HIGH PRESSURE CAPILLARY RHEOMETERS

RHEOGRAPH 20, 25, 50, 75, 120

GÖTTFERT

Single- or multi barrel system for determination of the flow- and viscosity function

The **RHEOGRAPH 20, 25, 50, 75** and **120** with CAN-Bus technology were developed with the experience and potential from more than 40 years of the numerous generations before.
A higher rate of automation and user friendliness, a wide shear rate range as well as a testforce, which might be sufficient for many applications come as a standard.
Many useful options and nonstandard features can be realized.

The integrated color touchscreen, the automatic pressure transducer detection and the adaptive signal processing of the pressure signal (resolution 0.005%) are only a few of the noteworthy benefits.
With the script capable database Software "LabRheo" this device family fulfills exactly the requirements users from the Research & Development as well as Quality Assurance or Incoming Goods Inspection have to a product which meets the industrial standard.

Technical Highlights

- Single, twin or triple barrel system in 9.55, 12, 15, 20, 25 or 30 mm design – even mixed sizes possible
- Speed range 0.00004 – 40 mm/s (1:1000000), RG20: 0.0001 - 40 mm/s
- High dynamic acceleration of the test piston:

from 0 to 40 in 0.6 seconds

- Displacement sensor with an high resolution encoder
- Temperature range up to 400°C (500°C optional), display resolution 0.01°C
- "Plug & Test" pressure transducer connectivity without the need for manual entries by the user
- Adaptive Pressure Signal resolution down to 0.005 % of full range

RHEOGRAPH 20
The basic model

20, 25, 50, 75 or 120 kN force range...

Example views:

RHEOGRAPH 25

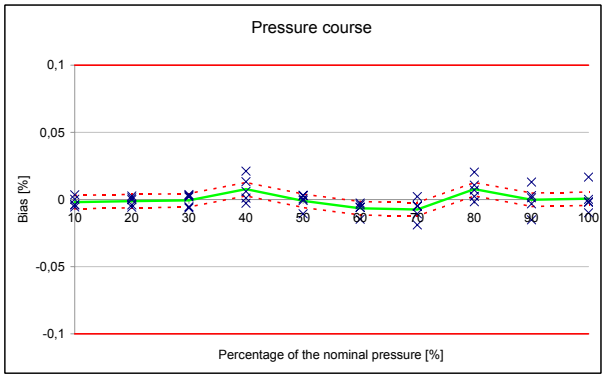
RHEOGRAPH 50

RHEOGRAPH 75

View previous model

RHEOGRAPH 120

View previous model



Increased accuracy with improvements to the pressure measurement!

As an example, a **2000 bar** pressure transducer now resolves down to only **0.1 bar**, or using a 30.000 PSI transducer that resolves down to only 1.5 PSI.

2000 bar → 0.1bar → 0,005%

The initial situation of the old machine generation

The NEW Precision

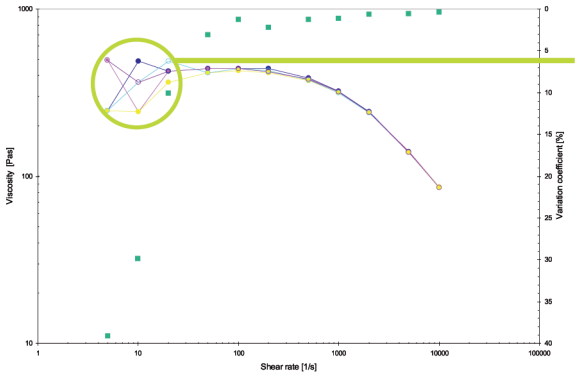


Figure 2:
Detection of the repeatability with the RHEOGRAPH 2003/6000 at the example of Polycarbonate (or method used currently by all other manufacturers)

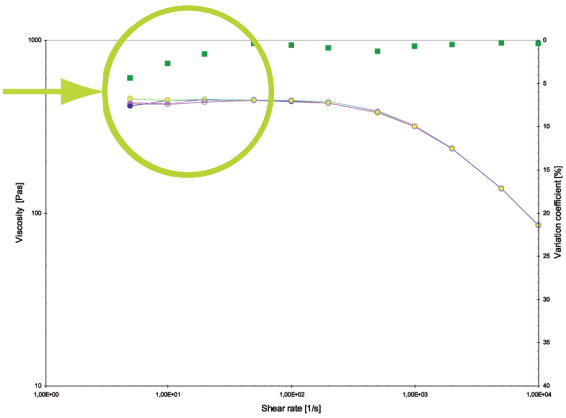


Figure 3:
Detection of the repeatability with the RHEOGRAPH 120 with optimized signal preparation

In the figure (3) the same measurement is shown with the new device (RHEOGRAPH 120) using optimized signal preparation. The lower measurement range was expanded by a full decade down to a shear rate of only 5 1/s with similar repeatability.

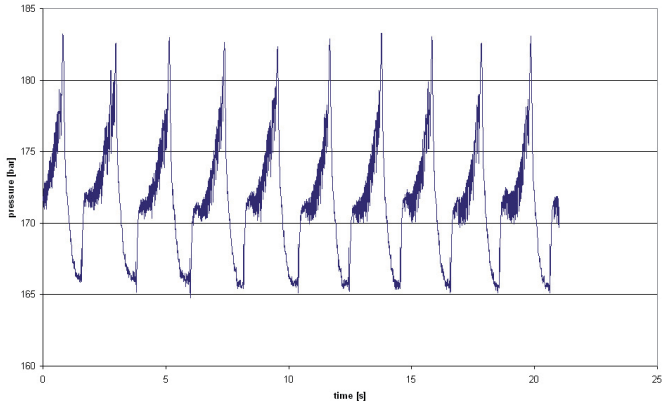
Summary:

With the latest machine generation RHEOGRAPH 20, 25, 50, 75 and 120 the accuracy of the pressure measurement was improved by more than factor 10.
The example above, with Polycarbonate, clearly shows that this accuracy leads to a widening of the measurement range of at least one decade.

The improvements in overview:

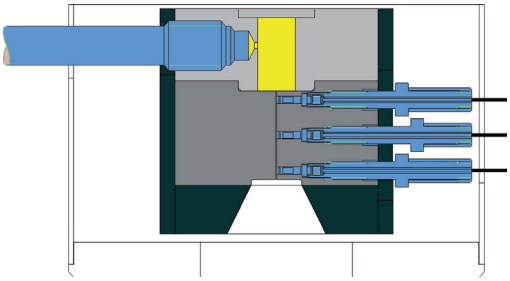
+ Resolution of the pressure measurement smaller than 0.005 % of full range
+ Improvement of the repeatability by factor 10 running testing material
+ Repeatability of the pressure measurement smaller than 0.05 % of full range
+ Broadening of the measuring range in the lower shear rates by at least one decade

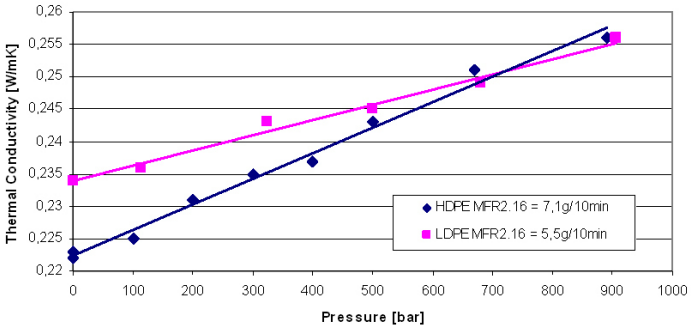
> Less test runs must be made, therefore less cleaning and less time spend on combining different test runs
> Less pressure transducers must be bought and calibrated



Determination of Flow Instabilities (Shark-Skin)

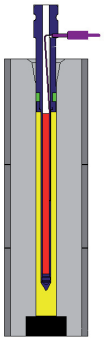
- Measuring cell for detection of the Shark-Skin effect
- Consisting of slit die, 3 new designed and higher frequented sensors (sample rate up to 20 kHz), as well as Software package
- Determination of the frequency spectrum and the statistical evaluation of the pressure signal
- Used for optimization in extrusion, film- and coating process

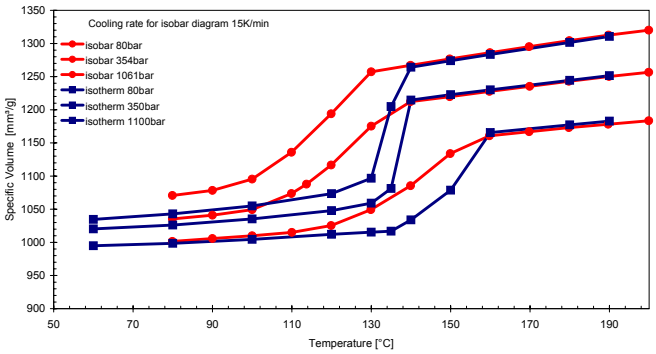




Thermal Conductivity

- Measurement of heat conductivity
- Temperature range up to 450°C, pressure up to 1000 bar
- Developed according to ASTM D5930
- Test probe with integrated heater element and temperature sensor
- No mechanical changeover required
- Process simulation and optimization of injection molding cycle times
- Also with automated sequence control possible

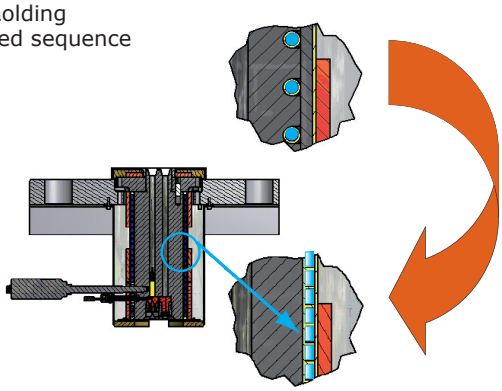


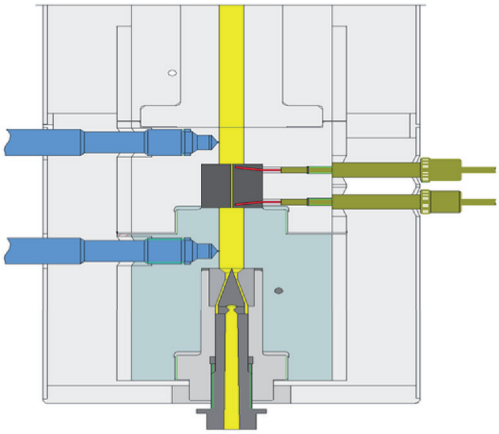


PVT (Pressure - Volume – Temperature)

- Measurement according to ISO 17744
- Determination of characteristics Pressure, Volume and Temperature
- Measurements isobar and isotherm
- Variable test sample volume
- Easy handling with quick die locking system
- Presentation of a PVT diagram
- Optimizing of the flow and shrinkage behaviour during injection molding
- Also with automated sequence control possible

New: **Optimized cooling system**



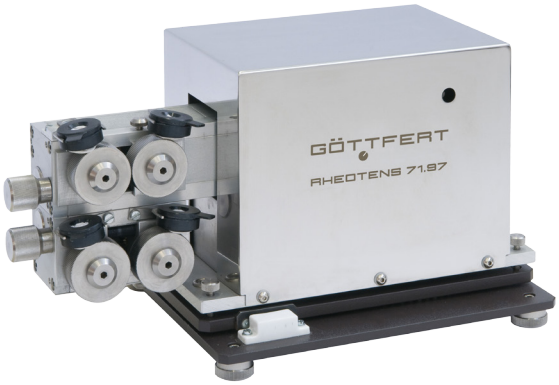


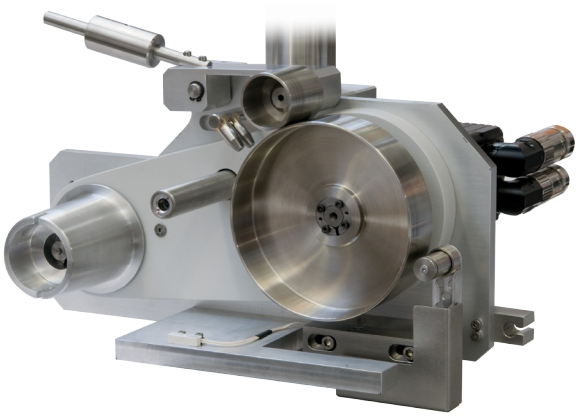
Pressure dependance of the viscosity, the Counter Pressure Chamber

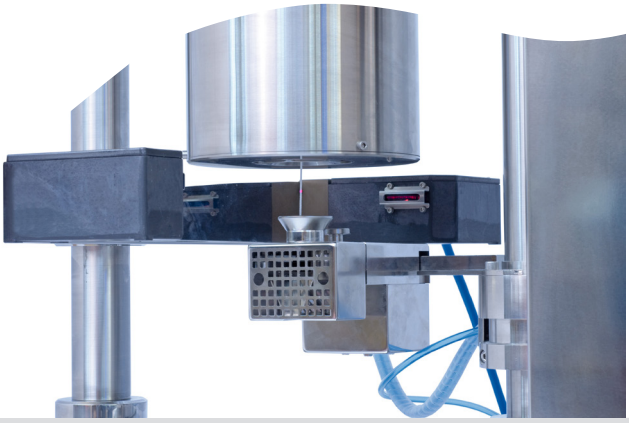
- Determination of the pressure coefficient
- Determination of the critical wall shear stress for wall slip
- Maximum mean pressure (Pm) 1200 bar
- Temperature range up to 400 °C
- Optimization of the flow process in converting machinery (injection molding, extrusion tools with long flow paths, melt pumps)

RHEOTENS / HAUL-OFF

- Measurement of melt extensional viscosity according to model Wagner
- Usable for nearly all materials
- Stepless variable speed from 0-114 m/min (HAUL-OFF 0-2000 m/min)
- Linear or exponential acceleration
- Force measurement range 0-2 N, resolution 0.001 N
- Automated force calibration
- Draw off wheels with smooth or corrugated surface (wheel cooling optional)
- Second pair of wheels avoid sticking of the test material
- Used in blown film and forms, spinning and coating







Die Swell Measurement

- Determination of the dynamic and static die swell
- Analysis of swell profile (BASELL method)
- Swivel arm with stepless height adjusting
- Standard resolution with 7 µm (micrometer) or with the high resolution system 0.1 µm
- Optional with melt cutting system
- Application: Simulation of the material swell behavior during injection molding

Network capable Software system for parameterization, measurement and evaluation

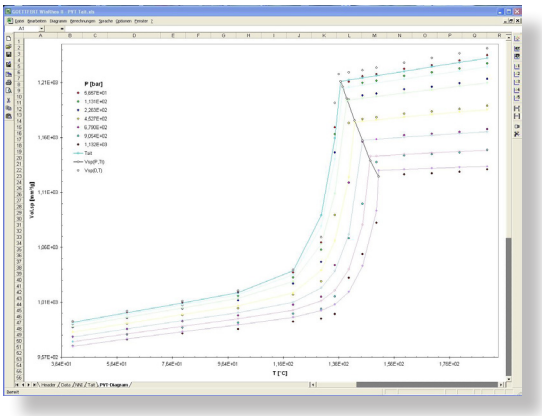
Functions

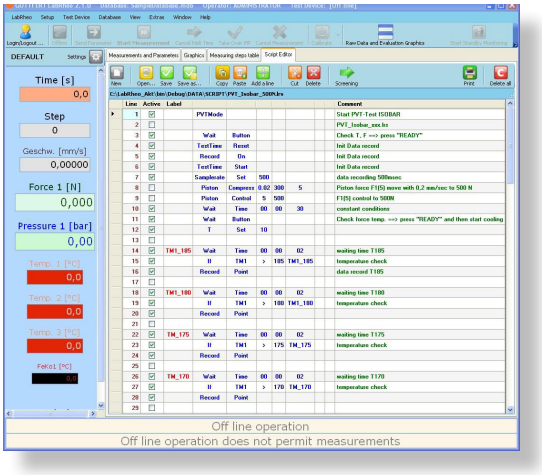
Ease of use, covering a wide range of application needs, this software offers an all in one solution tool.

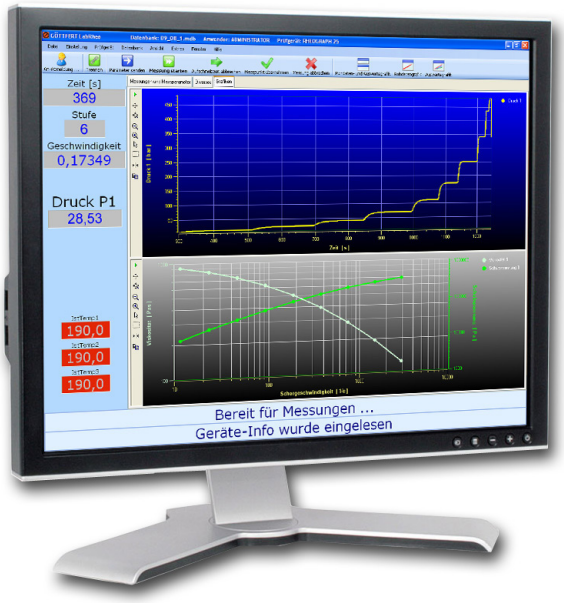
- Use of Microsoft ACCESS Database
- Freely configurable display of data tables and graphics
- Continuous display of the device status
- Automated acquisition of all test instrument data
- Online help, self-diagnostic and info fields to help the user
- Open platform for user specified fields and filters for measurements
- Managed access rights for more data security
- Script controlled measurement procedure

Evaluation with WinRheo II

- Calculations for round hole and slit capillaries
- Corrections like Rabinowitsch-Weissenberg, Bagley (linear/non-linear), Mooney, Hagenbach, Gleissle
- Approximation of flow curves according to the following models:
  Ostwald-De Waele (Power law), Carreau-Winter, Yasuda, Sabia, Muenstedt and Cross
- Elongation viscosity according to Cogswell
- A wide range of evaluation tools such as Non Newtonian Index calculation (NNI), thermal degradation, relaxation or wall slip and ramp functions
- Normal stress
- PVT – Diagramms with Tait adaption
- Temperatur Shift
  - Creation of master curves at different temperatures
  - Determination of model coefficients for the master curve
  - Approximation f the master curve according to Carreau-Winter and Cross
  - Calculation of shift factors according to WLF and Arrhenius










			Model			
			RHEOGRAPH 20	RHEOGRAPH 25	RHEOGRAPH 75	RHEOGRAPH 120
Test barrel geometry		Force range	20 kN	25 kN	75 kN	120 kN
	1-Barrel	9.55 mm	•	•	•	•
		12 mm	•	•	•	•
		15 mm	•	•	•	•
		20 mm	•	•	•	•
		25 mm	-	•	•	•
		30 mm	-	-	•	•
	2-Barrel	2x 12 mm	•	•	•	•
		2x 15 mm	•	•	•	•
		1x 12 mm + 1x 15 mm	•	•	•	•
		2x 20 mm	-	-	-	•
	3-Barrel	2x 12 mm + 1x 15 mm	-	-	•	•
		3x 12 mm	-	-	•	•
		3x 15 mm	-	-	-	•
		3x 20 mm	-	-	-	•
		Other geometries on request	•	•	•	•
Temperature	Range: +5°C higher than room temperature up to 400°C (option 500°C)		•	•	•	•
	Temperature control algorithm, Display +/- 0.01°C		•	•	•	•
	Temperature control: 3x Pt100 sensor		•	•	•	•
	5 Temperature calibration and control data set		•	•	•	•
	Integrated timer for temperature set value		•	•	•	•
Motion	Servo drive, resolution 0.0000016 mm		0.000053 mm	•	•	•
	Test piston speed range 0.00004 - 40 mm/sec (0.0024 - 2400 mm/min.)		0.0001 - 40 mm/s	•	•	•
	Drive torque monitoring and display		•	•	•	•
	Continuous variable control of test piston movement		•	•	•	•
Sensors	Pressure transducers / Accuracy 0.2 % of range		20 to 2000 bar / •	20 to 2500 bar / •		
	Force transducers / Accuracy class / Accuracy		20 kN / 0.02 / 0.4 %*	25 kN / 0.02 / 0.4%*	75 kN / 0.02 / 0.4%*	120 kN / 0.02 / 0.4%*
	Maximum number of pressure / force transducers		5 / 2	5 / 2	5 / 3	5 / 3
	Automatic identification of installed pressure transducers		•	•	•	•
	Adaptive signal processing of pressure signal		+/- 0.005 %	+/- 0.005 %	+/- 0.005 %	+/- 0.005 %
General	Device integrated PC with 14.48 cm (5.7") Color-QVGA-Touchscreen		•	•	•	•
	Microsoft Windows® data base Software "LabRheo" (script capable)		•	•	•	•
	Measuring mode constant speed or Pressure/Force		•	•	•	•
	3 times overload detection		•	•	•	•
	Power supply 3x400V, 3x230V / 50/60Hz		1 x 230V 50/60 Hz	•	•	•
	Size device (width x depth x height)		850x635x1550 mm	920x600x1655 mm	1020x700x1775 mm	1020x700x1775 mm
	Size table (width x depth x height)		600x600x550 mm	920x700x620 mm	1020x700x620 mm	1020x700x620 mm
	Weight		about 270 kg/600 lbs	about 400 kg/900 lbs	about 580 kg/1300lbs	about 600kg/1400lbs
Options	All options can be installed and used with the RHEOGRAPH 20, 25, 75 and 120 More applications and modifications on request * in range from 1% to 100%		Detection of flow instabilities (Shark-Skin)			
			Thermal Conductivity			
			PVT			
			Die Swell			
			Melt Cutting Unit			
			Pressure dependence of Viscosity (Counter Pressure Chamber)			
			Slit Die			
			RHEOTENS			
			HAUL OFF			
			Thermocouple (for determining the melt temperature)			
			External tempering of the test chamber			
			Corrosion- and wear-resistant test barrel system			
			Nitrogen purge unit			
			Pneumatic or battery driven cleaning device			

We take care of our instruments; you take care of its measurements.
Our reputation in each other's hands.

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