

HP 16044A Test Fixture

Operation and Service Manual

Third Edition



HP Part No. 16044-90020

April 1999

Printed in: Japan

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December 1998 First Edition

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April 1999 Third Edition

Safety Summary

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

The Hewlett-Packard Company 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 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 Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

- **Dangerous Procedure Warnings**

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

WARNING

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

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard 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 Hewlett-Packard 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, Hewlett-Packard 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 HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instruction when properly installed on that instrument. HP 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. HP 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. HP 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 Hewlett-Packard products.

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

Safety Symbol

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



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



Alternating current.



Direct current.



On (Supply).



Off (Supply).



In position of push-button switch.



Out position of push-button switch.



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

WARNING

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

CAUTION

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

NOTE

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

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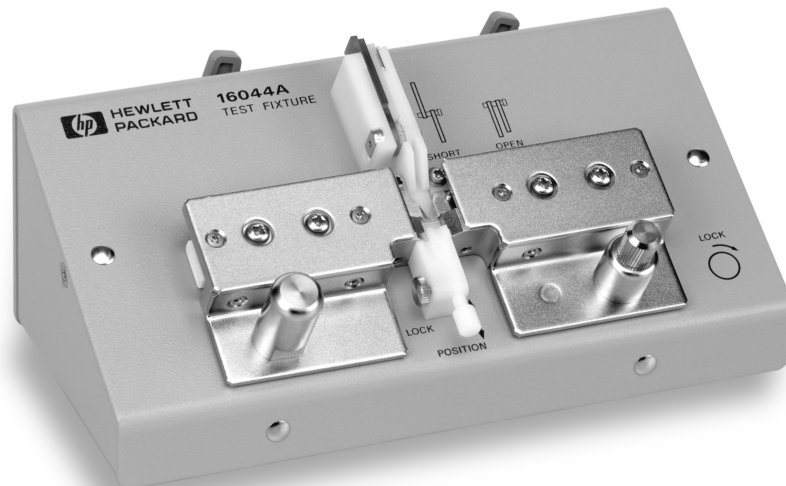
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1 Overview

Product Overview

The HP 16044A is a four-terminal test fixture designed for impedance measurements. Its precise measurement capabilities is adapted to evaluate low impedance components such as high value capacitor. Contact resistance produces an error in the D (dissipation factor) readings. In order to solve this problem, HP 16044A was designed to have a Kelvin (four terminal) contact, which ensures repeatable measurements for low impedance SMD L,C and R components. In addition , the HP 16044A is equipped with a mechanism that can easily perform Open and Short correction.

Figure 1-1 **Product Overview**



Contents

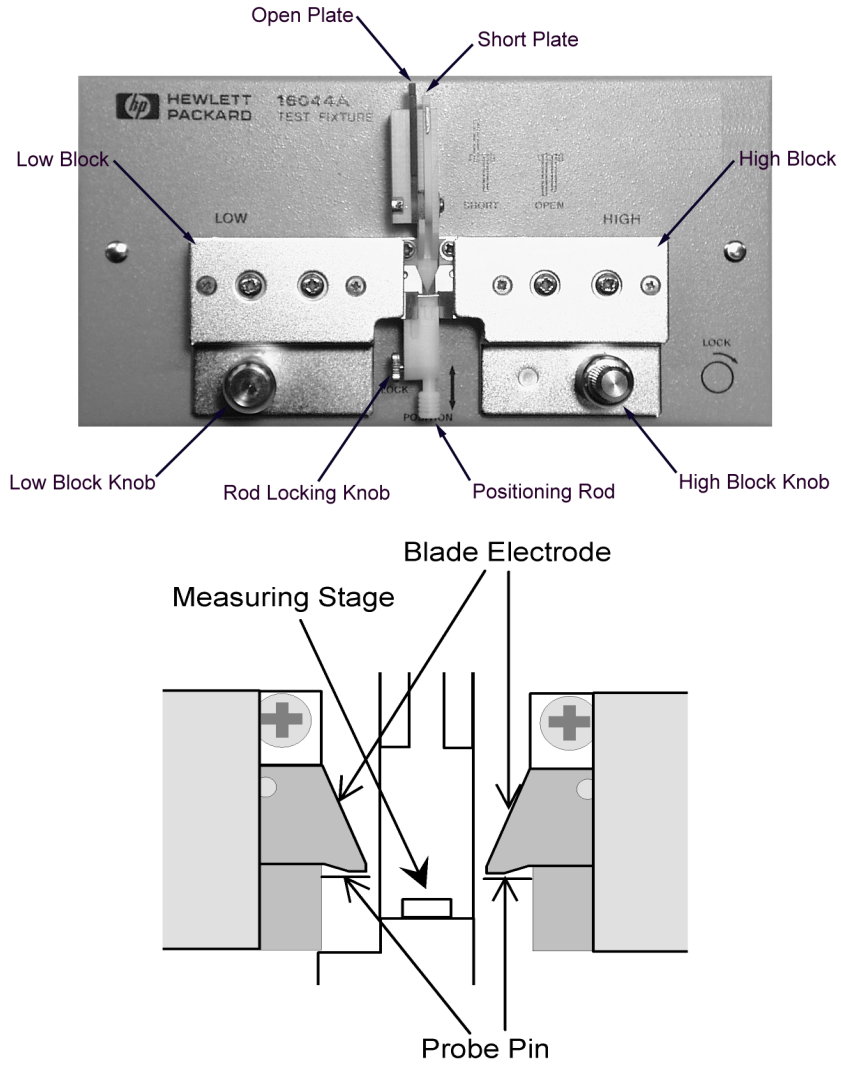
Table 1-1 shows contents of the HP 16044A.

Table 1-1 **Contents**

Description	HP Part Number	Quantity
HP 16044A Test Fixrure	HP 16044A	1
Operation and Service Manual (English)	16044-90010	1
Operation and Service Manual (Japanese)	16044-97010	1
Cleaning Rod	5182-7586	1

Functions

Figure 1-2 HP 16044A Parts



Parts	FUNCTION
Open Plate	Used for open correction measurement.
Short Plate	Used for open and short correction measurement.
Low Block	Connected to the L_{CUR} , L_{POT} terminals.
High Block	Connected to the H_{CUR} , H_{POT} terminals.
Low Block Knob	Use for lateral adjustments.
High Block Knob	Use for lateral adjustments, rotating the knob clockwise sets the block in a fix position.
Positioning Rod	Used for adjusting the stage height.
Rod Locking Knob	Used for locking the positioning rod in a fix position.
Blade Electrode	Connects the DUT electrode with the probe pin. The Blade Electrode of each Low and High Blocks are connected to the L_{POT} and H_{CUR} respectively.
Probe Pin	Connects the DUT electrode with the blade electrode. The Probe Pin of each Low and High Blocks are connected to the L_{CUR} and H_{POT} respectively.
Measuring Stage	Where the DUT is mounted.

2 **Operation**

This chapter describes the proper methods for open and short correction and DUT measurement.

Performing Open and Short Correction

To enhance measurement accuracy, open and short correction should be done before DUT measurement. The following procedure shows correction and measurement by the HP 16044A.

CAUTION

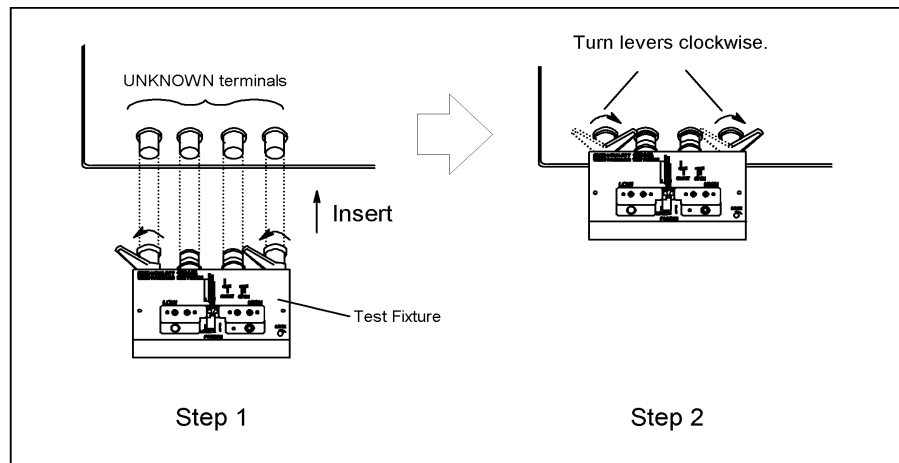
Proper handling care should be taken when using the test fixture. Refrain from applying brute force, doing so could damage the fixture. Particularly the upper portion (where the DUT is mounted) of the test fixture, where all the sensitive parts have been accurately set and adjusted. Do not place the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

Connecting the HP 16044A

1. Set the cable length setting of the measuring instrument at 0 m.
2. Connect the HP 16044A directly to the UNKNOWN terminals as shown in Figure 2-1.

Figure 2-1

Connecting the HP16044A



Performing Short Correction

1. Refer to Figure 2-2(1), adjust the positioning rod to its minimum height by gently pulling it backwards.
2. Adjust the High Block to the right, giving space for the short plate before locking the horizontal knob.

CAUTION

If the High Block can not be adjusted to the right, Do Not to pull down the short plate. Doing so could damage the probe pin.

3. Move the Low Block to the left, hold to a position before pulling down the short plate.
Pull down the short plate (Figure 2-2 (2)).

CAUTION

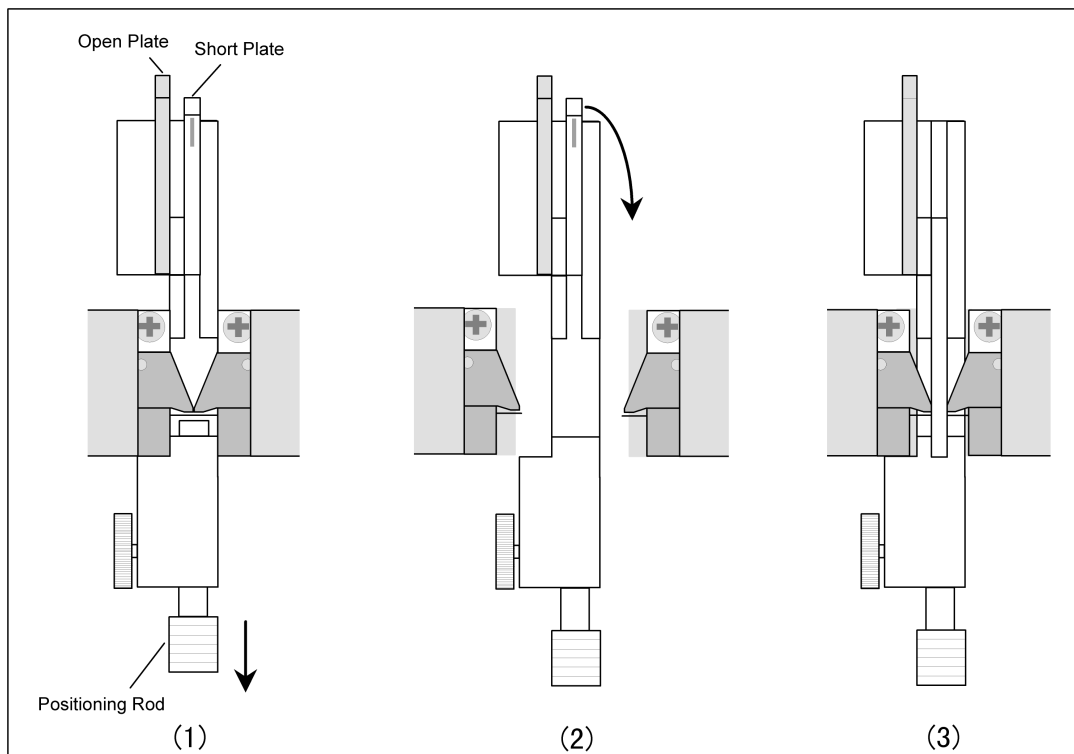
When operating the Low/High Block, take caution in applying force to the short plate. Sudden impact could damage the blade electrode and probe pin.

4. Connect the Low Block gently to the short plate.
5. Loosen the horizontal locking knob, connect the High Block slowly to the short plate.
6. Follow the directions in your manual when using the measuring instrument. Make sure that you perform the short correction (Figure 2-2 (3)).

CAUTION

During operation, with the High/Low Block connected to the short plate. Do Not attempt to move the short plate, doing so could damage the probe pin.

Figure 2-2 Performing Short Correction



Performing Open Correction

1. Adjust the positioning rod to its minimum height by gently pulling it backwards.
2. Adjust the High Block to the right giving enough space for the short plate before locking the horizontal knob.
3. Move the Low Block to the left, hold to a position before pulling down the open plate (Figure 2-3(1)).

CAUTION

If the Low Block can not be adjusted to the left terminal, Do Not pull down the open plate. Doing so could damage the probe pin.

4. Connect the Low Block slowly to the open plate.

CAUTION

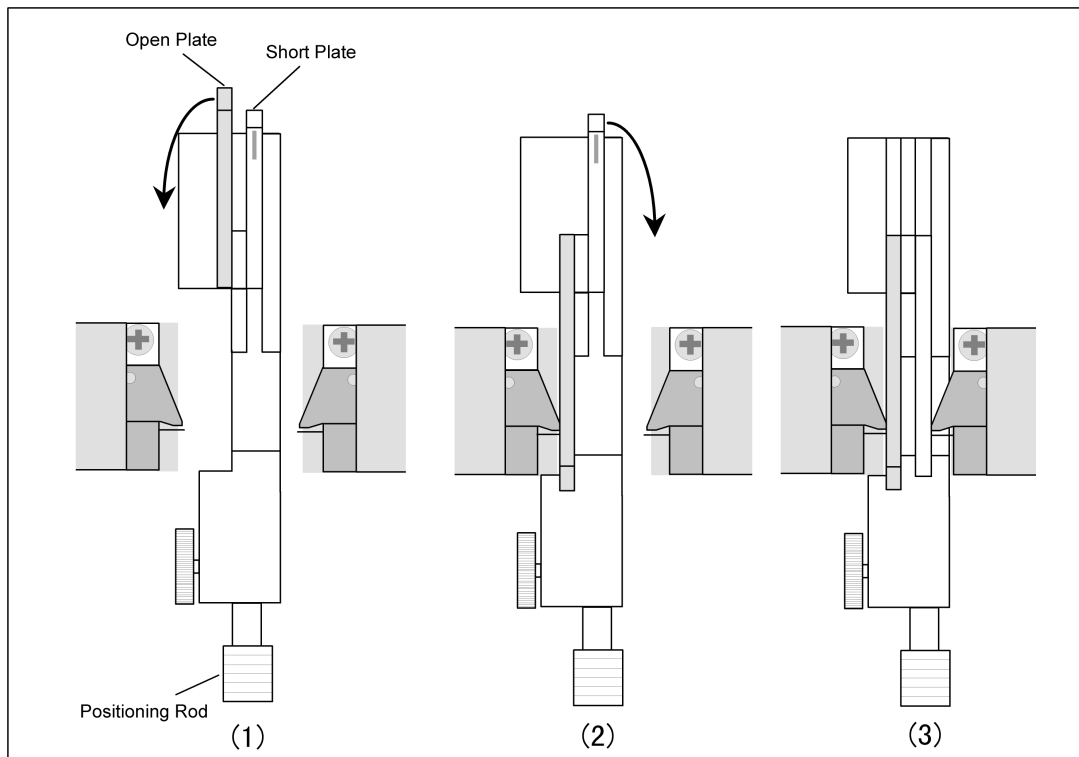
When operating the Low/High Block, take caution in applying force to the open and short plate. Sudden impact could damage the blade electrode and probe pin.

5. Slowly pull down the short plate (Figure 2-3(2)).
6. Loosen the horizontal locking knob, connect the High Block slowly to the short plate (Figure 2-3(3)).
7. Follow the directions in your manual when using the measuring instrument. Make sure that you perform the open correction.

CAUTION

During operation, when the High/Low Block is connected to the open/short plate. Do Not attempt to move the open/short plate, doing so could damage the probe pin.

Figure 2-3 Performing Open Correction

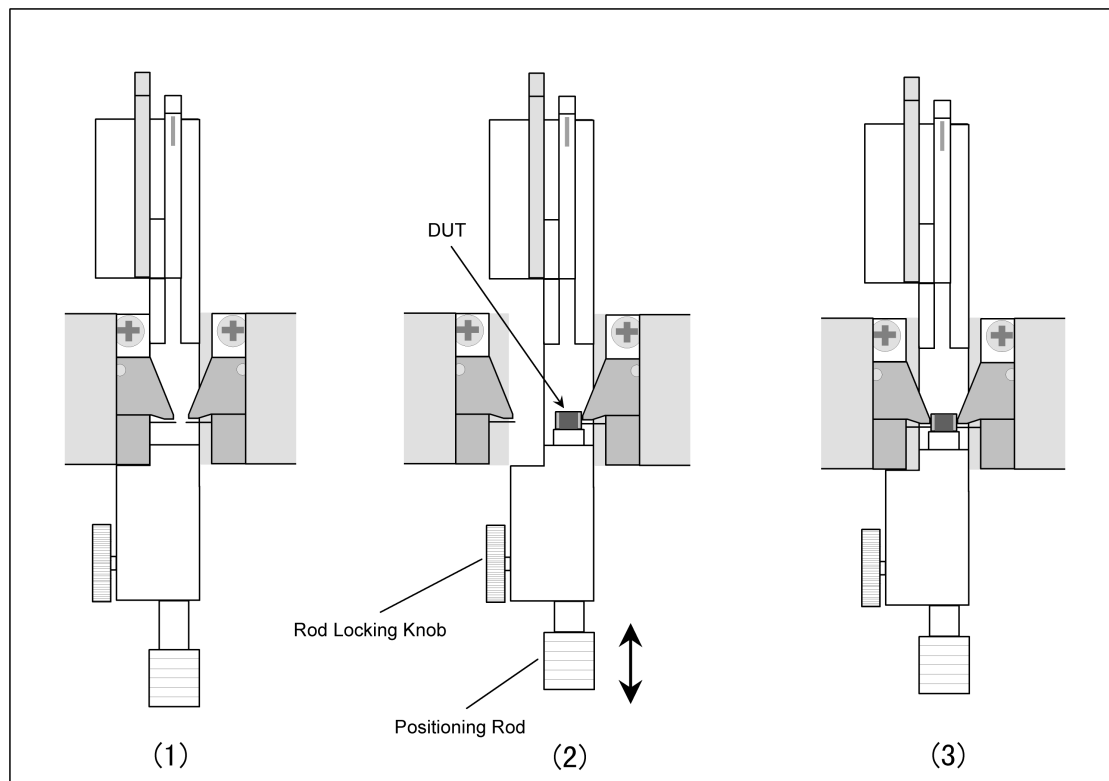


DUT Measurement

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

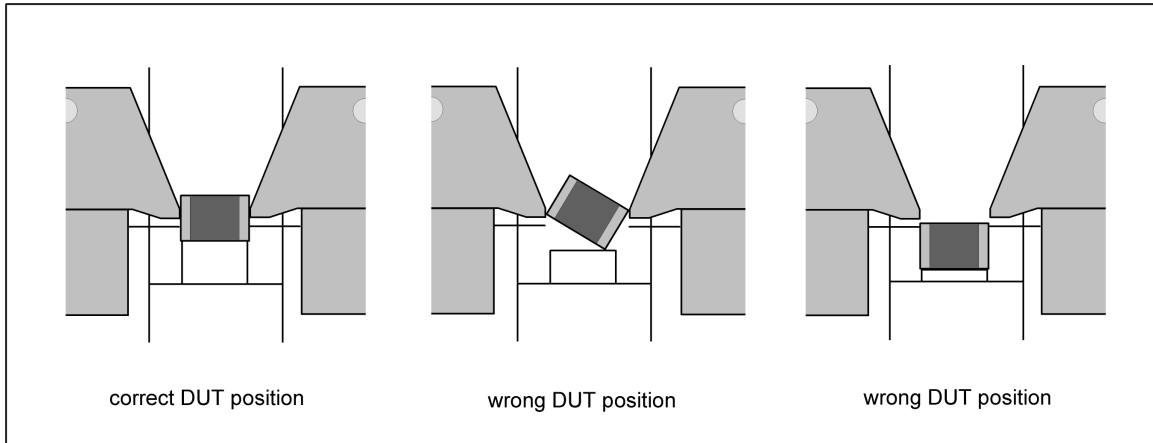
1. Adjust the High Block in order to position the DUT at the center of the measuring stage, then tighten the high block knob (Figure 2-5(1)).
2. Adjust the Low Block to the left then hold to a position giving enough space before placing the DUT on the measuring stage. Mount the DUT on the measuring stage.
3. Adjust the positioning rod with respect to the DUT's size (Figure 2-5(2)).

Figure 2-4 Performing DUT Measurement



NOTE Make sure that proper adjustments are made to ensure accurate measurement. The DUT should be properly connected with the probe pin and blade electrode at four points (refer to Figure 2-5). Even if the DUT is too small use a magnifying lens to make sure that four points are in proper contact.

Figure 2-5 Proper DUT Position



4. Tighten the rod locking knob.
5. Slowly connect the Low Block's blade electrode to the DUT (Figure 2-5(3)).
6. Follow the directions of the operating manual in doing the measurement.
7. If you are going to measure another DUT of the same size, simply adjust the Low Block to the left and change the DUT without moving the High Block.

NOTE Contact pressure could cause measurement variations in the DUT, when measuring ferrite inductor or multi-layer ceramic capacitors with high permittivity.

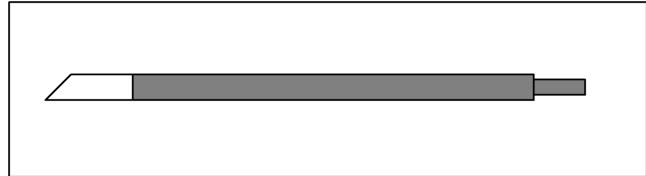
NOTE In case the probe pin got damaged use the provided probe pin with part number HP42110A (probe pin × 4). Replacement procedure is listed on “Chapter 4 Service”.

Cleaning

To keep higher reliability and better measurements, regular cleaning of the following points with the furnished cleaning rod (HP Part Number 5182-7586) is recommended.

Figure 2-6

Cleaning rod



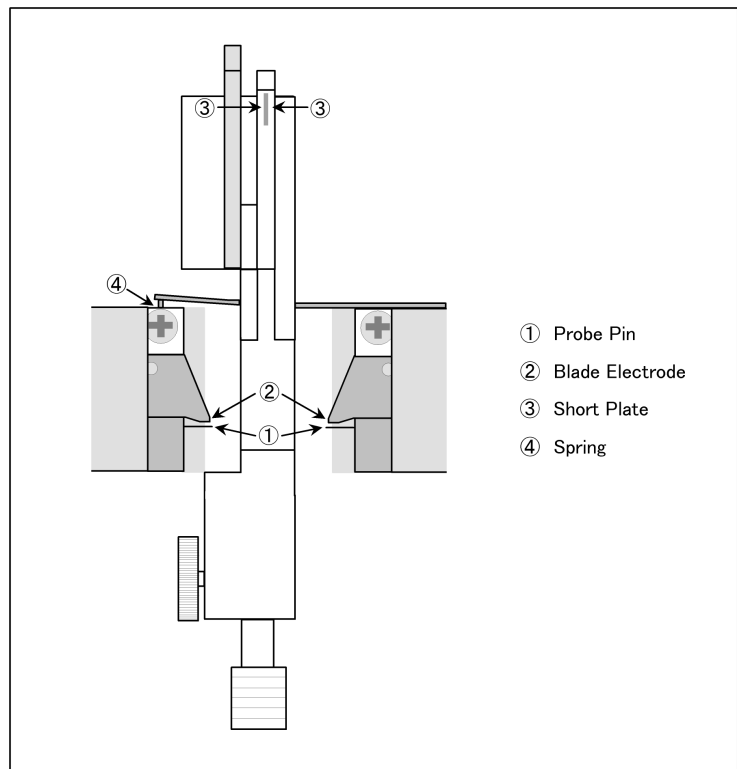
Cleaning Points

Figure 2-7 shows required cleaning points.

- Probe Pin (1 of Figure 2-7, contact points of the DUT)
- Blade Electrode (2 of Figure 2-7, contact points of the DUT)
- Short Plate (3 of Figure 2-7, contact points of the Probe Pin and Blade Electrode)
- Spring (4 of Figure 2-7, contact point of the Low BLock)

Figure 2-7

Cleaning Points



Cleaning Procedure

Scrub the dirt on the points shown in Figure 2-7 with the rubber (white) side of the cleaning rod. Particularly the probe pin, the plating of the DUT's electrode could stick to the probe pin. Take caution when cleaning the probe pin with the cleaning rod. The probe pin is very sensitive and could be damaged easily.

NOTE

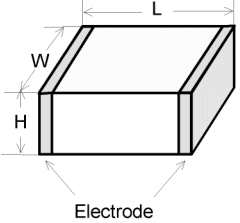
Replace the probe pin if the dirt can not be removed. And use the provided probe pin with part number HP42110A (probe pin × 4). Replacement procedure is listed on “Chapter 4 Service”.

3

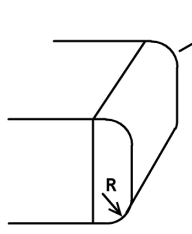
Specifications and Supplemental Performance Characteristics

This chapter provides the specifications and supplemental performance characteristics of the HP 16044A test fixture.

Specifications

Applicable Instruments	LCR meters and Impedance Analyzers with four-terminals	
Applicable DUT Type	SMD(surface mount device) or chip components	
Applicable DUT Size	 $0.8\text{mm} \leq H \leq 3.0\text{mm}$ $0.8\text{mm} \leq W \leq 8.0\text{mm}$ $1.0\text{mm} \leq L \leq 8.0\text{mm}$	
Frequency	$\leq 10\text{MHz}$	
DC Bias	$\pm 40\text{V}$ Maximum	
Operating Environment	temp.	0°C to $+55^{\circ}\text{C}$
	humidity	15% to 95%RH(@ wet bulb temp. $<40^{\circ}\text{C}$)
Non Operating Environment.	temp.	-40°C to $+70^{\circ}\text{C}$
	humidity	$\leq 90\%$ RH (@ wet bulb temp. $<65^{\circ}\text{C}$)
Dimension	160 (W) \times 70 (H) \times 98 (D) mm	
Weight	550g	

NOTE

 <p>Electrode</p> $R \leq 0.4\text{ mm}$	<p>In using the stage, the electrode of the DUT must be in contact at an angle (R) less than or equal to 0.4mm.If not the probe pin may not be able to measure the DUT properly.</p>
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Supplemental Performance Characteristics

This section provides useful data on the HP 16044A. These supplemental performance characteristics should not be considered specifications.

Additional Errors

Additional errors are calculated as follows.

|Z| Measurement

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

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

where

A [%] Additional Error (Proportional Error)

Z_s [Ω] Short Repeatability (Impedance)

Y_o [S] Open Repeatability (Admittance)

Z_x [Ω] Measured Value (Impedance)

Without extension cable

Applicable Instruments : HP 4192A, HP 4194A, HP 4263B, HP 4268A, HP4278A, HP4279A, HP 4284A, HP 4285A, HP 4294A, HP 4338B

Z_s	$\{ 1.5 + 40 \times (f / 10) \} \times 10^{-3} \text{ [}\Omega\text{]}$
Y_o	$\{ 1.5 + 200 \times (f / 10) \} \times 10^{-9} \text{ [S]}$
A	$2 \times (f / 10)^2 \text{ [%]}$

where f is the measurement frequency (MHz).

HP 4194A (extension cable 1m)

Z_s	$\{ 3 + 80 \times (f / 10 \text{ MHz}) \} \times 10^{-3} \text{ [}\Omega\text{]}$
Y_o	$\{ 3 + 400 \times (f / 10) \} \times 10^{-9} \text{ [S]}$
A	$5 \times (f / 10)^2 \text{ [%]}$

where f is the measurement frequency (MHz).

HP 4285A, HP 4294A (extension cable 1m)

Zs		$\{3 + 80 \times (f / 10)\} \times 10^{-3} [\Omega]$
Yo		$\{3 + 400 \times (f / 10)\} \times 10^{-9} [\text{nS}]$
A	$f \leq 5 \text{ MHz}$	$5 \times (f / 10)^2 [\%]$
	$5 \text{ MHz} < f \leq 10 \text{ MHz}$	$6 \times (f / 10) [\%]$

where f is the measurement frequency (MHz).

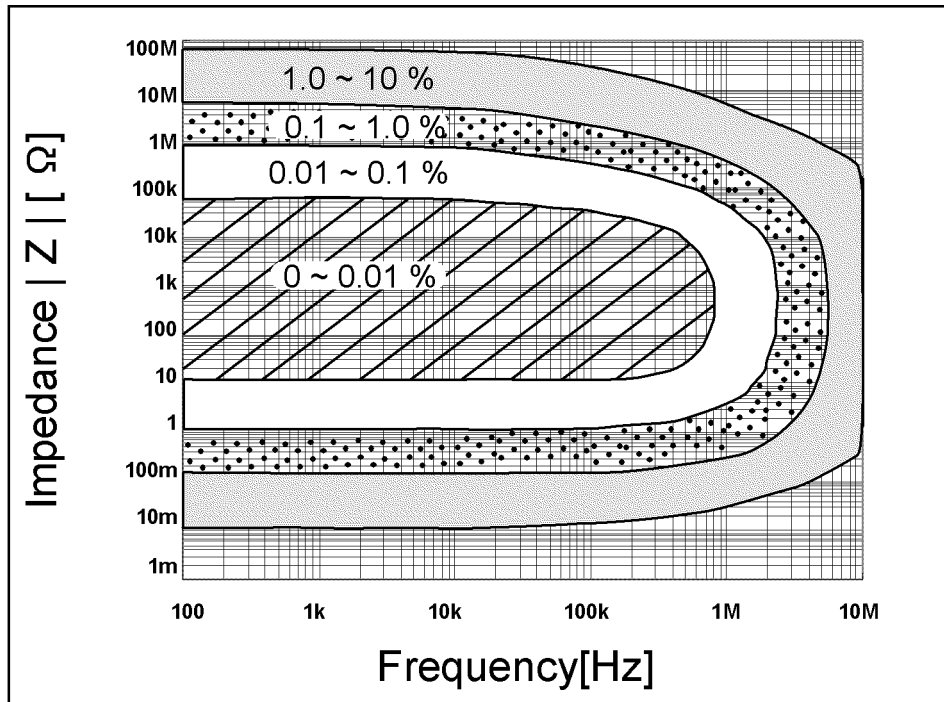
HP 4285A, HP 4294A (extension cable 2m)

Zs		$\{3 + 80 \times (f / 10)\} \times 10^{-3} [\text{W}]$
Yo		$\{3 + 400 \times (f / 10)\} \times 10^{-9} [\text{nS}]$
A	$f \leq 5 \text{ MHz}$	$7 \times (f / 10)^2 [\%]$
	$5 \text{ MHz} < f \leq 10 \text{ MHz}$	$6 \times (f / 10) [\%]$

where f is the measurement frequency (MHz).

Figure 3-1

Additional Error of the |Z| measurement



16044ace0310

D Measurement

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

If $D_x \leq 0.1$:

$$D_e = Z_e / 100$$

If $0.1 < D_x \leq 0.5$

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

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

NOTE

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

Rs (ESR) Measurement

Additional error R_{se} [%] of the R_s measurement is calculated by additional error Z_e [%] of |Z| measurement as follows.

If $D_x \leq 0.1$:

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

If $0.1 < D_x \leq 0.5$

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

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

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

where

f: measurement signal frequency

C_{sx} : measured value of C_s

R_{sx} : measured value of R_s ,

Spring pressure

Spring Pressure	200 g \pm 30 [g] (applicable short measurement)
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Specifications and Supplemental Performance Characteristics
Supplemental Performance Characteristics

4 Service

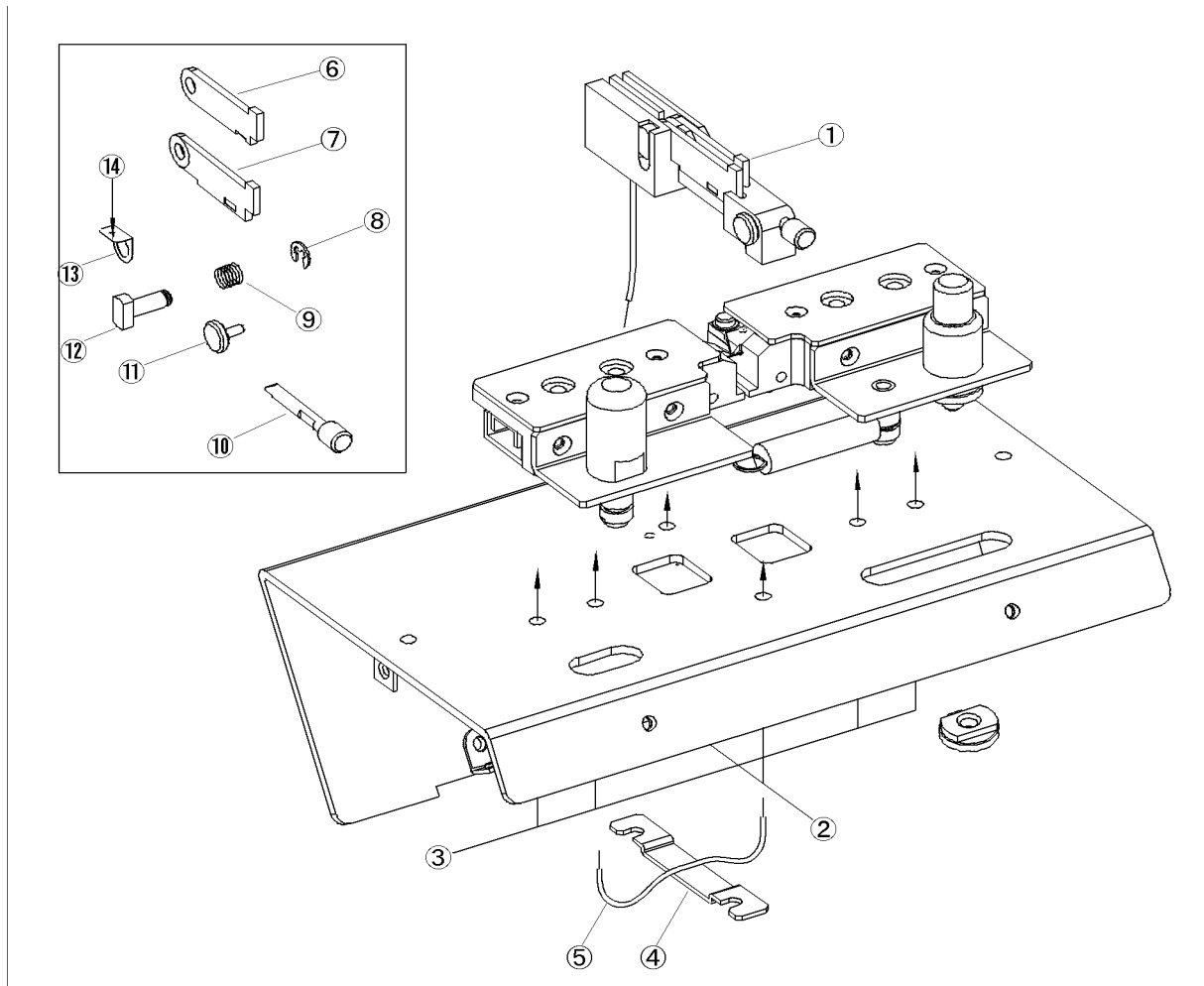
This chapter provides information on servicing and proper maintenance.

Maintenance

Check the parts number of all replaceable parts as provided in the tables and figures listed below. Do not attempt to disassemble any parts that is not included in the figure.

The tables and figures below show and list the replaceable parts for the HP 16044A. The parts listed can be ordered from your nearest Hewlett-Packard Sales and Service Office. Ordering information must include the HP part number and the quantity required.

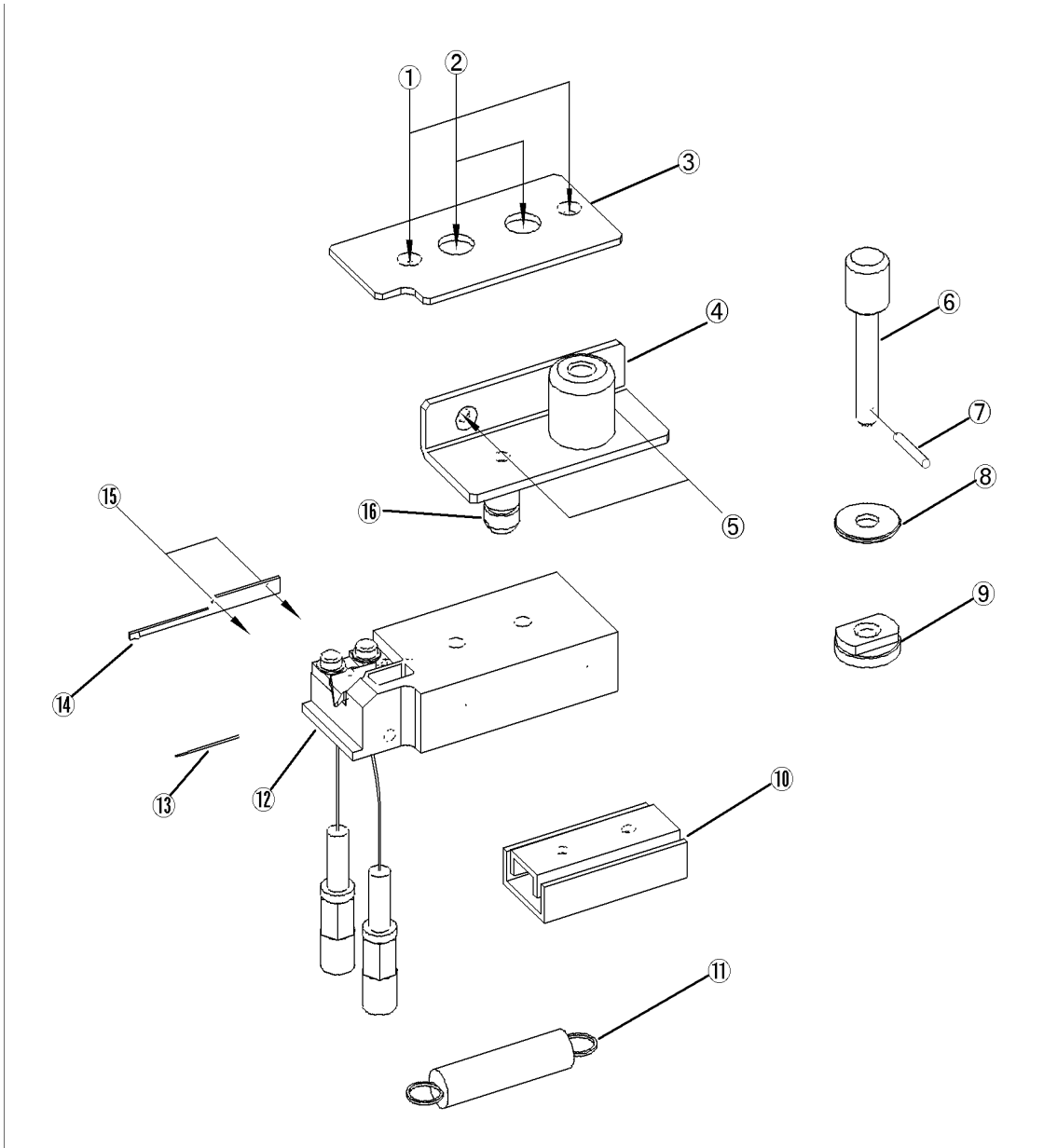
Figure 4-1 **Replaceable Parts for DUT Block Assembly**



Replacable Parts for DUT Block Assembly

Reference Designator	HP Part No.	Qty.	Description
1	16044-65003	1	DUT Block Assy (includes 6~15)
2	0515-1550	2	Screw
3	0515-0924	4	Screw
4	16044-00605	1	Angle
5	16044-61604	1	Wire Assy
6	16044-65004	1	Plate:Short
7	16044-26501	1	Plate:Open
8	0510-0015	1	E Ring
9	16044-08003	1	Spring
10	16044-25002	1	Positioning Rod
11	16044-24012	1	Rod Locking Knob
12	16044-24003	1	Shaft
13	16044-00604	1	Contact
14	0515-1872	1	Screw
15	16044-61603	1	Wire

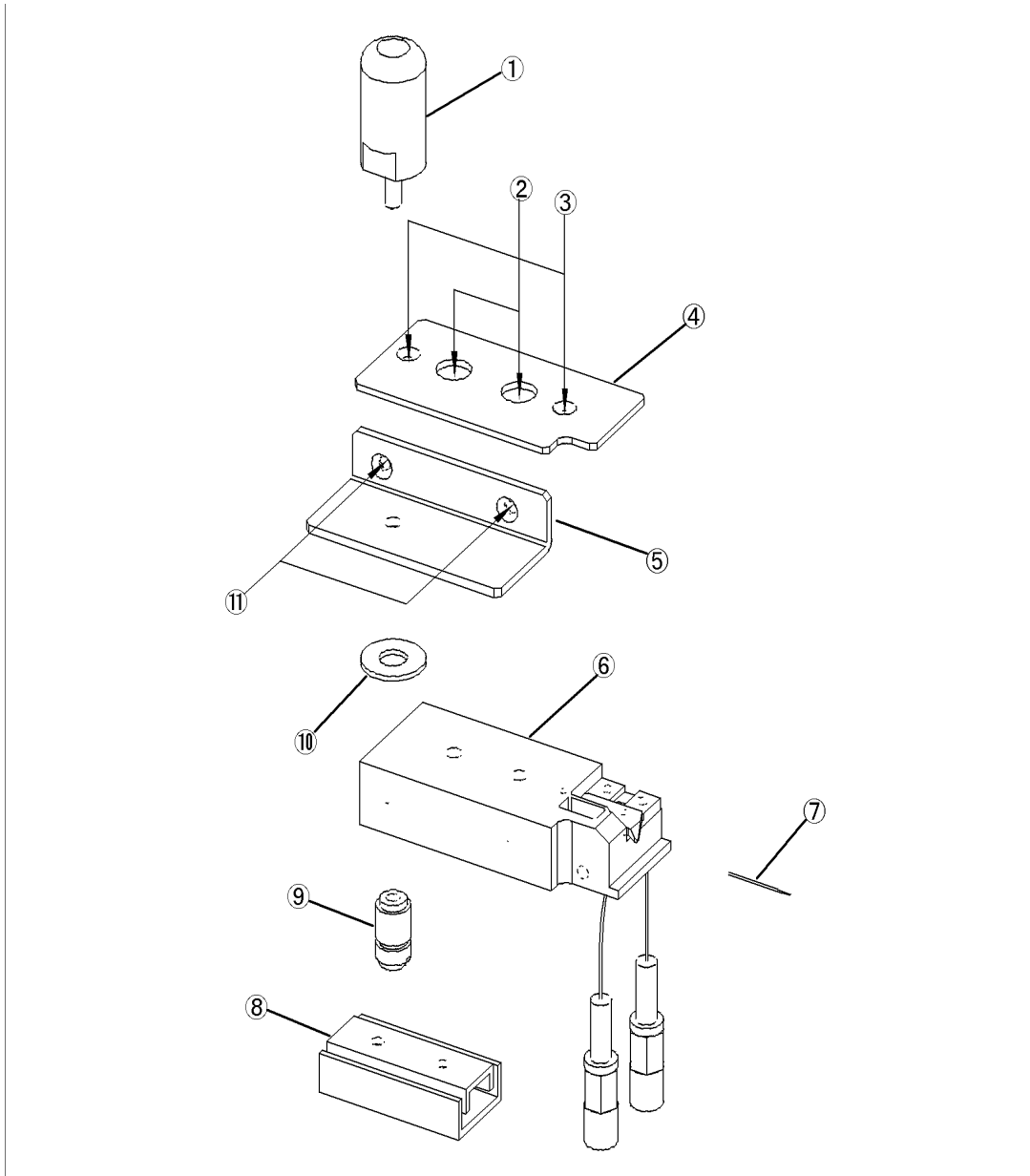
Figure 4-2 (Right) Replacable Parts for High Block Assembly



Replacable Parts for High Block Assembly

Reference Designator	HP Part No.	Qty.	Description
1	0515-0952	2	Screw
2	0515-0924	2	Screw
3	16044-04003	1	Top Cover
4	16044-04005	1	L - Cover
5	0515-0952	2	Screw
6	16044-24004	1	Knob
7	1480-0815	1	Spring Pin
8	3050-1983	1	Washer
9	16044-24010	1	Nut
10	1494-0078	1	Slide Unit
11	1460-2409	1	Spring
12	16004-65001	1	Right Meas Block (includes 13)
13	1253-0549	1	Probe Pin
14	16044-08001	1	Spring
15	0515-2421	2	Screw
16	16044-24007	1	Nut

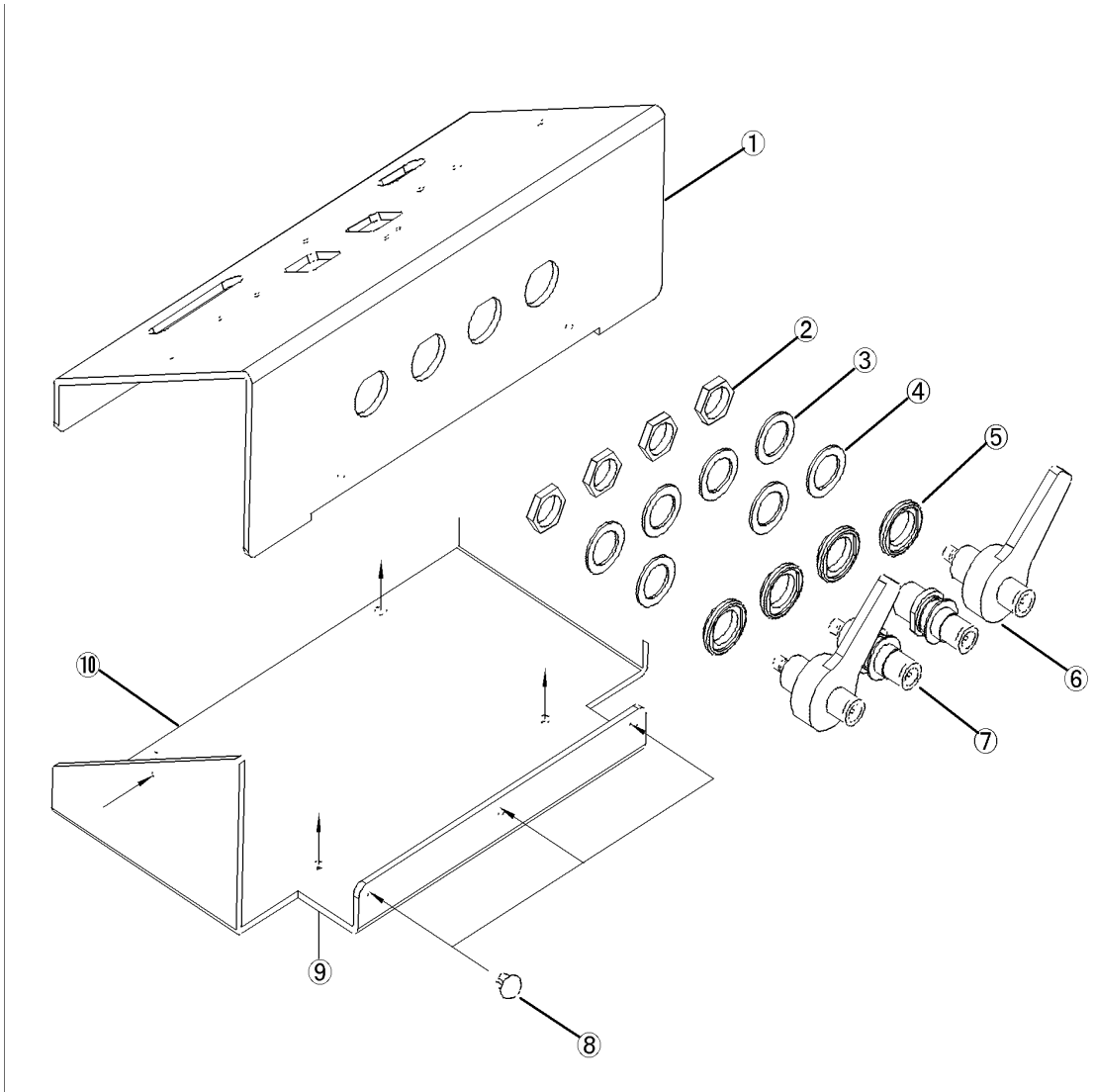
Figure 4-3 (Left) Replacable Parts for Low Block Assembly



Replacable Parts for Low Block Assembly

Reference Designator	HP Parts No.	Qty.	Description
1	16044-24011	1	Standoff
2	0515-0924	2	Screw
3	0515-0952	2	Screw
4	16044-04004	1	Upper Cover
5	16044-04006	1	L - Cover
6	16044-65002	1	Meas Block Left (includes 7)
7	1253-0549	1	Probe Pin
8	1494-0078	1	Slide Unit
9	16044-24007	1	Nut
10	3050-1984	1	Washer
11	0515-0952	2	Screw

Figure 4-4 Replacable Parts for Cover Assembly



Replacable Parts for Cover Assembly

Reference Designator	HP Parts No.	Qty.	Description
1	16044-04001	1	Top Cover
2	N/A	4	Nut (included in BNC connector)
3	3050-0067	4	Washer
4	3050-0789	3	Washer : Teflon
5	16047-40002	4	Washer : Insulator
6	16044-60002	2	BNC Connector (with lever)
7	1253-0476	2	BNC Connector (w/o lever)
8	6960-0016	3	Plug Hole
9	0515-0914	6	Screw
10	16044-04002	1	Bottom Cover

Replacing the Measuring Block and Pin Adjustment

This section describes the procedures in replacing the measuring block.

Replacing the measuring block consists the following procedures: preparing the measuring block (new), removing the measuring block (old) and mounting the (new) measuring block and adjusting its pin. If you are going to replace the probe pin only the above procedures need not be followed.

Follow the procedures listed below when replacing the high block. The same procedure follows for the low block.

You need to use a pin adjuster (HP P/N 16044-65005) when adjusting the position of the probe pin. Also, it is recommended that you use a pin set, magnifying lens and the like in doing this adjustment.

Preparing the Measuring Block

Insert the pin adjuster to the new measuring block.

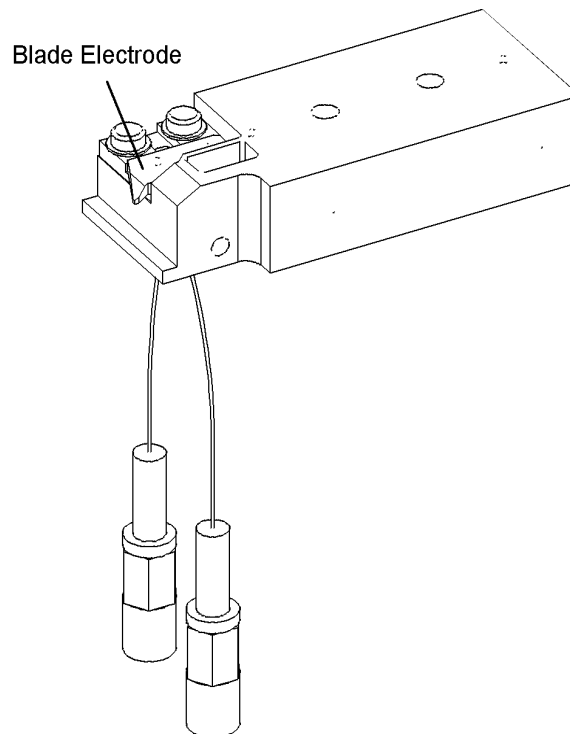
1. Have the replaceable parts prepared.

NOTE

The blade electrode of the new block has already been pre-adjusted. Do not loosen the screw that holds the blade electrode. Refrain from applying brute force.

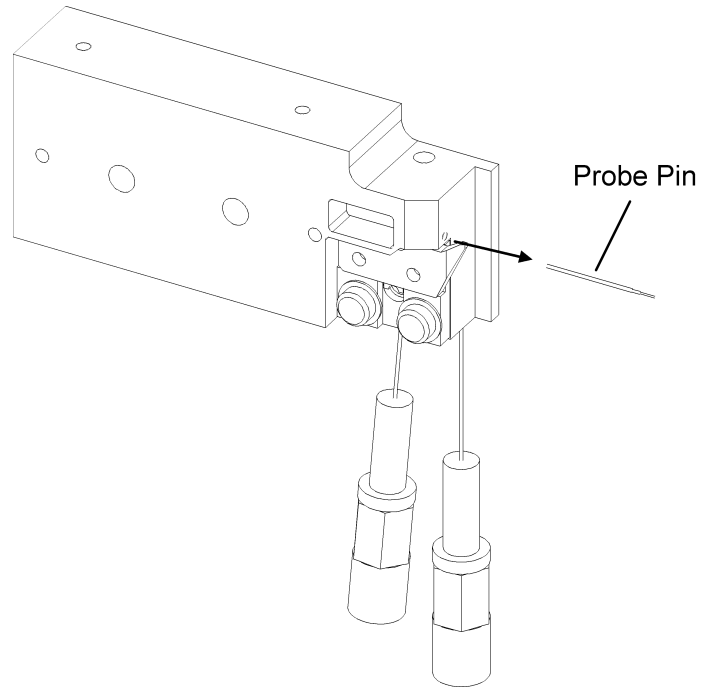
Figure 4-5

Measuring block replacement (new High block)



2. Remove the probe pin from the measuring block with a pin set or tools alike.

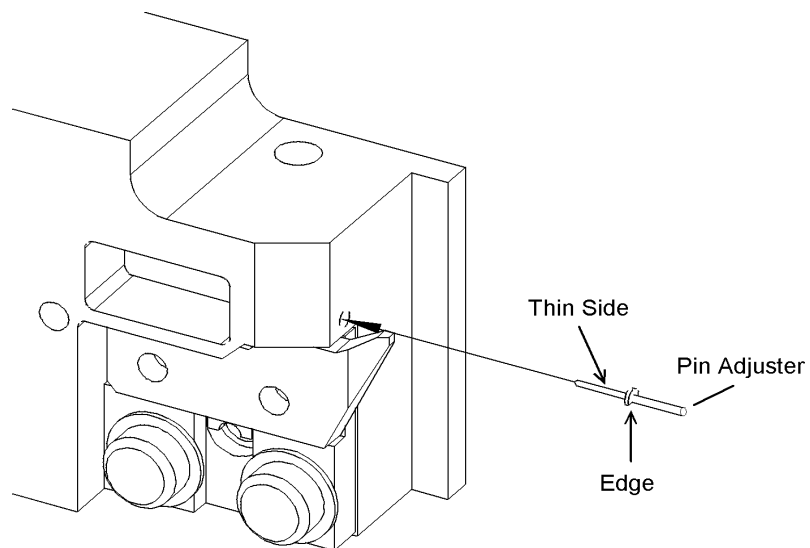
Figure 4-6 Removing the probe pin



NOTE Do not bend or misplace the probe pin since it will be used later on.

3. Insert the thin side pin of the adjuster while observing its edge.

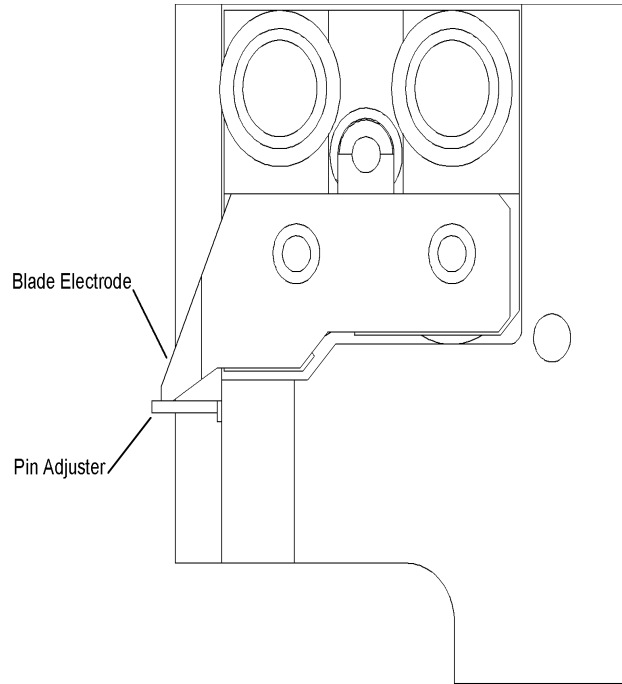
Figure 4-7 Inserting the pin adjuster



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4. Be sure there are no gaps between the pin adjuster and blade electrode.

Figure 4-8 **Checking the position of the pin adjuster**



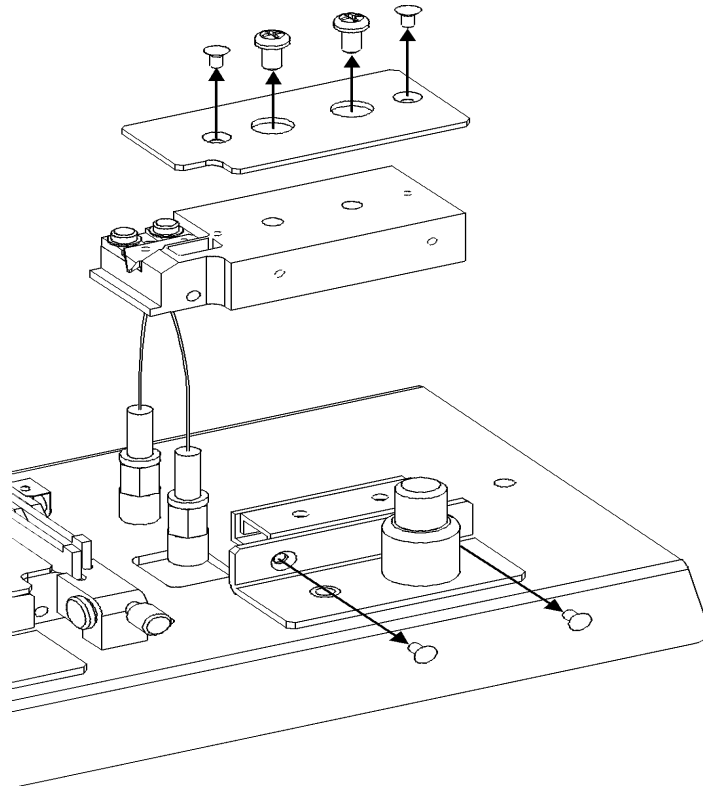
Removing the Measuring Block

Remove the old block from the main unit (test fixture).

1. Loosen the 6 screws from the main unit to remove the bottom cover.
2. Disconnect the shielded wires that connects the block from the BNC connector. Also, disconnect the lead wire from the block terminal.
3. Remove the screws holding the cover and measuring block.

Figure 4-9

Removing the old block



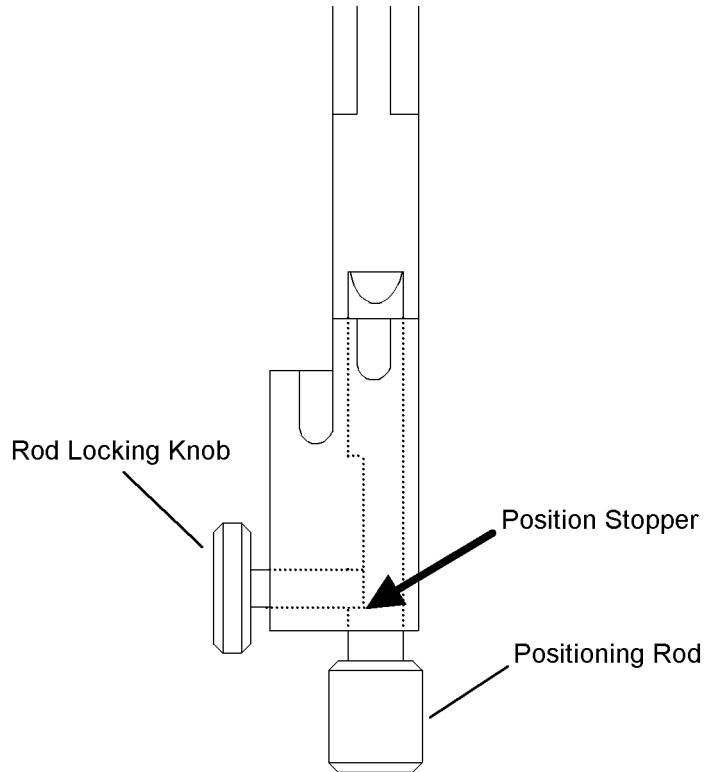
Mounting the Measuring Block and Adjusting the Pin

Mount the measuring block to the main unit with the pin adjuster attached and adjust the position of the pin.

1. Loosen the rod locking knob.
2. As shown in figure 4-10 adjust the height of the positioning rod until it reaches the position stopper.

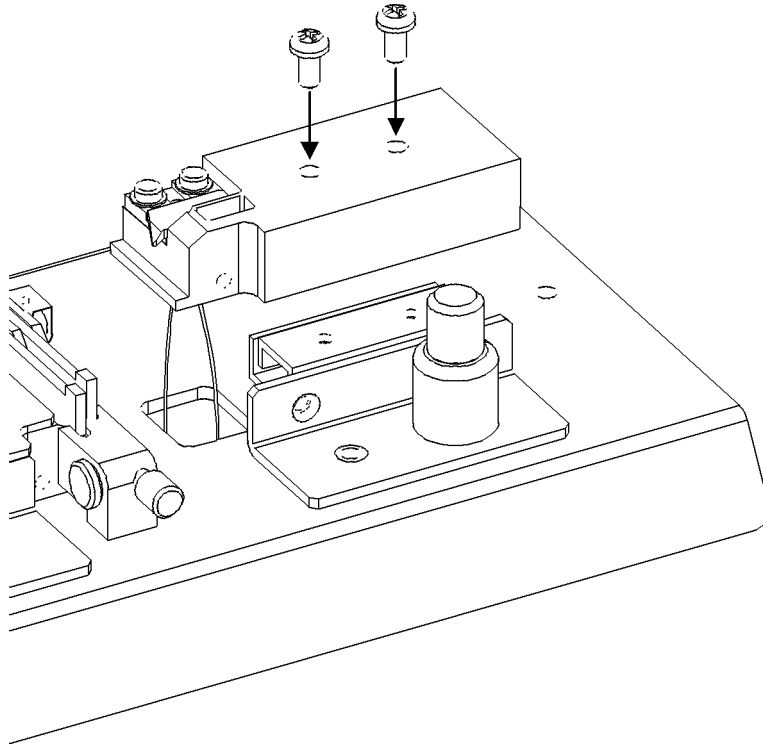
Figure 4-10

Adjusting the height of the positioning rod



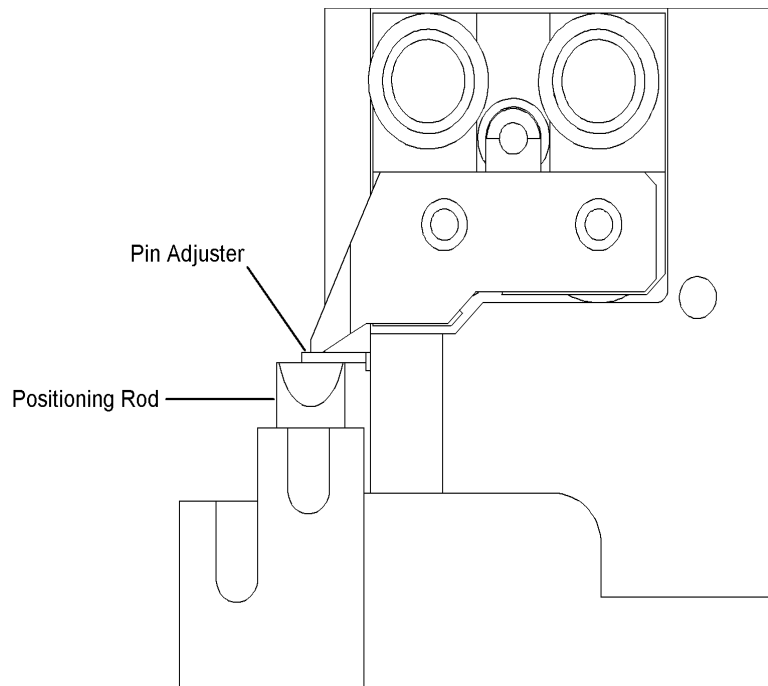
3. Tighten the rod locking knob.
4. As shown in figure 4-11 attach the measuring block to the unit, half-tight the 2 screws in order to adjust its position.

Figure 4-11 **Half-tight the measuring block**



5. Adjust the position of the measuring block, such that there are no contact gaps between the pin adjuster and positioning rod.

Figure 4-12 **Adjusting the position of the block**



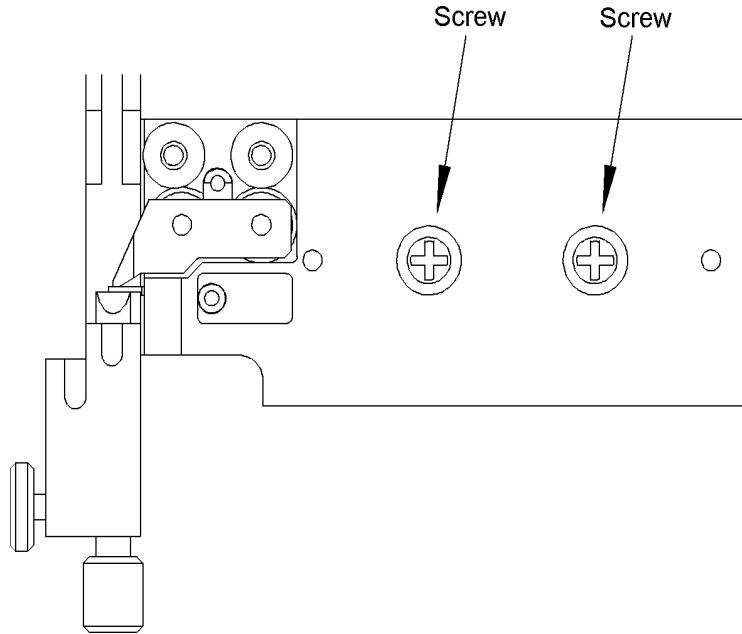
Service

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6. Tighten the 2 screws to secure the measuring block. Make sure the block is in proper position such that there are no position gaps.

Figure 4-13

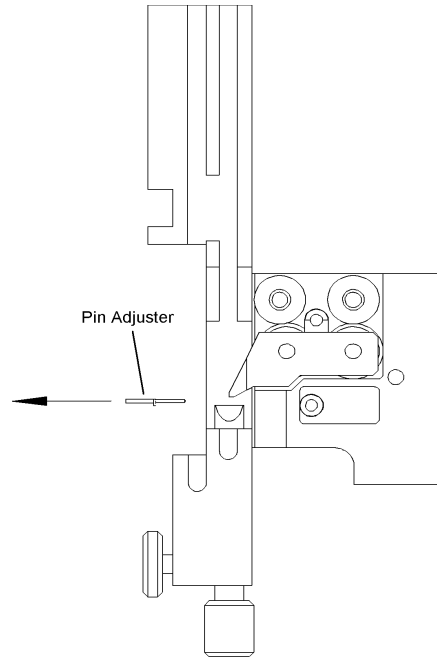
Screwing the block



7. Move the measuring block to its left and right sides. Check if there are no gaps between the positioning rod and the pin adjuster. The pin adjuster should not bump into the positioning rod.

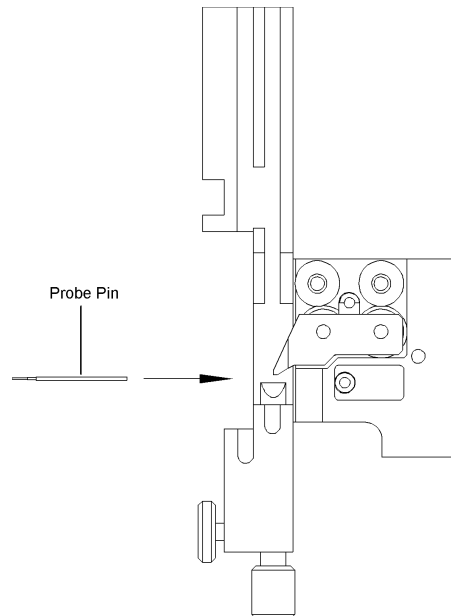
8. Move the measuring block to the right, then remove the pin adjuster.

Figure 4-14 Removing the pin adjuster



9. Move the measuring block to the right, then insert the probe pin previously removed.

Figure 4-15 Inserting the probe pin

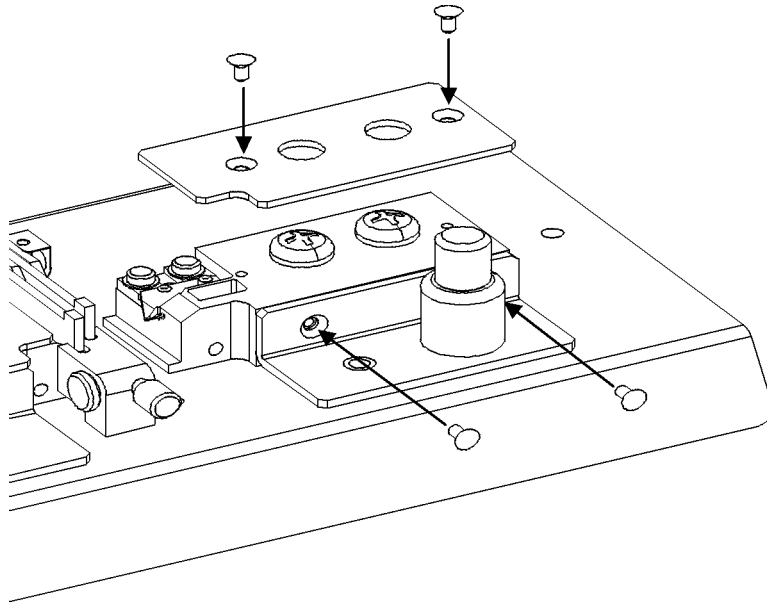


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10. Mount the cover on the block and tighten its screws.

Figure 4-16

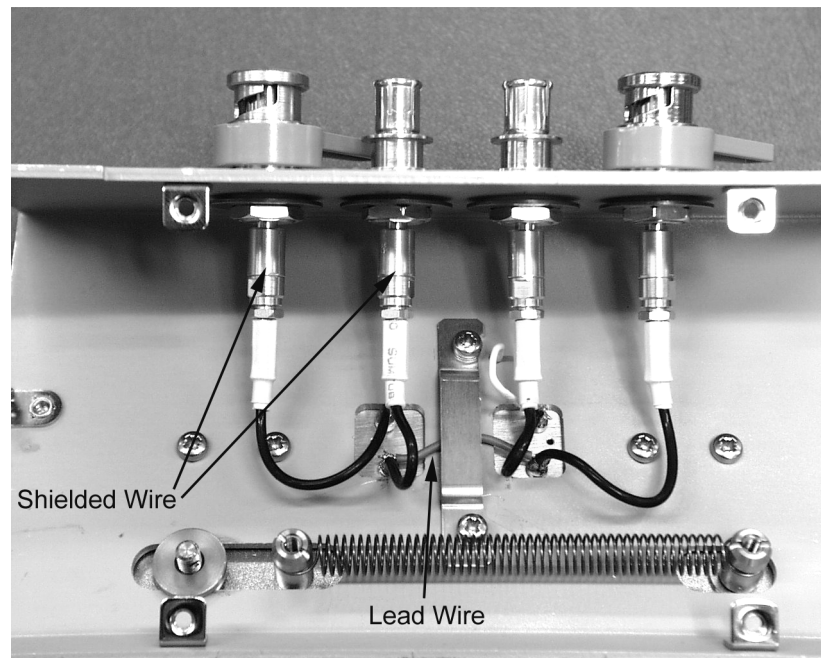
Mounting the cover



11. Connect the shielded wires of the block to the BNC connector. And resolder the lead wire to the terminal.

Figure 4-17

Connecting the lead and shielded wires



12. Attach the bottom cover and tighten its 6 screws to the main unit.

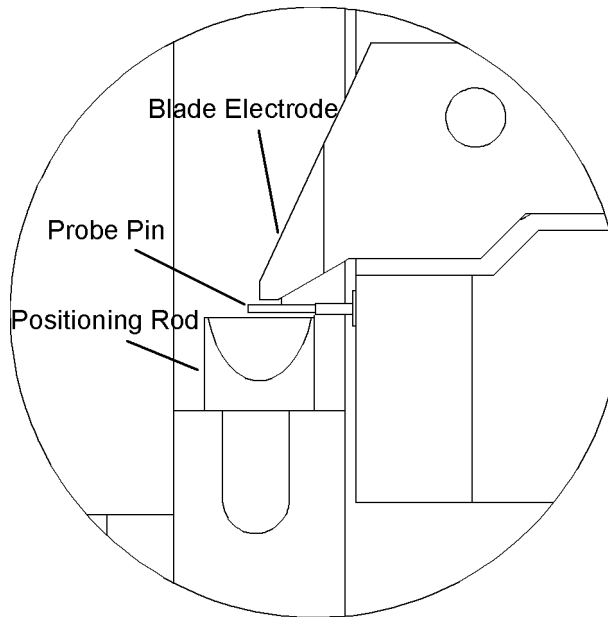
Checking the pin position

The following guidelines are provided in determining the correct position of the probe pin.

- The probe pin should be leading the blade electrode by approximately 0.3mm.
- The spacing between the probe pin and blade electrode should be approximately 0.1 mm.
- The spacing between the probe pin and positioning rod should be approximately 0.1 mm.
- The probe pin should not be in contact with the positioning rod, even if the block is moved laterally.

Figure 4-18

Magnifying the position of the probe pin



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