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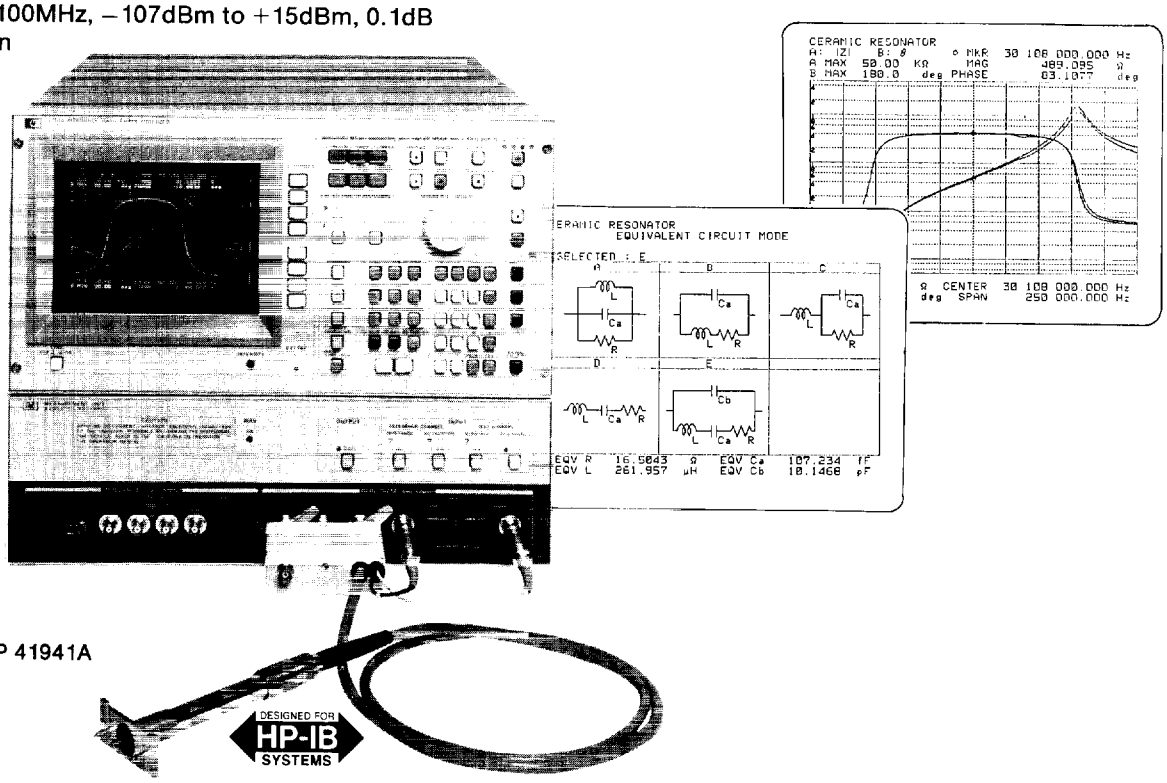
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COMPONENT MEASUREMENT

Impedance/Gain-Phase Analyzer

Model 4194A

- High Accuracy and Wide Range Impedance Measurement:
  - 100Hz to 40MHz, 0.1mΩ to 1.6MΩ, 0.17%
  - 10 kHz to 100 MHz, 0.1Ω To 1MΩ, 1.5% when used with the HP 41941A/B
- Gain-Phase Measurement:
  - 10Hz to 100MHz, −107dBm to +15dBm, 0.1dB resolution
- Flexible Measurement, Computation and Analysis Capabilities on a Color Graphic Display
- Fully Programmable



HP 4194A with HP 41941A

Description

The HP 4194A Impedance/Gain-Phase Analyzer is an integrated solution for efficient measurement and analysis or go/no-go testing of components and circuits. Detailed impedance and transmission characteristics including secondary parameter derivations can be simply and quickly evaluated or tested. The HP 4194A can contribute to improving engineering productivity and reducing test cost. The analyzer is flexible and has wide measurement capabilities in both impedance and transmission measurements, plus it is fully programmable using Auto Sequence Programming (ASP). Desired measurements and computations, including graphics analysis, can be programmed simply by storing front panel keystroke operations, allowing you to customize measurement, computation and analysis functions. The HP 4194A also features high accuracy and error elimination functions to ensure reliable measurements.

Wide Range Accurate Measurement

Featuring a wide test frequency range — 100Hz to 40MHz for impedance measurements (10kHz to 100MHz when using the HP 41941A/B Impedance Probe Kit) and 10Hz to 100MHz for gain-phase measurements — the HP 4194A satisfies a wide spectrum of needs. Realistic device characteristics can be analyzed under actual operating conditions by varying the test frequency, test signal level, and dc bias. The HP 4194's high degree of measurement accuracy — 0.17% for impedance measurements (1.5% when using the HP 41941A/B) with an amplitude ratio of 0.1 dB — ensures that you'll improve the quality of your test devices.

Quick Analysis

The HP 4194A makes high speed measurements, (approximately 3.7ms per point), displays results on a color CRT, and performs parameter analysis of components and circuits quickly and efficiently; substantially reducing development and evaluation time. The analysis function not only provides you with impedance and transmission characteristics, but also allows you to determine secondary parameters. Using the marker and line cursor functions, you can obtain the resonating frequency of resonators and the pass band width of band pass filters quickly.

Equivalent Circuit Analysis Function

Using the HP 4194A's Equivalent Circuit Analysis Function, you can easily and quickly obtain those equivalent circuit constants that, until now, required a number of time-consuming, complicated calculations. By using measured values, this unique function can approximate the circuit constant values of five circuit models. For example, a resonator's equivalent circuit elements or a coil's self inductance, lead resistance, and stray capacitance can be easily obtained.

The equivalent Circuit Analysis function also simulates the frequency characteristics of components by using derived circuit values or values you specify. By using approximation and simulation, you can compare design values to measurement values, and thereby, improve component design efficiency.

Auto Sequence Program (ASP)

The HP 4194A's ASP function, an internal programming feature, allows you to control all HP 4194A operations (measurement, display, and analysis) without the need for an external computer. By using ASP and actual measurement values, you can readily calculate many secondary parameters that you may need to evaluate. You can

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then use the HP 4194A's powerful analysis functions to analyze these calculated parameters.

You can also use ASP to enhance such HP 4194A functions as alternate sweep, sweep timing control, and marker tracking. Because ASP eliminates the need for external controller, thereby eliminating data transfer time, the HP 4194A can quickly and efficiently perform production line go/no-go testing of components such as resonators and filters. All these features combine to increase your engineering and manufacturing productivity.

Increased Capabilities With The HP 41941A/B Impedance Probe Kit

When using the HP 4194A with the HP 41941A/B Impedance Probe Kit, you can perform reliable impedance evaluations up to 100MHz. Measurement errors due to residual impedance and stray admittance are eliminated by using the calibration standards furnished with the HP 41941A/B and the HP 4194A's automatic calibration function. This makes it possible to make highly accurate measurements (basic measurement accuracy 1.5 to 3%) over a wide measurement range of 100mΩ to 1MΩ. Calibration accuracy is guaranteed to the tips of the HP 41941A (1.5m) and HP 41941B (3m) impedance probes.

The HP 41941A/B can be used as a grounded probe to evaluate the impedance of in-circuit components such as printed circuit patterns, and the input/output impedance of circuits. In addition, you can connect an external dc bias source directly to the HP 41941A/B to perform dc biased measurements up to ±150V/0.5A, to measure the dc characteristics of inductors, capacitors, materials, and semiconductors. To perform swept dc bias measurements, use the HP 4194A's ±40V internal dc bias source.

Specifications

Impedance Measurements

Measurement Parameters: |Z|, |Y|, θ, R, X, G, B, L, C, D, Q. 20 parameter combinations are available.
Test Frequency: 100 Hz - 40 MHz (CABLE LENGTH: 0m), 100Hz - 15 MHz (CABLE LENGTH: 1m), 1mHz resolution.
OSC Level: 10mV -1Vrms (≤10MHz), 10mV -0.5Vrms (>10MHz) (UNKNOWN terminal open), 3 digit resolution
DC Bias: 0 - ±40V, 10mV resolution
Measurement terminal: 4 - terminal pair configuration
Measurement Range and Maximum Resolution:

Measurement Parameter	Range	Max Resolution
|Z|,R,X	10mΩ to 100MΩ	100μΩ
|Y|,G,B	10nS to 100S	1nS
θ	± 180°	0.01°
L	1nH to 100kH	10pH
C	10fF to 0.1F	0.1fF
D	0.001 to 10	0.0001
Q	0.1 to 1000	0.1

Basic Measurement Accuracy: 0.17%
Level Monitor:

Gain-Phase Measurements

Measurement Parameters: Tch/Rch (dB, Linear Ratio), Tch, Rch (V, dBm, dBV), θ(degree, rad), τ
Tch= Test Channel, Rch= Reference Channel, τ = Group Delay
Measurement Frequency: 10Hz - 100MHz, 1mHz resolution
Aperture Frequency Range (Group Delay Measurements): 0.5% - 100% of frequency span
OSC Level: −65dBm - +15dBm, 0.1dB resolution
Measurement Range:
Tch/Rch: 0 - ±120dB, 0.001dB resolution
Tch, Rch: −107dBm - −5dBm (0dB Attenuator)
−87dBm - +15dBm (20 dB Attenuator)
0.001dB resolution
θ: ±180° (can display phase continuously with the phase scale expansion function), 0.01° resolution
τ: 0.1ns - 1s, 0.1ns resolution
Basic Measurement Accuracy:
Tch/Rch: 0.1dB, 0.5°
Tch, Rch: 0.35dBm
θ: 0.5°
Level Monitor

Impedance Measurements using the HP 41941A/B

The specifications listed below are for the HP 4194A when used with the HP 41941A/B.

Frequency Range: 10 kHz - 100 MHz, 1 mHz resolution
OSC Level: Opt. 350: 10 mV - 1.28 Vrms
Opt. 375: 10 mV - 1.54 Vrms
DC Bias: Internal: ± 40V, ± 20 mA
External: ± 150V, ± 500 mA, max 25 W
Measurement Range: 100 mΩ - 1 MΩ
Basic Measurement Accuracy:
± 1.5% to 3% (≧ 100 kHz), ±3% to 6% (< 100 kHz)
Cable Length: HP 41941A: 1.5 m, HP 41941B: 3 m

Common Specifications

Trigger Mode: Internal, External and Manual
Sweep Capability:
Sweep Parameter: Frequency, OSC Level, DC Bias (impedance measurements only)
Entry: START/STOP or CENTER/SPAN
Sweep Type: LIN, LOG, ZERO SPAN (DC Bias: LIN or ZERO SPAN only)
Number of Measurement Points: 2 to 401 points
Sweep Functions: Partial Sweep, Expand Markers Sweep, Program Points Measurement

Display

CRT: 7.5 inch color CRT
Display Mode: Rectangular (X- A & B), Rectangular (A - B), Table
Display Control: Autoscale, Superimpose and Storage

Analysis

Maker: Single, Delta, Double Makers
Line-Cursor: Line-Cursor, Delta-Line Cursor
Equivalent Circuit Function: Approximation, Simulation
Arithmetic Operation
Data Resister Manipulation: Use arithmetic operations and functions to manipulate data registers.
GO/No-Go Limits

Programming

Auto Sequence Program (ASP): Control the HP 4194A's operation with an internal program language. ASP Programs can be entered using the front panel keys or downloaded from HP-IB.
Program Memory Size: 20kBytes of non-volatile memory
Copy: Dump, Plot, Print Mode

General Specifications

Operating Temperature and Humidity: 0°C - 40°C (HP 41941A/B: −20 - +65°C), ≤95%RH at 40°C
Storage Temperature: −30°C - +60°C (HP 41941A/B: −40 - +65°C)
Safety: Based on IEC - 348, UL - 1244
Power: 100, 120, 220V ±10%, 240V - 10% + 5%, 48 - 66Hz, 400VA (max)
Dimensions: 425 (W) x 375 (H) x 620(D) mm
Weight: Approximately 37kg (net)

Reference Data

Typical Measurement Speed:
Impedance: Approximately 3.7ms/point
Gain-Phase: Approximately 3.5ms/point
Impedance when used with the HP 41941A/B: Approximately 6 ms/point

Accessories Furnished

HP 16047D: Direct Coupled Test Fixture
HP 8120-1838: 30cm BNC Cable (2ea) (OPT.350)
HP 04194-61640: 30cm BNC Cable (2ea) (OPT.375)
HP 8120-1839: 60cm NNC Cable (OPT.350)
HP 04194-61641: 60cm NNC Cable (OPT.375)
HP 1250-0080: BNC Adapter

Accessories Available

Refer to page 279

Ordering Information

	Price
4194A Impedance/Gain-Phase Analyzer	$22,100
Opt 350*: 50 Ohm System	$0
Opt 375*: 75 Ohm System	$0
Opt W30: 3-year hardware support	$440
Opt 001: High Stability Frequency Reference	$850
HP 41941A* Impedance Probe Kit (1.5m)	$1730
HP 41941B* Impedance Probe Kit (3 m)	$1730

*Must select either OPT.350 or 375

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