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Agilent 16047E TEST FIXTURE FOR AXIAL LEAD COMPONENTS
Operation and Service Manual

Manual Change

Agilent Part No. N/A

April 2009

Change 2

Change the part number in Table 5-1 in Page 33.

Table 5-1. Replaceable Parts List (part 1 of 2)

Reference Designator	Agilent Part Number	Quantity	Description
1	16047-00623	1	PLATE-H
2	16047-00624	1	PLATE-L
3	16047-24024	4	NUT
4	16047-00622	2	PLATE
5	16047-23021	2	SHAFT
6	16380-24001	4	TERMINAL
7	2950-0043	4	NUT
8	2190-0016	2	Washer
9	16047-09001	1	INSULATOR
10	16047-00625	1	SHIELD
11	16047-24022	1	SCREW
12	16047-00621	1	SHORT BAR
13	16047-04021	1	COVER
14	**16047-60015**	2	BNC LEVER ASSEMBLY
15	**16047-60016**	2	CONNECTOR-BNC
16	16047-00626	1	CONTACT
17	16047-24023	2	SLEEVE
18	16047-00627	1	PLATE
19	0515-0999	2	SCREW

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Caution

Proper handling care should be taken when using the test fixture. Refrain from applying brute force, doing so could damage the fixture. Particularly the upper portion (where the DUT is mounted) of the test fixture, where all the sensitive parts have been accurately set and adjusted. Do not place the test fixture on top of a desk or any hard objects with its face down (reverse).

注意

破損する可能性がありますので、本器に衝撃を与えないように、取扱いには注意してください。特に上面（試料を載せる面）側は、部品位置が精密に調整されており、細かな部品も使用されておりますので、絶対に衝撃を与えないで下さい。例えば、上面側を下にして、机などの硬い物の上に置かないで下さい。

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Agilent 16047E Test Fixture

Operation and Service Manual

Third Edition



Agilemt Part No. 16047-90040

January 2001

Printed in: Japan

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Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

April 1999	First Edition (part number: 16047-90040)
December 1999	Second Edition (part number: 16047-90040)
January 2001	Third Edition (part number: 16047-90040)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

The Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

- DO NOT Operate In An Explosive Atmosphere

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Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

- Keep Away From Live Circuits

  Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

- DO NOT Service Or Adjust Alone

  Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

- DO NOT Substitute Parts Or Modify Instrument

  Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

- Dangerous Procedure Warnings

  Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING **Dangerous voltages, capable of causing death, are presenting this instrument. Use extreme caution when handling, testing, and adjusting this instrument.**

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution’s calibration facility, or to the calibration facilities of other International Standards Organization members.

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

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when property installed on that instrument. Agilent Technologies 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 the environmental specifications for the product, or improper site preparation or maintenance.

IMPORTANT

No other warranty is expressed or implied. Agilent Technologies 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. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

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Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

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

Safety Symbol

General definitions of safety symbols used on the instrument or in manuals are listed below.


Instruction Manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instrument manual.

Alternating current.

Direct current.

On (Supply).

Off (Supply).


In position of push-button switch.


Out position of push-button switch.


Frame (or chassis) terminal. A connection to the frame (chassis) of the equipment which normally include all exposed metal structure.

WARNING **This warning sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.**

CAUTION This Caution sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE Note denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

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1 Installation Guide

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Incoming Inspection

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 16047E has been checked mechanically and electrically. The contents of the shipment should be as listed in Table 1-1. If the contents are incomplete, if there is mechanical damage or defect, notify the nearest Agilent Technologies office. If the shipping container is damaged, or the cushioning material shows signs of unusual stress, notify the carrier as well as the Agilent Technologies office. Keep the shipping materials for the carrier's inspection.

Table 1-1 Contents

Description	Part Number	Qty.
16047E Test Fixture	-	1
Shorting bar[a]	16047-00621	1
Operation and Service Manual	16047-90040	1

a. Fasten the guard terminal of the test fixture.

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Connecting the 16047E

Connecting to the 4294A

Follow these steps below to connect the 16047E to the 4294A.

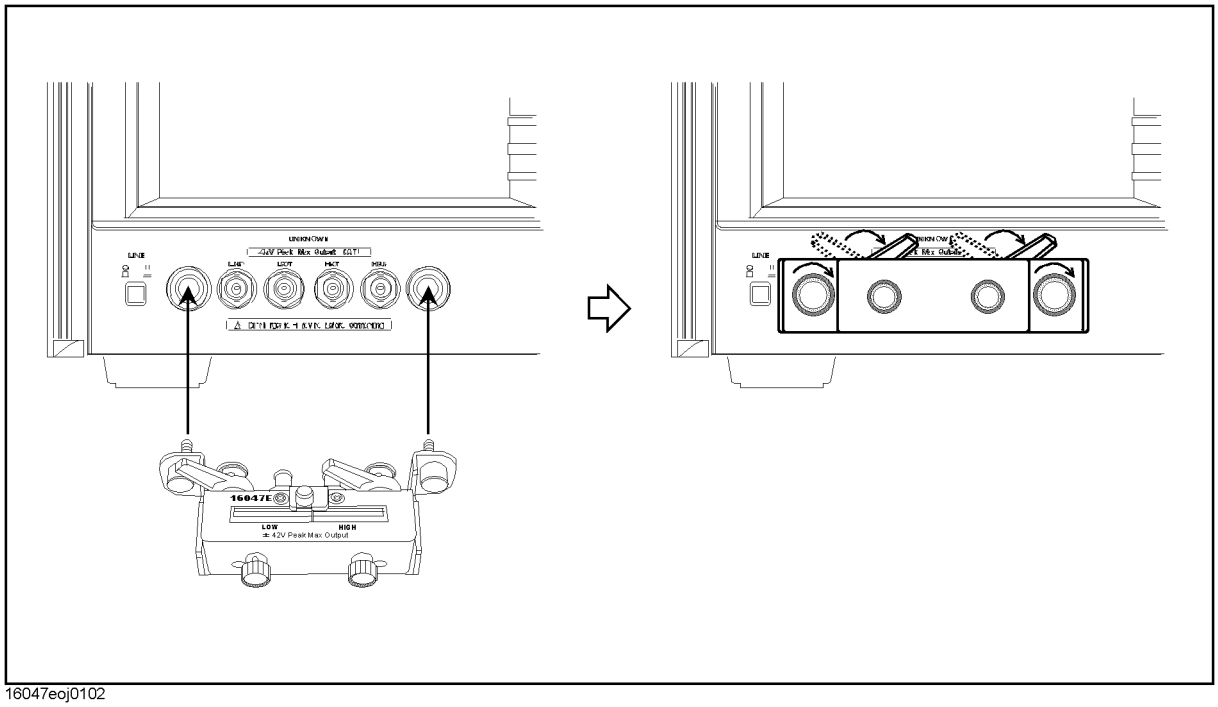
Step 1. Set the 16047E test fixture to the test connectors on the front panel of the 4294A by gradually coupling the four BNC connectors and fastening screws of the fixture with the test connectors and accessory mounting holes of the instrument until they come to complete contact.

Step 2. Fasten two of the four BNC connectors to the mating test connectors by gradually turning the two BNC connectors' rotation levers until each pair of connectors are securely connected.Be sure to align the grooves on both sides.

Step 3. Turn clockwise the fixture's two fastening screws together, so that the fixture is secured to the instrument.

Step 4. Finally, secure the remaining two BNC connectors of the fixture by turning clockwise their rotation levers.

Figure 1-1 Connecting 16047E to 4294A



16047eoj0102

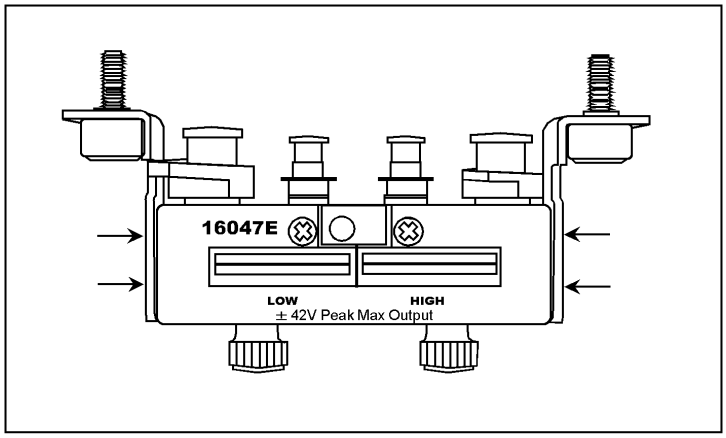
NOTE The fastening screws are designed to provide the fixture with mechanical stability and a prolonged life. Removing these screws will not affect measurement values.

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Connecting to the instrument other than 4294A

When connecting the 16047E to any instrument other than the 4294A, remove the four fastening screws as shown in Figure 1-2.

Figure 1-2 Locations of fastening screws

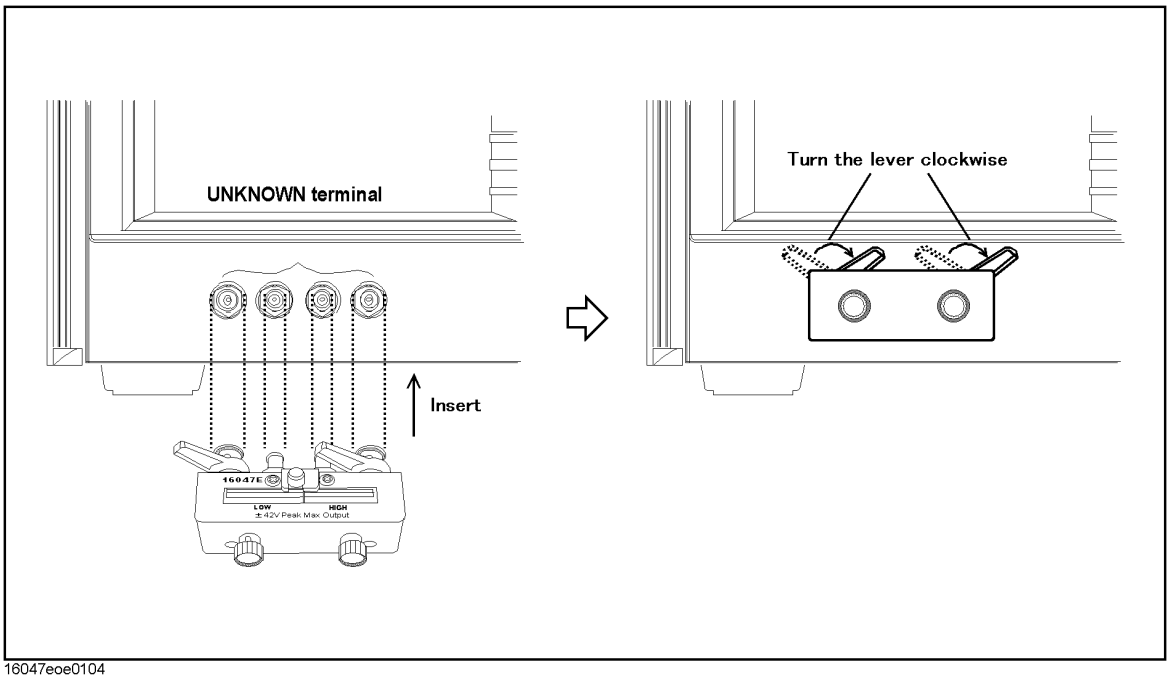


16047eoj0103

Step 1. Set the 16047E test fixture to the UNKNOWN connectors on the instrument by gradually coupling the four BNC connectors and fastening screws of the fixture with the connectors of the instrument until they come to complete contact. Be sure to align the grooves on both sides.

Step 2. Secure the two BNC connectors of the fixture by turning clockwise their rotation levers.

Figure 1-3 Connecting the fixture to the instrument



16047eoe0104

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Cleaning

When the electrodes get dirty, their contact resistance increases resulting in inaccurate measurement. Use soft cloth to clean the electrode to remove dust particles or any other dirt.

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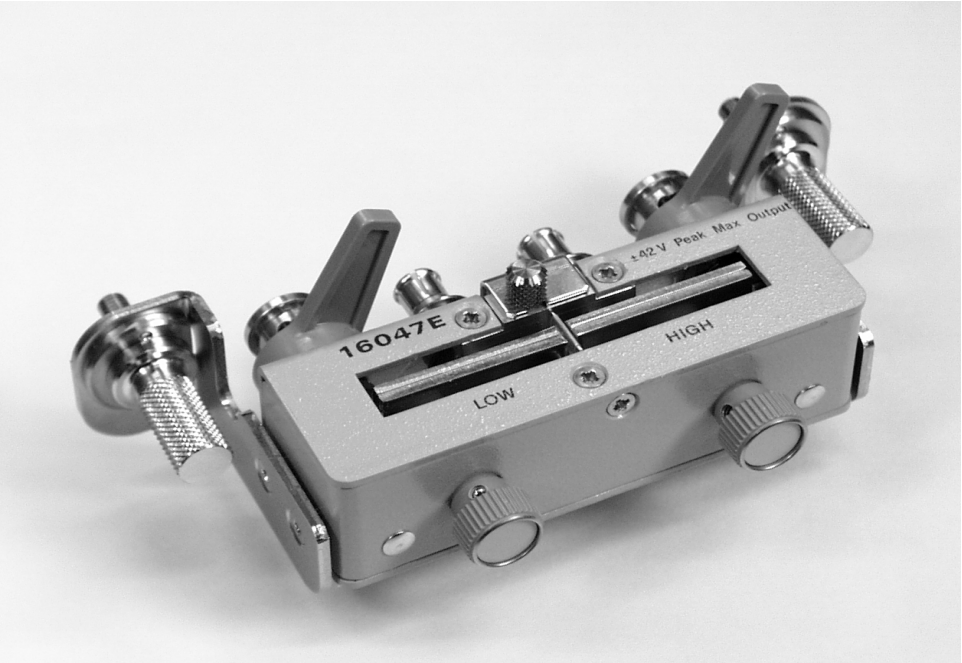
2 Overview

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Product Overview

The 16047E is a test fixture used to measure parts with leads. When used with the 4294A, the fixture provides highly accurate measurement with wide frequency range up to 110 MHz. Also it gains mechanical stability and a prolonged life when it is secured to the 4294A with its fastening screws.

Figure 2-1 **Product Overview**



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Functions

Figure 2-2 shows name of each part of the 16047E and Table 2-2 shows function.

Figure 2-2 **16047E Parts**

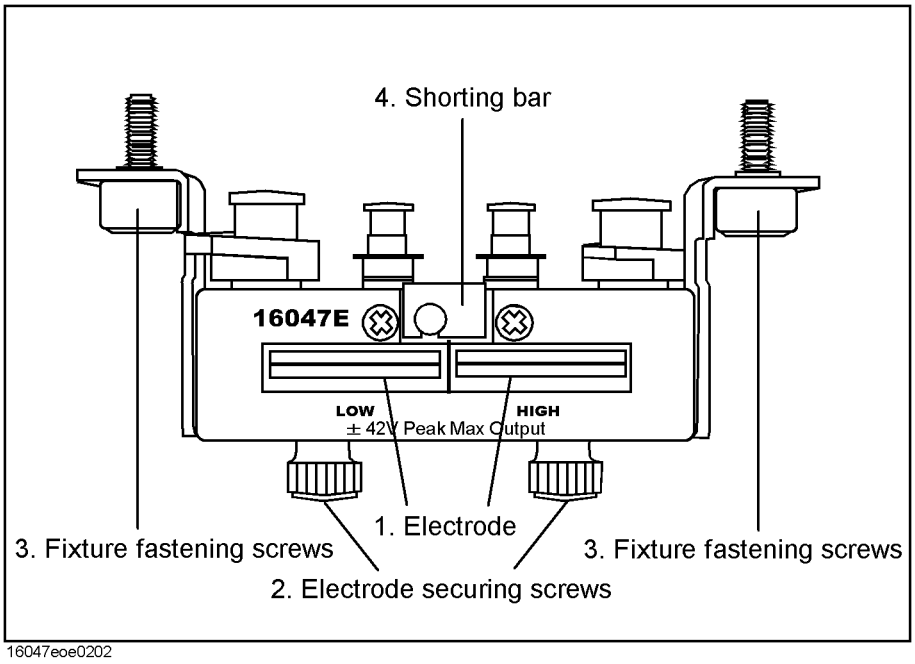


Table 2-1 **16047E Function**

No.	NAME	FUNCTION
1	Electrode	Contact for DUT electrode. The LOW side electrode connected to an instrument's L_{CUR}, L_{POT} and the HIGH side electrode connected to an instrument's H_{CUR}, H_{POT}.
2	Electrode securing screws	Secures the electrodes with DUT leads caught.
3	Fixture fastening screws	Secures the fixture to an instrument.
4	Shorting bar	Detached and used as a shorting bar when performing short correction. Also used as a guard terminal securing plate when measuring a 3-terminal device.

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3 Operation

This chapter describes the proper methods for fixture compensation with the 16047E and DUT measurement.

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Performing Fixture Compensation

To enhance measurement accuracy, fixture compensation should be done before DUT measurement. The fixture compensation requires measurements with the 16047E for open and short compensation data. The following procedure shows the measurement for the compensation data.

Performing Open Compensation

The open compensation procedure is as follows.

1. Fasten the electrode securing screws at the HIGH and LOW sides with no DUT leads caught in the electrodes.

NOTE Do not fasten the screws too tightly to prevent the electrodes from damaged.

2. Follow the instruction manual that came with your instrument to perform a measurement to obtain open compensation data.

Performing Short Compensation

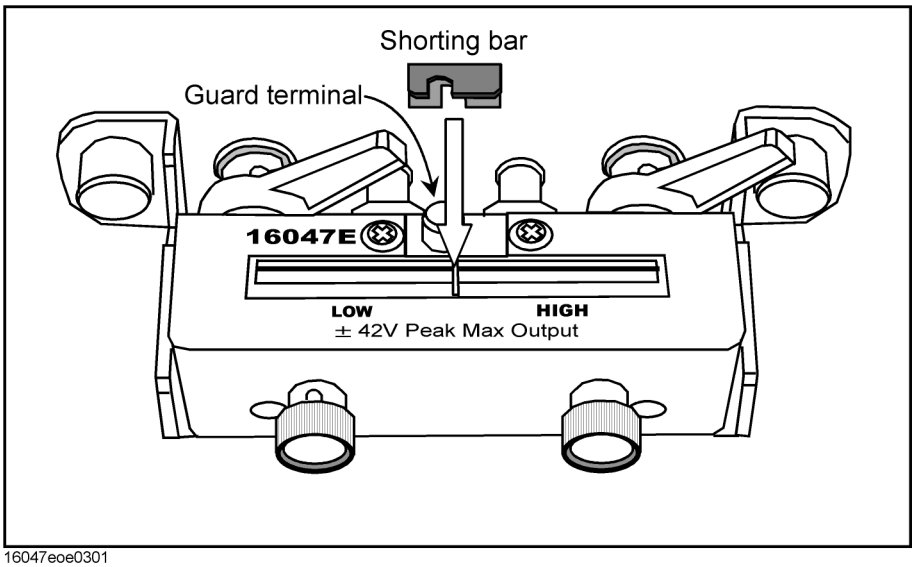
The short compensation procedure is as follows.

1. Remove the shorting bar secured on the guard terminal.
2. Loosen the electrode securing screws so that the shorting bar is caught in the electrodes.

NOTE Place the shorting bar in the proper direction so that it does not contact to the guard terminal.

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Figure 3-1 Performing short compensation



16047eoe0301

3. Fasten the electrode securing screws.

NOTE Do not fasten the screws too tightly to prevent the electrodes from damaged.

4. Follow the instruction manual that came with your instrument to perform a measurement to obtain short compensation data.

Performing Load Compensation

Generally, there is no need to perform load compensation. If you have any standard device or you need to keep consistency in measured data, perform load compensation.

The load compensation procedure is as follows.

1. Fasten the electrode securing screws at the HIGH and LOW sides with load leads caught in the electrodes.

NOTE Do not fasten the screws too tightly to prevent the electrodes from damaged.

2. Follow the instruction manual that came with your instrument to perform a measurement to obtain load compensation data.

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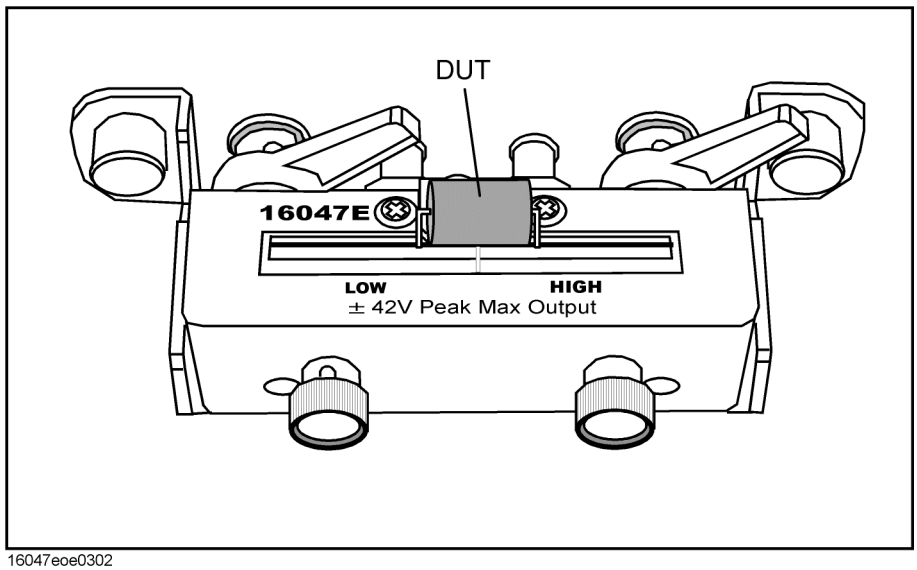
DUT Measurement

Before performing DUT measurement, open and short compensation should be done as described in the previous sections.

1. Loosen the electrode securing screws of both sides so that DUT leads are caught in the electrodes.
2. Fasten both of the securing screws.

NOTE Do not fasten the screws too tightly to prevent the electrodes from damaged.

Figure 3-2 Performing DUT Measurement



16047eoe0302

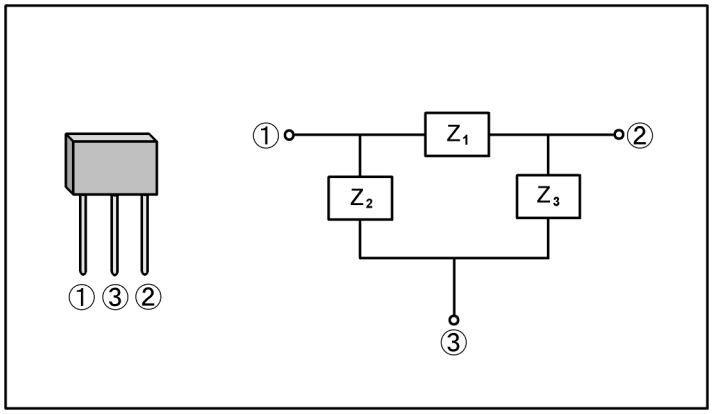
3. Follow the instruction manual that came with your instrument to measure your DUT.

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Measuring 3-terminal device

The 16047E allows you to measure a 3-terminal device shown in Figure 3-3.

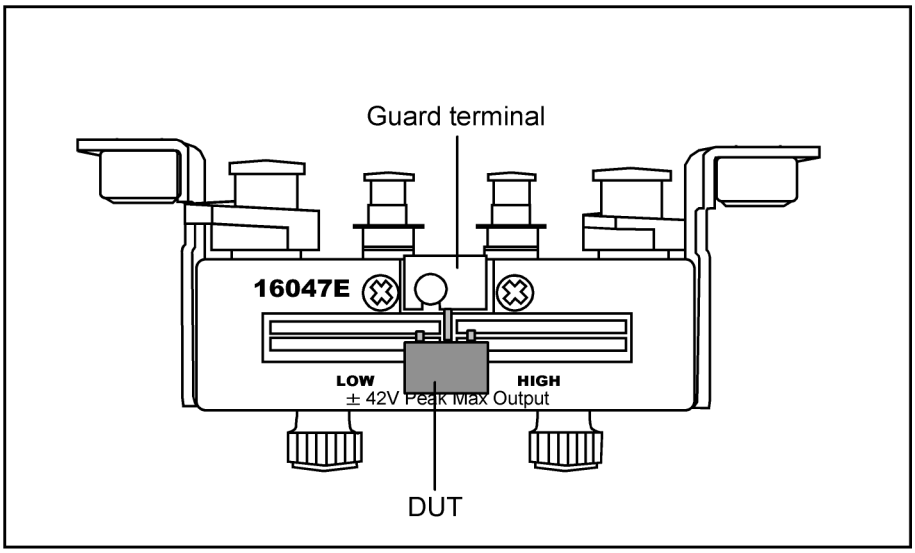
Figure 3-3 3-terminal device



Use the guard terminal on the fixture to measure a 3-terminal device.Connect the lead No. 3 to the guard terminal in order to measure only characteristics of Z_1 eliminating any effects from Z_2 and Z_3.

1. Loosen the electrode securing screws of both sides and the screw of the guard terminal.
2. Insert the leads No. 1 or 2 into the electrodes, then fasten the screws. Insert the lead No. 3 into the guard terminal, then secure it with the screw.

Figure 3-4 Measuring 3-terminal device



16047eoe0304

3. Follow the instruction manual that came with your instrument to measure your

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DUT.

Similarly, connect the lead No. 2 to the guard terminal in order to measure only characteristics of Z_2 eliminating any effects from Z_1 and Z_3.

NOTE Connect your device to the guard terminal with a shortest possible lead. Longer lead will degrade the guard effect resulting in less accurate measurement result.

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4 Specifications and Supplemental Performance Characteristics

This chapter provides specifications and supplemental performance characteristics of the 16047E test fixture.

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Specifications

Applicable Instruments		LCR meters and Impedance Analyzers with four-terminals
Applicable DUT Type		Lead components
Frequency		≤ 110MHz
DC Bias		± 42V peak max. (AC+DC)
Operating Environment	temp.	-20°C to +75°C
	humidity	15% to 95%RH(@ wet bulb temp. < 40°C)
Non Operating Environment.	temp.	-40°C to +70°C
	humidity	≤ 90 % RH (@ wet bulb temp. <65°C)
Dimension		Approximately 135 (W) × 40 (H) × 65 (D) mm
Weight		Approximately 200g

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Supplemental Performance Characteristics

This section provides useful data on the 16047E. These supplemental performance characteristics should not be considered specifications.

Additional Error

Additional errors are calculated as follows.

|Z| Measurement

Additional error Ze [%] of the |Z| measurement is calculated by substituting the values in the table below into the following equation.

$Ze\ [\%] = \pm \{A + (Zs/Zx + Yo \times Zx) \times 100\}$

where

A [%]	Additional Error (Proportional Error)
Yo [S]	Open Repeatability (Admittance)
Zs [Ω]	Short Repeatability (Impedance)
Zx [Ω]	Measured Value (Impedance)

Without extension cable

Applicable Instruments : 4294A

Yo		2 n + 10 µ × (f / 100) [S]
Zs		2 m + 600 m × (f / 100) [Ω]
A	f ≤ 15 MHz	0.2 % × (f / 10)^2 [%]
	f > 15MHz	4 % × (f / 100) [%]

where f is the measurement frequency (MHz).

Without extension cable

Applicable Instruments : 4192A, 4194A, 4263B, 4268A, 4278A, 4279A, 4284A, 4285A, 4338B

Yo	2 n + 10 µ × (f / 100) [S]
Zs	2 m + 600 m × (f / 100) [Ω]
A	0.2 % × (f / 10)^2 [%]

where f is the measurement frequency (MHz).

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4194A (extension cable 1m)

Yo	4 n + 20 μ × (f / 100) [S]
Zs	4 m + 1200 m × (f / 100) [Ω]
A	0.6 % × (f / 10)^2 [%]

where f is the measurement frequency (MHz).

4285A, 4294A (extension cable 1m)

Yo		4 n + 20 μ × (f / 100) [S]
Zs		4 m + 1200 m × (f / 100) [Ω]
A	f ≤ 5 MHz	0.6 % × (f / 10)^2 [%]
	f > 5MHz	8 % × (f / 100) [%]

where f is the measurement frequency (MHz).

4285A, 4294A (extension cable 2m)

Yo		4 n + 20 μ × (f / 100) [S]
Zs		4 m + 1200 m × (f / 100) [Ω]
A	f ≤ 5 MHz	1 % × (f / 10)^2 [%]
	f > 5MHz	8 % × (f / 100) [%]

where f is the measurement frequency (MHz).

D Measurement

Additional error De of the D measurement is calculated by additional error Ze [%] of |Z| measurement as follows.

If Dx ≤ 0.1:

$$De = Ze / 100$$

If 0.1 < Dx ≤ 0.5:

$$De = (Ze / 100) \times (1 + Dx)$$

where Dx is the measured value of D. It is necessary for Ze to be below 10 %.

NOTE D is not expressed as a percentage but as an absolute value.

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Rs (ESR) Measurement

Additional error Rse[%] of the Rs measurement is calculated by additional error Ze [%] of |Z| measurement as follows.

If $Dx \leq 0.1$:

$$Rse\ [\%] = Ze / Dx$$

If $0.1 < Dx \leq 0.5$:

$$Rse\ [\%] = (Ze / Dx) \times \sqrt{(1 + Dx^2)}$$

Dx is the measured value of D and is calculated as follows.

$$Dx = 2 \times \pi \times f \times Csx \times Rsx,$$

where

f: measurement signal frequency

Csx: measured value of Cs

Rsx: measured value of Rs.

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5 Service

This chapter provides information on servicing and proper maintenance.

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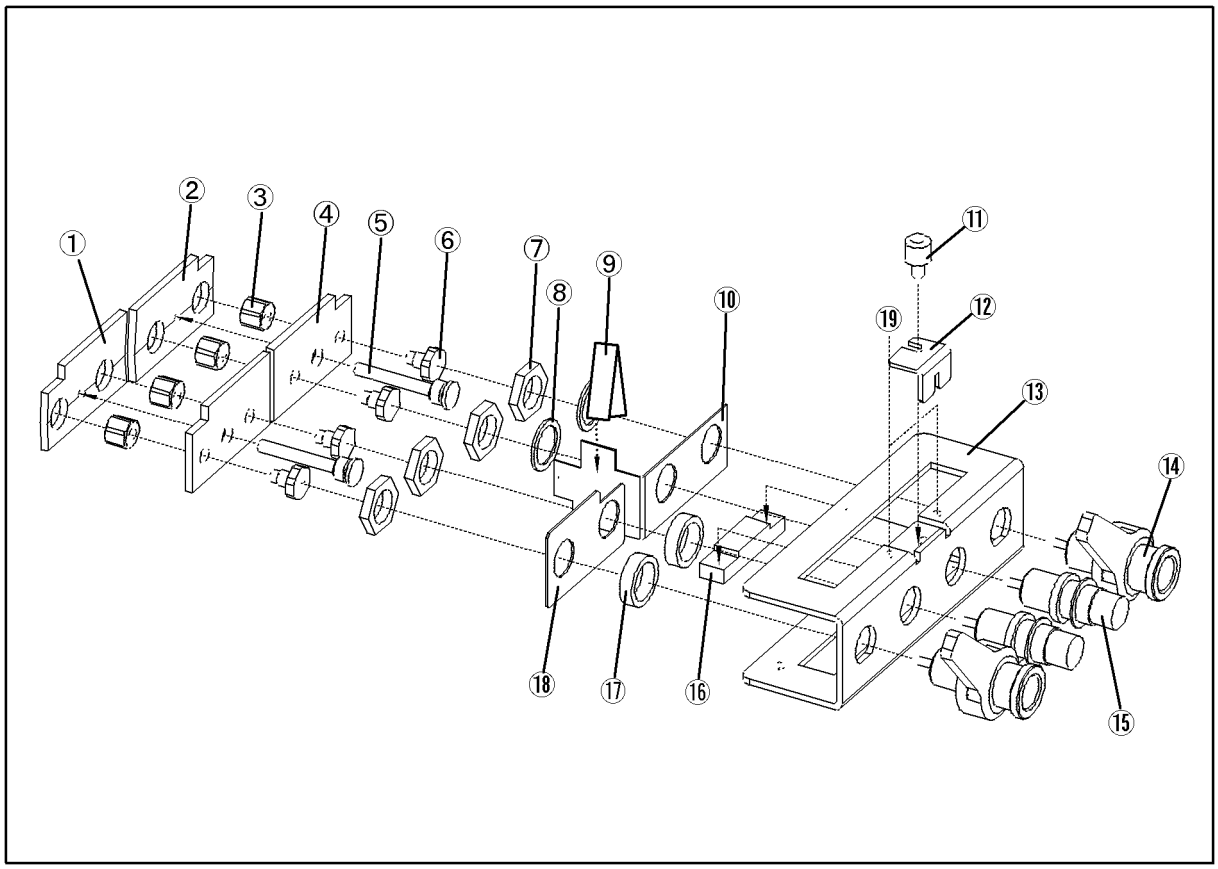
Maintenance

An exploded view of the 16047E for parts identification is shown in Figure 5-1 and Figure 5-2. Do not disassemble any further than shown. Maintenance consists principally of cleaning contacts and replacing worn or damaged parts. Take special care when cleaning contacts.

To order parts, use the Agilent Technologies part numbers listed in Table 1-1 and Table 1-2. If a faulty part is located in an assembly that cannot be disassembled, order the next higher assembly or return the fixture to the nearest Agilent Technologies Sales/Service Office for repair or replacement.

Replacable Parts

Figure 5-1 Replacable Parts (part 1 of 2)



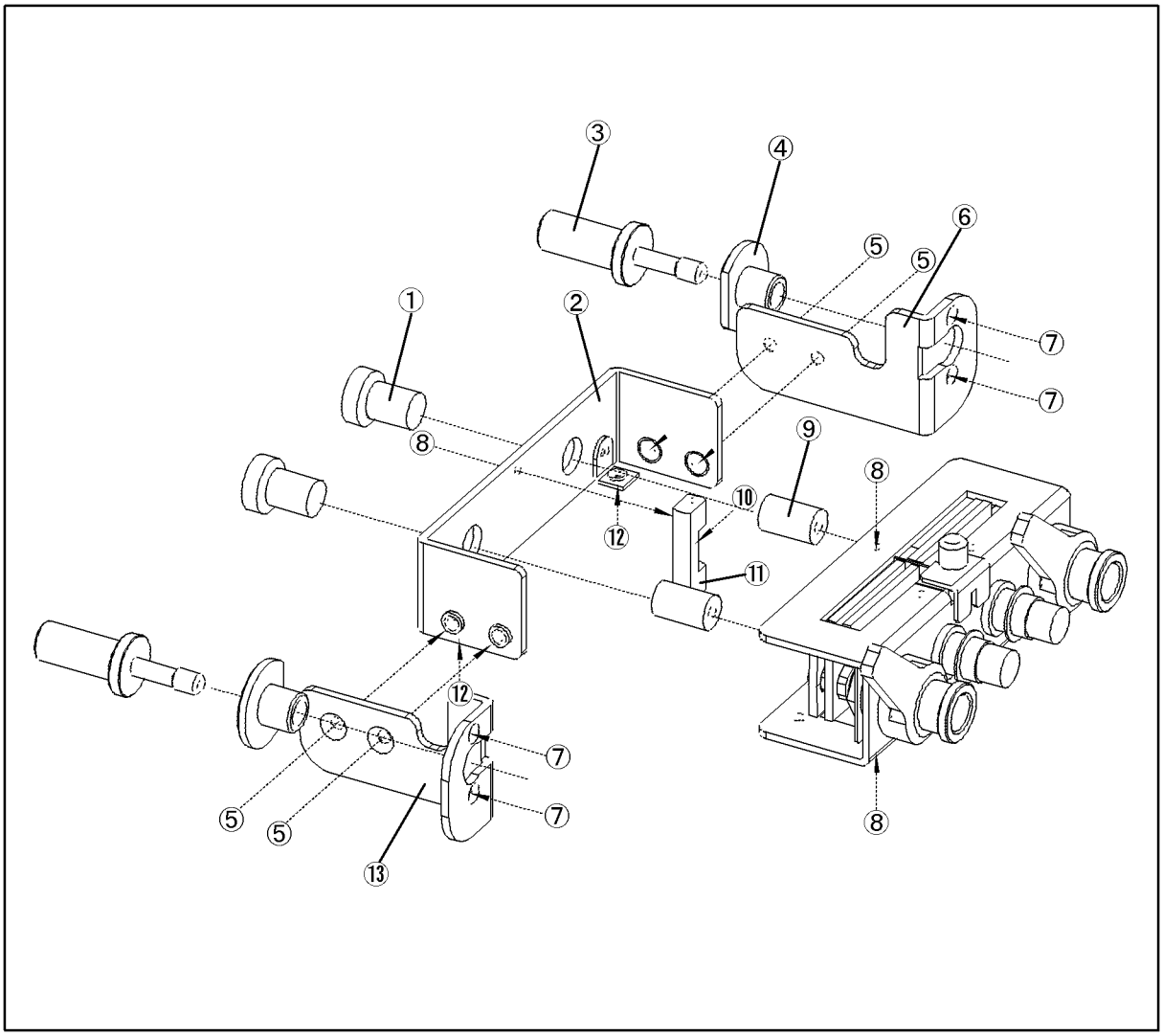
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Table 5-1 Replacable Parts (part 1 of 2)

Reference Designator	Agilent Part No.	Qty.	Description
1	16047-00623	1	PLATE-H
2	16047-00624	1	PLATE-L
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6	16380-24001	4	TERMINAL
7	2950-0043	4	NUT
8	2190-0016	2	Washer
9	16047-09001	1	INSULATOR
10	16047-00625	1	SHIELD
11	16047-24022	1	SCREW
12	16047-00621	1	SHORT BAR
13	16047-04021	1	COVER
14	16047-60011	2	BNC LEVER ASSEMBLY
15	1250-1798	2	CONNECTOR-BNC
16	16047-00626	1	CONTACT
17	16047-24023	2	SLEEVE
18	16047-00627	1	PLATE
19	0515-0999	2	SCREW

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Figure 5-2 Replacable Parts (part 2 of 2)



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Table 5-2 Replacable Parts (part 2 of 2)

Reference Designator	Agilent Part No.	Qty.	Description
1	0370-2446	2	KNOB
2	16047-04022	1	COVER
3	16047-24021	2	KNOB
4	16047-24026	2	FLANGE
5	0515-0914	4	SCREW
6	16047-01222	1	ANGLE
7	0515-0952	4	SCREW
8	0515-0999	3	SCREW
9	16047-25021	2	INSULATER
10	0515-2791	1	SCREW
11	16047-24025	1	SLEEVE
12	0515-0914	2	SCREW
13	16047-01221	1	ANGLE

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