panel MAIN GATE OUTPUT, DELAYED GATE OUTPUT, DELAYED SWEEP OUTPUT, or MAIN SWEEP OUTPUT connectors. Make the following changes to Table 6-2, Replaceable Parts, for Option 010: A3: Change HP Part No. to 00182-60020. A3MP2: Delete. A3W2: Delete. A8: Delete. J2-J5: Delete. W3: Change HP Part No. to 00182-61611. Add: RESISTOR, FXD MET FLM 5110 1% 1/8W, HP Part No. 0757-0438, to replace A8R15 on schematic 4. Add: TERMINAL BOARD, HP Part No. 0360-0013 to support added resistor.
011	Standard CRT (V1) is replaced by P11 phosphor CRT, HP Part No. 5083-3942. The intensification function of the FIND BEAM switch is deleted on Option 011 instruments equipped with P11 phosphor CRT to eliminate phosphor burn. Figure 7-1 shows the change to the schematic for the Control Module, A2. Figure 7-2 illustrates the location of the jumper wire to be removed. If the CRT is replaced with a standard P31 phosphor CRT, the FIND BEAM intensification capability may be restored by replacing the jumper wire.
013	Instrument is set at factory for operation from power source of 100 or 200 Vac ±10%, 48 to 440 Hz, 200 VA maximum. Oscilloscope mainframe is supplied without rear panel MAIN GATE OUTPUT, DELAYED GATE OUTPUT, DELAYED SWEEP OUTPUT, or MAIN SWEEP OUTPUT connectors. Make the following changes to table 6-2, Replaceable Parts, for Option 013: A1: Change HP and Mfr Part Nos. to 00182-60014 (pages 6-2 and 6-5). A3: Change HP and Mfr Part Nos. to 00182-60020 (pages 6-2 and 6-9). Delete: A8 (pages 6-2 and 6-15). Delete: J2 through J5. MP29: Change HP and Mfr Part Nos. to 00182-00218. Add: MP29R1, HP Part No. 0757-0438, R: FXD MET FLM 5110 OHM 1% 1/8W, Mfr Code 28480, Mfr Part No. 0757-0438 to replace A8R15 on schematic 4. Add: MP29MP1, HP Part No. 0360-0013, TERMINAL BOARD, Mfr Code 28480, Mfr Part No. 0360-0013 to support MP29R1. W3: Change HP and Mfr Part Nos. to 00182-61611. A1T1: Change HP and Mfr Part Nos. to 9100-3249. Delete: A3MP2 and A3W2.

Table 7-2. Model 182C Options (Cont'd)

<table>
<tr><th>OPTION</th><th>DESCRIPTION</th></tr>
<tr><td>807</td><td>
Factory modification for application, with spectrum analyzer plug-in units. Standard CRT (V1) is replaced by P7 phosphor, CRT, Standard Sweep Gate Output board (A8) is replaced by an Auxiliary Output board, and the rear panel labeling is changed to identify auxiliary outputs. Make the following changes for Option 807: Table 1-1, Specifications, change OUTPUTS to:
Four rear-panel BNC jacks provide recorder outputs for use with spectrum analyzer plug ins. (Refer to the plug-in operating and service manual for information about the use of these outputs). These outputs should not be used when a standard 1800-series time base plug-in is installed in the oscilloscope. The calibrated performance of the time base will be degraded due to loading.

NOTE

The signals present at the auxiliary output jacks are directly related to the plug-in installed. Refer to the plug-in operating and service manual for additional information.

Change CATHODE-RAY TUBE to:
Post-accelerator, 22-kV accelerating potential, alumized, P7 phosphor, internal graticule.

Table 6-2 Replaceable Parts. Change Table 6-2 as indicated for the listed components.
<table>
<tr><th>Ref. Desig.</th><th>HP Part No.</th><th>Description</th></tr>
<tr><td>A3</td><td>00182-60019</td><td>Assy: interconnect module</td></tr>
<tr><td>A3W2</td><td>00182-61807</td><td>Cable assy: auxiliary</td></tr>
<tr><td>A8</td><td>00180-66551</td><td>Board assy: auxiliary</td></tr>
<tr><td>A8C1</td><td>0160-3446</td><td>C: fxd cer 220 pF 10% 1K Vdc</td></tr>
<tr><td>A8E1</td><td>0360-1514</td><td>Terminal: pin</td></tr>
<tr><td>A8R1</td><td>0757-0438</td><td>R: fxd 5110 ohm 1% 1/8W</td></tr>
<tr><td>A8R2</td><td>0757-0438</td><td>R: fxd 5110 ohm 1% 1/8W</td></tr>
<tr><td>A8R3</td><td>0757-0438</td><td>R: fxd 5110 ohm 1% 1/8W</td></tr>
<tr><td>MP29</td><td>00182-60024</td><td>Panel: rear display, top</td></tr>
<tr><td>MP32</td><td>00182-62701</td><td>Filter assy: contrast</td></tr>
<tr><td>V1</td><td>5083-3932</td><td>CRT: P7, internal graticule</td></tr>
</table>
Note: Delete all other entries beginning with reference designation A8.

Page 8-16, Figure 8-9,
Replace Figure 8-9 with Figure 7-3.
Page 8-17, Figure 8-10,
Replace Schematic 3 with Figure 7-4.
</td></tr>
<tr><td>X95</td><td>
Mainframe with blue-gray covers. Make the following changes to Table 6-2, Replaceable parts, for Option X95:
MP24: Change to HP Part No. 00182-04102; COVER:
Top, BLUE-GRAY; Mfr. Code 28480; Mfr. Part No. 00182-04102.
MP25: Change to HP Part No. 00182-04103; COVER: BOTTOM,
BLUE-GRAY; Mfr. Code 28480; Mfr. Part No. 00182-04103.
</td></tr>
</table>

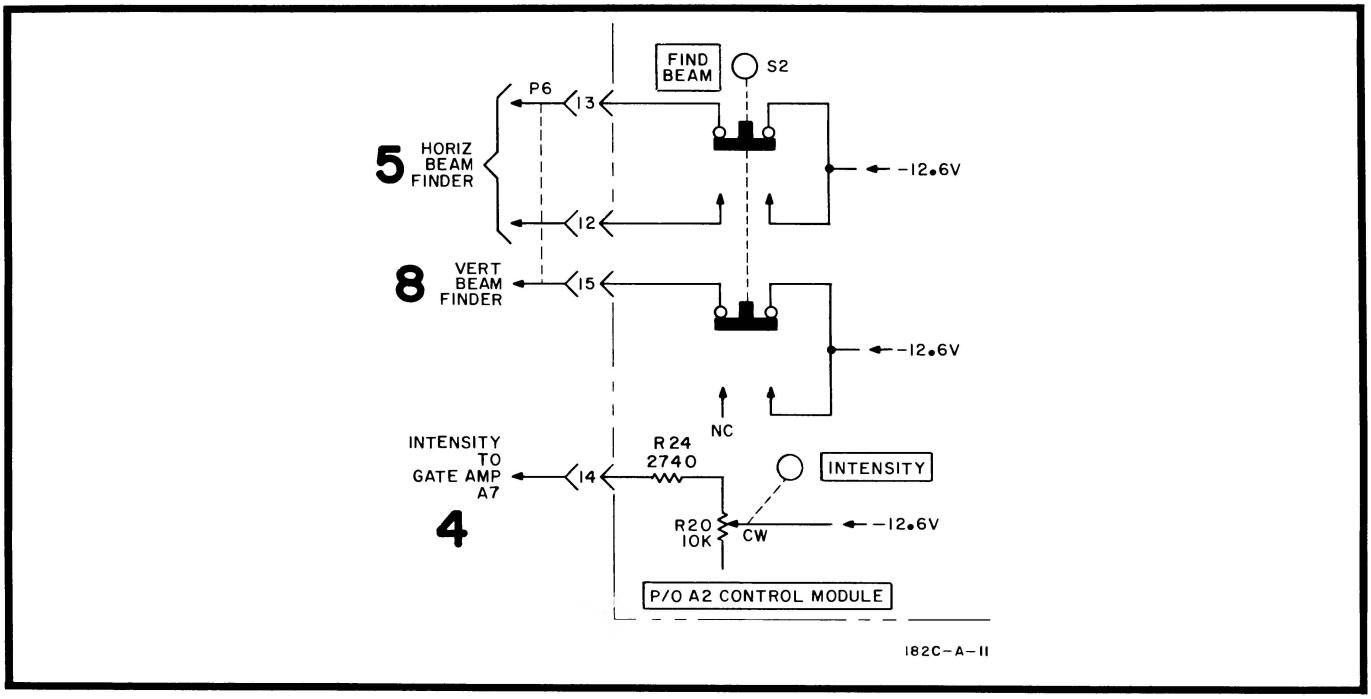


Figure 7-1. Option 011 Beam Finder Schematic

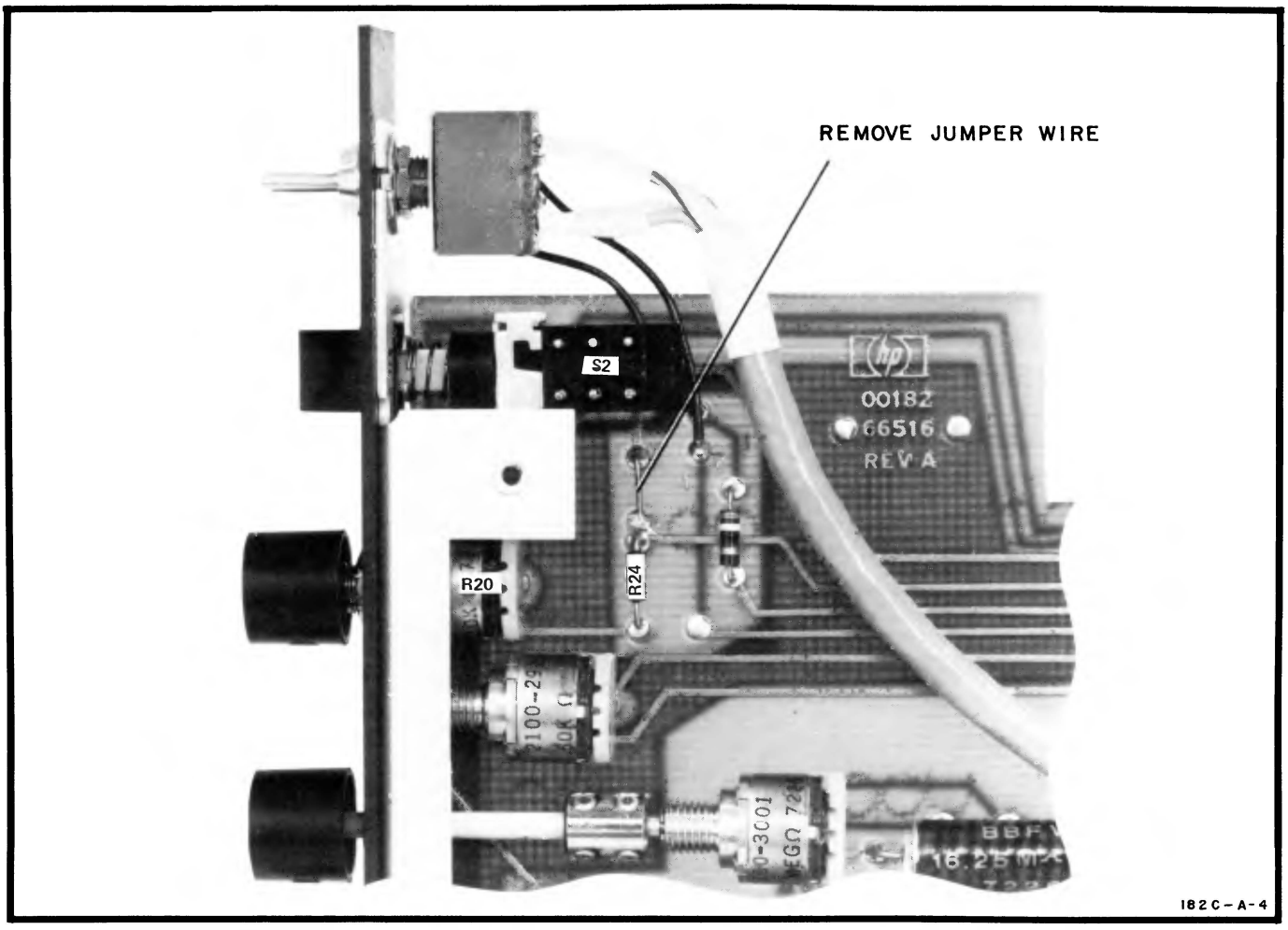


Figure 7-2. Location of Option 011 Circuit Change

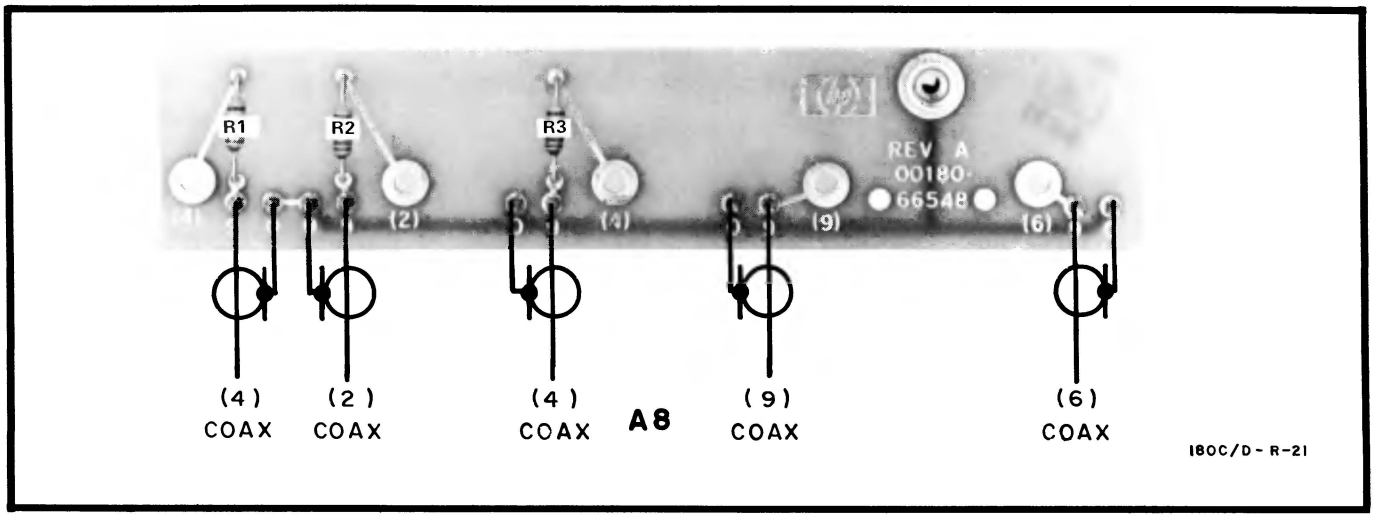


Figure 7-3. Auxiliary Output Board Component and Connection Identification

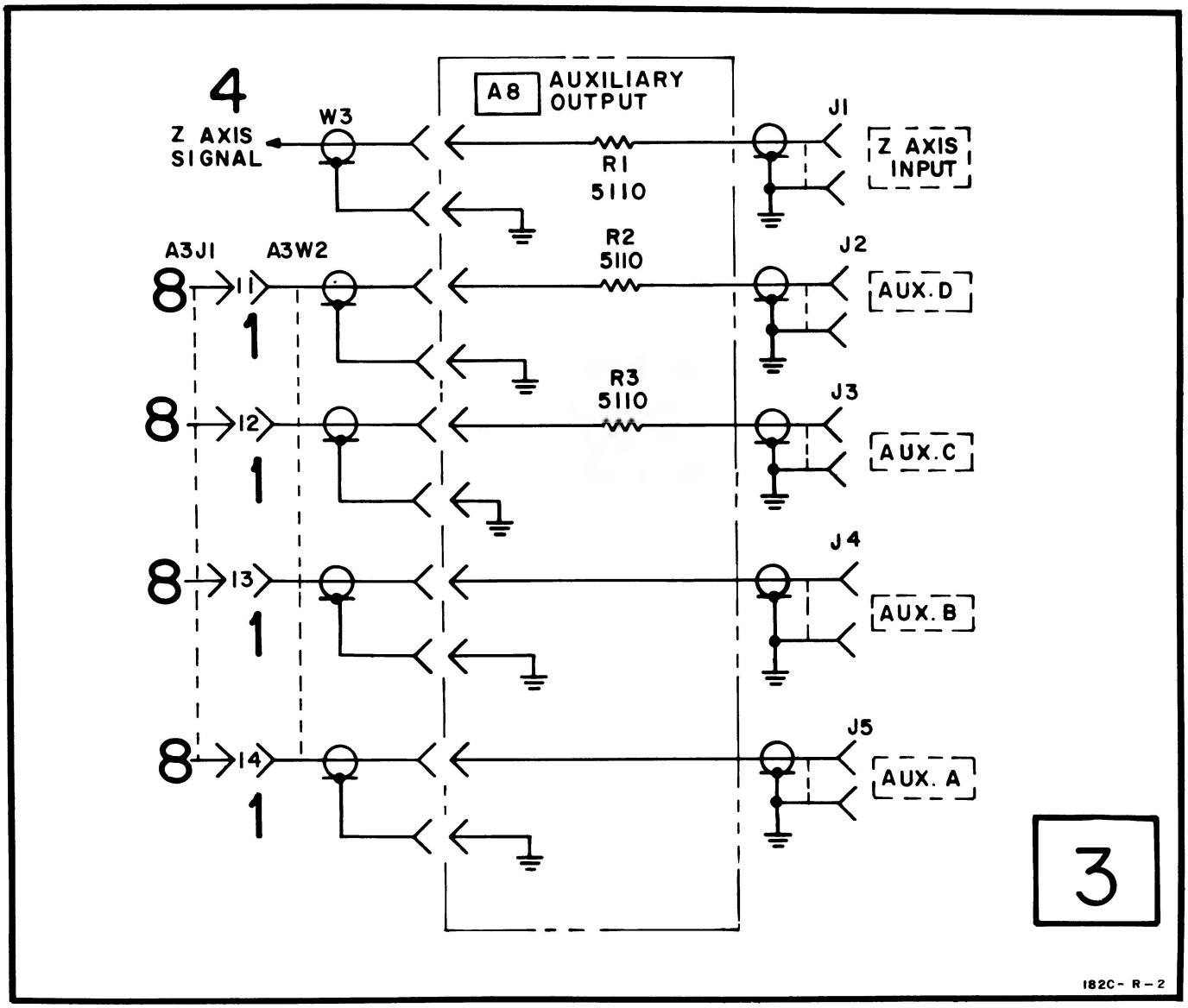
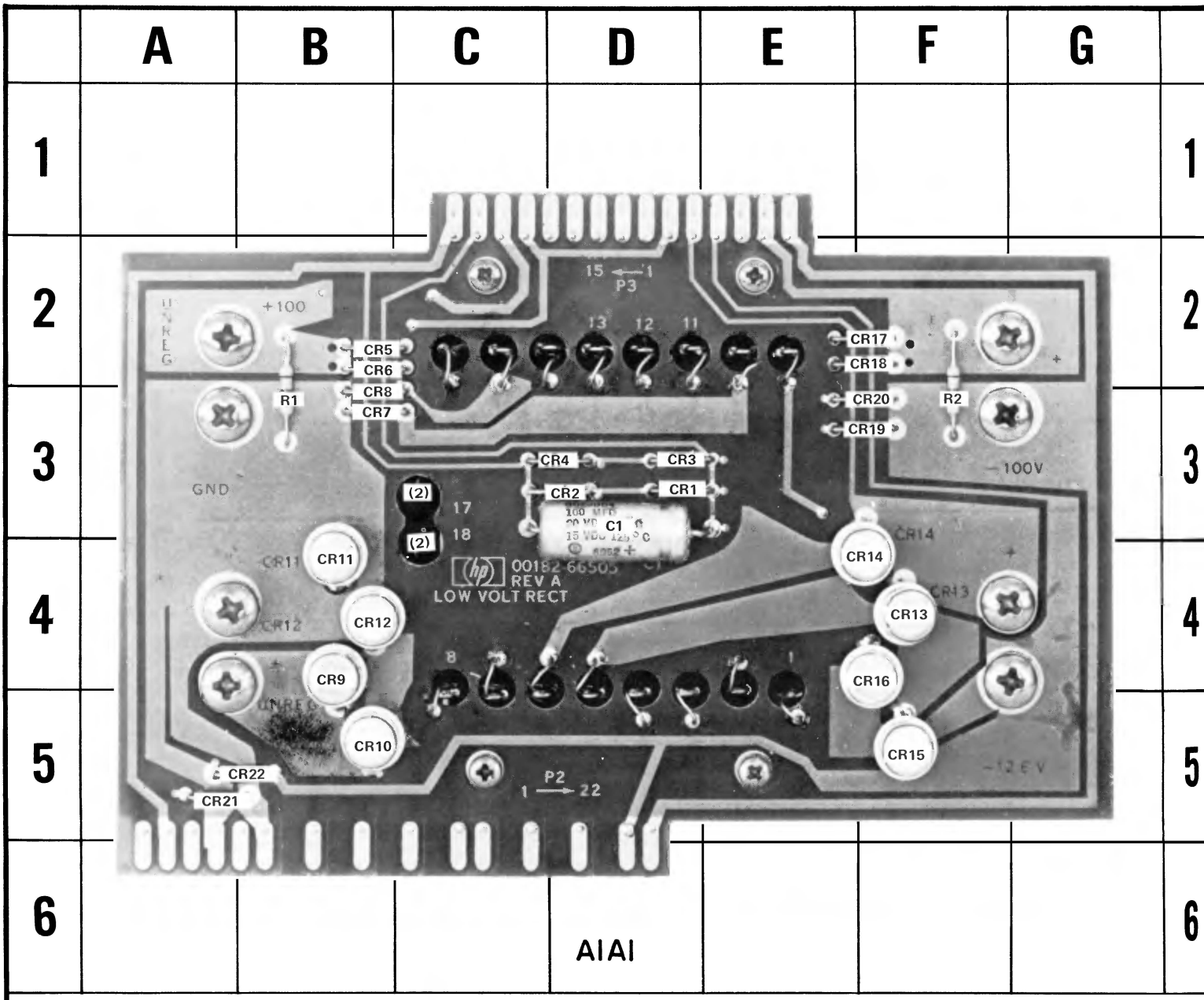


Figure 7-4. Auxiliary Output Schematic

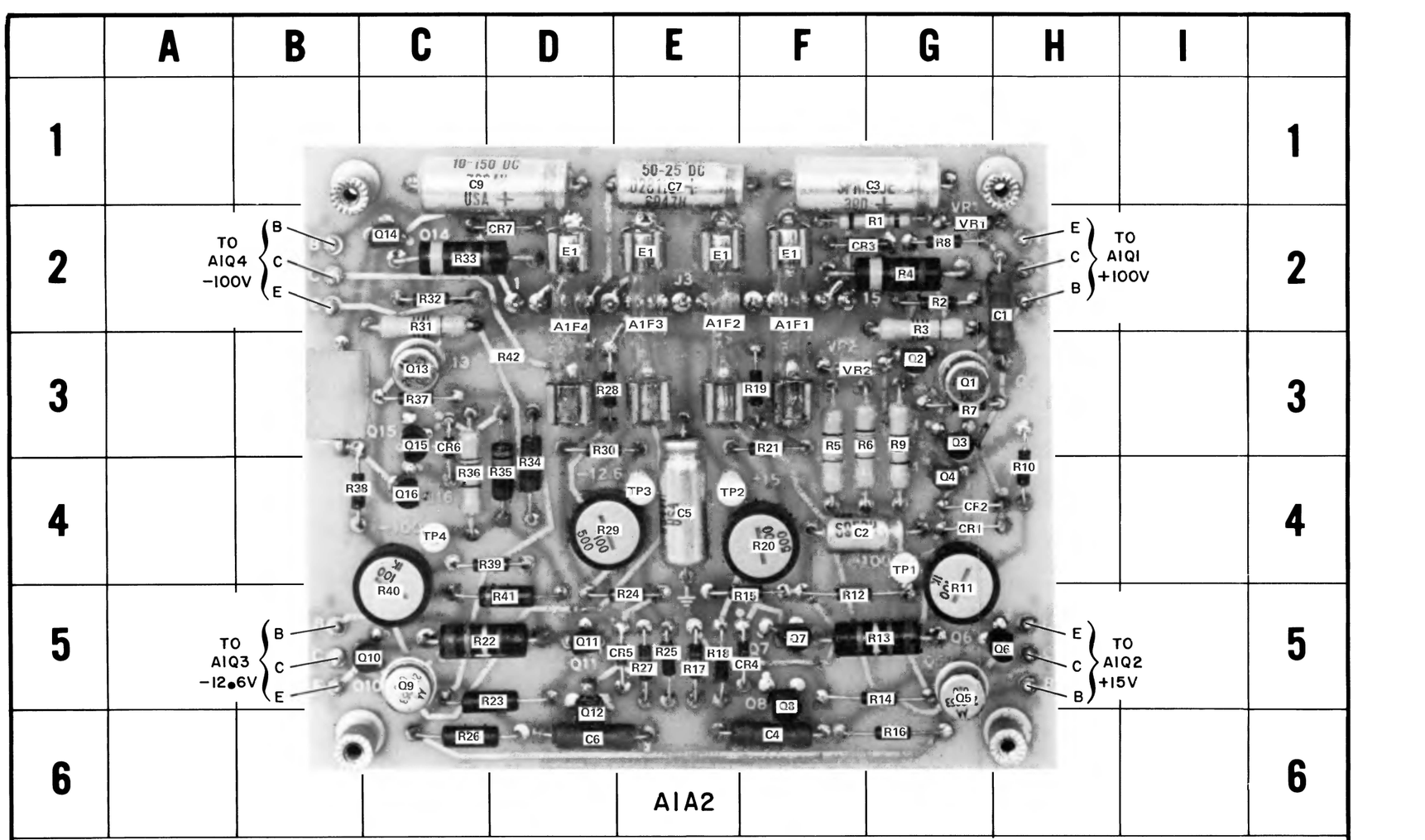


Note: Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	CR5	B-2	CR10	B-5	CR15	F-5	CR20	F-3
CR1	D-3	CR6	B-2	CR11	B-4	CR16	F-4	CR21	A-5
CR2	D-3	CR7	B-3	CR12	B-4	CR17	F-2	CR22	B-5
CR3	D-3	CR8	B-3	CR13	F-4	CR18	F-2	R1	B-3
CR4	D-3	CR9	B-4	CR14	F-4	CR19	F-3	R2	F-3

182A-8-

Figure 7-5. Low Voltage Rectifier (A1A1) Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
A1F1	F-2	C1	H-2	CR4	E-5	Q5	G-5	R1	G-2	R13	G-5	R25	E-5	R37	C-3
A1F2	E-2	C2	F-4	CR5	E-5	Q6	H-5	R2	G-2	R14	G-5	R26	C-6	R38	B-4
A1F3	E-2	C3	G-1	CR6	C-3	Q7	F-5	R3	G-2	R15	F-5	R27	E-5	R39	D-4
A1F4	D-2	C4	F-6	CR7	D-2	Q8	F-5	R4	G-2	R16	G-6	R28	D-3	R40	C-5
		C5	E-4	E1	D-2	Q9	C-5	R5	F-3	R17	E-5	R29	D-4	R41	D-5
		C6	D-6	E1	E-2	Q10	C-5	R6	F-3	R18	E-5	R30	D-3	R42	D-3
		C7	E-1	E1	E-2	Q11	D-5	R7	G-3	R19	F-3	R31	C-2	TP1	G-4
		C9	D-1	E1	F-2	Q12	D-6	R8	G-2	R20	F-4	R32	C-2	TP2	E-4
		CR1	G-4	Q1	G-3	Q13	C-3	R9	G-3	R21	F-3	R33	C-2	TP3	E-4
		CR2	G-4	Q2	G-3	Q14	C-2	R10	H-4	R22	C-5	R34	D-4	TP4	C-4
		CR3	F-2	Q3	G-3	Q15	C-3	R11	G-5	R23	D-5	R35	D-4	VR1	G-2
				Q4	G-4	Q16	C-4	R12	F-5	R24	E-5	R36	C-4	VR2	F-3

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

182A-8-4A

Figure 7-6. Low Voltage Regulator (A1A2) Component Identification

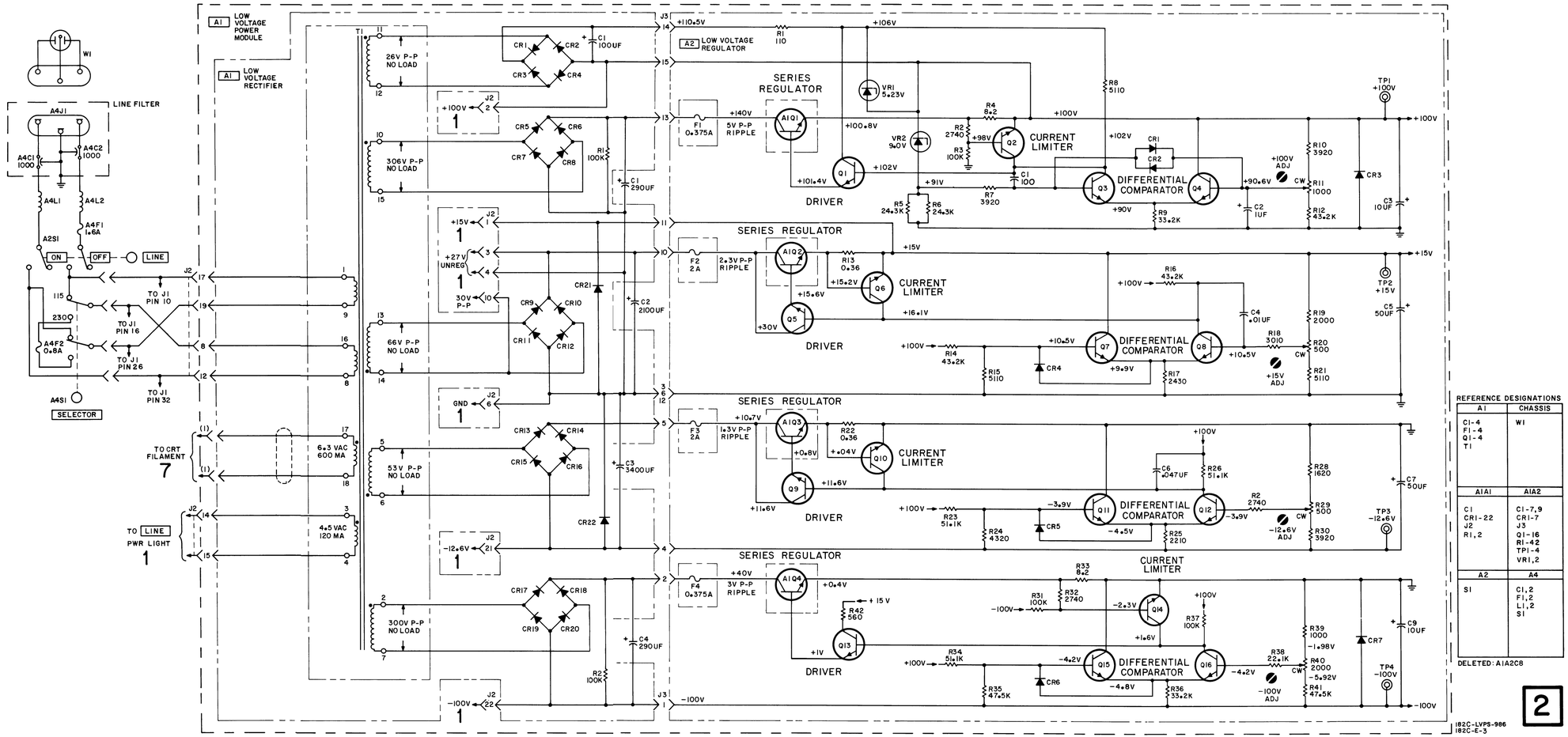


Figure 7-7
Low Voltage Power Supply (A1) Schematic 2

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematics, repair and replacement information, component identification illustrations, and troubleshooting and repair information. Table 8-1 defines symbols and conventions used on the schematics. The overall block diagram is located in Section IV.

8-3. SCHEMATICS.

8-4. Schematic diagrams appear on right hand pages that unfold outside the right edge of the manual. This allows viewing the schematics while referring to text and figures in another section of the manual.

8-5. The schematics are drawn primarily to show the electronic function of the circuit and instrument. A given schematic may include all or part of several assemblies. Schematics also include dc voltages and waveforms at helpful points. Information explaining the symbols and conventions used in these schematics is provided by Table 8-1. Voltage measurement conditions applicable to each schematic are shown next to the schematic.

8-6. Each schematic is identified by a code number. The number of the schematic is located in the lower right hand corner near the figure number and title. These numbers are used to make it easy to trace a circuit that begins on one schematic and is continued on another. When a circuit leaves a schematic it is identified with the code number of the schematic on which it is continued. Both schematics have the same circuit identification information such as voltage, function or circuit connection

8-7. REFERENCE DESIGNATIONS.

8-8. The unit system of reference designations used in this manual is in accordance with provisions of the USA Standard Reference Designations for Electrical and Electronic Parts and Equipments dated March 1, 1968. Minor variations due to design and manufacturing practices not specifically covered by the standard may be noted.

8-9. Each electrical component is identified by a class letter and number. This letter-number combination is the basic designation for each component. Components that are separately replaceable and are part of an assembly have, in addition to the basic designation, a prefix designation indicating the assembly on which the component is physically located. Components not located on an assembly will have only the basic designation and are listed in the replaceable parts list (Section VI) under chassis parts.

8-10. All components within the shaded areas on the schematics are physically located on an etched circuit board and should be prefixed with the assembly number assigned to the board (e.g. resistor R23 on assembly A3 is referred to as A3R23). There may also be an R23 on several other assemblies, but the assembly designation will always be different (A2R23, A1R23, etc.).

8-11. COMPONENT LOCATION.

8-12. All adjustments are shown in Section V, and mechanical and miscellaneous electrical parts are shown on exploded view drawings in Section VI. For ready reference, circuit assembly photographs are placed adjacent to the associated schematics.

8-13. Circuit assembly photographs are subdivided by a grid, and components within each subdivision are indexed to a location table below the photograph. A component can be easily located on the photograph by first referring to the table. However, reference designators are not complete on the assembly photographs. For the complete reference designator, prefix the assembly designation given in the photograph to each component designator.

8-14. TROUBLESHOOTING.

8-15. The most important prerequisite for successful troubleshooting is understanding how the instrument operates and correct usage of 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. 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.

8-18. 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.

8-19. PRELIMINARY CHECKOUT.

8-20. To help isolate malfunctions, perform the following checkout procedure:

a. Check for improper control settings (refer to Section III).

b. Check for proper operation of accessory equipment.

c. Visually inspect instrument for loose wire and cable connections. Check wiring to all board assemblies for proper connections.

d. Visually inspect for burned, broken or chafed wires; charred or discolored components; and any other indication of physical damage.

e. Check for proper power supply voltages and determine that fuses are not open.

8-21. DETAILED CHECKOUT.

8-22. If the trouble cannot be located using the preliminary checkout procedures, a detailed check of the circuits will be necessary. Troubleshooting charts, waveforms, and voltages are provided to help in locating problem areas and components. The troubleshooting charts and waveforms are to be used to isolate the problem to a specific area. The voltages can then be used to locate the faulty component within the problem area.

CAUTION

When taking waveform or dc voltage measurements, use extreme care to avoid shorting supply voltages or components.

8-23. Dc voltages are shown on the schematics near active components such as transistors. Waveforms are also placed on the schematics at points which will assist in determining proper circuit operation. As an aid to locating measurement points, a small dot is etched on the circuit board next to the emitter lead of each transistor, the source lead of FET's, the cathode end of diodes and the positive end of electrolytic capacitors. Use these points to assist in voltage and resistance measurement tests and as guidance in properly replacing components.

8-24. TROUBLESHOOTING TABLES.

8-25. Troubleshooting tips are given in several tables. The tables are 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.

8-26. REPAIR AND REPLACEMENT.

8-27. 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.

8-28. SERVICING ETCHED CIRCUIT BOARDS.

8-29. Etched circuit boards in this instrument have components mounted on one side of the board, conductive surfaces on both sides, and plated-through component mounting holes. Hewlett-Packard Service Note M-20E contains useful information on servicing etched circuit boards. Some important considerations are as follows:

a. Use a 37 to 47.5 watt chisel tip soldering iron with a tip diameter of 1/16 to 1/8 inch, and a small diameter rosin core solder.

b. Components may be removed by placing the soldering iron on the component leads on either side of the board and pulling the component straight away from the board. If heat is applied to the component side of the board, greater care is required to avoid damage to the components, especially semi-conductors. Heat damage may be minimized by gripping the lead with long nose pliers between the soldering iron and the component, thereby forming a heat sink.

c. If a component is obviously damaged or faulty, clip the leads close to the component and then unsolder the leads from the board.

d. Large components, such as potentiometers, may be removed by rotating the soldering iron from lead to lead and applying steady pressure to lift the part free. The alternative is to clip the leads of the damaged part and remove them individually.

e. Excessive heat or force will destroy the laminate bond between the metal plated surface (conductor) and the board. If this problem should occur, the lifted conductor may be cemented down with a small amount of quick-drying acetate-base cement having good insulating properties. Another method of repair is to solder a section of good conducting wire along the damaged area.

f. Before replacing a component, heat the remaining solder in the component hole and clean it out with a toothpick or "solder sucker". Sharp pointed metallic tools are not recommended since they may loosen eyelets in boards or remove plating from the inside of holes on plated-through etched circuit boards.

g. Tin and shape replacement component leads to fit existing holes.

h. Install the replacement component in the same position as the original.

8-30. SEMICONDUCTOR REPLACEMENT.

8-31. 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.

8-32. 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.

8-33. DETAILED TROUBLESHOOTING.

8-34. The following troubleshooting tips are categorized according to the various areas of the instrument. These tips can be helpful only after a trouble is localized to one of these areas. Read the theory of operation in Section IV to learn how a circuit should operate. With the aid of this information, it is easier to discover why a defective circuit is inoperative. Finally, make resistance checks to uncover the faulty component. If it appears necessary to calibrate the instrument, refer to Section V for the proper procedures.

8-35. LOW VOLTAGE POWER SUPPLY.

8-36. Fuses, test points for measuring regulated output voltages and voltage adjustment controls are located on the low voltage regulator assembly. Access to the assembly is obtained by removing the instrument rear panel. Each low voltage supply is fused. The fuses are in series with the regulator transistors, and all regulated output power flows through the fuse for the respective supply.

8-37. Since the +100V and −100V supplies are current fold-back limited, and the +15V and −12.6V supplies are current limited, an open fuse generally indicates that trouble exists in the regulator portion of the supply. If a fuse is open, check the series regulator transistor, driver transistor and comparator.

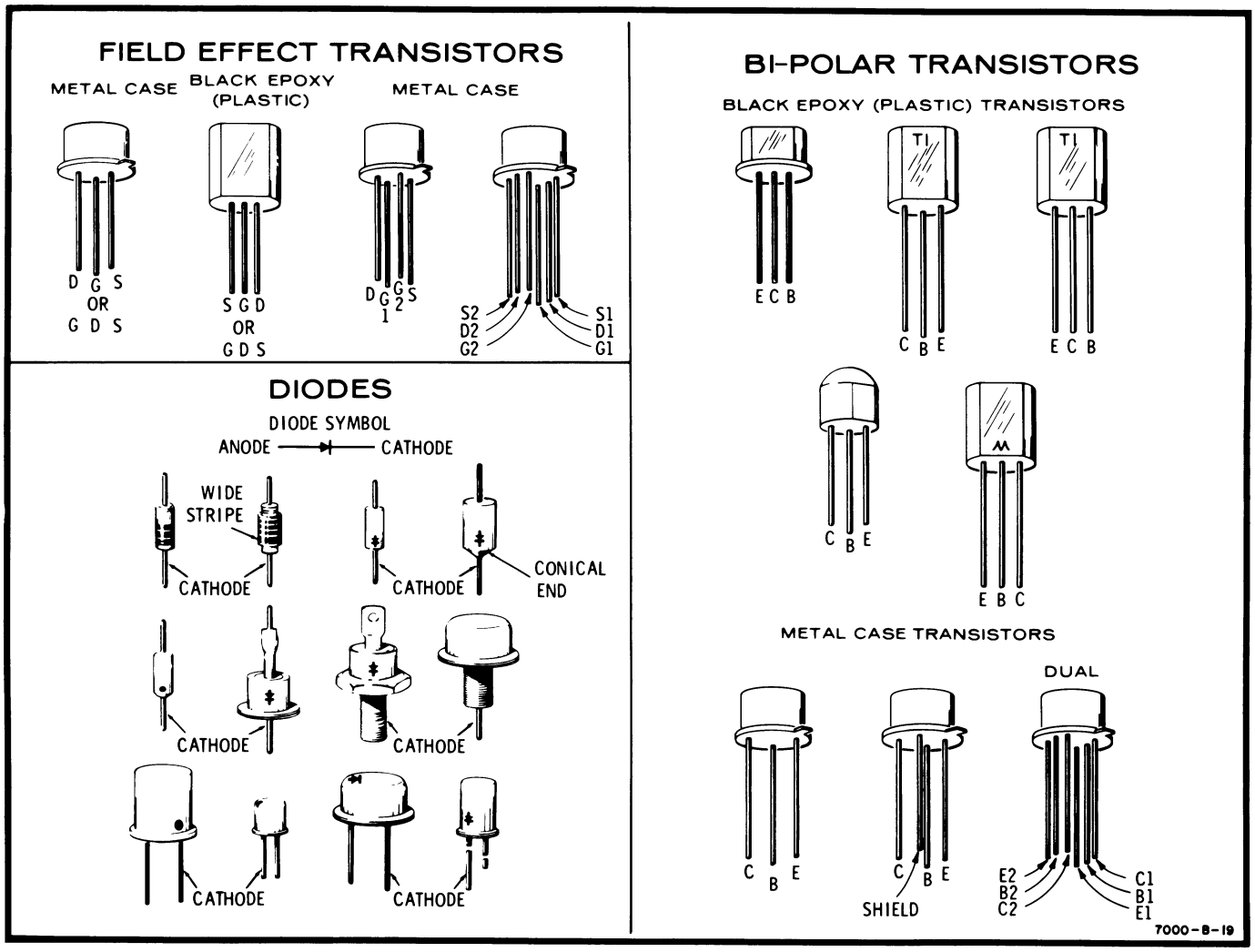


Figure 8-1. Semiconductor Identification

8-38. Troubleshooting the low voltage supply is facilitated by removing the power supply from the oscilloscope. This will provide access to the power transformer, rectifiers and filters. Removing the module also disconnects the power supply from all other circuits of the oscilloscope, thus confining the troubleshooting effort to the low voltage supply. The procedure for removing the power supply module is explained later in this section of the manual.

WARNING

Lethal voltages are exposed when the power supply module is operated outside the oscilloscope mainframe.

8-39. The low voltage power module can be powered from the oscilloscope mainframe by using the Model 10133A Service Extender. This provides line voltage power to the module while continuing to control it by the front-panel power LINE switch. The extender does not connect dc operating power to the oscilloscope mainframe. This permits troubleshooting the low voltage supplies with no external circuit loads.

8-40. The +100V supply should be checked first, since all other supplies use it as a reference. Unregulated operation of all of the other supplies may be the result of a defective +100V supply. Use the convenient test points to monitor the regulated output of a supply. If the +100V supply is defective, verify operation of the reference supply which is regulated by the 9-volt zener diode.

8-41. HIGH VOLTAGE POWER SUPPLY AND REGULATOR.

WARNING

Lethal voltages are exposed when the oscilloscope is turned on with the high voltage power supply cover removed.

8-42. High-voltage power supply problems are usually indicated by no display, a display that is too bright, an arcing sound, slow trace shift or blooming or sudden shifts in display intensity. Regulator problems may result in no high-voltage or excessive high-voltage.

8-43. If only one high voltage output is missing, check the appropriate rectifier and filter circuit. If high voltage is present but not properly adjustable, refer to the high voltage troubleshooting tables (Tables 8-7 and 8-8).

WARNING

The CRT post accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

WARNING

The CRT post accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

8-44. If no high voltage is present, check the high voltage oscillator circuitry. The oscillator supply voltage, unregulated +27V, is fused by F3 on the Regulator assembly. The oscillator frequency is approximately 40kHz. With the High Voltage Multiplier output disconnected, (by disconnecting the CRT post-accelerator lead), the oscillator frequency should increase to approximately 50 kHz.

8-45. The CRT cathode and grid high voltage leads can be disconnected by removing the CRT socket. This will further isolate the trouble. If it is determined that the H.V. Multiplier is faulty, it must be replaced as a complete unit, since it is a sealed assembly.

8-46. DISASSEMBLY INFORMATION.

8-47. If it is necessary to remove an assembly for servicing or replacement, the following information will provide guidance in accomplishing this in a manner to prevent damage and facilitate removal and replacement.

8-48. The instrument has been designed to readily permit disassembly for component removal, troubleshooting or replacement. Each module is a plug-in type, and may be removed without unsoldering any connections. Single or multi-contact connectors are used throughout for signal, control and operating power connections.

8-49. COVER REMOVAL.

8-50. The instrument has a two-piece cover. Remove the covers as follows:

a. Ensure that LINE power switch is OFF and disconnect power plug from line power source.

b. Set oscilloscope on rear end.

c. Release the 3 quarter-turn fasteners located on each side of the instrument. The cover retainers will be completely free. Figure 8-2 shows the location of the fasteners.

d. Loosen 2 captive screws located on handle ends.

e. Remove top cover by expanding slightly and pulling away from instrument.

f. Remove bottom cover by extending tilt stand, expanding and pulling away from instrument.

g. Return instrument to horizontal position and remove rear access cover by releasing single quarter turn fastener.

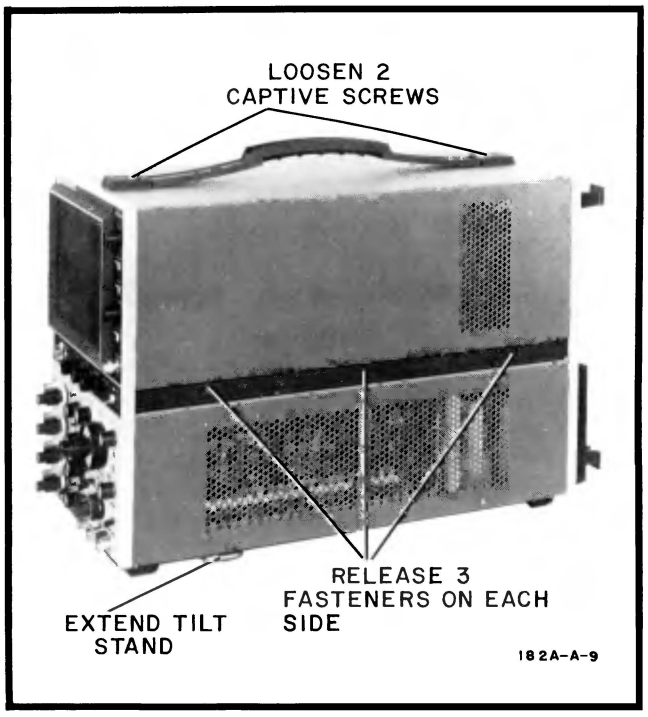


Figure 8-2. Cover Removal

8-51. POWER MODULE REMOVAL.

8-52. The low voltage power module includes the power transformer, low voltage rectifier assembly, low voltage regulator assembly, and the series regulators. The entire module is removable as a unit which can be further disassembled if desired.

8-53. To remove the power module, disconnect ac power input, remove the covers and proceed as follows:

a. Set the instrument on rear end.

b. Remove 4 screws located on bottom rear of instrument.

c. Return instrument to horizontal position and remove 2 rear screws. One screw is located on top of each series regulator heat sink. Do not remove screws holding rear feet to heat sink or screws located below rear feet.

d. Disconnect CRT filament lead connectors (brown wires) from rectifier assembly using long-nosed pliers and lifting straight up. (CRT filament leads may also be disconnected later, refer to step e.)

WARNING

Filament leads operate at -3150 Volts when power is on.

e. Remove module by grasping filter capacitors on each side and pressing toward rear of instrument. If CRT filament leads were not disconnected previously, be careful to pull module only partially free. Then disconnect filament leads and remove module.

8-54. CONTROL ASSEMBLY REMOVAL.

8-55. This assembly includes the calibrator, CRT controls, and LINE power switch.

8-56. To remove the Controls assembly, disconnect ac power input, remove the covers, and proceed as follows:

a. Disconnect 5 square-pin connections between cable, located on the underside of the assembly, and the Interconnect assembly circuit board.

b. Disconnect 8 square-pin connections located on the top side of the assembly. Use a long-nosed pliers and pull connections straight off to remove. These consist of: CRT focus (2 right-angle connections), trace alignment (2 connections), CRT flood gun (2 connections), CRT mesh, (1 connection), and ground (1 connection).

c. Remove 4 screws from underside of Control assembly. Two screws hold the assembly to the front casting frame and also hold the focus high voltage shield in place. The other 2 screws are located approximately at the center of the assembly.

d. Grasp the assembly internal to the instrument and remove with a straight pull toward the front of the instrument. Do not remove by pulling on knobs. Be careful that square-pins located on top of the assembly do not catch on front casting frame.

8-57. AC POWER INPUT MODULE REMOVAL.

8-58. The power input module contains the line power jack, line filter, fuse holders and LINE SELECTOR switch. It may be partially removed for servicing or completely removed if necessary.

8-59. Partial removal is possible since the cable carrying ac line power is long enough to expose the components without disconnecting the cable. To release the module, disconnect ac power input and remove the 2 screws holding the panel in place. Pull the module to the rear of the instrument.

8-60. If complete removal is desired, either remove the low voltage power module or open the upper rear panel. This exposes the ac line power cable connections to the Interconnect assembly. Then disconnect 6 square-pin connections from the cable to the Interconnect assembly circuit board. The module can now be completely removed from the oscilloscope.

8-61. SWEEP-GATE ASSEMBLY REMOVAL.

8-62. The Sweep-gate amplifier is located on the upper rear panel of the instrument. It is exposed for servicing by removing 4 screws holding the rear panel to the rear casting frame. (Do not remove rear feet from panel.) If complete removal is desired, disconnect 12 square-pin connections to the assembly. Five BNC connectors and one screw hold the circuit board to the rear panel.

8-63. GATE AMPLIFIER ASSEMBLY REMOVAL.

8-64. Disconnect ac power input and remove the instrument top cover. Then proceed as follows:
held in place by 4 screws. (Do not remove rear feet.) Then proceed as follows:

a. Disconnect Gate Out coaxial cable (2 square-pin connections) from rear of Gate Amplifier.

b. Remove 2 screws from rear casting frame.

c. Remove by pulling assembly back and pivoting connector end out of mainframe.

8-65. HORIZONTAL MODULE REMOVAL.

8-66. To remove the Horizontal module, use the following procedure:

a. Disconnect ac power input and remove the instrument top cover.

b. Disconnect 2 horizontal deflection cable pin connections from CRT neck.

c. Remove 2 screws holding bottom of circuit board to oscilloscope frame and 1 screw located at top center of circuit board.

d. Remove 1 screw from front casting frame.

e. Slide module toward front of instrument to disconnect module and turn rear of module to outside of oscilloscope mainframe.

f. Bend horizontal deflection cable forward and flat against rear of module.

g. Carefully slide module toward front of instrument for removal.

h. When reinstalling, be certain that horizontal deflection cable is placed toward front of module before installing. After module is inserted, bend cable toward rear before making connection to oscilloscope connector.

8-67. CRT REMOVAL.

8-68. Remove the CRT as follows:

WARNING

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

a. Disconnect ac power input and remove covers from instrument.

b. Disconnect CRT post-accelerator lead at connector mounted on H.V. module. Cable is permanently fastened to CRT. Completely discharge CRT and H.V. Multiplier connections by grounding both plug and jack.

WARNING

The CRT post accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

c. Remove 2 screws holding CRT socket cover to rear panel.

d. Carefully remove CRT socket by gently prying it loose. If desired, the instrument top rear panel may be removed to facilitate socket removal.

e. Disconnect 8 CRT neck pin connections. (See Figure 8-20 for connection identifications.)

f. Remove 4 screws which hold the front bezel in place. These screws are removed from the rear of front casting frame and are located near each corner of the CRT.

g. Loosen circular clamp securing CRT shield to CRT neck.

Note

If the standard P31 phosphor CRT is replaced with a P11 phosphor CRT, circuit modification is required. The increase in intensity from use of the FIND BEAM switch can cause phosphor burn. Refer to Section VII for information about the circuit change required.

h. Slide CRT forward out of shield to remove. Keep one hand on front face of CRT while using other to slide forward. Exercise care to prevent damage to neck pin connections.

8-69. HIGH VOLTAGE MODULE REMOVAL.

8-70. Assemblies in the H.V. module are separately removable. However, if it is desired to remove the module, first remove the CRT. Then proceed as follows:

WARNING

The CRT post-accelerator lead may have a high voltage present even if the instrument has been turned off for a long time. Ground both CRT and H.V. Multiplier connections to discharge.

a. Disconnect CRT post-accelerator lead at connector mounted on H.V. module. Cable is permanently fastened to CRT. Completely discharge CRT and H.V. Multiplier connections by grounding both plug and jack.

b. Remove cover from module by removing two screws.

c. Disconnect four square-pin connections, Gate Coax, Focus, Grid, and Cathode leads, located on rear of H. V. Oscillator and Recifier assembly.

d. Disconnect five-pin connector located on rear of H. V. Regulator assembly.

e. Remove six screws holding module to mainframe top and side struts.

Table 8-1. 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

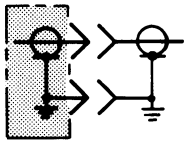
NC = No connection

= Waveform test point (with number)

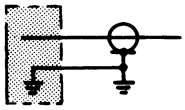
= Common electrical point (with letter) not necessarily ground

= 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

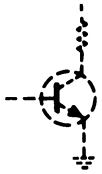
= Field-effect transistor (P-type base)

= Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

= Step-recovery diode

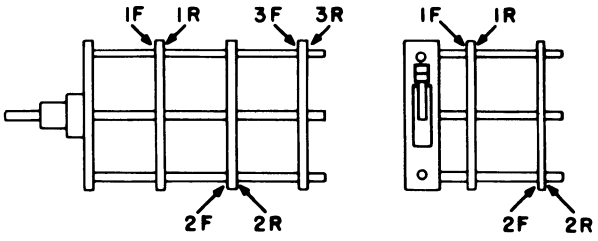


= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

(925) = Wire colors are given by numbers in parentheses using the resistor color code [(925) is wht-red-grn].

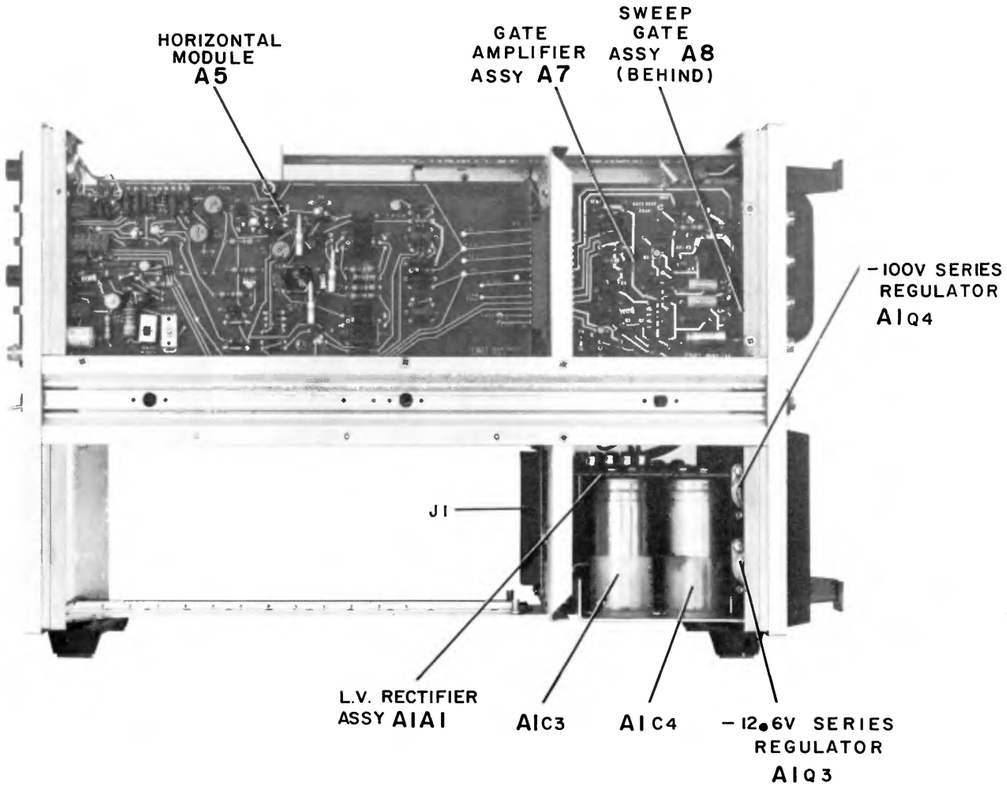
0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

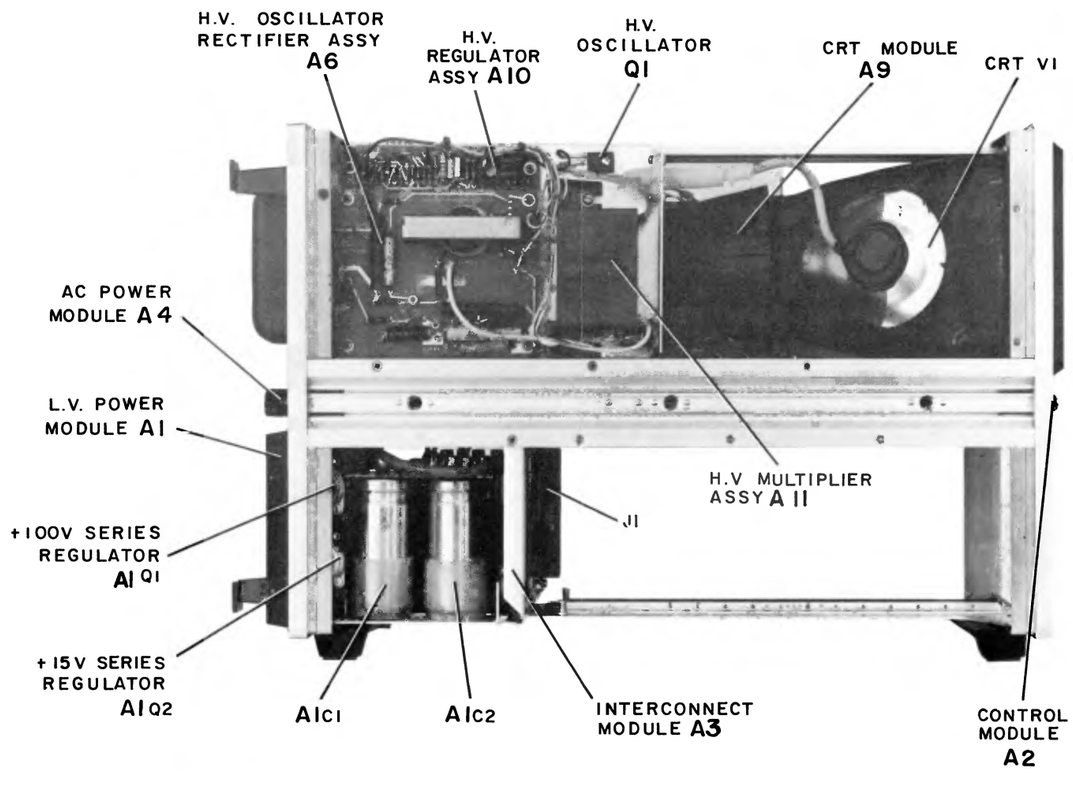
Switch wafers are identified as follows:



* = Optimum value selected at factory, typical value shown; part may have been omitted.

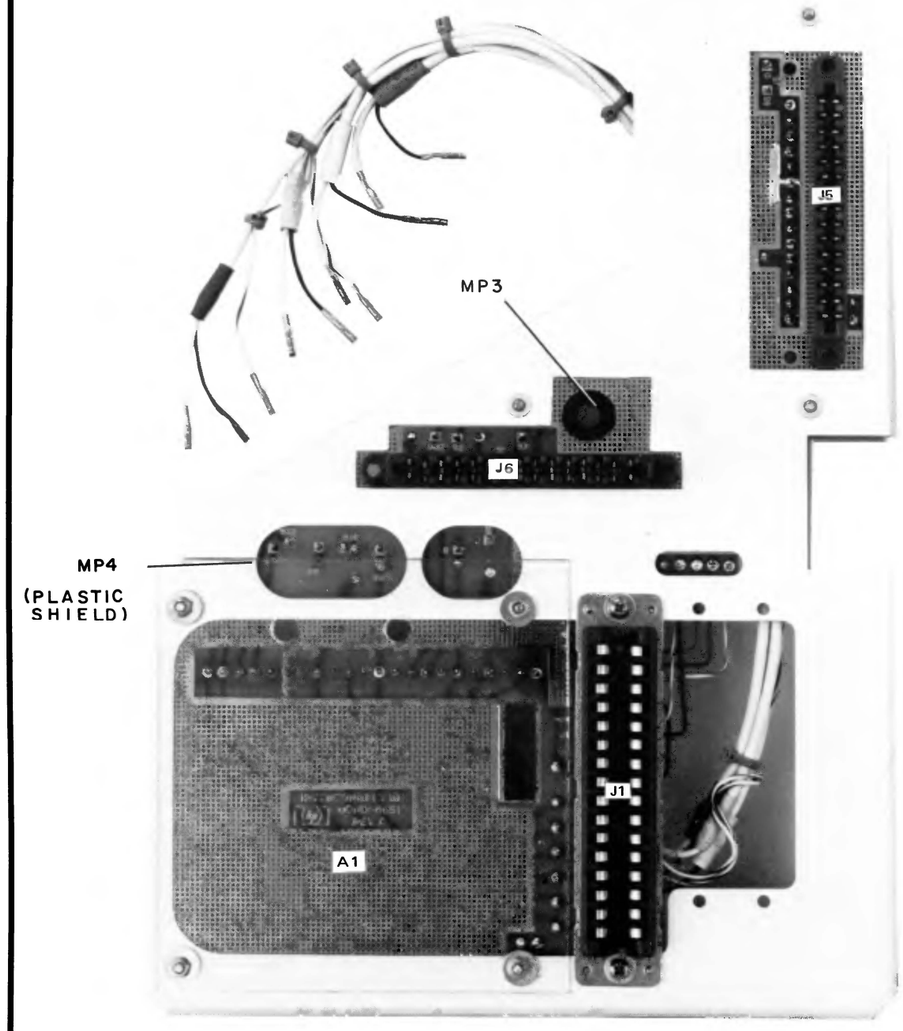
Unless otherwise indicated:
resistance in ohms
capacitance in picofarads
inductance in microhenries





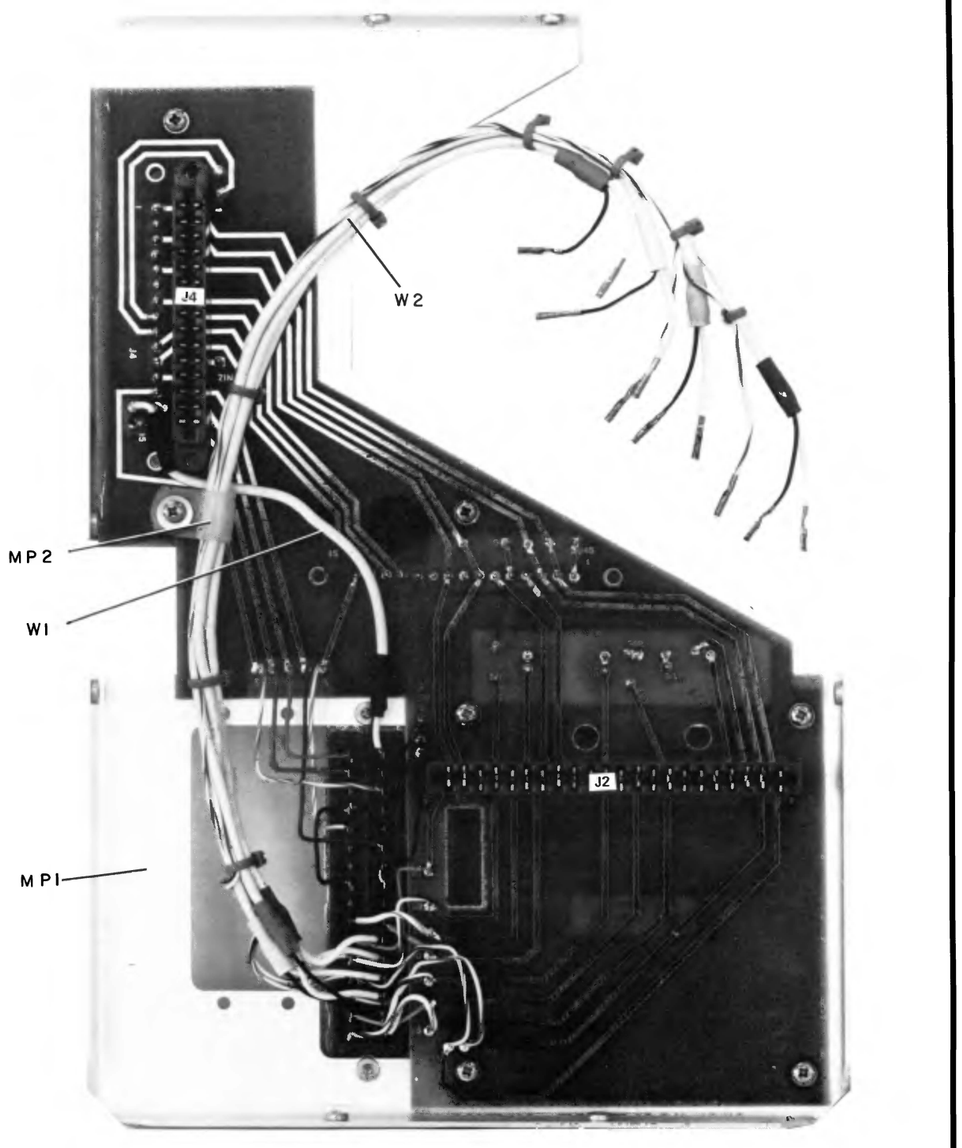
182C-A-7

Figure 8-3.
Mainframe Component Identification



FRONT VIEW

A3



REAR VIEW

182C-A-6

Figure 8-4. Interconnect Assembly (A3) Component Identification

Table 8-2. Miscellaneous Troubleshooting Tips

Symptom	Suggested Checks
Intermittent deflection	Check for loose or corroded connections to CRT neck pins. Check for intermittent open in deflection leads. (Refer to note for additional tips.)
Intensity variation causes trace shift (either axis).	Check for open deflection lead in axis affected. If trouble is vertical axis, check vertical plug-in connector and mating connector in oscilloscope.
No output from Gate or Sweep output jacks.	Check emitter-follower for output affected. Check circuit interconnections (cables, connectors).
Improper Z-axis modulation.	Check normal operation with plug-ins installed. If OK, check connections and check in-puts. (Refer to note for additional tips.)
CRT trace develops distortion over long period.	Instrument may have been subjected to high magnetic field, magnetizing CRT elements. Possible CRT malfunction.
Improper deflection	If symptom is apparent in both vertical and horizontal axes, check High Voltage. If H.V. is low, expanded display results. If H.V. is high, causes contracted display. Vertical axis only: check vertical plug-in, deflection leads and connectors. Horizontal axis only: check with replacement time base plug-in. If OK, problem is in time base plug-in, otherwise check oscilloscope horizontal amplifier, deflection leads and connectors.

NOTE

It may be helpful to isolate the Gate amplifier from the H.V. supply to isolate the problem. Disconnect the Gate Out cable connection from the High Voltage supply and ground the High Voltage Gate Coax connection. This will eliminate the Gate amplifier as a source of H.V. intensity trouble. In this mode, CRT intensity will only be controlled by the INT LIMIT adjustment. This potentiometer is located on the H.V. Osc & Rectifier Assembly, A6.

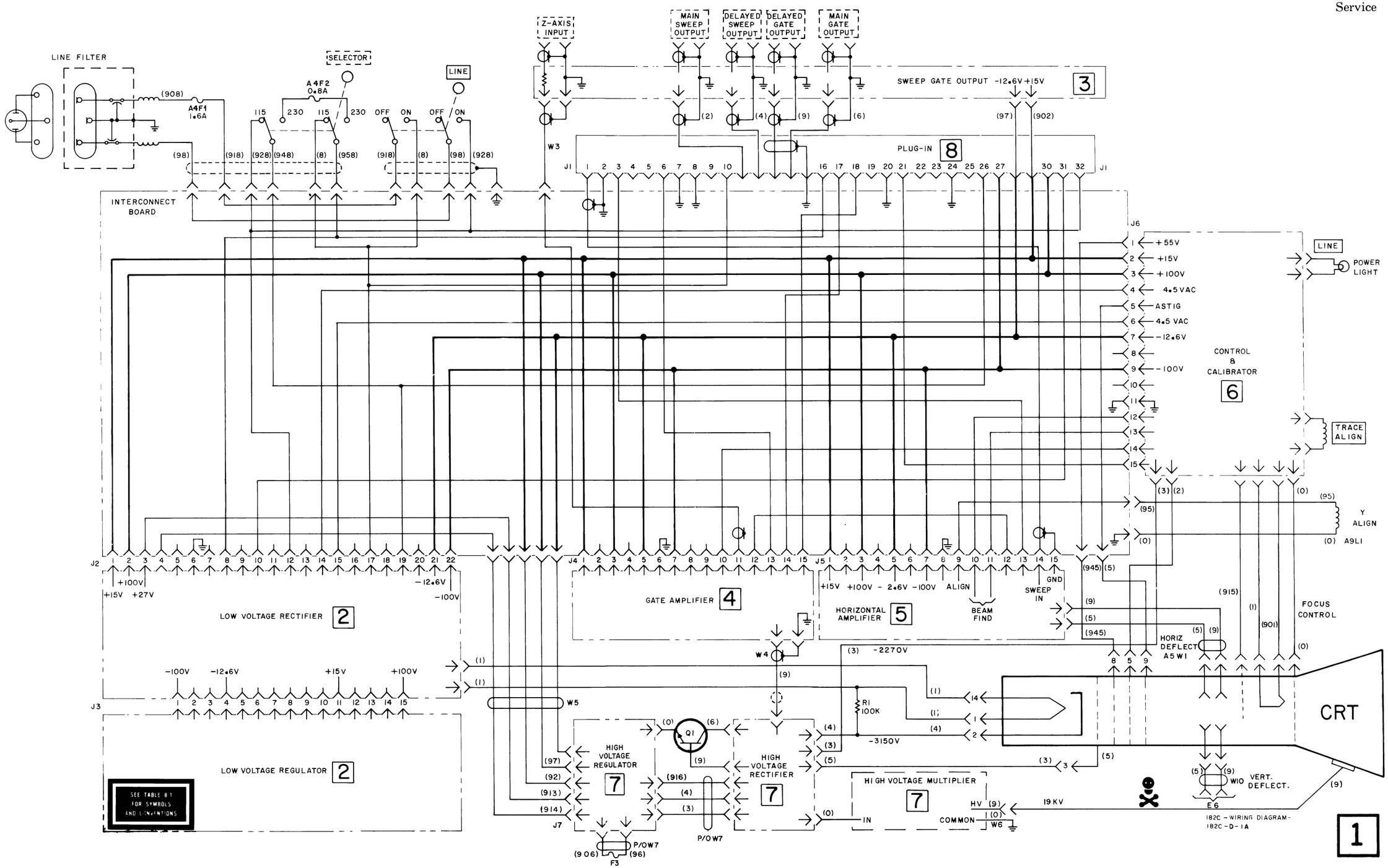
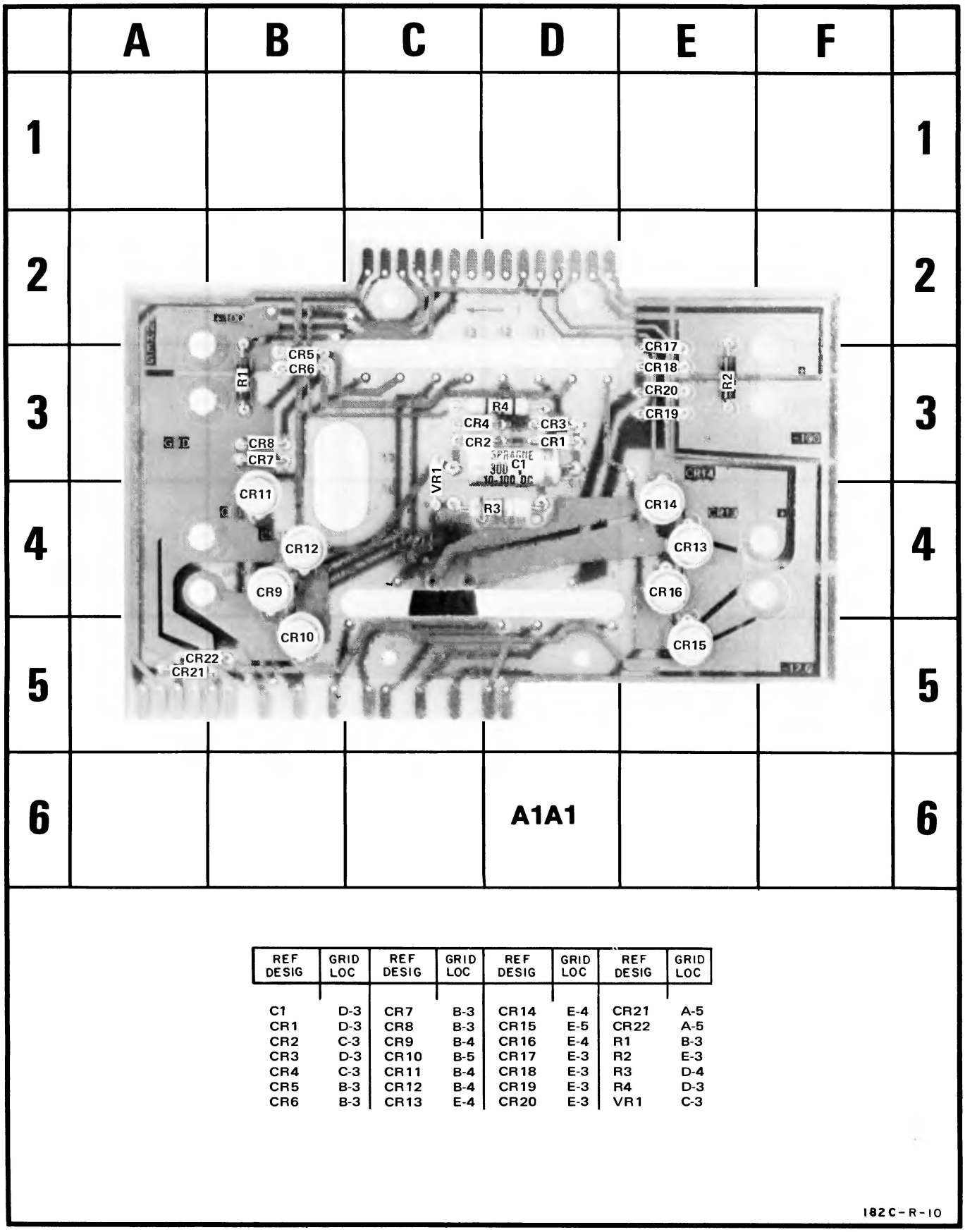
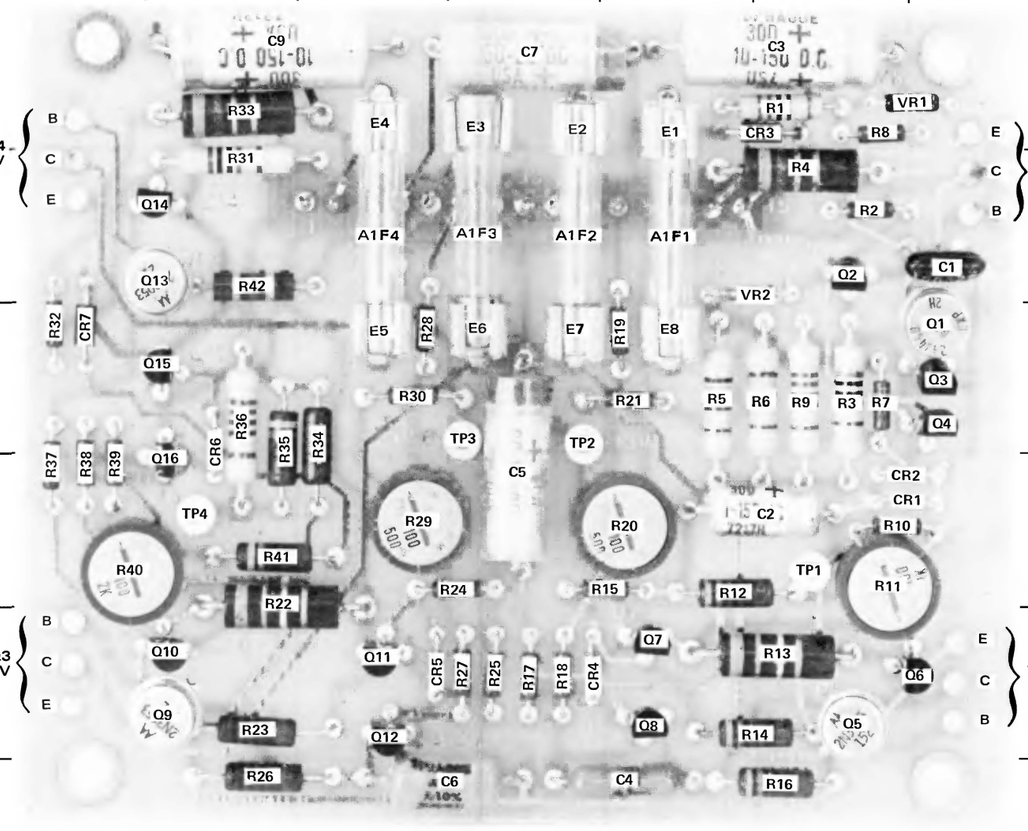


Figure 8-5.
Mainframe Wiring Diagram, Schematic 1



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	CR7	B-3	CR14	E-4	CR21	A-5
CR1	D-3	CR8	B-3	CR15	E-5	CR22	A-5
CR2	C-3	CR9	B-4	CR16	E-4	R1	B-3
CR3	D-3	CR10	B-5	CR17	E-3	R2	E-3
CR4	C-3	CR11	B-4	CR18	E-3	R3	D-4
CR5	B-3	CR12	B-4	CR19	E-3	R4	D-3
CR6	B-3	CR13	E-4	CR20	E-3	VR1	C-3

Figure 8-6. Low Voltage Rectifier (A1A1) Component Identification



A1A2

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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	J-2	CR4	G-5	E-7	G-3	Q5	I-5	Q15	E-3	R9	I-3	R19	H-3	R29	F-4	R39	D-4
C2	I-4	CR5	F-5	E-8	H-3	Q6	J-5	Q16	E-4	R10	I-4	R20	H-4	R30	F-3	R40	D-4
C3	I-1	CR6	E-4	A1F1	H-1	Q7	H-4	R1	I-1	R11	I-4	R21	H-3	R31	E-2	R41	E-4
C4	H-6	CR7	D-3	A1F2	G-2	Q8	H-4	R2	I-2	R12	H-4	R22	E-4	R32	D-3	R42	E-2
C5	G-4	E1	H-1	A1F3	G-2	Q9	E-5	R3	I-3	R13	I-5	R23	E-5	R33	E-1	TP1	I-4
C6	F-6	E-2	G-1	A1F4	F-2	Q10	E-5	R4	I-2	R14	H-5	R24	F-4	R34	F-3	TP2	G-3
C7	G-1	E-3	G-1	Q1	J-3	Q11	F-5	R5	H-3	R15	G-4	R25	G-5	R35	E-3	TP3	G-3
C9	E-1	E-4	F-1	Q2	I-2	Q12	F-5	R6	I-3	R16	I-6	R26	E-6	R36	E-3	TP4	E-4
CR1	I-4	E-5	F-3	Q3	J-3	Q13	E-2	R7	I-3	R17	G-5	R27	G-5	R37	D-4	VR1	J-1
CR2	I-4	E-6	G-3	Q4	J-3	Q14	E-2	R8	I-2	R18	G-5	R28	F-3	R38	D-4	VR2	H-2
CR3	I-1																

184A/B – A – 16

Figure 8-7. Low Voltage Regulator (A1A2) Component Identification

Table 8-3. Low Voltage Power Supply Troubleshooting Tips

Symptom	Suggested Checks *Most common fault.
All supplies low or high and unregulated.	Check ac input line voltage and position of rear-panel SELECTOR switch (115 or 230V) *Check + 100V supply and A1A2VR2. (+100V supply is used as reference for −100V, +15V, −12.6V supplies and A1A2VR2 provides reference voltage for +100V supply).
One supply high and unregulated with high ripple.	Check comparator and series regulator.
One supply low.	Check for excessive current drain. *Check comparator.
No output from one supply.	Check fuse. Check regulator. (Supplies are current limited. Fuse will not open due to shorted load.)
Open line fuse.	Check ac line voltage and position of rear-panel SELECTOR switch. *Check rectifier diodes. Check filter capacitors. Check power transformer.

Table 8-4. Low Voltage Power Supply Measurement Conditions

1. Set controls as follows:

   LINE power ON.

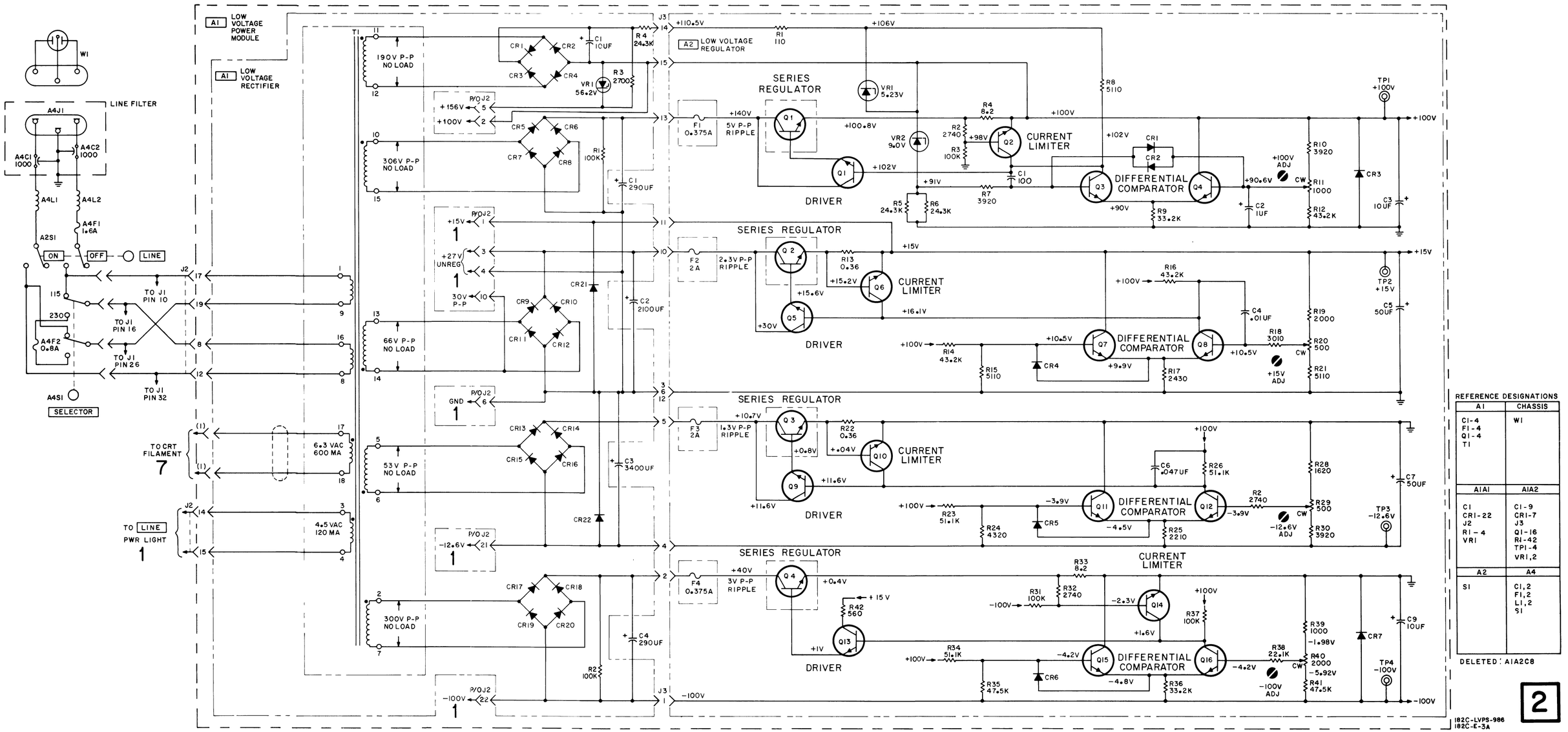
   Plug-ins not installed.

   Line voltage 115 Vac.

2. All dc voltages are referenced to ground.

3. All dc voltages measured with HP Model 1414A Auto Voltmeter. (100 MΩ input impedance).

4. Voltages indicated on schematic remain approximately as indicated when power supply is operated with HP Model 10133A Service Extender.



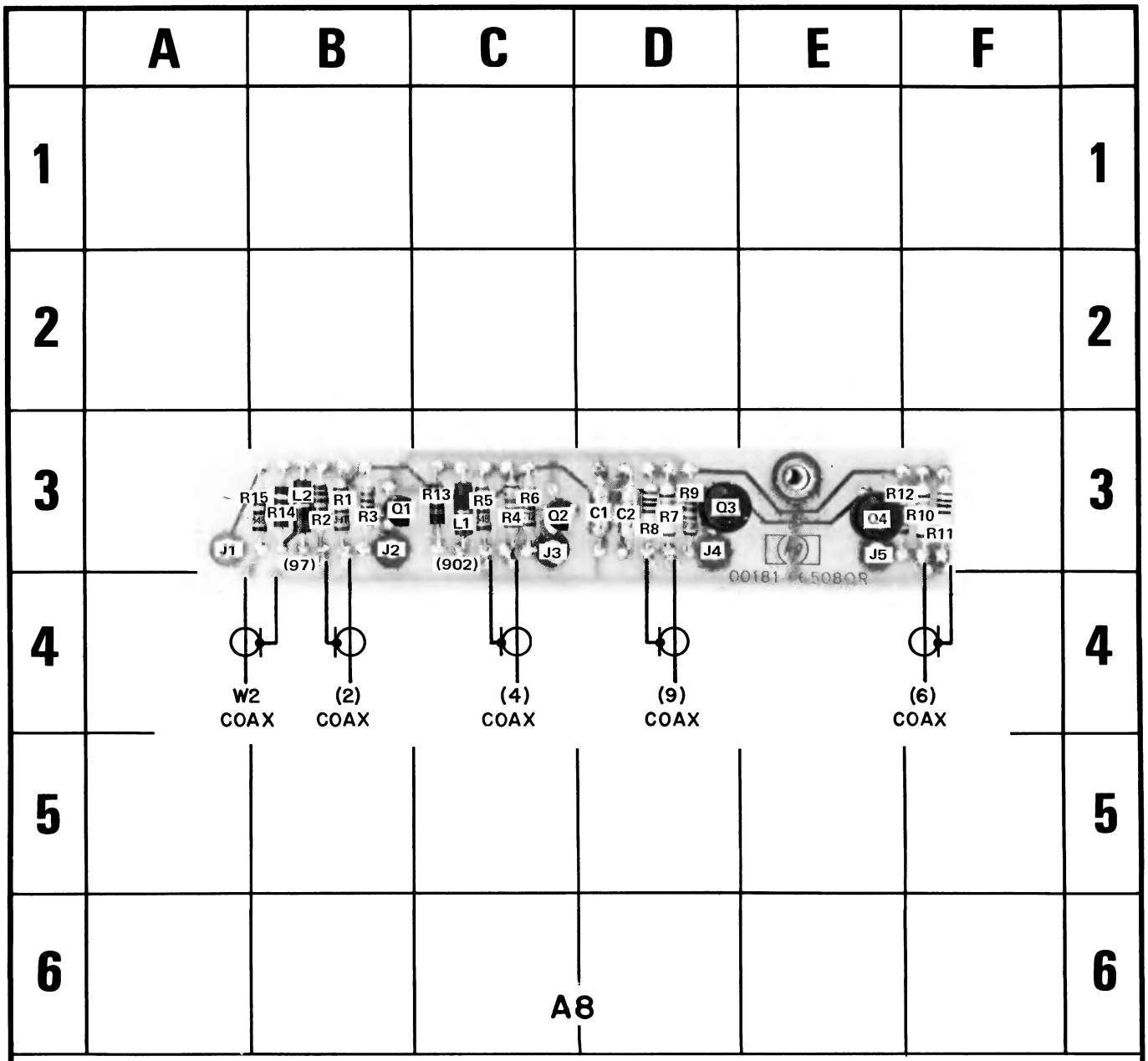
REFERENCE DESIGNATIONS

A1	CHASSIS
C1-4 F1-4 Q1-4 T1	W1
A1A1	**A1A2**
C1 CR1-22 J2 R1-4 VR1	C1-9 CR1-7 J3 Q1-16 R1-42 TP1-4 VR1,2
A2	**A4**
S1	C1,2 F1,2 L1,2 S1

DELETED: A1A2C8

2

Figure 8-8.
Low Voltage Power Supply (A1) Schematic 2
8-13/8-14

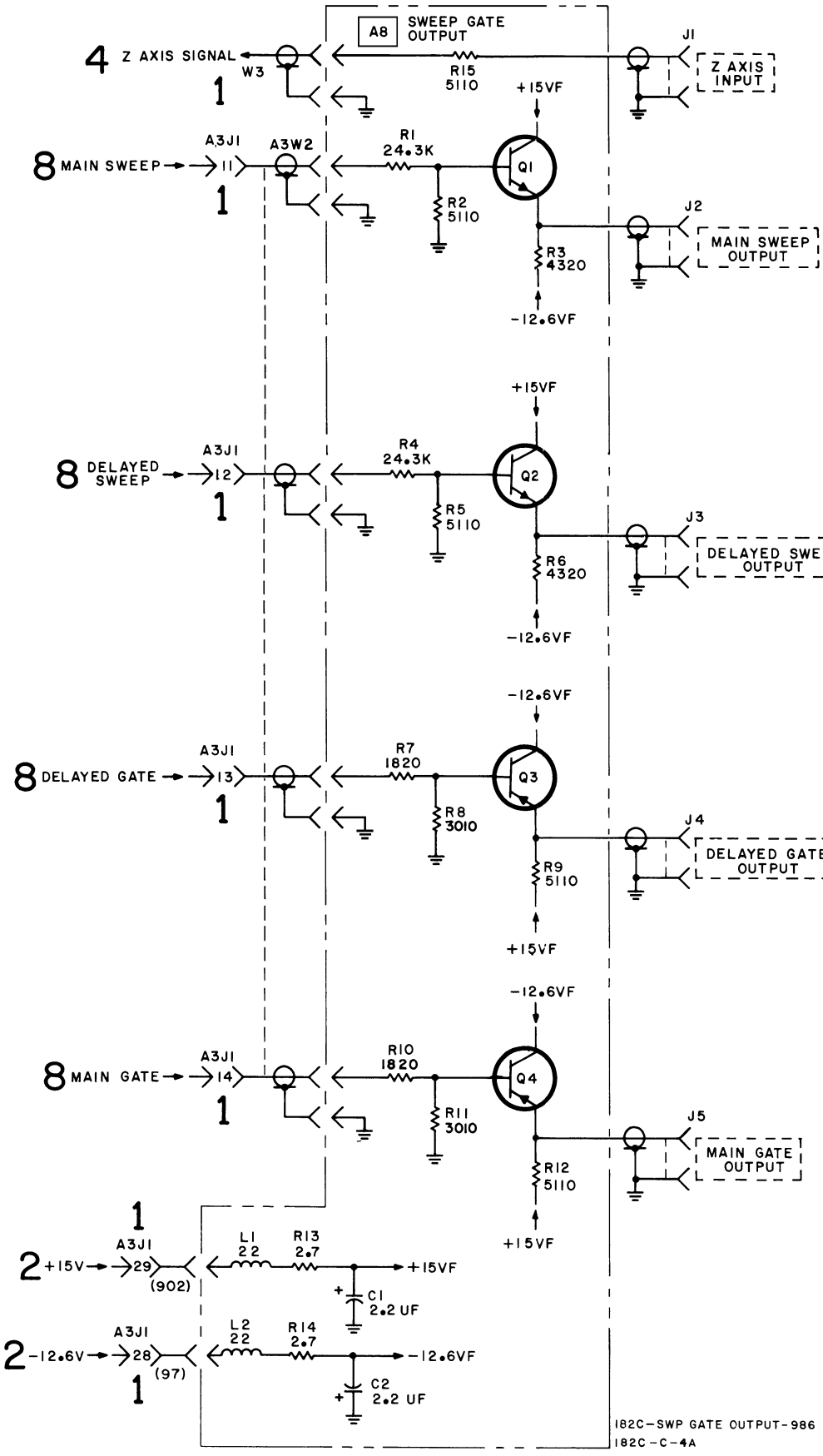


Etched circuit boards have plated-through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	D-3	L1	C-3	R6	C-3	R13	C-3
C2	D-3	L2	B-3	R7	D-3	R14	B-3
J1	A-3	R1	B-3	R8	D-3	R15	B-3
J2	B-3	R2	B-3	R9	D-3	Q1	B-3
J3	C-3	R3	B-3	R10	F-3	Q2	C-3
J4	D-3	R4	C-3	R11	F-3	Q3	D-3
J5	E-3	R5	C-3	R12	F-3	Q4	E-3

182A-A-11

Figure 8-9. Sweep-Gate Amplifier (A8) Component Identification



REFERENCE DESIGNATIONS

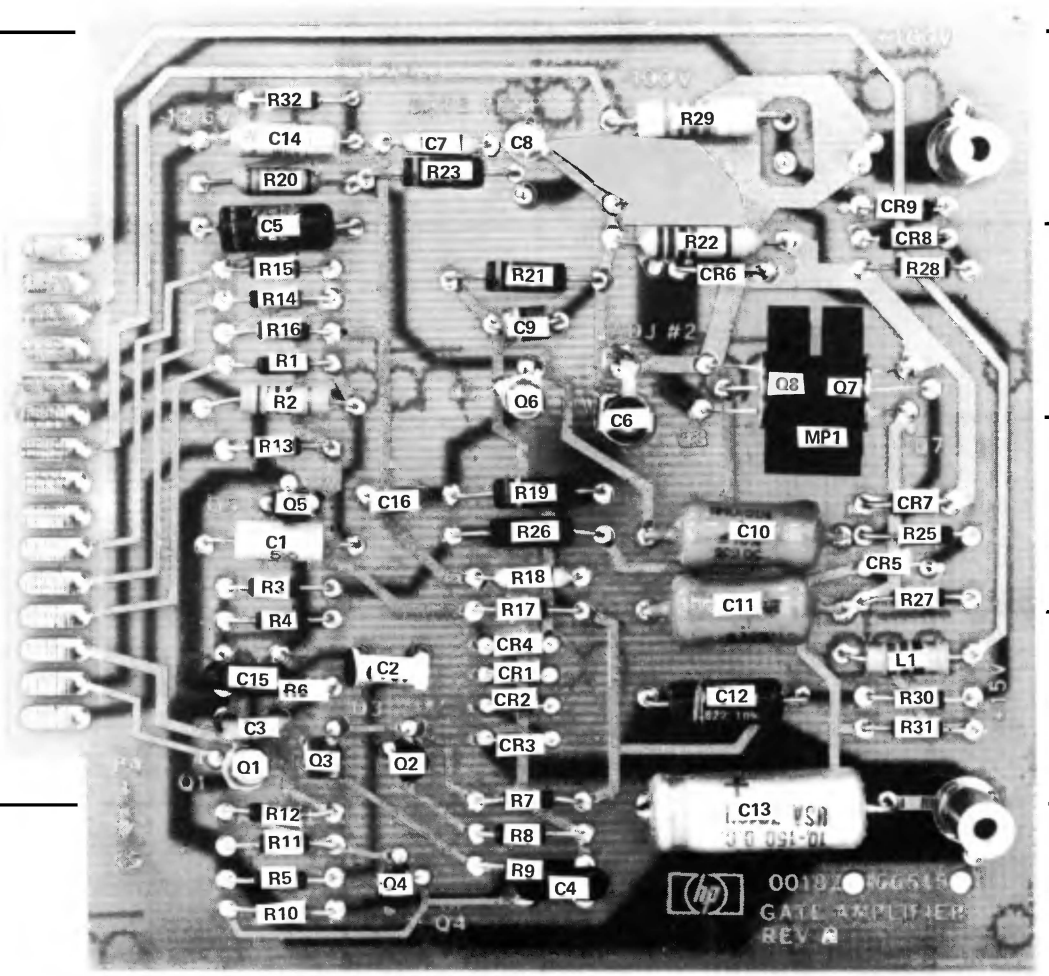
A8	CHASSIS
C1,2 L1,2 Q1-4 R1-15	J1-5

DELETED:

3

Figure 8-10.
Sweep-Gate Output Amplifier (A8) Schematic 3

	A	B	C	D	E	F	
1	Circuit boards have plated through component holes. This permits soldering from either side of the board.			A7			1
2							2
3							3
4							4
5							5
6							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	B-4	C11	E-4	CR6	D-3	Q7	E-3	R10	B-6	R21	C-3
C2	C-5	C12	D-5	CR7	E-4	Q8	E-3	R11	B-6	R22	D-3
C3	B-5	C13	D-6	CR8	E-3	R1	B-3	R12	B-6	R23	C-2
C4	D-6	C14	B-2	CR9	E-2	R2	B-3	R13	B-4	R25	E-4
C5	B-3	C15	B-5	L1	E-5	R3	B-4	R14	B-3	R26	C-4
C6	D-4	C16	C-4	Q1	B-5	R4	B-5	R15	B-3	R27	E-4
C7	C-2	CR1	C-5	Q2	C-5	R5	B-6	R16	B-3	R28	E-3
C8	C-2	CR2	C-5	Q3	B-5	R6	B-5	R17	C-4	R29	D-2
C9	C-3	CR3	C-5	Q4	C-6	R7	C-5	R18	C-4	R30	E-5
C10	E-4	CR4	C-5	Q5	B-4	R8	C-6	R19	C-4	R31	E-5
		CR5	E-4	Q6	C-3	R9	C-6	R20	B-2	R32	B-2

182C-R-7

Figure 8-11. Gate Amplifier (A7) Component Identification

Table 8-5. Gate Amplifier Voltage Measurement Conditions

1. Set controls as follows:

   LINE power ON.

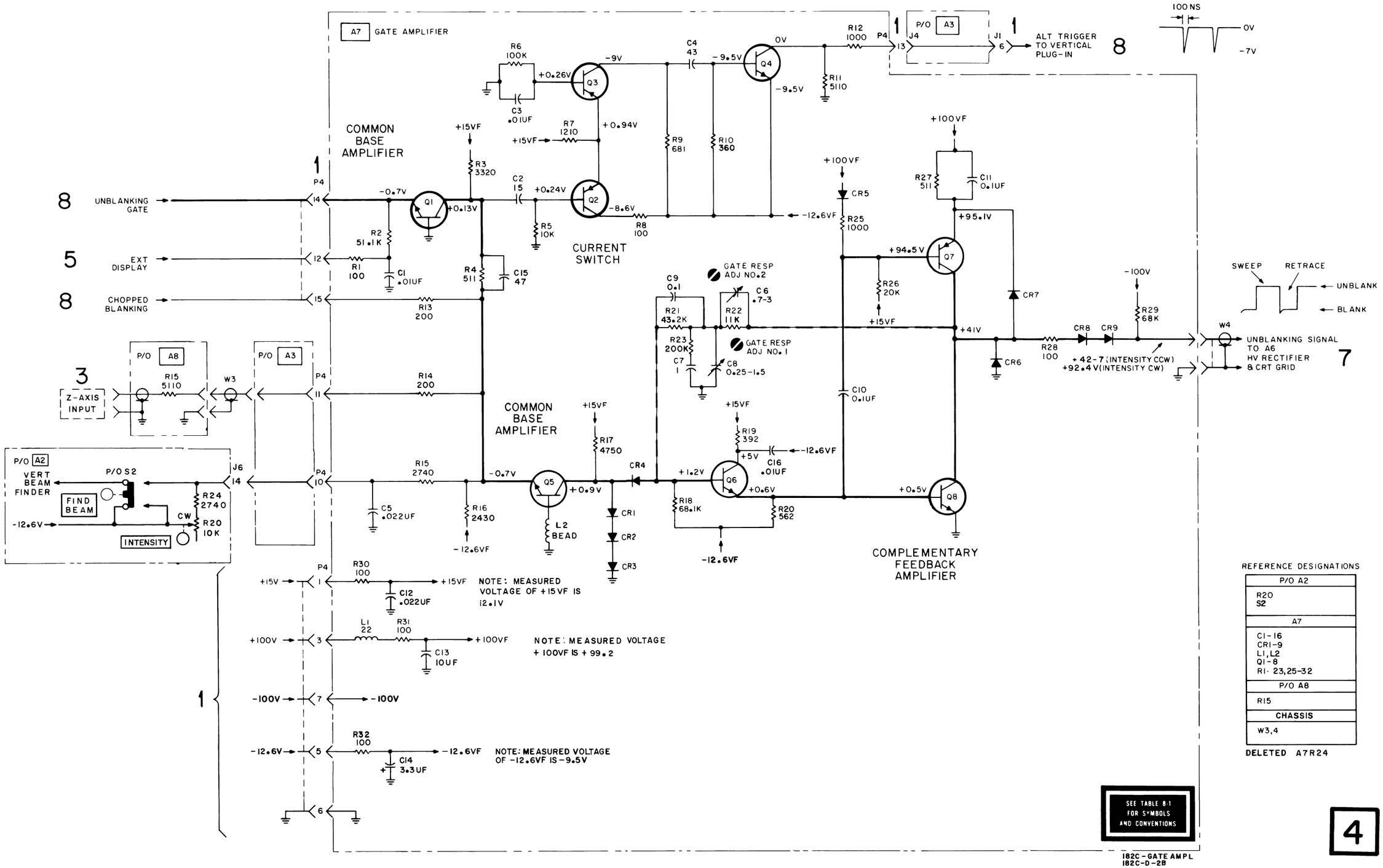
   Plug-ins not installed.

   No signal input.

INT	fully CCW
SCALE	fully CCW
FOCUS	fully CW
POSITION	centered
EXT VERNIER	CAL
DISPLAY	EXT
MAGNIFIER	X1

2. All voltages are referenced to ground.

3. All voltages measured with HP Model 414A Auto Voltmeter. (100 MΩ input impedance).



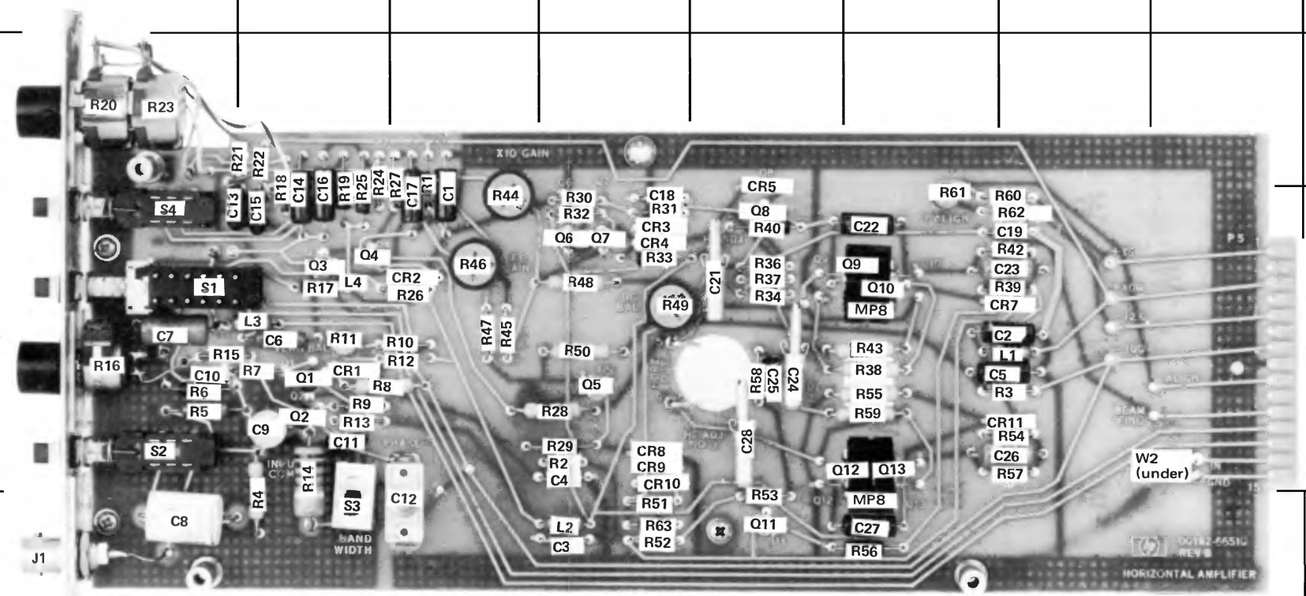
REFERENCE DESIGNATIONS

P/O A2
R20 S2
A7
C1-16 CR1-9 L1,L2 Q1-8 R1-23,25-32
P/O A8
R15
CHASSIS
W3,4

DELETED A7R24

4

Figure 8-12.
Gate Amplifier (A7) Schematic 4
8-17



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

A5

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	F-3	C14	E-3	C28	H-4	L2	G-5	Q9	I-3	R8	E-4	R20	D-2	R32	G-3	R46	F-3	R58	H-4
C2	J-3	C15	E-3	CR1	E-4	L3	E-3	Q10	I-3	R9	E-4	R21	E-2	R33	G-3	R47	F-3	R59	I-4
C3	G-5	C16	E-3	CR2	F-3	L4	E-3	Q11	H-5	R10	F-4	R22	E-2	R34	H-3	R48	G-3	R60	J-3
C4	G-4	C17	F-3	CR3	G-3	MP8	I-3	Q12	I-4	R11	E-4	R23	D-2	R36	H-3	R49	G-3	R61	I-3
C5	J-4	C18	G-3	CR4	G-3	Q1	E-4	Q13	I-4	R12	F-4	R24	E-3	R37	H-3	R50	G-4	R62	J-3
C6	E-4	C19	J-3	CR5	H-2	Q2	E-4	R1	F-3	R13	E-4	R25	E-3	R38	I-4	R51	G-5	R63	G-5
C7	D-3	C21	H-3	CR7	J-3	Q3	E-3	R2	G-4	R14	E-4	R26	F-3	R39	J-3	R52	G-5	S1	D-3
C8	D-5	C22	I-3	CR8	G-4	Q4	E-3	R3	J-4	R15	D-4	R27	F-2	R40	H-3	R53	H-5	S2	D-4
C9	E-4	C23	J-3	CR9	G-4	Q5	G-4	R4	E-5	R16	D-4	R28	G-4	R42	J-3	R54	J-4	S3	E-5
C10	D-4	C24	H-4	CR10	G-4	Q6	G-3	R5	D-4	R17	E-3	R29	G-4	R43	I-4	R55	I-4	S4	D-3
C11	E-4	C25	H-4	CR11	J-4	Q7	G-3	R6	D-4	R18	E-3	R30	G-3	R44	F-3	R56	I-5	W2	K-4
C12	F-5	C26	J-4	J1	C-5	Q8	H-3	R7	E-4	R19	E-3	R31	G-3	R45	F-3	R57	J-4		
C13	D-3	C27	I-5	L1	J-4														

182C-8-1

Figure 8-13. Horizontal Amplifier (A5) Component Identification

Table 8-6. Horizontal Amplifier Voltage Measurement Conditions

1. Set controls as follows:

   LINE power ON.

   Plug-ins not installed.

   No signal input.

INT	fully CCW
SCALE	fully CCW
FOCUS	fully CW
POSITION	centered
EXT VERNIER	CAL
DISPLAY	EXT
MAGNIFIER	X1

2. All voltages are referenced to ground.

3. All voltages measured with HP Model 414A Auto Voltmeter (100 MΩ input impedance).

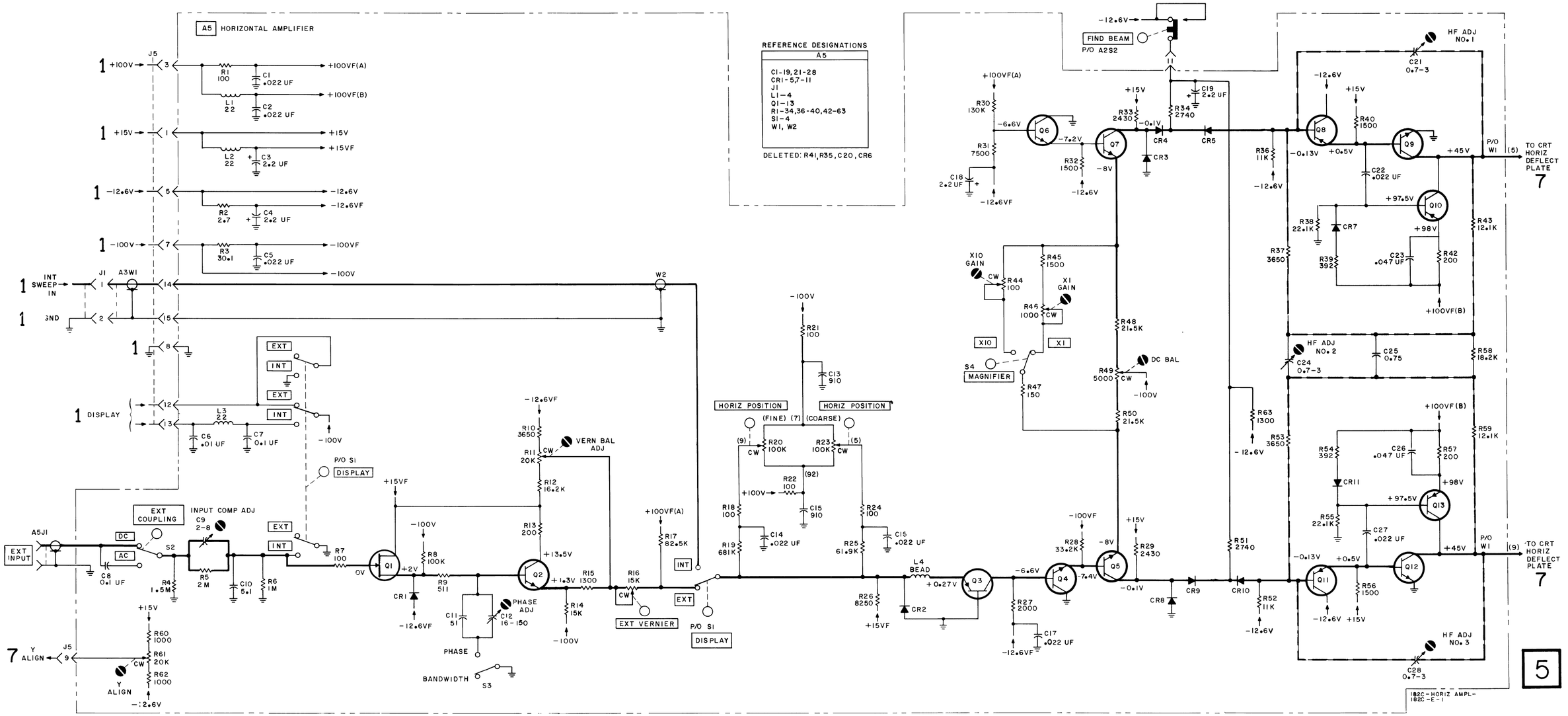
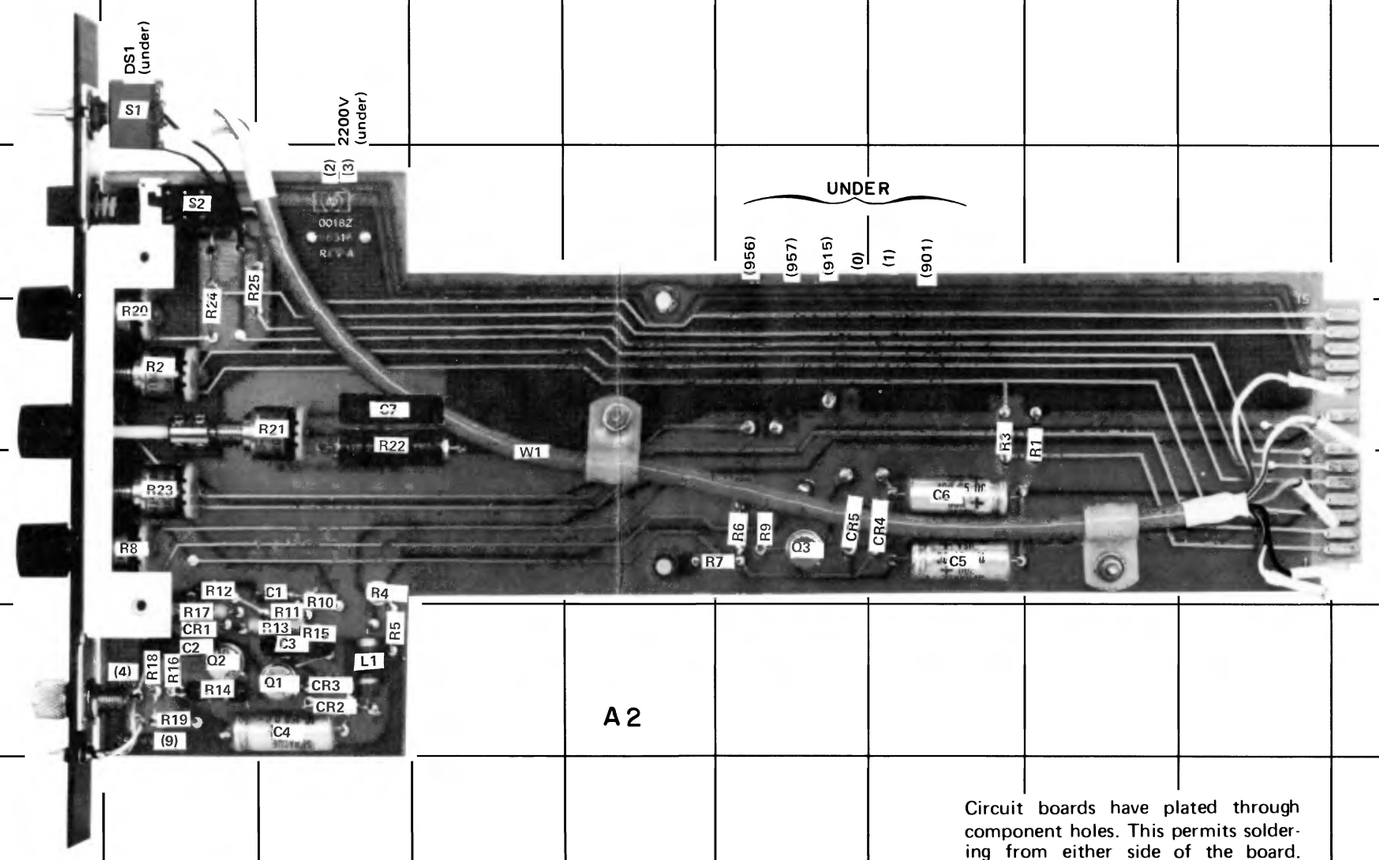


Figure 8-14.
Horizontal Amplifier (A5) Schematic 5



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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-4	DS1	D-1	R7	H-4	R18	D-5
C2	D-5	L1	E-5	R8	D-4	R19	D-5
C3	E-5	Q1	E-5	R9	H-4	R20	D-3
C4	E-5	Q2	D-5	R10	E-4	R21	E-3
C5	I-4	Q3	H-4	R11	E-5	R22	E-3
C6	I-4	R1	J-3	R12	D-4	R23	D-4
C7	E-3	R2	D-2	R13	E-5	R24	D-3
CR1	D-5	R3	I-3	R14	D-5	R25	D-2
CR2	D-5	R4	E-4	R15	D-5	S1	D-1
CR3	E-5	R5	E-5	R16	D-5	S2	D-2
CR4	I-4	R6	H-4	R17	D-5	W1	F-3
CR5	H-4						

182C-B-2A

Figure 8-15. Control Module (A2) Component Identification

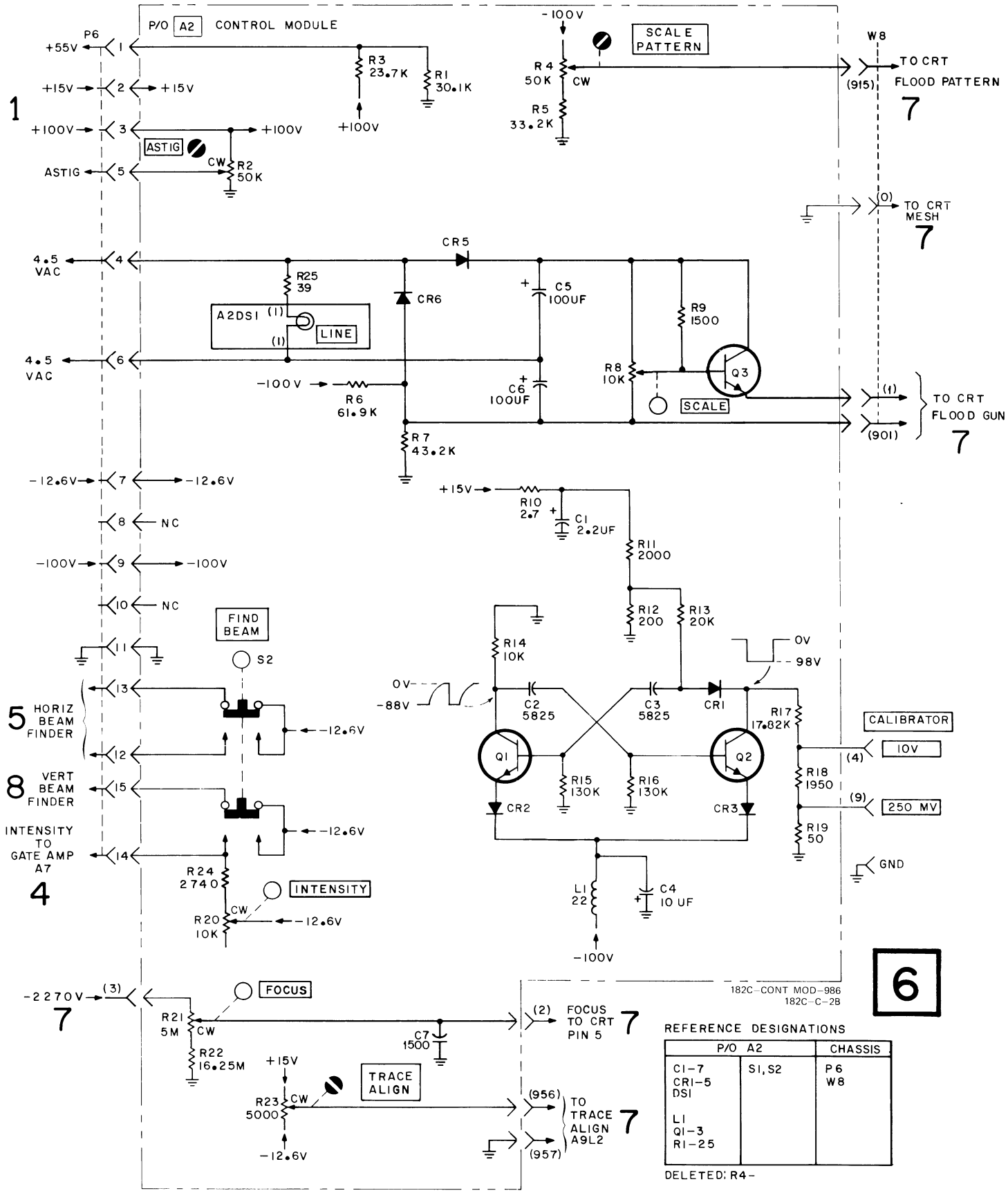
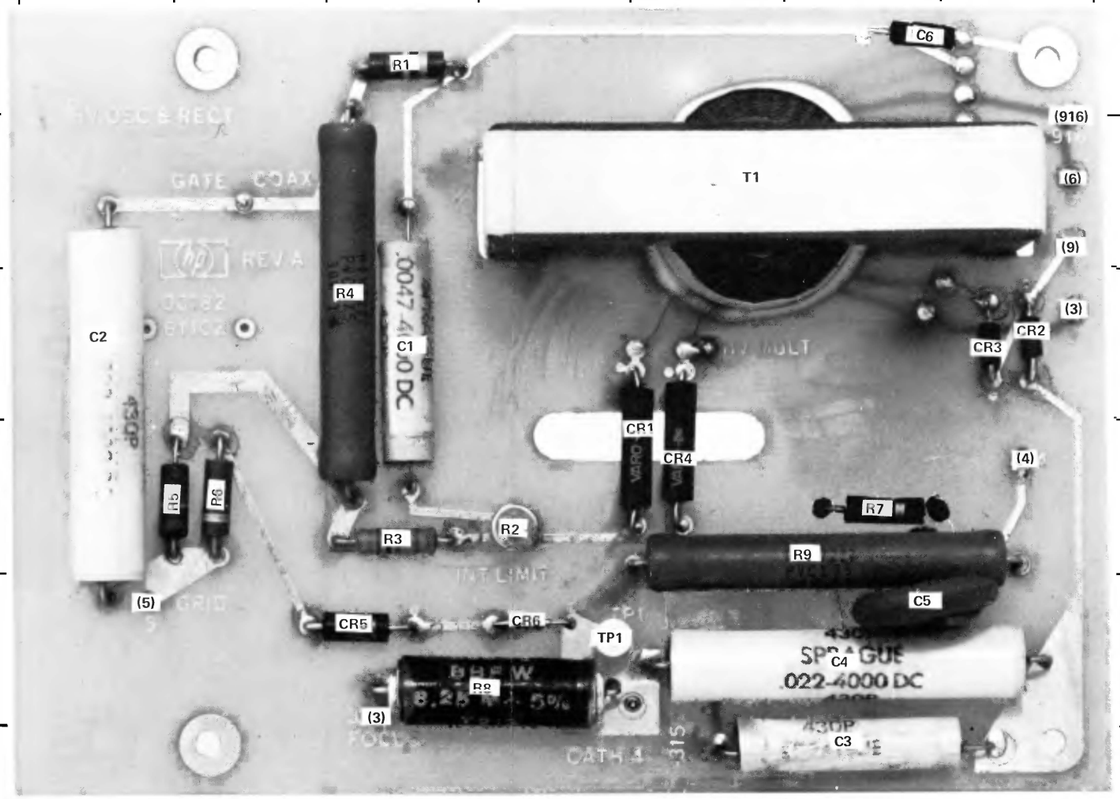


Figure 8-16.
Control Module (A2) Schematic 6



A6

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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	F-3	CR3	J-3	R5	E-4
C2	D-3	CR4	H-4	R6	E-4
C3	I-6	CR5	F-5	R7	I-4
C4	I-5	CR6	G-5	R8	G-5
C5	I-5	R1	F-1	R9	I-4
C6	I-1	R2	G-4	T1	H-2
CR1	H-4	R3	F-4	TP1	G-5
CR2	J-3	R4	F-3		

182C–B–3A

Figure 8-17. H.V. Oscillator & Rectifier (A6) Component Identification

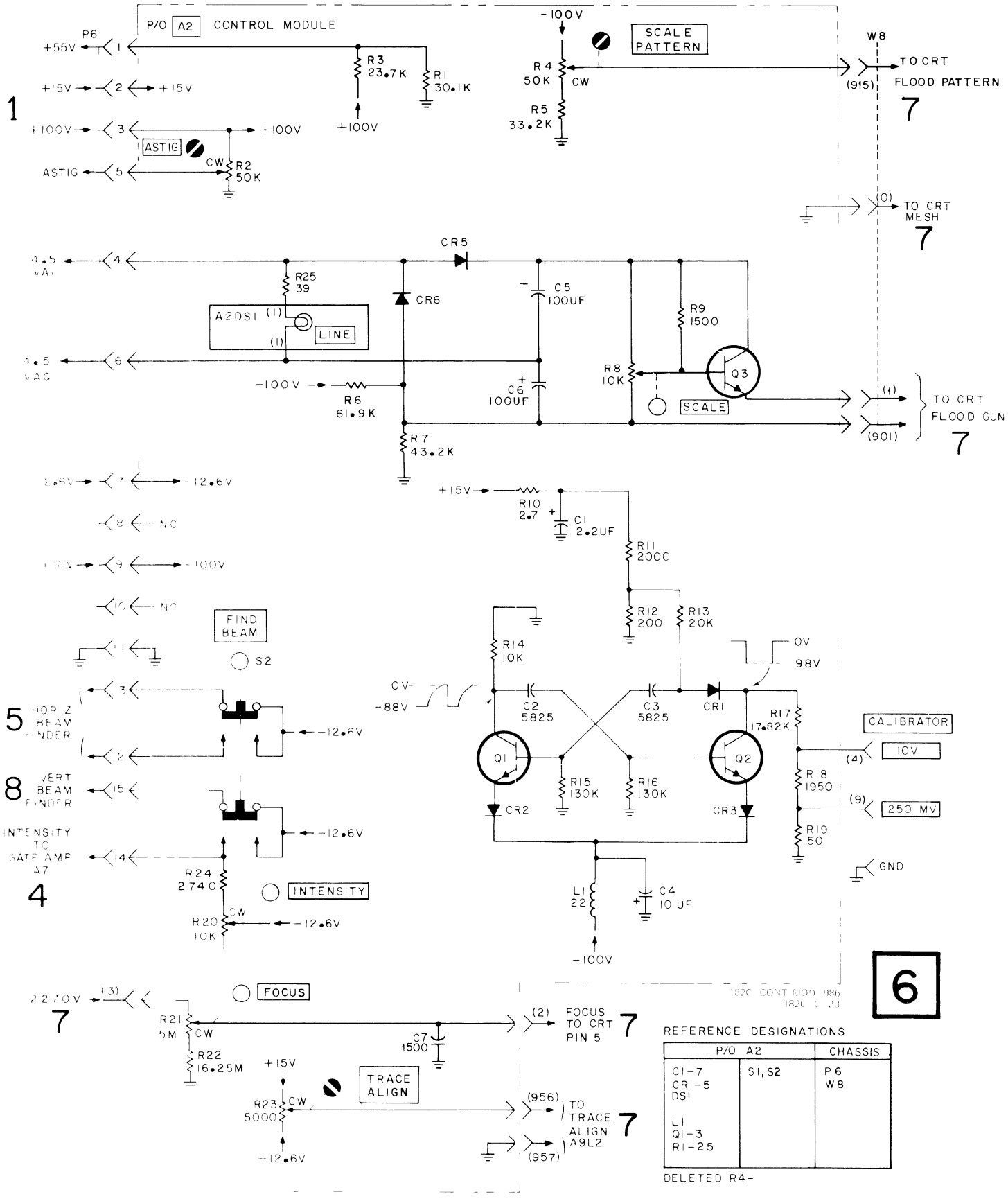


Figure 8-16
Control Module (A2) Schematic 6

Table 8-7. High Voltage Power Supply Troubleshooting Tips

Symptom	Suggested Checks
No high voltage.	*Most common fault. *Check oscillator power supply fuse located on H.V. Regulator Assembly. Check oscillator components: transistor, H.V. transformer, diodes, etc.
Voltage too high.	Check H.V. Adjust. Check regulator components and feedback loop. *Typical case is increased resistance in regulator feedback loop.
Voltage too low.	Check H.V. Adjust. Check regulator components and feedback loop. Typical case is decreased resistance in regulator feedback loop or CRT loading supply.
NOTE Refer to CRT Intensity Troubleshooting Tips for additional checks.	

Figure 8-18.
H. V. Multiplier

Table 8-8. CRT Intensity Troubleshooting Tips

Symptom	Suggested Checks
Low intensity	*Most common fault. Check Intensity Limit Adj. Check low voltage supplies. Check High Voltage Supply. Check Gate Amplifier and gate connection to H.V. Oscillator & Rectifier assembly. *Check CRT. (See Notes for additional tips.)
High intensity	Make checks listed for low intensity. *Check H.V. power supply diodes. Check CRT for grid-cathode leakage. Check CRT for open grid circuit. (See Notes for additional tips.)
Flickering intensity	Check High Voltage supply for arcing. Check High Voltage leads for arcing. Check CRT for loose connections to pins. Check CRT for possible intermittent internal connection. Check High Voltage regulator for intermittent components or connections. Check High Voltage Supply for intermittent components or connections. Check oscillator connections. (See Notes for additional tips.)

NOTE 1

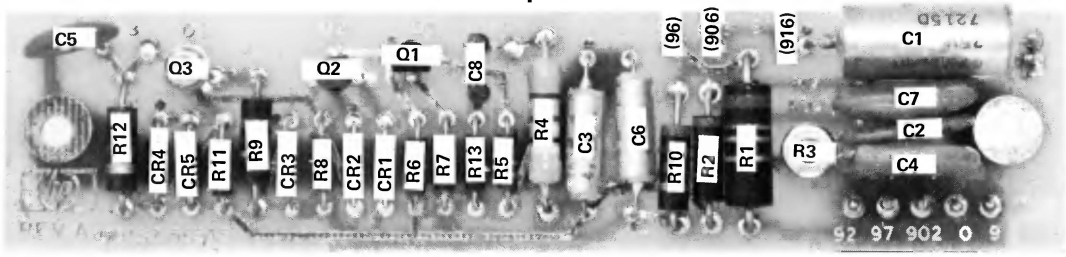
When troubleshooting the High Voltage Power Supply or CRT it is helpful to isolate the CRT. Do this by disconnecting CRT base socket and Post Accelerator High Voltage connection. With CRT disconnected, the High Voltage circuit is not loaded by the CRT if it is at fault, and the CRT is protected if the High Voltage supply is faulty.

NOTE 2

The CRT may be checked to determine if grid-cathode voltage is correct. Use a high-impedance voltmeter (VTVM) which has isolated input terminals to measure grid-cathode voltage. (Voltmeter input terminals must be isolated from ground, i.e.: floating, since grid and cathode are at high voltage in relation to ground.) With INTENSITY control set for maximum intensity (fully cw), grid should be more negative than cathode by about 20V. With control set for minimum intensity (fully CCW) grid should be more negative than cathode by about 60V.

NOTE 3

In checking for cause of excessive high voltage, remember that increased resistance in the feedback regulator loop will result in increasing the H. V. oscillator output. High Voltage output from the supply will therefore be increased. Conversely, low output from the High Voltage supply will result if the feedback loop resistance is lower than normal. Low voltage can also be the result of increased loading.



A10

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

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-3	CR3	B-3	R5	C-3
C2	E-3	CR4	B-3	R6	C-3
C3	D-3	CR5	B-3	R7	C-3
C4	E-3	Q1	C-3	R8	B-3
C5	A-2	Q2	B-3	R9	B-3
C6	D-3	Q3	B-3	R10	D-3
C7	E-3	R1	E-3	R11	B-3
C8	C-3	R2	D-3	R12	A-3
CR1	C-3	R3	E-3	R13	C-3
CR2	C-3	R4	D-3		

182C - A-3

Figure 8-19. H.V. Regulator (A10) Component Identification

Table 8-9. H.V. Power Supply Voltage Measurement Conditions

1. Set controls as follows:

   LINE power ON.

   Plug-ins not installed.

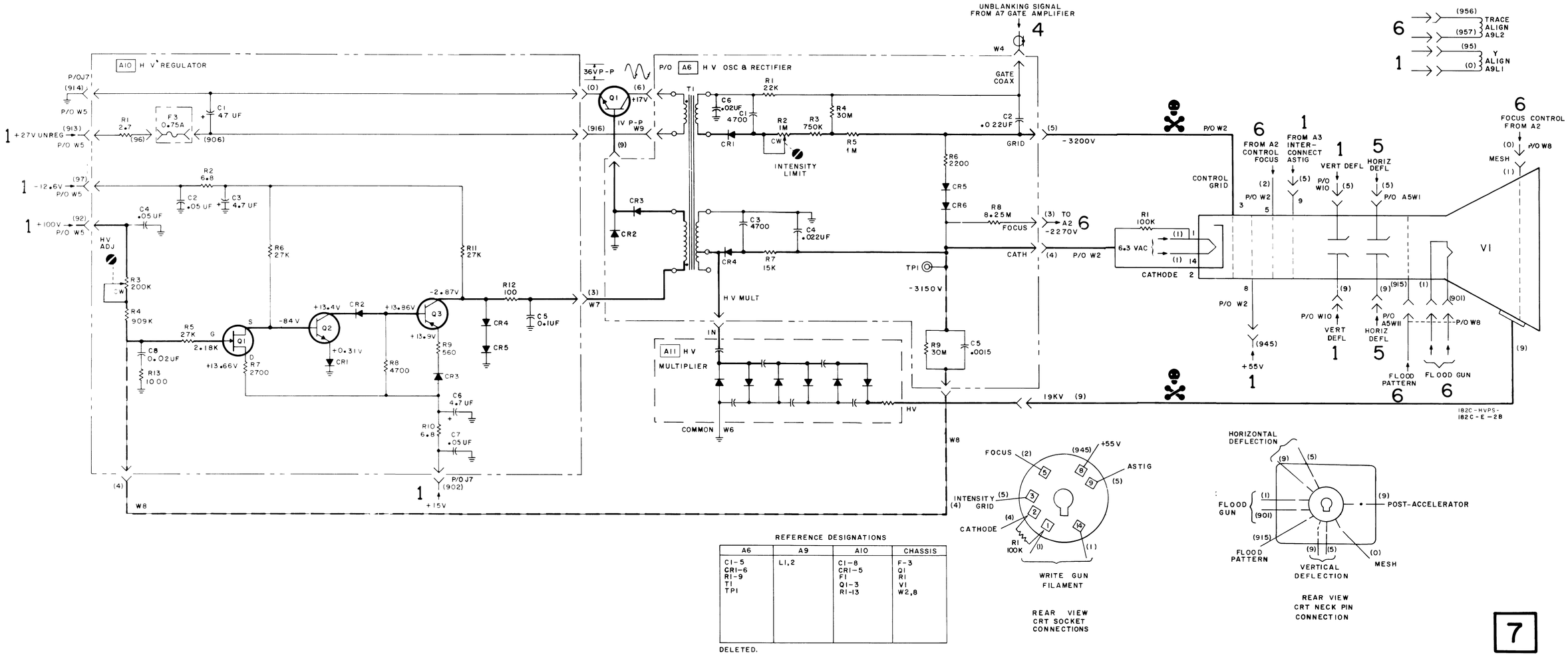
   No signal input

   INT . . . . . fully CCW
   SCALE . . . . . fully CCW
   FOCUS . . . . . fully CCW

2. All voltages are referenced to ground.

3. Low voltages measured with HP Model 414A Auto Voltmeter (100 MΩ input impedance).

4. To measure high voltages use HP Model K05-3440A 1000:1 Divider Probe and HP Model 3440A Digital Voltmeter with HP Model 3441A or 3444A plug-in.



REFERENCE DESIGNATIONS

A6	A9	A10	CHASSIS
C1-5 CR1-6 R1-9 T1 TP1	L1,2	C1-8 CR1-5 F1 Q1-3 R1-13	F-3 Q1 R1 V1 W2,8

DELETED.

Figure 8-20.
High Voltage Power Supply Schematic 7
8-25

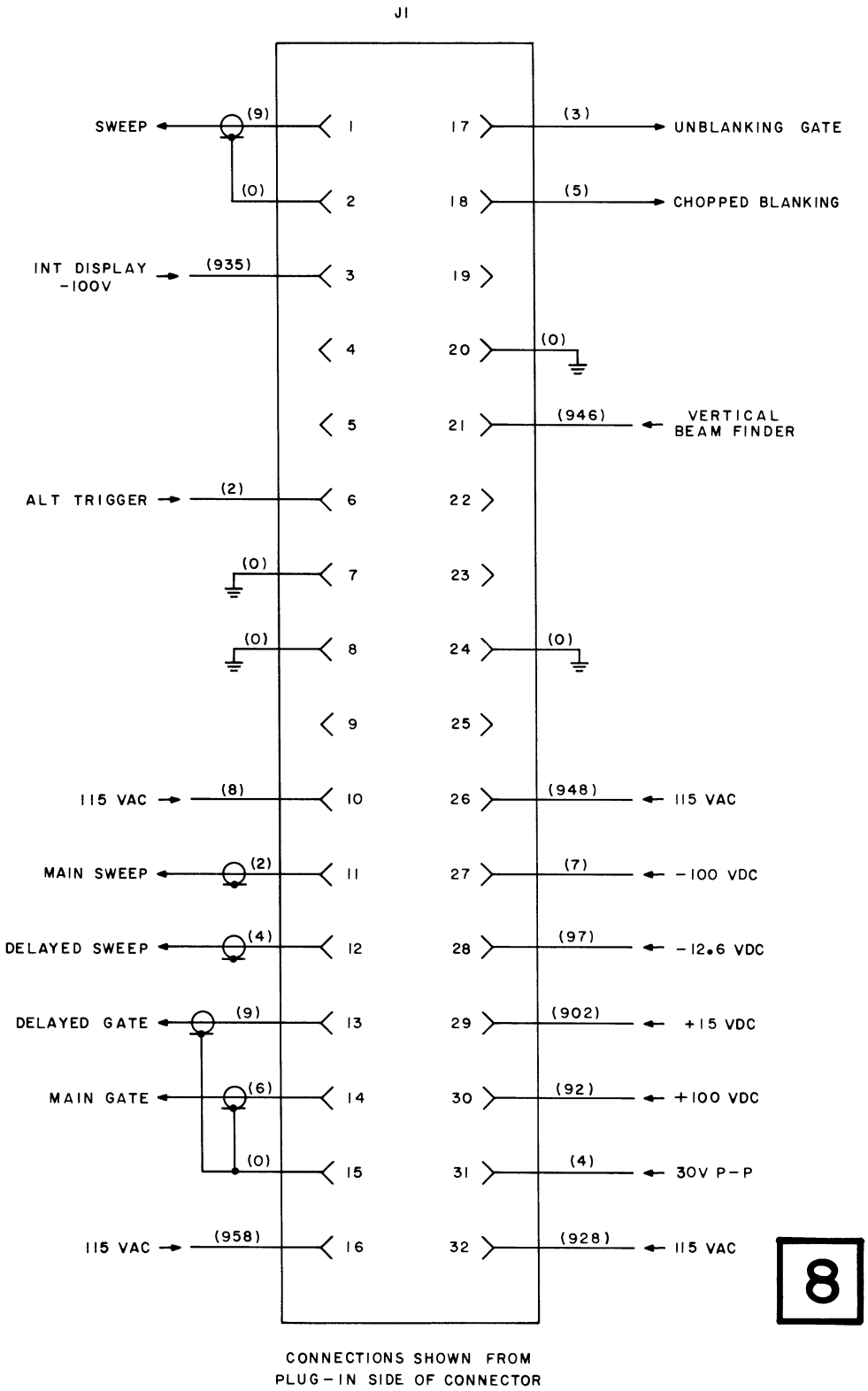


Figure 8-21. Horizontal Plug-in Connections, Schematic 8

HEWLETT hp PACKARD

CATHODE-RAY TUBE WARRANTY

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

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

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

Attention: CRT QA

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

SHIPPING INSTRUCTIONS

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

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

Thank you,

CRT Department

5950-7124

HEWLETT hp PACKARD

CATHODE-RAY TUBE FAILURE REPORT

DATE _____

FROM:

NAME _____

COMPANY _____

ADDRESS _____

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

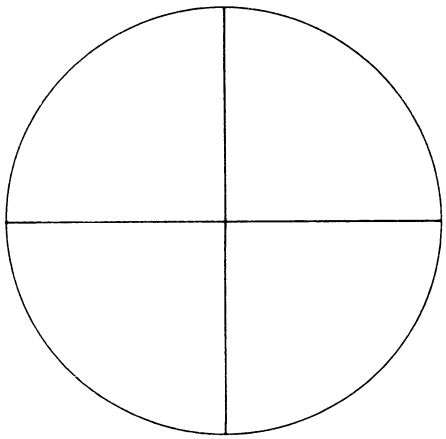
_____

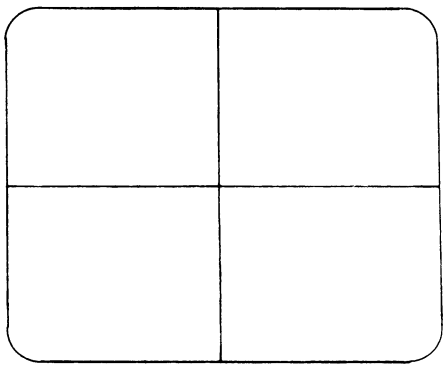
_____

_____

_____

_____





5. Warranty claimed ? Yes _____ No _____
6. HP Sales/Service Office _____ Repair Order No. _____

SALES & SERVICE OFFICES

UNITED STATES

ALABAMA
8290 Whitesburg Dr S E
P O Box 4207
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA
2336 E Magnolia St
Phoenix 85034
Tel (602) 244-1361
TWX 910-951-1330

5737 East Broadway
Tucson 85711
Tel (602) 298 2313
TWX 910 952 1162

(Effective Dec 15 1973)
2424 East Aragon Rd
Tucson 85706
Tel (602) 889 4661

CALIFORNIA
1430 East Orangethorpe Ave
Fullerton 92631
Tel (714) 870 1000
TWX 910 592 1288

3939 Lankershim Boulevard
North Hollywood 91604
Tel (213) 877-1282
TWX 910 499 2170

6305 Arizona Place
Los Angeles 90045
Tel (213) 649-2511
TWX 910-328 6148

1101 Embarcadero Road
Palo Alto 94303
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TWX 910 373 1280

2220 Watt Ave
Sacramento 95825
Tel (916) 482-1463
TWX 910 367 2092

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P O Box 23333
San Diego 92123
Tel (714) 279-3200
TWX 910-335 2000

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Englewood 80110
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TWX 510-955 4099

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Atlanta 30328
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TWX 910 223 3613

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Indianapolis 46205
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Tel (504) 721-6201
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TWX 710 862 9157

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Germantown 20767
Tel (31) 428 0700

P O Box 1648
2 Choke Cherry Road
Rockville 20850
Tel (301) 948-6370
TWX 710-828-9684

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32 Hartwell Ave
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TWX 710 326 6904

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23855 Research Drive
Farmington 48024
Tel (313) 476-6400
TWX 810-242-2900

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TWX 910-563-3734

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TWX 910-771 2087

148 Weldon Parkway
Maryland Heights 63043
Tel (314) 567-1455
TWX 910-764-0830

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TWX 710-892-4945

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HEWLETT hp PACKARD GmbH

MANUAL CHANGES

Model Number	182C
Date Printed:	February 1974
Part Number	00182-90906

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix		Make Changes	Serial Prefix	Make Change
1251G 00361	and above	1		
1251G 00501	and above	1-2		

ERRATA

-hp- Stock No.

Page 7-5 (Option 807)
Connect A8C3 (220pF) in parallel with A8R3

Page 8-13, Fig. 8-8
C3: Connect positive lead to J3 pin5, delete
Connection to J3 pins 3,6 and 12.

In Section VI Replaceable Parts and pertaining Schematics:

Change:	A1A1CR1-8,17-22	Diode Si to	1901-0159
	A1A1CR9-16	Diode Si to	1901-0415
	A1A1R1,2	to R:fxd., 100K, 10%, 5W	0687-1041
	A1A2CR3,7	Diode to	1901-0159
	A2	Assy: Control Module to	00182-66516
	A2CR4,5	Diode to	1901-0159
	A2R9	to R:fxd., 1.5K ± 2%, 1/4W	0757-0928
	A5	Assy: Horizontal Ampl Module to	00182-60003
	A5A11	Bd Assy: Horizontal Ampl to	00182-66510
Delete:	A5R16		
	A5R20,23		

ERRATA (Cont.)

-hp- Stock No.

Change:	A6	Assy: HV OSC Rectifier Board to	00182-66512
	A6CR2,3	Diode to	1901-0159
Delete:	A7C7		
Add:	A7C16	C:fxd., .01uF, 100V	0160-3451
Change:	A7CR6,7	Diode to	1901-0470
	A7R10	to R:fxd., 392 Ω, 1%, 1/8W	0757-0413
Delete:	A7R23		
Change:	A7R28	to R:fxd., 100 Ω, 1%, 1/8W	0757-0401
	A8	Assy: Sweep Gate Output Bd to	00180-66546
	A8R7	to R:fxd., 1.62K, 1%, 1/8W	0757-0429
	A8A8	to R:fxd., 3.01K, 1%, 1/8W	0757-0273
	A8R10	to R:fxd., 1.82K 1%, 1/8W	0757-0429
	A8R11	to R:fxd., 3.01K 1%, 1/8W	0757-0273
	A10C2,7	C:fxd., .05uF,100V to	0160-2917
	A10C8	to C:fxd., .1uF, 50VDCW	0160-3443
	A10CR4,5	Diode Si to	1901-0159

Under Chassis Parts

Change:	F3	Fuse .075A to	2110-0063
	F4	to Fuse 1.6A	2110-0005
	W1	Cable Assy Power to (Schuko)	8120-1692
	W3	Cable Coax to	00182-61607

CHANGE 1

Change:	A1T1	Transformer Power to	5080-0991
	A2L1	to coil-fxd., 910uH	9100-1653
	A2C5,6	to C:fxd., AL elect. 200uF -10+75%, 16WVDC	0180-0104
Add:	A2CR6	Diode - Breakdown 5.11V ± 5% connected between emitter of A2Q3 and junction of A2C6/R7	1902-0041
Change:	A5Q10,13	TSTR Si PNP to	1853-0232
	A5R11	R:var., 20K, 1W to	2100-0558

CHANGE 2

Change:	A7C3,16	to C:fxd., 0.01uF -20 + 80%, 100WVDC	0160-2055

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Change:	A7CR6,7	Diode to	1901-0470
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Delete:	A7R23		
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