

Melt Flow Indexer

The testing device can be individually adapted to the application by means of variously automated basic devices and many options.



+ Melt Density

+ Die Swell

+ Viscosity

+ Elongation

mi1

Highest precision - minimal automation



Learn more goettfert.com/mi1

According to standards:

ISO 1133
ASTM D1238
ASTM D3364



mi1

The mi1 is a **very compact** melt flow index tester. The plastometer impresses with maximum measuring accuracy using **high-quality** measurement-relevant components.

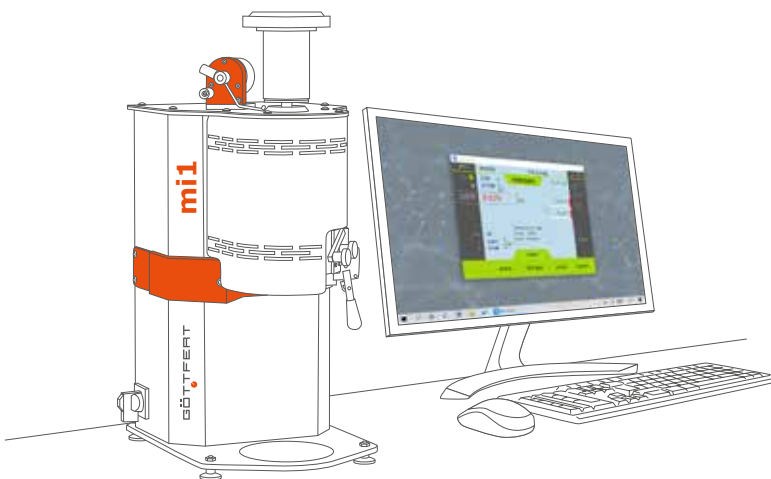
The compact, space-saving design enables cost-effective incoming goods and quality control of plastics in accordance with ISO1133 and ASTM D1238.

HIGHLIGHTS

- High resolution displacement transducer 0,003mm/Impulse
- Handling of measurement via single multifunctional Button
- Display of the Parameter menu and measurement results **via VNC** possible on various PC's
- Without installation

ADD-ON

- ⊕ Melt density
- ⊕ Moisture measurement instrument



mi2

Flexible, compatible, systematic



Learn more goettfert.com/mi2

According to standards:
ISO 1133
ASTM D1238
ASTM D3364



mi2

The mi2 series easily performs **MFR** (Melt Flow Rate), as well as **MVR** (Melt Volume Rate) measurements.

Due to the modular design of this system, it is possible to automate the measurement process step by step. The extrusion plastometer can be used either as a stand-alone instrument, or it can be run with a computer software for statistical analysis and data management.

mi2.2

The mi2.2 has a higher operating comfort than the mi2.1 thanks to an **automated weight lifting unit**. This enables users to start the measurement automatically after the pre-melt time, to lift the weights at the push of a button and to move to the starting position after the measurement has been carried out.



mi2.3

The Melt Flow Indexer mi2.3 has a **full weight handling system**, whose magazine holds up to 8 weights. There is no need to lift or move weights manually.



HIGHLIGHTS

- Convenient operation and display of measurement results via touch-screen

OPTIONS

- Manual die plug
- Automated melt cutting unit
- Nitrogen purge
- Barrel and piston in corrosion resistant or abrasion resistant design

ADD-ON

- + Melt density
- + Moisture measurement instrument

MI-3

Semi-automated melt indexer with full set of integrated measuring weights matching highest expectations



According to standards:
ISO 1133
ASTM D1238
ASTM D3364

HIGHLIGHTS

- High resolution displacement measurement (0.006 mm/pulse) with automatic determination of the resolution
- Automated pre-compression of the sample
- Weight guided test piston
- Individual selection of the basic weights (standard 1.2 kg)
- Weight magazine with integrated test weights from 2.16 kg to 21.6 kg (max. 8 weights)
- Additional weights optional
- Automated weight lifting unit



Learn more [goettfert.com/MI-3](https://www.goettfert.com/MI-3)



MI-3

The MI-3 is equipped with a weight magazine, to enable the operator to **choose the measuring weight manually**.

The instrument enables operators in quality control (QC) and incoming goods inspection to conduct single measurements, while meeting highest quality standards according to ISO 1133, as well as ASTM D1238 (Procedure A-B-C).

The high resolution position sensor with an automatic selection of the resolution allows a repeatable, reliable determination of MFR and MVR.

Besides the standardized measurement processes (ASTM and ISO) GÖTTFERT also provides add-ons, which are positively contributing to the total value of the instrument.

OPTIONS

- Manual die plug (also heatable for polymers with high temperature)
- Automated die plug
- Manual or automated melt cutting unit (also for sticky polymers)
- Nitrogen purge for hygroscopic polymers
- Barrel and piston in corrosion resistant or abrasion resistant design
- Automated backup of all values in the event of power failure via UPS
- Optimized test piston fixing, whereby users may choose to affix the piston to the weight, or not
- Battery powered cleaning device
- Pneumatic ejection unit (up to 50 kg/100 kg)
- Air exhaust unit at the test chamber

ADD-ON

- + Die Swell measurement
- + Automated determination of melt density with an integrated laboratory scale

mi40

Higher accuracy, as well as a higher level of automation, are the key advantages



HIGHLIGHTS

- Force controlled pre-loading/ ejection via drive and test weights
- Multi-load tests with up to 8 different weights, ascending, descending or freely selectable (ASTM procedure D)
- High precision timer with a resolution better than 0.001 s
- Temperature control algorithm, resolution 0 to 320 °C: 0.01 °C, 320 to 500 °C: 0.1 °C
- High resolution position transducer to measure volume output with automatic determination of resolution (0.006 mm/pulse)
- Automated weight selection



Learn more goettfert.com/mi40

mi40

The new generation of melt flow index measurements by GÖTTFERT is represented by the mi40. Operators in quality control (QC) departments have experienced the advantage of further **automated melt index measurements and the exact determination** of MFR (Melt Flow Rate) as well as MVR (Melt Volume Rate) according to ISO 1133 as well as ASTM D1238 (Procedure A-B-C-D).

Due to force compression with up to 60 kg, **the reproducibility is reaching a new standard**. An additional advantage of the mi40 is the **multi-load measurement** with up to 8 different weights, which are operable in a descending and ascending mode.

Thus the mi40 can be used to run a shear rate curve, using each weight to measure one shear rate. Therefore, it is possible to compare the mi40 to a measurement unit which is similar to a capillary rheometer.

The cleaning process of the test chamber was simplified by a freely accessible test chamber. The cleaning of the test chamber, which is necessary after every single measurement, is further helped by an integrated, semi-automated cleaning device.



OPTIONS

- Integrated, electric operated cleaning unit
- Manual die plug (also heatable for polymers with high temperature)
- Automated die plug
- Manual or automated melt cutting unit (also for sticky polymers)
- Nitrogen purge for hygroscopic polymers
- Barrel and piston in corrosion resistant or abrasion resistant design
- Automated backup of all values in the event of power failure via UPS
- Optimized test piston fixing, whereby users may choose to affix the piston to the weight, or not
- Air exhaust unit at the test chamber

ADD-ON

- ⊕ Die Swell measurement
- ⊕ Automated determination of melt density with an integrated laboratory scale

mi40 visco

For extended viscosity measurements



HIGHLIGHTS

- Melt indexer and moderate shear capillary rheometer
- Modified motor controller which controls the piston speed between 0.1-40 mm/s in 0.1 mm/s steps
- Modified Test piston to meet ISO 11443 measurement standard
- Measurement force of up to 800 N (max. pressure of 110 bar)
- Viscosity die with length 10 mm and a diameter of 1 mm (L/D=10/1 mm)
- Easy to use software extension for viscosity measurements



Learn more goettfert.com/mi40-visco

mi40 visco

Melt Flow Index Testers, also called plastometers, are used to measure the melt flow rate (MFR) and the melt volume rate (MVR) of pellets, powder or fine granules. Plastometers are generally designed according to the relevant standards ISO 1133 and ASTM D1238.

Using a capillary rheometer, the measurement is more challenging to operate and time consuming compared to a standardized MFR-test. Now using the Add-on "visco" for mi40, running these viscosity tests is as easy as standardized MFR-tests.

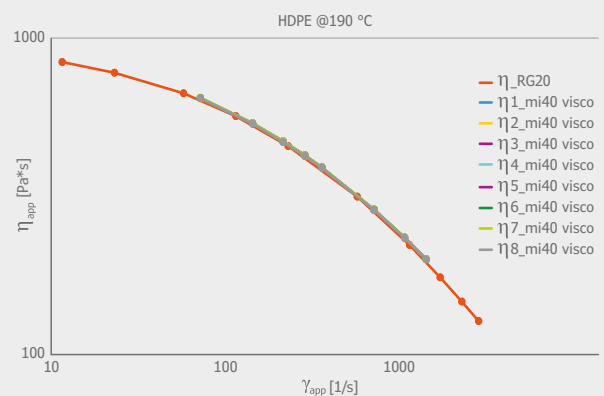
In this test mode, the mi40 is using the integrated motor to push the piston at constant defined speeds. The resulting pressure is measured with a force transducer in the piston holder. Compared to normal MFR-measurements, it is possible to reach higher shear rates which are more relevant for actual production processes.

Therefore, viscosity tests with this GÖTTFERT Plastometer are more **like a processability test** compared to the standard MFR-test.

ADD-ON

- + Die Swell measurement
- + Automated determination of melt density with an integrated laboratory scale

VISCOSITY MEASUREMENT



mi40 visco vs. Capillary Rheometer RG20 with HDPE, MFR (190 °C/2,16 kg) = 9 g/10min

IV TESTER

Determination of the Intrinsic Viscosity



HIGHLIGHTS

- Determination of Intrinsic Viscosity without chemical solvents
- Simple and fast measurement method
- Characterization of the average molecular weight of PET/PA/P



Learn more [goettfert.com/iv-tester](https://www.goettfert.com/iv-tester)

IV TESTER

The IV Tester is used to determine the **intrinsic viscosity** also called solvent viscosity or intrinsic viscosity.

No chemical solvents are used in the determination. This method is used in particular for quality control of polyester (PET) or polyamide (PA). The tester does not require a PC.



OPTIONS

- Manual die plug (special heated version for high temperatures available); Automatic melt cutting unit
- Nitrogen purge for hygroscopic materials
- Alternative steel grades for barrel and piston with higher corrosion or abrasion resistance
- Data protection of parameters and results via uninterruptible power supply
- Pre-compression and ejection with a higher weight

ADD-ON

-  Dryer/moisture measurement instrument

MI-ROBO 89.16

Fully automated Melt Index Tester
Filling, measuring, cleaning



HIGHLIGHTS

- Greatly increased accuracy and repeatability vs. more manual systems
- Complete automation of melt index measurements
 - ▶ autom. sample preparation
 - ▶ autom. measurements
 - ▶ autom. cleaning of test plunger, test channel and nozzle
- Integrated sample magazine for 30 single tests, to fill with plastic granules, powder or similar material profiles
- Temperature control algorithm, resolution 0 to 320 °C: 0.01 °C, 320 to 500 °C: 0.1 °C
- Precise digital position sensor to measure volume output
- High precision timer with a resolution better than 0.001 s
- MFR measurements according Method A (Determination of melt density)

According to standards:

ISO 1133
ISO 1133
ASTM D1238
ASTM D3364
BS 2782
NF51-016



Learn more goettfert.com/mi-robo

MI-ROBO

The MI-ROBO runs the melt flow rate testing process, sample loading, cleaning and die changing **fully automatically** and performs according to ISO 1133 and ASTM D1238 standards for granulate, as well as powder materials.

This means fully automated filling of the barrel, with running the process of the measurement as well as die and barrel cleaning right after the measurement. **Any number of measurements** can be conducted one after each other, **without any intervention of an operator.**

The MI-ROBO is individually configurable according to customer materials. This ensures the opportunity to measure all kinds of plastic material with a fully automated instrument.

OPTIONS

- Sample magazine in Standard or Inlet Design for sticky materials
- Additionally fixed loads with automatic load selection, for pre-load and test load selection
- Magazine heating
- Nitrogen purge
- Automated sampler feeding (option for sample magazine in Standard Design)
- Barrel and piston in corrosion resistant or abrasion resistant design
- MFR measurements according Method A (Determination of melt density)



SPECIFICATIONS

- A variety of cleaning tools assure optimized cleaning procedures
- Individual filling and cleaning procedures specified for each material
- Automated melt cutting unit
- Test chamber electrically heated with easily changeable test barrel
- 5 temperature calibration data sets, each with separate control parameters for optimal adaptation

SOFTWARE UND OPTIONS

mi2-Series, MI-3 and mi40

SOFTWARE miCONNECT

- Uniform and user-friendly operating concept
- Browser-based inspection software
- Easy setup, management and analysis of inspection plans
- Support of Microsoft® Access and Microsoft® SQL databases
- Flexible search filter (inspection plans/measurement results)
- OPC/UA interface
- Easy installation



Img. 1



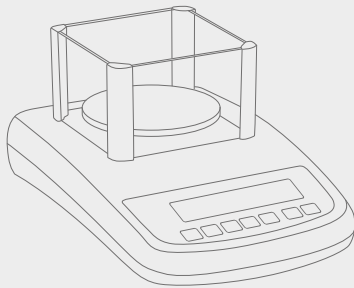
Img. 2

OPTIONS

- Manual or automated melt cutting unit (also for sticky polymers) (Img. 1)
- Time saving: Pneumatic compression and press through device for high viscous materials (MI-3) or via the drive and force control (mi40)
- Nitrogen purge for hygroscopic polymers
- Barrel and piston in corrosion resistant or abrasion resistant design
- Die plug (Img. 2)

ADD-ON

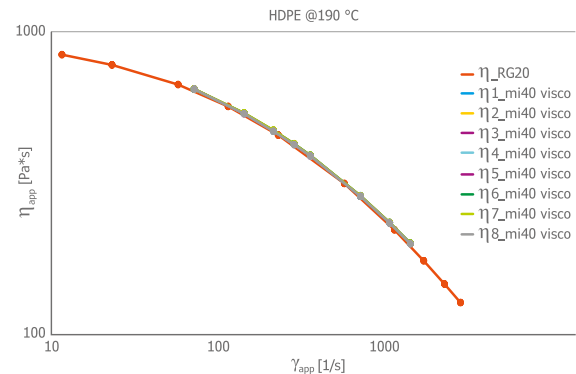
Additional expansion of our standardized melt index testers
mi2-serie, MI-3 und mi40



+ MELT DENSITY

When determining the melt volume flow rate (MVR) according to method B, the extruded volume per unit of time is determined via the piston speed of the in $\text{cm}^3/10 \text{ min}$. The melt density can be measured directly and used to convert between MVR and MFR.

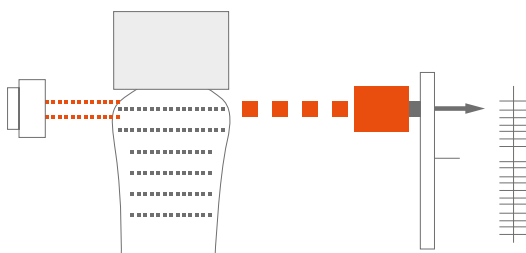
For this add-on, a laboratory balance and the cutting unit is required.



+ VISCOSITY

With the add-on “viscosity measurement” the mi40 is transformed into a mi40 visco. This enables the plastometer to perform viscosity measurements according to the standard for capillary rheometers ISO 11443.

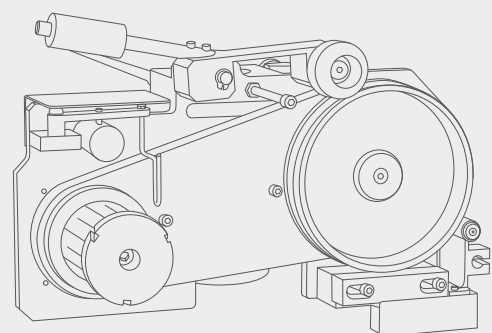
The proven ease of operation of the melt-flow indexer is combined with the increased material characterization capabilities of a capillary rheometer. This new option makes it possible to test viscosity as a QC criterion, without a huge investment in time, training or money.



+ DIE SWELL

The Die Swell measurement is one of many available add-ons for the series of GÖTTFERT capillary rheometers.

By means of a laser measuring head, which is adjustable in height, it is possible to measure the material-dependent swell of the extruded polymer strand. This add-on is particularly important for the process optimization and quality control of elastomer processing companies.



+ ELONGATION

The D-MELT consists of a GÖTTFERT melt index tester (plastometer) mi40 and an integrated HAUL-OFF system. The specially developed D-MELT measuring method offers the possibility to measure the melt flow rate (MFR) and the melt elasticity (ME) with only one filling of the test barrel. The HAUL-OFF system, which measures the melt elasticity, is fed by the melt index tester, also called plastometer.

APPLICATIONS

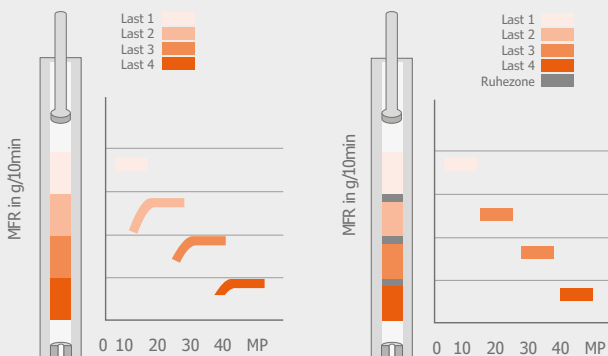
mi2-series, MI-3 und mi40

HIGHLIGHT: MI-3 & mi40

Automatic determination of the resolution!

The displacement transducer in the device has a resolution of 0.006 mm per impulse. For optimal test results (sampling single test points) it can be selected in 3 levels (high, regular, low), depending on the MVR value.

For the ideal determination of the resolution of the test piston displacement (mm/measuring point) this value can also be detected automatically. This is a big advantage in the case of unknown materials.



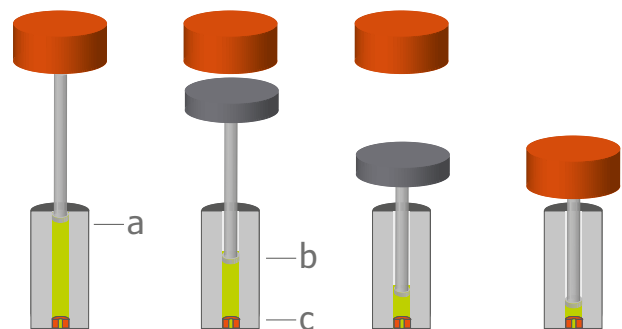
MULTI-WEIGHT-TEST

Conventional multiple load tests do not provide any relaxation phase while load changing: this results in higher dispersed test values compared to single test load measurements (figure at left). With our new multiple load function (up to 8 weights), being integrated in the mi40, the material is given enough relaxation time between load changes to minimize any pre-shearing influences. The result is that both, single load tests and multiple load tests are now in high conformity (figure at right).

COMPRESSION

Many polymers are very sensitive when it comes to packing and pre-loading, where handling differences directly impact measurement accuracy and repeatability. Our test devices offers different ways to pack and how to apply a pre-load to the test material. This control covers the complete pre-heat/melt time. Either the time spent on each is controlled, or the position of the piston /material at a specific point in the barrel. The loads used are chosen **manually with the mi2.3 and MI-3**, whereas with the **mi40 this can be defined in the software settings**, a big advantage when it comes to data integrity.

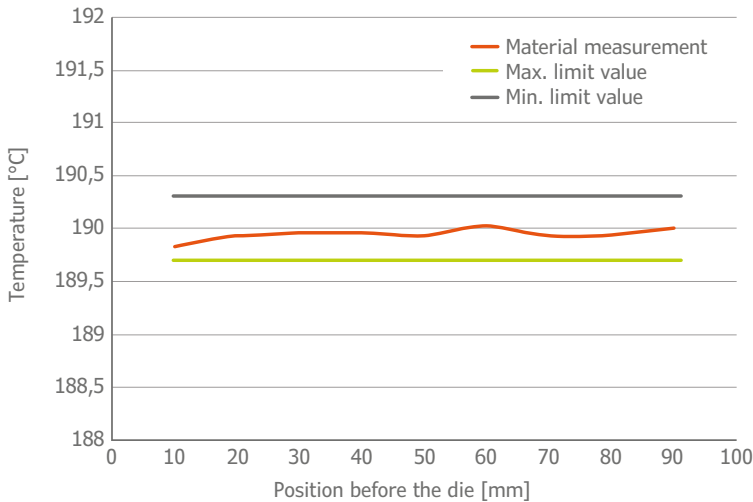
First, compression of the material with a preselected weight. Position controlled (see Pos. a) or time controlled and with force.



Re-compression with a preselected weight to a user defined position (see Pos. b), or to 55 mm above the die (see Pos. c), 5 mm above the ISO 1133 piston travel.

Automated measurement and test weight selection. Additional possibility to run Multi-Load measurements with up to 8 weights, selectable in any sequence (see below).

Automated purge of material with a pre-programmed and freely selectable test weight.



BETTER THAN NORM DEMANDS

The temperature process: stability and accuracy is much better than what ISO 1133 requests. The standard concept of the ISO 1133:2011, part 2 demands for the temperature profile $\pm 0.3^\circ\text{C}$ at a distance up to 70 mm above the die.

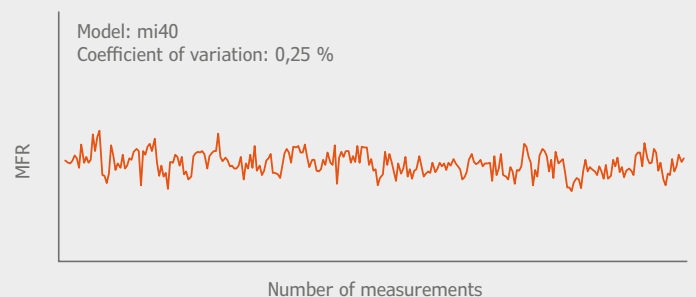
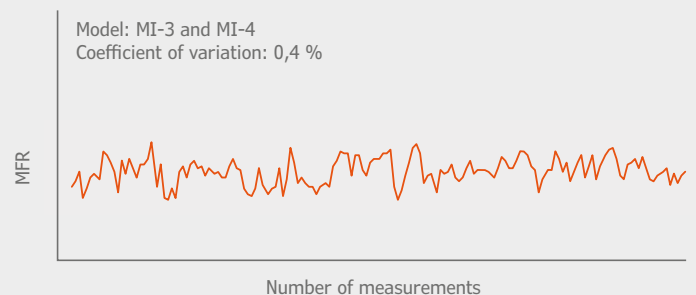
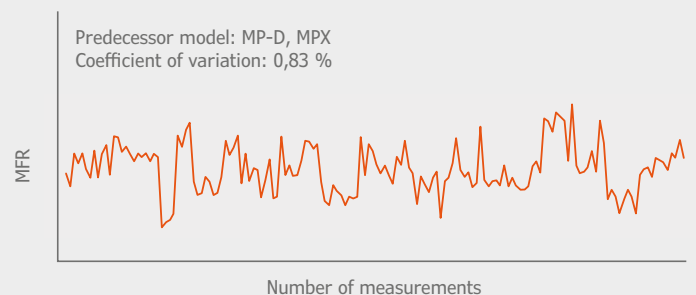
This high accuracy requirement is exceeded with our devices as shown in both diagrams. This also holds true, even when measured by part 1.

IMPROVED ACCURACY

Variance reduced by half, accuracy doubled. Easier said than done. The combination of our goal oriented development process, uncompromising engineering and long term manufacturing experience resulted in our new MI Series having 100 % improved accuracy and machine conformity (see graphics).

The results are based on internal quality tests that each machine has to pass before shipment. Test records of at least 40 machines are evaluated and standardized. Tests with a PE material performed having an MFR value of 7.5.

Whereas the predecessor models MP and MPX already achieved good minimum dispersion values of 0.83%, the new generation of the mi2 series and MI-3 now reduces the difference to 0.4% and the mi40 to only 0,25%. Variance reduced by half, accuracy doubled: that is a great advantage.



MAINTENANCE AND CALIBRATION

of our test instruments for a long service life with minimum failure rate

SUITABLE SERVICE

for various requirements



To ensure sustainably reproducible and reliable test results, periodic maintenance of reliable test equipment is essential. The **globally active and highly trained team** of our service technicians ensures sustainably reliable and accurate rheological test results.

Only **regular maintenance** ensures long-term reliability. We offer you a service contract tailored to your needs to ensure that your equipment is always maintained at the highest quality level. Our professionally trained service team and our certified quality management system (according to the international standard DIN EN ISO 9001) guarantee fast and **reliable service worldwide**.

Our service technicians are able to perform the following maintenance services in accordance with ISO/IEC 17025.

MAINTENANCE PACKAGES



SERVICE BASIC*

- ✓ Maintenance and calibration with traceable measuring equipment
- ✓ After successful completion Handover of maintenance checklist (test report)



SERVICE BASIC+

- ✓ Maintenance and calibration with traceable measuring equipment
- ✓ Specification of statistical uncertainty of measurement, determined from statistical evaluation of the measured quantities on several instruments
- ✓ After successful completion Issue of factory calibration certificate (test report)



SERVICE ISO 17025

- ✓ Maintenance and calibration with traceable measuring equipment
- ✓ Specification of the smallest measurement uncertainty, determined directly on the test instrument on site determined
- ✓ After successful completion Handing over of the result report (Verification Report) according to requirements of ISO 17025



Learn more
goettfert.com/maintenance

* SERVICE BASIC is no longer provided for manually operated melt index testers and capillary rheometers of the current model series.

EXTENDED SAFETY

for Melt Index Testers and Capillary Rheometers

BEST ADVICE

and sustainable support

All GÖTTFERT test instruments are supplied with a statutory warranty of 1 year. For our manually operated melt index testers and high-pressure capillary rheometers, „Extended Security“ additionally offers an extension of the warranty by another 24 months if the reliability of the machine is ensured with a maintenance contract (term 36 months from purchase and up to 12 months thereafter) and thus by semi-annual or annual maintenance visits.

We will be happy to provide you with a customized offer that includes other benefits such as SERVICE BASIC+ or SERVICE ISO 17025, discounted spare parts or priority handling of inquiries. This makes budget and operating costs easy to calculate.

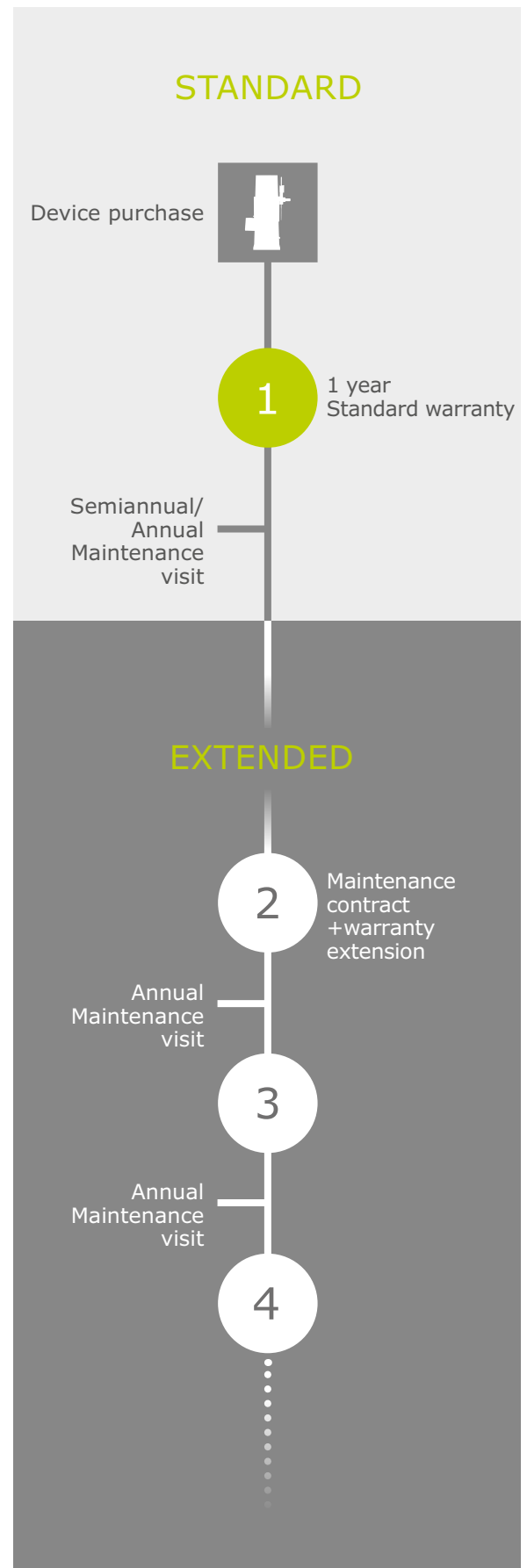
ADVANTAGES

- Cleaning, functional testing, replacement of wear parts* and calibration with certified standards according to the **SERVICE BASIC** maintenance protocol as well as calibration with **SERVICE BASIC+** or **SERVICE ISO 17025** factory calibration certificate.
- Spare parts and travel costs are included in SERVICE BASIC (excluding consumables and wear materials* as well as user-caused damage or transport costs).
- „Extended Security“ is available from the date of purchase of the system and for up to 12 months thereafter.
- Individual offers are also available upon request
- Software updates within the software version (subgroup) included
- Software updates according to individual offer



Learn more
goettfert.com/service-contract

* Wearing parts are test channels, test plungers, nozzles, test plunger holder, touch screen (operating panel), gas pressure spring of the protective hood as well as cleaning tools and cleaning material.



REMOTE SUPPORT

serviceCONNECT - a new platform for submitting service requests to customer service quickly, easily and specifically



REMOTE ASSISTANCE SUPPORT

FAST RESPONSE VIA REMOTE SUPPORT SOLUTIONS

Commissioning, repair or maintenance of your GÖTTFERT test instrument – We will find a solution that suits you and support you via Remote Support, regardless of your location.

The information platform serviceCONNECT offers the possibility to get in direct contact with our product managers.

- ✓ LOCATION-INDEPENDENT
- ✓ DIRECT CONTACT
- ✓ SHORT REACTION TIME
- ✓ UNCOMPLICATED



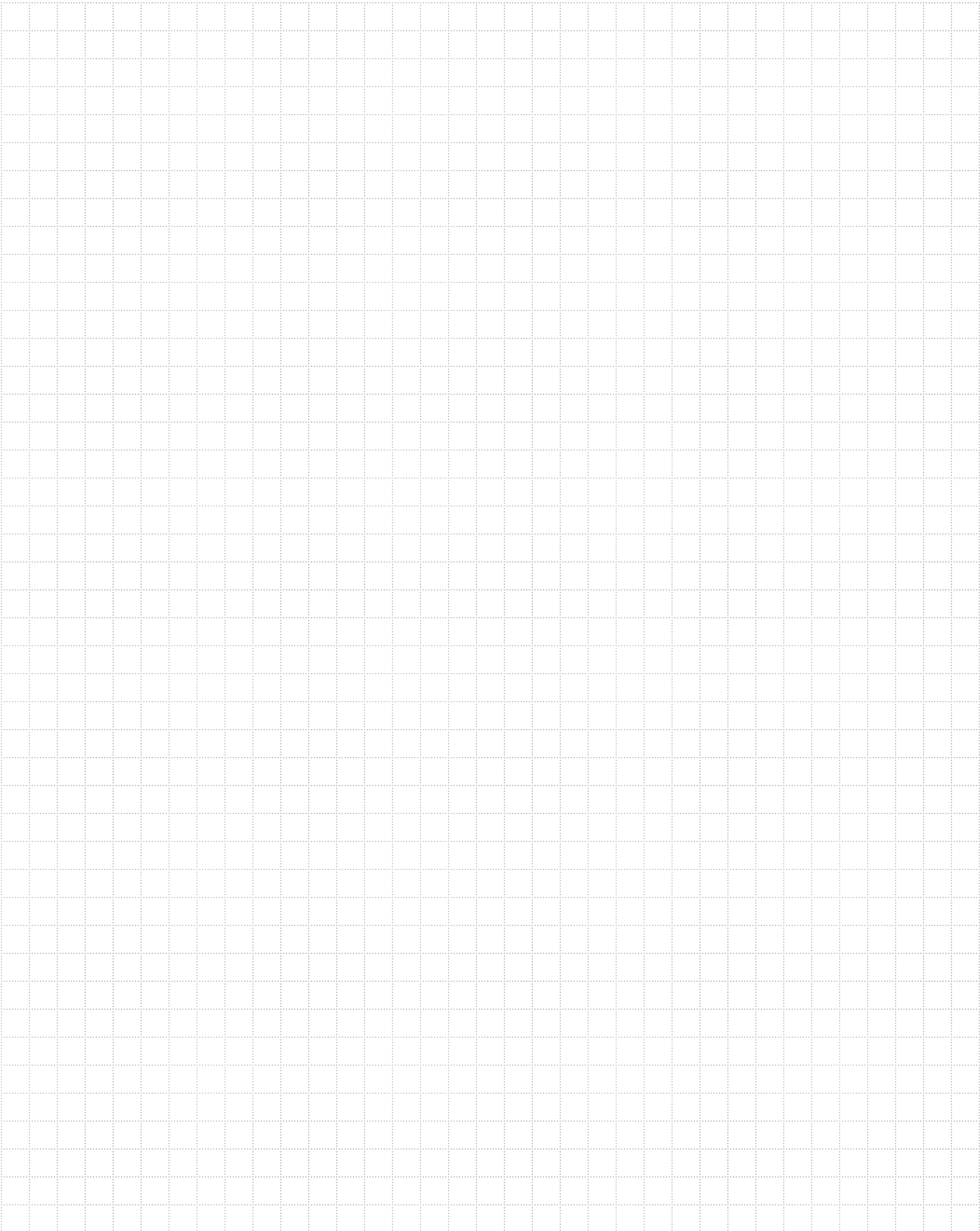
Learn more
goettfert.com/serviceconnect

SPECIFICATIONS

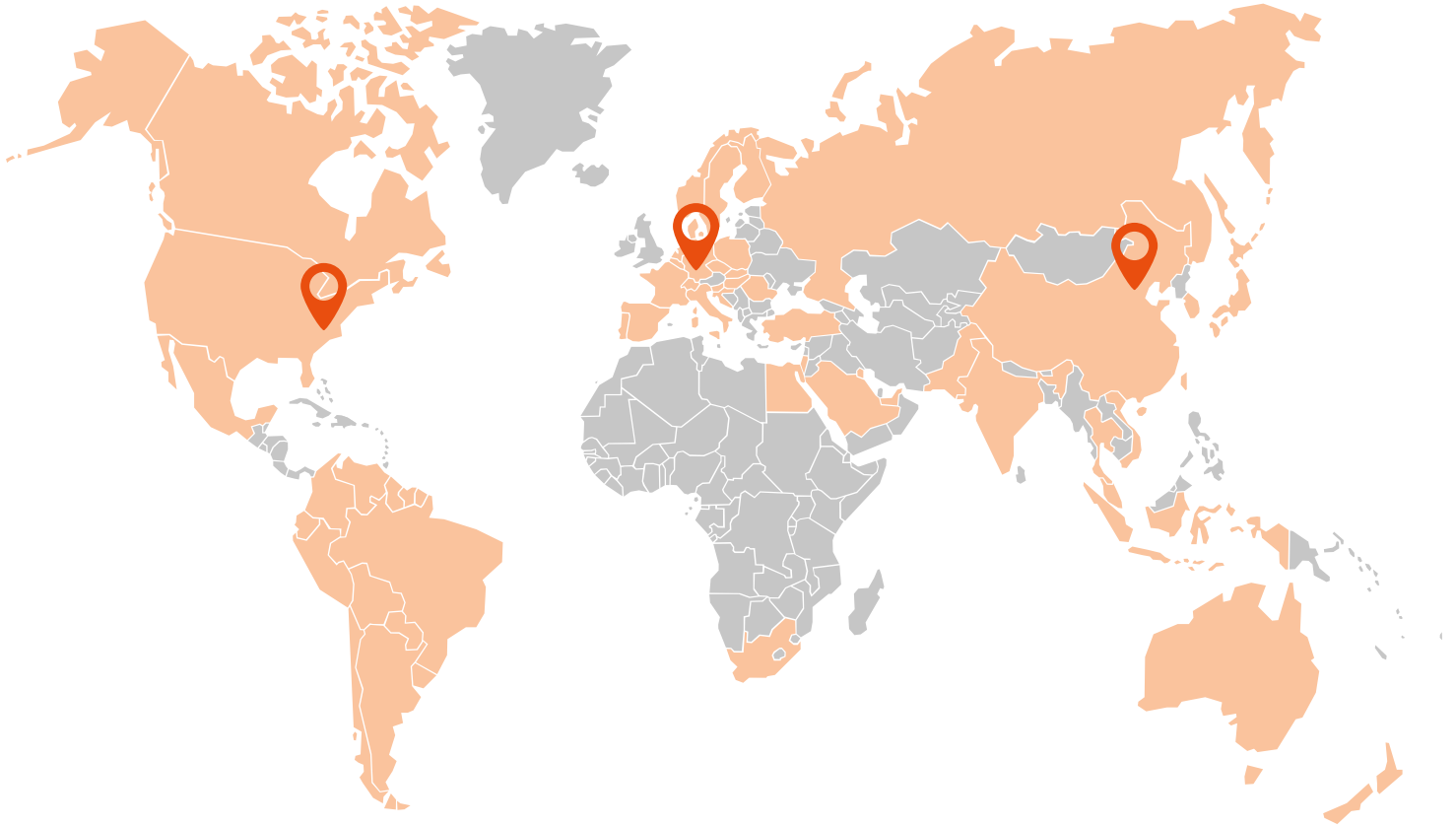


| Modell | mi1 | mi2.2 | mi2.3 | MI-3 | mi40 |
|---|---|--|--|---|--|
| Test procedure | Automated measurement with single load | | Automated measurement with single load and manual weight selection | | Automated measurement and software controlled weight selection, Multi load measurement |
| Test chamber | Two heater circuits, electrically heated, temperature sensor PT100 1/3 DIN Temperature difference over time: $< \pm 0.1^{\circ}\text{C}$ Temperature difference over distance (0 - 70 mm before the die) $< \pm 0.2^{\circ}\text{C}$ of set temperature (temperature range 60°C to 400°C) $< \pm 0.3^{\circ}\text{C}$ of set temperature (option: temperature range 400°C to 500°C) | | | | |
| Load steps | 0.325 - 21.6 kg | | | | |
| Weight guidance | Piston guidance according to ISO/ASTM | | | Piston guidance according to ISO/ASTM and internally installed test weights | |
| Weight handling system | - | Yes | Yes | Yes | Yes |
| Pre-load and material purge function | Manually with weights (option) | | Semi automated with manual weight selection | Automated with manual weight selection | Fully automated with weights or force controlled |
| Multi-Load function | - | | | | 8 weight steps, selectable in any sequence |
| Actual temperature display | 0 - 500°C on PC via VNC Viewer | | 0 - 500°C on touch screen monitor | | |
| Temperature acquisition | Via 16-bit converter, resolution 0 - 320°C : $0,01^{\circ}\text{C}$; resolution 320 - 500°C : $0,1^{\circ}\text{C}$ | | | | |
| Test barrel | 9.555 (-0.01) mm diameter | | | | |
| Touchscreen display | - | 14.48 cm (5.7") Color VGA touch screen monitor | | | |
| Test value acquisition | Electronically, resolution: 0,003 mm/Impuls | Electronically, resolution: 0.025 mm/impulse | | Electronically, resolution: 0.006 mm/impulse | |
| Test data display | Numerical | | | | |
| Die | 2.095 (± 0.003) mm diameter, 8 (± 0.025) mm length 1.048 (± 0.005) mm diameter, 4 (± 0.025) mm length (option) | | | | |
| Advanced evaluation 1 | IV calculation to characterize polyester and polyamide based plastics | | | | |
| Advanced evaluation 2: Add-On die swell measurement | - | | | Flow Rate Ratio (FRR) calculation for multi load tests | |
| Melt cutting unit | Option | | | | |
| Die locking mechanism | Option | | | | |
| Nitrogen purge | - | Option | | | |
| Corrosion resistant version | Option | | | | |
| Abrasion resistant version | Option | | | | |
| Pre-load function | Manual pre-loading (option) | | | Semi-automatic | Fully-automated |
| Data input | PC | Touch screen monitor | | | |
| Interfaces | 2x Ethernet | Ethernet, serial, 1 or 2 x USB (printer, memory) | | | |
| Power supply | 115 V or 230 V | | | | |
| Ambient temperature | $+10 - +40^{\circ}\text{C}$ | | | | |
| Ambient humidity | max. 90 % not condensing | | | | |
| Dimensions Width/Depth/Height (*with cleaning module) | W: 290 mm D: 530 mm H: 380 mm | W: 510 mm D: 430 mm H: 1,025 mm | W: 510 mm D: 430 mm H: 1,120 mm | W: 700 mm D: 450 mm H: 1,290 mm | W: 820 mm* D: 605 mm* H: 1,325 mm* |
| Weight | ca. 37 kg | Approx. 75 kg | Approx. 105 kg | Approx. 170 kg | Approx. 200 kg |

NOTES



THIS IS RHEOLOGY



GOETTFERT®
THIS IS RHEOLOGY

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