




## Dielectric Materials

Ferro/piezoelectrics, MEMs, NEMs, multiferroics, polymers, solid oxides SOFC, ionic conductors, solid electrolytes, nanomaterials, thin-film materials, quantum dots .....

smart phones | displays | loudspeakers | earphones | aerospace guidance systems  
semiconductor memory devices | cable insulators | fuel cells | solid state batteries

## the xm difference

-  **Market leading impedance analysis**
-  **Widest voltage and current range available**
-  **Time domain and impedance analysis in a single system**



ModuLab<sup>®</sup> XM MTS is the only dielectric materials test system that combines an accurate time domain analyzer and a high performance impedance analyzer into a single “plug and play” modular chassis. Purpose built for dielectric materials research the ModuLab XM provides:

- High-performance impedance analysis throughout the entire frequency range and across all three modes of operation
  - Swept sine (highest accuracy and repeatability)
  - Multi-sine/FFT (for increased test throughput especially at low frequency)
  - Harmonic analysis (to study non-linear materials)
- Optional 100 V test range enables tests of the linearity / breakdown properties of materials
- Low frequency (<10 Hz) impedance/C-V analysis for material purity and electrode polarization studies
- Multi-component system calibration for ensured measurement accuracy (capacitance and  $\tan \delta$ )
- Market leading frequency range and resolution for resonance analysis (1 in 65,000,000)
- Staircase or smooth ‘analog’ ramp waveforms. Important for I-V, hysteresis and polarization measurements.
- Wide current measurement range (over 16 decades from 0.1 fA to 2A). Ensures dielectric, insulator and conductor materials can be accurately characterized, including low loss / low leakage materials.
- Available voltage and current amplification modules (100 V amplifier and femto ammeter) for the greatest flexibility in application
- Compatibility with highly efficient cryostats, high temperature furnaces, and sample holders
- User friendly software with simple three step test setup/run, built-in live waveform displays, connection diagrams and equivalent circuit/ I-V fit functions
- Compatible potentiostat modules available for whole cell testing (e.g. solid oxide fuel cell)

# Accessories

## 129610A Cryostat System

Materials researchers often need to characterize the electrical performance of materials over a wide range of temperature, e.g. ionic conductors in solid oxide fuel cells, semiconductor and electronic materials, ceramic materials for aerospace applications .....

Solartron's 129610A provides :

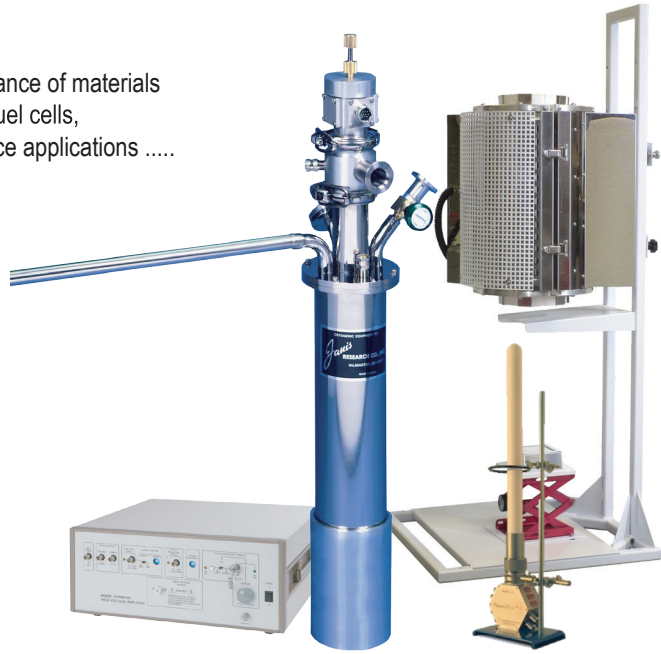
- Sample in static gas (no sample cracking)
- Very low cryogen usage (typically 250 ml/hr @ 77 K)
- Operation to 78K with LN2, 5K with LHe
- Switching between LHe/LN2 operation per experiment.

## Furnace Systems

ModuLab XM is compatible with various configurable high temperature furnace systems for testing ionic conductors, solid oxide, and solid electrolytes.

## High Voltage Amplifiers

ModuLab XM internal option modules provide up to  $\pm 100$  V operating range and is compatible with external amplifiers for high voltage operation (in the order of 10 kV).



# Software

ModuLab XM MTS software is a very flexible and comprehensive materials test software package. A large selection of test types are provided, from standard open circuit, I-V, pulse, C-V, Mott-Schottky to complete multi-step sequences that can include sample temperature control using a cryostat or high temperature furnace.

As test parameters are entered into the software, a waveform diagram displays the timing and levels that will be applied to the sample when the test is run.

Equivalent circuit models may be constructed using a range of components including resistors, capacitors, inductors, distributed elements, constant phase elements, Gerischer elements, and Warburg open / short elements.

A built-in report generator takes test results and outputs them, together with graphs, diagrams and analysis information into your selected word processor software.

