

# Agilent LCR Meters, Impedance Analyzers and Test Fixtures

Selection Guide



**Component and Material Measurement Solutions**



**Agilent Technologies**

# Cost Effective Solutions for Your Applications

Whether your application is in R&D, production, quality assurance, or incoming inspection, Agilent Technologies has the right impedance measurement solution for you. Agilent has a complete line of impedance test equipment and test accessories to help you task efficiently. When you choose an impedance measurement product from Agilent, you get more than accurate and reliable test results. Agilent offers:

*Complete solution:* Covering frequencies from 20 Hz to 3 GHz, Agilent's impedance product line offers you the widest selection of equipment for your application. In addition, several third-party companies have complementary products designed to work with Agilent equipment for special applications. This brochure gives an overview of all the products you can choose from.

*Knowledge:* Agilent has decades of experience providing impedance measurement solutions. Years of experience and continuing technical innovations go into the design and manufacturing of each Agilent LCR meter and impedance analyzer. Agilent also has a list of technical publication to assist you in many different applications (see page 15 for full listing.)

*Convenience:* Any time you have an impedance measurement need, help is only one phone call away. Agilent offers three types of impedance measurement solutions as shown in Table 1. Calling Agilent will put you in contact with one of our trained engineers to help you find a solution.

## Advanced measurement techniques for a wide range of applications

Figure 1 is a comparison of different measurement techniques used in Agilent's LCR meter and impedance analyzers. As you can see, each technique has special measurement advantages:

- Auto-balancing bridge offers widest impedance measurement range with typical frequency range of 20 Hz to 110 MHz. This technique is best for low-frequency, general-purpose testing.

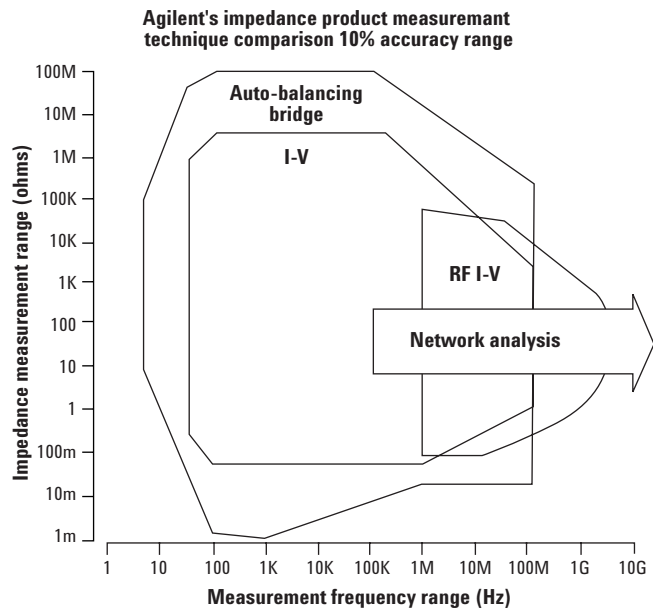


Figure 1. Impedance measurement technique

Table 1. Impedance measurement product type

	Product type		
Product highlights	LCR meter	Impedance analyzer	Combination analyzer
Frequency sweep capability	Spot	Continuous	Continuous
Display	Numeric only	Graphics	Graphics
Others	Handler interfaces	Equivalent circuit analysis built in	Equivalent circuit analysis built in, multiple functions in one instrument
Advantage	Lower-cost solution, ease of use, high speed	Frequency characteristics and resonant analysis, circuit modeling	Cost-effective, time-saving, compact in size

- I-V technique covers from 40 Hz to 110 MHz with a more focused impedance measurement range. I-V technique also allows probing for in-circuit testing.
- RF I-V, an enhancement of the I-V technique, offers some of the high-frequency benefit of network analysis while retaining some of the impedance measurement range of the I-V technique. Designed for accuracy and high-frequency performance, the RF I-V technique is excellent for RF component analysis, especially for small inductance and capacitance values.
- Network analysis offers the highest frequency coverage, but works best when the measurement range is close to 50 Ω. With this measurement technique, impedance values are derived from reflection coefficients. Network analysis is most widely used for RF and microwave component and circuit analysis.

## How to use this selection guide

Table 2 is a summary of all of Agilent's impedance products. It is designed to assist you in better comparing Agilent's wide range of instrumentation and in choosing possible solutions for your applications, depending on your requirements in the following areas:

- Test frequency range
- Device type or application type
- Accuracy requirement (measurement technique)
- Any other special needs

If you find several possible solutions for your application, go to the corresponding pages to find more details about each product. Call Agilent if you need further assistance.

**Table 2.** Agilent impedance measurement products

Product type	Freq. range	Purpose	Model	Page	Frequency range (Hz)	Basic Z accuracy <sup>1</sup> (%)	Measurement display range (Ω)	Feature <sup>5</sup>	Measurement technique <sup>6</sup>	Main application
Impedance analyzer	RF	High performance /multi function	E4991A	4	1 M-3 G	0.8	200 m-20 k <sup>4</sup>	A,B	RF I-V	LCR component, material, semiconductor
	LF/HF	High performance /multi function	4294A	4	40-110 M	0.08	25 m-40 M <sup>4</sup>	A,B	ABB	LCR component, material, semiconductor
		probe measurement	4294A with 42941A	4	40-110 M	1	50 m-4 M <sup>4</sup>	A,B	IV	LCR component, material, semiconductor
Combination analyzer	RF	Network/spectrum /impedance measurement	4396B <sup>3</sup>	5	100 k-1.8 G	3	2-5 k <sup>4</sup>	A,B	RF I-V	LCR component, other passive component, active component, circuit analysis
	HF	Network/spectrum /impedance measurement	4395A <sup>3</sup>	5	100 k-500 M	3	2-5 k <sup>4</sup>	A,B	RF I-V	LCR component, other passive component, active component, circuit analysis
LCR meter	RF	High performance /multi function	4287A	6	1M-3G	1	200 m-3k <sup>4</sup>	C	RF I-V	LCR component
	HF	High performance /multi function	4285A	7	75 k--30 M	0.1	0.01 m-100 M	D	ABB	LCR component, material, semiconductor
	LF	High performance /multi function	4284A	7	20-1 M	0.05	0.01 m-100 M	D	ABB	LCR component, material, semiconductor
	LF	Low-cost /multi function	4263B	8	100-100 k	0.1	0.01 m-100 M	D	ABB	LCR component, transformer
Application specific	LF	For high-value capacitor measurement	4268A	9	120 & 1 k only	0.2	0.1 p-10 mF <sup>2</sup>	D	ABB	MLCC
	LF	For capacitor measurement	4288A	9	1 k & 1 M only	0.07	0.00001 p-20 μF <sup>2</sup>	D	ABB	Ceramic capacitor
	LF	For milliohm measurement	4338B	8	1 k only	0.4	10 μ-100 k	D	OTR	Connector, resistor
	DC	For high resistance measurement	4339B 4349B	8, 9	DC only	0.6 2	1 k-1.6X10 <sup>16</sup> 1 k-1.0X10 <sup>15</sup>	D	OTR	Transformer, capacitor
	LF	For C-V measurement	4279A	9	1 M only	0.1	0.00001 p 1280 pF <sup>2</sup>	D	ABB	Diode

1. Basic Z accuracies are best-case values and vary depending on measurement conditions. See product data sheet for detail

2. Capacitance measurement only

3. Requires Option 4395A-010, 4396B-010, and 43961A.

4. Z range shows the 10% accuracy range

5. Feature A : Built-in equivalent circuit analysis.

Code B : Frequency sweep with color LCD display

C : Spot frequency with color LCD display

D : Spot frequency with LCD display

6. Measurement technique code

ABB : Auto-balancing bridge

I-V : I-V method

RF I-V : RF I-V method

NA : Network analysis

OTR : Others

# Impedance Analyzers

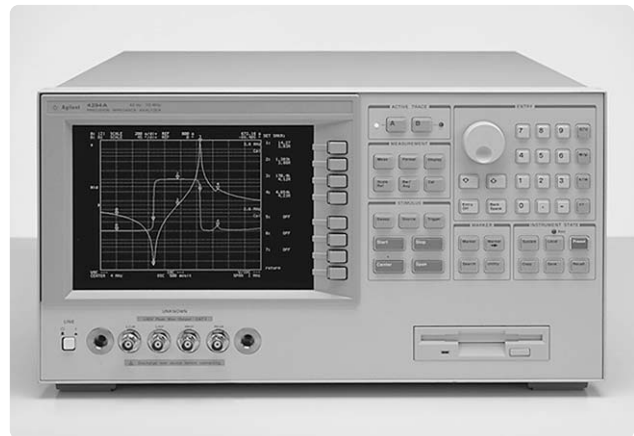
Impedance analyzers provide high measurement accuracy and sophisticated measurement functions:

- Frequency, DC bias, and AC voltage/current sweep capability lets you customize where and how test data will be taken.
- Built-in equivalent-circuit analysis computes a multi-element circuit model of the device under test.
- Color LCD/CRT can display multiple sets of measurement curves at the same time.
- Advanced calibration and compensation methods reduce measurement errors.



## E4991A RF impedance/material analyzer

- Provides top-of-the-line solution for measuring impedance from 1 MHz to 3 GHz, with an optional material-test function for measuring permittivity and permeability.
- Ideal instrument for RF surface mount inductors, capacitors, PC board materials and magnetic toroids.
- Measurement parameters:  $|Z|$ ,  $|Y|$ ,  $\theta$ , R, X, G, B, C, L, D, Q
- Optional material parameters :  $\epsilon$ ,  $\epsilon'$ ,  $\epsilon''$ ,  $\mu$ ,  $\mu'$ ,  $\mu''$
- Built-in LAN, GPIB interface



## 4294A precision impedance analyzer

- Highly accurate 4-terminal-pair impedance measurement in a wide frequency range of 40 Hz to 110 MHz. Extremely small variation in component characteristics can be precisely evaluated with sweep measurements of 0.08% basic accuracy.
- Best instrument for component evaluation like capacitors, inductors, resonators, semiconductors and for material evaluations like PC boards and toroidal cores. Improves evaluation efficiency with various measurement & analysis functions.
- In-circuit or grounded measurements with the 42941A Impedance Probe
- Built-in LAN interface
- Measurement parameters:  $|Z|$ ,  $|Y|$ ,  $\theta$ , R, X, G, B, L, C, D, Q

# Network/Spectrum/Impedance Analyzers

These combination analyzers offer a cost-effective and time-saving alternative. Instead of buying a rack full of stand-alone test equipment and spending extra time to make them work together, you can get a combination analyzer that has all the functions you need and is ready to go when you press the power-on button. For impedance measurement, analyzers have the same advanced features as the impedance analyzers described on page 4.



## 4396B network/spectrum/impedance analyzer (with 43961A RF impedance test kit and Option 4396B-010)

- 1.8 GHz three-in-one analyzer with no sacrifice in performance.
- Advanced features for meeting your future test requirements: time gated spectrum analysis for pulsed signal analysis, digital resolution bandwidth for faster sweeps, and more.
- Saves you money and time for RF component and circuit analysis.
- Built-in IBASIC function
- Measurement parameters:  $|Z|$ ,  $|Y|$ ,  $\theta$ ,  $\Gamma$ , X, G, B, C, L, D, Q



## 4395A network/spectrum/impedance analyzer (with 43961A RF impedance test kit and Option 4395A-010)

- 500 MHz three-in-one analyzer for components and circuit design up to 500 MHz.
- Advanced features for meeting your future test requirements: time gated spectrum analysis for pulsed signal analysis, digital resolution bandwidth for faster sweeps, and more.
- Best-valued bench-top tool for R&D
- Built-in IBASIC function
- Optional dc bias source
- Measurement parameters:  $|Z|$ ,  $|Y|$ ,  $\theta$ ,  $\Gamma$ , X, G, B, C, L, D, Q

# Precision LCR Meters

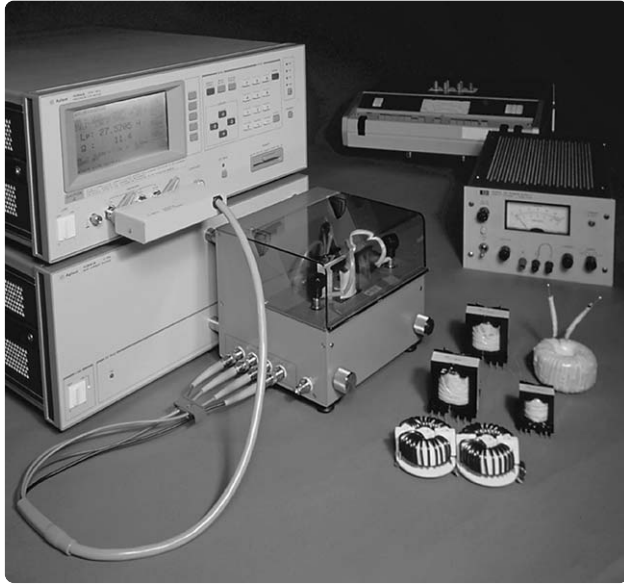
Designed for measurement precision and ease-of-use, this family of LCR meters fits both R&D and production applications. Although the LCR meters do not have all the sophisticated features as impedance analyzers, the LCR meters offers excellent performance at an affordable price:

- Wide selection of frequency range from 20 Hz to 3 GHz.
- Frequency list sweep for continuous testing at multiple frequency points.
- Great for general-purpose testing of leaded components surface-mount components, materials, and more.
- GPIB and handler interface for easy test automation in production environment.



## 4287A RF LCR meter

- 3 GHz LCR meter for precisely testing actual characteristics of components at demanded RF operating frequencies.
- RF I-V technique provides a wide impedance range (0.2  $\Omega$  to 3 k  $\Omega$ ).
- 9 ms high speed measurement and 1% accuracy suitable for production testing.
- Highly stable measurement of low-inductance and excellent Q accuracy (6% @ Q=100, 100 MHz) for meeting chip inductor test requirements.
- Handler, GPIB and LAN interfaces
- Measurements parameter  $|Z|$ ,  $|Y|$ ,  $\theta$ , R, X, G, B, C, L, D, Q



### 4284A precision LCR meter

- 0.05% basic accuracy
- 20 Hz to 1 MHz
- Option 4284A-001 adds  $\pm 40$  V internal dc bias voltage
- For testing power inductors and transformers, choose Option 4284A-002, 42841A, and 42842A/B to get up to 20 A dc bias current<sup>1</sup>
- Measurement parameters:  $|Z|$ ,  $|Y|$ ,  $\theta$ , R, X, G, B, C, L, D, Q



### 4285A precision LCR meter

- 0.1% basic accuracy
- 75 kHz to 30 MHz
- Option 4285A-001 adds  $\pm 40$  V dc bias voltage
- Option 4285A-002, 42841A, and 42842C provide up to 10 A dc bias current
- Measurement parameters:  $|Z|$ ,  $|Y|$ ,  $\theta$ , R, X, G, B, C, L, D, Q

1. 40A dc bias current, when using 2 x 42841A and 1 x 42842B.

# Basic Products

The following products are designed for basic or special-purpose applications. Their features are optimized to achieve maximum performance for the particular applications.



## 4263B LCR meter

- Spot frequency testing at 100 Hz, 120 Hz, 1 kHz, 10 kHz, and 100 kHz (optional 20 kHz)
- Compact, easy-to-use, entry-level LCR meter
- Measurement parameters:  $|Z|$ ,  $|Y|$ ,  $\theta$ , R, X, G, B, C, L, D, Q
- Add N, M, DCR (Option 4263B-001) for transformer/Coil measurements
- Set signal level (20 mV to 1 Vrms) in 5 mVrms steps
- Monitor actual ac voltage and current levels
- Select the number of displayed digit (3, 4, or 5)



## 4338B milliohm meter (10 $\mu\Omega$ to 100 k $\Omega$ )

- 1 kHz ac measurement with selectable test signal current from 1  $\mu\text{A}$  to 10 mA
- Designed for ultra-low resistance measurements of switches, batteries, relays, cables, connectors, and PC boards.
- Measurement parameters: R, X,  $|Z|$ , L, Q
- Contact check function for reliable tests.
- Select the number of displayed digits (3, 4, or 5)



## 4339B high-resistance meter

- Test voltage: 0.1 to 1000 Vdc
- Measurement range: R:  $1 \times 10^3\Omega$  to  $1.6 \times 10^{16}\Omega$ , I: 60 fA to 100  $\mu\text{A}$
- Great solution for evaluating leakage current and insulation resistance of components.
- Can be programmed to measure surface and volume resistivity.
- Measurement parameters: I, R, surface, and volume resistivity
- Contact check function for reliable tests.



# Capacitance Meters



## 4268A 120 Hz/1 kHz capacitance meter

- Suitable for high value multi-layer ceramic capacitor testing
- 120 Hz and 1 kHz test frequencies
- Constant test signal level and 25 msec high speed measurement by newly-developed high speed auto level control function.
- Measurement parameters: C, D, Q, ESR, G



## 4288A 1 kHz/1 MHz capacitance meter

- Two standard frequencies (1 kHz and 1 MHz) for capacitor testing
- Measurement speed and accuracy optimized for production testing
- Measurement parameters: C, D, Q, ESR, G

# Others



## 4279A C-V meter

- 1 MHz only for semiconductor C-V testing
- Internal programmable dc bias sweep source
- Automatic bias polarity control for quick selection of the correct polarity bias voltage
- Measurement Parameters: C, D, Q, ESR, G



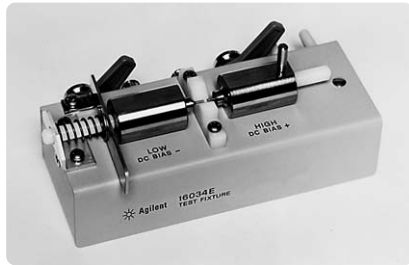
## 4349B 4-channel high-resistance meter

- 4-channel simultaneous testing<sup>1</sup>
- Fast contact check function for reliable testing
- Measurement range:
  - R:  $1 \times 10^3\Omega$  to  $1.0 \times 10^{15}\Omega$
  - I: 1 pA to 100  $\mu$ A

1. Because the 4349B has 4-measurement channels, with no internal dc source, an external dc source is required.

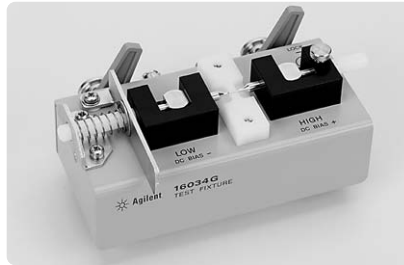
# Test Fixtures and Accessories (Four-Terminal-Pair)

## Basic test fixtures



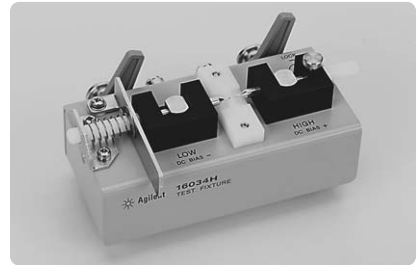
**16034E SMD/chip test fixture**

*Frequency:*  $\leq 40$  MHz  
*Maximum dc bias:*  $\pm 40$  V



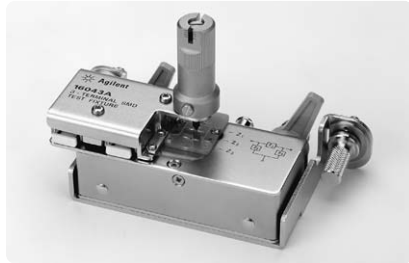
**16034G small SMD/chip test fixture**

*Frequency:*  $\leq 110$  MHz  
*Maximum dc bias:*  $\pm 40$  V



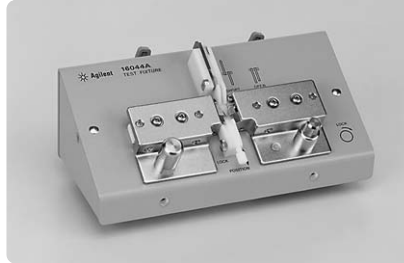
**16034H SMD/chip test fixture**

*Frequency:*  $\leq 110$  MHz  
*Maximum dc bias:*  $\pm 40$  V  
*Suitable for array-type devices*



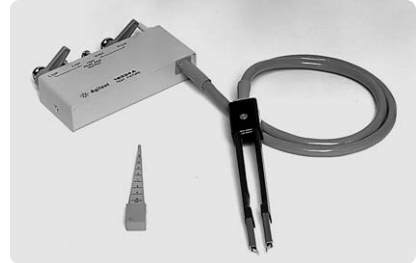
**16043A/B test fixture**

*Frequency:*  $\leq 110$  MHz  
*Maximum dc bias:*  $\pm 40$  V



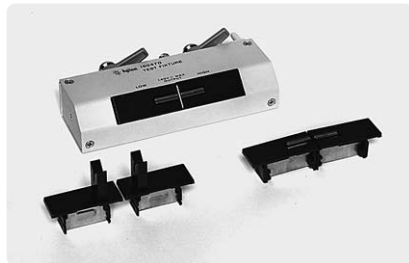
**16044A SMD Kelvin contact test fixture**

*Frequency:*  $\leq 10$  MHz  
*Maximum dc bias:*  $\pm 40$  V



**16334A SMD/chip tweezers**

*Frequency:*  $\leq 15$  MHz  
*Maximum dc bias:*  $\pm 42$  V



**16047A/D axial & radial test fixture**

*Frequency:* A:  $\leq 13$  MHz, D:  $\leq 40$  MHz  
*Maximum dc bias:* A:  $\pm 35$  V, D:  $\pm 40$  V



**16047E test fixture**

*Frequency:*  $\leq 110$  MHz  
*Maximum dc bias:*  $\pm 40$  V



**16089A/B/C/D/E clip leads**

*Connector type:* A/B/C/E: Kelvin  
 D: alligator  
*Frequency:* 5 Hz to 100 kHz  
*Cable length:* A/B/C/D: 0.94 m  
 E: 1.3 m

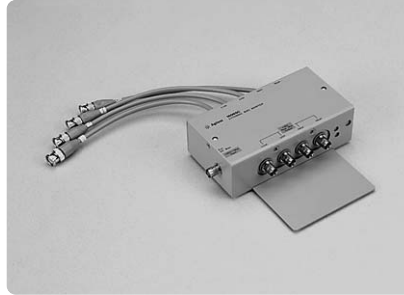
# Test Fixtures and Accessories (Four-Terminal-Pair)

## External DC bias fixtures



**16065A axial and radial test fixture with safety cover**

*Frequency:* 50 Hz to 2 MHz  
*Maximum externally supplied dc bias:*  $\pm 200$  V  
Blocking capacitor of  $5.6 \mu\text{F}$  is connected in series with the Hc terminal



**16065C external bias adapter**

*Frequency:* 50 Hz to 1 MHz  
*Maximum externally supplied dc bias:*  $\pm 40$  V  
Blocking capacitor of  $50 \mu\text{F}$  is connected in series with the Hc terminal

## Test leads



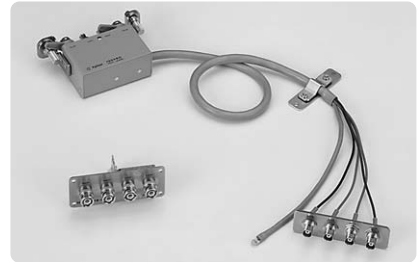
**16048A/D/E BNC test leads**

*Frequency:* A:  $\leq 30$  MHz, D:  $\leq 30$  MHz, E:  $\leq 1$  MHz  
*Cable length:* A: 0.94 m, D: 1.89 m, E: 3.8 m  
*Maximum dc bias:*  $\pm 40$  V



**16048B SMC test leads**

*Frequency:*  $\leq 30$  MHz  
*Cable length:* 0.94 m  
*Maximum dc bias:*  $\pm 40$  V



**16048G/H BNC test leads**

*Frequency:*  $\leq 110$  MHz  
*Cable length:* G: 1 m, H: 2 m  
*Maximum dc bias:*  $\pm 40$  V  
Use with only 4294A

## Terminal adapters



**4294A four-terminal-pair to 7 mm terminal adapter**

*Frequency:*  $\leq 110$  MHz  
*Maximum dc bias:*  $\pm 40$  V  
Use with only 4294A



**16085B four-terminal-pair to 7 mm terminal adapter**

*Frequency:*  $\leq 40$  MHz  
*Maximum dc bias:*  $\pm 40$  V

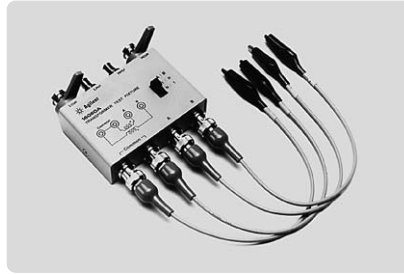
# Test Fixtures and Accessories (Four-Terminal-Pair)

## Others



**42941A impedance probe kit**

*Frequency:* 40 Hz to 100 MHz  
*Maximum dc bias:*  $\pm 40$  V  
*Probe cable length:* 1.5 m  
*Use with only 4294A.*



**16060A transformer test fixture**

*Frequency:* dc to 100 kHz  
*Use with only 4263B*



**16064B LED display/trigger box**

For production test applications.  
*Use with only 4263B, 4338B, 4339B  
 and 4349B*

## Material measurements



**16451B dielectric test fixture**

*Measurement parameters:*  
 capacitance (C), dissipation factor (D),  
 and dielectric constant ( $\epsilon_r'$ ,  $\epsilon_r''$ )  
*Material-under-test size:*  
 thickness:  $\leq 10$  mm  
 diameter: 10 to 56 mm  
*Frequency:*  $\leq 30$  MHz



**16452A liquid test fixture**

*Measurement parameter:*  
 capacitance (C), dielectric constant  
 ( $\epsilon_r'$ ,  $\epsilon_r''$ ) Liquid sample  
*Quantity:*  $\leq 6.8$  ml  
*Frequency:* 20 Hz to 30 MHz

## Balanced/unbalanced test fixture



**16314A balanced/unbalanced  
 4-terminal converter**

*Frequency:* 100 Hz to 10 MHz  
 Connectors: 4 BNCs (unbal.), 2 signal  
 terminals (bal.) & 1 ground terminal  
*Characteristic Z:* 50  $\Omega$



**16315A<sup>1</sup> 50  $\Omega$  balanced/  
 50  $\Omega$  unbalanced converter**

*Frequency:* 100 Hz to 10 MHz  
**16316A<sup>1</sup> 100  $\Omega$  Balanced/50  $\Omega$   
 Unbalanced Converter**  
*Frequency:* 100 Hz to 10 MHz  
**16317A<sup>1</sup> 600  $\Omega$  Balanced/50  $\Omega$   
 Unbalanced Converter**  
*Frequency:* 100 Hz to 3 MHz

1. All have 1 BNC connector (unbalanced) and 2 signal terminals (balanced) and 1 ground terminal.

# Test Fixtures and Accessories (7-mm Terminal)

## RF SMD/chip components



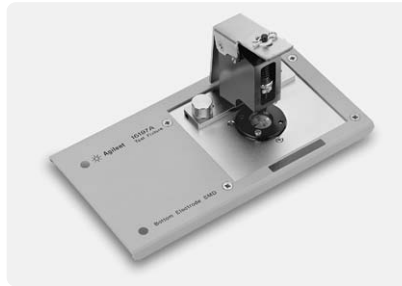
**16196A/B/C/D SMD test fixture**

Coaxial fixture for parallel electrode SMDs.

*Frequency:* dc to 3 GHz  
*Maximum dc bias:*  $\pm 40$  V

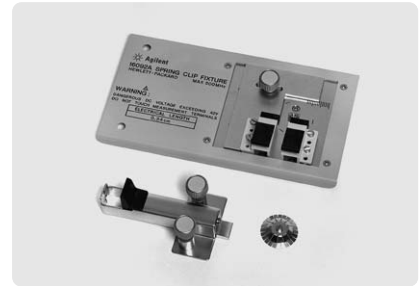
Applicable SMD size:

- 16196A: 1.6 mm x 0.8 mm
- 16196B: 1.0 mm x 0.5 mm
- 16196C: 0.6 mm x 0.3 mm
- 16196D: 0.4mm x 0.2mm



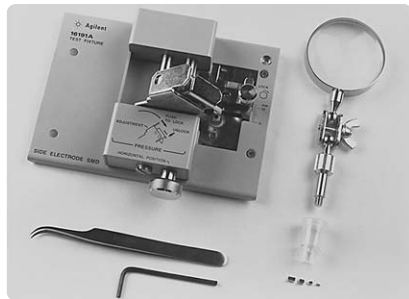
**16197A bottom-electrode SMD test fixture**

*Frequency:* dc to 3 GHz  
*Maximum dc bias:*  $\pm 40$  V



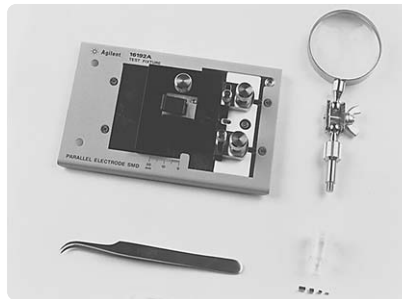
**16092A axial, radial, and SMD test fixture**

*Frequency:*  $\leq 500$  MHz  
*Maximum dc bias:*  $\pm 40$  V



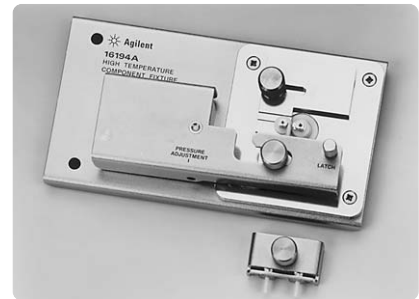
**16191A bottom-electrode SMD test fixture**

*Frequency:* dc to 2 GHz  
*Maximum dc bias:*  $\pm 40$  V



**16192A parallel-electrode SMD test fixture**

*Frequency:* dc to 2 GHz  
*Maximum dc bias:*  $\pm 40$  V



**16194A high temperature component test fixture**

*Frequency:* dc to 2 GHz  
*Maximum dc bias:*  $\pm 40$  V  
*Operating temperature:*  $-55$  °C to  $+200$  °C

## Material measurements



**16200B external DC bias adapter**

*Frequency:* 1 MHz to 1 GHz  
*External dc bias:* up to 5 A,  $\pm 40$  V



**16453A dielectric test fixture**

*Frequency:* 1 MHz to 1 GHz  
*Sample size (smooth sheets only):*  
thickness: 0.3 mm to 3 mm  
diameter:  $\geq 15$  mm



**16454A magnetic test fixtures**

*Frequency:* 1 kHz to 1 GHz  
*Sample size (toroids only):*  
height:  $\leq 8.5$  mm  
inner diameter:  $\geq 3.1$  mm  
outer diameter:  $\leq 20$  mm

# Simplify and Improve Your Measurements with Agilent's Test Accessories

Selecting a test fixture is as important as selecting the right instrument. Agilent offers a wide range of accessories for axial, radial, and SMD/Chip devices. In addition, a variety of test leads are available to simplify remote testing and systems applications. External test fixtures with safety covers are also available.

You will improve your measurement results with the proper test fixture.

- more reliable and repeatable measurement
- higher through-put
- fewer handling errors
- tighter test limits
- better measurement accuracy

For sales information or technical assistance call Agilent Technologies.

**Table 3. Test accessories/fixtures**

			4263B	4268A	4279A	4284A	4285A	4287A	4288A	4294A	4294A with 42942A	4395A w/Option 4395A-010 and 43961A	4396B w/Option 4396B-010 and 43961A	E4991A
16034E	SMD/chip test fixture	DC-40 MHz	•	•	•	•	•	•	•	•				
16034G	SMD/chip test fixture, small	DC-110 MHz	•	•	•	•	•	•	•	•				
16034H	SMD/chip test fixture, general	DC-110 MHz	•	•	•	•	•	•	•	•				
1643A/B	3-terminal SMD test fixture	DC-110 MHz	•	•	•	•	•	•	•	•				
16044A	SMD/chip test fixture, Kelvin contacts, 10 MHz	DC-10 MHz	•	•	•	•	•	•	•	•				
16047A	Axial and radial test fixture	DC-13 MHz	•	•	•	•	•	•	•	•				
16047D	Axial and radial test fixture	DC-40 MHz	•	•	•	•	•	•	•	•				
16047E	Axial and radial test fixture, 110MHz	DC-110 MHz	•	•	•	•	•	•	•	•				
16048A	One meter test leads, BNC	DC-30 MHz	•	•	•	•	•	•	•	•				
16048B	One meter test leads, SMC	DC-30 MHz	•	•	•	•	•	•	•	•				
16048D	Two meter test leads, BNC	DC-30 MHz	•	•	•	•	•	•	•	•				
16048E	Four meter test leads, BNC	DC-1 MHz	•			•								
16048G	One meter test leads, BNC, 110 MHz	DC-110 MHz								•				
16048H	Two meter test leads, BNC, 110 MHz	DC-110 MHz								•				
16060A	Transformer test fixture	DC-100 kHz	•											
16065A	Ext. voltage bias with safety cover (<=200 vdc)	50 Hz-2 MHz	•	•	•	•	•	•	•	•				
16065C	External bias adapter (<=40 vdc)	50 Hz-1 MHz	•	•					•					
16085B	Four-terminal pair to 7-mm adapter	DC-40 MHz	•	•	•	•	•	•	•	•				
16089A/B/C/D/E	Kelvin clip leads	5 Hz-100 kHz	•	•	•	•	•	•	•	•				
16092A	RF spring clip: axial, radial and SMD	DC-500 MHz	•1	•1	•1	•1	•1	•4	•1		•	•	•	•
16094A	RF probe tip/adapter	DC-125 MHz	•1,2	•1,2	•1,2	•1,2	•1,2	•2,4	•1,2		•2	•2	•2	•2
16095A	LF impedance probe	DC-13 MHz	•3	•3	•3	•3	•3		•3					
16191A	Side (bottom) electrode SMD test fixture	DC-2 GHz	•1	•1	•1	•1	•1	•4	•1		•	•	•	•
16192A	Parallel electrode SMD test fixture	DC-2 GHz	•1	•1	•1	•1	•1	•4	•1		•	•	•	•
16194A	High temperature component test fixture	DC-2 GHz	•1	•1	•1	•1	•1	•4	•1		•	•	•	•
16196A/B/C/D	Parallel electrode SMD test fixture	DC-3 GHz	•1	•1	•1	•1	•1	•4	•1		•	•	•	•
16197A	Bottom electrode SMD test fixture	DC-3 GHz	•1	•1	•1	•1	•1	•4	•1		•	•	•	•
16200B	External DC bias adapter	1 MHz-1 GHz						•4			•	•	•	•
16314A	4-terminal balun (50 Ohm bal. to 50 Ohm unbal.)	100 Hz-10 MHz	•	•	•	•	•	•	•					
16315A	One terminal (BNC) Balun (50 Ohm bal. to 50 Ohm unbal.)	100 Hz-10 MHz										•	•	
16316A	One terminal (BNC) Balun (100 Ohm bal. to 50 Ohm unbal.)	100 Hz-10 MHz										•	•	
16317A	One terminal (BNC) Balun (600 Ohm bal. to 50 Ohm unbal.)	100 Hz-3 MHz										•	•	
16334A	SMD/chip tweezer	DC-15 MHz	•	•	•	•	•	•	•					
16451B	Dielectric material test fixture	5 Hz-30 MHz	•	•	•	•	•	•	•					
16452A	Liquid test fixture	20 Hz-30 MHz				•	•		•					
16453A	Dielectric material test fixture	1 MHz-1 GHz												•
16454A	Dielectric material test fixture	1 kHz-1 GHz									•			•
42842A/B	High bias current 20 A/40T test fixture	20 Hz-1 MHz				•								
42842C	High bias current 10 A test fixture	75 kHz-30 MHz					•							
42941A	Impedance probe kit	DC-110 MHz								•				
42942A	Four-terminal pair to 7-mm adapter	DC-110 MHz								•				

**Note:** Refer to the accessory descriptions for frequency and operational limits.

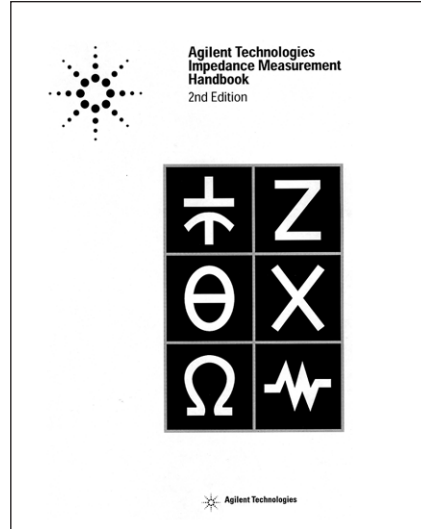
1. Compatible when used in conjunction with 16085B.
2. 7-mm cable is required
3. Do not connect the ground lead to the instrument
4. 3.5-mm (M) to 7-mm adapter is required

# Applications Information

## Helping you make better measurements

Agilent's application knowledge can help you make better measurements. Use the matrix below to select the Agilent Application Notes of interest. For copies of these Application Notes, contact your local Agilent Technologies sales office. "8 Hints for successful Impedance Measurement" (P/N 5968-1947E) and "The Impedance Measurement Handbook" (P/N 5950-3000) are comprehensive guide to impedance measurements.

Beginning with the basics it contains in-depth practical advice to help you make better measurements. These documents answer many commonly asked questions. To get your copy, contact your local Agilent Technologies sales office.



**Table 4. List of application notes**

Kind	Number	Title	Product	P/N
OT	-	Impedance Measurement Handbook 2nd Edition	General	5950-3000
OT	-	Accessories Selection Guide For Impedance Measurement	General	5965-4792E
AN	346-4	8 Hints for Successful Impedance Measurements	General AN	5968-1947E
PN	-	16196A/B/C/D Correlating RF Impedance Measurements When Using SMD Test Fixtures	16196A/B/C/D	5980-1336E
AN	1305-3	Effective Transformer/LF Coil Testing	4263B	5967-5377E
AN	1305-4	Effective Electrolytic Capacitors Testing	4263B	5967-5378E
AN	1224-5	Effective Multi-tap Transformer Measurement using a Scanner and the 4263B LCR Meter	4263B	5091-6310E
AN	369-1	Optimizing Electronic Component and Material Impedance Measurements	4284A	5950-2949
AN	369-3	Impedance Measurements of Magnetic Heads Using Constant Current	4284A	5950-2951
AN	369-5	Multi-frequency C-V Measurements of Semiconductors	4284A	5950-2953
AN	369-6	Impedance Testing Using Scanner	4284A	5950-2975
AN	369-7	Measurement of Capacitance Characteristics of Liquid Crystal Cell	4284A	5950-2994
AN	369-8	Wide Range DC Current Biased Inductance Measurement	4284A	5950-2367
AN	369-9	Improve Electronic Product Quality and Performance with Agilent Precision LCR Meters	4284A	5090-0233
AN	346-2	Balanced Circuit Measurement with an Impedance Analyzer/LCR Meter/Network Analyzer	4284A	5091-4480E
AN	346-3	Effective Impedance Measurement Using OPEN/SHORT/LOAD Correction	4284A	5091-6553E
AN	369-12	Measurement of Impedance of Magnetic Heads	4285A	5965-6663E
PN	4294-1	Reliable Electronic Component Evaluation and Circuit Design with the 4294A 110 MHz Precision Impedance Analyzer	4294A	5968-4505E
PN	4294-2	New Technologies For Accurate Impedance Measurements (40 Hz to 110 MHz)	4294A	5968-4506E
PN	4294-3	Evaluation of MOS Capacitor Oxide C-V Characteristics Using the 4294A	4294A	5988-5102EN
PN	E4991A-1	New Generation Analyzer Offers Exceptional and Powerful Analysis Functions for RF Impedance Measurement	E4991A	5988-0200EN
PN	E4991A-2	Achieving Fast Cycle Time Using an Electronic Design Automation (EDA) Tool and the E4991A RF Impedance/Material Analyzer	E4991A	5988-3029EN
AN	1369-1	Solutions for Measuring Permittivity and Permeability with LCR Meters and Impedance Analyzers	E4991A	5980-2862EN
AN	1369-2	Advanced Impedance Measurement Capability of the RF I-V Method Compared to the Network Analysis Method	E4991A	5988-0728EN
AN	1369-3	Accurate Impedance Measurement with Cascade Microtech Probe System	E4991A	5988-3279EN
AN	1305-1	Contact Resistance and Insulation Resistance Measurements of Electro-Mechanical Components	4338B/4339B	5968-0325E
AN	1288-1	Combining Network and Spectrum Analysis and IBASIC to Improve Device Characterization and Test Time	4396B	5965-7656E
AN	1288-2	Configuring the 4396B 1.8 GHz Network/Spectrum Impedance Analyzer for O/E Testing	4396B	5965-7657E
AN	1288-4	How to Characterize CATV Amplifiers Effectively	4396B	5965-9434E
PN	4395/96-1	How to Measure Noise Accurately Using the Agilent Combination Analyzers	4396B	5966-2292E
PN	4395-1	4395A Network/Spectrum/Impedance Analyzer ADSL Copper Loop Measurements	4395A	5968-1196E
PN	4395-2	4395A Network/Spectrum/Impedance Analyzer Switching Power Supply Evaluation	4395A	5968-7274E
AN	1308-1	"Network, Spectrum and Impedance Evaluation of Electronic Circuits and Components"	4395A	5967-5942E

# Complementary Products and Accessories

To help you find a complete solution, we have listed the following companies that make complementary products or specialized accessories for Agilent's impedance measurement products. Please contact each company directly if you are interested in its products. (Agilent does not make any special endorsement of these companies' products; this list is for reference only.)

Company name	Product specialty/ expertise	Web site address
Cascade Microtech, Inc.	RF and microwave probes and accessories for semiconductor and IC applications.	<a href="http://www.cascademicrotech.com/">www.cascademicrotech.com/</a>
Inter-continental Microwave (ICM)	Automated device handling systems, RF and microwave test fixtures and non-coaxial calibration standards.	<a href="http://www.icmicrowave.com/">www.icmicrowave.com/</a>
North Hills Signal Processing	Wide-band transformers (baluns) for balanced measurement.	<a href="http://www.northhills-sp.com/">www.northhills-sp.com/</a>
Espec/ESPEC Corp. (America)	Temperature chamber for component and material testing.	<a href="http://www.espec.com/">www.espec.com/</a> <a href="http://www.espec.co.jp/english">www.espec.co.jp/english</a>
BH Electronics	Wideband transformers	<a href="http://www.bhelectronics.com/">www.bhelectronics.com/</a>
ArumoTech (Asia)	Custom test fixtures	<a href="http://www.arumotech.com/en">www.arumotech.com/en</a>

**Agilent Technologies' Test and Measurement Support, Services, and Assistance**  
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