

1296A

Dielectric Interface

Analyzing low conductivity, low loss materials stretches the capabilities of even the best frequency response analyzers (FRAs). Used alone, they lack the sensitivity required for accurate measurements, especially at low frequencies.

The 1296A Dielectric Interface overcomes these limitations to give you fast, accurate and repeatable impedance measurements over 12 decades of frequency, yielding valuable insights into the characteristics of a wide range of materials, including polymers, rubber, wood, adhesives, electronic components, waxes and oils, etc. Coupled with easy-to-use software, a 1296A-based system takes care of experimental technique and lets you concentrate on interpreting the results.

1296A enhances the capabilities of Solartron Analytical's renowned 1260A and 1255A FRAs to cope with ultra-low current and capacitance levels experienced in testing dielectric materials, enabling:

- Impedance measurements to exceed 100 TΩ (10¹⁴ Ω)
- Accurate tan delta measurements down to <10⁻⁴
- Frequency range from 10 μHz up to 10 MHz
- AC signal and DC bias voltages up to 1000 V (with external psu or amplifier)

revealing essential data in areas previously inaccessible.

Highly accurate reference capacitors are built in to 1296A, or you can choose to use an external reference, offering unrivalled flexibility to meet almost every measurement need. Support for temperature and dc controllers is integral to the measurement software, further increasing the scope for materials analysis.

Defining Dielectrics

Many materials have the properties of low conductance (high impedance) and low loss. They are often referred to as dielectrics, although many materials not normally considered as dielectrics exhibit these properties.

One popular technique for analyzing such materials is Impedance spectroscopy - measuring the electrical impedance over a range of frequencies. The impedance is related to the conductivity and capacitance of the material, and these parameters can in turn be related to the molecular activity of the material.

When an alternating voltage is applied to a dielectric sample, some energy is stored by the capacitance, and some is dissipated by the resistance effects. The resulting current in the sample will exhibit a phase lag, δ . In materials research, the capacitance effect is known as the permittivity (or dielectric constant) ϵ' , and the resistive effect as dielectric loss, ϵ'' . $\tan \delta$, the dissipation factor equals ϵ''/ϵ' .

In materials where ϵ'' is very small and ϵ' large, the resolution of $\tan \delta$ becomes critical if an accurate measurement is to be made. The 1296A overcomes this by taking a reference measurement on a precision capacitor which is automatically substituted for the sample; a second measurement is made, this time on the sample itself. The two results are used to derive a very accurate estimate of the permittivity of the material - in effect, the first measurement is used to eliminate the effects of extraneous capacitance.

Temperature Options

Cryostat System covering 77 K to 500 K, complete with solid and liquid sample holder for testing polymers, rubber, pharmaceuticals etc. Potentiostatic/galvanostatic techniques Cyclic voltammetry CorrWare and ZPlot are an ideal tool for corrosion analysis, battery/fuel cell research, and general electrochemistry. The software provides, real-time analysis, multiple display formats and curve fitting routines.



1296A Dielectric Interface Specification




	1296A+ 1260A/1255A	1296A+1250A	1296A+1253A
Frequency Range	10 μ Hz to 10 MHz	10 μ Hz to 65 kHz	1 mHz to 20 kHz
Signal Amplitude	up to 7Vrms*	up to 10 Vrms	up to 10 Vrms
DC Bias	up to \pm 40 V	up to \pm 10 V	up to \pm 10 V

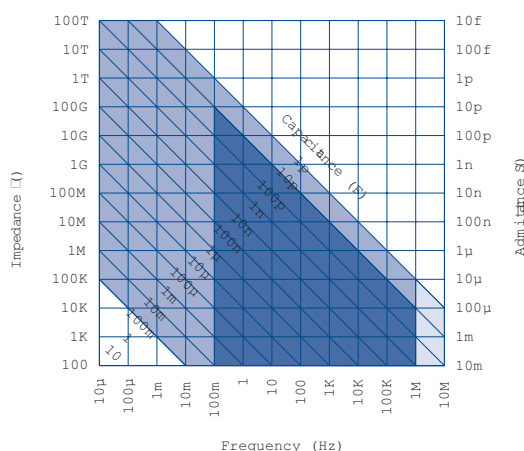
* For signals >3 Vrms, an internal amplifier is used, and signal amplitude + dc bias must not exceed 10 V peak

Current measurement	1 fA to 100 mA
Tan delta range	<10 ⁴ to 10 ³ (reference mode)
Impedance range	100 Ω to >100 T Ω (10 ¹⁴ Ω)
Capacitance range	1 pF to >0.1 F

Typical Accuracy (reference mode)

Capacitance (real)

	<0.2%
	<2%
	<5%



Applications

The range of applications for a 1296A system is huge, and includes the investigation of:

- Relaxation processes in the molecular dynamics of liquid crystals, polymers and liquids
- Charge transport in semiconductors, organic crystals, ceramics etc.
- Analysis of chemical reactions, polymerization and curing processes
- Non-linear electrical and optical effects
- Novel gas and liquid sensors
- Characterization of insulating and semiconductor materials
- Quality control in the production of insulators, printed circuit boards, etc.
- Fuel cell/battery materials

Solartron Analytical is a world leader in instrumentation and software for the characterization of materials and electrochemical systems using precision electrical measurement techniques.

These techniques find particular use in the fields of corrosion, battery and fuel cell research, dielectric analysis and electrochemistry. The product portfolio includes industry standard frequency response analyzers, potentiostats, electrochemical software (Zplot and CorrWare) and battery test equipment.

Software	Provides control of FRA, 1296A and optional temperature controller, dc bias and ac signal amplifiers
Result parameters plotted vs on	Z*, Y*, ϵ^* , C* (real, imaginary, magnitude, phase, tan δ) frequency, time, temperature, bias, ac level Bode, complex plane
Power supply	85 Vac to 264 Vac (47 to 440 Hz)
Power consumption	30 VA max.
Dimensions (w x h x d)	340 mm x 120 mm x 300 mm (13.39 in x 4.72 in x 11.81 in)
Weight	5.5 kg (12.13lb)
Operating temp. range	10 to 30°C (50 to 80°F)



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