Τ.Ε.Ι. ΣΤΕΡΕΑΣ ΕΛΛΑΔΑΣ
ΤΜΗΜΑ ΗΛΕΚΤΡΟΝΙΚΩΝ ΜΗΧΑΝΙΚΩΝ ΤΕ

ΕΡΓΑΣΤΗΡΙΟ

«ΗΛΕΚΤΡΟΝΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΦΑΣΜΑΤΟΣΚΟΠΙΑΣ»

ΕΡΓΑΣΤΗΡΙΑΚΗ ΑΣΚΗΣΗ 7:

"ΕΓΚΑΤΑΣΤΑΣΗ – ΛΕΙΤΟΥΡΓΙΑ- ΧΡΗΣΗ ΔΙΑΤΑΞΗΣ ΔΗΛΕΚΤΡΙΚΗΣ ΦΑΣΜΑΤΟΣΚΟΠΙΑΣ ΥΨΗΛΩΝ ΣΥΧΝΟΤΗΤΩΝ"

Α.ΚΑΝΑΠΙΤΣΑΣ
Καθηγητής

ΛΑΜΙΑ 2013

Στην παρούσα εργαστηριακή άσκηση θα μελετηθεί ο τρόπος εγκατάστασης, η υλοποίηση της κατάλληλης συνδεσμολογίας και η λειτουργία της διάταξης Διηλεκτρικής Φασματοσκοπίας *Agilent E 4991 A*.

Παρατίθενται παρακάτω οδηγίες και τεχνικά χαρακτηριστικά απο το εγχειρίδιο χρήσης της διάταξης.

2   Installation Guide

This chapter describes how to install and set up the Agilent E4991A after it is delivered and explains daily maintenance procedures.

Contents of this chapter

Incoming Inspection

WARNING   **To avoid dangerous electrical shock, do not turn the power on if any part of the instrument's exterior (top cover, bottom cover, side covers, front panel, rear panel, LCD display, connectors or line switch) appears to have been damaged during shipment.**

Inspect the equipment by following these steps while unpacking the contents of the shipping container.

Figure 2-1   **Flow for incoming inspection**
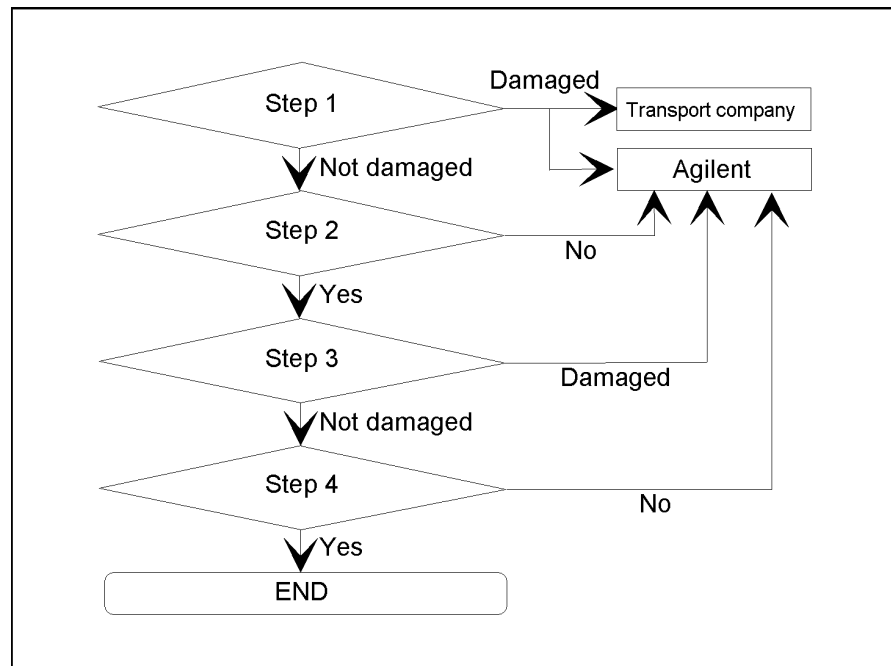
E4991aqe002

Step 1. Confirm that the shipping container or cushioning material is not damaged.

Step 2. Confirm that all of the contents of the shipment are included in the package.

Step 3. Confirm that there exists no mechanical or electrical defect.

Step 4. Confirm that the E4991A operates normally both mechanically and electrically.

For a list of the package's contents, refer to Table 2-1. Figure 2-2 shows the contents of the standard package that comes with the E4991A.

NOTE   If any of the contents of the package is missing or found to have mechanical damage or defects, or if any failure is found during verification of equipment operation, inform the nearest Agilent Technologies office. If the box is damaged or the cushioning materials show signs of unusual stress, inform the transport company in addition to the Agilent Technologies office. Keep the box, cushioning materials, and contents of the package as you found them; these materials will need to be examined in their delivered condition during the incoming inspection.

Table 2-1　　　　　**Contents of E4991A package**

Name of item	Agilent product/ part No.	Quantity
Standard Accessories		
❏　Main unit of E4991A	E4991A	1
❏　Test Head	E4991-60011	1
❏　CD-ROM (for installing E4991A VBA software)[1]	E4991-1610x	1
❏　7-mm Calibration Kit[2]	16195-60021	1
❏　Torque Wrench	8710-1766	1
❏　CD-ROM (for manuals)[3]	E4991-905xx	1
❏　Power Cable[4]	-	1
❏　GPIB Adapter[5]	E2078-62101	1
❏　E4991A Recovery Disk	E4991-16100	1
Options		
❏　Keyboard (Option 810)	-	1
❏　Mouse (Option 820)	-	1
❏　High-Stability Frequency Reference (Option 1D5)		
• BNC cable	8120-1838	1
❏　Manuals (Option ABA)[6]		
• Operation Manual	E4991-900x0	1
• Quick Start Guide	E4991-900x1	1
• Programming Manual	E4991-900x2	1
• Sample Programs Disk (3.5 inch floppy disk)	E4991-180x0	1
❏　Probe Station Connection Kit (Option 010)		
• Option 010 Test Head (with an extension cable)	-	1
• N(m) to SMA(f) Adapters	1250-2879	3
• 3.5-mm to 7-mm Adapter	1250-1747	1
• Screws	0515-1551	4
• Washers	3050-0891	4
❏　Temperature Characteristic Test Kit (Option 007)		
• Measurement Cable	-	1
• Test Fixture Stand	E4991-60005	1
• Test Head Stand Kit[7]	E4991-60006	1
• 7-mm OPEN Standard	E4991-60032	1
• 7-mm SHORT Standard	E4991-60031	1
• Extension Cable	04287-61651	1
• N(m) to SMA(f) Adapters	1250-2879	3
• N(f) to SMA(f) Adapters	1250-3157	3
• Pad (for the test fixture stand)	04291-09001	1
• Mount Cable Tie (for fixing the extension cable)	1400-0584	1
• Sample Program Disk (for VBA program, 3.5 inch floppy disk)	E4991-18001	1

Table 2-1 **Contents of E4991A package**

Name of item	Agilent product/part No.	Quantity
Handle Kit (Option 1CN)	5063-9229	1
Rack Mount Kit (Option 1CM)	5063-9216	1
Rack Mount / Handle Kit (Option 1CP)	5063-9223	1

*1. Used when installing VBA on an external PC. "x" in the part number indicates firmware revision, with "0" for revision 1.00 and then increments of one for each subsequent revision. The latest revision is supplied with the product.

*2. Includes a 0 S (OPEN), 0 Ω (SHORT), and 50 Ω (LOAD) standard and a low-loss capacitor. Carrying case is not shown in Figure 2-2.

*3. Contains the contents of the Operation Manual, Quick Start Guide, Programming Manual, and Sample Programs. "x" in the part numbers of CD-ROM indicates revision numbers, with "0" for the initial edition and then increments of one for each subsequent edition. The latest editions are supplied with the product.

*4. This accessory is not shown in Figure 2-2. For the part number, refer to Figure 2-12 on page 30.

*5. Use this adapter when a GPIB cable is connected to the rear panel GPIB connector.

*6. "x" in the part numbers of manuals, and Sample Programs disk indicates edition or revision numbers, with "0" for the initial edition and then increments of one for each subsequent edition. The latest editions are supplied with the product.

*7. Includes a stand, a holder kit (two items), and four screws.

Figure 2-2 **Standard contents of package**
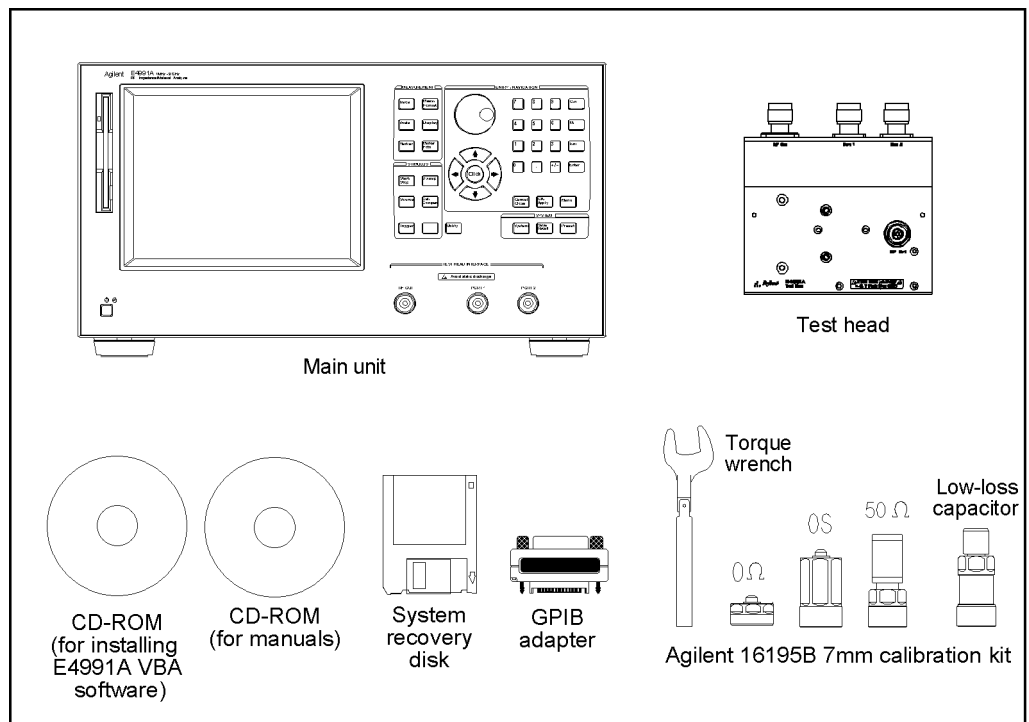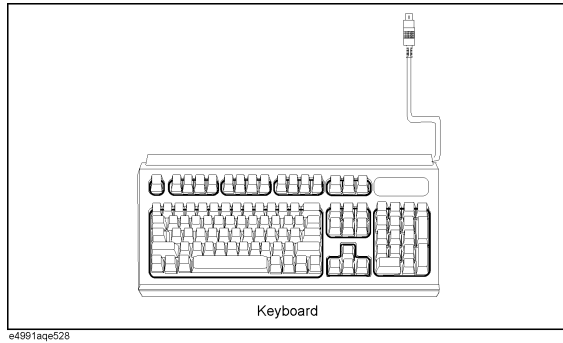

e4991aqe9001

Figure 2-3   **Option 810 content**

Keyboard

e4991aqe528

Figure 2-4   **Option 820 content**

e4991aqe8002
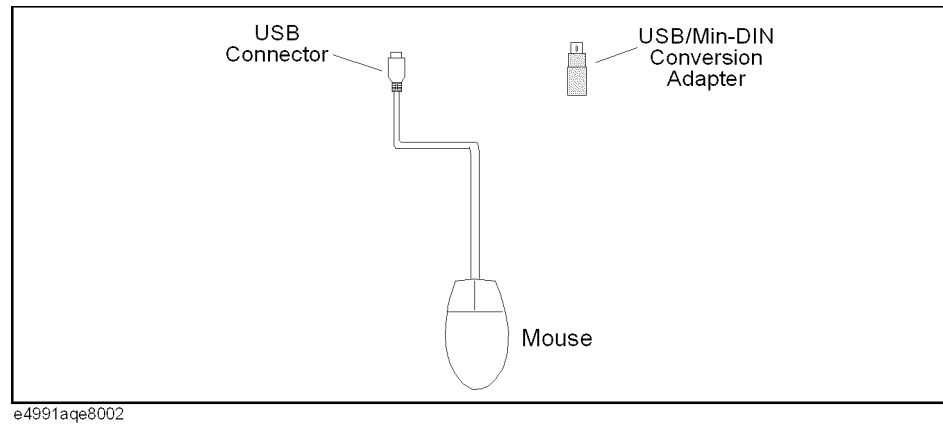
Figure 2-5   **Option ABA contents**
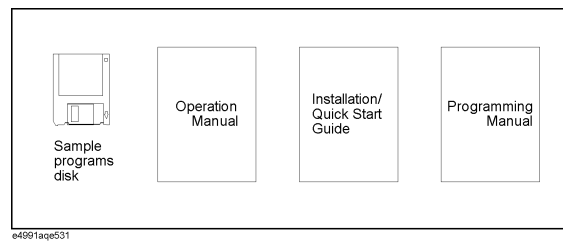
e4991aqe531

Figure 2-6   **Option 010 contents**

Option 010 Test Head

N(m) to SMA(f) Adapters   Screws

3.5-mm to 7-mm Adapter   Washers
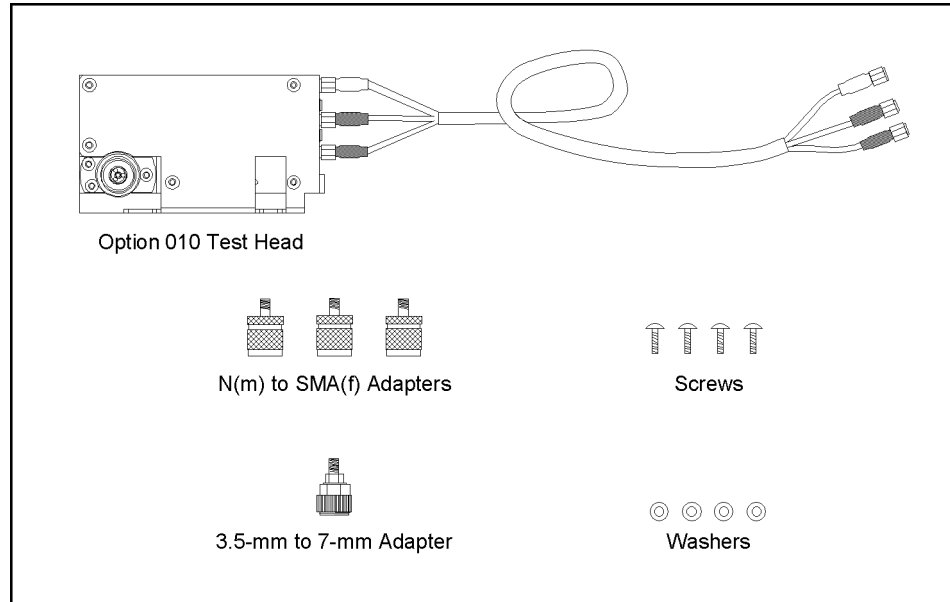
e4991aqe525

Figure 2-7   **Option 007 contents**

Stand   Measurement Cable

Holder

Screws   Test Fixture Stand

Test Head Stand Kit

N(m) to SMA(f) Adapters

Pad

Extension Cable

N(f) to SMA(f) Adapters   Sample Program Disk

7-mm OPEN/SHORT Standard   Mount Cable Tie

e4991aqe532

2. Installation Guide
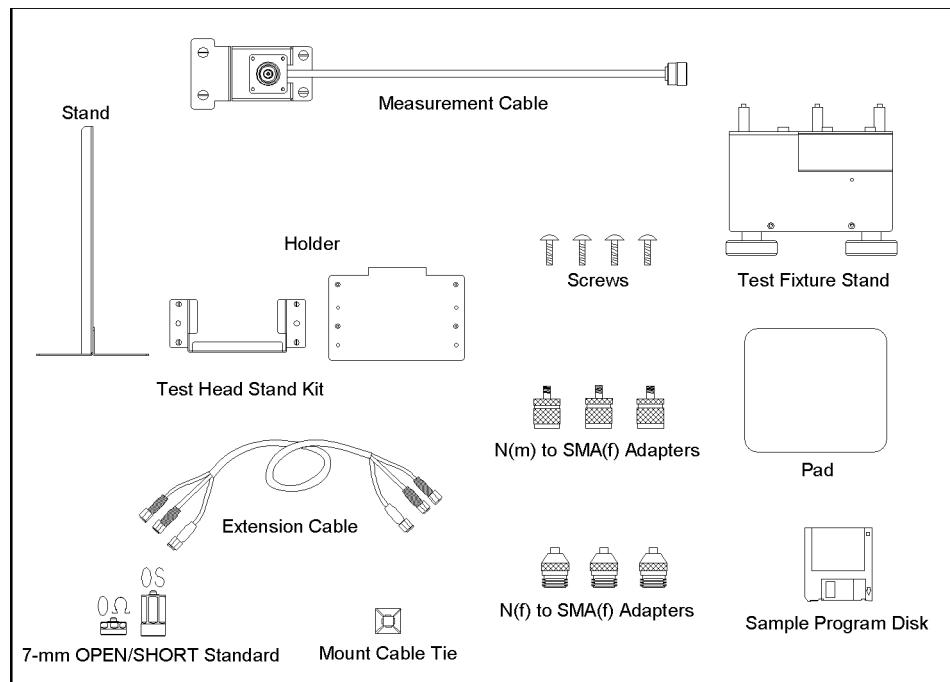
How to Install Front Handles/Rack Mounting Flanges

The E4991A can be made more convenient for use with two key options (Table 2-2): handles mounted on each side of the front for easy transport and flanges to attach the instrument to a rack as part of a multi-component measurement system.

**Table 2-2**   **Agilent E4991A handles/rack mounting options**

Option	Name	Agilent Part Number
1CN	Handle Kit	5063-9229
1CM	Rack-mount Kit	5063-9216
1CP	Rack-mount and Handle Kit	5063-9223

Table 2-3   **Contents of each option**

Option	Contents	Quantity
1CN	Front Handles	2
	Screws	6
	Trim Strips	2
1CM	Rack-mounting flanges (locking side plate)	2
	Screws	6
1CP	Rack-mounting flanges (locking side plate)	2
	Front Handles	2
	Screws	8

Figure 2-8   **Installing front handle/rack-mount kits**
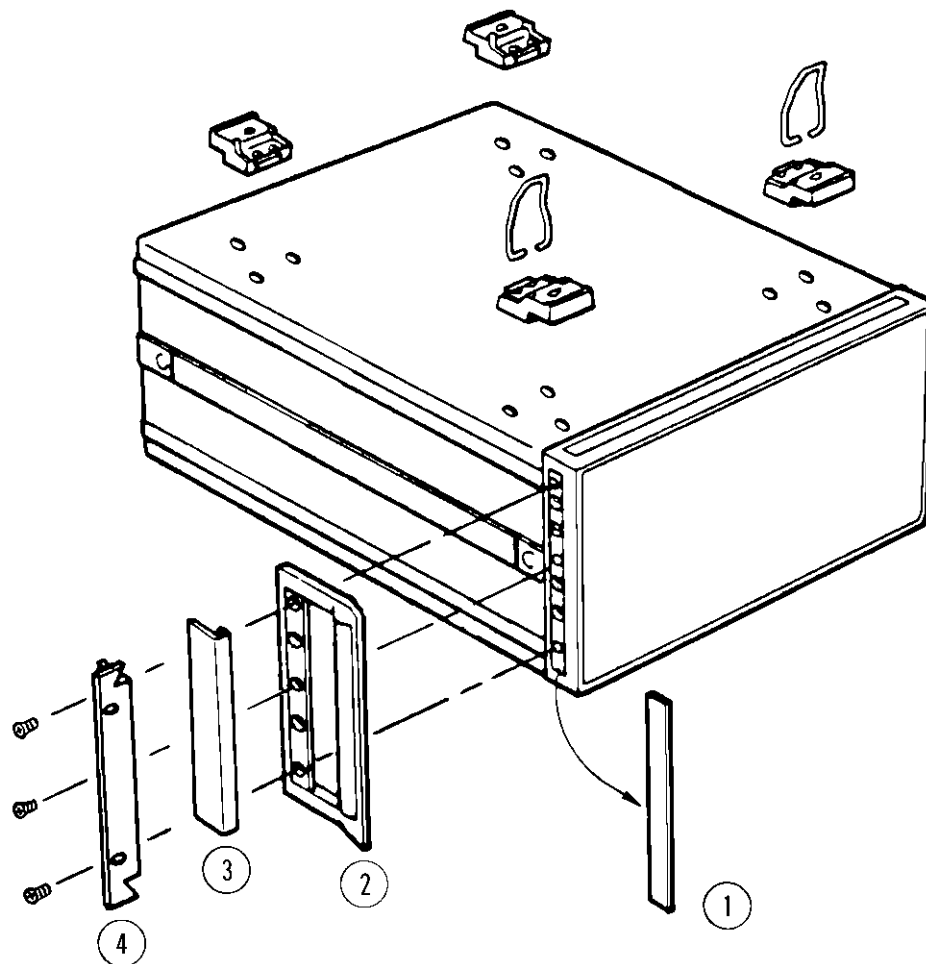
e4991aqj004

How to Install the Handle Kit (Option 1CN)

The handle kit is used for transport and relocation of the E4991A. While referring to Figure 2-8, install the handle kit by following these steps.

Step 1. Remove the adhesive-backed trim strip (1) from each side of the outer frame of the E4991A front panel.

Step 2. Use the provided screws to mount the front handles (2) on each side of the E4991A front panel frame.

Step 3. Attach the provided modified trim strip (3) to each front handle in order to cover the front panel locking screws.

WARNING   **If the installed front handle becomes damaged, replace it with a new one immediately. A damaged handle can break while moving or lifting the instrument and cause personal injury or damage to the instrument.**

How to Install the Rack-mount Kit (Option 1CM)

The rack-mount kit includes two flanges (locking side plates) for mounting the E4991A on a rack (482.6 mm/19 inches) conforming to the EIA Standard. While referring to Figure 2-8, install the rack-mount kit by following these steps.

Step 1. Remove the adhesive-backed trim strip (1) from each side of the outer frame of the E4991A front panel.

Step 2. Use the provided screws to mount a rack-mounting flange (4) on each side of the E4991A front panel frame.

Step 3. Remove the four bottom feet of the E4991A (lift the bar marked TAB on the inner side of the foot and slide the foot toward the bar).

Step 4. Mount the E4991A on the rack.

How to Install the Rack-mount and Handle Kit (Option 1CP)

The rack-mount and handle kit includes both the rack-mounting flanges (locking side plates) and front handles. While referring to Figure 2-8, install the rack-mount kit by following these steps.

Step 1. Remove the adhesive-backed trim strip (1) from each side of the outer frame of the E4991A front panel.

Step 2. Use the provided screws to mount a front handle (2) and rack-mounting flange (4) on each side of the E4991A front panel frame.

Step 3. Remove the four bottom feet of the E4991A (lift the bar marked TAB on the inner side of the foot and slide the foot toward the bar).

Step 4. Mount the E4991A on the rack.

Environmental Requirements

Ensure that the following environmental requirements are met before using the E4991A.

Operation Environment

Use the E4991A under the following environmental conditions.

Temperature	5°C to 40°C
Relative humidity (wet bulb temperature ≤ 29°C, under non-condensation)	20% to 80% (Built-in floppy disk drive operating condition) 15% to 90% (Built-in floppy disk drive non-operating condition)
Altitude	0 to 2,000 m (0 to 6,561 feet)
Vibration	0.5 G maximum, 5 Hz to 500 Hz
Warm-up Time	more than 30 minutes

NOTE   The E4991A must be protected from temperature extremes that might cause condensation within the instrument.

2. Installation Guide

Ventilation Space

To ensure the specifications and measurement accuracy of the product, you must keep ambient temperature around the product within the specified range by providing appropriate cooling clearance around the product or, for the rackmount type, by forcefully air-cooling inside the rack housing. For information on ambient temperature to satisfy the specifications and measurement accuracy of the product, refer to Specifications and "Supplemental Performance Characteristics" in *Operation Manual*.

When the ambient temperature around the product is kept within the temperature range of the operating environment specification (refer to"Operation Environment" on page 25), the product conforms to the requirements of the safety standard. Furthermore, under that temperature environment, it has been confirmed that the product still conforms to the requirements of the safety standard when it is enclosed with cooling clearance as follows:

Back	≥ 180 mm
Sides	≥ 60 mm (both right and left)

Figure 2-9   **Ventilation space at installation site**
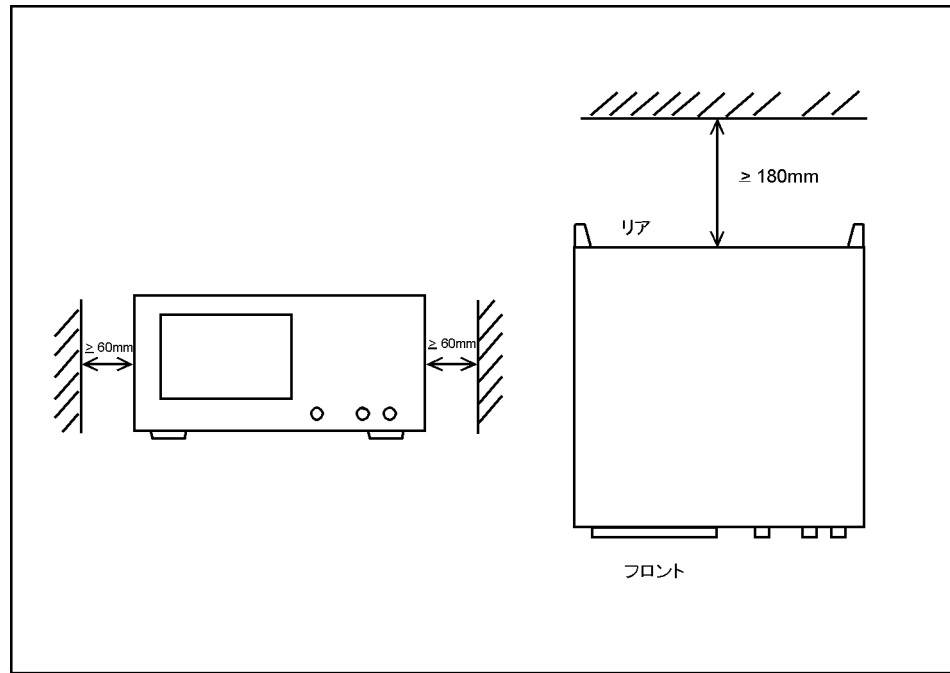

4287aoj004

Ensuring Adequate Free Space around Analyzer for Immediate Disconnection of Power Cable in Case of Emergency

As described in "Disconnection from Supply Source" on page 32, the power supply is disconnected by removing the power cable's connector plug from either the AC outlet or the E4991A unit. When installing the E4991A, ensure that there is sufficient free space around the unit to permit quick disconnection of the plug (from AC outlet or E4991A unit) in case of emergency.

Connection to Rear Panel

Figure 2-10   **Connection to rear panel**
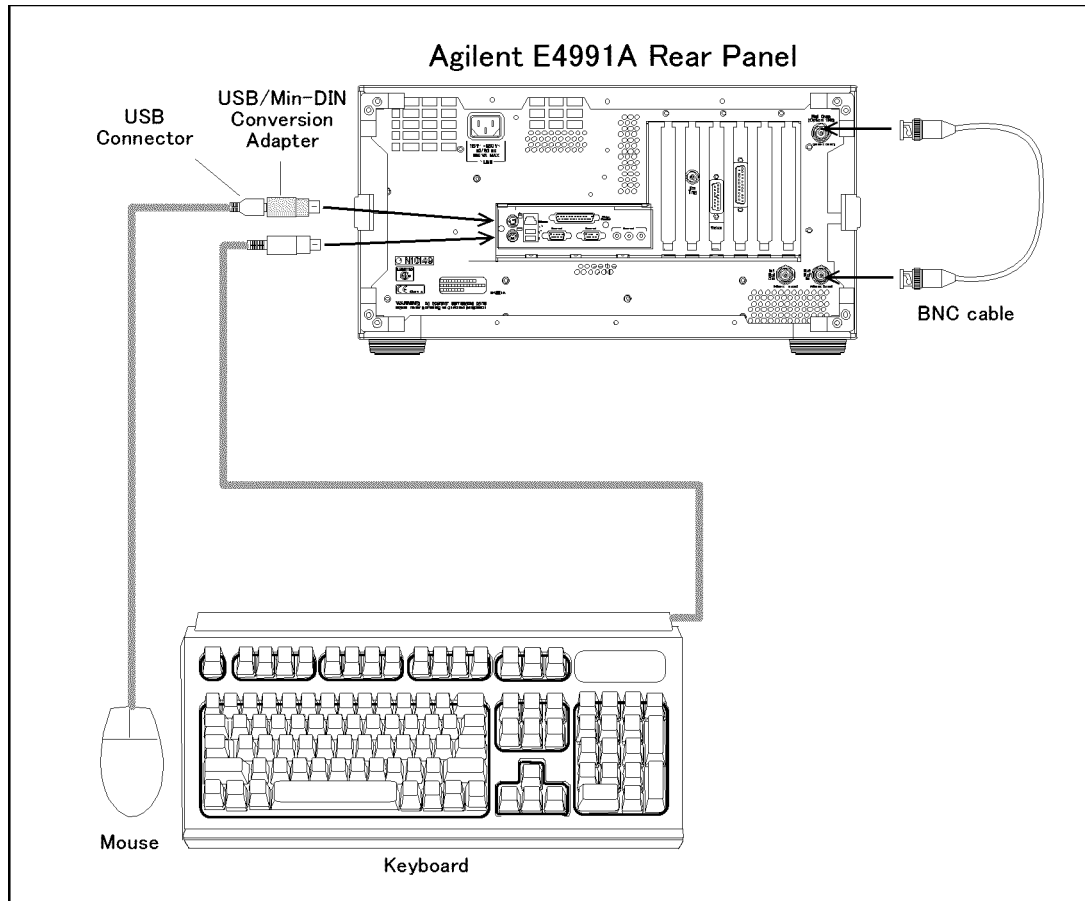
E4991aqe8003

Connecting Mouse and Keyboard

Before turning the power ON, connect the supplied mouse and keyboard as shown in
Figure 2-10. The mouse allows efficient setting and operation by moving the cursor on the
LCD display of the E4991A. The keyboard allows efficient entry of numerals and character
strings.

Connecting BNC Cable (Option 1D5 Only)

When Option 1D5 (High-Stability Frequency Reference) is installed, connect the BNC
cable between output terminal REF OVEN and input terminal EXT REF on the rear panel
of the E4991A in accordance with Figure 2-10. The BNC cable is supplied with Option
1D5. Installation of Option 1D5 increases the instrument's frequency accuracy and
stability.

Connecting the Test Head

When performing calibration with the 7-mm Calibration Kit or measuring DUTs with the test fixture and 7-mm terminal, you must first connect the test head to the E4991A. The procedure for making this connection is described below.

NOTE   When connecting the test head:

- Do not remove the four feet on the bottom of the E4991A; doing this would make the connection more difficult.

- Turn the N-type connectors in the order given in the instructions below when tightening them. The N-type connector for the RF OUT terminal is mounted with a special design for **flexible movement** to provide easier connection or removal of the test head.

Figure 2-11   **Connecting test head to E4991A**

e4991aqe036
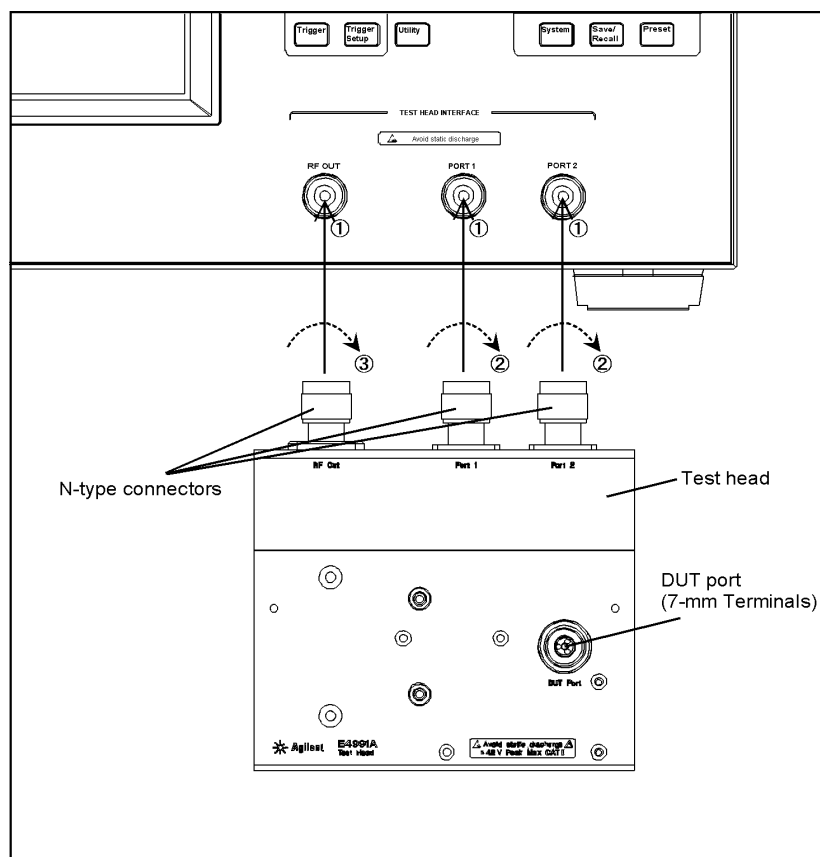
Step 1. Attach the N-type connectors (test head side) to their corresponding terminals (RF OUT, PORT 1 and PORT 2), which serve as the test head interface of the E4991A.

Step 2. Turn the N-type connectors for PORT 1 and PORT 2 at the same time to tighten them.

Step 3. Finally, turn the N-type connector for RF OUT to tighten it.

NOTE   When removing the test head, loosen and disconnect the N-type connector connected to the RF OUT terminal first.

NOTE   The N-type connector for the RF OUT terminal is mounted with a special design for **flexible movement** to provide easier connection or removal of the test head.

Power Supply and Blown Fuses

Check the Power Supply

Confirm that the power supplied to the E4991A meets the following requirements:

	Requirements
Voltage	90 to 132 VAC or 198 to 264 VAC [*1]
Frequency	47 to 63 Hz
Maximum power consumption	350 VA

*1. Switched automatically by the E4991A in conformity to the voltage used.

Verification and Connection of Power Cable

The three-wire power cable attached to the E4991A has one wire serving as a ground. Using this power cable allows the E4991A to be grounded, thereby protecting you against electrical shock from the power outlet.

Step 1. Confirm that the power cable is not damaged.

WARNING   **NEVER use a power cable showing any sign of damage. Faulty cables can cause electrical shock.**
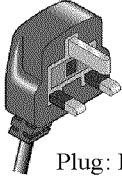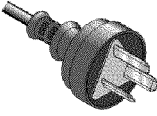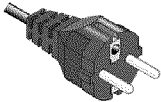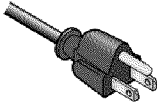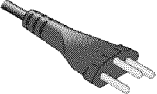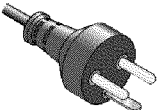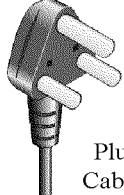
Step 2. Use the supplied cable to connect between the power terminal (Figure 2-10 on page 27) on the rear panel of the E4991A and a three-wire power outlet with the grounding prong firmly connected in the ground slot.

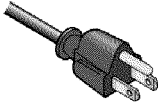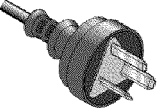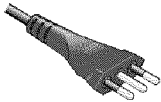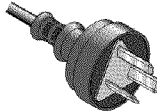**WARNING**   **Use the supplied power cable with grounding wire to securely ground the E4991A.**

Figure 2-12 shows the power cable options.

Figure 2-12   **Power cable options**

OPTION 900 United Kingdom Plug: BS 1363/A, 250V, 10A Cable: 8120-1351, 8120-8705	OPTION 901 Australia/New Zealand Plug: AS 3112, 250V, 10A Cable: 8120-1369
OPTION 902 Continental Europe Plug: CEE 7 Standard Sheet VII, 250V, 10A Cable: 8120-1689	OPTION 903 U.S./Canada Plug: NEMA 5-15P, 125V, 10A Cable: 8120-1378
OPTION 904 U.S./Canada Plug: NEMA 6-15P, 250V, 6A Cable: 8120-0698	OPTION 906 Switzerland Plug: SEV Type 12, 250V, 10A Cable: 8120-2104
OPTION 912 Denmark Plug: SR 107-2-D, 250V, 10A Cable: 8120-2956	OPTION 917 India/Republic of S. Africa Plug: IEC 83-B1, 250V, 10A Cable: 8120-4211
OPTION 918 Japan Plug: JIS C 8303, 125V, 12A Cable: 8120-4753	OPTION 920 Argentina Plug: Argentine Resolution 63, Annex IV, 250V, 10A Cable: 8120-6870
OPTION 921 Chile Plug: CEI 23-16, 250V, 10A Cable: 8120-6978	OPTION 922 China Plug: GB 1002, 250V, 10A Cable: 8120-8376
NOTE: Each option number includes a 'family' of cords and connectors of various materials and plug body configurations (straight, 90° etc.).	

power_e

Blown Fuses

If the fuse appears to have blown during operation, this equipment may be subject to failure and must be repaired. Contact the Agilent Technologies sales office or the company from which you purchased the equipment.

The E4991A uses the following fuse type: UL/CSA Type, Slo-Blo, 8 A/250 Vac

WARNING   **Do NOT replace the fuse yourself; doing this may expose you to dangerous electrical shock.**

Turning the Power ON and OFF

Perform the following steps to turn the power ON or OFF.

Turning the Power ON

Step 1. If the standby switch (⏻) in the lower-left part of the front panel is in the depressed (▭) position, press it to put it in the popped up position (▯).

Step 2. Press the standby switch to put it in the depressed position (▭).

This operation turns ON the power, and the E4991A starts the self-test.

Step 3. Confirm that the self-test indicates normal operation.

Normal operation is confirmed by the self-test if no error message appears.

Turning the Power OFF

Step 1. Use either of the following methods to turn the power OFF.

- Press the standby switch (⏻) in the lower-left part of the front panel (now in the pressed down (▭) position) to put it in the popped up (▯) position.

- Send the shutdown command from an external controller.

These operations will start the E4991A shutdown process (required software and hardware processes for turning the power off), and the power will turn OFF after a few seconds.

NOTE   Under normal circumstances, always press the standby switch (⏻), or send the shutdown command from an external controller, to execute the E4991A shutdown process. **Never cut off the power supply directly by disconnecting the power cable plug from the rear panel of the unit.**

If the power supply is cut off directly by disconnecting the power cable plug from the instrument or the AC outlet, the shutdown process is not carried out and there is a risk of damage to the E4991A's software or hardware.

Disconnection from Supply Source

The power supply of the E4991A is cut off by disconnecting the plug of the power cable (on either AC outlet side or E4991A side). When it is necessary to disconnect the power supply in order to avoid shock hazards, etc., pull out the power cable plug from either the AC outlet side or the E4991A side.

NOTE   To allow this operation to be performed smoothly, be sure to follow the guidelines in "Ensuring Adequate Free Space around Analyzer for Immediate Disconnection of Power Cable in Case of Emergency" on page 26.

When turning the power OFF under normal circumstances, always follow the methods described in "Turning the Power OFF" on page 31.
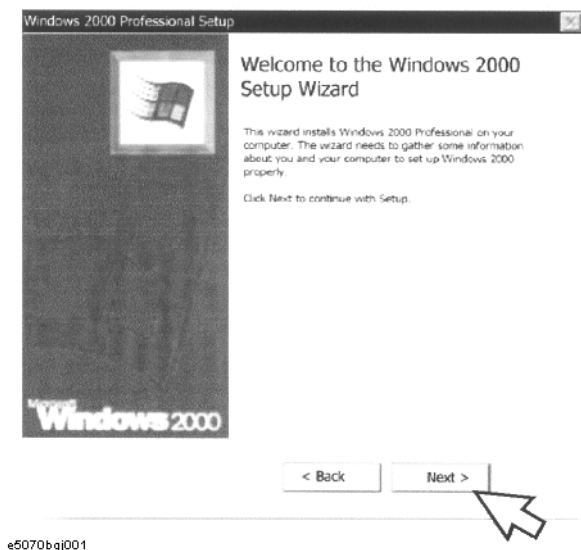
Initial Registration of E4991A

When you start up the E4991A for the first time or after executing system recovery, you need to perform the initial registration of the Windows 2000 operating system of the E4991A.

NOTE   You cannot use the front panel keys during the initial registration of the E4991A therefore connect the mouse and the keyboard before turning on the power.

NOTE   If you perform the following procedure incorrectly, a message asking you whether to return to the previous registration screen and perform the registration appears. In this case, follow the instruction to return to the previous registration screen.

Step 1. Turns on the E4991A.

**Step 2.** The Windows 2000 Professional Setup wizard appears. Click the **Next >** button (Figure 2-13).

Figure 2-13   **Windows 2000 Professional Setup wizard**

e5070bqj001

2. Installation Guide

Step 3. In the Windows 2000 Professional Setup dialog box, select the **I accept this agreement**
box and click the **Next >**button (Figure 2-14). Then, the Windows 2000 operating system is
restarted automatically.

**Figure 2-14** **Windows 2000 Professional Setup dialog box**

e5070bqj004
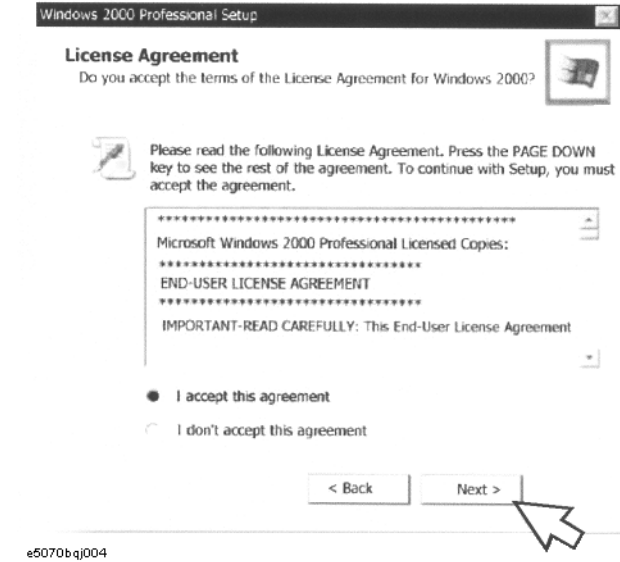
Step 4. The Network Identification wizard appears. Click the **Next >** button (Figure 2-15).

Figure 2-15 **Network Identification wizard**


e5070bqj002
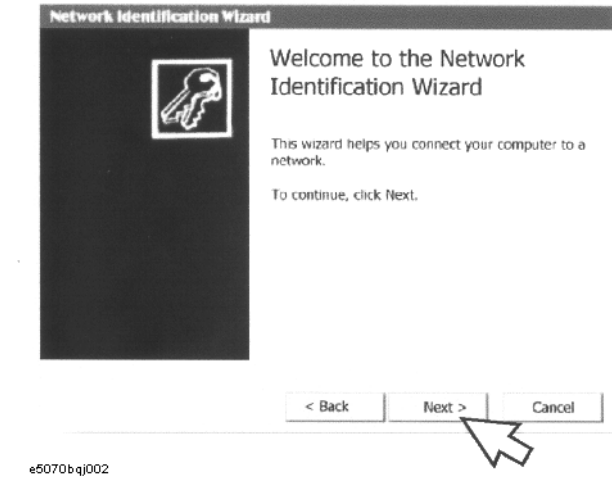
Step 5. In the Network Identification Wizard dialog box (1/2), select the **Windows always assumes the following user has logged on to this computer** box and check that **agt_instr** is in the **User Name** box. If not, type in **agt_instr**. Finally, click the **Next>** button (Figure 2-16).

Figure 2-16   **Network Identification Wizard dialog box (1/2)**

e4991aqj6004
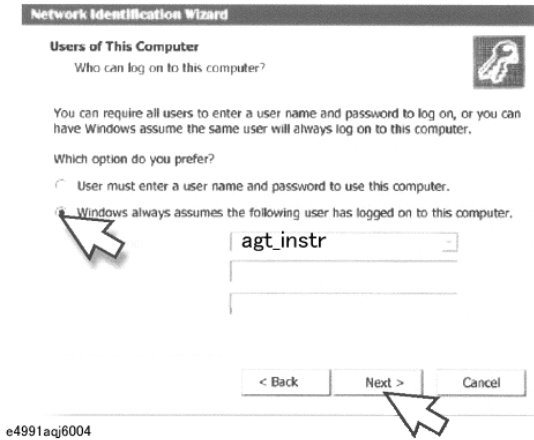
Step 6. In the Network Identification Wizard dialog box (2/2), click the **Finish** button to finish the initial registration of the E4991A (Figure 2-17). Then, the measurement display of theE4991A appears.

Figure 2-17   **Network Identification Wizard dialog box (2/2)**

e5070bqj005
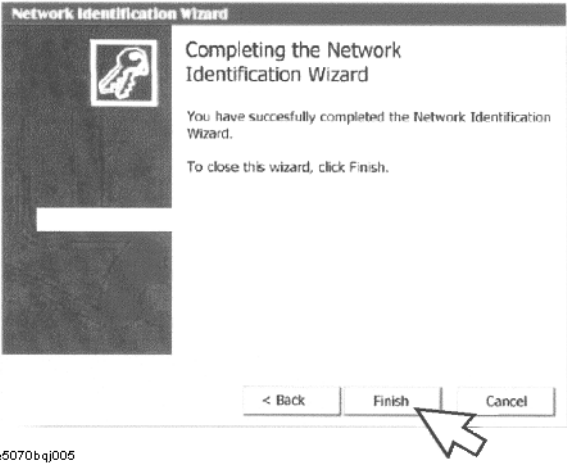
Test Fixtures Available for E4991A

Test fixtures are used to provide high stability and repeatability in measurements. The test fixtures that can be used with the E4991A are listed in the following table. Select the appropriate test fixture depending on the type and size of the DUT. For detailed specifications of the test fixtures, refer to accessory catalogs or the operation manual of each test fixture.

Figure 2-18 Type and sizes of DUTs
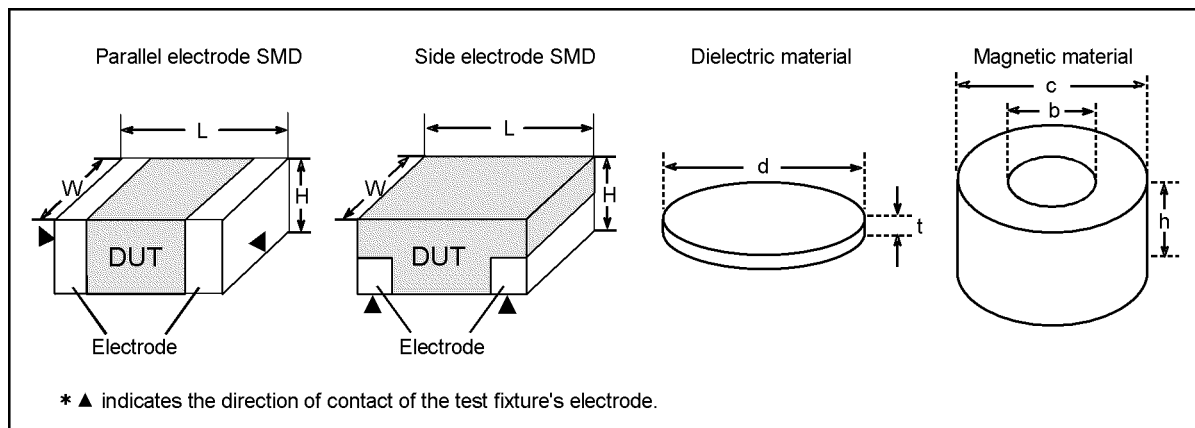
E4991aqe005

Table 2-4 Test fixtures for parallel electrode SMD

Test fixture	Frequency range	Size of DUT (SMD) (mm)		
		Length (L)	Width (W)	Height (H)
16196A	1 MHz to 3 GHz	1.6	0.8	0.5 to 0.8
16196B		1.0	0.5	0.35 to 0.5
16196C		0.6	0.3	0.3
16192A	1 MHz to 2 GHz	1.0 to 20.0	0.5 to 5.0	0.5 to 5.0

Table 2-5 Test fixtures for bottom electrode SMD

Test fixture	Frequency range	Size of DUT (SMD) (mm)		
		Length (L)	Width (W)	Height (H)
16197A[*1]	1 MHz to 3 GHz	1.0	0.5	0.4 to 3.0
		1.6	0.8	
		2.0	1.2	
		3.2	1.6 to 2.5	
16193A	1 MHz to 2 GHz	0.5 to 3.2	≤ 3.0	≤ 3.0

Table 2-5   **Test fixtures for bottom electrode SMD**

Test fixture	Frequency range	Size of DUT (SMD) (mm)		
		Length (L)	**Width (W)**	**Height (H)**
16191A	1 MHz to 2 GHz	2.0 to 12.0	0.5 to 5.0	0.5 to 5.0

*1. When Option 001 is selected, SMD size of 0603 (mm) / 0201 (inch) is covered.

Table 2-6   **Test fixtures for dielectric materials**

Test fixture	Frequency range	Size of DUT (dielectric materials) (mm)	
		Width / Diameter (d)	**Thickness (t)**
16453A	1 M to 1 GHz	$\geq \phi 15.0$	0.3 to 3.0

Table 2-7   **Test fixtures for magnetic materials**

Test fixture	Frequency range	Size of DUT (magnetic materials) (mm)		
		Inner diameter (b)	**Outer diameter (c)**	**Height (h)**
16454A	1 M to 1 GHz	$\geq \phi 3.1$	$\leq \phi 20.0$	≤ 8.5

NOTE   In addition to the above test fixtures, you can also use your own custom-made fixtures.

Instructions for Cleaning

To clean the exterior of the E4991A, gently wipe the surfaces with a clean dry cloth or a clean cloth that has been soaked in water and wrung tightly. Do not attempt to clean the internal parts of the E4991A.

WARNING   **To prevent electrical shock, disconnect the E4991A's power cable from the AC outlet before cleaning.**