

# IMPEDANCE MEASURING INSTRUMENTS

## LF Impedance Analyzer, 5 Hz to 13 MHz

### HP 4192A

- 5 Hz to 13 MHz variable frequency
- Gain-phase measurement: amplitude, phase, group delay
- Floating or grounded devices
- Impedance measurement:  $|Z|$ ,  $|Y|$ ,  $\Theta$ , R, X, G, B, L, C, D, Q,  $\Delta$ ,  $\Delta\%$
- Standard HP-IB



HP 4192A (shown with Option 907 handles)



## HP 4192A LF Impedance Analyzer

The HP 4192A LF impedance analyzer performs both network analysis and impedance analysis on such devices such as telecommunication filters, audio/video electronic circuits, and basic electronic components. Both floating and grounded devices can be tested.

### Specifications (Refer to data sheet for complete specifications.)

#### Measuring Signal (23° ±5°C)

**Frequency Range:** 5 Hz to 13 MHz  
**Frequency Step:** 0.001 Hz (5 Hz to 10 kHz), 0.01 Hz (10 kHz to 100 kHz), 0.1 Hz (100 kHz to 1 MHz), 1 Hz (1 MHz to 13 MHz)  
**Frequency Accuracy:** ±50 ppm  
**OSC Level:** 5 mV to 1.1 V rms variable into 50 Ω (amplitude-phase measurement) or open circuit (impedance measurement)  
**OSC Level Step:** 1 mV (5 mV to 100 mV), 5 mV (100 mV to 1.1 V)  
**Level Monitor** (impedance measurement): Current-through or voltage-across sample can be monitored  
**Control:** Spot and sweep via front panel or HP-IB

#### Measuring Mode

**Spot Measurement:** At specific frequency (or dc bias)  
**Swept Measurement:** Manual or automatic sweep from START to STOP frequency (or dc bias) at selected STEP frequency (or dc bias) rate  
**Sweep Mode:** Linear or logarithmic (frequency only)  
**Recorder Outputs:** Output dc voltage proportional to each measured value, and frequency or dc bias  
**Maximum Output Voltage:** ±1 V  
**Key Status Memory:** Five sets of measuring conditions can be stored and recalled at any time  
**HP-IB Data Output and Remote Control:** Standard  
**Self-Test:** Automatic introspective testing  
**Trigger:** Internal, external, manual, or HP-IB

#### Amplitude-Phase Measurement

**Parameter Measured:** Relative amplitude B-A (dB) and phase  $\Theta$  (degrees or radians), B-A and group delay, absolute amplitude A (dBm or dBV) or B (dBm or dBV), and deviation ( $\Delta$ ,  $\Delta\%$ ) of all parameters  
**Reference Amplitude:** 0 dBV = 1 V rms, 0 dBm = 1 mW (with 50 Ω termination)  
**OSC Output Resistance:** 50 Ω  
**Channels A and B: Input Impedance:** 1 M Ω ±2%, shunt capacitance: 25 pF ±5 pF  
**Measurement Accuracy** (23 ±5°C): Specified at BNC unknown terminals after 30-minute warm-up (test speed: normal or average)  
**B-A (relative amplitude) and  $\Theta$  (phase) measurement:** ±0.01 dB, ±0.05° (at -20 to 0.8 dB V input, freq. = 100 to 10 kHz)  
**A, B (absolute amplitude) measurement:** ±0.4 dB (at -50 to 0.8 dB V input, freq. = 100 to 1 MHz)

#### Impedance Measurement

**Parameter Measured:**  $|Z|$ - $\Theta$ ,  $|Y|$ - $\Theta$ , R-X, G-B, L-D, Q, R,G, C-D, Q, R, G and deviation ( $\Delta$ ,  $\Delta\%$ ) of all parameters

**Display:** 4½ digits, max. display 12999 counts, 19999 for L & C

#### Circuit Mode:

Series equivalent circuit ( ) and parallel equivalent circuit ( ). Automatic selection available.

**Auto ZERO Adjustment:** Automatic normalization of the readout offset due to residuals of the test fixture by pushbutton operation (at spot frequency)

**Measuring Range and Accuracy** (23° ±5°C): Specified at BNC unknown terminals after 30 minute warmup when OSC level is more than 0.1 V and when auto ZERO adjust is performed (test speed: normal or average). Accuracy given below is only valid when the measured value is equal to full scale of each range.

#### $|Z|$ - $\Theta$ , R-X, $|Y|$ - $\Theta$ , G-B Measurement:

Parameters	Measurement range	Basic accuracy
$ Z $ , R, X	1.0000 Ω to 1.000 MΩ	0.15%
$ Y $ , G, B	10.000 μS to 10.00 S	0.15%
$\Theta$	-180.00° ± 180.00°	0.08°

R accuracy (D≥10); X accuracy (D<1)  
 G accuracy (D>1); B accuracy (D≤0.1)

**L-D • Q, C-D • Q Measurement:** (automatically calculated from measured Z/Y values)

Parameter	Measuring range*	Basic accuracy
L	0.01 nH to 1000 H	0.27%
C	0.1F to 199** mF	0.15%
D(1/Q)	0.0001 to 19.999	0.001 (C-measurement) 0.003 (L-measurement)

\*Varies with measuring frequency except for D(1/Q)

\*\*Accuracy of C ranges over 100 mF is not specified

**Internal dc Bias:** Standard (impedance measurement only)

**Voltage Range:** -35 V to +35 V, 10 mV step

**Setting Accuracy** (23° ±5°C): 0.5% of setting +5 mV

**Bias Control:** Spot and swept, using front panel controls or HP-IB

#### General Specifications

**Measuring Time** (high-speed mode)

**B-A and  $\Theta$ , A or B:** 88 to 127 ms (≥400 Hz)

**Impedance Parameters:** 58 to 91 ms (≥1 kHz)

**Test Level Monitor Range** (impedance measurement)

**Voltage:** 5 mV to 1.1 V

**Current:** 1 μA to 11 mA

**Operating Temperature:** 0° to 55° C, ≤ 95% RH at 40° C

**Power:** 100, 120, 220 V ±10%, 240 V +5% to -10%, 48 to 66 Hz, 150 VA max.

**Size:** 425.5 mm W x 235 mm H x 615 mm D (16.5 in x 9 in x 22.6 in)

**Weight:** Approximately 19 kg (41.9 lb)

**Furnished Accessories and Parts:** HP 16047A test fixture, HP 11048C 50 Ω feed thru terminations (2 ea), power splitter, HP 11170A BNC cables (2 ea), BNC adapter

#### Key Literature

HP 4192A LF Impedance Analyzer Data Sheet, p/n 5952-8896

#### Ordering Information

**HP 4192A** LF Impedance Analyzer

#### Accessories

**HP 16095A** Probe Fixture

**HP 16096A** 2-Port Component Test Fixture

**HP 16097A** Accessory Kit

**HP 16047C** Test Fixture

**HP 16048A** Test Leads (BNC connector)