

Online-Rheometer

Generate real-time process information on the rheological and molecular structure of polymers



- + Viscosity
- + Melt Index (MFR/MVR)
- + Elongation Viscosity
- + Flow Rate Ratio
- + Intrinsic Viscosity

Online-Rheometer

Rheological measurements in real time

Reliable process control

A GÖTTFERT Online-Rheometer provides 24/7 measurement data of polymer melts to evaluate material properties as well as processability. Whether with or without melt return, GÖTTFERT Rheometers feature a compact design and can be easily integrated into your process.

In most applications, the Online-Rheometer is used for process monitoring (MFR/MVR measurement) and control of polymer melts. MFR/MVR is measured and displayed continuously every second. Due to the high reproducibility of the measured values and the high availability of the Rheometer, many customers already use the Online-Rheometer for product classification, while the Melt Flow Indexer plays only a secondary role.

GÖTTFERT Online-Rheometers use capillary (round-hole) dies, allowing fast purging and efficient material changes – another aspect of their scale-up capability compared to conventional Melt Flow Indexers.

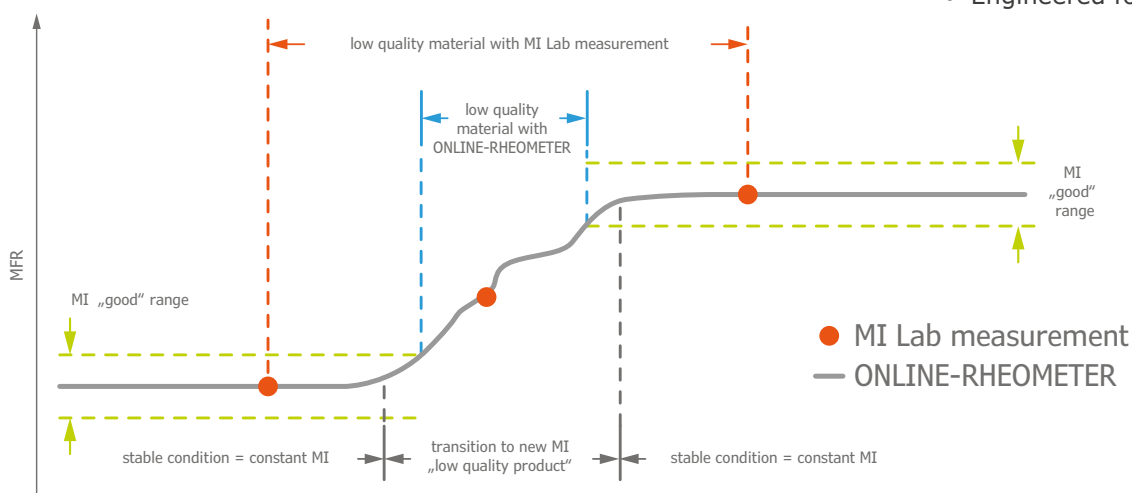
With Online-Rheometers, significant cost savings can be achieved – either through automation of workflows, reducing personnel costs, or through improved process control during material changes, resulting in fewer low-quality intermediate products.

Equipped with special melt pumps, the system can also be used for measuring products containing recyclate. Optionally, operation up to 450 °C is possible.

HIGHLIGHTS

- Elongation viscosity with all Twin Die Rheometers (TD)
- Advanced shear rate range of up to 5 decades
- Online determination of Bagley correction and wall slip
- Consideration of dissipation in the spinning pump and die
- Compensation of process temperature fluctuations up to 40 °C
- Correlation to intrinsic viscosity
- Standardized components -> reduced spare parts for all Rheometer types
- Plug and Play exchange of electronic and mechanical components
- Wide cable distances possible up to 500 m
- Easy to maintain by integrated purge valves and shut off valves
- Process adaptations realized by GÖTTFERT
- Engineered for Recycling process

APPLICATION EXAMPLE





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MBR/MBR-TD

Rheometer without melt return

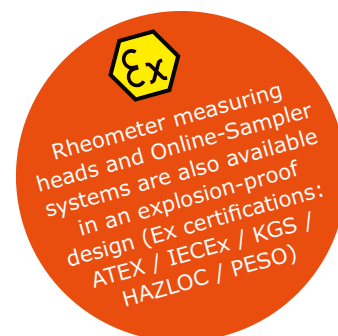
- Particularly suitable for small batches and frequently changing products
- Small internal volume to minimize residence time
- Purge valve for fast product changes
- Suitable for degrading, reactive, foaming materials that must not be returned to the process
- Fast adjustment of the measuring range through simple capillary exchange
- Expandable with successor measurements of the melt strand



SSR/SSR-TD

Rheometer with melt return

- No material waste
- Easy installation, only one bore required
- Flexible installation position
- Cost-effective Online-Rheometer with melt return
- Very compact design



RTR/RTS-TD

Rheometer with melt return, ideal for process control

- Very short response time due to circulating flow, even at low MFR/MVR
- RTS-TD with two capillaries: wide MFR/viscosity measuring range; direct determination of flow exponent
- Especially suitable for production monitoring and control
- RTS-TD prepared for integration of IR/UV sensors
- Temperature controlled electronics chamber, no drifts, exact measurement
- + Add-on: Determination of extensional viscosity

Extensions for advanced material characterization

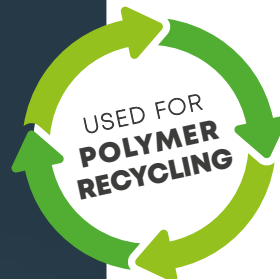


In some applications, not the polymer melt itself but the precursor or the granulated end product needs to be examined. For this purpose, we offer the ideal solution with our **AT-LINE-RHEOMETER (ALR)**. The Online-Rheometer measuring heads are mounted on a GÖTTFERT laboratory extruder and supplied with melt. Material feeding of the laboratory extruder is fully automated by our Online-Samplers. Additional measuring systems can be integrated downstream:

- Die Swell Measurement
- Melt elongation with RHEOTENS, HAUL-OFF
- Shark Skin
- Film unit with optical film analysis

Mini-Bypass-Rheograph

Compact Online Capillary Rheometer for laboratory applications and measurement of degrading, foaming and reactive materials



HIGHLIGHTS

- Measuring head can be directly flanged to the production line
- Very compact design
- Easy die exchange and barrel cleaning
- Wide measuring range due to a shear rate ratio of 1:1000
- Used for frequently changing products in laboratory application
- Direct relation to Melt Indexer with special dies
- Operation at constant speed (shear rate) or constant pressure (shear stress)
- Single-point or multi-point measurement
- Operation via PC, integrated industrial workstation, or directly through the process control system
- Cost-effective Online-Rheometer
- MBR strand outlet is very constant and usable for various strand measurements
- Shear viscosity
- MBR-TD: additional elongational viscosity
- Counter-Pressure-Chamber: Determine pressure influence on viscosity measurement; measure foaming materials



Learn more goettfert.com/mb



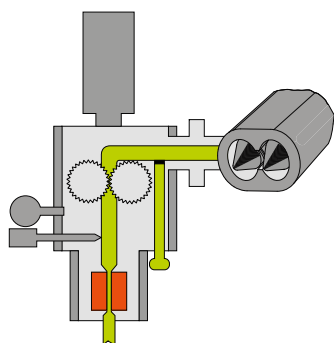
MBR/MBR-TD

A compact Online Capillary Rheometer for **continuous measurement of MFR and the viscosity function** in polymer production (measuring head can be directly integrated into the production extruder).

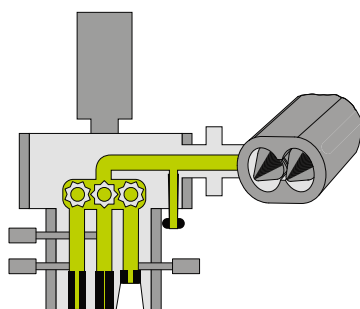
The MINI BYPASS RHEOGRAPH is distinguished by its extremely **compact design**. With a system width of approx. 150 mm, it is one of the **smallest Online-Rheometers** available, enabling integration even in challenging extruder configurations.

Due to its low weight of only 30 kg, complex mounting arrangements are not required. An innovative die locking system simplifies die changes and further enhances user-friendliness.

The system is also suitable for measuring degrading, reactive, or foaming materials and provides a continuous output of an exact melt strand for subsequent measurements.



Measuring principle MBR



MBR-TD with three dies

MEASUREMENT RESULTS

Depending on the operating mode, the following measurement results are available:

- Melt Flow Index (MFR) or Melt Volume Index (MVR)
- FRR (Flow Rate Ratio), ratio of two successive MFR/MVR measurements corresponding to different weight loads in laboratory testing
- Apparent shear rate, shear stress and viscosity
- Measurement of degrading materials that must not be returned to the process
- MBR-TD: Shear viscosity (Bagley-corrected); Elongational viscosity

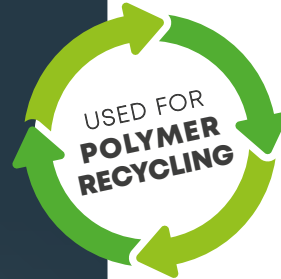
ADD-ON

- + Counter Pressure
- + Elongation (HAUL-OFF, RHEOTENS)
- + Die Swell Measurement
- + Shark Skin
- + Filter measuring option according EN 23900-5
- + Spin Line Rheometer

Also for hazardous areas Zone 1, 2, 21, 22 and Class 1 Div 2.

Side-Stream-Rheometer

Compact Online Capillary Rheometer with melt return
at low cost and minimum installation space



HIGHLIGHTS

- No material waste
- Extruder installation also possible retroactively (only one bore required)
- Flexible installation position
- Especially suitable for production monitoring
- No downtime due to purging procedures
- Flexible installation position
- Maintenance-friendly machine design
- Used for continuous process control of virgin and recycled PET
- Easy calibration to MFR
- Cost-effective Online-Rheometer with melt return
- Very compact design
- SSR-TD: Shear viscosity (Bagley-corrected); Elongational viscosity



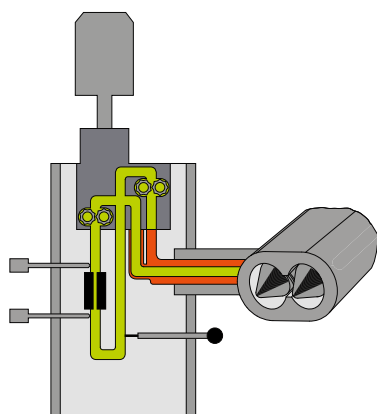
Learn more goettfert.com/ssr

SSR/SSR-TD

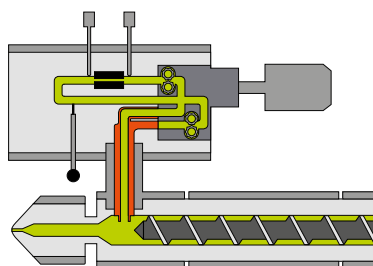


The concept of the SSR side-stream Rheometer is based on an annular gap system developed by GÖTTFERT many years ago.

This system enables both the feed and return melt channels to be realized in an Online-Rheometer with melt return – all with only a single bore. Used for process control, for example for IV measurement and for controlling additives (such as glycol).



SSR, horizontal installation



SSR, vertical installation (in red melt return)

TECHNICAL SPECIFICATIONS

The SSR annular gap adapter is compatible with the standardized M36 x 1.5 bore. This enables **flexible and fast connection of the SSR to any existing extruder bore that was already intended**, for example, for pressure or temperature measurements.

This results in **minimal planning effort at low cost**.

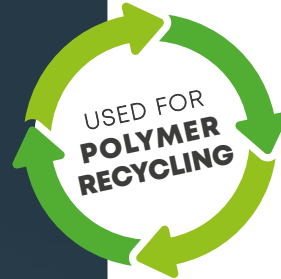
The **compact design** allows both horizontal and vertical installation on the extruder.

The proven ROSWin Windows software, also used in the RTR/RTS and MBR series, enables the determination of the melt index in a range of 0.001–10 cm³/10 min (capillary 60/8) or 5–5500 cm³/10 min (capillary 60/1) **without requiring a die change**.

Also for hazardous areas Zone 1, 2, 21, 22 and Class 1 Div 2.

Real-Time-Rheometer

Online Capillary-Rheometer with melt return for continuous real-time measurement and process control



HIGHLIGHTS

- Shear and elongational viscosity
- No material waste
- Very short response time through continuous circulation flow
- Significantly larger MVR measuring range than MBR or SSR
- Especially suitable for production monitoring
- No downtime due to purging procedures
- Flexible installation position
- Maintenance-friendly machine design
- Continuous calculation of flow exponent
- Measurement of extensional viscosity (Add-on)
- Prepared for IR/UV measuring sensors



Learn more goettfert.com/rtr



RTR/RTS-TD

The Real-Time-Rheometer RTR/RTS is a continuously measuring Capillary Rheometer designed for use in online process control due to constant answering time, even when running low MI's. It is applied for production monitoring and control of both high- and low-viscosity polymers during raw material manufacturing and processing.

In a closed loop, the RTR returns the melt taken from the product line back into the process after measurement.

Differences and benefits of RTS-TD (Twin die) to RTR (one die): The RTS-TD is the first Online-Capillary Spectrometer to provide real-time information on the rheological and molecular structure of polymer melts. In addition to the melt index, a viscosity spectrum and the flow exponent are determined in continuous operation.

RTS-TD equipped with a zero length die the Rheometer corrects bagley pressures losses and measures corrected shear viscosity and elongation viscosity in an alternating mode of operation, which is only possible with GÖTTFERT RTS-TD.

The new elongation viscosity function provides a high level of selectivity for different material structures such as branching and molecular weight distribution. RTR / RTS-TD can not only be used in virgin material production. With special pumps the Rheometer is also a perfect match for process supervision and control in recycling applications.

RTS-TD can be equipped with 1/2" UNF sensor probes for IR/UV/color measurement in reflection or transmission. Ideal to measure rheological and spectroscopic data at same conditions.

Also for hazardous areas Zone 1, 2, 21, 22 and Class 1 Div 2.

TECHNICAL SPECIFICATIONS

Melt return

No melt is lost. Disposal and removal of melt are no longer necessary.

Short residence time

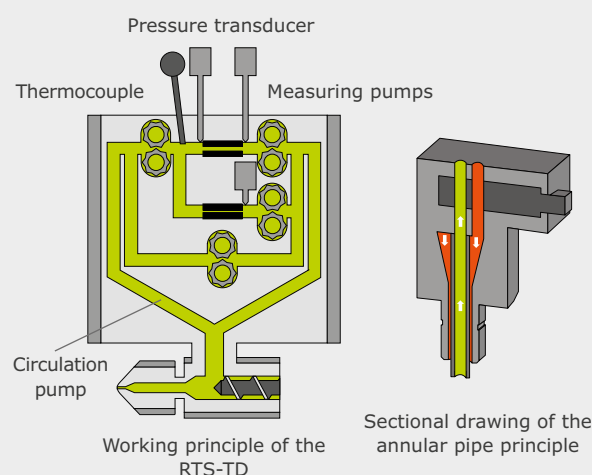
Since the circulating stream (CS) operates at up to 100 times the flow rate of the measuring stream (MS), residence times are significantly reduced, preventing polymer degradation. For process control (e.g. peroxide control) the constant answering time is ideal.

Large measuring range

Because the CS always ensures sufficient flow, measurements in the MS can be taken even at the lowest pump speeds. The usable control range is 1:1000, corresponding to an MFR range 0,035 – 27600 g/10min. Changes in molecular structure can be detected down to a minimum shear rate of 0.1 1/s, while the CS drastically reduces residence time.

Short response time

The short residence times achieved by the CS result in equally short response times during material changes.



Software

Multifunctional software system for complete control of all Online-Rheometer, Extrusimeter and downstream units

ROSWin - intuitive and powerful

The Windows-based software is the **central control and visualization platform** for continuously measuring Online-Rheometer and Extrusimeter. Downstream units can also be integrated seamlessly.

Key advantages:

- Stable on all Windows operating systems
- Continuously tested in-house in several hundreds of customer applications
- Easy operation and flexible visualization
- Open interfaces (analog, Modbus RTU/ASCII, Profibus DP, OPC server)



Control of measurement processes

In addition, ROSWin includes a **comprehensive evaluation package**. For **advanced rheological analysis** of ROSWin measurement data and comparison with lab data, the proven WinRheo II software is used.

- **Configuration** of the rheometer for various measurement procedures via parameter sets
- **Storage** of all parameters and measurement data in databases
- **Rheological evaluation** of measurement data (extended evaluation with WinRheo II)
- **Display of measured** variables in tables, diagrams and trends
- **Freely definable protocol** printouts of test values, alarms and parameter files
- **Access rights** and freely definable window arrangements for individual visualization
- Automatic **calibration** of the rheometer to preset MFR/MVR set values
- **Adjustable limits** for all measured variables
- **Digital output** of operating states
- Network connection: OPC, Modbus, Profibus/Profinet
- Several compensation methods and models integrated

360° SERVICE

To ensure consistently reproducible and reliable test results, periodic maintenance of dependable testing instruments is essential. Our **globally active and highly trained team** of service technicians guarantees long-term reliable and precise rheological test results.

Our professionally trained service team and our certified quality management system (according to international standard DIN EN ISO 9001) **ensure fast and reliable worldwide service.**



Learn more
goettfert.com/maintenance

Specifications

Overview of main parameters



Modell	MBR/MBR-TD	SSR/SSR-TD	RTR/RTS-TD
MFR (Melt Flow Rate)*	0,0375-29600 g/10 min / 0,06-1700 g/10 min	0,035-27600 g/10 min	0,035-27600 g/10 min
FRR (Flow Rate Ratio)*	•	•	•
MVR (Melt Volume Rate)*	0,07 - 3700 cm³/10 min	0,07 - 3400 cm³/10 min	0,001 - 5500 cm³/10 min
Viscosity	0,3 Pa*s - 500 KPa*s		
Shear stress	280 Pa - 31 Mpa		
Shear rate	0,065 s ⁻¹ - 54200 s ⁻¹	0,06 s ⁻¹ - 50600 s ⁻¹	0,06 s ⁻¹ - 50600 s ⁻¹
Single or multi-point measurements	•	•	•
Alternating tests (freely definable test cycles)	•	•	•
Automatic MFR adjustment (MFR(TM), MFR(T0))	•	•	•
Bagley- and Mooney-Correction	- / •	-	•
Test mode constant pressure/speed	•	•	•
Working range	40 - 350 °C / 60 - 350 °C ①	40 - 350 °C ①	40 - 350 °C ①
Temperature control algorithm, display +/- 0.01 °C	•	•	•
Temperature control via Pt100 sensor (1/3 DIN B)	•	•	•
Thermocouple Fe-CuNi Type "J", Class 1, for melt temperature	•	•	•
5 temperature calibration and controlling data sets	•	•	•
Ambient control cabinet conditions	0 - 55 °C / IP54 (IP65**)		
Servo drive, accuracy	+/- 0,1 min ⁻¹		
Torque range	0,1 - 100 min ⁻¹		0,1 (5) - 100 min ⁻¹
Torque	33 Nm / 50 Nm	100 Nm	MP 100 Nm, ULP 70 Nm
Displacement rate	0,4 cm³/U ② ③	0,372 cm³/U ③	MP (2x) 0,595 cm³/U ③ ULP 1,321 cm³/U ③
Overload protection, electronic and mechanical	•	•	•
Multiple-die reception	- / •	-	- / •
Diameter 0.5 to 10 mm, lengths of up to 40mm, e.g. L/D=20/0.5, 40/10 RTR: 60 mm long capillaries, but also zero die	•	•	•
Tolerance dimensions +/- 0.0005	•	•	•
Pressure transducer (bar) / max. system pressure (bar)	20, 50, 100, 200 / 300		
Accuracy (bar)	+/- 0,1		
Automatic pressure transducer detection	•	•	•
Adaptive signal resolution of pressure signal	+/- 0,005 %		
Internal PC with 14.48 cm (5.7") color QVGA touchscreen	•	•	•
Machine control (PLC) with Microsoft Windows® database software „ROSWin“ (if necessary WR II) on external PC; Internal PC -> PLC Machine	•	•	•
Measuring head installation position	fixed	variable	variable
Circulating stream (bypass)	- / -	-	•
Purge valves	• / •	•	•
Shut-off valve	•	•	•
Three-phase mains voltages possible acc. to local conditions	•	•	•
Dimensions measuring head (height x width x depth)	550 x 175 x 335 mm / 580 x 140 x 410 mm	664 x 147 x 361 mm	550 x 175 x 335 mm
Weight	approx. 20 kg / ca. 22 kg	approx. 30 kg	approx. 70 kg

Optional expansion and follow-up units:

- Distance from control cabinet to measuring head up to 400m
- Explosion-proof version, Gas-Ex: Ex II 2G Ex h IIC/IIB T2 Gb X and Dust-Ex: Ex II 2D Ex h IIC/IIB IP65 Ta,max Db X
- Connection to process control system via Modbus RTU, Modbus TCP, Profibus DP, Profinet as well as OPC server
- Pre-pressure control unit (recommended for pulsating system pressure)
- Programmable analog measured value output
- Programmable digital outputs
- Remote control and digital display on extruder
- Additional heating circuits
- Special adapters for connection to various (third-party) extruder systems
- Integrated industrial workstation

- Remote maintenance via telephone or internet connection
- Engineering support
- Various PC configurations
- Further applications and modifications on request
- Subject to technical modifications

* Depending on the material, die and operating mode

** Optional

① Optionally 450°C

② 0,6 ccm/U ; 1,2 ccm/U optionally

③ Special pumps depending on application



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