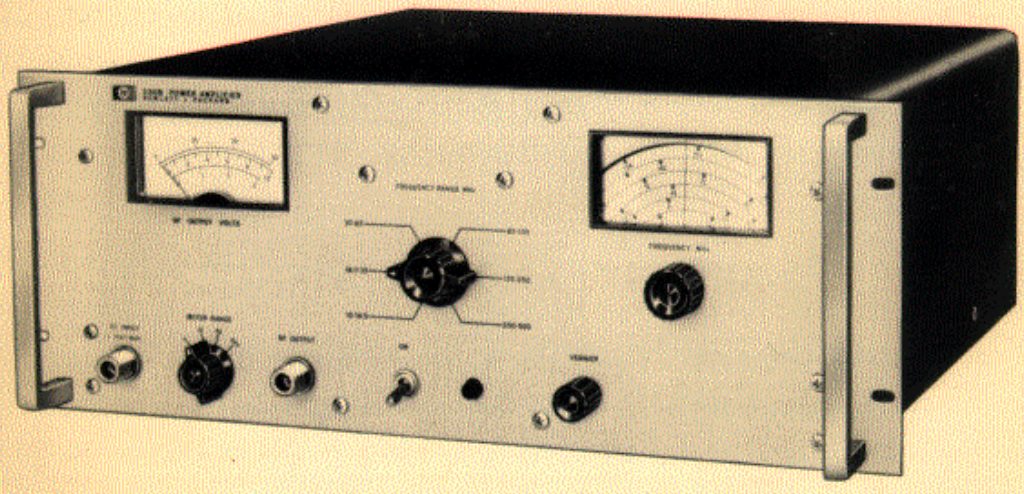
FOR SERIAL No. 1202A03721

OPERATING AND SERVICE MANUAL

POWER AMPLIFIER

230B



HEWLETT hp PACKARD

HP230B

POWER AMPLIFIER

MODEL 230B

OPERATING AND SERVICE MANUAL

FOR SERIALS 935-02700 - up*

*For Serials Above 935-02700
A change page may
be included.

Green Pond Road, Rockaway, New Jersey 07866

HP Part No. 00230-~~90001~~ 90039

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SECTION I
GENERAL INFORMATION

1-1 DESCRIPTION

1-2 The Model 230B Signal Generator Power Amplifier, shown on the cover, is manufactured by Hewlett-Packard. The amplifier offers a convenient way of obtaining high level RF from the output of conventional signal generators. When used in 50 ohm systems, it is capable of producing up to 4.5 Watts output in the 10MHz to 500MHz frequency range and will reproduce AM, FM, Pulse or CW modulation within its bandwidth capabilities. The 230B employs three grounded grid amplifiers to produce linear, class AB, operation with a typical noise figure of 6 to 9dB. The entire 10 to 500MHz is covered in six ranges and an RF voltmeter is provided which indicates the voltage at the front panel RF OUTPUT connector. Complete specifications are provided in Table 1-1.

1-3 INSTRUMENT IDENTIFICATION

1-4 Each Model 230B carries a two-section, eight-digit serial number (e. g. , 000-00000) which is stamped on a plate fastened to the rear panel. The five-digit number is an identification unique to each instrument, and the three-digit number is a serial prefix used to document instrument revisions.

1-5 When the SERIALS PREFIXED number on the title page of this manual is the same as the first three digits of the instrument serial number, the manual applies directly to the instrument. A change sheet will be included with the manual for newer instruments having a higher serial prefix than shown on the title page. If a change sheet is missing, it can be supplied by any Hewlett-Packard Sales Office listed at the back of this manual.

Table 1-1. Specifications

FREQUENCY RANGE:
- Range 1: 10 to 18.5MHz
- Range 2: 18.5 to 35MHz
- Range 3: 35 to 65MHz
- Range 4: 65 to 125MHz
- Range 5: 125 to 250MHz
- Range 6: 250 to 500MHz

RF GAIN
- 30dB (10 to 125MHz)
- 27dB (125 to 250MHz)
- 24dB (250 to 500MHz)
- (with 10 Volts output into 50 ohms)

RF BANDWIDTH
- >700kHz (10 to 150MHz)
- >1.4MHz (150 to 500MHz)
- (with 10 Volts output into 50 ohms)

RF OUTPUT
- Level: Up to 15 Volts across external 50 ohm load (4.5 Watts).

LEVEL MONITOR
- Ranges: 3, 10, 30 Volts full-scale
- Accuracy: 10% from 10 to 500MHz

FREQUENCY CALIBRATION:
- Calibration: Increments of approximately 10% accurate to ±10%.

AM CHARACTERISTICS
- AM Range: Reproduces 0 to 100% modulation of driving source.
- AM Distortion: <10% added to distortion of driving source, up to 5 Volts maximum carrier output for up to 100% AM.

FM CHARACTERISTICS
- FM Range: Reproduces modulation of driving source, except as limited by RF bandwidth.
- Incidental AM: <10% added to modulation of driving signal generator at 150kHz deviation.
- FM Distortion: Negligible distortion added to distortion of driving signal generator for <150kHz deviations and modulation frequencies.

POWER REQUIREMENTS
- 105 to 125 Volts or 210 to 250 Volts, 50 or 60Hz, 150 Watts.

CONNECTORS: Type N Female.

SECTION II
INSTALLATION

2-1 INITIAL INSPECTION

2-2 MECHANICAL CHECK

2-3 If damage to the shipping carton is evident, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for scratches, dents, broken knobs and switches, and any other mechanical damage. Also check the cushioning material for signs of severe stress as an indication of rough handling in transit.

2-4 PERFORMANCE CHECK

2-5 The electrical performance of the 230B should be verified as soon as possible after receipt. A performance check that is suitable for initial inspection is contained in Section V.

2-6 CLAIM FOR DAMAGE

2-7 If upon receipt, the 230B is damaged or fails to meet performance specifications, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately (a list of offices is provided at the back of this manual). Retain the shipping carton and padding material for the carrier's inspection.

2-8 PREPARATION FOR USE

2-9 POWER REQUIREMENTS

2-10 The 230B requires a power source of 105 to 125V or 210 to 250V, 50 or 60Hz, 150 Watts.

2-11 115/230 VOLT OPERATION

2-12 A two position slide switch, located on the rear panel, permits operation from either a 115 or 230 Volt source. Before connecting the 230B to the power source, check that the number visible on the slide switch matches the line voltage. If required, slide the switch to the other position using a thin-bladed screwdriver.

2-13 When the instrument leaves the factory, the proper fuse is installed for 115 Volt operation. An envelope containing a fuse for 230 Volt operation is attached to the front handle. Be sure that the correct fuse is installed if the position of the slide switch is changed. Markings on the chassis next to the slide switch indicate the correct fuse rating for operation from either source.

2-14 POWER CABLE

2-15 To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panels and cabinets be grounded. The 230B is equipped with a detachable, three-conductor power cable which, when plugged into an appropriate receptacle, grounds the panel and cabinet of the instrument. The offset pin on the power cable three-prong connector is the ground pin. The power connector is in accordance with CEE 22, Standard VI.

2-16 To preserve the protective feature when operating the instrument from a two-contact outlet, use a three-prong adapter (hp Stock No. 1251-0048) and connect the green pigtail on the adapter to ground.

2-17 COOLING

2-18 The 230B uses a forced-air cooling system. The air intake and filter are located at the rear of the instrument. For adequate ventillation, allow at least 3 inches clearance around the filter and cabinet ventillation holes.

CAUTION

Damage to 230B components may result from a dirty air filter. Check filter regularly and clean when necessary.

2-19 RACK MOUNTING

2-20 The 230B is designed for either bench or rack mounting operation. To install it in a rack

type installation, remove the four rubber feet from the bottom plate.

2-21 REPACKAGING FOR SHIPMENT

2-22 The original shipping carton and packing material should be used for repackaging. A Hewlett-Packard Sales and Service Office will provide information and recommendations on materials to be used if the original packaging materials are not available or reusable.

NOTE

If the instrument is to be shipped to a Hewlett-Packard Sales and Service Office, attach a tag showing owner, model number, complete serial number, and repairs required. Mark the shipping container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

SECTION III
OPERATION

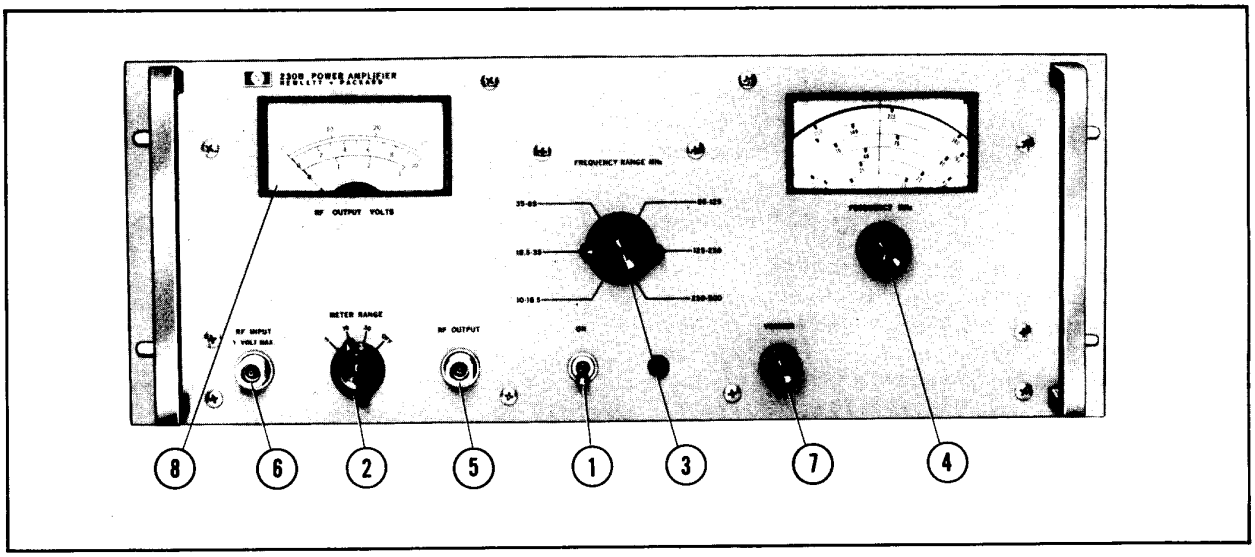


Figure 3-1. 230B Operating Controls

3-1 INTRODUCTION

3-2 The 230B Power Amplifier is designed to increase the output power of a conventional signal generator and becomes a high level signal source in the VHF range from 10MHz to 500MHz. With a typical noise figure of 6 to 9dB, the instrument provides up to 30dB of gain and a maximum power output of 4.5 Watts. It can be driven with any conventional signal source, and will reproduce AM, FM, and Pulse modulation within the 230B bandwidth limitations. The 230B may be used for both high and low level applications.

3-3 CONTROLS AND INDICATORS

3-4 Figure 3-1 identifies the function of the front and rear panel controls, indicators, and connectors.

3-5 OPERATING INSTRUCTIONS

3-6 The following paragraphs describe the 230B turn-on and operating procedures. All numbers following control and connector names refer to callouts in Figure 3-1.

3-7 TURN-ON PROCEDURE

3-8 To turn on the 230B, proceed as follows:

a. Check that 115/230 Volt slide switch is set for the nominal line voltage. The switch position can be changed by using a thin-bladed screwdriver.

b. Check that proper line fuse is installed in the fuseholder. The correct fuse rating is marked on the chassis next to the 115/230 Volt slide switch.

c. Connect one end of power cable to the line input connector and the other end to the appropriate line voltage source.

d. Set power switch (1) to ON position, and allow 15 minutes warm-up before proceeding.

3-9 OPERATING PROCEDURES

3-10 To operate the 230B as a power amplifier, proceed as follows:

CAUTION

To avoid output circuit damage, especially at the high end of the first two ranges (18.5MHz and 35MHz), DO NOT operate unit with more than one Volt input or an unterminated output.

a. Set voltmeter RANGE switch (2) to 30.

b. Set Frequency Range switch (3) to desired range.

c. Adjust FREQUENCY MHz (4) to desired range.

d. Connect RF OUTPUT connector (5) to equipment under test.

e. Connect external signal to RF INPUT connector (6).

f. Using the VERNIER tuning control (7), tune for a maximum indication on the voltmeter (8). The output voltage is then read directly from the meter.

3-11 FREQUENCY RESPONSE

3-12 Figure 3-2 illustrates 230B typical bandwidth at the response curve 3dB points. The 230B reproduction fidelity for AM signals is dependant upon two factors; (1) the 230B bandwidth at the frequency to which it is tuned and (2) the modulating frequency of the input signal. The minimum 230B bandwidth at the response curve 3dB points is approximately 700kHz.

3-13 The reproduction fidelity of FM signals can be determined by the following relationship:

$$BW \text{ required} = 2\,(MOD\ FREQ)\,(M+1)$$

$$\text{When } M = \frac{\text{Deviation}}{\text{Modulating Freq}}$$

Where: BW = Bandwidth
M = Modulation Index

Using Figure 3-2, the required bandwidth may be compared with the 230B typical bandwidth at the frequency desired.

3-14 If the 230B does not have sufficient bandwidth at the desired frequency, the first and second RF amplifiers may be stagger tuned to provide more bandwidth. However, by obtaining bandwidth in this manner, there will be a sacrifice of gain.

3-15 RF VOLTMETER

3-16 The meter detector is physically connected to the output connector. When operating at the higher frequencies, the length of the connecting lead becomes important in that if there is a mismatch between the 230B output impedance and the load impedance, there could be sufficient VSWR to cause the meter to read something other than the actual voltage at the RF OUTPUT connector.

3-17 VSWR

3-18 The Model 230B was designed for use in 50 ohm systems. A wide-band, tuned amplifier, such as the 230B, however, cannot maintain a constant output impedance without a complex method of controlling both output coupling coefficient and tank circuit reactance, or allowing for an insertion loss of a broad-band matching pad. Where the application requires it, the 230B input and output impedances may be matched to the source or load through matching networks, pads, or stub tuners, depending upon power gain requirements and operating frequency.

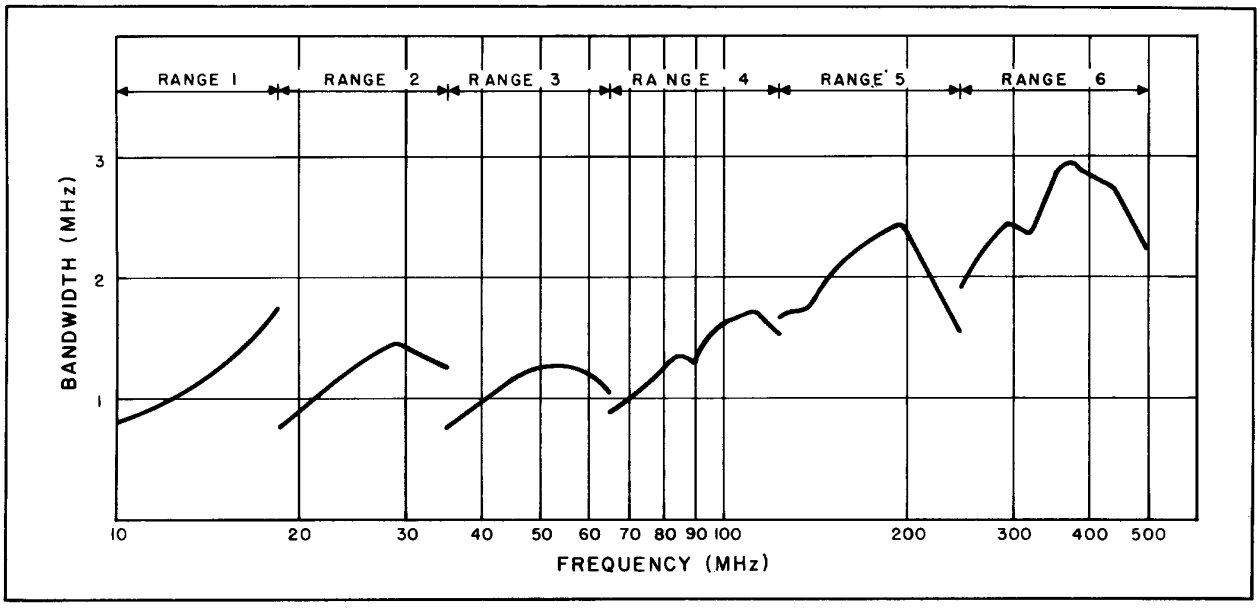


Figure 3-2. 230B Bandwidth vs Frequency

3-19 NOISE FIGURE

3-20 The equivalent noise figure for the 230B is kept very low; typically 6 to 9dB over the entire frequency range.

3-21 APPLICATIONS

3-22 The following paragraphs list some typical 230B applications.

3-23 AGC CHARACTERISTICS

3-24 AGC (automatic gain control) characteristics are measured or determined by measuring the relationship between RF input voltage and the dc voltage bias developed by the AGC detector. it is often desirable to determine the RF level which will override the AGC and cause blocking and/or distortion. This level is often much higher than 500,000 microvolts in well-designed systems.

3-25 SKIRT SELECTIVITY

3-26 Skirt selectivity testing of a communications system requires that the performance of the frequency selective circuits be determined at a frequency considerably removed from the desired frequency, or on the "skirts" of the resonance curve, where attenuation is at a very high value. Typical values are 2 to 5 Volts for attenuation figures of 80 to 120dB. In this test, one must be cautious of the possibility of overload occurring before the desired point on the skirt is reached. In AM systems, an increase in distortion indicates that overloading has taken place and limits the extent of the "skirt" measurement.

3-27 ADJACENT CHANNEL DESENSITIZATION TEST

3-28 Most communication centers transmit on many channels simultaneously. Usually, a given receiver will be in contact with signals of less than 100 microvolts in strength, while one or more transmitters in the same room are operating at a frequency only a few channels from the receiver frequency. The receiver must not, therefore, be affected by strong signals in adjacent channels. It is for this reason that desensitization characteristics are specified by communication system designers, and the desensitization tests are made.

3-29 Desensitization tests are made by connecting the equipment as shown in Figure 3-3. Signal generator #1 is set to give a convenient metered detector level (sometimes specified for a given system). This is the "desired signal" on channel. Using signal generator #2 in conjunction with the 230B Power Amplifier, the adjacent channel level is raised until the detector level is reduced by a specific amount (usually 3dB). The reading on the 230B voltmeter is twice the voltage required for "desensitization".

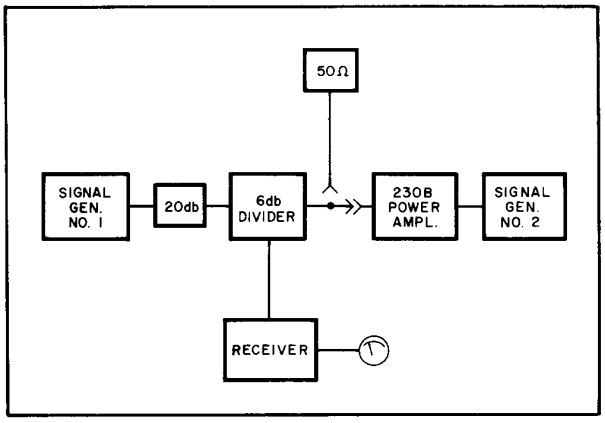


Figure 3-3. Connections For Desensitization

3-30 HIGH LEVEL DRIVER

3-31 As a high level driver, the 230B can be used to power bridges and slotted lines to improve the resolution and accuracy of these measurements. Computers that require high-level signal sources for synchronizing purposes, at moderately high frequencies, may also be driven by the 230B Power Amplifier.

3-32 ANTENNA TESTING

3-33 The 230B is capable of supplying moderate power for antenna measurements, while, at the same time, providing relatively small leakage from the Power Amplifier itself.

3-34 ATTENUATION MEASUREMENTS

3-35 Using the 230B Power Amplifier and an RF millivolt meter, attenuation measurements can be made in the order of 80dB. The 230B provides an additional 24 to 30dB of gain or signal level (assuming the circuit being measured will permit the high voltage) to add to the existing measuring system in the field of attenuation measurements, filters, long transmission lines, etc., can be tested in this manner.

3-36 Certain of these applications are susceptible to the absolute values of the source or load impedance. Where these impedances are critical, matching pads, attenuators, stub tuners or tunable networks may be employed to accomplish the necessary proper match for the application.

3-37 FREQUENCY MULTIPLYING

3-38 A number of approaches to this application

are possible. First, it is possible to amplify the harmonics present in the input signal. The output under these conditions is in the order of 0.2 to 0.5 Volts, with 0.2 Volts of fundamental input. Another approach is to use a semiconductor harmonic generator to augment the harmonics present in the input signal. This technique yields several Volts output, depending upon the input levels available. If sufficient input is available, the 230B input stage may be overdriven and the attendant distortion will produce higher harmonic levels. Approximately 1 to 2 Volts may be expected for inputs of the order of 1 Volt. A crystal frequency synthesizer output may be multiplied as many as ten times, extending the usefulness of these units to the UHF range. Further information is contained in the Hewlett-Packard Application Note 920, "Harmonic Generation using Step Recovery Diodes and Step Recovery Diode Modules" available through your local HP office.

SECTION IV
THEORY OF OPERATION

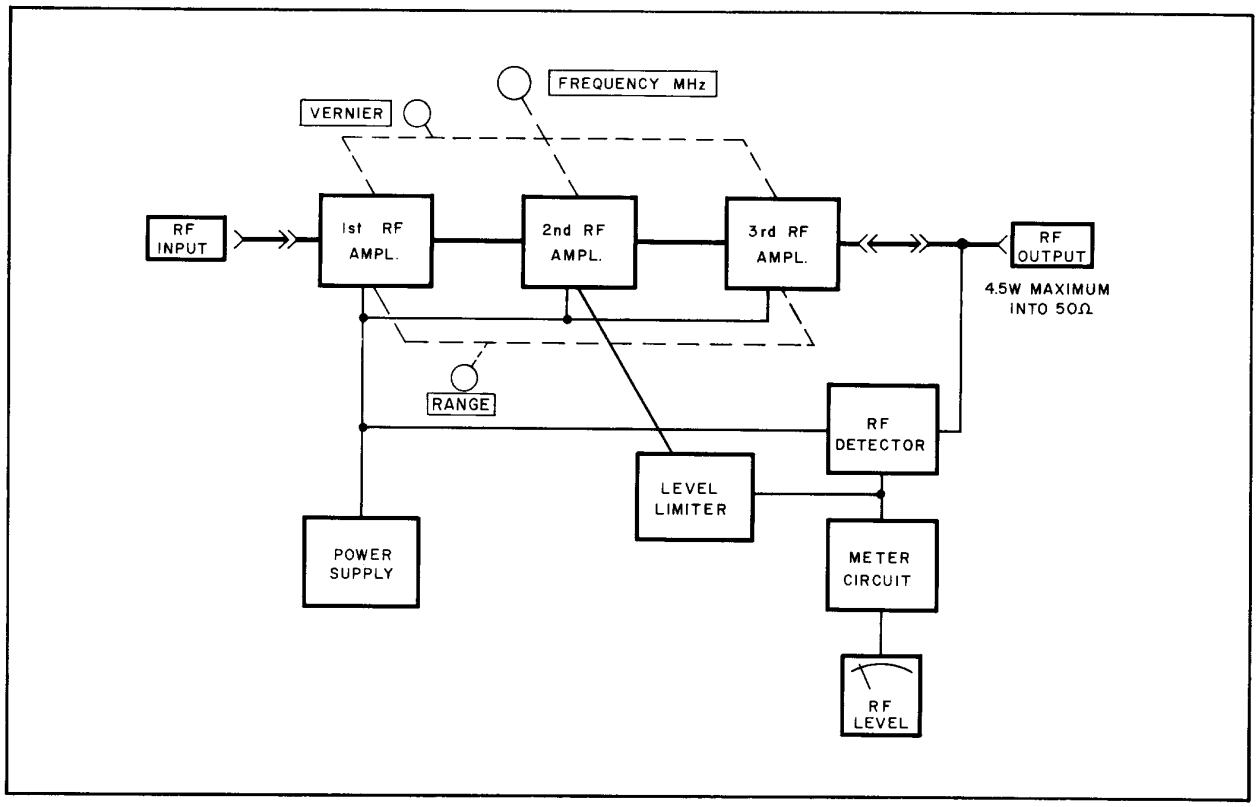


Figure 4-1. 230B Block Diagram

4-1 INTRODUCTION

4-2 The Model 230B Power Amplifier is capable of increasing low level signals up to 30dB. It employs three grounded-grid amplifiers, tuneable from 10MHz to 500MHz, in three ranges, and an RF voltmeter to monitor the output.

4-3 OVERALL DESCRIPTION

4-4 Figure 4-1 is a block diagram of the 230B. The input signal is amplified by the three grounded-grid amplifiers, the first being operated class A and the second and output amplifiers operated class AB.

4-5 At the output, a portion of the RF output is detected and used to drive the RF voltmeter. The voltmeter is calibrated to read rms Volts.

4-6 DETAILED DESCRIPTION

4-7 RF AMPLIFIERS

4-8 The RF amplifiers in the 230B use conventional grounded-grid circuitry. Special 2C39A tubes with reduced size radiators are used in all three stages to increase coupling efficiency at 500MHz. Since all three stages are alike only the second stage will be discussed.

4-9 Transistors Q1 and Q2 and associated components form an output level limiter. During normal operation, VR6 is non-conducting. Q1-Q2 are held in saturation by the positive current source through R11. The cathode current of V2 flows through CR7 and Q2 (normally saturated) and provides a fixed bias of approximately +1.4V at the cathode of A2V2.

4-10 When the RF output voltage exceeds approximately 30Vrms (43V pk) VR6 begins to conduct. This reduces the current flow into the base of Q1 thus causing Q2 to go out of saturation. Since the cathode current of V2 is flowing through Q2, its Vce increases. This in turn increases the + voltage at the cathode of V2 which reduces the output to a point not exceeding 30Vrms. This action reduces the possibility of any internal damage that might occur if the output exceeded 30Vrms.

4-11 The tuned plate circuit consists of C11 and C12 in series across the plate circuit inductance. As the 230B is tuned from the low end of a range to the high end, a point is reached (approx. 320 MHz on range 6) at which C12 becomes ineffective as part of the tuning process. At this point the circuit changes from series-parallel tuned to series tuned. This is accomplished by making the piston of C12 (C4 and C18) physically shorter than C11 (C4 and C18). The results of this tuning method are greater tuning ratio, and less compression of frequencies at the high end of the dial. The complete frequency range is covered by inserting different value plate circuit inductors, by means of a turrent switching assembly.

4-12 The plate circuit inductors for the first and output stages are identical while those of the second stage are wound in the reverse direction from the other two stages. This reduces the possibility of regeneration occuring.

4-13 METER CIRCUIT

4-14 The meter circuit provides an indication of the rms output. The RF detector provides the input to the circuit. The METER RANGE switch selects the desired range by providing the proper voltage dividing resistor in series with the meter. R13 allows calibration of the meter sensitivity.

4-15 POWER SUPPLY

4-16 The 230B power supply consists of power transformer T1, bridge rectifier CR1-CR4, series regulator V1, error amplifier V2 and reference tube V3.

4-17 The cathode of V1 supplies a regulated + 320 Volts to the three RF amplifiers. Series regulator V1 serves as an adjustable impedence in series with the output, controlled by error amplifier V2. Error amplifier V2 samples a portion of the regulated output obtained from a voltage divider consisting of R4, R5 and R18. R18 is adjusted for + 320 Volts at the cathode of V1.

4-18 Regulation is accomplished by the application of the sampled voltage to the grid of V2. V2 amplifies any changes in the output and applies it in the proper phase and amplitude to the grid of V2. This causes V2 to conduct more or less in accordance with the error signal applied to it, thus obtaining the proper well-regulated output at the cathode of V1.

4-19 V3 supplies a constant voltage to the cathode of V2 and to the meter circuit which is used as a reference voltage.

SECTION V
MAINTENANCE

5-1 INTRODUCTION

5-2 This section contains information required to maintain the 230B Signal Generator Power Amplifier. The information covered is summarized below:

a. TEST EQUIPMENT REQUIRED - Lists and describes test equipment necessary to perform the operations in this section.

b. PERFORMANCE CHECKS - Verify proper operation of the 230B.

c. ADJUSTMENT PROCEDURES - Used to adjust the 230B after repair.

d. COMPONENT REPLACEMENT PROCEDURES - Describes step by step procedures for major component replacement.

e. TROUBLESHOOTING PROCEDURES - Aid in locating malfunctions.

5-3 TEST EQUIPMENT REQUIRED

5-4 Instruments required to perform the operations in this section are listed in Table 5-1. This table lists the type of instrument required, critical specifications, and recommended model or type. For operating instructions refer to the manual supplied with the equipment. If the equipment listed is not available, equipment which meets or exceeds the critical specifications may be used.

Table 5-1. Test Equipment Required

INSTRUMENT OR ACCESSARY TYPE	CRITICAL SPECIFICATIONS	RECOMMENDED INSTRUMENT OR ACCESSARY
Oscilloscope	Bandwidth: dc to 500kHz VERT sensitivity: 0.1V/cm HORIZ sensitivity: 1.0V/cm	HP 130C
Sweep Generator	Frequency range: 10-500MHz Markers: 1, 10, 50MHz Output: 1.0V rms into 50 Ohms	Texscan VS50
Power Meter	Range: -20 to +10 dBm Accuracy: ±1% on +5 dBm Range	HP 431C
Xtal Detector	Frequency response flat from 10 to 500MHz	HP 423A
10 dB Attenuator	Frequency Range: dc to 12.4GHz Accuracy: ±0.5 dB Maximum input power: 2W average	HP 8491A Opt 10
20 dB Attenuator	Frequency range: dc to 12.4GHz Accuracy: ±0.5 db Maximum input power: 2W average	HP 8491A Opt 20
RF Voltmeter	Range: 1mV to 3V fullscale Frequency range: 10kHz to 1.2GHz	HP 3406A
DC Voltmeter	Range: 1mV to 1000V full scale Accuracy: ±1%	HP 412A

Table 5-1. Test Equipment Required (Continued)

INSTRUMENT OR ACCESSARY TYPE	CRITICAL SPECIFICATIONS	RECOMMENDED INSTRUMENT OR ACCESSARY
AC Voltmeter	Range: 1mV to 1000V full scale Frequency range: 40Hz to 1MHz Accuracy: ±1%	HP 400E
Variable Transformer	Output: 115V ± 20% or 230V ± 20% Current: 2A	General Radio Type W10M3TA
Tuning Tool	6 in. length of 1/8 Nylon rod with blade tip	
Electronic Counter	10 - 500MHz	HP 5245L with 5253B Plug-in

5-5 PERFORMANCE CHECKS

5-6 The Performance Checks verify 230B operation within its rated specifications (see Section I, Table 1-1). They may be used:

a. As part of incoming inspection
b. As monthly routine reliability checks
c. Before returning to normal service after being repaired
d. For troubleshooting purposes

5-7 A sample Performance Check Test Card is included in this section. The card may be duplicated and completed during 230B Performance Checks to provide a permanent record.

5-8 FREQUENCY DIAL ACCURACY

5-9 To check the frequency dial accuracy, proceed as follows:

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

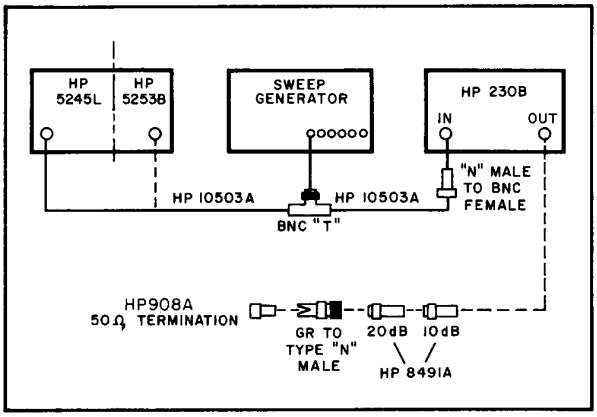


Figure 5-1. 230B Frequency Accuracy Test Setup

b. Set sweep generator controls as follows:
CENTER FREQUENCY See chart below
SWEEP WIDTH CW
ATTENUATION to maintain 5-10V output as read on 230B voltmeter.

c. Adjust 230B and sweep generator to frequencies listed in chart. The electronic counter should read between the limits shown.

230B DIAL FREQUENCY	COUNTER LIMITS
10MHz	9 - 11MHz
14MHz	12.6 - 15.4MHz
18MHz	16.2 - 19.8MHz
19MHz	17.1 - 20.9MHz
27MHz	24.3 - 29.7MHz
35MHz	31.5 - 38.5MHz
50MHz	45 - 55MHz
65MHz	58.5 - 71.5MHz
95MHz	85.5 - 104.5MHz
125MHz	112.5 - 137.5MHz
180MHz	162 - 198MHz
250MHz	225 - 275MHz
375MHz	337.5 - 412.5MHz
500MHz	450 - 550MHz

5-10 BANDWIDTH CHECK

5-11 To check the bandwidth, proceed as follows:

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

CAUTION

Always disconnect the input to the 230B before disconnecting the output. Operating the instrument without a load may cause serious electrical damage.

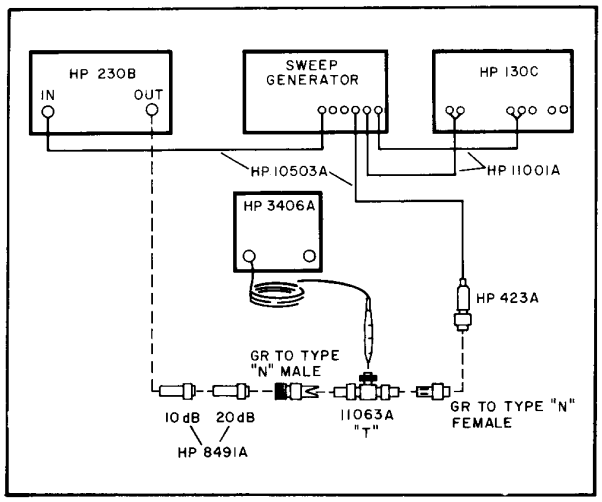


Figure 5-2. 230B Bandwidth Test Setup

b. Set sweep generator controls as follows:

CENTER FREQUENCY	10MHz (approx.)
ATTENUATION	30dB
SWEEP WIDTH	CW
SWEEP RATE	5-50Hz
SWEEP RATE vernier	FULL CW
Markers on	none

c. Set oscilloscope controls as follows:

VERTICAL INPUT	DC coupled
VERTICAL SENSITIVITY	0.1V/cm
VERNIER	CAL
HORIZONTAL INPUT	DC coupled
HORIZONTAL SENSITIVITY	1.0V/cm
VERNIER	CAL

d. Set external RF voltmeter controls as follows:

RANGE	0.3 Volt

e. Set 230B controls as follows:

Range	10 - 18.5
FREQUENCY MHz	10
Voltmeter RANGE	30

f. Adjust 230B VERNIER for maximum output and sweep generator ATTENUATOR and RF vernier for 0.316 Volts on external RF voltmeter.

g. Change sweep generator controls as follows:

SWEEP WIDTH	NARROW
Markers on	1MHz

h. Adjust sweep generator SWEEP WIDTH vernier until 1MHz equals 2cm on the oscilloscope graticule.

i. Using the oscilloscope VERTICAL POSITION control adjust for trace shown in Figure 5-3A.

j. Decrease sweep generator ATTENUATION 3dB.

k. The bandwidth between the two points where the waveform crosses the horizontal axis (see Figure 5-3B) should be 700kHz or 1.4cm minimum.

l. Using the above procedure, check several frequencies on each of the first three ranges. The 3dB bandwidth should be 700kHz minimum at any frequency.

m. On ranges 4, 5, and 6, repeat steps (a) through (l) using a SWEEP WIDTH setting of WIDE and adjusting 1MHz to equal 1cm in steps (g) and (h) respectively.

n. The 3dB bandwidth should be 700kHz minimum to 150MHz and 1.4MHz minimum from 150 to 500MHz.

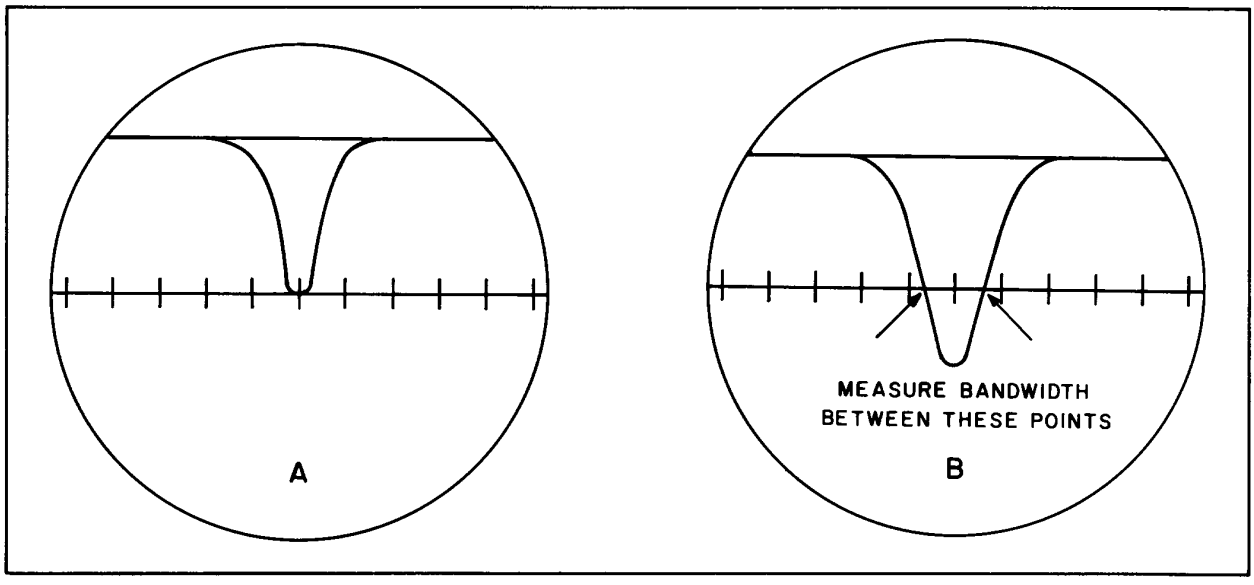


Figure 5-3. 230B Bandwidth Check Waveforms

o. Adjust sweep generator and 230B frequency controls from the low end to the high end of each range while noting the frequency on each range at which minimum output occurs.

NOTE

Adjust sweep generator ATTENUATION and SWEEP WIDTH controls as necessary for an on-screen oscilloscope display.

5-12 GAIN CHECK

5-13 To check the gain, proceed as follows:

a. Connect equipment as shown in Figure 5-4.

b. Set 230B controls as follows:

Range	10 - 18.5MHz
FREQUENCY MHz	Frequency of lowest output.

c. Set sweep generator controls as follows:

CENTER FREQUENCY	Same as 230B
SWEEP WIDTH	CW.

d. Set power meter controls as follows:

RANGE	+5dBm

e. Adjust sweep generator ATTENUATION and CENTER FREQUENCY controls for maximum output from the 230B as read on the power meter +5dBm range.

f. Adjust sweep generator RF VERNIER for a -2 reading on the power meter dBm scale, corresponding to +33dBm or 10V into 50 ohms.

g. Disconnect input to 230B and power meter.

h. Connect sweep generator RF OUT to power meter and note reading.

i. The 230B gain is equal to the algebraic difference between the 230B output and the sweep generator output and can be found by the following method:

GAIN = +33 - (sweep generator output from step h)

EXAMPLE: +33 - (-3) = +36dB

+33 - (+5) = +28dB.

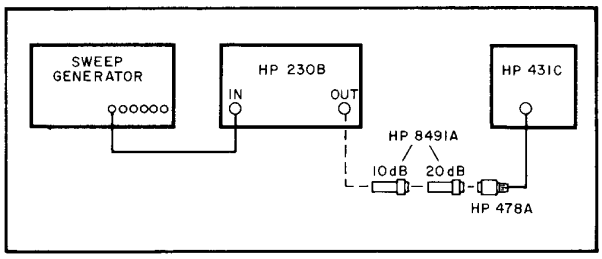


Figure 5-4. 230B Gain Check Setup

j. The 230B gain should be 30dB minimum.

k. Reconnect power meter and sweep generator to 230B.

l. Adjust auto transformer to 105Vac.

m. Repeat steps (e) through (i). The 230B gain should be 30dB minimum.

n. Repeat steps (a) through (m) for each frequency noted in Paragraph 5-11, step (o). The gain should be 30dB minimum from 10 to 125MHz, 27dB minimum from 125 to 250MHz, and 24dB minimum from 250 to 500MHz.

5-14 VOLTMETER ACCURACY

5-15 To check the voltmeter accuracy, proceed as follows:

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

b. Set 230B controls as follows:

Range	10 - 18.5MHz
FREQUENCY MHz	10
Voltmeter RANGE	3

c. Set sweep generator controls as follows:

230B VM RANGE	RF OUTPUT AS READ ON EXTERNAL RF VOLTMETER	230B METER LIMITS
3	0.1	0.9 - 1.1
3	0.2	1.8 - 2.2
3	0.3	2.7 - 3.3
10	0.3	2.7 - 3.3
10	0.4	3.6 - 4.4
10	0.5	4.5 - 5.5
10	0.6	5.4 - 6.6
10	0.7	6.3 - 7.7
10	0.8	7.2 - 9.0
10	0.9	8.1 - 9.9
10	1.0	9.0 - 11.0
30	1.0	9.0 - 11.0
30	1.2	10.8 - 13.2
30	1.5	13.5 - 16.5

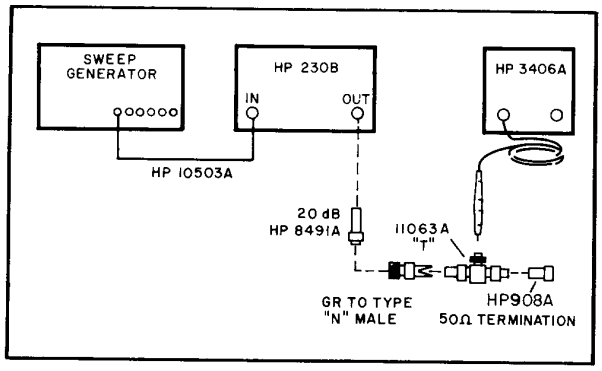


Figure 5-5. 230B Voltmeter Accuracy Setup

CENTER FREQUENCY 10MHz
SWEEP WIDTH CW

d. Adjust sweep generator ATTENUATION and RF VERNIER controls for 0.1 Volt on the external RF voltmeter. 230B voltmeter should read 0.89 to 1.10 Volts.

e. Adjust sweep generator for RF outputs listed below. The 230B voltmeter should indicate within limits listed.

f. Using the procedure in steps (d) and (e), any frequency may be checked against the limits listed in chart on previous page.

5-16 ADJUSTMENT PROCEDURES

5-17 The following adjustment procedures should be performed only if it has been determined by the Performance Checks in Paragraph 5-5 that the 230B is not within specifications. Tolerances associated with adjustments are given as aids to making the adjustments. These tolerances do not constitute a basis for qualification or acceptance of an instrument since no allowance has been made for temperature or aging effects. Qualification and overall performance should be based on the specifications listed in Section I, Table 1-1.

NOTE

Except where indicated, adjustments and tests are made at nominal line voltage.

5-18 PREPARATION FOR ADJUSTMENT

5-19 To obtain access to capacitor and coil slug adjustments it will be necessary to remove the top cover.

5-20 METER MECHANICAL ADJUSTMENT

5-21 This procedure adjusts the RF voltmeter mechanical zero. Proceed as follows:

a. Turn on instrument and allow it to come up to normal operating temperature (about 20 minutes).

b. Turn the instrument off. Wait one minute for power supply capacitors to discharge completely.

c. Insert sharp pointed object (pen point or awl) into the small indentation near top of round black plastic disc located directly below meter face.

d. Rotate plastic disc clockwise (cw) until meter reads zero, then rotate ccw slightly in order to free adjustment screw from meter suspension. If pointer moves, repeat Steps c and d.

5-22 POWER SUPPLIES

5-23 This procedure checks and adjusts power supply voltages for the proper level. Proceed as follows:

a. Turn on 230B and allow 5 minutes warm up.

b. Measure heater voltages of V1, V2, and V3 with ac voltmeter. Voltage should be 5.9V ac ±0.1Vac.

c. Adjust R18, VOLT ADJ, for +320Vdc at V3 plate.

d. Adjust line voltage from 105 to 125Vac. +320V should not change more than ±5.0Vdc.

5-24 RF ADJUSTMENTS

5-25 The procedure for adjusting the 230B tuned circuits is given in the following paragraphs. For locations of adjustments, see Figure 5-6. The 230B may be initially adjusted with the amplifier box covers off; however, final adjustments must be performed with both covers securely in place. All adjustments are tuned for maximum output and

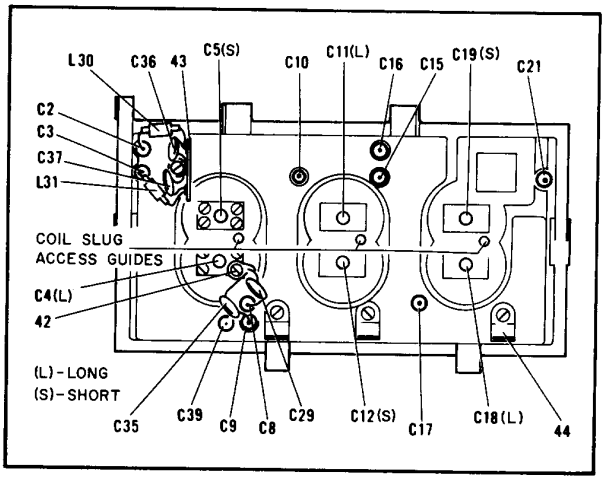


Figure 5-6. 230B Adjustments

proper frequency. Frequency accuracy is determined by the capacitor adjustments on range 6. The capacitors should not be moved during adjustment of the other five ranges.

5-26 After completing adjustment of a range and before proceeding to the next range, adjust the sweep generator and the 230B from one end of the range to the other while noting the frequency at which minimum output occurs. These points will be used during the gain check.

5-27 OSCILLOSCOPE CONTROL SETTINGS

5-28 Set oscilloscope controls as shown below. Once set, these controls will not be changed throughout the adjustment procedure. Should the waveform go off the screen, the sweep generator controls should be used to restore the waveform to normal.

5-29 250-500MHz ADJUSTMENT

5-30 The following procedure adjusts the 250-500 MHz range. Proceed as follows:

NOTE

The capacitor adjustments are performed on the 250-500MHz range only and should not be moved during subsequent range adjustments.

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

b. Set sweep generator controls as follows:

CENTER FREQUENCY	500MHz
ATTENUATION	16dB
ALC	INT
SWEEP WIDTH	WIDE
SWEEP RATE vernier	CW
SWEEP RATE	5-50Hz
Markers on	50MHz

c. Set 230B controls as follows:

Range	250-500MHz
FREQUENCY MHz	480MHz (approx)
Voltmeter RANGE	30

d. Adjust sweep generator CENTER FREQUENCY until 500MHz marker is at the vertical center line of the oscilloscope graticule.

NOTE

If no waveform is visible, decrease sweep generator attenuation until waveform appears. As capacitors are adjusted, increase sweep generator attenuation to keep waveform on tne screen.

e. Adjust C4, C11, and C18 until 500MHz marker is at peak of waveform and waveform is at maximum amplitude. Tighten locknuts finger tight.

f. Change equipment control settings as follows:

CENTER FREQUENCY	400MHz
230B FREQUENCY MHz	390MHz

g. Adjust sweep generator CENTER FREQUENCY until 400MHz marker is at the vertical center line of the oscilloscope graticule.

h. Using nylon tuning rod, adjust three coil slugs through holes in right side of amplifier box until 400MHz marker is at the waveform peak and the waveform is at maximum amplitude.

i. Change equipment controls as follows:

CENTER FREQUENCY	250MHz
230B FREQUENCY MHz	240MHz

j. Adjust C5, C12, and C19 until 250MHz marker is at the waveform peak and the waveform is at maximum amplitude. Tighten locknuts finger tight.

k. Repeat Steps b through j.

l. Tighten locknuts being careful not to turn adjusting screws.

m. Adjust sweep generator and 230B from the low end to the high end of the range while noting frequency at which lowest output occurs.

n. Perform the Bandwidth and Gain checks given in Paragraph 5-5 for Range 6.

5-31 125-250MHz ADJUSTMENT

5-32 The following procedure adjusts the 125-250 MHz range. Proceed as follows:

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

b. Set sweep generator controls as follows:

CENTER FREQUENCY	250MHz
ATTENUATION	16dB
SWEEP WIDTH	WIDE
Markers on	50MHz

c. Set 230B controls as follows:

Range	125-250MHz
FREQUENCY MHz	240MHz

d. Adjust sweep generator CENTER FREQUENCY until 250MHz marker is at the vertical center line of the oscilloscope graticule.

e. Adjust three coil slugs until 250MHz marker is at the waveform peak and the waveform is at maximum amplitude.

f. Adjust sweep generator and 230B from the low end to the high end of the range while noting frequency at which lowest output occurs.

g. Perform Bandwidth and Gain checks given in Paragraph 5-5 for the range being adjusted.

5-33 65-125MHz ADJUSTMENT

5-34 The following procedure adjusts the 65-125

MHz range. Proceed as follows:

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

b. Set sweep generator controls as follows:

CENTER FREQUENCY	125MHz
ATTENUATION	23dB
Markers on	1, 10, 50

c. Set 230B controls as follows:

Range	65-125MHz
FREQUENCY MHz	125MHz

d. Repeat Steps 5-24 d,e,f,g, using 125MHz marker.

5-35 35-65MHz ADJUSTMENTS

5-36 This procedure adjusts the 35 to 65MHz range. Proceed as follows:

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

b. Set sweep generator controls as follows:

CENTER FREQUENCY	65MHz
ATTENUATION	23dB
SWEEP WIDTH	NARROW
Markers on	1, 10, 50MHz

c. Set 230B controls as follows:

Range	35-65MHz
FREQUENCY MHz	65MHz

d. Repeat Steps 5-24 d,e,f, and g using 65MHz marker.

5-37 18.5-35MHz ADJUSTMENT

5-38 This procedure adjusts the 18.5 to 35MHz range. Proceed as follows:

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

b. Set sweep generator controls as follows:

CENTER FREQUENCY	35MHz
ATTENUATION	26dB
Markers on	1, 10, 50MHz

c. Set 230B controls as follows:

Range	18.5-35MHz
FREQUENCY MHz	35

d. Repeat Steps 5-24 d,e,f,g, using 35MHz marker.

5-39 10-18.5MHz ADJUSTMENT

5-40 This procedure adjusts the 10 to 18.5MHz range. Proceed as follows:

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

b. Set sweep generator controls as follows:

CENTER FREQUENCY	18MHz
ATTENUATION	26dB
Markers on	1, 10MHz

c. Set 230B controls as follows:

Range	10-18.5MHz
FREQUENCY MHz	18MHz

d. Repeat Steps 5-24 d,e,f, and g using 18MHz marker.

5-41 VOLTMETER FULL-SCALE ADJUST

5-42 The following procedure adjusts the accuracy of the RF voltmeter. Proceed as follows:

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

b. Set sweep generator controls as follows:

CENTER FREQUENCY	10MHz
ALC	INT
SWEEP WIDTH	CW
ATTENUATION	26dB
Markers on	none

c. Set external RF voltmeter controls as follows:

RANGE	1 Volt

d. Set 230B controls as follows:

Range	10-18.5MHz
FREQUENCY MHz	10
Voltmeter RANGE	10

e. Adjust 230B VERNIER control for maximum reading on the external RF voltmeter.

f. Adjust sweep generator output for 1.0 Volt reading on external RF voltmeter.

g. Adjust R125, METER SENS, for a full-scale reading on the 230B RF voltmeter 10 Volt range.

5-43 COMPONENT REPLACEMENT PROCEDURES

5-44 The following paragraphs give step by step procedures for replacing certain 230B components.

5-45 TUBE REPLACEMENT

5-46 Should it become necessary to replace one or more 2C39A tubes, they should be replaced with HP part number tubes only. These tubes have special reduced size heat radiators for reducing plate to ground capacitance. Proceed as follows:

a. Remove instrument cover and amplifier box top and bottom covers.

b. Refering to Figure 5-7, loosen the plate and grid ring clamps.

c. Slide the plate ring clamp forward until it is free of the plate.

d. Move 2C39A toward rear of amplifier box while moving cathode and filament connectors toward front of amplifier box until they disengage.

e. Remove 2C39A.

f. To replace 2C39A, reverse the above procedure.

NOTE

When installing 2C39A, be sure plate contact strap fingers are under plate ring clamp before it is tightened.

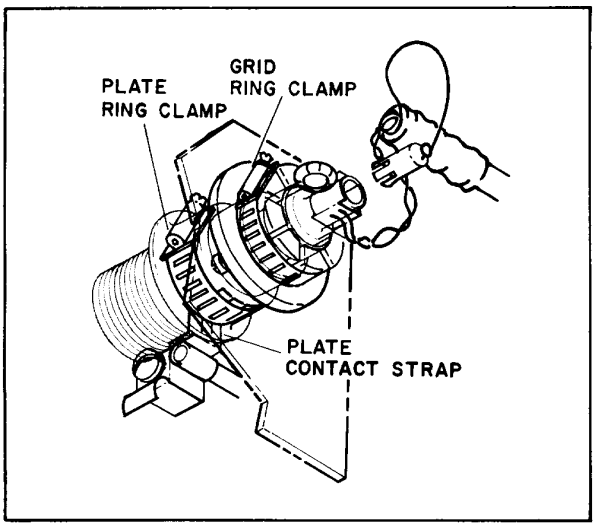


Figure 5-7. 2C39A Removal

5-47 DETECTOR DISASSEMBLY

5-48 Should it become necessary to replace the detector or part of the detector, the following steps should be used in sequence until desired part is removed. (Refer to Figure 5-8.)

a. Unsolder choke from diode lead.

b. Use solder sucker to remove all solder from the center of the feed-through capacitor.

c. Unscrew detector spacer (3).

d. Unsolder both diodes from the line connection (1) being careful not to let solder drip onto the line.

e. Unscrew front panel connector and remove line from detector body (2).

f. Unsolder line from TNC connector.

g. To replace the components, reverse the above procedure.

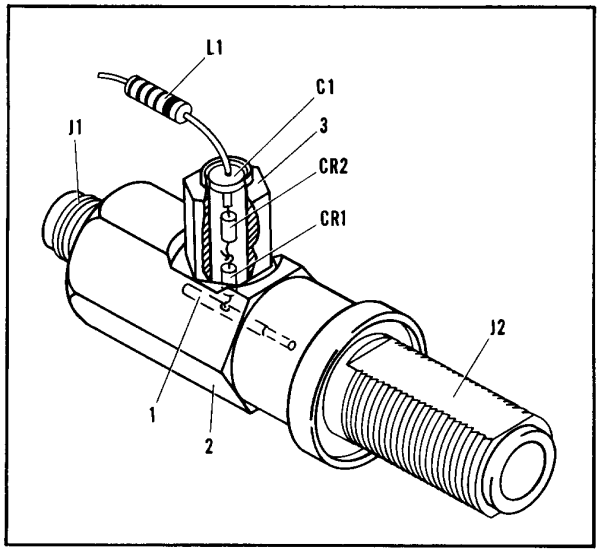


Figure 5-8. Detector Removal

5-49 CAPACITOR PISTON REPLACEMENT

5-50 The following procedure should be used when removing capacitor pistons. Pistons to be reused should be labeled and returned to their original positions. Proceed as follows:

a. Remove instrument cover, right side bracket, and amplifier box top and bottom covers.

b. Turn FREQUENCY MHz control to approximately mid-band.

c. Loosen setscrews on turret adjacent to piston to be removed.

d. Rotate turret on shaft to clear contacts while moving it toward rear of instrument.

e. Remove hex locknut and spacer from piston adjusting screw.

f. Turn adjusting screw clockwise, through hinge pin, until threads disengage.

g. Remove piston from inside amplifier box while exercising care not to damage the ground block spring fingers.

h. To replace piston, reverse the above procedure.

CAUTION

When replacing pistons, do not allow the lip on the piston to catch on the glass assembly, as damage may result.

5-51 PISTON MECHANICAL ALIGNMENT

5-52 After removal and replacement of any capacitor pistons, it is necessary to mechanically align them to make electrical adjustment easier. These are approximate settings only and will be readjusted during electrical adjustment.

a. Loosen setscrews adjacent to capacitor piston adjusting screws and set FREQUENCY MHz control to 13MHz.

b. Center hinge plate pins and tighten setscrews.

c. Set FREQUENCY MHz control near 250 MHz on range 5.

d. Align C4, C11, and C18 (long) piston ends with inner edge of silvering on the glass by adjusting piston screws.

e. Turn locknuts finger tight.

f. Set FREQUENCY MHz control near 13.5 MHz.

g. Align C5, C12, and C19 (short) piston ends with inner edge of silvering on the glass by adjusting piston screws.

h. Perform RF adjustments of Paragraphs

5-16 through 5-34.

5-53 CAPACITOR GLASS TUBE REPLACEMENT

5-54 The following is a step by step procedure for replacing capacitor glass tubes. Proceed as follows:

a. Remove instrument cover, right side bracket and amplifier box top and bottom covers.

b. Using procedure in Paragraph 5-26, remove 2C39A tubes.

c. Using the procedure in Paragraph 5-28, remove three pistons from hinge plate over glass tube to be replaced.

d. Remove tension from hinge plate springs with long nosed pliers by moving end of spring sideways until it releases from under lip of amplifier box.

e. Loosen setscrews retaining hinge plate shaft.

f. Move hinge plate shaft toward rear of instrument and remove both shaft and hinge plate.

g. Remove four ground block retaining screws and ground blocks.

h. Unsolder glass tube from terminal inside amplifier box and remove from outside unit.

CAUTION

Before reassembling, clean any excess solder from contact straps and any glass tubes to be reused.

i. Replace glass tube, ground block, four retaining screws and lockwashers.

CAUTION

Do not solder glass tube and contact strap until after ground block has been tightened or the glass tube may break.

j. Assemble hinge plate and pistons by reversing Steps c through f above.

k. Perform RF Adjustments of Paragraphs 5-16 through 5-34.

5-55 BLOWER MAINTENANCE

5-56 The 230B must always be used with the blower system in operation. For efficient cooling, the filter should be checked periodically and cleaned or replaced if necessary. To service:

a. Remove filter element retainer and filter element.

b. Wash filter element with water and mild detergent, or replace if necessary.

c. Reinstall filter assembly.

5-57 LUBRICATION

5-58 After performing repairs, it may be necessary to lubricate the ground block wiper springs and the cam and cam follower. The ground block wiper springs should be lubricated with Supermil ASU Grease M-100 only. The cam and cam follower should be lubricated with "Molykote G".

Supermil ASU Grease M-100 is available from:

American Oil Company
555 Fifth Avenue
New York, New York

Molykote G is available from:

Alpha Molykote Corp.
Stanford, Connecticut

5-59 SELECTED COMPONENTS

5-60 The following paragraphs explain the procedures used to determine values of selected components used in the 230B.

5-61 C5, C12, and C19 - selected to compensate for slight variations in capacitance between different instruments.

5-62 Each piston is color coded according to its end diameter (see Figure 5-9). When replacing any of the above pistons, they should be replaced with the same color coded part according to Table 5-2. If the color code cannot be determined, the piston diameter may be checked with a micrometer.

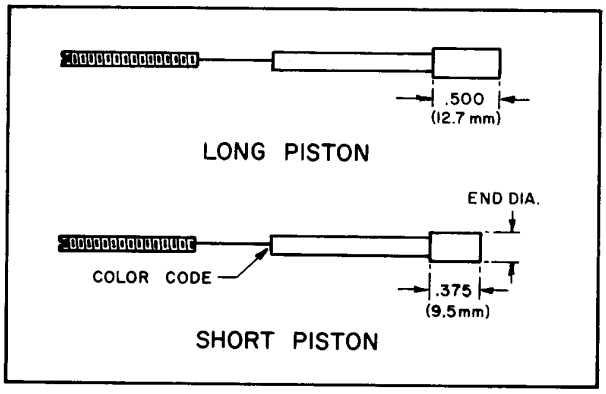


Figure 5-9. Piston Diameters

5-63 Should alignment difficulties be encountered after replacing any of the above pistons and/or

their glass assemblies, additional selection may be necessary. The most common indication is a serious drop in gain around 320MHz. This drop is caused by mis-tracking short pistons. To determine which piston is not tracking properly, proceed as follows:

a. Adjust 230B to frequency at which the gain drops.

b. Turn each piston slightly from its original position while noting if gain increases or decreases.

c. If a significant increase in gain occurs when a piston is turned clockwise, a piston one size larger should be used. If the gain increases when piston is turned counterclockwise, a piston one size larger should be used.

5-64 TROUBLESHOOTING

5-65 The voltages shown on the schematic diagram in Figure 7-1 are typical operating voltages and can be used to aid in locating failures. The conditions for measurement are given in Section VII.

5-66 The Performance Checks in Table 5-2 may be used to define problems such as low gain, frequency sensitive or intermittent failures. Causes of frequency sensitive and intermittent failures are too numerous to mention, but most problems in this area are caused by broken or worn contacts in the turret switching assembly. All contacts should be clean and free of grease or dirt. Turret contacts should make positive contact with their corresponding spring contact.

Table 5-2. Short Piston Color Codes

Part Number	Code/Color	End Diameter
00230-80041	1 Brown	0.1951 in.(4.956 mm)
00230-80042	2 Red	0.1952 in.(4.958 mm)
00230-80043	3 Orange	0.1953 in.(4.961 mm)
00230-80044	4 Yellow	0.1954 in.(4.963 mm)
00230-80045	5 Green	0.1955 in.(4.966 mm)

SECTION VI
REPLACEABLE PARTS

6-1 INTRODUCTION

6-2 This section contains information for ordering replacement parts.

6-3 Table 6-4 lists parts in alpha-numerical order of the reference designators and provides the following information:

a. Reference Designators. For abbreviations, refer to Table 6-1.

b. Description. Refer to Table 6-2 for abbreviations.

c. Total Quantity (TQ) used in the instrument; given only first time the part number is listed.

d. Manufacturer's part number.

e. Manufacturer's code number. Refer to Table 6-3 for manufacturer's name and address.

f. ℌ Part Number.

g. Recommended spare parts quantity (RS) for complete maintenance of one instrument during one year of isolated service.

h. Parts not identified by a reference designator are listed at the end of Table 6-4 under Miscellaneous.

6-4 ORDERING INFORMATION

6-5 To order a replacement part, address order or inquiry to your local Hewlett-Packard sales office (see lists at rear of this manual for addresses).

6-6 Specify the following information for each part:

a. Model and complete serial number of instrument.

b. Hewlett-Packard part number.

c. Circuit reference designator.

d. Description.

6-7 To order a part not listed in Table 6-4, give a complete description of the part and include its function and location.

Table 6-1. Reference Designators

A = assembly	CR = diode
B = motor	DS = device, signaling (lamp)
C = capacitor	E = misc. electronic part
F = fuse	J = jack
K = relay	L = inductor
M = meter	P = plug
Q = transistor	R = resistor
RT = thermistor	S = switch
T = transformer	V = vacuum tube, neon bulb, photocell, etc.
X = socket	XF = fuseholder
XDS = lampholder	Z = network

Table 6-2. Description Abbreviations

a = amperes	obd = order by description
c = carbon	p = peak
cer = ceramic	pc = printed circuit board
coef = coefficient	pf = picofarads = 10^{-12} farads
com = common	pp = peak-to-peak
comp = composition	ppm = parts per million
conn = connection	pos = position(s)
crt = cathode-ray tube	poly = polystyrene
dep = deposited	pot = potentiometer
elect = electrolytic	prv = peak reverse voltage
encap = encapsulated	rect = rectifier
f = farads	rot = rotary
fxd = fixed	rms = root-mean-square
GE = germanium	s-b = slow-blow
grd = ground(ed)	sect = section(s)
h = henries	Si = silicon
Hg = mercury	sil = silver
impg = impregnated	sl = slide
ins = insulation(ed)	td = time delay
K = kilo = 1000	TiO_2 = titanium dioxide
lin = linear taper	tog = toggle
log = logarithmic taper	tol = tolerance
mA = milli = 10^{-3}	trim = trimmer
M = megohms	twt = traveling wave tube
ma = milliamperes	var = variable
μ = micro = 10^{-6}	w/ = with
mfr = manufacturer	W = watts
mtg = mounting	w/o = without
my = mylar	cmo = cabinet mount only
NC = normally closed	
Ne = neon	
NO = normally open	

Table 6-3. Code List of Manufacturers

CODE NO.	MANUFACTURER	ADDRESS
00629	EBY Sales Co.	New York, N.Y.
00656	Aerovox Corp.	New Bedford, Mass.
00853	Sangamo Electric Company, Ordill Division (Capacitors)	Marion, Ill.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc. Semiconductor-Components Division	Dallas, Texas
01686	RCL Electronics, Inc.	Manchester, N.H.
01930	Amerock Corp.	Rockford, Ill.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02606	Fenwal Laboratories	Morton Grove, Ill.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Commercial Receiving Tube and Semiconductor Div.	Somerville, N.J.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.
03797	Eldema Corp.	Compton, Calif.
03877	Transitron Electronic Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co.	Cedar Knolls, N.J.
04009	Arrow, Hart and Hegeman Electric Co.	Hartford, Conn.
04072	ADC Electronics, Inc.	Harbor City, Calif.
04213	Caddell-Burns Mfg. Co. Inc.	Mineola, N.Y.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04713	Motorola, Inc., Semiconductor Products Division	Phoenix, Arizona
05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	Grand Junction, Colo.
05820	Wakefield Engr. Inc.	Wakefield, Mass.
06004	The Bassick Co.	Bridgeport, Conn.
06486	IRC, Inc. Semiconductor Div.	Lynn, Mass.
06540	Amathom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Nuclear Corp. of America, Inc. U.S. Semcor Div.	Phoenix, Arizona
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07263	Fairchild Semiconductor Div. of Fairchild Camera and Instrument Corp.	Mountain View, Calif.
07387	Birtcher Corp., The	Los Angeles, Calif.
07397	Sylvania Electric Products Inc. Mountain View Operations of Sylvania Electronic Systems	Mountain View, Calif.
07716	I. R. C. Inc.	Burlington, Iowa
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.
08484	Breeze Corporations, Inc.	Union, N.J.
08530	Reliance Mica Corp.	Brooklyn, N.Y.
08717	Sloan Company	Sun Valley, Calif.
08730	Vemaline Products Co.	Franklin Lakes, N.J.
08863	Nylomatic Corp.	Morrisville, Pa.
09021	Airco Speer Electronic Components	Bradford, Pa.
09182	Hewlett-Packard Co., New Jersey Div.	Berkeley Heights, N.J.
09353	C & K Components	Newton, Mass.
09922	Burndy Corp.	Norwalk, Conn.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11502	IRC Inc.	Boone, N.C.
11711	General Instrument Corp., Semiconductor Prod. Group, Rectifier Div.	Newark, N.J.
12136	Philadelphia Handle Co., Inc.	Camden, N.J.
12615	U.S. Terminals, Inc.	Cincinnati, Ohio
12617	Hamlin Inc.	Lake Mills, Wisconsin
12697	Clarostat Mfg. Co.	Dover, N.H.
14493	Hewlett-Packard Co., Loveland Division	Loveland, Colo.
14655	Cornell-Dubilier Elec. Corp.	Newark, N.J.
14936	General Instrument Corp., Semiconductor Prod. Group, Semiconductor Div.	Hicksville, N.Y.
15909	Daven Div. of Thos. Edison Industries, Mc Graw Edison Co.	Livingston, N.J.
16299	Corning Glass Works, Electronic Components Div.	Raleigh, N.C.
16758	Delco Radio Div. of General Motors Corp.	Kokomo, Ind.
17545	Atlantic Semiconductors, Inc.	Asbury Park, N.J.
17803	Fairchild	Mountainview, Calif.
19315	The Bendix Corp., Eclipse Pioneer Div.	Teterboro, N.J.
19701	Electra Mfg. Co.	Independence, Kan.

Table 6-3. Code List of Manufacturers (Continued)

CODE NO.	MANUFACTURER	ADDRESS
21520	Fansteel Metallurgical Corp.	No. Chicago, Ill.
22229	Union Carbide Corp., Linde Div., Kemet Dept.	Mountain View, Calif.
22767	ITT Semiconductors, A Division of International Telephone & Telegraph Corp.	Palo Alto, Calif.
24446	General Electric Co.	Schenectady, N.Y.
24455	General Electric Co., Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
26982	Dynacool Mfg. Co. Inc	Saugerties, N.Y.
27014	National Semiconductor Corp.	Santa Clara, Calif.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
33173	G.E., Tube Dept.	Owensboro, Ky.
35434	Lectrohm, Inc.	Chicago, Ill.
37942	P. R. Mallory & Co., Inc.	Indianapolis, Ind.
42190	Muter Co.	Chicago, Ill.
43334	New Departure-Hyatt Bearings Div., General Motors Corp.	Sandusky, Ohio
44655	Ohmite Manufacturing Co.	Skokie, Ill.
46384	Penn Engr.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
49956	Raytheon Mfg. Co., Microwave and Power Tube Div.	Waltham, Mass.
55026	Simpson Electric Co.	Chicago, Ill.
56289	Sprague Electric Co.	North Adams, Mass.
58474	Superior Electric Co.	Bristol, Conn.
61637	Union Carbide Corp.	New York, N.Y.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
70563	Amperite Co., Inc.	Union City, N.J.
70901	Beemer Engrg. Co.	Fort Washington, Pa.
70903	Belden Mfg. Co.	Chicago, Ill.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionic Corp.	Cambridge, Mass.
71400	Bussmann Mfg. Div. of Mc Graw-Edison Co.	St. Louis, Mo.
71450	CTS Corporation	Elkhart, Ind.
71468	I. T. T. Cannon Electric Inc.	Los Angeles, Calif.
71590	Centralab Div. of Globe Union, Inc.	Milwaukee, Wis.
71700	The Cornish Wire Co.	New York, N.Y.
71707	Coto-Coil	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro-Motive Mfg. Co. Inc., The	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72699	General Instrument Corp., Capacitor Div.	Newark, N.J.
72765	Drake Mfg. Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp. of America	Union, N.J.
72982	Erie Technological Products, Inc.	Erie, Pa.
73138	Helipot Div. of Beckman Instruments, Inc.	Fullerton, Calif.
73168	Fenwal, Inc.	Ashland, Mass.
73293	Hughes Components Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Electronic Co., Div. of North American Phillips Co., Inc.	Hicksville, N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73734	Federal Screw Porducts, Inc.	Chicago, Ill.
73978	Hardwick Hindle Co., Memcor Components Div.	Huntington, Ind.
74193	Heinemann Electric Co.	Trenton, N.J.
74545	Harvey Hubbel, Inc.	Bridgeport, Conn.
74868	FXR Div. of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E. F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75183	Howard B. Jones Div., of Cinch Mfg. Corp. (Use 71785)	New York, N.Y.
75382	Kulka Electric Corp.	Mt. Vernon, N.Y.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76381	Minnesota, Mining & Mfg. Co.	St. Paul, Minn.
76493	J. W. Miller Co.	Los Angeles, Calif.
76530	Cinch	City of Industry, Calif.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	Bendix Corp., Bendix-Pacific Div.	No. Hollywood, Calif.
77147	Patton Mac Guyer Co.	Providence, R.I.
77221	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine and Foundry, Potter and Brumfield Div.	Princeton, Ind.
77630	TRW Electronics, Components Div.	Camden, N.J.
77764	Resistance Products Co.	Harrisburg, Pa.
78189	Shakeproof Div. of Illinois Tool Works	Elgin, Ill.
78452	Everlock Chicago, Inc.	Chicago, Ill.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78526	Stanwyck Winding Co., Inc.	Newburgh, N.Y.
78553	Tinnerman Products, Inc.	Cleveland, Ohio

Table 6-3. Code List of Manufacturers (Continued)

CODE NO.	MANUFACTURER	ADDRESS
78584	Stewart Stamping Corp.	Yonkers, N.Y.
79136	Waldes Kohinoor, Inc.	L.I.C., N.Y.
79307	Whitehead Metal Products Co., Inc.	New York, N.Y.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
80031	Mepco Div. of Sessions Clock Co.	Morristown, N.J.
80294	Bourns, Inc.	Riverside, Calif.
81042	Howard Industries, Inc.	Racine, Wis.
81483	International Rectifier Corp.	El Segundo, Calif.
81751	Columbus Electronics Corp.	Yonkers, N.Y.
82099	Goodyear Sundries & Mechanical Co., Inc.	New York, N.Y.
82142	Airco Speer Electronic Components	Du Bois, Pa.
82219	Sylvania Electric Products, Inc., Electronic Tube Division	Emporium, Pa.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals and Controls, Inc., Spencer Products	Attleboro, Mass.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83186	Victory Engineering Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Eatontown, N.J.
83330	Herman H. Smith, Inc.	Brooklyn, N.Y.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co., Div. of Amerace Corp.	Brookfield, Mass.
83508	Grant Pulley and Hardware Co.	West Nyack, N.Y.
83594	Burroughs Corp., Electronic Components Div.	Plainfield, N.J.
83835	U.S. Radium Corp.	Morristown, N.J.
83877	Yardeny Laboratories, Inc.	New York, N.Y.
84171	Arco Electronics, Inc.	Great Neck, N.Y.
84411	TRW Capacitor Div.	Ogallala, Neb.
86684	Radio Corp. of America, Electronic Components & Devices Div.	Harrison, N.J.
86838	Rummel Fibre Co.	Newark, N.J.
87034	Marco Industries Co.	Anaheim, Calif.
87216	Philco Corp. (Lansdale Div.)	Lansdale, Pa.
87585	Stockwell Rubber Co., Inc.	Philadelphia, Pa.
87929	B.M. Tower Co., Inc.	Bridgeport, Conn.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
89473	General Electric Distributing Corp.	Schenectady, N.Y.
91345	Miller Dial and Nameplate Co.	El Monte, Calif.
91637	Dale Electronics, Inc.	Columbus, Neb.
91662	Elco Corp.	Willow Grove, Pa.
91929	Honeywell, Inc., Micro Switch Div.	Freeport, Ill.
93332	Sylvania Electric Prod., Inc., Semiconductor Prod. Div.	Woburn, Mass.
93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio
94144	Raytheon Co., Components Div., Industrial Components Operation	Quincy, Mass.
94154	Tung-Sol Electric, Inc.	Newark, N.J.
94222	South Chester Corp.	Chester, Pa.
94310	Tru-Ohm Products, Memcor Components Div.	Huntington, Ind.
95263	Leecraft Mfg. Co., Inc.	Long Island City, N.Y.
95354	Methode Mfg. Co.	Chicago, Ill.
95712	Bendix Corp, Microwave Div.	Franklin, Ind.
96791	Amphenol Controls Div. of Amphenol-Borg Electronics Corp.	Janesville, Wis.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99934	Renbrandt, Inc.	Boston, Mass.

THE FOLLOWING H-P VENDORS HAVE NO NUMBERS ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

0000	Cooltron	Oakland, Calif.
00000	Plastic Ware Co.	Brooklyn, N.Y.

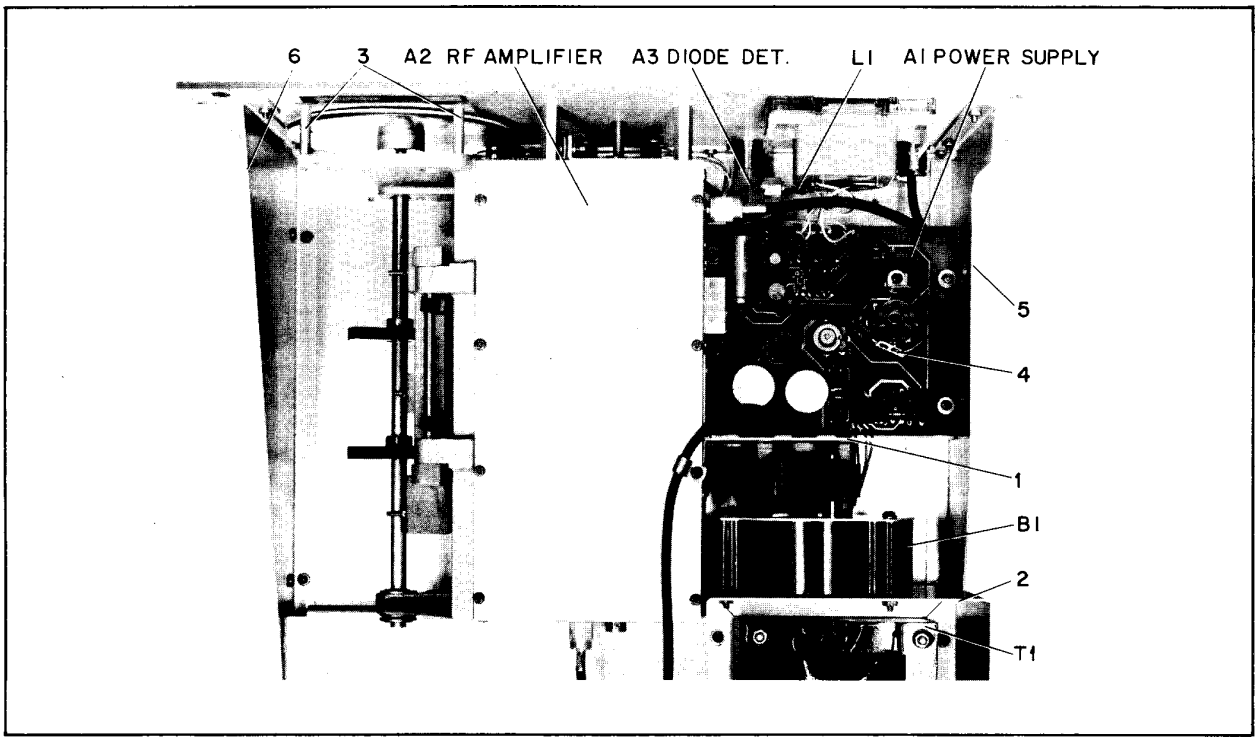


Figure 6-1. Overall Component Location

ITEM NO.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	℗ PART NO.	RS
1-1	Mounting Bracket, Fan Motor	1		09182	00230-01016	-
1-2	Bracket, Fan Mounting	1		09182	00230-01006	-
-	Spacer, P.C. Board	1	2112	83330	0380-0786	1
-	Panel, Front	1		09182	00230-01004	-
-	Knob, Frequency (Black)	1		09182	0370-0028	1
-	Knob, Meter Range	1		09182	0370-0112	1
-	Knob, Frequency, Range	1		09182	0370-0035	1
-	Knob, Vernier	1		09182	0370-0025	1
-	Handle, 7"	2		09182	5020-5584	1
-	Meter, Bezel	1		09182	4040-0296	1
-	Spring, Meter	4		09182	1460-0256	1
1-3	Spacer, Fiducial (spacer holding fiducial to casting)	1		09182	00250-20115	
1-4	Clamp, Tube	1	926C	07387	1400-0196	1
-	Cabinet Assembly	1		09182	00230-61001	-
1-5	Bracket, Left Side	1		09182	00230-01001	-
1-6	Bracket, Right Side	1		09182	00230-01002	-
-	Filter Assembly, Air	1		09182	5060-0878	-
-	Chassis	1		09182	00230-01005	-
-	Cover, Bottom	1		09182	00230-01003	-
-	Foot, Rubber	4	4-1/2 CB	76385	0403-0045	1
-	Holder, Fuse	1	342014	75915	1400-0084	1
-	Lock Washer Helical Spring Type	-		09182	2190-0086	-
-	Nut, Knurled 5/8 x 24 thread 3/4 in. O.D.	-		09182	0590-0011	-

Table 6-4. Replaceable Parts

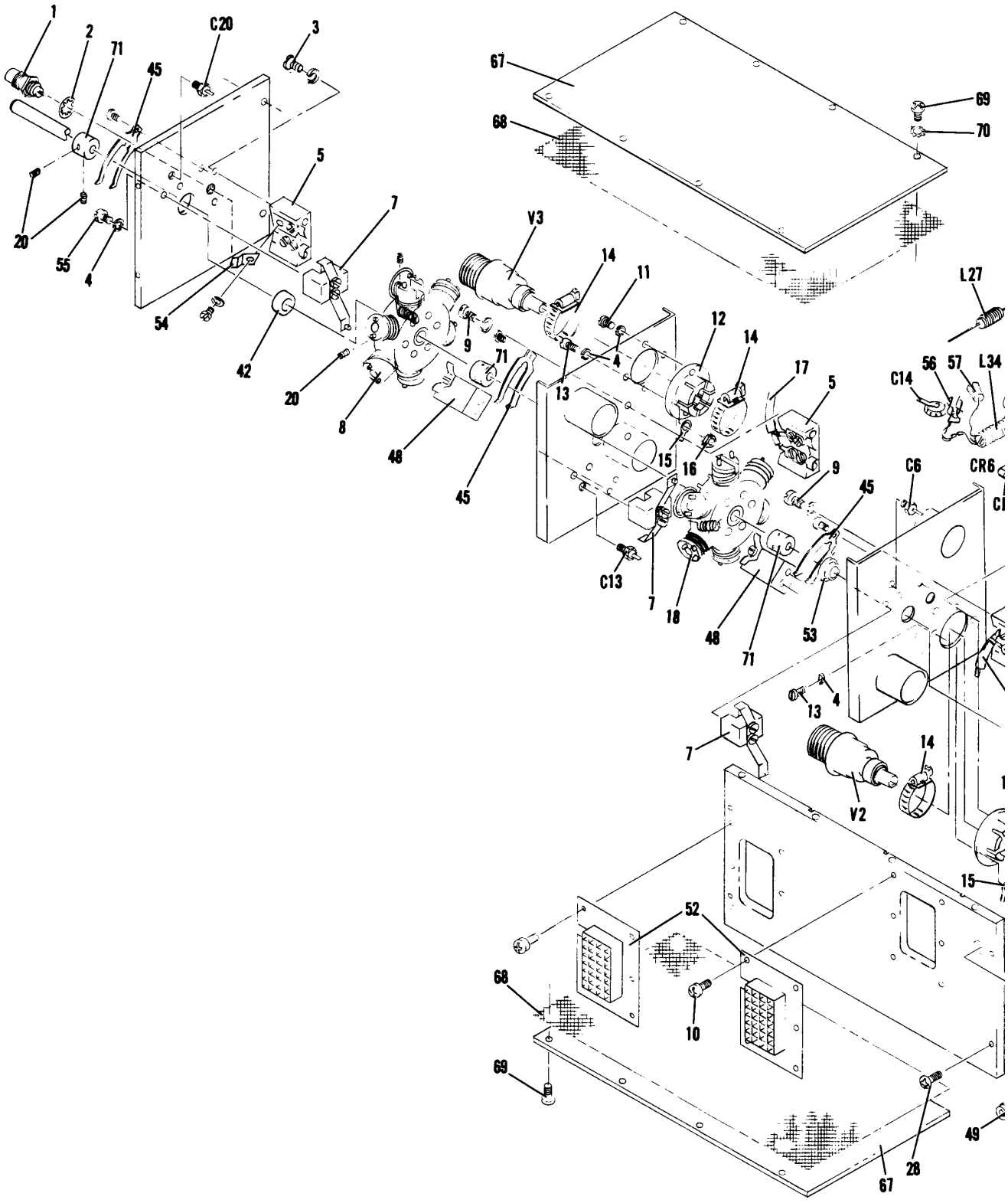
REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	hp PART NO.	RS
	CHASSIS ELECTRICAL PARTS					
B1	Motor, Fan			09182	3160-0215	
C1	fxd, ceramic 10,000pF ±20% 250Vac	1	41C157-CDH	56289	0150-0123	1
C2, C3	fxd, ceramic 0.002μf ±20% 250Vac	2	19C253	56289	0160-2108	1
DS1	Light, Indicator (Red)	1	599-124	72765	1450-0048	1
F1 (115Vac)	Fuse, 2A 125V S.B.	1	313.002	75915	2110-0006	5
F1 (230Vac)	Fuse, 1A 125V S.B.	1	313.001	75915	2110-0007	5
M1	Meter, 0-3, 0-10, 0-30 RF Volts	1		09182	1120-0413	1
P6	AC Power Connector	1		09182	1251-2357	1
R1	fxd, comp 43KΩ ±5% ½W	1	EB-4335	01121	0686-4335	1
S1	Toggle Switch, SPST	1	80994-HB	04009	3101-0001	1
S2	Slide Switch, DPDT	1	G326-0001	79727	3101-0033	1
S3	Meter Switch	1		09182	3100-1612	1
T1	Transformer, Power	1		09182	00230-80501	1
W1	Input Cable Assembly	1		09182	00230-61004	1
W7	AC Power Cord	1		09182	8120-1348	1
A1	Main P. C. Board (Loaded)	1		09182	00230-61020	1
A1C1	fxd, ceramic 0.02μf ±20% 2000WVdc	1	41C321-CDH	56289	0160-2569	1
A1C2	fxd, elect. 40μf 500WVdc +50 -10%	2	68D10031-DFP	56289	0180-2226	1
A1C3	fxd, mylar 0.1μf ±10% 200WVdc	1	192P10492-PTS	56289	0160-0168	1
A1C4	fxd, elect. 10μf 450WVdc +50 -10%	1		09182	0180-1944	1
A1C6	fxd, ceramic 0.02μf 25WVdc	1	5835Y5U203Z	72982	0160-2605	1
A1C7	fxd, elect. 40μf 500WVdc +50 -10%		68D10031-DFP	56289	0180-2226	
A1CR1-CR4	Diode, Si. 800PIV	4	34534	02735	1901-0388	4
A1CR5	Diode, Si.	1		09182	1901-0040	1
A1CR7	Diode, Si. 50PIV	1		09182	1901-0049	1
A1Q1	SS NPN Si.	1		09182	1854-0087	1
A1Q2	SS NPN Si.	1		09182	1854-0244	1
A1R1	fxd, comp 180KΩ ±5% ½W	1	EB-1845	01121	0686-1845	1
A1R2	fxd, comp 56KΩ ±5% ½W	1	EB-5635	01121	0686-5635	1
A1R3	fxd, met. ox. 15KΩ ±5% 4W ±250ppm	1	Type PMF-4	07716	0770-0006	1
A1R4	fxd, film 261KΩ ±1% 1/8W ±100ppm	1	Type CEA	07716	0698-3455	1
A1R5	fxd, film 200KΩ ±1% 1/8W ±100ppm	1	Type CEA	07716	0757-0472	1
A1R6	fxd, comp 27KΩ ±5% ½W	1	EB-2735	01121	0686-2735	1
A1R7	fxd, met. ox. 68KΩ ±5% 1W ±200ppm	1	L32	07716	0761-0083	1
A1R8	fxd, met. ox. 5.60KΩ ±5%4W ±250ppm	1	Type PMF-4	07716	0770-0011	1
A1R9	fxd, comp 300KΩ ± % ½W	1	EB-3045	01121	0686-3045	1
A1R10	fxd, comp 2MΩ ±5% ½W	1	EB-2055	01121	0686-2055	1
A1R11	fxd, comp 1.5MΩ ±5% ½W	1	EB-1555	01121	0686-1555	1
A1R12	fxd, comp 4.7KΩ ±5% ½W	2	EB-4725	01121	0686-4725	1
A1R13	var. ww 10KΩ ±10%	1	Type 500	75042	2100-1776	1
A1R14	fxd, comp 4.7KΩ ±5% ½W		EB-4725	01121	0686-4725	
A1R15	fxd, film 33.2KΩ ±1% 1/8W ±100ppm	1	Type CEA	07716	0757-0454	1
A1R16	fxd, film 107KΩ ±1% 1/8W ±100ppm	1	Type CEA	07716	0698-4515	1
A1R17	fxd, film 340KΩ ±1% 1/8W ±100ppm	1	Type CEA	07716	0698-4536	1
A1R18	var. ww 100KΩ ±30%	1		09182	2100-0095	1
A1R19	fxd, comp 10KΩ ±5% ½W	1	EB-1035	01121	0686-1035	1
A1R21	fxd, comp 100Ω ±5% ¼W	1	CB-1015	01121	0683-1015	1
A1V1	Electron Tube, Dual Triode	1	6AS7G	02735	1932-0018	1
A1V2	Electron Tube, Pentode	1	6AU6	02735	1923-0021	1
A1V3	Electron Tube	1	OA2	02735	1940-0004	1
A1VR6	Diode, Zener 43.2V ±2%	1		09182	1902-3327	1

ITEM NO.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	℔ PART NO.	RS
	PC BOARD 00230-61020 MECHANICAL PARTS					
-	Bracket, P.C. Board	2		09182	00230-01015	1
-	Heat Dissipator, Semiconductor	1	NF-207	05820	1205-0033	1
-	Socket, Tube (V1)	1	101-04-11-100	71785	1200-0084	1
-	Socket, Tube (V2, V3)	2	111-51-11-069	71785	1200-0053	2
-	Tube Clamp (V1)	1		09182	1400-0196	1
-	Spacer, Tube Clamp	1		09182	0380-0786	1

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	hp PART NO.	RS
A2	Amplifier Box Assembly (Loaded)	1		09182	00230-61002	1
A2C1	fxd, mica 1000pf ±10%	3		09182	0160-0428	1
A2C2, C3	fxd, ceramic feed-thru, 1000pf +100 -0%, 500WVdc	10	FB2B-102W	01121	0160-0345	2
A2C4, 5, 11, 12, 18, 19	See Paragraph 5-59	-	-	-	-	-
A2C6	fxd, ceramic 1000pf -20, +80%, 500WVdc	3	SB4A	01121	0160-0420	1
A2C7	fxd, mica 1000pf ±10%			09182	0160-0428	
A2C8-C10	fxd, ceramic feed-thru, 1000pf +100 -0%, 500WVdc		FB2B-102W	01121	0160-0345	
A2C13	fxd, ceramic 1000pf -20, +80%, 500WVdc		SB4A	01121	0160-0420	
A2C14	fxd, mica 1000pf ±10%			09182	0160-0428	
A2C15-C17	fxd, ceramic feed-thru, 1000pf, +100 -0%, 500WVdc		FB2B-102W	01121	0160-0345	
A2C20	fxd, ceramic 1000pf -20, +80%, 500WVdc		SB4A	01121	0160-0420	
A2C21	fxd, ceramic feed-thru, 1000pf, +100 -0%, 500WVdc		FB2B-102W	01121	0160-0345	
A2C22-28	NOT ASSIGNED	-	-	-	-	-
A2C29, 35, 36-38	fxd, ceramic 4700pf ±20%	5	DD472	71590	0160-0472	1
A2C39	fxd, ceramic feed-thru, 1000pf, +100 -0%, 500WVdc		FB2B-102W	01121	0160-0345	
A2CR1, 5, 6	Diode, Si. 50PIV	3		09182	1901-0049	3
A2J1	NOT ASSIGNED	-	-	-	-	-
A2J2, 3	RF Connector, TNC	2		09182	1250-0794	1
A2L9, 18, 27, 30, 31	Choke Assembly	5		09182	00230-80006	1
A2L34	Choke	1		09182	00230-60052	1
A2L35	Choke	1		09182	00230-60051	1
A2L36	Choke	1		09182	00230-60050	1
A2V1-V3	Electron Tube, 2 C39A, Triode	3		09182	1921-0046	3
A2W2	Output Cable	1		09182	00230-61005	1
A2Z1	Turret Assembly	2		09182	00230-60021	2
A2Z2	Turret Assembly	1		09182	00230-60026	1
A2Z3	Turret Assembly			09182	00230-60021	
A3	RF Detector (Loaded)	1		09182	00230-61003	1
A3C1	fxd, cer. feed-thru 220pf ±20% 300Vdc	1	FW5N-2212	01121	0160-2603	1
A3CR1, CR2	Diode	2		09182	1901-0518	2
A3J1	RF Connector (with cable)	1	2684-3	95712	1250-2041	1
A3J2	RF Connector, TNC	1	8306-1	95712	1250-0794	1
A3L1	Inductor, shielded 100μh ±10%	1	15S-101K	82142	9100-2562	1
	RF DETECTOR MECHANICAL PARTS (Refer to Figure 5-8)					
	Detector line	1		09182	00230-21007	1
	Detector body	2		09182	00230-21006	1
	Detector spacer	3		09182	00230-21008	1

ITEM NO.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	ℎ PART NO.	RS
	RF BOX MECHANICAL PARTS					
2-1	RF Connector	1	8306-1	95712	1250-0794	1
2-2	Lock Washer	-	1920-02	78189	2190-0016	-
2-3	Machine Screw	-		09182	2200-0145	-
2-4	Lock Washer	-		09182	2190-0086	-
2-5	Block & Contact Ass'y (see Fig. 6-7)	3		09182	-	1
2-6	NOT ASSIGNED	-	-	-	-	-
2-7	Block & Contact Ass'y (see Fig. 6-5)	3		09182	-	1
2-8	Turret Assembly (Z1,Z3)	2		09182	00230-60021	1
2-9	Machine Screw	-		09182	2200-0141	-
2-10	Screw, Tapping	-		09182	0624-0077	-
2-11	Machine Screw	-		09182	2200-0139	-
2-12	Tube Clamp	3		09182	00230-20009	1
2-13	Machine Screw	-		09182	2200-0145	-
2-14	Clamp, Hose	6	QS700-M10H	08484	1400-0720	2
2-15	Terminal, Solder Lug	-	2522-04-00	78189	0360-0374	-
2-16	Hex Nut	-		09182	2260-0009	-
2-17	Line Coupling	3		09182	00230-80001	1
2-18	Turret Assembly (Z2)	1		09182	00230-60026	1
2-19	NOT ASSIGNED	-	-	-	-	-
2-20	Set Screw	-		09182	3030-0033	-
2-21 through 2-25	NOT ASSIGNED	-	-	-	-	-
2-26	Machine Screw	-		09182	2510-0107	-
2-27	Lock Washer	-	2-618-BC	78452	2190-0008	-
2-28	Screw, Tapping	-		09182	0624-0208	-
2-29	NOT ASSIGNED	-	-	-	-	-
2-30	Lock Washer	-	2-820-BC	78452	2190-0010	-
2-31	Detent Bracket	1		09182	00230-01010	1
2-32	Machine Screw	-		09182	2510-0103	-
2-33	Detent, Spring	2		09182	5000-3001	1
2-34	Leaf, Spring	1		09182	1460-0209	1
2-35	Machine Screw	-		09182	2360-0197	-
2-36	Spacer, Internally Threaded Hex	2	8583-A-0832	06540	00230-20038	1
2-37	Set Screw	-		09182	3030-0001	-
2-38	Roller Detent	1		09182	00230-20065	1
2-39	Wheel Detent	1		09182	00230-20058	1
2-40	Shaft, Amplifier Box	1		09182	00230-20016	1
2-41	Retaining Ring	1	5133-25-S-MD	79136	0510-0083	1
2-42	Bearing, Ball	2	77R4LR3FY	43334	1410-0231	1
2-43	Washer, Flat	-		09182	3050-0273	-
2-44	Bracket, Amplifier Box	1		09182	00230-01009	1
2-45	Wiper, Rotor	5		09182	5000-4912	
2-46	Line, Matching	1		09182	00230-00014	1
2-47	Glass cloth insulation lgth as req'd	1	27	76381	0460-0283	1
2-48	Block & Contact Ass'y (see Fig. 6-8)	3		09182	-	1
2-49	RF Connector	1	8306-1	95712	1250-0794	1
2-50	Machine Screw	-		09182	0520-0131	-
2-51	NOT ASSIGNED	-	-	-	-	-
2-52	Waveguide Assembly	2		09182	00230-60016	1
2-53	Bushing, Insulating	1	N5330-1	08863	1410-0232	1
2-54	Grounding Strip	3		09182	00230-00053	1
2-55	Machine Screw	-		09182	2200-0147	-
2-56	Clip, Earless	3	123.002	75915	1400-0175	1
2-57	Plug, Terminal	3		09182	00230-20013	1
2-58	Block & Contact Ass'y (see Fig. 6-6)	3		09182	-	1
2-59	Terminal, Standoff	2	G-4777-10	12615	0340-0098	1

ITEM NO.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	℗ PART NO.	RS
2-60	Terminal, Solder Lug	-	4029	77147	0360-0002	-
2-61	Machine Screw	-		09182	2200-0147	-
2-62	Lock Washer	-		09182	2190-0086	-
2-63	NOT ASSIGNED	-	-	-	-	-
2-64	Lock Washer	-		09182	2190-0086	-
2-65	Machine Screw 4-40 x 1/2 ph posi.	-		09182	0624-0026	-
2-66	NOT ASSIGNED	-	-	-	-	-
2-67	Cover, RF Amplifier	2		09182	00230-20004	-
2-68	Shield, Screen	2		09182	00230-00007	1
2-69	Screw, Tapping	-		09182	0624-0208	-
2-70	Machine Screw 8-32 x 3/8" ph posi.	-		09182	2510-0103	-
2-71	Spacer, Shaft	5		09182	5020-2210	1
2-72	Terminal, Standoff	1	X1581	71279	0340-0097	1
2-73	Washer, Lock	-	1902-00	78189	2190-0014	-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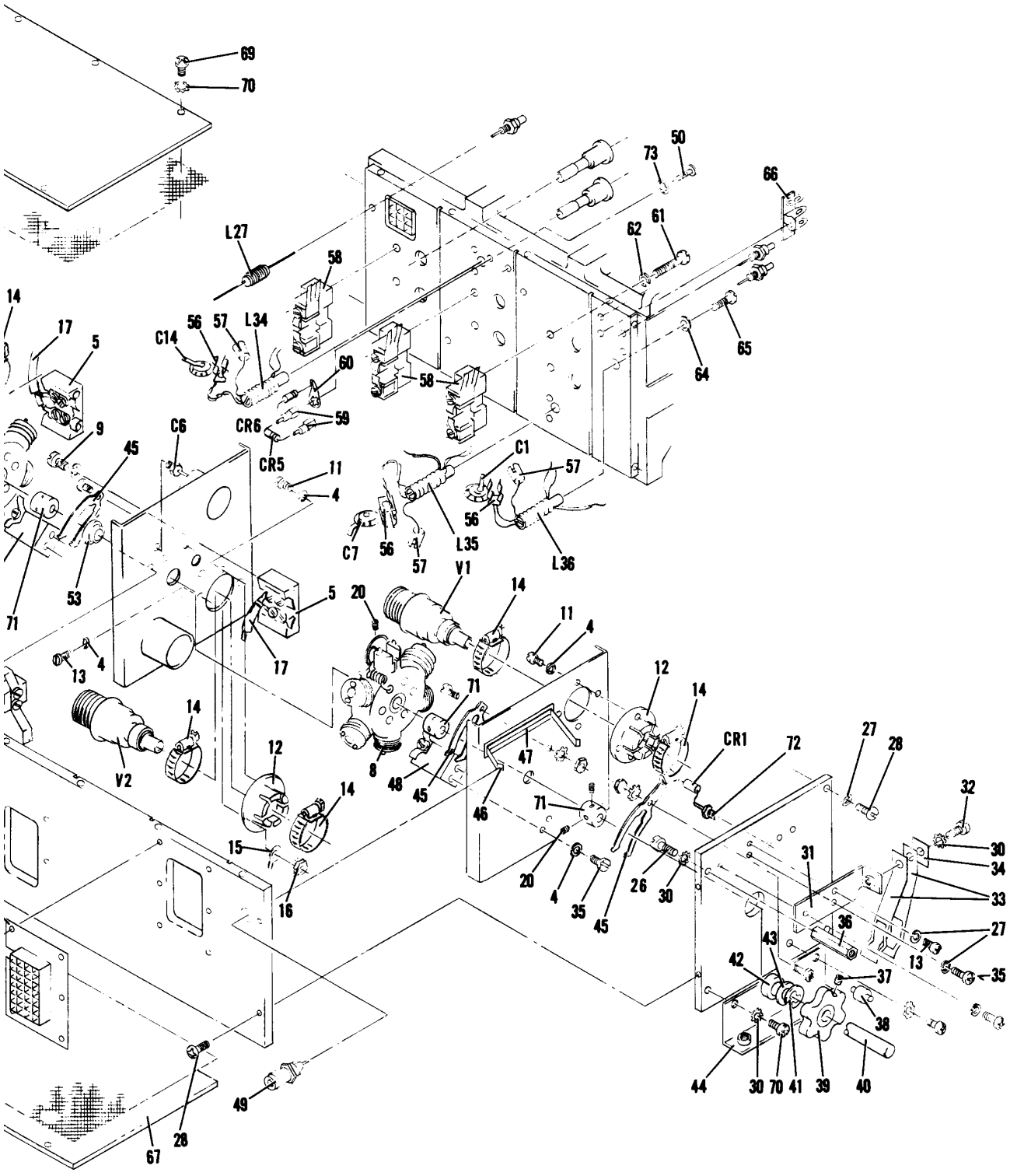
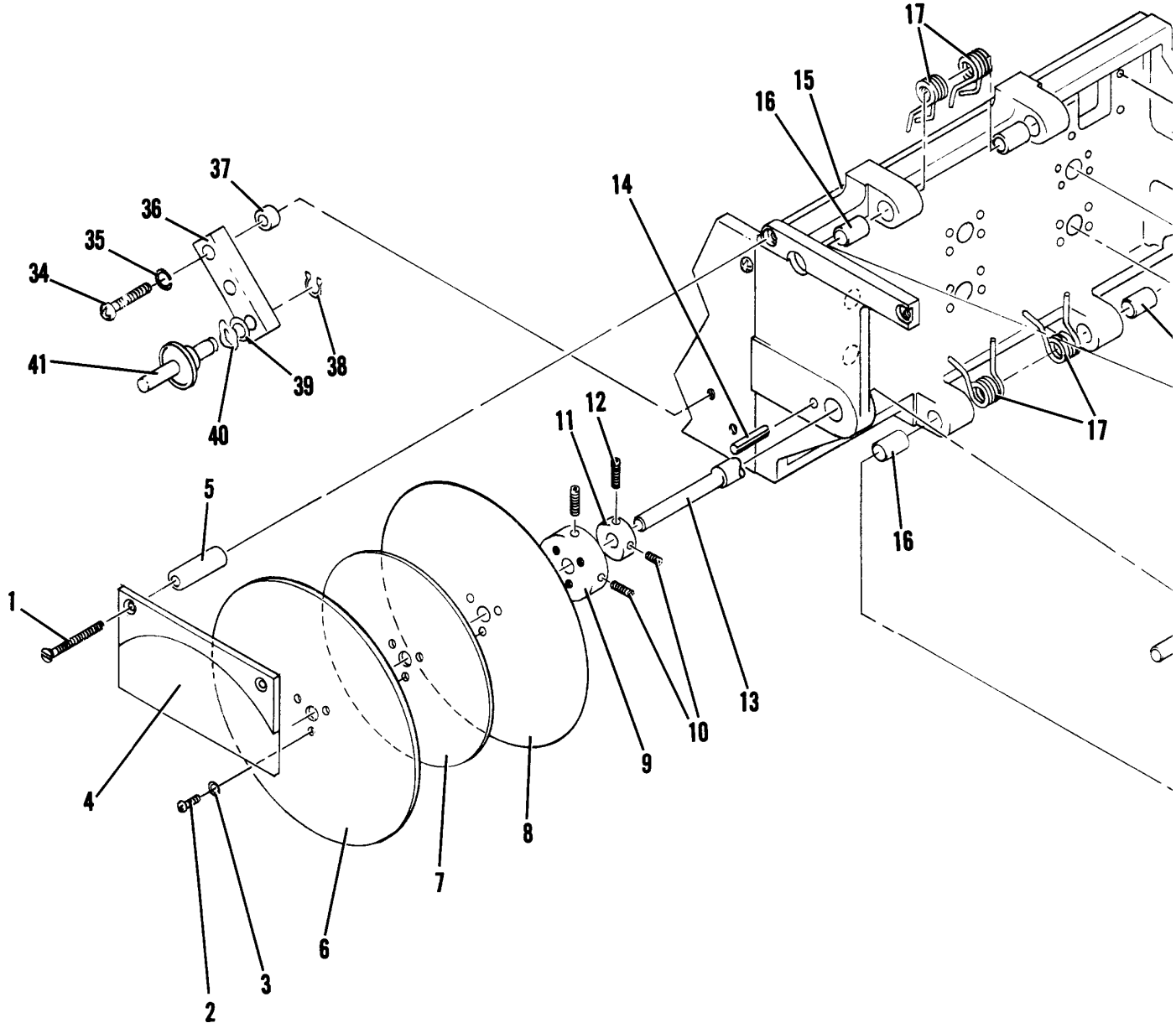


Figure 6-2. RF Amplifier Box Assembly

ITEM NO.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	HP PART NO.	RS
	RF BOX MECHANICAL PARTS					
3-1	Machine Screw 1.5 in. lg. #4-40 thd	-		09182	2200-0176	-
3-2	Machine Screw 0.5 in. lg. #4-40 thd	-		09182	2200-0147	-
3-3	Lock Washer Helical Spring Type	-		09182	2190-0086	-
3-4	Fiducial	1		09182	00230-20039	1
3-5	Spacer	2		09182	00250-20115	1
3-6	Dial	1	1868-30-0010	83835	0350-0029	1
3-7 to 3-9	Disc Drive Assembly	1		09182	00230-60012	1
3-7	Spacer	1		09182	00230-00042	1
3-8	Disc Drive	1		09182	00230-00041	1
3-9	Hub	1		09182	00230-20018	1
3-10	Set Screw .188 in. lg. #6-32 thd.	-		09182	3030-0033	-
3-11	Collar	1		09182	00230-20050	1
3-12	Set Screw .5 in. lg. #6-32 thd.	-		09182	3030-0143	-
3-13	Cam Shaft	1		09182	00230-20082	1
3-14	Rollpin .187 dia. 7/8 in. lg.	1	79-040-187-0875	72962	1480-0149	1
3-15	Pl. Side R. H.	1		09182	00230-21002	1
3-16	Bearing, Sleeve	4	AA-307-3	70901	1410-0156	1
3-17	Torsion Spring	4		09182	00230-80023	1
3-18	Waveguide Assembly	1		09182	00230-60014	1
3-19	Machine Screw .25 in. lg. #4-40 thd	-		09182	2200-0139	-
3-20	Washer, Flat 7/8 OD .391 ID	-		09182	3050-0297	-
3-21	Washer, Spring	-		09182	3050-0316	-
3-22	Ring, Retaining	1	5133-37-S-MD	79136	0510-0235	1
3-23	Bushing & Glass Assembly	6		09182	00230-60023	2
3-24	Piston Ass'y. (see Paragraph 5-35)	6		09182	-	2
3-25	Grounding Wiper Pl.	6		09182	00230-20068	2
3-26	Plate Hinge	1		09182	00230-20043	1
3-27	Shaft, Hinge Plate Pivot	1		09182	00230-20005	1
3-28	Pin Hinge Plate Mounting	3		09182	00230-20069	1
3-29	Spacer	3		09182	00230-20001	1
3-30	Hex Nut 6-32 x $\frac{1}{4}$ x 3/32 in.	-		09182	2420-0007	-
3-31	Bearing, Sleeve	2	AA-507-4	70901	1410-0157	1
3-32	Cam RF Translator	2		09182	00230-40001	1
3-33	Set Screw #6-32 thd. .188 in. lg.	-		09182	3030-0033	-
3-34	Machine Screw #8-32 thd. .875 lg.	-		09182	2510-0015	-
3-35	Lock Washer Helical Spring Type	-		09182	2190-0087	-
3-36	Plate Support	1		09182	00230-00006	1
3-37	Spacer, Sleeve	1		09182	00230-20003	1
3-38	Retaining Ring	1	5100-25-S-MD	79136	0510-0005	1
3-39	Flat Washer	-		09182	3050-0017	-
3-40	Washer, Spring	-		09182	3050-0272	-
3-41	Vernier Drive Assembly	1		09182	00230-60013	1
3-42	Terminal, Solder Lug	-	2102-04-00	78189	0360-0371	-
3-43	Terminal Board	1	1520-A	71785	0360-0364	1
3-44	Clamp, Plastic	3	HP-4N	09922	1400-0126	1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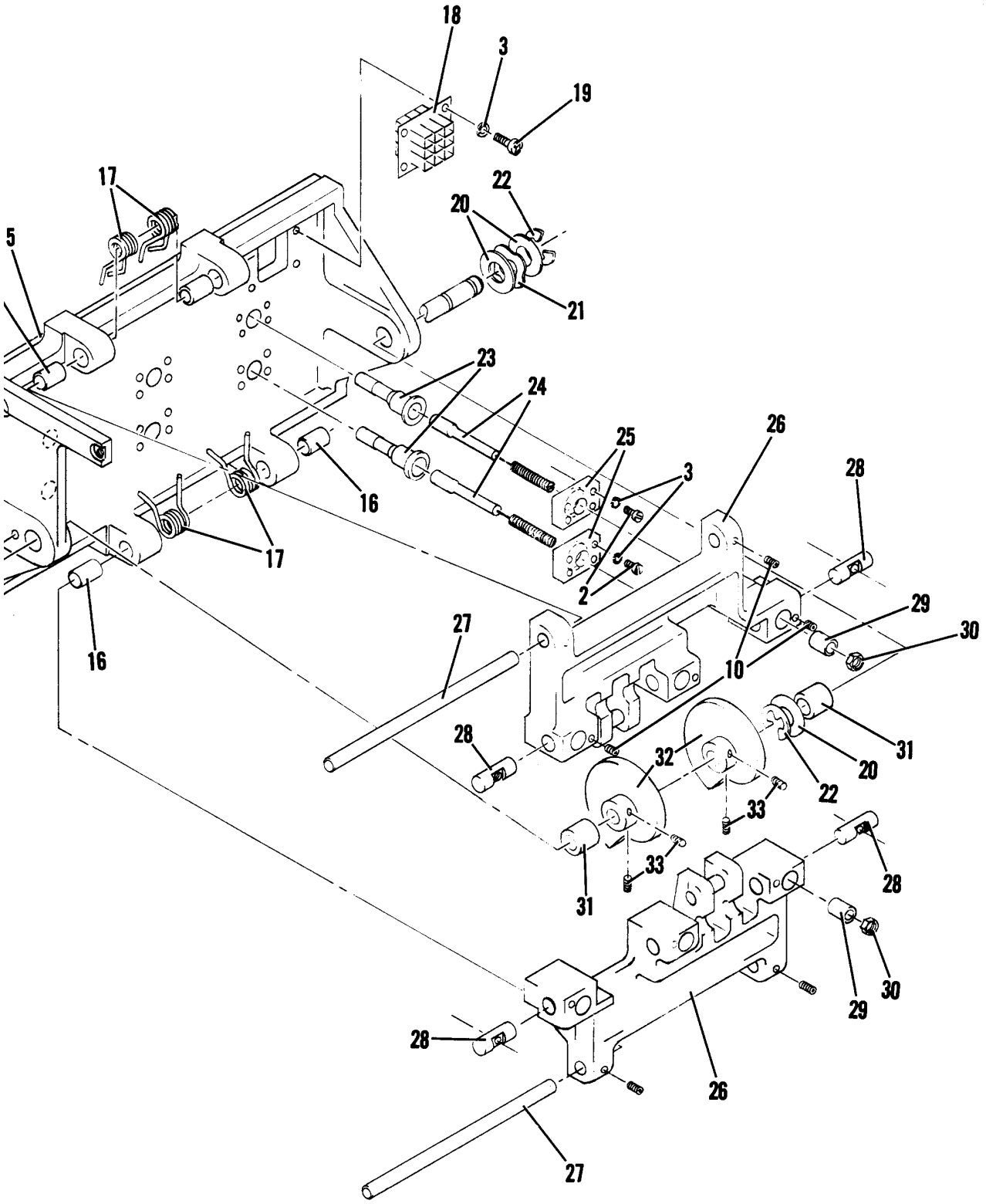


Figure 6-3. Hinge Plate Assembly

ITEM NO.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	℗ PART NO.	RS
	CONTACT BLOCK PARTS					
4-1	NOT ASSIGNED	-	-	-	-	-
4-2	Lock Washer	-		09182	2190-0086	-
4-3	Block, Contact	3		09182	00230-20010	1
4-4	Contact, Turret	3		09182	00230-60043	1
4-5	Machine Screw	-		09182	2200-0137	-
5-1	Block, Contact	3		09182	00230-20011	1
5-2	Plug, Terminal	3		09182	00230-20013	1
5-3	Contact Spring	3		09182	00230-00035	1
5-4	Machine Screw 4-40 x $\frac{1}{4}$ Binder Hd.	-		09182	-	-
5-5	Contact, Spring	3		09182	00230-00036	1
6-1	Grounding Strip	3		09182	00230-00053	1
6-2	Block, Contact	3		09182	00230-20012	1
6-3	Contact, Spring	3		09182	00230-00037	1
6-4	Terminal, Solder Lug	-	902-016-C	78584	0360-0037	-
6-5	Washer, Lock	-		09182	2190-0086	-
6-6	Machine Screw 4-40 x $\frac{1}{4}$ Pan head	-		09182	2200-0139	-
7-1	Block, Shorting Contact	3		09182	00230-20014	1
7-2	NOT ASSIGNED	-	-	-	-	-
7-3	Washer, Lock	-		09182	2190-0086	-
7-4	Contact, Shorting	3		09182	00230-00038	1
7-5	Screw, Machine 4-40 x $\frac{1}{4}$ Binder hd.	-		09182	-	-

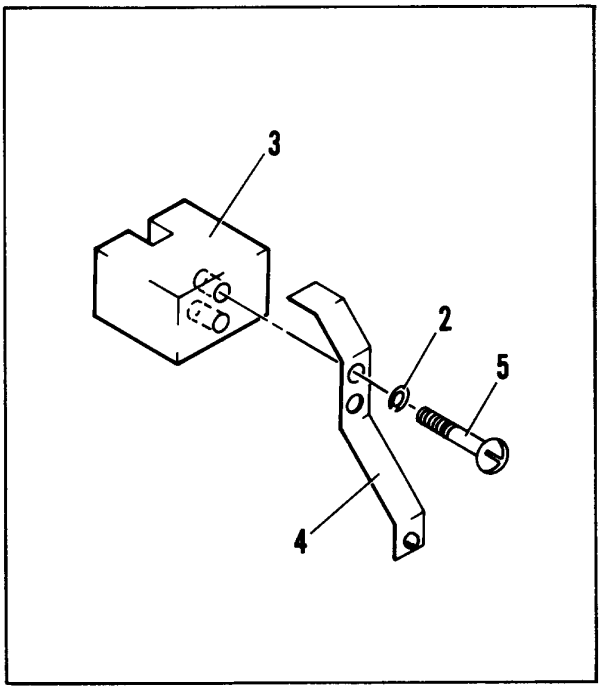


Figure 6-4. Refer to Figure 6-2, #7

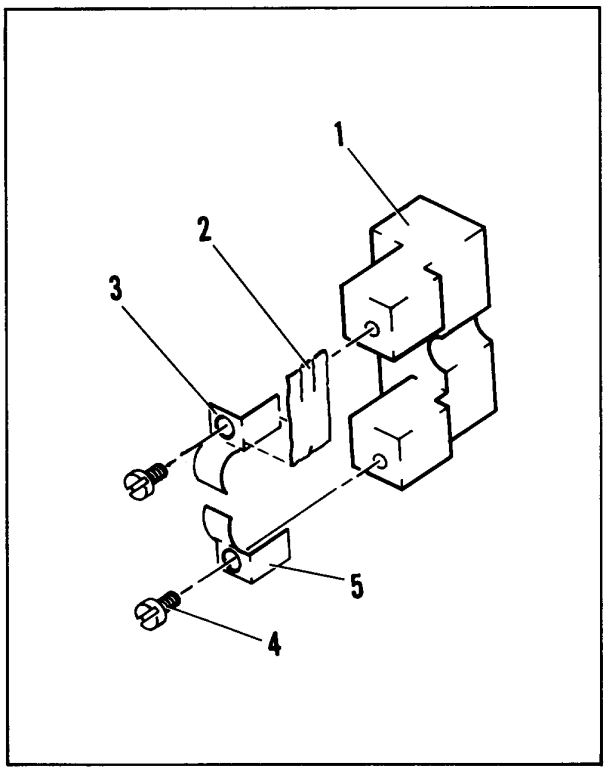


Figure 6-5. Refer to Figure 6-2, #58

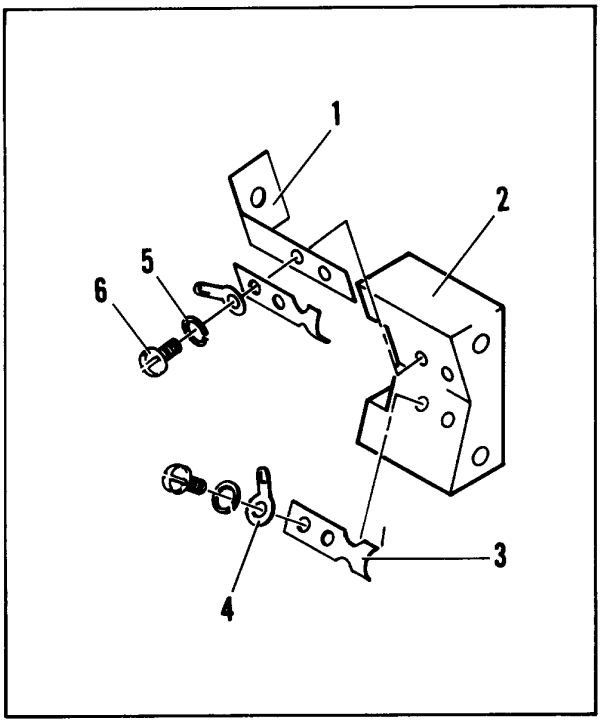


Figure 6-6. Refer to Figure 6-2, #5

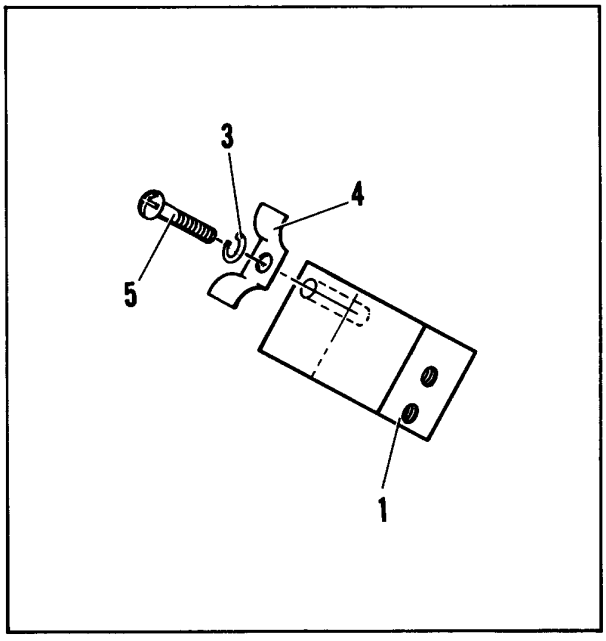


Figure 6-7. Refer to Figure 6-2, #48

SECTION VII
CIRCUIT DIAGRAMS

This section contains the circuit diagrams necessary for the operation and maintenance of this unit. Included are:

a. Component Location Diagrams which shows the physical location and reference designator of parts mounted on the printed wiring board.

b. Schematic Diagram, which illustrates the circuitry for the entire unit. Voltages are given adjacent to test points, identified by encircled numbers on the schematic.

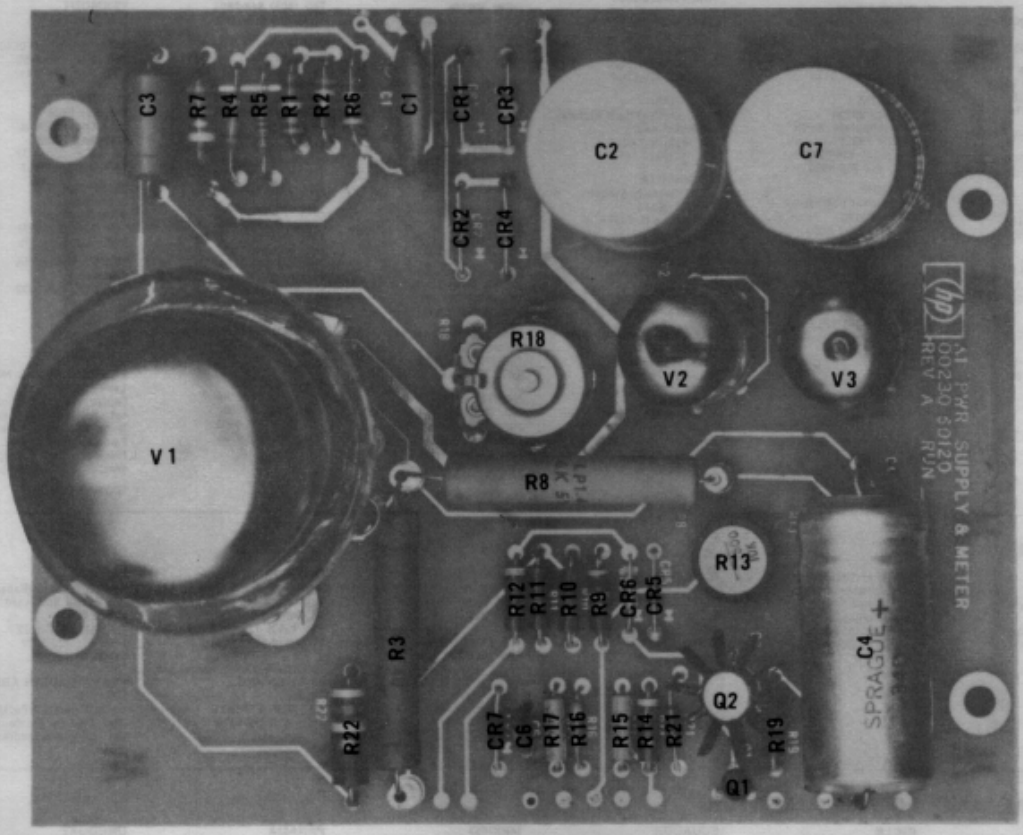
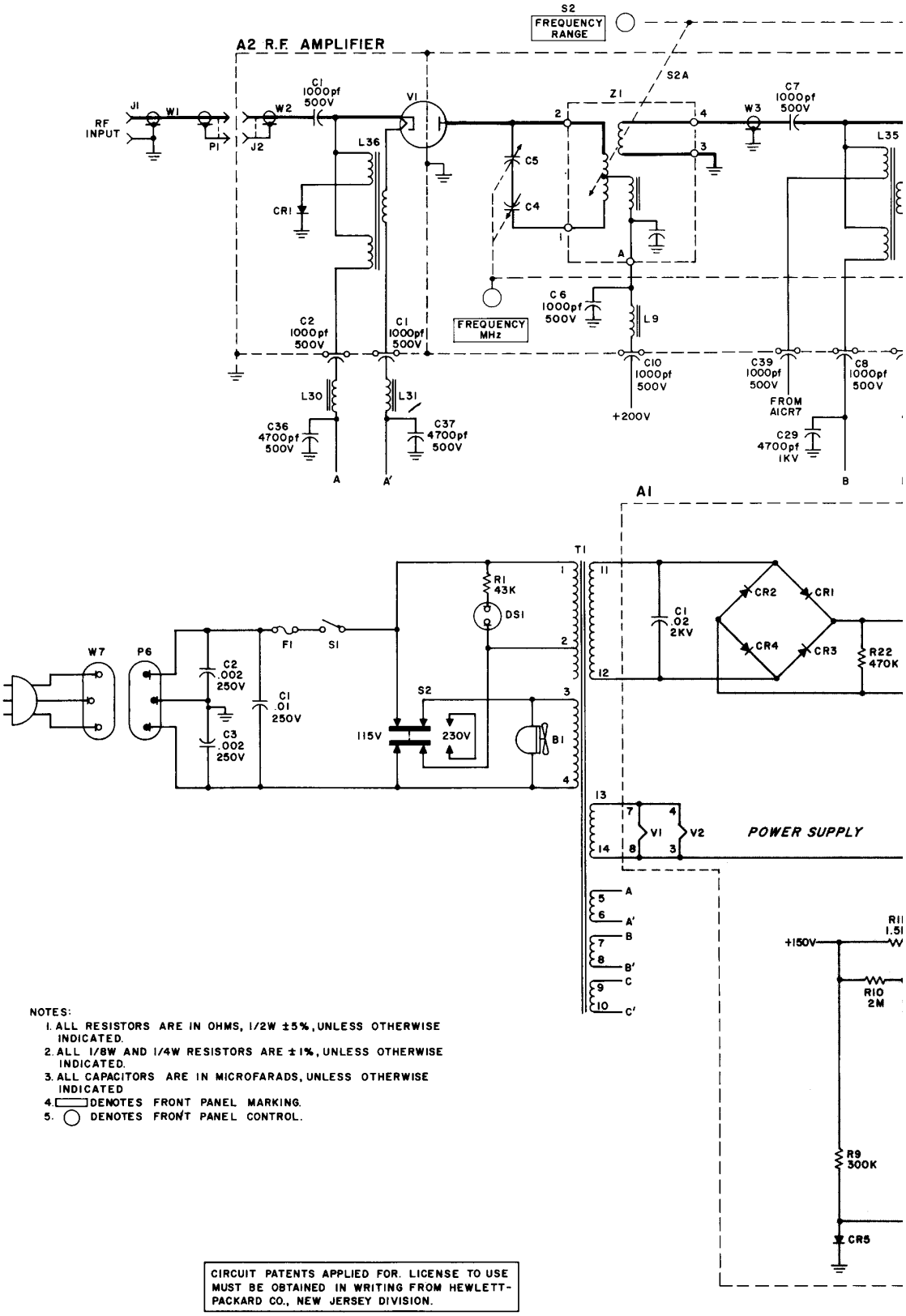


Figure 7-1. A1, Main Printed Circuit Board, Component Location



NOTES:

1. ALL RESISTORS ARE IN OHMS, 1/2W ±5%, UNLESS OTHERWISE INDICATED.
2. ALL 1/8W AND 1/4W RESISTORS ARE ±1%, UNLESS OTHERWISE INDICATED.
3. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE INDICATED
4. ▭ DENOTES FRONT PANEL MARKING.
5. ◯ DENOTES FRONT PANEL CONTROL.

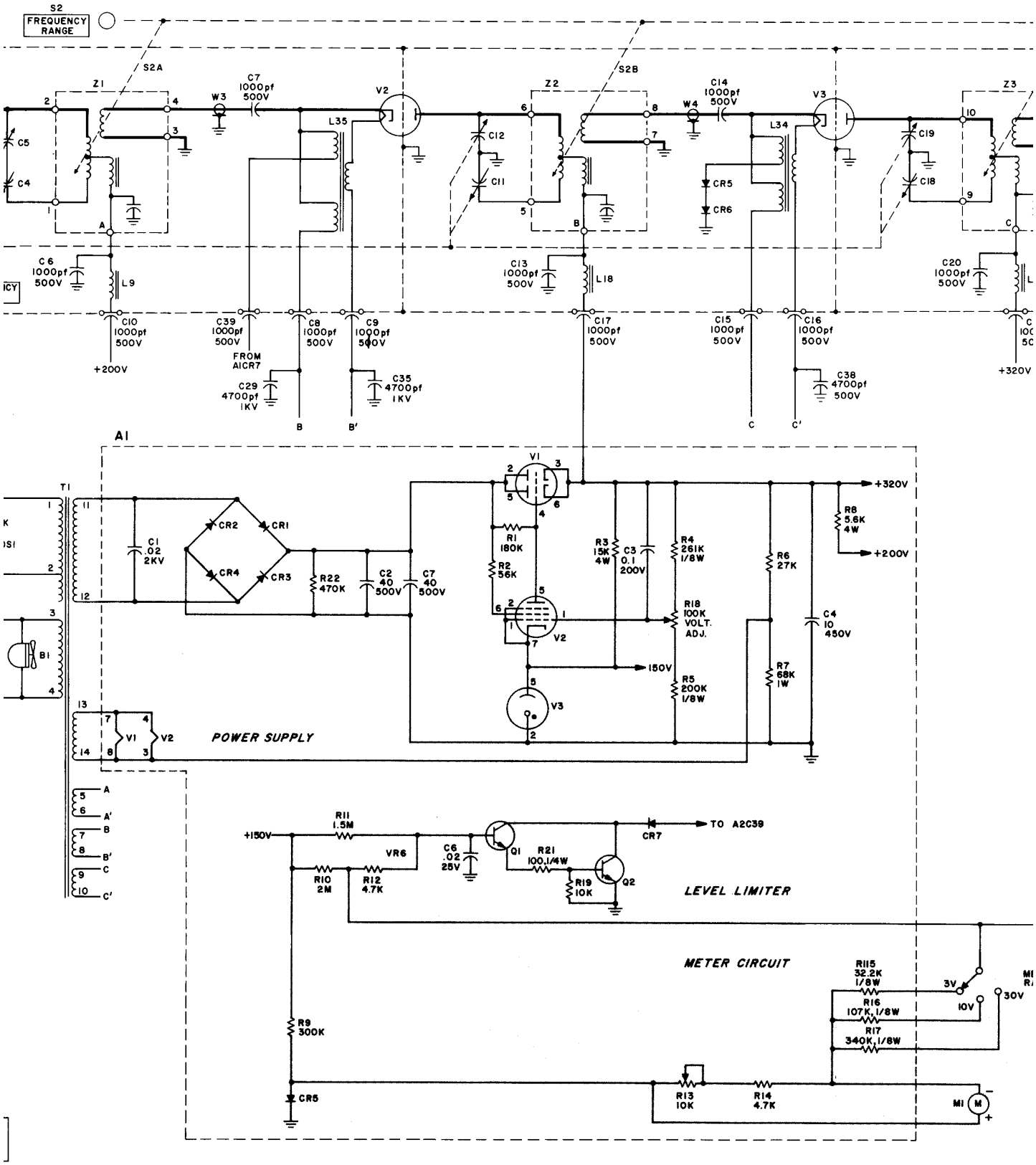


Figure 7-2. Mode

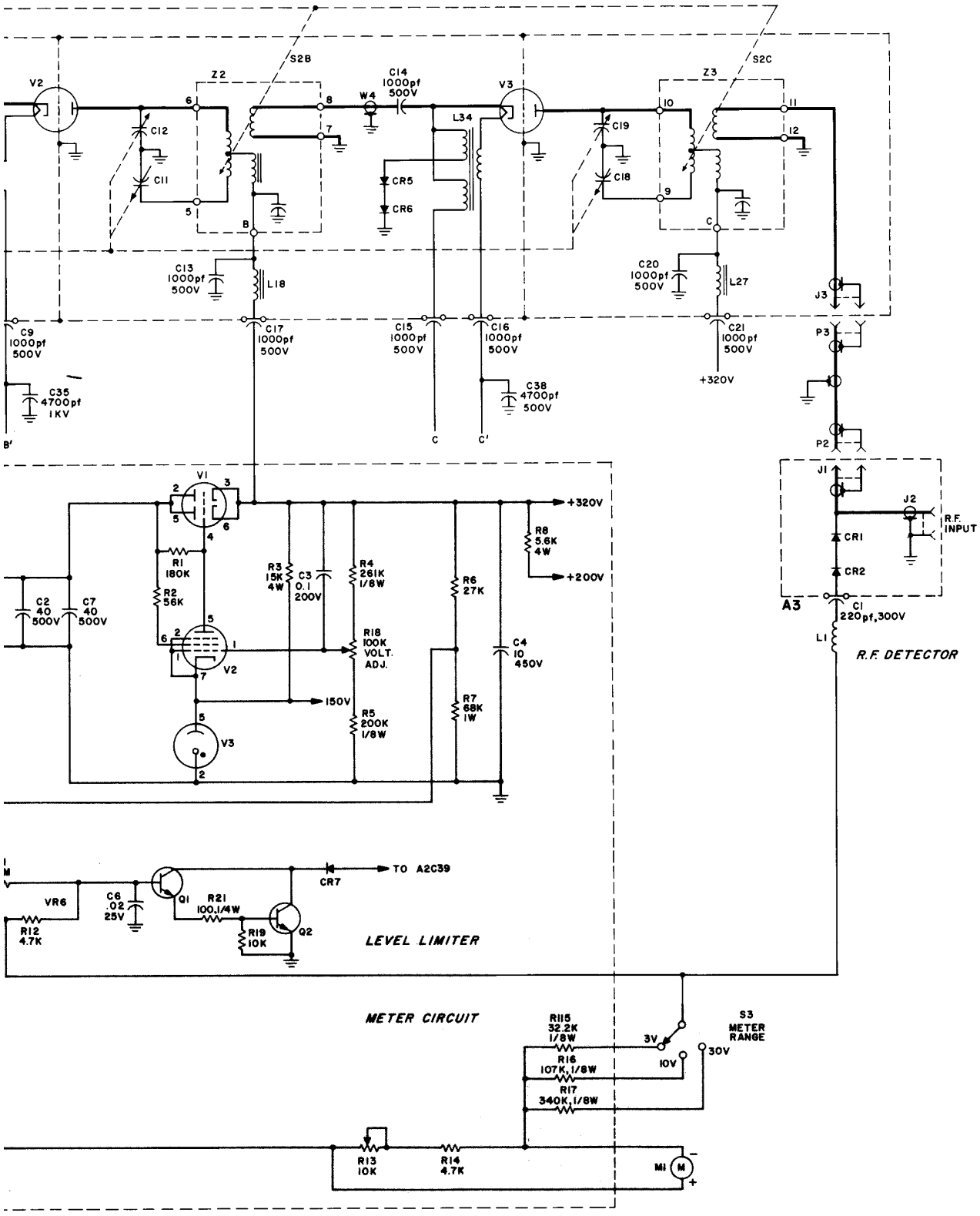


Figure 7-2. Model 230B, Schematic Diagram

MANUAL CHANGES

MODEL: 230B

Manual Serial Prefixed: 935

HP Part No.: 00230-90039

To adapt this manual to instruments with other serial previxes check for errata below, and make changes shown in tables.

Instrument Serial Prefix	Make Manual Changes
Errata	All
936	1
1026	1,2
1202	1,2,3

Instrument Serial Prefix	Make Manual Changes

Δ New or revised item.

ERRATA

Page 4-2, Paragraph 4-11.

The fourth sentence in the paragraph should read: This is accomplished by making the piston of A2C12 (A2C4 and A2C18) physically shorter than A2C11(A2C5 and A2C19).

Page 4-2, Paragraph 4-17.

The first sentence should read: The cathode of A1V1 supplies a regulated +320 volts to RF amplifiers A2V2 and A2V3. Resistor R8 drops the +320 volts to +200 volts for RF amplifier A2V1.

Page 5-7, Paragraph 5-42 (step g.)

Change: R125 to R13

Page 7-1, Figure 7-2.

Change notation of RF Input adjacent to A3-J2 to read RF Output.

Figures 5-1, 5-2, and 5-4.

Delete: HP Part No. 8491A for the 10db attenuator. Use instead HP Part No. 0950-0094 10db attenuator. Also reverse the physical positions of the attenuators so that the 10db attenuator is closest to the 50 ohm termination.

25 JAN 1972

CHANGE 1

Page 6-6. Table 6-4.

Change: DS1 description to read: light indicator (white) part number to 1450-0419.

F1(115v) part number to 2110-0303

F1 (230v) part number to 2110-0312

S1 part number to 3101-0003

S2 part number to 3101-1234

A1R15 description to read: 31.6K part number to 0698-3160.

Page 6-12, Item 5-2.

Change: description to read Strap, part number to 00230-00013.

Page 7-1, Figure 7-2. Schematic Diagram (meter circuit).

Change: R115 to read R15 and description to 31.6Kohms.

Δ CHANGE 2.

Page 6-5, Table 6-4.

Change the part number for Frequency Knob to 0370-0038.
Change the part number for Meter Bezel to 4040-0293.

Δ CHANGE 3.

The standard colors for this instrument are now mint gray (for front panel) and olive gray (for all other external surfaces). Option X95 designates use of the former color scheme of light gray and blue gray. Option A85 designates use of a light gray front panel with olive gray used for all other external surfaces. New part numbers are shown below:

DESCRIPTION	HP Part Number		
	Standard	Option A85	Option X95
Front Panel	00230-01017	00230-01004	Refer to Manual Parts List
Cabinet Assembly	00230-61007	00230-61007	
Air Filter	5060-8772	5060-8772	

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