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Agilent Technologies

Agilent Technologies
11691D and 11692D
Directional Couplers

Operating and Service
Manual

Serial Numbers

This manual applies directly to instruments with serial numbers prefixed 1212A.

Part number: 11691-90013
Printed in USA April 2002

Supersedes January 2000



11691-90013

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WARNING

The **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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Instrument Markings



When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.



This symbol indicates hazardous voltages.



The laser radiation symbol is marked on products that have a laser output.



This symbol indicates that the instrument requires alternating current (ac) input.



The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.



The CSA mark is a registered trademark of the Canadian Standards Association.



The C-tick mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australian EMC Framework regulations under the terms of the Radio communications Act of 1992.

1SM1-A

This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB du Canada.

Safety Earth Ground



This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Before Applying Power

Verify that the product is configured to match the available main power source as described in the input power configuration instructions in this manual. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Typeface Conventions

- | | |
|---------------------------|--|
| <i>Italics</i> | <ul style="list-style-type: none"> • Used to emphasize important information:
Use this software <i>only</i> with the Agilent xxxxxX system. • Used for the title of a publication:
Refer to the <i>Agilent xxxxxX System-Level User's Guide</i>. • Used to indicate a variable:
Type LOAD BIN <i>filename</i>. |
| Instrument Display | <ul style="list-style-type: none"> • Used to show on-screen prompts and messages that you will see on the display of an instrument:
The Agilent xxxxxX will display the message CAL1 SAVED. |
| [Keycap] | <ul style="list-style-type: none"> • Used for labeled keys on the front panel of an instrument or on a computer keyboard:
Press [Return]. |
| <i>{Softkey}</i> | <ul style="list-style-type: none"> • Used for simulated keys that appear on an instrument display:
Press <i>{Prior Menu}</i>. |
| User Entry | <ul style="list-style-type: none"> • Used to indicate text that you will enter using the computer keyboard; text shown in this typeface must be typed <i>exactly</i> as printed:
Type LOAD PARMFILE • Used for examples of programming code:
#endif // ifndef NO_CLASS |
| <i>Path Name</i> | <ul style="list-style-type: none"> • Used for a subdirectory name or file path:
Edit the file <i>usr/local/bin/sample.txt</i> |
| Computer Display | <ul style="list-style-type: none"> • Used to show messages, prompts, and window labels that appear on a computer monitor:
The Edit Parameters window will appear on the screen. • Used for menus, lists, dialog boxes, and button boxes on a computer monitor from which you make selections using the mouse or keyboard:
Double-click EXIT to quit the program. |

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Description

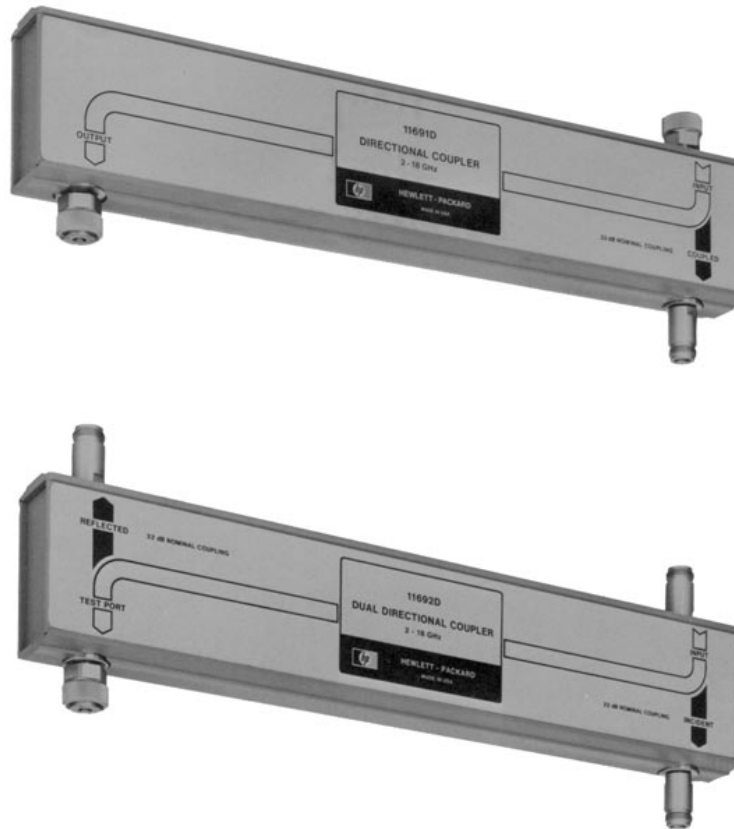


Figure 1 Agilent Technologies 11691D and 11692D Directional Couplers

Agilent 11691D Directional Coupler

The 11691D directional coupler is a three-port passive device. Directional couplers sample power flowing in one direction in the mainline and reject power flowing in the opposite direction. They may be used for measurement purposes or for power leveling. The coupling in the 11691D changes the same as the coupling variation of the input coupler in the 11692D. This property may be used to cancel out the coupling variation of the 11692D in a reflectometer setup by using the 11691D to change the coupling for tracking purposes.

Agilent 11692D Directional Coupler

The 11692D directional coupler is a four-port passive device. Directional couplers sample power flowing in one direction in a transmission line and reject power flowing in the opposite direction. Two couplers are incorporated in the 11692D 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.

Specifications

The specifications given below are the performance standards or limits against which the directional couplers are tested.

Table 1 *Specifications*

	Agilent 11691D	Agilent 11692D
Frequency range	2.0 to 18 GHz	2.0 to 18 GHz
Minimum directivity	INPUT PORT: 2 to 8 GHz, 30 dB 8 to 18 GHz, 26 dB ¹	TEST PORT: 2 to 8 GHz, 30 dB 8 to 18 GHz, 26 dB ¹ INPUT PORT: 2 to 18 GHz, 21 dB
Maximum primary line SWR	2 to 12.4 GHz, ≤ 1.3 12.4 to 18 GHz, ≤ 1.5	2 to 12.4 GHz, ≤ 1.3 12.4 to 18 GHz, ≤ 1.4
Maximum auxiliary ports SWR	1.3	1.3
Nominal coupling	20 dB	20 dB
Maximum coupling variation (with frequency)	$\leq \pm 1.0$ dB	$\leq \pm 1.0$ dB (incident to TEST PORT)
Tracking (auxiliary arms)	$-^2$	$\leq \pm 0.7$ dB ^{2,3}
Primary line residual loss	< 2 dB	< 1.5 dB
Primary line power handling capability	50 W average 250 W peak	50 W average 250 W peak
Net weight	4 lb, 4 oz (1.93 kg)	6 lb, 0 oz (2.72 kg)
Dimensions	L 404.8 mm (15-15/16 in)	L 404.8 mm (15-15/16 in)
	H 133.4 mm (5-1/4 in)	H 133.4 mm (5-1/4 in)
	W 42.9 mm (1-11/16 in)	W 42.9 mm (1-11/16 in)

1 Minimum directivity is 24 dB with type-N connector on the INPUT port of the 11691D or the TEST PORT of the 11692D.

2 Typical relative tracking between the 11691D and the 11692D $\leq \pm 0.7$ dB

3 With 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 the absolute power.

Supplemental characteristics are not specifications but are typical characteristics included as additional information for the user.

Table 2 Supplemental Performance Characteristics

	Agilent 11691D	Agilent 11692D
Effective source match*	≤ 1.4	≤ 1.2

* Effective source match is the apparent reflection coefficient at the output of an RF generator system which uses the 11691D or 11692D when used in a reflectometer.

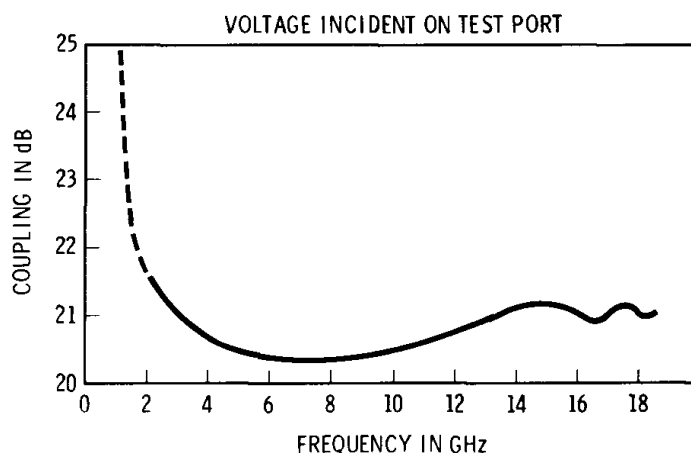


Figure 2 Voltage Incident on Test Port

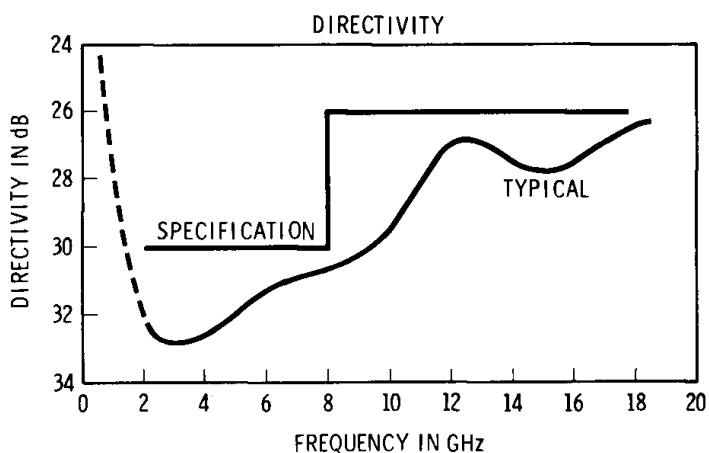


Figure 3 Directivity

Specifications

Error (11692D Only)

Analysis shows the measurement error of the 11692D to be:

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

where:

E_s = error of swept-frequency measurement

A = directivity of the 11692D

B = effective source match + coupler tracking

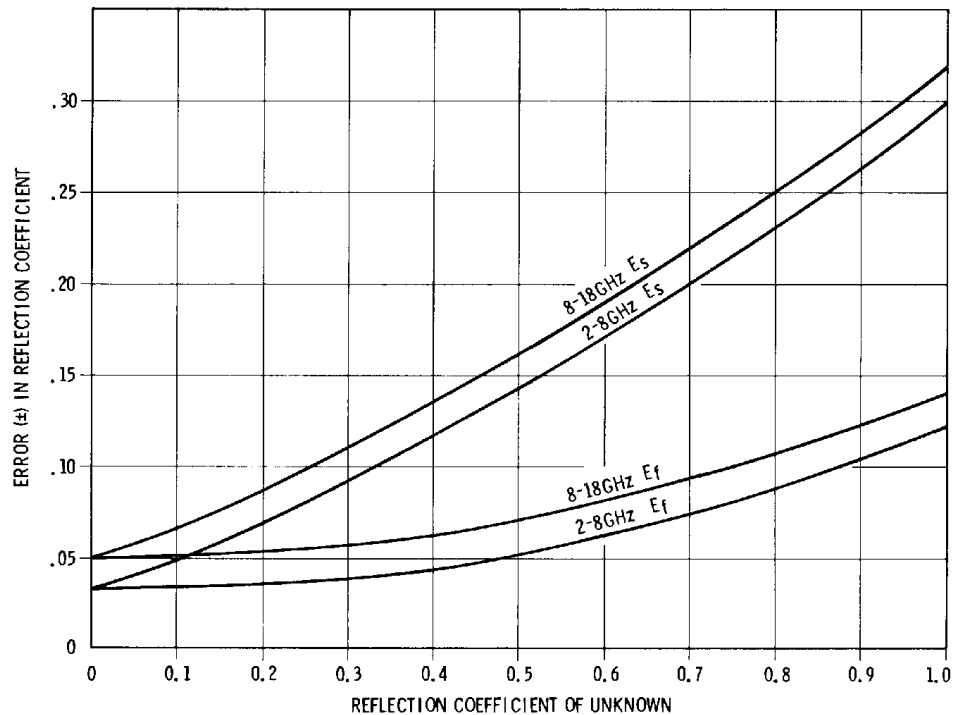
C = source match

Γ_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:

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

These two equations are graphed below.



E_s = Error of Swept-Frequency Measurement

E_f = Error of Swept-Frequency Measurement

Figure 4 Reflection Coefficient of Unknown

Connectors

11691D Connectors

The standard 11691D is furnished with APC-7 connectors on all ports, except the COUPLED port which has a type-N female connector.

11692D Connectors

The standard 11692D is furnished with type-N female connectors on all ports, except the TEST port which has an APC-7 connector. For other connector options, refer to the table below.

Connectors for Agilent 11692D Options				
Option	INPUT Port	INCIDENT Port	REFLECTED Port	TEST Port
001	N-female	N-female	N-female	N-female
002	N-female	N-female	N-female	N-male
003	N-female	APC-7	APC-7	APC-7
004	APC-7	APC-7	APC-7	APC-7

Mating Connectors

Mating connectors used with the 11691D and 11692D directional couplers for type-N connectors should be the opposite type connectors that are compatible with US specifications MIL-STD-348A.

Mating connectors for APC-7 connectors are other APC-7 connectors.

Installation

Initial Inspection

1. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are given under “[Performance Tests](#)” on [page 12](#).
2. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, contact the nearest Agilent Technologies (refer to “[Service and Support](#)” on [page iv](#)). Agilent will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier’s inspection.
3. If you are returning the instrument for service, repackaging the instrument requires original shipping containers and materials or their equivalents. Agilent can provide packaging materials identical to the original materials. Contact the nearest Agilent Technologies (refer to “[Service and Support](#)” on [page iv](#)). Attach a tag indicating the type of service required, return address, model number, and serial number. Mark the container **FRAGILE** to insure careful handling. In any correspondence, refer to the instrument by model number and serial number.

Storage and Shipment

The 11691D and 11692D directional couplers should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

- a. Temperature: -25 to +75 °C
- b. Altitude < 7620 meters (25,000 feet)
- c. Humidity < 95% relative

Operating Environment

The 11691D and 11692D directional couplers should be operated within the following limitations.

- a. Temperature: 0 to +55 °C
- b. Altitude < 4570 meters (15,000 feet)
- c. Humidity < 95% relative

Operating Instructions

Principles of Operation

Round center-conductor directional couplers, such as the 11691D and 11692D, depend upon balanced capacitance to the case for proper operation. The capacitance to the mainline and auxiliary lines must be balanced so that the magnetic field may give a directivity effect over a wide range of frequencies. Balance is dependent upon holding the concentricity and lack of skew of the center conductor of the coaxial connectors on the couplers.

Using the 11691D Directional Coupler



Figure 5 Agilent 11691D Directional Coupler

1. Connect the signal from the signal sources to the INPUT port (1).

CAUTION

Maximum power input is 50 W average, 250 W peak power. Greater power may damage the 11691D.

2. Connect the output signal from the OUTPUT port (3) to the test setup.
3. Connect the coupled signal from the COUPLED port (2) 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.

Using the 11692D Directional Coupler

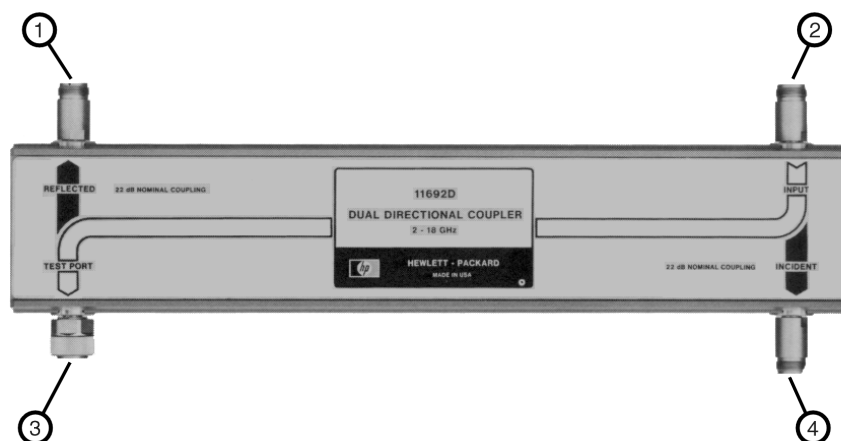


Figure 6 Agilent 11692D Directional Coupler

1. Connect the signal from the signal source to the INPUT connector (2).

CAUTION

Maximum power input is 50 W average, 250 W peak power. Greater power may damage the 11692D.

2. Connect the output signal from the TEST PORT connector (3) to the test setup.
3. Connect incident power-indicating device to the INCIDENT port (4). 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 (1). Coupler power from this port will be attenuated approximately 22 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.

Operator's Check

The following procedure is supplied to allow the operator to make a quick check of the directional couplers prior to use.

Table 3 Recommended Test Equipment

Instrument	Critical Specifications	Suggested Model	Use ¹
Sweep oscillator	CW and swept frequency signal in 2 to 18 GHz range	8350B mainframe with 83592B plug-in	P,T
Scalar network analyzer	Frequency range: 2 to 18 GHz Measurement range: +10 dBm to -50 dBm (noise level)	8757 series	P,T
Detectors (2)	11664-60039 only	11664-60039	P,T
Coaxial short	Mates with type-N male Mates with type-N female Mates with APC-7	85054-60026 85054-60025 85050-80007	P,T
Coaxial open	Mates with type-N male Mates with type-N female Mates with APC-7	85054-60028 85054-60027 85050-80010	P,T

¹ P = Performance test, T = Troubleshooting

Initial Adjustment

1. Connect the equipment as shown in [Figure 7 on page 11](#) for the 11691D or [Figure 8 on page 11](#) for 11692D.
2. Make the following rear panel connections.

- | | | |
|---|----|-----------------------|
| <input type="checkbox"/> GPIB interface | to | 8757 system interface |
| <input type="checkbox"/> Pos Z blank | to | Pos Z blank |
| <input type="checkbox"/> Stop sweep | to | Stop sweep |
| <input type="checkbox"/> Sweep out | to | Sweep in |

3. Set the equipment controls as follows:

Sweep Oscillator	Network Analyzer	RF Plug-In
Start marker: 2.0 GHz	Channel 1	ALC mode: internal
Stop marker: 18 GHz	Display: A/R	RF: ON
Modulation: ON	Scale: 1 dB/div	
	Reference level: 0 dB	

4. Using Channel 1 on the network analyzer, press **[MEAS]** and then the **{A/R}** softkey.
5. Press **[Display]** and then the **{Measure}** softkey.
6. Set **[Scale]** to 1 dB/div.
7. Press **[Ref]** and enter **[0] [dB]**.

Operating Instructions

Directivity Check

1. On the network analyzer, press [Cal].
2. Press the *{short/open}* softkey.
3. Connect the short and press the *{STORE SHORT}* softkey.
4. Connect the open and press the *{STORE OPEN}* softkey.
5. Press [Display], *{MEAS_MEM}* and then press [Ref].
6. To check tracking for the 11692D only, repeat steps 1 through 5. The trace represents tracking and should be no more than the specification referenced in [Table 1 on page 2](#).
7. Connect the sliding load.
8. Set [Ref] to -30 dB.
9. Verify that the directivity is:
Directivity (2 to 8 GHz)> -30 dB
Directivity (8 to 18 GHz)> -26 dB

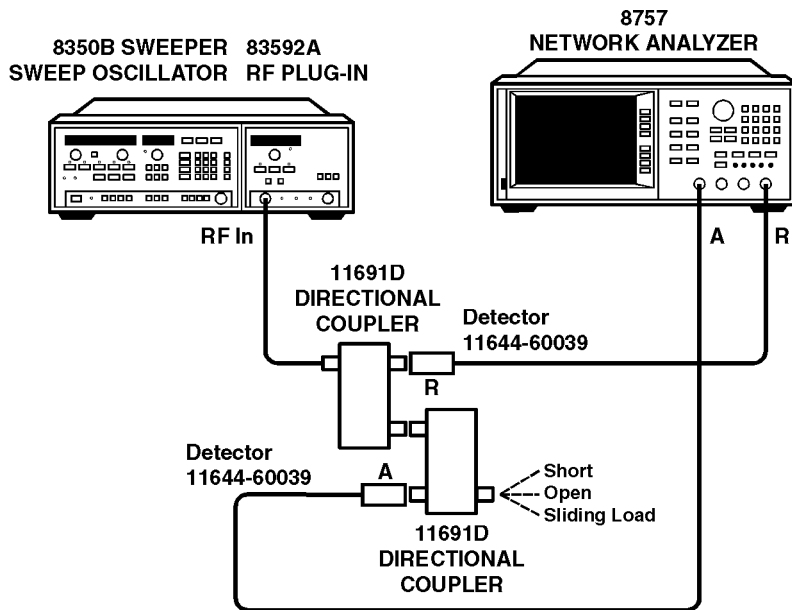


Figure 7 Test Equipment Setup for Agilent 11691D

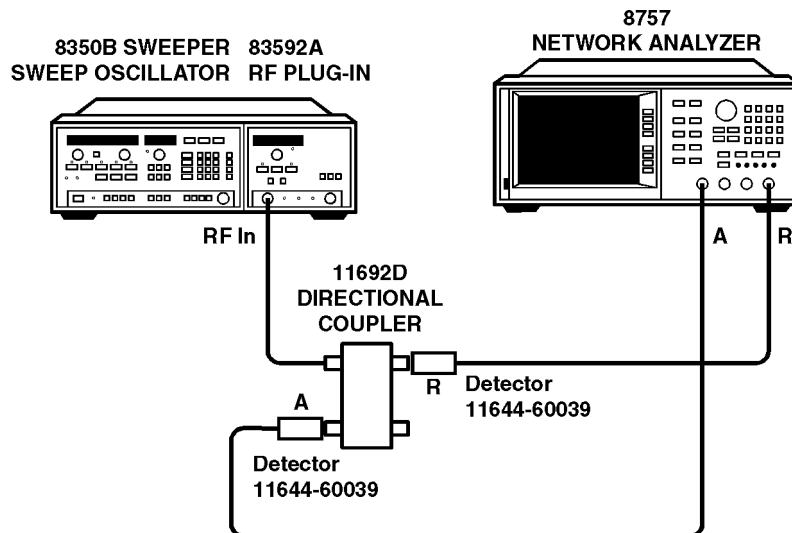


Figure 8 Test Equipment Setup for Agilent 11692D

Performance Tests

The following procedures test the electrical performance of the couplers using the specifications in [Table 1 on page 2](#) as the performance standards.

Refer to [Figure 7](#) and [Figure 8](#) for Test Equipment Setup. All tests can be performed without access to the interior of the instrument.

VSWR Test

To check that the directional coupler meets VSWR specifications in [Table 1](#), use any test system that has a reflection coefficient accuracy better than 0.03 (30 dB directivity).

1. Connect the port of the coupler under test to the system and terminate all unused ports with a 50 ohm load.
2. Repeat this measurement on both primary ports and all auxiliary ports.

Maximum Coupling Variation With Frequency Test

To check that the directional coupler meets the maximum coupling variation specifications in [Table 1](#), use any insertion loss measurement system capable of measuring to an accuracy of ± 0.3 dB, or better.

For example, connect the 11691D for a frequency response measurement or the 11692D for transmission measurement to make this measurement. Be sure to terminate any unused ports with accurate 50 ohm loads. Note that the accuracy of the measurement system must be added to the specification in [Table 1](#).

1. Measure the coupling at the COUPLED port with respect to the INPUT port on the 11691D.
2. On the 11692D, measure the coupling at the INCIDENT port with respect to the INPUT port.

Primary Line Residual Loss Test

To check that the 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 coupler connected in the test setup.

1. With maximum sensitivity on the indicator, mark the calibration trace on the display screen.
2. Insert the coupler under test and read the indication from the calibration line. Note that the accuracy of the measurement system must be added to the specification in [Table 1](#).

Service Instructions

Troubleshooting

Troubleshooting consists of using the performance tests to verify the electrical performance of the couplers.

If one internal coupler is defective, as shown by the performance tests, return both couplers to your nearest Agilent Service and Support Office. Both couplers are needed for proper testing, even though only one coupler may be defective.

Repair

The only repair recommended on the directional coupler assembly is the replacement of the center contact in the center conductor of the APC-7 type connectors.

NOTE

- Do not turn any of the screws in the directional coupler assembly case.
- Do not take the inside directional coupler assembly itself or any of its connectors apart.

Parts Replacement

Do not replace, or attempt to replace, any part for which replacement instructions are not specifically given. Any attempt to do so will most likely cause the 11691D or the 11692D to be out of specifications even when no breakage occurs.

On the 11691D only, connectors on the coaxial line assembly *external* to the inside directional coupler assembly may be replaced.

On 11692D, replace only the parts listed in [Table 5 on page 21](#) and the APC-7 center conductor contact.

Connector Use and Care

For instruction on connecting and care of your connectors, we recommend Microwave Connector Care Quick Reference Card (08510-90360).

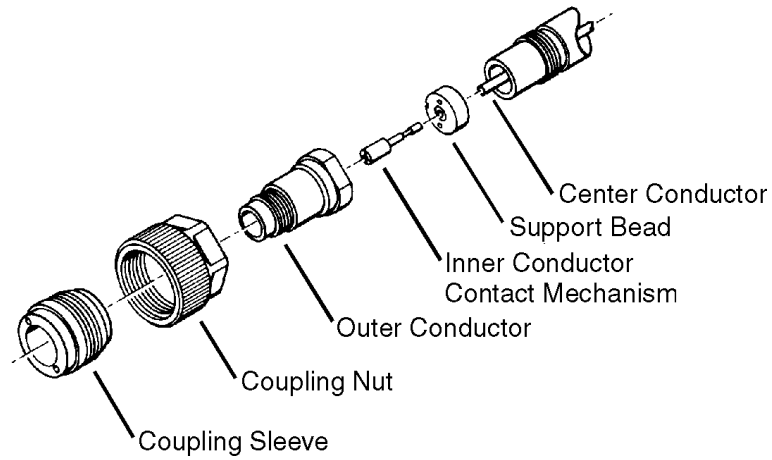
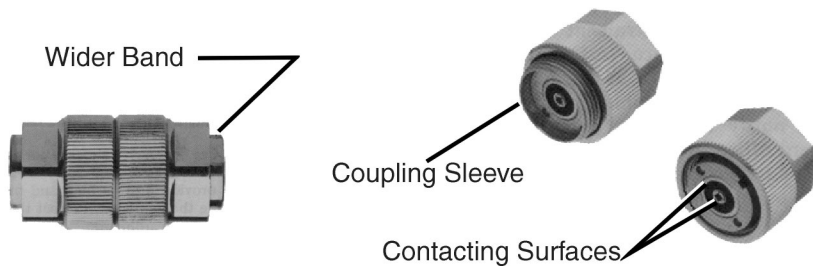


Figure 9 APC-7 Connector Parts Diagram

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

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

Replacing the APC-7 Center Conductor Contact

Through wear or damage, the contact in the center conductor may need replacement. This contact is a small four-pronged contact which snaps into a recess in the center conductor. With a magnifying glass, examine the contact for the necessary outward spring action by pushing it in with a fingernail. **DO NOT REMOVE THIS CONTACT FOR INSPECTION.** (It may be damaged by removal.) The prongs of the contact should be free from burrs or wear. If the contact is removed, do NOT reuse it. This contact is Amphenol* part number 131-129 and Agilent part number 1250-0907.

To replace the contact, if a new one is available, proceed as follows:

1. Place the instrument so the connector faces down, if possible.
2. Tap the connector lightly and the contact should now protrude slightly. Insert the centering pin of the collet remover (5060-0236) with the jaws open.
3. Allow the jaws on the tool used to close and pull straight back from the connector without twisting. The contact should come out with the tool. If not, repeat the process. Do NOT re-use the contact.
4. Snap in a new contact by pushing it in place. Test the action of the new contact by pushing in on it. It should spring out again when released.

* Amphenol RF division, Danbury, Conn.

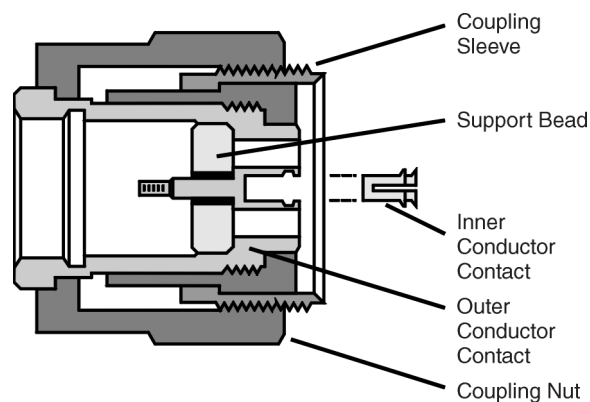


Figure 10 Replacing the APC-7 Center Contact

Service Instructions

Replacing the Output Connector Contacts (11691D Only)

Replace only the OUTPUT connector contacts. Any attempt to replace other connectors contacts may cause the coupler to be out of specifications.

Disassembly

1. With a 9/16 inch (1/2 inch for APC-7) open-end wrench, unscrew the outer connector body. Refer to [Figure 11 on page 19](#).
2. With a smooth-jawed pair of pliers, grasp the center conductor contact on the non-slotted portion of the contact and pull straight out. The contact assembly will come loose.
3. If some parts of the center conductor assembly are to be reused, unscrew the assembly with pin vises. These parts are cemented together to prevent the contact from coming loose if the mating connector is rotated when it is disconnected.

Assembly

1. If the parts for the center conductor assembly (refer to [Figure 11](#)) have not been cemented together, place a tiny amount of conducting silver paint on the threads of the contact and screw the assembly together.
2. Insert the long end of the assembly into the connector to mate with the center conductor of the coaxial cable and push in place.
3. Screw the connector shell in place and tighten with a wrench.

Opening the 11691D and the 11692D

Disassembly

1. Remove the four pozidrive screws in the corners of the bottom cover.
2. Place the directional coupler on its black plastic feet.
3. Carefully slide the top cover over the INPUT connector.

Assembly

1. Slide the top cover over the INPUT connector.
2. Place the coupler on its black plastic feet.
3. Replace the four pozidrive screws in the corners of the bottom cover.

Replacing the Coaxial Cable Assembly (11691D Only)

Disassembly

1. Remove the four pozidrive screws in the corners of the bottom cover.
2. With a pair of plastic-jawed pliers, unscrew the directional-coupler sub-assembly knurled connector from the connector body (refer to item 1 in [Figure 11](#)) on the coaxial cable assembly.

CAUTION

Do NOT attempt to unscrew the knurled connector shell on the connector on the coaxial cable assembly. If this is done, the cable assembly might be bent.

3. With a 3/4 inch open-end wrench, unscrew the brass hex nut on the other end of the coaxial cable assembly.
4. Pull the coaxial conductor assembly from the OUTPUT connector.
5. Pull the coaxial cable assembly straight away from the directional coupler assembly.
6. To replace parts on the coaxial line, refer to either [“Replacing the Brass Connector”](#) or [“Replacing the Knurled Connector”](#) depending upon the part to be replaced.

Assembly

1. Replace the coaxial cable assembly with either a new assembly, Agilent part number 11691-20009, or the repaired assembly.
2. Position, but do not connect, the knurled connector first. If this is not done, the mating contacts can be damaged or the tubing can be bent.
3. Continue by reversing the steps of the disassembly procedure above.

Replacing the Output Connector (11691D Only)
Disassembly

1. Remove the connector outer shell and the center conductor assembly. Refer to [“Replacing the Output Connector Contacts \(11691D Only\)”](#).
2. With a 7/8 inch open-end wrench, remove the nut from the connector body.
3. Remove the flat washer and connector body.

Assembly

1. Position the connector body loosely in the mounting hole.
2. Install the coaxial cable assembly.
3. Tighten the two hex nuts.

Replacing the Brass Connector

In the following procedure, refer to [Figure 11, “Agilent 11691D Coaxial Line Removal/Replacement,” on page 19](#) to identify the numbered items.

Removal

1. Remove the large brass nut (10) with a 3/4 inch open-end wrench.
2. Remove the smaller nut (11) with a 7/16 inch open-end wrench.
3. Remove the cable terminator (12).

Service Instructions

Replacement

1. Replace the cable terminator (12).
2. Replace the smaller nut (11). Tighten with a 7/16 inch open-end wrench.
3. Replace the large brass nut (10). Tighten with a 3/4 inch open-end wrench.

Replacing the Knurled Connector

In the following procedure, refer to [Figure 11 on page 19](#) to identify the numbered items.

NOTE

Proper cutting and bending of the coaxial cable is difficult, so replacement as a complete assembly is recommended.

Removal

1. Remove the hybrid terminator (1) by unscrewing it.
2. Remove the center contact assembly consisting of items (2), (3), and (4) by grasping item (2) as close to item (3) as possible with a pair of smooth-jawed pliers and pulling outward without twisting or bending.
3. Remove the silver-colored nut (6) using a 7/16 inch open-end wrench. Take care not to lose the cable washer (7) between the cable and the cable terminator.
4. Pull the outer conductor terminator loose by pulling straight off, without bending.

Replacement

1. Carefully replace the outer conductor terminator taking care not to bend it.
2. Replace the silver-colored nut (6) and cable washer (7). Carefully tighten the nut with a 7/16 inch open-end wrench.
3. Replace the center contact assembly consisting of items (2), (3), and (4). If items in this assembly were replaced, apply a tiny amount of conducting paint to the threads of item (2) before assembly.

NOTE

The coaxial cable center-conductor should protrude 1/8 inch beyond the outer conductor and should be tapered at the end. There should be no cuts or nicks in either conductor.

Replaceable Parts

NOTE:

Items 1 through 12 are furnished as a coaxial cable replacement assembly, Part No. 11691-20009.

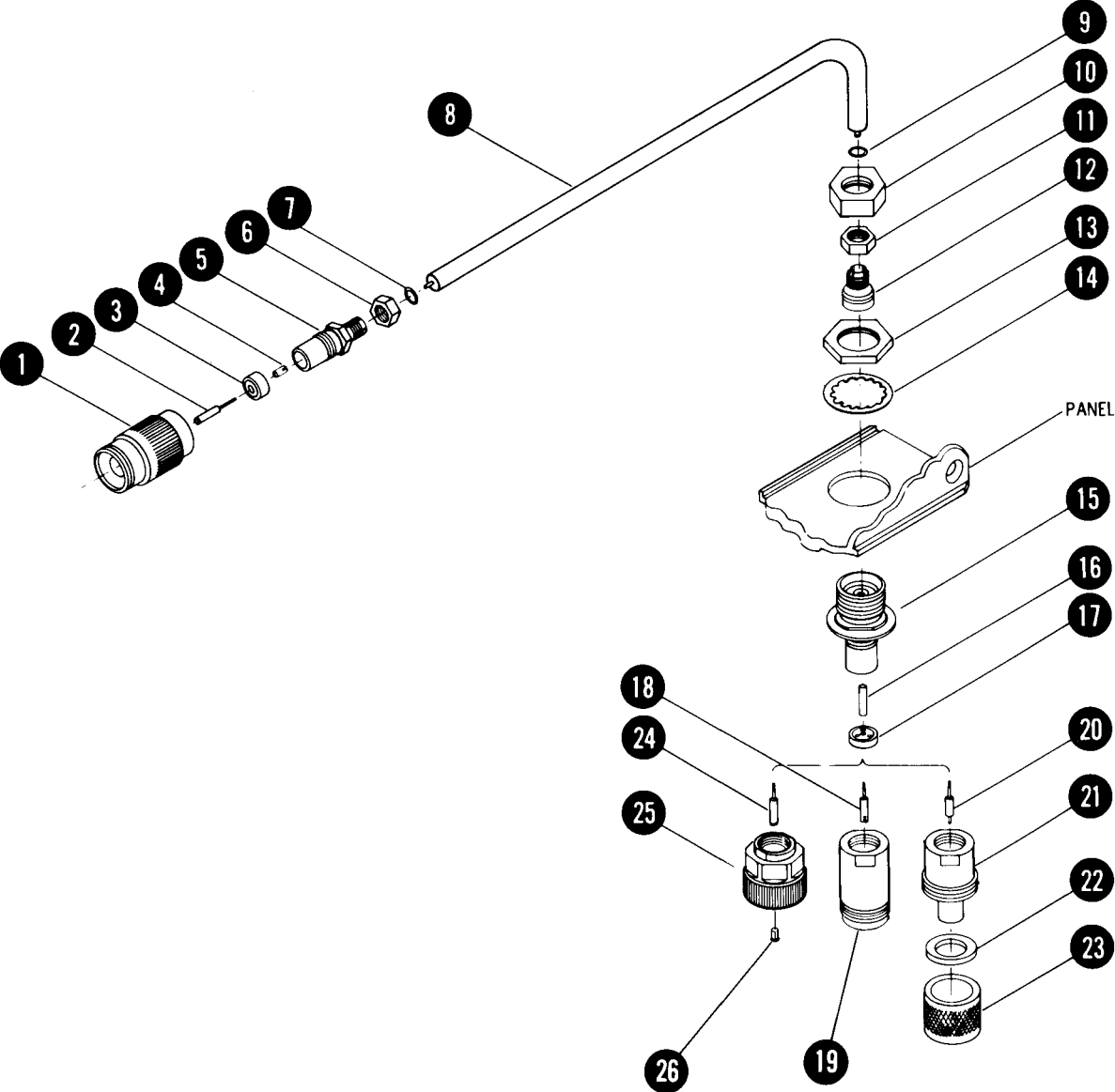


Figure 11 Agilent 11691D Coaxial Line Removal/Replacement

Replaceable Parts

Table 4 Agilent 11691D Replaceable Parts

Item	Agilent Part Number	Description
1	11600-2014	Terminator, hybrid
2	1250-0816	Contact holder, inner
	1250-0907	Contact, inner
3	5040-0306	Insulator, bead
4	08741-2010	Cable terminator, center conductor
5	08745-2021	Cable terminator, outer conductor
6	0590-0035	Nut, hex 3/8-32
7	5000-8676	Washer, cable
8	Not separately replaceable	Replaceable only as coaxial cable assembly (items 1 through 12), Agilent part number 11691-20009
9	5000-8676	Washer, cable
10	08740-2081	Nut, for semi-rigid cable
11	0590-0035	Nut, hex 3/8-32
12	08742-2028	Cable terminator, semi-rigid cable
13	2950-0090	Nut, hex 11/16-24 thread
14	2190-0002	Washer, flat 5/8 ID
15	116191-20011	Body, panel connector
16	08740-2087	Center conductor, panel connector
17	5040-0306	Insulator, bead
OUTPUT connector: consisting of one of the following:		
	00779-60010	Connector package: (Standard) type-N female consisting of:
18	1250-0915	Contact, center conductor type-N female
19	1250-0914	Connector body, type-N jack
OR		
	00779-60011	Connector package: (Option 002) type-N male consisting of:
20	1250-0917	Contact, center conductor type-N male
21	1250-0916	Connector body, type-N plug
22	1250-0918	Nut, connector body
23	1250-0016	Ring, connector body

Table 4 Agilent 11691D Replaceable Parts (Continued)

Item	Agilent Part Number	Description
	OR	
24	1250-0816	Contact assembly: center conductor APC-7 (includes 1250-0907 contact)
25	1250-1466	Contact assembly: outer conductor APC-7 includes:
26	1250-0907	APC-7 center conductor contact
Miscellaneous (not shown)		
	7120-0530	Label, identification
	2510-0119	Screw, flat-head pozidrive 8-32 x 1/4 (16 required)
	5040-0274	Plug-in foot for bottom package (4 required). Bottom package is not repairable since directional coupler assembly must be taken apart to replace.
	1401-0081	Dust cover for APC-7 connector

Table 5 Agilent 11692D Replaceable Parts (not shown)

Item	Agilent Part Number	Description
	7120-0529	Label, identification
	2510-0119	Screw, flat-head pozidrive 8-32 x 1/4 (16 required)
	5040-0274	Plug-in foot for bottom package (4 required). Bottom package is not repairable since directional coupler assembly must be taken apart to replace.
	1401-0081	Dust cover for APC-7 connector