Microreaction Technology

Chemical Process Technology of Tomorrow
Overview Microreaction Products

*mikroglas chemtech GmbH* develops and manufactures microreaction products made of glass, for example, microreaction modules such as static mixers, heat exchangers or a combination of both. The material glass makes the reactor modules resistant against aggressive media.

T-Mixer (page 2)
This mixer can be used to form a regular plug flow for two-phase organic systems. Different channel geometries are available. Therefore the mixer can be used for a wide variety of processes.

Interdigital Micro Mixer (page 3-6)
This mixer combines the regular flow pattern created by multi-lamination with geometric focusing. This speeds up liquid mixing of the multilamellae. The mixer can be used for a wide variety of processes such as mixing, emulsification, single-phase organic synthesis, and multi-phase organic synthesis.

Interdigital Mixer with Heat Exchanger (page 7-9)
This device comprises a stack of several micro structured plates that are arranged to build a mixer and heat exchanger. The mixer plate consists of 5 parallel reaction channels of 500µm width and 200µm depth. The device is utilized for liquid/liquid and gas/liquid phase reactions.

Counter Flow Micro Heat Exchanger (page 10)
This device comprises a stack of several micro structured plates that are arranged for a counter- or co-current flow practice. Each plate consists of 20 parallel micro channels of 1.4 mm width and 0.5 mm depth. The plate stack is encompassed by PTFE plates, for thermal insulation against the environment and the two steel caps. The device is utilized for liquid-phase micro heat exchanging.

Falling Film Micro Reactor (page 11)
This reactor utilizes a multitude of thin falling films that move by gravity force exhibiting typical residence times of seconds up to about one minute. Its unique properties are the specific interface of 20,000 m²/m³ and the excellent temperature control through the integrated heat exchanger. The reaction plate is available with different channel dimensions.

*mikroSyn microreaction System* (page 12-16)
The *mikroSyn microreaction laboratory system* is designed to run a micro reactor under controlled conditions. It is utilizing innovative microreactor components in combination with well-proven standard fluidic equipment. The system consists of 2 rotary pumps, 1 gear pump, valves, pressure and temperature sensors. The heating/cooling circulation is temperature controlled by a Huber polystat. The microreaction system is controlled by a SIMATIC S7-300 Control System by Siemens.

*mikroglas sensors* (page 17)
mikroglas chemtech GmbH develops and manufactures microtechnological products made of glass (FOTURAN), as for example microreactor modules, such as static mixers, heat exchangers, or a combination of both. The material glass makes the reactor modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for photochemical applications.

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of layers</td>
<td>3</td>
</tr>
<tr>
<td>Layer thickness</td>
<td>0.4 mm - 1 mm</td>
</tr>
<tr>
<td>Outer dimensions</td>
<td>106 mm x 56 mm x 25 mm</td>
</tr>
<tr>
<td>Number of reaction channels</td>
<td>1</td>
</tr>
<tr>
<td>Channel dimensions</td>
<td>height: 0.15 mm - 0.4 mm</td>
</tr>
<tr>
<td></td>
<td>width: 0.05 mm - 0.4 mm</td>
</tr>
<tr>
<td>Reaction channel</td>
<td>length: 40 mm - 450 mm</td>
</tr>
<tr>
<td>Flow rate</td>
<td>up to 5 l/h</td>
</tr>
<tr>
<td>Maximum viscosity</td>
<td>appr. 22.5 mPas</td>
</tr>
<tr>
<td>Connection</td>
<td>by ready-made Teflon tubes (UNF thread 1/4&quot;)</td>
</tr>
</tbody>
</table>
mikroglas chemtech GmbH develops and manufactures microtechnological products made of glass (FOTURAN), as for example microreactor modules, such as static mixers, heat exchangers, or a combination of both. The material glass makes the reactor modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for photochemical applications.

The mixer is available with two different designs of the mixing chamber:

- rectangular
- triangular

Developed in co-operation with the Institut für Mikrotechnik Mainz GmbH

<table>
<thead>
<tr>
<th>specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of layers</td>
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<tr>
<td>layer thickness</td>
</tr>
<tr>
<td>outer dimensions</td>
</tr>
<tr>
<td>number of reaction channels</td>
</tr>
<tr>
<td>channel dimensions (inlet)</td>
</tr>
<tr>
<td>reaction channel flow rate</td>
</tr>
<tr>
<td>connection</td>
</tr>
</tbody>
</table>

The graph shows the drop in pressure (bar) against the volume flow (ml/s) at 20°C for both rectangular and triangular designs.
mikroglas chemtech GmbH develops and manufactures microtechnological products made of glass (FOTURAN), as for example microreactor modules, such as static mixers, heat exchangers, or a combination of both. Due to the strong focusing within the mixing chamber a very fast mixture can be obtained even for high flow rates. The material glass makes the reactor modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for optical analysis.

Iron rhodanide reaction (Volume flow 5 l/h)

### Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of layers</td>
<td>6</td>
</tr>
<tr>
<td>layer thickness</td>
<td>0.5 mm - 1 mm</td>
</tr>
<tr>
<td>outer dimensions</td>
<td>130 mm x 56 mm x 25 mm</td>
</tr>
<tr>
<td>number of feeding channels</td>
<td>124</td>
</tr>
<tr>
<td>channel dimensions (inlet)</td>
<td>height: 0.5 mm</td>
</tr>
<tr>
<td></td>
<td>width: 100 µm</td>
</tr>
<tr>
<td>reaction channel</td>
<td>length: 50 mm</td>
</tr>
<tr>
<td>flow rate</td>
<td>up to 10 l/h</td>
</tr>
<tr>
<td>connection</td>
<td>by ready-made Teflon tubes (UNF thread 1/4&quot;)</td>
</tr>
</tbody>
</table>

Developed in co-operation with the Institut für Mikrotechnik Mainz GmbH
mikroglas chemtech GmbH develops and manufactures microtechnological products made of glass (FOTURAN), as for example microreactor modules, such as static mixers, heat exchangers, or a combination of both. The mikroglas mixer with cyclone design mixing chamber enables the user to mix liquid with gaseous media. The material glass makes the reactor modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for optical analysis.

Developed in co-operation with the Institut für Mikrotechnik Mainz GmbH
mikroglas chemtech GmbH develops and manufactures microtechnological products made of glass (FOTURAN), as for example microreactor modules, such as static mixers, heat exchangers, or a combination of both. The material glass makes the reactor modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for photochemical applications.

The reaction channel contains a field with 15,000 pillars. When a plug flow is running through this field the plugs will break up resulting in a homogeneous emulsion.

**specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of layers</td>
<td>4</td>
</tr>
<tr>
<td>layer thickness</td>
<td>150 µm - 1 mm</td>
</tr>
<tr>
<td>outer dimensions</td>
<td>106 mm x 56 mm x 25 mm</td>
</tr>
<tr>
<td>number of reaction channels</td>
<td>30</td>
</tr>
<tr>
<td>channel dimensions (inlet)</td>
<td>height: 150 µm&lt;br&gt;width: 50 µm&lt;br&gt;length: 25 mm</td>
</tr>
<tr>
<td>reaction channel</td>
<td>up to 500 ml/h&lt;br&gt;by ready-made Teflon tubes (UNF thread 1/4&quot;)</td>
</tr>
<tr>
<td>flow rate</td>
<td></td>
</tr>
<tr>
<td>connection</td>
<td></td>
</tr>
</tbody>
</table>
The range of products for microreaction technology produced by the mikroglas chemtech GmbH includes ready-to-connect modules such as different static mixers, microreactors, heat-exchangers and dwell devices. The new mikroglas reactor has new designed interdigital mixing structures and therefore an essentially higher efficiency. The material glass makes the reactor modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for photochemical applications.

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of layers</td>
<td>9</td>
</tr>
<tr>
<td>layer thickness</td>
<td>0.2 mm to 2 mm</td>
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<tr>
<td>outer dimensions frame</td>
<td>135 mm x 90 mm x 25 mm</td>
</tr>
<tr>
<td>outer dimensions glass part</td>
<td>118 mm x 73 mm x 7.5</td>
</tr>
<tr>
<td>number of reaction channels</td>
<td>5</td>
</tr>
<tr>
<td>reaction channel dimensions</td>
<td>height: 0.25 mm width: 0.5 mm length: 100 mm</td>
</tr>
<tr>
<td>heat exchange area</td>
<td>250 mm²</td>
</tr>
<tr>
<td>flow rate product</td>
<td>appr. 2 l/h (water 20°C; 1 bar)</td>
</tr>
<tr>
<td>flow rate heat exchange fluid</td>
<td>appr. 10 l/h (water 20°C; 1 bar)</td>
</tr>
<tr>
<td>connection</td>
<td>by ready-made Teflon tubes (1/4&quot;UNF threat)</td>
</tr>
</tbody>
</table>

![Diagram of the reactor](image-url)

![Graph of drop in pressure vs. volume flow](image-url)
The range of products for microreaction technology produced by the mikroglas chemtech GmbH includes ready-to-connect modules such as different static mixers, microreactors, heat-exchangers and dwell devices. The new mikroglas single channel reactor has an interdigital mixing structure followed by a 1.10 m long reaction channel. Depending on the flow rate the user can achieve a residence time in the range of minutes. The material glass makes the reactor modules resistant against aggressive liquids.

mikroglas single channel reactor with Swagelok connections. A version with HPLC fittings and Teflon tubes is also available.

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tr>
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<tr>
<td>outer dimensions frame</td>
<td>135 mm x 90 mm x 25 mm</td>
</tr>
<tr>
<td>outer dimensions glass part</td>
<td>118 mm x 73 mm x 7 mm</td>
</tr>
<tr>
<td>number of reaction channels</td>
<td>1</td>
</tr>
<tr>
<td>reaction channel dimensions</td>
<td>height: 0.5 mm</td>
</tr>
<tr>
<td></td>
<td>width: 2.0 mm</td>
</tr>
<tr>
<td></td>
<td>length: 1.10 m</td>
</tr>
<tr>
<td>heat exchange area</td>
<td>1100 mm²</td>
</tr>
<tr>
<td>flow rate product</td>
<td>appr. 2.6 l/h</td>
</tr>
<tr>
<td>related drop in pressure</td>
<td>appr. 2.0 bar (water at 20 °C)</td>
</tr>
<tr>
<td>flow rate heat exchange fluid</td>
<td>appr. 12 l/h</td>
</tr>
<tr>
<td>related drop in pressure</td>
<td>appr. 1.6 bar (water at 20 °C)</td>
</tr>
<tr>
<td>connection</td>
<td>Swagelok connections or ready-made Teflon tubes (1/4&quot; UNF threat)</td>
</tr>
</tbody>
</table>
The range of products for microreaction technology produced by the mikroglas chemtech GmbH includes ready-to-connect modules such as different static mixers, microreactors, heat-exchangers and dwell devices.

The mikroglas reactor cyclone design has a new designed mixing structure for gas liquid mixing. The material glass makes the reactor modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for photochemical applications.

### Specifications

<table>
<thead>
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</thead>
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<td>Number of layers</td>
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<tr>
<td>outer dimensions frame</td>
<td>135 mm x 90 mm x 25 mm</td>
</tr>
<tr>
<td>outer dimensions glass part</td>
<td>118 mm x 73 mm x 7.5</td>
</tr>
<tr>
<td>inlet nozzles</td>
<td>8 liquid, 8 gas</td>
</tr>
<tr>
<td>width nozzles liquid</td>
<td>0.070 mm</td>
</tr>
<tr>
<td>width nozzles gas</td>
<td>0.050 mm</td>
</tr>
<tr>
<td>mixing chamber dimensions</td>
<td>height: 2.5 mm, diameter: 10 mm</td>
</tr>
<tr>
<td>flow rate liquid</td>
<td>up to 1.0 l/h</td>
</tr>
<tr>
<td>flow rate gas</td>
<td>up to 12 l/h</td>
</tr>
<tr>
<td>flow rate heat exchange fluid connection</td>
<td>appr. 10 l/h (water 20°C; 1bar)</td>
</tr>
<tr>
<td>connection</td>
<td>by ready-made Teflon tubes (1/4&quot; UNF threat)</td>
</tr>
</tbody>
</table>
The range of products for microreaction technology produced by the mikroglas chemtech GmbH includes ready-to-connect modules such as different static mixers, microreactors, heat-exchangers and dwell devices.

The mikroglas dwell device has a 1.15 m long channel which offers extended reaction time under controlled temperature conditions. The material glass makes the fluidic modules resistant against aggressive liquids. Due to its optical transparency it is also possible to use the system for photochemical applications.

### Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of layers</td>
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<tr>
<td>Layer thickness</td>
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<tr>
<td>Outer dimensions frame</td>
<td>135 mm x 90 mm x 25 mm</td>
</tr>
<tr>
<td>Outer dimensions glass part</td>
<td>118 mm x 73 mm x 7.5</td>
</tr>
<tr>
<td>Number of reaction channels</td>
<td>1</td>
</tr>
<tr>
<td>Reaction channel dimensions</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>Width</td>
<td>2.0 mm</td>
</tr>
<tr>
<td>Length</td>
<td>1.15 m</td>
</tr>
<tr>
<td>Heat exchange area</td>
<td>2300 mm²</td>
</tr>
<tr>
<td>Flow rate product</td>
<td>appr. 2 l/h (water 20°C; 1bar)</td>
</tr>
<tr>
<td>Flow rate heat exchange fluid</td>
<td>appr. 10 l/h (water 20°C; 1bar)</td>
</tr>
<tr>
<td>Connection</td>
<td>by ready-made Teflon tubes</td>
</tr>
<tr>
<td></td>
<td>(1/4&quot; UNF threat)</td>
</tr>
</tbody>
</table>
The range of products for microreaction technology produced by the mikroglas chemtech GmbH includes ready-to-connect modules such as different static mixers, microreactors, heat-exchangers and dwell devices.

The mikroglas reactor falling film design was developed to carry out gas liquid reactions under controlled conditions. The glass module contains therefore a heat exchanger for preheating the liquid and to control the reaction temperature. The gas and liquid feed was designed to perform optimal flow distribution. The material glass makes the reactor modules resistant against aggressive media. Due to the optical transparency of the window it is also possible to use the system for photochemical applications.

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of layers</td>
<td>10</td>
</tr>
<tr>
<td>layer thickness</td>
<td>0.2 mm to 2.0 mm</td>
</tr>
<tr>
<td>outer dimensions frame</td>
<td>170 mm x 120 mm x 30 mm</td>
</tr>
<tr>
<td>outer dimensions glass part</td>
<td>150 mm x 100 mm x 8.0 mm</td>
</tr>
<tr>
<td>height of gas chamber</td>
<td>0.5 mm up to 5.0 mm</td>
</tr>
<tr>
<td>falling film channels</td>
<td>width/depth: 0.5 mm</td>
</tr>
<tr>
<td></td>
<td>length: 98 mm</td>
</tr>
<tr>
<td>area (48 channels in parallel)</td>
<td>2350 mm²</td>
</tr>
<tr>
<td>flow rate liquid</td>
<td>up to 5.0 ml/min.</td>
</tr>
<tr>
<td>flow rate gas</td>
<td>up to 100 ml/min.</td>
</tr>
<tr>
<td>flow rate heat exchange fluid</td>
<td>appr. 10 l/h (water 20°C; 1 bar)</td>
</tr>
<tr>
<td>connection</td>
<td>by ready-made Teflon tubes (1/4&quot; UNF threat)</td>
</tr>
</tbody>
</table>
The system consists of 2 rotary pumps, 1 gear pump, valves, pressure and temperature sensors. The heating/cooling circulation is tempered by a Huber polystat. The microreaction system is controlled by a SIMATIC S7-300 Control System by Siemens.

**Box:**

- **outer dim.:** 700 mm x 680 mm x 310 mm
- **weight:** approx. 30 kg

**Control System:**

The control system enables the user to adjust all parameters by a user interface. When running in manual mode all settings can be made by free choice. It is also possible to store the parameters in a file. This can be loaded, edited and executed to generate different programs. All measured data are available online and can also be printed or exported to a file.

**Microfluidic component:**

*mikroglas* module at your choice

**Rotary pump (educts):**
- number of pumps: 2
- material of pump head: ceramic
- flow rate of educt: 0.1 - 45 ml/min.
- max. pressure: 7 bar

**Gear pump (heater / chiller):**
- number of pumps: 1
- gear wheels: Ryton
- seal: Teflon
- flow rate: 6.0 - 560 ml/min.
- Max. pressure: 5.2 bar

**Valves:**
- function: 3 ways, nonreturn, pressure relief
- material: PVDF or PEEK
- sealing material: FFKM

**Sensors:**
- temperature: Glass-encapsulated Pt100 elements
- pressure: piezoceramic up to 10 bar
- housing: PEEK

**Heater / chiller:**
- temperature range: -20°C up to 120°C
The system is designed to run two chemical reactions in series! It consists of 3 rotary pumps, 2 gear pumps, valves, pressure and temperature sensors. The heating/cooling circulation is tempered by a Huber polystat. The microreaction system is controlled by a SIMATIC S7-300 Control System by Siemens.

Box:
outer dim.: 700 mm x 700 mm x 330 mm
weight: approx. 30 kg

Control System:
The control system enables the user to adjust all parameters by a user interface. When running in manual mode all settings can be made by free choice. It is also possible to store the parameters in a file. This can be loaded, edited and executed to generate different programs. All measured data are available online and can also be printed or exported to a file.

Microfluidic components:
\textit{mikroglas} modules at your choice

Rotary pump (educts):
number of pumps: 3
material of pump head: ceramic
flow rate of educt: 0.1 - 45 ml/min.
max. pressure: 7 bar

Gear pump (heater / chiller):
number of pumps: 2
gear wheels: Ryton
seal: Teflon
flow rate: 6.0 - 560 ml/min.
max. pressure: 5.2 bar

Valves:
function: 3 ways, nonreturn, pressure relief
material: PEEK
sealing material: FFKM

Sensors:
temperature: Glass-encapsulated Pt100 elements
pressure: piezoceramic up to 10 bar
housing: PEEK

Heater / chiller:
temperature range: -20°C up to 120°C
The mikroSyn µFlow system is designed to carry out chemical reactions in continuous flow with very low flow rates between 1 µl/min up to 1 ml/min. The system gives excellent control of reaction conditions and can be used for synthesis and reaction optimization. The system consists of syringe pumps for the feed streams and gear pumps for the heating/cooling liquid. Furthermore, it contains additional equipment like valves and pressure and temperature sensors. The heating/cooling circuit is tempered by a Huber polystat. The microreaction system is controlled by a SIMATIC S7-300 Control System by Siemens.

**Box:**
outer dim.: 850 mm x 680 mm x 340 mm
weight: approx. 30 kg

**Control System:**
The control system enables the user to adjust all parameters by a user interface. When running in manual mode, all settings can be made by free choice. It is also possible to store the parameters in a file. This can be loaded, edited, and executed to generate different programs. All measured data are available online and can also be printed or exported to a file.

**Microfluidic component:**
mikroglas module at your choice

**Syringe pump (educts):**
number of pumps: 3 up to 5
flow rate of educt: 1 – 1000 µl/min.
max. pressure: 6 bar

**Gear pump (heater / chiller):**
number of pumps: 1 or 2
gear wheels: Ryton
seal: Teflon
flow rate: 6.0 – 560 ml/min.
Max. pressure: 5.2 bar

**Valves:**
function: 3 ways
material: PVDF or PEEK
sealing material: FFKM

**Sensors:**
temperature: Glass-encapsulated Pt100 elements
pressure: piezoceramic up to 10 bar
housing: PEEK

**Heater / chiller:**
temperature range: -20°C up to 120°C
mikroSyn EDU - microreaction system for research and EDUcation

mikroSyn EDU is especially designed for university research and education with a low budget for investments.

The system is designed to run a microreaction module under controlled conditions.

The system consists of 2 rotary piston pumps and 1 gear pump, valves, pressure and temperature sensors. The temperature of the heating/cooling circuit can be controlled with an optional Huber polystat.

Due to the ease of use, the mikroSyn EDU shows a high flexibility for research tasks. All modules have electrical input/output ports to collect data during operation.

**Microreactor (optional):**
*mikroglas* module at your choice

**Rotary piston pump (educts):**
- number of pumps: 2
- material of pump head: ceramic
- flow rate of educt: 0.1 - 45 ml/min.
- max. pressure: 7 bar

**Gear pump (heater / chiller):**
- number of pumps: 1
- gear wheels: Ryton
- seal: Teflon
- flow rate: 6.0 - 560 ml/min.
- max. pressure: 5.2 bar

**Tubings:**
- material: PTFE fluoroplastic

**Valves:**
- function: 3 ways
- material: PTFE fluoroplastic

**Sensors:**
- temperature: Glass-encapsulated Pt100 elements
- pressure: piezoceramic up to 10 bar
- housing: PEEK

**Heater / chiller (optional):**
- temperature range: -20°C up to 120°C
The system consists of 2 rotary pumps, 1 gear pump, valves, pressure and temperature sensors. The heating/cooling circulation is tempered by a Huber polystat. The microreaction system is controlled by a SIMATIC S7-300 Control System by Siemens. Additionally an infrared spectrometer is connected to monitor the product quality online.

**Control System:**

The control system enables the user to adjust all parameters by a user interface. When running in manual mode all settings can be made by free choice. It is also possible to store the parameters in a file. This can be loaded, edited and executed to generate different programs. All measured data are available online and can also be printed or exported to a file.

**Online Process Control by FT-IR Spectroscopy:**

The FT-IR spectroscopy enables the user to analyze the chemical parameters and the product quality during the reaction online. It is possible to work with both systems, near infrared (N-IR) and mid infrared (M-IR) for different tasks. The main goal is the permanent control over the process which allows to adjust the settings and to optimize the process in a very short time.

**Microfluidic component:**

*mikroglas* module at your choice

**Rotary pump (educts):**

- number of pumps: 2
- material of pump head: ceramic
- flow rate: 0.1 - 45 ml/min.
- max. pressure: 7 bar

**Gear pump (heater / chiller):**

- number of pumps: 1
- gear wheels: Ryton
- seal: Teflon
- flow rate: 6.0 - 560 ml/min.
- max. pressure: 5.2 bar

**Valves:**

- function: 3 ways, nonreturn, pressure relief
- material: PVDF or PEEK
- sealing material: FFKM

**Sensors:**

- temperature: Glass-encapsulated Pt100 elements
- pressure: piezoceramic up to 10 bar
- housing: PVDF or PEEK

**Thermostat:**

- temperature range: -20°C up to 120°C
mikroglas chemtech GmbH develops and manufactures microtechnological products made of glass (FOTURAN). The material glass makes the reactor modules resistant against aggressive media. For this reason the material properties of the sensors were adapted to the system. The sensor block with integrated pressure- and temperature sensor is used to monitor the media supply of the micro reactor. Thereby the pressure and the temperature is measured directly in the liquid flow. The sensor block contains in addition a nonreturn valve and a pressure relief valve. With the help of a set screw the pressure relief valve can be adjusted manually to a limit value.

### Specifications sensor block

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing material</td>
<td>PTFE</td>
</tr>
<tr>
<td>Contacting material</td>
<td>Aluminium oxide ceramic (99% Al2O3), Glass, Simriz, Kalrez, FFKM</td>
</tr>
<tr>
<td>Volume flow</td>
<td>approx. 550 l/h gasflow at 1 bar inlet pressure and free outflow</td>
</tr>
<tr>
<td>Internal Volume</td>
<td>1.0 ml</td>
</tr>
<tr>
<td>Temperature</td>
<td>-40°C up to +125°C</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt 100</td>
</tr>
<tr>
<td>Pressure sensor</td>
<td>0...10 bar</td>
</tr>
<tr>
<td>Measurement range</td>
<td>12...30 V DC</td>
</tr>
<tr>
<td>Auxiliary energy</td>
<td>4...20 mA</td>
</tr>
<tr>
<td>Output signal</td>
<td>-40°C ...+80°C</td>
</tr>
<tr>
<td>Characteristic curve</td>
<td>linear</td>
</tr>
<tr>
<td>Outer dimension</td>
<td>50 mm x 50 mm x 65 mm</td>
</tr>
<tr>
<td>Connections</td>
<td>by ready-made Teflon tubes (UNF thread 1/4&quot;)</td>
</tr>
</tbody>
</table>

### Specifications temperature sensor

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing material</td>
<td>PTFE</td>
</tr>
<tr>
<td>Contacting material</td>
<td>Glass, Simriz, FFKM, Kalrez</td>
</tr>
<tr>
<td>Volume flow</td>
<td>approx. 550 l/h gasflow at 1 bar inlet pressure and free outflow</td>
</tr>
<tr>
<td>Internal Volume</td>
<td>0.25 ml</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt 100</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40°C up to +125°C</td>
</tr>
<tr>
<td>Outer dimension</td>
<td>20 mm x 30 mm x 50 mm</td>
</tr>
<tr>
<td>Connections</td>
<td>by ready-made Teflon tubes (UNF-thread 1/4&quot;)</td>
</tr>
</tbody>
</table>
Company profile

*mikroglas chemtech GmbH*, is based in Mainz, Germany and was established in February 2004. Its employees have more than 8 years of experience with the fabrication of micro-technological products made of glass. Because of its outstanding properties, glass offers a wide range of opportunities in micro-technology. *mikroglas* mainly works with a photoetchable glass from Schott called FOTURAN. Typical products are sensors, components for electronic devices, micro-titerplates, as well as microreactors and systems for the production of chemical and pharmaceutical products. *mikroglas* can offer to the customer its know-how in designing and producing microfluidic devices, as well as building laboratory equipment, including e.g. sensors, pumps, safety features and testing of the central devices. For production the most modern facilities of microtechnology are available. The technical equipment covers photolithographic devices, furnaces, wet etch benches, cleaning equipment, screen printing systems, as well as devices for quality assurance. The newest micro-structurization technology available at *mikroglas* is the laser processing of glass in a true 3D direct writing process. *mikroglas* also has equipment for mechanical glass handling, e.g. for grinding, lapping, polishing, sawing, etc. Additionally, different coatings of the glasses can be executed, e.g. thin film deposition of metals, electroplating, and bio-coating.

Products:

- FOTURAN, photoetchable glass
- microreaction technology: mixers, microreactors, heat exchangers, microreaction systems
- biotechnology: e.g. microtiterplates, lab-on-chip components
- sensoric: e.g. gas sensors
- display technology: components for FED, e.g. spacers

R&D:

- new products based on glass for microtechnological applications
- microfluidic devices made from glass, e.g. microreactors
- components for applications in biotechnology
- spacers for display technology

Services:

- glass structurization (customized)
- advice on effective use of microcomponents made of glass
- development of new products
- prototyping
- large scale production

Current Corporate Partners

*mikroglas* works closely together with research institutes, e.g. Institute for Microtechnology, Mainz in Germany, all major german and international chemistry companies as well as young and innovative biotechnology companies. *mikroglas* has managed to build up a world-wide sales network. Our representatives are located in the European, US and Asian markets.