Advanced Frequency Response Analyzer For Smart Measurement Applications

Novocontrol Technologies offers an advanced solution for the electric/dielectric characterization of materials in a single materials analysis system. The central idea is **modularity**: a mainframe ALPHA-A analyzer is always combined with a test interface to form a measurement solution.
By variation of the test interface, the system provides instant access to all essential characterization methods, like, e.g., **dielectric/impedance or conductivity spectroscopy, high voltage engineering, non-linear spectroscopy, electrochemical impedance spectroscopy, frequency response analysis**.
Switching to another method is done in less than a minute, simply by exchanging interfaces. Access to a new method is thus as easy as adding an additional test interface.
The combination of all your experiments in a **single materials analysis system** yields substantial gains in usability, accuracy and flexibility with significant cost savings. In addition, these systems offer a unique combination of **wide frequency range (13.1 decades), ultra-wide impedance range (up to 18 decades) and extremely high loss factor resolution** in a single unit.
This **easy-to-use system**, suitable for a virtually unlimited number of applications on the same platform, offers superior functionality and flexibility, increased throughput and improved results.

Alpha-A

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Ultra-High Bandwidth

Due to its extremely wide frequency range, the ALPHA-A is ideally suited to analyze both slow and fast relaxation and charge transport phenomena in materials. The DC resistance of a material, e.g., is usually extracted from the low frequency data, while molecular relaxations with relaxation times in the nanosecond regime require high frequency measurements.
Glasses or polymers frequently show multiple relaxations which typically differ in their relaxation times; others, like, e.g., ceramic conductors exhibit frequency-dependent features due to contributions of bulk, grain boundary, and electrode effects which may only be separated if a rather wide frequency range is monitored. Coverage of a broad frequency bandwidth is thus a crucial feature of instruments used for the characterization of such phenomena.
In a single instrument, the ALPHA-A covers frequencies from 3 µHz up to 40 MHz (Alpha-AT version) with an unlimited number of frequency points per sweep.

Ultra-Wide Impedance Range

For impedance measurements, the ALPHA-A mainframe is always connected to one of its test interfaces. The combination of an ALPHA-A frequency response analyzer and its test interfaces offers a unique measurement solution which covers up to eighteen decades of impedance. With our standard interfaces, e.g., values between 10 mΩ and 100 TΩ are determined continuously, i.e., without changing the setup.
The ALPHA-A based systems are thus capable to fully characterize a wide range of materials spreading from insulators to metallic conductors.

Ultra-High Phase Resolution

Electrical impedance measurements on materials analyze the property to store and transfer electrical charge.
These properties are expressed, and analyzed, e.g., in terms of the permittivity or conductivity of a material. In the complex representation of permittivity, δ denotes the phase angle between its imaginary and real parts, and tan δ represents dielectric loss.
When it comes to low-loss materials, the crucial property of a frequency response analyzer is its phase resolution. In this respect, the ALPHA-A offers unsurpassed performance, i.e., a very high phase resolution of less than 0.001°, equivalent to a tan δ resolution of 10^{-5}.

Noise Rejection

The ALPHA-A performs highly accurate digital correlation of amplitude and phase variation of both the excitation and response signals to achieve highly effective noise rejection.

Harmonics Analysis

In general, the electrical behavior of materials is expected to be linear. Some materials, however, exhibit an intrinsic non-linear behavior or are deliberately made non-linear for certain purposes or applications. The ALPHA-A analyzes higher harmonics of such materials by complex Fourier transformation. This opens the way to a new range of experiments, known as non-linear spectroscopy.

Auto Configuration

One key advantage of the modular system based on the ALPHA-A mainframe is the large variety of available test interfaces, each serving a particular measurement application.
Upon connecting to the ALPHA-A, test interfaces are automatically identified and their latest calibration data restored. It is thus not even necessary to recalibrate the system when switching test interfaces.
To the outside world, the ALPHA-A and its attached test interface form a single unit. This unique feature ensures a minimum of configuration effort when changing from one application to another.

Common Software Platform

DETACHEM is the complete Windows-based software toolkit to control a comprehensive range of measuring techniques. It comprises online graphics and post-analysis in various formats with overlays of measurement results for comparative studies.
Presetting facilities allow pre-programmed test sequences which run without user intervention. System control, test interface calibration, data acquisition and documentation are automatically carried out by this software package.

Data Transfer

The alphanumeric display of the ALPHA-A shows all relevant measurement data such as initialization, calibration, measurement running, frequency, voltage, sample capacitance, sample resistance and tan δ. Simultaneously, all measurement data are transferred to a computer via the GPIB (IEEE 488) bus.