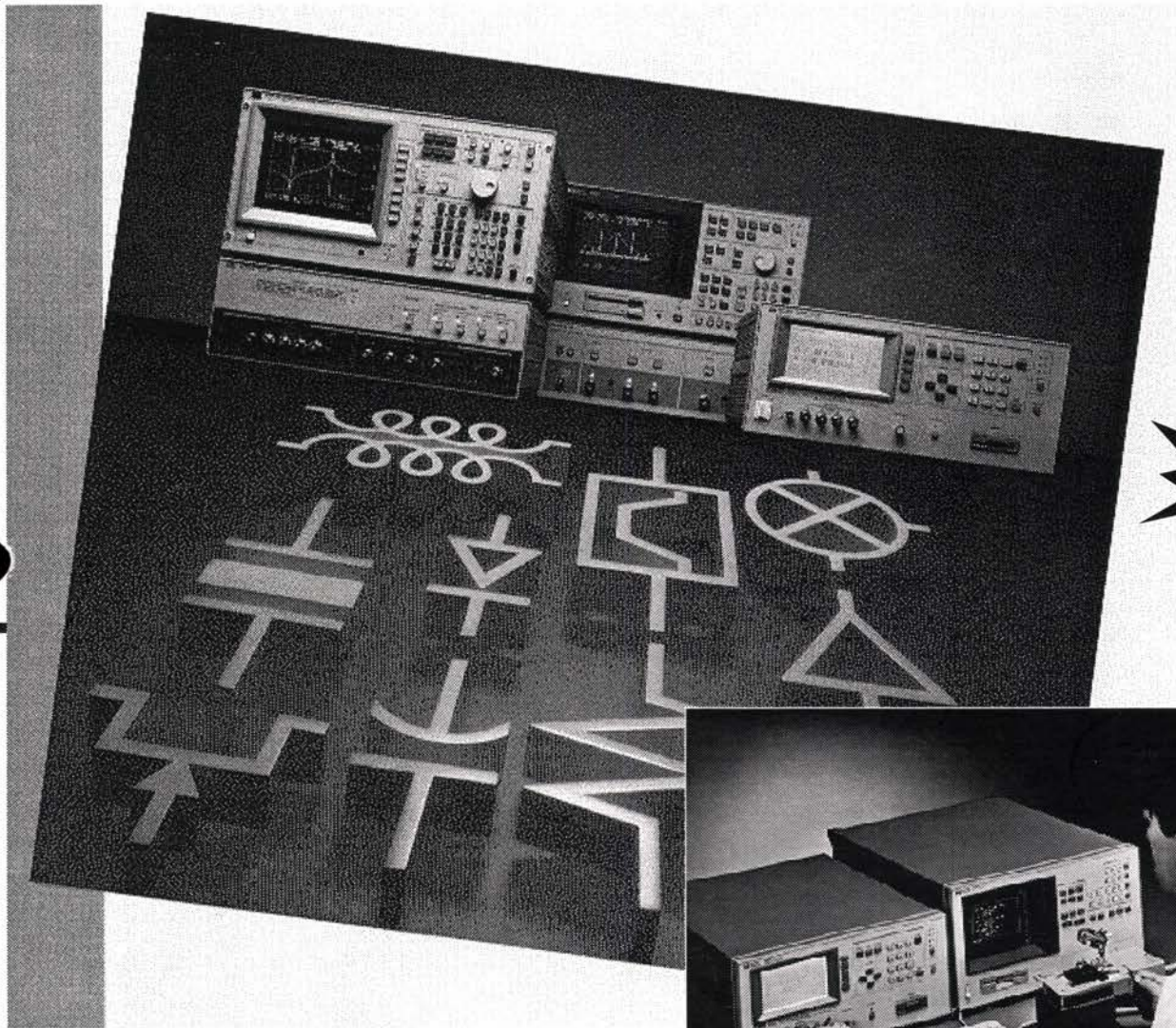
HEWLETT PACKARD

# LCR Meters, Impedance Analyzers, and Test Fixtures Selection Guide

## Component and Material Measurement Solutions



New!

See pages 7, 8, 9

## Cost Effective Solutions for Your Applications

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

Complete solution: Covering frequencies from 5 Hz to 1.8 GHz, HP's impedance product line offers your the widest selection of equipment for your application. In addition, several third-party companies have complementary products designed to work with HP equipment for special applications. This brochure gives an overview of all the products you can choose from.

Knowledge: HP has decades of experience providing impedance measurement solutions. Years of experience and continuing technical innovations go into the design and manufacturing of each HP LCR meter and impedance analyzer. HP also has a list of technical publication to assist you in many different applications (see page 14 for full listing.)

Convenience : Any time you have an impedance measurement need, help is only one phone call away. Calling HP will put you in contact with one of our trained engineers to help you find a solution.

### Selecting the Best solution

HP's offers three types of impedance measurement solutions:

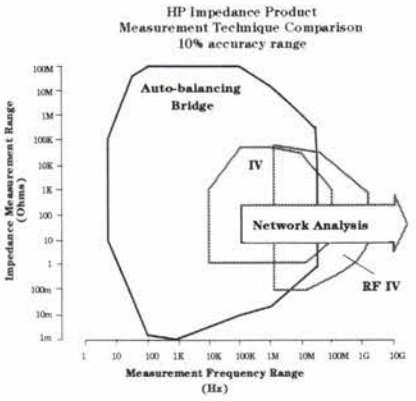
| | Product Type | | |
|---|---|---|---|
| **Product Highlights** | **LCR Meter** | **Impedance Analyzer** | **Combination Analyzer** |
| **Frequency sweep capability** | Spot | Continuous | Continuous |
| **Display** | Digital | CRT (1) | CRT |
| **Others** | Handler interfaces | Equivalent circuit analysis built in | Equivalent circuit analysis built in, multiple functions in one instrument |
| **Advantage** | Lower-cost solution, ease of use | Frequency characteristics and resonant analysis, circuit modeling | Cost-effective, time-saving, and compact in size |

(1) Except HP 4192A, which has an LCD display and no equivalent circuit analysis function

### Advanced Measurement Techniques for a Wide Range of Applications

Figure 1 is a comparison of different measurement techniques used in HP'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 with typical frequency range of 5 Hz to 40 MHz. This technique is best for low-frequency, general-purpose testing.
- IV technique covers from 10 kHz to 100 MHz with a more focused impedance measurement range. IV technique also allows probing for in-circuit testing.
- Network analysis offers the highest frequency coverage, but works best when the measurement range is close to 50 ohms. 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.
- RF IV, an enhancement of the IV technique, offers some of the high-frequency benefit of network analysis while retaining some of the impedance measurement range of the IV technique. Designed for accuracy and high-frequency performance, the RF IV technique is excellent for RF component analysis, especially for small inductance and capacitance values.



## How to Use This Selection Guide

Table 1 is a summary of all of HP's impedance products. It is designed to assist you in better comparing HP'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.
- 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 HP if you need further assistance.

| Product Family | Type of Measurement | HP Solution | Pg | Transistor, Bipolar | Transistor, FET | Transformer. IF/RF | Transformer, LF & Power | Transducer, Sonar & Pressure | Solenoid | Semiconductor, Input/Output | Semiconductor, C-V | Resonator, Ceramic | Resistor | Read Channel (Disk Drive) | Power Supply | PC Board | Optical Isolator | Magnetic Head | Liquid Materials | LCD Material | Inductor, IF/RF | Inductor, Power, LF | Integrated Circuit Packaging | Filter | Diode, Varactor & RF | Dielectric Material | Crystal | Circuit Design | Capacitor, Freq. Analysis | Capacitance High Accuracy | Cable | Battery | Antenna | Amplifier | Device Type/Applications | Frequency Range (Hz) | Basic Z Accuracy(%)3 | Z Measurement Range (ohms) | Special Features |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF/RF Analyzers | Impedance | HP 4291A | 4 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 1M to 1.8G | 0.8 | 0.1 to 50k | A,B |
| Network/Spectrum/ Impedance | | HP 4195A[1] | 5 | ● | ● | ● | ● | ● | ● | ★ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 100k to 500M | 1.5 | 0.03 to 30k | A,B |
| | | HP 4396A[2] | 5 | ● | ● | ● | ● | ● | ● | ★ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 100k to 1.8G | 3 | 2 to 5k | A,B |
| Impedance Analyzers | Impedance and Gain-Phase | HP 4192A | 9 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 5 to 13M | 0.1 | 0.1m to 1M | C |
| | | HP 4194A | 4 | ● | ● | ● | ● | ● | ● | ★ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 100 to 40M | 0.17 | 0.01 to 100M | A,B |
| | | HP 4194A with HP 41941A/B | 4 | ★ | ★ | ● | ● | ● | ● | ★ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 10k to 100M | 1.5 | 0.1 to 1M | A,B |
| LCR Meters | Precision | HP 4284A | 6 | ● | ● | ★ | ● | ● | ● | ★ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 20 to 1M | 0.05 | 0.01m to 99.9999 | D |
| | | HP 4285A | 6 | ● | ● | ● | ● | ● | ● | ★ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | 75k to 30M | 0.1 | 0.01m to 99.9999 | D |
| | | HP 4286A | 7 | ★ | ● | | | | | ★ | | | | | | | | | | | | ● | ● | | | | | | | | ● | | | | | 1M to 1G | 1.0 | 200m to 3k | E |
| | High Speed/Precision | HP 4278A | 9 | ● | ★ | | | | | | | | | | | | | | | | | ★ | | | | | | | | | | | | | | 1k & 1M only | 0.05 | 0.001p to 200$\mu^4$ | D |
| | Low Cost | HP 4263B | 8 | | ★ | | ● | | ● | | ● | ● | | | | | | | | | | ● | ● | | | | | | | | | ★ | | | | 1100 to 100k | 0.1 | 1m to 100M | D |
| | | HP E4196A with Opt. 001 and 010 | 8 | ● | ★ | ● | ● | ● | | ★ | ● | ● | ● | | | | | | | | | ● | ● | | | | | | | | | ★ | | | | 1M to 180M | 3 | 200m t o10k | D |
| | Precision Q | HP 4285A with HP 42851A | 6 | | | | | | | ★ | | | | | | | | | | | | ★ | | | | | | | | | | ★ | | | | 75k to 30M | 5 | Q: 5 to 1000 | D |
| | Resistance: Milliohm | HP 4338B | 7 | | ● | | ● | | ● | | ● | | | | | | | | | | | ★ | | | | | | | | | | | | | | 1k only | 0.4 | 10$\mu$ to 100k | D |
| | High Resistance | HP 4339B/HP 4349B | 8 | | ★ | | ★ | | ● | | | | | | | | | | | | | ★ | | | | | | | | | | | | | | HP 4339B=dc only | 0.6 | 10k to $1.6x10^{16}$ | D |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | HP 4349B=dc only | 2 | 10k to $1.0x10^{15}$ | D |

1 Refer to HP 4195A data sheet (P/N 5952-7970) for configuration information. 2 Refer to HP 4396A data sheet (P/N 5091-5189E) for configuration information.
3 Basic Z and D accuracies are best-case values and vary depending on measurement conditions. See product data sheet for detail. 4 Capacitance measurement only.

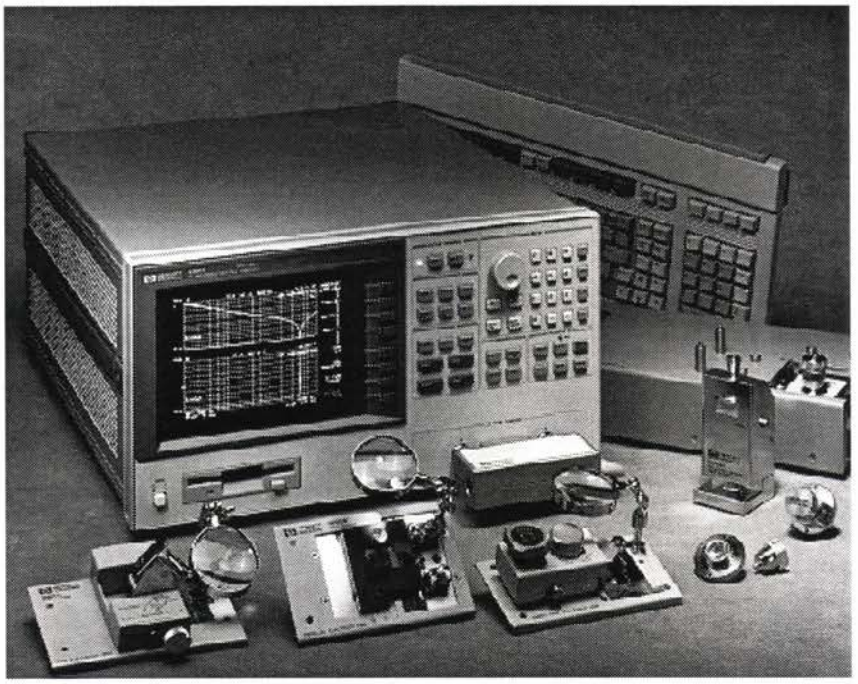
★ Best ● Very Good

Special Feature Code:
A: Built in equivalent circuit analysis.
B: Frequency sweep with CRT display.
C: Frequency sweep with LED display.
D: Spot frequency only with LDC display.
E: Spot frequency with CRT display.

## Product Highlights: Impedance Analyzers

Impedance analyzers provide high measurement accuracy and sophisticated measurement functions:

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



### HP 4291A 1.8 GHz Impedance/Material Analyzer

- Provides top-of-the-line solution for measuring impedance from 1 MHz to 1.8 GHz, with an optional material-test function for measuring permitivity and permeability.
- Ideal instrument for RF Surfacemount inductors, capacitors, PC board materials. and magnetic toroids.
- Measurement parameters: |Z|, |Y|, Θ, R, X, G, B, C, L, R, D, Q.
- Material parameters : ε, ε', ε", μ, μ', μ"

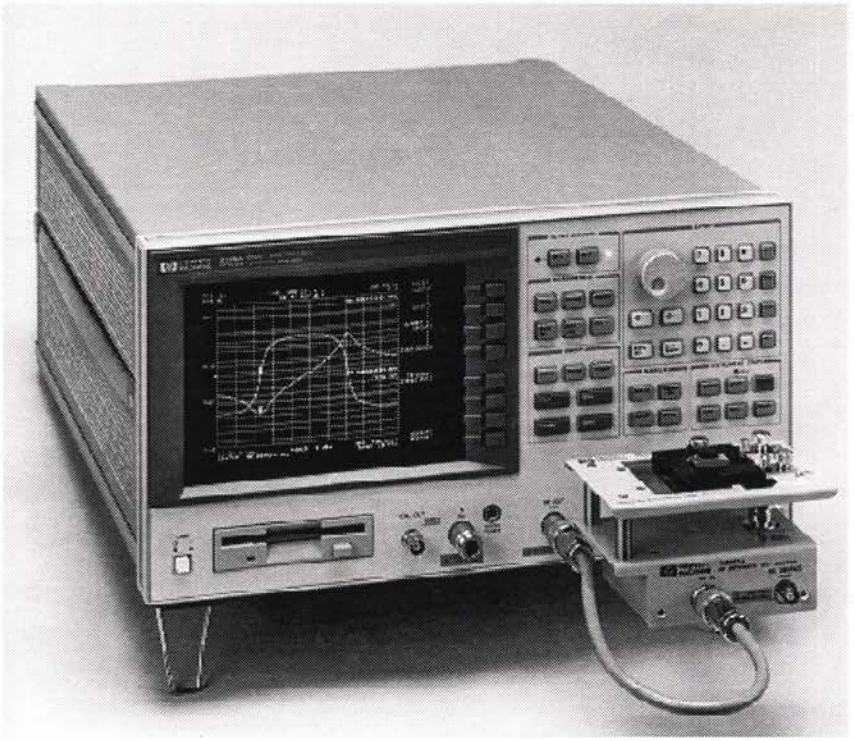


### HP 4194A Impedance/ Gain-Phase Analyzer

- Versatile instrument with 3 measurement capabilities: Impedance only: 100 Hz to 40 MHz Impedance with HP 41941A/B impedance probe: 10 kHz to 100 MHz Gain/phase: 10 MHz to 100 MHz
- Great R/D tool for all types of component and circuit analysis.
- Measurement parameters: |Z|, |Y|, Θ, R, X, G, B, C, L, R, D, Q.

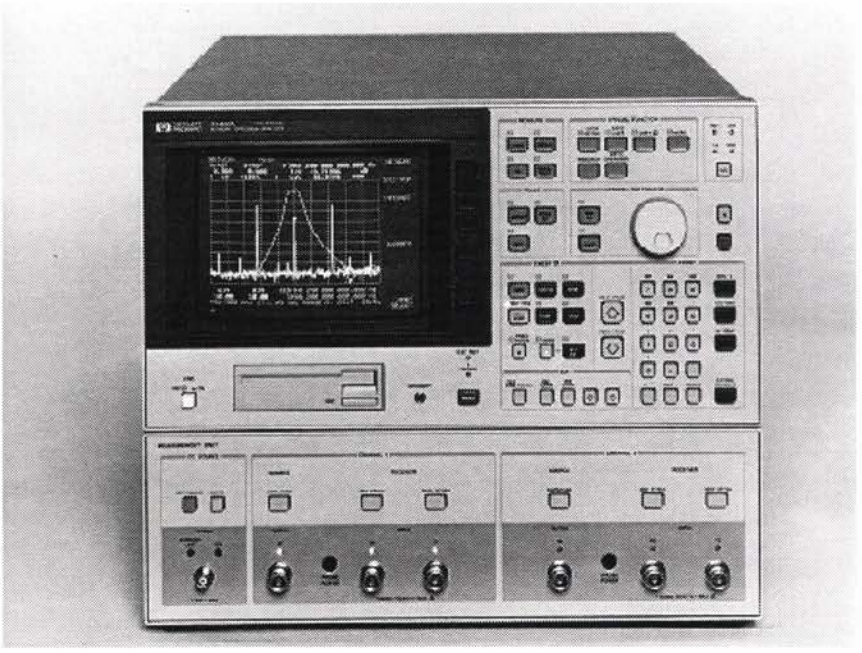
## Product Highlights: Network/Spectrum/Impedance Analyzers

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 analyzers have the same advanced features as the impedance analyzers described on page 4.



### HP 4396A Network/Spectrum/ Impedance Analyzer (with HP 43961A RF Impedance Test Kit and HP 4396A opt.010)

- 1.8 GHz three-in-one analyzer with no sacrifice in performance.
- Advanced features for meeting your future test requirements: 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.
- Measurement parameters: |Z|, |Y|, Θ, R, X, G, B, C, L, R, D, Q.



### HP 4195A Network/Spectrum/ Impedance Analyzer (with HP 41951A Impedance Test Set)

- Most popular combination analyzer for components and circuit design from 5 Hz to 500 MHz
- Three functions for a complete analog measurement system.
- Best-valued bench-top tool for R&D.
- Measurement parameters: |Z|, |Y|, Θ, R, X, G, B, C, L, R, D, Q.

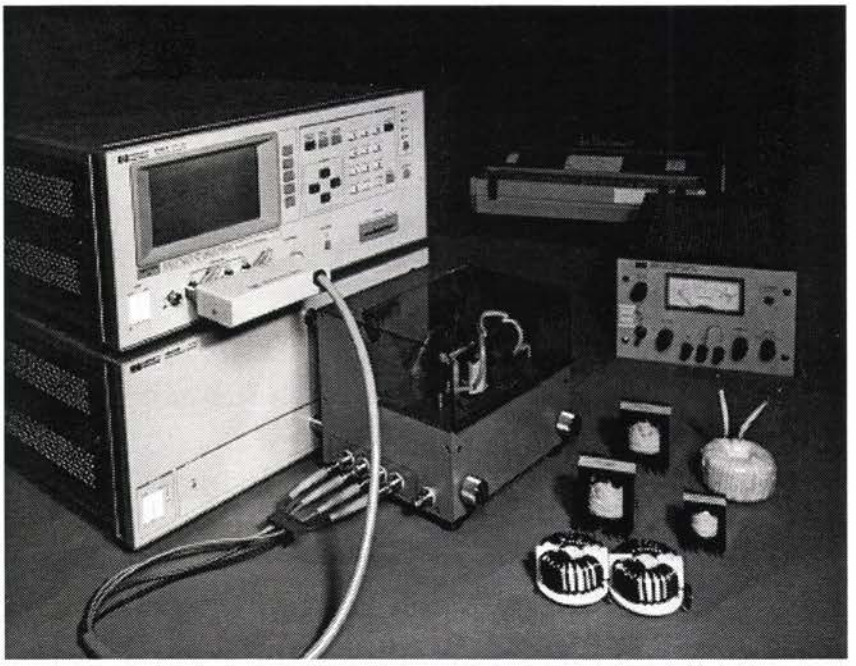
## Product Highlights: Precision LCR Meters

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 1 GHz.
- Frequency list sweep for continuos testing at multiple frequency points.
- Great for general-purpose testing of leaded components surface-mount components, materials, and more.
- HP-IB and handler interface for easy test automation in production environment.

### HP 4284A Precision LCR Meter

- 0.05% basic accuracy.
- 20 Hz to 1 MHz
- Option 001 adds ± 40V internal dc bias voltage
- For testing power inductors and transformers, choose option 002, HP 42841A, and HP 42841A/B to get up to 20 A dc bias current.[1]
- Measurement parameters: |Z|, |Y|, Θ, R, X, G, B, C, L, R, D, Q, ESR

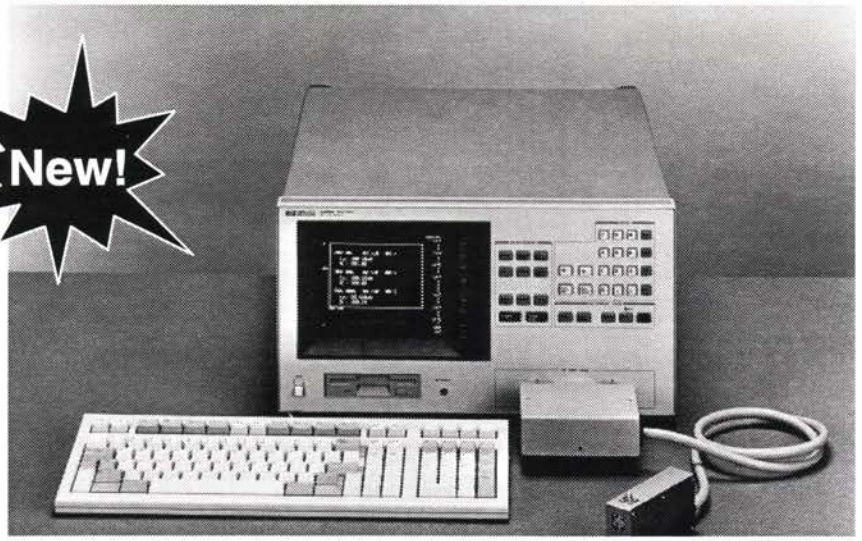




### HP 4285A Precision LCR Meter

- 0.1% basic accuracy
- 75 kHz to 30 MHz
- Option 001 adds ± 40V dc bias voltage.
- Option 002, HP 42841A, and HP 42842C provide up to 10 A dc bias current.
- Measurement parameters: |Z|, |Y|, Θ, R, X, G, B, C, L, R, D, Q, ESR.
- Best Q measurement solution up to 30 MHz when used with option 002 and HP 42851A Precision Q Adapter.

## Product Highlights: Precision RF LCR Meter




### HP 4286A RF LCR Meter

- 1.0% basic accuracy and wide impedance range
- Reliable Q measurement (6% @Q=100, 100MHz)
- 1 MHz to 1 GHz frequency range
- Measurement time fo 15 msec
- Handler and HP-IB Interfaces
- 1m/3m selectable extension cable with small APC3.5 test head
- SMD fixtures
- Measuremet parameters: |Z|, |Y|, θ, R, X, G, B, C, L, R, D, Q

## Product Highlights: 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.




### HP 4338B Milliohmmeter (1mΩ to 100kΩ)

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

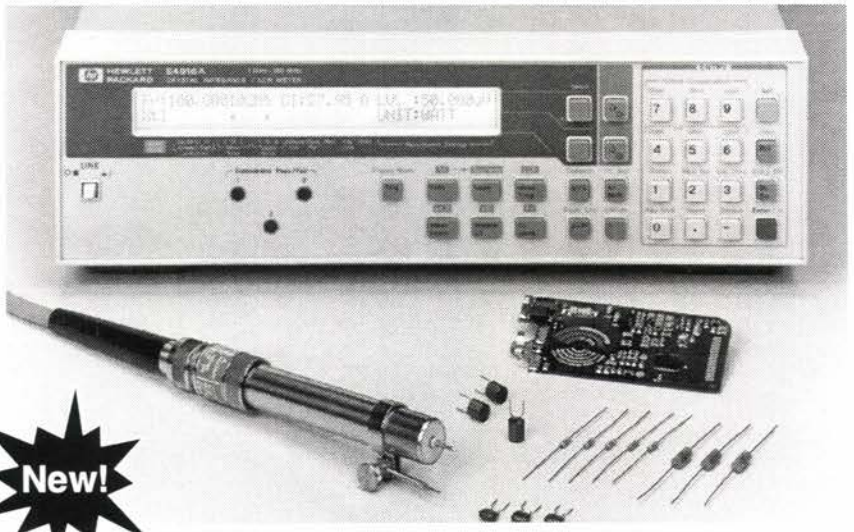
## Product Highlights: Basic Products

### HP 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|, θ, R, X, G, B, C, L, R, D, Q, ESR.
- Add N, M, DCR (Option 001) for transformer/Coil measurements.
- Set signal level (20 mV to 1 Vrms) in 5 mVrms steps.
- Monitor actual ac voltage and current levels.
- Contact check function for reliable tests.
- Select the number of displayed digits (3, 4, or 5).

### HP E4916A Crystal Impedance / LCR Meter (with Opt. 001 and 010)




- Spot frequency testing from 1 MHz to 180 MHz.
- Compact, easy to use, entry-level RF LCR meter.
- 3.0% basic accuracy.
- Floating or grounded measurement.
- Measurement parameters: |Z|,|Y|,θ,R,X,G,B,C,L,R,D,Q.
- Special function for crystal resonator testing.

### HP 4339B High-Resistance Meter




- Test voltage: 0.1 to 1000 Vdc.
- Measurement range: R: 1 x $10^3$ Ω to 1.6 x $10^{16}$ Ω, I: 60 fA to 100 μA.
- Great solution for evaluating leakage current and insulation resistance of components.
- Can be programmed to measure surface and volume resistivity.
- Measurement parameters: I, R, volume and surface resistivity.
- Contact check function for reliable tests.
- Select the number of displayed digits (3, 4, or 5).

## Product Highlights: Special Interest Products

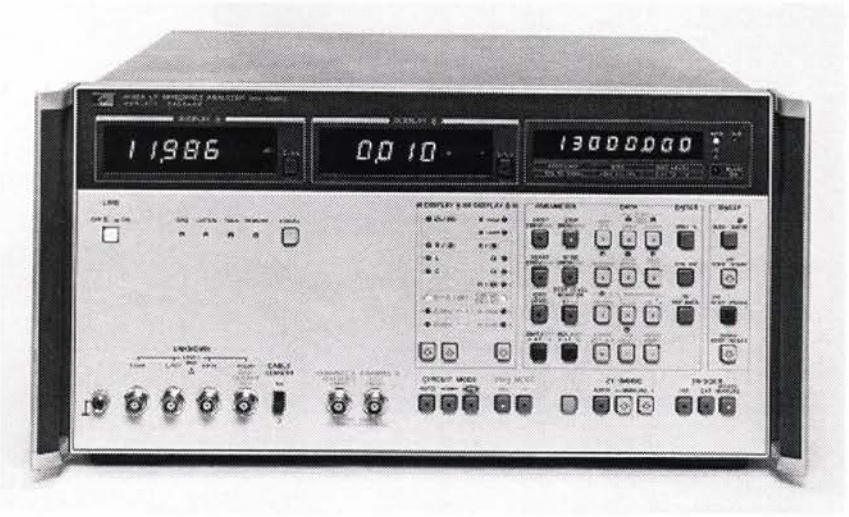
### HP 4349B 4-channel High-Resistance Meter




- Four-channel simultaneous testing.[1]
- Fast contact check function for reliable testing.
- Measurement range: R: 1 x $10^3$ Ω to 1.0 x $10^{15}$ Ω, I: 3 pA to 100 μA

1. HP 4349B, because it has 4-measurement channels, has no internal dc source so an external dc source must be required.

### HP 4192A LF Impedance Analyzer



- Unique 5 Hz-to-13 MHz frequency range for component test or circuit design evaluation.
- Only 4-terminal instrument that can make grounded or floating measurement.
- Measurement parameters: |Z|, |Y|, Θ, R, X, G, B, C, L, R, D, Q.
- Floating or grounded measurements.

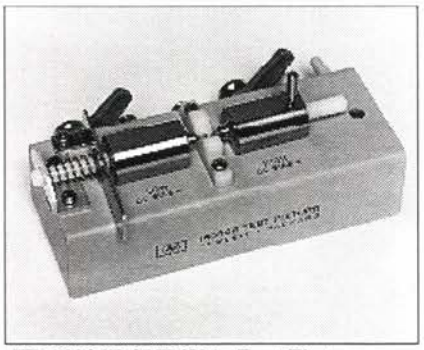
### HP 4278A Capacitance Meter



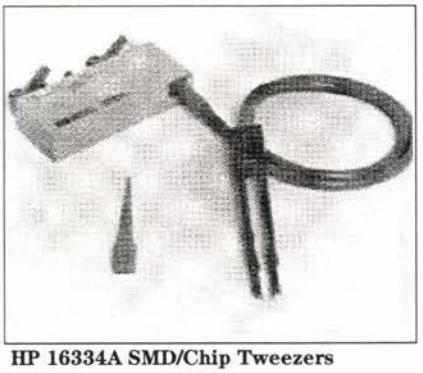
- Two standard frequencies ( 1 kHz and 1 MHz) for capacitor testing.
- Measurement speed and accuracy optimized for production testing
- Measurement parameters : C, D, Q, ESR, G.

## Test Fixtures and Accessories
## Four-terminal-pair Test Fixtures

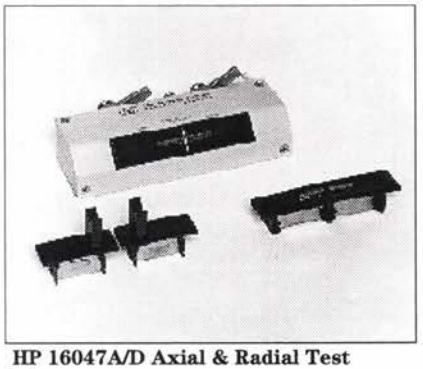
### Components



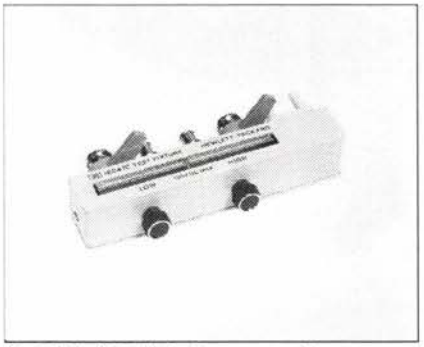
**HP 16034E SMD/Chip Test Fixtures**
*Frequency*: <= 40 MHz
*Maximum dc bias*: ± 40V



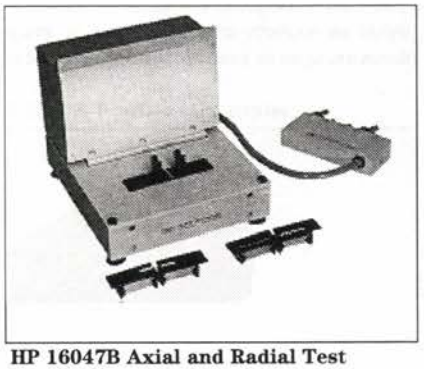
**HP 16334A SMD/Chip Tweezers**
*Frequency*: <= 15 MHz
*Maximum dc bias*: ± 42V



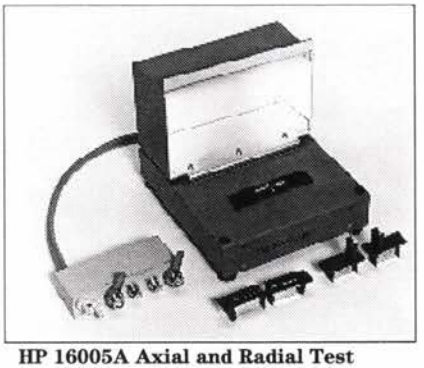
**HP 16047A/D Axial & Radial Test Fixture**
*Frequency*: A: <=13 MHz, D: <= 40 MHz
*Maximum dc bias*: A: ± 35 V, D: ± 40 V



**HP 160 47C High Frequency Test Fixture**
*Frequency*: <= 40 MHz
*Maximum dc bias*: ± 35V

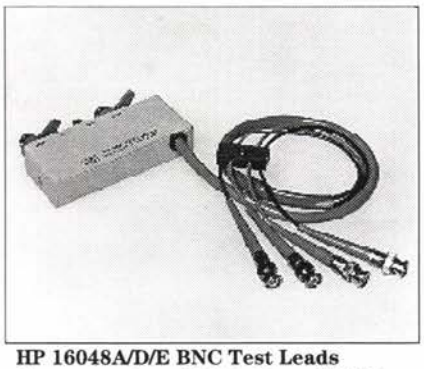


**HP 16047B Axial and Radial Test Fixture with Safety Cover**
*Frequency*: <= 2 MHz
*Maximum dc bias supplied from instrument*: ± 35V

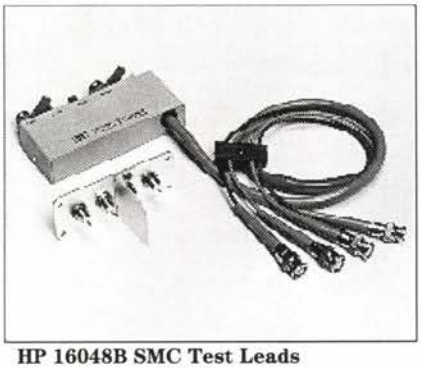


**HP 16005A Axial and Radial Test Fixture with Safety Cover**
*Frequency*: <= 2 MHz
*Maximum externally supplied dc bias*: ± 200V

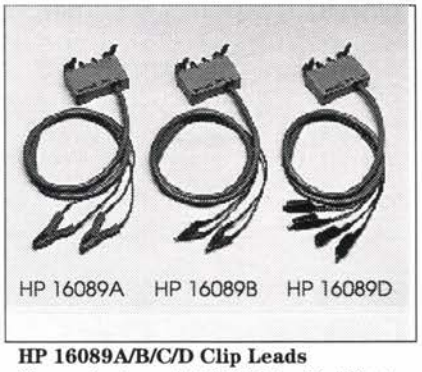
### Test Leads and Clips



**HP 16048A/D/E BNC Test Leads**
*Frequency*: A: <= 30 MHz, D: <= 30 MHz, E: <= 1 MHz
*Cable length*: A: 0.94m, D: 1.89m, E: 3.8m
*Maximum dc bias*: ± 300V



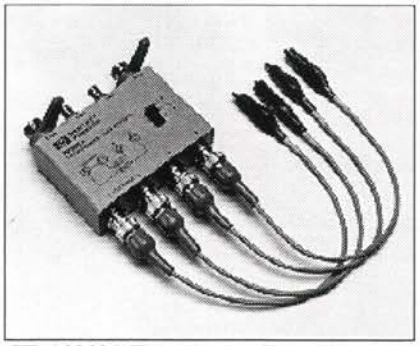
**HP 16048B SMC Test Leads**
*Frequency*: <= 30 MHz
*Cable length*: 0.94m
*Maximum dc bias*: ± 300V



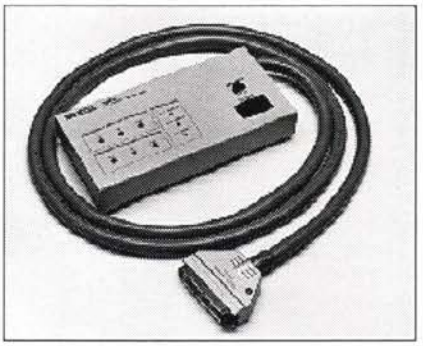

**HP 16089A/B/C/D Clip Leads**
*Connector type*: A/B/C: Kelvin, D: Alligator
*Frequency*: 5 Hz to 100 kHz
*Cable length*: A/B/C: 0.94 m, D: 1.3m

# Test Fixtures and Accessories
# Four-terminal-pair Test Fixtures

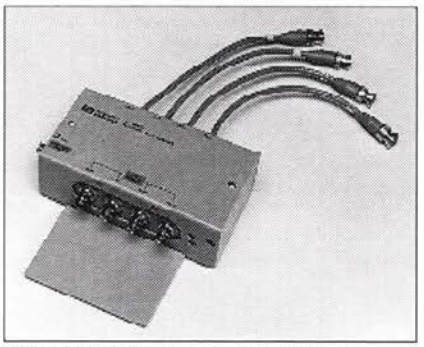
## Others



**HP 16060A Transformer Test Fixture**
*Frequency*: dc to 100 kHz
Use with only HP 4263B

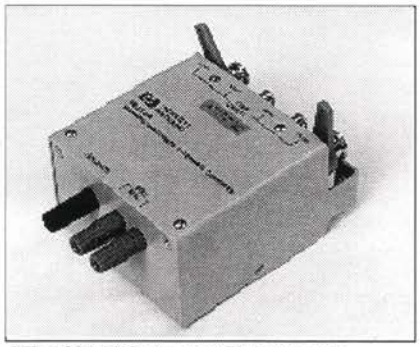


**HP 16064A LED**
Display/Trigger Box
For production test applications.



**HP 16065C External Bias Adapter**
*Frequency*: 100 Hz to 1 MHz
*Maximum externally supplied dc bias*: ± 40 V

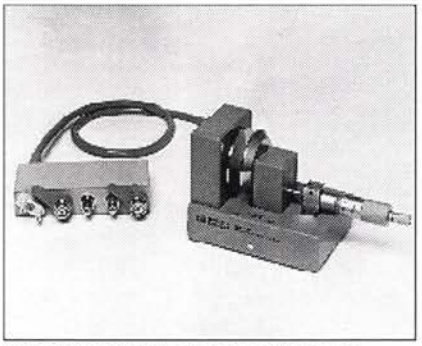
## Balanced/Unbalanced Test Fixture



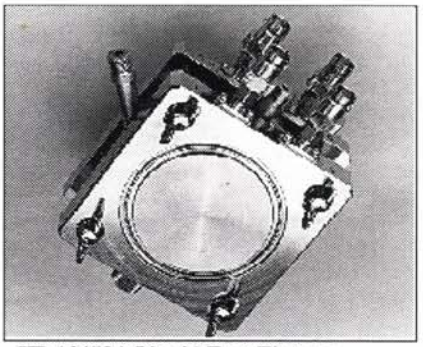
**HP 16314A Balanced/Unbalanced 4-Terminal Converter**
*Frequency*: 100 Hz to 10 MHz
*Connectors*: 4 BNCs (unbal.), 2 signal terminals & 1 ground terminal (bal.)
*Characteristic Z*: 50 ohms

## Material Measurements

Both are recommended for use with HP 4284A & HP 4285A LCR Meters and HP 4194A Impedance Analyzer.

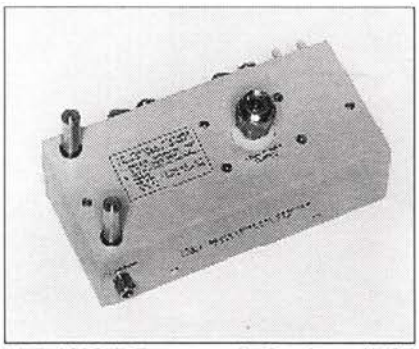


**HP 16451B Dielectric Test Fixture**
**Measurement parameters:**
*Capacitance (C), and dissipation factor (D) Material-under-test size: thickness: <=10 mm. diameter*: 10 to 56 mm
*Frequency*: <= 30 MHz



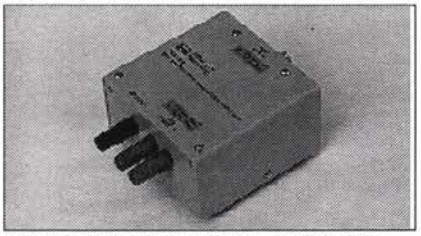
**HP 16452A Liquid Test Fixture**
*Measurement parameter: impedance, dielectric constant (er) Liquid sample quantity*: <=6.8 ml
*Frequency*: <= 20 Hz to 30 MHz

## RF Adapters



**HP 16085B Four-terminal-pair to APC7 Adapter**
*Frequency*: <= 40 MHz
*Maximum dc bias*: ± 40V

## Balanced/Unbalanced Test Fixtures

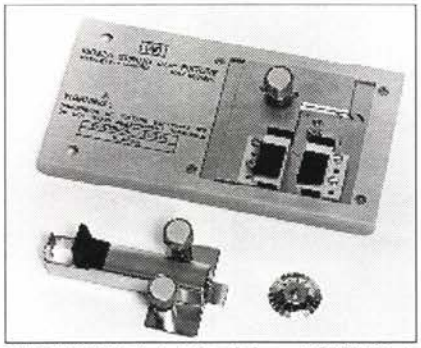


**HP 16315A 50 ohm Balanced/50 ohm Unbalanced Converter**
*Frequency*: 100 Hz to 10 MHz
**HP 16316A 100-ohm Balanced/50-ohm Unbalanced Converter**
*Frequency*: 100 Hz to 10 MHz
**HP 16317A 600-ohm Balanced/ 50-ohm Unbalanced Converter**
*Frequency*: 100 Hz to 3 MHz

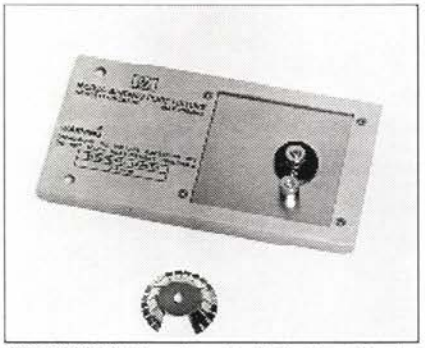
All have 1 BNC connector (unbalanced) and 2 signal terminals and 1 ground terminal (balanced).

# Test Fixtures and Accessories
# APC7 Test Fixtures

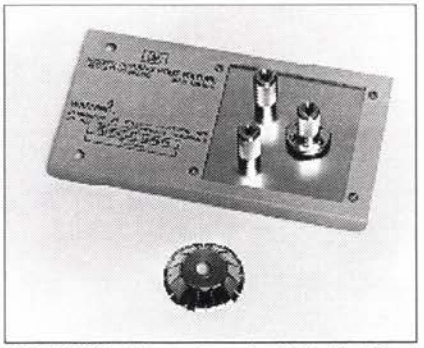
## RF SMD/Chip Components



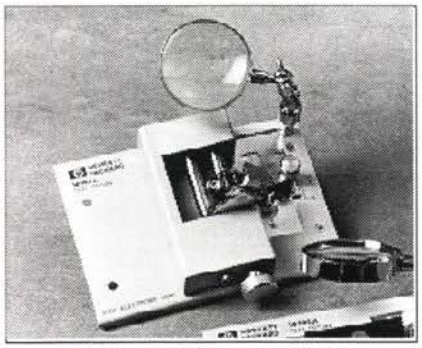
**HP 16092A Axial, Radial, and SMD Test Fixture**
*Frequency*: <= 500 MHz
*Maximum dc bias*: ± 40 V



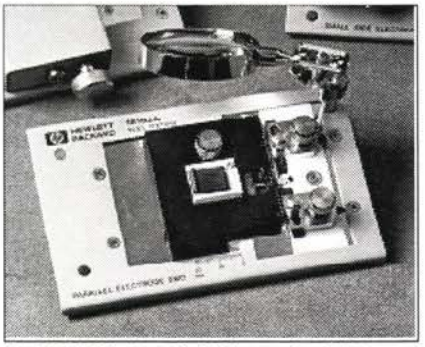
**HP 16093A Two-terminal Binding Post Test Fixture**
*Frequency*: <= 250 MHz
*Maximum dc bias*: ± 40V



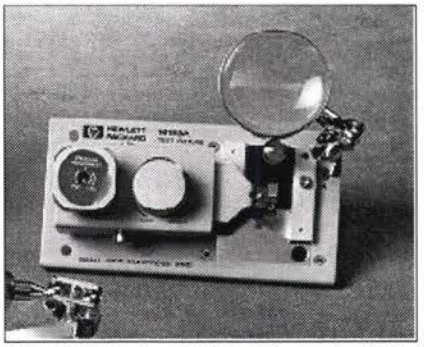
**HP 16093B Three-terminal Binding Post Test Fixture**
*Frequency*: <= 125 MHz
*Maximum dc bias*: ± 40 V



**HP 16191A Side-Electrode SMD Test Fixture**
*Frequency*: dc to 2 GHz
*Maximum dc bias*: ± 40 V

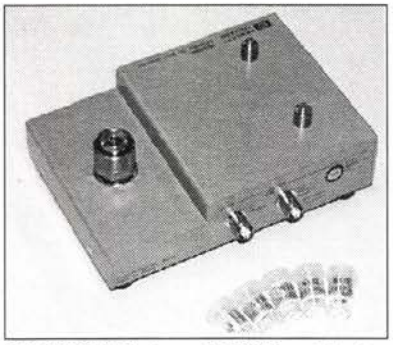


**HP 16192A Parallel-Electrode SMD Test Fixture**
*Frequency*: dc to 2 GHz
*Maximum dc bias*: ± 40 V



**HP 16193A Small Side-Electrode SMD Test Fixture**
*Frequency*: dc to 2 GHz
*Maximum dc bias*: ± 40V

## Material Measurements



**HP 16200A External DC Bias Adapter**
*Freequency*: 1 MHz to 1 GHz
*External dc bias*: Up to 5A, ± 40 V




**HP 16453A Dielectric Test Fixture**
*Frequency*: 1 MHz to 1.8 GHz
*Sample size (smooth sheets only)*:
thickness: <=3 mm, diameter: >= 15 mm




**HP 16454A Magnetic Test Fixtures**
*Frequency*: 1 MHz to 1.8 GHz
*Sample size (toroids only)* :
height: <=10 mm,
inner diameter: >=3.1 mm,
outer diameter: <=20 mm

## Simplify and Improve Your Measurements With HP Test Accessories

Selecting a test fixture is as important as selecting the right instrument. HP 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.

- Move reliable and repeatable measurement
- Higher through-put
- Fewer handling errors
- Tighter test limits
- Better measurement accuracy

For sales information or technical assistance call Hewlett-Packard.

| | | HP 4192A | HP 4194A | HP 4194A with HP 41941A/B | HP4195A with HP 41951A | HP 4263B | HP 4278A | HP 4284A | HP 4285A | HP 4286A | HP 4291A | HP 4396A with opt. 010 and HP 43961A | HP E4916A with Opt.001 and 010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HP 16034E | SMD/Chip Test Fixtures | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16047A | Axial and Radial | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16047B | Axial and Radial with Safety Cover | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16047C | HF Axial and Radial | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16047D | Axial and Radial | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16048A | One Meter Test Leads, BNC | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16048B | One Meter Test Leads, SMC | ● | ● | | | ● | ● | ● | | | | | |
| HP 16048D | Two Meter Test Leads, BNC | | | | | ● | ● | ● | ● | | | | |
| HP 16048E | Four Meter Test Leads, BNC | | | | | ● | | ● | | | | | |
| HP 16060A | Transformer Test Fixture | | | | | ● | | | | | | | |
| HP 16065A | Ext. Voltage Bias with Safety Cover | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16065C | External Bias Adapter (<=40 vdc) | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16085B | Four-Terminal Pair to APC-7 Adapter | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16089A/B/C/D | Clip Leads | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16092A | RF Spring Clip: Axial, Radial and SMD | ●[1] | ●[1] | ●[2] | ● | ●[1] | ●[1] | ●[1] | ●[1] | ● | ● | ● | ●[2] |
| HP 16093A | RF Two Terminal Binding Post | ●[1] | ●[1] | ●[2] | ● | ●[1] | ●[1] | ●[1] | ●[1] | ● | ● | ● | ●[2] |
| HP 16093B | RF Three Terminal Binding Post | ●[1] | ●[1] | ●[2] | ● | ●[1] | ●[1] | ●[1] | ●[1] | ● | ● | ● | ●[2] |
| HP 16094A | RF Probe Tip/Adapter | ●[1,3] | ●[1,3] | ●[3] | ●[3] | ●[1,3] | ●[1,3] | ●[1,3] | ●[1,3] | ●[5] | ●[3] | ●[3] | |
| HP 16095A | LF Probe Adapter | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16099A | RF Probe to APC-7 Adapter | | | ● | | | | | | | | | ●[2] |
| HP 16191A | Side-Electrode SMD Test Fixture | ●[1] | ●[1] | ●[2] | ● | ●[1] | ●[1] | ●[1] | ●[1] | ● | ● | ● | ●[2] |
| HP 16192A | Parallel Electrode SMD Test Fixture | ●[1] | ●[1] | ●[2] | ● | ●[1] | ●[1] | ●[1] | ●[1] | ● | ● | ● | ●[2] |
| HP 16193A | Small Side Electrode SMD Test Fixture | ●[1] | ●[1] | ●[2] | ● | ●[1] | ●[1] | ●[1] | ●[1] | ● | ● | ● | ●[2] |
| HP 16194A | High Temperature Component Test Fixture, SMD and Leaded | ●[1] | ●[1] | ●[2] | ● | ●[1] | ●[1] | ●[1] | ●[1] | ● | ● | ● | ●[2] |
| HP 16200A | External DC Bias Adapter | | | | | | | | | ● | ● | | |
| HP 16314A | 4-Terminal Balun | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16315/6/7A | BNC Balun/Binding Post Balun | ● | ● | ● | ● | | | | | | | | ● |
| HP 16334A | SMD/Chip Tweezer | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 42842A/B | High Bias Current 20A/40A Test Fixture | | | | | | | ●[4] | | | | | |
| HP 42842C | High Bias current 10A Test Fixture | | | | | | | | ●[4] | | | | |
| HP 16451A | Dielectric Material Test Fixture | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16452A | Liquid Test Fixture | ● | ● | | | ● | ● | ● | ● | | | | |
| HP 16453A | Dielectric Test Fixture | | | | | | | | | | | ● | |
| HP 16454A | Magnetic Test Fixture | | | | | | | | | | | ● | |

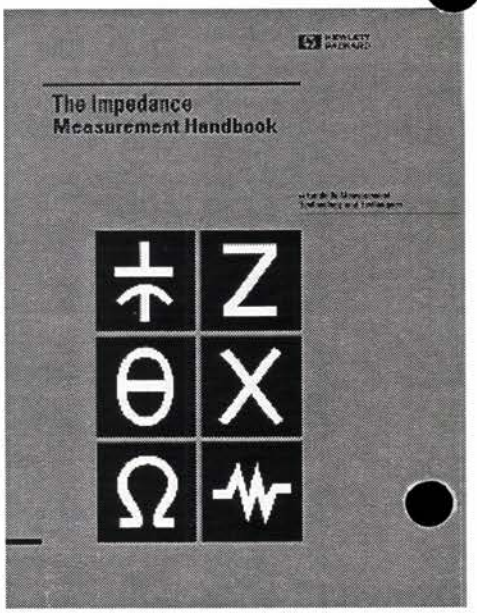
Note: Refer to the accessory descriptions for frequency and operational limits. 1.Compatible when used in conjunction with HP 16085B.
2.Compatible when used in conjunction with HP 16099A. 3.APC-7 to APC-7 cable is required. 4.See page 6 for configuration details
5.Do not connect the ground lead to the instrument. 6.APC-3.5 to APC-7 Adapter is required.

## Applications Information

### Helping You Make Better Measurements

HP's application knowledge can help you make better measurements. Use the matrix below to select the HP Application Notes of interest. For copies of these Application Notes, contact your local HP sales office

| App Note | Title/Subject | Featured | HP Pub# |
|---|---|---|---|
| 1210-1 | Package & component meas. | HP 4194A, ICM | 5091-1799E |
| 380-2 | Measuring cable parameters | HP 4284/5A | 5950-2399 |
| 369-10 | High accuracy & fast RF inductor testing | HP 4285A | 5091-1596E |
| 369-8 | DC current-biased inductance meas. | HP 4284A, | 5950-2367 |
| 369-7 | Cap meas. of liquid crystal cells | HP 4284A | 5950-2994 |
| 369-6 | Impedance testing using scanners | HP 4284A | 5950-2975 |
| 369-5 | Multi-frequency C-V meas. of semiconductor | HP 4284A | 5950-2953 |
| 369-4 | Incoming inspection | HP 4284A | 5950-2952 |
| 369-3 | Impedance meas. of magnetic head | HP 4284A | 5950-2951 |
| 369-1 | Component & material impedance meas. | HP 4284A | 5950-2949 |
| 357-4 | Testing magnetic disk read circuit | HP 4195A | 5950-2398 |
| 357-3 | Filter evaluation & limit testing | HP 4195A | 5950-2933 |
| 357-2 | S-parameter & distortion meas. of amplifier | HP 4195A | 5950-2932 |
| 357-1 | Evaluation of IF circuits | HP 4195A | 5950-2931 |
| 346-3 | Impedance meas. using open/short/load comp. | General | 5091-6553E |
| 346-2 | Balance circuit meas. | General | 5091-4480E |
| 346 | Designing external dc bias circuit | General | 5950-2912 |
| 339-14 | Testing switching power supplies | HP 4194A | 5950-2977 |
| 339-13 | Solid mat'l dielectric constant meas. | HP 4194A | 5950-2935 |
| 339-12 | HP-IB programming hints | HP 4194A | 5950-2929 |
| 339-11 | Filter testing for production | HP 4194A | 5952-7887 |
| 339-9 | Negative impedance meas. of crystal osc. | HP 4194A | 5950-2924 |
| 339-8 | Constant current meas. | HP 4194A | 5950-2923 |
| 339-7 | Evaluation of LISN & voltage probes for EMI | HP 4194A | 5950-2922 |
| 339-6 | Static head testing for disk drives | HP 4194A | 5952-7871 |
| 339-5 | Multi-frequency C-V meas. for semiconductor | HP 4194A | 5950-2919 |
| 339-4 | Characteristic impedance of balanced cables | HP 4194A | 5952-2918 |
| 339-3 | Crosstalk & impedance meas. of PCB patterns | HP 4194A | 5952-7863 |
| 339-2 | Characteristic impedance of PCB | HP 4194A | 5950-2908 |
| 339-1 | Impedance char. of resonators | HP 4194A | 5950-2882 |
| 339 | Component & circuit evaluation | HP 4194A | 5950-2856 |
| 317 | Practical design & evaluation of hi-freq. circuits | HP 4193A | 5953-6910 |
| SN4291-1 | Chip capacitor testing | HP 4291A | 5091-9267E |
| SN4291-2 | Chip inductor testing | HP 4291A | 5091-9904E |
| SN4291-3 | Temperature coefficient testing for components | HP 4291A | 5962-6922E |
| SN4291-4 | Permitivity measurement | HP 4291A | 5962-6973E |
| SN4291-5 | Permeability measurement | HP 4291A | 5962-6972E |
| SN4291-6 | Electronic characterization of IC packages | HP 4291A | 5962-9725E |
| PN16451B-1 | Dielectric constant meas. using the HP 16451B | HP 16451B | 5962-9522E |
| | Impedance Meas. Handbook | General | 5950-3000 |




The Impedance Measurement Handbook is a comprehensive guide to impedance measurements. Beginning with the basics it contains in-depth practical advice to help you make better measurements. This 104-page handbook answers many commonly asked questions.

To get your copy, contact your local HP sales office.

## 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 HP's impedance measurement products. Please contact each company directly if you are interested in its products. (HP does not make any special endorsement of these companies' products; this list is for reference only.)

| Company Name | Product Specialty/Expertise | Address & Phone Number |
|---|---|---|
| Cascade Microtech Inc. | Microwave frequency probes, probe stations, and accessories for semiconductor & IC applications. | 14255 SW Brigadoon Ct. Beaverton, OR 97005 (503) 626-8245 |
| Innovative Measurement Solutions (IMS) | Software and consulting for material analysis. | P.O.Box 70546 Marietta, GA (404) 578-8695 |
| Inter-continental Microwave | Standard and custom-designed RF and microwave test fixtures and calibration standards | 1515 Wyatt Drive Santa Clara, CA 95054 (408) 727-1596 |
| Ismeca USA, Inc. | Standard and custom-designed assembly and automation equipment (e.g. handlers) for electronic manufacturing. | 2440 Impala Drive Carlsbad, CA 92008 (619) 931-1153 |
| North Hills Electronics | Wide-band transformers (baluns) to 300 mHz for balanced measurement. | 575 Underhill Blvd. Syosset, NY 11791 (516) 682-7740 |
| Palomar Systems | Standard and custom designed assembly and automation equipment (e.g. handlers) for electronic manufacturing. | 2310 Aldergrove Ave. Escondido, CA 92029 (619) 741-9717 |
| Tabai Espec/ ESPEC Corp. (America) | Temperature chamber for component & material Testing. | 425 Gordon Inductrial Ct.SW Grand Rapids, MI 49509 (616) 878-0270, or 1-800-537-7320 |

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For more information on Hewlett-Packard Test and Measurement products, applications, or services please call your local Hewlett-Packard sales office. A current listing is available via the Web through AccessHP at http://www.hp.com. If you do not have access to the internet, please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

**United States:**
Hewlett-Packard Company
Test and Measurement Organization
5301 Stevens Creek Blvd.
Bldg. 51L-SC
Santa Clara, CA 95052-8059
1 800 452 4844

**Canada:**
Hewlett-Packard Canada Ltd.
5150 Spectrum Way
Mississauga, Ontario
L4W 5G1
(905) 206 4725

**Europe:**
Hewlett-Packard
European Marketing Centre
P.O. Box 999
1180 AZ Amstelveen
The Netherlands

**Japan:**
Hewlett-Packard Japan Ltd.
Measurement Assistance Center
9-1, Takakura-cho, Hachioji-shi,
Tokyo 192, Japan
Tel: (81) 426 48 3860
Fax: (81) 426 48 1073

**Latin America:**
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(305) 267 4245/4220

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31-41 Joseph Street
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131 347 ext. 2902

**Asia Pacific:**
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(852) 2599 7070

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