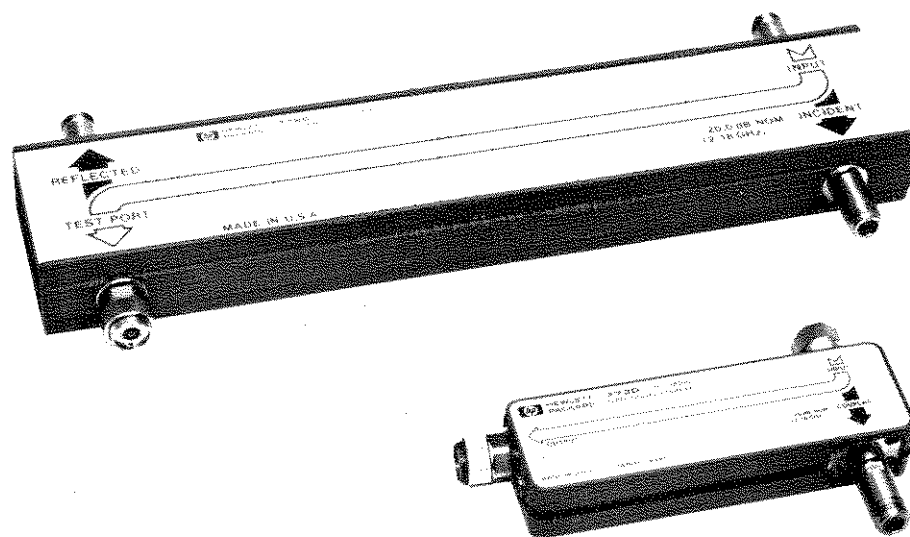


# HP 772D HP 773D DIRECTIONAL COUPLER



Operating and Service Manual Part No. 00772-90001  
Edition 1 E1288  
Microfiche Part No. 00772-90004



**HEWLETT  
PACKARD**

## **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.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

### **EXCLUSIVE REMEDIES**

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

## **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 772D HP 773D DIRECTIONAL COUPLER**

## **SERIAL NUMBERS**

This manual applies directly to instruments with serial numbers prefixed 2829A and above.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY THIS MANUAL.



© Copyright HEWLETT-PACKARD COMPANY 1988  
1501 PAGE MILL ROAD, PALO ALTO, CALIFORNIA, U.S.A.

OPERATING AND SERVICE MANUAL PART NO. 00772-90001

Edition 1 E1288

Microfiche Part No. 00773-90004



Figure 1. HP 772D and HP 773D Directional Couplers

## General Information

This Operating Manual contains information about initial inspection, performance tests, adjustments, operation, and troubleshooting of the HP 772D/773D Directional Couplers.

On the title page of this manual is a "Microfiche" part number. This number can be used to order a 4 x 6-inch microfilm transparency of this Operating Note.

## Description

**HP 772D Dual Directional Coupler.** The HP 772D Dual Directional Coupler is a four port passive device. Directional couplers sample power flowing in one direction and ignore power flowing in the opposite direction. Two couplers are incorporated in the HP 772D so that power flowing in either direction can be sampled. Such a system is usually called a reflectometer. In a reflectometer the incident power flowing into the setup and the reflected power from the device under test are compared.

**HP 773D Directional Coupler.** The HP 773D Directional Coupler is a three port passive device. Directional couplers in their auxiliary arms sample the power flowing in one direction in the mainline and ignore power flowing in the opposite direction. They can be used for measurement purposes or for power leveling. The coupling in the HP 773D changes the same as the coupling variation of the input coupler in the HP 772D. This property may be used to cancel out the coupling variation of the HP 772D in a reflectometer setup by using the HP 773D to change the coupling for tracking purposes.

## 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 a sequential suffix which is unique to each instrument. The contents of this manual apply directly to instruments having the serial number prefix listed under SERIAL NUMBERS on the title page.

## Manual Changes Supplement

Directional Couplers manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. If your Directional Coupler has a prefix number not listed on the title page look for a yellow Manual Changes supplement that documents the differences.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement is keyed to the manual print date and part number, both of which appear on the title page.

Copies of the supplement are available on request from your nearest Hewlett-Packard office.

For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

**Warranty** The Directional Couplers are warranted and certified as indicated on the inside cover of this manual.

**Specifications** The specifications listed in Table 1 are the performance standards or limits against which the Directional Couplers are tested. Unless otherwise stated, the specifications apply to both Directional Couplers.

**Table 1. Specifications**

Characteristics and Conditions	Limits	Comments
<b>Frequency Range</b>	0.1 to 18 GHz	
<b>Minimum Directivity</b> 0.1 to 2 GHz 2 to 12.4 GHz 12.4 to 18 GHz	36 dB 30 dB 27 dB	
<b>Maximum Primary Line SWR</b> HP 772D 0.1 to 2 GHz 2 to 12.4 GHz 12.4 to 18 GHz HP 773D 0.1 to 2 GHz 2 to 12.4 GHz 12.4 to 18 GHz	1.1 1.25 1.35 1.07 1.21 1.27	50 ohm nominal impedance
<b>Maximum Auxliary Line SWR</b> 0.1 to 2 GHz 2 to 12.4 GHz 12.4 to 18 GHz	1.09 1.3 1.3	50 ohm nominal impedance
<b>Nominal Coupling (2-18 GHz)</b>	$20.2 \pm 1$ dB	Established with a best fit line through the coupling curve.
<b>Maximum Coupling Variation</b> HP 772D 2 to 12.4 GHz 12.4 to 18 GHz HP 773D 2 to 18 GHz	$\pm 0.85$ dB $\pm 0.90$ dB $\pm 0.85$ dB	TEST PORT to INCIDENT  OUTPUT to COUPLED PORT

Table 1. Specifications (cont'd)

Characteristics and Conditions	Limits	Comments
Tracking	$\leq \pm 0.7$ dB	With HP 772D TEST PORT shorted and not including source-match ripple. Refers to the relative tracking of the auxiliary arms: auxiliary arms do not necessarily track in absolute power. Typical relative tracking between HP 772D and 773D is $\leq \pm 0.7$ dB
Primary Line Residual Loss		
HP 772D	$< 1.31$ dB	
Opt. 001	$< 1.38$ dB	
HP 773D	$< 0.75$	
Opt. 001	$< 0.90$	
Maximum Power Input	50W (47 dBm) average 250 W (54 dBm) peak	
Connectors	MIL-C-39012	
HP 772D: INPUT INCIDENT REFLECTED TEST PORT	Type N (female) Type N (female) Type N (female) APC-7	
HP 773D: INPUT COUPLED OUTPUT	APC-7 Type N (female) APC-7	
Option 001	Type N (female)	On all ports on both HP 772D and 773D.
Operating Environment:		
Temperature Range	0°C to +55°C	
Humidity	$< 95\%$	
Maximum Altitude	4570 metres (15,000 feet)	
Net Weight:		
HP 772D	2.6 kg (5.72 lb)	
HP 773D	0.8 kg (1.76 lb)	
Dimensions:		
HP 772D		
Length:	391 mm (15.4 in)	
Width:	133 mm (5.3 in)	
Height:	43 mm (1.7 in)	
HP 773D		
Length:	186 mm (7.3 in)	
Width:	108 mm (4.3 in)	
Height:	30 mm (1.2 in)	

### Supplemental Characteristics

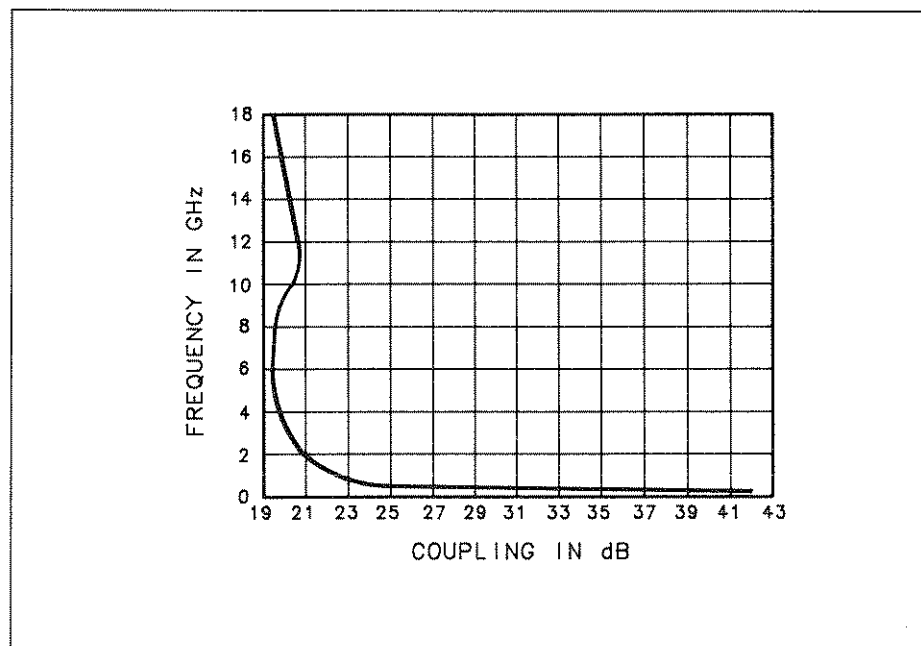
Supplemental characteristics are not specifications; that is, they are not covered by the certification and warranty at the beginning of this manual. They are typical or nominal characteristics included as additional information for the user.

**Effective Source Match.** Effective source match is the apparent reflection at the output of an RF generator system which uses the HP 772D (used as a reflectometer) or HP 773D.

**Table 2. Effective Source Match**

Frequency	HP 772D	HP 773D
0.1 to 2 GHz	$\geq 1.06$	$\geq 1.05$
2 to 12.4 GHz	$\geq 1.13$	$\geq 1.12$
12.4 to 18 GHz	$\geq 1.18$	$\geq 1.15$

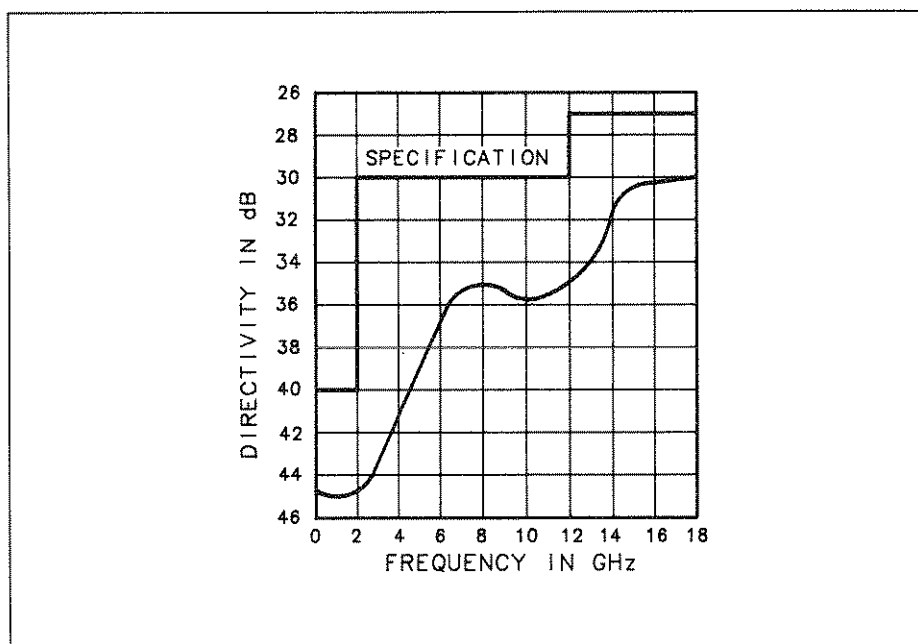
**Voltage Incident on HP 772D TEST PORT and HP 773D INPUT.** Figure 2 depicts the typical coupling curve of the HP 772D and HP 773D.



**Figure 2. Voltage Incident on HP 772D TEST PORT and HP 773D INPUT**



**Directivity.** The following graph depicts the HP 772D/773D typical changes in directivity over the frequency range.



**Figure 3. Directivity**

**Calculating HP 772D Error.** Analysis has shown the typical measurement error of the HP 772D to be:

$$E_s = A + B\Gamma_x + C\Gamma_x^2$$

where:

$E_s$  = Error of Swept-frequency Measurement

$A$  = Directivity of HP 772D

$B$  = Effective Source Match + Coupler Directivity

$C$  = Source Match

$\Gamma_x$  = Reflection Coefficient of Unknown

By using various techniques, such as fixed-frequency measurements, calibrating out the source match error by taking an average of the open and short-circuit readings, or by running a calibration grid this error can be reduced to:

$$E_f = A + C\Gamma_x^2$$

These two equations are graphed as follows:

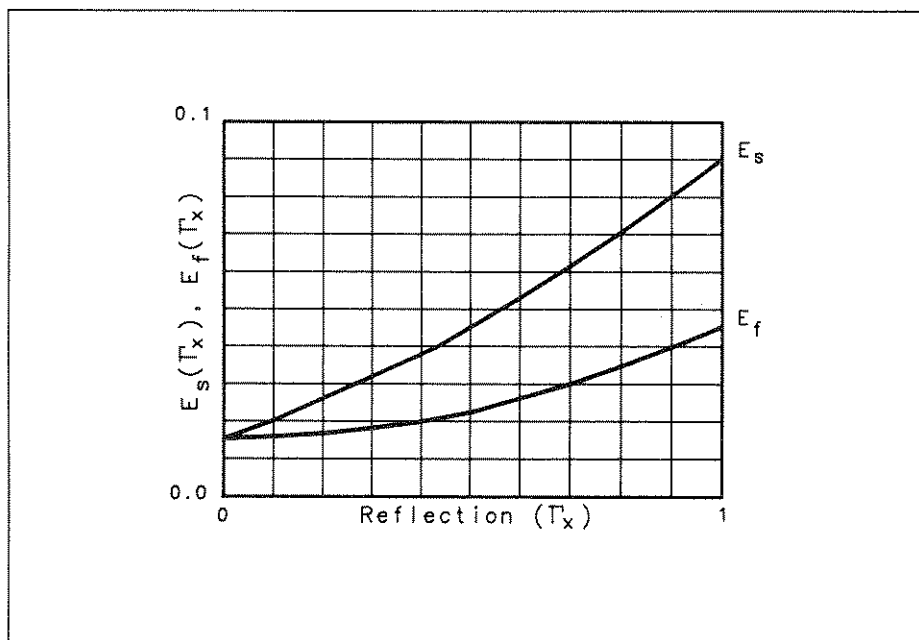


Figure 4. HP 772D Error 0.1 to 2.0 GHz

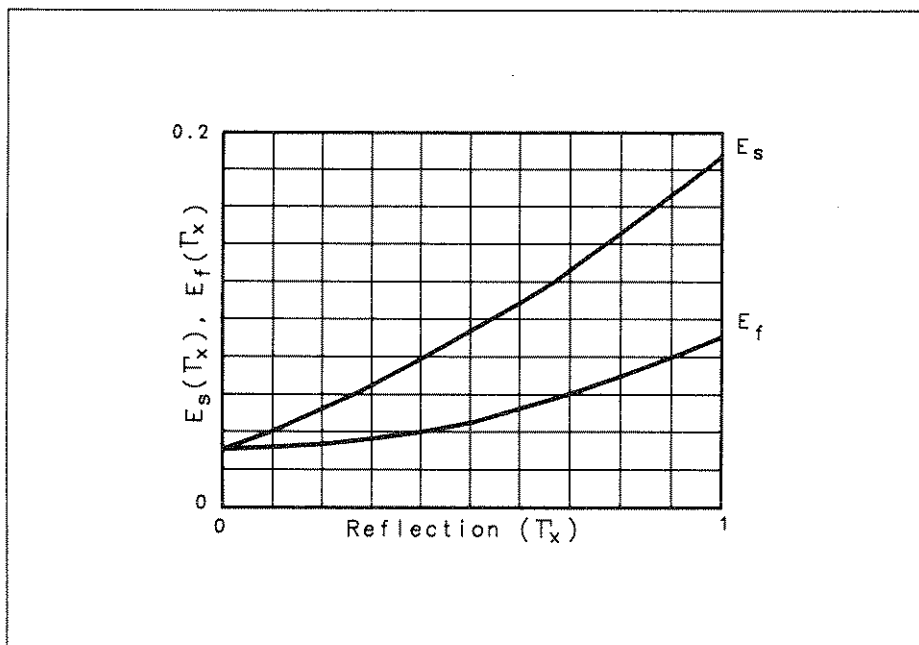


Figure 5. HP 772D Error 2.0 to 12.4 GHz

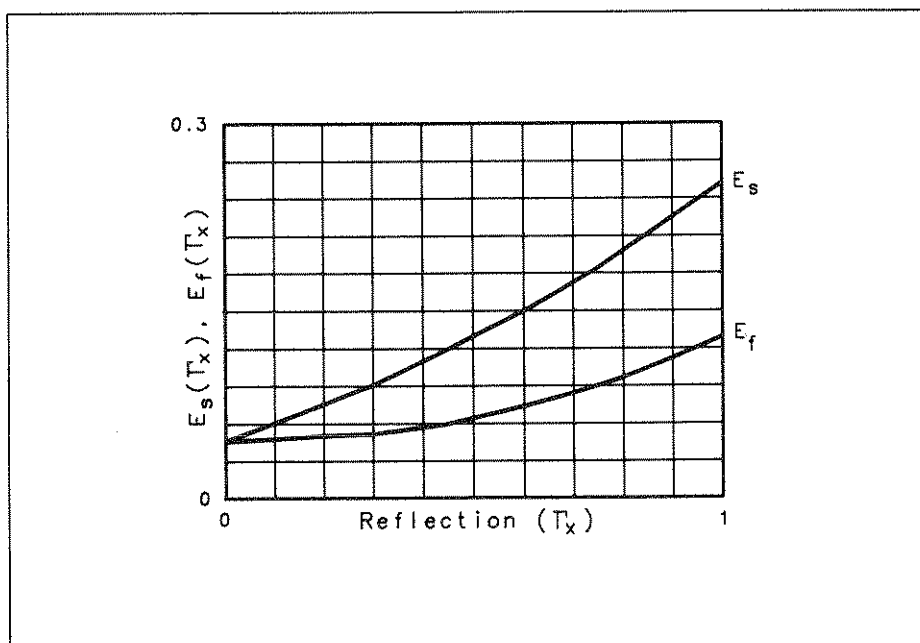


Figure 6. HP 772D Error 12.4 to 18.0 GHz

Table 3. Recommended Test Equipment

Instrument	Critical Specifications	Suggested Model	Use <sup>1</sup>
Sweep Oscillator	CW and swept frequency signal in 0.01 GHz to 40 GHz range	HP 8350B main frame with HP 83592B RF Plug-in (0.01 to 20 GHz)	P, T
Scalar Network Analyzer	Swept frequency transmission and reflection measurements from 0.01 to 60 GHz. AC/DC detection capability	HP 8757A	P, T
Detectors (2)	Range: -60 dBm to +16 dBm	HP 11664A	P, T
Fixed Termination	Range: dc to 6 GHz	HP 909F	P, T
Sliding Load	Range: 1.8 to 18 GHz	HP 905A	P, T
Coaxial Short	Mates with Type N (male) Mates with Type N (female) Mates with APC-7	HP 85054-60026 HP 85054-60025 HP 85050-80007	P, T
Coaxial Open	Mates with Type N (male) Mates with Type N (female) Mates with APC-7	HP 85054-60028 HP 85054-60027 HP 85050-80010	P, T

<sup>1</sup> P = Performance Test T = Troubleshooting

## Installation

### Initial Inspection

Inspect the shipping container for damage. If the shipping container or packaging material is damaged, it should be kept until the contents of the shipment have been checked. If there is mechanical damage or if the Directional Couplers do not pass the performance tests, notify the nearest Hewlett-Packard office. Keep the damaged shipping materials (if any) for inspection by the carrier and a Hewlett-Packard representative.

### Storage and Shipment

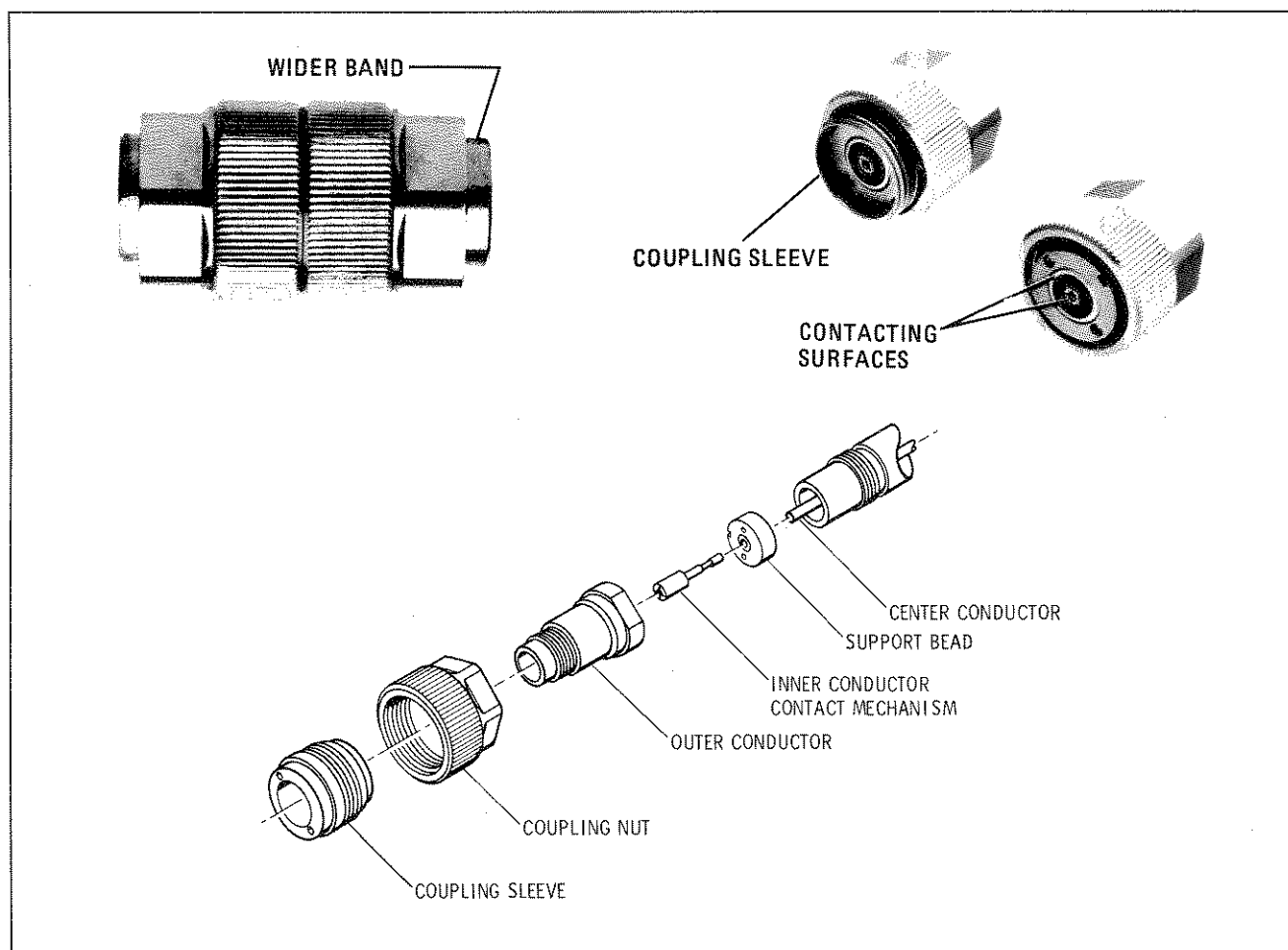
**Storage Environment.** The Directional Couplers should be stored in a clean, dry environment. The following limitations apply to both storage and shipment:

Temperature	-5 to +75°C
Relative Humidity	< 95%
Altitude	< 7620 metres (25,000 feet)

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

### Connectors

For instruction on connecting and care of your connectors we recommend *Microwave Connector Care* (HP part number 08510-90064). For the use and care of APC-7 connector see Figure 5.



**Figure 7. Use and Care of 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.
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.

### Caution



---

Part the connectors carefully to prevent striking the inner conductor contact.

---

### Care

1. Keep the 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 toothbrush 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, dioxane, gasoline, cellosolve acetate, or carbon tetrachloride. Keep exposure of the connector parts to both the cleaning fluid and its vapors as brief as possible.

---

## Operation

### Operating Environment

The operating environment for the Directional Couplers should be within the following limits:

Temperature	0 to +55°C
Relative Humidity	< 95%
Altitude	< 4570 metres (15,000 feet)

### Operating Precautions

#### Caution



Do not use aromatic hydrocarbons such as acetone, trichlorethylene, carbon tetrachloride or benzene to clean connector surfaces.

Do not spray any liquid solvent directly onto connector surfaces.

Connector wear eventually degrades performance. To prolong the life of your connectors:

1. Inspect and clean all surfaces that come in contact.
  2. Do not connect to a damaged connector. Replace damaged connectors.
  3. Turn only the connector nut (not the device) when making connection.
-

## Using the HP 772D Dual Directional Coupler

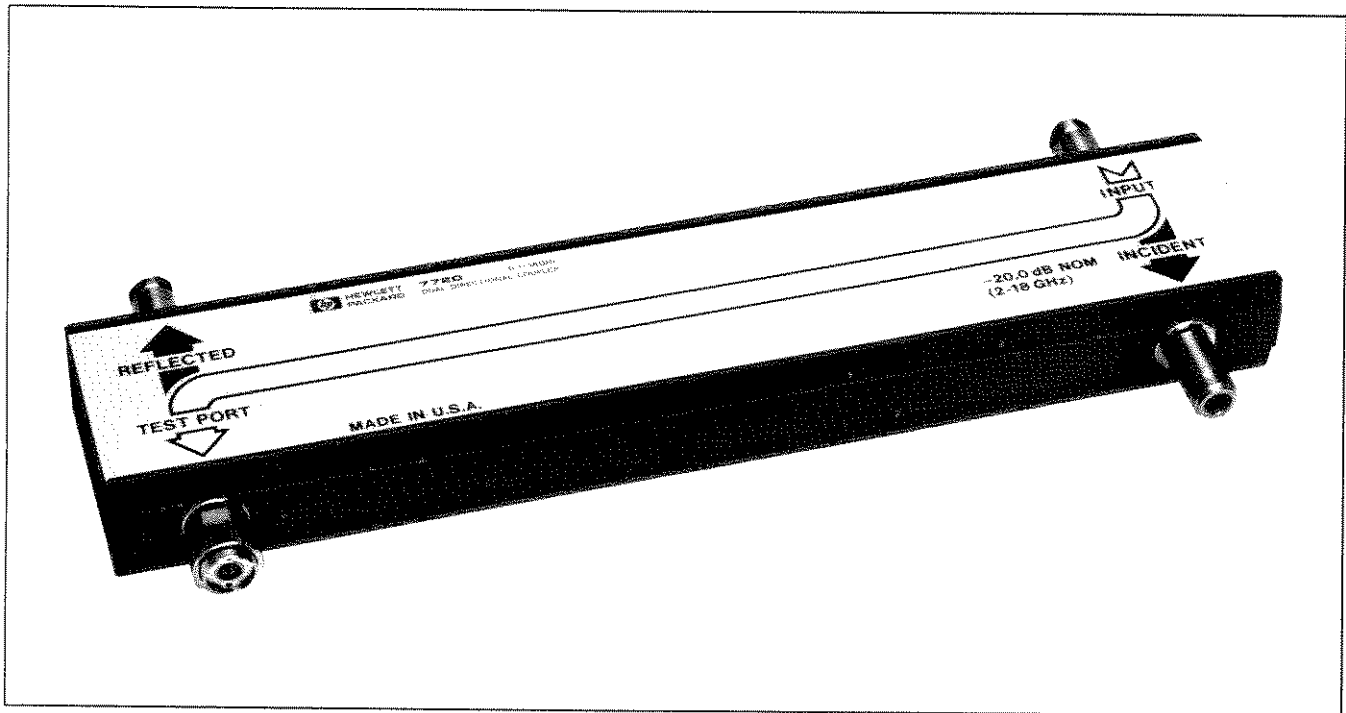


Figure 8. HP 772D Dual Directional Coupler

### Caution



Maximum power input is 50W CW or 250W peak. Greater power may damage the HP 772D

1. Connect signal from signal source to the INPUT connector.
2. Connect output signal from TEST PORT connector to the test setup.
3. Connect incident power-indicating device to the INCIDENT port. The power from this port is attenuated approximately 20 dB from that flowing on the mainline in a forward direction (from INPUT to TEST PORT).
4. Connect the reflected-power indicating device to the REFLECTED port. Coupler power from this port will be attenuated approximately 20 dB from the power reflected by a device under test connected to the TEST PORT. Mainline power flowing from the INPUT port to the REFLECTED port will be attenuated an additional amount equal to the directivity.



## Using the HP 773D Directional Coupler



Figure 9. HP 773D Directional Coupler

### Caution



Maximum power input is 50W CW, 250W peak. Greater power may damage the HP 773D.

Numerals are keyed to the numbers in parentheses below.

1. Connect signal from signal source to the INPUT port.
2. Connect output signal from OUTPUT port to the test setup.
3. Connect the coupled signal from the COUPLED port to the detector. The power from this port is attenuated approximately 20 dB from that flowing on the mainline in a forward direction (from INPUT to OUTPUT ports). Any voltage *reflected* from equipment connected to the OUTPUT port will be attenuated an additional amount equal to the directivity.

## Performance Tests

The following procedures test the HP 772D and 773D electrical performance specified in Table 1. All tests can be performed without access to the interior of the instrument.

### Setup and Calibration

Figure 10 shows the test setup used for the subsequent performance tests. To account for frequency response errors and calibrate your test setup, perform the following procedure.

#### Equipment:

Sweep Oscillator	HP 8350B
RF Plug-In	HP 83592B
Network Analyzer	HP 8757A
Detectors (2)	HP 11664A
Sliding Load	HP 905A (No substitution)
Fixed Termination	HP 909F
Directional Coupler	HP 773D
Fixed Short	HP 85050-80007 (APC-7) or HP 85054-60025 (Type N (m))

1. Connect your HP 772D or HP 773D to the test equipment as shown in Figure 10.
2. Set the test equipment controls as follows:

Sweep Oscillator	Network Analyzer	RF Plug-In
Start Marker: 100 MHz	Channel 1	ALC Mode: Internal
STOP Marker: 18 GHz	Display: A/R	Display: A/R
Trigger: Internal	Scale: 1 dB/din	RF: ON
Time: 0.2 seconds	Reference Level: 0 dBm	
Display Blanking: ON		
Modulation: ON		

3. Perform Short/Open calibrations according to the directions for your network analyzer. The calibration should be automatically stored in Channel 1 memory.
4. On the HP 8757A press M. MEM on Channel 1 display keys. On equivalent network analyzers press the key sequence that will remove calibration and frequency response errors from further measurements according to the equation:  $E_s = E_f = A + C\Gamma_x^2$ . (See Calculating HP 772D Error under Supplemental Characteristics in this manual.)

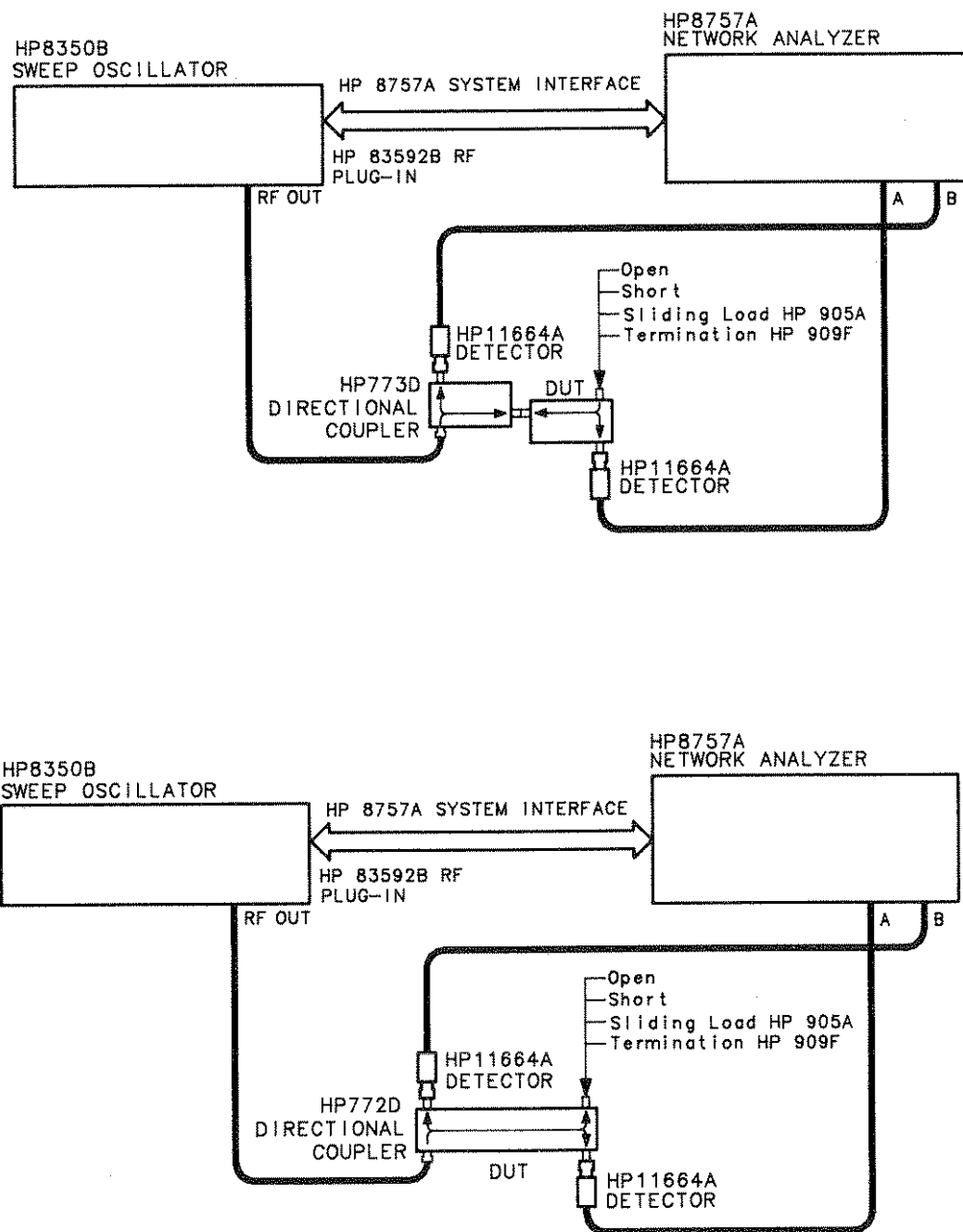


Figure 10. HP 772D/773D Performance Test Setup

**Directivity Test**

This test assumes that setup and calibration has already been completed. To check that the Couplers meet the directivity specifications in Table 1 perform the following steps:

**Note**

The accuracy of the test system must be added to the directivity specification in Table 1.

1. Connect the fixed termination as shown in Figure 10.
2. Set the network analyzer Channel 1 reference level to -36 dBm. Verify that the directivity is within specification from 0.1 GHz to 2 GHz.

Directivity (0.1 to 2 GHz) \_\_\_\_\_ < 36 dB

3. Connect the sliding load as shown in Figure 10. At frequencies of interest, phase (move) the load element. Read the peaks and troughs and calculate the difference in dB ( $\Delta D_{dB}$ ). Find the appropriate correction factor ( $D_{c_{dB}}$ ) from Table 4.

Actual directivity = Directivity peak value (in dB) -  $D_{c_{dB}}$ .

**Table 4. Correction for Element Reflection of the HP 905A.**

$\Delta D_{dB}$	$D_{c_{dB}}$	$\Delta D_{dB}$	$D_{c_{dB}}$	$\Delta D_{dB}$	$D_{c_{dB}}$
1.0	0.40	3.6	1.60	6.0	2.40
1.1	0.50	3.9	1.70	6.5	2.60
1.4	0.60	4.0	1.70	7.0	2.80
1.6	0.70	4.1	1.80	7.5	2.90
1.8	0.80	4.2	1.80	8.0	3.10
2.0	0.90	4.3	1.85	8.5	3.20
2.2	1.00	4.4	1.90	9.0	3.30
2.5	1.10	4.5	1.90	9.5	3.50
2.7	1.20	4.6	2.00	10.0	3.60
3.0	1.30	4.7	2.00	12.0	4.00
3.1	1.40	4.9	2.10	14.0	4.30
3.2	1.40	5.0	2.10	16.0	4.60
3.4	1.50	5.5	2.30		

4. Verify that directivity is within specification from 2 GHz through 18 GHz.

Directivity (2 GHz to 12.4 GHz) \_\_\_\_\_ <= 30 dB

Directivity (12.4 GHz to 18 GHz) \_\_\_\_\_ <= 27 dB

<b>VSWR Test</b>	To check that your Directional Coupler meets VSWR specifications in Table 1, use any test system that has a reflection coefficient accuracy better than 0.01 (40 dB directivity). Connect the port of the Coupler under test to the system and terminate all unused ports with a 50 ohm load. Repeat this measurement on both primary ports and all auxiliary ports.
<b>Maximum Coupling Variation With Frequency Test</b>	To check that your Directional Coupler meets the maximum coupling variation specification in Table 1, measure the coupling at the COUPLED port with respect to the OUTPUT port on the HP 773D. For the HP 772D, measure coupling at the INCIDENT port with respect to TEST PORT. Use any insertion loss measurement system capable of measuring to an accuracy of $\pm 0.3$ dB, or better. Be sure to terminate any unused ports with accurate 50 ohm loads.
<b>Tracking Test (HP 772D only)</b>	To check that the HP 772D meets the tracking specifications in Table 1, make a ratio measurement as shown in Figure 10BA. Measure the difference in coupling at the REFLECTED and INCIDENT ports while phasing (moving) a moving short connected to the TEST PORT. Read the average indication as the tracking. Note that the accuracy of the measurement system must be added to the specifications in Table 1.
<b>Primary Line Residual Loss Test</b>	To check that your Directional Coupler meets the primary line residual loss specifications in Table 1, first calibrate the same equipment as used for the coupling test without a DUT connected in the test setup. Store the trace in the Network Analyzer memory and use "Measurement Memory Mode." The trace can now be used as a reference. Insert the Directional Coupler under test and read the indication from the reference line.

## Replaceable Parts

There are no internal replaceable parts within the HP 772D or HP 773D Directional Couplers. The connectors and HP 772D bottom package are not considered field repairable and are not listed. The parts listed in Table 5 are field repairable.

**Table 5. Replaceable Parts**

HP Part No.	Description
00772-20001	HP 772D Top package (does not include ends)
00772-20003	HP 772D End (two required)
5040-0274	HP 772D Foot (4 required)
0361-0207	HP 773D Foot (4 required)
2510-0119	HP 772D Screw, Flat-Head Pozidrive 8-32 x 1/4 (16 required)
00772-80001	HP 772D ID Label
00773-80001	HP 773D ID Label
1401-0081	APC-7 Connector Dust Cover

### Service

If your HP 772D or 773D does not pass the performance tests, return it to Hewlett-Packard.

### Caution



Do not disassemble the HP 772D or 773D directional coupler assembly or any of the connectors. Doing so will disturb the center conductor and adversely affect directivity. Evidence of attempted customer repair will void warranty.

# MANUAL CHANGES

## DIRECTIONAL COUPLER

### MANUAL IDENTIFICATION

Model Number: HP 772D/773D  
Date Printed: E1288  
Part Number: 00772-90001

### ABOUT THIS SUPPLEMENT

Use this supplement to correct your manual or to update it for instrument changes that occurred after the manual was printed.

Some material in this supplement should be substituted for material in the manual. You can either perform the physical substitution or simply mark your manual with reference to appropriate pages in the supplement.

Change instructions are arranged in the manual's page-number order. Then, each instruction is identified by the word "Errata" or with a change number. Errata changes relate to all instruments. Instructions with change numbers relate only to certain instruments. These instruments are identified by serial number or prefix in the following table.

# -- This symbol identifies instructions that are appearing in the supplement for the first time.

Serial Prefix or Number	Make Manual Changes	Serial Prefix or Number	Make Manual Changes
No serial change	Errata Only		

### CHANGE INSTRUCTIONS

#### #Page 1-4: Table 1 Specifications:

The HP 772D and 773D Directional Couplers are specified from 2 GHz to 18 GHz. Delete all specifications for the 0.1 to 2 GHz frequency range as follows:

- Change the limits of Frequency Range to 2 to 18 GHz.

- Delete the Minimum Directivity specification for 0.1 to 2 GHz.

- Delete the Maximum Primary Line SWR specification for 0.1 to 2 GHz for both units.

- Delete the Auxiliary Line SWR specification for 0.1 to 2 GHz.

- Delete the Primary Line Residual Loss specification for Opt 001.

Change the specifications in the Limits column to the following:

- HP 772D Maximum Primary Line SWR (2 - 12.4 GHz) to 1.28;  
(12.4 to 18 GHz) to 1.40.

- Nominal Coupling (2-18 GHz) to 20 dB.

- HP 772/773D Maximum Coupling Variation (2 - 18 GHz) to +/- 1 dB.

- HP 772D Primary Line Residual Loss (2 - 18 GHz) to <1.5 dB.

- HP 773D Primary Line Residual Loss (2 - 18 GHz) to <0.90 dB.

(Errata)

#### NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

## CHANGE INSTRUCTIONS

**Page 1-6: Supplemental Characteristics**

Add the following information to Supplemental Characteristics:

- HP 772/773D Minimum Directivity (0.1 - 2 GHz) is 39 dB (Typ).
  - HP 772D Minimum Directivity (18 - 20 GHz) is 20 dB (Typ).
  - HP 773D Minimum Directivity (18 - 20 GHz) is 21 dB (Typ).
  - HP 772D Maximum Primary Line SWR (0.1 - 2 GHz) is 1.05 (Typ).
  - HP 773D Maximum Primary Line SWR (0.1 - 2 GHz) is 1.04 (Typ).
  - HP 772D Maximum Primary Line SWR (18 - 20 GHz) is 1.29 (Typ).
  - HP 773D Maximum Primary Line SWR (18 - 20 GHz) is 1.16 (Typ).
  - HP 772D Maximum Auxiliary Line SWR (0.1 - 2 GHz) is 1.08 (Typ).
  - HP 773D Maximum Auxiliary Line SWR (0.1 - 2 GHz) is 1.07 (Typ).
  - HP 772/773D Maximum Auxiliary Line SWR (18 - 20 GHz) is 1.17 (Typ).
  - HP 772D Primary Line Residual Loss (0.1 - 2 GHz) is <0.26 dB (Typ).
  - HP 773D Primary Line Residual Loss (0.1 - 2 GHz) is <0.15 dB (Typ).
  - HP 772D Primary Line Residual Loss (18 - 20 GHz) is <1.3 dB (Typ).
  - HP 773D Primary Line Residual Loss (18 - 20 GHz) is <0.6 dB (Typ).
- (Errata)

**Page 1-6: Table 2. Effective Source Match:**

Add a the frequency range 18 - 20 GHz. HP 772D Effective Source Match is  $\geq 1.32$ ; HP 773D is  $\geq 1.28$ .

(Errata)



## REGIONAL SALES AND SUPPORT OFFICES

*For information relating to Sales or Support of Hewlett-Packard products, first contact your local Hewlett-Packard office listed in the white pages of your telephone directory. If none is listed locally, contact Hewlett-Packard at one of the offices listed below to obtain the address or phone number of the Sales or Support office nearest you.*

### ASIA

Hewlett-Packard Asia Ltd.  
47/F, 26 Harbour Road  
Wanchai, **HONG KONG**  
G.P.O. Box 863, Hong Kong  
Tel: (852) 5-8330833  
Telex: 76793 HPA HX  
Cable: HPASIAL TD

### AUSTRALASIA

Hewlett-Packard Australia Ltd.  
31-41 Joseph Street  
**BLACKBURN**, Victoria 3130  
Australia  
Tel: (61) 895-2895  
Telex: 31-024  
Cable: HEWPARD Melbourne

### CANADA

Hewlett-Packard (Canada) Ltd.  
6877 Goreway Drive  
**MISSISSAUGA**, Ontario L4V 1M8  
Tel: (416) 678-9430  
Telex: 069-8644

### JAPAN

Yokogawa-Hewlett-Packard Ltd.  
29-21 Takaido-Higashi, 3 Chome  
Suginami-ku **TOKYO** 168  
Tel: 03 (331) 6111  
Telex: 232-2024 YHPTOK

### MEDITERRANEAN & MIDDLE EAST

Hewlett-Packard S.A.  
Mediterranean and Middle East  
Operations  
Atrina Centre  
32 Kifissias Avenue  
Paradissos-Amarousion, **ATHENS**  
Greece  
Tel: (30) 682 88 11  
Telex: 21-6588 HPAT GR  
Cable: HEWPACKSA Athens

### BENELUX & SCANDINAVIA

Hewlett-Packard S.A.  
Uilenstede 475  
P.O. Box 999  
NL-1183 AG **AMSTELVEEN**  
The Netherlands  
Tel: (31) 20/43 77 71  
Telex: 18 919 hpner nl

### SOUTH & EAST EUROPE, AFRICA

Hewlett-Packard S.A.  
7, rue du Bois-du-Lan  
CH-1217 **MEYRIN** 2, Geneva  
Switzerland  
Tel: (41) 22/83 12 12  
Telex: 27835 hmea  
Cable: HEWPACKSA Geneve

### FRANCE

Hewlett-Packard France  
Parc d'activités du Bois Briard  
2, avenue du Lac  
91040 **EVRY** Cedex  
Tel: 1 6/077 83 83  
Telex: 6923 15F

### GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH  
Hewlett-Packard-Strasse  
Postfach 1641  
D-6380 **BAD HOMBURG**  
West Germany  
Tel: 06172/400-0  
Telex: 410 844 hpbhg

### ITALY

Hewlett-Packard Italiana S.p.A.  
Via G. Di Vittorio 9  
I-20063 **CERNUSCO SUL NAVIGLIO**  
(Milano)  
Tel: 02/92 36 91  
Telex: 334632

### UNITED KINGDOM

Hewlett-Packard Ltd.  
King Street Lane  
Winnersh, **WOKINGHAM**  
Berkshire RG11 5AR  
Tel: 734/78 47 74  
Telex: 847178

### EASTERN U.S.A.

Hewlett-Packard Co.  
4 Choke Cherry Road  
**ROCKVILLE**, MD 20850  
Tel: (301) 670-4300

### MIDWESTERN U.S.A.

Hewlett-Packard Co.  
5201 Tollview Drive  
**ROLLING MEADOWS**, IL 60008  
Tel: (312) 255-9800

### SOUTHERN U.S.A.

Hewlett-Packard Co.  
2000 South Park Place  
P.O. Box 105005  
**ATLANTA**, GA 30348  
Tel: (404) 955-1500

### WESTERN U.S.A.

Hewlett-Packard Co.  
5161 Lankershim Blvd.  
P.O. Box 3919  
**NO. HOLLYWOOD**, CA 91609  
Tel: (818) 506-3700

### OTHER INTERNATIONAL AREAS

Hewlett-Packard Co.  
Intercontinental Headquarters  
3495 Deer Creek Road  
**PALO ALTO**, CA 94304  
Tel: (415) 857-1501  
Telex: 034-8300  
Cable: HEWPACK