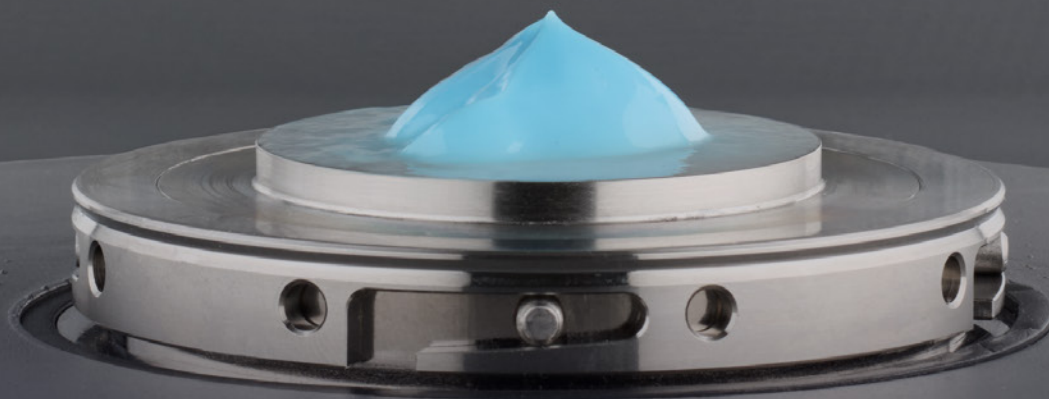


Waters™



TA

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DISCOVERY CORE RHEOMETER

INTRODUCING the DISCOVERY CORE RHEOMETER

The new Discovery™ Core Rheometer empowers every user to perform rheological measurements, guiding formulation development, optimizing performance and ensuring product quality. The Core Rheometer is the first system to combine wide-ranging measurements of viscosity and viscoelasticity with streamlined, walk-up usability. The new RheoGuide™ user interface enables complete operation directly from the touchscreen, with direction, illustration and validation at every step.

Whether you are new to rheology, upgrading your quality control testing, or expanding capabilities to meet growing demands, the Core Rheometer empowers your lab to discover insights into your materials' behavior needed to advance your goals.

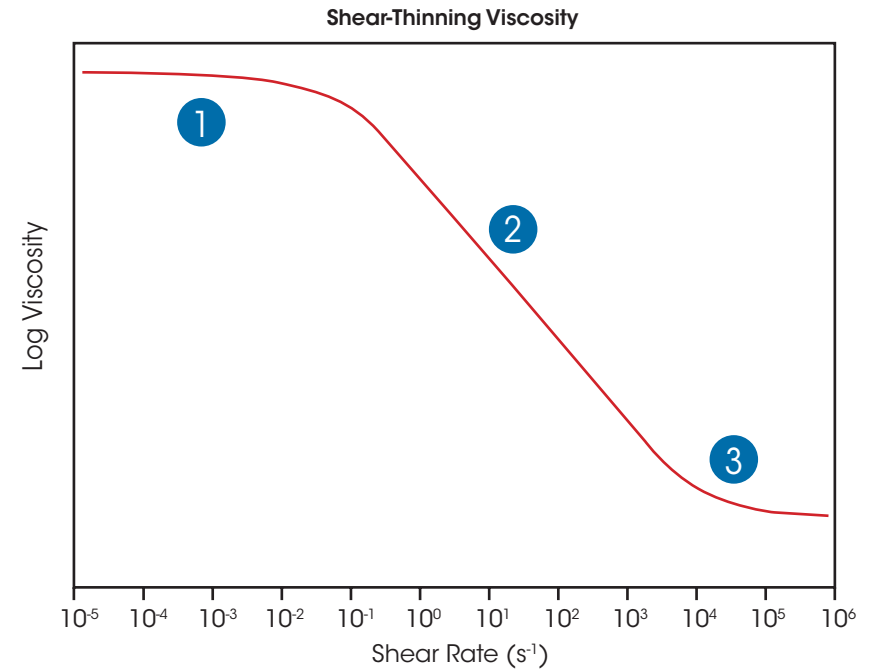


DISCOVER INSIGHTS beyond VISCOSITY

While viscometers report only a single viscosity value within a limited range, the Core Rheometer captures the complete viscosity profile, representing material behavior across all relevant conditions. Complex fluids like suspensions, emulsions, gels, pastes and slurries are non-Newtonian. Their viscosity changes with the applied shear rate and time; it is not a single value. Characterizing the full range of viscosity is critical to understand flow behavior under real-world conditions.

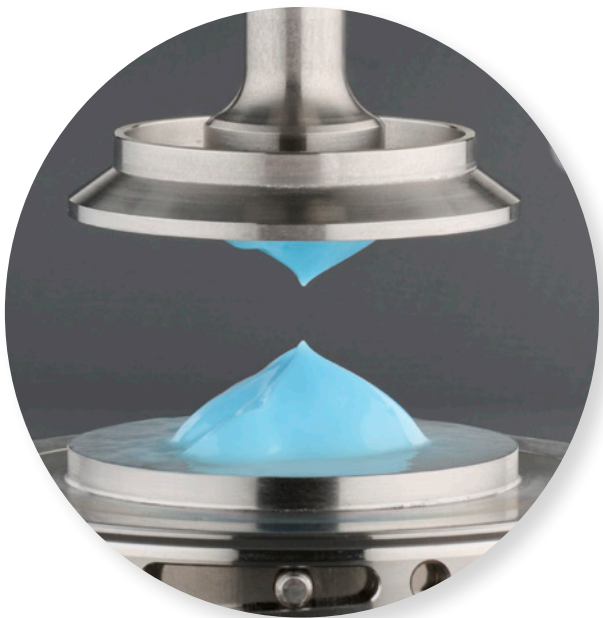
Rheometer Advantages:

- Accuracy and precision
- Range of measurement
- Controlled shear rate
- Replicate process conditions
- Small sample volume
- Rapid temperature control



- 1** High viscosity at low shear rates impacts sag and leveling of coatings and maintains uniform distribution in dispersions by preventing separation under gravity during storage.
- 2** With increasing shear rate, viscosity decreases. This enabling easy dispensing whether by pouring from a can, pumping through a pipe or squeezing from packaging.
- 3** High shear rates replicate applications such as coating onto a substrate or spreading a topical product on the skin, ensuring successful processing and consumer experience.

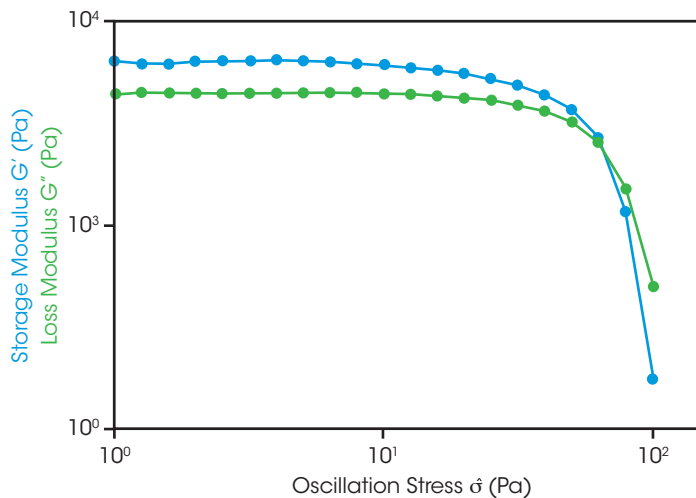
DISCOVERY CORE RHEOMETER | VISCOELASTICITY



Materials ranging from weakly structured dispersions to stiff gels or pastes exhibit both liquid-like and solid-like behavior, not available from traditional viscometry.

The Core Rheometer's oscillatory measurements quantify viscoelasticity - Storage Modulus G' (elastic behavior), Loss Modulus G'' (viscous behavior) and Tan d (damping). These key metrics aid in optimizing formulations, evaluating stability, and ensuring consistency in production.

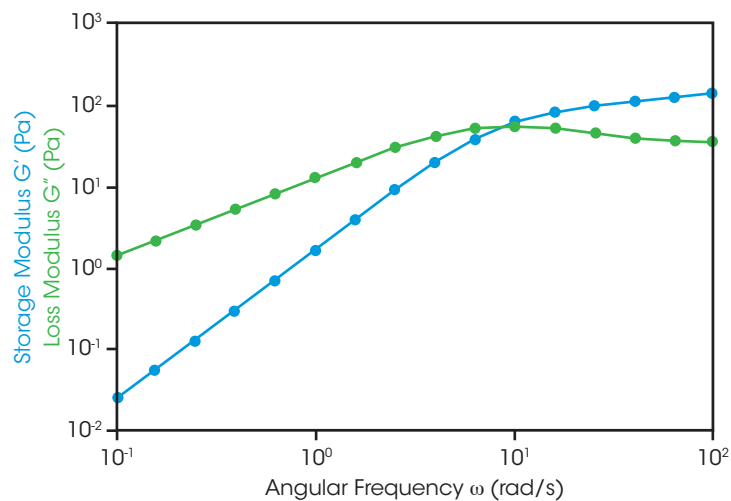
Topical Pharmaceutical



Amplitude

In this plot, a topical ointment measured with low stress in the linear viscoelastic region shows solid-like behavior ($G' > G''$). Increasing stress causes the ointment to begin to flow, indicating a yield stress of 66 Pa, key information for ensuring effective dispensing, spreading and stability.

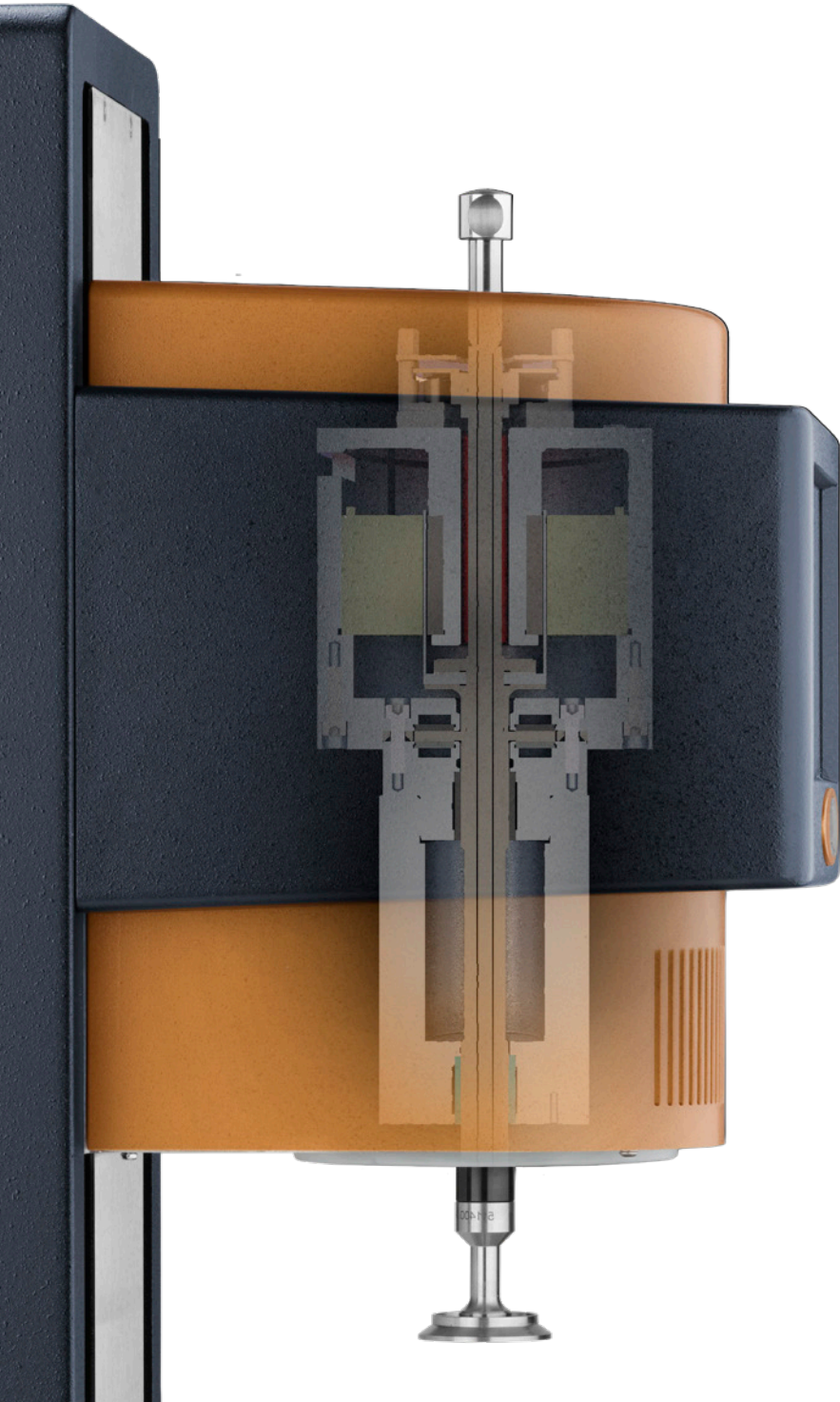
Body Wash



Frequency

Varying the oscillatory frequency characterizes viscoelasticity over different time scales. A liquid soap exhibits fluid-like behavior ($G'' > G'$) at rest, but under very short time scales, elastic behavior dominates ($G' > G''$). This impacts a consumer's experience and can only be quantified using oscillatory rheology.

DISCOVERY CORE RHEOMETER | CORE MEASUREMENT TECHNOLOGY



Precision air bearings

Air bearings eliminate the mechanical friction of ball bearing designs, extending torque sensitivity down to $0.5 \mu\text{N}\cdot\text{m}$ for flow measurements, and $0.1 \mu\text{N}\cdot\text{m}$ for oscillation measurements.

The Core Rheometer's torque sensitivity enables measurements of viscosities as low as 1 cP, low shear rates and yield stresses, and viscoelasticity of weakly-structured fluids.

Optical encoder

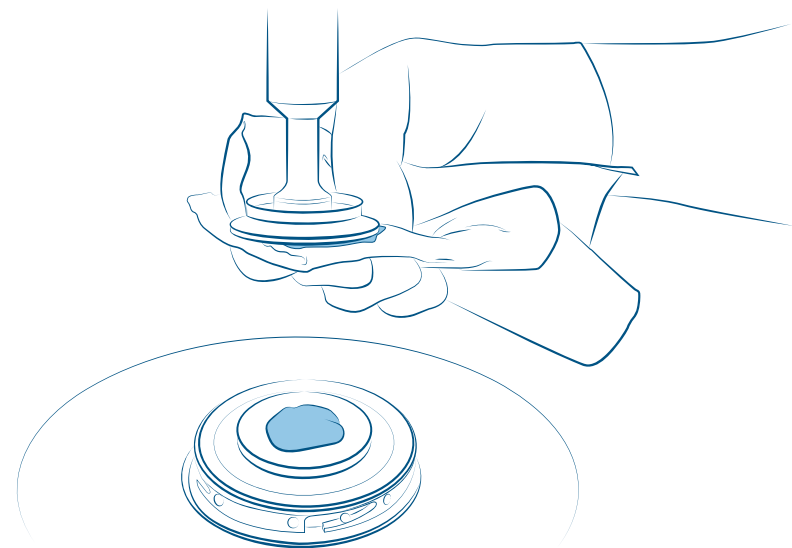
Precisely measure rotational velocity (Shear rate) and angular deformation (Strain)

Drag cup motor

Flexibility to perform shear rheology in controlled stress, rate or strain modes

Robust design

Streamline operations and expedite workflow with the Core Rheometer: safely clean liquid samples in place, without the need to remove tools from the rheometer.

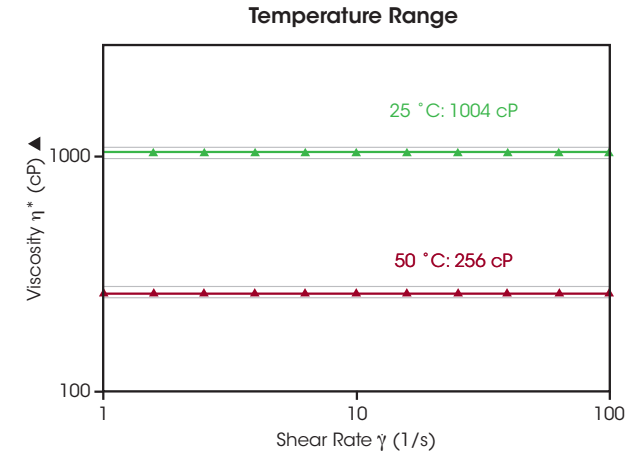


DISCOVERY CORE RHEOMETER | CORE TEMPERATURE TECHNOLOGY

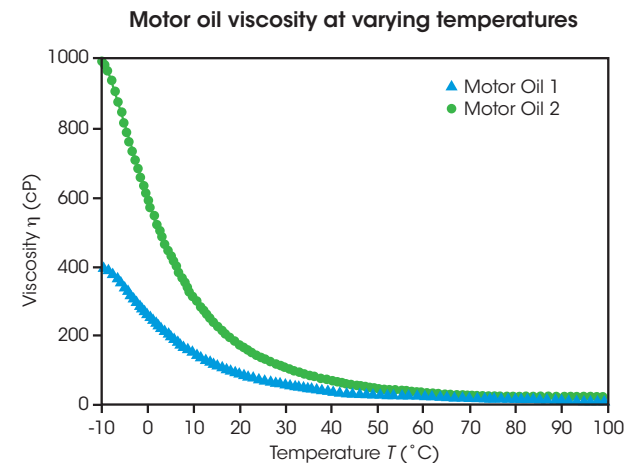
Temperature control is key for accurate rheology data to ensure data reproducibility and evaluate materials' behavior under real-world conditions. The Core Rheometer's integrated Peltier system provides precise, rapid temperature control. Equilibration time is reduced by up to 60% compared to typical viscometer configurations, minimizing down time between different measurements. Built-in air cooling eliminates the need for a liquid circulator, reducing cost, simplifying operation, and saving valuable bench space.



Configuration	
Peltier Plate	-10 °C to 200 °C
Peltier Concentric Cylinder	0 °C to 150 °C

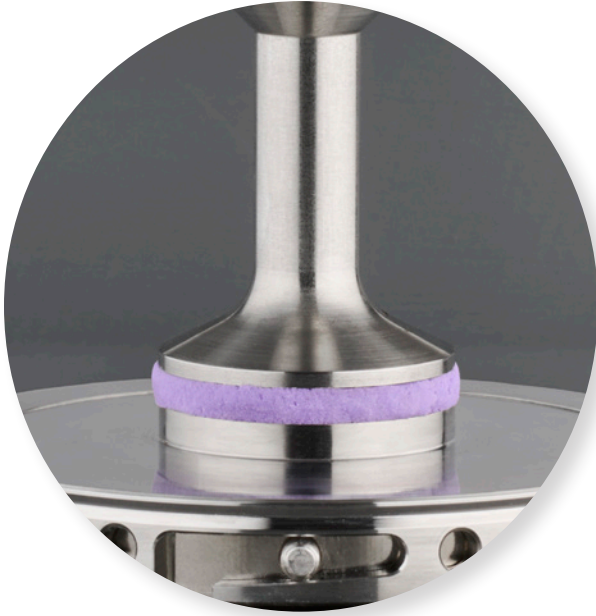


A silicone oil certified reference material measured at 25 °C and 50 °C, using the Insulated Solvent Trap, shows viscosity results within 5% of the reference values (dotted lines), verifying the accuracy of sample temperature



The two motor oils above show low viscosity at the elevated temperature of an active engine. However, their increased viscosity at low temperature is a key consideration when developing products for use in winter conditions

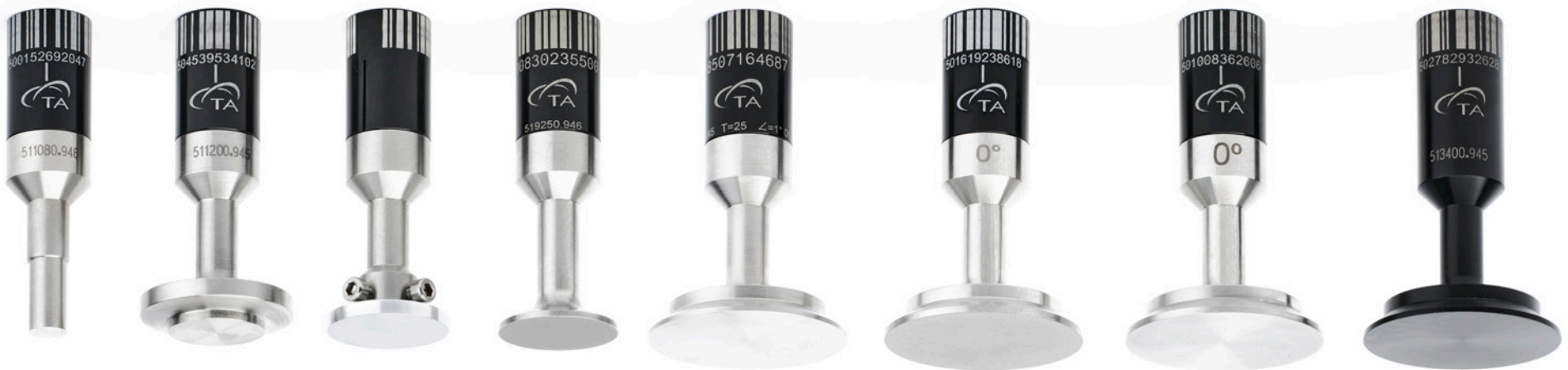
DISCOVERY CORE RHEOMETER | PELTIER PLATE GEOMETRIES



Parallel plate geometries offer versatility for wide ranging materials such as liquids, dispersions, creams and emulsions, gels and pastes, available in sandblasted or crosshatched surface finishes to prevent slip. **Cone** geometries provide a uniform shear rate, ideal for unfilled liquids. Both plate and cone geometries provide the convenience of small sample volumes (<2 mL) and easy cleaning.



SmartSwap2 geometries: Cones and parallel plates, available in a range of dimensions, materials, and surfaces to meet every need



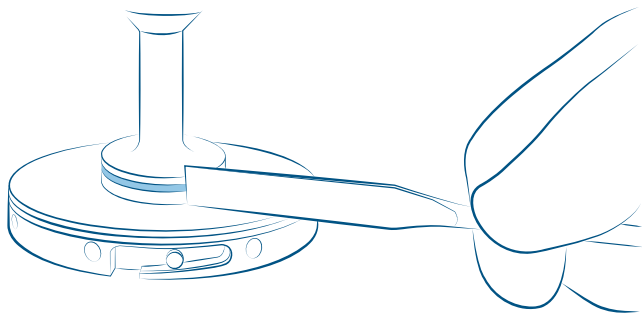
DISCOVERY CORE RHEOMETER | PELTIER PLATE FEATURES



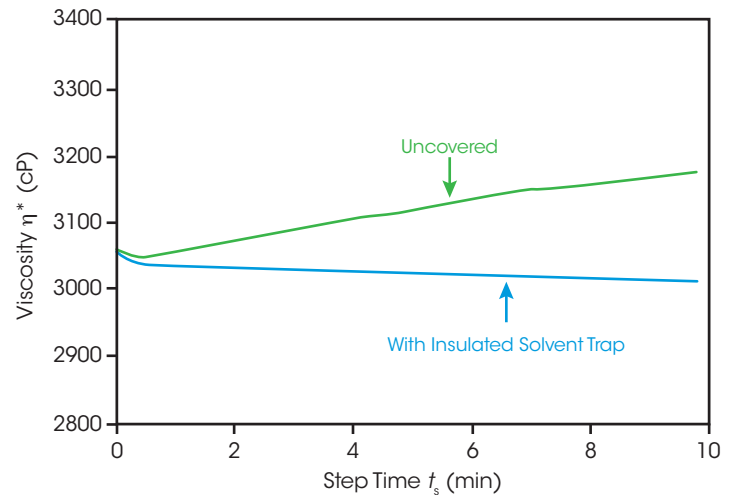
Add an **Insulated Solvent Trap** to prevent drying during measurements. The two split-covers integrate with compatible geometries to create an evaporation barrier. The conductive interior and insulating exterior promote temperature uniformity at extended temperatures.

Below, an acrylic paint's viscosity at 10 sec⁻¹ is measured both with and without a solvent trap cover. Uncovered, paint drying at the edge increases torque and presents as an increase in viscosity. With the solvent trap in place, drying effects are eliminated, and paint viscosity is measured accurately.

Quick-Change Plates make sample loading easy with a raised step for simplified sample trimming, critical for accurate data. Quick-Change plates match the upper geometry's size and surface finish, and mount directly to the Peltier with a unique tool-free and self-aligning system, swapped in seconds to support multiple sample types.



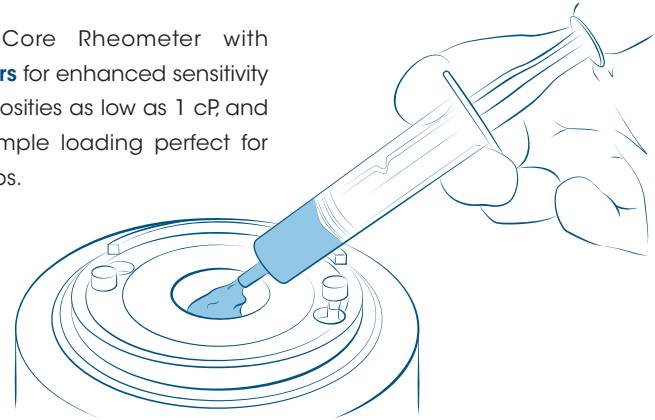
Paint Viscosity, with and without Solvent Trap





DISCOVERY CORE RHEOMETER | CONCENTRIC CYLINDER GEOMETRIES

Configure your Core Rheometer with **concentric cylinders** for enhanced sensitivity to characterize viscosities as low as 1 cP, and easy fool-proof sample loading perfect for high-throughput labs.



A variety of upper rotors and lower cups are available to accommodate materials and testing needs, including disposable cups for high-throughput testing.



DESIGNED to STREAMLINE EVERY STEP

- 1 Automatic gap control** provides faster workflow and precise gap positioning. The axial motor automatically raises and lowers the head throughout the method and controls the test gap position with 0.1 μm resolution for accurate and reproducible results.
- 2 Touchscreen** capabilities go beyond basic controls, providing a new user experience ideal for high-throughput labs. Perform routine measurements directly at the instrument without need for PC interaction.
- 3 Integrated lighting** enhances visibility for easier, more reproducible sample preparation leading to increased data accuracy and precision. The sample is automatically spotlighted during user interaction, guiding the operator and signaling test status.
- 4 Smart Swap™ 2** reader automatically identifies attached geometry, recalls dimensions and stored calibrations, and validates geometry aligns with the selected RheoGuide™ method. Smart Swap eliminates common sources of error and enables more efficient operation.
- 5 Compact design** incorporates electronics, Peltier and air-cooling heat exchanger in one unit. Compared to modular systems with liquid circulators, the Core Rheometer requires up to 75% less bench space.



EMPOWER your LAB with RHEOGUIDE™ SOFTWARE

RheoGuide is your entry point to the world of rheology, directly from the Core Rheometer touchscreen. Select a method from the app-style interface and follow instructions and illustrations through every step, eliminating sources of operator error. Results are immediately available on the touchscreen, allowing users to take immediate action, perfect for fast-paced environments.



Rheology testing improves quality and consistency by identifying variations not detected by viscometers, preventing future problems and downstream costs. These insights used in R&D are now available to QA/QC labs, with the ease of use of a viscometer.

Methods are customizable to incorporate every step of your standard operating procedure and instantly indicate Pass or Fail based on your specifications. Test methods are easily synchronized across labs worldwide with consistent operation and data you can trust to drive decisions and solutions.

DISCOVERY CORE RHEOMETER | RHEOGUIDE™ FEATURES AND BENEFITS



Walk up usability: Perform routine tests directly from the instrument touchscreen, from start to finish, without need to interact with the PC.



Guided operation: Pre-defined Methods and on-screen instructions and illustrations direct operator actions in a step-by-step workflow enabling every user to perform successful rheology measurements with minimal training.



Validation throughout: Common sources of error are eliminated- the correct geometry is installed and calibrated, the sample information is updated, and every step is complete. When operators never miss a step, data is more accurate.



Ensure operator safety: On-screen messages alert if the method exceeds safe-touch temperature with reminders for proper PPE. RheoGuide prompts operator interactions when needed and disables interaction when the head is in motion.



Rapid results: Automated analysis results are displayed on the touchscreen immediately upon test completion, along with pass or fail indication. Eliminating the need for routine manual data processing is ideal for fast-paced Quality Assurance/Quality Control testing labs.



Synchronize methods: Discovery Hybrid Rheometer methods directly transfer to Core Rheometers to replicate R&D's measurements in QC testing. Methods shared across instruments and sites help ensure every operator performs the same measurement.



Powered by TRIOS™ software: Customize RheoGuide methods and access all raw data files for additional analysis through TRIOS, the popular software platform from TA Instruments.

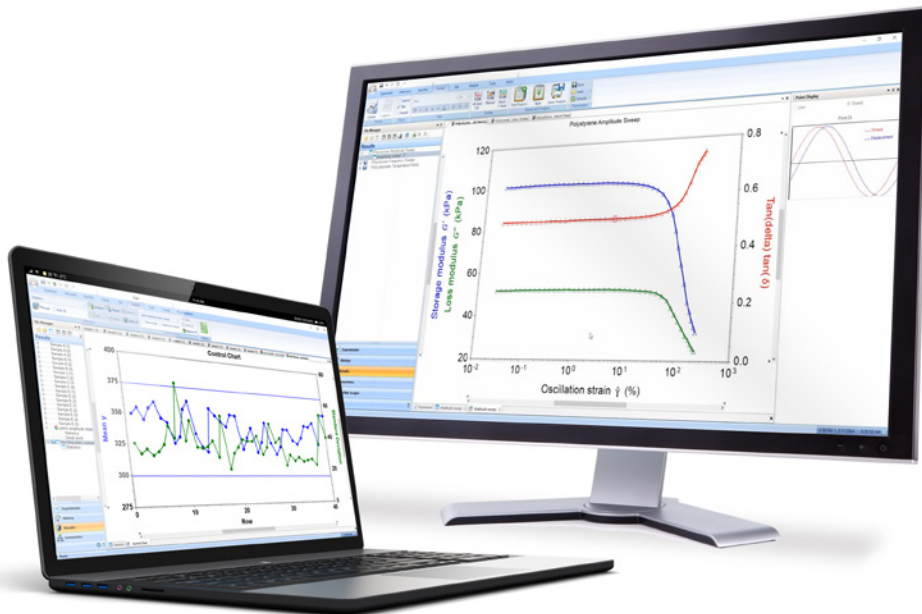
DISCOVERY CORE RHEOMETER | TRIOS SOFTWARE

TRIOS is a state-of-the-art software platform using cutting-edge technology for instrument control, data collection and data analysis for both rheology and thermal analysis. Customize RheoGuide methods to incorporate every step of your standard operating procedure using the intuitive Method Builder.

Complete Data Analysis Capabilities

Every measurement made on the Core Rheometer, whether through RheoGuide or directly in TRIOS, generates a unique data file containing all parameters and raw data for complete traceability.

- Intuitive and flexible data visualization
- Extensive analysis capabilities, including mathematical models, curve fitting, statistics
- Batch Processing: Automated analysis and report generation
- Control Charts for monitoring trends in results over time
- Data export in JSON format for integration with LIMS
- Unlimited licenses: access and analyze your data from anywhere



Unlock Direct Rheometer Controls

The Core Rheometer offers more than routine testing – experienced users can switch from RheoGuide mode to TRIOS Classic mode to directly control measurement parameters. **The intuitive user interface allows you to simply and effectively program experiments and move easily between modifying procedures and viewing and analyzing data.**



DISCOVERY CORE RHEOMETER | SPECIFICATIONS

Measurement Specifications	
Minimum Torque	0.5 μ N.m
Maximum Torque	125 mN.m
Torque Resolution	10 nN.m
Displacement Resolution	100 nrad
Maximum Rotational Velocity	300 rad/s
Minimum Angular Frequency	10^{-4} rad/s
Maximum Angular Frequency	628 rad/s
Motor Inertia	< 25 μ N.m.s ²
Gap positioning speed	10 mm/s
Dimensions (width x height x depth)	30 cm x 77 cm x 42 cm 11.8 in x 30.3 in x 16.3 in
Weight	34.5 kg (76 lb)

Peltier Plate Specifications	
Minimum Temperature	-10 °C
Maximum Temperature	200 °C
Temperature Accuracy	0.1 °C
Maximum Heating Rate	50 °C/minute
Maximum Cooling Rate	30 °C/minute
Insulated Solvent Trap	Optional

Features and Technology	
Precision Air Bearings	
SmartSwap™ geometry identification	
Integrated sample spotlight	
Automatic gap positioning	
18 cm touchscreen	
TRIOS™ software	
RheoGuide™ software	

Test Modes	
Flow	Shear rate control
	Stress control
Oscillation	Strain control
	Stress control
Transient	Creep-Recovery
	Stress Relaxation

Concentric Cylinder Specifications	
Minimum Temperature	0 °C°
Maximum Temperature	150 °C
Temperature Accuracy	0.1 °C
Maximum Heating Rate	5 °C/minute
Maximum Cooling Rate	5 °C/minute
Disposable Cups	Optional



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