



Rheological instruments backed with rheological experience

Advanced bench-top capillary rheometers for research, product development and quality control

The RH2000 series of bench top capillary rheometers are compact systems capable of most testing requirements encountered in capillary rheometry. The series is available in both single bore or twin bore configurations, the RH2100 and RH2200 respectively. Both versions incorporate many of the features and attributes found in the floor standing models (Rosand RH7&10). A new digital drive system gives the RH2000 series unsurpassed speed control, accuracy, and dynamic operating range. This new hardware is supported by the latest generation of Windows™ based software, Flowmaster™, offering many new experimental possibilities.



Key Features and Benefits

Rigid frame design

The RH2000 series mechanics are contained within a rigid one-piece housing which gives the cantilever design extreme strength and stiffness. This is an important consideration in transient tests such as PVT, which rely upon compliance free measurement for accurate volume determination.

Swivel head design

A unique, safety interlock protected, swivel design means that the actuated part of the rheometer can be moved to one side affording ease of access for cleaning and sample loading.

Bi-modal speed control

Bespoke bi-modal digital speed control technology has been developed for the latest generation of capillary rheometers. The technology uses different speed control algorithms suited to high and low speed operation to optimize performance. This gives the rheometer an impressive dynamic range in speed control. In practice, the lower limit is determined only by long experimental times at low shear rates but a dynamic range in speed of in excess of 200,000:1 is available if required. This greatly enhances the system's flexibility and means that a wider range of shear rates can be covered using any particular die.

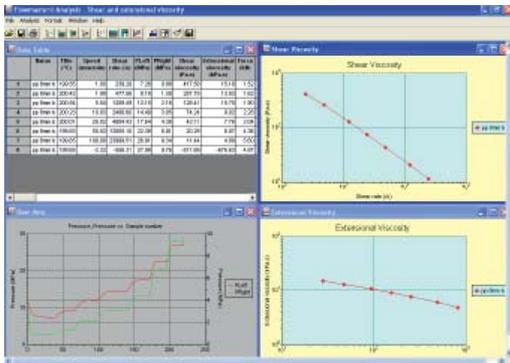
Rosand Twin Bore Principle (RH2200 model)

Rosand capillary rheometers were the first to introduce the twin bore measurement principle to the commercial market. Simultaneous measurements can be made on both long and short dies to determine the inlet pressure drop at the die and, therefore, absolute viscosity, using the Bagley method. More commonly, Rosand 'zero length' dies are used to directly measure the inlet pressure drop and measure the extensional viscosity using the Cogswell method. The twin bore technique gives obvious experimental advantages including improved throughput, since both experiments are preheated simultaneously. Alternatively, the software can be configured to run a two material test which allows measurement of the viscosity of two different materials simultaneously.

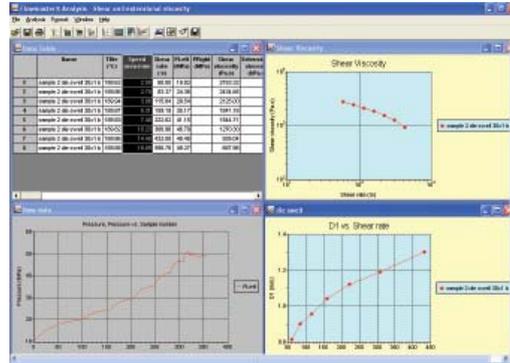


Flowmaster™ software

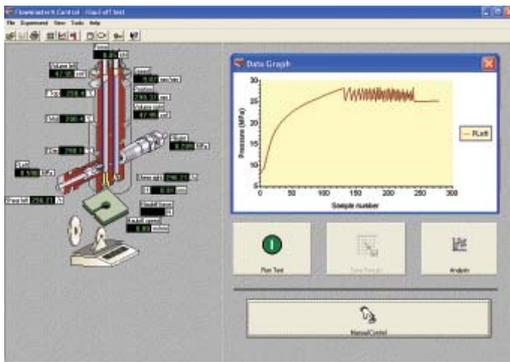
Continuous development of the Rosand Flowmaster™ software has produced a comprehensive data acquisition and analysis package with a wide range of measurement options and an extensive help system.



Constant shear and extensional tests
Measurement of shear or extensional stress and shear or extensional viscosity as a function of shear rate. Extensional tests are carried out with an orifice die.



Die swell Measurement of the extrudate diameter close to the die exit. Directly interfaced with the control software and die swell is stored as part of the measurement data file.



Melt fracture/flow instability Accelerated shear rate ramp with continuous monitoring of the pressure to detect flow instabilities, such as melt fracture which may occur during flow through a capillary die.

Software modules and analysis functions include:

- Constant shear test
- Extensional test
- Manual control
- Flow/no flow
- Non-Newtonian index
- Bagley correction by orifice die and extrapolation methods
- Rabinowitsch correction
- Hagenbach correction for fluid inertia
- Cogswell convergent flow model and extensional viscosity assessment
- Extensive plot and print options
- Data export

Software options

- Wall slip analysis
- Melt fracture/flow instability
- Die swell
- Material degradation/thermal stability
- Low speed degradation
- Eta-0 (Intrinsic Melt Viscosity)
- Stress relaxation
- Low level scripting

Options

The Rosand RH2000 capillary rheometers can be configured with a variety of options to provide complete measurement solutions across all applications.



High Force

Extends the maximum force (summed over both barrels if applicable) to 20kN.

High Speed

Extends the upper speed limit of the unit to 1200mm/min for high shear rate measurement with no loss in speed sensitivity or available force. The high speed option is fully compatible with the high force option.

Barrel Materials and Dimensions

For aqueous or aggressive materials, stainless steel or Hastelloy barrels are available in place of the standard Nitrided steel version. The wide dynamic range in speed means that the standard 15mm diameter barrel is suitable for the vast majority of testing applications. However, barrels are available with 9.5mm, 12mm, 19mm and 24mm bores as an option.

Low Temperature

For applications that require sub-ambient measurements, a special cooling coil option is available.

Accessories

Several accessories are available to suit particular applications or enhance the testing capability of the base units.

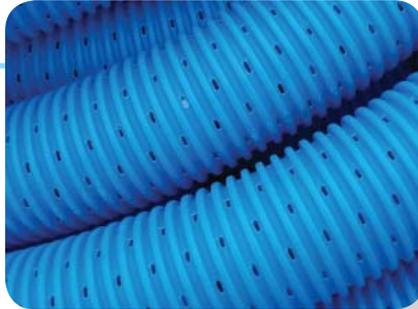
The main accessories are listed below

- Alternative test dies
- Alternative pressure transducers
- Nitrogen purge
- Die and melt cutters
- Laser die swell measurement
- Slot die assembly
- PVT test



Applications

- Polymers
- Foods
- Ceramics
- Coatings and Inks
- Pharmaceuticals



Laboratory and pilot scale testing
Formulation behaviour of complex multi-component systems
Ease of processing

Dimensional stability
Extrusion behaviour
Elasticity and die swell
Mould filling



Thermal properties
Thermal degradation testing
Melt compressibility
Stress relaxation



Simulation of extensional viscosity-dominated processes such as fibre spinning, blow moulding, film blowing and thermoforming

Direct simulation of processing conditions
High shear rate testing including low viscosity fluids
High force testing
Melt fracture and flow instabilities



Overview

Rosand RH2000

Comprehensive rheological analysis

Number of bores	Single (RH2100) Double (RH2200)
Maximum force	12kN standard (20kN option)
Frame stiffness	100kN
Maximum speed	600mm/min standard (1200mm/min high speed option)
Dynamic range in speed	>120000:1 (240000:1 with high speed option)
Speed uncertainty	<0.1%
Temperature range	Ambient to 400°C (500°C option) 5°C to 200°C (Low temperature cooling coil option)
Temperature control	<±0.1°C
Bore diameter	15mm standard (9.5, 12, 19 and 24mm bore options)
Barrel bore length	250mm
Barrel material	Nitrided steel standard (Hastelloy or stainless steel options)
Pressure transducer ranges	30000, 20000, 10000, 5000, 1500, 500 or 250psi
Pressure transducer accuracy	<0.5%
Dies	Tungsten carbide, precision ±5µm
Die diameter	0.5 to 2mm (in 0.5mm increments) and 3mm standard (other diameters, including fine bore dies, available to special order)
Height	Rheometer 1.1m Electronics box 0.65m
Width	Rheometer 0.55m (without accessories) Electronics box 0.34m
Depth	Rheometer 0.65m (without accessories) Electronics box 0.53m
Weight	Rheometer 120kg (without accessories) Electronics box 30kg
Power requirements	Single phase AC 230V 50Hz 16A

Every Rosand RH2000 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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Rosand
RH2000

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