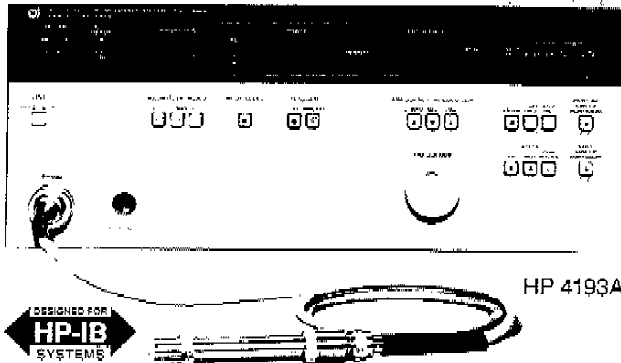


# IMPEDANCE MEASURING INSTRUMENTS

## Vector Impedance Meter, 400 kHz to 110 MHz HP 4193A

- 400 kHz to 110 MHz spot or swept frequency
- Measure impedance magnitude (10 m $\Omega$  to 120 k $\Omega$ ) and phase ( $-180.0^\circ$  to  $+180.0^\circ$ )
- Test components in-circuit and out-of-circuit



### HP 4193A Vector Impedance Meter

The HP 4193A vector impedance meter measures impedance magnitude and phase. An internal oscillator provides test signals from 400 kHz to 110.0 MHz. The test signal is a constant current between 10  $\mu$ A and 100  $\mu$ A, depending on  $|Z|$  range.

### Reliable and Accurate Impedance Measurement

The HP 4193A can measure and display impedance magnitudes from 10 m $\Omega$  to 120 k $\Omega$ . Impedance phase is displayed from  $+180.0^\circ$  to  $-180.0^\circ$ . Accuracy is as good as 3.0 percent of reading (magnitude) and 3.2 $^\circ$  (phase).

Also, the HP 4193A's 3 $\frac{1}{2}$ -digit resolution makes it easy to see small changes in measurement results during adjustment procedures.

### Frequency Sweep for Complex Component Testing

When you're testing complex components such as ceramic resonators, it's useful to sweep frequency to get the big picture, and to identify such critical impedance points as the series resonant point. This requires both swept measurement and measurements at individual "spot" frequencies. The HP 4193A can do both.

The HP 4193A can be tuned to any individual frequency from 400 kHz to 110.0 MHz with a maximum resolution of 1 kHz. If a greater frequency resolution is required, it can be provided by connecting an external synthesized source such as the HP 3335A or HP 8656B to the HP 4193A EXT OSC input.

Flexible internal frequency sweep is an exciting HP 4193A feature. Frequency can be swept linearly over any portion of the HP 4193A frequency range or swept logarithmically over the entire 400 kHz to 110.0 MHz range.

### Test In-Circuit and Out-of-Circuit Components

Several test fixtures help adapt the HP 4193A to your device under test. For example, the handy L-ground probe is useful for in-circuit testing. The HP 16099A test fixture adapter and three associated fixtures help connect to out-of-circuit devices of various sizes and shapes.

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

#### Test Signal Output Specifications

Test signal is output from the furnished low-ground probe.

**Frequency Range:** 400 kHz to 110.0 MHz

#### Frequency Resolution

- 400 kHz to 9.999 MHz: 1 kHz resolution
- 10.00 MHz to 99.99 MHz: 10 kHz resolution
- 100.0 MHz to 110.0 MHz: 100 kHz resolution

**Frequency Accuracy:**  $\pm 0.01\%$  of setting after calibration

**Frequency Stability:**  $\pm 100$  ppm per month ( $0^\circ$  to  $55^\circ$  C)

#### Frequency Control

- Spot:** Spot frequency is set using coarse, medium and fine controls
- Full sweep:** Logarithmic sweep at 43 points over full range of 400 kHz to 110 MHz

- Fixtures include low-grounded probe, spring clip fixture, and binding post fixture
- Standard HP-IB and analog outputs

**Partial Sweep:** Linear sweep from selected START to STOP frequency. Number of steps is selected as 100, 1000 or "HIGH RESOLN." When "HIGH RESOLN" steps are selected, the operator must also select "coarse," "medium," or "fine" resolution.

**EXT OSC:** Increase frequency resolution by connecting an external frequency synthesizer

### Impedance Measurement Specifications

**Input Configuration:** Low-grounded probe (furnished)

**Digital Display of Impedance:** 3 $\frac{1}{2}$  digits

**$|Z|$ :** 0 to 1999 counts (0 to 120 counts on 100 k $\Omega$  range)

**$\theta$ :**  $-1800$  to  $+1800$  counts ( $-180$  to  $+180$  counts on 100 k $\Omega$  range)

**Measurement Trigger:** Internal, external, and manual

**Measurement Range Control:** Auto, hold, and manual

#### Measurement Range

**$|Z|$ :** Five decade ranges: 10  $\Omega$ , 100  $\Omega$ , 1 k $\Omega$ , 10 k $\Omega$ , 100 k $\Omega$

**Minimum  $|Z|$  (sensitivity):** 10 m $\Omega$

**Maximum  $|Z|$ :** 120 k $\Omega$

**$\theta$ :** One range:  $-180.0^\circ$  to  $+180.0^\circ$

### Reference Data

#### Test Signal Output

**Frequency Settling Time:** 5 ms to 400 ms. Best case is when  $(\Delta f/f)^2$  is less than 10% (below 10 MHz) and less than 1% (above 10 MHz).

#### Signal Purity

**Spurious:**  $-60$  dBc (dBc is dB below carrier)

**Harmonics:**  $-30$  dBc

**Residual FM:** Measured in a 100 Hz band centered on the carrier

**1 MHz to 110 MHz:** 100 Hz p-p FM

**Test Level:** Constant current source

### Impedance Measurement

#### Residual Impedance of Probe (at probe tip)

**Resistance:**  $\leq 0.55 \Omega$

**Inductance:**  $\leq (4.9 + 10/f)$  nH where f is measuring frequency in MHz

**Parallel capacitance:**  $\leq 0.11$  pF

**Measuring Speed:** Assumes range is fixed; recorder output is OFF

**HI SPEED:** Approximately 150 ms per measurement

**NORMAL:** Approximately 1 s per measurement

**Ranging Time:** Approximately 1.2 s

**Temperature Coefficient at  $23^\circ$  C  $\pm 5^\circ$  C**

**$|Z|$ :** 2 m  $\Omega/^\circ$  C,  $\theta$ : 0.02 $^\circ/^\circ$  C

### General

**Operating Temperature/Humidity:**  $0^\circ$  to  $55^\circ$  C,  $\leq 95\%$  RH @  $40^\circ$  C

Note that measurement error in  $0^\circ$  C to  $55^\circ$  C temperature range is typically double the error in the  $23^\circ$  C  $\pm 5^\circ$  C range.

**Power:** 100/120/220 V  $\pm 10\%$ , 240 V  $-10\%$  to  $+5\%$ , 48 to 66 Hz, 150 VA max

**Size:** 426 mm W  $\times$  178 mm H  $\times$  498 mm D (16.75 in  $\times$  7 in  $\times$  19.6 in)

**Weight:** 18 kg (40 lb)

**Accessories Furnished:** The low-ground probe kit includes a probe, spare pins, spare clips, BNC adapter, component mounting adapter, probe socket, and accessory case.

### Key Literature

HP 4193A Vector Impedance Meter Data Sheet, p/n 5952-8889.

### Ordering Information

HP 4193A Vector Impedance Meter

### Accessories

HP 16099A Test Fixture Adapter

(used with HP 16092A and HP 16093A/B)

HP 16092A Spring Clip Fixture (used with HP 16099A)

HP 16093A Binding Post Fixture

(used with HP 16099A)

HP 16093B Binding Post Fixture

(used with HP 16099A)

Refer to page 340 for accessories.