KEYSIGHT TECHNOLOGIES (AGILENT HP)

4291A

The HP Keysight 4291A is a high-precision RF impedance and material analyzer designed for surface mount component evaluation and material testing. Operating across a broad frequency range of 1 MHz to 1.8 GHz, it provides highly accurate and repeatable impedance measurements from 0.1 ¸ to 50 ķ, featuring a built-in 7.5-inch color CRT display, equivalent circuit analysis, and optional DC bias capabilities.

SPECIFICATIONS

General

Interfaces	HP-IB (IEEE-488) supporting SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C11, E2
Display	7.5-inch Color CRT, 512 x 400 resolution, 2 channels
Warm-Up Time	30 minutes

Physical

Power Supply	90 V to 132 V / 198 V to 264 V, 47 Hz to 66 Hz, 500 VA max
Operating Temperature	10 to 50 °C (Mainframe), 0 to 55 °C (Test Station) °C
Dimensions (W×H×D)	426 mm × 234 mm × 537 mm (Mainframe), 275 mm × 95 mm × 205 mm (Test Station) mm
Weight	24 kg (mainframe), 3.7 kg (test station) kg
Test Station Dimensions (W×H×D)	275 mm × 95 mm × 205 mm
Test Station Weight	3.7 kg
Test Station Cable Length	1.5 m

Measurement Capabilities & Parameters

Impedance Measurement Parameters	|Z|, θz, |Y|, θy, R, X, G, B, Cp, Cs, Lp, Ls, Rp, Rs, D, Q, |Γ|, θγ, Γx, Γy
Impedance Measurement Range	0.1 Ω to 50 kΩ
Connector Type	APC-7

Stimulus AC Signal Characteristics

Frequency Range	1 MHz to 1.8 GHz
Frequency Resolution	1 mHz
AC Voltage Signal Level Range	0.2 mVrms to 1 Vrms
AC Current Signal Level Range	4 µArms to 20 mArms
AC Power Level Range	-67 dBm to 7 dBm

DC Bias Source

DC Bias Voltage Range (Option 001)	0 to ±40 V
DC Bias Current Range (Option 001)	20 µA to 100 mA, -20 µA to -100 mA
DC Bias Voltage Resolution (Option 001)	1 mV
DC Bias Current Resolution (Option 001)	20 µA

Sweep & Measurement Speed

Sweep Parameter Selection	Frequency, OSC level (voltage), DC bias voltage/current
Sweep Setup Modes	Start/Stop, Center/Span
Sweep Types	Linear, Log, List
Sweep Modes	Continuous, Single, Manual, Number of groups
Sweep Direction	Up sweep, Down sweep
Number of Sweep Points	2 to 801 points
Averaging Types	Sweep average, Point average
Sweep Delay Functions	Point delay time, Sweep delay time

Calibration & Compensation

Calibration Functions	Open/Short/50 Ω calibration, Low loss calibration
Compensation Functions	Open/Short/Load compensation, Port extension, Electric length

Display & User Interface

Display Formats	Single, dual split, or overwrite; graphic or tabular
Trace Capacity	1 trace/channel for measurement, 1 trace/channel for memory
Equivalent Circuit Simulation	Built-in component equivalent circuit analysis
Limit Line Testing	Supported (go/no-go testing)

Interfaces & Connectivity

External Reference Input	10 MHz (typical), >-5 dBm (typical)
External Trigger Input	TTL level, pulse width >2 µs (typical)

Storage & Memory

Disk Storage	1.4 MB flexible disk drive (DOS and LIF compatible)
Internal Memory	RAM disk memory

Frequency

Frequency Accuracy	±20 ppm (at 23 °C ± 5 °C)
Frequency Reference Stability	±10 ppm / year (standard); ±0.13 ppm / year (with Option 1D5)

Signal Source

Source Level Resolution	0.1 dB

Measurement Accuracy

Basic Impedance Accuracy	±0.8%

Performance

Measurement Time	15 ms per point (typical)

Storage

Floppy Disk Drive Format	3.5-inch, DOS (1.44 MB) and LIF formats

Environmental

Non-Operating Temperature Range	-40 °C to +70 °C
Operating Humidity	15% to 95% RH
Operating Altitude	Up to 4,500 m

Interfaces

External Video Output	15-pin D-sub (VGA)
Keyboard Port	Mini-DIN
I/O Port	25-pin D-sub (8-bit I/O port)

Measurement Setup

Measurement Channels	2 channels

System & Control

Programming Languages	SCPI, HP Instrument BASIC (IBASIC)

Measurement Parameters

Material Measurement Parameters (Option 002)	Complex permittivity (εr', εr''), Complex permeability (μr', μr''), loss tangent (tan δ)

TECHNOLOGY

RF Impedance Analyzer

APPLICATIONS

Surface mount component evaluation, dielectric/magnetic material testing