Process instrumentation and Measurement solutions

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To perform well, you have to be constantly improving. This is particularly true for companies in the food and beverage industry, and for their suppliers. After all, this industry, more than any other, is in a state of constant change and sometimes faces extremely short product life cycles. On top of that, there are strict hygienic and legal regulations that must be adhered to.

KROHNE Food & Beverage is a dedicated expert division that rises to these challenges and offers a whole spectrum of flow, level, temperature and pressure measurement as well as process analysis technology including complete solutions and the pertaining services.

Our extensive range includes measuring devices for storage and interim storage, dosing and mixing, filling and cleaning and utility systems for steam and hot water. We have the right technology for difficult applications such as processing honey and chocolate or measuring the flow of low-conductivity water in mixing stations or hygienic level measurement in product tanks.

KROHNE devices fulfill all international standards. They are 3A and FDA certified, the most important ones are EHEDG registered.

True to the company claim “Measure the facts” the KROHNE Food & Beverage Division supports you to achieve reliable measurement of process variables and clear and precise process diagnostics.

Over 90 years’ experience:

1952
The first electromagnetic flowmeter for industrial measurement.

1989
The first FMCW radar level transmitter for process measurement.

1994
The first single straight tube Coriolis mass flowmeter.

1996
Special electromagnetic flowmeter for filling machines.

2003
Hygienic electromagnetic flowmeter with special L-shaped gasket, integrated diagnostic features and conductivity measurement.

2004
World’s only EHEDG-certified variable area flowmeter.

2006
The first Vortex flowmeter with integrated gross and net heat management.

2008
Special Coriolis mass flowmeter for filling machines.

2009
Innovative Drop antenna for level measurement in very dusty atmospheres.

2010
Standardised operating and service concept for both flowmeters and analysis instruments.

2011
First inline spectroscopic analysis system for fat, protein, lactose and total solids. Temperature transmitter with insulation resistance monitoring to detect cracks in the thermowell.

2013
Coriolis mass flowmeter without sensitivity for gas entrainment. The first digital sensor portfolio with integrated transmitter technology.
# Product selection list – Flow measurement

This table will help you in selecting the right measurement solution for your application.

<table>
<thead>
<tr>
<th>Measuring principle</th>
<th>Variable area</th>
<th>Electromagnetic</th>
<th>Coriolis mass</th>
<th>Electromagnetic</th>
<th>Coriolis mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquids</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Low flow rates (&lt;2 l/h)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>High flow rates (&gt;100000 m³/h)</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Non-conductive liquids</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
</tr>
<tr>
<td>Viscous media</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>o</td>
<td>-</td>
</tr>
<tr>
<td>Accuracy</td>
<td>1.6% of volume</td>
<td>0.5%/0.3%/0.2% of volume</td>
<td>0.15%/0.1%/0.1% of mass</td>
<td>0.2% of volume</td>
<td>0.1% of mass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gases</th>
<th>x</th>
<th>-</th>
<th>x</th>
<th>x</th>
<th>-</th>
<th>x</th>
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<tbody>
<tr>
<td>Industrial gases</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>x</td>
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<tr>
<td>Low flow rates (&lt;20 l/min)</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>High flow rates</td>
<td>o</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td>o</td>
<td>-</td>
<td>o</td>
<td>-</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>1.6% of volume</td>
<td>-</td>
<td>0.5%/0.35%/0.35% of mass</td>
<td>-</td>
<td>0.35% of mass</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special applications</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hygienic process flowmeter</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Slurry, media with pulps, solids</td>
<td>-</td>
<td>x</td>
<td>o</td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>Emulsions (oil/water)</td>
<td>x</td>
<td>o</td>
<td>x</td>
<td>x</td>
<td>o</td>
</tr>
<tr>
<td>Corrosive CIP liquids (acids, alkalis)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Non Newtonian fluids</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
</tr>
<tr>
<td>Bi-directional measurements</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2-wire</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4-wire</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

x = suitable, o = suitable under certain conditions, – = not suitable
## Product selection list – Level measurement

<table>
<thead>
<tr>
<th></th>
<th>OPTISWITCH 6500/6600</th>
<th>BM 500</th>
<th>OPTIFLEX 2200</th>
<th>OPTIWAVE 6300</th>
<th>OPTIWAVE 7300</th>
<th>OPTIBAR P 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>Electromagnetic wave</td>
<td>Potentiometric</td>
<td>TDR guided radar</td>
<td>FMCW radar 24…26 GHz</td>
<td>FMCW radar 24…26 GHz</td>
<td>Hydrostatic pressure</td>
</tr>
<tr>
<td>Liquids and liquid products</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Storage tanks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Process tanks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Complex process tanks (e.g. with agitators)</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Interface measurement</td>
<td>o</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Accuracy</td>
<td>-</td>
<td>0.5% of measuring range</td>
<td>±10mm; ±0.4”</td>
<td>±3mm; ±0.12”</td>
<td>±3mm; ±0.12”</td>
<td>±0.25% of upper range limit</td>
</tr>
<tr>
<td>Solids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk solids</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>Dusty atmospheres (e.g. flour silos)</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Low reflecting products</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pressure ≤2 barg; ≤29 psig</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Pressure ≤40 barg; ≤580 psig</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Process connection temp. ≤+80°C; ≤+176°F</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Process connection temp. ≤+200°C; ≤+392°F</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>Measuring range ≤30 m; ≤98.4 ft</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Measuring range ≤80 m; ≤262.4 ft</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2-wire</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4-wire</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

X = suitable, O = suitable under certain conditions, – = not suitable
# Product selection list – Temperature and pressure measurement

This table will help you in selecting the right measurement solution for your application.

<table>
<thead>
<tr>
<th></th>
<th>OPTITEMP TRA-C10</th>
<th>OPTITEMP TRA-H10/H20</th>
<th>OPTITEMP TRA-H30</th>
<th>OPTIBAR P 2010</th>
<th>OPTIBAR PC/PM 5060</th>
<th>OPTIBAR DP7060</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process connections</strong></td>
<td>Hygienic, clamp</td>
<td>Hygienic, clamp</td>
<td>Hygienic, clamp</td>
<td>Hygienic</td>
<td>Hygienic</td>
<td>Standard</td>
</tr>
<tr>
<td><strong>Standard sensor material</strong></td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel/ceramic</td>
<td>Stainless steel</td>
</tr>
<tr>
<td><strong>Standard housing material</strong></td>
<td>Stainless steel</td>
<td>Aluminium</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Plastic, aluminium</td>
<td>Plastic, aluminium</td>
</tr>
<tr>
<td><strong>Measuring range</strong></td>
<td>-50…150°C; -58…302°F</td>
<td>-50…200°C; -58…392°F</td>
<td>-40…150°C; -40…302°F</td>
<td>-1…40 bar; -14,5…218 psi</td>
<td>25 mbar..100 bar; 0,73...1450 psi</td>
<td>30 mbar..16 bar; 0,73...232 psi</td>
</tr>
<tr>
<td><strong>Maximum pressure</strong></td>
<td>16 bar; 232 psi</td>
<td>16 bar; 232 psi</td>
<td>16 bar; 232 psi</td>
<td>40 bar; 580 psi</td>
<td>100 bar; 1450 psi</td>
<td>40 bar; 580 psi</td>
</tr>
<tr>
<td><strong>Temperature sensor</strong></td>
<td>Pt100 class A</td>
<td>Pt100 class A/replaceable</td>
<td>Pt100 class A in-situ cal.</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±0.15%</td>
<td>±0.15%</td>
<td>±0.15%</td>
<td>±0.25% of upper range limit</td>
<td>±0.10% (TD 5:1)</td>
<td>±0.10% (TD 5:1)</td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Liquids</strong></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Solids</strong></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Gas/steam</strong></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>2-wire</strong></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>4-wire</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

x = suitable, o = suitable under certain conditions, – = not suitable
### Product selection list – Process analysis

<table>
<thead>
<tr>
<th></th>
<th>SMARTPAT PH 8570</th>
<th>OPTISYS IND 8100</th>
<th>VISCOLINE</th>
<th>OPTIQUAD-M 4050</th>
<th>OPTIQUAD-FFA 4050</th>
<th>OPTIQUAD-WW 4050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process connections</td>
<td>Screw-in</td>
<td>Hygienic</td>
<td>Hygienic</td>
<td>Hygienic</td>
<td>Hygienic</td>
<td>Hygienic, insertion, tank</td>
</tr>
<tr>
<td>Standard sensor material</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Standard housing material</td>
<td>Aluminium</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0…14 pH</td>
<td>0…1000 µS/cm</td>
<td>50…200.000 cP</td>
<td></td>
<td></td>
<td>E.g. COD: 0…10000 mg/l</td>
</tr>
<tr>
<td>Pressure range</td>
<td>12 bar; 174 psi</td>
<td>Max. 10 bar; 145 psi</td>
<td>0.1…40 bar; 1.5…580 psi</td>
<td>10 bar; 145 psi</td>
<td>10 bar; 145 psi</td>
<td>Max. 10 bar; 145 psi</td>
</tr>
<tr>
<td>Temperature range</td>
<td>0…+140°C; +32…284°F</td>
<td>-20…+140°C; -4…+284°F</td>
<td>-</td>
<td>+4…+130°C; +39…266°F</td>
<td>+4…+180°C; +39…356°F</td>
<td>+4…+90°C; +39…194°F</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.5%</td>
<td>1.0%</td>
<td>0.2% repeatability</td>
<td>Typical Fat: ±0.03%</td>
<td>Typical FFA: ±0.03%</td>
<td>Typical COD: ±5%</td>
</tr>
<tr>
<td>Power supply</td>
<td>24 VDC</td>
<td>24 VDC</td>
<td>24 VDC/230 VAC</td>
<td>24 VDC</td>
<td>24 VDC</td>
<td>24 VDC</td>
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<td>Medium</td>
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<tr>
<td>Liquids</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>2-wire</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4-wire</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

x = suitable, o = suitable under certain conditions, – = not suitable
Improved measurements throughout the complete process

- **Storage**
  - Flow: OPTIFLUX 6100
  - Level: OPTIBAR P 2010
  - Flow: OPTIFLUX 6300/6100

- **Mixing**
  - Level: OPTISWITCH 6500
  - Temperature: OPTITEMP
  - Flow: OPTIFLUX 6300/6100

- **Pasteurisation Homogenisation**
  - Level: OPTISWITCH 6500
  - Temperature: OPTITEMP
  - Flow: BATCHFLUX
  - Flow/Density: OPTIMASS 6400
  - Flow: OPTIFLUX 6300/6100

Solutions for the soft ice industry

- Pasteurisation
- Homogenisation
- Ageing
- Storage
- Filler Freezer
- Mixing

Innovative measurement solutions for a cost-effective ice cream industry

The first mentioning of ice cream dates back to 1265. Since then, process automation and measures have advanced, but just recently KROHNE unlocked the next stage of savings in ice cream processing.

The EGM™ (Entrained Gas Management) functionality with OPTIMASS Coriolis mass and density meters overcomes all difficulties with aerated products. Where previously an automation of the density measurement of frozen, aerated ice cream has not been available, you can now exploit this advantage for your production.

You can also significantly reduce waste time during start-up and ramp-down of your process. As EGM™ stands for any composition of air and product between 0 and 100 %, the density of ice cream can be determined inline and in real time for an overrun between 0 and 160.

Value-added applications:

- Measure mass or volume in the aerated and frozen part of ice cream
- Batching aerated sauces and gravy into main ice cream lines (e.g. 400 ms shots)
- Dosing of (inert) gasses or air
- Intake of dairy products (milk concentrate) in empty-full-empty with EGM™
- Storage of milk powder
- Viscosity control of coatings (chocolate)
Precise measurement solutions for an economical juice industry

The current worldwide market volume for orange juice is more than $2.3 billion the biggest regional markets being the United States followed by Canada, Western Europe, and Japan.

In addition to a full range of measuring solutions, KROHNE specifically provides extremely precise control options needed in the beverage industry – including the mass flow of juice concentrate, tank levels in sugar silos, as well as the °Brix concentration and the ratio of juice and pulp during the filling process.

Due to the low temperatures, the juice produces a high pressure drop where a straight tube mass flowmeter is the only choice. KROHNE has the perfect solution – OPTIMASS 7400. The single straight tube device has a low pressure drop while maintaining a high accuracy in mass flow, density and juice concentration measurement.

Value-added applications:

- Measure pulp and liquid with EGM™
- Accurate concentration measurement
- Volumetric or mass based filling
- Compact net energy measurement

Improved measurements throughout the complete process
Improved measurements throughout the complete process

**Milk reception**
- Analysis: OPTIQUAD-M 4050
- Flow: OPTIFLUX 6300/6100
- Level: OPTISWITCH 6500
- Pressure: OPTIBAR PM 2010
- Temperature: OPTITEMP

**Separation**
- Flow: VA, H250
- Analysis: OPTIMA5 6400/7400
- Flow: OPTIFLUX 6300
- Temperature: OPTITEMP
- Pressure: OPTIBAR PM 2010

**Standardisation**
- Flow: OPTIFLUX 6300/6100
- Level: OPTISWITCH 6500
- Pressure: OPTIBAR PM 2010
- Temperature: OPTITEMP
Advanced measurement solutions for the trendy dairy industry

In 2012, the world’s annual production of milk was 620 million tonnes, with the largest producers being the United States with 90 million tonnes followed by India and China. About 37% of this was consumed as liquid milk and cream, about 32% was converted into various cheeses, about 17% was made into butter, and about 8% was used to make ice cream and other frozen desserts.

To support the variety of the dairy industry with constantly changing products geared to specific target groups, KROHNE has not only the right solutions for flow, level and temperature measurement. We have also developed an inline analytical device for milk-based liquids. The OPTIQUAD precisely measures the fat, protein, lactose and total solid content allowing for significant cost savings in the milk and cheese making process.

Value-added applications:

- Real-time qualification of milk intake
- Mass and density measurement with EGM™ with immunity to air slugs in line (empty-full-empty)
- Protein, fat and lactose determination through complete loading cycle – elimination of approximation via offline sample measurement
- Whey protein concentrate optimization (accurate prediction of final WPC percentage)
- Temperature point verification inline
- Product consistency for e.g. mozzarella through inline real-time viscosity measurement to predict offline viscosity
- Cheese milk standardisation – milk concentrate from various sources blended to specification
Flow measurement

Variable area flowmeters · Electromagnetic flowmeters · Coriolis mass flowmeters
KROHNE has unique expertise when it comes to flow measurement. We hold over 1,000 patents relating to flow products and not only demonstrate our ability with standard applications, but also with applications that are demanding and require custom solutions.

For us, customer orientation starts as early as research and development. Many of our products, which are considered today’s industrial standards, were developed in close cooperation with our customers.

We have developed solutions for the most difficult flow applications, e.g. for viscous, dense liquids or liquids that have to be measured with entrained gas. Another example is the filling machines market segment where we developed dedicated electromagnetic and Coriolis mass flowmeters.

Typical applications include:

- Mixing, dosing and filling of drinks under hygienic conditions
- Inerting of tanks or containers
- Measurement and dosing of additives
- Filling systems applications
- Measurement of hot steam, also for CIP and SIP processes
- Measurement of degrees Brix, flow, density, specific gravity

Highlights:

OPTIFLUX – series of electromagnetic flowmeters

- All KROHNE EMF are wet-calibrated with a direct comparison of volumes
- Electric conductivity of the medium can be used for detection of product change
- For high bubble content, high solids content and pulsating flow
- 3x100% diagnostics (application and device diagnostic, out-of-spec test)
- OPTICHECK – inline verification of meter accuracy

OPTIMASS – series of Coriolis mass flowmeters

- Single straight tube design eliminates effects of high viscous liquids or pastes on measurement
- Not susceptible to installation effects
- Minimal pressure loss with straight tube measuring devices: up to two sizes smaller than competitor devices if compared by pressure drop
- EGM™ enables measurements of highly viscous mediums, inhomogeneous mixtures, media with solid content or gas inclusions
- OPTIMASS 7000 suitable for highly shear sensitive mediums as well as media requiring low flow velocity
- OPTICHECK – inline verification of meter accuracy

Variable area flowmeters

- Local indication without the need for auxiliary power
- World’s only all-metal variable area flowmeter with EHEDG certification
H250 M40 – Reliable and cost-effective variable area flowmeter for liquids and gases

The H250 M40 is the only all-metal variable area flowmeter certified by the EHEDG. It can be used for hygienic process applications, e.g. the measurement of cream or milk. It is also installed in utility systems for measuring carbon dioxide or nitrogen/air consumption. Furthermore, it does not need a minimum conductivity. And through its modular system, it can be upgraded on site from a simple gauge to a true process meter.

- Pipe size: DN15 to DN100
- Temperature range: 0...+200 °C / +32...+392 °F
- Accuracy: 1.6 %
- Process connections: DIN 11851, 11864-2, SMS, Tri Clamp, APV Flange
- Protection class: IP66/68, IP69K
- Optional stainless steel converter housing
- Contact, current and pulse outputs, PROFIBUS®, FOUNDATION™ fieldbus

BATCHFLUX 5500 – Electromagnetic flowmeter for volumetric filling systems

The light weight compact device was specifically developed for the precise cold and hot dosing of any drink, even with fibre content. Due to its high measuring accuracy and long-term stability, the BATCHFLUX has already proven its effectiveness in many rotary fillers for filling thin-walled PET bottles of various sizes. The extremely high reproducibility is largely because of the ceramic tube that retains its shape and is vacuum-proof at temperatures of over +130 °C / +266 °F despite frequent hot cleaning cycles.

- Pipe size: DN2.5 to DN40
- For very short filling cycles <500 ms
- Temperature range: 0...+150 °C / +32...+302 °F
- Vacuum-proof ceramic tube
- Process connections: hygienic adapters
- Protection class: IP66/69K
- CIP/SIP cleanable
- Pulse and status outputs
- Low power consumption of 3 W
- Standard deviation <0.08 %

Best practice

When cold filling following pasteurisation with KHS-ACF-[Aseptic-Cold-Filling] technology, KHS AG – one of the leading international suppliers of filling and packaging systems – uses electromagnetic flowmeters by KROHNE.
OPTIFLUX 6300/6100/6050 – Electromagnetic flowmeters for basic hygienic applications

OPTIFLUX 6X00 electromagnetic flowmeters are the standard hygienic meters for conductive liquids. Their sensor features an outstanding sealing concept. The L shaped gasket has the largest sealing force at the end towards the process pipe. This reduces the danger of the seal being pushed out of place during the cleaning process, it only extends backwards into the expansion chamber. This guarantees a hygienic seal and also increases its lifetime.

For basic hygienic applications such as in CIP stations, the OPTIFLUX 6050 version is the first choice. The regular process meter is the OPTIFLUX 6100 offering the required accuracy and the required communications like Profibus and Fieldbus. The OPTIFLUX 6300 is used when it comes to difficult applications or custody transfer approval is required.

All electronics offer conductivity measurement for identifying product changes. All three instruments, as any electromagnetic flowmeter from KROHNE, can be validated on site by using our special OPTICHECK tool.

Best practice

KHS AG in its latest generation of blending systems specifically introduced KROHNE to achieve shorter product changeover times, e.g. performed volume flow measurement of the mixed product with OPTIFLUX 6300 as this device does not allow deposits to build up on the sealing ring.

- Pipe size: DN2.5 to DN150
- Temperature range: 0...+140 °C / +32...+284 °F
- Vacuum-proof liner, stabilised by stainless steel mesh
- Accuracy: OPTIFLUX 6300: 0.2 %, 6100: 0.3 %, 6050: 0.5 %
- Process connections: DIN 11850, ISO 2037, 11851, 11864-2, SMS, Tri Clamp, welded ends
- CIP/SIP cleanable
- Optional stainless steel converter housing
- Contact, current and pulse outputs, PROFIBUS®, FOUNDATION™ fieldbus
A high level of performance, in combination with a wide operating temperature range up to +230 °C / +446 °F, makes the OPTIMASS 6400 the ideal choice for mass flow measurement in a wide variety of applications.

Due to the synthesised drive control, OPTIMASS 6400 overcomes any difficulty with air entrainment in the product, whether it is homogeneously distributed or in slugs. KROHNE unlocks potentials in measuring shake type milk mix drinks, aerated yogurts, cream, dough or margarine.

OPTIMASS 6400 – Bent tubes Coriolis mass flowmeter with highest precision available for aerated products

- Entrained Gas Management EGM™
- Pipe sizes: DN8 to DN100
- One device for mass flow, volume, density, temperature and concentration
- Two-phase flow signal
- Temperature range: -70...+230 °C / -94...+446 °F
- Accuracy: 0.10 % for liquids (0.05 % optional), 0.35 % for gases
- Process connections: DIN 11851, 11864-2, 32676, SMS, Tri Clamp and others
- Optional stainless steel converter housing
- Contact, current and pulse outputs, PROFIBUS®, FOUNDATION™ fieldbus, Modbus, EtherNet/IP

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OPTIMASS 1400 –
Two straight tubes
Coriolis mass flowmeter with
an excellent efficiency ratio

The OPTIMASS 1400 is the general purpose meter for
liquids and gases. Compared to other Coriolis meters,
it also features a very small footprint. The flow splitter
is optimised to create a minimum pressure loss.

Best practice

TOPOCHICO Soft Drinks of Mexico with its high-quality
mixing plants for domestic and export products relies
on KROHNE for the exact measurement of level,
temperature, pressure and flow.
For example during product changeover, dilute syrup
phases can be completely recovered with the self-
draining OPTIMASS 1400 used for syrup concentrate
measurement.

• Entrained Gas Management EGMTM
• Pipe size: DN15 to DN50
• One device for mass flow, volume, density,
temperature and concentration
• Two-phase flow signal
• Temperature range: -40...+130 °C / -40...+266 °F
• Accuracy: 0.15 % for liquids, 0.35 % for gases
• Process connections: DIN 11851, 11864-2,
SMS, Tri Clamp and others
• Optional stainless steel converter housing
• Contact, current and pulse outputs,
PROFIBUS®, FOUNDATION™ fieldbus,
Modbus, EtherNet/IP
Flow measurement

The single straight tube technology of the OPTIMASS 7400 keeps the pressure loss to a bare minimum. The meter precisely measures the mass flow as well as density – independently from viscosity changes.

**OPTIMASS 7400 – Single straight tube Coriolis mass flowmeter for dense, viscous and shear sensitive liquids**

The single straight tube technology of the OPTIMASS 7400 keeps the pressure loss to a bare minimum. The meter precisely measures the mass flow as well as density – independently from viscosity changes.

- **Entrained Gas Management EGM™**
- **Pipe size:** DN8 to DN80
- **One device for mass flow, volume, density, temperature and concentration**
- **Two-phase flow signal**
- **Temperature range:** -40...+150 ºC / -40...+302 ºF (titanium)
- **Accuracy:** 0.10 % for liquids, 0.35 % for gases
- **Measuring tubes in titanium, stainless steel, Hastelloy®, tantalum**
- **Process connections:** DIN 11851, 11864-2, 32676, SMS, Tri Clamp and others
- **Optional stainless steel converter housing**
- **Contact, current and pulse outputs, PROFIBUS®, FOUNDATION™ fieldbus, Modbus, EtherNet/IP**
- **Custody transfer according to MID or OIML**

**Best practice**

EDELWEISS, one of the most renowned cheese makers in Germany, ensures a consistent quality of its end products. To ensure reproducibility, the maintenance-free OPTIMASS 7300 is used in the production line. It also allows for the processing of different media in succession.
OPTIBATCH 4011 –
Coriolis batch meter
for linear and rotating filling machines

OPTIBATCH 4011 measures regardless of viscosity, conductivity or inlet runs and determines volume or mass flow in extremely short filling cycles. Using Coriolis batch meter allows exact measuring while filling products. OPTIBATCH 4011 was specifically developed for use with filling machines and features superior accuracy through direct measurement. The filling processes can take place both with and without pressure. Depending on requirements, both carbonated and non-carbonated products can be measured using the meters. A separate evaluation unit is not required; the entire electronics of the measuring device is integrated into a fully welded stainless steel housing.

**Best practice**

KRONES AG of Bavaria develops, manufactures and installs complete systems for process, filling and packaging technology. For a rotary filling machine with over 100 filling points for different carbonated products in a bottling line, measuring devices with high accuracy and long-term stability are required. The use of OPTIBATCH 4011 during filling operation meets the high demands of KRONES’ customers – even for non-conducting and fatty liquids.

- Pipe size: DN8 to DN15
- One device for mass and volume flow
- Temperature range: 0...+100 °C / +32...+212 °F (+120 °C / +248 °F 1h for cleaning)
- Standard deviation ≤0.04 %
- Measuring tubes in stainless steel
- Process connections: DIN 11864-2, 32676, SMS, Tri Clamp
- Complete housing in stainless steel
- Pulse output
Level measurement

FMCW radar level transmitters · TDR guided radar level transmitters · Potentiometric level transmitters · Electromagnetic level switches
For the highest level of quality – Level measurement for the food and beverage industry

KROHNE has always been a pioneer in the development of level measurement technology that meets the industry’s growing demands for efficiency. The food and beverage industry is subject to constant change with sometimes extremely short product life cycles that must be aligned to new trends again and again. We help our customers to stay on top of these developments.

Some examples:
KROHNE was one of the first manufacturers to develop level measuring equipment for industrial use. Among them the world’s first process radar device; the first TDR (Time Domain Reflectometry) level transmitter suitable for the measurement of the distance, level, volume and mass of liquids and solids; the first non-contact FMCW (Frequency Modulated Continuous Wave) measurement in 2-wire design. To complement our innovative technology, our OPTIFLEX and OPTIWAVE product lines feature a sophisticated and modular housing concept with bayonet locking system for maximum flexibility.

Current applications include, for example:

- Inventory management for malt or grain silos
- Monitoring of the tank level in sugar silos
- Blending control for mixing tanks
- Storage of milk powder

Highlights:

**FMCW radar / TDR guided radar level transmitters**

- Distance, level, volume, mass and/or interface measurement
- Not affected by process conditions: dust, foam, vapour, agitated or boiling surfaces, changes in pressure, temperature and density

- Flat PEEK antenna for liquids
- Drop antenna for solids: its ellipsoidal shape and non-adhesive surface avoid product deposits in dusty or humid atmosphere
- Measuring distances up to 80 m; 262.47 ft

**Potentiometric level transmitters**

- Measurement independent of media properties
- Not sensitive to adhesives and foam
- For small tanks
- Quick response time
OPTIWAVE 6300 – FMCW radar level transmitter for solid applications

With its 24...26 GHz FMCW radar, the OPTIWAVE 6300 non-contact level transmitter generates a powerful wave signal for accurate and reliable measurement even in very dusty atmosphere as, e.g., in flour silos. It allows accurate and reliable level measurement on a low reflective medium with an uneven or moving surface.

Best practice

Built in the 14th century, Brittany’s last remaining water-powered mill MOULIN DE CHARBONNIÈRE today sets itself high standards for a modern and efficient management when it comes to storage and production costs and opted for KROHNE for the accurate measurement of the silo levels. With its drop-antenna, the OPTIWAVE 6300 allows measurements in the flour dust atmosphere of the silos, it is durable, maintenance-free and also has a data logger for monitoring.

- 2-wire FMCW radar
- Insensitive to build-up or dust due to PP drop antenna
- Empty tank detection
- Tank heights: up to 80 m / 262.4 ft
- Accuracy: ±3 mm / 0.12“
- Configurable measuring range
- Precise level measurement for non-flat surfaces
OPTIFLEX 2200 –
TDR guided radar level transmitter
for solid and liquid application

Some level applications require insertion type instruments, due to the fact that the liquid comes along with a layer of foam on top. But even these devices often do not provide correct values. OPTIFLEX 2200 features DPR (Dynamic Parasite Rejection) software for the elimination of the false reflections caused by environmental disturbances and product build-up. Dust, foam, vapour, agitated surfaces, temperature and density do not affect device performance.

Another advantage is the modularity of the OPTIFLEX 2200: Thanks to the innovative housing design, you can specify the way the display is fixed to the device. This makes it accessible, regardless of whether it is installed on a tank, in a recess or in buildings with low roofs. The remote version – OPTIFLEX 2200 F – features a separate signal converter with display. It allows installation and operation up to 100 m / 328 ft away from the probe, e.g. at the tank bottom or in a control room. Today, KROHNE is the only manufacturer to offer this possibility over such a distance.

- 2-wire loop-powered HART®
- Quick coupling system permits removal of the converter under process conditions and 360° rotation for better readability of the display screen
- Remote converter: up to 100 m / 328 ft distance to the probe
- Measuring range: up to 40 m / 131 ft
- Process connection: Tri Clamp, DIN 11851

FDA
The OPTIWAVE 7300 offers a signal for tank level or indicating the total volume of liquid in the tank. Its specially designed flat encapsulated PEEK antenna is easy to clean and is not affected by density changes due to product variation or temperature.

Best practice

A mustard producer was looking for a suitable solution for his warehouse in France. The task was to implement the continuous and non-contact measurement of the level of different varieties of mustard in the silos. Maintenance-free OPTIWAVE 7300 radar level transmitters were installed with Drop antennas for each tank. Besides the optimisation of the stock management, the non-contact technology also allows the measurement during the filling process.

OPTIWISE 7300 –
Level transmitter for liquid applications

• 2-wire FMCW radar level transmitter with encapsulated PEEK antenna for liquids
• Insensitive to cleaning in place
• Not affected by adhesive media
• Empty tank detection
• Accuracy: ±3 mm / 0.12”
• Process connection: DIN 11851, SMS, Tri Clamp, VARIVENT
• Configurable measuring range
• CIP to +140 °C / +284 °F 1 hour

BM 500 –
Potentiometric level transmitter for liquids
**OPTISWITCH 6500/6600 – Hygienic level switches**

Electromagnetic wave level switches for level detection and dry-run protection for liquids and solids. Through their small and optimised sensor shape, the devices are easy to clean and the risk of clogging of sticky products is minimised. The measurement is precise and not affected by the mounting position. Coating of the sensor or condensate are not detected. Easier to clean than a vibrating fork switch.

**Best practice**

For their excellent beers, the world renowned brewery ST-FEUILLIEN of Belgium prefers – besides other devices provided by KROHNE – the OPTISWITCH 6500 for the filtering of malt and mash during the brewing process. During measuring, alternating media are accurately identified and excellent product quality is always guaranteed.

**BM 500 – Potentiometric level transmitter for liquids**

Level transmitter dedicated for small metal tanks for conductive liquids. Based on the potentiometric measuring principle, the BM 500 does not have a dead zone or blocking distance. Transmitter performance is also not affected by coatings on the sensor rod. Device can be installed from top or from bottom of the tank.

- One switch type for all media/functions
- High or low level alarm for liquids and solids (E-value >1.5)
- Detects foam and interface
- Identifies a liquid and its changed characteristics e.g. degree of water contamination
- Available with stainless steel housing or with minimised electronics in sensor
- Minimum insertion length as small as 12 mm / 0.47”
- External LED alarm indicator

- Insensitive to foam, sticky or splashing liquids
- Continuous level measurement in small tanks >50 mm / 2” (no dead zone)
- Accuracy: ±0.5 % of full measuring range
- Not affected by adhesive media
- LED level monitoring
- Empty tank detection
- Configurable measuring range
Impressive control – Pressure measurement for the food and beverage industry

Pressure transmitters are used for many different tasks in food business. Many of them are used as hydrostatic pressure devices for level monitoring of open or pressurised tanks.

Other pressure devices control the process pressure in the pipelines. A lot of important process steps like homogenisation or evaporation are controlled by pressure.

Delta p transmitters are used for filter or leakage control on filter systems in breweries or dairies, or as level measurement of pressurised tanks with young beer.

These manifold applications need individual solutions, which is why KROHNE offers a wide range of pressure devices.

Typical applications include:

- Level control in process and storage tanks
- Wort cooler pressure management
- Carbon dioxide head pressure measurement
- Pressure control at pasteuriser
- Pressure control at heat exchanger

Highlights:

OPTIBAR – series of process / differential pressure transmitters

- Measuring differential pressure up to +150 °C / +302 °F without diaphragm seal
- Flush and recessed metal (PM) and ceramic (PC) diaphragms
- Absolute, gauge differential pressure measurement
- Low measuring ranges dp cell with high static pressure
- Various housing materials available
- Very good repeatability and long-term stability
- Turndown ratio up to 100:1
OPTIBAR PC 5060/PM 5060 –
Process pressure transmitters with ceramic or stainless steel diaphragm

The pressure transmitters are universal measuring devices for gases, vapours and liquids. The measuring cells can be built into the process flush and the radially recessed position of the gasket provides additional protection in abrasive media.

The OPTIBAR PC 5060 features a ceramic capacitive measuring cell that demonstrates its robustness and longevity in many applications. As a special advantage, the pressure transmitters offer process temperatures up to +150 °C / +302 °F and complete resistance against sudden temperature shocks. The OPTIBAR PM 5060 offers proven performance up to +105 °C / +221 °F.

- Flush and recessed ceramic diaphragm
- Accuracy: 0.05...0.2 % of upper range value
- Process connections: DIN 11851, Varivent, SMS, DRD, Tri Clamp, Neumo BioConnect
- Protection class: IP66, 67, optional IP69K
- Current output, PROFIBUS®, FOUNDATION™ fieldbus

OPTIBAR P 2010 –
Ultra compact pressure transmitter with stainless steel diaphragm

Compact transmitter in stainless steel with fully-welded flush diaphragm. Exceptional linearity, low temperature effects and high overpressure capability. Food-grade oil filling for all hygienic process connections.

- Fully-welded flush-mount stainless steel diaphragm
- Accuracy: 0.25 % of upper range limit
- Temperature range: -10...+125 °C / +14...+257 °F
- Process connections: DIN 11851, Varivent, SMS, Tri Clamp
- Protection class: IP67
OPTIBAR DP 7060 –
Differential pressure transmitter
for flow, level and differential pressure

Newly developed measuring cell with a centred overload protection diaphragm, which limits the maximum applied pressure to the differential pressure sensor. A permanent memory stores various events for analysis.

- Piezoresistive differential pressure cell
- Accuracy: <0.065% of upper range value
- Measuring range: from 10 mbar to 16 bar / 0.15 to 232 psi
- Temperature range: -40...+85 °C / -40...+185 °F
- Integrated line pressure measurement
- Insensitive against static pressure effects
- Protection class: IP66, 67, optional IP69K
- Current output, PROFiBUS®, FOUNDATION™ fieldbus
- Hygienic process connection with diaphragm seals [3A]
The highest degree of precision – Temperature measurement for the food and beverage industry

Temperature assemblies are the devices, which are required most in the food process. Many processes as, e.g., pasteurization or the mashing process are temperature controlled. But also where the media for heating or cooling buildings are being monitored for energy consumption, precise temperature elements are required.

All hygienic temperature assemblies feature a robust design, meticulous workmanship and dimensional accuracy. Certified materials, testing throughout the production process and consistent final inspections guarantee the consistently high quality of our products.

Please note our in-situ verifiable temperature device that allows for the element to stay in place during periodical verifications. This drastically reduces the cost of ownership per measurement point.

Typical applications include:

- Temperature measurement in the mash tun
- Temperature control in the sugar dissolving tank
- Temperature before separator
- Pasteurisation control
- Control after the heat exchanger
- CIP temperature control

Highlights:

OPTITEMP – series of temperature assemblies

- Very good repeatability and long-term stability
- Standardised and customer-specific temperature assemblies
- Compact, fast and precise measurement
- Fabricated in hygienic design
- Pt100 class A acc. to IEC 60751
- In-situ verification
OPTITEMP TRA-H10 – Standard temperature assembly for the food market

The OPTITEMP TRA-H10 consists of a 6 or 10 mm / 0.24 or 0.39” stainless steel sensor and an aluminium connection head. Various immersion lengths and a stainless steel connection heads are available.

• Construction with no dead space
• Surface roughness of 0.8 µm, optional 0.5 µm
• Standard connection heads or stainless steel versions
• Single or double Pt100 sensor
• Standard and customised insertion lengths

OPTITEMP TRA-H20 – Hygienic temperature assembly with replaceable insert

The OPTITEMP TRA-H20 has the same features as the OPTITEMP TRA-H10 plus the possibility to replace the measuring insert. The insert for a 6 mm / 0.24” thermowell is 3 mm / 0.12”; for 10 mm / 0.39” – 6 mm / 0.24”.

• Construction with no dead space
• Surface roughness of 0.8 µm, optional 0.5 µm
• Standard connection heads or stainless steel versions
• Transmitter mounted in head or in field housing
• Single or double Pt100 sensor
• Standard and customised insertion lengths
• Replaceable insert
Temperature measurement

• Construction with no dead space
• Surface roughness of 0.8 μm, optional 0.5 μm
• Standard connection heads or stainless steel versions
• Transmitter mounted in head
• Single or double Pt100 sensor
• Standard and customised insertion lengths
• Can be calibrated on site under process conditions

The OPTITEMP TRA-H30 is the high-end device for critical applications. Periodical verification of your temperature points can be done during operation. Apart from your savings from not having to dismount the elements the shut-down for maintenance can be avoided. The on-site calibration takes places under actual process conditions.

OPTITEMP TRA-C10 – Compact temperature sensor with a very small footprint

The small form factor and robust design make the OPTITEMP TRA-C10 suitable for any application where space is a challenge. With the integrated transmitter preconfigured to a fixed temperature range, the sensor is simple to order, easy to install and maintain.

OPTITEMP TRA-C10 is a highly accurate sensor featuring great reliability over the long term and excellent measuring stability.

OPTITEMP TRA-H30 – Hygienic temperature assembly for on-site calibration

OPTITEMP TRA-C10 – Compact temperature sensor with a very small footprint

• Pt 100 or 4...20 mA output
• Process connection: DIN, ISO or 1” Tri Clamp

• Construction with no dead space
• Surface roughness of 0.8 μm, optional 0.5 μm
• Standard connection heads or stainless steel versions
• Transmitter mounted in head
• Single or double Pt100 sensor
• Standard and customised insertion lengths
• Can be calibrated on site under process conditions
Process analysis

Analytical sensors with integrated transmitter · Inline analysis system for free fatty acids (FFA) · Inline analysis system for protein, fat, lactose and total solids · Inline process rheometers · Inline analysis system for chemical oxygen demand (COD) · Conductivity measuring systems
KROHNE is your partner for all aspects of analytical instrumentation. From pH measurement to the inline analysis of protein, fat and lactose: with the wide range of analytical devices and systems, KROHNE supplements the measurement of physical parameters. Our main goals are attaining sturdiness, reliability and quality in the various application areas.

Typical applications include:

- Process control in water treatment
- Filter monitoring
- Backflushing control ion exchanger
- Protection of reverse osmosis (RO) membranes
- Process control in the production of cheese, milk, beer, fruit juices, yogurt
- Pure water and ultrapure water monitoring
- Separation processes (milk/water)
- Distillation
- CIP/SIP processes
- Set a constant ratio of fat to protein for a constant quality of cheese or WPC
- Standardise fat content in drinking milk production
- Measurement and setting of the fat and protein content in the production of UHT milk and evaporated milk
- Monitor FFA value and control maximum FFA value in frying oil
- Minimise usage of fresh oil in production of fried snacks, fish, meat, French fries or vegetables
- Measure highest COD loads directly in the wastewater flow

From analysis to the solution – Process analysis products for the food and beverage industry

**Highlights:**

**SMARTPAT – series of analytical sensors**
- No external transmitter needed
- Configuration and easy offline calibration via PACTware™ with dedicated DTM
- Easy installation and retrofitting on site: sensors fit on 98% of all existing mounting assemblies
- Very cost-effective for new installations

**OPTISYS – conductivity measuring system**
- Fast temperature compensation
- Configuration via touch display

**OPTIQUAD – series of analysis systems**
- Inline measurement of milk ingredients, FFA in edible oil, COD in wastewater
- Permanent control, no sample measurement needed
SMARTPAT sensors with integrated transmitter technology

Introduced in 2013, SMARTPAT is the first family of analytical sensors that no longer require transmitters: KROHNE miniaturised the transmitter and fitted it into the sensor head. This technical achievement cuts the price in half compared to all measurement systems.

KROHNE is the only company who offers a real open standard without transmitter and a direct connection via standardised fieldbus from the sensor to the process control system. The SMARTPAT sensor stores all data and sends these as bidirectional digital signals with 4...20 mA / HART® 7 protocol to the control and asset management systems, handheds, PC and other peripherals.

SMARTPAT PH 8570 – Hygienic pH sensor

The SMARTPAT PH 8570 is the dedicated sensor for the food and beverage industry. The robust design withstands the typically cleaning with caustic soda solutions at +90 °C / +194 °F and has therefore a much longer lifetime than any dry pH sensor element. The maximum temperature is +140 °C / +284 °F.

- Long-term stability with pressurised RheoLid electrolyte filled reference electrode
- Fast and stable adjustment behaviour of the membrane glass type S
- Suitable for CIP and SIP
- Low maintenance – high potential of cost savings with offline calibration under controlled conditions
- With integrated Pt1000 and standard VP 2.0 connector
OPTISYS IND 8100 –
Hygienic conductivity measuring system

OPTISYS IND 8100 is used to analyse and differentiate liquid media. It provides either the direct measured conductivity or the calculated concentration value. Additionally, the measured temperature is also available as an output.

- Measuring range: from 500 μS/cm to 1 S/cm
- Compact hygienic design (≤DN40)
- Very fast temperature compensation
- Touch display
- Compact and remote separate output for conductivity and temperature

VISCOLINE –
Rheometer for continuous inline measurement of process viscosity

VISCOLINE is ideal for use wherever viscosity measurement is required for process or quality control.

This innovative rheometer is extremely adaptable and can be used for a variety of non-Newtonian applications including ketchup, mayonnaise, yogurt, sauces, cheese, emulsions and many, many more. The measurement of viscosity under process conditions makes it possible to predict offline viscosity at atmosphere or point of final filling.

- No moving parts – no recalibration
- Analog outputs or digital communications
- Immune to sudden changes in process viscosity
- Re-homogenised flow by mixer
- Digital communication protocol
- 0.2 % repeatability, 0.1 cp resolution
OPTIQUAD-M 4050 –
Analysis system for continuous inline measurement of protein, fat, lactose and total solids in milk products

OPTIQUAD-M 4050 can be installed using a standard VARINLINE process connection without bypass, directly in the production line. The optical measuring system contains no moving parts and is cleaned by the regular CIP cleaning process. The OPTIQUAD-M 4050 can be calibrated on site based on reference values from the in-house laboratory. To this end, the device features a sampling valve and an integrated automatic calibration function.
For European dairy companies, constant samples of the protein level are essential for the production of yogurt specialties. For automated optical line analysis, KROHNE was selected over time-consuming manual sampling systems.

- Non-contact analysis
- High precision and long-term stability
- For use in dynamic control loops
- Permanent process control
- No costs for chemicals, reagents and cleaning agents
- Impressive price-performance ratio
OPTIQUAD-FFA 4050 –
Analysis system for continuous inline measurement
of free fatty acids (FFA) in deep fried oils

Unlike conventional laboratory methods, the OPTIQUAD-FFA 4050
continuously measures the FFA value in the pipeline – without
touching the product. This enables the device to deliver extremely
precise readings in seconds, enabling much quicker intervention
in production. The advantages are obvious: OPTIQUAD-FFA 4050
helps minimise the need for fresh oil and maintain a high level of
product quality.

- First choice for the use in dynamic control loops: Eliminates the need for dangerous sampling, sample transport and preparation
- Permanent process control
- Significant savings of fresh oil

OPTIQUAD-WW 4050 –
Analysis system for continuous inline determination of
chemical oxygen demand (COD) in dairy wastewater

OPTIQUAD-WW 4050 uses up to four optical principles and up
to twelve wavelengths. This makes it technologically superior
to conventional COD methods, which typically only use one
optical principle and one wavelength. The system does not have
a measuring gap like other known COD sensors. Therefore, the
OPTIQUAD-WW 4050 has a much better availability than other
instruments and delivers actual values 24 hours a day. This gives
users a permanent control over the produced waste compared to
devices that just take samples periodically.

- Can measure extremely large COD loads
- Direct installation in wastewater flow
- Permanent process control
- Reduced risk of clogging of sensor
- Reduced maintenance cost
- Reduced costs for COD determination in the laboratory
- Impressive price-performance ratio

Best practice
Time for maintenance is very low. As one of Germany’s largest
private dairies, RÜCKER is committed to clear up organic
wastewater loads at its sites before transferring it to the
municipal wastewater system. RÜCKER was looking for a
cost-reducing and time-saving alternative to manual sampling
processes and laboratory analyses. The use of the
OPTIQUAD-WW 4050 low-maintenance spectroscopic analysis
system allows the continuous measurement of the COD and also
fulfilled expectations with respect to cost savings.
Many organisations measure utilities precisely to report the reduction of their carbon footprint periodically. Besides that fact, an increase of efficiency can be unlocked with specialised instruments by KROHNE.

They help to identify potentials for energy efficiency improvement and meet the requirements of energy management systems such as ISO 50001. The choice of the most suitable measuring device depends not only on the medium to be measured, but also on other factors such as pressure, volumetric flow rate, temperature and density.

**Typical applications include:**

- Measurement of the thermal energy of warm and hot water
- Measurement of the flow rates in compressed air networks
- Measurement of free air delivery (FAD)
- Measurement of the flow rate of steam
- Measurement of heavy fuel oil consumption

**Highlights:**

- **OPTISWIRL 4200 – Vortex flowmeter**
  - Integrated temperature and pressure compensation
  - Gross and net heat measurement
  - Integrated nominal diameter reduction
  - Development according to IEC 61508

- **OPTISONIC 3400 – ultrasonic flowmeter**
  - Thermal energy measurement
  - No effect of magnetite scaling

- **OPTISONIC 6300 – Clamp-on flowmeter**
  - Installation without interruption of the process
  - From DN15 to DN400

- **WATERFLUX – water meter**
  - Installation without inlet/outlet straight run
Energy measurement

KROHNE devices help to identify potential solutions to improve the efficiency of the compressed air network. For example by identifying leaks, monitoring the compressor’s efficiency, monitoring consumption profiles and peak consumption.

Management of compressed air production and distribution

KROHNE is committed to improving the efficiency and accuracy of measuring thermal energy. Whether it comes to developing new projects or retrofitting existing facilities, we offer a variety of measurement solutions for different ranges of pressure, temperature and flow with numerous national and international approvals.

Thermal energy control

Management of steam production and distribution

KROHNE offers solutions to measure the fuel consumption, steam production and distribution as well as the consumption of the boiler feedwater to fully analyse the efficiency of the steam system.
## Flow measurement

<table>
<thead>
<tr>
<th>Measuring accuracy</th>
<th>Reliable and cost-effective variable area flowmeter for liquids and gases</th>
<th>Electromagnetic flowmeter for volumetric filling systems</th>
<th>Electromagnetic flowmeter for basic hygienic applications</th>
<th>Electromagnetic flowmeter for general hygienic applications</th>
<th>Electromagnetic flowmeter for difficult hygienic applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6% ±0.2% of measured value</td>
<td>H250 M40</td>
<td>BATCHFLUX 5500</td>
<td>OPTIFLUX 6050</td>
<td>OPTIFLUX 6100</td>
<td>OPTIFLUX 6300</td>
</tr>
</tbody>
</table>

### Measuring range
- **Water:** 10...120000 l/h 4...4500 l/h 4...760000 l/h 4...760000 l/h 4...760000 l/h
- **Air:** 0.7...2800 m³/h 4...4500 l/h 4...760000 l/h 4...760000 l/h 4...760000 l/h

### Electrical conductivity
- ≥5 μS/cm (water ≥20 μS/cm)

### Outputs
- Current, pulse, status
- Current, pulse, status
- Current, pulse, status
- Current, pulse, status
- Current, pulse, status

### Inputs
- Binary
- Binary

### Communication
- HART®, FF, PA
- HART®, Modbus
- HART®, FF, PA, DP, Modbus
- HART®, FF, PA, DP, Modbus
- HART®, FF, PA, DP, Modbus

### Power supply
- 14...30 VDC [2 wire]
- 24 VDC
- 100...230 VAC, 24 VDC
- 100...230 VAC, 12...24 VDC, 24 VAC/DC
- 100...230 VAC, 12...24 VDC, 24 VAC/DC

### Protection category:
- **Compact (C)**: IP66, 68; NEMA4, 4X, 6
- **Field (F)**: IP66, 67; NEMA4, 4X
- **Wall (W)**: IP66, 67; NEMA4, 4X, 6P

### Process connections
- **Nominal sizes**: DN15...100; 1/2"...4"
- **Flanges**: EN 1092 or ASME
- **Hygienic connections**: DIN 11851, 11864-2; SMS; DIN clamp, Ti clamp, APV
- **Threaded**: G1/2...2; 1/2"...2" NPT
- **Pressure rating**: Depending on process connection
- **Process temperature**: -200...+300°C; -328...+572°F
- **Ambient temperature**: Non-Ex: -40...+120°C; -40...+248°F

### Materials
- **Wetted parts**: Stainless steel, Hastelloy®, titanium, Monel®, ceramic, PTFE
- **Liner**: Zirconium dioxide
- **Electrodes**: Cermet
- **Approvals**: H250 M40 | BATCHFLUX 5500 | OPTIFLUX 6050 | OPTIFLUX 6100 | OPTIFLUX 6300

### Other approvals
- MI-005
## Technical data

<table>
<thead>
<tr>
<th>Two straight tubes Coriolis mass flowmeter with an excellent efficiency ratio</th>
<th>Bent tubes Coriolis mass flowmeter with highest precision available for aerated products</th>
<th>Single straight tube Coriolis mass flowmeter for dense, viscous and shear sensitive liquids</th>
<th>Coriolis batch meter for linear and rotating filling machines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring accuracy</strong></td>
<td>Liquid: ±0.15% Gas: 0.35% Density: ±2 kg/m³</td>
<td>Liquid: ±0.1%, ±0.05% optional Gas: 0.35% Density: ±1 kg/m³</td>
<td>Liquid: ±0.1% Gas: 0.35% Density: ±2 kg/m³</td>
</tr>
<tr>
<td><strong>Measuring range</strong></td>
<td>48…170000 kg/h</td>
<td>5…1500000 kg/h</td>
<td>9.5…560000 kg/h</td>
</tr>
<tr>
<td><strong>Electrical conductivity</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Current, pulse/frequency, status</td>
<td>Current, pulse/frequency, status</td>
<td>Current, pulse/frequency, status</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td>Binary</td>
<td>Binary</td>
<td>Binary</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>HART®, FF, PA, DP, Modbus, EtherNet/IP</td>
<td>HART®, FF, PA, DP, Modbus, EtherNet/IP</td>
<td>HART®, FF, PA, DP, Modbus, EtherNet/IP</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>85…250 VAC, 11…31 VDC, 20.5…36 VAC/DC</td>
<td>85…250 VAC, 11…31 VDC, 20.5…36 VAC/DC</td>
<td>85…250 VAC, 11…31 VDC, 20.5…36 VAC/DC</td>
</tr>
<tr>
<td><strong>Protection category:</strong></td>
<td>IP66, 67; NEMA4, 4X, 6</td>
<td>IP66, 67; NEMA4, 4X, 6</td>
<td>IP66, 67; NEMA4, 4X, 6</td>
</tr>
<tr>
<td><strong>Field (F) Wall (W)</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-40…+55°C; -40…+131°F</td>
<td>-40…+55°C; -40…+131°F</td>
<td>-40…+55°C; -40…+131°F</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Duplex stainless steel</td>
<td>Stainless steel, Hastelloy® C22, duplex steel</td>
<td>Stainless steel, Hastelloy® C22, titanium, tantalum</td>
</tr>
</tbody>
</table>

### Process connection

<table>
<thead>
<tr>
<th>Nominal sizes</th>
<th>DN15…50</th>
<th>DN8…100</th>
<th>DN6…80</th>
<th>DN8…15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flanges</td>
<td>EN 1092 or ASME</td>
<td>EN 1092 or ASME</td>
<td>EN 1092 or ASME</td>
<td>-</td>
</tr>
<tr>
<td>Hygienic connections</td>
<td>DIN 11851, 11864-2; SMS; DIN clamp, Tri clamp, others on request</td>
<td>DIN 11851, 11864-2; SMS; DIN clamp, Tri clamp, others on request</td>
<td>DIN 11851, 11864-2; SMS; DIN clamp, Tri clamp, others on request</td>
<td>DIN 11864-2; DIN clamp, Tri clamp</td>
</tr>
<tr>
<td>Threaded</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pressure rating</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
</tr>
<tr>
<td>Process temperature</td>
<td>-40…+130°C; -40…+266°F</td>
<td>200…+400°C; -328…+752°F</td>
<td>-40…+150°C; -40…+302°F</td>
<td>0…+100°C; +32…+212°F</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-40…+65°C; -40…+149°F</td>
<td>-40…+65°C; -40…+149°F</td>
<td>-40…+65°C; -40…+149°F</td>
<td>-40…+65°C; -40…+149°F</td>
</tr>
</tbody>
</table>

### Approvals

| Ex approvals | ATEX, FM, CSA, NEPSI, IECEx | ATEX, cFMus, IECEx, NEPSI | ATEX, FM, CSA, NEPSI, IECEx | - |
| Other approvals | - | MID 2004/22/EC, OIML | Inmetro, NTEP, MID 2004/22/EC, OIML | - |
## Technical data

### Level measurement

<table>
<thead>
<tr>
<th>2-wire FMCW radar level transmitter for solid applications</th>
<th>2-wire FMCW radar level transmitter for liquid applications</th>
<th>2-wire TDR guided radar level transmitter for solid / liquid applications</th>
<th>4-wire potentiometric level transmitter for hygienic applications</th>
<th>Microwave level switches for hygienic applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTIWAVE 6300</td>
<td>OPTIWAVE 7300</td>
<td>OPTIFLEX 2200</td>
<td>BM 500</td>
<td>OPTISWITCH 6500/6600</td>
</tr>
</tbody>
</table>

#### Measuring accuracy
- ±3 mm; ±0.12”
- ±3 mm; ±0.12”
- ±3 mm; ±0.12”
- ±0.5% from probe length

#### Measuring range
- 0.2…80 m; 0.7…263 ft
- 0.2…35 m; 0.7…105 ft
- 0.6…40 m; 2…131 ft
- 0.2…3 m; 0.7…10 ft

#### Measurable products
- Powders, granulates, bulk solids
- Liquids, pastes, slurries
- Liquids and solids
- Liquids and pastes
- Liquids and solids

#### Dielectric constant
- ≥1.5
- ≥1.5
- ≥1.4 (1.1)
- > 1.5

#### Outputs
- Current, optional: 2nd current
- Current, optional: 2nd current
- Current, optional: 2nd current
- Current
- Status

#### Inputs
- -
- -
- -
- -

#### Communication
- HART®, FF, PA
- HART®, FF, PA
- HART®, FF, PA
- -

#### Power supply
- 14…30 VDC (non-Ex and Ex i)
- 14…30 VDC (non-Ex and Ex i)
- 14…30 VDC (non-Ex and Ex i)
- 18…36 VDC (non Ex)

#### Protection category Compact (C)
- IP66, 67; NEMA4X, 6P
- IP66, 67; NEMA4X, 6P
- IP66, 67; NEMA4X, 6P
- IP66, 67; NEMA4X, 6P

#### Field (F)
- IP66, 67; NEMA4X, 6P
- IP66, 67; NEMA4X, 6P
- IP66, 67; NEMA4X, 6P
- IP66, 67; NEMA4X, 6P

#### Process connection

<table>
<thead>
<tr>
<th>Nominal sizes</th>
<th>DN50...200</th>
<th>DN40...150</th>
<th>DN25...150</th>
<th>DN50</th>
<th>DN25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flanges</td>
<td>EN 1092 or ASME</td>
<td>EN 1092 or ASME</td>
<td>EN 1092 or ASME</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hygienic connections</td>
<td>-</td>
<td>VARIVENT® DN50, DIN 11851 DN50, SMS 51, Neumo Biocontrol</td>
<td>DIN 11851, Tri clamp</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Threaded</td>
<td>G1 1/2; 1 1/2” NPT</td>
<td>G1 1/2; 1 1/2” NPT</td>
<td>G1 1/2;...1 1/2” NPT</td>
<td>G1 h</td>
<td>G1/2 h</td>
</tr>
<tr>
<td>Pressure rating</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
</tr>
<tr>
<td>Process temperature</td>
<td>-40...+100°C; -40...+212°F (PP drop) -50...+150°C; -58...+302°F (PTFE drop) -50...+200°C; -58...+392°F (horn)</td>
<td>-20...+150°C; -4...+302°F (hygienic PEEK) -50...+150°C; -58...+302°F (PTFE drop) -40...+212°F (PP)</td>
<td>-50...+150°C; -58...+302°F, -20...+140°C; -4...+284°F</td>
<td>-20...+85°C; -4...+185°F</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-40...+80°C; -40...+176°F</td>
<td>-40...+80°C; -40...+176°F</td>
<td>-40...+80°C; -40...+176°F</td>
<td>-20...+60°C; -4...+140°F (compact) -20...+100°C; -4...+212°F (remote)</td>
<td>-40...+85°C; -40...+185°F</td>
</tr>
</tbody>
</table>

#### Materials

- Wetted parts: PTFE, PP or stainless steel, PEEK, PTFE, PP, Stainless steel, Hastelloy®
- Approvals: Stainless steel, PEEK, stainless steel

#### Approvals

| Ex approvals                  | ATEX, IECEx, FM, CSA, NEPSI, INMETRO, KGS | ATEX, IECEx, FM, CSA, NEPSI, INMETRO, KGS | ATEX, IECEx, cFMus, NEPSI, INMETRO | - | ATEX |
| Other approvals               | CRN, EAC | WHG, CRN, EAC | SIL2, CRN, WHG, EAC | EAC | EAC |
## Pressure measurement

<table>
<thead>
<tr>
<th></th>
<th>OPTIBAR P 2010</th>
<th>OPTIBAR PM 5060</th>
<th>OPTIBAR PC 5060</th>
<th>OPTIBAR DP 7060</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ultra-compact pressure transmitter with flush metallic diaphragm also for hygienic applications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Process pressure transmitter with metallic measuring cell for pressure and level measurement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Process pressure transmitter with ceramic measuring cell for pressure and level measurement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Differential pressure transmitter for hydrostatic level measurement with integrated absolute pressure measurement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Measuring accuracy</strong></th>
<th>&lt;± 0.25% FSO</th>
<th>&lt;± 0.075% of upper range value</th>
<th>&lt;± 0.05% of upper range value</th>
<th>&lt;± 0.045% of upper range value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring range</strong></td>
<td>0.1…40 bar; 1…580 psig</td>
<td>0.025…100 bar; 0.4…1450 psig</td>
<td>0.025…100 bar; 0.4…1450 psig</td>
<td>10, 30, 100, 500 mbar, 3, 16 bar, 0.15, 0.4, 1.4, 7.2, 43.5, 232 psi</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>4…20 mA, 0…10 V</td>
<td>4…20 mA</td>
<td>4…20 mA</td>
<td>4…20 mA</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>- HART®, FF, PA HART®, FF, PA HART®, FF, PA</td>
<td>- HART®, FF, PA HART®, FF, PA HART®, FF, PA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>24 VDC</td>
<td>9.5…35 VDC</td>
<td>9.5…35 VDC</td>
<td>9.5…35 VDC</td>
</tr>
</tbody>
</table>

### Process connection

<table>
<thead>
<tr>
<th><strong>Nominal sizes</strong></th>
<th>From DN25; 1/2”</th>
<th>From G1/2; 1/2” NPT front flush</th>
<th>From G1/2; 1/2” NPT front flush</th>
<th>1/4” NPT, 1/2” NPT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flanges</strong></td>
<td>-</td>
<td>From DN25, 1” ASME</td>
<td>From DN25, 1” ASME</td>
<td>With OPTIBAR diaphragm seal</td>
</tr>
<tr>
<td><strong>Hygienic connections</strong></td>
<td>VARIVENT®, SMS, DIN 11851, DIN clamp and Tri clamp</td>
<td>DIN 11851, 11864-1, SMS, VARIVENT®, DRD, PMC</td>
<td>DIN 11851, 11864-1, SMS, VARIVENT®, DRD, PMC</td>
<td>-</td>
</tr>
<tr>
<td><strong>Threaded</strong></td>
<td>From G1/2 front flush</td>
<td>From G1/2; 1/2” NPT front flush</td>
<td>From G1/2; 1/2” NPT front flush</td>
<td>1/4” NPT, 1/2” NPT</td>
</tr>
<tr>
<td><strong>Pressure rating</strong></td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
</tr>
<tr>
<td><strong>Process temperature</strong></td>
<td>-40…+125°C; -40…+257°F</td>
<td>-40…+105°C; -40…+221°F</td>
<td>-40…+150°C; -40…+302°F</td>
<td>-40…+85°C; -40…+185°F</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>-40…+85°C; -40…+185°F</td>
<td>-40…+80°C; -40…+176°F</td>
<td>-40…+80°C; -40…+176°F</td>
<td>-40…+80°C; -40…+176°F</td>
</tr>
</tbody>
</table>

### Materials

<table>
<thead>
<tr>
<th><strong>Wetted parts</strong></th>
<th>Stainless steel, Hastelloy® C-276</th>
<th>Stainless steel, Hastelloy® C-276</th>
<th>Stainless steel, 99.996% ceramic or stainless steel only</th>
<th>Stainless steel, Hastelloy® C-276, Monel®, tantalum</th>
</tr>
</thead>
</table>

### Approvals

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex approvals</strong></td>
<td>ATEX / IECEx Ex ia 1G / 1D</td>
<td>ATEX / IECEx Ex ia, Ex d, Ex d ia</td>
<td>ATEX / IECEx Ex ia, Ex d, Ex d ia</td>
<td>ATEX / IECEx Ex ia, Ex d, Ex d ia</td>
</tr>
<tr>
<td><strong>Other approvals</strong></td>
<td>-</td>
<td>-</td>
<td>SIL 2</td>
<td>-</td>
</tr>
</tbody>
</table>
## Temperature measurement

<table>
<thead>
<tr>
<th>Temperature measurement sensor</th>
<th>Compact temperature sensor with a very small footprint</th>
<th>Standard temperature assembly for the food market</th>
<th>Hygienic temperature assembly with replaceable insert</th>
<th>Hygienic temperature assembly for on-site calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>OPTITEMP TRA-C10</td>
<td>OPTITEMP TRA-H10</td>
<td>OPTITEMP TRA-H20</td>
<td>OPTITEMP TRA-H30</td>
</tr>
<tr>
<td>Measuring range</td>
<td>-50...+200°C; -58...+392°F</td>
<td>-50...+200°C; -58...+392°F</td>
<td>-50...+200°C; -58...+392°F</td>
<td>-50...+200°C; -58...+392°F</td>
</tr>
<tr>
<td>Measurable products</td>
<td>Liquids, gases or solids</td>
<td>Liquids, gases or solids</td>
<td>Liquids, gases or solids</td>
<td>Liquids, gases or solids</td>
</tr>
<tr>
<td>Outputs</td>
<td>Resistance or current output</td>
<td>Resistance or current output</td>
<td>Resistance or current output</td>
<td>Resistance or current output</td>
</tr>
<tr>
<td>Communication</td>
<td>-</td>
<td>HART®, PA</td>
<td>HART®, PA</td>
<td>HART®, PA</td>
</tr>
<tr>
<td>Power supply</td>
<td>24 VDC</td>
<td>24 VDC</td>
<td>24 VDC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Protection category</td>
<td>Compact (C)</td>
<td>Depending on connection head: IP54, 65, 67 or 68</td>
<td>Depending on connection head: IP54, 65, 67 or 68</td>
<td>Depending on connection head: IP54, 65, 67 or 68</td>
</tr>
<tr>
<td>Protection category Compact (C)</td>
<td>Depending on connection head: IP54, 65, 67 or 68</td>
<td>Depending on connection head: IP54, 65, 67 or 68</td>
<td>Depending on connection head: IP54, 65, 67 or 68</td>
<td>Depending on connection head: IP54, 65, 67 or 68</td>
</tr>
<tr>
<td>Process connection</td>
<td>Number of sensors</td>
<td>1</td>
<td>1 or 2</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Standard length</td>
<td>Ø6 mm; 0.24&quot;</td>
<td>Ø6, 10 mm; 0.24, 0.39&quot;</td>
<td>Ø6, 10 mm; 0.24, 0.39&quot;</td>
<td>Ø6, 10 mm; 0.24, 0.39&quot;</td>
</tr>
<tr>
<td>Standard length</td>
<td>50, 100 mm; 2, 4&quot; (other on request)</td>
<td>50, 100 mm; 2, 4&quot; (other on request)</td>
<td>50, 100 mm; 2, 4&quot; (other on request)</td>
<td>50, 100, 150, 200 mm; 2, 4, 6, 8&quot; (other on request)</td>
</tr>
<tr>
<td>Hygienic connections</td>
<td>DIN, ISO or Tri clamp</td>
<td>DIN, ISO or Tri clamp</td>
<td>DIN, ISO or Tri clamp</td>
<td>DIN, ISO or Tri clamp</td>
</tr>
<tr>
<td>Threaded</td>
<td>G1/2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pressure rating</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
<td>Depending on process connection</td>
</tr>
<tr>
<td>Process temperature</td>
<td>See measuring range</td>
<td>See measuring range</td>
<td>See measuring range</td>
<td>See measuring range</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-40...+70°C; -40...+158°F</td>
<td>-40...+70°C; -40...+158°F</td>
<td>-40...+70°C; -40...+158°F</td>
<td>-40...+70°C; -40...+158°F</td>
</tr>
<tr>
<td>Materials</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Other approvals</td>
<td>-</td>
<td>SIL 2</td>
<td>SIL 2</td>
<td>-</td>
</tr>
</tbody>
</table>
## Process analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>pH</th>
<th>Inductive conductivity</th>
<th>Dynamic viscosity</th>
<th>Milk ingredients</th>
<th>COD wastewater</th>
<th>FFA value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring accuracy</td>
<td>0.5%</td>
<td>1.00%</td>
<td>0.2% repeatability</td>
<td>Typ. 0.03% fat</td>
<td>Typ. 5..10%</td>
<td>Typ. 0.03% FFA</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0...14 pH</td>
<td>0...200.000 cP</td>
<td>Typ. 0...3.5% fat</td>
<td>Typ. 0...3.0% protein</td>
<td>Typ. 0...3.5% fat</td>
<td>Typ. 0...3.0% protein</td>
</tr>
<tr>
<td>Process conditions</td>
<td>Liquids</td>
<td>Liquids</td>
<td>Liquids</td>
<td>Liquids</td>
<td>Liquids</td>
<td>Liquids</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt 1000</td>
<td>Pt 1000</td>
<td>-</td>
<td>-</td>
<td>Pt 1000</td>
<td>Pt 1000</td>
</tr>
<tr>
<td>Outputs</td>
<td>1 x 4...20 mA (passive)</td>
<td>2 x 4...20 mA (passive) 2 relays</td>
<td>4...20 mA, EtherNet IP</td>
<td>4x 4...20 mA</td>
<td>1x 4...20 mA</td>
<td>2x 4...20 mA</td>
</tr>
<tr>
<td>Inputs</td>
<td>-</td>
<td>2 inputs for changing measuring ranges</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Communication</td>
<td>HART® 7</td>
<td>-</td>
<td>Ethernet, Profinet</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Power supply</td>
<td>15...30 VDC (loop powered)</td>
<td>15...35 VDC, 150 mA</td>
<td>24 VDC, 230 VAC</td>
<td>24 VDC</td>
<td>24 VDC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Process connection</td>
<td>IP68</td>
<td>IP67, 69K</td>
<td>IP67; NEMA4</td>
<td>IP65; NEMA4X</td>
<td>IP65; NEMA4X</td>
<td>IP65; NEMA4X</td>
</tr>
<tr>
<td>Temperature/pressure range</td>
<td>Max. 12 bar; 174 psi</td>
<td>Max. 25 bar; 362 psi</td>
<td>Max. 40 bar; 580 psi</td>
<td>Max. 25 bar; 362 psig</td>
<td>Max. 25 bar; 362 psig</td>
<td>Max. 25 bar; 362 psig</td>
</tr>
<tr>
<td>Process temperature</td>
<td>0...+140°C (CIP, SIP)</td>
<td>-20...+140°C; -4...+285°F</td>
<td>0...+130°C; +32...+266°F</td>
<td>+4...+90°C; +40...+194°F</td>
<td>0...+190°C; +32...+374°F</td>
<td>0...+50°C; +32...+122°F</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-10...+85°C; +14...+185°C</td>
<td>-30...+80°C; -22...+176°F</td>
<td>0...+50°C; +32...+122°F</td>
<td></td>
<td>0...+50°C; +32...+122°F</td>
<td>0...+50°C; +32...+122°F</td>
</tr>
<tr>
<td>Materials</td>
<td>Glass, ceramic, Rheoloid gel</td>
<td>Stainless steel, PEEK</td>
<td>Stainless steel</td>
<td>Stainless steel, glass, EPDM</td>
<td>Stainless steel, glass, EPDM</td>
<td>Stainless steel, glass, EPDM, FKM</td>
</tr>
<tr>
<td>Approvals</td>
<td>IECEx, ATEX, NEPSI, FM (zone 0)</td>
<td>-</td>
<td>EC, UL, CSA</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>
## Energy measurement

<table>
<thead>
<tr>
<th>Vortex</th>
<th>Ultrasonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTISWIRL 4200</td>
<td>UF M 3030</td>
</tr>
</tbody>
</table>

### Recommended energy measurements

<table>
<thead>
<tr>
<th>Heating</th>
<th>Cooling</th>
<th>Compressed air</th>
<th>Steam</th>
<th>Gas</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>–</td>
<td>–</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>–</td>
<td>–</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

### Process conditions

<table>
<thead>
<tr>
<th>Temperature range</th>
<th>Maximum pressure</th>
<th>Measuring range</th>
<th>Digital communication</th>
<th>Measuring accuracy</th>
<th>Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating –40…+240°C; –40…+464°F</td>
<td>LN100; CL 600</td>
<td>0...+20 m/s; 0...+66 ft/s</td>
<td>HART®, PA, FF</td>
<td>±0.5%</td>
<td>• Integrated temperature and pressure compensation Gross and net heat measurement With integrated nominal diameter reduction Development according to IEC 61508</td>
</tr>
<tr>
<td>Cooling –25…+180°C; –13…+356°F</td>
<td>PN100; CL 1500</td>
<td>+0.5...+20 m/s; +1.6...+66 ft/s</td>
<td>HART®, Modbus, FF</td>
<td>±1%</td>
<td>• Independent of conductivity, viscosity, temperature, density and pressure No moving or intruding parts, therefore no pressure loss or wear Minimal operational and maintenance costs</td>
</tr>
<tr>
<td>Compressed air –40…+200°C; –40…+392°F</td>
<td>–</td>
<td>+0.5...+20 m/s; +1.6...+66 ft/s</td>
<td>USB slave</td>
<td>±1%</td>
<td>• Ultrasonic clamp-on flowmeter with separate UFC 300 converter Easy installation without process interruption – no need to open piping Universally applicable from DN15 to DN4000</td>
</tr>
<tr>
<td>Steam –40…+200°C; –40…+392°F</td>
<td>–</td>
<td>+0.5...+20 m/s; +1.6...+66 ft/s</td>
<td>HART®, PA, FF</td>
<td>±1%</td>
<td>• Portable ultrasonic clamp-on flowmeter User friendly operation through full-colour graphic display and full keypad Quick and easy transfer of logged data to your PC through USB interface</td>
</tr>
<tr>
<td>Gas –40…+200°C; –40…+392°F</td>
<td>–</td>
<td>0...+30 m/s; 0...+66 ft/s</td>
<td>HART®, Modbus, FF</td>
<td>±0.5...+20 m/s; ±0.98...+65 ft/s</td>
<td>• Thermal energy measurement No effect of magnetite scaling</td>
</tr>
<tr>
<td>Oil –40…+180°C; –40…+356°F</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>±1%</td>
<td>• Universal 2-path ultrasonic flowmeter for process gases Integrated volume calculation with pressure and temperature compensation Independent of gas properties No moving parts, no pressure loss</td>
</tr>
</tbody>
</table>

### Flowmeter features

<table>
<thead>
<tr>
<th>Diameter to EN 1092-1</th>
<th>Inlet and outlet section</th>
<th>Digital communication</th>
<th>Measuring accuracy</th>
<th>Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN15…100</td>
<td>15DN/7DN</td>
<td>HART®, PA, FF</td>
<td>±0.75% for liquids Re &gt; 20,000</td>
<td>• Integrated temperature and pressure compensation Gross and net heat measurement</td>
</tr>
<tr>
<td>DN25…3000</td>
<td>10DN/5DN</td>
<td>HART®</td>
<td>±1% for gases and steam 10,000 &lt; Re &lt; 20,000 ±1%</td>
<td>• Independent of conductivity, viscosity, temperature, density and pressure No moving or intruding parts, therefore no pressure loss or wear Minimal operational and maintenance costs</td>
</tr>
<tr>
<td>DN15…4000</td>
<td>10DN/5DN</td>
<td>HART®</td>
<td>±1% for liquids, gases and steam 0.25...7 m/s; 0.8...23 ft/s (optional up to 10 m/s; 32.8 ft/s) Gases and steam: 2...80 m/s; 6.6...262.5 ft/s (depends on density)</td>
<td>• Ultrasonic clamp-on flowmeter with separate UFC 300 converter Easy installation without process interruption – no need to open piping Universally applicable from DN15 to DN4000</td>
</tr>
<tr>
<td>DN15…4000</td>
<td>10DN/5DN</td>
<td>HART®</td>
<td>±1% for liquids, gases and steam 0.25...7 m/s; 0.8...23 ft/s (optional up to 10 m/s; 32.8 ft/s) Gases and steam: 2...80 m/s; 6.6...262.5 ft/s (depends on density)</td>
<td>• Portable ultrasonic clamp-on flowmeter User friendly operation through full-colour graphic display and full keypad Quick and easy transfer of logged data to your PC through USB interface</td>
</tr>
<tr>
<td>DN25…3000</td>
<td>5DN/3DN</td>
<td>USB slave</td>
<td>±1% for liquids, gases and steam 0.25...7 m/s; 0.8...23 ft/s (optional up to 10 m/s; 32.8 ft/s) Gases and steam: 2...80 m/s; 6.6...262.5 ft/s (depends on density)</td>
<td>• Thermal energy measurement No effect of magnetite scaling</td>
</tr>
<tr>
<td>DN50...600</td>
<td>10DN/3DN</td>
<td>HART®, Modbus, FF</td>
<td>±1% for liquids, gases and steam 0.25...7 m/s; 0.8...23 ft/s (optional up to 10 m/s; 32.8 ft/s) Gases and steam: 2...80 m/s; 6.6...262.5 ft/s (depends on density)</td>
<td>• Universal 2-path ultrasonic flowmeter for process gases Integrated volume calculation with pressure and temperature compensation Independent of gas properties No moving parts, no pressure loss</td>
</tr>
</tbody>
</table>
### Electromagnetic Flowmeters

<table>
<thead>
<tr>
<th>OPTIFLUX 4300</th>
<th>WATERFLUX 3070</th>
<th>WATERFLUX 3300</th>
<th>OPTIMASS 1400</th>
<th>OPTIMASS 6400</th>
<th>OPTIMASS 7400</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="" /></td>
<td><img src="image2" alt="" /></td>
<td><img src="image3" alt="" /></td>
<td><img src="image4" alt="" /></td>
<td><img src="image5" alt="" /></td>
<td><img src="image6" alt="" /></td>
</tr>
</tbody>
</table>

- **Optimum Flowrate:**
  - OPTIFLUX 4300: 48...170,000 kg/h
  - WATERFLUX 3070: 5...1,500,000 kg/h
  - WATERFLUX 3300: 9.5...560,000 kg/h

- **Min./Max. Flow:**
  - OPTIFLUX 4300: 12...+12 m/s; -40...+40 ft/s
  - WATERFLUX 3070: 12...+12 m/s; -40...+40 ft/s
  - WATERFLUX 3300: 12...+12 m/s; -40...+40 ft/s

- **Pipe Sizes:**
  - OPTIFLUX 4300: DN2.5...2000; 1/10...80"
  - WATERFLUX 3070: DN25...600; 1...24"
  - WATERFLUX 3300: DN25...600; 1...24"

- **Accuracy:**
  - OPTIFLUX 4300: ±0.2%
  - WATERFLUX 3070: ±0.2%
  - WATERFLUX 3300: ±0.2%

- **Protocols:**
  - OPTIFLUX 4300: HART®, FF, PA, DP, Modbus
  - WATERFLUX 3070: HART®, FF, PA, DP, Modbus
  - WATERFLUX 3300: HART®, FF, PA, DP, Modbus

### Mass Flowmeters

<table>
<thead>
<tr>
<th>OPTIMASS 1400</th>
<th>OPTIMASS 6400</th>
<th>OPTIMASS 7400</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="" /></td>
<td><img src="image8" alt="" /></td>
<td><img src="image9" alt="" /></td>
</tr>
</tbody>
</table>

- **Optimum Flowrate:**
  - OPTIMASS 1400: 51,000...1,000,000 kg/h
  - OPTIMASS 6400: 51,000...1,000,000 kg/h
  - OPTIMASS 7400: 51,000...1,000,000 kg/h

- **Accuracy:**
  - OPTIMASS 1400: ±0.2%
  - OPTIMASS 6400: ±0.1%
  - OPTIMASS 7400: ±0.1%

### Technical Data

- **Temperature Range:**
  - OPTIFLUX 4300: -40...+180°C; -40...+356°F
  - WATERFLUX 3070: -5...+70°C; +23...+158°F
  - WATERFLUX 3300: -5...+70°C; +23...+158°F
  - OPTIMASS 1400: -40...+130°C; -40...+266°F
  - OPTIMASS 6400: -200...+400°C; -328...+752°F
  - OPTIMASS 7400: -40...+150°C; -40...+302°F

### Key Features

- **Standard device in the process industry**
- **Battery-driven with very low power consumption for remote locations**
- **Chemically resistant to alkaline solutions and acids**
- **Easy installation without straight inlet or outlet sections**
- **IP68 rated signal converter for submersion in flooded chambers**
- **Excellent price-performance ratio**
- **Supplied standard with secondary containment housing**
- **Supreme liquid and gas performance with CT approval**
- **Single straight measuring tube in titanium, HASTELLOY® or stainless steel**
- **Sterilisable and cleanable**
KROHNE services

Engineering services · Online tools and services · Maintenance services ·
Quality · Training and seminars · Calibration

For us, service starts at our first contact with you and
lasts as long as the life of our systems installed at
your plant.

Quality and reliability are key to maintaining the
highest service standards. All KROHNE feeder
factories are ISO 9001 certified. In fact, long before
ISO 9000 existed, KROHNE was already manufacturing
to the highest industrial standards. Today, certification
exists in every factory to demonstrate that we not only
fulfil ISO requirements but have passed the ISO
certification procedure every three years since the
standard was introduced.

But it’s not simply a one-way process. We actively
encourage companies like yours to participate in our
research and development activities. Many of our
products that are today considered the pinnacle of
excellence were developed in cooperation with our
customers.

Beyond the highest requirements

Engineering services throughout all project stages

- Project management
- Control and asset management systems in project
  concept phase
- Basic engineering based on the specification
  required by the user
- Detail engineering phase
- Commissioning services
- On-site start-up and commissioning
- Product training (on site)
- Calibration services
Proven quality

Before shipping, every meter is thoroughly inspected. This rigorous programme of specific measurements, tests and factory inspections is called "KROHNE proved".

So, if you install and operate any KROHNE product by following our operating instructions correctly, problems shouldn’t occur. If they do, we will provide you with all the technical support and service you need.

Choose from maintenance and service contracts tailored to suit all business sizes and needs:

- Spare parts and consumables
- Field service and on-site repair
- Returns
- Workshop repair
- Helpdesk

KROHNE Academy and KROHNE Academy online

The KROHNE Academy is a series of seminars organised in collaboration with leading automation companies aimed at plant engineers, operators and contractors across the process industries. It brings industry experts together to provide an insight into the various technologies, industrial standards and procedures that plant operators can find themselves faced with.

Taking place in various countries, KROHNE Academy seminars address key operating issues, from plant safety to ways of increasing plant efficiency and controlling costs, and show possible solutions. They also provide an ideal opportunity for you to speak to the experts and benefit from their vast application knowledge.

Learn more about KROHNE Academy at www.krohne.com

KROHNE Academy online is a free eLearning platform that contains audio-enhanced, interactive Web-based training. As with its on-site seminars, the online KROHNE academy learning material is vendor-agnostic and not specific to individual products and/or industries. The main focus of each course is on a measurement technology such as Variable Area, Vortex, Ultrasonic or Mass flow or on a more general topic such as the basics of gas measurement or pipeline leak detection.

Register now for free and start your training at http://academy-online.krohne.com

Please check www.krohne.com for your local service contact.

Additional online services:

[Find them at www.krohne.com]

- **Configure It**
  Configure It is a highly advanced online configuration tool for standard devices offering free 2D/3D CAD data of KROHNE flow devices for planning engineers. It enables you to configure any KROHNE product to handle your application in a few simple steps.

- **KROVASYS 4**
  Selection and calculation tool for variable area flowmeters.

- **PiCK**
  Get any information related to your KROHNE product from our dedicated online resource PiCK. Just enter your serial number, and key material like manuals, quick start guides and calibration documents is at your fingertips.
KROHNE is committed to making communication convenient. Which is why our field devices communicate reliably with controllers, control systems and PCs, and can also be used for a variety of control and regulating tasks. They meet all of the prerequisites for integration into modern plant asset management systems, based on integration technologies such as DD/EDD and FDT/DTM.

We are a longstanding member of PACTware™ and the FDT Group®. Since 2003, we have made DTMs available for our field devices with HART®, PROFIBUS® or FOUNDATION™ fieldbus interfaces.

For remote monitoring of applications such as water metering, KROHNE has developed a GSM-based solution for online data transmission and logging.

So you will always have the information you need conveniently close to hand.
Clear and fast access to process and device data from any level

KROHNE DTMs are available for many field devices with HART®, FOUNDATION™ fieldbus or PROFIBUS® communication interfaces. They can be integrated into all FDT frame applications.

To assure conformity with the FDT standard, KROHNE DTMs are certified by the FDT Group after certification tests at the KROHNE FDT DTM Test Site, accredited in 2014. In addition, intensive interoperability tests with frames of major host system suppliers are performed.

KROHNE DTMs do not require any licence, providing full functionality free of charge. Next to standard operating features, they provide additional information for commissioning and application engineers.

For example, the DTM for the MFC 400 mass flow converter features clear and configurable diagnostics according to NAMUR recommendations NE 107, and an intuitive layout for fast access to the most used functions. DTMs for level devices are enhanced by fully configurable parameterisation screens for easy commissioning.

Together with PACTware™, KROHNE DTMs come alongside the device on a CD and can also be downloaded from KROHNE Download Centre at www.krohne.com

Diagnostic data is categorized or can be user-mapped into five categories according to the severity and ease reactions by the operator. Detailed configuration enables predictive maintenance.
Calibration is one of KROHNE’s core areas of expertise. If you buy a KROHNE product, you will get a measuring device that performs most accurate with low uncertainty under real process conditions.

To achieve this, we operate more than 120 calibration facilities for volume flow, mass flow, level, temperature, density and pressure to (wet-)calibrate any device we manufacture. For example, every flowmeter is wet-calibrated using water or air as standard before leaving our facilities.

We can also provide customer specific calibration such as:

- Carry out multipoint calibrations
- Vary different parameters such as temperatures, viscosities, pressures etc.
- Use the actual medium or similar
- Build or emulate customer-specific flow geometries
- Use piping provided by the customer

For calibration we only use direct comparison of measurands (e.g. we calibrate our Coriolis mass flowmeters with a gravimetric weighing system). Our calibration rigs are the most accurate used in measuring device production worldwide: the accuracy of the reference is usually 5 to 10 times better than that of the meter under test.

The world’s most precise volumetric calibration rig for flowmeters up to DN 3000/120”
This goes for small as well as for very large sizes: KROHNE operates the world’s most precise volumetric calibration rig for flowmeters up to DN 3000/120” with a certified accuracy of 0.013 %. The reference vessel is a 44 m/144 ft high tank containing almost ½ million litres/132,000 gal (US) of water which allows for a maximum flow rate of 30,000 m³/h/7,925,000 gal (US)/h.

Certified technology for fiscal & custody transfer applications

Our meters can be calibrated and certified according to various standards such as OIML, API, Measuring Instruments Directive (MI-001, 002, 004, 005), GOST, etc. The standards we use for calibration are ISO/IEC 17025 accredited and traceable to international or national standards. Regular inspections by national metrology institutes, round robin tests and alignments with national and international metrological standards according to ISO 9000 and EN 45000 guarantee the quality and comparability of our calibration rigs. Staff performing the calibrations are trained and given regular re-trainings to ensure quality and continuity.
KROHNE – Process instrumentation and Measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process analysis
- Services