



## Imatek R6000

The R6000 from Imatek is a laboratory grade twin-bore capillary rheometer. In conjunction with the RheoSolve software package it enables you to rapidly make high accuracy rheological measurements on a wide range of materials.

Both shear and extensional properties of the specimens can be obtained, at rates representative of those encountered during normal processing, such as extrusion, injection moulding, blow moulding and film blowing. Suitable for research, process development and quality control in the polymer, food, pharmaceutical, ceramics and many other industries.

Key features:

- High quality instrumentation
- Robust, reliable design
- High throughput
- Low cost of ownership
- CE-approved safety features
- Wide range of optional equipment
- World-class analysis software
- Imatek support



## Mechanical

Construction	H-frame consisting of two vertical 50mm diameter chrome bars, base plate, barrel support, crosshead and top plate. Area below barrel open access Area above barrel guarded, access door with motor drive interlock
Frame strength	250kN
Stiffness	100kN / mm drive to die (with 15mm bore)
Safety	Interlocked guarding to protect operator from moving and high-temperature parts Crosshead force transducer to prevent mechanical damage Motor over-current trip Emergency stop switch Fume extraction 89/392/EEC & 91/368/EEC - machinery safety accreditation
Barrel	Twin bore, 15mm diameter as standard (optional 20mm, 12mm) Bore length 280mm Three zone temperature control, RTD temperature sensors
Dimensions	2400mm(h) x 730mm(w) x 800mm(d) Weight 400kg
Services	220VAC±10%, 16 Amp, 50/60Hz ± 1%, single-phase, Neutral and Protective Earth



## Imatek Rheometer R6000

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### Drive

Type	875W brushless motor driving recirculating ball screw
Feedback	10,000 pulse encoder giving 0.02 $\mu$ m resolution
Range	0 to 50kN drive force 0.01mm/min to 500mm/min speed 50kN/500mm/min combination possible
Drive modes	Constant speed 0.01mm/min to 500mm/min Constant pressure 1% full scale to 95% full scale Constant crosshead force 2kN to 45kN

### Temperature Control

Type	Three zone measurement and control
Sensors	Platinum resistance thermometers to DIN 43760
Accuracy	$\pm 0.5^{\circ}\text{C}$
Uniformity	$\pm 1.5^{\circ}\text{C}$ throughout both barrel bores

### Instrumentation

Pressure transducers	One per bore, mounted just above the dies at equal heights
Ranges available	500, 750, 1000, 1500, 3000, 5000, 7500, 10000, 15000, 20000, 30000 psi
Accuracy	$\pm 0.25\%$ full scale
Temperature drift	0.2psi/ $^{\circ}\text{C}$ melt temperature
Contact material	15-5 PH with Amoloy coating
Data conversion	16-bit
Force measurement	By transducer in crosshead.
Melt temperature	By platinum resistance thermometer to DIN 43760
Flow rate	By 10,000ppr encoder on drive motor, resolution 0.02 $\mu$ m Accumulated position error <50 $\mu$ m full travel
User channels	Five 4-20mA channels are available for connection to user-supplied measurement devices. The inputs are sampled at 16-bits, and the measurements may be recorded and manipulated within the RheoSolve software

### Dies

Type	Tungsten carbide
Tolerance	$\pm 5\mu\text{m}$ diameter, $\pm 10\mu\text{m}$ length
Range	Length 0.25mm to 30mm Diameter 0.25mm to 5mm Entry angle 180 $^{\circ}$ to 60 $^{\circ}$

### User Interface

Display	Backlit LCD display, showing machine operating status and barrel temperature
Input	Keypad and thumbwheel
Functions	Crosshead up/down Set barrel temperature Diagnostics



## Software

The RheoSolve software is a single package that is used to configure experiments and to analyse the resulting data. It may also be used in stand-alone mode for offline analysis.

The software is designed for high productivity and includes many ease-of-use features and very powerful analysis and reporting. The user interface is highly configurable to let you work in the way you want, and a series of user levels can be defined to restrict access to certain features of the software so that less advanced users can use the software without the risk of producing invalid results.

Platform	Windows XP/Vista
Recommended system (minimum)	Pentium 2GHz, 512MB RAM, 80GB disk drive, 1280x1024 display resolution. A single Ethernet port is required for connection to the rheometer.
Rheometer control	Manual crosshead control Temperature zone control Pre-condition sample (thermal stabilisation and compression) Run pre-defined test Purge barrel contents
Transducer database	Details of all transducer configuration, including calibration information, is held in a database, so working with multiple transducers is made more convenient. The software contains routines to assist with multi-point calibration of pressure and force transducers
Die database	Database of available dies Support for capillary, orifice and rectangular slot dies
Available test types	Shear rate sequence – twin bore Shear stress sequence (constant pressure) Thermal degradation tests Pressure vs volume test Melt fracture test Melt rupture test User defined test (script based)
Data logging	Low-pass filtering available Recorded data: 2x pressure, 3x temperature, piston speed, piston position, time, user-defined acquisition channels
Test information	Test progress bar Real time graphs of pressures, speed and position Real-time calculation and graphing of rheological properties
Pressure equilibrium	Automatic or manual
Basic analysis	Calculation of shear and extensional viscosity Calculation of power law index (n) Bagley and Rabinowitsch correction Non-Newtonian index Carreau, Cross, power law and polynomial curve fits
Derived curves	Shear rate, melt volume, volumetric flow rate
User defined curves	Facility to use data from the standard channels (force, pressure, temperature), or user-provided measurement channels to derive further curves
User defined analysis	A powerful set of functions is provided to allow user-defined calculations to be made on the captured data.
Units	The software allows you to work in whatever units you choose – it provides by default SI, cgs and US units, but also allows you to define your own. All numeric quantities (measured data and documentation information) are recorded along with their units, and when results are calculated their resulting units are calculated too, ensuring consistency and greatly reducing the potential for errors.
Documentation	Two types of documentation information are saved along with the test data: automatically recorded documentation (transducer and die information for example), and user-entered



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	documentation. Documentation fields are configurable depending on your particular requirements, and fields can be made mandatory to ensure that critical information is recorded for every test.
Graphs	Graphs are used for displaying measured and calculated data. Multiple tests and multiple quantities may be displayed on the same graph. Highly configurable appearance including colours, automatic or manual axis scaling, linear or logarithmic scaling, user-defined or automatic labelling. Graphs may be zoomed to examine the data in detail.
Tables	Tables are used to display calculated results or documentation information. The results from multiple tests may be displayed in the same table. Flexible formatting includes colours, fonts, column headings, units and the format of numeric results.
Data export	Data can be exported to Microsoft Excel (Office 95 onwards) in native file format. There is also the facility to export data in CSV (comma separated values) format, compatible with almost all numeric analysis packages.
Test database	Test data may be saved either in individual files, or in a test database (Microsoft Access format). Multiple databases may be created, for different users or different applications. Test data stored in files may be copied into the database and <i>vice versa</i> . A powerful search tool can be used to interrogate the database and find tests that match particular criteria: for example, by the date of the test, the type of sample, a shear viscosity falling outside specified limits or a test performed at a particular temperature.
Auto-save	An auto-save facility ensures that data from a test is never lost, and also imposes a consistent naming scheme for data files. Data can be automatically saved to files or to the test database.
User levels	The software provides for three password-protected user levels. The software functions available to each level may be defined, preventing access to sensitive operations that might affect the accuracy of the data.
Saving settings	Entire software configurations, or partial configurations, may be saved and later restored. This facility is useful both as a back-up mechanism and also to allow quick switching between different test types (for example, single bore and twin bore).
Documentation	Full context sensitive help is available, together with a printed and an on-line manual.

## Die Swell Measurement Option

Mode of operation	Optical micrometer using CCD laser
Resolution	5µm
Samples/sec	780
Display	Two colour LED
Measuring area	35mm x 300mm
Minimum object	0.5mm diameter opaque material
Linearity	±0.1% of full scale
Power requirements	110V / 230V, 50/60Hz ac, 500VA

## Melt Strength Measurement Option

Draw-off speed	0.1m/min to 1000m/min
Speed control	Automatic through software or manually via touch screen
Speed sequence	Stepped speed or continuous ramp
Drive	Direct-drive servo motor with high-resolution encoder
Force measurement	Extrudate tension measured via force on pulley-wheel
Force resolution	0.01N
Linearity	<1% full scale