

**Agilent 16191A Side Electrode SMD Test Fixture**  
**Operation and Service Manual**



**Agilent Part No. 16191-90040**  
**Printed in JAPAN May 2003**

**Sixth Edition**

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## Manual Printing History

The manual 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.

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## 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** given elsewhere in this manual 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

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

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#### Warning



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

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The voltage levels found in this test fixture when used with the intended instruments do not warrant more than normal safety precautions for operator safety.

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## Operating Precaution

Do not exceed the operating input power, voltage, and current level and signal type appropriate for the instrument being used, refer to your instrument's operation manual.

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### Caution



Electrostatic discharge (ESD) can damage the highly sensitive microcircuits in your instrument. ESD damage is most likely to occur as the test fixtures are being connected or disconnected. Protect them from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any static charge built-up by touching the outer shell of any grounded instrument chassis before touching the test port connectors.

Never touch the test clip contacts.

Use a work station equipped with an anti-static work surface.

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## 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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## Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed in *Instrument Specifications* of this manual, the warranty shall be for the specified period. During the warranty period, Agilent Technologies will, at its option, either repair or replace products which prove to be defective.

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Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when properly 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.

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## **Limitation Of Warranty**

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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.

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## Safety Symbols

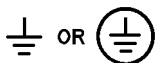
General definitions of safety symbols used on equipment or in manuals.



Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.



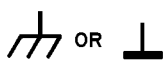
Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with wiring terminals to indicate the terminal which must be connected to ground before operating equipment.



Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (Operation) manual, and before operating the equipment.



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



Alternating current (power line).



Direct current (power line).



Alternating or direct current (power line).

### Warning



**Warning** 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



**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 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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# Contents

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## 1. General Information

|                                                    |     |
|----------------------------------------------------|-----|
| Introduction . . . . .                             | 1-1 |
| Manual Summary . . . . .                           | 1-1 |
| Product Description . . . . .                      | 1-1 |
| Applicable Instruments . . . . .                   | 1-1 |
| Options Available . . . . .                        | 1-2 |
| Accessories Supplied . . . . .                     | 1-2 |
| Specifications . . . . .                           | 1-3 |
| Supplemental Performance Characteristics . . . . . | 1-3 |
| Residual Inductance of the Shorting Bar . . . . .  | 1-4 |

## 2. Preparation for Use

|                                                                     |     |
|---------------------------------------------------------------------|-----|
| Introduction . . . . .                                              | 2-1 |
| Initial Inspection . . . . .                                        | 2-1 |
| Connecting the Test Fixture for Use . . . . .                       | 2-3 |
| Repackaging the Test Fixture For Shipment . . . . .                 | 2-4 |
| Measurement Error Correcting Function for Each Instrument . . . . . | 2-4 |

## 3. Operation

|                                                                  |     |
|------------------------------------------------------------------|-----|
| Introduction . . . . .                                           | 3-1 |
| Operating Flow . . . . .                                         | 3-1 |
| Overview . . . . .                                               | 3-2 |
| How to set the SHORT condition, and the OPEN condition . . . . . | 3-3 |
| Setting the SHORT condition . . . . .                            | 3-3 |
| Setting the OPEN condition . . . . .                             | 3-5 |
| How to connect the DUT . . . . .                                 | 3-6 |
| Adjusting the Pressure Arm Stroke . . . . .                      | 3-7 |

## 4. Service

|                                                                       |      |
|-----------------------------------------------------------------------|------|
| Introduction . . . . .                                                | 4-1  |
| General Information . . . . .                                         | 4-1  |
| Assembly Replacement . . . . .                                        | 4-3  |
| Disassembly and Assembly Procedure . . . . .                          | 4-3  |
| Test Stage, Pressure Arm, and Locking Arm Assembly Removal: . . . . . | 4-3  |
| Replaceable Parts . . . . .                                           | 4-4  |
| Troubleshooting . . . . .                                             | 4-10 |
| Open Impedance Check . . . . .                                        | 4-10 |
| Short Impedance Check . . . . .                                       | 4-10 |
| Short Impedance Repeatability Check . . . . .                         | 4-11 |

## Figures

---

|                                                                          |     |
|--------------------------------------------------------------------------|-----|
| 1-1. Applicable DUT Size . . . . .                                       | 1-4 |
| 1-2. Simulation Setup . . . . .                                          | 1-5 |
| 2-1. 16191A Product Overview . . . . .                                   | 2-2 |
| 2-2. Connecting the Test Fixture with APC-7® Connector (4291B) . . . . . | 2-3 |
| 3-1. 16191A Test Fixture Overview . . . . .                              | 3-2 |
| 3-2. Arm Stroke Adjustment . . . . .                                     | 3-7 |
| 4-1. Replaceable Parts for Test Stage . . . . .                          | 4-8 |

## Tables

---

|                                                                           |      |
|---------------------------------------------------------------------------|------|
| 1-1. Furnished Accessories . . . . .                                      | 1-2  |
| 1-2. Option 701 Shorting Device Residual Inductance (Typical) . . . . .   | 1-4  |
| 1-3. Option 010 Shorting Device Residual Inductance (Typical) . . . . .   | 1-5  |
| 2-1. 16191A Contents . . . . .                                            | 2-2  |
| 2-2. Measurement Error Correcting Functions for Each Instrument . . . . . | 2-4  |
| 4-1. 16191A Product Overview . . . . .                                    | 4-2  |
| 4-2. Replaceable Parts for Main Assembly . . . . .                        | 4-4  |
| 4-3. Replaceable Parts for Main Assembly (without Top Cover) . . . . .    | 4-5  |
| 4-4. Replaceable Parts for Locking Arm Assembly . . . . .                 | 4-6  |
| 4-5. Replaceable Parts for Pressure Arm Assembly . . . . .                | 4-7  |
| 4-6. Replaceable Parts for Test Stage Assembly . . . . .                  | 4-9  |
| 4-7. Open Impedance Value Guideline . . . . .                             | 4-10 |
| 4-8. Short Impedance Value Guideline . . . . .                            | 4-11 |
| 4-9. Short Impedance Repeatability Guideline . . . . .                    | 4-11 |

# General Information

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## Introduction

The purpose of this manual is to enable you to use your 16191A Side Electrode SMD Test Fixture efficiently and confidently.

## Manual Summary

This manual contains the following:

- The specifications of the 16191A (see this chapter).
- Installing the 16191A (see Chapter 2).
- Operating the 16191A (see Chapter 3).
- Ordering replaceable parts for the 16191A (see Chapter 4).

---

## Product Description

The 16191A is used to measure a side electrodes surface mount device (SMD) with high repeatability.

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## Applicable Instruments

The 16191A has been designed to operate specifically with the following LCR meters and impedance analyzers:

|                                                |                                             |
|------------------------------------------------|---------------------------------------------|
| You can directly connect the 16191A to:        | 4191A, 4291B, E4991A                        |
| You can use the 16191A with 43961A:            | 4395A (option 010),<br>4396A/B (option 010) |
| You can use the 16191A with 41951A:            | 4195A                                       |
| You can use the 16191A with RF adapter 42942A: | 4294A                                       |
| You can use the 16191A with RF adapter 16085B: | 4284A <sup>1</sup>                          |
| You can use the 16191A with RF adapter 16099A: | 4194A with 41941A <sup>2</sup>              |

1 The 4284A is a typical instrument. Other 4-terminal pair instruments that can be used with the 16085B are also applicable.

2 The 4194A with 41941A is a typical instrument. Other instruments that can be used with the 16099A are also applicable.

---

## Options Available

The following option is supplied for the 16191A:

- Option 010      Add industry standard size short bar set
- Option 701      Short bars set (1x1x2.4, 1.6x2.4x2, 3.2x2.4x2.4, 4.5x2.4x2.4)mm
- Option 710      Add the magnifying lens and tweezers

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## Accessories Supplied

The following accessories are supplied with the 16191A:

**Table 1-1. Furnished Accessories**

| Description                   | Part Number     | Quantity |
|-------------------------------|-----------------|----------|
| Operation and Service Manual  | P/N 16191-90040 | 1        |
| Option 701                    | P/N 16191-29001 | 1        |
|                               | P/N 16191-29002 | 1        |
|                               | P/N 16191-29003 | 1        |
|                               | P/N 16191-29004 | 1        |
|                               | P/N 1540-0692   | 1        |
| Case for shorting devices     | P/N 1540-0692   | 1        |
| Option 010 <sup>*1</sup>      | P/N 16191-29005 | 1        |
|                               | P/N 16191-29006 | 1        |
|                               | P/N 16191-29007 | 1        |
|                               | P/N 16191-29008 | 1        |
|                               | P/N 16193-60002 | 1        |
| Magnifying lens <sup>*2</sup> | P/N 16193-60002 | 1        |
| Tweezers <sup>*2</sup>        | P/N 8710-2081   | 1        |
| Wrench                        | P/N 8710-1181   | 1        |

<sup>\*1</sup> Option 010 sizes are the same as industry standard (EIA/EIAJ) SMD sizes. This short bar set has the following SMD sizes included : 1005(mm)/0402(inch), 1608(mm)/0603(inch), 2012(mm)/0805(inch), 3216(mm)/1206(inch). Order option 010 if the SMD that is to be measured has the same size as the EIA/EIAJ sizes.

<sup>\*2</sup> Furnished with the option 710

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## Specifications

This section lists the complete 16191A specifications. These specifications are the performance standards and limits against which the 16191A is tested. When shipped from the factory, the 16191A meets the following specifications:

|                                                                                       |                                                                      |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| <b>Maximum DC Bias Voltage</b> .....                                                  | $\pm 40\text{V}$                                                     |
| <b>Operating Temperature</b> .....                                                    | $-55$ to $+85^{\circ}\text{C}$                                       |
| <b>Operating Humidity</b> (@wet bulb temperature $<40^{\circ}\text{C}$ )<br>.....     | $15\%$ to $95\%$ RH                                                  |
| <b>Non-operating Temperature</b> .....                                                | $-55$ to $+85^{\circ}\text{C}$                                       |
| <b>Non-operating Humidity</b> (@wet bulb temperature $<65^{\circ}\text{C}$ )<br>..... | Up to $90\%$ RH                                                      |
| <b>Weight</b> .....                                                                   | $500\text{ g}$                                                       |
| <b>Dimension</b> .....                                                                | $150(\text{W}) \times 70(\text{H}) \times 110(\text{D}) [\text{mm}]$ |

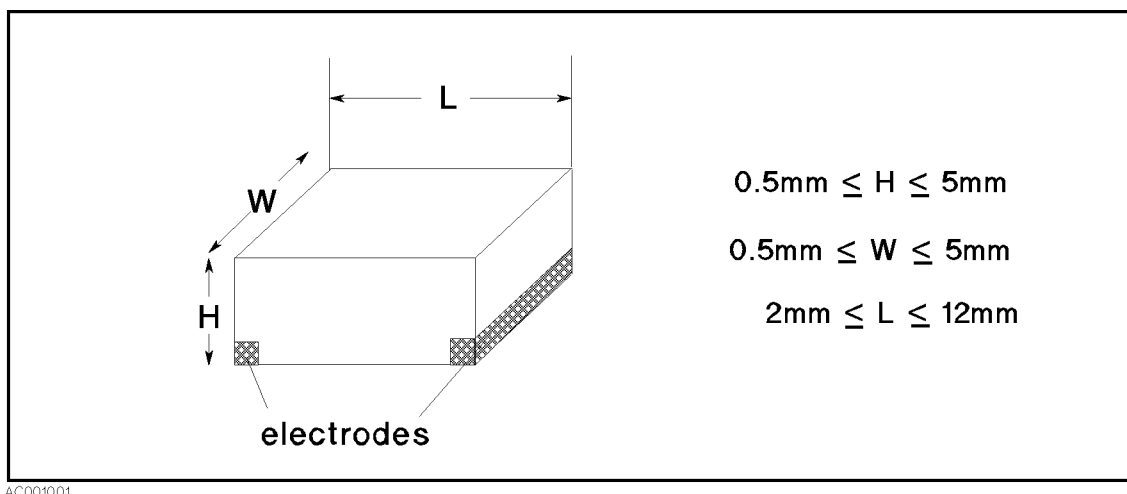
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## Supplemental Performance Characteristics

This section lists supplemental performance characteristics. Supplemental performance characteristics are not specifications, but are typical characteristics included as additional information for the operator. Supplemental performance characteristics are not guaranteed.

|                                                                                       |                                                                                              |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>Frequency Range</b> .....                                                          | DC to $2\text{ GHz}$                                                                         |
| <b>Applicable DUT size</b> (see Figure 1-1) .....                                     | $2\text{ mm}$ to $12\text{ mm}$                                                              |
| <b>Option 701 shorting device size</b>                                                |                                                                                              |
| P/N 16191-29001 .....                                                                 | $1 \times 1 \times 2.4 [\text{mm}]$                                                          |
| P/N 16191-29002 .....                                                                 | $1.6 \times 2.4 \times 2 [\text{mm}]$                                                        |
| P/N 16191-29003 .....                                                                 | $2.4 \times 2.4 \times 3.2 [\text{mm}]$                                                      |
| P/N 16191-29004 .....                                                                 | $2.4 \times 2.4 \times 4.5 [\text{mm}]$                                                      |
| <b>Option 010 shorting device size</b>                                                |                                                                                              |
| P/N 16191-29005 .....                                                                 | $1.0(\text{L}) \times 0.5(\text{W}) \times 0.5(\text{H}) [\text{mm}]$                        |
| P/N 16191-29006 .....                                                                 | $1.6(\text{L}) \times 0.8(\text{W}) \times 0.8(\text{H}) [\text{mm}]$                        |
| P/N 16191-29007 .....                                                                 | $2.0(\text{L}) \times 1.2(\text{W}) \times 0.8(\text{H}) [\text{mm}]$                        |
| P/N 16191-29008 .....                                                                 | $3.2(\text{L}) \times 1.6(\text{W}) \times 0.8(\text{H}) [\text{mm}]$                        |
| <b>Electrical length</b> (when the length between electrodes is $2\text{ mm}$ ) ..... | $14.0\text{ mm}$                                                                             |
| <b>Additional Error</b> * .....                                                       | $1.5 \times f^2 [\%]$                                                                        |
| <b>Repeatability</b> *                                                                |                                                                                              |
| (for inductive component) .....                                                       | $30 + 250 \times f [\text{m}\Omega]$<br>(impedance of $30\text{ m}\Omega$ , $40\text{ pH}$ ) |
| .....                                                                                 | $2 + 30 \times f [\mu\text{S}]$<br>(admittance of $2\text{ }\mu\text{S}$ , $5\text{ fF}$ )   |

\* f: frequency (GHz)



AC001001

**Figure 1-1. Applicable DUT Size**

## Residual Inductance of the Shorting Bar

The usual method to compensate the test fixture's residual inductance is to let  $\text{SHORT} = 0H$ . In this method, the measurement result is the relative value of the measured impedance to the shorting bar's impedance. The short bar's residual inductance as a result of its size and shape is not estimated.

On the other hand, there is a definition method to let  $\text{SHORT} = x H$ . In this method, the measurement result is the absolute value of the device's impedance. The short bar's residual inductance as a result of its size and shape is estimated under specific conditions and is used as a reference value. This method, is useful for devices with values which are close to the short conditions of the measurement system.

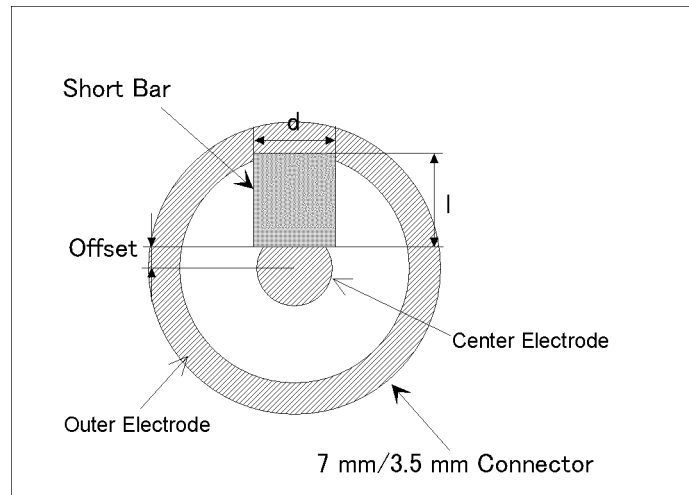
The reference inductance values presented Table 1-2 and Table 1-3 were simulated as the relative difference to a disk-type  $0 \Omega$  termination on either the 7 mm or the 3.5 mm connector. The measurement of these short bars under other conditions than shown below cannot reproduce the reference inductance values.

**Table 1-2. Option 701 Shorting Device Residual Inductance (Typical)**

| Shorting Bar    | l [mm] | d [mm] | h [mm] | Offset [mm] | Connector | Inductance (Typical) |
|-----------------|--------|--------|--------|-------------|-----------|----------------------|
| P/N 16191-29001 | 1      | 2.4    | 1      | 0.75        | 3.5 mm    | 0.2 nH               |
| P/N 16191-29002 | 1.6    | 2.4    | 2      | 0.45        | 3.5 mm    | 0.2 nH               |
| P/N 16191-29002 | 2      | 2.4    | 1.6    | 0.25        | 3.5 mm    | 0.2 nH               |
| P/N 16191-29002 | 2.4    | 2      | 1.6    | 1.3         | 7 mm      | 0.7 nH               |
| P/N 16191-29003 | 3.2    | 2.4    | 2.4    | 0.9         | 7 mm      | 0.6 nH               |
| P/N 16191-29004 | 4.5    | 2.4    | 2.4    | 0           | 7 mm      | 0.6 nH               |

**Table 1-3. Option 010 Shorting Device Residual Inductance (Typical)**

| Shorting Bar    | l [mm] | d [mm] | h [mm] | Offset [mm] | Connector | Inductance (Typical) |
|-----------------|--------|--------|--------|-------------|-----------|----------------------|
| P/N 16191-29005 | 1.0    | 0.5    | 0.5    | 0.75        | 3.5 mm    | 0.5 nH               |
| P/N 16191-29006 | 1.6    | 0.8    | 0.8    | 0.45        | 3.5 mm    | 0.4 nH               |
| P/N 16191-29007 | 2.0    | 1.2    | 0.8    | 1.5         | 7 mm      | 0.9 nH               |
| P/N 16191-29008 | 3.2    | 1.6    | 0.8    | 0.9         | 7 mm      | 0.8 nH               |



**Figure 1-2. Simulation Setup**





## Preparation for Use

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### Introduction

This chapter explains how to install the 16191A. The topics include the following:

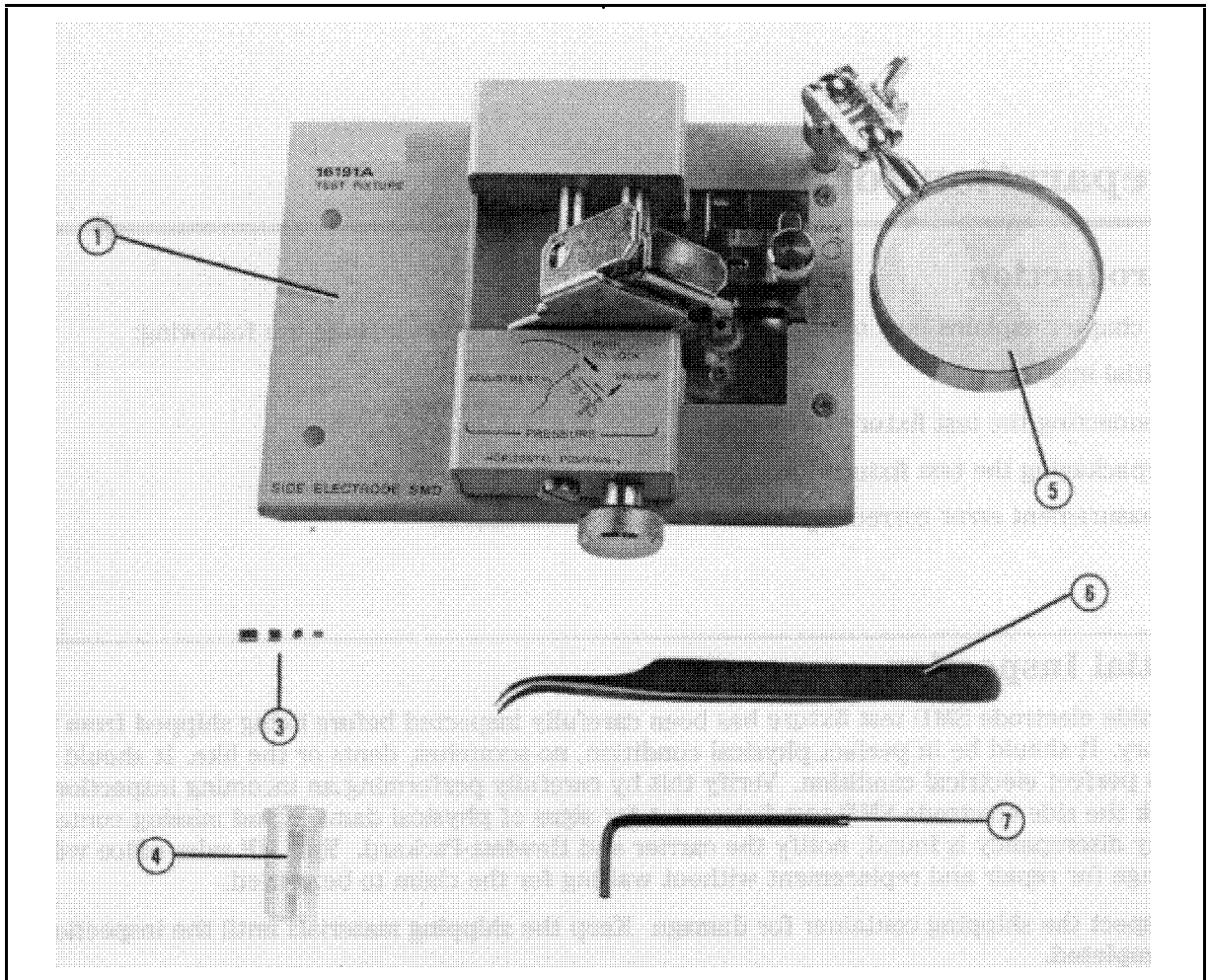
- Initial inspection.
- Connecting the test fixture for use.
- Repackaging the test fixture for shipment.
- Measurement error correcting function for each instrument.

---

### Initial Inspection

The side electrode SMD test fixture has been carefully inspected before being shipped from the factory. It should be in perfect physical condition, no scratches, dents or the like. It should also be in perfect electrical condition. Verify this by carefully performing an incoming inspection to check the side electrode SMD test fixture set for signs of physical damage and missing contents. If any discrepancy is found, notify the carrier and Agilent Technologies. Your Agilent Technologies sales office will arrange for repair and replacement without waiting for the claim to be settled.

- Inspect the shipping container for damage. Keep the shipping materials until the inspection is completed.
- Verify that the shipping container contains everything shown in Figure 2-1 and listed in Table 2-1.
- Inspect the exterior of the 16191A for any signs of damage.



**Figure 2-1. 16191A Product Overview**

**Table 2-1. 16191A Contents**

| Description                                  | Agilent Part Number | Quantity |
|----------------------------------------------|---------------------|----------|
| ① Test fixture                               | 16191A              | 1        |
| ② Operation and Service Manual <sup>1</sup>  | P/N 16191-90020     | 1        |
| ③ Shorting device <sup>2</sup> (1×1×2.4[mm]) | P/N 16191-29001     | 1        |
| (1.6×2.4×2[mm])                              | P/N 16191-29002     | 1        |
| (2.4×2.4×3.2[mm])                            | P/N 16191-29003     | 1        |
| (2.4×2.4×4.5[mm])                            | P/N 16191-29004     | 1        |
| ④ Case for shorting device                   | P/N 1540-0692       | 1        |
| ⑤ Magnifying lens <sup>34</sup>              | P/N 16193-60002     | 1        |
| ⑥ Tweezers <sup>4</sup>                      | P/N 8710-2081       | 1        |
| ⑦ Wrench                                     | P/N 8710-1181       | 1        |

1 Operation and Service Manual is not shown in Figure 2-1.

2 Contained if you ordered the 16191A option 701.

3 The magnifying lens is packed separately from the 16191A body. Connect it as shown in Figure 2-1.

4 Contained if you ordered the 16191A option 710.

## 2.2 Preparation for Use

## Connecting the Test Fixture for Use

### Note



Some instruments require an adapter to be connected to the 16191A (see “Applicable Instruments” in Chapter 1).

1. Calibrate your analyzer at the APC-7® connector plane before connecting test fixture. See Table 2-2 for the applicable error correcting function. After calibration, disconnect any standards from the APC-7® connector.
2. Place the fixture on the APC-7® connector.
3. Tighten (turn counterclockwise) the coupling nut of the APC-7® connector.

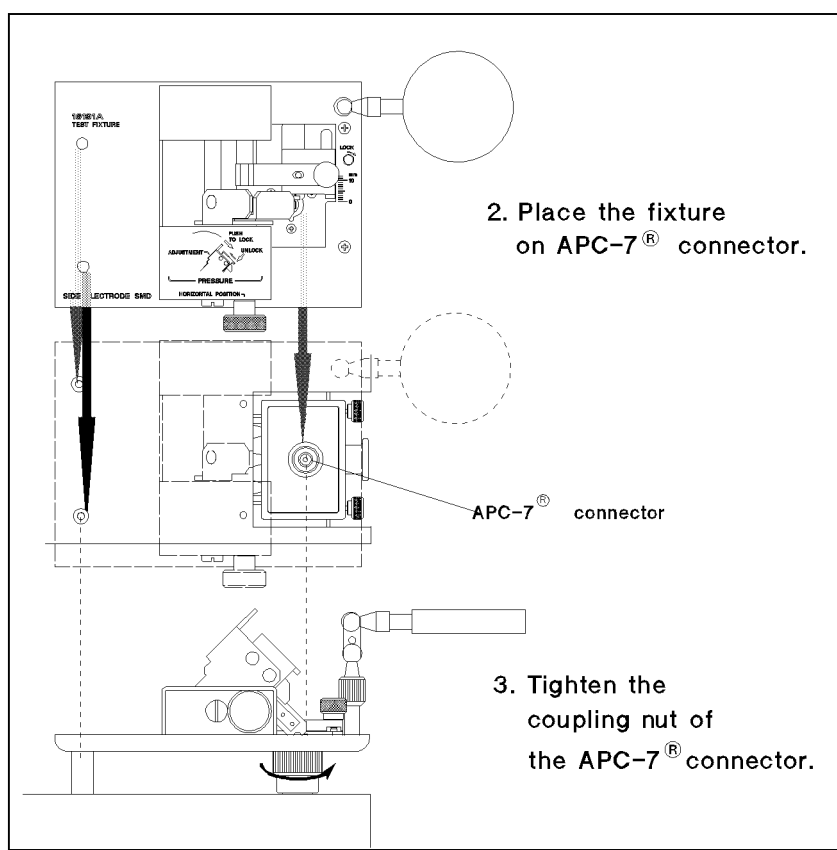


Figure 2-2. Connecting the Test Fixture with APC-7® Connector (4291B)

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## Repackaging the Test Fixture For Shipment

If shipment to an Agilent Technologies service center is required, each test fixture should be repackaged using the original factory packaging materials.

If this material is not available, comparable packaging materials may be used. Wrap the side electrode SMD test fixture in heavy paper and pack in anti-static plastic packing material. Use sufficient shock absorbing material on all sides of the 16191A to provide a thick, firm cushion and to prevent movement. Seal the shipping container securely and mark it *FRAGILE*.

---

## Measurement Error Correcting Function for Each Instrument

Each LCR meter or analyzer has measurement error correcting functions. Table 2-2 shows the functions of the instrument that can be used for calibration, setting the electrical length, and Open/Short/Load compensation.

**Table 2-2. Measurement Error Correcting Functions for Each Instrument**

| Instrument                        | Calibration                                                             | Electrical length                        | OPEN Compensation         | SHORT Compensation         | LOAD Compensation                 |
|-----------------------------------|-------------------------------------------------------------------------|------------------------------------------|---------------------------|----------------------------|-----------------------------------|
| 4291B                             | Calibration<br>OPEN<br>SHORT<br>LOAD<br>LOW-LOSS Capacitor <sup>1</sup> | Selecting Test Fixture<br>Port Extension | OPEN<br>Compensation      | SHORT<br>Compensation      | LOAD<br>Compensation <sup>1</sup> |
| 4191A                             | Calibration<br>0 S<br>0 $\Omega$<br>50 $\Omega$                         | Electrical Length                        | No capability             | No capability              | No capability                     |
| 4194A with<br>16085B              | No capability                                                           | No capability                            | OPEN Correction           | SHORT Correction           | LOAD Correction <sup>1</sup>      |
| 4195A with<br>41951A              | Calibration OPEN<br>SHORT<br>LOAD                                       | Port Extension<br>(Port 1 or Port 2)     | 0 S OFFSET                | 0 $\Omega$ OFFSET          | No capability                     |
| 4194A with<br>41941A/B,<br>16099A | Calibration<br>0 S<br>0 $\Omega$<br>50 $\Omega$                         | No capability                            | Compensation<br>ZERO OPEN | Compensation<br>ZERO SHORT | No capability                     |
| 4194A with<br>16085B              | Calibration<br>0 S<br>0 $\Omega$<br>50 $\Omega$                         | No capability                            | Compensation<br>ZERO OPEN | Compensation<br>ZERO SHORT | No capability                     |

<sup>1</sup> According to demand for precise measurement

# Operation

## Introduction

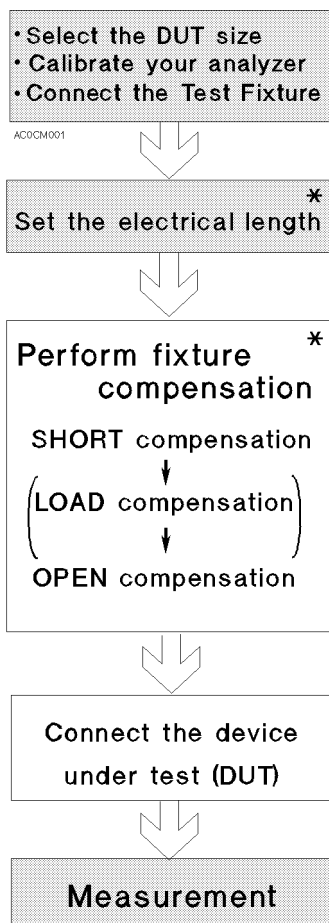
This chapter describes how to use the test fixture and the measurement error correcting techniques for the test fixture.

## Operating Flow

Before performing a measurement, you have to compensate for the residual error of the test fixture by using the measurement error correcting functions. Perform the following steps when measuring the DUT:

The 16191A has inherent stray capacitance, residual inductance, and residual resistance that affect the measurement. To compensate for these residuals and thus minimize their effect on measurement accuracy, the measurement instrument's OPEN and SHORT compensation capabilities must be used.

( ▶ indicates procedures in the following pages.)



Described in Chapter 2.

The 16191A's electrical length is 14.0 mm (typical value).

To set the electrical length, see your analyzer's Operation Manual.

To set the fixture and devices for fixture compensation, see:

▶ "How to set the SHORT condition, and the OPEN condition"

These procedures show how to set the test fixture for the OPEN/SHORT/LOAD compensation procedure.

For how to measure OPEN/SHORT/LOAD, see the Operation Manual supplied with your analyzer. (You can omit LOAD compensation.)

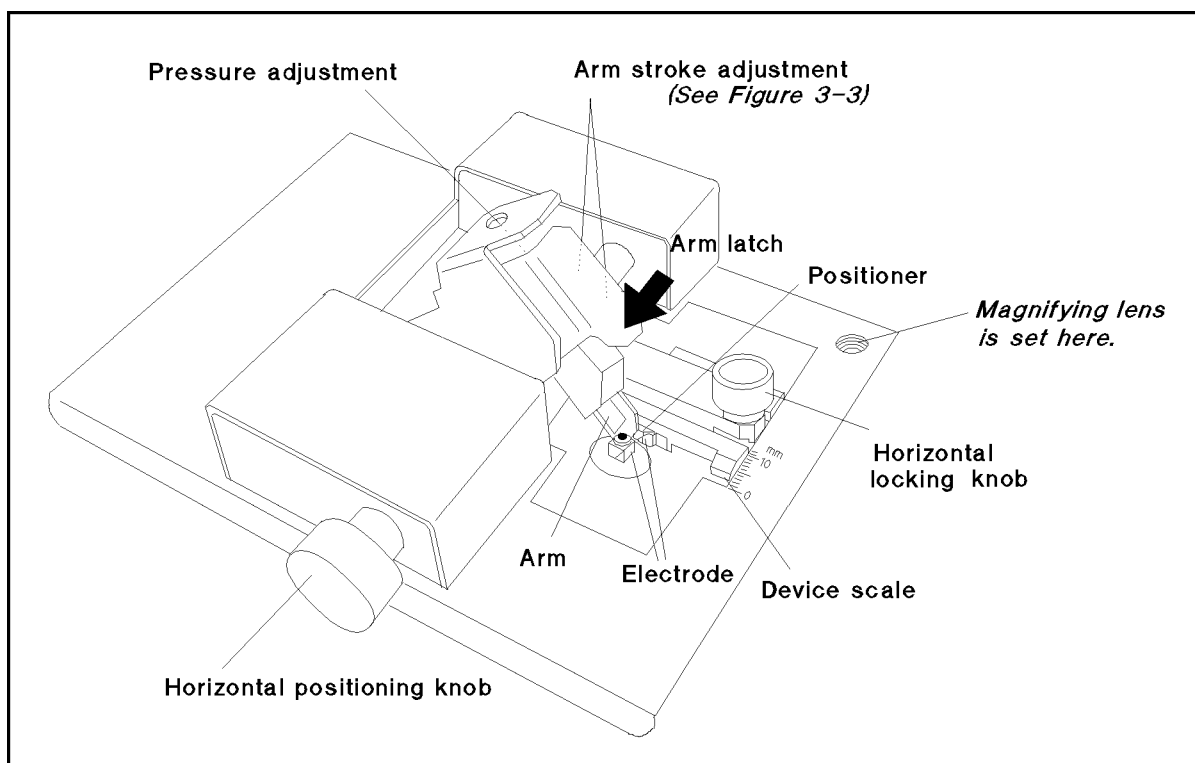
To connect the DUT, see:

▶ "How to connect the DUT"

\* The compensating functions are different for each instrument. See Table 2-2 and perform the listed functions.

---

## Overview



**Figure 3-1. 16191A Test Fixture Overview**

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Electrodes</b>                    | These are connected to the device.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>(Pressure) arm</b>                | Fixes the device.                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Pressure adjustment</b>           | Adjusts the pressure applied to the device.                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Arm latch</b>                     | Latches the arm off to turn up and down the arm.                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Positioner</b>                    | Slides to fix an electrode.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>(Horizontal) positioning knob</b> | Opens and closes the positioner.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>(Horizontal) locking knob</b>     | Locks the positioner.                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>(Device) scale</b>                | Used for rough adjustment of the positioner.                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Shorting device</b>               | <i>(Not shown in Figure 3-1)</i> Used for short compensation.<br><br>If you ordered the option 010 or 701, four types of shorting devices are supplied with the 16191A. Use one that has dimensions similar to the DUT. When making a shorting device of same dimensions as your DUT, very low residual impedance and a high conductivity metal (that is not easily corroded) must be used to construct the shorting device. (It must also be clean.) |
| <b>Magnifying lens</b>               | <i>(Not shown in Figure 3-1)</i> Used when placing a small device within the electrodes.                                                                                                                                                                                                                                                                                                                                                              |

---

**Warning**      **DO NOT look at the sun through the magnifying glass.**



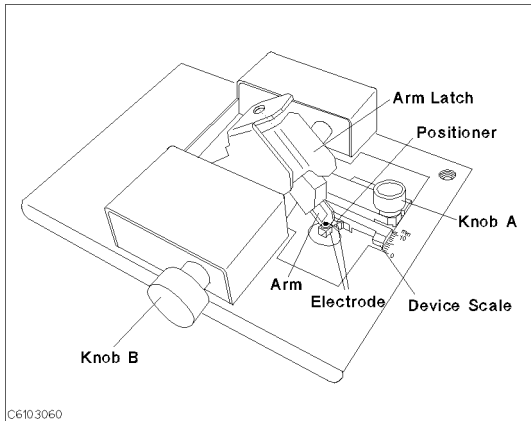
**DO NOT operate or leave the magnifying glass under direct sunlight.**

---

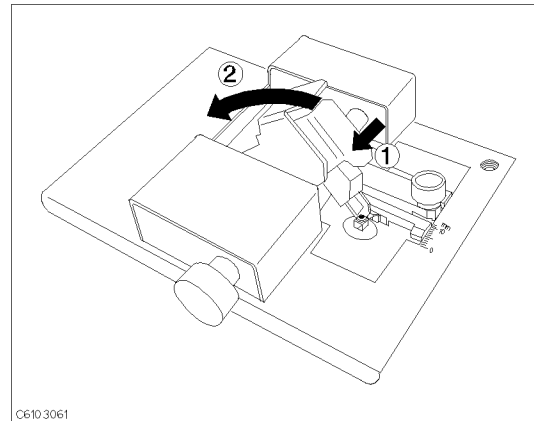
---

## How to set the SHORT condition, and the OPEN condition

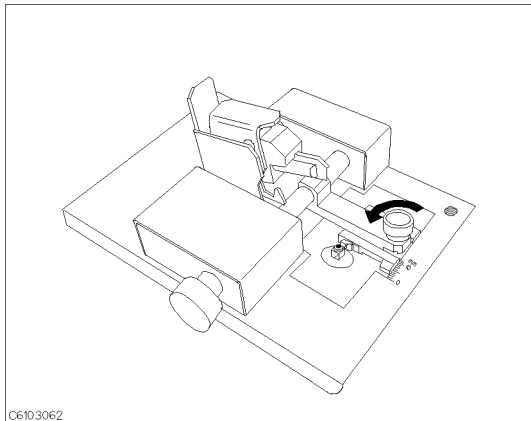
### Setting the SHORT condition



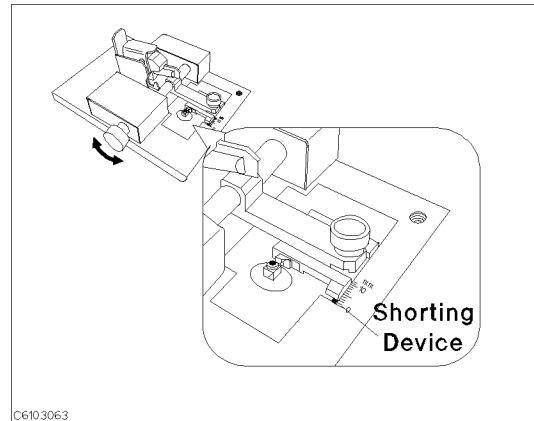
The names of each part are listed above.



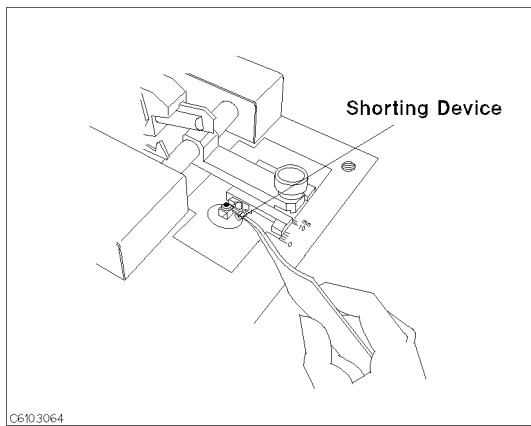
1. ① Latch off the arm latch. ② Hold up the pressure arm.



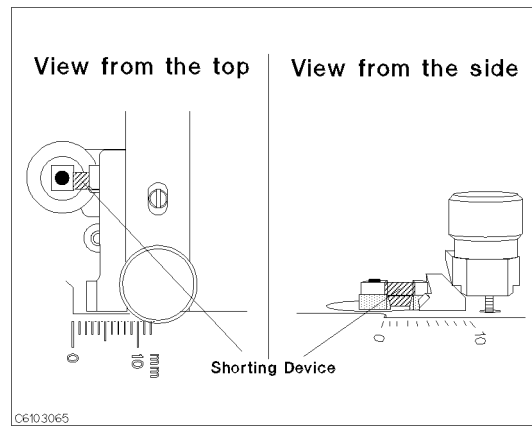
2. Loosen knob A



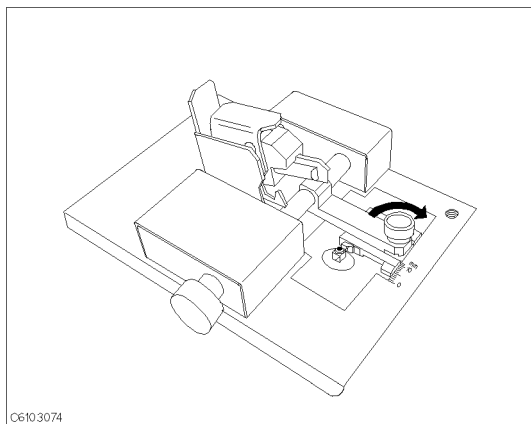
3. Adjust knob B to fit the shorting device to the device scale.



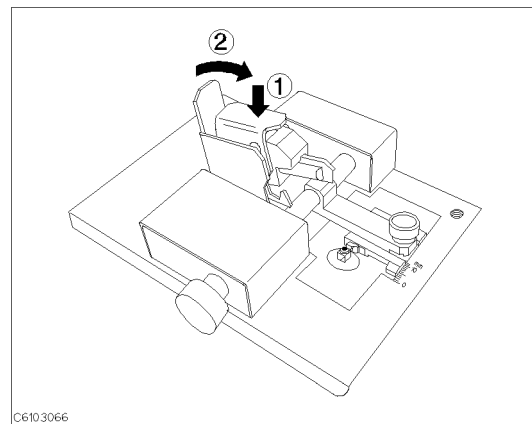
4. Place the shorting device on the electrode and turn knob B for fine adjustment.



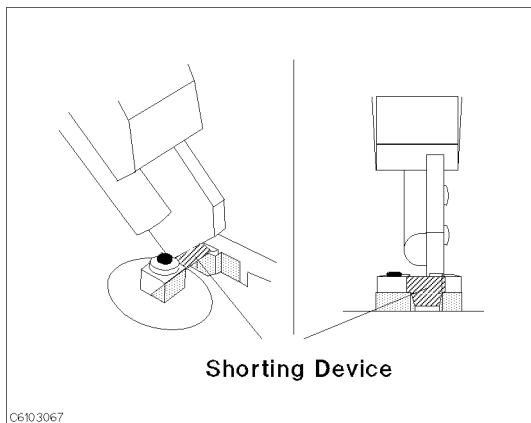
5. Verify that the shorting device contacts the electrodes securely.



6. Tighten knob A.



7. ① Press the arm latch. ② Turn down the pressure arm.

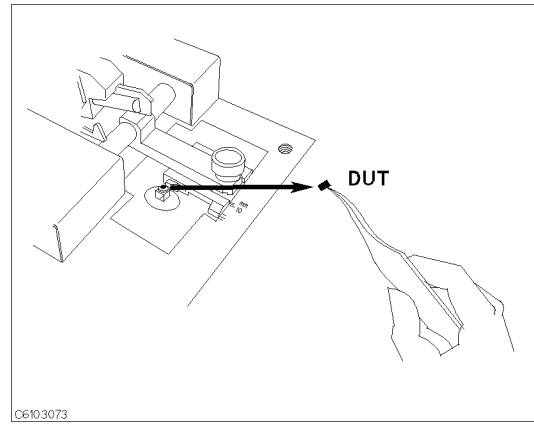
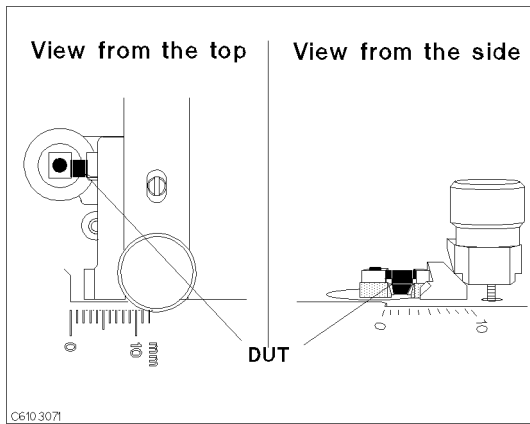


8. Verify that pressure arm presses the shorting device.

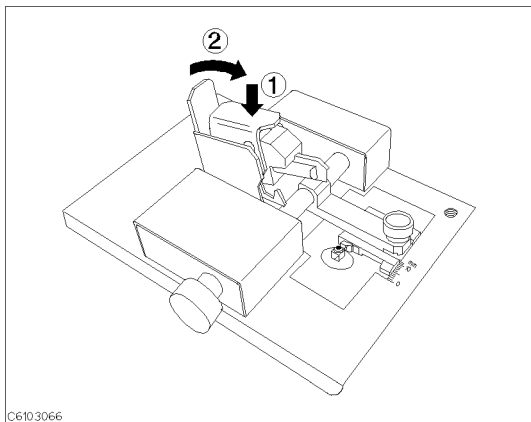
### 3.4 Operation



## Setting the OPEN condition



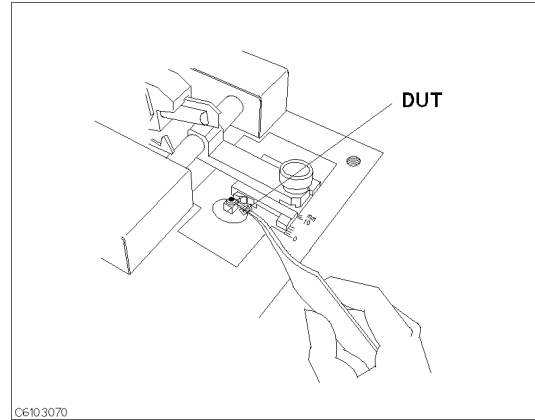
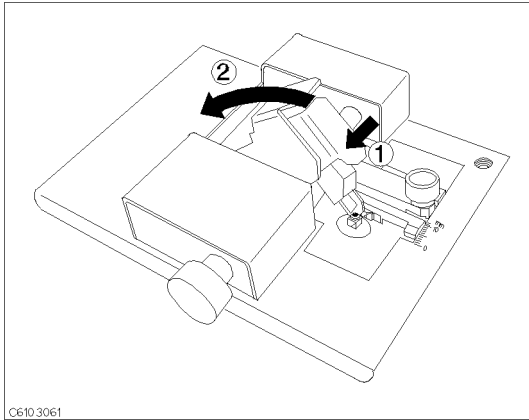
1. Place the DUT on the electrode just as you set the shorting device in the short compensation.
2. Remove the DUT from the electrodes.



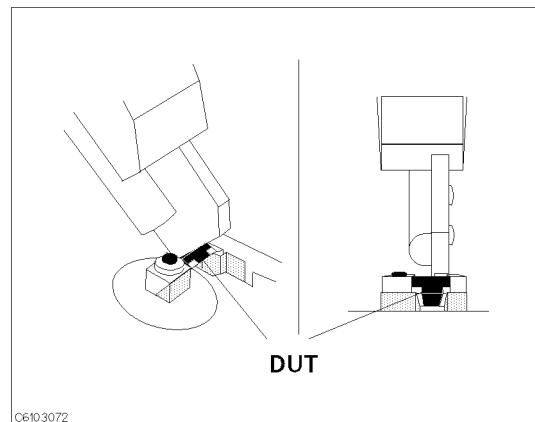
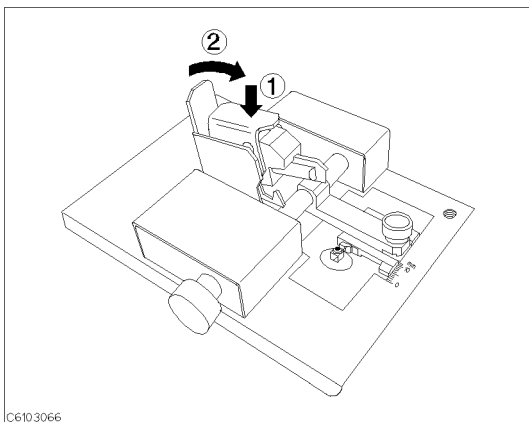
3. ① Press the arm latch. ② Turn down the pressure arm.

---

## How to connect the DUT



1. ① Latch off the arm latch. ② Hold up the pressure arm. 2. Place the DUT on the electrodes.



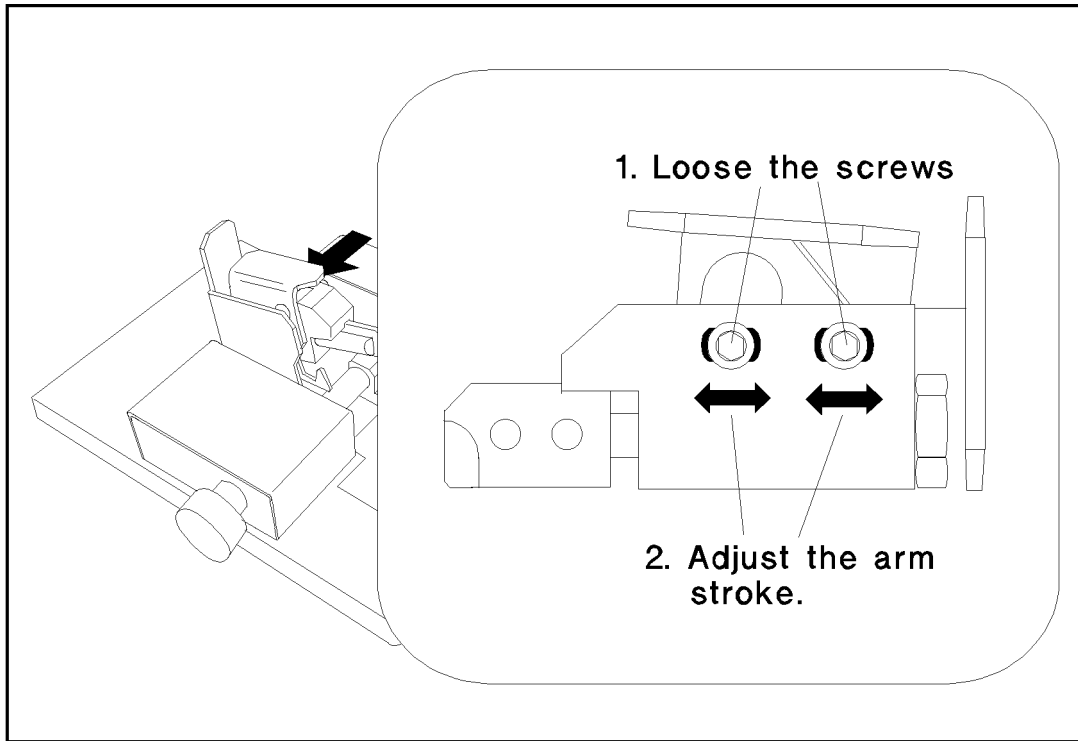
3. ① Press the arm latch. ② Turn down the pressure arm. 4. Verify that pressure arm presses the DUT.

---

## Adjusting the Pressure Arm Stroke

Depending on the device size, change the pressure arm stroke, so that the arm properly presses the device.

1. Loosen the screws with the wrench.
2. Adjust the arm stroke.
3. Tighten the screws.



AC003004

**Figure 3-2. Arm Stroke Adjustment**



## Service

---

### Introduction

This chapter covers the following subjects:

- General Information
- Assembly Replacement
  - Disassembly Procedure for Main Assembly
  - Replaceable Parts
- Troubleshooting

---

#### Warning



**These servicing instructions are for use by qualified personnel only. Do NOT perform any servicing (other than that contained in the operating section) unless you are qualified to do so.**

---

#### Caution



When you repair the 16191A, put on lint-free gloves to avoid contaminating inner parts of the 16191A. Agilent Technologies supplies lint-free gloves (Agilent part number 9300-0163).

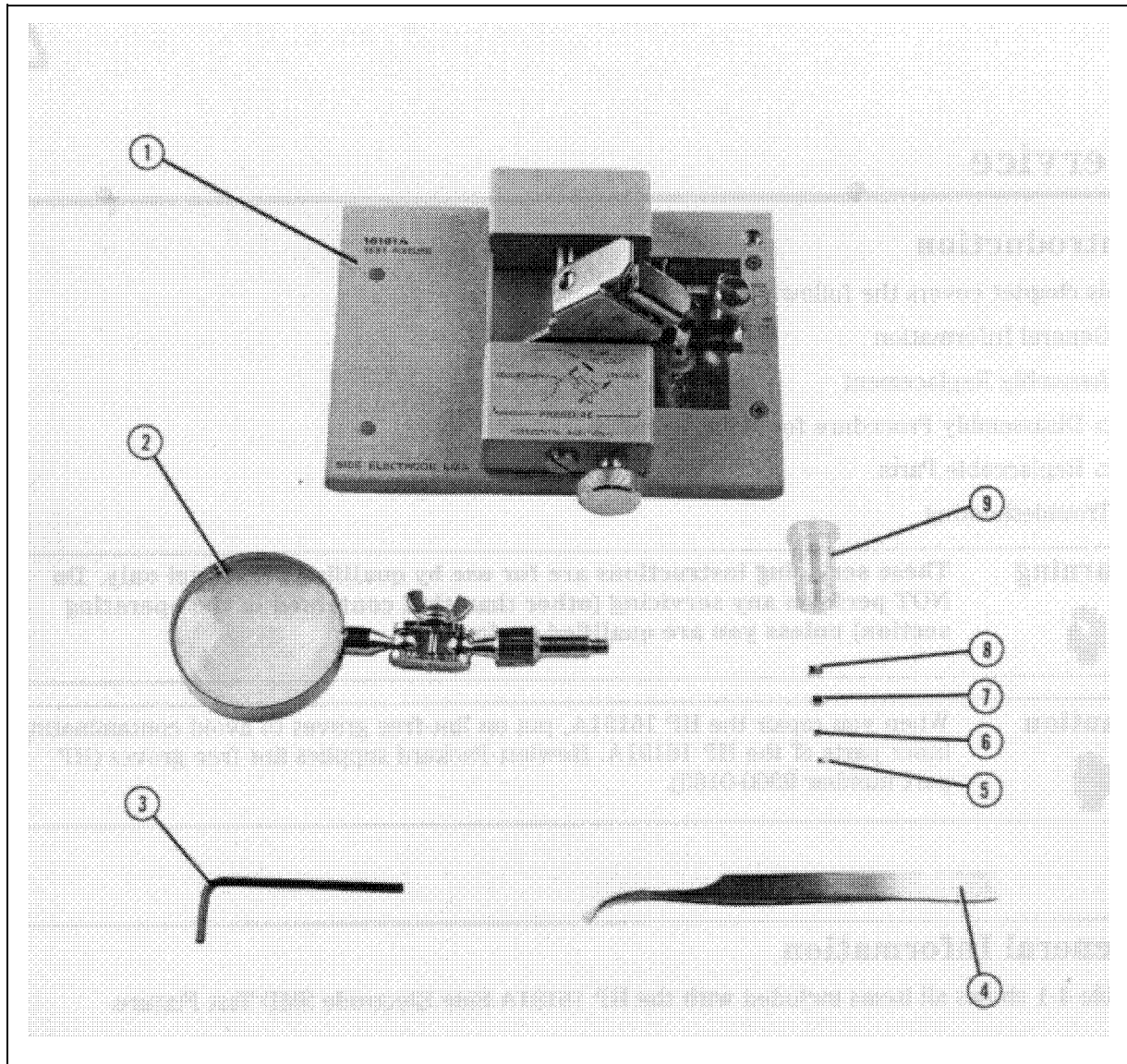
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---

### General Information

Table 4-1 shows all items included with the 16191A Side Electrode SMD Test Fixture.

**Table 4-1. 16191A Product Overview**



| Reference Designator | Agilent Part Number | Qty. | Description                                   |
|----------------------|---------------------|------|-----------------------------------------------|
| 1                    | (not assigned)      | 1    | Main Assembly                                 |
| 2                    | 16193-60002         | 1    | Magnifying Glass <sup>1</sup>                 |
| 3                    | 8710-1181           | 1    | Wrench                                        |
| 4                    | 8710-2081           | 1    | Tweezers <sup>1</sup>                         |
| 5                    | 16191-29001         | 1    | Shorting Device (1×1×2.4 mm) <sup>2</sup>     |
| 6                    | 16191-29002         | 1    | Shorting Device (1.6×2.4×2 mm) <sup>2</sup>   |
| 7                    | 16191-29003         | 1    | Shorting Device (2.4×2.4×3.2 mm) <sup>2</sup> |
| 8                    | 16191-29004         | 1    | Shorting Device (2.4×2.4×4.5 mm) <sup>2</sup> |
| 9                    | 1540-0692           | 1    | Case for shorting devices                     |
| -                    | 16191-29021         | 1    | Styrofoam Holder <sup>3</sup>                 |
| -                    | 16191-90040         | 1    | Operation and Service Manual <sup>3</sup>     |

<sup>1</sup> Contained if you ordered the 16191A option 710.

<sup>2</sup> Contained if you ordered the 16191A option 701.

<sup>3</sup> Not shown in the figure.

#### 4-2 Service

---

## **Assembly Replacement**

This section includes Disassembly and Assembly Procedures and Replacement Parts for the Main Assembly.

### **Disassembly and Assembly Procedure**

This section contains the information required to disassemble and assemble the Main Assembly.

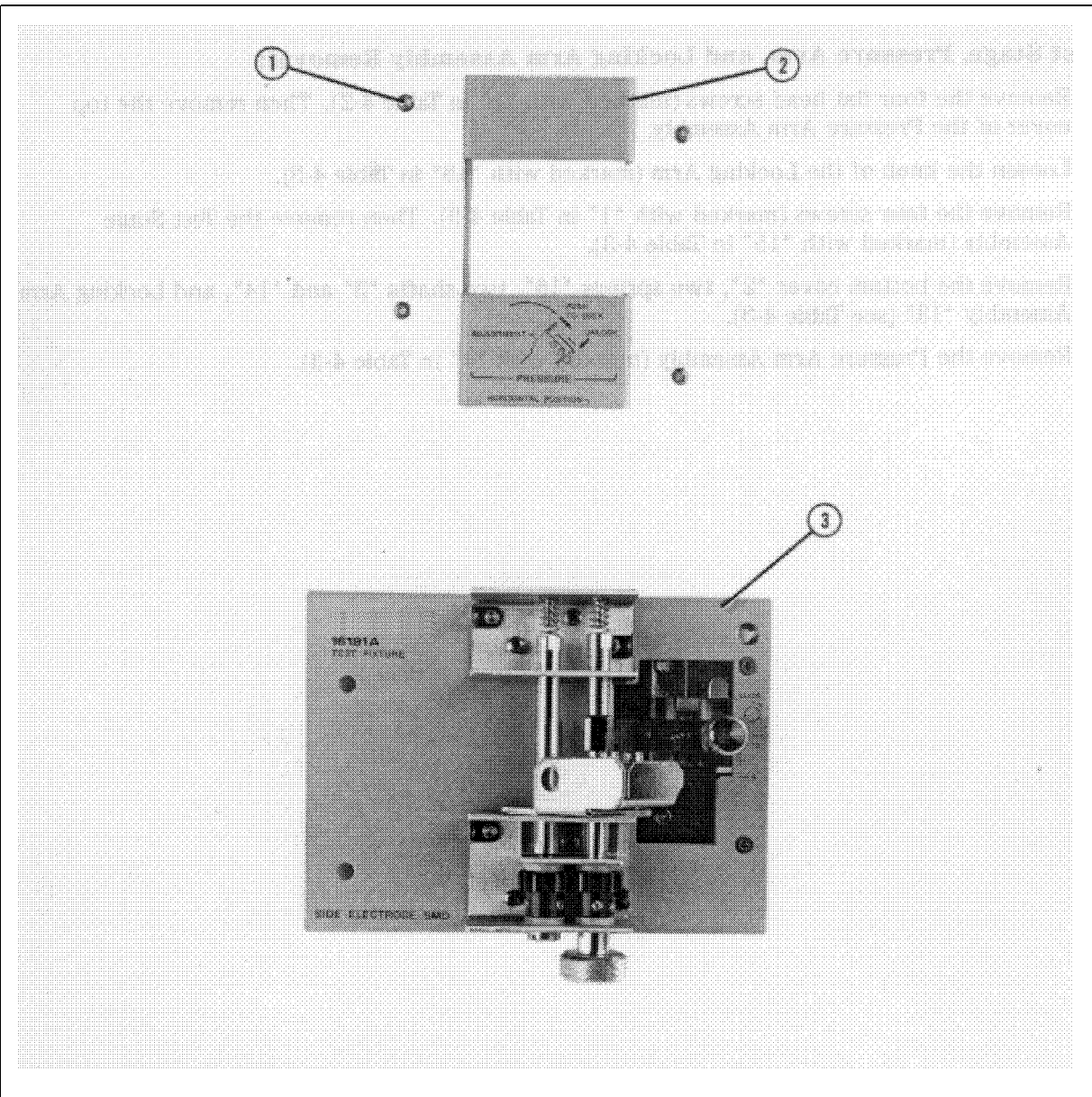
#### **Test Stage, Pressure Arm, and Locking Arm Assembly Removal:**

1. Remove the four flat-head screws (marked with “1” in Table 4-2). Then remove the top cover of the Pressure Arm Assembly.
2. Loosen the knob of the Locking Arm (marked with “13” in Table 4-3).
3. Remove the four screws (marked with “1” in Table 4-3). Then remove the Test Stage Assembly (marked with “15” in Table 4-3).
4. Remove the bottom cover “2”, two springs “16”, two shafts “3” and “14”, and Locking Arm Assembly “13” (see Table 4-3).
5. Remove the Pressure Arm Assembly (marked with “4” in Table 4-3).

## Replaceable Parts

Table 4-2 through Table 4-6 show and list the replaceable parts for the 16191A. The parts listed can be ordered from your nearest Agilent Technologies Office. Ordering information must include the Agilent part number and the quantity required.

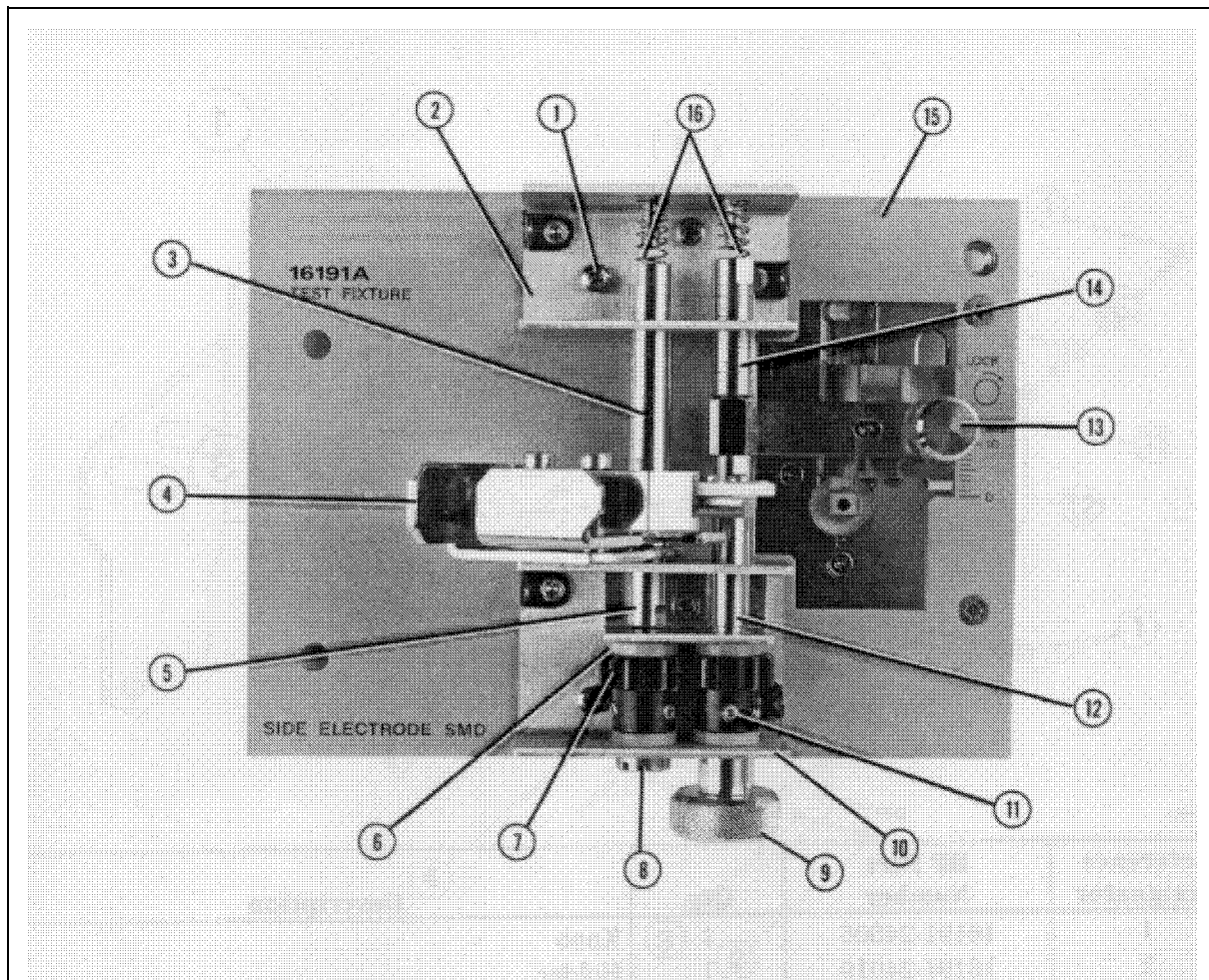
**Table 4-2. Replaceable Parts for Main Assembly**



| Reference Designator | Agilent Part Number | Qty. | Description                     |
|----------------------|---------------------|------|---------------------------------|
| 1                    | 0515-0914           | 4    | Screw Flat Head                 |
| 2                    | 16191-04001         | 1    | Top Cover                       |
| 3                    | (not assigned)      | 1    | Main Assembly without Top Cover |

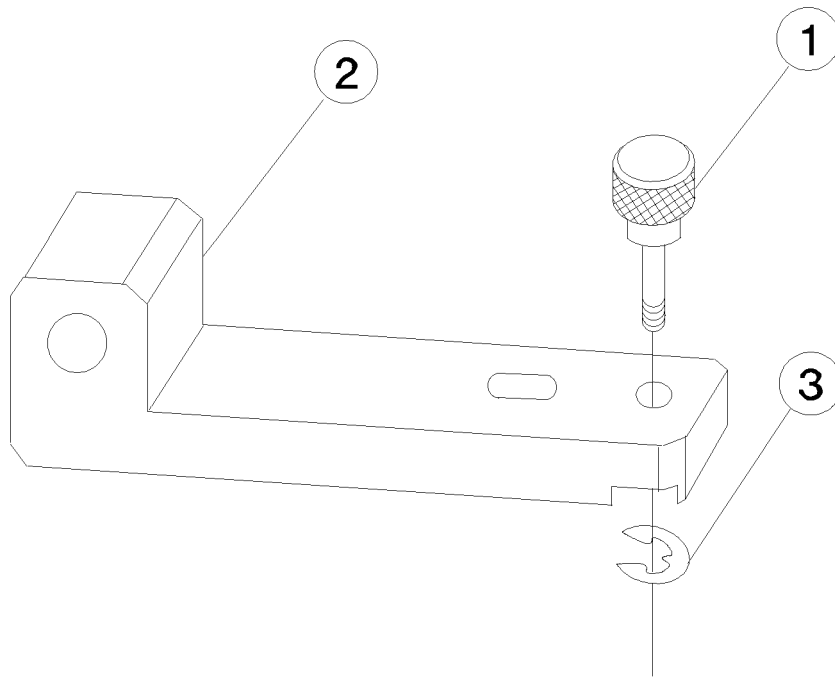


**Table 4-3. Replaceable Parts for Main Assembly (without Top Cover)**



| Reference Designator | Agilent Part Number | Qty. | Description                 |
|----------------------|---------------------|------|-----------------------------|
| 1                    | 0515-1550           | 4    | Screw Pan Head M3L8         |
| 2                    | 16191-04003         | 1    | Bottom Cover                |
| 3                    | 16191-23001         | 1    | Shaft                       |
| 4                    | (not assigned)      | 1    | Pressure Arm Assembly       |
| 5                    | 16191-23003         | 1    | Shaft                       |
| 6                    | 16191-25005         | 4    | Bushing                     |
| 7                    | 16191-23010         | 2    | Gear                        |
| 8                    | 16191-24017         | 1    | Screw                       |
| 9                    | 16191-24016         | 1    | Horizontal Positioning Knob |
| 10                   | 16191-04002         | 1    | Bottom Cover                |
| 11                   | 3030-0007           | 4    | Set Screw                   |
| 12                   | 16191-23004         | 1    | Shaft                       |
| 13                   | (not assigned)      | 1    | Locking Arm Assembly        |
| 14                   | 16191-23002         | 1    | Shaft                       |
| 15                   | (not assigned)      | 1    | Test Stage Assembly         |
| 16                   | 1460-2372           | 2    | Spring                      |

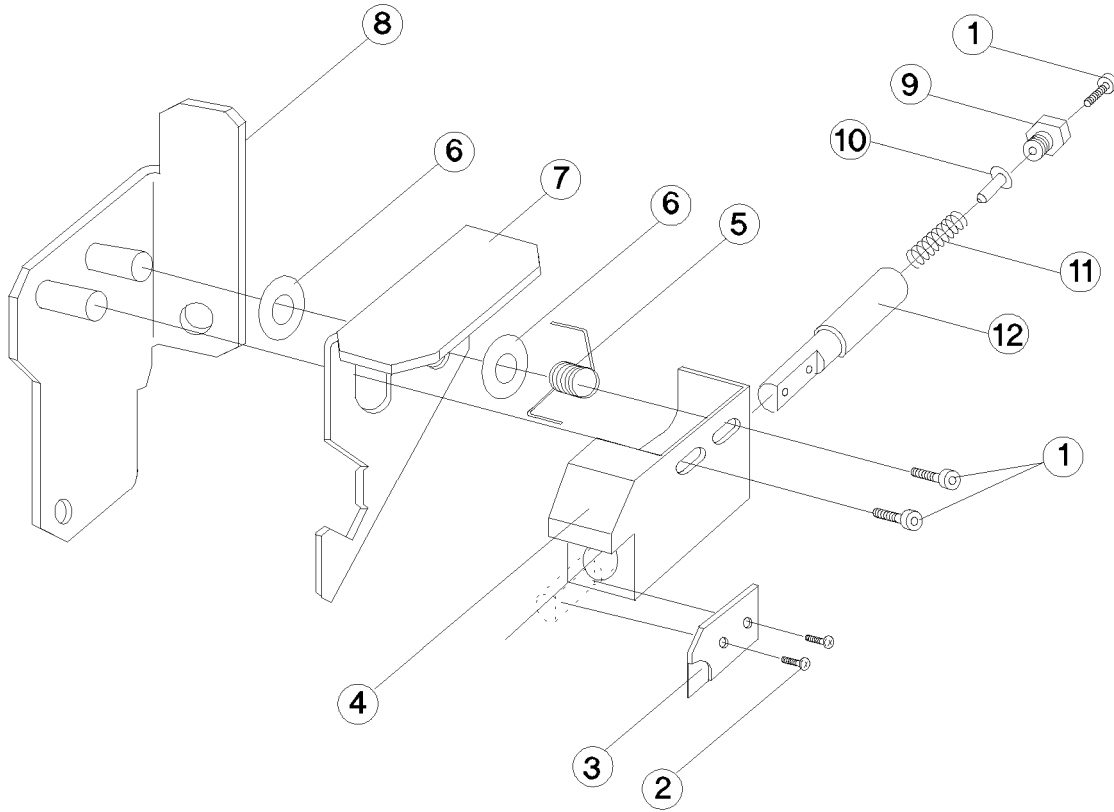
**Table 4-4. Replaceable Parts for Locking Arm Assembly**



AC004004

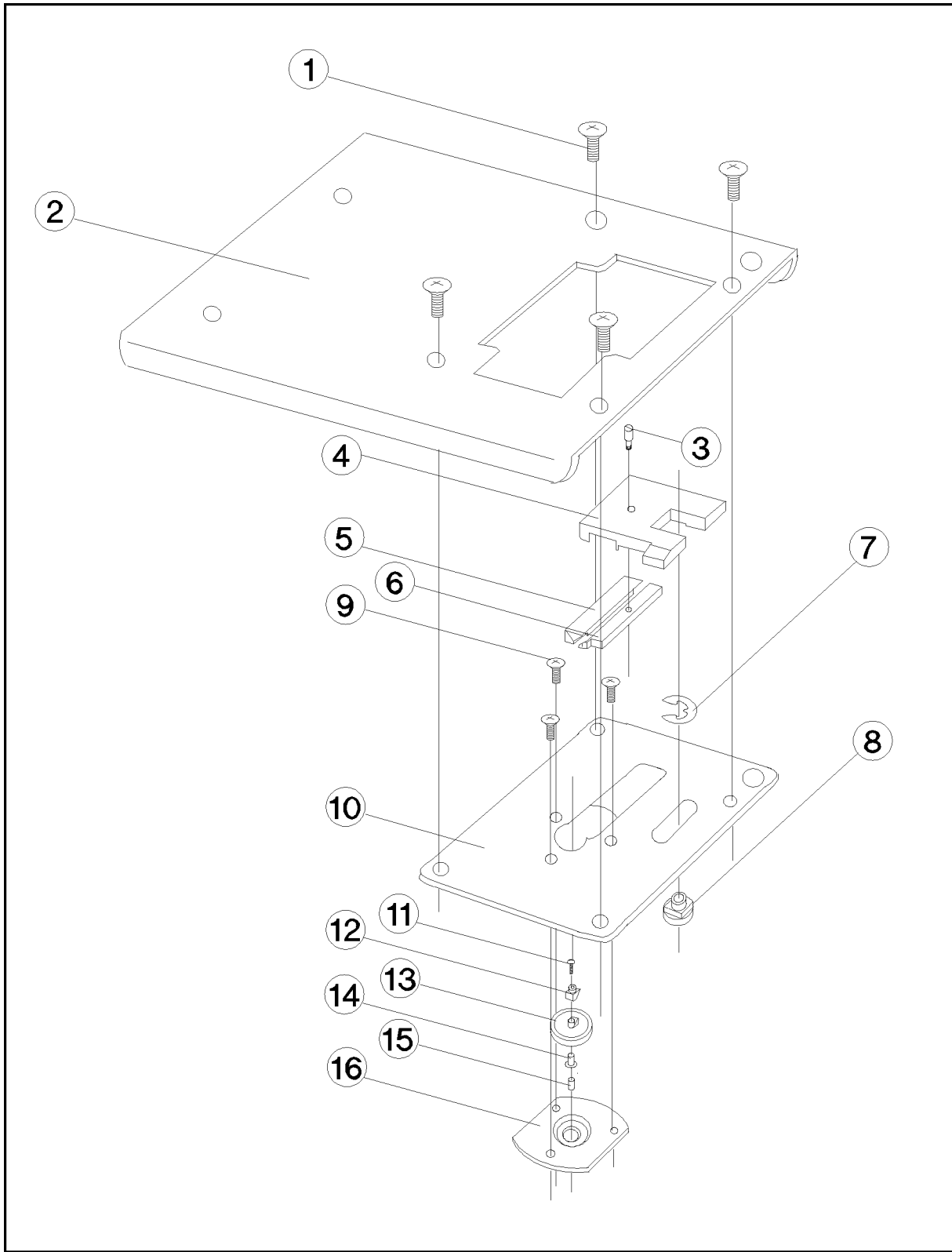
| Reference Designator | Agilent Part Number | Qty. | Description |
|----------------------|---------------------|------|-------------|
| 1                    | 16191-24005         | 1    | Knob        |
| 2                    | 16191-24019         | 1    | Holder      |
| 3                    | 0510-0015           | 1    | E-ring      |

**Table 4-5. Replaceable Parts for Pressure Arm Assembly**



AC004005

| Reference Designator | Agilent Part Number | Qty. | Description            |
|----------------------|---------------------|------|------------------------|
| 1                    | 0515-1050           | 3    | Screw Socket Head M3L8 |
| 2                    | 0510-0976           | 2    | Screw Pan Head M2L6    |
| 3                    | 16191-25003         | 1    | Holder                 |
| 4                    | 16191-24018         | 1    | Block                  |
| 5                    | 16191-29011         | 1    | Spring                 |
| 6                    | 16191-25006         | 2    | Washer                 |
| 7                    | 16191-01203         | 1    | Angle                  |
| 8                    | 16191-00602         | 1    | Plate                  |
| 9                    | 16191-24006         | 1    | Screw                  |
| 10                   | 16191-24010         | 1    | Pin                    |
| 11                   | PPNR007783          | 1    | Spring                 |
| 12                   | 16191-23005         | 1    | Plunger                |



AC004006

**Figure 4-1. Replaceable Parts for Test Stage**

**Table 4-6. Replaceable Parts for Test Stage Assembly**

| <b>Reference Designator</b> | <b>Agilent Part Number</b> | <b>Qty.</b> | <b>Description</b>    |
|-----------------------------|----------------------------|-------------|-----------------------|
| 1                           | 0515-0914                  | 1           | Screw Flat Head M3L6  |
| 2                           | 16191-00201                | 1           | Table                 |
| 3                           | 16191-24022                | 1           | Screw                 |
| 4                           | 16191-24014                | 1           | Guide                 |
| 5                           | 16191-25004                | 1           | Guide                 |
| 6                           | 16191-24015                | 1           | Contact-L             |
| 7                           | 0510-0045                  | 1           | E-Ring                |
| 8                           | 16191-24021                | 1           | Nut                   |
| 9                           | 0510-0952                  | 3           | Screw Flat Head M2L4  |
| 10                          | 16191-00601                | 1           | Ground Plate          |
| 11                          | 0515-2421                  | 1           | Screw Pan Head M1.4L3 |
| 12                          | 16191-25002                | 1           | Guide                 |
| 13                          | 16191-60001                | 1           | Contact Assembly      |
| 14                          | 16191-24004                | 1           | Contact               |
| 15                          | 1250-0907                  | 1           | Collet                |
| 16                          | 16193-24001                | 1           | Flange                |

---

## Troubleshooting

This section includes the functional check procedure used to troubleshoot the 16191A Side Electrode SMD Test Fixture.

### Open Impedance Check

1. Adjust the electrode distance for connecting the 1.6×2×2.4 mm Shorting Device (16191-29002).
2. Place the fixture on the calibrated APC-7 terminal of the 4291B RF Impedance Analyzer.
3. Set the 4291B RF Impedance Analyzer as follows:

|                        |                           |
|------------------------|---------------------------|
| Measurement Parameter  | Cp (parallel capacitance) |
| Start Frequency        | 100 MHz                   |
| Stop Frequency         | 1 GHz                     |
| OSC Level              | 0.12 V                    |
| Number of Point        | 2                         |
| Point Averaging Factor | 16                        |
| Point Averaging        | ON                        |

4. Perform a single sweep measurement.
5. Read Cp value at 100 MHz and 1 GHz.

The guideline for the open impedance value is as follows:

**Table 4-7. Open Impedance Value Guideline**

| Parameter | Frequency | Guideline (absolute value) |
|-----------|-----------|----------------------------|
| Cp        | 100 MHz   | 770 fF ± 400 fF            |
| Cp        | 1 GHz     | 770 fF ± 400 fF            |

### Short Impedance Check

1. After the Open Impedance Check is completed, put the 1.6×2×2.4 mm Shorting Device (16191-29002) between the electrodes.
2. Set the 4291B RF Impedance Analyzer as follows:

|                        |                        |
|------------------------|------------------------|
| Measurement Parameter  | Ls (series inductance) |
| Start Frequency        | 100 MHz                |
| Stop Frequency         | 1 GHz                  |
| OSC Level              | 0.12 V                 |
| Number of Point        | 2                      |
| Point Averaging Factor | 16                     |
| Point Averaging        | ON                     |

3. Make a single sweep measurement.
4. Read Ls value at 100 MHz and 1 GHz.

The guideline of the short impedance value is as follows:

**Table 4-8. Short Impedance Value Guideline**

| Parameter | Frequency | Guideline (absolute value) |
|-----------|-----------|----------------------------|
| Ls        | 100 MHz   | 3 nH $\pm$ 1 nH            |
| Ls        | 1 GHz     | 3 nH $\pm$ 1 nH            |

### **Short Impedance Repeatability Check**

1. After the Short Impedance Check is completed, remove the Shorting Device and put it back on the same place again.
2. Make a single sweep measurement with the same measurement conditions.
3. Read Ls value at 100 MHz and 1 GHz and check the value is within the Short Impedance Value Guideline described in Table 4-8.
4. Calculate the difference between the first Ls measurement value and second Ls measurement value at each frequency.

The guideline of the short impedance repeatability is as follows:

**Table 4-9. Short Impedance Repeatability Guideline**

| Parameter | Frequency | Guideline (difference) |
|-----------|-----------|------------------------|
| Ls        | 100 MHz   | $\pm$ 45 pH            |
| Ls        | 1 GHz     | $\pm$ 20 pH            |





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