MI-4
Melt Flow Indexer
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Introduction

This unique melt indexer with automatic weight selection can carry out a single weight test according to ISO 1133 and ASTM D1238, procedures B, as well as ISO 1133 and ASTM D1238 Procedure C for the “Half Height / Half Diameter” standard. Tests can be made either with one test load (single load mode) or with several test loads per barrel filling (multiple test load mode).

The technical highlights

- Multi-Load tests with up to 8 different weights, ascending, descending or freely selectable
- 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

Additional features of the MI-4:

- Brilliant 5.7” Color-QVGA Touch screen display for the operation, program control and display of the measurement results
- Single load mode for tests with one load
- Storage of up to 500 parameter sets with 3000 measurements for each parameter set
- Electric weight handling system
- Capillary/die quick-release and locking mechanism
- Guided test piston
- Base weight 1.200 kg, (0.325 kg, 1.000 kg and 1.050 kg option)
- Test weights from 2.160 kg to 21.600 kg integrated into the machine and automatically selected
- Electrically heated test chamber with easily exchangeable test channel and die quick closure
- 5 Calibration settings for set temperatures with dedicated parameter files
- Melt cutting unit (manual/automatic) even for stickier polymers (optional)
- Manual and timer-programmable on/off override switch for the heaters
- Automated backup of the test results in the event of power failure (optional)
• Die plug (option)
• Die swell measurement (option)
• Nitrogen purge (option)
• Built-in USB-connection (Data Stick) for data back-up
• USB printer port
• Serial connection to communicate with the MFR Host software or the optional scale
• Ethernet-connection (LAN)
• Integrated Web-Server

Application

The melt index test device MI-4 is equipped with an automatic measuring data acquisition according to method B and C.

The data are being displayed on a colour QVGA touchscreen and onto a paper printer as well as in combination with our prepared Office PC and the user friendly Software “MFRHost”.

With the help of a high-resolution position transducer the melt index MFR in g/10min and/or the volume flow index MVR in cm³/10min of pellets, powder or fine granules are being determined (volume output).

The tests can be performed according to DIN ISO 1133 and ASTM D 1238.

This test unit is designed for only be used to determine the MVR and MFR (or “melt index”) of polymers (intended use).
Here the plastic granulate or powder is being melted in the test cylinder and after a melting time the test sample is being pressed through a die by using a test piston and a weight load.

With the option “melt cutting” a manual determination of the melt density is possible.
By adding option laboratory balance the determination of the melt density can be done automatically.
**Concept**

**MI-4**

- Base weight (1,000 kg, ...)
- Capillaries (ASTM D1238, ...)
- Additional test weights
- Optimized test piston fixing
- Version "Inconel"
- Die swell measurement
- Melt cutting unit
- Die plug
- Pneum. Press through unit
- Nitrogen purge
- Electronic analytic balance
- Precision balance, data interface, interface cable
- Control thermometer
- Feeding tool
- Cleaning device
- Software "MFRHost"
- PC
- Printer and accessories
- Special table
Optional units

The basic test device is no functioning instrument without the following optional units:

- Power Supply
- English version or German version

Options

The Göttfert Melt Flow Indexer are already equipped with large basic functions. Our extensive option program provides a more detailed characterisation of the test materials as well as supplementing accessories to the completion of the basic equipment.

- Basic weight
- Capillaries (ASTM D1238, ...)
- Additional test weights
- Test piston fixing
- Die swell measurement
- Melt cutting unit
- Die plug
- Pneumatic press through device
- Nitrogen purge
- Electronic analytic balance
- Precision balance, data interface, interface cable
- Control thermometer
- Feeding tool
- Uninterrupted power supply (USV)
- Automatic cleaning, pneumatic cleaning device or angled cleaning device (accu-driven)
- Software „MFRHost“
- PC
- Printer and accessories
- Special table
Set-up

![Overall view MI-4](Image)

Automatic weight selection
Test chamber swiveling
Color-QVGA-Touch screen
Die quick release and locking mechanism
Melt cutting system, motor driven (optional unit)

The Melt Indexer consists of the following components:

**Housing**
Sturdy frame on 4 feet. The feet are adjustable in height, which facilitates leveling of the equipment.

**Test chamber**
The insulated test chamber is heated with two heating circuits and is easily accessable from top and below for cleaning, especially since it can be swiveling out to aid the process.

**Test barrel**
easy to replace, with serial number.
Test piston
with serial number.

Capillary
with serial number.

Die quick release and locking mechanism
The capillary is held and released by the quick-locking mechanism, which works simply and fast. Thus the test channel can be cleaned user friendly.

Test weights
The MI-4 features a base weight of 1.200 kg (0.325, 1.000 or 1.050 kg see options) and permanently installed weights of 2.160 / 3.800 / 5.00 / 10.000 / (12.500 / 15.000 see options) and 21.600 kg. The selection of weights is program controlled. No mechanical settings are necessary.

Digital position transducer
High-resolution digital encoder to measure volume output.

Color-QVGA-Touch screen
For the input of parameters, for program control and for the display of results.

Compact I/O-Module
For control and to receive input signals.

Temperature Controller
The test chamber temperature is controlled by a special temperature control algorithm. The temperature set points are entered via the touch screen display. During the test, the temperatures are displayed on the screen with a 0.01 °C resolution.

USB Connections
1. to connect to a printer (port 2). Suitable printers, please see options.
2. to communicate with a PC, or to connect to a data stick for data back-up in ASCII-Format.

Ethernet-connection
LAN connection and communication with HOST software via TCP/IP, FTP, or Web-Server.

Serial Connection
Connection to a scale or PC. The HOST software program is available as an option (see separate product description).
Technical Data

Test chamber: Two heater circuits, electrically heated, Temperature transducer PT 100 1/3 DIN
Temperature deviation over time: less than ±0.1 °C
Spatial temperature distribution over the used barrel range 0-70mm before the die):
≤ ±0.2 °C of operating temperature (60°C to 400°C)
≤ ±0.3 °C of operating temperature (400°C to 500°C)

Temperature controller: Temperature control algorithm

Temperature input: With touch screen from 060.0 – 400.0 °C
(Extended range to 500.0 °C option)

Display of temperature: 000.00 – 500.00 °C on Touch screen Display

Temperature Acquisition: via 16 Bit converter
Temperature resolution from 320°C: 0.01°C, 320 to 500°C: 0.1°C

Test barrel: 9.555 -0.01 mm diameter
Test piston: 9.48 -0.01 mm diameter

Capillary: 2.095 ± 0.003 mm diameter, 8 ± 0.025 mm length
Material: tungsten carbide

Capillary ASTM D1238 Method C: 1.048 ± 0.005 mm diameter, 4 ± 0.025 mm length (option)
Material: tungsten carbide

Test weights: 1.200 kg (Option base weights 0.325 kg  1.000 kg or 1.050 kg)
2.16 kg / 3.8 kg / 5.0 kg / 10.0 kg / 21.6 kg (Option test weights
12.5 kg  15,000 kg) Tolerance ± 0.5 %

Drive: Capacity motor, 150 watt with brake
Overload protection: Electrical overload protection for torque limitation.

Digital position transducer: Digital encoder, resolution 0.006 mm/impulse

Time measurement: Resolution 1 millisecond
Time basis 48 MHz quartz, precision 50 ppm

Color touch screen display: 5,7“ color-QVGA touch screen

Power supply: See options.
Please note that the Melt Indexer is fitted with microprocessors. The power supply must be free of any interference in order to guarantee trouble-free operation. Mains filters or stabilizers must be connected on the line side if any interference occurs.

Standby power of a heated Melt Indexer at an ambient temperature of 25 °C:

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Power Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>190 °C &lt; 130 W</td>
<td></td>
</tr>
<tr>
<td>230 °C &lt; 140 W</td>
<td></td>
</tr>
<tr>
<td>300 °C &lt; 220 W</td>
<td></td>
</tr>
</tbody>
</table>

Ambient temperature: + 10 to + 40 °C
Air humidity: max. 90% not condensating

Dimensions: Width: 700 mm, Depth: 450 mm, Height: 1220 mm

Color: Cover plates: Light-grey RAL 7035
Hood: pastel orange RAL 2003

Weight: net weight approx. 170 kg, gross weight approx. 200 kg
Scope of supply

MI-4

1. User information consisting of operating manual, technical documentation and calculation basis
1. Wrench for removing piston nuts
1. Material filler
1. Die scraper
1. Material compressor
1. Steel brush with handle
1. Cleaning piston with handle
1. Set of micro fuse
1. Mains cable
1. Pair of tweezers

Order information

Melt Flow Indexer MI-4
Basic device
Order number ..............................................................................................................................................5.70.500

Necessary optional units to basic device:

Language version and user information

English Version
Marking and user information* (on CD) in English, operating manual on paper format.
Order number ..............................................................................................................................................5.70.502

German Version
Marking and user information* (on CD) in German, operating manual on paper format.
Order number ..............................................................................................................................................5.70.501

Additional user information* English, on paper format
Complete printed English user information* in single A4 ring binder.
One user information* on CD belongs to standard scope of the basic instrument.
Order number ..............................................................................................................................................5.70.504

Additional user information* German, on paper format
Complete printed German user information* in single A4 ring binder.
One user information* on CD belongs to standard scope of the basic instrument.
Order number ..............................................................................................................................................5.70.503

* The user information contains:

Operating manual, technical documentation and calculation basis.
Power supply
Following power supplies are available:

**Power supply 230 V and test temperature up to 400 °C**
Voltage: 230V, + PE
Permissible voltage fluctuations: +/- 10%
Frequency: 50 Hz +/- 1%
Power consumption: ca. 870 W
Order number ..............................................................................................................................................5.70.510

**Power supply 115 V and test temperature up to 400 °C**
Voltage: 115V, + PE
Permissible voltage fluctuations: +/- 10%
Frequency: 60 Hz +/- 1%
Power consumption: ca. 870 W
Order number ..............................................................................................................................................5.70.511

If you work with tests temperatures above 400 °C, you need a special test chamber with ceramic heaters. Please note that at temperatures from 400 °C to 500 °C the spatial temperature deviation is ≤ ± 0.3°C:

**Power supply 230 V and test temperature up to 500 °C**
Voltage: 230V, + PE
Permissible voltage fluctuations: +/- 10%
Frequency: 50 Hz +/- 1%
Power consumption: ca. 1 kW
With this option, temperatures up to 500 °C can be used.
Order number ..............................................................................................................................................5.70.512

**Power supply 115 V and test temperature up to 500 °C**
Voltage: 115V, + PE
Permissible voltage fluctuations: +/- 10%
Frequency: 60 Hz +/- 1%
Power consumption: ca. 1 kW
With this option, temperatures up to 500 °C can be used.
Order number ..............................................................................................................................................5.70.513
**Additional options for the basic device:**

**Base weights**

**Base weight 0.325 kg**  
instead of base weight 1.200 kg  
Order number ................................................................. 5.07.063  
or

**Base weight 1.000 kg**  
instead of base weight 1.200 kg  
Order number ................................................................. 5.07.370  
or

**Base weight 1.050 kg**  
instead of base weight 1.200 kg  
Order number ................................................................. 5.07.369  

**Capillaries**

**Capillary**  
2.095 ± 0.003 mm diameter, 8 ± 0.025 mm length, constructed from tungsten carbide.  
(one belongs to standard scope of the basic instrument)  
Order number ................................................................. 4.23.000  

**ASTM D1238 Method C (Half-height, half length)-Set**  
1.048 mm diameter, 4 mm length, made of tungsten carbide. Test piston to bridge length differences.  
Order number ................................................................. 5.07.358  

**Capillary ASTM D 1238 Method C**  
1.048 ± 0.005 mm diameter, 4 ± 0.025 mm length, constructed from tungsten carbide. As replacement for the optional unit ASTM D 1238 method C, article No. 5.07.358.  
Order number ................................................................. 4.23.043  

**Additional test weights**

**Additional test weights 12.500 and 15.000 kg**  
Are used in the base system between the test weight 10.000 and 21.600 kg. Selectable with the test weight selection lever.  
Order number ................................................................. 5.07.359  

**Optimized test piston fixing**

**Optimized test piston fixing**  
By manual activation the setting of the piston fixing in the basic load can be selected from lose to a fixed position.  
Order number ................................................................. 5.07.495
Version “Inconel”

Additional costs for version “Inconel” for following parts:
Heating cylinder, locking nut, holding nut, quick closure nut, test channel, test piston, brass brush for cleaning the test channel
Order number ..............................................................................................................................................5.70.516

Die swell measurement

To measure the diameter of the extruded strand, for determination of static and dynamic die swell.
Consists of:
- Laser measuring head: Laser Diode class 1 (780nm)
  Distance 28 mm, Measurement Area 0.15 to 28 mm, Repeatability ± 0.1 µm
Order number ..............................................................................................................................................5.07.470

Melt cutting tool

Melt cutting tool - manual
Cutting the strand is done by a tool mounted close to the die. The cutter is operated manually by the user. The cutting device has been proven to operate with a number of polymers over a wide MFR/MVR range.
Nevertheless, some polymers cannot be cut properly because of their material characteristics (e.g. sticky, adhesive materials, or rheological complex materials). For such materials it is not possible to guaranty that the cutting device will operate properly. Please ask for details.
Order number ..............................................................................................................................................5.07.175

Melt cutting tool – motor powered
Cutting the strand is done by a motor powered tool mounted close to the die. The cutter is activated via program control. The cutting device has been proven to operate with a number of polymers over a wide MFR/MVR range.
Nevertheless, some polymers cannot be cut properly because of their material characteristics (e.g. sticky, adhesive materials, or rheological complex materials). For such materials it is not possible to guaranty that the cutting device will operate properly. Please ask for details.
Order number ..............................................................................................................................................5.07.251

Die plug

Die plug with Clamping Lever
To manually close the die while system is packed and material melted. Recommended for certain high flow materials.
Note: this die plug can only be operated with the motor powered melt cutting tool (order number 5.07.251), but not with the operated cutting tool.
Order number ..............................................................................................................................................5.07.471
Die plug (heatable)
To manually close the die while system is packed and material melted. Recommended for certain high flow materials.
Order number ..............................................................................................................................................5.07.160

Pneumatic Press Through Device
For timesaving pressing through of viscous materials. Maximum press through force of 50 kg together with the test weight.
Order-number ..............................................................................................................................................5.70.515

Nitrogen purge device

Nitrogen purge
Contains ring injection nozzle with socket for nitrogen purge to mount to the top of the test chamber.
Material must be appropriately conditioned by user and carefully loaded.
Order number ..............................................................................................................................................5.07.416

Cleaning devices

Automatic Cleaning
The fully automated cleaning module includes the cleaning of test barrel, test piston and capillary all in one. The capillary must not be removed from the test barrel for cleaning. After the test the test piston is being removed by a grabber and cleaned. Meanwhile the test barrel and the capillary are cleaned. The magazines can be equipped for up to 30 cleaning cycles. For operation a power supply with 230 VAC and oil free as well as water free compressed air with 4-6 bar is required.
Order number ..............................................................................................................................................5.70.200

Pneumatic Cleaning Device
Air driven rotary cleaning tool for quick, easy and through cleaning of the test barrel. The device needs an air supply of 4-6 bar. The air supply must be oiled and water free.
Accessories supplied: 1 Quick connect coupling for a 9 mm air hose (NW 9)
1 Air hose
Order number ..............................................................................................................................................5.11.082

Angled Cleaning device (accu-driven)
Easy cleaning of barrel with coupling 5.11.155 and the cleaning tools steel brush 5.03.188 and/or cleaning piston 5.03.189.
Technical data: 9.6V nominal voltage 0-800 min⁻¹ idling speed 335mm length clock/counter clock wise rotation overload protection weight 1.3 kg
In the scope of supply are: 1 Accu charger 230 V 2 Spare accus 9.6V; 1300 mAh
Order number ..............................................................................................................................................4.56.194
**Coupling**
The coupling is necessary to attach the steel brush 5.03.188 and the cleaning piston 5.03.189 to the offset driver.
Order number ..............................................................................................................................................5.11.155

**Cleaning brush**
For the cleaning of the test barrel, with coupling part for the pneumatic cleaning device.
Order number ..............................................................................................................................................5.03.188

**Cleaning piston**
For cleaning the test barrel with a cloth patch, with coupling part for the pneumatic cleaning device.
Order number ..............................................................................................................................................5.03.189

**Balances**

**Electronic Analytical Balance**
Mettler-Toledo AB54-S/FACT
Readability: 0.1 mg
Maximum Capacity: 0…51 g

Additional:
- Wind-protection made of glass with sliding doors
- Brilliant backlit display
- Built-in calibration weight
- Application programs as per percent weighing, etc.
- FACT (fully automatic calibration and adjustment) with built-in weight
- RS232c interface

Order number ..............................................................................................................................................8.85.026

**Precision Balance**
Kern EW 150-3M
Readability: 0.001 g
Maximum Capacity: 0.02…150 g

- Verification value 0.01 g
- Reproducibility 0.002 g
- Calibration weight 50 g
- Ambient temperature 10-30 °C

Order number ..............................................................................................................................................8.85.027

**Data interface RS 232**
For precision balance Kern EW 150-3M.
Order number ..............................................................................................................................................8.85.028

**Interface cable**
9-pin, for Precision Balance Kern EW 150-3M.
Order number ..............................................................................................................................................8.85.029
Control thermometer

Following control thermometer are available to check the test chamber, all of which come with a 90° angle for ease of use.

Control thermometer +50 °C to +100 °C
Resolution 0.1 °C.
Order number ..............................................................................................................................................4.55.100

Control thermometer +100 °C to +150 °C
Resolution 0.1 °C.
Order number ..............................................................................................................................................4.55.101

Control thermometer +150 °C to +200 °C
Resolution 0.1 °C.
Order number ..............................................................................................................................................4.55.102

Control thermometer +200 °C to +250 °C
Resolution 0.1 °C.
Order number ..............................................................................................................................................4.55.103

Control thermometer +250 °C to +300 °C
Resolution 0.1 °C.
Order number ..............................................................................................................................................4.55.104

Control thermometer +300 °C to +350 °C
Resolution 0.1 °C.
Order number ..............................................................................................................................................4.55.105

Control thermometer +350 °C to +400 °C
Resolution 0.1 °C.
Order number ..............................................................................................................................................4.55.106

Control thermometer +400 °C to +500 °C
Resolution 0.5 °C.
Order number ..............................................................................................................................................4.55.107

Feeding tool

Feeding tool for low viscous materials
Consists of:
- Die closure
- Hopper PTFE
- Feeding piston made of Vespel
Order number ..............................................................................................................................................5.07.417

Special tables

Special Table I
For reception of the test machine and accessories.
The table includes a European style multiple socket outlet (6x).
Width: 1100 mm, Depth: 750 mm, Height: 720 mm.
Order number ..............................................................................................................................................5.13.300
Special Table II
For reception of the test machine and accessories.
The table includes a European style multiple socket outlet (6x).
Width: 1600 mm, Depth: 750 mm, Height: 720 mm.
Order number ................................................................. 5.04.810

Thermal protective gloves and protective goggles

Thermal protective gloves
Material: Para-Aramid Cotton, Kat.III EN 388 (2541), EN 407 (4341), Temperature insulation up to 350°C, cut resistant.
Order number .............................................................................................................................................. 1.44.214

Protective goggles
Light and adjustable to fit many sizes, shield is made of polycarbonate, color yellow/ black.
Order number .............................................................................................................................................. 1.40.131

Printer

HP Deskjet
Printer for measurement data.
Included:  
1 Printer cartridge, black  
1 Mains cable  
1 Manual

Printer with AC 100-240V / 50-60Hz and Manual (or similar system)
Order number .............................................................................................................................................. 8.94.054

USB-Printer cable
Cable to connect to the MI-4
Order number .............................................................................................................................................. 8.90.066

Details and closer information you will find in the separate product description "PC Specifications for GÖTTFERT systems".

Further details for the PC-software you will find in the separate product description "MFRHost".
Subject to change due to technical developments.

☐
Note

Göttfert GmbH provides full warranty for the function of machines that have been supplied as complete system that means with PC and printer by Göttfert. PC means generally the complete system comprising of PC, monitor, keyboard, interfaces, mouse and if applicable joysticks.
Principally, we do not give a functioning guarantee for connecting externally supplied PCs and printers (non-Göttfert supply).

If the customer provides the PC by himself, Göttfert cannot guarantee the troublefree functioning of PC and Göttfert unit. Service work, which will be essential due to appearing problems in regard to configuration, serial interfaces, connection cables, communication etc. do not belong to the warranty obligations and will therefore be invoiced on an actual expense basis.

Due to the various printer executions that are available on the market, we do not give any function guarantee for printers not supplied by Göttfert. Support for possible adjustments will be charged on an actual expense basis.

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