

HP 16089E Kelvin Clip Leads
Operation Note



HP Part No. 16089-90001
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Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific **WARNINGS** 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 present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.

Safety Symbols

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

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

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 of one year from the date of shipment, except that in the case of certain components listed in *General Information* of this manual, the warranty shall be for the specified period. 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.

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.

General Information

Introduction

The purpose of this manual is to enable you to use your HP 16089E Kelvin Clip Leads efficiently and confidently. This manual contains both general and specific information.

Product Description

The HP 16089E has been designed to operate specifically with the following four-terminal-pair type LCR meters and impedance analyzers:

HP 4263B	HP 4284A	HP 4192A
HP 4278A	HP 4285A	HP 4194A

The HP 16089E makes it possible to measure odd-shaped components that cannot be measured with conventional test fixtures. The HP 16089E consists of a direct attachment, four-terminal-pair type test leads that are equipped with two insulated Kelvin clips.

Accessories Supplied

The following accessories are supplied with the HP 16089E:

Table 1-1. Furnished Accessories

Description	Part Number	Quantity
Operation Note	P/N 16089-90001	1

Operating and Safety Precautions

Operating

You need observe only normal precautions in handling and operating the HP 16089E. Do not exceed the operating input power, voltage, and current level and signal type appropriate for the instrument being used, refer to your instrument's operation manual.

Caution



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

Never touch the test clip contacts.

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

Service

The voltage levels found in the test leads when used with the intended instruments do not warrant more than normal safety precautions for operator safety. Nevertheless, service should be performed only by qualified personnel.

Specifications

These specifications are the performance standards and limits against which the HP 16089E is tested. When shipped from the factory, the HP 16089E meets the following specifications:

Applicable Instrument	HP 4263B, HP 4278A ¹ , HP 4284A ¹ , HP 4285A ¹ HP 4192A ¹ , HP 4194A ¹
Maximum dc Bias Voltage	±42 V peak max
Frequency Range	5 Hz to 100 kHz
Operating Temperature	0 to 55°C
Operating Humidity	≤95% RH (@40°C)
Non-operating Temperature	-40 to 70 °C
Non-operating Humidity	≤95% RH (@40°C)
Cable Length	approximately 1 m

¹ Except for the frequency range over 100 kHz.

Supplemental Performance Characteristics

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

Applicable DUT size	
Diameter of DUT's terminals	≤6.0 mm

Operation

Introduction

This chapter explains how to use the HP 16089E Kelvin Clip Leads.

Initial Inspection

The HP 16089E has been carefully inspected electrically and mechanically before being shipped from the factory. It should be in perfect physical condition, no scratches, dents or the like, and they should be in perfect electrical condition. Verify this by carefully performing an incoming inspection to check the test lead set for signs of physical damage and missing contents. If any discrepancy is found, notify the carrier and Hewlett-Packard. Your HP sales office will arrange for repair and replacement without waiting for the claim to be settled.

1. Inspect the shipping container for damage, and keep the shipping materials until the inspection is completed.
2. Verify that the shipping container contains everything shown in Figure 2-1 and listed in Table 2-1.
3. Inspect the exterior of the HP 16089E for any signs of damage.

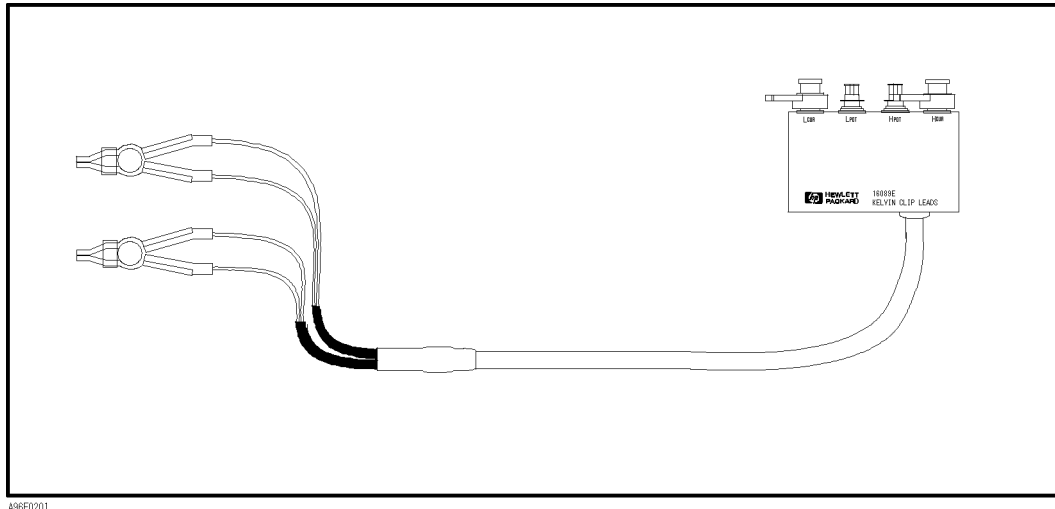


Figure 2-1. HP 16089E Product Overview

Table 2-1. Contents of HP 16089E

Description	HP Part Number	Quantity
① Kelvin Clip Leads	16089-60005	1
② Operation Note ¹	16089-90001	1

¹ Operation Note is not shown in Figure 2-1.

Ambient Environmental Considerations

Operating and Storage

The HP 16089E must be operated within an ambient temperature range of 0°C to 55°C and relative humidity up to 95% at 40°C (non-condensing).

The HP 16089E may be stored within a temperature range of -40°C to +70°, and at a relative humidity of up to 95% at +40°C (non-condensing).

Packaging the Test Leads

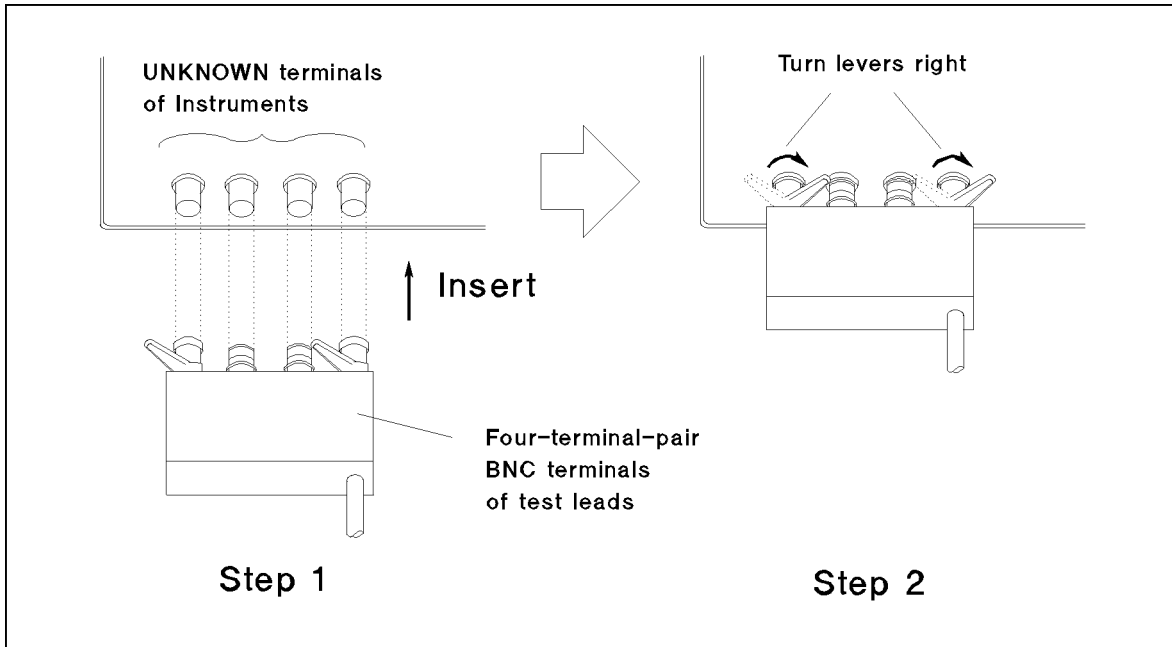
If shipment to a Hewlett-Packard service center is required, each test lead set should be repackaged using the original factory packaging materials.

Alternatively, comparable packaging materials may be used. Wrap the test leads in heavy paper and pack in anti-static plastic packing material. Use sufficient shock absorbing material on all sides of the HP 16089E to provide a thick, firm cushion and to prevent movement. Seal the shipping container securely and mark it *FRAGILE*.

Operation

Step-by-step instructions on how to make a measurement with the HP 16089E are as follows:

1. Set the instrument's Cable Length setting to 1 m.
2. Connect the HP 16089E to the instrument's UNKNOWN terminals.



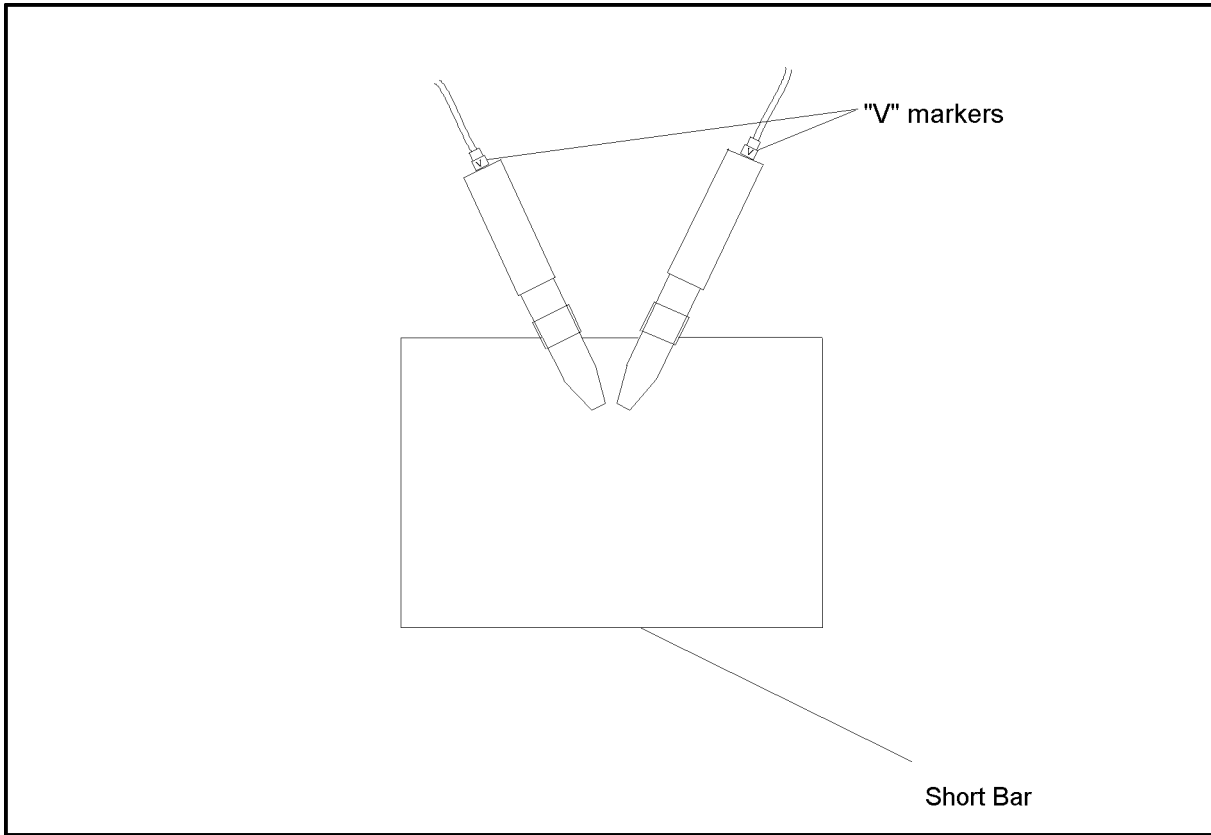
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Figure 2-2. Connecting the Test Leads

3. Perform the OPEN and SHORT compensation as described in the instrument's operation manual. Figure 2-3 shows how to make the short condition for the SHORT compensation.
4. Connect the DUT to the test clips.

OPEN and SHORT Compensation

The HP 16089E has inherent stray capacitance, residual inductance, and residual resistance that affect the measurement. To cancel the effects caused by these residuals and thus minimize their effect on measurement accuracy, the instrument's OPEN and SHORT compensation capabilities must be used. The procedures are described in the instrument's operation manual.



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Figure 2-3. Making a Shorting Condition for the HP 16089E

Shorting Bar

The short bar should have very low residual impedance, so a high conductivity metal plate that is not easily corroded, must be used to construct the shorting bar. (It must be clean.)