



Bohlin

C-VOR



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Rheological instruments backed with rheological experience

A high resolution, modular rheometer and dynamic spectrometer system with triple-mode motor control which allows strain, stress or shear rate controlled measurement to be performed. A built-in normal force sensor is used for a range of measurement, gap control and sample loading protocols.

The Bohlin C-VOR is not simply an advanced rheology research tool, it is a complete system ready to measure what you need, in ways you define and with the accuracy which the demands of modern industry and research require.



Triple motor control – with inductive motor technology

Enables the motor to be engaged and run as a conventional servo motor allowing true strain controlled measurements such as relaxation. Alternatively, the motor can be run at pre-set speeds to generate shear rate controlled data. Conversely, by running in open-loop mode, stress controlled tests such as creep and creep recovery can be performed.

Inductive motor technology avoids using permanent magnets and results in a low inertia motor. The motor design gives additional benefits of superb low torque response, does not require user re-calibration, and cannot be affected by any ambient magnetic fields. These design principles and characteristics create a motor with outstanding transient response – a step change in strain can be effected in less than 10ms.

Complete rheology – total control

- **High resolution normal force control**
High resolution normal force sensor incorporated directly into the C-VOR mechanics which gives both extreme sensitivity and a wide range. Capable of measuring just 0.1g, data for the first normal stress difference can be generated at even low values of thrust. In oscillation, the sensor can be used to compress or tension a sample with a pre-defined force using 'autotension' mode
- **Wide dynamic range**
Motor technology combined with an inherently sensitive air bearing generates a dynamic range in torque in excess of 1:1 million, and means that large variations in modulus during material transitions can be properly followed. The minimum torque is just 0.1 μ Nm which enables investigations of even the most weakly structured viscoelastic dispersions.
- **Unique high speed facility**
Unique, high dynamic range position sensor technology can generate data at high shear rates, applicable to coating applications. An upper speed of 600rad s⁻¹ can achieve shear rates in excess of 5 x 10⁵s⁻¹.
- **Sub micro-strain position sensing**
Advanced position sensor technology has obvious benefits in sensitivity for low strain measurement. Complemented by the C-VOR's low torque response, this enables extremely sensitive creep and recovery measurements to be performed.
- **Flexible temperature control**
For maximum flexibility and to suit all testing requirements, the C-VOR can be quickly and easily configured with a wide range of temperature control units. These include fluids circulators, Peltier devices, electrically heated plates and a forced gas oven with a liquid nitrogen cooling option.



Applications – from fluids to solids

- Coatings
- Adhesives
- Cosmetics
- Personal care products
- Foods
- Composites
- Petrochemicals
- Polymers
- Pharmaceuticals
- Asphalt
- Solids
- Low viscosity fluids



Optional equipment

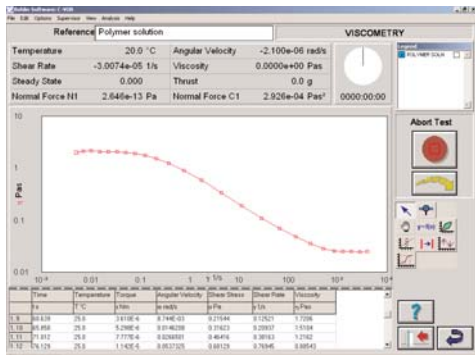
- Parallel plate, cone and plate
- Coaxial cylinders (DIN)
- Double gap
- Small sample cell
- Roughened and serrated systems
- Vane tool
- Solids and fibre film fixtures
- Vacuum disposable systems for thermosets
- Optical UV curing cell
- Optical analysis cell
- High pressure cells
- Electro-rheology cell
- Humidity enclosure



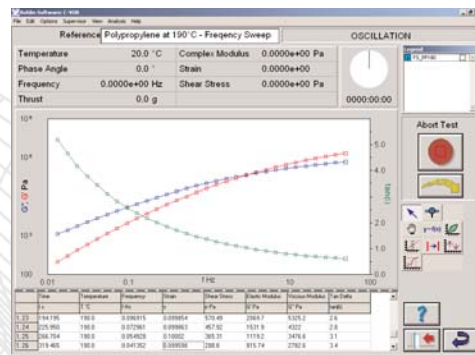
Software to make it happen

As you would expect, all software provided with the Bohlin C-VOR is Windows™ compatible and designed with flexibility and ease of use in mind and includes an in-built rheology “textbook” and topic search facility.

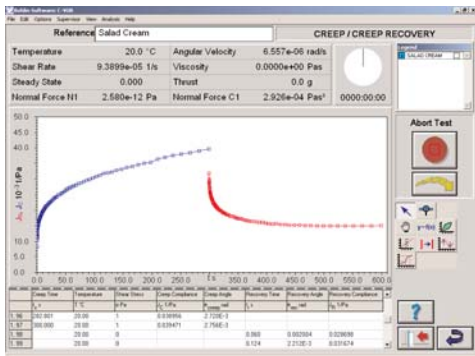
Data analysis programs, which can be incorporated into user-defined templates for automated procedures, include advanced Model Fitting, Time-Temperature Superposition (WLF), advanced viscoelastic analysis (VE data conversion) and molecular weight determination. Multiwave analysis is available as an option.



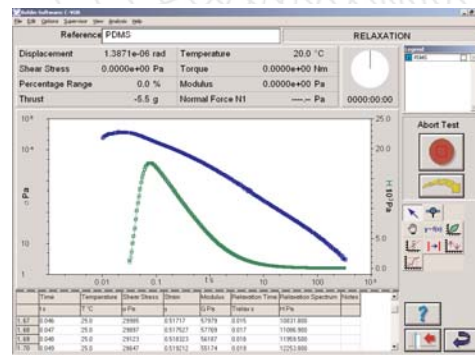
Viscometry measures viscosity as a function of shear stress or shear rate. Measurements include single value of shear rate (or stress), table of shear rates (or stresses), continuous shear rate (or stress) ramp (including yield stress) and complex shear rate (or stress) profile. Temperature control can be isothermal (time sweep), or follow defined gradients or step changes.



Oscillation measures the dynamic viscoelastic properties as a function of frequency. Measurements include single frequency, frequency sweep, amplitude sweep, time sweep and temperature sweep (gradient, step change or profile). Tests can be performed at constant stress or constant strain amplitude (under direct control). Oscillation measurements can be superimposed on steady shear. Partial wave and Multiwave sampling are available.



Creep and Creep Recovery measures the creep compliance and recoverable compliance as a function of time. User defined sampling modes can be set. Zero shear viscosity and yield stress can be determined.



Relaxation measures relaxation modulus as a function of time following a step change in strain. The relaxation spectrum and zero shear viscosity can be determined.

Overview

Bohlin C-VOR

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| <i>Torque range:</i> | 0.1µNm to 150mNm |
| <i>Torque resolution:</i> | 0.1µNm to 200mNm |
| <i>Position resolution:</i> | Better than 1nNm |
| <i>Frequency range:</i> | 50nrad |
| <i>Controlled speed range (CR mode):</i> | 1µHz to 150Hz |
| <i>Measurable speed range (CS mode):</i> | 0.01mrad s ⁻¹ to 600rad s ⁻¹ |
| <i>Normal force N1 measurement range:</i> | 10nrad s ⁻¹ to 600rad s ⁻¹ |
| <i>Step change in strain:</i> | 0.001N to 20N (50N optional) |
| <i>Temperature range (dependent on control used):</i> | <10ms |
| | -150°C to 550°C |

Temperature controls

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|---|------------------|
| <i>Fluids Circulator:</i> | -40°C to 250°C |
| <i>ETO (Extended Temperature Option):</i> | -15°C to 300°C |
| <i>Melts Oven:</i> | ambient to 450°C |
| <i>Peltier Plate:</i> | -30°C to 200°C |
| <i>Peltier Cylinder:</i> | -20°C to 180°C |
| <i>Universal Peltier Option – Coaxial Cylinder or Cone/Plate Geometries</i> | |
| <i>ETC (Extended Temperature Cell):</i> | ambient to 550°C |
| <i>ETC with optional LTU (Low Temperature Unit):</i> | -150°C to 550°C |

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|------------------------------------|--------------------------------|
| <i>Nominal operating voltage</i> | 110 or 220V |
| <i>Size (with Peltier plate)</i> | 52cm (H) x 29cm (W) x 34cm (D) |
| <i>Weight (with Peltier plate)</i> | 27kg |

Optional equipment

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|---|-----------------------------------|
| <i>Measuring Systems</i> | |
| <i>Vacuum Disposable Plates:</i> | Peltier Plate, Melts Oven or ETO |
| <i>High Pressure (Sealed Cell):</i> | 40bar pressure, 30°C to 150°C |
| <i>High Pressure/High Temperature Cell:</i> | 300bar pressure, ambient to 300°C |
| <i>Optical UV Curing Cell</i> | |
| <i>Optical Analysis Cell</i> | |
| <i>Immobilisation Cell</i> | |
| <i>Electro-rheology Cell:</i> | DC voltage up to c.10kV |

Every Bohlin C-VOR from Malvern is backed with the technical and sales support of Malvern Instruments, the only material characterization company with the resources and equipment to measure particle size and shape, zeta potential and molecular weight as well as the expertise to advise on how these parameters influence rheological properties.

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