Compact Gas Conditioning
MAK10-Peltier

Application
The compact gas conditioning systems series MAK10-Peltier are used for continuous extractive gas analysis. They serve primarily for exact constant lowering of the sample gas dew point and thus for drying of the humid sample gas flow. In this way water vapour cross sensitivities and volumetric errors are minimized and damages of the sensible analyzer are avoided. With optional components like condensate pumps, pre-separators, filters, liquid sensors, flow meters and sample gas pumps devices of series MAK10-Peltier can be upgraded to complete compact quick and simple integrable conditioning systems. The flexible modular design guarantees an optimum adaption to every measuring task.

Technology
The precise temperature control with pulse width modulation in combination with the innovative corrosion resistant heat exchangers achieves low extremely constant dew points. Also load fluctuations and high thermal stress is compensated reliably. The hydrophobic corrosion resistant PTFE coating and the very short retention time in the heat exchanger ensure a lowest possible gas dissolution rate.

Functions
An electronic system controls dew point and cooling air temperature. Potential free alarm contacts allow remote monitoring of the device. Operating parameters are stored for diagnosis in a log. An operation hours counter controls the service intervals. Available housing versions are wall mounting housing, 19"-rack and very light-weight mobile versions with carrying handle. The mobile version with optional aluminium housing is especially light-weight.

- High performance peltier-cooler with two long lasting peltier-elements
- Precise outlet dew point even at significant load variations
- Corrosion resistant PTFE / PVDF heat exchanger
- Very compact design
- Digital display for temperature, alarms, logbook, operating hours counter and service interval indication
- Modular upgradeable and application dependently configurable
- 1 - 2 gas paths
- Integrable filters, flow meters, flow alarms, liquid sensors, gas pumps, pre-separators und acid dosing
- Wall mounting, 19"-rack, or mobile housing
Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>MAK10P-1</th>
<th>MAK10P-1 PS1</th>
<th>MAK10P-2</th>
<th>MAK10-2 PS2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>MAK10P-1101-4-00-F</td>
<td>MAK10P-3303-4-00-F</td>
<td>MAK10P-2502-4-00-F</td>
<td>MAK10P-2224-4-00-F</td>
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<tr>
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<tr>
<td><strong>Number of gas paths</strong></td>
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<td></td>
<td>2</td>
<td></td>
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<td><strong>Number of condensate pumps</strong></td>
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<td>4</td>
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<tr>
<td><strong>Number of pre-separators</strong></td>
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<td>2</td>
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<tr>
<td><strong>Docking Station</strong></td>
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<td>ja</td>
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<tr>
<td><strong>Material of gas paths</strong></td>
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<tr>
<td><strong>Cooling transmission / storage</strong></td>
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<td></td>
<td></td>
<td>aluminium- block</td>
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<td><strong>Cooling surface</strong></td>
<td>PTFE-coating</td>
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<td></td>
<td>PVDF (SS316 optional)</td>
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<td><strong>Housing / sealings</strong></td>
<td>PVDF / FPM</td>
<td></td>
<td></td>
<td>PVDF (SS316 optional)</td>
</tr>
</tbody>
</table>

**Operating data**

- **Gas flow V<sub>n</sub> at 65°C<sup>†</sup>**
  - MAK10P-1: 1 x 110 l/hr
  - MAK10P-1 PS1: 1 x 125 l/hr
  - MAK10P-2: 2 x 70 l/hr
  - MAK10-2 PS2: 2 x 85 l/hr
- **Gas flow V<sub>n</sub> at 55°C<sup>†</sup>**
  - MAK10P-1: 1 x 150 l/hr
  - MAK10P-1 PS1: 1 x 170 l/hr
  - MAK10P-2: 2 x 90 l/hr
  - MAK10-2 PS2: 2 x 110 l/hr
- **Gas inlet temperature**
  - MAK10P-1: 9°C
  - MAK10P-1 PS1: 10°C
  - MAK10P-2: 11°C
  - MAK10-2 PS2: 11°C
- **Ambient temperature**
  - MAK10P-1: 1°C
  - MAK10P-1 PS1: 2°C
  - MAK10P-2: 3°C
  - MAK10-2 PS2: 3°C
- **Operating pressure**
  - MAK10P-1: 0,2 to 2,2 bar
  - MAK10P-1 PS1: 0,3 to 3,0 bar
  - MAK10P-2: 0,3 to 3,0 bar
  - MAK10-2 PS2: 0,3 to 3,0 bar
- **Outlet dew point**
  - MAK10P-1: 0°C
  - MAK10P-1 PS1: 0°C
  - MAK10P-2: 0°C
  - MAK10-2 PS2: 0°C
- **Dead space per gas path**
  - MAK10P-1: 26 ml
  - MAK10P-1 PS1: 26 ml
  - MAK10P-2: 55 ml
  - MAK10-2 PS2: 55 ml
- **Ready for start up**
  - MAK10P-1: 0 min
  - MAK10P-1 PS1: 0 min
  - MAK10P-2: < 15 min
  - MAK10-2 PS2: < 15 min
- **Cooling capacity**
  - MAK10P-1: 1 KJ/hr
  - MAK10P-1 PS1: 1 KJ/hr
  - MAK10P-2: 1 KJ/hr
  - MAK10-2 PS2: 1 KJ/hr

**Design data**

- **Dimensions (W x H x D)**
  - MAK10P-1: 310 x 266 x 321 mm
  - MAK10P-1 PS1: 449 x 266 x 321 mm
  - MAK10P-2: 449 x 266 x 321 mm
  - MAK10-2 PS2: 449 x 266 x 321 mm
- **Weight without options**
  - MAK10P-1: 9.5 kg
  - MAK10P-1 PS1: 10.0 kg
  - MAK10P-2: 12.0 kg
  - MAK10-2 PS2: 14.0 kg
- **Housing**
  - wall mounting (19" rack and mobile optional) / RAL 7035
- **Connections**
  - gas: PVDF DN 4/6 / condensate: PVDF DN 4/6

**Electrical data**

- **Mains connection**
  - plug
- **Digital display**
  - temperature (outlet dew point resp. ambient), operating status, alarm and alarm storage, service control, operating hours, condensate pump control
- **Alarm set-points**
  - MAK10P-1: < +2.0 / > +10.0°C
  - MAK10P-1 PS1: < +2.0 / > +10.0°C
  - MAK10P-2: < +2.0 / > +10.0°C
  - MAK10-2 PS2: < +2.0 / > +10.0°C
- **Protection rate**
  - MAK10P-1: IP 20 EN 60529 / EN 61010
  - MAK10P-1 PS1: IP 20 EN 60529 / EN 61010
  - MAK10P-2: IP 20 EN 60529 / EN 61010
  - MAK10-2 PS2: IP 20 EN 60529 / EN 61010
- **Conformity**
  - CE
- **Power supply**
  - MAK10P-1: 230V 50/60Hz or 115V 50/60Hz
  - MAK10P-1 PS1: 230V 50/60Hz or 115V 50/60Hz
  - MAK10P-2: 230V 50/60Hz or 115V 50/60Hz
  - MAK10-2 PS2: 230V 50/60Hz or 115V 50/60Hz
- **Power consumption**
  - MAK10P-1: 170 - 180 W
  - MAK10P-1 PS1: 170 - 180 W
  - MAK10P-2: 170 - 180 W
  - MAK10-2 PS2: 170 - 180 W

<sup>†</sup> at standard conditions, dew point 55 / 65°C inlet temperature, 10-25°C ambient temperature

Options

- Condensate pump
- PTFE-depth filter, length 65mm or 102mm
- Sample gas pump N86 IP00 or IP20
- Flow meter for max. 150 or 250 or 500 l/h
- Flow meter with light barrier and electronic
- Liquid sensor internal or external incl. electronic
- Pre-separator incl. condensate pump
- Acid dosing incl. condensate pump
- Docking Station
- 19"-rack
- Portable light-weight aluminium housing (- 2.5kg)
- Voltage 115V 50/60H

Due to the large number of options a big variety of individual configurations of the MAK10P is possible. Basically devices with 3-4 condensate pumps, 1-2 sample gas pumps, 2 filters and 2 flow meters need additionally always the docking station. Thereby the housing width changes from 310mm to 449mm. For your individual configuration of a MAK10P please contact our sales team in Erkelenz.
MAK10 Heat-Exchanger System

More efficiency, no energy losses, even at high ambient temperatures
- Coldness transfer through aluminium
- Good thermal conductance 204 W/m°K
- Double sided cold transfer with 2 peltier elements
- Extremely compact design
- Optimal shielding from the environment

High and constant dryness rate even at extreme load variations
- PTFE-coated, hydrophobic surface
- Immediate formation of large condensate droplets
- Spiral performing condensate stream goes downwards
- Consistent use of gravity
- Discharge of condensate at the lowest point
- Copper core and block as cold storage

Exceptionally low gas dissolution rates enable accurate analysis
- Very low dead volume
- Extremely short retention time of the gas in the system
- Small heat-exchanger surface
- Rapid saturation of the surface
- Reduced response-time of gas to condensate
- Minimized contact surface of sample gas and condensate
- On three sides evacuated condensate spiral stream
- Coating reduces electrostatics

Reliability and sustainability reduce time and efforts for maintenance
- Exchangeable heat-exchangers
- Optimum chemical resistance
- No abrasive wear-out
- Self-cleaning effects, no contamination
- Maintenance-free system
- Proven and safe technology
- Monitored quality
- More than 10,000 systems in successful operation
MAK10-Peltier Model Examples

MAK10P-1
✓ 1 heat exchanger PTFE / PVDF
✓ 1 gas path (1 x 110 l/hr)
✓ 1 condensate pump
✓ 1 MAK-alarm contact

MAK10P-1 with pre-separator
✓ 1 heat exchanger PTFE / PVDF
✓ 1 gas path (1 x 125 l/h)
✓ 1 pre-separator
✓ 2 condensate pumps
✓ 1 PTFE depth filter
✓ 1 flow meter
✓ 1 sample gas pump
✓ 1 MAK alarm contact

MAK10P-2 with docking station
✓ 1 heat exchanger dual PVDF
✓ 2 gas paths (2 x 70 l/h)
✓ 2 condensate pumps
✓ 2 PTFE depth filters
✓ 2 liquid sensors with electronic
✓ 1 MAK-/ 2 sensor alarm contacts

MAK10P-2 19"-rack version
✓ 2 heat exchangers PTFE / PVDF
✓ 2 gas paths (1 x 150 l/h)
✓ 2 pre-separators
✓ 4 condensate pumps
✓ 1 PTFE depth filter
✓ 1 liquid sensor and electronic
✓ 1 flow meter
✓ 1 MAK-/ 1 sensor alarm contact
Configuration examples

MAK10P-1

MAK10P-2

1. Heat exchanger
2. Condensate pump
3. Condensate pre-separator
4. PTFE depth filter
5. Sample gas pump
6. Flow meter
7. Electronic
8. Liquid sensor
9. Light barrier

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Integrated components / options

**Condensate pump**
- Reliable continuous condensate removal
- Low rotation speed, long lasting pump tube

**Condensate pre-separator**
- Separation of free condensate and solid particles
- Sample gas pre-cooling for inlet dew points >65°C

**PTFE depth filter**
- Reliable filtration of solid particles
- Quick and simple filter change

**Flow meter**
- Exact dosing, with fine adjustment needle valve
- Optional with light barrier

**Liquid sensor**
- Protects against condensate break through
- Reliable detection of smallest amounts of liquid

**Electronic**
- Control / alarm for liquid sensors / light barriers
- Potential free switch contact

**Sample gas pump**
- Pure pumping of sample gases
- Perfect integration in the sample gas cooler