

RF UNITS

8691B

8692B

8693B

8694B

8695B



HEWLETT  PACKARD

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8691B

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8694B

8695B

SERIAL PREFIX: 984-

This manual applies directly to HP RF Units having serial prefix number 984.

SERIAL PREFIXES NOT LISTED

For serial prefixes above 984, a yellow Manual Changes sheet is included with this manual.

For serial prefixes below 984, see Appendix I.

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Figure 1-1. Typical Model 8691B-8695B RF Units

SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Model 8691B through 8695B RF Units combine with the 8690A/B Sweep Oscillator to form an electronically tuned microwave signal source with a frequency range of 1 GHz to 18 GHz. Individual RF Unit Model specifications are given in Table 1-1.

1-3. The 8691B — 8695B RF Units are modulated by a solid-state PIN attenuator-modulator included within the RF Unit. The 8691B through 8694B Models have a coaxial RF output while the 8695B has a waveguide RF Output.

1-4. OPTIONS AVAILABLE.

1-5. Option 001 is available for Models 8693B and 8694B RF Units. It offers internal leveling that enables the Sweep Oscillator to hold RF Power constant as frequency is changed.

1-6. Option 004 is available for Models 8691B, 8692B, 8693B, and 8694B RF Units. It provides a rear panel RF output.

1-7. Option 100 is available for Models 8692B, 8693B, and 8694B RF Units. It extends the normal frequency band over a wider range (refer to Table 1-1).

1-8. Option 200 is available for Model 8694B RF Units.

1-9. INSTRUMENT IDENTIFICATION.

1-10. Each RF Unit carries a two-section, eight-digit serial number (000-00000) of which the first three digits are a prefix. The contents of this manual apply to those RF Units having the serial number prefix(es) listed on the title page.

1-11. MANUAL CHANGES.

1-12. Changes required to adapt this manual to serial number prefixes not listed on the title page are contained in a yellow Manual Changes sheet insert supplied with the manual, or in Appendix I located at the rear of this manual. For information concerning serial number prefixes not listed either

on the title page in Appendix I, or in an insert, contact one of the Hewlett-Packard sales and service offices.

1-13. INSTALLATION.

1-14. The RF Unit is designed to be installed into the 8690A/B Sweep Oscillator from the rear. To install the RF Unit, perform the following steps:

a. Push the plastic retaining catch inward to release the handle on the rear of the RF Unit.

b. Raise the RF Unit handle 90 degrees to a position perpendicular to the RF Unit rear panel.

c. Gently push the RF Unit into the 8690A/B Sweep Oscillator from the rear.

d. Return the RF Unit handle to the locked position in line with the RF Unit rear panel. This step should firmly secure the RF Unit into the 8690A/B Sweep Oscillator.

1-15. OPERATION.

1-16. Operating procedures of the Sweep Oscillator-RF Unit combinations are given in the 8690A/B Sweep Oscillator Manual. Figures 1-2 and 1-3 show the front and rear views of a typical 8691B-8695B RF Unit. Front and rear panel controls, connectors, and indicators are also described in Figures 1-2 and 1-3.

1-17. PRINCIPLES OF OPERATION.

1-18. Principles of circuit operation of the Sweep Oscillator — RF Unit combinations are given in the 8690A/B Sweep Oscillator Manual. Circuit functions included in the RF Unit are: (1) microwave signal generation by the backward wave oscillator (BWO) tube, (2) BWO anode voltage and shaping for proper BWO currents, (3) BWO helix voltage shaping for frequency accuracy, (4) automatic leveling control (ALC) gain, (5) unlevelled lamp control, (6) internal leveling in Option 001 8693B and 8694B Models, and (7) PIN attenuation and modulation.

Table 1-1. Specifications

Residual AM: At least 40 dB below CW output.	selected sweep range or when operating in un-leveled mode.
Spurious Signals: Harmonics, at least 20 dB below CW output; non-harmonics, at least 40 dB below CW output.	Equivalent Source Match: Externally Leveled: Depends upon coupler Unleveled: Less than 2.5:1.
Reference Output: Direct-coupled voltage proportional to RF frequency, approximately 0V at the low end of the band, increasing approximately 40 V/octave. Output impedance, 30,000 ohms.	Power Variation, Unleveled: Less than 10 dB over the entire band.
Leveling Indicator: Front-panel indicator lights when power level set too high to permit leveling over entire	Weight: 8691B, 8692B, Net, 20 lbs, (9 kg). Shipping, 28 lbs. (12,6 kg) 8693B, 8694B, Net, 12 lbs, (5,4 kg) Shipping, 20 lbs, (9 kg). 8695B, Net, 13 lbs, (6,9 kg).

*Model 8691B RF Unit
(Installed in 8690B Sweep Oscillator)*

Frequency Range:	8691B 1 to 2 GHz
Frequency Accuracy (over ≥6-dB range):	±10 MHz
Maximum Leveled Power	At least 70 mW (18.5 dBm)
RF Power Control	PIN Line
Frequency Stability	
With Temperature	±0.01%/°C
With 10% Change in Line Voltage	±500 kHz
With 10-dB Power Level Change	±500 kHz
Residual FM	< 10 kHz peak
Power Variation, External Leveling*	±0.1 dB
Output Impedance and/or Connector	50 ohms/Type N
Option 004. Rear panel RF Output	

*Models 8692B, 8692B, Opt. 100 RF Units
(Installed in 8690B Sweep Oscillator)*

	8692B	8692B, Opt. 100
Frequency Range	2 to 4 GHz	1.7 to 4.2 GHz
Frequency Accuracy (over ≥ 6-dB range)	±20 MHz	±25 MHz
Maximum Leveled Power	At least 40 mW (16 dBm)	At least 15 mW (11.8 dBm)
RF Power Control	PIN Line	PIN Line
Frequency Stability		
With Temperature	±0.01%/°C	±0.01%/°C
With 10% Change in Line Voltage	±500 kHz	±500 kHz
With 10-dB Power Level Change	±4 MHz	±4 MHz
Residual FM	<15 kHz peak	< 20 kHz peak
Power Variation, External Leveling*	±0.1 dB	±0.1 dB
Output Impedance and/or Connector	50 ohms/Type N	50 ohms/Type N
Option 004, Rear panel RF Output		

*Excluding coupler and detector variation

Table 1-1. Specifications (cont'd)

<i>Models 8693B, 8693B, Opt. 100 RF Units (Installed in 8690B Sweep Oscillator)</i>			
	8693B	8693B, Opt. 100	
Frequency Range	4 to 8 GHz	3.7 to 8.3 GHz	
Frequency Accuracy (over \geq 6-dB range)	± 40 MHz	± 45 MHz	
Maximum Leveled Power	At least 15 mW (11.8 dBm)	At least 5 mW (7 dBm)	
RF Power Control	PIN Line	PIN Line	
Frequency Stability			
With Temperature	$\pm 0.01\%/^{\circ}\text{C}$	$\pm 0.01\%/^{\circ}\text{C}$	
With 10% Change in Line Voltage	± 1 MHz	± 1 MHz	
With 10-dB Power Level Change	± 1 MHz	± 1 MHz	
Residual FM	< 15 kHz peak	< 20 kHz peak	
Power Variation, External Leveling*	± 0.1 dB	± 0.1 dB	
Output Impedance and/or Connector	50 ohms/Type N	50 ohms/Type N	
Option 001. Internal Leveling Power			
Power Variation (into matched load)	± 0.4 dB	± 0.4 dB	
Equivalent Source Match (approx.)	1.25:1	1.25:1	
Option 004. Rear Panel RF Output			
<i>Models 8694B, 8694B, Opt. 100, 8694B, Opt. 200 RF Units (Installed in 8690B Sweep Oscillator)</i>			
	8694B	8694B, Opt. 100	8694B, Opt. 200
Frequency Range	8 to 12.4 GHz	7 to 12.4 GHz	7 to 11 GHz
Frequency Accuracy	± 40 MHz	± 50 MHz	± 40 MHz
Maximum Leveled Power	At least 30 mW (14.8 dBm)	At least 15 mW (11.8 dBm)	At least 15 mW (11.8 dBm)
RF Power Control	PIN Line	PIN Line	PIN Line
Frequency Stability			
With Temperature	$\pm 0.01\%/^{\circ}\text{C}$	$\pm 0.01\%/^{\circ}\text{C}$	$\pm 0.01\%/^{\circ}\text{C}$
With 10% Change in Line Voltage	± 1 MHz	± 1 MHz	± 1 MHz
With 10-dB Power Level Change	± 1 MHz	± 1 MHz	± 1 MHz
Residual FM	< 15 kHz peak	< 20 kHz peak	< 20 kHz peak
Power Variation, External Leveling*	± 0.1 dB	± 0.1 dB	± 0.1 dB
Output Impedance and/or Connector	50 ohms/Type N	50 ohms/Type N	50 ohms/Type N
Option 001. Internal Leveling			
Power Variation (into matched load)	± 0.75 dB	± 0.75 dB	± 0.75 dB
Equivalent Source Match (approx.)	1.5:1	1.5:1	1.5:1
Opt. 004. Rear Panel RF Output			
<i>Model 8695B RF Unit (Installed in 8690B Sweep Oscillator)</i>			
	8695B		
Frequency Range	12.4 to 18 GHz		
Frequency Accuracy	± 50 MHz		
Maximum Leveled Power	At least 15 mW (11.8 dBm)		
RF Power Control	PIN Line		
Frequency Stability			
With Temperature	$\pm 0.01\%/^{\circ}\text{C}$		
With 10% Change in Line Voltage	± 10 MHz		
With 10-dB Power Level Change	± 1 MHz		
Residual FM	< 50 kHz peak		
Power Variation, External Leveling*	± 0.1 dB		
Output Impedance and/or Connector	Waveguide WG-419/U		

*Excluding coupler and detector variation.

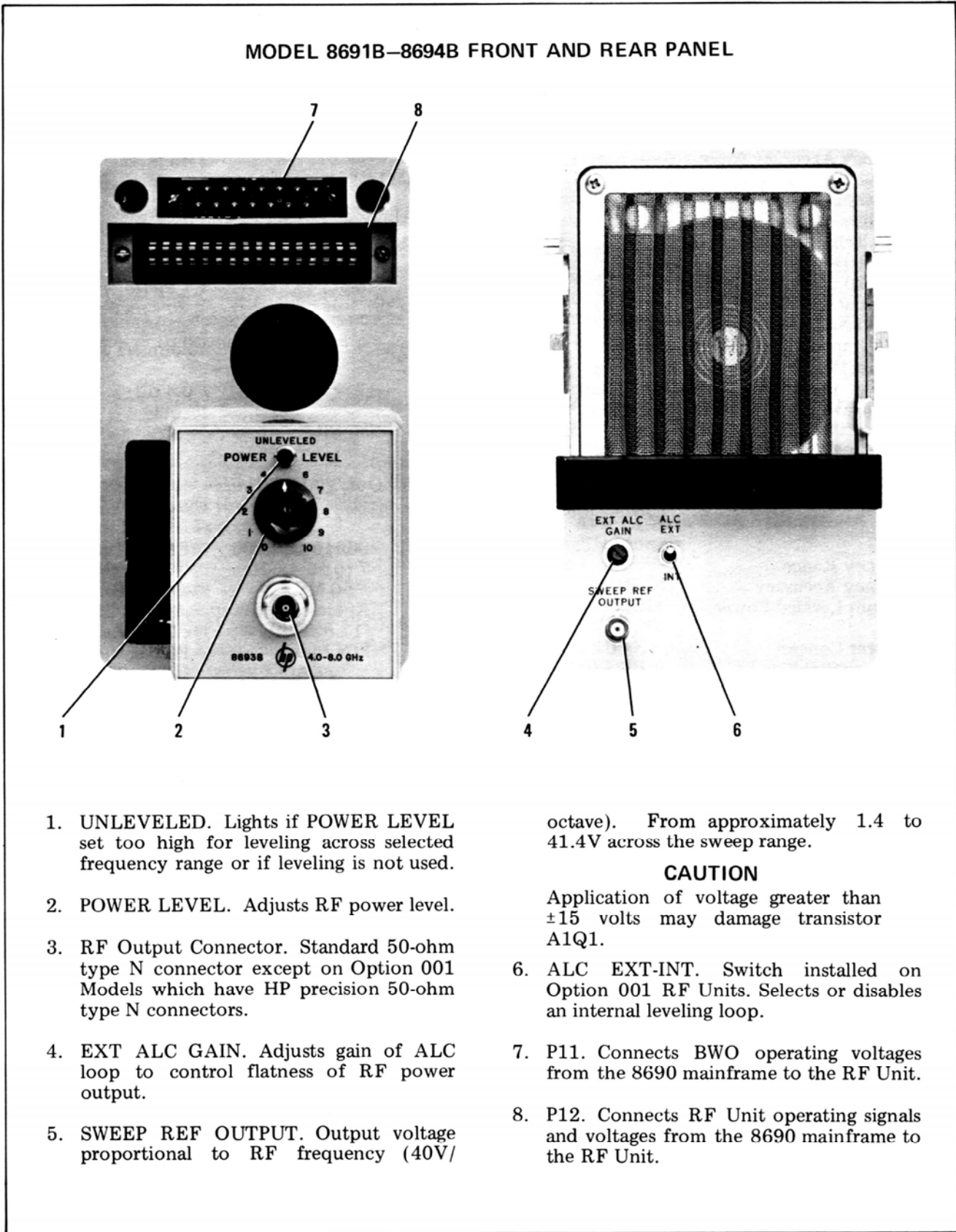


Figure 1-2. Model 8691B-8694B Front and Rear Panel Controls, Connectors and Indicators

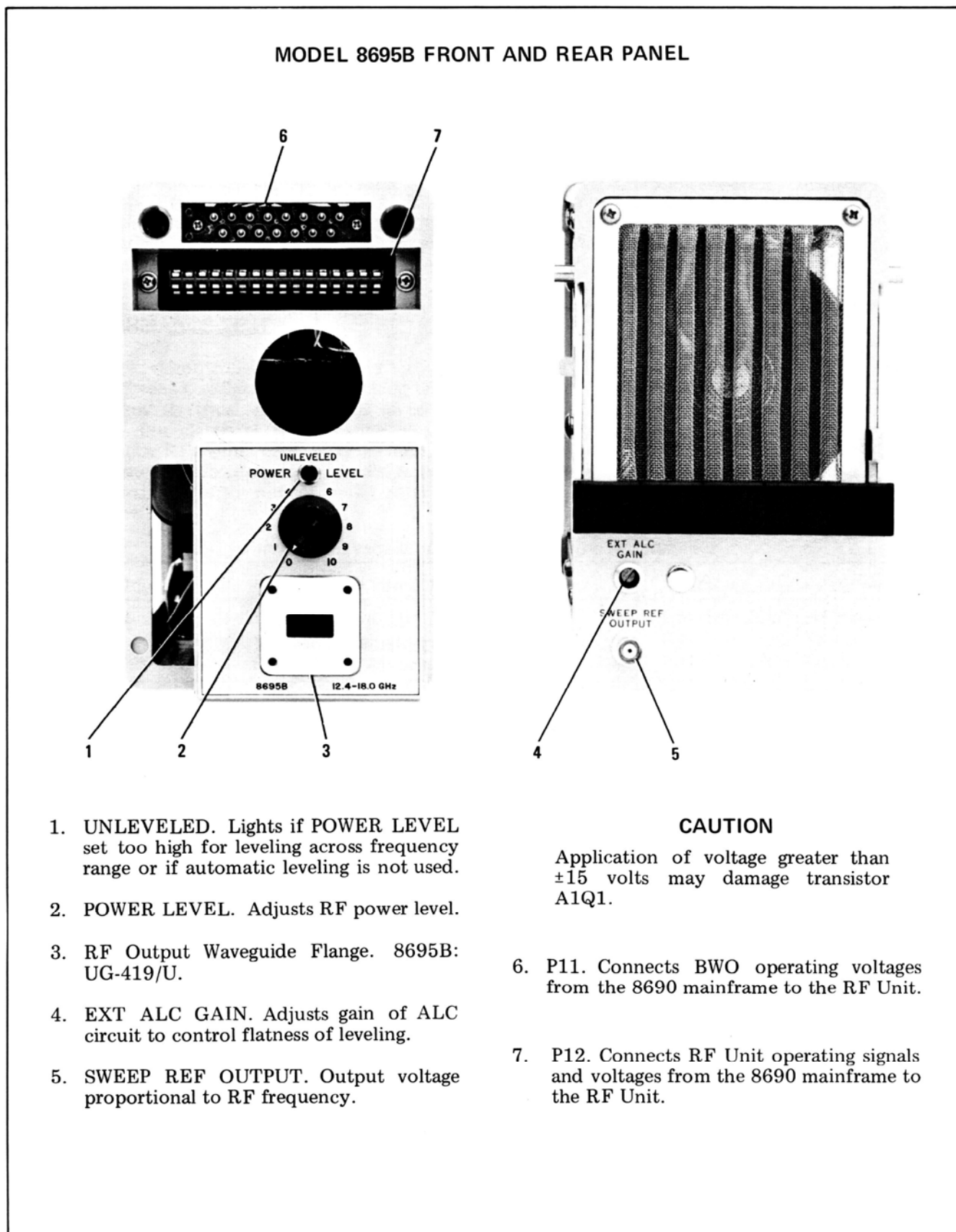


Figure 1-3. Model 8695B Front and Rear Panel Controls, Connectors and Indicators

SECTION II MAINTENANCE

2-1. INTRODUCTION.

2-2. This section provides adjustment procedures for the circuits included within the RF Unit. In addition, procedures for BWO replacement and the required electrical adjustments after replacement are given. Test equipment required for RF Unit maintenance is listed in Table 2-1.

2-3. PERFORMANCE TESTS.

2-4. Front panel controlled performance tests in the 8690A/B Sweep Oscillator Manual include tests of the RF Unit electrical specifications given in Table 1-1. If the electrical performance of the Sweep Oscillator-RF Unit combination fails to meet any of the specifications listed in Table 1-1, and a circuit malfunction is not suspected, refer to

the adjustment paragraphs. If substandard performance occurs, and a circuit malfunction is suspected, refer to the troubleshooting paragraphs in the 8690A/B Sweep Oscillator Manual.

2-5. TROUBLESHOOTING.

2-6. Complete troubleshooting procedures for all Sweep Oscillator-RF Unit combinations are included in the 8690A/B Sweep Oscillator Manual. Where applicable, these troubleshooting procedures analyze the circuit functions contained in the RF Unit. If a circuit malfunction has occurred in the RF Unit, sufficient detailed information is provided at that point in the troubleshooting analysis to define the smallest functional circuit block that contains the malfunctioning circuit. Appropriate references are then made to this manual.

Table 2-1. Test Equipment Required for Maintenance

Instrument	Critical Specifications	Recommended HP Models
Oscilloscope	Vertical Bandwidth: 5 MHz Vertical Sensitivity: 5 mV/cm Sweep Time Accuracy: $\pm 3\%$	140 with 1402 and 1420 Plug-ins 175 with 1752 Plug-in
Crystal Detector	Frequency Range: Same as RF Unit used Sensitivity: 100 mV dc from < 0.35 mW, high level; > 0.4 mV dc/ μ W, low level Frequency Response: ± 0.5 dB or better	423A, P424A
Fixed Attenuator	Frequency Range: Same as RF Unit used Attenuation: nominal 20 dB nominal 10 dB	8491 { Option 10:10 dB Option 20:20 dB
Frequency Meter	Frequency Range: Same as RF Unit used Accuracy: $\pm 0.1\%$	536 537
Power Meter and Thermistor Mount	Frequency Range: Same as RF Unit used Power Range: 1 μ W to 10 mW	431 with 478 and 486
Waveguide-to-Coaxial Adapter	Frequency Range: Same as RF Unit used	H, X281
DC Voltmeter	Range: 0 to ± 300 V Accuracy: $\pm 0.2\%$ minimum Input Impedance: 10 megohms	3440/3442
Clip-On DC Ammeter	Range: 10 mA to 5 amps Accuracy: $\pm 5\%$	428

2-7. DETAILED COMPONENT MAINTENANCE.

2-8. Information on etched circuit board repair, including component, transistor, and tube socket replacement, and etched conductor repair is given in the maintenance section of the 8690A/B Sweep Oscillator Manual.

2-9. ATTENUATOR-MODULATOR REPAIR.

2-10. The PIN modulator CANNOT be repaired in the field. If the PIN is found to be faulty, it should be returned to the factory through the nearest HP service office.

2-11. DIRECTIONAL DETECTOR REPAIR.

2-12. Instructions for repairing the Directional Detector Assembly (A5 in option 001 RF Units), are contained in the HP Model 788C Operating Note (HP Part No. 00786-90008).

2-13. BWO TUBE REPLACEMENT.

2-14. Warranty.

2-15. BWO tube V1 is not covered by the RF Unit warranty. A separate warranty covers the BWO for one full year from the date of purchase. If the BWO tube fails within this warranty period, use the Warranty Claim form supplied with the BWO tube.

2-16. Ordering Replacement BWO Tube.

2-17. When ordering a replacement BWO tube, use the HP Part Number printed on the label of the BWO being replaced.

NOTE

An equivalent substitute BWO may be the recommended replacement (refer to paragraph 3-5).

2-18. BWO Tube Removal.

- a. Disconnect Sweep oscillator from ac line power.
- b. Remove RF Unit.
- c. Disconnect BWO tube RF output.

NOTE

Watkins-Johnson (Stewart) BWO tubes used in 8691B-8694B RF Units are equipped with impedance-matching balun units attached to the two white RF output leads. IMPORTANT: Do not disassemble the balun unit or detach the adapter from the balun. Both units are

part of the BWO tube and must be included when a BWO tube is returned for warranty. New and replacement BWO tubes are supplied with a balun and adapter attached.

- d. Disconnect BWO tube leads from terminal assembly A3.
- e. Remove 4 screws fastening BWO tube to chassis.
- f. Remove BWO tube.

2-19. BWO Tube Installation.

a. Bolt BWO tube to RF Unit chassis. Tighten mounting bolts.

b. Connect BWO tube RF output as originally connected.

c. Before soldering BWO tube leads to A3 assembly plug the RF Unit into the 8690 mainframe. Set Sweep Oscillator for CW operation (single-frequency) at some frequency in the middle of the RF tuning range.

d. Measure anode voltage at A3TP2, and adjust A1R42, ANODE ADJ, to obtain an anode voltage within ± 5 volts of the value printed on the BWO label.

e. Remove RF Unit from 8690 mainframe. Solder the BWO tube leads to appropriate A3 terminals. (Use wire color code on A3 Assembly.)

f. Set Sweep Oscillator for CW operation at the highest frequency in the high end of the RF tuning range. Set POWER LEVEL for maximum output.

g. Measure BWO tube anode voltage at A3TP2, and monitor current in BWO tube cathode lead using clip-on dc Ammeter (Table 2-1). Adjust A1R42, Anode Adjust, to obtain cathode-current specified in Table 2-2.

h. Equalize RF power output over tuning range as follows:

- (1) Connect equipment as shown in Figure 2-1.
- (2) Set Sweep Oscillator for CW operation and maximum power output (POWER LEVEL fully clockwise).
- (3) Tune Sweep Oscillator for frequency in lower half of RF tuning range, at which the RF power output is at a minimum.

- (4) Monitor the helix and cathode currents with the dc clip-on Ammeter (Table 2-1).
- (5) Adjust A1R40, ANODE SHAPE ADJ, for maximum RF output without exceeding the maximum helix and cathode currents specified in Table 2-2. (If anode shaping is required, remove capacitor C1 (0.05 μ F) until adjustment is completed.

NOTE

Excessive helix current actuates 8690A/B Helix Over-current relay K3, starting a sequence which disconnects BWO operating voltages. To reconnect voltages, set LINE to OFF, then back to RF and wait for time delay to recycle.

- (6) Manually tune through the full band checking that neither cathode nor helix current exceeds the maximum values listed in Table 2-2. If maximum values are exceeded, readjust A1R42, ANODE ADJ, and/or A1R40, ANODE SHAPE ADJ, to reduce current. (ANODE SHAPE ADJ affects lower half of RF tuning range; ANODE ADJ affects full band.)
 - (7) Repeat steps (5) and (6) to obtain best full-band RF power flatness within the current limits specified in Table 2-2.
- i. Perform adjustment procedures given in Table 2-3.

2-22. ADJUSTMENT.

2-23. The adjustment procedures given in Table 2-3 include instructions to set the proper operation of the following RF Unit circuit functions: (1) BWO anode voltage and shaping for proper BWO currents, (2) BWO helix voltage shaping and frequency accuracy, and (3) crystal ALC leveled output.

2-24. The adjustments given in Table 2-3 are to be performed in the order listed, and should only be made with the RF Unit installed in an 8690A/B Sweep Oscillator known to be accurately calibrated. Accurate 8690A/B Sweep Oscillator calibration can be ensured by performing the adjustment procedures listed in the Sweep Oscillator Manual. If an adjustment requirement cannot be satisfied, refer to the troubleshooting paragraphs in the 8690A/B Sweep Oscillator Manual.

2-25. Adjustment Control Settings. Unless otherwise specified, set the 8690A/B Sweep Oscillator controls for all adjustments as follows:

LINE	RF
START/CW	
MARKER 1 — START/CW	} Low end of specified range, any RF Unit
MARKER 2 — STOP	
STOP/ Δ F	
SWEEP SELECTOR	CW
FUNCTION pushbuttons	All released
AMPLITUDE MOD pushbuttons	All released
ALC	Released
MANUAL SWEEP	MAX CCW
SWEEP TIME (SEC)	100—10
VERNIER	LINE SYNC
INT SQ WAVE FREQ	MAX CCW
BLANKING	OFF
ALL BNC INPUTS and OUTPUTS	No connection

Table 2-2. Maximum BWO Currents, mA

RF Unit Model	Watkins-Johnson		Varian		
	Helix	Cathode	Helix	Cathode	Anode
8691B	4.0	17.0	35.0	45.0	10.0
8692B	3.5	15.0	30.0	40.0	10.0
8692B, Opt. 100	3.5	15.0	30.0	40.0	10.0
8693B	3.0	12.0	30.0	40.0	10.0
8693B, Opt. 100	3.0	12.0	30.0	40.0	10.0
8694B	3.0	12.0	30.0	40.0	10.0
8694B, Opt. 100	3.0	12.0	30.0	40.0	10.0
8694B, Opt. 200	3.0	12.0	30.0	40.0	10.0
8695B	2.5	12.0	20.0	28.0	10.0

Table 2-3. Adjustments

ANODE VOLTAGE ADJUSTMENT

Procedure

- a. Ensure that RF Unit is properly installed in 8690A/B and connect equipment as shown in Figure 2-1.
- b. Set 8690A/B controls as follows:
 FUNCTION START-STOP
 SWEEP SELECTOR CW
 START/CW High end of specified range
- c. Set RF Unit POWER LEVEL control MAX CW.
- d. Connect 3440 Voltmeter (Table 2-1) from A3TP2 to 8690A/B chassis ground.
- e. Adjust A1R42, ANODE ADJUST (Figure 2-3) for the voltage shown on the BWO tube label.
- f. Perform ANODE SHAPING and BWO currents adjustment procedures.

ANODE SHAPING ADJUSTMENT

Procedure

- a. Ensure that RF Unit is properly installed in 8690A/B.
- b. Set 8690A/B controls as follows:
 FUNCTION START-STOP
 SWEEP SELECTOR CW
 ALC Depressed
 START/CW Low end of specified range
- c. Connect equipment as shown in Figure 2-1, according to RF Unit used.
- d. Measure leveled power output. If power level is not at least the appropriate minimum level tabulated below, proceed to step e.

RF Unit Model	Power Level, dBm
8691B	18.5
8692B	16.0
8692B, Opt. 100	11.8
8693B	11.8
8693B, Opt. 100	7.0
8694B	14.8
8694B, Opt. 100	11.8
8694B, Opt. 200	11.8
8695B	16.0

- e. Adjust A1R40, ANODE SHAPE ADJ, to achieve the appropriate power output specified in step d. Do not adjust A1R40, ANODE SHAPE ADJUST, unless necessary. If anode shaping is necessary, remove capacitor C1 (.05 μ F) until adjustment is completed.

BWO CURRENTS ADJUSTMENT

Procedure

- a. Ensure that RF Unit is properly installed in the 8690A/B.
- b. Set 8690A/B controls as follows:
 FUNCTION START/STOP
 SWEEP SELECTOR CW
 START/CW Low end of specified range
- c. Connect 428 DC Ammeter (Table 2-1) clip-on probe around BWO helix lead (red).
- d. Measure helix current with START/CW at low end of specified range; then at high end of specified range.
- e. If low or high end current is greater than specified in Table 2-2, adjust A1R42, ANODE ADJUST, to bring current within limits.
- f. Perform ANODE SHAPING adjustment procedure, and steps a through e of BWO CURRENTS ADJUSTMENT procedure until further adjustments are not required.
- g. On Watkins-Johnson BWO, connect 428 DC Ammeter clip-on probe around cathode lead (yellow). On Varian BWO, connect 428 DC Ammeter clip-on probe around anode lead (blue).
- h. Measure cathode (Watkins-Johnson BWO) or anode (Varian BWO) current with START/CW at low end of specified range; then at high end of specified range.
- i. Repeat steps e and f.

HELIX VOLTAGE SHAPING ADJUSTMENT
(With 2 pot A2 Assembly)

Procedure:

- a. Ensure that RF Unit is properly installed in the 8690A/B.

Table 2-3. Adjustments (cont'd)

- b. Set 8690A/B controls as follows:
 FUNCTION ΔF
 SWEEP SELECTOR MANUAL
 STOP/ΔF MAX CW
- c. Connect 3440 Voltmeter (Table 2-1) from A4TP4 on 8690A/B Helix Amplifier Assy A4 to 8690A/B chassis ground.
- d. Set START/CW and MANUAL SWEEP for 69.5 Vdc at A4TP4 (8690A/B Assy A4).
- e. Adjust A1R24, SHAPE ADJ, on "B" Modulator Assy A1, for approximately 0.0 Vdc across A1CR3.
- f. Connect equipment as shown in Figure 2-2.
- g. Set START/CW and MANUAL SWEEP for 3.00±0.01 Vdc at A4TP4 (8690A/B Assy A4).
- h. Adjust A2R12 on Freq Shape Assy A2 for low end frequency of specified range. Use frequency meter and oscilloscope display to determine frequency setting.
- i. Set START/CW and MANUAL SWEEP for 38.00 ±0.01 Vdc at A4TP4 (8690A/B Assy A4).
- j. Adjust A2R13 on Freq Shape Assy A2 for midpoint frequency of specified range. Use frequency meter and oscilloscope display to determine frequency setting.
- k. Repeat steps g through j until adjustments are not necessary.
- l. Set START/CW and MANUAL SWEEP for 73.00 ±0.01 VDC at A4TP4 (8690A/B Assy A4).
- m. Adjust A1R24, SHAPE ADJ, on "B" Modulator Assy A1 for high end frequency of specified range.

FREQUENCY ACCURACY ADJUSTMENT

Procedure:

- a. Ensure that RF Unit is properly installed in the 8690A/B.

- b. Set 8690A/B controls as follows:
 FUNCTION ΔF
 SWEEP SELECTOR MANUAL
 STOP/ΔF MAX CW
- c. Connect equipment as shown in Figure 2-2.
- d. Connect 3440 Voltmeter (Table 2-1) from A4TP4 (8690A/B Helix Amplifier Assy A4) to 8690A/B chassis ground.
- e. Set START/CW and MANUAL SWEEP for voltages at A4TP4 (8690A/B Assy A4) as listed in Table 2-4.
- g. If necessary, set frequency of RF output by compromise adjustment of A1R24, SHAPE ADJ, A2R12, and A2R13.

POWER LEVEL CONTROL ADJUSTMENT

Procedure:

- a. Ensure that RF Unit is properly installed in the 8690A/B.
- b. Connect equipment as shown in Figure 2-1.
- c. Set 8690A/B controls as follows:
 SWEEP SELECTOR AUTO
 START/CW . . . Low end of frequency range
 STOP/ΔF . . . High end of frequency range
 ALC Depressed
 LINE RF
- d. Set RF out for maximum leveled power (refer to leveling procedure in the 8690A or 8690B Operating and Service Manual).
- e. Adjust A1R1, LEVEL SHUNT ADJ., fully counterclockwise.
- f. Set RF Unit POWER LEVEL control to 7.
- g. Adjust A1R1, LEVEL SHUNT ADJ, clockwise until UNLEVELED light comes on.
- h. Readjust A1R1 slowly counterclockwise until the UNLEVELED light just goes out.

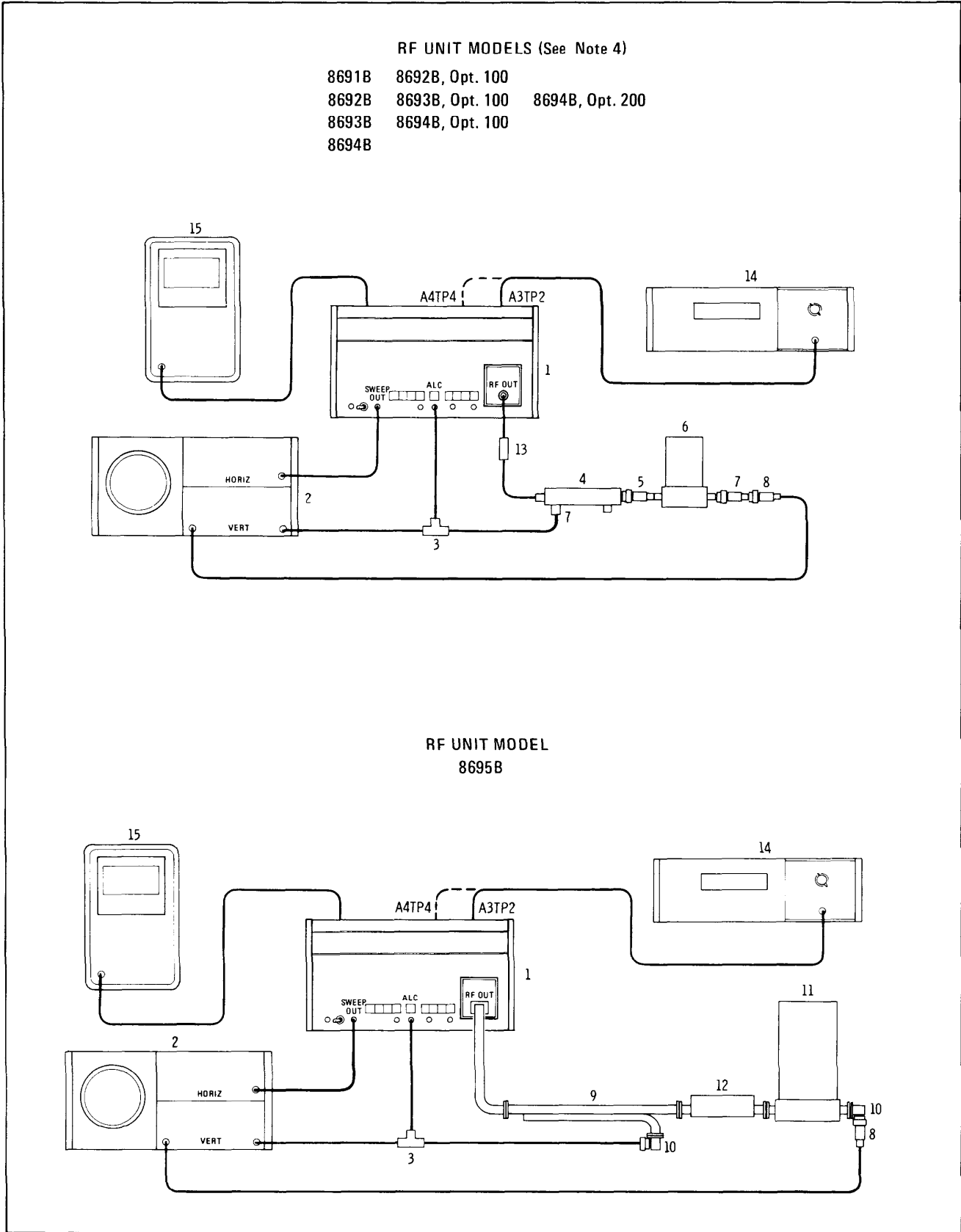


Figure 2-1. Maintenance Setup Number 1

1. SWEEP OSCILLATOR HP 8690A/B
2. OSCILLOSCOPE HP 140/1420/1402
3. BNC TEE CONNECTOR
4. DIRECTIONAL DETECTOR (Refer to Note 1)
5. ATTENUATOR HP 8691B (Refer to Note 2)
6. FREQUENCY METER (Refer to Note 1)
7. CRYSTAL DETECTOR HP 423
8. 100 OHM LOAD RESISTOR HP 11523
(HP 422, 423, P424, Opt. 002)
9. DIRECTIONAL COUPLER HP 752
(Refer to Note 2)
10. CRYSTAL DETECTOR HP P424
11. FREQUENCY METER HP P532
12. WAVEGUIDE ATTENUATOR HP 370, 375 (Refer to Note 2)
13. MALE N to MALE N ADAPTER (UG 57B)
(Refer to Note 3)
14. DIGITAL VOLTMETER HP 3440A/3442A
15. CLIP ON DC AMMETER HP 428A

NOTES

1. Use the appropriate equipment.

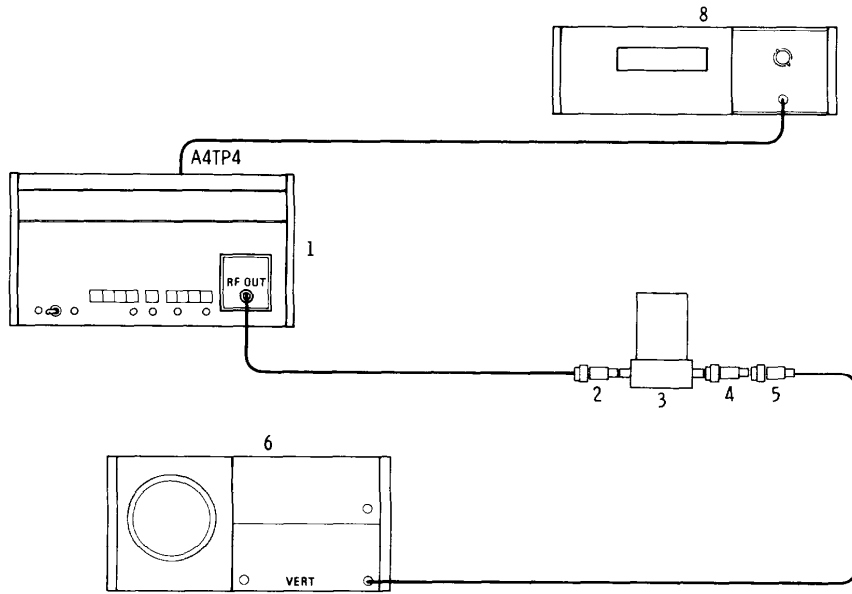
RF UNIT	DIRECTIONAL DETECTOR	FREQUENCY METER
8691B	HP 786	HP 536
8692B	787	536
8692B, Opt. 100	787	536
8693B	788	537
8693B, Opt. 100	788	537
8694B	789	537
8694B, Opt. 100	Narda 22440	537
8694B, Opt. 200	with HP 423 Crystal Detector	537
8695B	P752D with HP P424 Crystal Detector	P 532

2. As required to reduce power to Crystal Detector to less than 100 mW.
3. For use with Narda 22440 when testing 8694B, Opt. 100, Opt. 200 models
4. For internally leveled RF Units, omit the external leveling loop.

Figure 2-1. Maintenance Setup Number 1 (cont'd)

RF UNIT MODELS

8691B	8692B, Opt. 100	
8692B	8693B, Opt. 100	8694B, Opt. 200
8693B	8694B, Opt. 100	
8694B		



RF UNIT MODEL
8695B

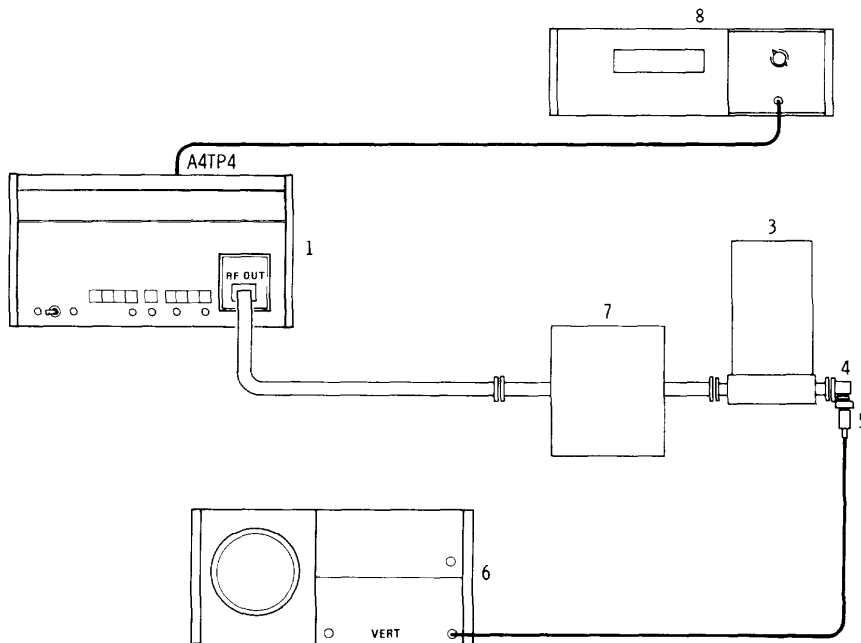


Figure 2-2. Maintenance Setup Number 2

1. SWEEP OSCILLATOR HP 8690A/B
2. ATTENUATOR HP 8691B – As required to reduce power to crystal detector to less than 100 mW
3. FREQUENCY METER (Refer to Note 1)
4. CRYSTAL DETECTOR HP 423 or HP P424A
5. 100 OHM LOAD RESISTOR HP 11523 (HP 422, 423 424, Option 002)
6. OSCILLOSCOPE HP 140/1420/1402
7. VARIABLE ATTENUATOR HP P382A
8. DIGITAL VOLTMETER HP 3440A/3442A

NOTE

1. Use the appropriate equipment

RF UNIT	FREQUENCY METER
8691B	HP 536
8692B	536
8692B	536
8693B	537
8693B, Opt. 100	537
8694B, Opt. 100	537
8694B, Opt. 200	537
8695B	P 532A

Figure 2-2. Maintenance Setup Number 2 (cont'd)

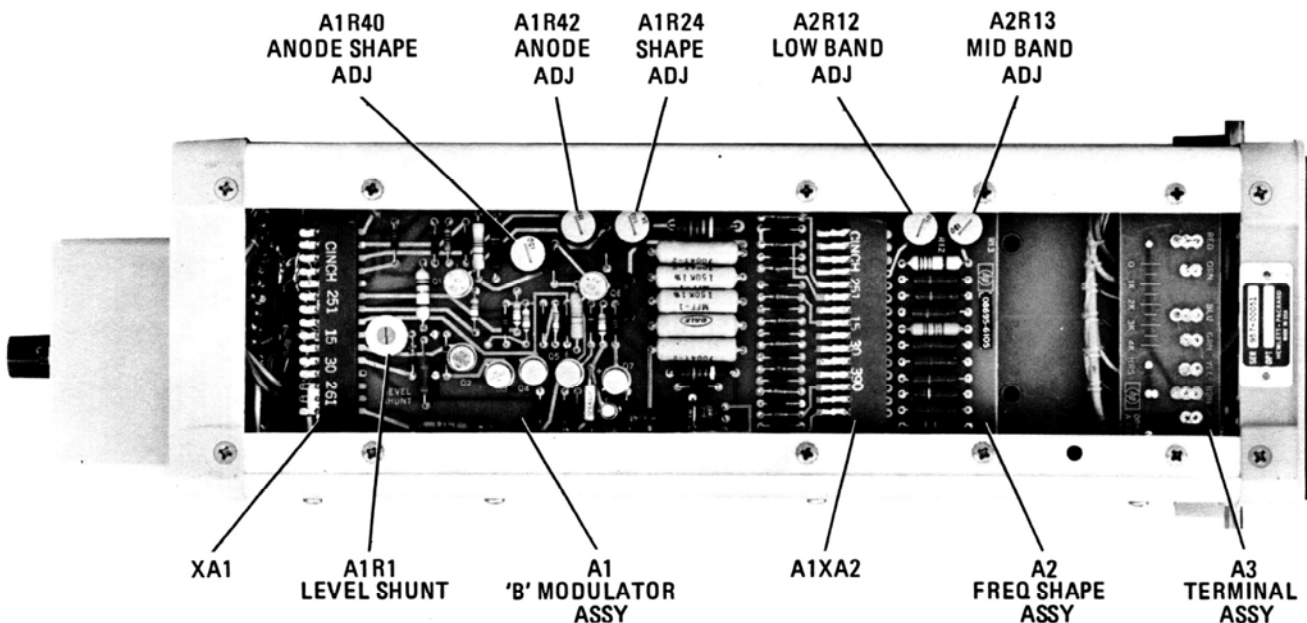


Figure 2-3. Component and Adjustment Identification Interior Top View

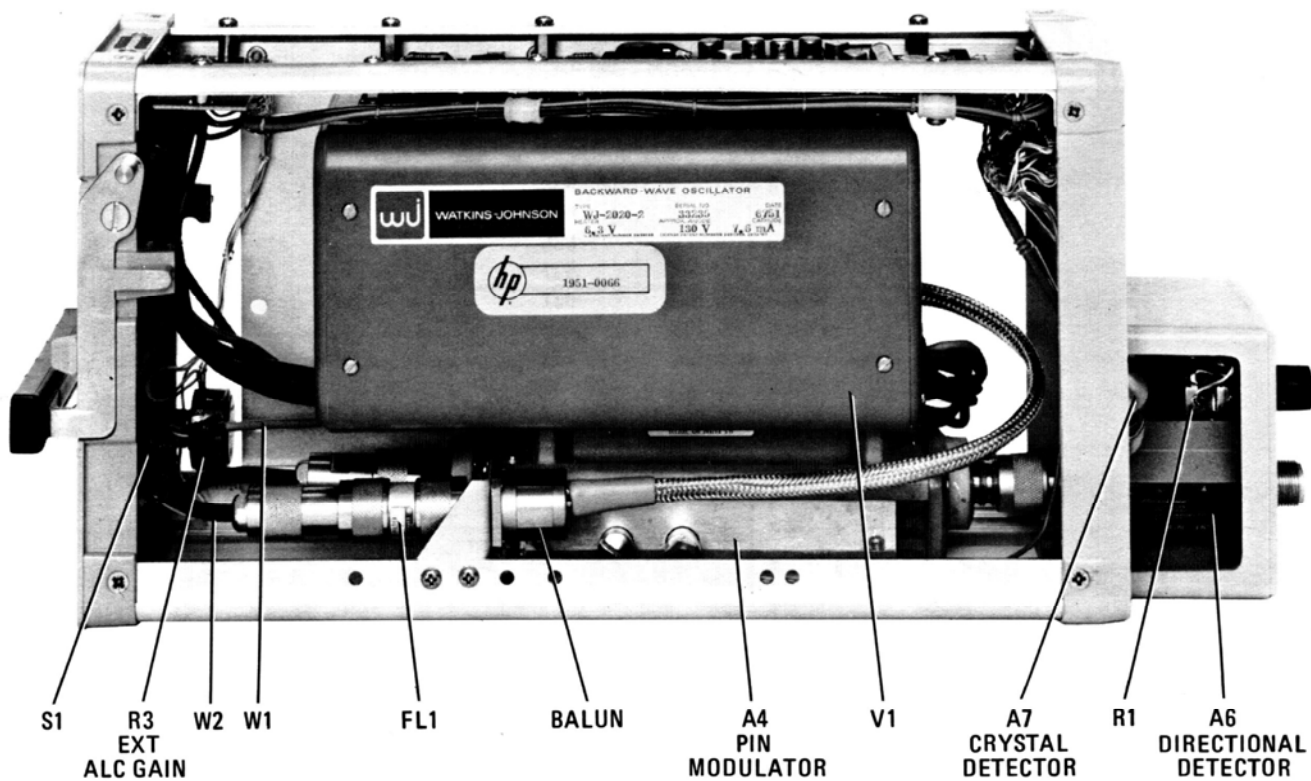


Figure 2-4. Component Identification, Option 001, 8694B

Table 2-4. Helix Voltage Shaping Adjustment Sequence

Vdc at Test Point 4 8690 Assembly A4	Adjust	8691B	8692B	8692B Opt. 100	8693B	8693B Opt. 100	8694B	8694B Opt. 100	8694B Opt. 200	8695B
73.00 ± 0.01	A1R24	2.000	4.000	4.200	8.000	8.300	12.40	12.40	11.00	18.000
66.00 ± 0.01		1.900	3.800	3.950	7.600	7.840	11.96	11.86	10.60	17.440
59.00 ± 0.01		1.800	3.600	3.700	7.200	7.380	11.52	11.32	10.20	16.880
52.00 ± 0.01		1.700	3.400	3.450	6.800	6.920	11.08	10.78	9.800	16.320
45.00 ± 0.01		1.600	3.200	3.200	6.400	6.460	10.64	10.24	9.400	15.760
38.00 ± 0.01	A2R13	1.500	3.000	2.950	6.000	6.000	10.20	9.700	9.000	15.200
31.00 ± 0.01		1.400	2.800	2.700	5.600	5.540	9.760	9.160	8.600	14.640
24.00 ± 0.01		1.300	2.600	2.450	5.200	5.080	9.320	8.620	8.200	14.080
17.00 ± 0.01		1.200	2.400	2.200	4.800	4.620	8.880	8.080	7.800	13.520
10.00 ± 0.01		1.100	2.200	1.950	4.400	4.160	8.440	7.540	7.400	12.960
3.00 ± 0.01	A2R12	1.000	2.000	1.700	4.000	3.700	8.000	7.000	7.000	12.400
TEST LIMIT (MHz):		± 10	± 20	± 25	± 40	± 45	± 40	± 50	± 40	± 50

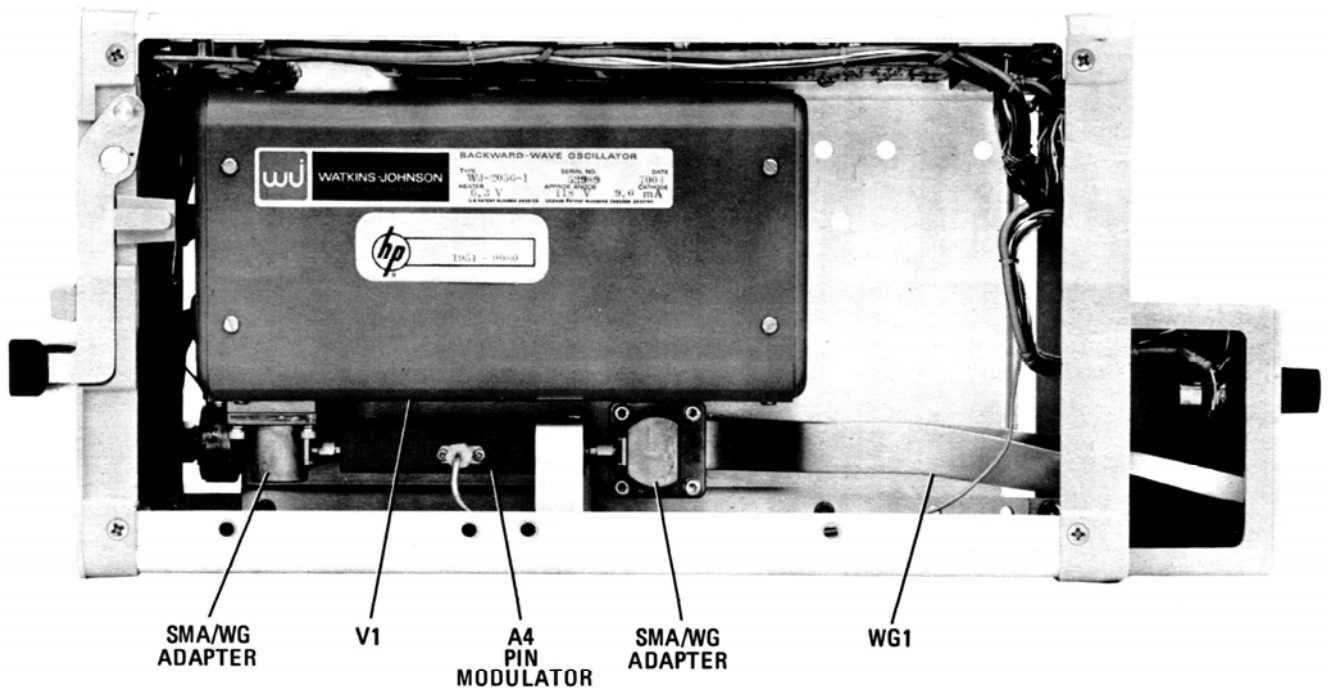


Figure 2-5. Component Identification, 8695B

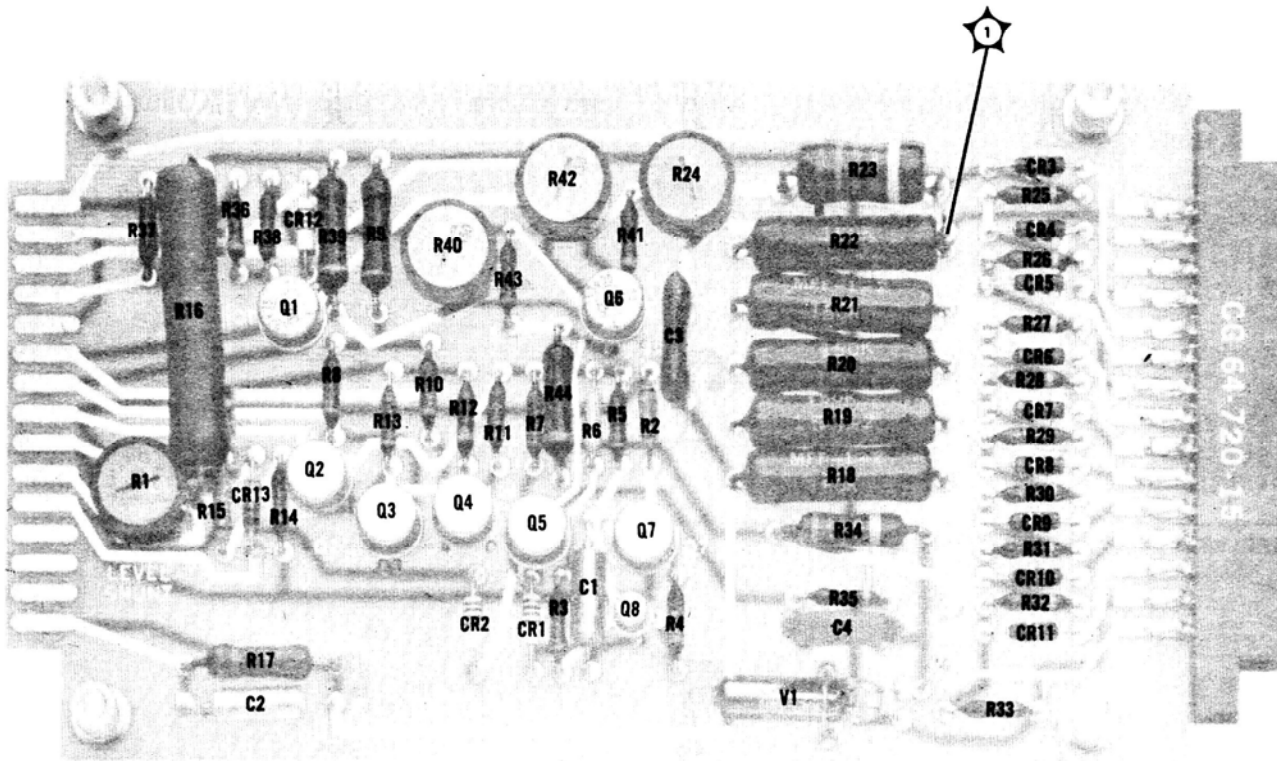
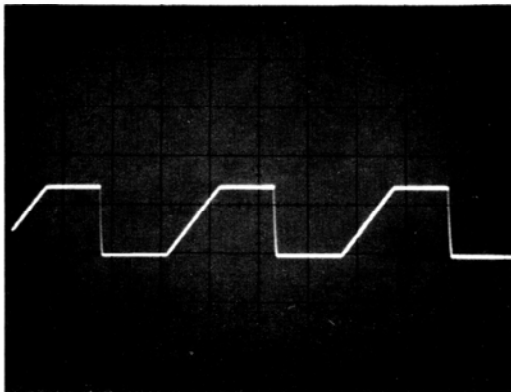
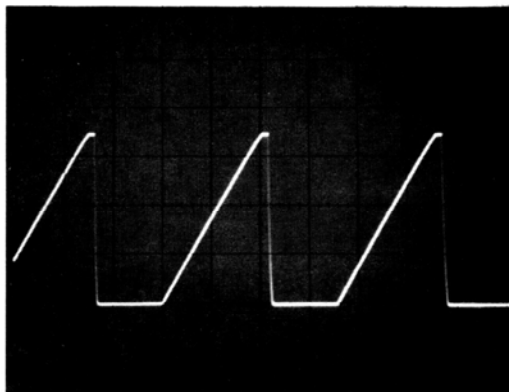


Figure 2-6. Component Identification Assembly A1

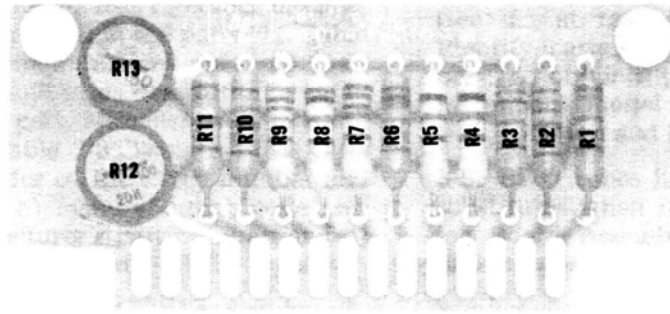


Junction A1R38, A1R39
20 V/div 5 ms/div

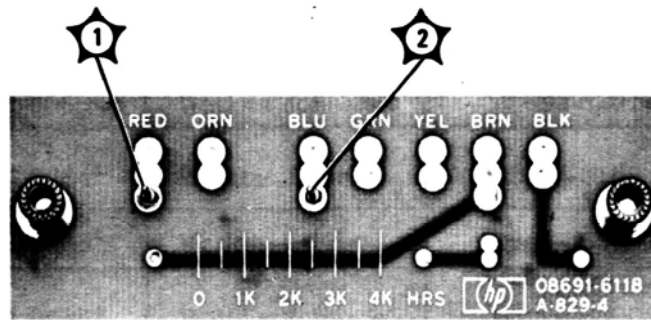


Emitter A1Q1
20 V/div 5ms/div

Figure 2-7. Waveforms



A2



A3

Figure 2-8. Component Identification, Assemblies A2 and A3

SECTION III

REPLACEABLE PARTS

3-1. INTRODUCTION

3-2. This section contains information for ordering replacement parts. Table 3-2 lists reference designations and abbreviations used in the parts list. Table 3-3 lists parts in alpha-numerical order of their reference designators and gives description and HP part number of each part. Miscellaneous parts are listed at the end of Table 3-3. Table 3-4 lists parts in alpha-numerical order of their part number and gives: a) description; b) manufacturer's code (see Table 3-5); c) manufacturer's part number; and d) total quantity used (TQ column).

3-3. ORDERING INFORMATION.

3-4. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard field office (see list at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers. To obtain a part that is not listed, include: a) instrument model and serial number; b) description, function and location of the part.

3-5. BWO tubes listed in parts list are equivalent substitutes when used with the appropriate Shaping Board Assembly (A2) and Helix Overcurrent Shunt Resistor (A1R17). Refer to Table 3-1.

Table 3-1. BWO Tube, Shaping Board Assembly and Helix Overcurrent Shunt Resistor Combinations

RF Unit Model	BWO Tube (V1)	BWO Manufacturer	Shaping Board Assembly (A2)	Helix Overcurrent ¹ Shunt Resistor (A1R17)
8691B	1951-0020	Watkins Johnson	08691-6103	8.25K ohm
8692B	1951-0055	Varian	08692-6102	1.0K ohm
	1951-0064	Watkins Johnson	08692-6101	8.25K ohm
8692B Opt. 100	1951-0072 ²	Watkins Johnson	08692-6103	8.25K ohm
8693B	1951-0057	Varian	08693-6102	1.0K ohm
	1951-0065	Watkins Johnson	08693-6101	8.25K ohm
8693B Opt. 100	1951-0084 ³	Watkins Johnson	08693-6103	8.25K ohm
8694B	1951-0085 ⁴	Watkins Johnson	08694-60001	8.25K ohm
8694B Opt. 100	1951-0085 ⁴	Watkins Johnson	08694-60002	8.25K ohm
8694B Opt. 200	1951-0085 ⁴	Watkins Johnson	08694-60003	8.25K ohm
8695B	1951-0080	Watkins Johnson	08695-6105	14.7K ohm

¹The 8.25K ohm helix overcurrent shunt resistor is HP Part No. 0757-0837. The 1.0K ohm helix overcurrent shunt resistor is HP Part No. 0761-0021. The 14.7K ohm helix overcurrent shunt resistor is HP Part No. 0698-3414.

²BWO (HP Part No. 1951-0072) is the recommended replacement for BWOs (1951-0055 and 1951-0064) used in all 8692B Option 100 RF Units (regardless of serial prefix).

³BWO (HP Part No. 1951-0084) is the recommended replacement for BWOs (1951-0057 and 1951-0065) used in all 8693B Option 100 RF Units (regardless of serial prefix or added options).

⁴BWO (HP Part No. 1951-0085) has higher output power and is the recommended replacement for BWOs (1951-0058 and 1951-0066) used in all 8694B RF Units (regardless of option or serial prefix).

Table 3-2. Reference Designators and Abbreviations Used in Parts List

REFERENCE DESIGNATORS							
A	= assembly	F	= fuse	P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor	FL	= Filter	Q	= transistor	VR	= voltage regulator
BT	= battery	J	= jack	R	= resistor	W	= cable
C	= capacitor	K	= relay	RT	= thermistor	X	= socket
CP	= coupler	L	= inductor	S	= switch	Y	= crystal
CR	= diode	LS	= loud speaker	T	= transformer	Z	= tuned cavity, network
DL	= delay line	M	= meter	TB	= terminal board		
DS	= device signaling (lamp)	MK	= microphone	TP	= test point		
E	= misc electronic part	MP	= mechanical part	U	= integrated circuit		

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

Table 3-3. Parts List Indexed by Reference Designation

Reference Designation	Part No.	Description #	Note
A1	08692-0113	ASSY:"B" MODULATOR (8691B THRU 8695B)	
A1C1	0180-0161	C:FXD ELECT 5.3 UF 20% 35VDCW	
A1C2	0180-0116	C:FXD ELECT 6.8 UF 10% 35VDCW	
A1C3	0160-0383	C:FXD MICA 10 UF 10% 250CVDCW	
A1C4	0180-0089	C:FXD ELECT 10UF-10%+10% 150VDCW	
A1C5	0160-0158	C:FXD MY 0.0056 UF 10% 200VDCW FACTORY SELECTED PART	
A1CR1	1901-0033	DIODE:SILICON 100MA 180WV	
A1CR2	1901-0033	DIODE:SILICON 100MA 180WV	
A1CR3	1901-0096	DIODE:SILICON 120V	
A1CR4	1901-0096	DIODE:SILICON 120V	
A1CR5	1901-0096	DIODE:SILICON 120V	
A1CR6	1901-0096	DIODE:SILICON 120V	
A1CR7	1901-0096	DIODE:SILICON 120V	
A1CR8	1901-0096	DIODE:SILICON 120V	
A1CR9	1901-0096	DIODE:SILICON 120V	
A1CR10	1901-0096	DIODE:SILICON 120V	
A1CR11	1901-0096	DIODE:SILICON 120V	
A1CR12	1901-0033	DIODE:SILICON 100MA 180WV	
A1CR13	1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	
A1Q1	1854-0232	Q:SI NPN(SELECTED FROM 2N3440)	
A1Q2	1854-0039	Q:SI NPN	
A1Q3	1854-0003	Q:SI NPN(SELECTED FROM 2N1711)	
A1Q4	1854-0003	Q:SI NPN(SELECTED FROM 2N1711)	
A1Q5	1854-0003	Q:SI NPN(SELECTED FROM 2N1711)	
A1Q6	1854-0232	Q:SI NPN(SELECTED FROM 2N3440)	
A1Q7	1854-0003	Q:SI NPN(SELECTED FROM 2N1711)	
A1Q8	1853-0010	Q:SI PNP(SELECTED FROM 2N3251)	
A1R1	2100-1772	R:VAR WW 500 OHM 5% TYPE H 1W	
A1R2	0698-3428	R:FXD MET FLM 14.7 OHM 1% 1/8W	
A1R3	0757-0430	R:FXD MET FLM 2.21K OHM 1% 1/8W	
A1R4	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R5	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	
A1R6	0698-3157	R:FXD MET FLM 19.6K 1% 1/8W	
A1R7	0757-0454	R:FXD MET FLM 33.2K OHM 1% 1/8W	
A1R8	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	
A1R9	0757-0063	R:FXD MET FLM 196K OHM 1% 1/2W	
A1R10	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	
A1R11	0698-3151	R:FXD MET FLM 2.87K OHM 1% 1/8W	
A1R12	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A1R13	0698-3157	R:FXD MET FLM 19.6K 1% 1/8W	
A1R14	0698-3425	R:FXD MET FLM 316K OHM 1% 1/2W	
A1R15	0698-3442	R:FXD MET FLM 237 OHM 1% 1/8W FACTORY SELECTED PART	
A1R16	0757-0442	R:FXD MET FLM 10.0K 1% 1/8W	
A1R17	0757-0837	R:FXD MET FLM 8.25K 1% 1/2W(WJ BWO TUBES)	**
A1R17	0761-0021	R:FXD MET FLM 1K OHM 5% 1W(VARIAN BWO TUBES)	**
A1R18	0760-0023	R:FXD MET FLM 150K OHM 1% 1W	
A1R19	0760-0023	R:FXD MET FLM 150K OHM 1% 1W	
A1R20	0760-0023	R:FXD MET FLM 150K OHM 1% 1W * FACTORY SELECTED PART	

See introduction to this section for ordering information

Table 3-3. Parts List Indexed by Reference Designation (cont'd)

Reference Designation	Part No.	Description #	Note
A1R21	0760-0023	R:FXD MET FLM 150K OHM 1% 1W	
A1R22	0760-0023	R:FXD MET FLM 150K OHM 1% 1W	
A1R23	0764-0007	R:FXD MET FLM 27K OHM 5% 2W	
A1R24	2100-1775	R:VAR WW 5K OHM 5% TYPE H 1W	
A1R25	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R26	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R27	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R28	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R29	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R30	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R31	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R32	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R33	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A1R34	0761-0032	R:FXD MET OX 56K OHM 5% 1W	
A1R35	0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	
A1R36	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W (8691B)	
	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W (8692B)	
	0757-0123	R:FXD MET FLM 34.8K OHM 1% 1/8W (8692B OPT 100)	
	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W (8693B)	
	0698-3161	R:FXD MET FLM 38.3K 1% 1/8W (8693B OPT 100)	
	0757-0463	R:FXD MET FLM 82.5K 1% 1/8W (8694B)	
	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (8694B OPT 100)	
	0757-0462	R:FXD MET FLM 75.0K OHM 1% 1/8W (8694B OPT 200)	
	0757-0465	R:FXD MET FLM 100K 1% 1/8W (8695B)	
A1R37	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (8691B)	
	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (8692B)	
	0757-0464	R:FXD MET FLM 90.9K OHM 1% 1/8W (8692B OPT 100)	
	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (8693B)	
	0757-0462	R:FXD MET FLM 75.0K OHM 1% 1/8W (8693B OPT 100)	
	0698-3161	R:FXD MET FLM 38.3K 1% 1/8W (8694B)	
	0698-3162	R:FXD MET FLM 46.4K OHM 1% 1/8W (8694B OPT 100)	
	0698-3161	R:FXD MET FLM 38.3K 1% 1/8W (8694B OPT 200)	

See introduction to this section for ordering information

Table 3-3. Parts List Indexed by Reference Designation (cont'd)

Reference Designation	Part No.	Description #	Note
	0757-0123	R:FXD MET FLM 34.8K OHM 1% 1/8W (8695B)	
A1R38	0757-0465	R:FXD MET FLM 100K 1% 1/8W	
A1R39	0757-0137	R:FXD MET FLM 750K OHM 1% 1/2W	
A1R40	2100-0945	R:VAR MET FLM 500K 20% LIN 3/4W	
A1R41	0757-0463	R:FXD MET FLM 82.5K 1% 1/8W	
A1R42	2100-0945	R:VAR MET FLM 500K 20% LIN 3/4W	
A1R43	0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	
A1R44	0757-0374	R:FXD MET FLM 485K OHM 1% 1/2W	
A1R45	0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	
A1V1	1940-0013	ELECTRON TUBE:82.0 +/- 1V	
A1XA1		NOT ASSIGNED	
A1XA2	1251-0494	CONNECTOR:PC 30 CONTACTS	

See introduction to this section for ordering information

Table 3-3. Parts List Indexed by Reference Designation (cont'd)

Reference Designation	Part No.	Description #	Note
A3	08691-6118	BOARD ASSY:BWO TERM	
A4	C05-33001C	MODULATOR:PIN (8695B)	
	08691-6111	MODULATOR:PIN (8691B)	
	08692-6111	MODULATOR:PIN (8692B & OPT 100)	
	08693-6111	MODULATOR:PIN (8693B, OPT 001, OPT 100)	
	08694-6111	MODULATOR:PIN (8694B, OPT 001, OPT 100, OPT 200)	
A5	08693-6110	DETECTOR:DIRECTIONAL (8693B, OPT 001, OPT 100)	
A6	1130-0032	DETECTOR:DIRECTIONAL (8694B, OPT 001, OPT 100, OPT 200)	
A7	08694-6110	DETECTOR:CRYSTAL (8694B, OPT 001, OPT 100, OPT 200)	
C1	0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	
DS1	2140-0092	LAMP:5V 60 MA	
DS1	1450-0153	LAMPHOLDER:FOR T-1 SERIES	
DS1	1450-0157	LEN:LAMPHOLDER	
FL1	00693-604	FILTER:LOW PASS (8693B, OPT 001, OPT 100)	
FL1	00694-604	FILTER:LOW PASS (8694B, OPT 001, OPT 100, OPT 200)	
J1	1250-0083	CONNECTOR:BNC(SWEEP REF)	
P1- P10		NOT ASSIGNED	
P11	1251-1322	CONNECTOR:15 CONTACTS MALE	
P12	1251-0136	CONNECTOR:32 PIN MALE	
R1	2100-2675	R:VAR GANGED 2 X 1K CHM 20% LIN PART OF R1	
R2			
R3	2100-0051	R:VAR COMP 20K OHM 10% CWLOG 2W	
R4		DELETED	
R5	0757-0273	R:FXD MET FLM 3.01K CHM 1% 1/8W	

See introduction to this section for ordering information

Table 3-3. Parts List Indexed by Reference Designation (cont'd)

Reference Designation	Part No.	Description #	Note
A2	08694-6101	ASSY:FREQ. SHAPE(8694B) (USED WITH 1951-0066 ALT BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-6102	ASSY:FREQ. SHAPE(8694B) (USED WITH 1951-0058 BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-6103	ASSY:FREQ. SHAPE(8694B OPT 100) (USED WITH 1951-0066 ALT BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-6104	ASSY:FREQ. SHAPE(8694B OPT 100) (USED WITH 1951-0058 BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-6105	ASSY:FREQ. SHAPE(8694B OPT 200) (USED WITH 1951-0066 ALT BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-6106	ASSY:FREQ. SHAPE(8694B OPT 200) (USED WITH 1951-0058 BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-60001	ASSY:FREQ. SHAPE(8694B) (USED WITH 1951-0085 BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-60002	ASSY:FREQ. SHAPE(8694B OPT 100) (USED WITH 1951-0085 BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-60003	ASSY:FREQ. SHAPE(8694B OPT 200) (USED WITH 1951-0085 BWD) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2 A2 A2	08695-6105	ASSY:FREQ SHAPE(8695B) (USED WITH 1951-0080 BWD) REFER TO PARAGRAPH 3-5.	
A2R1- A2R13		FACTORY SELECTED VALUE	

See introduction to this section for ordering information

Table 3-3. Parts List Indexed by Reference Designation (cont'd)

Reference Designation	Part No.	Description #	Note
A3	08691-6118	BOARD ASSY:BWD TERM	
A4	C05-33001C	MODULATOR:PIN (8695B)	
	08691-6111	MODULATOR:PIN (8691B)	
	08692-6111	MODULATOR:PIN (8692B & OPT 100)	
	08693-6111	MODULATOR:PIN (8693B, OPT 001, OPT 100)	
	08694-6111	MODULATOR:PIN (8694B, OPT 001, OPT 100, OPT 200)	
A5	08693-6110	DETECTOR:DIRECTIONAL (8693B, OPT 001, OPT 100)	
A6	1130-0032	DETECTOR:DIRECTIONAL (8694B, OPT 001, OPT 100, OPT 200)	
A7	08694-6110	DETECTOR:CRYSTAL (8694B, OPT 001, OPT 100, OPT 200)	
C1	0150-0052	C:FXD CER 0.05 UF 20% 40CVDCW	
DS1	2140-0092	LAMP:5V 60 MA	
DS1	1450-0153	LAMPHOLDER:FOK T-1 SERIES	
DS1	1450-0157	LEN:LAMPHOLDER	
FL1	00693-604	FILTER:LOW PASS (8693B, OPT 001, OPT 100)	
FL1	00694-604	FILTER:LOW PASS (8694B, OPT 001, OPT 100, OPT 200)	
J1	1250-0083	CONNECTOR:BNC(SWEEP REF)	
P1- P10		NOT ASSIGNED	
P11	1251-1322	CONNECTOR:15 CONTACTS MALE	
P12	1251-0136	CONNECTOR:32 PIN MALE	
R1	2100-2675	R:VAR GANGED 2 X 1K OHM 20% LIN PART OF R1	
R2			
R3	2100-0051	R:VAR COMP 20K OHM 10% CWLOG 2W	
R4		DELETED	
R5	0757-0273	R:FXD MET FLM 3.01K OHM 1% 1/8W	

See introduction to this section for ordering information

Table 3-3. Parts List Indexed by Reference Designation (cont'd)

Reference Designation	Part No.	Description #	Note
V1	1951-0020	ELECTRON TUBE:BWO (8691B) REFER TO PARAGRAPH 3-5.	
V1	1951-0064	ELECTRON TUBE:BWO 2.0 TO 4.0 GC (8692B) REFER TO PARAGRAPH 3-5.	
V1	1951-0055	ELECTRON TUBE:BWO (8692B) REFER TO PARAGRAPH 3-5.	
V1	1951-0072	ELECTRON TUBE:BWO (ALL 8692B OPT 100 MODELS) REFER TO PARAGRAPH 3-5.	
V1	1951-0057	ELECTRON TUBE:BWO (8693B) REFER TO PARAGRAPH 3-5.	
V1	1951-0065	ELECTRON TUBE:BWO (8693B) REFER TO PARAGRAPH 3-5.	
V1	1951-0084	ELECTRON TUBE:BWO (ALL 8693B OPT 100 MODELS) REFER TO PARAGRAPH 3-5.	
V1	1951-0085	ELECTRON TUBE:BWO (ALL 8694B MODELS) REFER TO PARAGRAPH 3-5.	
V1	1951-0080	ELECTRON TUBE:BWO 12.4 TO 18.0 GC (8695B) REFER TO PARAGRAPH 3-5.	

See introduction to this section for ordering information

Table 3-3. Parts List Indexed by Reference Designation (cont'd)

Reference Designation	Part No.	Description #	Note
w1	08691-6003	ASSY:COAX CABLE	
w2	08691-6006	ASSY:RF CABLE	
w2		(ALL 8691B & 8692B MODELS)	
w2	08693-6112	ASSY:RF CABLE	
w2		(ALL 8693B & 8694B MODELS)	
wG1	08695-20007	WAVEGUIDE ASSY	
wG1		(8695B)	
xA1	1251-0159	CONNECTOR:2X15 CONTACT MISCELLANEOUS	
	0370-0133	KNOB:SKIRTED FOR 0.250" DIA SHAFT (POWER LEVEL)	
	3150-0054	FILTER:AIR	
	6960-0046	PLUG-HOLE(OPT 004 MODELS)	
	08691-0107	MOUNTING PLATE:8W0	
	08691-0101	PANEL:FRONT (8691B)	
	08691-310	NUT:KNURLED(P/O RF OUTPUT JACK)	
	08691-2010	HANDLE ASSY	
	08691-2110	SCALE(1.0-2.0GHZ)8691B	
	08691-2114	PANEL:REAR(8691B THRU 8694B OPT 004 MODELS)	
	08691-2112	PANEL:REAR(8691B THRU 8695B)	
	08692-0101	PANEL:FRONT(8692B)	
	08692-0110	PANEL:FRONT(8692B OPT 100)	
	08692-2110	SCALE(2.0-4.0GHZ)8692B	
	08692-2111	SCALE(1.7-4.2GHZ)8692B OPT 100	
	08693-0101	PANEL:FRONT(8693B OPT 001)	
	08693-0108	PANEL:FRONT(8693B OPT 001, & OPT 100)	
	08693-2110	SCALE(4.0-8.0GHZ)8693B & OPT 001	
	08693-2111	SCALE(3.7-8.3GHZ)8693B & OPT 001, 100	
	08694-0101	PANEL:FRONT	
	08694-0113	PANEL:FRONT(8694B OPT 001, 100)	
	08694-0115	PANEL:FRONT(8694B & OPT 001, 200)	
	08694-2110	SCALE(8.0-12.4GHZ)8694B & OPT 001	
	08694-2111	SCALE(7.0-12.4GHZ)8694B OPT 001, 100	
	08694-2112	SCALE(7.0-11.0GHZ)8694B & OPT 001, 200	
	08695-0100	PANEL:FRONT(8695A)	
	08695-00001	BRACKET:PIN MODULATOR(8695B ONLY)	
	08695-00002	PANEL:FRONT(8695B)	
	08695-2115	PANEL:REAR(8695B & OPT 004)	
	08695-2110	SCALE:12.4-18.0 GHZ(8695B)	
	08695-60005	ADAPTER :SMA/WAVEGUIDE(8695B)	

See introduction to this section for ordering information

Table 3-4. Parts List Indexed by Part Number

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	56289	33C17A	1
0160-0158	C:FXD MY 0.0056 UF 10% 200VDCW	56289	192P56292-PTS	1
0160-0383	C:FXD MICA 10 UF 10% 2500VDCW	2848C	0160-0383	1
0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	56289	30U106G150UF4	1
0180-0116	C:FXD ELECT 6.8 UF 10% 35VDCW	28480	0180-0116	1
0180-0161	C:FXD ELECT 5.3 UF 20% 35VDCW	56289	150D335X0035B2-DYS	1
0370-0133	KNOB:SKIRTED FOR 0.250" DIA SHAFT	2848C	0370-0133	1
C698-3151	R:FXD MET FLM 2.87K OHM 1% 1/8W	2848C	0698-3151	1
C698-3157	R:FXD MET FLM 19.6K OHM 1% 1/8W	14674	C4	2
C698-3161	R:FXD MET FLM 38.3K OHM 1% 1/8W	14674	C4	3
C698-3162	R:FXD MET FLM 46.4K OHM 1% 1/8W	2848C	0698-3162	1
C698-3425	R:FXD MET FLM 316K OHM 1% 1/2W	2848C	0698-3425	1
C698-3428	R:FXD MET FLM 14.7 OHM 1% 1/8W	2848C	0698-3428	1
C698-3442	R:FXD MET FLM 237 OHM 1% 1/8W	2848C	0698-3442	1
C698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W	2848C	0698-3450	3
0757-0063	R:FXD MET FLM 196K OHM 1% 1/2W	28480	0757-0063	1
0757-0123	R:FXD MET FLM 34.8K OHM 1% 1/8W	91637	MF-1/10-32	2
0757-0137	R:FXD MET FLM 750K OHM 1% 1/2W	2848C	0757-0137	1
0757-0273	R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273	1
0757-0279	R:FXD MET FLM 3.16K OHM 1% 1/8W	14674	C4	2
0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	14674	C4	10
0757-0374	R:FXD MET FLM 485K OHM 1% 1/2W	2848C	0757-0374	1
0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	14674	C4	1
0757-0430	R:FXD MET FLM 2.21K OHM 1% 1/8W	28480	0757-0430	1
0757-0442	R:FXD MET FLM 10.0K OHM 1% 1/8W	14674	C4	1
0757-0454	R:FXD MET FLM 33.2K OHM 1% 1/8W	2848C	0757-0454	1
0757-0458	R:FXD MET FLM 51.1K OHM 1% 1/8W	91637	MF-1/10-32	1
0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W	91637	MF-1/10-32	4
0757-0462	R:FXD MET FLM 75.0K OHM 1% 1/8W	2848C	0757-0462	2
0757-0463	R:FXD MET FLM 82.5K OHM 1% 1/8W	14674	C4	2
0757-0464	R:FXD MET FLM 90.9K OHM 1% 1/8W	28480	0757-0464	1
0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465	2
0757-0837	R:FXD MET FLM 8.25K OHM 1% 1/2W	28480	0757-0837	1
0760-0023	R:FXD MET FLM 150K OHM 1% 1W	2848C	0760-0023	5
0761-0021	R:FXD MET FLM 1K OHM 5% 1W	28480	0761-0021	1
0761-0032	R:FXD MET OX 56K OHM 5% 1W	2848C	0761-0032	1
0764-0007	R:FXD MET FLM 27K OHM 5% 2W	28480	0764-0007	1
1130-0032	DETECTOR: DIRECTIONAL	28480	1130-0032	1
1250-0083	CONNECTOR: BNC	28480	1250-0083	1
1251-0136	CONNECTOR: 32 PIN MALE	0266C	26-4100-32P	1
1251-0159	CONNECTOR: 2X15 CONTACT	28480	1251-0159	1
1251-0494	CONNECTOR: PC 30 CONTACTS	71785	251-15-30-390	1
1251-1322	CONNECTOR: 15 CONTACTS MALE	81312	SA-15P	1
1450-0157	LEN: LAMPHOLDER	06717	102XX-R	1
1450-0153	LAMPHOLDER: FOR T-1 SERIES	08717	1C2SR	1
1853-0010	Q:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010	1
1854-0003	Q:SI NPN(SELECTED FROM 2N1711)	28480	1854-0003	4
1854-0039	Q:SI NPN	04713	2N3053	1
1854-0232	Q:SI NPN(SELECTED FROM 2N3440)	2848C	1854-0232	2
1901-0033	DIODE: SILICON 100MA 180MV	07263	FD3369	3
1901-0096	DIODE: SILICON 120V	2848C	1901-0096	9
1910-0016	DIODE: GERMANIUM 100MA/0.85V 60PIV	93332	D2361	1
1940-0013	ELECTRON TUBE: 82.0 +/- 1V	74276	Z82R7	1
1951-0020	ELECTRON TUBE: 8W0	28480	1951-0020	1
1951-0055	ELECTRON TUBE: 8W0	28480	1951-0055	1

See introduction to this section for ordering information

Table 3-4. Parts List Indexed by Part Number (cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
1951-0057	ELECTRON TUBE:8W0	2848C	1951-0057	1
1951-0058	ELECTRON TUBE:8W0	2848C	1951-0058	1
1951-0064	TUBE:ELECTRON 8W0 2.0 TO 4.0 GC	2848C	1951-0064	1
1951-0065	ELECTRON TUBE:8W0	2848C	1951-0065	1
1951-0066	ELECTRON TUBE:8W0	2848C	1951-0066	1
1951-0072	ELECTRON TUBE:8W0	2848C	1951-0072	1
1951-0080	TUBE:8W0 12.4-18.0 GC	2848C	1951-0080	1
1951-0084	ELECTRON TUBE:8W0	2848C	1951-0084	1
2100-0051	R:VAR COMP 20K OHM 10% CWLOG 2W	2848C	2100-0051	1
2100-0945	R:VAR MET FLM 500K 20% LIN 3/4W	75042	CT150	2
2100-0969	R:VAR MET FLM 50K OHM 20%	75042	CT150	1
2100-1772	R:VAR WW 500 OHM 5% TYPE H 1W	2848C	2100-1772	1
2100-1775	R:VAR WW 5K OHM 5% TYPE H 1W	2848C	2100-1775	1
2100-1777	R:VAR WW 20K OHM 5% TYPE H 1W	2848C	2100-1777	1
2100-2675	R:VAR GANGED 2 X 1K OHM 20% LIN	2848C	2100-2675	1
2140-0092	LAMP:5V 60 MA	2848C	2140-0092	1
3150-0054	FILTER:AIR	2848C	3150-0054	1
6960-0046	PLUG-HOLE	C000C	08D#	1
CC5-33001C	MODULATOR:PIN	2848C	C05-33001C	1
CC693-604	FILTER:LOW PASS	2848C	CC693-604	1
00694-604	FILTER:LOW PASS	2848C	00694-604	1
08691-0101	PANEL:FRONT(8691B)	2848C	08691-0101	1
08691-0107	MOUNTING PLATE:8W0	2848C	08691-0107	1
08691-2010	HANDLE ASSY	2848C	08691-2010	1
08691-2110	SCALE(1.0-2.0GHZ)8691B	2848C	08691-2110	1
08691-2112	PANEL:REAR	2848C	08691-2112	1
08691-2114	PANEL:REAR(8691B THRU 8694B)	2848C	08691-2114	1
08691-6003	ASSY:COAX CABLE	2848C	08691-6003	1
08691-6006	ASSY:RF CABLE	2848C	08691-6006	1
08691-6103	ASSY:FREQ. SHAPE(8691B)	2848C	08691-6103	1
08691-6111	MODULATOR:PIN	2848C	08691-6111	1
08691-6118	PCARD ASSY:8W0 TERM	2848C	08691-6118	1
08692-0101	PANEL:FRONT(8692B)	2848C	08692-0101	1
08692-0110	PANEL:FRONT(8692B OPT 100)	2848C	08692-0110	1
08692-2110	SCALE(2.0-4.0GHZ)8692B	2848C	08692-2110	1
08692-2111	SCALE(1.7-4.2GHZ)8692B	2848C	08692-2111	1
08692-6101	ASSY:FREQ. SHAPE(8692B)	2848C	08692-6101	1
08692-6102	ASSY:FREQ. SHAPE(8692B)	2848C	08692-6102	1
08692-6103	ASSY:FREQ. SHAPE(8692B OPT 100)	2848C	08692-6103	1
08692-6104	ASSY:FREQ. SHAPE(8692B OPT 100)	2848C	08692-6104	1
08692-6111	MODULATOR:PIN	2848C	08692-6111	1
08692-6113	ASSY:"B" MODULATOR(8691B-8695B)	2848C	08692-6113	1
08693-0101	PANEL:FRONT(8693B & OPT 001)	2848C	08693-0101	1
08693-0108	PANEL:FRONT(8693B & OPT 001, 100)	2848C	08693-0108	1
08693-2110	SCALE(4.0-8.0GHZ)8693B & OPT 001	2848C	08693-2110	1
08693-2111	SCALE(3.7-8.3GHZ)8693B & OPT 001, 100	2848C	08693-2111	1
08693-6101	ASSY:FREQ. SHAPE(8693B)	2848C	08693-6101	1
08693-6103	ASSY:FREQ. SHAPE(8693B OPT 100)	2848C	08693-6103	1
08693-6104	ASSY:FREQ. SHAPE(8693B OPT 100)	2848C	08693-6104	1
08693-6110	DETECTOR:DIRECTIONAL	2848C	08693-6110	1
08693-6111	MODULATOR:PIN	2848C	08693-6111	1
08693-6112	ASSY:RF CABLE	2848C	08693-6112	1
08694-0101	PANEL:FRONT	2848C	08694-0101	1
08694-0113	PANEL:FRONT(8694B & OPT 001, 100)	2848C	08694-0113	1

See introduction to this section for ordering information

Table 3-4. Parts List Indexed by Part Number (cont'd)

Part No.	Description #	Mfr.	Mfr. Part No.	TQ
C8694-0115	PANEL:FRONT(8694B & OPT 001, 200)	28480	08694-0115	1
C8694-2110	SCALE(8.0-12.4GHZ)8694B & OPT 001	28480	08694-2110	1
08694-2111	SCALE(7.0-12.4GHZ)8694B OPT 001, 100	28480	08694-2111	1
08694-2112	SCALE(7.0-11.0GHZ)8694B & OPT 001, 200	28480	08694-2112	1
C8694-60001	ASSY:FREQ. SHAPE(8694B)	28480	08694-60001	1
08694-60002	ASSY:FREQ. SHAPE(8694B OPT 100)	28480	08694-60002	1
08694-60003	ASSY:FREQ. SHAPE(8694B OPT 200)	28480	08694-60003	1
08694-6101	ASSY:FREQ. SHAPE(8694B)	28480	08694-6101	1
08694-6102	ASSY:FREQ. SHAPE(8694B)	28480	08694-6102	1
08694-6103	ASSY:FREQ. SHAPE(8694B OPT 100)	28480	08694-6103	1
08694-6104	ASSY:FREQ. SHAPE(8694B OPT 100)	28480	08694-6104	1
C8694-6105	ASSY:FREQ. SHAPE(8694B OPT 200)	28480	08694-6105	1
08694-6106	ASSY:FREQ. SHAPE(8694B OPT 200)	28480	08694-6106	1
08694-6110	DETECTOR:CRYSTAL	28480	08694-6110	1
08694-6111	MODULATOR:PIN	28480	08694-6111	1
08695-00001	BRACKET:PIN MODULATOR	28480	08695-00001	1
C8695-00002	PANEL:FRONT(8695B)	28480	08695-00002	1
C8695-0100	PANEL:FRONT(8695A)	28480	08695-0100	1
C8695-20007	WAVEGUIDE ASSY	28480	08695-20007	1
C8695-2110	SCALE:12.4-18.0 GHZ(8695B)	28480	08695-2110	1
08695-2115	PANEL:REAR(8695B & OPT 004)	28480	08695-2115	1
C8695-60005	ADAPTER/SMA/WAVEGUIDE(8695B)	28480	08695-60005	1
08695-6105	ASSY:FREQ SHAPE	28480	08695-6105	1
08731-310	NUT:KNURLED(8695B)	28480	08731-310	1

See introduction to this section for ordering information

Table 3-5. Code List of Manufacturers

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	Code No.	Manufacturer	Address
00000	U.S.A Common	Any supplier of U.S.	05347	Ultronix, Inc.	San Mateo, Cal.
00136	McCoy Electronics	Mount Holly Springs, Pa.	05397	Union Carbine Corp., Elect. Div.	New York, N.Y.
00213	Sage Electronics Corp.	Rochester, N.Y.	05574	Viking Ind. Inc.	Canoga Park, Cal.
00287	Cemco, Inc.	Danielson, Conn	05593	Icore Electro-Plastics Inc.	Sunnyvale, Cal.
00334	Humidial	Colton, Calif.	05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
00348	Mictron, Co., Inc.	Valley Stream, N.Y.	05624	Barber Colman Co.	Rockford, Ill.
00373	Garlock Inc.	Cherry Hill, N.J.	05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
00656	Aerovox Corp.	New Bedford, Mass.	05729	Metro-Tel Corp.	Westbury, N.Y.
00779	Amp. Inc.	Harrisburg, Pa.	05783	Stewart Engineering Co.	Santa Cruz, Cal.
00781	Aircraft Radio Corp.	Boonton, N.J.	05820	Wakefield Engineering Inc.	Wakefield, Mass.
00809	Croven, Ltd.	Whitby, Ontario, Canada	06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.	06090	Raychem Corp.	Redwood City, Cal.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.	06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
00866	Goe Engineering Co.	City of Industry, Cal.	06402	E.T.A. Products Co. of America	Chicago, Ill.
00891	Carl E. Holmes Corp.	Los Angeles, Cal.	06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
00929	Microlab Inc.	Livingston, N.J.	06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.	06666	General Devices Co., Inc.	Indianapolis, Ind.
01009	Alden Products Co.	Brockton, Mass.	06751	Components Inc., Ariz. Div.	Phoenix, Arizona
01121	Allen Bradley Co.	Milwaukee, Wis.	06812	Torrington Mfg. Co., West Div.	Van Nuys, Cal.
01255	Litton Industries, Inc.	Beverly Hills, Cal.	06980	Varian Assoc. Etmac Div.	San Carlos, Cal.
01281	TRW Semiconductors, Inc.	Lawndale, Cal.	07088	Kelvin Electric Co.	Van Nuys, Cal.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas	07126	Digitran Co.	Pasadena, Cal.
01349	The Alliance Mfg. Co.	Alliance, Ohio	07137	Transistor Electronics Corp.	Minneapolis, Minn.
01538	Small Parts Inc.	Los Angeles, Cal.	07138	Westinghouse Electric Corp., Electronic Tube Div.	Elmira, N.Y.
01589	Pacific Relays, Inc.	Van Nuys, Cal.	07149	Filmohm Corp.	New York, N.Y.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.	07233	Cinch-Graphik Co.	City of Industry, Cal.
01930	Amerock Corp.	Rockford, Ill	07256	Silicon Transistor Corp.	Carle Place, N.Y.
01960	Pulse Engineering Co.	Santa Clara, Cal.	07261	Avnet Corp.	Culver City, Cal.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.	07263	Fairchild Camera & Inst. Corp., Semiconductor Div.	Mountain View, Cal.
02116	Wheelock Signals, Inc.	Long Branch, N.J.	07322	Minnesota Rubber Co.	Minneapolis, Minn.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Cal.	07387	Birtcher Corp, The	Monterey Park, Cal.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.	07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Cal.
02735	Radio Corp. of America, Semiconductor and Materials Division	Somerville, N.J.	07700	Technical Wire Products Inc.	Cranford, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.	07829	Bodine Elect. Co.	Chicago, Ill.
02777	Hopkins Engineering Co.	San Fernando, Cal.	07910	Continental Device Corp.	Hawthorne, Cal.
02875	Hudson Tool & Die	Newark, N.J.	07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Cal.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.	07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N.J.
03705	Apex Machine & Tool Co.	Dayton, Ohio	08145	U.S. Engineering Co.	Los Angeles, Cal.
03797	Eldema Corp.	Compton, Calif.	08289	Blinn, Delbert Co.	Pomona, Cal.
03818	Parker Seal Co.	Los Angeles, Cal.	08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
03877	Transitron Electric Corp.	Wakefield, Mass.	08524	Deutsch Fastener Corp.	Los Angeles, Cal.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.	08664	Bristol Co., The	Waterbury, Conn.
03954	Singer Co., Diehl Div., FINDERNE Plant	Sumerville, N.J.	08717	Stolan Company	Sun Valley, Cal.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.	08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
04013	Tarus Corp.	Lambertville, N.J.	08727	National Radio Lab. Inc.	Paramus, N.J.
04062	Arco Electronic Inc.	Great Neck, N.Y.	08792	CBS Electronics Semiconductor Operations, Div. of CBS Inc.	Lowell, Mass.
04217	Essex Wire	Los Angeles, Cal.	08806	General Electric Co., Miniature Lamp Dept.	Cleveland, Ohio
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.	08984	Mel-Rain	Indianapolis, Ind.
04354	Precision Paper Tube Co.	Wheeling, Ill.	09026	Babcock Relays Div.	Costa Mesa, Cal.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Cal.	09134	Texas Capacitor Co.	Houston, Texas
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Cal.	09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Cal.
04673	Dakota Engr. Inc.	Culver City, Cal.	09250	Electro Assemblies, Inc.	Chicago, Ill.
04713	Motorola Inc, Semiconductor Prod. Div.	Phoenix, Arizona	09353	C & K Components Inc.	Newton, Mass.
04732	Filtron Co., Inc. Western Div.	Culver City, Cal.	09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
04773	Automatic Electric Co.	Northlake, Ill.	09922	Burdy Corp.	Norwalk, Conn.
04796	Sequoia Wire Co.	Redwood City, Cal.	10214	General Transistor Western Corp.	Los Angeles, Cal.
04811	Precision Coil Spring Co.	El Monte, Cal.			
04870	P. M. Motor Company	Westchester, Ill.			
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.			
05006	Twentieth Century Plastics, Inc.	Los Angeles, Cal.			
05277	Westinghouse Electric Corp. Semiconductor Dept.	Youngwood, Pa.			

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Code	Manufacturer	Address	Code	Manufacturer	Address
10411	Ti-Tal, Inc.	Berkeley, Cal.	19589	Concoa	Baldwin Park, Cal.
10646	Carbondum Co.	Niagara Falls, N.Y.	19644	LRC Electronics	Horsheds, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.	19701	Electra Mfg. Co.	Independence, Kansas
11237	Chicago Telephone of California, Inc.		20183	General Atomics Corp.	Philadelphia, Pa.
11242	Bay State Electronics Corp.	So. Pasadena, Cal.	21226	Excutoon, Inc.	Long Island City, N.Y.
11312	Teleyne Inc., Microwave Div.	Waltham, Mass.	21355	Farnir Bearing Co., The	New Britain, Conn.
11314	National Seal	Palo Alto, Cal.	23042	Texscan Corp.	Chicago, Ill.
11343	Precision Connector Corp.	Dorney, Cal.	23783	British Radio Electronics Ltd.	Indianapolis, Ind.
11534	Duncan Electronics Inc.	Costa Mesa, Cal.	24455	G.E. Lamp Division	Washington, D.C.
11711	General Instrument Corp., Semiconductor Division, Prod-		24655	General Radio Co.	West Concord, Mass.
11717	Imperial Electronic, Inc.	Buena Park, Cal.	26365	Gries Reproducer Corp.	Huntington, Ind.
11870	Melabs, Inc.	Newark, N.J.	26681	Memcor Inc., Comp. Div.	West Concord, Mass.
12136	Philadelphia Handle Co.	Camden, N.J.	26851	Compact/Holster Co.	West Concord, Mass.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.	26992	Hamilton Watch Co.	Lancaster, Pa.
12574	Gulton Ind. Inc., Data System Div.	Albuquerque, N.M.	28480	Hewlett-Packard Co.	Lancaster, Pa.
12674	Claroast Mfg. Co.	Dover, N.H.	28520	Hewlett-Packard Co.	Palo Alto, Cal.
12728	Eimat Filter Corp.	W. Haven, Conn.	30817	Instrument Specialties Co., Inc.	Little Falls, N.J.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan	33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
12881	Metex Electronics Corp.	Clark, N.J.	35434	Lectrohm Inc.	Chicago, Ill.
12930	Delta Semiconductor Inc.	Newport Beach, Cal.	36196	Stanwyck Coil Products, Ltd.	Chicago, Ill.
12954	Dickson Electronics Corp.	Scottsdale, Arizona	36287	Cunningham, W.H. & Hill, Ltd.	Hawkesbury, Ontario, Canada
13019	Alco Supply Co., Inc.	Wichita, Kansas			
13103	Thermoloy	Dallas, Texas			
13966	Telefunken (GmbH)	Hanover, Germany			
13835	Midland-Wright Div. of Pacific Industries, Inc.				
14099	Sem-Tech	Kansas City, Kansas			
14193	Calif. Resistor Corp.	Santa Monica, Cal.			
14298	American Components, Inc.	Conshohocken, Pa.			
14433	ITT Semiconductor, A Div. of Int. Telephone &				
14493	Hewlett-Packard Company	West Palm Beach, Fla.			
14655	Cornell Dublier Electric Corp.	Corning, N.Y.			
14674	Corning Glass Works	Corning, N.Y.			
14752	Electro Cube Inc.	San Gabriel, Cal.			
14960	Williams Mfg. Co.	San Jose, Cal.			
15106	The Sphere Co., Inc.	Little Falls, N.J.			
15203	Webster Electronics Co.	New York, N.Y.			
15287	Scientific Corp.	New York, N.Y.			
15291	Adjustable Bushing Co.	N. Hollywood, Cal.			
15358	Micron Electronics	Garden City, Long Island, N.Y.			
15566	Amprobe Inst. Corp.	Lyndbrook, N.Y.			
15631	Cabletronics	Costa Mesa, Cal.			
15772	Twentieth Century Coil Spring Co.	Santa Clara, Cal.			
15801	Fenwal Elect. Inc.	Framingham, Mass.			
15818	Amelco Inc.	Mountain View, Cal.			
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.			
16179	Omni-Spectra Inc.	Detroit, Ill.			
16352	Computer Diode Corp.	Lodi, N.J.			
16585	Boots Aircraft Nut Corp.	Pasadena, Cal.			
16688	Ideal Prec. Meter Co., Inc., De Jur Meter Div.				
16758	Delco Radio Div. of G.M. Corp.	Brooklyn, N.Y.			
17109	Thermometrics Inc.	Canaan Park, Cal.			
17474	Tranex Company	Mountain View, Cal.			
17675	Hamlin Metal Products Corp.	Akron, Ohio			
17745	Angstrom Prec. Inc.	No. Hollywood, Cal.			
17856	Siliconix Inc.	Sunnyvale, Cal.			
17870	McGraw-Edison Co.	Palo Alto, Cal.			
18042	Power Design Pacific Inc.	Palo Alto, Cal.			
18083	Signetics Corp., Semiconductor Div.	Palo Alto, Cal.			
18324	Signetics Corp.	Sunnyvale, Cal.			
18476	TY-Car Mfg. Co., Inc.	Holliston, Mass.			
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.			
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.			
18612	Vishay Instruments Inc.	Malvern, Pa.			
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.			
18911	Durant Mfg. Co.	Millwaukee, Wis.			
19315	The Bendix Corp., Navigation & Control Div.				
19500	Thomas A. Edison Industries, Div. of McGraw-Edison	West Orange, N.J.			

Table 3-5. Code List of Manufacturers (cont'd)

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
71436	Chicago Condenser Corp.	Chicago, Ill.	77764	Resistance Products Co.	Harrisburg, Pa.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Cal.	77969	Rubbercraft Corp. of Calif.	Torrance, Cal.
71450	CTS Corp.	Elkhart, Ind.	78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
71468	ITT Cannon Electric Inc.	Los Angeles, Cal.	78277	Sigma	So. Braintree, Mass.
71471	Cinema, Div. Aerovox Corp.	Burbank, Cal.	78283	Signal Indicator Corp.	New York, N.Y.
71482	C.P. Clare & Co.	Chicago, Ill.	78290	Struthers-Dunn Inc.	Pitman, N.J.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.	78452	Thompson-Bremer & Co.	Chicago, Ill.
71616	Commercial Plastics Co.	Chicago, Ill.	78471	Tilley Mfg. Co.	San Francisco, Cal.
71700	Cornish Wire Co., The	New York, N.Y.	78488	Stackpole Carbon Co.	St. Marys, Pa.
71707	Coto Coil Co., Inc.	Providence, R.I.	78493	Standard Thomson Corp.	Waltham, Mass.
71744	Chicago Miniature Lamp Works	Chicago, Ill.	78553	Tinnerman Products, Inc.	Cleveland, Ohio
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.	78790	Transformer Engineers	San Gabriel, Cal.
71984	Dow Corning Corp.	Midland, Mich.	78947	Ucinite Co.	Newtonville, Mass.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.	79136	Waldes Kohinor Inc.	Long Island City, N.Y.
72619	Dialight Corp.	Brooklyn, N.Y.	79142	Veeder Root, Inc.	Hartford, Conn.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.	79251	Wenco Mfg. Co.	Chicago, Ill.
72699	General Instrument Corp., Cap. Div.	Newark, N.J.	79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
72765	Drake Mfg. Co.	Harwood Heights, Ill.	79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.	80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
72928	Gudeman Co.	Chicago, Ill.	80033	Prestole Corp.	Toledo, Ohio
72962	Elastic Stop Nut Corp.	Union, N.J.	80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
72964	Robert M. Hadley Co.	Los Angeles, Cal.	80131	Electronic Industries Association, Any Brand Tube meeting EIA Standards-Washington, D.C.	
72982	Erie Technological Products, Inc.	Erie, Pa.	80207	Unimax Switch, Div. Maxon Electronics Corp.	
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.			Wallingford, Conn.
73076	H.M. Harper Co.	Chicago, Ill.	80223	United Transformer Corp.	New York, N.Y.
73138	Helipot Div. of Beckman Inst. Inc.	Fullerton, Cal.	80248	Oxford Electric Corp.	Chicago, Ill.
73293	Hughes Products Division of Hughes Aircraft Co.		80294	Bourns Inc.	Riverside, Cal.
		Newport Beach, Cal.	80411	Arco Div. of Robertshaw Controls Co.	Columbus, Ohio
73445	Amperex Elect. Co.	Hicksville, L.I., N.Y.	80486	All Star Products Inc.	Defiance, Ohio
73506	Bradley Semiconductor Corp.	New Haven, Conn.	80509	Avery Label Co.	Monrovia, Cal.
73559	Carling Electric, Inc.	Hartford, Conn.	80583	Hammarlund Co., Inc.	Mars Hill, N.C.
73586	Circle F Mfg. Co.	Trenton, N.J.	80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
73682	George K. Garrett Co., Div. MSL Industries Inc.		80813	Dimco Gray Co.	Dayton, Ohio
		Philadelphia, Pa.	81030	International Instruments Inc.	Orange, Conn.
73734	Federal Screw Products Inc.	Chicago, Ill.	81073	Grayhill Co.	LaGrange, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio	81095	Triad Transformer Corp.	Venice, Cal.
73793	General Industries Co., The	Elyria, Ohio	81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
73846	Goshen Stamping & Tool Co.	Goshen, Ind.	81349	Military Specification	
73899	JFD Electronics Corp.	Brooklyn, N.Y.	81483	International Rectifier Corp.	El Sugundo, Cal.
73905	Jennings Radio Mfg. Corp.	San Jose, Cal.	81541	Airpax Electronics, Inc.	Cambridge, Maryland
73957	Groove-Pin Corp.	Ridgefield, N.J.	81860	Barry Controls, Div. Barry Wright Corp.	
74276	Signalite Inc.	Neptune, N.J.			Watertown, Mass.
74455	J.H. Winns, and Sons	Winchester, Mass.	82042	Carter Precision Electric Co.	Skokie, Ill.
74861	Industrial Condenser Corp.	Chicago, Ill.	82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.			Hoboken, N.J.
74970	E.F. Johnson Co.	Waseca, Minn.	82116	Electric Regulator Corp.	Norwalk, Conn.
75042	International Resistance Co.	Philadelphia, Pa.	82142	Jefferis Electronics Division of Speer Carbon Co.	
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.			Du Bois, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.	82170	Fairchild Camera & Inst. Corp., Space & Defense Systems Div.	Paramus, N.J.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.	82209	Magurie Industries, Inc.	Greenwich, Conn.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.	82219	Sylvania Electric Prod. Inc., Electronic Tube Division	
75915	Littlefuse, Inc.	Des Plaines, Ill.			Emporium, Pa.
76005	Lord Mfg. Co.	Erie, Pa.	82376	Astron Corp.	East Newark, Harrison, N.J.
76210	C.W. Marwedel	San Francisco, Cal.	82389	Switchcraft, Inc.	Chicago, Ill.
76433	General Instrument Corp., Micamold Division		82647	Metals & Controls Inc., Spencer Products	
		Newark, N.J.			Attleboro, Mass.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.	82768	Phillips-Advance Control Co.	Joliet, Ill.
76493	J.W. Miller Co.	Los Angeles, Cal.	82866	Research Products Corp.	Madison, Wis.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.		82877	Roltron Mfg. Co., Inc.	Woodstock, N.Y.
		San Leandro, Cal.	82893	Vector Electronic Co.	Glendale, Cal.
76545	Mueller Electric Co.	Cleveland, Ohio	83058	Carr Fastener Co.	Cambridge, Mass.
76703	National Union	Newark, N.J.	83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.	83125	General Instrument Corp., Capacitor Div.	
77068	The Bendix Corp., Electrodynamics Div.				Darlington, S.C.
		N. Hollywood, Cal.	83148	ITT Wire and Cable Div.	Los Angeles, Cal.
77075	Pacific Metals Co.	San Francisco, Cal.	83186	Victory Eng. Corp.	Springfield, N.J.
77221	Phanostran Instrument and Electronic Co.		83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
		So. Pasadena, Cal.	83315	Hubbell Corp.	Mundelein, Ill.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.	83324	Rosan Inc.	Newport Beach, Cal.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.	83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
77630	TRW Electronic Components Div.	Camden, N.J.	83332	Tech Labs	Palisades Park, N.J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.	83385	Central Screw Co.	Chicago, Ill.

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Code	Manufacturer	Address	Code	Manufacturer	Address
83501	Gavit Wire and Cable Co., Div. of Amerace Corp.	Brookfield, Mass.	94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.	94148	Scientific Electronics Products, Inc.	Loveland, Colo.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.	94154	Wagner Elec. Corp., Tung-Sol Div.	Newark, N.J.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.	94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
83821	Loyd Scruggs Co.	Festus, Mo.	94222	South Chester Corp.	Chester, Pa.
83942	Aeronautical Inst. & Radio Co.	Lord, N.J.	94330	Wire Cloth Products, Inc.	Bellwood, Ill.
84171	Arco Electronics, Inc.	Great Neck, N.Y.	94375	Automatic Metal Products Co.	Brooklyn, N.Y.
84396	A.J. Gleesner Co., Inc.	San Francisco, Cal.	94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
84411	TRW Capacitor Div.	Gallah, Neb.	94696	Magnetcraft Electric Co.	Chicago, Ill.
84470	Sarkes Tarzian, Inc.	Bloomington, Ind.	95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
84544	Boonton Molding Company	Boonton, N.J.	95236	Allies Products Corp.	Dania, Fla.
85471	R.B. Boyd Co.	San Francisco, Cal.	95238	Continental Connector Corp.	Woodside, N.Y.
85474	R.M. Brecaomonte & Co.	San Francisco, Cal.	95263	Teccraft Mfg. Co., Inc.	Long Island, N.Y.
85660	Rollad Kords, Inc.	Hamden, Conn.	95265	National Coil Co.	Sheridan, Wyo.
85911	Seamless Rubber Corp.	Chicago, Ill.	95275	Vitramon, Inc.	Bridgeport, Conn.
86174	Fahrer Bearing Co.	Los Angeles, Calif.	95348	Gordos Corp.	Bloomfield, N.J.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.	95354	Method Mfg. Co.	Rolling Meadows, Ill.
86579	Precision Rubber Products Corp.	Dayton, Ohio	95566	Arnold Engineering Co.	Marengo, Ill.
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.	95987	Stemon Mfg. Co.	Wayne, Ill.
86928	Seastrom Mfg. Co.	Gendale, Cal.	95984	Stemon Mfg. Co.	Wayne, Ill.
87034	Marco Industries	Anaheim, Cal.	96067	Microwave Assoc., West Inc.	Chicago, Ill.
87216	Phico Corporation (Lansdale Division)	Lansdale, Pa.	96095	H-Q Div. of Aerovox Corp.	Olean, N.Y.
87473	Western Fibrous Glass Products Co.	San Francisco, Cal.	96256	Thorndarson-Meissner Inc.	Mt. Carmel, Ill.
87664	Van Waters & Rogers Inc.	San Francisco, Cal.	96296	Solar Manufacturing Co.	Los Angeles, Cal.
88140	Tower Mfg. Corp.	Providence, R.I.	96330	Microwitch, Div. of Minn.-Honeywell	Peepore, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.	96336	Carton Screw Co.	Chicago, Ill.
88298	General Electric Co.	Bartlett, N.Y.	96341	Microwave Associates, Inc.	Burlington, Mass.
88698	Graybar Electric Co.	Oakland, Cal.	96508	Excel Transformer Co.	Oakland, Cal.
89231	G.E. Distributing Corp.	Schenectady, N.Y.	96501	Excel Transformer Co.	Oakland, Cal.
89473	G.E. Distributing Corp.	Schenectady, N.Y.	96508	Excel Transformer Co.	Oakland, Cal.
89665	United Shoe Machinery Corp.	Beverly, Mass.	96733	San Fernando Elect. Mfg. Co.	San Fernando, Cal.
90030	United Transformer Co.	Chicago, Ill.	96781	Thomson Ind. Inc.	Long Island, N.Y.
90179	U S Rubber Co., Consumer Prod. Div.	Passaic, N.J.	96881	Industrial Retaining Ring Co.	Irvington, N.J.
90763	United Carr Fastener Corp.	Chicago, Ill.	97464	Automatic & Precision Mfg.	Englewood, N.J.
90970	Bearing Engineering Co.	San Francisco, Cal.	97539	Reon Resistor Corp.	Yonkers, N.Y.
91146	ITT Cannon Elect. Inc., Salem Div.	Salem, Mass.	97979	Liton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
91260	Connor Spring Mfg. Co.	San Francisco, Cal.	98159	Rubber Tech, Inc.	Gardena, Cal.
91345	Miller Dial & Namplate Co.	El Monte, Cal.	98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Cal.
91418	Radio Materials Co.	Chicago, Ill.	98278	Microdot, Inc.	Pasadena, Cal.
91506	Augat Inc.	Attleboro, Mass.	98291	Sealcraft Corp.	Mamamontch, N.Y.
91637	Date Electronics, Inc.	Columbus, Nebr.	98378	Zero Mfg. Co.	Burbank, Cal.
91662	Eico Corp.	Willow Grove, Pa.	98410	Ezo Inc.	Cleveland, Ohio
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.	98731	General Mills Ins., Electronics Div.	Minneapolis, Minn.
91827	K F Development Co.	Redwood City, Cal.	98734	Pasco Div. of Hewlett-Packard Co.	Palo Alto, Cal.
91866	Malco Mfg. Co., Inc.	Chicago, Ill.	98821	North Hills Electronics, Inc.	Glendale, N.Y.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.	98978	International Electronic Research Corp.	Burbank, Cal.
91961	Nahn-Bros., Spring Co.	Oakland, Cal.	99109	Columbia Technical Corp.	New York, N.Y.
92180	Tru-Connector Corp.	Paabody, Mass.	99313	Varian Associates	Palo Alto, Cal.
92267	Fluget Optical Co., Inc.	Rochester, N.Y.	99378	Alice Corp.	Winchester, Mass.
92670	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.	99515	Marshall Ind., Capacitor Div.	Monrovia, Cal.
92702	IMC Magnetics Corp.	Westbury, Long Island, N.Y.	99707	Control Switch Division, Controls Co. of America	El Segundo, Cal.
92966	Hudson Lamp Co.	Keamney, N.J.	99800	Delecan Electronics Corp.	East Aurora, N.Y.
93332	Sylvania Electric Prod. Inc., Semiconductor Div.	Woburn, Mass.	99848	Wico Corporation	Indianapolis, Ind.
93360	Robbins & Myers Inc.	Palisades Park, N.J.	99928	Branson Corp.	Whippany, N.J.
93410	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio	99934	Hoffman Electronics Corp., Semiconductor Div.	Boston, Mass.
93632	Waters Mfg. Co.	Culver City, Cal.	99942	Technology Instrument Corp. of Calif.	El Monte, Cal.
93929	G.V. Controls	Livingston, N.J.	99957	Technology Instrument Corp. of Calif.	Newbury Park, Cal.
94137	General Cable Corp.	Bayonne, N.J.			
0000F	Malco Tool and Die	Los Angeles, Calif.	000MM	Rubber Eng. & Development	Hayward, Cal.
0000Z	Willow Leather Products Corp.	Newark, N.J.	000NN	A. N. D. Mfg. Co.	San Jose, Cal.
000AB	Precision Instrument Components Co.	England	000OQ	Cooltron	Oakland, Cal.
000BS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado	000WV	California Eastern Lab	Burlington, Cal.
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado	000XY	S.K. Smith Co.	Los Angeles, Cal.

SECTION IV

SCHEMATIC DIAGRAMS

4-1. INTRODUCTION

4-2. Schematic presentations in this manual show electrical circuit operation and are not intended to serve as wiring diagrams. Figure 4-1 lists notes which apply to the schematic diagrams.

4-3. 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. Reference designations within assemblies are abbreviated. The full designation includes the assembly on which the component is mounted, and the individual component designa-

tion. For example, Resistor R1 mounted on Assembly A1 has the complete reference designation of A1R1. Certain parts are not included on assemblies, and are classified as chassis parts. Chassis parts are assigned only the reference designation shown on the schematic diagram.

4-4. An asterisk indicates a factory selected part; the component value shown is the typical or most commonly selected value.

4-5. Component procurement information and specific component descriptions are included in Section III. Refer to page 3-1 for information on how to order parts.

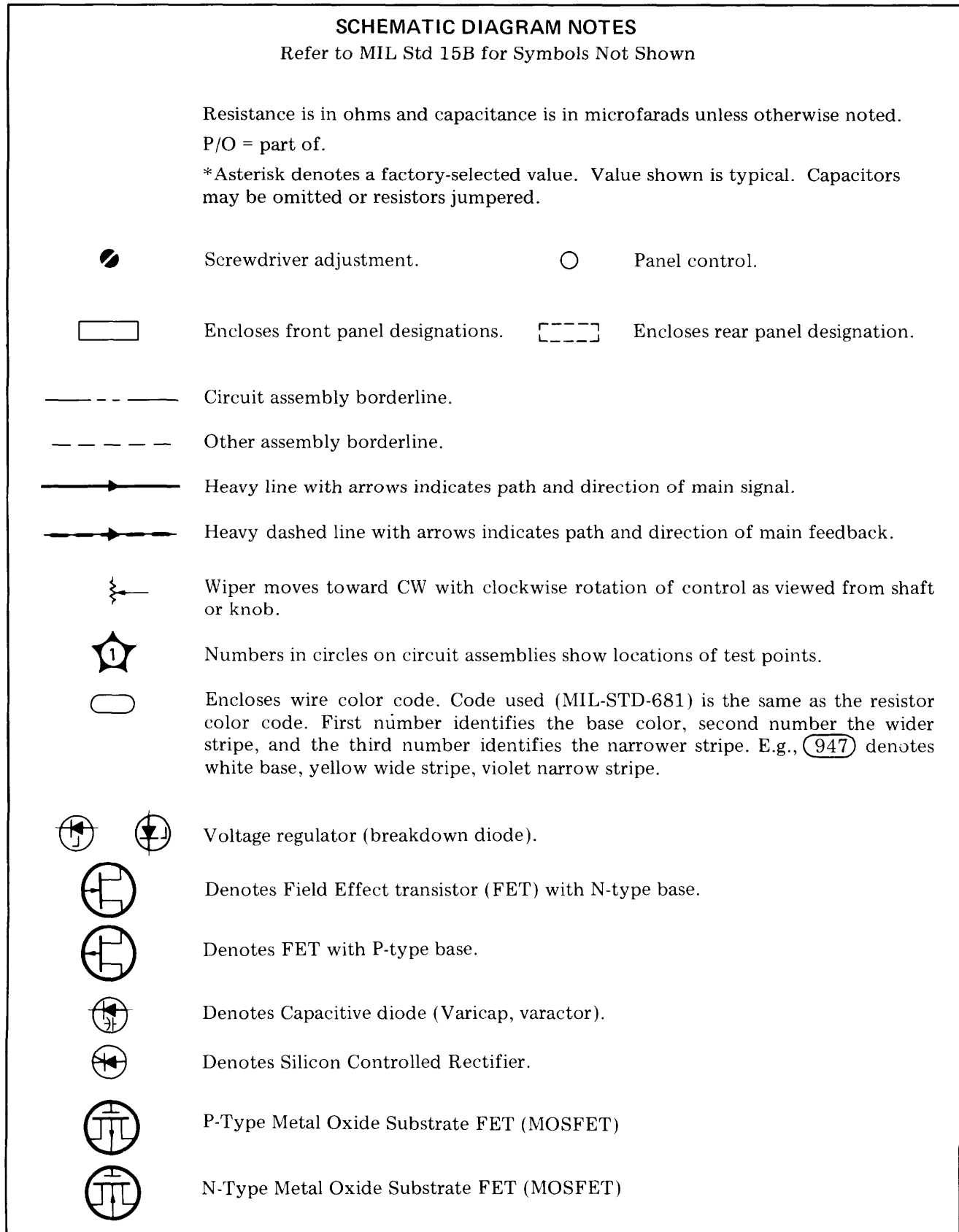
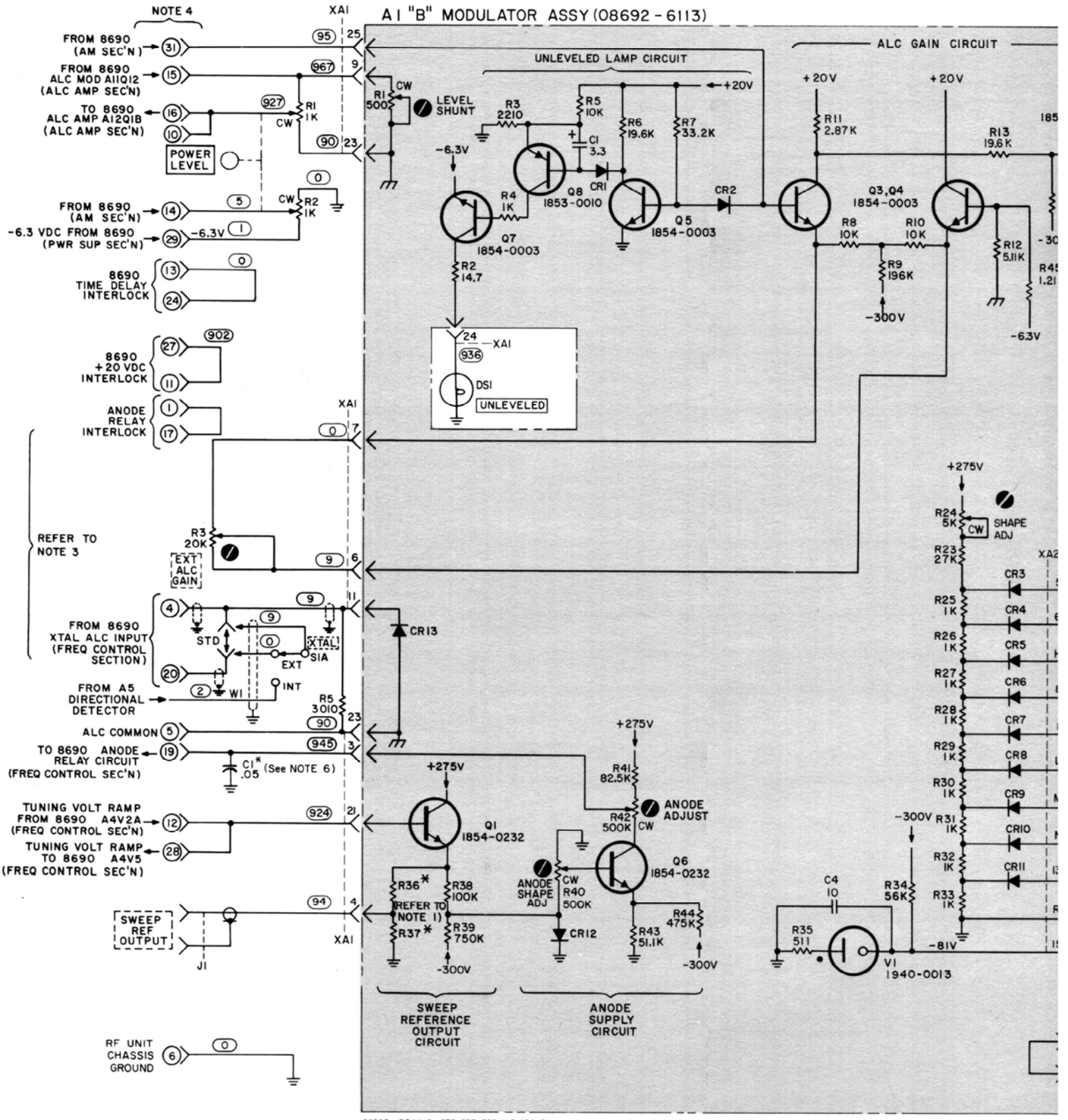
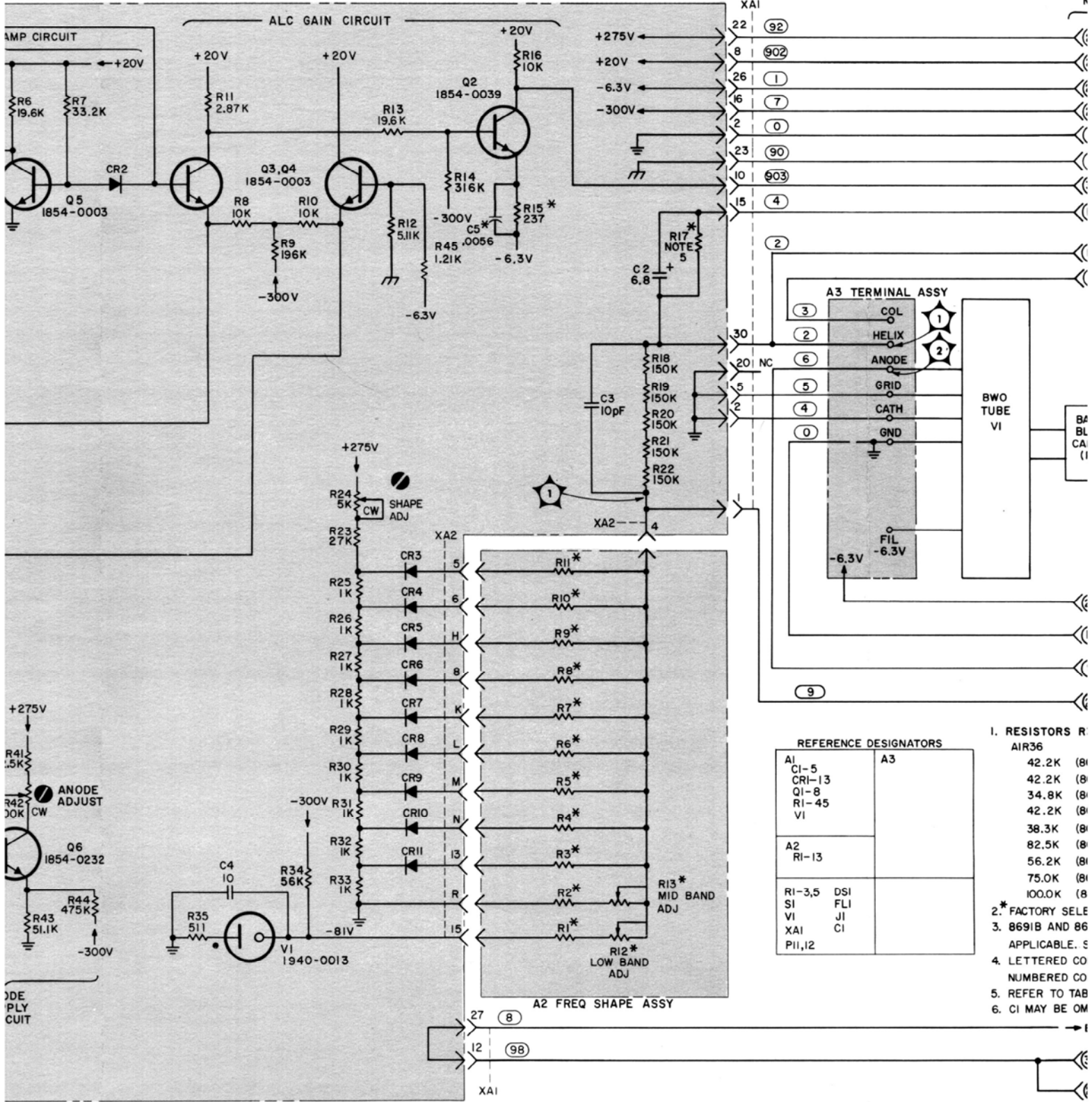


Figure 4-1. Schematic Diagram Notes



8692B - RF UNIT - SER PRE 728 AND ABOVE



REFERENCE DESIGNATORS

A1	DS1	A3
CI-5	FLI	
CR1-13	J1	
Q1-8	CI	
R1-45		
VI		
A2		
R1-13		
R1-3,5		
SI		
VI		
XA1		
PI1,12		

- I. RESISTORS R**
- AIR36
- 42.2K (8)
 - 42.2K (8)
 - 34.8K (8)
 - 42.2K (8)
 - 38.3K (8)
 - 82.5K (8)
 - 56.2K (8)
 - 75.0K (8)
 - 100.0K (8)
- 2.* FACTORY SELE
 3. 8691B AND 86
 APPLICABLE. S
 4. LETTERED CO
 NUMBERED CO
 5. REFER TO TAB
 6. CI MAY BE OM

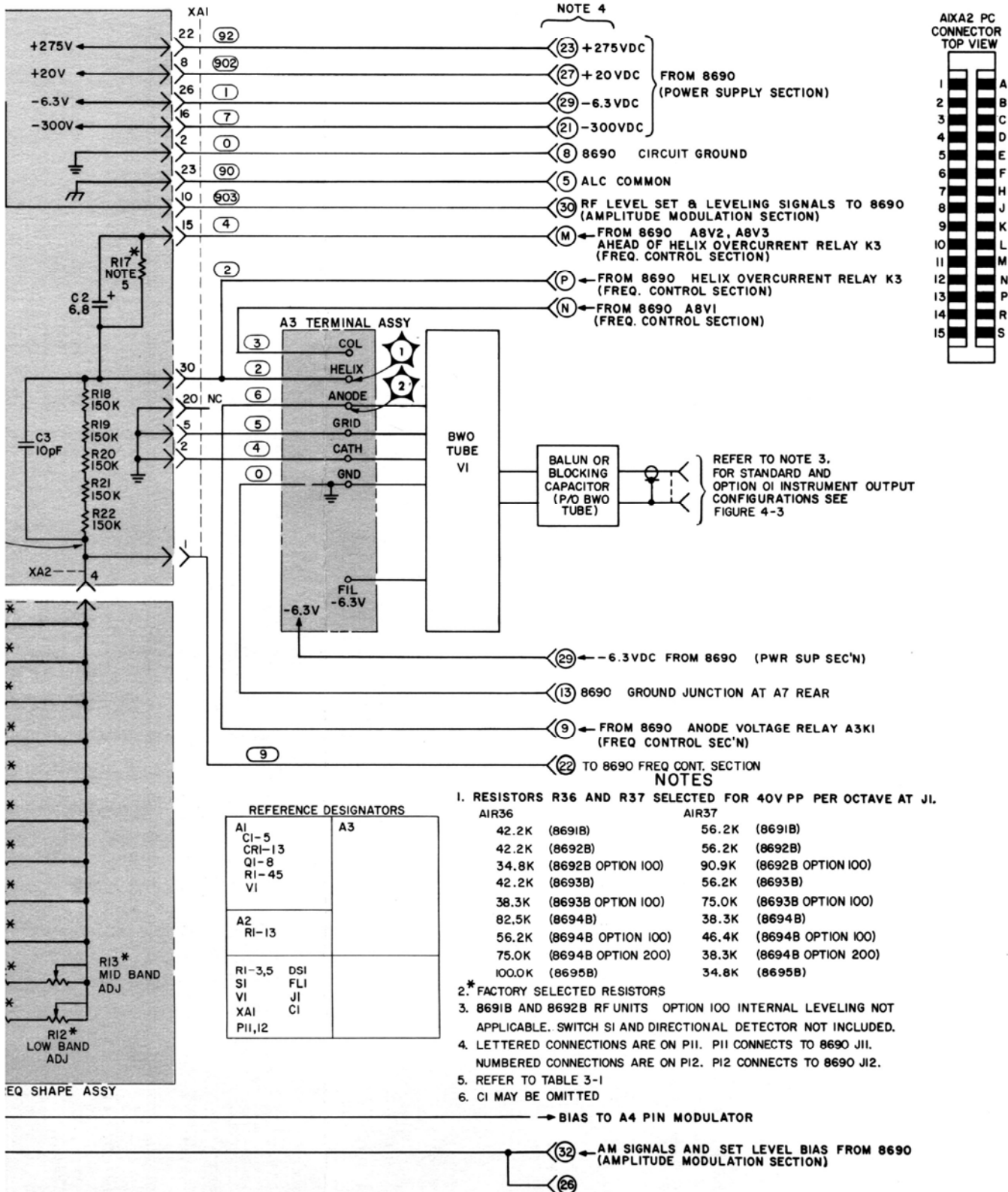
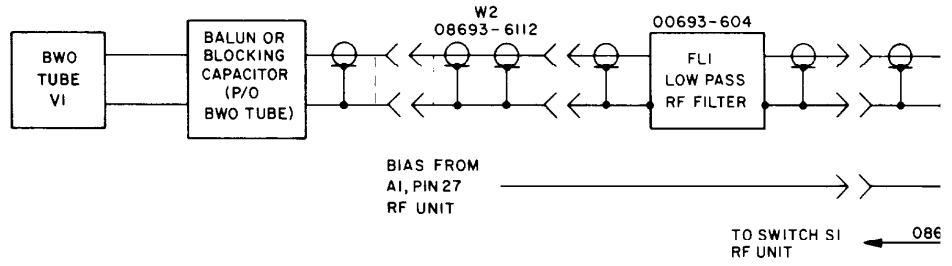
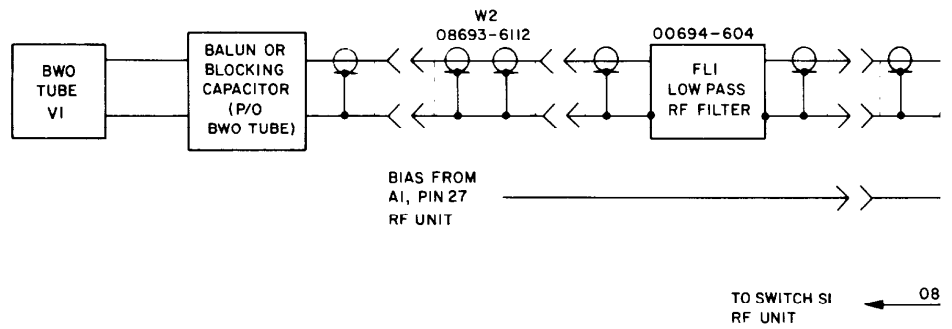


Figure 4-2. RF Unit for Serial Prefix 728 and Above

OPTION 001
 MODELS: 8693B
 8693B OPT.100



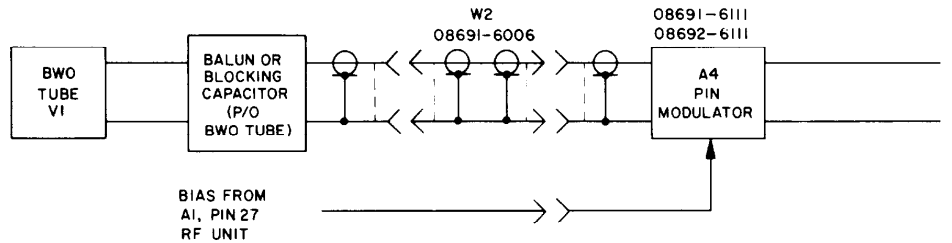
OPTION 001
 MODELS: 8694B
 8694B OPT. 100
 8694B OPT. 200



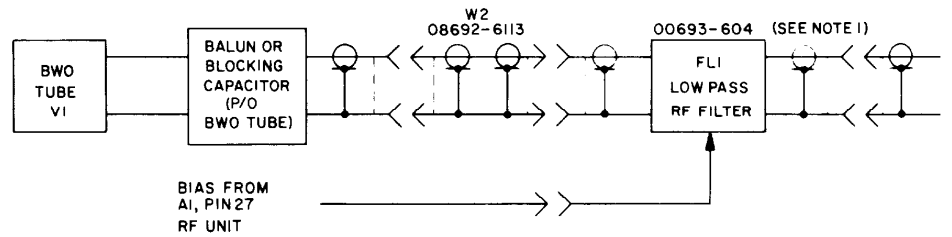
STANDARD
 MODELS: 8695B



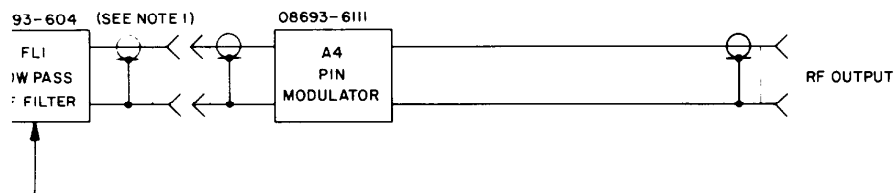
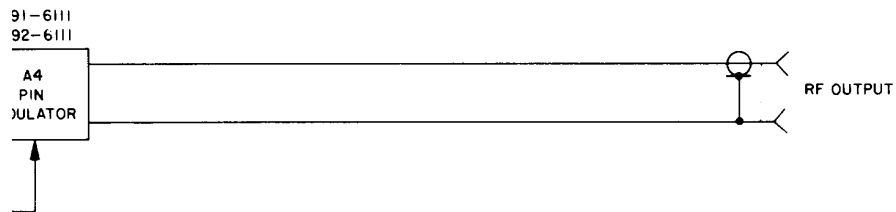
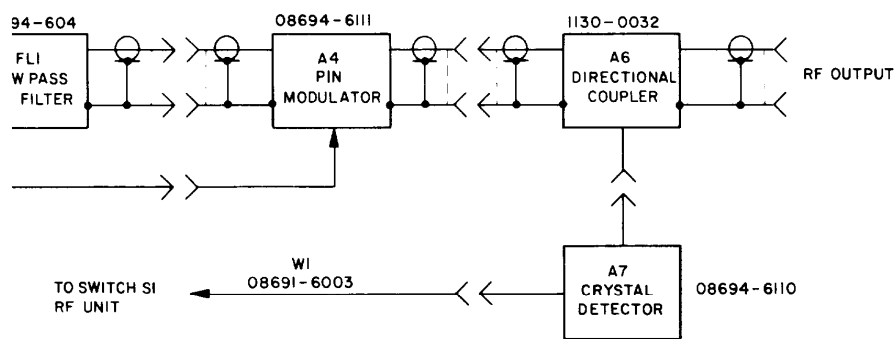
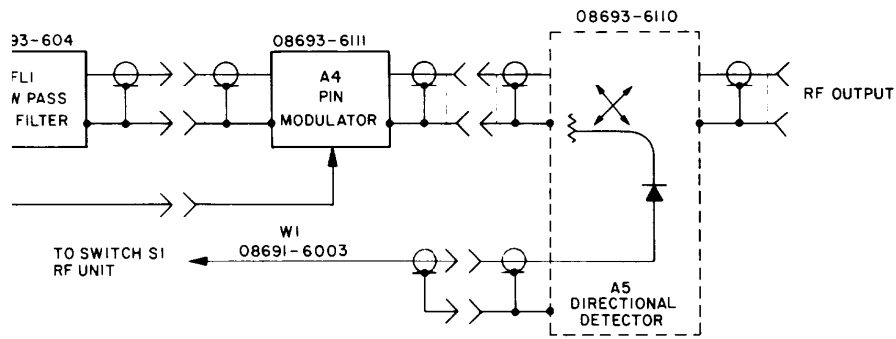
STANDARD
 MODELS: 8691B
 8692B
 8692B OPT. 100



STANDARD
 MODELS: 8693B
 8694B
 8693B OPT. 100
 8694B OPT. 100
 8694B OPT. 200



NOTI
1. LC
IS



NOTE:
 1. LOW PASS FILTER HP PART NO. 00694-604 IS USED WITH 8694B RF UNITS.

Figure 4-3. Output Configurations

APPENDIX I**MANUAL CHANGES**

MODEL 8691B–8695B

RF UNITS

To adapt this manual to instruments with Serial Numbers listed in the table below, make the indicated changes.

Information for adapting this manual to instruments with Serial Numbers not listed in the table below may be included in a yellow MANUAL CHANGES insert supplied with the manual. Information about Serial Numbers not covered in any of these ways can be obtained from the nearest Hewlett-Packard office.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES	SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
620-	F, E, D, C, B, A	728-	K, J, I, H, G
636-	F, E, D, C	822	K, J, I, H
715-	F, E, D	835	K, J, I
720-	F, E	838	K, J
724-	F	916-	K
		967-	L

CHANGE A: A2R12 on Freq Shape Assy A2 is adjusted for proper calibration when RF Unit serials prefixed 620 are used with 8690A serials prefixed 615.

If an RF Unit, serials prefixed 620, is used with an 8690A Sweep Oscillator, 636 or above, approximately -1% calibration error will occur. In this case, perform Adjustments 4, HELIX VOLTAGE SHAPING and 5, FREQUENCY ACCURACY, Table 2-3.

Page 4-3/4-4; Figure 4-2:

Substitute Appendix I schematic for Figure 4-2.

Add: 3.01K resistor (R5) between XA1 Pin 23 and XA1 Pin 11.

CHANGE B: A2R12 on Freq Shape Assy A2 is adjusted for proper calibration when RF unit serials prefixed 636 are used with 8690A serials prefixed 636.

If an RF Unit, serials prefixed 636, is used with an 8690A/B Sweep Oscillator, serials prefixed 615, approximately +1% calibration error will occur. In this case, perform Adjustments 4, HELIX VOLTAGE SHAPING and 5, FREQUENCY ACCURACY, Table 2-3.

- CHANGE B: Page 3-3, Table 3-3:
(cont'd) Change: A1R7 to HP Part No. 0757-0458 R: FXD MET FLM 51.1K OHM 1% 1/8W
- Page 3-4, Table 3-3:
Delete: asterisk in Note column of A1R36.
Change: A1Q1 and A1Q6 to HP Part No. 1854-0079.
- Page 3-8, Table 3-3:
For RF Units serial prefixed 636-00135 and below:
Change chassis mounted R3 to HP Part No. 2100-0060 (no description change).
- Page 3-11, Table 3-4:
Delete HP Part No. 0756-0454.
Add HP Part No. 0757-0458 R: FXD MET FLM 51.1K OHM 1% 1/8W; 28480, TQ 1.
Delete HP Part No. 1854-0232.
Add HP Part No. 1854-0079 TRANSISTOR: SILICON NPN; 28480, TQ 1.
- Page 3-12, Table 3-4:
Change HP Part No. 2100-0051 to HP Part No. 2100-0060 (no description change).
- Page 4-3/4-4,, Figure 4-2:
Substitute Appendix I schematic for Figure 4-2.
Change: A1R7 to 51.1K ohms.
Change: A1Q1 and A1Q6 HP Part No. to 1854-0079.
Delete: asterisk next to A1R36.
- CHANGE C: No change. Affects 8691A through 8697A RF Units only.
Page 4-3/4-4, Figure 4-2:
Substitute Appendix I schematic for Figure 4-2.
- CHANGE D: (Affects Option 001 Models only).
Page 4-3/4-4, Figure 4-2:
Substitute Appendix I schematic for Figure 4-2.
Add factory selected resistor R4 (which may be a straight through connection) between the wiper of R3 and INT position of chassis mounted switch S1B (Refer to Appendix I schematic).
- CHANGE E: Page 1-2/1-3, Table 1-1:
For the following models, change the "Frequency Accuracy" Specification to read:
- | | |
|------------------|----------|
| 8692B | ± 10 MHz |
| 8692B Option 100 | ± 13 MHz |
| 8693B | ± 20 MHz |
| 8693B Option 100 | ± 25 MHz |
| 8694B | ± 30 MHz |
| 8694B Option 100 | ± 40 MHz |
| 8694B Option 200 | ± 30 MHz |
- For the following models, change the "Residual FM" Specifications for CW operation in START-STOP, ΔF, and MARKER SWEEP functions to read:
- | | |
|------------------|-------------|
| 8691B | 30 kHz peak |
| 8692B | 30 kHz peak |
| 8692B Option 100 | 30 kHz peak |
| 8693B | 50 kHz peak |
| 8693B Option 100 | 50 kHz peak |
| 8694B | 50 kHz peak |
| 8694B Option 100 | 50 kHz peak |
| 8694B Option 200 | 50 kHz peak |
- Page 4-3/4-4, Figure 4-2:
Substitute Appendix I schematic for Figure 4-2.
Delete the following jumper connections:
from P12 pin 16 to P12 pin 10

CHANGE E: Page 4-3/4-4 , Figure 4-2:
 (cont'd) Delete the following jumper connections: (cont'd)
 from P12 pin 32 to P12 pin 26

Change the chassis ground from P12 pin 6 to P12 pin 8.

NOTE

To use RF Units serial prefixed 724- and above with 8690A Sweep Oscillators serial number 641-00260 and below (including serial prefixes 636- and 615-) it is necessary to disconnect two wires which are connected to pins 26 and 10 of J12 in the 8690A. Removing these wires ensures compatability and does not affect instrument calibration.

The WHITE-YELLOW-GREEN (color 945) wire going to pin 26 of J12 is connected to a push-on connector on the top side of the Interconnection Assembly A7. This wire connects to pin 20 of XA4 through a conductor on Assy A7. Disconnect this wire (color 945) from Assy A7; then cut it off where it enters the cable harness. Tape the cut end to the harness.

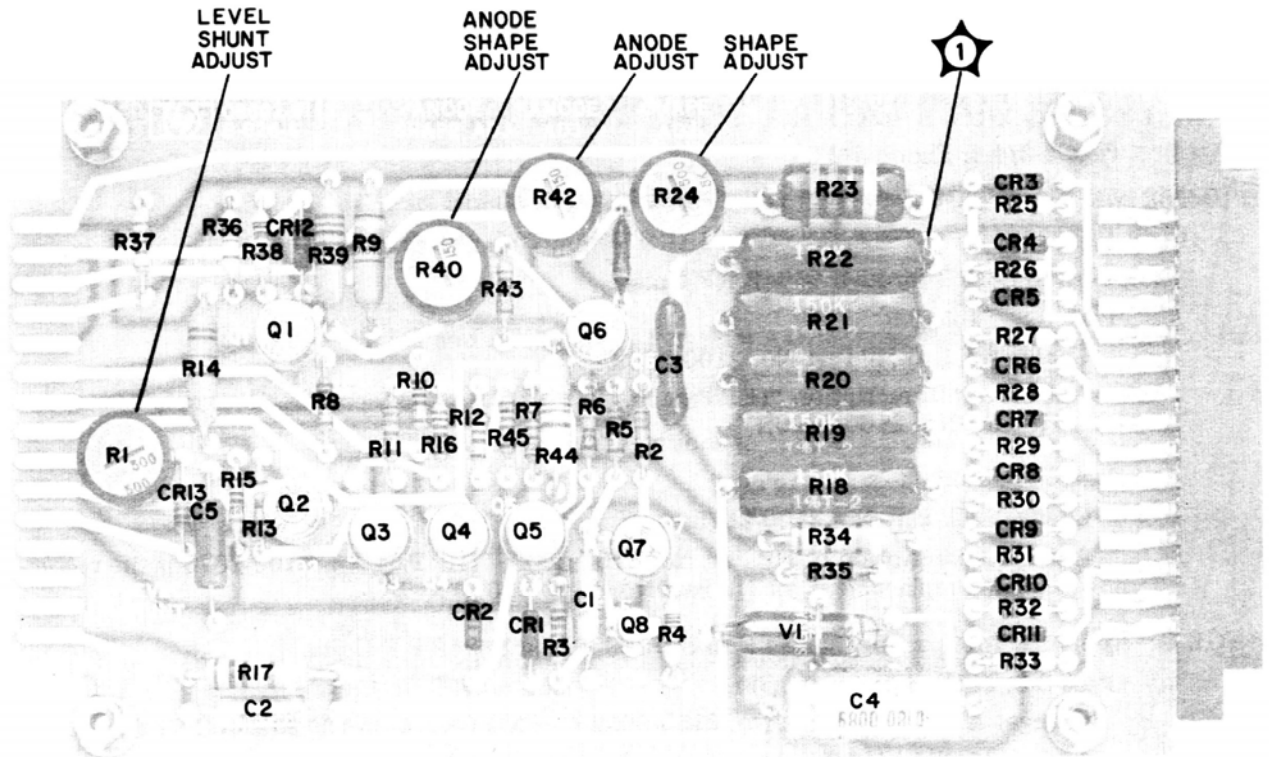
The WHITE-BROWN-YELLOW (color 914) wire going to pin 10 of J12 can best be disconnected by removing the RF Unit and locating the wire in the cable harness just below J12. Pull out this wire (color 914) far enough so that it can be easily reached and cut out about a one inch section between adjacent turns of the cable harness. Tape the cut ends to the harness.

CHANGE F: The first part of Change F applies only to the 8691B and 8692B RF Units. The second part applies to the 8691B through 8694B RF Units.

(8691B and 8692B RF Units Only)

Page 2-10, Figure 2-6:

Substitute the following photograph for Figure 2-6 in Manual.



CHANGE F: Page 3-3, Table 3-3:
(cont'd)

Change: A1 Assembly to HP Part No. 08691-6101.

Add: To A1 Assembly description "(HP Part No. 08692-6113 is the recommended replacement for HP Part No. 08691-6101.)"

Delete: A1C5.

Delete: A1CR14.

Change: Following components to read as follows:

A1R9	0757-0860	R: FXD MET FLM 121K OHM 1% 1/2W
A1R11	0757-0442	R: FXD MET FLM 10K OHM 1% 1/8W
A1R12	0757-0280	R: FXD MET FLM 1K OHM 1% 1/8W
A1R13	0757-0430	R: FXD MET FLM 2.21K OHM 1% 1/8W
A1R14	0757-0280	R: FXD MET FLM 1K OHM 1% 1/8W
A1R15	0698-3160	R: FXD MET FLM 46.4 OHM 1% 1/8W
A1R16	0771-0007	R: FXD MET FLM 30K OHM 10% 4W

Page 3-11, Table 3-4:

Delete the following:

HP Part No. 0160-0158
 HP Part No. 0180-0089
 HP Part No. 0698-3151
 HP Part No. 0698-3157
 HP Part No. 0698-3442
 HP Part No. 0757-0063
 HP Part No. 0757-0274
 HP Part No. 0757-0428

Change: Total quantity (TQ) of HP Part No. 0757-0280 to 12.

Change: Total quantity (TQ) of HP Part No. 0757-0430 to 2.

Change: Total quantity (TQ) of HP Part No. 1901-0033 to 3.

Add: HP Part No. 0698-3160 R: FXD MET FLM 46.4 OHM 1% 1/8W; 28480, TQ 1.

Add: HP Part No. 0757-0860 R: FXD MET FLM 121K OHM 1% 1/2W; 28480, TQ 1.

Add: HP Part No. 0771-0007 R: FXD MET FLM 30K OHM 10% 4W; 28480, TQ 1.

Page 4-3/4-4, Figure 4-2

Substitute Appendix I schematic for Figure 4-2.

(Applies to 8691B through 8694B RF Units)

Page 3-8, Table 3-3:

Change: R1 to HP Part No. 2100-2009.

Add: To R1 description "(HP Part No. 2100-2675 is the recommended replacement for HP Part No. 2100-2009.)"

Page 3-12, Table 3-4:

Change: HP Part No. 2100-2675 to HP Part No. 2100-2009.

Add: To description of HP Part No. 2100-2009, "(HP Part No. 2100-2675 is the recommended replacement for HP Part No. 2100-2009.)"

CHANGE G: Apply the first part of Change F to the 8693B and 8694B RF Units.

Page 3-3, Table 3-3:

Change: A1C4 to HP Part No. 0150-0052 C: FXD CER 0.05 UF 20% 400 VDCW.

Add: A1CR14 HP Part No. 1901-0033 DIODE: SILICON IN 485B.

CHANGE G: Page 3-4 , Table 3-3:
 (cont'd) Change: A1R35 to HP Part No. 0757-0401 R: FXD MET FLM 100 OHM 1% 1/8W.

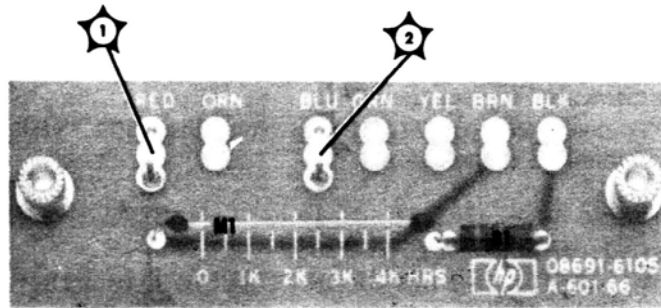
Page 3-8 , Table 3-3:
 Change A3 Assembly to HP Part No. 08691-6105. No description change.
 Delete Chassis mounted component C1.

Page 3-11, Table 3-4:
 Add: HP Part No. 0757-0401 R: FXD MET FLM 100 OHM 1% 1/8W; 28480, TQ 1.
 Change Total quantity (TQ) of HP Part No. 1901-0033 to 4.

Page 3-12, Table 3-4:
 Change HP Part No. 08691-6118 to HP Part No. 08691-6105. No description change.

Page 4-3/4-4, Figure 4-2:
 Change: Capacitor A1C4 to 0.05 UF.
 Change: Resistor A1R35 to 100 ohms.
 Add: Diode A1CR14 between XA1 pin 10 and ground (connect anode to pin 10).

CHANGE H: Page 2-11, Figure 2-8:
 Substitute the following photograph for A3 Assembly in Figure 2-8.



Page 3-8, Table 3-3:
 Add: A3M1 HP Part No. 1010-0005 INDICATOR: ELAPSED TIME.
 Add: A3R1 HP Part No. 0686-2455 R: FXD COMP 2.4 MEGOHM 5% 1/2W.

Page 3-11, Table 3-4:
 Add: HP Part No. 0686-2455 R: FXD COMP 2.4 MEGOHM 5% 1/2W; 28480, TQ 1.
 Add: HP Part No. 1010-0005 INDICATOR: ELAPSED TIME; 28480, TQ 1.

Page 4-3/4-4, Figure 4-2:
 Add: A3 M1 and A3R1 to A3 Terminal Assembly as shown in Appendix I schematic.

CHANGE I: Pages 1-2/1-3 , Table 1-1:
 Change: “Residual FM Specifications to read as follows:

8691B	30 kHz peak
8692B	30 kHz peak
8692B, Option 100	30 kHz peak
8693B	50 kHz peak
8693B, Option 100	50 kHz peak
8694B	60 kHz peak
8694B, Option 100	60 kHz peak
8694B, Option 200	60 kHz peak

CHANGE I: Delete the following below Table 1-1:
(cont'd) Residual FM specifications give peak deviation for modulating components within a 10 kHz bandwidth. Peak deviation may vary $\pm 50\%$ for a corresponding $\pm 10\%$ line voltage change. Specifications apply for both leveled and unleveled operation. Residual FM specifications are twice the above when the RF Unit is used in the 8707A RF Unit Holder. The residual FM specifications are only applicable for RF Units used with 8690B and 8707A instruments having serial prefix 838 or above.

CHANGE J: Entire Manual:
Change all Option 100 references to H01.
Change all Option 200 references to H02.
Change all Option 001 references to Option 01.

Page 1-2/1-3, Table 1-1:
Add: Option 004 available, Rear Panel RF Output (8691B thru 8694B).

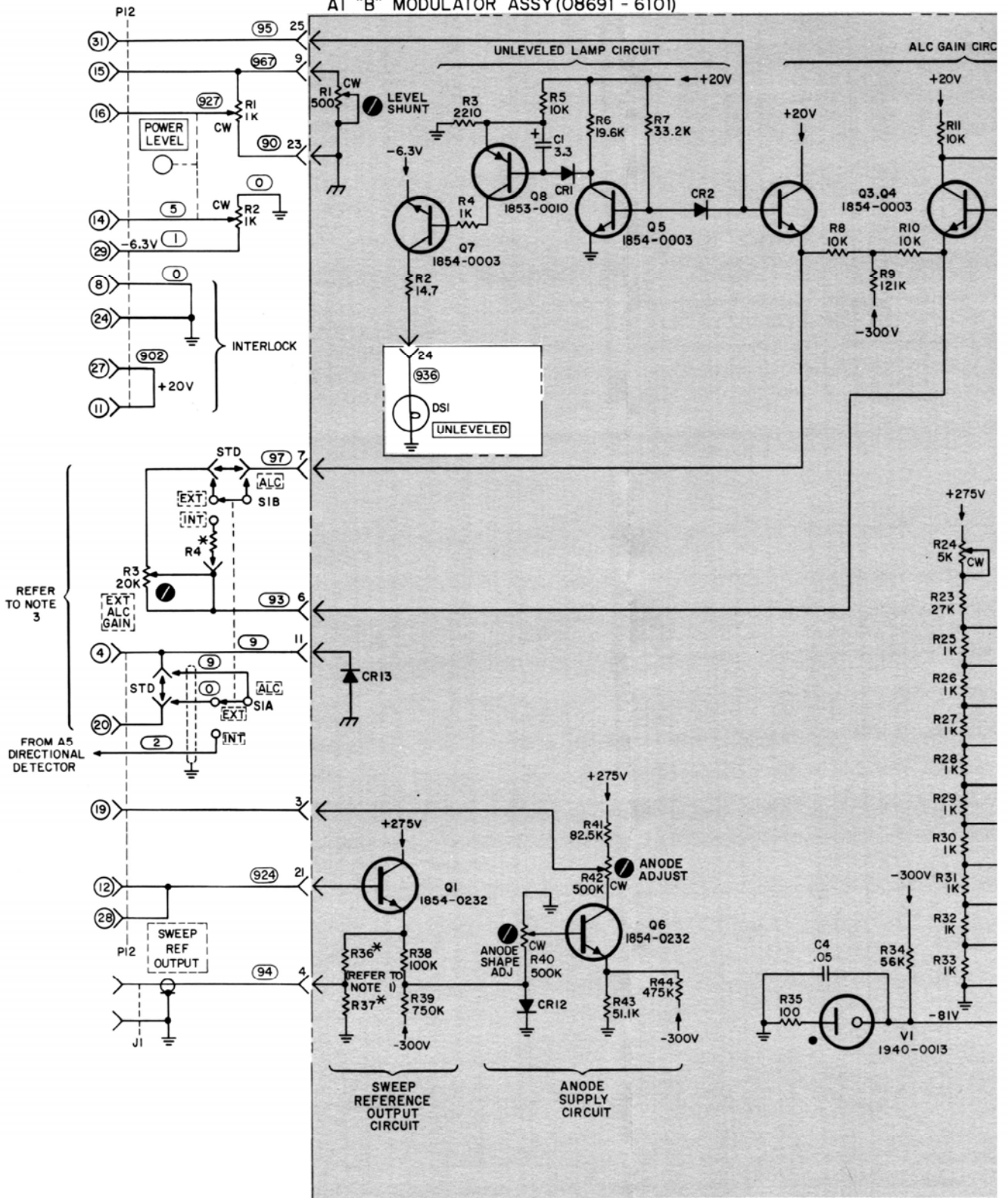
Page 3-9, Table 3-3:
Delete: HP Part No. 1951-0072.
Delete: HP Part No. 1951-0084.
Add: To description of V1, HP Part No. 1951-0055, "(HP Part No. 1951-0072 is the recommended replacement)."
Add: To description of V1, HP Part No. 1951-0064, "(HP Part No. 1951-0072 is the recommended replacement)."
Add: To description of V1, HP Part No. 1951-0057, "(HP Part No. 1951-0084 is the recommended replacement)."
Add: To description of V1, HP Part No. 1951-0057, "(HP Part No. 1951-0084 is the recommended replacement).

CHANGE K: Page 3-9, Table 3-3:
Delete: V1, HP Part No. 1951-0085.
Add: V1 1951-0058 ELECTRON TUBE: BWO (8694B, 8694B, Option 100).
Add: To description of V1, HP Part No. 1951-0058, "(HP Part No. 1951-0085 is the recommended replacement)".
Add: V1 1951-0066 ELECTRON TUBE: BWO (8694B, 8694B, Option 100) (HP Part No. 1951-0085 is the recommended replacement), 28480, TQ: 1.

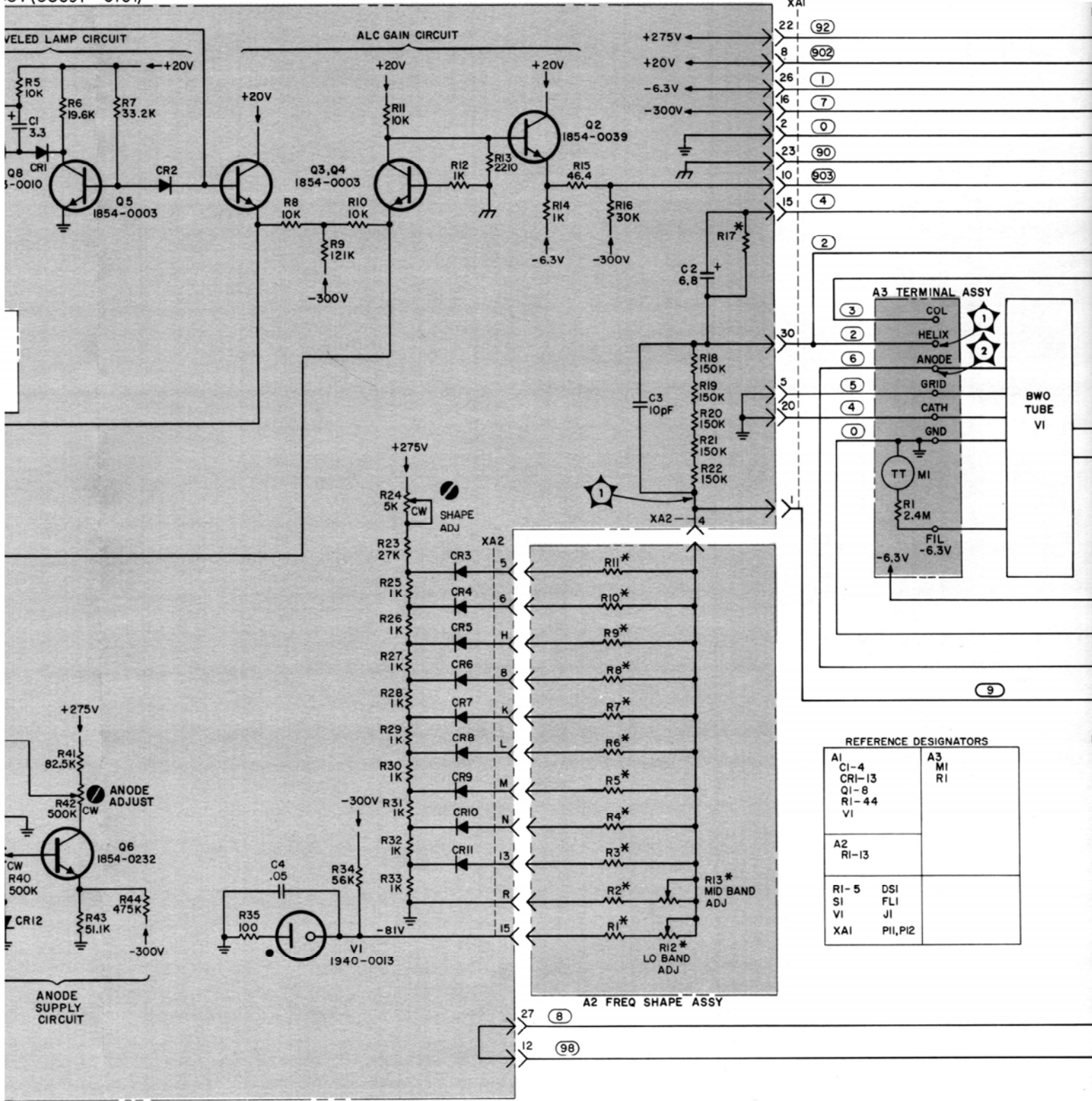
Page 3-7, Table 3-3:
Delete: A2 Assy, HP Part No. 08694-60001.
Delete: A2 Assy, HP Part No. 08694-60002.
Delete: A2 Assy, HP Part No. 08694-60003.

CHANGE L: Page 3-3, Table 3-3:
Change: A1R12 to HP Part No. 0757-0428 R: FXD MET FLM 5.11K OHM 1% 1/8W.
Page 3-5, Table 3-3:
Change A1R45 to HP Part No. 0757-0274 R: FXD MET FLM 1.21K OHM 1% 1/8W.
Page 3-11, Table 3-4:
Add: HP Part No. 0757-0274 R: FXD MET FLM 1.21K OHM 1% 1/8W, 28480, TQ: 1.
Delete: HP Part No. 0757-0279.
Add: HP Part No. 0757-0428 R: FXD MET FLM 5.11K OHM 1% 1/8W, 28480, TQ: 1.
Page 4-3/4-4, Figure 4-2:
Change A1R12 to 1.21K ohms.
Change A1R45 to 5.11K ohms.

AI "B" MODULATOR ASSY (08691 - 6101)



8691B - RF UNIT - SER PRE: 724 AND BELOW



REFERENCE DESIGNATORS

A1 C1-4 CR1-13 Q1-8 R1-44 V1	A3 M1 R1
A2 R1-13	
R1-5 S1 V1 XA1	DS1 FL1 J1 PI1,PI2

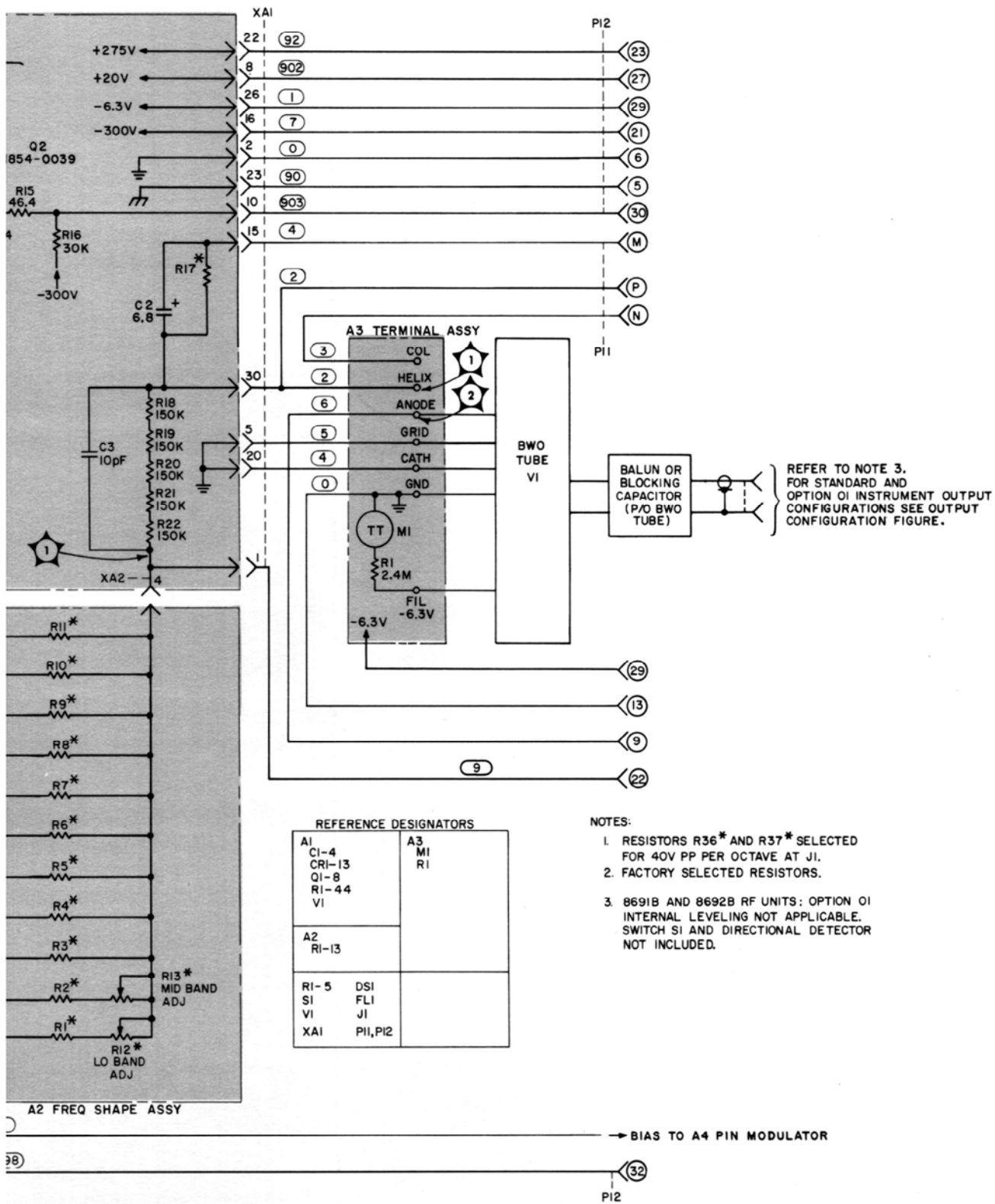


Figure 4-2. RF Unit for Serial Prefix 724 and Below

SALES & SERVICE OFFICES

UNITED STATES

ALABAMA

P.O. Box 4207
2003 Byrd Spring Road S.W.
Huntsville 35802
Tel: (205) 881-4591
Tel: (205) 881-2294
TWX: 810-726-2204

ARIZONA

3009 North Scottsdale Road
Scottsdale 85251
Tel: (602) 945-7601
Tel: (602) 298-2313
TWX: 910-952-1162

5737 East Broadway
Tucson 85716
Tel: (602) 298-2313
TWX: 910-952-1162

CALIFORNIA

1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000

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

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

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

1055 Shafter Street
San Diego 92106
Tel: (714) 223-8103
TWX: 910-335-2000

COLORADO

7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT

508 Tolland Street
East Hartford 06108
Tel: (203) 289-9394
TWX: 710-425-3416

111 East Avenue
Norwalk 06851
Tel: (203) 853-1251
TWX: 710-468-3750

DELAWARE

3941 Kennett Pike
Wilmington 19807
Tel: (302) 655-6161
TWX: 510-666-2214

FLORIDA

P.O. Box 24210
2806 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099

P.O. Box 20007
Herndon Station 32814
621 Commonwealth Avenue
Orlando
Tel: (305) 841-3970
Tel: (813) 850-0113

P.O. Box 8128
Madrera Beach 33708
410 150th Avenue
St. Petersburg
Tel: (813) 391-0211
TWX: 810-853-0366

GEORGIA

P.O. Box 28234
450 Interstate North
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

ILLINOIS

5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA

3839 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 810-341-3263

LOUISIANA

P.O. Box 856
1942 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND

6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-0850

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

MASSACHUSETTS

32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN

24315 Northwestern Highway
Southfield 48075
Tel: (313) 353-9100
TWX: 810-224-4882

MINNESOTA

2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI

11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

2812 South Brentwood Blvd.
St. Louis 63144
Tel: (314) 962-5000
TWX: 910-760-1670

NEW JERSEY

W. 120 Century Road
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

1060 N. Kings Highway
Cherry Hill 08034
Tel: (609) 667-4000
TWX: 710-892-4945

NEW MEXICO

P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 265-3713
TWX: 910-989-1665

NEW YORK

1702 Central Avenue
Albany 12205
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