OPTIWAVE 3500 C

80 GHz Radar (FMCW) Level Transmitter for liquids with hygienic requirements

- Extensive choice of hygienic process connections
- Flush-mounted PEEK Lens antenna; CIP/SIP-suitable
- Small dead zone and beam angle for small and narrow tanks
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1.1 The FMCW radar level transmitter for liquids with hygienic requirements

This device is a non-contact radar level transmitter that uses FMCW technology. It measures distance, level and volume of liquids and pastes. It is ideal for measuring the level of hygienic liquids with its PEEK Lens antenna and wide range of process connection options.

![Image of the product]

1. PEEK Lens antenna for the measurement of hygienic products
2. 2-wire 80 GHz FMCW radar level transmitter
3. Large, backlit LCD screen with 4-button keypad can be used with a bar magnet without opening the housing cover. The software has a quick setup assistant for easy commissioning. 12 languages are available.
4. Aluminium or stainless steel housing

**Highlights**

- KROHNE is the pioneer of FMCW radar level measurement and has more than 28 years of experience with this technology
- 2-wire loop-powered 80 GHz transmitter – HART® 7
- Accuracy: ±2 mm / ±0.08”
- PEEK Lens antenna measures distances up to 50 m / 164 ft at +150°C / +302°F and 25 barg / 362 psig
- Extensive choice of hygienic process connections: Tri-Clamp, Tuchenhagen VARIVENT®, SMS, DIN 11851, DIN 11864, NEUMO BioControl®
- Small dead zone and beam angle (8° with DN40 / 1½” Lens antenna, 10° with DN25 / 1”)
- Extensive choice of hygienic process connections (ideal for cleaning-in-place / sterilization-in-place [CIP-SIP] processes)
- One user interface for all applications
- Empty tank spectrum function eliminates false reflections caused by tank internals
- Diagnosis functions according to NAMUR NE 107
- Conforms to NAMUR Recommendations NE 21, NE 43 and NE 53
- Can measure in fast moving processes (≤60 m/min / 196.85 ft/min)
1.2 Applications

1. Level measurement of liquids

The level transmitter can measure the level of a wide range of liquid products on a large variety of installations within the stated pressure and temperature range. It is ideal for hygienic, pharmaceutical, and food and beverage applications. It does not require any calibration: it is only necessary to do a short configuration procedure.

2. Volume (mass) measurement

A strapping table function is available in the configuration menu for volume or mass measurement. Up to 50 volume (mass) values can be related to level values. For example:

- Level 1 = 2 m / Volume 1 = e.g. 0.7 m³
- Level 2 = 10 m / Volume 2 = e.g. 5 m³
- Level 3 = 20 m / Volume 3 = e.g. 17 m³

This data permits the device to calculate (by linear interpolation) volume or mass between strapping table entries.

PACTware™ software and a DTM (Device Type Manager) is supplied free of charge with the device. This software permits the user to easily configure the device with a computer. It has a conversion table function with a large number of tank shapes.
1.3 Product family

OPTIWAVE 1010 (6 GHz)
for liquids in bypass chambers

The OPTIWAVE 1010 is a non-contact FMCW radar welded to a bypass chamber with an optional IP68 level indicator (BM 26 Advanced). It continuously measures the distance and level of clean liquids.

It measures in bypass chambers up to 8 m / 26.2 ft high with a maximum accuracy of ±5 mm / ±0.2". It can measure in process conditions with temperatures up to +150°C / +302°F and pressures up to 40 barg / 580 psig.

OPTIWAVE 5200 C/F (10 GHz)
for liquids in storage and process applications

This 10 GHz 2-wire FMCW radar level transmitter measures distance, level, volume, mass and flow rate of liquids and pastes. It is ideal for corrosive products with its PP or PTFE antenna options. It features unique PP and PTFE antennas for aggressive products. The device is able to measure distances up 30 m / 98.4 ft in process conditions up to +250°C / +482°F and 40 barg / 580 psig.

The device agrees with SIL2 requirements for safety-related systems (as per IEC 61508). Output options include HART®, FOUNDATION™ fieldbus and PROFINET PA industrial communication protocols.
OPTIWAVE 5400 C (24 GHz)
for liquids in basic process applications

Designed for basic liquid applications, this market entry 24 GHz 2-wire FMCW radar transmitter provides accurate readings even in fast moving processes, in closed tanks or in the open air like rivers or dams. Its proven PP Drop antenna is insensitive to condensation.

The OPTIWAVE 5400 can measure in process conditions with temperatures up to +130°C / +266°F and pressures up to 16 barg / 232 psig. The antenna options permit to measure distances up to 100 m / 328 ft. The device can be installed in high nozzles (≤1 m / 3.28 ft) when it is fitted with antenna extensions.

OPTIWAVE 7400 C (24 GHz)
for agitated and corrosive liquids

This 24 GHz FMCW radar level transmitter is designed for liquids in harsh environment like tanks with agitators containing corrosives or in non-Ex applications with extremely high process temperatures, like molten salt in solar plants (+700°C / +1292°F). For toxic and dangerous products, the use of a Metaglas® second sealing barrier is recommended.

The PTFE and PEEK Drop antennas have optional flange plate protection for corrosive media. Heating and cooling systems prevent from crystallization inside the Metallic Horn antennas. The device measures distances up to 100 m / 328 ft and can be installed in high nozzles (≤1 m / 3.28 ft) when fitted with antenna extensions. Standard process conditions up to +200°C / 392°F; 100 barg / 1450 psig (higher on request).
OPTIWAVE 7500 C (80 GHz)
for liquids in narrow tanks with internal obstructions

The small beam angle and negligible dead zone of this 80 GHz FMCW radar level transmitter makes it the premium choice for liquids in small and narrow tanks with internal obstructions like agitators or heating coils, as well as tanks with long nozzles. It can even measure through tank roofs made of non-conductive material (e.g. plastic, fiberglass or glass). The flush-mounted PEEK Lens antenna (no tank intrusion) is insensitive to deposit.

There is an extensive choice of process connections starting from ¾". Flanges have an optional PEEK plate protection for corrosive tank contents. The OPTIWAVE 7500 operates in process conditions with temperatures up to +150°C / +302°F and pressures up to 40 barg / 580 psig. It measures distances up to 100 m / 328 ft and a 112 mm / 4.4" extension is available for high nozzles.

OPTIWAVE 3500 C (80 GHz)
for liquids with hygienic requirements

This 80 GHz FMCW radar transmitter for hygienic liquid applications in the pharmaceutical, food and beverage industries is CIP-SIP suitable and offers a large choice of hygienic process connections: Tri-Clamp®, Tuchenhagen VARIVENT®, SMS, DIN 11851, DIN 11864-1 Form A, NEUMO BioControl®.

The small dead zone and beam angle of its flush-mounted Lens antenna enables precise measurement even in small and narrow tanks with agitators. The OPTIWAVE 3500 measures up to 50 m / 164 ft in process conditions up to +150°C / +302°F and 25 barg / 363 psig.
OPTIWISE 6400 C (24 GHz)  
for solids from granulates to rocks

By combining high signal dynamics and FMCW radar technology, this market-entry 24 GHz radar device measures accurately and reliably the level of solids like stone, plastic granulates or coffee beans. No need for expensive antenna aiming kits or purging systems; the proven Drop antenna design minimizes scaling and is not affected by the angle of repose.

It operates in process conditions with temperatures up to +130°C / +266°F and pressures up to 16 barg / 232 psig. The antenna options permit the device to measure distances up to 100 m / 328 ft.

OPTIWISE 6500 C (80 GHz)  
for powders and dusty atmosphere

Accurate continuous level measurement of fine powders has to deal with a series of issues like dust, low-reflective media, build-up and uneven surfaces. The specific algorithms and high signal dynamics of this 80 GHz FMCW radar transmitter are the key to provide reliable and accurate readings despite these difficult conditions. Thanks to the small beam angle of the flush-mounted Lens antenna, this powerful device handles high and narrow silos even in the presence of internal obstructions.

The OPTIWISE 6500 operates in process conditions with temperatures up to +200°C / +392°F and pressures up to 40 barg / 580 psig. It offers an extensive choice of threaded (≥1½") and flanged (≥DN50 / 2") process connections. The antenna options permit the device to measure distances up to 100 m / 328 ft. A 112 mm / 4.4" extension is available for high nozzles.
1.4 Measuring principle

A radar signal is emitted via an antenna, reflected from the product surface and received after a time \( t \). The radar principle used is FMCW (Frequency Modulated Continuous Wave).

The FMCW-radar transmits a high frequency signal whose frequency increases linearly during the measurement phase (called the frequency sweep). The signal is emitted, reflected on the measuring surface and received with a time delay, \( t \). Delay time, \( t=2d/c \), where \( d \) is the distance to the product surface and \( c \) is the speed of light in the gas above the product.

For further signal processing the difference \( \Delta f \) is calculated from the actual transmitted frequency and the received frequency. The difference is directly proportional to the distance. A large frequency difference corresponds to a large distance and vice versa. The frequency difference \( \Delta f \) is transformed via a Fast Fourier Transform (FFT) into a frequency spectrum and then the distance is calculated from the spectrum. The level results from the difference between the tank height and the measured distance.

![Figure 1-1: Measuring principle of FMCW radar](image)

- Transmitter
- Mixer
- Antenna
- Distance to product surface, where change in frequency is proportional to distance
- Differential time delay, \( \Delta t \)
- Differential frequency, \( \Delta f \)
- Frequency transmitted
- Frequency received
- Frequency
- Time
Measurement modes

"Direct" mode
If the dielectric constant of the liquid is high \( \varepsilon_r \geq 1.4 \), the level signal is the reflection on the surface of the liquid.

"TBF Auto" mode
If the dielectric constant of the liquid is low \( \varepsilon_r \leq 1.4 \ldots 1.5 \), for long-distance measurement), you must use "TBF Auto" mode to measure level correctly. "TBF Auto" is an automatic mode that lets the device make a selection between "Direct" mode and "TBF" mode. If the device finds a large radar reflection above the "tank bottom area" (the bottom 20% of the tank height), the device will use "Direct" mode. If the device finds a large radar reflection in the "tank bottom area", the device uses TBF mode. This mode can be used only in tanks with flat bottoms or in stilling wells with a reference plate at the bottom.

"Full TBF" mode
TBF = Tank Bottom Following. If the dielectric constant of the liquid is very low \( \varepsilon_r < 1.4 \), you must use "TBF Full" mode to measure level correctly. The device uses the radar reflection on the bottom of the tank (the signal goes through the liquid). This mode can be used only in tanks with flat bottoms or in stilling wells with a reference plate at the bottom.
2.1 Technical data

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

### Measuring system

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>2-wire loop-powered level transmitter; FMCW radar</td>
</tr>
<tr>
<td>Frequency range</td>
<td>W-band (78...82 GHz)</td>
</tr>
<tr>
<td>Max. radiated power [EIRP]</td>
<td>&lt; -41.3 dBm according to ETSI EN 307 372 [TLPR] and ETSI EN 302 729 [LPR]</td>
</tr>
<tr>
<td>Application range</td>
<td>Level measurement of liquids, pastes and slurries in hygienic applications</td>
</tr>
<tr>
<td>Primary measured value</td>
<td>Distance and reflection</td>
</tr>
<tr>
<td>Secondary measured value</td>
<td>Level, volume and mass</td>
</tr>
</tbody>
</table>

### Design

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>The measurement system consists of a measuring sensor (antenna) and a signal converter</td>
</tr>
<tr>
<td>Options</td>
<td>Integrated LCD display [-20..+70°C / -4...+158°F]; if the ambient temperature is not in these limits, then this condition can stop the display</td>
</tr>
<tr>
<td>Max. measuring range (antenna)</td>
<td>Lens, DN25 [1”]: 25 m / 82 ft</td>
</tr>
<tr>
<td></td>
<td>Lens, DN40 [1½”]: 50 m / 164 ft</td>
</tr>
<tr>
<td></td>
<td>Refer also to &quot;Measuring accuracy&quot; on page 16</td>
</tr>
<tr>
<td>Min. tank height</td>
<td>0.2 m / 8”</td>
</tr>
<tr>
<td>Recommended minimum blocking distance</td>
<td>Lens, DN25 [1”]: 0.1 m / 4”</td>
</tr>
<tr>
<td></td>
<td>Lens, DN40 [1½”]: 0.2 m / 8”</td>
</tr>
<tr>
<td>Beam angle (antenna)</td>
<td>Lens, DN25 [1”]: 10°</td>
</tr>
<tr>
<td></td>
<td>Lens, DN40 [1½”]: 8°</td>
</tr>
</tbody>
</table>

### Display and user interface

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Backlit LCD display</td>
</tr>
<tr>
<td>Interface languages</td>
<td>English, French, German, Italian, Spanish, Portuguese, Chinese (simplified), Japanese, Russian, Czech, Polish and Turkish</td>
</tr>
</tbody>
</table>

### Measuring accuracy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>1 mm / 0.04”</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±1 mm / ±0.04”</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±2 mm / ±0.08”, when distance ≤ 10 m / 33 ft; ±0.02% of measured distance, when distance &gt; 10 m / 33 ft. For more data, refer to Measuring accuracy on page 16</td>
</tr>
<tr>
<td>Digital temperature drift</td>
<td>Max. ±10 mm / ±0.39” for the full temperature range</td>
</tr>
</tbody>
</table>
### Reference conditions acc. to EN 61298-1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>+15...+25°C / +59...+77°F</td>
</tr>
<tr>
<td>Pressure</td>
<td>1013 mbar ±50 mbar / 14.69 psia ±0.73 psi</td>
</tr>
<tr>
<td>Relative air humidity</td>
<td>60% ±15%</td>
</tr>
<tr>
<td>Target</td>
<td>Metal plate in an anechoic chamber</td>
</tr>
</tbody>
</table>

### Operating conditions

#### Temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-40...+80°C / -40...+176°F</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0...99%</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40...+85°C / -40...+185°F</td>
</tr>
<tr>
<td>Process connection temperature [higher temperature on request]</td>
<td>-40...+150°C / -40...+302°F</td>
</tr>
</tbody>
</table>

Integrated LCD display: -20...+70°C / -5...+140°F; if the ambient temperature is not in these limits, the display switches off. The device continues to operate correctly. Ex: see supplementary operating instructions or approval certificates.

#### Pressure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process pressure</td>
<td>DN25 [1&quot;] Lens antenna with DN50 VARIVENT® Type N connection -1...10 barg / -14.5...145 psig</td>
</tr>
<tr>
<td>Process pressure</td>
<td>DN25 [1&quot;] Lens antenna and DN40 [1½&quot;] Lens antenna with all process connections except the DN50 VARIVENT® Type N -1...25 barg / -14.5...363 psig</td>
</tr>
</tbody>
</table>

#### Other conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric constant ($\varepsilon_r$)</td>
<td>Direct mode: ≥1.4 TBF mode: ≥1.1</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IEC 60529: IP66 / IP68 (0.1 barg / 1.45 psig) NEMA 250: NEMA type 6 - 6P (housing) and type 6P (antenna)</td>
</tr>
<tr>
<td>Maximum rate of change</td>
<td>60 m/min / 196 ft/min</td>
</tr>
</tbody>
</table>

### Installation conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process connection position</td>
<td>Make sure that there are not any obstructions directly below the process connection for the device. For more data, refer to Installation on page 23.</td>
</tr>
<tr>
<td>Dimensions and weights</td>
<td>For dimensions and weights data refer to Dimensions and weights on page 19.</td>
</tr>
</tbody>
</table>

### Materials

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard: Polyester-coated aluminium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>Option: Stainless steel (1.4404 / 316L) – non-Ex devices only. Ex approvals will be available in the second quarter of 2018.</td>
</tr>
<tr>
<td>Wetted materials</td>
<td>PEEK Victrex 450G and stainless steel (1.4404 / 316L)</td>
</tr>
<tr>
<td>Surface roughness of wetted parts</td>
<td>Ra &lt; 0.8 μm / 32 μin – AARH</td>
</tr>
<tr>
<td>Gaskets</td>
<td>BioControl®: EPDM [-20°C...+150°C / -4...+302°F] SMS, Tri-Clamp®, VARIVENT®, DIN 11851, DIN 11864-1: without ①</td>
</tr>
<tr>
<td>Cable gland</td>
<td>Standard: none Options: Plastic (Non-Ex: black, Ex i-approved: blue); nickel-plated brass; stainless steel; M12 [4-pin connector]</td>
</tr>
<tr>
<td>Weather protection [Option]</td>
<td>Stainless steel (1.4404 / 316L)</td>
</tr>
</tbody>
</table>
### Process connections

<table>
<thead>
<tr>
<th>For DN25/1” Lens antenna</th>
<th>Tri-Clamp® 1½” or 2”; DIN 11851 DN40 or DN50; DIN 11864-1 DN40 or DN50; SMS 51; VARIVENT® Type N (DN50); others on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>For DN40/1½” Lens antenna</td>
<td>BioControl® DN50; Tri-Clamp® 2”; others on request</td>
</tr>
</tbody>
</table>

### Electrical connections

<table>
<thead>
<tr>
<th>Power supply</th>
<th><strong>Terminals output – Non-Ex / Ex i:</strong> 12...30 VDC; min./max. value for an output of 21.5 mA at the terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum current</td>
<td>21.5 mA</td>
</tr>
<tr>
<td>Current output load</td>
<td>Non-Ex / Ex i: $R_L [\Omega] \leq (</td>
</tr>
<tr>
<td>Ex d: $R_L [\Omega] \leq (</td>
<td>U_{ext}</td>
</tr>
<tr>
<td>Cable entry</td>
<td>Standard: M20×1.5; Option: ½ NPT</td>
</tr>
<tr>
<td>Cable gland</td>
<td>Standard: none  Options: M20×1.5 (cable diameter: 7...12 mm / 0.28...0.47”); others are available on request</td>
</tr>
<tr>
<td>Cable entry capacity (terminal)</td>
<td>0.5...3.31 mm² (AWG 20...12)</td>
</tr>
</tbody>
</table>

### Input and output

<table>
<thead>
<tr>
<th>Current output</th>
<th>Standard: 4...20 mA  Options: 3.8...20.5 mA acc. to NAMUR NE 43; 4...20 mA (reversed); 3.8...20.5 mA (reversed) acc. to NAMUR NE 43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal</td>
<td>Passive</td>
</tr>
<tr>
<td>Resolution</td>
<td>±5 µA</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>Typically 50 ppm/K</td>
</tr>
<tr>
<td>Error signal</td>
<td>High: 21.5 mA; Low: 3.5 mA acc. to NAMUR NE 43</td>
</tr>
</tbody>
</table>

**HART®**

<table>
<thead>
<tr>
<th>Description</th>
<th>Digital signal transmitted with the current output signal [HART® protocol]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>7.4</td>
</tr>
<tr>
<td>Load</td>
<td>$\geq 250 \Omega$</td>
</tr>
<tr>
<td>Digital temperature drift</td>
<td>Max. ±15 mm / 0.6” for the full temperature range</td>
</tr>
<tr>
<td>Multi-drop operation</td>
<td>Yes. Current output = 4 mA. Enter Program mode to change the polling address (1...63).</td>
</tr>
<tr>
<td>Available drivers</td>
<td>FC475, AMS, PDM, FDT/DTM</td>
</tr>
</tbody>
</table>

### Approvals and certification

**CE**

The device meets the essential requirements of the EU Directives. The manufacturer certifies successful testing of the product by applying the CE marking.

For more data about the EU Directives and European Standards related to this device, refer to the EU Declaration of Conformity. You can find this documentation on the DVD-ROM supplied with the device or it can be downloaded free of charge from the website [Download Center].
## Conformity to sanitary regulations
FDA 21 CFR 177.2600 and and CFR 177.2415

## Vibration resistance
EN 60068-2,64 and EN 60721-3-4 (1...9 Hz: 3 mm / 10...200 Hz:1g; 10g shock ½ sinus: 11 ms)

### Explosion protection

**ATEX (EU Type Approval)**
- II 1/2 G Ex ia IIC T6...T3 Ga/Gb;
- II 1/2 D Ex ia IIC T85°C...T150°C Da/Db;
- II 1/2 G Ex db ia IIC T6...T3 Ga/Gb;
- II 1/2 D Ex ia tb IIC T85°C...T150°C Da/Db

**ATEX (Type Approval)**
- II 3 G Ex nA IIC T6...T3 Gc;
- II 3 G Ex ic IIC T6...T3 Gc;
- II 3 D Ex ic IIC T85°C...T150°C Dc

**IECEx**
- Ex ia IIC T6...T3 Ga/Gb;
- Ex ia IIC T85°C...T150°C Da/Db;
- Ex db ia IIC T6...T3 Ga/Gb;
- Ex ia tb IIC T85°C...T150°C Da/Db;
- Ex ic IIC T6...T3 Gc;
- Ex ic IIC T85°C...T150°C Gc

**cQPSus**

#### Division ratings
- XP-IS, Class I, Div 1, GPS ABCD, T6...T3 – available in September 2017;
- DIP, Class II, III, Div 1, GPS EFG, T85°C...T150°C – available in September 2017;
- IS, Class I, Div 1, GPS ABCD, T6...T3;
- IS, Class II, III, Div 1, GPS EFG, T85°C...T150°C;
- NI, Class I, Div 2, GPS ABCD, T6...T3 – available in September 2017;
- NI, Class II, III, Div 2, GPS EFG, T85°C...T150°C – available in September 2017

#### Zone ratings
- Class I, Zone 1, AEEx db ia [ia Ga] IIC T6...T3 Gb (US) – antenna suitable for Zone 0 – available in September 2017;
- Ex db ia [Ex ia Ga] IIC T6...T3 Gb (Canada) – antenna suitable for Zone 0 – available in September 2017;
- Class I, Zone 0, AEEx ia IIC T6...T3 Ga (US);
- Ex ia IIC T6...T3 Ga (Canada);
- Class I, Zone 2, AEEx nA IIC T6...T3 Gc (US);
- Ex nA IIC T6...T3 Gc (Canada);
- Zone 20, AEEx ia IIC T85°C...T150°C Da (US);
- Ex ia IIC T85°C...T150°C Da (Canada);
- Zone 21, AEEx ia tb [ia Da] IIC T85°C...T150°C Db (US) – antenna suitable for Zone 20 – available in September 2017;
- Ex ia tb [Ex ia Da] IIC T85°C...T150°C Db (Canada) – antenna suitable for Zone 20 – available in September 2017

**NEPSI**

(available in September 2017)
- Ex ia IIC T3~T6 Ga/Gb;
- Ex d ia IIC T3~T6 Ga/Gb;
- Ex iaD 20/21 T85°C...T150°C IP6X;
- Ex iaD tD A20/A21 T85°C...T150°C IP6X
## TECHNICAL DATA

| EAC-EX  | Ga/Gb Ex ia IIC T6...T3;  
|         | Ex ia IIC T85°C...T150°C Da/Db;  
|         | Ga/Gb Ex ia IIC T6...T3;  
|         | Ex ia tb IIC T85°C...T150°C Da/Db;  |

**Hygienic**

- **3-A®**
  - Available in September 2017. For VARIVENT® Type N and Tri-Clamp®.

- **EHEDG**
  - Available in September 2017. For VARIVENT® Type N and Tri-Clamp® when fitted with an alternative gasket [which agrees with EHEDG Position paper “Easy cleanable pipe couplings and process connections” Version 3, December 2015].

**Other standards and approvals**

- **Electromagnetic compatibility**
  - **EU**: Electromagnetic Compatibility directive (EMC)

- **Radio approvals**
  - **EU**: Radio Equipment directive (RED)
  - **FCC Rules**: Part 15
  - **Industry Canada**: RSS-211

- **Electrical safety**
  - **EU**: Agrees with the safety part of the Low Voltage directive (LVD)
  - **USA and Canada**: Agrees with NEC and CEC requirements for installation in ordinary locations

- **NAMUR**
  - **NAMUR NE 21** Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment
  - **NAMUR NE 43** Standardization of the Signal Level for the Failure Information of Digital Transmitters
  - **NAMUR NE 53** Software and Hardware of Field Devices and Signal Processing Devices with Digital Electronics
  - **NAMUR NE 107** Self-Monitoring and Diagnosis of Field Devices

- **CRN**
  - Option available in September 2017. This certification is applicable for all Canadian provinces and territories. For more data, refer to the website.

- **Construction code**
  - Option: ASME B31.3

---

1. Tri-Clamp® is a registered trademark of Ladish Co., Inc. BioControl® is a registered trademark of Neumo-Ehrenberg-Group.
2. VARIVENT® is a registered trademark of GEA Tuchenhagen GmbH.
3. HART® is a registered trademark of the HART Communication Foundation
2.2 Measuring accuracy

Use these graphs to find the measuring accuracy for a given distance from the transmitter.

DN25 (1") Lens antenna

![Graph](image1.png)

Figure 2-1: DN25 (1") Lens antenna: measuring accuracy (graph of measuring accuracy in mm against measuring distance in m)

X: Measuring distance from the thread stop or flange facing of the process connection [m]
Y: Measuring accuracy [+yy mm / -yy mm]

1 100 mm

![Graph](image2.png)

Figure 2-2: DN25 (1") Lens antenna: measuring accuracy (graph of measuring accuracy in inches against measuring distance in ft)

X: Measuring distance from the thread stop or flange facing of the process connection [ft]
Y: Measuring accuracy [+yy inches / -yy inches]

1 3.94"

To calculate the accuracy at a given distance from the antenna, refer to Technical data on page 11 (measuring accuracy).
DN40 (1 1/2") Lens antenna

Figure 2-3: DN40 (1 1/2") Lens antenna: measuring accuracy (graph of measuring accuracy in mm against measuring distance in m)

X: Measuring distance from the thread stop or flange facing of the process connection [m]
Y: Measuring accuracy [+yy mm / -yy mm]
1 50 mm
2 200 mm

Figure 2-4: DN40 (1 1/2") Lens antenna: measuring accuracy (graph of measuring accuracy in inches against measuring distance in ft)

X: Measuring distance from the thread stop or flange facing of the process connection [ft]
Y: Measuring accuracy [+yy inches / -yy inches]
1 1.97" 2 7.87"

To calculate the accuracy at a given distance from the antenna, refer to Technical data on page 11 [measuring accuracy].
2.3 Minimum power supply voltage

Use these graphs to find the minimum power supply voltage for a given current output load.

**Figure 2-5:** Minimum power supply voltage for an output of 21.5 mA at the terminal (Non-Ex and Hazardous Location approval (Ex i / IS))

- X: Power supply U [VDC]
- Y: Current output load $R_L$ [$\Omega$]

**Hazardous Location (Ex d / XP/NI) approved devices**

**Figure 2-6:** Minimum power supply voltage for an output of 21.5 mA at the terminal (Hazardous Location approval (Ex d / XP/NI))

- X: Power supply U [VDC]
- Y: Current output load $R_L$ [$\Omega$]
2.4 Dimensions and weights

DN25 / 1” Lens antenna versions

- **Cable glands are delivered on demand with non-Ex, Ex i- and Ex d-approved devices.**
- **The diameter of the outer sheath of the cable must be 7...12 mm or 0.28...0.47”.
- **Cable glands for cQPSus-approved devices must be supplied by the customer.**
- **A weather protection cover is available as an accessory with all devices.**

### DN25 / 1” Lens antenna: Dimensions in mm

<table>
<thead>
<tr>
<th>Type of process connection</th>
<th>Dimensions [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
</tr>
<tr>
<td>1½” Tri-Clamp®</td>
<td>151</td>
</tr>
<tr>
<td>2” Tri-Clamp®</td>
<td>151</td>
</tr>
<tr>
<td>SMS 1145</td>
<td>151</td>
</tr>
<tr>
<td>VARIVENT®</td>
<td>151</td>
</tr>
<tr>
<td>DN40 DIN 11851</td>
<td>151</td>
</tr>
<tr>
<td>DN50 DIN 11851</td>
<td>151</td>
</tr>
<tr>
<td>DN50 DIN 11864-1</td>
<td>151</td>
</tr>
<tr>
<td>DN40 DIN 11864-1</td>
<td>151</td>
</tr>
</tbody>
</table>
## DN25 / 1” Lens antenna: Dimensions in inches

<table>
<thead>
<tr>
<th>Type of process connection</th>
<th>Dimensions [inches]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
</tr>
<tr>
<td>1½” Tri-Clamp®</td>
<td>5.94</td>
</tr>
<tr>
<td>2” Tri-Clamp®</td>
<td>5.94</td>
</tr>
<tr>
<td>SMS 1145</td>
<td>5.94</td>
</tr>
<tr>
<td>VARIVENT®</td>
<td>5.94</td>
</tr>
<tr>
<td>DN40 DIN 11851</td>
<td>5.94</td>
</tr>
<tr>
<td>DN50 DIN 11851</td>
<td>5.94</td>
</tr>
<tr>
<td>DN50 DIN 11864-1</td>
<td>5.94</td>
</tr>
<tr>
<td>DN40 DIN 11864-1</td>
<td>5.94</td>
</tr>
</tbody>
</table>
**OPTIWAVE 3500 C**

**TECHNICAL DATA**

---

**DN40 / 1½” Lens antenna versions**

![Diagram of DN40 / 1½” Lens antenna versions]

- **Cable glands are delivered on demand with non-Ex, Ex i- and Ex d-approved devices.**
- **The diameter of the outer sheath of the cable must be 7…12 mm or 0.28…0.47”.**
- **Cable glands for cQPSus-approved devices must be supplied by the customer.**
- **A weather protection cover is available as an accessory with all devices.**

---

### DN40 / 1” Lens antenna: Dimensions in mm

<table>
<thead>
<tr>
<th>Type of process connection</th>
<th>Dimensions [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
</tr>
<tr>
<td>2” Tri-Clamp®</td>
<td>151</td>
</tr>
<tr>
<td>DN50 NEUMO BioControl®</td>
<td>151</td>
</tr>
</tbody>
</table>

---

### DN40 / 1” Lens antenna: Dimensions in inches

<table>
<thead>
<tr>
<th>Type of process connection</th>
<th>Dimensions [inches]</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
</tr>
<tr>
<td>2” Tri-Clamp®</td>
<td>5.94</td>
</tr>
<tr>
<td>DN50 NEUMO BioControl®</td>
<td>5.94</td>
</tr>
</tbody>
</table>
Weather protection option

Figure 2-9: Weather protection option
① Front view (with weather protection closed)
② Left side (with weather protection closed)
③ Rear view (with weather protection closed)

Weather protection: Dimensions and weights

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>Weights [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mm]</td>
<td>[inch]</td>
<td>[mm]</td>
<td>[inch]</td>
<td>[mm]</td>
</tr>
<tr>
<td>Weather protection</td>
<td>177</td>
<td>6.97</td>
<td>153</td>
<td>6.02</td>
</tr>
</tbody>
</table>

Converter weight

<table>
<thead>
<tr>
<th>Type of housing</th>
<th>Weights [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>[lb]</td>
<td></td>
</tr>
<tr>
<td>Compact aluminium housing</td>
<td>2.1</td>
</tr>
<tr>
<td>Compact stainless steel housing</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Antenna option weights

<table>
<thead>
<tr>
<th>Antenna options</th>
<th>Min./Max. weights [kg] [lb]</th>
</tr>
</thead>
</table>

Standard options, with converter

- DN25 (1\text{"}) Lens antenna with 1.5\text{"} Tri-Clamp® connection: 2.8 kg / 6.2 lb
- DN25 (1\text{"}) Lens antenna with 2\text{"} Tri-Clamp® connection: 2.8 kg / 6.2 lb
- DN25 (1\text{"}) Lens antenna with DN40 DIN11851 connection: 2.9 kg / 6.4 lb
- DN25 (1\text{"}) Lens antenna with DN50 DIN11851 connection: 3.2 kg / 7.1 lb
- DN25 (1\text{"}) Lens antenna with DN51 SMS1145 connection: 3.2 kg / 7.1 lb
- DN25 (1\text{"}) Lens antenna with DN50 VARIVENT® Type N connection: 2.9 kg / 6.4 lb
- DN25 (1\text{"}) Lens antenna with DN40 DIN11864-1 connection: 2.9 kg / 6.4 lb
- DN25 (1\text{"}) Lens antenna with DN50 DIN11864-1 connection: 3.2 kg / 7.1 lb
- DN40 (1\text{\frac{1}{2}}\text{"}) Lens antenna with DN50 NEUMO BioControl® connection: 2.9 kg / 6.4 lb
- DN40 (1\text{\frac{1}{2}}\text{"}) Lens antenna with 2\text{"} Tri-Clamp® connection: 2.4 kg / 5.3 lb
3.1 Intended use

**Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.**

**The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.**

This radar level transmitter measures distance, level, mass, volume and reflectivity of liquids, pastes and slurries.

It can be installed on tanks for hygienic applications.

3.2 Pre-installation requirements

**Obey the precautions that follow to make sure that the device is correctly installed.**

- Make sure that there is sufficient space on all sides.
- Protect the signal converter from direct sunlight. If necessary, install the weather protection accessory.
- Do not subject the signal converter to heavy vibrations. The devices are tested for vibration and agree with EN 50178 and IEC 60068-2-6.

3.3 Installation

3.3.1 Pressure and temperature ranges

![Figure 3-1: Pressure and temperature ranges](image)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | Temperature at the process connection  
Non-Ex devices: The temperature range depends on the type of antenna, process connection and the seal material. Refer to the table that follows.  
Devices with Hazardous Location approvals: see supplementary instructions |
| 2 | Ambient temperature for operation of the display  
-20...+70°C / -4...+158°F  
If the ambient temperature is not between these limits, then it is possible that the display screen will not operate temporarily. The device continues to measure level and send an output signal. |
| 3 | Ambient temperature  
Non-Ex devices: -40...+80°C / -40...+176°F  
Devices with Hazardous Location approvals: see supplementary instructions |
| 4 | Process pressure  
Depends on the type of antenna and process connection. Refer to the table that follows. |
The process connection temperature range must agree with the temperature limits of the gasket material. The operating pressure range is subject to the process connection used and the flange temperature.

### Maximum process connection temperature and operating pressure

<table>
<thead>
<tr>
<th>Antenna type</th>
<th>Options</th>
<th>Maximum process connection temperature</th>
<th>Maximum operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lens DN25, PEEK</td>
<td>LN50 VARIVENT® Type N adaptor</td>
<td>+150 [°C] +302 [°F]</td>
<td>10 barg 145 [psig]</td>
</tr>
<tr>
<td>Lens DN25, PEEK</td>
<td>DN40 DIN 11851 adaptor; DIN 11864-1; Tri-Clamp®</td>
<td>+150 [°C] +302 [°F]</td>
<td>40 barg 580 [psig]</td>
</tr>
</tbody>
</table>

#### 3.3.2 Recommended mounting position

Follow these recommendations to make sure that the device measures correctly. They have an effect on the performance of the device.

We recommend that you prepare the installation when the tank is empty.

**Recommended nozzle position for liquids, pastes and slurries**

- Socket for the DN25 Lens antenna
- Socket for the DN40 Lens antenna
- Tank diameter
- Minimum distance of the nozzle or socket from the tank wall (depends on the antenna type and size — refer to items 1 and 2 in this list):
  - DN25 Lens: 1/5 × tank height
  - DN40 Lens: 1/10 × tank height
- Maximum distance of the nozzle or socket from the tank wall (depends on the antenna type and size — refer to items 1 and 2 in this list):
  - Lens: 1/3 × tank height
- Tank height
If there is a nozzle on the tank before installation, the nozzle must be a minimum of 200 mm / 7.9" from the tank wall. The tank wall must be flat and there must not be obstacles adjacent to the nozzle or on the tank wall.

Number of devices that can be operated in a tank

There is no maximum limit to the number of devices that can be operated in the same tank. They can be installed adjacent to other radar level transmitters.

3.3.3 Mounting restrictions

LPR and TLPR devices

LPR (Level Probing Radar) devices measure level in the open air or in a closed space (a metallic tank etc.). TLPR (Tank Level Probing Radar) devices measure level in a closed space only. You can use LPR devices for TLPR applications. For more data, refer to Order code on page 34, antenna options.

Causes of interference signals

- Objects in the tank or pit.
- Sharp corners that are perpendicular to the path of the radar beam.
- Sudden changes in tank diameter in the path of the radar beam.

Do not install the device above objects in the tank (agitator etc.) or pit. Objects in the tank or pit can cause interference signals. If there are interference signals, the device will not measure correctly.

If it is not possible to install the device on another part of the tank or pit, do an empty spectrum scan. For more data, refer to the handbook.

Equipment and obstacles: how to prevent measurement of interference signals

Do not put the device immediately above equipment and obstacles in a tank or pit. This can have an effect on the performance of the device.

If possible, do not install a nozzle on the tank centerline.
Do not tilt the device more than 2°.

2. We recommend that you do an empty spectrum recording if there are too many obstacles in the radar beam (refer to the handbook).

3. Beam radius of the antenna: refer to the table below. The beam radius increases by increments of “x” mm for each metre of distance from the antenna.

<table>
<thead>
<tr>
<th>Antenna type</th>
<th>Beam angle</th>
<th>Beam radius, x</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm/m]</td>
<td>[in/ft]</td>
</tr>
<tr>
<td>Lens, DN25 [1&quot;]</td>
<td>10°</td>
<td>87</td>
</tr>
<tr>
<td>Lens, DN40 [1½&quot;]</td>
<td>8°</td>
<td>70</td>
</tr>
</tbody>
</table>

**Product inlets**

Do not put the device near to the product inlet. If the product that enters the tank touches the antenna, the device will measure incorrectly. If the product fills the tank directly below the antenna, the device will also measure incorrectly.

*Figure 3-4: Equipment and obstacles: how to prevent measurement of interference signals*

*Figure 3-5: Product inlets*
For more data about the measuring range of each type of antenna, refer to Measuring accuracy on page 16.

3.3.4 Process connections

Requirements for hygienic connections: General notes

Installation conditions for EHEDG-approved devices
- To prevent contamination of the tank contents by microorganisms, make sure that the bottom of the antenna is flush with the inner surface of the tank.
- The antenna must be accessible for cleaning.
- Make sure that you do not damage parts made of PEEK, polished parts and the O-ring. Use standard CIP-SIP process conditions. Make sure that the antenna, gaskets and other process seals are resistant to the tank contents and the product used for the cleaning process.

Installation conditions for 3-A®-approved devices
- To prevent contamination of the tank contents by microorganisms, make sure that the bottom of the antenna is flush with the inner surface of the tank.
- Make sure that the position of the device permits liquid to drain from the antenna.
- The antenna must be accessible for cleaning.
- Process connections must agree with 3-A® Sanitary Standards. Refer to 3-A® Sanitary Standard for Sensors and Sensor Fittings and Connections, Number 74-06.
- Process seals must agree with 3-A® Sanitary Standards. Refer to 3-A® Sanitary Standard for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-03. Refer also to 3-A Sanitary Standards for Sanitary fittings, Number 63-03.
- Make sure that you do not damage parts made of PEEK, polished parts and the O-ring. Use standard CIP-SIP process conditions. Make sure that the antenna, gaskets and other process seals are resistant to the tank contents and the product used for the cleaning process.

Nozzles and sockets
To make the cleaning of the antenna easier, attach the device to a short process connection. The height of the process connection must be equal or less than its diameter.

BioControl® (hygienic) connections: installation procedure

Figure 3-6: BioControl® connection: installation procedure

① BioControl® connection on the tank
② Flange bolts
Tri-Clamp® (hygienic) connections: installation procedure

Figure 3-7: Tri-Clamp® connection: installation procedure

1. Tank socket
2. Clamp

**EHEDG-approval**
You can only use EHEDG-approved devices that have a Tri-Clamp® connection with a Combifit T-seal.

DIN 11851 (hygienic) connections: installation procedure

Figure 3-8: DIN 11851 connection: installation procedure

1. Tank socket
2. Union nut for DIN 11851 connection

You can only use EHEDG-approved and 3-A®-approved devices that have a DIN 11851 connection with:
- an **ASEPTO-STAR, type k-flex upgrade** gasket from Kieselmann GmbH, or
- an EPDM or FKM/FPM inner gasket from SKS B.V.
DIN 11864-1 (hygienic) connections: installation procedure

Figure 3-9: DIN 11864-1 connection: installation procedure

① Tank socket
② Union nut for DIN 11864-1 connection

*DIN 11864-1 Form A agrees with EHEDG design criteria.*

SMS connections: installation procedure

Figure 3-10: SMS connection: installation procedure

① Tank socket
② Union nut for SMS connection

*The SMS connection does not agree with 3-A® and EHEDG sanitary design standards.*
VARIENT® (hygienic) connections: installation procedure

Figure 3-11: VARIENT® connection: installation procedure
① Tank socket (VARIENT® Access Unit – not supplied)
② Clamp

You can only use EHEDG-approved and 3-A-approved devices that have a VARIENT® connection with an EPDM O-ring.
4.1 Electrical installation: 2-wire, loop-powered

Terminals for electrical installation

- Grounding terminal in the housing (if the electrical cable is shielded)
- Current output -
- Current output +
- Location of the external grounding terminal (at the bottom of the converter)

*Electrical power to the output terminal energizes the device. The output terminal is also used for HART® communication.*

4.2 Non-Ex devices

- Power supply
- Resistor for HART® communication (typically 250 ohms)
- Optional connection to the grounding terminal
- Output: 12...30 VDC for an output of 21.5 mA at the terminal
- Device

4.3 Devices for hazardous locations

*For electrical data for device operation in hazardous locations, refer to the related certificates of compliance and supplementary instructions (ATEX, IECEx etc.). You can find this documentation on the DVD-ROM delivered with the device or it can be downloaded free of charge from the website (Download Center).*
4.4 Networks

4.4.1 General information

The device uses the HART® communication protocol. This protocol agrees with the HART® Communication Foundation standard. The device can be connected point-to-point. It can also have a polling address of 1 to 63 in a multi-drop network.

The device output is factory-set to communicate point-to-point. To change the communication mode from point-to-point to multi-drop, refer to “Network configuration” in the handbook.

4.4.2 Point-to-point connection

Figure 4-3: Point-to-point connection (non-Ex)

1. Address of the device (0 for point-to-point connection)
2. 4...20 mA + HART®
3. Resistor for HART® communication (typically 250 ohms)
4. Power supply
5. HART® converter
6. HART® communication software
4.4.3 Multi-drop networks

![Diagram of multi-drop network]

Figure 4-4: Multi-drop network (non-Ex)

1. Address of the device (each device must have a different address in multidrop networks)
2. 4 mA + HART®
3. Resistor for HART® communication (typically 250 ohms)
4. Power supply
5. HART® converter
6. HART® communication software
### 5.1 Order code

Make a selection from each column to get the full order code.

<table>
<thead>
<tr>
<th>VFDA</th>
<th>4</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTIWAVE 3500 C 80 GHz Radar [FMCW] level transmitter for liquids with hygienic requirements (up to 40 barg [580 psig] and 150°C (302°F))</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Regional directives
1. Europe
2. China
3. USA
4. Canada
5. Brazil
6. Australia
A. Russia
B. Kazakhstan
C. Belarus
W. Worldwide

#### Ex approvals
0. Without
1. ATEX II 1/2 G Ex ia IIC T6...T3 Ga/Gb + II 1/2 D Ex ia IIC T85°C...T150°C Da/Db
2. ATEX II 1/2 GD Ex db ia IIC T6...T3 Ga/Gb + II 1/2 D Ex ia tb IIC T85°C...T150°C Da/Db
3. ATEX II 3 G Ex ic IIC T6...T3 Gc + II 3 D Ex ic IIC T85°C...T150°C Dc
4. ATEX II 3 G Ex nA T6...T4 Gc
5. NEPSI Ex ia IIC T6...T3 Ga/Gb + Ex iaD 20/21 T85°C...T150°C IP6X ①
6. NEPSI Ex d ia IIC T6...T3 Ga/Gb + Ex iaD tD A20/A21 T85°C...T150°C IP6X ①
A. cQPSus IS CL I/II/III DIV 1 GP A-G + CL I Z0 AEx ia/Ex ia ia IIC T6...T3 Ga + Z20 AEx ia/Ex ia IIC T85°C...T150°C Da
B. cQPSus XP-1S/DIP CL I DIV 1 GP A-G + CL I Z1 AEx ia/Ex ia ia IIC T6...T3 Ga + Z21 AEx ia tb/Ex ia tb IIC T85°C...T150°C Db ②
C. cQPSus NI CL I/II/III DIV 2 GP A-G + CL I Z2 AEx na/Ex na ni IIC T6...T3 Gc
K. IECEx Ex ia IIC T6 Ga/Gb + Ex ia IIC Da/Db
L. IECEx Ex d ia IIC T6...T3 Ga/Gb + Ex ia tb IIC T85°C...T150°C Da/Db
M. IECEx Ex ic IIC T6...T3 Gc + Ex ic IIC T85°C...T150°C Dc
P. EAC Ex Ga/Gb Ex ia T6...T3 + Ex ia IIC T85°C...T150°C Da/Db ③
R. EAC Ex Ga/Gb Ex d ia T6...T3 + Ex ia tb IIC T85°C...T150°C Da/Db ③

#### Industry / Safety

#### Construction
0. Without
2. CRN / ASME B31.3 ①

**Order code (complete this code on the pages that follow)**
### ORDER INFORMATION

<table>
<thead>
<tr>
<th>Converter version (Housing material / IP class)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 C / Compact version (aluminium housing – IP66/68 0.1 barg)</td>
</tr>
<tr>
<td>3 C / Compact version (stainless steel housing – IP66/68 0.1 barg)</td>
</tr>
</tbody>
</table>

### Outputs

| 1 | 2-wire / 4...20mA passive HART® |

#### Cable entry / cable gland

| 1 | M20×1.5 / without |
| 2 | M20×1.5 / 1 x plastic + plug |
| 3 | M20×1.5 / 1 x nickel-plated brass + plug |
| 4 | M20×1.5 / 1 x stainless steel + plug |
| 5 | M20×1.5 / 1 x M12 (4-pin connector) + plug |
| 6 | M20×1.5 / 2 x plastic |
| 7 | M20×1.5 / 2 x nickel-plated brass |
| 8 | M20×1.5 / 2 x stainless steel |
| A | M20×1.5 / 2 x M12 (4-pin connector) |
| C | ½ NPT / without |
| D | ½ NPT / 1 x nickel-plated brass + plug |
| E | ½ NPT / 1 x stainless steel + plug |
| F | ½ NPT / 2 x nickel-plated brass |
| G | ½ NPT / 2 x stainless steel |

#### Display

| 0 | Without (no display, cover without window) |
| 4 | Plug-in display (cover with window) |

#### Display – Documentation language

| 1 | English |
| 2 | German |
| 3 | French |
| 4 | Italian |
| 5 | Spanish |
| 6 | Portuguese |
| 7 | Japanese |
| 8 | Chinese (simplified) |
| A | Russian |
| B | Czech |
| C | Turkish |
| D | Polish |

#### Process conditions (Pressure, temperature, material and remarks) / Process seal

| 0 | Process conditions (Pressure, temperature, material and remarks) / Process seal |
| 1 | -1...10 barg (-14.5...145 psig) / -40°C...+150°C (-40°F...+302°F) / PEEK (©) |
| 2 | -1...25 barg (-14.5...362 psig) / -40°C...+150°C (-40°F...+302°F) / PEEK (©) |

VFDA 4 0 1 0

Order code [complete this code on the pages that follow]
### Antennas (antenna type, material, radio approval)

<table>
<thead>
<tr>
<th></th>
<th>Lens, DN25 (1&quot;) / PEEK / TLPR (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Lens, DN40 (1½&quot;) / PEEK / LPR (7)</td>
</tr>
</tbody>
</table>

### Process connection: Size / Pressure class / Type

<table>
<thead>
<tr>
<th></th>
<th>Hygienic (surface roughness, Ra &lt;0.8 µm / 32 µin – AARH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>H</td>
<td>G</td>
</tr>
<tr>
<td>G</td>
<td>G</td>
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<tr>
<td>H</td>
<td>F</td>
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<td>H</td>
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<td>H</td>
<td>D</td>
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<tr>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>H</td>
<td>G</td>
</tr>
</tbody>
</table>

### Calibration certificate

<table>
<thead>
<tr>
<th></th>
<th>Without: Accuracy ±2 mm (±0.08&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Calibration certificate ±2 mm (±0.08&quot;) up to 10 m (32.81 ft), 2 points</td>
</tr>
<tr>
<td>2</td>
<td>Calibration certificate ±2 mm (±0.08&quot;) up to 10 m (32.81 ft), 5 points</td>
</tr>
<tr>
<td>3</td>
<td>Calibration certificate ±2 mm (±0.08&quot;) up to 10 m (32.81 ft), 5 points specified by the customer min. ≥ 400 mm (16&quot;)</td>
</tr>
</tbody>
</table>

### Options

<table>
<thead>
<tr>
<th></th>
<th>Without</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td>5</td>
<td>Electropolished wetted parts</td>
</tr>
</tbody>
</table>

### Accessories / Tag plate

<table>
<thead>
<tr>
<th></th>
<th>Without</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Weather protection</td>
</tr>
<tr>
<td>3</td>
<td>Stainless steel Tag plate (18 characters max.)</td>
</tr>
<tr>
<td>6</td>
<td>Weather protection + Stainless steel Tag plate (18 characters max.)</td>
</tr>
</tbody>
</table>

### Order code

|   | VFDA | 4 | 0 | 1 | 0 | 0 | 0 |

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1. Available in September 2017
3. Available in November 2017
4. For non-Ex devices only. Ex approvals will be available in the second quarter of 2018.
5. For DN25 [1"] Lens antenna with adaptor for DN50 VARIVENT® Type N
6. For all Lens antennas and process connections, but do not use with adaptor for DN50 VARIVENT® Type N
7. LPR = You can install the antenna in a closed tank or outdoors, but the antenna must point down. Do install LPR devices near sensitive installations e.g. a radio astronomy station). TLPR = You must install the antenna in a closed tank.
8. The process connection includes the ring nut
KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

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