Agilent 16065C External Bias Adapter

Operation and Service Manual

Agilent Technologies

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Notice

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

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Warranty

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

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The 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 Institute's calibration facility, or to the calibration facilities of other International Standards Organization members.

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If you need assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

Manual Printing History

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

November 1991 ..... First Edition (part number: 16065-90020)

March 2000 ..... Second Edition (part number: 16065-90020)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.

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

Do NOT operate in an Explosive Atmosphere

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

Keep Away from Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only 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 injury, always disconnect power and discharge circuits before touching them.

Do NOT Service or Adjust While Alone

Do *not* attempt internal service or adjustment unless another person, capable of turning off power and capable of rendering first aid and resuscitation, is present.

Do NOT Substitute Parts or Modify Instrument

Because of the danger of introducing additional hazards, do *not* substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.

Dangerous Procedure Warnings

Warnings, such as the example below, precede *POTENTIALLY DANGEROUS PROCEDURES* throughout this manual. Instructions contained in the **warnings** must be followed.

Warning

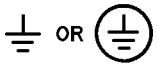
Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.

Safety Symbols

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

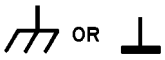
Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

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



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

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



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

Alternating current (power line).

Direct current (power line).

Alternating or direct current (power line).

Warning

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

Caution

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

Note

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

Contents

Figures

Tables

1

General Information

Introduction

The purpose of this manual is to enable you to use your 16065C External Bias Adapter efficiently and confidently. This manual contains both general and specific information. To use the 16065C to perform a specific function (without having to read the entire manual), follow the directions in "Using the 16065C".

Using the 16065C

- To install the 16065C, turn to Chapter 2.
- To operate the 16065C, turn to Chapter 3.
- To order replaceable parts for the 16065C, turn to "Replaceable Parts" in Chapter 4.

Product Description

The 16065C has been designed to operate specifically with the 4263B and 4278A LCR meters. By connecting an external dc voltage source to the 16065C, the 16065C can supply a bias voltage across components of up to ±40 V dc through a four-terminal pair type test fixture.

Accessories Supplied

The following accessories are supplied with the 16065C:

Table 1-1. Furnished Accessories

Description	Part Number	Quantity
Operation and Service Manual	P/N 16065-90020	1

Operating and Safety Precautions

Operating

You need observe only normal precautions when handling and operating the 16065C. Do not exceed the operating input power, voltage, and current level and signal type appropriate for the measurement 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 16065C is being connected or disconnected. Protect the 16065C from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any static charge build-up by touching the outer shell of any grounded instrument chassis before touching the test port connectors.

Never touch a test port connector's center contacts.

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

Service

The voltage levels in this adapter do not warrant more than normal caution for operator safety. Nevertheless, service should be performed only by qualified personnel.

Specifications

This section lists the complete 16065C specifications. These specifications are the performance standards and limits against which the 16065C is tested. When shipped from the factory, the 16065C meets the following specifications:

External DC Bias	Up to ±40 V can be applied to the DC BIAS INPUT BNC connector.
Frequency Range	100 Hz to 1 MHz
Applicable Instrument	4263B, 4278A
Applicable Fixture	16034E, 16047A, C, 16038A, B, C, D, E
Input Resistance	2 kΩ±10%
Weight	450 g
Operating Temperature	0 to 55°C
Operating Humidity	≤95% RH (@40°C)
Non-operating Temperature	−40 to 70 °C
Non-operating Humidity	≤95% RH (@65°C)
Dimensions	160 mm (W) × 50 mm (H) × 150 mm (D)
Cable length	210 mm

2

Preparation for Use

Introduction

This chapter explains how to install the 16065C External Bias Adapter. The topics covered include initial inspection, ambient environmental considerations, connecting the adapter for use, and repackaging the adapter.

Initial Inspection

The adapter 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 it should be in perfect electrical condition. Verify this by carefully performing an incoming inspection to check the adapter for signs of physical damage and missing contents. If any discrepancy is found, notify the carrier and Agilent Technologies. Your Agilent Technologies sales office will arrange for repair and replacement without waiting for the claim to be settled.

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 16065C for any signs of damage.

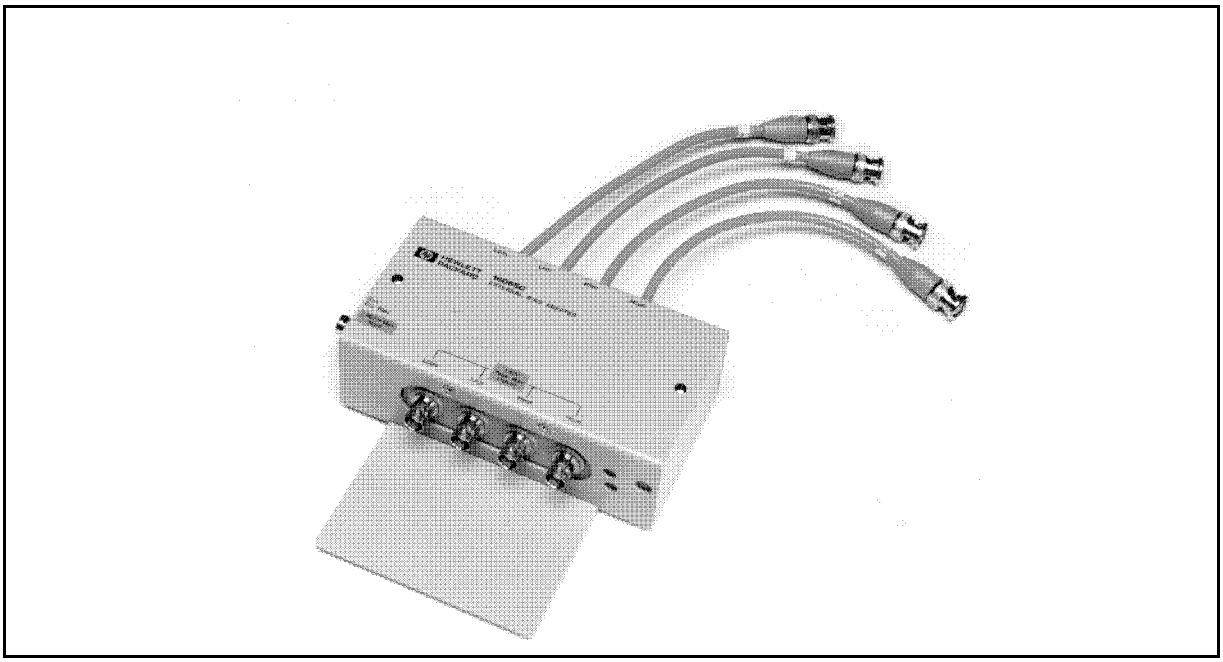


Figure 2-1. Product Overview

Table 2-1. Contents

Description	Agilent Part Number	Quantity
① External BIAS Adapter	16065-60300[1]	1
② Operation and Service Manual[2]	16065-90020	1

1 Agilent internal-only part number.

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

Environmental Considerations

Operating and Storage

The 16065C should 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 16065C may be stored within a temperature range of −40°C to +70°C, and at a relative humidity of up to 95% at +65°C (non-condensing).

Connecting the Adapter for Use

Caution Make sure that the voltage source is turned off before you start making connections.

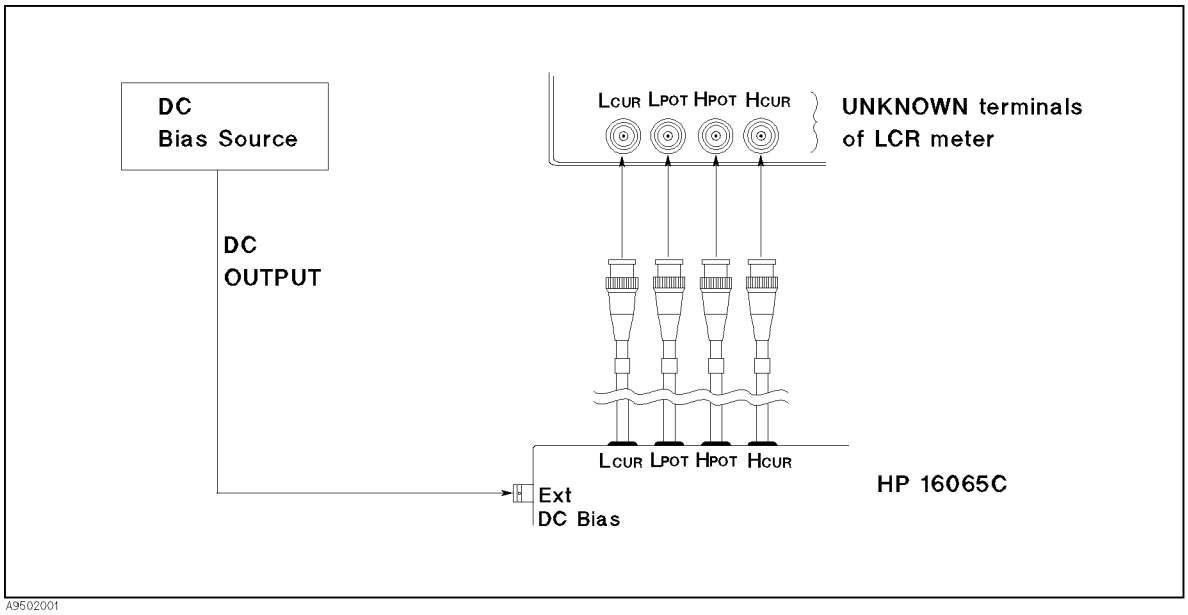


Figure 2-2. Connecting the Adapter

Repackaging the Adapter

If shipping to a Agilent Technologies service center is required, each adapter should be repackaged using the original factory packaging materials.

Alteratively, comparable packaging materials may be used. Wrap the adapter in heavy paper and pack in anti-static plastic packing material. Use sufficient shock absorbing material on all sides of the 16065C to provide a thick, firm cushion and to prevent movement. Seal the shipping container securely and mark it *FRAGILE*.

3

Operation

Introduction

This chapter describes the features of the 16065C (Figure 3-1), the connection to an external voltage source and test fixture, and compensation techniques.

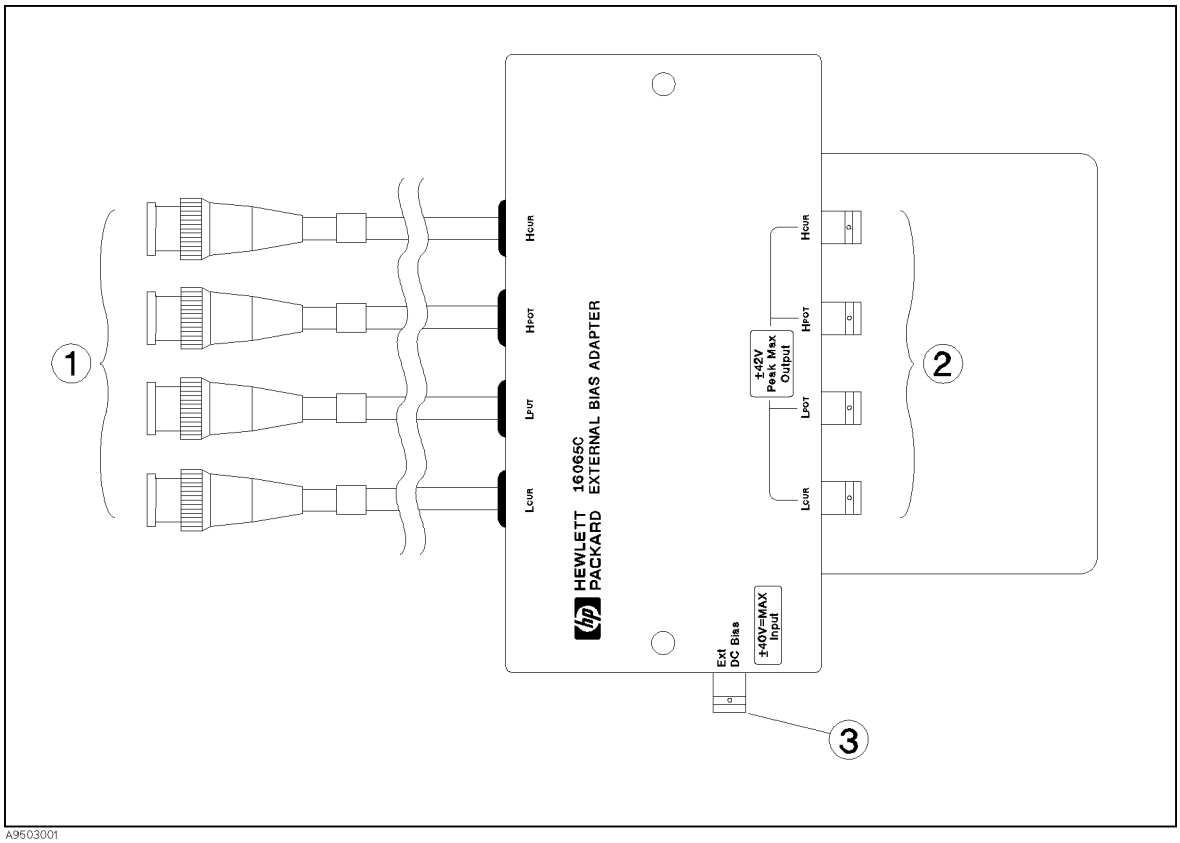


Figure 3-1. Adapter Features

1. *Four-terminal-pair test leads.* These are connected to the UNKNOWN terminals of an LCR meter or impedance analyzer.
2. *Four-terminal-pair BNC terminals.* These terminals are connected to a four-terminal-pair type fixture.
3. *DC Bias Input BNC.* This terminal is connected to an external voltage source in order to apply dc bias voltage to the DUT.

OPEN/SHORT Correction

The 16065C has inherent stray capacitance, residual inductance, and residual resistance which, if not properly compensated for before a measurement is made, will degrade measurement accuracy. To cancel these residuals and thus minimize measurement error, the measuring instrument's OPEN/SORT correction capability must be used. The procedure is described in the instrument's operation manual.

Operation

The step-by-step instructions on how to make a measurement with the 16065C are:

1. Connect the test leads of 16065C to the measuring Instrument's UNKNOWN terminals.
2. Connect the test fixture directly to the 16065C.
3. Connect the dc voltage source to the 16065C's DC BIAS INPUT BNC.

Caution Do NOT turn on the voltage source while correction is in progress.

4. Perform OPEN and SHORT correction as described in the measuring instrument manual.
5. Insert the component to be tested into the test fixture.

Caution Do NOT short the high and low terminals when the voltage source is turn ON.

Caution When a positive bias voltage is used, the positive terminal of an electrolytic capacitor must be connected to the instruments high terminal. When using a negative bias voltage, connect an electrolytic capacitor's negative terminal to the instrument's high terminal.

Note When measuring high value capacitors, allow sufficient time for the capacitor to charge to the applied voltage.

DC Bias

You Can NOT Use the Internal DC BIAS Source of Your Instrument

The 16065C contains a 100 μF capacitor, series connected between the H_{cur} terminal and the component under test. Its function is to block the applied dc voltage from flowing back into the measuring instrument. Also, because of its location, this capacitor makes it impossible to bias samples from the measuring instrument's internal bias source. Thus, the 16065C can not be used for applications in which the instrument's internal bias source is used.

Requirement for External Voltage Source

The external dc voltage source used for biasing samples connected to the 16065C must be capable of delivering 20 mA at 40 V.

Current Limiting

The 16065C's DC Bias Input has a 2 kΩ current limiting resistor in series with the component under test.

Capacitive Component Requires Time to Charge

The 16065C DC BIAS INPUT has a 2 kΩ current limiting resistor in series with the component under test. The time required for a capacitive component to charge through this resistance is calculated as:

$$T(s) = 1.6 + (0.01 \times C)\ [sec]$$

Where C is the capacitance of the sample, in μF.

Additional Error for D Measurement

Because of the series-connected capacitor between the H_{pot} terminal and the component under test, there is a test frequency dependent phase shift between the H_{pot} terminal and the L_{cur} terminal. The input impedance of the instrument causes additional error in some measurement modes. The additional error for phase measurements (E_p) is derived by the following equation:

$$E_p \simeq 70 / f\ (\%)$$

(Typical)

where **f** is measurement frequency and unit is Hz.

The additional error for D measurements (E_D) is derived by the following equation:

$$E_D \simeq 0.7 / f$$

(Typical)

Note

STANDARD compensation function of the 4278A and LOAD correction function of the 4263B can correct the additional error due to the 16065C. For more information on compensation and correction, refer your instrument's manual.

4

Service

Introduction

This chapter gives service information for the 16065C. The Replaceable Parts List and the Schematic Diagram are included.

Replaceable Parts

Figure 4-1 and Table 4-1 identify the replaceable mechanical parts. Table 4-2 and Figure 4-2 identify the replaceable parts on the PC board. The parts listed can be ordered from your nearest Agilent Technologies office. Ordering information should include the Agilent part number and the quantity required.

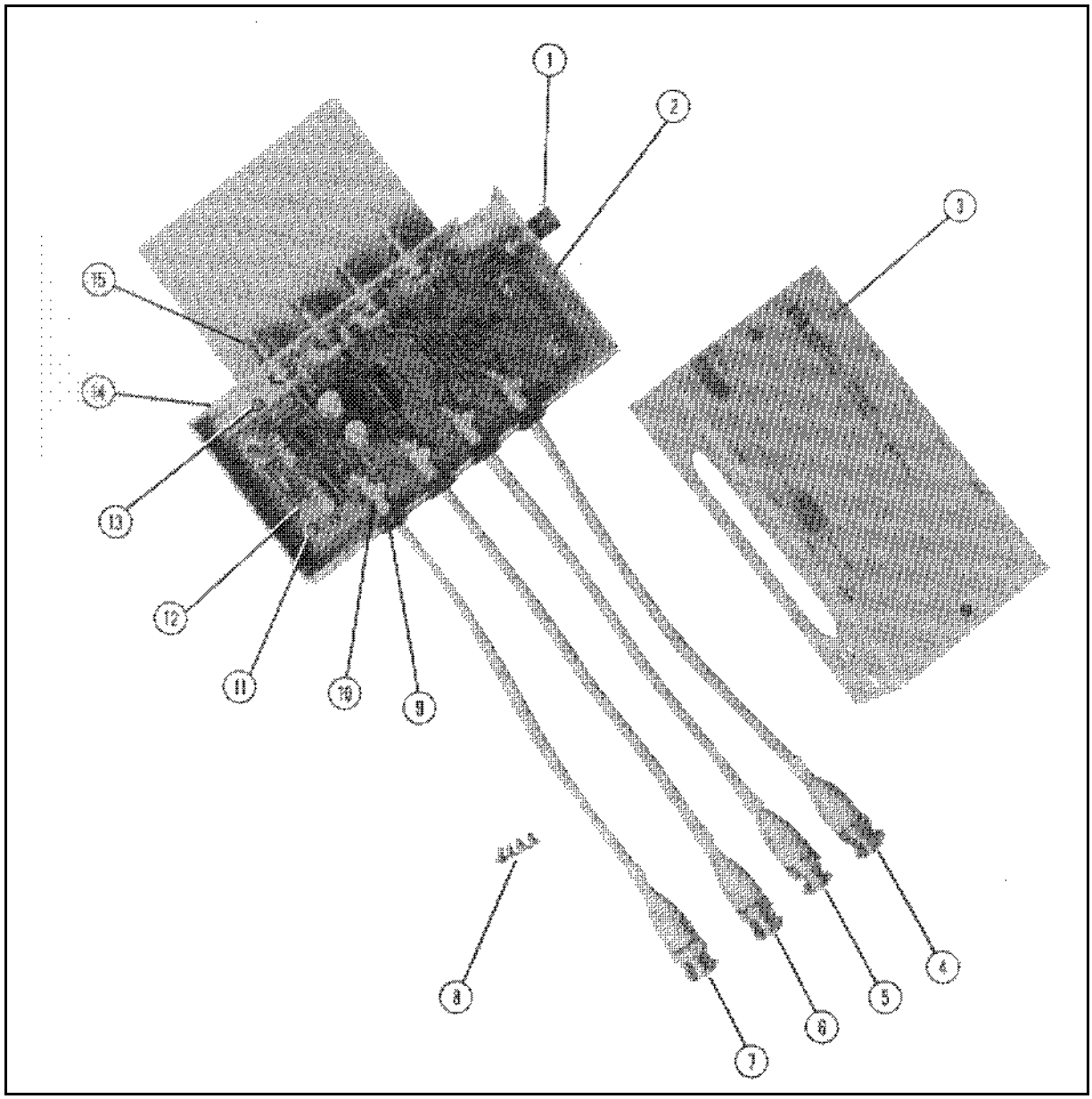


Figure 4-1. Replaceable Parts Identifiers

Table 4-1. Replaceable Mechanical Parts

Reference Designator	Agilent Part Number	Qty.	Description
1	1250-0083	1	Connector BNC (for “Ext DC Bias”)
	2190-0016	1	Washer[1]
	2950-0043	1	Nut[1]
2	16065-04002	1	Chassis
3	16065-04001	1	Chassis Top Cover
4	16065-61602	1	Cable Assembly “LC”
5	16065-61603	1	Cable Assembly “LP”
6	16065-61605	1	Cable Assembly “HP”
7	16065-61604	1	Cable Assembly “HC”
8	0515-0914	4	Screw Flat Head M3 L6
9	94801-40042	4	Grommet
10	1400-0249	4	Cable Tie
11	0515-1550	4	Screw Pan Head M3×0.5 L8 w/ Washer
12	16065-66503	1	PC Board Assembly
13	0515-1550	3	Screw Pan Head M3×0.5 L8 w/ Washer
14	16065-01201	1	Angle
15	1250-0118	4	Connector BNC
	16047-40002	8	Insulator[2]
	2190-0016	4	Washer[2]
	0360-1190	4	Terminal Solder Lug[2]
	2950-0043	4	Nut[2]
	0403-0427	6	Bumper Foot

1 These parts are for 1.

2 These parts are for 15.

Table 4-2. Replaceable Parts

Reference Designator	Agilent Part Number	C D	Qty.	Description
A1	16065-66503	1	1	PC BOARD ASSEMBLY
A1C1	0160-5755	2	1	CAP-FXD 0.1μF ±10% 100 V CER X7R
A1C2	0180-3596	7	1	CAP-FXD 100μF ±20% 100 V AL-ELCTLT
A1C3	0180-3596	7	1	CAP-FXD 100μF ±20% 100 V AL-ELCTLT
A1C4	0160-6342	5	1	CAP-FXD 1μF ±5% 100 V POLYE-MET
A1CR1	1902-1540	0	1	DIODE-ZNR 47V 10% PD=2W IR=5μA
A1CR2	1902-1540	0	1	DIODE-ZNR 47V 10% PD=2W IR=5μA
A1CR3	1901-1250	7	1	DIODE-PWR RECT 400V 1A
A1CR4	1901-1250	7	1	DIODE-PWR RECT 400V 1A
A1R1	0764-0016	8	1	RESISTOR 1K ±5% 2W MO TC=0±200
A1R2	0764-0016	8	1	RESISTOR 1K ±5% 2W MO TC=0±200
A1R3	0698-3457	6	1	RESISTOR 316K ±1% 0.125W TF TC=0±100

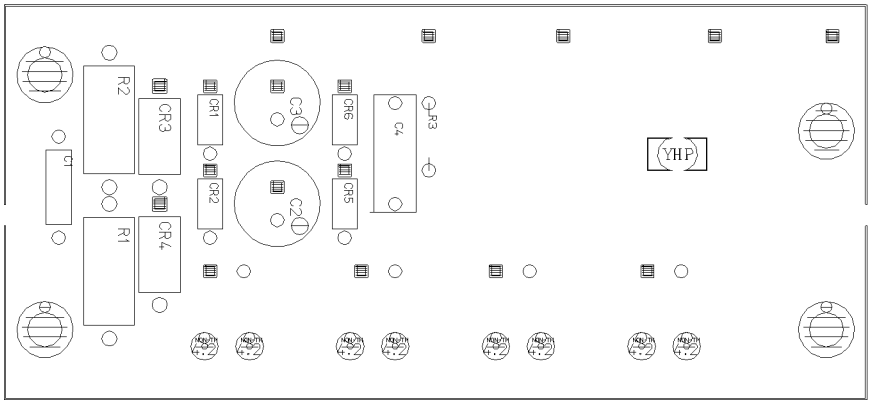


Figure 4-2. Component Locations

Schematic Diagram

Figure 4-3 shows the schematic diagram of the 16065C.

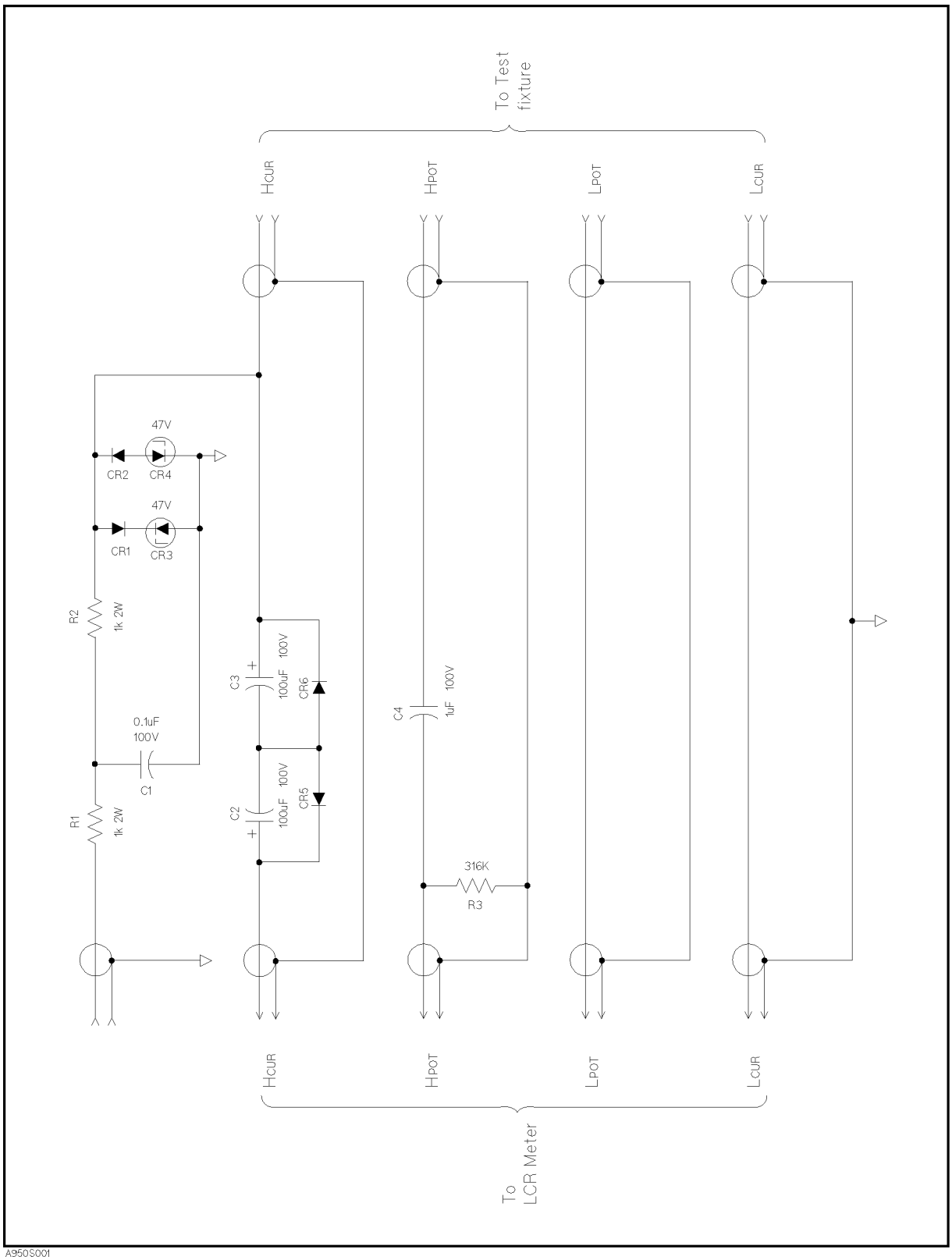


Figure 4-3. 16065C Schematic Diagram

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