ARES-G3™ Rheometer

Modern scientists, researchers, and manufacturers across academia and industry need reliable characterization of complex fluids and materials. The Discovery™ ARES-G3™ Rheometer represents the next generation in rheology, building upon TA Instruments' legacy of accurate, publication-quality data since the 1970s combined with new features making it even easier than ever to acquire reliable results.

The advanced ARES-G3 Rheometer delivers higher quality data under a wider range of rheological measurement conditions. Innovative technology and designed-for-purpose hardware brings rheological measurements closer to true fluid dynamics with no geometry or inertia calibrations.

Advanced Rheology

Rheology, the study of flow and deformation of materials, requires two key measurements: the force/strain applied and the sample's response. With superior technology in both the motor and force rebalanced transducer, the ARES-G3 Rheometer offers improved accuracy and reliability in key rheological measurements:

- Viscosity
- Viscoelasticity
- Yield Stress
- Shear Thinning
- Thixotropy
- Stress Relaxation
- Creep and Recovery

The ARES-G3 Rheometer goes beyond simple rheology with an upgradable platform and key accessories for complete rheology insights. Additionally, dynamic mechanical analysis (DMA) capabilities deliver flexural bending, tension, and compression testing without the need of a second motor. Complete data transparency and customization deliver more options at your fingertips for comprehensive experimental control. These features empower users to discover new interactions between materials and uncover fluid behavior, providing deeper insights than basic viscometers or rheometers.

ARES-G3 Rheometer Technology

ARES-G3 Rheometer Technology delivers:

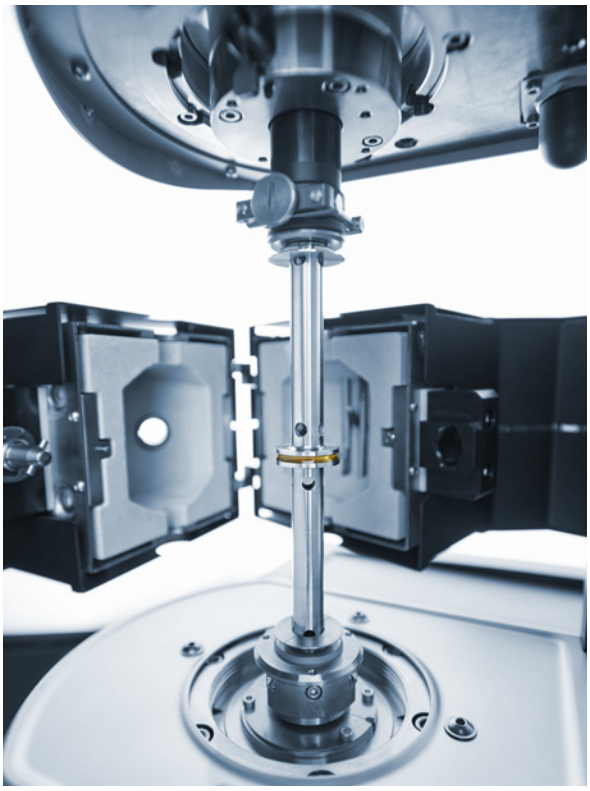
- Higher quality data under a wider range of rheological measurement conditions
- Closer measurements to true fluid dynamics with no geometry or inertia calibrations
- Accuracy powered by pioneering separate motor and transducer (SMT) technology
- Confidence to measure sample behavior at high temperature with top-rated forced convection oven
- More data and insights at your fingertips with higher data acquisition rates, improved functionality, and dual data acquisition
- Integrated Fast Frequency Chirps use Optimally Windowed Chirps (OWCh) to capture viscoelastic data reducing QC test time by up to 80%.
- Modern, streamlined software with fewer calibrations, walk-up usability, and faster throughput

Advanced Features for Unparalleled Results

Building on the ARES™ Rheometer legacy as a leading research rheometer for over 55 years, the new ARES-G3 Rheometer empowers deeper insights with new data acquisition capabilities and integrated advanced analyses.

1. Pioneering **separate motor and transducer (SMT)** technology delivers best in class data accuracy under a wide range of measurement conditions
2. The industry's only **force-rebalanced transducer** delivering minimal corrections to data[1]
3. **New touchscreen** gives full experimental control right at the instrument
4. **Fast-responding and accurate oxygen exclusion environment** with dual gun heaters for reliable polymer melt and composites testing
5. **Updated keypad** facilitates common experiment controls, like moving the instrument head or starting an experiment, with ease
6. **Trustworthy data** with access to raw phase angle measurements and waveforms
7. **High-speed data acquisition** and fully integrated Fast Frequency Chirps reduce test time by up to 80%, enabling analysis of fast changing materials
8. **Modern, streamlined TRIOS™ Express Software** delivers fewer calibrations and walk-up usability
9. New electronics power **high-speed data acquisition** and **dual data acquisition** for ultimate clarity and trustworthiness

Separate Motor and Transducer (SMT) Technology



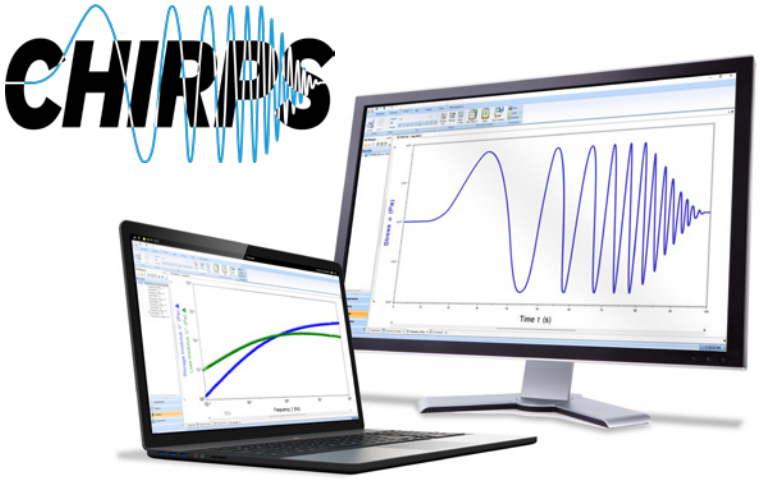
Separate Motor and Transducer (SMT) technology uniquely isolates the motor from the sample measurement, reducing the need for frequent calibrations and enhancing overall data quality. With the only true SMT on the market[1], the ARES-G3 Rheometer reveals small changes in materials that may be masked by calibrations on other rheometers.

This configuration enables independent control over the sample's mechanical history, making it ideal for applications requiring precise deformation analysis, such as large amplitude oscillatory strain (LAOS) testing. SMT excels in processing soft, weakly structured materials at high frequencies and is particularly effective for quality control of polymers and research in complex fluids like emulsions and suspensions.

At the heart of SMT is a Force Rebalanced Transducer (FRT) that remains stationary and measures the sample's response with negligible or no interference from motor dynamics, unlike other competitive instruments. Complemented by a high-capacity drive motor that delivers accurate rotational motion, SMT helps ensure more pure, undistorted measurement by nearly eliminating motor-driven artifacts, giving researchers the confidence to explore subtle rheological behaviors.

Fast Frequency Chirps

New Fast Frequency Chirps using OWCh technology developed by McKinley et. Al. revolutionizes rheology frequency sweeps by dramatically increasing speed and data density[2]. These faster frequency sweeps enable ramped time temperature superposition (TTS) master curves, reducing experiments from hours/days to less than an hour without sacrificing accuracy or resolution. Fast Frequency Chirps also offers higher data density, particularly at low frequencies.



Traditional single frequencies often fall short for evolving and unstable systems, such as during curing or chemical reactions. Fast Frequency Chirps uses rapid frequency sweeps that keep pace with these fast-changing systems, making it ideal for testing polymers, thermosets, composites, and other dynamic materials.

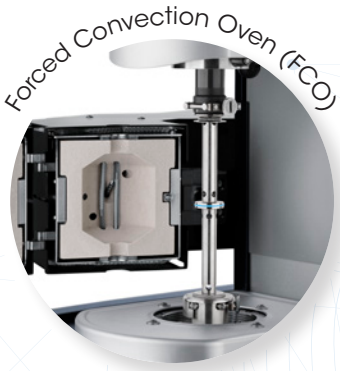
Fast Frequency Chirps is fully integrated into TRIOS Software, which processes this extra data load with a simplified, user-friendly workflow. A simplified test form and automated data analysis make it easy to work with the data in your desired format. Leveraging TTS superposition, Fast Frequency Chirps delivers faster results with big data without sacrificing data quality.

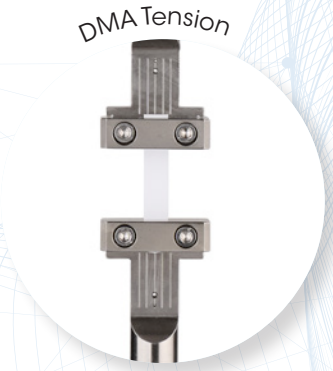
Delve Deeper into Advanced Rheology

Rheology measurements alone are valuable insofar as they predict real-world applications of your materials. From rapid temperature changes to applied force and pressure, the ARES-G3 Rheometer is designed to efficiently simulate a myriad of conditions so you can design and test your materials with confidence.

Environmental

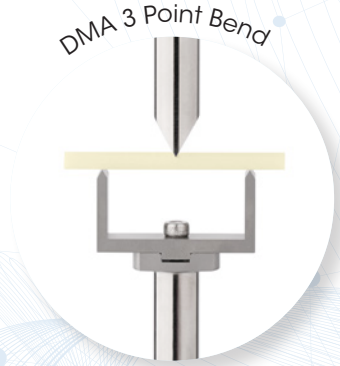
The fast-responding forced convection oven (FCO) minimizes downtime by rapidly reaching target temperatures from –150 C to 600 C with high accuracy by directly measuring the temperature at the sample plate. The advanced Peltier system (APS) is the accessory of choice for fluids supporting parallel plate, cone and plate, and concentric cylinder testing from -10 ˚C to 150 ˚C. Both accessories are easy to install with plug and play SmartSwap™ Technology.





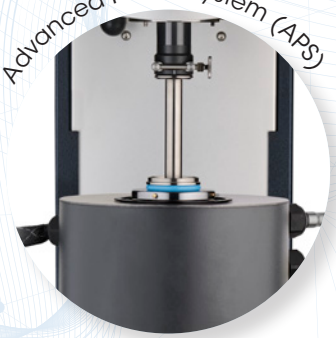
Complete DMA Capabilities – Rheology of Solids

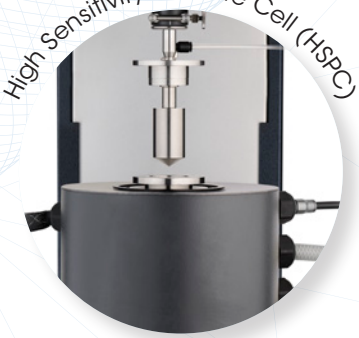
The ARES-G3 Rheometer uniquely offers complete DMA capabilities including flexural bending, tension, and compression testing without the need of a second motor, thanks to FRT technology. Axial sample deformation is applied by driving the high sensitivity FRT in controlled strain sinusoidal oscillation, unlocking all new capabilities for solids testing.



Accessories for More Powerful Analytical Tools

The wide range of ARES-G3 Rheometer accessories expand the instrument's capabilities to enhance material understanding and futureproof your investment. Accessories can be installed easily right from the touchscreen leveraging plug and play SmartSwap Technology, making them accessible for most users.





Software and Hardware for Research-Ready Analysis

The new express mode of TRIOS Software offers streamlined analysis and customization. Advanced users can control aspects including data acquisition rates, motor movement and more, while new users are given walk-up usability with pre-built TRIOS express forms.

The new touchscreen simplifies workflows by eliminating the need for PC control. With complete control of the instrument on the touchscreen, users can load samples, set temperatures, prepare a test, change geometries, and remove a sample at the work station.

Advanced Testing Modes and Analysis

With high-performance hardware and its SMT design, the ARES-G3 Rheometer is a preferred rheometer for advanced testing modes. The fast-responding motor is ideal for applying complex or custom deformation profiles, giving users greater control beyond standard test templates. The FRT delivers near correction-free data, bringing analysis closer to true material behavior for ultimate confidence.

Large Amplitude Oscillatory Shear (LAOS)

The ARES-G3 Rheometer is the ideal platform for LAOS testing thanks to its high-speed data acquisition and digital signal processing. With double the sampling rates of the ARES-G2 Rheometer for up to 24,000 Hz, the ARES-G3 Rheometer accurately characterizes complex behaviors including sudden changes in materials. This additional data enables scientists to quantify microstructure changes under large shear applications, such as skin cream applications or typical manufacturing conditions. With improved clarity and superior mathematical analysis, users gain deeper understandings that enable new discoveries.

Arbitrary Waveform Testing

Take research to the next level with ultimate control over your material. Arbitrary waveform testing delivers support for most user-defined waveforms, going beyond traditional rheology. TRIOS Software captures time-based strain and stress data and converts it via Fourier transform to deliver a full analysis of viscoelastic properties. Users gain improved analysis under custom conditions: square waves, pulses, etc., or developing the next new rheology method.

Orthogonal Superposition (OSP)

Don't settle for choosing between oscillatory or shear testing – with OSP, you can understand the structure of a fluid while it's flowing. The unique separate motor and transducer of the ARES-G3 Rheometer can apply rotational shear with the motor while the transducer oscillates, providing enhanced controlled-flow rheology measurements. With OSP, you can see how a material's structural changes during flow and predict behavior during processing, pumping, and application.

Dual Data Acquisition

Extending TA's promise of data transparency, the ARES-G3 Rheometer can simultaneously collect both correlated and transient data in a single test. With dual data acquisition, you gain a more complete understanding of complex behaviors and know exactly what raw signals went into your correlated data. This mode is ideal for probing nonlinear and anisotropic behaviors of complex fluids. Comprehensive data capture and analysis provide accuracy and confidence in results.

Ultimate Upgrade Flexibility

The ARES-G3 Rheometer redefines flexibility with its uniquely modular design, offering ultimate upgrade potential tailored to each user's evolving needs.

The ARES-G3 Rheometer base model is streamlined for productivity without compromising confidence in lot-to-lot metrics. Routine measurements are expedited, and the field-proven forced convection oven is built for robust testing capabilities.

Optional Upgrades Include:

- **Fully-integrated Fast Frequency Chirps** end-to-end workflow for up to 80% faster polymer melt QC tests, which captures more comprehensive data and can accelerate master curve generation from 8 hours down to 1 hour.
- **Dynamic Mechanical Analysis** for testing solids in bending, tension, and compression without the need for additional motors.
- **Orthogonal Superposition** to measure viscoelasticity under well-controlled flow conditions with easy-to-interpret results.
- **Dual Data Acquisition** provides deeper insights with simultaneous, reliable recording of transient and correlated data in the same test.
- **Improved Arbitrary Waveform Capabilities** designed for cutting-edge rheological research studies and complex materials.
- **Fast Data Acquisition** enables users to capture a material's true stress response without missing any rapid transition.

The ARES-G3 Rheometer is more than just a rheometer; it's a platform built to grow alongside your research and quality control needs.

Unparalleled Service and Support

With a long legacy of rheology innovation that started in the 1970s, TA Instruments brings unmatched expertise to support our customers' breakthroughs. From expert application scientists to skilled service representatives with decades servicing ARES Systems, our team combines a legacy of deep scientific insight with real-world experience to help ensure users get the most out of their instruments. This legacy of excellence translates into unparalleled support—responsive, knowledgeable, and always focused on enabling your success in the lab.

Force/Torque Rebalance Transducer (Sample Stress)	
Minimum Transducer Torque in Oscillation	0.02 µN.m
Minimum Transducer Torque in Steady Shear	0.1 µN.m
Transducer Torque Resolution	1 nN.m
Transducer Normal/Axial Force Range	0.001 to 20 N
Drive Motor (Sample Deformation)	
Maximum Motor Torque	800 mN.m
Strain Resolution	0.04 µrad
Min. Angular Displacement in Oscillation	1 µrad
Angular Velocity Range	1 x 10^{-6} rad/s to 300 rad/s
Angular Frequency Range	1 x 10^{-7} rad/s to 628 rad/s
Step Change in Velocity	5 ms
Step Change in Strain	10 ms
Temperature Systems	
Forced Convection Oven, FCO	-150 °C to 600 °C
Advanced Peltier System, APS	-10 °C to 150 °C

[1] At time of publication.
[2] G. McKinley et. al., Time-Resolved Mechanical Spectroscopy of Soft Materials via Optimally Windowed Chirps, Physical Review 8, 041042 (2018).

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