Errata

Title & Document Type: **851A/B Spectrum Analyzer Display Section Operating and Service Manual**

Manual Part Number: **00851-90010**

Revision Date: **June 1969**

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HP References in this Manual

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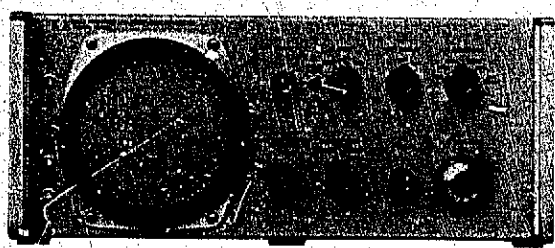
OPERATING AND SERVICE MANUAL

SPECTRUM ANALYZER DISPLAY SECTION

851A/B



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SPECTRUM ANALYZER
DISPLAY SECTION
MODELS 851A/B

SERIAL PREFIX: 923

This manual applies directly to HP Model 851B Spectrum Analyzer Display Sections having serial prefix number 923.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 923, a "Manual Changes" sheet is included with this manual. For HP Model 851A and HP Model 851B with serial prefixes below 923, refer to Appendix A1 and A2.

00851-90019 Printed: JUNE 1969

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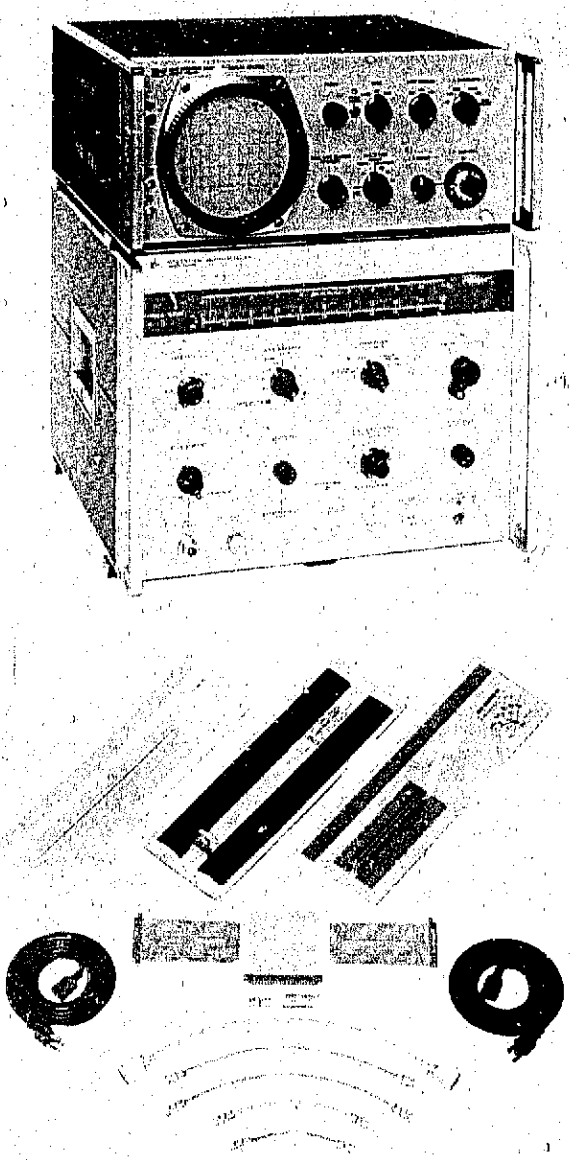


Figure 1-1. Model 851B Spectrum Analyzer - Display Section and Supplied Accessories

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Model 851 is the Display Section of the Hewlett-Packard Spectrum Analyzer; Model 8551 is the RF Section. Together, the 851/8551 combination is an analyzer that can display up to 2 Gc of spectrum. Analyzer input range is from 10 Mc to 40 Gc, dynamic range is 60 dB, sensitivity is at least -65 dBm, image separation is 4 Gc, and functions are calibrated. The RF section, a receiver that electronically scans the input signal is described in a separate Operating and Service Manual.

1-3. DESCRIPTION.

1-4. The 851 Display Section is an oscilloscope with a very wide dynamic range. It displays amplitude versus frequency, and range is such that a fundamental and harmonics down as far as 60 dB can be viewed simultaneously. In addition to standard oscilloscope functions -- calibrated sweep times, calibrated gain, choice of synchronizing voltages, vertical and horizontal positioning, focus adjustments, and intensity variation -- the 851 provides additional facilities that widen the scope of the analyzer as an electronic tool.

a. Amplitude Calibrations. The 851 display can be made proportional to voltage (linear), proportional to power (square), or proportional to the log of the input voltage. Use of logarithmic calibration makes it possible to view amplitude variations as great as 60 dB in the same display.

b. Calibrated IF Bandwidths. The 851 has calibrated IF bandwidths of 1 Mc, 100 kc, 10 kc, 3 kc and 1 kc. The narrow bandwidths provide resolution for closely spaced signals, and for greater sensitivity. Wide bandwidths ensure sufficient IF bandwidth at fast sweep rates and narrow spectrum widths. Wide bandwidths also allow the 851/8551 to recover modulation operating as a fixed-tuned receiver.

c. Automatic Selection of Optimum IF Bandwidth. Characteristics of the display are a function of the width of frequency band swept (determined by the setting of the SPECTRUM WIDTH switch in the 8551 RF Section), the IF bandwidth, and the sweep speed. There is an AUTO SELECT position on the I.F. BANDWIDTH switch for automatic selection of optimum bandwidths.

d. Oscillograms. The 851 CRT internal graticule gives a parallax-free presentation. This graticule can be illuminated by ultra-violet light for making well-defined oscillograms. (The HP 196B Oscilloscope Camera includes an ultra-violet light source.) The display section has baseline blanking capability also. This is used when viewing low-level signals or when making an oscillogram since features of interest are clearer when base line glow is blanked. The CRT includes a bezel for mounting a camera, and a SINGLE SWEEP lamp that indicates duration of the sweep.

Table 1-1. Specifications, 851B Display Section (when connected to 8551B RF Section)

DISPLAY CHARACTERISTICS

Vertical Display (7-cm full scale deflection):

Mode	Scale Factor	Accuracy**
LINEAR	Relative Voltage/cm	±3% full scale
SQUARE	Relative Power/cm	±6% full scale*
LOG	10 dB/cm calibrated over 0 to 60 dB on CRT display	<±0.2 dB/dB but not more than ±2 dB over full calibrated 60 dB CRT display range*

*Except pulse spectra on 1-Mc bandwidth
**0°C to +40°C

Cathode Ray Tube: 7.5 kV post-accelerator tube with P2 medium persistence phosphor (others optional) and internal graticule. Light blue filter supplied. Light-proof CRT bezel provides firm mount for oscilloscope camera.

CRT Internal Graticule: Parallax-free, 7 x 10 cm, marked in centimeter squares with 2-mm subdivisions on major horizontal and vertical axes.

CRT Base Line Clipper: Front panel control permits blanking of CRT trace baseline to allow more detailed analysis of low repetition rate signals.

IF CHARACTERISTICS

IF Input Center Frequency: 20 Mc (accepts 20-Mc output from 8551 RF Section).

IF Bandwidth:

Manual: Bandwidths of 1, 3, 10, 100 kc and 1 Mc can be selected

Auto Select: One of the above bandwidths automatically selected for best resolution of a CW signal for each combination of spectrum width and sweep time.

Table 1-1. Specifications, 851B Display Section (when connected to 8551B RF Section) Continued

Bandwidth Accuracy: Individual bandwidths are calibrated within ±20%, bandwidth repeatability and stability typically better than ±3%.

IF Gain Set: 2-section attenuator provides 0 to 80 dB attenuation in 1-dB steps. One section provides 0 to 70 dB attenuation in 10-dB steps; the 0 to 10 dB in 1-dB steps. IF Vernier provides continuous adjustment between 1-dB steps.

IF Gain Set Accuracy: 70-dB section, ±0.5 dB; 10-dB section, ±0.1 dB.

SWEEP CHARACTERISTICS

Sweep Time: Six calibrated rates from 3 ms/cm to 1 s/cm in a 1, 3, 10 sequence. Vernier provides continuous adjustment between calibrated rates and extends slowest rate to at least 3 s/cm.

Sweep Time Accuracy: ±3%.

Sweep Synchronization:

Internal: Sweep free runs.

Line: Sweep synchronized with power-line frequency.

External: Sweep synchronized with externally applied signal of +3 to +15 volts peak amplitude. BNC female input connector on rear panel.

Single Sweep: Sweep actuated by front panel pushbutton. Panel light signifies duration of single sweep.

External Sweep:

Input: 0 to +15 volt external signal (from 10 K ohm source impedance) results in full 10-cm CRT horizontal trace. BNC female connector on rear panel, direct-coupled.

Blanking: -5 volt external blanking signal required to blank retrace. BNC female connector on rear panel.

GENERAL

Output Signals: Vertical and horizontal signals applied to CRT are available for external applications. Rear panel BNC female connectors. IF Test Point (20 Mc) also provided; rear panel BNC female connector.

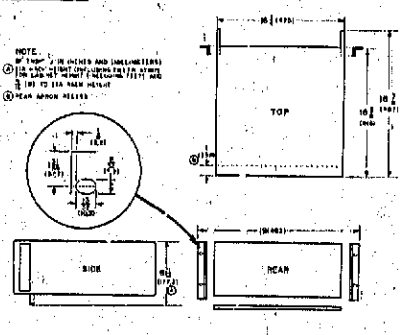
Vertical: 0 to approximately -4 volts, open circuit; 4700 ohms source impedance.

Horizontal: 10 volts p-p ±0.3 volt, open circuit; sweep approximately symmetrical about 0 volts. Sweep impedance 4700 ohms.

RFI: Conducted and radiated leakage limits are below those specified in MIL-I-6181D and MIL-I-16910C, when connected to the 8551 using the bracket joining kit.

Power: 115 or 230 volts ±10%, 50 to 60 cps, less than 55 watts.

Dimensions:



Weight: Net 34 lb (15,2 kg). Shipping 38-1/4 lb (17,1 kg).

Accessory Items Supplied: 7-1/2-foot (2290 mm) power cable; rack mounting kit; joining bracket kit for mounting Model 851 on Model 8551.

Accessory Items Available: 8442A 20-Mc Crystal filter for increased resolution on 1-kc bandwidth.

Options:

07. P7 phosphor in lieu of P2 (amber filter supplied), no additional charge.

31. P31 phosphor in lieu of P2 (green filter supplied), no additional charge.

Table 1-2. Accessories Supplied

HP Stock Number	Name	Description
8120-0078	Power cable	Standard 3-conductor, 7-1/2 foot NEMA power cable
5060-0216	Joining Bracket Kit	Plates and hardware for bonding 851 to 8551
5060-0076	Rack Mounting Kit	Parts and hardware for mounting 851 in 19-inch rack

1-5. APPLICATIONS.

1-6. Many of the applications of the Hewlett-Packard Spectrum Analyzer are discussed in Application Notes 63 and 63A. One of these applications is the analysis of short RF pulses. Because of a choice of IF bandwidths, dynamic range of at least 60 dB, and calibrated sweep speeds, the analyzer is a valuable tool in pulse work. Short RF pulses (tens of nanoseconds) have been difficult to analyze in the frequency domain because of limitations in dynamic range and the IF bandwidth of available analyzers. The 1-Mc IF bandwidth of the 851 gives 11 dB of additional dynamic range when measuring short pulses, i.e., additional by comparison to a hypothetical system having 80-kc IF bandwidth and equal CW dynamic range. With the 851 calibrated sweep times, pulse repetition rate can be determined directly from the display, eliminating the need for measuring repetition rate externally.

1-7. CATHODE-RAY TUBE WARRANTY.

1-8. The cathode-ray tube (CRT) supplied with the 851 is guaranteed against electrical failure by Hewlett-Packard for one year from the date of sale. Warranty claim and adjustment procedures for the CRT are given on the warranty at the rear of this manual. Use this form and follow claim instructions exactly when returning a CRT for warranty adjustment.

Table 1-3. Accessories Available

Model Number	Name	Description
6442	1 KC Bandwidth Crystal Filter	For use ahead of 851 IF input; improves skirt selectivity -- pass band less than 10 kc, 60 dB down

Table 1-4. Options

Number	Description
07	P7 long-persistence phosphor and amber filter supplied in lieu of P2 phosphor; no additional charge.
31	P31 medium-persistence phosphor and green filter supplied in lieu of P2 phosphor; no additional charge.

INSTALLATION

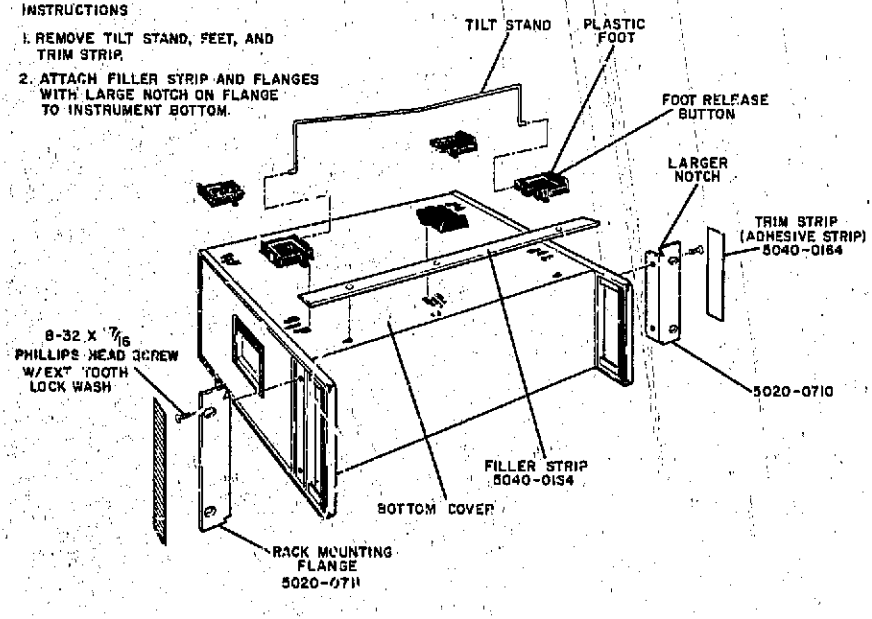


Figure 2-1. Rack-Mounting Procedure

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION.

2-2. MECHANICAL CHECK.

2-3. If damage to the shipping carton is evident, ask that carrier's agent be present when instrument is unpacked. Inspect instrument for mechanical damage such as scratches, dents or broken knobs. Also check the cushioning material for signs of severe stress.

2-4. PERFORMANCE CHECK.

2-5. The electrical performance of the 851 should be verified as soon as possible after receipt. Performance checks suitable for incoming inspection are given in Paragraphs 5-7 through 5-34.

2-6. CLAIM FOR DAMAGE.

2-7. If the 851 is mechanically damaged or fails to meet specifications on receipt, notify the carrier and the nearest Hewlett-Packard office immediately. (A list of sales and service offices is at the back of this manual.) Retain the shipping carton and the padding material for the carrier's inspection. The field office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-8. CONNECTIONS.

2-9. To interconnect the 851 and 8551, proceed as in Figure 2-2 and as follows:

a. Do not connect primary power to the 851/8551 until other interconnections have been made.

b. Place the model 851 Display section on the Model 8551 RF Section.

c. A power cable is supplied with the 851, and five cables are supplied with the 8551. Connect cables as shown in Figure 2-2.

d. To obtain the best common ground for the two sections, strap them together with the plates provided in the joining kit (supplied). Bonding instructions are supplied with the kit.

2-10. POWER REQUIREMENTS.

2-11. The 851 is designed to operate from either a 115- or 230-volt, 50- to 400-cycle source, and requires approximately 55 watts. However, when used as the display section of the analyzer, the line input for the 851 is in the 8551 RF Section and power is extended to the 851 by external cable. The two sections of the analyzer require approximately 330 watts and a nominally 115- or 23-volt, 50- to 60-cycle source.

2-12. Both sections are equipped with input transformers. Primary windings on each input transformer can be connected in series or in parallel; a slide switch (115/230) located on the rear panel changes from one type of connection to the other (see Figure 3-2). Always check the setting of the slide switches in both sections before connecting the analyzer to a power source; the setting of the 115/230 switch must agree with the voltage of the power source. Refer to Figure 2-2 for sequence of the plug-in procedure. Sequence for turn-on is given in Figure 3-3.)

2-13. The fuse installed at the factory is for 115-volt operation. When operating from 230 volts, use a fuse of the value shown adjacent to the 230-volt position of the slide switch.

2-14. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panel and cabinet be grounded. The analyzer is equipped with a three-conductor power cable; the third conductor grounds the instrument when the cable is plugged into an appropriate receptacle. The offset pin on the power cable three-prong connector is the ground connection. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green lead on the adapter to ground.

2-15. ESTABLISHING FIGURE-OF-MERIT RATING.

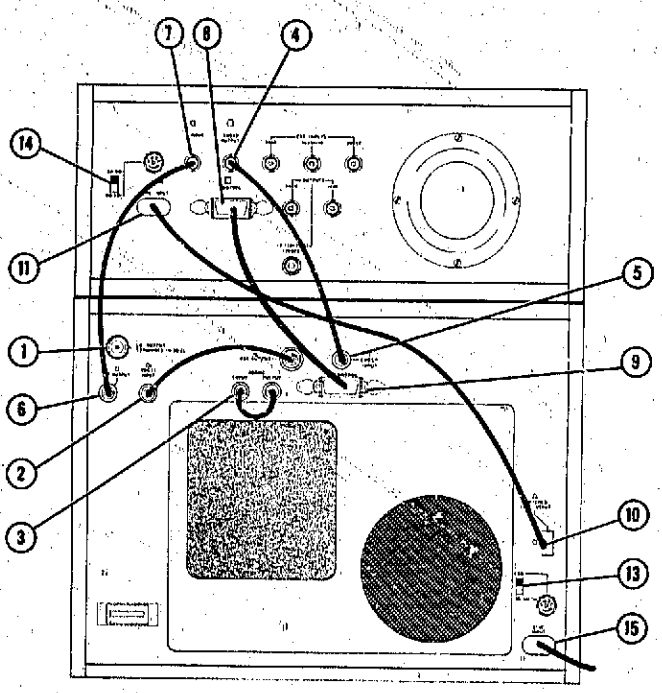
2-16. Immediately following initial inspection, it is good practice to establish a figure-of-merit rating for your 851 Display Section. The IF Sensitivity Check (Paragraph 5-24) can be used to establish this figure. Space is provided in the table below for recording the figures obtained.

2-17. RACK MOUNTING.

2-18. Procedure for rack-mounting the 851 is indicated in Figure 2-1.

Table 2-1. Figure-of-Merit Rating

Input		Settings (VERT Display at LIN)		Sig Gen Used	Cable Used	Power Input for 6-cm Vertical Deflection
Freq	Point	I. F. BW	I. F. GAIN (DB)			
20 Mc	I. F. INPUT	1 MC	70 + 10 I. F. VERNIER, max cw	606A	10503A	
		100 KC				
		10 KC				
		3 KC				
		1 KC				



NOTE

Appearance of the 851/8551 shown may vary from other versions. Interconnections shown do not vary, and connection sequence is the same.

1. 08551-6070 Coaxial Termination: install in LO OUTPUT - TERMINATE in 50Ω.
2. Connect 2GC OUTPUT to 2GC I.F. INPUT.
3. Connect 200MC INPUT to OUTPUT.
4. Connect SWEEP OUTPUT to SWEEP INPUT.
5. Connect SWEEP OUTPUT to SWEEP INPUT.
6. Connect I.F. OUTPUT to I.F. INPUT.
7. Connect I.F. OUTPUT to I.F. INPUT.
8. Connect 851 CONTROL to 8551 CONTROL.
9. Connect 851 CONTROL to 8551 CONTROL.
10. Connect SWITCHED LINE OUTPUT to LINE INPUT.
11. Connect SWITCHED LINE OUTPUT to LINE INPUT.
12. Set LINE to OFF.
13. 8551 line voltage switch: set for nominal voltage of power source (set with blade of screwdriver); check that fuse is value marked adjacent to selected switch position.
14. 851 line voltage switch: set to same setting as set at 8551 line voltage switch; check that fuse is proper value for voltage set.
15. LINE INPUT: connect to 115/230 V, 50/60 cps 330-watt source.
16. 1250-0207 Coaxial Termination: install in EXT MIXER INPUT when using internal mixing signals.

Figure 2-2. Installation Connections, Model 851/8551 Spectrum Analyzer (sheet 1 of 2)

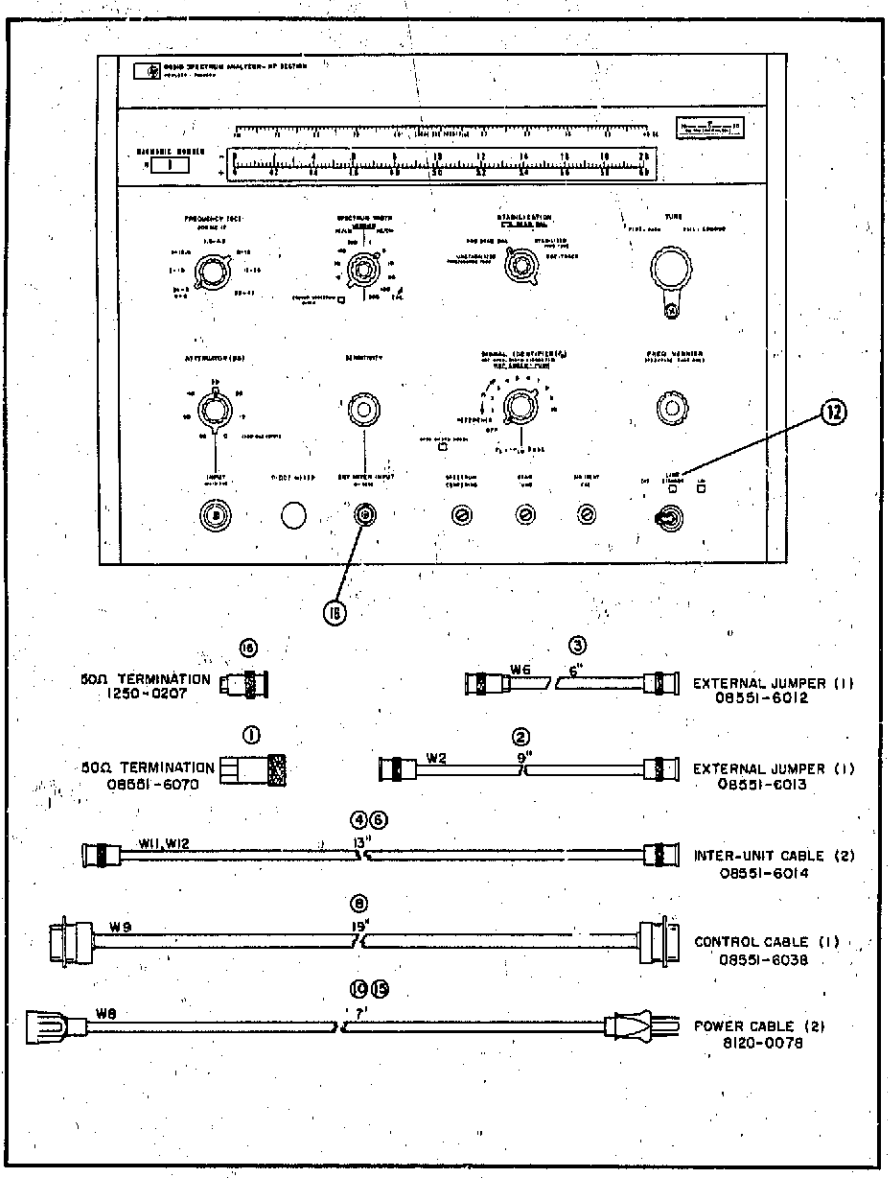


Figure 2-2. Installation Connections, Model 851/8551 Spectrum Analyzer (sheet 2 of 2)

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. The Model 851/8551 Spectrum Analyzer is a triple-conversion, superheterodyne, scanning receiver with a visual amplitude-versus-frequency output. Information obtained by the 8551 RF Section is displayed on the 851 CRT. Analyzer controls are calibrated and thus considerable information can be read directly from the display; calibration accuracies are given in Table 1-1.

3-3. Basic procedures for operating the analyzer are given in this section of the Manual. Information on spectrum analysis and applications of the 851/8551 Spectrum Analyzer are provided in HP Application Notes 63, 63A, and 63B.

3-4. Operating the analyzer requires both the display and RF sections. As instructions for the 851 are more easily understood in conjunction with instructions for the 8551 RF Section, the Operating Plates, Figure 3-3 and 3-4, include instructions for both instruments. However, always remember that instructions given in this Manual do not discuss limitations on input signal level. Therefore, before turning on the analyzer, also refer to the operating instructions (Section III) in the 8551 Manual.

3-5. Front panel controls are identified and briefly described in Figure 3-1, and rear panel connectors and switches are identified in Figure 3-2; initial turn-on instructions are given in Figure 3-3, and photographic procedures in Figure 3-4.

3-6. Optimum I.F. BANDWIDTH setting for selected SPECTRUM WIDTH and SWEEP TIME settings is given in Table 3-1. Optimum is defined as the narrowest bandwidth that does not attenuate the signal because of limitations in the rise time of the 20-Mc IF amplifier. (The SPECTRUM WIDTH switch is on the 8551, and determines width of band swept by the 8551 Local Oscillator.)

Note

With I. F. BANDWIDTH at AUTO SELECT, optimum bandwidth is automatically selected.

3-7. FUNCTION DESCRIPTIONS.

3-8. The 851 Display Section includes a 20-Mc IF amplifier with five calibrated bandwidths, shaping circuits that provide a choice of amplitude calibration, and a cathode-ray tube and associated circuits, one of which is a calibrated SWEEP TIME switch.

3-9. IF BANDWIDTH.

3-10. SELECTION. Bandwidth of the 20-Mc I.F. amplifier is 1 Mc. However, by means of selectable precision filters, this bandwidth can be narrowed to 100 kc, 10 kc, 3 kc, or 1 kc; selection is made with the IF BANDWIDTH switch.

3-11. RESOLUTION. Display signal resolution is determined by the I.F. BANDWIDTH setting. The signal shown on the CRT can be considered a presentation of the spectrum as seen through a moving passband. The amount of spectrum seen at any instant is the ratio of IF amplifier bandwidth to spectrum width. For example, if the I. F. BANDWIDTH switch is set at 1 Mc and the SPECTRUM WIDTH switch is set at 100 MC/CM the spectrum being examined is 1 Gc. One-thousandth of the spectrum can be seen at any instant as the horizontal sweep voltage moves the passband across the CRT. The rate at which the passband moves is set by the SWEEP TIME switch. The shape of the display is the passband characteristic of the IF amplifier.

3-12. OSCILLOSCOPE.

3-13. TUBE. The 851 CRT is a 5-inch tube with an internal, parallax-free, graticule. Unless otherwise ordered, the tube is supplied with a P-2 medium persistence phosphor and light blue filter.

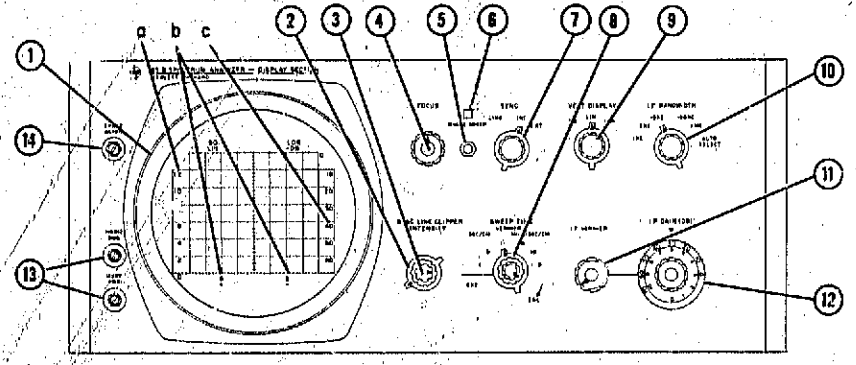
3-14. TIME BASE. Time base range is from 3 milliseconds per centimeter to 1 second per centimeter, and is selected with the SWEEP TIME switch. The time base can be synchronized with an internal or externally supplied signal or with line frequency. For photographic use, a single-sweep mode is provided; selection of mode is made with the SYNC switch.

3-15. ALIGN AND BASE LINE CLIPPER CONTROLS. An ALIGN control tilts the trace angularly to permit alignment with the graticule, and a BASE LINE CLIPPER control blanks the base line when viewing low-level signals or when photographing waveforms.

3-16. OSCILLOSCOPE DISPLAY.

3-17. In using the analyzer oscilloscope, remember that the display information is not the same as that presented on a conventional oscilloscope. The information displayed by the analyzer is amplitude versus frequency, whereas the conventional oscilloscope displays amplitude versus time.

3-18. SHAPING. In addition to the usual oscilloscope controls and circuits, the 851 Display Section has circuits for shaping the signal output from the 20-Mc IF amplifier. In addition to the conventional linear display (proportional to signal voltage), by means of these

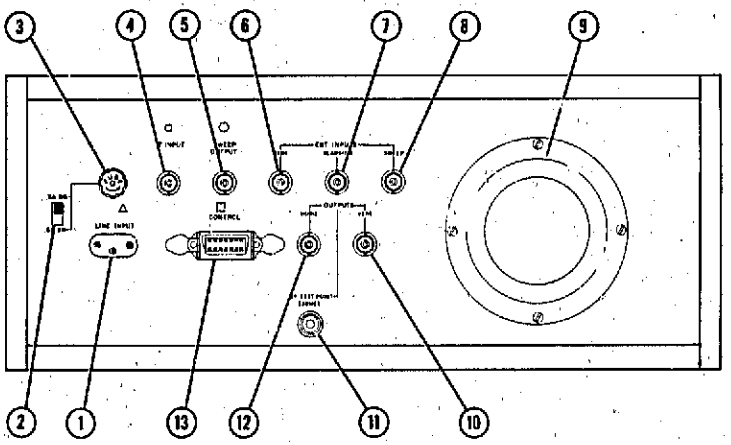


1. CRT:
   a. Scale used with VERT DISPLAY at SQ or LIN.
   b. Markers used in signal identification technique. (See 8551 RF Section Manual.)
   c. LOG scale for VERT DISPLAY.
2. Turn clockwise to blank base line.
3. Adjusts brightness of trace.
4. Adjusts focus of trace.
5. To obtain one non-recurring sweep, set SYNC at SINGLE SWEEP and depress pushbutton.
6. Lights when single sweep starts, goes out when single sweep ends.
7. SYNC:
   a. SINGLE SWEEP: sets up internal connections for single-sweep operation.
   b. LINE, INT, EXT: sets up internal connections for type of sync voltage selected. For EXT operation, input (SYNC INPUT) is on rear panel.
8. Selects time base for horizontal sweep from six sweep rates. At EXT, sets up internal conditions required when using sweep voltage supplied from external source. VERNIER provides continuous adjustment between calibrated steps.

   Note

   At EXT, apply sweep voltage to SWEEP input on rear panel, and compatible blanking pulse to BLANKING input, also on rear panel.
9. Selects vertical calibration:
   LINE: amplitude proportional to voltage
   SQ: amplitude proportional to power
   LOG: amplitude proportional to logarithm of input signal; level indicated in dB.
10. I.F. BANDWIDTH switch:
   1 KC to 1 MC: manual selection of IF bandwidth
   AUTO SELECT: automatic selection, for CW signals, of optimum IF bandwidth for chosen SPECTRUM WIDTH (on 8551) and SWEEP TIME settings.
11. Vernier for I.F. GAIN (dB): as vernier is turned cw, up to 1 dB of additional gain is inserted.
12. Controls IF input attenuator, in 10-dB and 1-dB steps.
   Highest gain setting: 70 + 10 (outer control at 70, inner at 10)
   Max atten setting: both controls at 0
13. Position adjustments: HORIZ POS shifts trace to right or left; VERT POS shifts trace up or down.
14. Adjusts trace angularly, enabling operator to align trace with graticule horizontal axes.

Figure 3-1. Front Panel Controls, Connectors, and Indicators



1. △ J4: power cable connects here. Cable supplied with 851.

2. S1: Line voltage slide switch: controls power-supply input connections. Always check that switch is set for nominal voltage of external power source.

3. Fuseholder: rating of fuse is marked at the line voltage switch setting which corresponds to voltage of power source.

4. ○ J1: cable for carrying 20-Mc IF signal from 8551 RF Section connects here. Cable supplied with RF section.

5. ○ J7: cable carrying sweep voltage from 851 to RF section connects here. Cable supplied with RF section.

6. J6: input for exte nal sync signal; requires positive-going pulse of between 3 volts peak and 15 volts peak.

7. J3: input for externally supplied blanking voltage; requires negative 4- to 10-volt pulse, width of which is compatible with retrace time of external sweep voltage used.

8. J2: input for externally supplied sweep voltage; requires 0 to approximately +15V sawtooth voltage from 10,000-ohm source.

9. CRT protective cover: may be removed for servicing and/or tube replacement.

10. J10: signal to CRT, sampled at output of video detector following 20-MC IF amplifier and just ahead of vertical amplifier; 0 to -4 volts open circuit, 4700 ohms impedance; BNC female. With high-impedance earphones, output can be used to monitor modulated signals tuned in on analyzer.

11. J5: for sampling 20-Mc IF signal just ahead of video detector; BNC female.

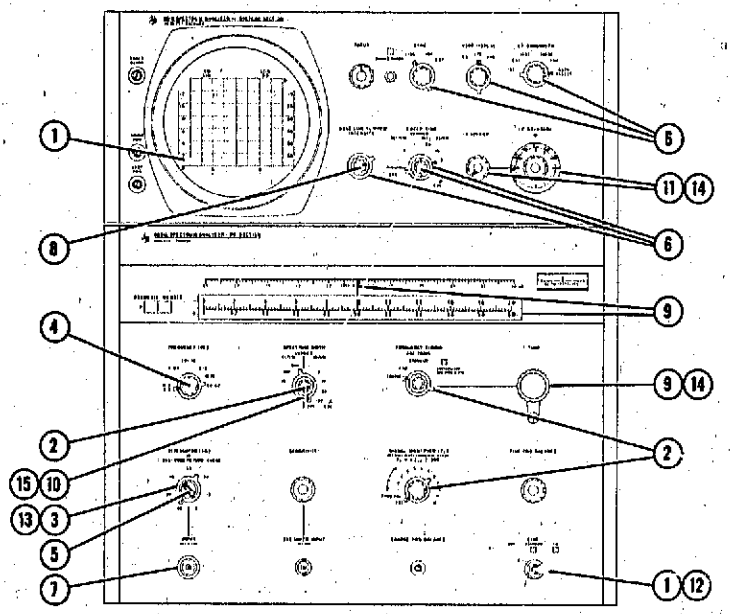
12. J8: sweep voltage, sampled just ahead of horizontal amplifier; 10 volts ±0.3V peak-to-peak open circuit, 4700 ohms impedance; BNC female.

Note

VERT and HORIZ outputs will drive a high impedance X-Y recorder to obtain an X-Y plot of spectrum displayed on CRT.

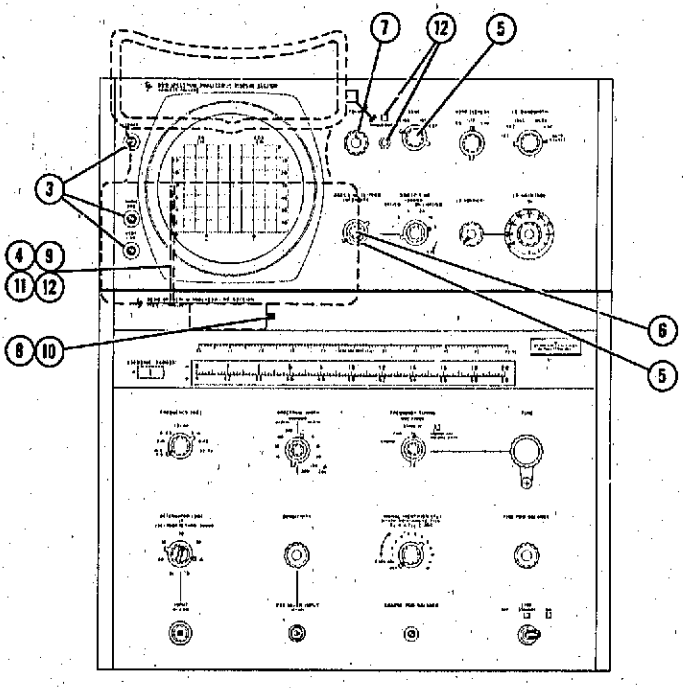
13. □ J9: 14-conductor cable connects here; carries ±15 Vdc to RF section, and SWEEP TIME/SPECTRUM WIDTH connections required for IF bandwidth AUTO SELECT operation. Cable supplied with RF section.

Figure 3-2. Rear Panel Switches and Connectors



1. LINE: set to STANDBY; light should glow, fan turn. After about 10 seconds, base line should appear on CRT. CAUTION: Before setting LINE to ON (step 12), be sure fan is turning; BWO can be damaged if fan is not operating.
2. Set: SIGNAL IDENTIFIER. . . . . OFF
   FREQUENCY TUNING . . . . COARSE
   SPECTRUM WIDTH VERNIER. . . CAL
3. ATTENUATOR (DB): Set to 60. Be sure switch seats in detent.
4. Set range switch, FREQUENCY (GC).
5. Set IF
   a. 200 MC if FREQUENCY (GC) is at 1.8 - 4.2.
   b. 2 GC for all other inputs.
6. Set: BASE LINE CLIPPER. . . . . max ccw
   SYNC . . . . . LINE
   I. F. BANDWIDTH. . . . AUTO SELECT
   VERT DISPLAY. . . LINE, LOG, or SQ
   SWEEP TIME . . . . 3 MILLISEC/CM
   VERNIER . . . . . CAL
7. Connect signal under investigation; range: 10 Mc to 12 Gc. CAUTION: Input must not exceed 1 watt average with ATTEN (DB) set at 60; see 8551 RF Section Manual.
8. INTENSITY: Set at about 3 o'clock.
9. If input frequency is unknown, set TUNE to about 3 on LOCAL OSC FREQ scale; if known, set TUNE for frequency scale reading near that of input signal.
10. Set SPECTRUM WIDTH for 200MC/CM.
11. Set I. F. GAIN (DB) at 70 or 80, I.F. VERNIER max ccw.
12. Set LINE to ON; indicator light will glow. When TUNE is at 2 Gc, large signal will appear; this is the BWO signal used for self-check and can be ignored.
13. ATTENUATOR (DB): Adjust to bring signal on CRT. CAUTION: Attenuator must be set for sufficient loss to reduce input signal to 1 mW or less.
14. Set I. F. GAIN for convenient signal-to-noise ratio, and adjust TUNE to center signal on CRT.
15. Adjust SPECTRUM WIDTH for best detail in region of interest. If display shifts position, check COARSE POS BALANCE (refer to 8551 Manual). (COARSE POS controls range-to-range position.)

Figure 3-3. Initial Operating Procedure for 10-Mc to 12-Gc Inputs



Note: Before taking pictures, read Paragraph 3-22.

1. Perform steps 1 through 14 of initial operating procedure, Figure 3-3; refer to information on input signal levels in 8551 Manual.
2. If 8551 SPECTRUM WIDTH is set for 1 MC/CM or less, stabilize the analyzer; see Figure 3-5, 8551 Manual.
3. Align trace, and adjust SWEEP TIME, SPECTRUM WIDTH, I.F. GAIN for detail of interest.
4. Install and align oscilloscope camera. Load film pack; Polaroid ASA 3000 is recommended.
5. Set:
   SYNC . . . . . .SINGLE SWEEP
   BASE LINE CLIPPER. . . cw until base line is blanked
6. Adjust INTENSITY so that fast transients in waveform almost disappear.
7. Adjust FOCUS for finest trace.
8. Depress ultra-violet light pushbutton on camera; determine exposure required when graticule is illuminated by ultra-violet light and no sweep is present. For Polaroid ASA 3000, F11 at 1/5 is recommended.
9. After setting camera, depress ultra-violet light pushbutton, and hold it on until phosphor glows. Photograph the graticule.
10. Release ultra-violet light.
11. Set camera for photographing the trace. Exposure required is a function of sweep speed and intensity.
12. Open camera shutter, depress SINGLE SWEEP pushbutton, and watch SINGLE SWEEP light. When light goes out, close shutter.

Figure 3-4. Photographic Procedure

shaping circuits, the display can be made proportional to signal power (square) or to the logarithm (level in dB) of the signal. Signal shaping (together with the wide dynamic range of the analyzer) makes it possible to show signals of widely varying amplitudes on the same display; for example, signals at -30 dBm and -90 dBm can be viewed simultaneously. Choice of display ratio is made with the VERT DISPLAY switch.

3-19. SCALES. There are two calibrations on the 851 CRT graticule. One is numerical (0.2/cm), the other is logarithmic (10 dB/cm). With VERT DISPLAY at LIN or SQ, use the numerical calibration; at LOG, use the DB scale.

3-20. OPERATING INSTRUCTIONS.

3-21. Basic procedure for putting the analyzer into operation is given in Figure 3-3.

CAUTION

Before turning on the analyzer be sure that input signals are within limits for optimum operation and instrument safety. See the 8551 RF Section Manual.

3-22. PHOTOGRAPHIC TECHNIQUES.

3-23. The 851 has an internal graticule which, with the use of ultra-violet light illumination, makes excellent oscilloscope photography possible. The UV light causes the CRT phosphor to glow uniformly, resulting in a gray background in the finished photo. This gray contrasts sharply with both the white trace and the black graticule lines, producing an oscillogram that is easy to read. The HP Model 198B Oscilloscope Camera includes an ultra-violet light source.

3-24. For uniform gray backgrounds, the double-exposure technique is best.

a. First determine the exposure required when, without any sweep on the display, the graticule is illuminated by the UV light. (F11 at 1/5 is usually adequate for Polaroid ASA 3000 film.) Photograph the graticule, and then turn off the light.

b. Second, start the sweep and photograph the display again. The required exposure will depend on sweep speed and intensity setting on the CRT. For 3 ms/cm sweeps with the intensity turned down to about half normal brightness, F11 at 1/5 is a good starting point.

3-25. To stop the sweep while exposing the graticule, either dim the display with INTENSITY or, more conveniently, set SYNC to SINGLE SWEEP. When it is necessary to obtain matched sets of photographs, the SINGLE SWEEP feature should be used.

3-26. For slow sweep pictures, ALWAYS use the BASE LINE CLIPPER. Blanking the base line prevents fogging the bottom of the exposure.

3-27. The information offered here and in the photographic operating plate, Figure 3-4, is presented as a guide only.

Table 3-1. Optimum 851 I. F. BANDWIDTH Settings for SPECTRUM WIDTH/SWEEP TIME Settings

SPECTRUM WIDTH SETTINGS	SWEEP TIME SETTINGS					
	MILLISEC/CM			SEC/CM		
	3	10	30	.1	.3	1
10KC/CM	3KC	1KC	1KC	1KC	1KC	1KC
30KC/CM	3KC	3KC	1KC	1KC	1KC	1KC
100KC/CM	10KC	3KC	3KC	1KC	1KC	1KC
300KC/CM	10KC	10KC	3KC	3KC	1KC	1KC
1MC/CM	100KC	10KC	10KC	3KC	3KC	1KC
3MC/CM	100KC	100KC	10KC	10KC	3KC	3KC
10MC/CM	100KC	100KC	100KC	10KC	10KC	3KC
30MC/CM	1MC	100KC	100KC	100KC	10KC	10KC
100MC/CM	1MC	1MC	100KC	100KC	100KC	10KC
200MC/CM	1MC	1MC	1MC	100KC	100KC	100KC

THEORY

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. The 851/8551 Spectrum Analyzer receives signals and displays them on a CRT as a function of frequency versus amplitude. Figure 4-1 is a simplified block diagram of the analyzer. Figure 4-2 is a block diagram of the 851 Display Unit showing its major functions.

4-3. The 851 generates a sweep voltage that drives both the 8551 RF Section and the 851 CRT horizontal amplifier. As both sections are driven by the same voltage, the CRT sweep starts at the same time that the 8551 front end begins sweeping. Signals from the 8551 front end are mixed down to a -20 Mc IF and fed to the display unit, which presents a calibrated display of signal frequency versus amplitude.

4-4. 851 BLOCK DIAGRAM.

4-5. RF SECTION.

4-6. The 20-Mc IF signal and its video components from the 8551 RF Unit are attenuated and then filtered by a 1-Mc bandpass filter. The 50-ohm input attenuator is a gain control calibrated in dB for the IF amplifiers in the Display Unit RF circuit assembly. In the A2 RF circuit assembly there are further filtering circuits that narrow the bandpass to 1, 3, 10, and 100 kc. The I. F. BANDWIDTH control is used to select the desired bandpass.

4-7. After signals have been filtered, the display mode is determined by a current-controlled attenuator in conjunction with the video detector circuit. The VERT DISPLAY switch selects either LOG, LIN, or SQ displays. An IF VERNIER control is located in an amplifier in the video detector circuitry.

4-8. The vertical amplifier connects directly to the CRT plates. Blanking during the flyback portion of the horizontal sweep is fed to the vertical amplifier from the horizontal amplifier.

4-9. SWEEP AND HORIZONTAL AMPLIFIER SECTION.

4-10. The sweep generator employs a Miller Integrator. Selection of capacitors in a feedback circuit by the SWEEP TIME switch controls the time of the sweep. Once the sweep is completed, it must be reset before it will sweep again. The SYNC switch selects SINGLE SWEEP, LINE, INT, or EXT modes of operation. On the block diagram, the INT mode is represented by the normally open section of the SYNC switch. All other modes are controlled by signals, or switching of the Schmitt trigger. The SYNC INPUT is used to trigger the sweep from an external source.

4-11. The reset amplifier is a differential amplifier acting as a gate. When the output of the sweep generator reaches +5 volts, the gate opens to initiate the sweep reset function. At this time, the switching of the reset results in a blanking signal that is fed to the vertical amplifier.

4-12. The horizontal amplifier sweeps the CRT beam across the oscilloscope face at a rate determined by the sweep generator. The horizontal amplifier also has an output that is used to drive the 8551 BWO. This output is fed to the SWEEP OUTPUT jack on the rear panel.

4-13. TALKING SCHEMATICS.

4-14. Figures 4-7 through 4-13 contain detailed information on the operation of circuits throughout the 851 Display Unit. They are in schematic form to allow the reader to follow the descriptions and to refer to the circuitry as easily as possible. Figures containing circuit descriptions have blocks of text placed directly over the circuits to which they apply.

4-15. CIRCUIT DESCRIPTION.

4-16. DISPLAY SECTION.

4-17. IF INPUT ATTENUATOR. The 20-Mc IF from the 8551 is first applied to an attenuator calibrated as a gain switch (IF GAIN). This attenuator includes a two-section switch that attenuates from 0 to 80 dB in 1-dB steps. The IF VERNIER provides up to 1 dB adjustment between steps. It is just ahead of the final 20-Mc amplifier and the video detector.

4-18. BANDWIDTH SWITCHING CIRCUITS. The bandwidth of the first 20-Mc IF amplifier is selected by the I. F. BANDWIDTH switch. Amplifier bandwidth determines the resolution of the display; the narrower the bandwidth, the more detailed the presentation of the frequency components of signals. Variations in bandwidth are provided by transistor switched, fixed bandpass filters whose center frequency is always 20 Mc. When the switches are off, the bandwidth of the display is 1 Mc. Switching provides bandwidths of 1, 3, 10, and 100 kc, and 1 Mc.

4-19. Automatic bandwidth selection may be used to select the IF bandwidth that provides optimum display for the SPECTRUM WIDTH and SWEEP TIME settings selected. Optimum bandwidth is the narrowest bandwidth that does not attenuate signals due to the rise time of the 20-Mc amplifier. When I. F. BANDWIDTH is at AUTO SELECT, current to operate the bandwidth switch circuits is routed through contacts on the 8551 SPECTRUM WIDTH switch and the 851 SWEEP TIME switch in addition to the regular route through the I.F. BANDWIDTH switch. Connections for this mode of operation are carried through the CONTROL cable between the 851 and the 8551.

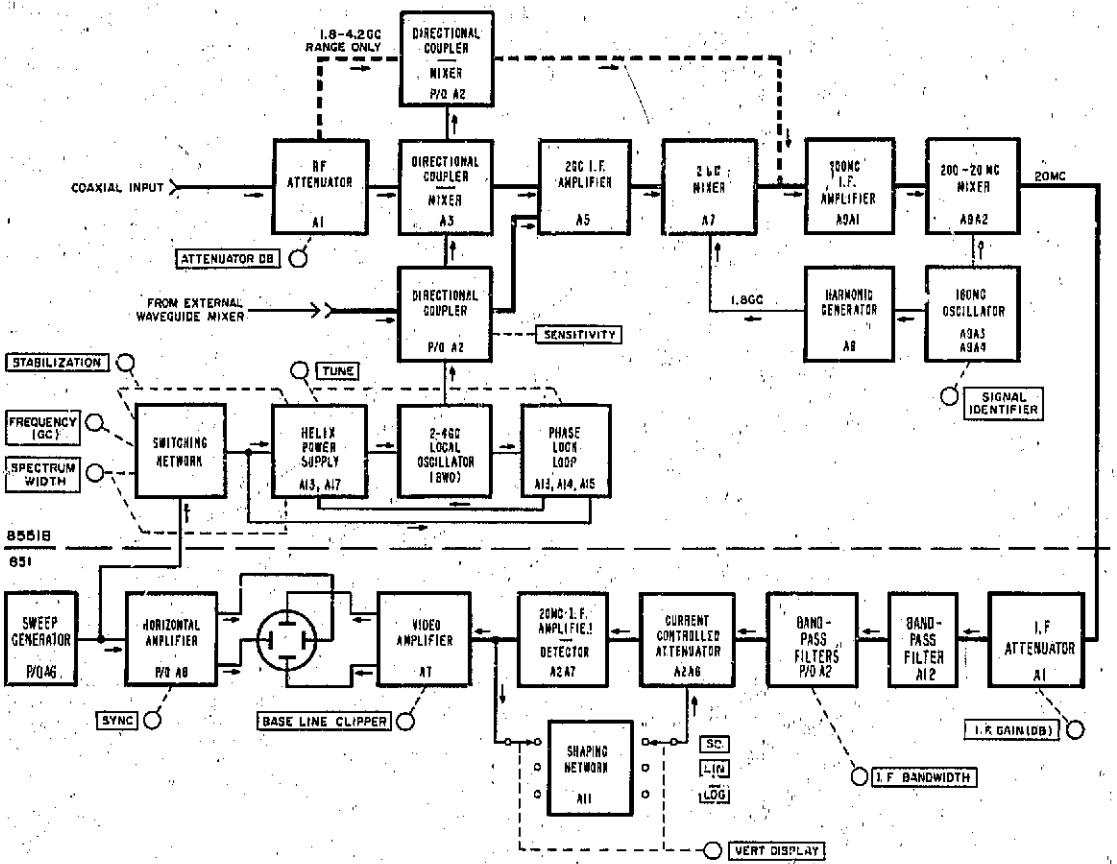


Figure 4-1. Model 851/8551 Spectrum Analyzer, Block Diagram

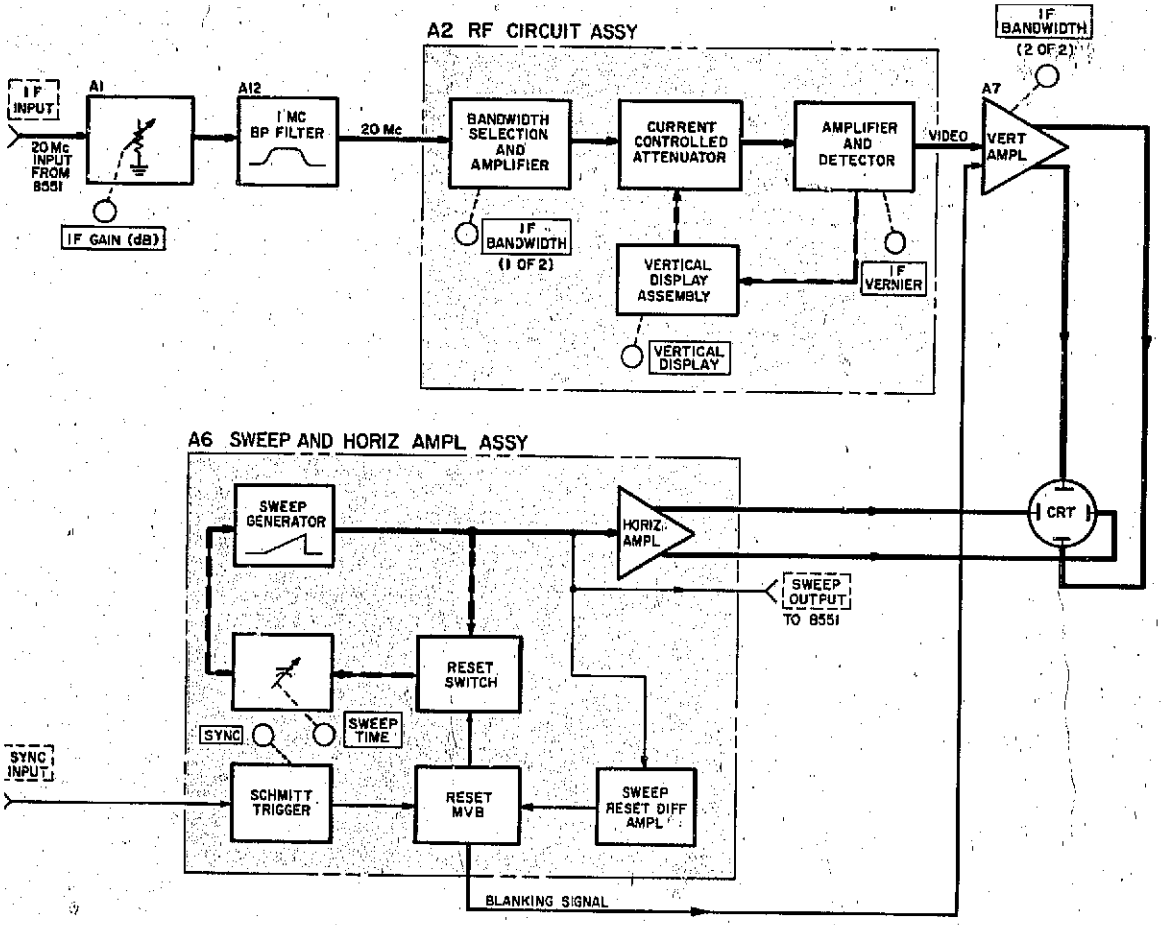


Figure 4-2. Model 851 Block Diagram

Note

The narrower the IF bandwidth, the greater the attenuation of signals at faster SWEEP TIME settings.

4-20. VIDEO DISPLAY. The display section provides a choice of linear, square, or logarithmic presentations on the CRT. The signal is converted to the proper ratio by the current-controlled attenuator. This circuit includes hot carrier diodes to shunt the signal path. The diodes act as variable resistors whose resistance depends on the bias current supplied. For linear displays, bias current is fixed. For log or square displays, bias current is changed by shaping the output voltage of the video amplifier. The shaped voltage is applied to the diodes as bias for the current-controlled attenuator.

4-21. SWEEP AND HORIZONTAL AMPLIFIER.

a. This circuit generates the sweep voltage and blanking signal. Rate of sweep generated is determined by RC networks connected into circuit by the SWEEP TIME switch. Connections for the type of SYNC voltage selected are set up by SYNC switch S2.

b. Sweep voltage for driving the first local oscillator (BWO) in the 8551 RF Section is taken at the output of the sweep generator, just ahead of the horizontal amplifier. This voltage appears at SWEEP OUTPUT on the rear panel and is carried by inter-unit SWEEP cable to the 8551. Sweep voltage, sampled at the same point in the circuit, appears also at the HORIZ output connector on the rear panel.

c. Sweep voltage is applied to the base of A6Q16 and the signal on the base of A6Q18 is determined by the setting of HORIZ POS adjust R9. Horiz Gain adjust A8R54 in the collector circuit of the amplifier is adjusted when calibrating the horizontal amplifier. Amplified sweep voltage is applied to the CRT horizontal deflection plates.

d. The blanking signal, taken from the emitter of A6Q6, is amplified by A7Q9 on the vertical amplifier board before it is applied to the CRT.

e. Sweep voltage from a suitable external source such as one of the HP 8690 Sweep Oscillators can be applied via contacts at the EXT position of SWEEP TIME to the horizontal amplifier to drive CRT horizontal plates. The horizontal amplifier requires a sawtooth voltage of from 0 to +15 volts. Inputs for sweep voltage and compatible blanking signal are on the rear panel.

4-22. The horizontal sweep generator is shown in block-diagram form in Figure 4-3.

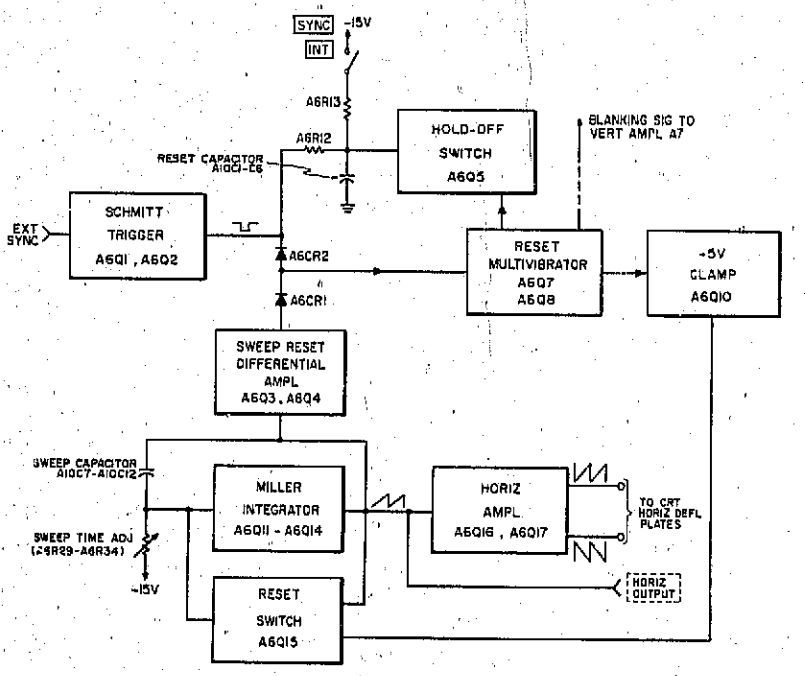


Figure 4-3. Horizontal Sweep Generator, Block Diagram

4-23. EXTERNAL SYNC. With SYNC at EXT, a positive input signal will cause Schmitt Trigger A6Q1, A6Q2 to generate a negative trigger pulse at the collector of A6Q1. This negative pulse is coupled through A6CR2 to the base of A6Q7, one half of a bi-stable multivibrator. The negative pulse turns A6Q7 off and A6Q8 on.

4-24. When A6Q7 turns off, it turns off A6Q6. This cuts off the blanking signal, allowing the horizontal sweep to be seen on the CRT if the base line clipper has not biased off the CRT.

4-25. When A6Q8 turns on, Pulse Amplifier A6Q conducts, turning off -5V Clamp A6Q10. When A6Q10 turns off, its emitter goes positive, biasing off Reset Switch A6Q15. When the reset switch cuts off, Sweep Capacitor A10C7-A10C12 in the base circuit of A6Q11 starts to charge, applying a negative-going signal to the base of A6Q11.

4-26. Transistors A6Q11, A6Q12, A6Q13, and A6Q14 form a Miller Integrator. The output of A6Q14 is a positive-going ramp. The positive ramp voltage is fed back to the Sweep Capacitor A10C7-A10C12. As the sweep capacitor charges negatively on its bottom plate, the top of the capacitor is going positive. The result is that the voltage drop across R35 and A6R29-A6R34 is almost constant as the sweep capacitor charges. If the voltage drop is constant, the current through the resistors is constant. This same current is the charging current for the sweep capacitor. If the charging current is constant, then the capacitor is charging linearly and a linear ramp voltage out of the Miller Integrator is the result.

4-27. The positive ramp fed back to the sweep capacitor also goes to the base of A6Q4, one half of the sweep reset amplifier. The signal is amplified and appears as a positive-going voltage at the collector of A6Q3. The signal is coupled through A6CR1 and delivered to the base of A6Q7. When the sweep voltage from the Miller Integrator circuit reaches a predetermined level, A6Q7 starts to conduct, cutting off A6Q8. This causes Pulse Amplifier A6Q9 to cut off, turning on -5V Clamp A6Q10. When A6Q10 conducts, it turns on Reset Switch A6Q15 which discharges the sweep capacitor, ending the sweep. At the time A6Q7 turns on, it turns on A6Q6, blanking the CRT during retrace.

4-28. INTERNAL SYNC. With SYNC at INT, operation of the sweep circuit is essentially the same except that no external trigger is needed to turn off A6Q7.

a. With SYNC at INT, Reset Capacitor A10C1-A10C6 is connected through A6R13 to the -15-V supply. As the reset capacitor charges negatively, the voltage is coupled through A6R12 and A6CR2 to the base of A6Q7. This triggers A6Q7 and starts the sweep. Sweep termination is the same as when operating from an external trigger.

b. The one other difference in operation is that the conduction of A6Q8 also turns on A6Q5, discharging the reset capacitor until the end of sweep. At the end of sweep when the reset multivibrator flips back, A6Q5 is cut off, allowing Reset Capacitor A10C1-A10C6 to charge negatively again and restart sweep.

4-29. OPERATION OF VERTICAL DISPLAY.

4-30. CURRENT-CONTROLLED ATTENUATOR.

4-31. Between the first and second 20-Mc IF amplifiers, the 20-Mc IF is passed through the current-controlled attenuator. The attenuating element is a network of the hot carrier diodes that shunt the signal path.

4-32. Hot carrier diodes are used because they have very low shunt capacity and a very predictable dynamic resistance-versus-current characteristic. This predictable characteristic makes it possible to design shaping circuits that will give the desired attenuation characteristics in the LOG and SQuare modes of operation.

4-33. Figure 4-4 shows a dynamic resistance-versus current curve for a hot carrier diode. As current through the diodes increases, dynamic resistance decreases. In the current-controlled attenuator, lower diode resistance causes more signal shunting, i.e., more attenuation of the signal.

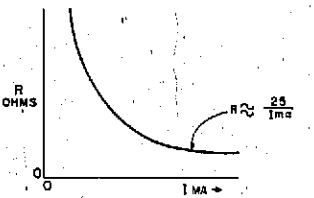


Figure 4-4. Typical Dynamic Resistance-vs-Current Curve, Hot Carrier Diodes

4-34. SQUARE MODE OF OPERATION.

4-35. In the SQuare mode of operation, the voltage (linear) indication on the CRT is converted to a voltage-square display representing power. If two signals are present with a voltage ratio of 2:1 (VERT DISPLAY at LIN), at SQ they will appear on the CRT as signals with a 4:1 ratio. To achieve this change in the display, the amount of current to the current-controlled attenuator must decrease with an increase in signal level.

4-36. The video signal into the VERT DISPLAY switch assembly is negative-going. A negative signal on the base of A11Q2 (see Figure 4-5) will increase its conduction. This will decrease current through A11CR1, A11CR2, and A11Q1; this current flows through the hot carrier diodes in the current-controlled attenuator. Larger signals will cause a much greater decrease in current through the attenuator diodes than small signals will. Shaping circuit characteristics are such that any increase in signal level will cause the square of the increase to appear on the CRT. For example, as the signal goes from 1 to 2 in voltage, the decrease in shaping circuit current is such that four times as much signal gets through the attenuator. In general, any increase in signal level will cause the square of the increase to appear on the CRT.

4-37. LOGARITHMIC MODE OF OPERATION.

4-38. In the LOG mode of operation the incoming voltage is converted to bias current of such value that the resulting display is proportional to the log of the input voltage. To achieve such a display, larger signals must cause much greater attenuation than small signals; that is, as signal level increases, a much greater amount of current must flow through the diodes in the attenuator. With VERT DISPLAY at LOG, current out of the shaping circuit is such that gain through the current-controlled attenuator is logarithmic; that is, for each 10 dB of change in signal level, there is a 1-centimeter change in signal display.

4-39. Refer to the simplified schematic of VERT DISPLAY at LOG, Figure 4-6. The video signal fed back to A11Q1 is negative-going. As A11Q1 conducts more, diodes A11CR3 and A11CR4 are biased on. When they conduct, they decrease the emitter resistance of A11Q1, increasing the gain. This causes proportionately more current to flow through the attenuator hot carrier diodes on large signals than on small. The shaping circuit in the emitter of A11Q1 is designed to provide a logarithmic gain through the current-controlled attenuator.

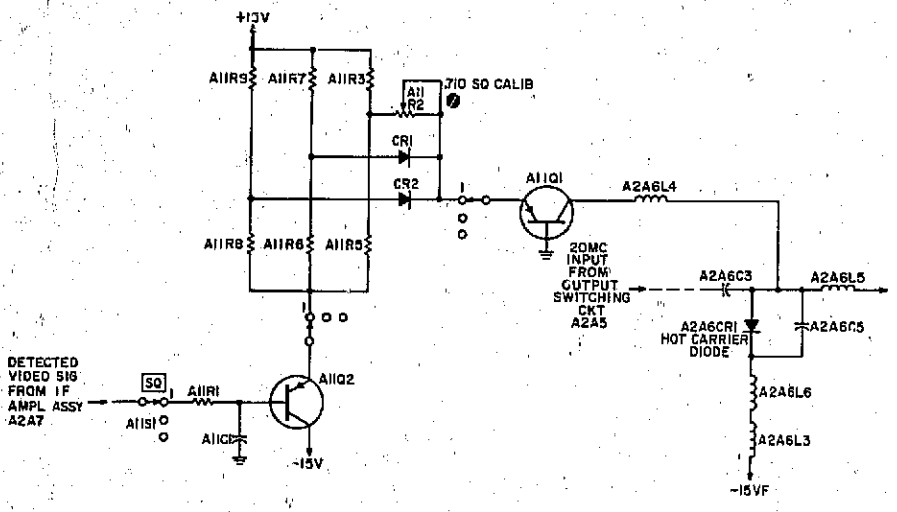


Figure 4-5. VERT DISPLAY Switch at SQ, Simplified Schematic

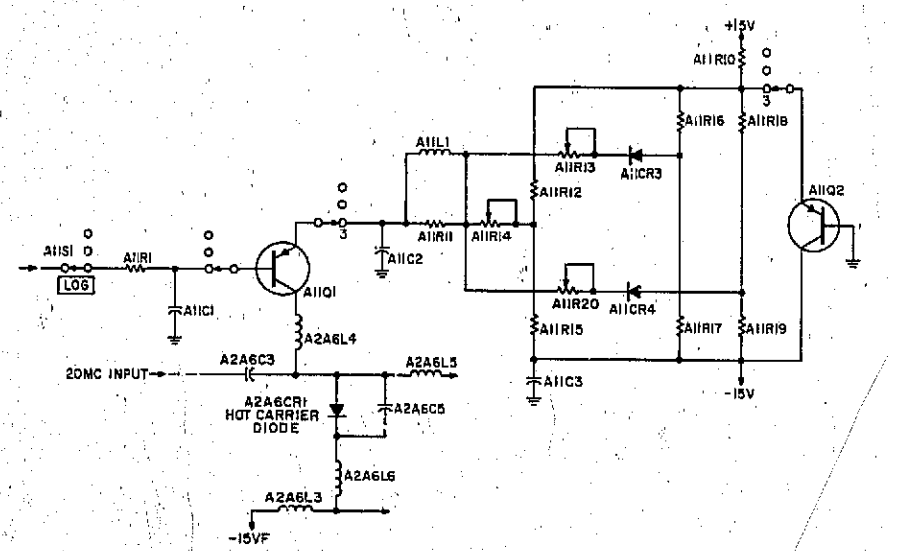


Figure 4-6. VERT DISPLAY Switch at LOG, Simplified Schematic

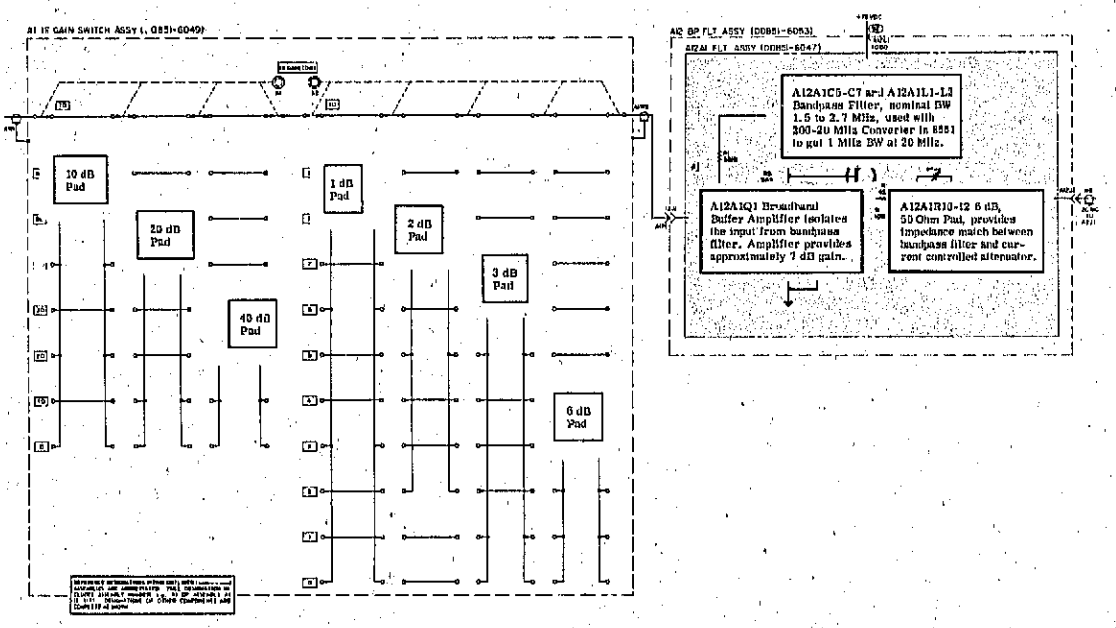


Figure 4-7. 20-MC IF Input and Attenuator (1 of 2)

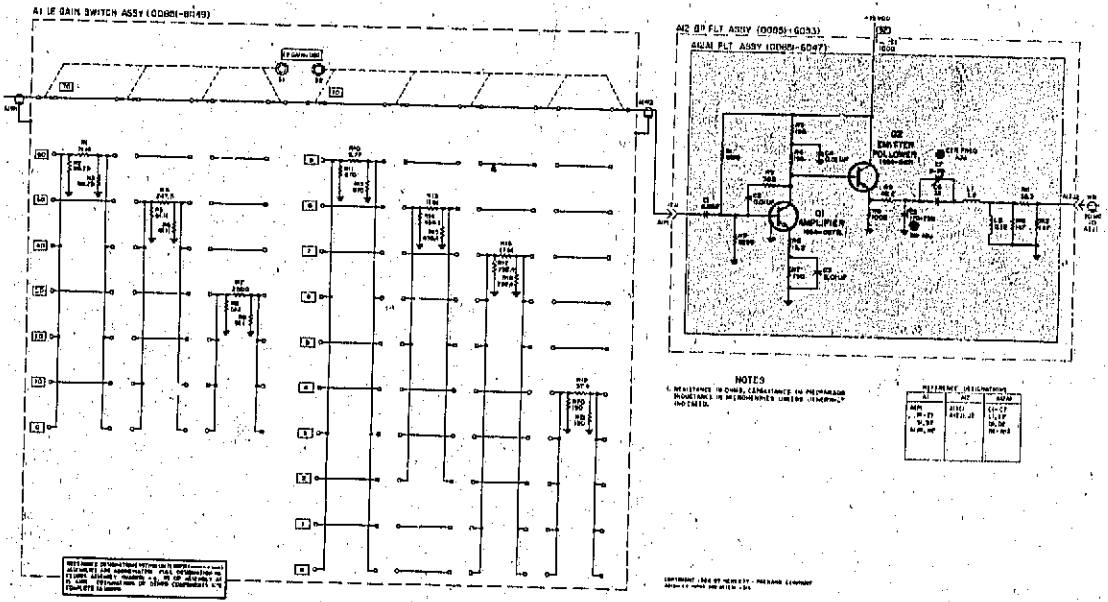


Figure 4-7. 20-MC IF Input and Attenuator (2 of 2)

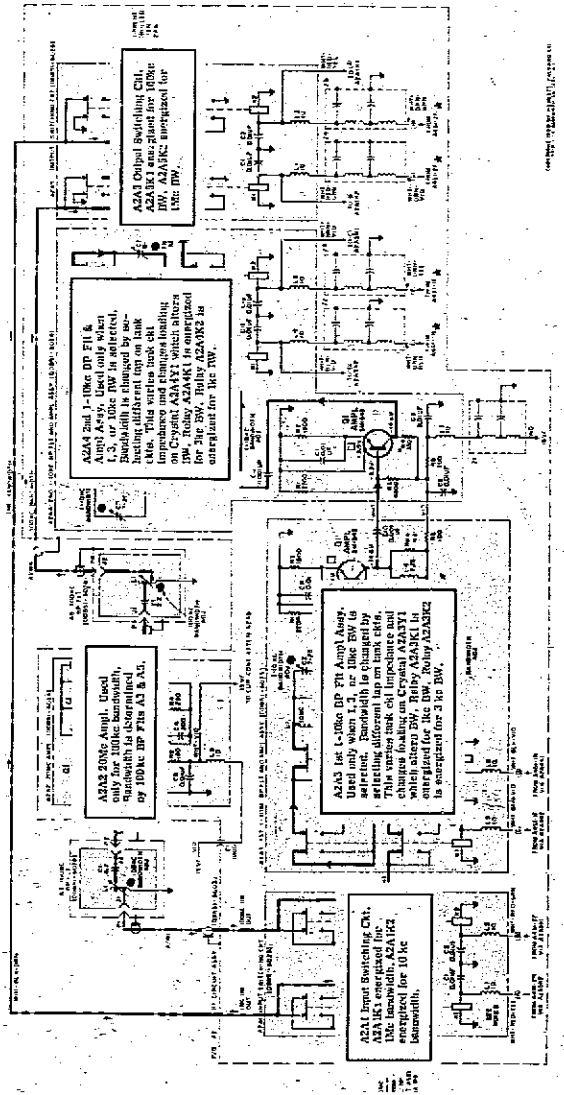


Figure 4-8. IF Bandwidth Switching Circuits (1 of 2)

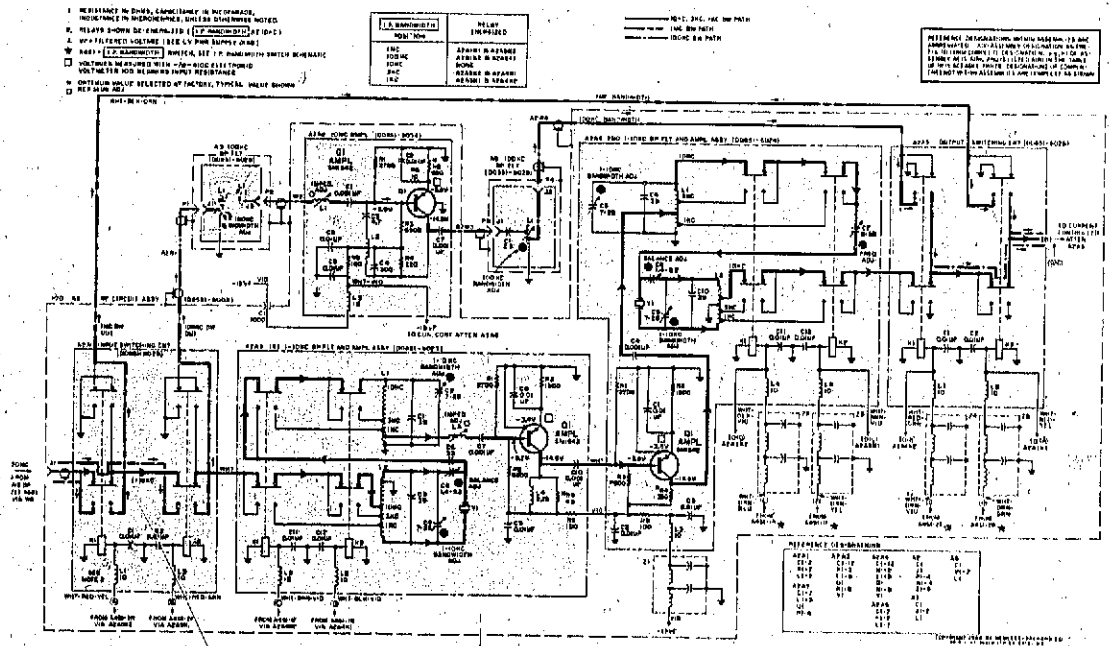


Figure 4-8. IF Bandwidth Switching Circuits (2 of 2)

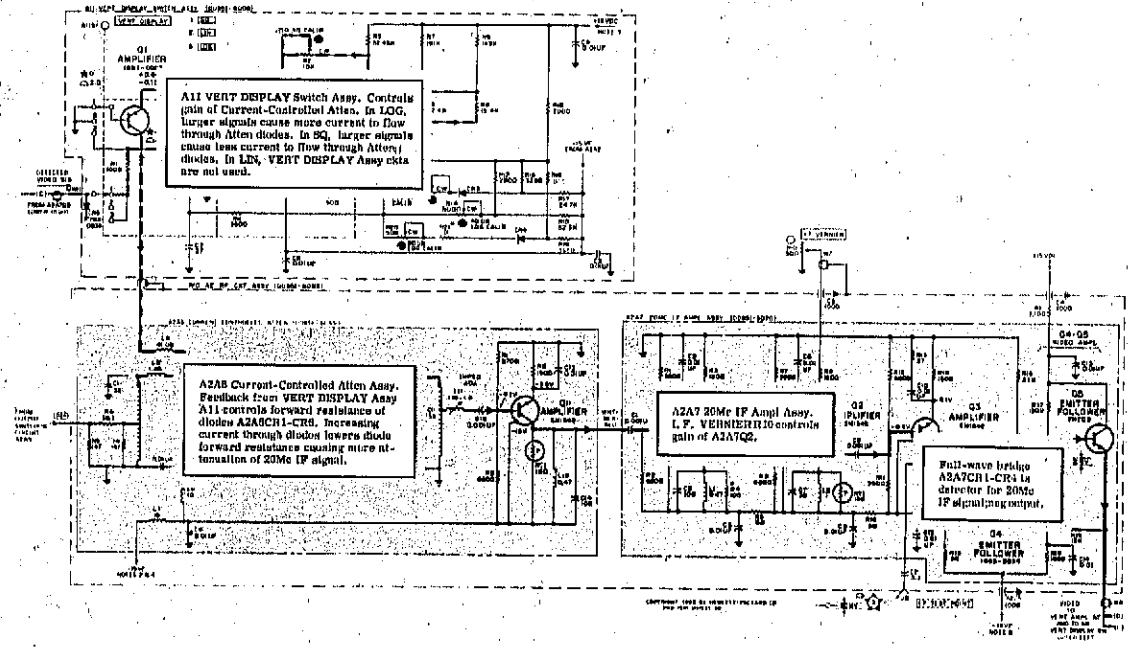


Figure 4-9. VERT DISPLAY Switch, Current-Controlled Attenuator, and 20-MC IF Amplifier (1 of 2)

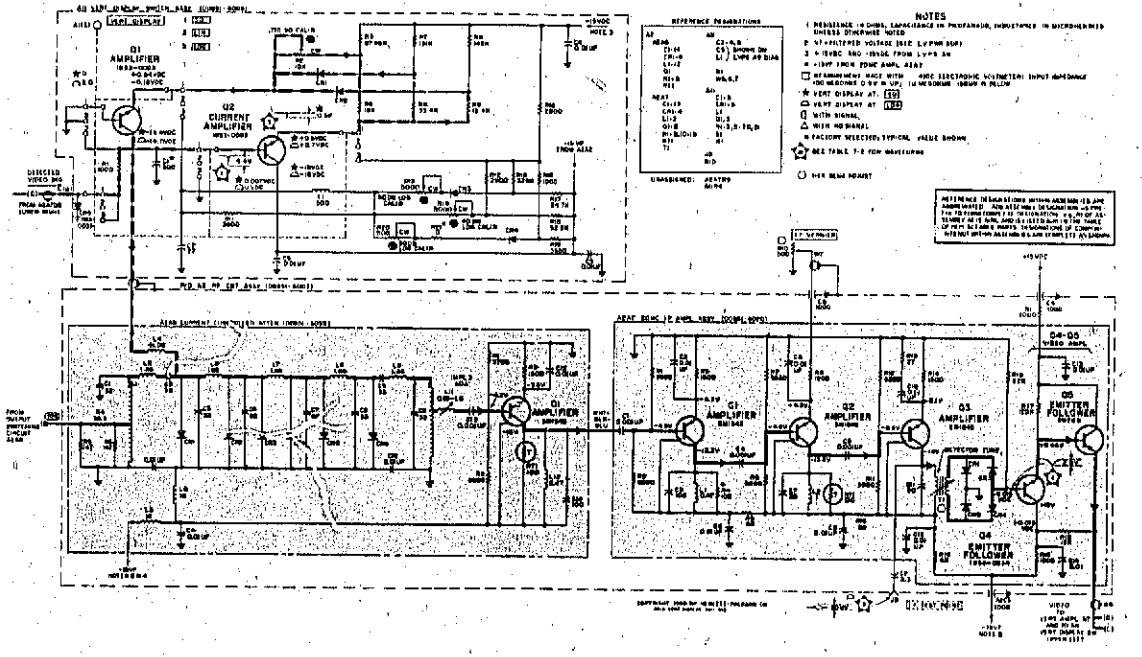


Figure 4-9. VERT DISPLAY Switch, Current-Controlled Attenuator, and 20-MC IF Amplifier (2 of 2)

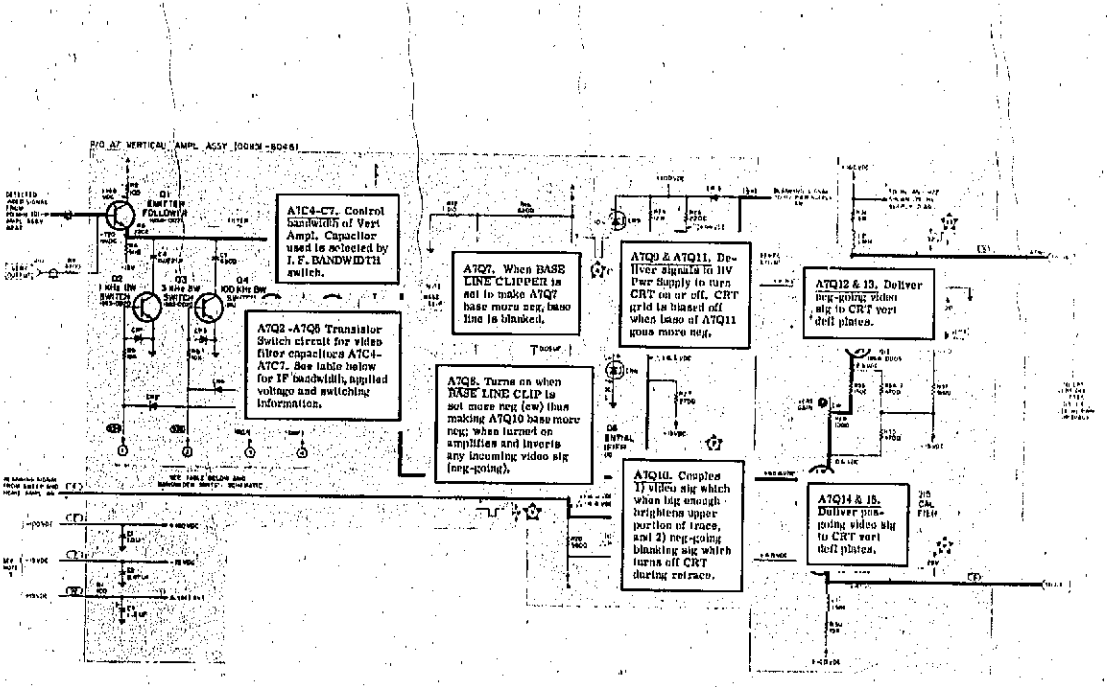


Figure 4-10. Vertical Amplifier (1 of 2)

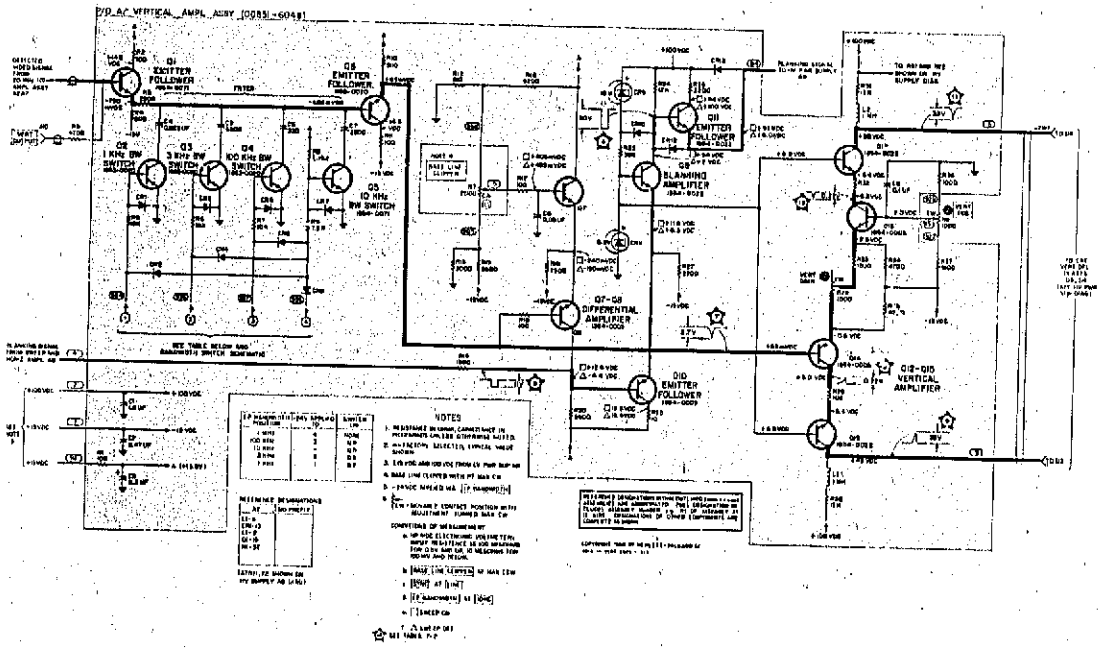


Figure 4-10. Vertical Amplifier (2 of 2)

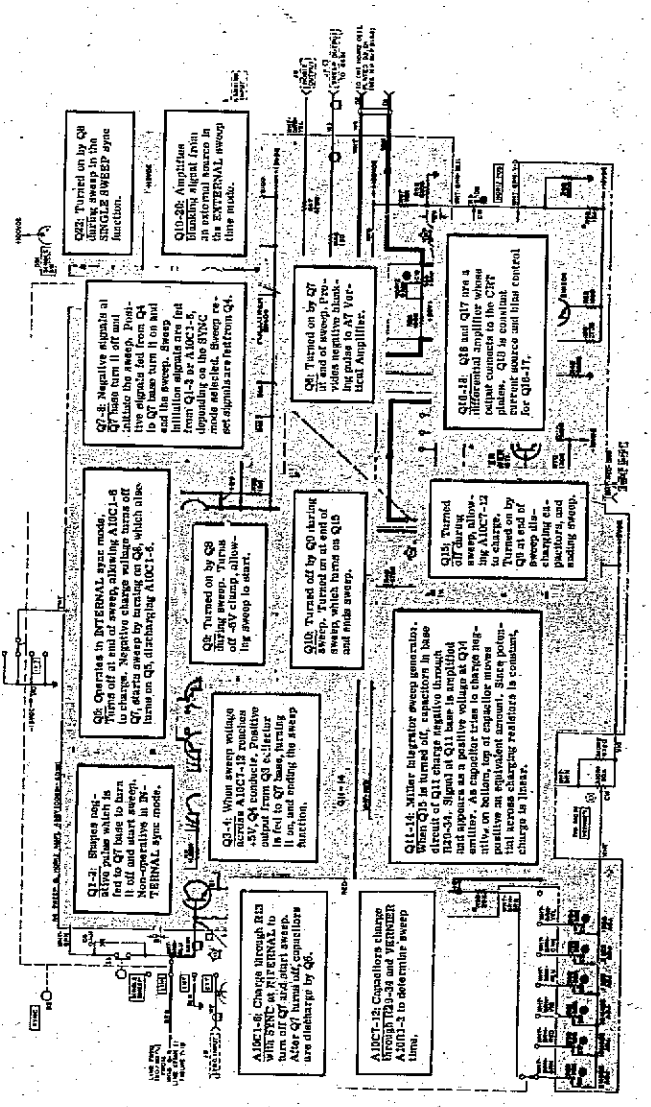


Figure 4-11. Sweep and Horizontal Amplifier (1 of 2)

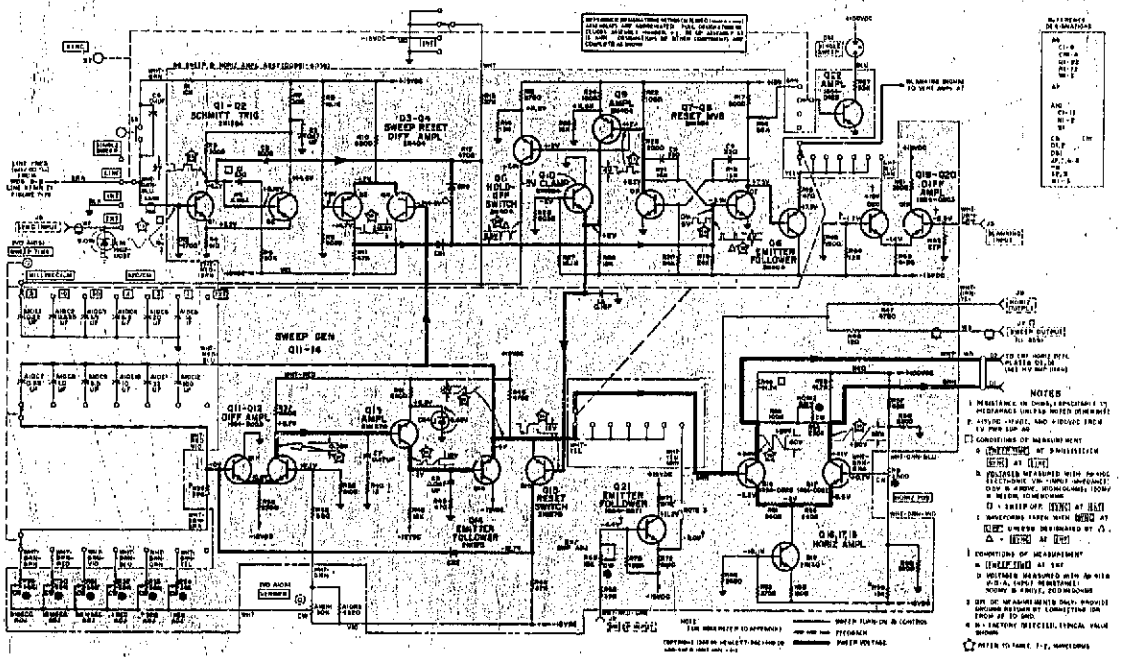


Figure 4-11. Sweep and Horizontal Amplifier (2 of 2)

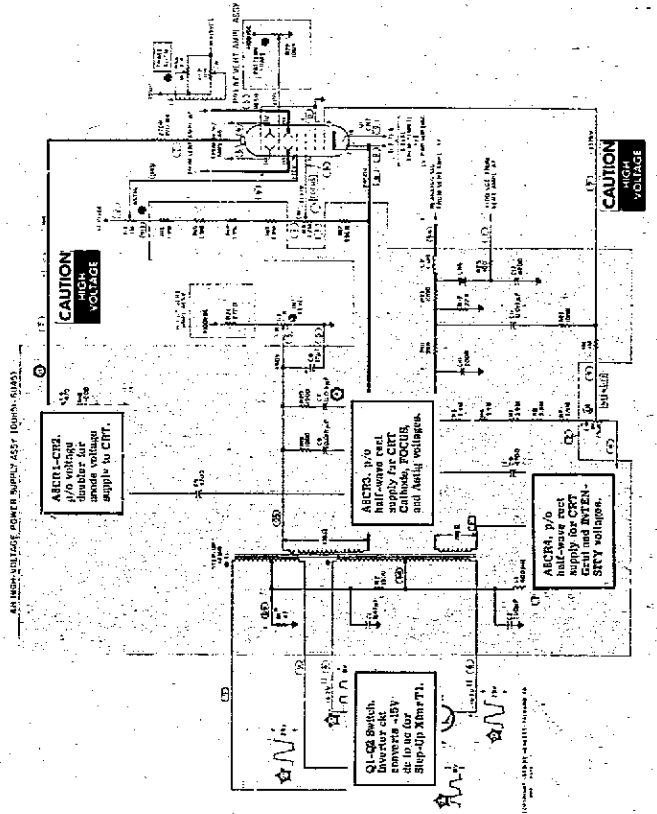


Figure 4-12. HV Power Supply (1 of 2)

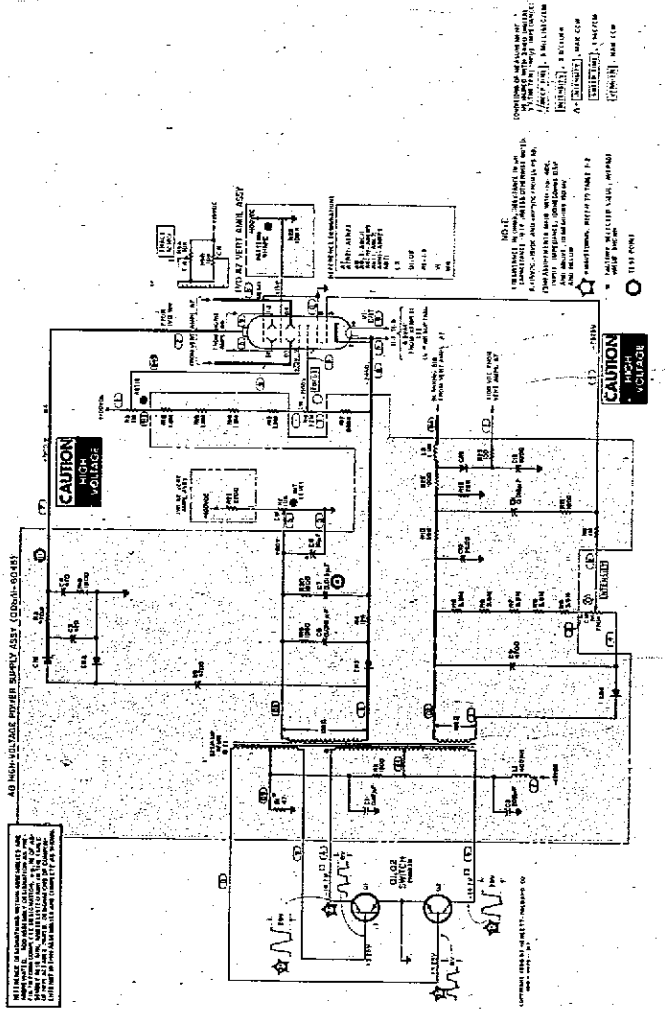


Figure 4-12. HV Power Supply (2 of 2)

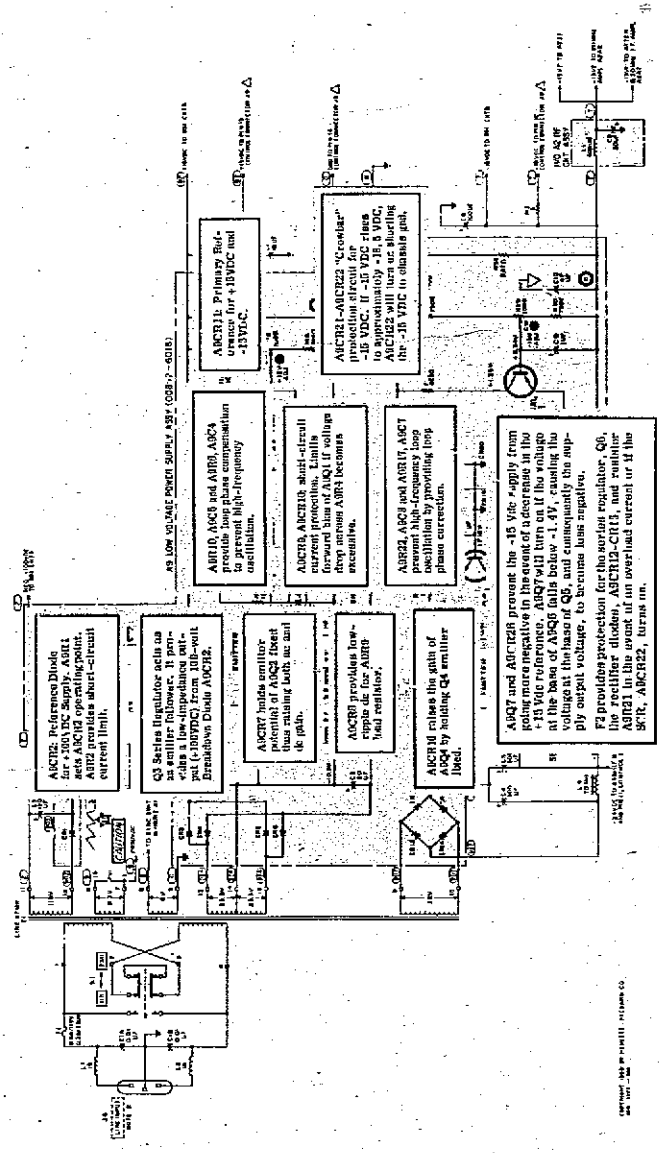


Figure 4-13. LV Power Supply (1 of 2)

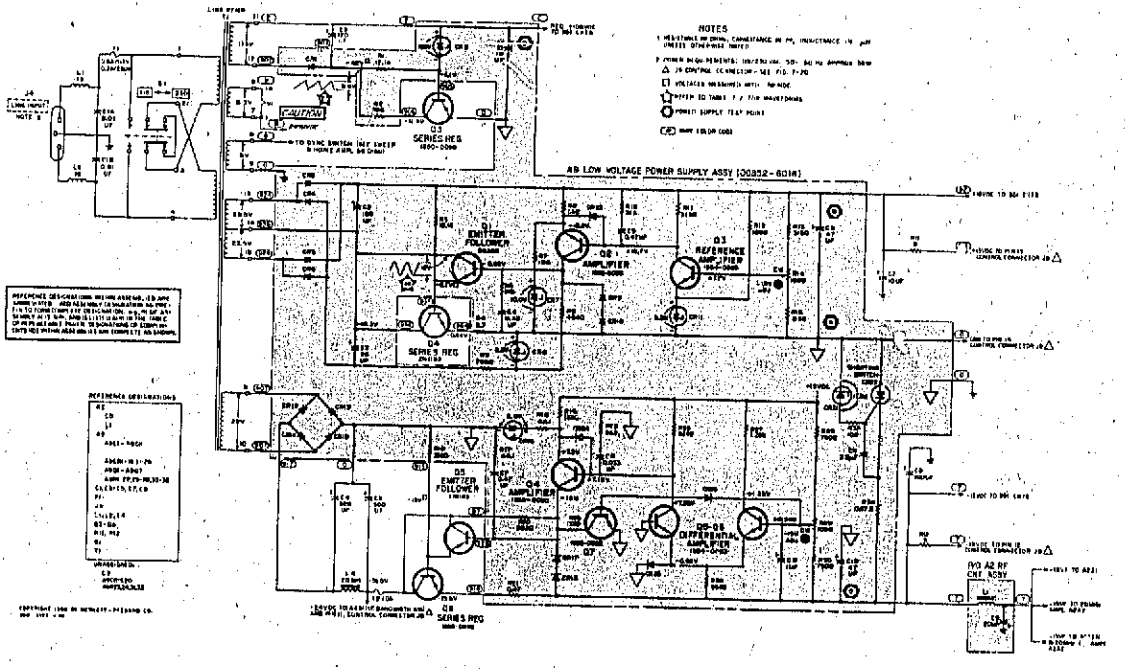


Figure 4-13. LV Power Supply (2 of 2)

MAINTENANCE

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. Information required to maintain the 851 Spectrum Analyzer Display Section in working condition is provided in this section. Type of information covered is summarized briefly in Paragraph 5-5.

5-3. "Right" and "left", "backward" and "forward" as used in this section are with respect to the instrument as seen by the operator when he is facing the front panel and the instrument is upright.

5-4. Unless otherwise specified, test procedures assume the 851 is connected to a 115- or 230-volt, 50- to 400-cycle, approximately 55-watt source.

5-5. CONTENT.

a. Performance Checks. Tables 5-2 and 5-8. Paragraphs 5-9 through 5-34.

b. Checks and Adjustments. Procedures are given in brief form in Table 5-18 and, in more detail, in Paragraphs 5-37 through 5-130.

c. Required Test Equipment. Instruments required for tests and adjustments are listed and briefly specified in Table 5-1; each instrument is given a reference. Accessories required for the procedures are also listed in Table 5-1; each accessory is given a reference letter. Required equipment is listed at the beginning of each procedure by reference number or letter.

d. Schematics. Section VII.

e. Waveforms: Table 7-2.

f. Assembly and Component Locations: Silk-screening on the instrument chassis and assembly covers identifies assembly numbers. Parts on circuit boards are identified both by silk-screening and by photographs in the schematic section at the back of the manual.

(1) Assembly locations and internal adjustment locations are shown in Figures 5-4, 5-15, & 5-16.

(2) Each board-mounted component is identified on a photograph of the board. In the main, these illustrations face the schematic in which the assembly appears.

g. Troubleshooting Information: Tables 5-23 through 5-26. Troubleshooting information is included in a series of tables designed as flow charts.

h. Disassembly Instructions: Paragraphs 5-151 through 5-166.

5-6. COVER AND SIDE PANEL REMOVAL.

a. Equipment Required: No. 2 Phillips screwdriver.

b. Top Cover Removal.

(1) Remove four Phillips head screws (6-32 x 7/16").

(2) Slide cover to rear and off instrument.

c. Side Panel Removal. After removing the top cover, remove the four Phillips head screws (6-32 x 3/16") from each panel. The side panels lift off.

d. Bottom Plate Removal.

(1) Remove the four Phillips head screws (6-32 x 7/16").

(2) Push plate to rear and off instrument.

5-7. PERFORMANCE CHECKS.

5-8. Front panel checks for incoming or routine inspection are given in Table 5-2, and procedures for verifying that the 851 meets specifications are given in Table 5-8. Both sets of procedures are spelled out in greater detail in Paragraphs 5-9 through 5-34. Both tables reference the more detailed procedures as an aid in case brevity has obscured clarity. Table 5-8, in test-card form, briefly describes test sequences and provides space for recording measurement results.

Table 5-1. Recommended Test Equipment and Accessories

Ref	Instrument	Required Specifications	Recommended Equipment
1	Oscilloscope	Sensitivity: 0.1 mV/cm	hp 130C 200 μV/cm
2	DC Digital Voltmeter	Accuracy: 0.05% Input Impedance: 10 megohms Automatic Range Selection: Range to 150 V	hp 3440A Digital Voltmeter with hp 3442A Automatic Range Selector Plug-In
3	Variable Auto Transformer	Range: 103 to 127 Vac at approx 1/2 amp Voltmeter Range: 103 to 127 ±1 volt	General Radio Type W5MT3A Superior Electric UC1M
4	DC Milliammeter	Accuracy: ±0.1 mA±3% of FS	hp 428B w/clip-on probe
5	DC Voltmeter	Accuracy: ±2% of FS Input Resistance: 100 megohms Can accommodate voltage-divider probe	hp 410C Electronic Voltmeter
6	DC Voltage Divider	Division Ratio: 100:1 Accuracy: ±5% Input Resistance: 10,000 megohms Max Volts: 6000	hp 11045A DC Voltage Divider
7	Electronic Counter	Frequency: 200 Mc Accuracy: 5 parts in 10^8 ±1 count Multiple period averaging feature	hp 5245L Electronic Counter and HP 5253B Frequency Converter
8	Low-Frequency Oscillator	Frequency Range: 1 cps to 350 cps, continuously variable Output: 5 volts peak Distortion: less than 0.5% above 5 cps	hp 202C
9	HF Signal Generator	Output Frequency: 50 kc to 20 Mc Frequency Accuracy: ±1% Output: at least 3 volts into 50 ohms External modulation: Output level meter	hp 606A/B
10	VHF Attenuator	To 60 dB, in 10-dB steps, at 2 Gc	hp 355D
11	UHF Signal Gen.	Frequency: 2 Gc	hp 8614A
12	Precision 10-dB/ Step Attenuator	Accuracy at 20 Mc: 0-10 dB, ±0.02 dB 10-20 dB, ±0.03 dB 20-70 dB, ±0.03 dB + 0.03 dB/20 dB	hp H25-355D VHF Attenuator
13	Precision 1-dB/ Step Attenuator	Accuracy at 20 Mc: ±0.02 dB	hp H53-355C VHF Attenuator
A	Cable Assembly (2 each)	Shielded 50-ohm cable terminated with dual banana plugs	hp 11000A
B	Cable Assembly	Shielded 50-ohm cable, dual banana plug to alligator clips	hp 11037A
C	Cable Assembly (3 ea)	RG-58C/U, BNC male to dual banana plug	hp 11001A
D	Cable Assembly	RG-58C/U, BNC male to BNC male	hp 10503A
E	Adapter	BNC female to dual banana plug adapter	hp 10111A
F	BNC Tee	BNC male to 2 BNC females	UG-274A/U, hp 1250-0072
G	Plastic tuning wand	Approx 7" long x 3/8" diam plastic	Modified* General Cement #GC8721
H	Cable Assembly	Shielded coax, type N male to type N male, 6 feet long	hp 11500A
J	Adapter	BNC male to male	UG-491A/U
K	Screwholding Screwdriver		Quick Wedge 7731-XM or 736-50

*One end modified by cutting shield away, exposing tuning blade.

5-9. FRONT PANEL CHECKS.

5-10. INTENSITY CONTROL AND DISPLAY POSITIONING.

a. Set 8551 LINE to ON.

b. Set 851 controls as follows:

(1) Set INTENSITY to approximately +90°.

(2) Set SYNC to INT.

(3) Set BASE LINE CLIPPER maximum CCW.

c. Turn SWEEP TIME through its calibrated ranges and watch display for retrace. There should be no retrace at any setting of the SWEEP TIME control.

Note

In the EXT position of the SWEEP TIME control (851B only), no trace should appear on the CRT.

d. Set INTENSITY maximum CCW. No trace should be visible. Reset INTENSITY for normal trace.

e. Adjust VERT POS and TRACE ALIGN to align trace exactly on graticule base line. (VERT POS control should permit approximately ±0.5 cm of vertical trace adjustment.)

f. Adjust HORIZ POS to center the trace on graticule base line. (HORIZ POS control should allow approximately ±0.5 cm of horizontal trace adjustment.)

5-11. BASE LINE CLIPPER.

a. Perform steps 1 through 15 of initial turn-on procedure (see Figure 3-3), using any signal from 10 Mc to 10 Gc.

b. Set I.F. GAIN (DB) at 70.

c. Adjust level at signal generator for a 7-cm display. Center display with TUNE.

d. Turn BASE LINE CLIPPER maximum cw. At least the bottom 2 cm of the display should be blanked.

5-12. FOCUS CONTROL.

5-13. The FOCUS control is within specifications if focus is obtained somewhere within -90° and +90° of FOCUS travel; white arrow is vertical at 0°.

5-14. VERTICAL DISPLAY ACCURACY CHECK.

5-15. EQUIPMENT REQUIRED.

a. UHF Signal Generator (8614A); item 11 in Table 5-1.

b. Cable terminated with Type N male connectors (11500A); item H in Table 5-1.

5-16. PRELIMINARY PROCEDURE. With Analyzer turned on (see Figure 3-3) and signal applied (1 Gc or any other frequency in the 10-Mc to 1.0-Gc range); Input signal amplitude: -10 dBm.

SPECTRUM WIDTH . . . . . 1 MC/CM
SWEEP TIME . . . . . 3 MILLISEC/CM
I.F. BANDWIDTH . . . . . AUTO SELECT
TUNE (8551) . . . . . CENTER DISPLAY

Table 5-2. Front Panel Checks

		Note: Checks are made with 851 connected to the 8551.	
Par. Ref	Control Under Check	Procedure	Proper Performance
5-10	INTENSITY	LINE (8551) . . . . . ON INTENSITY . . . . . +90° SYNC . . . . . INT BASE LINE CLIPPER . . . . . max ccw	
		IF GAIN (DB) . . . . . 50 DB	No retrace at any SWEEP TIME setting
		Turn SWEEP TIME through range watching for retrace.	
		Turn INTENSITY . . . . . max ccw	No trace visible
5-11	BASE LINE CLIPPER	Perform initial turn-on (Fig. 3-3), 1 Gc input I.F. GAIN . . . . . 70 Adjust signal level for 7.0-cm display Set BASE LINE CLIPPER . . . . . max cw	At least bottom 2 cm of display should blank
5-12	FOCUS	Set FOCUS with white arrow vertical; this is 0°. Set FOCUS to -90°, then to +90°	Focus should be obtained between -90° and +90°.

5-17. LINEAR.

Accuracy Specification: ±3% of full scale.

a. Set VERT DISPLAY to LIN, inner I.F. GAIN control to 10.

b. Adjust I.F. GAIN outer control for low-noise base line trace (set to about 50).

c. Adjust VERT POS and TRACE ALIGN to align trace line exactly with graticule base line.

d. Adjust 8551 ATTENUATOR (DB) and signal generator output for 7.0-cm 851 display.

e. Set inner I.F. GAIN control to 4 (attenuate 6 dB). Display should be no higher than 3.7 cm and no lower than 3.3 cm.

5-18. SQUARE.

Accuracy Specification: ±5% of full scale.

a. Set VERT DISPLAY to SQ, inner I.F. GAIN control to 10.

b. Adjust I.F. GAIN outer control for low-noise base line trace, bottom of which should coincide with first horizontal axis.

c. Adjust ATTENUATOR (DB) and signal generator output for 7.0-cm 851 display.

d. Set inner I.F. GAIN control to 7 (attenuate 3 dB). Display should be no higher than 3.85 cm and no lower than 3.15 cm.

5-19. LOG.

<0.2 dB but ≤ ±2 dB over 60 dB CRT range.

a. Set VERT DISPLAY to LOG, I.F. GAIN to 70 + 0.

b. Adjust 8551 ATTENUATOR (DB) and level at signal generator for 7.0-cm 851 display.

c. Set I.F. GAIN outer control to 60. Display should be within 5.8 to 6.2 cm.

d. If display does not coincide exactly with 6.0-cm graticule line, at signal generator readjust signal level for coincidence.

e. Step I.F. GAIN through remaining positions without changing signal level. Limits are given in Table 5-3.

Table 5-3. VERT DISPLAY Accuracy Check

Set Display to (cm)	I.F. GAIN Setting From	I.F. GAIN Setting To	VERT DISPLAY Limits (cm)
7.0	70	60	5.8 to 6.2
6.0	60	50	4.8 to 5.2
5.0	50	40	3.8 to 4.2
4.0	40	30	2.8 to 3.2
3.0	30	20	1.8 to 2.2
2.0	20	10	0.8 to 1.2

f. With I.F. GAIN outer control at 10, set inner control to 10, and adjust level at signal generator for 851 2.0-cm display. Set outer control to 0. Display should be within 0.8 to 1.2.

5-20. I.F. BANDWIDTH ACCURACY CHECK.

Specification: Individual bandwidths are calibrated within ±20%. Bandwidth repeatability and stability typically better than ±3%.

5-21. EQUIPMENT REQUIRED.

a. VHF attenuator (355D); item 10, Table 5-1.

b. Shielded coax cable terminated with BNC male connectors (10503A); item D, Table 5-1.

c. 8551 RF Section.

5-22. 1-MC, 100-KC, AND 10-KC BANDWIDTHS.

a. Connect Attenuator 355D between 851 and 8551, set VERT DISPLAY to LIN, and find 2-Gc BWO signal; see Paragraphs 5-83 through 5-103. (See Figure 5-1.)

b. Check bandwidths as indicated in Table 5-4, in each case recording actual bandwidth in cm.

c. Switch to any other setting of I.F. BANDWIDTH, then back to setting for bandwidth under test. Bandwidth should be within ±3% of recorded bandwidth (between 0.77 and 1.23 cm).

Table 5-4. I.F. Bandwidth Accuracy Checks (1MC, 100KC, 10KC)

Settings			Adjust Atten* for Display of	Read Display at	Spec Limits, BW (cm)	Record Actual BW (cm)
I.F. BW	SPECT WIDTH	SWEEP TIME				
1MC	1 Mc/cm	3 ms/cm	7.0 cm	5.0 cm	0.8 - 1.2	
100KC	100 kc/cm	3 ms/cm	7.0 cm	5.0 cm	0.8 - 1.2	
10KC	10 kc/cm	3 ms/cm	7.0 cm	5.0 cm	0.8 - 1.2	

*I.F. GAIN (DB) and external Attenuator (355D)

5-23. 3 KC AND 1 KC BANDWIDTHS.

a. Connect 606A/B to 5245 Counter and 851A/B thru 355D Attenuator. See Figure 5-1.b.

b. Set 851 controls:

I. F. BANDWIDTH . . . . . 3 KC
VERT DISPLAY . . . . . LIN

c. Adjust 606 FREQ (approx. 20 Mc) until 851 CRT trace peaks, and adjust 355D and/or 851 I. F. ATTN for 7.0 cm at the peak.

d. Decrease 606 FREQ until CRT trace equals 5.0 cm and note 5245L FREQ reading. Now increase 606 FREQ beyond CRT display peak until the trace is again 5.0 cm. Note 5245L FREQ.

e. Change I. F. BANDWIDTH to 1 KC and repeat steps c and d.

f. The difference of the 5245L readings should be within:

For 3 KC BW	2.31 to 3.69 KC
For 1 KC BW	0.77 to 1.23 KC

Note

This same procedure may also be used for 10 KC BW.

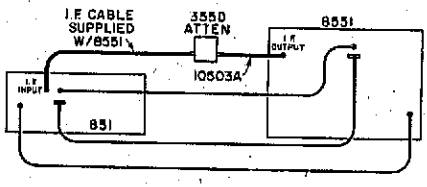


Figure 5-1.a. 1 MC, 100 KC and 10 KC Bandwidths

5-24. I.F. INPUT SENSITIVITY CHECK.

851A Specification: Typical for 851B Input Required* for 8-cm Vertical Display	
1-Mc bandwidth	-62 to -53 dBm
100-kc bandwidth	-75 to -60 dBm
10-kc bandwidth	-95 to -80 dBm
3-kc bandwidth	-95 to -80 dBm
1-kc bandwidth	-86 to -71 dBm

*With I. F. GAIN at 80 and I. F. VERNIER full counterclockwise.

5-25. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
0	Signal Generator set for 20 Mc; Generator must have calibrated power output (606A)	1
D	Shielded coax with BNC male connectors (10503A)	1

*Table 5-1

5-26. PROCEDURE.

a. Connect signal generator to I. F. INPUT on 851 rear panel. Check that Line Switch 115/230 is set for voltage of power source and connect 851 directly to 115/230V power source.

b. Set 851:

I. F. GAIN (DB) . . . . . 70 +10
I. F. VERNIER . . . . . fully ccw
I. F. BANDWIDTH . . . . . 1 MC
VERT DISPLAY . . . . . LIN

c. At signal generator, adjust for 6.0 cm-display on 851.

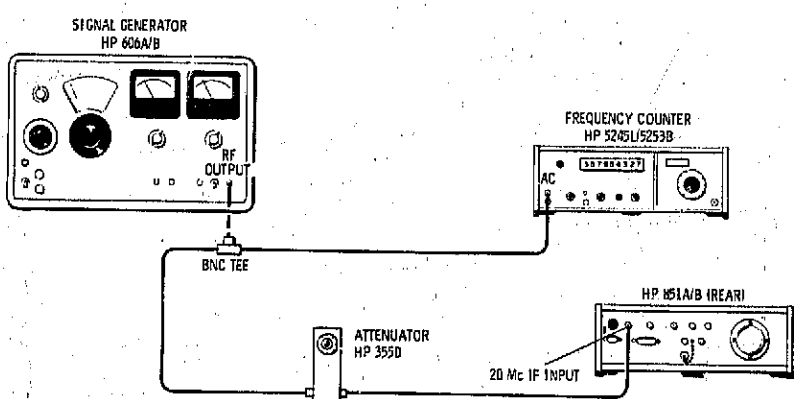


Figure 5-1.b. I. F. Bandwidth Accuracy Setup: 3 KC and 1 KC Bandwidths

Table 5-5. I. F. Bandwidth Accuracy Checks, 3 KC and 1 KC

Settings		SWEEP TIME	Adjust Atten** for Display of	Read Display at	Spec Limits, BW (cm)	Record Actual BW (cm)
I. F. BW	SPECT WIDTH					
3 KC	10* kc/cm	3 ms/cm	6.0 cm	5.0 cm	1.6 - 2.4	
1 KC	10* kc/cm	10 ms/cm	7.0 cm	5.0 cm	1.6 - 2.4	

*Calibrated to 1.5 kc/cm for 3 KC BW, 500 cycles/cm for 1 KC BW
**I. F. GAIN (DB) and external attenuator

d. Read output signal level at Signal Generator and take into consideration loss through input cable. Limits are given in Table 5-6.

e. Perform steps c and d at other settings of I. F. BANDWIDTH.

5-27. I.F. INPUT GAIN SET ACCURACY CHECK.

Specification: 70-dB section: ±0.5 dB
10-dB section: ±0.1 dB

5-28. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
12	Precision 10-dB/step Attenuator (H25-355D)	1
13	Precision 1-dB/step Attenuator (H25-355C)	1
9	Signal Generator (606A)	1
D	Coax cable terminal with BNC male connectors (10503A)	2
J	Adapter, BNC male-to-male (UG-491A/U)	1

*Table 5-1

5-29. SETUP. Connect the H25-355C and H25-355D Precision Attenuators between the I. F. INPUT and the signal generators as shown in Figure 5-2. The Precision Attenuators are calibrated at 20 Mc to insure the accuracy needed to check the I. F. GAIN (DB) input attenuator.

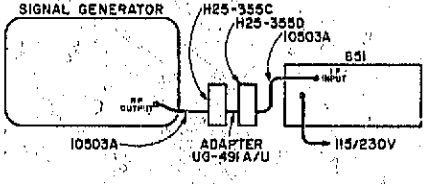


Figure 5-2. I. F. Gain Set Accuracy Setup

a. Set Signal Generator for 20 Mc.

b. Check that 851 115/230V Line Switch is set for voltage of power source, and connect 851 directly to 115/230V, 50-60 cps source.

c. Set 851:
I. F. GAIN inner control 0
I. F. GAIN outer control 0
I. F. BANDWIDTH . . . . . 100 KC
SYNC . . . . . LINE
SWEEP TIME . . . . . 3 MILLISEC/CM
VERT DISPLAY . . . . . SQ

d. Connect H25-355D to H25-355C via Adapter UG-491A/U. Set both external attenuators for 0.

e. Connect one attenuator to signal generator RF output and other to I. F. INPUT on 851 rear panel.

5-30. PROCEDURE.

a. I. F. GAIN Outer Control.

(1) With external attenuator and I. F. GAIN outer control both set for 0, adjust level at signal generator for 6.0-cm trace on 851 CRT.

(2) Set external attenuator for 10-dB loss; set I. F. GAIN outer control to 10. Trace should be within 5.2 and 6.8 cm.

Table 5-6. I. F. Input Sensitivity Check

I. F. BANDWIDTH	Input Signal Level Limits*
1 MC	-62 to -53
100 KC	-75 to -60
10 KC	-95 to -80
3 KC	-95 to -80
1 KC	-86 to -71

*For 6-cm deflection with I. F. GAIN at 80 dB and I. F. VERNIER full counterclockwise.

Note

With signal reference at 6.0 cm, ±0.3 cm is approximately ±0.5 dB.

(3) If necessary, adjust level at signal generator to return reference trace to 6.0 cm.

(4) Check other I. F. GAIN positions in same manner, turning both external attenuator and I. F. GAIN in 10-dB steps to 70 dB. Trace should be within 5.2 and 6.8 cm, at each 10-dB change.

Note

If necessary, readjust signal level at 10-dB change to maintain reference at 6.0 cm.

b. I. F. GAIN Inner Control.

(1) Set I. F. GAIN inner control 0
I. F. GAIN outer control 0
External Attenuator 0
Signal Generator . . . for 6.0 cm trace on 851 CRT

(2) Set external attenuator for 1-dB loss; set I. F. GAIN inner control to 1. Trace should be within 5.8 and 6.2.

Note

With signal reference at 6.0 cm, ±0.2 cm is approximately ±0.1 dB.

(3) If necessary, adjust level at signal generator to return reference trace to 6.0 cm.

(4) Check other I.F. GAIN inner control positions in same manner, maintaining reference trace at 6.0 cm. Trace should be within 5.8 and 6.2 cm, at each 1-dB change.

5-31. SWEEP RATE ACCURACY CHECK.

Sweep Rate Accuracy Specification: ±3%

5-32. EQUIPMENT REQUIRED.

Ref.	Equipment	Qty.
7	Electronic Counter (5245L)	1
8	Low-Frequency Oscillator (202C)	1
9	Signal Generator (606A)	1
C	Shielded cable, BNC male to banana plug (11001A)	1
D	Shielded cable, terminal with BNC male connectors (10503A)	1
*Table 5-1		

5-33. SETUP. Connect as indicated in Figure 5-3, except that 851 can be connected directly to 115/230V, 50-60 cycle source.

5-34. PROCEDURE. Instructions assume use of equipments shown in Figures 5-3 and 5-7.

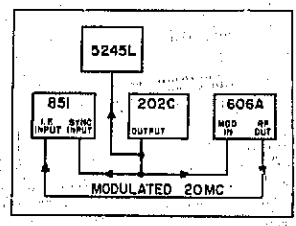


Figure 5-3. Sweep Rate Accuracy Setup

a. Set 851:
SWEEP TIME VERNIER . . . . . CAL
I. F. BANDWIDTH . . . . . 1 MC
SYNC . . . . . EXT

b. Set low-frequency oscillator for output of about 3 volts (AMPLITUDE control at about 90).

c. Set Counter FUNCTION selector for 10 PERIOD AVERAGE.

d. Set Signal Generator Controls:
RANGE, FREQUENCY . . . for 20-Mc output
ATTENUATOR, VERNIER, for -20-dBm output
MODULATION SELECTOR . . . . . EXT DC
MODULATION AMPLITUDE . . . . . fully cw

e. With equipments connected as shown in Figure 5-3, output of Oscillator 202C, monitored by counter, is modulating the 20-Mc output of the signal generator. Output of signal generator is displayed on 851 CRT.

f. To check sweep-rate accuracy specification:

(1) Set SWEEP TIME to 3 MILLISEC/CM.

(2) Adjust Oscillator 202C for output of precisely 333 cps (reading of 3.00 ms with counter set for 10-period average). Sweep rate is within specifications if 9.7 to 10.3 cycles appear on display.

Note

Period of 333-cycle signal is 0.003 second.

g. Check other SWEEP TIME positions, using limits in Table 5-7. With settings as specified, sweep rate is within specifications if 9.7 to 10.3 cycles appear on display.

Table 5-7. Sweep Rate Accuracy Check

LF Osc set for cps	*Counter Reading	SWEEP TIME Setting
100	10.00 ms	10 MILLISEC/CM
33.3	30.00 ms	30 MILLISEC/CM
10	100.00 ms	.1 SEC/CM
3.33	300.00 ms	.3 SEC/CM
1	1000.00 ms	1 SEC/CM
*Set for 10-Period Average		

NOTES

INSTRUMENT SERIAL NUMBER

_____

TABLE 5-8. PERFORMANCE CHECK TEST CARD.

PROCEDURES IN THIS CARD CORRESPOND TO

PARAGRAPHS 5-14 THROUGH 5-34

Table 5-8. Performance Check Test Card (1 of 5)

Ref	Procedure		Min	Act.	Max
5-14	**1. VERTICAL ACCURACY:**				
	a. Equipment Required: Stable Signal Generator (8614A) 851B RF Section				
	b. SPECTRUM WIDTH . . . . . 1 Mc/cm SWEEP TIME . . . . . 3 ms/cm I.F. BANDWIDTH . . . . . AUTO SELECT				
	c. Perform initial turn-on (Fig. 3-3), 1 Gc input				
5-17	**Linear:** ±3% of full scale				
	a. VERT DISPLAY . . . . . LIN Inner I.F. GAIN . . . . . 10 Outer I.F. GAIN . . . for low-noise baseline trace (about 50)				
	b. Align trace base exactly with graticule base line.				
	c. Adjust ATTENUATOR (DB) and output of signal generator for 7.0-cm display.				
	d. Set Inner I.F. GAIN to 4 -6 dB	cm	3.3	_____	3.7
5-18	**Square:** ±5% of full scale				
	a. VERT DISPLAY . . . . . SQ Inner I.F. GAIN . . . . . 10 Outer I.F. GAIN . . . . . for low noise base line trace				
	b. Align trace base exactly with graticule base line.				
	c. Adjust ATTENUATOR (DB) and output of signal generator for 7.0-cm display.				
	d. Set Inner I.F. GAIN to 7 -3 dB	cm	3.15	_____	3.85
5-19	**Logarithmic:** $< \pm 0.2$ dB/dB $\leq \pm 2$ dB/60 dB CRT range				
	a. VERT DISPLAY . . . . . LOG Inner I.F. GAIN . . . . . 0 Outer I.F. GAIN 70				
	b. Adjust signal generator and I.F. GAIN (DB) for 7.0-cm display.				
	c. I.F. GAIN 80	cm	5.8	_____	6.2
	d. Adjust input signal level for 6.0-cm I.F. GAIN 50	cm	4.8	_____	5.2
	e. I.F. GAIN 40	cm	3.8	_____	4.2
	f. I.F. GAIN 30	cm	2.8	_____	3.2
	g. I.F. GAIN 20	cm	1.8	_____	2.2
	h. I.F. GAIN 10	cm	0.8	_____	1.2
	i. I.F. GAIN outer control . . . . . 10 I.F. GAIN inner control 10				
	j. I.F. GAIN outer control 0	cm	0.8	_____	1.2

Table 5-8. Performance Check Test Card (2 of 5)

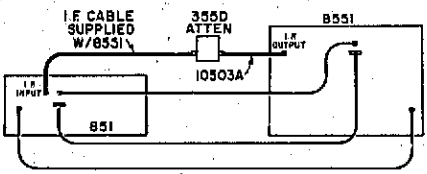
Ref	Procedure	Min	Act	Max
	2. I.F. BANDWIDTH ACCURACY: Individual bandwidths are calibrated within ±20%. Bandwith repeatability and stability typically better than ±3%.			
	Equipment Required: VHF Attenuator (355D) Cable terminal with BNC male connectors (10503A) 8551 RF Section				
5-22	1-MC, 100-KC and 10-KC Bandwidths			
	a. Set VERT DISPLAY to LIN. Find 2-Gc BWO signal: see Paragraphs 5-38 thru 5-103.			
	b. SWEEP TIME . . . . . 3 ms/cm			
	c. I. F. BANDWIDTH . . . . . 1 MC SPECTRUM WIDTH . . . . . 1 MC/cm			
	d. Adjust VHF atten and I. F. Gain for 7.0-cm display.			
	e. Read display at 5.0 cm. cm	0.8	_____	1.2
	f. I. F. BANDWIDTH . . . . . 100 KC SPECTRUM WIDTH . . . . . 100 kc/cm			
	g. Adjust for 7.0-cm display, read at 5.0 cm. cm	0.8	_____	1.2
	h. I. F. BANDWIDTH . . . . . 10 KC SPECTRUM WIDTH . . . . . 10 kc/cm			
	i. Adjust for 7.0-cm display, read at 5.0 cm. cm	0.8	_____	1.2
	j. Return to each setting of I. F. BANDWIDTH and note bandwidth at 5.0 cm.			
	k. Each should be within ±3% of recorded bandwidth.			
	Maximums cm	0.77	_____	1.23
5-23	3-KC and 1-KC Bandwidths			
	a. Connect test equipment as shown in Figure 5-1.b.			
	b. Set 851 controls: I. F. BANDWIDTH . . . . . 3 KC VERT DISPLAY . . . . . LIN			
	c. Adjust 606 FREQ (approx. 20 Mc) for peak display. Set 355C/D and 851 I. F. ATTEN for 7.0 cm.			
	d. Decrease 606 FREQ until display is 5.0 cm. Note frequency on 5245L. Increase 606 FREQ until display passes through 7.0 cm peak, and decreases again to 5.0 cm. Note frequency.			
	e. Change I. F. BANDWIDTH to 1 Kc and repeat steps c and d.			
	f. The difference of the readings should be between: For 3 KC BW 2.31 to 3.69 KC	2.31	_____	3.69
	For 1 KC BW 0.77 to 1.23 KC	0.77	_____	1.23
	Note This procedure may also be used for the 10 KC bandwidth.			

Table 5-8. Performance Check Test Card (3 of 5)

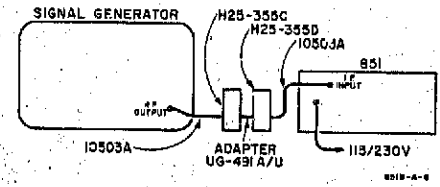
Ref	Procedure	Min	Act.	Max
	3. I.F. INPUT SENSITIVITY: Input required* for 6-cm vertical display			
	Bandwidth: 1 Mc — Limits (dBm): -62 to -53 100 kc — -75 to -60 10 kc — -95 to -80 3 kc — -95 to -80 1 kc — -86 to -71			
	*With I.F. GAIN at 80 and I.F. VERNIER full ccw.			
	a. Equipment Required: Signal Generator with calibrated power output (606A) Cable term. with BNC male connectors (10503A)			
5-26	b. Connect 851 to 115/230V, 50-60 cps power source.			
	c. Set signal generator for 20 Mc; connect to 851 I.F. INPUT.			
	d. I.F. GAIN . . . . . 70 +10 I.F. VERNIER . . . . . fully ccw I.F. BANDWIDTH . . . . . 1MC VERT DISPLAY . . . . . LIN			
	e. Set signal generator output for 6.0-cm 851 display.			
	f. Read output at signal generator, taking into consideration loss through input cable. dBm	-62	_____	-53
	g. Perform steps e and f for other I.F. BANDWIDTH settings.			
	100KC dBm	-75	_____	-60
	10KC	-95	_____	-80
	3KC	-95	_____	-80
	1KC	-86	_____	-71
	4. I.F. GAIN SET ACCURACY: 70-dB section: ±0.5 dB 10-dB section: ±0.1 dB			
	a. Equipment Required: Precision 10-dB/step Attenuator (hp H25-355D) Precision 1-dB/step Attenuator (hp H25-355C) Signal Generator (606A) Adapter, BNC male-to-male (UG-491A/U) 2 coax cables term. with BNC male connectors (10503A)			
				
5-29	b. Set Signal Generator for 20 Mc.			

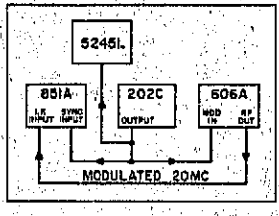
Table 5-8. Performance Test Card (4 of 5)

Ref	Procedure		Min	Act.	Max
	4. I.F. GAIN SET ACCURACY (cont'd)				
	c. Set I.F. GAIN inner control . . . . . 0 I.F. GAIN outer control . . . . . 0 I.F. BANDWIDTH . . . . . 100KC SYNC . . . . . LINE SWEEP TIME . . . . . 3 MILLISEC/CM VERT DISPLAY . . . . . SQ				
	d. Connect 851 to 115/230V source.				
	e. Set external attenuators for 0.				
	f. Adjust signal generator for 6.0-cm 851 display.				
5-30a	g. Set external attenuators for 10-dB loss, I.F. GAIN (DB) to 10.	cm	5.2	_____	6.8
	h. If necessary, adjust signal generator for 6.0-cm 851 display.				
	i. Other I.F. GAIN positions; if necessary, adjust signal generator for 6.0-cm 851 display after each group of settings is changed.				
	Ext Attens / I.F. GAIN: 20 / 20	cm	5.2	_____	6.8
	30 / 30		5.2	_____	6.8
	40 / 40		5.2	_____	6.8
	50 / 50		5.2	_____	6.8
	60 / 60		5.2	_____	6.8
	70 / 70		5.2	_____	6.8
	j. Set I.F. GAIN inner and outer controls to 0, and external attenuators to 0.				
	k. Adjust signal generator for 6.0-cm 851 display.				
5-30b	m. Set external attens for 1-dB loss, I.F. GAIN inner control to 1.	cm	6.8	_____	8.2
	n. If necessary, adjust signal generator for 6.0 cm 851 display.				
	p. Other I.F. GAIN positions; if necessary, adjust signal generator for 6.0-cm 851 display, after each set of settings is changed.				
	Ext Attens / I.F. GAIN: 2 / 2	cm	5.8	_____	6.2
	3 / 3		5.8	_____	6.2
	4 / 4		5.8	_____	6.2
	5 / 5		5.8	_____	6.2
	6 / 6		5.8	_____	6.2
	7 / 7		5.8	_____	6.2
	8 / 8		5.8	_____	6.2
	9 / 9		5.8	_____	6.2
	10 / 10		5.8	_____	6.2

MAINTENANCE

CON'T

Table 5-8. Performance Check Test Card (5 of 5)

Ref	Procedure		Min	Act.	Max
	5. SWEEP RATE ACCURACY: ±3%				
	a. Equipment Required: Electronic Counter (5245L) LF Oscillator (202C) Signal Generator (606A) Cable term. with BNC male connector, banana plug (11001A) Cable term. with BNC male connectors, (10503A)				
					
5-34	b. SWEEP TIME VERNIER . . . . . CAL I. F. BANDWIDTH . . . . . 1MC SYNC . . . . . EXT				
	c. LF Oscillator . . . . . about 3 volts Counter . . . . . 10 PERIOD AVERAGE Signal Generator . . . . . 20 Mc Output . . . . . -20 dBm MOD SELECT . . . . . EXT DC MOD AMPLITUDE . . . . . fully cw				
	d. SWEEP TIME . . . . . 3 MILLISEC/CM LF Osc . . . . . 333 cps (reading of 3.0 ms on counter)				
	e. Note number cycles displayed.	cycles	9.7	_____	10.3
	f. For other sweep times:				

LF Osc set for cps	*Counter Reading	SWEEP TIME Setting				
100	10.00 ms	10 MILLISEC/CM	cycles	9.7	_____	10.3
33.3	30.00 ms	30 MILLISEC/CM		9.7	_____	10.3
10	100.00 ms	.1 SEC/CM		9.7	_____	10.3
3.33	300.00 ms	.3 SEC/CM		9.7	_____	10.3
1	1000.00 ms	1 SEC/CM		9.7	_____	10.3

* Set for 10-Period Average

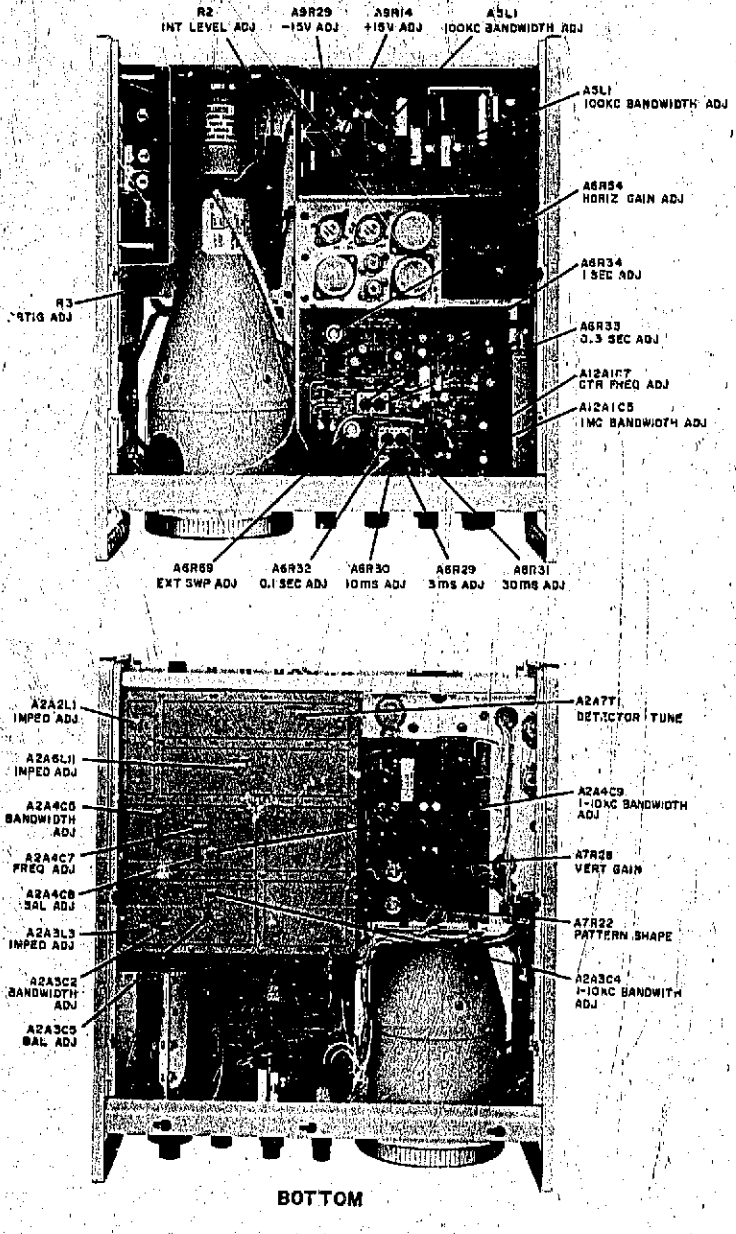


Figure 5-4. Model 851, Adjustment Locations

5-35. 851B CHECK AND ADJUSTMENT TEST CARD.

5-36. Table 5-18 lists checks and adjustment procedures, and provides space for recording test results. The Test Card is intended not only as a short-form test procedure, but as an index and overall outline of 851 test procedures. For each procedure, reference is made to a paragraph or table containing additional information. Checks are tabulated in recommended order.

Note

Unless the 851 is malfunctioning, the Performance Checks, Paragraphs 5-14 through 5-34 will be adequate to verify proper performance.

5-37. CHECKS AND ADJUSTMENTS.

5-38. Procedures for checking and adjusting the 851 are provided in Paragraphs 5-39 through 5-130.

a. Most of the procedures call for the use of other equipment; only those instructions pertinent to the procedure are given. For full operating instructions, refer to the test equipment Manual.

b. Unless specified otherwise, the 851 is not connected to the 8551, but is powered separately. Procedures assume a 115-volt line.

c. Instructions for removal of cover plates are given in Paragraph 5-6.

d. When making a thorough check of the instrument, it is recommended that procedures be performed in the order presented.

5-39. PRELIMINARY ADJUSTMENT PROCEDURE.

5-40. EQUIPMENT REQUIRED.

One variable transformer

a. Remove 851 top cover plate.

b. Set 115V/230V slide switch on rear panel to 115V.

c. Set front panel controls:

BASE LINE CLIPPER . . . . . max ccw
INTENSITY . . . . . max ccw
SWEEP TIME. . . . . 1 SEC/CM
SWEEP TIME VERNIER . . . . . max ccw
SYNC . . . . . INT
VERT DISPLAY . . . . . LIN
I.F. BANDWIDTH . . . . . 100 KC
I.F. GAIN . . . . . 30 DB

d. Set Int Level R2 max cw. (R2 is located to right of cathode-ray tube toward rear of instrument; see Figure 5-4.)

e. Set variable transformer to minimum. Connect 851 to power source through variable transformer, and increase transformer voltage slowly to 115 volts.

5-41. LV POWER SUPPLY ADJUSTMENTS.

5-42. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
3	Variable Transformer, set for 115V input	1
1	Oscilloscope (130C)	1
2	Digital DC Voltmeter (3440A)	1
A	Shielded cable, banana plug to banana plug (11000A)	1
B	Shielded cable, banann plug to alligator clips (11037A)	1

*Table 5-1

5-43. PROCEDURE.

a. Connect digital voltmeter and vertical input of oscilloscope in parallel using shielded cables.

b. Locate Low-Voltage Power Supply Board A9 (see Figure 5-5).

(1) Make ground connection at -A9C6 (point A, Figure 7-18.)

(2) Measure and adjust the low-voltage power supplies in accordance with Table 5-9. (Normal resistances to ground are given for reference in Table 5-10.)

Table 5-9. LV Power Supply Measurement Data

Supply	Meas* Point	Ref Fig. 7-18	Adjust	115V Line (Vdc)	103.5V to 126.5V Line	
					Reg (max ΔVdc)	Max Ripple (mV p/p)
+ 15Vdc	+A9C6	B	A9R14	+15±0.1	±0.03	1.5
- 15Vdc	-A9C10	C	A9R29	-15±0.1	±0.03	6.0
+100Vdc	+A9C1	D		100±7.5	±3.0	75

* -A9C6 is ground for these measurements.

Table 5-10. Resistances to Ground, LV Power Supply

Supply	Meas Point	Ref (Fig. 7-18)	Normal Resistance* (ohms)
+ 15 Vdc	+A9C6	B	> 300
- 15 Vdc	-A9C10	C	> 27
+100 Vdc	+A9C1	D	> 6000

*As measured with electronic volt-ohmmeter such as HP 410B, 410C, or 412A

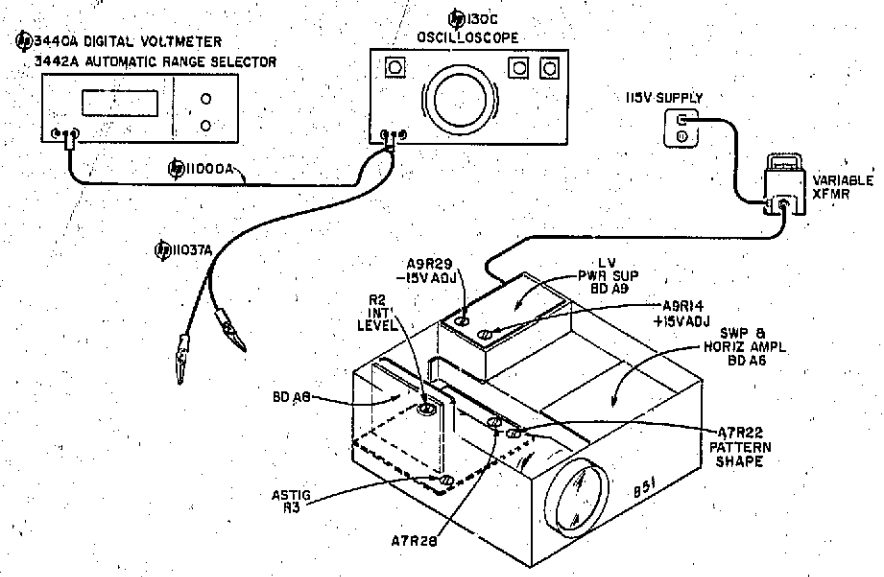


Figure 5-5. Low Voltage Power Supply, Check and Adjustment

5-44. HV POWER SUPPLY CHECK.

5-45. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
3*	Variable Transformer, set for 115V input	1
4*	Clip-On DC Milliammeter (428B)	1
5*	DC Voltmeter (410C)	1
6*	DC Voltage Divider (11045A)	1

*Table 5-1

5-46. PROCEDURE.

a. Instrument Condition. Top cover plate, left side plate, and CRT protective cover (on rear of instrument) are removed.

b. Cathode Current.

(1) Wiring to CRT base is shown in Figure 5-6. Note gray wire designated A ; clip milliammeter probe around gray conductor A .

(2) Turn INTENSITY max cw, and adjust Int Level R2 (to right of CRT, see Figure 5-5) for 0.5 mA.

(3) Turn INTENSITY fully cw, and check that beam is extinguished (no cathode current).

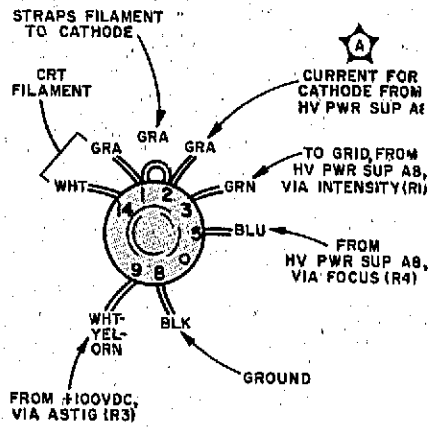


Figure 5-6. CRT Base as Seen from Rear, CRT Protective Cover Removed

c. Cathode and Post-Accelerator Voltages. Using a dc voltmeter and voltage-divider probe, check voltages as shown in Table 5-11. Location of A8 board is shown in Figure 5-5.

Table 5-11. HV Power Supply Voltages

Voltage Checked	Settings	Meas Point	Ref (Fig. 7-16)	Test Limits (Vdc)
Cathode	INTENSITY, full ccw	A8C7	A	2500 ±100
	INTENSITY, full cw	A8C7	A	*
Grid	INTENSITY, ccw	A8R11/R21		3575 ±100
Post Acceler	same	Junction A8R3, A8C4	11	5100 ±350

*The change in cathode voltage should not exceed 60 Vdc.

5-47. FOCUS CHECK AND ADJUSTMENT.

5-48. CHECK.

a. With the 851 connected to a source of power (either the Model 8551 or through a variable transformer set for 115 V), adjust FOCUS for a sharp spot on the CRT.

b. Turn INTENSITY through its range and adjust FOCUS to maintain a sharp spot at all INTENSITY levels.

5-49. ADJUSTMENT. If a sharp spot is not obtained, adjust FOCUS, Astig Adj R3, and Pattern Shape Adj A7R22 for a sharp spot. Then check that a sharp spot can be obtained as INTENSITY is turned through its range. See Figure 5-5 for location of Astig Adj R3 and Pattern Shape Adj A7R22.

5-50. HORIZONTAL AMPLIFIER CHECKS AND ADJUSTMENTS.

5-51. CALIBRATION.

a. Adjust TRACE ALIGN so that horizontal trace is parallel to horizontal axis.

b. Rotate HORIZ POS (R9); trace should move to right. Adjust HORIZ POS to center trace on graticule.

c. Adjust Horiz Gain adjust A6R54 (see Figure 7-15) for 10 cm of horizontal deflection.

d. Turn front panel HORIZ POS adjust full cw and note how far trace moves, then turn HORIZ POS full ccw and note trace movement; trace should move at least 1.0 ±0.5 cm each direction.

e. Center trace.

5-52. SWEEP TIME CALIBRATION.

5-53. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
3	Variable Transformer, set for 115V	1
7	Electronic Counter (5245L)	1
8	Low-Frequency Oscillator (202C)	1
9	Signal Generator (606A)	1
C	Shielded cable, BNC male to dual banana plug (11001A)	3
D	Shielded cable, BNC male to BNC male (10503A)	1

*Table 5-1

5-54. MEASUREMENT SETUP. Connect as indicated in Figure 5-7.

5-55. PROCEDURE. The following instructions assume use of equipment shown in Figure 5-7.

a. Set 851 controls:

SWEEP TIME VERNIER ..... CAL
I.F. BANDWIDTH ..... 1 MC
SYNC ..... EXT
VERT. DISPLAY ..... LIN

b. Set low-frequency oscillator for output of about 3 volts (AMPLITUDE control at about 90).

c. Set Counter FUNCTION selector for 10 PERIOD AVERAGE.

d. Set Signal Generator controls:

RANGE, FREQUENCY. . . . . for 20-Mc output
ATTENUATOR, VERNIER. . for -20-dBm output
MODULATION SELECTOR. . . . . EXT DC
MODULATION AMPLITUDE . . . . . full cw

e. With equipments connected as shown in Figure 5-7, the output of Oscillator 202C, monitored by the counter, modulates the 20-Mc output of the signal generator. Output of the signal generator is displayed on the 851 CRT. To check the linearity of the sweep generator output and to calibrate the 3 MILLISECOND/CM position of the 851 SWEEP TIME switch:

(1) Set SWEEP TIME to 3 MILLISEC/CM.

(2) Adjust Oscillator 202C for an output of precisely 333 cps (reading of 3.0 ms with counter set for 10-period average).

(3) Adjust A6R29 (see Figure 7-15) so that modulation peaks are precisely aligned with graticule vertical lines. The distance between each successive modulation peak on the display should not exceed 1 ±0.2 cm. This checks sweep linearity; if linearity is good in one position of SWEEP TIME it will be good in all others.

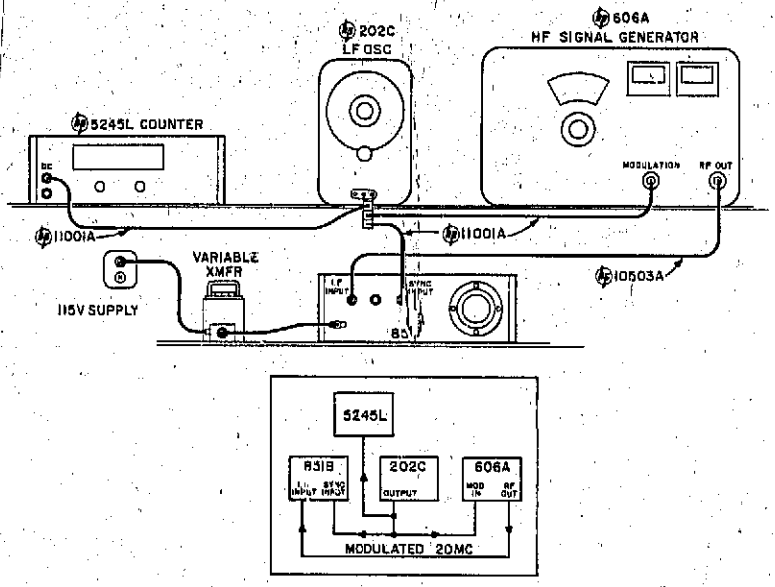


Figure 5-7. Sweep Calibration Test Setup

Table 5-12. Sweep Time Calibration

Mod Freq (cps)	Counter Reading*	SWEEP TIME Setting	851 Adjust	Fig. Ref
333	3.0 ms	3 MILLISEC/CM	A6R29	7-15
100	10.0 ms	10 MILLISEC/CM	A6R30	
33.3	30.0 ms	30 MILLISEC/CM	A6R31	
10	.1 sec	.1 SEC/CM	A6R32	
3.33	.3 sec	.3 SEC/CM	A6R33	
1	1.0 sec	1 SEC/CM	A6R34	

*For 10-period average

f. Set SWEEP TIME to 10 MILLISEC/CM, and oscillator output for precisely 100 cps. Adjust A6R30 to align the first and last modulation peak with the first and tenth vertical lines on graticule.

g. Follow the same procedure at other positions of SWEEP TIME, using data given in Table 5-12.

5-56. SWEEP TIME VERNIER CHECK.

5-57. SETUP. To check that the SWEEP TIME VERNIER has the proper range, use the SWEEP TIME calibration setup (see Paragraph 5-51 and Figure 5-7).

5-58. PROCEDURE.

a. Set SWEEP TIME . . . . . 3 MILLISEC/CM
SWEEP TIME VERNIER . . . . . CAL

b. Set low-frequency oscillator for precisely 100 cps (counter reading of 10.0 ms when set for 10 PERIOD AVERAGE).

c. Rotate SWEEP TIME VERNIER full ccw, and note period of one cycle as displayed on 851 CRT; width of cycle waveform should be less than 1.0 cm.

5-59. SINGLE SWEEP AND SWEEP AMPLITUDE CHECKS.

5-60. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
3	Variable Transformer, set for 115V	1
2	Digital Voltmeter (3440A)	1
C	Shielded cable, dual banana plug to BNC male (11001A)	1

*Table 5-1

5-61. PROCEDURE.

a. On the 851, set
SWEEP TIME . . . . . 1 SEC/CM
SWEEP TIME VERNIER. . . . . ccw
SYNC . . . . . SINGLE SWEEP

b. Connect SWEEP OUTPUT (on rear of 851) to digital voltmeter. Note reading obtained.

c. Depress SINGLE SWEEP button on 851 front panel.

d. Note that single sweep is obtained, and record maximum positive voltage indicated by voltmeter. Sweep amplitude should be 10.0 ±0.3 volts.

5-62. SYNCHRONIZATION AND OUTPUT CHECKS.

5-63. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
3	Variable Transformer set for 115V	1
1	Oscilloscope (130C)	1
8	Low-Frequency Oscillator (202C)	1
9	Signal Generator (606A)	1
A	Shielded cable, dual banana plug to dual banana plug (11000A)	1
C	Shielded cable, BNC male to dual banana plug (11001A)	2
D	Shielded cable, BNC male to BNC male (10503A)	1

*Table 5-1

5-64. MEASUREMENT SETUP. Similar to that shown in Figure 5-7 except that oscilloscope replaces counter, and is connected as noted in Paragraphs 5-65, 5-66, and 5-67.

5-65. EXTERNAL SYNC CHECK.

a. On 851, set SYNC to EXT.

b. Set low-frequency oscillator for output of 8 volts peak-to-peak.

c. Set signal generator output attenuator to -20 dBm.

d. Vary oscillator output frequency from 1 cps to 5 kc and, changing 851 sweep time as required, observe signal displayed on 851. Signal displayed should be stable from 1 cps to 5 kc.

5-66. VERTICAL OUTPUT CHECK.

a. Connect oscilloscope to VERT OUTPUT on 851 rear panel.

b. Signal should be displayed on oscilloscope.

5-67. HORIZONTAL OUTPUT CHECK.

a. Connect oscilloscope to HORIZ OUTPUT on 851 rear panel.

b. Signal should be displayed on oscilloscope.

5-68. LINE SYNC CHECK.

a. On 851, set SYNC to LINE.

b. Set oscilloscope input for dc coupling, sync on line.

c. Connect 851 SWEEP OUTPUT to oscilloscope. Display of sweep signal should remain in synchronization.

5-69. BASE LINE CLIPPER CHECK. Rotate BASE LINE CLIPPER full cw; trace on at least lower 2 cm of 851 CRT should blank.

Note

At high INTENSITY levels, it is normal for trace to defocus slightly when BASE LINE CLIPPER is set cw.

5-70. CRT CHECKS.

5-71. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
8	Low-Frequency Oscillator (202C)	1
9	Signal Generator (606A)	1
C	Shielded cable, banana plug to BNC male (11001A)	2
D	Shielded cable, BNC male to BNC male (10503A)	1

*Table 5-1

5-72. MEASUREMENT SETUP. Make connections between low-frequency oscillator, signal generator, and 851 as indicated in Figure 5-7. Refer to Par. 5-55, steps a through d, for initial control settings.

5-73. ALIGNMENT. Before starting to check the CRT, make sure horizontal trace is parallel to horizontal axis of graticule; if not, readjust TRACE ALIGN.

5-74. PATTERN DISTORTION AND RESOLUTION.

a. Modulate signal generator 100 percent at 20 kc using a low-frequency oscillator as modulating voltage source.

b. Set 851 I.F. GAIN for 8 cm of vertical deflection on 851 CRT.

c. Check pattern for excessive barrelling or pincushioning (see Figure 5-8); if present, adjust A7R22, Pattern Shape Adj on Vert Ampl Bd A7 (Figure 5-5), for best compromise-minimum average distortion of horizontal and vertical edges of pattern.

PIN CUSHIONING BARRELLING

Figure 5-8. Pin-cushioning and Barrelling

d. Decrease low-frequency oscillator output frequency to 1 kc; at normal intensity, focus should be uniform throughout the 8-x 10-cm screen area.

5-75. BLANKING.

a. Set INTENSITY full cw.

b. Observe trace on all sweep speeds. No retrace should be seen.

5-76. VERTICAL AMPLIFIER CHECKS AND ADJUSTMENTS.

5-77. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
3	Variable Transformer, set for 115V	1
2	Voltmeter with automatic range finder (3440A & 3442A)	1
9	Signal Generator (606A)	1
8	Low-Frequence Oscillator (202C)	1
B	Shielded cable, dual banana plug to alligator clips (11037A)	1
D	Shielded cable, BNC male to BNC male (10503A)	1
E	Adapter, BNC female to dual banana plug (10111A)	1
A	Shielded cable term. w/dual banana plugs (11000A)	

*Table 5-1

5-78. VERTICAL CALIBRATION.

5-79. VERTICAL POSITION.

a. Rotate VERT POS adjust cw; trace should move upward.

b. With no input, align trace with base line of graticule.

5-80. MEASUREMENT SETUP.

a. Turn instrument upside down. Remove bottom plate.

b. Set up equipment as shown in Figure 5-9. Connect voltmeter (digital with automatic range-finding capability) at feed-thru terminal (Video Out) at output of RF Circuit Assembly A2. This terminal projects through the casting that encloses Assembly A2, and is identified in Figure 5-9.

5-81. PROCEDURE.

a. Set signal generator:
RANGE, FREQUENCY . . . . . for 20-Mc output
ATTENUATOR, VERNIER . . . . for 4.0 ±0.1 Vdc detected input to vertical amplifier (as read on digital voltmeter)

b. Adjust Vert Gain Adj A7R28 (see Figure 5-9) for 6.0-cm vertical deflection on CRT.

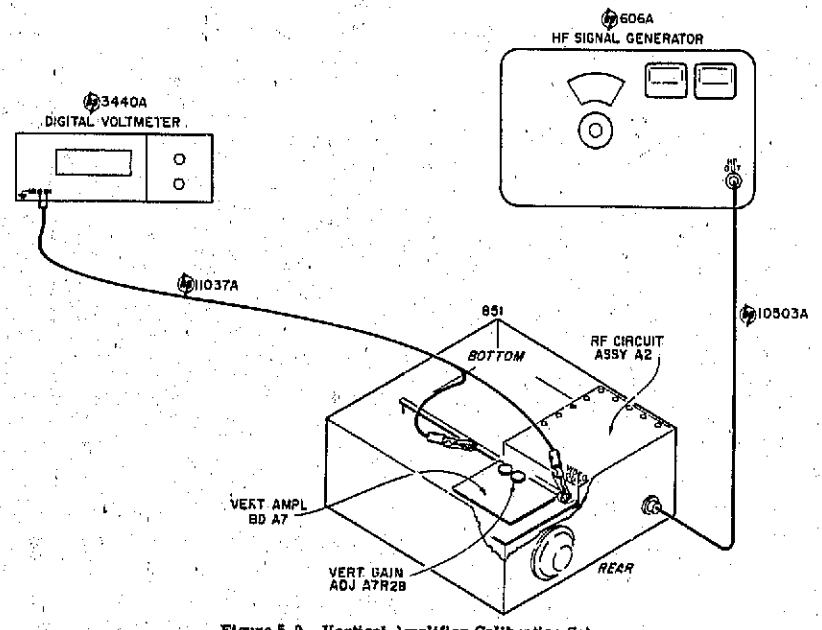


Figure 5-9. Vertical Amplifier Calibration Setup

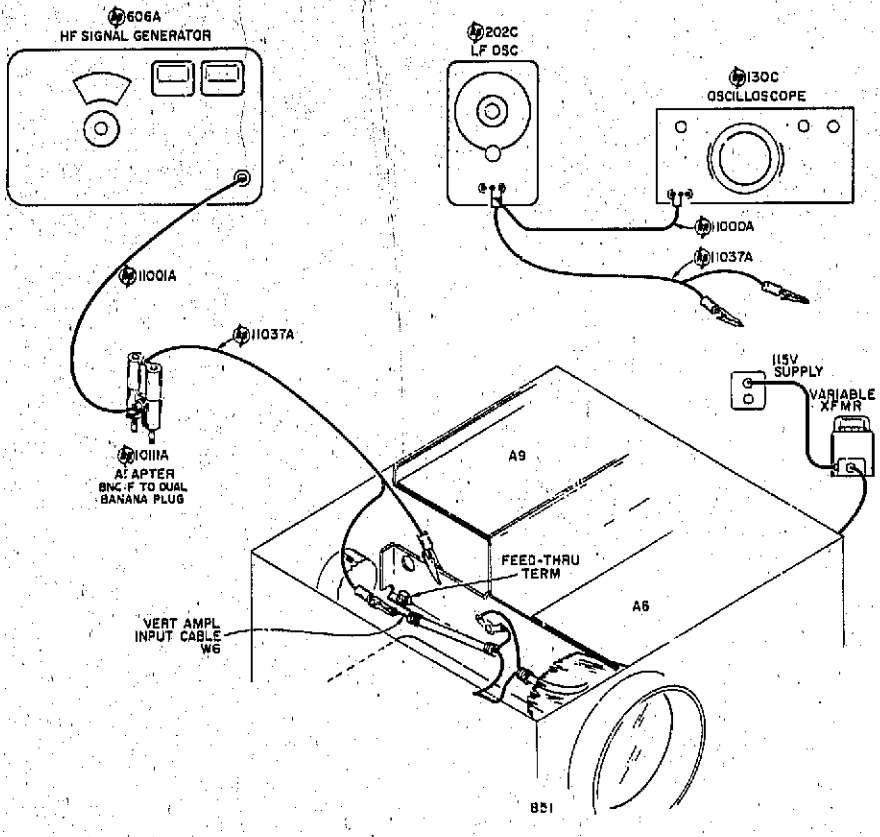


Figure 5-10. Setup for 851 Video Bandwidth Measurements

c. Disconnect signal generator; trace should return to graticule base line.

(1) If trace does not return to base line, again adjust VERT POS to align trace with base line.

(2) Then perform calibration procedure again (steps a, b, and c).

(3) Continue until requirements of both steps b and c are met.

NOTE

Since VERT POS and VERT GAIN interact, it may be necessary to repeat adjustments several times.

5-82. VIDEO BANDWIDTH.

a. Disconnect coaxial lead at feed-thru terminal coming out of casting which houses RF Circuit Assembly A2. Connect signal generator to this coaxial lead (this lead is Vertical Amplifier Input Cable W6 and is identified in Figure 5-10).

b. Set 851 I.F. BANDWIDTH to 1 Mc. Set VERT DISPLAY to LIN.

c. Set signal generator:

RANGE, FREQUENCY . . . . . for 50-kc output
ATTENUATOR . . . . . 0.3 VOLT Range

d. Adjust signal generator output for 2.0-cm vertical deflection. Offset VERT POS to position display on bottom 2 cm of 851 CRT. Note reading of signal generator output meter.

e. Increase frequency of signal generator output to 1.2 Mc, and adjust level of output to obtain same meter reading as was noted in step d.

f. Vertical deflection on 851 CRT should exceed 1.4 cm peak-to-peak.

g. Replace signal generator with low-frequency oscillator such as the hp 202C. Monitor amplitude of oscillator output with an oscilloscope.

h. Set 851 I.F. BANDWIDTH at 100KC.

(1) Set oscillator for 1-kc output, and adjust output level (use AMPLITUDE on 202C) for 2.0 cm of vertical deflection on 851 CRT. On monitoring oscilloscope, note amplitude at which 2.0-cm deflection was obtained.

(2) Increase oscillator output frequency until 851 CRT vertical deflection decreases to 1.4 cm. While increasing oscillator frequency, adjust output level if necessary to maintain same signal amplitude as noted on oscilloscope in step (1).

(3) The vertical deflection decrease to 1.4 cm should take place at 200 ±40 kc.

i. Using a 1-kc signal while obtaining a 2.0-cm vertical deflection, check other positions of I.F. BANDWIDTH using procedure given in step h. Frequency at which deflection should decrease to 1.4 cm is given in Frequency column of Table 5-13.

Table 5-13. Video Bandwidth Check Data

I.F. BANDWIDTH Setting	Frequency
100 KC	200 ±40 Kc
10 KC	40 ±8 Kc
3 KC	12 ±2.4 Kc
1 KC	4 ±0.8 Kc

j. Disconnect oscillator from Vertical Amplifier Input Cable W0, and reconnect cable to RF Circuit Assembly A2 feed-thru terminal.

5-83. 1-MC I.F. BANDWIDTH ALIGNMENT AND CHECK.

5-84. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
7	Counter (5245L)	1
0	Signal Generator (606A)	1
D	Shielded Cable term. w/BNC male connectors (10503A)	1
F	BNC tee, male and 2 female connectors (UG-274A/U)	1
G	Plastic tuning wand	1
	Adapter, male type N to female BNC (UG-201A/U) hp 1250-0067	1

*Table 5-1

5-85. SETUP AND INITIAL SETTINGS.

a. Setup. See Figure 5-11. Casting which houses RF Circuit Assembly A2 is on bottom of 851, and that which houses Bandpass Filter Assembly A12 is in top of 851, on right side near front panel. Access to both is required in this procedure; locations of assemblies and adjustments are called out in Figures 5-11 and 5-12. With top and bottom covers removed, rest 851 on its right side. Access holes in cover plates of assembly castings are provided for adjustments called for in alignment procedure; holes are covered by removable plug-in buttons.

b. Settings:

SYNC	INT
SWEEP TIME	3 MILLISEC/CM
I.F. BANDWIDTH	1 MC
VERT DISPLAY	LIN

c. Initial Procedure. Set signal generator for 20 Mc at -10 dBm.

5-86. 1-MC ALIGNMENT.

a. With modified GC plastic tuning wand, adjust 851 Detector Tune T1 (A2A7T1) for maximum deflection on CRT.

NOTE

Two peaks are present; adjust for maximum deflection of the highest one.

b. Tune L11 Imped (A2A6L11) and A12A1 adjustments A12A1C5/C7 for maximum vertical deflection.

NOTE

Adjustments of A12A1C5 and A12A1C7 preset them; final adjustments of A12A1C5 and A12A1C7 is made with 851 connected to 8551 (see Paragraph 5-94b).

5-87. 1-MC BANDWIDTH CHECK.

a. Set signal generator output level for 7.0-cm 851 display.

b. While watching 851 display, decrease frequency at signal generator until 851 display amplitude is 5.0 cm. Note counter reading.

c. Still watching 851 display, increase frequency and observe display go through maximum and return to 5.0 cm. Note counter reading. Frequency difference between the two readings should be within 1.5 and 2.7 Mc.

5-88. 100-KC I.F. BANDWIDTH ALIGNMENT AND CHECK.

5-89. SETUP AND INITIAL SETTINGS.

a. Use setup indicated in Figure 5-11. 100-Kc Bandpass Filter Assemblies A3 and A5 are located toward rear of 851 on right side, beneath Low-Voltage Power Supply A9; access to adjustments A3L1 and A5L1 is through holes in the A9 Board; see Figure 7-18.

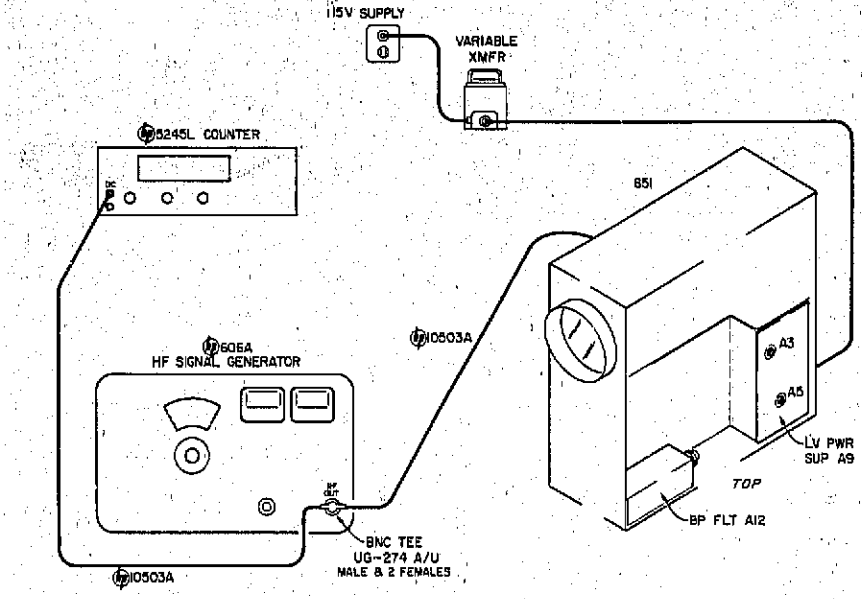


Figure 5-11. 1-Mc and 100-kc IF Bandwidth Alignment Setup

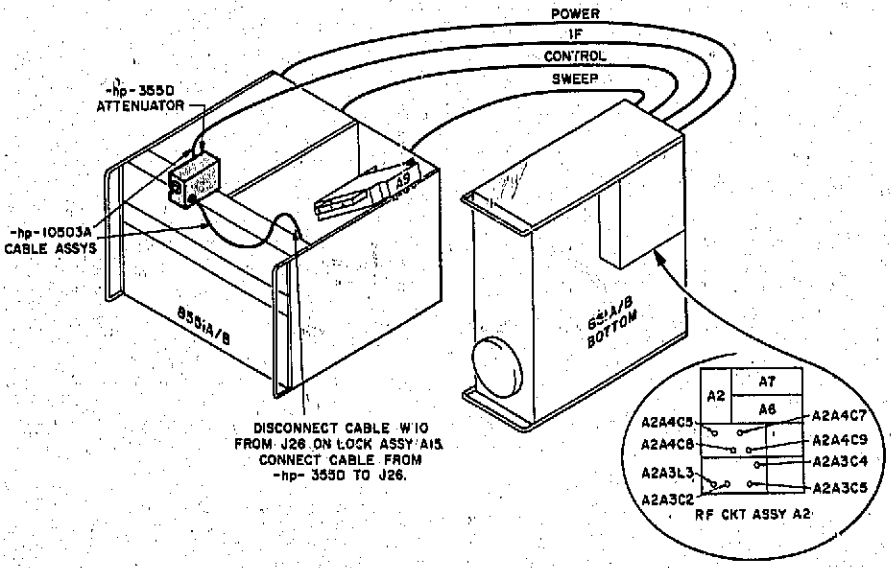


Figure 5-12. 10-KC Bandwidth Alignment Setup

b. Use same initial procedure as given in Paragraph 5-85, subparagraph c, changing control settings as follows:

SPECTRUM WIDTH	100 KC/CM
I. F. BANDWIDTH	100KC

5-90. 100-KC ALIGNMENT. Tune L1 Imped Adj (A2A2L1 in RF Circuit Assembly A2) and 100-KC Bandpass Filter adjustments A3L1 and A5L1 for maximum vertical deflection.

5-91. 100-KC BANDWIDTH CHECK.

a. Set signal generator output level for 7.0-cm 851 display.

b. While watching 851 display, decrease frequency at signal generator until 851 display amplitude is 5.0 cm. Note counter reading.

c. Still watching 851 display, increase frequency and observe display go through maximum and return to 5.0 cm. Note counter reading. Frequency difference between the two readings should be within 80 and 120 kc.

5-92. FINAL 1-MC AND 100-KC BANDWIDTH ADJUSTMENTS.

5-93. SETUP. Connect the 851 to the 8551; see Figures 5-2 and 5-12.

a. Set 8551:

LINE	STANDBY
SIGNAL IDENTIFIER	OFF
SPECTRUM WIDTH VERNIER	CAL
FREQUENCY (GC)	.01-2
I. F.	2GC
FREQUENCY TUNING	COARSE
ATTENUATOR (DB)	60

Set 851:

SYNC	INT
SWEEP TIME	3 MILLISEC/CM
I. F. BANDWIDTH	1MC
VERT DISPLAY	LIN

b. Set signal generator for some frequency above 10 Mc, such as 50 Mc, and at some level less than 1 watt.

c. Perform steps 1 through 15 of Initial Operating Procedure, Figure 3-3, using settings given in step a.

5-94. PROCEDURE.

a. Set SPECTRUM WIDTH ..... 1 MC/CM
VERT DISPLAY ..... LOG

b. Check symmetry, and if necessary readjust A12A1C7 in 851 and A9A2L2 in 8551 for maximum amplitude on CRT. Adjust A12A1C5 for 1 Mc bandwidth.

c. Set SPECTRUM WIDTH to 100KC/CM.

d. Check symmetry, and if necessary readjust A12A1C7, A12A1C5 and A9A2L2 for best symmetry.

e. Switch VERT DISPLAY back to LIN, and if necessary readjust A2A2L1, A3L1, and A3L5 for best compromise on symmetry and amplitude while keeping bandwidth within 100 ±20 kc.

f. Recheck at LOG, then LIN, readjusting as required.

g. Return VERT DISPLAY to LIN, set I. F. BANDWIDTH to 1 MC, and SPECTRUM WIDTH to 1 MC/CM.

h. Check display for maximum amplitude, correct bandwidth, and symmetry, readjusting Impedance Adj A2A6L11 if required.

i. Set VERT DISPLAY at LOG and, if required, readjust A12A1C7 and A12A1C5 for best symmetry and amplitude.

j. Set I. F. BANDWIDTH to 100KC and SPECTRUM WIDTH to 100 KC/CM, and again check the 100-kc filter bandpass characteristics.

k. Continue readjusting as required to obtain the best compromise on amplitude and symmetry with VERT DISPLAY at LIN and LOG for both 1-Mc and 100-kc filters while keeping respective bandwidths within specifications.

5-95. 10-KC, 3-KC, AND 1-KC I.F. BANDWIDTH ALIGNMENT AND CHECKS.

5-96. Signals for the three narrower bandwidth filters (10, 3, and 1 kc) pass through two double-tuned crystal filters. The four tuning coils are tapped; change of bandwidth is obtained by using different taps. The same filters are used for all three bandwidths; accurate adjustment of the 10-kc bandwidth should bring the 3-kc and 1-kc bandwidths within specifications. After adjustment of the 10-kc bandwidth, bandwidth is verified at the 3-kc and 1-kc settings.

5-97. IF bandwidth alignment is not a simple technique. While tuning for correct IF bandwidth, remember:

a. It will be necessary to repeat the adjustments more than once to obtain the best tuning of the four filters.

b. Final adjustment should be the compromise that obtains the best characteristics for all four filters. Do not attempt to adjust the filters unless one or more are out of specifications.

5-98. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
10	VHF Attenuator (355D)	1
D	Coax Term. with BNC male connectors (1C503A)	2
G	GC plastic tuning wand	1
K	Screw-holding screwdriver	1

*Table 5-1

5-99. SIGNAL SOURCE CALIBRATION. To check the bandpass characteristics of the narrower IF filters, the 851 sweep width must be narrow enough that the IF bandwidth can be determined accurately at the half-power points. This may be done by applying a signal to the 20MC IF which is swept in synchronism with the 851 sweep. Such a signal can be derived from the second harmonic of the 8551 10MC Reference Oscillator.

5-100. When the 8551 is stabilized, the BWO is phase-locked to a 10-MC reference oscillator. For a BWO frequency of 4 Gc and a spectrum width of 1 Mc/cm, the reference oscillator would be swept 2.5 kc/cm (BWO locked to the 400th harmonic of 10 Mc: 1 Mc/cm divided by 400 is 2.5 kc/cm). NOTE: for a 4-Gc BWO frequency, FREQUENCY(GC) must be at .01-2 or 1.8-4.2 (at these settings n = 1). If the output of the reference oscillator is connected to a narrow-band IF filter tuned to 20 Mc, the IF will pass only the second harmonic of the 10-MC reference oscillator. This is 20 Mc swept at 5 kc/cm. Other values of sweep width may similarly be derived:

Spectrum Width	20MC Sweep Width (851 Display)
1 Mc/cm	5 kc/cm
300 kc/cm	1.5 kc/cm
100 kc/cm	500 cycles/cm
30 kc/cm	150 cycles/cm

5-101. MEASUREMENT SETUP. Use the 8551 10MC Reference Oscillator as the signal source for the narrower IF bandwidth alignment procedures. See Figure 5-12 for test setup and Paragraph 5-98 for recommended equipment.

5-102. 10-KC PROCEDURE, INITIAL SETUP.

a. Set the 355D to 40 dB.

b. Make the following settings:

8551

LINE	STANDBY*
SPECTRUM WIDTH	1 MC/CM
SPECTRUM WIDTH VERNIER	CAL
FREQUENCY(GC)	.01-2
TUNE	4 Gc on LOCAL OSC FREQ (FLO scale)

*Note: LINE remains in STANDBY throughout the procedure.

8551A only

FREQUENCY TUNING	STABILIZE**

8551B only

TUNING SELECTOR	STABILIZED NORMAL**
STABILIZATION	STABILIZED**

**Note: Control setting only; do not perform stabilization procedure.

851

BASE LINE CLIPPER	max ccw
SYNC	INT
VERT DISPLAY	LIN
SWEEP TIME	3 MILLISEC/CM
SWEEP TIME VERNIER	CAL
INTENSITY	about 2 o'clock
I.F. GAIN	30 + 0
I.F. VERNIER	ccw

c. Check alignment of the base line trace with the horizontal axis. If necessary, adjust VERT POS and TRACE ALIGN to bring base line trace exactly parallel with and on the graticule base line.

5-103. 10-KC ALIGNMENT PROCEDURE.

a. Adjust 8551 TUNE to center the display on the 851. Adjust I.F. GAIN VERNIER for a maximum vertical deflection of exactly 7.0 cm.

b. Bandwidth tuning adjustments are inside the RF Circuit Assembly casting (see Figure 7-5); location of adjustments is marked on the cover. Access holes, covered with removable plug-in buttons, are provided in the casting cover. Unless Balance Adj capacitor A2A3C5 or A2A4C8 has been replaced, do not remove casting cover.

Note

It is unlikely that Capacitor A2A3C5 or A2A4C8 will require replacement. However, if either has to be replaced, before removing it, note degree of mesh between stator and rotor. When installing replacement capacitor, set it to approximately the mesh of original capacitor. After installing and presetting replacement capacitor, fasten cover to casting with five or six of the 26 screws which hold the casting cover in place.

Perform the rest of the 10-KC alignment procedure with the cover in place on the casting.

c. Adjust 1-10KC Bandwidth Adj Capacitors A2A3C4, A2A3C2, A2A4C5, and A2A4C9 for maximum bandwidth.

Note

In tuning Capacitor A2A3C4, A2A3C2, or A2A4C5 through its tuning range, it will be found there are two points that give vertical deflection peaks. Since there is little difference between the amplitude of the two peaks, it is difficult to distinguish which is the correct tuning region. If correct IF bandwidth tuning cannot be obtained on one peak, try the other. Correct IF bandwidth tuning can only be obtained when the adjustment of each capacitor is made in its true tuning region. Maximum bandwidth is usually obtained by tuning off the peak slightly.

d. Adjust Imped Adj A2A3L3 and Frequency Adj A2A4C7 for maximum vertical deflection.

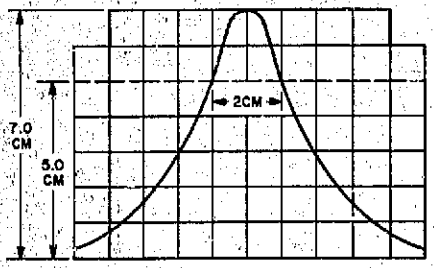


Figure 5-13. IF Bandwidth Adjustment: Optimum Bandpass Characteristics

e. Center display with TUNE and set maximum vertical deflection to exactly 7.0 cm with IF GAIN. See Figure 5-13. Display should be 2-cm wide at 5-cm amplitude (half-power points) (sweep width of 851 display is 5 kc/cm). If not within ±20% of the correct bandwidth (1.6 to 2.4 cm at 5-cm amplitude), repeat steps c through e until the correct bandwidth is obtained.

5-104. 3-KC AND 1-KC BANDWIDTH CHECK PROCEDURE:

a. Set I.F. BANDWIDTH to 3KC and SPECTRUM WIDTH to 300KC/CM (which gives 851 display sweep width of 1.5 kc/cm).

b. Adjust I.F. GAIN and I.F. VERNIER for maximum vertical deflection of exactly 7.0 cm.

c. Width of display at 5.0-cm axis should be between 1.6 and 2.4 cm. See Figure 5-13.

d. Set I.F. BANDWIDTH to 1KC and SPECTRUM WIDTH to 100 KC/CM (which gives 851 display sweep width of 500 cycles/cm).

e. Adjust I.F. GAIN and I.F. VERNIER for vertical deflection of exactly 7.0 cm.

f. Width of display at 5.0-cm axis should be between 1.3 and 2.4 cm.

Note

If 1-kc bandwidth appears too wide, recheck tuning of Freq Adj A2A4C7 (Paragraph 5-103, step d).

g. If Capacitor A2A3C5 or A2A4C8 was replaced, and casting cover is only partly secured, fasten in place with all 20 screws. For final adjustment (Paragraph 5-105), the cover must be tightly fastened to the casting.

Note

A screw-holding screwdriver is recommended for turning the screws.

5-105. FINAL 1- TO 10-KC BANDWIDTH ADJUSTMENT.

5-106. Set I.F. BANDWIDTH to 10KC and SPECTRUM WIDTH to 1 MC/CM. Recheck bandwidths (Paragraphs 5-103, 5-104), making adjustment if necessary, until all bandwidths are within specifications.

Note

Cover must be fastened down tightly during final adjustment.

5-107. AUTO SELECT CHECK.

5-108. With I.F. BANDWIDTH at AUTO SELECT, the analyzer automatically selects the IF bandwidth which provides optimum operation for whatever combination of 8551 SPECTRUM WIDTH and 851 SWEEP TIME settings is selected.

5-109. Connections to the filters which determine IF bandwidth are made through relays. With I.F. BANDWIDTH at 1KC, 3KC, 100KC, or 1 MC, dc to operate the relays is applied via contacts on the I. F. BANDWIDTH switch. With I.F. BANDWIDTH at AUTO SELECT, however, dc to operate the relays is applied via contacts on the 8551 SPECTRUM WIDTH switch and the 851 SWEEP TIME switch. Inter-unit connections required for automatic selection of IF bandwidth are carried in the CONTROL cable.

5-110. To check that the AUTO SELECT feature is functioning, I.F. BANDWIDTH, SPECTRUM WIDTH and SWEEP TIME are given the settings known to result in optimum operation, the display is noted, then I.F. BANDWIDTH is set to AUTO SELECT, and the resulting display is compared to the preceding display. To perform this check:

a. Connect (see Figure 2-2) the 851 to an 8551 known to be in adjustment.

b. Perform the initial operating procedure, Figure 3-3, using an input signal of less than a watt, 10 Mc or higher in frequency.

c. Set SPECTRUM WIDTH ..... 10 KC/CM
SWEEP TIME ..... 10 MILLISEC/CM
I.F. BANDWIDTH ..... 1 KC

d. Note display.

e. Switch I.F. BANDWIDTH to AUTO SELECT.

f. Note display; it should be same as display noted in step d.

g. Follow same procedure for all settings shown in Table 5-14, switching to AUTO SELECT after each change of switch settings.

5-111. I.F. SENSITIVITY CHECK.

5-112. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
3	Variable Transformer, set for 115V	1
9	Signal Generator (606A)	1
D	Shielded cable, BNC male to male (10503A)	1

*Table 5-1

Table 5-14. Switch Settings for AUTO SELECT Check

I.F. BANDWIDTH	SPECTRUM WIDTH	SWEEP TIME
1 KC	10 KC/CM	10 MILLISEC/CM
	30 KC/CM	30 MILLISEC/CM
	100 KC/CM	.1 SEC/CM
	300 KC/CM	.3 SEC/CM
	1 MC/CM	1 SEC/CM
3 KC	10 MC/CM	1 SEC/CM
	3 MC/CM	.3 SEC/CM
	1 MC/CM	.1 SEC/CM
	300 KC/CM	30 MILLISEC/CM
	100 KC/CM	10 MILLISEC/CM
	30 KC/CM	3 MILLISEC/CM
10 KC	300 KC/CM	3 MILLISEC/CM
	1 MC/CM	10 MILLISEC/CM
	3 MC/CM	30 MILLISEC/CM
	10 MC/CM	.1 SEC/CM
	30 MC/CM	.3 SEC/CM
	100 MC/CM	1 SEC/CM
100 KC	200 MC/CM	.3 SEC/CM
	100 MC/CM	.1 SEC/CM
	30 MC/CM	30 MILLISEC/CM
	10 MC/CM	10 MILLISEC/CM
	3 MC/CM	3 MILLISEC/CM

5-113. MEASUREMENT SETUP. Connect signal generator to I.F. INPUT (on 851 rear) and line voltage through a variable transformer set for 115V.

Set 851:

I.F. GAIN (DB) 80
I.F. VERNIER . . . . . full ccw
VERT DISPLAY . . . . . LIN

5-114. SIGNAL LEVEL CHECK.

a. Set signal generator for 20-Mc output.

b. Set I.F. BANDWIDTH to 1 Mc, and adjust signal generator output level to obtain 6 cm of vertical deflection on 851 CRT. The 6-cm deflection should be obtained with signal generator output level at -67.5 dBm ±4.5 dBm.

c. Adjust signal generator output level to obtain 6 cm of vertical deflection on 851 CRT at each setting of I.F. BANDWIDTH. Level at which 6-cm deflection should be obtained at each I.F. BANDWIDTH setting is given in Table 5-15.

d. Disconnect signal generator.

Table 5-15. IF Sensitivity Check Data

I.F. BANDWIDTH Setting	Input-signal Level Limits*
1MC	-62 to -53 dBm
100KC	-75 to -60 dBm
10KC	-95 to -80 dBm
3KC	-95 to -80 dBm
1KC	-86 to -71 dBm

*For 6-cm deflection with I.F. GAIN at 80 dB and VERNIER full counterclockwise and VERT DISPLAY in LIN.

5-115. NOISE LEVEL CHECK. With no signal connected to I.F. INPUT, switch I.F. BANDWIDTH through all positions. The noise displayed on the CRT should not exceed 0.45 cm at any setting of I.F. BANDWIDTH.

5-116. VERT DISPLAY CHECKS AND ADJUSTMENTS.

5-117. PRELIMINARY CHECK.

a. Connect to line voltage through variable transformer, set for 115V.

b. Set 851:

VERT DISPLAY . . . . . LOG
I.F. GAIN (DB) 20
I.F. VERNIER . . . . . full cw
I.F. BANDWIDTH . . . . . 1 MC

c. With no signal input, check that trace aligns with graticule base line.

5-118. LOG DISPLAY.

5-119. ADJUSTMENT.

a. Connect signal generator to I.F. INPUT; set for 20-Mc output at level that obtains 1 cm of vertical deflection on 851 CRT.

b. On 851, increase I.F. GAIN to 40 dB, and adjust A11R14 (on VERT DISPLAY switch, see Figure 7-8) for 3 cm of vertical deflection.

c. Increase I.F. GAIN to 60 dB, and adjust A11R13 (Figure 7-8) for 5 cm of vertical deflection.

d. Increase I.F. GAIN to 80 dB (outer control at 70, inner at 10), and adjust potentiometer A11R20 (Figure 7-8) for 7 cm of vertical deflection.

e. Decrease I.F. GAIN 1 dB, and note deflection level. Reset I.F. GAIN to 80 dB (70 + 10), and rotate I.F. GAIN VERNIER fully counterclockwise. Deflection level decrease should exceed 1 dB.

f. Reset I.F. GAIN VERNIER fully clockwise.

5-120 LINEARITY CHECK.

a. Decrease I.F. GAIN in steps of 10 dB, and observe trace. Each step should lower trace 1.0 cm on CRT and, at each 10-dB step, alignment between trace and horizontal line on graticule should be within ±0.2 cm.

b. Reset I.F. GAIN to 70 + 10, and repeat step a for all other IF bandwidths.

5-121. SQ DISPLAY.

5-122. ADJUSTMENT.

a. On 851 set:
VERT DISPLAY . . . . . SQ
I.F. GAIN (DB) . . . . . 20 + 10
(outer control at 20, inner control at 10)

b. Set signal generator signal level to give 7.0 cm of vertical deflection on 851 CRT.

c. Decrease I.F. GAIN 6 dB, and adjust .710 SQ CALIB A11R2 (Figure 7-8) for 1.75 cm of vertical deflection.

d. Increase signal level for 7.0-cm vertical deflection; decrease I.F. GAIN 6 dB in 3-dB steps. See Table 5-16 for vertical deflection limits.

e. Perform step d at all other IF bandwidths.

Table 5-16. SQ Display Linearity Check Data

I.F. GAIN (DB) Settings	Step	Vertical Deflection (cm)
30	Ref	7.0
27	-3 dB	3.15 - 3.85
24	-6 dB	1.40 - 2.10

5-123. LIN DISPLAY LINEARITY CHECK.

a. Set 851
VERT DISPLAY . . . . . LIN
I.F. GAIN (DB) . . . . . 30 (20 + 10)

b. Increase signal level for 7.0 cm of vertical deflection.

c. Decrease I.F. GAIN 12 dB in 6-dB steps; see Table 5-17 for vertical deflection limits.

d. Repeat steps b and c at all other IF bandwidths.

Table 5-17. LIN Display Linearity Check Data

I.F. GAIN (DB) Settings	Step	Vertical Deflection (cm)
30	Ref	7.0
24	-6 dB	3.29 - 3.71
18	-12 dB	1.54 - 1.96

5-124. FINAL IF BANDWIDTH ADJUSTMENTS.

5-125. EQUIPMENT REQUIRED.

Ref*	Equipment	Qty.
11	UHF Signal Generator (8614A)	1
	8551 (adjusted	1
H	3-ft shielded coax cable term. with type N male (11500A) connectors	1
G	GC plastic tuning wand	1

*Table 5-1

5-126. MEASUREMENT SETUP AND INITIAL PROCEDURE.

a. Setup. Remove top and bottom covers from 851 and top cover from 8551; connect as indicated in Figure 5-14.

b. Settings:

(1) 8551:
LINE . . . . . STANDBY
SPECTRUM WIDTH VERNIER . . . . . CAL
SPECTRUM WIDTH . . . . . 300 KC/CM
FREQUENCY TUNING . . . . COARSE or FINE
FREQUENCY (GC) 01-2
I.F. . . . . 2 GC
TUNE . . . . . 1.8 GC
FREQUENCY IDENTIFIER . . . . . OFF

(2) 851:
SWEEP TIME . . . . . 30 MILLISEC/CM
SWEEP TIME VERNIER . . . . . CAL
I.F. BANDWIDTH . . . . . 10 KC
VERT DISPLAY . . . . . LOG
I.F. GAIN (DB) 80
I.F. GAIN VERNIER . . . . . full cw

(3) Signal Generator:
Frequency . . . . . 1.8 Gc
Output Level . . . . . 0 dBm

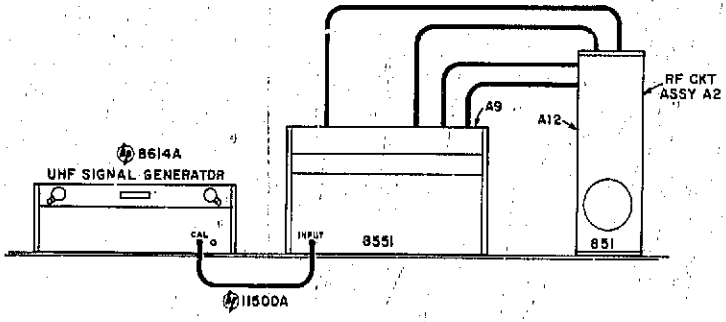


Figure 5-14. Final IF Bandwidth Alignment Setup

c. Initial Procedure:

(1) Follow steps 1-15 of initial operating procedure, Figure 3-3, using above settings.

(2) Switch FREQUENCY TUNING to STABILIZE, and stabilize analyzer (refer to 8551 manual).

5-127. CRYSTAL FILTER (10KC, 3KC, 1KC) BALANCE.

a. Adjust signal generator output level at 60 Mc for 7 cm of vertical deflection on 851 CRT.

b. Tune BALANCE ADJ A2A3C5 and A2A4C8 for a symmetrical display. Capacitor locations are marked on RF Circuit Assembly A2 cover plate, and capacitors can be tuned through access holes in cover plate.

c. Set I.F. BANDWIDTH and SPECTRUM WIDTH as shown in the following table, and readjust A2A3C5 and A2A4C8 for best symmetry compromise for the three bandwidths.

851 I.F. BANDWIDTH	8551 SPECTRUM WIDTH
3KC	100KC/CM
1KC	30KC/CM

5-128. 1-MC BANDPASS FILTER ADJUSTMENTS.

5-129. ADJUSTMENT LOCATIONS. Location of Bandpass Filter Assembly A12 on top of 851 is shown in Figure 5-11 and that of Converter Assembly A9 in top of 8551 is indicated in Figure 5-13. Both assemblies are housed in castings, and each provides access to adjustments through holes in top cover plate.

5-130. PROCEDURE

a. Set:
SPECTRUM WIDTH . . . . . 1 MC/CM
VERT DISPLAY . . . . . LIN

b. Set I.F. BANDWIDTH to 100 KC/CM, and center display with TUNE.

c. Adjust A12A1C7 and A12A1C5 in the 851 and A9A2L2 in the 8551 for best symmetry and a 1-Mc bandwidth.

Note

A12A1C7 controls bandwidth, A12A1C5 and A9A2L2 controls mainly the frequency at which maximum amplitude occurs.

d. Switch I.F. BANDWIDTH to 100 KC/CM, and check that frequency at which maximum amplitude occurs does not shift. Readjust A9A2L2, as required, to assure maximum amplitude occurs at same frequency with I.F. BANDWIDTH in 100-KC and 1MC positions.

INSTRUMENT SERIAL NUMBER

_____

TABLE 5-18. CHECK AND ADJUSTMENT TEST CARD.

PROCEDURES IN THIS CARD CORRESPOND TO

PARAGRAPHS 5-39 THROUGH 5-130.

Table 5-18. Check and Adjustment Test Card (1 of 5)

Seq	Ref	Operation	Record Min	Act.	Max
INSTRUMENT OFF					
1		MECHANICAL AND VISUAL INSPECTION	By _____		
2	5-39	PRELIMINARY PROCEDURE Int Level R2 . . . . . max cw 115/230V Switch . . . . . 115V BASE LINE CLIPPER . . . . max ccw INTENSITY . . . . . max ccw SWEEP TIME . . . . . 1 sec/cm SWEEP TIME VERNIER . . . max ccw SYNC . . . . . INT VERT DISPLAY . . . . . LIN I.F. BANDWIDTH . . . . . 100KC I.F. GAIN . . . . . 30 dB			
3	INSTRUMENT ON		115V	230V	
	5-41	LV POWER SUPPLIES			
4		+15V Adj A9R14 for +15.00 Vdc Vdc	+14.9	_____	+15.1
		103.5 - 126.5V line: Regulation Vdc		_____	±0.03
		Ripple mV p-p		_____	1.5
5		-15V Adj A9R29 for -15.00 Vdc Vdc	-14.9	_____	-15.1
		103.5 - 126.5V line: Regulation Vdc		_____	±0.03
		Ripple mV p-p		_____	6.0
6		+100V Vdc	+92.5	_____	+107.5
		103.5 - 126.5V line: Regulation Vdc		_____	±3.0
		Ripple mV p-p		_____	75
	5-44	HV POWER SUPPLY			
		INTENSITY . . . . . max cw Adj Int Level R2 for 0.5 mA cathode current			
7		INTENSITY . . . . . ccw no cathode current cathode voltage Vdc	2310	_____	2690
8		INTENSITY & FOCUS . . . . . cw cathode voltage change Vdc		_____	60
9		post accelerator voltage Vdc	4750	_____	5450
10	5-47	FOCUS Astigmatism, & Pattern Shape adjustments produce sharp spot FOCUS produces sharp spot at all INTENSITY levels			
		HORIZONTAL AMPLIFIER			
11	5-51	Adjust TRACE ALIGN			
12		Calibration: cw rotation of HORIZ POS moves trace right - center trace Adjust Horiz Gain A6R54 for 10-cm deflection HORIZ POS trace movement: 1 ±0.5 cm each direction cm	0.5	_____	1.5

Table 5-18. Check and Adjustment Test Card (2 of 5)

Seq	Ref	Operation	Record Min	Record Act.	Record Max
	5-55	**TIME BASE**			
13		Sweep Calibration: SWEEP TIME VERNIER . . . . . .CAL			
		Mod Freq (cps) / 10 Period Average / SWEEP TIME / Adj			
		333 / 3.0 ms / 3 ms / A6R29			
		100 / 10.0 ms / 10 ms / A6R30			
		33.3 / 30.0 ms / 30 ms / A6R31			
		10 / 0.1 s / .1 s / A6R32			
		3.33 / 0.3 s / .3 s / A6R33			
		1 / 1.0 s / 1 s / A6R34			
14	5-55	Sweep Linearity: SWEEP TIME . . . . . 3 ms/cm Distance between successive positive mod peaks cm	0.8	_____	1.2
15	5-58	SWEEP TIME VERNIER: Mod frequency. . . . . 100 cps SWEEP TIME . . . . . 3 ms/cm SWEEP TIME VERNIER . . . full ccw 1-cycle waveform width cm		_____	1.0
16	5-61	SINGLE SWEEP & sweep amplitude V p-p	9.7	_____	10.3
	5-65	**SYNC & OUTPUT CHECKS**			
17		EXT SYNC: 1 cps ~ 5 kc			
18		VERT OUTPUT check			
19		HORIZ OUTPUT check			
20		LINE sync check			
21		BASE LINE CLIPPER blanks at least lower 2 cm of trace			
22	5-73	**CRT CHECKS**			
		Check TRACE ALIGN			
23		Pattern distortion and resolution: Adjust Pattern Shape A7R22 for minimum average distortion on edges of 20-kc pattern			
		Check 1-kc pattern for uniform focus at normal intensity			
24		Blanking: no retrace all sweep speeds			
25	5-78	**VERTICAL AMPLIFIER**			
		Calibration: a. cw rotation of VERT POS moves trace upward b. Align trace with base line - no input c. Set 20-Mc signal generator for 4.0 ±0.1 Vdc detected input to Vert Ampl d. Adjust A7R28 for 6.0-cm deflection e. Repeat steps b and d until both conditions are met			
26	5-82	Video Bandwidth: I. F. BANDWIDTH . . . . . 1MC Set 50-kc vertical amplifier input for 2.0-cm deflection Increase frequency to 1.2 Mc, same input V			
		Vertical deflection cm	1.4	_____	

Table 5-16. Check and Adjustment Test Card (3 of 5)

Seq	Ref	Operation		Record Min	Act.	Max
		Other I. F. BANDWIDTH positions				
		1 kc ref				
		100KC I. F. BANDWIDTH	kc	180	____	240
		10KC		32	____	48
		3KC		9.6	____	14.4
		1KC		3.2	____	4.8
		I. F. BANDWIDTH VERT DISPLAY . . . LIN				
27	5-86	1-Mc Alignment:				
		Adjust Detect. Tune A2A7T1				
		Tune Imped Adj A2A6L11				
		Preset A12A1C7, A12A1C5				
28	5-87	1MC BANDWIDTH check	Mc	1.4	____	2.2
29	5-89	100-kc Alignment:				
		Tune 100-kc BW Adj in A3 & A5				
		Tune Imped Adj A2A2L1				
30	5-91	100KC BANDWIDTH check:	kc	80	____	120
31	5-94	Final 1MC and 100KC Bandwidth Adjusts				
		Connect 851 to 8551				
		Perform 1-14, Fig. 3-3				
		SWEEP TIME . . . . . 3 ms/cm				
		I. F. BANDWIDTH 1MC				
		Input signal . . . . . anywhere between 10 Mc and 5 Gc				
		SPECTRUM WIDTH . . . . . 100 kc/cm				
		VERT DISPLAY . . . . . LOG				
		Check symmetry and if necessary readjust A12A1C7 and A12A1C5				
		Switch back and forth between LIN and LOG and between 1MC and 100KC I. F. BANDWIDTH, readjusting as required for best compromise on amplitude and symmetry while keeping bandwidths within specifications.				
32	5-95	1-, 3-, 10-kc Alignment:				
		SPECTRUM WIDTH . . . . . 10 kc				
		I. F. BANDWIDTH . . . . . 10 kc				
		SWEEP TIME . . . . . 3 ms/cm				
		If desired, remove RF Ckt Assy A2 cover.				
		Preset Bal Adj A2A3C5 & A2A4C8 at 1/3 mesh.				
		Tune 1-10 kc BW Adj A2A3C4, A2A3C2, A2A4C6, & A2A4C9 for max BW				
		Adjust Imped Adj A2A3L3 and Freq Adj A2A4C7 for max deflection				
		Set I. F. GAIN for 7.0-cm display				
		Check bandwidth at 5.0 cm	cm	1	____	1
		Readjust until BW at 5.0-cm vertical deflection is 1 cm				
33	5-102	3KC & 1KC BANDWIDTH checks:				
		See Calibration, Paragraph 5-104				
		BW at 5.0 cm with 7.0-cm max deflection				
		3KC	cm	1.6	____	2.4
		1KC		1.6	____	2.4
		Reinstall Assy A2 cover				
34	5-105	Recheck 10-kc BW Adj:				
		SPECTRUM WIDTH . . . . . 10 kc				
		I. F. BANDWIDTH . . . . . 10 kc				
		BW at 5.0 cm with 7.0-cm maximum deflection	cm	0.8	____	1.2

Table 5-18. Check and Adjustment Test Card (4 of 5)

Seq	Ref.	Operation		Record Min	Record Act.	Record Max
35	5-107	AUTO SELECT CHECK Optimum BW is automatically selected For check see Paragraph 5-110 and Table 5-14				
	5-111	I. F. SENSITIVITY I. F. GAIN . . . . . .80dB I. F. GAIN VERNIER . . . . . full cw				
36	5-114	Power input for 6-cm vertical deflection				
		I. F. BW				
		1 Mc	dBm	-53	_____	-62
		100 kc		-60	_____	-75
		10 kc		-80	_____	-95
		3 kc		-80	_____	-95
		1 kc		-71	_____	-86
37	5-115	Noise Level				
		I. F. BW				
		1 Mc	cm		_____	0.45
		100 kc			_____	0.45
		10 kc			_____	0.45
		3 kc			_____	0.45
		1 kc			_____	0.45
	5-116	VERTICAL DISPLAY I. F. GAIN . . . . . 20dB I. F. BW. . . . . .1 Mc				
38	5-117c	Check trace alignment				
39	5-118	LOG Display Adj: Adjust input for 1-cm deflection Increase I. F. GAIN to 40 dB Adjust A11R14 for 3-cm deflection Increase I. F. GAIN to 60 dB Adjust A11R13 for 5-cm deflection Increase I. F. GAIN to 70 + 10 dB Adjust A11R20 for 7-cm deflection I. F. GAIN VERNIER . . . full cw Gain decrease Reset VERNIER full ccw	dB	1	_____	
40	5-120	LOG Display Linearity: Decrease I. F. GAIN in 10-dB steps. Trace should decrease 1 cm/step. Error at each cm division Repeat 40 for other IF bandwidths	cm		_____	±0.2
41	5-122	SQ Display Adj: Adjust input for 7.0-cm deflection with 20 +dB I.F. GAIN Decrease I.F.GAIN 6 dB. Adj A11R2 for 1.75-cm deflection				

Table 5-18. Check and Adjustment Test Card (5 of 5)

Seq	Ref	Operation	Record Min	Act.	Max
42		SQ Display Linearity: I. F. GAIN		Vertical Deflection - cm	
		-3 dB	3.15	_____	3.85
		-6 dB	1.40	_____	2.10
		Repeat 42 for other IF BW's			
43	5-123	LIN Display Linearity: I. F. GAIN		Vertical Deflection - cm	
		-6 dB	3.29	_____	3.71
		-12 dB	1.54	_____	1.96
		Repeat 43 for other IF BW's			
		FINAL I. F. BANDWIDTH ADJUSTS (with 8551)			
44	5-126	Crystal Filter Balance: VERT DISPLAY . . . . . LOG 60-Mc input: 7-cm deflection Tune A2A3C5 & A2A4C8 for best symmetrical display and best compromise: 8551 SPECTRUM WIDTH — 851 I. F. BANDWIDTH 300 kc/cm — 10 kc 100 kc/cm — 3 kc 30 kc/cm — 1 kc			
45	5-128	1-Mc Bandpass Filter Adjustments: VERT DISPLAY . . . . . LIN SPECTRUM WIDTH . . . . 1 Mc/cm I. F. BW. . . . . 100 kc Center display on CRT			
		I. F. BW. . . . . 1 Mc Adjust 851 A12A1C7, A12A1C5, and 8551 A9A2L2 for symmetrical display and 1-Mc BW			
	5-130	I. F. BW. . . . . 100 kc Maximum amplitude on CRT is at same frequency as 1-Mc bandwidth			

Note

Do not change an operating voltage or calibration adjustment unless it is either definitely outside specified tolerance, or calibration of a dependent function is unsatisfactory. Improving a marginal adjustment can adversely affect calibration.

5-131. TROUBLESHOOTING.

5-132. LOCALIZATION.

5-133. Tables 5-2, Front Panel Checks and 5-8, Performance Check Test Card, are valuable aids in the localization of trouble in the 851. In addition to the performance checks, Tables 5-23 through 5-26 are troubleshooting flow charts designed to isolate instrument malfunctions to specific areas. In the troubleshooting charts, the circuits most likely to be trouble area(s) are named, at the completion of an action or series of actions. When troubleshooting, it is best to follow the charts down to a specified circuit and then to examine the voltages and waveforms associated with that circuit to isolate the components that have failed. Visual examination of suspected trouble area(s) are also suggested as a quick means of detecting failed components.

5-134. PARTS LOCATION.

5-135. The key to part location is part designation.

a. If a component is mounted on an assembly board, the designation is prefixed with the assembly number, e.g., A1R5. Location of each assembly is called out in Figures 5-15 and 5-16. In addition, a picture of each assembly board is provided near the schematics and all components on the board are identified. Board pictures face the schematic in which the assembly appears. All board pictures are listed in the List of Illustrations.

b. If a component is mounted on the chassis, the designation has no prefix, e.g., R5. These parts are harder to locate, so many are marked directly on the instrument chassis.

5-136. TRANSISTORS.

5-137. The following general information is provided for those without extensive transistor experience.

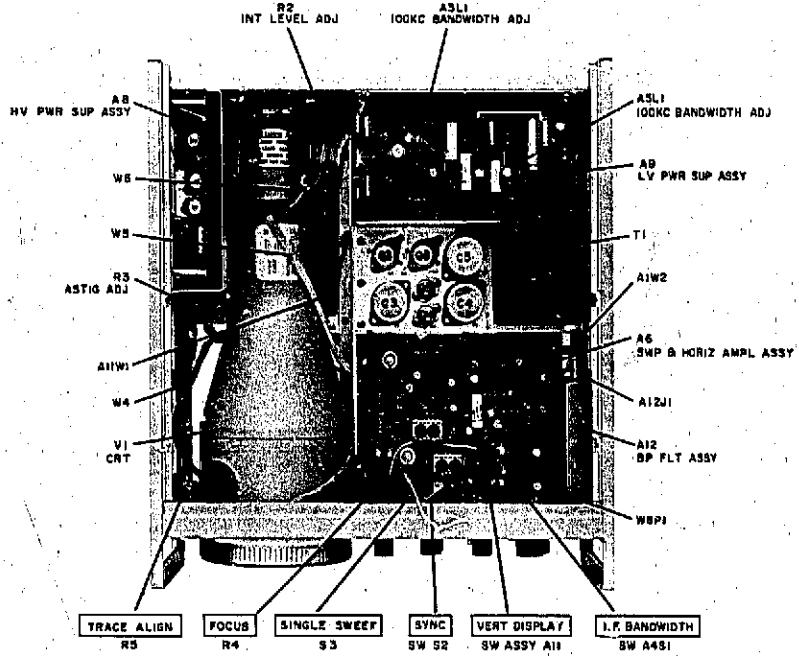


Figure 5-15. 851B Top View, Cover Removed

5-138. In transistor testing the most important consideration is the base-emitter junction. Like the control grid of a vacuum tube, this is the operational control point on the transistor. This junction is essentially a solid-state diode, and for the transistor to conduct this diode must be forward biased.

5-139. The transistor symbol (see Figure 5-17) can be used to determine the polarity required to forward-bias the base-emitter junction. Remember that the base material is the middle letter of the transistor type (NPN or PNP). Referring to part A of Figure 5-18, notice that the emitter arrow points toward the N-type material. Thus when the arrow points away from the base (NPN), the base must be positive with respect to the emitter to forward-bias the junction, and when the arrow points toward the base (PNP), the base must be negative with respect to the emitter to forward-bias the junction.

5-140. Bias polarity for cutoff and conduction for vacuum tubes as well as transistors is also shown in part A of Figure 5-17. Part B shows simplified versions of the three basic transistor circuits, and gives the amplifier characteristics of each.

5-141. ISOLATING TROUBLE IN TRANSISTOR CIRCUITS.

5-142. For general data on transistors, see Paragraph 5-136 and Figure 5-17.

5-143. IN-CIRCUIT TESTING.

a. When checking a transistor stage, first determine if the emitter-base junction is forward-biased. Do not place an electronic voltmeter directly across the junction to measure the voltage difference; there could be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure each voltage separately with respect to a common point (e.g., chassis). If the junction is not forward-biased, and power supply voltages are known to be correct, the base-emitter junction may be open (see Paragraph 5-144).

b. If the emitter-base junction is forward-biased, check for amplifier action by short-circuiting base to emitter while observing collector voltage. The short eliminates base-emitter bias and should cause the transistor to stop conducting. Collector voltage should then shift to near the supply voltage. Any difference is due to leakage current through the transistor and, in general, the smaller this current, the better the transistor. If collector voltage does not change, the transistor either has an emitter-collector short circuit or emitter-base open circuit.

5-144. OUT-OF-CIRCUIT TESTING WITH OHMMETER. If a short or open circuit is suspected, remove the transistor from the circuit (see Paragraph 5-153) and use an ohmmeter to measure internal resistance. See Table 5-19 for typical measurement data.

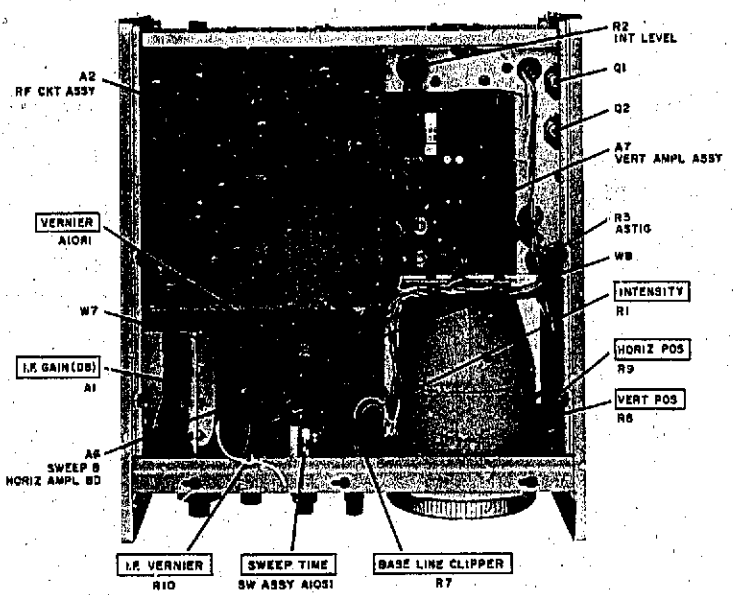
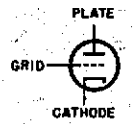
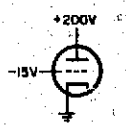
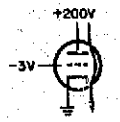
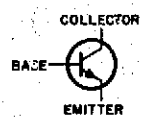
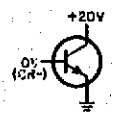
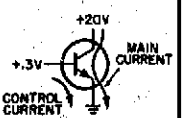
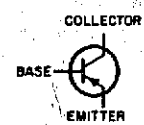
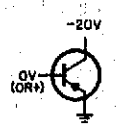
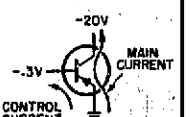


Figure 5-16. 851B Bottom View, Cover Removed

A. TRANSISTOR BIASING

DEVICE	SYMBOL	CUT OFF	CONDUCTING
VACUUM TUBE			
NPN TRANSISTOR			
PNP TRANSISTOR			

B. AMPLIFIER CHARACTERISTICS

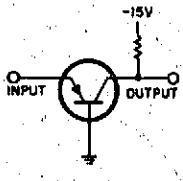
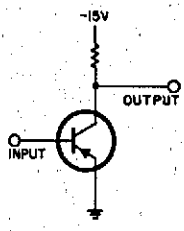
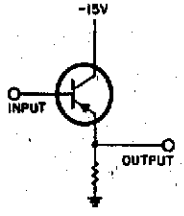
CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT Z	30-50 Ω	500-1500 Ω	20-500K Ω
OUTPUT Z	300-500K Ω	30-50K Ω	50-1000 Ω
VOLTAGE GAIN	500-1500	300-1000	< 1
CURRENT GAIN	< 1	25-50	25-50
POWER GAIN	20-30 db	25-40 db	10-20 db
			

Figure 5-17. Transistor Biasing and Typical Amplifier Characteristics

Table 5-19. Out-of-Circuit Transistor Resistance

Transistor Type		Connect Ohmmeter: Pos lead to	Neg lead to	Measure Resistance (ohms)
PNP Germanium	Small Signal	emitter	base*	200-500
		emitter	collector	10 K-100 K
	Power	emitter	base*	30-50
		emitter	collector	several hundred
NPN Silicon	Small Signal	base	emitter	1 K-3 K
		collector	emitter	very high (might read open)
	Power	base	emitter	200-1000
		collector	emitter	high, often greater than 1 M

*To check collector, short collector to base; resistance should decrease.

CAUTION

Most ohmmeters can supply enough current or voltage to damage a transistor. Before using the ohmmeter, check ohmmeter open-circuit voltage and short-circuit current output ON THE RANGE TO BE USED. Open-circuit voltage must not exceed 1.5 volts and short-circuit current must be less than 3 mA. See Table 5-20 for safe resistance ranges for some common ohmmeters.

5-145. IN-CIRCUIT TESTING OF TRANSISTORS Q3, Q4, Q5, Q6.

5-146. To check base-emitter junction of transistors Q3, Q4, Q5, or Q6, connect voltmeter as noted in Table 5-21. Any sensitive high-impedance voltmeter, such as the hp 3440A Digital Voltmeter or hp 412A Precision V-O-A is suitable.

Table 5-20. Safe Ohmmeter Ranges for Transistor Resistance Measurements

Ohmmeter	Safe Range(s)	Open Ckt Voltage	Short Ckt Current	Color	Polarity
hp 412A	R x 1K	1.0 V	1 mA	Red	+
	R x 10K	1.0 V	100 µA	Black	-
	R x 100K	1.0 V	10 µA		
	R x 1M	1.0 V	1 µA		
	R x 10M	1.0 V	0.1 µA		
hp 410C	R x 1K	1.3 V	0.57 mA	Red	+
	R x 10K	1.3 V	57 µA	Black	-
	R x 100K	1.3 V	5.7 µA		
	R x 1M	1.3 V	0.5 µA		
	R x 10M	1.3 V	0.05 µA		
hp 410B	R x 100	1.1 V	1.1 mA	Black	+
	R x 1K	1.1 V	110 µA	Red	-
	R x 10K	1.1 V	11 µA		
	R x 100K	1.1 V	1.1 µA		
	R x 1M	1.1 V	0.11 µA		
Simpson 260	R x 100	1.5 V	1 mA	Red	+
				Black	-
Simpson 260	R x 1K	1.5 V	0.82 mA	Black	+
				Red	-
Triplett 630	R x 100	1.5 V	3.25 mA	Varies with Serial Number	
	R x 1K	1.5 V	325 µA		
Triplett 310	R x 10	1.5 V	750 µA		
	R x 100	1.5 V	75 µA		

Table 5-21. Connection Points; Q3, Q4, Q5, Q6 Base-Emitter Forward Bias Check

Xstr	Measurement	Connect VM Between Chassis and: Component	Pointon Fig.7-18
Q3	Base to chassis	A9R1	28
Q4	Base to chassis	A9R3	
	Emitter to chassis	A9R4	
Q5	Base to chassis	A9C7	
	Emitter to chassis	A9R16	
Q6	Base to chassis	A9R16	
	Emitter to chassis	A9R21	

5-147. ETCHED CIRCUITS.

5-148. The etched circuit boards in the 851 Spectrum Analyzer Display Section are of the plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results. Table 5-23 lists recommended tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution: It can result in damage to the circuit board and/or adjacent components.

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

c. Use a suction device (Table 22) or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion. See Table 5-22 for recommendations.

5-149. ETCHED CONDUCTOR REPAIR. A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

5-150. COMPONENT REPLACEMENT.

a. Remove defective component from Board.

Note

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

b. If component was unsoldered, remove solder from mounting holes with a suction desoldering aid (Table 5-22) or wooden toothpick.

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes, and position component as original was positioned. DO NOT FORCE LEADS INTO MOUNTING HOLES; sharp lead ends may damage plated-through conductor.

Table 5-22. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 47-1/2 - 56-1/2 Tip Temp: 850 - 900°	Ungar #776 Handle with *Ungar #4037 Heating Unit
Soldering *Tip	Soldering Unsoldering	*Shape: pointed	*Ungar #PL111
De-soldering aid	To remove molten solder from connection	Suction device	Soldapullt by Edsyn Co. Arleta, California
Resix (flux) solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, light tin content (60/40 tin/lead), 18 guage (SWG) preferred	
Protective	Contamination, corrosion protection	Good electrical insulation, corrosion-prevention properties	Krylon** ® #1302 Humiseal Protective Coating, Type 1B12 by Columbia Technical Corp. Woodside 77, New York

*For working on 851 Boards: for general purpose work, use Ungar #1237 Heating Unit (37.5W, tip temp of 750-800°) and Ungar #PL113 1/8" chisel tip.
**Krylon, Inc., Norristown, Pennsylvania

Table 5-23. General Troubleshooting

NOTES:

1. Set Slide Switch to line voltage available (115/230 VAC).

*2. If no Base Line appears at this point and it is possible to illuminate the screen with the INTENSITY control, refer to Table 5-25, Sweep and Horizontal Amplifier Troubleshooting.

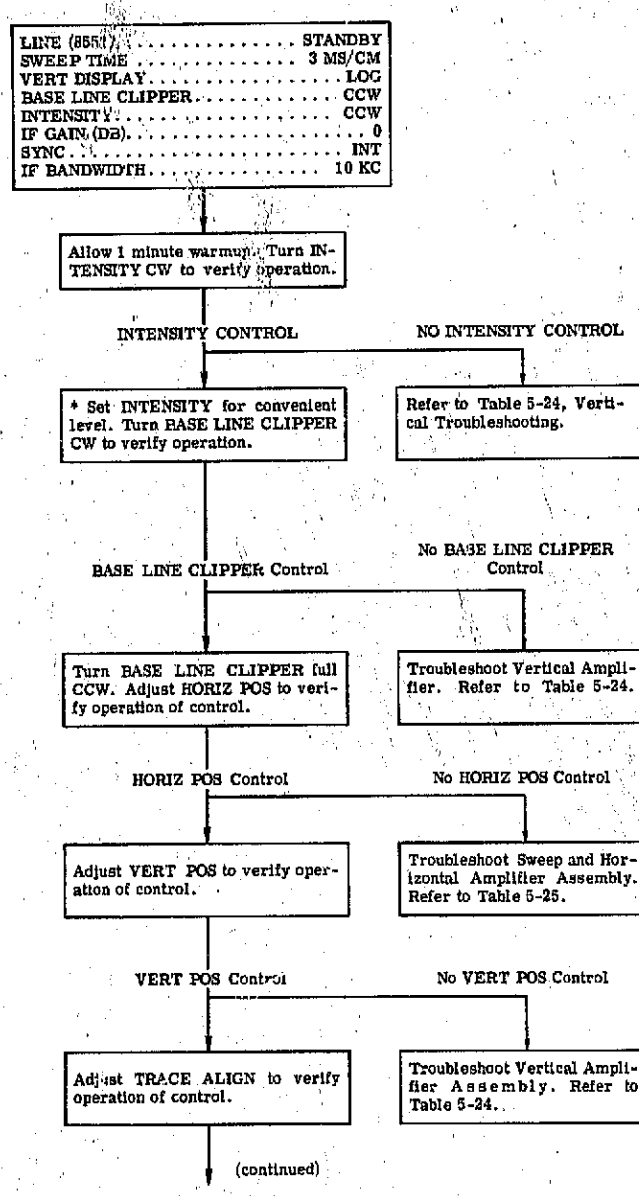


Table 5-23. General Troubleshooting (cont)

NOTES: (cont)

*3. With IF GAIN (DB) in the 0 DB position, there should be no indication of noise. If noise is present, refer to Table 5-24, and Figures 7-3 through 7-12 and troubleshoot vertical circuits.

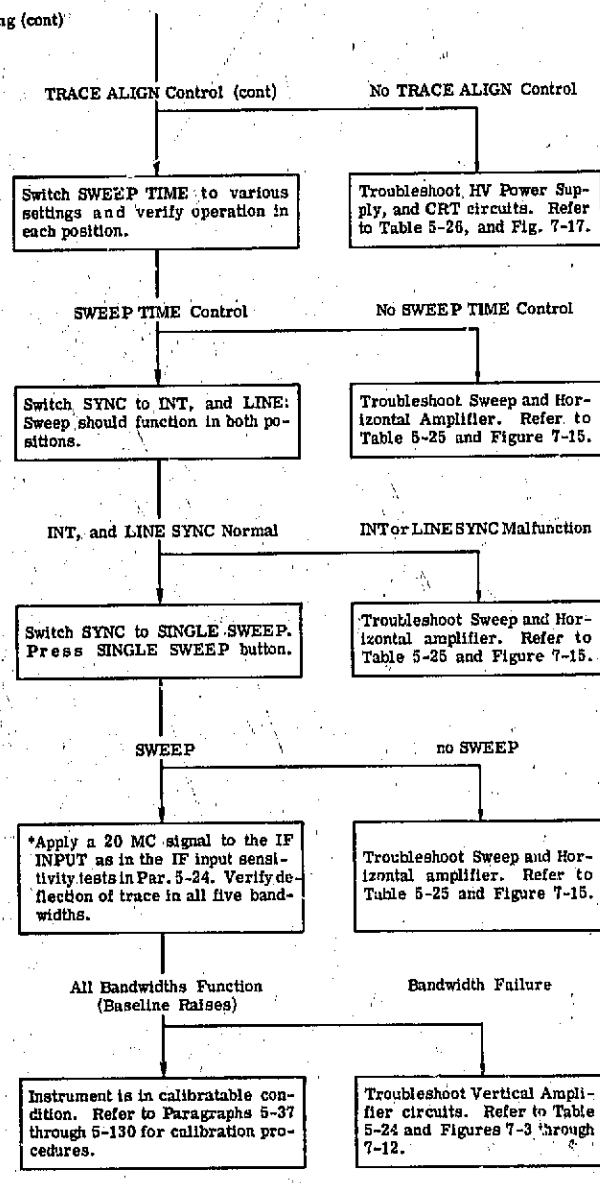
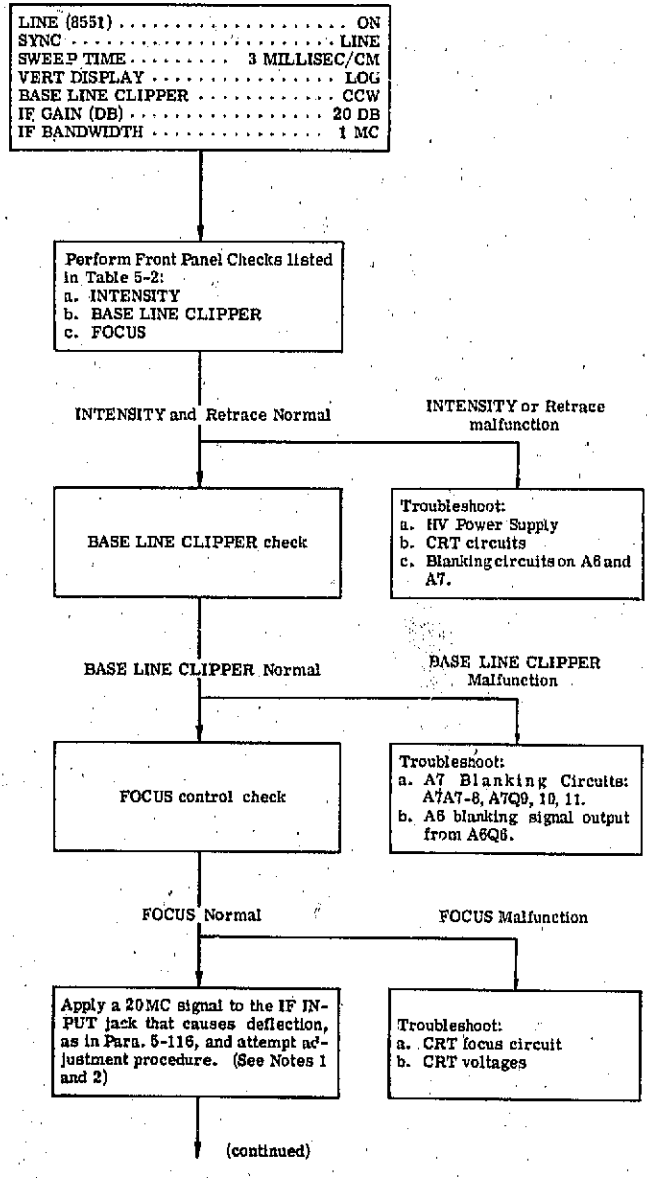


Table 5-24. Vertical Circuit Troubleshooting



NOTES:

1. With a 20 MC unmodulated signal applied to the IF INPUT, the base line of the display rises.
2. At narrow bandwidth settings, tune the signal source to maximum deflection.
3. Check instrument operation using the Performance Checks in Table 5-8, and Paragraphs 5-14 through 5-30:
   a. Vertical Display accuracy
   b. IF Bandwidth accuracy
   c. IF Input sensitivity
   d. IF Gain Set accuracy

Table 5-24. Vertical Circuit Troubleshooting (cont)

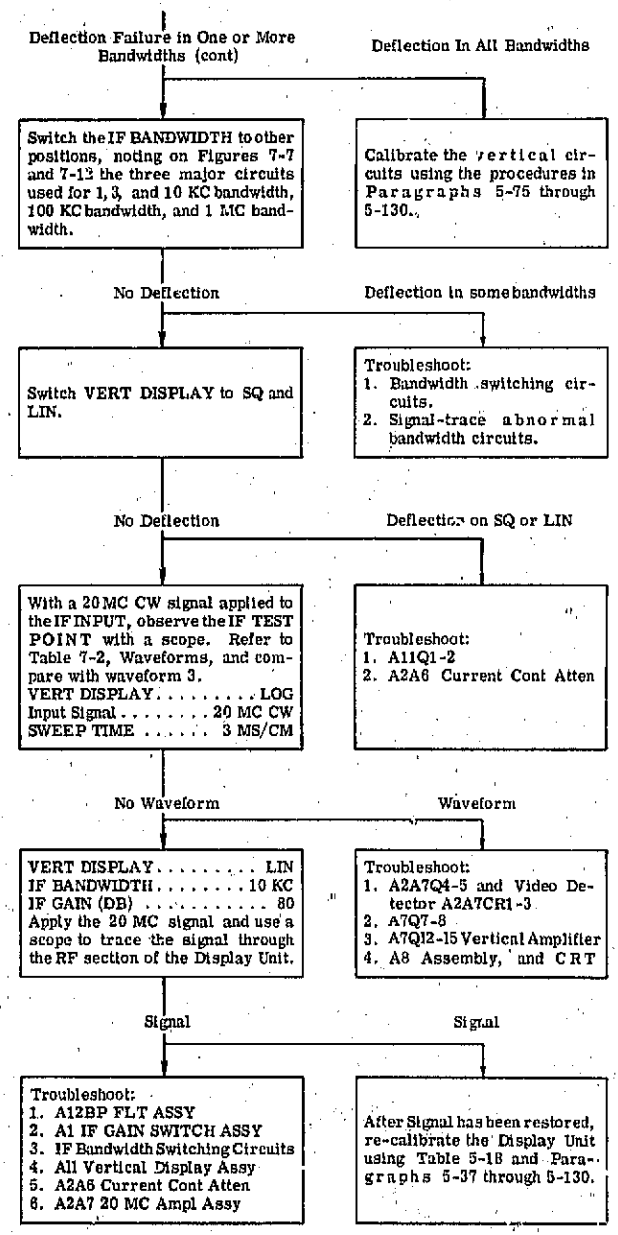
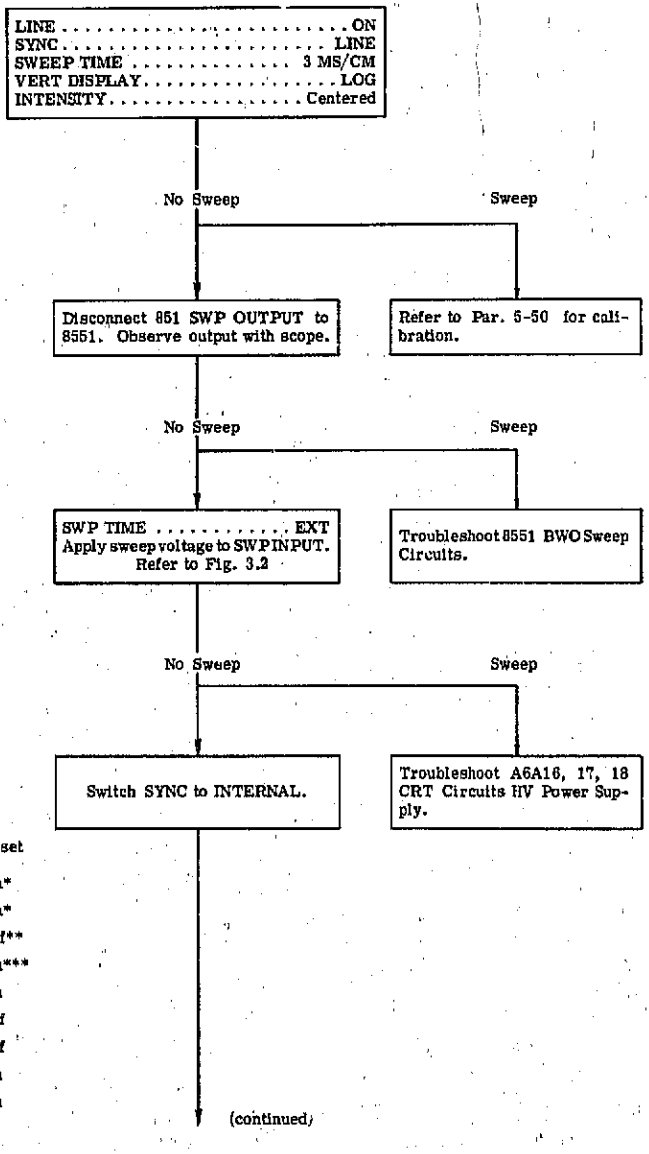


Table 5-25. Sweep and Horizontal Amplifier Troubleshooting



NOTES:

1. Refer to the following:
   a. Figure 7-14, A6 Sweep and Horizontal Ampl. Schematics
   b. Table 7-2, Waveforms
   c. Section IV, Principles of Operation

2. Transistor Switching:

	Swp	Reset
A6Q3	Off	On*
Q4	Off	On*
Q5	On	Off**
Q6	Off	On***
Q7	Off	On
Q8	On	Off
Q9	On	Off
Q10	Off	On
Q15	Off	On

Table 5-25. Sweep and Horizontal Amplifier Troubleshooting (cont)

NOTES: (cont)

2. Transistor Switching: (cont)

*Turns on to initiate sweep reset.

**Turns on only long enough to start sweep in INT sync mode.

***Turned on during sweep reset for blanking.

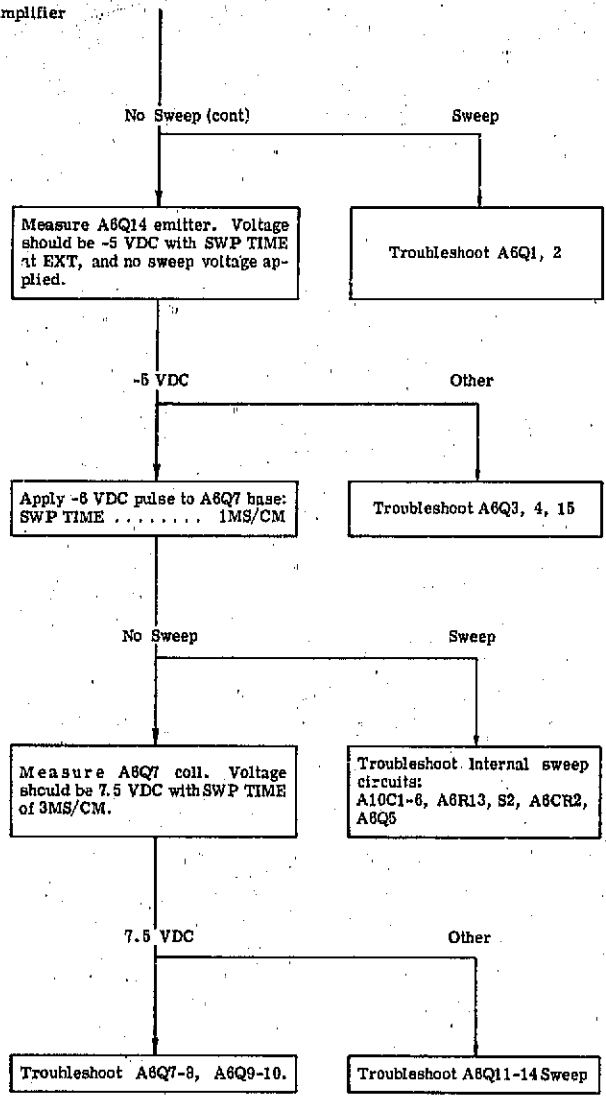


Table 5-26. Power Supply Troubleshooting

NOTES:

115V/230V slide switch set to line voltage

LINE (8551) ..... ON
SWEEP TIME ..... 3 MS/CM
VERT DISPLAY ..... LOG
BASE LINE CLIPPER ..... CCW
INTENSITY ..... Centered
IF GAIN ..... 40 DB
IF BANDWIDTH ..... 1 MC

LV SUPPLY TOLERANCES:

Measure LV PWR SUPPLY voltages as in Para. 5-43.

Voltage Indications

No Voltage Indications

+15 Vdc ±0.1, 1.5 mV rms Ripple

Measure +15 Vdc supply from A9C6 (+) to grnd. Refer to Power Supply schematic. Adjust A9R14 if necessary.

Check:
Line Voltage
Fuse
Power Cord

+15V Supply Within Tolerance

+15V Supply Not Within Tolerance

-15 Vdc ±0.1, 6.0 mV rms Ripple

Measure -15 Vdc supply from A9C10(-) to grnd. Adjust A9R29 if necessary.

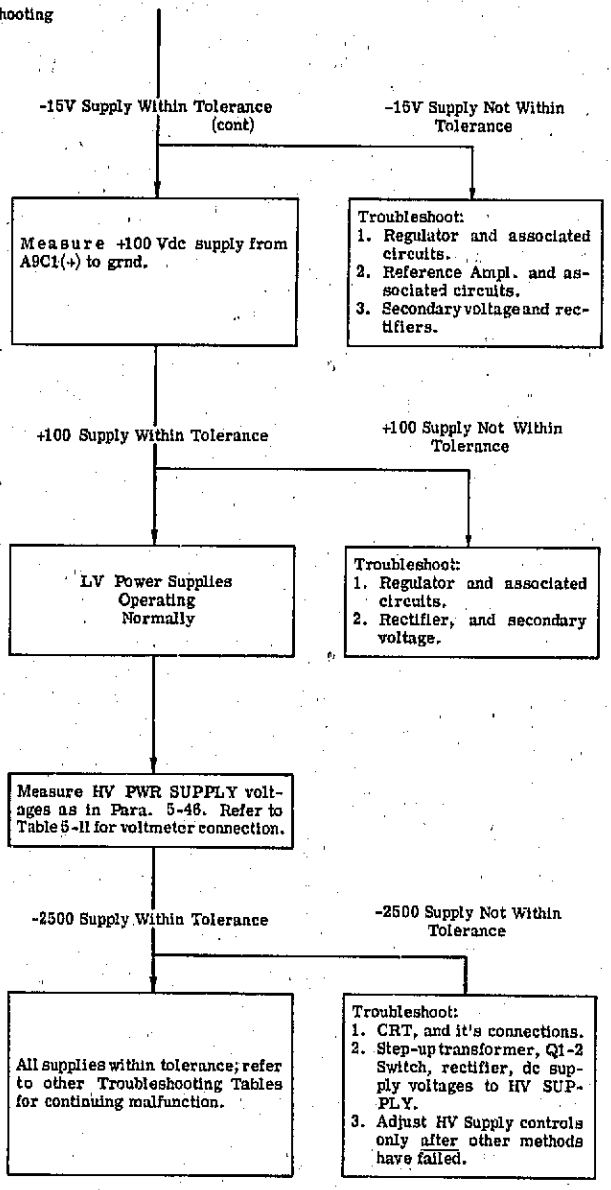
Troubleshoot:
1. Regulator and associated circuits.
2. Reference Ampl. and associated circuits.
3. Secondary voltage and rectifiers.

(continued)

Table 5-26. Power Supply Troubleshooting (cont)

NOTES: (cont)

+100 Vdc ±7.5, 75 mV rms Ripple



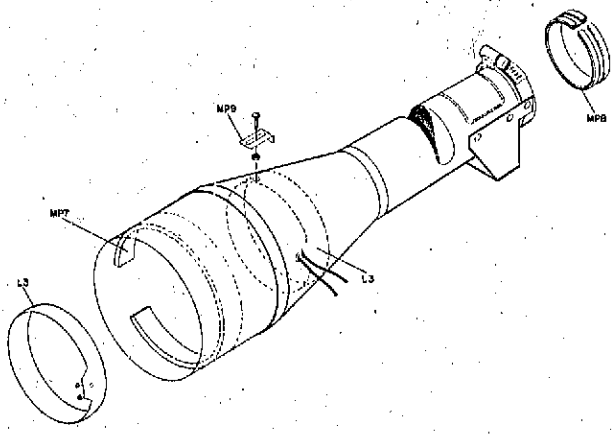


Figure 5-18. CRT Shield Assembly

5-151. DISASSEMBLY PROCEDURES.

5-152. Refer to Table 5-27 for recommendations regarding component removal, to Paragraph 5-147 for general information about working on etched circuits, to Table 5-28 for recommendations regarding checks to be made after replacing components, and to Table 5-22 for recommended soldering equipment.

5-153. TRANSISTOR REPLACEMENT.

a. Do not apply excessive heat; see Table 5-22 for recommended soldering tools.

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

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

5-154. CHASSIS-MOUNTED TRANSISTORS. Transistors Q1 and Q2, which drive the Step-up Transformer in HV Power Supply A8, and Q3, Q4, Q5, Q6, Series Regulators for LV Power Supply A9, are high-current types which require good thermal contact with mounting surfaces for adequate heat dissipation. To assure good thermal contact for a replacement transistor, coat both sides of the black insulator with Dow Corning #5 silicone compound or equivalent before fastening the transistor to the chassis. Dow Corning #5 compound is available in 3-oz tubes from Hewlett-Packard; order hp stock No. 8500-0069.

5-155. TRANSISTORS Q1, Q2. Location of Q1 and A2 on the left side of the chassis is called out on Figures 5-15 and 5-16. To test these transistors, it is necessary to remove the left and top cover plates; to replace them, it is necessary to remove both the bottom and left-side cover plates. Base, emitter, and collector terminals are identified on the inner side of the deck on which Q1 and Q2 are mounted on.

5-156. TRANSISTORS Q3, Q4, Q5, Q6. To replace Q3, Q4, Q5, or Q6, it is necessary to gain access to the under side of the deck (see Figure 5-15) on which they are mounted.

a. Rest 851 on left side. Remove top, bottom, and right-side covers.

b. Refer to Figure 5-19. Remove the three screws designated (1) ; these are 6-32 x 3/8 BH machine screws with integral lockwasher, and are accessible from the rear plate.

c. Remove screws (2) , (3) , (4) ; these are 6-32 x 3/8 BH machine screws, each fitted with a split lockwasher.

d. Remove the two screws designated (5) ; these are 8-32 x 3/8 FH machine screws fitted with integral lockwashers. Screw heads are accessible from right side of instrument.

e. Remove three screws (6) on the deck; these are 6-32 x 3/8 BH machine screws fitted with toothed lockwashers.

f. Remove the 6-32 x 5/16 stainless steel hex nut designated (7) ; a 5/16 socket wrench (Spintite) is recommended. This nut secures a 6-32 x 1/2 spade lug connected to a cable clamp. After removing nut, push down on screw so it will drop out of deck hole and hole in A6 Board.

g. On rear of A6 Board, find screw designated (8) on Figure 5-21. This screw is also a 6-32 x 1/2 spade lug connected to a cable clamp, and is secured to the A6 Board by a nut which is located under Assembly A12. Long-nose pliers can be put on the nut while

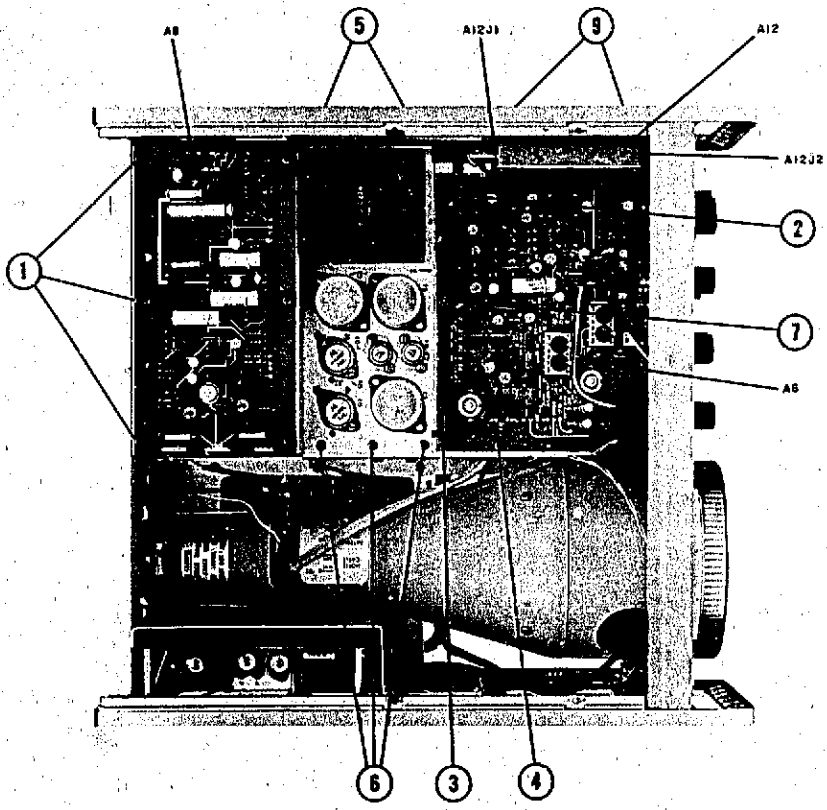


Figure 5-19. Top View of 851 Display Section

loosening the screw by going through an opening on the left side of the instrument.

h. When the deck on which the transistors are mounted is free of its fastenings, it can be shifted so the under side can be exposed. One method is to pull it gently out from under the A6 Board, and then turn the deck over. Transistors and terminals are identified in Figure 5-20.

5-157. REMOVING BANDPASS FILTER ASSEMBLY A12.

5-158. A12 components are mounted on a Board inside the casting; see Figure 7-2. To free A12, proceed as follows:

a. Rest 851 on left side, and remove top and right side covers.

b. Disconnect cable from A12J1 (Figure 5-19).

c. Remove two screws (9) which hold A12 to the side casting; these are 6-32 x 3/8 FH machine screws with integral lockwashers.

d. Lift A12 free of the mounting recess and turn it over so top cover can be removed.

e. Remove four screws which hold top cover on; these are 4-40 x 1/4 RH machine screws with integral lockwashers.

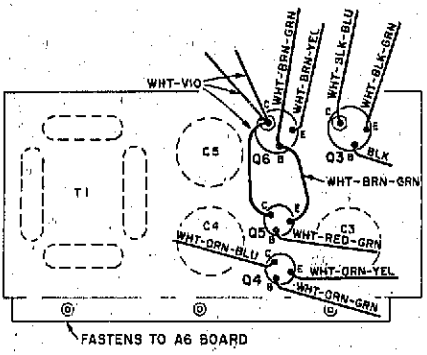


Figure 5-20. Q3-Q6 Terminal Identification: Bottom View

5-159. REMOVING SWITCHES.

5-160. Larger knobs secure to the shaft with an 8-32 x 3/16 setscrew which is loosened with a No. 8 Allen wrench. The red verniers secure to the shaft with a 6-32 x 1/8 setscrew; loosen with a No. 6 Allen wrench. Each shaft is secured to the panel with a 3/9-32 x 1/2 hex nut which takes a 1/2" wrench.

5-161. REMOVING ASSEMBLIES A3 AND A5.

5-162. To reach 100KC Bandpass Filter Assembly A3 or A5:

a. Remove 851 top cover.

b. A3 and A5 are beneath the LV Power Supply A9 Board (see Figure 5-15), and some of the cabling is beneath the Transformer/Transistor Deck. The A9 Board and the Deck lift as one piece; free them as described in Paragraph 5-150.

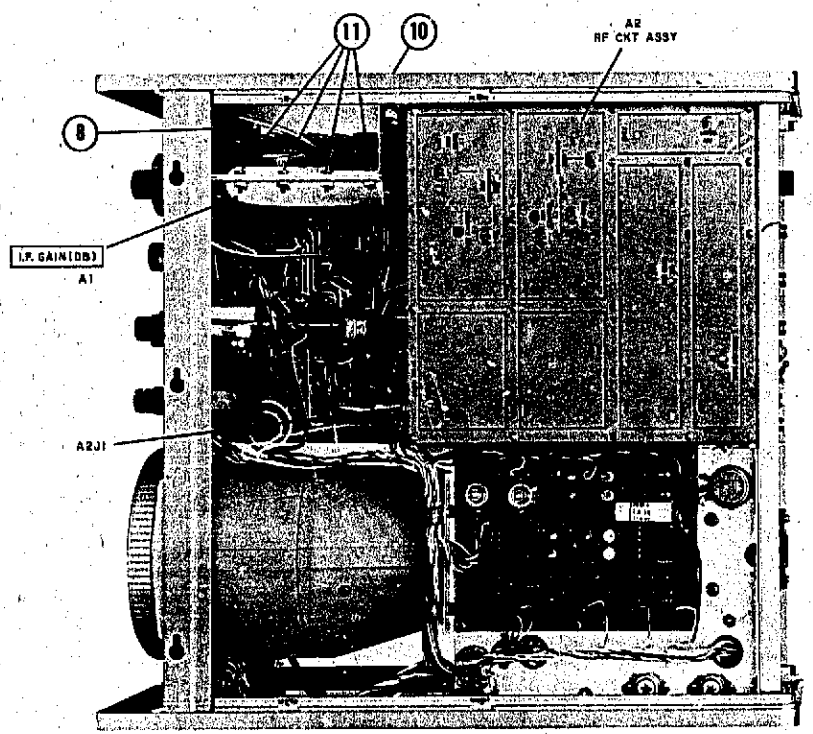


Figure 5-21. Bottom View of 851 Display Section

c. Disconnect the two cables connected to the Filter Assembly of interest, and remove the four screws which attach the Assembly to the bottom of the A2 casting. Assembly A3 is fastened with three 6-32 x 3/8 BH machine screws with integral lockwasher and one 6-32 x 1/2 BH machine screw with lockwasher (this screw also secures a 3-terminal tie point to the casting). Assembly A5 is fastened with four 6-32 x 3/8 BH machine screws with integral lockwasher.

5-163. REMOVING I.F. GAIN SWITCH ASSEMBLY A1.

5-164. To check or replace components on the I.F. GAIN switch Assembly, the switch and its shield must be removed.

a. Rest 851 on right side, and remove bottom and left-side covers.

b. Remove knobs; each secures to the shaft with an 8-32 x 3/16 setscrew that can be loosened with a No. 8 Allen wrench. Loosen locknut under knob with a 1/2" wrench; locknut is a 3/8-32 x 1/2 hex nut.

c. Disconnect I.F. INPUT Cable A1W1 from rear panel.

d. Disconnect cable from A12J1 (see Figure 5-19). This is a right-angle connector and is a tight fit; if there is difficulty disconnecting it, remove screws designated (9) which secure A12 to the side casting, and lift Assembly A12 up far enough to disconnect the cable from A12J1.

e. Remove screw (10) (Figure 5-21) which holds Assembly A1 bracket to left-side casting; this is an 8-32 x 1/2 FH machine screw with integral lockwasher.

f. Assembly A1 is now free of its fastenings, but clearance is small. Carefully slide A1 shaft out of front panel being ready to slant A1 to the left as soon

Table 5-27. Recommendations, Component Removal

Component p/o (Assy No.)	Access for Unsoldering	REFERENCES	
		PARA.	FIGURE
A1	Inside metal shield	5-163	7-1
A2	Front of Boards, inside the casting	Remove 851 bottom plate, A2 casting cover;	5-16, 7-5
A3		5-161	7-9
A5		5-161	7-9
A6	From front or rear of Board; remove 851 top and bottom covers		5-15, 5-16, 7-14
A7	From front of Board; remove 851 bottom cover		5-16, 7-11
A8	From front of Board; remove 851 top and left-side covers		5-15, 7-16
A9	From front of Board; remove 851 top cover		5-15, 7-18
A10	From switch Assembly; remove 851 bottom cover	5-159	5-16, 7-13
A11	From switch Assembly; remove 851 top cover	5-150	5-15, 7-9
A12	Inside metal shield	5-157	7-2
Q1, 2		5-154, 5-155	5-15, 5-16
Q3, 4, 5, 6		5-154, 5-156	5-15

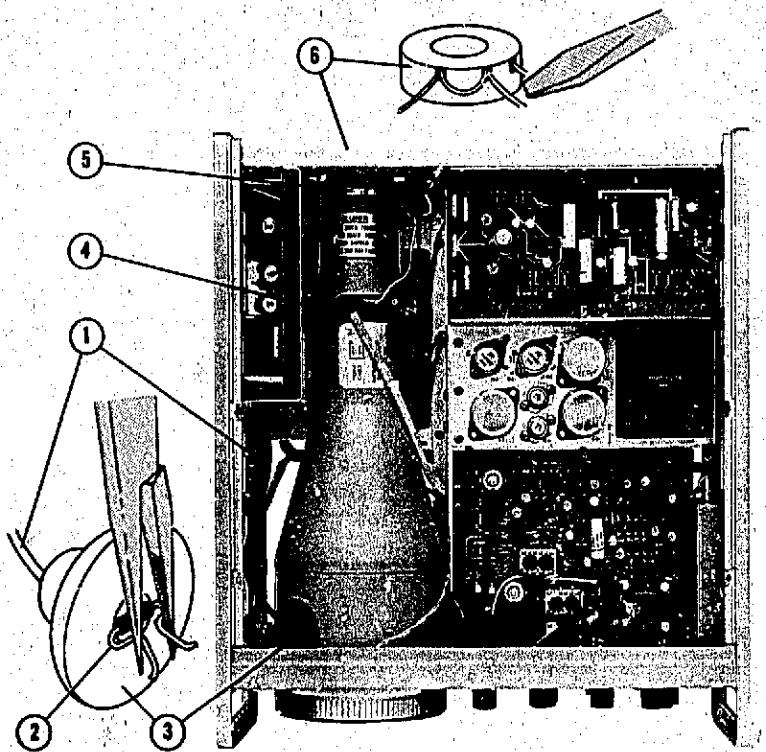


Figure 5-22. Cathode-Ray Tube Disassembly

as panel-clearance permits. Maneuver A1 free of the instrument.

g. To unfasten the shield, remove five screws (11); these are 6-32 x 1/2 BH machine screws with integral lockwasher.

5-165. REPLACEMENT OF CATHODE-RAY TUBE.

5-166. REMOVAL. A face mask or goggles and gloves should be used when it is necessary to handle the CRT. Perform removal procedures with 851 in normal position. Remove 851 top cover to reach the CRT. Parts mentioned in the following procedure are identified in Figure 5-22 by numbered callouts.

a. Disconnect post-accelerator lead (1).

(1) The post-accelerator lead connects to the tube by means of a spring-clip arrangement (2), and the connection is protected by a rubber cap (3).

(2) Lift edge of cap with screwdriver and, using a pair of long-nose pliers, compress spring contacts as indicated in Figure 5-22. This will free lead-and-spring assembly from recess.

b. Disconnect the six leads (4) at the neck of the CRT. The lead pins pull straight out; be careful not to bend the pins.

c. Remove the four screws which hold bezel to front panel; a No. 2 Phillips screwdriver is required.

d. Loosen clamp (5) at socket of CRT.

e. The socket (6) is a tight fit; carefully pry socket loose with a screwdriver to remove it.

f. Carefully slide CRT forward and out of instrument while keeping one hand on front face of CRT.

5-167. INSTALLATION. Reverse removal procedure. Color-coding of leads to CRT is stamped on CRT shield. After installing new tube, perform CRT checks specified in Table 5-2B.

Table 5-28. Adjustments Required After Component Replacement

Component	Type/Part No.	Function	Adjustment, Par. No.
A2A3Y1, A2A4Y1	0410-0091	Crystals in 1-10KC BP Filters (matched pair)	1-10KC I.F. Bandwidth Align., Paragraphs 5-83 thru 5-94, 5-127
A2A8CR1-A2A8CR8	1901-0162	Shunt diodes in Current-Controlled Attenuator (matched set of 8)	VERT DISPLAY Checks and Adjusts, Paragraphs 5-118 thru 5-123
A3, A5	00851-6028	100KC BP Filter	100KC I.F. Bandwidth Align., Paragraphs 5-88 thru 5-94, 5-130
A7Q13 A7Q14	2N708	p/o Vertical Amplifier	Vertical Calibration, Paragraphs 5-78 thru 5-82
A11CR1 A11CR2	1901-0047	p/o Square shaping network	VERT DISPLAY Checks and Adjusts., Paragraphs 5-118 thru 5-123
A11CR3	1901-0047	p/o LOG shaping network	VERT DISPLAY Checks and Adjusts., Paragraphs 5-117, 5-119
V1	5083-9010* *See Table 6-1 for Options 07 and 31.	CRT	CRT current, voltage checks, Paragraphs 5-44 thru 5-49 Horizontal Calib, Linearity Checks, Paragraphs 5-50 thru 5-55 CRT Checks, Paragraphs 5-70 thru 5-75 Vertical Amplifier Checks and Adjusts., Paragraphs 5-76 thru 5-81

PARTS LIST

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts.

6-3. Table 6-1 lists parts in the alpha-numerical order of their reference designations and gives the Hewlett-Packard stock number and description for each part, together with any applicable notes. Miscellaneous parts not assigned a reference designation are listed at the end of the Table which covers the Assembly with which the part is associated. Reference Designation Index Tables cover the following Assemblies:

Table 6-1. Assemblies A1 through A12, and parts mounted on the chassis.

6-3. Table 6-2 lists parts in the alpha-numerical order of their HP Stock Numbers, and provides the following information on each part: 1) description of part (see list of abbreviations below), 2) typical manufacturer of part in five-digit code (see code list of manufacturers in Appendix), 3) manufacturer's stock number, 4) total quantity used in instrument (TQ col).

6-5. ORDERING INFORMATION.

6-6. To order a replacement part, address order or inquiry to your nearest Hewlett-Packard sales and service office. Addresses of sales and service offices around the world are given at the rear of this manual.

6-7. Specify the following for each part: 1) model and complete serial number of instrument, 2) Hewlett-Packard stock number, 3) reference designation, and 4) description.

6-8. When ordering from Hewlett-Packard, always furnish the HP stock number. The part you receive may not be made by the manufacturer listed but will be electrically and mechanically interchangeable, and performance will be equal. Manufacturer's part number is listed for your convenience should you want to order directly.

6-9. To order a part not listed, give complete description of the part and include its function and location.

REFERENCE DESIGNATORS

A	= assembly	E	= misc electronic part	MP	= mechanical part	TB	= terminal board
B	= motor	F	= fuse	P	= plug	TP	= test point
C	= capacitor	FL	= filter	Q	= transistor	V	= vacuum tube, neon bulb, photocell, etc.
CP	= coupling	J	= jack	R	= resistor		
CR	= diode	K	= relay	RT	= thermistor	W	= cable
DL	= delay line	L	= inductor	S	= switch	X	= socket
DS	= device signaling (lmnp)	M	= meter	T	= transformer	Y	= crystal

ABBREVIATIONS

A	= amperes	GE	= germanium	N/C	= normally closed	RMO	= rack mount only
A,F,C	= automatic frequency control	GL	= glass	NE	= neon	RMS	= root-mean-square
AMPL	= amplifier	GRD	= ground(ed)	NI PL	= nickel plate		
				N/O	= normally open	S-B	= slow-blow
B.F.O.	= beat frequency oscillator	H	= henries	NPO	= negative positive zero (zero temperature coefficient)	SCR	= screw
BE CU	= beryllium copper	HEX	= hexagonal			SE	= selenium
BH	= binder head	HG	= mercury			SECT	= section(s)
BP	= bandpass	HR	= hour(s)	NRFR	= not recommended for field replacement	SEMICON	= semiconductor
BRS	= brass					SI	= silicon
BWO	= backward wave oscillator	IF	= intermediate freq	NSR	= not separately replaceable	SIL	= silver
		IMPG	= impregnated			SL	= slide
CCW	= counter-clockwise	INCD	= incandescent			SPL	= special
CER	= ceramic	INCL	= include(s)	OBD	= order by description	SST	= stainless steel
CMO	= cabinet mount only	INS	= insulation(ed)	OH	= oval head	SR	= split ring
COEF	= coefficient	INT	= internal	OX	= oxide	STL	= steel
COM	= common						
COMP	= composition	K	= kilo = 1000	P	= peak	TA	= tantalum
CONN	= connector			PC	= printed circuit	TD	= time delay
CP	= cadmium plate	LIN	= linear taper	PF	= picofarads = 10^{-12} farads	TGL	= toggle
CRT	= cathode-ray tube	LK WASH	= lock washer			TI	= titanium
CW	= clockwise	LOG	= logarithmic taper	PH BRZ	= phosphor bronze	TOL	= tolerance
		LPF	= low pass filter	PHL	= Phillips	TRIM	= trimmer
DEPC	= deposited carbon			PIV	= peak inverse voltage	TWT	= traveling wave tube
DR	= drive	M	= milli = 10^{-3}	P/O	= part of		
		MEG	= meg = 10^{6}	POLY	= polystyrene	U	= micro = 10^{-6}
ELECT	= electrolytic	METFLM	= metal film	PORC	= porcelain		
ENCAP	= encapsulated	MFR	= manufacturer	POS	= position(s)	VAR	= variable
EXT	= external	MINAT	= miniature	POT	= potentiometer	VDCW	= dc working volts
		MOM	= momentary	PP	= peak-to-peak		
F	= farads	MTG	= mounting	PT	= point	W/	= with
FH	= flat head	MY	= "mylar"	RECT	= rectifier	W	= watts
FIL H	= fillister head			RF	= radio frequency	WW	= wirewound
FXD	= fixed	N	= nano (10^{-9})	RH	= round head	W/O	= without

01194-10

Table 6-1. Reference Designation Index

Reference Designation	Part No.	Description #	Note
A1	00851-6049	SWITCH ASSY:IF GAIN	
A1MP1	00851-0014	COVER:SWITCH	
A1MP2	00851-0015	PLATE:COVER	
A1MP3	00851-0015	PLATE:COVER	
A1R1	0698-6227	R:FXD MET FLM 71.16 OHM 1/2% 1/8W	
A1R2	0698-6235	R:FXD MET FLM 96.25 OHM 1/2% 1/8W	
A1R3	0698-6235	R:FXD MET FLM 96.25 OHM 1/2% 1/8W	
A1R4	0698-6226	R:FXD MET FLM 247.5 OHM 1/2% 1/8W	
A1R5	0698-6233	R:FXD MET FLM 61.11 OHM 1/2% 1/8W	
A1R6	0698-6233	R:FXD MET FLM 61.11 OHM 1/2% 1/8W	
A1R7	0698-5577	R:FXD MET FLM 2.50K OHM 1/2% 1/8W	
A1R8	0698-67[illegible]	R:FXD MET FLM 51.1 OHM 1/2% 1/8W	
A1R9	0698-6716	R:FXD MET FLM 51.1 OHM 1/2% 1/8W	
A1R10	0698-6228	R:FXD CARBON FLM 5.77 OHM 1/2% 1/8W	
A1R11	0698-6229	R:FXD MET FLM 870 OHM 1/2% 1/8W	
A1R12	0698-6229	R:FXD MET FLM 870 OHM 1/2% 1/8W	
A1R13	0698-6231	R:FXD MET FLM 11.61 OHM 1/2% 1/8W	
A1R14	0698-6237	R:FXD MET FLM 436.2 OHM 1/2% 1/8W	
A1R15	0698-6237	R:FXD MET FLM 436.2 OHM 1/2% 1/8W	
A1R16	0698-6234	R:FXD MET FLM 17.61 OHM 1/2% 1/8W	
A1R17	0698-6236	R:FXD MET FLM 292.4 OHM 1/2% 1/8W	
A1R18	0698-6236	R:FXD MET FLM 292.4 OHM 1/2% 1/8W	
A1R19	0698-5820	R:FXD MET FLM 37.4 OHM 1/2% 1/8W	
A1R20	0698-5828	R:FXD MET FLM 150 OHM 1/2% 1/8W	
A1R21	0698-5828	R:FXD MET FLM 150 OHM 1/2% 1/8W	
A1S1	3100-0812	SWITCH:ROTARY	
	00851-2027	KNOB:IF GAIN 0-70 DB	
A1S2	3100-0812	SWITCH:ROTARY	
	00851-2028	KNOB:IF GAIN 0-10DB	
A1W1	00851-6052	CABLE ASSY:IF INPUT	
A1W2	00851-6051	CABLE ASSY:ATTENUATOR OUTPUT MISCELLANEOUS	
	00851-2002	CONDUCTOR:OUTER-SHORT	
	00851-2003	CONDUCTOR:OUTER-LONG	
A2	00851-6003	RF CIRCUIT ASSY	
	00851-0013	COVER:RF HOUSING	
A2C1	0150-0005	C:FXD CER 1000 PF 20% 500VDCW	
A2C2	0150-0022	C:FXD TI 3.3 PF 10% 500VDCW	
A2C3	0150-0019	C:FXD CER 1000 PF 20% 500VDCW	
A2C4	0150-0019	C:FXD CER 1000 PF 20% 500VDCW	
A2C5	0180-0076	C:FXD ELECT 20UF 25VDCW	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A2C6	0150-0019	C:FXD CER 1000 PF 20% 500VDCW	
A2J1	1250-0083	CONNECTOR:BNC	
A2L1	9140-0051	COIL:FXD 400 UH	
A2P1	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN (P/O A2W1)	
A2P2	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN (P/O A2W2)	
A2P3	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN (P/O A2W3)	
A2P4	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN (P/O A2W4)	
A2R1	0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	
A2W1	00851-6029	CABLE ASSY 7-INCH COAX W/MALE RF CONN	
	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN	
A2W2	00851-6030	CABLE ASSY 9-INCH COAX W/MALE RF CONN	
	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN	
A2W3	00851-6029	CABLE ASSY 7-INCH COAX W/MALE RF CONN	
	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN	
A2W4	00851-6029	CABLE ASSY 7-INCH COAX W/MALE RF CONN	
	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN	
A2W5	00851-6031	CABLE ASSY 22-INCH COAX:ATTEN-VERT DISPLAY SWITCH	
A2Z1	00851-8003	FILTER:LOW PASS	
A2Z2	00851-8003	FILTER:LOW PASS	
A2Z3	00851-8003	FILTER:LOW PASS	
A2Z4	00851-8003	FILTER:LOW PASS	
A2Z5	00851-8003	FILTER:LOW PASS	
		MISCELLANEOUS	
	0340-0095	TERMINAL:FEED-THRU TEFLON INSULATED OUTPUT:20MC 1 K TO VERT AMPL	
A2A1	00851-6025	BOARD ASSY:INPUT SWITCHING CIRCUIT	
A2A1C1	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A1C2	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A1K1	0490-0125	RELAY:DPDT 24VDC	
A2A1K2	0490-0125	RELAY:DPDT 24VDC	
A2A1L1	9140-0146	COIL:FXD RF 10.0 UH	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A2A1L2	9140-0146	COIL:FXD RF 10.0 UH	
A2A1TB1	00851-2058	BOARD:BLANK PC	
A2A2	00851-6054	BOARD ASSY:AMPLIFIER	
A2A2C1	0150-0050	C:FXD CER 1000 PF 600VDCW	
A2A2C2	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A2C3	0150-0042	C:FXD TI 4.7 PF 5% 500VDCW	
A2A2C4	0140-0225	C:FXD MICA 300 PF 1%	
A2A2C5	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A2C6	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A2C7	0150-0050	C:FXD CER 1000 PF 600VDCW	
A2A2L1	9140-0235	COIL:RF VAR .95-1.8 UH	
A2A2L2	9140-0232	COIL:RF VAR .254 UH	
A2A2L3	9140-0146	COIL:FXD RF 10.0 UH	
A2A2Q1	1850-0153	TRANSISTOR:GERMANIUM PNP	
A2A2R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A2A2R2	0683-6215	R:FXD COMP 620 OHM 5% 1/4W FACTORY SELECTED PART	
A2A2R3	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2A2R4	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A2A2R5	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A2A2R6	0757-0346	R:FXD MET FLM 10 OHM 1% 1/8W	
A2A2TB1	00851-2007	BOARD:BLANK PC	
A2A3	00851-6023	BOARD ASSY:BANDPASS FILTER	
A2A3C1	0140-0175	C:FXD MICA 39 PF 2% 300VDCW	
A2A3C2	0121-0037	C:VAR CER 7-25 PF	
A2A3C3	0140-0175	C:FXD MICA 39 PF 2% 300VDCW	
A2A3C4	0121-0037	C:VAR CER 7-25 PF	
A2A3C5	0121-0033	C:VAR AIR TRIMMER 1.4-9.2 PF	
A2A3C6	0160-0179	C:FXD MICA 33 PF 5% 300VDCW	
A2A3C7	0160-2218	C:FXD MICA 1000 PF 5%	
A2A3C8	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A3C9	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A3C10	0160-2218	C:FXD MICA 1000 PF 5%	
A2A3C11	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A3C12	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A3K1	0490-0125	RELAY:DPDT 24VDC	
A2A3K2	0490-0125	RELAY:DPDT 24VDC	
A2A3L1	00851-8005	COIL:RF	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	@ Part No.	Description #	Note
A2A3L2	00851-8004	COIL:RF	
A2A3L3	9140-0235	COIL:RF VAR .95-1.8 UH	
A2A3L4	9140-0150	COIL:FXD RF 2.75 UH	
A2A3L5	9140-0146	COIL:FXD RF 10.0 UH	
A2A3L6	9140-0146	COIL:FXD RF 10.0 UH	
A2A3Q1	1850-0153	TRANSISTOR:GERMANIUM PNP	
A2A3R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A2A3R2	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2A3R3	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A2A3R4	0683-4305	R:FXD COMP 43 OHM 5% .25W FACTORY SELECTED PART	
A2A3R5	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2A3T81	00851-2056	BD:RD:BLANK PC	
A2A3Y1	0410-0091	CRYSTAL:QUARTZ 20MC MATCHED PAIR A3Y1 AND A4Y1	
A2A4	00851-6024	BOARD ASSY:BANDPASS FILTER	
A2A4C1	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A4C2	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A4C3	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A4C4	0160-2216	C:FXD MICA 1000 PF 5%	
A2A4C5	0121-0037	C:VAR CER 7-25 PF	
A2A4C6	0140-0175	C:FXD MICA 39 PF 2% 300VDCW	
A2A4C7	0130-0017	C:VAR CER 8-50 PF	
A2A4C8	0121-0033	C:VAR AIR TRIMMER 1.4-9.2 PF	
A2A4C9	0121-0037	C:VAR CER 7-25 PF	
A2A4C10	0140-0175	C:FXD MICA 39 PF 2% 300VDCW	
A2A4C11	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A4C12	0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A4K1	0490-0125	RELAY:DPDT 24VDC	
A2A4K2	0490-0125	RELAY:DPDT 24VDC	
A2A4L1	00851-8006	COIL:RF	
A2A4L2	00851-8004	COIL:RF	
A2A4L3	9140-0146	COIL:FXD RF 10.0 UH	
A2A4L4	9140-0146	COIL:FXD RF 10.0 UH	
A2A4L5	9140-0146	COIL:FXD RF 10.0 UH	
A2A4Q1	1850-0153	TRANSISTOR:GERMANIUM PNP	
A2A4R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A2A4R2	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A2A4R3	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2A4R4	0683-2215	R:FXD COMP 220 OHM 5% 1/4W FACTORY SELECTED PART	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A2A4R5	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A2A4T81	00851-2057	BOARD:BLANK PC	
A2A4Y1	0410-0091	CRYSTAL:QUARTZ 20MC MATCHED PAIR A3Y1 AND A4Y1	
A2A5	00851-6026	BOARD ASSY:OUTPUT SWITCHING CIRCUIT	
A2A5C1	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A5C2	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A5K1	0490-0125	RELAY:DPDT 24VDC	
A2A5K2	0490-0125	RELAY:DPDT 24VDC	
A2A5L1	9140-0146	COIL:FXD RF 10.0 UH	
A2A5L2	9140-0146	COIL:FXD RF 10.0 UH	
A2A5TB1	00851-2059	BOARD:BLANK PC	
A2A6	00851-6055	BOARD ASSY:CURRENT CONTROLLED	
A2A6C1	0160-0179	C:FXD MICA 33 PF 5% 300VDCW	
A2A6C2	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A6C3	0160-0179	C:FXD MICA 33 PF 5% 300VDCW	
A2A6C4	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A6C5	0160-0179	C:FXD MICA 33 PF 5% 300VDCW	
A2A6C6	0140-0192	C:FXD MICA 68 PF 5%	
A2A6C7	0140-0192	C:FXD MICA 68 PF 5%	
A2A6C8	0160-0179	C:FXD MICA 33 PF 5% 300VDCW	
A2A6C9	0160-0179	C:FXD MICA 33 PF 5% 300VDCW	
A2A6C10	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A6C11	0160-0179	C:FXD MICA 33 PF 5% 300VDCW	
A2A6C12	0150-0050	C:FXD CER 1000 PF 600VDCW	
A2A6C13	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A6C14	0140-0176	C:FXD MICA 100 PF 2%	
A2A6CR1	1901-0162	DIODE(MATCHED SET OF SIX DIODES)	
A2A6CR2	1901-0162	DIODE(MATCHED SET OF SIX DIODES)	
A2A6CR3	1901-0162	DIODE(MATCHED SET OF SIX DIODES)	
A2A6CR4	1901-0162	DIODE(MATCHED SET OF SIX DIODES)	
A2A6CR5	1901-0162	DIODE(MATCHED SET OF SIX DIODES)	
A2A6CR6	1901-0162	DIODE(MATCHED SET OF SIX DIODES)	
A2A6L1	00851-8009	COIL:RF	
A2A6L2	9140-0149	COIL:FXD RF 1.86 UH	
A2A6L3	9140-0146	COIL:FXD RF 10.0 UH	
A2A6L4	9140-0152	COIL:FXD RF 41.06 UH	
A2A6L5	9140-0149	COIL:FXD RF 1.86 UH	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A2A6L6	9140-0146	COIL:FXD RF 10.0 UH	
A2A6L7	9140-0145	COIL:FXD RF 1.86 UH	
A2A6L8	9140-0149	COIL:FXD RF 1.86 UH	
A2A6L9	9140-0149	COIL:FXD RF 1.86 UH	
A2A6L10	00851-8010	COIL:RF	
A2A6L11	9140-0235	COIL:RF VAR .95-1.8 UH	
A2A6L12	9140-0159	COIL:FXD 0.47UH 20%	
A2A6Q1	185C-0153	TRANSISTOR:GERMANIUM PNP	
A2A6R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A2A6R2	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2A6R3	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A2A6R4	0698-3435	R:FXD MET FLM 38.3 OHM 1%1/8W FACTORY SELECTED PART	
A2A6R5	0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W FACTORY SELECTED PART	
A2A6R6	0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W FACTORY SELECTED PART	
A2A6RT1	0852-0021	R:FXD SILICON 100 OHM 5% 1/8W	
A2A6TB1	00851-2010	BOARD:BLANK PC	
A2A7	00851-6020	BOARD ASSY:I.F. AMPL.	
A2A7C1	0150-0050	C:FXD CER 1000 PF 600VDCW	
A2A7C2	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7C3	0140-0176	C:FXD MICA 100 PF 2%	
A2A7C4	0150-0050	C:FXD CER 1000 PF 600VDCW	
A2A7C5	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7C6	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7C7	0140-0190	C:FXD MICA 39 PF 5%	
A2A7C8	0150-0050	C:FXD CER 1000 PF 600VDCW	
A2A7C9	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7C10	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7C11	0140-0215	C:FXD MICA 80 PF 2% 300VDCW	
A2A7C12	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7C13	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7C14	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A2A7CR1	1910-0011	DIODE:GERMANIUM 5MA AT 1V	
A2A7CR2	1910-0011	DIODE:GERMANIUM 5MA AT 1V	
A2A7CR3	1910-0011	DIODE:GERMANIUM 5MA AT 1V	
A2A7CR4	1910-0011	DIODE:GERMANIUM 5MA AT 1V	
A2A7L1	9140-0159	COIL:FXD 0.47UH 20%	
A2A7L2	9140-0158	COIL:FXD RF 1 UH 10%	
A2A7Q1	185C-0153	TRANSISTOR:GERMANIUM PNP	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A2A7C2	1850-0153	TRANSISTOR:GERMANIUM PNP	
A2A7C3	1850-0153	TRANSISTOR:GERMANIUM PNP	
A2A7C4	1853-0034	TRANSISTOR:SILICON PNP	
A2A7C5	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A2A7R1	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A2A7R2	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2A7R3	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A2A7R4	0683-6805	R:FXD COMP 68 OHM 5% 1/4W FACTORY SELECTED PART	
A2A7R5	0683-6805	R:FXD COMP 68 OHM 5% 1/4W	
A2A7R6	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2A7R7	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A2A7R8	0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	
A2A7R9		NOT ASSIGNED	
A2A7R10	0683-6805	R:FXD COMP 68 OHM 5% 1/4W	
A2A7R11	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A2A7R12	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2A7R13	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
A2A7R14	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A2A7R15	0683-6805	R:FXD COMP 68 OHM 5% 1/4W	
A2A7R16	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	
A2A7R17	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A2A7R18	0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	
A2A7R19	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A2A7RT1	0852-0020	R:FXD SILICON 150 OHM 5% 1/8W	
A2A7T1	9120-0090	TRANSFORMER:IF	
A2A7T101	00851-2011	BOARD:BLANK PC	
A3	00851-2022	CAVITY:FILTER	
	00851-6028	FILTER ASSY:100KC BANDPASS	
	08551-2083	BOARD:BLANK PC	
A3C1	0160-0822	C:FXD TI 2.2 PF 5% 500VDCW	
A3J1	1250-0228	CONNECTOR:RF	
A3J2	1250-0228	CONNECTOR:RF	
A3L1	00851-6008	COIL:RF	
A4S1	00851-6007	SWITCH ASSY:IF BANDWIDTH	
	0370-0112	KNOB:BLACK,RANGE	
A5	00851-2022	CAVITY:FILTER	
	00851-6028	FILTER ASSY:100KC BANDPASS	
	08551-2083	BOARD:BLANK PC	
A5C1	0160-0822	C:FXD TI 2.2 PF 5% 500VDCW	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	ⓗ Part No.	Description #	Note
A5J1	1250-0228	CONNECTOR:RF	
A5J2	1250-0228	CONNECTOR:RF	
A5L1	00851-8068	COIL:RF	
A6	00851-6038	BOARD ASSY:SWEEP HORIZ. AMPL.	
A6C1	0140-0207	C:FXD MICA 330 PF 5%	
A6C2	0140-0180	C:FXD MICA 2000 PF 2%	
A6C3	0160-0174	C:FXD CER 0.47 UF +80-20% 25VDCW	
A6C4	0140-0207	C:FXD MICA 330 PF 5%	
A6C5	0140-0207	C:FXD MICA 330 PF 5%	
A6C6	0170-0085	C:FXD MY 0.1UF 20% 50VDCW	
A6C7	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A6C8	0170-0075	C:FXD MY 0.047UF 20% 50VDCW	
A6CR1	1901-0096	DIODE:SILICON 120V	
A6CR2	1901-0096	DIODE:SILICON 120V	
A6CR3	1901-0096	DIODE:SILICON 120V	
A6CR4	1902-0050	DIODE BREAKDOWN:8.66V	
A6Q1	1851-0017	TRANSISTOR:2N1304	
A6Q2	1851-0017	TRANSISTOR:2N1304	
A6Q3	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q4	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q5	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q6	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q7	1851-0017	TRANSISTOR:2N1304	
A6Q8	1851-0017	TRANSISTOR:2N1304	
A6Q9	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q10	1851-0017	TRANSISTOR:2N1304	
A6Q11	1854-0003	TRANSISTOR:NPN SILICON	
A6Q12	1854-0003	TRANSISTOR:NPN SILICON	
A6Q13	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A6Q14	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A6Q15	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A6Q16	1854-0022	TRANSISTOR:NPN SILICON	
A6Q17	1854-0022	TRANSISTOR:NPN SILICON	
A6Q18	1851-0017	TRANSISTOR:2N1304	
A6Q19	1854-0003	TRANSISTOR:NPN SILICON	
A6Q20	1854-0003	TRANSISTOR:NPN SILICON	
A6Q21	1854-0071	TRANSISTOR:SILICON NPN	
A6Q22	1854-0022	TRANSISTOR:NPN SILICON	
A6R1	0684-1031	R:FXD COMP 10K OHM 10% 1/4W	
A6R2	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A6R3	0727-0124	R:FXD CARBON 3000 OHM 1% 1/2W	
A6R4	0683-9115	R:FXD COMP 910 OHM 5% 1/4W	
A6R5	0727-0163	R:FXD DEPC 11.88K OHM 1% 1/2W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A6R6	0727-0173	R:FXD DEPC 20K OHM 1% 1/2W	
A6R7	0684-1011	R:FXD COMP 100 OHM 10% 1/4W	
A6R8	0727-0158	R:FXD DEPC 10.1K OHM 1% 1/2W	
A6R9	0727-0136	R:FXD DEPC 5.03K OHM 1% 1/2W	
A6R10	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A6R11	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
A6R12	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A6R13	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R14	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A6R15	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A6R16	0684-4711	R:FXD COMP 470 OHM 10% 1/4W	
A6R17	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A6R18	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A6R19	0683-2435	R:FXD COMP 24K OHM 5% 1/4W	
A6R20	0683-2435	R:FXD COMP 24K OHM 5% 1/4W	
A6R21	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A6R22	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A6R23	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R24	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A6R25	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A6R26	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A6R27	0727-0158	R:FXD DEPC 10.1K OHM 1% 1/2W	
A6R28	0727-0136	R:FXD DEPC 5.03K OHM 1% 1/2W	
A6R29	2100-0910	R:VAR COMP 2 SECT 35K OHM 20% LIN 1/4W	
A6R30	2100-0910	R:VAR COMP 2 SECT 35K OHM 20% LIN 1/4W	
A6R31	2100-0910	R:VAR COMP 2 SECT 35K OHM 20% LIN 1/4W	
A6R32	2100-0910	R:VAR COMP 2 SECT 35K OHM 20% LIN 1/4W	
A6R33	2100-0910	R:VAR COMP 2 SECT 35K OHM 20% LIN 1/4W	
A6R34	2100-0910	R:VAR COMP 2 SECT 35K OHM 20% LIN 1/4W	
A6R35	0758-0050	R:FXD MET OX 39K OHM 5% 1/2W FACTORY SELECTED PART	
A6R36	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A6R37	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A6R38	0758-0002	R:FXD MET OX FLM 560 OHM 5% 1/2W	
A6R39	0758-0038	R:FXD MET OX 9100 OHM 5% 1/2W	
A6R40	0683-1205	R:FXD COMP 12 OHM 5% 1/4W	
A6R41	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A6R42	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A6R43	0683-4715	R:FXD COMP 470 OHM 5% 1/4W	
A6R44	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R45	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A6R46	0683-1215	R:FXD COMP 120 OHM 5% 1/4W	
A6R47	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A6R48	0758-0057	R:FXD MET OX 5600 OHM 5% 1/2W	
A6R49	0727-0189	R:FXD DEPC 41.7K OHM 1% 1/2W	
A6R50	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
A6R51	0758-0034	R:FXD MET OX 2400 OHM 5% 1/2W	
A6R52	0758-0004	R:FXD MET OX 2700 OHM 5% 1/2W	
A6R53	0758-0043	R:FXD MET OX 1800 OHM 5% 1/2W	
A6R54	2100-0144	R:VAR COMP 250K OHM 30% LIN 1/5W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A6R55	0758-0034	R:FXD MET OX 2400 OHM 5% 1/2W	
A6R56	0727-0189	R:FXD DEPC 41.7K OHM 1% 1/2W	
A6R57	0758-0022	R:FXD FLM 82K OHM 5% 1/4W	
A6R58	0758-0044	R:FXD MET OX 2200 OHM 5% 1/2W	
A6R59	0758-0012	R:FXD MET OX 12K OHM 5% 1/2W FACTORY SELECTED PART	
A6R60	0758-0044	R:FXD MET OX 2200 OHM 5% 1/2W	
A6R61	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A6R62	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R63	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R64	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A6R65	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R66	0684-6831	R:FXD COMP 685 OHM 10% 1/4W	
A6R67	0683-3335	R:FXD COMP 33K OHM 5% 1/4W	
A6R68	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A6R69	2100-0092	R:VAR COMP 10K OHM 20% LIN 1/5W	
A6R70	0683-1345	R:FXD COMP 130K OHM 5% 1/4W	
A6R71	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R72	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6T01	00851-2029	BOARD:BLANK PC	
A7	00851-6046	BOARD ASSY:VERT. AMP.	
A7C1	0170-0018	C:FXD MY 1UF 5% 200VDCW	
A7C2	0160-0174	C:FXD CER 0.47 UF +80-20% 25VDCW	
A7C3	0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW	
A7C4	0160-0162	C:FXD MY 0.022 UF 10% 200VDCW	
A7C5	0160-0159	C:FXD MY 0.0068 UF 10% 200VDCW	
A7C6	0160-2268	C:FXD MICA 330 PF 5% 300VDCW	
A7C7	0160-0154	C:FXD MYLAR 2200PF 10%	
A7C8	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
A7C9	0150-0121	C:FXD CER 0.1 UF +80-20% 50VDCW	
A7CR1	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR2	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR3	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR5	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR6	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR7	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR8	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR9	1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	
A7CR10	1901-0096	DIODE:SILICON 120V	
A7CR11	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A7CR12	1901-0096	DIODE:SILICON 120V	
A7CR13	1901-0025	DIODE:SILICON 100WV 100MA	
A7L1	9140-0137	COIL:FXD RF 1 MH 5%	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A7L2	9140-0137	COIL:FXD RF 1 MH 5%	
A7Q1	1854-0071	TRANSISTOR:SILICON NPN	
A7Q2	1853-0020	TRANSISTOR:SILICON PNP	
A7Q3	1853-0020	TRANSISTOR:SILICON PNP	
A7Q4	1853-0020	TRANSISTOR:SILICON PNP	
A7Q5	1854-0071	TRANSISTOR:SILICON NPN	
A7Q6	1853-0020	TRANSISTOR:SILICON PNP	
A7Q7	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q8	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q9	1854-0022	TRANSISTOR:NPN SILICON	
A7Q10	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q11	1854-0022	TRANSISTOR:NPN SILICON	
A7Q12	1854-0022	TRANSISTOR:NPN SILICON	
A7Q13	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q14	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q15	1854-0022	TRANSISTOR:NPN SILICON	
A7R1	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A7R2	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A7R3	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R4	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A7R5	0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	
A7R6	0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	
A7R7	0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	
A7R8	0757-0290	R:FXD MET FLM 6.19K OHM 1% 1/8W	
A7R9	0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	
A7R10	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A7R11	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A7R12	0686-5115	R:FXD COMP 510 OHM 5% 1/2W	
A7R13	0686-2025	R:FXD COMP 2000 OHM 5% 1/2W	
A7R14	0686-1825	R:FXD COMP 1800 OHM 5% 1/2W	
A7R15	0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	
A7R16	0686-6225	R:FXD COMP 6200 OHM 5% 1/2W	
A7R17	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A7R18	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A7R19	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A7R20	0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	
A7R21	0690-2721	R:FXD COMP 2700 OHM 5% 1/4W	
A7R22	2100-0095	R:VAR COMP 100K OHM 30% LIN 1/5W	
A7R23	0687-3931	R:FXD COMP 39K OHM 10% 1/2W	
A7R24	0690-1231	R:FXD COMP 12K OHM 10% 1W	
A7R25	0684-1001	R:FXD COMP 10 OHM 10% 1/4W	
A7R26	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R27	0686-2725	R:FXD COMP 2700 OHM 5% 1/2W	
A7R28	2100-0154	R:VAR COMP 1K OHM 30% LIN 0.5W	
A7R29	0758-0024	R:FXD MET OX 100 OHM 5% 1/2W	
A7R30	0761-0074	R:FXD MET FLM 15K OHM 5% 1W	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	© Part No.	Description #	Note
A7R31	0761-0074	R:FXD MET FLM 15K OHM 5% 1W	
A7R32	0758-0024	R:FXD MET OX 100 OHM 5% 1/2W	
A7R33	0758-0017	R:FXD MET OX 1500 OHM 5% 1/2W	
A7R34	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A7R35	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A7R36	0758-0003	R:FXD MET OX 1000 OHM 5% 1/2W FACTORY SELECTED PART	
A7R37	0758-0038	R:FXD MET OX 9100 OHM 5% 1/2W	
A7T81	00851-2046	BOARD:BLANK PC	
A7W1	00851-6037	CABLE ASSY:CAT VERT INPUT (4 INCH)	
A8	00851-6045	HV POWER SPLY ASSY	
A8C1	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A8C2	0180-0104	C:FXD ELECT 200UF 15VDCW	
A8C3	0150-0036 5040-0400	C:FXD CER 470 PF 20% 6KV SUPPORT:CAPACITOR	
A8C4	0150-0036 5040-0400	C:FXD CER 470 PF 20% 6KV SUPPORT:CAPACITOR	
A8C5	0160-0151 5040-0401	C:FXD CER 4700 PF +80-20% 4000VDCW SUPPORT:CAPACITOR	
A8C6	0160-2054	C:FXD MY 0.015 UF 10% 3000VDCW	
A8C7	0160-2054	C:FXD MY 0.015 UF 10% 3000VDCW	
A8C8	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A8C9	0160-0151 5040-0401	C:FXD CER 4700 PF +80-20% 4000VDCW SUPPORT:CAPACITOR	
A8C10	0150-0023	C:FXD CER 2000 PF 20% 1000VDCW	
A8C11	0160-2054	C:FXD MY 0.015 UF 10% 3000VDCW	
A8CR1	1901-0142	DIODE ASSY:SILICON HIGH VOLTAGE	
A8CR2	1901-0142	DIODE ASSY:SILICON HIGH VOLTAGE	
A8CR3	1901-0142	DIODE ASSY:SILICON HIGH VOLTAGE	
A8CR4	1901-0142	DIODE ASSY:SILICON HIGH VOLTAGE	
A8CR5	1901-0025	DIODE:SILICON 100WV 100MA	
A8L1	9140-0051	COIL:FXD 400 UH	
A8L2	9140-0096	COIL:FXD RF 1 UH	
A8R1	0687-4701	R:FXD COMP 47 OHM 10% 1/2W FACTORY SELECTED PART	
A8R2	0687-1521	R:FXD COMP 1500 OHM 10% 1/2W	
A8R3	0687-2741	R:FXD COMP 270K OHM 10% 1/2W	
A8R4	0687-1231	R:FXD COMP 12K OHM 10% 1/2W	
A8R5	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R6	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R7	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R8	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R9	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R10	0687-3931	R:FXD COMP 39K OHM 10% 1/2W	

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A8R11	0687-1051	R:FXD COMP 1 MEGOHM 10% 1/2W	
A8R12	0687-2231	R:FXD COMP 22K OHM 10% 1/2W	
A8R13	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R14	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R15	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R16	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R17	0690-5641	R:FXD COMP 560K OHM +10% 1W	
A8R18	0690-1021	R:FXD COMP 1000 OHM 10% 1W	
A8R19	0690-1021	R:FXD COMP 1000 OHM 10% 1W	
A8R20	0690-1021	R:FXD COMP 1000 OHM 10% 1W	
A8R21	0690-1021	R:FXD COMP 1000 OHM 10% 1W	
A8R22	0690-1021	R:FXD COMP 1000 OHM 10% 1W	
A8R23	0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	
A8T1	9120-6092	TRANSFORMER:IF STEP-UP	
A8T81	00851-2045	BOARD:BLANK PC	
A9	00852-6016	BOARD ASSY:LVPS	
A9C1	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A9C2	0180-0138	C:FXD ELECT 100UF -10+100% 40VDCW	
A9C3	0180-0049	C:FXD AL ELECT 20UF 50VDCW	
A9C4	0160-2393	C:FXD MY 0.33 UF 5% 100VDCW	
A9C5	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C6	0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	
A9C7	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C8	0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	
A9C9	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A9C10	0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	
A9C11	0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	
A9CR1	1901-0029	DIODE:SILICON 600 PIV	
A9CR2	1902-0241	DIODE BREAKDOWN:100V	
A9CR3	1901-0045	DIODE:SILICON 100PIV	
A9CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR5	1901-0045	DIODE:SILICON 100PIV	
A9CR6	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR7	1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	
A9CR8	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR9	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR10	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR11	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR12	1901-0049	DIODE:SILICON 50PIV	
A9CR13	1901-0049	DIODE:SILICON 50PIV	
A9CR14	1901-0049	DIODE:SILICON 50PIV	
A9CR15	1901-0049	DIODE:SILICON 50PIV	
A9CR16	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	

See Introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A9CR17	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR18	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR19		NOT ASSIGNED	
A9CR20		NOT ASSIGNED	
A9CR21	1902-3224	DIODE:BREAKDOWN 17.8V 5% 400MW	
A9CR22	1884-0012	RECTIFIER:SILICON CONTROLLED 2N3528	
A9CR23	1901-0040	DIODE:SILICON 30MA 30WV	
A9CR24	1901-0040	DIODE:SILICON 30MA 30WV	
A9CR25	1901-0040	DIODE:SILICON 30MA 30WV	
A9CR26	1901-0040	DIODE:SILICON 30MA 30WV	
A9Q1	1850-0040	TRANSISTOR:GERMANIUM PNP	
A9Q2	1853-0020	TRANSISTOR:SILICON PNP	
A9Q3	1854-0003	TRANSISTOR:NPN SILICON	
A9Q4	1853-0020	TRANSISTOR:SILICON PNP	
A9Q5	1854-0003	TRANSISTOR:NPN SILICON	
A9Q6	1854-0003	TRANSISTOR:NPN SILICON	
A9Q7	1853-0020	TRANSISTOR:SILICON PNP	
A9R1	0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	
A9R2	0761-0037	R:FXD MET FLM 390 OHM 5% 1W	
A9R3	0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	
A9R4	0811-1671	R:FXD WW 2.7 OHM 5% 2W	
A9R5	0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	
A9R6	0698-3441	R:FXD MET FLM 215 OHM 1% 1/8W	
A9R7	0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	
A9R8	0757-0417	R:FXD MET FLM 562 OHM 1% 1/8W	
A9R9	0698-3155	R:FXD MET FLM 4.64K OHM 1% 1/8W	
A9R10	0698-3444	R:FXD MET FLM 316 OHM 1% 1/8W	
A9R11	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R12	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A9R13	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R14	2100-1773	R:VAR WW 1K OHM 10% LIN 1/2W	
A9R15	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R16	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R17	0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	
A9R18	0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	
A9R19	0698-3406	R:FXD MET FLM 1.33K OHM 1% 1/2W	
A9R20	0698-3153	R:FXD MET FLM 3.83K OHM 1% 1/8W	
A9R21	0811-0019	R:FXD WW 0.47 OHM 10% 2W	
A9R22	0757-0417	R:FXD MET FLM 562 OHM 1% 1/8W	
A9R23		NOT ASSIGNED	
A9R24		NOT ASSIGNED	
A9R25	0757-0441	R:FXD MET FLM 8.25K OHM 1% 1/8W	
A9R26	0757-0200	R:FXD MET FLM 5.62K OHM 1% 1/8W	
A9R27	0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	
A9R28	0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	
A9R29	2100-1773	R:VAR WW 1K OHM 10% LIN 1/2W	
A9R30	0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	
A9R31		NOT ASSIGNED	
A9R32		NOT ASSIGNED	

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Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A9R33	0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	
A9R34	0811-1662	R:FXD WW 0.47 OHM 5% 2W	
A9R35	0698-3406	R:FXD MET FLM 1.33K OHM 1% 1/2W	
A9TB1	00852-2016	BOARD:BLANK PC	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A1D	00851-6039	SWITCH ASSY:SWEEP TIME	
	5040-0218	COUPLER:SWITCH SHAFT P/O SWEEP TIME SWITCH	
A1DC1	0170-0038	C:FXD MY 0.22 UF 10% 200VDCW	
A1DC2	0170-0051	C:FXD MY 0.635UF 5% 100VDCW	
A1DC3	0180-0101	C:FXD ELECT 1.8 UF 10% 35VDCW	
A1DC4	0180-0116	C:FXD ELECT 6.8 UF 10% 35VDCW	
A1DC5	0180-0233	C:FXD ELECT 20 UF +20-15% 60VDCW	
A1DC6	0180-0235	C:FXD ELECT 56 UF 20% 75VDCW	
A1DC7	0170-0042	C:FXD MY 0.33UF 5% 100VDCW	
A1DC8	0180-0230	C:FXD ELECT 1.0 UF 20% 50VDCW	
A1DC9	0180-0231	C:FXD ELECT 3.5 UF 75VDCW	
A1DC10	0180-0232	C:FXD ELECT 10 UF 20% 100VDCW	
A1DC11	0180-0234	C:FXD ELECT 33 UF 20% 75VDCW	
A1DC12	0180-0113	C:FXD ELECT 7A 100UF +20-15% 30VDCW	
A1DR1	2100-0107	R:VAR COMP 50K OHM 30% 1/3W	
	0370-0114	KNOB:RED W/ARROW 5/8" OD 1/8" SHAFT VERNIER FOR SWEEP TIME SWITCH	
A1DR2	0757-0831	R:FXD MET FLM 4.32K OHM 1% 1/2W	
A1DS1	3100-1600	SWITCH:ROTARY	
	0370-0113	KNOB:BLACK, SENSITIVITY SWEEP TIME	
	3130-0041	SHIELD:SWITCH	
A11	00851-6006	SWITCH ASSY:VERT. DISPLAY	
A11C1	0140-0225	C:FXD MICA 300 PF 1%	
A11C2	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A11C3	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11C4	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11C5	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11CR1	1901-0047	DIODE JUNCTION:SILICON 20PIV	
A11CR2	1901-0047	DIODE JUNCTION:SILICON 20PIV	
A11CR3	1901-0047	DIODE JUNCTION:SILICON 20PIV	
A11CR4	1901-0047	DIODE JUNCTION:SILICON 20PIV	
A11CR5	1901-0033	DIODE:SILICON 100MA 180WV	
A11L1	9140-0118	COIL:FXD 500 UH 5%	
A11Q1	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A11Q2	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A11R1	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	

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Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A11R2	2100-0558	R:VAR COMP 10K OHM 20% LIN 1/20W	
A11R3	0727-0405	R:FXD DEPC 57.46K OHM 1/2% 1/2W	
A11R4		NOT ASSIGNED	
A11R5	0727-0170	R:FXD DEPC 18K OHM 1% 1/2W	
A11R6	0757-0887	R:FXD MET FLM 32.4K OHM 1% 1/4W	
A11R7	0757-0890	R:FXD MET FLM 191K OHM 1% 1/4W	
A11R8	0757-0885	R:FXD MET FLM 15.4K OHM 1% 1/4W	
A11R9	0757-0889	R:FXD MET FLM 143K OHM 1% 1/4W	
A11R10	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A11R11	0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	
A11R12	0727-0123	R:FXD DEPC 2900 OHM 1% 1/2W	
A11R13	2100-0957	R:VAR COMP 5000 OHM 20% LIN 1/20W	
A11R14	2100-0957	R:VAR COMP 5000 OHM 20% LIN 1/20W	
A11R15	0727-0403	R:FXD DEPC 52.3K OHM 1/2% 1/2W	
A11R16	0727-0126	R:FXD DEPC 3.266K OHM 1% 1/2W	
A11R17	0727-0178	R:FXD DEPC 24.7K OHM 1% 1/2W	
A11R18	0757-0159	R:FXD MET FLM 1000 OHM 1% 1/2W	
A11R19	0757-0829	R:FXD MET FLM 3650 OHM 1% 1/2W	
A11R20	2100-0956	R:VAR COMP 500 OHM 20% LIN 1/20W	
A11R21		R:0-500 OHM FACTORY SELECTED PART	
A11S1	3100-0815	SWITCH:ROTARY	
	0370-0112	KNOB:BLACK,RANGE	
A11W1	00851-6033	CABLE ASSY:IF VERNIER 17-IN COAX:VERT INPUT TO A11S1	
A12	00851-6053	BANDPASS FILTER ASSY	
A12C1	0160-2357	C:FXD CER FEED-THRU 1000 PF +80-20%	
A12J1	1250-0731	CONNECTOR:RF BNC BULKHEAD MOUNT	
A12J2	1250-0731	CONNECTOR:RF BNC BULKHEAD MOUNT	
A12MP1	00851-0020	COVER:INPUT BP FILTER	
A12MP2	00851-2017	HOUSING:INPUT BP FILTER	
A12A1	00851-6047	BOARD ASSY:INPUT BP FILTER ASSY	
A12A1C1	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12A1C2	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12A1C3	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12A1C4	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A12A1C5	0131-0003	C:VAR MICA 170-780 PF 175VDCW	
A12A1C6	0160-2150	C:FXD MICA 33 PF 5%	
A12A1C7	0121-0046	C:VARI CER 9-35 PF	
A12A1L1	9100-1615	COIL/CHOKE FXD 1.20 UH 10%	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Part No.	Description #	Note
A12A1L2	9100-1610	COIL:MOLDED CHOKE 0.15 UH 20%	
A12A1Q1	1854-0073	TRANSISTOR:SILICON NPN	
A12A1Q2	1854-0071	TRANSISTOR:SILICON NPN	
A12A1R1	0757-0439	R:FXD MET FLM 6.81K OHM 1% 1/8W	
A12A1R2	0757-0441	R:FXD MET FLM 8.25K OHM 1% 1/8W	
A12A1R3	0698-3440	R:FXD MET FLM 196 OHM 1% 1/8W	
A12A1R4	0698-3440	R:FXD MET FLM 196 OHM 1% 1/8W	
A12A1R5	0698-3446	R:FXD MET FLM 383 OHM 1% 1/8W	
A12A1R6	0698-3427	R:FXD MET FLM 13.3 OHM 1% 1/8W	
A12A1R7	0757-0420	R:FXD MET FLM 750 OHM 1% 1/8W	
A12A1R8	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A12A1R9	0757-0316	R:FXD MET FLM 42.2 OHM 1% 1/8W	
A12A1R10	0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W	
A12A1R11	0698-3435	R:FXD MET FLM 38.3 OHM 1%1/8W	
A12A1R12	0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W	
A12A1TB1	00851-2047	BOARD:BLANK PC	
C1	0150-0119	C:FXD CER 2 X 0.01 UF 20% 250WVAC	
C2		NOT ASSIGNED	
C3	0180-0042	C:FXD ELECT 120UF 350VDCW	
	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	
C4	0180-0047	C:FXD ELECT 500 UF 75VDCW	
	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	
C5	0180-0047	C:FXD ELECT 500 UF 75VDCW	
	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	
C6	0150-0121	C:FXD CER 0.1 UF +80-20% 50VDCW	
C7	0180-0059	C:FXD ELECT 10 UF +75-10% 25VDCW	
C8	0180-0098	C:FXD ELECT 100 UF 20% 20VDCW	
CR1	1902-0037	DIODE BREAKDOWN:9.09V 10%	
DS1	2140-0018	LAMP:GLOW 1/10W	
	5040-0234	LAMPHOLDER	
	5040-0235	BASE:LAMPHOLDER	
F1	2110-0016	FUSE:CARTRIDGE 0.6 AMP 125V MAX SLOW BLOW 115V OPERATION	
F1	2110-0044	FUSE:0.30A 250V SLOW-BLOW 230V OPERATION	
F2	2110-0001	FUSE:1.0 A 250V	
J1	1250-0140	CONNECTOR:BNC JACK I.F. INPUT PART OF CABLE A1W1	
J2	1250-0171	CONNECTOR:RF BNC BULKHEAD MOUNT SWEEP INPUT	
J3	1250-0171	CONNECTOR:RF BNC BULKHEAD MOUNT BLANKING INPUT	
J4	1251-0148	CONNECTOR:POWER 3 PIN MALE LINE INPUT	
J5	1250-0083	CONNECTOR:BNC I.F. TEST POINT	
	1200-0081	BUSHING:INSULATOR NYLON	

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	@ Part No.	Description #	Note
J5	1250-0053	CONNECTOR:RF BNC CAP AND CHAIN	
J6		SYNC INPUT. PART OF CABLE W2.	
J7		SWEEP OUTPUT. PART OF CABLE W3.	
J8	1250-0171	CONNECTOR:RF BNC BULKHEAD MOUNT HORIZ OUTPUT	
J9	1251-0143	CONNECTOR:FEMALE 14-CONTACT JACK	
J10	1250-0171	CONNECTOR:RF BNC BULKHEAD MOUNT VERT OUTPUT	
L1	9140-0082	COIL:FXD RF 15 UH	
L2	9140-0082	COIL:FXD RF 15 UH	
L3	5060-0409	COIL:ALIGNMENT	
L3		IN CRT TRACE ALIGN CIRCUIT	
L4	9110-0042	CHOKE:FILTER 0.07HY 1.0 AMP 1.5 OHM	
MP1	5040-0466	RETAINER:CRT SHIELD	
MP2	00851-0006	BRACKET:POWER SUPPLY	
MP3	00851-0007	SHIELD:HIGH VOLTAGE	
MP4	00851-0008	COVER:SOCKET	
MP5	00851-0009	BRACKET:PC BOARD	
MP6	00851-6008	CRT SHIELD ASSY	
MP7	0905-0050	GASKET:FELT	
MP8	4320-0007	EXTRUSION:RUBBER	
MP9	5006-0408	COIL:BRACKET	
Q1	1850-0090	TRANSISTOR:GERMANIUM PNP 2N1183B	
	1200-0092	BUSHING:TRANSISTOR	
	1200-0076	INSULATOR:TRANSISTOR	
Q2	1850-0090	TRANSISTOR:GERMANIUM PNP 2N1183B	
	1200-0076	INSULATOR:TRANSISTOR	
	1200-0092	BUSHING:TRANSISTOR	
Q3	1850-0058	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR MOUNTING	
Q4	1850-0064	TRANSISTOR:GERMANIUM PNP 2N1183	
	1200-0076	INSULATOR:TRANSISTOR	
	1200-0081	BUSHING:INSULATOR NYLON	
	1200-0087	CLAMP:TRANSISTOR	
Q5	1850-0064	TRANSISTOR:GERMANIUM PNP 2N1183	
	1200-0076	INSULATOR:TRANSISTOR	
	1200-0087	CLAMP:TRANSISTOR	
Q6	1850-0058	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR MOUNTING	
R1	2100-0853	R:VAR COMP 2 SECT2K/750K OHM LIN 1/2W	
	0370-0127	KNOB:RED ROUND 5/8" DIA	
	5040-0421	INSULATOR(FOR R3B FOCUS)	
R2	2100-0027	R:VAR COMP 10K OHM 10% LIN 2W INT LEVEL ADJ	
R3	2100-0189	R:VAR COMP 1M OHM 30% LIN 1/4W ASTIG. ADJ.	
R4	2100-0218	R:VAR COMP 1.2 MEGOHM 20% LIN 2W FOCUS	
	5040-0418	INSULATOR:POT	
	0370-0026	KNOB:BLK W/ARROW 3/4" OD 1/8" SHAFT	
R5	2100-0150	R:VAR GANGED 10K OHM 20% LIN 1/4W TRACE ALIGN ADJ.	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont.)

Reference Designation	© Part No.	Description #	Note
R6	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
R7	2100-0893	R:VAR COMP 2 SECT2K/750K OHM LIN 1/2W	
	0370-0120	KNOB:BLACK CONCENTRIC 3/4" DIA	
R8	2100-0036	R:VAR COMP 1000 OHM LIN	
		VERTICAL POSITION	
R9	2100-0067	R:VAR COMP 2500 OHM 10% LIN 1/2W	
		HORIZONAL POSITION	
R10	2100-0015	R:VAR COMP 500 OHM 10% LIN 1/2W	
	0370-0026	KNOB:BLK W/ARROW 3/4" OD 1/8" SHAFT	
		IF VERNIER	
R11	0727-0004	R:FXD DEPC 5 OHM 1% 1/2W	
R12	0727-0004	R:FXD DEPC 5 OHM 1% 1/2W	
S1	3101-0033	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	
		115V/230V	
S2	00851-6040	SWITCH ASSY:SYNC.	
	0378-0112	KNOB:BLACK,RANGE	
S3	3101-0052	SWITCH:PUSHBUTTON SPST	
		SINGLE SWEEP	
S2W1	00851-6032	CABLE ASSY	
		6-INCH COAX	
T1	9100-0274	TRANSFORMER:POWER	
		LINE	
V1	5083-9010	ELECTRON TUBE:PHOSPHOR CRT P-2	
		NOT USED WHEN OPTION 07, OR 31 SPECIFIED	
	00851-2026	FILTER:CRT LITE BLUE	
		USED WITH P-2 PHOSPHOR	
	1204-20	BEZEL:CRT	
V1	5083-9011	ELECTRON TUBE:PHOSPHOR CRT P-7	
		OPTION 07	
	1204-83A	LIGHT:FILTER AMBER	
		FOR CRT V1	
V1	5083-9012	ELECTRON TUBE:PHOSPHOR CRT P-31	
		OPTION 31	
	1204-83G	LIGHT:FILTER GREEN	
		FOR CRT V1	
W1		NOT ASSIGNED	
W2	00851-6016	CABLE ASSY:SYNC INPUT	
		23-INCH COAX W/BNC FEMALEJACK J6	
W3	00851-6015	CABLE ASSY:SWEEP OUTPUT	
		24-IN COAX W/BNC FEMALE J7	
W4	00140-61606	CABLE:CRT	
W5	00851-6036	CABLE ASSY:CRT HORIZ	
		12-INCH CABLE TERM. W/FEMALE PIN	
W6	00851-6034	CABLE ASSY:5" COAX	
		5-INCH COAX	
W7	00851-6033	CABLE ASSY:IF VERNIER	
		16-1/2-INCH COAX	
W8	00851-6050	CABLE ASSY:20MHZ OUTPUT FROM BP FILTER	
XF1	1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	

See introduction to this section for ordering information

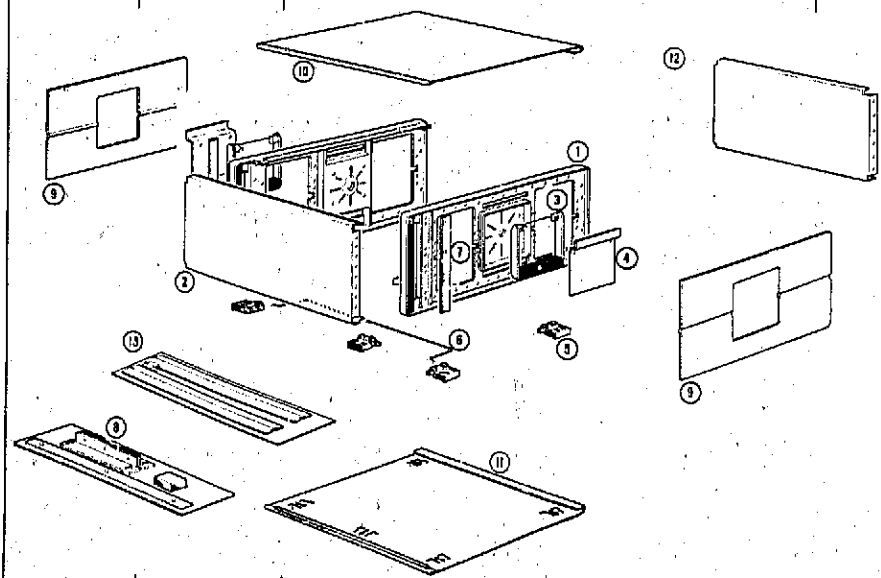
Table 6-1. Reference Designation Index (Cont.)

Reference Designation	Ⓜ Part No.	Description #	Note
XF2	1400-0008	FUSEHOLDER:BRONZE CLIP	
		MISCELLANEOUS	
XV1	1200-0085	COVER PLATE:CRT SOCKET	
XV1	1200-0050	PIN:CRT SOCKET	
XV1	1200-0037	SOCKET:CRT TUBE	
XV2	8120-0078	CABLE ASSY:POWER CORD	

See introduction to this section for ordering information

Table 6-1. Reference Designation Index (Cont)

Reference Designation	Part No.	Description #	Note
1	5060-0734	FRAME ASSY:7 X 16 FM	
	0590-0053	NUT:CAPTIVE 6-32 GOLD CHROMATE	
2	00851-0018	FRONT PANEL	
	2530-0011	SCREW:SST FLAT HD 8-32 X 3/8	
3	5060-0763	HANDLE ASSY-SIDE	
4	5060-0765	RETAINER-HANDLE ASSY.	
	2550-0013	SCREW:SST BH 8-32 X 5/16	
5	5060-0767	FOOT ASSY:FM	
6	1490-0030	STAND:TILT	
7	5000-0052	PLATE:FLUTED ALUMINUM	
8	5060-0776	KIT:7H RACK MOUNT	
9	5000-0742	COVER:SIDE 7 X 16 SM	
	2370-0020	SCREW:SST FM PHIL DR 6-32 X 3/16	
10	5060-0740	TOP COVER ASSY:16L FM	
	2370-0021	SCREW:SST FM PHIL DR 6-32 X 7/16	
11	5060-0752	BOTTOM COVER ASSY:16L FM	
	2370-0021	SCREW:SST FM PHIL DR 6-32 X 7/16	
12	00851-0019	REAR PANEL	
	2515-0017	SCREW:PAN HD PHIL DR 8-32 X 1/4	
13	5060-0216	BRACKET:JOINING KIT	
	2370-0013	SCREW:SST FLAT HD PHL DR 6-32 X 3/8	



See introduction to this section for ordering information

Table 6-2. Replaceable Parts

# Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0121-0033	C:VAR AIR TRIMMER 1.4-9.2 PF	28480	0121-0033	2
0121-0037	C:VAR CER 7-25 PF	28480	0121-0037	4
0121-0046	C:VARI CER 9-35 PF	28480	0121-0046	1
0130-0017	C:VAR CER 8-50 PF	28480	0130-0017	1
0131-0003	C:VAR MICA 170-760 PF 175VDCW	72136	T52910 REV.D	1
0140-0175	C:FXD MICA 39 PF 2% 300VDCW	28480	0140-0175	4
0140-0176	C:FXD MICA 100 PF 2%	28480	0140-0176	2
0140-0180	C:FXD MICA 2000 PF 2%	28480	0140-0180	1
0140-0190	C:FXD MICA 39 PF 5%	28480	0140-0190	1
0140-0192	C:FXD MICA 68 PF 5%	28480	0140-0192	2
0140-0207	C:FXD MICA 330 PF 5%	28480	0140-0207	3
0140-0215	C:FXD MICA 80 PF 2% 300VDCW	28480	0140-0215	1
0140-0225	C:FXD MICA 300 PF 1%	28480	0140-0225	2
0150-0005	C:FXD CER 1000 PF 20% 500VDCW	04222	CFS-1	1
0150-0019	C:FXD CER 1000 PF 20% 500VDCW	72982	327C05X5U0102M	3
0150-0022	C:FXD TI 3.3 PF 10% 500VDCW	78488	GA	1
0150-0023	C:FXD CER 2000 PF 20% 1000VDCW	56289	20C295A2-CDH	1
0150-0036	C:FXD CER 470 PF 20% 6KV	91418	6KV470 20%	2
0150-0042	C:FXD TI 4.7 PF 5% 500VDCW	78488	TYPE GA	1
0150-0050	C:FXD CER 1000 PF 600VDCW	77630	DBD	6
0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA	26
0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA	1
0150-0119	C:FXD CER 2 X 0.01 UF 20% 250WVAC	56289	36C219A	1
0150-0121	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML	2
0160-0151	C:FXD CER 4700 PF +80-20% 4000VDCW	71590	DA045-040CD	2
0160-0154	C:FXD MYLAR 22000PF 10%	28480	0160-0154	1
0160-0159	C:FXD MY 0.0068 UF 10% 200VDCW	28480	0160-0159	1
0160-0162	C:FXD MY 0.022 UF 10% 200VDCW	28480	0160-0162	1
0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	28480	0160-0163	1
0160-0174	C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CML	2
0160-0178	C:FXD MICA 27PF 5% 300VDCW	04062	RDM15E270J3S	1
0160-0179	C:FXD MICA 33 PF 5% 300VDCW	04062	DM15E330J 300V	7
0160-0822	C:FXD TI 2.7 PF 5% 500VDCW	78488	TYPE GA	2
0160-2054	C:FXD MY 0.015 UF 10% 3000VDCW	71436	PMS153-3MS	3
0160-2150	C:FXD MICA 33 PF 5%	28480	0160-2150	1
0160-2208	C:FXD MICA 330 PF 5% 300VDCW	28480	0160-2208	1
0160-2218	C:FXD MICA 1000 PF 5%	28480	0160-2218	3
0160-2357	C:FXD CER FEED-THRU 1000 PF +80-20%	28480	0160-2357	1
0160-2393	C:FXD MY 0.33 UF 5% 100VDCW	18486	663 UW	1
0160-2930	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA	9
0170-0018	C:FXD MY 1UF 5% 200VDCW	84411	TYPE 621M 10552	1
0170-0038	C:FXD MY 0.22 UF 10% 200VDCW	56289	148P22492 PUM	1
0170-0042	C:FXD MY 0.33UF 5% 100VDCW	99515	E1-3340 TYPE E120	1
0170-0051	C:FXD MY 0.635UF 5% 100VDCW	99515	E-120-EP-31704	1
0170-0064	C:FXD MY 0.47UF 10% 100VDCW	24446	64F40AA474	4
0170-0079	C:FXD MY 0.047UF 20% 50VDCW	84411	STYLE 3 TYPE 601PE	1
0170-0085	C:FXD MY 0.1UF 20% 50VDCW	84411	601PE STYLE 3	1
0180-0042	C:FXD ELECT 120UF 350VDCW	56289	D32353	1
0180-0047	C:FXD ELECT 500 UF 75VDCW	56289	D32443 DFP	2
0180-0049	C:FXD AL ELECT 20UF 50VDCW	56289	30D206G050DC6M1	1
0180-0059	C:FXD ELECT 10 UF +75-10% 25VDCW	28480	0180-0059	1
0180-0076	C:FXD ELECT 20UF 25VDCW	56289	40D206G025DC6M1	1
0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	56289	30D106G150DF4	2
0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	28480	0180-0097	2
0180-0098	C:FXD ELECT 100 UF 20% 20VDCW	28480	0180-0098	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont.)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0180-0101	C:FXD ELECT 1.8 UF 10% 35VDCW	28480	0180-0101	1
0180-0104	C:FXD ELECT 200UF 15VDCW	56289	30D207G015DH4	1
0180-0113	C:FXD ELECT TA 100UF +20-15% 30VDCW	56289	109D107C2030T2	1
0180-0116	C:FXD ELECT 6.8 UF 10% 35VDCW	28480	0180-0116	1
0180-0138	C:FXD ELECT 100UF -10+100% 40VDCW	56289	D36254	1
0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW	28480	0180-0155	1
0180-0197	C:FXD ELECT 2.2 UF 10% 20VDCW	28480	0180-0197	1
0180-0230	C:FXD ELECT 1.0 UF 20% 50VDCW	28480	0180-0230	1
0180-0231	C:FXD ELECT 3.5 UF 75VDCW	56289	109D355C2075C2	1
0180-0232	C:FXD ELECT 10 UF 20% 100VDCW	56289	109D106C2100F2	1
0180-0233	C:FXD ELECT 20 UF +20-15% 60VDCW	56289	109D206C2060F2 DYP	1
0180-0234	C:FXD ELECT 33 UF 20% 75VDCW	56289	109D336X0075F2	1
0180-0235	C:FXD ELECT 56 UF 20% 75VDCW	56289	109D566X0075T2	1
0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	28480	0180-0291	1
0340-0095	TERMINAL:FEED-THRU TEFLON INSULATED	98291	FT-310 P-20	1
0370-0026	KNOB:BLK W/ARROW 3/4" OD 1/8" SHAFT	28480	0370-0026	2
0370-0112	KNOB:BLACK,RANGE	28480	0370-0112	3
0370-0113	KNOB:BLACK,SENSITIVITY	28480	0370-0113	1
0370-0114	KNOB:RED W/ARROW 5/8" OD 1/8" SHAFT	28480	0370-0114	1
0370-0120	KNOB:BLACK CONCENTRIC 3/4" DIA	28480	0370-0120	1
0370-0127	KNOB:RED ROUND 5/8" DIA	28480	0370-0127	1
0410-0091	CRYSTAL:QUARTZ 20MC(MATCHED PAIR)	28480	0410-0091	2
0490-0125	RELAY:DPDT 24VDC	28480	0490-0125	8
0590-0053	NUT:CAPTIVE 6-32 GOLD CHROMATE	00000	080	1
0683-1015	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015	6
0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025	4
0683-1205	R:FXD COMP 12 OHM 5% 1/4W	01121	CB 1205	1
0683-1215	R:FXD COMP 120 OHM 5% 1/4W	01121	CB 1215	1
0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225	1
0683-1235	R:FXD COMP 12K OHM 5% 1/4W	01121	CB 1235	2
0683-1245	R:FXD COMP 120K OHM 5% 1/4W	01121	CB 1245	1
0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	01121	CB 1325	1
0683-1345	R:FXD COMP 130K OHM 5% 1/4W	01121	CB 1345	1
0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525	3
0683-1535	R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535	3
0683-1635	R:FXD COMP 16K OHM 5% 1/4W	01121	CB 1635	2
0683-1815	R:FXD COMP 180 OHM 5% 1/4W	01121	CB 1815	1
0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825	2
0683-1835	R:FXD COMP 18K OHM 5% 1/4W	01121	CB 1835	1
0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025	3
0683-2215	R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215	2
0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225	4
0683-2235	R:FXD COMP 22K OHM 5% 1/4W	01121	CB 2235	1
0683-2435	R:FXD COMP 24K OHM 5% 1/4W	01121	CB 2435	2
0683-2705	R:FXD COMP 27 OHM 5% 1/4W	01121	CB 2705	1
0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	01121	CB 2725	5
0683-2735	R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735	3
0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025	1
0683-3335	R:FXD COMP 33K OHM 5% 1/4W	01121	CB 3335	1
0683-3625	R:FXD COMP 3600 OHM 5% 1/4W	01121	CB 3625	1
0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925	4
0683-3935	R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935	1
0683-4305	R:FXD COMP 43 OHM 5% .25W	01121	CB 4305	1
0683-4715	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715	1

 # See Introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont.)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725	3
0683-4735	R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735	1
0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125	2
0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625	1
0683-6215	R:FXD COMP 620 OHM 5% 1/4W	01121	CB 6215	1
0683-6805	R:FXD COMP 68 OHM 5% 1/4W	01121	CB 6805	4
0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825	9
0683-9115	R:FXD COMP 910 OHM 5% 1/4W	01121	CB 9115	1
0684-1001	R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001	1
0684-1011	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011	1
0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021	2
0684-1031	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031	1
0684-4711	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711	1
0684-6831	R:FXD COMP 685 OHM 10% 1/4W	01121	CB 6831	1
0686-1825	R:FXD COMP 1800 OHM 5% 1/2W	01121	EB 1825	1
0686-2025	R:FXD COMP 2000 OHM 5% 1/2W	01121	EB 2025	1
0686-2725	R:FXD COMP 2700 OHM 5% 1/2W	01121	EB 2725	1
0686-5115	R:FXD COMP 510 OHM 5% 1/2W	01121	EB 5115	1
0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	01121	EB 5625	1
0686-6225	R:FXD COMP 6200 OHM 5% 1/2W	01121	EB 6225	1
0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	01121	EB 7525	1
0687-1041	R:FXD COMP 100K OHM 10% 1/2W	01121	EB 1041	1
0687-1051	R:FXD COMP 1 MEGOHM 10% 1/2W	01121	EB 1051	1
0687-1231	R:FXD COMP 12K OHM 10% 1/2W	01121	EB 1231	1
0687-1521	R:FXD COMP 1500 OHM 10% 1/2W	01121	EB 1521	1
0687-2231	R:FXD COMP 22K OHM 10% 1/2W	01121	EB 2231	1
0687-2741	R:FXD COMP 270K OHM 10% 1/2W	01121	EB 2741	1
0687-3931	R:FXD COMP 39K OHM 10% 1/2W	01121	EB 3931	2
0687-4701	R:FXD COMP 47 OHM 10% 1/2W	01121	EB 4701	1
0690-1021	R:FXD COMP 1000 OHM 10% 1W	01121	GB 1021	5
0690-1231	R:FXD COMP 12K OHM 10% 1W	01121	GB 1231	1
0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	01121	GB 1851	4
0690-2721	R:FXD COMP 2700 OHM 5% 1/4W	01121	GB 2721	1
0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	01121	GB 3951	5
0690-5641	R:FXD COMP 560K OHM +10% 1W	01121	GB 5641	1
0698-3153	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153	1
0698-3155	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155	1
0698-3406	R:FXD MET FLM 1.33K OHM 1% 1/2W	28480	0698-3406	2
0698-3427	R:FXD MET FLM 13.3 OHM 1% 1/8W	28480	0698-3427	1
0698-3435	R:FXD MET FLM 38.3 OHM 1%1/8W	28480	0698-3435	2
0698-3438	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438	4
0698-3440	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440	2
0698-3441	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441	1
0698-3444	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444	1
0698-3446	R:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446	1
0698-5537	R:FXD MET FLM 2.50K OH 1/2% 1/8W	28480	0698-5537	1
0698-5820	R:FXD MET FLM 37.4 OHM 1/2% 1/8W	28480	0698-5820	1
0698-5828	R:FXD MET FLM 150 OHM 1/2% 1/8W	28480	0698-5828	2
0698-6226	R:FXD MET FLM 47.5 OHM 1/2% 1/8W	28480	0698-6226	1
0698-6227	R:FXD MET FLM 71.16 OHM 1/2% 1/8W	28480	0698-6227	1
0698-6228	R:FXD CARBON FLM 5.77 OHM 1/2% 1/8W	28480	0698-6228	1
0698-6229	R:FXD MET FLM 870 OHM 1/2% 1/8W	28480	0698-6229	2
0698-6231	R:FXD MET FLM 11.61 OHM 1/2% 1/8W	28480	0698-6231	1
0698-6233	R:FXD MET FLM 61.11 OHM 1/2% 1/8W	28480	0698-6233	2

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont.)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0698-6234	R:FXD MET FLM 17.61 OHM 1/2% 1/8W	28480	0698-6234	1
0698-6235	R:FXD MET FLM 96.25 OHM 1/2% 1/8W	28480	0698-6235	2
0698-6236	R:FXD MET FLM 292.4 OHM 1/2% 1/8W	28480	0698-6236	2
0698-6237	R:FXD MET FLM 436.2 OHM 1/2% 1/8W	28480	0698-6237	2
0698-6796	R:FXD MET FLM 51.1 OHM 1/2% 1/8W	28480	0698-6796	2
0727-0004	R:FXD DEPC 5 OHM 1% 1/2W	28480	0727-0004	2
0727-0123	R:FXD DEPC 2900 OHM 1% 1/2W	28480	0727-0123	1
0727-0124	R:FXD CARBON 3000 OHM 1% 1/2W	28480	0727-0124	1
0727-0126	R:FXD DEPC 3.266K OHM 1% 1/2W	28480	0727-0126	1
0727-0136	R:FXD DEPC 5.03K OHM 1% 1/2W	28480	0727-0136	2
0727-0158	R:FXD DEPC 10.1K OHM 1% 1/2W	28480	0727-0158	2
0727-0163	R:FXD DEPC 11.88K OHM 1% 1/2W	28480	0727-0163	1
0727-0170	R:FXD DEPC 18K OHM 1% 1/2W	28480	0727-0170	1
0727-0173	R:FXD DEPC 20K OHM 1% 1/2W	28480	0727-0173	1
0727-0178	R:FXD DEPC 24.7K OHM 1% 1/2W	28480	0727-0178	1
0727-0189	R:FXD DEPC 41.7K OHM 1% 1/2W	28480	0727-0189	2
0727-0403	R:FXD DEPC 52.3K OHM 1/2% 1/2W	28480	0727-0403	1
0727-0405	R:FXD DEPC 57.6K OHM 1/2% 1/2W	28480	0727-0405	1
0757-0159	R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159	1
0757-0260	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0260	1
0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279	4
0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280	2
0757-0290	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290	1
0757-0316	R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316	1
0757-0346	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346	1
0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397	2
0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401	3
0757-0417	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417	2
0757-0420	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420	1
0757-0438	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438	3
0757-0439	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439	1
0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440	4
0757-0441	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441	2
0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442	3
0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444	2
0757-0829	R:FXD MET FLM 4650 OHM 1% 1/2W	28480	0757-0829	1
0757-0831	R:FXD MET FLM 4.32K OHM 1% 1/2W	28480	0757-0831	1
0757-0885	R:FXD MET FLM 15.4K OHM 1% 1/4W	28480	0757-0885	1
0757-0887	R:FXD MET FLM 32.4K OHM 1% 1/4W	28480	0757-0887	1
0757-0889	R:FXD MET FLM 143K OHM 1% 1/4W	28480	0757-0889	1
0757-0890	R:FXD MET FLM 191K OHM 1% 1/4W	28480	0757-0890	1
0758-0002	R:FXD MET OX FLM 560 OHM 5% 1/2W	28480	0758-0002	1
0758-0003	R:FXD MET OX 1000 OHM 5% 1/2W	28480	0758-0003	1
0758-0004	R:FXD MET OX 2700 OHM 5% 1/2W	28480	0758-0004	1
0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	28480	0758-0005	4
0758-0012	R:FXD MET OX 12K OHM 5% 1/2W	28480	0758-0012	1
0758-0017	R:FXD MET OX 1500 OHM 5% 1/2W	28480	0758-0017	1
0758-0022	R:FXD FLM 82K OHM 5% 1/4W	28480	0758-0022	1
0758-0024	R:FXD MET OX 100 OHM 5% 1/2W	28480	0758-0024	2
0758-0034	R:FXD MET OX 2400 OHM 5% 1/2W	28480	0758-0034	2
0758-0038	R:FXD MET OX 9100 OHM 5% 1/2W	28480	0758-0038	2
0758-0043	R:FXD MET OX 1800 OHM 5% 1/2W	28480	0758-0043	1
0758-0044	R:FXD MET OX 2200 OHM 5% 1/2W	28480	0758-0044	2
0758-0050	R:FXD MET OX 39K OHM 5% 1/2W	28480	0758-0050	1

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont.)

@ Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0758-0057	R:FXD MET OX 5600 OHM 5% 1/2W	28480	0758-0057	1
0761-0037	R:FXD MET FLM 390 OHM 5% 1W	28480	0761-0037	1
0761-0074	R:FXD MET FLM 15K OHM 5% 1W	28480	0761-0074	2
0811-1662	R:FXD ww 0.47 OHM 5% 2W	28480	0811-1662	1
0811-1671	R:FXD WW 2.7 OHM 5% 2W	28480	0811-1671	1
0813-0019	R:FXD ww 0.47 OHM 10% 2W	28480	0813-0019	1
0852-0020	R:FXD SILICON 150 OHM 5% 1/8W	01295	08D	1
0852-0021	R:FXD SILICON 100 OHM 5% 1/8W	01295	08D	1
0905-0050	GASKET:FELT	85471	08D	1
1200-0037	SOCKET:CRT TUBE	72825	97097	1
1200-0043	INSULATOR:TRANSISTOR MOUNTING	71785	293011	2
1200-0050	PIN:CRT SOCKET	72825	9553	1
1200-0076	INSULATOR:TRANSISTOR	02735	DF 143	4
1200-0081	BUSHING:INSULATOR NYLON	26365	9745PECIAL	2
1200-0085	COVER PLATE:CRT SOCKET	72825	9309-1	1
1200-0087	CLAMP:TRANSISTOR	02735	DF-13-A	2
1200-0092	BUSHING:TRANSISTOR	02735	495334 1	2
1250-0053	CONNECTOR:RF BNC CAP AND CHAIN	28480	1250-0053	1
1250-0083	CONNECTOR:BNC	28480	1250-0083	2
1250-0140	CONNECTOR:BNC JACK	28480	1250-0140	1
1250-0171	CONNECTOR:RF BNC BULKHEAD MOUNT	28480	1250-0171	4
1250-0228	CONNECTOR:RF	28480	1250-0228	4
1250-0229	CONNECTOR:RF CABLE PLUG SUB-MIN	94375	RF 6621-27	8
1250-0731	CONNECTOR:RF BNC BULKHEAD MOUNT	28480	1250-0731	2
1251-0143	CONNECTOR:FEMALE 14-CONTACT JACK	28480	1251-0143	1
1251-0148	CONNECTOR:POWER 3 PIN MALE	87930	1065-1	1
1400-0008	FUSEHOLDER:BRONZE CLIP	95915	3510-11	1
1400-0084	FUSEHOLDER:EXTRACTOR POST TYPE	79515	342014	1
1490-0030	STAND:TILT	28480	1490-0030	1
1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	28480	1520-0001	3
1850-0040	TRANSISTOR:GERMANIUM PNP	28480	1850-0040	1
1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	28480	1850-0062	5
1850-0064	TRANSISTOR:GERMANIUM PNP 2N1183	86684	2N1183	2
1850-0065	TRANSISTOR:GERMANIUM 2N1370	01295	2N1370	3
1850-0090	TRANSISTOR:GERMANIUM PNP 2N1183B	02735	2N1183B	2
1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	28480	1850-0098	2
1850-0153	TRANSISTOR:GERMANIUM PNP	04713	SM1671	7
1851-0017	TRANSISTOR:2N1304	01295	2N1304	6
1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	28480	1853-0003	2
1853-0020	TRANSISTOR:SILICON PNP	28480	1853-0020	7
1853-0034	TRANSISTOR:SILICON PNP	28480	1853-0034	1
1854-0003	TRANSISTOR:NPN SILICON	28480	1854-0003	7
1854-0005	TRANSISTOR:SILICON NPN 2N708	02735	2N708	6
1854-0022	TRANSISTOR:NPN SILICON	28480	1854-0022	7
1854-0071	TRANSISTOR:SILICON NPN	28480	1854-0071	4
1854-0073	TRANSISTOR:SILICON NPN	28480	1854-0073	1
1884-0012	RECTIFIER:SILICON CONTROLLED 2N3528	02735	2N3528	1
1901-0025	DIODE:SILICON 100MV 100MA	28480	1901-0025	16
1901-0029	DIODE:SILICON 600 PIV	28480	1901-0029	1
1901-0033	DIODE:SILICON 100MA 180MV	28480	1901-0033	1
1901-0040	DIODE:SILICON 30MA 30MV	07263	FDG1088	4
1901-0045	DIODE:SILICON 100PIV	28480	1901-0045	2
1901-0047	DIODE JUNCTION:SILICON 20PIV	28480	1901-0047	4
1901-0049	DIODE:SILICON 50PIV	28480	1901-0049	4

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont.)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
1901-0096	DIODE:SILICON 120V	28480	1901-0096	5
1901-0142	DIODE ASSY:SILICON HIGH VOLTAGE	28480	1901-0142	4
1901-0162	DIODE:MATCHED SETS OF SIX DIODES	28480	1901-0162	6
1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	28480	1902-0017	4
1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025	2
1902-0037	DIODE BREAKDOWN:9.09V 10%	28480	1902-0037	1
1902-0050	DIODE BREAKDOWN:8.66V	28480	1902-0050	1
1902-0241	DIODE BREAKDOWN:100V	28480	1902-0241	1
1902-3224	DIODE:BREAKDOWN 17.8V 5% 400MW	28480	1902-3224	1
1910-0011	DIODE:GERMANIUM 5MA AT 1V	28480	1910-0011	4
2100-0019	R:VAR COMP 500 OHM 10% LIN 1/2W	28480	2100-0019	1
2100-0027	R:VAR COMP 10K OHM 10% LIN 2W	28480	2100-0027	1
2100-0036	R:VAR COMP 1000 OHM LIN	28480	2100-0036	1
2100-0067	R:VAR COMP 2500 OHM 10% LIN 1/2W	28480	2100-0067	1
2100-0092	R:VAR COMP 10K OHM 20% LIN 1/5W	28480	2100-0092	1
2100-0095	R:VAR COMP 100K OHM 30% LIN 1/5W	28480	2100-0095	1
2100-0107	R:VAR COMP 50K OHM 30% 1/3W	28480	2100-0107	1
2100-0144	R:VAR COMP 250K OHM 30% LIN 1/5W	28480	2100-0144	1
2100-0150	R:VAR GANGED 1UK OHM 20% LIN 1/4W	28480	2100-0150	1
2100-0154	R:VAR COMP 1K OHM 30% LIN 0.15W	28480	2100-0154	1
2100-0189	R:VAR COMP 1M OHM 30% / 7N 1/4W	28480	2100-0189	1
2100-0218	R:VAR COMP 1.2 MEGOHM 20% LIN 2W	28480	2100-0218	1
2100-0893	R:VAR COMP 2 SECT2K/750K OHM LIN 1/2W	28480	2100-0893	2
2100-0910	R:VAR COMP 2 SECT 35K OHM 20% LIN 1/4W	28480	2100-0910	6
2100-0956	R:VAR COMP 500 OHM 20% LIN 1/20W	28480	2100-0956	1
2100-0957	R:VAR COMP 5000 OHM 20% LIN 1/20W	28480	2100-0957	2
2100-0958	R:VAR COMP 10K OHM 20% LIN 1/20W	28480	2100-0958	1
2100-1773	R:VAR WW 1K OHM 10% LIN 1/2W	28480	2100-1773	2
2110-0001	FUSE:1.0 A 250V	75915	312001.	1
2110-0016	FUSE:CARTRIDGE 0.6A 125V MAX SLOW BLOW	75915	313.6 0	1
2110-0044	FUSE:0.30A 250V SLOW-BLOW	28480	2110-0044	1
2140-0018	LAMP:GLOW 1/10W	24455	NE 2E1	1
2370-0013	SCREW:SST FLAT HD PHL DR 6-32 X 3/8	28480	2370-0013	1
2370-0020	SCREW:SST FH PHIL DR 6-32 X 3/16	00000	OBD	1
2370-0021	SCREW:SST FH PHIL DR 6-32 X 7/16	00000	OBD	2
2515-0017	SCREW:PAN HD PHIL DR 8-32 X 1/4	00000	OBD	1
2530-0011	SCREW:SST FLAT HD 8-32 X 3/8	78189	OBD#	1
2550-0013	SCREW:SST BH 8-32 X 5/16	28480	2550-0013	1
3100-0812	SWITCH:ROTARY	28480	3100-0812	2
3100-0815	SWITCH:ROTARY	28480	3100-0815	1
3100-1600	SWITCH:ROTARY	28480	3100-1600	1
3101-0033	SWITCH:SLIDE DPDT 0.5A 125V AC/DC	79727	G326-0001	1
3101-0052	SWITCH:PUSHBUTTON SPST	82389	961 LESS HWD	1
3130-0041	SHIELD:SWITCH	28480	3130-0041	1
4320-0007	EXTRUSION:RUBBER	28480	4320-0007	1
5000-0052	PLATE:FLUTED ALUMINUM	28480	5000-0052	1
5000-0408	COIL:BRACKET	28480	5000-0408	1
5000-0742	COVER:SIDE 7 X 16 SM	28480	5000-0742	1
5040-0218	COUPLER:SWITCH SHAFT	28480	5040-0218	1
5040-0234	LAMPHOLDER	28480	5040-0234	1
5040-0235	BASE:LAMPHOLDER	28480	5040-0235	1
5040-0400	SUPPORT:CAPACITOR	28480	5040-0400	2
5040-0401	SUPPORT:CAPACITOR	28480	5040-0401	2
5040-0418	INSULATOR:POT	28480	5040-0418	1

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Table 6-2. Replaceable Parts (Cont.)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
5040-0421	INSULATOR:FOR R3B FOCUS	28480	5040-0421	1
5040-0466	RETAINER:CRT SHIELD	28480	5040-0466	1
5060-0216	BRACKET:JOINING KIT	28480	5060-0216	1
5060-0409	COIL:ALIGNMENT	28480	5060-0409	1
5060-0734	FRAME ASSY:7 X 16 FM	28480	5060-0734	
5060-0740	TOP COVER ASSY:16L FM	28480	5060-0740	1
5060-0752	BOTTOM COVER ASSY:16L FM	28480	5060-0752	1
5060-0763	HANDLE ASSY-SIDE	28480	5060-0763	1
5060-0765	RETAINER-HANDLE ASSY.	28480	5060-0765	1
5060-0767	FOOT ASSY:FM	28480	5060-0767	1
5060-0776	KIT:7H RACK MOUNT	28480	5060-0776	1
5083-9010	ELECTRON TUBE:PHOSPHOR CRT P-2	28480	5083-9010	1
5083-9011	ELECTRON TUBE:PHOSPHOR CRT P-7	28480	5083-9011	1
5083-9012	ELECTRON TUBE:PHOSPHOR CRT P-31	28480	5083-9012	1
8120-0078	CABLE ASSY:POWER CORD	28480	8120-0078	1
9100-0274	TRANSFORMER:POWER	28480	9100-0274	1
9100-1610	COIL:MOLDED CHOKE 0.15 UH 20%	28480	9100-1610	1
9100-1615	COIL/CHOKE FXD 1.20 UH 10%	28480	9100-1615	1
9110-0042	CHOKE:FILTER 0.07HY 1.0 AMP 1.5 OHM	28480	9110-0042	1
9120-0090	TRANSFORMER:IF	28480	9120-0090	1
9120-0092	TRANSFORMER:IF	28480	9120-0092	1
9140-0051	COIL:FXD 400 UH	28480	9140-0051	2
9140-0082	COIL:FXD RF 15 UH	28480	9140-0082	2
9140-0096	COIL:FXD RF 1 UH	28480	9140-0096	1
9140-0118	COIL:FXD 500 UH 5%	28480	9140-0118	1
9140-0137	COIL:FXD RF 1 MH 5%	28480	9140-0137	2
9140-0146	COIL:FXD RF 10.0 UH	99800	1025-44	12
9140-0149	COIL:FXD RF 1.86 UH	28480	9140-0149	5
9140-0150	COIL:FXD RF 2.75 UH	28480	9140-0150	1
9140-0152	COIL:FXD RF 41.06 UH	28480	9140-0152	1
9140-0158	COIL:FXD RF 1 UH 10%	99800	1025-20	1
9140-0159	COIL:FXD 0.47UH 20%	99800	1025-SERIES	2
9140-0232	COIL:RF VAR .254 UH	28480	9140-0232	1
9140-0235	COIL:RF VAR .95-1.8 UH	28480	9140-0235	3
00140-61606	CABLE:CRT	28480	00140-61606	1
00851-0006	BRACKET:POWER SUPPLY	28480	00851-0006	1
00851-0007	SHIELD:HIGH VOLTAGE	28480	00851-0007	1
00851-0008	COVER:SOCKET	28480	00851-0008	1
00851-0009	BRACKET:PC BOARD	28480	00851-0009	1
00851-0013	COVER:RF HOUSING	28480	00851-0013	1
00851-0014	COVER:SWITCH	28480	00851-0014	1
00851-0015	PLATE:COVER	28480	00851-0015	2
00851-0018	FRONT PANEL	28480	00851-0018	1
00851-0019	REAR PANEL	28480	00851-0019	1
00851-0020	COVER:INPUT BP FILTER	28480	00851-0020	1
00851-2002	CONDUCTOR:OUTER-SHORT	28480	00851-2002	1
00851-2003	CONDUCTOR:OUTER-LONG	28480	00851-2003	1
00851-2007	BOARD:BLANK PC	28480	00851-2007	1
00851-2010	BOARD:BLANK PC	28480	00851-2010	1
00851-2011	BOARD:BLANK PC	28480	00851-2011	1
00851-2017	HOUSING:INPUT BP FILTER	28480	00851-2017	1
00851-2022	CAVITY:FILTER	28480	00851-2022	2
00851-2026	FILTER:CRT LITE BLUE	28480	00851-2026	1
00851-2027	KNOB:IF GAIN 0-70DB	28480	00851-2027	1

 # See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont.)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
00851-2028	KNOB:IF GAIN 0-10DB	28480	00851-2028	1
00851-2029	BOARD:BLANK PC	28480	00851-2029	1
00851-2045	BOARD:BLANK PC	28480	00851-2045	1
00851-2046	BOARD:BLANK PC	28480	00851-2046	1
00851-2047	BOARD:BLANK PC	28480	00851-2047	1
00851-2056	BOARD:BLANK PC	28480	00851-2056	1
00851-2057	BOARD:BLANK PC	28480	00851-2057	1
00851-2058	BOARD:BLANK PC	28480	00851-2058	1
00851-2059	BOARD:BLANK PC	28480	00851-2059	1
00851-6003	RF CIRCUIT ASSY	28480	00851-6003	1
00851-6006	SWITCH ASSY:VERT. DISPLAY	28480	00851-6006	1
00851-6007	SWITCH ASSY:IF BANDWIDTH	28480	00851-6007	1
00851-6008	CRT SHIELD ASSY	28480	00851-6008	1
00851-6015	CABLE ASSY:SWEEP OUTPUT	28480	00851-6015	1
00851-6016	CABLE ASSY:SYNC INPUT	28480	00851-6016	1
00851-6020	BOARD ASSY:I.F. AMPL.	28480	00851-6020	1
00851-6023	BOARD ASSY:BANDPASS FILTER	28480	00851-6023	1
00851-6024	BOARD ASSY:BANDPASS FILTER	28480	00851-6024	1
00851-6025	BOARD ASSY:INPUT SWITCHING CIRCUIT	28480	00851-6025	1
00851-6026	BOARD ASSY:OUTPUT SWITCHING CIRCUIT	28480	00851-6026	1
00851-6028	FILTER ASSY:100KC BANDPASS	28480	00851-6028	2
00851-6029	CABLE ASSY	28480	00851-6029	3
00851-6030	CABLE ASSY	28480	00851-6030	1
00851-6031	CABLE ASSY	28480	00851-6031	1
00851-6032	CABLE ASSY	28480	00851-6032	1
00851-6033	CABLE ASSY:IF VERNIER	28480	00851-6033	2
00851-6034	CABLE ASSY:5" COAX	28480	00851-6034	1
00851-6036	CABLE ASSY:CRT HORIZ	28480	00851-6036	1
00851-6037	CABLE ASSY:CRT VERT	28480	00851-6037	1
00851-6038	BOARD ASSY:SWEEP HORIZ. AMPL.	28480	00851-6038	1
00851-6039	SWITCH ASSY:SWEEP TIME	28480	00851-6039	1
00851-6040	SWITCH ASSY:SYNC.	28480	00851-6040	1
00851-6045	HV POWER SUPPLY ASSY	28480	00851-6045	1
00851-6046	BOARD ASSY:VERT. AMP.	28480	00851-6046	1
00851-6047	BOARD ASSY:INPUT BP FILTER ASSY	28480	00851-6047	1
00851-6049	SWITCH ASSY:IF GAIN	28480	00851-6049	1
00851-6050	CABLE ASSY:20MHZ OUTPUT FROM BP FILTER	28480	00851-6050	1
00851-6051	CABLE ASSY:ATTENUATOR OUTPUT	28480	00851-6051	1
00851-6052	CABLE ASSY:IF INPUT	28480	00851-6052	1
00851-6053	BANDPASS FILTER ASSY	28480	00851-6053	1
00851-6054	BOARD ASSY:AMPLIFIER	28480	00851-6054	1
00851-6055	BOARD ASSY:CURRENT CONTROLLED	28480	00851-6055	1
00851-8003	FILTER:LOW PASS	28480	00851-8003	5
00851-8004	COIL:RF	28480	00851-8004	2
00851-8005	COIL:RF	28480	00851-8005	1
00851-8006	COIL:RF	28480	00851-8006	1
00851-8008	COIL:RF	28480	00851-8008	2
00851-8009	COIL:RF	28480	00851-8009	1
00851-8010	COIL:RF	28480	00851-8010	1
00852-2016	BOARD:BLANK PC	28480	00852-2016	1
00852-6016	BOARD ASSY:LVPS	28480	00852-6016	1
08551-2083	BOARD:BLANK PC	28480	08551-2083	2
120A-20	BEZEL:CRT	28480	120A-20	1
120A-83A	LIGHT:FILTER AMBER	28480	120A-83A	1
120A-83G	LIGHT:FILTER GREEN	28480	120A-83G	1

See introduction to this section for ordering information

Table 6-3. Code List of Manufacturers (Sheet 1 of 3)

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

Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00297	Comar, Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Hewlett-Packard Co., Inc.	Valley Stream, N.Y.
00373	Gertsch Inc.	Cherry Hill, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Antinell Radio Corp.	Clifton, N.J.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
00929	Microlab Inc.	Livingston, N.J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp.	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02288	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vaculine Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
02875	Hudson Tool & Die Co.	Newark, N.J.
03508	G. E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Calif.
03877	Transition Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div. Finderne Plant	Somerville, N.J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lambertville, N.J.
04062	Arco Electronics Inc.	Great Neck, N.Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.
04673	Dakota Engr. Inc.	Culver City, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05245	Components Corp.	Chicago, Ill.
05277	Westinghouse Electric Corp. Semiconductor Dept.	Youngwood, Pa.
05347	Illtronx, Inc.	San Mateo, Calif.
05397	Union Carbide Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind. Inc.	Canoga Park, Calif.
05583	Icore Electronic Plastics Inc.	Sunnyvale, Calif.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Hollo-Tal Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E. T. A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Arco Div.	Phoenix, Ariz.
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
07005	Varian Assoc. Elmac Div.	San Carlos, Calif.
07044	Kaiser Electric Co.	Van Nuys, Calif.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Fairchild Corp.	New York, N.Y.
07233	Glinch-Graphite Co.	City of Industry, Calif.
07256	Sylvania Transistor Corp.	Costa Mesa, Calif.
07261	Avnet Corp.	Culver City, Calif.
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Glidden Corp., The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc., Ml. View Operations	Mountain View, Calif.
07500	Technical Wire Products Inc.	Cranford, N.J.
07629	Dodge Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.
07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N.J.
08145	U. S. Engineering Co.	Los Angeles, Calif.
08289	Bliss, Delbert Co.	Pomona, Calif.
08358	Bulgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Beutsch-Fastener Corp.	Los Angeles, Calif.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div of C. B. S. Inc.	Lowell, Mass.
08806	General Electric Co. Miniat. Lamp Dept.	Cleveland, Ohio
08984	Mal-Rain	Indianapolis, Ind.
09076	Babcock Relays Div.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Alden Elect.	Quincy, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & H Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09922	Burndy Corp.	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	TriTal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N.J.
11717	Imperial Electronic Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12040	National Semiconductor	Danbury, Conn.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Crown Mfg. Co., Inc.	Shady Grove, Pa.
12574	Bulton Ind. Inc. Bells System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elcon Filter Corp.	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N.J.
12910	Delta Semiconductor Inc.	Newport Beach, Calif.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13103	Thermalloy	Dallas, Texas
13390	Teleflunken (Gmbh)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Gorsell Dubbier Electric Corp.	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Calif.
14850	Williams Mfg. Co.	San Jose, Calif.
15203	Webster Electronics Co.	New York, N.Y.
15287	Sribonics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15559	Micron Electronics	Garden City, Long Island, N.Y.
15565	Amperex Inst. Corp.	Lynbrook, N.Y.
15631	Cabletronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Ameico Inc.	Mt. View, Calif.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Dumi-Spectra Inc.	Farmington, Mich.
16352	Computer Diode Corp.	Lodi, N.J.
16565	Boots Aircraft Nut Corp.	Pasadena, Calif.
16888	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermometrics Inc.	Canoga Park, Calif.
17474	Tinnes Company	Mountain View, Calif.
17554	Components Inc.	Biddeford, Me.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Calif.

Table 6-3. Code List of Manufacturers (Sheet 2 of 3)

Code No.	Manufacturer	Address
17876	McGraw-Edison Co.	Manchester, N. H.
18042	Power Design Pacific Inc.	Palo Alto, Calif.
18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
18324	Signetics Corp.	Sunnyvale, Calif.
18476	Tyr-Cal Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18612	Mishby Instruments Inc.	Malvern, Pa.
18873	E. I. DuPont and Co., Inc.	Wilmington, Del.
18951	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N. J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N. J.
19589	Cancor	Baldwin Park, Calif.
19644	LRC Electronics	Horsehead, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Atronics Corp.	Philadelphia, Pa.
21225	Excelsite, Inc.	Long Island City, N.Y.
21335	Fahnir Bearing Co., The	New Britain, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23042	Taxscan Corp.	Indianapolis, Ind.
23783	Brittan Radio Electronics Ltd.	Washington, D.C.
24455	G.E., Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
24996	Pacific Inc.	San Juan Capistrano, Calif.
25366	Grins Reproducer Corp.	New Rochelle, N.Y.
25462	Grobet File Co. of America, Inc.	Carlstadt, N. J.
25691	Compac/Hollister Co.	Hollister, Calif.
25982	Hamilton Watch Co.	Lancaster, Pa.
27253	Specialities Mfg. Co., Inc.	Stafford, Conn.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
29526	Heyman Mfg. Co.	Kenilworth, N. J.
30817	Instrument Specialties Co., Inc.	Little Falls, N. J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35424	Lectrohm Inc.	Chicago, Ill.
36195	Sinewyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W. H. & Hill, Ltd.	Toronto Ontario, Canada
37942	P. R. Mallory & Co. Inc.	Indianapolis, Ind.
52983	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
42990	C. A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
45384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	Sanborn Company	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N. C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
56446	Telex Corp.	Tulsa, Okla.
56730	Thomas & Betts Co.	Elizabeth, N. J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Inc. Weston-Newark	Newark, N.J.
66295	Wilhit Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co.	Revere Nissen Div. St. Paul, Minn.
70275	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70553	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70933	Boldon Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71216	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	C. P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71707	Cornish Wire Co., The	New York, N.Y.
71707	Cole Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana Gear Worl-Corp., Electronics Div.	Roselle, N.J.
72699	General Instrument Corp., Gen. Div.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N.J.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H. H. Harper Co.	Chicago, Ill.
73138	Heilipot Div. of Bethlehem Inst., Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Elect Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73596	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. NSL Industries Inc.	Philadelphia, Pa.
73734	Federal Screw Products Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
73957	Glaser-Pac Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74485	J. H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	A. F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E. F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littelfuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C. W. Marwedel	San Francisco, Calif.
76433	General Instrument Corp., Micamold Division	Newark, N. J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J. W. Miller Co.	Los Angeles, Calif.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N. J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N. J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77909	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Signe	So. Braintree, Mass.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Stratford-Dunn Inc.	Pitman, N.J.
78474	Specialty Leather Prod. Co.	Newark, N.J.
78952	Thompson-Bremer & Co.	Chicago, Ill.
78971	Tilley Mfg. Co.	San Francisco, Calif.
78988	Stackpole Carbon Co.	St. Marys, Pa.
79043	Standard Thomson Corp.	Waltham, Mass.
79063	Tinnerman Products, Inc.	Cleveland, Ohio
79189	Transistor Engineers	San Gabriel, Calif.
79307	Melinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Weaton Rock, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N. J.
80120	Schnitzer Alloy Products Co.	Elizabeth, N. J.
80131	Electronic Industries Association. Any brand, Tube meeting EIA Standards-Washington, DC.	
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio

Table 6-3. Code List of Manufacturers (Sheet 3 of 3)

Code No.	Manufacturer	Address
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Calif.
80583	Hammarlund Co., Inc.	Mars Hill, N. C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80833	Dimco Gray Co.	Dayton, Ohio
81032	International Instruments Inc.	Orange, Conn.
81073	Graphtol Co.	LaGrange, Ill.
81096	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec. Div. Litton Ind., Inc.	Daleville, Conn.
81349	Military Specification	
81483	International Rectifier Corp.	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81853	Bahy Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sprll Faraday Inc., Copper Hewill Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp. Space & Defense Systems Div.	Paramus, N. J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
82768	Phillips Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83014	Horlewell Corp.	Los Angeles, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83149	ITT Wire and Cable Div.	Los Angeles, Calif.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Raxan Inc.	Newport Beach, Calif.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisade's Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A. J. Glessener Co., Inc.	San Francisco, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.
84970	Sealed Tonzlon, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N. J.
85471	A. B. Boyd Co.	San Francisco, Calif.
85474	R. M. Bracamonte & Co.	San Francisco, Calif.
85560	Rolled Metals, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N. J.
86928	Seastrom Mfg. Co.	Glendale, Calif.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87654	Van Waters & Rogers Inc.	San Francisco, Calif.
87918	Tower Mfg. Corp.	Providence, R. I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	G. E. Distributing Corp.	Schenectady, N.Y.
89565	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N. J.
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect. Inc., Salem Div.	Salem, Mass.
91259	Cannon Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91505	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91731	Cramer Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91885	Maico Mfg. Co., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91951	Hahn-Dreis Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92357	Eigeet Optical Co. Inc.	Rochester, N.Y.
92609	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury Long Island, N.Y.
92968	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Stanco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93639	Waters Mfg. Co.	Culver City, Calif.
93925	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94142	Phelps Dodge	Yonkers, N.Y.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94339	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94692	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researches, Inc.	Boston, Mass.
95236	Alltos Products Corp.	Dania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Lescraft Mfg. Co., Inc.	Long Island, N.Y.
95298	National Coil Co.	Sheridan, Wyo.
95275	Wilamson, Inc.	Bridgeport, Conn.
95348	Gardos Corp.	Bloomfield, N.J.
95354	Methods Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95964	Stancor Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West Inc.	Sunnyvale, Calif.
96095	Mi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thickness-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96366	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96503	Excel Transformer Co.	Oakland, Calif.
95733	San Fernando Elect. Mfg. Co.	San Fernando, Calif.
96681	Thompson Ind. Inc.	Long Is., N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Bean Rossiter Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98041	R-Tronics, Inc.	Jamaica, N.Y.
98159	Rubber Tech, Inc.	Gardena, Calif.
98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Selectro Corp.	Hamburack, N.Y.
98378	Zero Mfg. Co.	Burbank, Calif.
98410	Etc Inc.	Cleveland, Ohio
99731	General Mills Inc., Electronics Div.	Minneapolis, Minn.,
98734	Perce Div. of Hewlett-Packard Co.	Palo Alto, Calif.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Beacon Corp.	Whippany, N.J.
99934	Rembrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

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

00B0F	Metco Tool and Die	Los Angeles, Calif.
00B0Z	Willow Leather Products Corp.	Newark, N. J.
00BAB	ETA	England
00BBB	Precision Instrument Components Co.	Van Nuys, Calif.
00BCS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
00BHH	Rubber Eng. & Development	Hayward, Calif.
00BNN	A "H" O Mfg. Co.	San Jose, Calif.
00BQQ	Coilton	Oakland, Calif.
00BWW	California Eastern Lab.	Burlingten, Calif.
00BYY	S. K. Smith Co.	Los Angeles, Calif.

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SCHEMATIC DIAGRAMS

SECTION VII

SCHEMATIC DIAGRAMS, WAVEFORMS AND COMPONENT LOCATION INFORMATION

7-1. INTRODUCTION.

7-2. Schematics in this manual show electrical operation and are not intended to serve as wiring diagrams. Table 7-1 lists notes which apply to the schematic diagrams.

7-3. Some switch and circuit board assemblies are shown in part on different pages. To find a specific instrument component, refer to the REFERENCE DESIGNATIONS box which appears on each schematic diagram. Components are designated using the UNIT NUMBERING SYSTEM. The full designation of a component includes the assembly on which the part is mounted plus the individual part designation. For example, resistor R34 mounted on Assembly A6 would carry the full designation of A6R34. Certain parts are not included on assemblies and are listed as chassis parts. Chassis parts are assigned only the reference designation shown on the schematic diagram.

7-4. Components marked with an asterisk (*) are factory selected. Typical values are shown, and in most cases, the HP stock number for the typical value is listed in Tables 6-1 or 6-2. Component ordering information is given on Page 6-1.

Table 7-1. Schematic Diagram Symbols

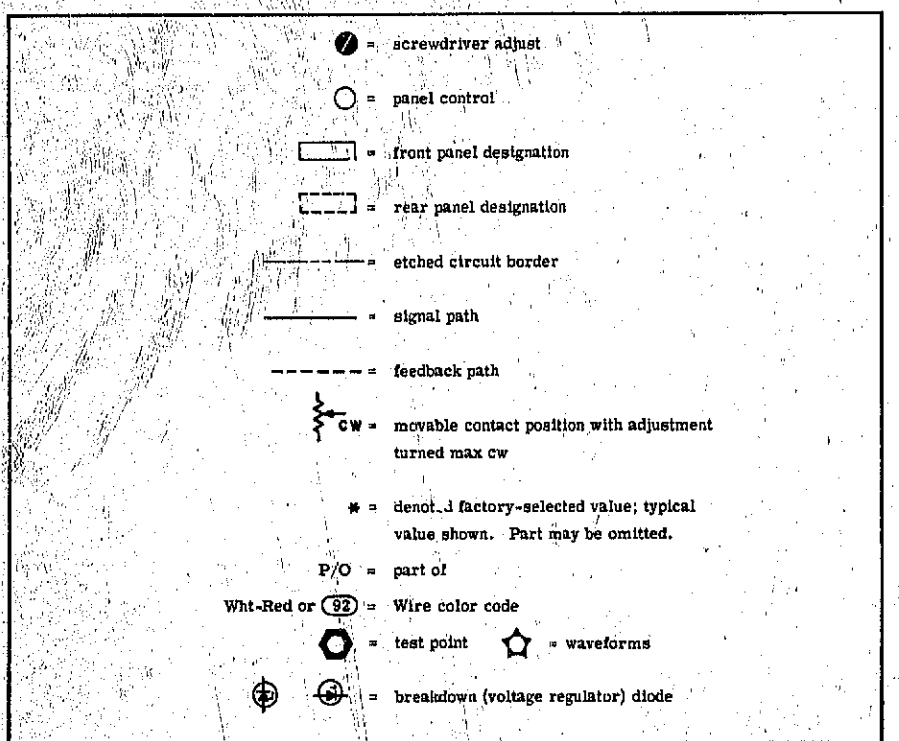


Table 7-2. Waveforms

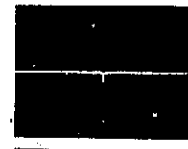
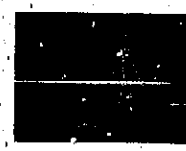
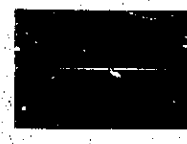
	Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	VERT DISPLAY SWTCH AND 20MC IF AMPL			
	I. F. BANDWIDTH...3KC SWEEP TIME...3MS/CM Input signal...CW			
1	VERT DISPLAY...SQ Display signal amplitude...1.4	Base, A11Q2	2 v/cm 5 ms/cm Ext sync, from 851 HORIZ OUTPUT	
2	VERT DISPLAY...SQ Displayed signal amplitude...1.4	Emitter, A11Q2	0.2 v/cm 5 ms/cm Ext sync, from 851 HORIZ OUTPUT	
3	VERT DISPLAY...LOG Displayed signal amplitude...60DB	I. F. Test Point	50 mv/cm Sweep from 851 HORIZ OUTPUT	
4	VERT DISPLAY...LOG Displayed signal amplitude...60DB	Base, A2A7Q4	2 v/cm Sweep from 851 HORIZ OUTPUT	
	851 VERTICAL AMPLIFIER			
	SYNC.....INT I. F. BANDWIDTH...1KC SPECTRUM WIDTH...10KC/CM SWEEP TIME.....3MS/CM Input signal....CW			
5		Input to A7Q10 (blanking voltage)	5 V/cm 10 ms/cm	
6		Base, A7Q11 (blanking voltage)	50 v/cm 10 ms/cm	

Table 7-2. Waveforms (Cont'd)

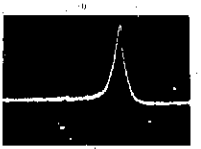
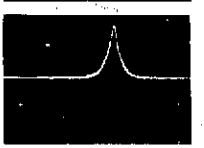
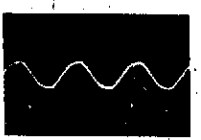
Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	851 VERTICAL AMPLIFIER (cont'd)		
SYNC..... INT I. F. BANDWIDTH..1KC SPEC WIDTH.....10KC/CM SWEEP TIME.... 3MS/CM Input signal..... CW			
7	Base, A7Q14 (video)	1 v/cm 10 ms/cm	
8	Collector, A7Q14	50 mv/cm 10 ms/cm	
9	Collector, A7Q15	10 v/cm 10 ms/cm	
10	Collector, A7Q13	0.1 v/cm Sweep from 851A HORIZ OUTPUT	
11	Collector, A7Q12	10 v/cm Sweep from 851A HORIZ OUTPUT	
Unless otherwise specified: SYNC..... LINE SWEEP TIME..3MS/CM	SWEEP & HORIZ AMPLIFIER		
12	Base, A8Q1	10 v/cm 5 ms/cm	
13	Collector, A8Q1	10 v/cm 5 ms/cm	

Table 7-2. Waveforms (Cont'd)

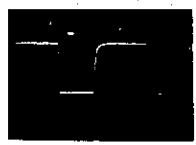
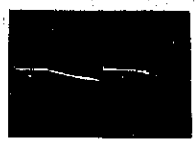
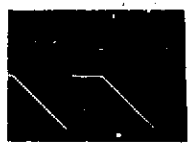
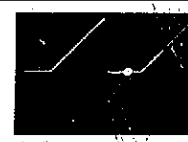
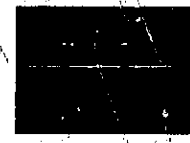
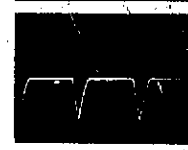
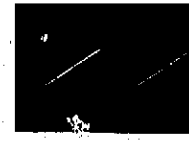
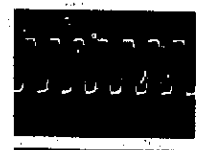
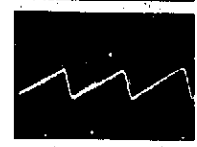
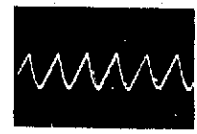
Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	SWEEP & HORIZ AMPLIFIER (cont'd)		
SYNC ..... LINE SWEEP TIME..3MS/CM			
14	Base, A6Q7	2 v/cm 10 ms/cm	
15	Base, A6Q9	2 v/cm 10 ms/cm	
16	Base, A6Q15	5 v/cm 10 ms/cm	
17	Collector, A6Q12	0.5 v/cm 10 ms/cm	
18	Emitter, A6Q14	5 v/cm 10 ms/cm	
19	Connector, A6Q3	5 v/cm 10 ms/cm	
20	Collector, A6Q16	20 v/cm 10 ms/cm	

Table 7-2. Waveforms (Cont'd)

	Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
		SWEEP & HORIZ AMPLIFIER (cont'd)		
21	SYNC ..... LINE SWEEP TIME...3MS/CM	Collector, A8Q17	20 v/cm 10 ms/cm	
22	SYNC..... INT SWEEP TIME...3MS/CM	Base, A8Q7	5 v/cm 10 ms/cm	
23	SYNC..... INT SWEEP TIME...3MS/CM	Collector, A8Q5	5 v/cm 10 ms/cm	
24		Collector, A8Q13	5 v/cm 10 ms/cm	
		HIGH-VOLTAGE SUPPLY AND CRT		
25		Base, Q1 Q2	5 v/cm 50 us/cm	
26		Collector, Q1 Q2	10 v/cm 50 μs/cm	
		LOW-VOLTAGE POWER SUPPLY		
27		Junction, A9R1 A9R2	2 v/cm 5 ms/cm	
28		Collector, A9Q1	5 v/cm 5 ms/cm	

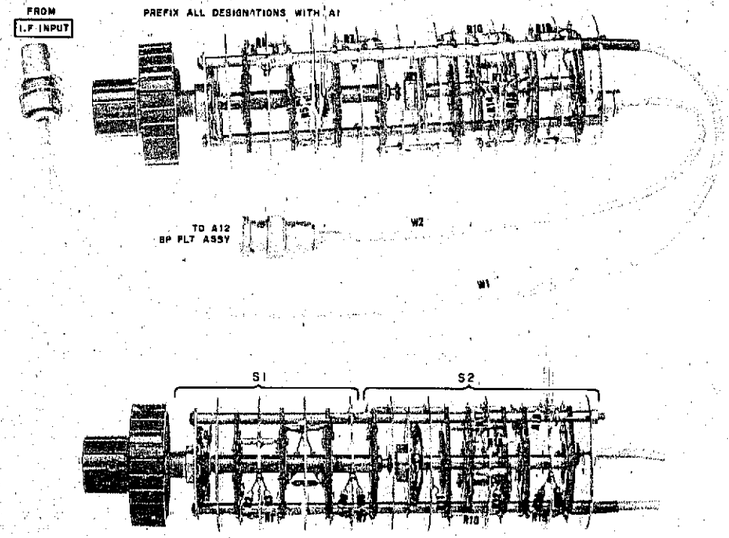


Figure 7-1. I.F. GAIN (DB) Switch Assembly A1, Component Identification

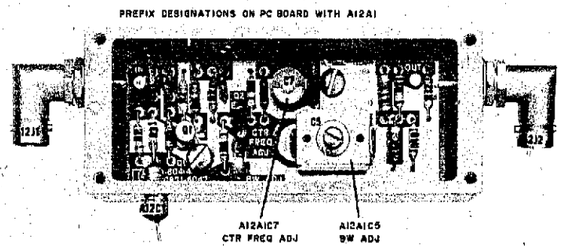


Figure 7-2. Bandpass Filter Assembly A12, Component Identification

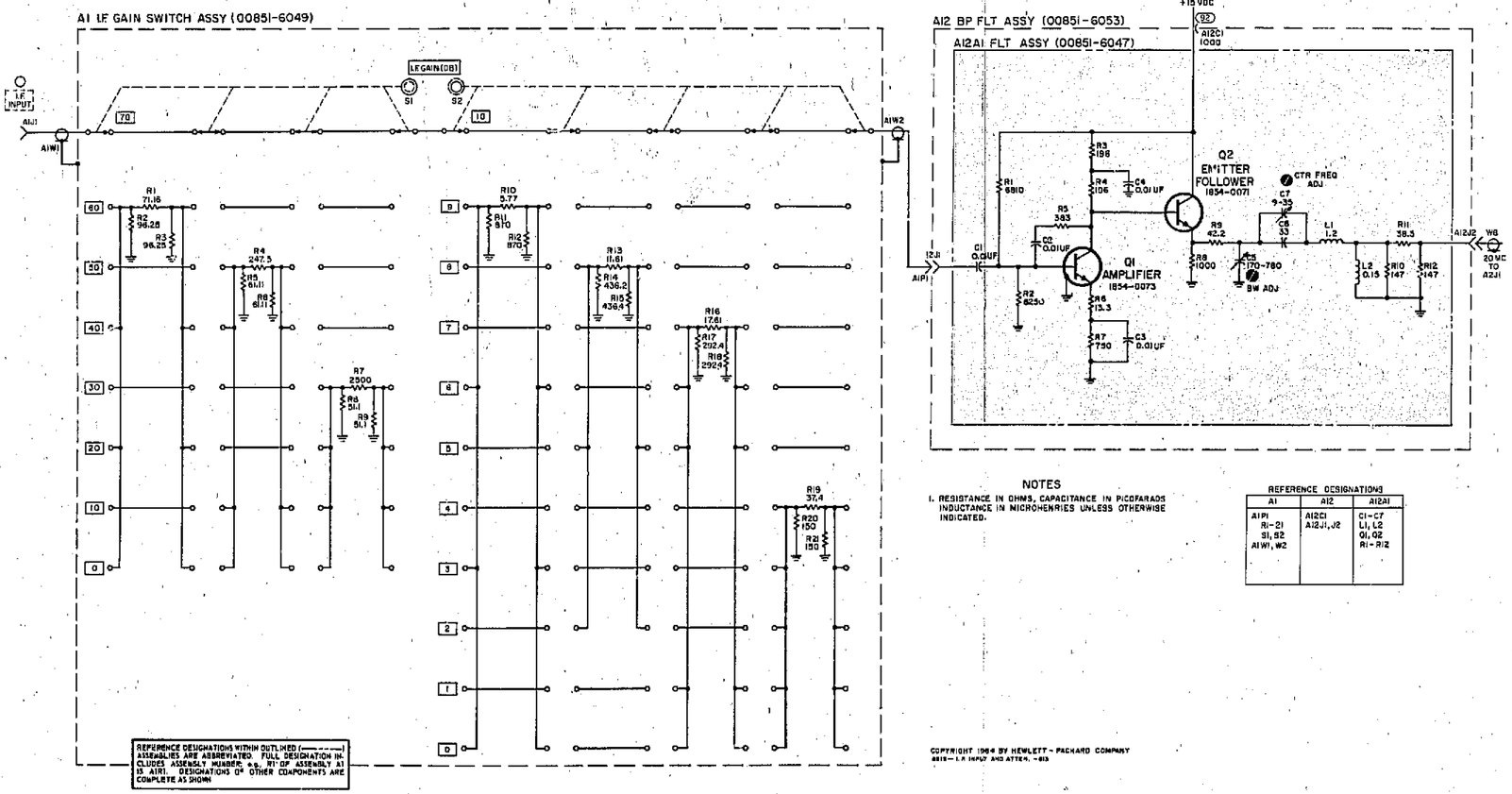


Figure 7-3. 20 MC IF Input and Attenuator Schematic

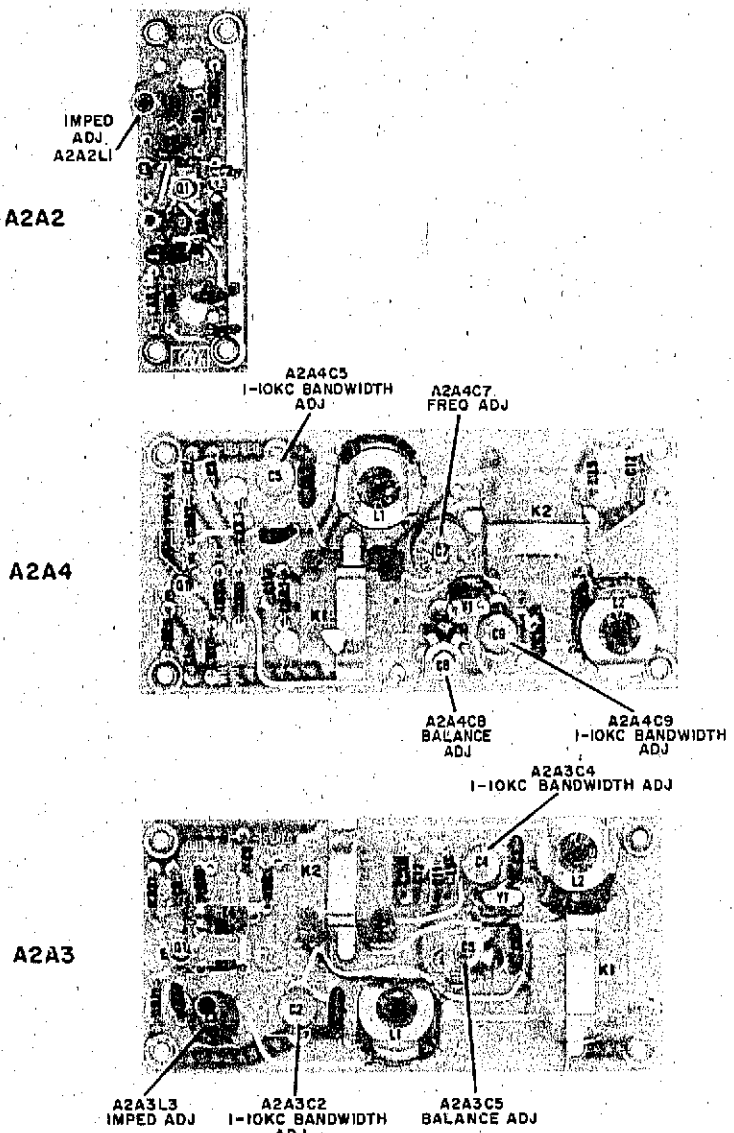


Figure 7-4. RF Circuit Assembly Boards A2A2, A2A3, A2A4

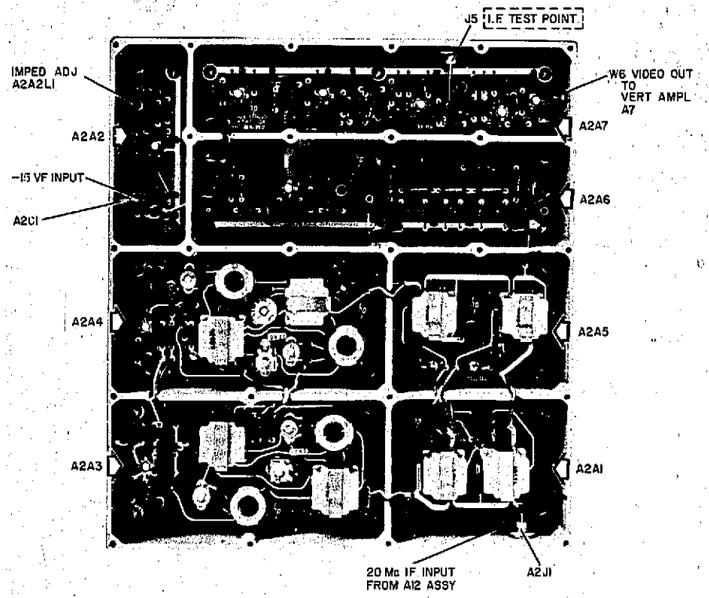


Figure 7-5. (A2) RF Circuit Assembly, Cover Removed

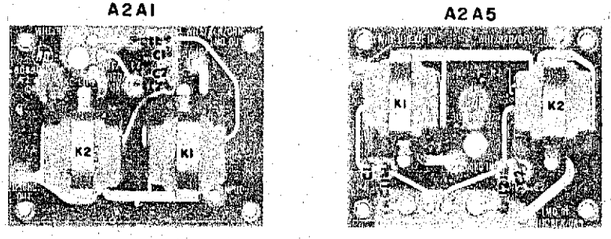


Figure 7-6. RF Circuit Assembly Boards A2A5 and A2A1

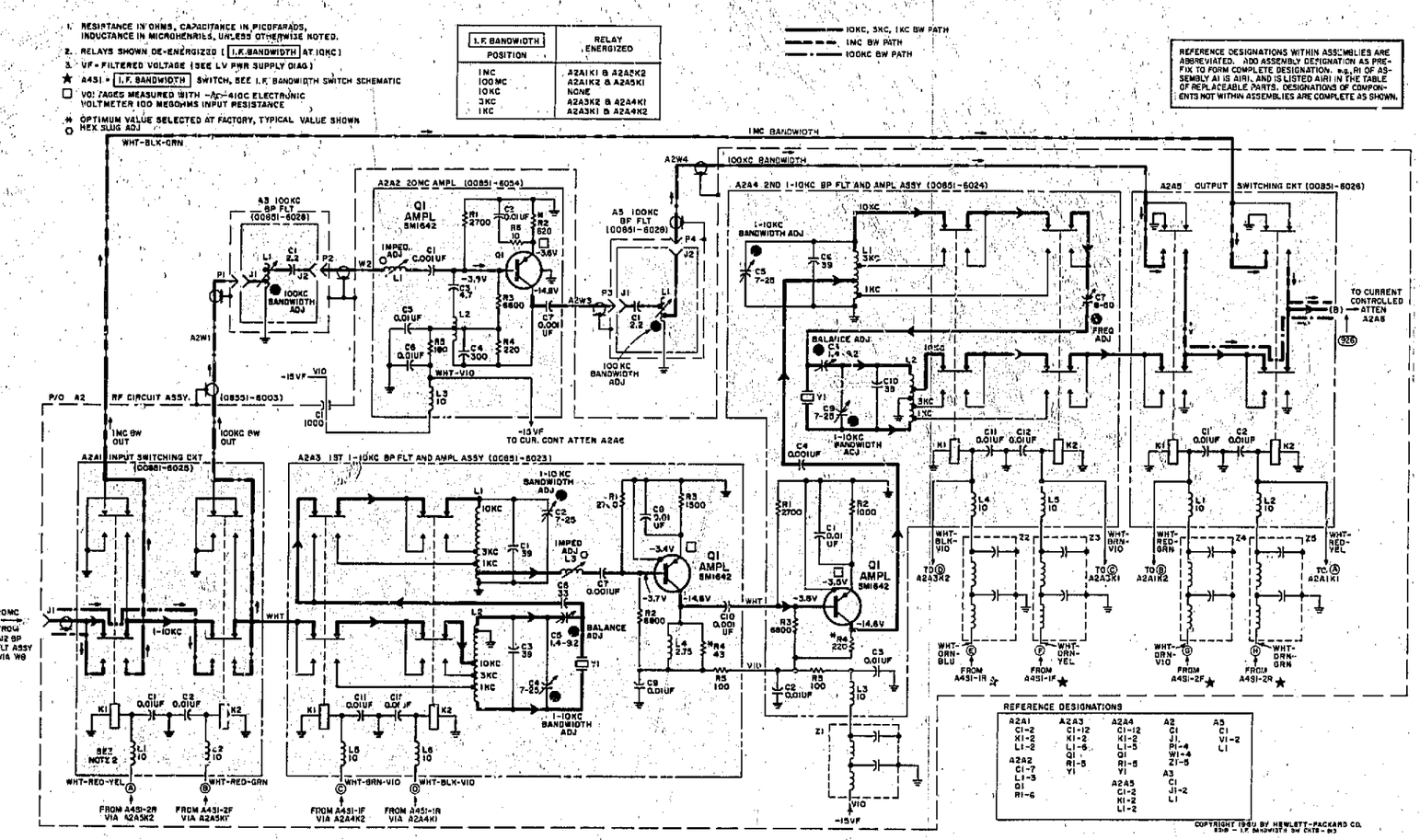


Figure 7-7. IF Bandwidth Switching Circuits Schematic

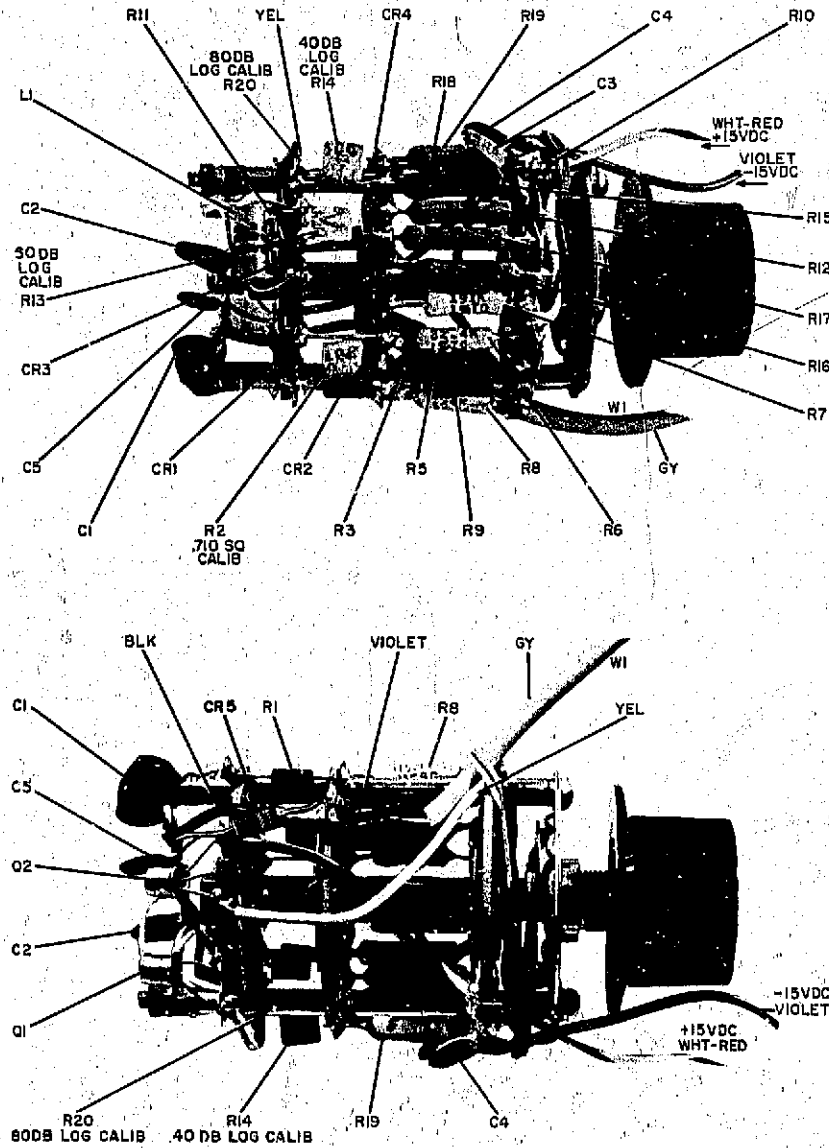


Figure 7-8. VERT DISPLAY Switch A11

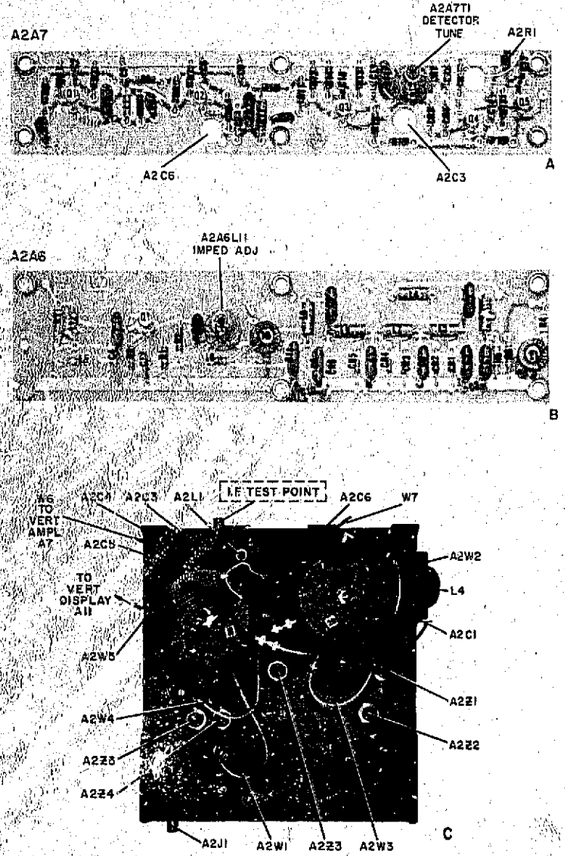
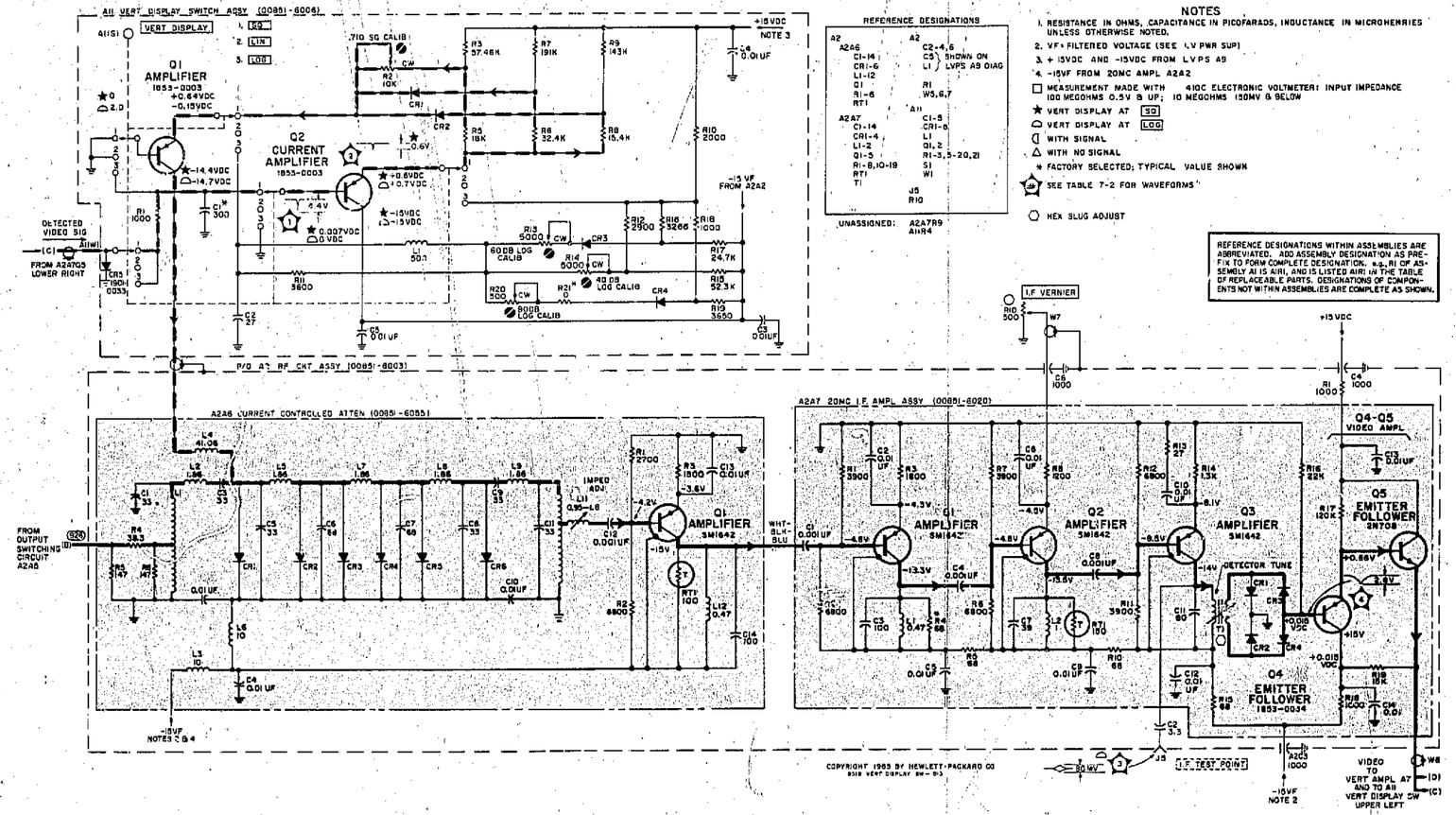


Figure 7-9. RF Circuit Assembly Boards A2A6, A2A7, and Rear of Casting



REFERENCE DESIGNATIONS

A2	A2
A2A6	C2-4,5
C1-14	C8 } SHOWN ON
CR1-6	L1 } LVPS A9 DIAG
L1-12	
Q1	R1
R1-6	W5,6,7
RT1	
A2A7	A11
C1-14	C1-5
CR1-4	CR1-6
L1-2	L1
Q1-5	Q1,2
R1-8,10-19	R1-3,5-20,21
RT1	S1
T1	W1
	J5
	R10

UNASSIGNED: A2A7R9 A11R4

NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS, INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE NOTED.
2. VF = FILTERED VOLTAGE (SEE LV PWR SUP)
3. +15VDC AND -15VDC FROM LVPS A9
4. -15VF FROM 20MC AMPL A2A2
- MEASUREMENT MADE WITH 410C ELECTRONIC VOLTMETER: INPUT IMPEDANCE 100 MEGOHMS 0.5V & UP; 10 MEGOHMS 150MV & BELOW
- ★ VERT DISPLAY AT SQ
- VERT DISPLAY AT LOG
- WITH SIGNAL
- △ WITH NO SIGNAL
- * FACTORY SELECTED; TYPICAL VALUE SHOWN
- SEE TABLE 7-2 FOR WAVEFORMS
- HEX SLUG ADJUST

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION. e.g., R1 OF ASSEMBLY A1 IS A1R1, AND IS LISTED A1R1 IN THE TABLE OF REPLACEABLE PARTS. DESIGNATIONS OF COMPONENTS NOT WITHIN ASSEMBLIES ARE COMPLETE AS SHOWN.

Figure 7-10. VERT DISPLAY Switch, Current-Controlled Attenuator, and 20 MC IF Amplifier Schematics

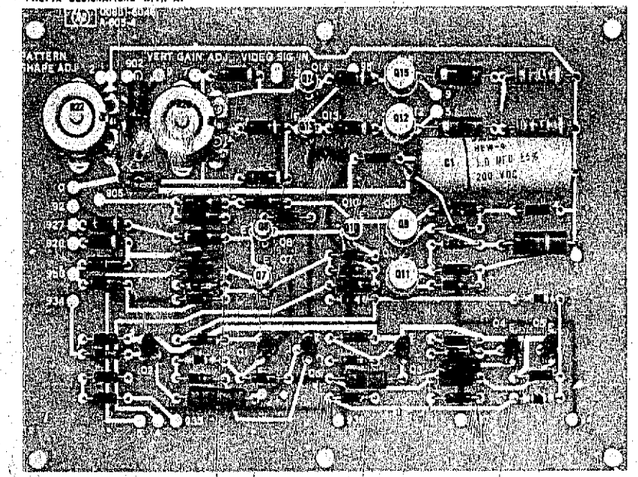


Figure 7-11. Vertical Amplifier A7 Board

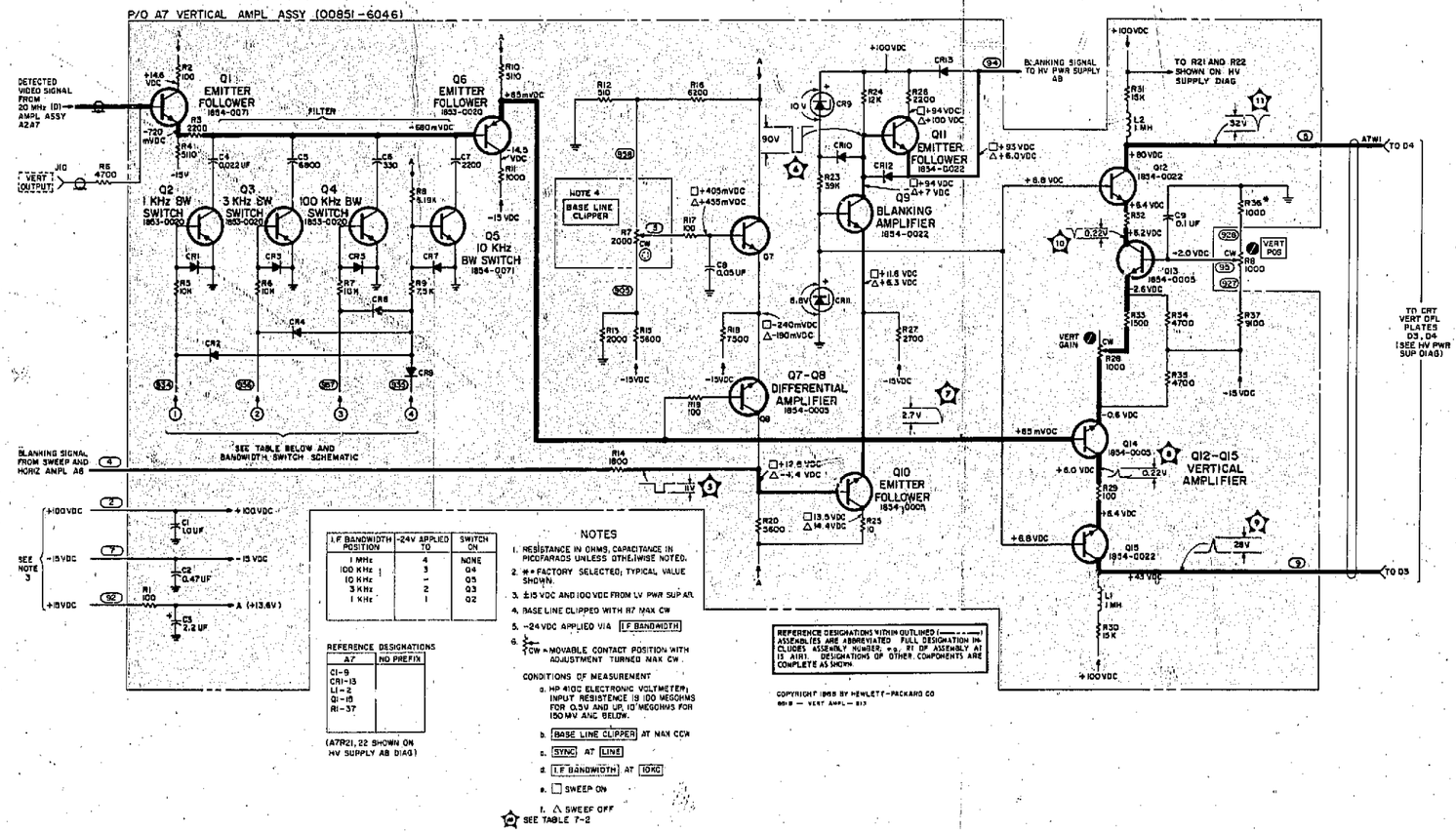


Figure 7-12. Vertical Amplifier Schematic

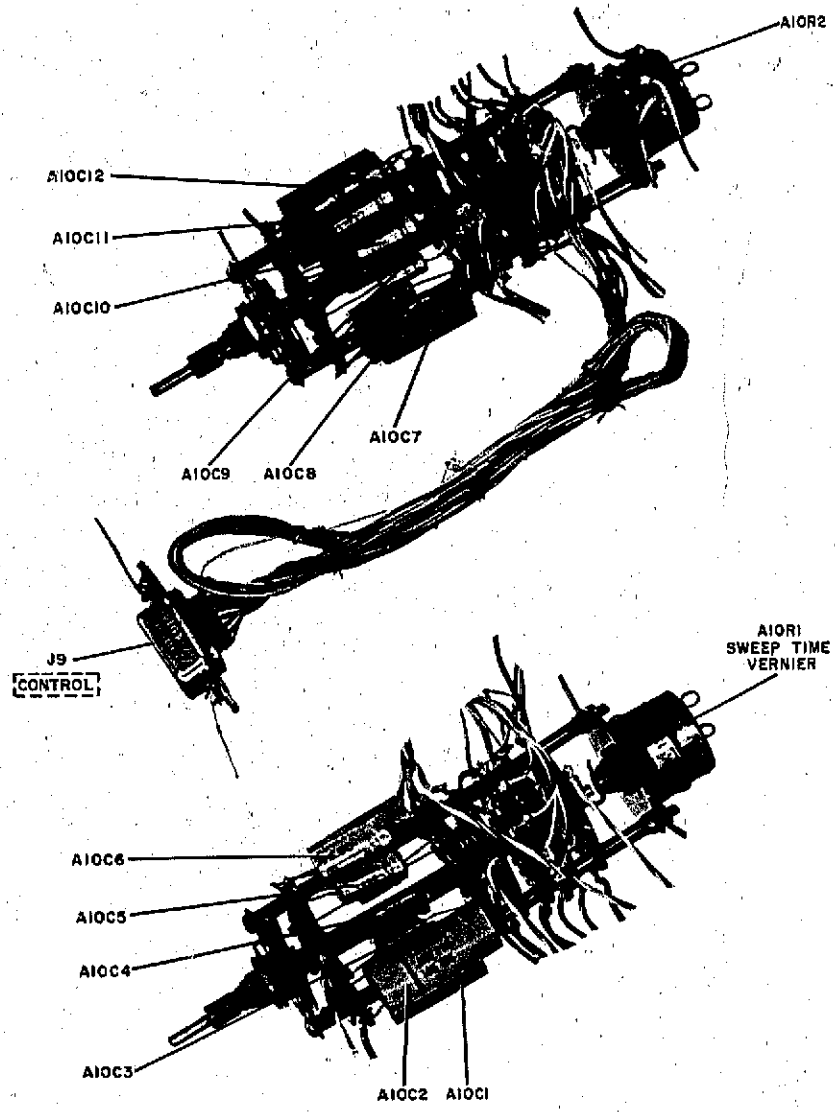


Figure 7-13. SWEEP TIME Switch A10S1, Component Identification

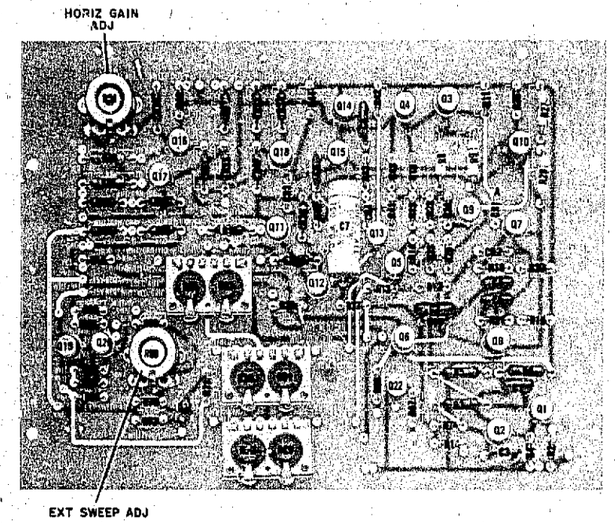


Figure 7-14. Sweep and Horizontal Amplifier A6 Board

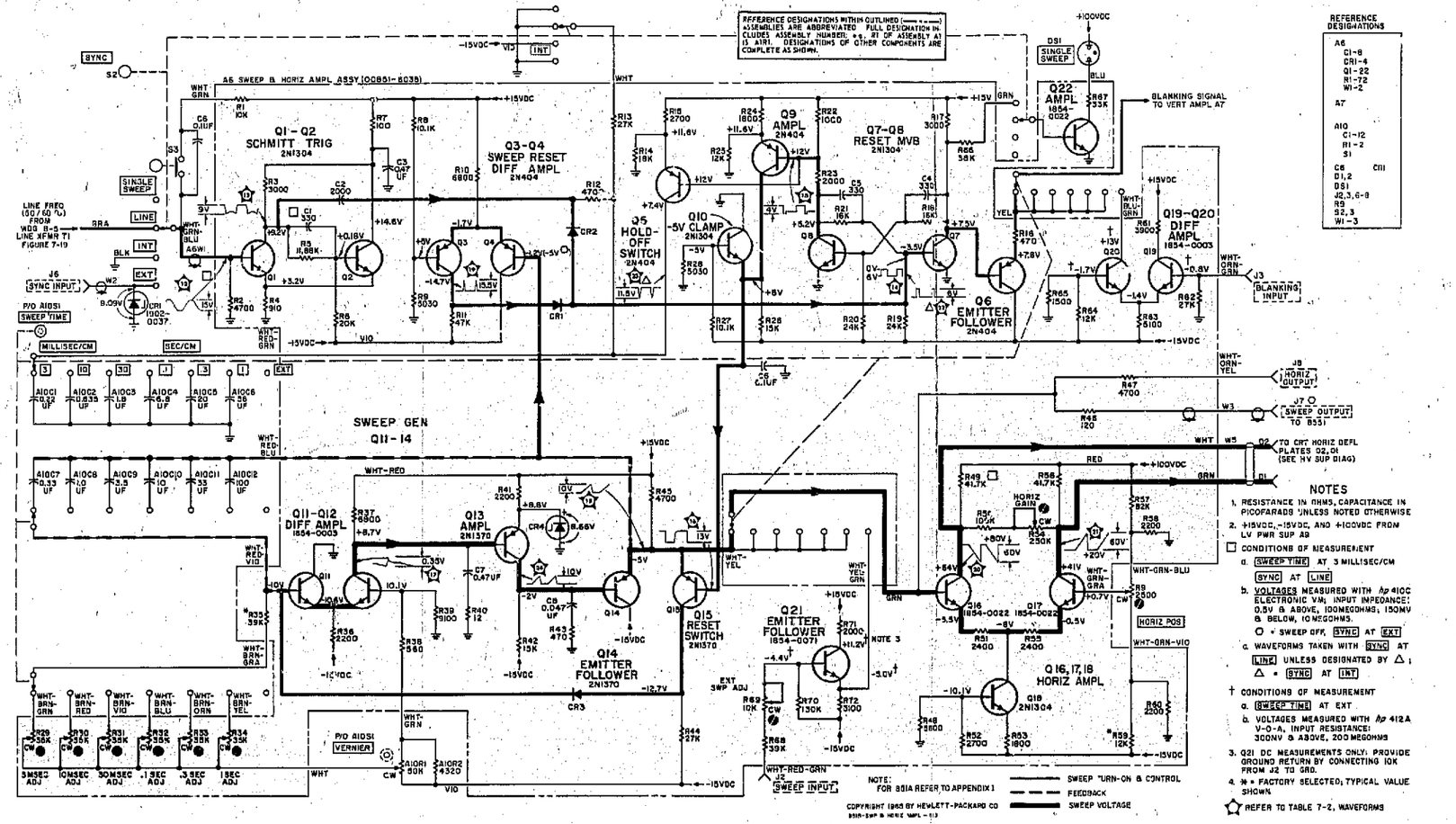


Figure 7-15. Sweep and Horizontal Amplifier Schematic

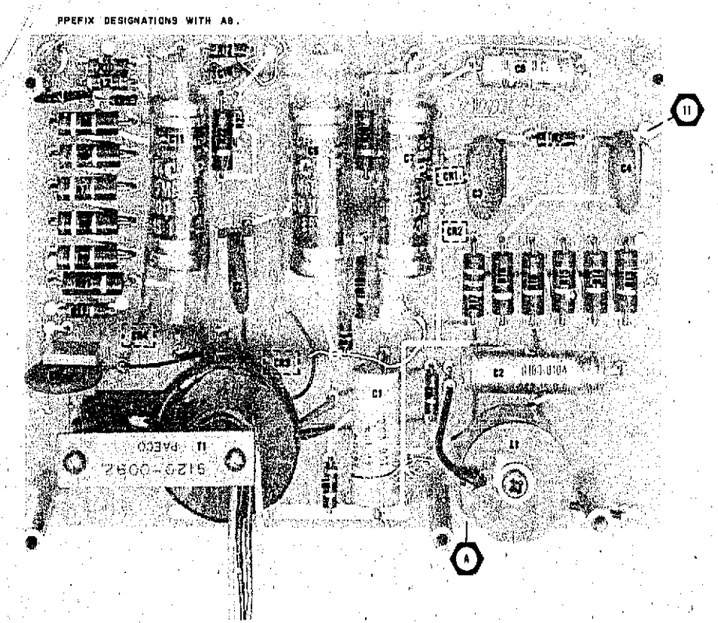


Figure 7-16. HV Power Supply A8 Board

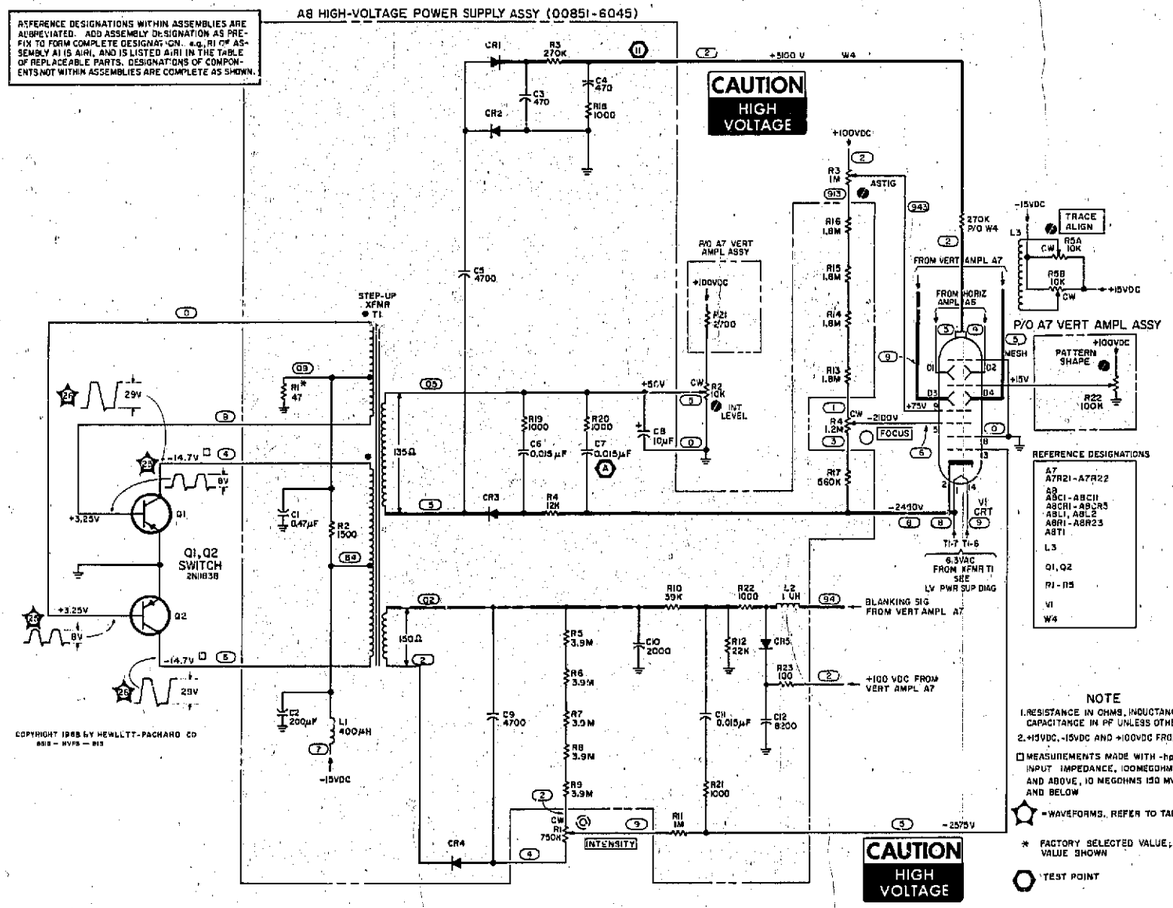


Figure 7-17. HV Power Supply Schematic

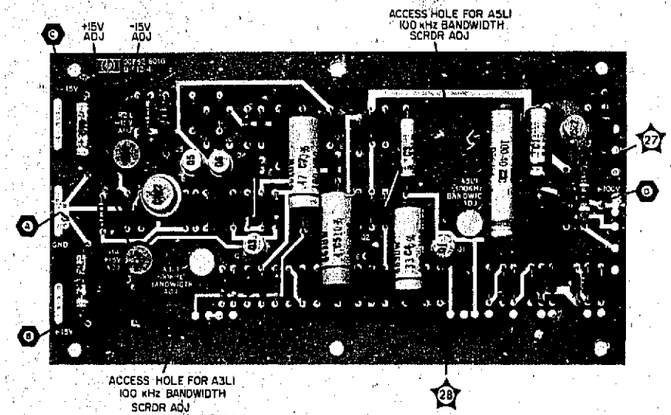


Figure 7-18. LV Power Supply A9 Board

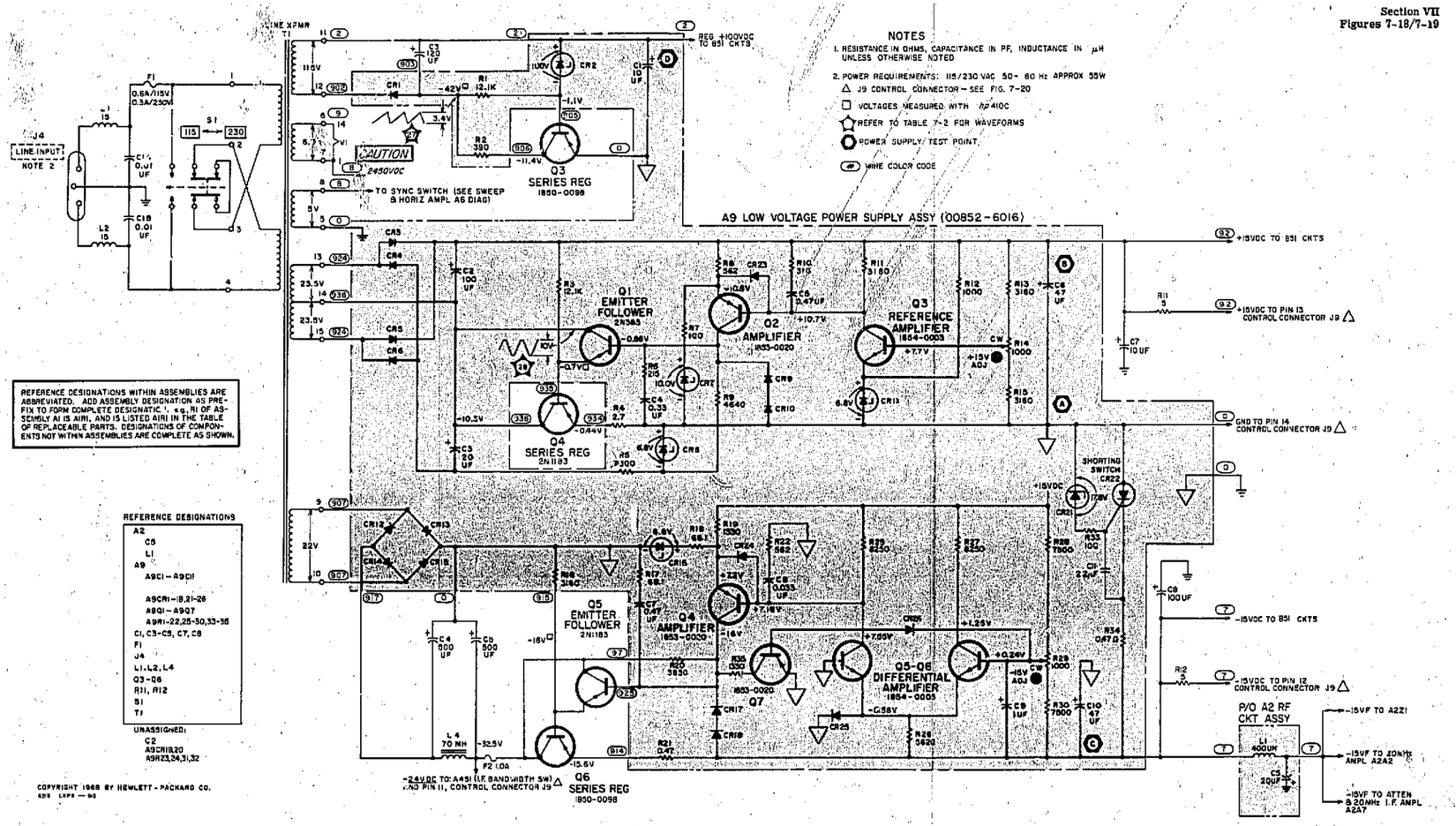
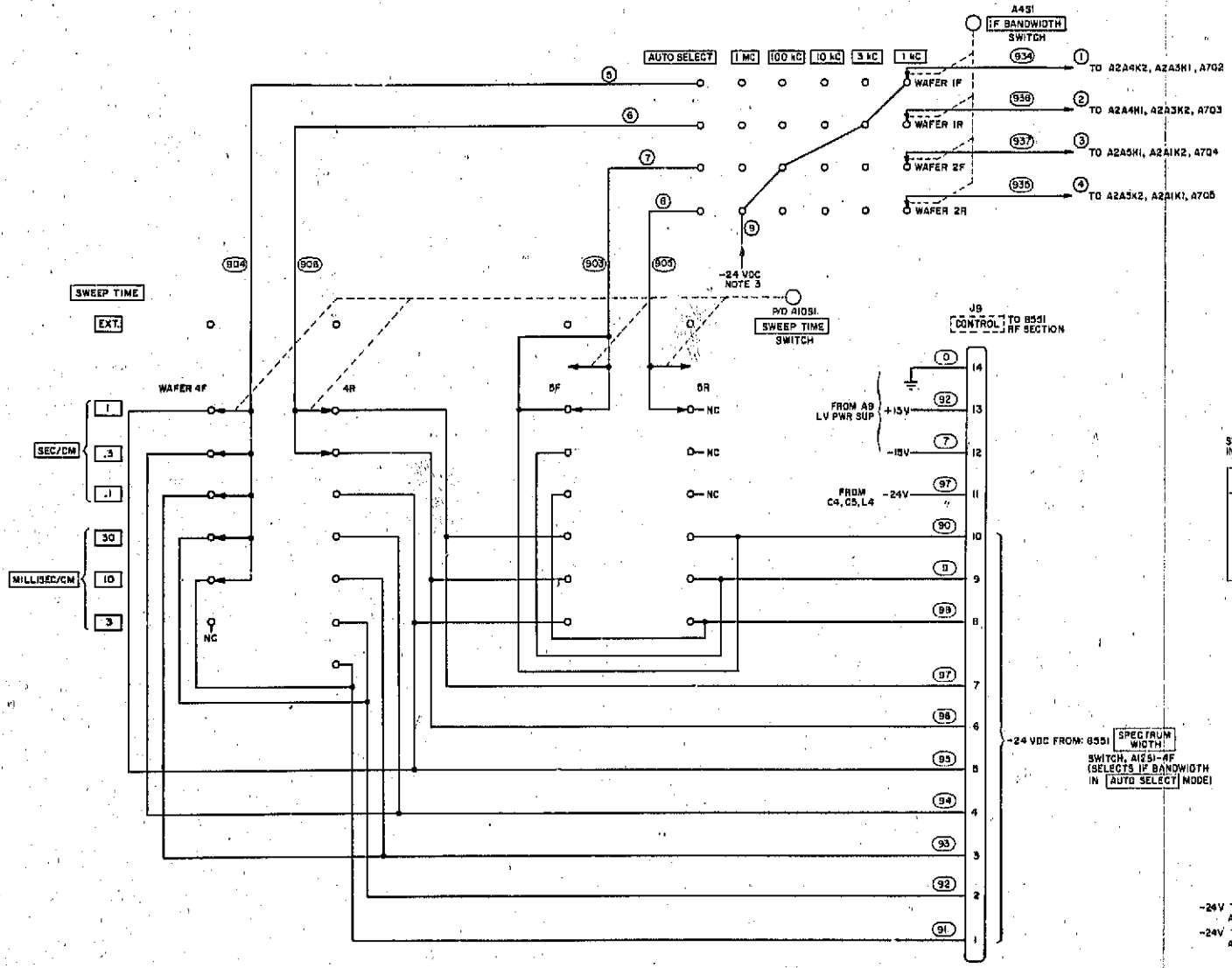


Figure 7-19. LV Power Supply Schematic



NOTE:

1. 10 kC BANDWIDTH SELECTED WHEN NO RELAYS IN THE A2 RF CIRCUIT ASSY ARE ENERGIZED
2. SWITCH POSITIONS:
   a). A431 IF BANDWIDTH : 1 kC
   b). A10S1 SWEEP TIME : 1 SEC
3. IF BANDWIDTHS ARE SELECTED BY SWITCHED -24 VDC AT A431.

NOTE

SWITCH VIEWED FROM KNOB END, IN MAX CCW POSITION (1 kC)

CODE	A431 POS
1	1 kC
2	3 kC
3	10 kC
4	100 kC
5	1 MC
6	AUTO SELECT

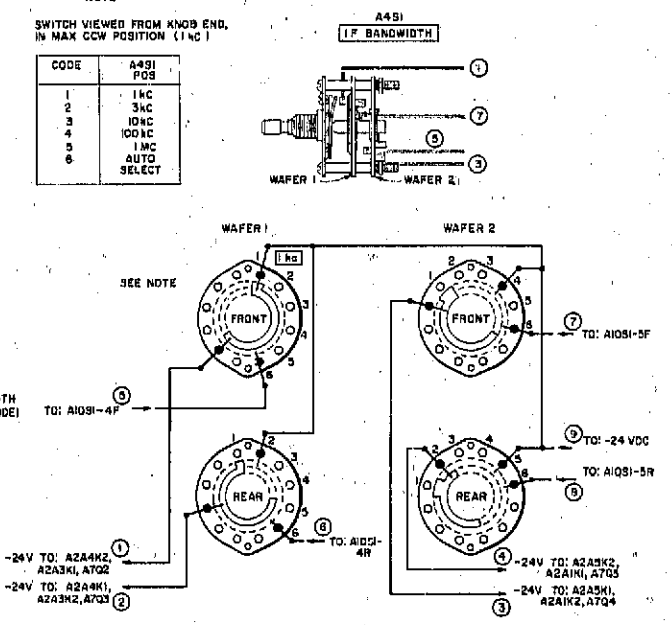


Figure 7-20. IF Bandwidth Switching Schematic

APPENDIX A

APPENDIX I
BACKDATING AND MODIFICATION INFORMATION

A1-1. INTRODUCTION.

A1-2. This appendix is provided to backdate the manual for 851A and earlier 851B models. Difference information is arranged in tabular form (Tables A1-1 and A1-2). Earliest versions are shown in the far left column. Changes are listed by serial number.

A1-3. Components not in the 851A, but in the 851B, are listed in Table A1-1 as NOT ASSIGNED. Stock numbers and descriptions of each part added, changed, or deleted are listed in Tables A1-1 and A1-2.

A1-4. Also included are sections of HP Service Notes describing modifications that may be made to the 851A and the 851B.

A1-5. 851A/8551A EXTERNAL SWEEP OPERATION.

A1-6. The 851A has no provision for external sweep operation. To drive the 851A from an external sweep voltage the instrument must be modified as described in HP Service Note 851A-3, part of which is contained in this appendix under 851A EXTERNAL SWEEP INPUT INSTALLATION.

A1-7. SERVICE NOTE EXTRACTS.

A1-8. 851A IMPROVED 1-MC LOG DISPLAY.

A1-9. To improve the waveshape of the 1-Mc IF bandwidth response in LOG in HP Model 851A Spectrum Analyzer Display sections, serials below 439-00402, change A11C1 on the vertical display assembly to a capacitor, fixed mica, 300 pF ±1%, 300 VDCW, HP stock number 0140-0225. No recalibration is required when A11C1 is changed.

A1-10. 851A VIDEO AMPLIFIER CIRCUIT PROTECTION.

A1-11. To prevent the video signal line connected to the base of A7Q8 from going positive and possibly damaging transistors in the video amplifier, add Diode A11CR5 to the vertical display switch assembly in HP Model 851A Spectrum Analyzers display sections, all serials.

A1-12. The diode, HP stock number 1901-0033, is added between the center conductor on cable W1, where it connects to the vertical switch assembly, and ground. The diode is connected with the cathode toward ground. No recalibration of the instrument is required upon completion of this modification.

A1-13. 851A EXTERNAL SWEEP INPUT INSTALLATION.

A1-14. This procedure describes installation of the external sweep input modification in HP Model 851A Spectrum Analyzer Display Sections, all serials.

A1-15. The modification consists of installing an external sweep input assembly, a BNC connector, and a switch. A hand drill is required for making holes in the rear panel to mount the BNC connector and switch.

A1-16. Parts included in external sweep modification kit, HP stock number 00851-6042:

Qty	Description	HP Stock Number
1	External Sweep Assembly	00851-6044
1	Connector, BNC	1250-0001
1	Washer, BNC	2190-0016
2	Binding Head Screw with L/W 6-32 x 1/2"	2390-0001
1	Nut, BNC	2950-0001
2	Nut, Hex Switch 15/32-32	2950-0035
1	Lockwasher, Switch 15/32" I.D.	3050-0050
1	Switch, DPDT	3101-0038
1	ON-OFF Switch Plate	7122-0006

A1-17. Replacement parts list for external sweep board assembly 00851-6041:

Ref. Desig.	Description	HP Stock Number
R46	Resistor, Fixed, Comp, 1.2K ±5%, 1/4W	0683-1215
R47	Resistor, Fixed, Mtl. Ox., 4.7K ±5%, 1/2W	0758-0005
R68	Resistor, Fixed, Comp, 39K ±5%, 1/2W	0683-3935
R69	Resistor, Var., Comp, 10K ±20%, Lin, 1/5W	2100-0092
R70	Resistor, Fixed, Comp, 130K ±5%, 1/4W	0683-1345
R71	Resistor, Fixed, Comp, 2K ±5%, 1/4W	0683-2025
R72	Resistor, Fixed, Comp, 5.1K ±5%, 1/4W	0683-5125
Q21	Transistor, Silicon NPN 2N3391	1854-0071
	Board, Etched Circuit	00851-2041

A1-16. MODIFICATION PROCEDURE.

a. Disconnect power. Remove top and bottom covers.

b. Remove screws supporting power supply assembly from rear panel.

c. Remove screws holding front of power supply.

d. Use center punch to mark hole location on rear panel about 1/2 inch above horizontal and vertical output connectors.

e. Drill a 3/8-inch hole. Mount BNC connector for external sweep input.

f. Use center punch to mark hole location for external sweep input switch on rear panel. Switch is mounted between the vertical output connector and the rear circuit shield.

g. Drill a 15/32-inch hole. Mount switch. Use ON-OFF plate.

h. Refer to Figure A1-1. Remove A6R46 and A6R47 from horizontal amplifier board.

i. Remove conductor between R46 and R47 from board.

j. Refer to Figure A1-2. Mount external sweep input assembly at place shown. Component side of external sweep assembly should be toward horizontal sweep assembly A6.

k. Unsolder yellow wire from A6R16. Remove from wiring harness. Unsolder other end from A7R5.

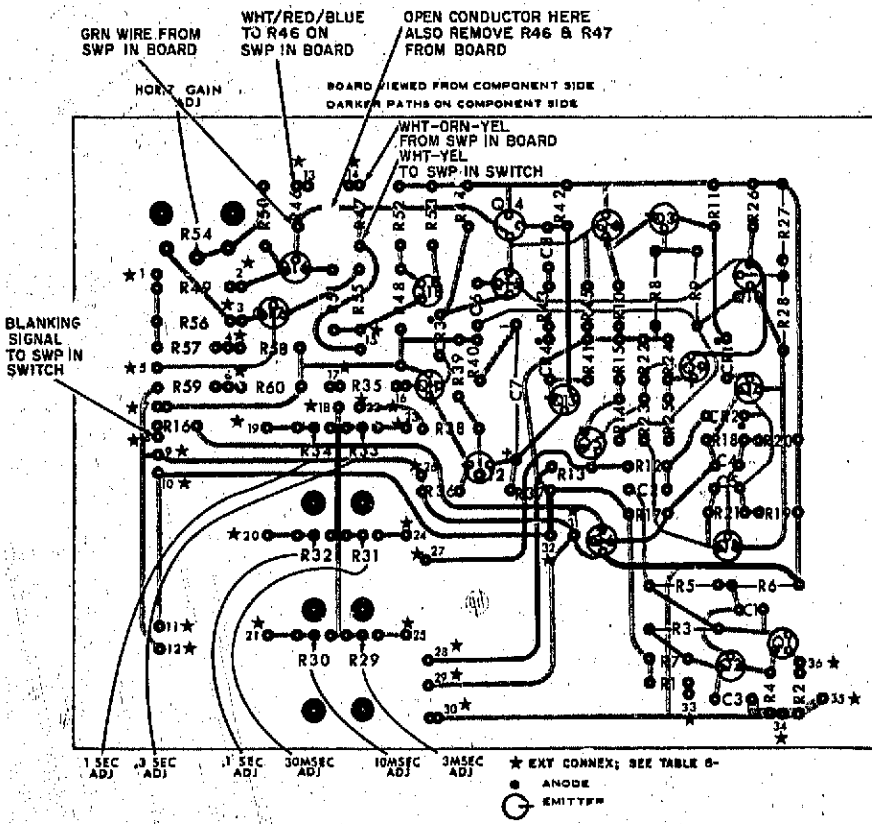


Figure A1-1. Horizontal Sweep Assembly Changes

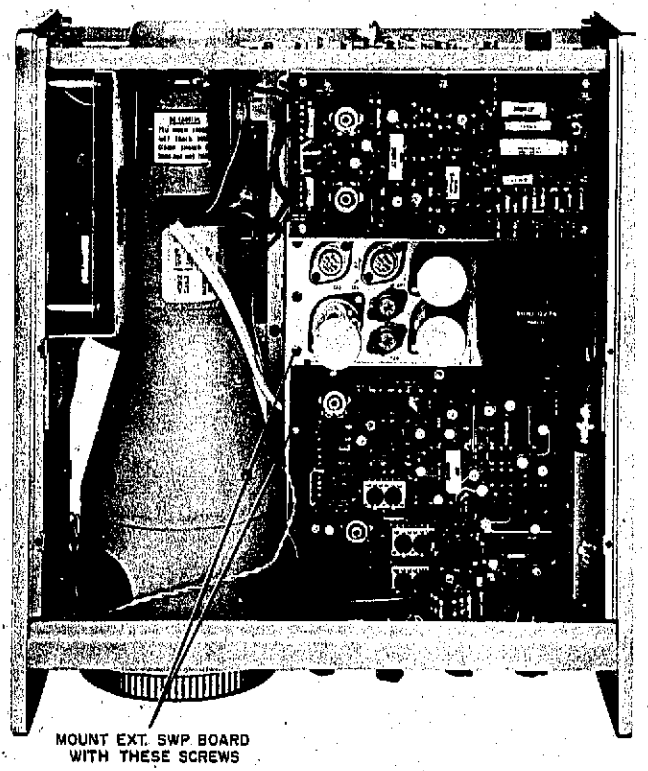


Figure A1-2. External Sweep Assembly Mounting Location

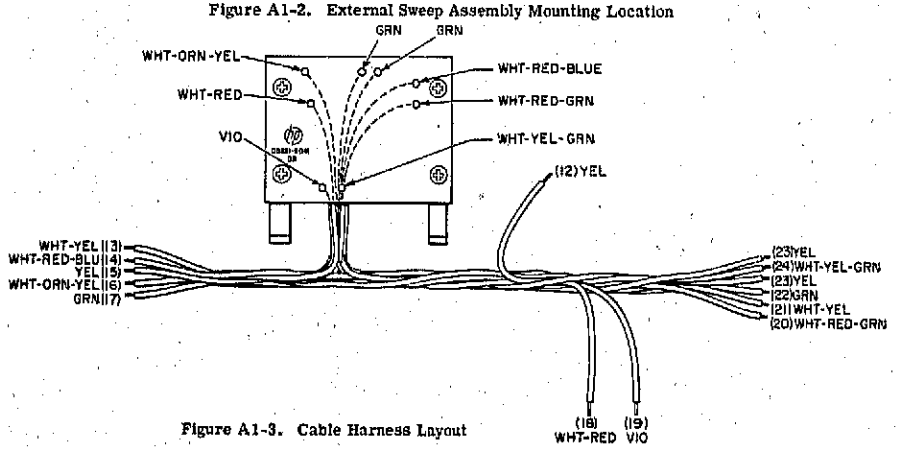


Figure A1-3. Cable Harness Layout

NOTE

The numbers next to the wire colors in Figure A1-3 refer to the following steps.

l. Connect yellow wire to A7R5.

NOTE

Connections n-r are to bottom of A6 Horizontal Sweep Assembly.

m. Connect white-yellow wire to inside terminal of A6R47.

n. Connect white-red-blue wire to outside terminal of A6R48.

o. Connect yellow wire to A6R16.

p. Connect white-orange-yellow wire to outside terminal of A6R47.

q. Connect green wire to inside terminal of A6R46.

r. Connect white-red wire to positive side of A2C4, located just behind 100-kc filter assembly A3. This is +15-volt supply.

s. Connect violet wire to terminal strip just behind 100-kc filter assembly A3. Connect to terminal with violet wire already installed. This is -15-volt supply.

NOTE

For following steps see Figure A1-4.

t. Connect white-red-green wire to external sweep in BNC connector.

u. Connect white-yellow wire to external sweep input switch.

v. Connect green wire to center terminal of external sweep input switch.

w. Connect the two yellow wires to external sweep input switch. Interchanging leads will not affect circuit operation.

x. Connect white-yellow-green wire to external sweep input switch.

y. Remount screws holding low voltage power supply assembly.

A1-19. A 0- to about +15-volt sawtooth voltage from a 10,000-ohm source is needed for full horizontal deflection. Control R69 on the external sweep assembly adjusts the amount of deflection on the CRT when external sweep is being used.

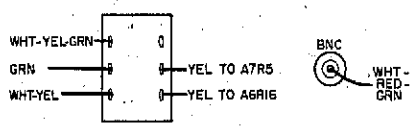


Figure A1-4. External Sweep Input Switch and BNC Connections

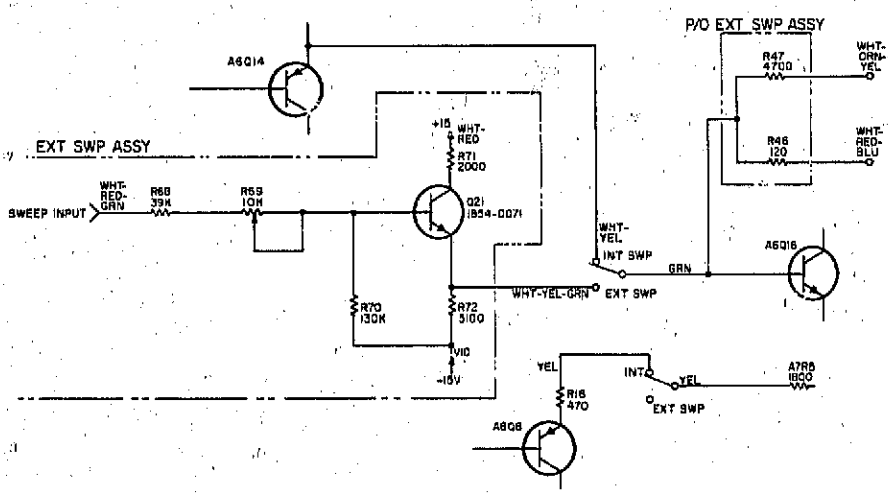


Figure A1-5. Horizontal Sweep Circuit After External Sweep Modification

A1-20. 851A/B IMPROVED SWEEP OSCILLATOR STABILITY.

A1-21. For improved sweep oscillator stability in HP Model 851A, all serials, and HP Model 851B, serials below 526-00201, change Resistor A5R13, on the sweep and horizontal amplifier assembly to a Resistor, Fixed, Composition, 470 ohms ± 5%, 1/4 watt, HP stock number 0683-4715. No recalibration is required after this change.

A1-22. 851A/B IMPROVED VERTICAL AMPLIFIER SURGE PROTECTION.

A1-23. This procedure outlines modification of HP Model 851A/B Spectrum Analyzer Display Sections, HP Model 851A, all serials, HP Model 851B, serials below 526-00226, for improved vertical amplifier surge protection. The modification consists of adding a resistor in series with the blanking signal output from the A6 Vertical Amplifier Assembly. The resistor reduces the surge current if the high voltage power supply should arc to ground.

A1-24. No special tools are required for the procedure. No recalibration is required after the modification.

A1-25. PARTS REQUIRED.

Qty	Description	HP Stock Number
1	Strip, 1-Terminal	0360-0011
1	Resistor, Fixed, Composition 1000 ohm ±10%, 1/2 watt for A7R26	0687-1021

A1-26. MODIFICATION PROCEDURE.

a. Disconnect power. Remove bottom cover.

b. Disconnect white-yellow wire next to Relay A7K3, from A7 Vertical Amplifier Assembly.

c. Install terminal strip using screw next to A7K3.

d. Connect 1000-ohm Resistor A7R26 between ungrounded terminal on terminal strip and white-yellow eyelet on A7.

e. Connect white-yellow wire to terminal strip end of A7R26.

A1-27. 851A/B INCREASED POWER SUPPLY RELIABILITY.

A1-28. In 851A (all serials) and 851B (serials below 526-00480) Spectrum Analyzer Display Sections, the power supply reliability can be improved by increased insulation of Emitter Follower Q5. When replacing Q5, two (2) mica insulators, HP stock number 1200-0078, should be used between the body of the transistor and the chassis. Be sure to use silicon grease, Dow Corning 5 Compound (HP stock number 8500-0059) between the transistor, mica insulators, and chassis for effective heat transfer.

A1-29. 851A/B RECOMMENDED REPLACEMENT TRANSISTOR.

A1-30. The recommended replacement for transistor A2A7Q4 in the HP Model 851A/B is stock number 1853-0034. This transistor eliminates the need for selecting A2A7Q4 for good video linearity. The new transistor should only be used if the old transistor fails.

Table A1-1. 851A Backdating Changes

Ref Desig	Instrument Serial Numbers				
	439-00101	439-00201	439-00251	439-00301	439-00402
A6	00851-6018 Bd. Assy: Sweep & Horiz. Ampl.				
A6Q19 - A6Q22	N/A				
A6R35	0759-0051 R:fxd met flm 43K 5% 1/2W				
A6R43	0683-1025 R:fxd comp 1000 ohm 5% 1/4W				
A6R61 - A6R72	N/A				
A6TB1	00851-2005 Blank PC Board				
A6R59	0758-0012 R:fxd met flm 12K 5% 1/2W				
A7C2	0160-0174 C:fxd cer 0.47 μF 80% 25 VDCW				
A7R19	0758-0089 R:fxd met ox 56K 5% 1/2W				
A7R26	N/A				
A8C6	0160-0062 C:fxd paper, 0.015μF 10% 3000 VDCW		0160-2054 C:fxd my 0.015μF 10% 3000 VDCW		
A8C7	0160-0062		0160-2054		
A8C11	0160-0062		0160-2054		
A8R1	0687-6801 R:fxd comp 68 ohm 10% 1/2W				
A8R17	0690-8241 R:fxd comp 820K 10% 1W			0690-5641 560K	
A9C10	0180-0151 C:fxd TA 47μF 20% 35 VDCW				
A10	00851-6004 Switch Assy: SWEEP TIME				
A10S1	3100-0738 Rotary Switch				
A11C1	0160-0134 C:fxd mica 320 pF 5% 300 VDCW				0140-0225

Notes: N/A = Not Assigned (*) Factory Selected Part; Typical Value Given
Refer to Table 6-3, Replaceable Parts for part descriptions not shown.

Table A1-1. 851A Backdating Changes (Cont'd)

Ref Desig	Instrument Serial Numbers				
	439-00101	439-00201	439-00251	439-00301	439-00402
A11CR5	N/A				
A11R18	0721-0002 R:fxd depc 1.3K 1% 1/8W	0727-0101 1.03K 1% 1/2W			
A11R19	0727-0136 R:fxd depc 5030 ohm 1% 1/2W	0727-0398 3.79K 1/2% 1/2W			
A11R21	N/A				
A12J2	1250-0149 Connector:RF jack chassis right angle				
CHASSIS PARTS					
CR1	N/A				
J1-J3	N/A				
J8	1510-0006 Black Binding Post				
	1510-0007 Red Binding Post				
	0340-00087 Triple-In-Line Insulator				
	0340-0091 Triple-In-Line Insulator w/locating key				
J10	N/A				
S2	00851-6005 Switch Assy: Sync				
A2A2R2	0683-1525(*) R:fxd comp 1500 ohm 5% 1/4W				
A2A4R4	0683-2215 R:fxd comp 220 ohm 5% 1/4W				
A2A6R4 A2A6R5	N/A N/A				
A2A7Q4	1853-0003 (Preferred Replacement: 1853-0034)				
A2A7R4	0683-5105 R:fxd comp 51 ohm 5% 1/4W				
A2C1	0150-0119 C:fxd cer 2X (0.01μF) 20% 250 VDCW				
	00851-0002 Front Panel				
	00851-0001 Rear Panel				

Table A1-2. 851B Backdating Changes

Ref Desig	Instrument Serial Number					
	526-00101	526-00126	526-00226	526-00536	526-00678	526-00858
A6	00851-6038					
A6Q19	1854-0003					
A6Q20	1854-0003					
A6Q21	1854-0033					
A6Q22	1854-0022					
A6R35	0758-0050(*)					
A6R43	0683-4715					
A6R61	0683-3925					
A6R62	0683-2735					
A6R63	0683-5125					
A6R64	0683-1235					
A6R65	0683-1525					
A6R66	0684-6831					
A6R67	0683-3335					
A6R68	0683-3935					
A6R69	2100-0092					
A6R70	0683-1345					
A6R71	0683-2025					
A6R72	0683-5125					
A6TB1	00851-2029					
A8R59	0758-0012(*)					
A7C2	0160-0174	0180-0155(*)				
A7R19	0758-0003(*)					
A7R26			0687-1021(*)			
A8C6	0160-2054					
A8C7	0160-2054					
A8C11	0160-2054					
A8R1	0687-6801			0687-6801(*)		
A8R17	0690-5641					
A9C10	0180-0897					
A10	00851-6039					
A10S1	3100-1600					
A11C1	0140-0225					
A11CR5	1901-0033					
A11R18	0727-0101					
A11R19	0727-0398					
A11R21	N/A					In series w/A11R20(*)
A12J2	1250-0149					1250-0731

Notes: N/A = Not Assigned (*) Factory Selected Part; Typical Value Given
Refer to Table 6-3, Replaceable Parts for part descriptions not shown.

Table A1-2. 851B Backdating Changes (Cont'd)

Ref Desig	Instrument Serial Numbers					
	526-00101	526-00126	526-00226	526-00536	526-00678	526-00858
CHASSIS PARTS						
CR1	N/A					1902-0037
J1	p/o W1					
J2	1250-0171					
J3	1250-0171					
J8	1250-0171					
J10	1250-0171					
S2	00851-6040					
A2A2R2	0683-1525				0683-1225(*)	
A2A4R4	0683-2215					(*)
A2A6R4	N/A					(*)
A2A6R5	N/A					(*)
A2A7Q4	1853-0003 (Preferred Replacement: 1853-0034)					1853-0034
A2A7R4	0683-5105				0683-1015	
A2C1	0150-0119					0150-0005
	00851-0018 Front Panel					
	00851-0019 Rear Panel					

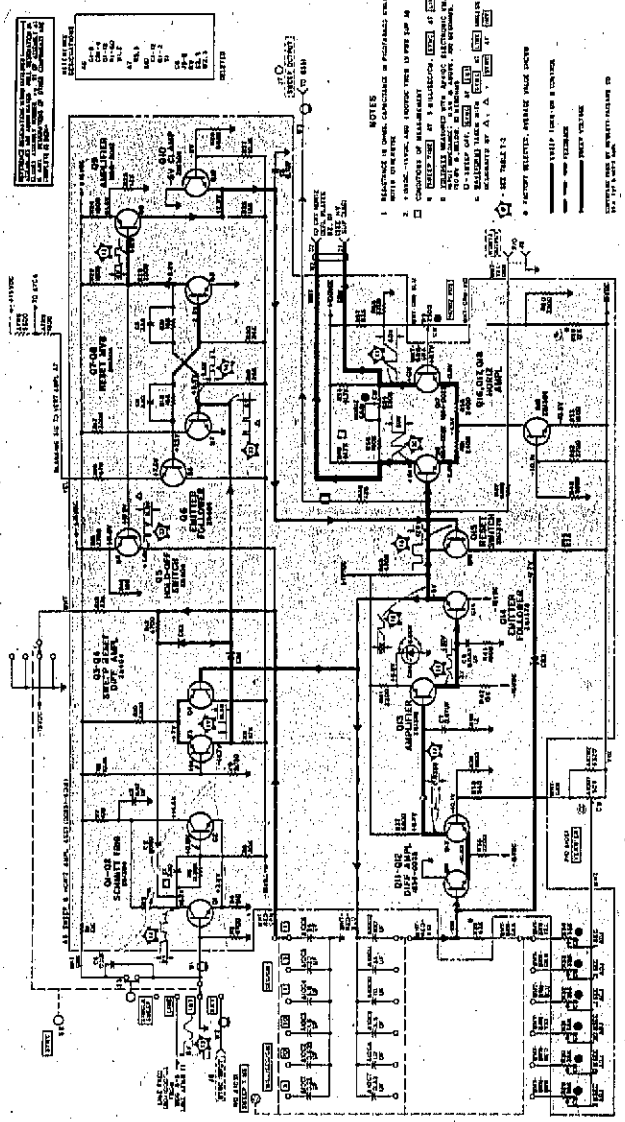


Figure A1-6. 851A Sweep and Horizontal Amplifier Schematic

APPENDIX II

BACKDATING AND MODIFICATION INFORMATION
851B INSTRUMENTS PREFIXED 808-02122 AND BELOW

A2-1. INTRODUCTION.

A2-2. This appendix provides backdate information for 851B instruments with serial prefix between 526-00858 and 808-02122. For instruments with serial prefix below 526-00858 refer to Appendix I.

A2-3. Also included are schematic diagrams, component location illustrations and replaceable parts information for instruments below 813-02123.

A2-4. Stock numbers and descriptions of each part or assembly added, changed or deleted are listed in a brief description of each modification.

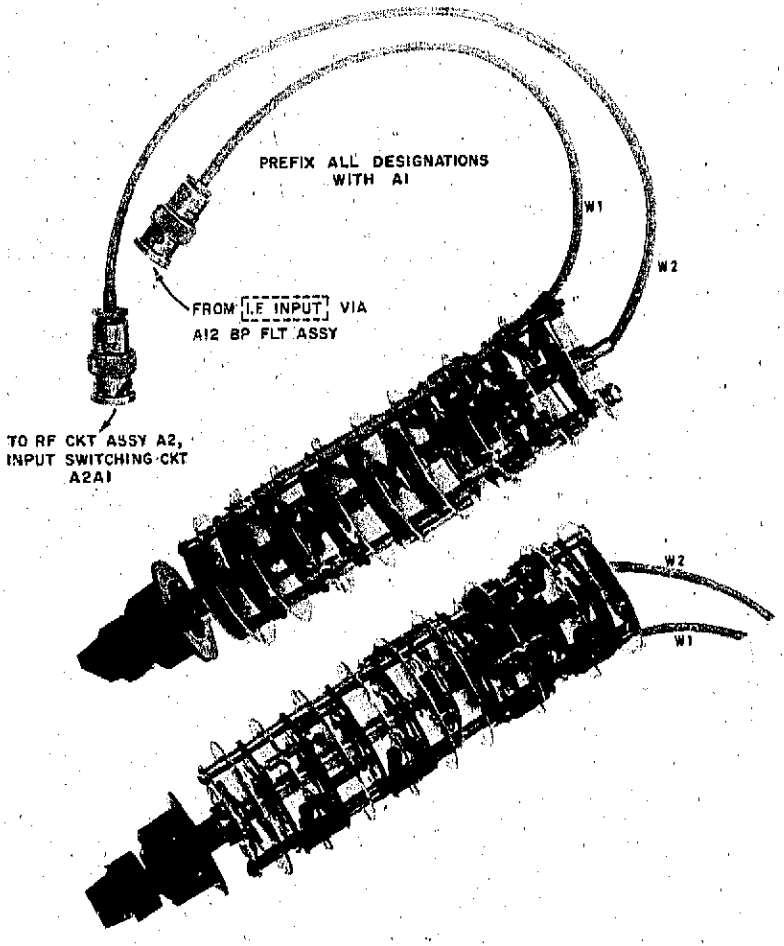


Figure A2-1. I. F. GAIN (DB) Switch Assembly A1, Component Identification

A2-5. I.F. GAIN SWITCH ASSEMBLY A1.

A2-6. On instruments 813-02123 and above, the I.F. Gain Switch Assy A1, stock number 00851-6049, is positioned ahead of the 1 Mc Bandpass Filter A12. Except for cables A1W1 and A1W2, the 00851-6049 assembly is interchangeable with assembly 00851-6002.

A2-7. 1 MC BP FILTER ASSEMBLY A12.

A2-8. On instruments 813-02123 and above, the 1Mc Bandpass Filter A12, stock number 00851-6035, replaced by 1 Mc Bandpass Filter A12, stock number 00851-6053. The 00851-6053 assembly contains a wideband, 50 ohm, input impedance amplifier, bandpass filter and a 6 dB, 50 ohm pad at the output. The 00851-6053 A12 Bandpass Filter Assembly together with the relocation of the I. F. Gain Switch Assembly, provide an improved impedance match between the 851 display unit and the 8551 RF unit. The 00851-6053 assembly is not directly interchangeable with the 00851-6035 assembly. However, replacement is possible, providing the I. F. Gain Switch Assembly A1, stock number 00851-6002, is replaced by I. F. Gain Switch Assembly, stock number 00851-6049 and Cable Assembly W8, stock number 00851-6050 (see Figure 7-3). Cable W8 connects output of bandpass filter to A2J1.

A2-9. VERTICAL AMPLIFIER ASSEMBLY A7.

A2-10. On instruments 813-02123 and above Vertical Amplifier Assembly 00851-6019, replaced by Vertical Amplifier Assembly 00851-6046 (see Figure 7-12.) Modification of Vertical Amplifier Assembly A7 provides protection against transient responses and replaces video filter relays with transistor switch circuits. Vertical Amplifier Assembly, stock number 00851-6019 is not directly interchangeable with stock number 00851-6046. Replacement of 00851-6019 with 00851-6046 requires replacement of HV Power Supply 00851-6001 with HV Power Supply 00851-6045.

A2-11. HV POWER SUPPLY ASSEMBLY A8.

A2-12. On instruments 813-02123 and above, HV Power Supply 00851-6001 replaced by HV Power Supply 00851-6045. Power supply modifications improve CRT blanking and reduce transients in Vertical Amplifier Assembly A7. Power supply 00851-6045 is not directly interchangeable with 00851-6001. Replacement can be accomplished by changing both HV Power Supply A8 and Vertical Amplifier A7 (see Figures 7-12 and 7-17).

A2-13. CURRENT CONTROLLED ATTENUATOR A2A6.

A2-14. On instruments 813-02123 and above, Current Controlled Attenuator A2A6, stock number 00851-6021, replaced by A2A6, stock number 00851-6055. The new A2A6 contains a 6 dB pad to isolate the current controlled attenuator from the bandwidth filters. The A2A6 assembly 00851-6055 is interchangeable with the A2A6 assembly 00851-6021. The 6 dB pad can be removed by removing resistors A2A6R5 and A2A6R6 and shorting resistors A2A6R4 (see Figure 7-10).

A2-15. 20 MC AMPLIFIER ASSY A2A2.

A2-16. On instruments 813-02123 and above, the 20 Mc (100 kc bandwidth) amplifier, stock number 00851-6022, replaced with 20 Mc Amplifier 00851-6054. The 00851-6054 assembly is interchangeable with 00851-6022 assembly. Amplifier gain reduced in 00851-6054 by addition of resistor A2A2R6 in series with A2A2C2 and change in value of A2A2R2 from 1200 to 620 ohms.

A2-17. LV POWER SUPPLY A9.

A2-18. Instruments below 808-01972 contain LV Power Supply Assembly A9, HP stock number 00851-6017. Instruments with serials above 808-01972 contain LV Power Supply Assembly A9, HP stock number 00852-6016. These supplies are directly interchangeable. Differences are identified as follows:

a. 00852-6016 contains an added "crowbar" protection circuit in the -15 Vdc power supply.

b. Separately listed parts are provided in the Replaceable Parts table at the back of this appendix.

c. Separate schematics are provided in this section showing the addition of fuse protection for serials above 850-02972.

A2-19. VERTICAL DISPLAY SWITCH ASSY A11.

A2-20. On instruments 813-02123 and above the value of A11R18 and A11R19 reduced to center adjustment of 80 dB LOG CALIB potentiometer. Value of A11R18 changed from 1030 ohms to 1000 ohms. Value of A11R19 changed from 3790 ohms to 3650 ohms. Refer to Table 6-1 or Table A2-1 for appropriate stock number.

A2-21. REPLACEABLE PARTS.

A2-22. Component parts required for instruments through 808-02122, but not in instruments 813-02123 and above are listed in Table A2-1 (see A2-18 LV Power Supply A9).

Figure A2-2. Bandpass Filter Assembly A12, Component Identification

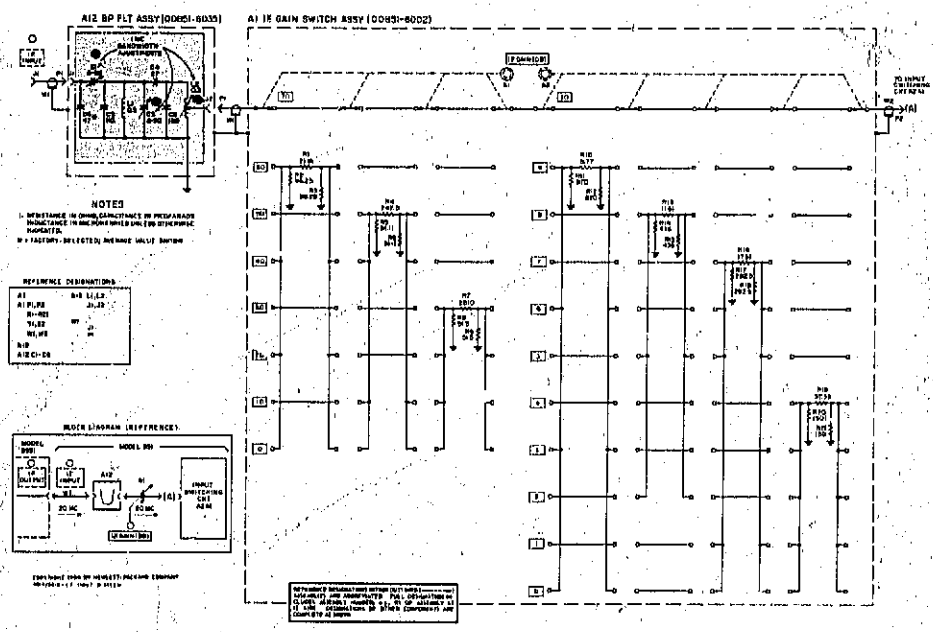


Figure A2-3. 20-MC IF Input and Attenuator

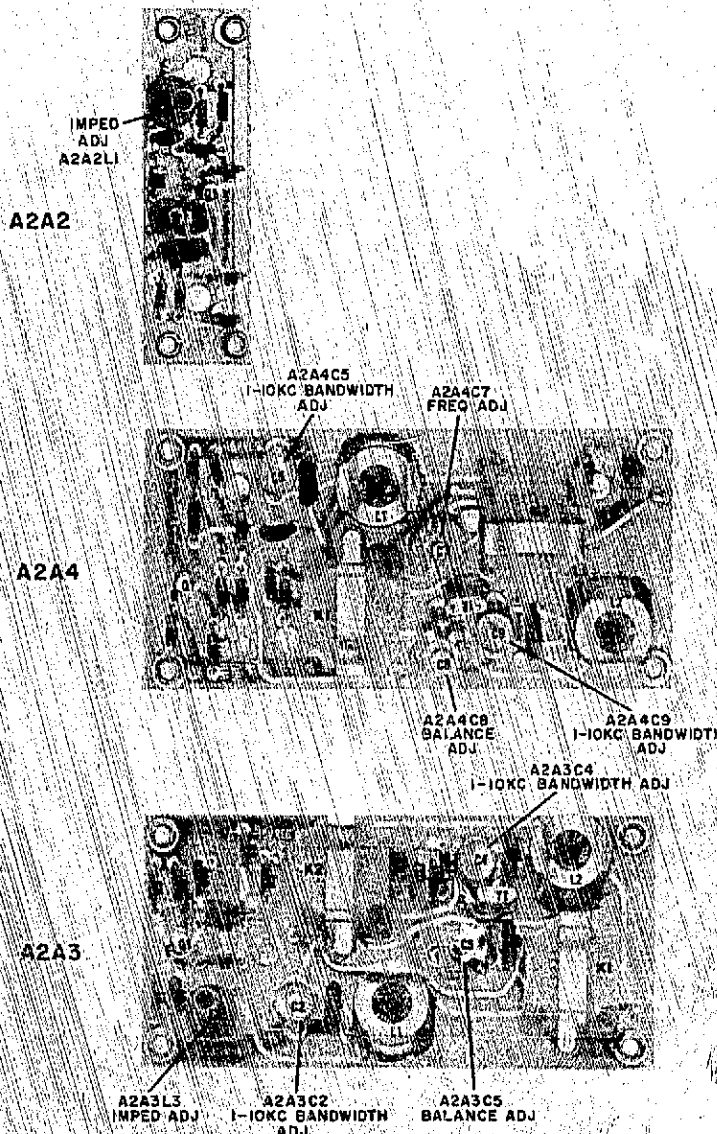


Figure A2-4. RF Circuit Assembly Boards A2A2, A2A3, A2A4

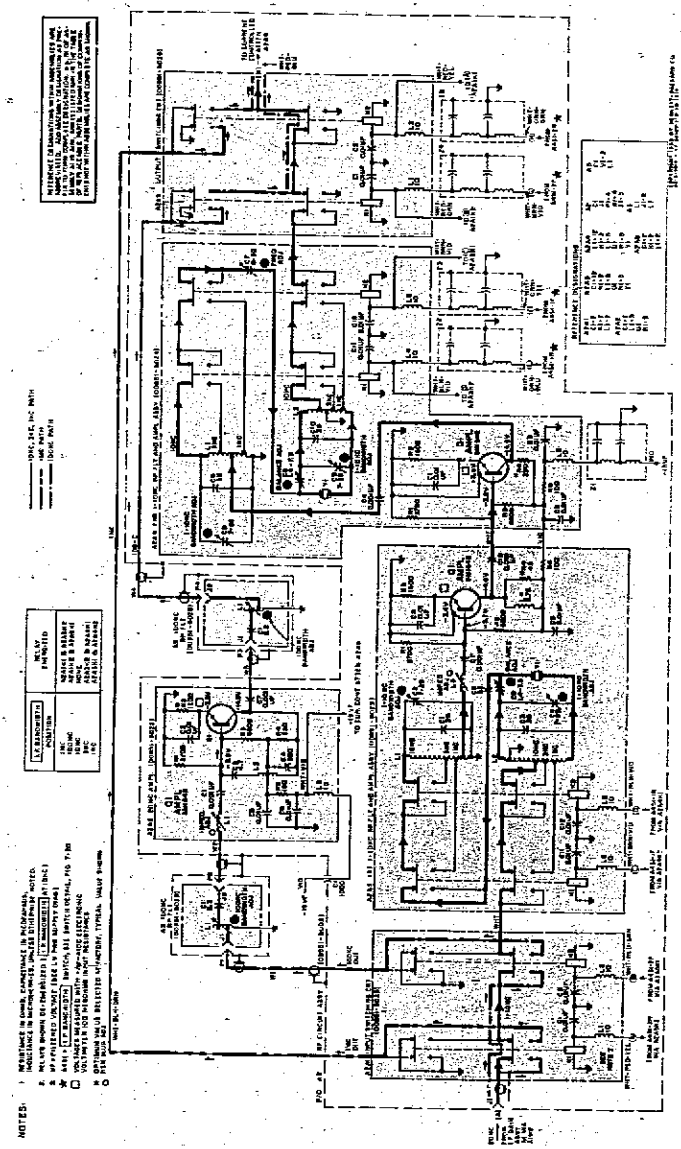


Figure A2-5. IF Bandwidth Switching Circuits

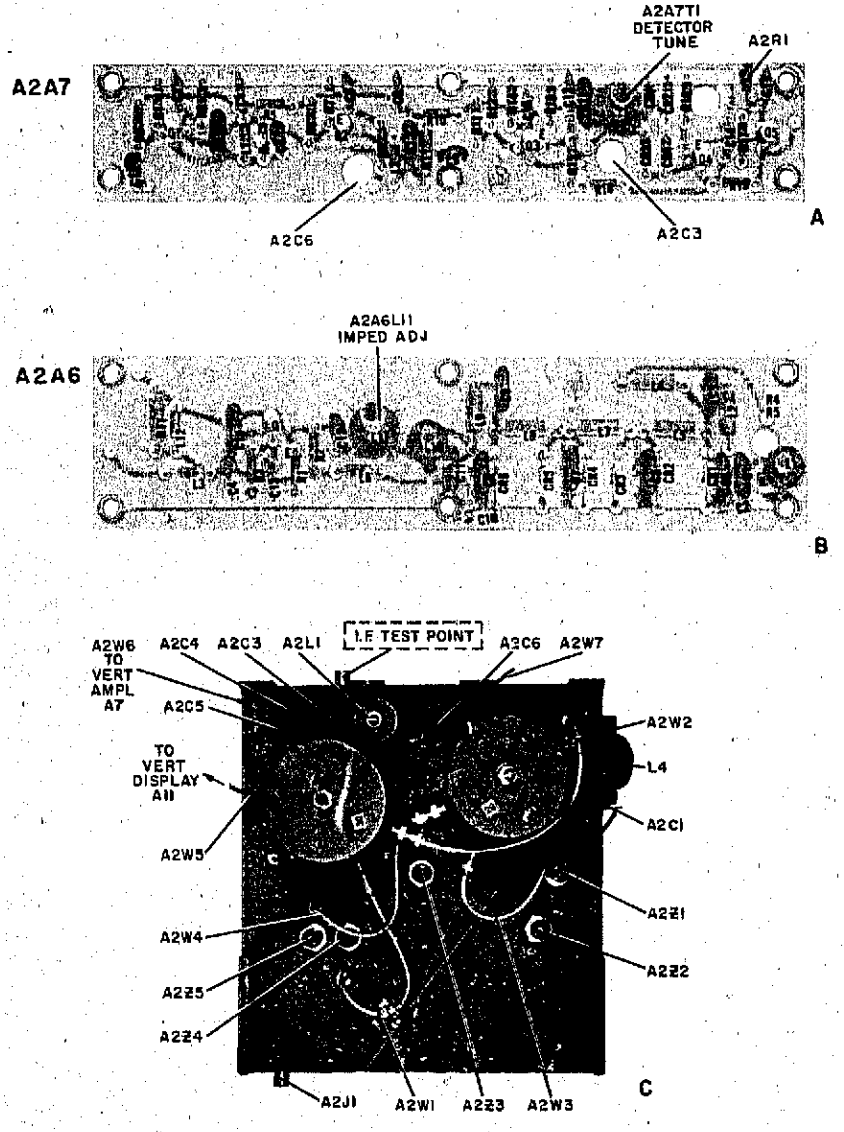


Figure A2-6. RF Circuit Assembly Boards A2A6, A2A7, and Rear of Casting

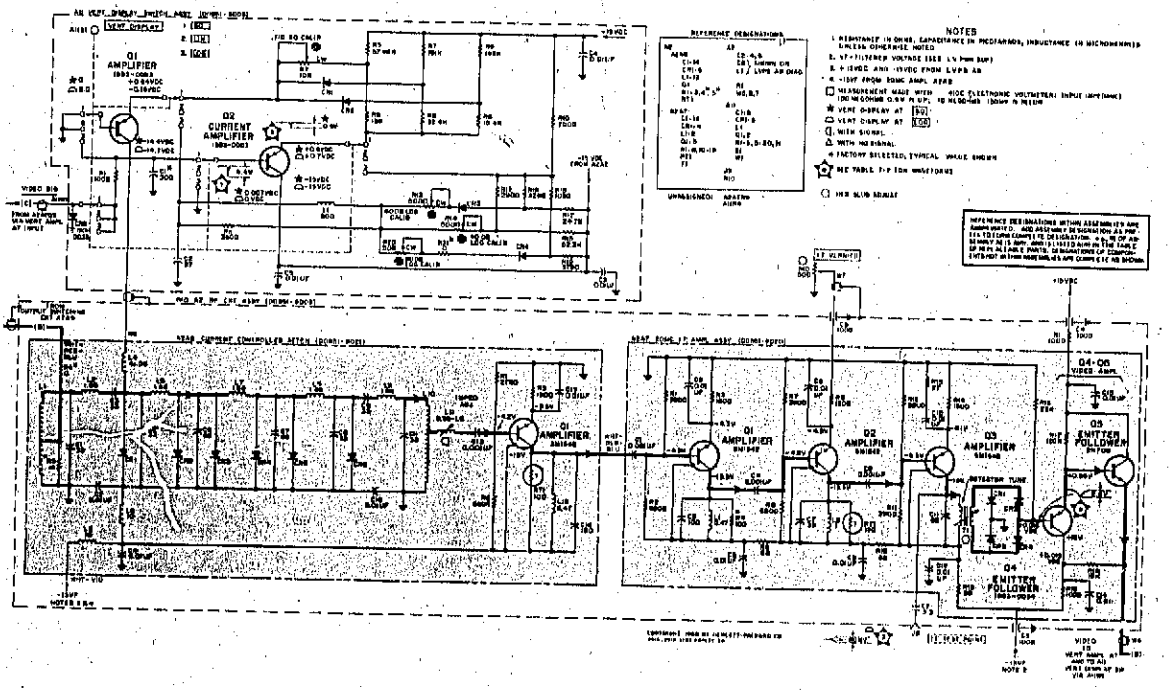


Figure A2-7. VERT DISPLAY Switch, Current-Controlled Attenuator, and 20-MC IF Amplifier

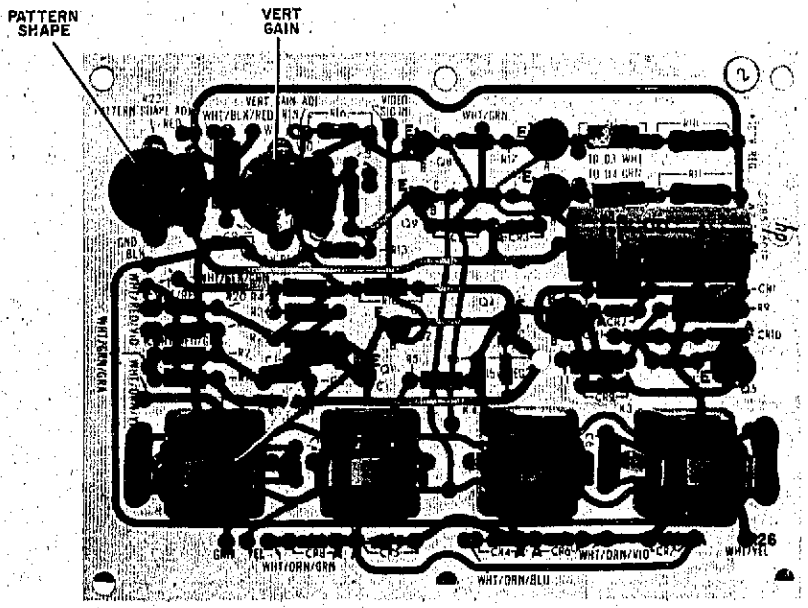


Figure A2-8. Vertical Amplifier A7 Board

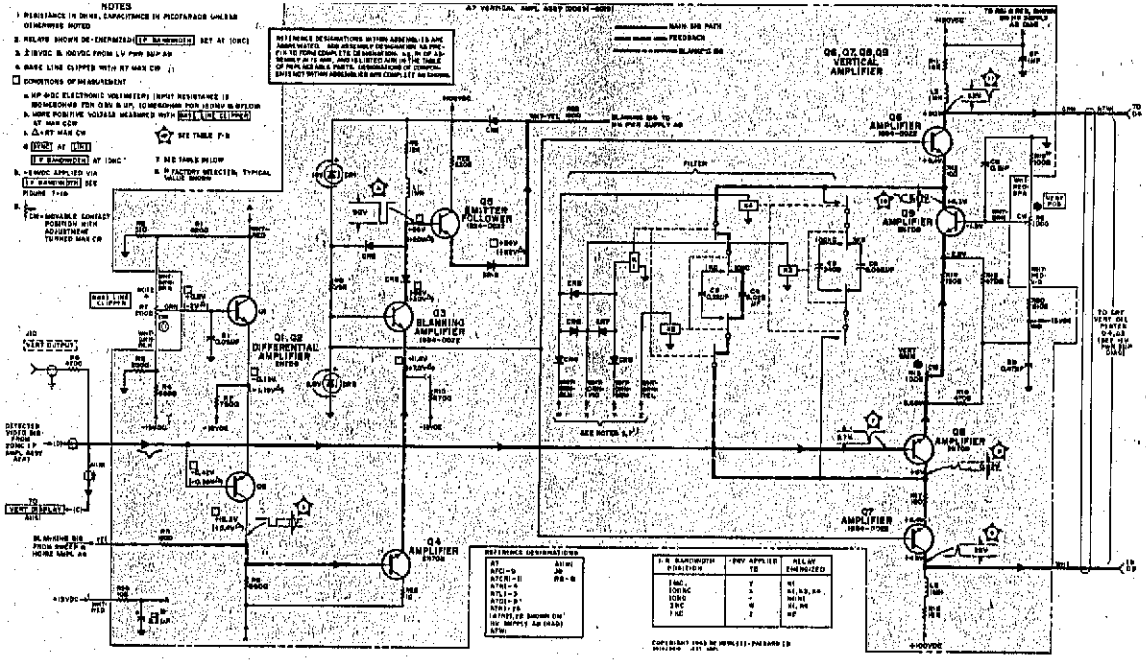


Figure A2-9. Vertical Amplifier

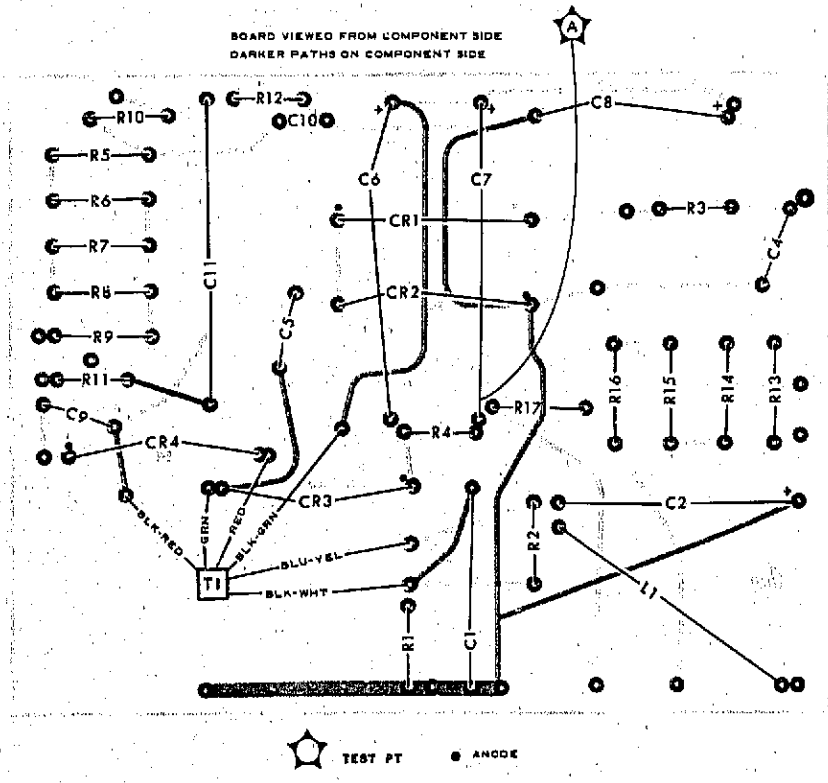


Figure A2-10. HV Power Supply A8 Board

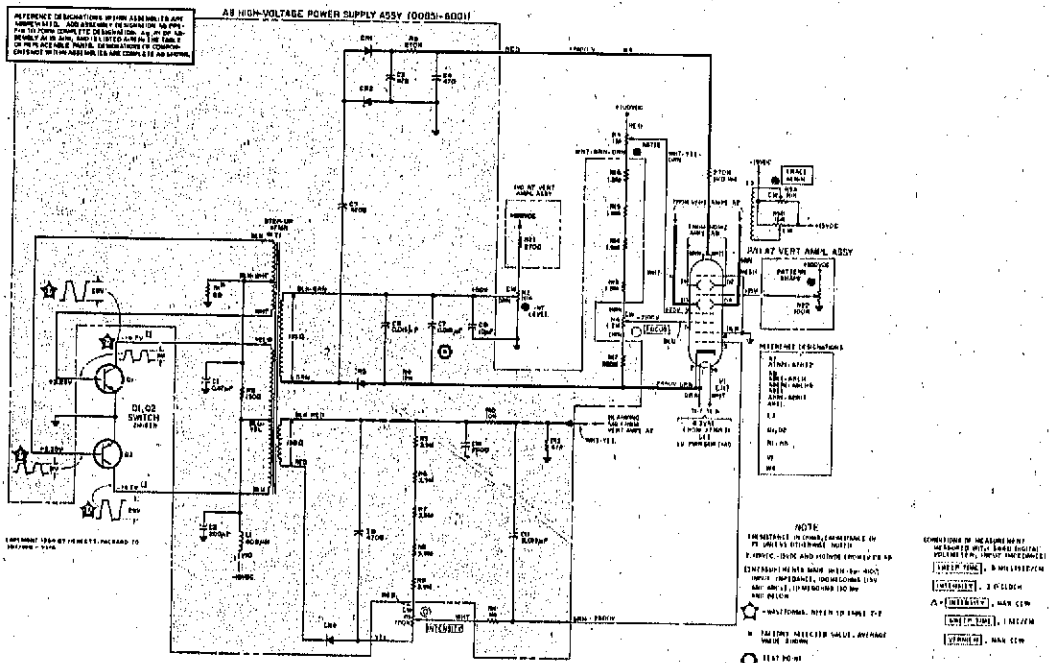


Figure A2-11. HV Power Supply

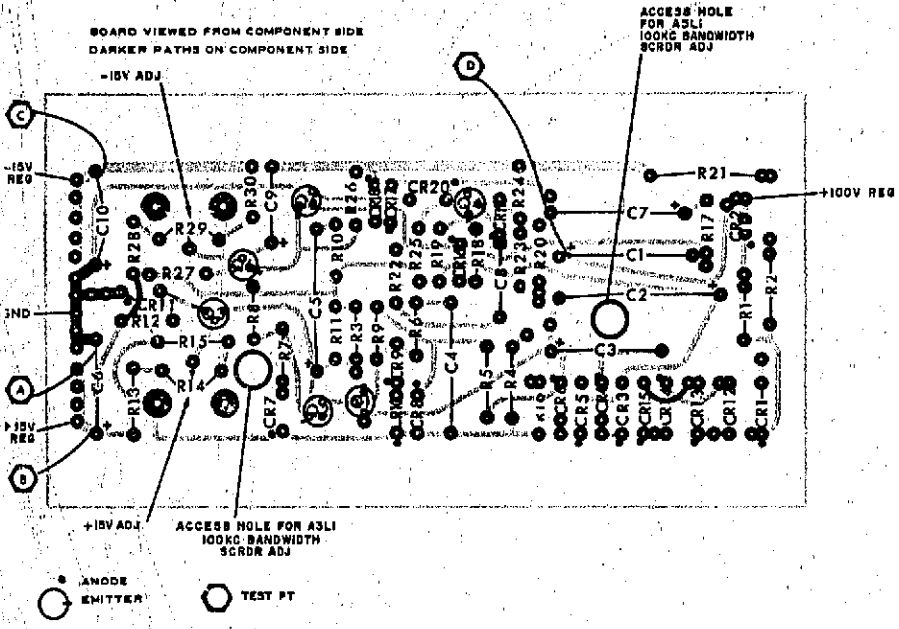


Figure A2-12. LV Power Supply A0 Board, Serials Below 808-01972

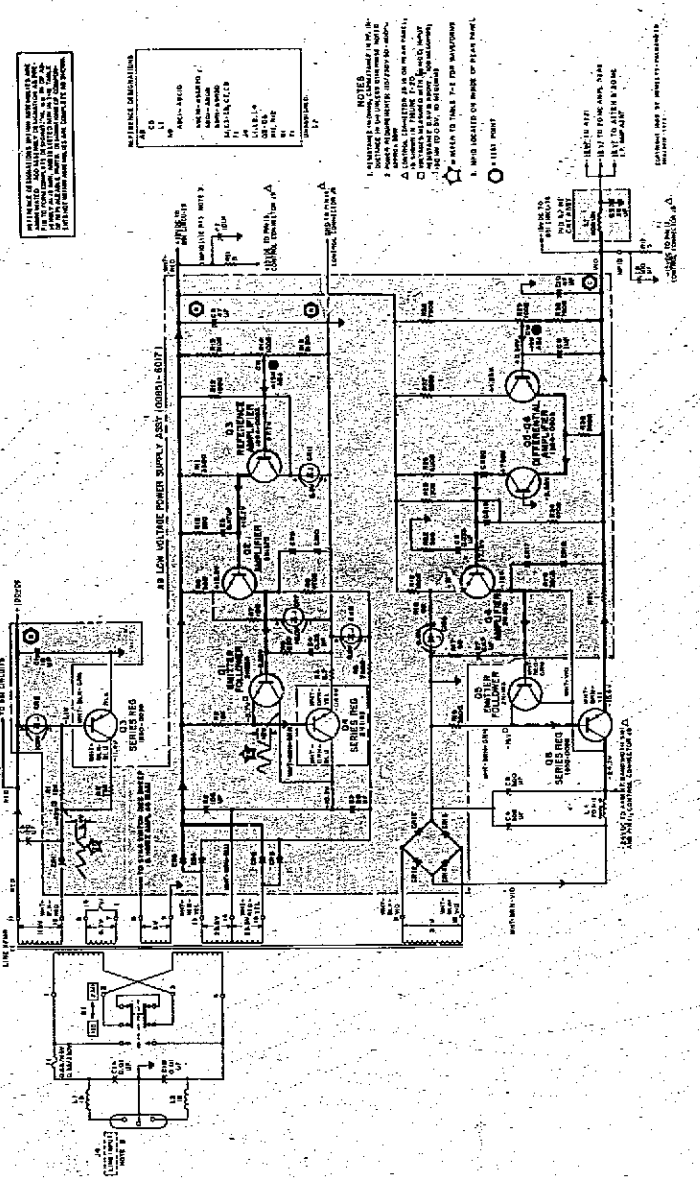


Figure A2-13. LV Power Supply, Serials Below 808-01972

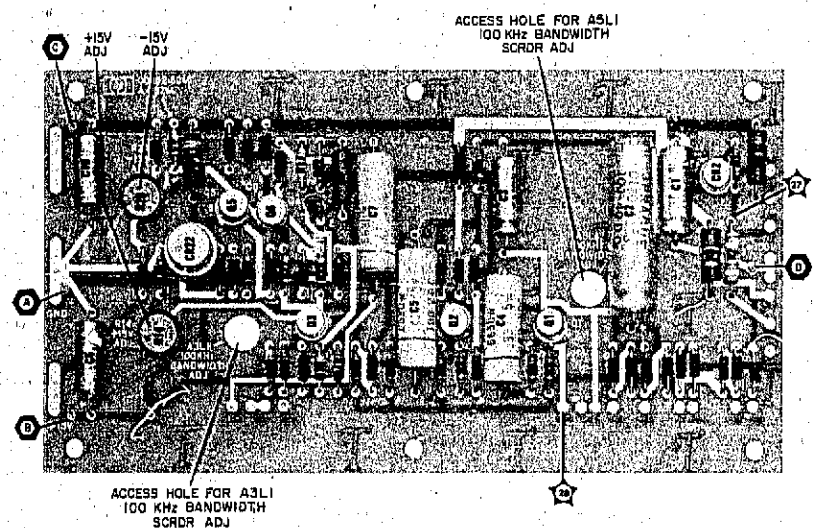


Figure A2-14. LV Power Supply Board, Serials Above 808-01972

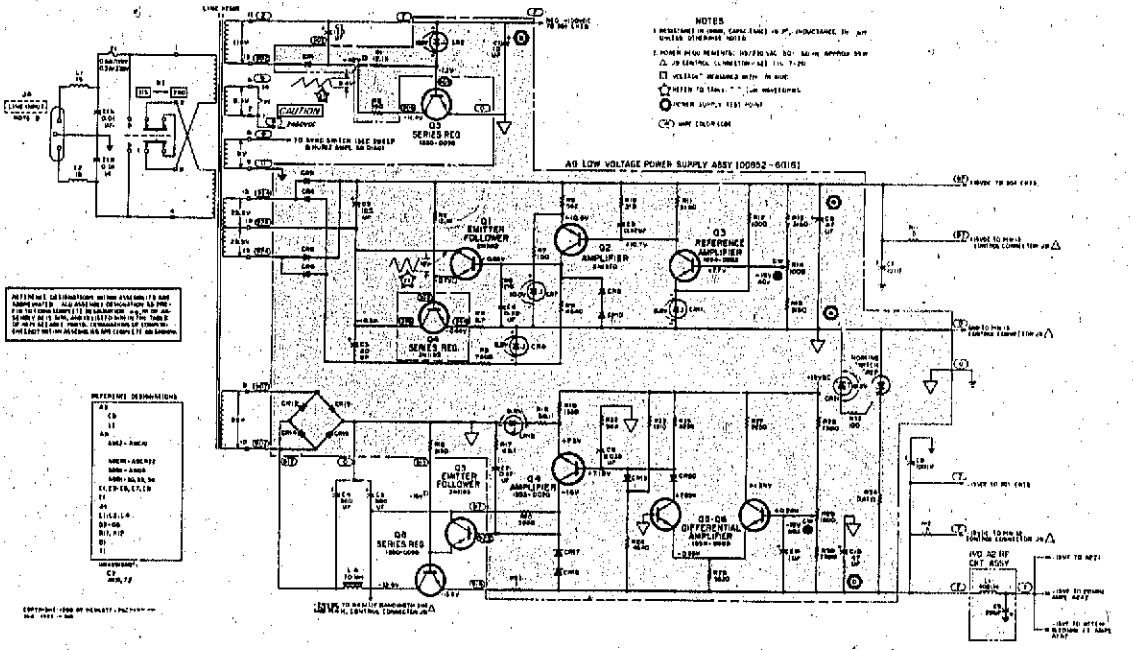


Figure A2-15. LV Power Supply, Serials Above 808-01972

Table A2-1. Reference Designation Index

Reference Designation	Part No.	Description #	Note
A1	00851-6002	SWITCH ASSY:I.F. GAIN	
A1R1	0727-0036	R:FXD DEPC 71.16 OHM 1% 1/2W	
A1R2	0727-0042	R:FXD DEPC 96.25 OHM 1/2% 1/2W	
A1R3	0727-0042	R:FXD DEPC 96.25 OHM 1/2% 1/2W	
A1R4	0727-0062	R:FXD DEPC 247.5 OHM 1/2% 1/2W	
A1R5	0727-0033	R:FXD DEPC 61.11 OHM 1% 1/2W	
A1R6	0727-0033	R:FXD DEPC 61.11 OHM 1% 1/2W	
A1R7	0727-0122	R:FXD DEPC 2.51K OHM 1% 1/2W	
A1R8	0727-0025	R:FXD DEPC 51.5 OHM 1% 1/2W	
A1R9	0727-0025	R:FXD DEPC 51.5 OHM 1% 1/2W	
A1R10	0727-0005	R:FXD DEPC 5.77 OHM 1/2% 1/2W	
A1R11	0727-0094	R:FXD DEPC 870 OHM 1/2% 1/2W	
A1R12	0727-0094	R:FXD DEPC 870 OHM 1/2% 1/2W	
A1R13	0727-0008	R:FXD DEPC 11.61 OHM 1/2% 1/2W	
A1R14	0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	
A1R15	0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	
A1R16	0727-0010	R:FXD DEPC 17.61 OHM 1/2% 1/2W	
A1R17	0727-0063	R:FXD DEPC 292.5 OHM 1% 1/2W	
A1R18	0727-0063	R:FXD DEPC 292.5 OHM 1% 1/2W	
A1R19	0727-0017	R:FXD DEPC 37.35 OHM 1/2% 1/2W	
A1R20	0727-0048	R:FXD DEPC 150 OHM 1% 1/2W	
A1R21	0727-0048	R:FXD DEPC 150 OHM 1% 1/2W	
A1W1	00851-6014	CABLE ASSY:ATTEN INPUT 13-INCH COAX W/BNC MALE PLUG P1	
A1W2	00851-6013	CABLE ASSY:ATTEN OUTPUT 12-INCH COAX W/BNC MALE PLUG P2	
A2A2	00851-6022	AMPLIFIER ASSY:20 MC	
A2A2R2	0683-1225	R:FXD COMP 1200 OHM 5% 1/4W FACTORY SELECTED PART	
A2A2R6		NOT ASSIGNED	
A2A6	00851-6021	BOARD ASSY:CURRENT CONTROLLED	
A2A6R4		R:0-10 OHM FACTORY SELECTED PART	
A2A6R5		R:100K OHM TO UNFINITY FACTORY SELECTED PART	
A2A6R6		NOT ASSIGNED	
A7	00851-6019	BOARD ASSY:VERT AMPL.	
A7C1	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
A7C2	0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW FACTORY SELECTED PART	
A7C3	0170-0086	C:FXD MY 0.22UF 20% 50VDCW	
A7C4	0170-0083	C:FXD MY 0.022UF 20% 50VDCW	

See Introduction to this section for ordering information

Table A2-1. Reference Designation Index (Cont)

Reference Designation	Part No.	Description #	Note
A7C5	0140-0160	C:FXD MICA 3400 PF 5% 500VDCW	
A7C6	0170-0084	C:FXD MY 0.068UF 20% 50VDCW	
A7C7	0170-0018	C:FXD MY 1UF 5% 200VDCW	
A7C8	0150-0121	C:FXD CER 0.1 UF +80-20% 50VDCW	
A7C9	0160-0174	C:FXD CER 0.47 UF +80-20% 25VDCW	
A7CR1	1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	
A7CR2	1901-0096	DIODE:SILICON 120V	
A7CR3	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A7CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR5	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR6	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR7	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR8	1901-0025	DIODE:SILICON 100WV 100MA	
A7CR9	1901-0055	DIODE:SILICON 1N629	
A7CR10	1901-0033	DIODE:SILICON 100MA 180WV	
A7CR11	1901-0033	DIODE:SILICON 100MA 180WV	
A7K1	0490-0125	RELAY:DPDT 24VDC	
A7K2	0490-0125	RELAY:DPDT 24VDC	
A7K3	0490-0125	RELAY:DPDT 24VDC	
A7K4	0490-0125	RELAY:DPDT 24VDC	
A7L1	9140-0137	COIL:FXD RF 1 MH 5%	
A7L2	9140-0137	COIL:FXD RF 1 MH 5%	
A7L3	9140-0137	COIL:FXD RF 1 MH 5%	
A7Q1	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q2	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q3	1854-0022	TRANSISTOR:NPN SILICON	
A7Q4	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q5	1854-0022	TRANSISTOR:NPN SILICON	
A7Q6	1854-0022	TRANSISTOR:NPN SILICON	
A7Q7	1854-0022	TRANSISTOR:NPN SILICON	
A7Q8	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7Q9	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A7R1	0686-6225	R:FXD COMP 6200 OHM 5% 1/2W	
A7R2	0686-5115	R:FXD COMP 510 OHM 5% 1/2W	
A7R3	0686-2025	R:FXD COMP 2000 OHM 5% 1/2W	
A7R4	0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	
A7R5	0686-1825	R:FXD COMP 1800 OHM 5% 1/2W	
A7R6	0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	
A7R7	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A7R8	0687-3931	R:FXD COMP 39K OHM 10% 1/2W	
A7R9	0690-1231	R:FXD COMP 12K OHM 10% 1W	
A7R10	0686-2725	R:FXD COMP 2700 OHM 5% 1/2W	
A7R11	0761-0074	R:FXD MET FLM 15K OHM 5% 1W	

See introduction to this section for ordering information

Table A2-1. Reference Designation Index (Cont)

Reference Designation	@ Part No.	Description #	Note
A7R12	0758-0024	R:FXD MET OX 100 OHM 5% 1/2W	
A7R13	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A7R14	0758-0017	R:FXD MET OX 1500 OHM 5% 1/2W	
A7R15	2100-0154	R:VAR COMP 1K OHM 30% LIN 0.15W	
A7R16	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A7R17	0758-0024	R:FXD MET OX 100 OHM 5% 1/2W	
A7R18	0761-0074	R:FXD MET FLM 15K OHM 5% 1W	
A7R19	0758-0003	R:FXD MET OX 1000 OHM 5% 1/2W FACTORY SELECTED PART	
A7R20	0758-0038	R:FXD MET OX 9100 OHM 5% 1/2W	
A7R21	0690-2721	R:FXD COMP 2700 OHM 5% 1/4W	
A7R22	2100-0095	R:VAR COMP 100K OHM 30% LIN 1/5W	
A7R23	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R24	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A7R25	0684-1001	R:FXD COMP 10 OHM 10% 1/4W	
A7R26	0687-1021	R:FXD COMP 1000 OHM 10% 1/2W FACTORY SELECTED PART	
A7TB1	00851-2013	BOARD:PC BLANK	
A7W1	00851-6037	CABLE ASSY:CRT VERT 4-INCH CABLE TERM. W/FEMALE PIN	
A8	00851-6001	HV POWER SUPPLY ASSY	
A8CR5	1901-0025	DIODE:SILICON 100WV 100MA	
A8L2	9140-0056	COIL:FXD RF 1 UH	
A8R1	0687-4701	R:FXD COMP 47 OHM 10% 1/2W (FACTORY SELECTED PART)	
A8R2	0687-1521	R:FXD COMP 1500 OHM 10% 1/2W	
A8R3	0687-2741	R:FXD COMP 270K OHM 10% 1/2W	
A8R4	0687-1231	R:FXD COMP 12K OHM 10% 1/2W	
A8R5 THRU			
A8R9	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R10	0687-3931	R:FXD COMP 39K OHM 10% 1/2W	
A8R11	0687-1031	R:FXD COMP 10K OHM 10% 1/2W	
A8R12	0687-4731	R:FXD COMP 47K OHM 10% 1/2W	
A9	00851-6017	LOW VOLTAGE POWER SUPPLY ASSY SERIAL NUMBERS BELOW 808-01972	
A9C1	0180-0089	C:FXD ELECT 100UF-10%+100% 150VDCW	
A9C2	0180-0138	C:FXD ELECT 100UF -10+100% 40VDCW	
A9C3	0180-0049	C:FXD AL ELECT 20UF 50VDCW	
A9C4	0170-0042	C:FXD MY 0.33UF 5% 100VDCW	
A9C5	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C6	0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	
A9C7	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C8	0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	
A9C9	0180-0119	C:FXD ELECT 1UF -10+100% 25VDCW	
A9C10	0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	
A9CR1	1901-0029	DIODE:SILICON 600 PIV	
A9CR2	1902-0241	DIODE BREAKDOWN:100V	
A9CR3	1901-0045	DIODE:SILICON 100PIV	
A9CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR5	1901-0045	DIODE:SILICON 100PIV	

See introduction to this section for ordering information

Table A2-1. Reference Designation Index (Cont)

Reference Designation	Part No.	Description #	Note
A9CR6	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR7	1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	
A9CR8	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR9	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR10	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR11	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR12	1901-0049	DIODE:SILICON 50PIV	
A9CR13	1901-0049	DIODE:SILICON 50PIV	
A9CR14	1901-0049	DIODE:SILICON 50PIV	
A9CR15	1901-0049	DIODE:SILICON 50PIV	
A9CR16	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR17	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR18	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR19	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR20	1901-0025	DIODE:SILICON 100WV 100MA	
A9Q1	1854-0040	TRANSISTOR:GERMANIUM PNP 2N383	
A9Q2	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A9Q3	1854-0003	TRANSISTOR:NPN SILICON	
A9Q4	1850-0040	TRANSISTOR:GERMANIUM PNP	
A9Q5	1854-0003	TRANSISTOR:NPN SILICON	
A9Q6	1854-0003	TRANSISTOR:NPN SILICON	
A9R1	0758-0012	R:FXD MET OX 12K OHM 5% 1/2W	
A9R2	0757-0817	R:FXD MET FLM 750 OHM 1% 1/2W	
A9R3	0687-1231	R:FXD COMP 12K OHM 10% 1/2W	
A9R4	0695-0005	R:FXD COMP 2.7 OHM 10% 1W	
A9R5	0761-0016	R:FXD MET FLM 7500 OHM 5% 1W	
A9R6	0687-2211	R:FXD COMP 220 OHM 10% 1/2W	
A9R7	0687-1011	R:FXD COMP 100 OHM 10% 1/2W	
A9R8	0687-5611	R:FXD COMP 560 OHM 10% 1/2W	
A9R9	0687-4721	R:FXD COMP 4700 OHM 10% 1/2W	
A9R10	0687-3311	R:FXD COMP 330 OHM 10% 1/2W	
A9R11	0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	
A9R12	0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	
A9R13	0812-0027	R:FXD WW 3100 OHM 5% 3W	
A9R14	2100-0154	R:VAR COMP 1K OHM 30% LIN 0.15W	
A9R15	0812-0027	R:FXD WW 3100 OHM 5% 3W	
A9R16	0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	
A9R17	0683-6801	R:FXD COMP 68 OHM 10% 1/2W	
A9R18	0683-6801	R:FXD COMP 68 OHM 10% 1/2W	
A9R19	0687-1521	R:FXD COMP 1500 OHM 10% 1/2W	
A9R20	0687-3921	R:FXD COMP 3900 OHM 10% 1/2W	
A9R21	0813-0019	R:FXD WW 0.47 OHM 10% 2W(SERIAL NUMBERS ABOVE 850-02648)	
A9R21	0811-0040	R:FXD WW 1 OHM 1% 5W	
A9R22	0687-5611	R:FXD COMP 560 OHM 10% 1/2W	
A9R23	0686-1225	R:FXD COMP 1200 OHM 5% 1/2W	
A9R24	0686-4725	R:FXD COMP 4700 OHM 5% 1/2W	

See introduction to this section for ordering information

Table A2-1. Reference Designation Index (Cont)

Reference Designation	Part No.	Description #	Note
A9R25	0687-8221	R:FXD COMP 8200 OHM 10% 1/2W	
A9R26	0687-5621	R:FXD COMP 5600 OHM 10% 1/2W	
A9R27	0687-8221	R:FXD COMP 8200 OHM 10% 1/2W	
A9R28	0758-0047	R:FXD MET OX 7500 OHM 5% 1/2W	
A9R29	2100-0154	R:VAR COMP 1K OHM 30% LIN 0.15W	
A9R30	0758-0047	R:FXD MET OX 7500 OHM 5% 1/2W	
A9T61	00851-2004	BOARD:BLANK PC	

See introduction to this section for ordering information

Table A2-1. Reference Designation Index (Cont)

Reference Designation	Part No.	Description #	Note
A9	00852-6016	BOARD ASSY:&VPS SERIAL NUMBERS BELOW 808-01973	
A9C1	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A9C2	0180-0138	C:FXD ELECT 100UF -10+100% 40VDCW	
A9C3	0180-0049	C:FXD AL ELECT 20UF 50VDCW	
A9C4	0160-2393	C:FXD MY 0.33 UF 5% 100VDCW	
A9C5	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C6	0180-0097	C:FXD ELECT 47 UF 30% 35VDCW	
A9C7	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C8	0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	
A9C9	0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	
A9C10	0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	
A9CR1	1901-0029	DIODE:SILICON 400 PIV	
A9CR2	1902-0241	DIODE BREAKDOWN:100V	
A9CR3	1901-0045	DIODE:SILICON 100PIV	
A9CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR5	1901-0045	DIODE:SILICON 100PIV	
A9CR6	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR7	1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	
A9CR8	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR9	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR10	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR11	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR12	1901-0049	DIODE:SILICON 50PIV	
A9CR13	1901-0049	DIODE:SILICON 50PIV	
A9CR14	1901-0049	DIODE:SILICON 50PIV	
A9CR15	1901-0049	DIODE:SILICON 50PIV	
A9CR16	1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	
A9CR17	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR18	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR19	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR20	1901-0025	DIODE:SILICON 100WV 100MA	
A9CR21	1902-0766	DIODE BREAKDOWN:18.2V	
A9CR22	1884-0012	RECTIFIER:SILICON CONTROLLED 2N3528	
A9Q1	1850-0040	TRANSISTOR:GERMANIUM PNP	
A9Q2	1850-0065	TRANSISTOR:GERMANIUM 2N1970	
A9Q3	1854-0003	TRANSISTOR:NPN SILICON	
A9Q4	1853-0020	TRANSISTOR:SILICON PNP	
A9Q5	1854-0003	TRANSISTOR:NPN SILICON	
A9Q6	1854-0003	TRANSISTOR:NPN SILICON	
A9R1	0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	
A9R2	0761-0037	R:FXD MET FLM 390 OHM 5% 1W	
A9R3	0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	
A9R4	0811-1611	R:FXD WW 2.7 OHM 5% 2W	
A9R5	0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	

See introduction to this section for ordering information

Table A2-1. Reference Designation Index (Cont)

Reference Designation	Part No.	Description #	Note
A9R6	0698-3441	R:FXD MET FLM 215 OHM 1% 1/8W	
A9R7	0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	
A9R8	0757-0417	R:FXD MET FLM 562 OHM 1% 1/8W	
A9R9	0698-3155	R:FXD MET FLM 4.64K OHM 1% 1/8W	
A9R10	0698-3444	R:FXD MET FLM 316 OHM 1% 1/8W	
A9R11	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R12	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A9R13	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R14	2100-1773	R:VAR WW 1K OHM 10% LIN 1/2W	
A9R15	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R16	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A9R17	0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	
A9R18	0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	
A9R19	0698-3406	R:FXD MET FLM 1.33K OHM 1% 1/2W	
A9R20	0698-3153	R:FXD MET FLM 3.83K OHM 1% 1/8W	
A9R21	0811-1666	R:FXD WW 1.0 OHM 5% 2W	
A9R22	0757-0417	R:FXD MET FLM 562 OHM 1% 1/8W	
A9R23	0757-0274	R:FXD MET FLM 1.21K OHM 1% 1/8W	
A9R24	0698-3155	R:FXD MET FLM 4.64K OHM 1% 1/8W	
A9R25	0757-0441	R:FXD MET FLM 8.25K OHM 1% 1/8W	
A9R26	0757-0200	R:FXD MET FLM 5.62K OHM 1% 1/8W	
A9R27	0757-0441	R:FXD MET FLM 8.25K OHM 1% 1/8W	
A9R28	0757-0446	R:FXD MET FLM 7.50K OHM 1% 1/8W	
A9R29	2100-1773	R:VAR WW 1K OHM 10% LIN 1/2W	
A9R30	0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	
A9R31		NOT ASSIGNED	
A9R32		NOT ASSIGNED	
A9R33	0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	
A9R34	0811-1662	R:FXD WW 0.47 OHM 5% 2W	
A9T81	00852-2016	BOARD:BLANK PC	

See introduction to this section for ordering information

Table A2-1. Reference Designation Index (Cont)

Reference Designation	Part No.	Description #	Note
A11P18	0757-0101	R:FXD FLM 1.708K OHM 0.5% 1/4W	
A11P19	0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	
A12	00851-6035	BOARD ASSY:INPUT BANDPASS FILTER	
	00851-0037	COVER:INPUT BP FILTER	
A12C1	0130-0017	C:VAR CER 8-50 PF	
A12C2	0140-0194	C:FXD MICA 110 PF 5%	
A12C3	0130-0017	C:VAR CER 8-50 PF	
A12C4	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A12C5	0140-0197	C:FXD MICA 180 PF 5% 300 VDCW	
A12C6	0140-0204	C:FXD MICA 47P6 5% MPO 500VDCW	
A12J1	1250-0212	CONNECTOR:JACK CHASSIS BNC	
A12J2	1250-0731	CONNECTOR:RF BNC BULKHEAD MOUNT	
A12L1	00851-8001	COIL:RF	
A12L2	00851-8002	COIL:RF	
A12TB1	00851-2016	BOARD:BLANK PC	
		CHASSIS PARTS	
F2	2110-0001	FUSE:1.0A 250V SERIAL NUMBERS ABOVE 850-02648	
W1	00851-6027	CABLE ASSY:IF INPUT	
XF2	1400-0508	FUSEHOLDER:BRONZE CLIP SERIAL NUMBERS ABOVE 850-02648	

See introduction to this section for ordering information

Table A2-2. Replaceable Parts

Part No.	Description #	Mfr.	Mfr. Part No.
0130-0017	C:VAR CER 8-50 PF	28480	0130-0017
0140-0160	C:FXD MICA 3400 PF 5% 500VDCW	28480	0140-0160
0140-0194	C:FXD MICA 110 PF 5%	28480	0140-0194
0140-0197	C:FXD MICA 180 PF 5% 300 VDCW	04062	RDM15F181J3C
0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	04062	RDM15E470J5C
0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
0150-0121	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
0160-0163	C:FXD MY 0.033 UF 10% 200VDCW	28480	0160-0163
0160-0174	C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C1187S-CML
0160-0178	C:FXD MICA 27PF 5% 300VDCW	04062	RDM15E270J3S
0160-2393	C:FXD MY 0.33 UF 5% 100VDCW	18486	663 UW
0170-0018	C:FXD MY 1UF 5% 200VDCW	84411	TYPE 621M 10552
0170-0042	C:FXD MY 0.33UF 5% 100VDCW	99515	E1-334D TYPE E120
0170-0064	C:FXD MY 0.47UF 10% 100VDCW	24446	64F40AA474
0170-0083	C:FXD MY 0.022UF 20% 50VDCW	84411	601PE STYLE 1
0170-0084	C:FXD MY 0.068UF 20% 50VDCW	84411	601PE STYLE 3
0170-0086	C:FXD MY 0.22UF 20% 50VDCW	84411	601PE STYLE 3
0180-0049	C:FXD AL ELECT 20UF 50VDCW	56289	30D206G050DC4M1
0180-0089	C:FXD ELECT 100F-10%+100% 150VDCW	56289	30D106G150DF4
0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	28480	0180-0097
0180-0119	C:FXD ELECT 1UF -10+100% 25VDCW	56289	30D105G025AA4
0180-0138	C:FXD ELECT 100UF -10+100% 40VDCW	56289	D36254
0180-0155	C:FXD ELECT 2.2 UF 20% 20VDCW	28480	0180-0155
0180-0291	C:FXD ELECT 1.0 UF 10% 35VDCW	28480	0180-0291
0490-0125	RELAY:DPDT 24VDC	28480	0490-0125
C683-1015	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
C683-1225	R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
C683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
C683-5625	R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
C684-1001	R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
C686-1225	R:FXD COMP 1200 OHM 5% 1/2W	01121	EB 1225
C686-1825	R:FXD COMP 1800 OHM 5% 1/2W	01121	EB 1825
C686-2025	R:FXD COMP 2000 OHM 5% 1/2W	01121	EB 2025
C686-2725	R:FXD COMP 2700 OHM 5% 1/2W	01121	EB 2725
C686-4725	R:FXD COMP 4700 OHM 5% 1/2W	01121	EB 4725
C686-5115	R:FXD COMP 510 OHM 5% 1/2W	01121	EB 5115
C686-5625	R:FXD COMP 5600 OHM 5% 1/2W	01121	EB 5625
C686-6225	R:FXD COMP 6200 OHM 5% 1/2W	01121	EB 6225
C686-7525	R:FXD COMP 7500 OHM 5% 1/2W	01121	EB 7525
C687-1011	R:FXD COMP 100 OHM 10% 1/2W	01121	EB 1011
C687-1021	R:FXD COMP 1000 OHM 10% 1/2W	01121	EB 1021
C687-1031	R:FXD COMP 10K OHM 10% 1/2W	01121	EB 1031
C687-1231	R:FXD COMP 12K OHM 10% 1/2W	01121	EB 1231
C687-1521	R:FXD COMP 1500 OHM 10% 1/2W	01121	EB 1521
C687-2211	R:FXD COMP 220 OHM 10% 1/2W	01121	EB 2211
C687-3311	R:FXD COMP 330 OHM 10% 1/2W	01121	EB 3311
C687-3321	R:FXD COMP 3300 OHM 10% 1/2W	01121	EB 3321
C687-3921	R:FXD COMP 3900 OHM 10% 1/2W	01121	EB 3921
C687-3931	R:FXD COMP 39K OHM 10% 1/2W	01121	EB 3931
C687-4721	R:FXD COMP 4700 OHM 10% 1/2W	01121	EB 4721
C687-4731	R:FXD COMP 47K OHM 10% 1/2W	01121	EB 4731
C687-5611	R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611
C687-5621	R:FXD COMP 5600 OHM 10% 1/2W	01121	EB 5621
C687-6801	R:FXD COMP 68 OHM 10% 1/2W	01121	EB 6801

See introduction to this section for ordering information

Table A2-2. Replaceable Parts (Cont)

Part No.	Description #	Mfr.	Mfr. Part No.
0683-8221	R:FXD COMP 8200 OHM 10% 1/2W	01121	EB 8221
0690-1231	R:FXD COMP 12K OHM 10% 1W	01121	GB 1231
0690-2721	R:FXD COMP 2700 OHM 5% 1/4W	01121	GB 2721
0698-3153	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
0698-3155	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
0698-3406	R:FXD MET FLM 1.33K OHM 1% 1/2W	28480	0698-3406
0698-3441	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
0698-3444	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
0699-0005	R:FXD COMP 2.7 OHM 10% 1W	01121	GB 2761
0727-0065	R:FXD DEPC 5.77 OHM 1/2% 1/2W	28480	0727-0065
0727-0008	R:FXD DEPC 11.61 OHM 1/2% 1/2W	28480	0727-0008
0727-0010	R:FXD DEPC 17.61 OHM 1/2% 1/2W	28480	0727-0010
0727-0017	R:FXD DEPC 37.35 OHM 1/2% 1/2W	28480	0727-0017
0727-0025	R:FXD DEPC 51.5 OHM 1% 1/2W	28480	0727-0025
0727-0033	R:FXD DEPC 61.11 OHM 1% 1/2W	28480	0727-0033
0727-0036	R:FXD DEPC 71.16 OHM 1% 1/2W	28480	0727-0036
0727-0042	R:FXD DEPC 96.25 OHM 1/2% 1/2W	28480	0727-0042
0727-0048	R:FXD DEPC 150 OHM 1% 1/2W	28480	0727-0048
0727-0062	R:FXD DEPC 247.5 OHM 1/2% 1/2W	28480	0727-0062
0727-0063	R:FXD DEPC 292.5 OHM 1% 1/2W	28480	0727-0063
0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	28480	0727-0074
0727-0094	R:FXD DEPC 870 OHM 1/2% 1/2W	28480	0727-0094
0727-0122	R:FXD DEPC 2.51K OHM 1% 1/2W	28480	0727-0122
0757-0101	R:FXD FLM 1.708K OHM 0.5% 1/4W	28480	0757-0101
0757-0280	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0280
0757-0274	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
0757-0397	R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397
0757-0398	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
0757-0417	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
0757-0440	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
0757-0441	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
0757-0444	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
0757-0817	R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
0758-0003	R:FXD MET OX 1000 OHM 5% 1/2W	28480	0758-0003
0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	28480	0758-0005
0758-0012	R:FXD MET OX 12K OHM 5% 1/2W	28480	0758-0012
0758-0017	R:FXD MET OX 1500 OHM 5% 1/2W	28480	0758-0017
0758-0024	R:FXD MET OX 100 OHM 5% 1/2W	28480	0758-0024
0758-0038	R:FXD MET OX 9100 OHM 5% 1/2W	28480	0758-0038
0758-0047	R:FXD MET OX 7500 OHM 5% 1/2W	28480	0758-0047
0761-0016	R:FXD MET FLM 7500 OHM 5% 1W	28480	0761-0016
0761-0037	R:FXD MET FLM 390 OHM 5% 1W	28480	0761-0037
0761-0074	R:FXD MET FLM 15K OHM 5% 1W	28480	0761-0074
0811-0040	R:FXD WW 1 OHM 1% 5W	28480	0811-0040
0811-1662	R:FXD WW 0.47 OHM 5% 2W	28480	0811-1662
0811-1666	R:FXD WW 1.0 OHM 5% 2W	28480	0811-1666
0811-1671	R:FXD WW 2.7 OHM 5% 2W	28480	0811-1671
0812-0027	R:FXD WW 3100 OHM 5% 3W	28480	0812-0027
0813-0019	R:FXD WW 0.47 OHM 10% 2W	28480	0813-0019
1250-0212	CONNECTOR:JACK CHASSIS BNC	95712	30409-1
1250-0731	CONNECTOR:RF BNC BULKHEAD MOUNT	28480	1250-0731

See introduction to this section for ordering information

Table A2-2. Replaceable Parts (Cont)

Part No.	Description #	Mfr.	Mfr. Part No.
1400-0068	FUSEHOLDER:BRONZE CLIP	95915	3510-11
1850-0040	TRANSISTOR:GERMANIUM PNP	28480	1850-0040
1850-0065	TRANSISTOR:GERMANIUM 2N1370	01295	2N1370
1853-0020	TRANSISTOR:SILICON PNP	28480	1853-0020
1854-0003	TRANSISTOR:NPN SILICON	28480	1854-0003
1854-0005	TRANSISTOR:SILICON NPN 2N708	02735	2N708
1854-0022	TRANSISTOR:NPN SILICON	28480	1854-0022
1854-0040	TRANSISTOR:GERMANIUM PNP 2N383	02735	2N383
1884-0012	RECTIFIER:SILICON CONTROLLED 2N3528	02735	2N3528
1901-0025	DIODE:SILICON 100WV 100MA	28480	1901-0025
1901-0029	DIODE:SILICON 600 PIV	28480	1901-0029
1901-0033	DIODE:SILICON 100MA 180WV	28480	1901-0033
1901-0045	DIODE:SILICON 100PIV	28480	1901-0045
1901-0049	DIODE:SILICON 50PIV	28480	1901-0049
1901-0059	DIODE:SILICON 1N629	03877	1N629
1901-0096	DIODE:SILICON 120V	28480	1901-0096
1902-0017	DIODE,BREAKDOWN:6.81V 10% 400 MW	28480	1902-0017
1902-0025	DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0026
1902-0241	DIODE BREAKDOWN:100V	28480	1902-0241
1902-0766	DIODE BREAKDOWN:18.2V	28480	1902-0766
2100-0095	R:VAR COMP 100K OHM 30% LIN 1/5W	28480	2100-0095
2100-0154	R:VAR COMP 1K OHM 30% LIN 0.15W	28480	2100-0154
2100-1773	R:VAR WW 1K OHM 10% LIN 1/2W	28480	2100-1773
2110-0001	FUSE:1.0A 250V	75915	312001.
9140-0096	COIL:FXD RF 1 UH	28480	9140-0096
9140-0137	COIL:FXD RF 1 MH 5%	28480	9140-0137
00851-0017	COVER:INPUT BP FILTER	28480	00851-0017
00851-2004	BOARD:BLANK PC	28480	00851-2004
00851-2013	BOARD:PC BLANK	28480	00851-2013
00851-2016	BOARD:BLANK PC	28480	00851-2016
00851-6001	HV POWER SUPPLY ASSY	28480	00851-6001
00851-6002	SWITCH ASSY:I.F. GAIN	28480	00851-6002
00851-6013	CABLE ASSY:ATTEN OUTPUT	28480	00851-6013
00851-6014	CABLE ASSY:ATTEN INPUT	28480	00851-6014
00851-6017	LOW VOLTAGE POWER SUPPLY ASSY	28480	00851-6017
00851-6019	BOARD ASSY:VERT AMPL.	28480	00851-6019
00851-6021	BOARD ASSY:CURRENT CONTROLLED	28480	00851-6021
00851-6022	AMPLIFIER ASSY:20 MC	28480	00851-6022
00851-6027	CABLE ASSY:IF INPUT	28480	00851-6027
00851-6035	BOARD ASSY:INPUT BANDPASS FILTER	28480	00851-6035
00851-6037	CABLE ASSY:CRT VERT	28480	00851-6037
00851-8001	COIL:RF	28480	00851-8001
00851-8002	COIL:RF	28480	00851-8002
00852-2016	BOARD:BLANK PC	28480	00852-2016
00852-6016	BOARD ASSY:LVPS	28480	00852-6016

See introduction to this section for ordering information

CATHODE RAY TUBE WARRANTY

The cathode ray tube (CRT) supplied in your Hewlett-Packard Oscilloscope and replacement CRT's purchased from hp are guaranteed by the Hewlett-Packard Company against electrical failure for a period of one year from the date of sale. Broken tubes or tubes with burned phosphor are not included under this guarantee. If the CRT is broken when received, a claim should be made with the responsible carrier.

Your nearest Hewlett-Packard Sales/Service Office maintains a stock of replacement tubes and, if desired, will assist in processing the warranty claim.

In order to ensure credit for a CRT under the warranty period, the reverse side of this sheet should be filled out completely and returned with the defective tube. To avoid damage to the tube while in shipment, carefully follow the shipping instructions listed below; credit is not allowed on broken tubes.

SHIPPING INSTRUCTIONS

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 four inches of packed excelsior or similar shock absorbing material; be sure the packing is tight all around the tube.
5. Tubes returned from outside the continental United States should be packed in a wooden box.
6. Ship prepaid by AIR FREIGHT or RAILWAY EXPRESS.