

# RHEOTEST Messgeräte Medingen

## Series RHEOTEST® RN



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### Traditions

Rheometers with the mark name RHEOTEST® are in use in many countries for more than 40 years and represent constancy of Medingen's traditions in development, manufacture and sale of rotational rheometers.



### Novelties

1. There are 2 basic versions of the Rheometer RHEOTEST® RN 4.1 on offer:
  - **PC-controlled** rheometer series RHEOTEST® RN 4.1 with complete software for realization and evaluation of rheological tests in CR-, CS- and Oscillation mode. First time a rheometer system with ball bearings carries out also oscillation tests in a very well price-performance-relation.
  - **Viscometer with separate operating unit.** It enables to carry out tests with controlled shear rate and with controlled shear stress as well as in extreme temperature conditions. At the same time we fulfil first of all requirements of laboratories of oil-producing branch in former CIS countries where it is necessary easy-to-maintain, very reliable and with reasonable price the subsequent model RHEOTEST® RV2.1 for measurement of dynamic viscosity of petroleum products in temperature range of  $-60$  to  $+200^{\circ}\text{C}$ .
2. There are news also in the field of measurement systems. Measurement systems and methods of measurement have been developed as a result of oriented to practical needs cooperation with research institutions. They are very much right for reproducible assessment of rheological properties of substances' systems that contains solid particles, such, e.g., as plasters, adhesive mixtures for ceramic tile, cement binding materials and liquid concrete and are repaid when using in laboratories of building materials.

## Features

Rheometer is a highly sophisticated item of instrument engineering both in development, manufacturing and marketing and also for the consumers and users.

At present *development of rheometers* is justified only in individual cases by needs of existing oriented to the practical purposes branch rheological sciences.

It is required *for the quality production*:

- mature technology of manufacture
- well-trained and experienced production personnel
- high-performance equipment for mounting, adjustment, calibration and final check-up
- good and trustworthy cooperation with the corresponding partners.

*Serious marketing activities* should be oriented in a proper way and require exclusively close cooperation between the marketing service of the manufacturer, possible go-between and future consumer.

It is necessary purpose-oriented training of the service personnel concerning operational regulations of the instrument for its *efficient operation*, as well as corresponding to the requirements After Sales Service that is carried out by the manufacturer or seller.

*Only some manufacturers and suppliers meet these specific requirements.*

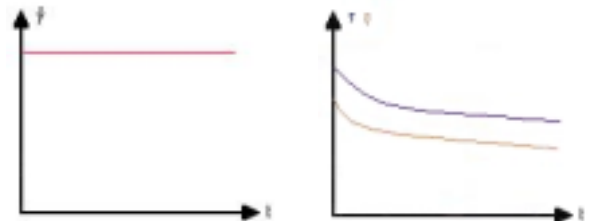
## Price-Performance Ratio

Modular design allows also realization of a long-term investment strategy and successful adaptation in the future to the changing task settings in the field of measurement technique.

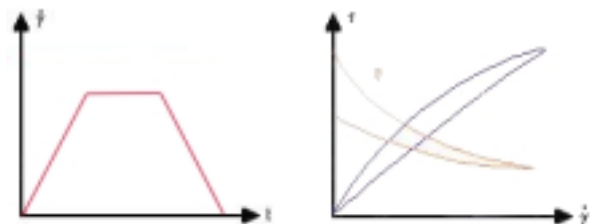
## Possible Types of Measurements (Tests) (depending on selected main version of the instrument)

### Measurements with Controlled Rate (CR-Tests):

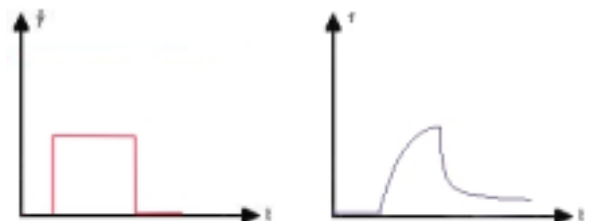
1. Mode: constant shear rate and measurement of shear stress  
Result: viscosity



2. Mode: shear rate - time ramps and measurement of shear stress  
Results: flow curve and viscosity curve

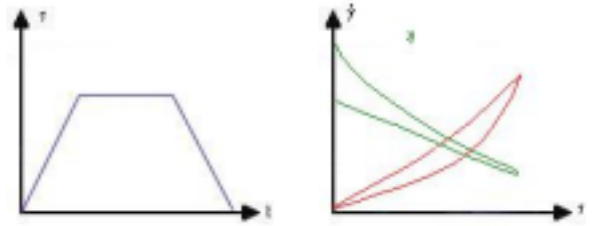


3. Mode: shear rate steps (measurement of stress-/relaxation) and measurement of shear stress  
Results: curve of speed-up and damping, shear modulus, viscosity, time of stress/relaxation

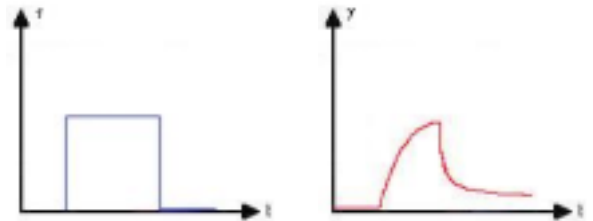


## Measurements with Controlled Stress (CS-Tests):

1. Mode: Controlled stress - time ramps and shear rate measurement  
 Results: flow curve, viscosity curve, yield point



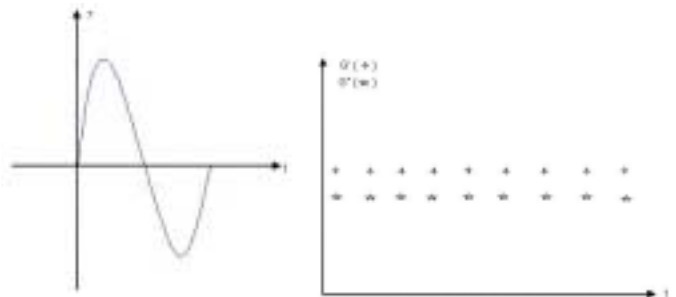
2. Mode: Controlled stress jumps (measurement of creep-/ retardation) and deformation measurements  
 Results: creep diagram, elastic deformation



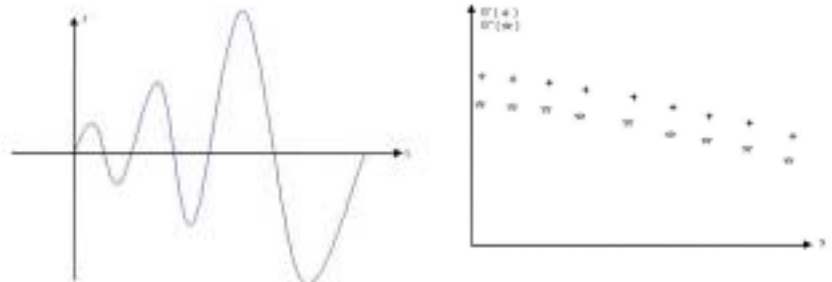
## Measurements with Oscillation Tests

Settings of harmonic stress oscillations and deformation measurement:

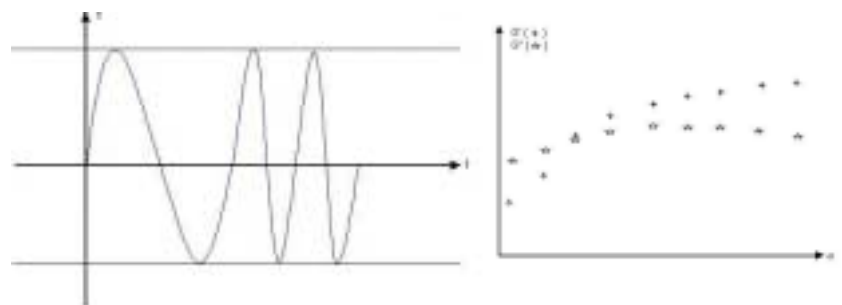
1. Mode: constant amplitude, constant frequency  
 Results: Memory Modulus  $G'$ , Loss Modulus  $G''$ , Complex Modulus  $G^*$ , loss factor  $\tan \delta$  as function of time



2. Mode: amplitude sweep  
 increasing amplitude,  
 constant frequency  
 Results: Memory Modulus  $G'$ ,  
 Loss Modulus  $G''$ ,  
 Complex Modulus  $G^*$ ,  
 loss factor  $\tan \delta$  as  
 function of deformation

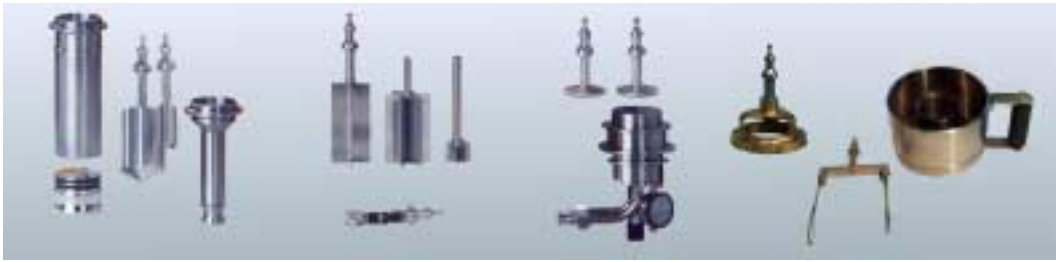


3. Mode: frequency sweep  
 constant amplitude,  
 increasing frequency  
 Results: Memory Modulus  $G'$ ,  
 Loss Modulus  $G''$ ,  
 Complex Modulus  $G^*$ ,  
 loss factor  $\tan \delta$  as  
 function of frequency



## Measuring Systems

- Cylinder measuring system and cone-and-plate measuring system according to DIN
- Special measuring system (castle sensor and measuring cell for liquid concrete ) for construction materials as well as for similar materials as for structure of product and flow properties
- Different blade measuring systems, first of all for yoghurt, dressings and dross



## Several Examples of Application (see our Homepage for more detailed information)

- Development and production of paints, varnishes and other coating materials as well as control of coating process
- Development and production of pharmaceuticals and cosmetics
- Development and production of food products particularly of chocolate and chocolate icing as well as dressings and dairy produce
- Development and production of lubricants
- Development and production of ceramic materials and coating process control of these materials
- Development and production of plastics, initial and intermediate products inclusive

## Main Technical Data

- |                      |                                      |
|----------------------|--------------------------------------|
| • Viscosity Range:   | appr. 1 ... 3 * 10 <sup>9</sup> mPas |
| • Speed Range:       | appr. 0 ... 1000 rpm                 |
| • Speed Accuracy:    | appr. 0,015 rpm                      |
| • Torque Range:      | appr. 0,1 ... 150 mNm                |
| • Torque Resolution: | appr. 0,002 mNm                      |
| • Angle Range:       | appr. -50 ... 300°                   |
| • Angle Resolution:  | appr. 0,001°                         |
| • Frequency Range:   | appr. 0,001 ... 10 Hz                |
| • Temperature Range: | appr. -30 ... 200°C                  |

## Remarks to Viscosity Measuring Ranges

Viscosity measuring ranges for rotational measuring systems published through viscometer and rheometer producer are mostly theoretical measuring ranges. The measuring ranges are calculated with minimum torque, maximum speed of rotation and the geometrical data of the measuring system. That means, most published low viscosity values can be reached only at maximum speed of rotation and samples with Newtonian flow properties.

Upper viscosity values can be reached only with the necessary accuracy if the whole sample was filled into the measuring system in homogeneous condition without cavities, caused e.g. through air bubbles. Also the complete sample material must be thermostated to the measuring temperature very well. In case of high viscous pastes we suggest to use cylinder measuring systems only up to viscosities of appr. 10<sup>5</sup> mPas, because filling the measuring cup without air bubbles is complicated very often. Therefore we suggest to use cone and plate measuring systems for high viscous samples. Within our "Suggested Measuring Range" it is possible to get accurate viscosity values in a larger range of speed of rotation. Additional rheological determinations are possible also in the necessary accuracy.

## Temperature Control Solutions

- Temperature control by liquid for cylinder measuring system
- Temperature control by liquid for cone-and-plate measuring system
- Temperature control by Peltier system for cone and plate measuring system

## Order Overview

Order No.	Description	
<u>Main Instrument, PC-controlled</u>		
3022.1.00001	Main instrument RHEOTEST RN 4.1 with stand and software for CR-Tests	
3022.1.00003	Main instrument RHEOTEST RN 4.1 with stand and software for CR- and CS-Tests	
3022.1.00005	Main instrument RHEOTEST RN 4.1 with stand and software for CR-, CS- and Oscillation tests	
<u>Main Instrument with separate operation unit</u>		
3022.1.00006	RHEOTEST® RN 4.1-SE for CR- and CS-tests with stand, electronic unit and operation unit	
<u>Package version for petroleum products according to GOST 1929:</u>		
3022.0.00001	RHEOTEST® RN 4.1-SE with selected cylinder measuring systems (rotors H1+H2, measuring cup G1, temperature control vessel G with Pt 100)	
3022.0.00002	RHEOTEST® RN 4.1-SE with selected cylinder and cone-plate measuring systems (rotor H1, measuring cup G1, temperature control vessel G with Pt 100, cone and plate measuring system with cone K3)	
<u>Package version for greasing substances and fats:</u>		
3022.0.00003	RHEOTEST® RN 4.1-SE with cone-and plate measuring system and cone K3	
<u>Package version for chocolate and chocolate glazes according to OICCC-Standard:</u>		
3022.0.00004	RHEOTEST® RN 4.1-SE with DIN-cylinder measuring system (rotor S1, measuring cup G1, temperature control vessel G with Pt 100)	
<u>Cylinder measuring system (viscosity ranges are recommended values)</u>		
	viscosity	shear rate
3021.2.33100	Rotor S 1    20 ... 10 <sup>5</sup> mPas	0,13 ... 1300 s <sup>-1</sup>
3021.2.31100	Rotor H 1    10 ... 10 <sup>5</sup> mPas	0,20 ... 2000 s <sup>-1</sup>
3021.2.31200	Rotor H 2    100 ... 10 <sup>5</sup> mPas	0,04 ... 400 s <sup>-1</sup>
3021.2.31300	Rotor HS     3 ... 10 <sup>4</sup> mPas	0,67 ... 6700 s <sup>-1</sup>
3021.2.35100	Rotor S 2    100 ... 10 <sup>5</sup> mPas	0,13 ... 1300 s <sup>-1</sup>
3021.2.31400	Rotor H 3    100 ... 10 <sup>5</sup> mPas	0,10 ... 1000 s <sup>-1</sup>
3021.2.31500	Rotor H 4    200 ... 10 <sup>5</sup> mPas	0,04 ... 400 s <sup>-1</sup>
3021.2.36600	Blade rotor F1 20 ... 10 <sup>5</sup> mPas for sedimentary and shear sensitive substances (blade diameter 34 mm)	
3021.2.36700	Blade rotor F2 100 ... 10 <sup>5</sup> mPas for sedimentary and shear sensitive substances (blade diameter 14 mm)	

Order No.	Description
3021.2.33300	Measuring cup G1 (for rotors S 1, H 1, H 2, HS, F1 and F2)
3021.2.33600	Special plug HS for measuring cup G 1 (for rotor HS) (More rapid temperature control is achieved due to reduced quantity of material under study)
3021.2.33400	Measuring cup M1 (for rotors S 2, H 3, H 4 and F2)
3021.2.03000	Temperature-controlled cup G with Pt 100 (for measuring cup G1)
3021.2.05000	Temperature-controlled cup M with Pt 100 (for measuring cup M1)
<u>Cone and plate measuring system (viscosity ranges are recommended values)</u>	
3021.2.50000	Measuring plate complete (with Pt 100, mounting and adapter)
3022.2.51000	Measuring plate system with Peltier measuring plate and Pt 100, cooling unit, temperature control unit and power supply, measuring plate support and adapter
	viscosity
	shear rate
3021.2.53200	Plate P1    Ø 36            100 ...    10 <sup>8</sup> mPas            —
3021.2.53300	Cone K 1    Ø 36/0,3°        10 ...    10 <sup>6</sup> mPas        2 ... 20000 s <sup>-1</sup>
3021.2.53400	Cone K 3    Ø 36/1°            50 ...    10 <sup>7</sup> mPas        0,6 ... 6000 s <sup>-1</sup>
3021.2.53500	Cone K 5    Ø 36/5°            100 ...    10 <sup>8</sup> mPas        0,12 ... 1200 s <sup>-1</sup>
3021.2.55200	Plate P2    Ø 12                1000 ...    10 <sup>9</sup> mPas            —
3021.2.55300	Cone K 2    Ø 12/0,3°        500 ...    10 <sup>8</sup> mPas        2 ... 20000 s <sup>-1</sup>
3021.2.55400	Cone K 4    Ø 12/ 1°            1000 ...    10 <sup>8</sup> mPas        0,6 ... 6000 s <sup>-1</sup>
3021.2.55500	Cone K 6    Ø 12/ 5°            1000 ...    10 <sup>9</sup> mPas        0,12 ... 1200 s <sup>-1</sup>
3022.2.51100	Cone KP    Ø 70/ 1°
3022.2.54000	Cone K8-P                            1 ...    2*10 <sup>5</sup> mPas        0,6 ... 6000 s <sup>-1</sup>
<u>Measuring system for building materials</u>	
3022.2.60000	Measuring cell for fresh concrete, cement binding material and other strong sedimentary products, that consists of: cyclic measuring chamber with claw type rotor (stainless steel)
3022.2.70000	Crown sensor for plaster, adhesive mixture and other inhomogeneous products (with high content of solid, gas and liquid inclusions)
<u>Special accessories</u>	
3022.2.22000	Software for PC-controlled CR- and CS-tests valid only for version RHEOTEST® RN –SE
3022.2.24000	Software to control specific thermostats / cryostats, valid only for RHEOTEST® RN, PC-controlled
without no.	Different liquid thermostats
without no.	PC
without no.	Printer