HP 42941A Impedance Probe Kit

Operation and Service Manual

First Edition

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Notices

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

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Manual Printing History

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

April 1999 First Edition

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.

NOTE HP 42941A comply with INSTALLATION CATEGORY I and POLLUTION DEGREE 2 in IEC 1010-1. HP 42941A are INDOOR USE product.

- 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 property 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.

Contents

Contents

1 Installation Guide

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 HP 42941A has been checked mechanically and electrically. The contents of the shipment should be as listed in Table 1-1. If the contents are incomplete, if there is mechanical damage or defect, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of unusual stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

Table 1-1 Contents

Description	HP Part Number	Qty.
Probe and Four-terminal Pair Connection Block	-	1
Pin Probe	42941-60002	1
Spare pin set (includes 3 spare pins)	42941-60004	1
3.5-mm short[a]	-	1
3.5-mm load[a]	-	1
Operation and Service Manual	42941-90000	1
BNC Adapter	1250-1787	1
Clip lead	-	1
Ground lead	04193-61629	1
Carrying case	42941-60011	1

a. Not furnished with the Option 001.

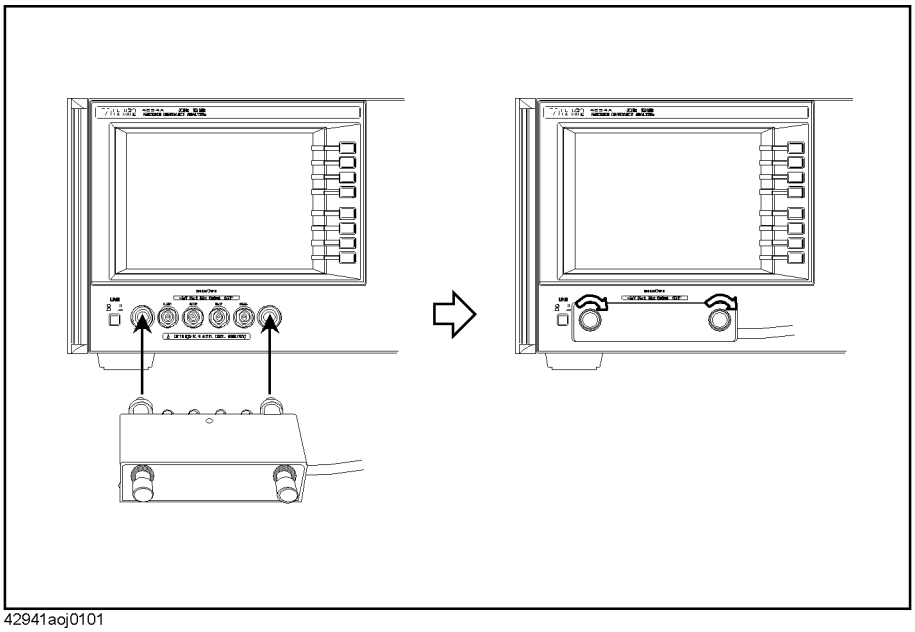
Connecting the HP 42941A

Follow these steps below to connect the HP 42941A to the HP 4294A.

Step 1. Set the HP 42941A four-terminal pair connection block to the test connectors on the front panel of the HP 4294A by gradually coupling the four BNC connectors and securing screws of the block with the test connectors and accessory mounting holes of the instrument until they come to complete contact.

Step 2. Turn clockwise the block's two fastening screws together, so that the four-terminal pair connection block is secured to the instrument.

Figure 1-1 Connecting HP 42941A to HP 4294A



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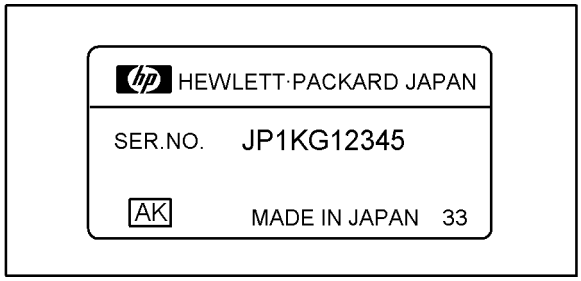
Serial Number

Hewlett-Packard uses a two-part, nine-character serial number that is stamped on the serial number plate (see Figure 1-2) attached to the bottom of the four-terminal pair connection block. The first four digits and the letter are the serial prefix and the last five digits are the suffix.

Figure 1-2 Serial Number Plate



2 Overview

Product Overview

The HP 42941A is the impedance probe kit designed for the HP 4294A Precision Impedance Analyzer. When used with the HP 4294A, this kit allows impedance measurement and analysis with wide frequency range up to 110 MHz. Also its probes with a 1.5-meter cable allow you to evaluate implemented circuits and mounted devices.

Figure 2-1 **Product Overview**

Functions

Figure 2-2 and Figure 2-3 show names of the parts of the HP 42941A and the probe adapters, respectively.

Figure 2-2 **HP 42941A Parts**

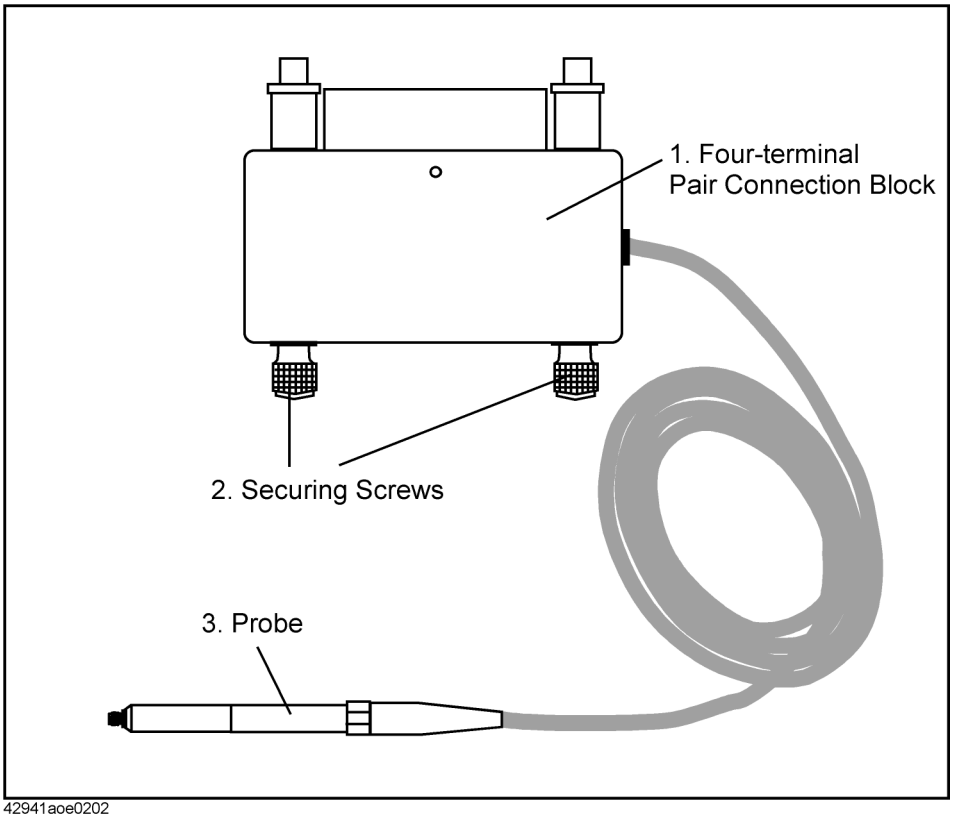


Table 2-1 **HP 42941A Function**

No.	NAME	FUNCTION
1	Four-terminal Pair Connection Block	Contact the HP 42941A to the HP 4294A
2	Securing Screws	Secures the HP 42941A to the HP 4294A.
3	Probe	Attached to various probe adapters for measurement.

Figure 2-3 **Probe Adapters**

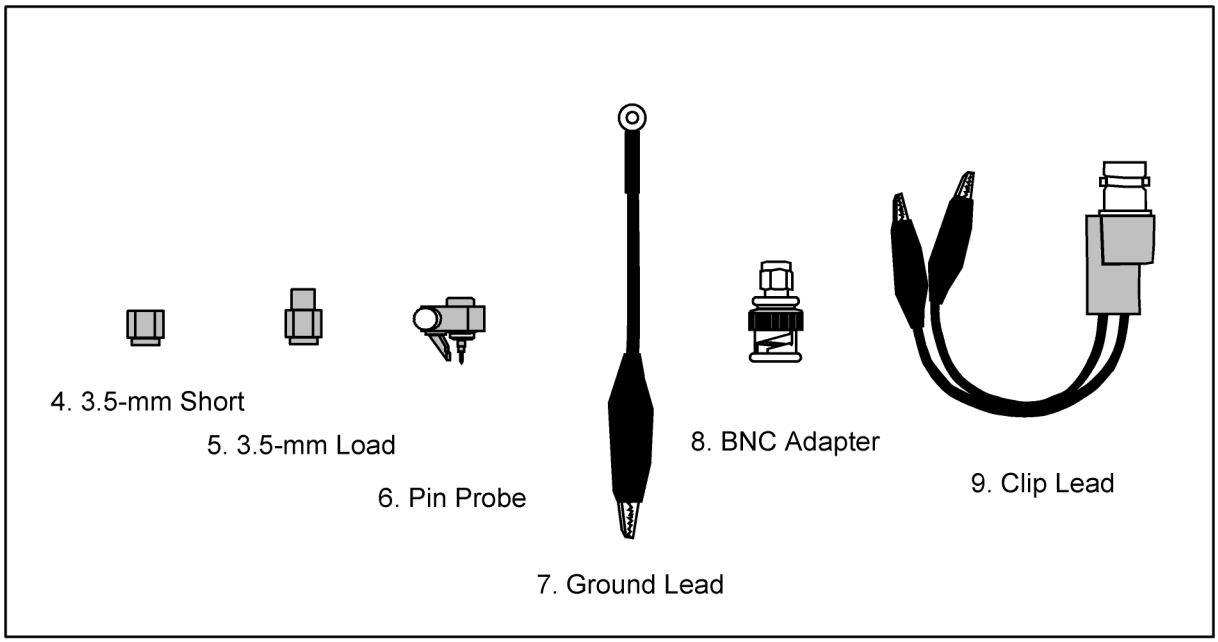


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Table 2-2 **Probe Adapters**

No.	NAME	FUNCTION
4	3.5-mm Short	A short device used for the adapter setup.
5	3.5-mm Load	A load device (50 Ω) used for the adapter setup.
6	Pin Probe	Attached to the probe to measure implemented circuits, mounted devices, and printed circuit patterns.
7	Ground Lead	Attached to the pin probe to connect to GND of the DUT.
8	BNC Adapter	Attached to the probe to measure devices and cables that have BNC connectors.
9	Clip Lead	Attached to the top of the BNC adapter with the probe to measure mounted lead components or large devices.

3 Operation

This chapter describes the proper methods for setting the HP 4294A, connecting the probe adapter, fixture compensation with the HP 42941A, and DUT measurement.

HP 4294A Setting

Before you begin your measurement, you should perform the adapter setup to extend the calibration plane from the surface of the four-pair terminal to the tip of the probe. Also refer to the operation manual of the HP 4294A about the adapter setting.

NOTE For adapter setup, use the furnished short and load devices.

CAUTION When handling the HP 42941A, care must be taken not to give any mechanical shock, which may cause damage to the fixture. Never give any mechanical shock to the probe.

Adapter Setup

Connect the HP 42941A to the HP 4294A as shown in Figure 1-1 and perform the adapter setup described below.

1. More than 30 minutes warm-up time is required after turning on the HP 4294A.
2. Press **[Cal]** key to bring up the Calibration Menu.
3. Press **ADAPTER [ ]** key to bring up the Adapter setup Menu. [ ] should indicate current settings.
4. Select **PROBE 42941A**. When selected, the softkey label will be underlined.
5. Press **SETUP** key to bring up the Adapter Setup Menu.
6. Leave the 3.5-mm port of the HP 42941A open (no connection). There is no OPEN standard for the HP 42941A.
7. Press **PHASE COMP [-]** key to start the phase compensation data measurement. About 1 minutes later, phase compensation data measurement is completed and the softkey label changes to **PHASE COMP [DONE]**.
8. With nothing connected to the 3.5-mm port, press **OPEN [-]** key to start open data measurement. When the open data measurement is completed, the softkey label changes to **OPEN [DONE]**.
9. Connect the SHORT to the 3.5-mm port.
10. Press **SHORT [-]** key to start the short data measurement.When the short data measurement is completed, the softkey label changes to **SHORT [DONE]**.
11. Remove the SHORT from the 3.5-mm port of the HP 42941A. Then connect the LOAD to the 3.5-mm port.
12. Press **LOAD [-]** key to start the load data measurement. When the load data measurement is completed, the softkey label changes to **LOAD [DONE]**.
13. Press **done** key.

Connecting Probe Adapter

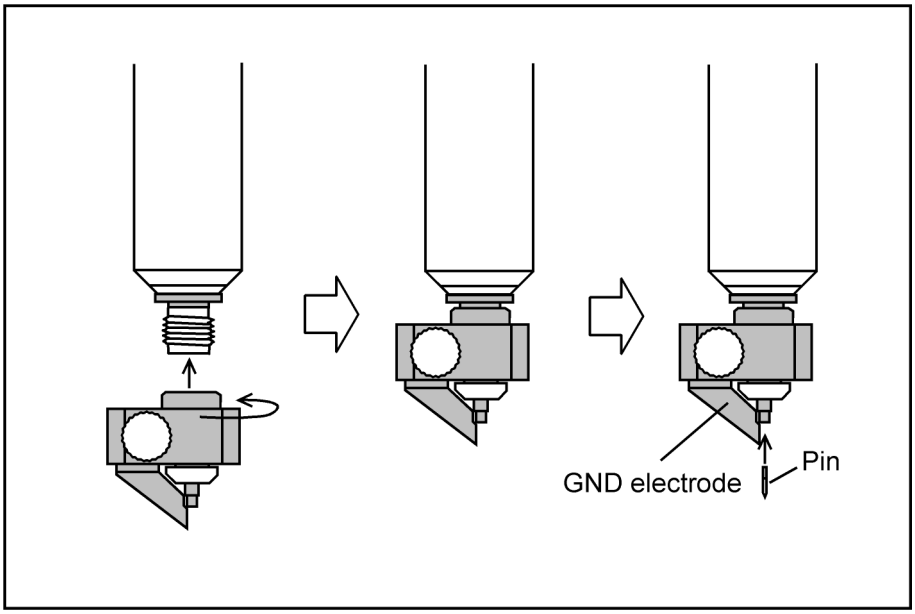
Probe adapters are furnished with the HP 42941A to measure DUTs in various shapes and characteristics. Attach an appropriate probe adapter for your DUT.

Connecting Pin Probe

Attach the pin probe to the 3.5-mm connector top of the probe and insert the pin.

WARNING **The pin is pointed and potentially hazardous to personnel. When using or changing, handle the pin probe with care to prevent from injury.**

Figure 3-1 **Connecting Pin Probe**



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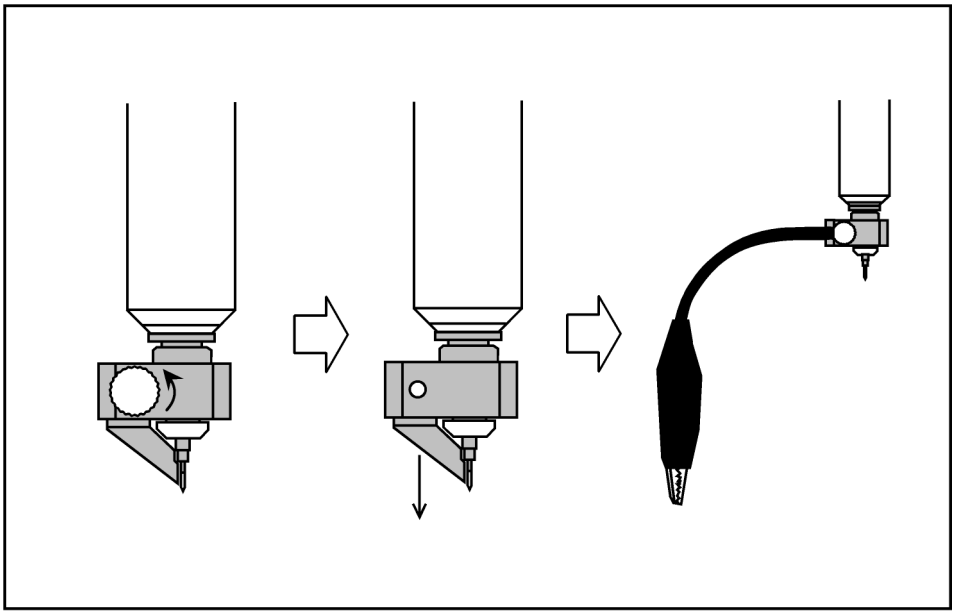
Connecting Ground Lead

Remove the screw fixing the ground contact to detach the contact. Use the screw you removed to attach the ground lead to the pin probe.

Figure 3-2 **Connecting Ground Lead**



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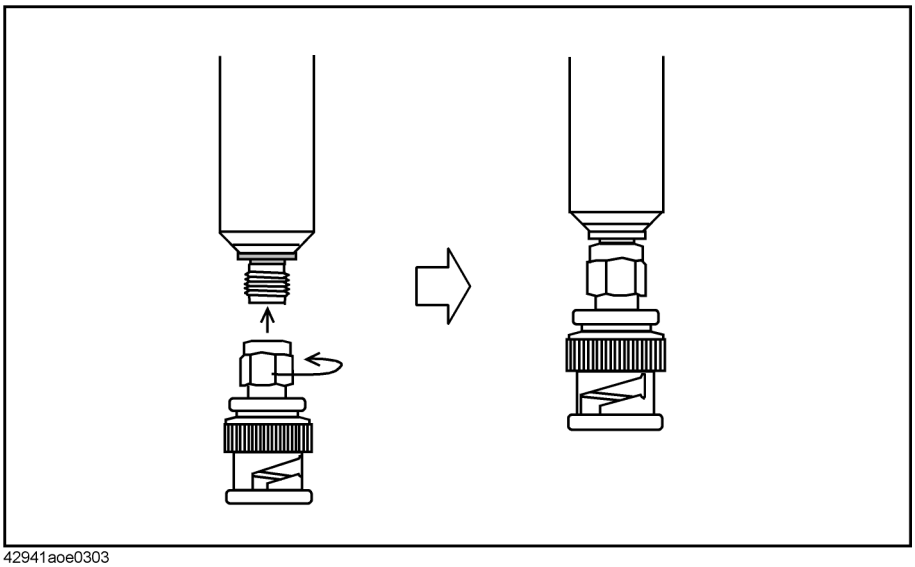
Connecting BNC Adapter

Attache the BNC adapter to the 3.5-mm connector on the top of the probe.

Figure 3-3 **Connecting BNC Adapter**



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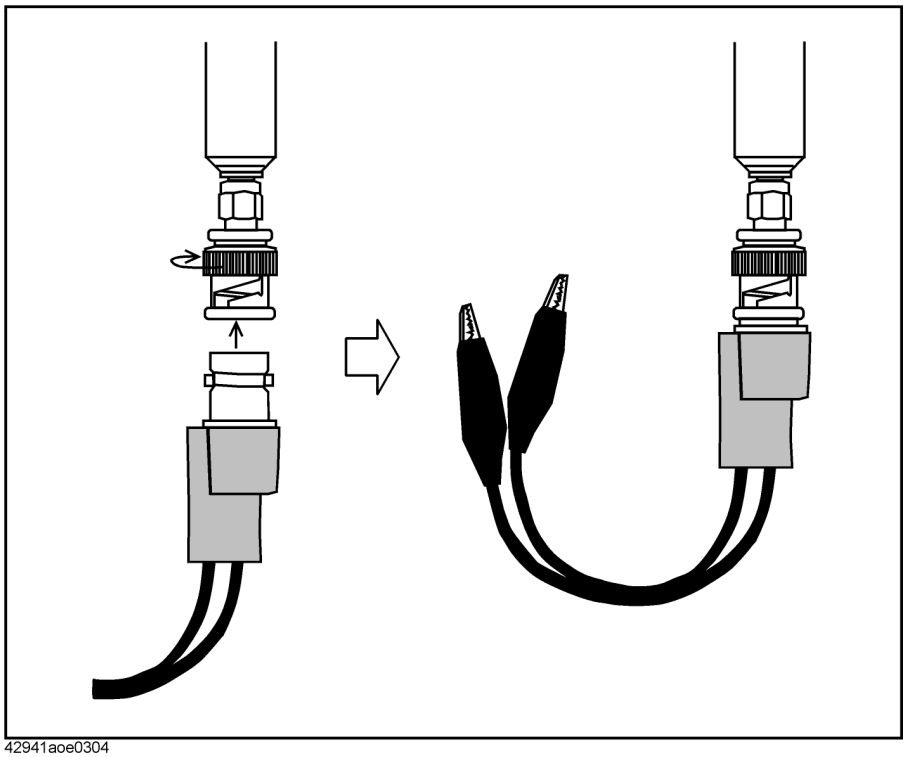
Connecting Clip Lead

Attach the BNC adapter to the probe then attach the clip lead to the adapter.

Figure 3-4 **Connecting Clip Lead**



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Fixture Compensation

In an actual measurement, a probe adapter will be attached to the probe. Fixture compensation is required for compensating residual impedance and admittance. The fixture compensation includes OPEN and SHORT compensation measurements. About fixture compensation, also refer to the HP 4294A Operation Manual.

NOTE Generally, there is no need to perform load compensation. If you have any standard device, perform load compensation as your needs.

The following procedure shows the measurement for the compensation data with the HP 42941A.

Performing Fixture Compensation

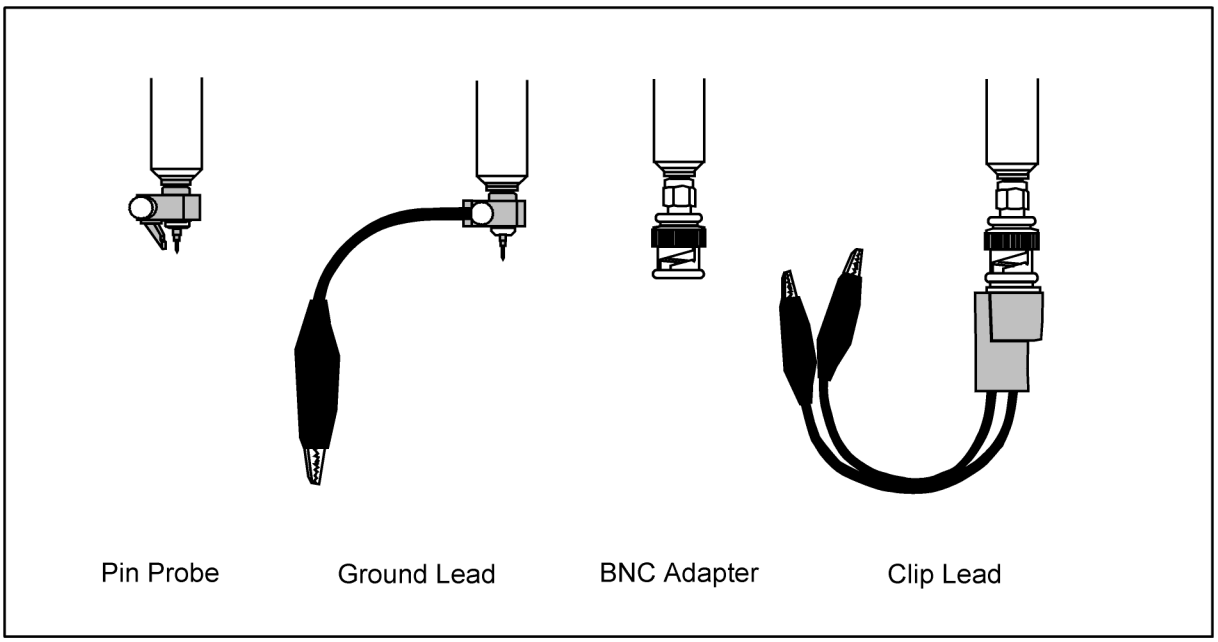
Attach the probe adapter to be used for your measurement and perform fixture compensation.

1. Press **[Cal]** key to bring up the Calibration Menu.
2. Press **FIXTURE COMPEN** key to bring up the Fixture Compensation Menu.

Performing Open Compensation

1. Attache the probe adapter to the probe and leave the probe adapter with no connection.

Figure 3-5 Performing Open Compensation



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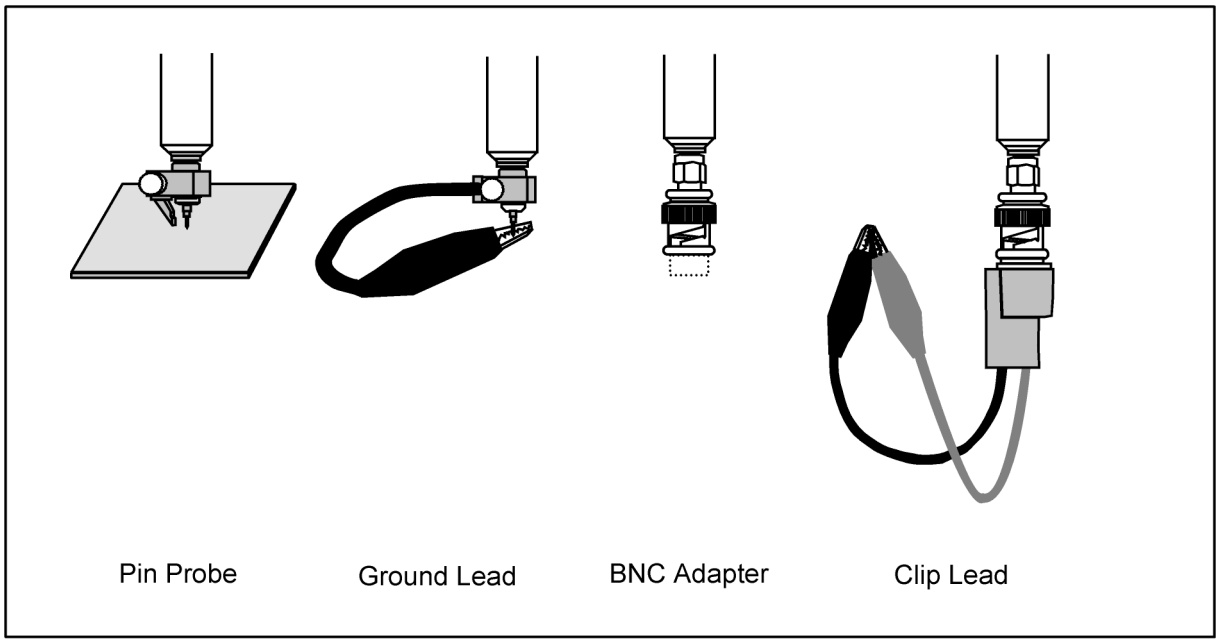
2. Press **OPEN** key to start OPEN compensation data measurement. When OPEN compensation data measurement is completed, the softkey label **OPEN on OFF** (if it is off) changes to **OPEN ON off**.

Performing Short Compensation

1. Put the probe adapter into the SHORTed state as Figure 3-6. Use an appropriate device for shorting since no short device is supplied with the BNC adapter.

NOTE For short compensation, we recommend using a short device with gold-plated surfaces, which provide stable contact resistance.

Figure 3-6 Performing Short Compensation



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2. Press **SHORT** key to start SHORT compensation data measurement.When SHORT compensation data measurement is completed, the softkey label **SHORT on OFF** (if it is off) changes to **SHORT ON off**.

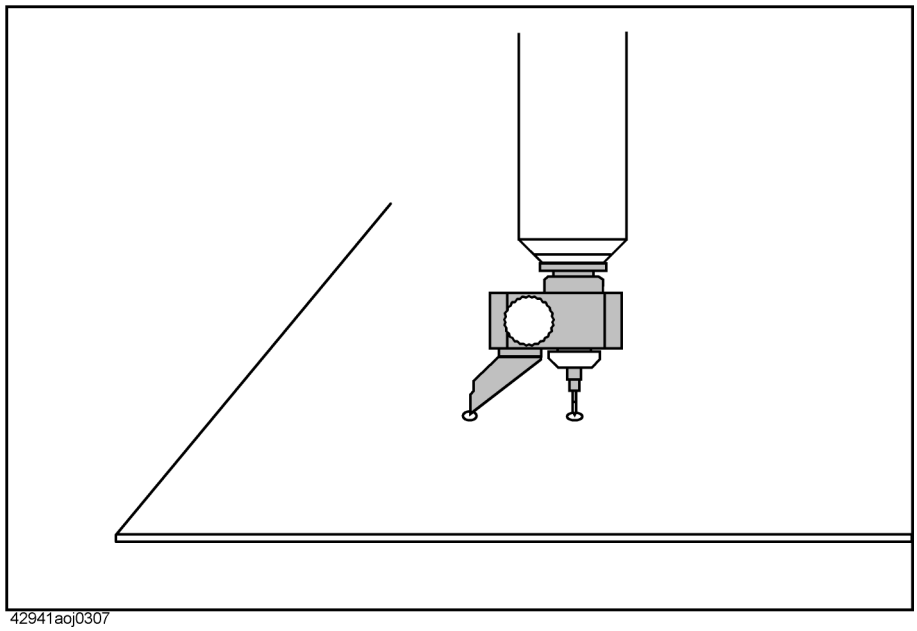
DUT Measurement

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

DUT Measurement Using Pin Probe

When measuring implemented circuits, mounted devices, and printed circuit patterns, use the pin probe.

Figure 3-7 **DUT Measurement Using Pin Probe**

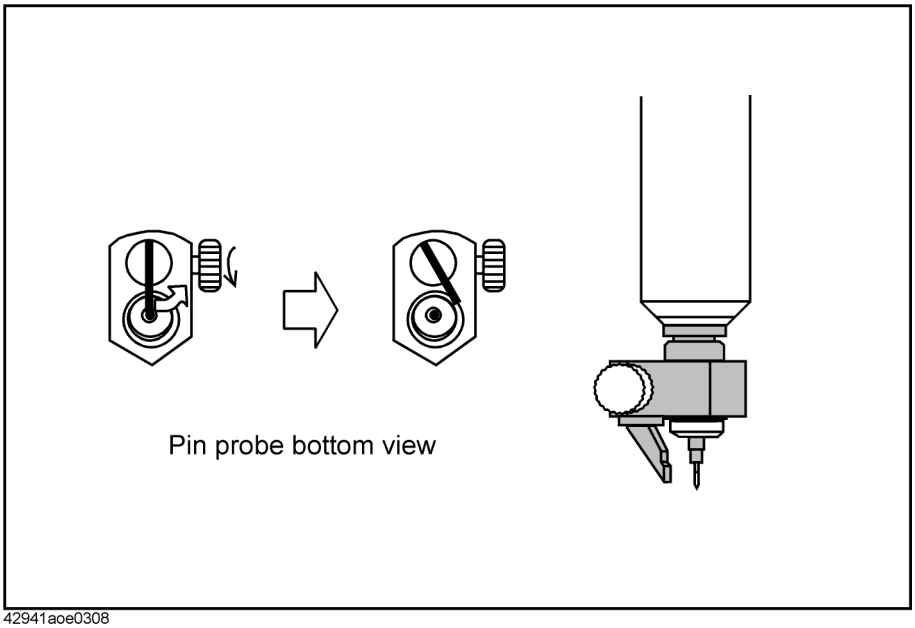


NOTE The pin of the pin probe is replaceable. Replace it when damaged or gets dirty.

Adjusting Pin-to-GND Gap

The gap between the pin and the GND contact is adjustable for DUT, ranging from 0.5 mm to 13.5 mm. To adjust the gap, release the screw fastening the GND contact then rotate the contact (See Figure 3-8).

Figure 3-8 **Adjusting Pin-to-GND Gap**



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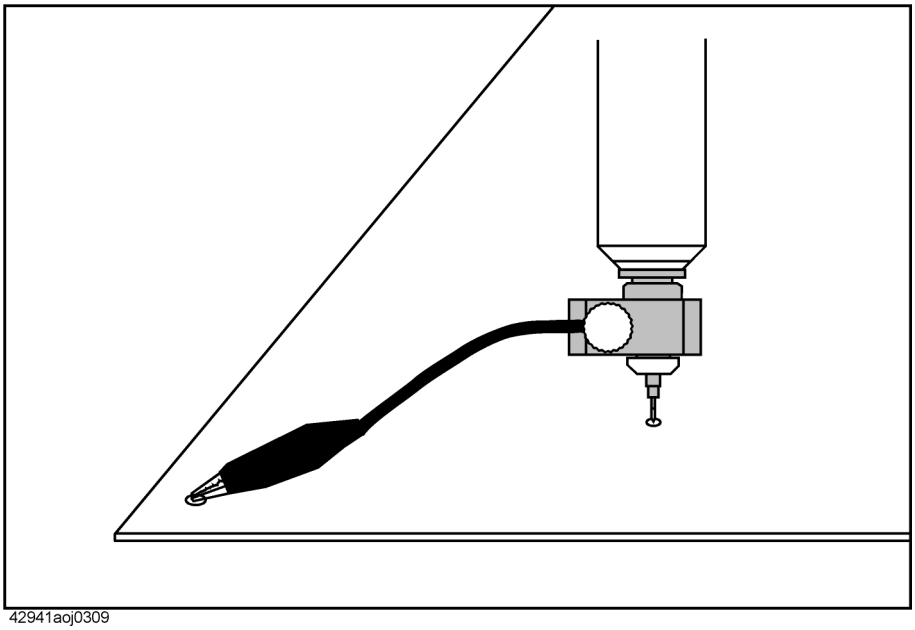
DUT Measurement Using Ground Lead

Use the ground lead to ground the probe to a distant point. When you attach the ground lead to the pin probe, detach the ground contact (refer to the Figure 3-2).

Figure 3-9 **DUT Measurement Using Ground Lead**



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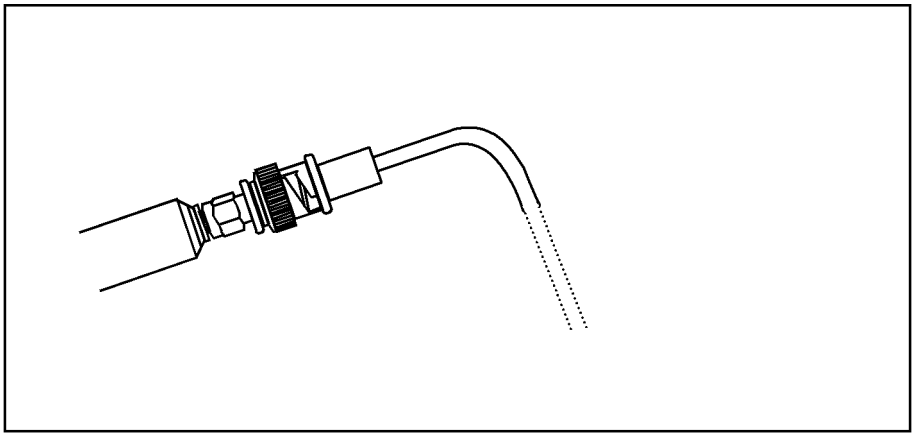
DUT Measurement Using BNC Adapter

The BNC adapter is used to measure I/O terminals or cables that have BNC connectors. It is also used as a mounting base for the alligator lead.

Figure 3-10 **DUT Measurement Using BNC Adapter**



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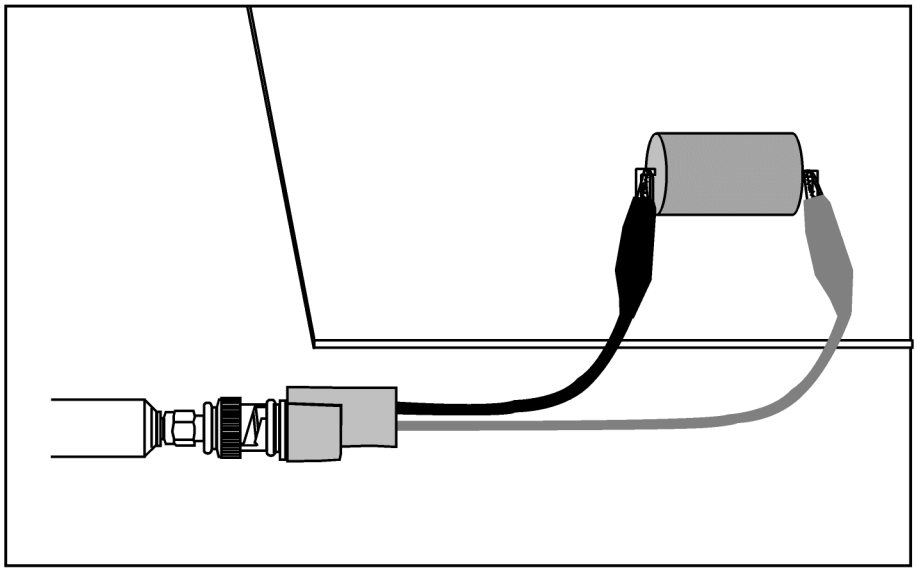
DUT Measurement Using Clip Lead

Use the clip lead to measure devices that have leads, large in shape, or mounted on the circuit board.

Figure 3-11 **DUT Measuring Using Clip Lead**



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4 Specifications

This chapter provides specifications of the HP 42941A test fixture.

Specifications

Applicable Instruments		HP 4294A Precision Impedance Analyzer
Frequency		40 Hz to 110MHz
Maximum voltage		± 42V peak max. (AC+DC)
Operating Environment	temp.	-20°C to +75°C (Except Four-terminal pair connection block) 0°C to +55°C (Four-terminal pair connection block)
	humidity	15% to 95%RH(@ wet bulb temp. < 40°C)
Non Operating Environment.	temp.	-40°C to +70°C
	humidity	≤ 90 % RH (@ wet bulb temp. <65°C)
Dimension		350 (W) × 100 (H) × 280 (D) mm (Include carrying case)
Weight		2400g (Four-terminal pair connection block 1000g)
Safety Standards		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

About impedance measurement accuracy at 3.5-mm port and additional error, refer to the HP 4294A Operation Manual.

5 Service

This chapter provides information on servicing and proper maintenance.

Maintenance

An exploded view of the HP 42941A for parts identification is shown in Figure 5-1 and Figure 5-2. Do not disassemble any further than shown. Maintenance consists principally of cleaning contacts and replacing worn or damaged parts. Take special care when cleaning contacts.

To order parts, use the Hewlett-Packard part numbers listed in Table 5-1 and Table 5-2. If a faulty part is located in an assembly that cannot be disassembled, order the next higher assembly or return the fixture to the nearest Hewlett-Packard Sales/Service Office for repair or replacement.

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

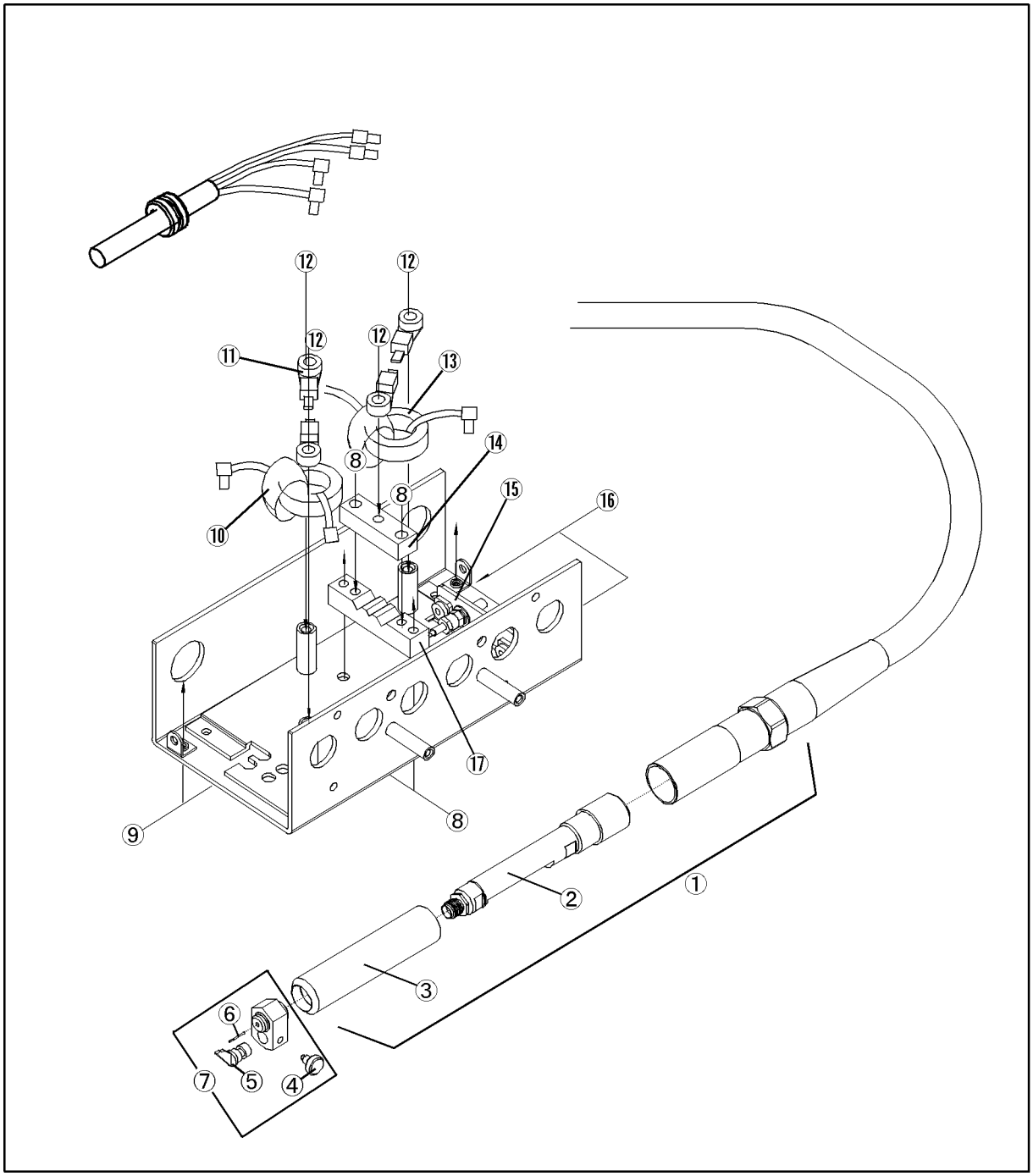

Table 5-1 Replacable Parts (part 1 of 2)

Reference Designator	HP Part No.	Qty.	Description
1	42941-60001	1	PROBE
2	42941-65001	1	CHASSIS
3	42941-24001	1	COVER
4	42941-24015	1	KNOB
5	42941-24013	1	GND
6	-	1	CANTACT PROBE
7	42941-60002	1	CONTACT ASSY
8	0515-1718	4	SCR M4X12
9	0515-0914	2	SCR-MACH M3X0.5
10	42941-61602	1	RF CBL ASSY
11	1400-0719	4	CABLE TIE
12	0515-1718	4	SCR M4X12
	3050-0893	4	WSHR-FL
13	42941-61604	1	RF CBL ASSY
14	42941-24006	1	PLATE
15	42941-66501	1	BOARD
16	0515-1550	2	SCR M3-L 8 P-H
17	42941-24005	1	BLOCK

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

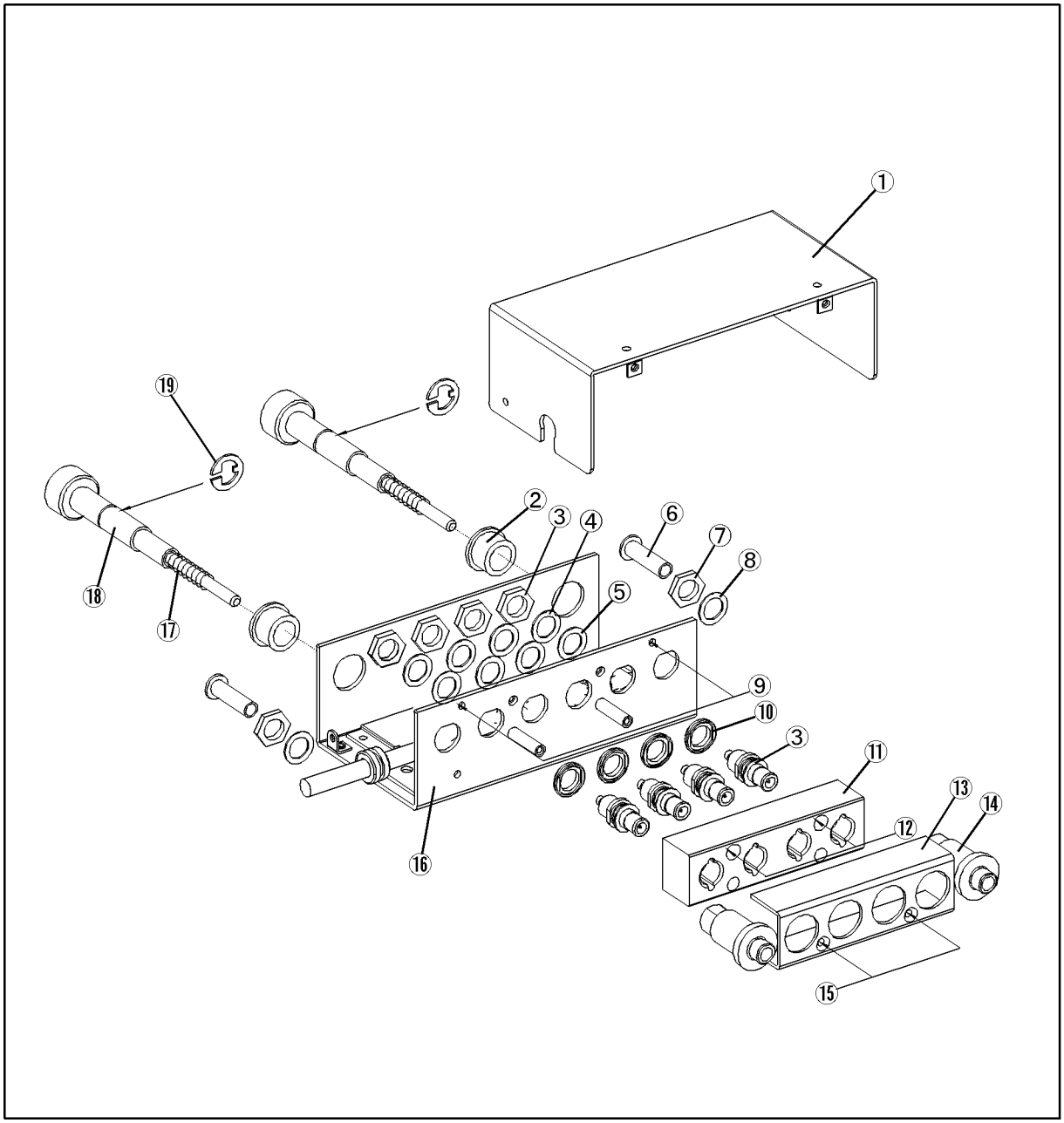

Table 5-2 Replacable Parts (part 2 of 2)

Reference Designator	HP Part No.	Qty.	Description
1	42941-00601	1	COVER TOP
2	42941-40002	2	BUSHING
3	1253-0476	4	ADPT BNC-SMB
4	3050-0067	4	WSHR-FL MTLC
5	3050-0789	4	WSHR-FL NM
6	42941-25002	2	SLEEVE
7	2950-0054	2	NUT-HEX-DBL-CHAM
8	2190-0054	2	WSHR-LK INTL T
9	0515-0914	2	SCR-MACH M3X0.5
10	16047-40002	4	INSULATOR
11	42942-25006	1	GUIDE BNC
12	0515-1550	2	SCR M3-L 8 P-H
13	42942-00603	1	COVER
14	42941-24003	2	GUIDE
15	0515-0914	2	SCR-MACH M3X0.5
16	42941-00602	1	COVER BOTTOM
17	-	2	SPRING
18	42941-24004	2	SHAFT
19	0510-0083	2	RTNR-R