

Agilent 16043A/B 3-terminal SMD Test Fixture

Operation and Service Manual

Second Edition



Agilent Technologies

Agilent Part No. 16043-90010

May 2000

Printed in Japan

Notices

The information contained in this document is subject to change without notice.

This document contains proprietary information that is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced, or translated to another language without the prior written consent of the Agilent Technologies.

Agilent Technologies Japan, Ltd.

Component Test PGU-Kobe

1-3-2, Murotani, Nishi-Ku, Kobe-shi, Hyogo, 651-2241 Japan

Copyright © Agilent Technologies Japan, Ltd. 2000

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.

February 2000 First Edition (part number : 16043-90000)

May 2000 Second Edition (part number : 16043-90010)

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.

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

- **Ground The Instrument**

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

- **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 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.

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.

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.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period corresponding to the individual warranty periods of its component products. Instruments are warranted for a period of one year. Fixtures and adapters are warranted for a period of 90 days. During the warranty period, Agilent Technologies Company will, at its option, either repair or replace products that prove to be defective.

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.

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.

Typeface Conventions

Bold	Boldface type is used when a term is defined. For example: icons are symbols.
<i>Italic</i>	Italic type is used for emphasis and for titles of manuals and other publications.
[Hardkey]	Indicates a hardkey labeled "Hardkey."
Softkey	Indicates a softkey labeled "Softkey."
[Hardkey] - Softkey1 - Softkey2	Indicates keystrokes [Hardkey] - Softkey1 - Softkey2 .

1. Installation Guide	
Incoming Inspection	10
Connecting the 16043A/B to a Measuring Instrument	14
Mounting the Contact Board	14
Fabricating and Mounting the Device Guide	14
Connectable Measuring Instruments	14
Connecting to 4294A	15
Connecting to Other Instruments than 4294A	16
2. Product Overview	
Product Overview	18
Measurement Principle	19
Names of Parts and Functions	21
Names of Accessories and Functions	22
3. Operation	
Flow of Measurements	26
Preparations for Measurement	27
Fabricating the Device Guide	27
Creating the Short Bar	28
Selecting and Mounting the Contact Board	29
Mounting the 16043A Contact Board	29
Mounting the 16043B Contact Board	30
Mounting the Device Guide	32
Carrying Out Fixture Compensation.	33
Measuring Open Compensation Data	33
Measuring Short Compensation Data	34
Connecting and Measuring DUT	36
Measuring a 3-terminal Device	37
4. Specifications and Supplemental Performance Characteristics	
Specifications	40
Supplemental Performance Characteristics	41
Additional Errors (When Open/Short Compensation is Conducted)	41
Changes in Measurement Data Caused by Parallel Impedance	44
5. Maintenance and Service	
Maintenance	48
Cleaning	48
Replacement of Contact Board	48
Maintenance Kit	49
16043U/V Maintenance Kit	49
Replaceable Parts	50
4-Terminal Pair Assembly	50
DUT Holder	52
Device Holding Block	54
Other Parts	57
Replacement of Parts	58

Contents

Sliding Function (16043A Only)	58
Adjusting Ball Plunger (16043A only)	60
Adjusting Device Holder Position	61
Assembling Check	63
Required Instruments	63
Procedure	63

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 16043A/B has been checked mechanically and electrically.

The shipment should contain everything listed in Table 1-1 to 1-2. If the contents are incomplete or if there is mechanical damage or defect, notify the nearest Agilent Technologies Sales 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 16043A Package Contents

No.	Name	Agilent Part Number	Qty.
1	16043A 3-terminal SMD Test Fixture *1	-	1
2	Support Angle for the 4294A *2	16043-01203	1
3	Device Guide *3	16043-00601	3
4	Screws for the Device Guide *3	0515-2791	2
5	Guide Pin *3	16043-24004	2
6	Support Angle	16043-01212	1
7	Tweezer	8710-2081	1
8	Carrying Case	16043-60150	1
9	Operation and Service Manual (this manual)	16043-90010	1
Option 001			
	Contact Board No. 1	16043-66501	1
Option 002			
	Contact Board No. 2	16043-66502	1
Option 003			
	Contact Board No. 3	16043-66503	1
Option 004			
	Additional Device Guide	16043-00601	3

*1.Furnished with a contact board that specified option when shipped from the factory.

*2.Mounted in the Test Fixture when shipped from the factory.

*3.Contained in the case (Part number 1540-0622, 9282-0114) when shipped from the factory.

Figure 1-1 16043A Package Contents

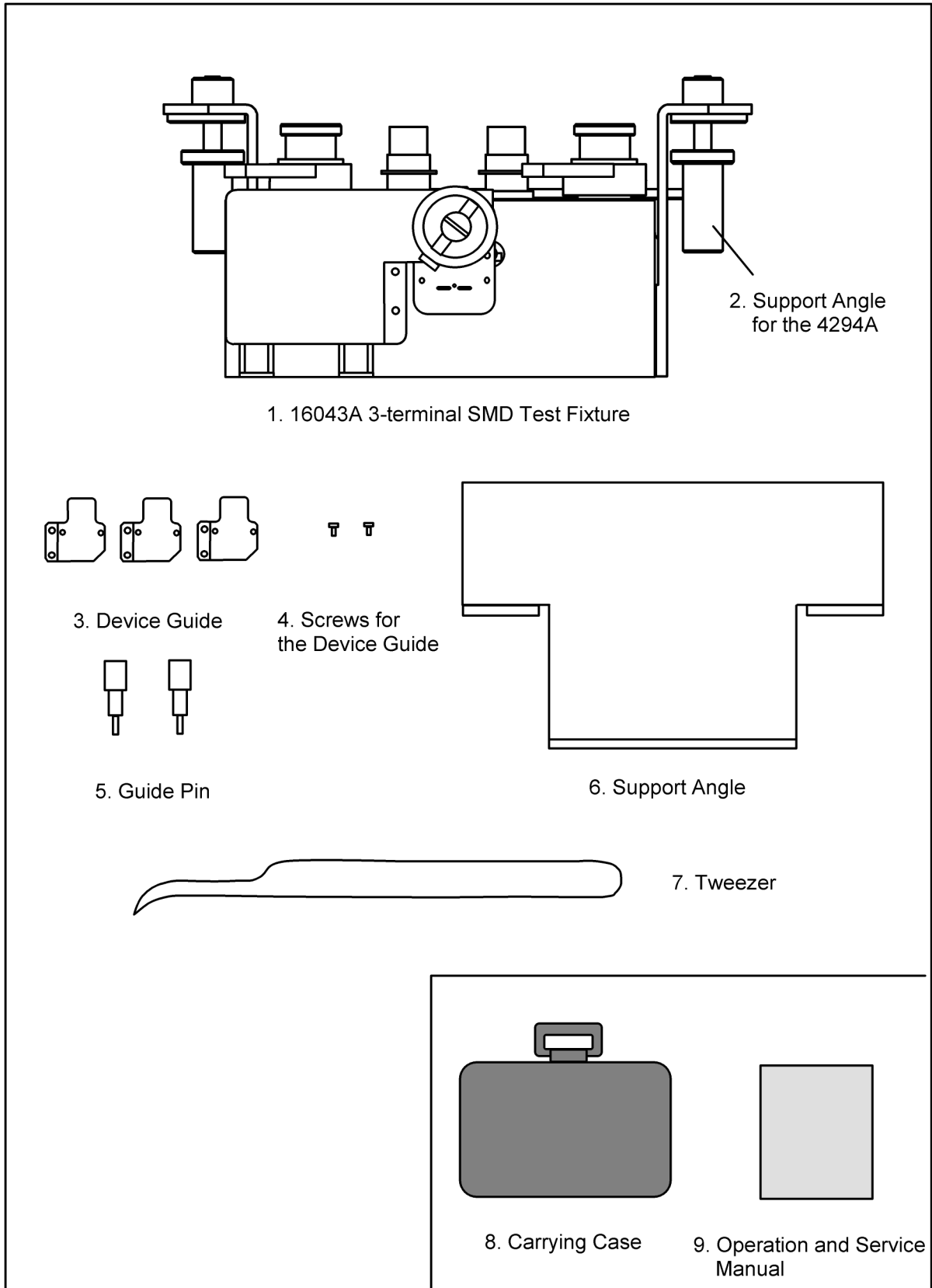


Table 1-2 16043B Package Contents

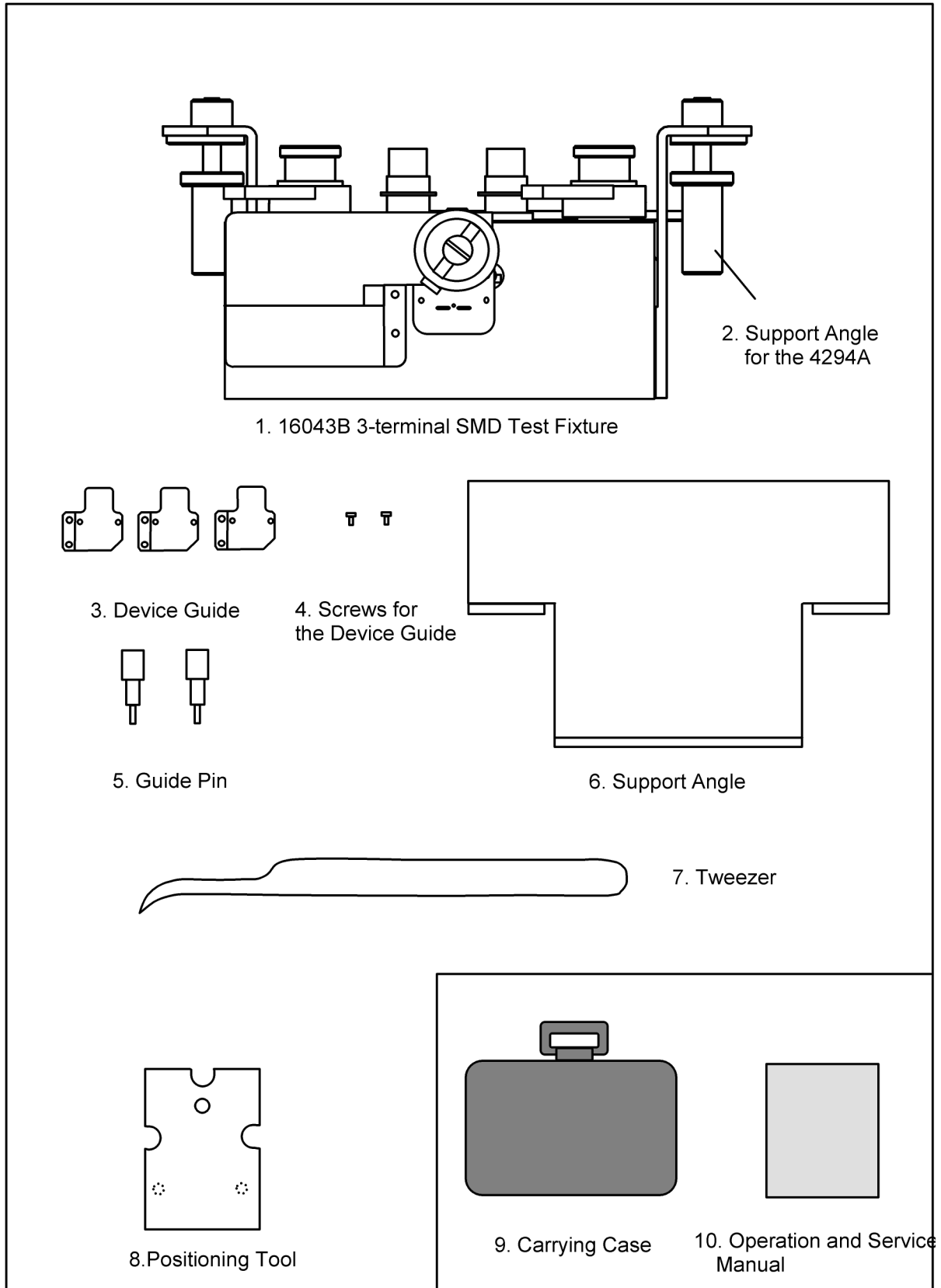
No.	Name	Agilent Part Number	Qty.
1	16043B 3-terminal SMD Test Fixture *1	-	1
2	Support Angle for the 4294A *2	16043-01203	1
3	Device Guide *3	16043-00601	3
4	Screws for the Device Guide *3	0515-2791	2
5	Guide Pin *3	16043-24004	2
6	Support Angle	16043-01212	1
7	Tweezer	8710-2081	1
8	Positioning Tool	16043-00607	1
9	Carrying Case	16043-60250	1
10	Operation and Service Manual (this manual)	16043-90010	1
Option 001			
	Contact Board No. 1	16043-66511	1
Option 002			
	Contact Board No. 2	16043-66512	1
Option 003			
	Contact Board No. 3	16043-66513	1
Option 004			
	Additional Device Guide	16043-00601	3

*1. Furnished with a contact board that specified option when shipped from the factory.

*2. Mounted in the Test Fixture when shipped from the factory.

*3. Contained in the case (Part number 1540-0622, 9282-0114) when shipped from the factory.

Figure 1-2 16043B Package Contents



Connecting the 16043A/B to a Measuring Instrument

The contact board should be mounted; the device guide fabricated and mounted, and the test fixture should be connected to the measuring instrument.

Mounting the Contact Board

Select a contact board that matches the size and shape of the DUT, and then place it on the fixture. For details, see “Selecting and Mounting the Contact Board” on page 29.

Fabricating and Mounting the Device Guide

Fabricate the provided blank device guide and make the device hole. Mount this device guide on the fixture. For details, see “Fabricating the Device Guide” on page 27 and “Mounting the Device Guide” on page 32.

Connectable Measuring Instruments

The 16043A/B Test Fixture can be connected to a Measuring instrument using four BNC connectors.

Table 1-3 Instruments With Four BNC Connectors Connectable With the 16043A/B

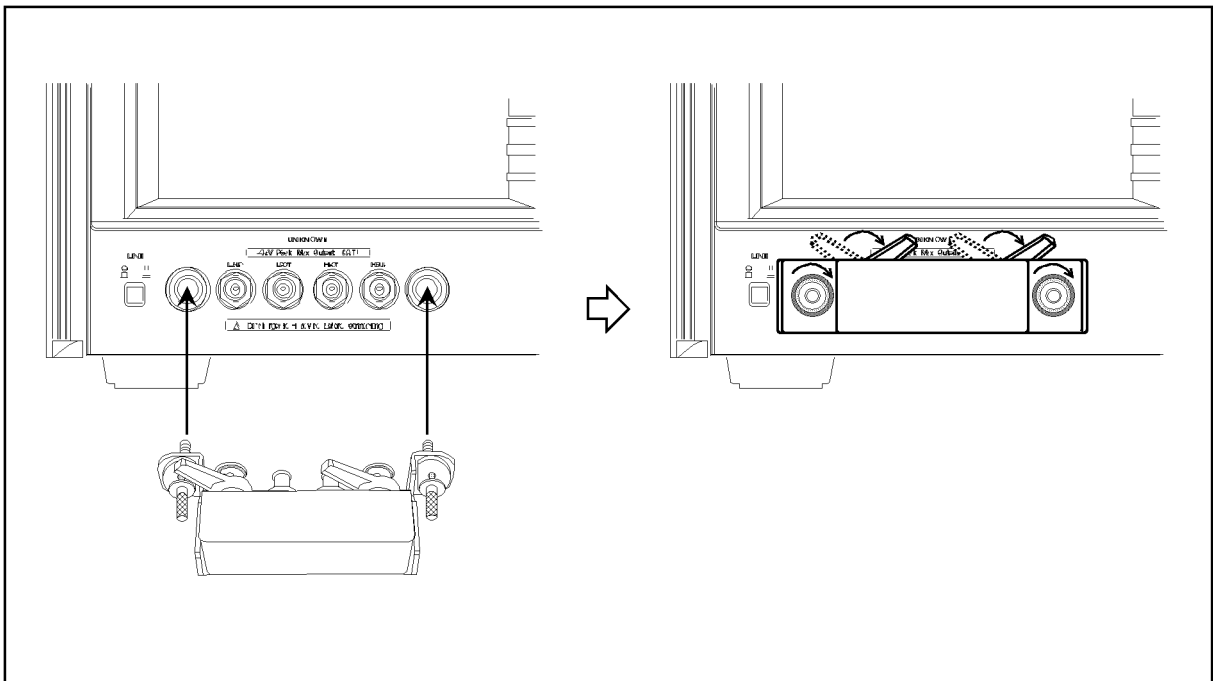
Model	Name
4294A	Precision Impedance Analyzer
4194A	Impedance/Gain Phase Analyzer
4263B	LCR Meter
4278A	1 kHz/1 MHz Capacitance Meter
4284A	Precision LCR Meter
4285A	Precision LCR Meter

Connecting to 4294A

Follow the steps below to connect the 16043A/B to the 4294A.

- Step 1.** Match the four BNC connectors and fastening screws of the 16043A/B with the test connectors and accessory mounting holes of the 4294A and gently press the fixture straight in as long as it will go.
- Step 2.** Turn the two BNC connector rotation levers of the 16043A/B to align the positions of the connector grooves. Then press straight in until the two units come into complete contact.
- Step 3.** Flip the two BNC connector rotation levers of the 16043A/B to the right to secure the fixture.
- Step 4.** Turn the two fastening screws of the 16043A/B clockwise at the same time until the fixture is firmly secured to the 4294A.

Figure 1-3 Connecting to 4294A



16043aboj0106

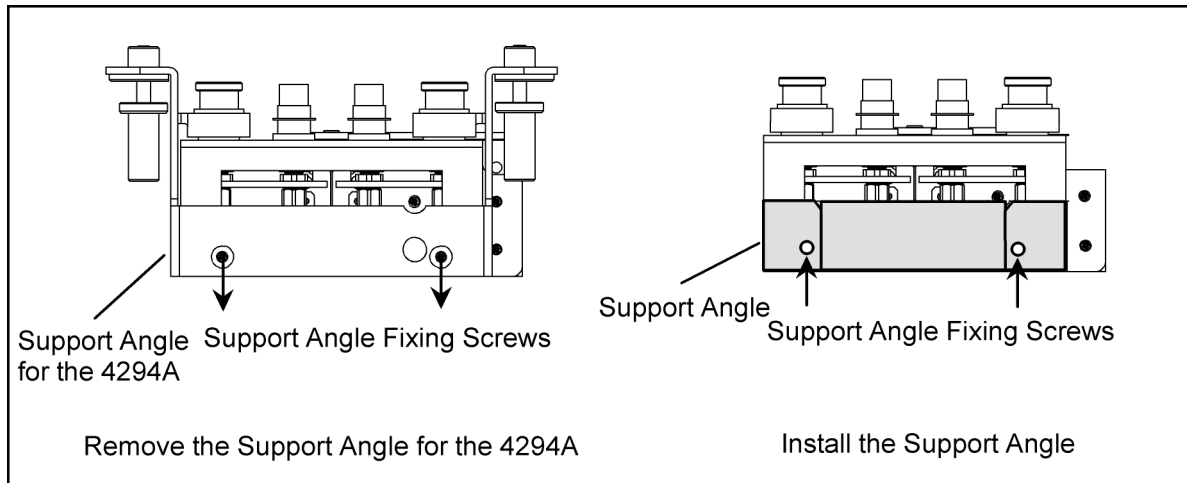
NOTE

The support angle are provided to enhance the fixture's mechanical stability and durability. Removing the angle does not affect measurement results.

Connecting to Other Instruments than 4294A

To connect the 16043A/B to other instruments than 4294A, remove the support angle for the 4294A. The 4294A support angle is detached by removing the two fixing screws at the bottom of the 16043A/B (Figure 1-4). As replacement, mount an all-purpose support angle.

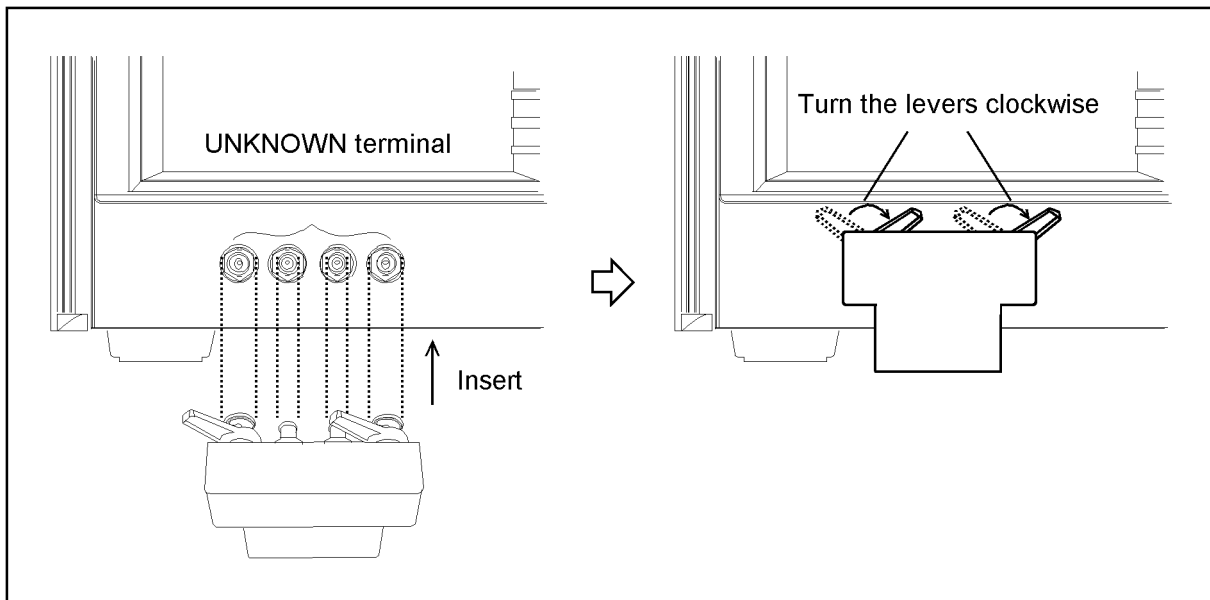
Figure 1-4 Support Angle



16043aboe0104

- Step 1.** Turn the two BNC connector rotation levers of the 16043A/B to align the positions of the connector grooves, and align the connectors with the UNKNOWN terminal. Then gently press straight in until the two units come into complete contact.
- Step 2.** Flip the two BNC connector rotation levers of the 16043A/B to the right to secure the fixture.

Figure 1-5 Connecting to Instrument



2 **Product Overview**

Product Overview

16043A and 16043B are 3-terminal SMD test fixtures. They enable SMD type devices with three terminals to be measured with high precision and measurement repeatability. By replacing the contact board the 16043A/B allows measurement of SMD devices ranging from 8133 sizes^{*1} to 2022 sizes^{*1}. The 16043A is also provided with a function for measuring only the load capacity of a ceramic resonator with load capacity.

Figure 2-1

Product Overview (The photograph shows the 16043A)



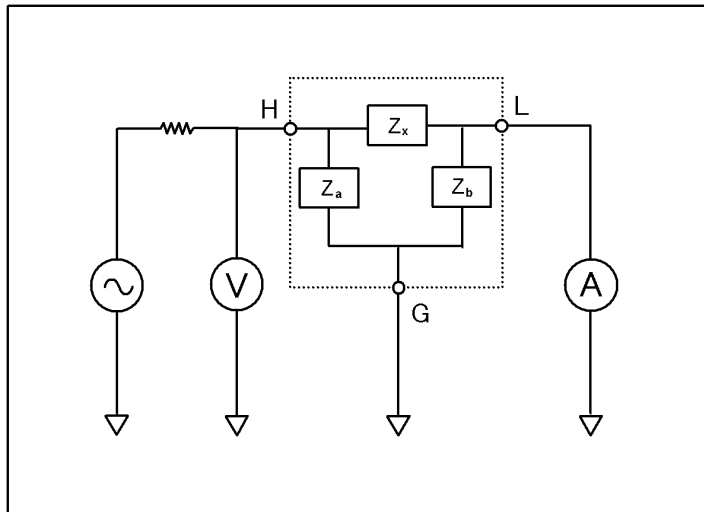
*1. This size is a nominal size in millimeters.

Measurement Principle

16043A/B is employed for guard measurements of 3-terminal devices using the guard terminal of an impedance instrument with four BNC connectors. Figure 2-2 shows an example of a 3-terminal device. In this example, the device's ground terminal is connected to the guard terminal of the measuring instrument in order to eliminate the influence of Z_a and Z_b and only measure Z_x . In the case of the 16043A, Z_a and Z_b can be measured by changing the connections to the H, L and G terminals. For details, see "Measuring a 3-terminal Device" on page 37.

Figure 2-2

Guard Measurement Using Impedance Instrument



Electrode Construction

A DUT with electrodes attached on the underside is placed on the fastening electrodes on the contact board of the 16043A/B and pressed down from above to connect.

Figure 2-3

Electrode Construction

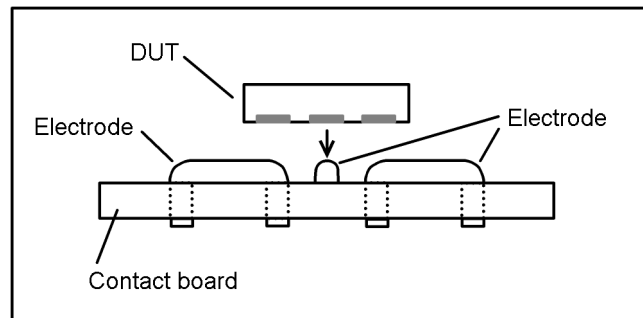
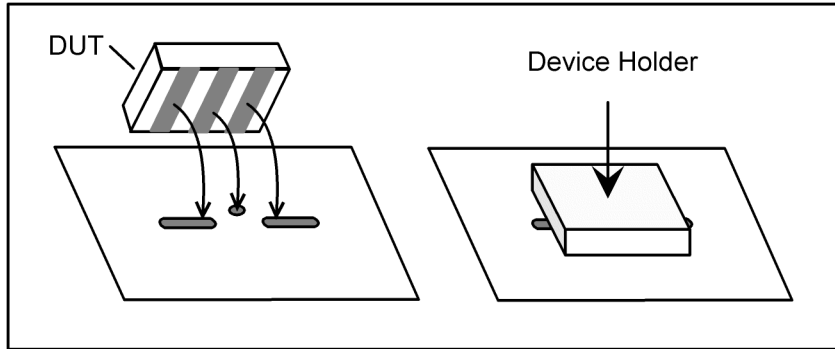


Figure 2-4

Connection Arrangement



Names of Parts and Functions

The names of each part of 16043A/B are shown in Figure 2-5, and their functions are described in Table 2-1.

Figure 2-5

Names of Parts

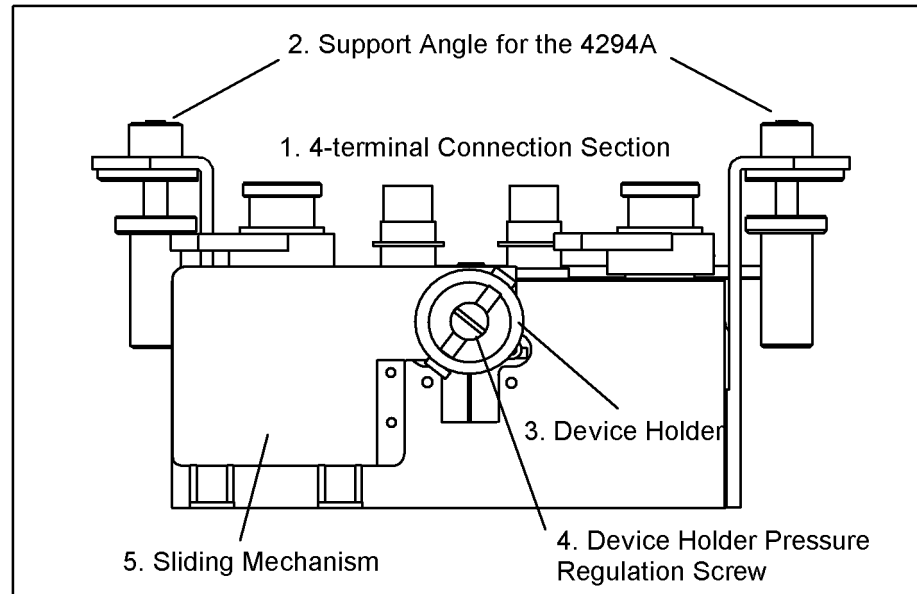


Table 2-1

Names of Parts and Functions

No.	Name	Function
1	4-terminal Connection Section	Connects to the UNKNOWN terminal of instrument.
2	Support Angle for the 4294A	To fasten the fixture to the instrument.
3	Device Holder	Restrains the DUT to keep the DUT and electrodes in firm contact.
4	Device Holder Pressure Regulation Screw	To adjust the force with which the DUT is held in place.
5	Sliding Mechanism (16043A only)	To change the positions of the electrodes to conduct measurement of the capacity load of the DUT.

Names of Accessories and Functions

The names of accessories are shown in Figure 2-6, and their functions are described in Table 2-2.

Figure 2-6

Accessories

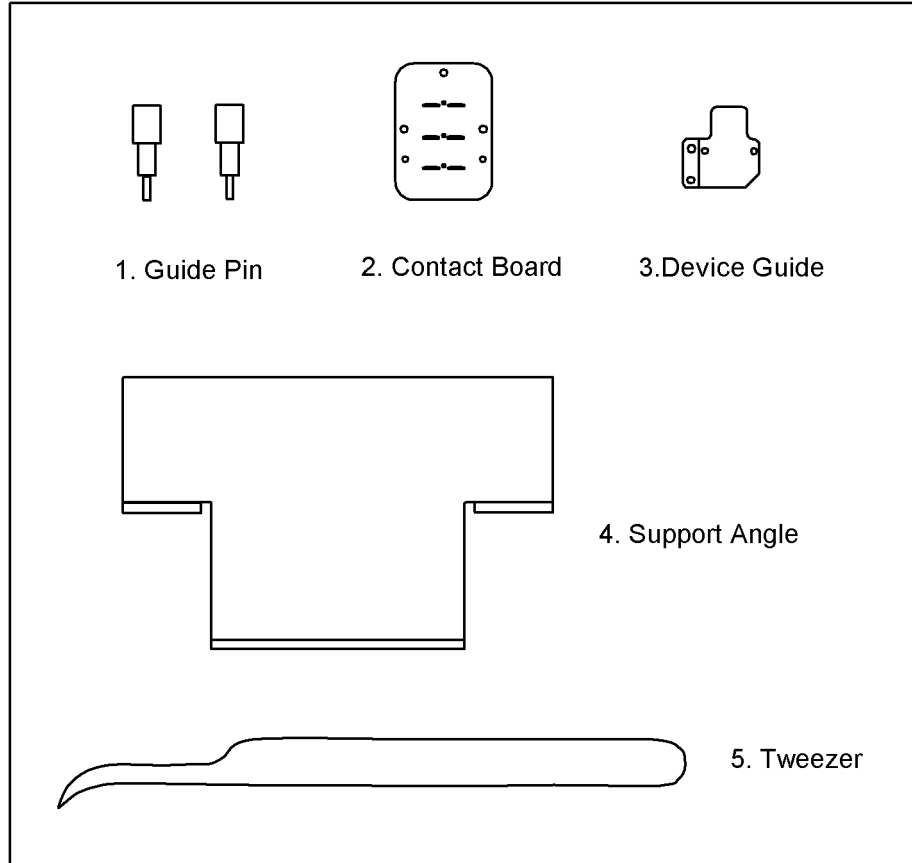


Table 2-2

Names of Accessories and Functions

No.	Name	Function
1	Guide Pin	Used for aligning the position when the device guide is attached.
2	Contact Board (Option)	Electrode used when measuring DUT of different sizes and shapes.
5	Device Guide (Blank)	Decides the position when connecting the DUT to the electrodes.
6	Support Angle	Supports the fixture when it is used with instruments other than 4294A.
7	Tweezer	Used for handling tiny DUT and for preventing contamination of the DUT or electrodes.

Contact Board

To enable measurement of DUTs of different sizes, three types of contact boards with different distances between the electrodes are available as options. Contact boards are available for use with 16043A and 16043B. To distinguish the contact board types, figures are imprinted on the boards.

Figure 2-7

Contact Board (16043A)

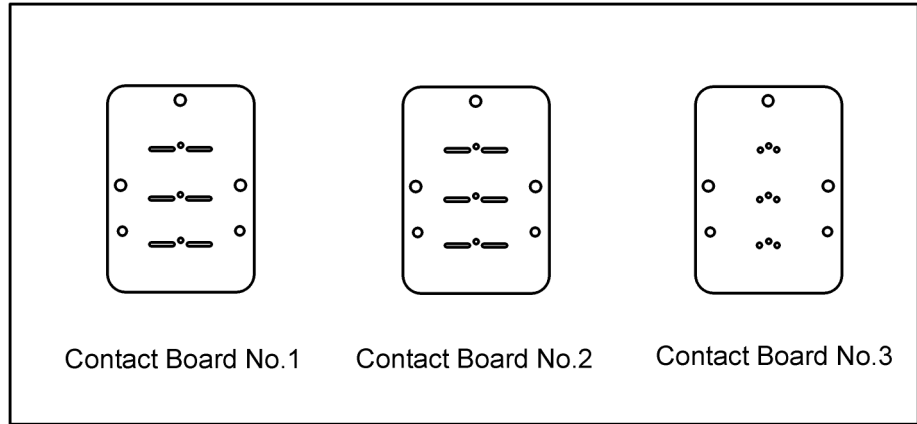
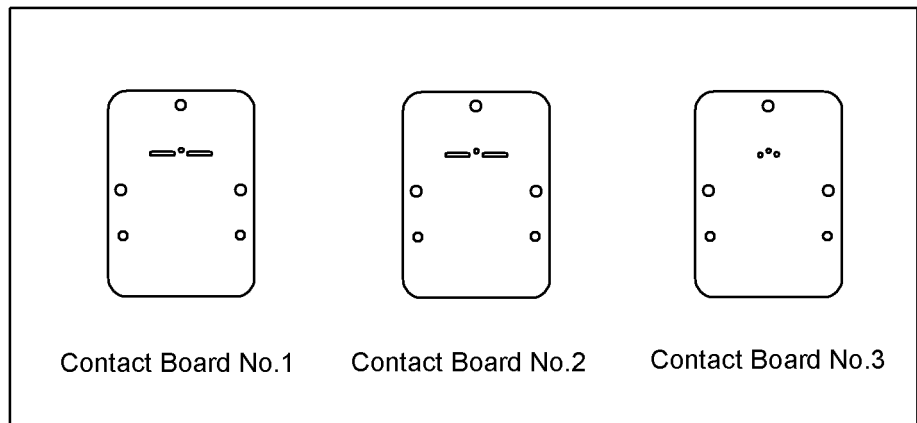


Figure 2-8

Contact Board (16043B)



The distances between the electrodes on the different contact boards are shown in Figure 2-9. The distance between the electrodes is the same for both 16043A and 16043B.

Figure 2-9 Distances Between Electrodes on Contact Boards

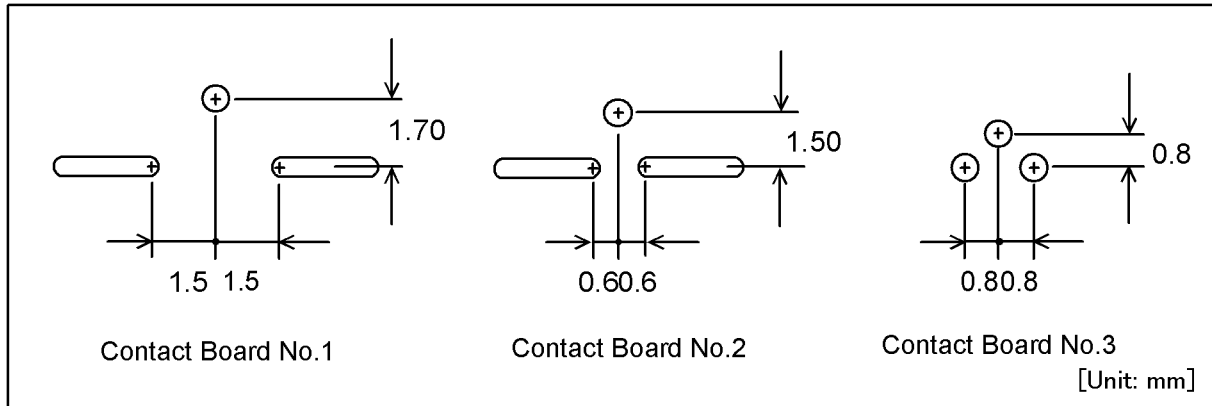


Table 2-3 Contact Boards and Compatible Chip Sizes

Contact Board	Compatible Chip Size
No.1	8133 - 3731
No.2	3731 - 2520
No.3	2520 - 2012

3 **Operation**

This chapter describes preparations, fixture preparations, and fixture compensation when using the 16043A/B to take measurements as well as DUT connection and measurement methods.

Flow of Measurements

Follow the steps below when taking DUT measurements with the 16043A/B.

1. Preparation for Measurement
Create a device guide and short bar to fit the shape of the DUT to be measured. Also create a short bar that matches the size and shape of the DUT to be measured.
2. Selecting and Mounting the Contact Board
Select and mount the contact board that fits the shape and size of the DUT to be measured.
3. Attaching the device guide
Attach the device guide.
4. Carrying out Fixture Compensation
Measure the data for open compensation and measure the data for short compensation.
5. Connecting and Measuring the DUT
Connect the DUT and take measurements.

Preparations for Measurement

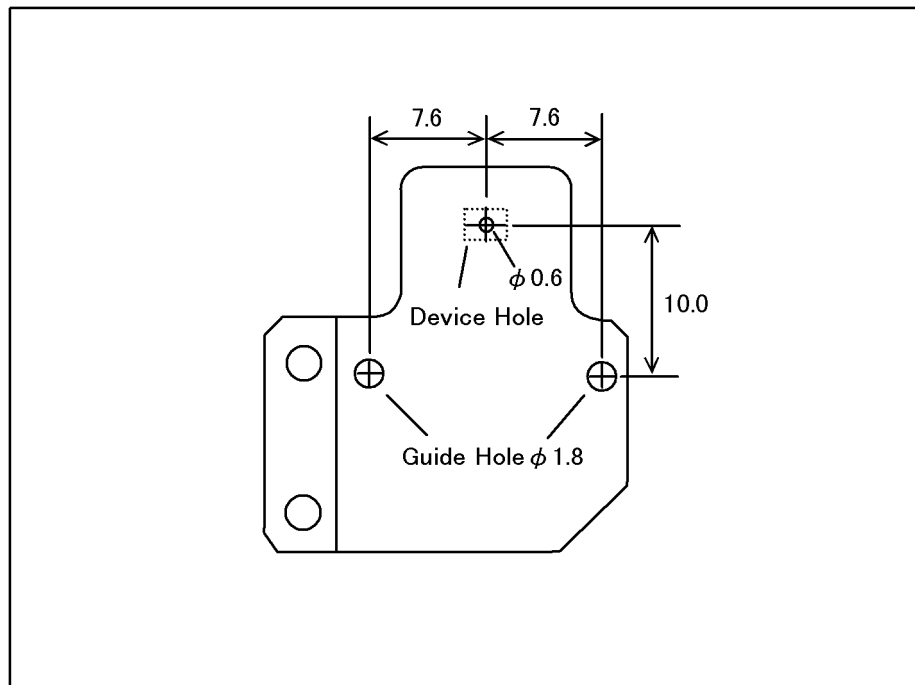
Fabricating the Device Guide

The device hole in the device guide determines the position when the DUT or short bar is placed on the electrodes of the contact board. Consequently, measuring with a device hole that does not match the shape of the DUT will prevent proper contact between the DUT and the electrodes and correct measurement will not be accomplished. Create a device hole that matches the shape of the DUT to be measured.

Using a die and a punch fitting the size and shape of the DUT, cut out the form of the device hole using a handpress, etc. At this point, use the guide pin and guide hole to align the position of the die and the punch.

Figure 3-1

Shape and Dimensions of Device Guide



Creating the Short Bar

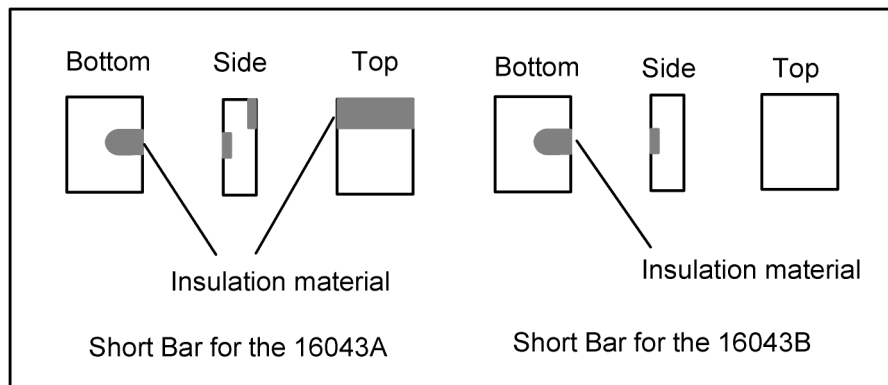
Short bars are not furnished with the 16043A/B. Create a short bar that matches the size and shape of the DUT to be measured. The short bar is used to compensate for the same amount of residual short as when the DUT is measured. Consequently, the sizes and shapes of the device guide and the short bar must be in agreement.

When taking measurements of load capacity with the 16043A, short bars are required for shorting each electrode. To accomplish more accurate measurement, prepare short bars for when load capacity is measured.

Create the short bars as shown in Figure 3-2 using materials with high electrical conductivity (brass + gilding, etc.) and insulation material (polycarbonate film, etc.).

Figure 3-2

Example of Short Bar Creation



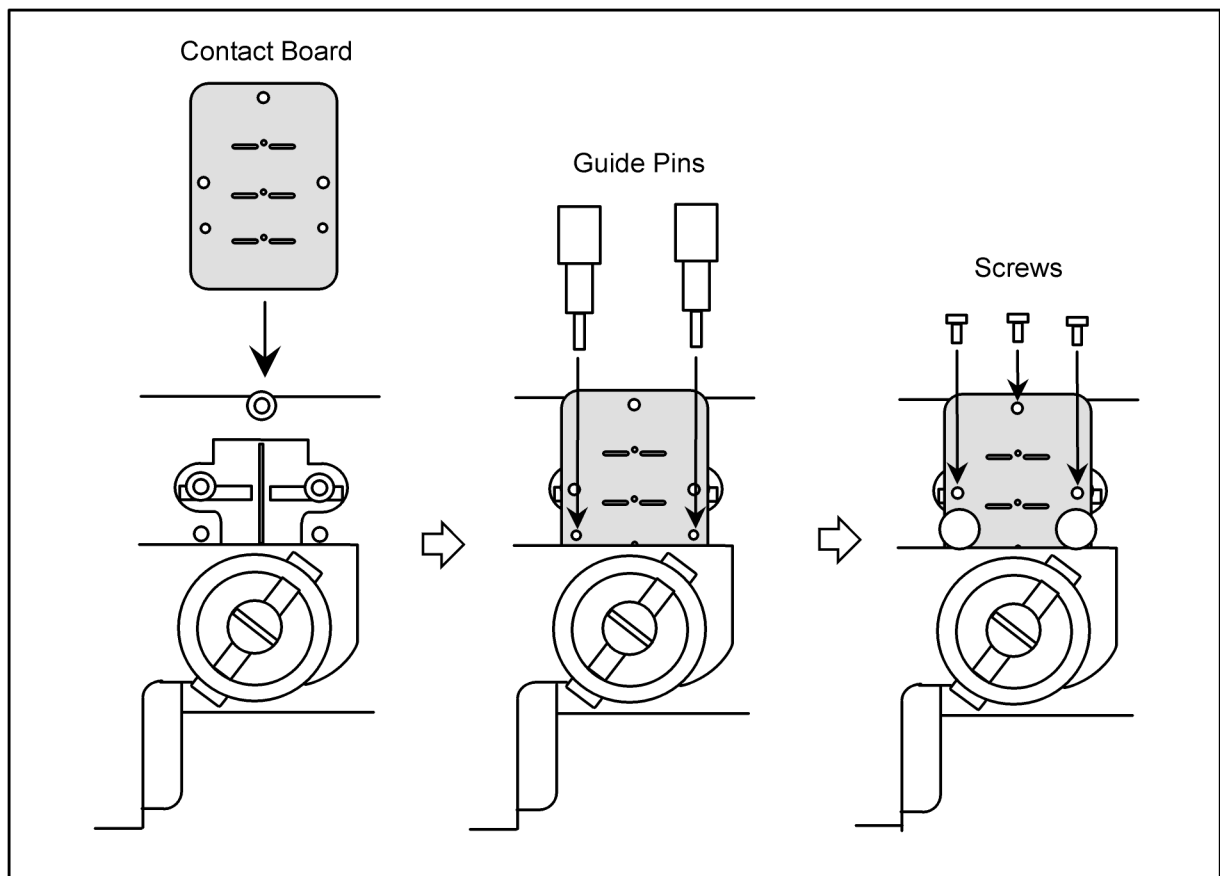
Selecting and Mounting the Contact Board

To accommodate various sizes and shapes of DUTs, three types of contact boards are optionally available for 16043A and 16043B. While referring to Chapter 2 “Contact Board” on page 23, select a contact board that fits the DUT to be measured. The contact board is mounted in different ways for the 16043A and 16043B.

Mounting the 16043A Contact Board

Step 1. Move the sliding mechanism all the way to the front.

Figure 3-3 Mounting the 16043A Contact Board



Step 2. Place the selected contact board on the fixture and insert the guide pin into the guide hole to align the position.

CAUTION

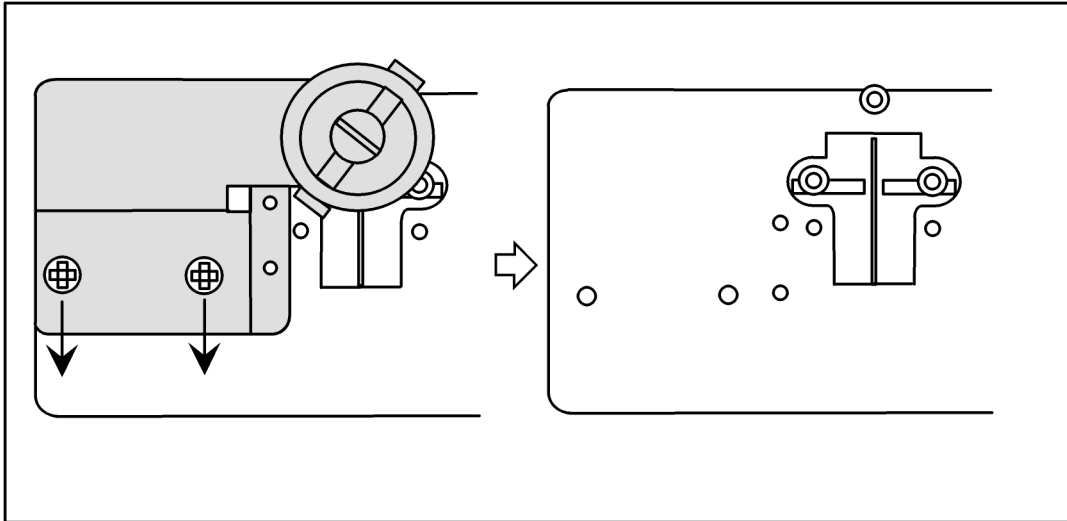
Do not touch the electrodes with hands or damage them in any way as this could adversely affect the measuring precision and repeatability.

Step 3. Tighten the screws to secure the contact board, then pull out the guide pin.

Mounting the 16043B Contact Board

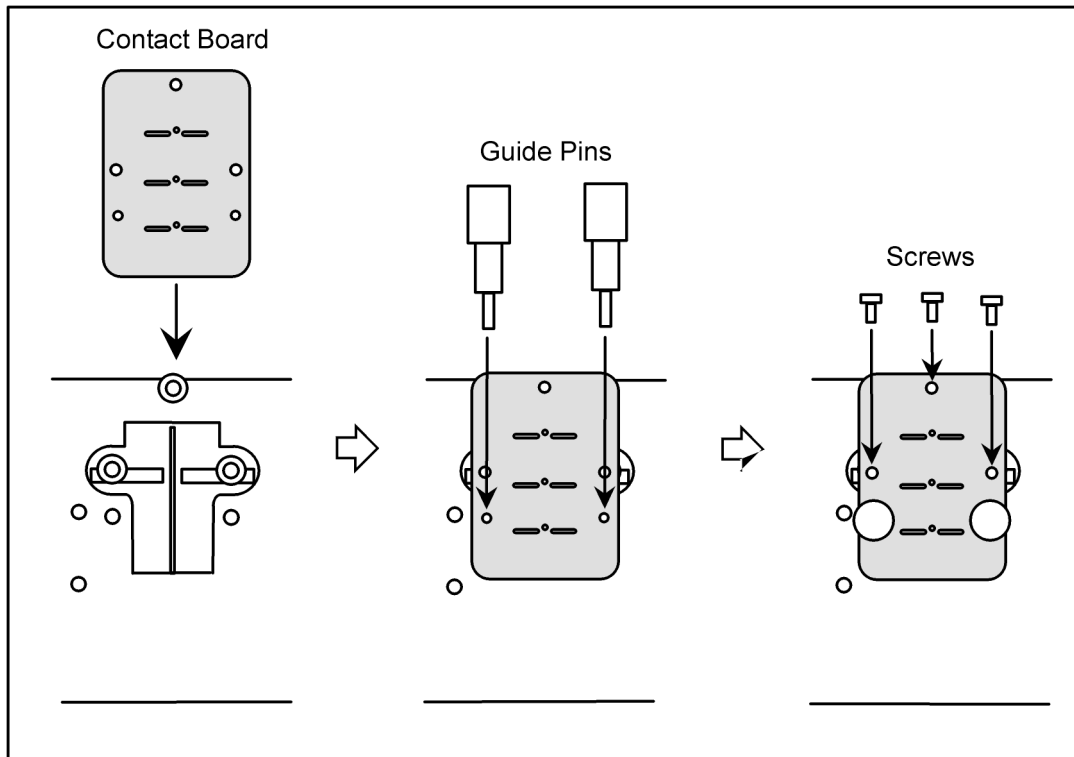
Step 1. Remove the screws from the two positions on the upper part of the fixture and remove the device holder block.

Figure 3-4 Remove the Device Holder Block



Step 2. Place the selected contact board on the fixture and insert the guide pins into the guide hole to align the position.

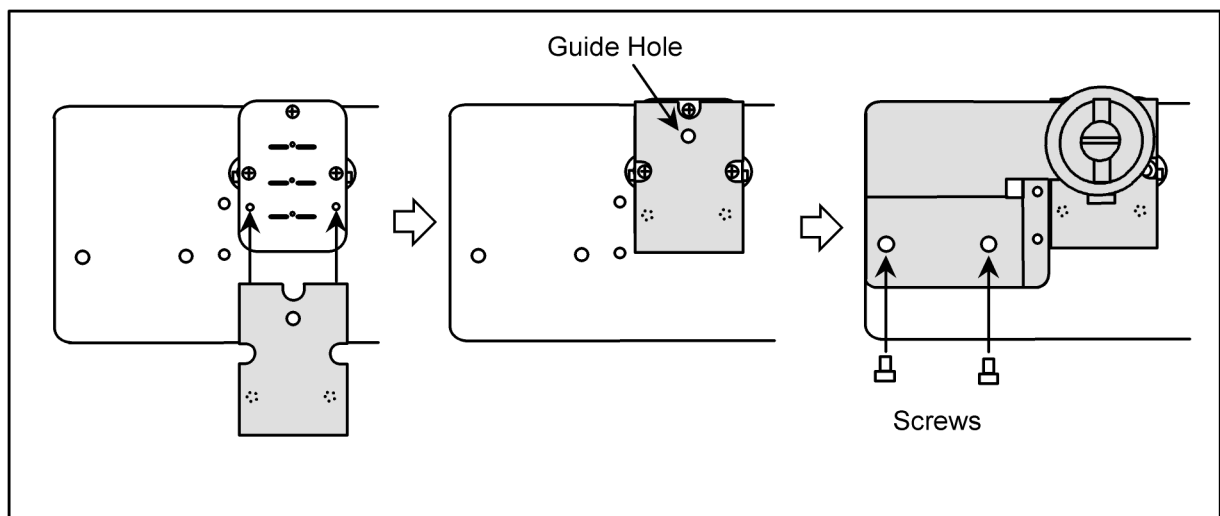
Figure 3-5 Mounting the 16043B Contact Board



CAUTION Do not touch the electrodes with hands or damage them in any way as this could adversely affect the measuring precision and repeatability.

- Step 3.** Tighten the screws to secure the contact board.
- Step 4.** Pull out the guide pin.
- Step 5.** Align the positioning tool with the guide hole in the contact board and insert the tool.
- Step 6.** The detached device holder block will leave the device holder lowered and locked with rod protruding. Insert this device holder rod into the guide hole of the positioning tool, and align with the position for mounting the device holder block.

Figure 3-6 Mount the Device Holder Block



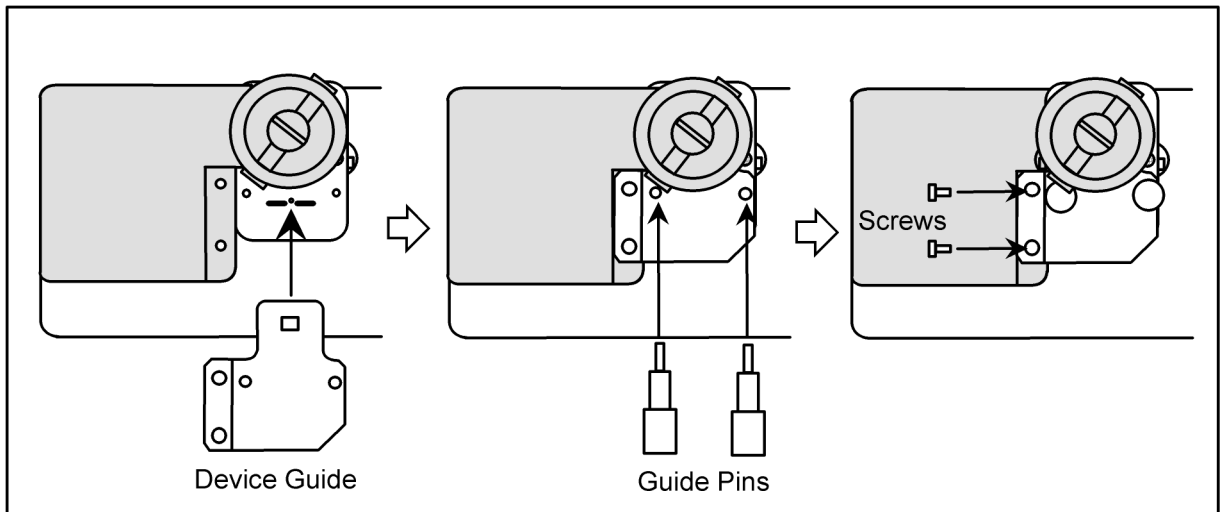
- Step 7.** Tighten the screws of the device holder block.
- Step 8.** Remove the positioning tool.

Mounting the Device Guide

The device guide determines the position when the DUT is placed on the electrodes of the contact board. Consequently, a guide pin should be used to align the position when the device guide is secured.

- Step 1.** In the case of the 16043A, move the sliding mechanism all the way back.
- Step 2.** Place the device guide on the contact board and insert the guide pin into the guide hole to align the position.

Figure 3-7 Mounting the Device Guide



- Step 3.** Tighten the screws to secure the device guide.

After the contact board has been changed and the device guide mounted, connect the test fixture to the instrument.

Connect the test fixture to the instrument as described in Chapter 1 “Connecting the 16043A/B to a Measuring Instrument.”

Carrying Out Fixture Compensation

In order to take more accurate measurements, before beginning the measurement procedure, it is necessary to carry out fixture compensation. For the 16043A/B, take measurements of the data for open compensation and of the data for short compensation. Also, when the 16043A is to be used for load capacity measurement, fixture compensation is necessary to ensure more accurate measurements. For the electrode used for load capacity measurement, take measurements of the data for open compensation and of the data for short compensation.

NOTE

If measurements of the data for open compensation and of the data for short compensation are not taken for the electrode used for load capacity measurement, the measurement results will have an error factor of about 0.1 pF.

NOTE

If there are temperature fluctuations that exceed a temperature range of $\pm 5^{\circ}\text{C}$ after fixture compensation has been carried out, then perform fixture compensation again.

Measuring Open Compensation Data

Place the fixture in the open state and take measurements of the data for open compensation. For the 16043A, move the sliding mechanism to the position above the electrode to be measured.

- Step 1.** Place the fixture in the open state with nothing placed on the contact board.
- Step 2.** Take measurements of the data for open compensation in accordance with the operation manual for the measuring instrument you are using.

Measuring Short Compensation Data

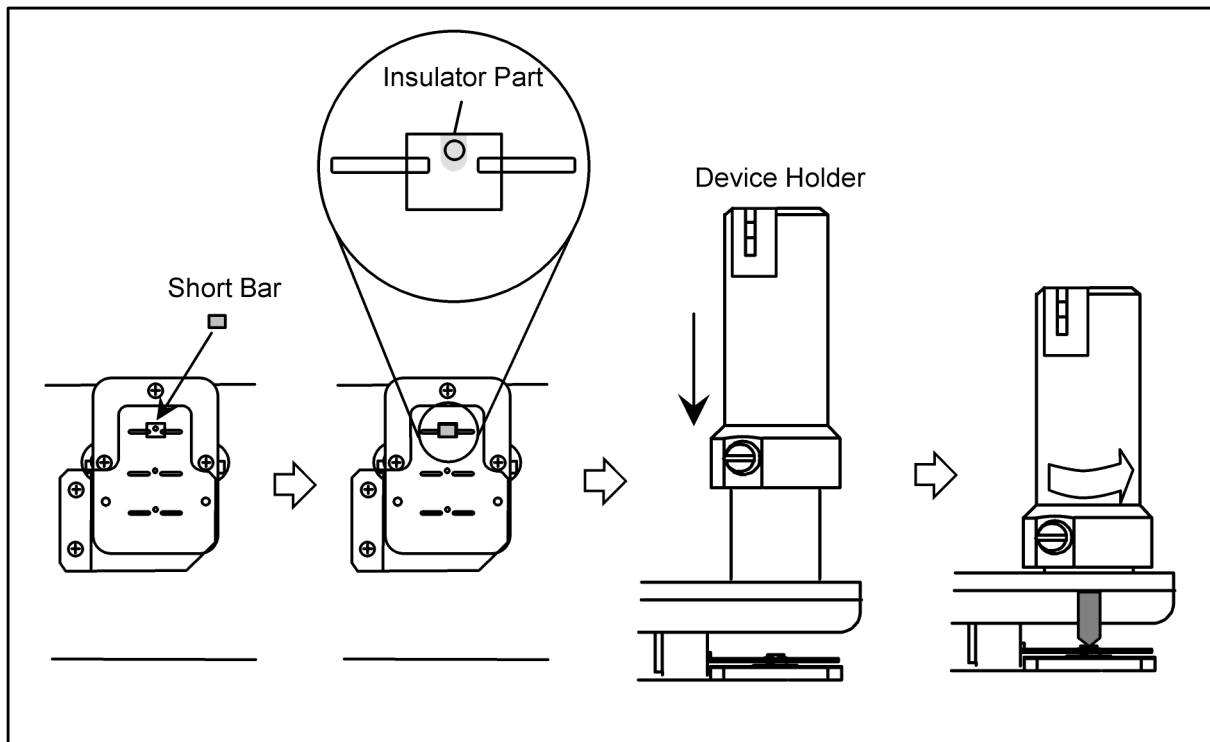
Place the fixture in the short state and take measurements of the data for short compensation.

- Step 1.** Using tweezers, place the short bar on the electrodes in such a manner that the insulator part contacts the G terminal and so that the H terminal and L terminal are shorted.

CAUTION Handle the short bar with tweezers. If dirt, etc. contaminates the short bar, measuring precision and repeatability may be adversely affected.

CAUTION Use a short bar of the same size and shape as the DUT to be measured.

Figure 3-8 Setting the Short State Using the Short Bar

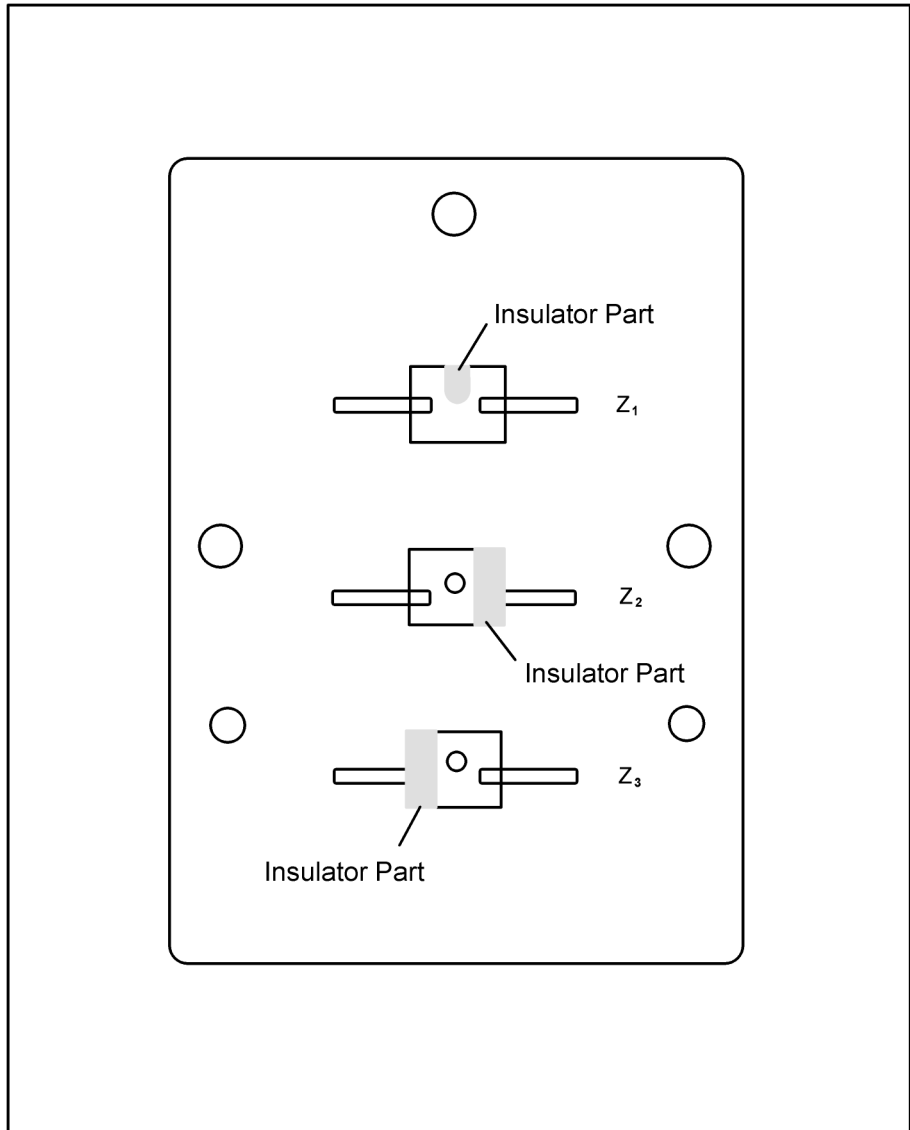


- Step 2.** Lower the device holder and rotate it counterclockwise to lock and hold the short bar in place.

- Step 3.** Take measurements of the data for short compensation in accordance with the operation manual for the measuring instrument you are using.

For normal guard measurement using the 16043A/B, short the electrode's H terminal and the L terminal on the contact board. When measuring load capacity using the 16043A, short the electrode connected to the H terminal and the L terminal on the contact board and make the insulator part contact the G terminal as shown in Figure 3-9.

Figure 3-9 Shorting the Electrodes Using the Short Bar (16043A)

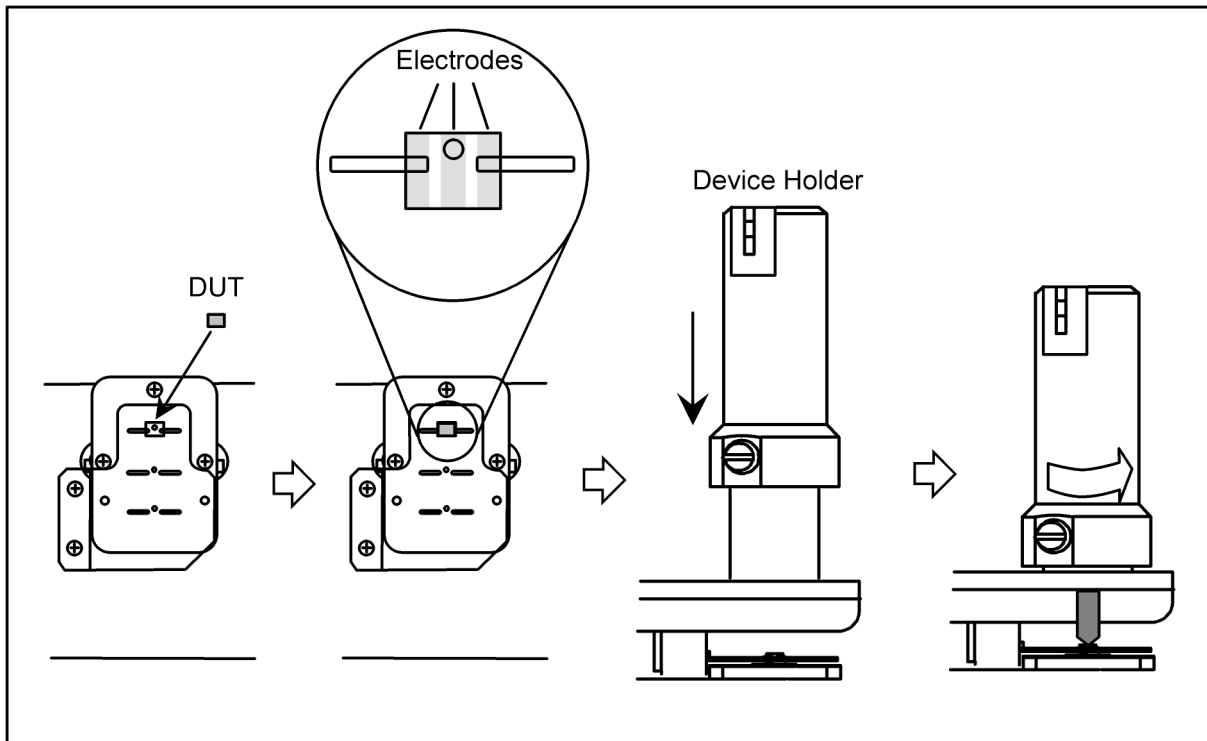


Connecting and Measuring DUT

Connect the DUT to the electrodes and take measurements.

- Step 1.** Using tweezers, align the DUT with the device guide and place on the electrodes.

Figure 3-10 Connecting a DUT



- Step 2.** Lower the device holder and turn it counterclockwise to lock and hold the DUT in place.

NOTE

The force with which the DUT is secured can be adjusted using the device holder pressure regulating screw. The force can be shown by the following expression.

Approximately $(70.5+92t) \pm 80a$ (gf)

In this case, the DUT thickness is expressed as t mm, the adjustment amount as a mm, and the adjustment amount is ± 2 mm.

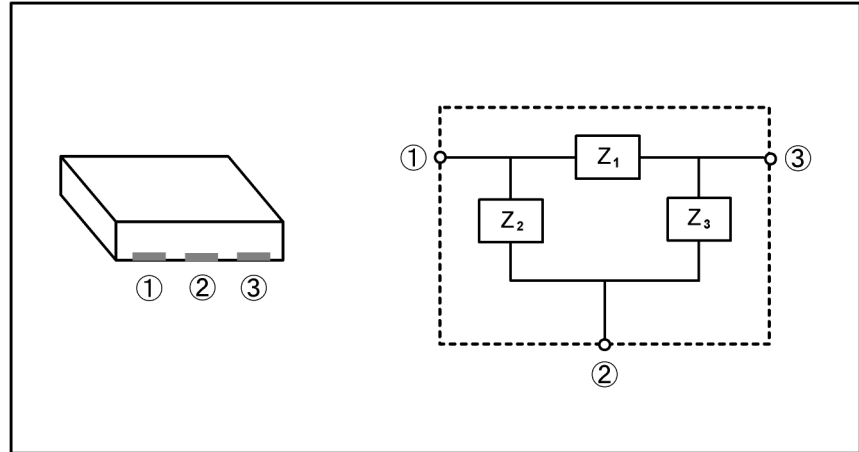
- Step 3.** Take measurements in accordance with the operation manual for the measuring instrument you are using.

Measuring a 3-terminal Device

The 16043A enables measurement of all the constituent elements of a 3-terminal device.

Figure 3-11

3-terminal Device

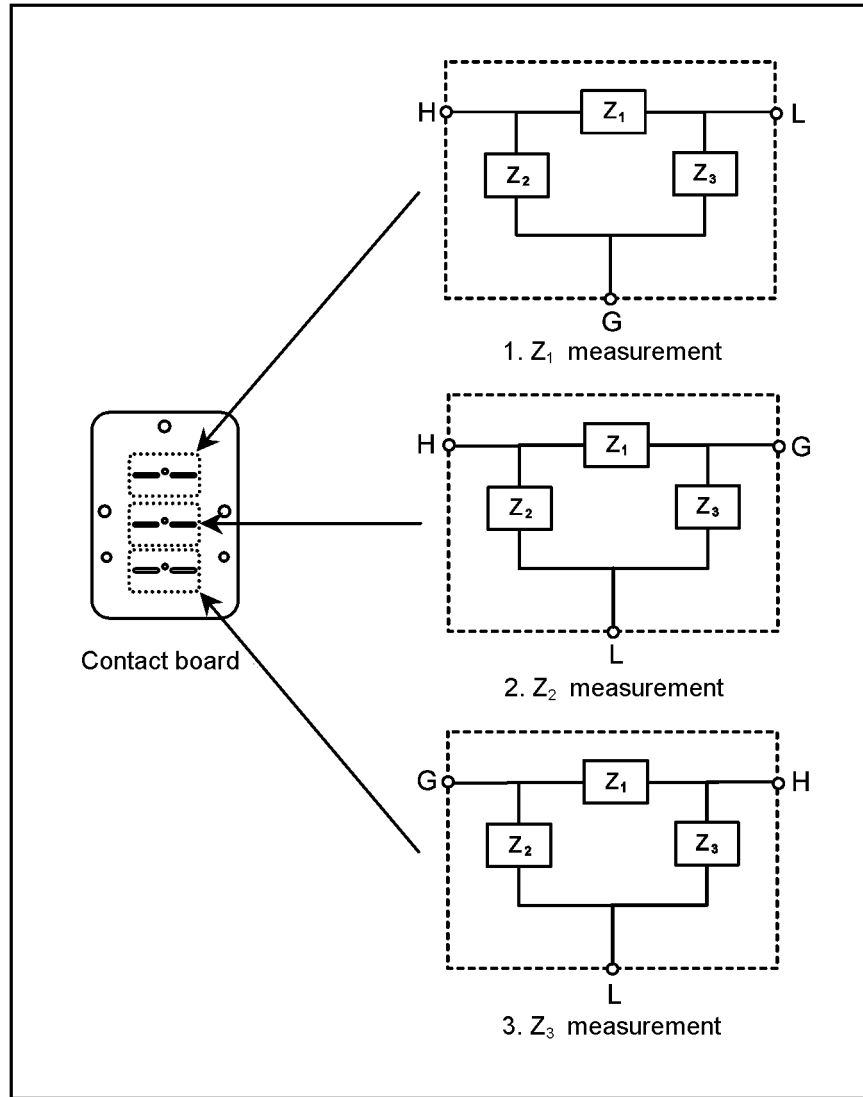


To measure all the constituent elements of a 3-terminal device, use the sliding mechanism to move the measurement stage to change the electrode of the contact board to which the DUT is connected.

The electrodes on the contact board allow the connection of the H terminal, the L terminal and the G terminal to be changed in order to enable measurement of all the constituent elements of a 3-terminal device as shown in Figure 3-12.

Figure 3-12

Connection of the Electrodes on the Contact Board of the 16043A



The following measurements can be taken by each electrode.

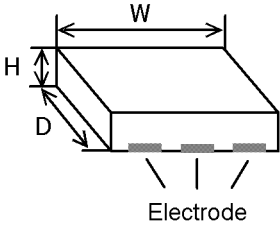
1. Measurement of the characteristics of Z_1 only (1 in Figure 3-12)
2. Measurement of the characteristics of Z_2 only (2 in Figure 3-12)
3. Measurement of the characteristics of Z_3 only (3 in Figure 3-12)

NOTE

The positions of the electrodes can be changed by moving the sliding mechanism while the DUT remains placed in the device guide. At this point, raise the device holder before moving the sliding mechanism.

Move the measurement stage to the target electrode, connect the DUT and take the measurements.

Specifications

Connectable instruments		See Table 1-3 in Chapter 1.
Measurable DUT		SMD with electrodes on underside
Size of measurable DUT		Width (W) × Length (D) × Height (H) (mm) 8.1 × 4.5 × 4.0 mm to 2.0 × 1.2 × 0.7 mm
		
Frequency		DC - 110 MHz
Operating environment	Temperature	0 °C - +70 °C
	Relative humidity	15% - 95%RH (wet-bulb temperature < 40°C)
Storage environment	Temperature	-40 °C - +70 °C
	Relative humidity	≤ 90 %RH (wet-bulb temperature < 65°C)
Dimensions		75 (D) × 105 (W) × 95 (H) mm
Mass		Approximately 500 g (16043A), Approximately 330 g (16043B)
Safety standard compliance		EN61010-1:1993 +A2:1995 IEC61010-1:1990 +A1:1992 +A2:1995 CSA C22.2 No.1010.1:1992 INSTALLATION CATEGORY I POLLUTION DEGREE 2 INDOOR USE

Supplemental Performance Characteristics

Useful data for use of the 16043A/B are found in this section. These reference data are not guaranteed as specifications.

Additional Errors (When Open/Short Compensation is Conducted)

The additional errors when the 16043A/B is connected by two terminals can be found in the following ways.

For |Z| Measurement

The impedance additional error Z_e [%] can be found by substituting the values in the following expression.

$$Z_e [\%] = \pm \{ A + (Z_s/Z_x + Y_o \times Z_x) \times 100 \}$$

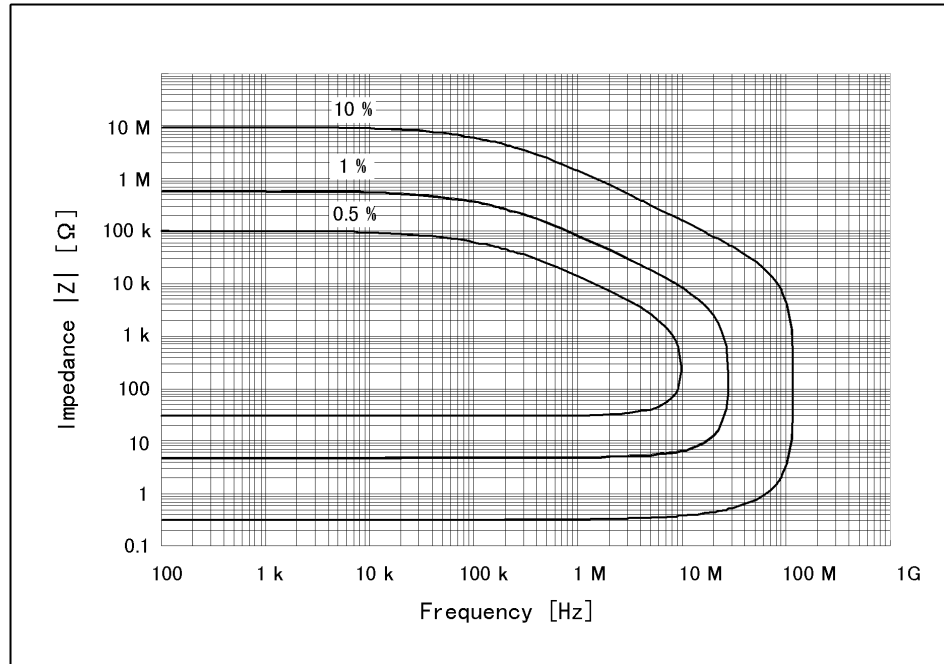
A [%]	Proportional error of fixture (%)
Z_s [Ω]	Short repeatability of fixture (Ω)
Y_o [S]	Open repeatability of fixture (S)
Z_x [Ω]	Measured impedance value of fixture (Ω)

Z_s	$\{ 30 + 6 \times (f / 10) \}$ [m Ω]
Y_o	$10 + 600 \times (f / 10)$ [nS]
A	$0.4 + \{ 7.2 \times (f / 100)^2 \}$ [%]

In the above chart, f denotes the measurement frequency (MHz).

Figure 4-1

Impedance Additional Error



For D Measurement

The loss factor additional error D_e can be found using the impedance additional error Z_e [%] as shown in the following.

When $D_x \leq 0.1$

$$D_e = Z_e / 100$$

When $0.1 < D_x \leq 0.5$

$$D_e = (Z_e / 100) \times (1 + D_x)$$

D_x is the measured value for D. However, this is not required when Z_e is less than 10%.

NOTE

The additional error of D is not a percentage but an absolute value.

For R_s (ESR) Measurement

The additional error R_{se} [%] for R_s measurement can be found using the impedance additional error Z_e [%] as shown in the following.

When $D_x \leq 0.1$

$$R_{se} [\%] = Z_e / D_x$$

When $0.1 < D_x \leq 0.5$

$$R_{se} [\%] = (Z_e / D_x) \times \sqrt{1 + D_x^2}$$

D_x is the measured value for D. It is calculated using the following expression.

$$D_x = 2 \times \pi \times f \times C_{sx} \times R_{sx}$$

Here we have the following denotations:

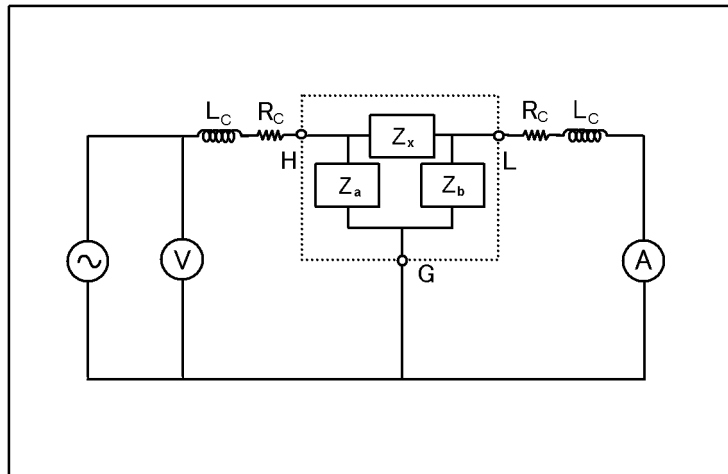
f: Measurement frequency
 Csx: Measured value for Cs
 Rsx: Measured value for Rs

Changes in Proportional Errors in Measurement of 3-terminal Device

When measuring impedance, the relations between the residual impedance held by the fixture's connectors and the contact resistance and Z_a , Z_b (Figure 4-2) have the effect that the actual measured voltage differs from the voltage applied to the device. This causes changes in the values of the proportional errors.

Figure 4-2

Changes in Proportional Errors in Measurement of 3-terminal Device



For example, when measuring a ceramic vibrator with load capacity, the relation between changes in proportional errors and the load capacity can be expressed as follows.

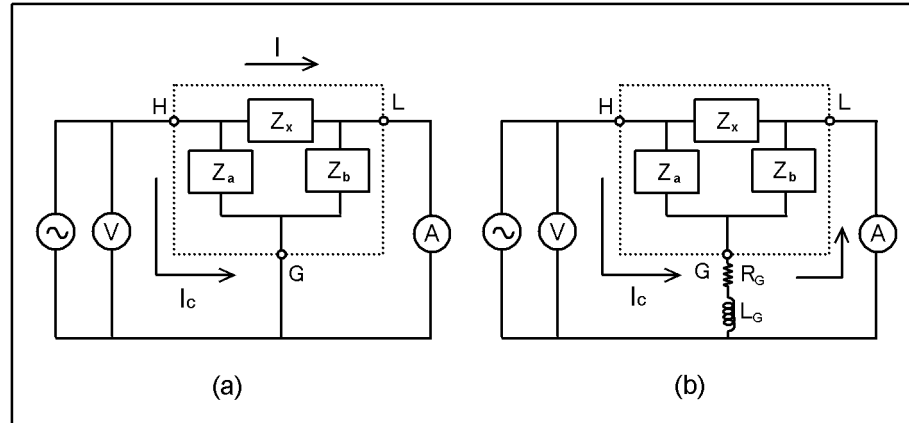
A	$0.4 + [\{ 1.2 \times (6 + C_L) \} \times (f / 100)^2] \quad [\%]$
---	--

C_L is the load capacity value pF.

Changes in Measurement Data Caused by Parallel Impedance

Figure 4-3

Changes in measurement waveform caused by parallel impedance when measuring a 3-terminal device



When measuring a 3-terminal device, guard measurement is effective for measuring only the characteristics of Z_x while the influence of Z_a and Z_b is eliminated. As shown in Figure 4-3 (a), measurement is conducted with the device connected to the H terminal, L terminal and G terminal of the instrument. In guard measurement, a part of the current entering the H terminal passes through the guard and flows to the - side of the instrument, but the current flowing to Z_x and the voltage applied between Z_x are measured by the ammeter and voltmeter of the instrument. Accordingly, this enables measurement of the impedance of Z_x only.

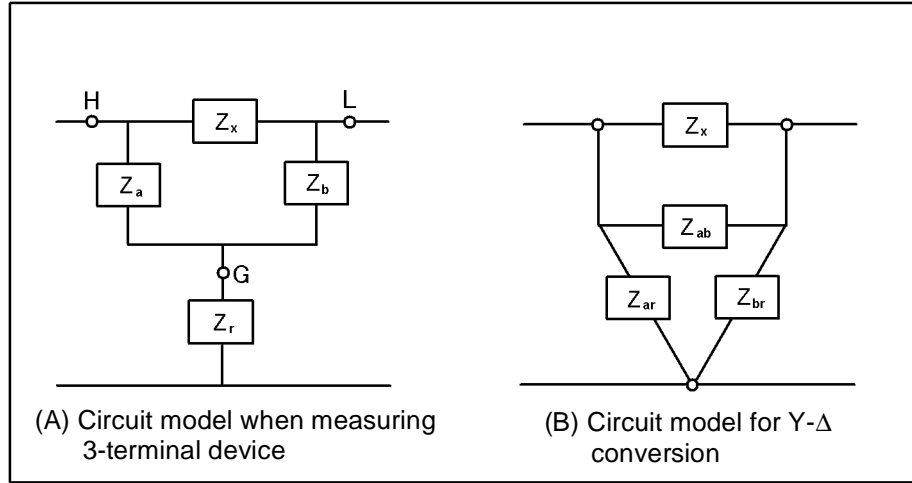
However, if the card terminal holds residual or contact resistance, the voltage at point G in Figure 4-3 (b) does not become 0 V, and a part of I_c flows to the L side. This occurs when the guard terminal's impedance amount R_G and L_G ($R_G + j\omega L_G$) cannot be ignored when compared with the impedance of Z_a and Z_b .

The residual amounts of R_G and L_G of the guard of the 16043A/B are as follows (reference values).

L_G	6 nH or less
R_G	20 m Ω or less

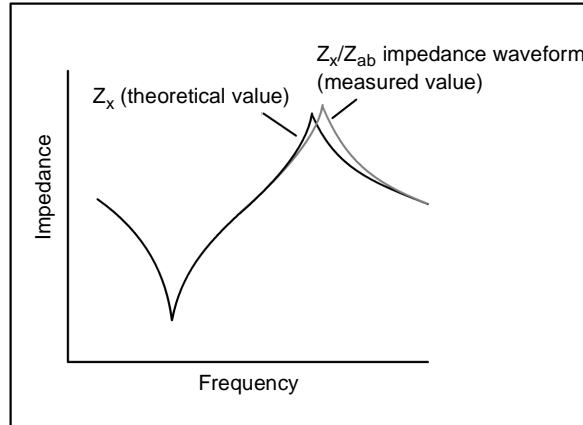
The measurement waveform changes in accordance with the relationship between R_G , L_G and Z_a , Z_b , but in that event it is possible to regard this as described on the following page.

Figure 4-4 **Circuit Model When Measuring 3-terminal Device**



As shown in Figure 4-4 (A), changes in measurement results occur as parallel impedance is formed in relation to Z_x by the impedance Z_r caused by the internal impedance Z_a, Z_b of the 3-terminal device and the test fixture's GND lead impedance Z_r . For example, when measuring a ceramic vibrator with load capacity, the effect of the parallel impedance will shift the antiresonance points of the measurement wave (Figure 4-5).

Figure 4-5 **Impedance Waveform When Guard Measuring a Ceramic Vibrator with Load Capacity**



By subjecting the fixture impedance model of Figure 4-4 to Y-Δ conversion, Z_{ab} can be approximated as follows:

$$Z_{ab} = \frac{Z_a Z_b + Z_r (Z_a + Z_b)}{Z_r}$$

Where, $Z_r = 0.02 + j\omega (6 \times 10^{-9})$

If the parallel impedance of Z_a and Z_b is sufficiently large compared to Z_r , Z_{ab} can be approximated as follows.

$$Z_{ab} \cong \frac{Z_a Z_b}{Z_r}$$

Specifications and Supplemental Performance Characteristics

Supplemental Performance Characteristics

The measurement value Z_{meas} can be expressed as

$$Z_{meas} = \frac{Z_x Z_{ab}}{Z_x + Z_{ab}}$$

and Z_x is found by the following equation.

$$Z_x = \frac{Z_{meas} Z_{ab}}{Z_{ab} - Z_{meas}}$$

Substituting the parallel impedance Z_{ab} in this equation, the impedance Z_x of the device can be found, and the shift becomes the difference from the measurement value Z_{meas} .

5 Maintenance and Service

This chapter mainly describes cleaning and replacement parts for the fixture.

Maintenance

The following describes the maintenance required in order to ensure accomplishment of accurate measurements. Maintenance comprises the following two items.

- Cleaning
- Replacement of contact board

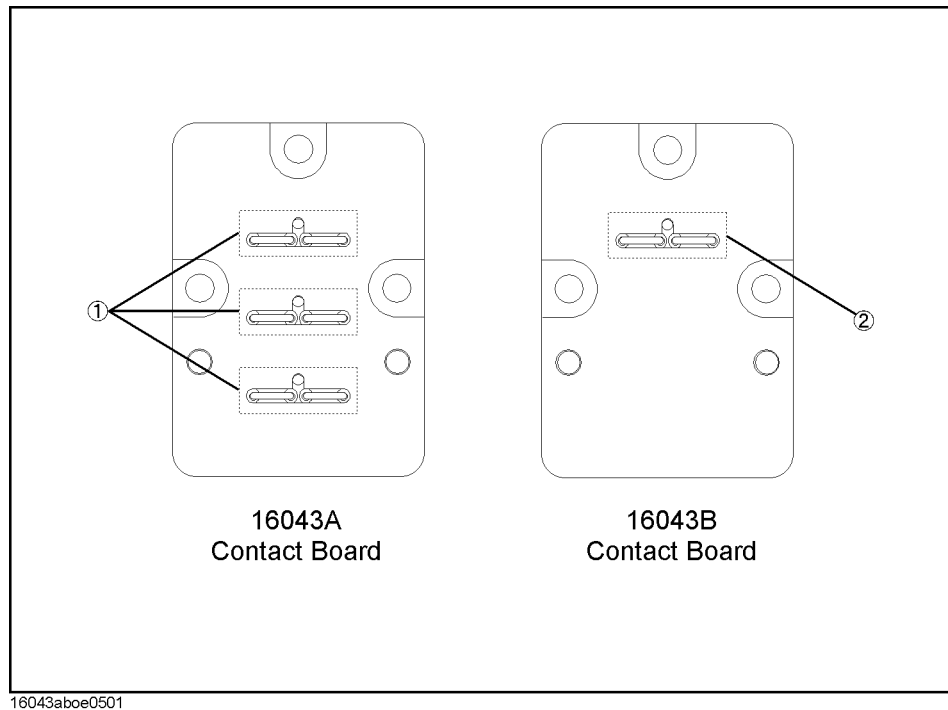
Cleaning

To maintain accurate measurements, the electrode sections of the contact board should be cleaned periodically. As a yardstick, conduct cleaning once for every 1000 measurements. The Cleaning Rod (Agilent parts number 5182-7586) is recommended for cleaning.

The places that need to be cleaned are indicated by (1) and (2) in Figure 5-1.

Figure 5-1

Places to be Cleaned



Replacement of Contact Board

The contact between the contact board and the DUT deteriorates as the contact board is used for repeated measurements, and this adversely affects the measurements. As a yardstick, replace the contact board once for every 10000 measurements. For the replacement procedure, see “Selecting and Mounting the Contact Board” on page 29.

Maintenance Kit

The 16043U/V maintenance kit is available to provide consumable products and replacement parts for the 16043A/B.

16043U/V Maintenance Kit

The 16043U maintenance kit is available for the 16043A, and the 16043V maintenance kit is available for the 16043B. Options are separately available for each kit.

Table 5-1 **16043U Option**

Opt001	Contact Board No.1(16043A)
Opt002	Contact Board No.2(16043A)
Opt003	Contact Board No.3(16043A)
Opt004	Device Guide Set (3 pieces)

Table 5-2 **16043V Option**

Opt001	Contact Board No.1(16043B)
Opt002	Contact Board No.2(16043B)
Opt003	Contact Board No.3(16043B)
Opt004	Device Guide Set (3 pieces)

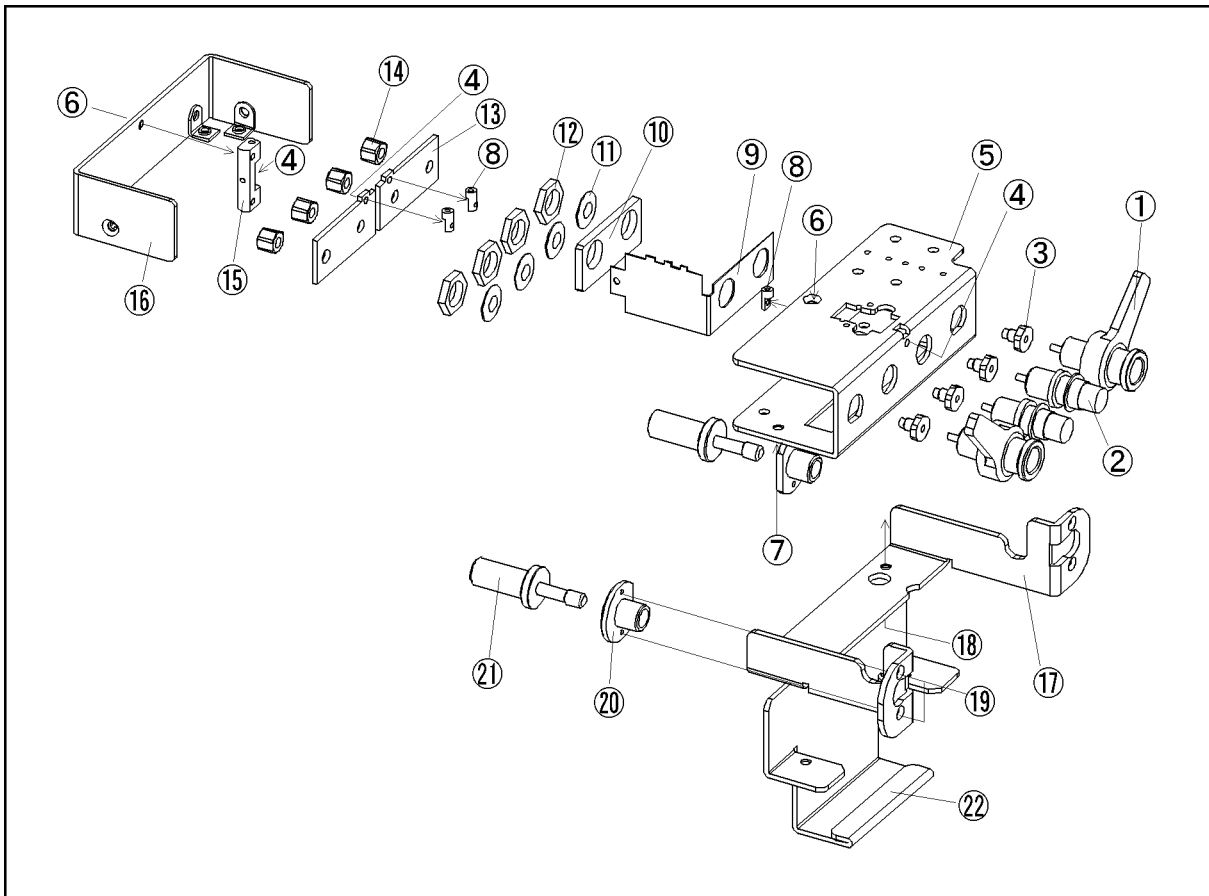
Replaceable Parts

Use the exploded view below to check the part number. Do not disassemble the fixture beyond what is shown in this exploded view.

To order parts, specify the Agilent part number and the check digit (C/D). If the part, which is causing problems, is a part that cannot be disassembled, please order the part unit, which the affected part is a part of. Sales and Service Offices of Agilent Technologies also accept products for repairs.

4-Terminal Pair Assembly

Figure 5-2 Exploded View (Common for the 16043A/B)



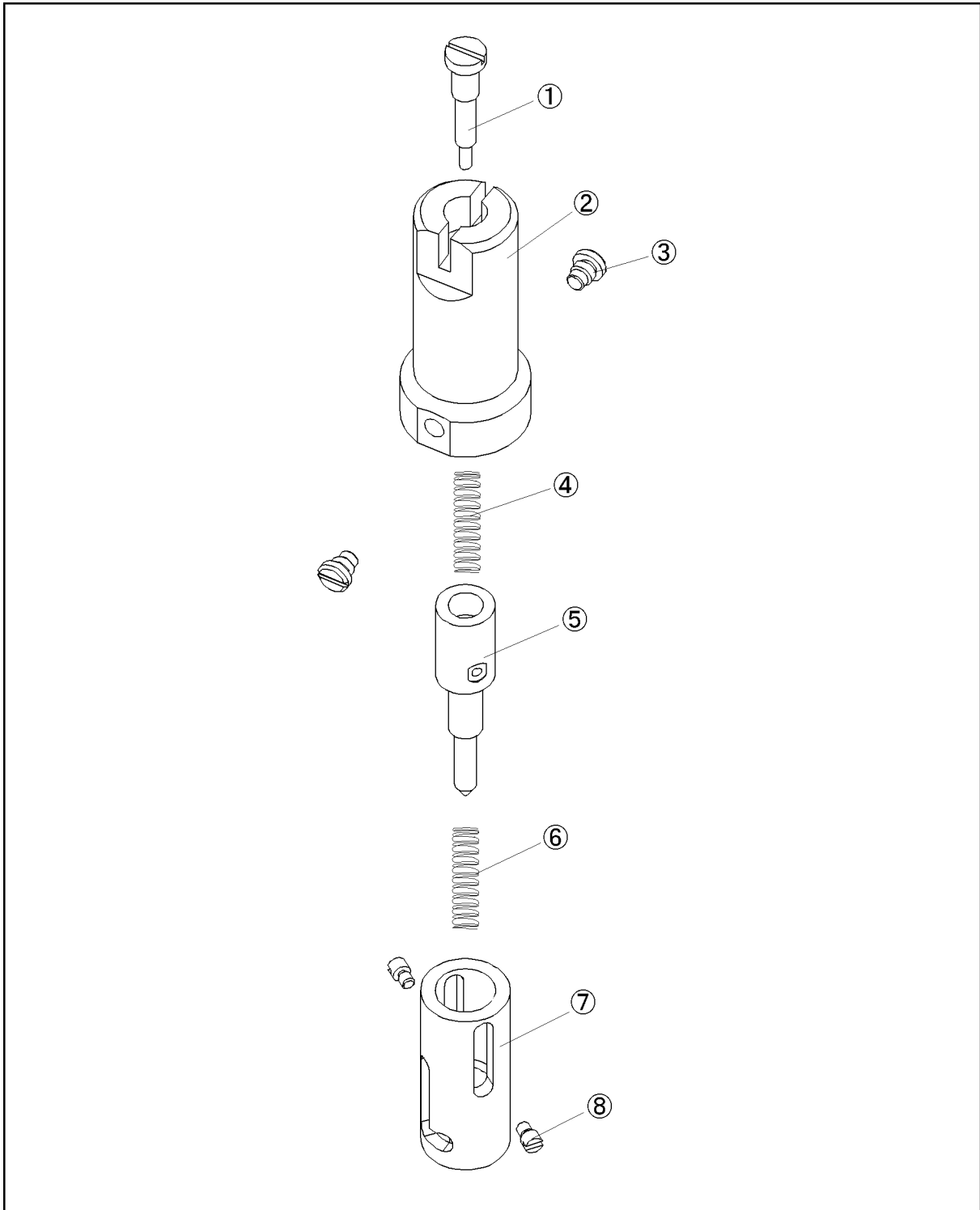
16043aboj0503

Table 5-3 Replaceable Parts (Common for the 16043A/B)

No.	Agilent Part No.	C/D	Qty	Description
1	16047-60015	7	2	BNC Connector Assembly
2	16047-60016	8	2	BNC Connector
3	16380-24001	9	4	Terminal
4	0515-0977	3	4	Screw M2L4
5	N/A		1	Cover
6	0515-0999	9	3	Screw M2.5L4
7	0515-0914	8	2	Screw M3L6
8	16043-24003	3	3	Clevis
9	16043-01202	6	1	Shield
10	16043-00606	2	1	Plate (16043A)
	16043-00602	8	1	Plate (16043B)
11	2190-0016	8	4	Washer
12	2950-0043	8	4	Nut
13	16043-00604	0	2	Plate
14	0535-0043	6	4	Nut
15	16047-24025	3	1	Sleeve
16	N/A		1	Cover
17	16043-01203	7	1	Angle
18	0515-0914	8	2	Screw M3L6
19	0515-0952	4	4	Screw M2L4
20	16047-24026	4	2	Flange
21	16047-24021	9	2	Knob
22	16043-01212	8	1	Angle

DUT Holder

Figure 5-3 Exploded View (DUT Holder Common for 16043A/B)



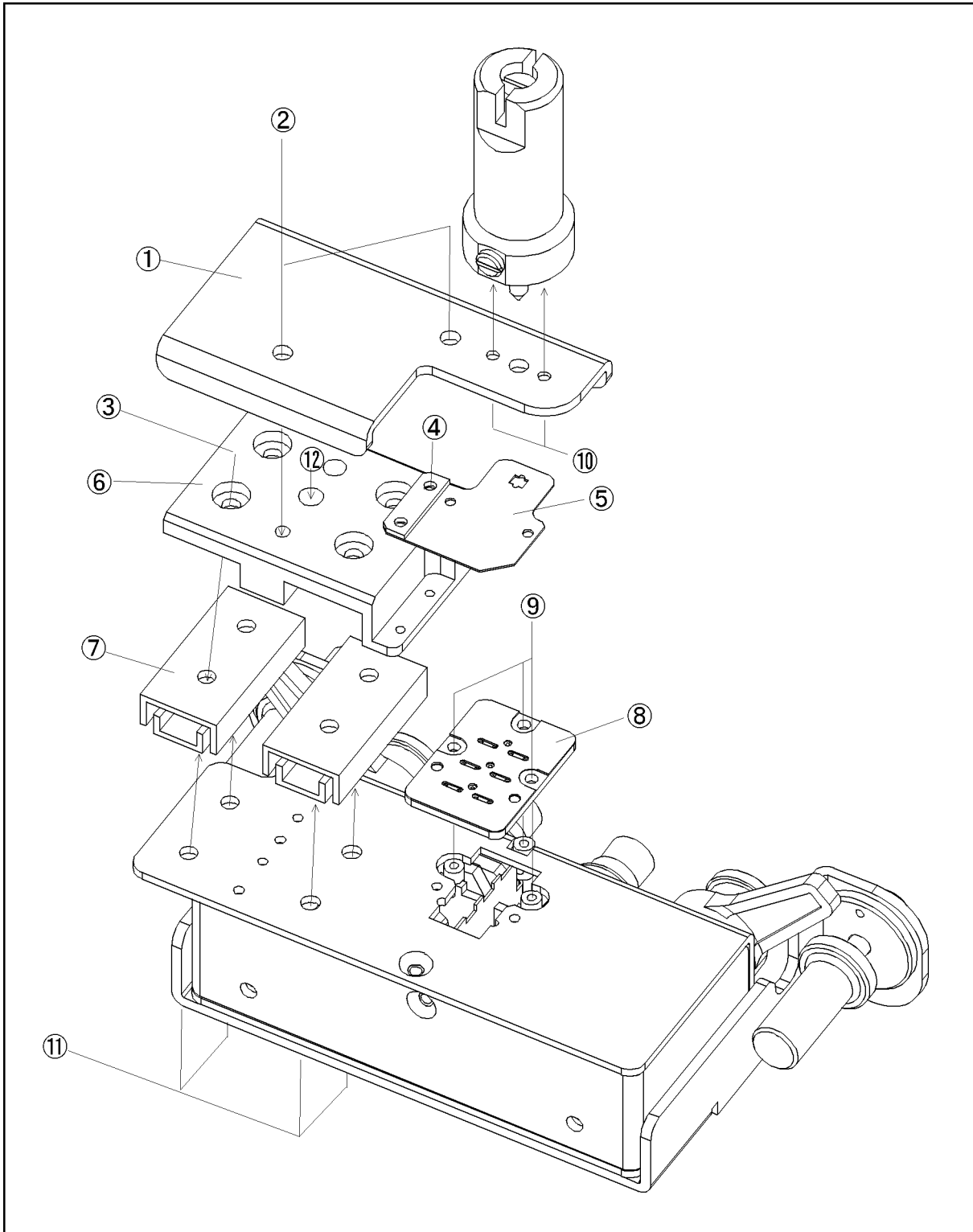
16043aboj0504

Table 5-4 **Replaceable Parts (DUT Holder Common for 16043A/B)**

No.	Agilent Part No.	C/D	Qty	Description
1	16043-24013	5	1	Screw
2	16043-24012	4	1	Cover
3	16043-24015	7	2	Screw
4	1460-2636	9	1	Spring
5	16043-25001	3	1	Rod
6	1460-2635	8	1	Spring
7	16043-24011	3	1	Cylinder
8	16043-24014	6	2	Screw

Device Holding Block

Figure 5-4 Exploded View (Device Holding Block for 16043A)



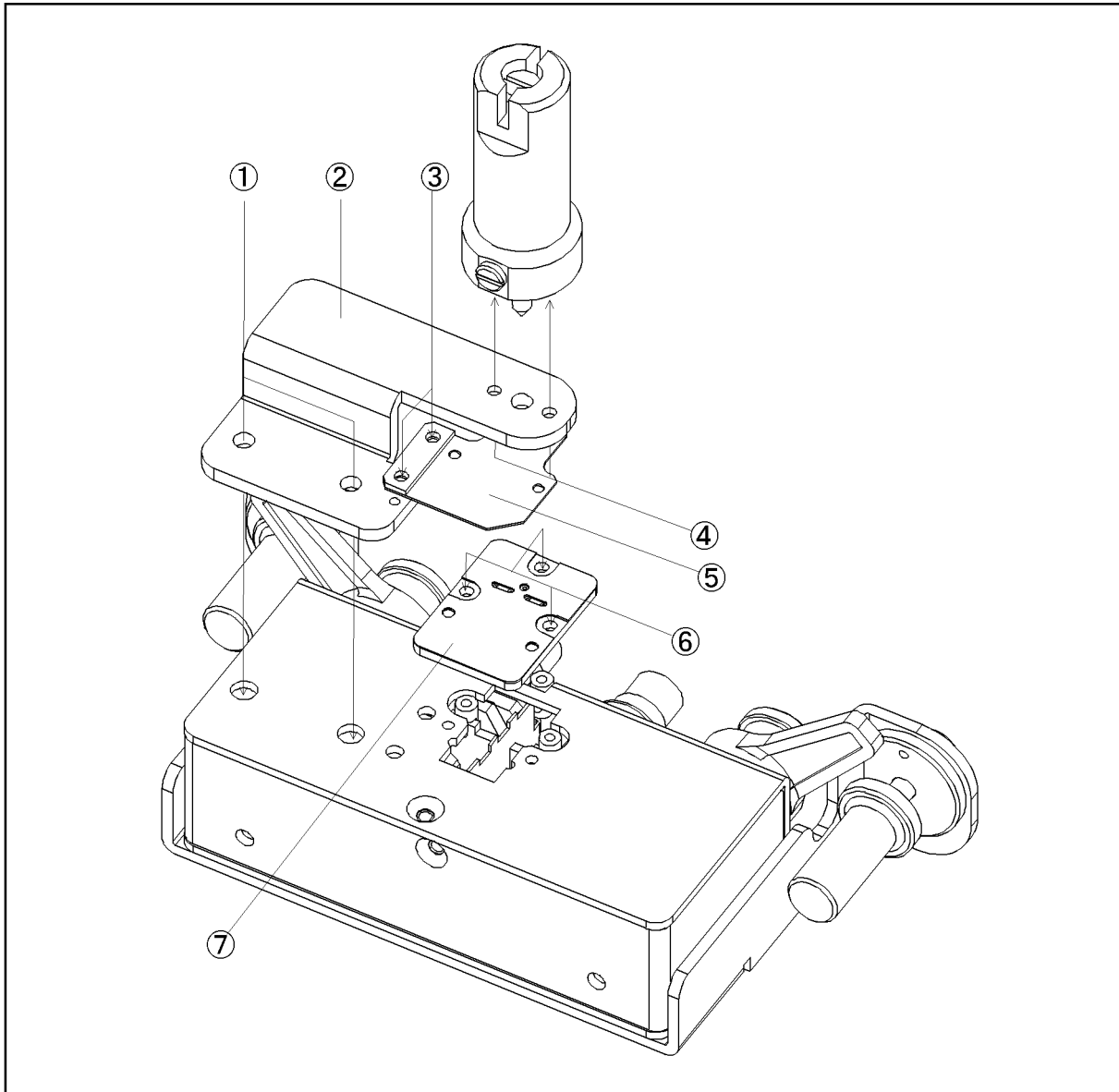
16043aboj0502

Table 5-5 Replaceable Parts (Device Holding Block 16043A)

No.	Agilent Part No.	C/D	Qty	Description
1	16043-01201	5	1	Angle
2	0515-0924	0	2	Screw M3L6
3	0515-1508	8	4	Screw M3L4
4	0515-2791	3	2	Screw M2L3
5*1	16043-00601	7	1	DUT Guide
6	16043-20001	3	1	Base
7	1494-0078	0	2	Slide Unit
8*1	16043-66501 16043-66502 16043-66503		1	Contact Board No.1(16043A) Contact Board No.2(16043A) Contact Board No.3(16043A)
9	0515-0977	3	3	Screw M2L4
10	0515-0994	4	2	Screw M2L6
11	0515-0924	0	2	Screw M3L6
12	0570-1634	7	1	Ball Plunger

*1. The maintenance kit is available to provide replaceable parts for the 16043A/B. Refer to “Maintenance Kit” on page 49 for detail.

Figure 5-5 Replaceable Parts (Device Holding Block 16043B)



16043aboj0507

Table 5-6 Replaceable Parts (Device Holding Block 16043B)

No.	Agilent Part No.	C/D	Qty	Description
1	0515-0924	0	2	Screw M3L6
2	16043-01204	8	1	Angle
3	0515-2791	3	2	Screw M2L3
4	0515-0994	4	2	Screw M2L6
5*1	16043-00601	7	1	DUT Guide
6	0515-0977	3	3	Screw M2L4
7*1	16043-66511 16043-66512 16043-66513		1	Contact Board No.1(16043B) Contact Board No.2(16043B) Contact Board No.3(16043B)

*1. The maintenance kit is available to provide replaceable parts for the 16043A/B. Refer to “Maintenance Kit” on page 49 for detail.

Other Parts

Table 5-7 Replaceable Parts (Other Parts)

No.	Agilent Part No.	C/D	Qty	Description
1	16043-60150 16043-60250	7 8	1	Carrying Case (for 16043A) Carrying Case (for 16043B)
2	16043-24004	4	2	Pin
3	8710-2081	6	1	Tweezers
4	16043-00607	3	1	Fixture for Position Adjustment (16043B)
5	16043-90000 16043-97000		1	OP & SVC Manual(English) OP & SVC Manual(Japanese)

Replacement of Parts

The following explains the method for replacing the sliding mechanism.

Sliding Function (16043A Only)

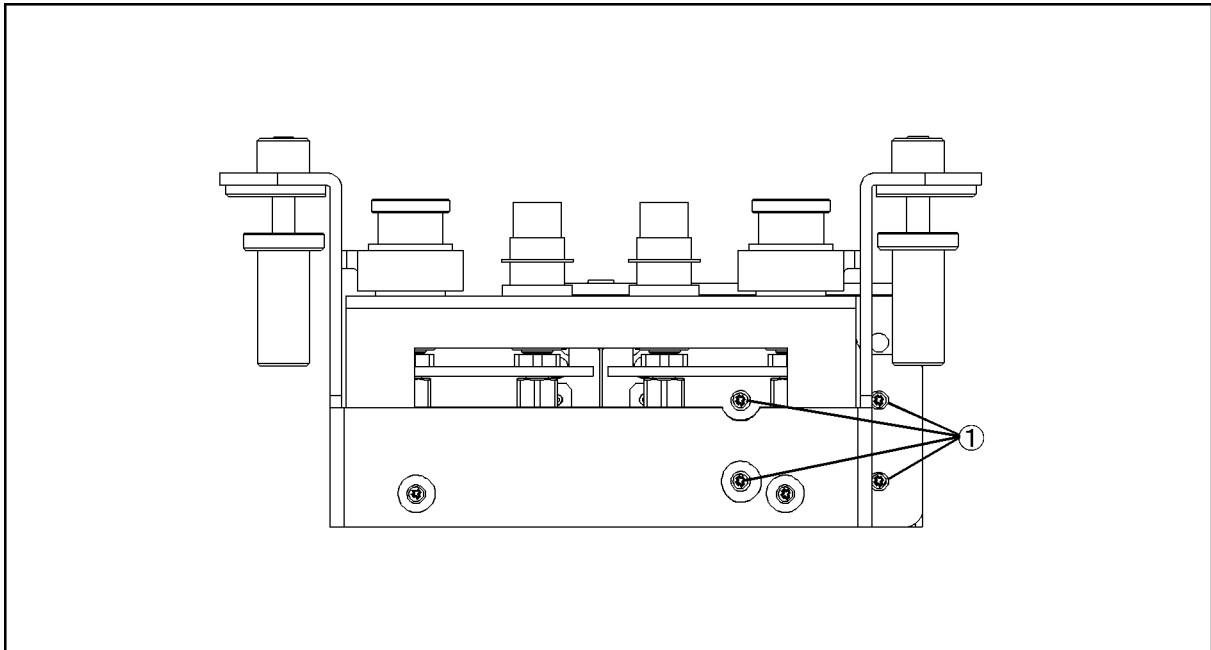
Required Tools

- Posidriv screwdriver #2
- Hex wrench 2.5 mm

Procedure

- Step 1.** From the underside of the fixture, remove the screws (Figure 5-6 (1)) securing the sliding unit.

Figure 5-6 **Underside of Fixture**



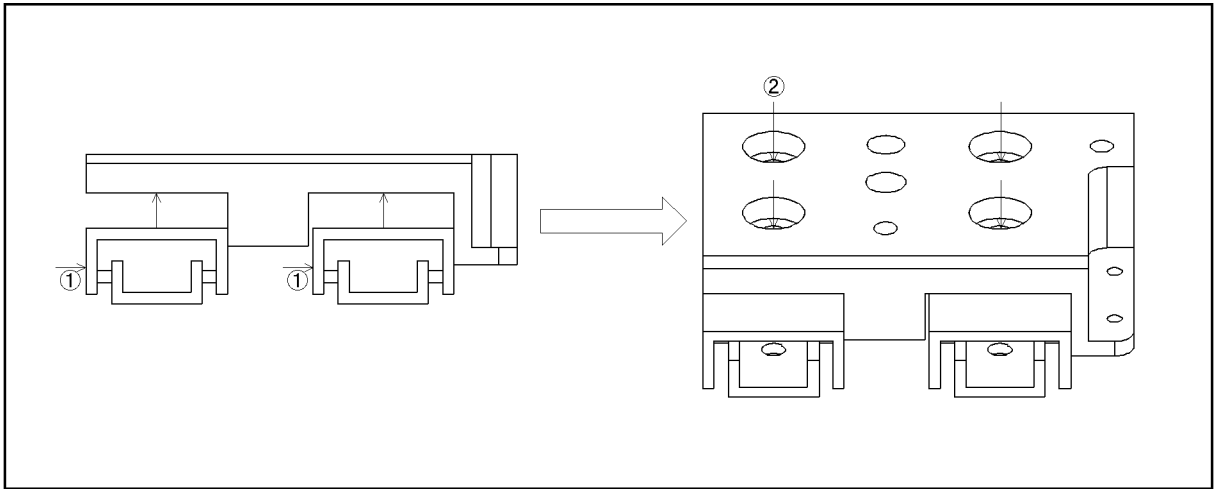
16043aboj0506

- Step 2.** Detach the upper cover from the fixture.
- Step 3.** Remove the sliding unit.
- Step 4.** Ensure that the right side surface of the replacement slide unit contacts the base (Figure 5-7, (1)), and then secure the sliding unit with the screws. (Figure 5-7, (2))

CAUTION

If there is a gap between the base and slide, smooth movement of the sliding mechanism may be prevented.

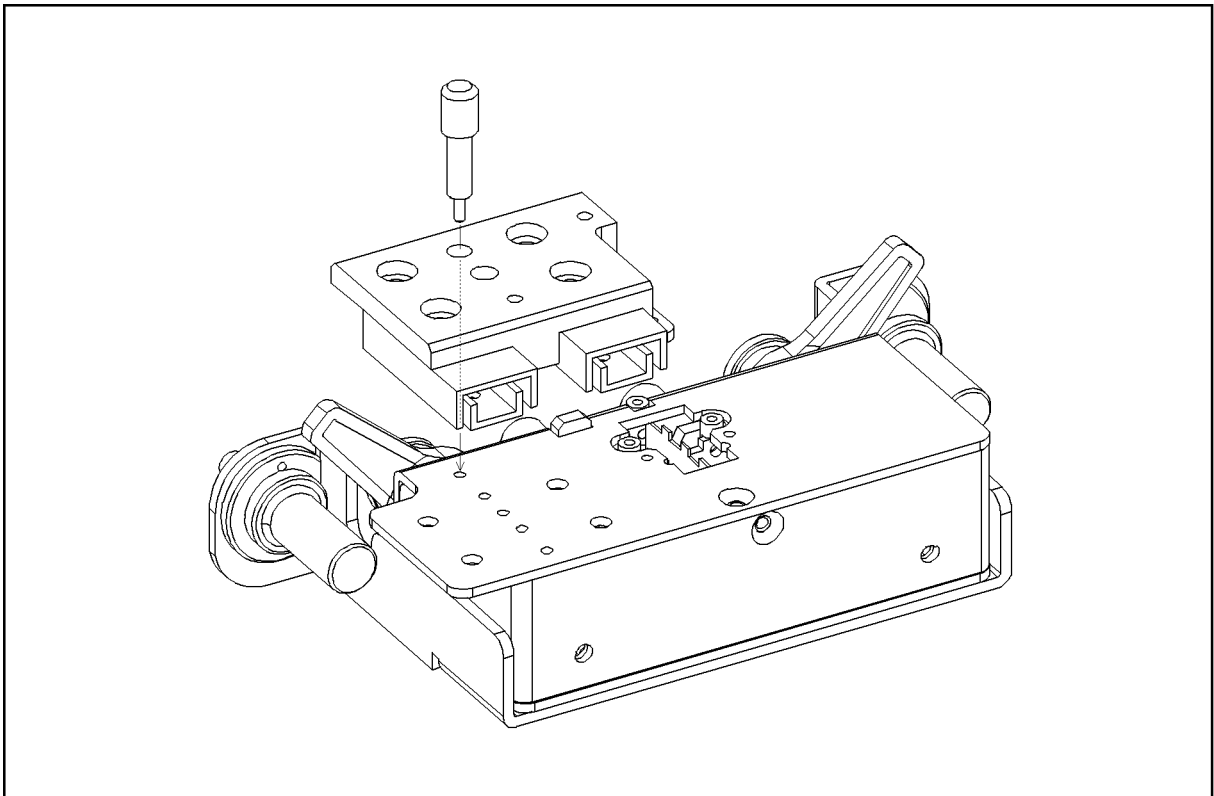
Figure 5-7 Attaching the Sliding Unit



16043aboj0511

Step 5. Secure the sliding mechanism with the pin (Agilent P/N 16043-24004) as shown in Figure 5-8.

Figure 5-8 Determining Sliding Mechanism Position



16043aboj0510

Step 6. Check that the sliding mechanism moves smoothly, and also that it can be fixed at designated positions. If the mechanism moves abnormally, adjust the position of the ball plunger while referring to “Adjusting Ball Plunger (16043A only).”

Maintenance and Service

Replacement of Parts

- Step 7.** From the underside of the fixture, insert screws and secure the sliding mechanism, then remove the pin.
- Step 8.** Mount the specimen holder while referring to “Adjusting Device Holder Position” on page 61.

Adjusting Ball Plunger (16043A only)

Required Tools

- Posidriv screwdriver #2
- Hex wrench 2.5 mm
- LOCTITE™ #290

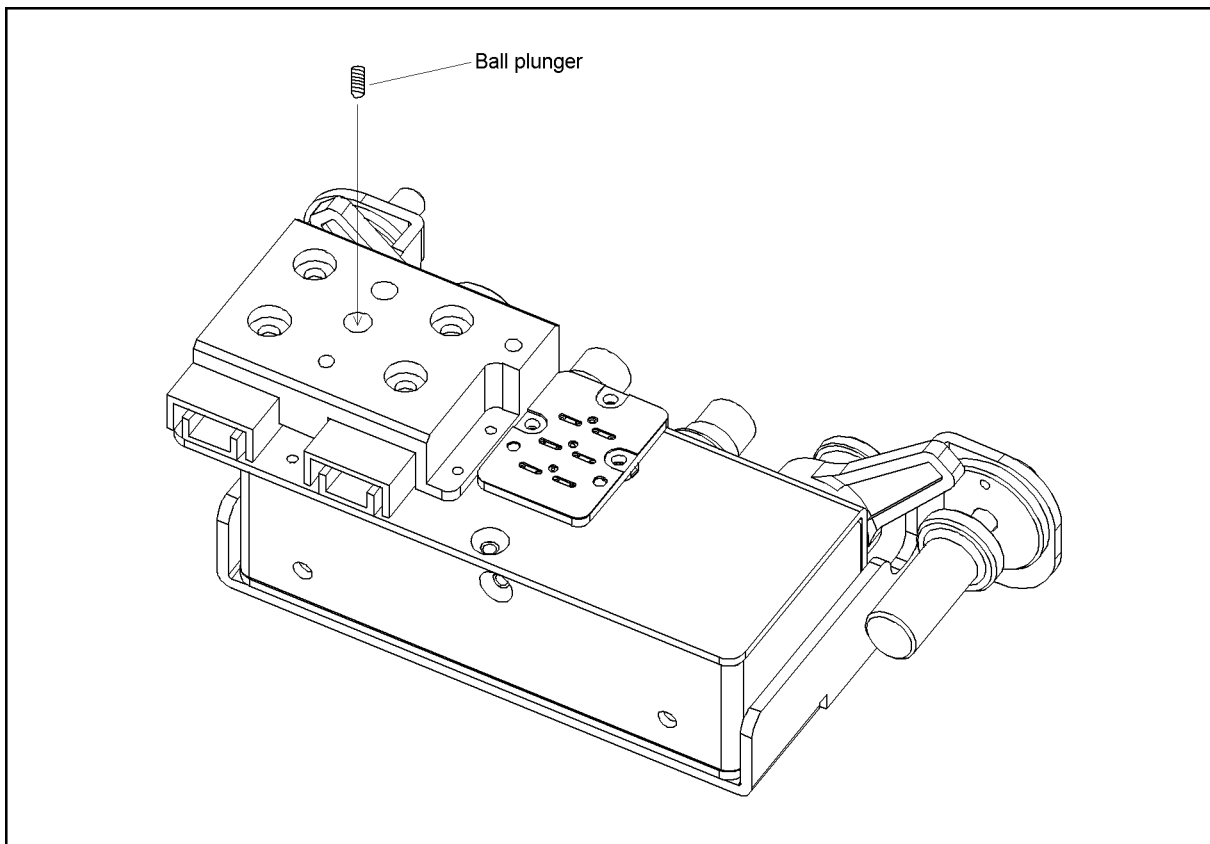
Procedure

- Step 1.** Using the hex wrench, remove the ball plunger (Figure 5-9).

NOTE

The ball plunger is secured with LOCTITE™*1. A certain force will be required to remove it.

Figure 5-9 **The Ball Plunger**



16043aboe0508

*1. LOCTITE™ is U.S. trademark of Loctite Corporation

Step 2. Apply LOCTITE™ to the screw thread of the side of the ball plunger.

CAUTION

Be sure not to apply LOCTITE™ to the tip of the ball.

Step 3. Rotate clockwise until the ball plunger can be rotated no further.

Step 4. Rotate the ball plunger 1/4 turn counterclockwise.

Step 5. Wait until the LOCTITE™ hardens. The ball plunger is now held in place.

Adjusting Device Holder Position

The following explains the procedure for position adjustment of the specimen holder for 16043A. For the procedure for 16043B, refer to “Mounting the 16043B Contact Board” on page 30.

Required Tools

- Fixture for position adjustment (p/n 16043-00607)
- Posidriv screwdriver #2

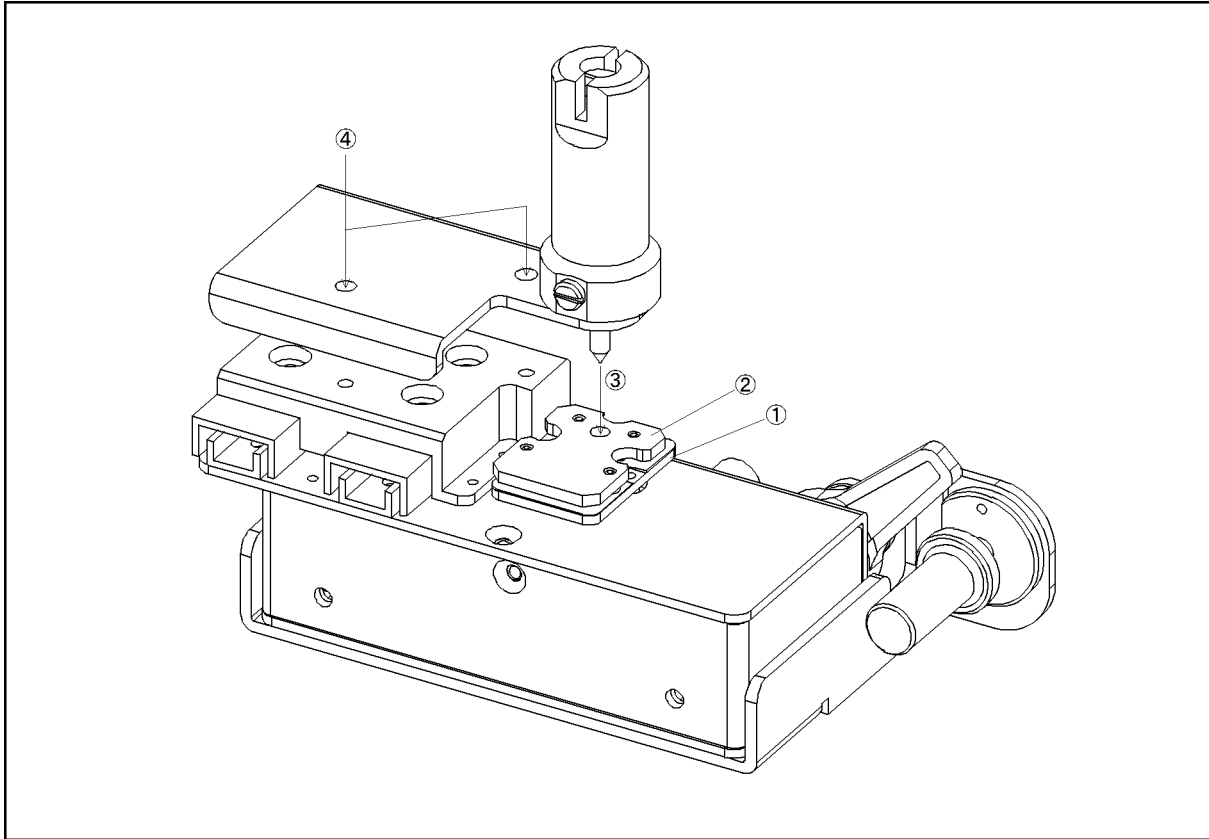
Procedure

Step 1. Remove the device guide.

Step 2. Mount the positioning tool (Figure 5-10 (2)) on the contact board (Figure 5-10 (1)).

Step 3. Lower the tip (Figure 5-10 (3)) of the specimen holder to lock by inserting it into the hole in the positioning tool.

Figure 5-10 **Adjusting Device Holder Position**



16043aboj0509

Step 4. Secure the cover with screws (Figure 5-10 (4)).

Step 5. Raise the specimen holder, and remove the positioning tool.

Assembling Check

The assembling check is for confirming that assembling has been conducted correctly. Perform an assembling check after replacement of the following parts.

- Contact Board
- Parts (1) to (16) in Figure 5-2 on page 50.

Required Instruments

- Tester or Multimeter

Procedure

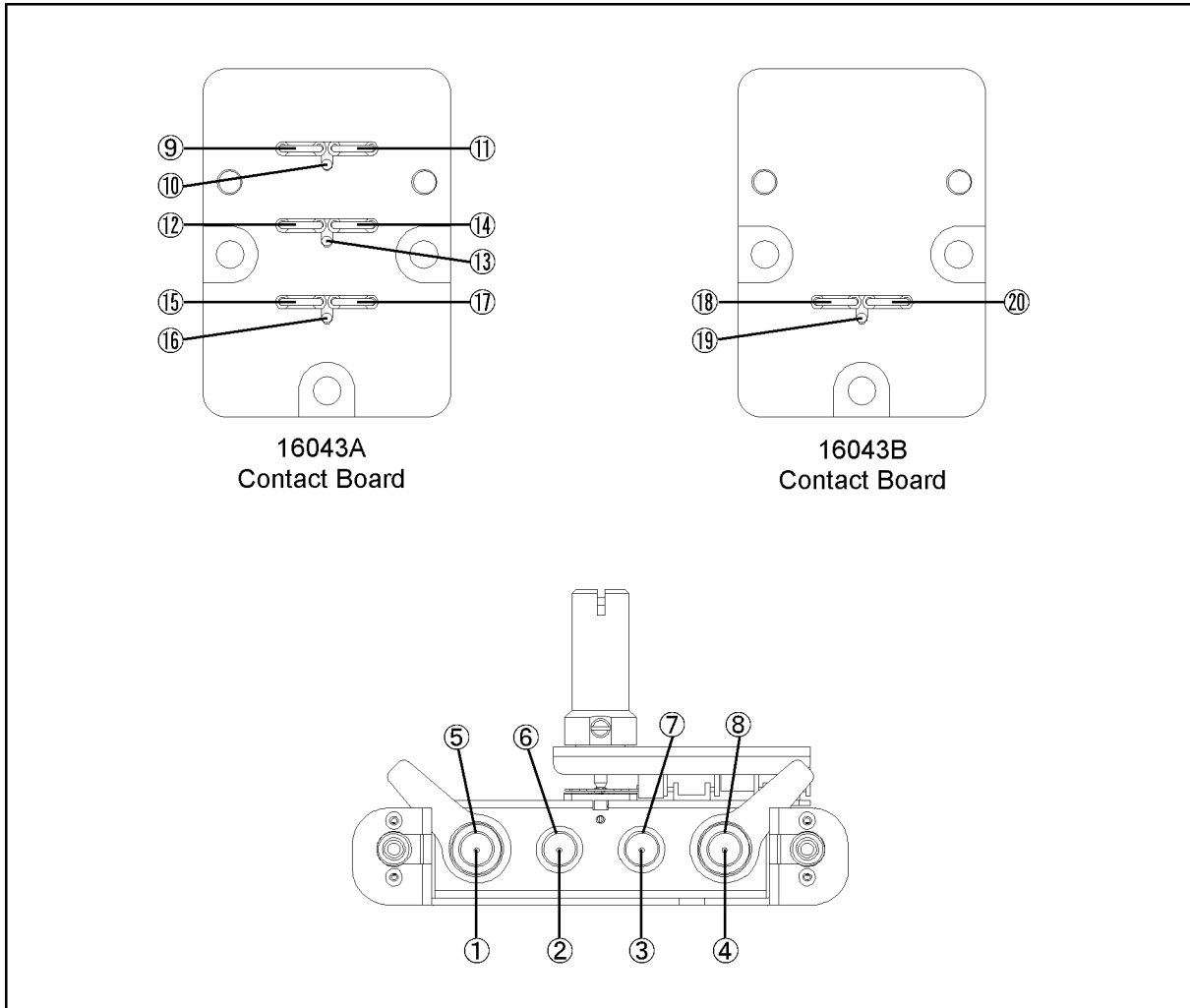
- Step 1.** Ensure that nothing is placed on the contact board.
- Step 2.** Remove the device guide.
- Step 3.** Use a tester or a multimeter to check continuity. The continuity of each position is shown in Table 5-8.

NOTE For the test points, refer to Figure 5-11.

Table 5-8 Assembling Check Items

16043A		16043B	
Path	Continuity	Path	Continuity
(1) to (2)	Yes	(1) to (2)	Yes
(3) to (4)	Yes	(3) to (4)	Yes
(1) to (4)	No	(1) to (4)	No
(1) to (5)	No	(1) to (5)	No
(3) to (5)	No	(3) to (5)	No
(5) to (6)	Yes	(5) to (6)	Yes
(5) to (7)	Yes	(5) to (7)	Yes
(5) to (8)	Yes	(5) to (8)	Yes
(1) to (9)	Yes	(1) to (18)	Yes
(4) to (10)	Yes	(4) to (20)	Yes
(5) to (11)	Yes	(5) to (19)	Yes
(1) to (13)	Yes		
(4) to (14)	Yes		
(5) to (12)	Yes		
(1) to (15)	Yes		
(4) to (17)	Yes		
(5) to (16)	Yes		

Figure 5-11 Assembling Check Points



16043aboe0505