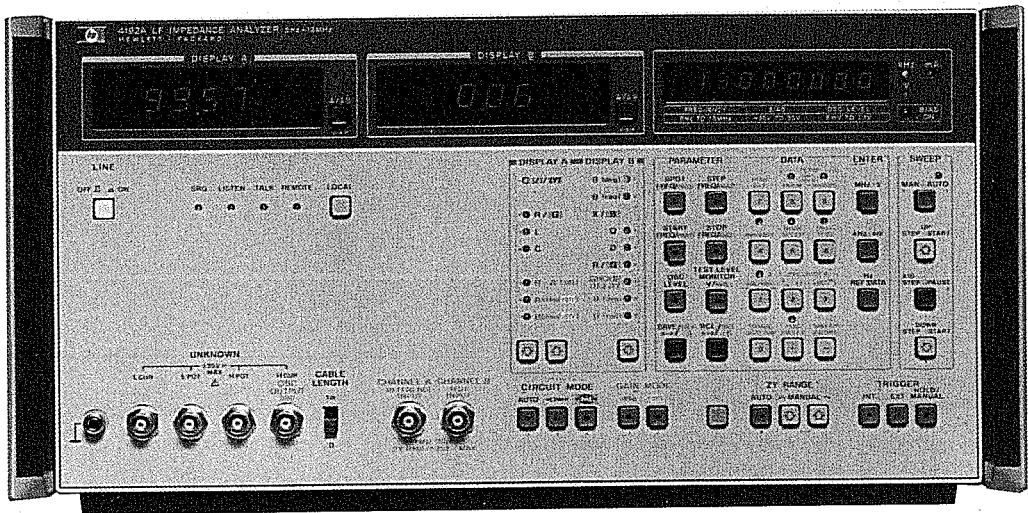


COMPONENT MEASUREMENT

LF Impedance Analyzer (5 Hz to 13 MHz)

HP 4192A

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



HP 4192A (shown with Opt. 907 handles)



Description

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.

Automatic Swept Frequency Measurement of All Impedance Parameters

The HP 4192A can measure 11 impedance parameters ($|Z|$, $|Y|$, θ , R, X, G, B, L, C, D, Q) over a wide range $|Z|$: 0.1 m Ω to 1 M Ω ; $|Y|$: 1 nS to 10 S).

The built-in frequency synthesizer can be set from 5 Hz to 13 MHz with a maximum resolution of 1 mHz. This feature allows accurate characterization of such high Q devices as crystals. Test signal level is variable from 5 mV to 1.1 V with 1 mV resolution. Also, an internal dc bias voltage source provides ± 35 V at 10 mV increments. Thus, the HP 4192A can evaluate components and entire circuits at near actual operating conditions.

Specifications (complete specifications on data sheet)

- Measuring signal** (23 \pm 5 $^\circ$ 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 Vrms 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).
- OSC level accuracy:** 5 Hz to 1 MHz: $\pm((5 + 10/f)\%$ of setting + 2 mV) where f is in Hz. 1 MHz to 13 MHz: $\pm((4 + 1.5 \times F)\%$ of setting + 2 mV) where F is in MHz.
- 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
- Output voltage accuracy:** $\pm(0.5\%$ of voltage + 20 mV)

- 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 θ (degrees or radians), B-A and group delay, absolute amplitude A (dBm or dBV) or B (dBm or dBV), and deviation (Δ , $\Delta\%$) of all parameters

Reference amplitude: 0 dBV = 1 Vrms, 0 dBm = 1 mW (with 50 Ω termination)

OSC output resistance: 50 Ω
Channels A and B: input impedance: 1 M Ω $\pm 2\%$, shunt capacitance: 25 pF ± 5 pF
Display range and resolution
 B-A: 0 to ± 100 dB, 0.001 dB (0 to ± 20 dB), 0.01 dB (± 20 to ± 100 dB)
 θ : 0 to $\pm 180^\circ$, 0.01 $^\circ$
Group delay: 0.1 ns to 19 s, max. resolution 4 1/2 digits
A or B: +0.8 to -100 dBV, 0.001 dB (> -20 dB), 0.01 dB (≤ -20 dB), +13.8 to -87 dBm, 0.001 dB (> -20 dBm), 0.01 dB (≤ -20 dBm)

Measuring accuracy (23 \pm 5 $^\circ$ C): Specified at BNC unknown terminals after 30 minute warmup (test speed: normal or average)

B-A (relative amplitude) and θ (phase) Measurement: Determined by sum of channel A and B accuracies given below (accuracy of each channel changes according to absolute input level)

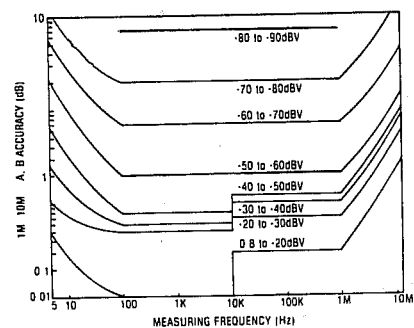


FIGURE 1 : GAIN MEASUREMENT ACCURACY

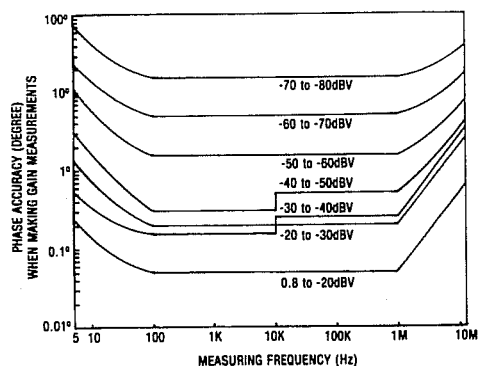


FIGURE 2 : PHASE ACCURACY WHEN MAKING GAIN MEASUREMENT

Impedance Measurement

Parameter measured: $|Z| - \theta$, $|Y| - \phi$, R-X, G-B, L-D · Q · R · G, C-D · Q · R · G and deviation (Δ , $\Delta\%$) 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| - θ , R - X measurement: Range: $|Z|$, R, X: 0.1 m Ω to 1.2999 M Ω ; θ : -180.00° to +180.00°. Accuracy: R accuracy (D ≥ 10); X accuracy (D < 1)

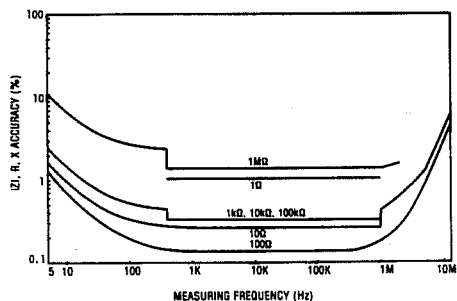


FIGURE 3 : $|Z|$, R, X ACCURACY

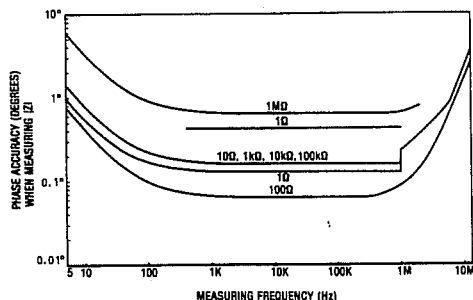


FIGURE 4 : PHASE ACCURACY WHEN MEASURING $|Z|$

|Y| - ϕ , G - B measurement: range: $|Y|$, G, B: 1 nS to 12.999 S; ϕ : -180.00° to +180.00°. Accuracy: G accuracy (D > 1); B accuracy (D ≤ 0.1).

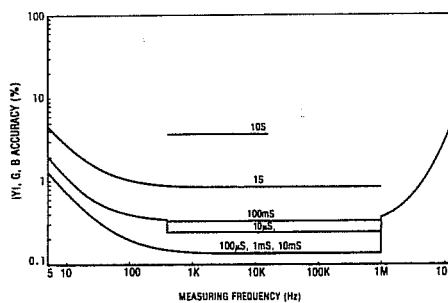


FIGURE 5 : $|Y|$, G, B ACCURACY

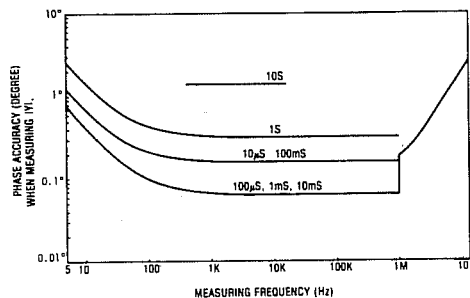


FIGURE 6 : PHASE ACCURACY WHEN MEASURING $|Y|$

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	0.1fF 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

Measuring time (high speed mode)

B-A and θ , 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 μ A 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 × 235 mm H × 615 mm D (16.75 in × 9 in × 22.6 in).

Weight: Approx. 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

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)

HP 16048C Test Leads with alligator clip

Refer to page 357 for accessories.

☎ For off-the-shelf shipment, call 800-452-4844.

Price

HP 4192A \$16,400

HP 16095A \$840

HP 16096A \$1,425

HP 16097A \$2,280

HP 16047C \$315

HP 16048A \$330

HP 16048C \$440

