

**aixCMA with temperature option**

**Ceramic Multilayer Actuator test bench (aixCMA) with temperature control**

The aixCMA test bench for ceramic multilayer actuator characterization has been extended by a temperature control unit which allows now to perform all measurements in the temperature range from room temperature up to 200°C. This system has been developed by aixACCT Systems to fulfill customers requests for system solutions. It includes a unique sample holder for a wide range of different sized actuator devices, necessary amplifiers for excitation voltage and current response measurements, aixACCT's advanced measurement software, and optional software tools for data analysis and data exchange with database management systems.

The aixCMA system offers comprehensive electrical and electro-mechanical characterization of ceramic multilayer actuator devices for device qualification and production control. Important actuator characteristics like blocking force diagram and actuator stiffness can be derived for a wide temperature range. Special user defined excitation waveforms for electrical and mechanical load allow investigations of the CMAs performance under real application conditions.

■ Application

- Blocking force and actuator stiffness measurements
- Large and small signal electrical and piezoelectric measurements
- Characterization of piezoelectric materials for energy harvesting devices
- Reliability and fatigue tests
- Impedance resonance measurements

■ Highlights/Benefits

- One system for comprehensive evaluation of piezo- and ferroelectric sensor and actuator devices
- One software for external hardware control (e.g. high voltage amplifier, laser displacement sensor, temperature controller, oscilloscope) and data acquisition
- Investigation of CMA under



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real application conditions (dynamic control of electrical and mechanical load, temperature from RT up to 200°C)

- Remote access and script control available
- Optional database connection (ODBC) for easy access on material / device characteristics
- Adaption to customers' hardware and customer specific requirements
- Update service and user support

### ■ Features

#### 1. Supported hardware

- Internal and external high voltage amplifier (100 V up to 10 kV)
- Sample holder for a wide range of multilayer actuators geometries
  - 5 mm - 50 mm actuator length
  - 2 mm - 15 mm actuator width and depth  
(other geometries on request)
- Static and dynamic mechanical force load
- Displacement sensors (e.g. laser interferometer, capacitive, or inductive)
- Precise four point measurement
- External lock-in or impedance bridge control

#### 2. Measurements

- Measurements under static and dynamic mechanical force load
- Temperature dependent measurements from room temperature up to 200°C
- Large signal electric polarization and displacement measurements (uni- & bipolar)
- Small signal capacitance, loss tangent, and piezocoefficient measurements vs. uni- and bipolar DC bias voltage
- Leakage current measurements
- Fatigue measurements
- Impedance measurements with special low impedance measurement probe head ( $|Z_{min}| = 20 \text{ m}\Omega$ )
- User defined excitation signals

#### 3. Software

- Windows 2000/XP operating system
- Remote access and script control via GPIB or Ethernet
- Database connection via ODBC interface
- Measurement data export to ASCII
- Measurement data exchange with aixPlover software and Resonance Analyzer

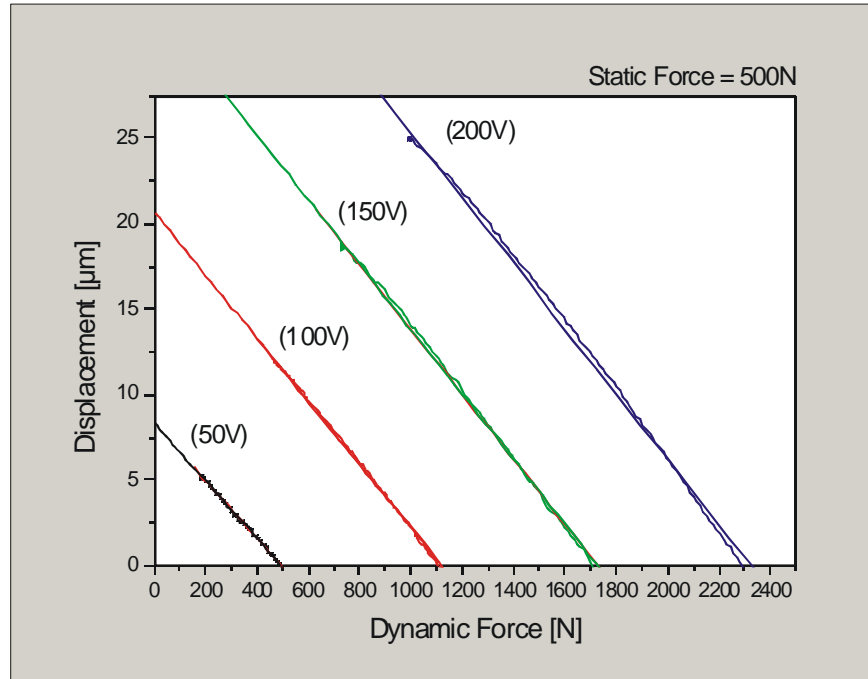
### ■ Specifications

- All components of the aixCMA setup comply with part 15 of the FCC rules
- Detailed specifications and overall performance are strongly dependent on the integrated single components

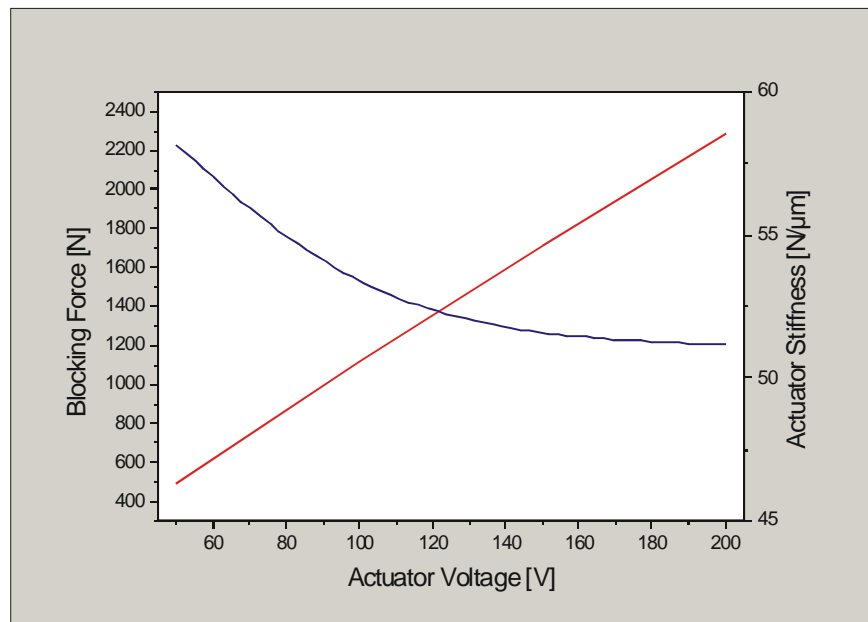
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### ■ Sample Measurements

- Blocking force diagram of a CMA at different excitation voltages and static preload

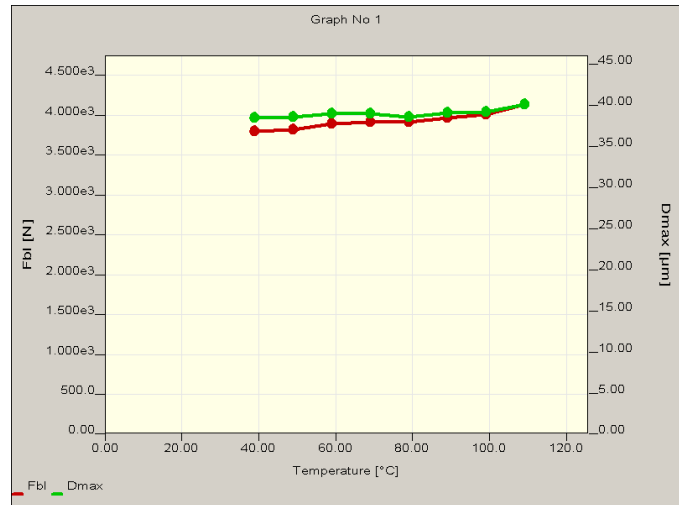


- Blocking force and CMA stiffness vs. excitation voltage

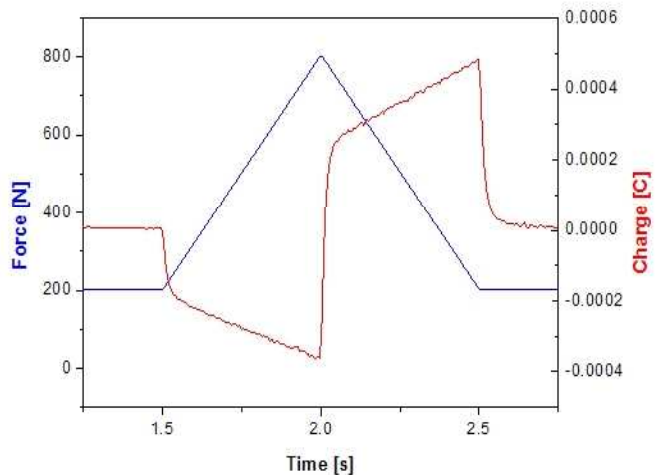


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- Temperature dependency of blocking force and maximum displacement for a ceramic multilayer actuator  $10 \times 10 \times 36 \text{ mm}^3$



- Charge generation of a multilayer actuator at constant voltage and applied dynamic force excitation



- Impedance measurement of the length resonance of a  $10 \times 10 \times 36 \text{ mm}^3$  CMA with low impedance measurement probe head

