Errata

Title & Document Type: **606B Signal Generator Operating and Service Manual**

Manual Part Number: **00606-90017**

Revision Date: **September 1972**

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HP References in this Manual

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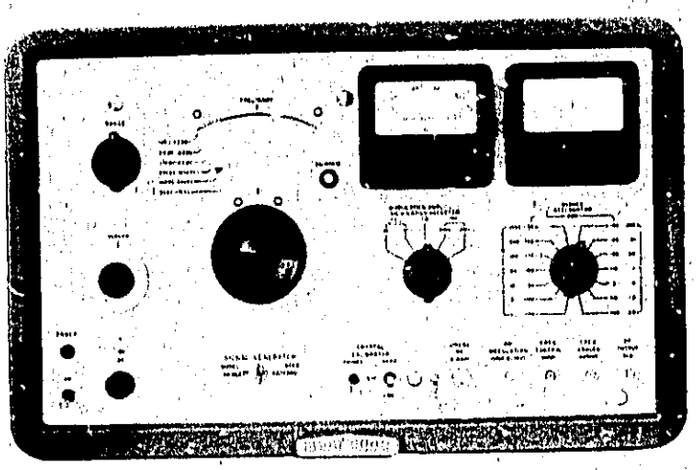
OPERATING AND SERVICE MANUAL

HF SIGNAL GENERATOR
606B



HEWLETT hp PACKARD

CERTIFICATION

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

WARRANTY AND ASSISTANCE

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

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

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

OPERATING AND SERVICE MANUAL

HIGH FREQUENCY

SIGNAL GENERATOR

606B

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1152A.

With changes described in Appendix I, MANUAL CHANGES, this manual also applies to instruments with serial numbers prefixed 608, 724, 811, 959 and 0959A.

For instruments with serial number prefixes greater than 1152A, a Manual Changes supplement which keeps the manual up-to-date, may be obtained, on request, from your nearest HP office.

1501 PAGE HILL ROAD, PALO ALTO, CALIFORNIA, U.S.A.

Manual Part No. 00606-90017
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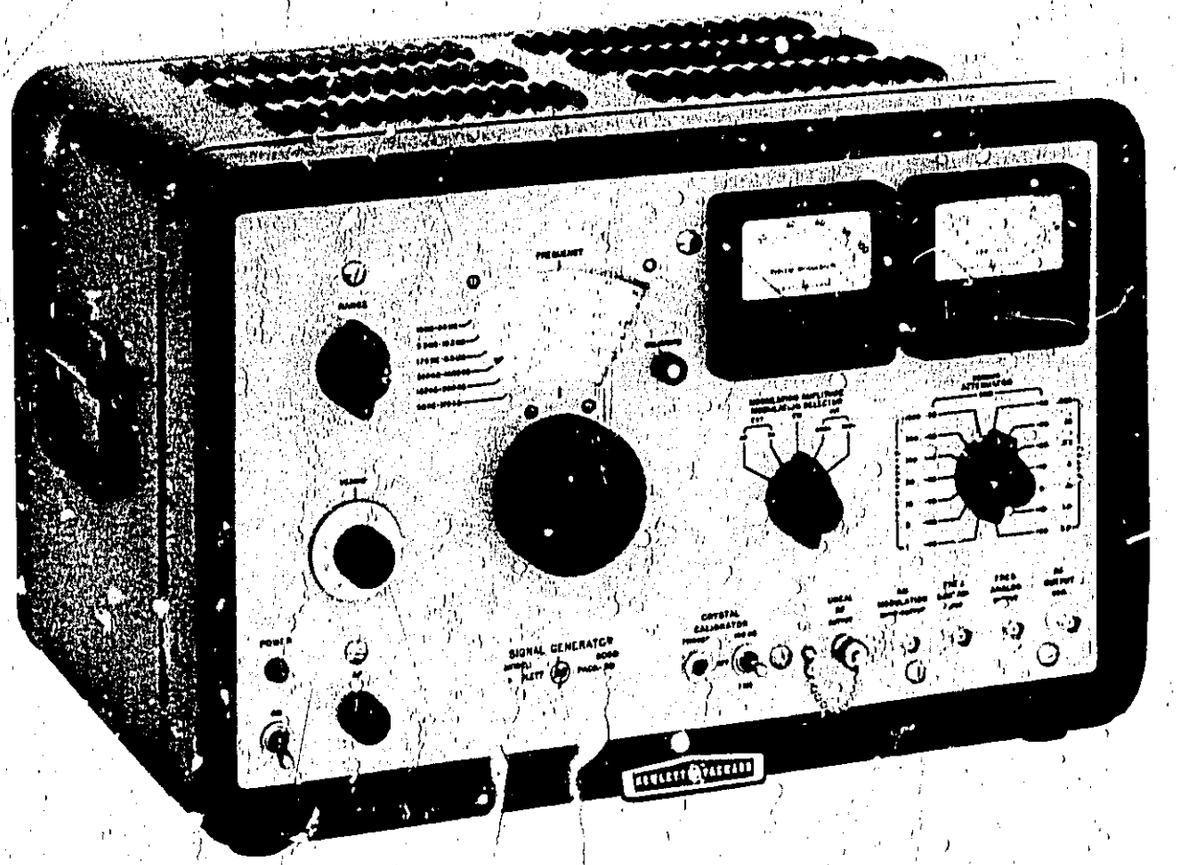


Figure 1-1. Model 606B Signal Generator

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Hewlett-Packard Model 606B (Figure 1-1) is a general purpose, high-frequency signal generator. The instrument is a self-contained unit with all operating controls on the front panel. The direct reading frequency dial is calibrated to an accuracy of 1 percent. An RF output meter indicates RF output voltage level and a percent modulation meter indicates the percent of amplitude modulation for frequencies within the modulation bandwidth.

1-3. The amplitude-modulation system provides modulation up to 90% with low distortion and incidental FM. This feature provides a precision distortion check capability for receivers from antenna to output. Modulation capabilities include internal modulation at 400 or 1000 Hz and external modulation from dc to 20 kHz or more, depending on the RF frequency in use. In addition, complex waveforms, square waves, and dc voltages may be used to modulate the signal generator for testing and evaluating filters, networks, amplifiers, and receivers. Detailed specifications are contained in Table 1-1.

Table 1-1. Specifications

FREQUENCY CHARACTERISTICS

Range: 50 kHz to 65 MHz in 6 bands (50 to 170 kHz, 165 to 560 kHz, 530 to 1800 kHz, 1.76 to 6 MHz, 5.8 to 19.2 MHz, 19 to 65 MHz). Total scale length approximately 95 in.

Accuracy: ±1%

Drift: (Attenuator on 1 volt range and below). Less than 50 parts in 10^6 (or 5 hertz, whichever is greater) per 10 minute period after 2 hr warmup. Less than 10 minutes to restabilize after changing frequency.

Stability when used with 8708A Synchronizer: 5×10^{-8}/minute, 2×10^{-7}/10 minutes, 2×10^{-6}/day; 2×10^{-7}/°C, 0° to 55°C; 2×10^{-7}/10% line voltage change.

Resettability: VERNIER control resettability better than 0.15% after initial warmup.

ΔF Control: Ultra-fine frequency vernier provides better than 10 parts in 10^6 settability; total range of ΔF control approximately 0.1%.

Crystal Calibrator: Provides frequency checkpoints every 100 kHz and 1 MHz. Headphone jack provided for audio frequency output (headphone not included). Crystal frequency accuracy better than 0.01% from 0°to 50°C. Cursor on frequency dial adjustable over small range to aid in interpolation adjustment. Calibrator may be turned off when not in use.

Residual FM: Less than 1 part in 10^6 or 20 hertz peak, whichever is greater.

Frequency Control Input: BNC female connector for "Frequency Control Output" from 8708A Synchronizer. Can also be used for external frequency control: Voltage change from -2 to -32 volts changes frequency approximately 0.2% at low end of each band and approximately 2% at high end. Nominally 4K ohm input impedance, direct-coupled. Voltage limits: 0 volts applied ≥ applied voltage ≥ -50 volts.

OUTPUT CHARACTERISTICS

Output Level: Continuously adjustable from 0.1 microvolt to 3 volts into 50 ohm resistive load. Output ATTENUATOR calibrated in 10 dB steps from 3 volts full scale to 1.0 microvolt full scale (into 50 ohms), also calibrated in dBm (0 dBm = 1 milliwatt in 50 ohms). VERNIER control provides continuous adjustment of voltage between full scale ranges. Output level indicated on RF Output Meter calibrated in volts (0 to 1 and 0 to 3 volts) and dBm (-10 to +3 dBm).

Frequency Response and Output Accuracy (Attenuator range 1 volt and below; 50 ohm resistive load): At any output voltage setting, output level variation with frequency change is less than 2 dB, total, across entire frequency range. Output accuracy better than ±1 dB at any frequency.

Impedance: 50 ohms, SWR less than 1.2 on 0.3 volt attenuator range, and below.

RFI: Meets all conditions specified in MIL-I-6181D; permits receiver sensitivity measurements down to at least 0.1 microvolt.

Harmonic Output: At least 30 dB below the carrier.

Spurious AM: Hum and noise sidebands are 70 dB below carrier down to thermal level of 50 ohm output system.

Auxiliary RF Output: Fixed level CW signal from RF oscillator (minimum amplitude 100 mV into 50Ω on Bands 1-5; 200 mV into 50Ω on Band 6) provided at front panel BNC female connector for use with HP 8708A Synchronizer or other external equipment (e.g., frequency counter).

Table 1-1. Specifications (cont'd)

MODULATION CHARACTERISTICS

Internal AM:

Frequency: 400 and 1000 Hz, ±5%. Modulation signal available at front panel BNC female connector for synchronization of external equipment.

Modulation Level: 0 to 95% on 1 volt range and below; 0 to at least 30% on 3 volt range.

Carrier Envelope Distortion: Less than 1% at 30% AM; less than 3% at 70% AM (Attenuator on 1 volt range and below).

External AM:

Frequency: dc to 20 kHz maximum, dependent on carrier frequency (f_c) and percent modulation as tabulated:

Maximum Modulation Frequency

30% Mod	70% Mod	Squarewave Mod
0.06 f_c	0.02 f_c	0.003 f_c (3 kHz max)

Modulation Level: 0 to 95% on 1 volt attenuator range and below, 0 to at least 30% on 3 volt range.

Input required: 4.5 volts peak produces 95% modulation (maximum input 50 volts peak); input impedance 1000 ohms.

Carrier Envelope Distortion: Less than 3% at 70% AM (Attenuator on 1 volt range and below).

Modulation Meter:

Accuracy: ±5% of full scale, 0 to 90%, for modulation frequencies to 10 kHz, ±10% of full scale for frequencies from 10 kHz to 20 kHz.

Modulation Level Constancy (internal or external AM; Attenuator on 1 volt range and below): Modulation level stays constant within ±1/2 dB regardless of carrier frequency and output level changes.

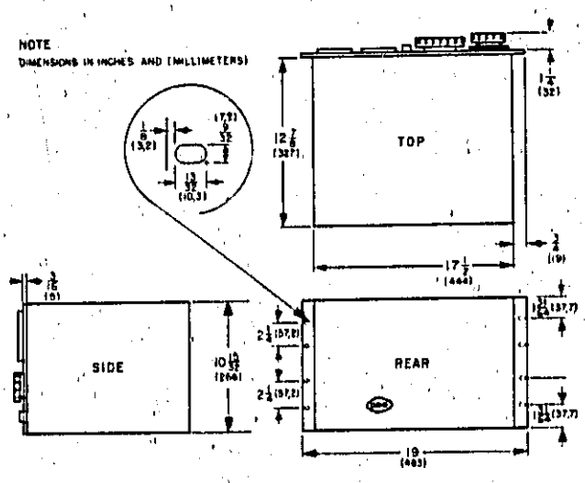
Incidental Frequency Modulation (attenuator on 1 volt range and below, 30% modulation): Less than 5×10^{-6} + 100 hertz peak.

GENERAL

Power: 115 or 230 volts ±10%, 50 to 400 Hz, 135 watts.

Dimensions:
Cabinet Mount: 20-3/4 in. wide, 12-1/2 in. high 14-3/4 in. deep (527 x 318 x 370 mm).

Rack Mount:



Net Weight:
Cabinet Mount: 53 lbs (23,9 kg); Rack Mount, 48 lb (21,6 kg).

Accessories Available:

11507A Output Termination, provides 3 positions: 50 ohms (for use into high impedance); 5 ohms (10:1 voltage division); IEEE Standard Dummy Antenna (driven from 10:1 divider);

11509A Fuse Holder, provides protection for output attenuator when 606B is used for transceiver tests;

10514A Mixer, for use as nanosecond pulse modulator;

8708A Synchronizer

1-4. Accessories available for use with the Model 606B include the 8708A Synchronizer, the 11507A Output Termination and the 11509A Fuseholder. The Output Termination has three capabilities. It can be used as a 50-ohm termination which reduces the source impedance to 25 ohms, as a 20-dB attenuator (10:1 voltage divider) which reduces the source impedance to 5 ohms, or it can be used to simulate an IEEE standard dummy antenna (10:1 voltage division) for precision measurements on receivers. The Fuseholder protects the signal generator output attenuator from damage when transceiver type equipment is being tested. If the transmitter is accidentally keyed, the fuse prevents power from being applied to the signal generator RF OUTPUT connector. The Fuseholder requires two type BNC-to-N adapters, UG-201A/U and UG-349A/U (not furnished), unless equipment cables are used. The Model 8708A Synchronizer is a frequency stabilizer by means of which the 606B can be phase-locked on any carrier frequency with 2×10^{-7} settability.

1-5. INSTRUMENT IDENTIFICATION.

1-6. Hewlett-Packard instruments have a two-part serial number. The first three digits are the serial prefix. If the prefix on your instrument is not listed on the title page of this manual, in the appendix, or on a Manual Change sheet enclosed with the manual, the correct information may be obtained from any Sales and Service Office listed at the rear of this manual.

SECTION II
INSTALLATION

2-1. INCOMING INSPECTION.

2-2. This instrument was inspected mechanically and electrically prior to shipment. Inspect for damage in transit, and test electrical performance using the procedure given in paragraph 5-3. If there is damage or deficiency, or if electrical performance is not within specifications, contact the carrier and your nearest Hewlett-Packard Sales Office immediately. (See list at rear of this manual.)

2-3. PREPARATION FOR USE.

2-4. POWER REQUIREMENTS.

2-5. The Model 606B requires a power source of 115 or 230 volts ± 10%, single phase, 50 to 400 Hz, which can deliver approximately 135 watts. To prepare the Model 606B for operation, remove the rear cover, position the 115-230 volt switch to correspond with line voltage, and install line fuse of correct rating (slow blow, 2.5 ampere for 115 volts, 1.25 ampere for 230 volts).

CAUTION

To avoid damage to the instrument, set the 115-230 volt switch for the line voltage to be used before connecting the power cable.

2-6. POWER CABLE.

2-7. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panel and cabinet be grounded. This instrument is equipped with a three-connector power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset round pin on the power cable connector is the ground pin.

2-8. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter (HP Part No. 1251-0048) and connect the green pigtail on the adapter to ground.

2-9. COOLING.

2-10. No forced cooling is used in this instrument. Louvers in the chassis are used for heat dissipation. If the 606B is mounted in a rack cabinet, supply sufficient cooling to assure that the ambient air around the 606B does not exceed 50° C.

2-11. REPACKAGING FOR SHIPMENT.

2-12. If the Model 606B is to be packaged for shipment, use original shipping container and packing materials. If these have been discarded or are not in condition for reuse, obtain new materials from your local Hewlett-Packard sales and service office (see rear of this manual for locations), or follow these general instructions:

a. Wrap the instrument in heavy paper or plastic. (If the instrument is being shipped to a Hewlett-Packard service facility, attach a tag indicating type of servicing required, return address, model number, and full serial number.)

b. Use a strong shipping container. A carton made of 500-600 pound test material will usually provide adequate protection.

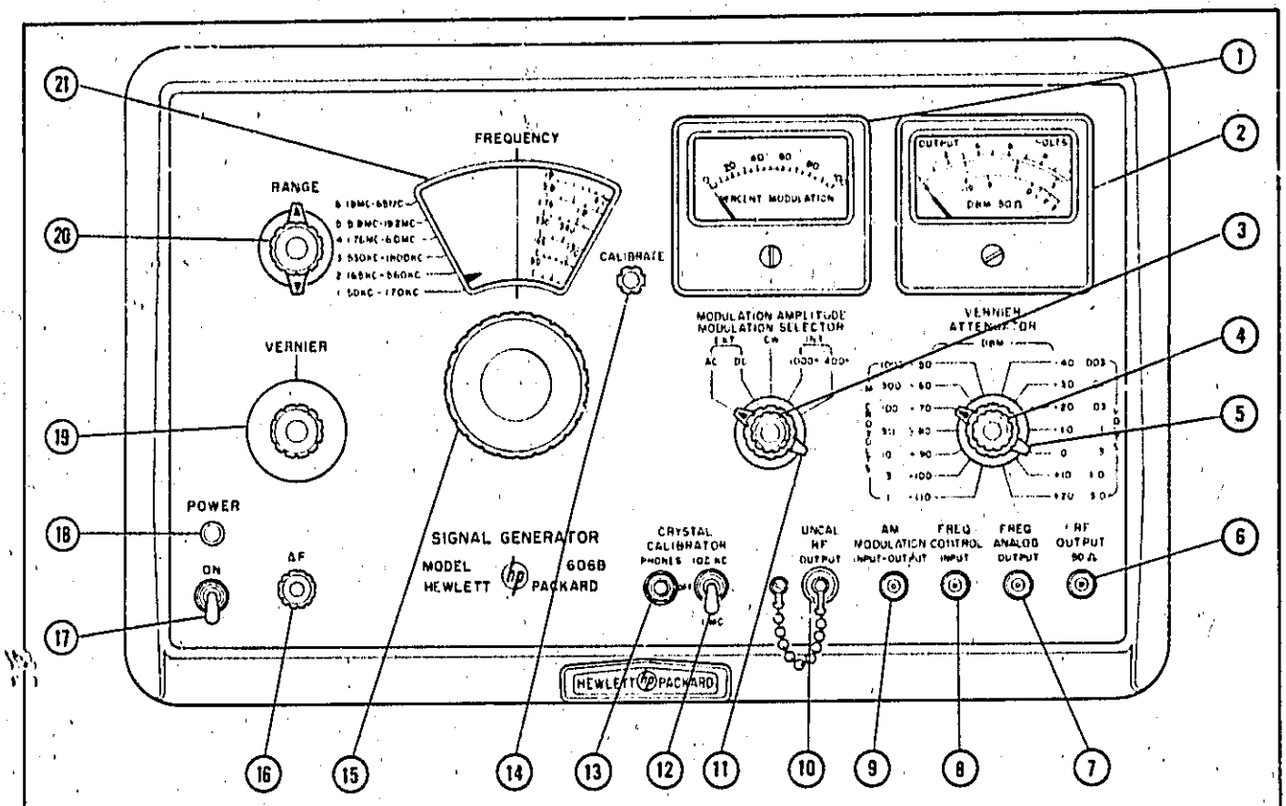
c. Use enough shock-absorbing material (3 to 4 inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the front control panel with cardboard. With Hewlett-Packard "floater pack" packaging, the foam blocks provide sufficient shock protection. Additional material is unnecessary.

d. Seal the shipping container securely.

e. Mark the shipping container "FRAGILE".

2-13. In any correspondence, refer to the instrument by model number and full serial number.

OPERATION



1. PERCENT MODULATION. Indicates modulation amplitude selected by MODULATION AMPLITUDE control.
2. OUTPUT VOLTS. Indicates RF output voltage level.
3. MODULATION AMPLITUDE. Controls level of modulation amplitude.
4. VERNIER. Controls RF output voltage level between ranges selected by ATTENUATOR control.
5. ATTENUATOR. Controls RF output voltage level in ranges of 10 dB.
6. RF OUTPUT. Provides RF output signal.
7. FREQ ANALOG. Zero to 5000 ohms variable, proportional to the setting of the FREQUENCY control.
8. FREQ CONTROL. Accepts external frequency control signals.
9. AM MODULATION. Accepts external modulation signals or provides synchronization signals, depending on position of MODULATION SELECTOR control.
10. UNCAL RF. Provides uncalibrated RF output signals.
11. MODULATION SELECTOR. Selects source of modulation signals.
12. CRYSTAL CALIBRATOR. Selects frequency of calibration signal.
13. PHONES. Provides audio signals for frequency calibration.
14. CALIBRATE. Controls movable index line on FREQUENCY indicator dial.
15. FREQUENCY. Provides coarse frequency adjustment.
16. ΔF. Provides extra-fine frequency adjustment. (Normally used to shift output frequency by a few cycles as indicated by an external counter.)
17. POWER. Controls application of AC line power.
18. POWER. Lights when AC line power is applied.
19. VERNIER. Provides fine frequency adjustment.
20. RANGE. Selects frequency band for frequency selection.
21. FREQUENCY. Indicates frequency band and frequency selected.

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

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section provides instructions for operating the Model 606B Signal Generator and identifies operating controls and indicators. Front panel controls, connectors, and indicators are shown and described in Figure 3-1. Three fuses and an ac line power connector are located on the rear panel. The power connector accepts either 115- or 230-volt power. The upper fuse on the rear panel protects the overall unit from circuit overloads. The center fuse protects the +300-volt power supply, and the lower fuse protects the -200-volt power supply.

3-3. BASIC OPERATING PROCEDURES.

3-4. Prepare the instrument for operation by performing the following basic operating procedures:

a. Set 115-230 line power switch to match line voltage and check that line fuse has correct rating. (Refer to paragraph 2-5.)

b. Connect instrument to power source.

c. Set front panel power switch to ON and ensure that POWER indicator lights.

3-5. OPERATING MODES.

3-6. GENERAL OPERATION.

3-7. USE OF OUTPUT ATTENUATOR. The output attenuator contains resistors that can be burned out by careless usage.

CAUTION

Damage to output attenuator may be incurred if: (1) output is shorted in the 3-volt range, (2) external voltage is applied to the attenuator output.

If the output is shorted out in the 3-volt range, or if voltage is applied into the attenuator accidentally, the resistors may be burned out or heated up so that the resistance is no longer calibrated. This may occur while measuring the sensitivity of a receiver in a mobile transmitter-receiver installation if the transmit button is activated. An attenuator fuse, HP Model 11509A, is available as an accessory when it is desired to use the Signal Generator under conditions where the attenuator may be damaged. The resistors in the attenuator are NOT field replaceable. Do not open the attenuator to check the resistors as placement of resistors is critical. The attenuator may be removed from the instrument and returned to the factory for repair.

3-8. The unusually high output range of 3 volts is useful for driving RF bridges or other equipment requiring a calibrated high-level, high-frequency voltage. This useful range is obtained at the expense of operating the power amplifier stage near the overload point. You will obtain best life from these tubes by not leaving the generator on the 3 VOLT range any longer than necessary to make your measurement. Never leave it on this range while warming up or during standby operation.

3-9. FREQUENCY STABILIZATION. The frequency of the Model 606B may be stabilized by using the phase-lock capability of the Model 8708A Synchronizer. The procedure is described in the Operating and Service Manual for the Model 8708A.

3-10. USE OF SYNCHRONIZATION SIGNAL. When the Model 606B is modulated internally, a signal is available at the AM MODULATION jack for synchronization purposes. This signal is supplied from the same oscillator which modulates the carrier. It is of approximately 3-volts rms amplitude from a high-impedance source. Since the signal comes from a high-impedance source, use it only as a voltage source and do not attempt to draw current.

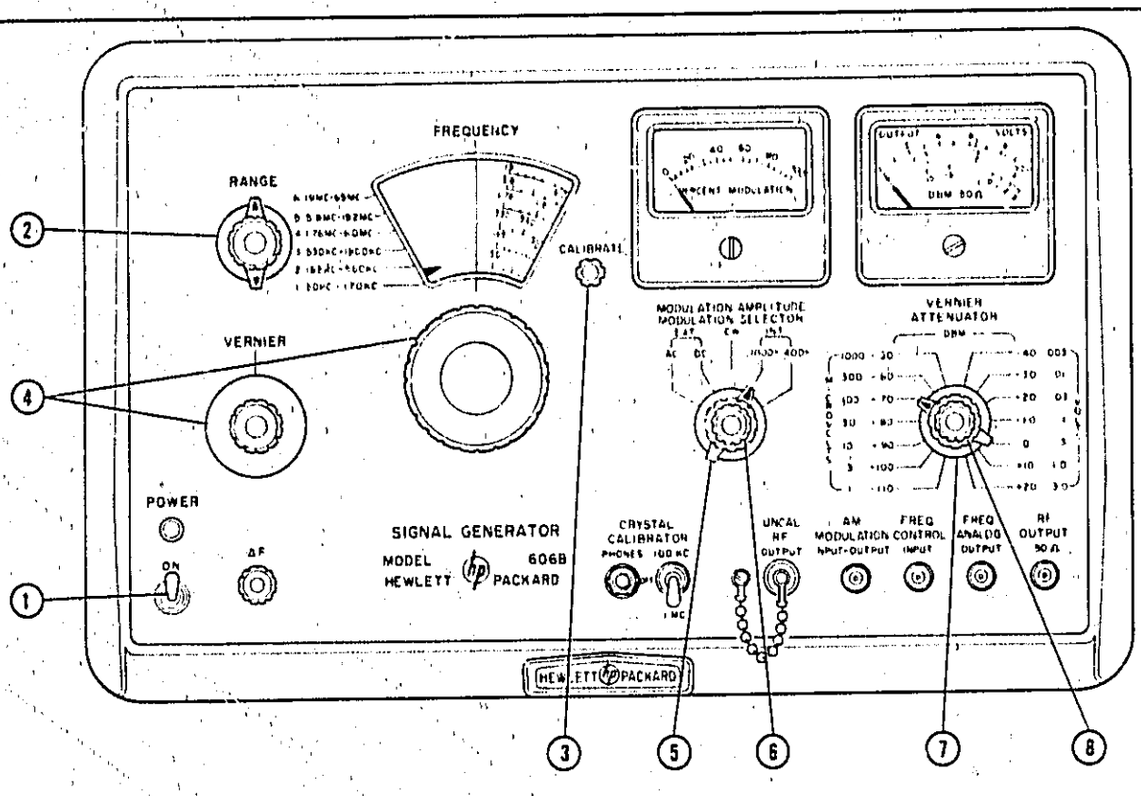
3-11. The use of all remaining controls for the Model 606B are of a general nature, and step-by-step instructions for operating the unit are given in Figure 3-2.

3-12. EXTERNAL OUTPUT TERMINATION OPERATION.

3-13. The Model 606B output level is calibrated only when terminated with a 50-ohm resistive load. For use with any other load, the HP Model 11507A Output Termination is recommended (refer to Table 1-1).

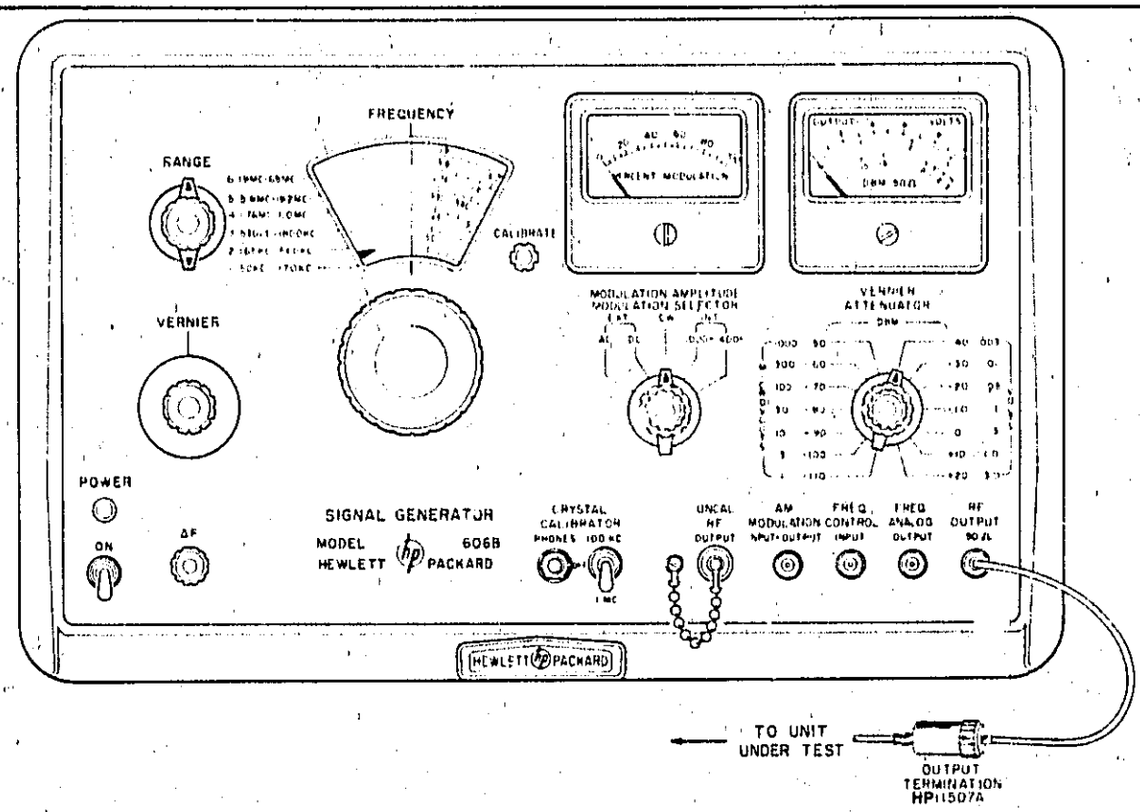
3-14. A coaxial cable of 50-ohms nominal impedance with BNC male connectors is suitable for use with the 606B. Single braid shield types are suitable for use from maximum output to approximately -80 dBm (30 microvolts). Double braid or solid types are recommended for use over the entire attenuation range. A good general-purpose cable is 3 feet of RG-55/U (double braid shield) with UG-88C/U BNC connectors on each end.

3-15. The output jack on the HP 11507A has been provided as a BNC connector for maximum shielding. Clip-lead connection may be provided easily by inserting a UG-290/U connector with soldered-on clip leads into the output jack of the Output Termination. Keep the length of the clip leads as short as possible. See Figure 3-3 for information concerning output cable termination.



1. Set POWER switch to ON.
2. Set RANGE switch to desired frequency band.
3. Using CALIBRATE control, align the index on the FREQUENCY indicator dial with the engraved line on the front panel. FREQUENCY dial is not calibrated until this operation is performed.
4. Select desired frequency by rotating FREQUENCY and VERNIER controls. (Read selected frequency on FREQUENCY dial scale indicated by red RANGE pointer.)
5. Set MODULATION SELECTOR switch to INT. and select desired modulation frequency (400 Hz or 1000 Hz modulation).
6. Select desired level of modulation by rotating the MODULATION AMPLITUDE control. (Read modulation level on PERCENT MODULATION meter.)
7. Set ATTENUATOR switch to setting closest to the desired RF output voltage level.
8. Rotate the attenuator VERNIER control until desired RF output voltage is indicated on OUTPUT VOLTS meter. (Read range of OUTPUT VOLTS meter on ATTENUATOR switch and output voltage level on meter.)

Figure 3-2. General Operation



The attenuator on the Model 606B Signal Generator is calibrated only when used with a load of 50 ohms. For high-impedance loads or receiver inputs, Output Termination Model 11507A is recommended. This Output Termination is designed for use at the end of a 50-ohm shielded cable, and to operate into a high-impedance (500 ohms or greater) load.

The 11507A has three positions as the rear shell is rotated clockwise as follows:

a. DUMMY ANTENNA: Output impedance varies as per IEEE Standard Dummy Antenna* at an output level 20 dB below the input level (10:1 voltage division ratio).

b. ZERO DB ATTENUATION: 25-ohms output impedance (1:1 voltage ratio).

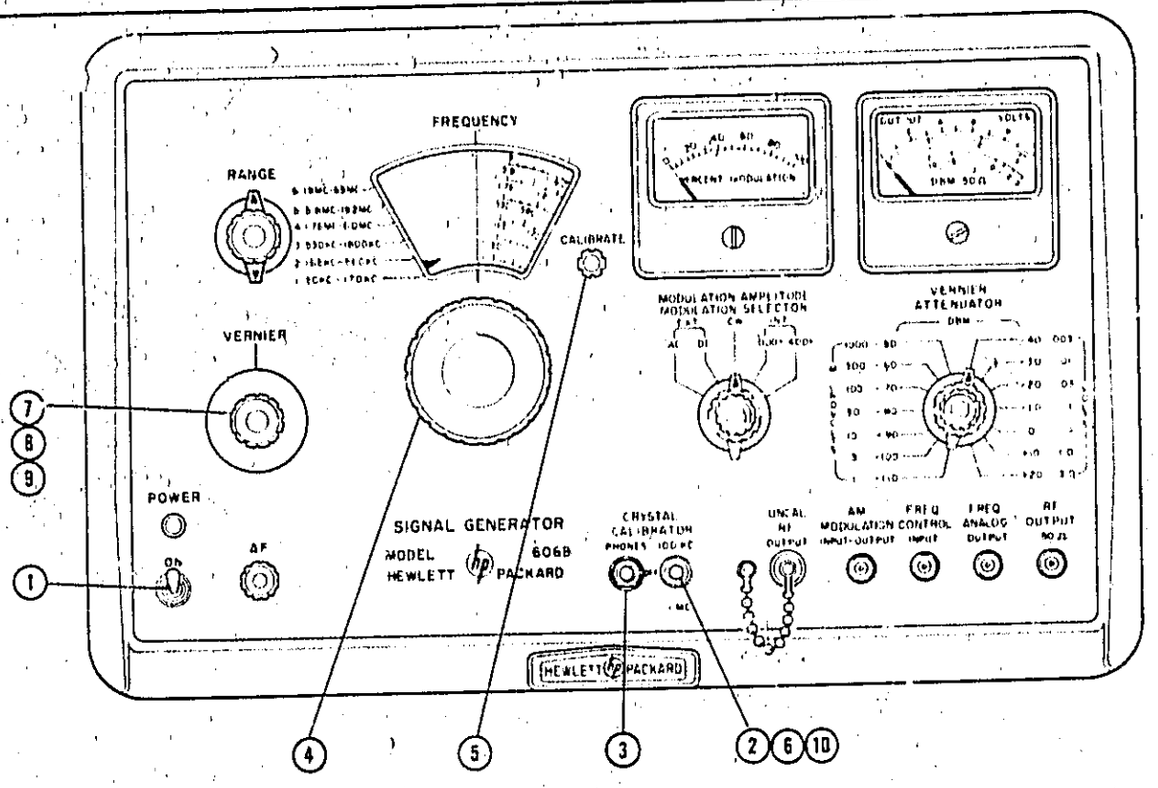
c. TWENTY DB ATTENUATION: 5-ohms output impedance (10:1 voltage division).

NOTE

Maximum permissible input power is 180 milliwatts (3 volts across 50 ohms).

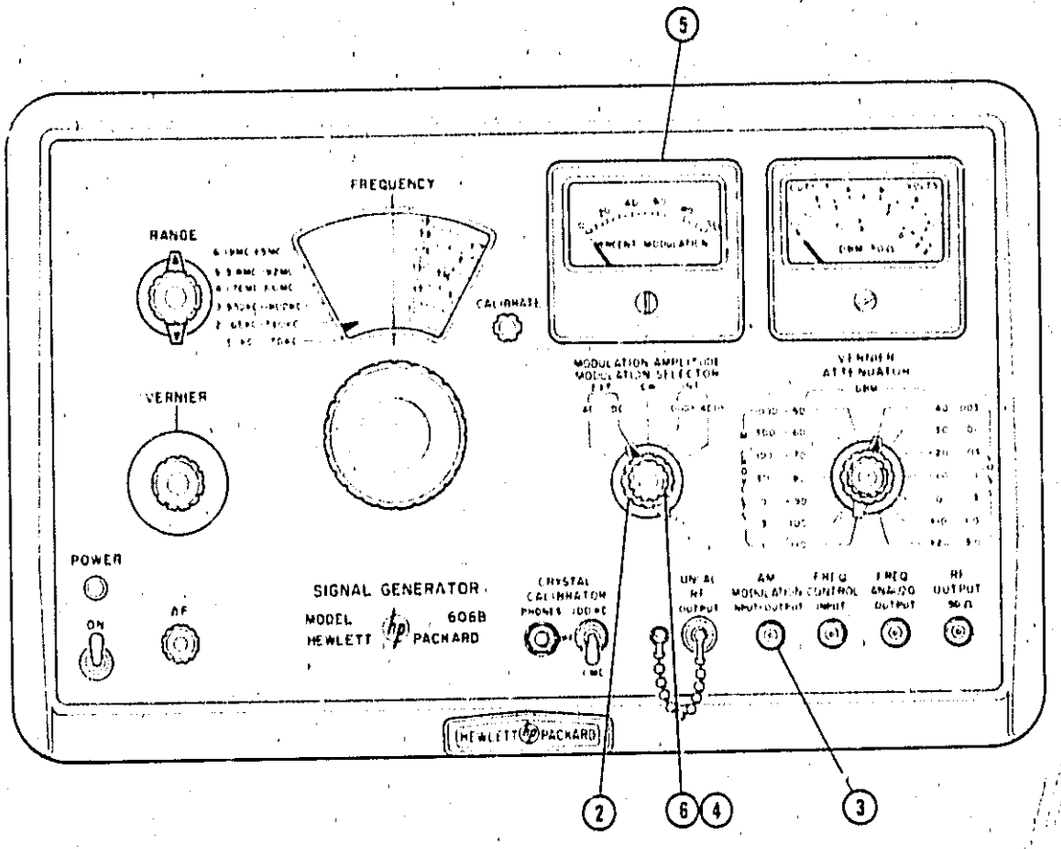
*See "Standards on Radio Receivers, "Institute of Radio Engineers, 1938; and Terman, "Radio Engineers Handbook," section entitled "Measurements on Radio Receivers."

Figure 3-3. External Output Termination



1. Set POWER switch to ON.
2. Set CRYSTAL CALIBRATOR switch to 1 MC.
3. Plug a set of high-impedance headphones into PHONES jack.
4. Using FREQUENCY control and headphones, zero-beat nearest even-megahertz division to desired frequency.
5. Using CALIBRATE control, set movable index on FREQUENCY indicator dial exactly on the megahertz mark.
6. Remove headphones and set CRYSTAL CALIBRATOR switch to 100 KC.
7. Put on headphones and rotate VERNIER control toward desired frequency while counting 100 kHz beats. This procedure will set frequency within 100 kHz. If frequency is desired with greater accuracy, follow the remaining steps.
8. Determine number of scale divisions on VERNIER control between zero-beat of the two 100-kHz beats on either side of desired frequency.
9. Rotate VERNIER control to proportional number of divisions from nearest 100-kHz beat to desired frequency.
10. Remove headphones and set CRYSTAL CALIBRATOR switch to OFF. If switch is left on, it will modulate the output signal.

Figure 3-4. Calibration



1. Perform general operation procedures (Figure 3-2).
2. Set MODULATION SELECTOR control to EXT. (AC or DC coupling).
3. Connect external modulation signal (three volts or more adjustable) to AM MODULATION jack.
4. Rotate MODULATION AMPLITUDE control fully clockwise.
5. Increase signal from external source until PERCENT MODULATION meter indicates 100%.
6. Using MODULATION AMPLITUDE control, reduce the percent modulation to desired level.

NOTE

On the 3.0 VOLTS output range, modulation beyond 30% is not recommended between 19 and 65 MHz.

7. Limits of modulation frequency depend upon maximum tolerable envelope distortion. For 3% envelope distortion, limits in terms of carrier frequency, f_c, are:

	30% Mod.	70% Mod.	Square-Wave Mod.
$f_{mod.\ max}$	$= 0.06\, f_c$	$0.02\, f_c$	$0.003\, f_c$
absolute $f_{mod.\ max}$	= 20 kHz	20 kHz	3 kHz

Applying these formulas, typical bandwidths are:

Carrier Freq.	Modulation Frequency 30% Mod.	70% Mod.	Square Wave
50 kHz	3 kHz	1 kHz	150 Hz
200 kHz	12 kHz	4 kHz	600 Hz
500 kHz	20 kHz	10 kHz	1500 Hz
1 MHz and above	20 kHz	20 kHz	3000 Hz

Distortion at 30% modulation is typically much below 1% except near the limit stated above.

Figure 3-5. External Modulation Operation

3-16. CALIBR.. TION.

3-17. Step-by-step instructions for calibrating the Model 606B are given in Figure 3-4.

3-18. EXTERNAL MODULATION OPERATION.

3-19. Take care when using external modulation with direct coupling. The dc level of the signal will affect the average RF level. If only the ac component of the modulating signal is desired, switch the MODULATION SELECTOR to EXT. AC. Do not apply more than 10 volts dc or ac to the AM MODULATION jack. Overloading will shorten the life of the MODULATION AMPLITUDE control. Step-by-step instructions for externally modulating the Model 606B are given in Figure 3-5. Figure 3-6 shows the modulation limits for various types of modulation over the operating frequency range.

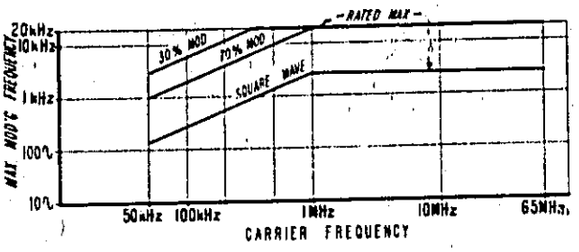


Figure 3-6. Modulation Frequency vs. Carrier Frequency

THEORY

SECTION IV
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains explanations of the operation of the Model 606B circuits. Figure 4-1 is a simplified block diagram showing principal circuit sections and major operating controls. Each circuit section and important individual circuits are explained in succeeding paragraphs.

4-3. As illustrated in Figure 4-1, the Model 606B consists of an RF Oscillator and Level Control Circuit, a ΔF Assembly, a Buffer Amplifier, an Amplifier Circuit, an RF Feedback and Level Control Circuit, an RF Attenuator, a Crystal Calibrator Circuit, and a Modulation Circuit. Signal outputs are generated in the RF Oscillator and Level Control Circuit. These signals are amplified and applied to the RF Attenuator by the RF Amplifier Circuit. External or internal modulation is provided by the Modulation Circuit, and overall stabilization is provided by the RF Feedback and Level Control Circuit. Two calibration frequencies are generated by the Crystal Calibrator Circuit. Generally, the block diagram represents the standard for signal generators.

4-4. THE RF OSCILLATOR AND LEVEL CONTROL CIRCUIT.

4-5. The RF oscillator and Level Control Circuit (Figure 4-2) consists of tuned-plate, push-pull RF Oscillator A4V2, Detector A4CR1, dual-purpose Oscillator Level Control A4V1, and associated circuits. The frequency of oscillation is controlled by either the FREQUENCY and frequency VERNIER controls or an external signal through the FREQ CONTROL jack and the ΔF Assembly. The level of the RF oscillator is stabilized by a feedback circuit from A4V2 to A4V1 across detector A4CR1. The pentode section of A4V1 acts a variable cathode resistor for A4V2 to control the oscillator level. The control grid of this pentode

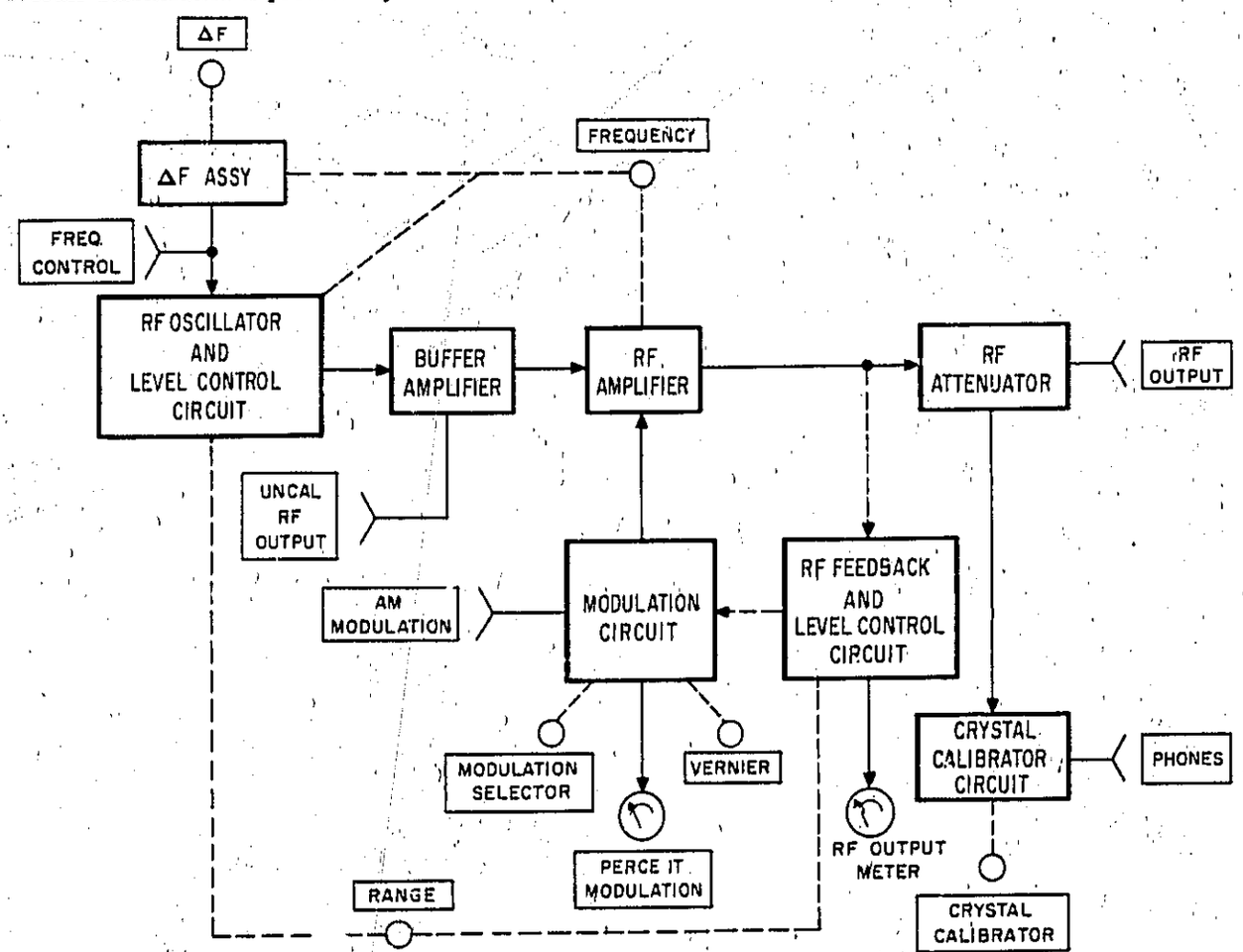


Figure 4-1. Simplified Block Diagram

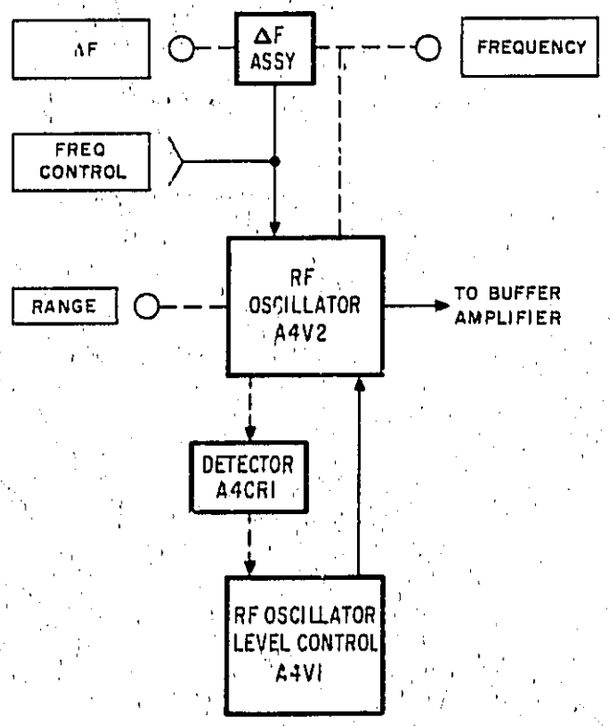


Figure 4-2. RF Oscillator and Level Control Circuit Block Diagram

receives a rectified portion of the oscillator signal. This voltage decreases the current through A4V1 when the oscillator level rises and increases the current when the oscillator level drops. Since this current is also the cathode current of RF oscillator A4V2, the level of oscillation is held constant. The triode section of A4V1 is a cathode follower which provides a bias voltage for the oscillator.

4-6. THE ΔF ASSEMBLY.

4-7. The ΔF Assembly (Figure 4-2) provides a means of shifting the output frequency of the RF Oscillator by a very few hertz. Breakdown diode VR1 provides a stable -23.7 volts across a voltage divider network consisting of potentiometers R6 and R7. The resistance of R6 is controlled by the FREQUENCY dial. Rotating the ΔF control changes the bias on A5CR3 and A5CR4. As the voltage drop is increased or decreased across the voltage divider network (R6 and R7), the capacitive reactance of A5CR3 and A5CR4 changes proportionally, which minutely varies the output frequency of the RF Oscillator.

4-8. THE BUFFER AMPLIFIER AND THE RF AMPLIFIER CIRCUIT.

4-9. The output of the oscillator is fed to the control grids of the push-pull Buffer Amplifier stage, A4V3 and A4V4 (Figure 4-3). An uncalibrated RF signal is transformer-coupled from the cathode circuit of the Buffer Amplifier and applied to the UNCAL RF OUTPUT jack. The Oscillator signal is amplified and applied to the control grids of the push-pull Amplifier stage, A4V5 and A4V6, through the plate circuits of A4V3 and A4V4 respectively. The cathode current for the Amplifier stage is varied by Modulator A4V9 which, in turn, amplitude-modulates the RF signal level. This modulated and amplified RF signal is transformer-coupled to the RF Attenuator.

4-10. THE RF ATTENUATOR.

4-11. The RF output signal is center-tapped from the secondary winding of the RF output transformer in use in Amplifier Turret Assembly A8 and applied to the input of the RF Attenuator. The RF Attenuator provides a maximum attenuation of 120 dB in 10-dB ranges. The output level may be varied between steps by changing the input voltage to the Attenuator with the attenuator VERNIER control (refer to paragraph 4-22).

4-12. THE RF FEEDBACK AND LEVEL CONTROL CIRCUIT.

4-13. The RF Feedback and Level Control Circuit (Figure 4-4) consists of Detector diodes CR1 and CR2, an RC filter, a two-position attenuator circuit, an RF output meter, and associated circuitry. The modulated RF output signal from the RF Amplifier Circuit is sampled at the secondary winding of the RF output transformer in use in Amplifier Turret Assembly A8 and rectified by Detector diodes CR1 and CR2. This detected signal is applied across an RC filter and a two-position attenuator. The time constant of the RC filter is determined by the position of frequency RANGE switch S4. The time constant is selected to bypass the RF component but not the modulation or dc level. The demodulated RF signal is then applied to one control

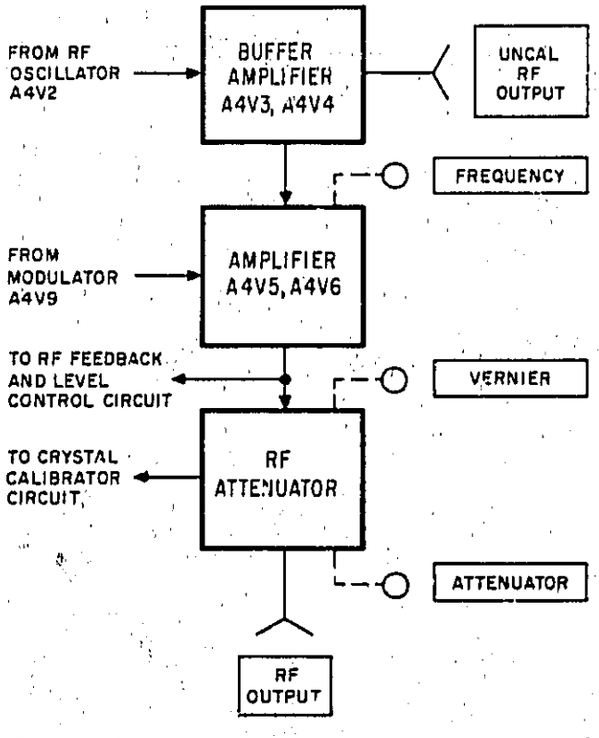


Figure 4-3. Buffer Amplifier, RF Amplifier, and Attenuator Block Diagram

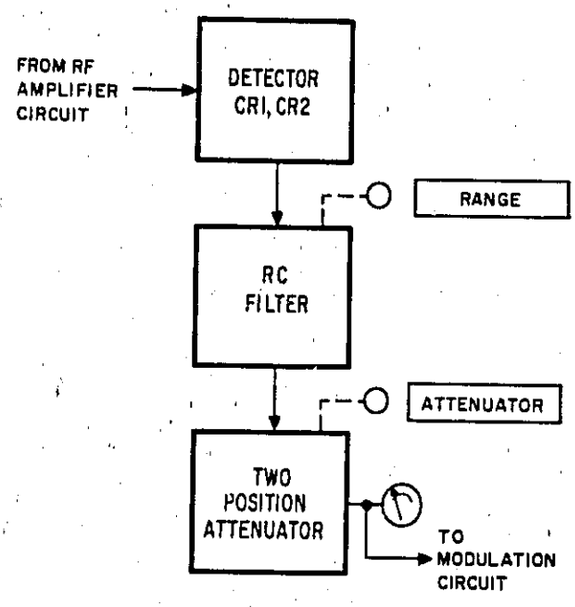


Figure 4-4. RF Feedback and Level Control Circuit Block Diagram

grid of Differential Amplifier A4V8 (refer to paragraph 4-23). The signal is dc-coupled and therefore has a dc component corresponding to the RF voltage level. The demodulated RF signal also passes through an RF filter (A4R52, A4C27, A9C4, and A9L1) which produces a dc-current proportional to the CW RF level. This current is applied to, and monitored by, RF output meter M2, which indicates the RF level input to the RF Attenuator.

4-14. The amount of RF feedback is controlled by a two-position attenuator between the Detector diodes and Differential Amplifier A4V8. When the ATTENUATOR control is set to +10 DBM or lower, relay A4K1 is not energized, and the RF feedback is obtained through divider resistors A4R49 and A4R52. Only when the ATTENUATOR control is set to +20 DBM is relay A4K1 energized. With A4K1 energized, resistor A4R52 is shunted by resistor A4R51 which raises the current through the RF Amplifier Circuit by 10-dB.

4-15. THE MODULATION CIRCUIT.

4-16. The Modulation Circuit (Figure 4-5) consists of Audio Oscillator A1V5, a Percent Modulation Meter Circuit (Modulation Monitor A1V9A and meter M1), Differential Amplifier and Bias Supply Circuit (A4V8 and A4V7), Modulator A4V9, and associated circuitry.

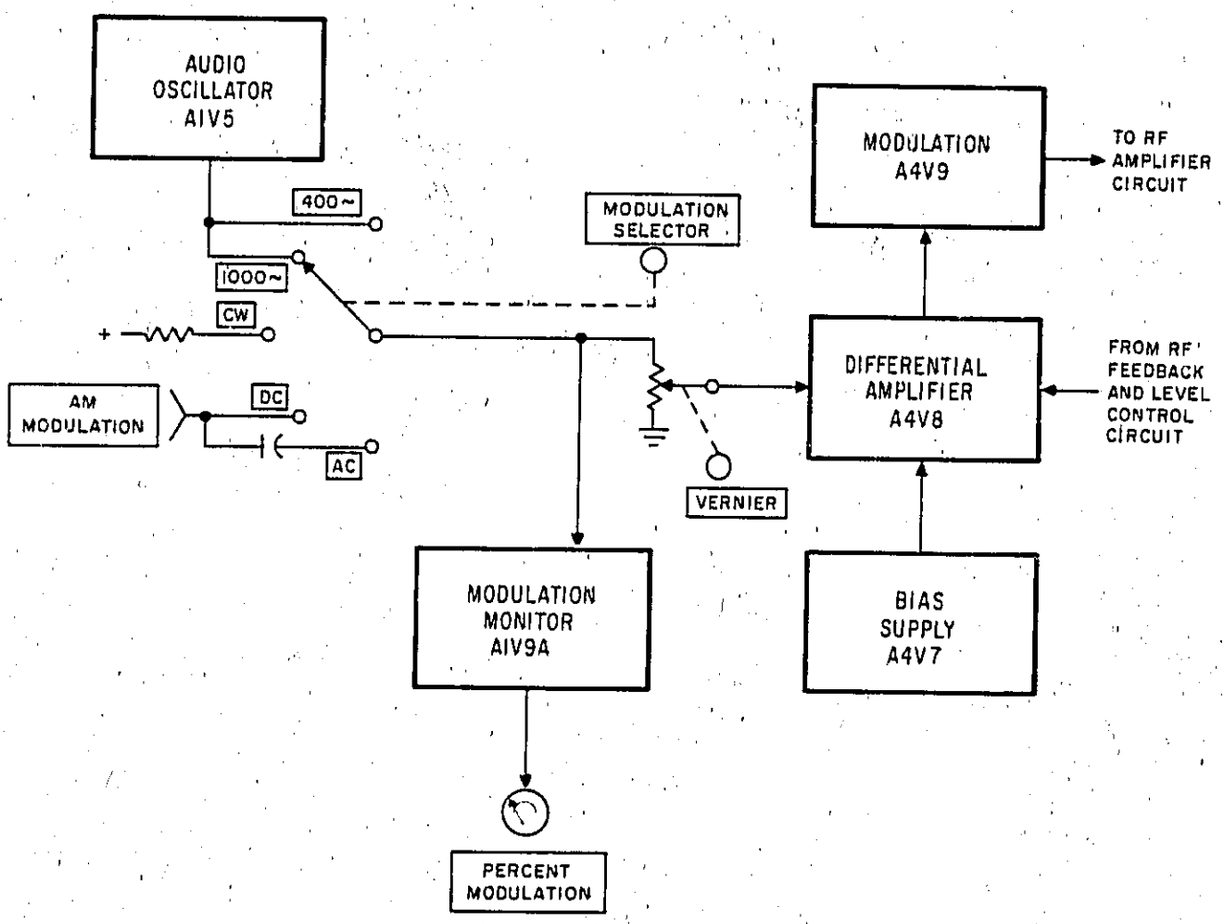


Figure 4-5. Modulation Circuit Block Diagram

4-17. THE AUDIO OSCILLATOR.

4.18. Audio Oscillator A1V5 is a modified Wien-bridge oscillator with amplitude stabilization. The feedback signal is taken from the secondary winding of the output transformer. Two oscillation frequencies (400 and 1000 Hz) can be selected by switching resistors of different values into the Wien bridge with MODULATION SELECTOR switch S1. Modulation amplitude for internal or external modulation is controlled by MODULATION AMPLITUDE potentiometer R2. The level of oscillation is set by MOD OSC ADJ potentiometer R51 which controls the amount of feedback to lamp RT1. Increased feedback causes the temperature of RT1 to rise, which increases its resistance. The increased resistance causes more degeneration in the cathode of A1V5, thus limiting the gain. With MODULATION SELECTOR switch S1 set to INT., the modulating voltage is available at the front panel AM MODULATION jack. This voltage is supplied for synchronization purposes and has a source impedance of 82K ohms.

4-19. THE PERCENT MODULATION METER CIRCUIT.

4-20. The Percent Modulation Meter Circuit (Figure 4-5) consists of modulation monitor A1V9A, PERCENT MODULATION meter M1, and associated circuits. A portion of the modulation signal is applied to the control grid of A1V9A. The output of this cathode follower is rectified by diode CR5 and a dc voltage corresponding to the modulation signal is applied to PERCENT MODULATION meter M1. Clamping diode CR4 prevents the cathode of A1V9A from going negative, which protects capacitor C56 whose voltage rating is 25 volts. This point would otherwise go toward -200 volts should A1V9A be removed or have low emission.

4-21. THE DIFFERENTIAL AMPLIFIER AND BIAS SUPPLY CIRCUIT.

4-22. The Differential Amplifier and Bias Supply Circuit (Figure 4-5) consists of Differential Amplifier A4V8, Cathode Follower A4V7, and associated circuits. The external or internal modulation signal is combined with a dc reference level and applied to Differential Amplifier A4V8. The modulation signal is applied to a resistive network consisting of R57, R4, and R3 and added to the dc reference voltage. The combined voltages appear at VERNIER potentiometer R5. This control varies the dc, which controls the carrier and the modulation signal at the same rate. Therefore, the percentage of modulation remains constant regardless of carrier level. This circuit is also used to reduce the voltage on the RF amplifier during switching. When the RANGE switch is rotated out of its detent position, switch S3 disconnects the +300-volt power supply which causes the grid voltage of A4V8 to drop to ground potential. The +300 volts is not reconnected until after the turret has made contact in its new position. Therefore, switch S3 prevents the amplifier tubes from drawing excessive screen current when the turret is disengaged from the plate circuit.

4-23. The dc (carrier level) and ac (modulation) signals are applied through an RF filter to the control grid of A4V8A as a reference signal to be compared with a signal from the output which is applied to the control grid of A4V8B. The triode plus the pentode section of A4V8 form the Differential Amplifier. The ac level of both control grid signals is proportional to the modulation. The modulating signal is the reference signal and the actual modulation of the output is compared to this reference. The dc level of the output (proportional to the RF) is compared to a reference dc level that is proportional to the desired RF level controlled by VERNIER potentiometer R5.

4-24. Since the cathodes of A4V8 are connected, the reference signal applied to the triode section also appears on the cathode of the pentode section. This signal will be compared to the signal from the output which is applied to the grid. Any deviation from a fixed voltage between these two signals results in an output signal with a polarity to reduce the difference which, in turn, restores the original conditions. For example, if the RF level drops, the voltage on the control grid of A4V8B will become more negative. This reduces the amount of current flow through the tube, and the plate becomes more positive. The grid voltage of Modulator A4V9 is proportional to the plate voltage of A4V8. As this grid voltage becomes more positive, the current through A4V9 will increase. This current is also the cathode current for the RF Amplifier and, therefore, the output will continue to increase, until the original conditions are restored. Therefore, the output is stabilized and is constant to better than ±1 dB over the entire frequency range. The RF level can be changed by varying the VERNIER control which will change the reference bias. In a similar manner the modulation is held constant. Since the crystal detector circuit has a time constant fast enough to follow the modulation envelope, the output modulation is compared to the modulating frequency and distortion is minimized.

4-25. Bias voltages required by the Differential Amplifier are supplied by cathode follower A4V7. One half of A4V7 is used as a constant voltage source to furnish the plate potential for A4V8A. The other half of A4V7 supplies the screen grid potential for A4V8B. The screen grid potential is adjusted by CARRIER ZERO SET potentiometer R21 for RF Amplifier cutoff when both grids of the Differential Amplifier are at ground potential. This establishes the zero point for the VERNIER control.

4-26. MODULATOR.

4-27. The cathode current for the Amplifier stage is controlled by Modulator A4V9 which acts as a variable cathode resistor. Modulator A4V9 provides cathode modulation for the amplifier stage. The internal resistance of A4V9 varies according to the modulation signal applied to its control grid from the Differential Amplifier. (Refer to paragraph 4-24).

4-28. THE CRYSTAL CALIBRATOR CIRCUIT.

4-29. The Crystal Calibrator Circuit (Figure 4-6) consists of a Crystal Oscillator, a Frequency Divider

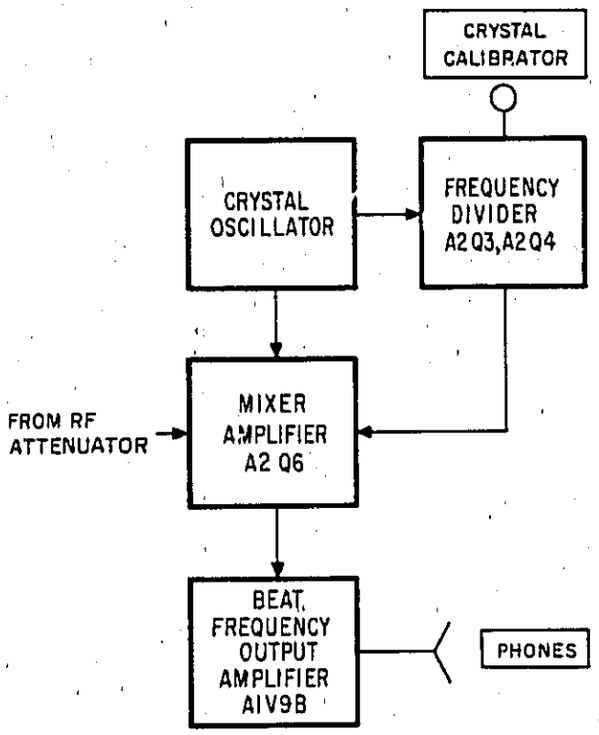


Figure 4-6. Crystal Calibrator Circuit Block Diagram

(A2Q3 and A2Q4), Mixer/Amplifier A2Q6, Beat-Frequency Amplifier A1V9B, and associated circuits. A small signal coupled from the RF Attenuator and the output signal of the Crystal Oscillator are mixed and applied to the base of Mixer/Amplifier transistor A2Q6. The output signal from A2Q6 is applied to the control grid of Beat-Frequency Amplifier A1V9B, which amplifies and applies the signal to the PHONES output jack.

4-30. When CRYSTAL CALIBRATOR switch S2 is set to 100 KC or 1 MC, crystal A2Y1 provides 1-MHz oscillations for the calibration signal, which appears at the collector of transistor A2Q2. This signal is applied to the base of Driver Transistor A2Q5. Transistor A2Q5 amplifies and applies the signal to the mixer stage where it is mixed with the signal coupled from the RF attenuator. This combined signal is applied to the base of transistor A2Q6. The frequency of the signal applied to A2Q6 is controlled by Crystal Calibrator switch S2. With switch S2 set at 100 KC, Frequency Divider transistors A2Q3 and A2Q4 are biased into conduction, dividing the 1-MHz output frequency of the oscillator by ten, which provides a signal frequency of 100 kHz. With switch S2 set to 1 MC, transistors A2Q3 and A2Q4 are cut off, and the signal frequency is that of crystal A2Y1, 1 MHz.

4-31. THE POWER SUPPLIES.

4-32. GENERAL OPERATING PRINCIPLES.

4-33. All of the dc operating voltages are electronically regulated, and obtained directly from regulated supplies. There are three transistor type electronic regulators which supply +300, -200, and +25.6 volts.

4-34. The +300 and -200 volt supplies operate as follows. As shown in Figure 4-7, a regulating element (Series Regulator) is connected in series with the load and the dc power source (Rectifier). The resistance of the regulating element is made adjustable so that the voltage at its output will be adjustable. The resistance is adjusted by a control voltage; the higher the control voltage, the higher the output voltage. A sample of the Series Regulator output voltage is compared

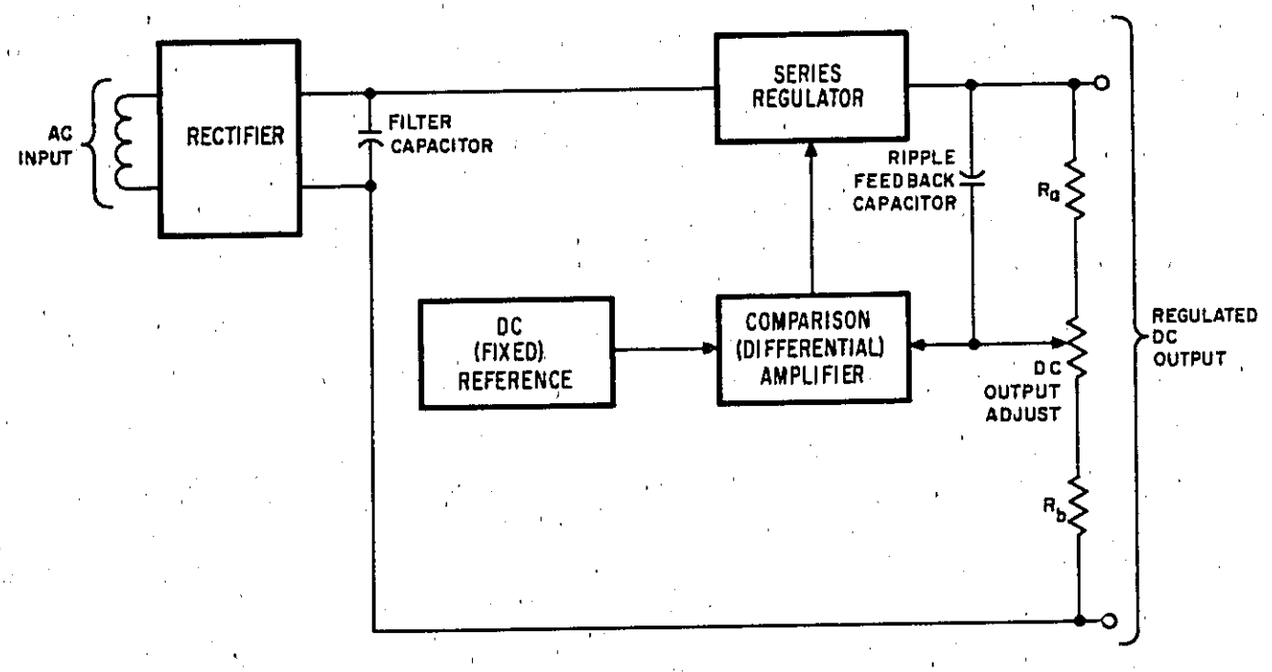


Figure 4-7. Regulated Power Supply Block Diagram

against a stable dc reference voltage by a Comparison Amplifier and the difference voltage is inverted and fed to the Series Regulator through a Control Amplifier. Since the gain of the Comparison Amplifier determines the degree of regulation, it is followed by a Control Amplifier to improve regulation. As a result, any tendency for output voltage change is counteracted by the control voltage, and the output voltage remains substantially constant.

4-35. THE +300 VOLT SUPPLY.

4-36. The +300 volt supply operates as explained under General Operating Principles. Reference voltage for the Comparison (Differential) Amplifier, A11Q2 and A11Q3, is obtained from Reference Diode A11VR1. The Series Regulator, Q1, receives its control voltage from the Comparison (Differential) Amplifier through Control (Driver) Amplifier A11Q1. This supply is independent and does not rely on other supplies for reference voltages.

4-37. THE -200 VOLT SUPPLY.

4-38. The -200 volt supply operates as explained under General Operating Principles. Reference voltage for the Comparison (Differential) Amplifier A11Q5 and A11Q6, is obtained from Reference Diode A11VR3. The Series Regulator, Q2, receives its control voltage from the Comparison (Differential) Amplifier through Control (Driver) Amplifier A11Q4. This supply is independent and does not rely on other supplies for reference voltages.

4-39. THE +25.6 VOLT SUPPLY

4-40. The +25.6 volt supply operates as an emitter follower. The output voltage is that of reference diode A11VR5 less the base-emitter voltage drops of A11Q7 and Q3 and the drop across A11R20. When the supply draws current in excess of 2 amperes, diodes A11CR13-16 are biased into conduction and decrease the current drive to A11Q7, limiting the output current. Because the +300 volt supply acts as a current source for A11Q7 and A11VR5, through A11R21, the 25.6 volt supply will become inoperative if the +300 volt supply fails.

MAINTENANCE

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides instructions for performance testing, calibrating, troubleshooting, and repairing the Model 606B.

5-3. PERFORMANCE TESTS.

5-4. PURPOSE. The procedures of paragraphs 5-6 through 5-21 check instrument performance for incoming inspection, periodic evaluation, troubleshooting, and calibration. The tests can be performed without access to the instrument interior. The specification of Table 1-1 are the performance standards.

5-5. TEST EQUIPMENT REQUIRED. The test instruments required to make the performance tests are listed in Table 5-1. Test instruments other than those listed may be used provided performance equals or exceeds Critical Specifications.

5-6. RF OUTPUT IMPEDANCE.

5-7. The following procedure tests the output impedance of the Signal Generator:

a. Connect test equipment as shown in Figure 5-1.

b. Set line voltage to 115 (230) volts and set VTVM to the 1-volt range and the attenuator to the 0.3 volt range.

c. Set Signal Generator FREQUENCY dial to 20 MHz and adjust ATTENUATOR until VTVM indicates 1 on the 0-1 VTVM scale.

d. Remove the 50-ohm output termination and remeasure RF output. VTVM should indicate 2 (± 0.2).

e. Set FREQUENCY dial to 65 MHz and reconnect the 50-ohm output termination.

f. Adjust ATTENUATOR until VTVM indicates 1 volt.

g. Remove the 50-ohm output termination and remeasure RF output. VTVM should indicate 2 (±0.2) volts.

5-8. RF OUTPUT ACCURACY.

5-9. The following procedure tests the RF output accuracy of the Signal Generator. Test the RF output accuracy as follows:

a. Connect test equipment as shown in Figure 5-2, test setup A.

b. Set MODULATION SELECTOR switch to CW.

c. Set RANGE switch to band 6 and adjust FREQUENCY control to 65 MHz.

d. Rotate VERNIER control and check that OUTPUT VOLTS meter pointer sweeps full range of meter.

e. Set ATTENUATOR control to +20 DBM and adjust VERNIER control until OUTPUT VOLTS meter indicates 0 DBM. Power Meter should indicate 0 ± 1 dB.

NOTE

In all of the following steps, maintain 0 DBM indication on the OUTPUT VOLTS meter by adjusting the VERNIER attenuator control, if necessary.

f. Set ATTENUATOR control to +10 DBM. Power meter should indicate -10 ± 1 dB.

g. Set ATTENUATOR control to 0 DBM. Power meter should indicate -20 ±1 dB.

h. Set ATTENUATOR control to -10 DBM. Power meter should indicate -30 ± 1 dB.

i. Without changing any Signal Generator control settings, connect test equipment as shown in Figure 5-2, test setup B.

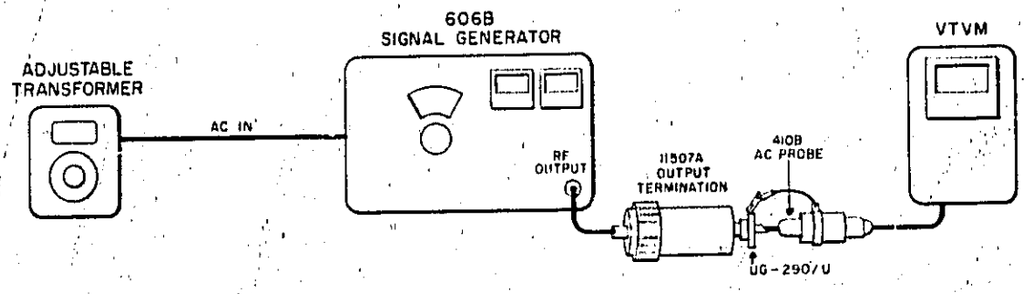
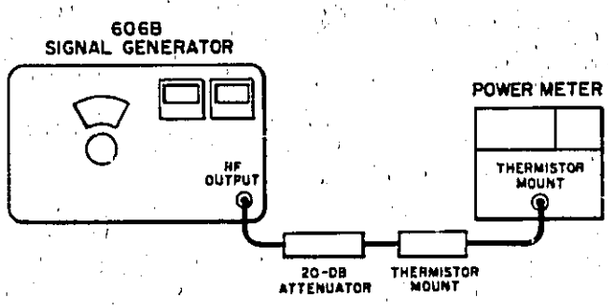


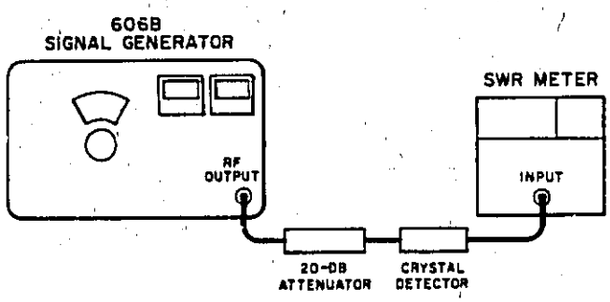
Figure 5-1. RF Output Impedance and RF Frequency Response Test Setup

Table 5-1. Test Equipment Required for Performance Testing, Adjustment, and Troubleshooting

Test Instrument	Critical Specifications	Recommended Models
Vacuum Tube Voltmeter	AC Range: 1 to 300 volts full scale Frequency Range: 20 Hz to 65 MHz DC Range: 1 to 500 volts full scale Resistance Range: 0.2 ohm to 500 megohms Accuracy: ±3% of full scale	HP 410B
Electronic Counter	Range: 50 kHz to 65 MHz Accuracy: ±0.005%	HP 5245L with 5253A Converter
Oscilloscope	Vertical Bandwidth: 10 MHz Vertical Sensitivity: 5 V/cm	HP 140A with 1402A and 1420A plug-ins
Adjustable Line Voltage Transformer	Voltage Range: 102 to 127 volts Current: 7.5 amperes Voltmeter Accuracy: ±1 volt	General Radio W10MT3A Superior Electric UC1M
Power Meter	Range: 10 microwatts to 10 milliwatts Accuracy: ±5% of full scale	HP 431B
Thermistor Mount	Frequency Range: 50 kHz to 65 MHz VSWR: 1.6 max.	HP 478A
SWR Meter	Sensitivity: 1 microvolt (min.) full scale Attenuator Range: 70 dB Attenuator Accuracy: ±0.1 dB	HP 415E
Crystal Detector	Frequency Range: 10 to 65 MHz VSWR: 1.2 max. Deviation from Square Law: ±0.5 dB max. over 30 dB range	HP 423A, Option 02
Coaxial Attenuator	Attenuation: 20 dB	HP 8491A
Audio Oscillator	Frequency: 1000 Hz Output: 5 volts across 600 ohms	HP 200CD
Receiver	Frequency: 5, 10, or 15 MHz	Collins 51J series
Square-Wave Generator	Frequency: 1000 Hz Output: 10 volts across 600 ohms	HP 211A
Clip-On DC Milliammeter	Range: 15 to 30 milliamperes Accuracy: ±5% of full scale	HP 428B
AC Voltmeter	Range: 1 millivolt to 300 volts Accuracy: 1%	HP 400E



TEST SETUP A



TEST SETUP B

Figure 5-2. RF Output Accuracy Test Setups

j. Set MODULATION SELECTOR switch to INT. 1000~ and adjust MODULATION AMPLITUDE control until PERCENT MODULATION meter indicates 100.

k. Adjust SWR Meter for convenient reference level and, starting with -30 DBM, set ATTENUATOR control through remaining settings in 10-dB steps until lower limit of SWR Meter is reached.

m. Compare each ATTENUATOR setting with SWR Meter indication. Maximum deviation from linearity on SWR Meter should not exceed 1 dB.

n. Remove 8491A Attenuator from test setup and adjust SWR Meter for convenient reference level.

p. Set ATTENUATOR control through remaining settings and compare each setting with SWR Meter indication. Maximum deviation from linearity should not exceed 1 dB.

5-10. OUTPUT FREQUENCY RESPONSE.

5-11. The following procedure tests the output level frequency response of the Signal Generator. Test the output level frequency response as follows:

a. Connect test equipment as shown in Figure 5-1.

b. Solder tip of AC probe to center conductor of UG-290/U connector and clip ground lead of probe to skirt of the connector.

c. Set line voltage to 115 (230) volts.

d. Set RANGE switch to band 3 and adjust ATTENUATOR until VTVM indicates 0.9 volt.

e. Tune Signal Generator through its full frequency range and check that VTVM does not vary more than $\pm 11\%$ (1 dB).

f. Set line voltage to 103.5 (207) volts and repeat steps d and e.

g. Set line voltage to 126.5 (253) volts and repeat steps d and e.

5-12. OUTPUT AND CRYSTAL CALIBRATOR FREQUENCY CALIBRATION.

5-13. The following procedures test the frequency calibration of the Signal Generator. Frequency calibration can be tested with an Electronic Counter or with a WWV receiver.

5-14. ELECTRONIC COUNTER METHOD. Test frequency calibration with an Electronic Counter as follows:

a. Connect test equipment as shown in Figure 5-3 and allow Signal Generator to warmup for fifteen minutes.

b. Set line voltage to 115 (230) volts.

c. Set ΔF control to midrange and using CALIBRATE control, align cursor on FREQUENCY indicator dial with engraved index line above dial.

d. Tune Signal Generator through its full frequency range and check that Electronic Counter indications are within 1% of FREQUENCY indicator dial settings.

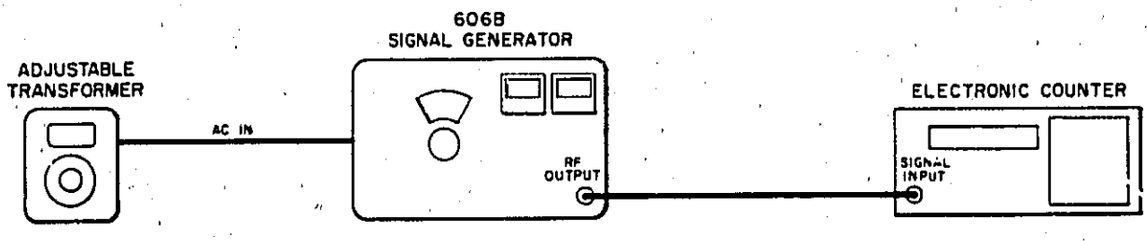


Figure 5-3. Frequency Calibration Test Setup Using Electronic Counter

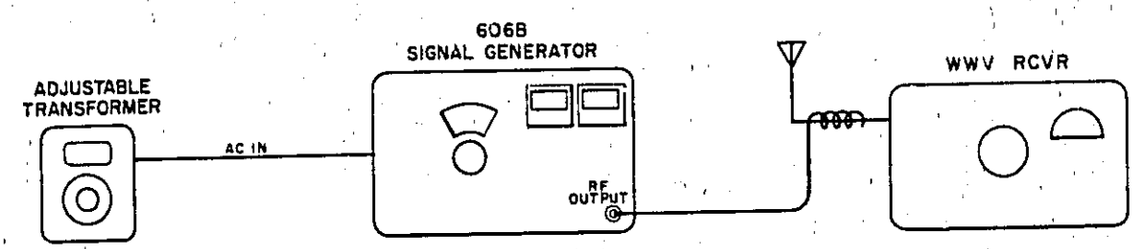


Figure 5-4. Frequency Calibration Test Setup Using WWV Receiver

e. Adjust Signal Generator for output of 15 MHz, as indicated on Electronic Counter.

f. Set CRYSTAL CALIBRATOR switch to 1 MC and insert headset into PHONES jack. Beat note should be less than 1000 Hz.

g. Set CRYSTAL CALIBRATOR switch to 100 KC. Beat note should be less than 1000 Hz.

h. Set line voltage to 103.5 (207) volts and repeat steps d through g.

i. Set line voltage to 126.5 (253) volts and repeat steps d through g.

5-15. WWV RECEIVER METHOD. Test frequency calibration with a Receiver capable of receiving WWV as follows:

a. Set line voltage to 115 (230) volts and allow both Receiver and Signal Generator to warm up for fifteen minutes.

b. Tune in WWV on 5, 10, or 15 MHz, whichever gives best reception.

c. Lightly couple a single wire from the RF OUTPUT jack to receiver antenna, as shown in Figure 5-4.

d. Tune RANGE and FREQUENCY controls of Signal Generator to frequency of incoming WWV signal. Set MODULATION SELECTOR switch to CW (no modulation) and center ΔF control.

e. Adjust output level to be about the same as WWV (use S meter on Receiver if it has one). Too much signal will block receiver and obscure beat note.

f. Zero-beat frequency of Signal Generator to WWV signal during period that WWV has no modulation. Do not disturb FREQUENCY dial after this adjustment. Set CALIBRATE adjustment to align window.

g. Set CRYSTAL CALIBRATOR switch to 1 MC and insert headset into PHONES jack. Beat note should be less than 1000 Hz.

h. Set CRYSTAL CALIBRATOR switch to 100 KC. Beat note should be less than 1000 Hz.

i. Tune Signal Generator throughout ranges of bands 1 through 3, and check calibration at each 100-kHz point. Zero-beat should occur within 1% of dial marking.

j. Reset CRYSTAL CALIBRATOR switch to 1 MC.

k. Tune Signal Generator throughout ranges of bands 4 through 6, and check calibration at each megahertz point. Zero-beat should occur within 1% of dial marking.

m. Set line voltage to 103.5 (207) volts and repeat steps d through k.

n. Set line voltage to 126.5 (253) volts and repeat steps d through k.

5-16. FREQUENCY DRIFT.

5-17. The following procedure tests the amount of drift in the output frequency of the Signal Generator. Test for the amount of frequency drift as follows:

a. Connect test equipment as shown in Figure 5-3 and set line voltage to 115 (230) volts.

b. Allow Signal Generator to warm up for at least two hours.

c. Using FREQUENCY and VERNIER controls, set output frequency at 1 MHz.

d. Monitor frequency output of the Signal Generator with Electronic Counter for 10 minutes and check that frequency drift is less than 50 hertz.

5-18. MODULATION METER ACCURACY.

5-19. The following procedure tests the calibration of the PERCENT MODULATION meter. Test the meter as follows:

a. Connect test equipment as shown in Figure 5-5 and set line voltage to 115 (230) volts.

b. Set RANGE switch to band 3.

c. Set FREQUENCY control to 1000 kHz.

d. Set MODULATION SELECTOR switch to CW.

e. Set ATTENUATOR switch to 1 VOLT.

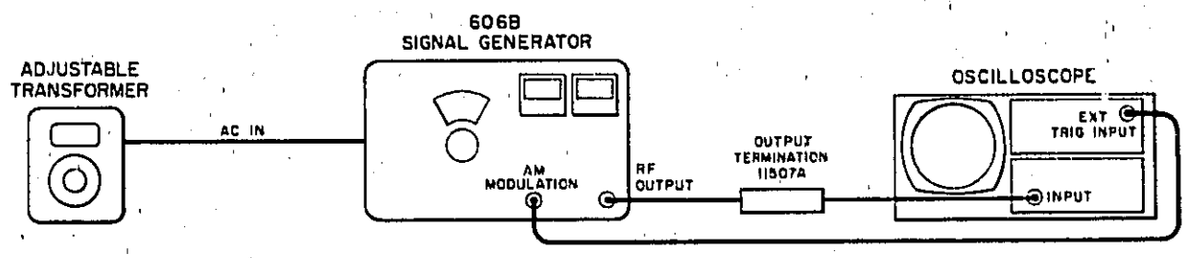


Figure 5-5. Modulation and Percent Modulation Meter Test Setup

f. Adjust vertical sensitivity of Oscilloscope for 4 cm deflection.

g. Set MODULATION SELECTOR switch to INT. 1000~.

h. Adjust MODULATION AMPLITUDE control until Oscilloscope indicates that maximum deflection is exactly 6 cm high; see Figure 5-6.

i. Check that PERCENT MODULATION meter indicates between 45 and 55.

j. Adjust MODULATION AMPLITUDE control until oscilloscope indicates zero deflection and check that PERCENT MODULATION meter indicates 0.

k. Adjust MODULATION AMPLITUDE control until oscilloscope indicates that maximum deflection is exactly 7.6 cm high and check that PERCENT MODULATION meter indicates between 85 and 95.

5-20. MODULATION TEST.

5-21. The following procedure tests the modulation of the Signal Generator. Test the modulation as follows:

a. Perform procedure outlined in paragraph 5-18.

b. Tune the Signal Generator through its full frequency range and check oscilloscope indication for excessive distortion.

c. Repeat steps a and b with line voltage set at 103.5 (207) and 126.5 (253) volts.

d. Reset line voltage to 115 (230) volts.

e. Set MODULATION SELECTOR switch to EXT. AC.

f. Rotate MODULATION AMPLITUDE control fully clockwise.

g. Using FREQUENCY and VERNIER controls, set output frequency at 1000 kHz.

h. Connect 1000-Hz output from Audio Oscillator to Signal Generator AM MODULATION jack and to EXT SYNC jack on oscilloscope.

i. Adjust Audio Oscillator for output of 4.5 volts peak (3.18 volts RMS) and check that Oscilloscope pattern has twice amplitude of unmodulated output. PERCENT MODULATION meter should indicate 100.

j. Set line voltage to 103.5 (207) volts and repeat steps f through i.

k. Set line voltage to 126.5 (253) volts and repeat steps f through i.

5-22. CABINET AND RF SHIELD REMOVAL.

5-23. To perform adjustments, troubleshoot, and repair the Signal Generator it is necessary to remove the main chassis from the cabinet. Remove the chassis as follows:

a. Disconnect power cord from the receptacle.

b. Remove the screw attaching the power inlet bracket to rear panel.

c. Remove four screws from rear cover and remove rear cover from cabinet.

CAUTION

Do not tip the Signal Generator completely onto its back. You may damage the three fuseholders mounted on the rear of the unit.

d. Tip Signal Generator partially up on its back and loosen the two screws on bottom of cabinet which clamp

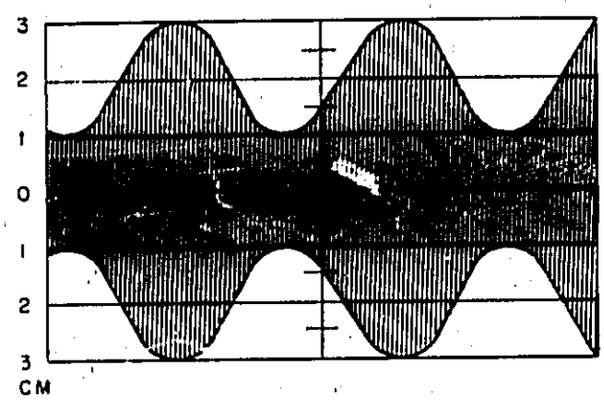


Figure 5-6. Waveform for 50% Modulation

cabinet to front panel. (Do not remove any screws from front panel.)

e. Set Signal Generator back on its four rubber feet and slide chassis out of cabinet.

WARNING

With the cabinet removed, dangerous voltages are exposed. Contact with these voltages may result in personal injury or death. Take adequate safety precautions.

5-24. If it is necessary to remove the RF shield, proceed as follows:

a. Remove two screws holding the inlet bracket and allow bracket to hang free.

b. Remove all screws securing RF shield to chassis. (Use Allen wrench clipped to top of shield to remove cap screws.)

c. Hold inlet bracket to one side and remove shield by pulling it toward rear of chassis.

5-25. ADJUSTMENTS.

5-26. PURPOSE. The following adjustment and calibration procedures include all instructions required to keep the Signal Generator operating at peak performance. Usually, the Signal Generator will not need all adjustment and calibration procedures performed at one time. This is particularly true when repair has been accomplished without changing any internal adjustments. Prior to performing any internal adjustments, refer to paragraph 5-53. Allow the Signal Generator to warm up for at least 15 minutes prior to performing any internal adjustments.

5-27. TEST EQUIPMENT REQUIRED. Test instruments required to perform the adjustments and calibrations are listed in Table 5-1. Instruments other than those listed may be substituted provided their specifications equal or exceed the Critical Specifications.

5-28. MECHANICAL ZERO METER ADJUSTMENT.

5-29. When the PERCENT MODULATION and OUTPUT VOLTS meters are properly zero-set, meter pointers should indicate exactly zero when the instruments are at normal operating temperature and turned off. To obtain best accuracy and mechanical stability, perform zero adjustment on each meter as follows:

a. Operate Signal Generator for at least 20 minutes to allow meter movement to reach normal operating temperature.

b. Turn instrument off and allow 30 seconds for all capacitors to discharge.

c. Rotate mechanical zero-adjustment screw on face of meter clockwise until meter pointer is left of zero and moving upscale toward zero.

d. Continue to rotate adjustment screw until pointer indicates exactly zero. If pointer overshoots zero, repeat steps c and d.

e. When pointer indicates exactly zero, rotate adjustment screw a few degrees counterclockwise to free adjustment screw from meter suspension. If pointer moves during this step, repeat steps c through e.

5-30. POWER SUPPLY ADJUSTMENT.

5-31. The power supplies in this instrument are extremely stable and will require infrequent adjustment. The output voltages may be measured at regular intervals or as a first troubleshooting step but unnecessary adjustment should be avoided. A defective tube or component may overload the power supply and lead you to believe that the power supply is not functioning properly. As long as the power supply regulator is functioning properly, you need not know the absolute values of the power supply output voltages. However, when power supply adjustment is necessary, you should use a voltmeter with a known calibration accuracy.

5-32. Regulation of the power supply can be checked by varying the power line voltage between 103 (206) and 127 (254) volts. The output voltage will vary only slightly, if at all, from the value measured with a 115 (230)-volt line. Loss of power supply regulation is most easily detected, as a sudden large increase in power supply ripple as the line voltage is raised and lowered ±10% from 115 (230) volts. When the power supply output voltages are within limits with the line voltage at 115 (230) volts, adjustment is not necessary. Only the +300-volt power supply output is adjustable. The -200-volt and +25.6-volt supply outputs are non-adjustable.

5-33. To test the power supplies proceed as follows:

a. Measure power supply outputs. They should be within the limits shown in Table 5-2.

Table 5-2. Regulated Power Supply Tolerances

Nominal Voltage	Nominal Ripple at 115/230 V RMS Input	Output Voltage Range
-200	10 mV	200+5, -15 volts
+300	10 mV	300 ±12 volts
+25.6	10 mV	25.6 ±1 volts

b. If the output voltage of the +300-volt supply is outside the limits in the table adjust B+ SET potentiometer A11R8 for +300 volts. See Figure 5-7 for adjustment location.

c. You may wish to check the regulation of the power supplies as the line voltage is varied between 103 (206) and 127 (254) volts. All regulated voltages should remain within ±1% over this range of line voltage.

d. Measure the ripple voltage on the various supplies. They should be less than the values indicated in Table 5-2 with the power line voltage set at 115 or 230 volts.

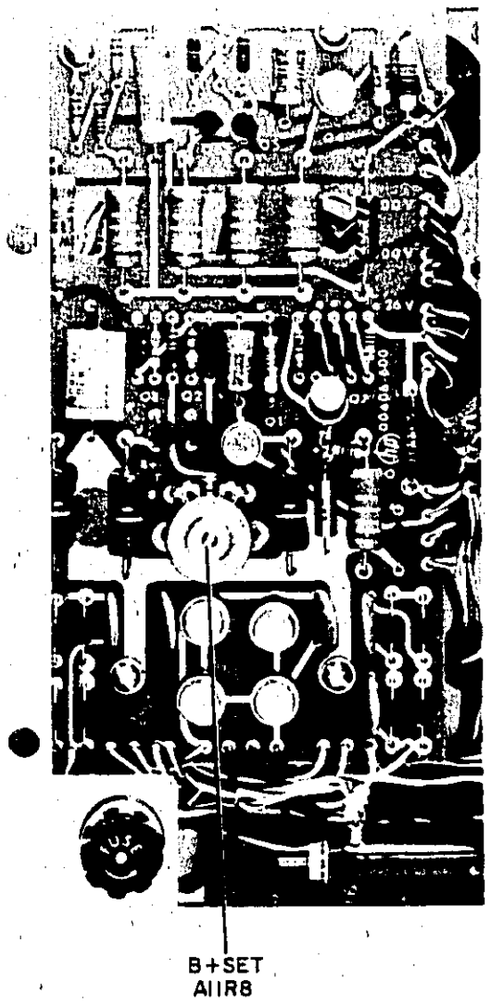


Figure 5-7. Power Supply Adjustment Location

5-34. AUDIO OSCILLATOR ADJUSTMENT.

5-35. Perform audio oscillator adjustment as follows:

a. Connect an AC VTVM to output tap on audio transformer A1T1 (yellow lead on signal tie point behind OUTPUT VOLTS meter). Connect ground lead of VTVM to chassis.

b. Set RANGE switch to band 3.

c. Set MODULATION SELECTOR switch to INT. 400~.

d. Set POWER switch to ON.

e. Adjust MOD. OSC. ADJ. potentiometer A1R51 until VTVM indicates 3.2 volts. See Figure 5-8 for adjustment location.

5-36. CRYSTAL OSCILLATOR ADJUSTMENT.

5-37. Perform crystal oscillator adjustment as follows:

a. Connect an electronic counter to test point A2R11.

b. Set CRYSTAL CALIBRATOR switch to 1 MC.

c. Set POWER switch to ON.

d. Adjust trimmer capacitor A2C3 until electronic counter indicates 1 MHz. See Figure 5-9 for adjustment location.

Table 5-3. Checks Following Tube and Semiconductor Replacement

Reference Designation	Check	Paragraph
A4V1, A6VR1, A5CR1-A5CR4, A4CR1	Output Frequency Calibration	5-12
	Frequency Drift	5-16
A4V2	Same as A4V1	
A4V3, A4V4, CR1, A4CR2, A4CR3	RF Output Accuracy	5-8
A4V5-A4V9, A1CR4, A1CR5	RF Output Accuracy	5-8
	Modulation Test	5-20
A1V9	Crystal Calibrator Frequency Calibration	5-12
	Modulation Test	5-20
A1V5	Modulation Test	5-20
A2Q1-A2Q5, A2CR1-A2CR9	Crystal Calibrator Frequency Calibration	5-12
A11Q1-A11Q3, Q1, A11CR1-A11CR4, A11VR1, A11VR2	+300 Volt Power Supply Check	5-30
A11Q4-A11Q6, Q2, A11CR5-A11CR8, A11VR3, A11VR4	-200 Volt Power Supply Check	5-30
A11Q7, Q3, A11CR9-A11CR16, A11VR5	+25.6 Volt Power Supply Check	5-30

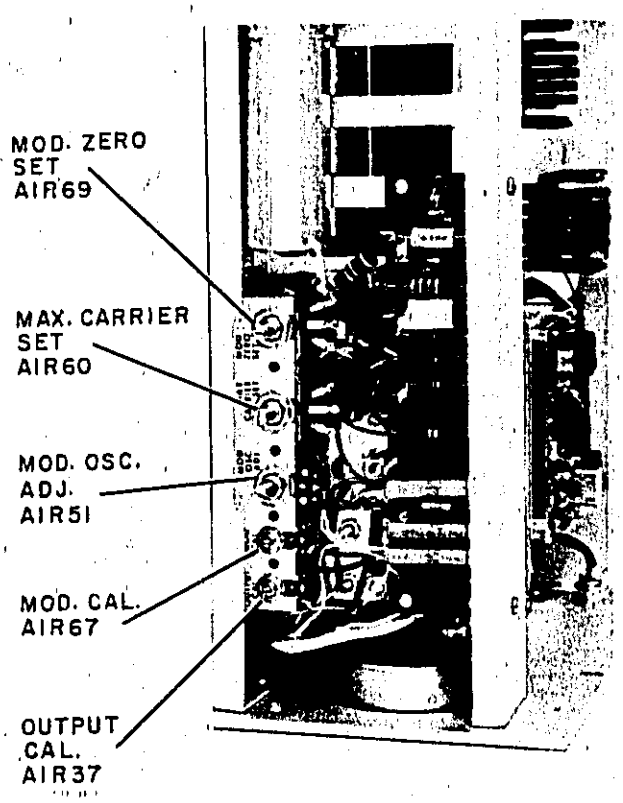


Figure 5-8. Modulation Deck Adjustment Locations

e. Set CRYSTAL CALIBRATOR switch to 100 KC.

f. Adjust potentiometer A2R11 until Electronic Counter indicates 100 kHz. See Figure 5-9 for adjustment location.

g. Set potentiometer A2R11 approximately halfway between limits at which frequency jumps to values other than 100 kHz.

5-36. RF OSCILLATOR AND AMPLIFIER ADJUSTMENT.

NOTE

This procedure should be performed only if there is a definite indication that the oscillator is off frequency. It should NOT be done on a routine basis.

RF OSCILLATOR

5-39. Perform RF oscillator and amplifier adjustment as follows:

a. Connect Electronic Counter with converter to RF OUTPUT jack.

b. Set CALIBRATE movable index in line with etched FREQUENCY centerline.

c. Set ATTENUATOR switch to 0.3 volt and MODULATION SELECTOR switch to CW.

d. Set ΔF control to midrange (arrow vertical) and adjust FREQUENCY to low end of any band except band 6.

e. Set POWER switch to ON.

f. If Electronic Counter indicates a frequency in error of more than 1% from frequency indicated on FREQUENCY dial, adjust tuning slug (A8T1, T2, T3, T4, or T5) of oscillator coil in use until frequency output is within limits. Clockwise rotation of slugs will decrease frequency.

g. Shift frequency to high end of same band. If frequency as read on FREQUENCY dial is off more than 1%, adjust trimmer capacitor across oscillator coil to correct. Always use a plastic screwdriver when making this adjustment.

h. Repeat steps f and g until no further adjustment is necessary.

i. Repeat steps d through h on all other bands. On band 6 adjust slug with a plastic Allen wrench (#8). If any adjustment is necessary, check maximum oscillator current as in paragraph 5-40.

RF AMPLIFIER

j. Connect probe of an oscilloscope to cathode of A4CR3. This point can be found on pink-white wire between amplifier stator turret terminal block and tie-point for 34.8K resistor, A4R49.

k. Set MODULATION SELECTOR switch to EXT. DC.

m. Connect a square-wave generator, set to 1 kHz, to AM MODULATION jack. Feed in sufficient square-wave signal so that carrier is cut off for at least part of the cycle.

n. Tune throughout all bands and check pattern on oscilloscope for ringing or squegging. Reduce frequency of external modulation to 300 Hz on lowest frequency band to keep from overmodulating. If ringing is found, tune amplifier.

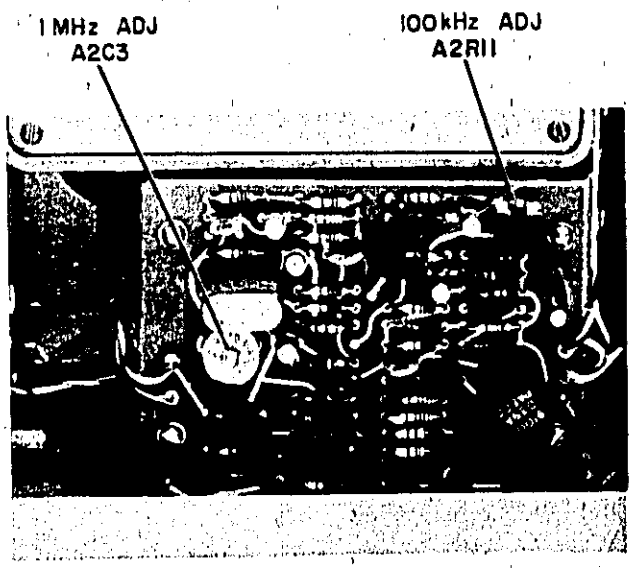


Figure 5-9. Calibrator Adjustment Locations

o. Measure the RF amplifier plate current with a clip-on milliammeter clipped over red lead going to 100-ohm resistor A4R9 on turret stator contact terminal block (beneath RF amplifier chassis). If a Model 428B is not available, unsolder red lead on B+ side and insert a conventional 300-mA dc milliammeter. Bypass point between 100-ohm resistor and meter with a 0.1-μF capacitor.

p. Tune inner slug in amplifier coil from top for a plate current dip at low end of one band.

q. Tune trimmer capacitor for a plate current dip at high end of same band. This adjustment is made through a hole in chassis between A4V5 and A5V6 underneath amplifier turret shaft. Use a plastic screwdriver for this adjustment. In addition, if this tool has a metal tip, slide a tiny piece of tubing over metal tip to prevent trimmer shorting to ground when making this adjustment.

r. Recheck ringing as in step n.

s. Repeat steps n through r on all bands.

5-40. OSCILLATOR MAXIMUM CURRENT ADJUSTMENT.

5-41. Perform maximum current adjustment as follows:

a. Set MODULATION SELECTOR switch to CW.

b. Set RANGE switch to band 6.

c. Set POWER switch to ON.

d. Measure RF oscillator plate current with a clip-on DC milliammeter clipped over red lead going to control assembly A5 from oscillator-amplifier assembly A4. If a Model 428B is not available, unsolder the red lead on oscillator-amplifier assembly A4 (B+) side and insert a conventional 300-mA dc milliammeter. Bypass point between 100-ohm resistor and meter with a 0.1-μF capacitor.

e. Tune FREQUENCY dial throughout the 19 MC-65MC band while noting the current.

f. Adjust oscillator level control potentiometer A4R10 on the oscillator-amplifier deck for a maximum current of 25 mA at frequency of maximum current. See Figure 5-10 for adjustment location. If this adjustment is made, check the following:

(1) Paragraph 5-42, Carrier Zero Adjustment

(2) Paragraph 5-44, Maximum Carrier and Modulation Zero Adjustment

(3) Paragraph 5-46, Modulation Meter Adjustment

5-42. CARRIER ZERO ADJUSTMENT.

5-43. Perform carrier zero adjustment as follows:

a. Set RANGE switch to band 1.

b. Set ATTENUATOR switch to 1 VOLT.

c. Set MODULATION SELECTOR switch to EXT. DC.

d. Set attenuator VERNIER control fully counterclockwise.

e. Set MODULATION AMPLITUDE control fully counterclockwise.

f. Set CARR ZERO potentiometer A4R21 fully counterclockwise. See Figure 5-10 for adjustment location.

g. Mechanically zero output meter in accordance with paragraph 5-28.

h. Set POWER switch to ON.

i. Connect an oscilloscope to RF OUTPUT jack.

j. Slowly turn CARR ZERO potentiometer A4R21 on RF amplifier chassis clockwise until there is some output on oscilloscope. Then adjust carrier zero set until indication on oscilloscope, set to its most sensitive range, just collapses. Set sweep on oscilloscope for a free-running condition so that indication will not disappear for lack of synchronizing signal.

k. Check for zero output across each band. Bands 5 and 6 typically have a minimum output of 0.03 volt RMS. If this adjustment is made, check the following:

(1) Paragraph 5-44, Maximum Carrier and Modulation Zero Adjustment

(2) Paragraph 5-46, Modulation Meter Adjustment

5-44. MAXIMUM CARRIER AND MODULATION ZERO ADJUSTMENT.

5-45. Perform maximum carrier and modulation zero adjustment as follows:

a. Set attenuator VERNIER control fully clockwise.

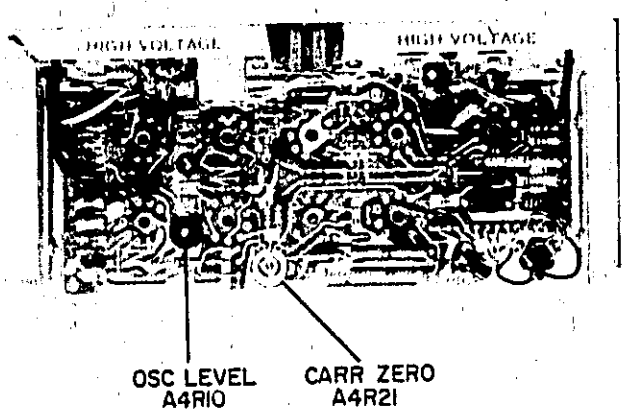


Figure 5-10. Oscillator-Amplifier Deck Adjustment Locations

b. Set MODULATION SELECTOR switch to EXT. AC.

c. Connect VTVM ac probe to end of output termination. Solder tip of ac probe to center conductor of a UG-290/U connector. Clip ground end of probe to skirt of connector. (See Figure 5-1.) Insert connector into RF OUTPUT jack of Signal Generator.

d. Set POWER switch to ON.

e. Set RANGE switch to band 1 and turn FREQUENCY dial over band at moderate speed, noting minimum output voltage read on VTVM.

f. Repeat step e on bands 2, 3, 4, and 5. Repeat on band 6, but turn much more slowly.

g. Set Signal Generator to range and frequency having lowest output voltage, typically 1.76 MHz. Set MODULATION SELECTOR switch to CW, adjust MAX. CARRIER SET potentiometer A1R60 for 1.05 volt RF output on VTVM. See Figure 5-8 for adjustment location.

h. Switch MODULATION SELECTOR from CW to EXT. AC while noting output-voltage change on VTVM. There should be no change in voltage. If necessary adjust MOD. ZERO SET potentiometer A1R69 until there is no change of output when MODULATION SELECTOR is switched. See Figure 5-8 for adjustment location. Turn MODULATION AMPLITUDE control; output should not change. If necessary, readjust potentiometer A1R69.

i. Recheck steps g and h and adjust, if necessary. Controls A1R69 and A1R60 interact with each other. Recheck other adjustment any time one control is adjusted.

5-46. MODULATION METER ADJUSTMENT.

5-47. Perform PERCENT MODULATION meter adjustment as follows:

a. Mechanically zero meter in accordance with paragraph 5-28.

b. Connect test equipment as shown in Figure 5-5.

c. Perform test of paragraph 5-18, steps a through i.

d. If PERCENT MODULATION meter indication is not within limits, adjust MOD. CAL. potentiometer A1R67 until meter indicates 50. See Figure 5-8 for adjustment location.

e. Set ATTENUATOR switch to 0.3 VOLT.

f. Repeat step c. If PERCENT MODULATION meter does not indicate 50 ±5%, adjust MODULATION AMPLITUDE control until it does. Adjust CARR ZERO potentiometer A4R21 slightly until pattern on oscilloscope is as shown in Figure 5-6. See Figure 5-10 for adjustment location. Recheck maximum carrier adjustment (paragraph 5-44) and readjust potentiometer A1R60, if necessary.

5-48. OUTPUT METER ADJUSTMENT.

5-49. Perform the OUTPUT VOLTS meter adjustment as follows:

a. Mechanically zero the meter in accordance with paragraph 5-28.

b. Connect ac probe of VTVM (1 volt range) to end of output termination using a UG-290/U connector. Solder tip of ac probe to center conductor of connector (see Figure 5-1). Insert connector into RF OUTPUT jack.

c. Set attenuator VERNIER control so that the OUTPUT VOLTS meter indicates 0.9 volt RMS.

d. Rotate FREQUENCY dial and RANGE switch through all frequencies, keeping indication on OUTPUT VOLTS meter at 0.9 volt. Record lowest and highest readings on VTVM.

e. Determine average of two readings recorded in step d.

f. Set FREQUENCY dial and RANGE switch to a frequency that will give this average reading on VTVM.

g. Set attenuator VERNIER control so that VTVM indicates 0.9 volt.

h. Set the OUTPUT VOLTS meter to read 0.9 volt by adjusting OUTPUT CAL. potentiometer A1R37. See Figure 5-8 for adjustment location.

5-50. TROUBLESHOOTING.

5-51. PURPOSE. The following paragraphs explain how to isolate a malfunction to a circuit section, how to isolate a malfunction to a circuit within a section, and how to isolate a malfunction in transistor circuits.

5-52. TEST EQUIPMENT REQUIRED. The test equipment required to troubleshoot the Signal Generator is listed in Table 5-1. Instruments other than those listed may be used provided their specifications equal or exceed the Critical Specifications.

5-53. TUBE REPLACEMENT.

5-54. In many cases instrument malfunction can be corrected by replacing a weak or defective tube. Before changing the setting of any internal adjustment check the tubes. Adjustments made in an attempt to restore operation when the cause is a defective tube will often complicate the repair problem.

5-55. Check tubes by substitution rather than using a tube checker. The results obtained from the tube checker can be misleading. Before removing a tube, mark it so that if the tube is good it can be returned to the same socket. Replace only those tubes proved to be weak or defective.

5-56. Any tube with corresponding standard EIA characteristics can be used as replacement. Where variations in tube characteristics will affect circuit performance, an adjustment is provided. Table 5-3 lists the tests to make and the adjustments that may be necessary if such tubes are replaced.

5-57. TRANSISTOR CIRCUIT TROUBLESHOOTING.

5-58. The following procedures and data are given to aid in determining whether a transistor is operational. Tests are given for both in-circuit and out-of-circuit transistors.

5-59. IN-CIRCUIT TESTING. The common causes of transistor failures are internal short- and open-circuits. In transistor circuit testing the most important consideration is the transistor base-emitter junction. Like the control grid of a vacuum tube, the base is the operational control point in the transistor. This junction is essentially part of a solid-state diode. For the transistor to conduct, the diode must conduct; that is, the diode must be forward biased. As with simple diodes, the forward-bias polarity is determined by the materials forming the junction. Use the transistor symbol on the schematic diagram to determine the bias polarity required to forward bias the base-emitter junction. Part A of Figure 5-11 shows transistor symbols with terminals labeled. Notice that the emitter arrow conventionally points toward the type N material. The other two columns of the illustration compare the biasing required to cause conduction and cutoff in transistors and vacuum tubes. If the transistor base-emitter diode (junction) is forward biased the transistor conducts. If the diode is heavily forward biased, the transistor saturates. However, if the base-emitter diode is reverse biased, the transistor is cut off. The voltage drop across a forward-biased emitter-base diode varies with transistor collector current. For example, a germanium transistor has a typical forward-bias base-emitter voltage of 0.2-0.3 volt when collector current is 1-10 mA, and 0.4-0.5 volt when collector current is 10-100 mA. In contrast, forward-bias voltage for silicon transistors is about twice that for germanium types: about 0.5-0.6 volt when collector current is low, and about 0.8-0.9 volt when collector current is high.

5-60. Figure 5-11, part B, shows simplified versions of the three basic transistor circuits and gives the operating characteristics of each. When examining a transistor stage, first determine if the emitter-base diode is biased for conduction (forward-biased) by measuring the voltage difference between emitter and base. When using an electronic voltmeter, do not measure directly between emitter and base: there may be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure each voltage separately with respect to a voltage common point (e.g., chassis). If the emitter-base diode is forward biased, check for amplifier action by short-circuiting the base to emitter while observing collector voltage. The short-circuit eliminates base-emitter bias and should cause the transistor to stop conducting (cut off). Collector voltage should then shift to near the supply voltage. Any difference is due to leakage current through the transistor and, in general, the smaller this current, the better the transistor. If collector voltage does not change, the transistor has either an emitter-collector short circuit or emitter-base open circuit.

5-61. OUT-OF-CIRCUIT TESTING. Two common causes of transistor failure are internal short- and open-circuits. Remove the transistor from the circuit and use an ohmmeter to measure internal resistance. See Table 5-4 for measurement data.

CAUTION

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

5-62. GENERAL TROUBLESHOOTING PROCEDURES.

5-63. In general, internal adjustments have only a limited range and are designed to compensate for minor variations in tubes and/or circuit components. If a major section or the complete instrument is inoperative, internal adjustments will seldom, if ever, restore operation. To avoid complications and reduce down-time, locate and correct the cause of trouble before attempting internal adjustments. The loss of a major function of the Signal Generator will appear as one or more of the following symptoms.

a. Very low or no RF output level.

b. Excessive RF output with ATTENUATOR and VERNIER controls having little or no effect on RF output.

c. Normal RF output with very low or no modulation.

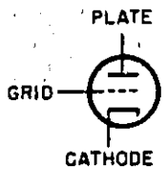
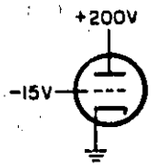
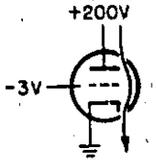
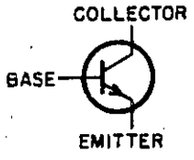
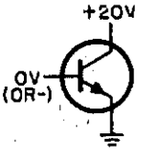
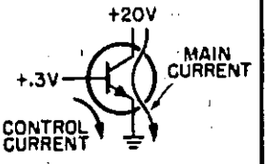
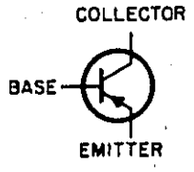
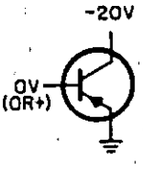
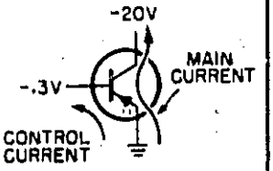
d. RF output normally modulated but PERCENT MODULATION meter has abnormal indication.

e. Normal RF output but no beat note output at PHONES jack.

5-64. A good starting point when troubleshooting is the power supply. Check line cord, the three fuses, and the power supply output voltages. If a defective power supply transistor is found, replacement will normally restore instrument operation without any internal adjustments. Check the output voltages of each supply to see if the output is within limits. If the output is within the limits given in the power supply section do not attempt to refine the adjustments. IF THE INSTRUMENT IS INOPERATIVE, FIRST TRY BLOWING OUT THE PLATES OF THE TUNING CAPACITOR WITH A LOW VELOCITY AIR STREAM SUCH AS THAT FROM A VACUUM CLEANER. Blow out these plates every time you remove the instrument from the cabinet for maintenance. Do not use high-pressure air or air saturated with lubricating oil.

5-65. Assuming that all power supply outputs are normal, very low or no RF output could be caused by the failure of the RF Oscillator, the RF Buffer, the RF

A. TRANSISTOR BIASING

DEVICE	SYMBOL	CUT OFF	CONDUCTING
VACUUM TUBE			
NPN TRANSISTOR			
PNP TRANSISTOR			

B. AMPLIFIER CHARACTERISTICS

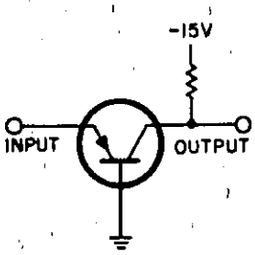
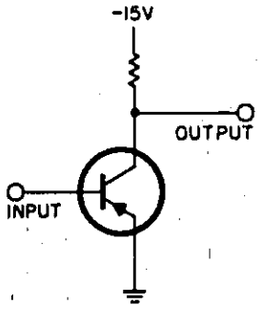
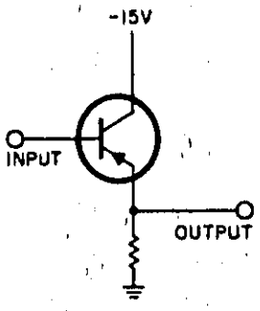
CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT Z	30-50 Ω	500-1500 Ω	20-500K Ω
OUTPUT Z	300-500K Ω	30-50K Ω	50-1000 Ω
VOLTAGE GAIN	500-1500	300-1000	< 1
CURRENT GAIN	< 1	25-50	25-50
POWER GAIN	20-30 dB	25-40 dB	10-20 dB
			

Figure 5-11. Transistor Biasing and Operating Characteristics

Table 5-4. Out-of-Circuit Transistor Resistance Measurement

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

*To test for transistor action, add collector-base short. Measured resistance should decrease.

Amplifier, or the Modulator. Excessive RF output with little or no control by the VERNIER control could be caused by the failure of the RF leveling feedback loop of the Modulator Section. Little or no modulation could be caused by the failure of Audio Oscillator. If modulation is normal with the PERCENT MODULATION meter indicating abnormally, the trouble is probably in the Modulation Monitor circuit or the PERCENT MODULATION meter. No beat note output at the PHONES jack probably indicates trouble in the Crystal Calibrator. The performance tests contained in paragraph 5-3 will serve as an aid in further isolating a trouble to a specific circuit section. Since the operation of certain circuit sections is dependent upon the proper operation of other sections, troubleshooting must be performed in the proper sequence. After determining the faulty section, refer to the appropriate section of Table 5-6 and perform the tests indicated. If the trouble cannot be found by any other means, perform the steps of Table 5-6 in the indicated sequence until the trouble is found. If the trouble is in the output termination or attenuator you may return them separately to the factory for repair. They are not field repairable.

5-66. If an output is obtained, troubleshoot the particular section giving difficulty by referring to the appropriate part of Table 5-6. If no output is obtained, the trouble may be anywhere in the RF leveling feedback loop. Refer to Table 5-7, Troubleshooting the Feedback Loop, for instructions.

5-67. REPAIR PROCEDURES.

5-68. ETCHED CIRCUITS.

5-69. The etched circuit boards in the Signal Generator are of the plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results. Table 5-8 lists recommended tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work.

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

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

c. Use a suction device (Table 5-8) or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion. See Table 5-8 for recommendations.

e. When removing a multiple-connection component held tightly in a socket, such as a vacuum tube, loosen it gradually using gentle side-to-side motion to avoid damage to the plated-through conductors

Table 5-5. Safe Ohmmeter Range for Transistor Resistance Measurements

Ohmmeter	Safe Range(s)	Open Ckt Voltage	Short Ckt Current	Lead Color	Lead Polarity
HP 412A	R x 1K	1.0V	1 mA	Red	+
	R x 10K	1.0V	100 μA	Blk	-
	R x 100K	1.0V	10 μA		
	R x 1M	1.0V	1 μA		
	R x 10M	1.0V	0.1 μA		
HP 410C	R x 1K	1.3V	0.57 mA	Red	+
	R x 10K	1.3V	57 μA	Blk	-
	R x 100K	1.3V	5.7 μA		
	R x 1M	1.3V	0.5 μA		
	R x 10M	1.3V	0.05 μA		
HP 410B	R x 100	1.1V	1.1 mA		
	R x 1K	1.1V	110 μA	Blk	+
	R x 10K	1.1V	11 μA	Red	-
	R x 100K	1.1V	1.1 μA		
	R x 1M	1.1V	0.11 μA		
Simpson 260	R x 100	1.5V	1 mA	Red	+
				Blk	-
Simpson 269	R x 1K	1.5V	0.82 mA	Blk	+
				Red	-
Triplett 630	R x 100	1.5V	32 mA	Varies with Serial Number	
	R x 1K	1.5V	3.25 mA		
Triplett 310	R x 10	1.5V	750 μA		
	R x 100	1.5V	75 μA		

Table 5-6. Troubleshooting Chart

Measure	Normal Indication	Possible Cause of Malfunction
A. +300 VDC SUPPLY		
PREPARATION: Unless otherwise specified, measure the voltage to ground at the following points:		
1. Transformer T1, pin 1	115 Vac ± 10%	Open F1 or S6
2. Across A11C18 and A11C19	300 Vac ± 10%	Open secondary of T1
3. A11Q1 (collector)	+400 Vdc ± 10%	Check A11C1, C18, C19, A11CR1, A11CR2, A11CR3, and A11CR4
4. Test point 19	+300 Vdc ± 5%	Check Q1, A11Q2, A11Q3, and F2. Also check voltage across A11VR1 and A11VR2
B. -200 VDC SUPPLY		
PREPARATION: Unless otherwise specified, measure the voltage to ground at the following points:		
1. Across A11C5	220 Vac ± 10%	Open secondary of T1
2. A11Q4 (collector)	+100 Vdc ± 5%	Check A11C5, A11CR5, A11CR6, A11CR7, A11CR8, and A11C21
3. Test point 20	-200 Vdc ± 5%	Check A11Q2, A11Q4, A11Q5, A11Q6, and F3. Also check voltage across A11VR3 and A11VR4
C. +25.6 VDC SUPPLY		
PREPARATION: The +300-volt power supply is assumed to be operating correctly. Measure the voltage to ground at the following points:		
1. Across A11C10	21 Vac ± 10%	Open secondary of T1
2. A11Q7 (collector)	+40 Vdc ± 5%	Check A11C10, A11C11, A11CR9, A11CR10, A11CR11, A11CR12 and A11C22
3. Test point 21	+25.6 Vdc ± 5%	Check Q3, A11Q7, A11CR13, A11CR14, A11CR15, and A11CR16. Also check voltage across A11VR5.
D. RF OSCILLATOR		
PREPARATION: This procedure assumes that the power supplies are operating correctly. Use a clip-on lead to short across A4R27 (caution -200 volts) to disable RF Amplifier temporarily while measuring the following voltages. Unless otherwise specified measure the voltage to ground at the following points.		
1. a. A4V2, pin 9	+20 Vdc ± 10%	Check filament circuits of A4V1, A4V2, A4V7, A4V8, and A4V9
b. A4V2, pins 5 and 4	+13.4 Vdc ± 10%	Same as a.
2. a. A4V1, pin 5	+20 Vdc ± 10%	Same as step 1
b. A4V1, across pins 4 and 5	6.3 Vdc	Same as step 1
c. A4V1, pin 3	+300 Vdc (nominal)	Check RF filter (A3C2, A4C3, C7A, C7B, C2, and A4C29 for shorts, A3L1 for open circuit.

Table 5-6. Troubleshooting Chart (Cont'd)

Measure	Normal Indication	Possible Cause of Malfunction
D. RF OSCILLATOR (CONT'D)		
d. A4V1, pin 2	+100 Vdc	Check A4R1, A4R2, A4R10 and A4C1
e. A4V1, pin 1	+102 Vdc	Check A4R4, A4V1 or RF lead to 12HG7's
3. a. A4V2, pin 1 & 6	+300 Vdc (nominal)	Check A5R2, C3A, and C3B for shorts
b. A4V2, pin 2 & 7	+107 Vdc	Check A4V1 and associated components
c. A4V2, pin 3 & 8	+108 Vdc	Check A4V1, A4CR1 or associated components
d. A4V2, pin 2 & 7	6 volts rms (nominal) to 19 MHz, 3 to 5 volts rms to 65 MHz (measure with HP 410B ac probe).	Check A4V2, A4CR1, C3A, C3B, A7T2 (tank coil) and grid line to 12HG7's
4. Across A5R2 (turn off instrument and measure resistance)	100 ohms ± 10%	Check C3A, C3B, or A4V1 or A4V2 for shorts
E. RF BUFFER		
PREPARATION: This procedure assumes the power supplies and RF Oscillator are operating correctly. (Disconnect short across A4R27, if installed in step D.) Measure voltage at:		
1. Across filaments of A4V3, A4V4, A4V5, and A4V6	6.3 Vdc ± 10%	A4L1, A4L2 open; A4C5, A4C7 shorted, A4V3-A4V6 faulty
2. A4V3, V4, V5, and V6 (across heaters)	6.3 Vdc ± 10%	Same as 1
3. A4V3 and V4 (12HG7's)		
a. Test Points 1 & 2	+220 Vdc (nominal)	Check A4R37-A4R40, A4C23, A4C24
b. Pin 8	+180 Vdc (nominal)	Check A4R38, A4R40, A4C23, and A4C24
c. Test Points 3 & 4	+0 Vdc (nominal)	Check A4R29, A4R30, A4R31, A4R32, A4C19, A4C20, and triode section of A4V1
d. Pin 1	+3.75 Vdc (nominal)	Check A4R33, A4R34, A4R35, and A4C22
F. RF AMPLIFIER, DIFFERENTIAL AMPLIFIER, AND MODULATOR		
PREPARATION: This procedure assumes that the power supplies, RF Oscillator, and RF Buffer are operating correctly. Measure voltage at:		
1. Junction of R8 and R9	+295 Vdc ± 10%	A1L8, R9 open; C7A, C7B, A4C25 shorted
2 A4V8 (6AW8)		
a. Test Point 8	+3.0 Vdc	A4R18, A4CR2 faulty
b. Pin 2	0 to 3.5 Vdc as R5 is rotated	A4R17, A9R1, A1R57, A1R60, A1R61, A1R62 faulty
c. Pin 9	+90 Vdc (nominal)	A4R22, R21, A4R25, A4R26, A4R27, A4V8 faulty
d. Pin 3	+150 Vdc (nominal)	A4C16, A4C17, A4R19, A4R20, A4R21, A4V7
e. Pin 8	+43 Vdc (nominal)	Same as c.

Table 5-6. Troubleshooting Chart (Cont'd)

Measure	Normal Indication	Possible Cause of Malfunction
F. RF AMPLIFIER, DIFFERENTIAL AMPLIFIER, AND MODULATOR (CONT'D)		
f. Test Point B	0 to +3.4 Vdc as R5 (VERNIER) is rotated	A4C27, A4C26, CR1, A4CR3, A4R49, A4R50, A4R51, A4R52, A4V8
3. A4V9 (12B4)		
a. Test point 6	-10 to -25 Vdc as R5	A4C18, A4R22, R21, A4R25, A4R26, A4R27, A4V7 or A4V8
b. Pin 9	112 Vdc (nominal)	A4R28, A4V5, A4V6, A4V9
4. A4V5 and V6 (12HG7's)		
a. Test point 5	+300 Vdc (nominal)	Shorted C9A, C9B; open turret transformer; or contacts on turret
b. Pin 8	+300 Vdc (nominal)	Check A4C3, C7, A4C25, C9, R9
c. Pin 2	+104 Vdc (nominal). If this voltage is incorrect the RF buffer or oscillator is not functioning properly.	A4R41, A4R42, A4L6, A4L7, A4V3, A4V4, triode section of A4V1
d. Pin 1	+112 Vdc (nominal)	A4R46, A4R48, check voltage on pin 9, A4V9
5. Test point 18	6 volts rms (nominal) with 1 VOLT output level. Varies from 0 to 6 volts rms as VERNIER is rotated.	Check A4V5 and A4V6 plate voltage and output voltages

NOTES

If a sharp drop (hole) occurs in power output level, or a sharp increase (peak) occurs in RF Oscillator or RF Amplifier current as frequency dial is tuned, check shorting fingers in turret.

If resistor R9 burns out, check for shorted tuning capacitor C9A, C9B, or A4C36; open or shorted CR1, A4CR3; or shorted S4. If this condition affects one band only, check the turret contact and coil for that one band. If this condition persists on all bands, see Table 5-7.

G. AUDIO OSCILLATOR

PREPARATION: This procedure assumes that the power supplies are operating correctly. Set MODULATION SELECTOR switch to INT. 1000~. Adjust MODULATION AMPLITUDE control for 100%. Measure voltage at:

Measure	Normal AC Indication	Normal DC Indication
1. A1V5 (12AT7)		
a. Pin 1	3.7 volts rms	+160 Vdc
b. Pin 2	6.6 volts rms	0 Vdc

Table 5-6. Troubleshooting Chart (Cont'd)

Measure	Normal AC Indication	Normal DC Indication
G. AUDIO OSCILLATOR (CONT'D)		
c. Pin 3	6.2 volts rms	+2.7 Vdc
d. Pin 6	80 volts rms	+290 Vdc
e. Pin 7	3.8 volts rms	0 Vdc
f. Pin 8	1.88 volts rms	+4.3 Vdc
2. T1 leads		
a. Green	20 volts rms	0 Vdc
b. Yellow	3 volts rms	0 Vdc
c. Blue	80 volts rms	+292 Vdc
H. MODULATION MONITOR		
PREPARATION: This procedure assumes that the power supplies and Audio Oscillator are operating correctly. Set MODULATION SELECTOR switch to INT. 1000~. Adjust MODULATION AMPLITUDE control for 100%. Measure voltage at:		
1. A1V9A (1/2 12AT7)		
Pin 2	2.8 volts rms	0 Vdc (approximate voltages)
Test Point 9	2.8 volts rms	+4.8 Vdc
NOTE		
Diode A1CR4 prevents a high negative voltage developing at the cathode of A1V9A during warmup. Such a high voltage of reversed polarity would damage electrolytic capacitor A1C56. The high negative voltage could also be developed if the heater of A1V9 burned out or if the instrument were turned on with A1V9 removed. Diode A1CR5 is the detector for the modulation meter.		
Both diodes, A1CR4 and A1CR5, can be measured only out of the circuit. Forward resistance should be approximately 500 ohms. Back resistance should be greater than 100K ohms.		
I. CRYSTAL CALIBRATOR		
PREPARATION: This procedure assumes that the power supplies are operating correctly. Set CRYSTAL CALIBRATOR switch to 1 MC. Measure voltage at:		
Measure	**Normal Indication**	**Possible Cause of Malfunction**
1. A2Q5 (base)	+16 Vdc	A2Y1, A2Q1, A2Q2 faulty
2. A2CR4 (cathode)	+15.5 Vdc	A2Q5, A2CR4, A2R17 faulty
Set CRYSTAL CALIBRATOR switch to 100 KC		
3. A2CR4 (cathode)	+13 Vdc	A2Q3, A2Q4, A2CR1, A2CR2, A2CR3, A2R10, A2R11, A2R12 faulty

Table 5-6. Troubleshooting Chart (Cont'd)

Measure	Normal Indication	Possible Cause of Malfunction
I. CRYSTAL CALIBRATOR (CONT'D)		
4. A2Q6 (base)	+10 Vdc	A2T1, A2C8, A2C9, A2C11, A3CR6, A2CR7, A2R23 faulty
5. A1V9B (1/212AT7)		
a. Pin 7	-0.7 Vdc	A2CR8, A2CR9, A2C12, A2C13, A2Q6 faulty
b. Test point 10	+111 Vdc	A1R45, A1V9 faulty

Table 5-7. Troubleshooting the Feedback Loop

SYMPTOM. No output on all ranges, or A4R9 (100 ohms) burns out on all ranges.

PREPARATION. This procedure assumes that:

a. The +25.6 volt, -200 volt, and +300 volt supplies are functioning properly.

b. All heater voltages in the RF chassis measure the correct value.

c. All tubes and transistors have been checked.

d. The Oscillator is working properly on all bands and gives approximate voltages listed in Table V-6, Part D.

e. The tuning capacitor or its leads are not short circuited.

PROCEDURE. Unless otherwise noted all measurements are made at 115 volts rms, 60-hertz line, with the Signal Generator on CW.
Proceed from step to step. Rectify any troubles before proceeding to the next step. Measurements are made with an Hewlett Packard Model 410B VTVM and Model 428A Clip-On Milliammeter.

E = dc voltages; e = ac voltages; I = current.

Procedure	Observe or Measure		
1. Disable the feedback by connecting pin 2 of A4V9 to -200 volts by shorting A4R27 (215K).	This bias should cutoff V9. There should be no current through R9. Check with Hewlett-Packard Model 428B.		
2. Connect a series combination of a fixed 5000-ohm, 5-watt and a variable 2000-ohm, 2-watt resistor from pin 9 of A4V9 (12B4A) to ground. Terminate output with 50-ohm load. Adjust variable resistor to obtain 1 volt at 1 MHz.	A4V9 (12B4A)	pin 1 to ground	I_k is approximately 19 mA
	A4R28	bands 1 to 5	I is approximately 5.6 mA
		band 6	I is approximately 0 mA
	A4V5 or A4V6 (12HG7)	pin 1 to ground	e is approximately 2.0 Vrms
		pin 1 to 2	E is approximately -14 Vdc
		pin 8 to ground	E is approximately +295 Vdc
		pin 7 to ground	E is approximately +295 Vdc
	Drop across A4R46 or A4R48		E is approximately 0.15 Vdc
	CR1 (anode)		e is approximately 5.7 Vrms
	A4CR3 (cathode)		E is approximately 7.1 Vdc
	A4V8 (6AW8)	pin 7 to ground	E is approximately 3.1 Vdc
		pin 7 to ground	e is approximately 0 Vrms
3. Repeat Procedure 2 for bands 1, 2, 4, 5 and 6	Check with data listed in Table 5-6. Data for CR1, CR2 and V8 for this test are same as listed in procedure 2.		

Table 5-7. Troubleshooting the Feedback Loop (Cont'd)

Procedure	Observe or Measure		
4. Adjust the variable resistor for 3.1 Vdc at pin 7 of A4V8. Set R5 (VERNIER) fully counterclockwise.	A4V8 (6AW8)	pins 1 and 6	E is approximately +3.0 Vdc
		pin 2	E is approximately 0 Vdc
		pin 3	E is approximately +60 Vdc
		pin 4	E is approximately 0 Vdc
		pin 5	E is approximately +6.6 Vdc
		pin 7	E is approximately +1.2 Vdc
		pin 8	E is approximately +80 Vdc
		pin 9	E is approximately +10 Vdc
	A4V7 (12AT7)	pins 1 and 6	E is approximately +295 Vdc
		pin 2	E is approximately +50 Vdc
		pin 3	E is approximately +54 Vdc
		pins 4 and 5	E is approximately +19.5 Vdc
		pin 7	E is approximately +135 Vdc
		pin 8	E is approximately +143 Vdc
		pin 9	E is approximately +13 Vdc
5. Turn R5 (VERNIER) fully clockwise.	A4V8 (6AW8)	pins 1 and 6	E is approximately +4.5 Vdc
		pin 2	E is approximately +3.3 Vdc
		pin 3	E is approximately +138 Vdc
		pin 6	E is approximately +4.5 Vdc
		pin 7	no voltage change as R5 is rotated
		pin 8	E is approximately +54 Vdc
		pin 9	E is approximately +42 Vdc
6. Disconnect jumper from pin 2 of 2A4V9 to -200 volts. Remove 5000- and 2000-ohm resistors.	The Signal Generator should be operating properly.		
7. Realign the RF Oscillator and Amplifier Sections if any tubes or components have been replaced or altered.	See paragraphs on maximum carrier and modulation zero (5-44), carrier zero (5-42), modulation meter (5-46) and output meter (5-48) adjustments.		

Table 5-8. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering Tool	Soldering Unsoldering	Wattage rating: 37.5 Tip Temp: 750-800°F Tip Size: 1/8" OD	Ungar #776 Handle with Ungar #1237 Heating Unit
Soldering Tip,	Soldering	Shape: chisel	Ungar #PL113
General Purpose	Unsoldering	Size: 1/8"	
De-soldering aid	Unsoldering multi-connection components (e.g., tube sockets)	Suction device to remove molten solder from connection	Soldapult by the Edsyn Company, Arleta, California
Resin (flux) solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred	
Protective Coating	Contamination, corrosion protection after soldering	Good electrical insulation, corrosion-prevention properties	Krylon R #1302* Humiseal Protective Coating, Type 1B12 by Columbia Technical Corp. Woodside 77, New York

*Krylon, Inc., Norristown, Pennsylvania

5-70. COMPONENT REPLACEMENT.

a. Remove defective component from circuit board.

b. Remove solder from mounting holes using a suction desoldering aid (Table 5-8) or wooden toothpick.

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

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

Note

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

5-71. TUBE SOCKET REPLACEMENT. There are three ways to remove a tube socket from the etched circuit board:

a. Cut terminals attaching socket to circuit board, remove socket, and unsolder remaining terminal pieces individually.

b. Using long nose pliers, break insulating material of socket away from its metal connectors, then unsolder connectors from board individually.

c. Use a special soldering iron tip designed to heat all socket connections simultaneously and remove socket as a unit; or use a suction device (Table 5-8) to desolder all connections and remove socket.

5-72. ETCHED CONDUCTOR REPAIR. A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

5-73. TRANSISTOR REPLACEMENT. Replace transistors as follows:

a. Do not apply excessive heat. See Table 5-8 for soldering tool specifications.

b. Use a heat sink such as pliers or hemostat between transistor body and hot soldering iron.

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

5-74. DRIVE CABLE ASSEMBLY REPLACEMENT.

5-75. Replacement of the drive cable assembly (HP Stock Number 606B-18) requires only the removal of the old drive cable assembly and winding the replacement drive cable onto the idler shaft, tuner pulley, and drive pulley. An adjustment of the drive cable assembly is made to obtain proper rotation of the frequency dial and tuner plates. No special tools are required. Following is the installation procedure:

a. Disconnect power. Remove cabinet and RF generator shield.

b. Turn instrument upside down and remove the aluminum shielding plate between the RF Oscillator and RF Amplifier.

c. Refer to Figure 5-12. Loosen the two setscrews in spring load nut and the one setscrew in end of drive pulley.

d. Remove old drive cable assembly.

e. Push end of replacement drive cable nearest drive collar over tuner pulley. Press drive collar into notch in tuner pulley.

f. Wrap short end of drive cable around tuner pulley as shown in Figure 5-12. Attach end of cable to floating collar on spring-loaded idler shaft with 4-40 x 1/4 inch round-head machine screw.

g. Wind two full turns of drive cable onto floating collar. Be sure spring load nut is positioned so that one of the setscrews is accessible. Place a 9/16-inch open-end wrench over spring load nut to prevent its turning.

h. Wrap one and a half turns of drive cable around drive pulley as shown in Figure 5-12.

i. Rotate spring-loaded idler shaft so that No. 4-40 screw hole in spring-loading collar is accessible.

j. Attach long end of drive cable to spring loading collar using the 4-40 x 1/4 round-head machine screw.

k. Place screwdriver in slot at end of spring-loaded idler shaft and rotate shaft counterclockwise to remove slack in drive cable. Continue to hold spring-load nut with end wrench.

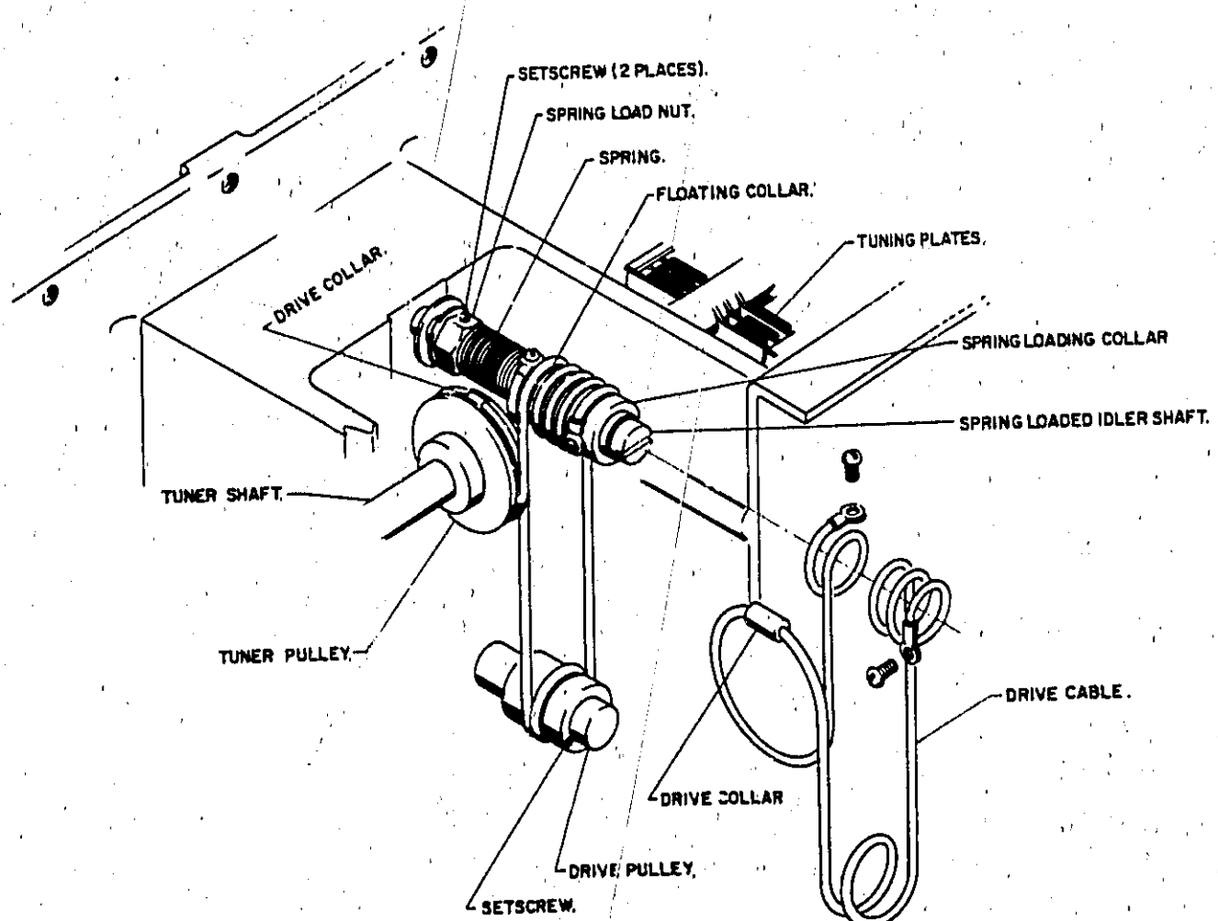


Figure 5-12. Installation of Drive Cable Assembly

m. Tighten one setscrew in spring-load nut and remove end wrench.

n. Turn frequency dial to approximately mid-range and seat cable in slot on drive pulley.

p. Holding spring-load nut with 9/16 inch open-end wrench, loosen the previously tightened setscrew in spring-load nut and turn spring-loaded idler shaft counterclockwise to a torque of approximately 7 inch-pounds. Retighten setscrew and remove wrench.

q. Hold frequency dial against its low frequency stop. Slip drive cable on drive pulley by turning spring-loaded idler shaft with screwdriver. Turn idler shaft until both tuning capacitors are fully meshed.

r. Tighten the 4-40 Allen setscrew in drive pulley.

s. Rotate frequency dial through its range and observe position of drive cable.

t. Check dial calibration as outlined in paragraph 5-12.

u. Replace aluminum shielding plate between RF Oscillator and RF Amplifier.

v. Turn instrument right-side up. Replace RF generator shield and cabinet.

5-76. TURN-ON PROCEDURE AFTER REPAIR.

5-77. Be sure to check for shorts in tuning capacitors A4C3 and A4C9 with an ohmmeter after repair and before turning on the instrument. Solder splashes may occur which short these capacitors when repairing other parts of the instrument. If the instrument is turned on with these capacitors shorted, resistors A4R2 or A4R9 may be damaged.

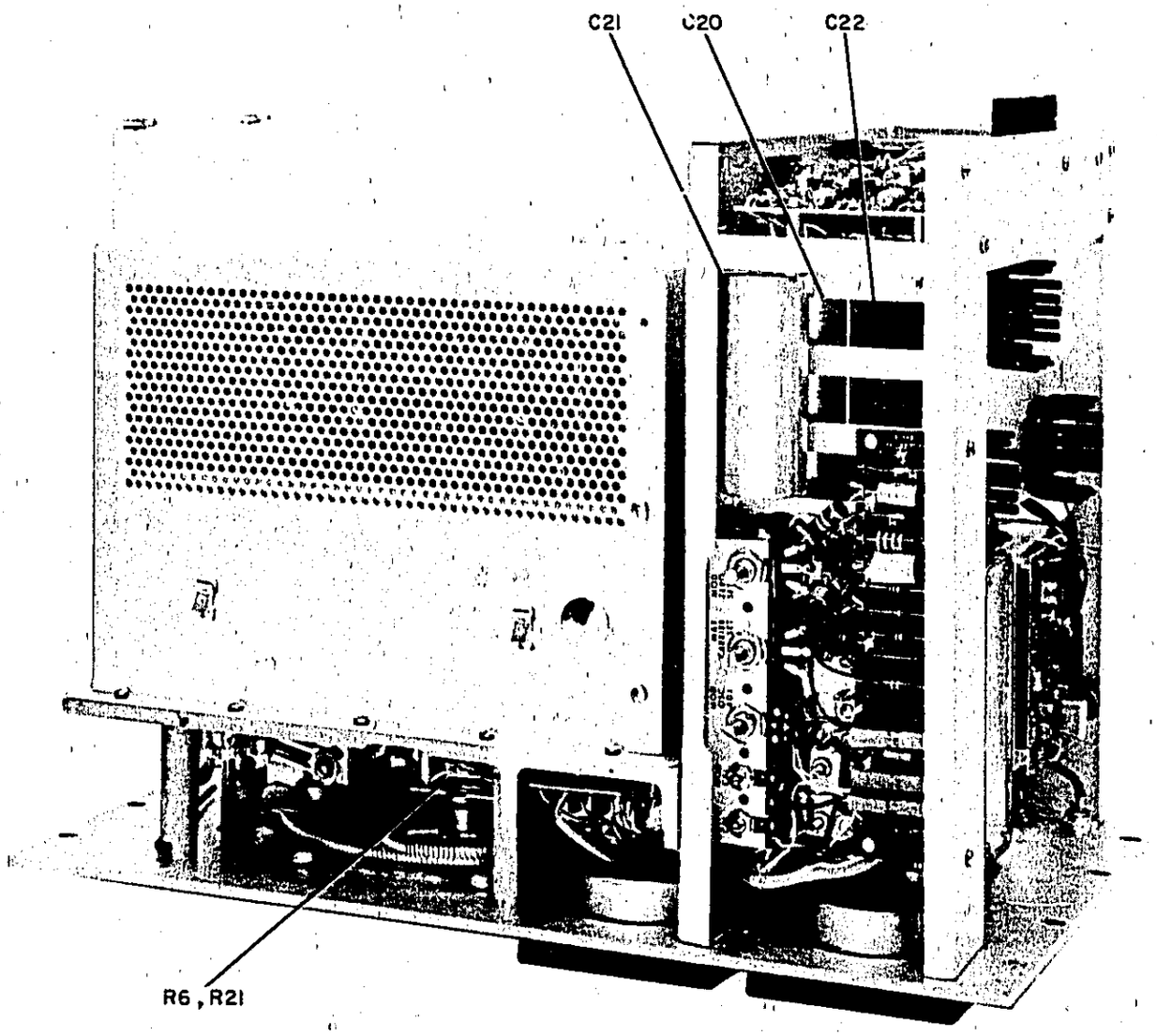


Figure 5-13. Interior View Showing Locations of Unlabeled Chassis Components

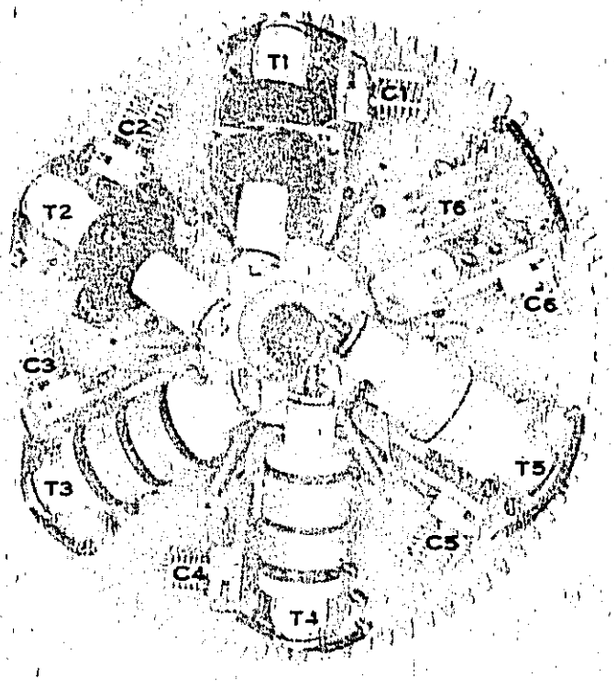


Figure 5-14. Oscillator Turret Assembly A7

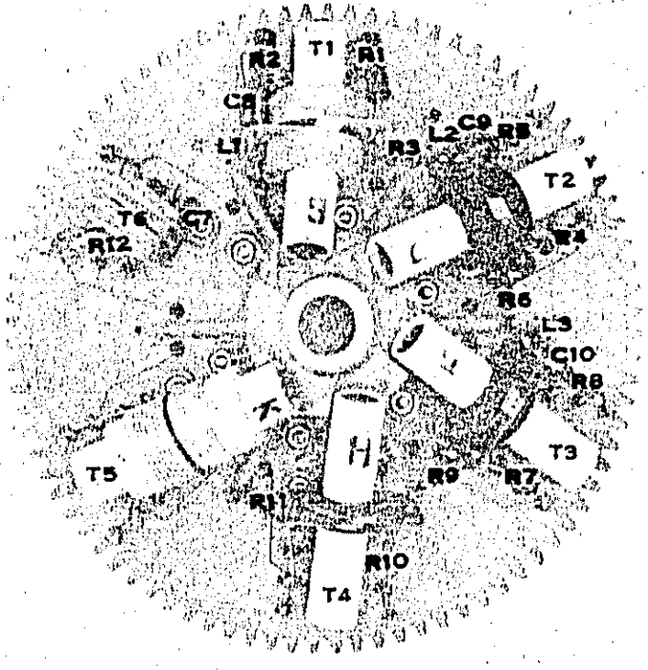


Figure 5-15. Amplifier Turret Assembly A8

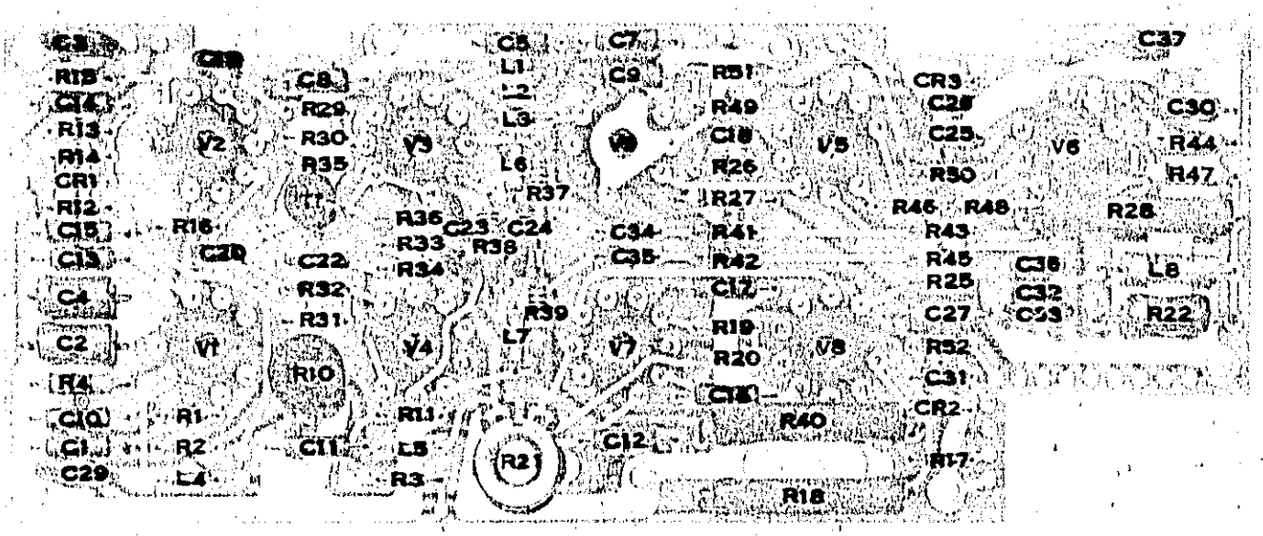


Figure 5-16. Etched Circuit A4 Oscillator Amplifier Assembly Component Locations

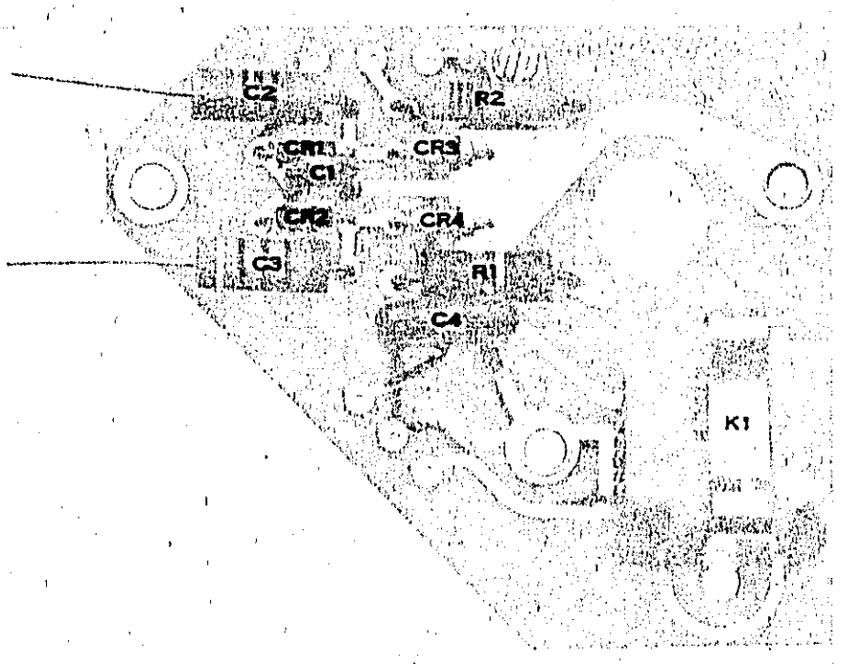


Figure 5-17. Etched Circuit A5 Varactor Control Assembly Component Locations

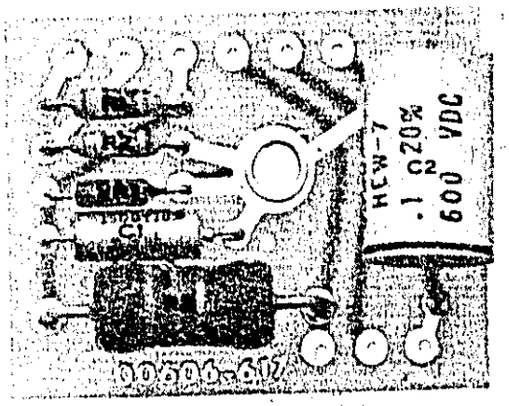


Figure 5-18. Etched Circuit A6 ΔF Assembly Component Locations

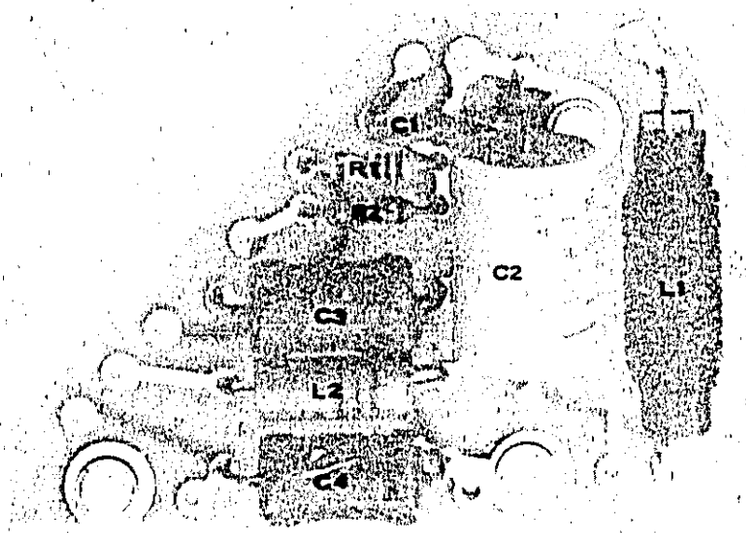
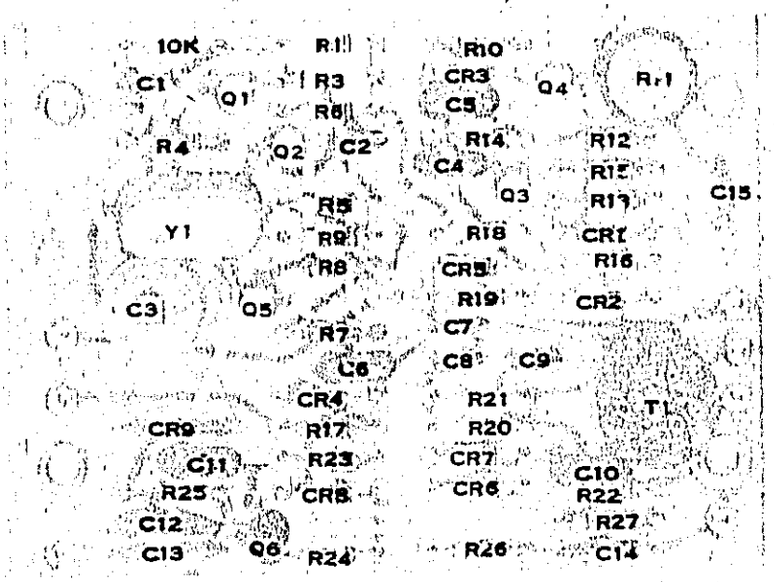


Figure 5-19. Etched Circuit A3 Control Input Assembly Component Locations



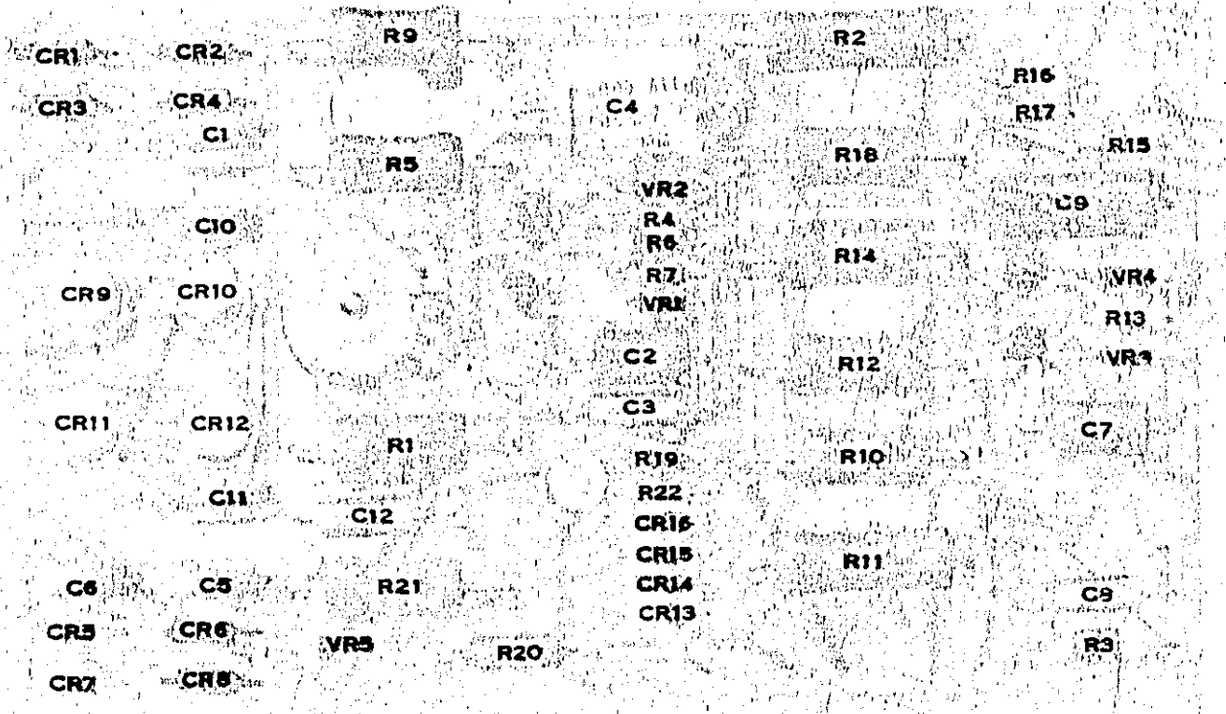
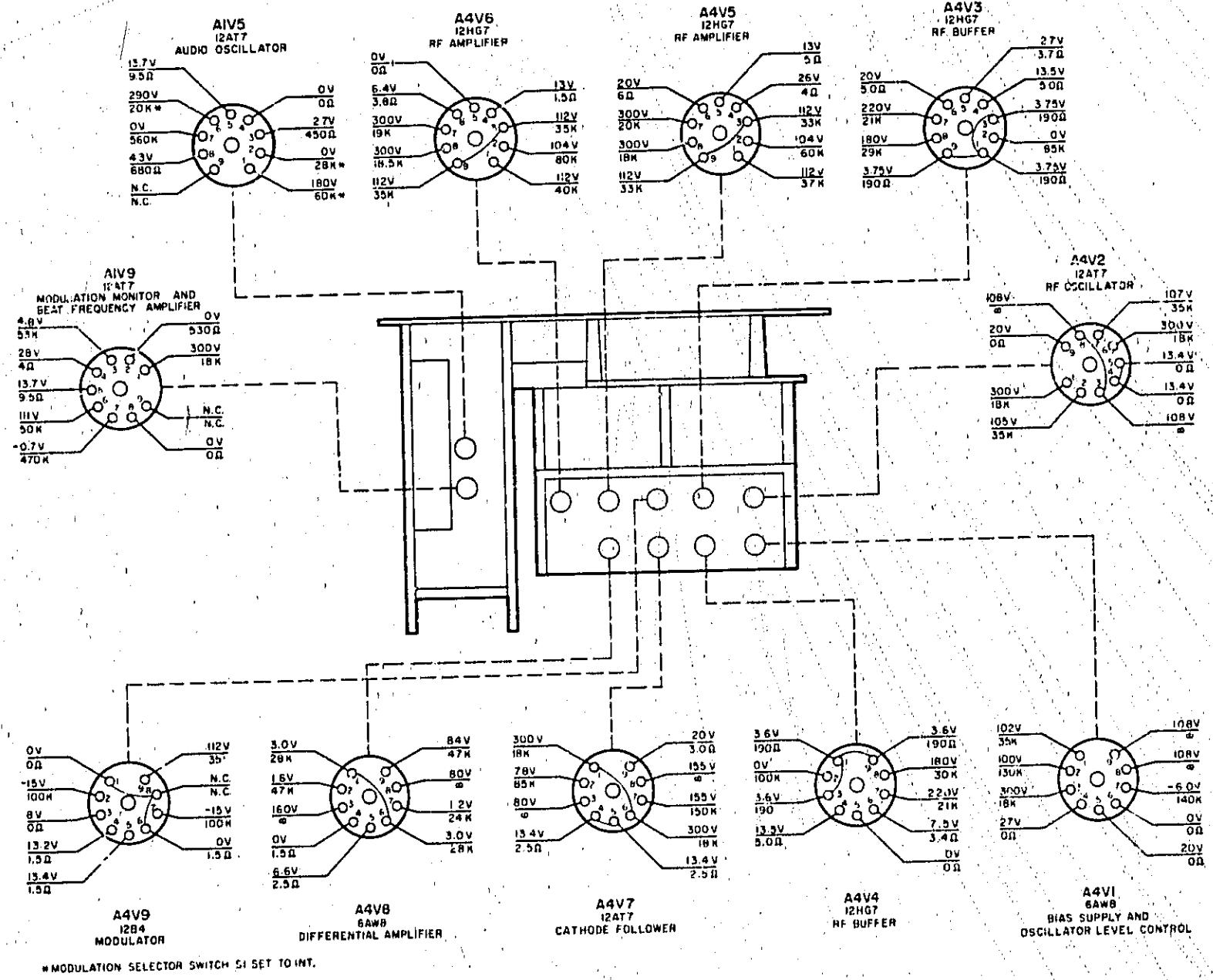


Figure 5-20. Etched Circuits A2 Calibrator Assembly (above) and A11 Power Supply Assembly (below) Component Locations



*MODULATION SELECTOR SWITCH S1 SET TO INT.

Figure 5-21. Tube Socket Voltage and Resistance Measurements

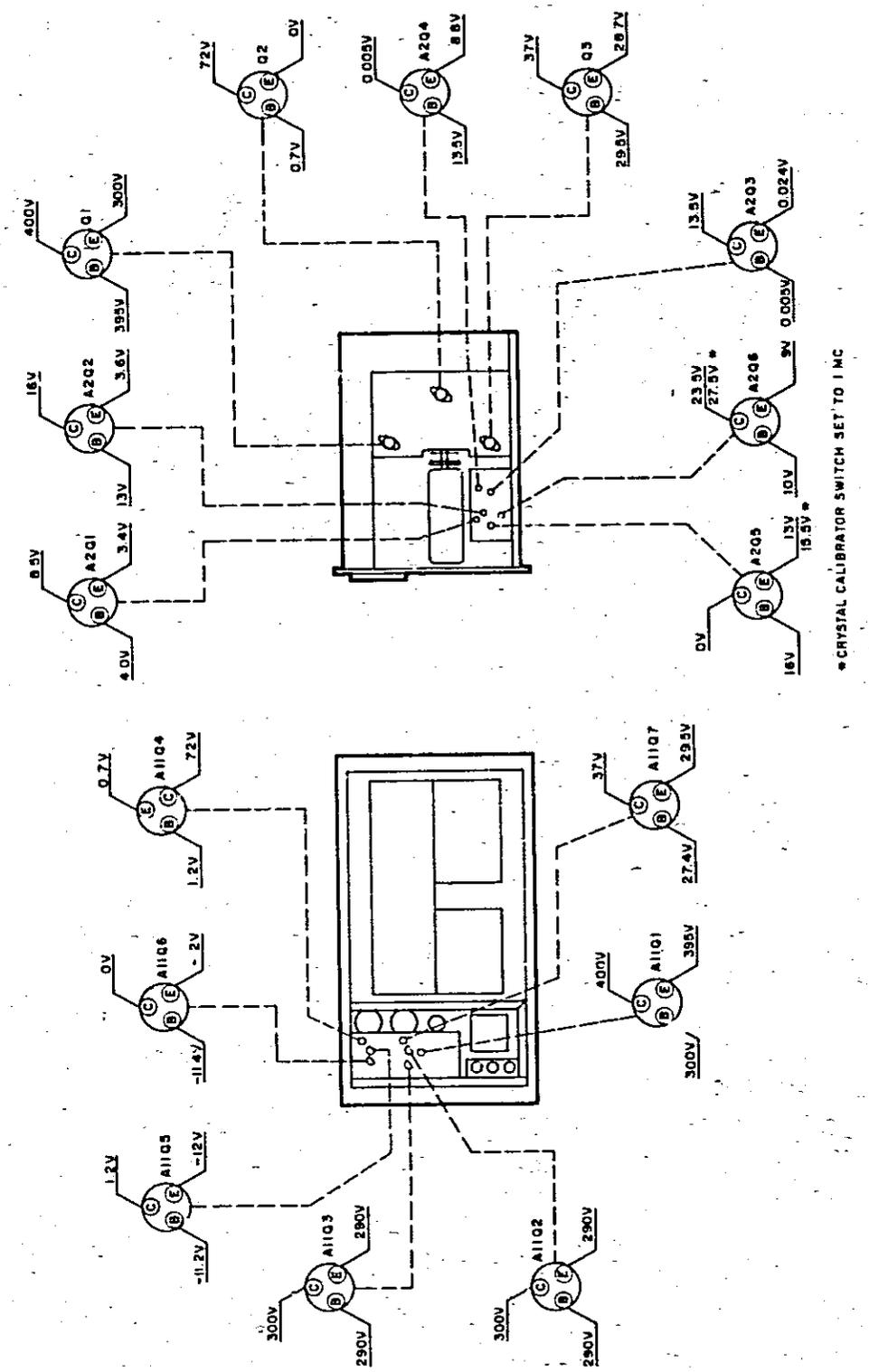


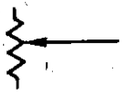
Figure 5-22. Transistor Voltage Measurements

1. Resistance in ohms, inductance in microhenry, capacitance in picofarads unless otherwise indicated

2.  screwdriver adjust
   panel control

3. front panel designation

4. ——— etched circuit borderline
   ——— signal path ——— feedback path

5.  CW indicates movable contact position at clockwise rotation limit of control shaft (shaft viewed from knob or slotted end)

6. *denotes a factory-selected value. Typical value shown. Part may be omitted.

7.  = test point

8.  Voltage regulator (breakdown) diode

9. Relays shown in condition prevailing during normal instrument operation

10. Unless otherwise noted, voltage and resistance measurements taken with controls set as follows:

    RANGE switch - Band 5

    VERNIER (frequency) control - 0

    MODULATION SELECTOR switch - 1000~

    MODULATION AMPLITUDE control - 50%

    ATTENUATOR switch - Any setting except 3.0 VOLTS

    VERNIER (attenuator) control - Adjusted for 0 DBM

    CRYSTAL CALIBRATOR switch - 100KC

Figure 5-23. Schematic Diagram Notes

WARNING

SOME OF THE MAINTENANCE AND SERVICING OPERATIONS DESCRIBED HEREIN ARE PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT WHILE PROTECTIVE COVERS ARE REMOVED. BE CAREFUL WHEN PERFORMING THESE OPERATIONS. LINE VOLTAGE IS ALWAYS PRESENT ON TERMINALS INCLUDING THE POWER INPUT CONNECTOR, FUSE HOLDER, POWER SWITCH, ETC. IN ADDITION, WHEN THE INSTRUMENT IS ON, ENERGY AVAILABLE AT MANY POINTS MAY RESULT IN PERSONAL INJURY OR DEATH WHEN CONTACTED.

REFERENCE DESIGNATIONS

A1, 3-8 C2-4, 7-9, 23-31 L3-5 P1 R5-12, 21-23 S3-5	A1 R37, 60-62	A4 C1-5, 7-27, 29-38 CR1-3 L1-8 R1-22, 25-55 T1 V1-9	A6 C1, 2 R1-3 VR1
CR1 J3-7 M2	A3 C1-4 L1, 2 R1, 2	A5 C1-4 K1 CR1-4 R1-6	

[1] SEE APPENDIX I TABLE 1.

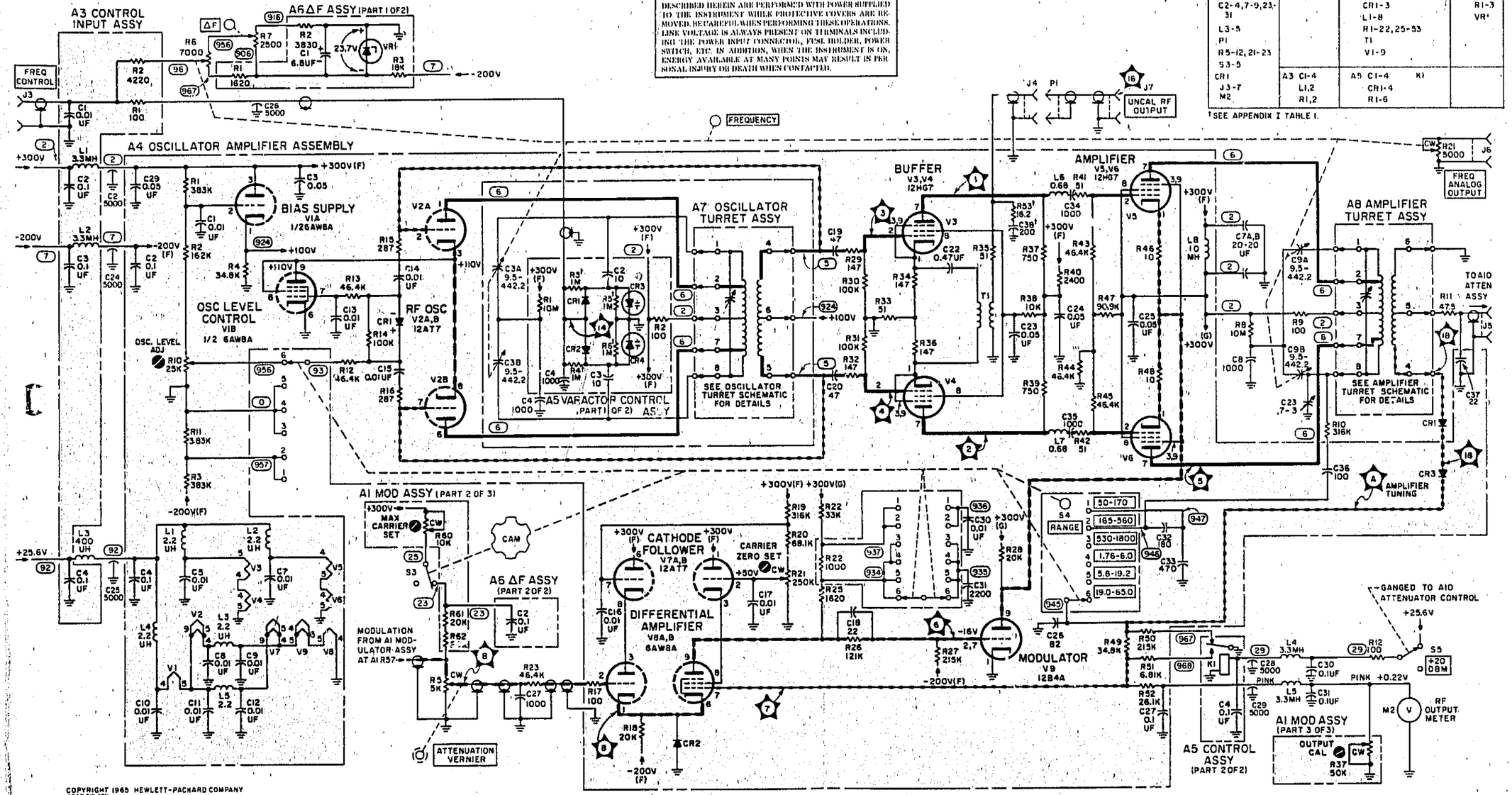


Figure 5-24. RF Generator and Modulator Circuits Schematic Diagram

WARNING

SOME OF THE MAINTENANCE AND SERVICING OPERATIONS DESCRIBED HEREIN ARE PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT WHILE PROTECTIVE COVERS ARE REMOVED. BE CAREFUL WHEN PERFORMING THESE OPERATIONS. LINE VOLTAGE IS ALWAYS PRESENT ON TERMINALS INCLUDING THE POWER INPUT CONNECTOR, FUSE HOLDER, POWER SWITCH, ETC. IN ADDITION, WHEN THE INSTRUMENT IS ON, ENERGY AVAILABLE AT MANY POINTS MAY RESULT IN PERSONAL INJURY OR DEATH WHEN CONTACTED.

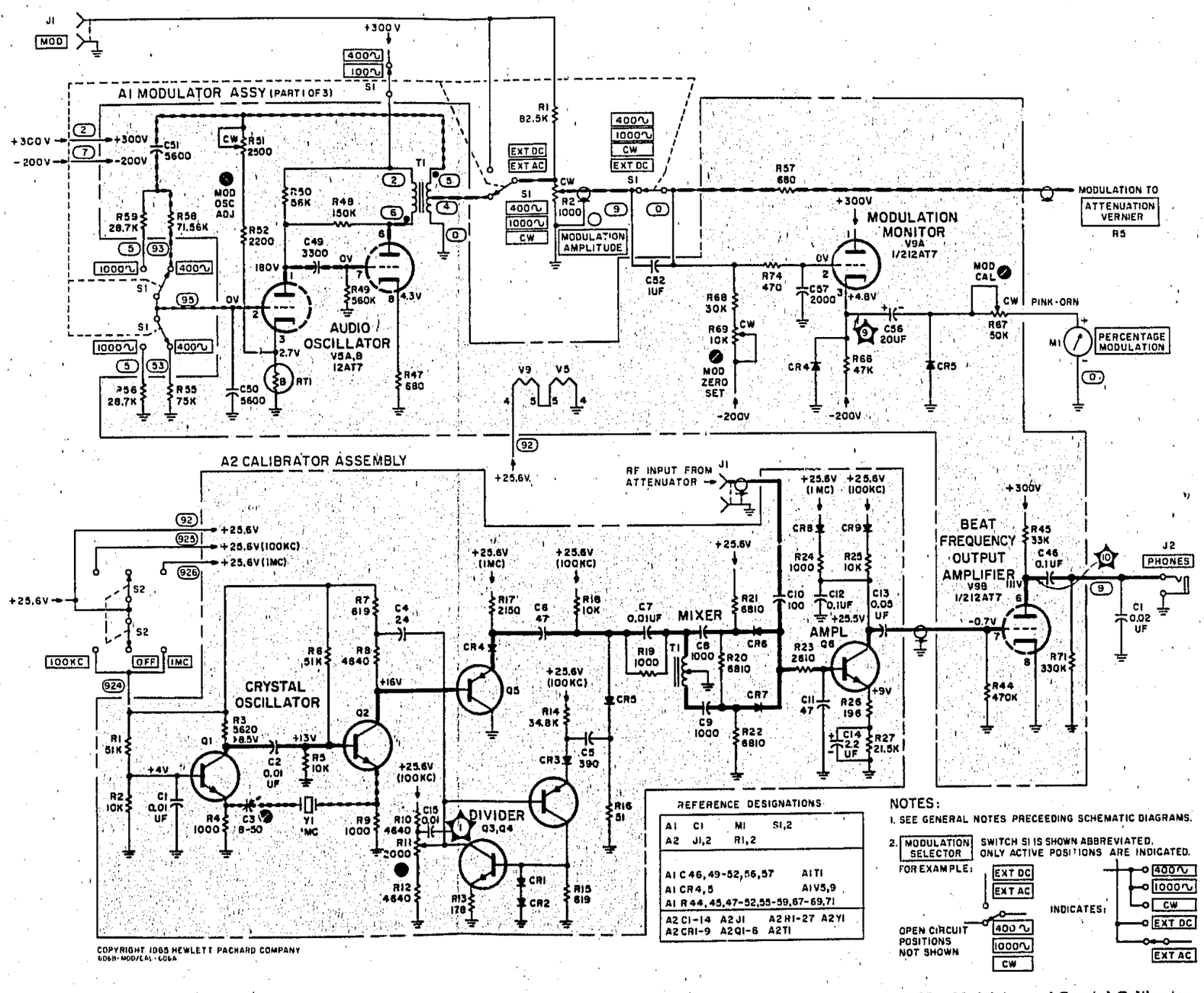
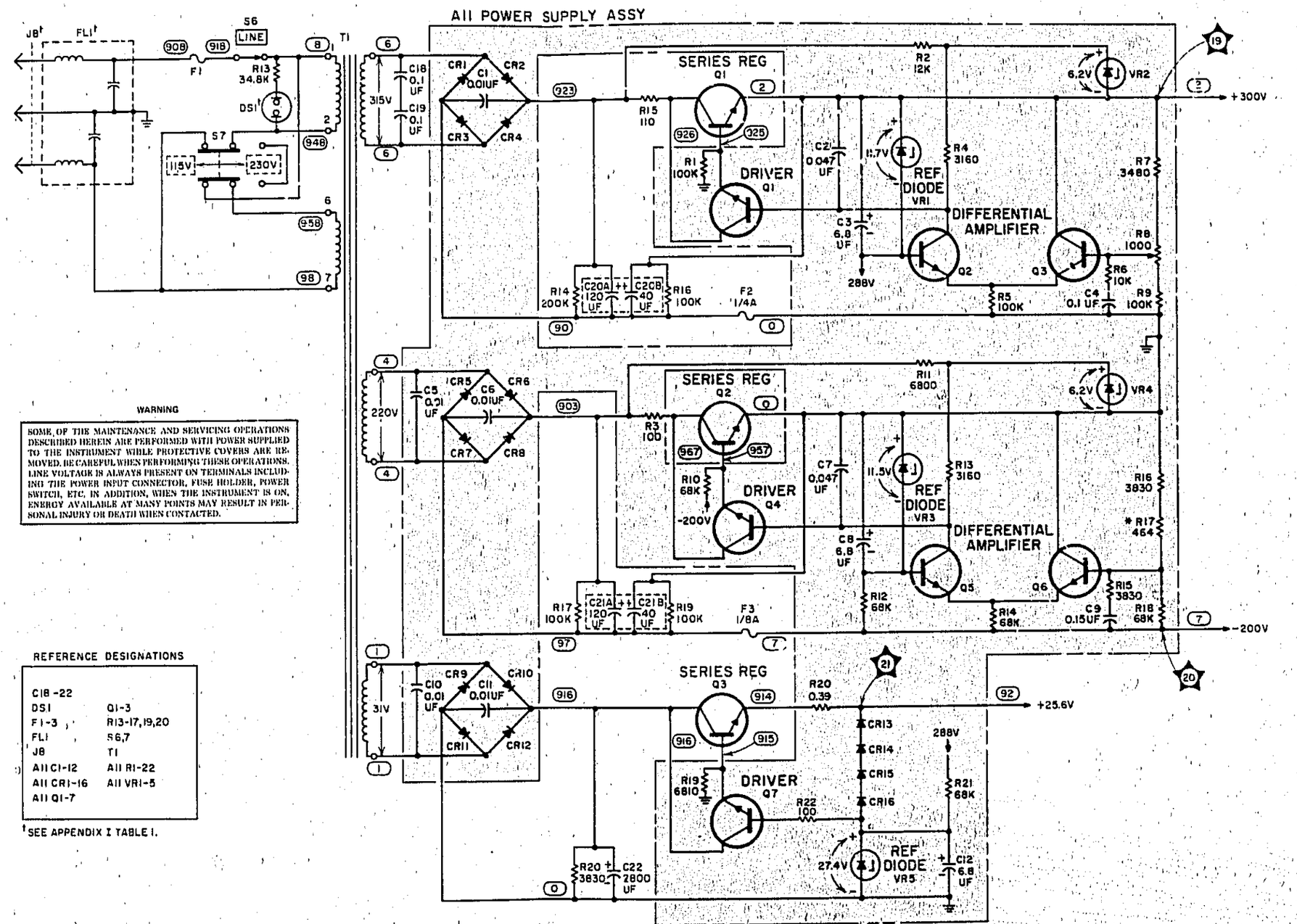


Figure 5-25. Modulator and Crystal Calibrator Circuits Schematic Diagram



WARNING

SOME OF THE MAINTENANCE AND SERVICING OPERATIONS DESCRIBED HEREIN ARE PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT WHILE PROTECTIVE COVERS ARE REMOVED. BE CAREFUL WHEN PERFORMING THESE OPERATIONS. LINE VOLTAGE IS ALWAYS PRESENT ON TERMINALS INCLUDING THE POWER INPUT CONNECTOR, FUSE HOLDER, POWER SWITCH, ETC. IN ADDITION, WHEN THE INSTRUMENT IS ON, ENERGY AVAILABLE AT MANY POINTS MAY RESULT IN PERSONAL INJURY OR DEATH WHEN CONTACTED.

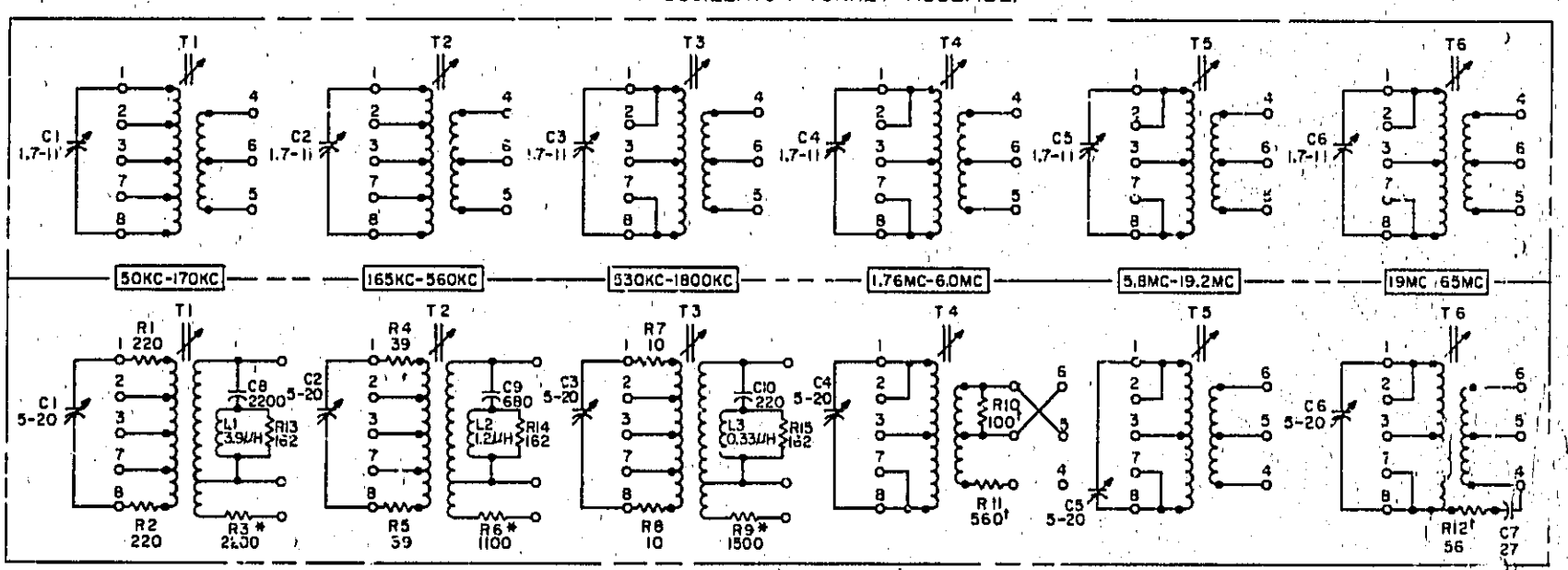
REFERENCE DESIGNATIONS

C18 -22	
DS1	Q1-3
F1-3	R13-17,19,20
FL1	S6,7
J8	T1
A11 C1-12	A11 R1-22
A11 CR1-16	A11 VR1-5
A11 Q1-7	

[1] SEE APPENDIX I TABLE I.

Figure 5-26. Power Supply Schematic Diagram

A7 OSCILLATOR TURRET ASSEMBLY



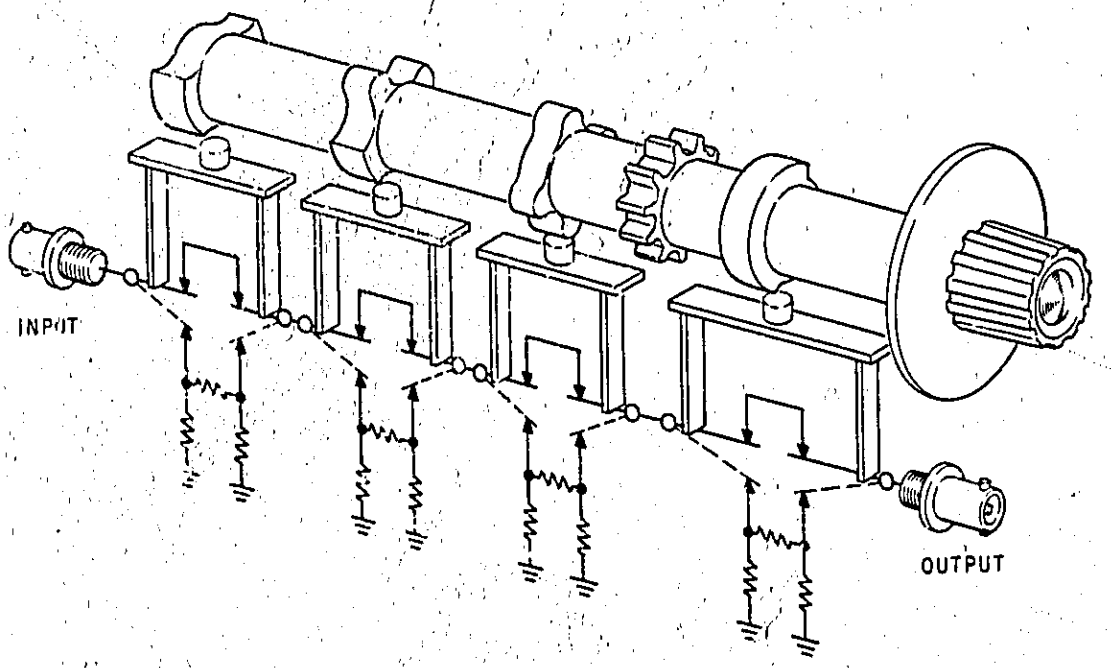
A8 AMPLIFIER TURRET ASSEMBLY

REFERENCE DESIGNATIONS

A7	A8
A7C1-6	A8C1-10
A7T1-6	A8L1-3
	A8R1-12
	A8T1-6

† SEE APPENDIX I TABLE I.

Figure 5-27. Oscillator and Amplifier Turrets Schematic Diagram



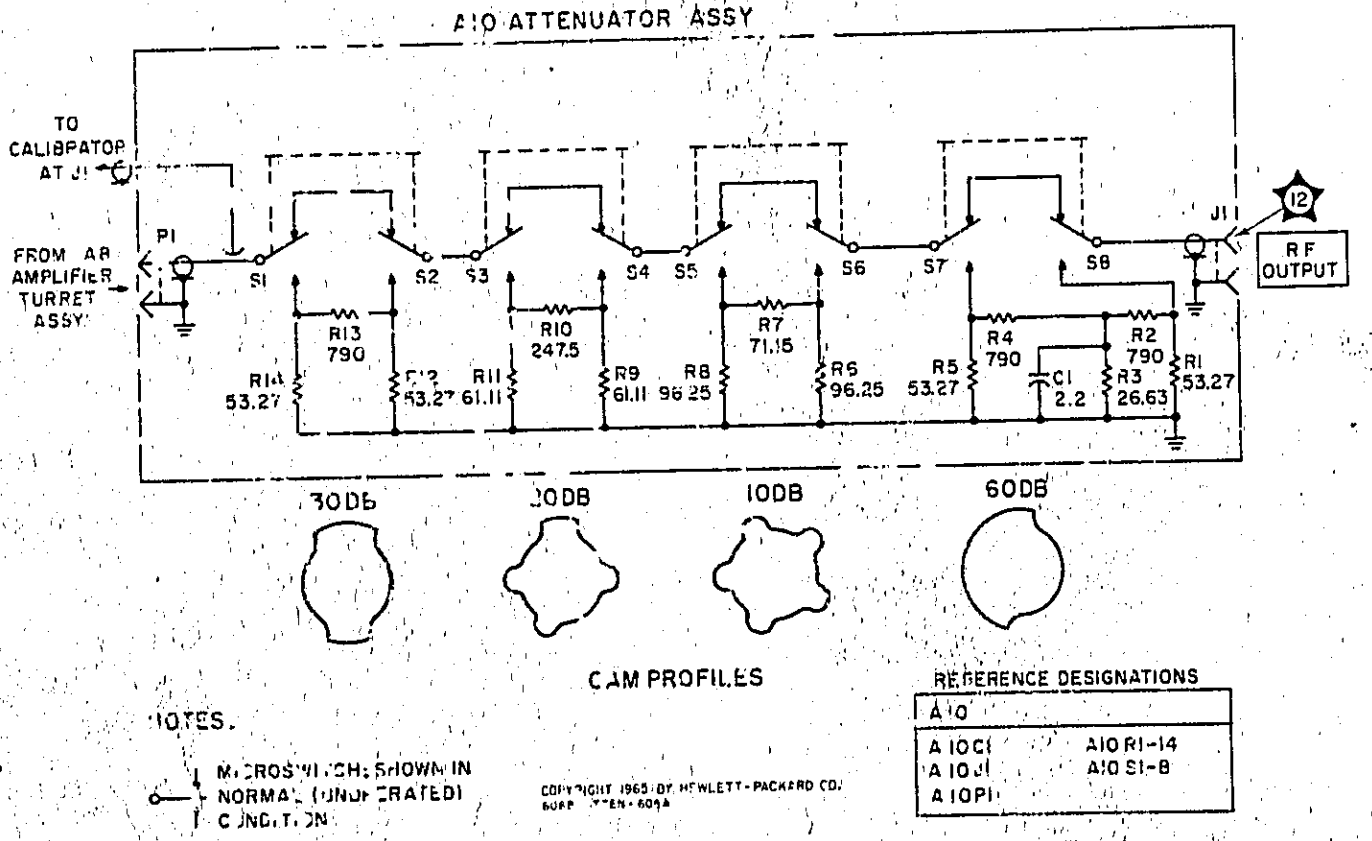


Figure 5-28 Output Attenuator Pictorial and Schematic Diagram

PARTS LIST

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 contains the names and addresses that correspond to the manufacturer's code number.

6-3. ABBREVIATIONS

6-4. Table 6-1 gives a list of abbreviations used in the parts list, schematics, and throughout the manual. In some cases, two forms of the abbreviation are given, one all capital letters and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-5. REPLACEABLE PARTS LIST

6-6. Table 6-2 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numeric order by reference designation.

b. Chassis-mounted parts in alpha-numeric order by reference designation.

c. Miscellaneous parts.

d. Illustrated parts breakdown.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity (Qty) in the instrument.

c. The description of the part.

d. Typical manufacturer of the part in a five-digit code.

e. Manufacturer code number for the part.

The total quantity for each part is given only once; at the first appearance of the part number in the list.

6-7. ORDERING INSTRUCTIONS

6-8. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

Table 6-1. Reference Designators and Abbreviations

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	NPN	= negative-positive-negative	SE	= selenium
		IF	= intermediate freq			SECT	= section(s)
BE CU	= beryllium copper	IMPG	= impregnated	NRFR	= not recommended for field replacement	SEMICON	= semiconductor
BH	= binder head	INCD	= incandescent			SI	= silicon
BP	= bandpass	INCL	= include(s)			SIL	= silver
BRS	= brass	INS	= insulation(ed)	NSR	= not separately replaceable	SL	= slide
BWO	= backward wave oscillator	INT	= internal			SPG	= spring
						SPL	= special
CCW	= counterclockwise	K	= kilo = 1000	OBD	= order by description	SST	= Stainless steel
CER	= ceramic			OH	= oval head	SR	= split ring
CMO	= cabinet mount only			OX	= oxide	STL	= steel
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	= metallized 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 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	00606-624	1	MODULATOR ASSY	28480	00606-624
A1	00606-605	1	WIRING HARNESS:MAIN	28480	00606-605
A1C1 - THRU A1C45			NOT ASSIGNED		
A1C46	0170-0022	4	C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24
A1C47			NOT ASSIGNED		
A1C48			NOT ASSIGNED		
A1C49	0160-0003	1	C:FXD MY 0.0033 UF 10% 600VDCW	56289	106P332%6 PMO
A1C50	0140-0071	2	C:FXD MICA 5600PF 1% 500WVDC	28480	0140-0071
A1C51	0140-0071		C:FXD MICA 5600PF 1% 500WVDC	28480	0140-0071
A1C52	0170-0018	1	C:FXD MY 1UF 5% 200VDCW	86411	TYPE 621M 10552
A1C53			NOT ASSIGNED		
A1C55			NOT ASSIGNED		
A1C56	0180-0045	1	C:FXD AL ELECT 20 UF +75-10% 25VDCW	56289	30D206G025CD2-DSM
A1C57	0150-0023	1	C:FXD CER 2000 PF 20% 1000VDCW	56289	20C295A2-CDH
A1CR1 - THRU A1CR3			NOT ASSIGNED		
A1CR4	1910-0016	10	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A1CR5	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A1R1 - THRU A1R36			NOT ASSIGNED		
A1R37	2100-0141	2	R:VAR COMP 50K OHM 20% LIN 1/4W	28480	2100-0141
A1R38 - THRU A1R43			NOT ASSIGNED		
A1R44	0687-4741	1	R:FXD COMP 470K OHM 10% 1/2W	01121	EB 4741
A1R45	0693-3331	1	R:FXD COMP 33K OHM 10% 2W	01121	HB 3331
A1R46			NOT ASSIGNED		
A1R47	0687-6811	1	R:FXD COMP 680 OHM 10% 1/2W	01121	EB 6811
A1R48	0687-1541	1	R:FXD COMP 150K OHM 10% 1/2W	01121	EB 1541
A1R49	0687-5641	1	R:FXD COMP 560K OHM 10% 1/2W	01121	EB 5641
A1R50	0690-5631	1	R:FXD COMP 56K OHM 10% 1W	01121	GB 5631
A1R51	2100-0067	1	R:VAR COMP 2500 OHM 10% LIN 1/2W	28480	2100-0067
A1R52	0687-2221	2	R:FXD COMP 2200 OHM 10% 1/2W	01121	EB 2221
A1R53					
A1R54			NOT ASSIGNED		
A1R55	0757-0856	1	R:FXD MET FLM 75.0K OHM 1% 1/2W	28480	0757-0856
A1R56	0698-3103	2	R:FXD MET FLM 28.7K OHM 1% 1/2W	28480	0698-3103
A1R57	0757-0816	1	R:FXD MET FLM 681 OHM 1% 1/2W	28480	0757-0816
A1R58	0757-0888	1	R:FXD FLM 71.5K OHM 1% 1/4W	28480	0757-0888
A1R59	0698-3103		R:FXD MET FLM 28.7K OHM 1% 1/2W	28480	0698-3103
A1R60	2100-0053	2	R:VAR WW 10K OHM 20% LIN 2W	28480	2100-0053
A1R61	0771-0004	3	R:FXD MET FLM 20K OHM 10% 4W	28480	0771-0004
A1R62	0771-0005	1	R:FXD MET FLM 24K OHM 10% 4W	28480	0771-0005
A1R63					
A1R65			NOT ASSIGNED		
A1R66	0693-4731	1	R:FXD COMP 47K OHM 10% 2W	01121	HB 4731
A1R67	2100-0141		R:VAR COMP 50K OHM 20% LIN 1/4W	28480	2100-0141
A1R68	0771-0007	1	R:FXD MET FLM 30K OHM 10% 4W	28480	0771-0007
A1R69	2100-0053		R:VAR WW 10K OHM 20% LIN 2W	28480	2100-0053
A1R70			NOT ASSIGNED		
A1R71	0687-3341	1	R:FXD COMP 330K OHM 10% 1/2W	01121	EB 3341
A1R72 - THRU A1R73			NOT ASSIGNED		
A1R74	0687-4711	1	R:FXD COMP 470 OHM 10% 1/2W	01121	EB 4711
A1XI1	2140-0007	1	LAMP:INCANDESCENT 10W 250V	08806	8A/56-12V
A1T1	9120-0036	1	TRANSFORMER:AUDIO	28480	9120-0036
A1V1 - THRU A1V4			NOT ASSIGNED		
A1V5	1932-0027	3	ELECTRON TUBE:12AT7 DUAL TRIODE	33173	12AT7
A1V6 - THRU A1V8			NOT ASSIGNED		
A1V9	1932-0027		ELECTRON TUBE:12AT7 DUAL TRIODE	33173	12AT7
A2	00606-603	2	BOARD ASSY:CRYSTAL CALIBRATION	28480	00606-603
A2	0380-0059	1	SPACER:SLEEVE BRASS FOR #6 HDW	00866	OBO
A2C1	0160-2055	4	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103Z522-CDH
A2C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103Z522-CDH
A2C3	0130-0017	1	C:VAR CER 8-50 PF	28480	0130-0017
A2C4	0160-0196	1	C:FXD MICA 24PF 5% 300VDCW	04062	RDM15C240J3S
A2C5	0140-0200	1	C:FXD MICA 390 PF 5%	72136	RDM15F391-J3C
A2C6	0140-0204	4	C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A2C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103Z522-CDH
A2C8	0150-0050	2	C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102Z526-CDH
A2C9	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102Z526-CDH
A2C10	0140-0176	2	C:FXD MICA 100 PF 2%	28480	0140-0176
A2C11	0140-0204		C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2C12	0150-0121	1	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-GNL
A2C13	0160-2917	1	C:FXD CER 0.05 UF +80-20% 100VDCW	84411	TYPE TA
A2C14	0180-0155	1	C:FXD ELECT 2.2 UF 20% 20VDCW	56289	150D225X0020A2-DYS
A2C15	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103Z522-CDH
A2CR1	1901-0621	1	DIODE:SI ALLOY 100V 200MA	28480	1901-0621
A2CR2	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A2CR3	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A2CR4	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A2CR5	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A2CR6	1901-0040	2	DIODE:SILICON 30MA 30WV	07263	FDG1088
A2CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A2CR8	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A2CR9	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A2Q1	1854-0005	3	TSTR:SI NPN	80131	2N708
A2Q2	1854-0005		TSTR:SI NPN	80131	2N708
A2Q3	1854-0005		TSTR:SI NPN	80131	2N708
A2Q4	1853-0009	2	TSTR:SI PNP	28480	1853-0009
A2Q5	1853-0009		TSTR:SI PNP	28480	1853-0009
A2Q6	1854-0071	5	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0757-0458	2	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R2	0757-0442	5	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R3	0757-0200	1	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A2R4	0757-0280	5	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R6	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R7	0757-0418	2	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A2R8	0698-3155	3	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R9	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R10	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R11	2100-1774	1	R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A2R12	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R13	0698-3439	1	R:FXD MET FLM 178 OHM 1% 1/8W	28480	0698-3439
A2R14	0757-0123	3	R:FXD MET FLM 34.8K OHM 1% 1/8W	28480	0757-0123
A2R15	0757-0418		R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A2R16	0757-0394	5	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A2R17	0698-0084	1	R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A2R18	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R19	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R20	0757-0439	5	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A2R21	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A2R22	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A2R23	0698-0085	1	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A2R24	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R25	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R26	0698-3440	1	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A2R27	0757-0199	1	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A2T1	9100-0399	1	TRANSFORMER	28480	9100-0399
A2Y1	0410-0013	1	CRYSTAL:QUARTZ 1MHZ	28480	0410-0013
A3	00606-615	2	BOARD ASSY:POWER SUPPLY FILTER	28480	00606-615
A3	00606-614	3	CAPACITOR ASSY:BRIDGE RECTIFIER	28480	00606-614
A3C1	0150-0091	2	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-R800011
A3C2	0170-0022		C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24
A3C3	0160-0168	7	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3C4	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A3L1	9140-0052	1	COIL:FXD RF 3.3 MHY	28480	9140-0052
A3L2	9100-1665	3	COIL/CHOKE 3300 UH 5%	28480	9100-1665
A3R1	0757-0401	4	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R2	0698-3154	1	R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A4	00606-601	1	BOARD ASSY:PF	28480	00606-601
A4C1	0160-0161	14	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C2	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C3	0150-0052	5	C:FXD CER 0.05 UF 20% 400VDCW	56289	33C17A
A4C4	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C5	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C6			NOT ASSIGNED		
A4C7	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C8	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C9	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C10	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C11	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C12	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C13	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C14	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C15	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C16	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4C17	0160-0161		C:FXD MY 0.01 UF 10%,200VDCW	56289	192P10392-PT
A4C18	0160-0145	2	C:FXD MICA 22 PF 5%	28480	0160-0145
A4C19	0140-0204		C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A4C20	0140-0204		C:FXD MICA 47 PF 5% NPO 500VDCW	14655	RDM15E470J5C
A4C21			NOT ASSIGNED		
A4C22	0160-0174	1	C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CNL
A4C23	0150-0052		C:FXD CER 0.05 UF 20% 400VDCW	56289	33C17A
A4C24	0150-0052		C:FXD CER 0.05 UF 20% 400VDCW	56289	33C17A
A4C25	0150-0052		C:FXD CER 0.05 UF 20% 400VDCW	56289	33C17A
A4C26	0140-0193	1	C:FXD MICA 82 PF 5%	28480	0140-0193
A4C27	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C28			NOT ASSIGNED		
A4C29	0150-0052		C:FXD CER 0.05 UF 20% 400VDCW	56289	33C17A
A4C30	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C31	0160-0154	2	C:FXD MICA MY 0.0022 UF 10% 200VDCW	56289	192P22292-PTS
A4C32	0140-0197	1	C:FXD MICA 180 PF 5% 300VDCW	14655	RDM15F181J3C
A4C33	0160-2210	1	C:FXD MICA 470 PF 5%	28480	0160-2210
A4C33	0380-0336	1	STANDOFF	28480	0380-0336
A4C34	0160-0153	2	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A4C35	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A4C36	0140-0176		C:FXD MICA 100 PF 2%	28480	0140-0176
A4C37	0140-0145		C:FXD MICA 22 PF 5%	28480	0140-0145
A4C38	0140-0220	1	C:FXD MICA 200 PF 1% 300VDCW	28480	0140-0220
A4CR1	1910-0042	3	DIODE:GE 5MA AT 1.0V	28480	1910-0042
A4CR2	1910-0016		DIODE:GERMANIUM 100MA/0.65V 60PIV	93332	D2361
A4CR3	1910-0042		DIODE:GE 5MA AT 1.0V	28480	1910-0042
A4L1	9140-0142		COIL:FXD RF 2.20 UH 10%	82142	09-4436-4R
A4L2	9140-0142		COIL:FXD RF 2.20 UH 10%	82142	09-4436-4R
A4L3	9140-0142		COIL:FXD RF 2.20 UH 10%	82142	09-4436-4R
A4L4	9140-0142		COIL:FXD RF 2.20 UH 10%	82142	09-4436-4R
A4L5	9140-0142		COIL:FXD RF 2.20 UH 10%	82142	09-4436-4R
A4L6	9140-0094	2	COIL:FXD RF: 0.68UH	99800	1537-08
A4L7	9140-0094		COIL:FXD RF: 0.68UH	99800	1537-08
A4L8	9140-0131	1	COIL:FXD RF 10 MH	28480	9140-0131
A4R1	0698-3459	2	R:FXD MET FLM 383K OHM 1% 1/8W	28480	0698-3459
A4R2	0757-0470	1	R:FXD MET FLM 162K OHM 1% 1/8W	28480	0757-0470
A4R3	0698-3459		R:FXD MET FLM 383K OHM 1% 1/8W	28480	0698-3459
A4R4	0698-3420	1	R:FXD MET FLM 34.8K OHM 1% 1/2W	28480	0698-3420
A4R5 THRU A4R9			NOT ASSIGNED		
A4R10	2100-2452	1	R:VAR COMP 25K OHM 20% LIN 1/4W	28480	2100-2452
A4R11	0698-3153	4	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A4R12	0698-3162	5	R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R13	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R14	0757-0465	3	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A4R15	0698-3443	2	R:FXD MET FLM [illegible]7 OHM 1% 1/8W	28480	0698-3443
A4R16	0698-3443		R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A4R17	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A4R18	0771-0004		R:FXD MET FLM 20K OHM 10% 4W	28480	0771-0004
A4R19	0698-3457	1	R:FXD MET FLM 316K OHM 1% 1/8W	28480	0698-3457
A4R20	0757-0461	1	R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A4R21	2100-0144	1	R:VAR COMP 250K OHM 30% LIN 1/5W	28480	2100-0144
A4R22	0764-0046	1	R:FXD MET OX 33K OHM 5% 2W	28480	0764-0046
A4R23 THRU A4R24			NOT ASSIGNED		
A4R25	0757-0428	2	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A4R26	0757-0467	1	R:FXD MET FLM 121K OHM 1% 1/8W	28480	0757-0467
A4R27	0757-0127	1	R:FXD MET FLM 215K OHM 2% 1/2W	28480	0757-0127
A4R28	0771-0004		R:FXD MET FLM 20K OHM 10% 4W	28480	0771-0004
A4R29	0698-3438	4	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A4R30	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A4R31	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A4R32	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A4R33	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A4R34	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A4R35	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A4R36	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A4R37	0757-0817	2	R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A4R38	0757-0839	1	R:FXD MET FLM 10K OHM 1% 1/2W	28480	0757-0839
A4R39	0757-0817		R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A4R40	0770-0002	1	R:FXD MET OX 2400 OHM 5% 4W	28480	0770-0002
A4R41	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A4R42	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A4R43	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R44	0698-3423	1	R:FXD MET FLM 46.4K OHM 1% 1/2W	28480	0698-3423
A4R45	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R46	0757-0346	2	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A4R47	0757-0858	1	R:FXD MET FLM 90.9K OHM 1% 1/2W	28480	0757-06 3
A4R48	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A4R48			FACTORY SELECTED PART		
A4R49	0757-0123		R:FXD MET FLM 34.8K OHM 1% 1/8W	28480	0757-0123
A4R50	0698-3454	1	R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A4R51	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A4R52	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A4R53	0757-0382	1	R:FXD MET FLM 16.2 OHM 1% 1/8W	28480	0757-0382
A4T1	9100-0396	1	TRANSFORMER	28480	9100-0398
A4V1	1933-0011	2	ELECTRON TUBE:6AW8A	33173	6AW8A
A4V1	1200-0190	9	SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V2	1932-0027		ELECTRON TUBE:12AT7 DUAL TRIODE	33173	12AT7
A4V2	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V3	1923-0071	4	ELECTRON TUBE:12HG7	02735	12HG7
A4V3	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V4	1923-0071		ELECTRON TUBE:12HG7	02735	12HG7
A4V4	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V5	1923-0071		ELECTRON TUBE:12HG7	02735	12HG7
A4V5	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V6	1923-0071		ELECTRON TUBE:12HG7	02735	12HG7
A4V6	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V7	1932-0042	1	ELECTRON TUBE:12AT7	03508	12AT7
A4V7	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V8	1933-0011		ELECTRON TUBE:6AW8A	33173	6AW8A
A4V8	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A4V9	1921-0010	1	ELECTRON TUBE:1284A	33173	1284A
A4V9	1200-0190		SOCKET:TUBE 9 PIN MINIATURE	71785	121-51-11-141
A5	00606-602	1	BOARD ASSY:VARICAP	28480	00606-602
A5	7100-0101	1	SHIELD:MU-METAL	02675	HUB920-11/16-MU-MTD
A5C1	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800D11
A5C2	0160-2319	1	C:FXD CER 10 PF/0.5 PF 500VDCW	72982	315-N1500-10/0.5 PF
A5C3	0150-0032	1	C:FXD CER 10 1 PF 500VDCW	72982	315-000-U2J0-100F
A5C4	0170-0085	1	C:FXD MY 0.1UF 20% 30VDCW	84411	601PE STYLE 3
A5CR1	1901-0025	5	DIODE:SILICON 100MA/1V	07263	FD 2387
A5CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A5CR3	0122-0017	2	C:VOLTAGE VAR 12 PF 20% 100VDCW	01281	1N4804
A5CR4	0122-0017		C:VOLTAGE VAR 12 PF 20% 100VDCW	01281	1N4804
A5K1	0490-0018	1	RELAY:ARMATURE SPDT	77342	MS-1124 5000 OHM
A5R1	0690-1061	2	R:FXD COMP 10 MEGOHM 10% 1W	01121	GB 1061
A5R2	0757-0198	3	R:FXD MET FLM 100 OHM 1% 1/2W	28480	0757-0198
A5R3	0683-1055	4	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	GB 1055
A5R4	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	GB 1055
A5R5	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	GB 1055
A5R6	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	GB 1055
A6	00606-617	2	BOARD ASSY:DELTA MFM	28480	00606-617
A6C1	0180-0116	4	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A6C2	0170-0022		C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24
A6R1	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A6R2	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A6R3	0764-0006	1	R:FXD MET OX 18K OHM 5% 2W	28480	0764-0006
A6VR1	1902-3256	1	DIODE:BREAKDOWN SILICON 23.7V 5%	28480	1902-3256
A7	00606-612	3	TURRET ASSY:OSCILLATOR	28480	00606-612
A7C1	0121-0031	6	C:VAR AIR 1.85-10.38 PF	28480	0121-0031
A7C2	0121-0031		C:VAR AIR 1.85-10.38 PF	28480	0121-0031
A7C3	0121-0031		C:VAR AIR 1.85-10.38 PF	28480	0121-0031
A7C4	0121-0031		C:VAR AIR 1.85-10.38 PF	28480	0121-0031
A7C5	0121-0031		C:VAR AIR 1.85-10.38 PF	28480	0121-0031
A7C6	0121-0031		C:VAR AIR 1.85-10.38 PF	28480	0121-0031
A7T1	00606-612		TURRET ASSY:OSCILLATOR	28480	00606-612
A7T2			N.S.R. PART OF A7		
A7T3			N.S.R. PART OF A7		
A7T4			N.S.R. PART OF A7		
A7T5			N.S.R. PART OF A7		
A7T6			N.S.R. PART OF A7		
A8	00606-622	2	TURRET ASSY:AMPLIFIER	28480	00606-622
A8C1	0130-0006	6	C:VAR CER 5-20 PF N300	28480	0130-0006
A8C2	0130-0006		C:VAR CER 5-20 PF N300	28480	0130-0006
A8C3	0130-0006		C:VAR CER 5-20 PF N300	28480	0130-0006
A8C4	0130-0006		C:VAR CER 5-20 PF N300	28480	0130-0006
A8C5	0130-0006		C:VAR CER 5-20 PF N300	28480	0130-0006
A8C6	0130-0006		C:VAR CER 5-20 PF N300	28480	0130-0006
A8C7	0140-0042	1	C:FXD MICA 27PF 5% 500VDCW	28480	0140-0042
A8C8	0160-0154		C:FXD MICA MY 0.00022 UF 10% 200VDCW	56289	192P22292-PTS
A8C9	0160-2141	1	C:FXD CER 680 PF 80/20% 1000VDCW	91418	TYPE B

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8C10	0160-2139	1	CAPXD CER 220 PF +80-20% 1000VDCW	91418	TYPE B
A8L1	9100-1617	1	COIL/CHOKE 3.90 UH 10%	28480	9100-1617
A8L2	9100-1615	1	COIL/CHOKE FXD 1.20 UH 10%	28480	9100-1615
A8L3	9100-1612	1	COIL:FXD RF 0.33 UH 20%	28480	9100-1612
A8R1	0690-2211	2	R:FXD COMP 220 OHM 10% 1W	01121	GB 2211
A8R2	0690-2211		R:FXD COMP 220 OHM 10% 1W	01121	GB 2211
A8R3	0687-2221		R:FXD COMP 2200 OHM 10% 1/2W	01121	EB 2221
A8R3			FACTORY SELECTED PART		
A8R4	0687-3901	2	R:FXD COMP 39 OHM 10% 1/2W	01121	EB 3901
A8R5	0687-3901		R:FXD COMP 39 OHM 10% 1/2W	01121	EB 3901
A8R6	0686-1125	1	R:FXD COMP 1100 OHM 5% 1/2W	01121	EB 1125
A8R6			FACTORY SELECTED PART		
A8R7	0687-1001	2	R:FXD COMP 10 OHM 10% 1/2W	01121	EB 1001
A8R8	0687-1001		R:FXD COMP 10 OHM 10% 1/2W	01121	EB 1001
A8R9	0687-1521	1	R:FXD COMP 1500 OHM 10% 1/2W	01121	EB 1521
A8R9			FACTORY SELECTED PART		
A8R10	0687-1011	1	R:FXD COMP 100 OHM 10% 1/2W	01121	EB 1011
A8R11	0687-5611	1	R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611
A8R12	0687-5601	1	R:FXD COMP 56 OHM 10% 1/2W	01121	EB 5601
A8R13	0757-0405	3	R:FXD MET FLM 162 OHM 1% 1/8W	28480	0757-0405
A8R14	0757-0405		R:FXD MET FLM 162 OHM 1% 1/8W	28480	0757-0405
A8R15	0757-0405		R:FXD MET FLM 162 OHM 1% 1/8W	28480	0757-0405
A8T1			N.S.R. PART OF A8 ASSY		
A8T2			N.S.R. PART OF A8 ASSY		
A8T3			N.S.R. PART OF A8 ASSY		
A8T4			N.S.R. PART OF A8 ASSY		
A8T5			N.S.R. PART OF A8 ASSY		
A8T6			N.S.R. PART OF A8 ASSY		
A9			NOT ASSIGNED		

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1*			NOT ASSIGNED		
A1	00606-600	2	BOARD ASSY:POWER SUPPLY	28480	00606-600
A1C1	0150-0012	5	C:FXD CER 0.01 UF 20% 1000VDCW	56289	29C214A3
A1C2	0170-0040	2	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A1C3	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A1C4	0170-0022		C:FXD MY 0.1UF 20% 600VDCW	09134	TYPE 24
A1C5	0150-0012		C:FXD CER 0.01 UF 20% 1000VDCW	56289	29C214A3
A1C6	0150-0012		C:FXD CER 0.01 UF 20% 1000VDCW	56289	29C214A3
A1C7	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A1C8	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A1C9	0160-0303	1	C:FXD MYLAR .15 UF 10% 200VDCW	28480	0160-0303
A1C10	0150-0012		C:FXD CER 0.01 UF 20% 1000VDCW	56289	29C214A3
A1C11	0150-0012		C:FXD CER 0.01 UF 20% 1000VDCW	56289	29C214A3
A1C12	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A1CR1	1901-0029	8	DIODE:SILICON 600 PIV	28480	1901-0029
A1CR2	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A1CR3	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A1CR4	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A1CR5	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A1CR6	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A1CR7	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A1CR8	1901-0029		DIODE:SILICON 600 PIV	28480	1901-0029
A1CR9	1901-0200	4	DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR10	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR11	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR12	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A1CR13	1910-0016		DIODE:GERMANIUM 100MA/0.85V 30PIV	93332	D2361
A1CR14	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR15	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR16	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1Q1	1854-0079	2	TSTR:SI NPN	80131	2N3439
A1Q2	1854-0071		TSTR:SI NPN:SELECTED FROM 2N3704)	28480	1854-0071
A1Q3	1854-0071		TSTR:SI NPN:SELECTED FROM 2N3704)	28480	1854-0071
A1Q4	1854-0079		TSTR:SI NPN	80131	2N3439
A1Q5	1854-0071		TSTR:SI NPN:SELECTED FROM 2N3704)	28480	1854-0071
A1Q6	1854-0071		TSTR:SI NPN:SELECTED FROM 2N3704)	28480	1854-0071
A1Q7	1854-0019	1	TSTR:SI NPN	80131	2N3053
A1R1	0764-0028	6	R:FXD MET OX 100K OHM 5% 2W	28480	0764-0028
A1R2	0767-0009	1	R:FXD MET FLM 12K OHM 3W	28480	0767-0009
A1R3	0757-0198		R:FXD MET FLM 100 OHM 1% 1/2W	28480	0757-0198
A1R4	0757-0279	2	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R5	0764-0028		R:FXD MET OX 100K OHM 5% 2W	28480	0764-0028
A1R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R7	0698-3152	1	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A1R8	2100-0154	1	R:VAR COMP 1K OHM 30% LIN 0.15W	28480	2100-0154
A1R9	0764-0028		R:FXD MET OX 100K OHM 5% 2W	28480	0764-0028
A1R10	0698-5059	5	R:FXD MET OX 60K OHM 2% 2W	28480	0698-5059
A1R11	0767-0013	1	R:FXD MET FLM 6800 OHM 5% 3W	28480	0767-0013
A1R12	0698-5059		R:FXD MET OX 60K OHM 2% 2W	28480	0698-5059
A1R13	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R14	0698-5059		R:FXD MET OX 60K OHM 2% 2W	28480	0698-5059
A1R15	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R16	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R17	0698-0082	1	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A1R17			FACTORY SELECTED PART		
A1R18	0698-5059		R:FXD MET OX 60K OHM 2% 2W	28480	0698-5059
A1R19	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A1R20	0812-0020	1	R:FXD WW 0.39 OHM 5% 3W	28480	0812-0020
A1R21	0698-5059		R:FXD MET OX 60K OHM 2% 2W	28480	0698-5059
A1R22	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1VR1	1902-0018	1	DIODE BREAKDOWN:11.7V 5%	04713	1N961
A1VR2	1902-0036	2	DIODE BREAKDOWN:6.19V 10%	28480	1902-0036
A1VR3	1902-0569	1	DIODE:SILICON 1N961 11.5V 2%	04713	SZ 11489
A1VR4	1902-0036		DIODE BREAKDOWN:6.19V 10%	28480	1902-0036
A1VR5	1902-0185	1	DIODE:BREAKDOWN 27.4V 5% 400MW	28480	1902-0185
C1	0150-0024	1	C:FXD CER 0.02 UF +80-20% 600VDCW	71590	TYPE DD 203
C2	0160-2049	6	C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
C3	0121-0145	1	C:VAR AIR 442.2 PF	28480	0121-0145
C4	0150-0119	2	C:FXD CER 1000 PF 20% 500VDCW	72982	327005X5001D2M
C5 THRU C6			NOT ASSIGNED		
C7	0180-0012	1	C:FXD ELECT 2A20 UF 450VDCW	56289	032640
C8	0150-0119		C:FXD CER 1000 PF 20% 500VDCW	72982	327005X5001D2M
C9	0121-0144	1	C:VAR AIR 442.2 PF	28480	0121-0144
C10 THRU C12			T ASSIGNED		

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
C13	0160-0001	1	C:FXD MY 0.1 UF 10% 600VDCW	56289	106P10496 PMD
C14 THRU					
C17			NOT ASSIGNED		
C18	00606-614		CAPACITOR ASSY:BRIDGE RECTIFIER	28480	00606-614
C19	00606-614		CAPACITOR ASSY:BRIDGE RECTIFIER	28480	00606-614
C20	0180-1812	2	C:FXD ELECT 2 SECTION 120/40 UF 475VDCW	56289	042348-DFP
C21	0180-1812		C:FXD ELECT 2 SECTION 120/40 UF 475VDCW	56289	042348-DFP
C22	0180-0369	1	C:FXD ELECT 2800 UF +75-10% 60VDCW	56289	039023
C23	0132-0003	1	C:VAR POLY 0.7-3.0 PF	28480	0132-0003
C24	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
C25	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
C26	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
C27	0160-2357	1	C:FXD CER FEED-THRU 1000 PF +80-20%	28480	0160-2357
C28	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
C29	0160-2049		C:FXD CER FEED-THRU 5000 PF +80-20%	28480	0160-2049
C30	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
C31	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
CR1	1910-0042		DIODE:GE 5MA AT 1.0V	28480	1910-0042
DS1	1450-0419	1	LIGHT:INDICATOR SELECTED NE-2H	28480	1450-0419
F1	2110-0305	2	FUSE:1.25 AMP SLOW BLOW	71400	MDX-1-1/4A
F1			FOR 230V OPERATION		
F1	2110-0015	1	FUSE:CARTRIDGE 2.5 AMP 125V MAX SLOW BL	75915	31302.5
F1			FOR 115V OPERATION		
F1	1400-0084	3	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
F2	2110-0004	1	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
F2	1400-0084		FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
F3	2110-0027	1	FUSE:0.125A 250V	75915	312.125
F3	1400-0084		FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
FL1	9170-2887	1	FILTER:LINE 50/400 HZ	05245	F1221A
J1	1250-0118	3	CONNECTOR:BNC	24931	28JR 128-1
J2	1251-0066	1	JACK:TELEPHONE 2 CONDUCTOR	82389	2J-1339
J3	1250-0118		CONNECTOR:BNC	24931	28JR 128-1
J4			N.S.R. PART OF W1		
J5			N.S.R. PART OF W3		
J6	1250-0118		CONNECTOR:BNC	24931	28JR 128-1
J7	1250-0053	1	CONNECTOR:RF BNC CAP AND CHAIN	28480	1250-0053
J7			N.S.R. PART OF W2		
J8	1251-2357	1	SOCKET:3-PIN MALE POWER RECEPTACLE	82389	EAC-301
L1 THRU					
L2			NOT ASSIGNED		
L3	9140-0051	1	COIL:FXD 400 UHY	28480	9140-0051
L4	9100-1665		COIL/CHOKE 3300 UH 5%	28480	9100-1665
L5	9100-1665		COIL/CHOKE 3300 UH 5%	28480	9100-1665
M1	1120-0075	1	METER:0-200 MA SPEC SCALE 0-100%	28480	1120-0075
M2	1120-0074	1	METER:0-100 MA SPEC SCALE 0-3V	28480	1120-0074
P1			N.S.R. PART OF W2		
P2	8120-1348	1	CABLE ASSY:POWER, DETACHABLE	70903	KHS-7041
Q1	1854-0080	2	TSTR:SI NPN	28480	1854-0080
Q1	1200-0147	3	SLEEVE:INSULATOR NYLON	26365	974-302
Q1	1200-0043	3	INSULATOR:TSTR MOUNTING(TO-3)	71785	293011
Q2	1854-0080		TSTR:SI NPN	28480	1854-0080
Q2	1200-0147		SLEEVE:INSULATOR NYLON	26365	974-302
Q2	1200-0043		INSULATOR:TSTR MOUNTING(TO-3)	71785	293011
Q3	1854-0063	1	TSTR:SI NPN	80131	2N3055
Q3	1200-0147		SLEEVE:INSULATOR NYLON	26365	974-302
Q3	1200-0043		INSULATOR:TSTR MOUNTING(TO-3)	71785	293011
R1	0757-0857	1	R:FXD MET FLM 82.5K OHM 1% 1/2W	28480	0757-0857
R2			N.S.R. PART OF S1		
R3 THRU					
R4			NOT ASSIGNED		
R5	2100-0225	1	R:VAR WW 5000 OHM 10% LIN 2W	28480	2100-0225
R6	2100-1695	2	R:VAR COMP 7K-5K OHM 10% LIN DUCC 10	28480	2100-1695
R7	2100-0207	1	R:VAR COMP 2500 OHM 20% LIN 2W	28480	2100-0207
R8	0698-1061		R:FXD COMP 10 MEGOHM 10% 1W	01121	GB 1061
R9	0757-0198		R:FXD MET FLM 100 OHM 1% 1/2W	28480	0757-0198
R10	0698-3425	1	R:FXD MET FLM 316K OHM 1% 1/2W	28480	0698-3425
R11	0757-0999	1	R:FXD MET FLM 47.5 OHM 1.0% 1/2W	28480	0757-0999
R12	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
R13	0757-0123		R:FXD MET FLM 34.0K OHM 1% 1/8W	28480	0757-0123
R14	0698-3664	1	R:FXD MET FLM 270K OHM 5% 2W	28480	0698-3664
R15	0816-0020	1	R:FXD WW 110 OHM 10% 10W	28480	0816-0020
R16	0764-0028		R:FXD MET OX 100K OHM 5% 2W	28480	0764-0028
R17	0764-0028		R:FXD MET OX 100K OHM 5% 2W	28480	0764-0028

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
R18			NOT ASSIGNED		
R19	0764-0028		R:FXD MET OX 100K OHM 5% 2W	28480	0764-0028
R20	0698-3412	1	R:FXD MET FLM 3.83K OHM 1% 1/2W	28480	0698-3412
R21	2100-1695		R:VAR COMP 7K-5K OHM 10% LIN LOGC LOG	28480	2100-1695
R22	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
R23	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
S1	3100-0190	1	SWITCH-ROTARY: 1 SECT 5 POS	28480	3100-0190
S2	3101-0012	1	SWITCH:TOGGLE DPDT ON-OFF-ON	27191	8926K319
S3	3102-0010	1	SWITCH: SENSITIVE SPDT 125 VAC 10 AMP	91929	BZ 2RN822
S4	3100-1854	1	SWITCH:ROTARY	28480	3100-1854
S5	3130-0105	1	SECTION:ROTARY SWITCH	28480	3130-0105
S6	3101-0030	1	SWITCH:TOGGLE SPST ON-NONE-OFF	27191	8900K368
S7	3101-1234	1	SWITCH:SLIDE DPDT	82389	11A-1242
T1	9100-0375	1	TRANSFORMER	28480	9100-0375
W1	00606-607	2	CABLE ASSY:UNCAL OUTPUT	28480	00606-607
W2	00606-608	1	CABLE ASSY:UNCAL RF	28480	00606-608
W3	606A-16B	1	CABLE:AMPLIFIER OUTPUT	28480	606A-16B
W3			INCLUDES J5		
			MISCELLANEOUS		
	00606-600		BOARD ASSY:POWER SUPPLY	28480	00606-600
	00606-001	1	PANEL:RUNTILIGHT GRAY	28480	00606-001
	00606-00028	1	PANEL:FRONT(MINT GRAY)	28480	00606-00028
	00606-603		BOARD ASSY:CRYSTAL CALIBRATION	28480	00606-603
	00606-615		BOARD ASSY:POWER SUPPLY FILTER	28480	00606-615
	00606-616	1	BOARD ASSY:MODULATOR FILTER	28480	00606-616
	00606-617		BOARD ASSY:DELTA "F"	28480	00606-617
	00606-00024	1	BRACKET:INLET	28480	00606-00024
	606A-55A	1	BOX SHIELD	28480	606A-55A
	00606-010	1	BRACKET:POTENTIOMETER	28480	00606-010
	00606-013	1	BRACKET:AMPLIFIER SWITCH	28480	00606-013
	606A-36H	1	BRACKET:DETENT MOUNT	28480	606A-36H
	606A-44B-2	1	CABINET BODY ASSY:BLUE-GRAY	28480	606A-44B-2
	00606-60034	1	CABINET BODY ASSY:OLIVE GRAY	28480	00606-60034
	00606-607		CABLE ASSY:UNCAL OUTPUT	28480	00606-607
	606A-108A	1	CAM ASSY:DIAL POINTER	28480	606A-108A
	606A-83E	1	CAM:DETENT	28480	606A-83F
	00606-620	1	COIL:BAND 6 SECONDARY	28480	00606-620
	1251-0156	1	CONNECTOR:RECEPTACLE	01009	CS402 ACG
		1			
	00606-00021	2	COVER:REAR(CABINET ONLY)BLUE-GRAY	28480	00606-00021
	00606-00031	1	COVER:REAR(CABINET ONLY)OLIVE GRAY	28480	00606-00031
	606A-36E	1	ASSY:DETENT LIFT	28480	606A-36E
	00606-003	1	DIAL ASSY:FREQUENCY VERNIER	28480	00606-008
	00606-625	1	DIAL:FREQUENCY	28480	00606-625
	00606-206	1	DIAL:HUB, INNER	28480	00606-206
	606A-83C	1	DRUM:CABLE	28480	606A-83C
	606A-100E	1	DRUM:DIAL DRIVE	28480	606A-100E
	00606-00025	1	DUST COVER:BACK	28480	00606-00025
	00606-00033	1	DUST COVER ASSY:OLIVE GRAY(606BR)	28480	00606-00033
	00606-00026	1	DUST COVER ASSY:BLUE-GRAY(606BR)	28480	00606-00026
	00606-209	1	FORM:COIL	28480	00606-209
	606A-36C	1	GEAR:TURRET DRIVE	28480	606A-36G
	606A-48T	1	GROUNDING STRAP	28480	606A-48T
	00606-014	1	HEAT SINK:SOCKET	28480	00606-014
	606A-105B	1	HUB:OUTER DIAL	28480	606A-105B
	0370-0026	1	KNOB:BLK W/ARROW 3/4" OD 1/8" SHAFT	28480	0370-0026
	0370-0036	1	KNOB:SKIRTED BAR BLK 1.0" DIA	28480	0370-0036
	0370-0037	1	KNOB:SKIRTED BAR 1" DIA,BLACK	28480	0370-0037
	0370-0063	1	KNOB:RED 3/4" DIA	28480	0370-0063
	0370-0066	1	KNOB:ROUND BLACK 0.375" DIA SHAFT	28480	0370-0066
	0370-0083	1	KNOB:ROUND, BLACK 0.500" DIA	28480	0370-0083
	606A-74A	1	KNOB ASSY:WINDOW DIAL	28480	606A-74A
	606A-99A	1	POINTER ASSY	28480	606A-99A
	606A-75C	1	RESISTOR BOARD ASSY:AUDIO OSCILLATOR	28480	606A-75C
	00606-610	1	RF GENERATOR ASSY	28480	00606-610
	606A-102	1	ROLLER:DETENT	28480	606A-102
	606A-37A	1	SHAFT:TURRET DRIVE	28480	606A-37A
	606A-37B	1	SHAFT:POINTER	28480	606A-37B
	606A-37C	1	SHAFT:IDLER	28480	606A-37C
	606A-37D	1	SHAFT:TUNER	28480	606A-37D
	606A-37E	1	SHAFT:TURRET AMPLIFIER	28480	606A-37E
	606A-37F	1	SHAFT:TURRET OSCILLATOR	28480	606A-37F
	606A-47A	1	SPACER:CHASSIS MOUNTING (HELICAL)	28480	606A-47A
	606A-47B	1	SPACER:CHASSIS MOUNTING (SCALE)	28480	606A-47B
	00606-205	1	SPACER:POT BRACKET	28480	00606-205

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	606A-918	1	SPRING:LEAF	28480	606A-918
	606A-838	1	TERMINAL BOARD	28480	606A-838
	00606-622		TURRET ASSY:AMPLIFIER	28480	00606-622
	00606-612		TURRET ASSY:OSCILLATOR	28480	00606-612
	00606-621	1	WIRING HARNESS:CRYSTAL CAL CONTROL	28480	00606-621
	00606-606	1	WIRING HARNESS:REGULAR	28480	00606-606
	00606-618	1	WIRING HARNESS:RF DECK	28480	00606-618
	606A-830	1	WINDOW:FREQUENCY	28480	606A-830
	1470-0010	1	WRENCH:KEY FOR RF COVER	28480	1470-0010
	1205-0059	1	HEAT SINK:FOR 9 PIN PC TUBE SOCKET	28480	1205-0059

See Introduction to this section for ordering information

TABLE 6-3.
CODE LIST OF MANUFACTURERS

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

Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U. S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N. Y.
00287	Cemco Inc.	Danielson, Conn.
00334	Humiseal	Colton, Calif.
00348	Microtron Co., Inc.	Valley Stream, N. Y.
00373	Gaskets Inc.	Cherry Hill, N. J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N. J.
00809	Erie on Ltd.	Whitby, Ontario Canada
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S. C.
00866	Bor Engineering Co.	City of Industry, Calif.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
00929	Metrolab Inc.	Livingston, N. J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N. Y.
01009	Allen Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01538	Small Parts Inc.	Los Angeles, Calif.
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01670	Godbrod Bros. Silk Co.	New York, N. Y.
01930	Amerock Corp.	Rockford, Ill.
01961	Pacific Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N. Y.
02116	Wheelock Signals, Inc.	Long Branch, N. J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N. J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
02875	Hudson Tool & Die Co	Newark, N. J.
03508	G. E. Semiconductor Prod., Dept.	Syracuse, N. Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Calif.
03877	Transition Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N. J.
03954	Singer Co., Diehl Div. Finishing Plant	Somerville, N. J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lambertville, N. J.
04062	Acco Electronic Inc.	Great Neck, N. Y.
04217	Essex Wire	Los Angeles, Calif.
04272	H-Q Division of Aeroyes	Myrtle Beach, S. C.
04356	Precision Paper Tube Co.	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.
04673	Dakota Engr. Inc.	Culver City, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
048[illegible]	P. M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05245	Components Corp.	Chicago, Ill.
05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05397	Union Carbide Corp., Elect. Div.	New York, N. Y.
05574	Viking Ind. Inc.	Canoga Park, Calif.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Calif.
05616	Cosmo Plastic (Icore Electrical Spec. Co.)	Cleveland, Ohio
05624	Walter Colman Co.	Rockford, Ill.
05728	Tallen Optical Co.	Roslyn Heights, Long Island, N. Y.
05729	Metro-Tel Corp.	Westbury, N. Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co.	Rochester, N. Y.
06407	L. T. A. Products Co. of America	Chicago, Ill.
06540	Allen Electronic Hardware Co., Inc.	New Rochelle, N. Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N. H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Ariz. Div.	Phoenix, Ariz.
06812	Tuttington Mfg. Co., West Div.	Van Nuys, Calif.
06980	Varian Assoc. Eimac Div.	San Carlos, Calif.
07006	Melvin Electric Co.	Van Nuys, Calif.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N. Y.
07149	Filtrohm Corp.	New York, N. Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07256	Silicon Transistor Corp.	Carle Place, N. Y.
07261	Avnet Corp.	Culver City, Calif.
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Butcher Corp., The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc., Ml. View Operations	Mountain View, Calif.
07700	Technical Wire Products Inc.	Cranford, N. J.
07829	Byeline Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co. Semiconductor Div.	Mountain View, Calif.
07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N. J.
08145	U. S. Engineering Co.	Los Angeles, Calif.
08289	Bliss, Delbert Co.	Pomona, Calif.
08356	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Calif.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N. J.
08792	CBS Electronics Semiconductor Operations, Div of C B S. Inc.	Lowell, Mass.
09806	General Electric Co. Minial. Lamp Dept.	Cleveland, Ohio
09954	Mel-Rain	Indianapolis, Ind.
09976	Babcock Relays Div.	Costa Mesa, Calif.
09984	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Alpha Elect.	Burbank, Calif.
09250	Electro-Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09927	Bunnly Corp.	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Tu-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N. Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11251	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11453	Precision Connector Corp.	Jamaica, N. Y.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N. J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Metabs, Inc.	Palo Alto, Calif.
12040	National Semiconductor	Danbury, Conn.
12136	Philadelphia Handle Co.	Camden, N. J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N. M.
12697	Clarostat Mfg. Co.	Dover, N. H.
12728	Elmar Fuller Corp.	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12861	Metex Electronics Corp.	Clark, N. J.
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13019	Amco Supply Co., Inc.	Kansas
13103	Thermalloy	Dallas, Texas
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Portable Industries, Inc.	Kansas City, Kansas
14099	Semi-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dubilier Electric Corp.	Newark, N. J.
14674	Corning Glass Works	Corning, N. Y.
14752	Electro Cube Inc.	San Gabriel, Calif.
14960	Williams Mfg. Co.	San Jose, Calif.
15108	The Sprecher Co., Inc.	Little Falls, N. Y.
15203	Webster Electronics Co.	New York, N. Y.
15287	Sceptics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15558	Micron Electronics	Garden City, Long Island, N. Y.
15566	Amperex Inst. Corp.	Lynbrook, N. Y.
15631	Cabletronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15801	Fenwal Elec. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mt. View, Calif.
15837	Spruce Pine Mica Co.	Spruce Pine, N. C.
16179	Omni-Spectra Inc.	Farmington, Mich.
16352	Computer Diode Corp.	Lodi, N. J.
16585	Boots Aircraft Nut Corp.	Pasadena, Calif.
16888	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N. Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Calif.
17474	Trames Company	Mountain View, Calif.
17594	Components Inc.	Biddeford, Me.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	N. Hollywood, Calif.
17856	Siliconix Inc.	Sunnyvale, Calif.

From: FSC Handbook Supplements

TABLE 6-3.

CODE LIST OF MANUFACTURERS (Continued)

Code No.	Manufacturer	Address
17870	McGraw-Edison Co.	Man Dexter, N.H.
18042	Power Design Pentlit Inc.	Palo Alto, Calif.
18083	Cleveite Corp., Semiconductor Div.	Palo Alto, Calif.
18324	Signetics Corp.	Sunnyvale, Calif.
18476	Tyco Mfg. Co., Inc.	Hollister, Mass.
18486	THW Elect. Comp. Div.	Des Plaines, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18611	Vishay Instruments Inc.	Malvern, Pa.
18873	E.I. DuPont and Co., Inc	Wilmington, Del.
15911	Dutane Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19589	Concoa	Baldwin Park, Calif.
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Abrasive Corp.	Philadelphia, Pa.
21276	Executone, Inc.	Long Island City, N.Y.
21335	Fafnir Bearing Co., The	New Britain, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23042	Texscan Corp.	Indianapolis, Ind.
23753	British Radio Electronics Ltd.	Washington, D.C.
24155	G.E. Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
24796	Potelco Inc.	San Juan Capistrano, Calif.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Globet File Co. of America, Inc	Carlstadt, N.J.
26851	Compac Hollister Co.	Hollister, Calif.
26992	Hamilton Watch Co.	Lancaster, Pa.
27251	Specialities Mfg. Co., Inc	Stratford, Conn.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
30817	Instrument Specialties Co., Inc.	Little Falls, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
36267	Cunningham, W.H. & Hill, Ltd.	Toronto Ontario, Canada
37942	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Meir Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	Jarbom Company	Waltham Mass.
54294	Shallcross Mfg. Co.	Selma, N.C
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co	Elizabeth, N.J.
60741	Tinnerell Electrical Inst. Co.	Bluffton, Ohio
61775	Unirp Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Instl. Inc. Weston-Newark	Newark, N.J.
66295	Willek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70417	Amptex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray C. of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Caldwell Condenser Corp.	Lindenhurst L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centriplab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71709	Cornish Wire Co., The	New York, N.Y.
71707	Cole Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.
72699	General Instrument Corp., Cap. Div.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N.J.
72963	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc	Princeton, Ind.
73076	H.W. Harper Co.	Chicago, Ill.
73138	Heliopot Div. of Beckman Instl., Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif
73445	Amperex Electl Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Calling Electric, Inc.	Hartford, Conn.
73586	Carrie F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries Inc	Philadelphia, Pa.
73734	Federal Screw Products Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co	Goshen, Ind.
73899	J.O Electronics Corp	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp	San Jose, Calif.
73957	Gloss-Pin Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc	St. Marys, Pa.
75378	CTS Knights Inc.	Sandwich, Ill
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littelfuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	O.W. Maxwell	San Francisco, Calif
76433	General Instrument Corp., Meramec Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
76545	Moeller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77271	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77909	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So. Braintree, Mass.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78424	Specialty Leather Prod. Co.	Newark, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tolley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78543	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Calif.
78947	Utielle Co.	Newtonsville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80035	Firestone Corp.	Toledo, Ohio
80120	Schmitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association	Any brand Tube meeting EIA Standards-Washington, Dc.
80207	Unimax Switch, Div. Maxon Electronics Corp	Wallingford, Conn.
80273	United Transformer Corp.	New York, N.Y.
80748	Dalent Electric Corp	Chicago, Ill.
80794	Bourns Inc	Riverside, Calif.
80811	Acic Div. of Robertshaw Controls Co	Columbus, Ohio

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TABLE 6-3.

CODE LIST OF MANUFACTURERS (Continued)

Code No.	Manufacturer	Address
00656	Ail Star Products Inc.,	Defiance, Ohio
00509	Avery Label Co.	Monrovia, Calif.
00583	Hammarlund Co., Inc.	Mars Hill, N. C.
00640	Stevens, Arnold, Co., Inc.	Boston, Mass.
00853	Dimco-Gray Co.	Dayton, Ohio
01030	International Instruments Inc.	Orange, Conn.
01073	Grayhill Co.	LaGrange, Ill.
01095	Triad Transformer Corp.	Venice, Calif.
01121	Winchester Elec. Div., Litton Ind., Inc.	Oakville, Conn.
01349	Military Specification	
01483	International Rectifier Corp.	El Segundo, Calif.
01561	Airpax Electronics, Inc.	Cambridge, Maryland
01660	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
02042	Carter Precision Electric Co.	Skokie, Ill.
02047	Speth Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N. J.
02116	Electric Regulator Corp.	Norwalk, Conn.
02142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
02170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Passaic, N. J.
02209	Maguire Industries, Inc.	Greenwich, Conn.
02219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
02376	Aston Corp. East Newark	Harrison, N. J.
02569	Switchcraft, Inc.	Chicago, Ill.
02660	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
02768	Phillips-Advance Control Co.	Joliet, Ill.
02866	Research Products Corp.	Madison, Wis.
02877	Holton Mfg. Co., Inc.	Woodstock, N. Y.
02893	Vector Electronic Co.	Glendale, Calif.
03014	Varian Corp.	Los Angeles, Calif.
03058	Cory Fastener Co.	Cambridge, Mass.
03165	New Hampshire Ball Bearings, Inc.	Peterborough, N. H.
03179	General Instrument Corp. Capacitor Div.	Darlington, S. C.
03180	T.I. Wire and Cable Div.	Los Angeles, Calif.
03181	Victory Eng. Corp.	Springfield, N. J.
03209	Heinemann Electric Co. Red Bank Div.	Red Bank, N. J.
03213	Hubbell, Harvey	Muhlenberg, Ill.
03220	Hoyad Inc.	Newport Beach, Calif.
03330	Smith, Herman H., Inc.	Brooklyn, N. Y.
03332	Tech Labs.	Palisade Park, N. J.
03365	Central Screw Co.	Chicago, Ill.
03501	Cavalt Wire and Cable Co. Div. Al Amerace Corp.	Brookfield, Mass.
03554	Ramsburg Corp. Electronic Tube Div.	Plainfield, N. J.
03740	Union Carbide Corp. Consumer Prod. Div.	New York, N. Y.
03777	Hydel Eng. and Mfg., Inc.	Huntington, Ind.
03821	Loyd Scruggs Co.	Festus, Mo.
03877	Aeronautical Ind. Radio Co.	Lodi, N. J.
04009	Arco Electronics Inc.	Great Neck, N. Y.
04090	A. J. Gleason Co., Inc.	San Francisco, Calif.
04111	TRW Capacitor Div.	Ogallala, Neb.
04270	Sales Division, Inc.	Bloomington, Ind.
04541	Boonton Molding Company	Boonton, N. J.
05471	A.H. Boyd Co.	San Francisco, Calif.
05474	A. W. Bracamonte & Co.	San Francisco, Calif.
05660	Rolled Metals, Inc.	Hamden, Conn.
05911	Seamless Rubber Co.	Chicago, Ill.
06174	Palmer Bearing Co.	Los Angeles, Calif.
06197	Clifton Division Products Co., Inc.	Clifton Heights, Pa.
06579	Precision Rubber Products Corp.	Dayton, Ohio
06664	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N. J.
06928	Sealtron Mfg. Co.	Glendale, Calif.
07034	Marco Industries	Anaheim, Calif.
07216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
07473	Western Fibrous Glass Products Co.	San Francisco, Calif.
07664	Van Waters & Rogers Inc.	San Francisco, Calif.
07910	Tower Mfg. Corp.	Providence, R. I.
08140	Cutler-Hammer, Inc.	Lincoln, Ill.
08220	Gould-National Batteries, Inc.	St. Paul, Minn.
08698	General Mills, Inc.	Buffalo, N. Y.
09231	Gray bar Electric Co.	Oakland, Calif.
09473	G. E. Distributing Corp.	Schenectady, N. Y.
09665	United Transformer Co.	Chicago, Ill.
09030	United Shoe Machinery Corp.	Beverly, Mass.
09179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N. J.
09763	United Cash Fastener Corp.	Chicago, Ill.
09979	Bearing Engineering Co.	San Francisco, Calif.
11146	ITT Cannon Elect., Inc., Salem Div.	Salem, Mass.
11260	Connor Spring Mfg. Co.	San Francisco, Calif.
11345	Miller Dial & Nameplate Co.	El Monte, Calif.
11418	Radio Materials	Chicago, Ill.
11506	Augat Inc.	Attleboro, Mass.
11737	Dale Electronics, Inc.	Columbus, Nebr.
11862	Elco Corp.	Willow Grove, Pa.
11937	Greer Hy. Mfg. Co., Inc.	Wakefield, Mass.
11977	H.F. Development Co.	Redwood City, Calif.
11986	Malco Mfg. Co., Inc.	Chicago, Ill.
11999	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
12161	Nahm-Bros. Spring Co.	Oakland, Calif.
12330	Tru-Connector Corp.	Peabody, Mass.
12357	Elgeet Optical Co. Inc.	Rochester, N. Y.
12507	Tensolite Insulated Wire Co., Inc.	Tarrytown, N. Y.
12702	IMC Magnetics Corp.	Westbury-Long Island, N. Y.
12966	Hudson Lamp Co.	Kearney, N. J.
13332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
13369	Rockwell & Myers Inc.	Palisades Park, N. J.
13410	Jennie Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
13637	Waters Mfg. Co.	Culver City, Calif.
13777	G. V. Controls	Livingston, N. J.
14131	General Cable Corp.	Bayonne, N. J.
14142	Phelps Dodge	Yonkers, N. Y.
14144	Raytheon Co., Comp. Div., Inc. Comp. Operations	Quincy, Mass.
14148	Scientific Electronics Products, Inc.	Loveland, Colo.
14433	Sprague Elect. Corp., Tung-Sol Div.	Newark, N. J.
14497	Curtiss-Wright Corp. Electronics Div.	East Paterson, N. J.
14672	South Chester Corp.	Chester, Pa
14830	Wire Cloth Products, Inc.	Bellwood, Ill.
14875	Automatic Metal Products Co.	Brooklyn, N. Y.
14882	Worcester Pressed Aluminum Corp.	Worcester, Mass.
14936	Magnecraft Electric Co.	Chicago, Ill.
15023	George A. Philbrick Researchers, Inc.	Boston, Mass.
15236	Alltex Products Corp.,	Dania, Fla.
15238	Continental Connector Corp.	Woodside, N. Y.
15263	Leecraft Mfg. Co., Inc.	Long Island, N. Y.
15265	National Coil Co.	Sheridan, Wyo.
15275	Viramon, Inc.	Bridgeport, Conn.
15348	Gordos Corp.	Bloomfield, N. J.
15354	Methode Mfg. Co.	Rolling Meadows, Ill.
15566	Arnold Engineering Co.	Marengo, Ill.
15712	Dage Electric Co., Inc.	Franklin, Ind.
15964	Simon Mfg. Co.	Wayne, Ill.
15967	Weckesser Co.	Chicago, Ill.
16067	Microwave Assoc., West Inc.	Sunnyvale, Calif.
16095	Hi-Q Div. of Aerovox Corp.	Olean, N. Y.
16256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
16295	Solar Manufacturing Co.	Los Angeles, Calif.
16306	Micro switch, Div. of Minn.-Honeywell	Freeport, Ill.
16330	Carlton Screw Co.	Chicago, Ill.
16341	Microwave Associates, Inc.	Burlington, Mass.
16501	Excel Transformer Co.	Oakland, Calif.
16506	Accelite Inc.	Richard Park, N. Y.
16733	San Fernando Elect. Mfg. Co.,	San Fernando, Calif.
16661	Thomson Ind. Inc.	Long Is., N. Y.
17404	Industrial Retaining Ring Co.	Irvington, N. J.
17539	Automatic & Precision Mfg.	Englewood, N. J.
17979	Resn-Resistor Corp.	Yonkers, N. Y.
17983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N. Y.
18161	R-Tronics, Inc.	Jamaica, N. Y.
18159	Rubber Tech, Inc.	Gardena, Calif.
18270	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
18278	Microdot, Inc.	So. Pasadena, Calif.
18791	Sealectro Corp.	Mamaroneck, N. Y.
18376	Zero Mfg. Co.	Burbank, Calif.
18410	CTS Inc.	Cleveland, Ohio
18731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
18734	Palco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
18873	Neith Hills Electronics, Inc.	Glen Cove, N. Y.
18978	International Electronic Research Corp.	Burbank, Calif.
19109	Columbia Technical Corp.	New York, N. Y.
19313	Varian Associates	Palo Alto, Calif.
19378	Allen Corp.	Winchester, Mass.
19515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
19707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
19800	Delevan Electronics Corp.	East Aurora, N. Y.
19856	Wico Corporation	Indianapolis, Ind.
19926	Bryson Corp.	Whippany, N. J.
19934	Herbrandt, Inc.	Boston, Mass.
19942	Hoffman Electronics Corp. Semiconductor Div.	Ellmonte, Calif.
19957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

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

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N. J.
00DAB	ETA	England
00DB8	Precision Instrument Components Co.	Van Nuys, Calif.
00DCS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
00DNM	Rubber Eng. & Development	Hayward, Calif.
00DNN	A "N" D Mfg. Co.	San Jose, Calif.
00DQQ	Coolitron	Oakland, Calif.
00DWW	California Eastern Lab.	Burlington, Calif.
00DYY	S. K. Smith Co.	Los Angeles, Calif.

From: FSC. Handbook Supplements

BACK DATING MANUAL CHANGES

APPENDIX I

BACKDATING

MANUAL CHANGES

Model 606B

HF Signal Generator

Table I-1, *Parts/Components Change Index*, (which follows the backdating), is a cross-reference of the change, the assembly on which the change was made, and the reference designation of the changed component.

Make all backdating corrections in this manual according to changes below.

Serial Prefix or Number	Make Manual Changes
608-00101 to 00750	A thru F
608-00751 to 724-01100	B thru F
724-01101 to 811-01850	C thru F

Serial Prefix or Number	Make Manual Changes
811-01851 to 02400	D, E, F
959-02401 to 02600	E, F
0959A02601 to 03200	F

CHANGE A

Page 6-4, Table 6-2:
Change A4R10 to 2100-0914,1, R:Var. Comp. 25 K ohm 20% LIN 1/5W, 28480, 2100-0914.
Delete A4C38.

Page 6-5, Table 6-2:
Delete A4R53

Page 5-31, Figure 5-24:
Delete A4C38 and A4R53.

CHANGE B

Page 5-31, Figure 5-24 and Page 6-5, Table 6-2:
Delete A5R3, A5R4, A5R5, and A5R6.

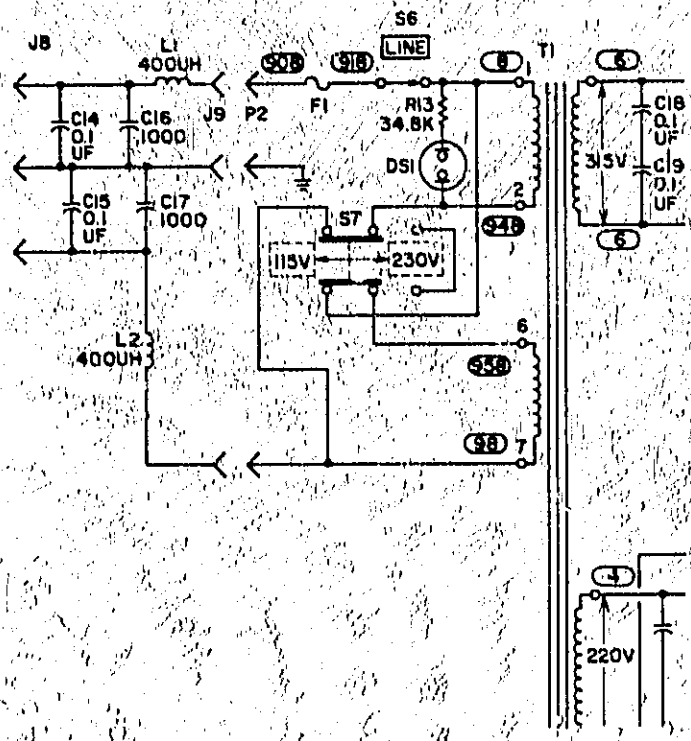
CHANGE C

Page 5-37, Figure 5-27 and Page 6-6, Table 6-2:
Add an asterisk immediately following the reference designations A8R10, A8R11, and A8R12. (This indicates a factory selected part).

CHANGE D

Page 5-35, Figure 5-26

Change the power supply schematic as shown in the partial schematic below.



Power Supply Partial Schematic (Part of Change D)

Page 6-7, Table 6-2:

Change C4 Qty to 4.

Page 6-8, Table 6-2:

Add

C14, 0132-0003, 2, C:VAR POLY 0.7-3.0 pF, 28480, 0132-0003;
C15, 0160-0002, C:FXD MYLAR 0.1 μF 10% 600 VDCW, 56289, 106P10496 PMD;
C17, 0150-0019, C:FXD CER 1000 pF 20% 509 VDCW, 72982, 327005x560102M;
J9, 1251-0095, 1 Connector: Power 2 female contacts, 75382, 221;
L1, 9140-0051, 3, Coil: FXD 400 μH, 28480, 9100-1665
L2, 9140-0051, Coil: FXD 400 μH, 18480, 9100-1665

Change

C13 Qty to 2
C23 Qty to 0
J8 to 1251-0148, 1, Connector: Power 3 Pin male, 60 27, H-1061-2;
L3 Qty to 0
P2 to 8120-0078, 1, Cable: Power 7.5 ft. 70903, KH 4147;

Delete FL1

Page 6-9, Table 6-2

Add W4, 8120-0045, 1, Cable Assembly: Power, 70903, KH 4077
Change HP Part No. 00606-00026 to 00606-623 and 00606-00025 to 606A-4-4R
Delete 00606-00024.

CHANGE E
Page 6-8, Table 6-2:
Change DS1 to 1450-0048, 1, Lamp:Indicator Red 115V, 72765, 599-124.

CHANGE F
Page 6-9, Table 6-2
Delete 00606-00028, 00606-00031, 00696-00033, and 00606-60034.

Table I-1. Component/Part Change Index

Component Locations	Chassis	A4	A5	A8
CHANGE A		C38[1] R53[1] R10[2]		
B			R3[1] R4[1] R5[1] R6[1]	
C				R10[3] R11[3] R12[3]
D	C14[4], C15[4], C16[4], C17[4], J9[4], L1[4], L2[4], W4[4], J8[2], P2[2], FL1[1]			
E	DS1[2]			
F	00606-00028[1] 00606-00031[1] 00606-00033[1] 00606-60034[1]			

[1]Delete Component(s)/Parts
[2]Change Part Number/Description
[3]Changed to Factory Selected Component
[4]Add component
[5]Change HP Part Number

MANUAL CHANGES

MANUAL IDENTIFICATION
Description: HF Sig. Gen.
Model Number: 606B
Date Printed: Sept. 1972
Part Number: 00606-90017

HF Signal Generator

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
1401A, 1432A, 1439A, 1515A	1
1518A	1, 2
1543A	1–3
1604A04636 to 04970	1–4
1604A04971 to 05010	1–5

Serial Prefix or Number	Make Manual Changes
1728A	1–5
1748A	1–6
1822A	1–7
1826A	1–8
▶2036A	1–9

▶ NEW ITEM

ERRATA

Pages 1-1 and 1-2, Table 1-1:

Add the following note.

NOTE: Unless otherwise noted, specifications for **OUTPUT CHARACTERISTICS** and **MODULATION CHARACTERISTICS** apply over the top 10 dB of the output level Vernier range. RF output terminated with a 50 ohm resistive load.

Under **MODULATION CHARACTERISTICS**, change the Modulation Meter Accuracy specification to the following wording.

"Accuracy: ± (5% of full scale +5% of reading), 0 to 90% modulation, for modulation frequencies to 10 kHz; ±10% of full scale for frequencies from 10 kHz to 20 kHz."

In the Modulation Level Constancy specification add the following wording to the last sentence.

"... for modulation levels up to 70%."

Page 5-1, paragraph 5-9:

Change step h to read as follows:

CAUTION

A power level of +20 dBm will damage the thermistor mount.

h. Remove the 20 dB attenuator. Set ATTENUATOR control to −10 DBM. Power meter should indicate −10 ± 1 dB.

Continued . . .

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 September 1980
7 Pages

HEWLETT hp PACKARD

Printed in U.S.A.

ERRATA (Cont'd)

Page 5-1, paragraph 5-9: (Cont.)
Add the following sentence to step i:
"Be sure to reconnect the 20 dB attenuator."

Page 5-8, paragraph 5-37:
Add the following sentence between step e and step f: "Remove the electronic counter from test point A2R11 and connect it to the junction of A2CR5 and A2R16."
Change the beginning of step g to read: "With the counter still connected, set potentiometer A2R11 . . . ."

Page 5-10, paragraph 5-49:
Add the following steps:

i. Repeat step d. The output voltage should be between 0.8V and 1V (±1 dB) throughout the entire frequency range of the Signal Generator.

j. Bands 1, 2, and 3 can be corrected if necessary by changing resistor values for A8R3, R6, and R9 respectively (increasing resistance increases output level across the band). The normal range of values for these resistors are as follows: R3, 1.5kΩ to 3.3kΩ; R6, 500Ω to 2.2kΩ; R9, 1kΩ to 2.2kΩ.

Page 5-31, Figure 5-24:
In the part 1 of 2 A5 schematic, change C4 1000 to C1 5000 pF.

Page 5-33, Figure 5-25:
Add an asterisk (*) to C5 (it is a factory selected part). To select a value for C5, set the CRYSTAL CALIBRATOR switch on the front panel to 100 KC. Then, connect an electronic counter to the junction of CR5 and R16. The counter should read 100 kHz when R11 is at approximately mid-range. Increase the capacitance if the frequency is greater than 100 kHz; decrease the capacitance if the frequency is less than 100 kHz. The allowable values for C5 range from 390 pF to 620 pF.

Page 5-35, Figure 5-26:
Change the nominal value of *R17 to 261Ω.

Page 5-37, Figure 5-27:
On the amplifier turret schematic, change R3* to 3300Ω and R6* to 1600Ω.

Page 6-3, Table 6-2:
Add an asterisk (*) to A2C5 and change the part number to 0160-3534 CAPACITOR-FXD 510 pF (nominal value).

Page 6-4, Table 6-2:
A2CR1 can be replaced by 1901-0621 or 1901-0025, depending on availability. Changing from one part number to the other may require changing A2C5.
Change A2Q1, A2Q2 and A2Q3 to 1854-0809.
Change A3C3 and A4C2 to 0170-0022 C: FXD MY 0.1 UF 20% 600 WVDC.

Page 6-5, Table 6-2:
Change A4CR1 and A4CR3 to 1910-0016.
Change HP Part Number for A4R10 to 2100-3573.

Page 6-6, Table 6-2:
Change A5C1 to 0160-2145 C: FXD CER 5000 pF +80–20% 100VDCW.
Change A5C4 part number to 0160-0168.

Page 6-7, Table 6-2:
Change A8R3 to 0687-3321 RESISTOR 3.3K 10% 0.5W CC T=0+647.
Change A8R6 to 0686-1625 RESISTOR 1.6K 5% 0.5W CC TC=0+647.

ERRATA (Cont'd)

Page 6-8, Table 6-2:
Change A10 to 606A-34C ATTENUATOR (EXCEPT FOR A10J1, NOT RECOMMENDED FOR FIELD REPAIR).
Add A10J1 with the following information.
A10J1 1250-0102 CONNECTOR-RF, BNC FEM SGL-HOLE-FR 50-OHM.
1250-0051 CONTACT-RF CONN; SER BNC; FEMALE; BE-CU.
Change A11R17 to 0698-3132 R: FXD 261Ω 1% .125W TC=0±100.

Page 6-9, Table 6-2:
Change CR1 to 1910-0016.
Delete 1400-0084.
Add 1400-0090 NEOPRENE WASHER
Add 2110-0470 FUSEHOLDER
Add 2110-0465 FUSEHOLDER CAP
Add 2110-0467 NUT

NOTE

If any part of the old fuseholder (1400-0084) needs replacing, all four parts of the new fuseholder must be ordered. The old fuseholder is identified by a straight solder lug with the white-black-gray wire attached. On the new fuseholder the solder lug is at a right angle to the body.

Change FL1 to 9100-3142.
Change Q2 1854-0080 to Q2 1854-0658.
Change HP Part Number for P2 to 8120-1378.
Change DS1 part number to 1450-0566.

Page 6-10, Table 6-2:
Delete 00606-001.
Delete 00606-616.
Delete 606A-44B-2.
Delete 00606-00021.
Delete 606A-71A.
Change 606A-75C to 00606-60037.
Add the following parts:

606A-37G	SHAFT
0370-0083	KNOB
1480-0061	PIN

Page 6-11, Table 6-2:
Change 606A-83B to 606A-95A.
Add 00606-60036 Terminal Board: Audio Oscillator.
Add the following parts:
7120-4162 LABEL, WARNING "HAZARDOUS VOLTAGE" LARGE.
7120-4163 LABEL, WARNING "HAZARDOUS VOLTAGE" SMALL (2 each).
7120-4295 LABEL, WARNING "HAZARDOUS VOLTAGE ALWAYS PRESENT . . ."
7120-5087 LABEL, WARNING "TO PREVENT ELECTRICAL SHOCK . . ." (2 each).
Change 1470-0010 to 00606-20013.

CHANGE 1

Page 1-1, Table 1-1:
Change HARMONIC OUTPUT specification to read as follows:
Harmonics (Output Volts meter set between −7 and +3 dB):
>25 dB below fundamental of 50 kHz to 65 MHz.

Page 5-31, Figure 5-25 (schematic):
Delete C23.

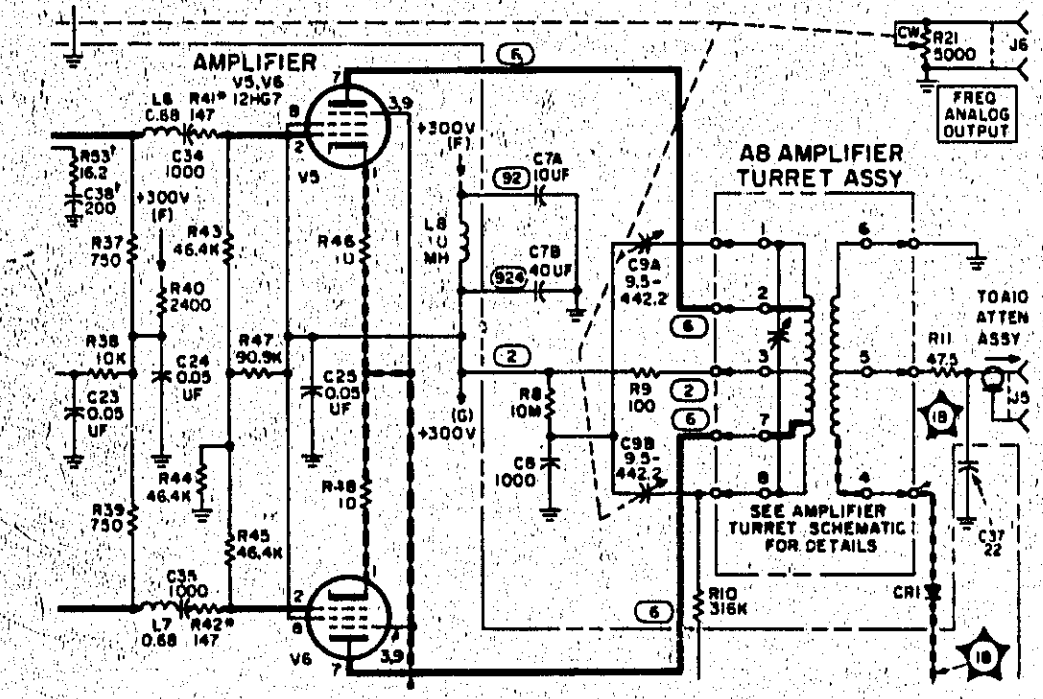
Page 6-9, Table 6-2:
Delete C23.

CHANGE 2

Page 5-31/5-32, Figure 5-24 (schematic):
Replace appropriate portion of schematic with attached partial schematic.

Page 6-5, Table 6-2:
Change A4R41 and A4R42 to 0698-3438 R:FXD MET FLM 147 OHM 1% 1/8 W.

Page 6-8, Table 6-2:
Change C7 to 0180-0135 C:FXD ELECT 40/10 μF 450V.



P/O Figure 5-24. RF Generator and Modulator Circuits Schematic Diagram (P/O Change 2)

CHANGE 2 (cont'd)

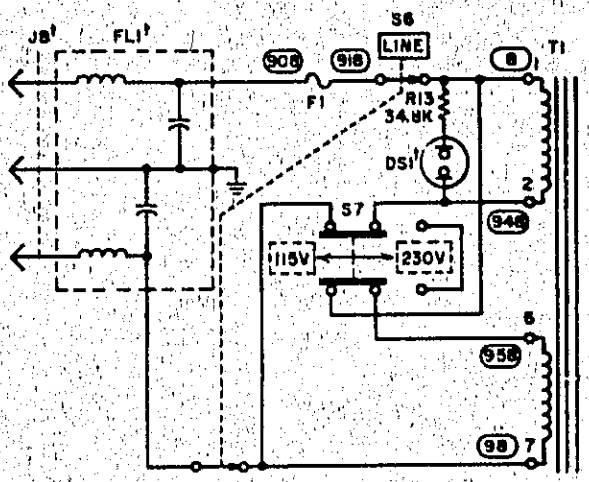
NOTE

In band 6 and on the 3.0V Attenuator range, resistors A4R41 and A4R42 affect incidental FM and maximum percent AM. Increasing resistance decreases incidental FM and also decreases maximum percent AM. If necessary, resistors should be selected to maximize performance for both characteristics. Both resistors should be the same value, between 51.1Ω and 287Ω (typically, 147Ω).

CHANGE 3

Page 5-35/5-36, Figure 5-26 (schematic):

Replace appropriate portion of schematic with attached partial schematic.



P/O Figure 5-26. Power Supply Schematic Diagram (P/O Change 3)

Page 6-10, Table 6-2:

Change S6 to 3101-0003 SWITCH-TGL BASIC DPST NS 3A 250 VAC/DC.

CHANGE 4

Page 5-31/5-32, Figure 5-24 (schematic, see Change 2):

Add a capacitor C32* to ground parallel to R8 and C8. Typical value of C32 is 1000 pF; may be omitted (see note).

Add a capacitor C33* to ground parallel to C8 only. Typical value of C33 is 1000 pF; may be omitted.

NOTE

C32 and C33 are added to circuit to decrease third harmonic at signal frequencies about 62 MHz, and fourth and fifth harmonics at signal frequencies above 40 MHz. However, adding either capacitor will slightly increase the second harmonic at signal frequencies between 60 and 65 MHz.

Change A4R53 to 26.1 Ω.

Page 6-6, Table 6-2:

Change A4R53 to 0698-3432 R: FXD 26.1 OHM 1% 1/8 W.

Page 6-9, Table 6-2:

Add C32 and C33 0150-0050 C: FXD, 1000 pF +80-20% 1000 WVDC.

Page 6-11, Table 6-2:

Add 0360-0001 LUG, SOLDER NO. 6 (FOR C33).

Add 0360-0269 LUG, SOLDER NO. 8 (FOR C32).

Add 1400-0749 (Qty, 2) CLIP, RETAINER.

CHANGE 5

Page 5-35/5-36, Figure 5-26:
On the A11 assembly, change C9 to 0.1 μF.

Page 6-8, Table 6-2:
Change A11C9 to 0170-0022 C: FXD MY 0.1 μF 20% 600 WVDC.

CHANGE 6

Page 5-22:
Add the following paragraph:

5-78. FACTORY SELECTED COMPONENTS

5-79. The following paragraphs explain how to choose the values of selected components. These components are designated by an asterisk (*) on the schematic and parts list.

5-80. SELECTING A4C39 AND A4C40

5-81. If incidental FM exceeds the specified level, vary C39 and C40 from zero (no capacitors) to 22 pf for a minimum level.

Page 5-31/5-32, Figure 5-24:
Draw in C39* from the plate of V3 to ground.
Draw in C40* from the plate of V4 to ground.
Write the following note on the bottom of the page:
*Selected value. See paragraph 5-78 for selection procedure.

Page 6-5, Table 6-2:
Add A4C39* and C40* 0160-2216 C:FXD 15 pF (nominal value).

CHANGE 7

Page 6-10, Table 6-2:
Change S6 part number to 3101-2329.

CHANGE 8

Page 6-9, Table 6-2:
Delete 1400-0090 NEOPRENE WASHER
Delete 2110-0470 FUSEHOLDER
Delete 2110-0465 FUSEHOLDER CAP
Delete 2110-0467 NUT.

Add 2110-0564 FUSEHOLDER BODY 12A MAX; 250V MAX 28480 2110-0564
Add 2110-0565 FUSEHOLDER CAP BAYONET; 12A, 250V MAX 28480 2110-0565
Add 2110-0569 NUT-HEX, PLASTIC 28480 2110-0569
Add 1400-0090 WASHER; RUBBER 5/8" OD 00000 OBD.

►CHANGE 9

Page 6-6:
Change A4R52 to 0698-3158, CD4, Qty 1, R:FXD MET FLM 27.3K OHM 1% 1/8W.

CHANGE 9 (Cont'd)

Page 6-9:

Change M1 to 1120-1578, CD6, Qty 1, METER MODULATION.
Change M2 to 1120-1577, CD5, Qty 1, METER OUTPUT.

Page 6-10:

Change TB1 to 0360-0055, CD9, Qty 1, TERMINAL LUG.

HP MANUAL CHANGES

Make all corrections in your manual according to errata. Check the following table for your instrument serial prefix and make indicated changes in the manual:

MANUAL TITLE: 606B
MANUAL PRINTED: September, 1972
MANUAL PART NO: 00606-90017
CHANGE DATE: 14th January, 1975

SERIAL PREFIX	MAKE CHANGE	SERIAL PREFIX	MAKE CHANGE	SERIAL PREFIX	MAKE CHANGE
ALL	ERRATA				
1251U	1				
1446U	1,2				
1446U-00986	1 - 3				

ERRATA — Table 6-1
Change : A2Y1 to Part No 0410-0407 Xtal:Quartz 1000KHz
A2CR6,7 to part no 1901-0518 Di. Hot Carrier
P2 to part no 8120-1351 Cbl Assy Power

All 10% carbon composition resistors are replaced with 5%
Number sequence is changed :

0684-XXX1 to 0683-XXX5
0687-XXX1 to 0696-XXX5

CHANGE 1 — Table 1-1 Specification
Change : Harmonic output to read:-
(RF output meter set between -10dB and +3dB for each attenuator setting).
>25dB below fundamental from 50kHz to 65mHz.
: Table 6-2
Delete : C23 part no 0132-0003 C.Var .7-3pF.

CHANGE 2 — Table 6-1 page 6-10
Change : Part no 606A-75B and 606A-75C to part no 00606-60036 and 00037. (These are pc boards instead of the Kingman boards and are interchangeable).

CHANGE 3 — Table 6-1, Page 6-11
Change : Q2 to Part No 1854-0658 XSTRSi.