The MINI BYPASS RHEOGRAPH is a continuously measuring capillary rheometer used in on-line quality control. It has been designed specifically for finishing and compounding processes, which typically have frequent product changes.

For automatic process control the MBR supplies important rheological variables in real-time mode which are used to assess the properties of the polymer.

One of the most outstanding features of the MBR is its compact size. Even in tight space this new design can be installed without problems. Since the melt is not returned into the system allowing an easy access to the die, it can be changed easily and with a minimum of downtime.

Special design features:

**Compact size:** With a system width of 175 mm the MBR can be installed even in tight space. The reduced weight of approx. 20 kg eliminates costly mounting arrangements.

**Easy die change:** The open system (no melt return flow) together with the new die exchange system allows an easy and fast die exchange for adaptation to different test tasks.
The measuring head of the MBR is mounted directly on the production unit. The Control Electronics are located in a control cabinet which is completely separate from the measuring head. The unit is controlled via a personal computer or an industrial workstation.

Characteristic features of the MINI BYPASS RHEOGRAPH:

- Flange-mounted measuring directly on the material supply line, separate Control Electronics
- Compact size
- Simple die exchange
- Large measuring range due to shear rate range of 1:1000
- System can be operated at a constant speed (shear rate) or constant pressure (shear stress)
- Operation, evaluation and visual displays are made via a personal computer, a built in industrial workstation or from the user side by a process control system
- Single or multi-point measurements
- The following test results are supplied depending on the selected operating mode:
  - Melt index MFR or melt volume index MVR with or without temperature-compensation
  - FRR (Flow Rate Ratio), ratio of 2 consecutive MFR/MVR measurements which correspond to laboratory tests with different weights
  - Apparent shear stress, shear rate and viscosity

- The test results can be:
  - Displayed in colour on the PC screen
  - Output in the form of a test-data log on a printer
  - Supplied via analog outputs 4...20mA (see options)
  - Requested via a host computer connected via serial interface (see options)
  - Database access via network (to be realized by the customer)
The MINI BYPASS RHEOGRAPH MBR CAN 71.05 comprises the units **MBR-Measuring Head**, **MBR-Control Electronics** and **Operation Software**:

**MBR-Measuring Head** which consists of the following

**Frame housing**
complete with terminal box, lifting frame and protective cover. Housing, frame and cover are made out of acid resistant stainless steel.

**Channel block**
with melt connection, for installation of capillary, pressure transducer, thermocouple and fitted with a bypass valve to release available melt in the inlet pipe or to reduce the residence time

**Heating**
2 electrical cylinder heaters with temperature sensors Pt 100, accuracy 1/3 DIN B acc. IEC 751

**Melt pump**
precision gear pump to supply melt to the die

**Drive**
brushless servo gear motor for driving the melt pump

**Thermocouple**
for measuring the melt temperature in the melt stream, Fe-CuNi, accuracy class 1 accord. to IEC 584 part 2, type ‘J’.

**Melt connection**
with threaded nozzle M30x1,5 (see drawing)

The measuring head must be supplied with capillary and pressure transducer. The customer must specify these (see options). Customer specific designed melt flanges and adapters are available as options.
Product description MINI BYPASS RHEOGRAPH MBR CAN 71.05

Dimension Drawing Measuring Head

Picture: MBR-measuring head with options

1. Frame housing
2. Drive
3. Channel block
4. Melt pump
5. Capillary
6. Bypass valve
7. Pressure transducer
8. Thermocouple
9. Melt connection (option)
10. Connection cable to the control electronics

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Control Electronics
The Control Electronics is located in a separate control cabinet. The modular extendable control electronics includes the following components in the basic model:

- **Test-data processor**
  A process computer that controls and monitors the Rheometer hardware. The process computer sets as slave the control signals of the operation PC to the internal CAN-BUS and transmits the status reports as well as the test data to the operation PC.

- **CAN-Bus**
  A serial Bus, which connects the operation components of the control electronics as well as the test data processor, temperature controller, motor controller, pressure transducer, and the input/output components.

- **Temperature controller**
  Microprocessor-controlled multi channel temperature controller, for 2 and 3 point-control zones.

- **Motor controller**
  A servo motor controller, whose parameter can be set via the software.

- **Terminal strips for external connections**
  Cables from outside of the control cabinet are connected to a tensioning clamp terminals. Exception: connection of the motor- and resolver cable directly at the motor controller with DSUB plug.

Control Signals
For external control of the machine following signals are available:

<table>
<thead>
<tr>
<th>Output signal</th>
<th>Description</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Alarm</td>
<td>Becomes active at machine failures and when limits are exceeded</td>
<td>1 potential-free relay contact closer</td>
</tr>
<tr>
<td>- Stop</td>
<td>Stop of the drives, from test mode or standby mode</td>
<td>4 potential-free Optocoupler-inputs</td>
</tr>
<tr>
<td>- Standby</td>
<td>Machine operation in standby-mode</td>
<td></td>
</tr>
<tr>
<td>- Start</td>
<td>Machine operation in test mode</td>
<td></td>
</tr>
<tr>
<td>- Release</td>
<td>Active: start of the drive is possible</td>
<td></td>
</tr>
</tbody>
</table>

For technical data see „Technical Data Control electronics“, on page 8.

Serial interface
for communicating with the PC or Device Control System DCS (see options).

Power supply
the Control Electronics must be supplied with the power supply according to customers specification (see options).
Connection cable to the measuring head
The connection cable is divided into two sections, those are connected by a junction box (option).

MBR operation modes
Together with the Operation Software, the MBR can be operated in various modes and can perform various evaluations in order to determine the melt viscosity, melt index and melt volume index by means of single-point measurements and viscosity functions by means of multi-point measurements.

Single-point measurement with constant pressure:
The MBR is operated in the 'constant pressure' mode with one measuring point. The following variables are determined in this mode:
- melt index MFR(TM), temperature-compensated melt index MFR(T0)
- melt volume index MVR(TM), temperature-compensated melt volume index MVR(T0)
- apparent shear rate, apparent shear stress and apparent viscosity.

Multi-point measurement with constant pressure:
The MBR is operated in the 'constant pressure' mode. 20 pressure steps are approached consecutively in this mode. The following are determined in addition to the variables mentioned above:
- FRR (Flow Rate Ratio), ratio of 2 consecutive MFR/MVR measurements which correspond to laboratory tests with different weights

Single-point measurement with constant speed:
The MBR is operated in the 'constant speed' (shear rate) mode with one measuring point. The following variables are determined in this mode:
- apparent shear rate, apparent shear stress and apparent viscosity

Multi-point measurement with constant speed:
The MBR is operated in the 'constant speed' (shear rate) mode. Several speed steps are approached consecutively in this mode. The following are determined in addition to the variables mentioned above:
- uncorrected flow curve

Alternating test cycles:
In this mode the rheometer alternates between 2 independent test cycles. It is thus possible, for example, to perform a 'constant pressure' cycle in order to determine the melt index and a 'constant speed' cycle to determine the melt viscosity. 1 - 8 speed or pressure steps can be selected per test cycle.

Automatic MFR-adjustment:
After having started the machine and manually set MFR-values (lab-values), it is possible to run an automatic adjustment as much as one likes MFR(TM)-, MFR(T0)-, MVR(TM)- or MVR(T0)-steps, depending on the selected operation mode.
Product description MINI BYPASS RHEOGRAPH MBR CAN 71.05

Technical data MBR - measuring head

Measuring pumps: Speed range: 0.1 - 100 rpm
Accuracy: +/- 0.1 rpm
Torque: 33 Nm
Spec. capac.: 0.4 cm³/rev.

Overload protection: mechanical via shearpin, electronic via torque limit

Material impurities: ≤10µm
Impurities larger than 10 µm can destroy the gear pumps

Operation temperature: max. 350 °C

Pressure in the production/polymer/extrusion/pipeline: max. 300 bar

Working ranges of the rheometer
MFR: 0.0375 – 29600 g/10min
Viscosity: 0.3 Pa·s – 500 k Pa·s
Shear stress: 280 Pa – 31 Mpa
Shear rate: 0.065 s⁻¹ – 54200 s⁻¹
Capillaries: 0.5 mm – 10 mm
Capillary length: 40 mm
Dynamic MVR-range: 1 : 1000 (1:min. speed / max.speed)
Response time: (Values without correction factor operation*)
MFR = 0.2 g/10min  18.8 min with a capillary diameter = 6 mm
MFR = 10 g/10min  0.37 min with a capillary diameter = 6 mm

MVR range without correction factor*:
8mm capillary 0.07 – 7 cm³/10min
6mm capillary 0.17 – 17 cm³/10min
4mm capillary 0.6 – 60 cm³/10min
2mm capillary 4.6 – 460 cm³/10min
1mm capillary 37 – 3700 cm³/10min

* Correction factor operation: Operation point shift via operation software. This allows to do test outside the operation range given by the capillary geometry. The application of a correction factor is material and of course dependent on the testing conditions.

Pressure transducer: Screw: 1/2"-20 UNF-2A
Flexible Stem: length = 18"
Accuracy: ± 0.5 % FSO
Temperature: max. 400 °C (diaphragm)

Temperature sensor: Pt 100 1/3 DIN B according to IEC 751 for heating- and temperature controlling

Thermocouple: Fe-CuNi type ‘J’ class “1”, according to IEC 584 part 2 for measuring the melt temperature
### Miscellaneous:
- **Dimensions:** H = 550 mm, W = 175 mm, D = 335 mm
- **Finish:** Drive black (mat), press.trans.holding pastel-orange RAL 2003, frame and side panels polished stainless steel
- **Weight:** approx. 20 kg.
- **Environ. conditions:**
  - **Temp. range:** 0 °C - 50 °C
  - **Temp. changes:** max. +/-10 °C
  - **Rel. humidity:** 90 % without condensation
  - **Protection:** IP 54 (standard)

### Power Supply
- **Power Supply:** Option, see the type plate at the control cabinet
- **Main fuse:** 3 x 20A blow-out fuse (line protection gG/gl)
- **Power consumption:** approx. 3.2 kW
- **Permissible voltage variations:** ± 10 %

### Technical data control electronics
- **Measuring data processor:** Industrial -PC and watchdog control
- **Operation interface:** Visualization ROS-Win on a desktop-PC or an industrial-workstation with Windows XP
- **Temperature control:** Type: microprocessor controlled multiple channel regulator with 3-point control zones
  - **Heating circuits:** max. 8 (2 standard, 3-4 = options)
  - **Sensor:** Pt 100 1/3 DIN IEC 751
  - **Temp. range:** 0 °C - 350 °C
  - **Resolution:** 0.1 °C for setpoint and actual value
  - **Accuracy:** max. ± 2 °C, typical ± 0.2 °C
- **Control inputs:** 4 functions can be controlled via external inputs:
  - **- Stop:** Stop drives, from test or standby mode
  - **- Standby:** Start standby mode
  - **- Start Test:** Start test mode
  - **- Release:** Active: drives startably
- **Version:**
  - **Opto-coupler inputs:** input voltage: 15-30V, input current: 5mA type
  - **Wiring of control inputs:** wiring of the inputs via closing- and opening relay contacts. Providing a 24 V supply voltage (potential free) or using the internal supply voltage (not potential free)
  - **Measures on customer side:** terminals inside of cabinet, shielded signal line, max. length of the cable depends on the cross section

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Emergency Stop input: Connection possibility of an external emergency stop command device
(not potential free)
Design:
Direct disconnection of the motor contactor in the control circuit (low voltage 24V),
**stop category 0**
Measures on customer side:
connection of an emergency stop switch with an opening contact, at least 30V, 1A switching capacity
Connection:
terminals inside of cabinet, shielded signal line, max. resistance of the external wiring = 20 Ohm.

Control outputs: - Alarm: active by machine failures and exceeding of limits
(potential free) - Standby mode active and
- Test mode active:
Design:
Relay contact: opening contact in failsafe version
Voltage: max. 30V ac/dc
Current: max. 0.5 A
Connection: terminals inside of cabinet, shielded signal line, the max. length of the cable depends on the cross section.

Analog Outputs: **10 programmable analog outputs**, all real time test values and calculated as well as corrected rheological sizes are selectable via menu (pressure, speed, temperature, melt- and volume indices, apparent shear stress, shear speed, viscosity)
(options)
Indicating range for freely definably in the operation software
For all outputs applies:
Output: 4 - 20mA, potential free
Output load: < 500 Ohm
Linearity: ± 2 LSB
Resolution: 12 Bit
Connection: terminals inside of cabinet, shielded signal line, the max. length of the cable depends on the cross section.

Digital outputs: (8 outputs) relay contact (closing contact), potential free
(options) For use see description on side 27
Voltage: max. 30V ac/dc
Current: max. 0.5A

Serial interface: RS 485 for connection of:
(option) • Control electronics (Control Cabinet) – PC
• PC - Distributed Control System 'DCS' 
• Industrial Workstation 'IWS' (cabinet) - Distributed Control System (DCS)
Cable specification for serial interface:
- Standard length: 3 m (in basic version)
- Max. length: 500 m (optional)
- Design: data cable min. 2 x 2 x 0,34mm², twisted pairs, shielded
- Connection: terminals in the cabinet, DSUB-plug at the PC

Connecting cable measuring head - Control Electronics:
(Option)
- General:
  - Separate power current and signal line bundles
  - Total. length: 200 m

  Divided into two cable sections which are connected by a junction box:
  1. measuring head – junction box:
     - temperature resistance cable upto 145°C: completely in a protective hose,
     - connection at the measuring head with plugs and in the control cabinet with terminals
     - Length: 2-10 m
  2. junction box – control cabinet:
     - standard cable: connection in the junction box and control cabinet with terminals,
     - exception: motor- and resolver connection in the control cabinet with DSUB-plug,
     - optional cables to the control cabinet with protective hose (3m)
     - Length max.: depends on the length of connection measuring head - junction box: 190-198 m

Mechanics:
Control cabinets:
(Options)
- Design: steel plate varnished, with transport eyelet

  Control Cab. TS 8606:
  - Dimensions: H=2000mm without base, W=600mm, D=600mm
  - Weight: Approx. 220 kg

  Control Cab. TS 8806:
  - Dimensions: H=2000mm without base, W=800mm, D=600mm
  - Weight: Approx. 240 kg

  Control Cab. TS 8808:
  - Dimensions: H=2000mm without base, W=800mm, D=800mm
  - Weight: Approx. 250 kg

  - Finish: Lightgrey RAL 7035
  - Temp. range: 0 °C - 40 °C
  - Rel. humidity: 90 % without condensation
  - Protection class: IP 54

Junction box:
- Design: Steel plate varnished, with external wall mounting holder,
  - cable bushing from the top and underneath.
- Dimensions: H = 300mm, B = 400mm, T = 120mm
- Finish: Lightgrey RAL 7035
- Weight: Approx. 5 kg
- Temp. Range: 0 °C - 60 °C
- Rel. Humidity: 90% without condensation
- Protection: IP 65
Safety measures

Electronics:       Hardware- and Software measures:
                  - Temperature-, speed- and pressure monitoring of minimum - and maximum values
                  - Torque limit and current monitoring of the drives
                  - Monitoring of data transmissions

Miscellaneous:   Torque limit with shear pin
As operation software the `Rheo Online Software ROS Win` is used. About this see the attached product description ,RHEO ONLINE SOFTWARE’.

Hardware Requirements for the PC

The operation Software runs on an IBM AT-compatible PC with the following requirements:

- Processor Pentium III or higher
- Minimum clock frequency of 500 MHz
- Min 64 MB RAM
- Min. 1 disk drive 3,5” 1,44 MB
- CD-ROM drive
- Min 2 GB hard disk
- VGA color monitor, 1024x768, 17”
- VGA graphic card with at least 4 MB RAM
- Two serial interfaces, the configuration depends on the option ‘Serial Interfaces’
- USB- or parallel interface PRN1 for connecting the printer, USB interface: if the option ‘Remote Access’ is ordered
- MF keyboard
- Mouse
- At least two free PCI-bus slots (if required for PC interface cards)
- Operation system: Windows® XP

The PC itself is not included

Windows® XP is a registered trademark of Microsoft Corporation.

In case the customers themselves provide the required PC following has to be considered:

**The PC must be sent to Goettfert prior to final inspection/dispatch of the rheometer system.** The final inspection test in-house Goettfert of the relevant rheometer will be performed only with the customer PC, which will be used onsite for operation, to guarantee a trouble free operation of the total system. In order to being able to prepare the PC best possible for operation with the rheometer, please make sure that the PC is sent to Goettfert on time.

Göttfert GmbH provides full warranty for 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 trouble free 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.

Supported Printers

The Rheo Online Software supports all printer models that own a Microsoft Windows® 2000 or Windows® XP printer driver.

Please specify the necessary side voltage 100/110 V or 230V absolutely when placing the order.

Supplied accessories

1 tool set for installation and maintenance
1 Anti-Seize grease
1 set shearing pins
1 set filter mats
1 user information optional in English or German language

The included documentation is delivered only in English or German language.
Preconditions for a troublefree operation of the MBR CAN 71.05

In order to guarantee a troublefree operation of the rheometer when being connected to a production extruder or a polymer line, the following conditions have to be fulfilled by the customer at the connection point:

- melt must be free from dirt particles (particle size < 8µm)
  Applications with dirt particles > 8µm are possible and successful at use. It has to be considered that dependent on the material to be tested an increased wear of the spinning pump may be possible.

- sufficient constant process pressure has to be available (if possible non-pulsing)
  Note: Constant pressure is of course dependent on what type of material is being used and the length of the adapter. According to our experience when PE is used with standard adapter, we recommend the following prepressures as guide values:
    - MFR (190/2.16) = 0.46 g/10': minimum pressure approx. 30 bar
    - MFR (190/2.16) = 7 g/10': minimum pressure approx. 20 bar
    - MFR (190/2.16) = 22 g/10': minimum pressure approx. 15 bar

Please note that the unit is fitted with microprocessors. The power supply must be free of any interference in order to guarantee trouble-free operation.

MBR CAN 71.05 basic module
MINI BYPASS RHEOGRAPH
consisting of Measuring Head, Control Electronics, Operation Software and Accessories corresponding to the present product description.
Order number ...................................................................................................................................................5.42.500

To complete the MBR, the basic model must be supplied customer-specific with the following optional units:

- 1 capillary insert with one capillary
- 1 pressure transducers
- German or English version selection
- Control cabinet
- Power supply
- Connection cable control cabinet – measuring head (needed cable length)
- Personal Computer or Industrial Workstation
- Serial interface to PC or Device Control System

Additional application-specific options are listed in this product description.

Subject to change due to technical developments.
The MINI BYPASS RHEOGRAPH plan of MBR

MBR
Basic Model

Language version

Capillary die

Pressure transducers

Control cabinet

Power supply

Interface configuration

Computer configuration
Optional units

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Digital Outputs ......................................................................................... 27
Remote control at the extruder ............................................................... 29
Digital display at the extruder ................................................................. 29
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Language versions and user information:

German version
Control cabinet lettering and user information in German.
Order number ............................................................................................ 5.42.504

English version
Control cabinet lettering and user information in English.
Order number ............................................................................................ 5.42.505

User information German
Additional set of user information.
Order number ............................................................................................ 5.42.506

User information English
Additional set of user information.
Order number ............................................................................................ 5.42.507

The user information consists of operating manual, technical documentation, calculation basis and program documentation.
Capillaries

With regard to the products to be tested and to the measuring range the appropriate capillaries can be selected from the following.

**Capillary die L/D = 20/1**
for an MFR range of approx. 2.8 - 2800 g/10 min.
Order number ................................................................. 4.23.428

**Capillary die L/D = 40/1**
for an MFR range of approx. 2.8 - 2800 g/10 min.
Order number ................................................................. 4.23.434

**Capillary die L/D = 20/2**
for an MFR range of approx. 0.36 - 360 g/10 min.
Order number ................................................................. 4.23.429

**Capillary die L/D = 40/2**
for an MFR range of approx. 0.36 - 360 g/10 min.
Order number ................................................................. 4.23.430

**Capillary die L/D = 20/3**
for an MFR range of approx. 0.11 - 110 g/10 min.
Order number ................................................................. 4.23.432

**Capillary die L/D = 40/3**
for an MFR range of approx. 0.11 - 110 g/10 min.
Order number ................................................................. 4.23.435

**Capillary die L/D = 20/4**
for an MFR range of approx. 0.044 - 44 g/10 min.
Order number ................................................................. 4.23.433

**Capillary die L/D = 40/4**
for an MFR range of approx. 0.044 - 44 g/10 min.
Order number ................................................................. 4.23.431

**Capillary die L/D = 40/5**
for a MVR range of approx. 0.022 - 22 cm³/10 min.
Order number ................................................................. 4.23.439

**Capillary die L/D = 40/0,5**
for a MVR range of approx. 0.022 - 22 cm³/10 min.
Order number ................................................................. 4.23.458
Test Pressure transducers

One Test Pressure Transducers is required in order to measure the melt pressure at the capillary. Please note at the selection of pressure transducer, that you get the highest possible accuracy between 10% and 90% of the nominal values of pressure transducers.

For measured value transmission all test pressure transducers are equipped with a CANBus measuring amplifier, which is located into the pressure transducer housing.

The following applies for all pressure transducers:

- Quality Class I: combined error ± 0.5 % FSO
- Temperature: max. 400 °C (diaphragm)
- Thread: 1/2"-20 UNF-2A
- Flexible Stem: length = 18"
- Non-German product

Test Pressure transducer  50 bar
Order number ...................................................................................................................................................8.81.194

Test Pressure transducer 100 bar
Order number ...................................................................................................................................................8.81.192

Test Pressure transducer 200 bar
Order number ...................................................................................................................................................8.81.193

Melt Flange

The MBR basic unit is supplied with a Melt Flange with threaded nozzle M30x1,5 (see drawing at page 4). With this connection the MBR can be flange-mounted on the product line or extruder system without any lifting device.

Melt Flange as special version
A special melt flange is available on request and will be designed in accordance with customer specifications.
Order number ...................................................................................................................................................9.00.360

Adapter

On request a heated Adapter with or without shut-off valve is available to connect the MBR on the product line or extruder system.

Adapter as special version
A special adapter is available on request and will be designed in accordance with customer specifications.
Order number ...................................................................................................................................................9.00.786
Executions of Control cabinet

For housing the control electronics following control cabinets are available:

**Control Cabinet TS 8606**
for installation of control electronics.
Dimensions: \( W = 600\text{mm}, D = 600\text{mm}, H = 2000\text{mm}, \) without base
Finish: Light grey RAL 7035
Order number ...................................................................................................................................................5.42.101

**Control Cabinet TS 8806**
for installation of control electronics.
Dimensions: \( W = 800\text{mm}, D = 800\text{mm}, H = 2000\text{mm}, \) without base
Finish: Light grey RAL 7035
Order number ...................................................................................................................................................5.42.102

**Control Cabinet TS 8808**
for installation of control electronics.
Dimensions: \( W = 800\text{mm}, D = 800\text{mm}, H = 2000\text{mm}, \) without base
Finish: Light grey RAL 7035
Order number ...................................................................................................................................................5.42.103

Other control cabinets on request.

Optional units for the control cabinets:

**Base 100mm for Electronics Cabinet TS 8606**
Order number ...................................................................................................................................................8.50.286

**Base 200mm for Electronics Cabinet TS 8606**
Order number ...................................................................................................................................................8.50.287

**Base 100mm for Electronics Cabinet TS 8806**
Order number ...................................................................................................................................................8.50.290

**Base 200mm for Electronics Cabinet TS 8806**
Order number ...................................................................................................................................................8.50.288

**Base 100mm for Electronics Cabinet TS 8808**
Order number ...................................................................................................................................................8.50.291

**Base 200mm for Electronics Cabinet TS 8808**
Order number ...................................................................................................................................................8.50.289
The selection of the cable bushing into the control cabinet depends on the requirements at the assembling place.
In principle the cable bushings should be installed in a suitable cable channel in which they are mechanically protected and the functional reliability is ensured.

- For installation of the control cabinet into a cabinet series the first both versions are suitable
- If the cable channel is not sunk in the ground the third version should be ordered
- If no cable channel for the reception of the cables available select the fourth version.

1. **Control cabinet – cable bushing**
   from **below**. The left and right side wall of control cabinet are kept free.
   Order number ...................................................................................................................................................5.42.253

2. **Control cabinet – cable bushing**
   from **the top**. The left and right side wall of control cabinet are kept free; this is not possible at the control cabinet standard with order number 5.42.250.
   Order number ...................................................................................................................................................5.42.254

The following versions can only be selected by a **control cabinet with base**:

3. **Control cabinet- cable bushing**
   from the **right side through a recess in the base**.
   Order number ...................................................................................................................................................5.42.255

4. **Control cabinet – cable bushing**
   from the **right side through the base**. The connection cables from the measuring head are leaded in the control cabinet via two protective hoses (length=3m), all other cables via cable glands.
   Order number ...................................................................................................................................................5.42.328

**Power Supply**
Select one of the following **Power Supplies** for the MBR:

**Power Supply 400V, 3L+N+PE - 50Hz**
Voltage: 3 x 360...440V, three-phase four-wire system
Permissible voltage fluctuations: ± 0 %
Frequency: 50 Hz ± 1%
Power consumption: Approx. 3.2 KW
Order number ...................................................................................................................................................5.42.231
**Power Supply 400V, 3L+PE – 50/60Hz**

Voltage: 3 x 360…440V, three-phase three-wire system  
Permissible voltage fluctuations: ± 0 %  
Frequency: 50/60 Hz ± 1%  
Power consumption: Approx. 3.2 KW  
Order number ...................................................................................................................................................5.42.232

**Power Supply 3 x 230V, 3L+PE – 50/60Hz**

Voltage: 3 x 207…253V, three-phase three-wire system  
Permissible voltage fluctuations: ± 0 %  
Frequency: 50/60 Hz ± 1%  
Power consumption: Approx. 3.2 KW  
Order number ...................................................................................................................................................5.42.230

The Power Supplies must be executed with a **fixed connection** and an **additional protective conductor** (10mm² Cu) in accordance DIN EN 50178 (VDE 0160):1998-04 because of a possible increased stray current. By this stray current the application of a current-operated earth-leakage protection can make problems.

Other power supply voltages available on request.

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**Connection cable from control cabinet to measuring head**

The connection cable consisting of a power current- and electronic cable bundle. The cable is divided into two sections, for reasons of the heat load at the measuring head, which are connected by a junction box:

- Connection cable from measuring head to junction box, execution with heat resistant cables  
- Connection cable from junction box to control cabinet, execution in standard cables for internal wiring

The maximum possible length of the total connection cable from the control cabinet to the measuring head amounts to: 200 m. Depending on the length of the cable section from the junction box to the measuring head the length of the section from the control cabinet to the junction box is to be selected.

The length determination of the cables must be made in the following way:

- Determine the assembly places for the measuring head, the control cabinet and the junction box  
  The junction box should be mounted nearly the measuring head so that the cable length is as short as possible. Please note that the max. heat load of the junction box (max. 60°C) must not be exceeded.
- Definition of the way of wiring from the connecting cables.
- Measuring of the length for the first line section from the measuring head to the junction box. Note that this length can only be may max 10 m long (for technical reasons).
- Measuring of the length for the second line section from the junction box to the control cabinet.
Connection cable measuring head – junction box
consisting of heat resistant cable completely into protecting hoses. This cable can be ordered
with a length of 2-10 m. Note that this cable should be ordered as short as possible.
Please specify the cable length (m) when placing the order.
Order number ...................................................................................................................................................5.42.512

Connection cable junction box – control cabinet
For wiring in rooms by a normal strain. Suitably for wiring outdoors on following conditions: only
with UV protection and by attention of the temperature range.
This cable can be ordered with a max. length of 190-198 m, depends to the length of connection
cable junction box – measuring head.
Please specify the cable length (m) when placing the order.
Order number ...................................................................................................................................................5.42.204

Remarks to the wiring
- Power current and electronic cable bundles are to be wired separately from each other
(distance approx. 30cm), in order to prevent electromagnetic disturbances.
- They are to be wired in or on suitable installation channels or cable basket.

Extra Heat Zone
to connect and control the temperature of a additional necessary adapter (e.g. supplied by
purchaser). This adapter has to provided with an electric heater and a temperature sensor.

Required temperature sensor: Pt100 1/3 DIN, IEC 751
Connection cable: With 1 cable for the heater and 1 cable for the temperature sensor, the
connection of heater and temperature sensor is carried out via respective
plugs and sockets that are contained in the order.
Mains lead heater: 230V/N~
Maximum power: $P_{\text{max}} = 1,5 \text{kW}$

Please mention, that the power consumption of the device increases.
Order number ...................................................................................................................................................5.42.262

The connection cable between extra heat zone and control electronics can be ordered to up
200m. The cable of the extra heat zone is laid in the cable bundle of the connection cable
measuring head – control cabinet and is executed in the same way. You find a detailed
description of the connection cable on the page 21.

Connection Cable Extra Heat Zone 1. Section
For connection of a heated adapter to the junction box with heat-resistant cables. For execution
and needed cable length see the option 'connection cable measuring head – junction box' order
number 5.42.512.
Please specify the cable length (m) when placing the order.
Order number ...................................................................................................................................................5.42.263
Connection Cable Extra Heat Zone 2. Section
For connection of the junction box to the control cabinet with standard cables. For execution and needed cable length see the option 'connection cable junction box – control cabinet' order number 5.42.204
Please specify the cable length (m) when placing the order.
Order number ...................................................................................................................................................5.42.264

Computer Configuration
The rheometer will be operated via the Rheo Online Software, which runs on an AT-compatible PC. Different operation modes are possible:

- Stand alone mode: manual operation at the Rheometer
- Stand alone mode with Host Connection: manual operation at the rheometer and test data transmission to a process control system
- Remote mode: Host Connection, operation and test date processing via a process control system

Adjusted to the requirements of the user and the desired control concept, different computer configurations are possible:

- Desktop Personal Computer stand alone or remote mode possible
- Industrial Workstation integrated in the control cabinet: stand alone or remote mode possible

Personal Computer
If the rheometer should be operated via a PC, please see the necessary hardware requirements as listed on page 12 of this product description.
If the operation PC should be supplied by Göttfert, please contact us for an suitable offer, which fulfills these requirements.
Information about the equipment features of the PC, printer and equipment you will find in the separate product description "Visualization – PC".

Special table
for the Personal Computer and printer.
With multiple socket outlet (x6) for 230-V power supply.
Width: 1100 mm, depth: 750 mm, height: 720 mm
Order number ...................................................................................................................................................5.29.086
Industrial Workstation

with integrated color display and membrane keypad, installed in the door of control cabinet, for operating the rheometer in stand alone mode or optionally with Host Connection, equipped with:

- Mobile Intel Celeron M 600 MHz
- 256 Mbytes RAM, 40 GB HDD
- 15" TFT color display (1.024 x 768)
- analog resistive touch screen
- front design in IP 65
- Windows XP
- DC 24V external USV 24V DC/100W
- Interfaces: 2 x COM (RS 232)
- 2 x USB; Network: 10/100 Mbit
- 1 free ISA/PCI + 1 free PCI-Slot

The previous listed equipment may vary depending on the application.

Industrial Workstation, English Version
Order number: .................................................................................................................................................5.42.174

Industrial Workstation, German Version
Order number: .................................................................................................................................................5.42.195

Remote Access

To help you with problems with the operating software or with the handling of the machine we recommend to use a remote control software. This will enable our service technicians to control your machine from our company remotely. Its also possible to install program updates and to fix configuration problems.

We strongly recommend the usage of the option “Remote Access”

Option “Remote Access” contains the remote control software, a modem and the needed cable material. The connections for the analogue telephone lines are realized as terminal strips.

Remote Access for personal computers / PC (desktop)

English version of the remote control software PC-Anywhere
Order number ..................................................................................................................................................5.80.114

German version of the remote control software PC-Anywhere
Order number ..................................................................................................................................................5.80.115
Remote Access for Industrial Workstation / IWS

English version of the remote control software  PC-Anywhere
Order number ..................................................................................................................................................5.42.333

German version of the remote control software  PC-Anywhere
Order number ..................................................................................................................................................5.42.332

Serial Interface

The RS 485 interface used by us is an industrial interface to compensate larger distances (up to 500 m). It is disturbance resistant by suppression of common-mode interference, bus able and high data transmission rates are possible (up to approx. 100 kBaud)

For connecting the control electronics to the operating PC following serial interfaces are available:

Interface control cabinet - PC via PC-card
RS 485, with interface in the control cabinet, connection cable and PC-card, opto-isolated.
Order Number...................................................................................................................................................5.42.319

Interface control cabinet - PC via interface at the PC
RS 485, with interface in the control cabinet, connection cable and RS 485 <> RS 232 interface to connect at the standard RS 232 PC-interface, opto-isolated. The connection of the interface at the PC is executed as 25-poles socket or via an adapter as 9-poles socket (female).
Please specify the necessary side voltage 100/110 V or 230V for the PC-interface power pack absolutely when placing the order.
Order Number...................................................................................................................................................5.42.320

For connecting the PC and the Device Control System (DCS) the following serial interfaces are available:

Interfaces PC – DCS via PC-card
RS 485 with connection cable from PC to the DCS, opto-isolated.
This optional unit can only be ordered in connection with the optional unit "interface with PC-card" no. 5.42.319, as for this the PC-card is needed of this optional unit.
Order Number...................................................................................................................................................5.42.330

Interface PC – DCS via interface at the PC
RS 485 with RS 485 <> RS 232 interface at the standard RS 232 PC-interface and connection cable from PC to the DCS, opto-isolated.
Please specify the necessary side voltage 100/110 V or 230V for the PC-interface power pack absolutely when placing the order.
Order Number...................................................................................................................................................5.42.331
If the PC is provided by the customer we recommend the serial interface configuration ‘RS 485 Interfaces via interface at the PC’. By this implementation you have not to make changes in your PC-hardware to realize a RS485 connection.

For Connecting the **Industrial Workstation (IWS)** to the **Device Control System (DCS)** following serial interfaces are available:

**Interface IWS - DCS**
RS 485 with RS 485 <> RS 232 interface in the control cabinet and connection cable from the control cabinet to the DCS, opto-isolated.
Order Number...................................................................................................................................................5.42.329

The standard scope of supply includes a 3m connection cable, which is delivered together with your ordered serial interface. If you require a longer connection cable, you have to order the additionally required length (see options ‘cable extension of interfaces’ on this page)

The standard connection cable to the DCS is executed for connection to terminal strips. If required, the connection cable at DCS connection side can be additionally equipped by a plug connector with shielded housing:

**Connection 9-polig Socket (female) DSUB**
Order Number...................................................................................................................................................5.39.181

**Connection 9-polig Plug (male) DSUB**
Order Number...................................................................................................................................................5.39.182

**Connection 25-polig Socket (female) DSUB**
Order Number...................................................................................................................................................5.39.183

**Connection 25-polig Plug (male) DSUB**
Order Number...................................................................................................................................................5.39.184

**Cable extensions of the interfaces**

To the extension of the serial connection of:
- Electronic at control cabinet and PC or
- PC and Device Control System (customer side) or
- Industrial Workstation at control cabinet and Device Control System (customer side)

The standard connection cable and the respective extension are supplied as one unit.
Cable extension of RS 485 interface
The connecting cable can be extended to a maximum of 500 m. Please specify the cable extension (m) when placing the order.
Order Number ...................................................................................................................................................5.39.195

Analog test data output
Maximum 10 programmable analog outputs are available. They can be ordered in quantities of 2 pcs (1 module).
If more than 10 analog outputs are required for connection to a Process Control System, we recommend option ROSWIN Modbus Interface. Therefore see also the separate product description „Rheo Online Software“.
The programmable analog outputs are configured separately via a menu in the Rheo Online Software. One measured or calculated signal of the single-point measurement can be selected for each programmable analog output ordered:

- speed-, pressure-, melt temperature- and steel temperature values
- all calculated and corrected rheological values

The indicating range of the two programmable analog outputs can be set in two ways:

- manually adjustable indicating ranges
- automatic range selection between several free defined ranges. The indication of the active ranges is given via digital outputs, see options “digital outputs”.

For technical data see „Technical Data Control Electronics“ on Page 8.

Analog output module 1 (max 1x), 4 –20mA
2 Analog outputs, free configuration in the Rheo Online Software.
Order number ..................................................................................................................................................5. 42.318

Analog output module 2-5 (max 4x), 4 –20mA
2 Analog outputs, free configuration in the Rheo Online Software.
Order number ..................................................................................................................................................5. 42.350

Digital Outputs
The option digital output contains 8 potential free relay-outputs. These outputs are executed as closer contacts.

For technical data see ‘Technical Data Control Electronics’ on page 8.

The digital outputs are individually configured in the Rheo Online Software.
Following signals can be given out via digital outputs:

- **EOAS - End of Analysis Signal**
  To find out, in connection with the analog outputs, when a test point was taken, there is given a pulse over a digital output.
  The first digital output will be designated.

- **Limit Value Indicator**
  The operation program supports user defined limit values for all measured and calculated values. If the limit of a value is exceeded, a signal can be output digitally.
  For each limit value you need one digital output.

- **Operation state**
  Following states are given out:
  - motors in operation
  - test active
  - standby mode active
  - error active
  One digital output is required for one status signal.

- **Automatic Range Switching - ARS (for module 1, 5.42.318)**
  For the options „programmable analog outputs“: The automatic range switching can be used for improvement of the resolution range, when a connection to the DCS is made via the programmable analog outputs. That means there are several ranges defined for a value to be measured, between which the rheometer can switch automatically. The indication of the active measuring range is coded via digital outputs.

  The quantity of possible measuring ranges is calculated out of the equation 2 raised to n, where n is the amount of digital outputs, which are applicable for this analog output. Please see the below table:

<table>
<thead>
<tr>
<th>Max. quantity of applicable measuring ranges</th>
<th>Required digital outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>

**Digital Outputs**

8 potential-free relay contacts (closing contact), free configuration in the Rheo Online Software

Order Number........................................................................................................................................................5.42.317
Remote control at the extruder

Separate console with three switches and two signal lamps with following functions:

- **Switch: Start Standby:** the pumps are started in standby mode
- **Switch: Start test:** the test is started
- **Switch: Stop:** the pump is switched off, the heatings remain in operation.
- **Lamp: Standby active:** the device is in the standby mode
- **Lamp: Test active:** the device is in the test mode

We recommend that this console should be used if the PC is not positioned in the immediate vicinity of the measuring head.

The console must be mounted by the customer.

Order number ...................................................................................................................................................5.42.256

For connection of the remote control console to the control electronics you need a connection cable:

**Cable extension remote control**

The connection cable is wired in the cable bundle of the signal cables of the cable connection from control cabinet to the measuring head up to the junction box and is branched in front of the junction box to the remote control console. It is not connected in the junction box! The needed length of the connection cable is ascertained from the length of the connection cable ‘junction box-control cabinet’ (see optional unit order number 5.42.512) and the distance between junction box and the mounting place of the remote control console. The maximum possible cable length is 220 m.

Alternatively or by retrofit the laying of the cables takes place directly from the control cabinet to the remote control console.

Please specify the length of the connection cable (m) when placing the order.

Order number ...................................................................................................................................................5.42.257

Digital display at the extruder

4-digit digital display which indicates the viscosity or the MFR value.

The digital display must be mounted by the customer.

Order number ...................................................................................................................................................5.42.258

For connection of the digital display to the control electronics you need a connection cable:

**Cable extension digital display**

The connection cable is wired in the cable bundle of the signal cables of the cable connection from control cabinet to the measuring head up to the junction box and is branched in front of the junction box to the digital display. It is not connected in the junction box!
The needed length of the connection cable is ascertained from the length of the connection cable 'junction box-control cabinet' (see optional unit order number 5.42.512) and the distance between junction box and the mounting place of the digital display. The maximum possible cable length is 220 m. Alternatively or by retrofit the laying of the cables takes place directly from the control cabinet to the digital display. Please specify the length of the connection cable (m) when placing the order.

Order number ................................................................. 5.42.259

**Engineering Support**

On request, Göttfert can provide special engineering assistance to our customers. This support would cover following:

- Customer will be provided with detailed plans, drawings for adaption of the rheometer on customer site
- A dummy model of the rheometer (dimensional accordance to original rheometer) for evaluation of the space requirements on extruder side
- Negotiations and discussions for the best solution with the extruder manufacturer to optimize spool piece and rheometer adapter as well as joint supply of both parts
- Definition of optimal test parameters for the customer material grades in Göttfert’s lab to optimize the calibration of the rheometer at customer site

Order number ................................................................. 9.01.557

The MBR can be supplied in explosion-proof design, too. See attached product description ‘MBR in explosion-proof design’.

Following designs are possible on request:
- Control Cabinet design in IP 65

Subject to change due to technical developments.