

OPERATING AND SERVICE MANUAL

8614A SIGNAL GENERATOR

SERIALS PREFIXED: 815- above 02201

This Operating and Service Manual applies to HP 8614A instruments with serial number prefix 815- above 02201.

SERIAL PREFIXES NOT LISTED

For instruments with serial number prefixes 815- below 02201, a "Backdating" Appendix is supplied in the back of this manual.

THIS PUBLICATION REPLACES T.O. 33A1-8-424-1, DATED 22 MAY 1974.

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

MANUAL PART NUMBER 08614-90001
Microfiche Part Number 08614-90007

Printed: MARCH 1979

CERTIFICATION

Hewlett-Packard Company certifies that this instrument met its published specifications at the time of shipment from the factory. Hewlett-Packard Company further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed in Section I of this manual, the warranty shall be for the specified period. Hewlett-Packard will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard, and provided the preventive maintenance procedures in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

Service contracts or customer assistance agreements are available for Hewlett-Packard products.

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

1-A. SAFETY CONSIDERATIONS

Safety Symbols



Instruction manual symbol: the apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.



Indicates dangerous voltages.



Earth terminal (sometimes used in manual to indicate circuit connected to grounded chassis).

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Operation

CAUTION

BEFORE APPLYING POWER make sure the instrument's ac input is set for the available ac line voltage, that the correct fuse is installed, and that all normal safety precautions have been taken.

Service

The information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. **SERVICE AND ADJUSTMENTS SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL.**

Adjustment or repair of the opened instrument with the

ac power connected should be avoided as much as possible and, when unavoidable, should be performed only by a skilled person who knows the hazard involved.

Capacitors inside the instrument may still be charged even though the instrument has been disconnected from its source of supply.

Make sure only fuses of the required current rating and type (normal blow, time delay, etc.) are used for replacement. Fuse requirements are indicated on the instrument's rear panel. Do not use repaired fuses or short-circuit fuse holders.

Whenever it is likely that the protection has been impaired, make the instrument inoperative and secure it against any unintended operation.

WARNING

If this instrument is to be energized through an auto-transformer (for voltage reduction), make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THE INSTRUMENT, the protective earth terminal of the instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with protective earth contact. The protection action must not be negated by using an extension cord (power cable) without a protective grounding conductor. Grounding one conductor of a two-conductor outlet is not sufficient protection.

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal is likely to make this instrument dangerous. Intentional interruption of the earth ground is prohibited. Whenever it is likely that the protection has been impaired, the instrument must be secured against any unintended operation.

Servicing this instrument often requires that you work with the instrument's protective covers removed and with ac power connected. Be very careful; the energy at many points in the instrument may, if contacted, cause personal injury.

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Figure 1-1. Model 8614A Signal Generator

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. The Model 8614A Signal Generator provides RF power in the 800 to 2400 MHz ranges and produces an RF power output of at least 10 milliwatts. Output frequency and attenuation are read directly on digital dials, and fine frequency changes can be made by means of the front-panel ΔF control. Complete specifications are given in Table 1-1. The 8614A is shown in Figure 1-1.

1-3. The instrument has two power output connectors which supply RF power simultaneously. One output provides at least 10 milliwatts of power and may be leveled. When in the leveled output mode of operation and the output is 0 dBm or less, the RF output is held quite constant across the band without resetting the attenuator or power monitor. The other output connector provides an uncalibrated output of at least 0.5 milliwatt. A waveguide-beyond-cutoff attenuator, which is referenced to the RF output, accurately attenuates the calibrated RF power output from 0 to -127 dBm.

1-4. RF power output can be internally square-wave modulated. In addition, the RF power can be externally AM, FM, or pulse modulated. An external ALC (automatic level control) input which can be used for remote leveling loop control and an external dc-coupled FM input which can be used for external AFC is also provided.

1-5. PIN diode attenuators are used for leveling, square wave, pulse, and amplitude modulation. The PIN attenuator is an absorption device that can be electrically controlled to attenuate RF power. A sampling loop which includes a PIN diode attenuator compensates for changes in RF power output to hold the RF power output nearly constant.

1-6. SUPPLEMENTARY INSTRUMENTS

1-7. The HP 8403A (Option 002), an external pulse and amplitude modulator, extends the Signal Generator's modulation capabilities.

1-8. The Model 2650A (obsolete) oscillator synchronizer may be used directly to stabilize all internal cavity reflex klystron signal generators. Short-term stability is one part in 10^8 /sec, and long-term stability is one part in 10^6 /week over 0 to 50 degrees centigrade.

1-9. INSTRUMENT OPTIONS

1-10. In addition to the standard instrument, the Option 01 is available. The Option 01 instrument has its input connectors located on both the front and rear panel and its output connectors located on the rear panel; in all other respects it is the same as the regular signal generator.

1-11. INSTRUMENTS COVERED BY MANUAL

1-12. This instrument has a two-part serial number. The first four digits and the letter constitute the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix as listed under SERIAL NUMBERS on the title page. If the serial prefix on your instrument does not appear on the title page of this manual, there are differences between the manual and your instrument which are described in the Appendix or in a Manual Change Sheet included with the manual. If the change sheet is missing, the information can be supplied by your local sales office.

1-13. KLYSTRON WARRANTY CLAIM SHEET

1-14. The klystron supplied and replacement klystrons purchased from the Hewlett-Packard Company are guaranteed by the manufacturer against electrical failure for a specified period of time (time from date of purchase or hours of operation); warranty conditions vary with the type of tube used. Thus, for the actual warranty period of the klystron in your instrument, contact your local sales office. A sheet for your use is included in the appendix of this manual; follow the instructions on the sheet explicitly.

Table 1-1. Specifications

FREQUENCY CHARACTERISTICS

Range: 800 to 2400 MHz; single, linearly calibrated control; direct reading within 2 MHz.

Vernier: ΔF control has a minimum range of 1.0 MHz for fine tuning.

Frequency Calibration Accuracy (0 dBm and below): ± 5 MHz.

Frequency Stability:

Line Voltage: < 30 ppm for $\pm 10\%$ change from nominal voltage.

Temperature: approximately 50 ppm/ $^{\circ}\text{C}$ change in ambient temperature.

Residual FM: < 2500 Hz peak in a 10 kHz bandwidth.

OUTPUT CHARACTERISTICS**Range:**

CAL Output: 0 dBm (0.223V) to -127 dBm (0.1 μV), continuously variable. Above 0 dBm output is not calibrated, max level +10 dBm (0.707V).

UNCAL Output: -3 dBm (0.16V) nominal.

Flatness: $< \pm 0.75$ dB.

Level Accuracy: ± 0.75 dB + attenuator accuracy (0 to -127 dBm).

Attenuator Accuracy: $+0, -3$ dB from 0 to -10 dBm; ± 0.2 dB ± 0.06 dB/10 dB from -10 to -127 dBm; direct reading linear dial, 0.2 dB increments.

Impedance: 50 ohms; SWR < 2.0 .

MODULATION CHARACTERISTICS

Internal Square-Wave: 950 to 1050 Hz. Other frequencies available on special order. On/off ratio at least 20 dB.

Square-Wave Sync: Square-wave can be synchronized with a +1 to +10-volt signal applied to the pulse input.

External Pulse: 50 Hz to 50 kHz, 2.0 μs rise time. +20 to +100V peak input. On/off ratio at least 20 dB.

External AM: dc to 1 MHz.

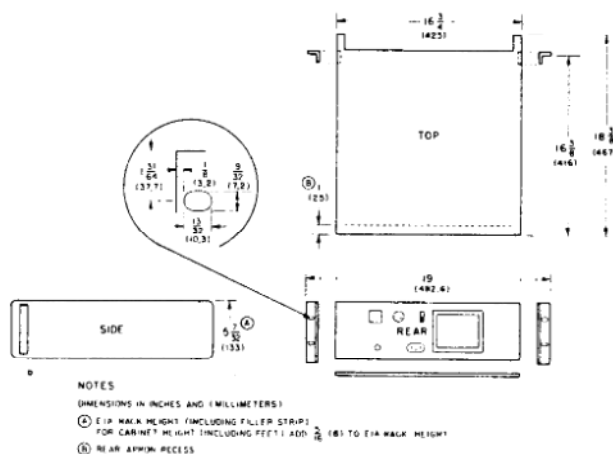
External FM: Mode width between 3 dB points varies from a minimum of approximately 4 MHz at a frequency of 800 MHz to a maximum of approximately 15 MHz at a frequency of 2000 MHz. Sensitivity is approximately 100 kHz/volt between 800 and 1600 MHz and 200 kHz/volt between 1600 and 2400 MHz.

- (a) Front-panel connector capacitively coupled to the repeller of the klystron. Input impedance, 220 k Ω shunted by approximately 300 pF.
- (b) Rear-panel connector is dc-coupled to the repeller of the klystron.

GENERAL

RFI: Conducted and radiated leakage limits are below those specified in MIL-I-6181D.

Power Source: 115 or 230 volts $\pm 10\%$, 50 to 60 Hz, approximately 130 watts.

Dimensions:

Weight: Net, 19.5 kg (43 lb).

Option 001: Ext. modulation input connectors on rear panel in parallel with front panel connectors, RF connectors on rear panel only.

NOTE: Specifications apply with the ΔF control centered.

SECTION II INSTALLATION

2-1. INCOMING INSPECTION

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, meters).

2-2. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are outlined in paragraph 5-8. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

2-3. INSTALLATION

2-4. The Model 8614A is delivered as a cabinet mount instrument. A kit is supplied with the instrument for conversion from cabinet to rack mount.

NOTE

This instrument is electrostatically shielded but not magnetically shielded. Hence, a magnetic field near the top or bottom covers can cause excessive incidental FM in the output signal. To eliminate this problem, a metal shield, such as a sheet of silicon steel, must be placed between the 8614A and any magnetic field.

2-5. Whether the instrument is cabinet or rack mounted, provision should be made for adequate circulation of air around the instrument. The instrument cooling fan is located at the rear of the instrument and louvers are located on instrument

side panels. Proper air circulation is most important at the sides and rear of the instrument.

CAUTION

IF FAN IS NOT OPERATING, THE INSTRUMENT SHOULD NOT BE OPERATED.

2-6. CONVERSION TO RACK MOUNT

- a. Remove trim strip on sides of instrument (refer to Figure 2-1).
- b. Remove tilt stand by pressing two sides of stand toward center of instrument and lifting it out.
- c. Remove five feet at bottom of instrument. Press button in center of each foot, slide them toward center of instrument, and lift out.
- d. Place rack mounting flanges (two) where trim strips were and secure with screws provided.
- e. Add filler strip to bottom of instrument.
- f. Rack mounting under *severe* vibration conditions must be supplemented with additional support at rear.

2-7. Air Filter Inspection

2-8. The Model 8614A uses forced-air cooling to maintain tolerable temperature within the instrument. Incoming air is filtered through a special filter at the rear of the instrument. The air filter should be checked periodically and if dirty, cleaned. Refer to paragraph 5-4 for air filter maintenance.

2-9. POWER REQUIREMENT

2-10. The Model 8614A can be operated from a 115- or 230-volt, 50- to 60-Hz source. A two-position slide switch (LINE VOLTAGE) at the rear of the instrument selects ac operation mode. The line voltage at which the instrument is set to

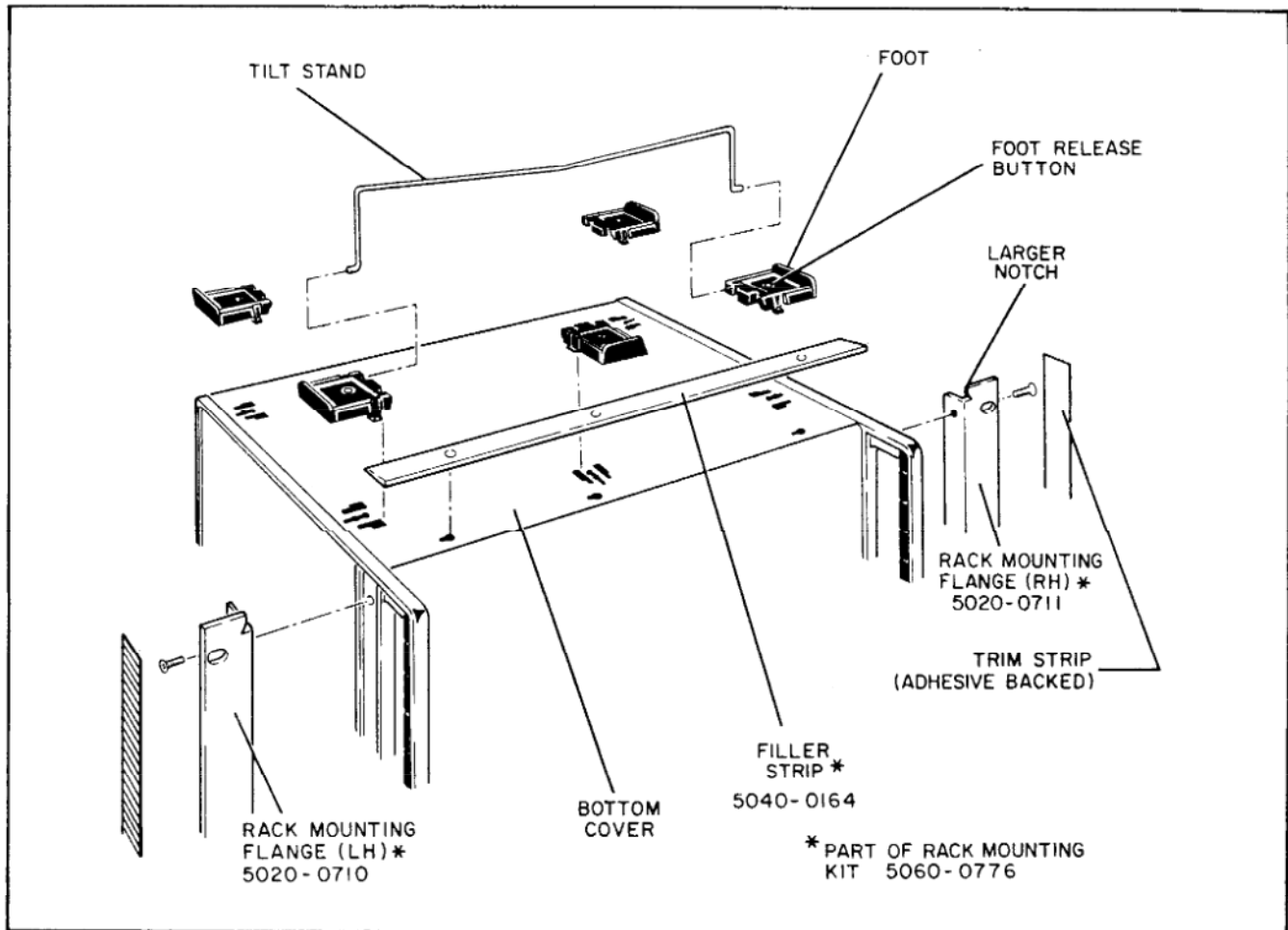


Figure 2-1. Conversion to Rack Mount

250V OPERATION PLUG*: SEV 1011.1959-24507 TYPE 12 CABLE*: HP 8120-2104	250V OPERATION PLUG*: NZSS 198/AS C112 CABLE*: HP 8120-1369	125V OPERATION PLUG*: NEMA 5-15P CABLE*: 8120-1378	250V OPERATION PLUG*: NEMA G-15P CABLE*: HP 8120-0698
250V OPERATION PLUG*: CEE7-VII CABLE*: HP 8120-1689	250V OPERATION PLUG*: CEE22-V1 CABLE*: HP 8120-1860	250V OPERATION PLUG*: BS 1363A CABLE: HP 8120-1351	
*The number shown for the plug is the industry identifier for the plug only. The number shown for the cable is an HP part number for a complete cable including the plug.			

Figure 2-2. Power Cable and Mains Plug Part Numbers

POWER REQUIREMENT (Cont'd)

operate appears on the slider of the switch. A 1½ ampere standard fuse is used for 115V operation; a ¾ ampere standard fuse is used for 230V operation.

2-11. THREE-CONDUCTOR POWER CABLE

WARNING

BEFORE CONNECTING THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (Mains) power cord. The Mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding).

2-12. This instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the

country of destination. Refer to Figure 2-2 for the part numbers of available cables.

2-13. REPACKAGING FOR SHIPMENT

2-14. The following list is a general guide for repackaging an instrument for shipment. However, if you have any questions, contact your local sales and service office (see lists at rear of manual).

a. If possible, use the original container designed for the instrument. If a carton and packing materials are desired, they can be ordered from your local sales and service office.

b. The instrument is supported by four polyethylene supports fitted to the instrument height; one support located at each corner.

NOTE

If the instrument is to be shipped to the Hewlett-Packard Company for service or repair, attach to the instrument a tag identifying the instrument by owner, model, and full serial number, and indicating the service or repair to be accomplished. In any correspondence, refer to the instrument by model number and complete serial number including the prefix.

SECTION III OPERATION

3-1. INTRODUCTION

3-2. The Model 8614A can provide 1.0 milliwatt of leveled power across its frequency range (RF outputs leveled to within ± 0.5 dB can be obtained across the band for attenuator setting of 0 dB or less). Output power can be attenuated to -127 dB. When operating unleveled, attenuation reference is the klystron power output; when operating leveled, attenuation reference is output reference setting. Internal square-wave modulation is available from 950 to 1050 Hz. External FM, AM, and pulse modulation voltages also can be used. Two or three modulation modes of operation can be applied to the instrument simultaneously; push-button controls select the mode of operation. External modulation signal inputs are located directly below the modulation button to which they apply.

CAUTION

RF power in excess of approximately 125 mW should never be applied to RF power output connectors as internal damage could result.

3-3. CONTROLS AND INDICATORS

3-4. Front and rear panel controls and connectors are shown in Figure 3-1. Each control and connector is identified with a numbered callout, and an explanation of the function, given in the accompanying text, is keyed to the callout number.

3-5. OPERATING PROCEDURES

3-6. The operating procedures (Figures 3-2 through 3-8) give step-by-step procedures for the various modes of operation. Instructions are given for obtaining the following leveled and unleveled outputs:

CW, square-wave modulated (modulating voltage supplied internally), and FM, AM, and pulse-modulated (modulating voltage supplied externally). Steps of each procedure are numbered according to the sequence in which they are to be performed, and any control or connector which is identified with the number of the step in which it is used.

NOTE

A magnetic field near the 8614A can cause excessive incidental FM in the output signal. A strong field can cut off the RF output. To eliminate the problem, place a sheet of high permeability metal, such as silicon steel, between the 8614A and radiation source.

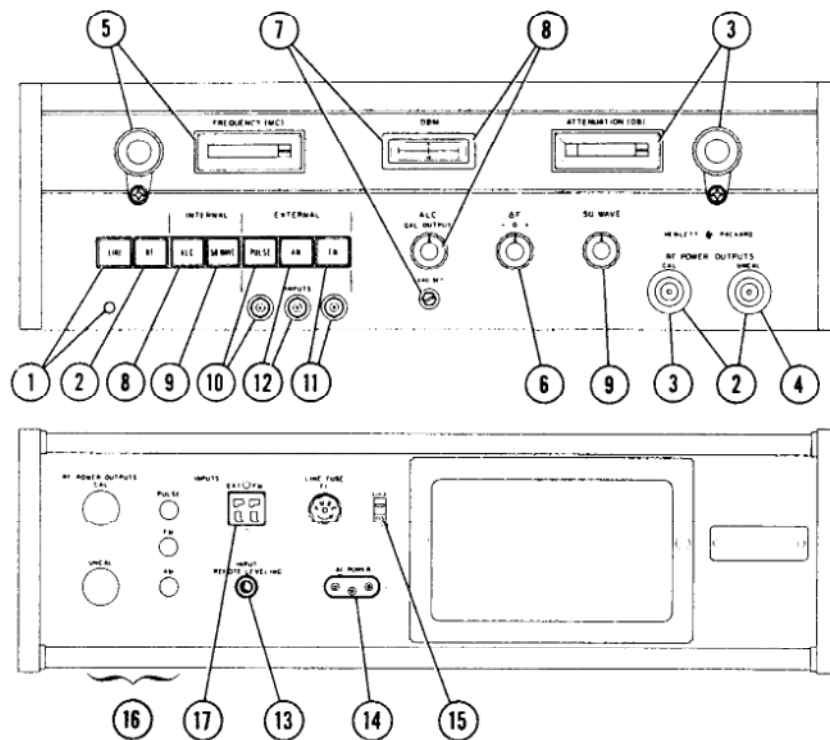
3-7. STABILIZED SOURCE

3-8. To use the 2650A Oscillator Synchronizer (obsolete) with the signal generator, proceed as follows:

a. The rear panel connector EXT FM (J201) is a Cinch-Jones type S304AB. Connection between this jack and J5 of the 2650A must be made as follows:

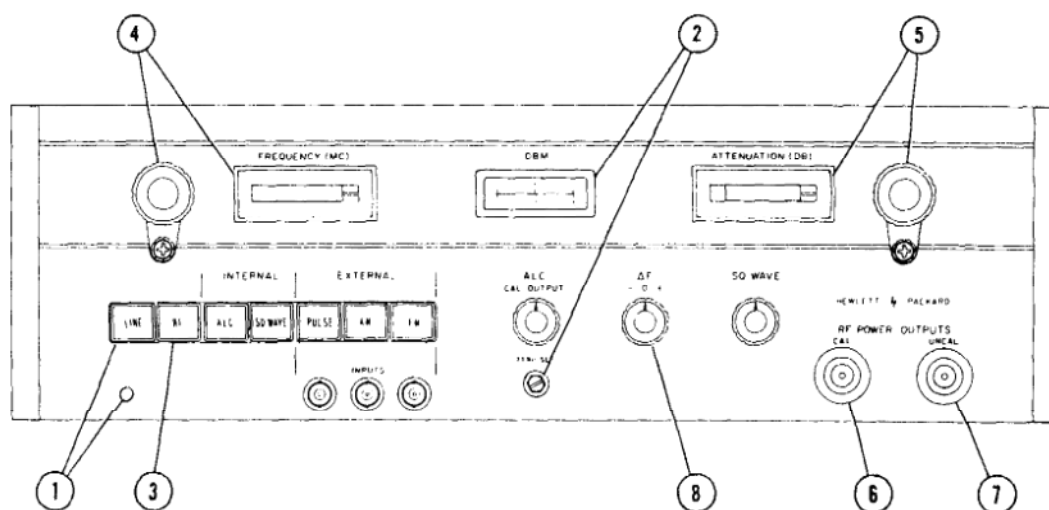
Pin 3, J201, to Pin E, J5 — 2650A
Pin 4, J201, to Pin F, J5 — 2650A
Pin 1, J201, to Pin G, J5 — 2650A
Pin 2, J201, no connection.

b. Connect RF output from UNCAL OUTPUT connector on Model 8614A to OSCILLATOR INPUT connector on Model 2650A. Depress EXTERNAL FM button on the Model 8614A and proceed as explained in the instruction manual for the Model 2650A.



1. **LINE.** Connects primary power to instrument; lamp glows.
2. **RF.** Applies power to RF POWER OUTPUTS.
3. **ATTENUATION (DB).** Sets RF power level at the CAL RF POWER OUTPUT.
4. **UNCAL RF POWER OUTPUT.** Provides approximately 0.5 mW unleveled and unattenuated RF power.
5. **FREQUENCY (MC).** Sets RF frequency.
6. **ΔF .** Permits small deviations from FREQUENCY (MC) setting (± 1.5 MHz minimum).
7. **ZERO SET.** Adjust for zero indication on DBM meter (with RF turned off).
8. **ALC.** Levels calibrated RF output; used to set a reference on DBM meter.
9. **INTERNAL SQ WAVE.** Modulates CAL RF OUTPUT. SQ WAVE control adjusts modulation frequency.
10. **EXTERNAL PULSE.** Positive pulses to external pulse input will provide modulation voltages required to pulse modulate CAL RF OUTPUT. Positive pulses turn RF "ON".
11. **EXTERNAL FM.** AC voltages applied to external FM input will provide frequency modulation of both CAL and UNCAL outputs.
12. **EXTERNAL AM.** Signals applied to external AM input will provide modulation voltages required to AM-modulate CAL RF OUTPUT.
13. **INPUT REMOTE LEVELING.** Input jack for external leveling loop voltage applied to level generator CAL RF POWER OUTPUT.
14. **POWER.** Male receptacle which connects to the power cord.
15. **LINE VOLTAGE.** Arranges input power transformer to accept either 115- or 230-volt, 50- to 60-Hz primary power input.
16. **OPTION 01.** Input and output connectors located on rear panel (input connectors also located on front panel).
17. **EXT FM.** Two terminal connector dc-coupled to klystron for stabilization of output frequency.

Figure 3-1. Front and Rear Panel Controls and Indicators



1. Depress LINE.
2. Note meter pointer on DBM meter.
3. Depress RF; there should be some deflection of DBM meter pointer.

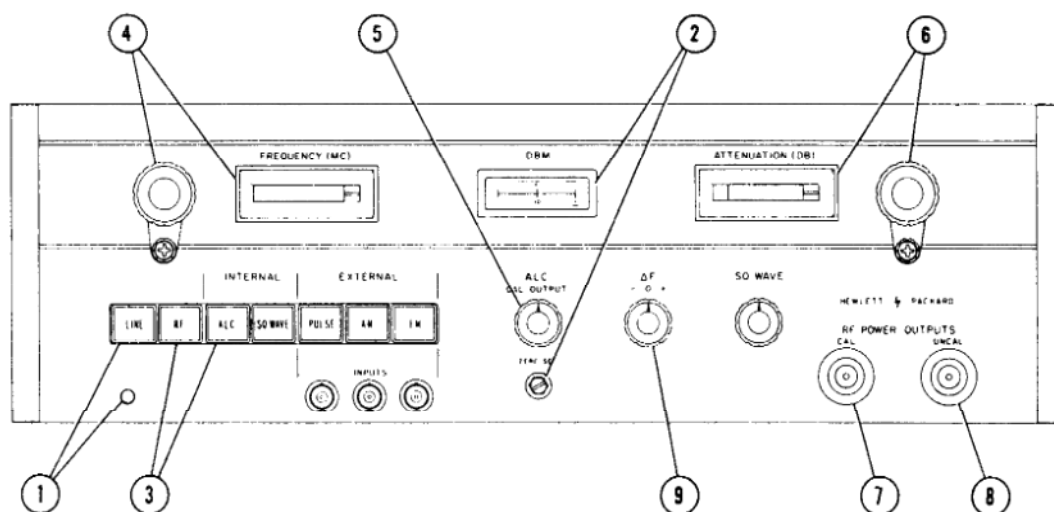
NOTE

When RF button is depressed, meter pointer will fluctuate from approximately +1 dBm at low frequency to +4 dBm or more at high frequency.

4. Set FREQUENCY (MC) to desired frequency.

5. The ATTENUATION (DB) knob will attenuate RF power at CAL RF POWER OUTPUT. Counterclockwise rotation will increase output power, although fully counterclockwise rotation will cause output power to decrease.
6. Take unleveled but attenuable RF power at CAL RF POWER OUTPUT.
7. Take unleveled and unattenuable RF power at UNCAL RF POWER OUTPUT.
8. For maximum output at the CAL RF POWER OUTPUT, adjust ATTENUATION (DB) and ΔF controls together and monitor output with a power meter. Note: changing ΔF setting will also change frequency.

Figure 3-2. Unleveled RF Power Output



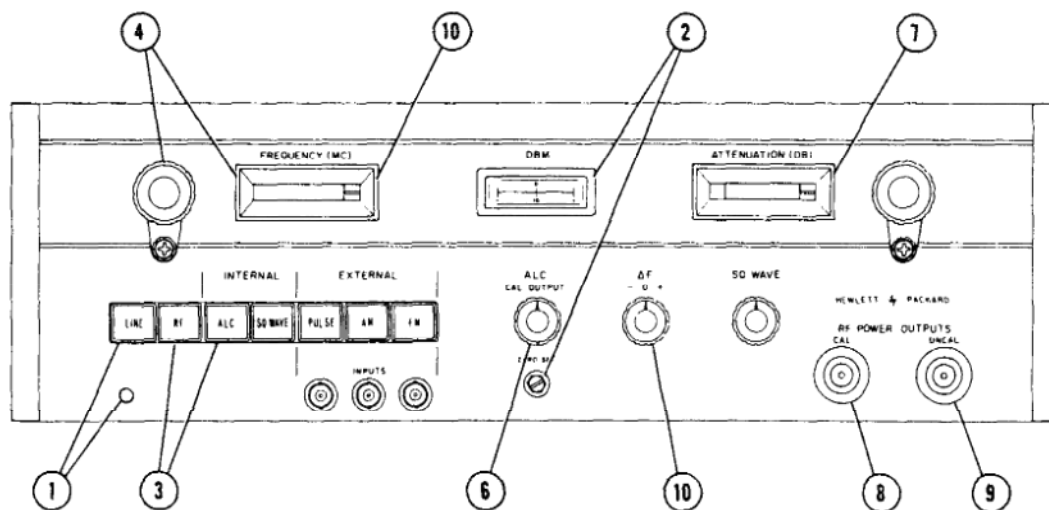
1. Depress LINE.
2. Check that meter pointer on DBM meter is on ZERO SET mark; if not, adjust accordingly.
3. Depress RF and INTERNAL ALC; there should be some deflection of DBM meter pointer.
4. Set FREQUENCY (MC) for 800 MHz.
5. Adjust ALC CAL OUTPUT for desired dBm reference on DBM meter. The ALC system holds RF output power across the band to within ± 0.75 dB for levels of 0 dBm or less. The most common DBM meter reference is 0 so that the attenuated RF output power can be read directly from attenuator readout. Note: the ATTENUATION (DB) will not accurately calibrate above -15 dB.

NOTE

Power may be leveled above 0 dBm over that portion of the band where the desired power is available.

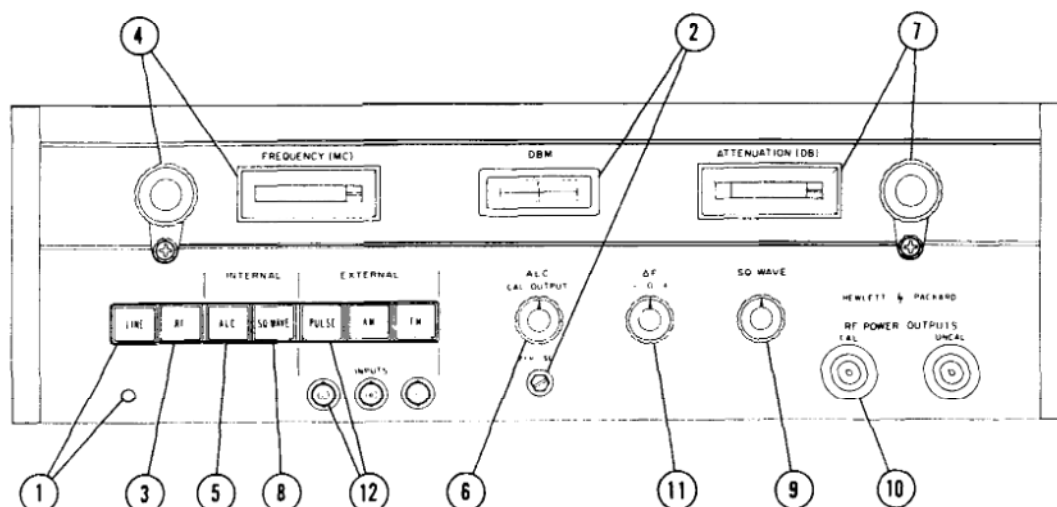
6. Set ATTENUATION (DB) to desired attenuation. The RF power level at CAL RF POWER OUTPUT is the algebraic sum of the DBM meter setting and of the ATTENUATION (DB) setting.
7. Take leveled and attenuable RF power available at CAL RF POWER OUTPUT.
8. Take unleveled and unattenuable RF power at UNCAL RF POWER OUTPUT.
9. ΔF control should be centered.

Figure 3-3. Internally Leveled RF Output



1. Depress LINE.
2. Check that meter pointer on DBM meter is on ZERO SET mark.
3. Depress RF and INTERNAL ALC.
4. Set FREQUENCY (MC) for 800 MHz.
5. With a directional coupler connected between CAL output and the load, and as close to the load as possible, sample and detect incident power and apply the detected signal to INPUT REMOVE LEVELING phone jack connection (rear panel). Adjust ATTENUATION (DB) control for detected 40 to 240 mV signal. Note: ATTENUATION (DB) control cannot be adjusted fully counterclockwise or loading effects will appear at higher frequencies.
6. Adjust ALC CAL OUTPUT for desired reference on DBM meter. This reference point may vary from that used with internal leveling due to different detector sensitivities.
7. Do not change ATTENUATION (DB) setting once leveling loop is set up. Adjusting attenuator position may degrade leveling loop operation.
8. Take leveled and attenuable RF power available at CAL RF POWER OUTPUT.
9. Take unleveled and unattenuable RF power at UNCAL RF POWER OUTPUT.
10. ΔF control should be centered when not in use.

Figure 3-4. Externally Leveled RF Power



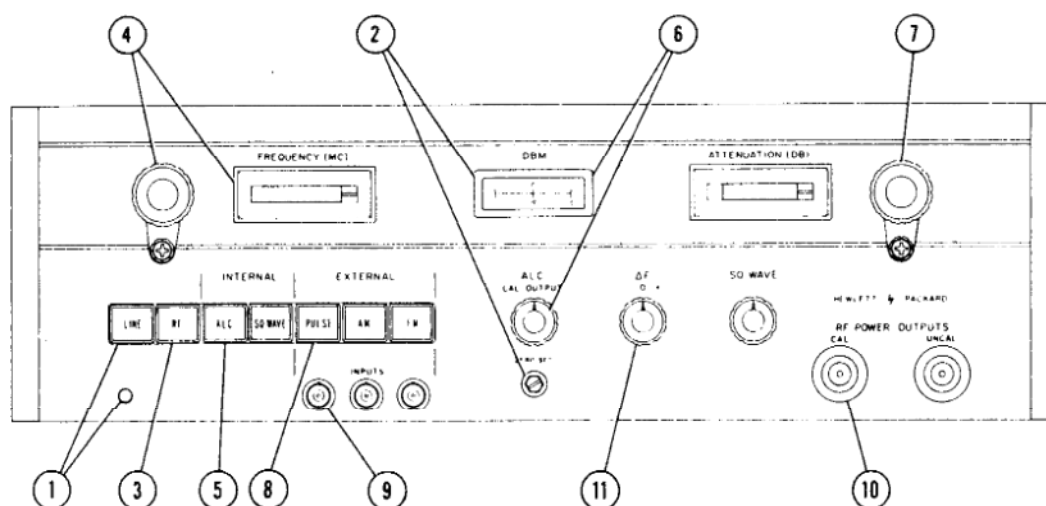
1. Depress LINE.

NOTE

When unleveled power is to be modulated, omit steps 2, 5, and 6.

2. Check that meter pointer on DBM meter is on ZERO SET mark.
3. Depress RF.
4. Set FREQUENCY (MC).
5. Depress INTERNAL ALC.
6. Adjust ALC CAL OUTPUT for 0 dBm reference on DBM meter.
7. Set ATTENUATION (DB).
8. Depress SQ WAVE.
9. Adjust SQ WAVE for desired modulation frequency.
10. Take leveled and attenuable RF power output at CAL RF POWER OUTPUT.
11. The ΔF control may be adjusted for small changes in RF frequency and to peak maximum output power. However, adjusting too far from centered position will cause RF power to decrease and, if in leveled operation, poor leveling.
12. EXTERNAL SYNCHRONIZATION.
 - a. Depress PULSE and apply +1 to +10V pulse.
 - b. Pulse repetition rate must be equal to desired square wave frequency (950--1050 Hz).
 - c. Decrease SQ WAVE frequency to a rate slightly slower than the pulse repetition rate.

Figure 3-5. Internal Square-Wave Modulation and External Sync



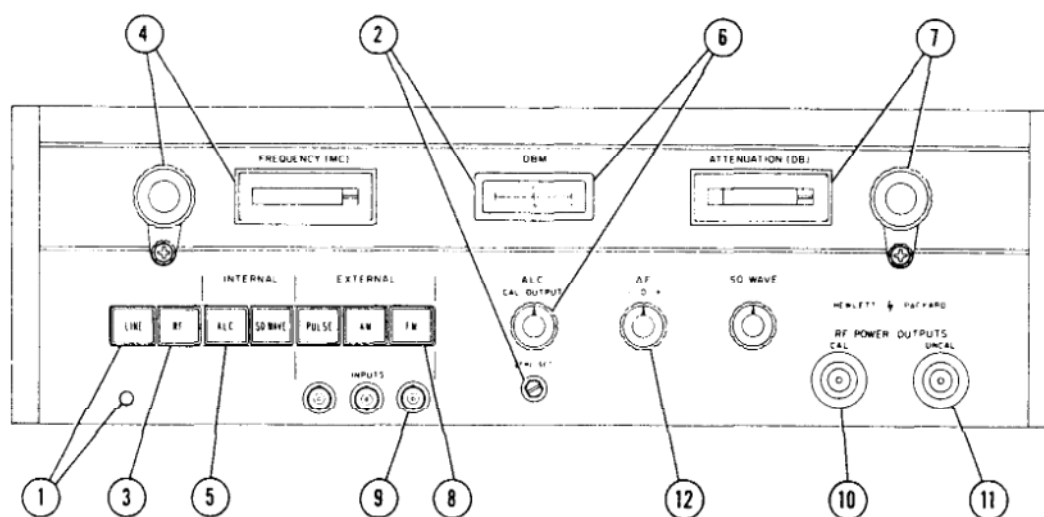
1. Depress LINE.

NOTE

If external pulse modulation of unleveled power is desired, omit steps 2, 5, and 6.

2. Check that meter pointer on DBM meter is on ZERO SET mark.
3. Depress RF.
4. Set FREQUENCY (MC).
5. Depress INTERNAL ALC.
6. Adjust ALC CAL OUTPUT for 0 dBm reference on DBM meter.
7. Set ATTENUATION (DB) as desired.
8. Depress EXTERNAL PULSE.
9. Apply 20- to 100-volt 50-Hz to 50-kHz positive pulse modulating signal to EXTERNAL PULSE INPUT.
10. Take leveled and attenuable pulse modulated RF power output at CAL RF POWER OUTPUT.
11. The ΔF control may be adjusted for small changes in RF frequency and to peak maximum output power. However, adjusting too far from centered position will cause RF power to decrease and, if in leveled operation, poor leveling.

Figure 3-6. External Pulse Modulation



1. Depress LINE.

NOTE

If external FM modulation of unleveled power is desired, omit steps 2, 5, and 6.

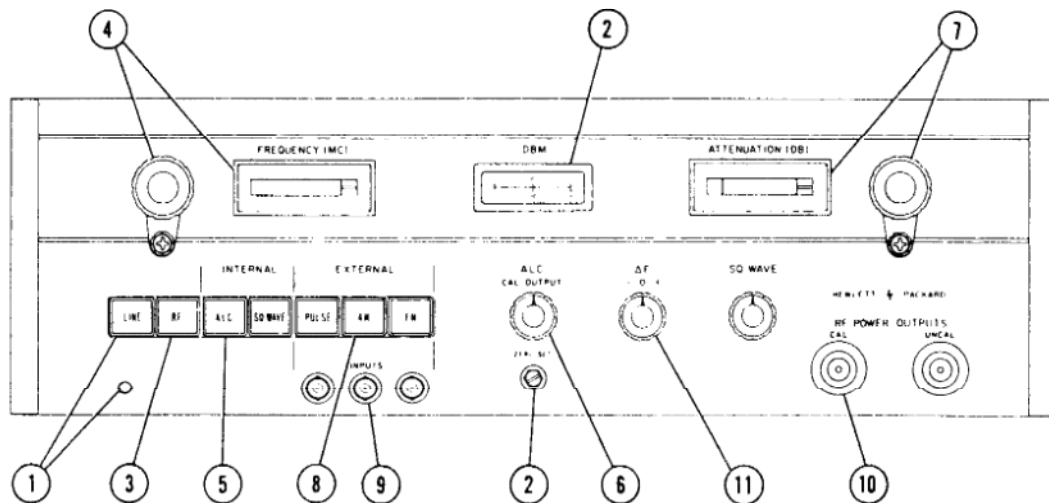
2. Check that meter pointer on DBM meter is on ZERO SET mark.
3. Depress RF.
4. Set FREQUENCY (MC).
5. Depress INTERNAL (ALC).
6. Adjust ALC CAL OUTPUT for 0 DBM meter reference. A 0 DBM reference allows a direct readout of ATTENUATION (DB) dial. The ALC system will level RF power with FM frequencies of 1 kHz or less and typically (depending upon individual klystron sensitivity) with FM voltage amplitudes of 40 volts or less between 800 and 1600 MHz and 60 to 75V between 1600 and 2400 MHz.

NOTE

Power may be leveled above 0 dBm over that portion of the band where the desired power is available.

7. Set ATTENUATION (DB).
8. Depress EXTERNAL FM.
9. Apply modulating signal to EXTERNAL FM INPUT (front or rear panel).
10. Take leveled and attenuable frequency modulated RF power output at CAL RF POWER OUTPUT.
11. Take unleveled FM-modulated RF power at UNCAL RF POWER OUTPUT.
12. ΔF control should be centered so that the klystron will operate in the center of the mode.

Figure 3-7. External FM Modulation



1. Depress LINE.
2. Check that meter pointer on DBM meter is on ZERO SET mark.
3. Depress RF.
4. Set FREQUENCY (MC).

NOTE

The modulator used is an absorption-type. If leveling mode of operation is not used, the positive portions of AM modulating signal will be clipped.

5. Depress INTERNAL ALC.
6. Adjust ALC CAL OUTPUT control for a -3 dBm reference on DBM meter. A -3 dBm reference on the DBM meter is the most common used

because this allows the AM signal to modulate the RF up to 3 dB above the output level.

7. Set ATTENUATION (DB) to 000 or less; re-check DBM meter.
8. Depress AM button.
9. Apply AM modulating signal to external AM INPUT (5 to 6 volts peak to peak), *See 3-9/3-10*
10. Modulated signal available at CAL RF OUTPUT only.

11. The ΔF control may be adjusted for small changes in RF frequency and to peak maximum output power. However, adjusting too far from centered position will cause RF power to decrease and, if in leveled operation, poor leveling.

Figure 3-8. External AM Modulation

SECTION IV PRINCIPLES OF OPERATION

4-1. INTRODUCTION

4-2. Basically, the instrument includes an RF Oscillator, PIN Diode Modulator, Automatic Leveling Circuit, Modulation Circuits, and Power Supply as shown in Figure 4-1. The RF Oscillator is a reflex klystron which always operates CW. The PIN diode modulator is a current-controlled device that attenuates RF power up to 20 dB or more. The control circuits provide the modulation currents required by the PIN modulator. The power supply provides the regulated dc voltages required to operate the circuits in the instrument.

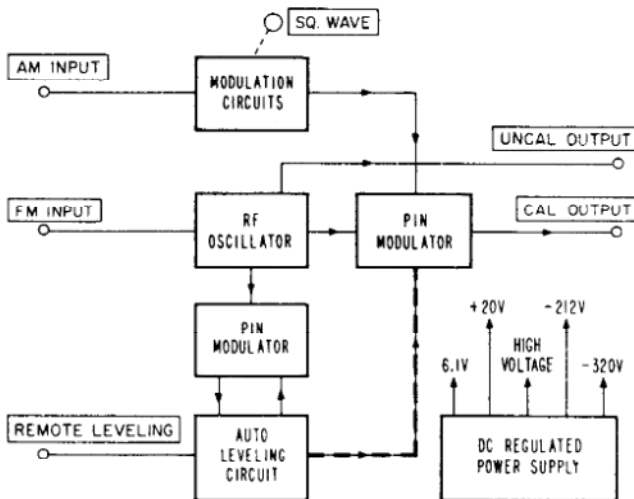


Figure 4-1. Circuit Block Diagram

4-3. RF OSCILLATOR

4-4. The RF Oscillator, providing the RF power, consists of a velocity-modulated tube operating in an external resonant cavity. The tube is a reflex klystron operating in the $1\frac{3}{4}$ and $2\frac{3}{4}$ repeller modes.

4-5. The RF power output from the oscillator, which may be CW or CW with FM, is obtained from the resonant cavity by means of pickup probes located in small sections of waveguide which open into the resonant cavity. One of these probes delivers RF power directly to the UNCALIBRATED RF OUTPUT connector, the other two deliver RF power to the PIN modulator.

4-6. PIN DIODE MODULATOR

4-7. The PIN modulator, which is two nearly identical units in one, is a high-speed, current, controlled absorption-type attenuator. The Modulator is shown in Figure 5-11. A simplified illustration of the modulator is shown in Figure 4-2. Each PIN diode unit includes a transmission line, PIN diodes, low-pass filter, and two high-pass filters.

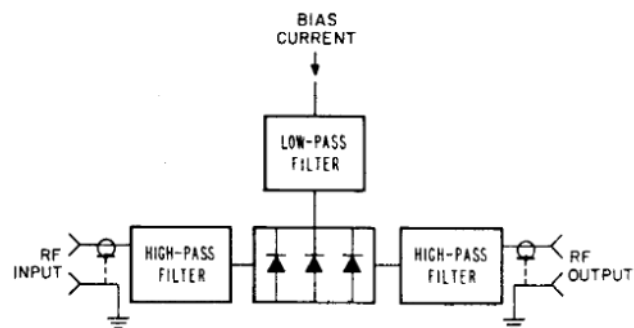


Figure 4-2. Simplified Block Diagram of PIN Modulator

4-8. The PIN diode is a slice of nearly pure silicon wafer in which the P and N traces are nearly equal. P-type impurities are diffused from one side into the wafer, and N-type impurities are diffused from the other side, leaving a layer of intrinsic semiconductor (silicon) through the middle; thus the name PIN diode. At frequencies below 100 MHz the PIN diode rectifies the same as any other good junction diode. However, at frequencies above 100 MHz, rectification efficiency drops rapidly because of carrier storage in the intrinsic (I) layer.

4-9. When forward-bias current flows through the PIN diode, holes and electrons are stored in the I layer. The more the bias current, the larger the amount of stored charge-carriers. When reverse bias is applied, reverse current flows until the stored carriers are depleted. During this period, the diode impedance remains low. Currents above several hundred megacycles do not flow in the reverse direction for a long enough time to remove those charge carriers. Therefore, the microwave currents do not significantly change the instantaneous amount of charge carriers stored, and there is negligible rectification.

PIN DIODE MODULATOR (Cont'd)

4-10. There is, however, a resistance to microwave current flow. This resistance is inversely proportional to the number of charge carriers stored in the I layer, and the number of charge carriers, in turn, is proportional to the forward bias current. By varying the bias on a diode from back bias (no stored charge) to about $\frac{1}{2}$ mA forward bias, the resistance to microwave currents varies from approximately 5000 ohms to 30 ohms.

4-11. Pin Diodes Mounted in a Transmission Line.

To understand how a PIN modulator works, consider a PIN diode mounted across a transmission line that has a characteristic impedance of 50 ohms. When the diode is back-biased to about 5000 ohms, the microwave signal on the transmission line is unattenuated because 5000 ohms compared to 50-ohm line impedance has little effect. However, when the diode is forward-biased to about

30 ohms, most of the microwave current will flow through the 30-ohm diode instead of propagating down the 50-ohm transmission line. This current through the 30-ohm diode represents microwave energy dissipated as heat. Consequently, the diode actually absorbs microwave energy.

4-12. Figures 4-3 and 4-4 show the schematic of the PIN diode modulator used in the Model 8614A. The PIN modulator contains seven PIN diodes which are placed at approximately $\frac{1}{4}$ wavelength along each strip transmission line. The $\frac{1}{4}$ wavelength at mid-band spacing results in the lowest average SWR because reflection from one diode will tend to be absorbed and cancelled by the adjacent diode. The resistance in series with the diodes reduces voltage to the diodes and thereby protects the circuit.

4-13. Modulation input in the form of diode bias is used to change attenuation of the PIN diodes.

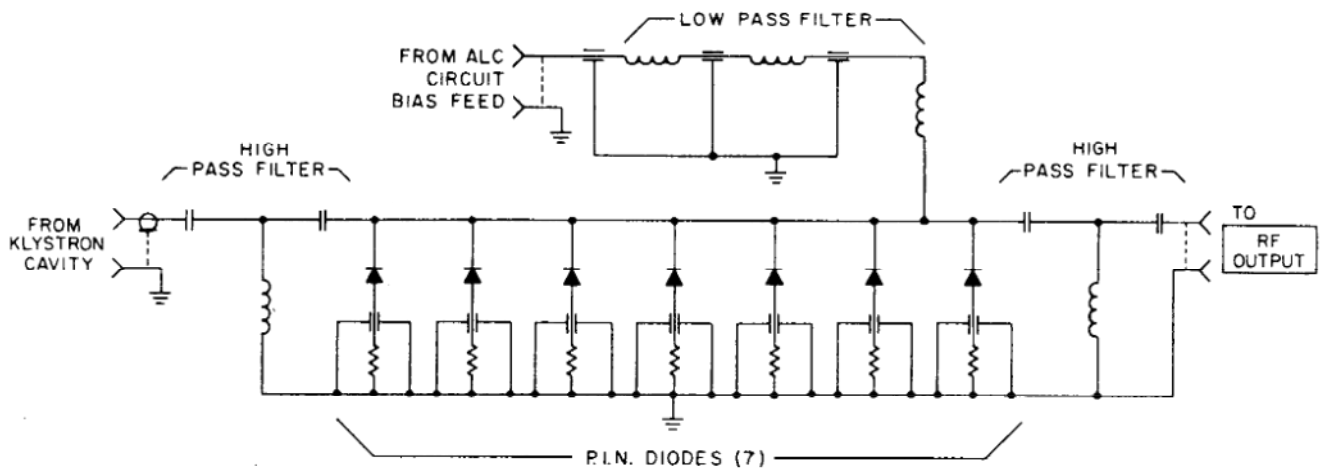


Figure 4-3. Controlled RF Attenuator Unit

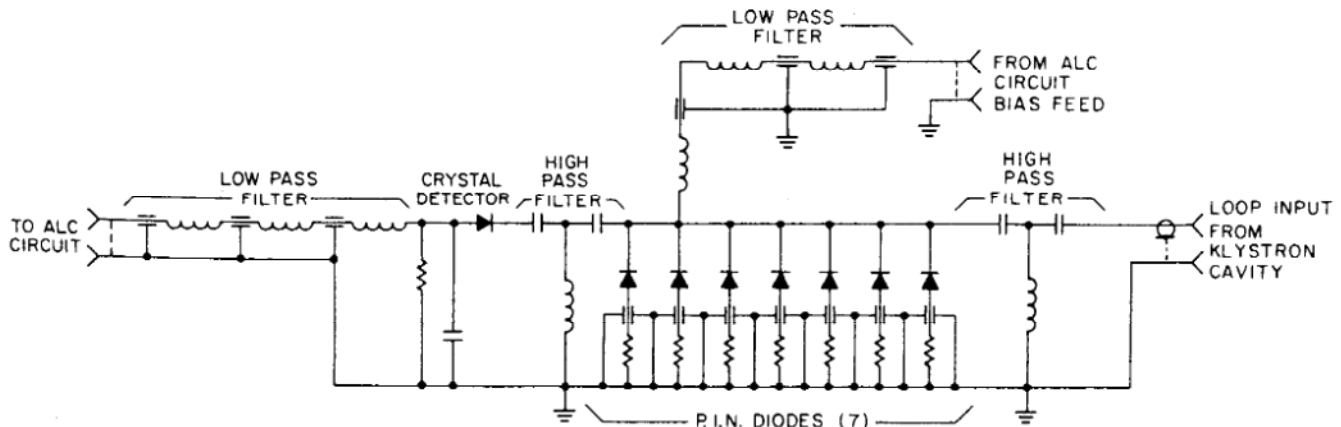


Figure 4-4. Control ALC Attenuator Unit

PIN DIODE MODULATOR (Cont'd)

Changes in diode bias produce changes in RF output level.

4-14. Modulation circuits external to the PIN modulator are protected by a low-pass filter (Figures 4-3 and 4-4) which prevents RF leakage. Leakage, if present, could cause erratic action in the circuits driving the PIN modulator and could also cause RF interference.

4-15. The high-pass filters (Figures 4-3 and 4-4) permit RF energy to enter and leave the diode strip line while keeping the low frequency modulating signals from entering the RF circuits preceding or following the PIN modulator.

4-16. MODULATION CIRCUITS

4-17. The basic function of the modulating circuit is to provide the forward- or reverse-bias to the RF PIN attenuator unit. The arrangement of the modulation circuit depends upon the mode of operation. The mode of operation is selected by depressing the appropriate front-panel button.

4-18. External Pulse

4-19. A simplified diagram of the circuits used in the external pulse mode of operation is shown in Figure 4-5. When the pulse button is depressed,

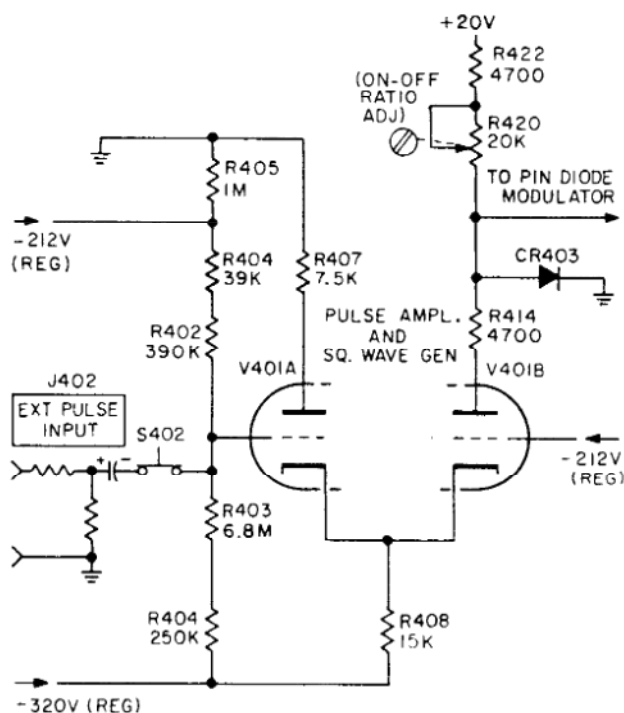


Figure 4-5. Pulse Modulation Circuit

V401A is cut off, and V401B is conducting. The conducting of V401B draws current through the PIN diodes in the RF attenuator unit; hence, conduction of V401B forward-biases the PIN diodes causing the RF output to decrease by more than 20 dB. A positive pulse applied to the external pulse input turns V401A on, turns V401B off, and allows RF power to pass through the PIN diode attenuator with the RF output level clamped to a set level by CR403. The amount of bias applied to the PIN diodes is limited by R420. Resistor R422 prevents the +20 volt supply from shorting to ground through CR403 when resistance of R420 is minimum.

4-20. Internal Square Wave

4-21. A simplified diagram of the circuits used in the internal square wave mode of operation is shown in Figure 4-6. When V401B is conducting, capacitor C402 is discharging toward approximately -200 volts while holding V401A cut off. When C402 discharges sufficiently, V401A begins to conduct and biases V401B off through the common cathode resistor R408. This results in C402 charging toward approximately -225 volts as long as V401 conducts. When C402 charges sufficiently, however, the current in V401A becomes limited and V401B again conducts causing V401A to cut off. The RC time constant of C402 is varied by R413, allowing frequency to be changed from 950 to 1050 Hz. When

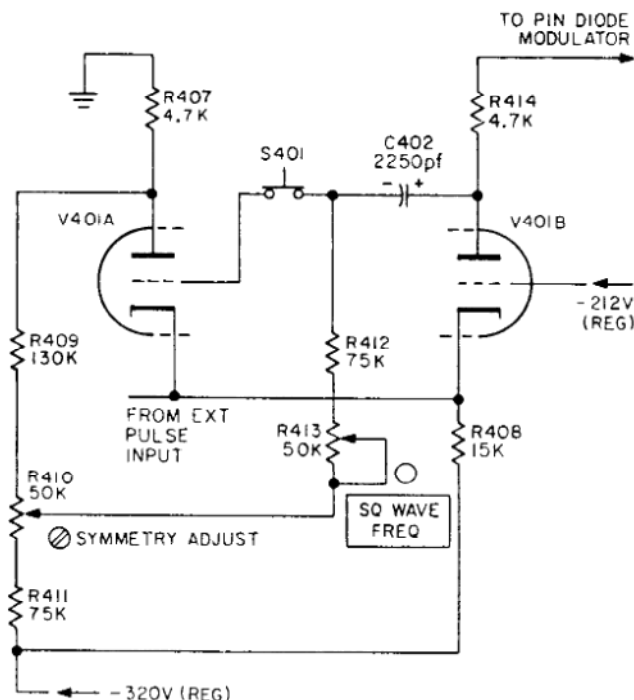


Figure 4-6. Square-Wave Modulation Circuit

Internal Square Wave (Cont'd)

401B is conducting the RF output is cut off by the PIN diodes. The symmetry of the square wave is adjusted by R410. R410 varies the voltage difference across C402; by varying R410, the time for C402 to charge or discharge to a given potential is controlled.

4-22. Synchronized Square Wave

4-23. With SQ WAVE and PULSE depressed and no signal applied to the pulse input, operation is as described in paragraph 4-21. When a positive pulse of at least 1 volt is applied to the cathode of V401A, tube current decreases. With limited current, V401B begins to conduct, causing the RF output to cut off. Any input signal applied while V401B is conducting will not affect normal square wave circuit operation. Square-wave frequency may be synchronized to any pulse repetition rate between about 955 to 1050 Hz providing internal square-wave frequency is set to a slightly slower rate.

4-24. External AM

4-25. A simplified diagram of the circuit used in the external AM mode is shown in Figure 4-7. With the AM button depressed, diode CR403 conducts clamping the voltage at the junction of R420 and R419 to about +0.6 volts. This back-biases CR404 which causes current to flow through R419 and R418. When an applied signal goes positive, it reduces the bias current, through R419 and R418, to the controlled RF PIN modulator. Reduced bias current increases the back bias on the PIN diodes which allows more RF power to pass through the PIN modulator. A negative signal increases the bias current which increases the forward bias which causes increased attenuation of RF power through the PIN modulator

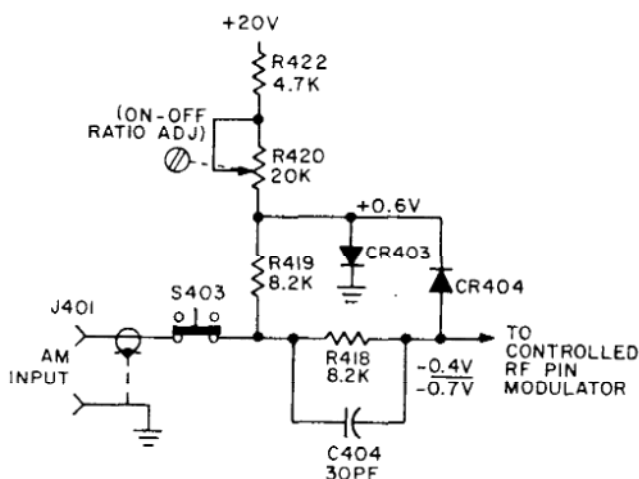


Figure 4-7. External AM Circuit

(up to about 20 dB maximum attenuation depending on the amplitude of the negative half cycle of the AM signal).

4-26. Since the PIN modulator is an absorption-type attenuator, it is necessary to lower the unmodulated RF output power level by an amount equal to the peak level of the AM signal so that the positive peaks will not be clipped. To do this, the instrument must be operated in the leveled mode of operation so that the ALC CAL CONTROL can be used to set the RF carrier power level.

4-27. For most purposes a signal level reduction of up to 20 dB should be sufficient since it approximates 100% modulation. The amount of distortion is dependent upon the percentage of modulation: at 30% modulation the amount of distortion is almost unnoticeable; at 100% modulation the distortion may be 5 to 20%.

4-28. Internal Meter and Automatic Level Control (ALC)

4-29. A simplified diagram of the ALC circuit is shown in Figure 4-8. The meter amplifier is a dual function circuit, performing both a leveling and/or a power output monitoring function. RF power is taken from the klystron cavity through the ALC attenuator assembly (part of the PIN diode modulator) and delivered to the ALC circuit. The meter amplifier monitors the power level and in leveled operation with the ALC amplifier, maintains a constant RF output.

4-30. Actual operation is as follows: RF power from the klystron is coupled from a fixed probe in the klystron cavity to the ALC attenuator (part of the PIN diode modulator). The RF power is delivered through a high-pass filter to the ALC diode attenuator, then through another high-pass filter to a crystal detector. The detected signal from CR701 is then delivered to a low-pass filter and to the ALC circuit.

4-31. The crystal detector CR701 is arranged so that the detected signal is negative in polarity. An increase in RF level as the klystron is tuned across the band will cause a more negative output. A decrease in RF power from the klystron causes a less negative output. The detected RF output level from CR701 is then delivered to the base of Q501A.

4-32. Consider the circuit operation when the RF level from the klystron increases. An increase in klystron output level causes a more negative signal

Internal Meter and Automatic Level Control (ALC) (Cont'd)

on the base of Q501A. The conduction of Q501A decreases, causing the collector of Q501A to go in a positive direction. The positive signal goes through the cathode follower, V401, and is applied to the base of Q502, decreasing the conduction of Q502. The collector of Q502 goes more negative.

4-33. A portion of the negative-going signal from the collector of Q502 is applied to the base of Q501B as negative feedback. The feedback factor is determined by the ratio of R513 to R514. The open loop gain of the meter amplifier (Q501A/B, Q502, and Q503) is sufficiently high so that the closed loop gain is essentially a function of the feedback factor and is, therefore, less dependent upon the normal aging effects on the tubes and transistors in the circuit.

4-34. The negative-going signal from Q502 is also applied to the meter M501 for output indication. The meter is protected against overload by the breakdown diode CR501. If the internal ALC switch, S601, is on, the negative-going output is applied to the base of the differential amplifier, Q601, causing a decrease in conduction. The collector of Q601 will go more positive, causing an increase in conduction of the emitter followers, Q603 and

Q604. This causes the emitter of Q604 to also become more positive. The positive-going signal is applied to the bases of Q605 and Q606, increasing their conduction and causing both collectors to become more negative.

4-35. The collectors of Q605 and Q606 appear as constant current sources, so the decrease in collector potential causes current to be drawn from the PIN diodes. This increased bias current (increased forward bias) reduces the RF power output to its original level. The negative-going output from Q605 is delivered to the RF PIN diode attenuator allowing less RF to pass through it also. The net result is that an increase in klystron output causes an increase of forward bias on the PIN diodes which decreases the RF output.

4-36. Leveling Accuracy. For accurate leveling, the ALC and RF PIN diode attenuators must track together as far as attenuation and frequency are concerned. The adjustment of R614, R615, R620, and R621 provide for matching the attenuator characteristics.

4-37. ALC CAL Output. The RF OUTPUT can be controlled by adjusting the front panel ALC CAL OUTPUT control which varies the bias on the base of the differential amplifier, Q602, which in turn changes the bias on the PIN diode attenuator.

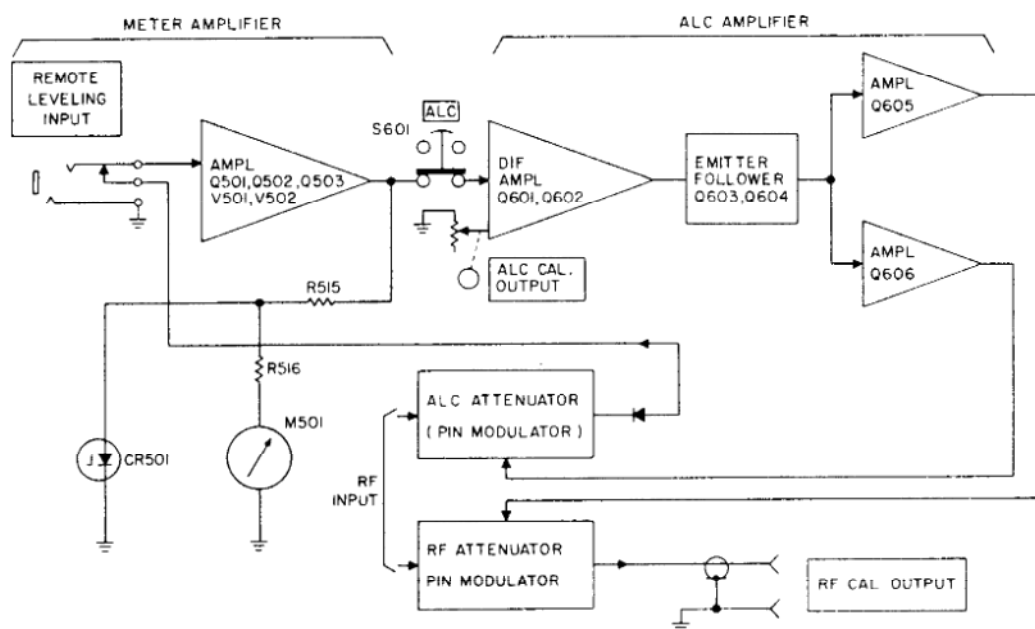


Figure 4-8. ALC and Meter Circuit

4-38. External Leveling

4-39. A simplified diagram of the ALC circuit is shown in Figure 4-8. Operation of the external leveling is the same as that described for internal leveling except that the ALC Attenuator and Q606 are no longer a part of the circuit. Also, the meter M501 does not accurately indicate RF output. If the RF output is to be changed, an external attenuator must be used once leveling is set up.

4-40. Regulated Power Supply

4-41. There are three regulated power supplies: high voltage, +20 volt, and filament. All three supplies are *series-regulated* types. The *series regulator* is connected in series with the main load. The output voltage is monitored and compared to a reference voltage. The voltage differential is applied through a control amplifier to the series regulator. This differential voltage changes the effective resistance of the series regulator which in turn holds the output voltage constant (see Figure 4-9).

4-42. The high-voltage supply consists of two supplies which have been combined to obtain required voltages. They are a -320 volt supply on which a

-350 volt supply has been stacked to provide a total of -670 volts. Both supplies use voltage doublers to drive series regulator circuits. Since this is a combined circuit arrangement, the -320 volt and -350 volt supplies are interdependent. There is also a gas regulator tube, V105, connected to the -320 volt supply to provide a -212 volt regulated source.

4-43. There are two low-voltage supplies. One provides +20 volts *ac* for the ALC circuit, the other 6.1 volts *dc* for filament operation. The +20 volt supply uses a voltage doubler and series regulator, while the filament supply uses a half-wave rectifier and a series regulator.

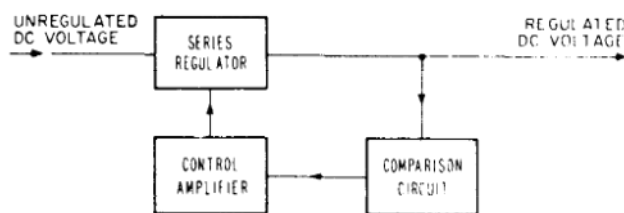


Figure 4-9. Series-Regulated Power Supply

SECTION V MAINTENANCE

5-1. INTRODUCTION

5-2. This section provides instructions for performance testing, calibrating, troubleshooting, and repairing the signal generator. If the serial prefix (the first three numbers of the serial number) of your instrument is different than that listed on the title page of this manual, differences exist between your instrument and the instrument described in this section (refer to the Appendix for difference information).

5-3. PERIODIC MAINTENANCE

5-4. Cleaning Air Filter

5-5. Inspect the air filter regularly and, if necessary, remove and wash in detergent and water. Dry filter and replace: no oiling or coating of filter is necessary. Unrestricted air flow gives longest component life. Keep the filter clean.

5-6. Lubrication

5-7. No routine lubrication is needed. Lubricate mechanical parts (e.g., dial drive, klystron cavity carriage assemblies) only when necessary using light machine oil on shafts and light grease on gears.

5-8. PERFORMANCE CHECKS

5-9. **Purpose.** The procedures of paragraphs 5-10 through 5-17 check signal generator performance for incoming inspection, periodic evaluation, calibration,

and troubleshooting. The tests can be performed without access to the signal generator interior. The specifications of Table 1-1 are the performance standards.

5-10. **Test Equipment Required.** The test instruments required to make the performance checks are listed in Table 5-1. Test instruments other than the ones listed may be used provided their performance equals or exceeds the Critical Specifications.

5-11. Frequency and Power Check

- Connect equipment as shown in Figure 5-1.
- Set up Signal Source as follows:
 LINE depressed
 RF depressed
 ΔF centered
 FREQUENCY (MC) 800
- Set Power Meter for a mid-scale reading.
- Using calibrated frequency meter, measure actual signal frequency. Specification: accuracy must be ± 5 MHz. Note: frequency meter must be calibrated to an accuracy of approximately $\pm 0.03\%$.
- Repeat above procedure every 200 MHz and at all points of particular interest to a frequency dial indication of 2400 MHz.
- If dial accuracy is not within specification, refer to paragraph 5-59 for adjustment procedure.

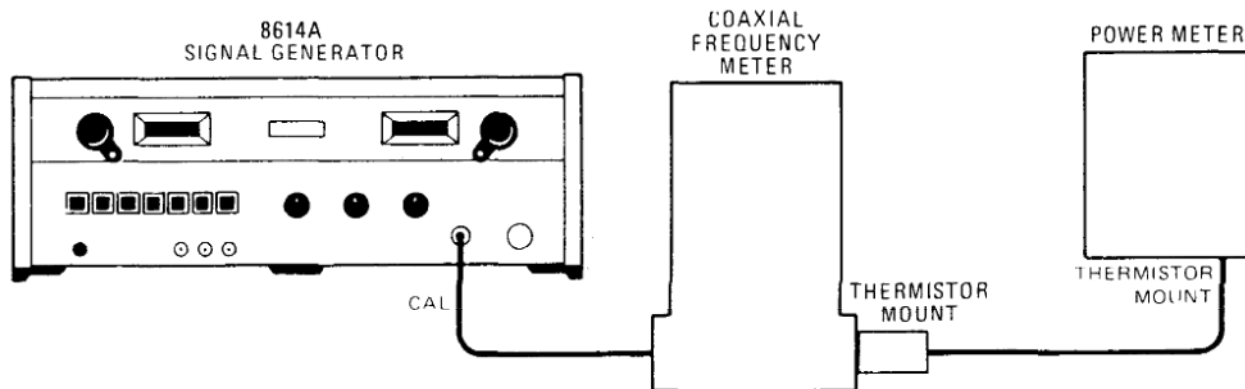


Figure 5-1. Frequency and Power Measurement

Table 5-1. Test Equipment Required

Instrument Type	Check	Critical Specifications	Recommended Instrument
Oscilloscope	Calibration Troubleshooting Performance	Frequency Response: > 1 MHz Range: 30 to 0.5 μ s/cm Sensitivity: 0.005 to 1.0 V/cm Accuracy: $\pm 3\%$	HP Model 180C with HP 1801A and HP 1821A
Crystal Detector	Calibration Troubleshooting Performance	Frequency Range: 800 to 2400 MHz Sensitivity: 100 mV/0.35 mW Frequency Response: ± 0.5 dB	HP Model 423A
Power Meter	Calibration Performance	Power Range: 0.1 to 10 mW Frequency Range: 800 to 2400 MHz Accuracy: $\pm 3\%$	HP Model 432A Power Meter with HP Model 478A Thermistor Mount
DC Voltmeter	Calibration Troubleshooting	Range: 1 to 685V Accuracy: $\pm 0.2\%$ of reading Floating Input: may operate within ± 470 Vdc of chassis ground	HP Model 3435A Digital Voltmeter
AC Voltmeter	Calibration Troubleshooting	Range: 0 to 20 mV Accuracy: $\pm 2\%$ of reading Floating Input: may operate within ± 470 Vdc of chassis ground	HP Model 3435A Digital Voltmeter
Clip-On Milliammeter	Calibration Troubleshooting	Range: 0 to 35 mA Accuracy: $3\% \pm 0.1$ mA	HP Model 428B
Frequency Counter	Calibration Performance	Range: 800 to 2400 MHz	HP Model 5342A
Pulse Generator	Calibration Performance	Pulse Width: 3 μ s Pulse Rep Rate: 50 Hz to 50 kHz Output: 27V peak	HP Model 214B
FM Modulator	Calibration	Outputs: 300V peak-to-peak and 6.3 Vac Input: 115 Vac, 60 Hz Phase Adjustable: Approx 80°	Power Transformer (1) (9100-0045) Capacitor (1) (0160-0904) Potentiometers (2) (2100-0047) Fuseholder, extractor post type (1) (1400-0084) Power Cord (1) (8120-0050) Fuse (1) Amp, 115V, Slo Blow (2110-0007) (see Figure 5-14)
DC Power Supply	Troubleshooting	Output: 315 to 353 Vdc Ripple: Less than 3 mV	HP Model 711A
Test Oscillator	Calibration Check	Frequency Range: 10 kHz Output: 5 to 6V peak Output Impedance: 50 ohms	HP Model 651B
Electronic Counter	Calibration Check	Compatible with Transfer Oscillator	HP Model 5245L
Transfer Oscillator	Calibration Check	Frequency Range: 90 MHz Harmonic: 20	HP Model 5257A
Modulation Analyzer	Calibration Check	Carrier Frequency: 500 kHz Audio Filtering: 15 kHz Low Pass	HP Model 8901A
Ohmmeter	Troubleshooting	Range: .02 to 500 megohms Accuracy: $\pm 3\%$ of full scale	HP Model 410C
10 dB Attenuator	Calibration Performance	Frequency Range: DC to 12.4 GHz	HP Model 8491A

Frequency and Power Check (Cont'd)

g. To check power output: remove frequency meter from test setup and measure maximum power output at both CAL and UNCAL RF OUTPUT connectors. Specification: The sum of attenuation of 10-dB attenuator plus power meter reading must be at least +10 dBm at CAL RF OUTPUT. The attenuator attenuation and meter reading must equal at least -3.0 dBm at UNCAL RF OUTPUT. If either output is not satisfactory, refer to paragraphs 5-58 and 5-60.

5-12. Leveled Output Check

a. Connect instruments as shown in Figure 5-1, omitting the frequency meter.

b. Set up Model 8614A as follows:

LINE	depressed
RF	depressed
FREQUENCY (MC)	800 MC
ALC	depressed
ALC CAL OUTPUT	counterclockwise
ΔF	centered

NOTE

Before ALC button is depressed, DBM meter should indicate approximately +1 dBm; depressing ALC button should cause DBM meter indication to decrease. ALC CAL OUTPUT: 0 dBm (DBM meter indication); ATTENUATOR (DB): -0 dB or less.

c. Set power meter for mid-scale reading.

d. Noting power meter variation from setting (step c), tune Model 8614A across frequency band. The variation should not exceed ± 0.75 dB.

e. If ALC operation is not satisfactory, refer to paragraph 5-64.

5-13. On-Off Ratio Check

a. Connect instruments as shown in Figure 5-1, omitting the frequency meter and attenuator.

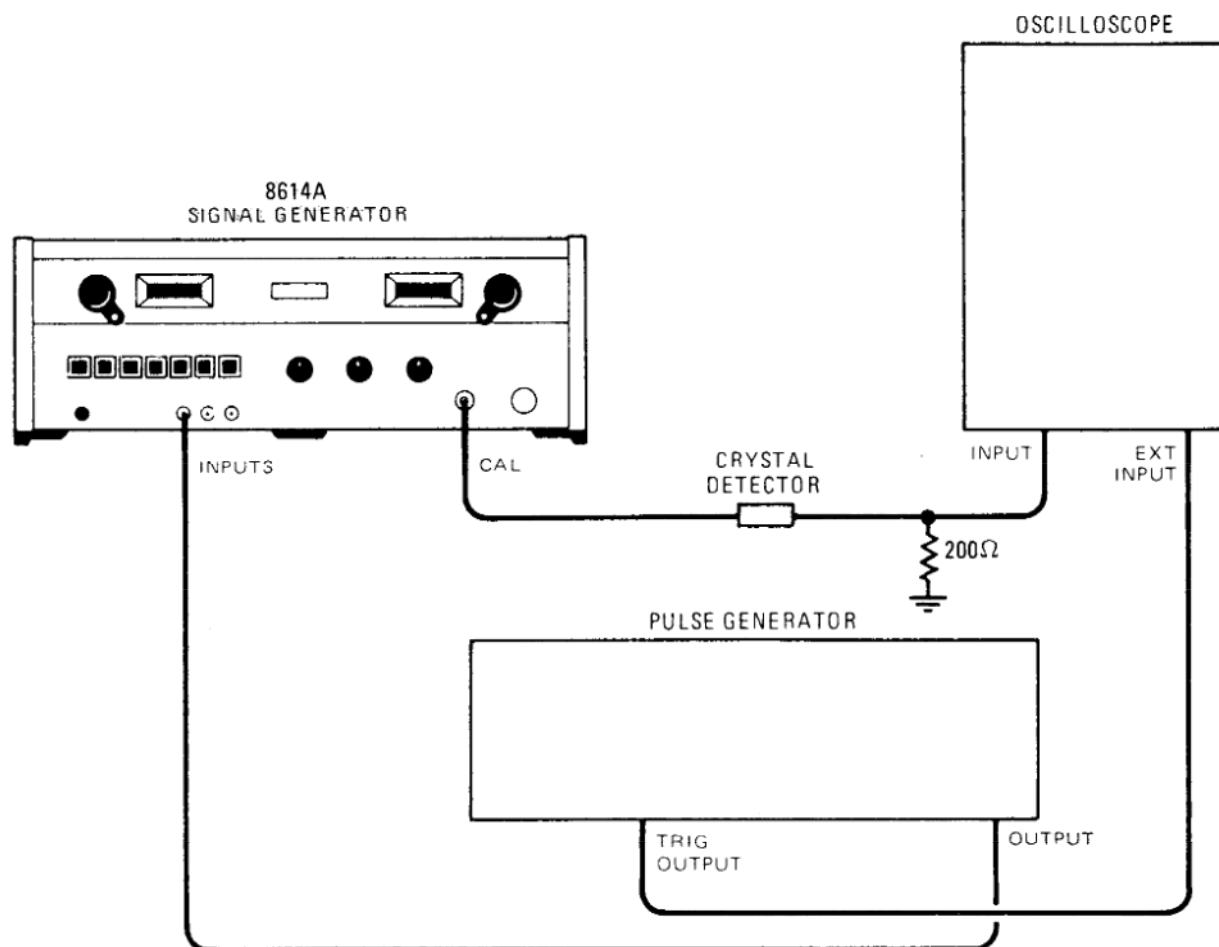


Figure 5-2. External Pulse Check

On-Off Ratio Check (Cont'd)

- b. Set up Model 8614A as follows:
- | | |
|------------------|---------------|
| LINE | depressed |
| RF | depressed |
| FREQUENCY (MC) | 2400 |
| EXTERNAL PULSE | not depressed |
| ATTENUATION (DB) | 000 |
| ALC | depressed |
| ΔF | centered |
- c. Set power meter on 0 DBM scale and adjust Model 8614A for convenient reference.
- d. Depress EXTERNAL PULSE on Model 8614A.
- e. Reference on the power meter should change to the -20 DBM scale. Specification: On-off ratio must be at least 20 dB.
- f. If on-off ratio is not at least 20 dB, refer to paragraph 5-68.

5-14. Pulse Modulation Check

- a. Connect instruments as shown in Figure 5-2.

NOTE

Oscilloscope vertical input should be shunted with 200-ohm resistor.

- b. Set up Model 8614A as follows:
- | | |
|------------|-----------|
| LINE | depressed |
| RF | depressed |
| EXT PULSE | depressed |
| ΔF | centered |
- c. Set up pulse generator for a +20 volt, 50-prf signal with a pulse width of 4 μ s.
- d. A pulse presentation should be seen on the oscilloscope. Specification: Rise Time, 2 μ s.

- e. Set up pulse generator for a +20 volt 5000-prf signal with a pulse width of 4 μ s.
- f. A pulse presentation should be seen on the oscilloscope. Specification: Rise Time, 2 μ s.
- g. If pulse operation is not satisfactory, refer to paragraph 5-69.

5-15. Square-Wave and Sync Check

- a. Connect instruments as shown in Figure 5-3 (see Note, paragraph 5-14, step a).
- b. Set up Model 8614A as follows:
- | | |
|------------------|-----------------------|
| LINE | depressed |
| RF | depressed |
| SQ WAVE | depressed |
| ATTENUATION (DB) | 0 DB |
| SQ WAVE FREQ | full counterclockwise |
| ΔF | centered |
- c. Set oscilloscope sweep time to .1 MHz/CM.
- d. Readjust rate control to display one complete square wave on oscilloscope. Square wave symmetry should be better than 45/55%. Range should be at least 950 to 1050 Hz. If square wave operation is not satisfactory, refer to paragraph 5-70.
- e. To check external synchronization, connect equipment as shown in Figure 5-2.
- f. With Model 8614A set up as detailed in step b above, set pulse generator as follows:
- | | |
|---------------------|-----|
| AMPLITUDE | 2.0 |
| LENGTH (μ SEC) | 1 |
| SYNC SELECTOR | X10 |
| PULSE RATE | 100 |
| POLARITY | (+) |

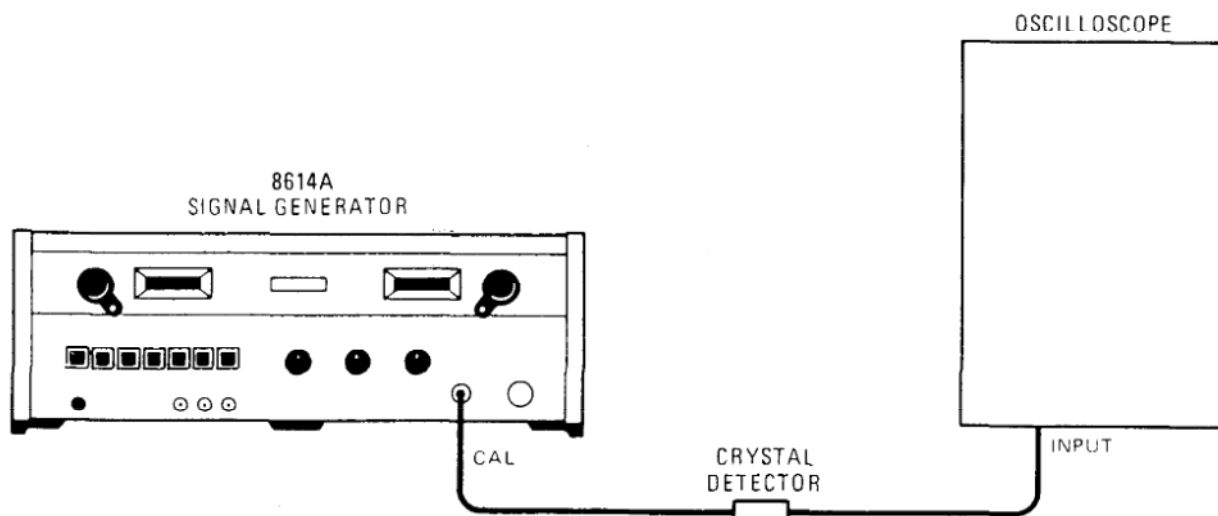


Figure 5-3. Internal Square-Wave Check

Square-Wave and Sync Check (Cont'd)

g. Set oscilloscope to INT TRIGGER SOURCE and adjust SQ WAVE FREQ for a period of 1 ± 0.02 ms.

h. Set oscilloscope to EXT AC TRIGGER INPUT and depress PULSE button. Slowly increase PULSE RATE of pulse generator until square wave presentation on oscilloscope becomes stationary. If synchronization operation is not satisfactory, refer to paragraph 4-22.

5-16. External AM Check

a. Connect instruments as shown in Figure 5-4 (see Note, paragraph 5-14, step a).

b. Set up Model 8614A as follows:

LINE	depressed
RF	depressed
AM	depressed
ALC	depressed

ALC CAL OUTPUT	-3 DBM
	(DBM Meter)
FREQUENCY (MC). . . .	800
ATTENUATION (DB) . . .	000 or less
ΔF	centered

c. Apply 5 to 6 volt peak sine wave to front panel BNC input.

d. Using ALC CAL OUTPUT, vary dc level of detected sinusoid so there is no peak clipping (vary input amplitude if necessary).

e. Adjust vertical sensitivity of oscilloscope to give 6-cm display of 1-kHz signal and then increase signal frequency to 1 MHz. The display should be greater than 3 cm.

f. If AM operation is unsatisfactory, refer to paragraph 4-24.

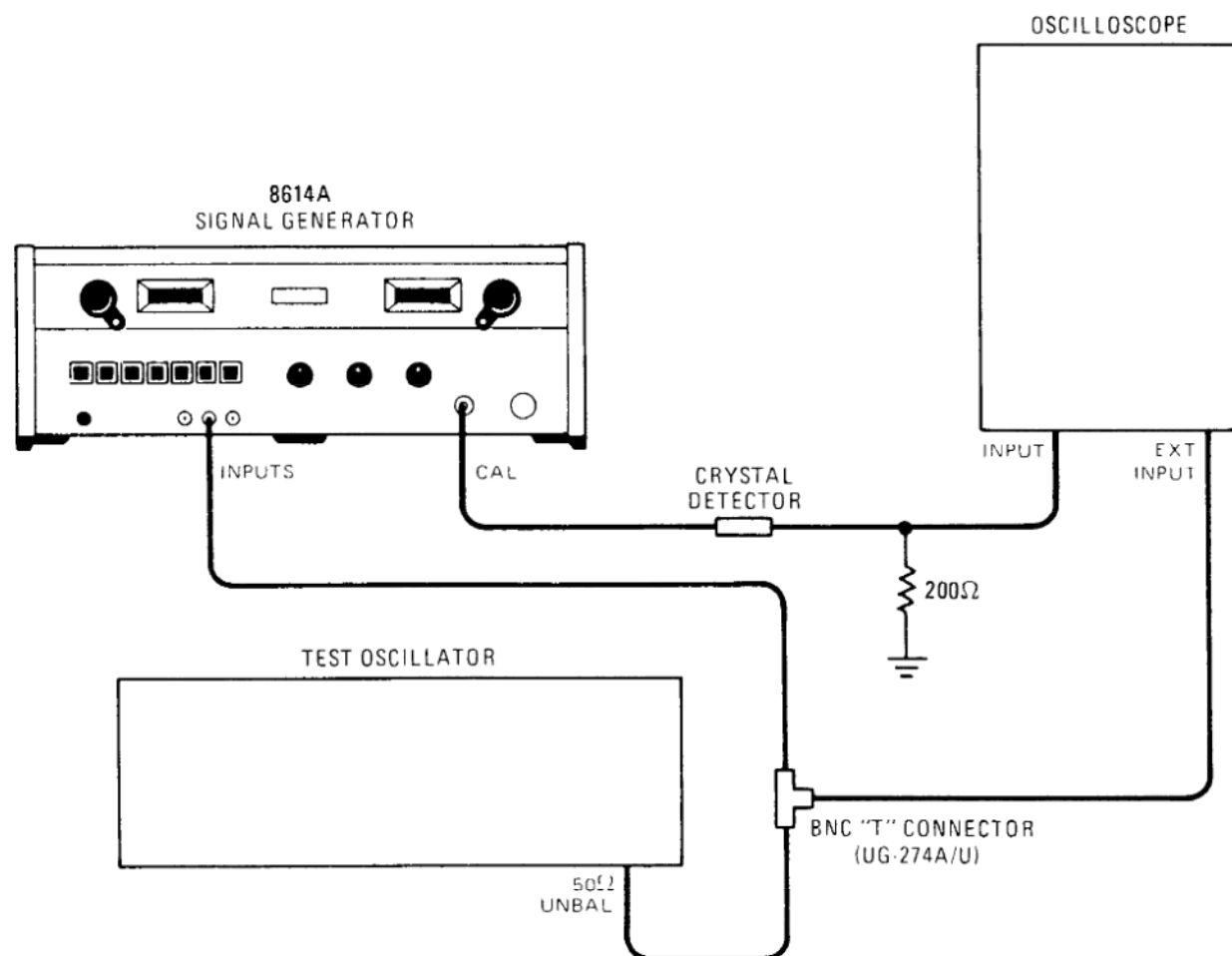


Figure 5-4. External AM Check

5-17. Measurement of Residual FM

- a. Connect equipment as shown in Figure 5-5.
- b. Set up ~~8614A~~ ^{8614A 900MHz} to ~~1.8 CHz~~ with LINE and RF pushbuttons pressed. Set RF output power to approximately -10 dBm.
- c. Adjust transfer oscillator for 90 MHz and harmonic of 20.
- d. Press AUTOMATIC and FREQ buttons on 8901A and tune 8616A frequency to obtain roughly 500 kHz to 1 MHz on 8901A display.
- e. Press FM, 15 KHZ LOW PASS, and AVG buttons. Also make sure FM De-emphasis is off.
- f. Read residual FM on display. It should be less than 5000 Hz.

5-18. TROUBLESHOOTING

5-19. Locating Trouble

5-20. Always start locating trouble with a thorough visual inspection for burned-out or loose components, loose connections, or any condition which suggests a source of trouble. Check tubes for open filaments

by touching tubes and replace all that are cold (except V105 and V202 which are cold cathode tubes). Replacing a cold tube, in some cases, will restore the generator to normal operation. Check the fuse to see that it is not open.

5-21. If trouble cannot be isolated to a bad component by visual inspection or a cold tube, the trouble should then be isolated to a circuit section. Isolation to a circuit section can best be accomplished by reference to the block diagram (Figure 5-20), the troubleshooting charts (Tables 5-2 and 5-3), and isolation of all trouble symptoms using the performance check procedure (paragraph 5-8).

5-22. When testing the signal generator, it is recommended that line voltage be applied through a variable transformer and that the transformer be adjusted to deliver line voltage at the low end of the rated range (103 Vac for 115-volt operation and 207 Vac for 230-volt operation). An instrument in good condition should operate satisfactorily from any voltage within rated range, but where there is marginal operation (from weak tubes, etc), weaknesses become easier to trace at low line voltages.

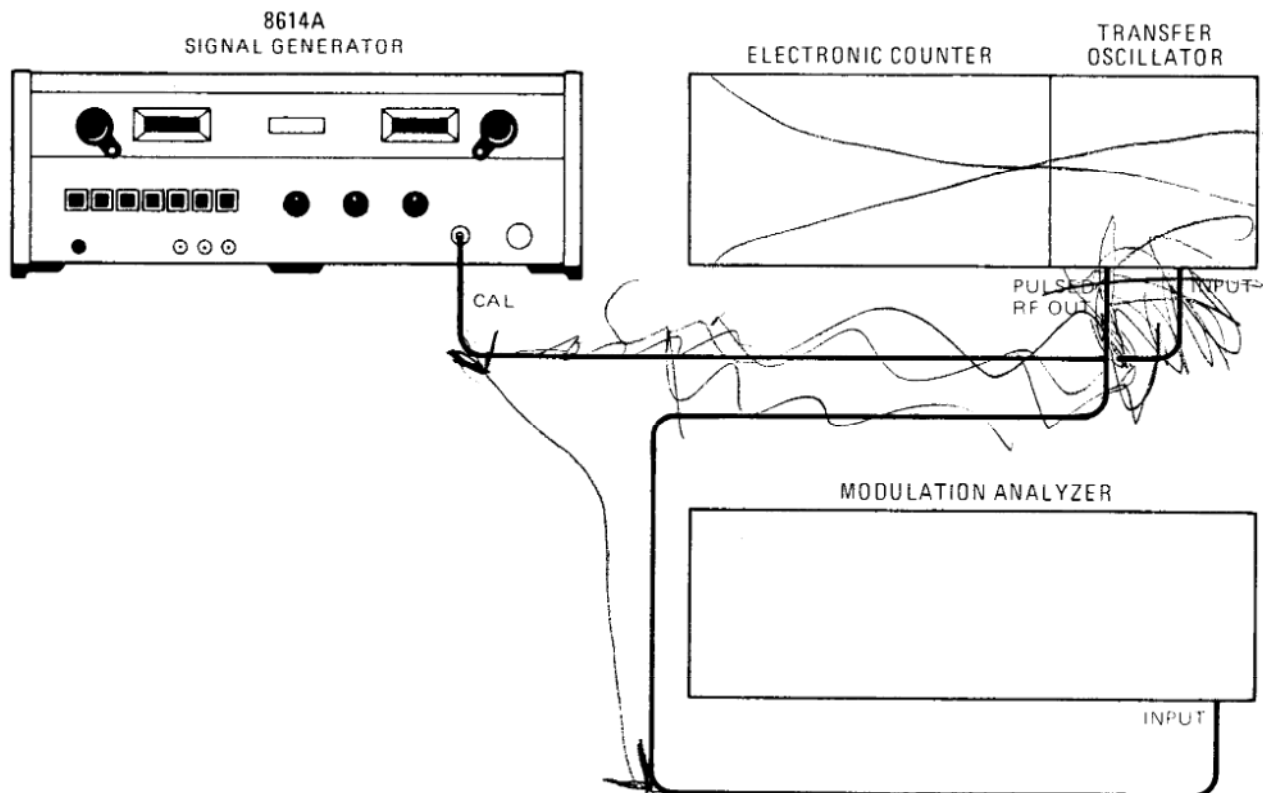


Figure 5-5. Residual FM Check

Table 5-2. Power Supply Troubleshooting

Symptom	Conclusion	Remedy
-350 VOLT SUPPLY Connect voltmeter common to test point 1 and voltage lead to test point 2 (see Figure 5-7). -350 $\pm$ 2 Vdc; 4 mV ac Small deviation Large or erratic deviation	Supply OK Out of adjustment -350V or -320V supply bad NOTE <i>See Figure 5-21 for component location.</i>	Adjust R212 (see Figure 5-6) Remove V101 and V102 and connect a -320 Vdc power supply between test point 1 and chassis ground. Recheck supply. If deviation still exists, check C201, C202, CR201, or CR202 voltages at test point 14 (see Figure 5-21). If OK, check V201, V202, V203, and V204.
-320 VOLT SUPPLY Connect voltmeter common to chassis ground and voltage lead to test point 1 (see Figure 5-7). +320 $\pm$ 5 Vdc; 7 mV ac Small deviation	Supply OK -350V supply out of adjustment -320V or -35V supply bad NOTE <i>See Figure 5-21 for component location</i>	Check and adjust -350V supply Remove V201 and connect a -350 Vdc power supply between test points 1 and 2. Recheck supply. If deviation still exists check C101, C102, CR101, or CR102 voltages at test point 13 (see Figure 5-21). If OK check V101, V102, V103, and V104.
-212 VOLT SUPPLY Connect voltmeter common to chassis ground and voltage lead to test point 5 (see Figure 5-7). -212 $\pm$ 5 Vdc Voltage unstable	Supply OK Defective V105 Defective -320V regulation	Check V105 Check -320V supply
FILAMENT SUPPLY Connect voltmeter between test points 3 and 4 (see Figure 5-24) -6.15 $\pm$ 0.1 Vdc; 25 mV ac Small deviation Large or erratic deviation	Supply OK Out of adjustment -320V reference or filament regulation defective	Adjust R5 (see Figure 5-6) Check -320V supply Check Q1, Q2, CR1, or CR4 (see paragraph 5-27)
+20 VOLT SUPPLY Connect voltmeter common to chassis ground and voltage lead to test point 6 (see Figure 5-23). +20 $\pm$ 0.1V; 4 mV ac Small deviation Large or erratic deviation	Supply OK Out of Adjustment -212V reference or 20V regulation	Adjust R53 (see Figure 5-23) Check -212V supply Check Q50, Q51, Q52, Q53 (see para. 5-27)

Table 5-3. General Trouble Location

Symptom (outputs)	Trouble Location	Check
NO RF	High-voltage power supply Filament supply RF probes Broken ground connection PIN diodes Klystron	Measure supply voltages (see Table 5-2) Measure supply voltages (see Table 5-2) Measure resistance of RF probes (see paragraph 5-61) Check chassis ground connections on both circuit boards Check RF PIN diodes (see paragraph 5-68) V1
No Square Wave or Pulse	Modulation circuit	V401A/B
No ALC	Regulated +20V supply ALC circuit ALC probe PIN diodes	Measure supply voltages (see Table 5-2) V501-502, Q501-503, Q601-606 Measure resistance (see paragraph 5-61) ALC PIN diodes and CR701 (see paragraph 5-61 and 5-68)

5-23. Power Supply Trouble

5-24. Correct operation of the power supply is vital to proper operation of the signal generator. Noise or variation in the regulated voltages causes other circuits to operate in a random or erratic manner. It is advisable to make a voltage check of the power supply whenever the instrument is suspected of mar-

ginal operation. This eliminates factors such as low voltages or poor regulation which cause unsatisfactory performance in other sections of the instrument.

5-25. The power supply consists of two interdependent series-regulated high voltage supplies furnishing -320 and -670 volts as measured from chassis ground and two series regulated low voltage supplies furnishing -6.15 and $+20$ volts.

a. The -320 volt supply furnishes voltage to the klystron cathode and modulation circuit. It also furnishes a regulated -212 volts for the modulation, ALC, and $+20$ volt supply circuits. This

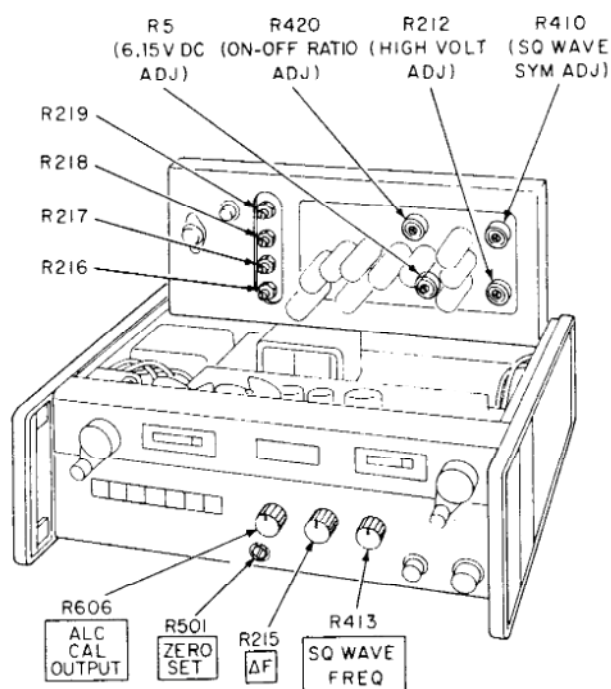


Figure 5-6. Electrical Adjustment Location

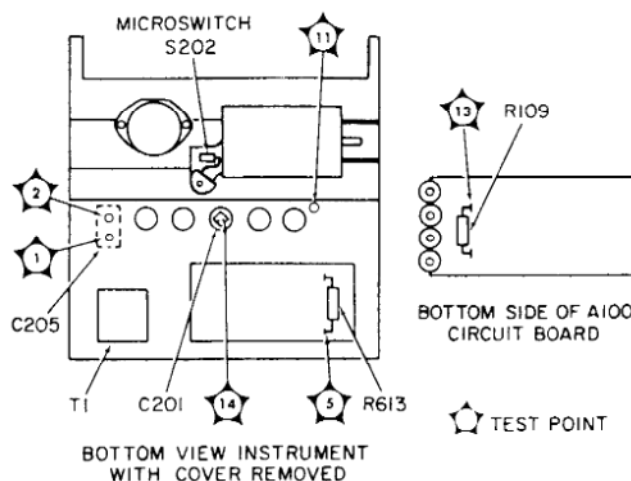
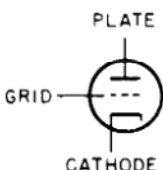
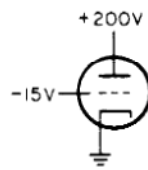
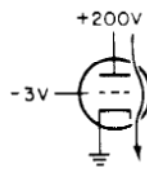
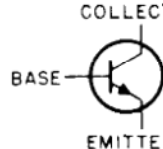
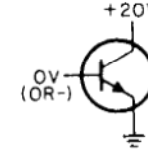
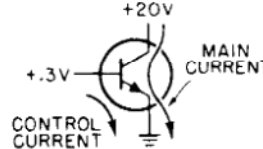
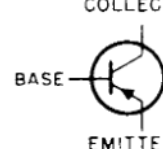
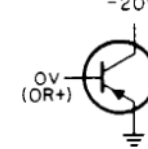
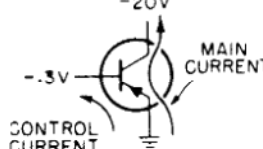


Figure 5-7. High-Voltage Test Point Location

A. TRANSISTOR BIASING			
DEVICE	SYMBOL	CUTOFF	CONDUCTING
VACUUM TUBE			
N P N TRANSISTOR			
P N P TRANSISTOR			

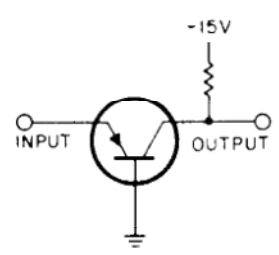
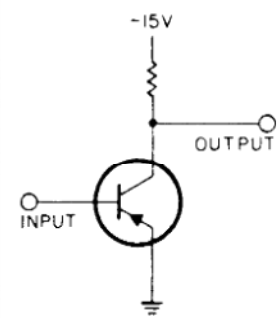
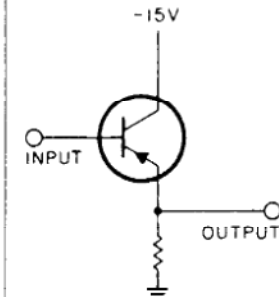
B. AMPLIFIER CHARACTERISTICS			
CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT Z	30-50 Ω	500-1500 Ω	20-500K Ω
OUTPUT Z	300-500K Ω	30-50K Ω	50-1000 Ω
VOLTAGE GAIN	500-1500	300-1000	<1
CURRENT GAIN	<1	25-50	25-50
POWER GAIN	20-30 dB	25-40 dB	10-20 dB
			

Figure 5-8. Transistor Biasing and Operating Characteristics

Power Supply Trouble (Cont'd)

—212 volts is taken from a voltage regulator tube, V105, included between the —320 volt supply and chassis ground.

b. The —670 volt supply consists of a —350 volt regulated supply stacked with the —320 volt supply. The —670 volt supply furnishes the klystron and modulation circuit.

c. The two low voltage supplies provide filament voltages (—6.15 volt supply) and operating voltages (+20 volt supply) to the ALC circuit. Both low voltage supplies are completely dependent upon proper operation of the high voltage supplies for their individual operation.

d. The two high voltage supplies are stacked and each supply provides reference voltages to the other. To troubleshoot either supply, always remove series regulator from one supply (V201 for the —350 volt supply) and replace with an external dc supply in order to check the other supply (see Table 5-2).

e. If trouble is isolated to either the —6.15 volt or +20 volt regulated supply refer to paragraph 5-27 for suggested troubleshooting techniques for transistor circuits (both “in-circuit” and “out-of-circuit” techniques).

5-26. To measure and adjust power supply voltages, remove top and bottom covers from instrument. Remove two screws that secure hinged power-supply board and place instrument on its side.

a. Set rear panel 115/230 switch as appropriate and check that proper fuse is installed in instrument.

b. Depress LINE button. Connect dc voltmeter and ac voltmeter in parallel and measure power supply voltages as instructed in Table 5-2.

WARNING

When using a metal case VTVM with common lead connected to chassis ground (the metal case), the metal case will be at common lead potential.

5-27. TRANSISTOR TROUBLESHOOTING

5-28. 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.

5-29. In-Circuit Testing

5-30. 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, this is the operational control point in the transistor. This junction is essentially 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. The A part of Figure 5-8 shows transistor symbols with terminals labelled. Notice that the emitter arrow points toward the type N material. The other two columns of the illustration compare the biasing required to cause conduction and cut-off 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 (open). 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 volts when collector current is 1–10 mA, and 0.4–0.5 volts 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 volts when collector current is low, and about 0.8–0.9 volts when collector current is high.

5-31. Figure 5-8, 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 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

In-Circuit Testing (Cont'd)

transistor. If collector voltage does not change the transistor has either an emitter-collector short circuit or emitter-base open circuit.

5-32. Out-of-Circuit Testing

5-33. The 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 its 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.

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

Transistor Type		Connect Ohmmeter		Measure Resistance (Ohms)
		Pos. lead to	Neg. lead to	
PNP Germanium	Small Signal	emitter	base*	200–250
		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 1M

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

5-34. ETCHED CIRCUITS

5-35. 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 5-6 lists required tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work.

- Avoid unnecessary component substitution: it can result in damage to the circuit board and/or adjacent components.
- Do not use a high-power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.
- Use a suction device (Table 5-6) 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.**
- After soldering, remove excess flux from the soldered areas and apply a protective coating to

Table 5-5. Ohmmeter Ranges for Transistor Resistance Measurements

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

Table 5-6. Etched Circuit Soldering Equipment

Item	Use	Specifications	Item Recommended
Soldering Tool	Soldering Unsoldering	Wattage rating: 37.5 Tip Temp: 750–800°F Tip size: 1/8 inch OD	Ungar #776 Handle with Ungar #1237 Heating Unit
Soldering Tip, general purpose	Soldering Unsoldering	Shape: chisel Size: 1/8"	Ungar #PL113
De-soldering aid	Unsoldering multi- connection components (e.g., tube sockets)	Suction device to remove molten solder from connection	Soldapullit by the Edsyn Company, Arleta, CA
Resin (flux) solvent	Remove excess flux from soldered area before appli- cations 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

ETCHED CIRCUITS (Cont'd)

prevent contamination and corrosion. See Table 5-6 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 or rotary motion to avoid damage to the plated-through conductor.

5-36. Component Replacement

- Remove defective component from circuit board.
- Remove solder from mounting holes using a suction desoldering aid (Table 5-6) or wooden toothpick.
- Shape leads of replacement component to match mounting hole spacing.
- 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.

5-37. Tube Socket Replacement. There are three ways to remove a tube socket from the etched circuit board:

- Cut terminals attaching socket to circuit board, remove socket, and unsolder remaining terminal pieces individually.
- Using long nose pliers, break insulating material of socket away from its metal connectors, then unsolder connectors from board individually.
- Use a special soldering iron tip designed to heat all socket connections simultaneously

ETCHED CIRCUITS (Cont'd)

and remove socket as a unit; or use a suction device (Table 5-6) to desolder all connections and remove socket.

5-38. 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.

5-39. Transistor Replacement

- Do not apply excessive heat. See Table 5-6 for soldering tool specifications.
- Use a heat sink such as pliers or hemostat between transistor body and hot soldering iron.
- 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.

5-40. KLYSTRON REPLACEMENT**5-41. Tube Removal****WARNING**

BEFORE ATTEMPTING KLYSTRON REMOVAL OR REPLACEMENT, BE CERTAIN THAT LINE POWER IS COMPLETELY REMOVED FROM INSTRUMENT.

- Remove panel cover on left (with respect to front panel) side of instrument.
- Set klystron frequency drive at top end (2400 MHz frequency dial setting).
- Using truarc pliers which are available in a repair kit, HP Part No. 08614-800, remove the outer truarc ring from the outer cover of the klystron cavity (see Figure 5-9).
- Remove outer cover. Pull tube socket from klystron with a straight pull.

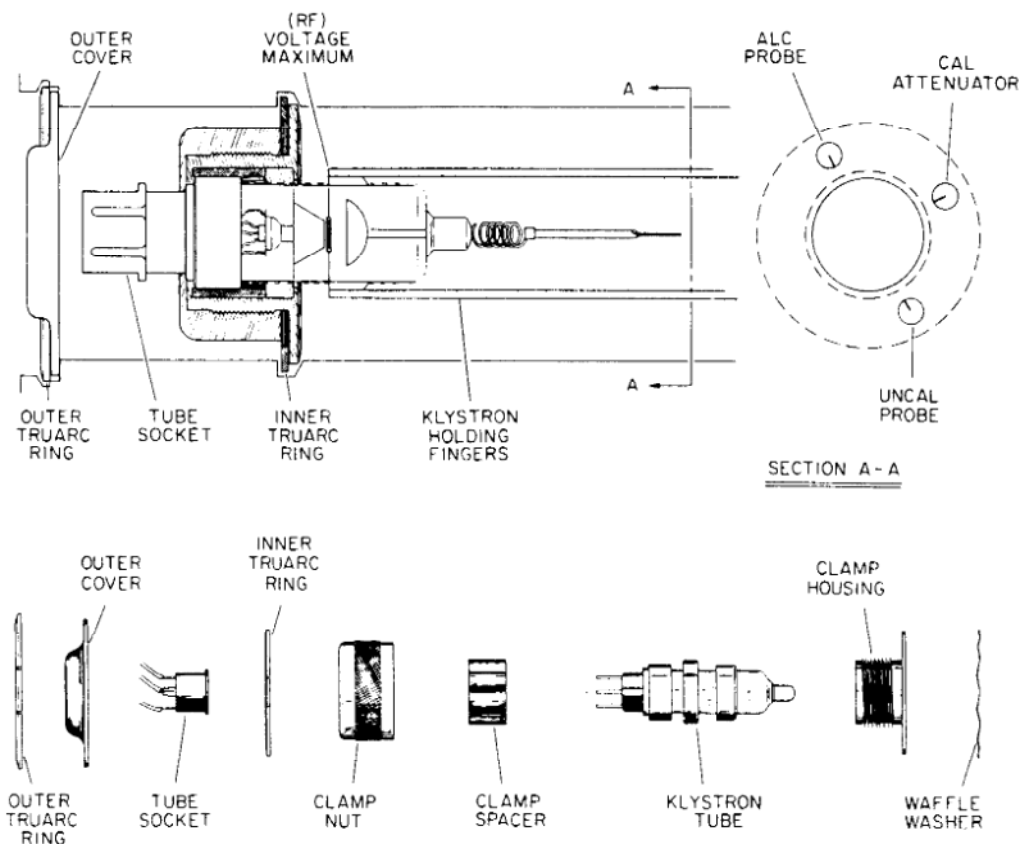


Figure 5-9. Klystron Cavity Assembly, Cutaway View

Tube Removal (Cont'd)

- e. Remove inner truarc ring holding klystron clamp housing in klystron cavity. Grasp klystron tube and remove from cavity.
- f. Unscrew clamp nut, lift out clamp saucer, and remove klystron (see Figure 5-9).
- g. Remove waffle washer from cavity.

NOTE

Refer to paragraph 1-14 for klystron warranty claim instructions.

5-42. Tube Replacement

- a. Reassemble new klystron, housing, spacer, and nut.
- b. Set klystron frequency drive at top end (high frequency dial setting) for klystron centering.
- c. Place waffle washer in klystron cavity.
- d. Insert klystron into klystron cavity.

CAUTION

Klystron should be inserted straight into cavity. Insertion of klystron should require no unnecessary force; the klystron should fit snugly but easily, into cavity.

- e. Replace inner truarc ring on clamp housing (if the klystron is properly in place the ring will fit properly). Allow tube to be centered by center conductor.
- f. Install tube socket and outer cover.
- g. Place edge of truarc ring on outer cover and rotate until ring lies flat on cover and is easily accessible with truarc pliers.
- h. Refer to Adjustment Procedure (paragraph 5-55) and make necessary adjustments.

5-43. RF PROBE REPLACEMENT**5-44. Probe Removal****WARNING**

Before attempting removal or replacement of probe assembly, be certain that line

power is completely removed from the instrument.

- a. Remove top cover from instrument.
- b. Set FREQUENCY (MHz) drive to the highest frequency setting (2400 MHz).
- c. Remove Attenuator Access Cover from Klystron Cavity Casting (see Figure 5-13).
- d. Remove Right Side Frame Assembly.
- e. Remove Cable Guide from Klystron Cavity Casting and disconnect cable assembly connectors from instrument.
- f. Remove the cable assembly connector from the defective RF probe cable. Be careful not to lose any connector parts as they will be required for re-assembly.
- g. Remove the probe cable from the cable guide.
- h. Remove the retaining screw holding the defective probe in the tuning carriage and remove the probe from the casting.
- i. The defective probe assembly should be returned to your local Hewlett-Packard sales and service office for repair or replacement (see list at rear of manual).

5-45. Probe Replacement**CAUTION**

The probe is fragile and should be handled with care. The probe should be placed in a protective shield when handling or shipping.

- a. To install a new probe assembly, carefully insert the new probe into the klystron cavity casting and replace the probe retaining screw.

CAUTION

Care must be taken not to damage the resistive element on the probe end or the spring wipers that make contact with the probe guide tube.

- b. Insert the probe assembly cable through the cable guide. Install the cable guide.

Probe Replacement (Cont'd)

c. Trim the insulation from the end of the probe assembly cable (for RF UNCAL probe, 5/16 inch; for RF CAL and ALC probes, 1/4 inch).

d. Place cable assembly connector parts on cable, with the exception of the clamping body, and fold the braid back upon the connector assembly (see Figure 5-10).

e. Place the clamping body on the cable and screw the clamp nut and clamping body together.

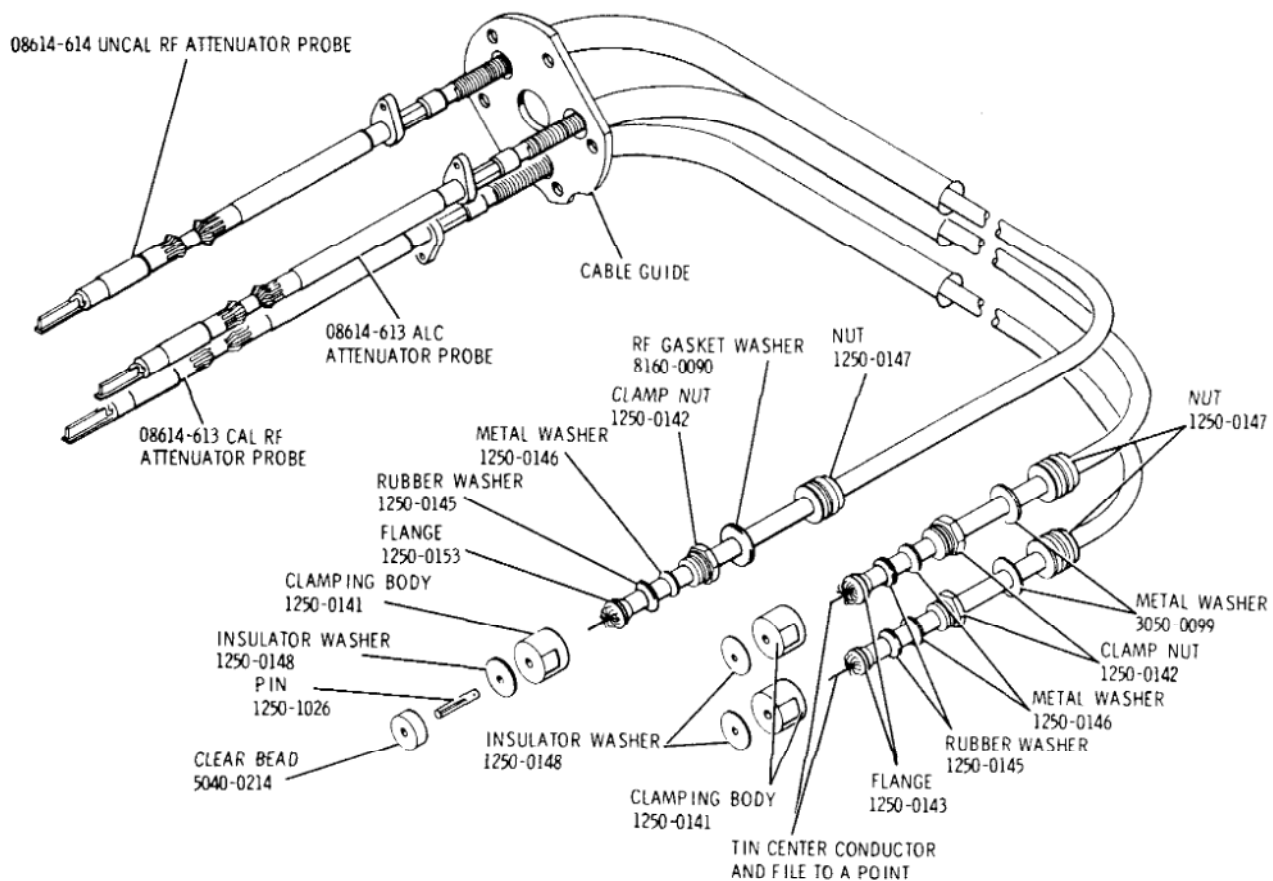
f. Trim the dielectric flush with the end of the clamping body so that the center conductor is bare.

g. Trim the center conductor protruding from the clamping body, then place the insulator washer on the center conductor.

NOTE

After tinning center conductor the diameter may be too large, making it necessary to file the center conductor to the proper diameter.

h. Before connecting connector assembly into the instrument, connect an ohmmeter between the probe center conductor and ground and measure the resistance across the range of the attenuator. The resistance should be approximately 50 ohms $\pm$ 5 ohms. If the probe is open or shorted at any



8614A

Figure 5-10. RF Probe Assembly

Probe Replacement (Cont'd)

point, the probe is defective and should be replaced.

i. Replace the connector assembly as it was before disassembly. Connect the probe connector to the instrument, making certain the center conductor makes good contact.

j. The probe installation is complete. Reassemble the instrument except for the front, right side panel, which is removed when performing the output power calibration adjustments.

5-46. PIN MODULATOR REPLACEMENT**5-47. Modulator Removal**

5-48. The PIN modulator CANNOT be repaired in the field. If the PIN modulator is found to be faulty, it should be returned for repair. Remove the five screws holding the PIN modulator only. Removal of screws holding the PIN diodes in place can cause contamination of the PIN diodes, high SWR, etc.

- Remove power line from instrument.
- Remove top and bottom covers.
- Place instrument on its side.

CAUTION

DO NOT HANDLE CRYSTAL DIODE, CR701, NEEDLESSLY. A static charge which builds up on a body, especially on a cold, dry day, must NEVER be allowed to discharge through element. When installing or removing, touch casting first to ensure no difference in potential between hand and casting.

d. Disconnect ground lug and wire from low pass filter.

e. Disconnect probe cable assembly connectors from the modulator (see Figure 5-10). Be careful not to lose any disassembled parts as they will be required for reassembly.

CAUTION

Do not disconnect RF output from the modulator.

f. Disconnect RF OUTPUT cable at RF CAL OUTPUT connector at front panel.

g. Disconnect ALC Bias Feed connections (1 and 2 on A500 board) from ALC circuit board.

h. Remove five screws holding PIN modulator to instrument chassis.

i. Remove PIN modulator from instrument.

j. Carefully pack PIN modulator in a container and return to your local Hewlett-Packard sales and service office for repair or replacement.

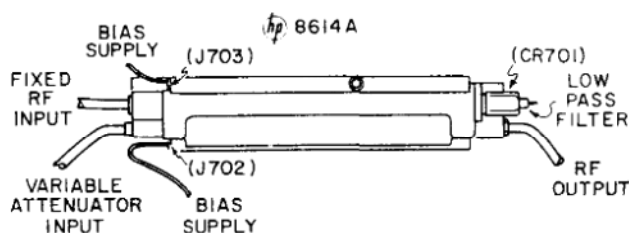


Figure 5-11. PIN Modulator (External View)

5-49. Modulator Replacement

a. Before installing PIN modulator, measure a resistance of PIN diodes with voltmeter, such as the HP 410B.

b. To measure PIN diode resistance, measure resistance between J703 and modulator ground and J702 and modulator ground. On the ohmmeter RX100 range with the common lead connected to ground, the resistance should measure approximately 1000 to 1500 ohms. On the ohmmeter RX1 Meg range with the ohms lead connected to ground, the resistance should measure approximately 100 megohms.

c. Replace five screws that hold PIN modulator in place.

d. Connect RF OUTPUT cable to front panel.

e. Connect ALC Bias Feed connections to ALC circuit board (A500).

f. Connect cable assembly connectors to PIN diode modulator (see CAUTION, paragraph 5-48).

5-50. CAM CABLE REPLACEMENT

5-51. Tools Required

- Open-end wrench (3/8-inch).
- Hex-socket wrench and 3/8-inch socket or equivalent tool.
- Book of matches.
- Roll of masking tape (1/2-inch or 1-inch width).
- Rubber cement.

5-52. Procedure

5-53. If it is necessary to replace cam cable, order it by HP Part No. 08614-299 and description of usage. For easier access to the cams, remove the screws holding the High Voltage circuit board and swing the board out of the way. Use Figures 5-12 and 5-13 as guides and proceed as follows:

- Remove power cord from instrument.
- Remove instrument top cover and attenuator access cover.
- Turn FREQUENCY (MC) to approximately the middle of the frequency band.
- Orient Length Cam to Frequency Cam as shown in Figure 5-12.
- Using a lead pencil, mark position of each cam and end of threaded portion of center conductor support rod on klystron cavity casing.

f. Using hex socket wrench and a 3/8-inch open-end wrench, remove both terminal screws, the four washers, and the two nuts (10-32 x 0.375 hex nuts).

g. Remove both terminal screws from cable.

h. On replacement cable, place a mark halfway between each end. Using matches, apply heat to an area approximately 1/2 to 3/4 inch on either side of mark to remove wire tension (heat to nearly white hotness).

i. Cut 10 or 11 strips of masking tape approximately one inch in length.

j. Remove three retaining screws from Frequency Cam and remove cam from instrument (Note: three retaining screws are 4-40 x 0.625 FH).

k. Slide cable through one terminal screw so that cable is oriented to terminal screw as shown in Figure 5-12 for the Frequency Cam, and install terminal screws on Frequency Cam.

CAUTION

Be careful not to catch cable between lock-washer and cam.

m. Slide cable onto cam just past point A and tape to cam (half of cable length should pass over points A and B; the other half should pass over points C, D, and E).

NOTE

Each cam as shown in Figure 5-12 has two lips along which the cable should travel: one cable MUST travel along the upper lip of both cams and one cable must travel along the lower lip of both cams.

n. Slide other half portion of cable onto cam just past point D and tape to cam.

p. Place Frequency Cam in original position in instrument and replace retaining screws.

q. Turn Length Cam so that cams are not touching at point F and place cable between cams: one cable along upper lip of cam and the other along lower lip of cam.

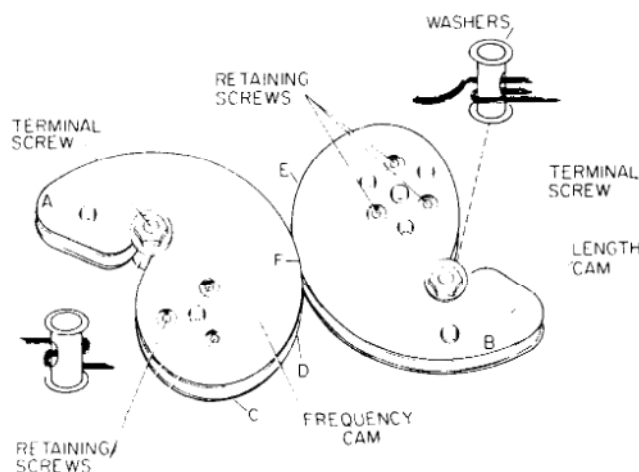


Figure 5-12. Cam Assembly

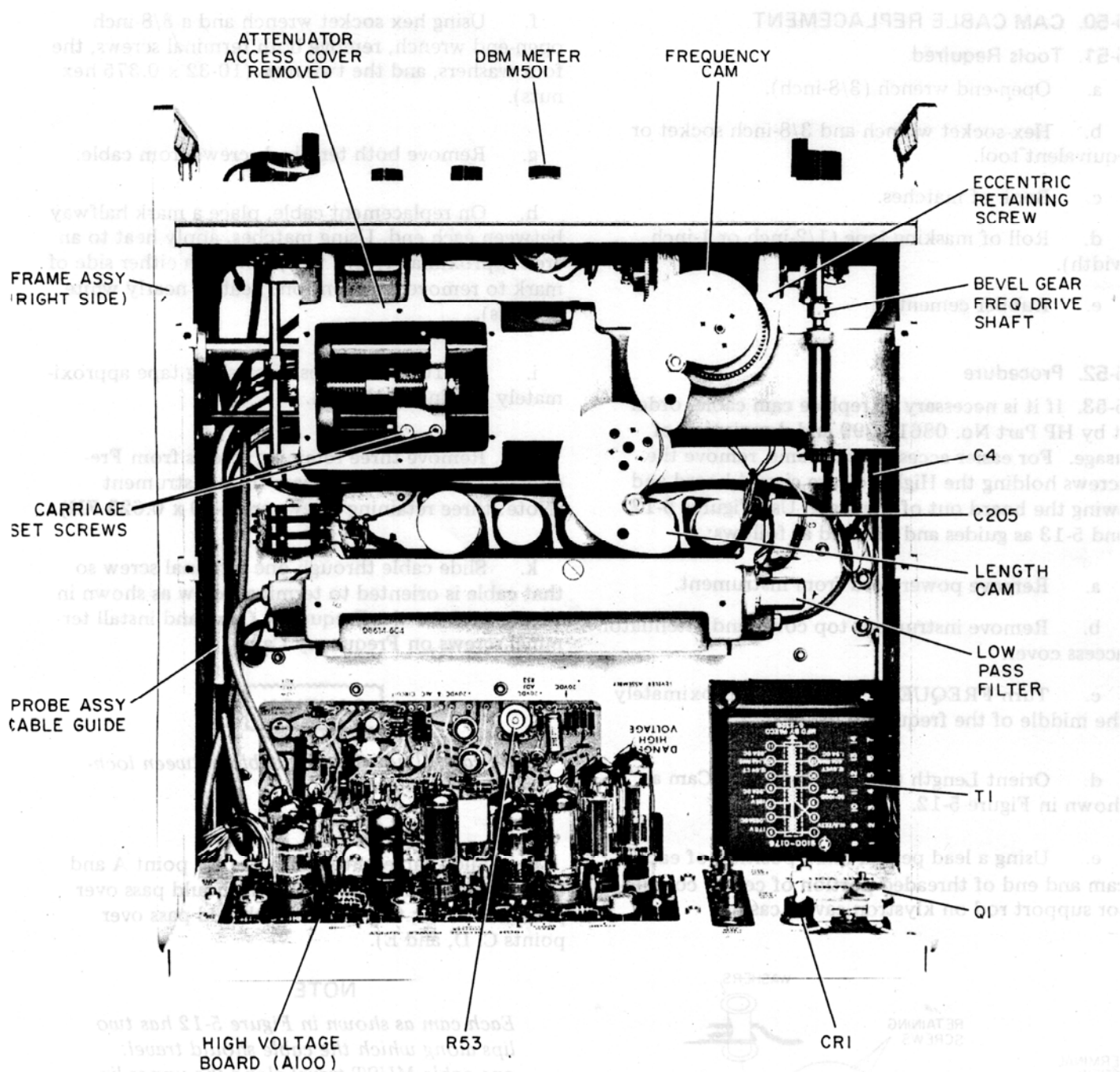


Figure 5-13. Instrument Top View, Cover Removed

Procedure (Cont'd)

r. Turn Length Cam so it is apparently touching Frequency Cam at point F and place two pieces of masking tape across the two cams at point F.

s. With cams held together, slide cable which passes over points C and D past point E and cable which passes over point A past point B and tape each portion of cable to cam.

NOTE

It is important that each cable portion have as little slack between it and the cams as possible; a loose cable causes backlash.

t. Slide cable ends through second terminal screw so that cable is oriented to terminal screw as shown in Figure 5-12 for the Length Cam.

Procedure (Cont'd)

u. Install second terminal screw on Length Cam and tighten both terminal screws to remove all slack in cable.

v. Remove masking tape from cams and apply rubber cement to ends of cable to ensure that cable will not unravel.

w. Turn FREQUENCY (MC) knob to match Frequency Cam to pencil mark made in step e; the other marks made should match appropriately.

x. Perform Frequency Range Spread Adjustment, paragraph 5-59.

5-54. ADJUSTMENTS**5-55. Adjustment After Klystron Replacement**

5-56. Following replacement of a klystron, certain adjustments must be made before the instrument will operate properly. The general steps in the overall procedure are as follows:

- Establish initial repeller tracking voltages.
- Establish proper repeller mode operation.
- Adjust frequency range spread.
- Adjust power output.
- Check internal leveling operation.

5-57. Initial Repeller-Voltage Adjust

- Remove top and bottom covers and remove two screws that secure circuit board.
- Check all power supply voltages as indicated in Table 5-2.
- Connect voltmeter between klystron repeller (test point 11 and chassis ground, see Figure 5-7). Make sure ΔF control on front panel is set at zero (center position), and set voltages as indicated in Table 5-7 (see Figure 5-6).

WARNING

Be careful not to ground test point 11 as power supply will be destroyed.

5-58. Repeller Mode Adjust

- At a dial frequency of 950 MHz, set attenuator dial for a calibrated output of about 0 dBm.
- To observe repeller modes of the klystron, a FM Modulator, with adjustable phase and amplitude controls, is necessary. Such a device is shown in Figure 5-14; it consists of a small power transformer connected with the primary and secondary windings

Table 5-7. Klystron Repeller Voltages

Frequency Dial	Adjust	Voltage (between klystron repeller and ground)
800	R216	$-370 \pm 5V$
Mid-frequency below switch above switch	R217	$-600 \pm 5V$
	R218	$-425 \pm 5V$
2400	R219	$-580 \pm 5V$
R216 and R217 interact as do R218 and R219; therefore, repeat above measurements after any adjustments.		

interchanged; two one-megohm potentiometers; a $0.05 \mu F$ capacitor; two BNC connectors; a fuseholder, and a power cord. Connected as shown, this modulator provides a power line frequency modulation voltage continuously variable in amplitude from 300 volts peak-to-peak, with phase variable over a range of approximately 95 degrees, plus a 6.3-volt ac output for oscilloscope sweep control (see Table 5-1).

- Apply external FM (60 cycles) and view mode patterns on oscilloscope. Adjust PHASE control of FM modulator and appropriate tracking pot for mode patterns shown.

NOTE

DC repeller voltages at 950 MHz and 1600 MHz (above switch) are relatively small and will not appear correctly if FM signal is excessive.

- Adjustments should allow about 2 MHz variations with ΔF control.
- The tracking pots interact making it necessary to repeat the adjustments a time or two in order to ensure proper tracking.

- Connect a clip-on milliammeter to wire on center feedthrough capacitor, C4 (wht/orn/vio wire, see Figure 5-13). Current must not exceed 30 mA unless klystron is defective.

5-59. Frequency Range Spread Adjust

- Using a calibrated frequency meter, measure actual frequency at dial settings of 1000 and 2400 MHz. To eliminate backlash error, always approach frequency dial settings from the same direction.

- The difference in the frequency measurements of step a should be 1400 MHz. If frequency

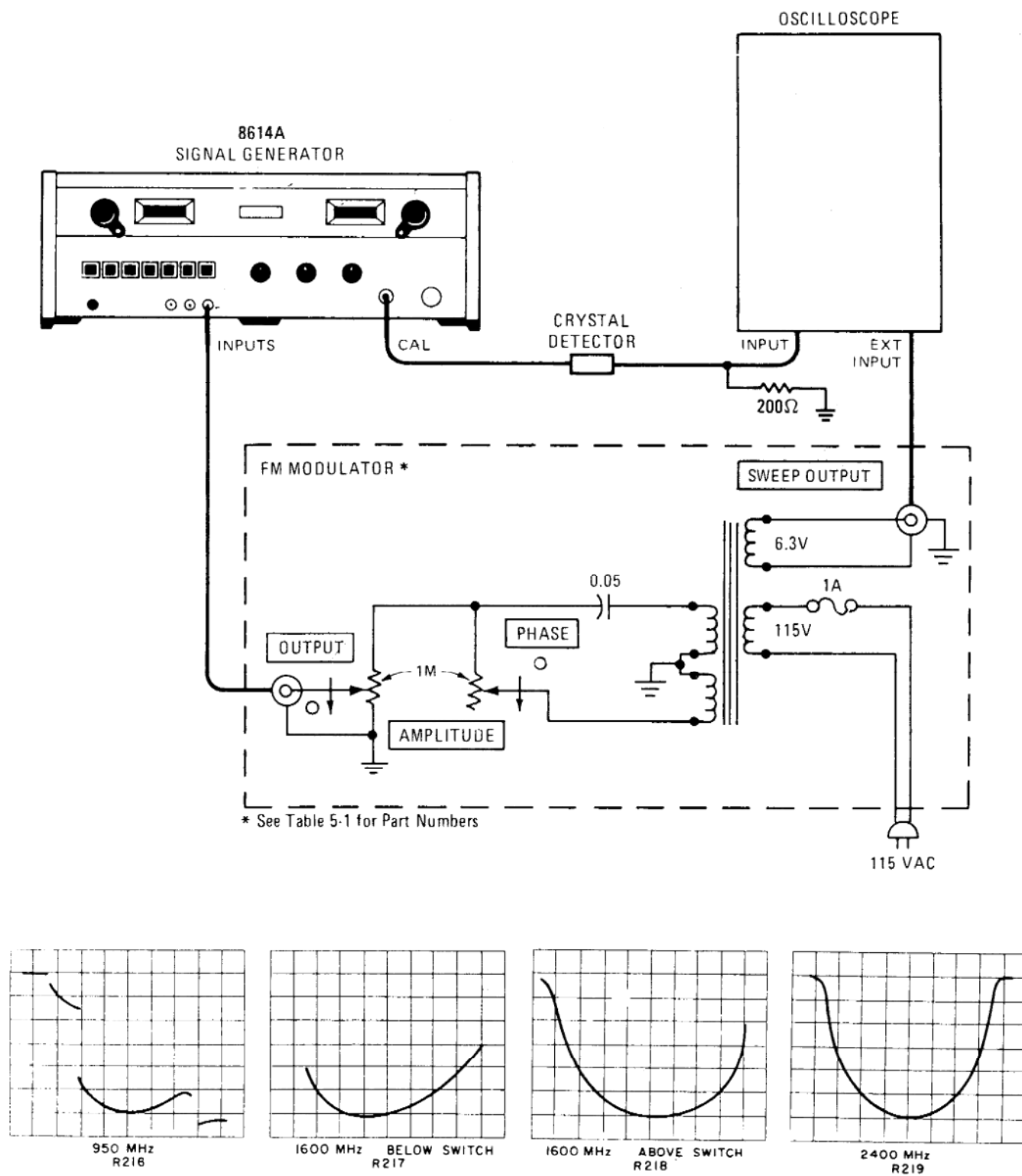


Figure 5-14. Repeller Mode Adjust Setup

Frequency Range Spread Adjust (Cont'd)

difference is other than specified, correction must be made (see step c).

c. Refer to graph, Figure 5-15. The horizontal axis represents the measured frequency change from step b, the vertical axis indicates the dial corrective setting. For example, if the difference between dial settings (step b) is 1354 MHz, the corrective setting for the dial as found on the graph is 990 MHz. To make correction, set frequency dial to 1000 MHz, loosen the two setscrews that clamp dial plunger to rack, hold dial plunger stationary, and set dial to 990 MHz. Tighten two setscrews (see Figure 5-16).

d. If any adjustment was necessary, repeat steps a, b, and c. Repeat this procedure until measured frequency difference corresponds to a change of $1400 \text{ MHz} \pm 3 \text{ MHz}$.

e. Set actual frequency to 1000 MHz. Loosen spur gear on worm shaft and rotate gear until frequency dial reads 1000 MHz (see Figure 5-13).

f. Check FREQUENCY (MC) dial settings at both upper and lower ends of dial travel. The respective dial end points should be less than 800 MHz and greater than 2400 MHz. If dial travel is not satisfactory, loosen bevel gear on frequency drive shaft and reset dial.

g. Check microswitch action: microswitch should energize and de-energize at about 1590 to

1610 MHz. If microswitch does not switch at proper dial settings, microswitch cam (located on underside of cavity casting) should be repositioned (see Figure 5-7).

h. Being careful to approach all dial settings from the same (either clockwise or counterclockwise) direction, using the procedure given in paragraph 5-11, check accuracy of frequency dial by approaching all dial settings from a clockwise direction and then from a counterclockwise direction.

NOTE

The frequency meter used must be calibrated to an accuracy of approximately $\pm 0.03\%$.

i. If frequency dial reading errors are greater than $\pm 5 \text{ MHz}$, shifting the dial may bring all errors within specification. If shifting dial will not sufficiently correct errors, it may be necessary to shift position of center conductor support rod (see Figure 5-16). The center conductor is notched at end closest to right side of instrument and may be loosened and then adjusted "in" or "out" of klystron cavity. Notch or scratch center conductor rod so that original position may always be known. If overall frequency error was positive, adjust center conductor toward right side of instrument. If overall error was negative, adjust center conductor toward left side of instrument. When adjusting cen-

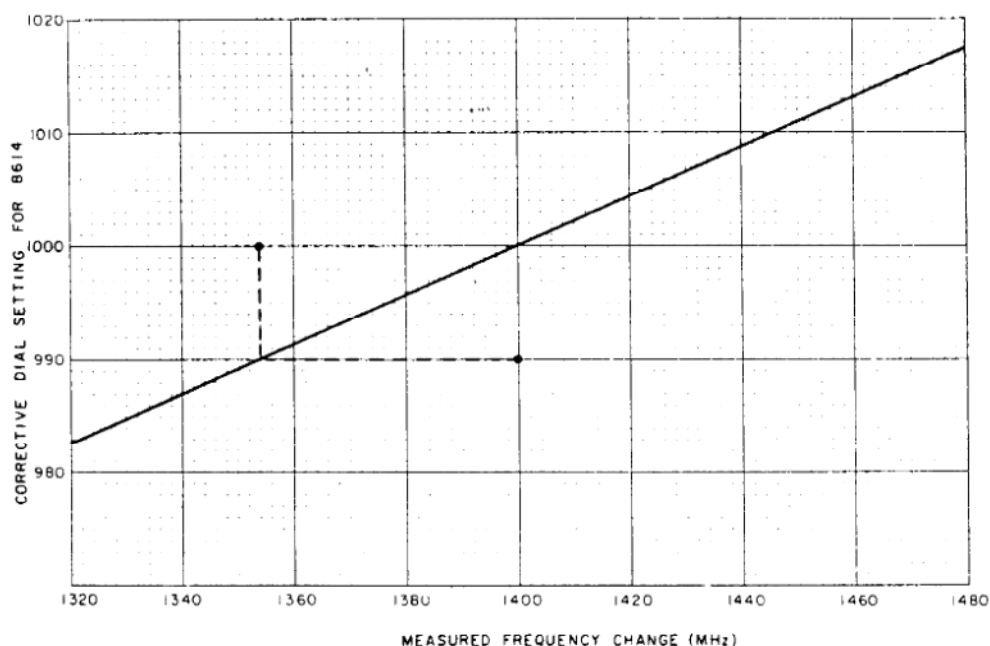


Figure 5-15. Frequency Range Spread Correction Curve

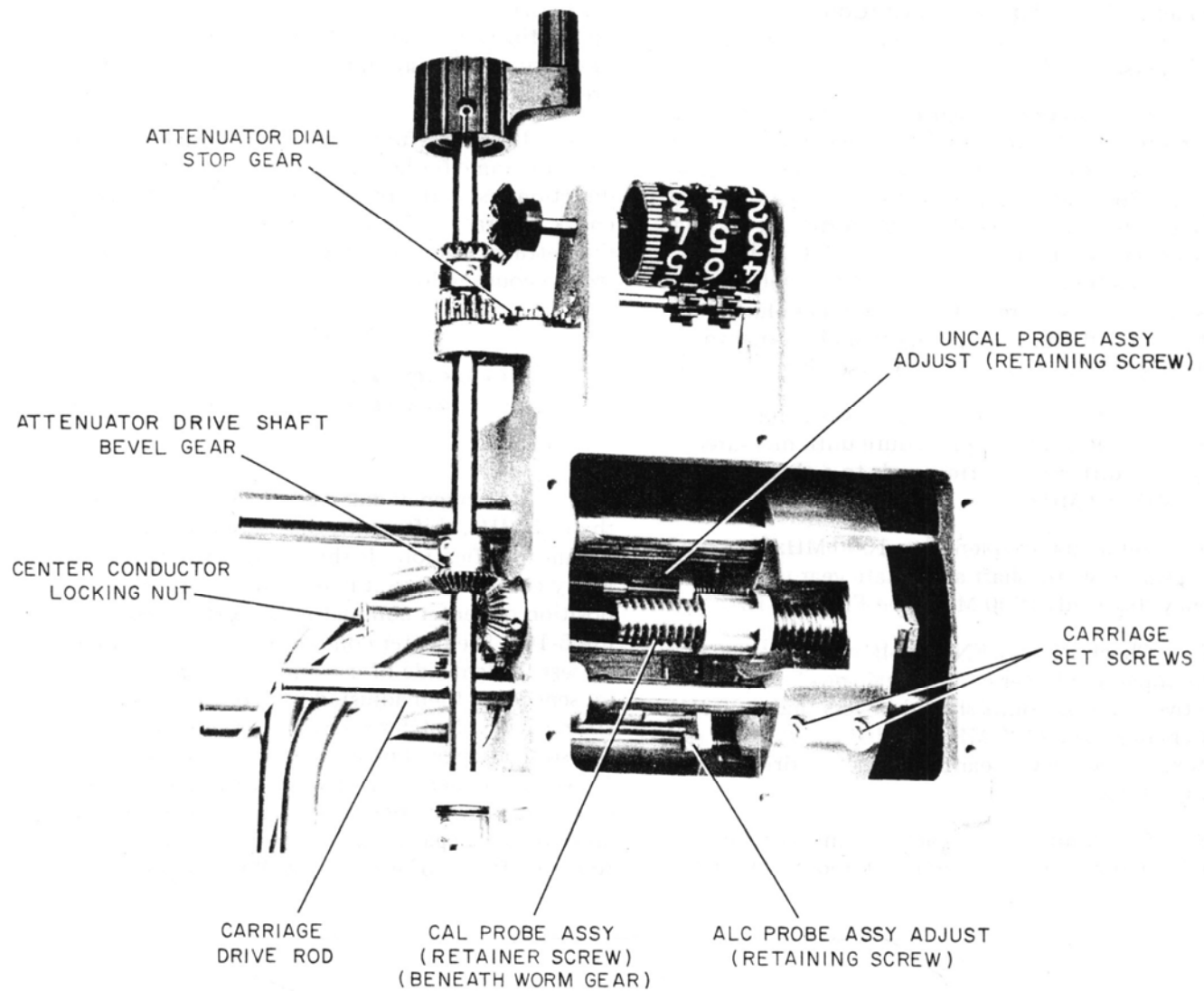


Figure 5-16. Probe Assembly Adjust

Frequency Range Spread Adjust (Cont'd)
 ter conductor position, never change by more than about 20 thousandths of an inch at a time.

NOTE

If any adjustment of instrument was necessary, repeat entire check and adjustment procedure until no adjustment is required.

5-60. RF Power Output Adjustment

5-61. Front Panel Settings: Have ALC button released (OFF). Set ATTENUATION (dB) to 012 dB. Set FREQUENCY to 800 MHz.

a. CAL RF Adjustment: if measurements made agree with readings shown in Table 5-8, proceed to next paragraph.

1. With a power meter, measure the CAL RF output power. It should be $-11 \text{ dBm} \pm 0.1 \text{ dBm}$.
2. If it is not, loosen the two setscrews in the attenuator drive shaft bevel gear (see Figure 5-13). With the bevel gear loose, turn the attenuator gear with your fingers until the output power is -11 dBm . Without disturbing the -11 dBm power setting, turn the attenuator knob on the front panel until the attenuator counter reads 012 dB. Tighten the two setscrews in the bevel gear.

b. UNCAL RF Adjustment:

1. Measure the UNCAL RF power output. It should be $-3 \text{ dBm} \pm 0.3 \text{ dBm}$.

RF Power Output Adjustment (Cont'd)

2. If it does not, the RF UNCAL probe requires adjustment. The front right side panel should be removed, exposing the probe assembly cable guide. Remove the screw in the cable guide that is in line with the UNCAL probe retaining screw (see Figure 5-13). Insert a long Allen wrench through the hole left by removing the cable guide screw into the UNCAL probe retaining screw. Turn the retaining screw to adjust the UNCAL probe penetration for $-3 \text{ dBm} \pm 0.3 \text{ dBm}$ output.

c. ALC Adjustment:

1. With a dc voltmeter (HP 3435A) measure the dc voltage at the output of the CR701 crystal diode, or the base of Q501A.

CAUTION

Do not use a digital voltmeter with Auto-ranging as it might damage the crystal diode.

The dc voltage should be $120 \text{ mV} \pm 2 \text{ mV}$.

2. If it is not, the ALC attenuator probe requires adjustment. The front right side panel should be removed, exposing the probe assembly cable guide. Remove the screw in the cable guide that is in line with the ALC probe retaining screw (see Figure 5-13). Insert a long Allen wrench through the hole left by removing the cable guide screw into the ALC probe retaining screw. Turn the retaining screw to adjust the ALC probe penetration for $120 \text{ mV} \pm 2 \text{ mV}$ at the ALC crystal output.

Table 5-8. Klystron Probe Adjust

Probe for	Measuring Point	Instrument	Reading
ALC	CR701 or base of Q501A	HP 3435A	$120 \pm 2 \text{ mV}$
Cal Pwr	Front panel connector	HP 432A	$-11 \pm 0.1 \text{ dBm}$
Uncal Pwr	Front panel connector	HP 432A	$-3 \pm 0.3 \text{ dBm}$

5-62. Internal Leveling Adjust

5-63. Replacement of the klystron should not affect internal leveling operation (ALC). However, the characteristics of the new klystrons can differ enough to require readjustment of the ALC Amplifier and the Meter Amplifier. Refer to paragraph 5-12 and check the leveled output; if adjustment is necessary refer to paragraph 5-64 for procedure.

5-64. Adjustments after PIN Modulator Replacement

5-65. Following replacement of a PIN modulator, certain adjustments must be made before the instrument will operate properly. The general steps in the overall procedure are as follows:

- a. Adjust Meter Amplifier
- b. Adjust ALC Amplifier
- c. Adjust on-off ratio
- d. Adjust Pulse Modulation
- e. Adjust Square-Wave Modulation
- f. Adjust AM Response.

5-66. Meter Amplifier Adjust

- a. Release RF button. Zero front-panel meter with front-panel ZERO SET.
- b. Depress RF button; set frequency dial to 800 MHz. Note: See paragraph 5-61 and adjust ALC probe.
- c. Measure meter amplifier output voltage (wire with green and violet tracers on front panel ALC switch). This voltage must be $-6.4 \pm 0.3 \text{ volts}$. This corresponds to a gain of $53 \pm 2 \text{ volts}$.
- d. Front panel DBM meter should read $+1.0 \pm 0.3 \text{ volts}$.

5-67. ALC Amplifier Adjust

- a. Set FREQUENCY (MC) to 800 MHz and ATTENUATION (DB) to 012.
- b. Depress ALC button and set front panel DBM meter to 0 DBM by means of ALC CAL OUTPUT knob.
- c. Track ALC amplifier at CAL RF OUTPUT and adjust as indicated in Table 5-9; use a power meter and a thermistor mount or equivalent equipment.

5-68. On-Off Ratio Adjust

- a. Set up Model 8614A as follows:
LINE depressed

On-Off Ratio Adjust (Cont'd)

ZERO SET . . . set DBM meter to ZERO SET
 RF depressed
 ALC CAL OUTPUT . . . full ccw for 0 dBm meter reading
 ALC depressed
 ΔF centered
 FREQUENCY (MC) . . . 1600
 ATTENUATION (DB)000

b. Connect power meter to CAL RF OUTPUT and adjust signal generator for a full scale reading on the 0 DBM range of the power meter.

c. With no input applied to PULSE INPUT, depress PULSE button. The CAL RF OUTPUT should drop at least 20 dBm.

Table 5-9. ALC Amplifier Adjust

Frequency	Adjust	Calibration Power Output
Low freq.	R614	-12 ± 0.2 dBm
Mid-freq. below switch	R621	-12 ± 0.2 dBm
Mid-freq. above switch	R615	-12 ± 0.2 dBm
High freq.	R620	-12 ± 0.2 dBm

Note: R614 and R621 interact as do R615 and R620. To simplify the adjustment, overcorrect with pot for frequency indicated, then back off with interacting pot. For example, the reading at 1600 MHz (below microswitch) is -10 dBm. Adjust R621 for -13 dBm, then adjust R614 for -12 dBm at 1600 MHz.

d. If the on-off ratio is not 20 dB or greater, adjust R420 for proper on-off ratio. If on-off ratio will not adjust properly, PIN modulator may be defective. Check bias current through R414 and through R420: the current through R414 should be approximately 6 mA, and the current through R420 should be 3 mA. If these bias currents are correct and CR403 is not shorted, then the modulator may be defective. Check RF Probe resistance (refer to paragraph 5-61); if resistance is OK then modulator is defective (refer to paragraph 5-46).

5-69. Pulse Modulation Adjust

a. Depress PULSE button and apply an externally generated 20 volt $4 \mu s$ positive pulse to front panel pulse BNC input (refer to paragraph 5-14).

b. If pulse operation is not satisfactory, adjust R420.

NOTE

Resistor R420 also adjusts the on-off ratio; if adjustment was necessary recheck on-off ratio (paragraph 5-68)

5-70. Square-Wave Modulation Adjust

a. Depress SQ WAVE button and check square wave output on an oscilloscope (refer to paragraph 5-15).

b. Adjust R410 for best symmetry at 1000 ± 50 Hz.

c. Rotate SQ WAVE control full counterclockwise: square wave frequency should be equal to or less than 950 Hz.

d. Rotate SQ WAVE control full clockwise: square wave frequency should be at least 1050 Hz.

e. The square-wave frequency range is determined by R413 (front panel SQ WAVE control) and C402. The value of C402 is selected for proper frequency range: it may be 2250 pF, 2676 pF, or 3000 pF. Increasing the capacity decreases the upper and lower limit of the range while decreasing the capacity will increase the upper and lower limit.

5-71. AM Response Adjust

a. Check AM operation at about 50 Hz (see paragraphs 5-16).

b. If AM waveform is not satisfactory, change value of C404 by about 10 pF and recheck operation. Note: typically, undistorted AM operation is achieved with either a 30- or 39-pF capacitor.

5-72. REPELLER POT (R220) REPLACEMENT**5-73. Tools Required**

- Small pair of wire cutters
- No. 6 allen drive wrench (hex head drive)
- Screwdriver with flat thin blade

5-74. Procedure

5-75. If it is necessary to replace the repeller pot (R220, a wirewound resistor), then both R220 (HP Part No. 2100-0399) and the insulator plate (HP Part No. 08614-254) must be replaced. Use Figure 5-7 as a location guide and Figures 5-17 and 5-18 as replacement guides and proceed as follows:

- Remove power cord from instrument.
- Remove instrument bottom cover and repeller pot access cover.
- Loosen the two allen screws retaining the tracking pot rotor and remove rotor.

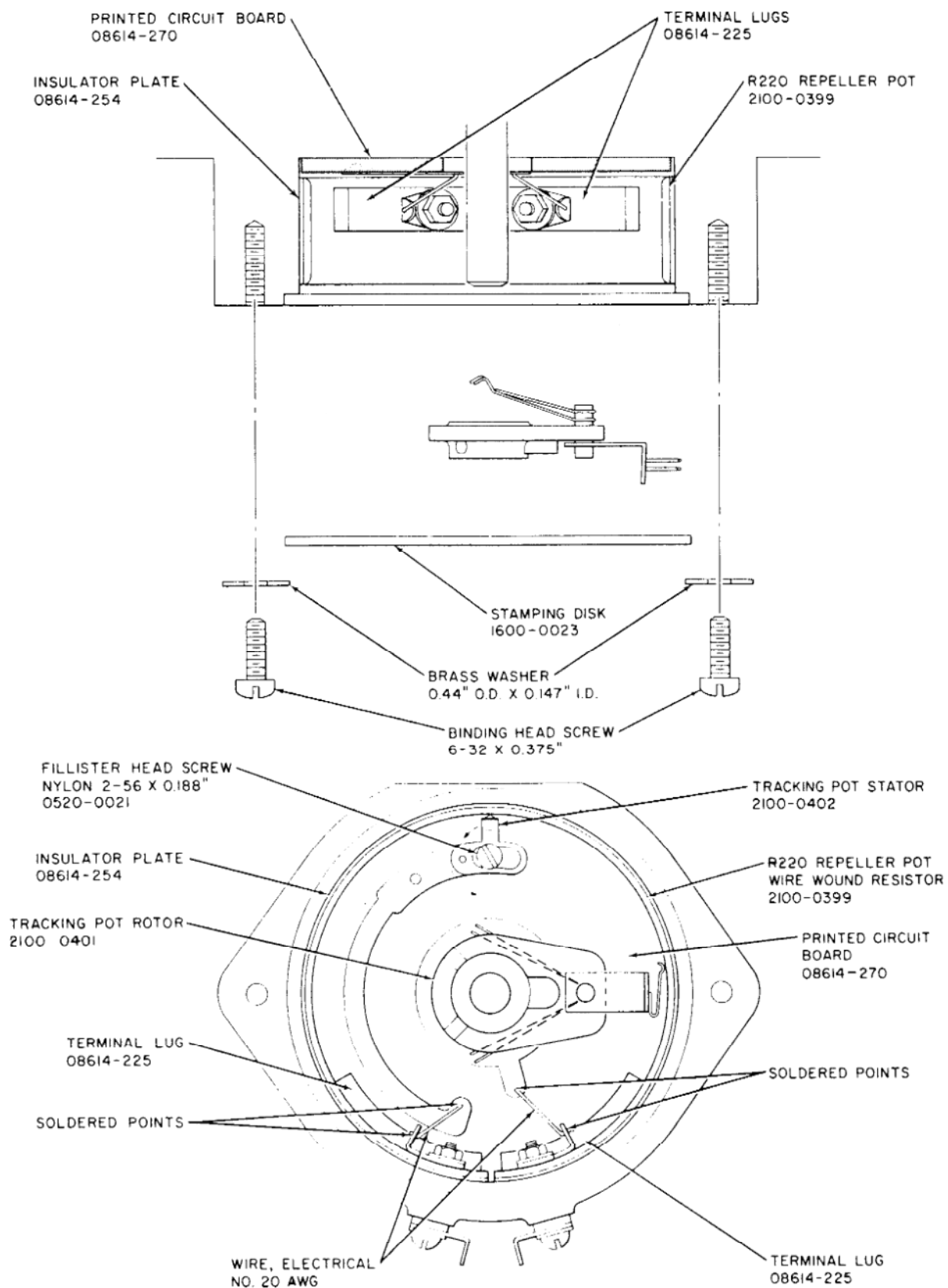


Figure 5-17. Repeller Pot Assembly

Procedure (Cont'd)

d. Using a flat blade screwdriver to turn the nylon screw, turn the tracking pot stator a quarter turn counterclockwise.

e. Remove hardware holding R220 in place and remove R220 and insulator plate from casting assembly.

f. Prepare new repeller pot, R220, for installation by cutting about 1/8 inch of material off each end. Also prepare new repeller pot, R220, for installation by gently bending to take some of the stiffness out. Note: If resistor is bent sharply, it will break in half.

g. Gently bend the wirewound resistor (R220) with the insulator plate behind it and insert in casting. Note the resistor must be inserted so that the "bronze colored section" contacts, or is closest to, printed circuit board.

h. Insert retaining hardware through casting holes and wirewound resistor and insulator plate. Do not tighten wirewound resistor firmly in place as adjustment is necessary.

i. Refer to Figure 5-17; R220 must be relatively flat against wall of casting. The resistor can be flattened against casting wall by pushing on edge, CAREFULLY, and tightening in place.

CAUTION

Do not push on R220 with a sharp metal object, such as a screwdriver, as the wire windings can be easily destroyed if the screwdriver blade slips.

j. Once R220 has been adjusted for flatness and the retaining screws firmly tightened, replace tracking pot rotor in assembly. The tracking pot rotor must be set in place so that contact is made with inner printed circuit board ring at all times. Also, the rotor contact with resistor must be uniform with contact made as illustrated in Figure 5-17; only the curved end of the contacts may touch the repeller pot at any point.

k. Using a flat blade screwdriver to turn the nylon screw, turn tracking pot stator back to original contacting position as illustrated in Figure 5-17.

m. Set FREQUENCY (MC) front panel dial to 1600 and note position of repeller tracking pot rotor: the tracking pot rotor resistor contacts

should be positioned almost exactly above the tracking pot stator.

n. Watching the tracking pot rotor to be sure that it does not hit either terminal lug (HP Part No. 08614-225), very slowly rotate FREQUENCY (MC) front panel dial from one end of travel to the other. If necessary, adjust terminal lug and tracking pot rotor position to ensure that tracking pot will not contact either terminal lug.

p. Replace the stamping disc (repeller pot access cover) and tighten in place with the two binding-head screws.

NOTE

When placing the stamping disc, be sure that it does not contact the repeller pot resistor. If it does, repeat above procedure and adjust repeller pot resistor position.

q. Refer to paragraph 5-56 and check all listed adjustments.

NOTE

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

5-76. LOW PASS FILTER REPLACEMENT**5-77. Tools Required**

- a. Soldering equipment (see Table 5-7)
- b. Small pair needle nose pliers
- c. Small pair pliers

5-78. Procedure

5-79. Figure 5-19 illustrates Low Pass Filter and ALC Crystal diode (CR701) parts with part numbers. The illustration is an assembly drawing. Part removal is the reverse of illustrated assembly instructions. The first step for disassembly is to unsolder the cable to Low Pass Filter and grounding lug connections. The last step of assembly is to solder the cable to Low Pass Filter and grounding lug connections.

CAUTION

Before touching CR701 refer to paragraph 5-48, Step c — CAUTION.

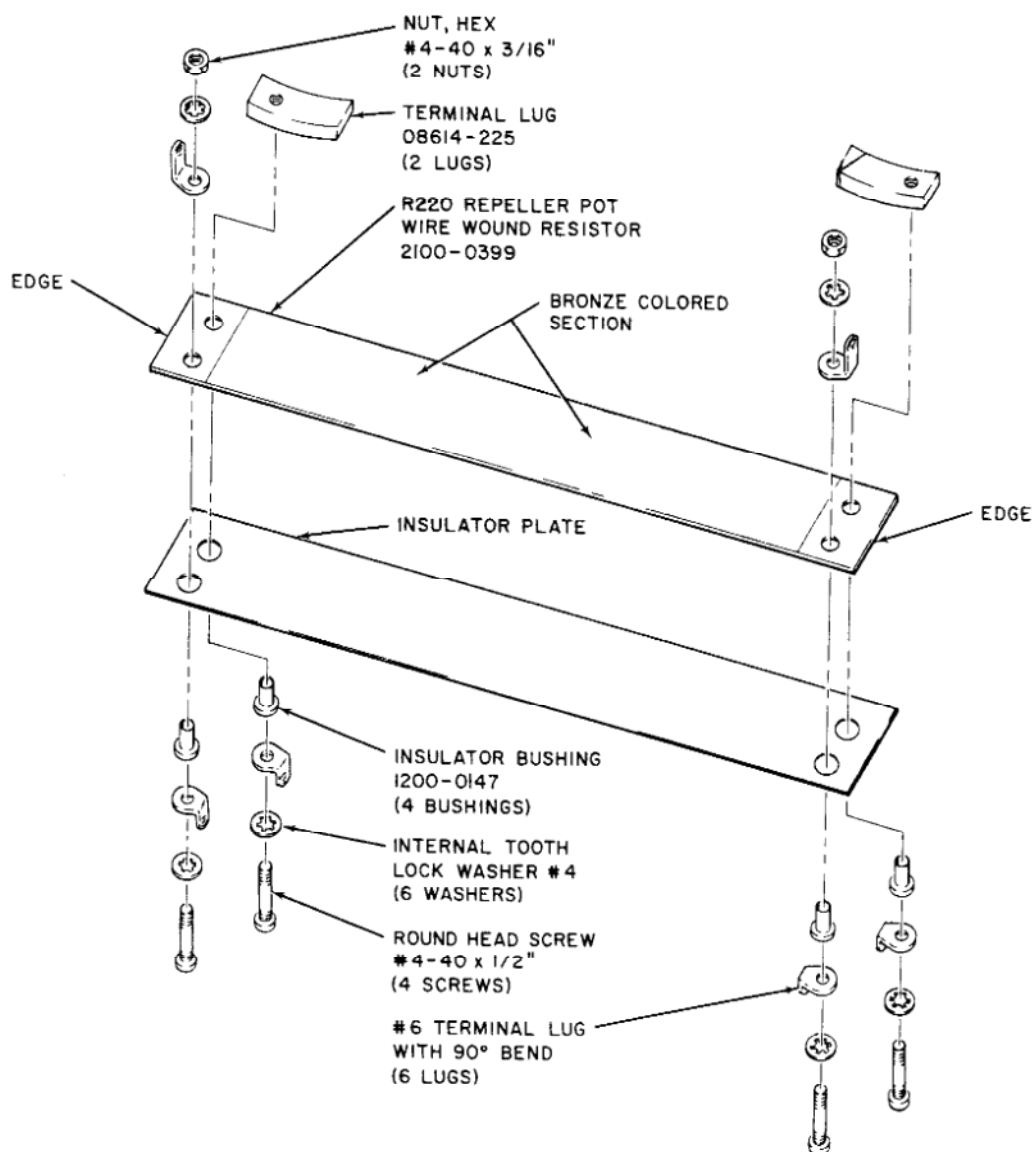
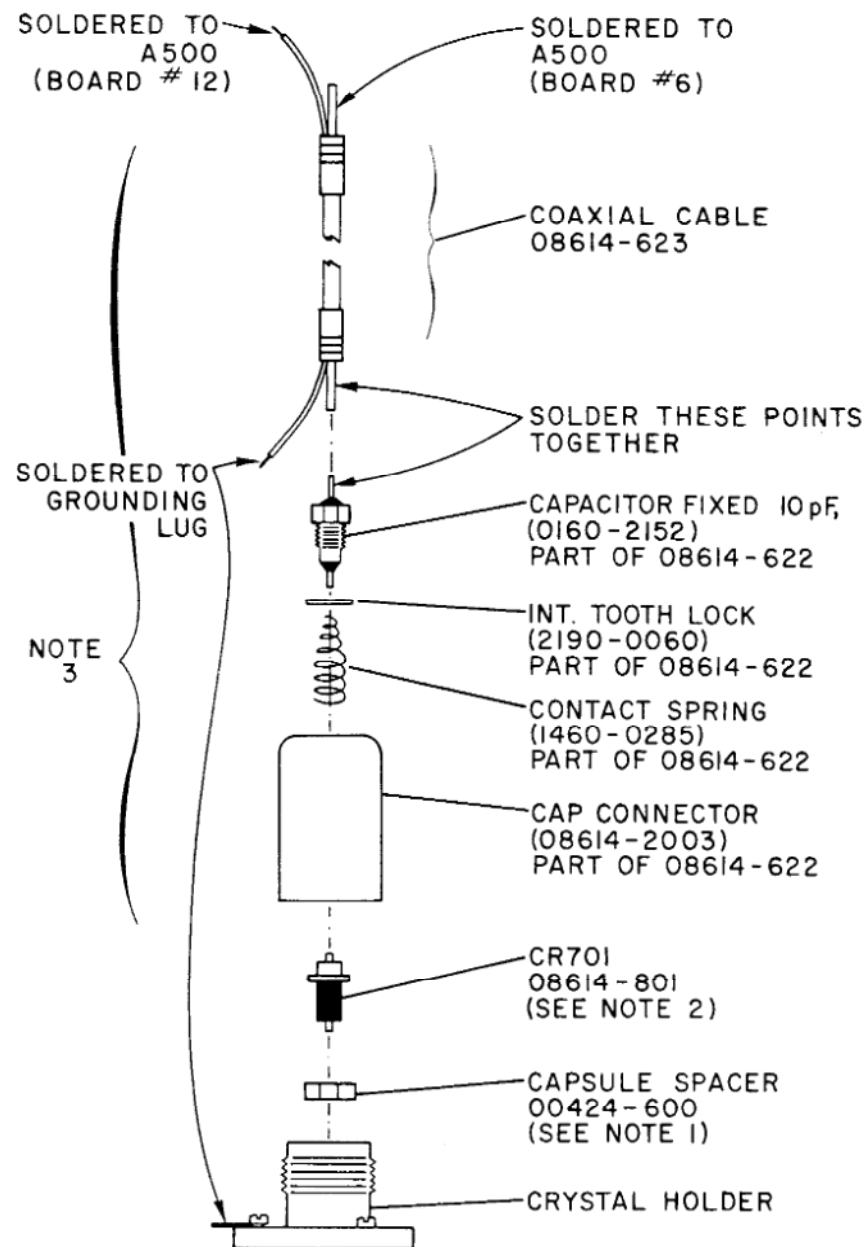


Figure 5-18. R220 Repeller Resistor Assembly



1. CAPSULE SPACER INCLUDES POLYIRON INSERT WHICH MUST ALWAYS BE INSERTED SO THAT INSERT WILL CONTACT WITH CRYSTAL HOLDER (POLYIRON DOWN).
2. STOCK NO. 08614-801 INCLUDES A SPECIAL MATCHING RESISTOR, R519, THAT MUST BE REPLACED WHENEVER CR701 IS REPLACED.
3. COAXIAL CABLE AND ALC FILTER ASSEMBLY PARTS ARE AVAILABLE AS PART OF LOW PASS FILTER KIT hp STOCK NO. 08614-625.

Figure 5-19. Low Pass Filter Assembly Drawing

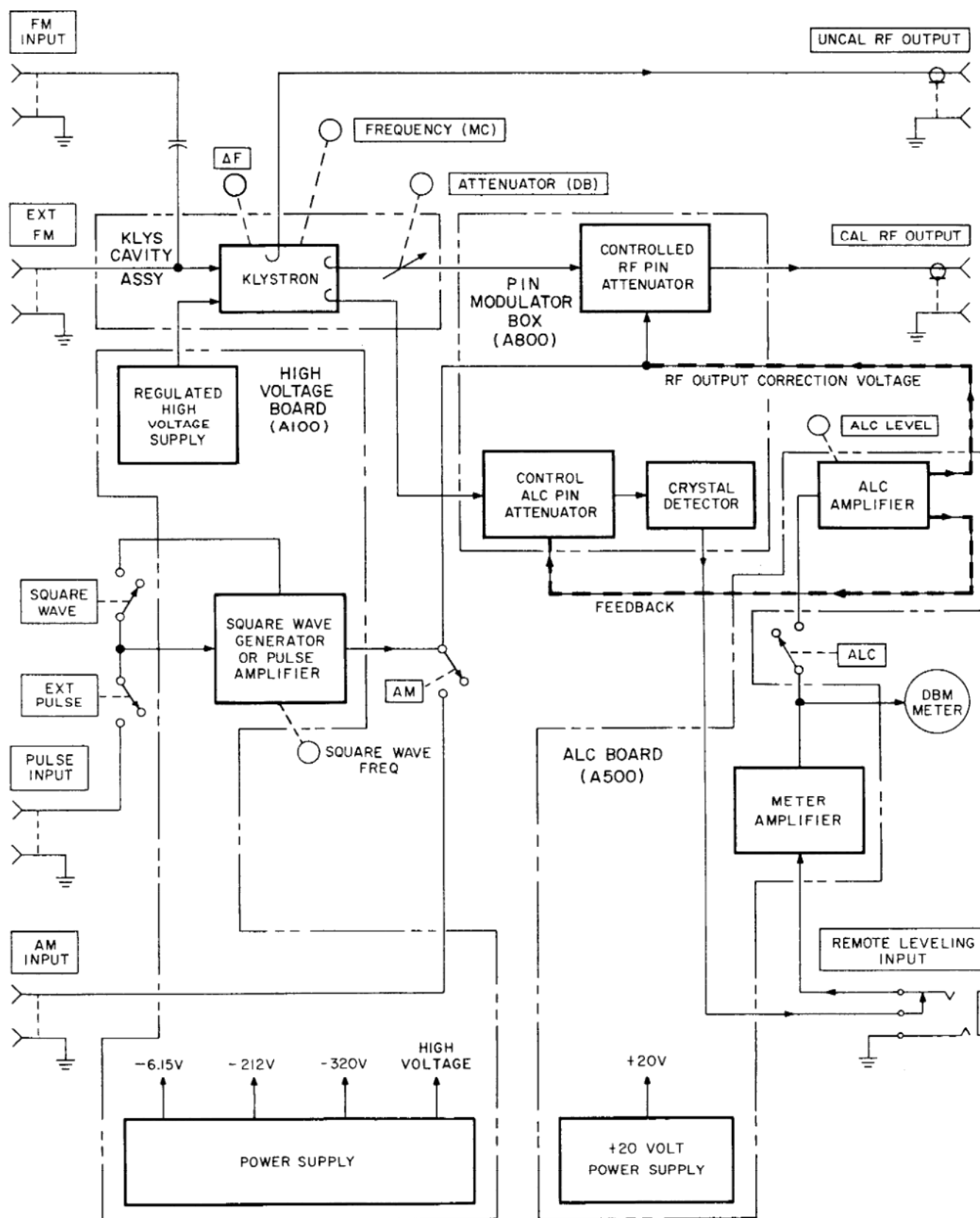


Figure 5-20. Instrument Block Diagram

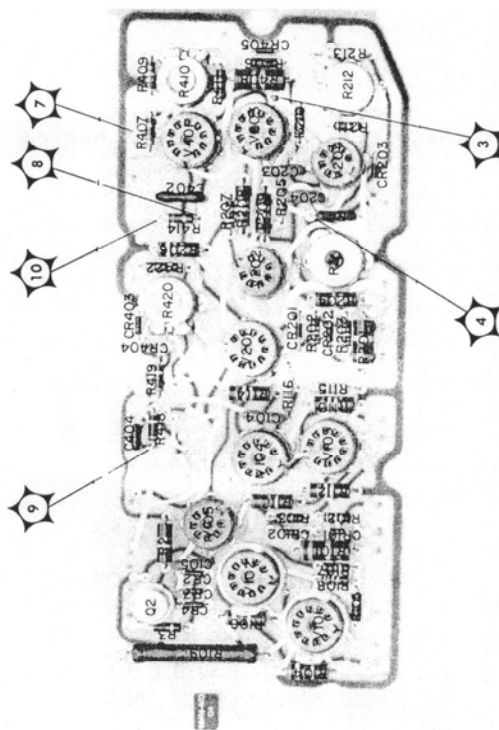
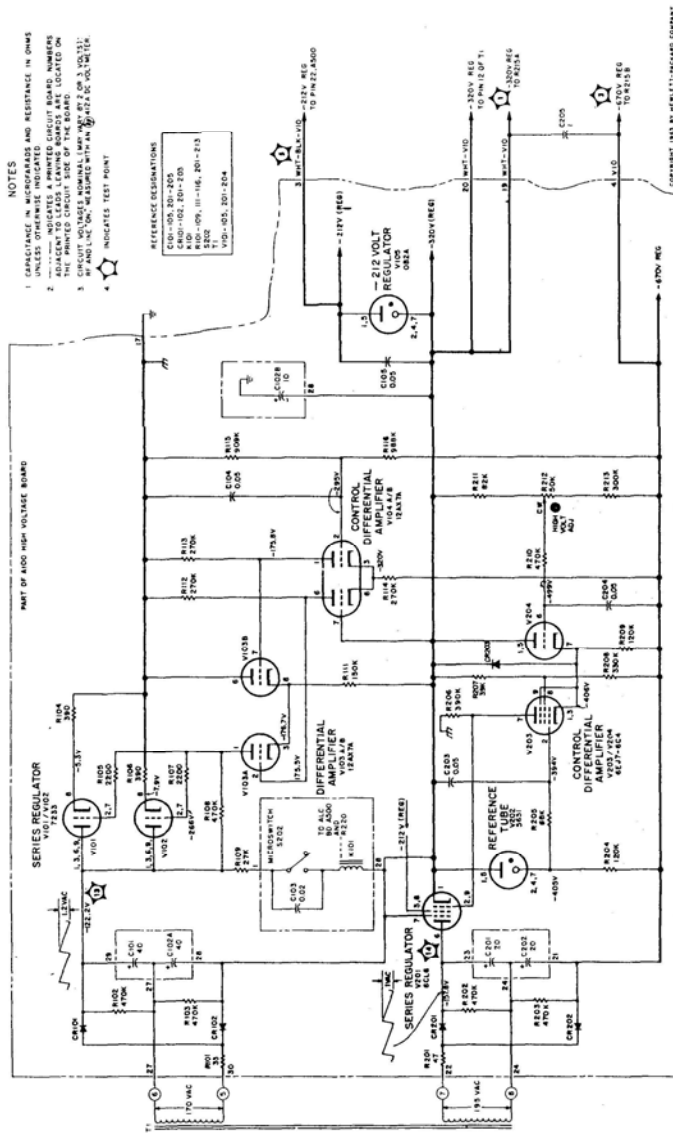


Figure 5-21. High-Voltage Board (A100)

Figure 5-22. High-Voltage Power Supply
5-32

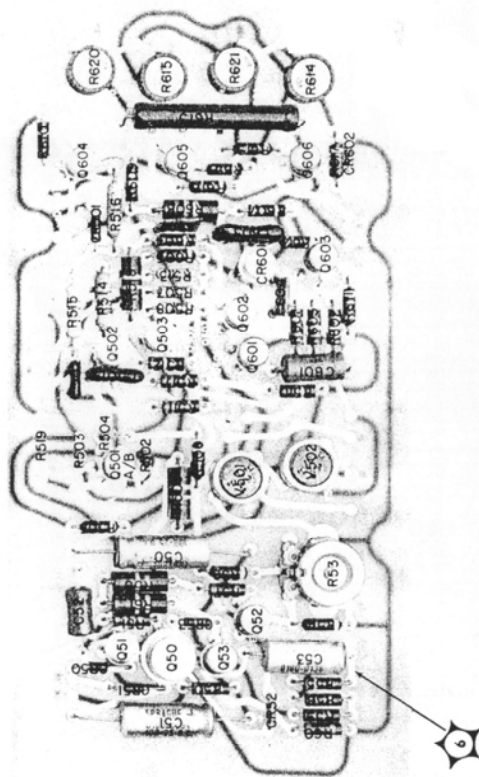


Figure 5-23. ALC Board (A500)

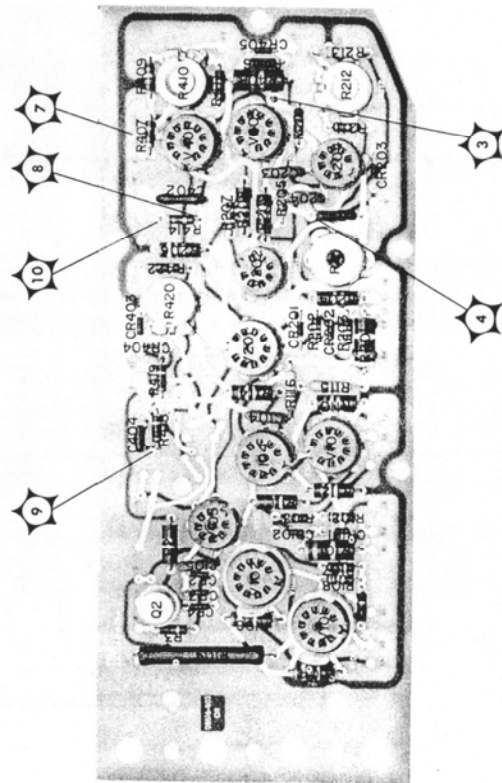


Figure 5-24. High-Voltage Board (A100)

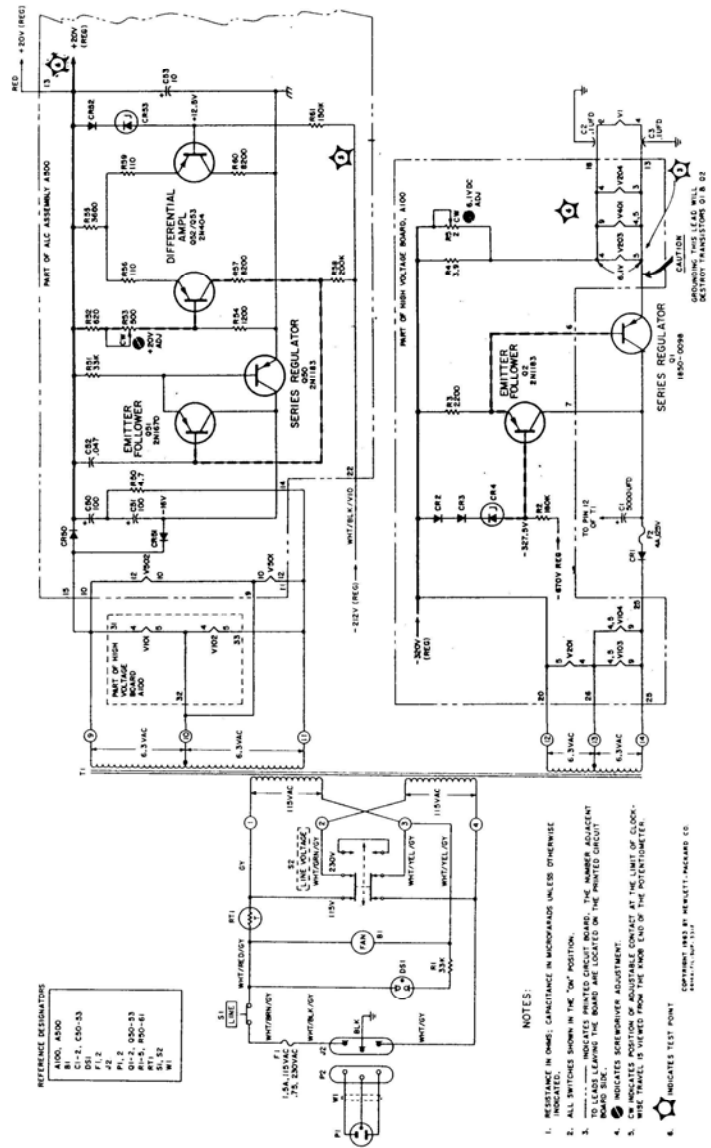
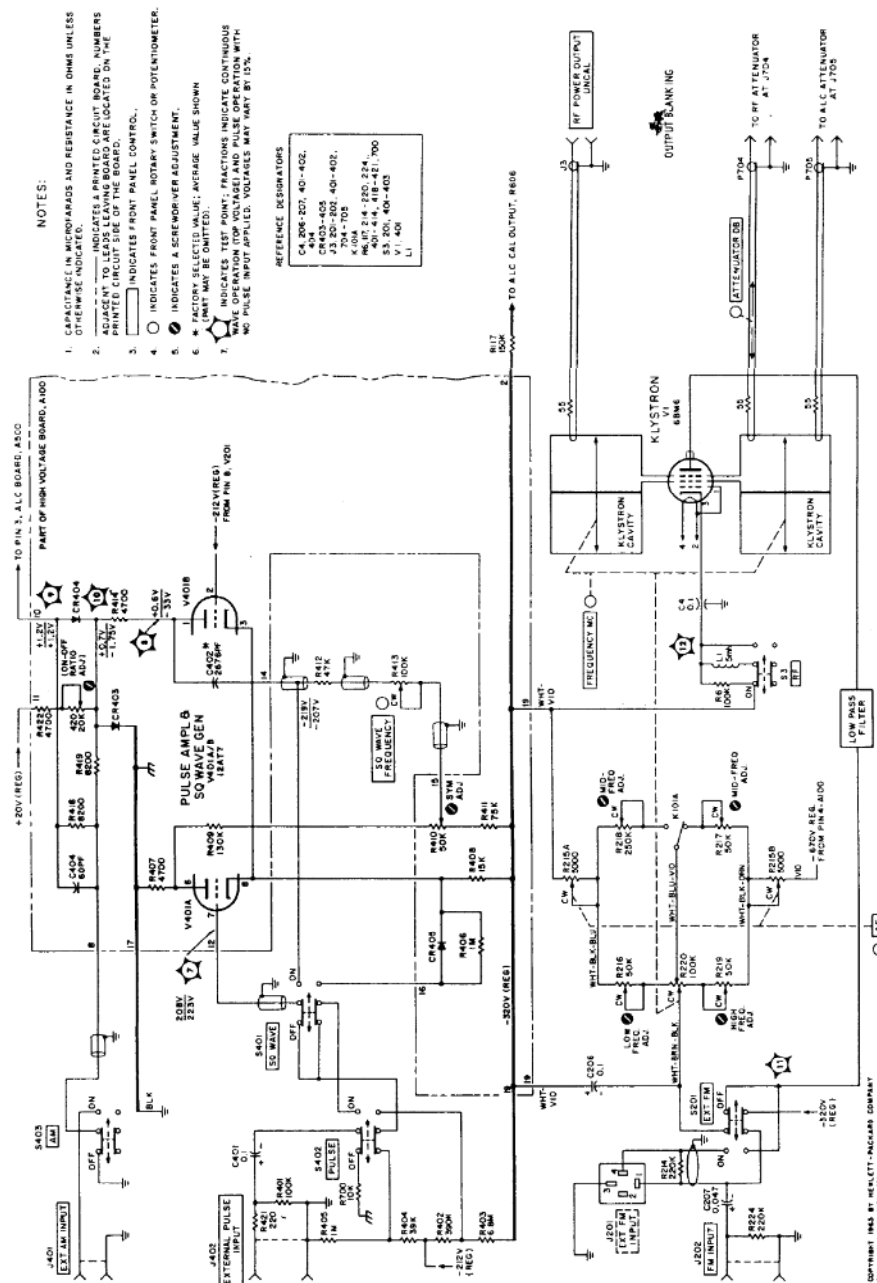
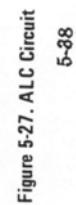


Figure 5-25. Regulated +20 Volt and Filament Supplies





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 designator.
- c. Miscellaneous parts.

The information given for each part consists of the following:

- a. The Hewlett-Packard Part Number.
- b. Part number check digit (CD).
- c. The total quantity (Qty) in the instrument.
- d. The description of the part.
- e. Typical manufacturer of the part in a five-digit code.
- f. 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 and check digit, 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 Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A assembly	E miscellaneous electrical part	P electrical connector (movable portion): plug	U integrated circuit; microcircuit
AT attenuator; isolator; termination	F fuse	Q transistor: SCR; triode thyristor	V electron tube
B fan; motor	FL filter	R resistor	VR voltage regulator; breakdown diode
BT battery	H hardware	RT thermistor	W cable; transmission path; wire
C capacitor	HY circulator	S switch	X socket
CP coupler	J electrical connector (stationary portion): jack	T transformer	Y crystal unit (piezo-electric or quartz)
CR diode; diode thyristor; varactor	K relay	TB terminal board	Z tuned cavity; tuned circuit
DC directional coupler	L coil; inductor	TC thermocouple	
DL delay line	M meter	TP test point	
DS annunciator; signaling device (audible or visual): lamp; LED	MP miscellaneous mechanical part		

ABBREVIATIONS

A ampere	COEF coefficient	EDP electronic data processing	INT internal
ac alternating current	COM common	ELECT electrolytic	kg kilogram
ACCESS accessory	COMP composition	ENCAP encapsulated	kHz kilohertz
ADJ adjustment	COMPL complete	EXT external	k Ω kilohm
A/D analog-to-digital	CONN connector	F farad	kV kilovolt
AF audio frequency	CP cadmium plate	FET field-effect transistor	lb pound
AFC automatic frequency control	CRT cathode-ray tube	F/F flip-flop	LC inductance-capacitance
AGC automatic gain control	CTL complementary transistor logic	FH flat head	LED light-emitting diode
AL aluminum	CW continuous wave	FIL H fillister head	LF low frequency
ALC automatic level control	cw clockwise	FM frequency modulation	LG long
AM amplitude modulation	cm centimeter	FP front panel	LH left hand
AMPL amplifier	D/A digital-to-analog	FREQ frequency	LIM limit
APC automatic phase control	dB decibel	FXD fixed	LIN linear taper (used in parts list)
ASSY assembly	dBm decibel referred to 1 mW	g gram	lin linear
AUX auxiliary	dc direct current	GE germanium	LK WASH lock washer
avg average	deg degree (temperature interval or difference)	GHz gigahertz	LO low; local oscillator
AWG American wire gauge	° degree (plane angle)	GL glass	LOG logarithmic taper (used in parts list)
BAL balance	°C degree Celsius (centigrade)	GRD ground(ed)	log logarithm(ic)
BCD binary coded decimal	°F degree Fahrenheit	H henry	LPF low pass filter
BD board	°K degree Kelvin	h hour	LV low voltage
BE CU beryllium copper	DEPC deposited carbon	HET heterodyne	m meter (distance)
BFO beat frequency oscillator	DET detector	HEX hexagonal	mA milliamper
BH binder head	diam diameter	HD head	MAX maximum
BKDN breakdown	DIA diameter (used in parts list)	HDW hardware	M Ω megohm
BP bandpass	DIFF AMPL differential amplifier	HF high frequency	MEG meg (10 ⁶) (used in parts list)
BPF bandpass filter	div division	HG mercury	MET FLM metal film
BRS brass	DPDT double-pole, double-throw	HI high	MET OX metallic oxide
BWO backward-wave oscillator	DR drive	HP Hewlett-Packard	MF medium frequency; microfarad (used in parts list)
CAL calibrate	DSB double sideband	HPF high pass filter	MFR manufacturer
ccw counter-clockwise	DTL diode transistor logic	HR hour (used in parts list)	mg milligram
CER ceramic	DVM digital voltmeter	HV high voltage	mHz megahertz
CHAN channel	ECL emitter coupled logic	Hz Hertz	mH millihenry
cm centimeter	EMF electromotive force	IC integrated circuit	mho mho
CMO cabinet mount only		ID inside diameter	MIN minimum
COAX coaxial		IF intermediate frequency	min minute (time)
		IMPG impregnated	 minute (plane angle)
		in inch	MINAT miniature
		INCD incandescent	mm millimeter
		INCL include(s)	
		INP input	
		INS insulation	

NOTE

All abbreviations in the parts list will be in upper-case.

Table 6-1. Reference Designations and Abbreviations (2 of 2)

MOD modulator	OD outside diameter	PWV peak working voltage	TD time delay
MOM momentary	OH oval head	RC resistance-capacitance	TERM terminal
MOS metal-oxide semiconductor	OP AMPL operational amplifier	RECT rectifier	TFT thin-film transistor
ms millisecond	OPT option	REF reference	TGL toggle
MTG mounting	OSC oscillator	REG regulated	THD thread
MTR meter (indicating device)	OX oxide	REPL replaceable	THRU through
mV millivolt	oz ounce	RF radio frequency	TI titanium
mVac millivolt, ac	Ω ohm	RFI radio frequency interference	TOL tolerance
mVdc millivolt, dc	P peak (used in parts list)	RH round head; right hand	TRIM trimmer
mVpk millivolt, peak	PAM pulse-amplitude modulation	RLC resistance-inductance-capacitance	TSTR transistor-transistor logic
mVp-p millivolt, peak-to-peak	PC printed circuit	RMO rack mount only	TV television
mVrms millivolt, rms	PCM pulse-code modulation; pulse-count modulation	rms root-mean-square	TVI television interference
mW milliwatt	PDM pulse-duration modulation	RND round	TWT traveling wave tube
MUX multiplex	pF picofarad	ROM read-only memory	U micro (10^6) (used in parts list)
MY mylar	PH BRZ phosphor bronze	R&P rack and panel	UF microfarad (used in parts list)
μ A microampere	PHL Phillips	RWV reverse working voltage	UHF ultrahigh frequency
μ F microfarad	PIN positive-intrinsic-negative	S scattering parameter	UNREG unregulated
μ H microhenry	PIV peak inverse voltage	s second (time)	V volt
μ hho micromho	pk peak	" second (plane angle)	VA voltampere
μ s microsecond	PL phase lock	S-B slow-blow (fuse) (used in parts list)	Vac volts, ac
μ V microvolt	PLO phase lock oscillator	SCR silicon controlled rectifier; screw	VAR variable
μ Vac microvolt, ac	PM phase modulation	SE selenium	VCO voltage-controlled oscillator
μ Vdc microvolt, dc	PNP positive-negative-positive	SECT sections	Vdc volts, dc
μ Vpk microvolt, peak	P/O part of	SEMICON semiconductor	VDCW volts, dc, working (used in parts list)
μ Vp-p microvolt, peak-to-peak	POLY polystyrene	SHF superhigh frequency	V(F) volts, filtered
μ Vrms microvolt, rms	PORC porcelain	SI silicon	VFO variable-frequency oscillator
μ W microwatt	POS positive; position(s) (used in parts list)	SIL silver	VHF very-high frequency
nA nanoampere	POSN position	SL slide	Vpk volts, peak
NC no connection	POT potentiometer	SNR signal-to-noise ratio	Vp-p volts, peak-to-peak
N/C normally closed	p-p peak-to-peak	SPDT single-pole, double-throw	Vrms volts, rms
NE neon	PP peak-to-peak (used in parts list)	SPG spring	VSWR voltage standing wave ratio
NEG negative	PPM pulse-position modulation	SR split ring	VTO voltage-tuned oscillator
nF nanofarad	PREAMPL preamplifier	SPST single-pole, single-throw	VTVM vacuum-tube voltmeter
NI PL nickel plate	PRF pulse-repetition frequency	SSB single sideband	V(X) volts, switched
N/O normally open	PRR pulse repetition rate	SST stainless steel	W watt
NOM nominal	ps picosecond	STL steel	W/ with
NORM normal	PT point	SQ square	WIV working inverse voltage
NPN negative-positive-negative	PTM pulse-time modulation	SWR standing-wave ratio	WW wirewound
NPO negative-positive zero (zero temperature coefficient)	PWM pulse-width modulation	SYNC synchronize	W/O without
NRFR not recommended for field replacement		T timed (slow-blow fuse)	YIG yttrium-iron-garnet
NSR not separately replaceable		TA tantalum	Z ₀ characteristic impedance
ns nanosecond		TC temperature compensating	
nW nanowatt			
OBD order by description			

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^9
M	mega	10^6
k	kilo	10^3
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A100 A101- A499 A500	08614-621	7	1	BOARD, HIGH VOLTAGE	28480	08614-621
			1	NOT ASSIGNED		
	08614-602	8	1	BOARD, LOW VOLTAGE & ALC	28480	08614-602
B1	3140-0030	7	1	MOTOR IND SHADED-P 115V 3000-RPM .001-HP	28480	3140-0030
C1	0180-0213	9	1	CAPACITOR-FXD 5000UF+75-10% 25VDC AL	28480	0180-0213
C2	0160-0152	3	3	CAPACITOR-FXD .1UF +-20% 600VDC PPR	28480	0160-0152
C3	0160-0152	3		CAPACITOR-FXD .1UF +-20% 600VDC PPR	28480	0160-0152
C4	0160-0152	3		CAPACITOR-FXD .1UF +-20% 600VDC PPR	28480	0160-0152
C5- C49				NOT ASSIGNED		
C50	0180-0094	4	2	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025D02
C51	0180-0094	4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025D02
C52	0170-0040	9	1	CAPACITOR-FXD .047UF +-10% 200VDC POLYE	56289	292P47392
C53	0180-0136	5	1	CAPACITOR-FXD 10UF+100-10% 50VDC AL	28480	0180-0136
C54- C100				NOT ASSIGNED		
C101	0180-0024	0	1	CAPACITOR-FXD 40UF+50-10% 450VDC AL	28480	0180-0024
C102	0180-0135	4	1	C-FXD AL ELEC .28ECT,40/450UF -10+50%	28480	0180-0135
C103	0150-0024	7	1	CAPACITOR-FXD .02UF +80-20% 600VDC CER	28480	0150-0024
C104	0150-0052	1	4	CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
C105	0150-0052	1		CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
C106- C200				NOT ASSIGNED		
C201	0180-0011	5	2	CAPACITOR-FXD 20UF+50-10% 450VDC AL	28480	0180-0011
C202	0180-0011	5		CAPACITOR-FXD 20UF+50-10% 450VDC AL	28480	0180-0011
C203	0150-0052	1		CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
C204	0150-0052	1		CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
C205	0160-0079	3	1	CAPACITOR-FXD 1UF +-10% 600VDC PPR	01002	23F467
	1210-0003	1	1	CLAMP-CAP .75-WD STL	28480	1210-0003
C206	0170-0022	7	2	CAPACITOR-FXD .1UF +-20% 600VDC POLYE	28480	0170-0022
C207	0160-0037	3	1	CAPACITOR-FXD .04UF +-20% 1.6KVDC PPR	28480	0160-0037
C208- C400				NOT ASSIGNED		
C401	0170-0022	7		CAPACITOR-FXD .1UF +-20% 600VDC POLYE	28480	0170-0022
C402- C403	0140-0150	7	1	CAPACITOR-FXD 2676PF +-1% 500VDC MICA	72136	DM20F2676RF0500HV1CR
				NOT ASSIGNED		
C404	0140-0214	6	1	CAPACITOR-FXD 60PF +-5% 300VDC MICA	72136	DM15E600J0300HV1CR
C405- C500				NOT ASSIGNED		
C501	0140-0180	5	1	CAPACITOR-FXD 2000PF +-2% 300VDC MICA	72136	DM19F202G0300HV1CR
C502	0140-0209	9	1	CAPACITOR-FXD 5PF +-10% 500VDC MICA	72136	DM15C050K0500HV1CR
C503- C600				NOT ASSIGNED		
C601	0170-0019	2	1	CAPACITOR-FXD .1UF +-5% 200VDC POLYE	28480	0170-0019
C602	0150-0121	5	2	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
C603	0140-0162	3	1	CAPACITOR-FXD 4700PF +-10% 300VDC MICA	72136	DM20F472K0300HV1CR
C604	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
CR1	1901-0032	1	1	DIODE-PWR RECT 1N3209 100V 15A DO-5	03508	1N3209
CR2	1901-0025	2	6	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
CR4	1902-0057	2	2	DIODE-ZNR 6.49V 5% DO-7 PDR,4W TC=+.02%	28480	1902-0057
CR5- CR49				NOT ASSIGNED		
CR50	1901-0026	3	2	DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
CR51	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
CR52	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
CR53	1902-0045	6	1	DIODE-ZNR 7.32V 2% DO-7 PDR,4W TC=+.048%	28480	1902-0045
CR54- CR100				NOT ASSIGNED		
CR101	1901-0030	9	4	DIODE-PWR RECT 800V 600MA DO-29	28480	1901-0030
CR102	1901-0030	9		DIODE-PWR RECT 800V 600MA DO-29	28480	1901-0030
CR103- CR200				NOT ASSIGNED		
CR201	1901-0030	9		DIODE-PWR RECT 800V 600MA DO-29	28480	1901-0030
CR202	1901-0030	9		DIODE-PWR RECT 800V 600MA DO-29	28480	1901-0030
CR203	1902-0175	5	1	DIODE-ZNR 100V 5% DO-15 PDR,1W TC=+.083%	28480	1902-0175
CR204- CR402				NOT ASSIGNED		
CR403	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
CR404	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2N3 DO-35	28480	1901-0040
CR405	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
CR406- CR500				NOT ASSIGNED		
CR501	1902-0057	2		DIODE-ZNR 6.49V 5% DO-7 PDR,4W TC=+.02%	28480	1902-0057

See introduction to this section for ordering information
 *Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
CR502- CR600 CR601 CR602 CR603- CR700	1902-0216 1901-0025	5 2	1	NOT ASSIGNED DIODE-ZNR 7.15V 5% PD=1.5W TC=+.042X DIODE-GEN PRP 100V 200MA DO-7	28480 28480	1902-0216 1901-0025
CR701	08614-801 5280-0321	5	1	NOT ASSIGNED DIODE, SPECIAL (INCLUDES MATCHING RESISTOR R519)	28480	08614-801
D81	1450-0566	9	1	LIGHT-IND WMT-TL .4-DIA SLDL-LUG-TERM	91802	2910517
F1	2110-0043	8	1	FUSE 1.5A 250V FAST-BLO 1.25X.25 UL IEC (FOR 115V OPERATION ONLY)	28480	2110-0043
F1	2110-0033	6	1	FUSE .75A 250V NORM-BLO 1.25X.25 (FOR 230V OPERATION ONLY)	28480	2110-0033
F2	2110-0014 1400-0008	3 9	1 1	FUSE 4A 250V BLO-BLO 1.25X.25 UL FUSEHOLDER-BLOCK 15A 250V 1-FU	75915 28480	313004 1400-0008
J1 J2 J3- J200 J201	1251-0148 1251-0011	1 7	1 1	NOT ASSIGNED CONNECTOR-AC PWR HP-6 MALE FLG-MTG NOT ASSIGNED CONNECTOR 4-PIN F JONES TYPE	28480 28480	1251-0148 1251-0011
J202 J203- J400 J401 J402	1250-0083 1250-0083 1250-0083	1 1 1	3 1 1	CONNECTOR-RF BNC FEM 8GL-HOLE-FR 50-OHM NOT ASSIGNED CONNECTOR-RF BNC FEM 8GL-HOLE-FR 50-OHM CONNECTOR-RF BNC FEM 8GL-HOLE-FR 50-OHM	28480 28480 28480	1250-0083 1250-0083 1250-0083
J403- J500 J501	1251-0070	8	1	NOT ASSIGNED CONNECTOR-TEL JACK 3-CKT .25-BMK-DIA	28480	1251-0070
K101	0490-1198	8	1	RELAY 3C 110VDC-COIL 5A 120VAC	28480	0490-1198
L1	9140-0072 9140-0805	3	1	COIL-MLD 5MH 10% 9#80 .375DX.625LG-NOM	28480	9140-0072
M501	1120-0134	8	1	METER METER,0-200UA 2X,EDGE VIEW	28480	1120-0134
Q1 Q2 Q3- Q49 Q50	1850-0098 1850-0064 1850-0064	0 0 0	1 2	TRANSISTOR PNP GE TO-3 PD=90W FT=300KHZ TRANSISTOR PNP 2N1183 GE TO-6 PD=7.5W	28480 01928	1850-0098 2N1183
Q51 Q52 Q53 Q54- Q500	1850-0128 1850-0062 1850-0062	7 8 8	1 4	TRANSISTOR PNP 2N3988 GE TO-5 PD=250MH TRANSISTOR PNP GE TO-5 PD=150MH TRANSISTOR PNP GE TO-5 PD=150MH	28480 28480 28480	1850-0128 1850-0062 1850-0062
Q501 Q502 Q503 Q504- Q600	1854-0014 1850-0062 1850-0062	8 8 8	1	NOT ASSIGNED TRANSISTOR-DUAL NPN TO-77 PD=600MH TRANSISTOR PNP GE TO-5 PD=150MH TRANSISTOR PNP GE TO-5 PD=150MH	28480 28480 28480	1854-0014 1850-0062 1850-0062
Q601 Q602 Q603 Q604 Q605	1854-0003 1854-0003 1854-0003 1854-0003 1854-0003	5 5 5 5 5	6	TRANSISTOR NPN 8I TO-39 PD=800MH TRANSISTOR NPN 8I TO-39 PD=800MH TRANSISTOR NPN 8I TO-39 PD=800MH TRANSISTOR NPN 8I TO-39 PD=800MH TRANSISTOR NPN 8I TO-39 PD=800MH	28480 28480 28480 28480 28480	1854-0003 1854-0003 1854-0003 1854-0003 1854-0003
Q606	1854-0003	5	1	TRANSISTOR NPN 8I TO-39 PD=800MH	28480	1854-0003
R1 R2 R3 R4 R5	0687-3331 0690-1841 0687-2221 0813-0030 2100-0317	2 2 7 1 8	1 2 3 1 1	RESISTOR 33K 10% .5W CC TC=0+765 RESISTOR 180K 10% 1W CC TC=0+882 RESISTOR 2.2K 10% .5W CC TC=0+647 RESISTOR 3.9 5% 3W PW TC=0+-50 RESISTOR-TRMR 2 20% WH TOP-ADJ 1-TRN	01121 01121 01121 91637 11236	EB3331 GB1841 EB2221 CW281-3N-T2-3R9-J 115-2N-2HD-M
R6 R7- R49 R50 R51	0757-0059 0698-0001 0686-3335	4 0 4	1 1	RESISTOR 1M 1% .5W F TC=0+-100 NOT ASSIGNED RESISTOR 4.7 5% .5W CC TC=0+412 RESISTOR 33K 5% .5W CC TC=0+765	28480 01121 01121	0757-0059 EB4765 EB3335
R52 R53 R54 R55 R56	0757-0088 2100-0151 0757-0077 0686-3625 0686-1115	9 8 6 5 4	1 1 1 1 2	RESISTOR 620 2% .25W F TC=0+-100 RESISTOR-VAR CONTROL CP 500 20% LIN RESISTOR 1.2K 2% .25W F TC=0+-100 RESISTOR 3.6K 5% .5W CC TC=0+647 RESISTOR 110 5% .5W CC TC=0+529	24546 28480 28480 01121 01121	C5-1/4-T0-621-G 2100-0151 0757-0077 EB3625 EB1115
R57 R58 R59 R60 R61	0686-8225 0689-2045 0686-1115 0686-8225 0690-1541	1 7 4 1 9	2 1 4	RESISTOR 8.2K 5% .5W CC TC=0+647 RESISTOR 200K 5% 1W CC TC=0+882 RESISTOR 110 5% .5W CC TC=0+529 RESISTOR 8.2K 5% .5W CC TC=0+647 RESISTOR 150K 10% 1W CC TC=0+882	01121 01121 01121 01121 01121	EB8225 GB2045 EB1115 EB8225 GB1541

See introduction to this section for ordering information
 *Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R62- R100 R101 R102 R103	0693-3301 0687-4741 0687-4741	9 0 0	1 6	NOT ASSIGNED RESISTOR 33 10K 2W CC TC=0+412 RESISTOR 470K 10K .5W CC TC=0+882 RESISTOR 470K 10K .5W CC TC=0+882	01121 01121 01121	HB3301 EB4741 EB4741
R104 R105 R106 R107 R108	0690-3911 0687-2221 0690-3911 0687-2221 0687-4741	1 7 1 7 0	2	RESISTOR 390 10K 1W CC TC=0+529 RESISTOR 2.2K 10K .5W CC TC=0+647 RESISTOR 390 10K 1W CC TC=0+529 RESISTOR 2.2K 10K .5W CC TC=0+647 RESISTOR 470K 10K .5W CC TC=0+882	01121 01121 01121 01121 01121	GB3911 EB2221 GB3911 EB2221 EB4741
R109 R110 R111 R112 R113	0774-0003 NOT ASSIGNED 0690-1541 0690-2741 0690-2741	4 9 3 3	1 3	RESISTOR 27K 10K 5W MO TC=0+250 NOT ASSIGNED RESISTOR 150K 10K 1W CC TC=0+882 RESISTOR 270K 10K 1W CC TC=0+882 RESISTOR 270K 10K 1W CC TC=0+882	27167 01121 01121 01121	FP5-5-250-2702-K GB1541 GB2741 GB2741
R114 R115 R116 R117 R118- R200	0690-2741 0757-0138 0698-3545 0760-0023 NOT ASSIGNED	3 0 3 9	1 1 1 1	RESISTOR 270K 10K 1W CC TC=0+882 RESISTOR 909K 1K .5W F TC=0+100 RESISTOR 988K 1K .5W F TC=0+100 RESISTOR 150K 1K 1W F TC=0+50	01121 28480 28480 19701	GB2741 0757-0138 0698-3545 MF8C1-12-1503-F
R201 R202 R203 R204 R205	0693-4701 0687-4741 0687-4741 0690-1241 0687-6831	5 0 0 6 3	1 2	RESISTOR 47 10K 2W CC TC=0+412 RESISTOR 470K 10K .5W CC TC=0+882 RESISTOR 470K 10K .5W CC TC=0+882 RESISTOR 120K 10K 1W CC TC=0+882 RESISTOR 68K 10K .5W CC TC=0+765	01121 01121 01121 01121 01121	HB4701 EB4741 EB4741 GB1241 EB6831
R206 R207 R208 R209 R210	0690-3941 0687-3931 0690-3341 0690-1241 0687-4741	7 8 1 6 0	1 2 1	RESISTOR 390K 10K 1W CC TC=0+882 RESISTOR 39K 10K .5W CC TC=0+765 RESISTOR 330K 10K 1W CC TC=0+882 RESISTOR 120K 10K 1W CC TC=0+882 RESISTOR 470K 10K .5W CC TC=0+882	01121 01121 01121 01121 01121	GB3941 EB3931 GB3341 GB1241 EB4741
R211 R212 R213 R214 R215	0758-0052 2100-0991 0761-0017 0687-2241 2100-2140	9 4 3 1 9	1 2 1 3 1	RESISTOR 91K 5K .25W F TC=0+100 RESISTOR-VAR CONTROL CP 50K 30K LIN RESISTOR 300K 5K 1W MO TC=0+200 RESISTOR 220K 10K .5W CC TC=0+882 RESISTOR-VAR DUAL 5K-10K-CC 5K-10K-CC	24546 28480 28480 01121 28480	C5-1/4-TD-9102-J 2100-0991 0761-0017 EB2241 2100-2140
R216 R217 R218 R219 R220	2100-0028 2100-0028 2100-0029 2100-0028 2100-0399 SD60-0335	8 8 9 8 6	3 1 1 1 1	RESISTOR-VAR CONTROL CCP 50K 10K LIN RESISTOR-VAR CONTROL CCP 50K 10K LIN RESISTOR-VAR CONTROL CCP 250K 10K LIN RESISTOR-VAR CONTROL CCP 50K 10K LIN RESISTOR ELEMENT 100K (REPELTER POT) CD7, CARD ASSY (REPELTER POT)	28480 28480 28480 28480 28480	2100-0028 2100-0028 2100-0029 2100-0028 2100-0399
R221- R223 R224 R225- R400	0687-2241	1	1	NOT ASSIGNED RESISTOR 220K 10K .5W CC TC=0+882	01121	EB2241
R401 R402 R403 R404 R405	0687-1041 0687-3941 0687-6831 0687-3931 0687-1051	7 0 7 8 9	1 1 1 3	RESISTOR 100K 10K .5W CC TC=0+882 RESISTOR 390K 10K .5W CC TC=0+882 RESISTOR 6.8M 10K .5W CC TC=0+1000 RESISTOR 39K 10K .5W CC TC=0+765 RESISTOR 1M 10K .5W CC TC=0+1000	01121 01121 01121 01121 01121	EB1041 EB3941 EB6831 EB3931 EB1051
R406 R407 R408 R409 R410	0687-1051 0686-4725 0693-1531 0686-1345 2100-0991	9 8 3 2 4	2 1 3	RESISTOR 1M 10K .5W CC TC=0+1000 RESISTOR 4.7K 5K .5W CC TC=0+647 RESISTOR 15K 10K 2W CC TC=0+765 RESISTOR 130K 5K .5W CC TC=0+882 RESISTOR-VAR CONTROL CP 50K 30K LIN	01121 01121 01121 01121 28480	EB1051 EB4725 HB1531 EB1345 2100-0991
R411 R412 R413 R414 R415- R417	0686-7535 0687-4731 2100-3798 0686-4725	4 8 5 8	1 1 2	RESISTOR 75K 5K .5W CC TC=0+765 RESISTOR 47K 10K .5W CC TC=0+765 RESISTOR VAR 100K +-10% LIN 0.500W RESISTOR 4.7K 5K .5W CC TC=0+647	01121 01121 28480 01121	EB7535 EB4731 2100-3798 EB4725
R418 R419 R420 R421 R422	0687-8221 0687-8221 2100-0093 0687-2211 0687-4721	9 9 7 5 6	2 1 1 1	NOT ASSIGNED RESISTOR 8.2K 10K .5W CC TC=0+647 RESISTOR 8.2K 10K .5W CC TC=0+647 RESISTOR-VAR CONTROL CP 20K 20K LIN RESISTOR 220 10K .5W CC TC=0+529 RESISTOR 4.7K 10K .5W CC TC=0+647	01121 01121 28480 01121 01121	EB8221 EB8221 2100-0093 EB2211 EB4721
R423- R500 R501 R502 R503	2100-3798 0687-1061 0757-0344	5 1 0	1 2	NOT ASSIGNED RESISTOR VAR 100K +-10% LIN 0.500W RESISTOR 10M 10K .5W CC TC=0+1059 RESISTOR 1M 1K .25W F TC=0+100	28480 01121 24546	2100-3798 EB1061 C5-1/4-TD-1004-F
R504 R505 R506 R507 R508	0757-0344 0758-0006 0758-0006 0758-0019 0758-0019	0 3 3 8 8	2 2	RESISTOR 1M 1K .25W F TC=0+100 RESISTOR 10K 5K .25W F TC=0+100 RESISTOR 10K 5K .25W F TC=0+100 RESISTOR 18K 5K .25W F TC=0+100 RESISTOR 18K 5K .25W F TC=0+100	24546 24546 24546 24546 24546	C5-1/4-TD-1004-F C5-1/4-TD-1002-J C5-1/4-TD-1002-J C5-1/4-TD-1802-J C5-1/4-TD-1802-J

See introduction to this section for ordering information
 *Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R509	0690-1541	9		RESISTOR 150K 10% 1W CC TC=0+882	01121	GB1541
R510	0687-1031	5	2	RESISTOR 10K 10% .5W CC TC=0+765	01121	EB1031
R511	0687-3311	8	3	RESISTOR 330 10% .5W CC TC=0+529	01121	EB3311
R512	0686-3045	3	1	RESISTOR 300K 5% .5W CC TC=0+882	01121	EB3045
R513	0757-0338	2	1	RESISTOR 1K 1% .25W F TC=0+100	24546	C5=1/4-TD=1001-F
R514	0698-4039	2	1	RESISTOR 52.3K 1% .5W F TC=0+100	28480	0698-4039
R515	0698-3542	0	1	RESISTOR 25.5K 1% .5W F TC=0+100	28480	0698-3542
R516	0757-1080	3	1	RESISTOR 26.7K 1% .5W F TC=0+100	28480	0757-1080
R517	0687-3311	8		RESISTOR 330 10% .5W CC TC=0+529	01121	EB3311
R518	0690-1541	9		RESISTOR 150K 10% 1W CC TC=0+882	01121	GB1541
R519-	0687-1231	7	1	RESISTOR 12K 10% .5W CC TC=0+765	01121	EB1231
R520-				NOT ASSIGNED		
R600				RESISTOR 330 10% .5W CC TC=0+529	01121	EB3311
R601	0687-3311	8		RESISTOR 330K 5% .5W CC TC=0+882	01121	EB1345
R602	0686-1345	2				
R603	0686-1345	2		RESISTOR 130K 5% .5W CC TC=0+882	01121	EB1345
R604	0687-1051	9		RESISTOR 1M 10% .5W CC TC=0+1000	01121	EB1051
R605	0758-0003	0	1	RESISTOR 1K 5% .25W F TC=0+100	24546	C5=1/4-TD=1001-J
R606	2100-0235	9	1	RESISTOR-VAR CONTROL CCP 5K 20% LIN	28480	2100-0235
R607	0687-6821	1	1	RESISTOR 6.8K 10% .5W CC TC=0+647	01121	EB6821
R608	0690-1841	2		RESISTOR 180K 10% 1W CC TC=0+882	01121	GB1841
R609	0687-2241	1		RESISTOR 220K 10% .5W CC TC=0+882	01121	EB2241
R610	0687-1521	8	1	RESISTOR 1.5K 10% .5W CC TC=0+647	01121	EB1521
R611	0758-0046	1	1	RESISTOR 6.2K 5% .25W F TC=0+100	24546	C5=1/4-TD=6201-J
R612	0758-0009	6	1	RESISTOR 6.8K 5% .25W F TC=0+100	24546	C5=1/4-TD=6801-J
R613	0773-0007	6	1	RESISTOR 20K 5% 5W MO TC=0+250	27167	FP5=5-250-2002-J
R614	2100-0896	8	2	RESISTOR-TMR 15K 5% HW TOP-ADJ 1-TRN	28480	2100-0896
R615	2100-0896	8		RESISTOR-TMR 15K 5% HW TOP-ADJ 1-TRN	28480	2100-0896
R616	0758-0012	1	2	RESISTOR 12K 5% .25W F TC=0+100	28480	0758-0012
R617	0758-0012	1		RESISTOR 12K 5% .25W F TC=0+100	28480	0758-0012
R618	0758-0002	9	2	RESISTOR 560 5% .25W F TC=0+100	24546	C5=1/4-TD=561-J
R619	0758-0002	9		RESISTOR 560 5% .25W F TC=0+100	24546	C5=1/4-TD=561-J
R620	2100-0898	0	2	RESISTOR-TMR 500 5% HW TOP-ADJ 1-TRN	28480	2100-0898
R621	2100-0898	0		RESISTOR-TMR 500 5% HW TOP-ADJ 1-TRN	28480	2100-0898
R622-				NOT ASSIGNED		
R699						
R700	0687-1031	5		RESISTOR 10K 10% .5W CC TC=0+765	01121	EB1031
RT1	0839-0020	3	1	THERMISTOR DISC 100-OHM TC=4.4%/C-DEG	28480	0839-0020
S1	3101-0042	9	1	SWITCH-PB SPST ALTNG 1.5A 230VAC	28480	3101-0042
S2	3101-0033	8	1	SWITCH-BL DPDTSTD .5A 125VAC/DC SLDG-LUG	28480	3101-0033
S3	3101-1153	5	2	SWITCH, PUSHBUTTON	28480	3101-1153
S4-				NOT ASSIGNED		
S200						
S201	3101-1153	5		SWITCH, PUSHBUTTON	28480	3101-1153
S202	3102-0009	0	1	SWITCH-BENS SPDT SUBMIN 5A 250VAC	28480	3102-0009
S203-				NOT ASSIGNED		
S400				SWITCH-PUSHBUTTON DPDT	28480	3101-0043
S401	3101-0043	0	4			
S402	3101-0043	0		SWITCH-PUSHBUTTON DPDT	28480	3101-0043
S403	3101-0043	0		SWITCH-PUSHBUTTON DPDT	28480	3101-0043
S404-				NOT ASSIGNED		
S600				SWITCH-PUSHBUTTON DPDT	28480	3101-0043
S601	3101-0043	0				
T1	9100-0176	4	1	TRANSFORMER-POWER TRANSFORMER-POWER	28480	9100-0176
V1				TUBE-ELECTRON 6BM6 KLYSTRON	14830	6BM6
V2-				NOT ASSIGNED		
V100				TUBE-ELECTRON 7233 TRIODE	33173	7233
V101	1921-0014	1	2	TUBE-ELECTRON 7233 TRIODE	33173	7233
V102	1921-0014	1				
V103	1932-0030	4	2	TUBE-ELECTRON 12AX7A TRIODE-DUAL	01928	12AX7A
V104	1932-0030	4		TUBE-ELECTRON 12AX7A TRIODE-DUAL	01928	12AX7A
V105	1940-0007	2	1	TUBE-ELECTRON 0B2 DIODE-V RGLTR	94151	0B2
V106-				NOT ASSIGNED		
V200						
V201	1923-0030	5	1	TUBE-ELECTRON 6CL6 PENTODE	94151	6CL6
V202	1940-0001	6	1	TUBE-ELECTRON 5651A DIODE-V RGLTR	01928	5651A
V203	1923-0046	3	1	TUBE-ELECTRON 6XJ7 PENTODE	28480	1923-0046
V204	1921-0005	0	1	TUBE-ELECTRON 6C4 TRIODE	01928	6C4
V205-				NOT ASSIGNED		
V400						
V401	1932-0042	8	1	TUBE-ELECTRON 12AT7 TRIODE-DUAL	33173	12AT7
V402-				NOT ASSIGNED		
V500				TUBE-ELECTRON 8056 TRIODE	94151	8056
V501	1921-0015	2	2	TUBE-ELECTRON 8056 TRIODE	94151	8056
V502	1921-0015	2				

See introduction to this section for ordering information
 *Indicates factory selected value

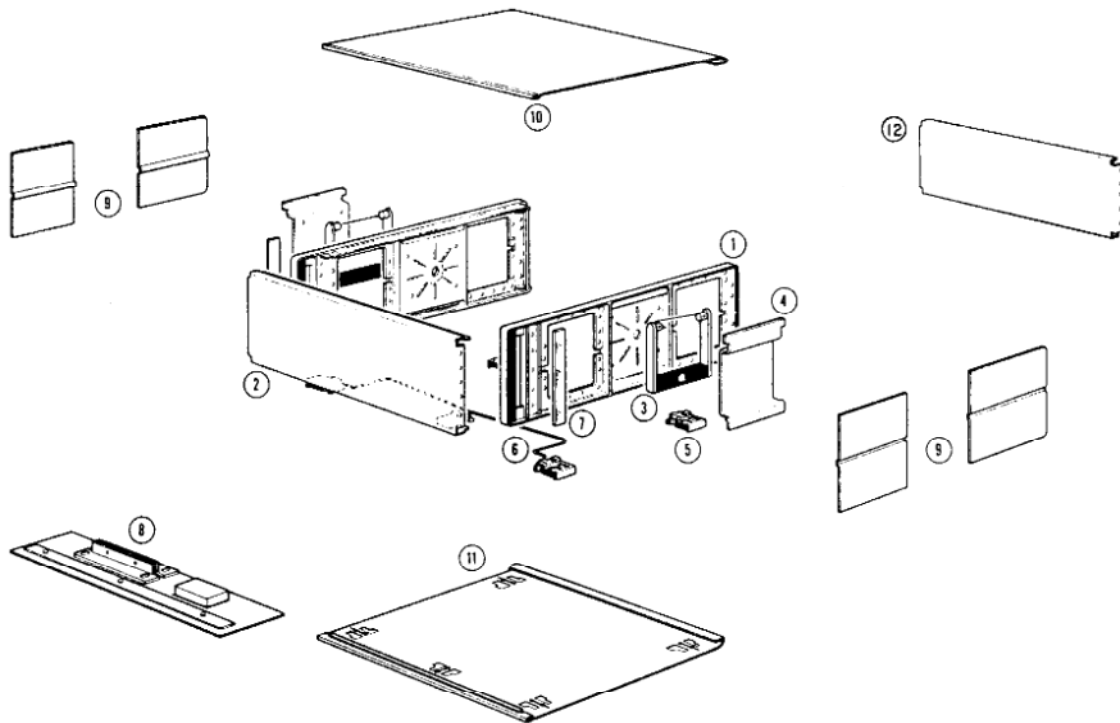
Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W1	8120-0078	6	1	CABLE ASSY 18AWG 3-CONDCT BLK-JKT	28480	8120-0078
XV101	5040-0417	4	2	SOCKET HOLDER, 9-PIN	28480	5040-0417
XV102	5040-0417	4		SOCKET HOLDER, 9-PIN	28480	5040-0417
XV103	1200-0062	1	5	SOCKET-TUBE 9-CONT DIP-SLDR	28480	1200-0062
XV104	1200-0062	1		SOCKET-TUBE 9-CONT DIP-SLDR	28480	1200-0062
XV105	1200-0053	0	3	SOCKET-TUBE 7-CONT DIP-SLDR	28480	1200-0053
XV106-				NOT ASSIGNED		
XV200				SOCKET-TUBE 9-CONT DIP-SLDR	28480	1200-0062
XV201	1200-0062	1		SOCKET-TUBE 7-CONT DIP-SLDR	28480	1200-0053
XV202	1200-0053	0		SOCKET-TUBE 9-CONT DIP-SLDR	28480	1200-0062
XV203	1200-0062	1		SOCKET-TUBE 7-CONT DIP-SLDR	28480	1200-0053
XV204	1200-0053	0		SOCKET-TUBE 7-CONT DIP-SLDR	28480	1200-0053
XV205-				NOT ASSIGNED		
XV400				SOCKET-TUBE 9-CONT DIP-SLDR	28480	1200-0062
XV401	1200-0062	1		NOT ASSIGNED		
XV402-				NOT ASSIGNED		
XV500				SOCKET-TUBE 5-CONT E5-65 DIP-SLDR	28480	1200-0086
XV501	1200-0086	9	2	SOCKET-TUBE 5-CONT E5-65 DIP-SLDR	28480	1200-0086
XV502	1200-0086	9				
				MISCELLANEOUS PARTS		
	5040-0201	4	1	BEZEL: COUNTER (ATTN) LIGHT GRAY	28480	5040-0201
	5040-0202	5	1	BEZEL: COUNTER (FREQ) LIGHT GRAY	28480	5040-0202
	08614-299	5	1	CABLE, SST	28480	08614-299
	08614-626	2	1	CAP, UNCAL RF POWER OUTPUT	28480	08614-626
	08614-605	7	1	CAVITY ASSEMBLY	28480	08614-605
	08614-623	9	1	CABLE ASSEMBLY	28480	08614-623
	9240-0007	6	1	CONTAINER, DESICCANT	28480	9240-0007
	1250-0144	5	1	BODY-RF CONN SERIES N1 BULKHEAD	28480	1250-0144
	7100-0091	0	1	COVER, KLYSTRON	28480	7100-0091
	08614-612	6	1	FAN ASSEMBLY, INCLUDES BLADE	28480	08614-612
	3160-0030	9	1	FAN BLADE .5-TNK 2.75-OD .125-ID	28480	3160-0030
	0510-0123	1	1	RETAINER-PUSH ON RECT EXT .312-IN-DIA	28480	0510-0123
	0370-0050	5	1	KNOB RND1BLK1.375D1CRANK SPINNER	28480	0370-0050
	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	28480	1200-0043
	08614-611	5	1	INTAKE AIR CLEANER ASSEMBLY	28480	08614-611
	0370-0025	4	1	KNOB RND1BLK1FOR .250 SHFT1.750D	28480	0370-0025
				(INT, SQUARE WAVE, ALC		
	0370-0026	5	1	KNOB RND1BLK1FOR .250 SHFT11 ARD1.750D	28480	0370-0026
	0370-0149	3	1	KNOB-CRANK 1.625 IN OD1 .250 IN DIA	28480	0370-0149
	5000-0237	2	1	LABEL:ALC	28480	5000-0237
	5000-0244	1	1	LABEL:FM	28480	5000-0244
	5000-0245	2	1	LABEL:PULSE	28480	5000-0245
	5000-0246	3	1	LABEL:SQUARE WAVE	28480	5000-0246
	5000-0247	4	1	LABEL:RF	28480	5000-0247
	5000-0248	5	1	LABEL:LINE	28480	5000-0248
	5000-0249	6	1	LABEL:AM	28480	5000-0249
	08614-604	6	1	LEVELER ASSEMBLY, INCLUDES CABLE	28480	08614-604
	08614-606	8	1	LEVELER CABLE ASSEMBLY, RF	28480	08614-606
	08614-624	0	1	LDE PASS FILTER KIT	28480	08614-624
	08614-622	8	1	LOW PASS FILTER ASSEMBLY	28480	08614-622
	08614-800	4	1	MAINTENANCE TOOL KIT	28480	08614-800
				(OPTIONAL) INCL1#23 OPEN END WRENCH		
	08614-613	7	1	(7/16) HEX WRENCH (9/16) HEX WRENCH & PLIERS	28480	08614-613
	08614-614	8	1	PROBE ASSEMBLY, CAL & ALC	28480	08614-614
				PROBE ASSEMBLY, UNCALIBRATED OUTPUT		
	08614-619	3	1	WIRING HARNESS, BRANCHED (AC)	28480	08614-619
	08614-620	6	1	WIRING HARNESS, BRANCHED (DC)	28480	08614-620
	1400-0090	9	1	WASHER: RUBBER 5/8" OD	00000	080
	2110-0465	8	1	FUSEHOLDER CAP EXTR PST; BAYONET; 20A	28480	2110-0465
	2110-0467	0	1	NUT-HEX 1/2-28 TND 0.688 A/F	75915	903-070
	2110-0470	5	1	FUSEHOLDER BODY EXTR PST; BAYONET; TND	75915	345003-010
	0340-0822	6	1	INSULATOR-FLG-BBHC TFE	28480	0340-0822
	3050-0591	4	1	WASHER-FL NM 1/4 IN .255-IN-ID	28480	3050-0591
	7120-4162	6	1	LABEL, WARNING*HAZARDOUS VOLTAGE*(LARGE)	28480	7120-4162
	7120-4295	6	1	LABEL, WARNING*HAZARDOUS VOLTAGE ALWAYS PRESENT*	28480	7120-4295
	7120-5087	6	1	LABEL, WARNING*TO PREVENT ELECTRICAL SHOCK	28480	7120-5087

See introduction to this section for ordering information
 *Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				CABINET PARTS		
1	5060-0732	8	1	SIDE FRAME ASSY	28480	5060-0732
	0590-0053	4	1	NUT-8MMET-J=TP 6-32-THD ,5-WD STL	28480	0590-0053
2	08614-009	5	1	FRONT PANEL	28480	08614-009
	2530-0011	0	1	SCREW-MACH 8-32 ,175-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
3	5060-0763	5	1	HANDLE ASSY-SIDE	28480	5060-0763
4	5060-0766	8	1	HANDLE ASSY-RETAINER(LIGHT GRAY)	28480	5060-0766
	2550-0013	4	1	SCREW-MACH 8-32 ,312-IN-LG PAN=HD=PML	00000	ORDER BY DESCRIPTION
5	5060-0767	9	1	FOOT ASSY-FM	28480	5060-0767
6	1490-0030	6	1	TILT STAND 3-IN-W 13.75-IN-DA-LG SST	28480	1490-0030
7	5000-0052	9	1	PLATE-FLUTED ALUMINUM	28480	5000-0052
8	5060-0775	9	1	KIT-RACK MOUNT, 5H(LIGHT GRAY)	28480	5060-0775
9				COVER, SIDE		
	5000-0738	8	1	COVER-REAR SIDE PLATE(LIGHT GRAY)	28480	5000-0738
	5000-0739	9	1	COVER-FRONT SIDE PLATE(LIGHT GRAY)	28480	5000-0739
	2370-0020	1	1	SCREW-MACH 6-32 ,188-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
10	5060-0740	8	1	COVER ASSY-TOP 16L(BLUE GRAY)	28480	5060-0740
	2370-0021	2	2	SCREW-MACH 6-32 ,438-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
11	5060-0752	2	1	BOTTOM COVER ASSY-16L FM(LIGHT GRAY)	28480	5060-0752
	2370-0021	2	1	SCREW-MACH 6-32 ,438-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
12	08614-024	4	1	REAR PANEL	28480	08614-024
	2616-0019	4	1	SCREW-MACH 8-32 ,36-IN-LG PAN=HD=PML	00000	ORDER BY DESCRIPTION



See introduction to this section for ordering information
 *Indicates factory selected value

Table 6-3. Code List of Manufacturers

Mfr Code	Manufacturer Name	Address	Zip Code
00000	ANY SATISFACTORY SUPPLIER		
01002	GE CO INDUSTRIAL & POWER CAP DEPT	HUDSON FALLS NY	12839
01121	ALLEN-BRADLEY CO	MILWAUKEE WI	53204
01928	RCA CORP SOLID STATE DIV	SOMERVILLE NJ	08876
03508	GE CO SEMICONDUCTION PROD DEPT	SYRACUSE NY	13201
11216	CTS OF BERNE INC	BERNE IN	46711
14810	RAYTHEON CO SPL U-WAVE DEVICES DIV	WALTHAM MA	02154
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
20506	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON NC	28401
28480	HENLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
33173	GE CO TUBE DEPT	OWENSBORO KY	42301
56280	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC CT	06226
75915	LITTELFUSE INC	DES PLAINES IL	60016
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601
91802	INDUSTRIAL DEVICES INC	EDGEWATER NJ	07020
94151	GTE SYLVANIA FLEX COMPONENTS GROUP	WALTHAM MA	02154

APPENDIX

BACKDATING

MANUAL CHANGES

Model 8614A
Signal Generator

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

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES	SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
331-	A through R	511-	J through R
343-	B through R	548-	K through R
351-	C through R	548-below 01350	L through R
408-	D through R	748-below 01850	M through R
411-	E through R	749-below 01900	N through R
424-	F through R	749-below 01950	O through R
434-	G through R	749-below 02000	P through R
448-	H through R	815-below 02100	Q, R
501-	I through R	815-below 02201	R

CHANGE A: R109 is a 27K-ohm, 4-watt resistor. The 4-watt rating is very close to operating power and should be changed to a 27K-ohm, 5-watt resistor (listed value Table 6-1) if replacement is ever necessary.

CHANGE B (see Note 1): Figure 2 (see Change F): Delete L1, connected in series with capacitor C4 and switch S3 (replace with a short circuit).

Table 6-1, Page 6-4,
Delete: L1

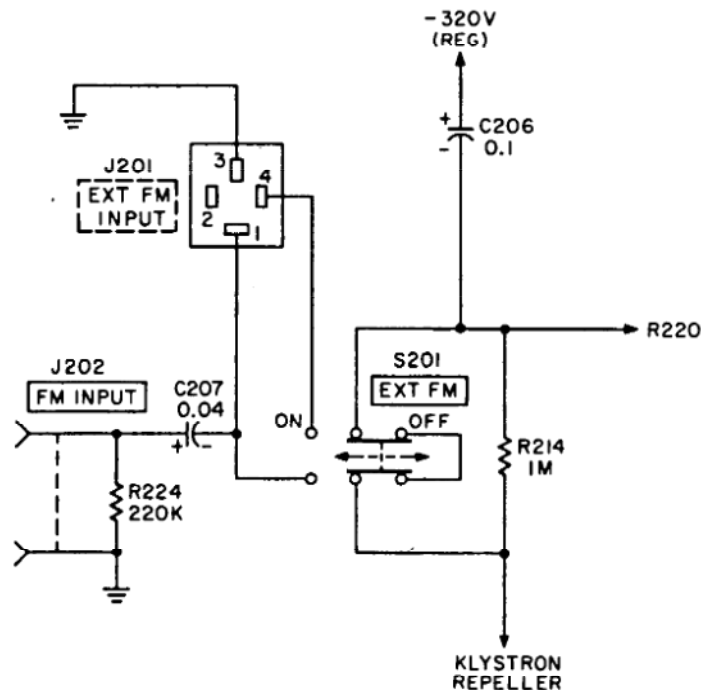
Table 6-2, Page 6-14,
Delete: HP Stock No. 9140-0072

NOTE 1

Some 6BM6 klystrons were manufactured with a low-beam current characteristic. These low-beam current klystrons would sometimes fail to start oscillating between 1500 MHz and 1600 MHz when the 8614A RF button was depressed. The following modification of your 8614A will provide reliable starting of oscillations.

- 1) Move lead between cathode of klystron V1 and center conductor on S3 to OFF side of S3; i.e., toward instrument panel.
- 2) Connect L1, a 5-mH inductor between OFF side of S3 and center conductor terminal of S3.
- 3) Do not make deletions as specified above for change B.

CHANGE C: Wiring of FM-input circuitry has been accomplished as shown below.



CHANGE D: Probe Carriage Assembly (HP Stock No. 08614-265) supports the wiper fingers in the cavity assembly. Should the need arise for replacement of wiper fingers it is recommended that the instrument be returned to the Hewlett-Packard Company or your local Sales and Service Office and the entire Probe Carriage Assembly be replaced with the new version (HP Stock No. 08616-218).

CHANGE E: Table 6-1, Page 6-7,
 R614 and R615: Change from HP Stock No. 2100-0896 to 2100-0409; R: var ww LIN 15K ohm 20% 2W
 R620 and R621: Change from HP Stock No. 2100-0898 to 2100-0410; R: var ww LIN 500 ohm 20% 2W

Table 6-2, Page 6-14,
 Delete: HP Stock No. 2100-0896
 Delete: HP Stock No. 2100-0898
 Add: HP Stock No. 2100-0409; R: var ww LIN 15K ohm 20% 2W; Mfr 28480; Mfr Part No. 2100-0409; TQ 2
 Add: HP Stock No. 2100-0410; R: var ww LIN 500 ohm 20% 2W; Mfr 28480; Mfr Part No. 2100-0410; TQ 2

CHANGE F: Page 1-0, Figure 1-1,
 The 8614A picture is in error; the physical position of the "AM" and "FM" buttons is reversed.

Section III, Figures 3-1 thru 3-8,
 The physical position of the "AM" and "FM" buttons and their respective input BNC connectors is reversed.

Figure 5-21 and Figure 5-24, High-Voltage Board (A100),
 Replace with component location and test point picture, Figure 1 (shown in this Appendix)

Figure 5-7, High Voltage Test Point Location,
 Delete test points 1 and 2 and C205. Note that test points 1 and 2 and C205 are shown in Figure 1.

Figure 5-22, High-Voltage Power Supply,
 Capacitor C205 is shown to be located off the circuit board. It should be shown to be within the circuit board outline: electrical connections are unchanged.
 Resistor R212: Change from 50K to 20K.

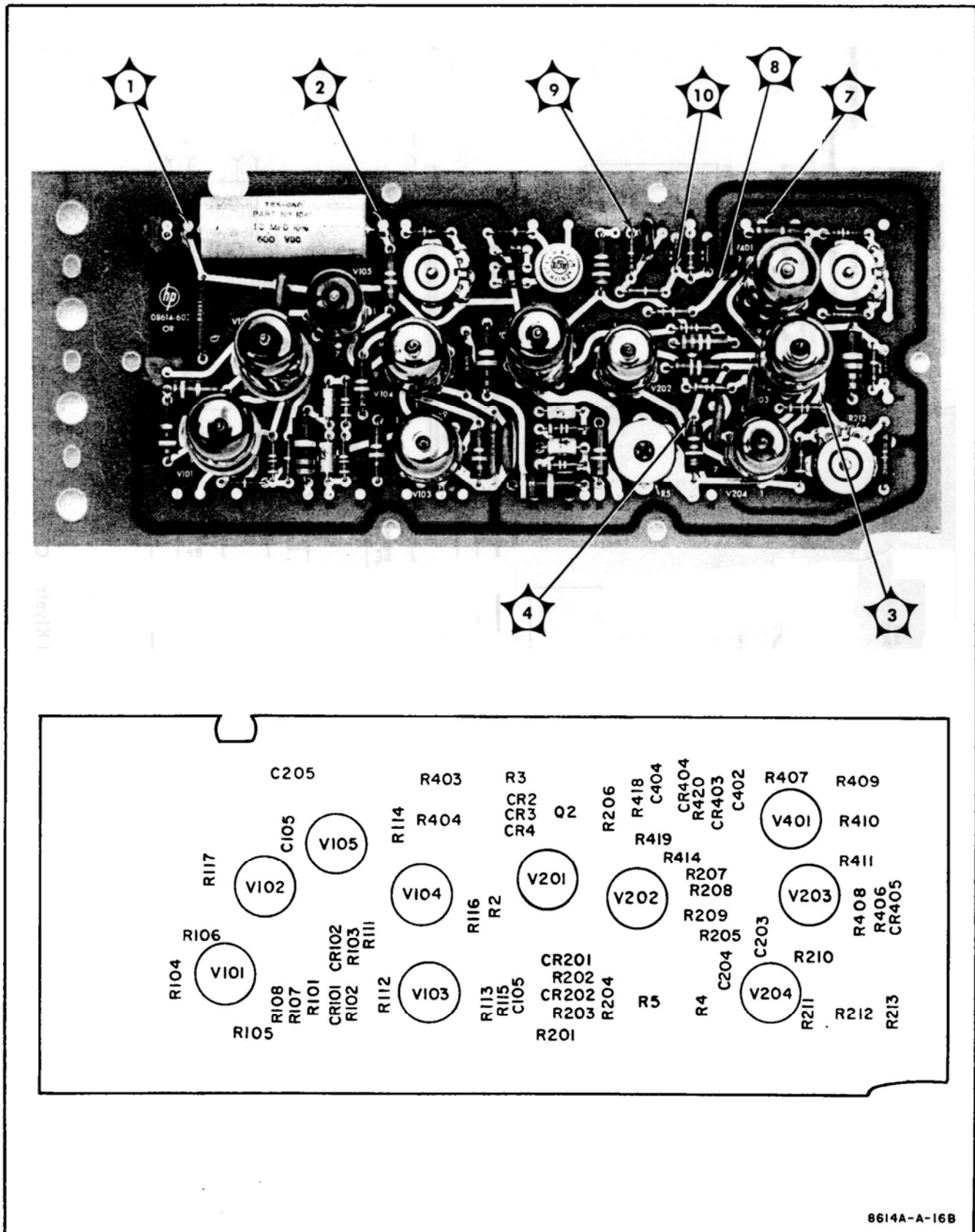


Figure 1. High Voltage Board (A100)

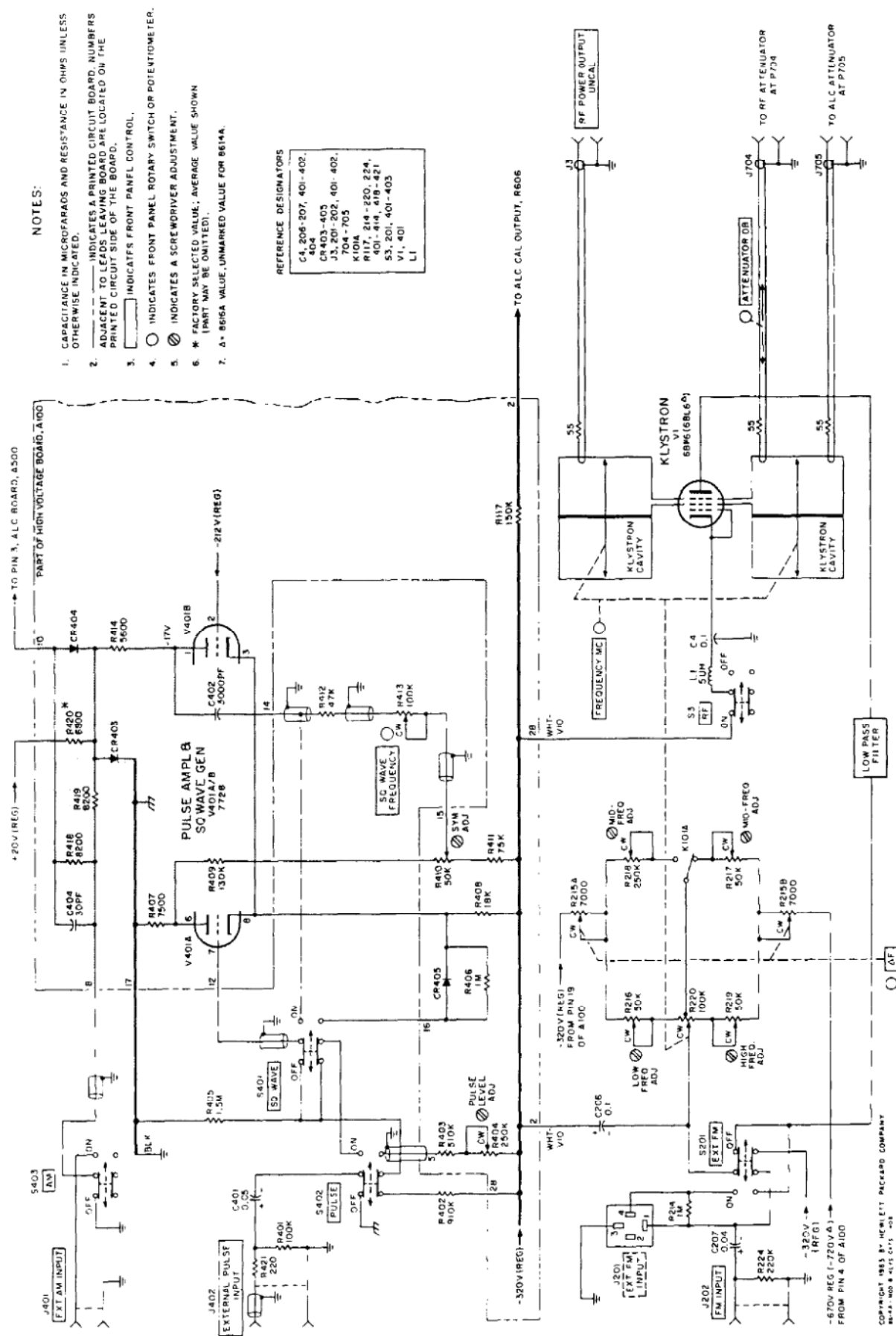


Figure 2. Modulation and Klystron Circuits

CHANGE F:
(Cont'd)

Page 5-21, paragraph 5-68, step d,

Change to read: "If on-off ratio is not 20 dB or greater, adjust R404 (refer to Figure 1) for proper on-off ratio. If on-off ratio will not adjust properly, PIN modulator may be defective. Check bias current through R414 and R420: the current through R414 should be approximately 6 mA, and the current through R420 should be approximately 3 mA. If current through R414 is correct but current through R420 is about 1 mA more or less than it should be, changing R420 to a higher or lower resistance may solve the problem. If these bias currents are correct and CR403 is not shorted, then the modulator or the RF probes are defective. Check RF Probe resistance (refer to paragraph 5-62); if resistance is OK then modulator is defective (refer to paragraph 5-47)."

Page 5-21, paragraph 5-69, step b,

Change to read: "If pulse operation is not satisfactory, slight adjustment of R404 and a change in the resistance of R420 may be necessary."

NOTE

Resistor R404 and the resistance value of R420 also adjust on-off ratio; if adjustment is necessary, recheck on-off ratio."

Figure 5-26, Modulation and Klystron Circuits,

Use included component location picture. Figure 2, in place of Figure 5-24.

Table 6-1, Pages 6-2, 6-5, and 6-6,

C205: Change from HP Stock No. 0160-0079 to 0170-0073; C: fxd my 1.0 μ fd 10% 6000 Vdcw. Delete: HP Stock No. 1210-0003; Bracket; mounting C205.

R212: Change from HP Stock No. 2100-0991 to 2100-0093; R: var comp 20K ohm 20% LIN 1/5 W.

R402: Change from HP Stock No. 0687-3931 to 0686-9145; R: fxd comp 910K ohm 5% 1/2 W.

R403: Change from HP Stock No. 0687-4741 to 0686-5145; R: fxd comp 510K ohm 5% 1/2 W.

R404: Change from HP Stock No. 0687-3931 to 2100-0144; R: var comp 250K ohm 30% LIN 1/5 W.

R405: Change from HP Stock No. 0687-1051 to 0687-1551; R: fxd comp 1.5 Megohm 10% 1/2 W.

R407: Change from HP Stock No. 0686-4725 to 0689-7525; R: fxd comp 7500 ohm 5% 1 W.

R410: Change from HP Stock No. 2100-0991 to 2100-0094; R: var comp 50K ohm 20% LIN 1/5 W.

R414: Change from HP Stock No. 0686-4725 to 0687-5621; R: fxd comp 5600 ohm 10% 1/2 W.

R420: Change from HP Stock No. 2100-0093 to 0687-6821; R: fxd comp 6800 ohm 10% 1/2 W.

R422: Change from HP Stock No. 0687-4721 to "not assigned".

Table 6-2, Pages 6-11, 6-12, 6-13, and 6-14:

Delete: HP Stock No. 0160-0079

HP Stock No. 0686-4725

HP Stock No. 0687-4721

HP Stock No. 0687-1051: Change TQ from 3 to 2

HP Stock No. 0687-3931: Change TQ from 3 to 1

HP Stock No. 0687-4741: Change TQ from 7 to 6

Delete: HP Stock No. 2100-0991.

Table 6-2, Page 6-11,

Add: HP Stock No. 0170-0073; C: fxd my 1 μ f 10% 600 Vdcw; Mfr 09134; Mfr Part No. 1041, TQ 1.

Table 6-2, Page 6-12,

Add HP Stock No.:

0686-5145; R: fxd comp 510K ohm 5% 1/2 W; Mfr 01121; Mfr Part No. EB5145; TQ 1

0686-9145; R: fxd comp 910K ohm 5% 1/2 W; Mfr 01121; Mfr Part No. EB 9145; TQ1

0687-1551; R: fxd comp 1.5 megohm 10% 1/2 W; Mfr 01121; Mfr Part No. EB 1551; TQ 1

0687-5621; R: fxd comp 5600 ohm 10% 1/2 W; Mfr 01121; Mfr Part No. EB 5621; TQ 1

0689-7525; R: fxd comp 7500 ohm 5% 1 W; Mfr 01121; Mfr Part No. GB 7525; TQ 1

Stock No. 0687-6821: Change TQ from 1 to 2.

Table 6-2, Page 6-14,

Add HP Stock No.:

2100-0094; R: var comp 50K 20% LIN 1/5 W; Mfr 28480; Mfr Part No. 2100-0094

2100-0144; R: var comp 250K 30% LIN 1/5 W; Mfr 28480; Mfr Part No. 2100-0144; TQ 1

CHANGE G (see Note 2): Figure 5-26, Modulation and Klystron Circuits,
Delete: R700, connected between S402 and ground and replace with a short circuit.

Page 6-7, Table 6-1, Delete: R700.

Page 6-12, Table 6-2,
HP Stock No. 0687-1031: Change TQ from 2 to 1.

NOTE 2

Resistor R700 is a necessary component in the pulse input circuitry of the 8614A if a low impedance output solid state pulse source is to be used. Without R700, a stored potential of about 200 volts dc may be discharged into the output of such a pulse source when the 8614A PULSE button is released.

CHANGE H: Page 1-0, Table 1-1, Specifications,
Attenuator Accuracy: Change to read "+0, -3 dB from 0 to -10 dBm; ± 0.2 dB ± 0.06 dB/
10 dB from -10 to -127 dBm; direct reading dial, 0.2 dB increments"
RF Output Power Accuracy (with respect to attenuation dial): Change . . . "(-15 to
-127 dBm) . . . " (-10 to -127 dBm) . . . "

Page 3-3, Figure 3-3, Instruction 5, last line, Change "-15 dB" to "-10 dB".

CHANGE I: Page 4-3, Figure 4-5,
R402: Change from 390K to 39K.
R403: Change from 6.8M to 470K.

Page 5-31/5-32, Figure 5-26,
C401: Change from 0.1 to 0.05
R402: Change from 390K to 39K
R403: Change from 6.8M to 470K

Page 6-2, Table 6-1,
C401 change from HP Stock No. 0170-0022 to 0150-0052; C: fxd cer 0.05 μ f 20% 400 Vdcw

Page 6-6, Table 6-1,
R402: Change from HP Stock No. 0687-3941 to 0687-3931; R: fxd 39K ohm 10% 1/2 W
R403: Change from HP Stock No. 0687-6851 to 0687-4741; R: fxd 470K ohm 10% 1/2 W

Page 6-11, Table 6-2,
HP Stock No. 0150-0052: Change TQ from 4 to 5
HP Stock No. 0170-0022: Change TQ from 2 to 1

Page 6-12, Table 6-2,
HP Stock No. 0687-3931: Change TQ from 2 to 3
HP Stock No. 0687-4741: Change TQ from 6 to 7
Delete: HP Stock No. 0687-3941; R: fxd comp 390K ohm 10% 1/2 W; Mfr. 01121; Mfr. Part
No. EB 3941; TQ 1
Delete: HP Stock No. 0687-6851; R: fxd comp 6.8 Megohm 10% 1/2 W; Mfr. 01121; Mfr.
Part No. EB 6851; TQ 1

CHANGE J: Page 6-8, Table 6-1, Miscellaneous,
Add the following items: HP Stock No. 08614-610; 08614-608; 08614-609.
Delete: HP Stock No. 08614-624; Low Pass Filter Kit which includes Low Pass Filter
Assembly (HP Stock No. 08614-622) and Coaxial Cable (HP Stock No. 08614-623).

Page 6-11, Table 6-2,
Add the following items: HP Stock Numbers. 08614-608 (TQ 1); 08614-609 (TQ 1); 08614-610
(TQ 1)
Delete: HP Stock No. 08614-622; Low Pass Filter Assembly; TQ 1.
Delete: HP Stock No. 08614-623; Cable Assembly; TQ 1.

Page 5-33/5-34, Figure 5-27,
Change as shown in partial schematic (Figure 3 Partial) shown at end of this appendix.

Section V

Delete: Paragraphs 5-75 through 5-78 and Figure 5-19.

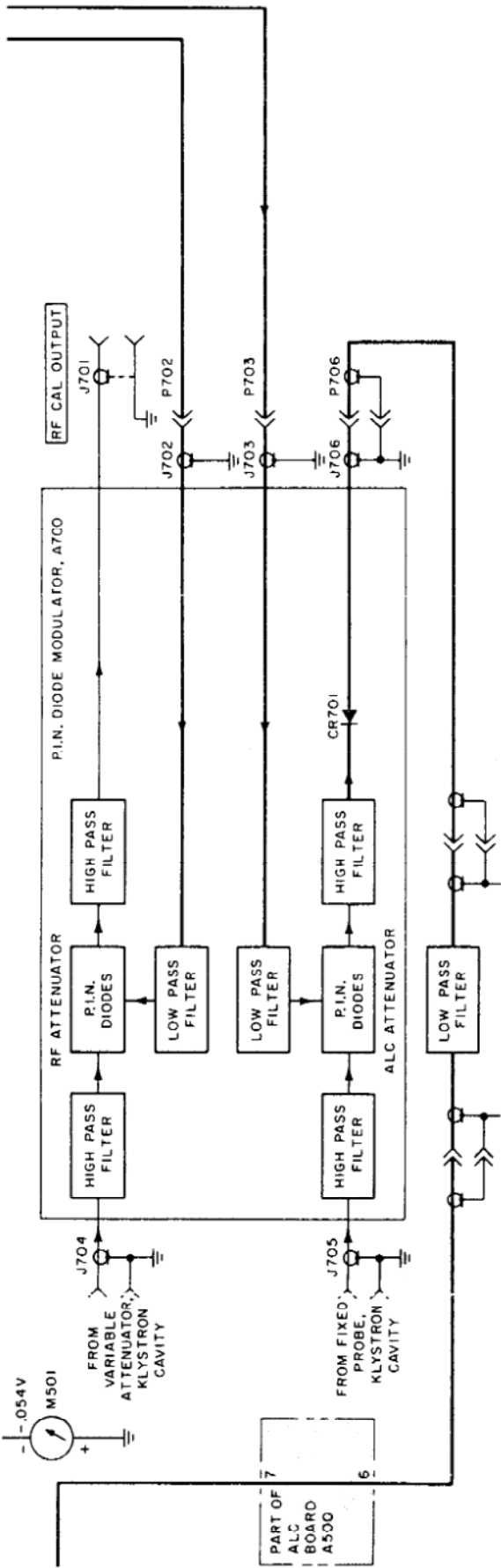


Figure 3. Partial Schematic

- CHANGE J:** Page 5-13, Paragraph 5-48, Step d and Page 5-14, Paragraph 5-49, Step h,
(Cont'd) Delete at beginning of both steps: "Referring to Figure 5-26 and Paragraph 5-78."
Figure 5-25 and Parts List:
Change Q51 stock number from 1850-0128 to 1850-0078.
- CHANGE K:** Figure 5-26 and Parts List:
Change R215 stock number from 2100-2140 to 2100-1549.
- CHANGE L:** Figure 5-25 and Parts List:
Delete fuse, F2, 3A, slo-blow, Stock No. 2110-0029.
Figure 5-22 and Parts List:
Delete breakdown diode CR203, 100V, 1 watt, Stock No. 1902-0175.
Figure 5-21 and 5-24, High-Voltage Board (A100), Replace with Figure 4 of this Appendix.
Parts List:
Delete under F2 listing: Fuseholder, Stock No. 1400-0008.
- CHANGE M:** Parts List:
Change S601 Stock No. from 3101-0043 to 3101-1153.
- CHANGE N:** Figure 5-25 and Parts List:
(Refer to CHANGE L.) For instrument serials 749-below 01950 change F2 from 4A 125V, slo blow, stock number 2110-0014 to 3A, 125V Stock Number 2110-0029.
Parts List:
Change S3 and S201 from HP Stock No. 3101-1153 to 3101-0043.
- CHANGE O:** Figure 5-26 and Parts List:
Delete resistor R6, 0757-0059, 1 meg $\pm 1\%$, 1/2W.
- CHANGE P:** Table 1-1 and Paragraph 5-12:
Change the Leveled Output specification from ± 0.75 dB to ± 0.5 dB.
- CHANGE Q:** Figure 5-25 and Parts List:
Change Capacitor C1 from 5000 μ fd, Stock No. 0180-0213 to 2800 μ fd, Stock No. 0180-0128.
- CHANGE R:** Figure 5-26 and Parts List (A100 Assy):
Change capacitor C404 on A100 Assy from 60 pF, HP Stock No. 0140-0214 to C404*, 30 pF, HP Stock No. 0160-0181, factor selected part.

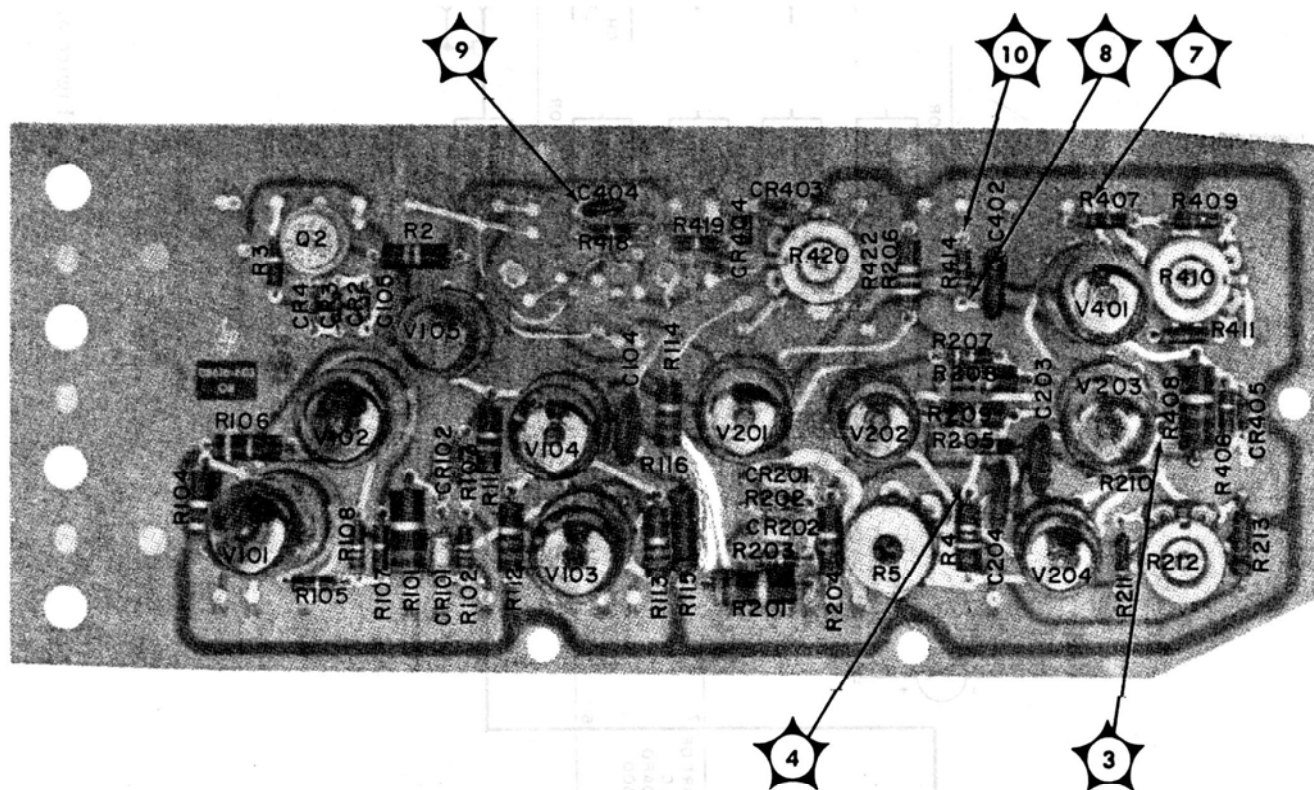


Figure 4. High Voltage Board (A100)

WARRANTY CLAIM AND ADJUSTMENT PROCEDURE

for microwave tubes supplied by the
HEWLETT-PACKARD COMPANY
for use in Hewlett-Packard instruments

The procedure described below is for use within the United States. For warranty claims arising outside the U.S.A., before returning the tube, fill out the form on the reverse side and send it with a request for shipping instructions to your nearest Hewlett-Packard Sales and Service Office or to:

(in Western Europe)

Hewlett-Packard S. A.
54 Route des Acacias
Geneva, Switzerland
Telephone: (022) 42.81.50
Telex: 2.24.86
Cable: HEWPACKSA

(Rest of World)

Hewlett-Packard Co.
International Marketing Dept.
1501 Page Mill Road
Palo Alto, California, 94304, U.S.A.
Telephone: (415) 326-7000
Telex: 033811
Cable: HEWPACK

Microwave tubes supplied by the Hewlett-Packard Company, either as original or replacement, for use in Hewlett-Packard instruments are actually warranted by the tube manufacturer and not by Hewlett-Packard. However, all warranty claims on tubes obtained from us either as original or replacement will be processed by Hewlett-Packard.

In the event of failure you should purchase a new tube and return your old tube immediately to Hewlett-Packard. Credit allowances will be passed on to you upon receipt of the defective tube.

For your convenience, warranty claims for all microwave tubes supplied by the Hewlett-Packard Company may be made on this single form; merely fill out the information on the reverse side and return this form, along with the defective tube, to your Hewlett-Packard Sales and Service Office or to Hewlett-Packard. Please be sure each space on the form is filled in--lack of complete information may delay processing of your claim.

Each tube manufacturer has his own warranty policy. Copies of individual Conditions of Warranty are available from your Hewlett-Packard Sales and Service Office or from the Hewlett-Packard Company.

SHIPPING INSTRUCTIONS

The following instructions are included to aid you in preventing damage in transit. Package your tube carefully--no allowance can be made on broken tubes.

1. Carefully wrap tube in 1/4-inch thick cellulosic cushioning, cotton batting, or other soft padding material. Cable assemblies and other accessories not rigidly mounted to the tube should be padded and wrapped separately to prevent damage to the tube during shipment.
2. Wrap the above in heavy kraft paper.
3. Pack in a rigid container which is at least 4 inches larger than the tube in each dimension.
4. Surround the tube with at least 2 inches of shock absorbing material. Be certain that the packing is tight all around the tube.
5. Tubes returned from outside the continental United States should be packed in a wooden box.
6. Mark container **FRAGILE** and ship prepaid via Air freight or Railway Express. Do not ship via Parcel Post or Air Parcel Post since experience has shown that fragile items are more apt to be damaged when shipped by these means.

Note

Tubes with permanent magnets can interfere with magnetic compasses.
For air shipment plainly mark container: "MAGNETIZED MATERIAL"

In warranty tubes purchased from Hewlett-Packard may be returned, with a completed warranty Claim Form, to your local Hewlett-Packard Sales and Service Office, or to:

Hewlett-Packard Company
Customer Service Center
333 Logue Avenue
Mountain View, California 94040
USA

MICROWAVE TUBE WARRANTY CLAIM
INFORMATION FORM

IMPORTANT: Please answer all questions fully -- insufficient information may delay processing
of your claim.

DATE: _____

FROM: (Tube Owner)

Company _____

Address _____

Tube type _____

Tube serial No. _____

Tube mfr. _____

Use in HP Model _____

Instrument serial No. _____

Tube is Original () or Replacement ()

Date tube received _____

Date of failure _____

Total hours filament operation _____

SYMPTOMS: (Please describe conditions prior to and at time of failure, along with description of
tube's defect, if known) _____

IMPORTANT:

Replacement (new) tube serial No. _____

Signature _____

Title _____

For HP use only

Repair order # _____

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IDENTIFYING TECHNICAL PUBLICATION SHEET

THIS PUBLICATION SUPPLEMENTS T.O. 33A1-8-424-1, DATED 30 NOVEMBER 1980, AND REPLACES T.O. 33A1-8-424-1G, DATED 30 MAY 1979, AND T.O. 33A1-8-424-1H, DATED 15 OCTOBER 1979. Reference to this supplement will be made on title page of basic commercial manual by personnel responsible for maintaining publication in current status.

I. IDENTIFICATION DATA

1. PURPOSE: This technical publication is issued for the purpose of identifying and authorizing the following commercial manual for Air Force use.

MANUFACTURER: HEWLETT-PACKARD COMPANY

PURCHASE ORDER OR CONTRACT NO.:

EQUIPMENT: 8614A

REQUISITION NO.

FEDERAL STOCK NUMBER: 6625

TITLE OPERATING AND SERVICE INSTRUCTIONS - SIGNAL GENERATOR

ADDITIONAL IDENTIFICATION ALSO APPLIES TO HP 8614A instruments with serial number prefix 815-above 02201

DATE: COPYRIGHT 1965/PRINTED MARCH 1979

2. FILE LOCATION: The above described commercial manual is filed in

(Each library will fill this in if this identifying technical publication sheet is filed separately from the commercial manual.)

II. SUPPLEMENTAL DATA

1. LIST OF AFFECTED PAGES IN BASIC MANUAL.

2. SUPPLEMENTAL INFORMATION. The information contained in the above identified commercial manual is supplemented as follows:

Hewlett-Packard Manual Changes, dated 28 April 1980 (13 pages), for Model Number 8614A, Part Number 08614-90001.

1/(2 Blank)

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

MANUAL CHANGES

SIGNAL GENERATOR

MANUAL IDENTIFICATION

Model Number: 8614A
Date Printed: Mar. '69, Mar. '79
Part Number: 08614-90001

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	Serial Prefix or Number	Make Manual Changes
815-02601 to 815-02850	1	1310A and 1347A	1-7
953-02851 to 953-02975	1, 2	1645A	1-8
953-02976 to 953-03025	1-3	1748A	1-9
953-03026 to 953-03475	1-4	1808A	1-10
1111A	1-5	1810A	1-11
1150A	1-6	1835A, 2015A	1-12

► NEW ITEM

*These changes apply only to manuals printed in March 1969. They have been incorporated into manuals printed in March 1979.

ERRATA

* Page 1-0, Table 1-1:

In the VERNIER specification, change 1.5 MHz to 1.0 MHz.

Change "RF OUTPUT POWER ACCURACY (with respect to attenuation dial)" to read:

" ± 0.75 dB + attenuator accuracy (0 to -127 dBm) including leveled output variations."

Add the following note below the table:

"NOTE: Specifications apply with the ΔF control centered."

* Page 5-0, Table 5-1:

Add 10 dB Fixed Attenuator HP Model 8491A.

* Page 6-11, Table 6-2:

Change connector 1250-0144 part number to 5021-0810.

Continued . . .

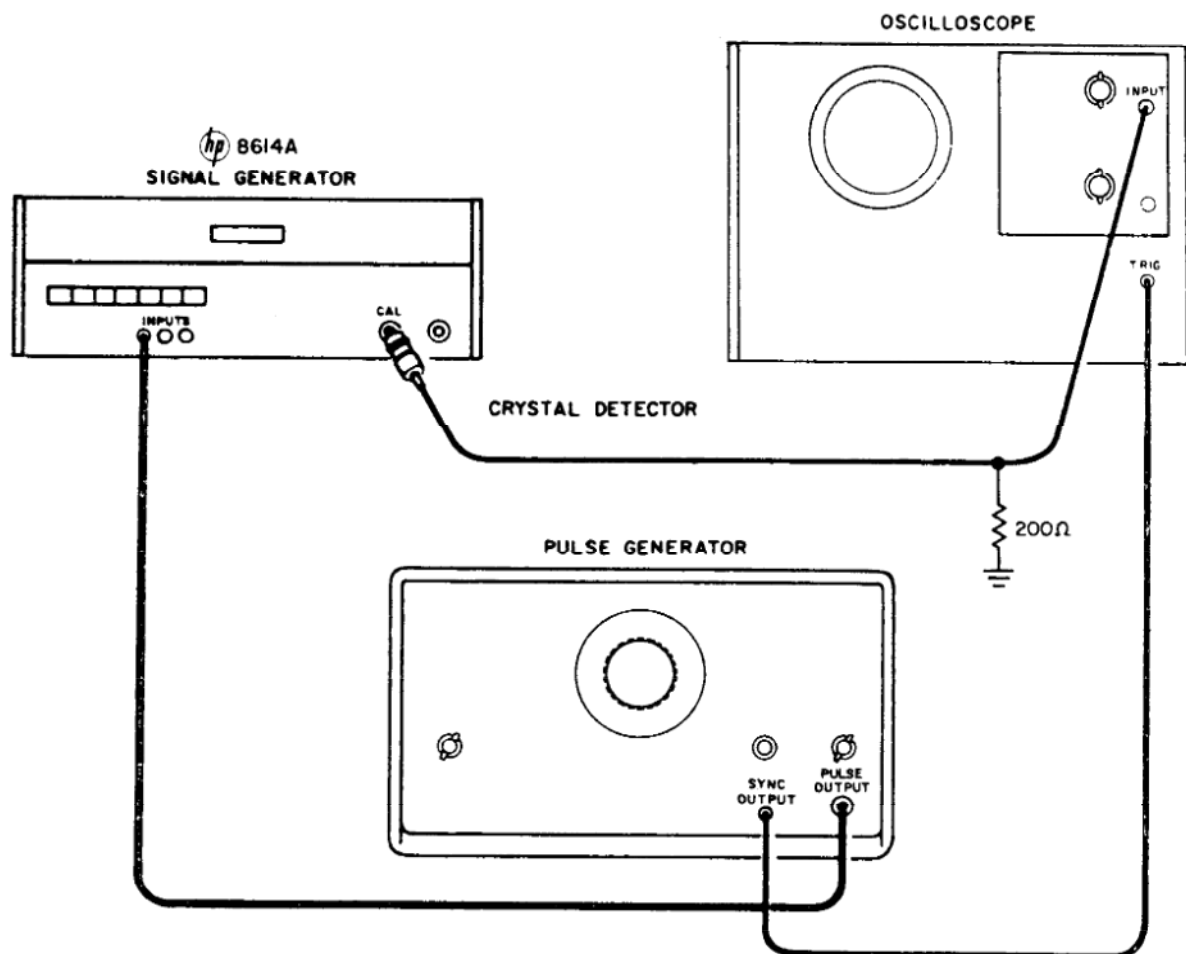
NOTE

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.

ERRATA (Cont'd)

* Page 5-2, Figure 5-2:

Replace Figure with attached Figure 5-2.

*Figure 5-2. External Pulse Check (P/O Errata)*

Continued . . .

ERRATA (Cont'd)

*Page 5-4, Figure 5-4:

Replace figure with attached Figure 5-4.

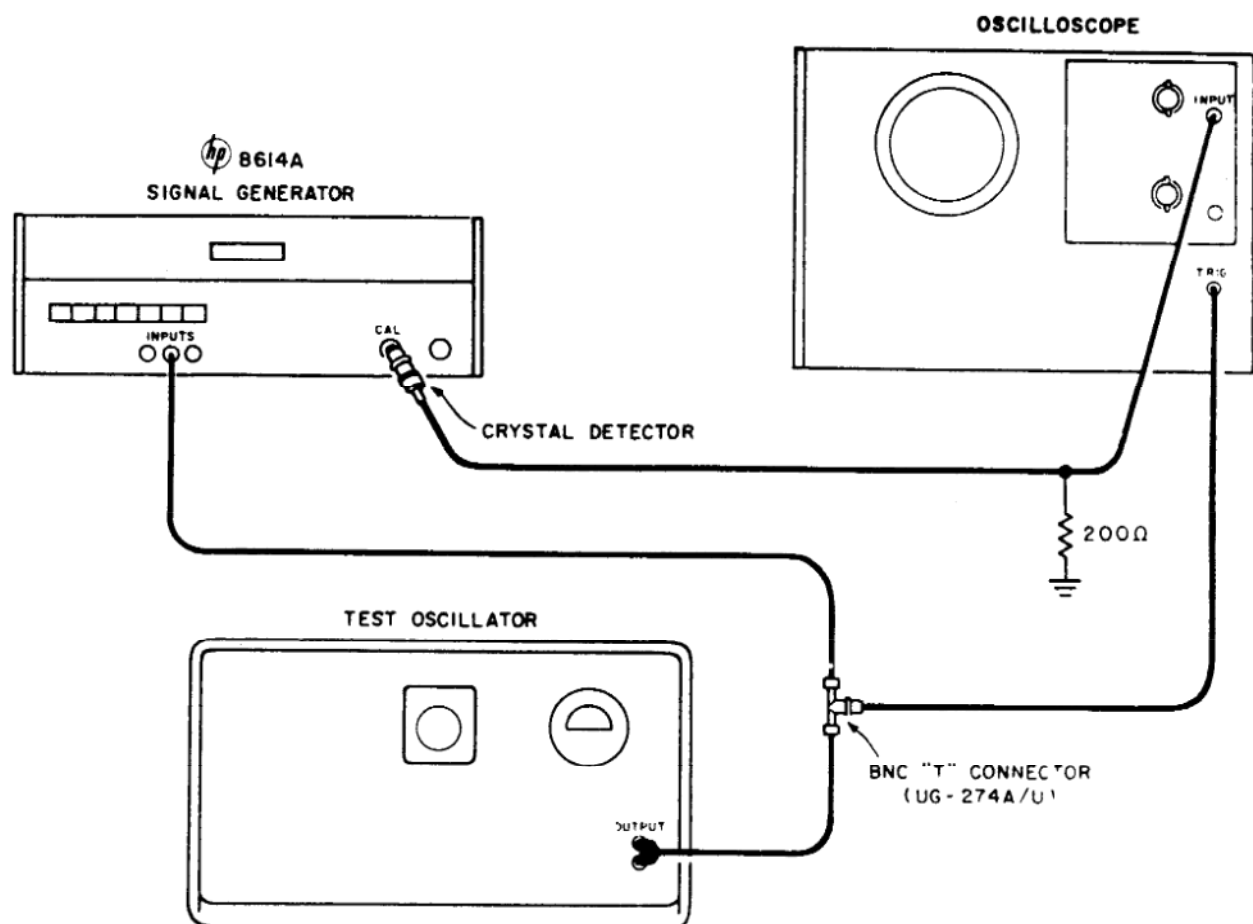


Figure 5-4. External AM Check (P/O Errata)

*Page 5-4, paragraph 5-17:

Change step f to read: "Residual FM (line related components) reading ("peak to trough") on oscilloscope is less than 500 mV peak (500 mV = 5000 Hz)."

*Page 5-12, Paragraphs 5-44 — 5-46:

Delete Paragraphs 5-45 and 5-46 and replace with the following:

5-45. PROBE REMOVAL.

WARNING

Before attempting removal or replacement of probe assembly, be certain that line power is completely removed from instrument.

- Remove top cover from instrument.
- Set FREQUENCY (MHz) drive to the highest frequency setting (2400 MHz).
- Remove Attenuator Access Cover from Klystron Cavity Casting (see Figure 5-13 P/O Errata).

ERRATA (Cont'd)

- d. Remove Right Side Frame Assembly.
- e. Remove Cable Guide from Klystron Cavity Casting and disconnect cable assembly connectors from instrument.
- f. Remove the cable assembly connector from the defective RF probe cable. Be careful not to lose any connector parts as they will be required for reassembly.
- g. Remove the probe cable from the cable guide.
- h. Remove the retaining screw holding the defective probe in the tuning carriage and remove the probe from the casting.
- i. The defective probe assembly should be returned to your local Hewlett-Packard sales and service office for repair or replacement (see list at rear of manual).

5-46. PROBE REPLACEMENT.**CAUTION**

The probe is fragile and should be handled with care. The probe should be placed in a protective shield when handling or shipping.

- a. To install a new probe assembly, carefully insert the new probe into the klystron cavity casting and replace the probe retaining screw.

CAUTION

Care must be taken not to damage the resistive element on the probe end or the spring wipers that make contact with the probe guide tube.

- b. Insert the probe assembly cable through the cable guide. Install the cable guide.
- c. Trim the insulation from the end of the probe assembly cable (for RF UNCAL probe, 5/16 inch; for RF CAL and ALC probes, 1/4 inch).
- d. Place cable assembly connector parts on cable, with the exception of the clamping body, and fold the braid back upon the connector assembly (see Figure 5-10 P/O Errata).
- e. Place the clamping body on the cable and screw the clamp nut and clamping body together.
- f. Trim the dielectric flush with the end of the clamping body so that the center conductor is bare.
- g. Trim the center conductor protruding from the clamping body, then place the insulator washer on the center conductor.

NOTE

After tinning center conductor the diameter may be too large, making it necessary to file the center conductor to the proper diameter.

ERRATA (Cont'd)

- h. Before connecting connector assembly into the instrument, connect an ohmmeter between the probe center conductor and ground and measure the resistance across the range of the attenuator. The resistance should be approximately 50 ohms $\pm$ 5 ohms. If the probe is open or shorted at any point, the probe is defective and should be replaced.
- i. Replace the connector assembly as it was before disassembly. Connect the probe connector to the instrument, making certain the center conductor makes good contact.
- j. The probe installation is complete. Reassemble the instrument except for the front, right side panel, which is removed when performing the output power calibration adjustments.

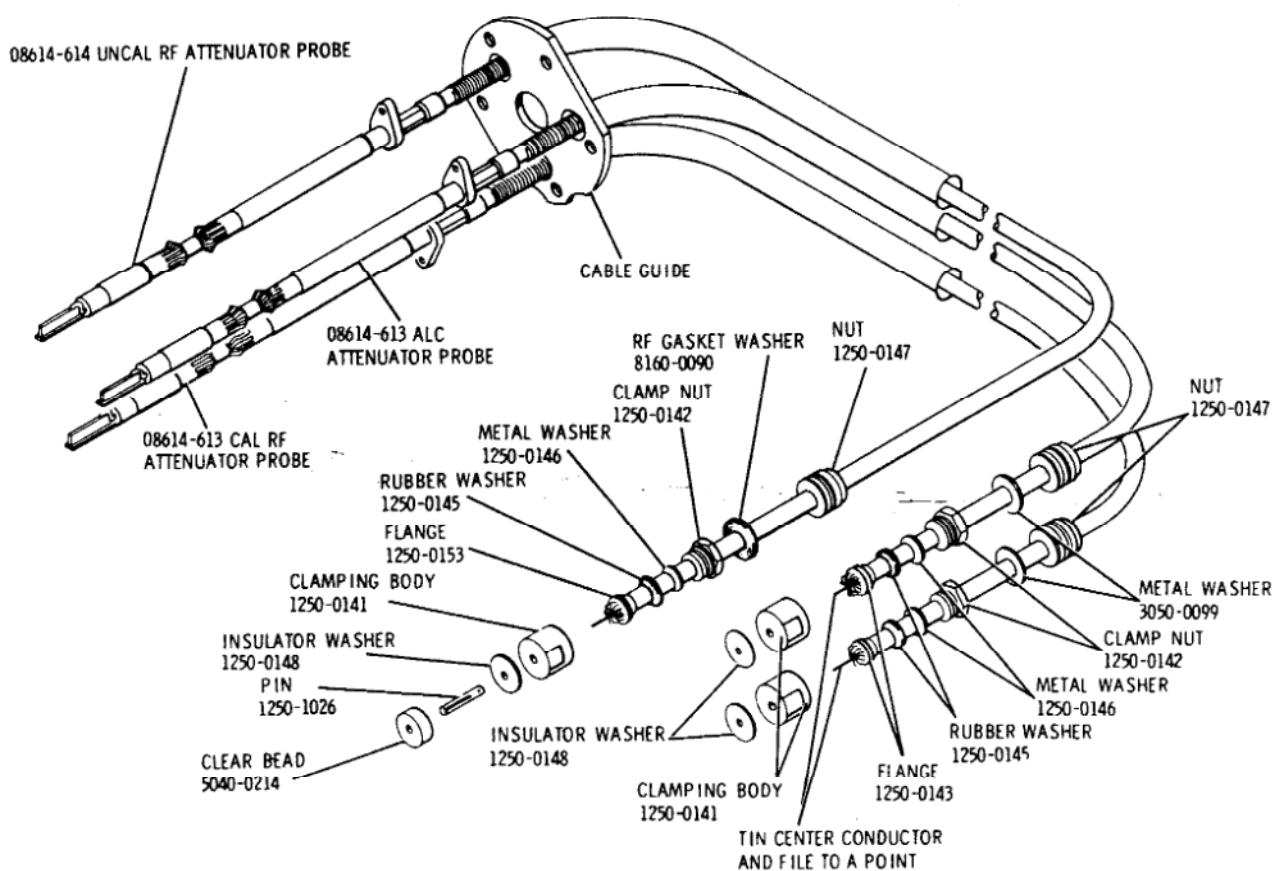
*Page 5-13, Paragraph 5-49:

Change step d to read:

"Disconnect ground lug and wire from low pass filter".

*Page 5-13, Figure 5-10:

Replace figure with attached Figure 5-10.



8614A

Figure 5-10. RF Probe Assembly (P/O Errata)

ERRATA (Cont'd)

Page 5-15, Figure 5-13:

Replace figure with attached Figure 5-13.

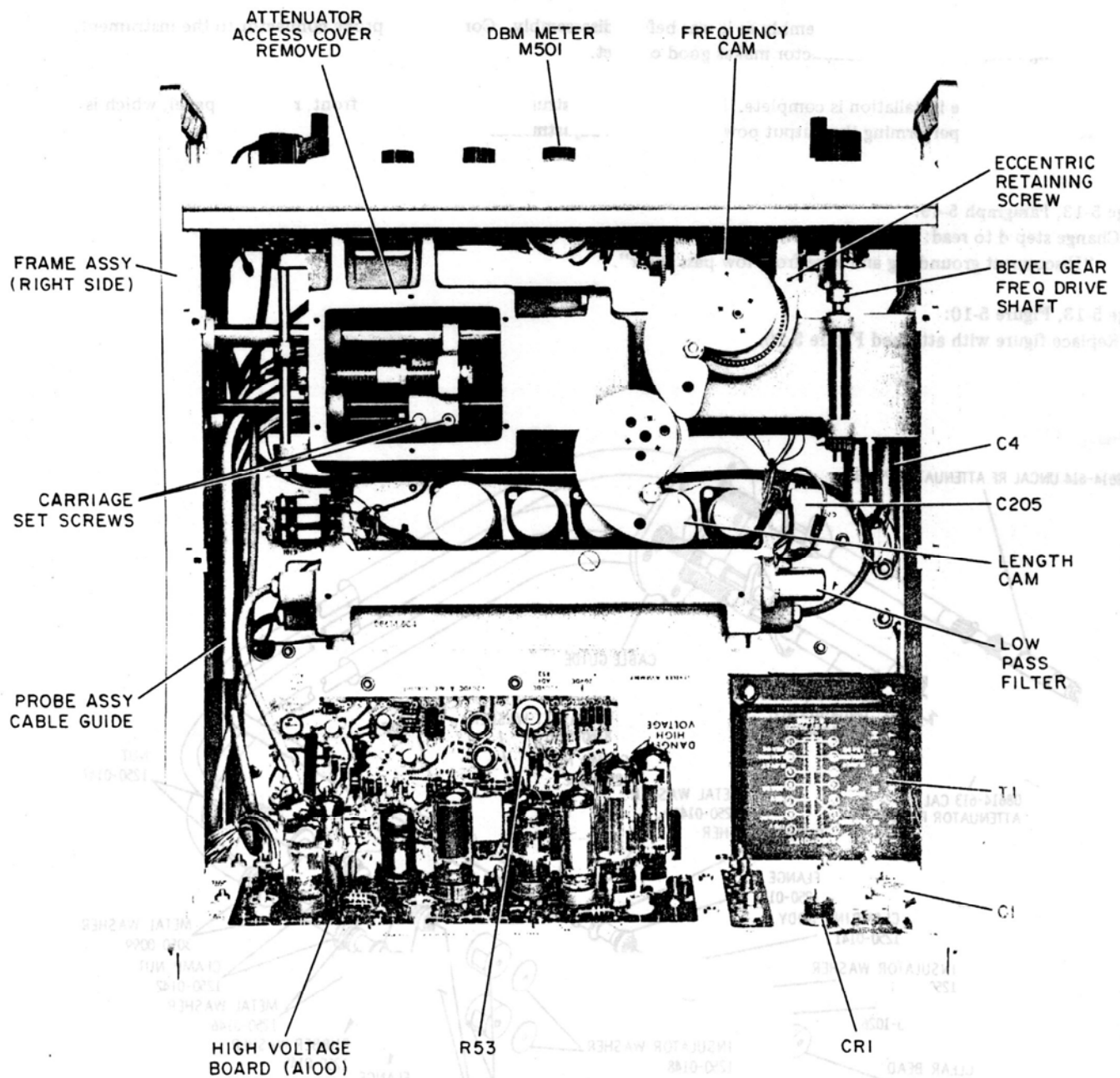


Figure 5-13. Instrument Top View, Cover Removed (P/O Errata)

Continued . . .

ERRATA (Cont'd)***Page 5-18, Paragraph 5-62:**

Delete paragraph 5-62 and replace with the following:

5-62. RF POWER OUTPUT ADJUSTMENT.

- a. Front Panel Settings: Have ALC button released (OFF). Set ATTENUATION (dB) to 012 dB. Set FREQUENCY to 800 MHz.
- b. CAL RF Adjustment:
 1. With a power meter, measure the CAL RF output power. It should be $-11 \text{ dBm} \pm 0.1 \text{ dBm}$.
 2. If it is not, loosen the two setscrews in the attenuator drive shaft bevel gear (see Figure 5-13 P/O Errata). With the bevel gear loose, turn the attenuator gear with your fingers until the output power is -11 dBm . Without disturbing the -11 dBm power setting, turn the attenuator knob on the front panel until the attenuator counter reads 012 dB. Tighten the two setscrews in the bevel gear.
- c. UNCAL RF Adjustment:
 1. Measure the UNCAL RF power output. It should be $-3 \text{ dBm} \pm 0.3 \text{ dBm}$.
 2. If it does not, the RF UNCAL probe requires adjustment. The front right side panel should be removed, exposing the probe assembly cable guide. Remove the screw in the cable guide that is in line with the UNCAL probe retaining screw (see Figure 5-13 P/O Errata). Insert a long Allen wrench through the hole left by removing the cable guide screw into the UNCAL probe retaining screw. Turn the retaining screw to adjust the UNCAL probe penetration for $-3 \text{ dBm} \pm 0.3 \text{ dBm}$ output.
- d. ALC Adjustment:
 1. With a dc voltmeter (HP Model 412A) measure the dc voltage at the output of the CR701 crystal diode, or the base of Q501A.

CAUTION

Do not use a digital voltmeter with Auto-Ranging as it might damage the crystal diode.

The dc voltage should be $120 \text{ mV} \pm 2 \text{ mV}$.

2. If it is not, the ALC attenuator probe requires adjustment. The front right side panel should be removed, exposing the probe assembly cable guide. Remove the screw in the cable guide that is in line with the ALC probe retaining screw (see Figure 5-13 P/O Errata). Insert a long Allen wrench through the hole left by removing the cable guide screw into the ALC probe retaining screw. Turn the retaining screw to adjust the ALC probe penetration for $120 \text{ mV} \pm 2 \text{ mV}$ at the ALC crystal output.

► Page 5-25, Figure 5-17:

Change the part number for R220 REPELLER POT to 5060-0335.

Change the part number for TRACKING POT STATOR to 5060-1113.

► Page 5-27, Figure 5-18:

Change the part number for R220 REPELLER POT to 5060-0335.

***Page 6-2, Table 6-1:**

Change A100 to 08614-621.

Change A50 to A500.

ERRATA (Cont'd)***Page 6-3, Table 6-1:**

Change DS1 to 1450-0566.

Page 6-6, Table 6-1:

Change R503 and R504 to 0757-0344 RESISTOR 1M 1% 0.25W F TC = 0±100.

Change R513 to 0757-0338 RESISTOR 1K 1% 0.25W F TC = 0±100.

Change R515 to 0698-3542 RESISTOR 25.5K 1% 0.5W F TC = 0±100.

Change R516 to 0757-1080 RESISTOR 26.7K 1% 0.5W F TC = 0±100.

Change R606 to 2100-0235 R:VAR 5K OHMS, 20%, 2W.

► Page 6-6, Table 6-1:

Change the part number of R220 to 5060-0335.

***Page 6-8, Table 6-1:**

Change 08614-600 to 08614-619.

Change 08614-601 to 08614-620.

Delete 1200-0088.

Delete 1400-0084 Fuseholder, and add the following items in its place.

1400-0090 WASHER, NEOPRENE

2110-0465 CAP, FUSEHOLDER

2110-0467 NUT, HEX

2110-0470 FUSEHOLDER

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 can be identified by a straight solder lug to which the white-black-gray wire attaches. On the new fuseholder the solder lug is at a right angle to the body.

Add the following parts:

0340-0822 BUSHING, TEFLON

3050-0591 INSULATOR, MICA

7120-4162 LABEL, WARNING "HAZARDOUS VOLTAGE" (LARGE)

7120-4163 LABEL, WARNING "HAZARDOUS VOLTAGE" (SMALL)

7120-4295 LABEL, WARNING "HAZARDOUS VOLTAGE ALWAYS PRESENT . . ."

7120-5087 LABEL, WARNING "TO PREVENT ELECTRICAL SHOCK . . ."

***Page 6-11, Table 6-2:**

Change 1450-0039 to 1450-0048.

***Page 6-13, Table 6-2:**

Change 08614-600 to 08614-619.

Change 08614-601 to 08614-620.

Change 08614-603 to 08614-621.

CHANGE 1**Page 5-31/5-32, Figure 5-26:**

Change R700 to 1 Megohm.

Page 6-6, Table 6-1:

Change R700 to 0687-1051 R:FXD COMP 1 MEGOHM 10% 0.5W.

CHANGE 2**Page 2-1, paragraph 2-10:**

Change the fourth sentence to read as follows:

A 2 ampere standard fuse is used for 115 volt operation;

a 1 ampere standard fuse is used for 230 volt operation.

CHANGE 2 (Cont'd)

Page 5-29/5-30, Figure 5-25:

Change F1 to 2A, 115 VAC, and 1A 230 VAC.

Page 6-3, Table 6-1:

Change F1 2110-0043 to 2110-0002 FUSE: CARTRIDGE 2 AMP 250V. (FOR 115 VOLT OPERATION ONLY).

Change F1 2110-0033 to 2110-0001 FUSE: 1 AMP 250V. (FOR 230 VOLT OPERATION ONLY).

Change J2 to 1251-2357.

Page 6-7, Table 6-1:

Change S2 to 3101-1234.

Change W1 to 8120-1378.

Page 6-8, Table 6-1:

Add 08614-6007 WIRING HARNESS PRIMARY POWER.

Pages 6-11 - 6-13, Table 6-2:

Change 1251-0148 to 1251-2357.

Change 2110-0033 to 2110-0001 FUSE: 1A 250V.

Change 2110-0043 to 2110-0002 FUSE: CARTRIDGE 2 AMP 250V.

Change 3101-0033 to 3101-1234.

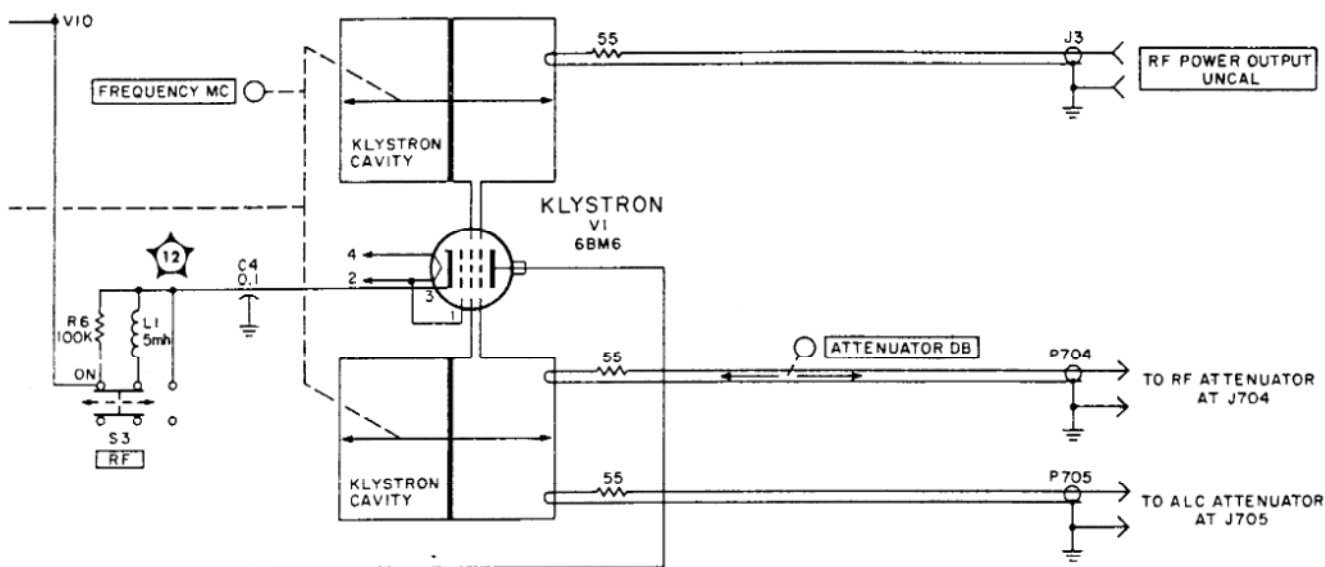
Change 8120-0078 to 8120-1348.

Add 08614-6007 WIRING HARNESS PRIMARY POWER.

CHANGE 3

Page 5-31/5-32, Figure 5-26:

Replace appropriate portions of figure with the attached partial schematic.



P/O Figure 5-26. Modulation and Klystron Circuits (P/O Change 3)

CHANGE 3 (Cont'd)

Page 6-4, Table 6-1:

Change R6 to 0757-0367 R:FXD MET FLM 100K OHM, 1% 0.5W.

Page 6-11, Table 6-2:

Change 0757-0059 to 0757-0367 R:FXD MET FLM 100K OHM, 1% 0.5W.

CHANGE 4

Page 6-3, Table 6-1:

Change DS1 to 1450-0419 INDICATOR: GLOW-LAMP NEON IN WHITE PLASTIC.

Page 6-11, Table 6-2:

Change 1450-0048 to 1450-0419 INDICATOR: GLOW-LAMP NEON IN WHITE PLASTIC.

►NOTE: The replacement DS1 for all 8614A's is 1450-0566.

CHANGE 5

Page 6-7, Table 6-1:

Change S1 to 3101-1606.

Change S3 and S201 to 3101-1590.

Change S401, S402, S403, and S601 to 3101-1590.

Page 6-9, Table 6-1:

Change 08614-009 to 08614-00026.

Page 6-12, Table 6-2:

Change 3101-0042 to 3101-1606.

Change 3101-0043 to 3101-1590 (TQ, 6).

Delete 3101-0053.

Page 6-13, Table 6-2:

Change 08614-009 to 08614-00026.

CHANGE 6

Page 1-1, paragraph 1-9:

Add the following sentence:

Option A85 (light gray panel) and option X95 (complete gray-blue color scheme) are available to match prior Hewlett-Packard instruments.

Page 6-8, Table 6-1:

Add 0370-0118 PUSHBUTTON (OPT A85 AND OPT X95).

Add 0370-0928 KNOB-PB (OPT A85 AND OPT X95).

Add 0370-1400 PUSHBUTTON.

Add 0370-1877 KNOB-PB.

Add 5040-0201 BEZEL COUNTER (OPT A85 AND OPT X95).

Add 5040-0202 BEZEL COUNTER (OPT A85 AND OPT X95).

Add 5040-0369 BEZEL COUNTER.

Add 5040-0370 BEZEL COUNTER.

CHANGE 6 (Cont'd)

Page 6-9, Table 6-1:

Change item 2 as follows:

08614-00026 PANEL FRONT (OPT A85 AND OPT X95)

08614-00028 PANEL FRONT

Change item 4 as follows:

5060-0766 HANDLE ASSY: RETAINER (OPT X95)

5060-8737 HANDLE ASSY: RETAINER

Change item 8 as follows:

5060-0775 KIT: 5 H RACK MOUNT (OPT X95)

5060-8740 KIT: 5 H RACK MOUNT

Change item 9 as follows:

5000-0738 COVER: REAR SIDE PLATE (OPT X95)

5000-8709 COVER: REAR SIDE PLATE

5000-0739 COVER: FRONT SIDE PLATE (OPT X95)

5000-8711 COVER: FRONT SIDE PLATE

Change item 10 as follows:

5060-0740 TOP COVER ASSY: 16L FM (OPT X95)

5060-8589 TOP COVER ASSY: 16L FM

Change item 11 as follows:

5060-0752 BOTTOM COVER ASSY: 16L FM (OPT X95)

5060-8713 BOTTOM COVER ASSY: 16L FM

Page 6-10, Table 6-2:

Add 0370-0118 PUSHBUTTON (OPT A85 AND OPT X95).

Add 0370-0928 KNOB-PB (OPT A85 AND OPT X95).

Add 0370-1400 PUSHBUTTON.

Add 0370-1877 KNOB-PB.

Page 6-13, Table 6-2:

Change 5000-0738 to COVER: REAR SIDE PLATE (OPT X95).

Change 5000-0739 to COVER: FRONT SIDE PLATE (OPT X95).

Add 5000-8709 COVER: REAR SIDE PLATE.

Add 5000-8711 COVER: FRONT SIDE PLATE.

Change 5040-0201 to BEZEL COUNTER (OPT A85 AND OPT X95).

Change 5040-0202 to BEZEL COUNTER (OPT A85 AND OPT X95).

Add 5040-0369 BEZEL COUNTER.

Add 5040-0373 BEZEL COUNTER.

Change 5060-0740 to TOP COVER ASSY: 16L FM (OPT X95).

Change 5060-0752 to BOTTOM COVER ASSY: 16L FM (OPT X95).

Change 5060-0766 to HANDLE ASSY: RETAINER (OPT X95).

Change 5060-0775 to KIT: 5 H RACK MOUNT (OPT X95).

Add 5060-8589 TOP COVER ASSY: 16L FM.

Add 5060-8713 BOTTOM COVER ASSY: 16L FM.

Add 5060-8737 HANDLE ASSY: RETAINER.

Add 5060-8740 KIT: 5 H RACK MOUNT.

Change 08614-00026 to PANEL FRONT (OPT A85 AND OPT X95).

Add 08614-00028 PANEL FRONT.

CHANGE 7

Page 6-2, Table 6-1:

Change:

C205 (0160-0079) to 0160-0593, C:FXD PAPER 1 UF $\pm$ 10% 600 VDCW.

C205 (1210-0003) to 1400-0512, BRACKET:CAPACITOR.

Page 6-10, Table 6-2:

Add 0160-0593, C:FXD PAPER 1 UF $\pm$ 10% 600 VDCW, 56289, P34315.

Delete 0160-0079.

Page 6-11, Table 6-2:

Add 1400-0512, BRACKET, CAPACITOR, 56289, 166P-5A6.

Delete 1210-0003.

CHANGE 8

Page 5-29 5-30, Figure 5-25:

Change Q1 to 1853-0252.

Change Q2 to 1853-0224.

Change the voltage level at the base of Q2 to -328.5V (CR4 changed from 6.49V to 7.5V zener voltage).

Page 6-3, Table 6-1:

Change CR4 to 1902-3129 DIODE-ZNR 7.5V 2% DO-7 PD=0.4W TC = +0.05%

Page 6-4, Table 6-1:

Change Q1 to 1853-0252 TRANSISTOR PNP SI TO-3 PD=150W FT = 4 MHz.

Change Q2 to 1853-0224 TRANSISTOR PNP SI TO-39 PD = 1W FT = 15 MHz.

Page 6-8, Table 6-1:

Delete insulator 1200-0043.

Add 0340-0875 INSULATOR, TRANSISTOR.

CHANGE 9

Page 5-33/5-34, Figure 5-27:

Change potentiometers R614 and R615 to 20 k Ω .

Page 6-6, Table 6-1:

Change R614 and R615 to 2100-1762 RESISTOR-TRMR 20K 5% WW SIDE-ADJ 1-TRN.

Change R620 and R621 to 2100-1757 RESISTOR-TRMR 500 5% WW SIDE-ADJ₂ 1-TRN.**CHANGE 10**

Page 6-8, Table 6-1:

Replace the 2110-0470 Fuseholder with the following parts:

2110-0564 FUSEHOLDER BODY 12A MAX: 250V MAX 28480 2110-0564

2110-0565 FUSEHOLDER CAP BAYONET: 12A, 250V MAX 28480 2110-0565

2110-0569 NUT-HEX, PLASTIC 28480 2110-0569

1400-0090 WASHER: RUBBER 5/8" OD 00900 OBD

Make the same changes to Table 6-2.

CHANGE 11

Page 5-29, Figure 5-25:

Change the following transistor types to part numbers:

Q50 from 2N1183 to 1853-0038

Q51 from 2N1670 to 1853-0012

Q52/Q53 from 2N404 to 1853-0001

Draw in capacitor C54 (330 pF) between the board ground () and chassis ground (). The capacitor is on the A500 board and chassis ground is off the board.

Page 5-33, Figure 5-27:

Change Q502/Q503 part number to 1853-0001.

Page 6-2, Table 6-1:

Add C54 0160-3694 CAPACITOR-FXD 330 PF $\pm 10\%$ 100 VDC CER 28480 0160-3694.

Page 6-4, Table 6-1:

Change the Q50-53, and Q502, 503 listing as follows:

Q50 1853-0038 TRANSISTOR PNP SI TO-39 PD = 1W FT = 100 MHz 28480 1853-0038

Q51 1853-0012 TRANSISTOR PNP 2N2904A SI TO-39 PD = 600MW 01698 2N2904A

Q52/53 1853-0001 TRANSISTOR PNP SI TO-39 PD = 600 MW 28480 1853-0001

Q502/503 (same as Q52/53).

CHANGE 12

Page 5-29, Figure 5-25:

Draw a ferrite bead on the base lead of Q50 and label it Z1.

Page 6-8, Table 6-1:

Add Z1 9170-0029 CORE-SHIELDING BEAD 28480-0029.

IDENTIFYING TECHNICAL PUBLICATION SHEET

T.O. 33A1-8-424-1K
30 MAY 1984

THIS PUBLICATION SUPPLEMENTS T.O. 33A1-8-424-1 DATED 30 NOVEMBER 1980. Reference to this supplement will be made on the title page of the basic publication by personnel responsible for maintaining the publication in current status.

I. IDENTIFICATION DATA

1. **PURPOSE:** This technical publication is issued for the purpose of identifying and authorizing the following commercial manual for Air Force use.

MANUFACTURER: Hewlett-Packard Company

PURCHASE ORDER OR CONTRACT NO.:

EQUIPMENT: 8614A

REQUISITION NO.:

FEDERAL STOCK NUMBER: 6625

TITLE: Operating and Service Instructions - Signal Generator

ADDITIONAL IDENTIFICATION: Also applies to HP 8614A instruments with serial number prefix
815-above 02201

DATE: Copyright 1965/Printed March 1979

2. **FILE LOCATION:** The above described commercial manual is filed in

(Each library will fill this in if this identifying technical publication sheet is filed separately from the commercial manual.)

II. SUPPLEMENTAL DATA

1. **LIST OF AFFECTED PAGES IN BASIC MANUAL.**

2. **SUPPLEMENTAL INFORMATION.** The information contained in the above identified commercial manual is supplemented as follows:

Add Hewlett-Packard Manual Changes, dated 30 August 1983 (6 pages), for Model No. 8614A, Part No. 08614-90001.

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

MANUAL CHANGES

SIGNAL GENERATOR

MANUAL IDENTIFICATION

Model Number: 8614A
Date Printed: March 1979
Part Number: 08614-90001

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	Serial Prefix or Number	Make Manual Changes
815-02601 to 815-02850	1	1310A and 1347A	1-7
953-02851 to 953-02975	1, 2	1645A	1-8
953-02976 to 953-03025	1-3	1748A	1-9
953-03026 to 953-03475	1-4	1808A	1-10
1111A	1-5	1810A	1-11
1150A	1-6	1835A, 2015A	1-12

► NEW ITEM

ERRATA

Title Page:

~~Change SERIALS PREFIXED:~~ 815- above 02201 to **SERIAL NUMBERS: 815-02201 and above.** Change the first sentence to "This Operating and Service Manual applies to HP 8614A instruments with serial numbers 815-02201 and above."

~~Change the second sentence to "For instruments with serial numbers 815-02200 and below ..."~~

► Page 3-9, Figure 3-8:

~~Change the last part of step 9 to "(6 volts peak to peak)."~~

Page 5-2, Table 5-1:

Change Instrument Type FM Modulator Recommended Instrument parts to:

Power Transformer	(1)	(9100-0139)	CD9
Capacitor	(1)	(0160-0043)	CD1
Potentiometers	(1)	(2100-0134)	CD7
	(1)	(2100-0047)	CD1
Resistor	(1)	(0687-1041)	CD7
Fuse 1/4A	(1)	(2100-0004)	CD0
Fuseholder, extractor			
post type	(1)	(1400-0084)	CD1
Power Cord	(1)	(8120-0050)	CD4

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.

CHANGE 1

Page 5-35, Figure 5-26:

Change R700 to 0687-1051 R:FXD COMP 1 MEGOHM 10% 0.5W.

CHANGE 2

Page 2-3, paragraph 2-10:

Change the fourth sentence to read as follows:

ampere standard fuse is used for 115 volt operation; a 1 ampere standard fuse is used for 230 volt operation.

Page 5-33, Figure 5-25:

Change F1 to 2A, 115 VAC, and 1A 230 VAC.

Page 6-5, Table 6-2:

Change F1 2110-0043 to 2110-0002 FUSE: CARTRIDGE 2 AMP 250V. (FOR 115 VOLT OPERATION ONLY).

Change F1 2110-0033 to 2110-0001 FUSE: 1 AMP 250V. (FOR 230 VOLT OPERATION ONLY).

Change J2 to 1251-2357.

Page 6-7, Table 6-2:

Change S2 to 3101-1234.

Page 6-8, Table 6-2:

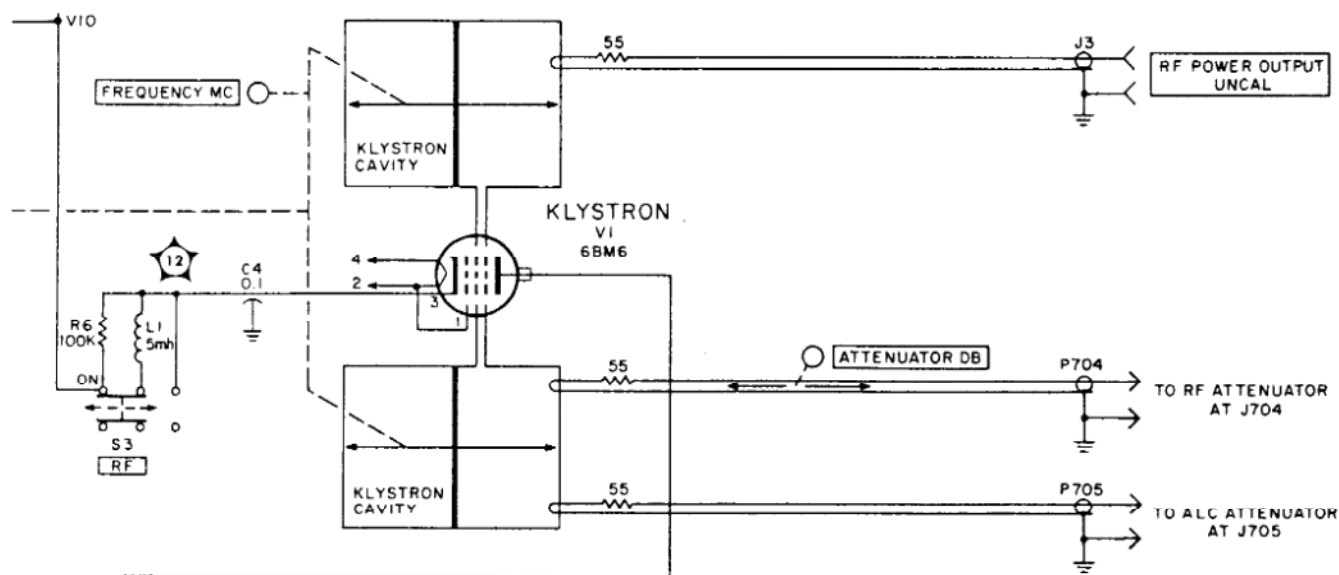
Change W1 to 8120-1378.

Add 08614-6007 WIRING HARNESS PRIMARY POWER.

CHANGE 3

Page 5-35, Figure 5-26:

Replace appropriate portions of figure with the attached partial schematic.



P/O Figure 5-26. Modulation and Klystron Circuits (P/O Change 3)

Page 6-5, Table 6-2:

Change R6 to 0757-0367 R:FXD MET FLM 100K OHM, 1% 0.5W.

CHANGE 4

Page 6-5, Table 6-2:

Change DS1 to 1450-0419 INDICATOR: GLOW-LAMP NEON IN WHITE PLASTIC.

CHANGE 5

Page 6-7, Table 6-2:

Change S1 to 3101-1606.

Change S3 and S201 to 3101-1590.

Change S401, S402, S403, and S601 to 3101-1590.

Page 6-9, Table 6-1:

Change 08614-009 to 08614-00026.

CHANGE 6

Page 1-1, paragraph 1-9:

Add the following sentence:

Option A85 (light gray panel) and option X95 (complete gray-blue color scheme) are available to match prior Hewlett-Packard instruments.

Page 6-8, Table 6-2:

Add 0370-0118 PUSHBUTTON (OPT A85 AND OPT X95).

Add 0370-0928 KNOB-PB (OPT A85 AND OPT X95).

Add 0370-1400 PUSHBUTTON.

Add 0370-1877 KNOB-PB.

Add 5040-0201 BEZEL COUNTER (OPT A85 AND OPT X95).

Add 5040-0202 BEZEL COUNTER (OPT A85 AND OPT X95).

Add 5040-0369 BEZEL COUNTER.

Add 5040-0373 BEZEL COUNTER.

Page 6-9, Table 6-2:

Change item 2 as follows:

08614-00026 PANEL FRONT (OPT A85 AND OPT X95)

08614-00028 PANEL FRONT

Change item 4 as follows:

5060-0766 HANDLE ASSY: RETAINER (OPT X95)

5060-8737 HANDLE ASSY: RETAINER

Change item 8 as follows:

5060-0775 KIT: 5 H RACK MOUNT (OPT X95)

5060-8740 KIT: 5 H RACK MOUNT

Change item 9 as follows:

5000-0738 COVER: REAR SIDE PLATE (OPT X95)

5000-8709 COVER: REAR SIDE PLATE

5000-0739 COVER: FRONT SIDE PLATE (OPT X95)

5000-8711 COVER: FRONT SIDE PLATE

Change item 10 as follows:

5060-0740 TOP COVER ASSY: 16L FM (OPT X95)

5060-8589 TOP COVER ASSY: 16L FM

Change item 11 as follows:

5060-0752 BOTTOM COVER ASSY: 16L FM (OPT X95)

5060-8713 BOTTOM COVER ASSY: 16L FM

CHANGE 7

Page 6-4, Table 6-2:

Change:

C205 (0160-0079) to 0160-0593, C:FXD PAPER 1 UF $\pm$ 10% 600 VDCW.

C205 (1210-0003) to 1400-0512, BRACKET:CAPACITOR.

CHANGE 8

Page 5-33, Figure 5-25:

Change Q1 to 1853-0252.

Change Q2 to 1853-0224.

Change the voltage level at the base of Q2 to -328.5V (CR4 changed from 6.49V to 7.5V zener voltage).

Page 6-4, Table 6-2:

Change CR4 to 1902-3129 DIODE-ZNR 7.5V 2% DO-7 PD=0.4W TC = +0.05%

Page 6-5, Table 6-2:

Change Q1 to 1853-0252 TRANSISTOR PNP SI TO-3 PD-150W FT = 4 MHz.

Change Q2 to 1853-0224 TRANSISTOR PNP SI TO-39 PD = 1W FT = 15 MHz.

Page 6-8, Table 6-2:

Delete insulator 1200-0043.

Add 0340-0875 INSULATOR, TRANSISTOR.

CHANGE 9

Page 5-37, Figure 5-27:

Change potentiometers R614 and R615 to 20 k Ω .

Page 6-7, Table 6-2:

Change R614 and R615 to 2100-1762 RESISTOR-TRMR 20K 5% WW SIDE-ADJ 1-TRN.

Change R620 and R621 to 2100-1757 RESISTOR-TRMR 500 5% WW SIDE-ADJ 1-TRN.

CHANGE 10

Page 6-8, Table 6-2:

Replace the 2110-0470 Fuseholder with the following parts:

2110-0564 FUSEHOLDER BODY 12A MAX; 250V MAX 28480 2110-0564

2110-0565 FUSEHOLDER CAP BAYONET; 12A, 250V MAX 28480 2110-0565

2110-0569 NUT-HEX, PLASTIC 28480 2110-0569

1400-0090 WASHER: RUBBER 5/8" OD 00000 OBD

CHANGE 11

Page 5-33, Figure 5-25:

Change the following transistor types to part numbers:

Q50 from 2N1183 to 1853-0038

Q51 from 2N1670 to 1853-0012

Q52/Q53 from 2N404 to 1853-0001

Draw in capacitor C54 (330 pF) between the board ground () and chassis ground (). The capacitor is on the A500 board and chassis ground is off the board.

CHANGE 11 (Cont'd)

Page 5-37, Figure 5-27:

Change Q502/Q503 part number to 1853-0001.

Page 6-4, Table 6-2:

Add C54 0160-3694 CAPACITOR-FXD 330 PF $\pm 10\%$ 100 VDC CER 28480 0160-3694.

Page 6-5, Table 6-2:

Change the Q50-53, and Q502, 503 listing as follows:

Q50 1853-0038 TRANSISTOR PNP SI TO-39 PD = 1W FT = 100 MHz 28480 1853-0038

Q51 1853-0012 TRANSISTOR PNP 2N2904A SI TO-39 PD = 600MW 01698 2N2904A

Q52/53 1853-0001 TRANSISTOR PNP SI TO-39 PD = 600 MW 28480 1853-0001

Q502/503 (same as Q52/53).

CHANGE 12

Page 5-33, Figure 5-25:

Draw a ferrite bead on the base lead of Q50 and label it Z1.

Page 6-8, Table 6-2:

Add Z1 9170-0029 CORE-SHIELDING BEAD 28480-0029.