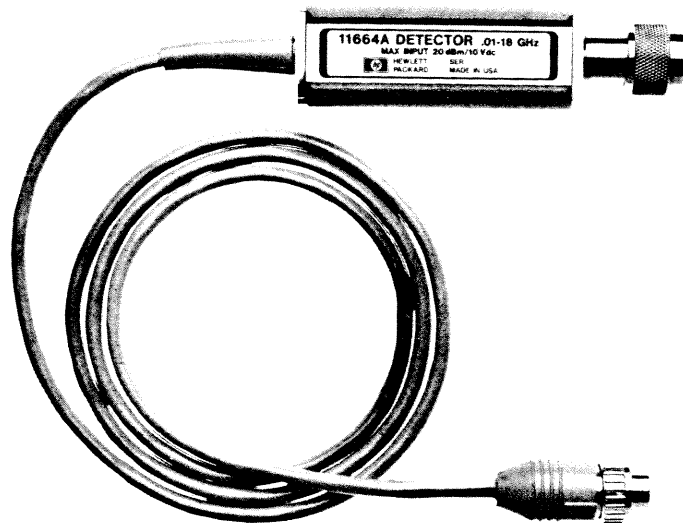


OPERATING AND SERVICE MANUAL

HP 11664A DETECTOR



Notice

Hewlett-Packard to Agilent Technologies Transition

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. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product name/number was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648 is now model number Agilent 8648.

Contacting Agilent Sales and Service Offices

The sales and service contact information in this manual may be out of date. The latest service and contact information for your location can be found on the Web at:

<http://www.agilent.com/find/assist>

If you do not have access to the Internet, contact your field engineer or the nearest sales and service office listed below. In any correspondence or telephone conversation, refer to your instrument by its model number and full serial number.

United States

(tel) 1 800 452 4844
(fax) 1 800 829 4433

Canada

(tel) +1 877 894 4414
(fax) +1 888 900 8921

Europe

(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Latin America

(tel) (305) 269 7500
(fax) (305) 269 7599

Japan

(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Australia

(tel) 1 800 629 485
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New Zealand

(tel) 0 800 738 378
(fax) 64 4 495 8950

Asia Pacific

(tel) (852) 3197 7777
(fax) (852) 2506 9284



Agilent Technologies

MANUAL CHANGES SUPPLEMENT

HP 11664A Detector

NOTE

Manual Change Supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically order the latest edition of this supplement. Copies are available through any HP office. When ordering copies, quote the supplement part number from the bottom of this page, or the model number and print date from the title page of the manual.

MANUAL IDENTIFICATION

Manual Part Number: 11664-90044

Date Printed: November 1983

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

TO USE THIS SUPPLEMENT: Make all changes applicable to the serial prefix or number of your instrument as indicated in the following reference table.

Note that there may be more than one Title Page and/or Parts Cross-Reference Table included in this supplement. The last change(s) applicable to your instrument will contain the most current information for these specific pages.

■ = NEW ITEM, CHANGED ITEM



Updates

Instructions

Page 2-1:

Add Figure 2-1, contained in this supplement.

Page 4-7, under Response Variation:

Change 8 to 11 HHZ to 8 to 12 GHz.

Change <1.5 GHz to <1.5 dB.

Page 6-3, Table 6-3:

Delete item 1.

Add 11664-60029, CD0, Qty 1, Rebuilt detector assy Type-N(m) Std.

Add 11664-60030, CD3, Qty 0, Rebuilt detector assy APC-7[®]1 Opt 001.

Add 11664-60031, CD4, Qty 0, Rebuilt detector assy Type-N(f) Special Order.

Delete item 2.

Change item 4 to 8120-3804, CD2.

Add footnote:¹APC-7 is a registered trademark of the Bunker-Ramo Corporation.

Page 8-2, Figure 8-2:

Change the BLACK WIRE board designation from E3 to E5.

Delete sections 8-7 and 8-8.

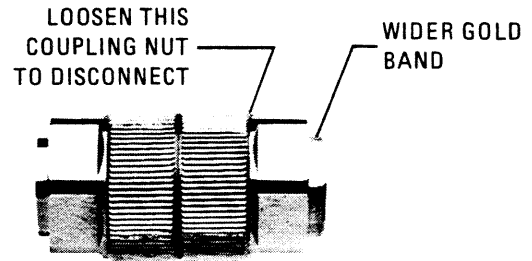
USE OF APC-7 CONNECTORS

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.
4. Do NOT tighten the other coupling nut since this will tend 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 OF APC-7 CONNECTORS

1. Keep contacting surfaces smooth and clean. Irregularities and foreign particles can degrade performance.
2. Protect the contacting surfaces when connector is not in use by leaving the coupling sleeve extended.
3. An accumulation of dust or grime can degrade connector performance. Periodic cleaning will avoid this. Use a soft brush (a toothbrush is acceptable) to clean the bead support and butting surfaces of the inner and outer contacts. DO NOT use solvents under any circumstances.



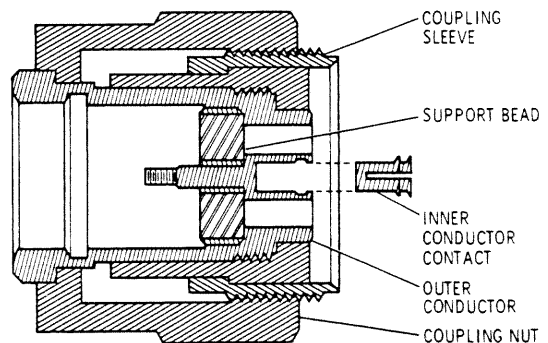
REPLACING APC-7 CENTER CONTACT

The inner conductor contact may be replaced if wear or damage is evident by inspection with a magnifying glass. The contact should have equally spaced prongs and be free of burrs or wear. **DO NOT REMOVE THE CONTACT FOR INSPECTION** as it may be damaged by removal. Do not reuse or attempt to repair a center contact which has been removed. To remove the contact, obtain HP 11591A APC-7 Connector Service Kit. Spare contacts,* tools for connector disassembly, and instructions are included in the kit.

2. Insert the centering pin of the HP contact extractor tool (HP Part No. 5060-0236) with the jaws open. Close the jaws and pull the contact straight out without twisting.
3. Snap a new contact in place with light finger pressure.

To replace an inner conductor contact:

1. With the connector positioned with the contact facing down, tap the connector lightly so that the contact protrudes slightly.



*Spare contacts are available separately as HP Part No. 1250-0907 or from Amphenol (Part No. 131-129, Amphenol RF Division, Danbury, Conn. 06810).

Figure 2-1. APC-7 Connectors (ERRATA)

CERTIFICATION

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

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

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

HP 11664A DETECTOR

SERIAL NUMBERS

This manual applies directly to serial number 25000 and above.

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

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1400 FOUNTAINGROVE PARKWAY, SANTA ROSA, CA 95401 U.S.A.

MANUAL PART NUMBER 11664-90044
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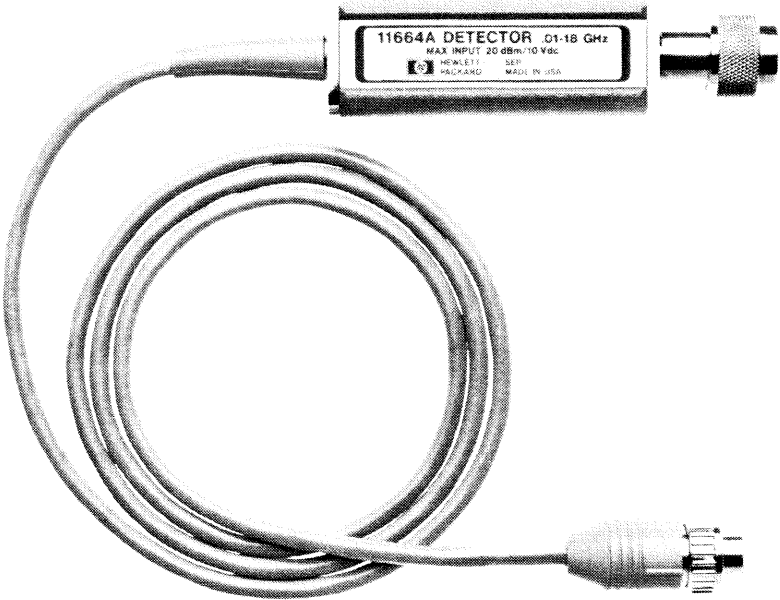
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TABLES

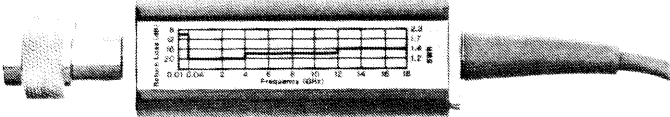
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HP 11664A DETECTOR

TOP



BOTTOM



CABLE MARKER KIT

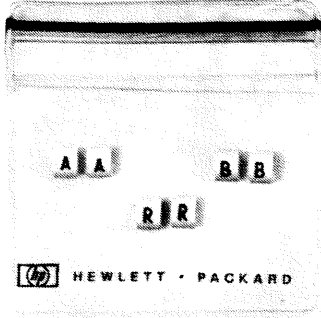


Figure 1-1. Model 11664A Detector

**SECTION I
GENERAL INFORMATION**

1-1. INTRODUCTION

1-2. This manual contains operating and service information for the Hewlett-Packard Model 11664A detector. The instrument and the supplied Cable Marker Kit are shown in Figure 1-1. Cable markers are used for identification when more than one detector is used in a test setup.

1-3. On the title page of this manual is a microfiche part number that can be used to order 10 cm x 15 cm (4 in x 6 in) microfilm transparencies of the manual. Each microfiche contains photocopies of up to 98 manual pages. The microfiche package also includes the latest Manual Changes Supplement as well as all pertinent Service Notes.

1-4. SPECIFICATIONS

1-5. Listed in Table 1-1 are the performance specifications for the HP 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.

1-6. SAFETY CONSIDERATIONS

1-7. The voltages present in the HP 11664A are not in the range to warrant more than normal caution.

1-8. INSTRUMENTS COVERED BY MANUAL

1-9. Each HP 11664A has a unique serial number. The contents of this manual apply directly to instruments with serial number 25000 and above. For instruments with serial numbers below 25000, refer to Operating and Service Manual HP Part Number 11664-90037.

1-10. An HP 11664A manufactured after the printing of this manual may require a yellow Manual Changes Supplement to document instrument "change information." The supplement will be included with the instrument manual. In addition to change information, the supplement contains information for correcting manual errors. 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 its print date and part number, which appear on the title page. Complimentary copies of the

Model 11664A

supplement are available from your local Hewlett-Packard office listed at the back of this manual.

1-11. DESCRIPTION

1-12. The HP 11664A detector must be used in conjunction with either the HP 8755C swept amplitude analyzer, or the HP 8756A scalar network analyzer. The HP 11664A detects RF signal levels from -50 to +10 dBm in the frequency range of 10 MHz to 18 GHz. The use of three HP 11664A detectors, or two detectors and a bridge enables simultaneous (amplitude only) transmission and reflection measurements via the analyzer CRT.

1-13. The HP 11664A detector and the input stages of the HP 8755C/8756A comprise an ac-coupled system. This detection scheme requires a 27.8 kHz squarewave amplitude modulation of the RF input signal. Additional information is provided in Paragraph 1-16, EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-14. OPTIONS

1-15. The HP 11664A detector is available with an *APC-7[®] RF input connector by ordering Option 001.

1-16. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-17. Reflection and transmission measurements require two or three HP 11664A detectors and either an HP 8755C swept amplitude analyzer, or an HP 8756A scalar network analyzer. Swept frequency measurements will require a sweep oscillator. In addition, the RF source signal must be amplitude modulated by a 27.8 kHz squarewave signal.

1-18. Sweep Oscillator

1-19. A sweep oscillator furnishes the RF input signal. The HP 8350 series or the HP 8620 series sweep oscillators may be used.

1-20. **HP 8350B Sweep Oscillator.** The HP 8350B sweep oscillator, used with an HP 83500 series RF plug-in, internally modulates the RF output signal when the front panel [MOD] button is enabled.

1-21. **HP 8620C Sweep Oscillator.** The HP 8620C sweep oscillator, used with an HP 86200 series plug-in, requires that the MODULATOR DRIVE signal from the analyzer be used. See plug-in Operating and Service Manual for details. This MODULATOR DRIVE signal is available at the front panel of the HP 8755C, and at the rear panel of the HP 8756A.

*APC-7[®] is a U.S. registered trademark of the Bunker Ramo Corp.

NOTE

Some earlier RF plug-ins (compatible with the HP 8620C) will require the use of an external Modulator (HP 11665B). Refer to the RF plug-in Operating and Service Manual for detailed information.

1-22. Modulator

1-23. The HP 11665B Modulator is designed to be used with either the HP 8755C swept amplitude analyzer, or the HP 8756A scalar network analyzer. The HP 8755C/8756A supplies a 27.8 kHz squarewave signal to the HP 11665B to squarewave modulate the RF signal.

1-24. EQUIPMENT AVAILABLE

1-25. Directional Couplers

1-26. 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 can be made concurrently with this setup. The HP 778D covers .1 to 2 GHz, and the HP 11692D covers from 2 to 18 GHz.

1-27. Directional Bridges

1-28. The HP 85021A/C are single-port directional bridges that allow transmission and reflection measurements from .01 to 18 GHz, with -40 dB directivity. The test port connector on the HP 85021A is an APC-7, and on the HP 85021C is a precision Type-N female.

1-29. The HP 11666A reflectometer bridge allows transmission and reflection measurements from .015 to 18 GHz. The HP 11666A houses two detectors, one in the reflection port, and one in the reference port. Because of this, only one HP 11664A detector is required for a ratio measurement.

1-30. Power Splitters

1-31. Ratio measurements to determine frequency response or other transmission characteristics can be obtained with a power splitter and two HP 11664A detectors. The HP 11667A power splitter provides this function from DC to 18 GHz.

Model 11664A

1-32. Accessories

1-33. The following accessories for the HP 11664A detector are available:

Model 11679A: 7.5 metre (25 foot) extension cable

Model 11679B: 60 metre (200 foot) extension cable

1-34. RECOMMENDED TEST EQUIPMENT

1-35. Equipment required for testing the HP 11664A is listed in Table 1-3. Other equipment may be substituted if it meets or exceeds the critical specifications indicated in the table.

Model 11664A

Table 1-1. Specifications

SPECIFICATIONS	
FREQUENCY	TRACKING BETWEEN TWO HP 11664A DETECTORS
Frequency Range: 10 MHz to 18 GHz	Tracking between two HP 11664A Detectors: Specified at same relative power level. Does not include mismatch or coupler uncertainties.
REFLECTION	
Return Loss (15 - 35° C):	
10 MHz to 40 MHz: ≥10 dB (≤1.92 SWR)	10 MHz to 8 GHz: <0.5 dB
40 MHz to 4 GHz: ≥20 dB (≤1.22 SWR)	8 GHz to 12 GHz: <1.0 dB
4 GHz to 12 GHz: ≥18 dB (≤1.29 SWR)	12 GHz to 18 GHz: <1.5 dB
12 GHz to 18 GHz: ≥16 dB (≤1.38 SWR)	

GENERAL	
Input Power Range: +10 to -50 dBm	
Temperature Range: Operation: 0° to 55°C (32° to 131°F); Storage: -40° to 75°C (-40° to 167°F)	
Input Impedance: 50 ohms nominal	
Connectors: Standard: Type N male Option 001: APC-7® Special Order: Type N Female	
Dimensions: Cable length is 1.2 metres (4 feet)	
Weight: Net 0.17 kg (6 oz.)	

Table 1-2. Supplemental Characteristics

<p>Typical Return Loss at 0dBm Input Power</p>	<p>Typical Tracking at 0dBm Input Power</p>
<p>Typical Frequency Response</p>	<p>Typical Variation due to Temperature</p>
GENERAL	
Input Damage Level:	
+ 20 dBm (100 mW) RF power 10 Vdc	

Model 11664A

Table 1-3. Recommended Test Equipment

Instrument Type	Critical Specification	Suggested Model
Sweep Oscillator	Frequency: 10 MHz to 18 GHz	HP 8350B mainframe with HP 83592A/B/C RF plug-in or HP 86222A/B RF plug-in and HP 86290A/B/C RF plug-in and HP 11869A adapter or HP 8620C mainframe with: HP 86222A/B RF plug-in and HP 86290A/B RF plug-in
Network Analyzer	Provides 27.8 kHz modulation signal. Powers 3 HP 11664A detectors. Processes/displays detected signals.	HP 8756A or HP 8755C with HP 182T/HP 180 series display mainframe.
Directional Bridge	Frequency: 10 MHz to 18 GHz	HP 85021A (APC-7®) HP 85021C (Type-N Female)
Detector	Frequency: 10 MHz to 18 GHz	HP 11664A
Power Splitter	Frequency: 10 MHz to 18 GHz	HP 11667A
Coaxial Short	Type-N Male	HP 11512A
Open	Type-N Male	HP Part Number 85032-60001
Calibrated Open/Short	APC-7®	HP Part Number 85021-60001
Adapters (2)	Type-N (m) to Type-N (m)	HP Part Number 1250-0778
Open-end Wrench	Thin 1/2 x 9/16	HP Part Number 8710-0877

**SECTION II
INSTALLATION**

2-1. INTRODUCTION

2-2. This section contains information concerning initial inspection, preparation for use, mating connectors, storage and shipment.

2-3. INITIAL INSPECTION

2-4. 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 both mechanically and electrically.

2-5. Section IV contains procedures for checking electrical performance. If the instrument does not pass these electrical tests, or shipping contents are incomplete, or there is mechanical damage or defect, notify your nearest Hewlett-Packard Office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as Hewlett-Packard. Keep the shipping materials for the carrier's inspection. Hewlett-Packard will arrange for repair or replacement without waiting for claim settlement.

2-6. PREPARATION FOR USE

CAUTION

Repeated electrostatic discharge (ESD) as low as 250 volts can destroy microwave diodes. If static discharge is noticed by the operator, it indicates a voltage of 20,000 volts or more. Materials conducive to static build-up include carpeting, nylon, dry air, paper adhesive tape, styrofoam and vinyl. The best method of preventing ESD is for the operator to wear a grounding strap connected to a conductive bench mat that provides a path to ground of between 1 and 2.5 Megohms. Alternatively, the operator can ground himself by touching any grounded instrument chassis before touching the HP 11664A connector. NEVER touch connector center contacts.

2-7. Power Requirements

2-8. Power for the Model 11664A Detector is supplied by either the Model 8755C Swept Amplitude Analyzer, or the Model 8756A Scalar Network Analyzer. Each detector requires 0.35 watts. The HP 8755C/8756A normally powers up to three detectors requiring a maximum total of 1.05 watts.

2-9. Replacing RF Input Connector

2-10. The RF input connector outer shell 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.

2-11. If the RF connector is, or has been replaced by, an APC-7 type connector, refer to Figure 2-1 for user instructions.

2-12. Connecting the HP 11664A Detector

2-13. Connect the HP 11664A to the HP 8755C/8756A as follows:

1. Insert the DC connector of the HP 11664A into the HP 8755C/8756A mating connector. The HP 11664A connector is keyed; the plug should be inserted with the key downward.
2. Secure the dc connector in the analyzer 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 HP 11664A.

4. Turn the outer shell of the male connector clockwise to secure the connection to the HP 11664A RF input.
5. If the RF input connector is an APC-7 type, refer to Figure 2-1 for user instructions.

2-14. Mating Connectors

2-15. Type-N connectors mate with the corresponding Type-N connectors whose dimensions conform to U.S. specification MIL-C-39012. APC-7 connectors mate with any other APC-7 connector.

2-16. Detector Lead Identification

2-17. Coded cable clips are furnished for lead identification. Place matching clips on either end of the cable.

2-18. Operating Environment

2-19. **Temperature:** 0°C to +55°C.

NOTE

See Table 1-2 for detector response variation with temperature

2-20. **Humidity:** Up to 95%. Protection should be provided from temperature extremes, which can cause condensation within the instrument.

2-21. **Altitude:** Up to 7,620 metres (25,000 feet).

2-22. STORAGE AND SHIPMENT

2-23. Environment

2-24. The instrument may be stored or shipped in environments within the following limits:

Temperature: -25°C to +75°C

Humidity: Up to 95%

Altitude: Up to 7,620 metres (25,000 feet)

2-25. Protection should be provided from temperature extremes, which can cause condensation within the instrument.

2-26. Packaging

2-27. **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. Ensure that the container is marked **FRAGILE** to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

Model 11664A - Installation

2-28. 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**

Repeated electrostatic discharge (ESD) as low as 250 volts can destroy microwave diodes. If static discharge is noticed by the operator, it indicates a voltage of 20,000 volts or more. Materials conducive to static build-up include carpeting, nylon, dry air, paper, adhesive tape, styrofoam and vinyl. The best method of preventing ESD is for the operator to wear a grounding strap connected to a conductive bench mat that provides a path to ground of between 1 and 2.5 Megohms. Alternatively, the operator can ground himself by touching any grounded instrument chassis before touching the HP 11664A connector. NEVER touch connector center contacts.

3-1. INTRODUCTION

3-2. This section contains information concerning operation of the HP 11664A detector.

3-3. FEATURES

3-4. Features of the HP 11664A are shown in Figure 3-1.

Model 11664A - Operation

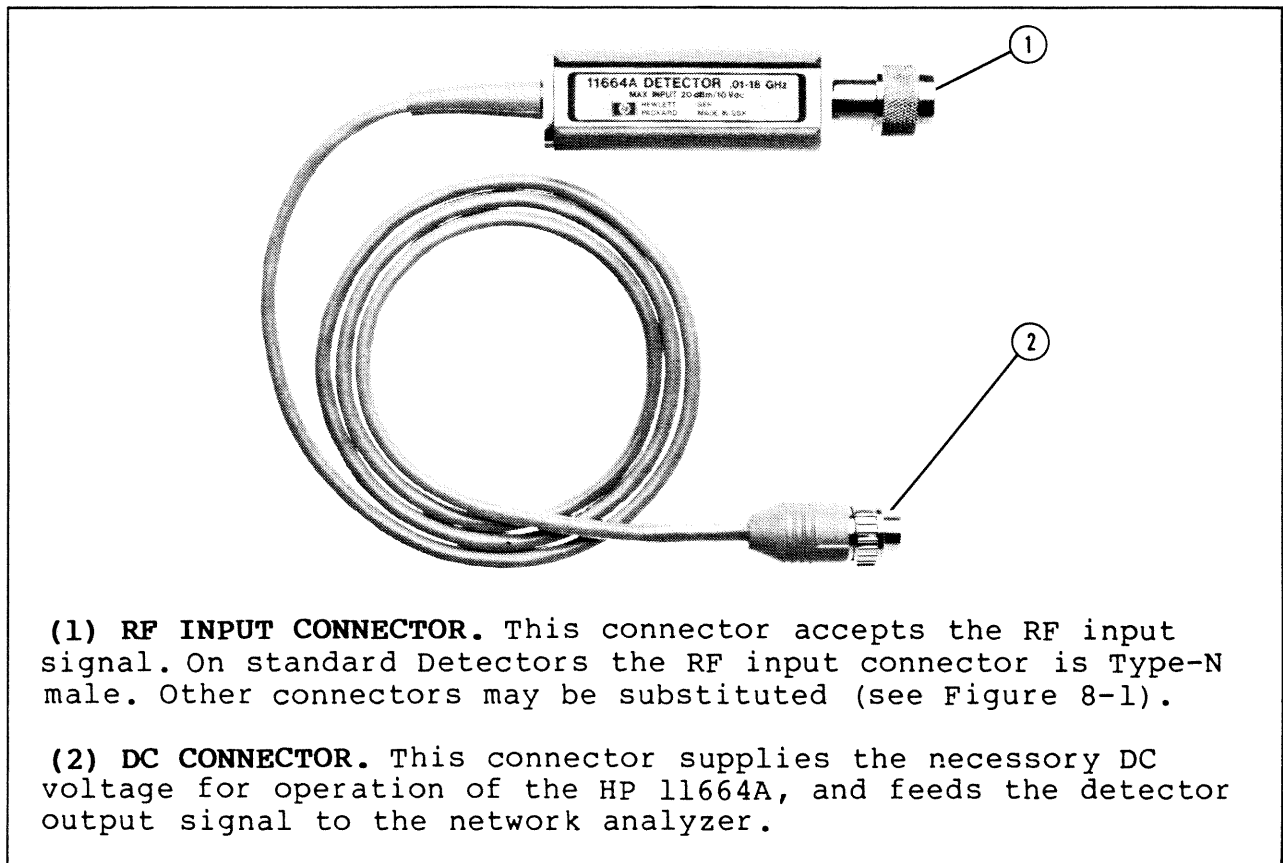


Figure 3-1. Model 11664A Features

3-5. OPERATOR'S CHECK

3-6. An Operator's Check of the HP 11664A is included in the Operator's Check provided in both the HP 8755C and the HP 8756A Operating and Service Manuals.

3-7. OPERATING PRECAUTIONS

See **CAUTION** on page 3-1.

3-8. Tighten the HP 11664A connectors with fingers only. Do NOT use a wrench.

CAUTION

Do NOT apply more than 8 in/lb (9.2 cm/kg) of torque when tightening the connectors. Greater torque may deform the mating surfaces.

Model 11664A - Operation

Do not apply more than +20 dBm RF CW power or more than +10 volts DC to the HP 11664A, or damage may occur

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

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

3-9. OPERATING INSTRUCTIONS

3-10. Operating instructions are given in the Operating and Service Manuals for the HP 8755C and the HP 8756A analyzers.

3-11. Typical Measurement Configuration

3-12. Amplitude measurement with the HP 11664A/8755C or 8756A analyzer system requires a modulation envelope to be developed via 27.8 kHz amplitude modulation of the RF test signal. Test set connections will vary depending on the analyzer and source oscillator selected.

3-13. Figure 3-2 illustrates a typical setup with the HP 8350B sweep oscillator/RF plug-in using internal modulation.

3-14. Figure 3-3 shows a similar test setup with an external modulator, HP 11665B, being driven by a MODULATOR DRIVE of the HP 8756A. This setup must be used for RF plug-ins that cannot respond to the 27.8 kHz drive signal. Refer to the Operation section of the particular RF plug-in Operating and Service Manual for details.

Model 11664A - Operation

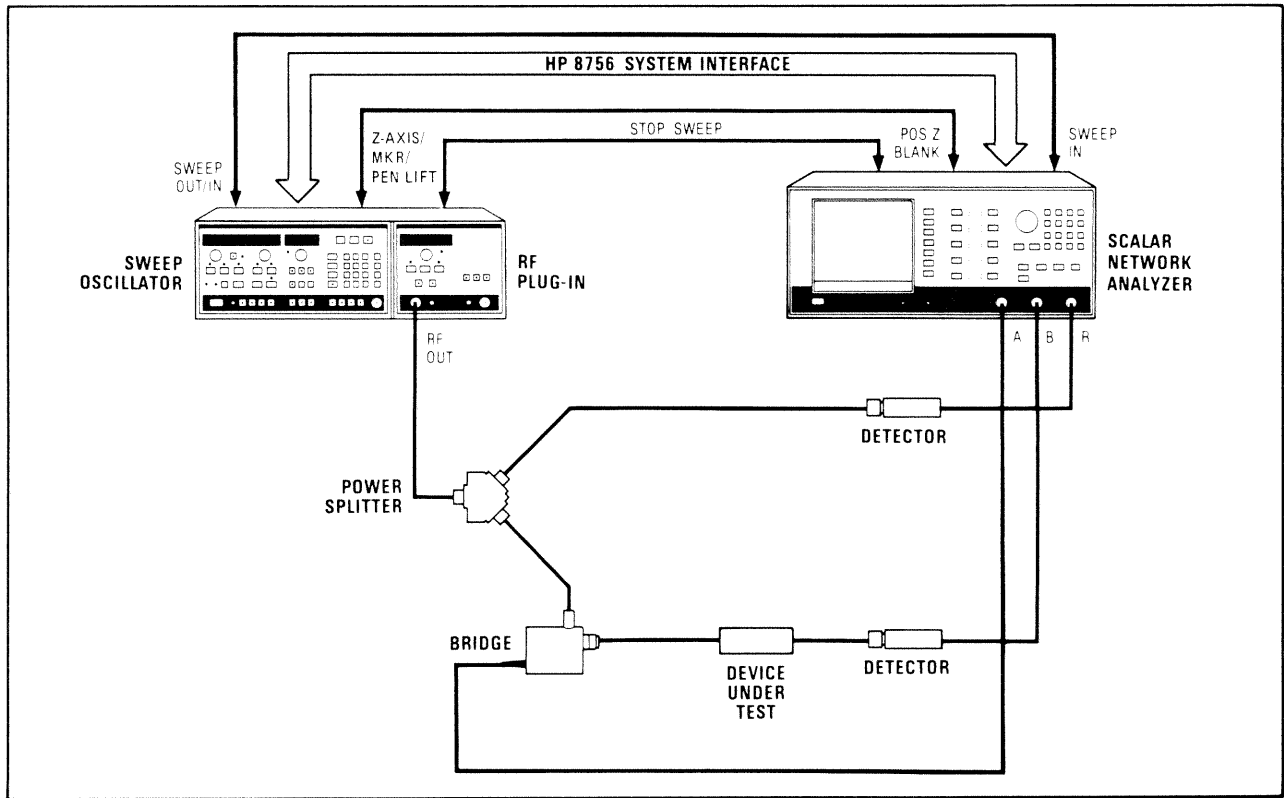


Figure 3-2. Model 11664A/8756A Typical Measurement Setup

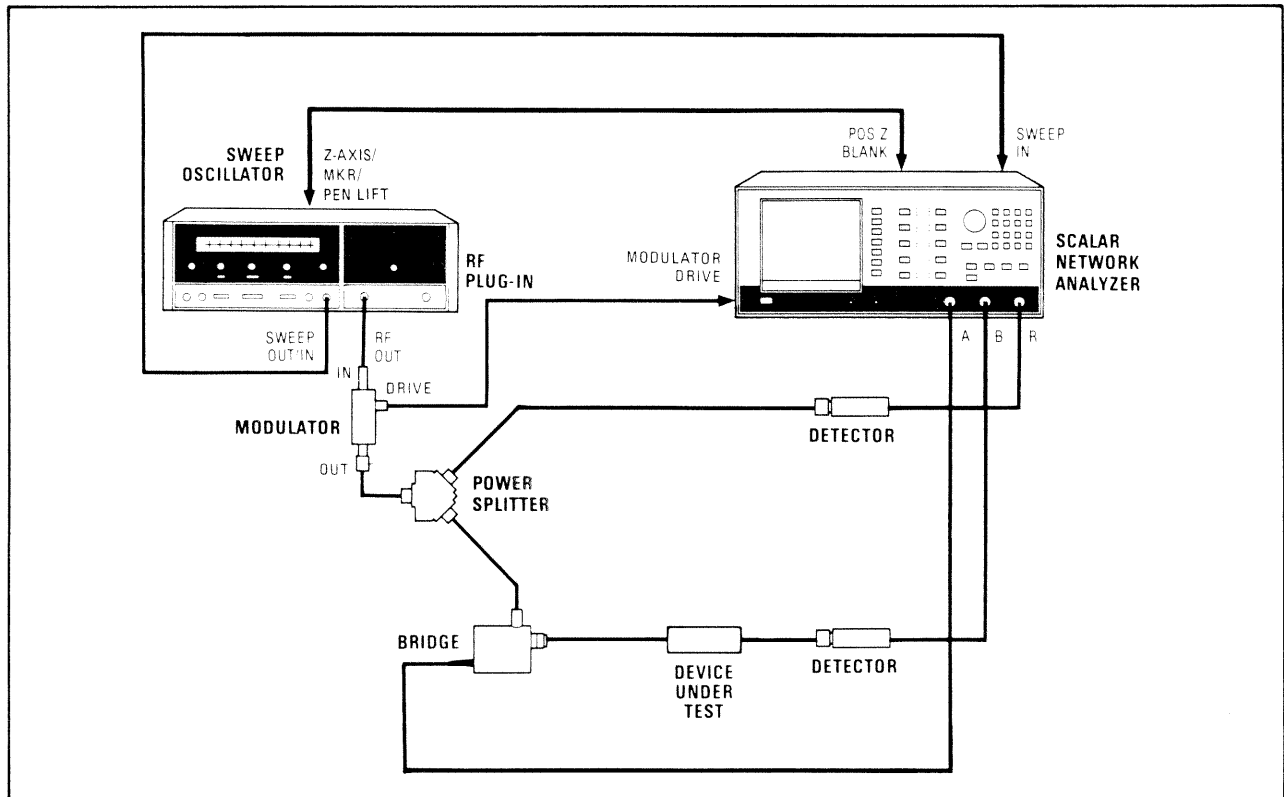


Figure 3-3. Model 11664A/8756A Typical Measurement Setup using Model 11665B External Modulator

**SECTION IV
PERFORMANCE TESTS**

4-1. INTRODUCTION

4-2. 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.

4-3. EQUIPMENT REQUIRED

4-4. Table 1-3 lists the Recommended Test Equipment for testing the performance standards of this instrument. Any equipment that satisfies the critical specifications given in that table may be substituted for the recommended model.

4-5. TEST RECORD CARD

4-6. 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.

4-7. RETURN LOSS

SPECIFICATIONS:

- .01 GHz to .04 GHz: >10 dB (<1.92 SWR)
- .04 GHz to 4 GHz: >20 dB (<1.22 SWR)
- 4 GHz to 12 GHz: >18 dB (<1.28 SWR)
- 12 GHz to 16 GHz: >16 dB (<1.38 SWR)

DESCRIPTION:

An HP 11664A detector, a directional bridge, and a power splitter comprise a reflectometer test setup. The test setup is calibrated using a short and an open to minimize frequency response errors. The device under test (DUT) is connected to the **TEST PORT** of the bridge, and return loss is measured on the HP 8756A.

The return loss should be equal to or greater than the limits listed above. Table 4-1 lists measurement uncertainty due to coupler directivity.

If the return loss is within the measurement uncertainty range, a vector impedance measurement with error correction should be made. At Hewlett-Packard, this is accomplished by using either the HP 8408 or the HP 8409 automatic network analyzers (the HP 8507 may be used for frequencies below 1.3 GHz). Further information is available in the HP 11863E/F Applications Pac and Application Note 221A.

Table 4-1. Return Loss Measurement Uncertainty

FREQUENCY (GHz)	SPECIFICATION (dB)	MEASUREMENT UNCERTAINTY RANGE (dB)	
		85021A (APC-7)	85021C (TYPE-N)
.01 to .04	>10	9.5 to 10.5	9.5 to 10.5
.04 to 4.0	>20	19.1 to 21.0	18.7 to 21.5
4.0 to 12	>18	17.3 to 18.8	16.9 to 19.2
12 to 18	>16	15.5 to 16.9	14.9 to 17.2

Model 11664A - Performance Tests

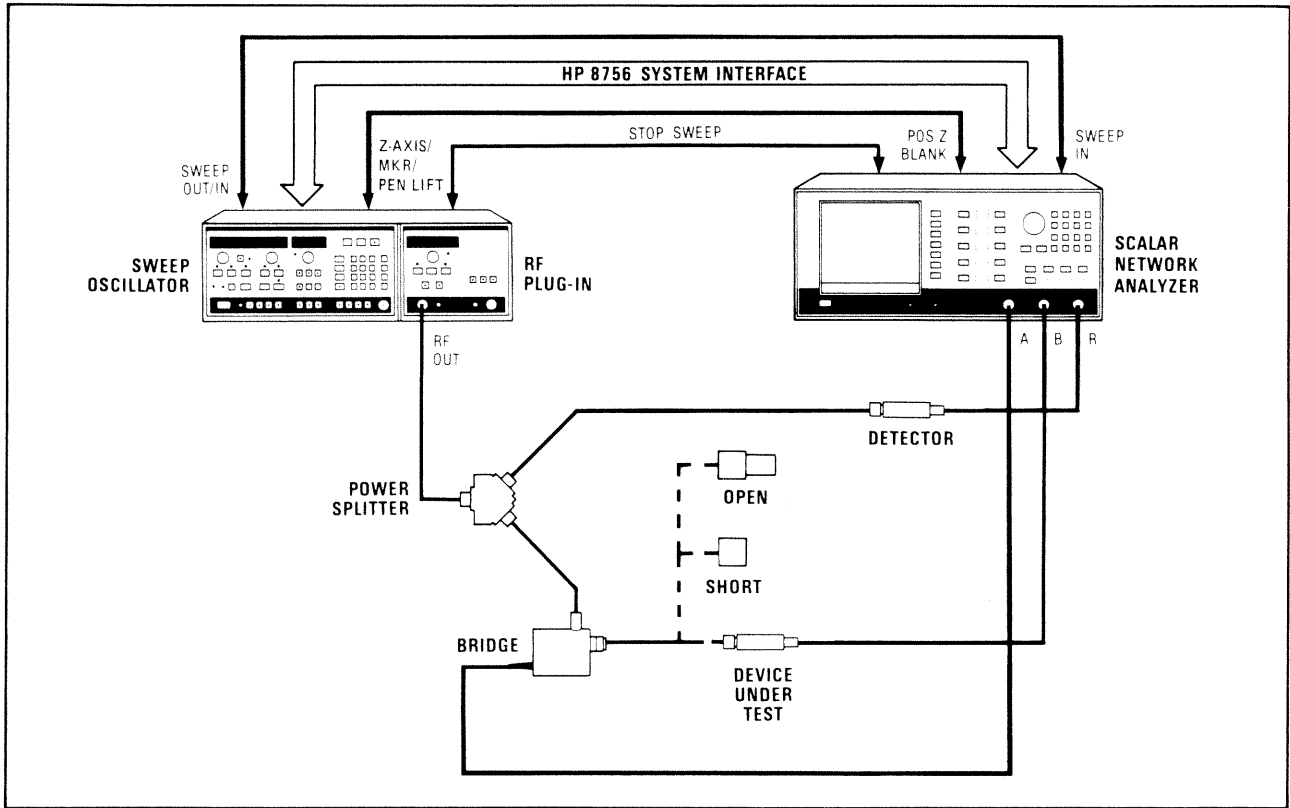


Figure 4-1. Return Loss Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350B
RF Plug-In	HP 83592A/B/C
Power Splitter	HP 11667A
Directional Bridge	
Type-N Female	HP 85021C
APC-7	HP 85021A
Detector	HP 11664A
Scalar Network Analyzer	HP 8756A
Coaxial Short	
Type-N Male	HP 11512A
Open	
Type-N Male	HP PN 85032-60001
Calibrated Open/Short	
APC-7	HP PN 85021-60001
Adapters (2 required)	
Type-N Male to Type-N Male	HP PN 1250-0778

PROCEDURE:

10 to 40 MHz

1. Set up equipment as shown in Figure 4-1, with nothing connected to the bridge **TEST PORT**. Press [**PRESET**] on the HP 8756A. This will preset both the HP 8756A and the HP 8350B (this will turn the HP 8350B [**MOD**] on and set the sweep time to 200ms). Allow 30 minutes warm-up.

NOTE

If testing a standard (Type-N) HP 11664A, use an HP 85021C bridge. If testing an option 001 (APC-7), use an HP 85021A bridge. Do not connect adaptors to the TEST PORT, as measurement accuracy may be severely degraded.

- On the HP 8350B, set **START** to 10 MHz, and **STOP** to 18 GHz. Adjust RF plug-in for maximum leveled output power. Set **START** to -10 MHz, and **STOP** to 40 MHz (unleveled light will flicker). Set markers **M1** to 0 MHz, **M2** to 10 MHz, and **M3** to 40 MHz.

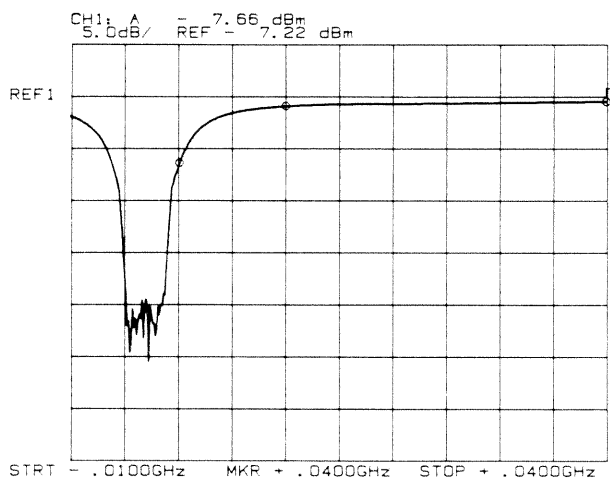


Figure 4-2. Trace Before Adjustment

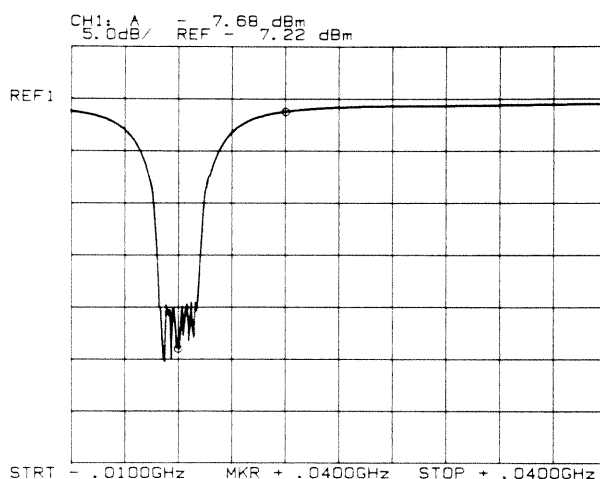


Figure 4-3. Properly Adjusted Trace

- On the HP 8756A Channel 2, press **[SHIFT] [MEAS RATIO]** to turn Channel 2 off. On Channel 1, press **[MEAS PWR]** until the **A** LED is on. Press **[REF]** until the **POSN** LED is on, and use the step keys or knob to move the **REF POS** one line down from the top CRT graticule. Press **[SHIFT] [SCALE]**. A response dip similar to Figure 4-2 should be visible on the display. This dip is formed because the sweeper is a hetrodyned source (in Band 1), sweeping through low frequencies where it is incapable of generating output power. The middle of this response dip is the "ZERO FREQUENCY" point.
- Using the **FREQ CAL** adjustment on the front panel of the HP 83592A/B/C, center the 0 MHz dip around the 0 MHz marker (the vertical graticule line two divisions from the left. See Figure

Model 11664A - Performance Tests

- 4-3). Change Channel 1 to **A/R** by pressing [**MEAS RATIO**] until the **A/R** LED is on.
5. With the **MAIN MENU** soft keys, select [**CAL**], then [**SHORT/OPEN**], then [**CHAN 1**]. Following the CRT prompts, connect the short to the **TEST PORT** of the bridge, and press [**STORE/SHORT**]. Connect the open and press [**STORE/OPEN**]. The CRT will display **OPEN/SHORT CAL SAVED IN CH1 MEM.**
6. On the HP 8756A, select **M-MEM** (press [**DISPLAY**] until the **M-MEM** LED is on). The CRT display should be similar to Figure 4-4.

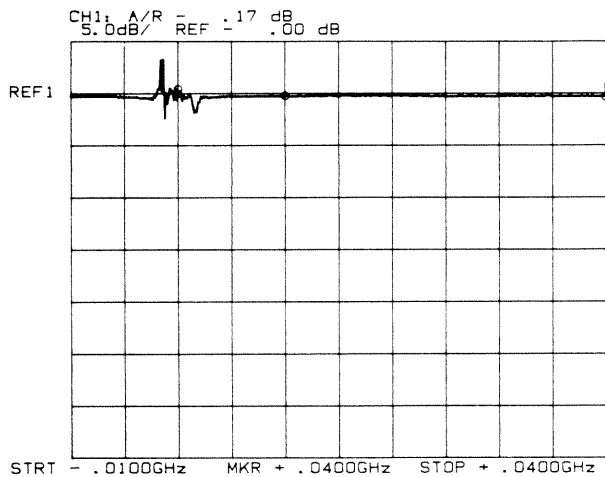


Figure 4-4. M-MEM Display

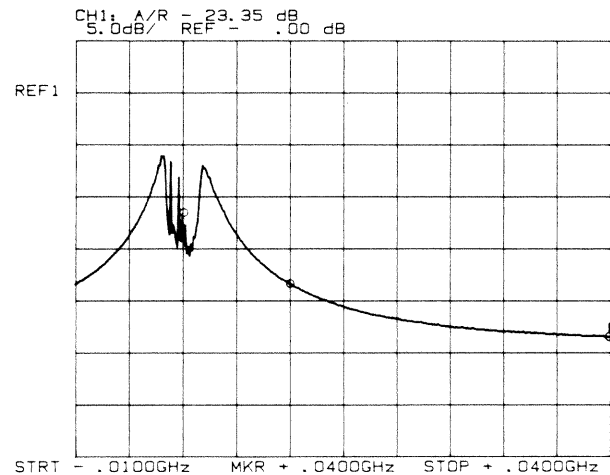


Figure 4-5. Reading Marker Value

7. Connect the DUT to the **TEST PORT**, and press [**SCALE**] [**5**] [**DB**] on the HP 8756A. The CRT display should be similar to Figure 4-5.
8. Select **M2**, then **M3**, and read the return loss from the marker value given in the upper left corner of the CRT (see Figure 4-5). Record these values on the test record card.

40 MHz to 18 GHz

9. On the HP 8350B, set **START** to 40 MHz, and **STOP** to 18 GHz. Set markers **M1** to 40 MHz, **M2** to 4 GHz, **M3** to 12 GHz, and **M4** to 18 GHz.
10. Remove the DUT, and ensure that **A/R** is selected for Channel 1 on the HP 8756A.

Model 11664A - Performance Tests

11. With the **MAIN MENU** soft keys, calibrate as in Step 5 above. Ensure that Channel 1 DISPLAY is still in **M-MEM**.

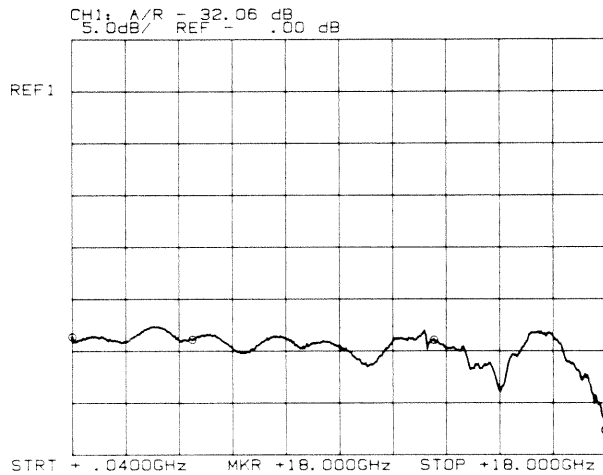


Figure 4-6. DUT Return Loss .04 to 18 GHz

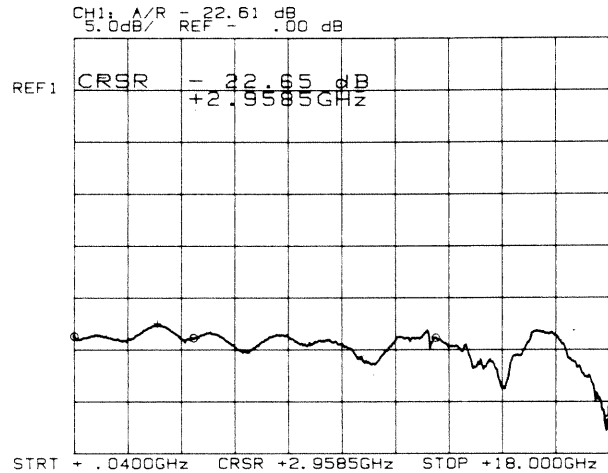


Figure 4-7. Reading Cursor Value

12. Connect the DUT to the **TEST PORT**, and press **[SCALE] [5] [DB]** on the HP 8756A. The display should be similar to Figure 4-6.
13. Using **MAIN MENU** soft keys, press **[CURSER]**. Use the knob to set the curser to the highest trace value (lowest return loss value) between **M1** and **M2** (.04 to 4 GHz), and read the curser value from the CRT (see Figure 4-7). Do the same thing between **M2** and **M3** (4 to 12 GHz), and between **M3** and **M4** (12 to 18 GHz). Note these values on the test record card.

4-8. TRACKING BETWEEN TWO DETECTORS

SPECIFICATIONS:

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

Response Variation:

- .01 to 8 GHz: <0.5 dB
- 8 to 11 GHz: <1.0 dB
- 12 to 18 GHz: <1.5 GHz

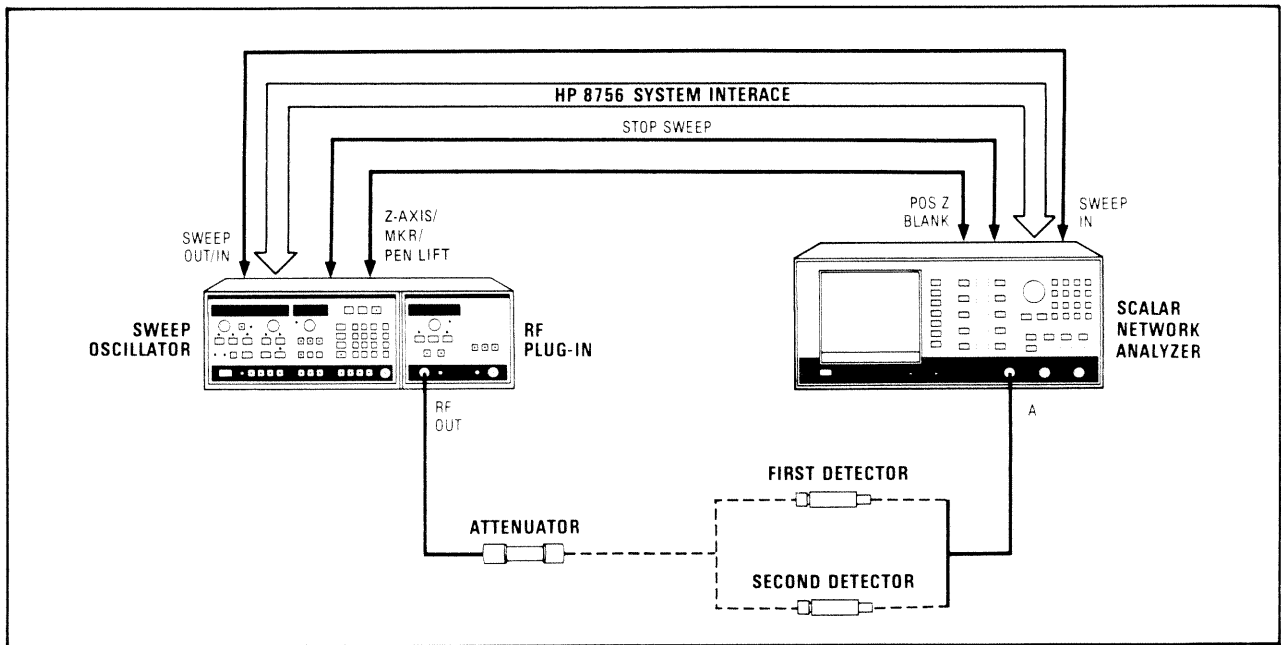


Figure 4-8. Tracking Test Setup

DESCRIPTION:

The frequency response of two detectors are compared using a sweep oscillator and a frequency response test instrument.

EQUIPMENT:

Sweep Oscillator	HP 8350B
RF Plug-In	HP 83592A/B/C
Scalar Network Analyzer	HP 8756A
10 dB Attenuator	HP 8491B Option 010
Detectors (1 plus DUT)	HP 11664A

Model 11664A - Performance Tests

PROCEDURE:

1. Connect equipment as shown in Figure 4-8. Press **[PRESET]** on the HP 8756A. This will preset both the HP 8756A and the HP 8350B (this will also turn the HP 8350B **[MOD]** on and set the sweep rate to 200ms). Set the source power level to 0dB and allow 30 minutes warm-up.
2. On the HP 8756A Channel 2, press **[SHIFT] [MEAS RATIO]** to turn Channel 2 off. On Channel 1, select **A** (press **[MEAS PWR]** until the **A** LED is on). Press **[REF]** until the **POSN** LED is on, and use the step keys or knob to set the reference level to mid-screen. Press **[SCALE] [.] [5] [DB]**.
3. Connect the first detector to the attenuator. On the HP 8350B, set **START** to 10 MHz, and **STOP** to 18 GHz. Set markers **M1** to 10 MHz, **M2** to 8 GHz, **M3** to 12 GHz and **M4** to 18 GHz.

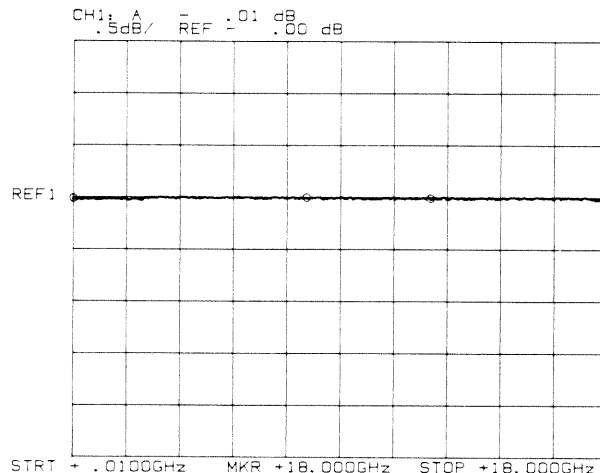


Figure 4-9. Detector Tracking M-MEM Trace

4. On the HP 8756A, press **[SHIFT] [DISPLAY]** to store the trace in memory. Press **[DISPLAY]** until the **M-MEM** LED is on. The display should be similar to Figure 4-9.
5. Remove the first detector from the HP 8756A and the attenuator, and connect the second detector. On the HP 8350B, press **M1** (the **FREQUENCY/TIME** display will read 0 MHz).

Model 11664A - Performance Tests

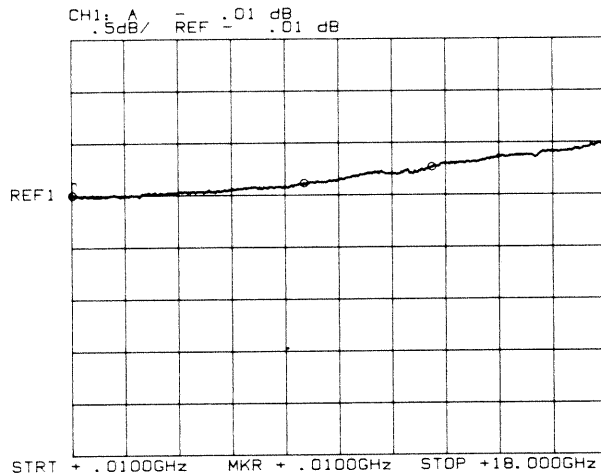


Figure 4-10. Detector Tracking Display

6. On the HP 8756A, press **[SHIFT] [REF]** to bring the active marker (**M1**) to the reference line. The trace between markers **M1** and **M2** (.01 to 8 GHz) should now be within one division (+.5 dB) of the reference line (see Figure 4-10). Read the trace between **M2** and **M3** (8 to 12 GHz). It should be within two divisions (+1 dB) of the reference line. Between **M3** and **M4** (12 to 18 GHz), the trace should be within three divisions (+1.5 dB) of the reference line.

Model 11664A - Performance Tests

Table 4-2. Performance Test Record

HP 11664A Detector Tested by _____ Serial No. _____ Date _____				
Paragraph Number	Test	Minimum	Actual	Maximum
4-7.	RETURN LOSS 0.01 to 0.04 GHz 0.04 to 4 GHz 4 to 12 GHz 12 to 18 GHz	10 dB 20 dB 18 dB 16 dB	_____ _____ _____ _____	
4-8.	TRACKING BETWEEN TWO DETECTORS 0.01 to 8 GHz 8 to 12 GHz 12 to 18 GHz		_____ _____ _____	<0.5 dB <1.0 dB <1.5 dB

Model 11664A - Adjustments

**SECTION V
ADJUSTMENTS**

5-1. The Model 11664A Detector has no field adjustable components.

**SECTION VI
REPLACEABLE PARTS**

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 gives all the manufacturers' code numbers that are used in the parts list. Table 6-3 lists all replaceable parts in reference designator order.

6-3. REPLACEABLE PARTS LIST

6-4. Table 6-3 is the list of replaceable parts. The information given for each part consists of the following:

- a. The Hewlett-Packard part number.
- b. The 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.

6-5. ORDERING INSTRUCTIONS

6-6. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number (with check digit), indicate the quantity required, and address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

6-7. To request information on a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, and the description and function of the part. Address the inquiry to the nearest Hewlett-Packard office.

Model 11664A/Replaceable Parts

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

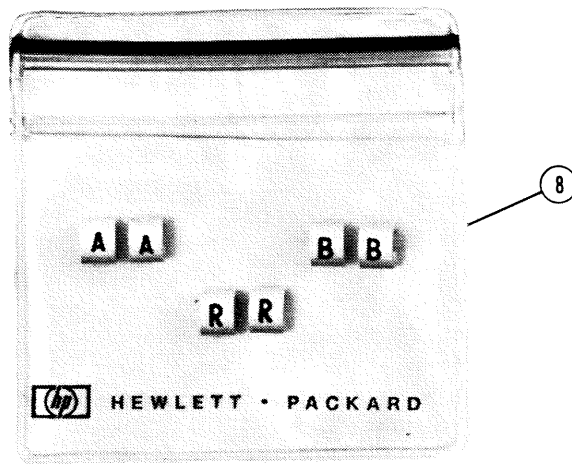
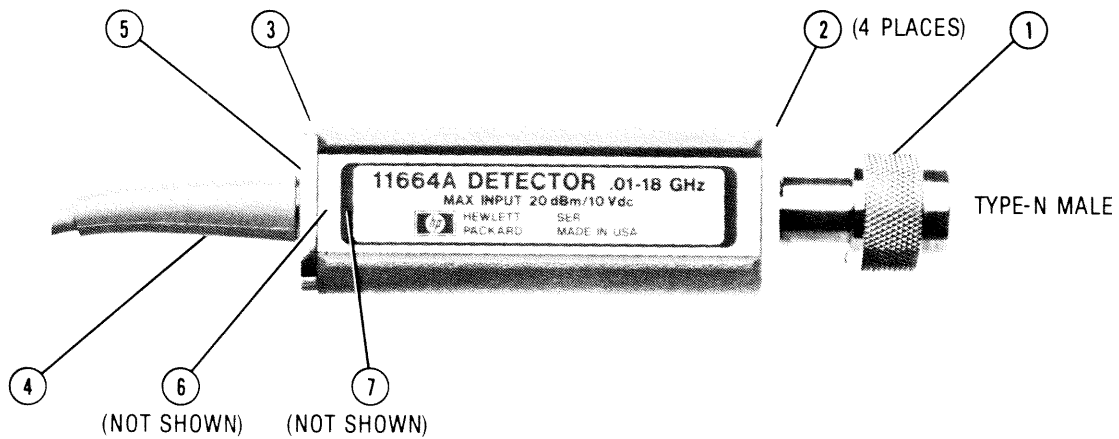
REFERENCE DESIGNATORS			
A.....	Assembly	J.....	Jack
C.....	Capacitor	P.....	Plug
CR.....	Diode	Q.....	Transistor
		R.....	Resistor
		W.....	Cable
ABBREVIATIONS			
B		I	
BE.....	Baume, Beryllium	IN.....	Inch, Indium
C		K	
CER.....	Ceramic	K.....	Kelvin, Key, Kilo, Potassium
CM.....	Centimeter		
CU.....	Copper, Cubic	M	
D		MA.....	Milliampere
DBM.....	Decibels Referred to 1 Milliwatt	MHZ.....	Megahertz
DC.....	Direct Current, Double Contact	MW.....	Milliwatt
DIM.....	Dimension	N	
DO.....	Package Type Designation	N.....	Fan Out, Intrinsic Stand Off Ratio, Nano, Nanosecond, Nitrogen, None
F		NPN.....	Negative Positive Negative (Transistor)
F.....	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency	P	
FT.....	Current Gain Bandwidth Product (Transition Frequency); Feet, Foot	P.....	Peak, Phosphorus, Pico, Picosecond, Pitch, Plastic, Plug, Pole, Polyester, Power, Probe, Pure
FXD.....	Fixed	PD.....	Pad, Palladium, Pitch Diameter, Power Dissipation
G		PF.....	Picofarad; Pipe, Female Connection; Power Factor
GHZ.....	Gigahertz		
		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

Table 6-2. Manufacturer's Code List

Mfr. No.	Manufacturer Name	Address	Zip Code
28480	HEWLETT-PACKARD CO. CORPORATE HQ.	PALO ALTO, CA.	94303

Model 11664A/Replaceable Parts

Table 6-3. Replaceable Parts



Item	HP Part Number	CD	Qty	Description	Mfr. Code	Mfr. Part Number
1	11664-60022	3	1	Input Connector (J1): Type-N (m) Standard	28480	11664-60022
	11664-60023	4	0	Input Connector (J1): APC-7® Option 001	28480	11664-60023
	11664-60024	5	0	Input Connector (J1): Type-N (f) Special Order	28480	11664-60024
2	2200-0167	8	4	Screw-Machine 4-40 .188-IN-LG 82 Degree	28480	2200-0167
3	11664-20004	7	1	End Plate	28480	11664-20004
4	8120-1788	7	1	Cable Assembly (W1)	28480	8120-1783
5				Washer, P/O W1		
6	2190-0016	3	1	Washer-Lock Internal Tooth 3/8 in .377-IN-ID (Not Shown)	28480	2190-0016
7	2950-0001	8	1	Nut-Hex-Double Chamfer (Not Shown)	28480	2950-0001
8	5061-1044	9	1	Cable Marker Kit	28480	5061-1044

**SECTION VII
MANUAL CHANGES**

7-1. INTRODUCTION

7-2. This manual was written for and applies directly to instruments with serial number 25000 and above. Earlier versions of the instrument (serial numbers lower than 25000) may be slightly different in design or appearance. For earlier versions of the HP 11664A, refer to Operating and Service Manual HP Part Number 11664-90037.

7-3. Any changes made to instruments manufactured after the printing of this manual are documented in a yellow Manual Changes Supplement. Complimentary copies of this supplement can be obtained from your nearest Hewlett-Packard office. Refer to INSTRUMENTS COVERED BY MANUAL in Section I, for additional information.

**SECTION VIII
SERVICE**

8-1. INTRODUCTION

8-2. This section provides procedures for replacing the connector and the cable of the HP 11664A.

8-3. RECOMMENDED TEST EQUIPMENT

8-4. Table 1-3 lists the recommended model numbers of equipment required to test the HP 11664A detector.

8-5. REPAIR

8-6. The following repair procedures are provided:

Replacing Input Connectors

Replacing Cable Assembly

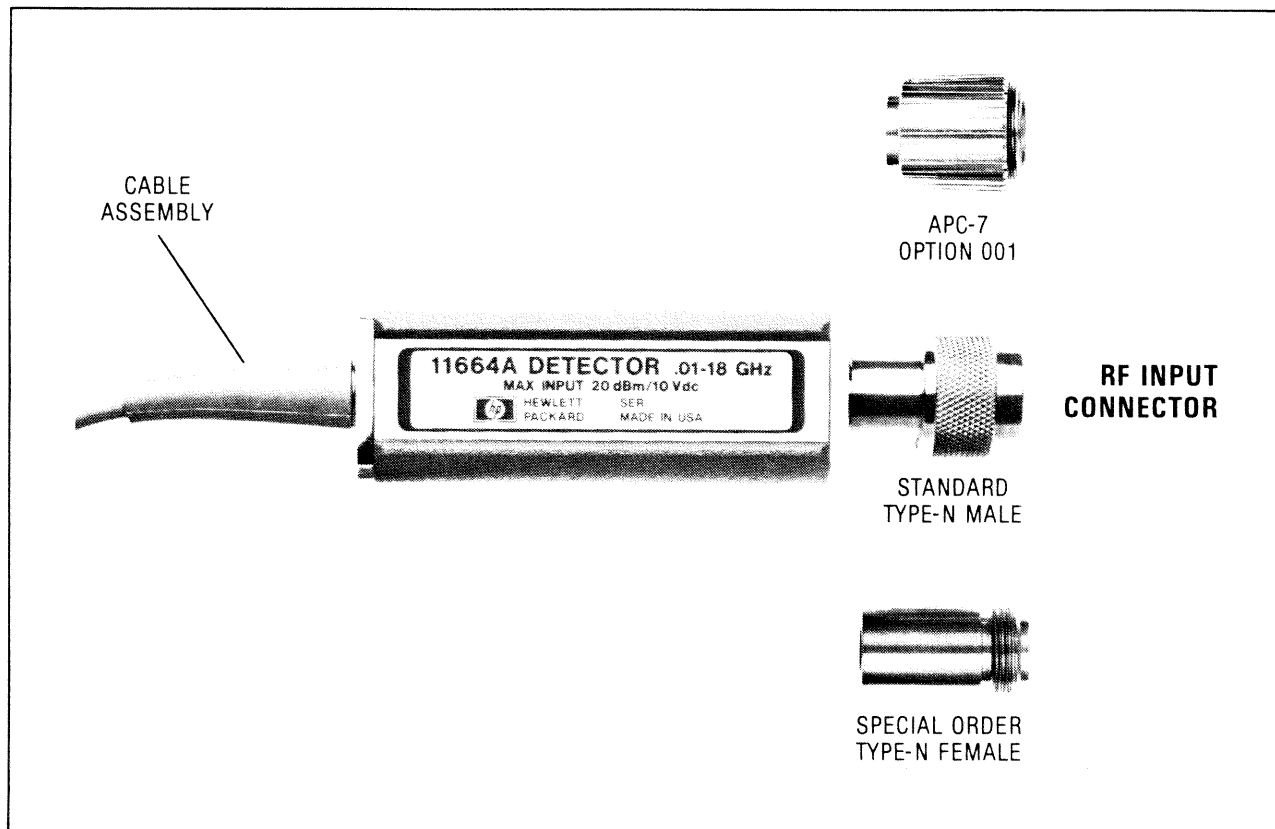


Figure 8-1. Major Assemblies

8-7. Replacing Input Connector

8-8. Order the assembled connector (J1 in Table 6-3), from your nearest Hewlett-Packard office. When it arrives, simply remove the old connector and replace it with the new one using a thin open-ended wrench (1/2" x 9/16", HP Part Number 8710-0877).

8-9. Replacing Cable Assembly

8-10. Remove the two pozi-drive screws on the cable end plate of the HP 11664A. Slide the printed circuit assembly out of the housing by pulling on the cable.

8-11. Carefully remove all cable wires from the board. Remove the lock washer and hex nut that hold the cable to the end plate, and remove the old cable.

8-12. Place new cable through end plate and secure with lock washer and hex nut. Install wires of the replacement cable in the printed circuit assembly (refer to Figure 8-2 for proper placement). Ensure that all cable wires are securely connected to the board. Slide the board into the runners on the inside of the housing. Reinstall and tighten the two pozi-drive screws.

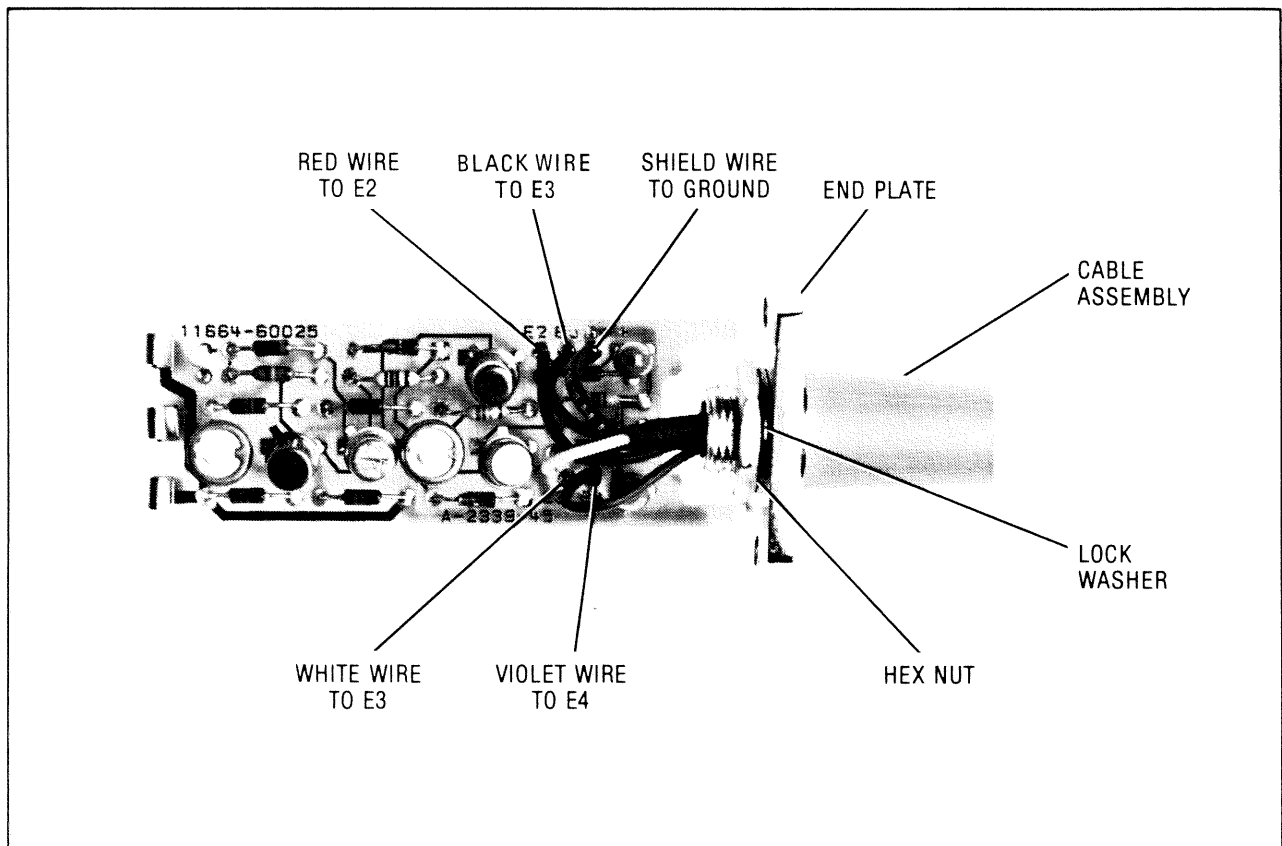


Figure 8-2. Cable Connections



SALES & SUPPORT OFFICES

Arranged alphabetically by country

Product Line Sales Support Key

- Key Product Line
- A Analytical
- CM Components
- C Computer Systems Sales only
- CH Computer Systems Hardware Sales and Services
- CS Computer Systems Software Sales and Services
- E Electronic Instruments & Measurement Systems
- M Medical Products
- MP Medical Products Primary SRC
- MS Medical Products Secondary SRC
- P Personal Computer Products
- S Sales only for specific product line
- Support only for specific product line

IMPORTANT: These symbols designate general product line capability. They do not insure sales or support availability for all products within a line. At all locations, contact your local sales office for information regarding locations where HP support is available for specific products.

HP distributors are printed in italics.

ANGOLA

Telectra
Empresa Técnica de Equipamentos
Eléctricos S.A.R.L.
R. Barbosa Rodrigues 411/DT
Caxa Postal 6487
LUNDA
Tel: 355 15 355 16
E.M.P.

ARGENTINA

Hewlett-Packard Argentina S.A.
Avenida Santa Fe 2035
Marinez 1640 BUENOS AIRES
Tel: 758 5725, 752 1293
Telex: 11595 BIONAR
Cable: HEWPAKARGIS
A.E.C.H.M.S.P.

AUSTRALIA

Adelaide, South Australia Office
Hewlett-Packard Australia Ltd.
153 Greenall Road
PARKSIDE S.A. 5066
Tel: 272 5911
Telex: 82558
Cable: HEWPAK Adelaide
A.C.H.M.C.E.M.S.P.

Brisbane, Queensland Office
Hewlett-Packard Australia Ltd.
5th Floor
Teachers Union Building
495 499 Boundary Street
SPRING HILL, Queensland 4000
Tel: 229 1544
Telex: 42 133
Cable: HEWPAK Brisbane
A.C.H.M.C.E.M.P.

Canberra, Australian Capital Territory Office
Hewlett-Packard Australia Ltd.
121 Wolongong Street
FISHKILL, Queensland A.C.T. 2609
Tel: 80 4244
Telex: 62650
Cable: HEWPAK Canberra
A.C.H.M.C.E.P.

Melbourne, Victoria Office
Hewlett-Packard Australia Ltd.
31 41 Joseph Street
BLACKBURN, Victoria 3130
Tel: 86 6357
Telex: 31 024
Cable: HEWPAK Melbourne
A.C.H.M.C.S.E.M.S.P.

Perth, Western Australia Office
Hewlett-Packard Australia Ltd.
1621 Stirling Highway
CLAREMONT W.A. 6010
Tel: 363 2188
Telex: 93650
Cable: HEWPAK Perth
A.C.H.M.C.E.M.S.P.

Sydney, New South Wales Office
Hewlett-Packard Australia Ltd.
17 23 Tavara Road
P.O. Box 308
NORTH RYDE N.S.W. 2113
Tel: 887 1611
Telex: 21561
Cable: HEWPAK Sydney
A.C.H.M.C.S.E.M.S.P.

AUSTRIA

Hewlett-Packard Ges.m.b.H.
Grottenhofstrasse 94
VERKAUFSDIENST
A-1052 GRAZ
Tel: 291 5 66
Telex: 32375
A.C.H.M.E.P.

Hewlett-Packard Ges.m.b.H.
Uebigstrasse 1
P.O. Box 7
A-1022 WIEN
Tel: 00222 23 65 111
Telex: 134425 HEPA A
A.C.H.M.C.S.E.M.S.P.

BELGIUM

Hewlett-Packard Belgium S.A./N.V.
Bldg. 36, Avenue de la Woluwe 111
WOLUWELAND
B-1200 BRUSSELS
Tel: 410 761 52 9
Telex: 23 444 (paper only)
A.C.H.M.C.S.E.M.P.

BRAZIL

Hewlett-Packard do Brasil S.A.
Lda.
Alameda Rio Negro 750
ALPHAVILLE 06400 Barueri SP
Tel: 421 1311
Telex: 011 33872 HPBR BR
Cable: HEWPAK São Paulo
A.C.H.M.C.S.E.M.S.

Hewlett-Packard do Brasil S.A.
Lda.
Avenida Epitácio Pessoa 4654
22471 RIO DE JANEIRO RJ
Tel: 285 0237
Telex: 02 21905 HPBR BR
Cable: HEWPAK Rio de Janeiro
A.C.H.M.C.S.E.M.S.P.

CANADA

Alberta
Hewlett-Packard (Canada) Ltd.
2105 7220 Fisher Street S.E.
CALGARY Alberta T2H 2H6
Tel: 403 253 2713
A.C.H.M.E.P.M.S.P.

Hewlett-Packard (Canada) Ltd.
1620A 168th Street
EDMONTON Alberta T6M 3T9
Tel: 403 452 3670
A.C.H.M.C.S.E.M.S.P.

British Columbia
Hewlett-Packard (Canada) Ltd.
10651 Sheltbridge Way
KICHMONG
British Columbia V6K 2W7
Tel: 604 275 2277
Telex: 610 422 0250
A.C.H.M.C.S.E.P.M.S.P.

Manitoba
Hewlett-Packard (Canada) Ltd.
380 550 Century Street
WINNIPEG Manitoba R3H 0Y1
Tel: 204 786 6701
A.C.H.M.E.P.M.S.P.

Nova Scotia
Hewlett-Packard (Canada) Ltd.
P.O. Box 93
900 Windmill Road
DARTMOUTH Nova Scotia B3Y 3Z6
Tel: 902 455 7525
Telex: 01921470
A.C.H.M.C.S.E.P.M.S.P.

Ontario
Hewlett-Packard (Canada) Ltd.
552 Newco Street
LONDON Ontario N6E 2S5
Tel: 519 686 9181
A.C.H.M.E.P.M.S.P.

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA Ontario L4 1W8
Tel: 416 678 9430
Telex: 0582154
A.C.H.M.C.S.E.M.P.

Hewlett-Packard (Canada) Ltd.
2670 Queensview Dr.
OTTAWA Ontario K2B 8K1
Tel: 613 910 8463
A.C.H.M.C.S.E.P.M.S.P.

CHINA, People's Republic of

China Hewlett-Packard Rep. Office
P.O. Box 478
14, Yulin 2, Luchang 51
Beijing 100 001
Tel: 011 33872 HPBR BR
Cable: HEWPAK Beijing
A.C.H.M.C.S.E.M.S.P.

Hewlett-Packard (China) Ltd.
10001, 685 44 52
Tel: 21 0329
A.C.H.M.C.S.E.M.S.

Hewlett-Packard (China) Ltd.
Le Monesteguy
Avenue du Président J.F. Kennedy,
F-91947 Les Ulis Cedex ORSAY
Tel: 01 90 71 78 25
Telex: 856449
A.C.H.M.C.S.E.M.P.

COLOMBIA

Instrumentación
H. A. Langenhack & Xier S.A.
Carrera 7 No. 48 75
Apartado Aéreo 6287
BOGOTÁ D.O.E.
Tel: 287 8877
Telex: 44400 INST CO
Cable: AARIS Bogota
A.C.M.E.M.P.

COSTA RICA

Científica Costamicense S.A.
Avenida 2, Calle 5
San Pedro de Montes de Oca
Apartado 10159
SAN JOSÉ
Tel: 24 38 20, 24 08 19
Telex: 2367 GALGUP
A.C.M.E.M.

CYPRUS

Pirella Ltd
P.O. Box 4809
140, Stassinos Avenue
NICOSIA
Tel: 62698
Telex: 2894 Levodov
E.M.P.

CZECHOSLOVAKIA

Hewlett-Packard
Obchodní Zastupitelství - VSSP
Posl. schránka 27
CS-118 01 PRAHA 011
Tel: 66 296
Telex: 121353 IHC

DENMARK

Hewlett-Packard A/S
Datavej 52
DK-3460 Birkerød
Tel: 021 81 66 40
Telex: 37409 hpas dk
A.C.H.M.C.S.E.M.S.P.

Hewlett-Packard A/S
Navlevvej 1
DK-8600 SILKEBORG
Tel: 066 80 71 66
Telex: 37409 hpas dk
A.C.H.M.E.P.

ECUADOR

CYEDE Cia. Ltda
Avenida Eloy Alfaro 1749
Daxila 5423 COTACACHI
QUITO
Tel: 450 975 243 052
Telex: 2548 CYEDE EO
A.C.M.E.P.

EGYPT

International Engineering Associates
24 Hussein Negazi Street
Kasr el-Am
CAIRO
Tel: 23 829
Telex: 93830
A.C.H.M.C.S.E.M.

EL SALVADOR

IRESA de El Salvador S.A.
29 Avenida Norte 1216
SAN SALVADOR
Tel: 26 6858 26 6868
Telex: Public Boom 20107
A.C.H.M.C.S.E.P.

FINLAND

Hewlett-Packard Oy
Reinovuoratie 7
SF-02100 ESPOO 10
Tel: 190 455 0211
Telex: 121563 hepos fi
A.C.H.M.C.S.E.M.S.P.

FRANCE

Hewlett-Packard France
21, Mercure B
Rue Berthelot
F-13763 Les Milet Cedex
AIX-EN-PROVENCE
Tel: 423 65 41 02
Telex: 410770P
A.C.H.M.C.S.E.P.M.

Hewlett-Packard France
Bureau de vente de Lyon
Chemin des Mouilles
Boite Postale 162
F-69130 ECULLY Cedex
Tel: 781 33 81 25
Telex: 319617P
A.C.H.M.C.S.E.M.P.

Hewlett-Packard France
Immeuble France Evry
Tour Lorraine
Boulevard de France
F-91035 EVRY Cedex
Tel: 601 77 96 60
Telex: 692315P
A.C.M.E.P.

CHILE

Hewlett-Packard France
Centre d'Affaires Paris Nord
Bâtiment Ampère 5, Allée
Rue de la Commune de Paris
Boite Postale 300
F-93163 LE BLANC MESNIL
Tel: 01 685 44 52
Telex: 21 0329
A.C.H.M.C.S.E.M.S.

Hewlett-Packard France
Le Monesteguy
Avenue du Président J.F. Kennedy,
F-91947 Les Ulis Cedex ORSAY
Tel: 01 90 71 78 25
Telex: 856449
A.C.H.M.C.S.E.M.P.

GREAT BRITAIN

Hewlett-Packard Ltd
Trafalgar House
Nightingale Road
ALTRINCHAM
Cheshire WA14 1NU
Tel: 061 308 6422
Telex: 668096
A.C.H.M.C.E.M.

Hewlett-Packard Ltd
Pinewood
Nine Mile Ride
EASTHAMPTON
Berks RG11 3LL
Tel: 3446 3100
Telex: 84 88 05
A.C.H.M.C.S.E.M.

Hewlett-Packard Ltd
Finger House
257, 261 High Street
LONDON COLNEY
Herts AL2 1HA St. Andrews
Tel: 07271 24430
Telex: 1 8952716
A.C.H.M.C.S.E.M.

Hewlett-Packard France
2 Allée de la Bourgonnette
F-35100 RENNES
Tel: 99 51 42 44
Telex: 7409 12P
A.C.H.M.E.M.S.P.

Hewlett-Packard France
4 Rue Thomas Mann
Boite Postale 56
F-67200 STRASBOURG
Tel: 88 28 56 46
Telex: 690147P
A.C.H.M.E.M.S.P.

Hewlett-Packard France
20 Chemin de la Chapelle
F-31081 TOULOUSE Cedex
Tel: 61 44 01 12
Telex: 531639P
A.C.H.M.C.S.E.P.

Hewlett-Packard France
Immeuble Pérenette
Rue van Gogh
F-59650 VILLENEUVE D'ASO
Tel: 201 91 41 25
Telex: 160124P
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Berlin
Kehlhofstrasse 2-4
D-1000 BERLIN 30
Tel: 1030 24 90 86
Telex: 018 3405 hpdd d
A.C.H.M.C.S.E.M.P.

Hewlett-Packard GmbH
Technisches Büro Böblingen
Herzenberg-Strasse 110
D-7030 BOBLINGEN
Tel: 07131 6671
Telex: 018 3405 hpdd d
A.C.H.M.C.S.E.M.P.

Hewlett-Packard GmbH
Technisches Büro Düsseldorf
Emanuel-Leutze-Strasse 1
D-4000 DUSSELDORF
Tel: 0211 5971
Telex: 085 86 533 hpdd d
A.C.H.M.C.S.E.M.P.

Hewlett-Packard GmbH
Technisches Büro Frankfurt
Kapslstraße 5
D-2000 HAMBURG 60
Tel: 040 63804
Telex: 021 93 032 hpdd d
A.C.H.M.C.S.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Hamburg
Kapslstraße 5
D-2000 HAMBURG 60
Tel: 040 63804
Telex: 021 93 032 hpdd d
A.C.H.M.C.S.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Hannover
Am Grossmarkt 6
D-3000 HANNOVER 91
Tel: 051 11 46 00 01
Telex: 092 3259
A.C.H.M.C.S.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Mannheim
Risslandweg 2-4
D-6800 MANNHEIM
Tel: 062 11 70050
Telex: 0462 105
A.C.M.E.P.

Hewlett-Packard GmbH
Technisches Büro Neu-Ulm
Messerschmidtstrasse 7
D-7910 NEU-ULM
Tel: 071 7024
Telex: 0712616 HP ULM D
A.C.E.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro München
Eschenstrasse 5
D-80028 TAUFKIRCHEN
Tel: 089 4 117 1
Telex: 0524585
A.C.H.M.C.S.E.P.

Hewlett-Packard GmbH
Technisches Büro New York
New York
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard GmbH
Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 NURNBERG
Tel: 092 11 52 20 83 87
Telex: 0629 860
A.C.H.M.E.M.S.P.

Hewlett-Packard Ltd
Traders House, St. Mary's Walk
MAIDENHEAD
Berks SL6 1ST
Tel: 0628/39151
A.C.H.M.C.S.E.P.

Hewlett-Packard Ltd
Quadrangle
106 118 Station Road
REDHILL, Surrey
Tel: 07371 68655
Telex: 947234 CH CS E

Hewlett-Packard Ltd
King St Street Lane
WIMBORNE Wokingham
Berks RG11 5AP
Tel: 10734 784774
Telex: 847178
A.C.H.M.E.M.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

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Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
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A.C.H.M.C.S.E.M.P.

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Kostas Karayannis S.A.
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Tel: 32 30 303 32 37 371
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A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
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A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
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4 Pireos Street
ATHENS GR 101
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A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Ltd
Kostas Karayannis S.A.
4 Pireos Street
ATHENS GR 101
Tel: 32 30 303 32 37 371
Telex: 21 59 62 RKAR GR
A.C.H.M.C.S.E.M.P.

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio 9
I-20063 CERUSSCO SUL NAVIGLIO
Tel: 02 903691
Telex: 180131 NAPLES
A.C.H.M.C.S.E.M.P.P.

Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco A
Capodimonte 62/A
I-80131 NAPLES
Tel: 106117413544
Telex: 710698
A.C.H.M.E.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Via Turazza 14
I-135100 PADOVA
Tel: 0491 654868
Telex: 430315
A.C.H.M.C.E.M.S.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: 1010 16 37 07
E.C.



SALES & SUPPORT OFFICES

Arranged alphabetically by country (cont.)

PANAMA
Electronica Baboia S.A.
Calle Samuel Lewis, Ed. Alta
Apartment 4929
P.O. Box 1510
Tel: 54-2700
Telex: 3438 ELECTRON PD
A.C.M.E.M.P.

PANAMA S
Tel: 54-2700
Telex: 3438 ELECTRON PD
A.C.M.E.M.P.

PERU
Cis Electro Máxima S.A.
Los Flamencos 145, San Isidro
Castilla 1030
LIMA 1
Tel: 41-4325 41-3703
Telex: Pdp. Boon 25306
A.C.M.E.M.P.

PHILIPPINES
The Onine Advanced Systems
Corporation
Rico House, Amoroso Cor. Herrera
Street
Legaspi Village, Makati
P.O. Box 1510
Metro MANILA
Tel: 85-35 81 85-34 91 85-32 21
Telex: 3274 ONLINE
A.C.H.C.S.E.M.P.

POLAND
Buro Informacji Technicznej
Hewlett-Packard
Ul. Stawki 2, 6P
P.O. Box 950 WARSZAWA
Tel: 39-59-62 39-67 43
Telex: 812453 hepa pl
A.C.H.C.S.E.M.P.

PORTUGAL
Telectra Empresa Técnica de
Equipamentos Eletrónicos S.A.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
LISBOA 1
Tel: (19) 68 60 72
Telex: 12598
CH.C.S.E.M.P.

ROMANIA
Hewlett-Packard Reprezentanta
Boulevard Nicolae Balescu 16
BUCURESTI
Tel: 130725
Telex: 10440

SAUDI ARABIA
Modern Electronic Establishment
P.O. Box 193
ALKHOBAR
Tel: 864 4678
Telex: 670136
Cable: ELECTAL KHOBAR
CH.C.S.E.M.P.

SAUDI ARABIA
Modern Electronic Establishment
P.O. Box 1228, Bagdadiat Street
JEDDAH
Tel: 640 0229
Telex: 4201035
Cable: ELECTAL JEDDAH
CH.C.S.E.M.P.

SAUDI ARABIA
Modern Electronic Establishment
P.O. Box 2728
RIYADH
Tel: 491 9715 491 6387
Telex: 200756
CH.C.S.E.M.P.

SCOTLAND
Hewlett-Packard Ltd.
SOUTH QUEENSFERRY
West Lochan, EH30 95T
GB Scotland
Tel: (031) 3311188
Telex: 72682
A.C.H.C.M.P.

SINGAPORE
Hewlett-Packard Singapore (Pty.)
Ltd.
P.O. Box 58, Alexandra Post Office
SINGAPORE 9115
6th Floor, Hutchape House
450 452 Alexandra Road
SINGAPORE 0511
Tel: 631786
Telex: HPSGSO RS 34209
Cable: HEWPAK, Singapore
A.C.H.C.S.E.M.P.

SOUTH AFRICA
Hewlett-Packard South Africa (Pty.)
Ltd.
P.O. Box 126
Howard Park
Pine Park Center, Forest Drive
Pinelands
CAPE PROVINCE 7450
Tel: 53 7455 53 7456 53 7417
Telex: 627916
A.C.H.C.M.E.M.P.

SOUTH AFRICA
Hewlett-Packard South Africa (Pty.)
Ltd.
P.O. Box 13344
Glenislie, D.D.10, TRANSVAAL
1st Floor, East
Constance Park, Ridge Shopping
Centre
Constance Park
PRETORIA
Tel: 460045
Telex: 32763
CH.E.

SOUTH AFRICA
Hewlett-Packard South Africa (Pty.)
Ltd.
Private Bag, Amnicor
SANDTON 2144
Tel: 800 5111, 800 5121
Telex: 416877
Cable: HEWPAK Johannesburg
A.C.H.C.M.E.M.P.

SPAIN
Hewlett-Packard España S.A.
C/ Enrique 321
E BARCELONA 29
Tel: (3) 322 24 51 321 73 54
Telex: 136031 HDEH
A.C.H.C.M.S.E.M.P.

SPAIN
Hewlett-Packard España S.A.
C/ San Vicente S.N.
Edificio Albia II 7 B
E BILBAO 1
Tel: (4) 23 8306 (4) 23 8206
A.C.H.C.M.S.E.M.P.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

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Calle Jerez 3
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Calle Jerez 3
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Telex: 23515 HDE
A.C.M.E.

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Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

SPAIN
Hewlett-Packard España S.A.
Calle Jerez 3
E MADRID 16
Tel: (1) 458 2600
Telex: 23515 HDE
A.C.M.E.

UNITED STATES
Alabama
Hewlett-Packard Co.
P.O. Box 4207
8250 Whitesburg Drive, S.E.
HUNTSVILLE, AL 35802
Tel: (205) 881 4591
CH.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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A.C.H.C.M.S.E.M.P.

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A.C.H.C.M.S.E.M.P.

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PHOENIX, AZ 85034
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A.C.H.C.M.S.E.M.P.

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A.C.H.C.M.S.E.M.P.

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A.C.H.C.M.S.E.M.P.

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2336 East Magnolia Street
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A.C.H.C.M.S.E.M.P.

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A.C.H.C.M.S.E.M.P.

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PHOENIX, AZ 85034
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A.C.H.C.M.S.E.M.P.

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2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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2336 East Magnolia Street
PHOENIX, AZ 85034
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A.C.H.C.M.S.E.M.P.

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Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

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Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Arizona
Hewlett-Packard Co.
2336 East Magnolia Street
PHOENIX, AZ 85034
Tel: (602) 273 8000
A.C.H.C.M.S.E.M.P.

Illinois
Hewlett-Packard Co.
5201 Tolview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255 9800
A.C.H.C.M.S.E.M.P.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

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Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

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Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

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P.O. Box 50607
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INDIANAPOLIS, IN 46250
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7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

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P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

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Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

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Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C.H.C.M.S.E.M.S.

Indiana
Hewlett-Packard Co.
P.O. Box 50607
7301 N. Shadeland Avenue
INDIANAPOLIS, IN 46250
Tel: (317) 842 1000
A.C

