Instruction Manual

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MODEL 1161-S(A)
SPECTRUM DISPLAY UNIT

May 1972

For Serial Nos. 167 and above

MICRODYNE Corporation

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

The following warnings appear in the text in this manual, and are repeated here for emphasis.

WARNING

Discharge power supply capacitors to ground before probing into or repairing the 1161-S(A).
(Page 5-4)

WARNING

Extreme care should be exercised when handling the crt. Improper handling may result in implosion.
(Page 5-6)

WARNING

Certain areas of the 1161-S(A) involving the crt and power supply contain potentials of +175V dc and -2000V dc. Exercise extreme caution when working in this area—contact may prove fatal.
(Page 5-6)

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(Page 5-7)

TABLE OF CONTENTS

continued

Table of Contents, continued

LIST OF ILLUSTRATIONS

LIST OF TABLES

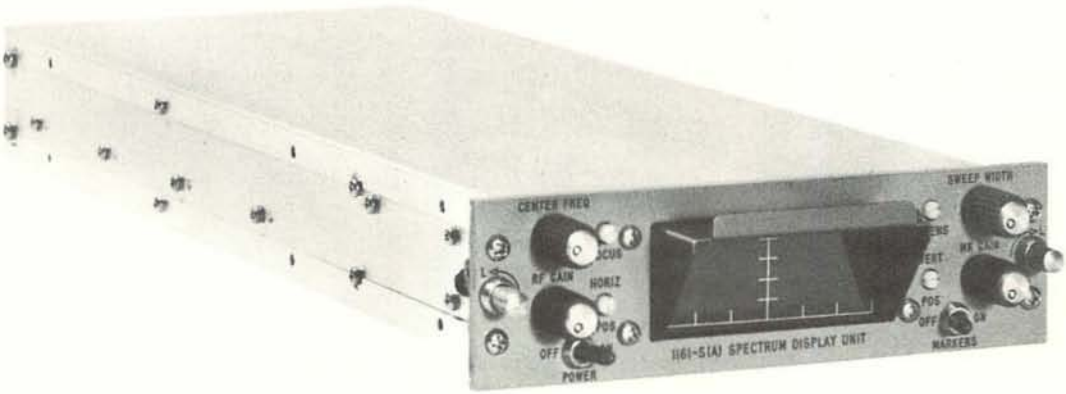


Figure 1-1. Model 1161-S(A) Spectrum Display Unit

SECTION I
GENERAL INFORMATION

1-1. SCOPE. This manual provides information concerning the description, installation, operation, and maintenance of the Model 1161-S(A) Spectrum Display Unit designed and manufactured by Microdyne Corporation, Rockville, Maryland. Schematic diagrams and replacement parts lists for the unit are included.

1-2. PURPOSE AND DESCRIPTION

1-3. The Model 1161-S(A) Spectrum Display Unit is a plug-in module designed as an accessory item for use with Microdyne telemetry receivers or playback monitors. The display unit is used to provide a visual representation of signals in a 6 MHz bandpass centered about a frequency of 50 MHz. Complete electrical, environmental, and mechanical specifications for the display unit are presented in table 1-1.

1-4. Except for the cathode ray tube, the 1161-S(A) is entirely solid-state making use of integrated circuits and subminiature components. The unit displays a frequency spectrum in a 6 MHz bandpass centered at 50 MHz with a resolution of 10 kHz. Marker generating circuitry is an integral part of the display unit to aid in analysis of the crt display. When activated by a front panel switch, the marker generator provides pips spaced at 500 kHz intervals on either side of a 50 MHz center frequency marker.

1-5. Front panel operating controls are provided for adjusting the gain of the 1161-S(A) over an 80 dB range and adjusting the sweep width from approximately 100 kHz to 6 MHz. Another operating control is included to adjust the center frequency display and marker over a ±500 kHz range to permit accurate centering on the vertical graticule. Marker amplitudes, both center frequency and sideband, are adjustable through a marker gain control; the marker gain is such that it maintains the amplitude of the center frequency pip at twice that of the sideband pips. Screwdriver controls are located on either side of the crt for adjusting the focus and intensity, and the vertical and horizontal positioning of the trace.

1-6. When used with such equipment as the Microdyne Model 1100-AR Telemetry Receiver, the 1161-S(A) plugs into a special receptacle in the receiver. When used with other equipment not having mounting provisions, the unit must be mounted in the Microdyne Model 2261-S(A) Dual Spectrum Display Unit Housing. All operating voltages required by the 1161-S(A) are supplied by the parent unit. Signal connections to the 1161-S(A) are made from the rear panel connectors of the parent unit via interconnecting cabling.

1-7. Basic components of the display unit are: a base chassis, three subassemblies, a cathode ray tube (crt), and a power transformer. The subassemblies include a signal processing subassembly and power supply subassemblies. The signal processing assembly is composed of two separate subassemblies: a printed circuit board containing primarily rf circuits, and a printed circuit board containing primarily i-f circuits. All circuitry, namely, the signal processing assembly, power supply circuit boards, crt, transformer, front panel controls, and rear panel connector, are mounted on a base chassis which is completely enclosed by top and bottom covers. These covers are held in place with machine screws and are easily removed for maintenance purposes.

Table 1-1. Specifications

ELECTRICAL	
Input Center Frequency	50 MHz.
Sweep Width	6 MHz, maximum.
Sweep Range	100 kHz to 6 MHz.
Sweep Rate	20 Hz.
Sensitivity	10 μV.
RF Gain Control	80 dB.
Resolution	10 kHz.
Input Impedance	50Ω.
Calibration Markers	Center frequency and sideband at 500 kHz intervals.
Power Requirements	+15V dc and -15V dc; supplied by parent unit.
ENVIRONMENTAL	
Temperature Range:	
Operating	0°C to +50°C.
Storage	-62°C to +65°C.
Barometric Pressure:	
Operating	10,000 feet.
Storage	50,000 feet.
Relative Humidity	To 95%.
MECHANICAL	
Dimensions:	
Height	1-3/4 inches.
Width	6-1/2 inches.
Depth	13 inches.

SECTION II
INSTALLATION

2-1. GENERAL

2-2. The Model 1161-S(A) Spectrum Display Unit is shipped separately from the parent unit. When shipped, the 1161-S(A) is sealed in a moisture-proof polyethylene bag, wrapped in shock absorbing insulation, and packaged in a rugged cardboard container.

2-3. UNPACKING AND HANDLING

2-4. Upon receipt of the 1161-S(A) carton, cut the sealing tape and lift the package from the box. Open the bag and remove the spectrum display unit. (Do not discard the packing material if the unit is to be reshipped; see paragraph 2-11.) Check the spectrum display unit for in-transit damage: broken connectors and controls, dents, etc. If damaged, notify the proper authority immediately.

2-5. STORAGE

2-6. Storage conditions must be within the environmental limits specified in table 1-1.

2-7. INSTALLATION

2-8. The 1161-S(A) may be installed in any parent unit which provides the necessary operating voltages and mounting facilities. Typical parent units are the Microdyne 1100-AR telemetry receiver and 2261-S(A) dual display unit equipment tray. The procedures required to mount the standard 1161-S(A) are the same regardless of the parent unit.

2-9. To install the 1161-S(A), proceed as follows:

a. Adjust the front panel thumbscrews to raise the securing pawls.

b. Insert the 1161-S(A) into the parent unit.

c. Adjust the thumbscrews to position and tighten the securing pawls.

2-10. To remove the 1161-S(A) from the parent unit, loosen the front panel thumbscrews to disengage the securing pawls and extract it from the slot.

2-11. PACKAGING FOR RESHIPMENT

2-12. To package the 1161-S(A) for reshipment, proceed as follows:

a. Place the spectrum display unit and a quantity of desiccant into a moisture-proof polyethylene bag and seal.

b. Place the unit in a cardboard container using enough shock-absorbing material to prevent movement within the carton.

c. Seal the carton.

d. Affix the necessary "Delicate Equipment" and "Fragile" labels.

SECTION III
OPERATION

3-1. GENERAL

3-2. This section provides operational information for the 1161-S(A) spectrum display unit. Included herein are: a list of the operating controls and a brief description of their function, and a general operating procedure. The operating procedure is for the display unit only and should be used in conjunction with the operating procedures for the parent unit.

3-3. CONTROLS AND INDICATORS

3-4. The controls and indicators, their reference designations, and their functions are listed in table 3-1. A front panel view of the 1161-S(A) is shown in figure 3-1.

Table 3-1. Controls and Indicators

Control/Indicator	Reference Designation	Function
POWER switch	S1	When placed to the ON position, this switch connects operating voltage to the display unit high voltage power supply.
MARKERS switch	S2	Energizes or deenergizes the internal marker generator.
RF GAIN control	R2	Used to adjust the vertical amplitude of the displayed signal.
CENTER FREQ control	R1	Used to adjust the center frequency on the crt baseline.
FOCUS control	R3	Used to adjust the sharpness of the crt display.
HORIZ POS control	R4	Used to adjust the horizontal position of the crt baseline.
INTENS control	R5	Used to adjust the brightness of the crt display.
VERT POS control	R6	Used to adjust the vertical position of the crt display.
SWEEP WIDTH	R7	Used to adjust the width of the crt display.

continued

Table 3-1, continued

Control/Indicator	Reference Designation	Function
MK GAIN	R8	Used to adjust the vertical amplitude of the displayed marker signal.

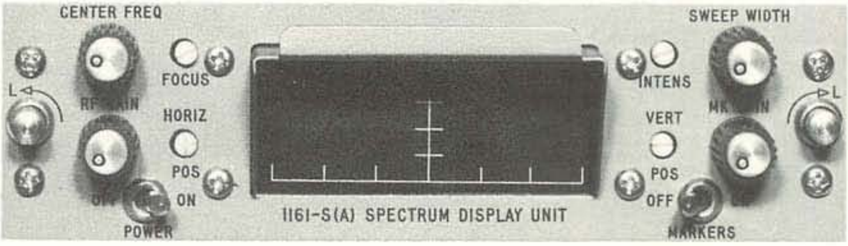


Figure 3-1. Model 1161-S(A) Spectrum Display Unit, Front Panel View

3-5. OPERATING PROCEDURE

3-6. The following procedure is recommended to place the 1161-S(A) in operation:

a. Apply power to the parent unit and check signal connections as given in the parent unit instruction manual.

b. Set the 1161-S(A) POWER switch to the ON position.

c. Adjust the INTENS control, if necessary, for the desired brightness of the crt display.

d. Adjust the FOCUS control, as necessary, to obtain a sharp trace.

e. Set the RF GAIN control fully counterclockwise.

f. Set the SWEEP WIDTH control fully clockwise.

g. Set the MARKERS switch to ON; the center frequency marker will appear with 500 kHz internal markers across the spectrum.

h. Adjust the MK GAIN control for the desired marker vertical amplitude.

i. Center the display on the center graticule using the CENTER FREQ control.

j. Adjust the SWEEP WIDTH control for the desired display width.

k. If the center frequency marker moves horizontally with an adjustment of the SWEEP WIDTH control, adjust the HORIZ POS control as follows:

1. Reduce the sweep width slowly from maximum to zero while adjusting the CENTER FREQ control, as necessary, to maintain the center frequency marker in the same horizontal position.

2. Readjust the sweep width until the marker is approximately 1/4 inch wide — do not remove the CENTER FREQ control while making this adjustment.

3. Adjust the HORIZ POS control until the marker is centered over the center graticule.

l. Adjust the VERT POS control, as necessary.

m. Adjust the RF GAIN control for the desired vertical amplitude.

n. If the baseline is tilted, refer to paragraph 5-16, step g.

SECTION IV
THEORY OF OPERATION

4-1. GENERAL

4-2. The Model 1161-S(A) Spectrum Display Unit is employed to present a visual display of signals appearing in a 6 MHz passband centered at 50 MHz. Although the unit is primarily designed for use with Microdyne telemetry receivers and playback monitors having a first i-f of 50 MHz, it may also be used with similar equipment exhibiting a 50 MHz i-f output meeting in the input requirements specified in table 1-1. Converters are available for use with the 1161-S(A) to convert other i-f signals to 50 MHz for display purposes. A block diagram of the unit is shown in figure 4-1. Paragraph 4-3 presents a block diagram description of the 1161-S(A) and paragraph 4-8 provides a detailed theory of operation.

4-3. FUNCTIONAL DESCRIPTION (See figure 4-1)

4-4. The nominal 50 MHz input signal is coupled to a gain controlled 50 MHz amplifier which drives the first mixer. In the mixer, the 50 MHz signal is heterodyned with the 67-73 MHz input from the swept oscillator to produce a 20 MHz difference frequency which is further amplified and filtered and coupled to the second mixer. Also applied to the second mixer is the 20.9 MHz output from a crystal oscillator which, when heterodyned with the 20 MHz signal, produces a 900 kHz intermediate frequency. The output of the second mixer is amplified and applied to the a-m detector which drives the vertical amplifier. Two outputs are provided by this amplifier to drive both vertical deflection plates within the crt. A blanking voltage from the sawtooth generator is also fed to the vertical amplifier and is utilized to drive the trace out of visible range during the retrace portion of the sweep.

4-5. Horizontal inputs to the crt are supplied from an internal ramp generator. The sawtooth provided by the ramp generator is applied to the crt via the horizontal deflection amplifier. The same sawtooth is also coupled to the swept oscillator to maintain the required relationship between the horizontal sweep voltage and the swept oscillator frequency.

4-6. In order to properly analyze the crt display and to locate various components of the displayed spectrum, the 1161-S(A) is equipped with an integral marker generator. When activated, the output of a 500 kHz oscillator pulse modulates the output of a companion 90 MHz oscillator. The modulated signal is then amplified and mixed with an input from the swept oscillator to produce marker pips at 500 kHz intervals on either side of a center frequency marker. The output of the marker mixer is injected into the signal path after the second mixer and processed with the input signal.

4-7. Primary operating voltages for the display unit are supplied by the parent unit. The +15 volt input from the parent unit is converted by the 1161-S(A) internal high voltage power supply to obtain the following three outputs: -2000V dc, +175V dc, and 6.3V ac.

4-8. CIRCUIT DESCRIPTION

4-9. Reference to the schematic diagrams contained in Section VII is recommended when reading the following circuit descriptions.

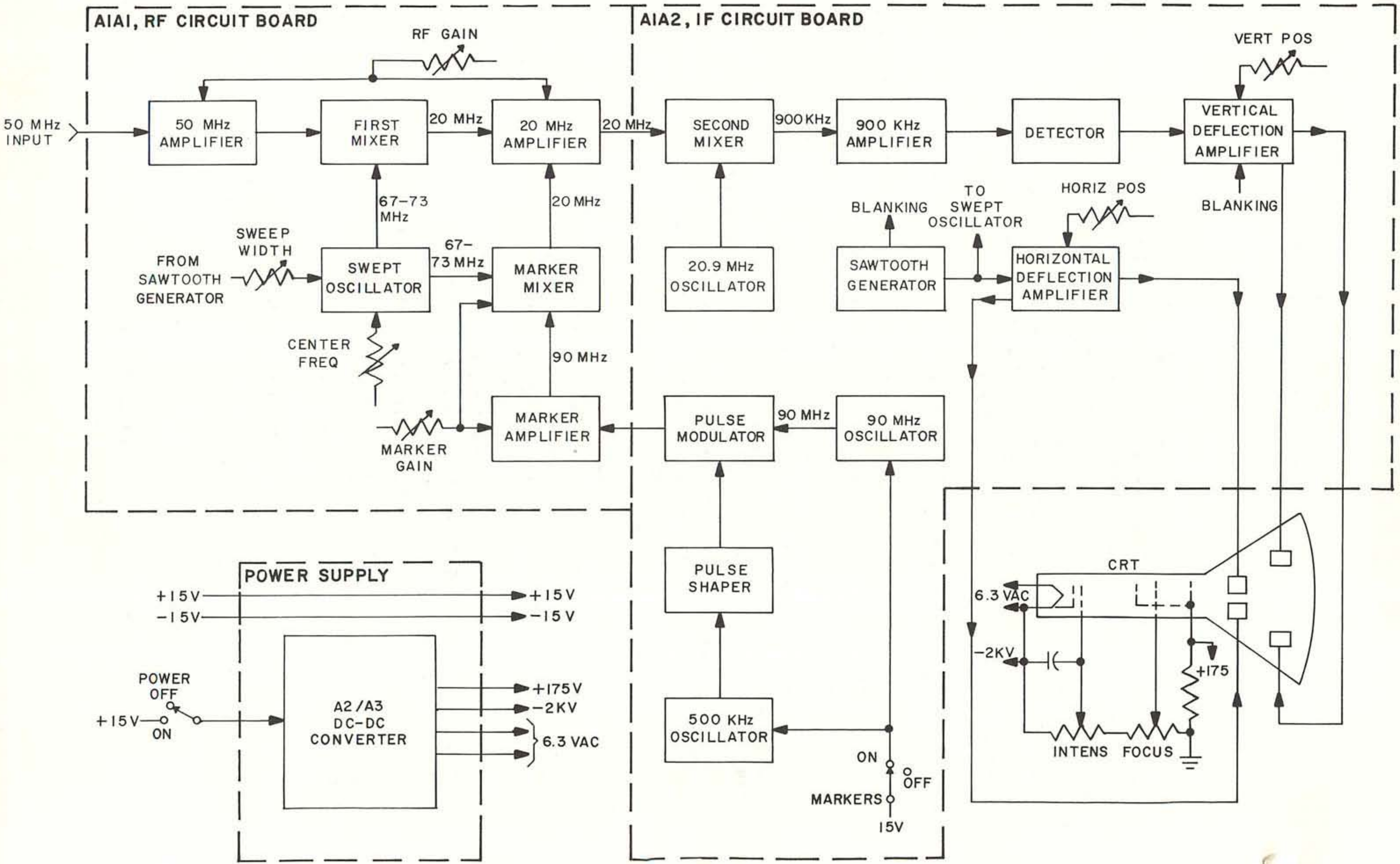


Figure 4-1. Functional Block Diagram

4-10. A1A1, RF CIRCUIT BOARD. The rf circuit board is shown in figure 7-6 and consists of three identical rf amplifier stages Q1-Q2, Q3-Q4, Q5-Q6; first mixer Q7-Q8-Q9; 20 MHz amplifier Q10-Q11; marker mixer Q12-Q13-Q14; marker amplifier Q15-Q16; swept oscillator Q17; and oscillator limiter Q18-Q19.

4-11. The 50 MHz input signal is coupled from P1-A1 on the base chassis to the input stage of the amplifier Q1-Q2. This stage is the first of three identical rf amplifiers each of which is composed of a common emitter amplifier driving a common base amplifier. Tuning of each amplifier is accomplished by the double-tuned output circuits of the common base stage. These circuits establish an rf bandpass centered at 50 MHz and flat between 47 MHz and 53 MHz. Gain control voltages from front panel gain control R2 are applied to the base circuit of the common emitter portion of each amplifier stage. After amplification, the 50 MHz signal is coupled to the first mixer Q7-Q8-Q9.

4-12. The first mixer is composed of emitter-coupled pair Q8-Q9 and current source Q7. Accepting inputs from the rf amplifier and local oscillator, the mixer functions to down convert the 50 MHz signal and any other signal in the 6 MHz bandpass to an intermediate frequency of 20 MHz also centered in a 6 MHz bandpass. This is accomplished by feeding the 67-73 MHz swept oscillator signal to Q8-Q9 which alternately turns one on and the other off. The current flow through the amplifier is, in turn, modulated by the 50 MHz signal applied to current source Q7. The resultant 20 MHz output is taken from the collector of Q8 and coupled by double-tuned circuit L7-L8 to output amplifier Q10-Q11. This stage operates in the same manner as the rf amplifiers previously discussed with the gain control voltage applied to the base of the common emitter amplifier Q10. The output of the amplifier is taken from Q11 and coupled through a double-tuned circuit to E11. Also injected into this circuit is the output of the marker mixer Q12-Q13 which is described in paragraph 4-15.

4-13. The oscillator portion of the rf subassembly is a voltage controlled circuit which provides the mixing signals applied to both the signal mixer and marker mixer. The oscillator is continuously swept from 67 MHz to 73 MHz by the output of the sawtooth generator applied at E12. The purpose of sweeping the oscillator over a 6 MHz range is to provide a mixer injection signal that will cause signals appearing in a 6 MHz rf passband to be displayed on the crt as pips or spectral lines.

4-14. Oscillator Q17 is in a modified Colpitts configuration with voltage variable capacitor CR6 functioning as the tuning element. The center frequency of the oscillator is determined by L13 and the voltage applied to the cathode of CR6 from front panel control R1 via E14. A tuning range of ±500 kHz from the normal 70 MHz center frequency is provided by R1 to compensate for small shifts in the applied input signal. The sawtooth voltage from the ramp generator is applied to the anode of CR6 via the front panel sweep width control R7 and a voltage shaping network. The shaping network is composed of diodes CR1 through CR5, CR7, R91, R93, and R97, and is employed to predistort the ramp input. Predistortion of the control voltage is necessary to compensate for the non-linearity of CR6 to obtain a linear frequency change in relation to the applied voltage change. The output of the oscillator is taken from the emitter of Q17 and coupled to limiter Q18-Q19 utilized to provide a constant mixer injection of approximately 420 mV rms over the entire oscillator frequency range.

4-15. The marker circuitry on the rf board consists of amplifier Q15-Q16 and mixer Q12-Q13-Q14. The 90 MHz marker signal and sideband pips from the marker generator in A1A2 are applied through E18/E19 to amplifier Q15-Q16. This amplifier operates in the same manner as the two-stage rf amplifiers previously described. Amplifier gain, hence marker amplitude, is controlled by potentiometer R8 on the front panel which is electrically connected to the base of Q16 via E17. The output of the amplifier is taken from the collector of Q15 and coupled through a double-tuned circuit to the input of marker mixer Q12-Q13-Q14. Also applied to the mixer is the 67-73 MHz signal from the swept oscillator.

4-16. The marker mixer functions in the same manner as the signal mixer described in paragraph 4-12. The resultant output of the 90 MHz signal input and the 67-73 MHz swept oscillator input is a broad spectrum of marker pips spaced at 500 kHz intervals and centered at 20 MHz. This output is then coupled to the output circuit of 20 MHz i-f amplifier Q10-Q11 and superimposed on the signal being processed.

4-17. A1A2, IF CIRCUIT BOARD. The i-f circuitry of the spectrum display unit is shown in figure 7-7, and is composed of mixer A1, 900 kHz amplifier Q1, 20.9 MHz oscillator Q2, 900 kHz amplifier Q6-Q7, detector CR1, amplifier Q10-Q11, vertical deflection amplifier Q12-Q13, horizontal deflection amplifier Q14-Q15, and sawtooth generator Q8-Q9-A2. In addition to these signal processing circuits, the i-f circuit board contains the marker generating circuitry. This section is composed of 500 kHz oscillator Q3, pulse generator and shaping network CR1-Q4, 90 MHz oscillator A3, and pulse modulator CR2-Q5.

4-18. A 20 MHz i-f signal from A1A1 is coupled through E1 to mixer A1 and heterodyned with the 20.9 MHz signal generator by crystal oscillator Q2. The 900 kHz difference frequency output of the mixer is amplified by common base amplifier Q1 and applied to cascode amplifier Q6-Q7 via tuned circuit L1-L2-L3; the tuned circuit is centered at 900 kHz and establishes a bandwidth of 7 kHz. From the cascode amplifier, the 900 kHz i-f signal is applied to detector CR5 which provides demodulated data to Darlington pair Q10-Q11. This stage then drives vertical deflection amplifier Q12-Q13.

4-19. Transistors Q12 and Q13 are configured as a differential pair with the output of each driving a vertical deflection plate in the crt. Positioning of the trace on the crt face is controlled by the dc voltage levels at the collectors of the two transistors. The vertical positioning control on the front panel is electrically connected to the base of Q13. An adjustment of this control varies the conduction rate of Q13 and either increases or decreases the collector voltage shifting the trace either down or up, respectively. Tied to the base of Q13 and E26 is the input from the horizontal tilt control. This input is a sample of the sawtooth output of the horizontal deflection amplifiers via potentiometer R11 on the main chassis. Its purpose is to correct any misalignment of the horizontal deflection plates by applying a correction voltage to the vertical plates. When applied, the low level sawtooth alters the vertical deflection voltage as required to obtain a horizontal baseline. Also applied to the vertical amplifier is the blanking voltage from the sawtooth generator at point E11. The positive blanking signal is coupled to the base of Q13 causing the collector voltage of Q13 to decrease and the collector voltage of Q12 to increase. Under these conditions, the bottom plate of the crt connected to Q12 is more positive than the top plate, thus pulling the crt electron beam down and out of visible range during the retrace portion of the sweep.

4-20. The sawtooth signal for application to the horizontal plates of the crt is generated by unijunction relaxation oscillator Q9 and companion current source Q8. The sawtooth is produced by the constant charge-discharge cycle of capacitors C40 and C41 which is controlled by Q9. During the charge cycle, the potential of the capacitors increases in a positive direction until the triggering point of Q9 is attained. When Q9 triggers, the capacitors discharge and the cycle begins again. The result is an extremely linear -0.8 volt to +0.8 volt, 20 Hz sawtooth output which is taken from the junction of C40 and C41 and is applied to amplifier A1. This stage provides a gain of approximately 10 and supplies a -10 volt to +10 volt sawtooth output to horizontal amplifier Q14-Q15.

4-21. The sawtooth generator also supplies the blanking pulse to the vertical amplifier to deflect the trace off the crt screen during retrace. This pulse is produced by the triggering of Q9 which produces a positive level at E22 which is then fed to the base of Q13.

4-22. The horizontal amplifier (Q14-Q15) is configured as a differential pair with the output of each transistor driving one of the crt horizontal deflection plates. The nominal sweep range is determined by the adjustment of R71 while the specific sweep range between 100 kHz and 6 MHz is controlled by front panel control R7 connected between the collector of Q14 and the crt. Horizontal positioning of the trace is accomplished by adjusting the dc level at the collector of Q15 with front panel control R4. A sample of the output of each stage of the differential is routed to potentiometer R11 on the chassis for application to the vertical amplifier.

4-23. Marker generator circuitry consists of 500 kHz oscillator Q3, pulse generator and shaper Q4-CR1, pulse modulator Q5-CR2, and 90 MHz oscillator A3. This circuit produces a series of marker pips on the crt spaced at 500 kHz intervals to assist in analysis of the display. Front panel switch S2 is utilized to de-energize the marker generator when markers are not desired.

4-24. The 500 kHz output of crystal oscillator Q3 is applied to pulse generator and shaper composed of Q4 and tunnel diode CR1.

4-25. Pulses are produced at a 500 kHz rate by the action of the tunnel diode in turning Q4 on and off. As the current of the applied 500 kHz oscillator signal reaches 1 mA during each half cycle, CR1 switches state which, in turn, causes Q4 to be turned on and off also at the 500 kHz rate. The pulses are shaped and filtered by C26, R28, L5, and C27, and applied to pulse modulator CR2-Q5 as is the 90 MHz signal from A3. A portion of the 90 MHz signal is coupled through R30 and bypasses the modulator. The result of this circuit arrangement is a large pulse at 90 MHz and a series of pulses on either side spaced at 500 kHz intervals. The amplitude of the 90 MHz pulse is controlled by the positioning of R30 and is nominally set to be 25% higher than the pulses appearing on either side of it. Output from the generator is taken from E20 and applied to the rf circuit board for down conversion to a 20 MHz center frequency and injection into the signal path.

4-26. POWER SUPPLY. The power supply is a dc to dc converter which accepts the +15V dc input from the parent unit and provides 2000V dc, +175V dc, and 6.3V ac operating voltages to the display circuitry. Positive 15 volts from power switch S1 is applied to the center tap of T1 primary (E2). End taps at E1 and E3 are connected to transistor switches Q1-Q2-Q5 and Q3-Q4-Q6 which are turned on and off at a 2 kHz rate by multivibrator Q7-Q8. With this type of circuit arrangement, a 2 kHz, 30 volt square wave is produced across the primary windings and coupled to high voltage secondary windings at E6-E7 and E8-E9-E10. Filament voltage (6.3V ac) for crt operation is supplied by the secondary at E4 and E5.

4-27. The high voltage output taken from E6/E7 is approximately 1000 volts peak and is applied to diode voltage doubler A2CR2 and A2CR4 to obtain the -2000 volt crt grid voltage. Intensity and focusing voltages are also taken from this supply and applied to the crt via controls R3 and R5.

4-28. The second high voltage output is taken from E8-E9-E10 and applied to full wave rectifier A2CR5 and A2CR6. The +175V dc output produced by this supply is applied to the vertical and horizontal deflection amplifiers in the i-f subassembly.

SECTION V
MAINTENANCE

5-1. GENERAL

5-2. This section contains maintenance information for the 1161-S(A) spectrum display unit. Included herein are: the list of test equipment, performance tests, preventive maintenance, and corrective maintenance.

5-3. TEST EQUIPMENT

5-4. The test equipment necessary to test, troubleshoot, and align the 1161-S(A) are listed in table 5-1.

Table 5-1. Test Equipment Required

Oscilloscope	HP180A
Dual Vertical Amplifier	HP1801A
Time Base	HP1820A
10:1 Probe	HP10004A
DC Voltmeter	HP412A
Voltmeter	RCA WV-98C
Sampling RF Voltmeter	HP3406A
Signal Generator	HP606A
Electronic Counter	HP5245L
Sweep Generator	Texscan VS-80
High Impedance Detector	Microdyne 200-529 (figure 5-2)
Test Cables (two required)	See paragraph 5-5
Power Supply	HP6216A
Dual Power Supply	HP6205B

5-5. SPECIAL CABLES

5-6. Two types of test cables are required to test and align the 1161-S(A). One cable is an extender cord to connect the 1161-S(A) to the parent unit to obtain power and signal connections. The other cable is for connecting the 1161-S(A) to two power supplies and a signal source. In either case, both cables must be fabricated.

5-7. To construct the extender cord, proceed as follows:

a. Gather the following material:

1. Fifteen feet of #22 stranded wire.
2. Three feet of RG-174/U coaxial cable.
3. One Cannon DBMF-13W3S connector.
4. One Cannon DBMF-3W3P connector.
5. Two Cannon DM-53742-1 coaxial inserts.

b. Cut the #22 wire into five three-foot lengths and make one-to-one connections between pins 1, 3, 4, 7, and 8 of the DBM-13W3 connectors.

c. Solder the two DM-53742-1 connectors to the RG-174/U cable.

d. Install the DM-53742-1 connectors into A1 of the DBMF-13W3S connectors.

e. This completes fabrication of the extender cord.

5-8. To fabricate the power supply and signal source cable, proceed as follows:

a. Gather the following material:

1. One Cannon DBMF-13W3S connector.
2. One Cannon DM-53742-1 coaxial insert.
3. One Bendix 30517-10 BNC connector.
4. Three feet of RG-174/U coaxial cable.
5. Fifteen feet of #22 stranded wire.

b. Cut the #22 wire into five three-foot lengths.

c. Solder one end of each length to pins 1, 3, 4, 7, and 8 of the DBMF-13W3S connector.

d. Solder the Bendix 30517-10 connector and the DM-53742-1 coaxial insert to the RG-174/U cable.

e. Install the DM-53742-1 connector into A1 of the DBMF-13W3S connector.

f. This completes fabrication of the power supply and signal source cable. The test setup for using this cable is shown in figure 5-1.

5-9. SPECIAL TEST EQUIPMENT

5-10. A high impedance detector is required to align certain sections of the 1161-S(A). This detector can be purchased from Microdyne Corporation under part number 200-529, or it can be fabricated following the instructions in paragraph 5-11.

5-11. To fabricate the high impedance detector, proceed as follows:

a. Gather the following material:

1. Two 100KΩ $\frac{1}{4}$w resistors, Allen Bradley CB1045.
2. One 10 pf capacitor, Erie 8101-100-COG-100J.
3. One 1N277 diode.
4. One UG-1094 BNC connector.
5. Two clips, Muellar Mini-gator type 30.

b. Construct detector following the schematic diagram shown in figure 5-2.

c. Fasten the clips to the input ends of the detector.

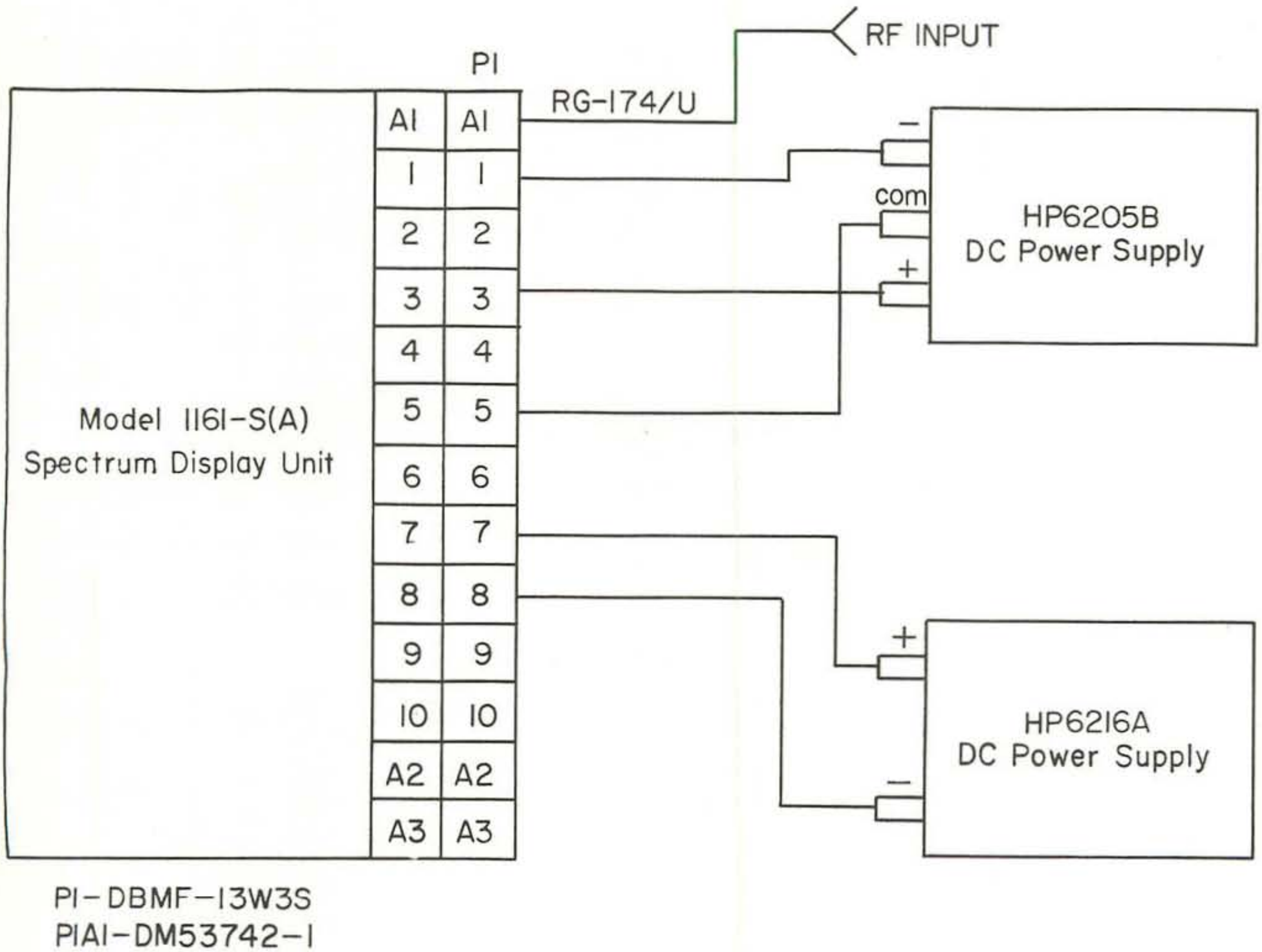


Figure 5-1. Test Setup

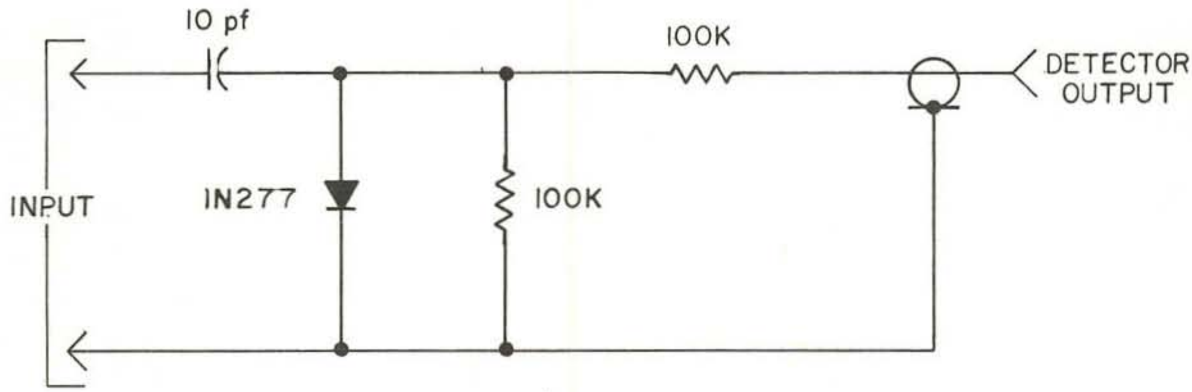


Figure 5-2. High Impedance Detector

5-12. PREVENTIVE MAINTENANCE

5-13. Preventive maintenance requirements for the 1161-S(A) consist of a semiannual inspection and a performance test. Periodic adjustment of internal controls and lubrication of switches and potentiometers are not required.

5-14. INSPECTION

5-15. The inspection of the 1161-S(A) should include checking of internal components for evidence of overheating; connectors for looseness, damage, and corrosion; screws and nuts for looseness; and wiring for cut, cracked, or frayed insulation. Damaged and corroded components should be replaced immediately. Screws and nuts should be tightened to prevent contact with circuitry. Damaged wiring should be replaced, although temporary repairs can be made with plastic insulating tape.

WARNING

Discharge power supply capacitors to ground before probing into or repairing the 1161-S(A).

5-16. PERFORMANCE TESTS

5-17. The following tests are provided to ensure acceptable performance of the 1161-S(A). An HP606A signal generator and HP5245L counter, or equivalents, are required to perform the tests. The 1161-S(A) should be installed in the parent unit and the HP606A should be connected to the applicable parent unit input for direct connection to the 1161-S(A) input.

a. INPUT FREQUENCY:

1. Set the HP606A for a 50 MHz output at 10 μV.
2. Set the SWEEP WIDTH control fully clockwise.
3. Adjust the CENTER FREQ control until the signal pip is on the center graticule.
4. Vary the input from 47 MHz to 53 MHz, and note that the signal pip moves from the extreme right to the extreme left of the crt.
5. Reset the input to 50 MHz.

b. SWEEP WIDTH:

1. Set the SWEEP WIDTH control fully clockwise.
2. Set the MARKERS switch to ON.
3. Adjust the MK GAIN control for a convenient marker amplitude.
4. Count the marker pips; there should be eight pips on either side of the center frequency pip.
5. Slowly turn the SWEEP WIDTH control counterclockwise and note a decreasing number of marker pips. No marker pips should be visible when the SWEEP WIDTH is fully counterclockwise.
6. Reset the SWEEP WIDTH fully clockwise.

c. SENSITIVITY:

1. Set the input signal frequency slightly off 50 MHz.
2. Set the RF GAIN control fully clockwise.
3. Note that the signal pip is either at or above full scale.
4. Reset to 50 MHz and full scale.

d. RESOLUTION:

1. Set the input frequency to 50.050 MHz at 1 mV.
2. Reduce the sweep width until the center frequency marker and two side-band markers are visible.
3. Adjust MK GAIN control for full scale deflection of the center frequency marker.
4. Adjust the signal generator for full scale deflection of the signal pip.
5. Reduce the input frequency to 50.010 MHz, and note that the signal and marker pips remain on the display.

e. GAIN CONTROL:

1. Set the HP606A to 50.250 MHz.
2. Set the RF GAIN control fully clockwise.
3. Set the input level for full scale deflection; this should occur at 10 μV or less.
4. Increase the input level to 80 dB.
5. Adjust the RF GAIN control for a full scale deflection. This should occur at or near the counterclockwise stop.

f. MARKER FREQUENCY:

1. Set input level to 1 mV at 50 MHz.
2. Adjust the RF GAIN control for full scale deflection.
3. Check that the marker pips occur at 500 kHz intervals by varying the input frequency from 47 MHz to 53 MHz and checking the frequency at each marker.

g. BASELINE TILT:

1. With no input to the display unit, observe that the baseline is in line with the horizontal graticule on the display face.
2. If the baseline is tilted, adjust potentiometer R14 to correct the tilt. This potentiometer is located at the top right rear corner and is accessible through a hole in the top cover.

This completes the performance tests.

5-18. CORRECTIVE MAINTENANCE

5-19. Corrective maintenance for the 1161-S(A) consists of troubleshooting and realigning the affected stage or stages. Defective or damaged components should be replaced using the identical component as referenced in the replacement parts list. Normal precautions such as attaching heat sinks and using a medium wattage soldering iron should be followed prior to and when working on the 1161-S(A).

WARNING

Extreme care should be exercised when handling the crt. Improper handling may result in implosion.

WARNING

Certain areas of the 1161-S(A) involving the crt and power supply contain potentials of +175V dc and -2000V dc. Exercise extreme caution when working in this area—contact may prove fatal.

5-20. TROUBLESHOOTING

5-21. To properly troubleshoot the 1161-S(A), it should be connected to the parent unit using the extender cord discussed in paragraph 5-7 or connected to power supplies and a signal source using the cable discussed in paragraph 5-8.

5-22. The problem should first be isolated to a particular section of the display unit and, second, isolated to a particular component within that section. A certain check of the noticeable symptoms and reference to the block diagram to determine the stages common to the symptoms can be used to isolate the problem to one of the circuit boards. The voltage charts and waveforms presented in tables 5-2 through 5-7 can be employed to locate the defective component(s).

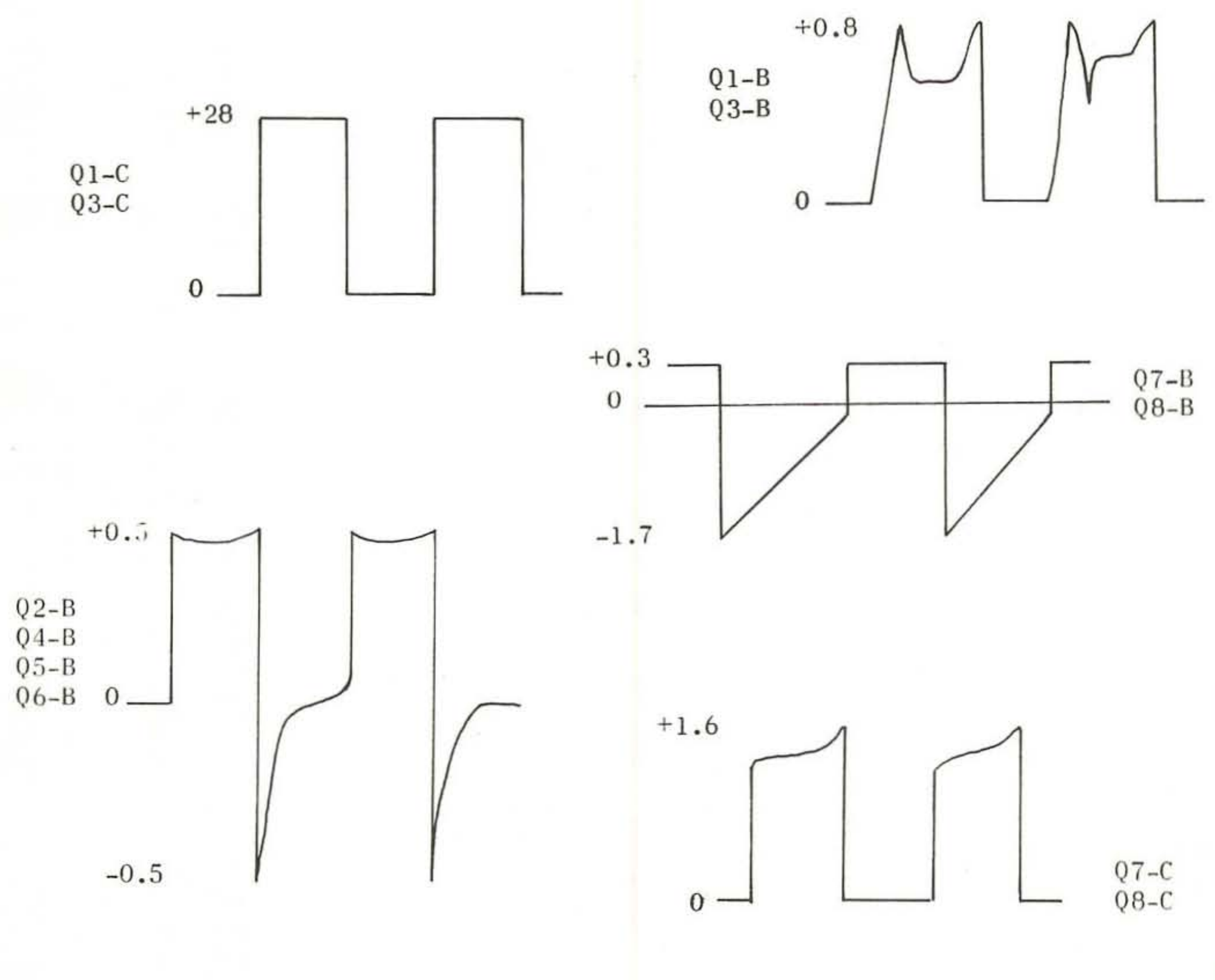
5-23. In many cases, the crt can be used to isolate the fault to a particular circuit. For example, with a known signal input, if there is a spot on the crt but no vertical or horizontal deflection, the problem probably lies within the +175V dc portion of the power supply. Similarly, if there is a vertical line present with a known input, the fault is probably located within the ramp generator or horizontal deflection amplifier.

5-24. POWER SUPPLY. Should the failure be isolated to the power supply, a comparison of the waveforms shown in table 5-2 and the voltages given in table 5-3 should be employed to locate the defective component. See figures 7-1 and 7-2 for location of components on the power supply circuit boards.

WARNING

Certain areas of the 1161-S(A) involving the crt and power supply contain potentials of +175V dc and -2000V dc. Exercise extreme caution when working in this area—contact may prove fatal.

Table 5-2. Power Supply Waveforms



NOTE

All measurements made with an HP180A oscilloscope containing an 1801A dual channel vertical plug-in, 1820A time base, and 10004A 10:1 probe.

Table 5-3. Power Supply Voltage Chart

Component	Voltage	
R1 (Arm)	+ 6.8	Full CW
R1 (Arm)	+ 4.9	Full CCW
R2 (Arm)	- 7.2	Full CW
R2 (Arm)	- 15	Full CCW
R3 (Arm)	-1670	Full CW - high voltage
R3 (Arm)	-1270	Full CCW - high voltage
R4 (Arm)	+ 15	Full CW
R4 (Arm)	- 15	Full CCW
R5 (Arm)	-1980	Full CW - high voltage
R5 (Arm)	-1940	Full CCW - high voltage
R6 (Arm)	+ 15	Full CW
R6 (Arm)	- 15	Full CCW
R7 (Arm)		AC measurement only
R8 (Arm)	- 10	Full CW
R8 (Arm)	- 15	Full CCW
XV1-1	87	
XV1-2	87	
XV1-3		See R5 above
XV1-4	-2000	
XV1-5		See R3 above
XV1-6	87	
XV1-7	87	
XV1-8	-2000	
XV1-Center	87	

NOTE

1. Voltages less than 1000V dc are measured with an HP412A dc vtvm.
2. Voltages greater than 1000V dc are measured with an RCA WV-98C vtvm equipped with a high voltage probe.
3. Voltage levels given are typical and may vary between units.

5-25. A1A1, RF AMPLIFIER. Should the malfunction be isolated to the rf amplifier circuit board, the defective stage and section may be located using the oscillator level chart given in table 5-4, and the dc voltage chart given in table 5-5. See figure 7-3 for location of components on the rf amplifier circuit board.

Table 5-4. RF Amplifier, Oscillator Levels

Component	Voltage
C71	500 mV rms
Q17E	400 mV rms
Q18B	395 mV rms
Q18C	1.9V rms
Q12B	420 mV rms
Q9B	420 mV rms
CR6 Anode	1.45V rms

NOTE

1. All measurements are made with an HP3406A sampling voltmeter using a 10:1 probe.
2. Voltage levels given are typical and may vary slightly between units.

Table 5-5. RF Amplifier DC Voltages

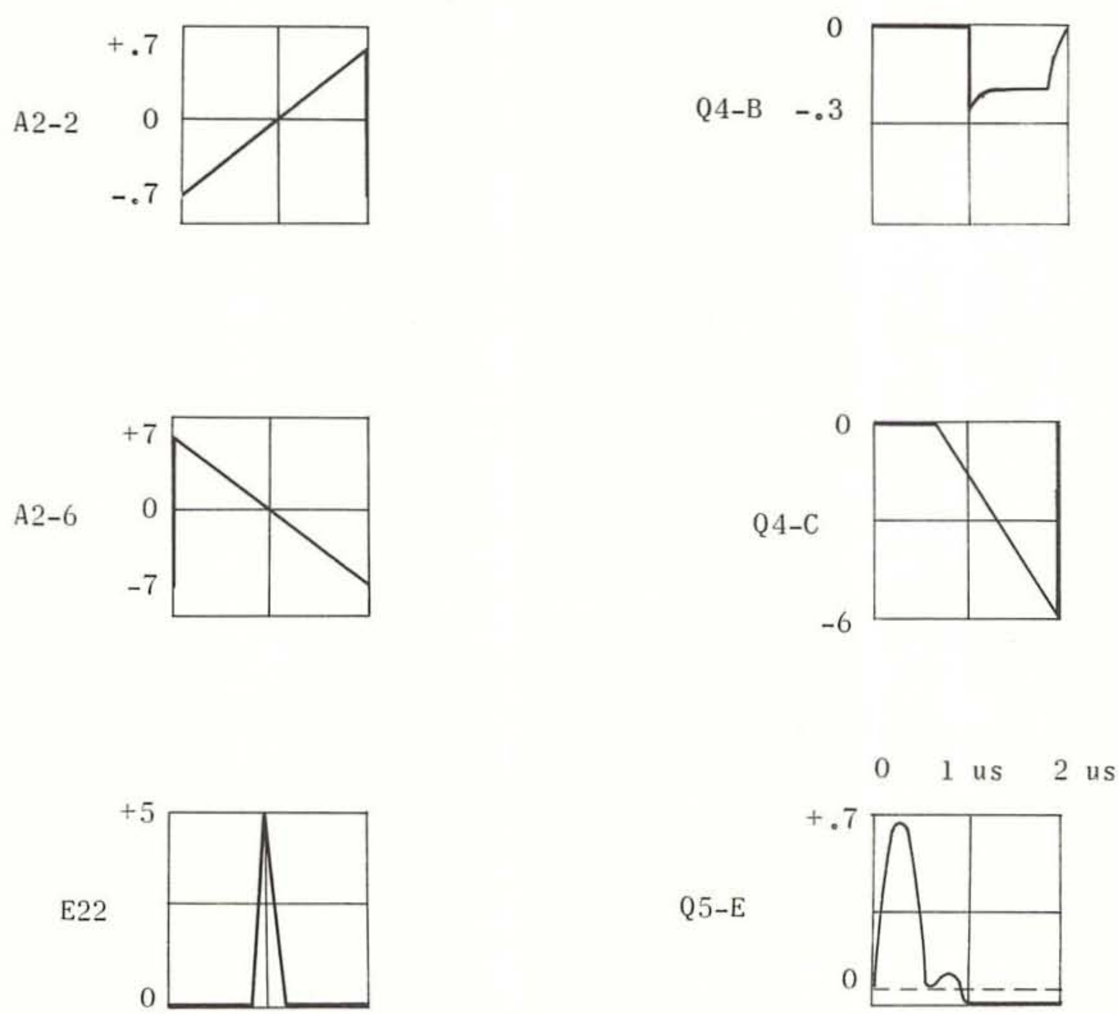
Component	Emitter	Base	Collector	Notes
Q1	- 4.3	-3.5	-2.7	RF Gain Maximum
Q1	- 7.2	-6.5	-1.2	RF Gain Minimum
Q2	- 8.9	-8.2	0	
Q3	- 4.2	-3.5	-1.2	RF Gain Maximum
Q3	- 7.3	-6.7	0	RF Gain Minimum
Q4	- 9.2	-8.4	0	
Q5	- 4.5	-3.8	-1.3	RF Gain Maximum
Q5	- 7.8	-7.2	0	RF Gain Minimum
Q6	- 9.8	-9.1	0	
Q7	-10.0	-9.4	-5.2	
Q8	- 5.0	-4.3	-0.85	
Q9	- 5.0	-4.3	0	
Q10	- 4.3	-3.6	-1.4	RF Gain Maximum
Q10	- 7.6	-7.0	0	RF Gain Minimum
Q11	- 5.3	-4.6	-1.9	
Q12	- 5.9	-5.3	-0.9	
Q13	- 5.9	-5.3	0	
Q14	-10.0	-9.4	-5.9	
Q15	- 9.4	-8.6	0	
Q16	- 4.6	-3.9	-1.1	MK Gain Maximum
Q16	- 7.4	-7.6	0	MK Gain Minimum
Q17	- 5.7	-5.1	0	
Q18	-10.0	-9.9	-0.45	
Q19	-10.0	-9.9	0	

Table 5-5, continued

NOTE
1. All measurements made with no signal input using an HP412A dc vtvm.
2. Voltage levels given are typical and may vary slightly between units.

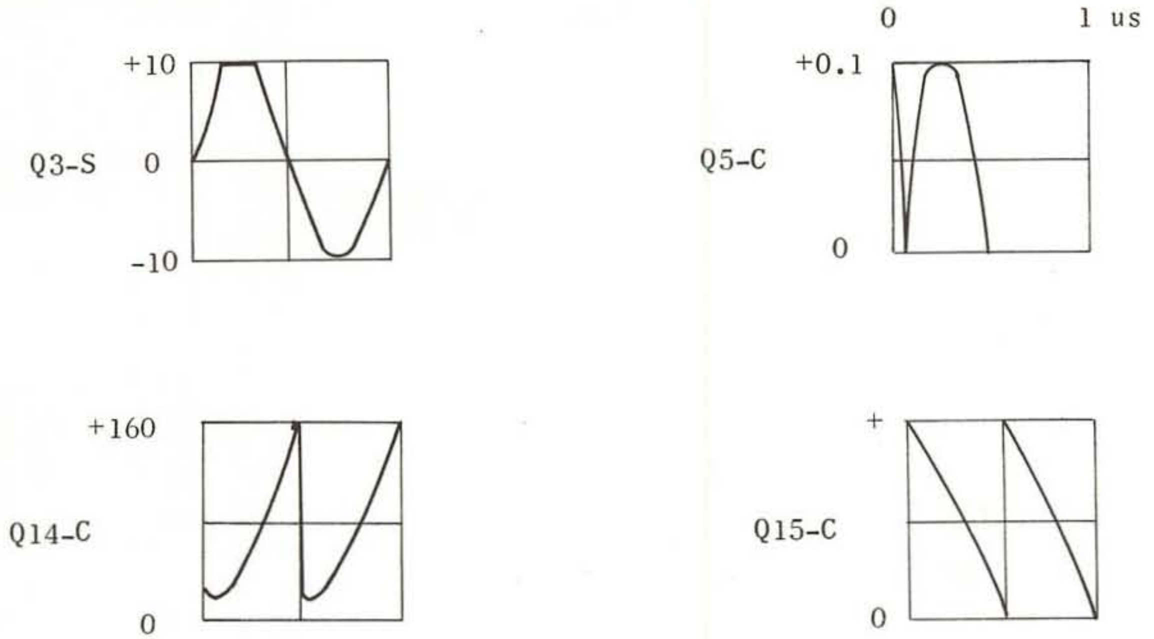
5-26. A1A2, IF AMPLIFIER. Should the malfunction be isolated to the i-f amplifier circuit board, the waveforms given in table 5-6 and the voltage levels given in table 5-7 can be used to determine the faulty components. See figure 7-4 for location of components on the i-f amplifier circuit board.

Table 5-6. IF Amplifier Waveforms



continued

Table 5-6, continued



NOTE

1. All measurements made with an HP180A oscilloscope equipped with an 1801A dual vertical amplifier, 1820A time base, and a 10004A 10:1 probe.
2. Oscilloscope set for internal sync, dc coupled.
3. Left to right graticule references for Q3, Q4, Ql4, and Q15 are 0, 50, and 100 milliseconds.
4. The duration of the sawtooth monitored at A2-2 is 50 milliseconds. The duration of the sawtooth monitored at A2-6 is adjustable by the front panel sweep width control.

Table 5-7. IF Amplifier DC Voltages

Component	Emitter	Base	Collector	Note
Q1	-11.5	-12.5	+ 2.5	
Q2	- 5.1	- 5.9	0	
Q3	+ 0.28(S)	- 1.6 (G)	+12 (D)	FET
Q4	- 0.18	- 0.18	- 2	
Q5	- 0.06	0	0	
Q6	+ 1.4 (S)	0 (G)	+12.5(D)	FET
Q7	-10.5	- 9.5	- 1.7	

continued

Table 5-7, continued

Component	Emitter	Base	Collector	Note
Q8	+11.7	+11	*	*Sawtooth
Q9	+ 0.1 (B1)	+14 (B2)	* (E)	*Sawtooth
Q10	- 0.48	0	+15	
Q11	- 1.05	- 0.48	+14.9	
Q12	- 0.8	- 0.3	+99	Function of VERT POS
Q13	- 0.47	- 0.07	+83	Function of VERT POS
Q14	- 0.56	0	+76	Function of HORIZ POS
Q15	- 0.61	- 0.05	+96	Function of HORIZ POS

	1	2	3	4	5	6	7	8	9	10	11	12
A1	- 4.7	-9	-13.7	- 9.8	- 4.7	- 0.39	Grd	Grd				
A2	+10	0	0	-15	-15	+150 mV	+15	+10.5				
A3	- 0.88	-	- 0.85	- 1.6	- 5.5	+150 mV	+11	- 0.85	-0.85	-0.1	Grd	Grd

NOTE

1. All measurements are made with an HP412A dc vtvm under "no signal" conditions.
2. Voltage levels given are typical and may vary between units.

5-27. REPAIR

5-28. No special tools or procedures are required to assemble and disassemble the 1161-S(A). All components used in the unit are considered non-repairable and must be replaced when proven defective. Replacement components should be those listed in Section VI for best results.

5-29. IF AND RF BOARDS. The i-f and rf printed circuit boards are held in place in the base unit with eight and 10 Phillips screws, respectively. Some wires may have to be unsoldered to gain access to the circuit sides of the boards, these should be tagged as to their placement. A recommended procedure for removing components mounted on the circuit boards is given in paragraph 5-32.

5-30. CRT REMOVAL AND REPLACEMENT. The procedure recommended for removing and replacing the crt is as follows:

a. Loosen the screw on the gromet securing the rear of the tube.

b. Remove the two screws on either side of the front panel. Pull the panel away from the unit taking care not to place a strain on any wiring.

c. Remove the two screws on either side of the screen. This separates the shield from the front panel.

d. Remove and replace the crt in the shield.

WARNING

Handle the crt carefully to avoid implosion.

e. Position the tube and shield on the front panel and secure.

f. Slide the assembly back to insert the crt pins in the socket and secure the front panel.

g. Tighten the gromet screw.

5-31. POWER SUPPLY COMPONENTS. The power supply components consist of a transformer and two printed circuit boards. These are held to the sidewall with machine screws. It is recommended that the crt be pulled (paragraph 5-30) to facilitate removal and minimize the dangers of damaging adjacent components.

5-32. PC BOARD COMPONENT REPLACEMENT. The following procedure is recommended for removing and replacing components mounted on printed circuit boards.

a. Gather the following materials:

1. Liquid soldering flux
2. Flux remover
3. Wire braid
4. Soldering iron, soldering aid, and longnose pliers.

b. Dip one end of the braid in the soldering flux.

c. Place the braid over the solder joint and apply heat; the braid will absorb most of the solder.

CAUTION

Excess heat may permanently damage the circuit board.

d. Apply heat directly to the solder joint and gently pry the component loose.

e. Clean the affected area with flux remover. If the hole in the board remains clogged, repeat the process using the braid and soldering flux.

f. Position the component on the pc board.

g. Solder the leads to the pc board and trim.

h. Clean the affected area with flux remover.

5-33. ALIGNMENT

5-34. Once the problem has been located and corrected, the unit is to be realigned. Only realign the circuitry in which work was done, i.e. marker generator, rf amplifier, local oscillator. Associated circuitry should be checked and aligned only when necessary.

5-35. To properly align the 1161-S(A), connect it to the parent unit with an extender cord (see paragraph 5-7) or to power and signal sources using the necessary interconnecting cables (see paragraph 5-8 and figure 5-1).

5-36. PROCEDURE

a. RF Amplifiers

1. Connect the high impedance detector (paragraph 5-9/figure 5-2) to A1A1E26. Connect the output of the detector to the oscilloscope vertical input.
2. Connect the VS-80 sweep generator output to A1A1E5. Connect the generator horizontal drive output to the oscilloscope horizontal input.
3. Set the generator to sweep 50 MHz and at an output level which produces a convenient display on the 10 mV full scale range on the oscilloscope with the display unit RF GAIN control fully clockwise.
4. Adjust L5 and L6 for an overcoupled response centered at 50 MHz with a 3 dB bandwidth of approximately 13(±3) MHz. The input level should be approximately -25 dB to obtain an 8 mV output.
5. Disconnect the generator from E5 and reconnect it to E3.
6. Adjust L3 and L4 for an overcoupled response centered at 50 MHz with a 3 dB bandwidth of 11(±3) MHz. The input level required to obtain an 8 mV output should be approximately -35 dB.
7. Disconnect the generator from E3 and connect it to 1161-S(A) input.
8. Adjust L1 and L2 for an overcoupled response centered at 50 MHz with a 3 dB bandwidth of 10(±3) MHz. The input level required to obtain an 8 mV output should be approximately -38 dB.
9. Disconnect all test equipment.

b. Marker Amplifier

1. Connect the high impedance detector (paragraph 5-9/figure 5-2) to A1A1E25. Connect the VS-80 output to A1A1E18.
2. Set the generator for a 90 MHz output at -10 dB.
3. Adjust L11 and L12 for a double-tuned response having a peak amplitude of approximately 4 mV.
4. Disconnect the test equipment.

c. 20 MHz Amplifiers

1. Connect the HP606A signal generator, set to exactly 20 MHz, to A1A1E26. Set the generator output level to 20 μV.

2. Adjust L7, L8, L9, and L10 for a peak response on the display unit crt. Adjust A1A2L1, A1A2L2, A1A2L3, and A1A2L7 slightly to obtain maximum deflection.

3. Set the generator output level to 6 μV. Measure the dc voltage at A1A2E25; it should be approximately 4 volts.

4. Disconnect the test equipment.

d. Swept Oscillator and Marker Oscillator

1. Connect the HP606A signal generator to the rf input. Set the generator to 50 MHz at 50 mV rms.

2. Adjust the display RF GAIN control for a full scale deflection. Set the SWEEP WIDTH control fully clockwise and the CENTER FREQ control to mid-range.

3. Adjust A1A1L13 to position the signal pip directly under the center graticule.

4. Connect the rf voltmeter to A1A1E27 and adjust A1A1L14 for maximum meter indication. Readjust L13, if necessary, to recenter the pip.

5. Set the MARKERS switch to ON and the MK GAIN fully clockwise. The marker pips should be full scale.

6. Adjust A1A2L8 until the center marker pip zero beats with the 50 MHz signal pips. Adjust A1A2L8 $\frac{1}{4}$ turn past the zero beat point.

7. Disconnect the 50 MHz signal input.

8. Adjust A1A2R30 so that the center frequency marker pip is one division higher than the sideband markers.

9. Adjust A1A2R71 until the horizontal trace does not quite fill the screen.

10. Adjust A1A2R78 until nine (9) marker pips are visible on either side of the center pip.

11. Adjust A1A2R71 to position eight (8) pips on either side of the center pip.

12. Adjust the SWEEP WIDTH control to obtain six (6) marker pips on either side of center.

13. Adjust A1A1R97 for right side markers and A1A1R91 and 93 for left side markers to position each marker under a vertical graticule within 0.05 of a division. Adjust A1A1L11 and L12 to obtain equal amplitude of all markers.

e. Measurements

Perform the measurements and tests listed in paragraph 5-16.

SECTION VI
REPLACEMENT PARTS LIST

6-1. GENERAL

6-2. This section contains the replacement parts list for the 1161-S(A) spectrum display unit. All parts are listed alphanumerically by subassembly and supply the reference designation, description, manufacturer, and manufacturer's part number. This information should be included with the unit serial number when ordering spare or replacement parts.

6-3. MAIN CHASSIS AND FRONT PANEL (See figure 7-5)

Reference Designation	Description
A1A1	RF Circuit Board, Microdyne 100-445
A1A2	IF Circuit Board, Microdyne 100-425
A2	Power Supply, Microdyne 100-413
A3	Power Supply, Microdyne 100-414
C2	Capacitor, ceramic, 0.001 μf ±20%, 100V, Erie 8111-100-X5R-102M
C3	Capacitor, plastic, 0.02 μF, Vitramon OF-20-203
C4	Capacitor, ceramic, 0.033 μf ±10%, 100V, Erie 8133-100-W5R-333K
E1 thru E6	Standoff, terminal, CTC4850-1-0516
E7	Standoff, Sealectro ST-SM-1
L1	Inductor, fixed, 10 μH, Jeffers 4445-2K
L2	Inductor, fixed, 10 μH, Jeffers 4445-2K
P1	Connector, multi-pin, Cannon DBM13W3P
P1A1	Connector, rf insert, Cannon DM-53741-1
R1	Potentiometer, variable, 10KΩ, Allen Bradley WA2G056S103UA *
R2	Potentiometer, variable, 10KΩ, Allen Bradley WA2G056S103UA *
R3	Potentiometer, variable, 1MΩ, Allen Bradley WA2G056S105UA *
R4	Potentiometer, variable, 10KΩ, Allen Bradley WA2G056S103UA *
R5	Potentiometer, variable, 100KΩ, Allen Bradley WA2G056S104UA *
R6	Potentiometer, variable, 10KΩ, Allen Bradley WA2G056S103UA *
R7	Potentiometer, variable, 100KΩ, Allen Bradley WA2G056S104UA *
R8	Potentiometer, variable, 10KΩ, Allen Bradley WA2G056S103UA *
R9	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
R10	Resistor, fixed composition, 300Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3015
R11	Resistor, fixed composition, 1MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1055
R12	Resistor, fixed composition, 1MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1055

*Modify per Microdyne 201-393

Replacement Parts List, continued

Reference Designation	Description
R13	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R14	Potentiometer, variable, 500KΩ, Allen Bradley WA2L040S504UC
S1	Switch, toggle, spdt, C & K 7101 (dress nut & blue cap)
S2	Switch, toggle, spdt, C & K 7101 (dress nut & blue cap)
T1	Transformer, DC-DC Inv, Microdyne 300-046
V1	Tube, cathode ray, Sylvania 3ASP1
XV1	Socket, cathode ray tube, Sylvania 200-886
XV2	HV Connector, 2nd anode, Cinch 3A1

6-4. A1A1, RF AMPLIFIER SUBASSEMBLY (See figures 7-3 and 7-6)

Reference Designation	Description
C1 thru C6	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, ceramic, 20 pf ± 5%, 100V, Erie 8111-100-COG-200J
C8	Capacitor, ceramic, 7.5 µf ±5%, 100V, Erie 8101-100-COG-759J
C9	Capacitor, ceramic, 33 pf ±5%, 100V, Erie 8121-100-COG-330J
C10	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J
C11 thru C16	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C17	Capacitor, ceramic, 18 pf ±5%, 100V, Erie 8111-100-COG-180J
C18	Capacitor, ceramic, 11 pf ±5%, 100V, Erie 81 -100-COG-110J
C19	Capacitor, ceramic, 30 pf ±5%, 100V, Erie 8121-100-COG-300J
C20	Capacitor, ceramic, 91 pf ±5%, 100V, Erie 8131-100-COG-910J
C21 thru C28	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C29	Capacitor, ceramic, 18 pf ±5%, 100V, Erie 8111-100-COG-180J
C30	Capacitor, ceramic, 11 pf ±5%, 100V, Erie 8111-100-COG-110J
C31	Capacitor, ceramic, 30 pf ±5%, 100V, Erie 8121-100-COG-300J
C32	Capacitor, ceramic, 91 pf ±5%, 100V, Erie 8131-100-COG-910J
C33	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C34	Capacitor, ceramic, 15 pf ±5%, 100V, Erie 8111-100-COG-150J
C35 thru C37	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M

Replacement Parts List, continued

Reference Designation	Description
C38	Capacitor, ceramic, 0.56 pf, Quality Components MC2-0.56 pf
C39	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C40	Capacitor, ceramic, 15 pf ±5%, 100V, Erie 8111-100-COG-150J
C41	Capacitor, ceramic, 150 pf ±5%, 100V, Erie 8121-100-COG-151J
C42	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8121-100-X5V-103M
C43	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C44	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8121-100-X5V-103M
C45	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8121-100-X5V-103M
C46	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C47	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C48	Capacitor, ceramic, 10 pf ±5%, 100V, Erie 8101-100-COG-100J
C49	Capacitor, ceramic, 0.56 pf, Quality Components MC2-0.56 pf
C50	Capacitor, ceramic, 200 pf ±5%, 100V, Erie 8121-100-COG-201J
C51	Capacitor, ceramic, 20 pf ±5%, 100V, Erie 8111-100-COG-200J
C52	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C53	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C54	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C55	Capacitor, ceramic, 82 pf ±5%, 100V, Erie 8131-100-COG-820J
C56	Capacitor, ceramic, 24 pf ±5%, 100V, Erie 8111-100-COG-240J
C57	Capacitor, ceramic, 18 pf ±5%, 100V, Erie 8111-100-COG-180J
C58	Capacitor, ceramic, 3.9 pf ±5%, 100V, Erie 8101-100-COG-399J
C59 thru C64	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C65	Capacitor, electrolytic, 10 µf, -10% +100%, Mallory MTA10D35
C66	Capacitor, ceramic, 470 pf ±5%, 100V, Erie 8121-100-COG-471J
C67	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C68	Capacitor, ceramic, 110 pf ±5%, 100V, Erie 8121-100-COG-111J
C69	Capacitor, ceramic, 51 pf ±5%, 100V, Erie 8131-100-COG-510J
C70	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-COG-102M
C71	Capacitor, ceramic, 68 pf ±5%, 100V, Erie 8131-100-COG-680J
C72	Capacitor, ceramic, 20 pf ±5%, 100V, Erie 8111-100-COG-200J
C73 thru C76	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C77	Capacitor, electrolytic, 68 µf ±20%, 15V, Kemet K68E15
C78	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C79	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8131-B106-X5V0-103M
C80	Not Assigned
C81	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C82	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C83	Capacitor, electrolytic, 1 µf ±20%, 20V, Kemet K1E20
C84	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M

Replacement Parts List, continued

Reference Designation	Description
CR1	Diode, silicon, Sylvania 1N914
CR2	Diode, silicon, Sylvania 1N914
CR3	Diode, silicon, Sylvania 1N914
CR4	Diode, silicon, zener, 3.3V ±5%, Motorola 1N4728A
CR5	Diode, silicon, Sylvania 1N914
CR6	Diode, voltage variable, Motorola MMV-2106
CR7	Diode, silicon, Sylvania 1N914
E1 thru E27	Terminal, swage-in, Cambion 2027-2
L1 thru L6	Inductor, variable, shielded, 0.33 μH, Cambion 7107-07
L7 thru L10	Inductor, variable, shielded, 3.3 μH, Cambion 7107-19
L11	Inductor, variable, shielded, 0.1 μH, Cambion 7107-01
L12	Inductor, variable, shielded, 0.1 μH, Cambion 7107-01
L13	Inductor, variable, shielded, 0.47 μH, Microdyne 100-488
L14	Inductor, variable, shielded, 0.22 μH, Cambion 7107-05
L15	Inductor, fixed, 1000 μH ±20%, Jeffers 1331-35J
L16	Inductor, fixed, 56 μH ±20%, Jeffers 1315-6M
Q1 thru Q19	Transistor, silicon, npn, RCA 2N5181
R1	Resistor, fixed composition, 68Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6805
R2	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R3	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Aslen Bradley CB1535
R4	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R5	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R6	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R7	Resistor, fixed composition, 2.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2225
R8	Resistor, fixed composition, 5.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5625
R9	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R10	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R11	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R12	Resistor, fixed composition, 22Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2205
R13	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R14	Resistor, fixed composition, 2.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2225
R15	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225

Replacement Parts List, continued

Reference Designation	Description
R16	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R17	Resistor, fixed composition, 13KΩ ±5%, ¼w, Allen Bradley CB1335
R18	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R19	Resistor, fixed composition, 12Ω ±5%, ¼w, Allen Bradley CB1205
R20	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R21	Resistor, fixed composition, 5.6KΩ ±5%, ¼w, Allen Bradley CB5625
R22	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R23	Resistor, fixed composition, 22Ω ±5%, ¼w, Allen Bradley CB2205
R24	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R25	Resistor, fixed composition, 22Ω ±5%, ¼w, Allen Bradley CB2205
R26	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R27	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R28	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R29	Resistor, fixed composition, 2.2KΩ ±5%, ¼w, Allen Bradley CB2225
R30	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R31	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R32	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R33	Resistor, fixed composition, 11KΩ ±5%, ¼w, Allen Bradley CB1135
R34	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R35	Resistor, fixed composition, 12Ω ±5%, ¼w, Allen Bradley CB1205
R36	Resistor, fixed composition, 4.3KΩ ±5%, ¼w, Allen Bradley CB4325
R37	Resistor, fixed composition, 5.6KΩ ±5%, ¼w, Allen Bradley CB5625
R38	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R39	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R40	Resistor, fixed composition, 22Ω ±5%, ¼w, Allen Bradley CB2205
R41	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R42	Resistor, fixed composition, 22Ω ±5%, ¼w, Allen Bradley CB2205
R43	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R44	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R45	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R46	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R47	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R48	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R49	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R50	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R51	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R52	Resistor, fixed composition, 6.8KΩ ±5%, ¼w, Allen Bradley CB6825
R53	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R54	Resistor, fixed composition, 3KΩ ±5%, ¼w, Allen Bradley CB3025
R55	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R56	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R57	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R58	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025

Replacement Parts List, continued

Reference Designation	Description
R59	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R60	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R61	Resistor, fixed composition, 5.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5625
R62	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R63	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R64	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R65	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R66	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R67	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225
R68	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R69	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R70	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R71	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R72	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R73	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225
R74	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R75	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R76	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225
R77	Resistor, fixed composition, 3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3025
R78	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R79	Resistor, fixed composition, 560Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5615
R80	Not Assigned
R81	Resistor, fixed composition, 22Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2205
R82	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R83	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225
R84	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R85	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R86	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R87	Resistor, fixed composition, 22Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2205
R88	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R89	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R90	Resistor, fixed composition, 5.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5625
R91	Potentiometer, variable, 200KΩ, $\frac{1}{4}$w, Spectrol 53-1-1-204
R92	Resistor, fixed composition, 11Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1105
R93	Potentiometer, variable, 200KΩ, $\frac{1}{4}$w, Spectrol 53-1-1-204
R94	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R95	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
R96	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
R97	Potentiometer, variable, 100KΩ, $\frac{1}{4}$w, Spectrol 53-1-1-104
R98	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
R99	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R100	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R101	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235

Replacement Parts List, continued

Reference Designation	Description
R102	Resistor, fixed composition, 24KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2435
R103	Resistor, fixed composition, 5.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5125
R104	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R105	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R106	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R107	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R108	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R109	Resistor, fixed composition, 750Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB7515
R110	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225
R111	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R112	Resistor, fixed composition, 100Ω ±5%. $\frac{1}{4}$w, Allen Bradley CB1015
R113	Resistor, fixed composition, 10Ω ± 5%, $\frac{1}{4}$w, Allen Bradley CB1005
R114	Resistor, fixed composition, 2.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2225
R115	Resistor, fixed composition, 300Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3015
R116	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R117	Resistor, fixed composition, 300Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3015
R118	Resistor, fixed composition, 300Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3015
R119	Resistor, fixed composition, 39KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3935
R120	Resistor, fixed composition, 24KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2435
R121	Resistor, fixed composition, 110Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1115
R122	Resistor, fixed composition, 68Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6805
R123	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R124	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R125	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R126	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R127	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R128	Resistor, fixed composition, 240Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2415
R129	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R130	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705

6-5. A1A2, IF AMPLIFIER SUBASSEMBLY (See figures 7-4 and 7-7)

Reference Designation	Description
A1	Integrated Circuit, RCA CA3028A
A2	Operational Amplifier, Fairchild μA709C
A3	Integrated Circuit, RCA CA3018A
C1	Capacitor, ceramic, 0.001 μf ±20%, 100V, Erie 8111-100-X5R-102M
C2	Capacitor, ceramic, 0.001 μf ±20%, 100V, Erie 8111-100-X5R-102M
C3	Capacitor, ceramic, 0.001 μf ±20%, 100V, Erie 8111-100-X5R-102M
C4	Capacitor, ceramic, 0.01 μf ±20%, 100V, Erie 8131-B106-X5V0-103M

Replacement Parts List, continued

Reference Designation	Description
C5	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8131-B106-X5V0-103M
C6	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, ceramic, 91 pf ±5%, 100V, Erie 8131-100-COG-910J
C8	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J
C9	Capacitor, ceramic, 1.2 pf ±5%, 100V, Erie 8101-100-COG-129J
C10	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C11	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C12	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8131-B106-X5V0-103M
C13	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C14	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J
C15	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J
C16	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J
C17	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C18	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C19	Capacitor, ceramic, 0.22 µf, +80-20%, 50V, Erie 8131-050-651-224Z
C20 thru C22	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J
C23 thru C26	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C27	Capacitor, ceramic, 110 pf ±5%, 100V, Erie 8121-100-COG-111J
C28	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8131-B106-X5V0-103M
C29	Capacitor, ceramic, 4.7 pf ±5%, 100V, Erie 8101-100-COG-479J
C30	Capacitor, ceramic, 27 pf ±5%, 100V, Erie 8121-100-COG-270J
C31	Capacitor, ceramic, 1.2 pf ±5%, 100V, Erie 8101-100-COG-129J
C32	Capacitor, ceramic, 1.5 pf ±5%, 100V, Erie 8101-100-COG-159J
C33	Capacitor, ceramic, 0.22 uf, +80-20%, 50V, Erie 8141-050-651-224Z
C34	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8131-B106-X5V0-103M
C35	Capacitor, ceramic, 820 pf ±5%, 100V, Erie 8121-100-COG-821J
C36	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J
C37	Capacitor, ceramic, 0.01 µf ±20%, 100V, Erie 8131-B106-X5V0-103M
C38	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C39	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C40	Capacitor, electrolytic, 1 uf, 20V, Kemet K1E20
C41	Capacitor, electrolytic, 3.3 µf, 20V, Kemet K3R3E20
C42	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5V-102M
C43	Not Assigned
C44	Capacitor, ceramic, 18 pf ±5%, 100V, Erie 8111-100-COG-180J
C45	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C46	Capacitor, ceramic, 82 pf ±5%, 100V, Erie 8131-100-COG-820J
C47	Capacitor, ceramic, 0.001 µf ±20%, 100V, Erie 8111-100-X5R-102M
C48	Capacitor, ceramic, 100 pf ±5%, 100V, Erie 8131-100-COG-101J

Replacement Parts List, continued

Reference Designation	Description
C49	Capacitor, ceramic, 20 pf ±5%, 100V, Erie 8111-100-COG-200J
C50	Capacitor, ceramic, 470 pf ±5%, 100V, Erie 8121-100-COG-471J
C51	Capacitor, ceramic, 0.22 μf ±80-20%, 50V, Erie 8131-050-651-224Z
C52	Capacitor, ceramic, 75 pf ±5%, 100V, Erie 8131-100-COG-750J
C53	Capacitor, ceramic, 0.01 μf ±20%, 100V, Erie 8131-B106-X5V0-103M
CR1	Diode, tunnel, GE 1N3712
CR2	Diode, Sylvania 1N914
CR3	Not Assigned
CR4	Not Assigned
CR5	Diode, Sylvania 1N914
E1 thru E26	Terminal, swage in, Cambion 2027-2
L1	Inductor, variable, 330 μH, Coil Craft Q2-330
L2	Inductor, variable, 330 μH, Coil Craft Q2-330
L3	Inductor, variable, 330 μH, Coil Craft Q2-330
L4	Choke, fixed, 56 μH, Jeffers 1315-6J
L5	Choke, fixed, 22 μH, Jeffers 4445-7J
L6	Choke, fixed, 56 μH, Jeffers 1315-6J
L7	Inductor, variable, 330 uH, Coil Craft Q2-330
L8	Inductor, variable, 0.1 μH, Cambion 7107-1
Q1	Transistor, silicon, RCA 2N5181
Q2	Transistor, silicon, RCA 2N5181
Q3	Transistor, fet, Union Carbide 2N4416
Q4	Transistor, silicon, Texas Inst. 2N711B
Q5	Transistor, silicon, RCA 2N3251
Q6	Transistor, fet, Union Carbide 2N4416
Q7	Transistor, silicon, RCA 2N5181
Q8	Transistor, silicon, Sprague 2N4413
Q9	Transistor, unijunction, GE 2N2646
Q10	Transistor, Sprague 2N2222
Q11	Transistor, Sprague 2N2222
Q12 thru Q15	Transistor, RCA 2N3440
R1	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R2	Resistor, fixed composition, 110Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1115

Replacement Parts List, continued

Reference Designation	Description
R3	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R4	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R5	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R6	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R7	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R8	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R9	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R10	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R11	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R12	Resistor, fixed composition, 3KΩ ±5%, ¼w, Allen Bradley CB3025
R13	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R14	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R15	Resistor, fixed composition, 24KΩ ±5%, ¼w, Allen Bradley CB2435
R16	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R17	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R18	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R19	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R20	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R21	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R22	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R23	Resistor, fixed composition, 1MΩ ±5%, ¼w, Allen Bradley CB1055
R24	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R25	Resistor, fixed composition, 82Ω ±5%, ¼w, Allen Bradley CB8205
R26	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R27	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R28	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R29	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R30	Potentiometer, variable, 50Ω, Spectrol 53-1-1-500
R31	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R32	Resistor, fixed composition, 24KΩ ±5%, ¼w, Allen Bradley CB2435
R33	Resistor, fixed composition, 13KΩ ±5%, ¼w, Allen Bradley CB1335
R34	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R35	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R36	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R37	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R38	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R39	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R40	Resistor, fixed composition, 12KΩ ±5%, ¼w, Allen Bradley CB1235
R41	Resistor, fixed composition, 6.2KΩ ±5%, ¼w, Allen Bradley CB6225
R42	Resistor, fixed composition, 39KΩ ±5%, ¼w, Allen Bradley CB3935
R43	Resistor, fixed composition, 680Ω ±5%, ¼w, Allen Bradley CB6815
R44	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R45	Resistor, fixed composition, 100KΩ ±5%, ¼w, Allen Bradley CB1045

Replacement Parts List, continued

Reference Designation	Description
R46	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R47	Resistor, fixed composition, 1.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1525
R48	Resistor, fixed composition, 470K ±5%, $\frac{1}{4}$w, Allen Bradley CB4745
R49	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R50	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R51	Resistor, fixed composition, 5.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5125
R52	Resistor, fixed composition, 24KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2435
R53	Not Assigned
R54	Resistor, fixed composition, 12KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1235
R55	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R56	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R57	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R58	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R59	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R60	Resistor, fixed composition, 27KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2735
R61	Resistor, fixed composition, 7.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB7525
R62	Resistor, fixed composition, 150KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1545
R63	Resistor, fixed composition, 150KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1545
R64	Resistor, fixed composition, 3.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3325
R65	Resistor, fixed composition, 3.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3325
R66	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R67	Resistor, fixed composition, 5.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5125
R68	Resistor, fixed composition, 24KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2435
R69	Resistor fixed composition, 200KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2045
R70	Resistor, fixed composition, 200KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2045
R71	Potentiometer, variable, 100KΩ, Spectrol 53-1-1-104
R72	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R73	Resistor, fixed composition, 470Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4715
R74	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
R75	Resistor, fixed composition, 470Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4715
R76	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R77	Resistor, fixed composition, 24KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2435
R78	Potentiometer, variable, 1MΩ, Spectrol 53-1-1-105
R79	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R80	Resistor, fixed composition, 11KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1135
R81	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R82 thru R85	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
Y1	Crystal, 20.9 MHz, Piezo 4201/CR-64/U
Y2	Crystal, 90.0 MHz, Microdyne A100-456
Y3	Crystal, 500 kHz, CR-46A/U

Replacement Parts List, continued

Reference Designation	Description
XY3	Crystal, socket, Augat 8000-D-G1

6-6. A2, POWER SUPPLY (See figures 7-1 and 7-5)

Reference Designation	Description
C1	Capacitor, electrolytic, 100 μf, Kemet K100E20
C2	Capacitor, mica, 0.01 μf, Centralab DD16-103
C3	Capacitor, mica, 0.01 μf, Centralab DD16-103
C4	Capacitor, electrolytic, 0.33 μf, Sprague 193P3349R8
C5	Capacitor, ceramic, 0.22 μf, +80 -20%, Erie 8141-000-651-224Z
C6	Capacitor, ceramic, 0.02 μf, Erie 8141-000-Z5V0-203M
CR1	Not Assigned
CR2	Diode, silicon, Varo VB50*
CR3	Not Assigned
CR4	Diode, silicon, Varo VB50*
CR5	Diode, silicon, 1N4005
CR6	Diode, silicon, 1N4005
E1 thru E15	Terminal, swage-in Cambion 2027-2
R1	Resistor, fixed composition, 51KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5135
R2	Resistor, fixed composition, 680KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6845
R3	Not Assigned
R4	Not Assigned
R5	Resistor, fixed composition, 2KΩ ±5%, 1/2w, Allen Bradley EB2025
R6	Resistor, fixed composition, 300KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3045
R7	Resistor, fixed composition, 300KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3045
R8 thru R10	Resistor, fixed composition, 820KΩ ±5%, 1/2w, Allen Bradley EB8245
R11	Resistor, fixed composition, 10KΩ ±5%, 1/2w, Allen Bradley EB1035

6-7. A3, POWER SUPPLY (See figures 7-2 and 7-5)

Reference Designation	Description
C1	Capacitor, ceramic, 0.022 μf, -20%+80%, 50V, Sprague 192P2239R8
C2	Capacitor, ceramic, 0.022 μf, -20%+80%, 50V, Sprague 192P2239R8

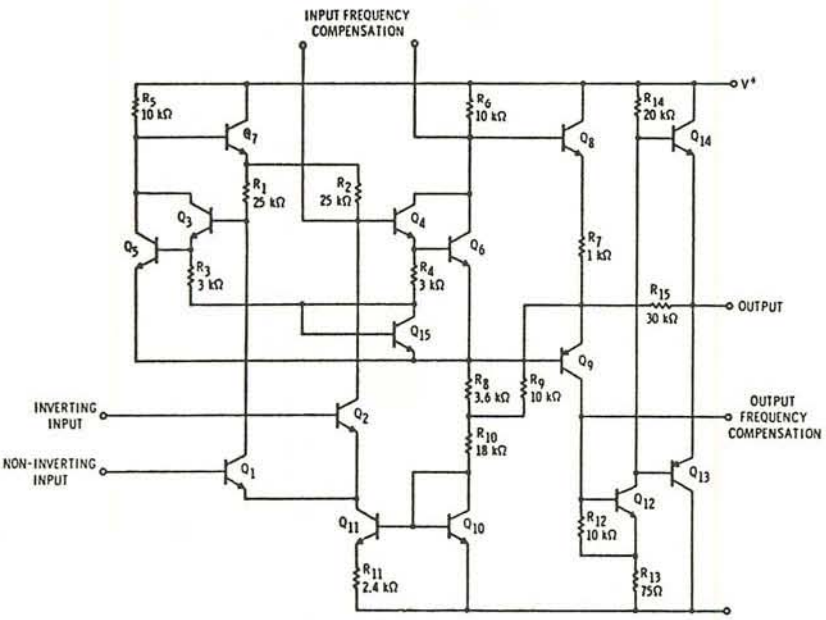
*MR996A (Mot) & 50D50 (AFI) may be substituted

Replacement Parts List, continued

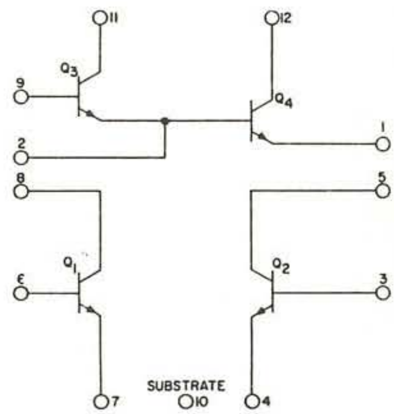
Reference Designation	Description
C3	Capacitor, ceramic, 0.01 μf ±20%, 100V, Erie 8131-B106-X5V0-103M
C4	Capacitor, ceramic, 0.001 μf ±20%, 100V, Erie 8111-100-X5R-102M
C5	Capacitor, ceramic, 0.01 μf ±20%, 100V, Erie 8131-B106-X5V0-103M
C6 thru C8	Capacitor, ceramic, 0.001 μf ±20%, 100V, Erie 8111-100-X5R-102M
E1 thru E6	Terminal, swage-in, Cambion 2027-2
Q1	Transistor, npn, RCA 2N3441
Q2	Transistor, npn, RCA 2N3440
Q3	Transistor, npn, RCA 2N3441
Q4	Transistor, npn, RCA 2N3440
Q5 thru Q8	Transistor, npn, RCA 2N4384
R1	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
R2	Resistor, fixed composition, 1.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1525
R3	Resistor, fixed composition, 1.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1525
R4	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
R5	Resistor, fixed composition, 470Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4715
R6	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R7	Resistor, fixed composition, 470Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4715
R8	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R9	Resistor, fixed composition, 1.0KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Resistor, fixed composition, 1.0KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025

SECTION VII
MAINTENANCE DIAGRAMS

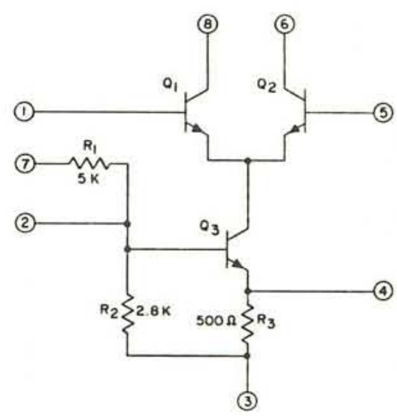
This section contains the component location drawings and the schematic diagrams for the Model 1161-S(A) Spectrum Display Unit. They appear in the following order:



Complete Schematic of the μA709



Schematic Diagram for CA3018 and CA3018A



Schematic diagram for CA3028A and CA3028B.

Transistor Arrays Schematics

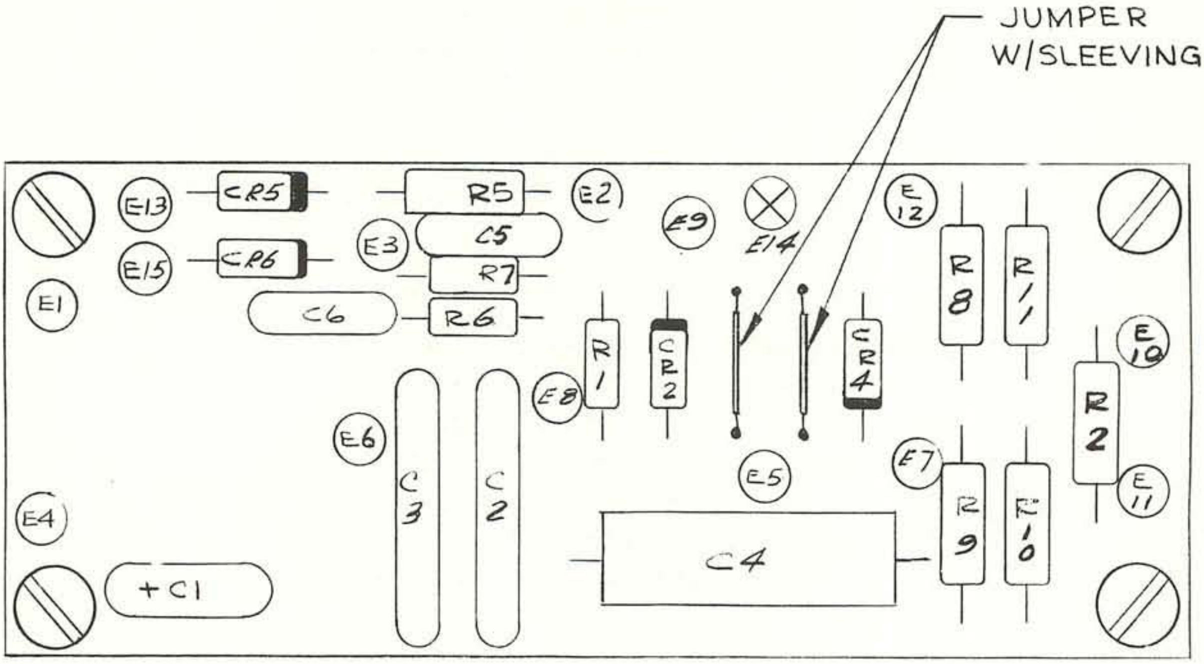


Figure 7-1. A2, Power Supply PC Board,
Component Location

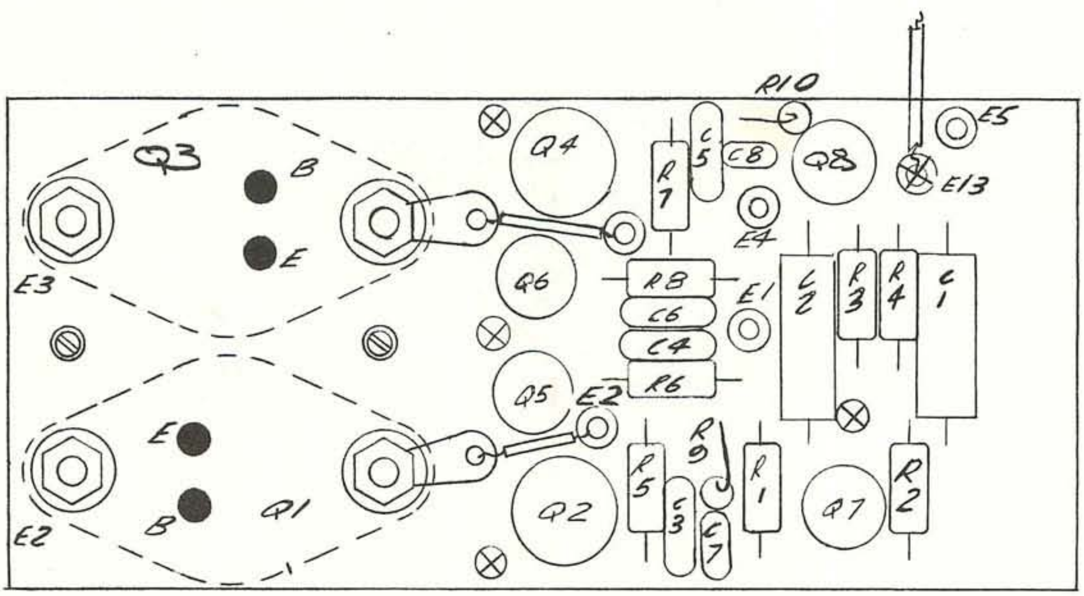


Figure 7-2. A3, Power Supply PC Board,
Component Location

NOTES:

1. ● INDICATES TOP SIDE SOLDER.
2. ⊗ INDICATES FEED-THRU

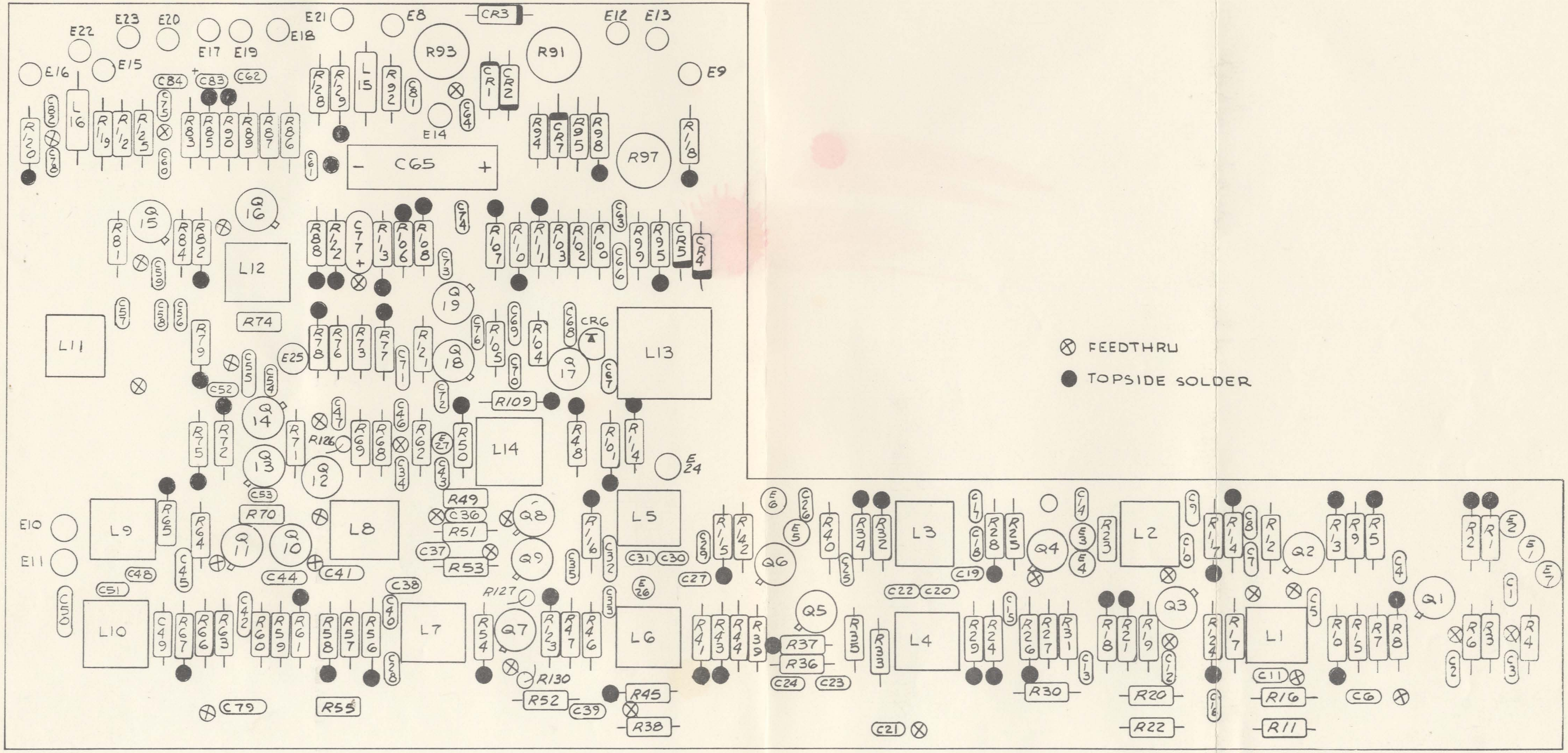


Figure 7-3. A1A1, RF Amplifier PC Board, Component Location

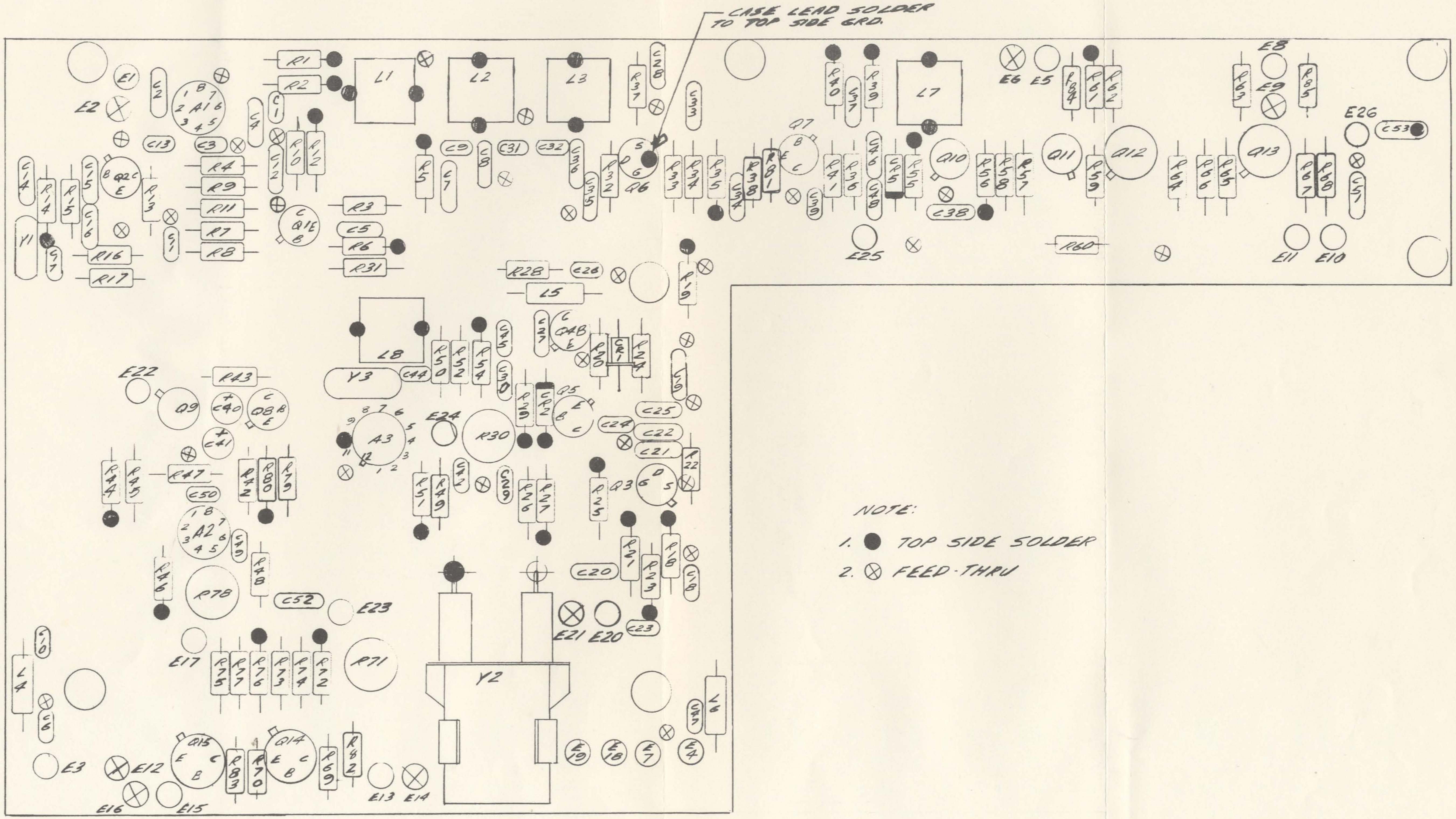
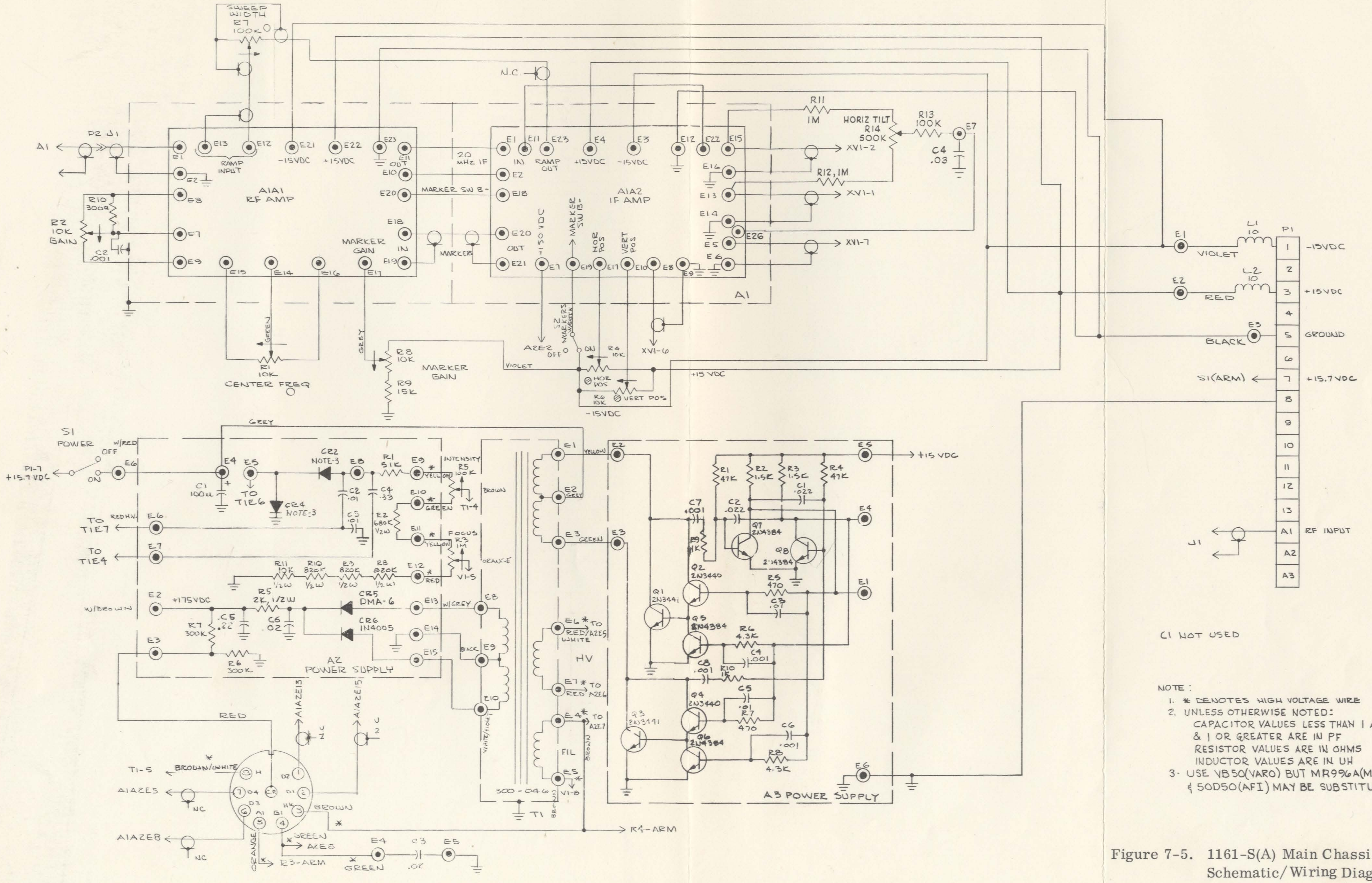


Figure 7-4. A1A2, IF Amplifier PC Board, Component Location



NOTE :
1. * DENOTES HIGH VOLTAGE WIRE
2. UNLESS OTHERWISE NOTED:
   CAPACITOR VALUES LESS THAN 1 ARE IN UF
   & 1 OR GREATER ARE IN PF
   RESISTOR VALUES ARE IN OHMS
   INDUCTOR VALUES ARE IN UH
3- USE VB50(VARO) BUT MR996A(MOTOROLA)
   & 50D50(AFI) MAY BE SUBSTITUTED

Figure 7-5. 1161-S(A) Main Chassis, Schematic/Wiring Diagram 400-304

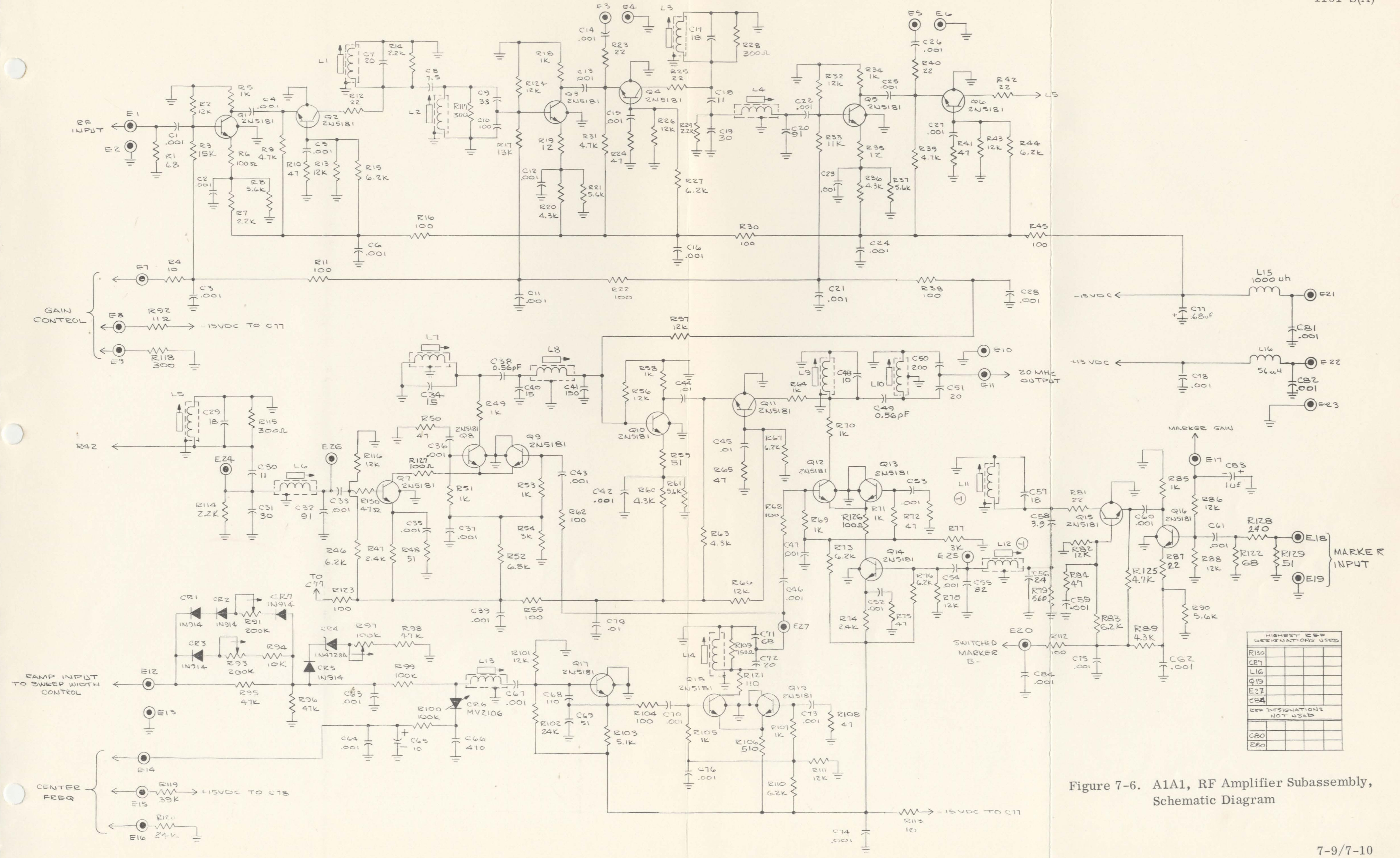
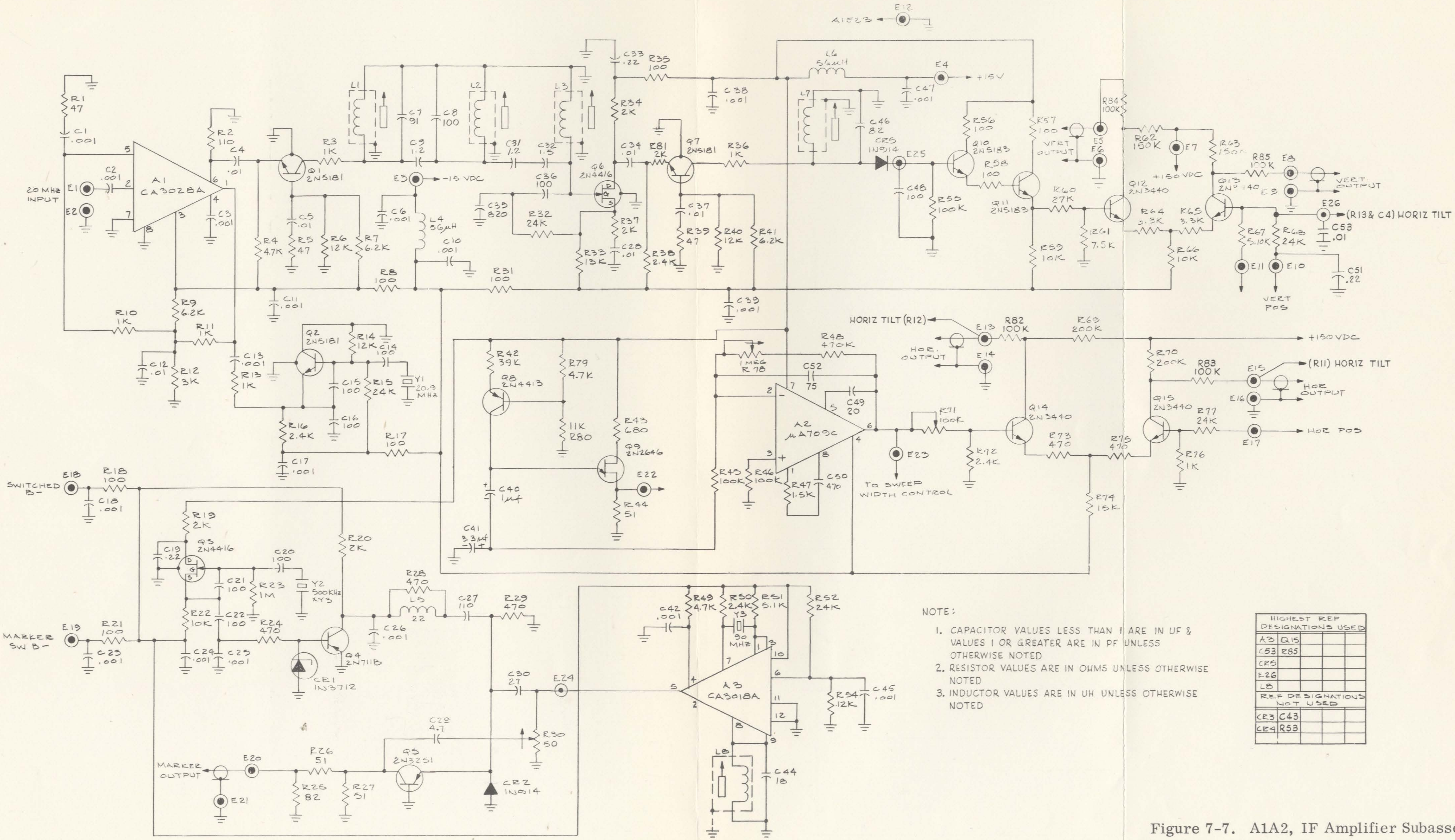


Figure 7-6. A1A1, RF Amplifier Subassembly, Schematic Diagram



NOTE:

1. CAPACITOR VALUES LESS THAN 1 ARE IN UF & VALUES 1 OR GREATER ARE IN PF UNLESS OTHERWISE NOTED
2. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE NOTED
3. INDUCTOR VALUES ARE IN UH UNLESS OTHERWISE NOTED

HIGHEST REF DESIGNATIONS USED	
A3	Q15
C53	R85
CR5	
E26	
L8	
REF DESIGNATIONS NOT USED	
CR3	C43
CR4	R53

Figure 7-7. A1A2, IF Amplifier Subassembly, Schematic Diagram