Errata

Title & Document Type: 11664A Detector Operating & Service Manual

Manual Part Number: 11664-90037

Revision Date: January 1982

HP References in this Manual

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

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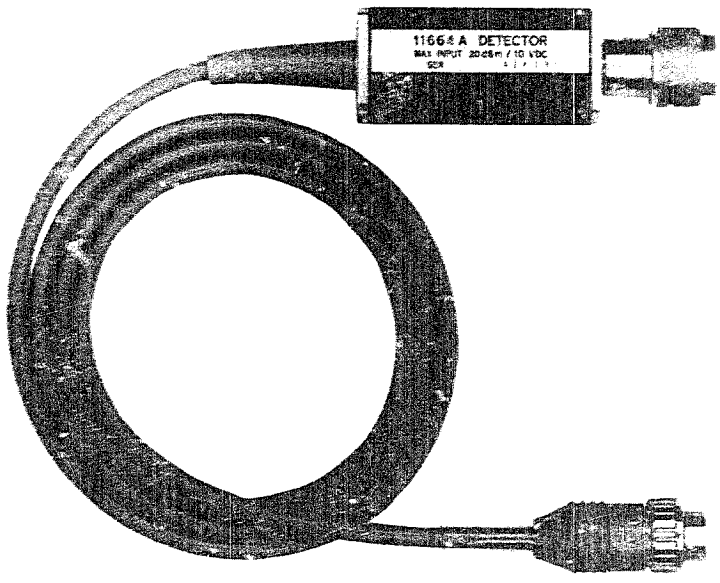
OPERATING AND SERVICE MANUAL

11664A DETECTOR



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11664A
DETECTOR

SERIAL NUMBERS

This manual applies directly to serial numbers with prefix 1836A.

With changes described in Section VII, this manual also applies to instruments with serial number prefix 1244A, 1413A, 1531A, and 1716A.

For additional important information concerning serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

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MANUAL PART NO. 11664-90037
Microfiche Part No. 11664-90038

Printed: JANUARY 1982

HEWLETT PACKARD

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CAUTION

Take care when connecting or disconnecting the 11664A. Always ground yourself by touching the outer shell of the 11664A OR ANY DEVICE CONNECTED TO THE OUTER SHELL. Another method is to wear non-porous gloves. If this is not done, the diode in the 11664A may burn out.

Design parameters of sensitive microwave diodes make these diodes susceptible to burn-out from static electricity. Tremendous voltages, of the order of tens of thousands of volts, can be built up on the human body under certain conditions. Conditions susceptible to static build-up are dry air, rubber or composition shoe soles, nylon clothing, or floor carpeting.

If static discharges are noticed by the operator, they indicate a voltage of 20,000 volts or more, which is more than enough to burn out the diode. In this case, some thought should be given to reducing the hazard by removing carpeting, wearing clothing other than nylon, or by adding a shunting path to ground on the 11664A. This consists of a piece of wire soldered to a ground lug held under one of the screws in the 11664A case, nearest the RF input connector. Another method, used here at Hewlett-Packard, is to have the operator wear a light, removable, copper bracelet to ground any static electricity on the body. The bracelet is permanently grounded to the system ground. This has been found to be the surest method of protecting the 11664A, since it does not depend on the operator grounding himself.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains operating and service information for the Hewlett-Packard Model 11664A Detector. The instrument, along with the supplied Cable Marker Kit, is shown in Figure 1-1. Cable markers are used for identification when more than one Detector is used in a test setup.

On the title page of this manual is a microfiche part number which can be used to order 10 by 15 centimeter (4 by 6 inch) microfilm transparencies of the manual. Each microfiche contains up to 60 photoduplicates of the manual pages. The microfiche package also includes the latest Manual Changes Supplement as well as all pertinent Service Notes.

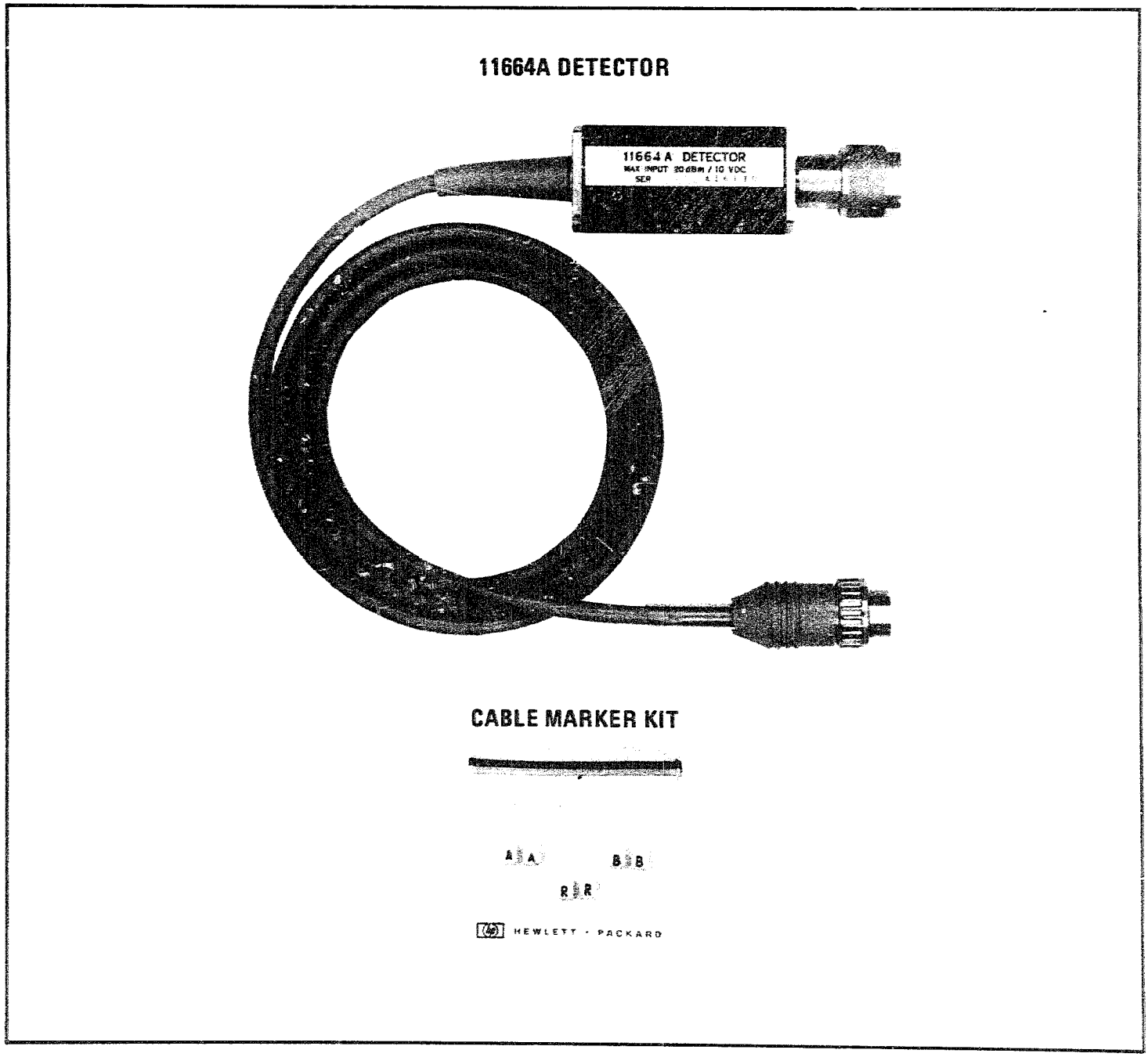


Figure 1-1. HP Model 11664A Detector

Table 1-1. Specifications

SPECIFICATIONS

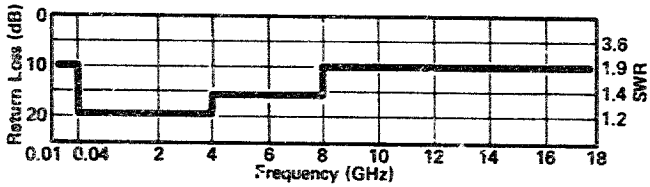
FREQUENCY

Frequency Range: 10 MHz to 18 GHz

REFLECTION

Return Loss:

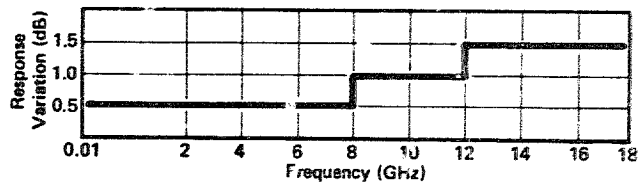
10 MHz to 40 MHz:	≥10 dB (≤1.92 SWR)
40 MHz to 4 GHz:	≥19 dB (≤1.25 SWR)
4 GHz to 8 GHz:	≥16 dB (≤1.38 SWR)
8 GHz to 18 GHz:	≥10 dB (≤1.92 SWR)



TRACKING BETWEEN TWO 11664A DETECTORS

Tracking between two 11664A Detectors: Specified at same relative power level. Does not include mismatch or coupler uncertainties.

10 MHz to 8 GHz:	<0.5 dB
8 GHz to 12 GHz:	<1.0 dB
12 GHz to 18 GHz:	<1.5 dB



GENERAL

Temperature Range: Operation: 0 to 55 degrees C; Storage: —40 degrees C to 75 degrees C.

Connectors: Standard: Type N male
Option 001: APC-7
Special Order: Type N Female

Dimensions: Cable length is 48 inches.

Weight: Net 6 oz. (0.17 kg).

1-2. SPECIFICATIONS

Listed in Table 1-1 are the performance specifications for the Model 11664A Detector. These are performance standards or limits against which the instrument may be tested. Table 1-2 lists Supplemental Characteristics. These are not specifications but are typical characteristics included as additional information for the user.

1-3. SAFETY CONSIDERATIONS

The voltages present in the 11664A are not in the range to warrant more than normal caution.

CAUTION

The CAUTION sign calls attention to an operating procedure or practice which, if not correctly performed or adhered to, could damage or destroy the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

1-4. INSTRUMENTS COVERED BY MANUAL

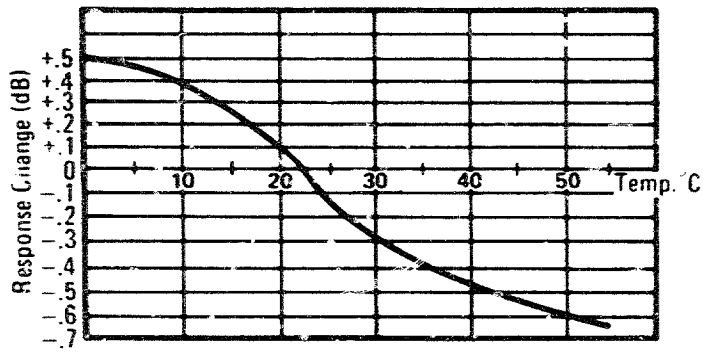
This instrument has a two-part serial number. The first four digits and the letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix as listed under SERIAL NUMBERS on the title page.

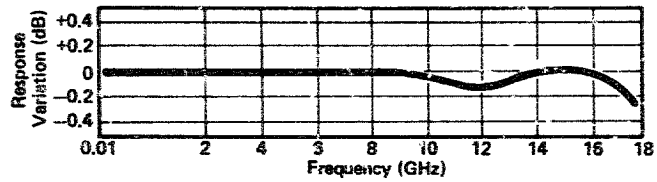
Table 1-2. Supplemental Characteristics

SUPPLEMENTAL CHARACTERISTICS

AMPLITUDE RESPONSE

Variation due to Temperature





GENERAL

Input Damage Level:
+ 20 dBm (100 mW) RF power 10 Vdc

Input Impedance:
50 ohms nominal

An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes Supplement that contains "change information" that documents the differences.

In addition to change information, the supplement contains information for correcting errors in the manual. To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes Supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from your local Hewlett-Packard Office listed at the end of this manual.

For information concerning a serial number that is not listed on the title page or in the Manual Changes Supplement, contact your nearest Hewlett-Packard Office.

1-5. DESCRIPTION

The HP Model 11664A Detector must be used in conjunction with the HP Model 8755C Swept Amplitude Analyzer. The 11664A detects RF signal levels from −50 to +10 dBm in the frequency range from 10 MHz to 18 GHz. Use of three 11664A Detectors enables simultaneous (amplitude only) transmission and reflection measurements via the 8755C Analyzer/180-series Display.

The 11664A Detector and the input stages of the 8755C comprise an ac-coupled system. This detection scheme requires 27.8 kHz squarewave modulation of the RF input signal. Additional information is provided in the following section, **EQUIPMENT REQUIRED BUT NOT SUPPLIED.**

1-6. OPTIONS

The 11664A Detector is available with an APC-7®* RF input connector by ordering Option 001.

*APC-7® is a registered trademark of the Bunker-Ramo Corporation.

1-7. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Reflection and transmission measurements require two or three 11664A Detectors and the 8755C Swept Amplitude Analyzer. Swept frequency measurements will require a Sweep Oscillator. In addition, the RF source signal must be modulated by a 27.8 kHz squarewave signal.

1-8. Sweep Oscillator

Sweep Oscillators furnish the RF input signal. Either the 8350-series or the 8620-series Sweep Oscillators may be used.

HP Model 8350A Sweep Oscillator. The 8350A Sweep Oscillator, used with 83500-series RF Plug-Ins, internally modulates the RF output signal when the front panel ## MOD pushbutton is engaged.

HP Model 8620C Sweep Oscillator. The 8620C Sweep Oscillator/RF Plug-In combination requires the MODULATOR DRIVE signal, available at the front panel of the 8755C, to be connected to the 8620C rear panel EXT AM input. However, be aware that some earlier RF Plug-Ins (compatible with the 8620C) will require the use of an external Modulator, HP Model 11665B. Refer to the particular RF Plug-In Operating and Service Manual to determine the appropriate method of amplitude modulation required for this measurement method. Figures 3-2 and 3-3 illustrate the test set configurations.

1-9. Modulator

The 11665B Modulator is designed to be used with the Model 8755C Swept Amplitude Analyzer. The Model 8755C supplies a 27.8 kHz squarewave signal to the Model 11665B which then squarewave modulates the RF signal. The appropriate test set configuration is shown in Figure 3-3.

1-10. EQUIPMENT AVAILABLE

1-11. Directional Couplers

Reflection measurements require the use of a Dual Directional Coupler or Bridge, or two Single Directional Couplers, to separate the reference, incident, and reflected signals. Reflection and transmission measurements may be made concurrently with this setup. See Table 1-3 for recommended model numbers.

The 11666A Reflectometer Bridge allows transmission and reflection measurements from 15 MHz to 18 GHz. The 11666A houses two detectors, one in the reflection port and one in the reference port. Therefore, only one 11664A Detector is required for a transmission measurement.

1-12. Power Splitters

Ratio measurements to determine frequency response or other transmission characteristics can be obtained with a Power Splitter and two 11664A Detectors. The HP Model 11667A provides this function from DC to 18 GHz.

1-13. Accessories

The following accessories for the Model 11664A Detector are available:

Model 11679A: 25-foot Extension Cable
Model 11679B: 200-foot Extension Cable

1-14. RECOMMENDED TEST EQUIPMENT

Equipment required for testing and troubleshooting the Model 11664A is listed in Table 1-3. Other equipment may be substituted if it meets or exceeds the critical specifications indicated in the table.

Table 1-3. Recommended Test Equipment

Instrument Type	Critical Specifications	Suggested Model	Use*
Sweep Oscillator	Frequency: 10 MHz to 18 GHz	HP 8350A Mainframe with: HP 83592A RF Plug-In or HP 86222A RF Plug-In HP 86290A RF Plug-In and HP 11869A Adapter or HP 8620C Mainframe with: 86222A RF Plug-In and 86290A RF Plug-In	P,T
Swept Amplitude Analyzer	Provides 27.8 kHz modulation signal Powers three 11664A Detectors Processes/Displays the detected signals	HP 8755C	P,T
Display Mainframe	See 8755C Operating & Service Manual. Table 1-4	HP 182T/HP 180-series	P,T
Audio Oscillator	Frequency: 27.8 kHz	HP 200CD	T
Modulator	Frequency: 15 MHz to 18 GHz Modulation: 27.8 kHz	HP 11665B	P,T
Directional Bridge (2)	Frequency: 10 to 100 MHz	HP 8721A	P
Dual Directional Coupler	Frequency: 10 MHz to 18 GHz	HP 773D (100 MHz to 2 GHz) HP 11692D (2 to 18 GHz) or HP 11666A Reflectometer Bridge (40 MHz to 18 GHz)	P,T
Detectors (2)	Frequency: 10 MHz to 18 GHz	HP 11664A	P,T
Power Splitter	Frequency: 10 MHz to 18 GHz	HP 11667A	P,T
Coaxial Short	Fits mating connector of directional coupler used	HP 11511A (Type N Female) HP 11512A (Type N Male) HP 11565A (APC-7)	P,T
Attenuators (2)	Frequency: 10 MHz to 18 GHz Attentuation: 10, 20, & 30 dB	HP 11582A	P,T
Open-end Wrench	Thin 1/2 x 9/16-inch	HP Part No. 8710-0877	T
Oscilloscope	Vertical Bandwidth: ≥ 250 kHz Vertical Sensitivity: ≥1 mV/cm	HP 1740A	

* P=Performance Testing, T=Troubleshooting

SECTION II
INSTALLATION

2-1. INTRODUCTION

This section contains information concerning initial inspection, preparation for use, mating connectors, and storage and shipment.

2-2. INITIAL INSPECTION

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. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the instrument does not pass these electrical tests, if the shipment contents are incomplete, or if there is mechanical damage or defect, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or if 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. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-3. PREPARATION FOR USE

2-4. Power Requirements

Power for the Model 11664A Detector is supplied by the Model 8755C Swept Amplitude Analyzer. Each Detector requires 0.35 watts. The Model 8755C normally powers up to three Detectors requiring a maximum total of 1.05 watts.

2-5. Replacing RF Input Connector

The RF input connector outer shell and inner conductor assembly may be replaced with an alternate type of RF connector. HP Part Numbers for several available connectors are given in Section VI, Replaceable Parts. The procedure for connector replacement is documented in Section VIII, Service.

If the RF input connector is, or has been replaced by, an APC-7 type connector, refer to Figure 2-1 for user instructions.

2-6. Connecting the 11664A Detector

Connect the 11664A to the 8755C as follows:

1. Insert the 11664A DC connector into the 8755C mating connector. The 11664A connector is keyed; the plug should be inserted with the key facing downward.

2. Secure the dc connector in the 8755C by turning the outer shell clockwise.

3. Connect the RF input as follows:

CAUTION

Do not apply more than 3 in/lb (3.5 cm kg) of torque when tightening the connectors. Greater torque may deform the mating surfaces.

CAUTION

Do not apply more than +20 dBm RF power or more than ±10 volts DC into the 11664A.

4. Turn the outer shell of the male connector clockwise to secure the connection to the 11664A RF input.

5. If the RF input connector is an APC-7 type, refer to Figure 2-1.

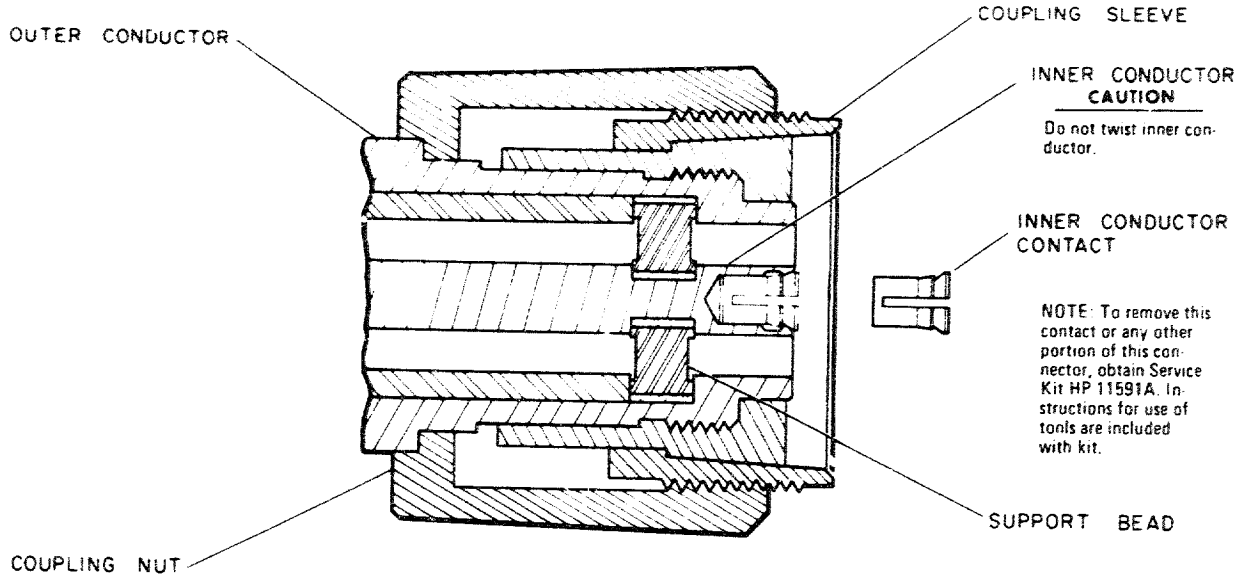
2-7. Mating Connectors

Type N connectors mate with the corresponding Type N connectors whose dimensions conform to US specification MIL-C-39012. APC-7 connectors mate with any other APC-7 connector.

2-8. Detector Lead Identification

Coded cable clips are furnished for lead identification. Place matching clips on both ends of the cable.

APC-7 CONNECTORS



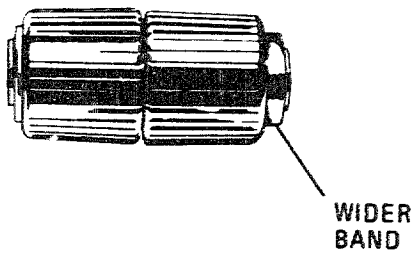
USE

To Connect:

1. On one connector, retract the coupling sleeve by turning the coupling nut counterclockwise until the sleeve and nut disengage.
2. On the other connector, fully extend the coupling sleeve by turning the coupling nut clockwise. To engage coupling sleeve and coupling nut when the sleeve is fully retracted, press back lightly on the nut while turning it clockwise.
3. Push the connectors firmly together, and thread the coupling nut of the connector with retracted sleeve over the extended sleeve. Leave the other coupling nut in the original position; closing the gap between coupling nuts tends to loosen the electrical connection.

To Disconnect:

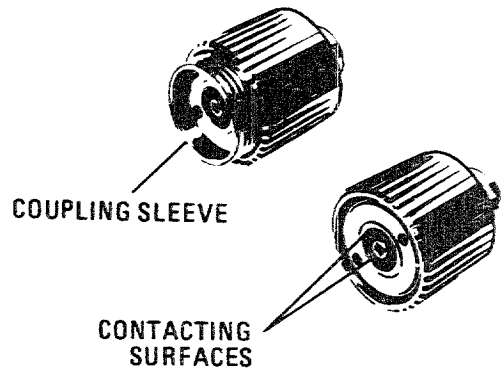
1. Loosen the coupling nut of the connector showing the wider gold band.



2. IMPORTANT: Part the connectors carefully to prevent striking the inner conductor contact.

CARE

1. Keep contacting surfaces smooth and clean. Irregularities and foreign particles can degrade electrical performance.



2. Protect the contacting surfaces when the connector is not in use by leaving the coupling sleeve extended.
3. Use lintless material and/or firm-bristled brush such as tooth brush for cleaning. If a cleaning fluid is needed use isopropyl alcohol. IMPORTANT: Do not use aromatic or chlorinated hydrocarbons, esters, ethers, terpenes, higher alcohols, ketones, or ether-alcohols such as benzene, toluene, turpentine, dioxanne, gasoline, cellosolve acetate, or carbon tetrachloride. Keep exposure of the connectors parts to both the cleaning fluid and its vapors as brief as possible.

Figure 2-1. Use and Care of APC-7 Connectors

2-9. OPERATING ENVIRONMENT

2-10. Temperature. The instrument may be operated in temperatures from −25°C to +55°C.

NOTE

See Table 1-2 for detector response variation due to temperature.

2-11. Humidity. The instrument may be operated in environments with humidity up to 95%. However, the instrument should also be protected from temperature extremes which cause condensation within the 11664A.

2-12. Altitude. The instrument may be operated at altitudes up to 7,620 meters (25,000 feet).

2-13. STORAGE AND SHIPMENT

2-14. Environment

The instrument may be stored or shipped in environments within the following limits:

Temperature: 0°C to +75°C
Humidity: Up to 95%
Altitude: Up to 7,620 meters (25,000 feet)

The instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-15. PACKAGING

2-16. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-17. Other Packaging. The following general instructions should be used for repackaging with commercially available materials:

1. Wrap the instrument in heavy paper or plastic. If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.

2. Use a strong shipping container. A double wall carton made of 350-pound test material is adequate.

3. Use enough shock absorbing material (3 to 4 inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container.

4. Seal the shipping container securely.

5. Mark the shipping container FRAGILE to assure careful handling.

SECTION III
OPERATION

CAUTION

SUSCEPTIBLE TO DAMAGE FROM STATIC DISCHARGE

Static discharge has proven to be a valid problem with hot-carrier diodes. To prevent damage to the detector module and reduce the likelihood of costly repair, care must be taken whenever contacting the Model 11664A Detector.

Always ground yourself by touching the system ground before touching the outer shell of the 11664A or any device connected to the outer shell.

If static discharges are noticed by the operator, they indicate a voltage of 20,000 volts or more, more than enough to destroy the diode encased in the Model 11664A.

This hazard may be reduced by removing carpeting, wearing clothing other than nylon, or by adding a shunting path to ground on the 11664A.

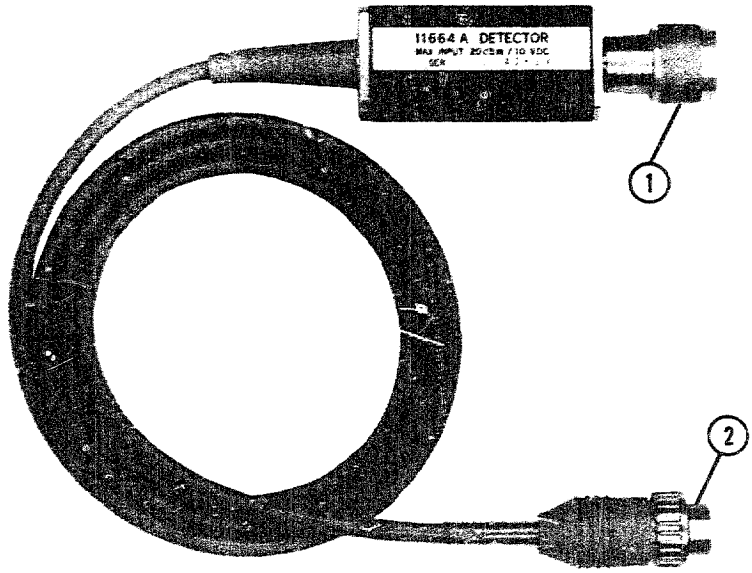
Use of a Static-Safe work station is the best method for preventing this type of damage. A safe setup consists of a conductive wrist-strap for the operator/technician, connected to a conductive bench mat, which in turn is connected through a 1 megohm resistor to a convenient earth ground.

3-1. INTRODUCTION

This section contains information concerning operation of the Model 11664A Detector.

3-2. FEATURES

Features of the Model 11664A are shown in Figure 3-1.



Note: Numbers shown are keyed to paragraph numbers.

RF INPUT CONNECTOR. This connector accepts the RF Input signal. On standard Detectors the RF input connector is Type N male. Other connectors may be substituted.

DC CONNECTOR. This connector supplies the necessary DC voltage for operation of the Model 11664A and feeds the Detector output signal to the Model 8755C.

Figure 3-1. Model 11664A Features

3-3. OPERATOR'S CHECK

An Operator's Check of the 11664A is included in the Operator's Check provided in the 8755C Operating and Service Manual.

3-4. OPERATING PRECAUTIONS

See **CAUTIONS** above.

Tighten the 11664A connectors with the fingers only. Do NOT use a wrench, especially with SMA connectors.

CAUTION

Do NOT apply more than 3 in/lb (3.5 cm/kg) of torque when tightening the connectors. Greater torque may deform the mating surfaces.

3-5. OPERATING INSTRUCTIONS

Operating instructions are given in the Operating and Service Manual for the Model 8755C Swept Amplitude Analyzer.

CAUTION

Do not apply more than +20 dBm RF CW power or more than ±10 volts DC into the 11664A or damage may occur.

If connecting a cable, always discharge the cable's center conductor static electricity to instrument ground before connecting 11664A RF connector.

Do not drop the 11664A or subject it to mechanical shock. The diode is easily damaged.

3-6. Typical Measurement Configuration

Amplitude measurement with the 11664A/8755C analyzer system requires a modulation envelope to be developed via 27.8 kHz modulation of the RF test signal. Test set connections will vary depending on the source oscillator selected.

Figure 3-2 illustrates a typical setup using the 8620C Sweep Oscillator/RF Plug-in, internally modulated by connecting a BNC cable from the 8755C MODULATOR DRIVE output to the 8620C rear panel EXT AM input.

Figure 3-3 shows a similar test setup with an external modulator, Model 11665B, being driven by the MODULATOR DRIVE of the 8755C. This setup must be used for RF Plug-ins which cannot respond to the 27.8 kHz drive. Refer to the Operation section of the particular RF plug-in's Operating and Service Manual for details.

The 8755C Operating and Service Manual illustrates a typical test setup using the Model 8350A Sweep Oscillator.

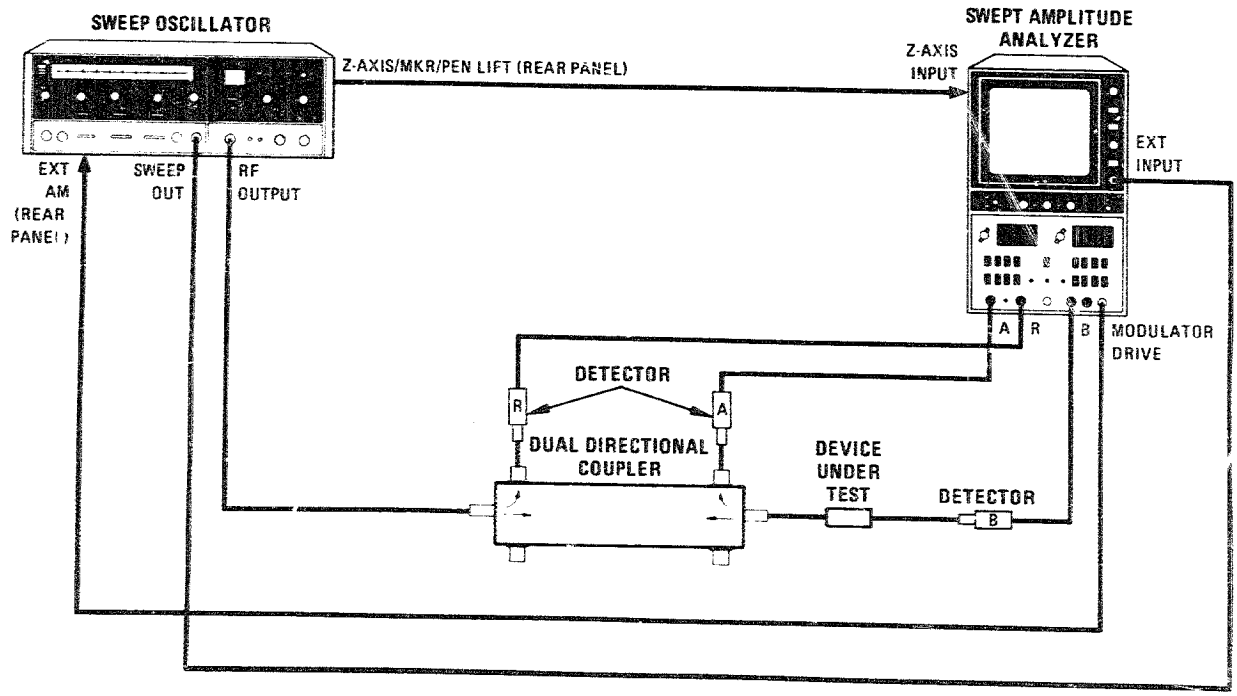


Figure 3-2. Model 8755C/11664A Typical Measurement Setup

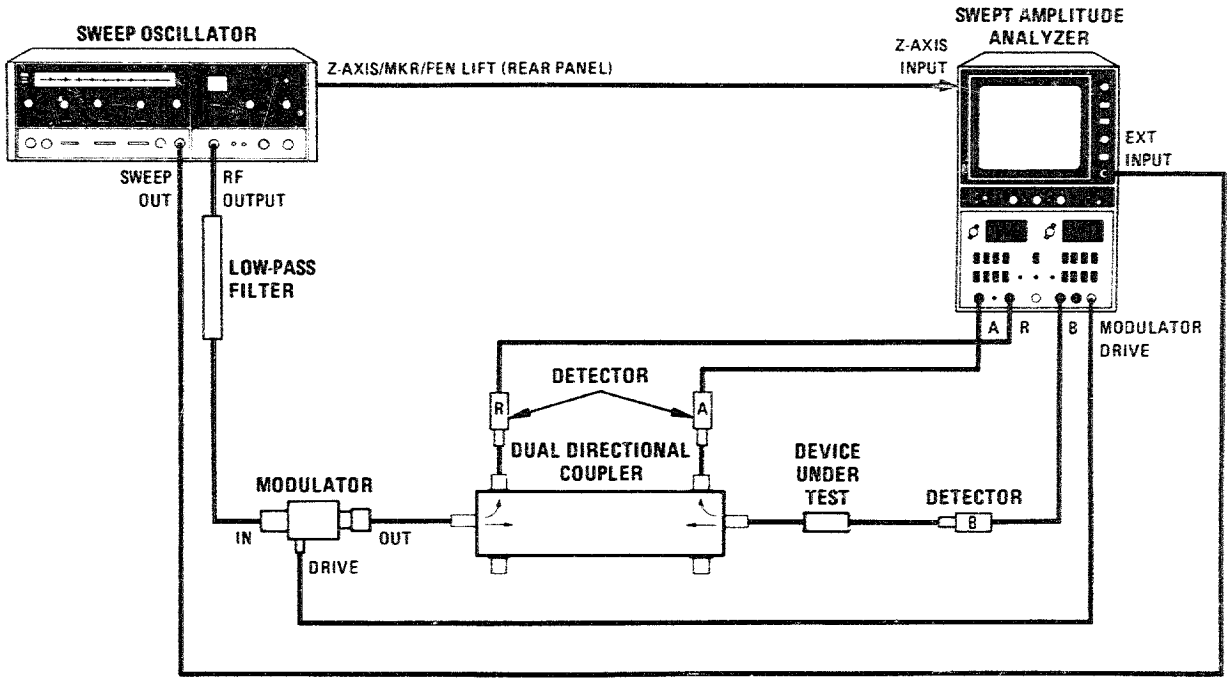


Figure 3-3. Model 8755C/11664A Typical Measurement Setup Using Model 11665B External Modulator

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

The procedures in this section test the instrument's electrical performance to the specifications in Table 1-1. None of the tests in this section requires access to the interior of the instrument.

4-2. EQUIPMENT REQUIRED

Table 1-3 lists the Recommended Test Equipment for testing the performance standards of this instrument. Any equipment which satisfies the critical specifications given in that table may be substituted for the recommended model.

4-3. TEST RECORD

Results of the performance tests may be tabulated in Table 4-2, Performance Test Record. This Record lists all of the tested specifications and their acceptable limits. Space is provided for recording test results.

4-4. RETURN LOSS

Specifications:

Return Loss:

10 MHz to 40 MHz:	≥10 dB (≤1.92 SWR)
40 MHz to 4 GHz:	≥19 dB (≤1.25 SWR)
4 GHz to 8 GHz:	≥16 dB (≤1.38 SWR)
8 GHz to 18 GHz:	≥10 dB (≤1.92 SWR)

Description:

Two 11664A Detectors and a dual directional coupler provide the reference and reflected paths of a reflectometer test setup. The reflectometer is calibrated using a short. The 11664A Detector (device under test) is connected to the TEST (or INCIDENT) port and return loss is measured on the 8755C/182T analyzer.

Because of the broad frequency range of the 11664A Detector, three different couplers will need to be incorporated into the test setup. The procedure begins with the highest frequency test.

Provided that the equipment meets the critical specifications listed in Table 1-3, the return loss should be equal to or greater than the limits listed above. The measurement uncertainty includes the effects of error due to coupler directivity, adapter mismatches, and transmission loss of the 20 centimeter airline.

Table 4-1 references measurement uncertainty to coupler directivity.

	Coupler Directivity		
Specification	**26 dB**	**30 dB**	**40 dB**
10 dB	11.7dB	11 dB	10.3 dB
19 dB	24.3 dB	22 dB	19.9 dB
16 dB	19.3 dB	18 dB	16.7 dB
10 dB	11.7 dB	11 dB	10.3 dB

Table 4-1. Lowest Limits Including Measurement Uncertainty

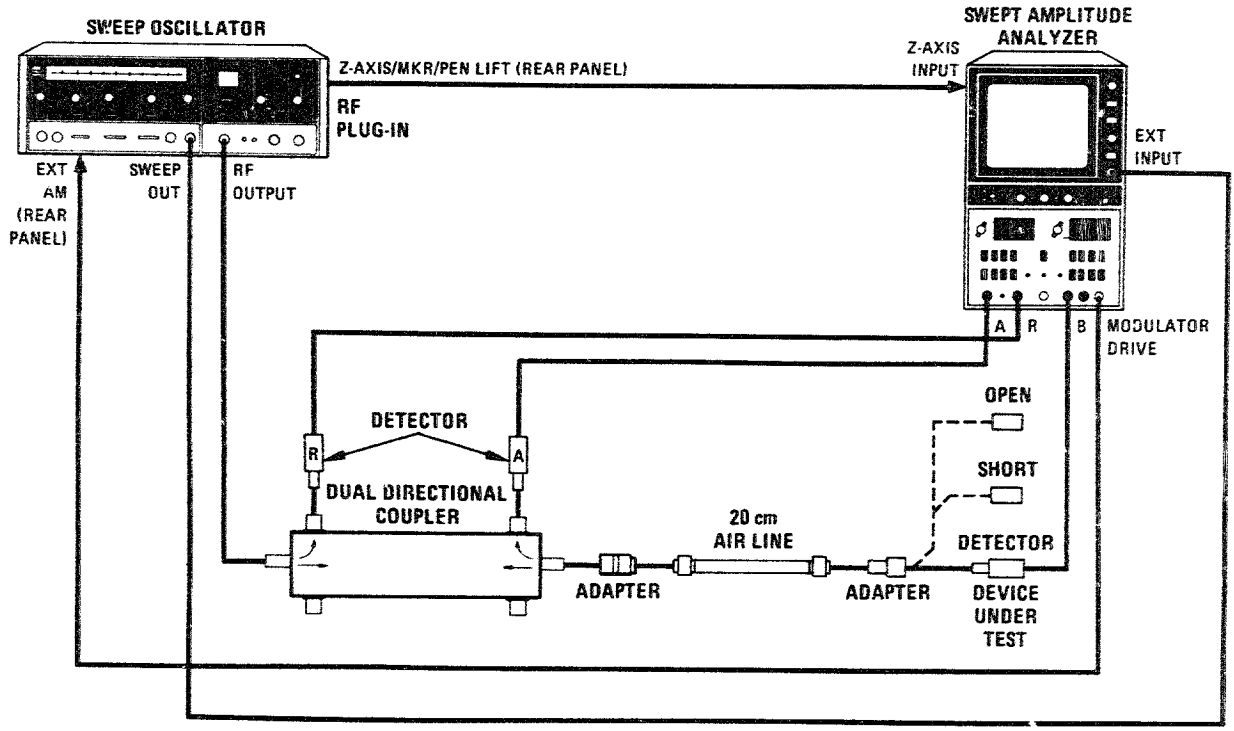


Figure 4-1. Return Loss Test Setup for Measurements from 100 MHz to 18 GHz

If the return loss appears not to meet the specifications but is within the measurement uncertainty range, a vector impedance measurement with error correction must be made. At Hewlett-Packard this is accomplished by using either the HP 8507C or the HP 8409B Automatic Network Analyzers. Further information is available in the HP 85030B Applications Pac and Application Note 221.

Equipment:

Sweep Oscillator	HP 8620C
RF Plug-in (0.01 to 2.4 GHz)	HP 86222A
RF Plug-in (2 to 18 GHz)	HP 86290A
Directional Bridge (2 required)	8721A
Dual Directional Coupler[1]	
100 MHz to 2 GHz	HP 778D
2 to 18 GHz	HP 11692D
Detectors (2 required)	HP 11664A
Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Coaxial Short	
Type N Female	HP 11511A
Type N Male	HP 11512A
APC-7	HP 11565A
20 cm Airline	HP 11567A
Adapters	
APC-7 to N Male (2 required)	HP 11525A
APC-7 to N Female	HP 11524A
N Male to BNC Female	HP Part No. 1250-0780
N Female to BNC Female	HP Part No. 1250-1474
BNC Female to BNC Female	HP Part No. 1250-0080

[1]Two single directional couplers connected as a dual directional coupler can also be used. Or the 11666A Reflectometer Bridge can be used from 40 MHz to 18 GHz. The 11666A contains its own reference and reflected arm detectors, thereby eliminating the need for the two 11664A Detectors.

Procedure:

2 to 18 GHz

1. Connect equipment as shown in Figure 4-1 using HP 86290A RF Plug-in and the 11692D dual directional coupler. Connect the short to the TEST port.

NOTE

Several front panel control names vary between the 8755B/C and the 8755A. The procedures are written for the 8755C. The differences are noted below.

8755B/C	8755A
CHANNEL 1	CHANNEL A
REFERENCE LEVEL dB	OFFSET dB
REFERENCE LEVEL VERNIER	OFFSET CAL
VIDEO FILTER	SMOOTHING
REFERENCE POSITION	POSITION

2. Set the 8755C CHANNEL 1 REFERENCE LEVEL dB control to 0 dB and the REFERENCE LEVEL VERNIER to OFF.

3. Press CHANNEL 1 REFERENCE POSITION pushbutton. Turn the adjacent screwdriver adjustment to place trace on the center graticule.

4. Press CHANNEL 1 pushbuttons marked DISPLAY R and 10 dB/DIV.

5. Set the Sweep Oscillator to sweep 2 to 18 GHz.

6. Adjust RF output power to place the trace on the second graticule below center. (Assuming 20 dB coupling to the reference leg, power to the R Detector should measure −20 dBm and power at the test port should be approximately 0 dBm.)

7. Press CHANNEL 1 pushbutton marked DISPLAY A/R.

8. Turn CHANNEL 1 REFERENCE LEVEL VERNIER to ON and adjust the vernier to place the trace on the first graticule below the top of the display. See Figure 4-2.

9. Increase resolution to 5 dB/DIV. If necessary, adjust the REFERENCE LEVEL VERNIER to return the trace to the first graticule below the top line of the display.

10. Insert the 20 centimeter airline (with adapter) between the coupler TEST port and the short.

11. Repeat steps 4 through 9 before continuing with the next step.

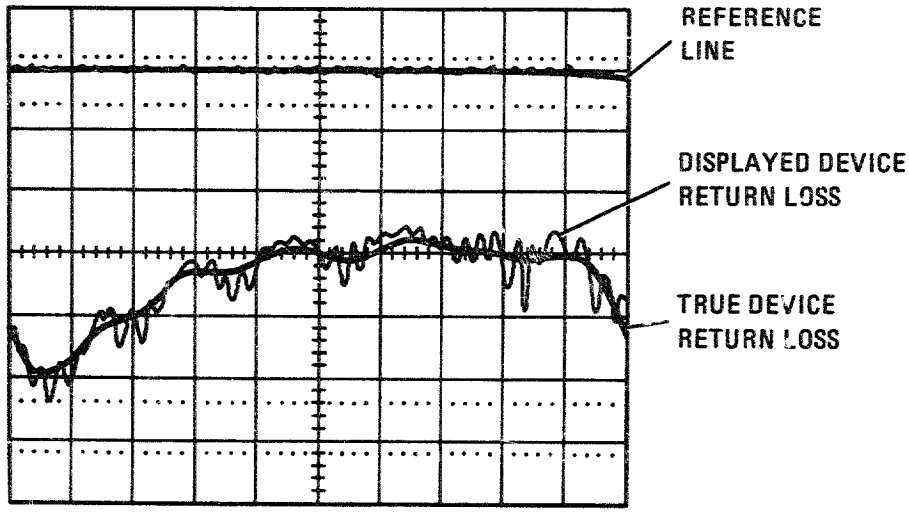


Figure 4-2. Return Loss Measurement Using Air Line Technique

12. The reference line is the average of the ripples on the trace. (See Figure 4-2.) With a black grease pencil, draw the reference line on the CRT display. The 20 cm airline allows the open-short reference line to be determined without actually using an open. At every quarter wavelength on a transmission line a short is seen as an open.

13. Connect the 11664A (device under test) between the reflectometer TEST port and the 8755C "B" input.

14. Return loss is the difference between the reference line and the response of the detector under test. Again, the airline will be responsible for the ripple in the trace. The true response of the detector is the average of the ripples (see Figure 4-2). Check the results against the specifications listed at the beginning of paragraph 4-4.

100 MHz to 2 GHz

15. Set up the equipment as shown in Figure 4-1 with the HP 86222A RF Plug-in and the HP 778D coupler with the short connected to the test port. The 20 centimeter airline is not required for measurements in this frequency range.

16. Repeat steps 4 through 9 to set reference levels on the CRT. With the short on the TEST port, draw the trace on the CRT with a grease pencil. Remove the short. The true reference line is the average of the reflected signals obtained with a short and an open. Draw the true reference line.

17. Connect the 11664A device under test between the TEST port and the 8755C "B" input.

18. Read the return loss as the difference between the reference line and the response of the detector. Check the results against the specifications given at the beginning of paragraph 4-4.

10 to 100 MHz

19. Connect equipment as shown in Figure 4-3 with the short connected to the LOAD port. Note: this test setup configures two 8721A Bridges into a dual directional bridge.

20. Press CHANNEL 1 pushbuttons marked DISPLAY R and 5 dB/DIV.

21. Set the Sweep Oscillator to sweep from 10 to 100 MHz.

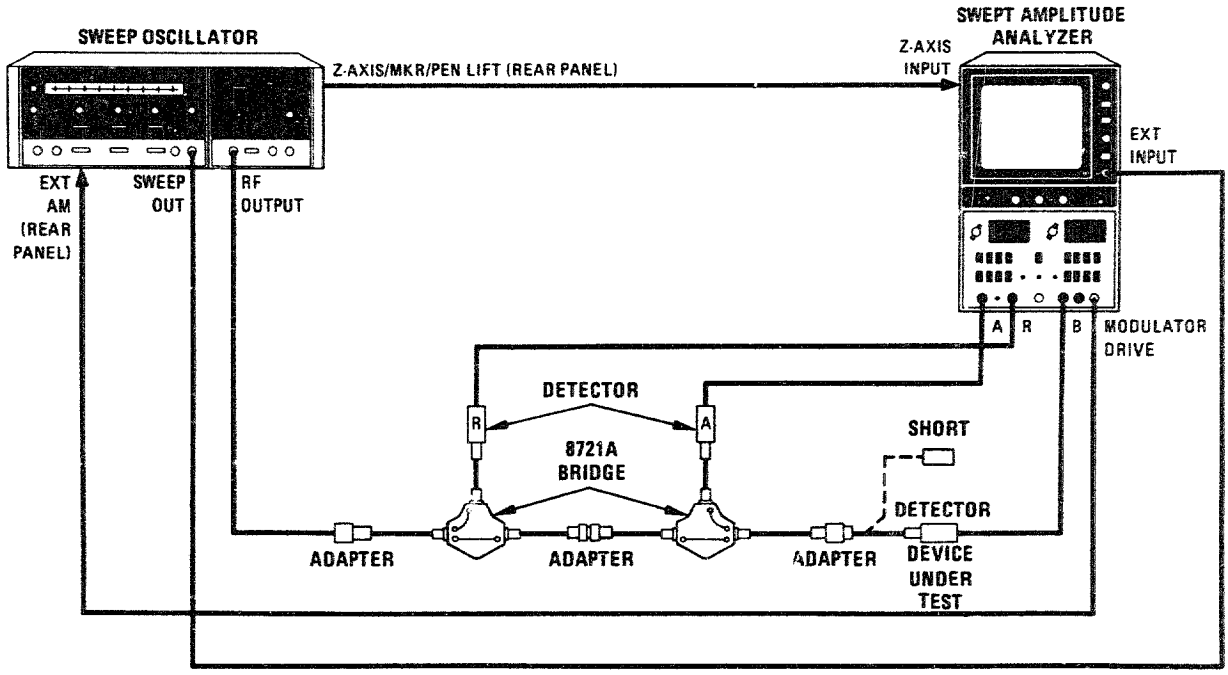


Figure 4-3. Return Loss Measurement Test Setup, 10 to 100 MHz.

22. Adjust RF output power to place the trace six minor divisions below the center graticule. This corresponds to −6 dBm to the INCIDENT leg and approximately 0 dBm to the LOAD port.

23. Press CHANNEL 1 DISPLAY A/R.

24. Turn CHANNEL 1 REFERENCE LEVEL VERNIER to ON and adjust trace to the first graticule below the top line. Draw this reference line on the CRT with a grease pencil. See Figure 4-2.

25. Remove short. The true reference line is the average of the reflections obtained with both a short and an open. Draw the average of the two traces.

26. Connect the 11664A device under test between the LOAD port and the 8755C "B" input.

27. Read the return loss as the difference between the true reference line and the response of the LOAD detector. See Figure 4-2. Check the results against the specifications listed at the beginning of Paragraph 4-4.

4-5. TRACKING BETWEEN TWO DETECTORS

Specification:

Tracking is specified between two detectors at the same relative power level. This does not include mismatch or coupler uncertainties.

Response Variation:

10 MHz to 8 GHz:	<0.5 dB
8 GHz to 12 GHz:	<1.0 dB
12 GHz to 18 GHz:	<1.5 dB

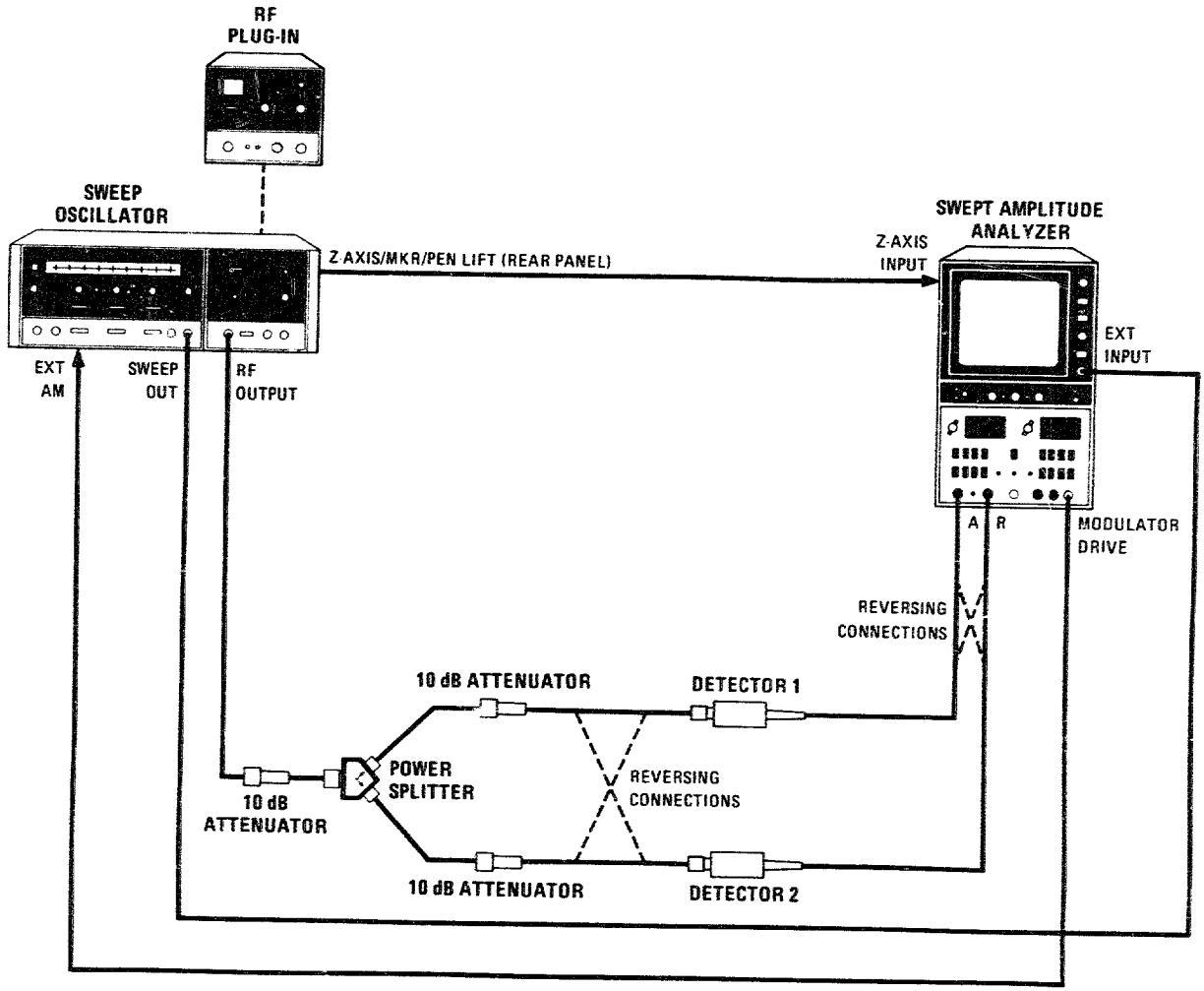


Figure 4-4. Tracking Test Setup

Description:

Two detectors are compared using a swept ratio measurement system consisting of a sweep oscillator, power splitter, and ratio-type frequency response test instrument.

Equipment:

Sweep Oscillator	HP 8620C
RF Plug-in (.01 – 2.0 GHz)	HP 86222A
RF Plug-in (2 – 18 GHz)	HP 86290A
Swept Amplitude Analyzer	HP 8755C/182T
Power Splitter	HP 11667A
Detectors (2 required)	HP 11664A
10 dB Attenuators (3 required)	HP 8491B Option 010

Procedure:

1. Connect equipment as shown in Figure 4-4. Install the 86222A RF plug-in for .01 to 2 GHz testing.

2. Set controls as follows:

8755C:

CHANNEL 1
- REFERENCE ..... +00 dB
- REFERENCE LEVEL VERNIER ..... ON
- DISPLAY ..... A/R
- dB/DIV ..... .25

8620C:
- Sweep Function ..... START/STOP
- START Frequency ..... .01 GHz
- STOP Frequency ..... 2 GHz
- Sweep MODE ..... AUTO
- TRIGGER ..... LINE
- 1 kHz SQ WV (rear panel) ..... OFF

RF Plug-in:
- RF ..... ON
- ALC ..... INT
- POWER LEVEL ..... Maximum Leveled

3. Adjust 8755C CHANNEL 1 REFERENCE LEVEL VERNIER to position left edge of trace (.01 GHz) on center horizontal graticule line.

4. Mark the trace with a grease pencil. Mark the left edge of the display to show the trace level at 2 GHz (See Figure 4-5). This mark is used to position the trace for the 2 to 18 GHz measurement in step 13.

5. Exchange the connections of the two detectors in the test setup. (Reverse the connections between the detectors and the attenuators as well as the connections to the 8755C A and R inputs.)

6. Adjust CHANNEL 1 REFERENCE LEVEL VERNIER to position the left edge of the trace (.01 GHz) on the center horizontal graticule line.

7. Mark the left edge of the display to show the trace level at 2 GHz (See Figure 4-5). This mark is used to position the 2 to 18 GHz measurement in step 10.

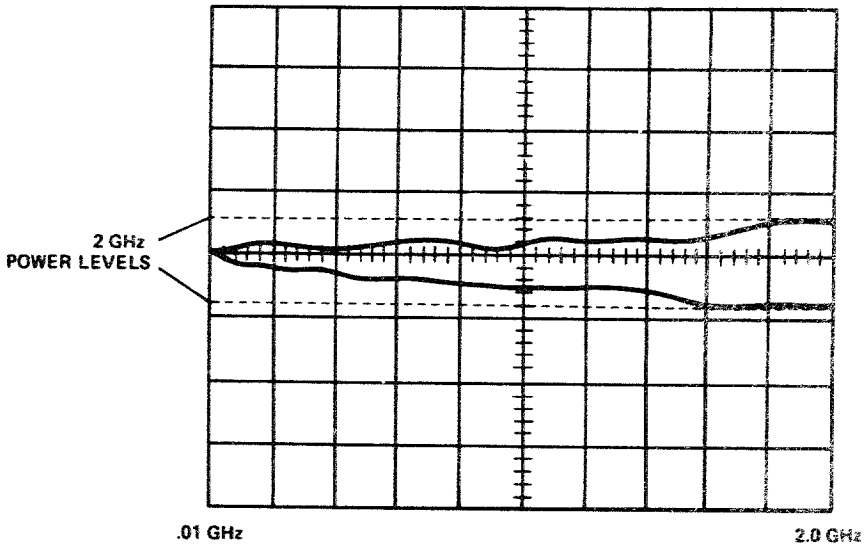
NOTE

The two measurements in this procedure cancel the tracking variations between power splitter output ports and also variation between the 10 dB attenuators, but add the tracking variations between the two detectors. This results in the peak-to-peak variation between traces being twice the actual tracking variation between detectors.

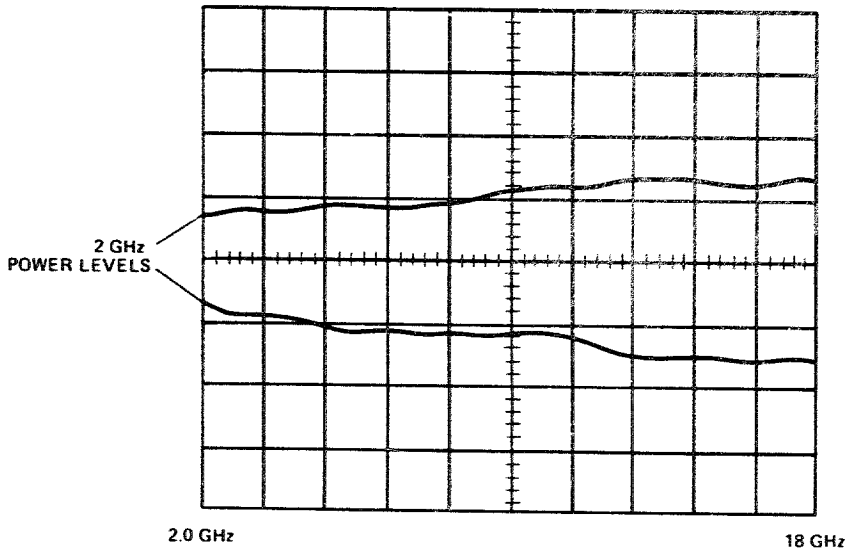
8. Check that the peak-to-peak variation between the two measurements is less than 1.0 dB.

9. Install 86290A RF Plug-in and set the sweep oscillator for a start/stop frequency of 2 to 18 GHz. Adjust the RF Plug-in power level to +10 dBm.

10. Adjust 8755C CHANNEL 1 REFERENCE LEVEL VERNIER to position the left edge of the trace (2 GHz) at the same level as marked in step 7. See Figure 4-5.



a. .01 TO 2 GHz MEASUREMENT DISPLAY



b. 2 TO 18 GHz MEASUREMENT DISPLAY

Figure 4-5. 8755C Displays

11. Mark the trace with a grease pencil.

12. Exchange the connections of the two detectors in the test setup. (Reverse the connections to the attenuators on the power splitter output ports, and reverse connections to the 8755C A and R inputs.)

13. Adjust 8755C CHANNEL 1 REFERENCE LEVEL VERNIER to position the left edge of the trace (2 GHz) at the same level as marked in step 4 (see Figure 4-5).

14. Verify that peak-to-peak variation between the two traces is within the following specifications. Use sweep oscillator intensity markers to determine each frequency range.

2 to 8 GHz:	<1.0 dB peak-to-peak
8 to 12 GHz:	<2.0 dB peak-to-peak
12 to 18 GHz:	<3.0 dB peak-to-peak

Table 4-2. Performance Test Record

Hewlett-Packard Model 11664A Detector Tested by _____

Serial No. _____ Date _____

Paragraph Number	Test	Minimum	Actual	Maximum
4-4.	**RETURN LOSS**			
	10 to 40 MHz:	10 dB	_____	
	40 MHz to 4 GHz:	19 dB	_____	
	4 to 8 GHz:	16 dB	_____	
	8 to 18 GHz:	10 dB	_____	
4-5.	**TRACKING BETWEEN TWO DETECTORS**			
	10 MHz to 8 GHz:		_____	<0.5 dB
	8 to 12 GHz:		_____	<1.0 dB
	12 to 18 GHz:		_____	<1.5 dB

SECTION V
ADJUSTMENTS

5-1. The HP Model 11664A Detector has no adjustments or factory selected components.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

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. Figure 6-1 contains an illustration and parts listing for the RF input connector assembly. Table 6-3 gives all the manufacturers' code numbers that are used in the parts list.

6-2. ILLUSTRATIONS

Figure 6-1 illustrates the replaceable assemblies included in the 11664A Detector and provides the Hewlett-Packard part numbers. The RF input assembly is detailed in Figure 6-2. Available connector assemblies for changing the configuration of the RF input are illustrated in Figure 6-3.

Table 6-1. Reference Designators and Abbreviations Used in Manual

REFERENCE DESIGNATORS

A ..... Assembly
C ..... Capacitor
CR ..... Diode
J ..... Jack
P ..... Plug
Q ..... Transistor
R ..... Resistor
W ..... Cable

ABBREVIATIONS

B

BE ..... Baume, Beryllium

C

CER ..... Ceramic
CM ..... Centimeter
CU ..... Copper, Cubic

D

DBM ..... Decibels Referred to 1 Milliwatt
DC ..... Direct Current, Double Contact
DIM ..... Dimension
DO ... Package Type Designation

F

F ..... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency
FT ..... Current Gain Bandwidth Product (Transition Frequency); Feet, Foot
FXD ..... Fixed

G

GHZ ..... Gigahertz

I

IN ..... Inch, Indium

K

K ..... Kelvin, Key, Kilo, Potassium

M

MA ..... Milliampere
MHZ ..... Megahertz
MW ..... Milliwatt

N

N ..... Fan Out, Intrinsic Stand Off Ratio, Nano, Nanosecond, Nitrogen, None
NPN ..... Negative Positive Negative (Transistor)

P

P ..... Peak, Phosphorus, Pico, Picosecond, Pitch, Plastic, Plug, Pole, Polyester, Power, Probe, Pure
PD ..... Pad, Palladium, Pitch Diameter, Power Dissipation
PF ..... Picofarad; Pipe, Female Connection; Power Factor
PNP ..... Positive Negative Positive (Transistor)

R

RF ..... Radio Frequency

S

SI ..... Silicon, Square Inch

T

TA ..... Ambient Temperature, Tantalum
TC ..... Thermoplastic
TO ..... Package Type Designation, Troy Ounce

U

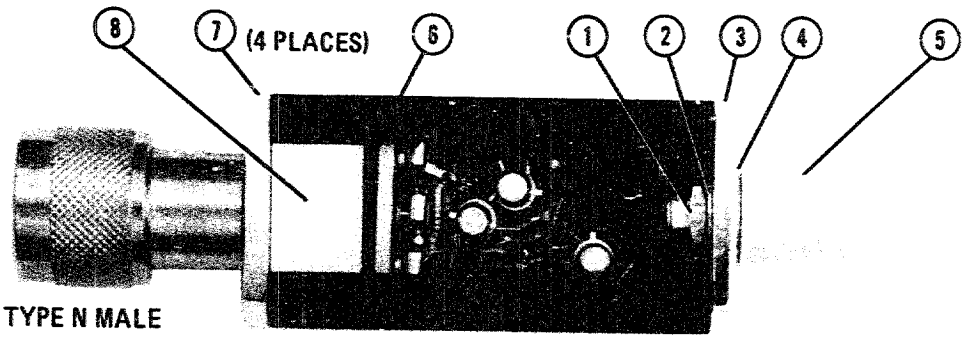
UF ..... Microfarad

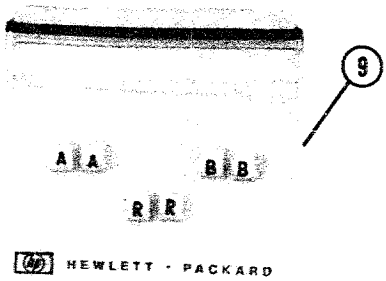
V

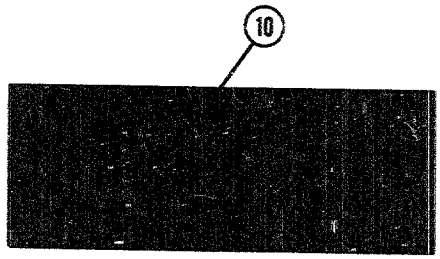
V ..... Vanadium, Variable, Violet, Volt, Voltage
VDC ..... Volts, Direct Current

W

W ..... Watt, Wattage, White, Wide, Width, Wire

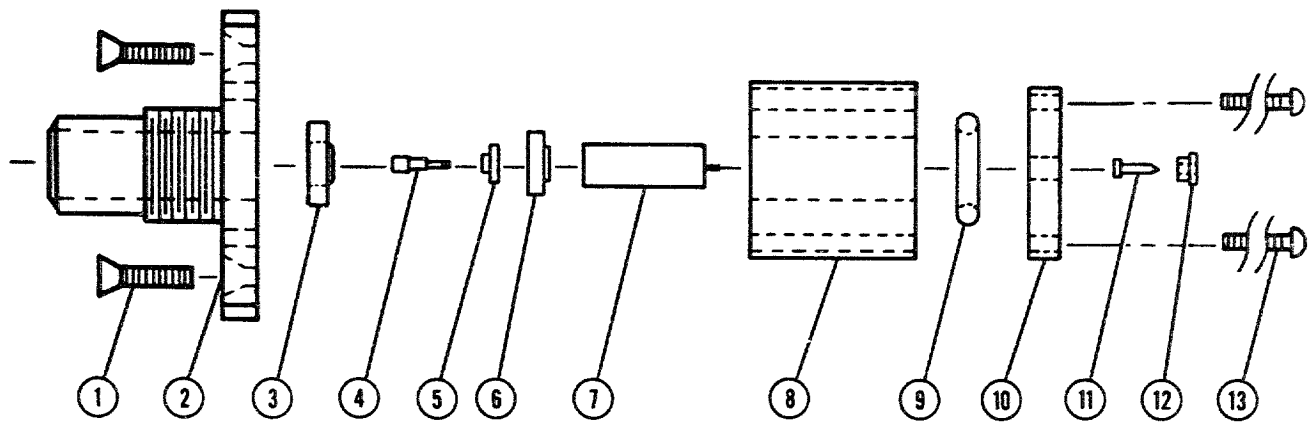






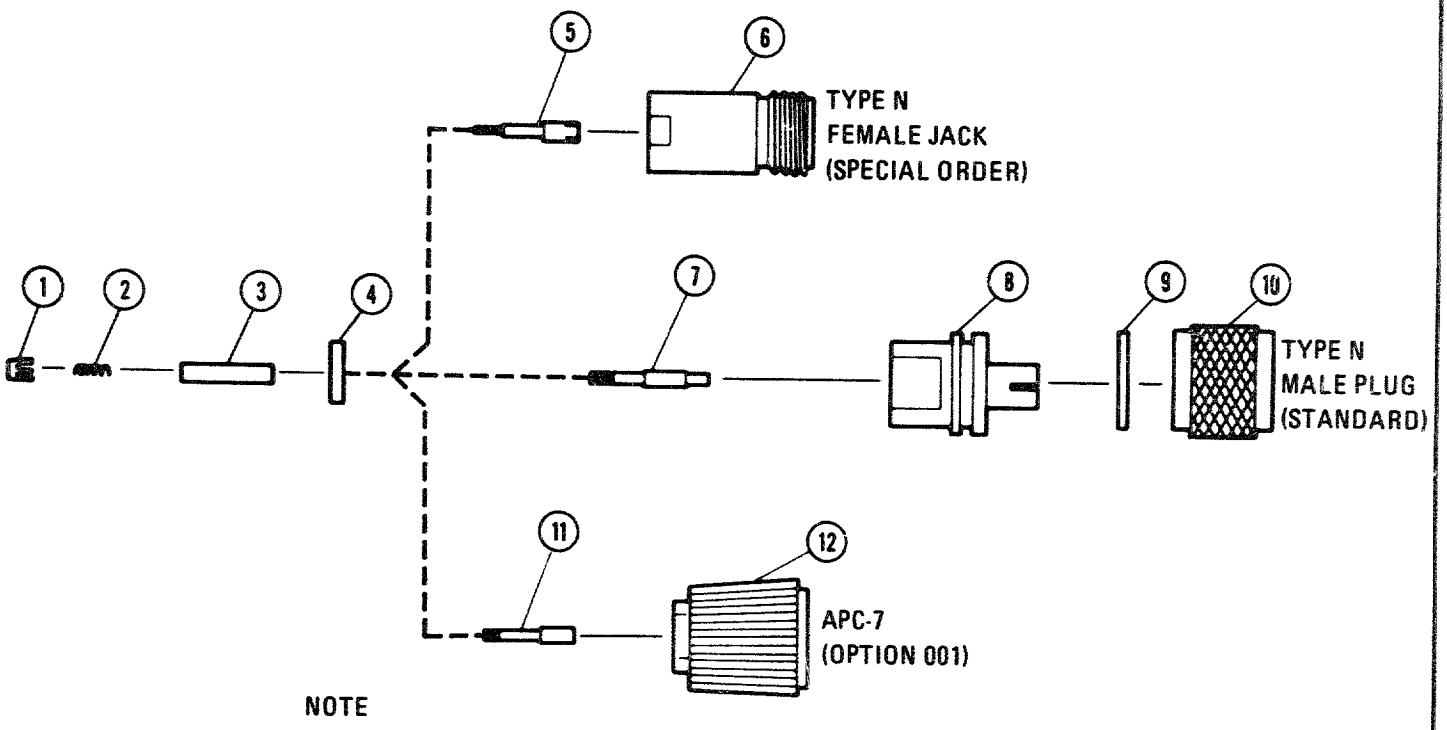
Item	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
1	2950-0001	8	1	NUT-HEX-DOUBLE CHAMFER	28480	2950-0001
2	2190-0016	3	1	WASHER-LOCK INTERNAL TOOTH ⅜ IN .377-IN-ID	28480	2190-0016
3	11664-20004	7	1	END PLATE	28480	11664-20004
4				WASHER, P/O W1		
5	8120-1788	7	1	CABLE ASSEMBLY W1 (INCLUDES P1)	28480	8120-1788
6	11664-20005	8	1	DETECTOR HOUSING	28480	11664-20005
7	2200-0167	8	4	SCREW-MACHINE 4-40 .188-IN-LONG 82 DEGREE	28480	2200-0167
8	11664-60003	0	1	A2 RF INPUT ASSEMBLY (INCLUDES RF INPUT CONNECTOR)	28480	11664-60003
9	5061-1044	9	1	CABLE MARKER KIT	28480	5061-1044
10	11664-00001	2	1	BOTTOM COVER	28480	11664-00001

Figure 6-1. Replaceable Assemblies



Item	Description	Qty	CD	HP Part Number	Mfr Code	Mfr Part Number
1	Screw Mach 4-40 x 0.375	4	8	2200-0167	28480	2200-0167
2	Connector Mounting Body	1	6	11664-20003	28480	11664-20003
3	Transition Washer	1	9	11664-20006	28480	11664-20006
4	Capacitor-Pin Assy	1	2	11664-60005	28480	11664-60005
5	Teflon Washer: Large	1	7	33102-20007	28480	33102-20007
6	Brass Washer: Small	1	6	33102-20006	28480	33102-20006
7	Diode	1	3	5086-7052	28480	5086-7052
8	Mounting Block	1	5	11664-20002	28480	11664-20002
9	O-Ring	1	8	0905-0371	28480	0905-0371
10	Mounting Plate	1	3	11664-00002	28480	11664-00002
11	Contact	1	2	1251-7517	28480	1251-7517
12	Teflon Washer: Small	1	3	5020-7422	28480	5020-7422
13	Screw Mach 2-56 x 0.75, gold plated (Do NOT use stainless steel)	2	0	11664-20007	28480	11664-20007

Figure 6-2. A2 RF Input Assembly Replaceable Parts



NOTE

HP Part Numbers for the assembled RF connectors (J1) are available in Table 6-2.

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	5020-3297	2	1	CONTACT-SLIDING	28480	5020-3297
2	1460-0977	7	1	SPRING-COMPRESSION, 0.054-IN-OD	00000	ORDER BY DESCRIPTION
3	5020-3296	1	1	CONDUCTOR-CENTER	28480	5020-3296
4	5040-0306	0	1	INSULATOR	28480	5040-0306
5	1250-0915	8	1	CONTACT-RF CONNECTOR, TYPE N FEMALE	28480	1250-0915
6	1250-0914	7	1	BODY-RF CONNECTOR, TYPE N FEMALE	28480	1250-0914
7	1250-0917	0	1	CONTACT-RF CONNECTOR, TYPE N MALE	28480	1250-0917
8	1250-0916	9	1	BODY-RF CONNECTOR, TYPE N MALE	28480	1250-0916
9	1250-0016	0	1	RING-RETAINING	28480	1250-0016
10	1250-0918	1	1	NUT-COUPLING, TYPE N	28480	1250-0918
11	1250-0816	8	1	CONTACT-RF CONNECTOR, APC-7	28480	1250-0816
12	1250-0909	0	1	ASSEMBLY-RF CONNECTOR, APC-7	28480	1250-0909

Figure 6-3. Replaceable Parts

Table 6-2 Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	**11664-60001**	**6**	**1**	**BOARD ASSEMBLY-PREAMPLIFIER**	**28480**	**11664-60001**
A1C1	0160-3878	6	1	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A1C2	0180-2492	0	2	CAPACITOR-FXD 2.7UF ±10% 20VDC TA	28480	0180-2492
A1C3	0180-2492	0		CAPACITOR-FXD 2.7UF ±10% 20VDC TA	28480	0180-2492
A1CR1	1901-0025	2	2	DIODE-GENERAL PURPOSE 100V 200MA DO-7	28480	1901-0025
A1CR2	1901-0025	2		DIODE-GENERAL PURPOSE 100V 200MA DO-7	28480	1901-0025
A1J1	0363-0070	4	1	CONTACT-ELECTRICAL BE CU DIM(IN): .125	28480	0363-0070
A1Q1	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A1Q2	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A1Q3	1854-0071	7	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q4	1853-0007	7		TRANSISTOR PNP 2N3251 SI	04713	2N3251
A1R1	0698-7249	2	1	RESISTOR 3.48K 1% .05W F TC=0±100	24546	C3-1/8-TO-3481-G
A1R2	0698-7279	8	1	RESISTOR 61.9K 1% .05W F TC=0±100	24546	C3-1/8-TO-6192-G
A1R3	0698-8273	4	1	RESISTOR 133 0.5% .05W F TC=0±100	19701	MF3C-1/20-133R-D
A1R4	0698-7236	7	1	RESISTOR 1K 1% 0.5W F TC=0±100	24546	C3-1/8-TO-1001-G
A1R5	0698-7238	9	1	RESISTOR 1.21K 1% 0.05W F TC=0±100	24546	C3-1/8-TO-1211-G
A1R6	0698-8274	5	1	RESISTOR 348 0.5% 0.05W F TC=0±100	19701	MF3C-1/20-348R-D
A1R7	0698-7205	0	2	RESISTOR 51.1 1% 0.05W F TC=0±100	24546	C3-1/8-TO-51R1-G
A1R8	0698-7205	0		RESISTOR 51.1 1% 0.05W F TC=0±100	24546	C3-1/8-TO-51R1-G
A2	**11664-60003**	**0**	**1**	**RF INPUT ASSEMBLY (INCLUDES RF INPUT CONNECTOR)**	**28480**	**11664-60003**
				Figure 6-2 details lower level parts for A2.		
				NOTE **The following connector assemblies are illustrated in Figure 6-3.**		
J1	**11665-60009**	**7**	**1**	**INPUT CONNECTOR: TYPE N MALE STANDARD**	**28480**	**11665-60009**
J1	11665-60010	0	0	INPUT CONNECTOR: APC-7 **OPTION 001**	28480	11665-60010
J1	11665-60008	6	0	INPUT CONNECTOR: TYPE N FEMALE **SPECIAL ORDER**	28480	11665-60008

See introduction to this section for ordering information

Table 6-3. Manufacturers Code List

MFR. NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
28480	HEWLETT-PACKARD CO. CORPORATE HQ.	PALO ALTO	CA	94304
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85036
19701	MEPCO/ELECTRA CORP.	MINERAL WELLS	TX	76067
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701

6-3. REPLACEABLE PARTS LIST

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

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

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

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. Description of the part.

e. A typical manufacturer of the part in a five-digit code.

f. The manufacturer's 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.

6-4. ORDERING INSTRUCTIONS

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number (with the check digit), indicate the quantity required, and address the order to the nearest Hewlett-Packard office. The check digit (CD) will ensure accurate and timely processing of your order.

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.

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

This section contains information for adapting this manual to instruments for which the content does not directly apply.

7-2. MANUAL CHANGES

To adapt this manual to your instrument, refer to Table 7-1 and make all of the manual changes listed opposite your instrument serial number. Perform these changes in the sequence listed.

If your instrument serial number is not listed on the title page of this manual or in Table 7-1 below, it may be documented in a yellow Manual Changes Supplement. For additional important information regarding serial number coverage refer to INSTRUMENTS COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Change
1716A	A, B
1531A	A, B
1413A	A, C
1244A01900 through 1244A0166	A, D
1244A01165 and below	A, D, E
1244A00237 and below	A, D, E, F

CHANGE A

Table 1-1:

Delete specification entitled: **Tracking Between Two Detectors.**

Section IV

Delete Paragraph 4-5.

Table 4-2:

Delete specification for **Tracking Between Two Detectors.**

CHANGE B

Table 1-1:

Change the Return Loss specification as follows:

10 MHz to 40 MHz: ≥15 dB (≤1.43 SWR)
40 MHz to 4 GHz: ≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz: ≥17 dB (≤1.32 SWR)
8 GHz to 18 GHz: ≥11 dB (≤1.78 SWR)

Section IV

Paragraph 4-4:
Change the Return Loss specification to read as follows:

10 MHz to 40 MHz: ≥15 dB (≤1.43 SWR)
40 MHz to 4 GHz: ≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz: ≥17 dB (≤1.32 SWR)
8 GHz to 18 GHz: ≥11 dB (≤1.78 SWR)

Table 4-1:
Replace Table 4-1 with the following:

Specification	Lower Limit of Reading		
	Coupler Directivity		
	26 dB	30 dB	40 dB
20 dB	26 dB	23.3 dB	20.9 dB
17 dB	20.9 dB	19.2 dB	17.7 dB
10 dB	11.7 dB	11.0 dB	10.3 dB
7 dB	8.2 dB	7.8 dB	7.3 dB

Table 4-2:
Change the Return Loss specification to the following:

10 MHz to 40 MHz: ≥15 dB (≤1.43 SWR)
40 MHz to 4 GHz: ≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz: ≥17 dB (≤1.32 SWR)
8 GHz.to 18 GHz: ≥11 dB (≤1.78 SWR)

CHANGE C

Table 1-1:
Change the Return Loss specification to read as follows:

10 MHz to 40 MHz: ≥10 dB (≤1.92 SWR)
40 MHz to 4 GHz: ≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz: ≥17 dB (≤1.32 SWR)
8 GHz to 16 GHz: ≥10 dB (≤1.92 SWR)
16 GHz to 18 GHz: ≥ 7 dB (≤2.61 SWR)

Section IV

Paragraph 4-4:
Change the Return Loss specification to read as follows:

10 MHz to 40 MHz: ≥10 dB (≤1.92 SWR)
40 MHz to 4 GHz: ≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz: ≥17 dB (≤1.32 SWR)
8 GHz to 16 GHz: ≥10 dB (≤1.92 SWR)
16 GHz to 18 GHz: ≥ 7 dB (≤2.61 SWR)

Table 4-2:
Change the Return Loss specification to the following:

10 MHz to 40 MHz:	≥10 dB (≤1.92 SWR)
40 MHz to 4 GHz:	≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz:	≥17 dB (≤1.32 SWR)
8 GHz to 16 GHz:	≥10 dB (≤1.92 SWR)
16 GHz to 18 GHz:	≥ 7 dB (≤2.61 SWR)

CHANGE D

Table 1-1:
Change the Frequency Range specification to "100 MHz to 18 GHz (usable to 10 MHz)."

Change the Return Loss specification to read as follows:

100 MHz to 4 GHz:	≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz:	≥17 dB (≤1.32 SWR)
8 GHz to 16 GHz:	≥10 dB (≤1.92 SWR)
16 GHz to 18 GHz:	≥ 7 dB (≤2.61 SWR)

Section IV

Paragraph 4-4:
Change the return loss specification to read as follows:

100 MHz to 4 GHz:	≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz:	≥17 dB (≤1.32 SWR)
8 GHz to 16 GHz:	≥10 dB (≤1.92 SWR)
16 GHz to 18 GHz:	≥ 7 dB (≤2.61 SWR)

Table 4-2:
Change the Return Loss specification as follows:

100 MHz to 4 GHz:	≥20 dB (≤1.22 SWR)
4 GHz to 8 GHz:	≥17 dB (≤1.32 SWR)
8 GHz to 16 GHz:	≥10 dB (≤1.92 SWR)
16 GHz to 18 GHz:	≥ 7 dB (≤2.61 SWR)

CHANGE E

Section VIII

Figure 8-2:
Replace Figure 8-2 with Figure 7-1.

Figure 8-8:
Replace Figure 8-8 with Figure 7-2.

CHANGE F

Table 6-2:
Delete A1C1

Figure 8-9:
Delete A1C1

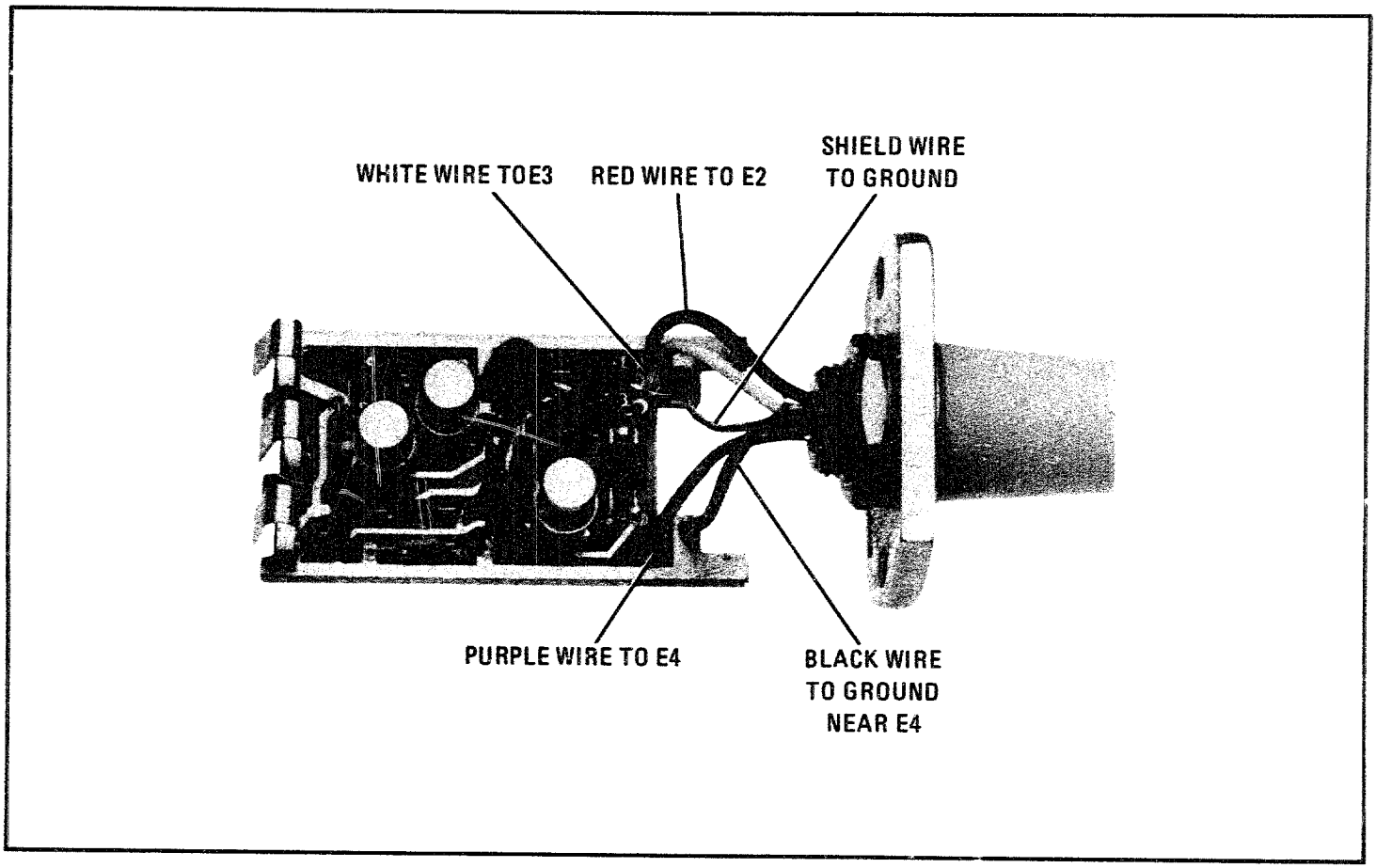


Figure 7-1. Cable Connections

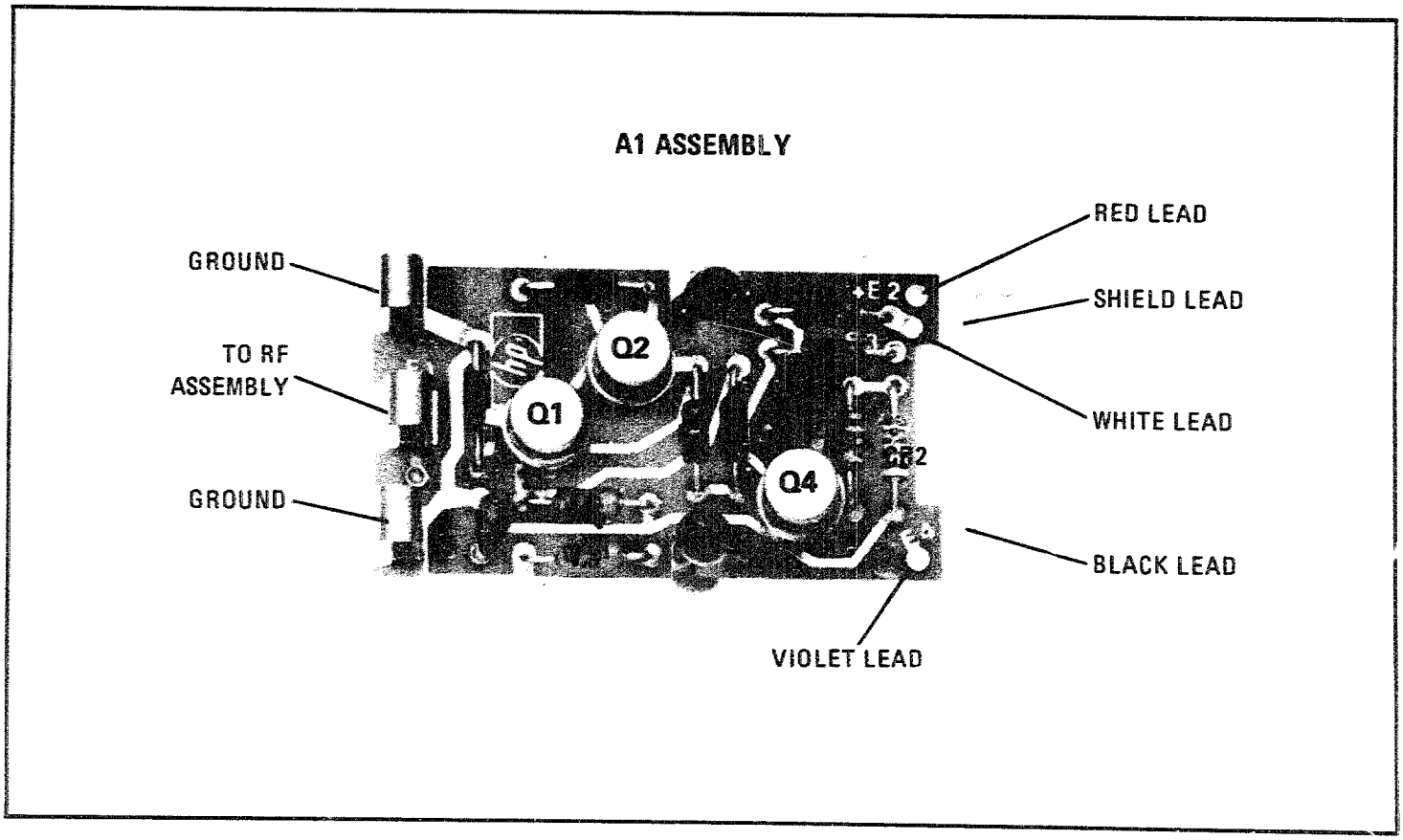


Figure 7-2. A1 Preamplifier Component Identification Illustration

SECTION VIII
SERVICE

8-1. INTRODUCTION

This section provides repair procedures and troubleshooting hints to aid in servicing the 11664A Detector. The instrument's electrical configuration is documented with a schematic diagram, circuit description, and component location map.

8-2. RECOMMENDED TEST EQUIPMENT

Table 1-3 lists the recommended model numbers of equipment required to test and maintain the 11664A Detector.

8-3. REPAIR

The following repair procedures are provided:

Replacing or Repairing Type N Input Connectors
APC-7 Connector Center Collet Replacement
Removing/Installing the Printed Circuit Assembly
Replacing the Hot Carrier Diode Module

Figure 8-1 shows the major assemblies.

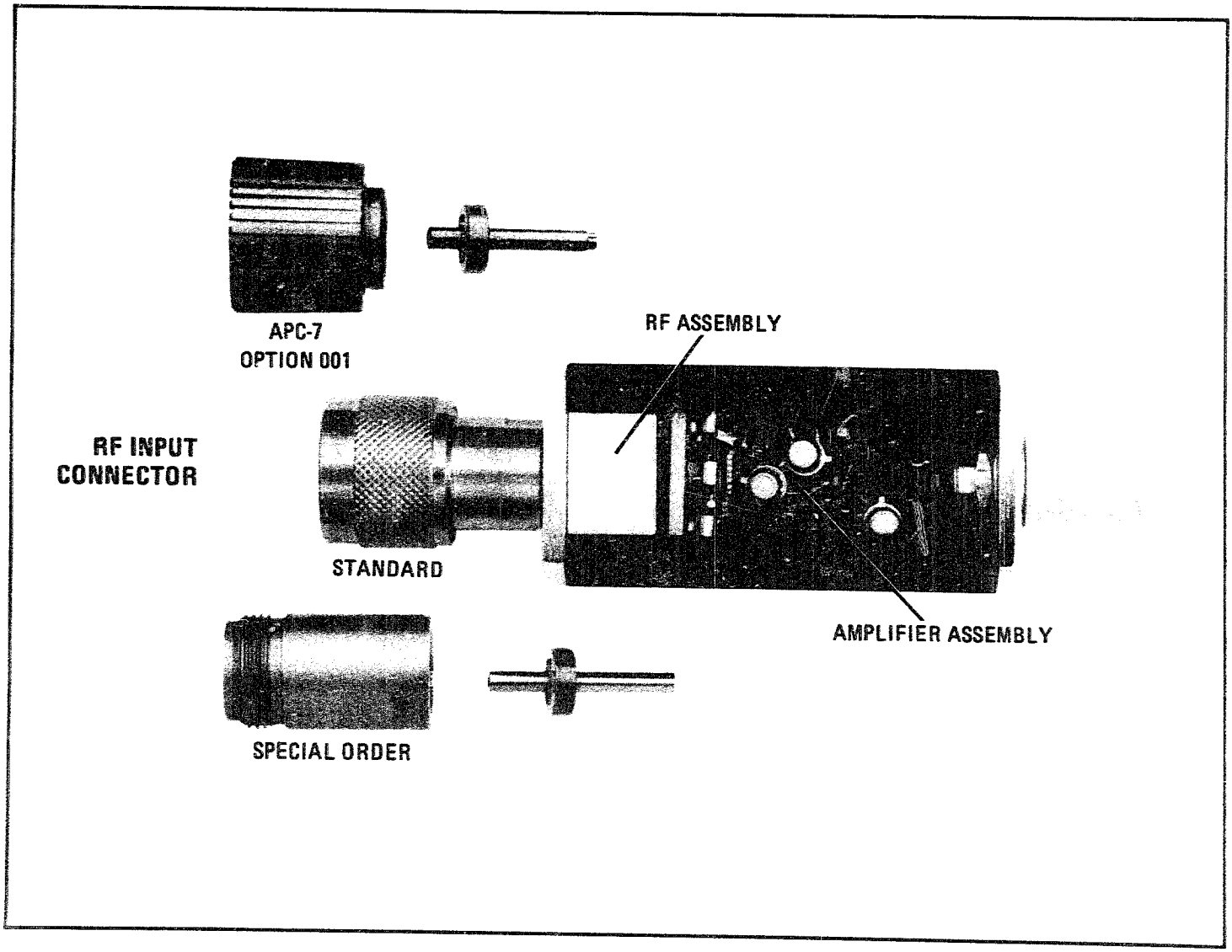


Figure 8-1. Major Assemblies

8-4. Replacing or Repairing Type N Input Connector

Center Conductor Replacement. There are two approaches to repairing a damaged or worn input connector. The first approach is conservative, but the confidence level is high: Order the assembled connector (J1 in Table 6-2) from your nearest Hewlett-Packard office. When it arrives simply remove the old connector and replace it with the new one using a 9/16-inch thin open-ended wrench, HP Part Number 8710-0877.

The second method is a bit more challenging: Assuming the damage (or wear-and-tear) has been correctly isolated to the inner conductor assembly, replacement parts may be ordered by using the reference diagram in Figure 6-3. When the damage is contained within the contact/insulator section of the inner conductor replace the entire inner conductor assembly. Disassembling the inner conductor is rarely accomplished without inflicting further damage.

When the parts arrive, summon forth your patience and dexterity and follow the procedure outlined below. Refer to Figure 6-3.

1. With a 9/16-inch open-end wrench, loosen the old connector assembly.

2. Remove the outer shell and discard the old inner conductor assembly.

3. Assemble the new inner conductor by inserting the threads of item ⑦ through item ④. Apply a drop of Locktite adhesive (HP Part Number 0470-0013) to the threads and attach item ③.

4. Insert the spring, ②, into the hollow of item ③. GENTLY grasp the contact, ①, and insert it into the center conductor. Ensure that none of the fingers of the sliding contact protrude from the center conductor. If the fingers aren't cooperating, wrap a fine piece of wire about the contact for easier insertion.

5. The tough part's over. Seat the inner conductor into the neck of the outer shell and screw it into place on the detector. Tighten with the 9/16-inch wrench.

Outer Shell Replacement. If the outer shell of the connector is damaged but the inner conductor is intact, order items ⑧, ⑨, and ⑩ on Figure 6-3 and proceed as follows:

1. Slide the retaining ring, ⑨, over the narrow lip of the connector body, ⑧, and into the channel. This should require only minimal prodding.

2. Set the knurled nut, ⑩, face down on a flat surface. Place the connector body/ring assembly into the nut. Compress the retaining ring with a pair of long nose pliers while applying considerable downward pressure on the connector body. The assembly should snap together.

8-5. APC-7 Connector Center Collet Replacement

The center contact of the APC-7 connector is susceptible to wear and damage. This contact is a small four-pronged collet which snaps into a recess in the center conductor and is held there by spring tension.

DO NOT REMOVE THIS CONTACT FOR INSPECTION as damage may occur. Examine this contact with a magnifying glass to determine if replacement is needed. The prongs should be equally spaced and free of burrs or wear.

NOTE

An APC-7 Connector Tool Kit is available from Hewlett-Packard. HP Model 11591A includes several center conductor collets and the tools necessary for APC-7 connector maintenance. The Operating Note supplied with the kit details all maintenance procedures.

If the collet is damaged or worn, it can be replaced separately by ordering HP Part Number 1250-0907. Proceed as follows:

1. Tap the connector lightly against a table top. This should cause the collet to protrude slightly. Use an extractor tool, HP Part Number 5060-0236. Insert the tool, jaws open, over the center conductor. (A mechanical drafting pencil may suffice if the extractor tool is not immediately available.)

2. Allow the jaws of the tool to close around the collet. Pull straight away from the connector without twisting.

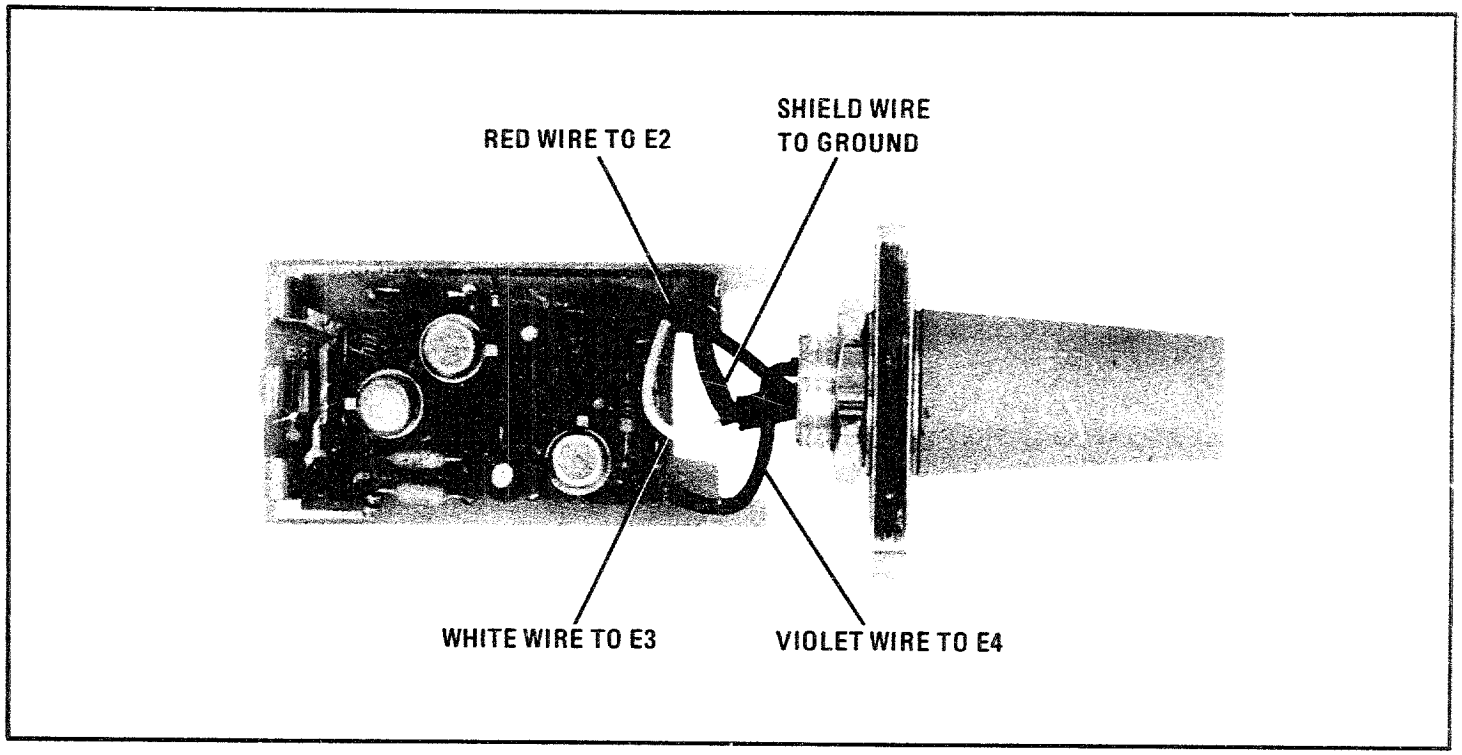


Figure 8-2. Cable Connections

3. Snap a new contact into place.

If the extractor tool is not available, you may opt to order a new inner conductor, items (1) through (4), and (11) listed in Figure 6-3. The contact collet is included with item (11). Follow the procedure in Paragraph 8-4, **Inner Conductor Replacement**, to assemble the APC-7 inner conductor. To remove the outer shell, use the 1/2 inch end of the open-ended wrench, HP Part Number 8710-0877.

8-6. Removing/Installing the Printed Circuit Assembly

Remove the two pozi-drive screws on the cable end of the 11664A. Slide the assembly out of the housing by pulling on the cable. The bottom cover of the 11664A may also be removed.

Prior to reinstalling the printed circuit board, ensure that all cable wires are securely connected to the board. Refer to Figure 8-2 for proper placement. Slide the board into the runners on the inside of the housing. Install and tighten two pozi-drive screws through the bottom cover.

8-7. Replacing the Hot Carrier Diode

Refer to Figure 8-3 while performing the following procedure:

DISASSEMBLY

1. Remove the two pozi-drive screws from the RF input end of the detector. Remove the RF input assembly.

2. Remove the two gold screws from the RF assembly and disassemble the package. Note the position of all parts, especially the three washers, items (3), (5), and (6).

REASSEMBLY

CAUTION

The diode module is very sensitive to static discharge. Please read the cautions in Section III, Operation, before attempting any repairs.

3. The new diode module may be supplied from the factory with long leads which must be trimmed before installation.

NOTE

Determine the polarity of the diode module as described below BEFORE trimming the leads.

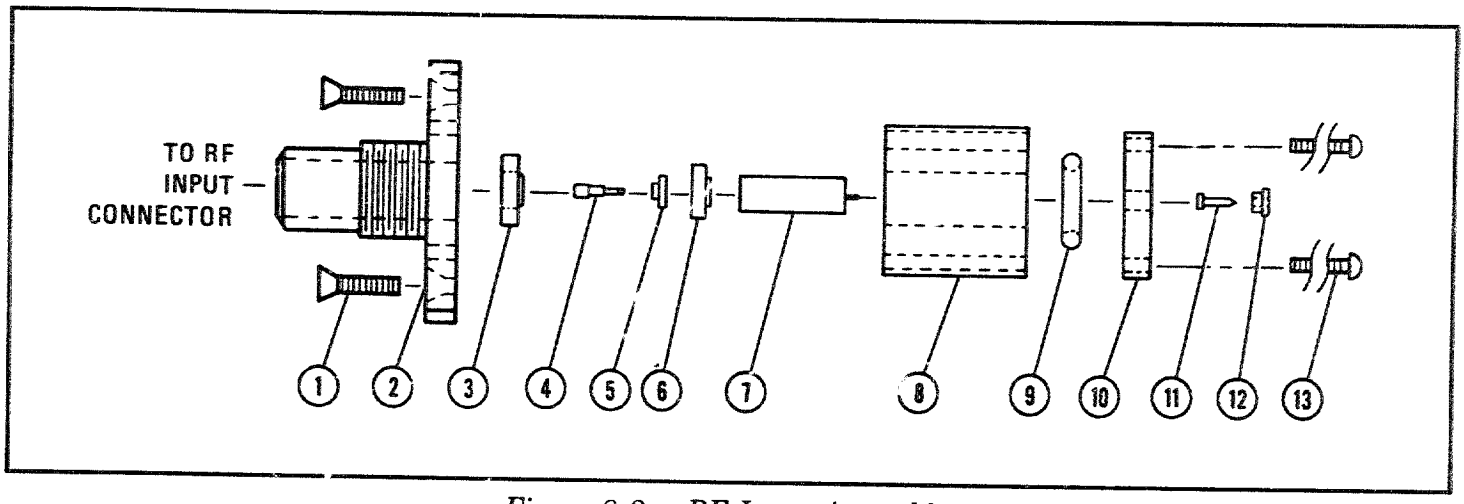


Figure 8-3. RF Input Assembly
(Parts for this Figure are listed in Figure 6-2.)

Figure 8-3 shows the RF end of the module on the left, the Preamplifier end on the right. The center lead which goes to the Preamplifier must be longer to ensure good contact with the printed circuit board.

One end of the module has a smaller, circular center conductor: this is the RF end. The other end has a larger, half-circle center conductor; this is the Preamplifier end. Cut the smaller, round con ductor lead (RF end) even with the end of the outer shell of the module. Cut the larger, half-circle conductor lead (Preamplifier end) 3/16 inch ± 1/32 inch beyond the end of the outer shell of the diode module.

4. Reassemble the RF input to the module beginning with items (3) through (6) as follows:

   Insert the Capacitor-Pin(4), through the teflon washer(5). Refer to Figure 8-3 for proper orientation of the lip of the washer.

   Pick up the diode module **by the outer shell.** Place the smaller brass washer,(6), onto the diode with the lip of the washer facing the module. Hold this assembly between thumb and forefinger. Now guide the Capacitor Pin onto the center conductor,(7).

   Add the transistion washer,(3), to the assembly. Take care not to pinch the sides of the teflon washer between the two brass washers. This will cause severe frequency response problems.

5. Slide the entire assembly into the aluminum mounting block(8).

   Place the red neoprene O-ring,(9), over the Preamplifier end of the diode outer shell.

   Set the mounting plate, (10), on top of the O-ring. Secure the assembly by inserting the pin/teflon washer assembly, (11) and (12), onto the diode lead.

6. Insert the two gold mounting screws, (13), through the mounting plate. Check the large brass washer. It has a tendency to break away from the assembly. Reseat it if necessary.

7. Set the RF input connector assembly face down on the table. Place the RF assembly onto the connector body,(2), guiding the two mounting screws,(1), into the tapped holes.

8. Proper tightening of the mounting screws is critical to the performance of the Detector. Both screws must be EQUALLY and FULLY tightened such that the mounting plate, (10), is parallel to the mounting block,(8).

9. Insert the completed assembly into the Detector housing. Insert and tighten the two pozidrive screws to secure the RF input assembly to the 11664A.

NOTE

Assembly alignment and clean contacts are critical to the performance of the 11664A. If the Detector does not comply with the performance specifications in Table 1-1, refer to Paragraph 8-9 for troubleshooting hints.

8-8. TROUBLESHOOTING

This troubleshooting section is designed to help the technician isolate the problem to the defective component.

1. Follow the procedure in Figure 8-4 to determine if the Detector has failed and to eliminate the possibility of failure in the 8755C Swept Amplitude Analyzer.

2. If the Detector is indeed the culprit, follow the procedures in Figure 8-5 to isolate the trouble to either the RF Assembly or the Preamplifier printed circuit board.

3. If the amplifier is suspected, follow the paths of Figure 8-7 to find the bad component.

4. If the failure is in the RF assembly, return the instrument to your nearest Hewlett-Packard Service Center. Or, if the DIODE ASSEMBLY proves to be shorted or open, replace it using the procedure in Paragraph 8-7.

8-9. Troubleshooting After Module Replacement

If, after replacing the diode module, the frequency response of the Detector exhibits gross frequency errors (e.g., power holes), suspect that the inner conductor may have been damaged during assembly or the teflon washer scched. Follow the disassembly/reassembly procedures to resolve the problem.

If the response of the Detector deteriorates at the high end of the frequency range, the mounting plate may be misaligned. This adjustment can be made most easily by setting up a frequency response measurement test consisting of a power splitter, reference detector and appropriate attenuators. The response of the detector (device under test) should resemble the graph in Table 1-2. If it does not, remove the RF input from the black housing. Reconnect the RF input to the test set. This will allow you to make quick response checks (slide the housing into place on the RF input connector) after adjusting the mounting screws.

8-10. Troubleshooting the Preamplifier Assembly

In order to troubleshoot the Preamplifier, a dummy input circuit (Figure 8-6) must be connected to the input of the Preamplifier. This circuit will provide the proper bias to the input transistor. In normal operation the Hot Carrier Diode in the RF Input Assembly provides the load for the Preamplifier. Follow the procedures in Figure 8-7.

If the equipment used in Figure 8-6 is not available, DC measurements may be used. The same dummy input circuit may be used to preserve the input bias. Any trouble will most likely shift the DC-coupled voltages far from their normal values. Start by measuring the input bias. If this voltage is >50% high or low, the voltages in the entire amplifier may be off. From this point on, standard transistor troubleshooting techniques should be used.

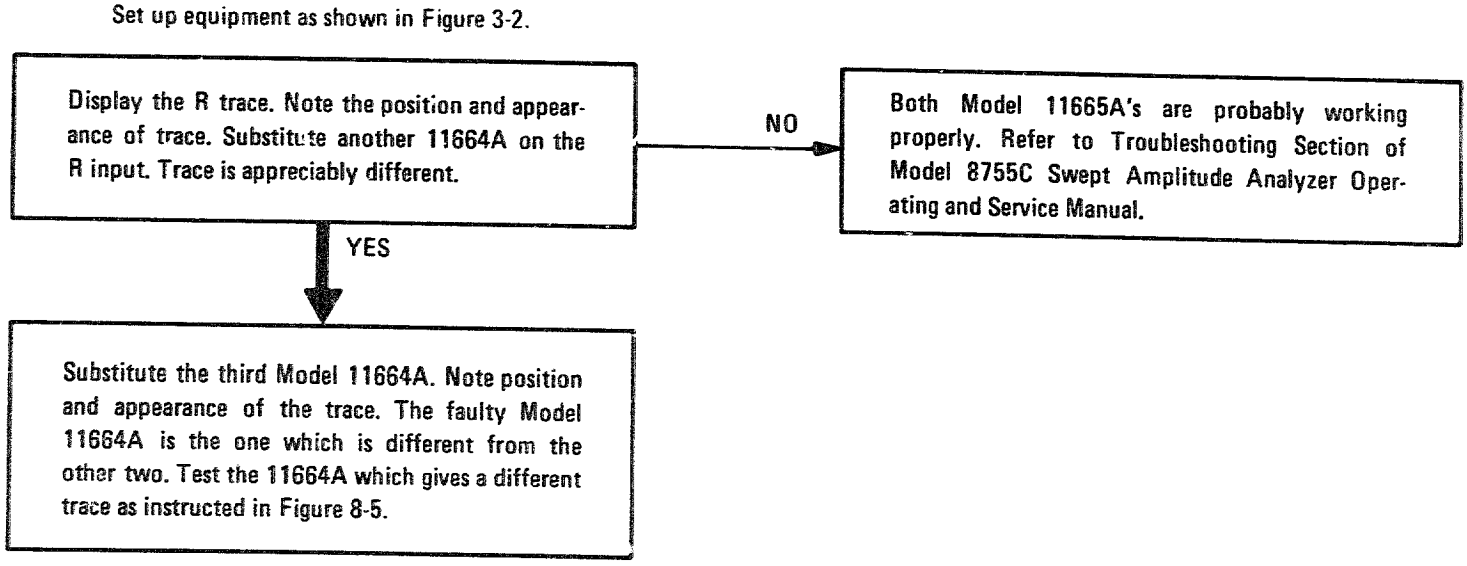


Figure 8-4. Preliminary Troubleshooting

From Figure 8-4, Preliminary Troubleshooting

Remove the Preamplifier from the 11664A as instructed in paragraph 8-6. Inspect cable wires going to printed circuit board. Wires OK.

NO → Repair Wiring.

YES ↓

Connect Preamplifier as shown in Figure 8-6. Apply a 10 mV 27.8 kHz signal. Measure output voltage. Output voltage >40 mV.

NO → The trouble is either in the Preamplifier or in the load to the Preamplifier. Remove plug W1P1 shell and measure resistance between pins 1 & 3. With polarity of ohmmeter connected for lowest resistance, the resistance should be >1000 ohms.

NO → Cable W1 or output of Preamplifier is shorted

YES ↓

YES ↓

Reverse the leads of the ohmmeter to pins 1 & 3. Resistance should read >30 Megohms.

NO → Cable W1 or output of Preamplifier is shorted.

YES ↓

Trouble is in RF Input Assembly. Replace Assembly as instructed in paragraph 8-6.

Trouble is in the Preamplifier. Refer to Figure 8-7 for further instructions.

Figure 8-5. Isolating Trouble to A2 RF Input Assembly or A1 Preamplifier

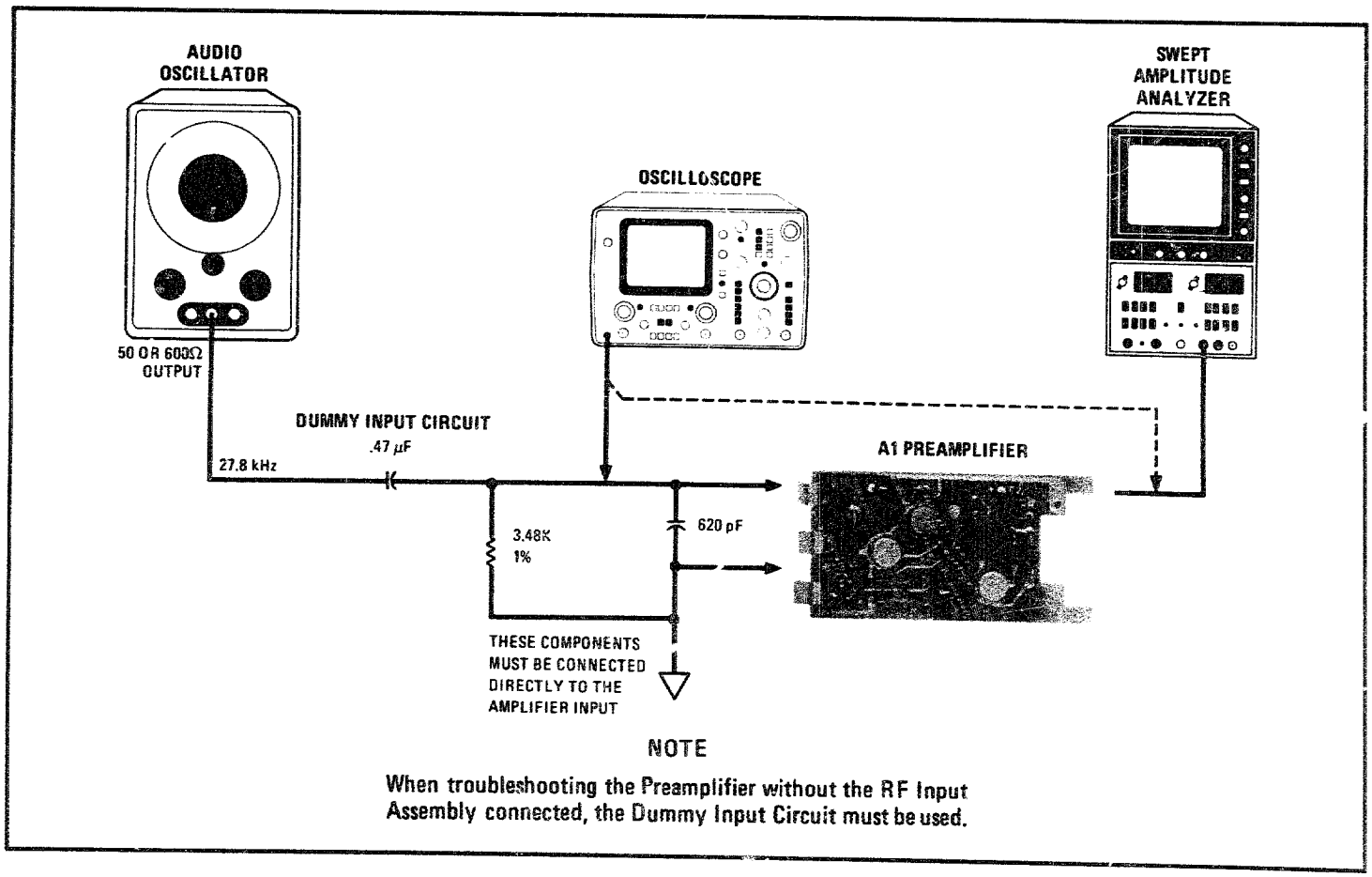


Figure 8-6. Test Setup for Measuring AC Gain

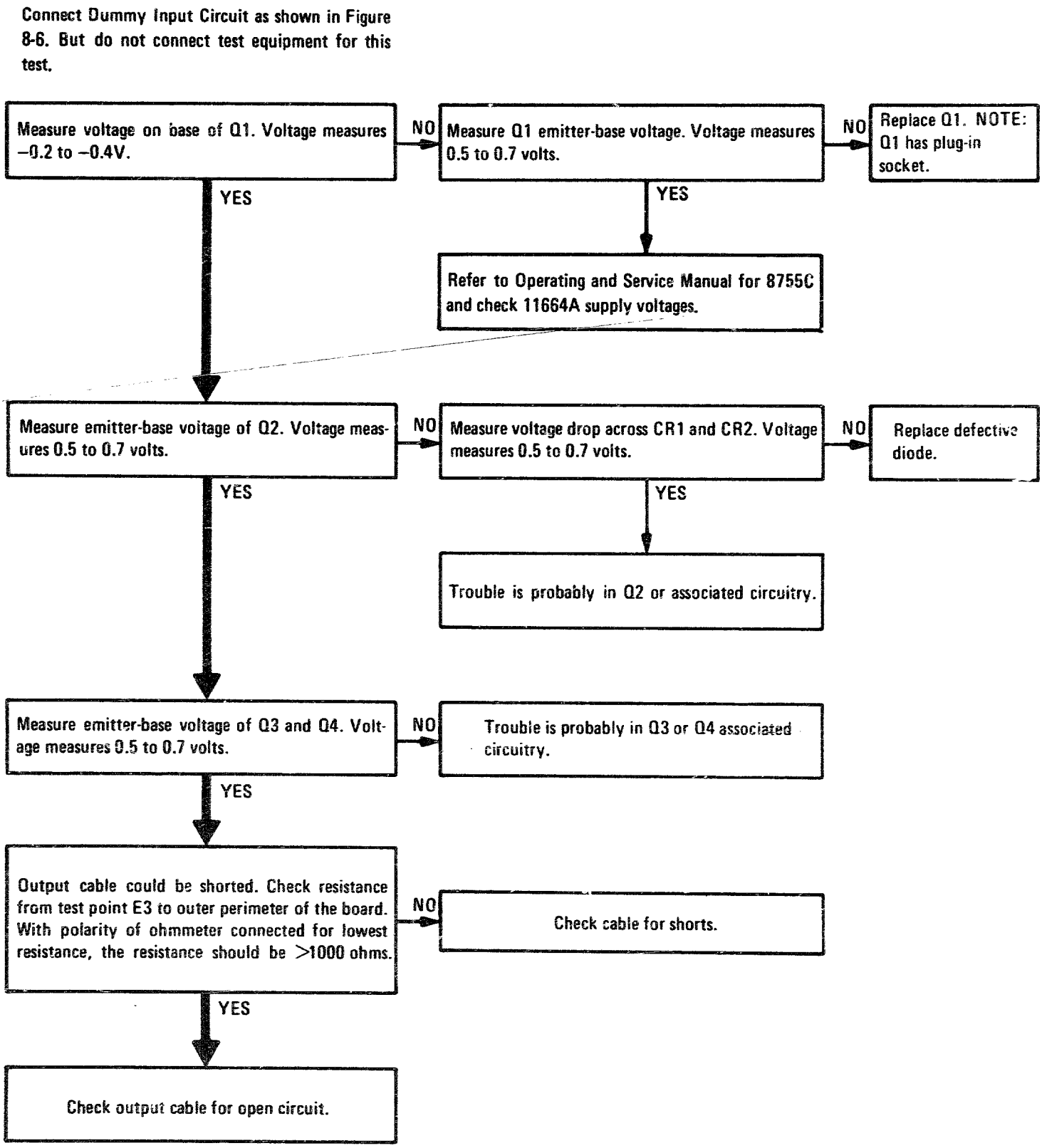


Figure 8-7. Isolating Trouble to an Individual Component in the A1 Preamplifier

PRINCIPLES OF OPERATION

The Model 11664A Detector consists of two basic assemblies, the A2 RF Input Assembly and the A1 Preamplifier Assembly.

A2 RF Input Assembly

The A2 RF Input Assembly consists of the input connector, the Hot Carrier Diode Assembly, and mounting hardware. The hot Carrier Diode consists of the diode itself and associated components in a hermetically sealed assembly. Capacitor A2C1 conducts the RF signal applied to the input connector to the Hot Carrier Diode A2CR1. Resistor A2R1 matches the impedance of the input to the cable. Diode A2CR1 detects the 27.8 KHz envelope of the modulated RF signal.

1A1 Preamplifier Assembly

The 27.8 KHz squarewave signal from the A2 RF Input Assembly is fed into the base of A1Q1. Resistor A1R1 reduces the input RC time-constant to less than 2 microseconds so that the input to the Amplifier will follow the modulation envelope at power levels greater than —5 dBm. A resistor, A1R2, adjusts the bias on the base of A1Q1 and across A1CR1.

Transistors A1Q1 and A1Q2 comprise a feedback pair. They are a high-gain direct-coupled amplifier stage composed of an NPN and a PNP transistor cascaded together. A positive-going pulse on the base of A1Q1 will increase the voltage through A1Q1, giving a negative-going pulse to the base of A1Q2. This pulse will, by a similar action, give a positive-going pulse going to the emitter of A1Q1. This positive-going pulse on the emitter of A1Q1 tends to limit the gain of the amplifier.

Transistors A1Q3 and A1Q4 are output emitter followers connected in parallel. They are complementary symmetry fed from the emitter and collector of A1Q1. The necessary difference in bias is furnished by diodes A1CR1 and A1CR2.

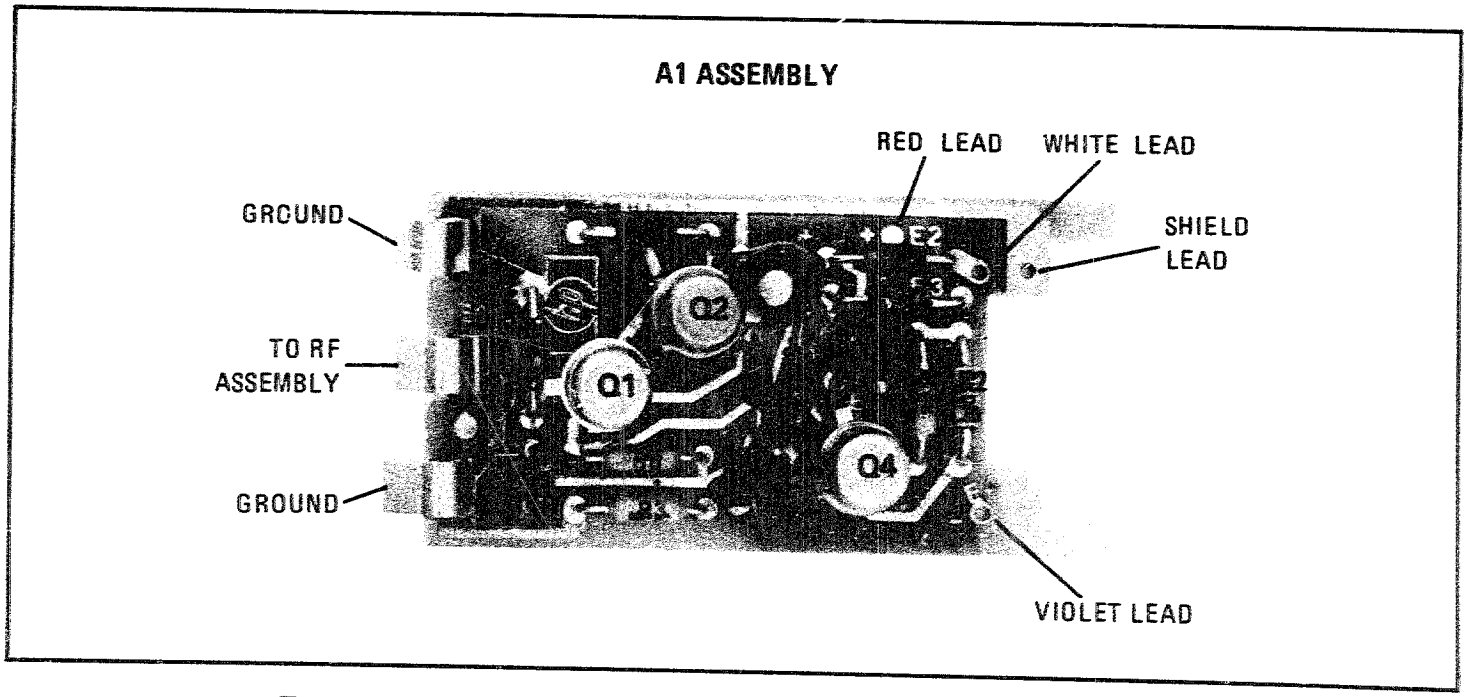
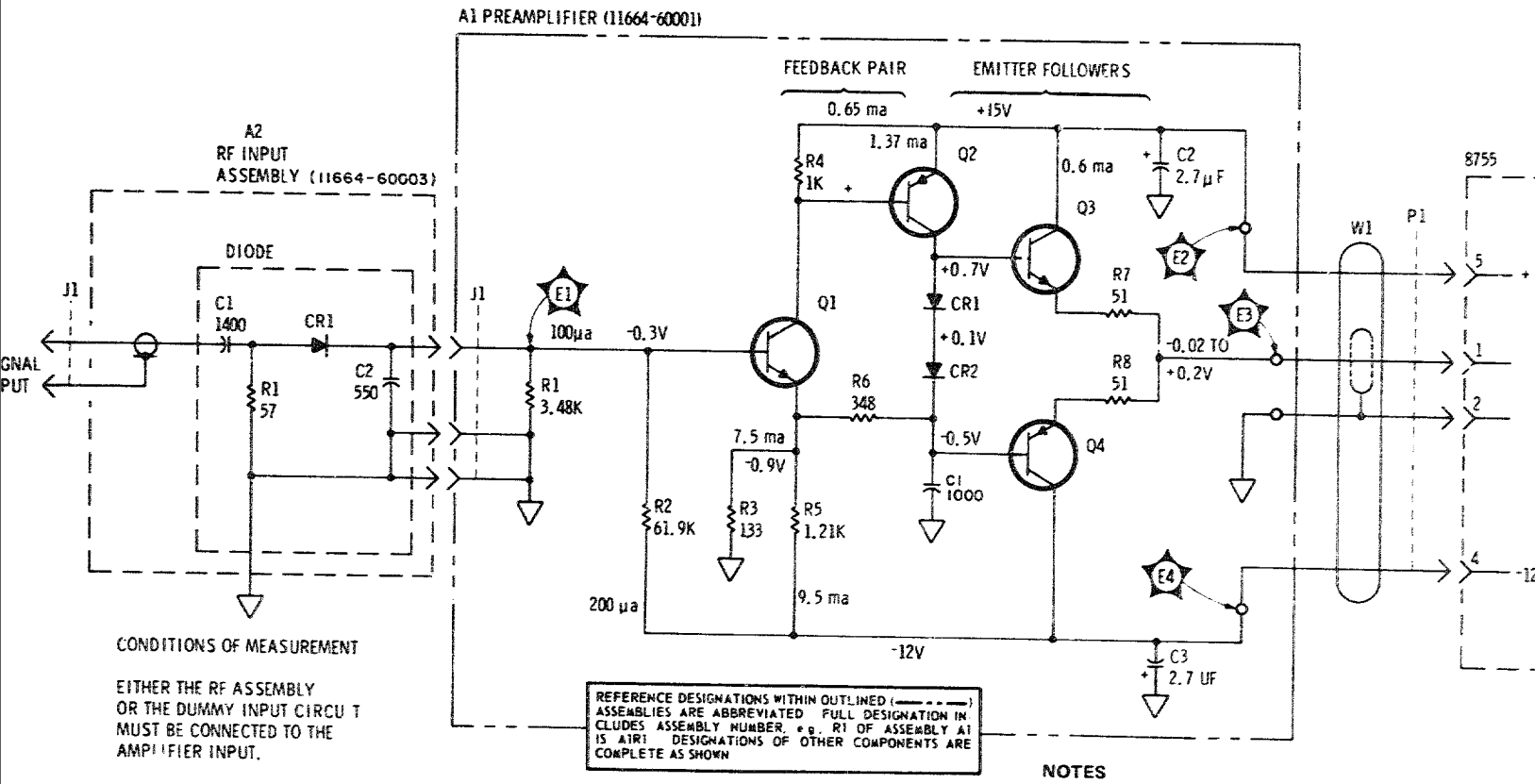


Figure 8-8. A1 Preamplifier Component Identification Illustration



NOTES

1. RESISTANCES ARE SHOWN IN OHMS AND CAPACI
   IN PICOFARADS UNLESS OTHERWISE INDICATED
2. VOLTAGES SHOWN ARE MEASURED TO COMMON