Errata

Title & Document Type: **8691B-8695B RF Units Operating and Service Manual**

Manual Part Number: **08691-90022**

Revision Date: **June 1970**

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

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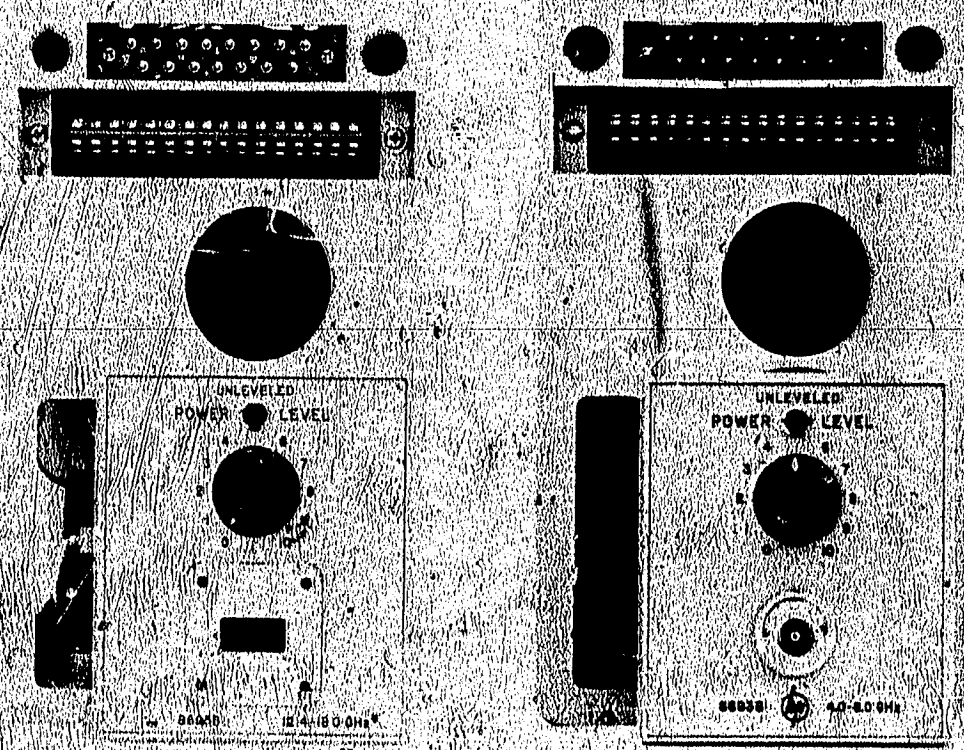
Agilent Technologies

OPERATING AND SERVICE MANUAL

RF UNITS

8691B
8692B
8693B
8694B
8695B



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HP 8691B–8695B

CERTIFICATION

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

WARRANTY AND ASSISTANCE

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

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

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

RF UNITS

8691B
8692B
8693B
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.

08691-90022 Printed: June 1970

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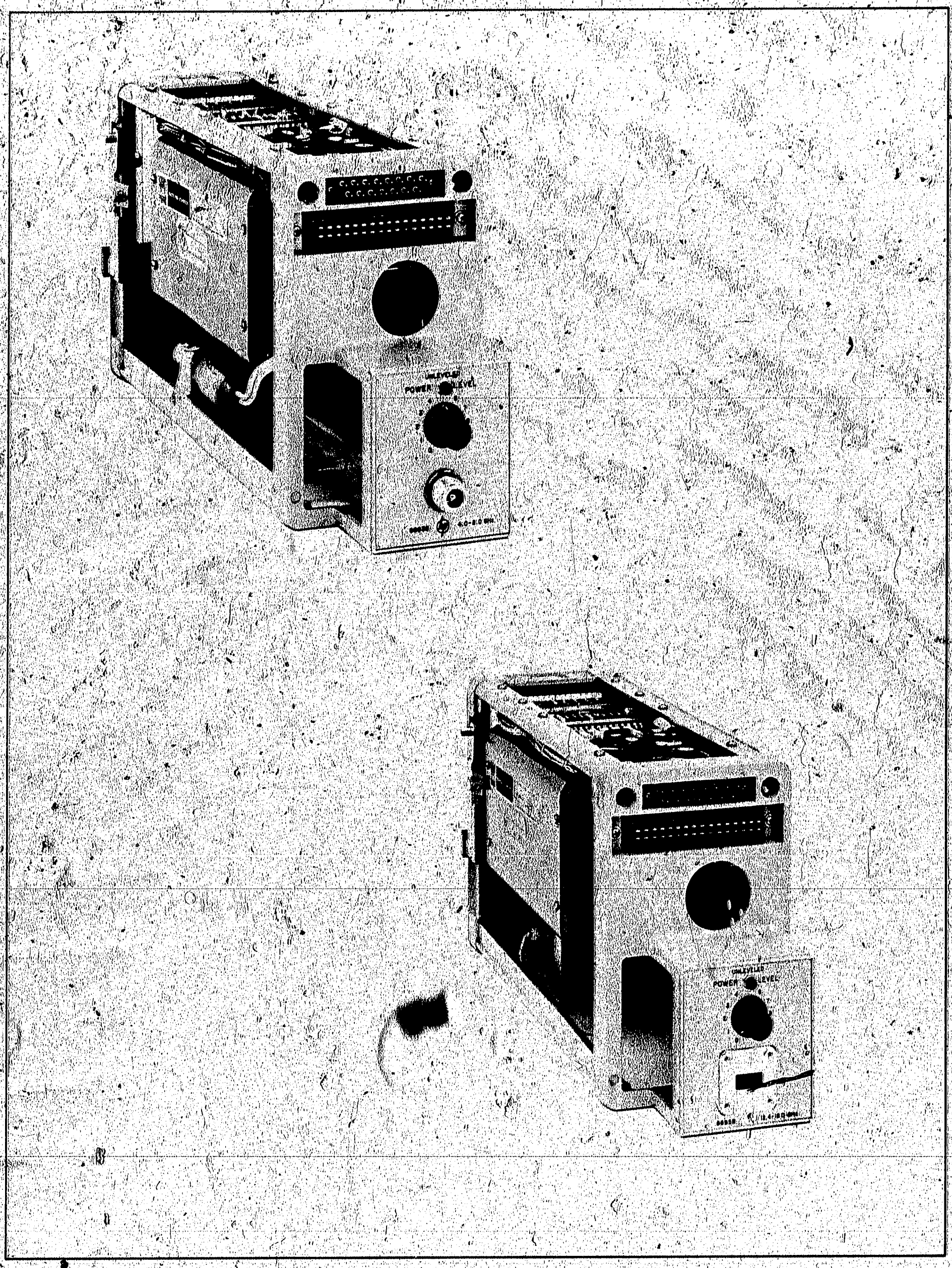


Figure 1-1. Typical Model 8691B—8695B RF Units

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) unleveled 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.

Spurious Signals:
Harmonics, at least 20 dB below CW output; non-harmonics, at least 40 dB below CW output.

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.

Leveling Indicator:
Front-panel indicator lights when power level set too high to permit leveling over entire selected sweep range or when operating in unleveled mode.

Equivalent Source Match:
Externally Leveled: Depends upon coupler
Unleveled: Less than 2.5:1.

Power Variation, Unleveled:
Less than 10 dB over the entire band.

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)

	8691B
Frequency Range:	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)

Models 8693B, 8693B, Opt. 100 RF Units
(Installed in 8690B Sweep Oscillator)

	8693B	8693B, Opt. 100
Frequency Range	4 to 8 GHz	3.7 to 8.3 GHz
Frequency Accuracy (over ⩾ 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	± 0.01%/°C	± 0.01%/°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		

Models 8694B, 8694B, Opt. 100, 8694B, Opt. 200 RF Units
(Installed in 8690B Sweep Oscillator)

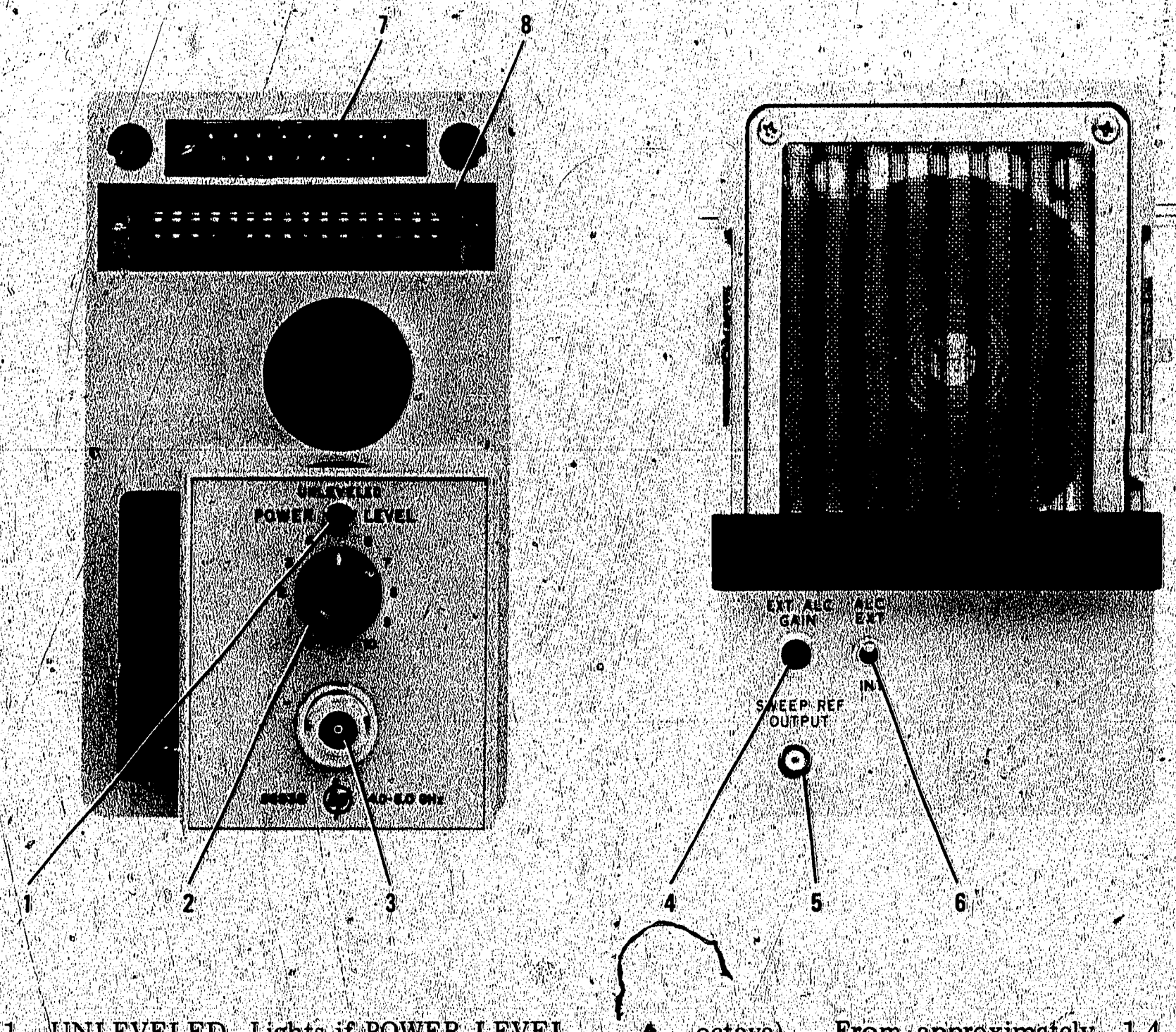
	8694B	8694B, Opt. 100	8694B, Opt. 200
Frequency Range	8 to 12.4 GHz	7 to 12.4 GHz	7 to 11 GHz
Frequency Accuracy	± 40 MHz	± 50 MHz	± 40 MHz
Maximum Leveled Power	At least 30 mW (14.8 dBm)	At least 15 mW (11.8 dBm)	At least 15 mW (11.8 dBm)
RF Power Control	PIN Line	PIN Line	PIN Line
Frequency Stability			
With Temperature	± 0.01%/°C	± 0.01%/°C	± 0.01%/°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			

Model 8695B RF Unit
(Installed in 8690B Sweep Oscillator)

	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	± 0.01%/°C
With Temperature	± 10 MHz
With 10% Change in Line Voltage	± 1 MHz
With 10-dB Power Level Change	< 50 kHz peak
Residual FM	± 0.1 dB
Power Variation, External Leveling*	Waveguide WG-419/U
Output Impedance and/or Connector	

*Excluding coupler and detector variation.

MODEL 8691B–8694B FRONT AND REAR PANEL



1. UNLEVELED. Lights if POWER LEVEL set too high for leveling across selected frequency range or if leveling is not used.

2. POWER LEVEL. Adjusts RF power level.

3. RF Output Connector. Standard 50-ohm type N connector except on Option 001 Models which have HP precision 50-ohm type N connectors.

4. EXT ALC GAIN. Adjusts gain of ALC loop to control flatness of RF power output.

5. SWEEP REF OUTPUT. Output voltage proportional to RF frequency (40V/octave). From approximately 1.4 to 41.4V across the sweep range.

CAUTION

Application of voltage greater than ±15 volts may damage transistor A1Q1.

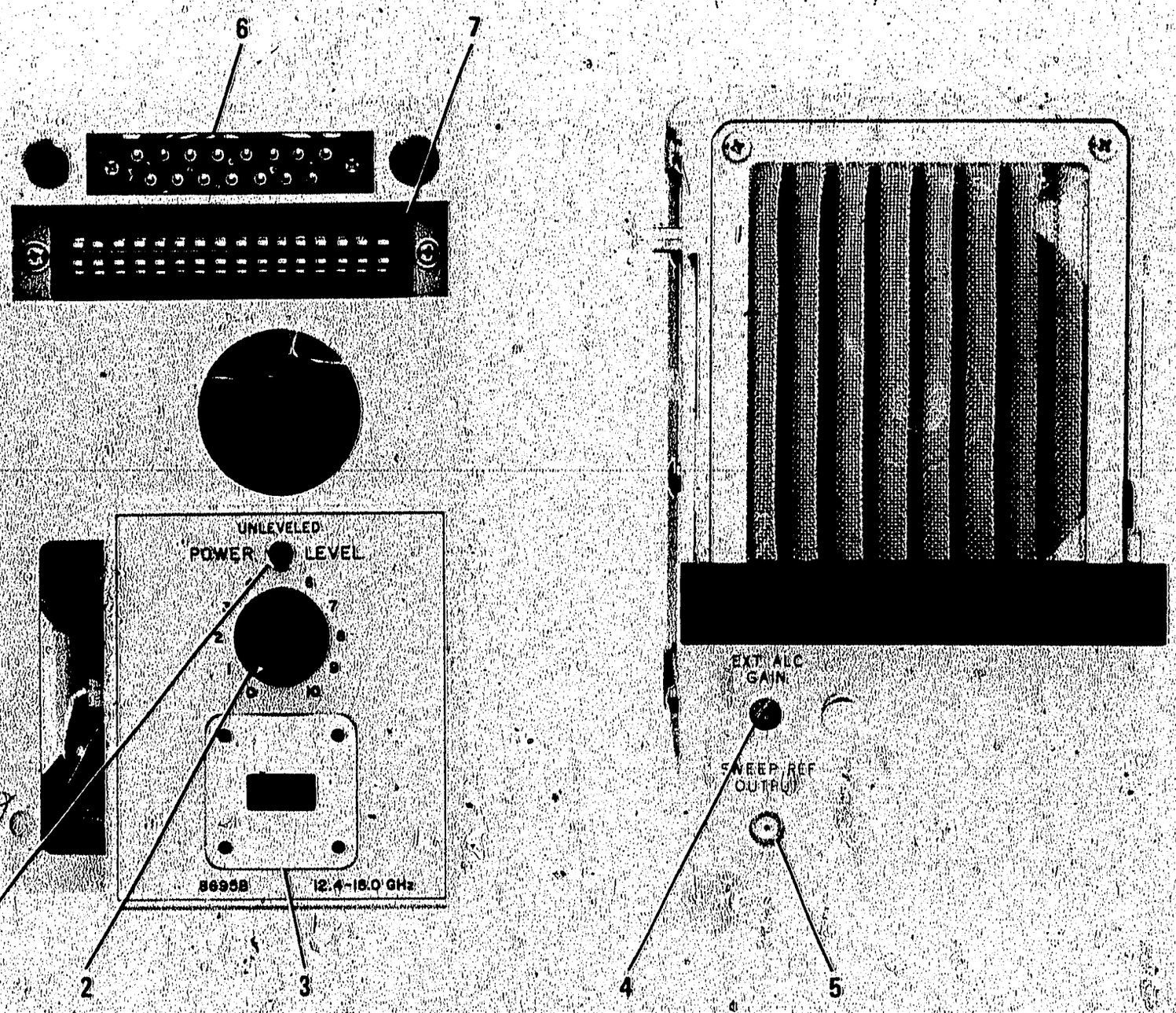
6. ALC EXT-INT. Switch installed on Option 001 RF Units. Selects or disables an internal leveling loop.

7. P11. Connects BWO operating voltages from the 8690 mainframe to the RF Unit.

8. P12. Connects RF Unit operating signals and voltages from the 8690 mainframe to the RF Unit.

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

MODEL 8695B FRONT AND REAR PANEL



1. UNLEVELED. Lights if POWER LEVEL set too high for leveling across frequency range or if automatic leveling is not used.

2. POWER LEVEL. Adjusts RF power level.

3. RF Output Waveguide Flange. 8695B: UG-419/U.

4. EXT ALC GAIN. Adjusts gain of ALC circuit to control flatness of leveling.

5. SWEEP REF OUTPUT. Output voltage proportional to RF frequency.

CAUTION

Application of voltage greater than ±15 volts may damage transistor A1Q1.

6. P11. Connects BWO operating voltages from the 8690 mainframe to the RF Unit.

7. P12. Connects RF Unit operating signals and voltages from the 8690 mainframe to the RF Unit.

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

MAINTENANCE

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: ±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/μW, 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: ±0.1%	536 537
Power Meter and Thermistor Mount	Frequency Range: Same as RF Unit used Power Range: 1 μW 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 ±300V Accuracy: ±02% minimum Input Impedance: 10 megohms	3440/3442
Clip-On DC Ammeter	Range: 10 mA to 5 amps Accuracy: ±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 μF) 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 MARKER 2 — STOP STOP/ΔF	Low end of specified range, any RF Unit
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 μF) 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 determmne 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.

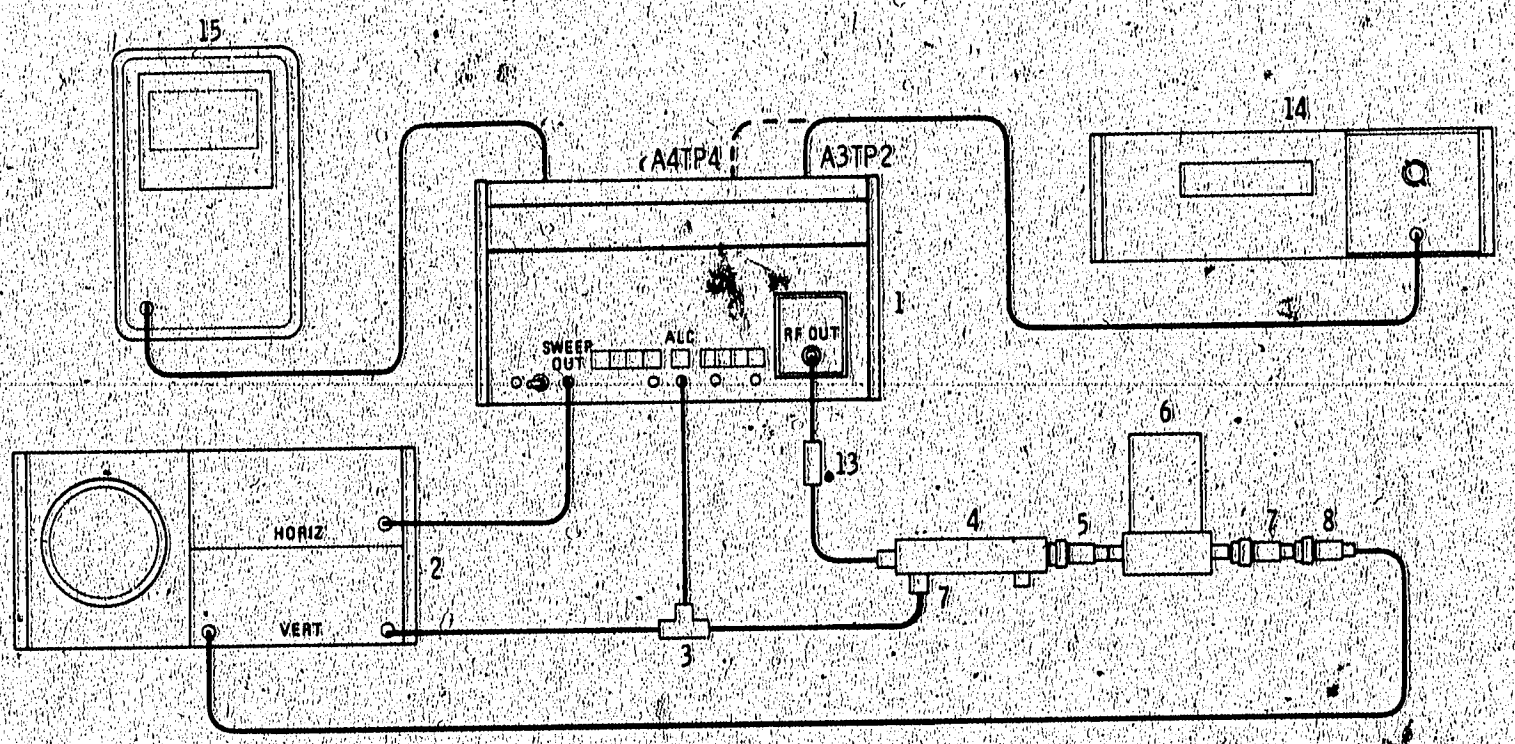
h. Readjust A1R1 slowly counterclockwise until the UNLEVELED light just goes out.

RF UNIT MODELS (See Note 4)

8691B
8692B
8693B
8694B

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

8694B, Opt. 200



RF UNIT MODEL
8695B

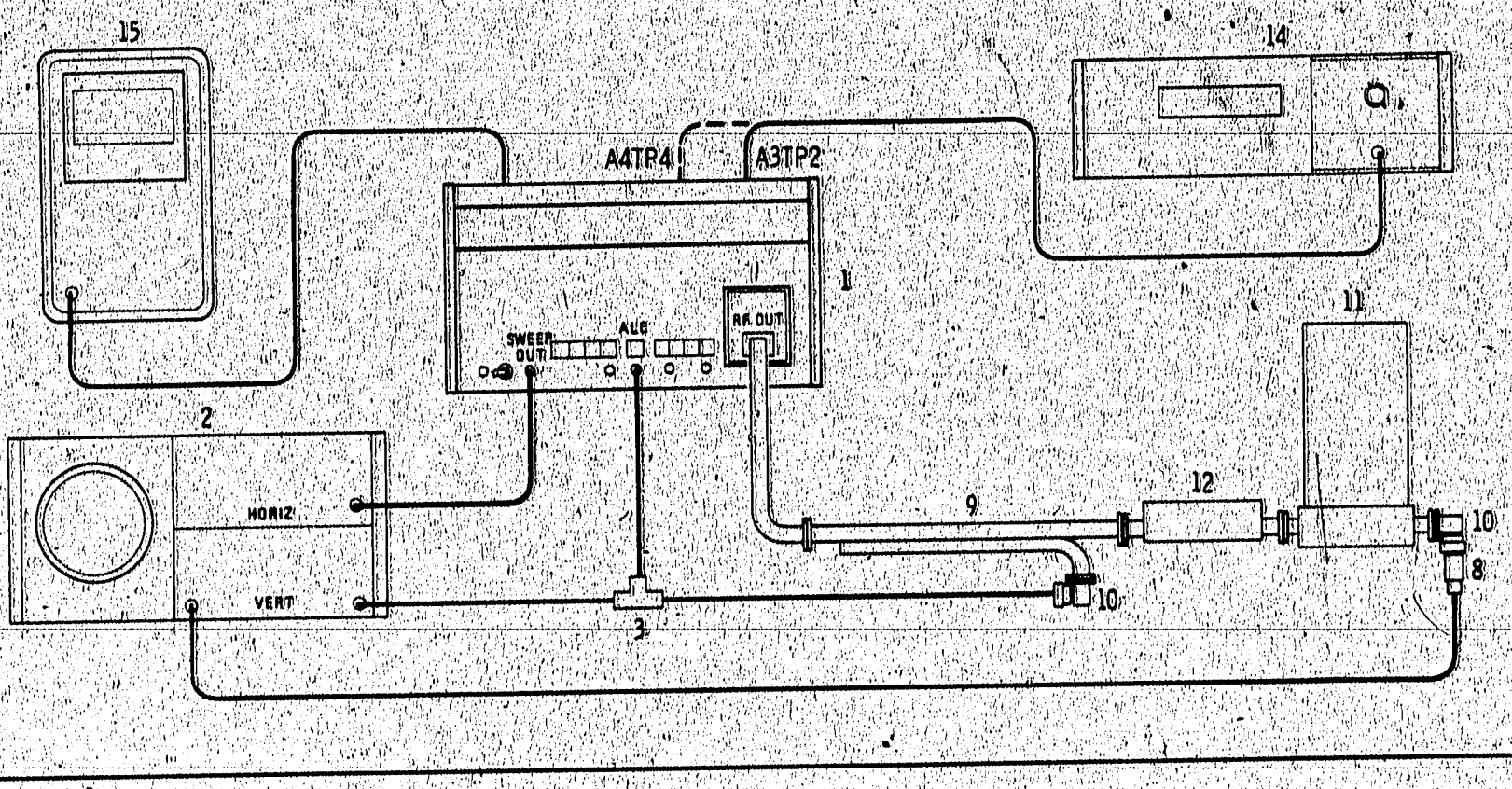


Figure 2-1. Maintenance Setup Number 1

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)

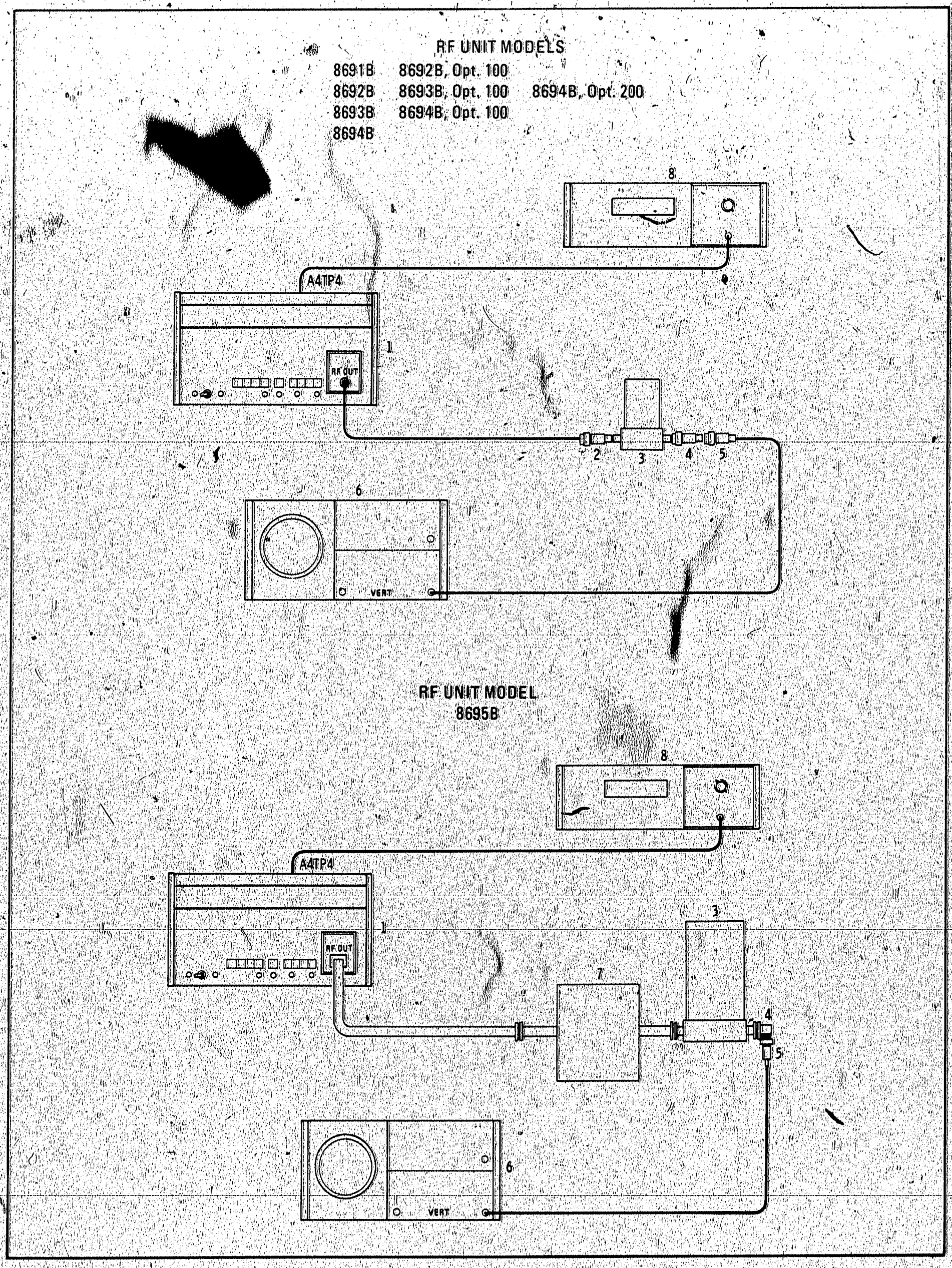


Figure 2-2. Maintenance Setup Number 2

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)

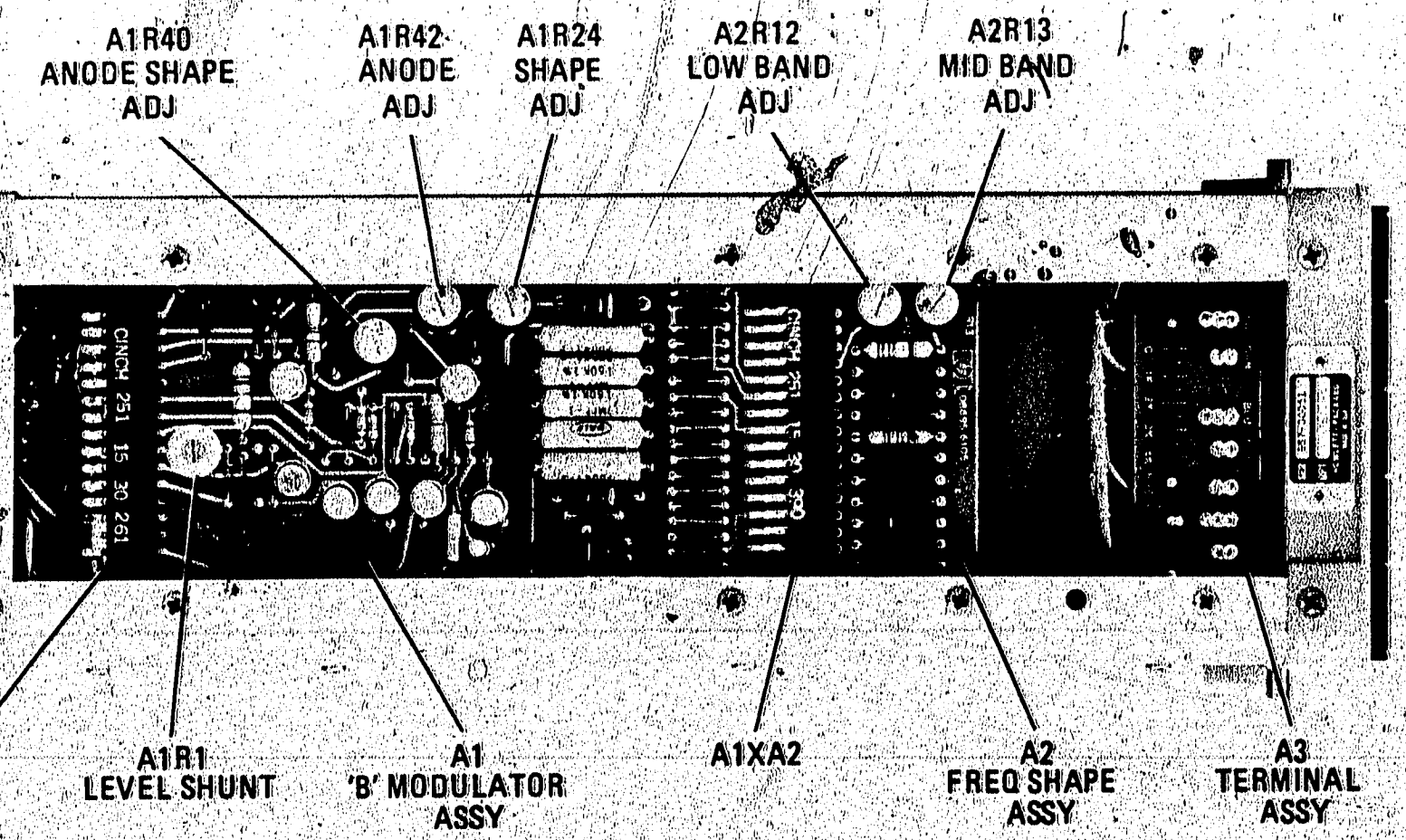


Figure 2-3. Component and Adjustment Identification Interior Top View

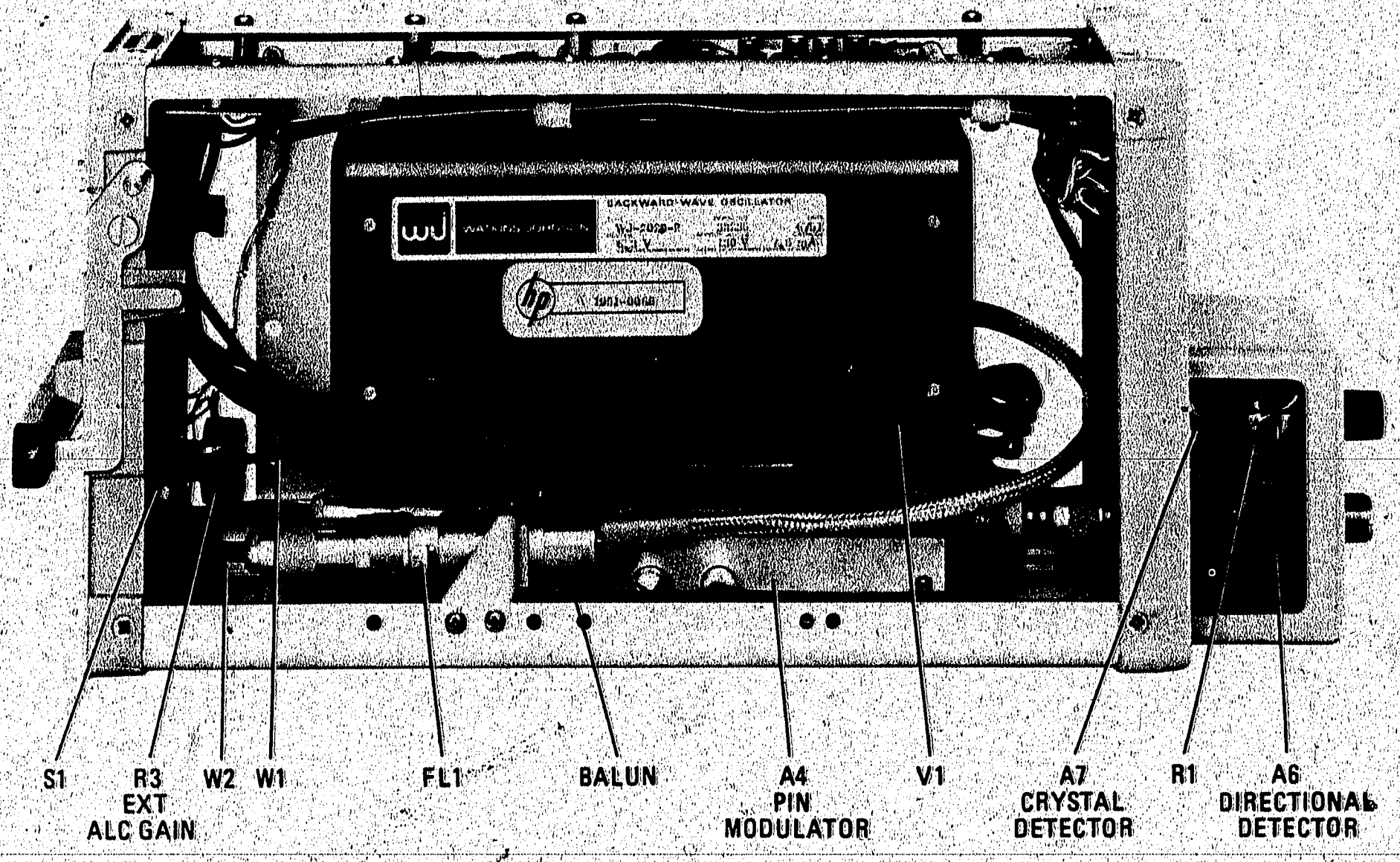


Figure 2-4. Component Identification, Option 001, 8694B

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

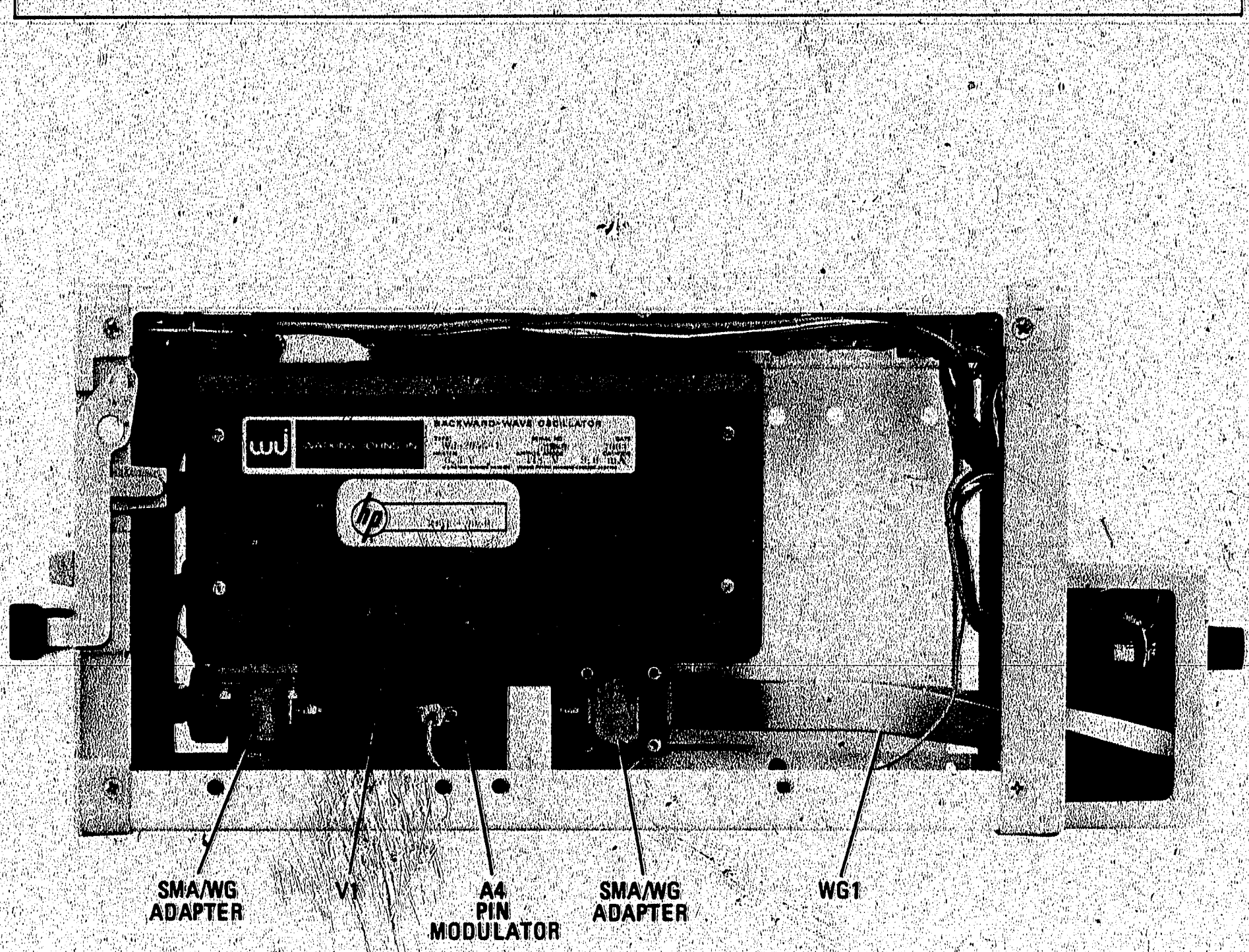


Figure 2-5. Component Identification, 8695B

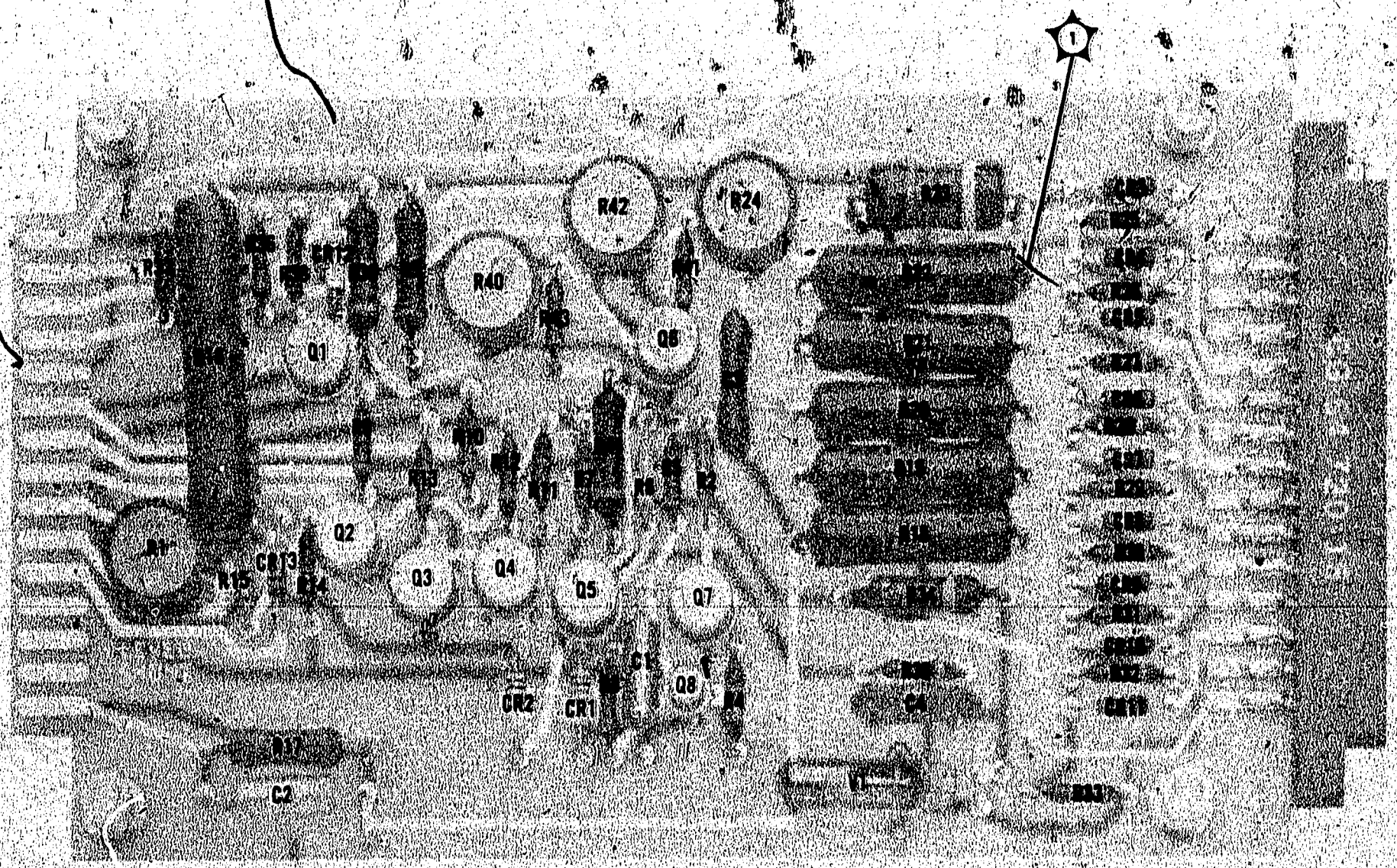
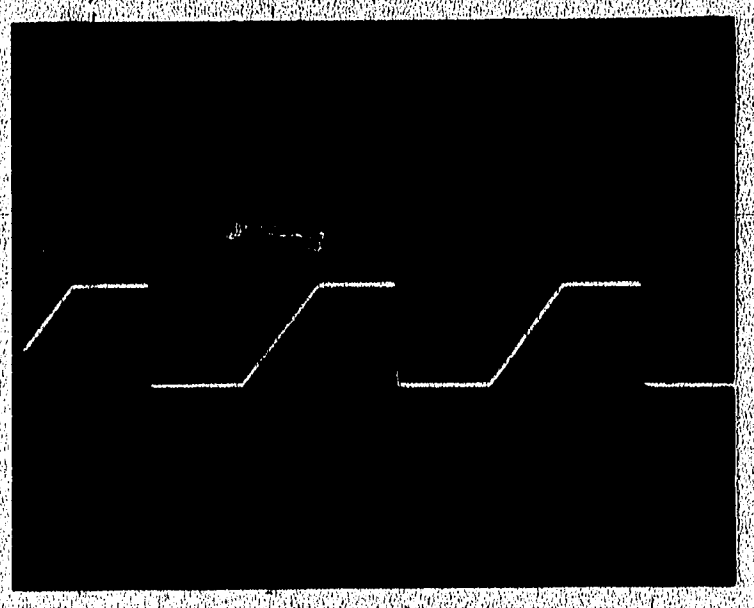
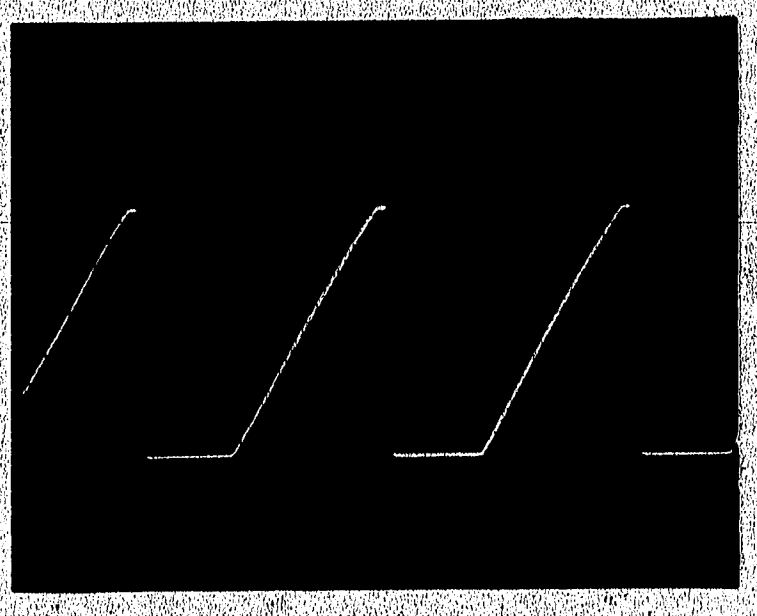


Figure 2-6. Component Identification Assembly A1



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



Emitter A1Q1
20 V/div 5ms/div

Figure 2-7. Waveforms

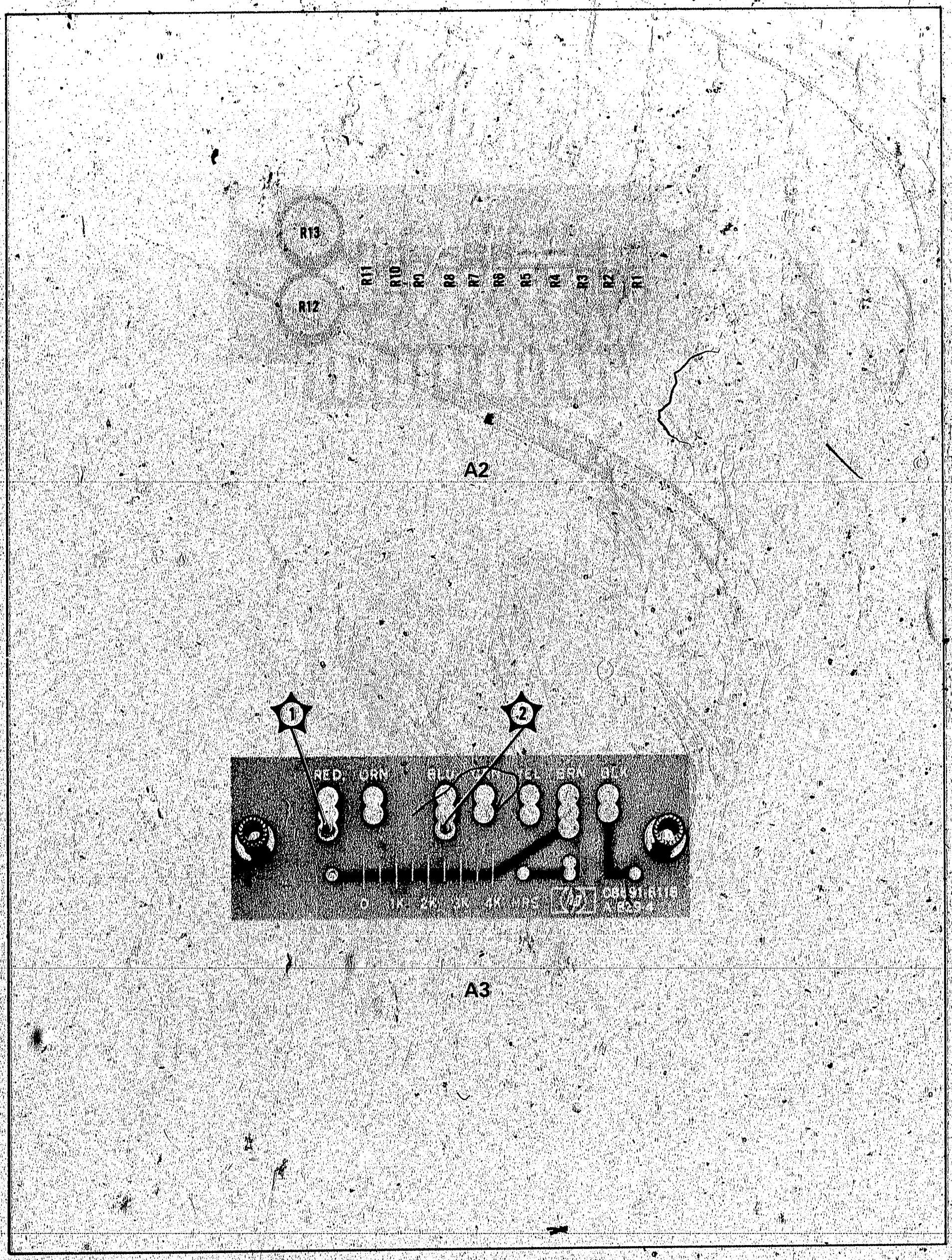


Figure 2-8. Component Identification, Assemblies A2 and A3

PARTS LIST

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 (V4)	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

[1] The 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.

[2] BWO (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).

[3] BWO (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).

[4] BWO (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		
BT	= battery	J	= jack	R	= resistor		
C	= capacitor	K	= relay	RT	= thermistor	VR	= voltage regulator
CP	= coupler	L	= inductor	S	= switch		
CR	= diode	LS	= loud speaker	T	= transformer	W	= cable
DL	= delay line	M	= meter	TB	= terminal board	X	= socket
DS	= device signaling (lamp)	MK	= microphone	TP	= test point	Y	= crystal
E	= misc electronic part	MP	= mechanical part	U	= integrated circuit	Z	= tuned cavity, network

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

Table 3-3. Parts List Indexed by Reference Designation

Reference Designation	℗ Part No.	Description #	Note
A1	08692-6113	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 100UF-10%+100% 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	hp 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 (86918)	
	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W (86928)	
	0757-0123	R:FXD MET FLM 34.8K OHM 1% 1/8W (8692B UPT 100)	
	0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W (86938)	
	0698-3161	R:FXD MET FLM 38.3K 1% 1/8W (86938 UPT 100)	
	0757-0463	R:FXD MET FLM 82.5K 1% 1/8W (86948)	
	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (86948 UPT 100)	
	0757-0462	R:FXD MET FLM 75.0K OHM 1% 1/8W (86948 UPT 200)	
	0757-0465	R:FXD MET FLM 100K 1% 1/8W (86958)	
A1R37	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (86918)	
	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (86928)	
	0757-0464	R:FXD MET FLM 90.9K OHM 1% 1/8W (86928 UPT 100)	
	0757-0459	R:FXD MET FLM 56.2K OHM 1% 1/8W (86938)	
	0757-0462	R:FXD MET FLM 75.0K OHM 1% 1/8W (86938 UPT 100)	
	0698-3161	R:FXD MET FLM 38.3K 1% 1/8W (86948)	
	0698-3162	R:FXD MET FLM 46.4K OHM 1% 1/8W (86948 UPT 100)	
	0698-3161	R:FXD MET FLM 38.3K 1% 1/8W (86948 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
A2	08691-6103	ASSY:FREQ. SHAPE(8691B) (USED WITH 1951-0020 BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R11		FACTORY SELECTED VALUE	
A2 R12 A2 R13	2100-1777 2100-0969	R:VAR WW 20K OHM 5% TYPE H 1W R:VAR MET FLM 50K OHM 20%	
A2	08692-6101	ASSY:FREQ. SHAPE(8692B) (USED WITH 1951-0064 BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08692-6102	ASSY:FREQ. SHAPE(8692B) (USED WITH 1951-0055 ALT BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08692-6103	ASSY:FREQ. SHAPE(8692B OPT 1C0) (USED WITH 1951-0064 BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08692-6104	ASSY:FREQ. SHAPE(8692B OPT 1C0) (USED WITH 1951-0055 ALT BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08693-6101	ASSY:FREQ. SHAPE(8693B) (USED WITH 1951-0065 ALT BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08693-6102	ASSY:FREQ. SHAPE(8693B) (USED WITH 1951-0057 BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08693-6103	ASSY:FREQ. SHAPE(8693B OPT 1C0) (USED WITH 1951-0065 ALT BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08693-6104	ASSY:FREQ. SHAPE(8693B OPT 1C0) (USED WITH 1951-0057 BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		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
A2	08694-6101	ASSY:FREQ. SHAPE(8694B) (USED WITH 1951-0066 ALT BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-6102	ASSY:FREQ. SHAPE(8694B) (USED WITH 1951-0058 BWO) 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 BWO) 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 BWO) 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 BWO) 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 BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2	08694-60001	ASSY:FREQ. SHAPE(8694B) (USED WITH 1951-0085 BWO) 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 BWO) 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 BWO) REFER TO PARAGRAPH 3-5.	
A2 R1- A2 R13		FACTORY SELECTED VALUE	
A2 A2	08695-6105	ASSY:FREQ SHAPE(8695B) (USED WITH 1951-0080 BWO) 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:BWO TERM	
A4	0O5-330010	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			
FL1	00694-604	FILTER:LOW PASS (8694B, OPT 001, OPT 100, OPT 200)	
FL1			
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	
R2		PART OF R1	
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 (ALL 8691B & 8692B MODELS)	
W2	08693-6112	ASSY:RF CABLE (ALL 8693B & 8694B MODELS)	
WG1	08695-20007	WAVEGUIDE ASSY (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:BWO	
	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	28480	0160-0383	1
0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	56289	30D106G150DF4	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	28480	0370-0133	1
0698-3151	R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151	1
0698-3157	R:FXD MET FLM 19.6K OHM 1% 1/8W	14674	C4	2
0698-3161	R:FXD MET FLM 38.3K OHM 1% 1/8W	14674	C4	3
0698-3162	R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162	1
0698-3425	R:FXD MET FLM 316K OHM 1% 1/2W	28480	0698-3425	1
0698-3428	R:FXD MET FLM 14.7 OHM 1% 1/8W	28480	0698-3428	1
0698-3442	R:FXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442	1
0698-3450	R:FXD MET FLM 42.2K OHM 1% 1/8W	28480	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	28480	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	28480	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	
0757-0454	R:FXD MET FLM 33.2K OHM 1% 1/8W	28480	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	28480	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	28480	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	28480	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	02660	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	08717	102XXR	1
1450-0153	LAMPHOLDER:FOR T-1 SERIES	08717	102SR	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)	28480	1854-0232	2
1901-0033	DIODE:SILICON 100MA 180WV	07263	FD3369	3
1901-0096	DIODE:SILICON 120V	28480	1901-0096	9
1910-0016	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361	1
1940-0013	ELECTRON TUBE:82.0 +/- 1V	74276	Z82R7	4
1951-0020	ELECTRON TUBE:BWO	28480	1951-0020	1
1951-0055	ELECTRON TUBE:BWO	28480	1951-0055	1

 # See introduction to this section for ordering information

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

hp Part No.	Description #	Mfr.	Mfr. Part No.	TQ
1951-0057	ELECTRON TUBE:BWO	28480	1951-0057	1
1951-0058	ELECTRON TUBE:BWO	28480	1951-0058	1
1951-0064	TUBE:ELECTRON BWO 2.0 TO 4.0 GC	28480	1951-0064	1
1951-0065	ELECTRON TUBE:BWO	28480	1951-0065	1
1951-0066	ELECTRON TUBE:BWO	28480	1951-0066	1
1951-0072	ELECTRON TUBE:BWO	28480	1951-0072	1
1951-0080	TUBE:BWO 12.4-18.0 GC	28480	1951-0080	1
1951-0084	ELECTRON TUBE:BWO	28480	1951-0084	1
2100-0051	R:VAR COMP 20K OHM 10% CWLOG 2W	28480	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	28480	2100-1772	1
2100-1775	R:VAR WW 5K OHM 5% TYPE H 1W	28480	2100-1775	1
2100-1777	R:VAR WW 20K OHM 5% TYPE H 1W	28480	2100-1777	1
2100-2675	R:VAR GANGED 2 X 1K OHM 20% LIN	28480	2100-2675	1
2140-0092	LAMP:5V 60 MA	28480	2140-0092	1
3150-0054	FILTER:AIR	28480	3150-0054	1
6560-0046	PLUG-HOLE	00000	08D#	1
C05-33001C	MODULATOR:PIN	28480	C05-33001C	1
00693-604	FILTER:LOW PASS	28480	00693-604	1
00694-604	FILTER:LOW PASS	28480	00694-604	1
08691-0101	PANEL:FRONT(8691B)	28480	08691-0101	1
08691-0107	MOUNTING PLATE:BWO	28480	08691-0107	1
08691-2010	HANDLE ASSY	28480	08691-2010	1
08691-2110	SCALE(1.0-2.0GHZ)8691B	28480	08691-2110	1
08691-2112	PANEL:REAR	28480	08691-2112	1
08691-2114	PANEL:REAR(8691B THRU 8694B)	28480	08691-2114	1
08691-6003	ASSY:COAX CABLE	28480	08691-6003	1
08691-6006	ASSY:RF CABLE	28480	08691-6006	1
08691-6103	ASSY:FREQ. SHAPE(8691B)	28480	08691-6103	1
08691-6111	MODULATOR:PIN	28480	08691-6111	1
08691-6118	BOARD ASSY:BWO TERM	28480	08691-6118	1
08692-0101	PANEL:FRONT(8692B)	28480	08692-0101	1
08692-0110	PANEL:FRONT(8692B OPT 100)	28480	08692-0110	1
08692-2110	SCALE(2.0-4.0GHZ)8692B	28480	08692-2110	1
08692-2111	SCALE(1.7-4.2GHZ)8692B	28480	08692-2111	1
08692-6101	ASSY:FREQ. SHAPE(8692B)	28480	08692-6101	1
08692-6102	ASSY:FREQ. SHAPE(8692B)	28480	08692-6102	1
08692-6103	ASSY:FREQ. SHAPE(8692B OPT 100)	28480	08692-6103	1
08692-6104	ASSY:FREQ. SHAPE(8692B OPT 100)	28480	08692-6104	1
08692-6111	MODULATOR:PIN	28480	08692-6111	1
08692-6113	ASSY:"B" MODULATOR(8691B-8695B)	28480	08692-6113	1
08693-0101	PANEL:FRONT(8693B& OPT 001)	28480	08693-0101	1
08693-0108	PANEL:FRONT(8693B & OPT 001, 100)	28480	08693-0108	1
08693-2110	SCALE(4.0-8.0GHZ)8693B & OPT 001	28480	08693-2110	1
08693-2111	SCALE(3.7-8.3GHZ)8693B & OPT 001, 100	28480	08693-2111	1
08693-6101	ASSY:FREQ. SHAPE(8693B)	28480	08693-6101	1
08693-6103	ASSY:FREQ. SHAPE(8693B OPT 100)	28480	08693-6103	1
08693-6104	ASSY:FREQ. SHAPE(8693B OPT 100)	28480	08693-6104	1
08693-6110	DETECTOR:DIRECTIONAL	28480	08693-6110	1
08693-6111	MODULATOR:PIN	28480	08693-6111	1
08693-6112	ASSY:RF CABLE	28480	08693-6112	1
08694-0101	PANEL:FRONT	28480	08694-0101	1
08694-0113	PANEL:FRONT(8694B & OPT 001, 100)	28480	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
08694-0115	PANEL:FRONT(8694B & OPT 001, 200)	28480	08694-0115	1
08694-2110	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
08694-60001	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
08694-6105	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
08695-00002	PANEL:FRONT(8695B)	28480	08695-00002	1
08695-0100	PANEL:FRONT(8695A)	28480	08695-0100	1
08695-20007	WAVEGUIDE ASSY	28480	08695-20007	1
08695-2110	SCALE:12.4-18.0 GHZ(8695B)	28480	08695-2110	1
08695-2115	PANEL:REAR(8695B & OPT 004)	28480	08695-2115	1
08695-60005	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

Mfr. No.	Manufacturer Name	Address	Zip Code
00000	U.S.A. Common	Any Supplier of U.S.A.	
01295	Texas Instruments Inc. Semiconductor Components Div.	Dallas, Tex.	75231
02660	Amphenol Corp.	Broadview, Ill.	60153
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Ariz.	85008
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.	94040
08717	Sloan Co.	Sun Valley, Calif.	91352
28480	Hewlett-Packard Co. Corporate HQ	Your nearest HP Office	
56289	Sprague Electric Co.	N. Adams, Mass.	01247
71744	Chicago Miniature Lamp Works	Chicago, Ill.	60640
71785	Cinch Mfg. Co. Div Trw Inc.	Elk Grove Village, Ill.	
74276	Signalite Inc.	Neptune, N.J.	07753
75042	International Resistance Co., Inc.	Philadelphia, Pa.	19108
80131	Electronic Industries Association	Washington, D.C.	20006
81312	Winchester Electronics Div. Litton Ind. Inc.	Oakville, Conn.	06779

SCHEMATIC DIAGRAMS

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 designation. 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.

SCHEMATIC DIAGRAM NOTES

Refer to MIL Std 15B for Symbols Not Shown

Resistance is in ohms and capacitance is in microfarads unless otherwise noted.

P/O = part of.

*Asterisk denotes a factory-selected value. Value shown is typical. Capacitors may be omitted or resistors jumpered.

Screwdriver adjustment.

Panel control.

Encloses front panel designations.

Encloses rear panel designation.

Circuit assembly borderline.

Other assembly borderline.

Heavy line with arrows indicates path and direction of main signal.

Heavy dashed line with arrows indicates path and direction of main feedback.

Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.

Numbers in circles on circuit assemblies show locations of test points.

Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number identifies the narrower stripe. E.g., (947) denotes white base, yellow wide stripe, violet narrow stripe.

Voltage regulator (breakdown diode).

Denotes Field Effect transistor (FET) with N-type base.

Denotes FET with P-type base.

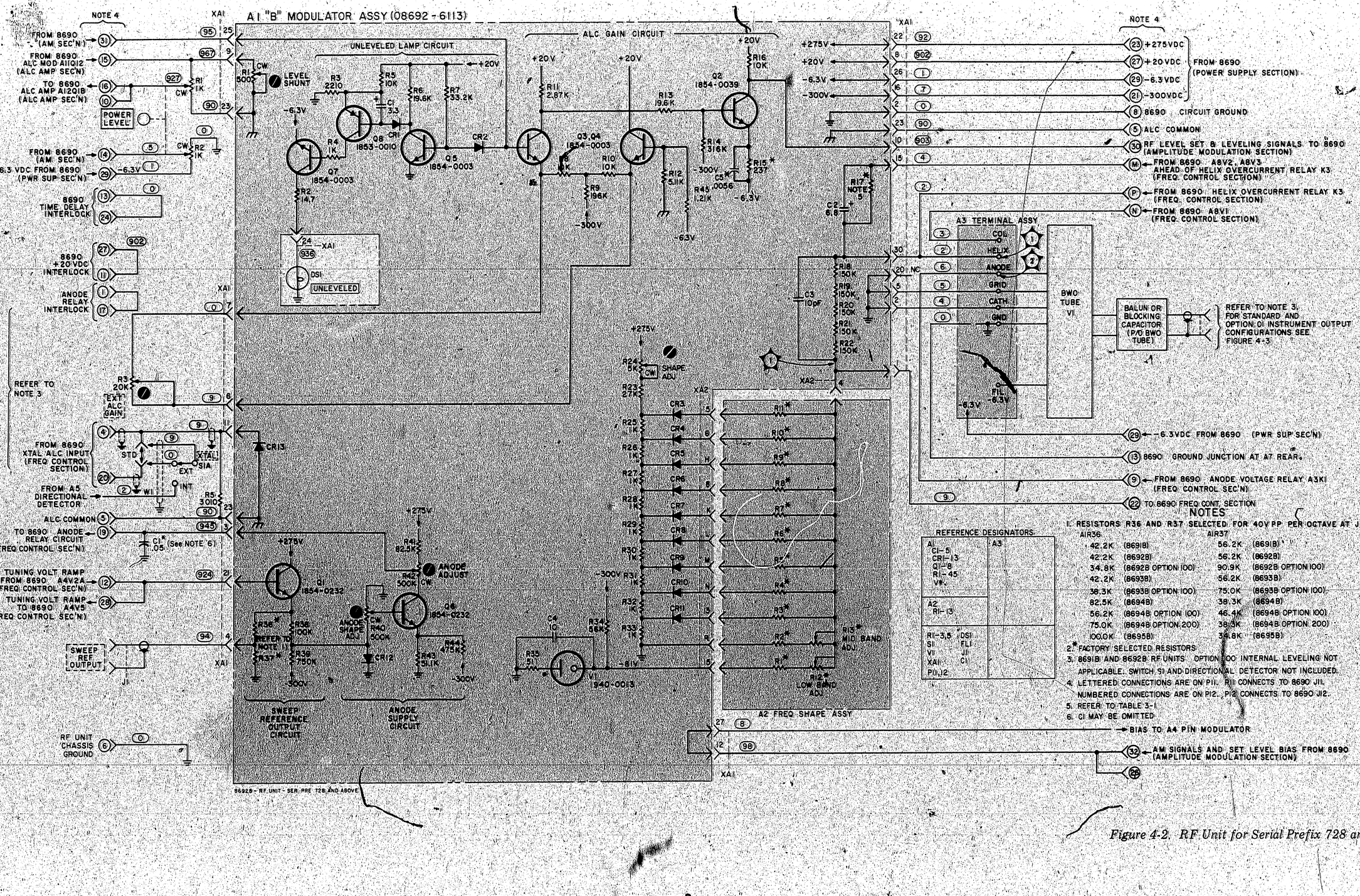
Denotes Capacitive diode (Varicap, varactor).

Denotes Silicon Controlled Rectifier.

P-Type Metal Oxide Substrate FET (MOSFET)

N-Type Metal Oxide Substrate FET (MOSFET)

Figure 4-1. Schematic Diagram Notes



REFERENCE DESIGNATORS

A1	A3
C1-5 CR1-13 Q1-8 R1-45 V1*	
A2 R1-13	
R1-3,5 S1 V1 XA1 P1,J2	DS1 FL1 J1 C1

NOTES

1. RESISTORS R36 AND R37 SELECTED FOR 40V PP PER OCTAVE AT J1.

AIR36		AIR37	
42.2K	(8691B)	56.2K	(8691B)
42.2K	(8692B)	56.2K	(8692B)
34.8K	(8692B OPTION 100)	90.9K	(8692B OPTION 100)
42.2K	(8693B)	56.2K	(8693B)
38.3K	(8693B OPTION 100)	75.0K	(8693B OPTION 100)
82.5K	(8694B)	38.3K	(8694B)
56.2K	(8694B OPTION 100)	46.4K	(8694B OPTION 100)
75.0K	(8694B OPTION 200)	38.3K	(8694B OPTION 200)
100.0K	(8695B)	38.8K	(8695B)

2. *FACTORY SELECTED RESISTORS
3. 8691B AND 8692B RF UNITS OPTION 100 INTERNAL LEVELING NOT APPLICABLE. SWITCH S1 AND DIRECTIONAL DETECTOR NOT INCLUDED.
4. LETTERED CONNECTIONS ARE ON P11. P11 CONNECTS TO 8690 J11. NUMBERED CONNECTIONS ARE ON P12. P12 CONNECTS TO 8690 J12.
5. REFER TO TABLE 3-1.
6. C1 MAY BE OMITTED.

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

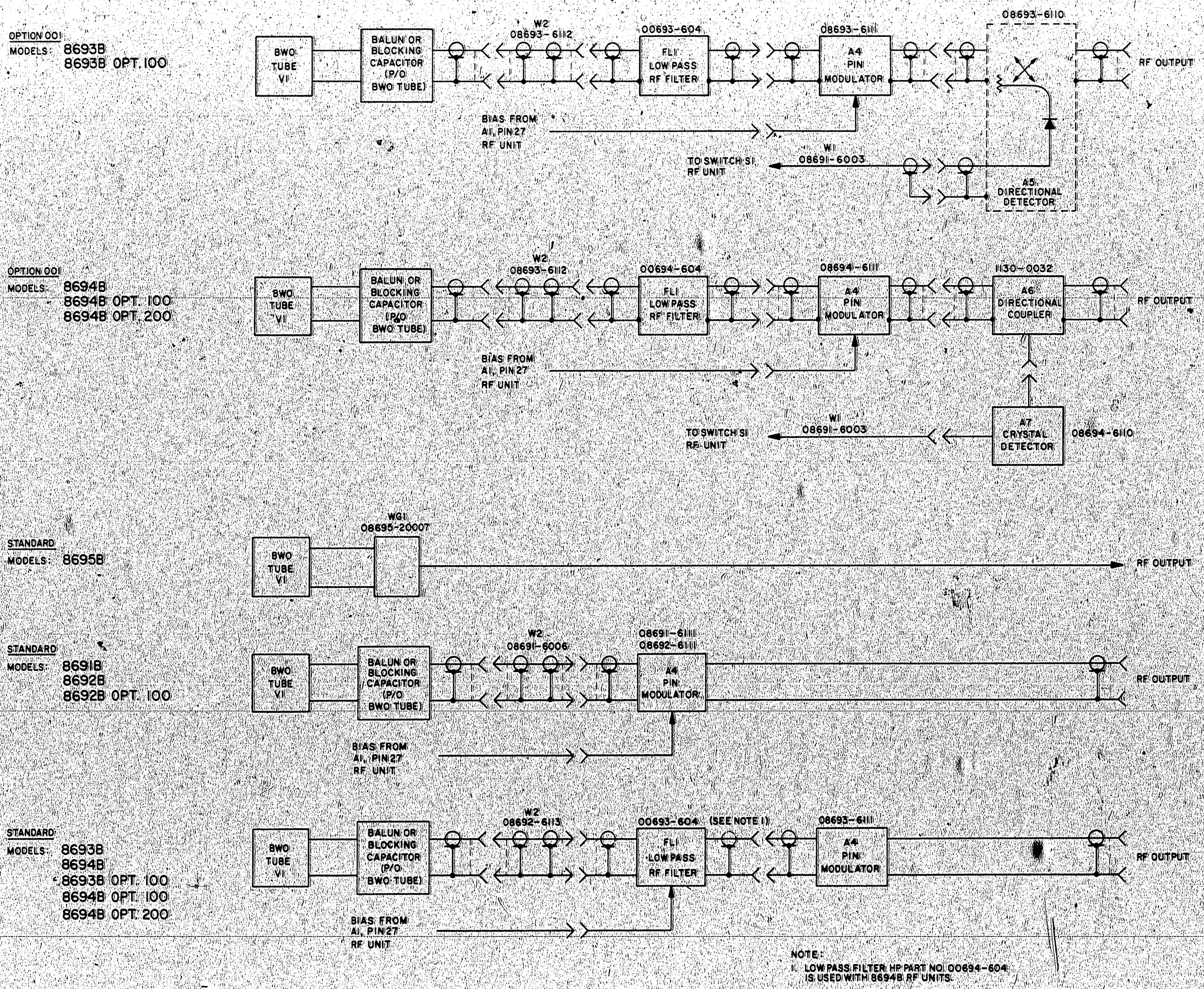


Figure 4-3. Output Configurations

BACK DATING MANUAL CHANGES

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
620-	F, E, D, C, B, A
636-	F, E, D, C
715-	F, E, D
720-	F, E
724-	F

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
728-	K, J, I, H, G
822	K, J, I, H
835	K, J, I
838	K, J
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: (cont'd)

Page 3-3, Table 3-3:
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: (cont'd) Page 4-3/4-4 , Figure 4-2:
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: (cont'd) Page 3-3, Table 3-3:

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: (cont'd)

Page 3-4 , Table 3-3:
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.

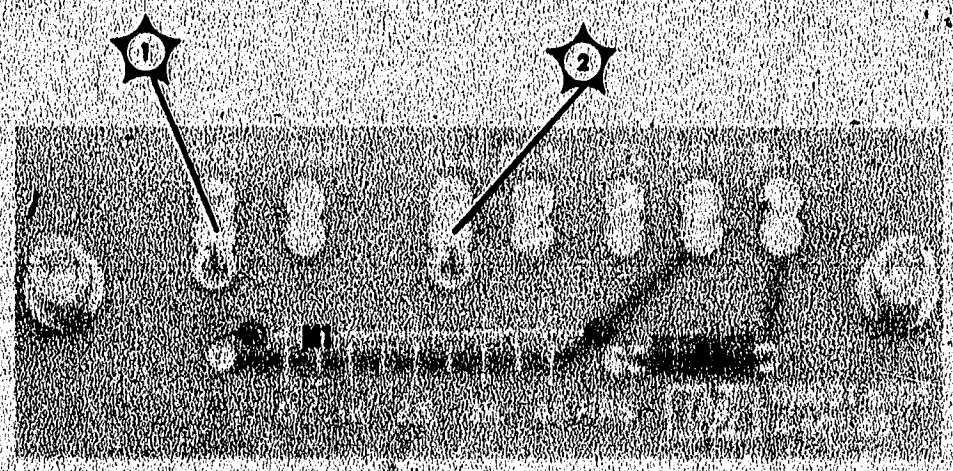
Page 3-11, Table 3-4:
Add: HP Part No. 0757-0401 R: FXD MET FLM 100 OHM 1% 1/8W; 28480, TQ 1.
Change Total quantity (TQ) of HP Part No. 1901-0033 to 4.

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: (cont'd) Delete the following below Table 1-1:

Residual FM specifications give peak deviation for modulating components within a 10 kHz bandwidth. Peak deviation may vary ±50% for a corresponding ±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.

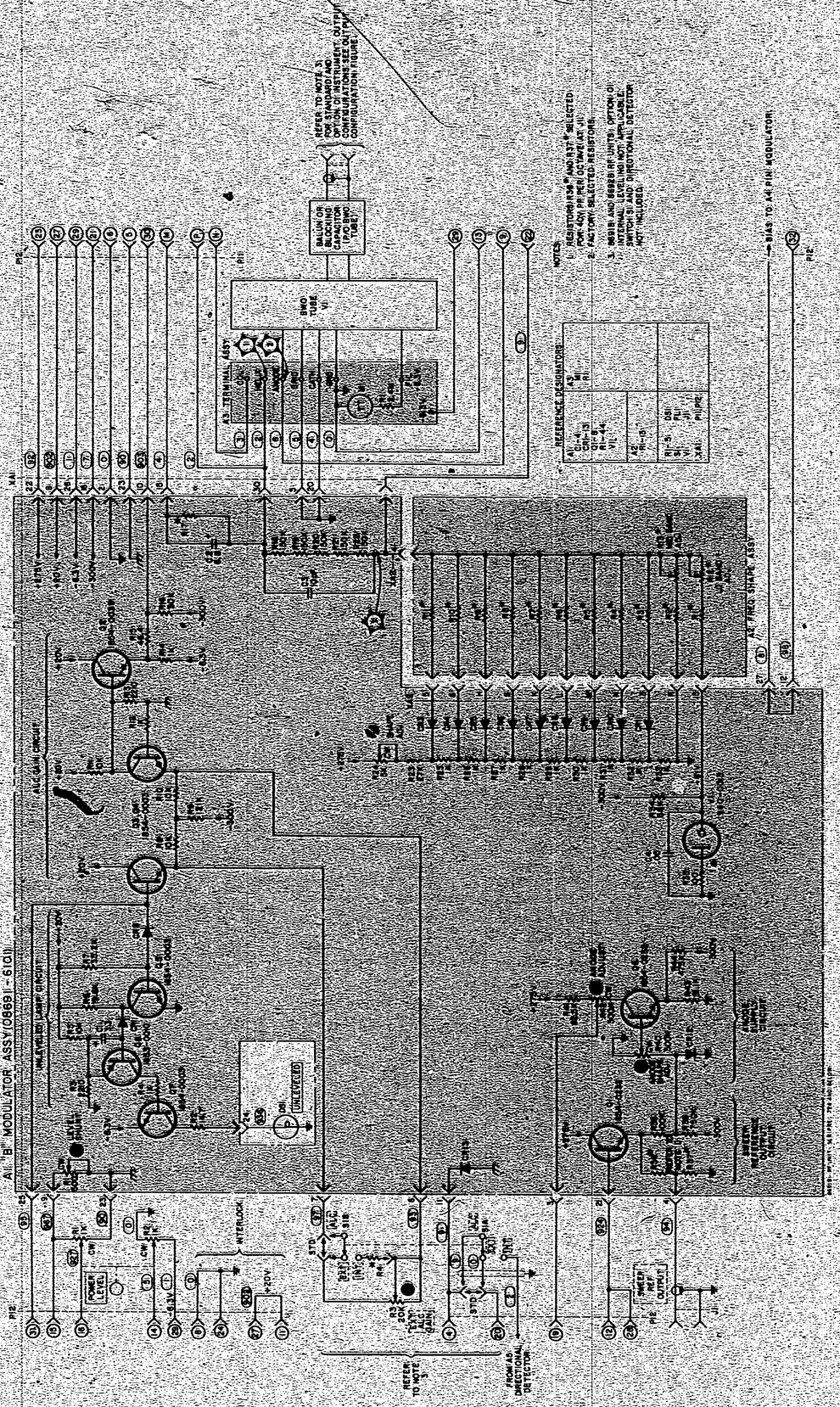


Figure 4-2. RF Unit for Serial Prefix 724 and Below

MANUAL SUPPLEMENT

OPTIONS

MANUAL SUPPLEMENT

RF UNIT
8694A/B
OPTION 300

USE THIS SUPPLEMENT WITH
MANUAL PART NO. 08691-90021
PRINTED NOVEMBER 1968
and
MANUAL PART NO. 08691-90022
PRINTED JUNE 1970

SUPPLEMENT
PART NO. 08694-90014

SEPTEMBER 1973

HEWLETT hp PACKARD

INTRODUCTION

This supplement describes the differences between the standard Model 8694A/B and the Model 8694A/B Option 300. In addition, this supplement describes the changes necessary to the 8694A Operating and Service Manual (08691-90021) or the 8694B Operating and Service Manual (08691-90022) to document Option 300.

DESCRIPTION

Option 300 for the 8694A/B is a Backward Wave Oscillator (BWO) that operates over the range 8 to 18 GHz. In all other respects and functions the Option 300 is the same as the standard 8694A/B.

MANUAL CHANGES FOR MODEL 8694A

Make the following manual changes to the Model 8694A Operating and Service Manual (08691-90021) to document Option 300.

Page 1-1, Table 1-1:
Delete Table 1-1 and add Table 1-1A.

Table 1-1A. Specifications (1 of 2)

8694A/OPTION 300 SPECIFICATIONS (Installed in the 8690B Mainframe)	
FREQUENCY	
Frequency Range:	8.0 to 18.0 GHz
Frequency Accuracy (at maximum leveled power):	
CW Mode	± 1%
All Sweep Modes	± 1%
Frequency Stability:	
With Temperature	.01%/°C
With 10% Line Voltage Change	± 10 MHz
With 10 dB Power Level Change (typ)	± 150 MHz
Residual FM peak (in 10 kHz bandwidth, CW Mode)	150 kHz
POWER OUTPUT	
Maximum Leveled Power (25°C):	
8.5 to 17.5 GHz	⩾ 15 mW
8 to 18 GHz	⩾ 10 mW
Power Variation: Externally Leveled (excluding detector/coupler variation)	± 0.3 dB
Spurious Signals (below fundamental at specified max power):	
Harmonics	20 dB
Non-Harmonics	40 dB
Residual AM: AM noise in 100 kHz bandwidth (below fundamental at max. power)	40 dB
Source VSWR: (50 ohm nominal impedance)	
Unleveled	⩽ 4.0:1

Table 1-1A. Specifications (2 of 2)

MODULATION

Internal AM: Square wave modulation continuously adjustable from 950 to 1050 Hz. On-Off ratio is 20 dB min.

External AM:
Bandwidth: dc to 50 kHz at maximum leveled power
Sensitivity: −10V reduces RF output level at least 25 dB below rated CW output.
Internal Impedance: Approximately 1000 ohms

Page 2-2, Table 2-2:
Add the following:

	Watkins-Johnson		Varian		
	Helix	Cathode	Helix	Cathode	Anode
8694A Option 300	4.0	12.0	30.0	40.0	15.0

Page 2-4, Table 2-3, step d:
Add the following:

RF Unit Model	Power Level, dBm
8694A Opt 300	⩾ 20 mW (8.5 to 17.5 GHz)
8694A Opt 300	⩾ 10 mW (8 to 18 GHz)

Page 2-5, Table 2-3:
Add the information in Table 2-3A.

Table 2-3A. Adjustments

Vdc at Test Point 4 8690A Assembly A4	Frequency (GHz) 8694A Option 300
73.00 ± 0.01	18.00
66.00 ± 0.01	17.00
59.00 ± 0.01	16.00
52.00 ± 0.01	15.00
45.00 ± 0.01	14.00
38.00 ± 0.01	13.00
31.00 ± 0.01	12.00
24.00 ± 0.01	11.00
17.00 ± 0.01	10.00
10.00 ± 0.01	9.00
3.00 ± 0.01	8.00

Page 3-2, Table 3-1:

Change A1R17 to A1R17*	0698-3147	R:FXD MET FLM 23.7K OHM 1% 1/2W. USED WITH WATKINS-JOHNSON BWO, HP PART NO. 1951-0089
A1R17*	0761-0021	R:FXD 1K OHM 5% 1W. USED WITH VARIAN BWO, HP PART NO. 1951-0090.
Change A1R36 to A1R36*	0698-3161	R:FXD MET FLM 38.3K OHM 1% 1/8W.

Page 3-3, Table 3-1:
Change to read as follows:

A2	08694-60011	ASSY: FREQUENCY SHAPING USED WITH WATKINS-JOHNSON BWO, HP PART NO. 1951-0089. FOR VARIAN BWO, SEE NEXT A2 LISTING
A2R1*	0757-0131	R:FXD 274K OHM 1% 1/2W
A2R2*	0757-0367	R:FXD 100K OHM 1% 1/2W
A2R3*	0757-0312	R:FXD 309K OHM 1% 1/2W
A2R4*	0757-0064	R:FXD 261K OHM 1% 1/2W
A2R5*	0757-0063	R:FXD 196K OHM 1% 1/2W
A2R6*	0757-0130	R:FXD 162K OHM 1% 1/2W
A2R7*	0698-3175	R:FXD 147K OHM 1% 1/2W
A2R8*	0757-0856	R:FXD 75K OHM 1% 1/2W
A2R9*	0757-0855	R:FXD 68.1K OHM 1% 1/2W
A2R10*	0698-3418	R:FXD 26.1K OHM 1% 1/2W
A2R11*	0757-0841	R:FXD 12.1K OHM 1% 1/2W
A2R12*	2100-0969	R:VAR 50K OHM 20% 3/4W
A2R13*	2100-0969	R:VAR 50K OHM 20% 3/4W
A2	08694-60012	ASSY: FREQUENCY SHAPING USED WITH VARIAN BWO, HP PART NO. 1951-0090. FOR WATKINS-JOHNSON BWO, SEE PREVIOUS A2 LISTING
A2R1*	0757-0133	R:FXD 383K OHM 1% 1/2W
A2R2*	0689-3175	R:FXD 147K OHM 1% 1/2W
A2R3*	0757-0135	R:FXD 511K OHM 1% 1/2W
A2R4*	0757-0195	R:FXD 348K OHM 1% 1/2W
A2R5*	0757-0195	R:FXD 348K OHM 1% 1/2W
A2R6*	0757-0195	R:FXD 348K OHM 1% 1/2W
A2R7*	0698-3175	R:FXD 147K OHM 1% 1/2W
A2R8*	0757-0130	R:FXD 162K OHM 1% 1/2W
A2R9*	0757-0859	R:FXD 110K OHM 1% 1/2W
A2R10*	0698-4943	R:FXD 73.2K OHM 1% 1/2W
A2R11*	0698-4039	R:FXD 52.3K OHM 1% 1/2W
A2R12*	2100-0969	R:VAR 50K OHM 5%
A2R13*	2100-0969	R:VAR 50K OHM 5%

Page 3-5, Table 3-1:

Change V1 to V1	1951-0090	ELECTRON TUBE: BWO VARIAN ASSOCIATES
V1	1951-0089	ELECTRON TUBE: BWO WATKINS-JOHNSON

Page 3-6, Table 3-1:

Delete all SCALE references and ADD:

08694-20123. SCALE: 8 to 18 GHz

Add the following:

08694-60013	CONNECTOR ASSY: TYPE N (NOT IN OPTION 005)	
	CONSISTS OF:	
1250-0915	CONTACT: TYPE N FEMALE	
2190-0493	WASHER: FLAT #10 STL CP	
5040-0306	INSULATOR	
08555-20093	CONTACT: FEMALE TYPE N TO FEMALE SMA	
08555-20094	CONNECTOR BODY: BULKHEAD SMA	
08745-20061	CONNECTOR BODY: FEMALE TYPE N	
08761-2027	INSULATOR	
08694-60014	CONNECTOR ASSEMBLY: APC-7	
	CONSISTS OF:	
1250-0816	CONTACT: APC-7	
2190-0493	WASHER: FLAT #10 STL CP	
5040-0306	INSULATOR	
08555-20093	CONTACT: APC-7 TO FEMALE SMA	
08555-20094	CONNECTOR BODY: BULKHEAD SMA	
08745-2047	CONNECTOR BODY: APC-7	
08761-2027	INSULATOR	
1250-0083	CONNECTOR: BNC (SWEEP REF OUTPUT)	
08694-00132	PANEL: FRONT (STANDARD) MINT GRAY	
08694-00133	PANEL: FRONT (OPTION 004) MINT GRAY	
08694-20115	CABLE: COAX (OUTPUT) NOT USED IN OPTION 004	
08694-20116	CABLE: COAX (OUTPUT) OPTION 004	
08694-20114	PANEL: REAR (STANDARD) MINT GRAY	
08691-2003	HANDLE: REAR	
08691-2005	PIVOT: HANDLE	
08691-40005	LATCH: HANDLE	
08691-6118	TRIM: HANDLE BLACK	

MANUAL CHANGES FOR MODEL 8694B

Make the following manual changes to the Model 8694B Operating and Service Manual (08691-90022) to incorporate the Model 8694B Option 300:

Page 1-2, Table 1-1:

Delete Table 1-1 and add Table 1-1B:

Figure 1-1B. Specifications (1 of 2)

8694B/OPTION 300 SPECIFICATIONS (Installed in the 8690B Mainframe)	
FREQUENCY	
Frequency Range:	8.0 to 18.0 GHz
Frequency Accuracy (at maximum leveled power):	
CW Mode	± 1%
All Sweep Modes	± 1%
Frequency Stability:	
With Temperature	.01%/°C
With 10% Line Voltage Change	±10 MHz
With 10 dB Power Level Change (typ)	±1 MHz
Residual FM peak (in 10 kHz bandwidth, CW Mode)	<50 kHz

Table 1-1B. Specifications (2 of 2)

POWER OUTPUT	
Maximum Leveled Power (25°C):	
8.5 to 17.5 GHz	⩾ 7.5 mW
8 to 18 GHz	⩾ 5 mW
Power Variation: Externally Leveled (excluding detector/coupler variation)	± 0.3 dB
Spurious Signals (below fundamental at specified max power)	
Harmonics:	20 dB
Non-Harmonics:	40 dB
Residual AM: AM noise in 100 kHz bandwidth (below fundamental at max power)	40 dB
Source VSWR: (50 ohm nominal impedance)	
Unleveled	⩽ 4.0:1
MODULATION	
Internal AM: Square wave modulation continuously adjustable from 950 to 1050 Hz. On-Off ratio is 20 dB min.	
External AM:	
Bandwidth: dc to 50 kHz at maximum leveled power	
Sensitivity: −10V reduces RF output level at least 25 dB below rated CW output	
Internal Impedance: Approximately 1000 ohms	

Page 2-3, Table 2-2:
Add the following

RF Unit Model	Watkins-Johnson		Varian		
	Helix	Cathode	Helix	Cathode	Anode
8694B Option 300	4.0	12.0	30.0	40.0	15.0

Page 2-4, Table 2-3, step d:
Add the following

RF Unit Model	Power Level, dBm
8694B Opt 300	⩾ 7.5 mW (8.5 to 17.5 GHz)
8694B Opt 300	⩾ 5 mW (8 to 18 GHz)

Page 2-11, Table 2-4:
Delete Table 2-4 and add Table 2-4A.

Table 2-4A. Helix Voltage Shaping Adjustment Sequence

Vdc at Test Point 4 8690 Assembly A4	Frequency (GHz) 8694B Option 300
73.00 ± 0.01	18.00
66.00 ± 0.01	17.00
59.00 ± 0.01	16.00
52.00 ± 0.01	15.00
45.00 ± 0.01	14.00
38.00 ± 0.01	13.00
31.00 ± 0.01	12.00
24.00 ± 0.01	11.00
17.00 ± 0.01	10.00
10.00 ± 0.01	9.00
3.00 ± 0.01	8.00

Page 3-1, Table 3-1.
Add the following

RF Unit Model	BWO Tube (VI)	BWO Manufacturer	Shaping Board Assembly	Helix Overcurrent Shunt Resistor
8694B Opt 300	1951-0089	Watkins-Johnson	08694-60011	28.7K ohm
8694 Opt 300	1951-0090	Varian Associates	08694-60012	82.5K ohm

Page 3-3, Table 3-3:

Change A1R17 to A1R17*	0698-3417	R:FXD MET FLM 23.7K OHM 1% 1/2W. USED WITH WATKINS-JOHNSON BWO
A1R17*	0761-0021	R:FXD 1K OHM 5% 1W. USED WITH VARIAN BWO, HP PART NO. 1951-0090

Page 3-4, Table 3-3:

Change A1R37 to A1R37*	0757-0463	R:FXD MET FLM 38.3K OHM 1% 1/8W.

Page 3-6, Table 3-3:
Change to read as follows:

A2	08694-60011	ASSY-FREQUENCY SHAPING USED WITH WATKINS-JOHNSON BWO, HP PART NO. 1951-0089. FOR VARIAN BWO, SEE FOLLOWING A2 LISTING
A2R1*	0757-0131	R:FXD 274K OHM 1% 1/2W
A2R2*	0757-0367	R:FXD 100K OHM 1% 1/2W
A2R3*	0757-0312	R:FXD 309K OHM 1% 1/2W
A2R4*	0757-0064	R:FXD 261K OHM 1% 1/2W
A2R5*	0757-0063	R:FXD 196K OHM 1% 1/2W

Page 3-6, Table 3-3 (cont'd):

A2R6*	0757-0130	R:FXD 162K OHM 1% 1/2W
A2R7*	0698-3175	R:FXD 147K OHM 1% 1/2W
A2R8*	0757-0856	R:FXD 75K OHM 1% 1/2W
A2R9*	0757-0855	R:FXD 68.1K OHM 1% 1/2W
A2R10*	0698-3418	R:FXD 26.1K OHM 1% 1/2W
A2R11*	0757-0841	R:FXD 12.1K OHM 1% 1/2W
A2R12*	2100-0969	R:FXD 50K OHM 20% 3/4W
A2R13*	2100-0969	R:FXD 50K OHM 20% 3/4W

Page 3-7, Table 3-3:
Change to read as follows:

A2	08694-90012	ASSY:FREQUENCY SHAPING USED WITH VARIAN BWO, HP PART NO. 1951-0090 FOR WATKINS-JOHNSON BWO, SEE PREVIOUS A2 LISTING
A2R1*	0757-0133	R:FXD 383K OHM 1% 1/2W
A2R2*	0689-3175	R:FXD 147K OHM 1% 1/2W
A2R3*	0757-0135	R:FXD 511K OHM 1% 1/2W
A2R4*	0757-0195	R:FXD 348K OHM 1% 1/2W
A2R5*	0757-0195	R:FXD 348K OHM 1% 1/2W
A2R6*	0757-0195	R:FXD 348K OHM 1% 1/2W
A2R7*	0698-3175	R:FXD 147K OHM 1% 1/2W
A2R8*	0757-0130	R:FXD 162K OHM 1% 1/2W
A2R9*	0757-0859	R:FXD 110K OHM 1% 1/2W
A2R10*	0698-4943	R:FXD 73.2K OHM 1% 1/2W
A2R11*	0698-4039	R:FXD 52.3K OHM 1% 1/2W
A2R12*	2100-0969	R:VAR 50K OHM 5%
A2R13*	2100-0969	R:VAR 50K OHM 5%

Page 3-9, Table 3-3:
Change V1 to

V1	1951-0090	ELECTRON TUBE:BWO VARIAN ASSOCIATES
V1	1951-0089	ELECTRON TUBE:BWO WATKINS-JOHNSON

Page 3-10, Table 3-3:
Delete all SCALE references and add

08694-20123	SCALE: 8.0 to 18.0 GHz

Add the following:

08694-60013	CONNECTOR ASSY: TYPE N (NOT IN OPTION 00! CONSISTS OF:
1250-0915	CONTACT; TYPE N FEMALE
2190-0493	WASHER: FLAT #10 STL CP
5040-0306	INSULATOR
08555-20093	CONTACT: FEMALE TYPE N TO FEMALE SMA
08555-20094	CONNECTOR BODY: BULKHEAD SMA
08745-20061	CONNECTOR BODY: FEMALE TYPE N
08761-2027	INSULATOR

Page 3-10, Table 3-3 (cont'd):

08694-60014	CONNECTOR ASSEMBLY: APC-7
	CONSISTS OF:
1250-0816	CONTACT: APC-7
2190-0493	WASHER: FLAT #10 STL CP
5040-0306	INSULATOR
08555-20093	CONTACT: APC-7 TO FEMALE SMA
08555-20094	CONNECTOR BODY: BULKHEAD SMA
08745-2047	CONNECTOR BODY: APC-7
08761-2027	INSULATOR
1250-0083	CONNECTOR: BNC (SWEEP REF OUTPUT)
08694-00132	PANEL: FRONT (STANDARD) MINT GRAY
08694-00133	PANEL: FRONT (OPTION 004) MINT GRAY
08694-20115	CABLE: COAX (OUTPUT) NOT USED IN OPTION 004
08694-20116	CABLE: COAX (OUTPUT) OPTION 004
08694-20114	PANEL: READ (STANDARD) MINT GRAY
08691-2003	HANDLE: REAR
08691-2005	PIVOT: HANDLE
08691-20116	HOUSING: PLASTIC
08691-40005	LATCH: HANDLE
08691-6118	TRIM: HANDLE BLACK

SERVICE NOTES

SERVICE NOTE

None

HP MODEL 8692-4A/B RF UNITS
EXCEPT 8693B AND H01-8693B
All Serials

INSTALLATION OF SHUNT TUBE MODULATOR KIT
HP PART NO. 08691-6119

This Service Note outlines the procedure to install Shunt Tube Modulator Kit 08691-6119 in the following RF Units:

8692A with Watkins-Johnson BWO
8692B with Watkins-Johnson BWO
8693A with Watkins-Johnson BWO
8694A with Watkins-Johnson BWO
8694B with Watkins-Johnson BWO
8694B with Varian BWO

Installation of this kit enables the instrument to be phase locked to an external synchronizer such as the HP Model 8709A, 2650A, or 2654A Oscillator Synchronizer.

Recalibration will be required according to the procedure at the end of this Service Note.

PARTS SUPPLIED IN SHUNT TUBE MODULATOR KIT, HP PART NO. 08691-6119

Description	Quantity	HP Part Number
Board Assembly	1	08691-6107
Cable, dc	1	08691-6109
Cable, Input	1	08691-6108
6:32 x 3/8 Screws	4	2360-0117
6:32 x 1/2 Screw	4	2360-0121
Pot, ALC Gain	1	2100-1816
Cable Clamp, 1/2"	1	1400-0025
Cable Clamp, 1/4"	3	1400-0024
Connector, BNC Female	1	1250-00[illegible]
Ground Lug 3/8"	1	0360-1190

Description	Quantity	HP Part Number
Nut, 6:32 x 5/16 w/lockwasher	4	2420-0001
Washer, flat No. 6 x 5/16	4	3050-0066
Nut, 3/8:32 x 7/16	1	2950-0043
Washer, Lock 3/8	1	2190-0016
Red No. 22 3 kV insulated wire	10-1/2"	8150-0098
6:32 x 3/8" Screws	4	2360-0118
6:32 x 1/2" Screws	3	2360-0122
Service Note 8692-4A/B-1	1	

MS/mh

Customer Service • 333 Logue Avenue, Mountain View, California 94040. Tel. (415) 968-9200
Europe: 54 Route Des Acacias, Geneva, Switzerland. Cable: "HEWPACKSA" Tel. (022) 42.81.50

7/68-4

HEWLETT hp PACKARD

INSTALLATION INSTRUCTIONS

1. Remove assemblies A1 and A2.

2. Drill four new mounting holes as shown in Figure 1.

3. Drill a 3/8" hole in rear panel as shown in Figure 2.

4. Mount the BNC connector and large ground lug with lock washer on rear panel in the 3/8" hole.

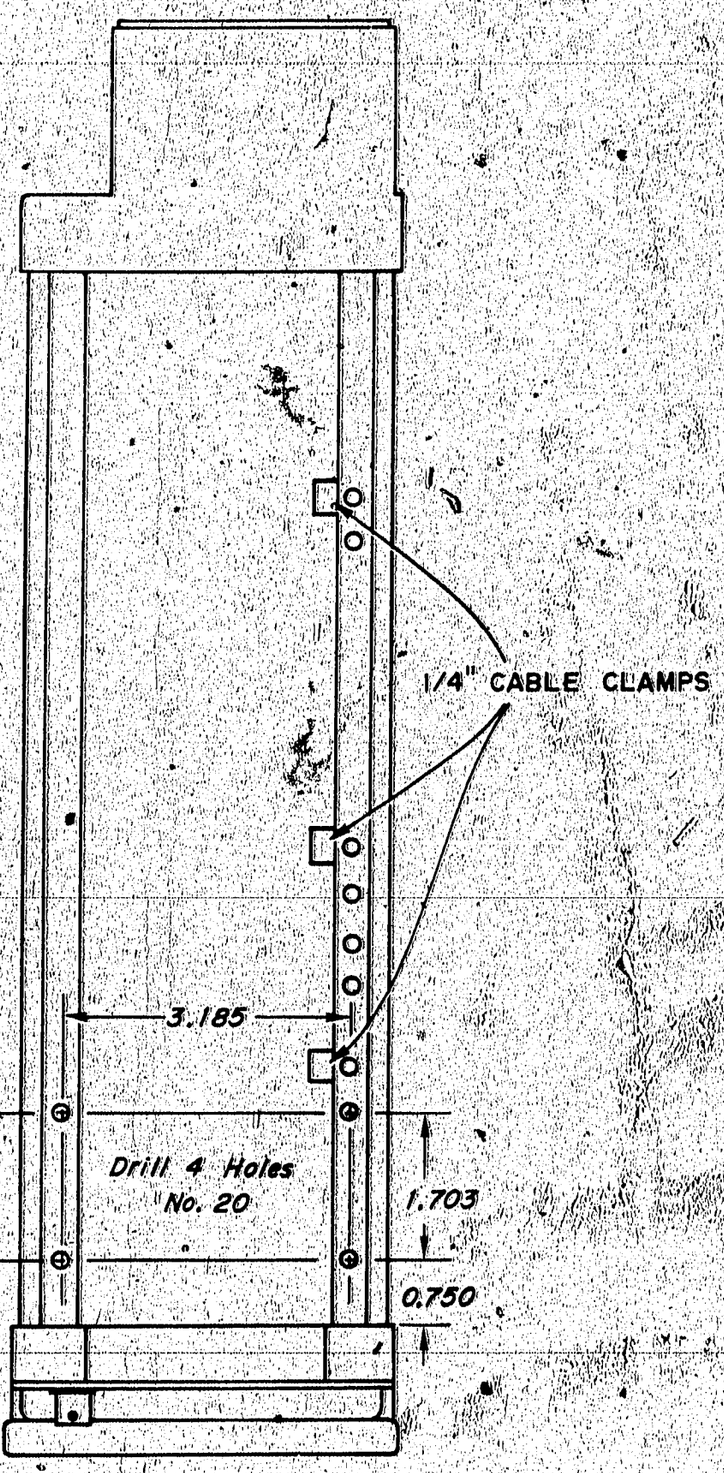


Figure 1. 8692A/B - 8694A/B Shunt Modulator Installation. Bottom View of RF Unit

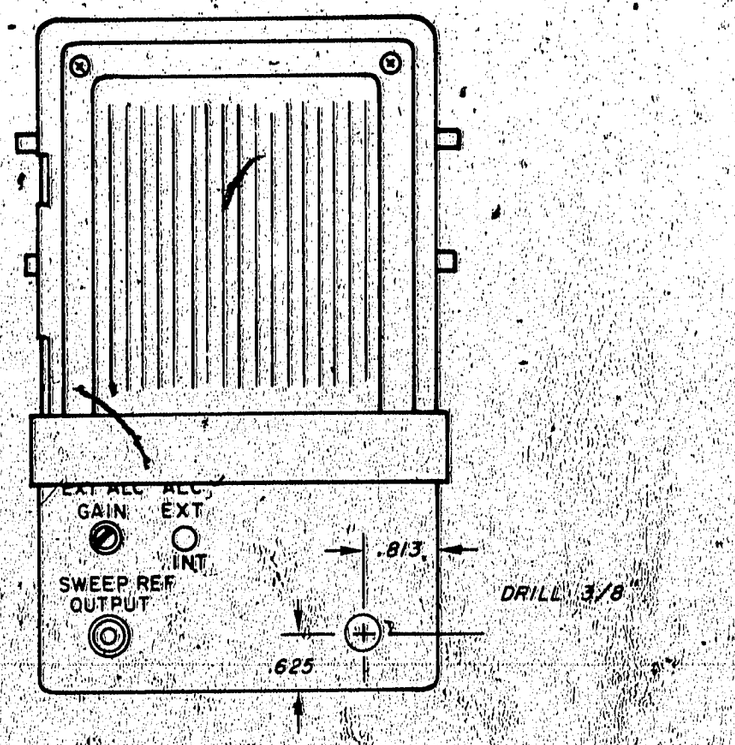


Figure 2. 8692A/B - 8694A/B Shunt Modulator Installation. Rear View of RF Unit

5. Make a sketch of the connections to the ALC gain pot.

6. Cut the two leads connected to the ALC gain pot and remove the pot.

7. Mount the new pot (in kit) with the old hardware in the same position as the old pot.

8. Reconnect the two leads to the new pot according to the sketch drawn in step 5.

9. Mount the modulator board assembly with Tube V1 and the large capacitor toward rear of instrument. Use four 6-32 x 3/8" screws. (Use panhead or flathead screws as required.)

10. With the 1/2" cable clamp, clamp the BWO leads to the BWO mounting plate using the upper hole on the rear of the plate. Use 6-32 x 1/2" screw, flat washer, and nut/lockwasher. (Use panhead or flathead screws as required.)

11. Route the new wiring harness along the lower left frame rail from the new board to the front of the instrument. Install three 1/4" cable clamps as shown in Figure 1 to hold the harness in place. Use 6-32 x 1/2" screws, flat washers, and nut/lockwasher.

12. Unsolder the red (helix) lead from the A3 BWO Terminal Board.

13. Connect the new red lead from the "BWO" terminal of the Shunt Tube Modulator Board to the helix (red) terminal on the A3 BWO Terminal Board.

14. Remove the red lead that connected the BWO to pin P of P11 from P11. Pull the red lead out of the harness and discard it.

15. Connect the red lead in the new wiring harness from the "Supply" terminal of the new board to pin P of P11.

16. Connect all other leads as shown in Figure 3.

17. Replace assemblies A1 and A2.

18. Connect the shielded cable from the rear panel BNC connector to the "Input" terminal of the new board. Connect the shield (black lead) to the ground lug on rear panel.

19. With an ohmmeter preset potentiometer R8 on the new board to the following value:

    8692 - 2 kΩ

    8693 - 5 kΩ

    8694 - 5 kΩ

20. This completes the modification procedure. Follow the Operation and Adjustment Procedure included in this Service Note. Finally, readjust the helix shaping (frequency accuracy) according to the procedure in the Operating and Service Manual, Section II, Table 2-3.

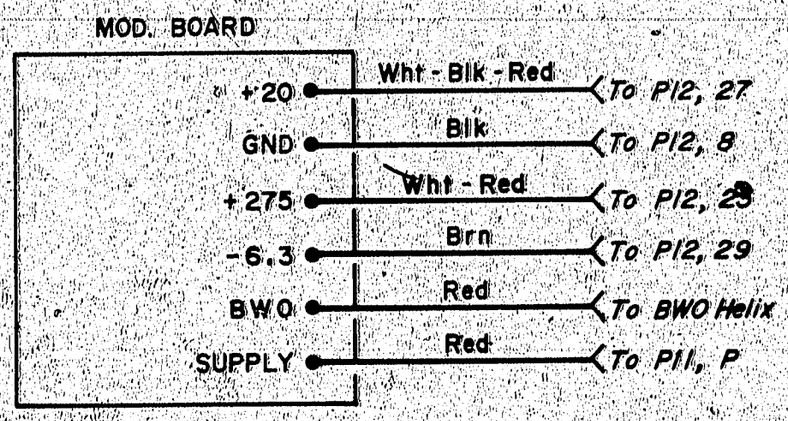


Figure 3. 8692A/B - 8694A/B Shunt Modulator Board Connections

OPERATION AND ADJUSTMENT PROCEDURE

8690 SERIES RF UNITS WITH SHUNT TUBE MODULATOR MODIFICATION INSTALLED

INTRODUCTION

This instrument can be used with the HP Model 8709A, 2650A, or 2654A Oscillator Synchronizer. When used with the 8709A and when using a 5105A/5110B Synthesizer as a frequency reference, the phase noise sidebands can usually be reduced by installing the external circuit shown in Figure 1.

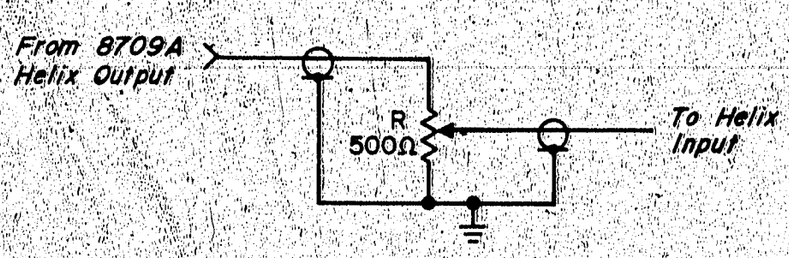


Figure 1. External Network for Use with 5105A/5110B Synthesizer

THEORY OF OPERATION

This instrument employs a shunt tube modulator to couple a synchronizer to the BWO helix and helix power supply. The error signal from the Oscillator Synchronizer is applied to the HELIX INPUT jack. The RC (R1, C1) filter at the input limits the response to high frequency (above 5 MHz) signals.

The signal is attenuated by the 20:1 divider (R2 and R3) and applied to the amplifier (V1) control grid. V1 is cathode biased by R4, CR1, and CR2. The cathode voltage is approximately +1.5 V.

The signal is attenuated by the plate load resistor R7. R8 is variable so that the modulation sensitivity can be adjusted. R8 is set for a modulation sensitivity of approximately 1.25 MHz/V for the 8691 and 8692, 7 MHz/V for the 8693-8694, and 6 MHz/V for the 8695-8697 at the low frequency end of the band.

The zener diode (CR3) sets the bias for emitter follower (Q1). The LC network (L1 and C6) provides additional power supply filtering.

PHASE LOCK OPERATION

Before inserting the RF unit into the Sweep Oscillator Main Frame, the slide switch on the shunt tube modulator printed circuit board must be set to the PHASE LOCK position. Do not attempt to change the position of this switch while the instrument is operating.

It may be necessary in some systems to make minor adjustments to the trimmer, C3, on the modulator board assembly. One method of adjusting this for a particular system is to apply a square wave modulating signal to the reference oscillator FM input. The amplitude of the square wave depends on the FM sensitivity of the particular reference oscillator used. Proceed as follows: With the system phase locked, connect a square wave generator to the FM input of the 8466 Reference Oscillator. Set the amplitude to minimum and frequency to 20 kHz. Connect an oscilloscope with good high frequency response such as the HP Model 140A to the servo output of the 8709A Synchronizer. Slowly increase the output from the square wave generator until the system breaks lock. Reduce the square wave generator output until the system relocks. With the square wave generator at this amplitude, adjust C3 on the modulator assembly for minimum ringing and/or overshoot.

NORMAL OPERATION

This instrument can be used as a standard 8690 series RF unit by setting the slide switch on the modulator assembly opposite the phase lock position. In this position the filter network is switched out of the circuit. Phase locking should not be attempted with the switch in this position.

OUT OF SYSTEM ADJUSTMENTS

Out of system adjustments must be made with the modified RF unit in an 8690A Sweep Oscillator. Remove the top and bottom covers from the 8690A Sweep Oscillator. Proceed as follows:

GAIN ADJUSTMENT

1. Adjust an audio oscillator to 50 Hz and 10 V peak-to-peak and then connect the equipment shown in Figure 2.

2. With the Sweep Oscillator set to the low frequency end of the band, observe the detected waveform on the oscilloscope. Slowly move the wavemeter through the operating frequency range of the Sweep Oscillator. The wavemeter pip should be visible on the oscilloscope. Set the wavemeter pip to one end of the sweep and record the frequency f1. Set the pip to the other end of the sweep and record frequency f2. Take the difference between f1 and f2. This should be 10-15 MHz for the 8691 and 8692, 22-28 MHz for the 8693 and 8694, and 55-65 MHz for Models 8695 through 8697. If not, adjust R8 on the modulator board.

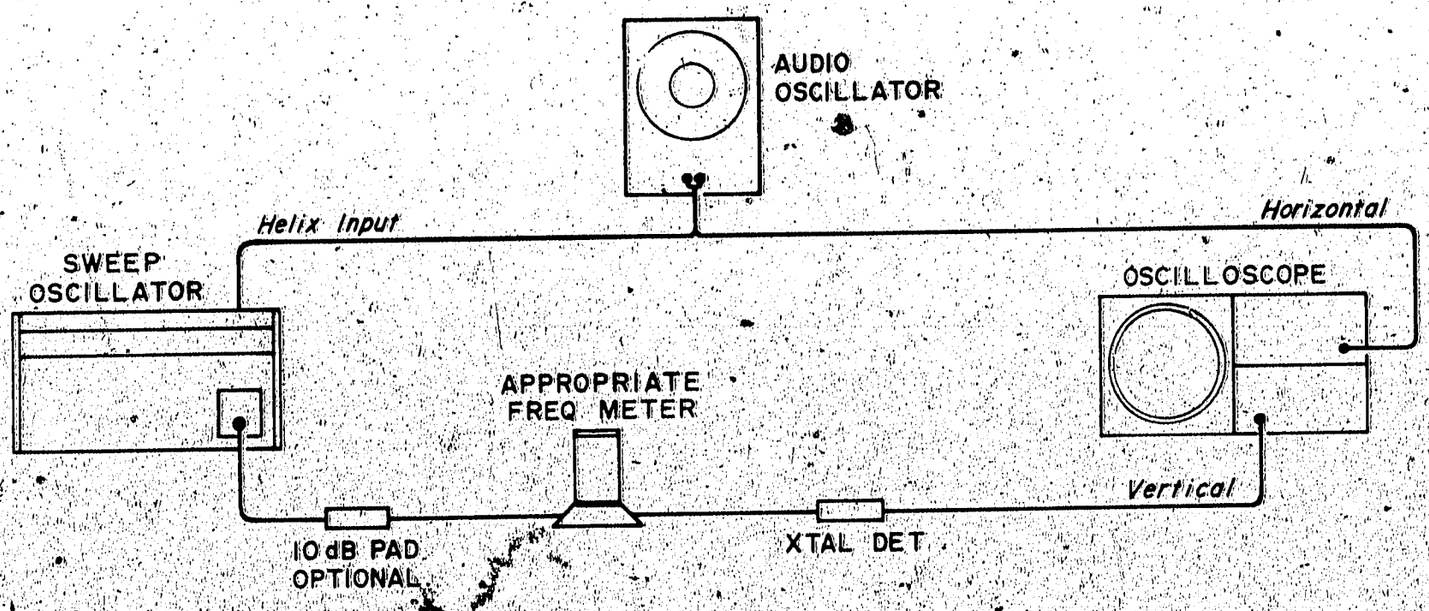


Figure 2. Test Setup for Gain Adjustment

FREQUENCY RESPONSE

1. Connect the equipment as shown in Figure 3.

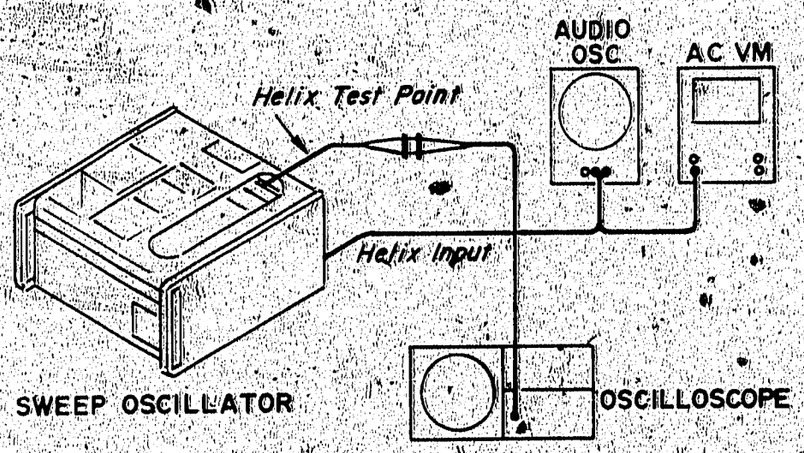


Figure 3. Test Setup for Frequency Response Adjustment

2. Set the audio oscillator output to approximately 2V RMS at 50 Hz.
3. Note the amplitude of the oscilloscope display.
4. Increase the frequency of the audio oscillator to 600 kHz. Using the ac voltmeter, reset the amplitude to the same level as in step 2. The oscilloscope display should be of the same amplitude as in step 3. If not, adjust C3 on the modulator assembly.
5. After completing adjustment of the shunt tube modulator board, re-check RF unit frequency accuracy as described in Table 2-3 of the Operating and Service Manual.

This completes the calibration procedure for the shunt tube modulator. For further adjustments in a particular system, refer to the paragraph on PHASE LOCK OPERATION.

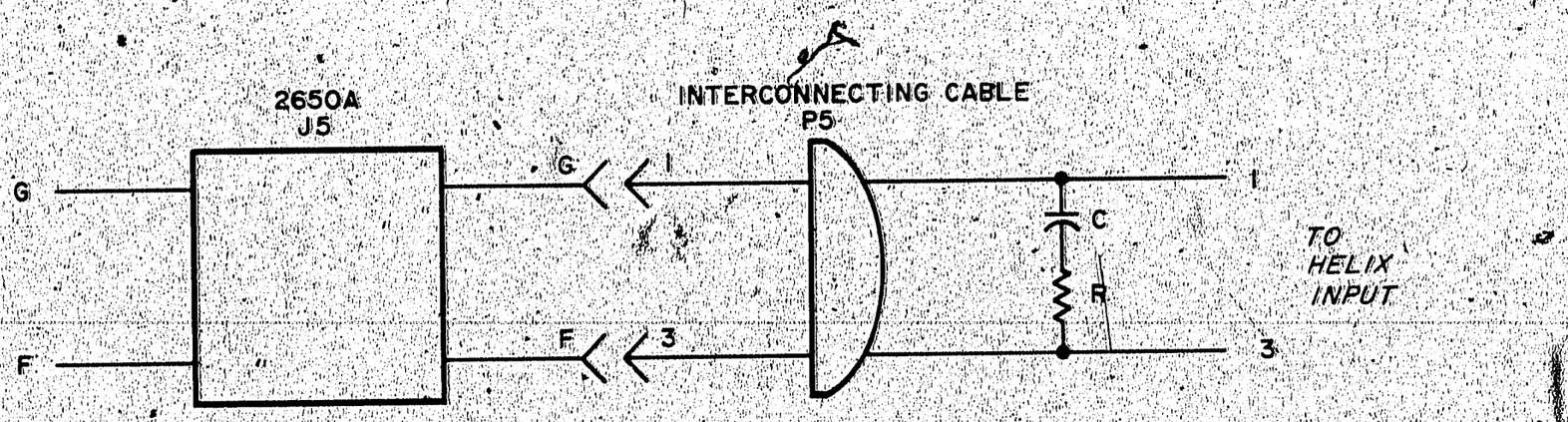
REPLACEABLE PARTS LIST

	SHUNT TUBE MODULATOR BOARD	
C1	Capacitor, fixed 12 pF	0140-0201
C2	Capacitor, fixed 3 pF	0160-2244
C3	Capacitor, variable 9-35 pF	0121-0046
C4	Capacitor, fixed 120 pF	0140-0216
C5	Capacitor, fixed .33 μF 35V	0180-0195
C6	Capacitor, fixed .25 μF 2000V	0169-0004
CR1, CR2	Diode, silicon	1901-0033
CR3	Diode, zener, 6.19V .4W	1902-0049
L1	Coil, fixed 10 mh	9140-0131
Q1	Transistor, silicon, NPN	1854-0039
R1	Resistor, fixed, 1.96K, 1/8W	0698-0083
R2	Resistor, fixed, 511K, 1/8W	0757-0482
R3	Resistor, fixed, 28.7K, 1/8W	0698-3449
R4	Resistor, fixed, 1.96K, 1/8W	0698-0083
R5	Resistor, fixed, 19.6K, 1/2W	0698-3415
R6	Resistor, fixed, 56K, 1W	0761-0032
R7	Resistor, fixed, 47K, 2W	0764-0031
R8	Resistor, variable, 10K	2100-1776
S1	Switch, DPDT	3101-0070
V1	Tube, electron 7234	1923-0073

OPERATING NOTES:

1. Output frequency should be tuned below midband before switching 8690A/B line switch to the RF position. Otherwise, the initial current surge drawn by the shunt tube modulator assembly may actuate the helix overcurrent relay in the 8690A/B mainframe.

2. When operating with the HP Model 2650A some difficulty may be experienced in adjusting gain adjust R8 for optimum phase lock at both ends of the band without loop oscillation. In this case it may be necessary to add an RC Filter to the cable connecting J5 of the 2605A to the RF unit helix input. This filter can be mounted on the back of plug P5 as shown below.



C = 0.0082 μf 200 WVDC
R = 30-500Ω 1/2W
(Selected for Optimum Phase Lock without Oscillation)

Figure 5. Optional Filter Network When Operating With HP Model 2650A Synchronizer

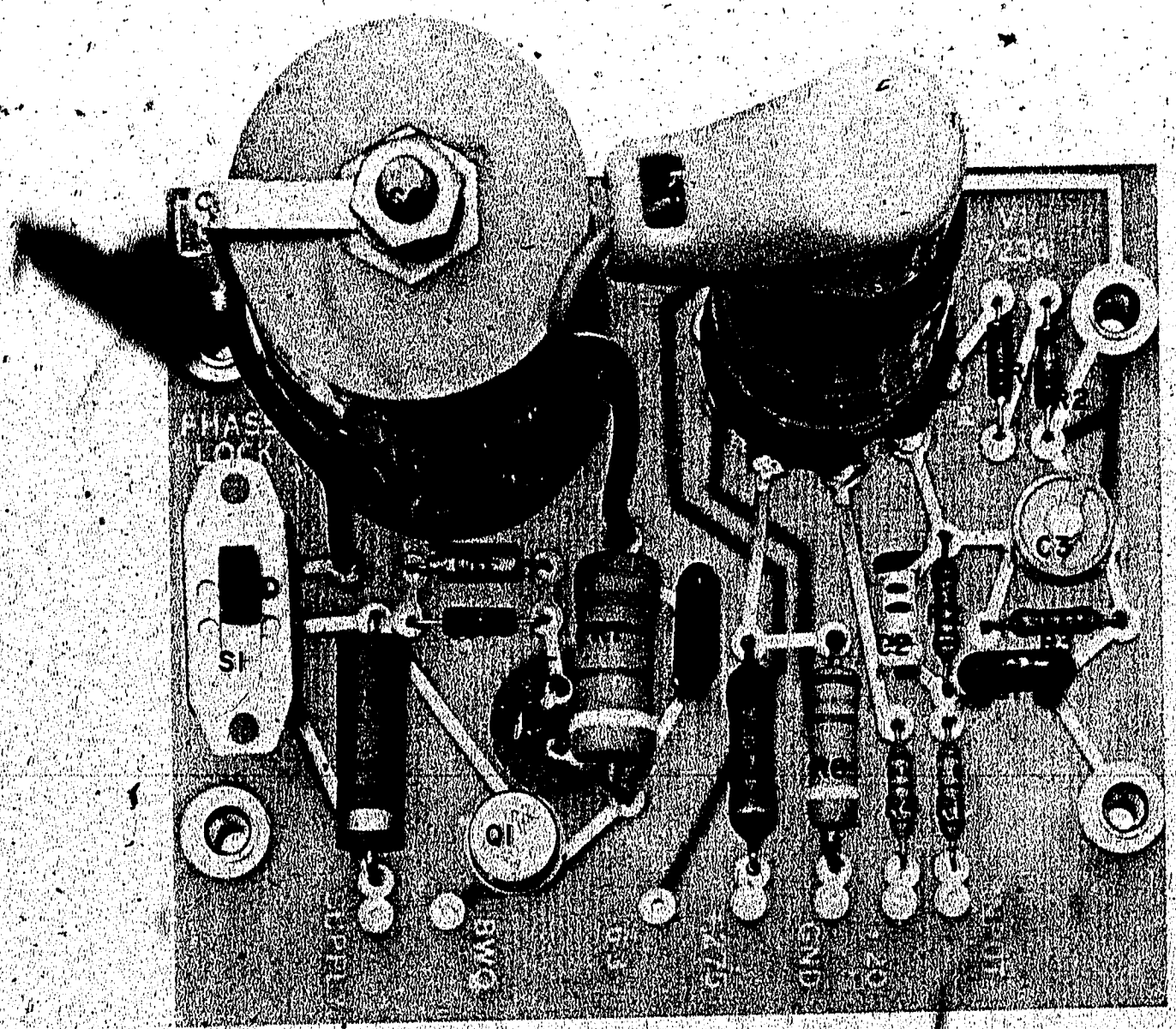


Figure 5. Shunt Tube Modulator Board Component Identification.

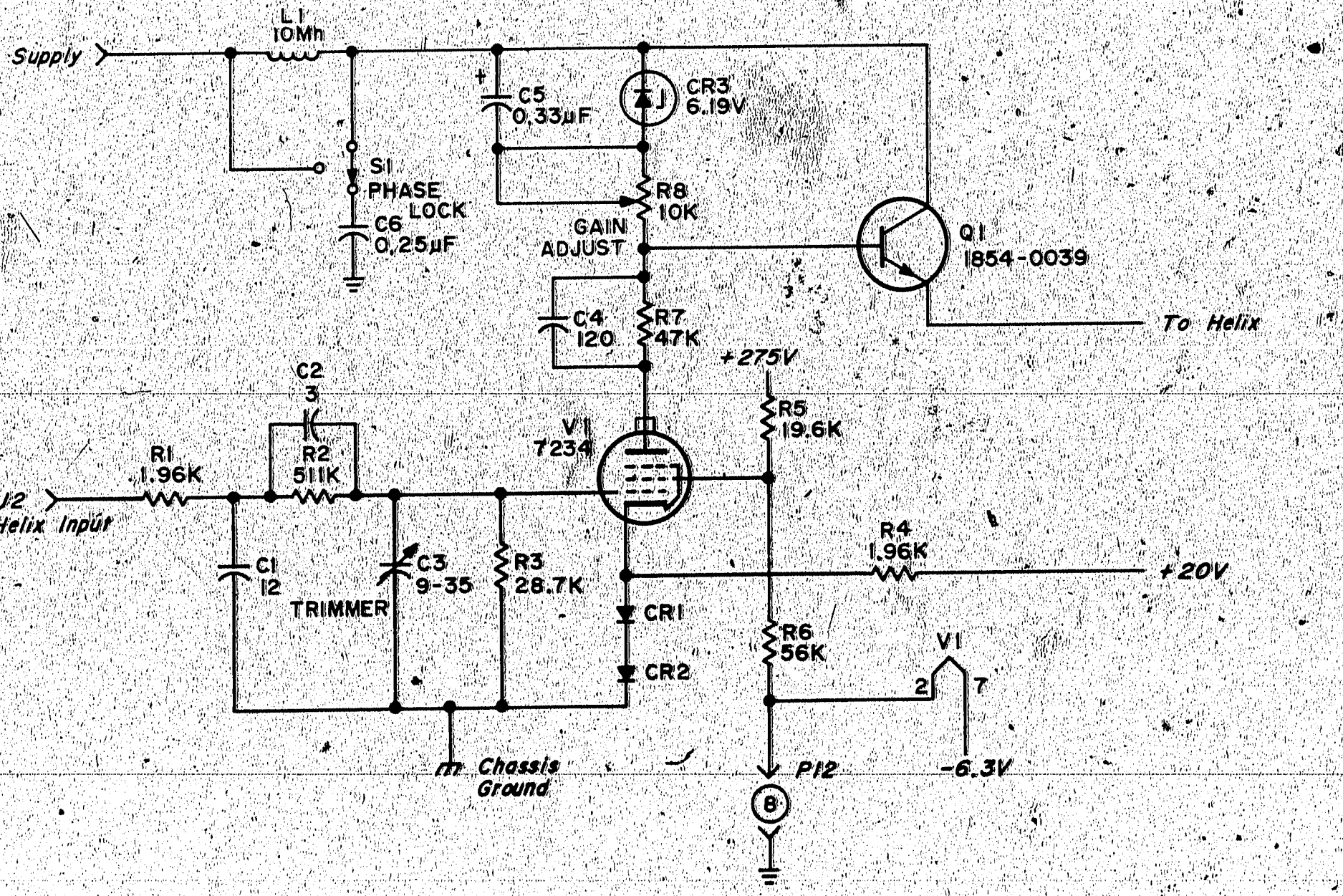


Figure 6. Shunt Tube Modulator Schematic

Series

8693B-1

SERVICE NOTE

SUPERSEDES:
None

HP MODEL 8693B RF UNITS WITH VARIAN BWO's

INSTALLATION OF SHUNT TUBE MODULATOR KIT 08695-6104 AND ADAPTER KIT 08693-6117

This Service Note outlines the procedure for installing Shunt Tube Modulator Kit 08695-6104 and Adapter Kit 08693-6117 in only those Model 8693B RF Units containing Varian backward wave oscillator tubes. In this case, Service Note 8692-4A/B included in the kit should be ignored.

Installation of these kits enables the instrument to be phase locked to an external synchronizer such as the HP Model 8709A, 2650A, or 2654A Oscillator Synchronizer.

Recalibration will be required according to the procedure at the end of this Service Note.

PARTS SUPPLIED IN SHUNT TUBE MODULATOR KIT HP PART NO. 08695-6104

Description	Qty.	HP Part No.
Board, Modulator Assy.	1	08691-6107
Harness, Wiring dc	1	08695-6102
Cable, Coax	1	08695-6103
Cable Clamp 1/8"	3	1400-0082
Screw, 6:32 x 1-1/2	4	2360-0018
Washer, Lock No. 6	4	2190-0006
Connector, BNC Female	1	1250-0083
Screw, 6:32 x 1-1/2"	4	2360-0216
Screw, 6:32 x 1/2"	3	2360-0122
Nut, 3/8:52 x 7/16	1	2950-0043
Washer, Lock 3/8	1	2190-0016
Ground, Lug 3/8"	1	0360-1190
Spacer, 7/8"	4	0380-0012
Screw, 6:32 x 1/2"	3	2360-0121
Washer, flat No. 6 x 5/16"	3	3050-0066
Nut, 6:32 x 5/16 w/lockwasher	3	2420-0001
Service Note 8693-7A-1	1	

PARTS SUPPLIED IN ADAPTER KIT HP PART NO. 08693-6114

Description	Qty.	HP Part No.
Board Mounting Bracket	1	08693-0107
Screw, 6:32 x 1/2"	2	2360-0121
Nut, 6:32 x 5/16" w/lockwasher	2	2420-0001
Screw, 6:32 x 3/8"	4	2360-0117
Spacer, 1/4"	4	0380-0018
Service Note 8693B-1	1	

MS/mh

7/68-4

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Europe: 54 Route Des Acacias, Geneva, Switzerland. Cable: "HEWPACKSA" Tel. (022) 42.81.50

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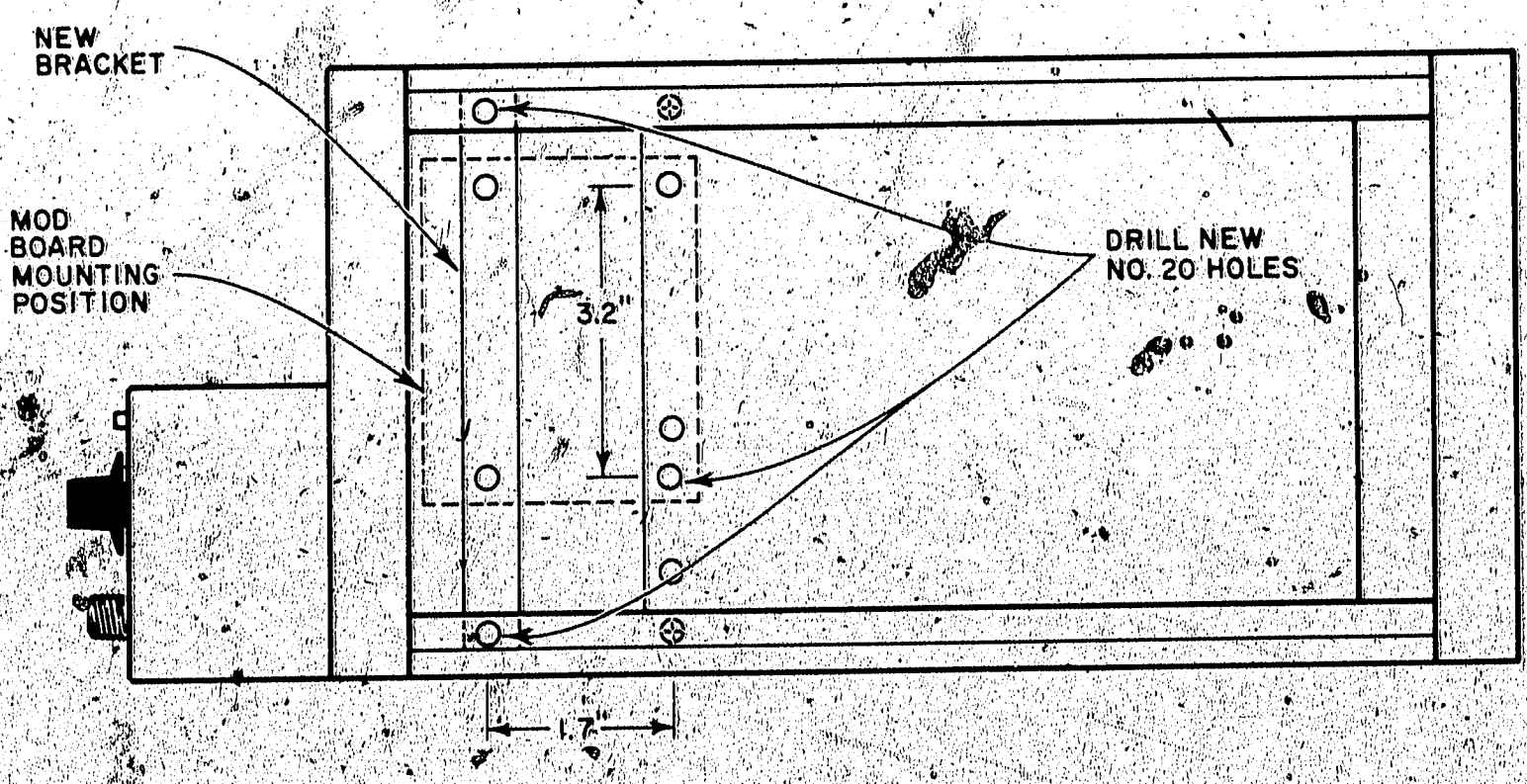


Figure 1. Modulator Board Mounting Details.

INSTALLATION PROCEDURE

1. Remove Modulator Board A1 and Frequency Shape Board A2 from the 8693B.

2. Drill three new No. 20 holes as shown in Figure 1. Install the new bracket using two 6:32 x 1/2" screws and nut/lockwashers.

3. Mount the Shunt Tube Modulator Board as shown in Figure 1. Tube V1 and the large capacitor should be toward the rear of the instrument. Use four 6:32 x 3/8" screws. NOTE: In some 8691A's the front end of the BWO mounting plate is folded toward the inside of the instrument. In these units it is necessary to install the 1/4" spacers under the modulator board standoffs for more clearance.

4. Drill a 3/8" hole in the rear panel as shown in Figure 2.

5. Mount the BNC connector and ground lug in the 3/8" hole drilled in step 4. Use the 3/8" lockwasher and jut.

6. Connect the shielded cable to the BNC connector. Connect the shield (black lead) to the ground lug on rear panel.

7. Connect other end of shielded cable to terminal marked "Input" on the Shunt Tube Modulator Board.

8. Secure shielded cable along lower left-hand frame using two 1/8" cable clamps and 6:32 x 1/2" screws, flat washers, and nut/lockwashers. It is not necessary to drill new mounting holes for the cable clamps. (Use panhead or flathead screws as required.)

9. At pin P of P11, disconnect the red lead that goes to the A3 BWO Terminal Board.

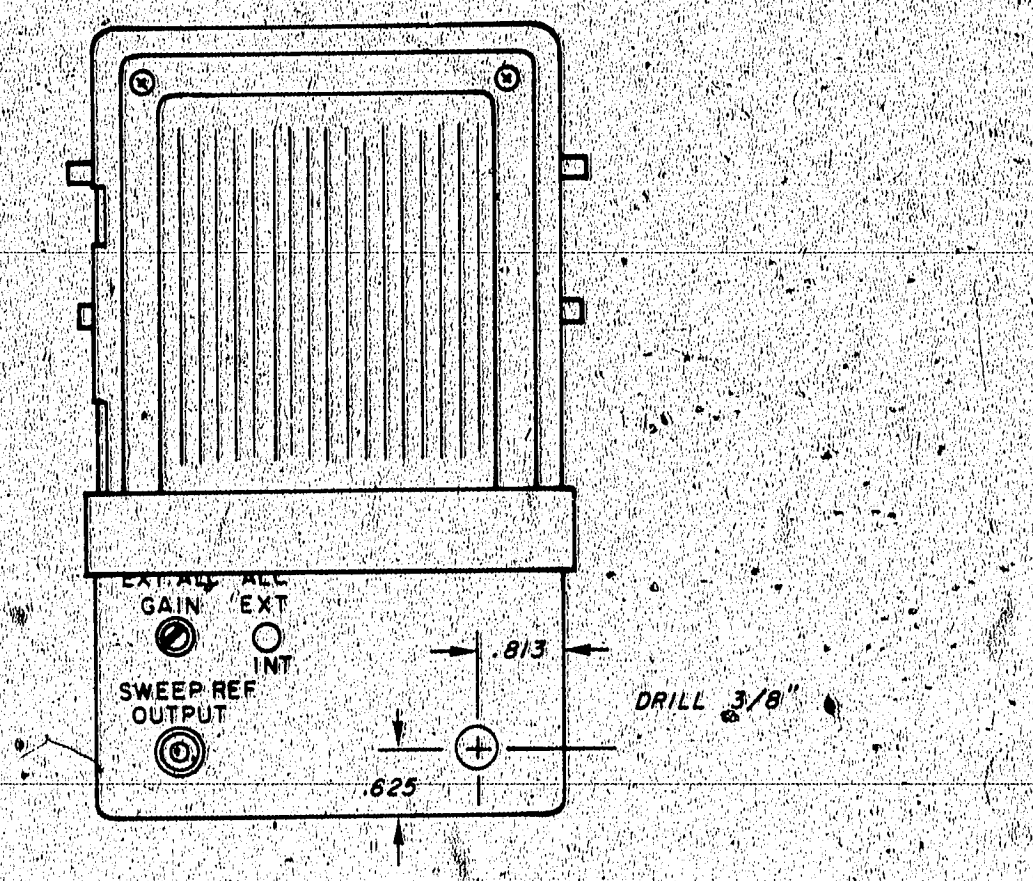


Figure 2. 8693B Shunt Modulator Installation. Rear View of RF Unit.

10. Connect the red lead removed in step 9 to the "BWO" terminal of the new modulator board. (If the lead will not reach, install a new 3 kV insulated in the wiring harness.)

11. Install the new wiring harness between connectors P11 and P12 and the new Modulator board. Connections are shown in Figure 3.

12. Use an ohmmeter to preset potentiometer R8 of the Shunt Tube Modulator Board to approximately 4 kΩ.

13. Replace Assemblies A1 and A2.

14. This completes the modification. Follow the Operation and Adjustment Procedure provided with this kit. Finally, readjust the helix voltage shaping (Frequency Accuracy) according to the 8691-4B Operating and Service Manual, Section II, Table 2-3.

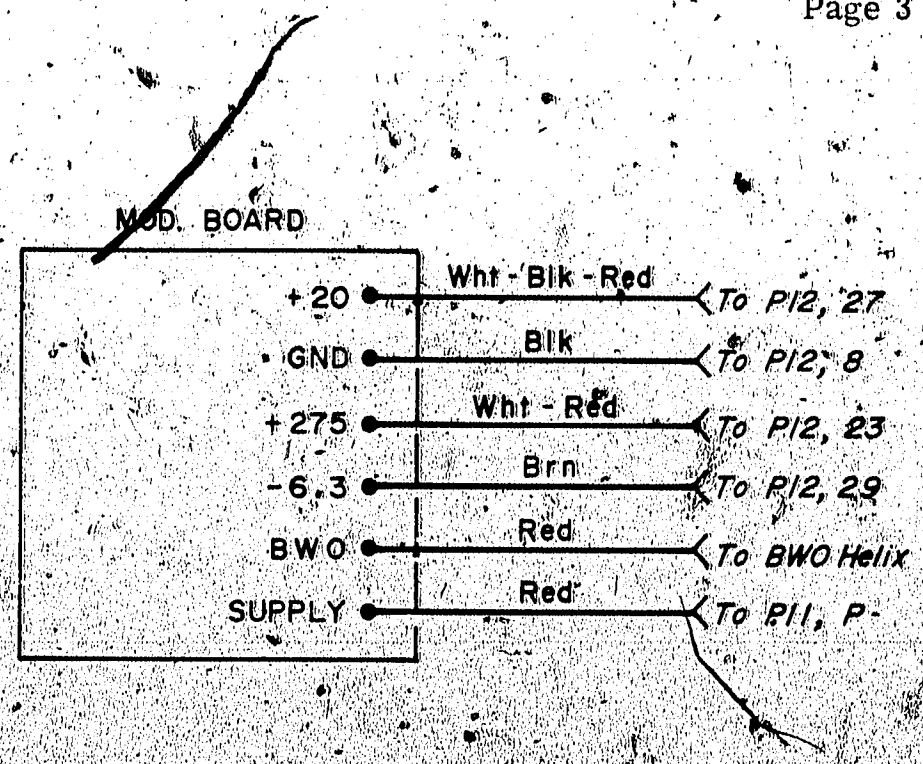


Figure 3. - 8693B Shunt Modulator Board Connections.

OPERATION AND ADJUSTMENT PROCEDURE

8690 SERIES RF UNITS WITH SHUNT TUBE MODULATOR MODIFICATION INSTALLED

INTRODUCTION

This instrument can be used with the HP Model 8709A, 2650A, or 2654A Oscillator Synchronizer. When used with the 8709A and when using a 5105A/5110B Synthesizer as a frequency reference, the phase noise sidebands can usually be reduced by installing the external circuit shown in Figure 1.

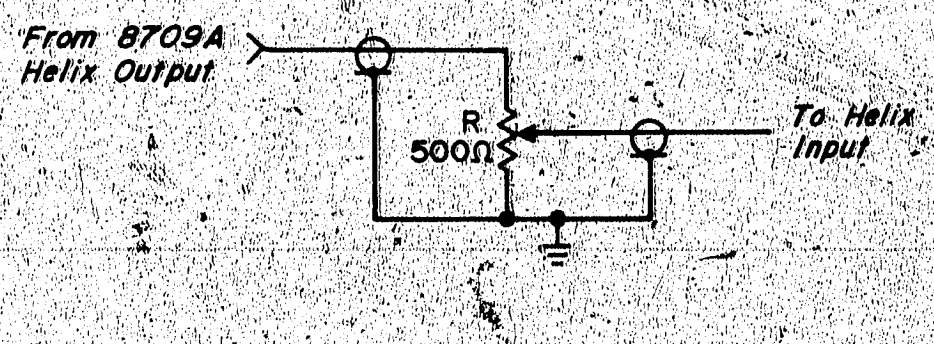


Figure 1. External Network for Use with 5105A/5110B Synthesizer

THEORY OF OPERATION

This instrument employs a shunt tube modulator to couple a synchronizer to the BWO helix and helix power supply. The error signal from the Oscillator Synchronizer is applied to the HELIX INPUT jack. The RC (R1, C1) filter at the input limits the response to high frequency (above 5 MHz) signals.

The signal is attenuated by the 20:1 divider (R2 and R3) and applied to the amplifier (V1) control grid. V1 is cathode biased by R4, CR1, and CR2. The cathode voltage is approximately +1.5 V.

The signal is attenuated by the plate load resistor R7. R8 is variable so that the modulation sensitivity can be adjusted. R8 is set for a modulation sensitivity of approximately 1.25 MHz/V for the 8691 and 8692, 7 MHz/V for the 8693-8694, and 6 MHz/V for the 8695-8697 at the low frequency end of the band.

The zener diode (CR3) sets the bias for emitter follower (Q1). The LC network (L1 and C6) provides additional power supply filtering.

PHASE LOCK OPERATION

Before inserting the RF unit into the Sweep Oscillator Main Frame, the slide switch on the shunt tube modulator printed circuit board must be set to the PHASE LOCK position. Do not attempt to change the position of this switch while the instrument is operating.

It may be necessary in some systems to make minor adjustments to the trimmer, C3, on the modulator board assembly. One method of adjusting this for a particular system is to apply a square wave modulating signal to the reference oscillator FM input. The amplitude of the square wave depends on the FM sensitivity of the particular reference oscillator used. Proceed as follows: With the system phase locked, connect a square wave generator to the FM input of the 8466 Reference Oscillator. Set the amplitude to minimum and frequency to 20 kHz. Connect an oscilloscope with good high frequency response such as the HP Model 140A to the servo output of the 8709A Synchronizer. Slowly increase the output from the square wave generator until the system breaks lock. Reduce the square wave generator output until the system relocks. With the square wave generator at this amplitude, adjust C3 on the modulator assembly for minimum ringing and/or overshoot.

NORMAL OPERATION

This instrument can be used as a standard 8690 series RF unit by setting the slide switch on the modulator assembly opposite the phase lock position. In this position the filter network is switched out of the circuit. Phase locking should not be attempted with the switch in this position.

OUT OF SYSTEM ADJUSTMENTS

Out of system adjustments must be made with the modified RF unit in an 8690A Sweep Oscillator. Remove the top and bottom covers from the 8690A Sweep Oscillator. Proceed as follows:

GAIN ADJUSTMENT

1. Adjust an audio oscillator to 50 Hz and 10 V peak-to-peak and then connect the equipment shown in Figure 2.

2. With the Sweep Oscillator set to the low frequency end of the band, observe the detected waveform on the oscilloscope. Slowly move the wavemeter through the operating frequency range of the Sweep Oscillator. The wavemeter pip should be visible on the oscilloscope. Set the wavemeter pip to one end of the sweep and record the frequency f1. Set the pip to the other end of the sweep and record frequency f2. Take the difference between f1 and f2. This should be 10-15 MHz for the 8691 and 8692, 22-28 MHz for the 8693 and 8694, and 55-65 MHz for Models 8695 through 8697. If not, adjust R8 on the modulator board.

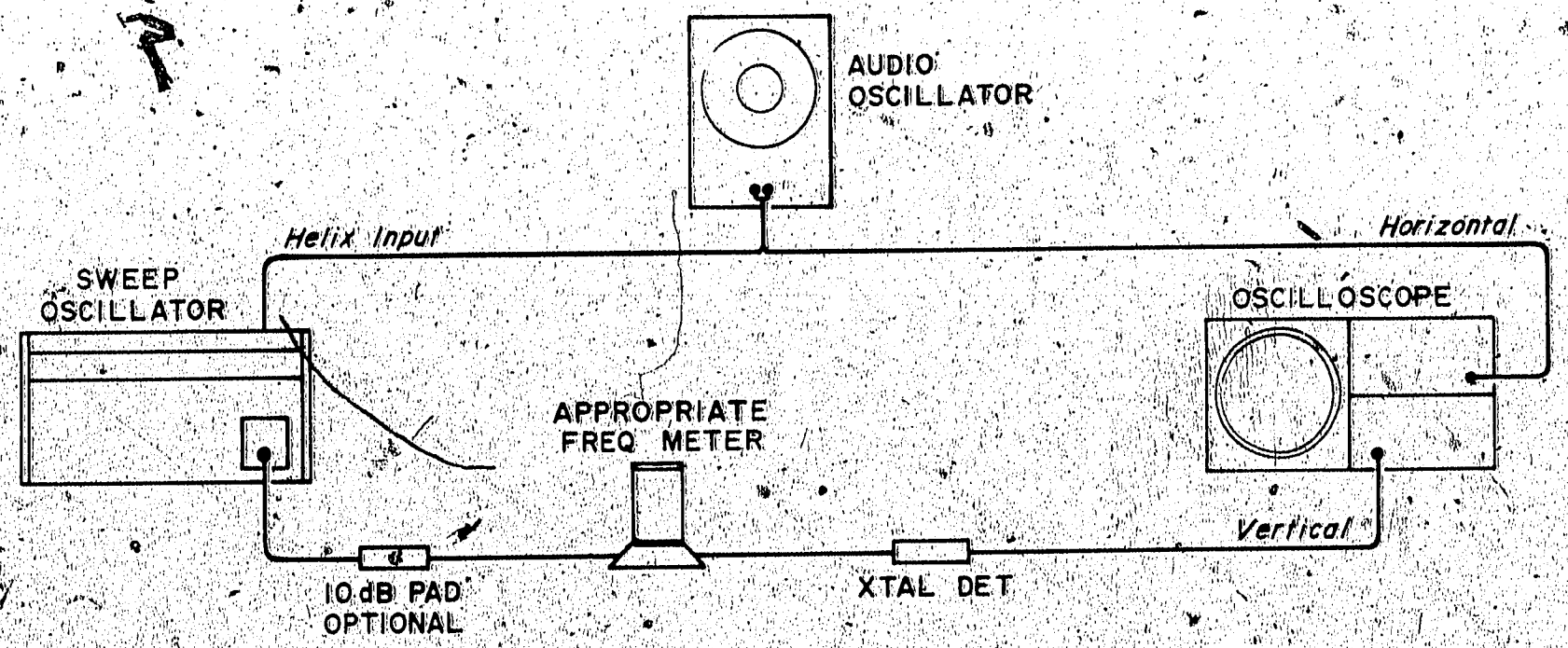


Figure 2. Test Setup for Gain Adjustment

FREQUENCY RESPONSE

1. Connect the equipment as shown in Figure 3.

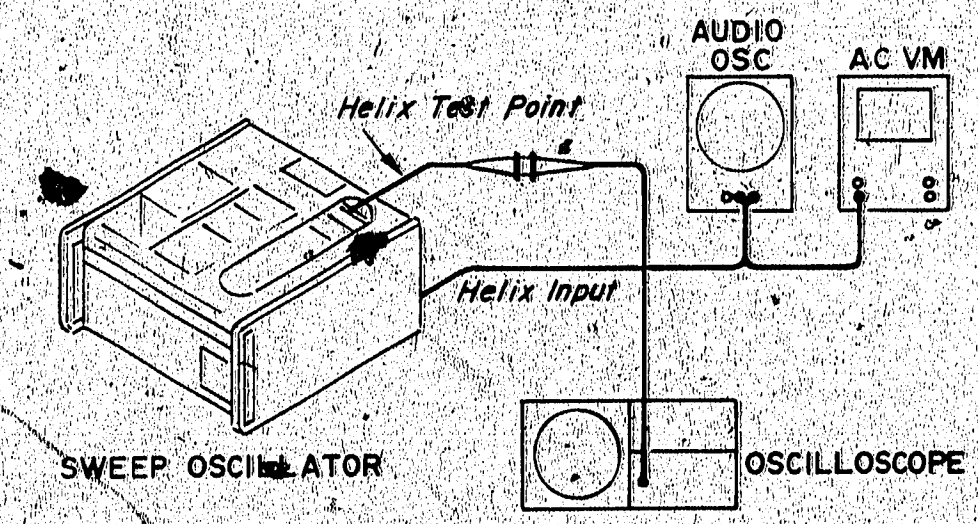


Figure 3. Test Setup for Frequency Response Adjustment

2. Set the audio oscillator output to approximately 2V RMS at 50 Hz.
3. Note the amplitude of the oscilloscope display.
4. Increase the frequency of the audio oscillator to 600 kHz. Using the ac voltmeter, reset the amplitude to the same level as in step 2. The oscilloscope display should be of the same amplitude as in step 3. If not, adjust C3 on the modulator assembly.
5. After completing adjustment of the shunt tube modulator board, re-check RF unit frequency accuracy as described in Table 2-3 of the Operating and Service Manual.

This completes the calibration procedure for the shunt tube modulator. For further adjustments in a particular system, refer to the paragraph on PHASE LOCK OPERATION.

REPLACEABLE PARTS LIST

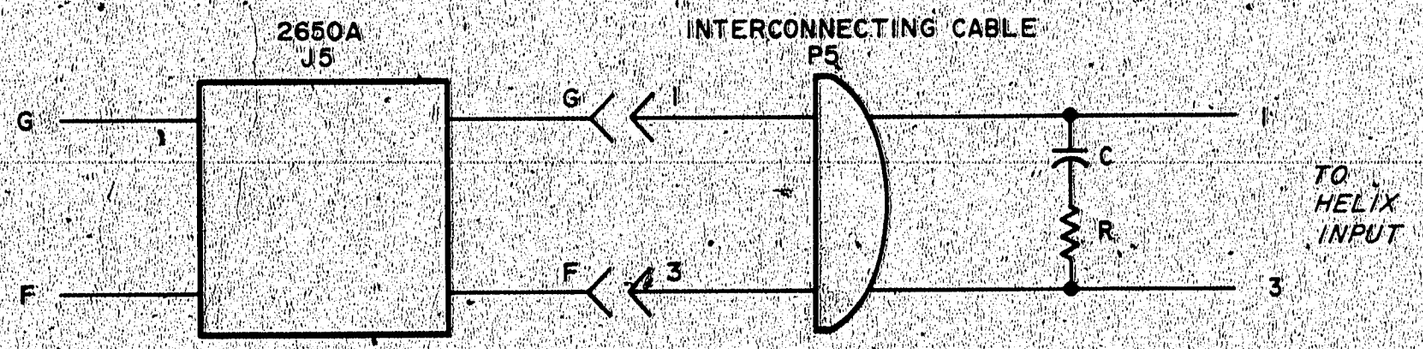
SHUNT TUBE MODULATOR BOARD

C1	Capacitor, fixed 12 pF	0140-0201
C2	Capacitor, fixed 3 pF	0160-2244
C3	Capacitor, variable 9-35 pF	0121-0046
C4	Capacitor, fixed 120 pF	0140-0216
C5	Capacitor, fixed .33 µF 35V	0180-0195
C6	Capacitor, fixed .25 µF 2000V	0169-0004
CR1, CR2	Diode, silicon	1901-0033
CR3	Diode, zener, 6.19V .4W	1902-0049
L1	Coil, fixed 10 mh	9140-0131
Q1	Transistor, silicon, NPN	1854-0039
R1	Resistor, fixed, 1.96K, 1/8W	0698-0083
R2	Resistor, fixed, 511K, 1/8W	0757-0482
R3	Resistor, fixed, 28.7K, 1/8W	0698-3449
R4	Resistor, fixed, 1.96K, 1/8W	0698-0083
R5	Resistor, fixed, 19.6K, 1/2W	0698-3415
R6	Resistor, fixed, 56K, 1W	0761-0032
R7	Resistor, fixed, 47K, 2W	0764-0031
R8	Resistor, variable, 10K	2100-1776
S1	Switch, DPDT	3101-0070
V1	Tube, electron 7234	1923-0073

OPERATING NOTES:

1. Output frequency should be tuned below midband before switching 8690A/B line switch to the RF position. Otherwise, the initial current surge drawn by the shunt tube modulator assembly may actuate the helix overcurrent relay in the 8690A/B mainframe.

2. When operating with the HP Model 2650A some difficulty may be experienced in adjusting gain adjust R8 for optimum phase lock at both ends of the band without loop oscillation. In this case it may be necessary to add an RC Filter to the cable connecting J5 of the 2605A to the RF unit helix input. This filter can be mounted on the back of plug P5 as shown below.



C = 0.0082 μf 200 WVDC
R = 30-500Ω 1/2W
(Selected for Optimum Phase Lock without Oscillation)

Figure 5. Optional Filter Network When Operating With HP Model 2650A Synchronizer

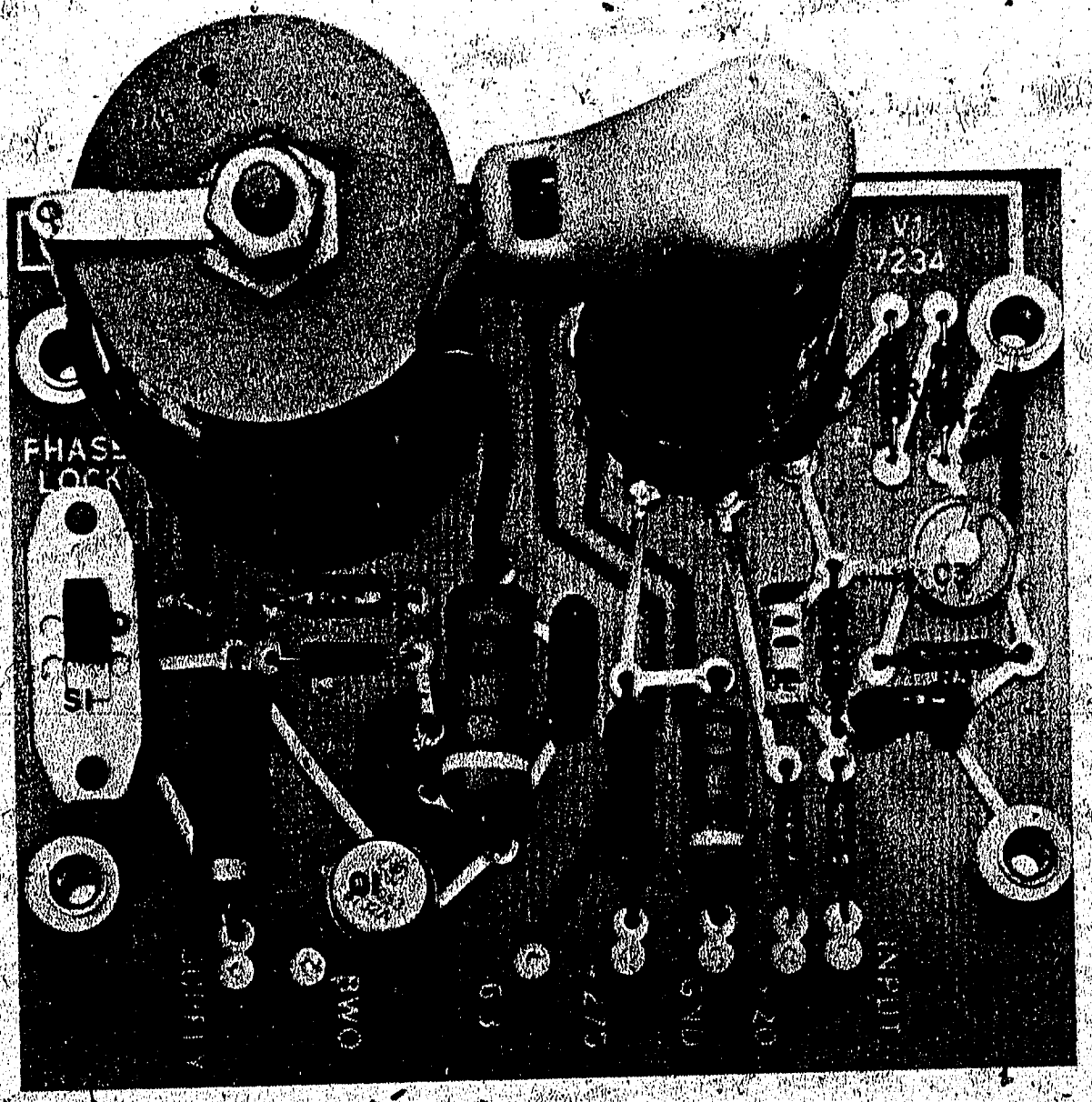


Figure 5. Shunt Tube Modulator Board Component Identification.

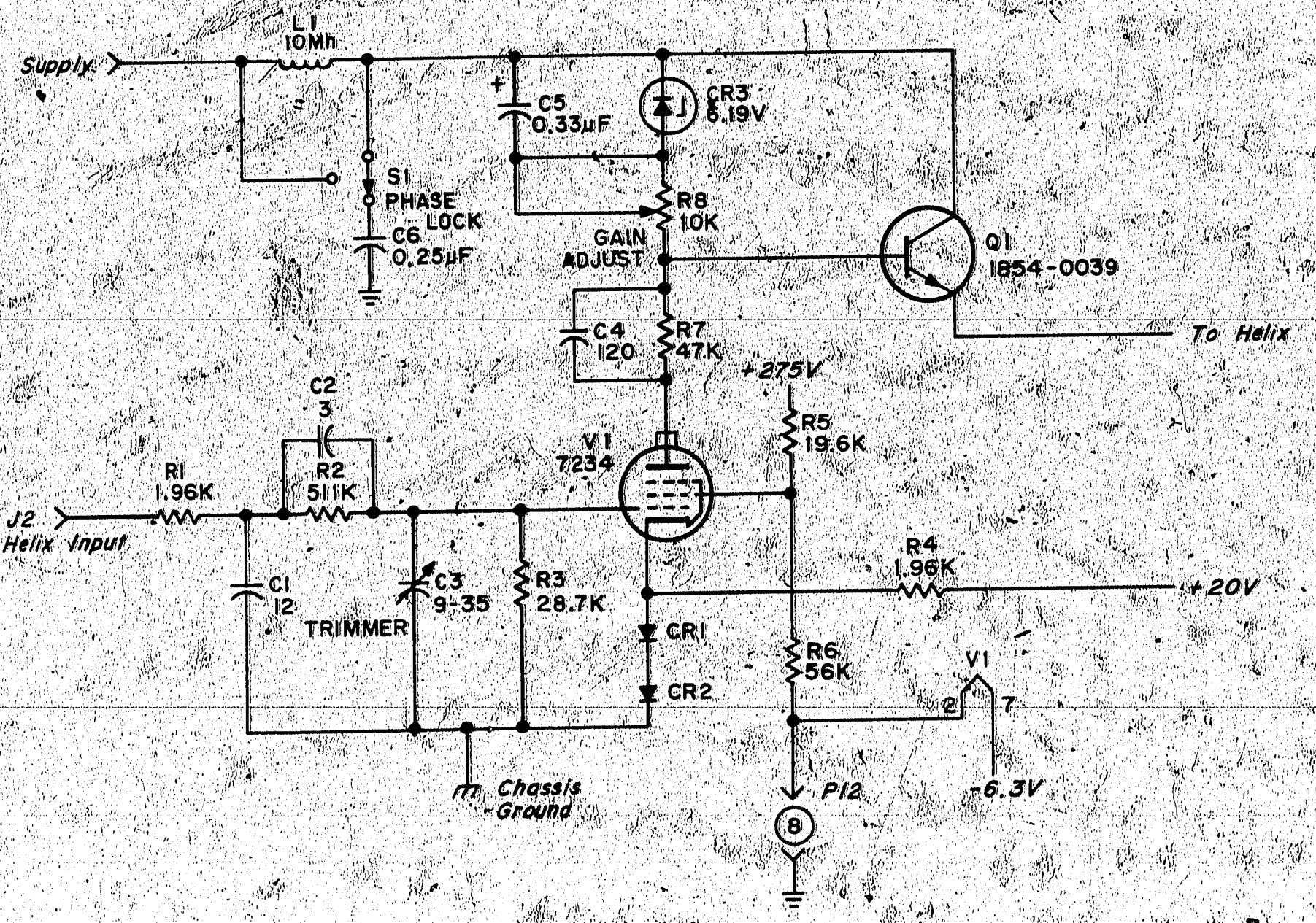


Figure 6. Shunt Tube Modulator Schematic

8691-4A/B-2
8695-7A-2

SERVICE NOTE

SUPERSEDES:

HP MODEL 8691-4A/B RF UNITS
Serials Below 835-01406

AND

HP MODEL 8695-7A RF UNITS
Serials Below 835-00481

REDUCE RESIDUAL AM

Residual 60 Hz Amplitude Modulation can be reduced on HP Model 8691-4A/B RF Units, serials below 835-01406, and HP Model 8695-7A RF Units, serials below 835-00481, by separating the BWO filament ground return from chassis ground.

A ground loop can occur from the Unleveled Indicator Lamp to the RF Output Connector through the front panel. This can allow 60 Hz feed-through to the ALC circuit and in turn to the output power. Relocating the Indicator Lamp ground return wire will prevent this from occurring.

Locate the ground return, black wire, running from the Unleveled Indicator Lamp DS1 to the Power Level Control R2 then to PIN 8 or PIN 13 on the P12 Connector (PIN 8 and PIN 13 are circuit and BWO filament grounds). Disconnect this ground return from PIN 8 or PIN 13 and connect it to PIN 6 (PIN 6 is chassis ground).

Show this wiring change on the schematics in your manual.

4/69-4

JD/rh/wo

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8691-4A-8
8695-7A-7
8691-5B-6

SERVICE NOTE

SUPERSEDES:

None

HP MODEL 8691-5A/B, 8696-7A RF UNITS

All Serials

BWO REPLACEMENT

This service note provides information for ordering and calibrating a replacement BWO in HP Model 8691-5A/B, 8696-7A RF Units, all serial numbers.

Table 1 lists the HP part numbers for the replacement BWO, the associated A2 Frequency Shaping Board, and the correct resistance for the Helix Overcurrent Relay Shunt resistor. It also gives the maximum BWO currents, the maximum leveled power output, and the frequency accuracy specifications for the RF Units.

The procedures for adjusting and calibrating the replacement BWO are divided into the following four steps:

I Check the Helix Overcurrent Relay operation.

II Adjust the anode voltage and anode shaping.

III Calibrate the frequency using the recommended A2 Shaping Board.

IV Calibrate the frequency, when it is necessary to selett A2 shaping resistor values.

I PROCEDURE FOR CHECKING THE HELIX OVERCURRENT RELAY:

1. Before connecting the DC leads of the replacement BWO, the Helix overcurrent protection circuit should be checked for proper operation.

2. Check the value of A1R17 Helix Overcurrent Relay Shunt Resistor in the RF unit. If different from the one recommended in Table 1, replace it with the recommended value.

3. Check the A2 Shaping board in the RF unit. If the part number is different from the one recommended in Table 1, replace it with the correct one. (See procedure IV if the correct shaping board is not available.)

4. To check the operation of the Helix Overcurrent relay it is necessary to connect a temporary load to the Helix Supply. If a Watkins Johnson tube is being installed, a 250K ohm 10 watt resistor should be used. If a Varian tube is being installed, a 10K ohm 10 watt resistor should be used. Connect the appropriate load resistor to the A3 Terminal board assembly from the point labeled red to the point labeled black.

5. Install the RF Unit in the 8690A/B. Turn the line switch to RF. Select CW mode of operation. Turn START/CW control to low end of band.

6. Connect a clip-on DC milliammeter, such as HP Model 428B, to the red lead connected to the bottom of the A3 terminal board.

JA/gf/WO

7/72-4

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8691-4A-8
8695-7A-7
8691-5B-6

Table 1. Replacement BWO Information

RF Unit Model	Replacement BWO Part Number	Vendor[6]	A2 Shaping Board Part Number	A1R 17[1] Helix Overcurrent Relay Shunt (Ohms)	Maximum[2] BWO Currents (mA)		Maximum[5] Leveled Power (mW)	Frequency Range (GHz)	Frequency[5] Accuracy
					Helix	Cathode			
8691A 8691B	1951-0020	WJ	08691-6103	8.25K	4.0	17.0	100 70	1.0-2.0	±1% ±10 MHz
8691A Opt 200	1951-0086	WJ	08691-60126	8.25K	4.0	17.0	100	1.4-2.5	±1%
8692A 8692B	1951-0072	WJ	08692-6101	8.25K	3.5	15	70 40	2.0-4.0	±1% ±20 MHz
8692B Opt 100	1951-0072	WJ	08692-6103	8.25K	3.5	15	15	1.7-4.2	±25 MHz
8693A 8693B	1951-0065	WJ	08693-6101	8.25K	3.0	12.0	30 15	4.0-8.0	±1% ±40 MHz
8693A Opt 200	1951-0087	WJ	08693-6118	8.25K	3.0	12.0	40	3.5-6.75	±1%
8693B Opt 100	1951-0065	WJ	08693-6103	8.25K	3.0	12.0	5.0	3.7-8.3	±45 MHz
8694A	1951-0085	WJ	08694-60001	8.25K	3.0	12.0	50.0	8.0-12.4	±1%
8694B	1951-0085	WJ	08694-60001	8.25K	3.0	12.0	30.0	8.0-12.4	±40 MHz
8694A Opt 100	1951-0085	WJ	08694-60002	8.25K	3.0	12.0	25.0	7.0-12.4	±1%
8694B Opt 100	1951-0085	WJ	08694-60002	8.25K	3.0	12.0	15.0	7.0-12.4	±50 MHz
8694A Opt 200	1951-0085	WJ	08694-60003	8.25K	3.0	12.0	25.0	7.0-11.0	±1%
8694B Opt 200	1951-0085	WJ	08694-60003	8.25K	3.0	12.0	15.0	7.0-11.0	±40 MHz
8695A 8695B	1951-0059[4]	V	08695-60109	1.0K	40	40	40.0 15.0	12.4-18	±1% ±50 MHz
8695A 8695B	1951-0080[3]	WJ	08695-6105	19.6K	4.0	12.0	40 15	12.4-18	±1% ±40 MHz
8696A	1951-0060	V	08696-60104	1.0K	40	40	10	18.0-26.5	±1%
8696A	1951-0081[3]	WJ	08696-60103	34.8K	2.0	10.0	10	18.0-26.5	±1%
8697A	1951-0061	V	08697-60103	1.0K	40	40	5	26.5-40	±%
8697A	1951-0082[3]	WJ	08697-6102	34.8K	1.5	5.0	5	26.5-40	±1%

NOTES:

1. Factory selected to adjust helix overcurrent relay, nominal value given. 8.25K Ohms, Fxd. Met, Film, 1%, 1/2W, 0757-0837. 34.8K ohms, Fxd, Met. Film, 1%, 1/8W, 0757-0123. 1.0K ohms, Fxd. Met. Film, 5% 1W, 0761-0021. 19.6K Ohms, Fxd. Met. Film, 1% 1/8W, 0698-3157.
2. These are maximum current ratings that should not be exceeded. BWO current adjustments should use the nominal current values given by the tube manufacturer for each tube.
3. 8695-7A serials below 838-00601 require BWO mounting plate 08691-0107; or drill new mounting holes in existing plate.
4. Not to be used in 8695B OPT 004.
5. Specifications subject to change. Consult your latest Operating and Service manual for correct specifications.
6. WJ Watkins-Johnson, V Varian.

7. After the RF light has come on, slowly adjust the START/CW control toward the high end of the band. Monitor the increasing helix current on the milliammeter. Note the maximum current reached before the overcurrent relay activates.

8. The maximum current should be ±10% of the value listed in Table 1.

9. Turn the 8690A/B Line Switch to OFF. Remove the helix load connected in step 4.

II PROCEDURE FOR ADJUSTING ANODE VOLTAGE AND ANODE SHAPING:

1. Remove the anode shaping by turning A1R40 maximum CCW.

2. Preset the anode voltage for the voltage called for on the operating parameters label that is attached to the BWO being installed.

   a. Turn 8690A/B line switch to RF.

   b. Connect voltmeter to A1TP3.

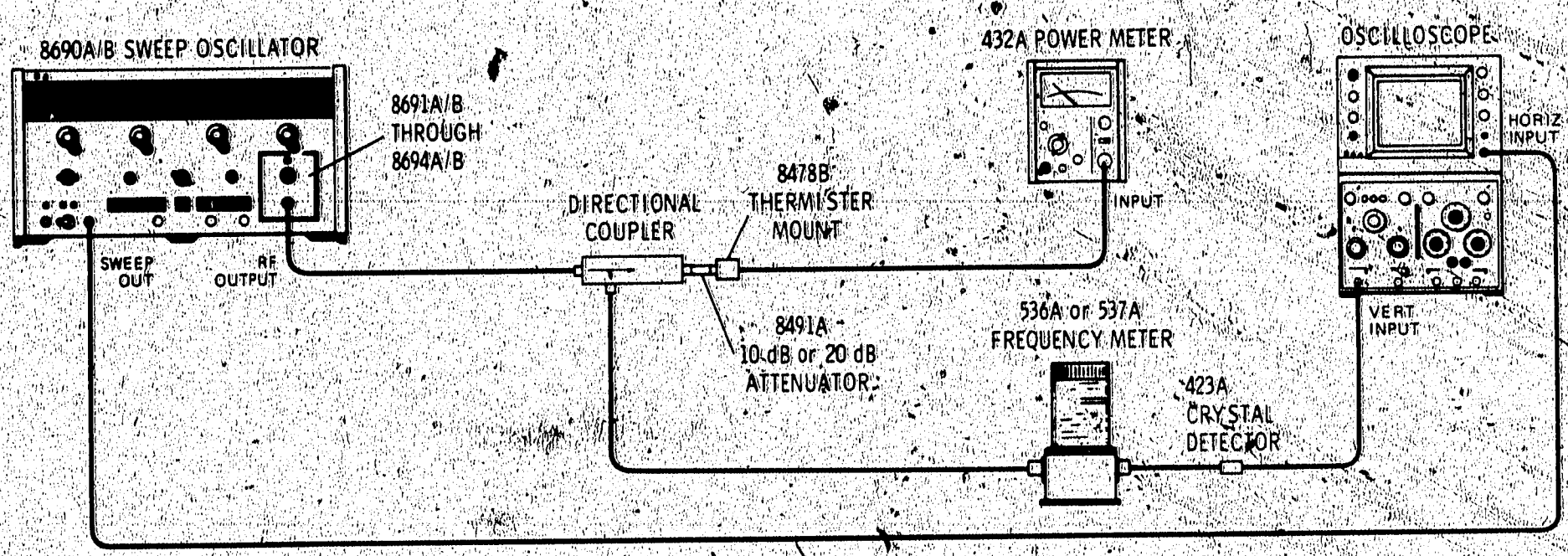
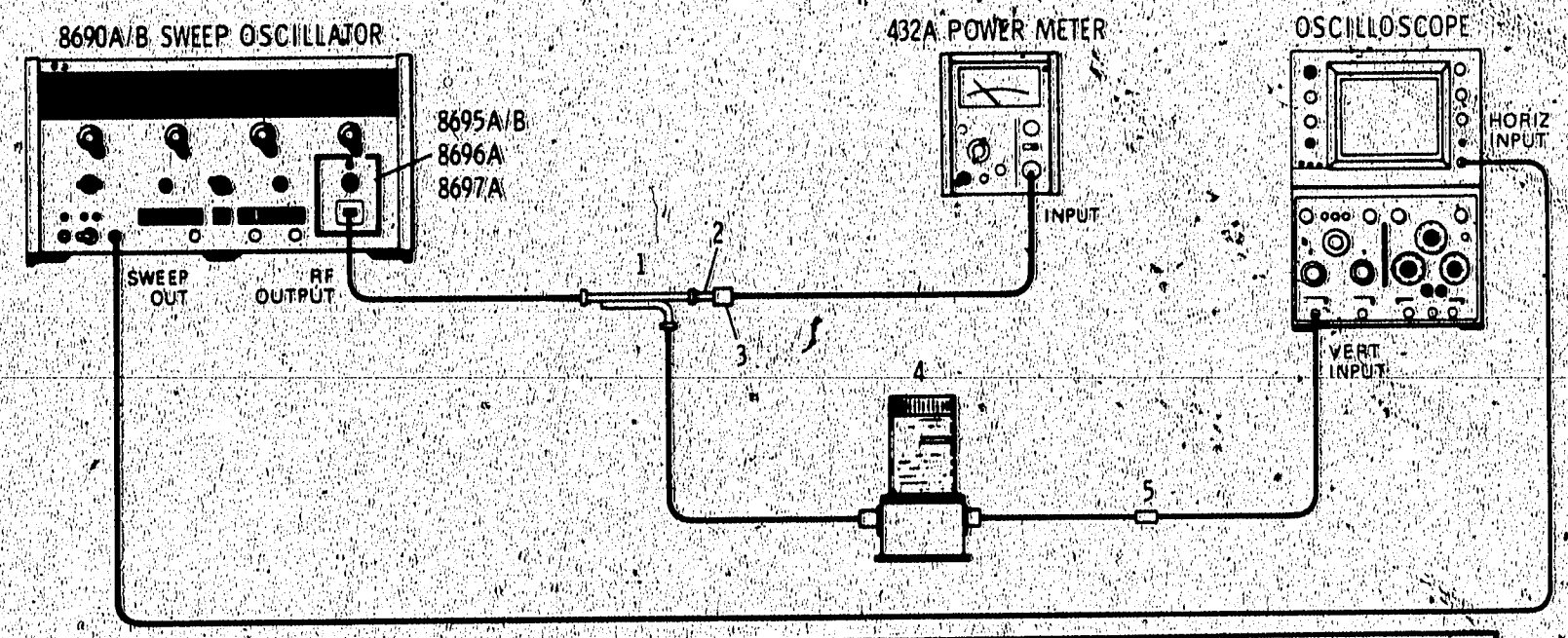


Figure 1. Test Setup For Adjusting 8691-4A/B



Item	Equipment Model No. 8695A/B	8696A	8697A	Description
1	P752C	K752C	R752C	Coupler, Directional
2	P382	K382	R382	Atten, Variable
3	P486	K486	R486	Mount, Thermistor
4	P352	K352	R352	Meter, Freq.
5	P424	K422	R422	Detector, Xtal

Figure 2. Test Setup for Adjusting 8695A/B, 8696A or 8697A

c. After RF light has come on adjust A1R42 for the correct anode voltage.

d. Turn 8690A/B line switch to OFF.

3. Connect the DC leads from the BWO to the A3 Terminal board. (Note the Varian tube will not have a collector or orange lead.) Use wire color code on A3 assembly.

4. Connect test equipment as shown in Figure 1 or 2 whichever is applicable. Figure 1 should be used for the RF units with coaxial output. Figure 2 should be used for the RF units with waveguide outputs.

5. Set the 8690A/B controls as follows:

FUNCTION	START/STOP
SWEEP SELECTOR	AUTO
SWEEP TIME	.01 to .1 sec.
SWEEP TIME VERNIER	Max CW
START/CW	Max CCW
STOP/ΔF	Max CW
RF BLANKING	ON
AMPLITUDE MOD.	OFF
MANUAL SWEEP	Max CCW
ALC	OFF
LINE	RF

6. Set the RF Unit control as follows:

POWER LEVEL	Max CW

7. After the RF light turns on, the oscilloscope display should be similar to Figure 3.

8. Set the frequency meter at the low frequency end for the BWO. Adjust A2R12 Low Band adjust or the START/CW control until the frequency meter pip is coincident with the start of the sweep on the oscilloscope.

9. Set the frequency meter at the high frequency end for the BWO. Adjust A2R13 Midband adjust, A1R24 Stop adjust, or STOP/ΔF control until the frequency meter pip is coincident with the stop of the sweep on the oscilloscope.

10. Set the 8690A/B sweep selector to manual and manually tune across the band while observing the power meter indication. Note the low and high power points. The low power should equal or exceed the power specification in Table 1 and the peak-to-peak power variation should be less than 10 dB.

11. If the power out and power variation is within specification, proceed to step 13. If the power out or the power variation is not within specifications, continue with step 12.

12. To increase the power out from the lower portion of the frequency band, adjust Anode Shaping adjustment A1R40. To increase the power across the entire frequency band, adjust Anode Voltage adjustment A1R42.

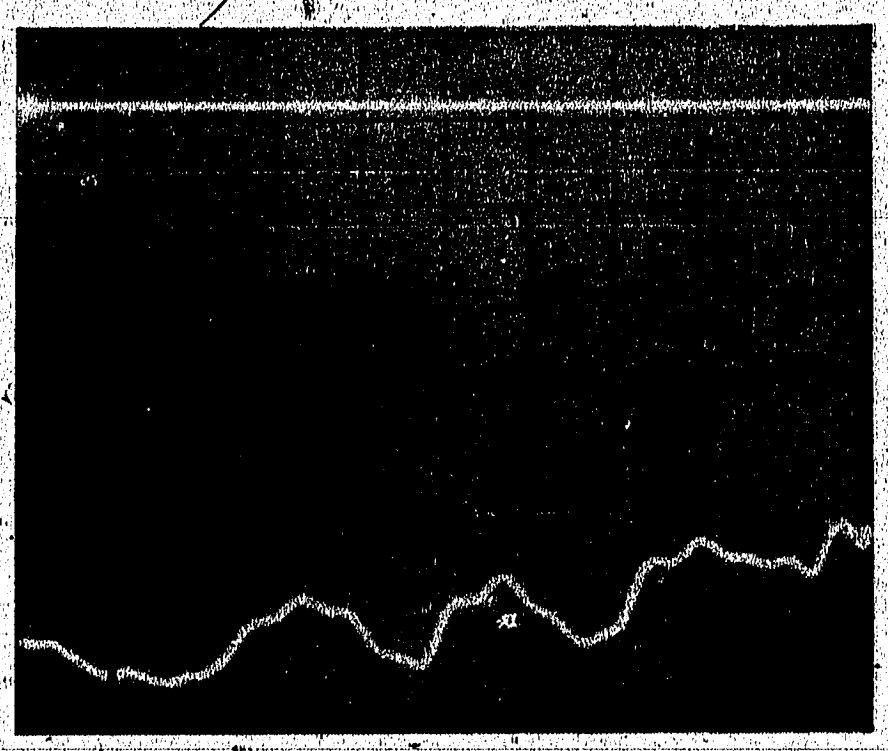


Figure 3. Detected RF Power

13. Clip a milliammeter alternately to the Cathode lead (yellow wire) and then the Helix lead (red wire). Manually tune through the frequency band and ensure that neither of the currents exceed the maximum values given in Table 1. If maximum currents are exceeded, readjust the Anode voltage and the Anode Shaping adjustment to reduce the currents within maximum limits.

14. Repeat steps 10 through 13 as necessary to ensure that the power output and power variation specifications are met without exceeding the maximum currents.

III PROCEDURE FOR CALIBRATING FREQUENCY ACCURACY:

To calibrate the frequency of a BWO to a linear scale, the helix voltage must change exponentially. The helix voltage generator receives the linear sweep ramp or dc voltage from the tuning voltage generator and converts it to an exponential voltage within the limits required by the BWO.

The exponential shaping is accomplished by using a nonlinear voltage divider in the feedback of a differential amplifier shown simplified in Figure 4. R_a is a linear element and R_b is the non-linear element. R_b consists of 9 diodes, each with a factory selected resistance in series, connected in parallel to 9 points on a voltage divider. At the low-frequency end of the band, when the helix voltage is lowest, all diodes are reversed biased. R_b is A2R1, A2R2, A2R12, and A2R13. As the helix voltage increases, the diodes conduct one-by-one, shunting A2R1, A2R2, A2R12, and A2R13 with their series resistance and decreasing the value of R_b. Since the gain of the differential amplifier is proportional to the ratio R_a/R_b, as R_b decreases the gain increases.

Because BWO tuning characteristics vary slightly from tube to tube, the factory selected resistance in series with diodes A1CR3-A1CR11 may vary. It may be necessary to again select the resistance values. This will adjust the helix voltage to track the RF frequency with the frequency dial.

NOTE

Adjusting the frequency at any point affects the dial tracking from that point up. Therefore it is important that the correct sequence be followed in calibrating the frequency.

1. The 8691-4A/B RF units are calibrated at maximum leveled power. Use the equipment setup shown in Figure 5 for these units.

2. The 8695A/B, 8696A, and 8697A are calibrated at 3dB below maximum leveled power. Use the equipment setup shown in Figure 6 for these units.

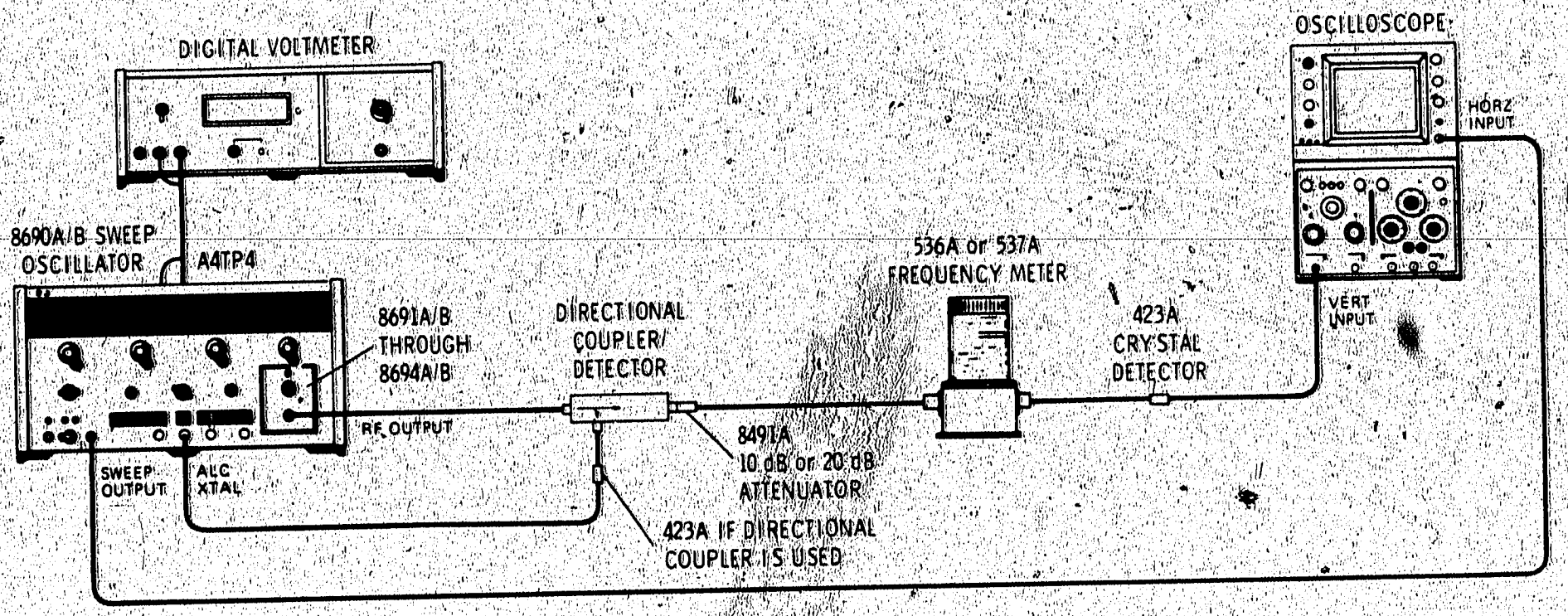


Figure 4. Equipment Setup for 8691-4A/B

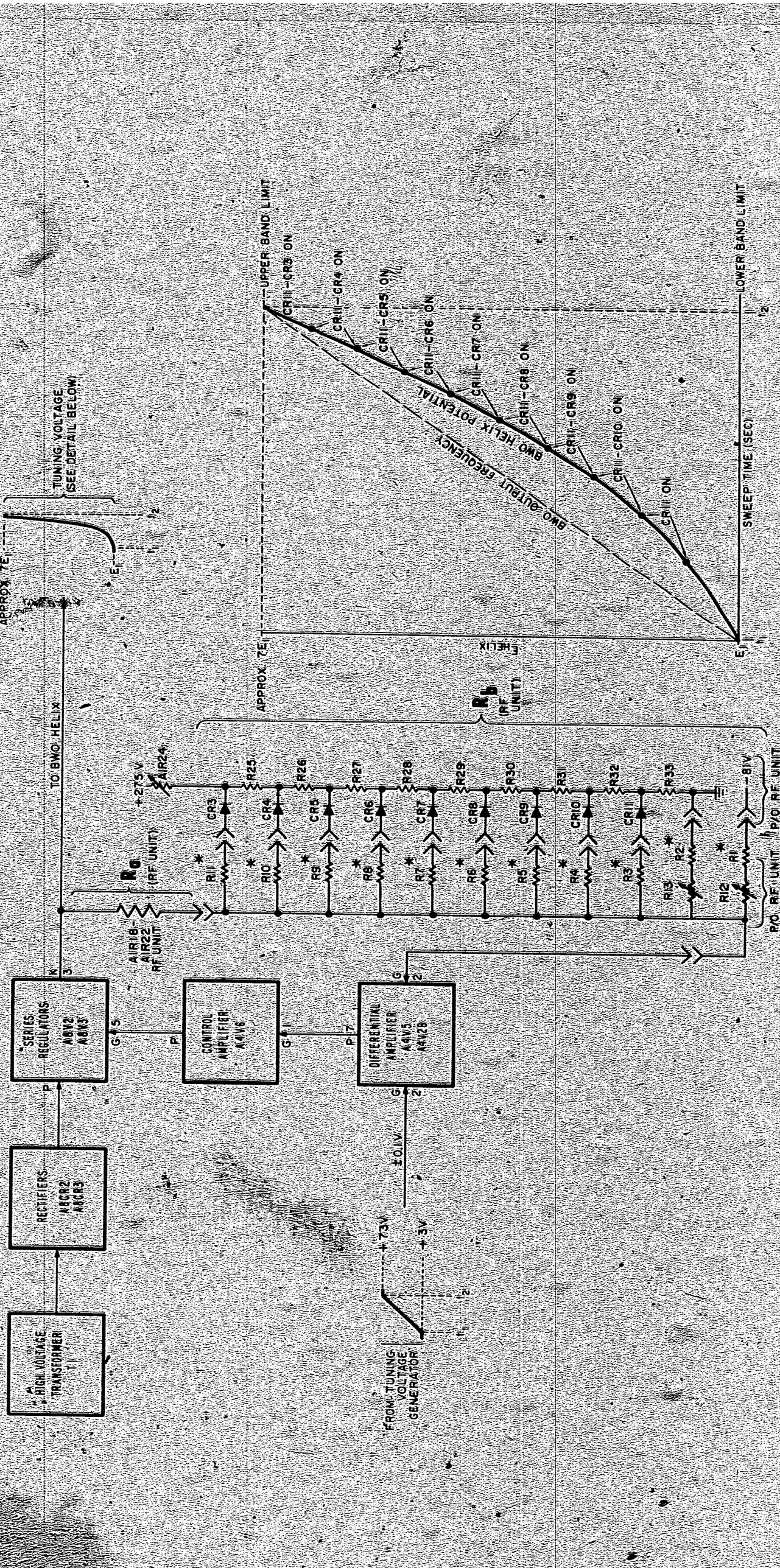
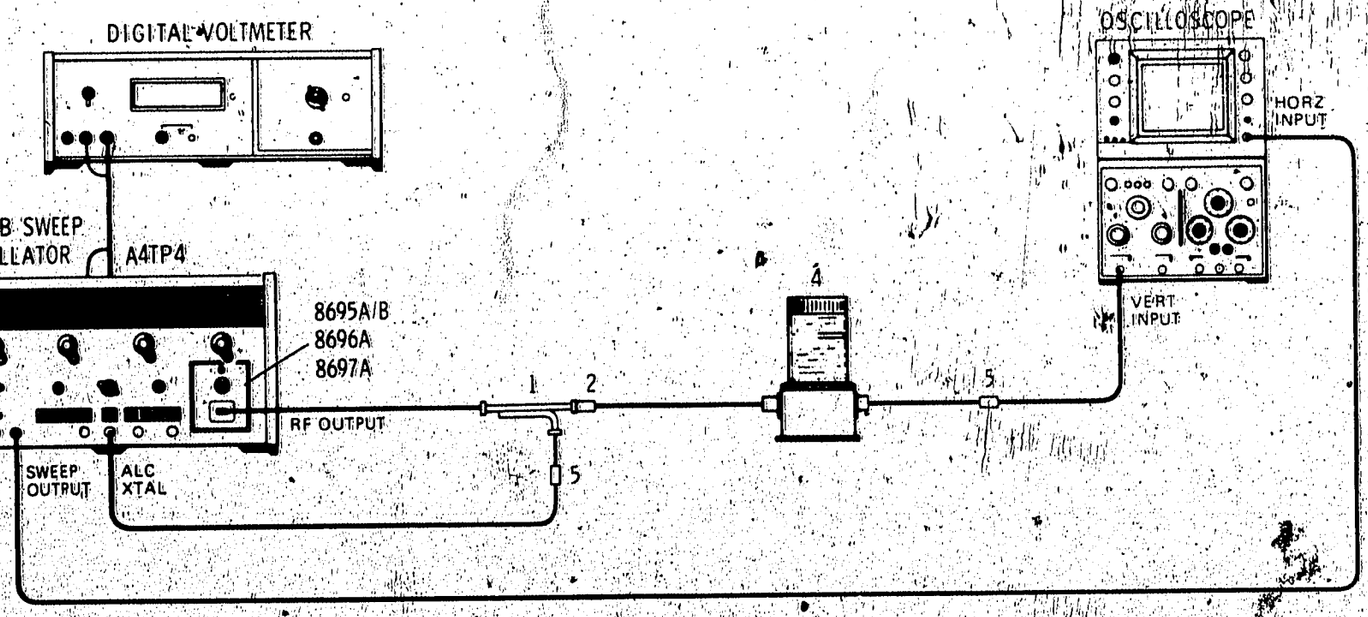


Figure 5. Helix Voltage Generator Block Diagram



NOTE: See Figure 2 for equipment identification.

Figure 6. Equipment Setup for 8695A/B, 8696A, 8697A

1. Set 8690A/B controls as follows:

FUNCTION	START/STOP
SWEEP SELECTOR	AUTO
SWEEP TIME	.01 to 0.1 sec.
SWEEP TIME VERNIER	Max CW
START/CW	Low Band end
STOP/ΔF	High Band end
RF BLANKING	ON
AM	OFF
MANUAL SWEEP	Max CCW
ALC	ON
LINE	RF

2. Set RF unit controls as follows:

Power level control	Max CW
ALC gain	Max CW

3. Adjust the power level control and ALC gain control for maximum leveled power and maximum ALC gain without loop oscillation. For 8695A/B, 8696A, and 8697A units only, reduce the power 3 dB from maximum leveled power.

4. Set 8690A/B for CW operation. Adjust START/CW control for 3.00 Vdc at A4TP4 in the 8690A/B. Check RF unit A1 or A8 TP1 should be zero ±0.01 Vdc. If not, adjust 8690A/B A4 R32 Helix feedback Zero adjust for zero ±0.01 Vdc.

5. Adjust A2R12 for the low end of the frequency band. If correct adjustment is not possible with A2R12, fixed resistor A2R1 must be changed. See the procedure for selecting shaping resistors, Procedure IV.

6. Set START/CW control for 38.00Vdc at A1TP4. Adjust A2R13 for the midband frequency. If correct adjustment is not possible with A2R13, the value of resistance for A2R2 will have to be changed. See procedure IV for selecting resistance values.

7. Set START/CW for 73.00 Vdc at A4TP4. Adjust A1R24 for the high end of the frequency band. If correct adjustment is not possible with A1R24, the value of resistance for A2R7 thru A2R11 may need to be changed. See procedure IV for selecting resistance values.

8. Repeat steps 4, 5, 6, and 7 until the RF unit is within frequency specifications.

IV. PROCEDURE FOR SELECTING A2 SHAPING RESISTORS

The helix tuning curve for each type of BWO is different. Even BWOs of the same type have a small variation in the tuning curve. Therefore, it may be necessary to select the resistance value of any of these resistors (A2R1 through A2R11). The following procedure gives a step by step process for selecting the correct shaping resistors to ensure frequency accuracy. This procedure can be used to reshape the helix if the A2 shaping board that correctly matches the BWO is not available.

A resistance substitution box is recommended as an aid in determining the correct value for the shaping resistors.

1. To change the fixed resistors on the A2 shaping board, follow the sequence below:

   a. Turn 8690A/B line switch to OFF.

b. Remove the A2 Shaping board through the top of the 8690A/B.

c. Change the appropriate resistor on the A2 board.

d. Reinstall the A2 board in the RF unit.

e. Turn the 8690A/B line switch to RF.

f. Allow 5 minute warm up before continuing with calibration.

2. To select value of A2R1:

a. Set START/CW control for 3.00 Vdc at A4TP4.

b. Set A2R12 to center of rotation.

c. Set A2R13 to center of rotation.

d. Set A1R24 to center of rotation.

e. Select value for A2R1 to adjust frequency of the BWO to the low band end.

f. Adjust A2R12 for the low band end frequency within frequency specifications.

3. To select value of A2R2:

a. Set START/CW control for 10.00 Vdc at A4TP4.

b. Select value for A2R2 to give the frequency specified in the frequency calibration table in the operating and service manual or for f2 as calculated from the calibration table. (Table 2)

c. Increasing the resistance will increase the frequency. If a compromise is required, select the value of resistance such that the frequency is on the low side of the specified frequency.

4. Repeat step 2 and 3 until no further adjustment is required to meet frequency accuracy specification. There is interaction between the two adjustments.

5. To select value for A2R3:

a. Set START/CW control for 17.0 Vdc at A4TP4.

b. Select value for A2R3 to give the frequency specified in the frequency calibration table in the operating and service manual or for f3 as calculated from the calibration table. (Table 2) If a compromise is required, select the value of resistance such that the frequency is on the low side of the specified frequency.

6. To select the value for A2R4 through A2R11, follow step 5. Progress to the next higher frequency point only after the preceeding point is calibrated.

7. After all points have been calibrated, the 8690A/B dial accuracy should be checked as outlined in procedure III. If necessary, compromise the adjustments of A2R12, A2R13, and A1R24 to achieve frequency accuracy specification.

Table 2. Table for Calculating Calibration Points

A4TP4 VDC	Frequency Designation	Frequency, GHz	Controlling Resistor, A2
3.00	f1	Low freq end of band	R1, R12
10.00	f2	$f2 = \frac{f11 - f1}{10} + f1$	R2, R13
17.00	f3	$f3 = \frac{f11 - f1}{10} + f2$	R3
24.00	f4	$f4 = \frac{f11 - f1}{10} + f3$	R4
31.00	f5	$f5 = \frac{f11 - f1}{10} + f4$	R5
38.00	f6	$f6 = \frac{f11 - f1}{10} + f5$	R6
45.00	f7	$f7 = \frac{f11 - f1}{10} + f6$	R7
52.00	f8	$f8 = \frac{f11 - f1}{10} + f7$	R8
59.00	f9	$f9 = \frac{f11 - f1}{10} + f8$	R9
66.00	f10	$f10 = \frac{f11 - f1}{10} + f9$	R10
73.00	f11	High freq end of band	R11

Make the following additional adjustments as outlined in your Operating and Service Manual:

A. ALC Shunt Level Adjustment.

B. Grid Sensitivity Adjustment, (A Modle RF Units only).

MANUAL CHANGES

MANUAL CHANGES

MANUAL IDENTIFICATION

Model Number: 8691B-95B
Date Printed: June 1970
Part Number: 08691-90022

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes
1140A	1
1144A06006	1, 2, 3
1210A	1, 2, 3, 4

NEW ITEM

Serial Prefix or Number	Make Manual Changes
1243A	1-5
1243A07863, 07915, 07938, 07939, 08001	1-6
1313, 1335A	1-7

ERRATA

Table of Contents, List of Illustrations:
Change Figure 2-2 entry to read:
Figure 2-2. Maintenance Setup Number 2 2-8

Page 1-1, Paragraph 1-8:
Add the following:
The option changes the normal frequency range of the RF Unit. (Refer to Table 1-1).

Page 1-1, Paragraph 1-15 and Page 2-3, Paragraph 2-22.
Add the following:

NOTE
Allow 30 minutes warmup.

Page 1-2, Table 1-1:
Add as a note that Residual FM specifications are degraded by 2 times normal specification when RF units are installed in HP 8707A RF Unit Holder.

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

12 March 1974

10 Pages

Printed in U.S.A.

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Page 1-3, Table 1-1:
Add the following Residual AM specification for the HP Model 8695B RF Units.

RESIDUAL AM: The rms Residual AM components in a 100 kHz modulation bandwidth are a minimum of 48 dB below the carrier.

Page 1-3, Table 1-1:
Change 8695B Residual FM specification to read: "< 40 kHz peak."

Page 1-5, Figure 1-3:
Delete the word "automatic" from UNLEVELED description (No. 1).

Page 2-1:
Add the following note after paragraph 2-3:

NOTE

Use a recently calibrated 8690 Mainframe.

Page 2-2,
Change Paragraph 2-15 to read as follows:
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 shipment from Hewlett-Packard. If the BWO tube fails within this warranty period, use the Warranty Claim form supplied with the BWO tube.

Page 2-2, Paragraph 2-18:
Add this Warning after paragraph 2-18:

WARNING

A possible SHOCK HAZARD exists when Varian BWO tubes are installed if the front panel connector is not grounded to the RF Unit chassis.

Page 2-2, Paragraph 2-19.
Add the following:

NOTE

Anode voltage and cathode current given on tube manufacturer's label.

Page 2-2, Paragraph 2-19, step g.
Change the last sentence to read:
Adjust A1R42, Anode Adjust, to obtain cathode current specified by the tube manufacturer. Operating parameter label is on BWO.

Page 2-3:
Add the following note after paragraph 2-22:

NOTE

Use a recently calibrated 8690 Mainframe.

Page 2-3, Paragraph 2-23:
Change item (3) to read: "Power level control adjustment."

Page 2-4, Table 2-3, ANODE SHAPING ADJUSTMENT:
Change 8695B power level tabulated in step d, to read: "11.8 dBm."

ERRATA (Cont'd)

Page 2-5, Table 2-3, Helix Voltage Shaping Adjustment:
Change steps k, l and m as follows:

k. Set START/CW and MANUAL SWEEP for 73.00 ±0.01 VDC at A4TP4 (8690A/B Assy A4).

l. Adjust A1R24, SHAPE ADJ, on "B" Modulator Assy A1 for high end frequency of specified range.

m. Repeat steps i through l until adjustments are not necessary.

Page 2-12, Figure 2-6:
Interchange present Figure 2-6 with Figure shown on page I-3 of Appendix I (rear of manual).

Page 3-1, Table 3-1:
Change value of 8695B Helix Overcurrent Shunt Resistor to 26.1K ohm.
Change the last sentence of footnote 1 to read "The 26.1K ohm helix overcurrent shunt resistor is HP Part No. 0698-3418".

Page 3-3, Table 3-3:
Add resistor A1R17 HP Part No. 0698-3418 R:FXD MET FLM 26.1K ohm 1% 1/2 W (8695B).

Page 3-4, Table 3-3:
Add asterisk (*) in Note column of resistors A1R36 (9 places) and A1R37 (8 places).
Add the following to the bottom of the page:
* FACTORY SELECTED PART.

Page 3-5, Table 3-3:
Add asterisk (*) in Note column of resistor A1R37.
Add the following to the bottom of the page:
* FACTORY SELECTED PART.

Page 3-8, Table 3-3:
Change A4 to HP Part No. 5086-7064 PIN MODULATOR (8695B).
Change DS1, HP Part No. 1450-0157 to read DS1 1450-0371 LENS:LAMP, AMBER.

Page 3-10, Table 3-3:
Add W5 HP Part No. 08691-6124 CABLE ASSY: OPTION 001 HARNESS.

Page 3-10, Table 3-3, under MISCELLANEOUS:
Change RF OUTPUT KNURLED NUT to HP Part 08691-210.

Page 4-5, Figure 4-3:
Change illustrations in the manual for the two in this change sheet.

Page 4-9, Figure 4-4:
Add to the manual the illustration in this change sheet.

Rear of manual, Appendix I, page I-3:
Change page number entry under Change F to read: "Page 3-12, Figure 2-6."

Rear of manual, last page:
Add attached copy of "Conditions of Warranty" with attached copy.
Replace "Warranty Claim and Adjustment Procedure" with Warranty Claim form shipped with the RF Unit.

CHANGE 1

Serial Prefix change only. Does not affect performance of instrument.

CHANGE 2

Page 3-10, Table 3-3; under MISCELLANEOUS:
Add the following note to define the 8691-95B color Scheme:

NOTE

This change implements a different color scheme for the standard instrument. Colors prior to this change are now available as options. Refer to listing below.

8691-95B STANDARD - Indicates color scheme for the 8691-95B Models beginning with this change. (Includes MINT GRAY front panel).

8691-95B Option A85 - Indicates combination color scheme. (Includes LIGHT GRAY front panel).

8691-95B Option X95 - Indicates color scheme for the 8691-95B models prior to this change. (Includes LIGHT GRAY front panel).

Add the following 8691-95B parts or description changes:

08691-0101 FRONT PANEL (LIGHT GRAY)(8691B).
\# 08691-00119 FRONT PANEL (MINT GRAY) (STANDARD)(8691B).

08691-2111 FRONT SNOUT (LIGHT GRAY)(8691B-94B).
\# 08691-20116 FRONT SNOUT (MINT GRAY) (STANDARD)(8691B-94B).

08691-2112 REAR PANEL (LIGHT GRAY)(8691B-95B).
\# 08691-20117 REAR PANEL (MINT GRAY)(STANDARD)(8691B-95B).

08691-2114 REAR PANEL (LIGHT GRAY)(STANDARD)(8691B-95B OPT 004).
\# 08691-20118 REAR PANEL, (MINT GRAY)(STANDARD)(8691B-95B OPT 004).

08691-4003 LATCH HANDLE (LIGHT GRAY)(8691B-95B).
\# 08691-40005 LATCH HANDLE (MINT GRAY)(STANDARD)(8691B-95B).

08692-0101 FRONT PANEL (LIGHT GRAY)(8692B , 8692B Opt. 004).
\# 08692-00009 FRONT PANEL (MINT GRAY)(STANDARD)(8692B, 8692B Opt. 004).
08692-0110 FRONT PANEL (LIGHT GRAY)(8692B OPT 100).
\# 08692-00013 FRONT PANEL (MINT GRAY)(STANDARD)(8692B Opt. 100).

08693-0101 FRONT PANEL (LIGHT GRAY) (8693B, 8693B Opt. 001, 8693B Opt. 004).
\# 08693-00112 FRONT PANEL (MINT GRAY)(STANDARD)(8693B, 8693B Opt. 001, 8693B Opt. 004).
08693-0108 FRONT PANEL (LIGHT GRAY)(8693B OPT 100).
\# 08693-00114 FRONT PANEL (MINT GRAY)(STANDARD)(8693B OPT 100).

08694-0101 FRONT PANEL (LIGHT GRAY)(8694B, Opt. 001, 8694B, Opt. 004).
\# 08694-00125 FRONT PANEL (MINT GRAY)(STANDARD)(8694B, 8694B, Opt. 001, 8694B Opt. 004).
08694-0113 FRONT PANEL (LIGHT GRAY)(8694B OPT 100).
\# 08694-00127 FRONT PANEL (MINT GRAY)(STANDARD)(8694B OPT 100).

08694-0115 FRONT PANEL (LIGHT GRAY)(8694B OPT 200).
\# 08694-00129 FRONT PANEL (MINT GRAY)(STANDARD)(8694B OPT 200).
08695-00002 FRONT PANEL (LIGHT GRAY)(8695B).
\# 08695-00008 FRONT PANEL (MINT GRAY)(STANDARD)(8695B).

08695-2111 HOUSING (LIGHT GRAY) (8695B).
08695-20010 HOUSING (MINT GRAY) (STANDARD) (8695B).

\# Denotes standard color for 8691B-95B parts beginning with this change.

CHANGE 3

Page 3-7, Table 3-3:
Add A2 HP Part No. 08695-60109 (Assy. Freq. Shape used with 1951-0059 VA BWO)

R1	0757-0127	R: FXD MET. FLM.	215K OHM	1%	.5W	*
R2	0757-0059		1M			
R3	0727-0278		1.13M			
R4	0757-0872		1.3M			
R5	0757-0870		825K			
R6	0757-0872		1.3M			
R7	0757-0870		825K			
R8	0757-0868		562K			
R9	0757-0869		681K			
R10	0757-0134		422K			
R11	0757-0136		619K			
R12	2100-0969	R: VAR MET FLM	50K	LIN 20%	.75W	
R13	2100-0945	R: VAR MET. FLM	500K	5%	.75W	

(*Factory selected value)

CHANGE 4

The following information aids in documenting the 8695B OPTION 004.

Page 1-1, Paragraph 1-6:
Add 8695B Option 004 available.

Page 1-3, Table 1-1:
Add to 8695B RF Unit, OPTION 004 Rear Panel RF Output.

Page 3-9, Table 3-3:
Add V1 HP Part No. 1951-0059 VARIAN BWO TUBE P BAND 8695B OPTION 004.

Page 3-10, Table 3-3:
Add HP Part No. 08695-00011 PANEL FRONT, 8695B OPTION A85/004 OR X95/004.
Add HP Part No. 08695-00012 PANEL FRONT, 8695B OPTION 004.
Change HP Part No. 08695-00001 to HP Part No. 08695-00013 BRACKET: PIN MODULATOR-SUPPORT, 8695B STANDARD AND OPTION 004.
Add W6 HP Part No. 08695-20013 CABLE ASSEMBLY: 8695B OPTION 004.
Add W6 HP Part No. 08695-20014 CABLE ASSEMBLY: 8695B.
Add WG1 HP Part No. 08695-20015 WAVEGUIDE ASSEMBLY P BAND 8695B STANDARD AND OPTION 004.
Add HP Part No. 08695-60005 ADAPTER: SMA TO WAVEGUIDE.
Add HP Part No. 08695-60008 RF UNIT ASSEMBLY: 8695B OPTION 004.
Add HP Part No. 08695-60012 RF UNIT ASSEMBLY: 8695B OPTION A85/004.
Add HP Part No. 08695-6106 RF UNIT ASSEMBLY: 8695B OPTION X95/004.

CHANGE 5

Page 3-1, Table 3-1:
Change 8695B, Watkins-Johnson BWO, Helix Current Shunt Resistor A1R17 to 19.6K ohm.
Change footnote 1 to read: The 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 resistor is Part No. 0698-3414. The 34.8K ohm resistor is Part No. 0757-0123. The 26.1K ohm resistor is Part No. 0698-3418. The 19.6K ohm resistor is Part No. 0698-3415.

CHANGE 5 (Cont'd)

Page 3-3, Table 3-3:
Change A1R17 to HP Part No. 0698-3415 R:FXD MET FLM 19.6K OHM 1% 0.5W (8695A) (WJ BWO).

CHANGE 6

This change applies only to the Model 8693B Option 001.

Page 3-6, Table 3-1:
Change description of A2 HP Part No. 08693-6101 to read: ASSY: FREQ. SHAPE (8693B) USED WITH 1951-0065 BWO (NOT TO BE USED WITH OPT 001) REFER TO PARAGRAPH 3-5.
Change description of A2 HP Part No. 08693-6102 to read: ASSY:FREQ. SHAPE (8693B Option 001) USED WITH 1951-0057 BWO REFER TO PARAGRAPH 3-5.

Page 3-9, Table 3-3:
Change V1 description of HP Part No. 1951-0057 to read: ELECTRON TUBE: BWO (ALL 8693B and Option 001) REFER TO PARAGRAPH 3-5.
Change V1 description of HP Part No. 1951-0065 to read: ELECTRON TUBE: BWO (ALL 8693B EXCEPT OPT 001 MODELS) REFER TO PARAGRAPH 3-5.

Page 3-10, Table 3-3:
Add W4 HP Part No. 08692-6115 ASSY:RF CABLE 8693B STD AND OPTION 001 USED WITH VARIAN BWO ONLY.

CHANGE 7

Page 3-10, Table 3-3:
Add W3 HP Part No. 08692-6114 ASSY: RF CABLE 8694B STD USED WITH VARIAN BWO ONLY.
Add HP Part No. 08691-0105 BRACKET: MOUNTING.

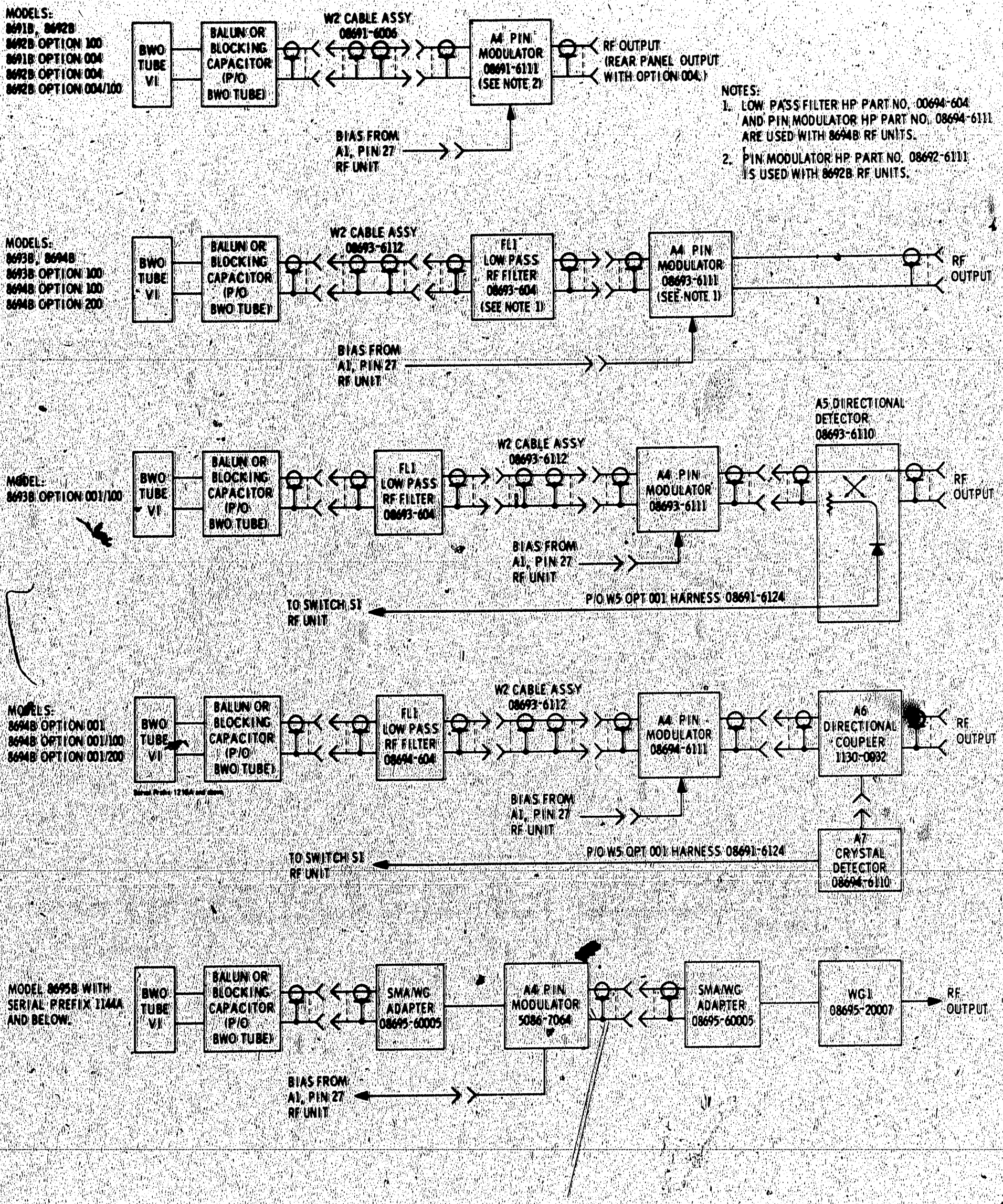
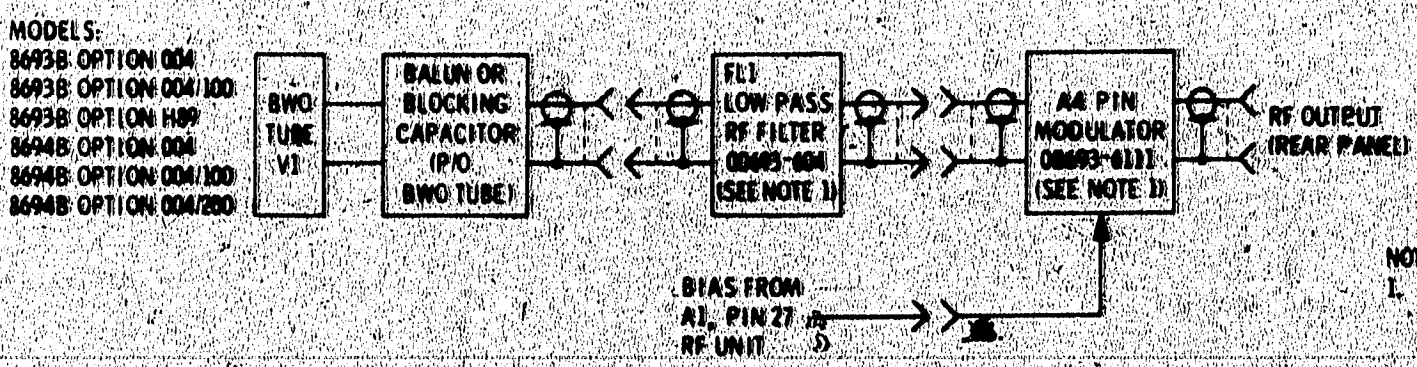
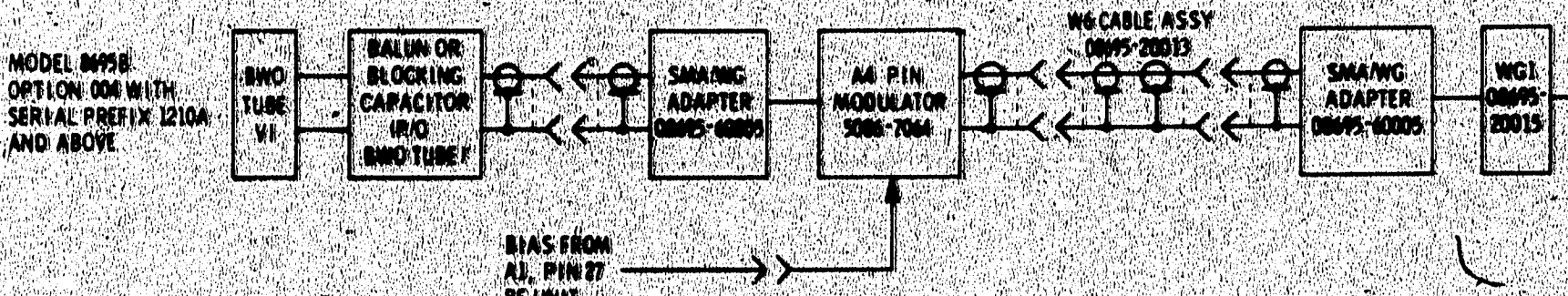


Figure 4-3. Output Configurations Used with Watkins-Johnson BWO Tubes (1 of 2)





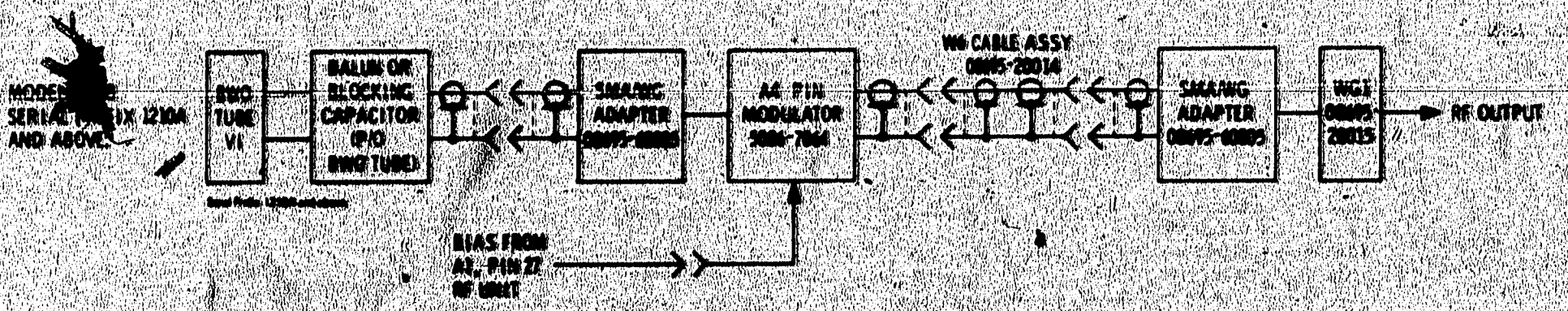


Figure 4-3. Output Configurations Used with Watkins-Johnson BWO Tubes (2 of 2)

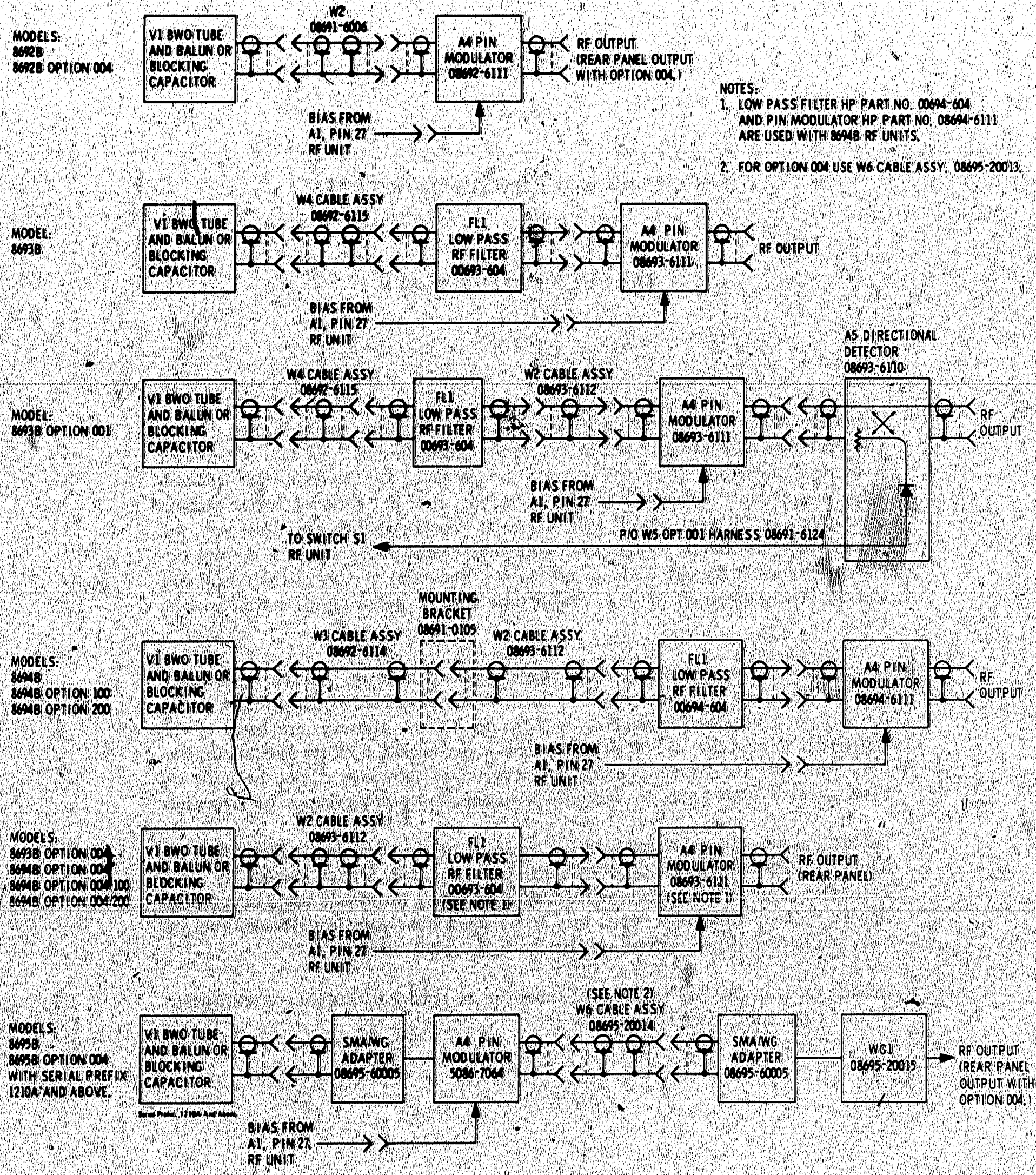


Figure 4-4. Output Configurations Used with Varian BWO Tubes

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CONDITIONS OF WARRANTY

FOR

BACKWARD WAVE OSCILLATOR TUBES

AND

TRAVELING WAVE TUBES

Microwave (BWO, TWT) tubes are warranted to be free from manufacturing defects. The operating tube warranty will be 12 months unconditional from date of shipment from Hewlett-Packard. If a tube carrying this warranty fails and must be replaced, only the applicable remaining warranty of the first tube is transferred to the replacement tube, or 90 days, which ever is greater. The Hewlett-Packard Company will process warranty claims for customers on tubes which were supplied by Hewlett-Packard for use in Hewlett-Packard instruments. The serial number of the tube failing and the serial number of the replacement tube must be noted on the warranty claim form.

"In Warranty" tubes purchased from Hewlett-Packard must be returned immediately (not to exceed 30 days from date of failure) with a completed Warranty Claim Form, to your local Hewlett-Packard Sales and Service Office. Addresses are listed in the Instrument Manual. Be sure to pack the tube in accordance with the Packing Instructions listed on the Warranty Claim Form; warranty allowance cannot be made on tubes received broken due to improper packaging or showing evidence of tampering.

Instructions for filing a warranty claim are listed on the *"Microwave Tube Warranty Claim"* form which is included with the Operating and Service Manual for your instrument. This form is also included with replacement Microwave tubes supplied by Hewlett-Packard. Additional copies may be obtained from your local Hewlett-Packard Sales and Service Office. (Please ref: HP Stock No. 9320-1865.)

Hewlett-Packard specified replacement tubes can be obtained from your local Hewlett-Packard Sales and Service Office.