

The Modular Compact Rheometer Series

MCR Evolution

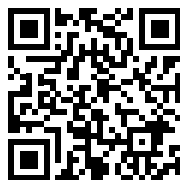


MCR: Your Future-Proof Rheometer

The MCR rheometer series from the market leader Anton Paar offers you one thing first and foremost: an open range of possibilities. Whatever your rheological requirements are and will be in the future, your MCR rheometer is efficiently adapted to meet your needs, from routine quality control to high-end R&D applications. Choose from the biggest portfolio available on the market.

AN INVESTMENT IN AN MCR RHEOMETER IS ALWAYS A SAFE INVESTMENT IN LONGSTANDING TECHNOLOGY AND ENDLESS POSSIBILITIES.

FIND OUT MORE



[www.anton-paar.com/
apb-rheometers](http://www.anton-paar.com/apb-rheometers)



Rheometers from the market leader

10,000+ installations worldwide

15 rheometer models

200+ accessories for the perfect custom fit

Over 25 years of EC motor technology

97 % of critical parts produced in-house in Austria

35+ subsidiaries provide qualified local support

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MCR by Numbers



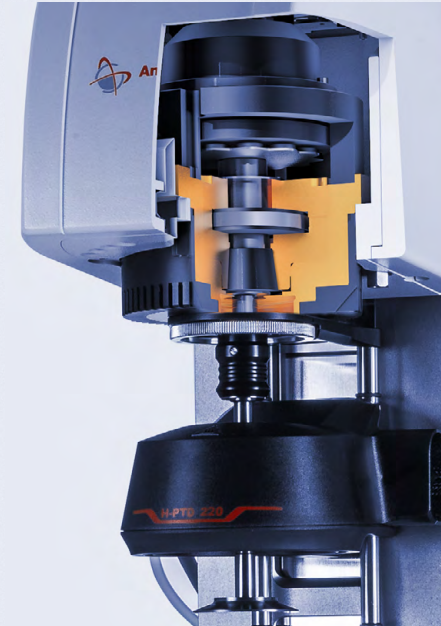
**MORE THAN 10,000
INSTALLATIONS WORLDWIDE**

MCR is the **most-used rheometer** worldwide. Highly satisfied with their MCR rheometers, thousands of users have been with us from the very beginning and have been using their MCRs for decades. Around the globe, our instruments are at work in R&D and academia, as well as in industrial laboratories, and are measuring substances ranging from paints and coatings, polymers, food, automotive liquids, and petrochemicals to building materials, adhesives, and many more.



**CHOOSE FROM 15 RHEOMETER
MODELS AND MORE THAN
200 ACCESSORIES**

We have the **broadest portfolio on the market**. This includes 15 different rheometers that can be combined with over 200 different accessories, giving you endless possibilities in the field of rheological characterization. Each accessory extends the capabilities of the rheometer and can easily be exchanged or added even years later.



**OVER 25 YEARS OF EC MOTOR
TECHNOLOGY**

Your rheological investigations demand the highest measuring sensitivity. To achieve this, the MCR's EC motor (Permanent Magnet Synchronous Motor) with an integrated normal force sensor has exceptional low-torque capabilities down to $0.0005 \mu\text{Nm}$ (approximately the weight of a single human hair). We were **the first company to employ an EC motor in a rheometer over 25 years ago**. This motor reached sensitivity values that were previously unthinkable and are still unrivaled today.



**APPROX. 97 % OF CRITICAL
PARTS PRODUCED IN-HOUSE
AND CUSTOMIZATION ON
OFFER**

At Anton Paar, we take quality very seriously. Our rheometers are produced at our headquarters in Austria, with more than 97 % of all critical mechanical parts manufactured in-house. This ensures a secure supply in case you need parts or accessories at a later date. As our production facilities are just next door to the R&D department, in which we invest 20 % of our turnover each year, we can also customize and develop products for your specific applications. Talk to us about your special requirements.



**MORE THAN 35 SUBSIDIARIES
PROVIDE QUALIFIED SUPPORT
ALL OVER THE WORLD**

Anton Paar started as a one-man machine shop in Graz back in 1922 and now has over 4,500 employees and a worldwide service network of more than 35 subsidiaries and numerous responsible partners. This means that an expert on your system is always close by. We're the first choice for answering any rheological question you may have. We're proud of our reputation for excellent service and support and look forward to being your reliable partner. Call us for advice on test definitions or to discuss different approaches to solving a measuring problem. Our experts are just a phone call away and are happy to help, in your local language free of charge.

To find out more about Anton Paar, visit:

www.anton-paar.com/apb-company

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95

**A FINE SELECTION OF FIRST-TIME,
UNIQUE RHEOMETER INNOVATIONS:**

1995

- EC motor and the modular rheometer concept with UDS 200
- Controlled stress, shear rate, and strain in one rheometer
- QuickConnect coupling

1996

- Normal force sensor principle (US Pat. 6167752, 1996)

1999

- Peltier hood (US Pat. 6571610, 1999) and cylinder temperature control (US Pat. 6240770, 1999)
- Direct-strain oscillation (DSO, TruStrain™)
- Automatic sample changer for automated measurement

2004

- Unique and still unrivaled features: Toolmaster™ (US Pat. 7275419, 2004), TruGap™ (US Pat. 6499336, 2000)
- CTD 1000 for measurements up to 1,000 °C
- Setups for tribology
- High-throughput rheometer (HTR)

2011

- T-Ready™ for detection of sample equilibrium time (US Pat. 8904852, 2011)

2012

- Pressure Cell for up to 1,000 bar

2014

- Humidity option (AT Pat. 531661, 2012)

2015

- Powder Flow Cell (US Pat. 10031057, 2015)

2016

- The entry-level rheometers MCR 72 and MCR 92, a completely new device category
- TruRay (EP Pat. 3220127, 2016), SafeGap (US Pat. 10180381, 2016), and air-cooled Peltier hood

2018

- MCR 702 MultiDrive DMA, a rheometer that is a dynamic mechanical analyzer at the same time (US Pat. 9574983, 2015)

2019

- Powder Shear Cell

The Best Now Better

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21

Our mission is never complete. We're always pushing the boundaries. For more than 25 years, we've continuously extended our portfolio in close collaboration with our most important innovation driver, YOU, our highly valued customer and rheometer user. We're now proud to present the new MCR Evolution series: Rheometers that lead you to results that take you and your scientific work one step ahead.

MCR Evolution – What's New?

- ✓ Easiest possible coupling and decoupling of measuring systems with one hand even at extreme temperatures (-160 °C to +1,000 °C): Novel quick-connect mechanism
- ✓ Precisely measure low-viscosity samples with our most compact rheometer model: Higher sensitivity with MCR 102e (from 7.5 nNm to 2 nNm)
- ✓ Glovebox-ready: MCR 702e Space MultiDrive is the only rheometer that can be operated in a glovebox with inert gas (nitrogen, argon)
- ✓ Stable results even for long-term measurements with low torque: Improved thermal management within the EC motor with MCR 302e
- ✓ More space for sample handling and exchange of accessories: Extended working height of MCR 302e
- ✓ Highly reproducible results: The only device on the market with a trimming mirror
- ✓ Detection of any sample behavior change even at the shortest time scales: Reproducible duration of each measuring point down to 1 ms
- ✓ Full pharma compliance: You get the best pharma package for the RheoCompass software (21 CFR Part 11, full data integrity according to ALCOA+)



Choose from the Broadest...

...Rheometer Portfolio on the Market



MCR 102e

**THE MOST COMPACT EVOLUTION RHEOMETER MODEL:
YOUR ENTRY TICKET INTO THE WORLD OF QC TESTING AND
RHEOLOGICAL PRODUCT DEVELOPMENT. UPGRADEABLE TO FIT
ALL YOUR FUTURE REQUIREMENTS.**

- Torque range from 2 nNm to 200 mNm
- Normal force measurements up to 50 N
- Sample-adaptive controllers (TruStrain™, TruRate™) available as an option



MCR 702e MultiDrive

**THE HIGH-END RHEOMETER AND SCIENTIFIC REFERENCE
FOR SOPHISTICATED RHEOLOGICAL RESEARCH
AND DMA: ONE RHEOMETER, TWO DRIVE UNITS,
ALL WORKING MODES.**

- Torque range from 0.5 nNm to 230 mNm
- Upgradeable with a second EC drive or linear drive
- Maximum speed of 6,000 rpm for high-shear applications
- Working modes: CMT, SMT, counter-movement

MCR 302e

**THE ESTABLISHED, UNIVERSAL AND
MOST-SOLD RHEOMETER. REFERENCE ON THE MARKET FOR
ADVANCED QC TESTING AND RHEOLOGICAL RESEARCH. FITS
ALL YOUR CURRENT AND FUTURE NEEDS.**

- Torque range from 0.5 nNm to 230 mNm
- Active thermal management of motor and bearing for long-term measurements even at high torques
- Sample-adaptive controllers (TruStrain™, TruRate™) included
- More space for sample handling and exchange of accessories, full compatibility with CTD 1000



MCR 702e Space MultiDrive

**DESIGNED TO PROVIDE A UNIQUE, MAXIMIZED WORKSPACE
BELOW THE RHEOMETER SUPPORT PLATE AND ON BOTH SIDES
OF THE INSTRUMENT.**

- Torque range from 0.5 nNm to 230 mNm
- Suitable for combination with additional instruments, e.g., a confocal microscope
- Glovebox-ready, even when using inert gas atmosphere (nitrogen, argon)

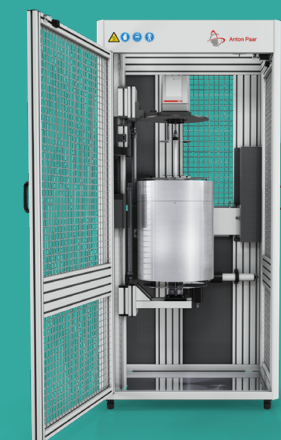


MCR 502e Power

**THE MOST POWERFUL RHEOMETER MODEL WITH
UNIQUE SPECIFICATIONS FOR SPECIAL APPLICATIONS,
e.g., FATIGUE TESTS ON ASPHALT MIXTURES.**

- Maximum torque of 300 mNm
- Maximum normal force of 70 N
- Active thermal management of motor and bearing for long-term measurements even at high torques

FRS FURNACE RHEOMETER



Additional MCR devices

**THE WORLD OF RHEOLOGY IS EXTENSIVE AND OFTEN
REQUIRES SPECIAL INSTRUMENT SOLUTIONS FOR
CHALLENGING MEASUREMENT TASKS.**

- MCR 72 and MCR 92 for quick and easy rheological measurements
- The SmartPave rheometer is designed for the asphalt industry
- The "furnace rheometer" FRS handles sample temperatures up to 1,730 °C
- The automated rheometer HTR is operated by a robotic arm
- The rheometer head DSR can be integrated into your process or used to build a customized rheometer system

MCR Evolution Series

Highly Evolved Features

**TAKES WORK OFF YOUR HANDS:
UNIQUE MOTOR AND SAMPLE-
ADAPTIVE CONTROLLER
TECHNOLOGY**

The MCR Evolution series builds on 25 years of research, development, and constant improvement. This has resulted in technology that pushes the boundaries of rheometry. The combination of the EC motor with the high-precision air bearing, integrated normal force sensor, and a high-resolution optical encoder, for example, allows rheological measurements at the lowest torques ever.

The unique sample-adaptive controllers for measurement in rotation (TruRate™) and oscillation (TruStrain™) work for 99 % of all samples and measurements “out of the box” with the perfect combination of speed and accuracy – save time and resources.

**CUSTOMIZE YOUR MCR WITH
OVER 200 ACCESSORIES**

Whatever your rheological applications are and will be in the future, our rheometers are quickly and easily adapted to meet your needs. Their flexibility makes them the most cited instruments in scientific publications on rheological investigations. A wide range of temperature accessories allows you to apply and control temperatures from -160 °C to +1,000 °C. An extensive range of application-specific accessories is available to extend the rheometer's capabilities.



EXCELLENCE IN EVERY COMPONENT AND EVERY WORK STEP

After decades in the field, we understand what's required for outstanding rheological analysis. With this knowledge in mind, we designed every component and created every handling step to be part of a smooth and intelligent whole:

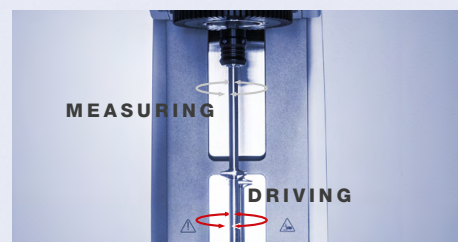
- ✓ The patented Toolmaster™ technology automatically recognizes measuring systems and accessories, transfers all relevant parameters to the software without the risk of errors, and stores the zero-gap position to save time when loading the next sample.
- ✓ Due to the QuickConnect coupling, measuring systems can be exchanged within one second with one hand.
- ✓ T-Ready™ increases your sample throughput and avoids measuring errors by detecting sample temperature equilibration in real-time.
- ✓ The TruGap™ feature detects the real measuring gap and ensures accurate gap settings in real-time, even when the room and sample temperatures change.
- ✓ The trimming mirror gives you a 360° view of the sample with no blind spots, avoids sample preparation errors, supporting high measurement repeatability.
- ✓ The steel frame is optimized for mechanical and thermal stiffness and minimizes torsional and axial compliance, which allows measurement of even the stiffest samples like ceramics and metal.
- ✓ The lift motor in the stand provides precise gap setting and automatically compensates gap changes related to temperature and normal force.
- ✓ The device display provides remote control of the software to minimize sample preparation time.
- ✓ The open design enables easy and fast sample loading and trimming.

MCR 702e MultiDrive and MCR 702e Space MultiDrive

The Features Beyond

MCR 702e MultiDrive and MCR 702e Space MultiDrive give you access to two drive units in a single instrument. Both cover all test modes, measuring systems, accessories, and temperature devices without any limitation on measurement precision.

Including all features known from the MCR series, these devices allow for the most sophisticated research in rheology, dynamic mechanical analysis, and other characterization methods.



ONE RHEOMETER, ALL RHEOLOGICAL WORKING MODES

MCR 702e MultiDrive lets you to work with one EC motor in Combined Motor Transducer (CMT) mode or two EC motors in Separate Motor Transducer (SMT) mode.

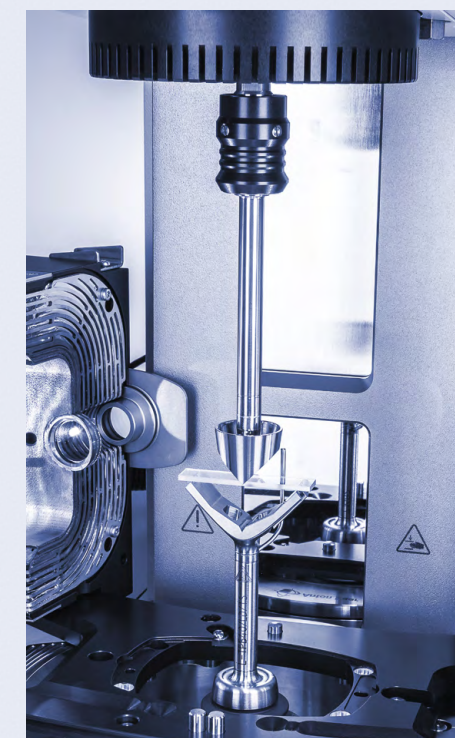
In SMT mode, one motor is operated solely as a torque transducer, while the other motor is used as a drive unit only. This delivers the purest rheological results even in the transient regime of the measurement (e.g., stress relaxation, start-up shear) and over a broad range of amplitude and frequency in oscillatory measurements.

Using CMT mode, you can use the motor's real-time position control (TruStrain™) or perform "classic" stress-controlled tests in combination with the extensive range of accessories. With this setup, you can cover the broadest range of rheological applications.



PUSH BACK THE LIMITS OF MATERIAL CHARACTERIZATION WITH THE COUNTER- MOVEMENT MODE

In counter-movement mode, the two EC motors can rotate or oscillate in opposite directions. This creates a fixed stagnation plane that can be used for advanced optical analysis of structures within a sheared sample using a microscope. This mode simply doubles the maximum achievable rotational speed of the rheometer up to 6,000 rpm, which helps to broaden the shear rate range for high-shear applications.



READY FOR DYNAMIC MECHANICAL ANALYSIS

Due to the modular concept of the MCR, an additional lower linear drive can easily be inserted to perform DMA in tension, bending, or compression mode, creep and creep recovery tests, relaxation tests, and even thermomechanical analysis.

In combination with the capability of the upper rotational drive for DMA in torsion, the setup enables a complete characterization of viscoelastic solids.



THE DEVICE FOR APPLICATIONS THAT WERE PREVIOUSLY UNTHINKABLE

The maximized workspace of MCR 702e Space MultiDrive allows easy installation of accessories and easy combination with additional external setups (e.g., a confocal microscope) suitable for advanced material characterization. In addition, the rheometer's separate electronics box lets you set up the rheometer in a laboratory glovebox or similarly small spaces, even when using inert gas (nitrogen, argon) atmosphere, e.g., for high-temperature measurements on samples with a certain hazard level.

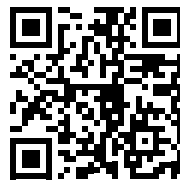
RheoCompass Software

THE MOST-COMPREHENSIVE RHEOMETER SOFTWARE ON THE MARKET

Whatever you want to investigate with your rheometer, the RheoCompass software provides appropriate templates to use or adapt and helps you analyze the results.

This powerful software can fully automate the entire process from sample preparation to the printout of results (using the Test, Analysis, and Report Designers). The software can even be remote-controlled from the rheometer display to minimize the time you spend on sample preparation.

READ MORE

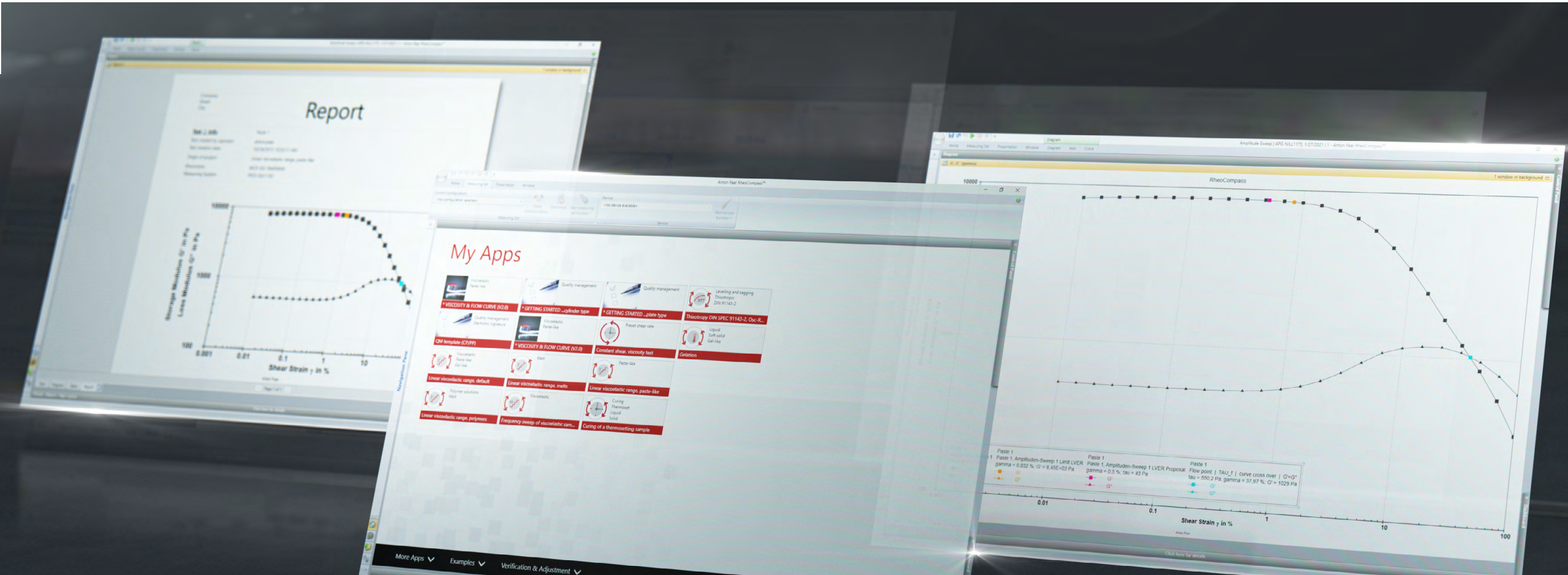


www.anton-paar.com/
apb-rheocompass

- ✓ Meets all challenges – from routine QC testing to scientific analysis
- ✓ More than 100 predefined and customizable measurement templates (apps)
- ✓ Available in eight languages
(English, German, Chinese, Japanese, French, Portuguese, Spanish, Polish)
- ✓ Central database handles all relevant data, guarantees data security, and enables server/client functionality
- ✓ Countless analysis methods available for routine and advanced data analysis
- ✓ Automatic data exchange with a lab information management system (LIMS)
- ✓ Complete pharma package including audit trail, electronic signature, and retrieval

Fully complies with QM regulations like GLP/GMP, 21 CFR Part 11, and ALCOA+ with full data integrity

Read more: <https://www.anton-paar.com/apb-pharma>



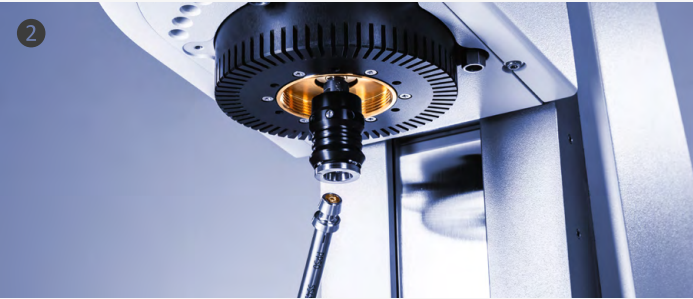
Measuring Geometries

Your MCR rheometer has a setup to suit all your applications, from investigations on liquids, solids, powders, and polymers to adhesives and slurries. Choose from hundreds of measuring geometries and combine them with a wide range of temperature devices and application-specific accessories to get outstanding analysis results.

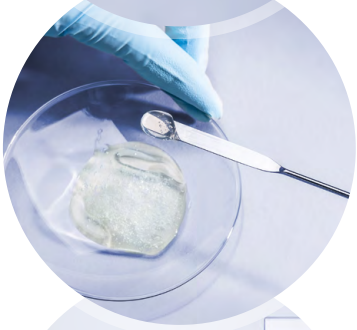
READ MORE



www.anton-paar.com/
apb-geometries



| | Concentric cylinder (CC) | Double gap (DG) | Cone-plate (CP) | Parallel plate (PP) | Stirrers | Tribology systems | Powder systems | DMA fixtures |
|-----------------------|--------------------------|-----------------|-----------------|---------------------|----------|-------------------|----------------|--------------|
| Low-viscosity liquids | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Viscoelastic liquids | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Melts | | | ✓ | ✓ | | | | |
| Paste-like materials | | | ✓ | ✓ | ✓ | ✓ | | |
| Gel-like materials | | | ✓ | ✓ | | ✓ | | |
| Soft solids | | | | ✓ | | ✓ | | ✓ |
| Reactive systems | | | | ✓ | | | | |
| Powder | ✓ | | | | ✓ | | ✓ | |
| Solids | | | | | | ✓ | | ✓ |



YOU CAN RELY ON THESE EVOLUTIONARY FEATURES

- 1 Error-free: Toolmaster™ technology**

Toolmaster (US Pat. 7275419) automatically recognizes measuring geometries and accessories, transfers all relevant parameters to the software without the risk of errors, and stores the zero-gap position to save time when loading the next sample.
- 2 Convenient: QuickConnect coupling**

Measuring geometries can be exchanged within one second with one hand. The reduced time and effort required for changing, cleaning, and reinstalling the geometry help you work even more efficiently in the laboratory.
- 3 More grip: Diverse surface treatments**

Geometries with sandblasted or profiled surfaces will prevent wall slip and guarantee the grip that is necessary for precise material characterization.
- 4 Disposable and resistant: Special geometries**

If the substances you investigate make it difficult to reuse or clean the measuring geometry (e.g., because of an irreversible hardening process), use our disposable geometries. We also have geometries resistant to harsh chemicals and temperatures up to 1,800 °C.
- 5 Sensitive: Integrated temperature sensor**

Integrated temperature sensors enable the determination of even the smallest deviations in sample temperature without affecting the torque sensitivity of the rheometer.
- 6 Made for you: Customized solutions**

Take advantage of our highly specialized production engineering "Made in Austria": We're happy to adapt each type of measuring geometry to fit your specific needs.

Temperature Devices



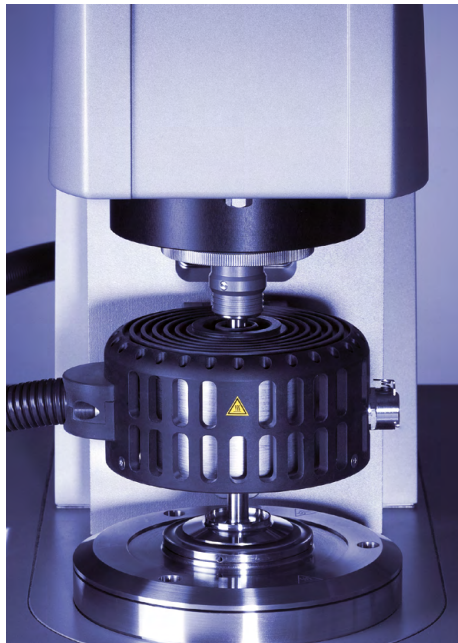
P-PTD 220 WITH H-PTD 220

- Peltier-temperature-controlled device (PTD) with active heating and cooling
- From -50 °C to +220 °C
 - Suitable for parallel-plate and cone-plate measuring geometries
 - Typical applications: food, paints, cosmetics, adhesives, bitumen
 - Active temperature-controlled hood guarantees lowest sample temperature gradients down to ≤ 0.1 °C
 - Gas flushing (air or inert gas) prevents ice formation at low temperatures and sample degradation
 - Modular screw-on plates for flexible adaption to your needs
 - LED-illuminated hood for clear viewing and 360° sample trimming



C-PTD 200 AND C-PTD 180/AIR

- Peltier-temperature-controlled device (PTD) with active heating and cooling
- From -30 °C to +200 °C
 - Suitable for concentric cylinders, double-gap geometries, and stirrers
 - Typical applications: liquids, solvents, solutions, bitumen
 - Minimized vertical sample temperature gradients due to optimized thermal transfer system
 - C-PTD 180/Air with counter-cooling by air to avoid the use of an additional fluid circulator (0 °C to 180 °C)
 - Changing the measuring cup takes only a few seconds



P-ETD 400 WITH H-ETD 400

- Electrically heated temperature device (ETD)
- From -150 °C to +400 °C
 - Suitable for parallel-plate and cone-plate measuring geometries
 - Typical applications: polymer melts, epoxy resins
 - Active temperature-controlled hood minimizes sample temperature gradients
 - Gas flushing (air or inert gas) prevents ice formation at low temperatures and sample degradation

WITH THESE ACCESSORIES, YOU'RE ABLE TO CONTROL THE GREATEST RHEOLOGICAL INFLUENCE OF ALL: TEMPERATURE. CHOOSE FROM A VAST RANGE OF MORE THAN 40 TEMPERATURE DEVICES AND RELY ON THE HIGH-PRECISION TEMPERATURE CONTROL REQUIRED FOR TRULY ACCURATE RHEOLOGICAL RESULTS.



CTD 600 MDR

- Convection temperature device (CTD oven)
- From -160 °C to +600 °C
 - Suitable for all kinds of measuring geometries
 - Typical applications: polymer melts and solids, epoxy resins, reinforced materials, films, and fibers
 - Chamber made by innovative 3D metal printing to ensure accurate and homogeneous sample temperature
 - Low (inert) gas consumption for reduced operating costs and precise measurements even at low torques
 - Integrated LED sample illumination and digital eye camera option



PTD 180 MD

- Peltier-temperature-controlled device (PTD) for MultiDrive configurations
- From -20 °C to +180 °C
 - Suitable for parallel-plate, cone-plate, concentric cylinders, and double-gap measuring geometries
 - Typical applications: food, paints, pharmaceuticals, cosmetics
 - Thermally coupled hood for reduced temperature gradients
 - No forced gas convection – optimized for low-viscosity and viscoelastic fluids
 - Determination of the true sample temperature with optoelectronic sensor technology



ADDITIONAL ACCESSORIES

- Low temperature options
- Evaporation Unit for cooling with liquid nitrogen down to -160 °C
 - Gas chiller units for cooling down to -90 °C without liquid nitrogen
- Passive temperature cover
- Provides optimal temperature gradients from 0 °C to 50 °C by creating convection
- Solvent traps and covers
- Minimize solvent evaporation
 - Reproducible measurements of volatile samples
 - Purge gas options
- Disposable options
- Suitable when cleaning is difficult
 - Available for upper and lower geometries

LIQUID TEMPERATURE CONTROL

COST-EFFECTIVE TEMPERATURE CONTROL SOLUTIONS BASED ON HEATING AND COOLING WITH CIRCULATING LIQUID; COVERS THE RANGE AROUND ROOM TEMPERATURE.

- Temperature range from -40 °C to +180 °C
- Temperature devices for parallel-plate, cone-plate, concentric-cylinder, double-gap measuring geometries, and stirrers
- XL version available for the measurement of liquids with very low viscosities

Read more: www.anton-paar.com/apb-tc-fluid

PELTIER TEMPERATURE CONTROL

COMPACT AND EASILY INSTALLABLE TEMPERATURE DEVICES BASED ON HEATING AND COOLING USING PELTIER ELEMENTS UP TO 220 °C.

- Unique temperature range from -50 °C to +220 °C
- Devices for all measuring systems available
- Active cooling without the need of additional low temperature options
- Air-cooled Peltier systems available (no fluid circulator needed)

Read more: www.anton-paar.com/apb-tc-peltier

ELECTRICAL TEMPERATURE CONTROL

FAST TEMPERATURE DEVICE BASED ON ELECTRICAL HEATING AND COOLING OF PRESSURIZED AIR OR WATER FOR PROPER TEMPERATURE CONTROL EVEN AT HIGH TEMPERATURES.

- Temperature range from -150 °C to +400 °C
- Temperature devices for parallel-plate, cone-plate, concentric-cylinder, double-gap measuring geometries, and stirrers
- Additional heated hoods for minimized temperature gradients

Read more: www.anton-paar.com/apb-tc-electrical

CONVECTION TEMPERATURE CONTROL

THE MOST FLEXIBLE TEMPERATURE DEVICE BASED ON FORCED CONVECTION OF AIR OR GAS AND RADIATION.

- Temperature range from -160 °C to +1.000 °C
- Modular configuration suitable for all measuring systems
- Lowest gas flow rates to avoid air vortexes or drying samples
- Unique Peltier-temperature-controlled oven available (CTD 180 HR)

Read more: www.anton-paar.com/apb-tc-convection

Accessories for Structure Analysis and RheoOptics



RHEOOPTICS TOOLBOX

- Lets you use the same universal temperature devices for rheo-microscopy, confocal microscopy, Raman- and IR spectroscopy, UV curing, Polarized Light Imaging, SALS, and customized systems
- Modular and cost-saving upgrade of the measurement possibilities depending on your present and future needs
- Switching to other optical accessories only requires a minimal setup time
- From -20 °C to +300 °C (higher temperatures available on request)
- Both temperature devices are with glass bottom plates
- Combination with an active temperature-controlled hood for minimized sample temperature gradients

Read more about this in the respective sections on this page



RHEO-MICROSCOPY

- Delivers insights into the inner structure of the sample during rheological measurements
- Allows the visualization of the influence of shear and deformation forces on the sample structure
- Typical applications: crystallization processes, food products, cosmetics, observation of low-shear orientation effects
- Modules for polarizers and fluorescence
- From -20 °C to +300 °C as standard (higher temperatures available on request)
- Direct assignment of images and videos to rheological data
- Combination with confocal microscopy possible based on customized solutions

Read more: www.anton-paar.com/apb-rheooptics-rm



STAGNATION PLANE MICROSCOPY

- Visualize structures of interest at the stagnation plane
- Shifts the limits of rheo-microscopy to larger shear rates and deformations as structures do not move out of the field of view
- Typical applications: observation of shear-induced deformation and orientation of individual structures or droplets in polymer solutions, emulsions, and dispersions
- Measuring systems made of glass enable observation from below and from the side to visualize alignment of structures in shear gradient and shear flow direction
- A speed balance lets you change the speed distribution without changing the shear rate applied to the sample

Read more: www.anton-paar.com/apb-microscopy

THE COMBINATION OF RHEOMETRY AND STRUCTURE ANALYSIS PROVIDES YOU WITH THE MACROSCOPIC “BIG PICTURE” AS WELL AS INFORMATION ON THE SMALLEST MICROSTRUCTURE CHANGES ALL AT ONCE – TAKING YOU A BIG STEP TOWARDS COMPLETELY UNDERSTANDING THE BEHAVIOR OF YOUR SAMPLE.



RAMAN AND IR SPECTROSCOPY

- Combines two powerful measurement principles: rheology as a mechanical and Raman or infrared as a molecular spectroscopy method
- Understand the relationship between macromolecular and structural parameters
- Can additionally be combined with UV radiation

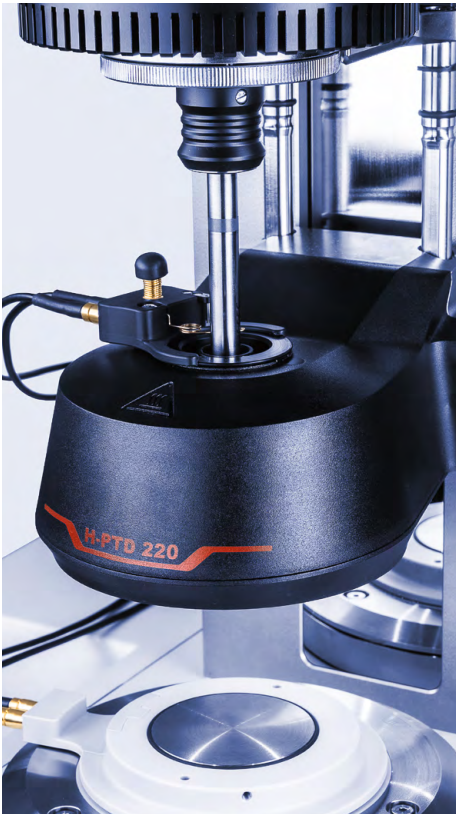
Rheometer-Raman Setup

- Can be combined with an Anton Paar Cora spectrometer and others
- From -20 °C to +300 °C
- Typical applications: crystallization, chemical reactions, morphology of polymers, biological samples

Read more: www.anton-paar.com/apb-rheo-raman

Rheometer-IR Setup

- Use near-IR (NIR) and mid-IR (MIR) in transmission mode and MIR spectroscopy also in attenuated total reflection (ATR) mode
- Many IR spectrometers and probes can be connected
- From -20 °C to +300 °C
- Typical applications: monitoring of chemical reactions



DIELECTRIC-RHEOLOGICAL DEVICE (DRD)

- Combines rheology as a mechanical spectroscopy method and dielectric spectroscopy
- The interpretation of the obtained dielectric spectrum provides information on the internal structure
- Typical applications: battery slurries, adhesives, resins, filled polymers (e.g., carbon black composites), and polar materials (like PVA, PVC, PMMA)
- From -160 °C to +600 °C
- Contact options for rotational and oscillatory tests are available
- Various LCR meters can be combined

Read more: www.anton-paar.com/apb-drd



FURTHER ACCESSORIES

- Polarized Light Imaging Option**
- For visualization of shear stress
- For parallel-plate and cone-plate measuring systems

Read more: www.anton-paar.com/apb-rheooptics-pi

Particle Imaging Velocimetry (PIV)

- Visualization of complex flow fields such as shear banding, turbulence, or flow instabilities

Read more: www.anton-paar.com/apb-piv

Small-angle Light Scattering (SALS)

- For investigating shear-dependent shape and orientation of microstructure

Read more: www.anton-paar.com/apb-sals

Small-angle X-ray/Neutron Scattering (SAXS/WAXS/SANS)

- For nanostructure analysis
- Modular, radiolucent CTD oven from -50 °C to +300 °C
- Ready for shear and extensional rheology and DMA

Read more: www.anton-paar.com/apb-sans-saxs

Accessories for Additional Parameter Setting



PRESSURE CELLS

- Pressure can significantly influence a material's rheological behavior due to the influence on intermolecular forces
- Pressure cells can be used to simulate process conditions, measure the sample's pressure dependence, and prevent sample evaporation above the boiling point
- Typical applications: polymers, petrochemicals, oil recovery, and food processing

PRESSURE CELLS UP TO 400 BAR

- From -30 °C to +300 °C
- Gas- and self-pressurization are used to control the pressure
- Low- and high-volume cells available
- Low-friction ball bearings for precise rheological measurements
- Choose between versions in stainless steel, titanium, or Hastelloy if you investigate aggressive media
- Flow-through option available

Read more:
www.anton-paar.com/apb-pressure-cell

PRESSURE CELLS UP TO 1,000 BAR

- From ambient to 300 °C
- Low temperature option available on request
- Gas-, liquid-, or self-pressurization can be used to control the pressure
- Low-friction and highly resistant jewel bearings enable characterization even of rod-climbing viscoelastic fluids
- Internal construction of titanium or Hastelloy for improved resistance to aggressive materials
- Flow-through options available



UV CURING SYSTEM

- When UV curing materials are exposed to UV light, a chemical cross-linking reaction occurs and causes changes in the rheological properties, typically within seconds or a few minutes
- Typical applications: epoxy resins, adhesives, glues, printing inks, coatings
- From -40 °C to +300 °C
- Different mercury and LED light sources as well as filters for the emission of discrete wavelengths are available
- Usable with Peltier, electrical, and convection temperature devices (part of the RheoOptics toolbox)
- Combinable with Raman or IR spectroscopy to determine changes on the molecular level simultaneously

Read more:
www.anton-paar.com/apb-uvlcs

THE ACCESSORIES FOR “ADDITIONAL PARAMETER SETTING” LET YOU PERFORM TEMPERATURE-CONTROLLED RHEOLOGICAL TESTS WHILE APPLYING AN ADDITIONAL WELL-DEFINED EXTERNAL INFLUENCING FACTOR. BUILD ON YOUR RHEOMETER TO INVESTIGATE HOW ADDITIONAL PARAMETERS SUCH AS PRESSURE OR AN ELECTRIC FIELD CHANGE THE FLOW AND DEFORMATION BEHAVIOR OF YOUR SAMPLE.



HUMIDITY OPTION FOR CTD 180 HR

- The relative humidity can influence the moisture content of various materials and affect their rheological and mechanical properties
- Study the impact on drying or plasticizing but also on curing reactions
- Typical applications: polymers, adhesives, sealants, coatings and paints, food, pharmaceuticals
- Humidity range from 5 % to 95 % RH
- From 5 °C to 120 °C
- Can be used with standard and specialized measuring systems for rheology and DMA in torsion, tension, bending, and compression
- Combinable with UV light, powder rheology, and tribology
- AT Pat. 513661

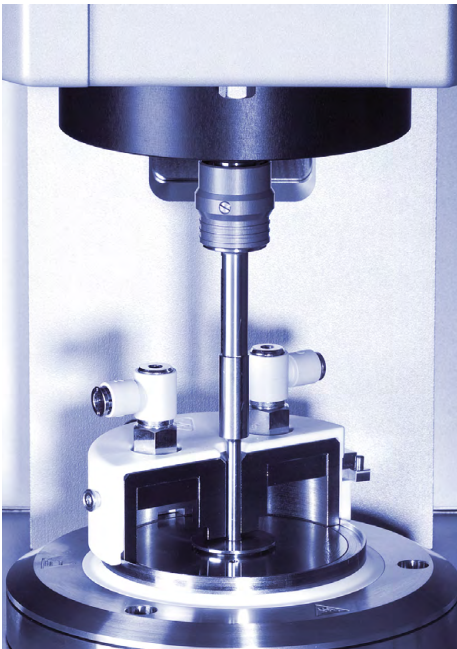
Read more:
www.anton-paar.com/apb-hmo



ELECTRO-RHEOLOGICAL DEVICE (ERD)

- Electro-rheological (ER) fluids are suspensions of electrically active particles dispersed in an electrically insulating fluid
- ER fluids change their rheological properties dramatically when an electric field is applied
- Typical applications: clutches, brakes, pumps, dampers, shock absorbers, printing inks, haptic devices
- Voltage range: 0 kV to 12.5 kV DC (AC on request)
- From -50 °C to +300 °C
- For parallel-plate and concentric-cylinder geometries
- Suitable for rotational and oscillatory tests as well as squeeze flow
- Customized solutions for combination with polarized imaging or microscopy

Read more:
www.anton-paar.com/apb-erd



MAGNETO-RHEOLOGICAL DEVICE (MRD)

- Magneto-rheological (MR) fluids react almost instantly to an applied magnetic field with a change in their rheological properties
- Typical applications: clutches, sealings, brakes, shock absorbers, seismic dampers, human prostheses
- Flux density: max. 1.4 Tesla
- From -10 °C to +170 °C (lower temperatures on request)
- Patented TwinGap™ geometry (US Pat. 8132445) enables the highest homogeneous magnetic fields and high shear rate measurements

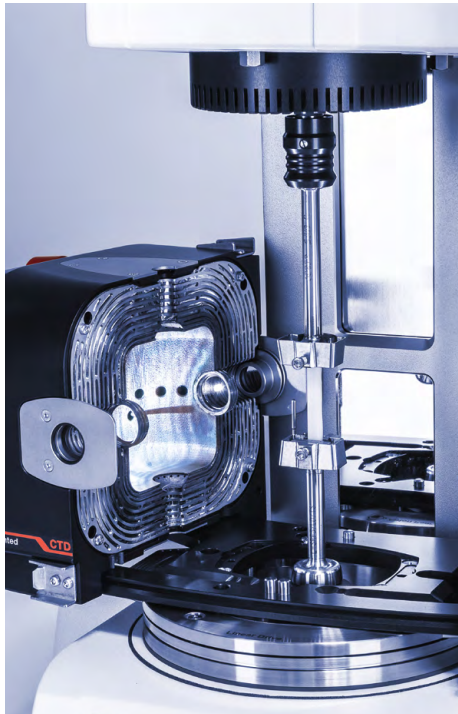
Read more:
www.anton-paar.com/apb-mrd

IMMOBILIZATION CELL (IMC)

- Investigate the immobilization kinetics and water retention of paints, coatings, and slurries by simulating process conditions
- US Pat. 6098450, 1998

Read more:
www.anton-paar.com/apb-imc

Accessories for Extended Material Characterization



DYNAMIC MECHANICAL ANALYSIS (DMA)

- DMA is an analytical method for determining the viscoelastic properties of materials under sinusoidal load
- The temperature of the sample and the frequency of the load are often varied to determine transitions within the material behavior (e.g., glass transition temperature)
- Typical applications: polymers and composites, foams, gels, food systems, elastomers
- MCR is the world's most versatile platform for both dynamic mechanical analysis and rheological investigations, allowing you to perform DMA in all working modes (torsion, tension, bending, compression)
- From -160 °C to +1,000 °C
- Touch-control for fast and easy positioning of the geometries

Read more:
www.anton-paar.com/apb-dma-mcr-702



EXTENSIONAL RHEOLOGY

- Extensional flow happens in many applications and processes, often in combination with shear flow
- Gain information about molecular structure, branching, temperature stability, shrinkage, relaxations, and brittleness, as well as the adhesion and peel strength of materials
- Typical applications: polymer films and fibers, melts, adhesives
- The Universal Extensional Fixture for a configuration with two EC drives (UXF-TD) enables measurements with unprecedented torque and strain resolution on low-viscosity films and fibers (US Pat. 9766172)
- The Sentmanat Extensional Rheometer (SER) system is perfectly suitable for extensional tests at high torques

Read more:
www.anton-paar.com/apb-uxf-ser

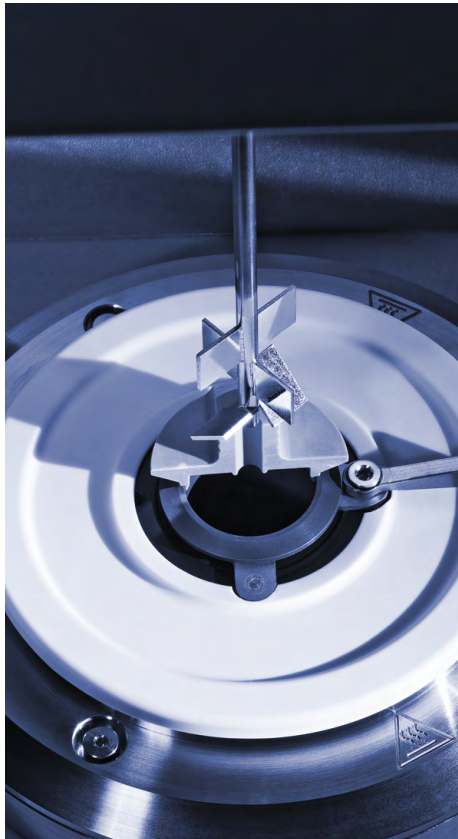


INTERFACIAL RHEOLOGY SYSTEM (IRS)

- Precise studies of the flow properties of interfacial layers
- Study the flow properties of two-dimensional liquid-liquid and liquid-air interfaces
- Comprehensive rheological investigations of emulsion and foam stability
- Typical applications: food products, detergents, life science
- From 5 °C to 70 °C
- Bi-cone measuring geometry or a Du Noüy ring, positioned directly in the interface
- Even the weakest interfacial structures can be measured with the MCR low-torque capabilities and the TruStrain™ feature
- Flow-through option available on request

Read more:
www.anton-paar.com/apb-irs

THE OPEN RANGE OF POSSIBILITIES WITH AN MCR RHEOMETER DOES NOT STOP AT SHEAR RHEOLOGY. A COMPREHENSIVE SELECTION OF EASILY INTEGRATED ACCESSORIES TRANSFERS THE CAPABILITIES OF THE INTRINSICALLY MODULAR MCR SERIES INTO OTHER MATERIAL.



STARCH CELL

- Starch pasting cell for analysis of starch gelatinization or pasting behavior
- Simulate the temperature and pressure conditions of food production processes
- Typical applications: food, confectionery products, paper and packaging, pharmaceuticals, adhesives
- Max. heating rate: 60 °C/min, max. cooling rate: 45 °C/min
- Robust and easy-to-clean cup and stirrer made of stainless steel
- Unique small sample amounts of around 18 mL
- RVA stirrer design available
- Optional Starch Pressure Cell up to 30 bar and 160 °C

Read more:
www.anton-paar.com/apb-sc



LARGE-PARTICLE RHEOLOGY

- Measure the flow properties of samples with large particles (typical particle size range of 1 mm to 10 mm)
- Typical applications: building materials (e.g., cement, concrete, plaster), food products, slurries, and sludges

Ball Measuring System (BMS)

- From -10 °C to +70 °C
- Measuring principle is an eccentrically rotating ball in a cup that avoids undesired slipping, gliding, and disturbing edges

Building Material Cell (BMC)

- From 0 °C to 90 °C
- Changeable, robust, and easy-to-clean inset cage and special stirrer
- Resistant to abrasive materials, prevents sample slippage, and provides improved mix-up effects to avoid separation

Read more:
www.anton-paar.com/apb-bms-bmc

FURTHER ACCESSORIES

SmartPave rheometer and Asphalt Setup

- Designed for quality control and routine measurements of asphalt and bitumen according to international standards

Read more:
www.anton-paar.com/apb-smartpave

Tribology Cells

- Allow the tribological characterization of a broad range of applications from lubricants, biomaterials, and polymers to food
- For extended Stribeck curves, static friction, limiting friction (including break-away torque)
- US Pat. 9702809, AT Pat. 505938

Read more:
www.anton-paar.com/apb-mcr-tribometer

Powder rheology

- Perform true powder rheology to analyze bulk solids in any state, from fluidized to consolidated powders
- Powder Shear Cell: ideal for determining the flow behavior of consolidated powders and their time-dependent behavior
- Powder Flow Cell: An innovative and scientific approach towards powder characterization offering a wide range of test methods (US Pat. 10031057)
- Only system on the market to combine powder rheology with the capability to determine envelope density of solid matter

Read more:
www.anton-paar.com/apb-powder

Special Instruments and Customized Solutions

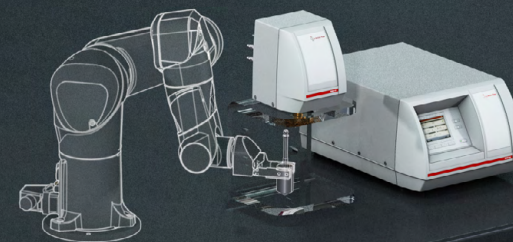
← CUSTOMIZED SOLUTIONS FOR DEVICES AND ACCESSORIES

Based on decades of experience in rheometry and rheology, we can make nearly everything possible. With our in-house production in Austria and a dedicated R&D team just next door, we develop and supply customized products for all kinds of specific applications. Don't hesitate to contact us in order to discuss your requirements and to find a customized solution for your measurement task.

← THINK BEYOND "CLASSIC" RHEOLOGY

Based on the air-bearing rotational and linear drives, MCR rheometers offer unique accurate and sensitive technologies to control torque, force, deflection, displacement, and speed. The additional combination with the extensive customization possibilities makes the MCR rheometers valuable tools for all kinds of precision mechanics measurements, e.g., for the most sensitive mechanical testing of different types of bearings and mechanical counters.

AS WELL AS BEING THE MOST CITED RHEOMETER SERIES, THE MCR IS THE MOST POPULAR RHEOMETER IN THE WORLD, WITH MORE MODELS SOLD THAN ANY OTHER RHEOMETER ON THE MARKET. THE SECRET TO THIS SUCCESS: LISTENING TO CUSTOMER FEEDBACK AND CREATING OUTSTANDING TECHNOLOGY IN RESPONSE. ALONG WITH CREATING AND CONSTANTLY IMPROVING OUR "CLASSIC" BENCHTOP RHEOMETERS, OUR TEAM HAS PRODUCED A NUMBER OF SPECIAL SOLUTIONS.



DSR 502 RHEOMETER HEAD

- Modular rheometer measuring head with separate control unit
- Full flexibility for integration into tailor-made setups
- Customized solution at your request: Support from different departments including CAD designers and engineers to create your product
- For implementation into process environments, for online and inline measurements, and combination with a fully automated system
- Ideal for rheological investigations in formulation and material handling areas or in high-temperature vessels
- High accuracy in a vast viscosity range and oscillatory mode
- Quick integration and exchange of measuring geometries

Read more: www.anton-paar.com/apb-dsr

HIGH-TEMPERATURE RHEOMETER FRS 1600 / FRS 1800

- The only device on the market that allows rotational and oscillatory rheometry at temperatures above 1,000 °C
- Measure samples at temperatures up to 1,730 °C in air or under inert gas atmosphere
- Ideal for research and process optimization of slags, metals, ceramics, and glass melts
- Combines a high-precision MCR rheometer head and an air bearing with a lab furnace in a safety cage
- The normal force measurement enables the characterization of the melting behavior
- Additional options like a gas-tight option for measurement in a defined gas atmosphere are available on request
- Customized measuring geometries and materials available to avoid interactions between sample and measuring geometry material

Read more: www.anton-paar.com/apb-frs

HIGH-THROUGHPUT RHEOMETER (HTR)

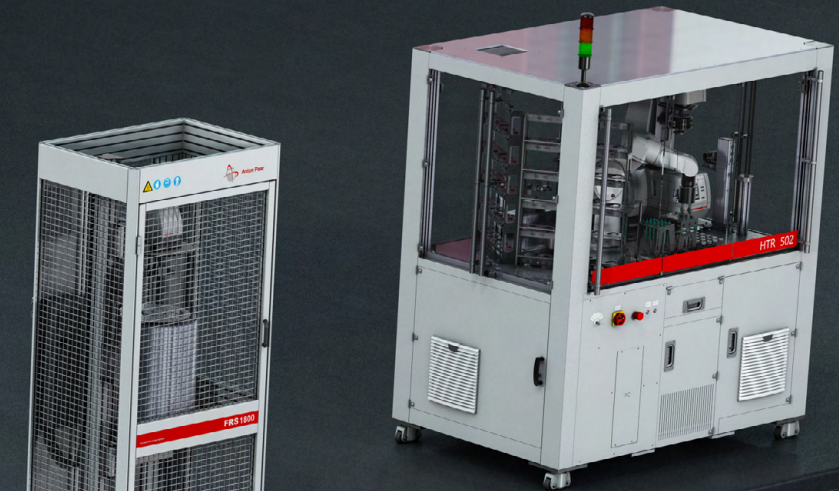
HTR rheometer automation for high sample throughput and complex sample handling

- The world's first fully automated high-throughput rheometer
- High-throughput operation with 96 samples in the standard rack
- Different types of racks for pipettes, syringes, and trim blades, and temperature-controlled sample storage (down to 4 °C) are available
- Built-in flexibility makes it the ideal choice for sophisticated and high-throughput R&D or QC work

HTR compact – Automated MCR rheometer platform in benchtop design

- High-throughput operation with 36 samples in two trays of 18 cups each
- Additional modules for growing automation needs (e.g., bar code reader for sample identification, wide range of measuring geometries, and ventilation for volatile and solvent-based samples)

Read more: www.anton-paar.com/apb-htr



Academy and Education

Successful work in the field of rheology is not only determined by the technology you use, but also by the partner that helps you solve your rheological challenges. We're here to give you support.

SIGN IN FOR OUR RHEOLOGY COURSES AND WEBINARS ALL OVER THE WORLD AT THE INTERNATIONAL ACADEMY OF RHEOLOGY

We regularly offer courses in our subsidiaries worldwide and also organize online courses or exclusive group courses for customers on request. The program covers classes for you to learn the basics of rheology, optimize your work with the RheoCompass software, and gain application-specific knowledge, (e.g., for investigations on food, polymers, asphalt, pharmaceuticals, and many more). You can also learn more about specialist subjects and meet our experts for discussions online by taking part in one of our free webinars.

Course program and registration:
www.anton-paar.com/apb-academy

Webinar overview and registration:
www.anton-paar.com/apb-webinars

ENJOY ACCESS TO AN EXTENSIVE DATABASE OF KNOWLEDGE

As one of our customers, you enjoy access to a large database of useful application reports, product documentation, and tutorial videos. You also benefit from our comprehensive background knowledge on theory (e.g., from our wiki and the book "Applied Rheology" by the renowned rheology expert Thomas Mezger).

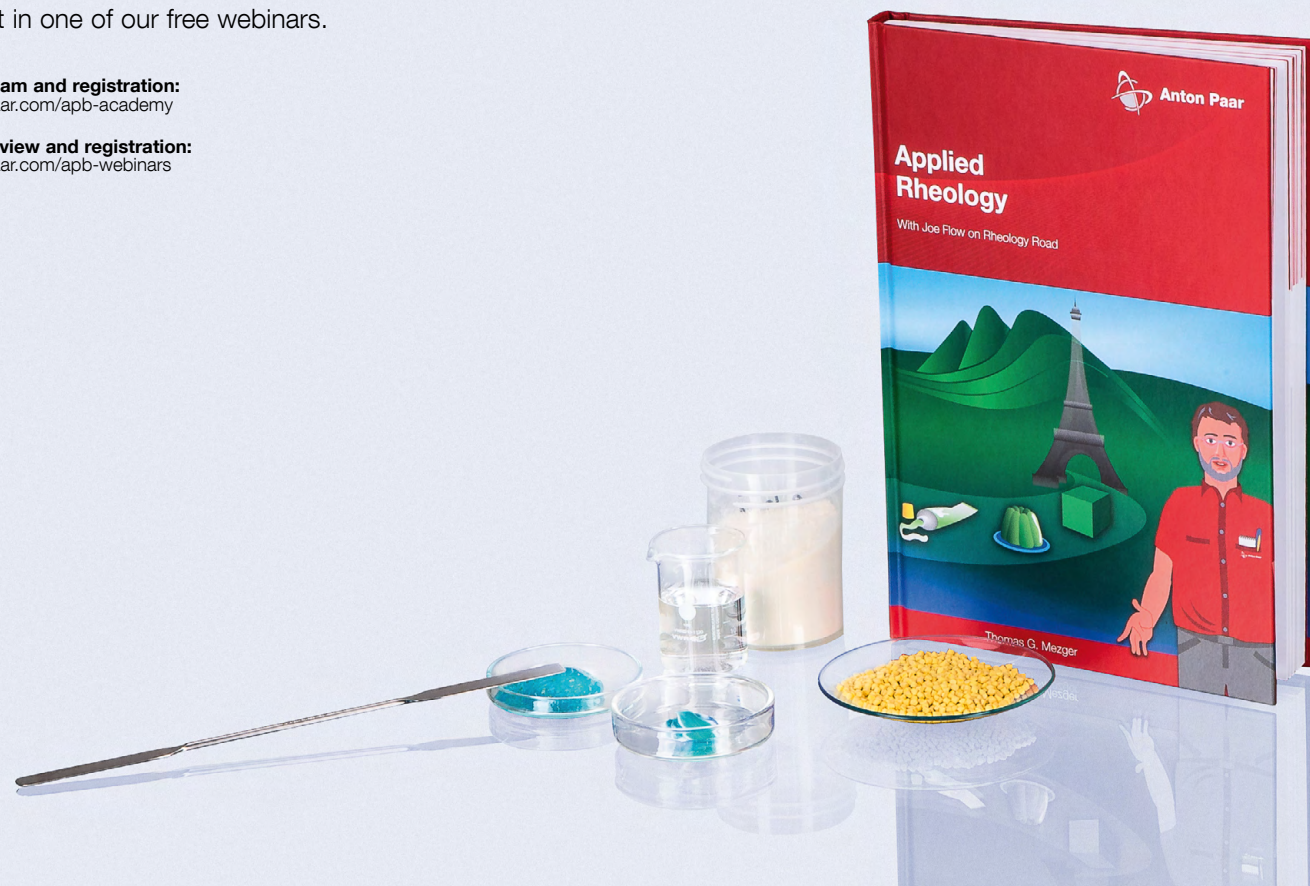
Application reports and product documentation:
www.anton-paar.com/apb-documents

Background knowledge:
www.anton-paar.com/apb-basics

Order the book:
www.anton-paar.com/apb-applied

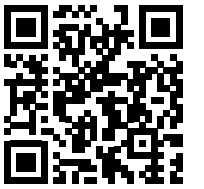
GET IN TOUCH WITH OUR EXPERTS

We provide excellent service and support. With more than 30 Anton Paar subsidiaries and numerous responsible partners worldwide, a rheological expert is close to you and happy to help, in your language and free of charge. Call us for advice on test definitions or to discuss the rheological challenges you're facing.



Reliable. Compliant. Qualified.

FIND OUT MORE



www.anton-paar.com/service

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



Maximum uptime

Regardless of how intensively you use your instrument, we help you keep your device in perfect shape and safeguard your investment. For at least 10 years after the discontinuation of a device, we'll provide you with any service and spare part that you might need.



Warranty program

We're confident in the high quality of our instruments. That's why we provide a full 3-year warranty. Just make sure to follow the relevant maintenance schedule. You can also extend your instrument's warranty beyond its expiration date.



Short response times

We know that sometimes it's urgent. That's why we provide a response to your inquiry within 24 hours. We give you straightforward help from great people, not from bots.



A global service network

Our large service network for customers spans 86 locations with more than 600 certified service technicians. Wherever you're located, there's always an Anton Paar service technician nearby.

| MCR 702e MultiDrive MCR 702e Space MultiDrive | | | | | |
|--|---|--------------------------|--------------------------|--|--|
| | MCR 102e | MCR 302e | MCR 502e Power | Configuration with 1 EC motor | Configuration with 2 EC motors |
| TECHNICAL SPECIFICATIONS | | | | | |
| Bearing design | Air, fine-pored carbon | | | | |
| Motor design | Electronically Commutated (EC) - Permanent Magnet Synchronous Motor | | | | |
| Displacement transducer design | High-resolution optical encoder | | | | |
| Normal force measurement design (US Pat. 6167752, 1996) | 360° capacitive sensor, non-contacting, fully integrated in bearing | | | | |
| Active thermal management of bearing and normal force sensor | × | ✓ | ✓ | ✓ | ✓ |
| Working modes | Combined Motor Transducer (CMT) | | | | Separate Motor Transducer (SMT), Counter-Movement ¹⁾ |
| Minimum torque (rotation) | 5 nNm | 1 nNm | 100 nNm | 1 nNm | |
| Minimum torque (oscillation) | 5 nNm ²⁾ | 0.5 nNm | 50 nNm | 0.5 nNm | |
| Maximum torque | 200 mNm | 230 mNm | 300 mNm | 230 mNm | |
| Minimum angular deflection (set value) | 0.5 µrad | 0.05 µrad | | | |
| Maximum angular deflection (set value) | ∞ µrad | | | | |
| Minimum angular velocity ³⁾ | 0 rad/s | 0 rad/s | 0 rad/s | 0 rad/s | 0 rad/s |
| Maximum angular velocity Maximum speed | 314 rad/s 3,000 1/min | | 220 rad/s 2,100 1/min | 314 rad/s 3,000 1/min | 628 rad/s 6,000 1/min |
| Minimum angular frequency ⁴⁾ | 10 ⁻⁷ rad/s | | | | |
| Maximum angular frequency ⁵⁾ Maximum frequency | 628 rad/s 100 Hz | | | | |
| Normal force range | -50 N to 50 N | | -70 N to 70 N | -50 N to 50 N | |
| With exposed support plate ⁶⁾ (WESP / Space) | × | Optional | × | ✓ ⁷⁾ | ✓ ⁷⁾ |
| Without support plate (WSP) | × | Optional | × | × | × |
| Dimensions (W x H x D) | 444 mm x 678 mm x 586 mm | 444 mm x 733 mm x 586 mm | 444 mm x 753 mm x 586 mm | 444 mm x 753 mm x 586 mm Space: 212 mm x 767 mm x 554 mm | 444 mm x 753 mm x 586 mm Space: 212 mm x 767 mm x 554 mm |
| Weight | 42 kg | 46 kg | 47 kg | 48 kg Space: 51 kg | 58 kg Space: 61 kg |

| RHEOCOMPASS SOFTWARE FEATURES AND SPECIFICATIONS | |
|---|--|
| Get even more out of your rheometer with the most powerful rheometer software on the market | |
| Read more: www.anton-paar.com/apb-rheocompass | |

| | MCR 102e | MCR 302e | MCR 502e Power | Configuration with 1 EC motor | Configuration with 2 EC motors |
|---|----------------------|----------|----------------|----------------------------------|--|
| ADDITIONAL DEVICE FEATURES | | | | | |
| Device display with remote control of software (decoupled from measuring sensor; mechanical and electromagnetic interference prevention) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Direct strain/stress controller | ✓ | ✓ | ✓ | ✓ | ✓ |
| TruRate™/TruStrain™ (sample-adaptive controller) | Optional | ✓ | ✓ | ✓ | ✓ |
| Raw data (LAOS, waveform) | Optional | ✓ | ✓ | ✓ | ✓ |
| Normal force profiles (set and read) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Velocity profiles, tack, squeeze | Optional | ✓ | ✓ | ✓ | ✓ |
| Automatic gap control/setting (AGC/AGS) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Electronic trim lock for measuring geometry | ✓ | ✓ | ✓ | ✓ | ✓ |
| Fully automatic temperature calibration | ✓ | ✓ | ✓ | ✓ | ✓ |
| TruGap™ (permanent control of the real measuring gap) (US Pat. 6499336, 2000) | Optional | Optional | Optional | Optional | Optional |
| T-Ready™ ⁸⁾ (detection of sample temperature equilibrium time) (US Pat. 8904852, 2011) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Toolmaster™ (measuring geometries and accessories, storing of zero-gap) (US Pat. 7275419, 2004) | ✓ | ✓ | ✓ | ✓ | ✓ |
| QuickConnect coupling for measuring geometries (one-hand operation, screwless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Trimming mirror (360° sample blind spot prevention) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Three-point support of device (three robust feet for tool-free one-hand alignment) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Three-point support for mounting of measuring cells (wobble prevention, no misalignment after changing of cells) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Maximum temperature range | -160 °C to +1,000 °C | | | | -160 °C to +600 °C (950 °C ⁹⁾) |
| Maximum pressure range | up to 1,000 bar | | | | n/a |
| Ready for DMA in torsion and tension | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ready for linear drive (DMA in tension, bending, and compression) (US Pat. 9574983, 2015) | × | × | × | ✓ | ✓ |
| Ready for tribology | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ready for powder flow and shear rheology | ✓ | ✓ | ✓ | ✓ | ✓ |

¹⁾ US Pat. 8453496
²⁾ 2 nNm with activated TruStrain™ option
³⁾ In controlled shear stress (CSS) mode. In controlled shear rate (CSR) mode depending on measuring point duration and sampling rate
⁴⁾ Theoretical value (duration per cycle = two years)
⁵⁾ Higher frequencies are possible using multi-wave functionality (942 rad/s (150 Hz) or even higher, depending on measuring system and sample)
⁶⁾ Enlarged working space underneath the support plate (flange)
⁷⁾ MCR 702e Space MultiDrive: Unique maximized workspace below the rheometer support plate and on both sides of the instrument
⁸⁾ Depending on used temperature device
⁹⁾ Customized systems used in CTD 1000

