Microwave level measurement
continuous level measuring for bulk goods

Appliance information

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ATEX option

B1 Dust

II 1/2D Ex ta[i]a/b IIIC T86 °C
**Application** (Intended use)
Continuous level measurement with integrated limit level detection for almost all bulk goods.
Independent from changing process characteristics as e.g. bulk density, conductivity, temperature, pressure, moisture and dusty milieu.
Usable in small vessels just as in big silos, also with difficult vessel geometry or nearby disturbing appliances.

**Mode of operation**
High-frequency electromagnetic impulses with low energy were generated by the sensor electronic and propagated along the probe. When these impulses hit the surface of the bulk goods, a part of the impulse energy will be reflected back up the probe to the electronic. The level will be calculated by the time difference between the impulses send and the impulses reflected and will be provided as a continuous measurement reading through its analogue output. A freely positionable switching output signal can be set.

**Construction**
The MWF consists of three components:
- the housing with the sensor electronic,
- the process connection with the feed through,
- the probe mounted on the feed through

Three probe types are deliverable:
- 27 wire rope probe with tensioning weight for all silos and vessels
- 21 rod probe, rigid for small vessels and bulk goods which exert low lateral forces at the probe

The high-frequency measuring signal will be transmitted by the sensor electronic through the feed-through to the probe in the bulk goods vessel and returned.

**Technical data**

<table>
<thead>
<tr>
<th>Material</th>
<th>Housing A1</th>
<th>Aluminium, coated RAL 7001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Housing A2</td>
<td>Stainless steel 1.4408 / 316</td>
</tr>
<tr>
<td></td>
<td>Feed-through</td>
<td>PEEK</td>
</tr>
<tr>
<td>Process connection</td>
<td>Stainless steel 1.4571 / 316 Ti</td>
<td></td>
</tr>
<tr>
<td>Flange F1 F70</td>
<td>1.4571 / 316 Ti or aluminium</td>
<td></td>
</tr>
<tr>
<td>Flange F2 F100</td>
<td>1.4301 / 304 or aluminium</td>
<td></td>
</tr>
<tr>
<td>Coupling sleeve</td>
<td>Stainless steel 1.4571 / 316 Ti</td>
<td></td>
</tr>
<tr>
<td>Rope</td>
<td>Stainless steel 1.4401 / 316</td>
<td></td>
</tr>
<tr>
<td>Rod</td>
<td>Stainless steel 1.4571 / 316 Ti</td>
<td></td>
</tr>
<tr>
<td>Tensioning weight</td>
<td>Stainless steel 1.4571 / 316 Ti</td>
<td></td>
</tr>
<tr>
<td>Hexagonal nut</td>
<td>G3 1.4571 / 316 Ti or 1.4301 / 304</td>
<td></td>
</tr>
</tbody>
</table>

| Wire rope probe | Ø 6 mm with tensioning weight Ø 30 mm |
| Probe length [LS] | 1.0 m ... 20.0 m |
| Rod probe | Ø 6 mm |
| Probe length [LW] | 0.5 m ... 3.0 m |
| Tolerance of the lengthen [L] | ± 10 mm |

**Electrical data**

| Supply voltage | $U_N$ 12 ... 30 V DC (reverse-polarity protected) |
| Analog output signal | $I_N$ 4 ... 20 mA (0 ... 100 %) active current output |
| Switching output | $U_S$ 0 ... $U_N$ DC PNP (active) NC or NO (selectable) Factory setting NC |
| Load current | ≤200 mA |
| Power consumption | ≤70 mA with 24 V DC (no burden) |
| Start-up time | <6 sec |
| Response time | <100 ms |
| Connection clamps | 0.5 - 2 mm², screwless |
| Cable entry | Cable gland M20x1.5 |
| Protection class | I 2P IP66 and in the vessel intrinsically safe „ia” |
Technical measuring data

- **Probe length [L]** Reference point [R] to end of probe
  - max. measuring range < probe length
- **Inactive area** Wire rope: 150 mm, Rod: 10 mm
  - Top: 120 mm, Bottom: 120 mm
- **Measuring range (analog) [M]**
  - 4 mA lower current value [uMG]
  - 20 mA upper current value [oMG]
- **Factory setting [uMG]** 4 mA Top edge tensioning weight
- **Factory setting [oMG]** 20 mA depending on probe length for bulk goods:
  - up to 3.0 m at 0.3 m
  - up to 5.0 m at 0.4 m
  - up to 10.0 m at 0.6 m
  - up to 15.0 m at 0.8 m
  - up to 20.0 m at 1.0 m
- **Beneath reference point [R]**
  - or depending on customers request

Switch-points [oSA] [uSA]
- Freely positionable inside measuring range [M] with switch-hysteresis
- Minimum distance 3 mm
- At 20% of probe length [L] below [R]

- **Measuring accuracy ±3 mm**
  - Or max. 0.03% of the measuring data
- **Repeatability <2 mm**
- **Resolution <1 mm** (at reference conditions)
- **Temperature drift <0.2 mm/K**
- **Measureable changes of filling level <1 m/s**

Application data

- **Dielectric constant [Er]** 1.8 (below 1.8 on request)
- **Ambient temperature [Ta]** -20 °C ... +70 °C
- **Bulk goods temperature (Process) [Ts]**
  - -20 °C ... +70 °C
  - -40 °C ... +150 °C
- **Pressure in container [p]** -1 bar ... 40 bar

Filling level [F]
Upper switch-point [oSA]
Lower switch-point [uSA]
Measuring range [M] 0 ... 100%
Probe length [L]
Inactive area
Filling level [F]
Measuring range [M]
Top edge tensioning weight
Bottom edge tensioning weight
Upper switch-point [oSA]
Lower switch-point [uSA]
Switch-points freely positionable inside measuring range [M]
Inactive area

Application information

Microwave level measurement
MWF wave

MOLLET Füllstandstechnik GmbH
MWF-GI-03

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**Maximum forces**

![Wire rope probe and Rod probe](image)

**Wire rope probe [LS]** maximum tractive force

\[ F_1 = 10 \text{ kN} \]

**Rod probe [LW]** maximum side load

\[ F_2 \times LW = 6 \text{ Nm} \]

**Dimensions**

![Probe length](image)

**Probe length**

- **Wire rope probe [LS]**
  
  1.0 m ... 20.0 m

- **Rod probe [LW]**
  
  0.5 m ... 3.0 m

**Process connection - thread**

<table>
<thead>
<tr>
<th>Thread code</th>
<th>Thread</th>
<th>for thread code</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1I</td>
<td>G1</td>
<td>46</td>
</tr>
<tr>
<td>G2I</td>
<td>G1¼</td>
<td>50</td>
</tr>
<tr>
<td>G3I</td>
<td>G1½</td>
<td>55</td>
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</tbody>
</table>

Delivery incl. Seals

**Hexagonal nuts**

<table>
<thead>
<tr>
<th>Art.-Nr.</th>
<th>Thread</th>
<th>for thread code</th>
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</thead>
<tbody>
<tr>
<td>SM1E</td>
<td>G1</td>
<td>6</td>
</tr>
<tr>
<td>SM2E</td>
<td>G1¼</td>
<td>8</td>
</tr>
<tr>
<td>SM3E</td>
<td>G1½</td>
<td>8</td>
</tr>
</tbody>
</table>
**Process connection - Flanges**

<table>
<thead>
<tr>
<th>Flange</th>
<th>D</th>
<th>B</th>
<th>A</th>
<th>F</th>
<th>LK</th>
<th>d</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1A</td>
<td>110</td>
<td>8</td>
<td>69</td>
<td>10</td>
<td>90</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>F1E</td>
<td>110</td>
<td>8</td>
<td>69</td>
<td>10</td>
<td>90</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>F5E</td>
<td>140</td>
<td>16</td>
<td>78</td>
<td>2</td>
<td>100</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td>F6E</td>
<td>210</td>
<td>16</td>
<td>170</td>
<td>18</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>F7E</td>
<td>220</td>
<td>20</td>
<td>180</td>
<td>18</td>
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<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Delivery incl. Gaskets

**Process connection - Flange F2**

Reference point [R]

Flange F100

F2

F2A = 15 mm

F2E = 12 mm

Delivery incl. Gaskets
Dairy coupling  F42

Level indicator with conical adapter and corresponding groove nut for dairy coupling. For installation of the level indicator into containers which must be cleaned for hygienic reasons, or for quick removal of the indicators when the vessels are changed.

**Coupling size**  Dairy coupling DN 50 / 2

**Material**  Conical adapter: 1.4571 / 316 Ti
  
  Groove nut: 1.4404 / 316 L

**Container pressure**  -0.9 bar ... 10 bar $p_{(Process)}$

Clamp connection  F46

Level indicator with clamp connection. For installation of the level indicator into containers which must be cleaned for hygienic reasons, or for quick removal of the indicators when the vessels are changed.

**Clamp size**  DN 50 / 2

**Material**  1.4571 / 316 Ti

**Container pressure**  -0.9 bar ... 10 bar $p_{(Process)}$

**Clamp seal**  not in the delivery extent

The Technical Data presented here are to be considered as maximum values, relating only to the equipment described herein. Depending on the selection of options and instruments used, these data must be considered or reduced correspondingly.
Weather protection hood  SH

Weather protection hood for outdoor use.
Protection against control head overheating and prevents the inside of the housing from development of condensation.

Materials

Hood: PVC, RAL 7001
Storm tape: EDPM, weather-resisting

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Protection from condensation  SDK

Condensate protection valve for insertion into a threaded hole.
A watertight but vapour-permeable membrane prevents condensate formation in the interior of the housing.

Material

Sealings: VITON
Polyamide

Connection thread: M20
Type of protection: IP66
Choice of mounting position

If possible place the probe so that a space remains:
- to plane metallic walls [A] >100 mm
- to concrete walls [A] >500 mm
- to adherences on the wall [B] >100 mm
- to metallic installations [C] >300 mm
- to metallic parts outside of plastic containers [D] >300 mm
- to metallic hoppers and bottoms [E] >150 mm

The probe must not touch metallic walls and bottoms.

Exception: Probe will be fixed.

By spaces [C] [D] <300 mm a disturbance signal suppression has to be done.

Filling level [F]
If possible choose measuring height (mounting position) so (~ ¾ to ~ ¼), that the proportion of volumes of the filling cone and the discharge hopper will be vaguely equalized.

Protection from impacting bulk goods

Choose the mounting position in that way the probe will not be hit by the filling flow rate.
Protruding nozzle

Protruding nozzle diameter \([G]\) \(\geq 100\) mm
Protruding nozzle height \([H]\) \(\leq 200\) mm

Smaller diameters and heights \(>200\) mm could restrict the measuring capability.

By use of thermally insulated vessels the nozzle should be also insulated in order to avoid condensation.

The protruding nozzle should be short and inside flush with the silo roof.

Installation in silos made of concrete

By mounting in a concrete floor the process connection should aligned with the bottom edge of the floor.

In concrete silos if possible a distance \([A]\) of minimum 500 mm between concrete walls and the probe should be kept. Optimal is 1000 mm.

Wire rope probe locate

Fixing of the probe can be necessary if:
- vibrations can bring the probe to swing
- the probe touch at times the silo walls, the cone, installations or other metallic parts
- the probe is closer than 500 mm to a concrete wall

For fixation a thread M12 is provided in the lower end of the tensioning weight.

The probe should hang loose to avoid to high tension loading and the danger of rope break and either reliable earthed or reliable insulated.
Electrical connection

- Connect grounding terminal with equalised potential of the complete plant.
- Wire as short as possible
- Cable cross-section ≥ 2.5 mm²