Anton Paar

Dynamic Mechanical Analyzer

MCR 703 MultiDrive

More Than DMA

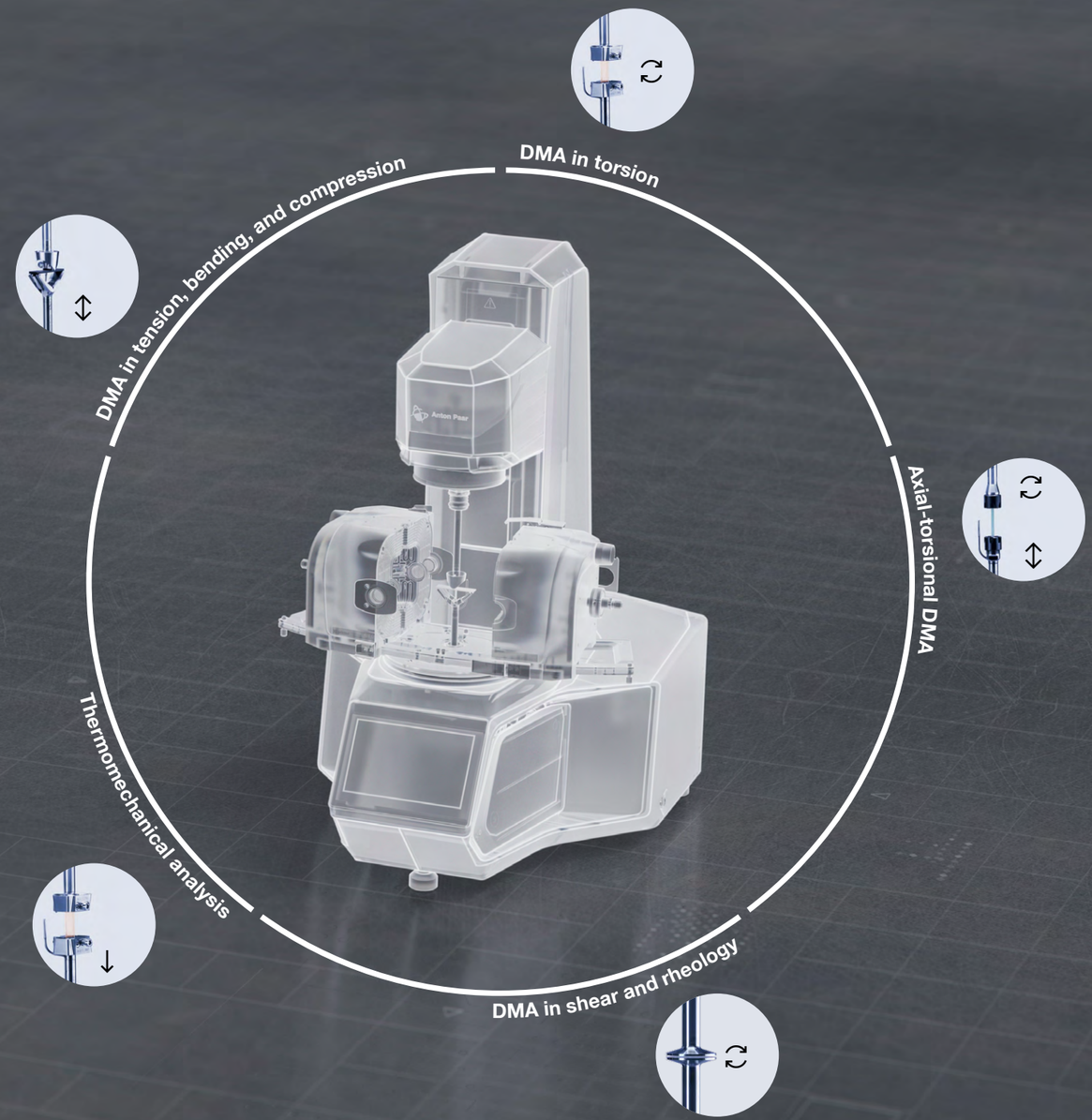
Find out more

MCR 703 MultiDrive redefines the boundaries of dynamic mechanical analysis

The MCR 703 MultiDrive redefines the possibilities of material characterization with its groundbreaking 5-in-1 functionality. It enables DMA in tension, bending, compression, and torsion as well as rheological characterization and thermomechanical analysis (TMA), all in a single device.

Take innovation further with combined axial-torsional DMA in one test. The MCR 703 MultiDrive is the perfect choice for advanced characterization of anisotropic materials and determining Poisson's ratio for isotropic materials.

Unlock new possibilities in material research with the new benchmark for dynamic mechanical analyzers.



DMA in tension, bending, and compression
The linear drive controls force or displacement, enabling accurate testing with fixtures for three-point bending, single or dual cantilever, tension, and compression – in full compliance with typical DMA standards.

DMA in torsion
The rotational drive applies precise torque or deflection, enabling the determination of dynamic mechanical properties in torsion for rectangular and cylindrical specimens. Unlike classical DMA, the dynamic load is separated from the forces required to clamp the sample, ensuring higher accuracy and minimizing measurement artifacts.

DMA in shear and rheology
The rotational drive enables standard and advanced rheological measurements, offering precise insights into material properties in compliance with rheological standards. It is compatible with all measuring systems, temperature devices, and application-specific accessories from the Anton Paar MCR series, ensuring flexibility for all kinds of rheological testing modes.

Thermomechanical analysis (TMA)
The linear drive controls displacement to enable accurate determination of thermal expansion in tensile or compression mode, allowing TMA to be performed on various sample types, including solids, films, and fibers.

Axial-torsional DMA
The linear and rotational drives work together to measure complex Young's modulus (E*) and shear modulus (G*) in a single experiment. For the first time, Poisson's ratio of isotropic materials can be determined quickly and accurately from a single sample. Combined axial-torsional testing also enables fast, direction-dependent characterization of composite materials for a deeper understanding of the properties of anisotropic materials.

The Smartest DMA, from Start to Finish

Electronic level
Eliminate inexplicable measurement errors due to lack of balance. The electronic level of the MCR is recorded quickly and straightforwardly in the measurement dataset, so you can fully trust your results.

QuickConnect coupling
Couple your measuring geometry within seconds with just one hand.

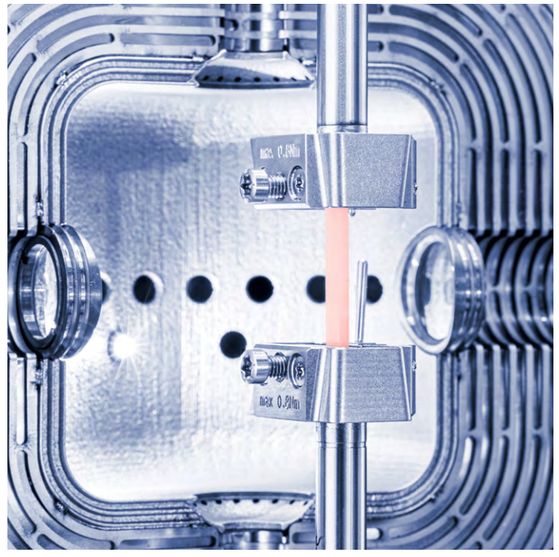
Toolmaster
With Toolmaster, measuring systems and accessories are instantly recognized and configured automatically in the software, ensuring a fast and reliable setup.

Temperature calibration
Our temperature calibration sets automatically calibrate temperature. They cover a range as wide as -160 °C up to +600 °C. Calibration data is saved to ensure accurate results for all subsequent measurements.

Touchscreen operation
The integrated touchscreen has all the functions necessary to prepare a test directly from the device.

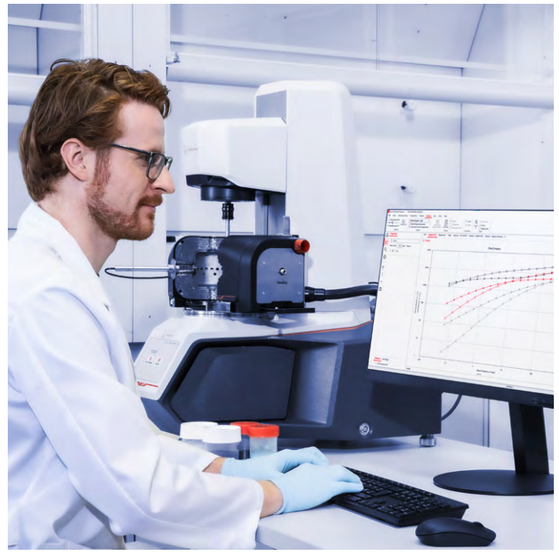
The reference for temperature control
Optimized accessories and measuring systems ensure the highest precision and reproducibility over the entire temperature range from -170 °C up to +1,000 °C. Each measuring system also includes an integrated temperature sensor positioned close to the clamped sample, enabling precise detection of the actual sample temperature.

Temperature equilibrium
The MCR's automatic temperature equilibrium recognition (T-Ready) gets you to accurate results quickly, so there's no need to waste time ensuring temperature equilibrium.



Automatic measuring system alignment
Fully automated procedures guarantee precise and repeatable alignment of the measuring systems without the need for manual interaction. The use of the lift drive and rotational drive for positioning enables you to measure over the complete specified displacement range independent of the sample length.

RheoCompass software
The powerful RheoCompass software offers templates with ready-to-use test definitions and includes more analysis tools – free of charge – than any other provider. New tools are frequently added, ensuring you always stay up to date.

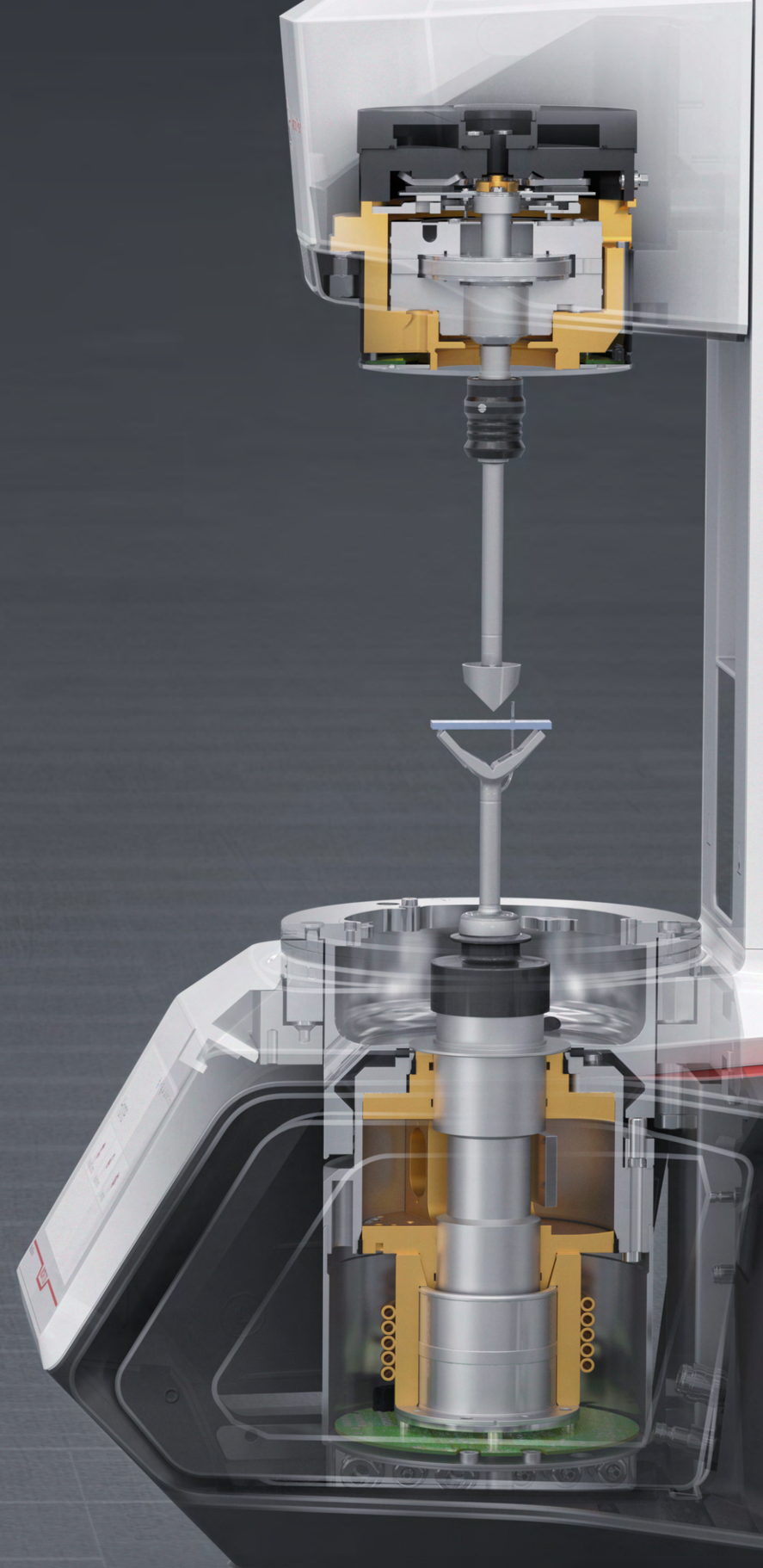


Revolutionize your material testing
Choose the testing mode that best fits your application. Solutions are available for DMA in tension, compression, bending, torsion, axial-torsional DMA, rheology, and TMA.

MCR 703 Space MultiDrive for any setup
With its maximized workspace, the MCR 703 Space MultiDrive enables easy combination with additional external setups and allows operation in a glovebox – even under inert gas atmosphere (nitrogen, argon).

Drive Units and Sensors

Step into a new era of precision, offering improved measurement quality and insights unattainable by users of other instruments. Extend the range, where precision matters.



Rotational drive

Based on an electronically commutated (EC) permanent magnet synchronous motor

- → Permanent magnets on the rotor and coils in the stator enable instantaneous and synchronous movement with a linear relationship between stator current and generated torque
- → Axial and radial air bearings enable frictionless movement for highly precise control and measurement

Measurement benefits

- → Unprecedented measuring quality for precise torque measurements down to 0.2 nNm
- → Outstanding thermal stability for characterization of even the stiffest materials with high torque up to 230 mNm over long time periods

Linear drive

Based on a moving-magnet motor

- → Stator coils and permanent magnet on a lightweight drive shaft allow for precise, fast displacements with the lowest currents
- → Radial and torsional air bearings enable stabilization and movement of the drive shaft without frictional losses

Measurement benefits

- → Exceptional force measurements with excellent signal-to-noise ratio down to 0.5 mN
- → Effective thermal management eliminating temperature-induced signal drifts even with high loads up to 40 N
- → Outstanding displacement range from 10 nm up to 9.4 mm

Exceptional Measuring Systems

Find out more

Whether you’re working with stiff samples, soft materials, or customized setups, our measuring systems push the limits of what’s measurable.

CFD-optimized design: Lowest possible temperature gradients

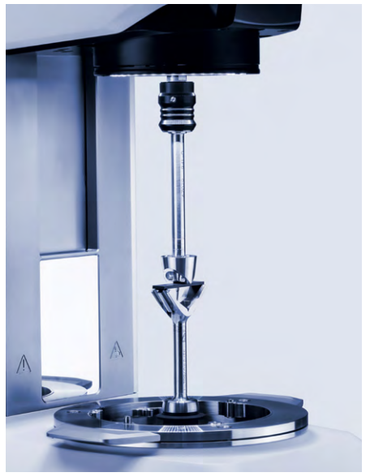
Robust geometry: Characterization of stiff samples

QuickConnect: Screwless fast changes of the measuring system in seconds

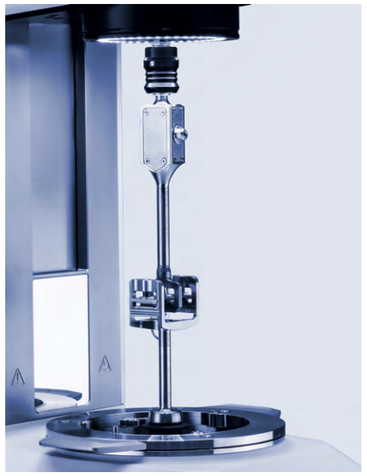
Toolmaster: Automatic tool recognition and configuration

Fully automated procedures for optimum alignment

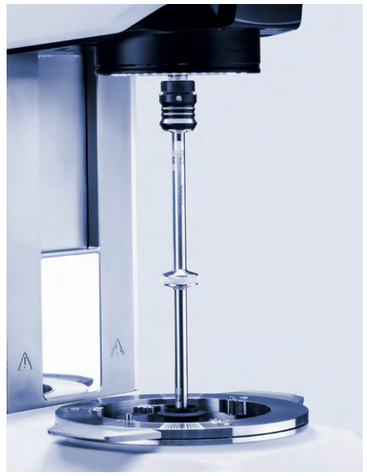
Integrated temperature sensor for the highest precision and reproducibility



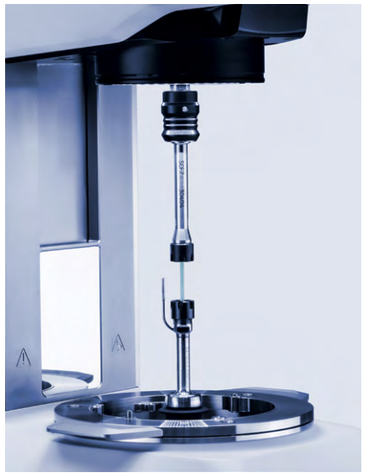
Three-point bending system
This measuring system is suitable for DMA in bending and flexural mode, and can be used to characterize stiff materials such as composites, thermosets, metals, and ceramics, as well as thermoplastics. Because no additional clamping of the sample is necessary, measuring errors due to restraints are minimized.



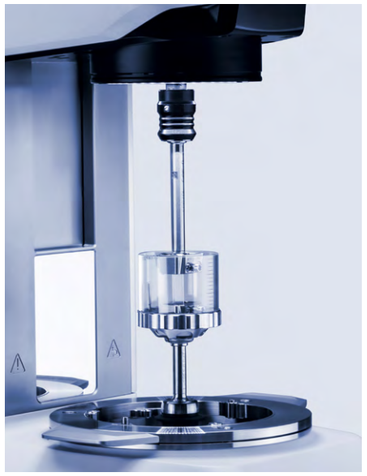
Single and dual cantilever
The cantilever can be used for measurements in bending mode while the sample is fixed between the clamps. Because the sample is clamped, the system can also accommodate low-stiffness materials like thermoplastics and elastomers, which are susceptible to sagging.



Compression systems
For DMA in compression, the sample is uniaxially loaded between two conventional plate-plate measuring systems. This deformation mode is particularly useful for the characterization of foams, elastomers, and other soft solids like food systems and gels. The same measuring system can also be used for shear rheological investigations.

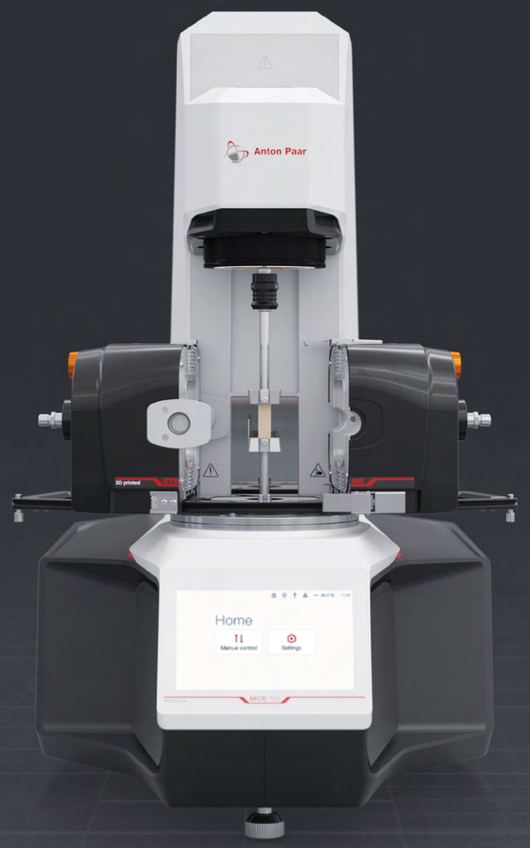


Solid rectangular and solid circular fixture
These systems can be used for DMA in tension and torsion, allowing characterization of films, fibers, and bars. These geometries also allow for the determination of Young’s modulus and shear modulus of the same specimen in a single test definition, making it possible to characterize properties previously beyond the scope of DMA, such as Poisson’s ratio.



Customized solutions
For specific applications, customized solutions are available. These include DMA on solids immersed in liquid; shafts combinable with any disposable or customized geometry; material pockets for testing powdery samples with DMA measuring systems typically used in bending mode; and a shear sandwich for characterizing viscoelastic materials in axial shear direction.

The World’s Most Precise Temperature Control for DMA

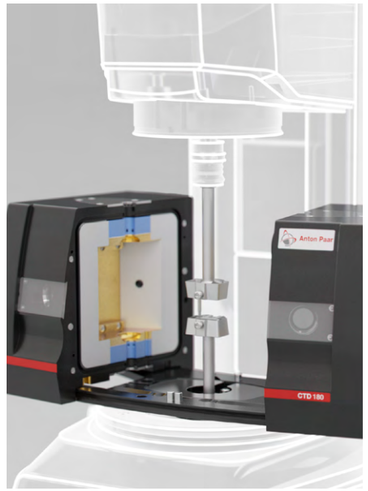


CTD 180
-20 °C to +180 °C

CTD 600
-170 °C to +600 °C

CTD 1000
-150 °C to +1,000 °C

⊖ **170 °C** **1,000 °C** ⊕



CTD 180

Peltier-based convection temperature control

- → Temperature range: From -20 °C to +180 °C
- → Suitable for cooling without the need for additional equipment such as a gas chiller or liquid nitrogen
- → Perfect choice for characterization of the impact of temperature and relative humidity on polymers, food, and pharmaceuticals

CTD 600

Most precise, zero-gradient temperature control based on combined convection and radiation

- → Temperature range: From -170 °C to +600 °C
- → Innovative 3D metal printing production technology for precise, stable temperature control even at minimum and maximum temperatures
- → Perfect choice for characterization of thermoplastics, thermosets, elastomers, reinforced composites, adhesives, films, and fibers

CTD 1000

Powerful convection temperature control for the widest temperature range

- → Temperature range: From -150 °C to +1,000 °C
- → Special design and material selection guarantee fast temperature control even at temperatures above 600 °C
- → Suitable for characterization of metals and alloys, glass, and ceramics

⊕ **Humidity option**
External humidity generator controls the relative humidity from 5 % to 95 %, depending on the actual temperature | Used to study the impact on drying, softening, and curing of materials

⊕ **Low temperature options**
Option 1: EVU 20 for temperatures down to -170 °C:
Controls the evaporation of liquid nitrogen and the continuous flow of nitrogen into the CTD 600 or the CTD 1000 | Gas supply switches automatically to air or inert gas to cover the full temperature range of the CTD 600

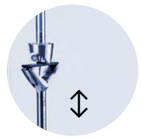
Option 2: Gas chiller unit for CTD 600 and temperatures down to -90 °C :
Uses compressed gas (air or inert gas) | Perfect choice if the use of liquid nitrogen is prohibited by internal safety regulations

⊕ **Digital eye camera option**
Gain real-time pictures and videos of your sample over the complete temperature range up to 600 °C | Identify reasons for unexpected measurement results such as sagging, slip, insufficient clamping, break, or optically visible phase transitions

Find out more

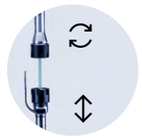
One Device, a World of Possibilities

The MCR 703 MultiDrive offers the most comprehensive range of testing modes available for dynamic mechanical characterization.

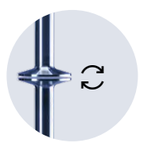


a | DMA in bending
Use DMA in bending mode to determine the viscoelastic properties of carbon-fiber-reinforced polymers (CFRP). Performing a test while changing the sample temperature enables the determination of the glass transition temperature (Tg), which helps to identify the suitable service temperature and assess mechanical performance during use.

b | DMA in torsion
DMA in torsion performed on the same CFRP indicates that the glass transition temperatures differ from those in bending. This demonstrates the dependence of viscoelastic properties in anisotropic polymeric composites on the mode of deformation.



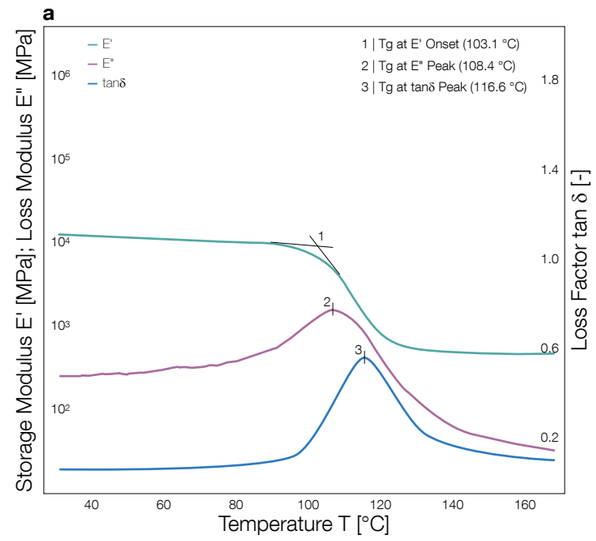
c | DMA in combined axial-torsional mode
Use DMA in torsion and tension to determine the ratio between E* and G* in a single test on the same specimen. A changing ratio indicates that the mechanical properties depend on the direction of loading, revealing anisotropic sample behavior.

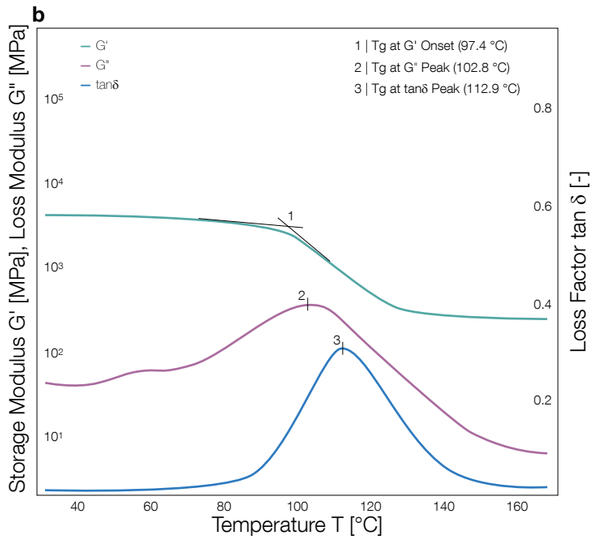


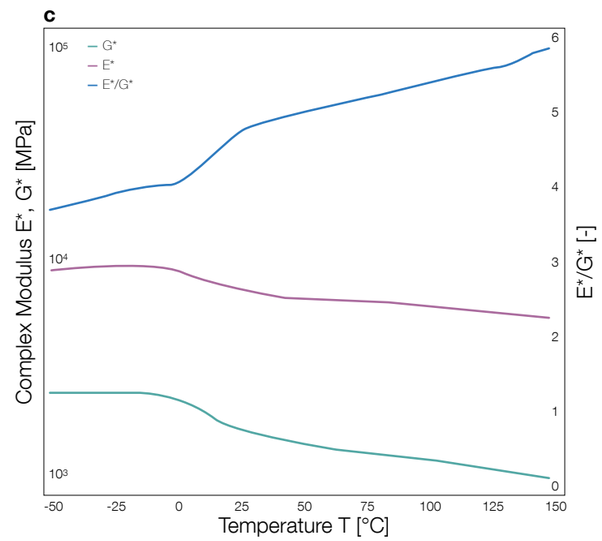
d | Rheology
Perform an isothermal oscillatory time sweep to measure the onset and rate of cross-linking, the crossover point of G' and G", and the final mechanical properties – enabling control and optimization of resin systems.

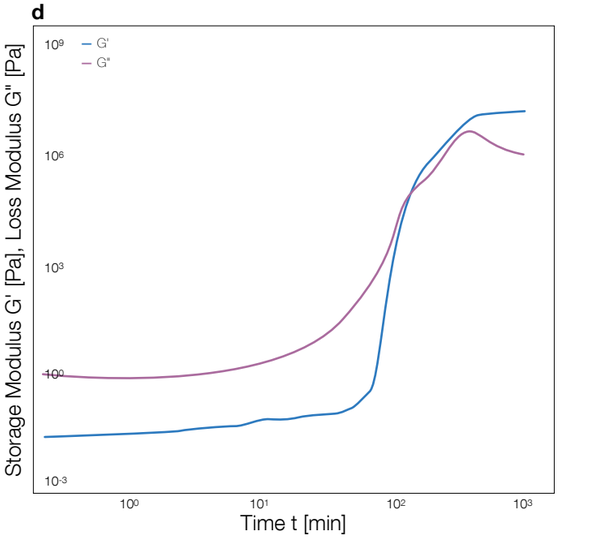
e | Thermomechanical analysis
Identify how the coefficient of thermal expansion (CTE) differs between the rubber-elastic and glassy states. Analyze the thermal expansion behavior to optimize component design and simulation.

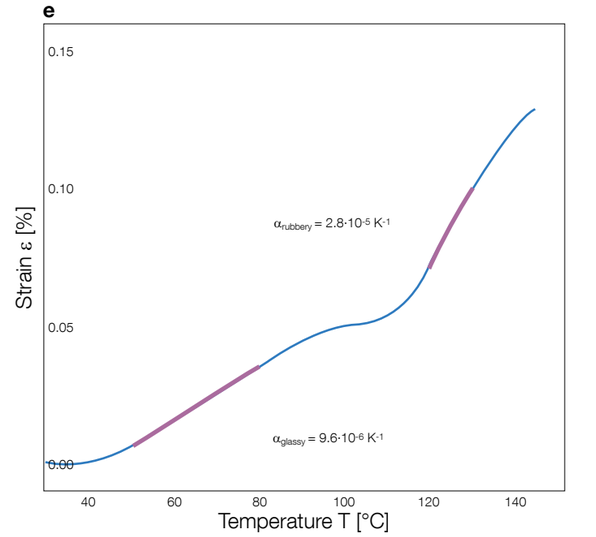
The following measurements illustrate the benefits of the setup for crucial applications in the polymer industry.





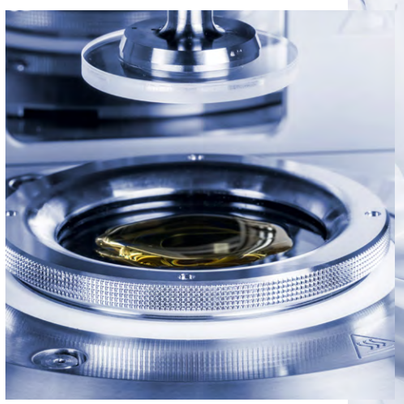






More Than Just a DMA

Our MCR 703 MultiDrive isn't just a DMA. It's a characterization platform. It makes tribology, powder characterization, shear and extensional rheology, as well as conventional mechanical testing, possible. The MCR 703 MultiDrive offers the most comprehensive range of testing modes available for dynamic mechanical characterization.



	MCR 703 MultiDrive
Linear drive for DMA in tension, bending, and compression	
Maximum force	40 N
Minimum force	0.0005 N
Maximum displacement	9,400 µm[1)]
Minimum displacement	0.01 µm
Maximum frequency	100 Hz
Minimum frequency	10^{-5} Hz
Rotational drive for DMA in torsion and rheology	
Maximum torque	230 mNm
Minimum torque, rotation	1 nNm
Minimum torque, oscillation	0.2 nNm
Angular deflection resolution	<1 nrad
Maximum angular velocity	314 rad/s
Minimum angular velocity	0 rad/s[2)]
Maximum frequency	200 Hz
Minimum frequency	2 x 10^{-8} Hz
Normal force range	0.001 N to 50 N
Temperature control	
Maximum temperature range	-170 °C to +1,000 °C[3)]
Maximum heating rate	60 K/min[3)]
Maximum cooling rate	30 K/min[3)]
Features	
DMA in tension, bending, and compression	✓
DMA in torsion	✓
DMA in combined axial-torsional mode	✓
DMA in shear and rheology	✓
Thermomechanical analysis	✓
Toolmaster, measuring system	✓
Toolmaster, measuring cell	✓
QuickConnect for measuring systems, screwless	✓
T-Ready	✓
Low-temperature option, nitrogen evaporation unit	○
Low-temperature option, gas chiller	○
Humidity option	○

Trademarks: RheoCompass (9177015), MultiDrive (16731581), T-Ready (9176983), Toolmaster (3623873)

✓ included | ○ optional

1) In oscillation a maximum displacement of ±4500 µm.
2) In controlled shear stress (CSS) mode. In controlled shear rate (CSR) mode, depending on measuring point duration and sampling rate.
3) Limits depend on convection temperature device used and measuring systems. Customized low-temperature option for temperatures down to -170 °C available upon request.

Our well-trained and certified technicians are ready to keep your instrument running smoothly.

Maximum uptime | Warranty program | Short response times | Global service network

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