Radar (FMCW) Level Transmitter for liquids in storage and process applications

- Modular design of housing and antenna ensures suitability for a variety of mounting positions and applications
- Universal measurement device for liquids, pastes and slurries
- SIL2-compliant according to IEC 61508 for safety-related systems
1.1 The low-cost FMCW level radar

This device is a non-contact radar level meter that uses FMCW technology. It measures distance, level and volume of liquids and pastes. It is ideal for measuring the level of corrosive products with its PP or PTFE antenna options.

1. PP or PTFE Wave Horn antennas for the measurement of corrosive products
2. Optional remote converter can be installed up to 100 m / 328 ft away from the antenna
3. Wall support
4. Horizontal / vertical housings and antenna options makes the device suitable for many applications and for installation in a variety of positions
5. Aluminium or stainless steel housing
6. 2-wire level meter
7. Optional LCD display with 4-button keypad
8. Converter is rotatable 360° and removable under process conditions
9. Dual process seal system
Optional integrated display

The display can be ordered with the device or as an accessory. It shows measurement data on a 128 x 64 pixel screen. The configuration menu permits the device to be set up in a small number of intuitive steps. 9 languages are available.

Highlights

- PP or PTFE Wave Horn antennas for the measurement of corrosive products
- Modular design: horizontal or vertical position of housing is suitable for almost all installations
- Optional local display with an integrated 4-button keypad. It is not necessary to remove the housing cover to get access to the keypad.
- Quick coupling system permits removal of the housing under process conditions and rotation of the housing through 360°
- Bayonet housing cover permits easy opening and closing of the housing, even after years in service
- Measuring range up to 30 m / 98.4 ft
- Converter is backwards compatible with all BM 70x flange systems
- SIL2-compliant according to IEC 61508 for safety-related systems
- Each device is calibrated on dedicated calibration rigs before it leaves the factory

Industries

- Chemical market
- Oil & Gas
- Power
- Food
- Wastewater
- Metals, Minerals & Mining
Applications
- Storage tanks
- Process tanks
- Open channel flow (if PACTware™ software tool is used)
- River level

1.2 Overview

OPTIWAVE 5200 C - Compact / Vertical version
- The converter is vertical. It is attached directly to the process connection [compact version].
- For installation of the device on the ground or in a recess.
- The optional LCD display is attached to the top or the side of the device.

OPTIWAVE 5200 C - Compact / Horizontal version
- The converter is horizontal. It is attached directly to the process connection [compact version].
- This version is ideal for installation in areas with low roof clearances.
- For locations where it is easier to read data on the optional LCD display if the converter is in a horizontal position.
OPTIWIWAVE 5200 F - Remote version

- Users can read measurements and configure the device from the bottom of the tank.
- The remote converter can be installed up to 100 m / 328 ft away from the process connection on the tank.
- Attach the remote converter to a wall, pipe or rigid surface with the supplied wall support.

Weather protection

A weather protection option can also be ordered with the device. It is recommended for outdoor applications.

- Can be ordered for the compact version of the device and the antenna housing of the remote version.
- Easily opened and closed.
1.3 Applications

1. Level measurement of liquids

The level meter 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 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 30 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.

3. Flow rate measurement

Flow rate measurement is available for field devices that are used with PACTware™ software. A flow rate conversion function is in the DTM supplied with the device. Make a selection from 6 flow profiles:

- Parshall (ISO 9826)
- Venturi Rectangular (ISO 4359)
- Venturi Trapezoidal (ISO 4359)
- Venturi U (ISO 4359)
- V-Notch (ISO 1438)
- Rectangular Notch (ISO 1438)
1.4 Antenna selection

The graphs below show which antenna to select for the application based on:
- \( D \), the measuring range,
- \( \varepsilon_r \), is the dielectric constant of the product being measured

![Figure 1-1: Selection of antenna (graph of distance in m against \( \varepsilon_r \))](image1)

![Figure 1-2: Selection of antenna (graph of distance in ft against \( \varepsilon_r \))](image2)

1. Tank height / Measuring range [m]
2. Tank height / Measuring range [ft]
3. \( \varepsilon_r \) for storage tanks with smooth product surface
4. \( \varepsilon_r \) for process tanks without agitator or foam
5. All antennas:
   - DN150 and DN200 Metallic Horn antenna with or without a stilling well* and PTFE and PP Wave Horn antennas
   - DN65/2.5”, DN80/3” and DN100/4” Metallic Horn antenna: only for use in a stilling well*. Maximum measuring range is 10 m / 32.81 ft.
   - Wave Guide antenna: maximum measuring range is 6 m / 19.68 ft
   - DN80 and DN : maximum measuring range is 6 m / 19.68 ft
6. DN150 and DN200 Metallic Horn antennas with or without a stilling well* and PTFE and PP Wave Horn antennas
7. DN150/6” and DN200/8” Metallic Horn antenna with or without a stilling well*
8. DN200/8” Metallic Horn antenna with or without a stilling well*

* A stilling well is equivalent to the Wave Guide antenna option or a bypass chamber
1.5 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 Fourier transformation (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 1-3: Measuring principle of FMCW radar
- ① Transmitter
- ② Mixer
- ③ Antenna
- ④ Distance to product surface, where change in frequency is proportional to distance
- ⑤ Differential time delay, \( \Delta t \)
- ⑥ Differential frequency, \( \Delta f \)
- ⑦ Frequency transmitted
- ⑧ Frequency received
- ⑨ Frequency
- ⑩ Time
Measurement modes

"Direct" mode
If the dielectric constant of the liquid is high ($\varepsilon_r \geq 1.8$), the level signal is a reflection on the surface of the liquid.

"TBF Partial" mode
If the dielectric constant of the liquid is low ($\varepsilon_r < 1.8$, for long-distance measurement), you must use "TBF Partial" mode to measure level correctly. "TBF Partial" 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.

"TBF Full" mode
TBF = Tank Bottom Following. If the dielectric constant of the liquid is very low ($\varepsilon_r < 1.6$), 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.

"TBF FULL" AND "TBF PARTIAL" MODES
It is important to enter the correct dielectric constant value in menu item 2.5.3 Er Product. If this value is incorrect, the device will not measure level accurately.
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>Feature</th>
<th>Specification</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>X-band (8.5...10.6 GHz)</td>
</tr>
<tr>
<td>Radio frequency output power</td>
<td>&lt; 41.3 dBm (outside of the tank)</td>
</tr>
<tr>
<td>Application range</td>
<td>Level measurement of liquids, pastes and slurries</td>
</tr>
<tr>
<td>Primary measured value</td>
<td>Distance and reflection</td>
</tr>
<tr>
<td>Secondary measured value</td>
<td>Level, volume, mass and flow rate</td>
</tr>
</tbody>
</table>

### Design

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</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></td>
<td>Compact (C) version: Measuring sensor (antenna) attached directly to a signal converter.</td>
</tr>
<tr>
<td></td>
<td>Remote (F) version: Measuring sensor (antenna) installed on a tank and connected by a signal cable (max. length 100 m / 328 ft) to a signal converter.</td>
</tr>
<tr>
<td>Options</td>
<td>Integrated LCD display (-20..+60°C / -4...+140°F); if the ambient temperature is not in these limits, the display switches off automatically.</td>
</tr>
<tr>
<td></td>
<td>High-temperature (HT) extension (if the process connection temperature is more than +150°C / +302°F – Metallic Horn antenna only).</td>
</tr>
<tr>
<td></td>
<td>Straight antenna extensions: Max. extension length, PTFE Wave Horn antenna: 300 mm / 11.8”。 Max. extension length, Metallic Horn antenna: 1000 mm / 39.4”。</td>
</tr>
<tr>
<td></td>
<td>S-bend antenna extension: only for DN150/6” and DN200/8” Metallic Horn antenna options.</td>
</tr>
<tr>
<td></td>
<td>L-bend (right angle) antenna extension: only for DN150/6” and DN200/8” Metallic Horn antenna and Wave Guide antenna options.</td>
</tr>
<tr>
<td></td>
<td>Antenna purging system (2 device options: liquid or gas): only for DN150/6” and DN200/8” Metallic Horn antenna options.</td>
</tr>
<tr>
<td></td>
<td>Heating / cooling system (with or without the antenna purging system): only for DN150/6” and DN200/8” Metallic Horn antenna options.</td>
</tr>
<tr>
<td></td>
<td>Signal cable for remote housing version (refer to cable properties in “Electrical connection: Remote device version”).</td>
</tr>
<tr>
<td>Weather protection</td>
<td>– for the compact version or the antenna housing of the remote version.</td>
</tr>
<tr>
<td>Max. measuring range</td>
<td>PTFE and PP Wave Horn antennas: 20 m / 65.6 ft</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>DN65 / DN80 / DN100 Metallic Horn antennas [installation only in stilling wells]: 10 m / 32.8 ft</td>
</tr>
<tr>
<td></td>
<td>DN150 / DN200 Metallic Horn antennas: 30 m / 98.4 ft</td>
</tr>
<tr>
<td></td>
<td>Wave Guide antenna: 6 m / 19.7 ft</td>
</tr>
<tr>
<td>Also depends on the dielectric constant of the product and the installation type. Refer also to “Antenna selection”.</td>
<td></td>
</tr>
<tr>
<td>Min. tank height</td>
<td>1 m / 3.3 ft</td>
</tr>
<tr>
<td>Top dead zone</td>
<td>Minimum value: Antenna length + antenna extension length + 100 mm / 3.9&quot;</td>
</tr>
<tr>
<td>Beam angle (½ angle) of antenna</td>
<td>PP Wave Horn: 10°</td>
</tr>
<tr>
<td></td>
<td>PTFE Wave Horn: 10°</td>
</tr>
<tr>
<td></td>
<td>Metallic Horn DN65 / 2.5&quot;: 20° – used only in RC W5200 reference chamber</td>
</tr>
<tr>
<td></td>
<td>Metallic Horn DN80 / 3&quot;: 16° – used only in stilling wells</td>
</tr>
<tr>
<td></td>
<td>Metallic Horn DN100 / 4&quot;: 12° – used only in stilling wells</td>
</tr>
<tr>
<td></td>
<td>Metallic Horn DN150 / 6&quot;: 8°</td>
</tr>
<tr>
<td></td>
<td>Metallic Horn DN200 / 8&quot;: 6°</td>
</tr>
<tr>
<td></td>
<td>Wave Guide / stilling well: n/a – the radar signal is inside the tube.</td>
</tr>
</tbody>
</table>

### Display and user interface

- **Display**: LCD display 128 × 64 pixels in 8-step greyscale with 4-button keypad
- **Interface languages**: 3 language pack options (the language is given in the customer order):
  1. English, French, German and Italian
  2. English, French, Spanish and Portuguese
  3. English, Chinese [simplified], Japanese and Russian

### Measuring accuracy

- **Resolution**: 1 mm / 0.04```
- **Repeatability**: ±1 mm / ±0.04```
- **Accuracy**
  - Standard: ±10 mm / ±0.4", when distance < 10 m / 33 ft; ±0.1% of measured distance, when distance > 10 m / 33 ft
  - Option: ±5 mm / ±0.2", when distance < 10 m / 33 ft; ±0.05% of measured distance, when distance > 10 m / 33 ft

### Reference conditions acc. to EN 61298-1

- **Temperature**: +15...+25°C / +59...+77°F
- **Pressure**: 1013 mbar ±50 mbar / 14.69 psia ±0.73 psi
- **Relative air humidity**: 60% ±15%
- **Target**: Metal plate in an anechoic chamber
## Operating conditions

| Temperature |  
|-------------|---
| Ambient temperature | -40...+80°C / -40...+176°F  
Integrated LCD display: -20...+60°C / -5...+140°F; if the ambient temperature is not in these limits, the display switches off. The device continues to operate correctly.  
| Storage temperature | -50...+85°C / -58...+185°F (min. -40°C / -40°F for devices with the integrated LCD display option)  
| Process connection temperature [higher temperature on request] | PP Wave Horn antenna:  
-20...+100°C / -4...+212°F  
PTFE Wave Horn antenna:  
-50...+150°C / -58...+302°F  
Metallic Horn antenna / Wave Guide antenna:  
Standard: FKM/FPM (-40...+150°C / -40...+302°F (+200 / +392°F with an HT extension));  
Options: Kalrez® 6375 (-20...+150°C / -4...+302°F (+250°C / +482°F with an HT extension)); PFA [-60°C...+130°C / -76...+266°F]; EPDM [-50...+130°C / -58...+266°F]  
The process connection temperature must agree with the temperature limits of the gasket material.  
Ex: see supplementary operating instructions or approval certificates  
| Pressure |  
| Process pressure | PP Wave Horn antenna:  
-1...16 barg / -14.5...232 psig. For more data, refer to Pressure ratings on page 20.  
PTFE Wave Horn antenna:  
-1...40 barg / -14.5...580 psig. For more data, refer to Pressure ratings on page 20.  
Metallic Horn antenna / Wave Guide antenna:  
Standard: -1...40 barg / -14.5...580 psig; subject to the process connection used and the flange temperature. Higher pressure on request.  
Purging system [options for gas or liquid] | Max. 6 barg / 87 psig [higher pressure on request]  
Heating / cooling system [option] | Max. 6 barg / 87 psig [higher pressure on request]  
Other conditions | Dielectric constant ($\varepsilon_r$)  
Direct mode: $\geq 1.8$  
TBF mode: $\geq 1.1$  
Refer also to "Technical data: Antenna selection".  
Ingress protection | IEC 60529: IP66 / IP67  
NEMA 250: NEMA type 4X [housing] and type 6P [antenna]  
Maximum rate of change | 10 m/min / 32.8 ft/min  
Installation conditions | Process connection size | The nominal diameter [DN] should be equal to or larger than the antenna diameter.  
Process connection position | Make sure that there are not any obstructions directly below the process connection for the device. For more data, refer to Installation on page 35.  
Dimensions and weights | For dimensions and weights data, refer to Dimensions and weights on page 26.
## Materials

| Housing          | Standard: Polyester-coated aluminium  
|                 | Option: Stainless steel (1.4404 / 316L) |

| Antenna options / Wetted materials | PTFE Wave Horn antenna with a PTFE flange cladding  
|                                | PP Wave Horn antenna with a PP jacket/threaded process connection  
|                                | Stainless steel (1.4404 / 316L) Metallic Horn antenna with a PTFE process seal and an FKM/FPM, EPDM, Kalrez® 6375 or PFA O-ring gasket  
|                                | Stainless steel (1.4404 / 316L) Wave Guide antennas with a PTFE process seal and an FKM/FPM, EPDM, Kalrez® 6375 or PFA O-ring gasket  

| Feedthrough | PP Wave Horn antenna: this is a single-piece antenna (the feedthrough is filled with PP)  
|             | PTFE Wave Horn antenna: this is a single-piece antenna (the feedthrough is filled with PTFE)  
|             | Metallic Horn and Wave Guide antennas: Dual process seal system – 1st seal: PTFE with O-ring gasket, 2nd seal: Metaglas® with O-ring gasket (2)  

| Cable gland      | Standard: none  
|                 | Options: Plastic (Non-Ex: black, Ex i-approved: blue); nickel-plated brass; stainless steel  

| Weather protection (Option) | Stainless steel (1.4404 / 316L)  

## Process connections

| Thread               | PP Wave Horn antenna: G 1¼A...2A; 1½...2 NPT  
|                     | Flange version  
|                     | EN  
|                     | PTFE Wave Horn antenna: DN50...200 in PN16, PN40  
|                     | Metallic Horn and Wave Guide antennas: DN80...200 in PN16, PN40; others on request  
|                     | ASME  
|                     | PTFE Wave Horn antenna: 2”...8” in 150 lb / 300 lb  
|                     | Metallic Horn and Wave Guide antennas: 3”...8” in 150 lb / 300 lb; others on request  
|                     | JIS  
|                     | PTFE Wave Horn antenna: 50…150A in 10K  
|                     | Metallic Horn and Wave Guide antennas: 80…200A in 10K; others on request  
|                     | Other  
|                     | Others on request  

## Electrical connections

| Power supply | Terminals output – Non-Ex / Ex i:  
|             | 11.5...30 VDC; min./max. value for an output of 22 mA at the terminal  
|             | Terminals output – Ex d:  
|             | 13.5...36 VDC; min./max. value for an output of 22 mA at the terminal  
| Maximum current | 22 mA  
| Current output load | Non-Ex / Ex i: R_L [Ω] \(\leq\) \(|U_{\text{ext}}| -11.5 \text{ V}/22 \text{ mA}\). For more data, refer to Minimum power supply voltage on page 19.  
|                     | Ex d: R_L [Ω] \(\leq\) \(|U_{\text{ext}}| -13.5 \text{ V}/22 \text{ mA}\). For more data, refer to Minimum power supply voltage on page 19.  
| Cable entry | Standard: M20×1.5; Option: ½ NPT  
| Cable gland | Standard: none  
|             | Options: M20×1.5 (cable diameter [non-Ex / Ex i: 6...7.5 mm / 0.24...0.30”; Ex d: 6...10 mm / 0.24...0.39”]); others are available on request  

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### Technical Data

**Signal cable – remote version**  
None for non-Ex devices (4-wire shielded cable of max. length 100 m / 328 ft to be supplied by the customer). Supplied with all Ex-approved devices. For more data, refer to the handbook.

**Cable entry capacity (terminal)**  
0.5…2.5 mm²

### Input and Output

<table>
<thead>
<tr>
<th><strong>Current output / HART®</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output signal</strong></td>
<td>4…20 mA HART® or 3.8…20.5 mA acc. to NAMUR NE 43 ³</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>±3 µA</td>
</tr>
<tr>
<td><strong>Temperature drift</strong></td>
<td>Typically 50 ppm/K</td>
</tr>
<tr>
<td><strong>Digital temperature drift</strong></td>
<td>Max. ±15 mm / 0.6° for the full temperature range</td>
</tr>
<tr>
<td><strong>Error signal</strong></td>
<td>High: 22 mA; Low: 3.6 mA acc. to NAMUR NE 43; Hold (frozen value – not available if the output agrees with NAMUR NE 43) ⁴</td>
</tr>
</tbody>
</table>

#### PROFIBUS PA

- **Type**: PROFIBUS MBP interface that agrees with IEC 61158-2 with 31.25 kbit/s; voltage mode (MBP = Manchester-Coded, Bus-Powered)
- **Function blocks**: 1 × Physical Block, 1 × Level Transducer Block, 4 × Analog Input Function Blocks
- **Device power supply**: 9…32 VDC – bus powered; no additional power supply required
- **Polarity sensitivity**: No
- **Basic current**: 15 mA

#### FOUNDATION™ fieldbus

- **Physical layer**: FOUNDATION™ fieldbus protocol that agrees with IEC 61158-2 and FISCO model
- **Communication standard**: H1
- **ITK version**: 6.1
- **Function blocks**: 1 × Resource Block (RB), 3 × Transducer Blocks (TB), 3 × Analog Input Blocks (AI), 1 × Proportional Integral Derivative Block (PID)
  - Analog Input Block: 30 ms
  - Proportional Integral Derivative Block: 40 ms
- **Device power supply**: Not intrinsically safe: 9…32 VDC
  - Intrinsically safe: 9…24 VDC
- **Basic current**: 14 mA
- **Maximum error current FDE**: 20.5 mA (= basic current + error current = 14 mA + 6.5 mA)
- **Polarity sensitivity**: No
- **Minimum cycle time**: 250 ms
- **Output data**: Level, distance, ullage conversion, level conversion
- **Input data**: None
- **Link Active Scheduler**: Supported

### Approvals and Certification

**CE**  
This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.

**Vibration resistance**  
EN 60068-2-64  
Metallic Horn (without antenna extension options): 5 Hz to 100 Hz: 4g  
Metallic Horn, PTFE or PP Wave Horn: 3.5 mm up to 8 Hz and 10 m/s²: 1g, 8.5 to 2000 Hz
## Explosion protection

### ATEX (Ex ia or Ex d or Ex tb)

DEKRA 11ATEX0166 X

<table>
<thead>
<tr>
<th>Compact version</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2 G, 2 G Ex ia IIC T6...T2 Ga/Gb or Ex ia IIC T6...T2 Gb;</td>
</tr>
<tr>
<td>II 1/2 D, 2 D Ex ia IIC T90°C Da/Db or Ex ia IIC T90°C Db;</td>
</tr>
<tr>
<td>II 1/2 G, 2 G Ex d ia IIC T6...T2 Ga/Gb or Ex d ia IIC T6...T2 Gb;</td>
</tr>
<tr>
<td>II 1/2 D, 2 D Ex ia tb IIC T90°C Da/Db or Ex ia tb IIC T90°C Db</td>
</tr>
</tbody>
</table>

### Remote version, transmitter

| II 2 G Ex ia [ia Ga] IIC T6...T4 Gb; |
| II 2 D Ex ia [ia Da] IIC T90°C Db; |
| II 2 G Ex d ia [ia Ga] IIC T6...T4 Gb; |
| II 2 D Ex ia tb [ia Da] IIC T90°C Db |

### Remote version, sensor

| II 1/2 G Ex ia IIC T6...T2 Ga/Gb or II 2 G Ex ia IIC T6...T2 Gb; |
| II 1/2 D Ex ia IIC T90°C Da/Db or II 2 D Ex ia IIC T90°C Db; |
| II 1/2 G Ex ia IIC T6...T2 Gb or II 2 G Ex ia IIC T6...T2 Gb; |
| II 1/2 D Ex ia IIC T90°C Db or II 2 D Ex ia IIC T90°C Db |

### ATEX (Ex ic)

DEKRA 13ATEX0051 X

<table>
<thead>
<tr>
<th>Compact version</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 3 G Ex ic IIC T6...T2 Gc;</td>
</tr>
<tr>
<td>II 3 D Ex ic IIC T90°C Dc</td>
</tr>
</tbody>
</table>

### Remote version, transmitter

| II 3 G Ex ic [ic] IIC T6...T4 Gc; |
| II 3 D Ex ic [ic] IIC T90°C Dc |

### Remote version, sensor

| II 3 G Ex ic IIC T6...T2 Gc; |
| II 3 D Ex ic IIC T90°C Dc |

### IECEx

IECEx DEK 11.0060 X

<table>
<thead>
<tr>
<th>Compact version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex ia IIC T6...T2 Ga/Gb or Ex ia IIC T6...T2 Gb or Ex ic IIC T6...T2 Gc;</td>
</tr>
<tr>
<td>Ex ia IIC T90°C Da/Db or Ex ia IIC T90°C Db or Ex ic IIC T90°C Dc;</td>
</tr>
<tr>
<td>Ex d ia IIC T6...T2 or Ex d ia IIC T6...T2 Gb;</td>
</tr>
<tr>
<td>Ex ia tb IIC T90°C Da/Db or Ex ia tb IIC T90°C Db</td>
</tr>
</tbody>
</table>

### Remote version, transmitter

| Ex ia [ia Ga] IIC T6...T4 Gb or Ex ic IIC T6...T4 Gc; |
| Ex ia [ia Da] IIC T90°C Db or Ex ic [ic] IIC T90°C Dc; |
| Ex d ia [ia Ga] IIC T6...T4 Gb; |
| Ex ia tb [ia Da] IIC T90°C Db |

### Remote version, sensor

<p>| Ex ia IIC T6...T2 Ga/Gb or Ex ia IIC T6...T2 Gb or Ex ic IIC T6...T2 Gc; |
| Ex ia IIC T90°C Da/Db or Ex ia IIC T90°C Db or Ex ic IIC T90°C Dc |</p>
<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>TECHNICAL DATA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>OPTIWAVE 5200 C/F</strong></td>
<td><a href="http://www.krohne.com07/2016">www.krohne.com07/2016</a> - 4001905503 - TD OPTIWAVE 5200 R03 en</td>
</tr>
<tr>
<td><strong>cFMus – Dual Seal-approved</strong></td>
<td>NEC 500 (Division ratings)</td>
</tr>
<tr>
<td></td>
<td>XP-AIS / Cl. I / Div. 1 / Gr. ABCD / T6–T1;</td>
</tr>
<tr>
<td></td>
<td>DIP / Cl. II, III / Div. 1 / Gr. EFG / T6–T1;</td>
</tr>
<tr>
<td></td>
<td>IS / Cl. I, II, III / Div. 1 / Gr. ABCDEFG / T6–T1;</td>
</tr>
<tr>
<td></td>
<td>NI / Cl. I / Div. 2 / Gr. ABCD / T6–T1</td>
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<tr>
<td></td>
<td><strong>NEC 505 (Zone ratings)</strong></td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>Cl. I / Zone 0 / AEx ia / IIC / T6–T1;</td>
</tr>
<tr>
<td></td>
<td>Cl. I / Zone 2 / AEx na / IIC / T6–T1;</td>
</tr>
<tr>
<td></td>
<td>Cl. I / Zone 2 / AEx ic / IIC / T6–T1 FISCO;</td>
</tr>
<tr>
<td></td>
<td>Zone 20 / AEx ia / IIC / T90°C;</td>
</tr>
<tr>
<td></td>
<td>Zone 20 / AEx tb [ia] / IIC / T90°C</td>
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<tr>
<td></td>
<td>Hazardous [Classified] Locations, indoor/outdoor Type 4X and 6P, IP66, Dual Seal</td>
</tr>
<tr>
<td></td>
<td><strong>CEC Section 18 (Zone ratings)</strong></td>
</tr>
<tr>
<td></td>
<td>Cl. I, Zone 0, Ex d [ia], IIC, T6–T1;</td>
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<td>Cl. I, Zone 0, Ex ia, IIC, T6–T1;</td>
</tr>
<tr>
<td></td>
<td>Cl. I, Zone 2, Ex na, IIC, T6–T1;</td>
</tr>
<tr>
<td></td>
<td>Cl. I, Zone 2, Ex ic, IIC, T6–T1 FISCO</td>
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<tr>
<td></td>
<td><strong>CEC Section 18 and Annex J (Division ratings)</strong></td>
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<tr>
<td></td>
<td>XP-AIS / Cl. I / Div. 1 / Gr. BCD / T6–T1;</td>
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<td></td>
<td>DIP / Cl. II, III / Div. 1 / Gr. EFG / T6–T1;</td>
</tr>
<tr>
<td></td>
<td>IS / Cl. I / Div. 1 / Gr. BCD / T6–T1;</td>
</tr>
<tr>
<td></td>
<td>NI / Cl. I / Div. 2 / Gr. ABCD / T6–T1</td>
</tr>
<tr>
<td><strong>NEPSI</strong></td>
<td>Ex ia IIC T2–T6 Gb or Ex ia IIC T2–T6 Ga/Gb DIP A20/A21 T90°C IP6X</td>
</tr>
<tr>
<td></td>
<td>Ex d ia IIC T2–T6 Gb or Ex d ia IIC T2–T6 Ga/Gb DIP A20/A21 T90°C IP6X</td>
</tr>
<tr>
<td><strong>DNV / INMETRO</strong></td>
<td><strong>Compact version</strong></td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC T6…T2 Ga/Gb or Ex ia IIC T6…T2 Gb or Ex ic IIC T6…T2 Gc;</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC T90°C Da/Db or Ex ia IIC T90°C Db or Ex ic IIC T90°C Dc;</td>
</tr>
<tr>
<td></td>
<td>Ex d ia IIC T6…T2 or Ex d ia IIC T6…T2 Gb;</td>
</tr>
<tr>
<td></td>
<td>Ex ia tb IIC T90°C Da/Db or Ex ia tb IIC T90°C Db</td>
</tr>
<tr>
<td></td>
<td><strong>Remote version, transmitter</strong></td>
</tr>
<tr>
<td></td>
<td>Ex ia [ia Ga] IIC T6…T4 Gb or Ex ic IIC T6…T4 Gc;</td>
</tr>
<tr>
<td></td>
<td>Ex ia [ia Da] IIC T90°C Db or Ex ic [ic] IIC T90°C Dc;</td>
</tr>
<tr>
<td></td>
<td>Ex d ia [ia Ga] IIC T6…T4 Gb;</td>
</tr>
<tr>
<td></td>
<td>Ex ia tb [ia Da] IIC T90°C Dc</td>
</tr>
<tr>
<td></td>
<td><strong>Remote version, sensor</strong></td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC T6…T2 Ga/Gb or Ex ia IIC T6…T2 Gb or Ex ic IIC T6…T2 Gc;</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC T90°C Da/Db or Ex ia IIC T90°C Db or Ex ic IIC T90°C Dc</td>
</tr>
<tr>
<td><strong>Other standards and approvals</strong></td>
<td><strong>SIL</strong></td>
</tr>
<tr>
<td></td>
<td>only for 4…20 mA output</td>
</tr>
<tr>
<td></td>
<td>Compact version: SIL 2 – certified according to all the requirements in EN 61508 (Full Assessment) and for high/low demand mode operation. HFT=0, SFF=94.1% (for non-Ex / Ex i devices) or 91% (for Ex d devices), type B device</td>
</tr>
<tr>
<td><strong>EMC</strong></td>
<td>Essential requirements of Electromagnetic Compatibility Directive 2014/30/EU in conjunction with EN 61326-1 [2013] SIL 2-approved devices agree with EN 61326-3-1 [2008] and EN 61326-3-2 [2008]</td>
</tr>
</tbody>
</table>
### Radio approvals

**RED**

**FCC Rules**
Part 15

**Industry Canada**
License-exempt RSS-210

### LVD
Essential requirements of Low-Voltage Directive 2014/35/EU in conjunction with EN 61010-1

### 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

### WHG Z-65.16-546
In conformity with the German Federal Water Act, §9

### CRN
This certification is applicable for all Canadian provinces and territories. For more data, refer to the website.

### Construction code
Metallic Horn and Wave Guide antennas: NACE MR0175 / ISO 15156; NACE MR0103

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1. If the process connection temperature is more than +150°C / +302°F and the device has Kalrez® 6375 or FKM/FPM gaskets, the device will also have a high temperature extension between the converter and the process connection. Kalrez® is a registered trademark of DuPont Performance Elastomers L.L.C.. The process connection temperature must agree with the temperature limits of the gasket material.
2. Metaglas® is a registered trademark of Herberts Industrieglas, GMBH & Co., KG
3. HART® is a registered trademark of the HART Communication Foundation
4. Only the 3.6 mA error signal is applicable to SIL-approved devices. Only the 22 mA error signal is applicable to WHG-approved devices.
2.2 Minimum power supply voltage

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

Non-Ex and Hazardous Location approved (Ex i / IS) devices

Figure 2-1: Minimum power supply voltage for an output of 22 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 2-2: Minimum power supply voltage for an output of 22 mA at the terminal (Hazardous Location approval (Ex d / XP/NI))

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

Make sure that the devices are used within their operating limits.

EN flanges: Metallic Horn, Wave Guide and PTFE Wave Horn antennas

Figure 2-3: Pressure / temperature rating (EN 1092-1), flange connections, in °C and barg

Figure 2-4: Pressure / temperature rating (EN 1092-1), flange connections, in °F and psig

1. $p$ [barg]
2. $T$ [°C]
3. $p$ [psig]
4. $T$ [°F]
5. Flange connection, PN16: Metallic Horn and Wave Guide antennas
6. Flange connection, PN40: Metallic Horn and Wave Guide antennas
7. Flange connection, PN40: Metallic Horn, Wave Guide and PTFE Wave Horn antennas
8. Flange connection, PN16: Metallic Horn, Wave Guide and PTFE Wave Horn antennas
ISO threaded connections: PP Wave Horn antenna

Figure 2-5: Pressure / temperature rating (ISO 228), threaded connection, in °C and barg

Figure 2-6: Pressure / temperature rating (ISO 228-1), threaded connection, in °F and psig

1. p [barg]
2. T [°C]
3. p [psig]
4. T [°F]
5. Threaded connection, G (ISO 228-1), PP Wave Horn antenna
ASME flanges: Metallic Horn, Wave Guide and PTFE Wave Horn antennas

Figure 2-7: Pressure / temperature rating [ASME B16.5], flange and threaded connections, in °C and barg

Figure 2-8: Pressure / temperature rating [ASME B16.5], flange and threaded connections, in °F and psig

1. $p$ [barg]
2. $T$ [°C]
3. $p$ [psig]
4. $T$ [°F]
5. Flange connection, Class 150: Metallic Horn and Wave Guide antennas
6. Flange connection, Class 300: Metallic Horn and Wave Guide antennas
7. Flange connection, Class 300: Metallic Horn and Wave Guide and PTFE Wave Horn antennas
8. Flange connection, Class 150: Metallic Horn and Wave Guide and PTFE Wave Horn antennas
CRN CERTIFICATION
There is a CRN certification option for devices with process connections that agree with ASME standards. This certification is necessary for all devices that are installed on a pressure vessel and used in Canada.

ASME flanges for CRN-approved devices: Metallic Horn, Wave Guide and PTFE Wave Horn antennas

Figure 2-9: Pressure / temperature rating (ASME B16.5), flange and threaded connections, in °C and barg

Figure 2-10: Pressure / temperature rating (ASME B16.5), flange and threaded connections, in °F and psig

1. p [barg]
2. T [°C]
3. p [psig]
4. T [°F]
5. Flange connection, Class 150: Metallic Horn and Wave Guide antennas
6. Flange connection, Class 300: Metallic Horn and Wave Guide antennas
7. Flange connection, Class 300: Metallic Horn and Wave Guide and PTFE Wave Horn antennas
8. Flange connection, Class 150: Metallic Horn and Wave Guide and PTFE Wave Horn antennas
ASME threaded connections: PP Wave Horn antenna

Figure 2-11: Pressure / temperature rating (ASME B1.20.1), threaded connection, in °C and barg

Figure 2-12: Pressure / temperature rating (ASME B1.20.1), threaded connection, in °F and psig

1. $p$ [barg]
2. $T$ [°C]
3. $p$ [psig]
4. $T$ [°F]
5. Threaded connection, NPT (ASME B1.20.1): PP Wave Horn antenna
CRN CERTIFICATION
There is a CRN certification option for devices with process connections that agree with ASME standards. This certification is necessary for all devices that are installed on a pressure vessel and used in Canada.

ASME threaded connections for CRN-approved devices: PP Wave Horn antenna

Figure 2-13: Pressure / temperature rating (ASME B1.20.1), threaded connection, in °C and barg

Figure 2-14: Pressure / temperature rating (ASME B1.20.1), threaded connection, in °F and psig

① p [barg]
② T [°C]
③ p [psig]
④ T [°F]
⑤ Threaded connection, NPT (ASME B1.20.1): PP Wave Horn antenna
2.4 Dimensions and weights

Housing, process connection and antenna options

Figure 2-15: Housing, process connection and antenna options

① **Housing options.** From left to right: compact converter with horizontal housing, compact converter with vertical housing, and remote converter [top] and antenna housing [bottom]

② **Process connection options.** From left to right: flange connection for PTFE Wave Horn antenna, threaded connection for PP Wave Horn antenna, flange connection for Metallic Horn and Wave Guide antennas, flange connection with a high-temperature (HT) extension for Metallic Horn and Wave Guide antennas, flange connection for DN65 Metallic Horn antenna

③ **Antenna options.** From left to right: PTFE Wave Horn antenna, PP Wave Horn antenna, Metallic Horn antenna (with or without an antenna extension option: straight, L-bend or S-bend extension), Wave Guide antenna, DN65 horn antenna with 2” 300 lb RF (ASME B16.5) flange for RC W5200 reference chamber

*All housing covers have bayonet connectors unless it is an explosion-proof (XP / Ex d-approved) device. The terminal compartment cover for explosion-proof devices has a thread with a flame path.*
### Housing options: Dimensions in mm and inches

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Compact – horizontal</th>
<th>Compact – vertical</th>
<th>Remote</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-Ex or Ex i (Ex d)</td>
<td>Non-Ex or Ex i (Ex d)</td>
<td>Non-Ex or Ex i (Ex d)</td>
</tr>
<tr>
<td>[mm]</td>
<td>[inches]</td>
<td>[mm]</td>
<td>[inches]</td>
</tr>
<tr>
<td>a</td>
<td>191 (258)</td>
<td>7.5 (10.2)</td>
<td>147 (210)</td>
</tr>
<tr>
<td>b</td>
<td>214 (214)</td>
<td>8.43 (8.43)</td>
<td>258 (258)</td>
</tr>
<tr>
<td>c</td>
<td>127 (127)</td>
<td>5.00 (5.00)</td>
<td>127 (127)</td>
</tr>
<tr>
<td>d</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>e</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>f</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>g</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

### Process connection and antenna options: Dimensions in mm

<table>
<thead>
<tr>
<th>Dimensions [mm]</th>
<th>PTFE Wave Horn</th>
<th>PP Wave Horn</th>
<th>Metallic Horn</th>
<th>Wave Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>DN65</td>
<td>DN80</td>
</tr>
<tr>
<td>h</td>
<td>68</td>
<td>33</td>
<td>100 (220 for the HT extension)</td>
<td>①</td>
</tr>
<tr>
<td>k</td>
<td>—</td>
<td>—</td>
<td>100, 200, 300, 400, 500, 1000</td>
<td>②</td>
</tr>
<tr>
<td>m</td>
<td>296 ③</td>
<td>322</td>
<td>65</td>
<td>80</td>
</tr>
<tr>
<td>Øp</td>
<td>43</td>
<td>43</td>
<td>1.69</td>
<td>1.69</td>
</tr>
</tbody>
</table>

① The HT extension is only for Metallic Horn and Wave Guide antennas. It is attached between the signal converter and the flange if the process connection temperature is +150...+250°C.

② These are the length options for the straight antenna extension. For data about the dimensions of S-bend and L-bend extensions, refer to the illustrations that follow.

③ Other antenna lengths are available: 396, 496 or 596 mm. These options are for tanks with long nozzles.

### Process connection and antenna options: Dimensions in inches

<table>
<thead>
<tr>
<th>Dimensions [inches]</th>
<th>PTFE Wave Horn</th>
<th>PP Wave Horn</th>
<th>Metallic Horn</th>
<th>Wave Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.5”</td>
<td>3”</td>
</tr>
<tr>
<td>h</td>
<td>2.68</td>
<td>1.30</td>
<td>3.94 (8.66 for the HT extension)</td>
<td>①</td>
</tr>
<tr>
<td>k</td>
<td>—</td>
<td>—</td>
<td>3.94, 7.87, 11.81, 15.75, 19.68 or 39.37</td>
<td>②</td>
</tr>
<tr>
<td>m</td>
<td>11.65 ③</td>
<td>12.68</td>
<td>3.39</td>
<td>4.41</td>
</tr>
<tr>
<td>Øp</td>
<td>1.69</td>
<td>1.69</td>
<td>2.56</td>
<td>3.15</td>
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</table>

① The HT extension is only for Metallic Horn and Wave Guide antennas. It is attached between the signal converter and the flange if the process connection temperature is +302...+482°F.

② These are the length options for the straight antenna extension. For data about the dimensions of S-bend and L-bend extensions, refer to the illustrations that follow.

③ Other antenna lengths are available: 15.59”, 19.53” or 23.46”. These options are for tanks with long nozzles.
Special antenna extensions for tanks with obstructions (DN150 / 6” and DN200 / 8” Metallic Horn antenna options only)

Figure 2-16: Special antenna extensions for tanks with obstructions (DN150 / 6” and DN200 / 8” Metallic Horn antenna options only)

1. L-bend (right angle) antenna extension
2. S-bend antenna extension

### Special antenna extensions: Dimensions in mm

<table>
<thead>
<tr>
<th>Dimensions [mm]</th>
<th>Metallic Horn antenna</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With L-bend (right angle) extension</td>
<td>With S-bend extension</td>
</tr>
<tr>
<td></td>
<td>DN150 / 6”</td>
<td>DN200 / 8”</td>
</tr>
<tr>
<td>k1</td>
<td>271</td>
<td>300</td>
</tr>
<tr>
<td>k2</td>
<td>494</td>
<td>606</td>
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<tr>
<td>m</td>
<td>140</td>
<td>200</td>
</tr>
<tr>
<td>Øp</td>
<td>19.45</td>
<td>23.86</td>
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</table>

### Special antenna extensions: Dimensions in inches

<table>
<thead>
<tr>
<th>Dimensions [inches]</th>
<th>Metallic Horn antenna</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With L-bend (right angle) extension</td>
<td>With S-bend extension</td>
</tr>
<tr>
<td></td>
<td>DN150 / 6”</td>
<td>DN200 / 8”</td>
</tr>
<tr>
<td>k1</td>
<td>10.67</td>
<td>11.81</td>
</tr>
<tr>
<td>k2</td>
<td>19.45</td>
<td>21.46</td>
</tr>
<tr>
<td>m</td>
<td>5.51</td>
<td>7.87</td>
</tr>
<tr>
<td>Øp</td>
<td>7.87</td>
<td>7.87</td>
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### Purging and heating/cooling system options

<table>
<thead>
<tr>
<th>Dimensions [mm]</th>
<th>Metallic Horn antenna</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Purging system</td>
</tr>
<tr>
<td></td>
<td>DN150 / 6&quot;</td>
</tr>
<tr>
<td>m</td>
<td>223</td>
</tr>
<tr>
<td>Øp</td>
<td>140</td>
</tr>
<tr>
<td>q</td>
<td>34</td>
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</table>

\(1\) This is the standard length. Longer on request.

### Purging system and heating/cooling system: Dimensions in inches

<table>
<thead>
<tr>
<th>Dimensions [inches]</th>
<th>Metallic Horn antenna</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Purging system</td>
</tr>
<tr>
<td></td>
<td>DN150 / 6”</td>
</tr>
<tr>
<td>m</td>
<td>8.78</td>
</tr>
<tr>
<td>Øp</td>
<td>5.51</td>
</tr>
<tr>
<td>q</td>
<td>1.34</td>
</tr>
</tbody>
</table>

\(1\) This is the standard length. Longer on request.

*All wetted parts (flange, antenna and heating/cooling jacket) of the heating/cooling system option are made of 316L / 1.4404.*
Weather protection option (vertical signal converters – for the compact version only)

Figure 2-18: Weather protection option for vertical signal converter versions (compact version only)

1. Non-Ex / Ex i / IS: Rear view (with weather protection closed)
2. Non-Ex / Ex i / IS: Right side (with weather protection closed)
3. Non-Ex / Ex i / IS: Front view (with weather protection closed)
4. Ex d / XP: Rear view (with weather protection closed)
5. Ex d / XP: Right side (with weather protection closed)
6. Ex d / XP: Front view (with weather protection closed)

<table>
<thead>
<tr>
<th>Weather protection</th>
<th>Version</th>
<th>Dimensions [mm]</th>
<th>Weights [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>Vertical signal converter</td>
<td>277</td>
<td>120</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex d / XP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weather protection</th>
<th>Version</th>
<th>Dimensions [mm]</th>
<th>Weights [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>Vertical signal converter</td>
<td>10.9</td>
<td>4.7</td>
<td>3.8</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex d / XP</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Weather protection option (horizontal signal converters – for the compact version only)

Figure 2-19: Weather protection option for horizontal signal converter versions (compact version only)

1. Non-Ex / Ex i / IS: Front view (with weather protection closed)
2. Non-Ex / Ex i / IS: Left side (with weather protection closed)
3. Non-Ex / Ex i / IS: Rear view (with weather protection closed)
4. Ex d / XP: Front view (with weather protection closed)
5. Ex d / XP: Left side (with weather protection closed)
6. Ex d / XP: Rear view (with weather protection closed)

Dimensions and weights in mm and kg

<table>
<thead>
<tr>
<th>Weather protection</th>
<th>Version</th>
<th>Dimensions [mm]</th>
<th>Weights [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal signal converter</td>
<td>Non-Ex / Ex i / IS</td>
<td>279 120 96 77</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Ex d / XP</td>
<td>279 120 166 77</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Dimensions and weights in inches and lb

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal signal converter</td>
<td>Non-Ex / Ex i / IS</td>
<td>11.0 4.7 3.8 3.0</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Ex d / XP</td>
<td>11.0 4.7 6.5 3.0</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Weather protection option (antenna housing – for the remote version only)

Figure 2-20: Weather protection option for the antenna housing (remote converter version only)

1. Front view (with weather protection closed)
2. Left side (with weather protection closed)
3. Rear view (with weather protection closed)

Dimensions and weights in mm and kg

<table>
<thead>
<tr>
<th>Weather protection</th>
<th>Dimensions [mm]</th>
<th>Weights [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Antenna housing</td>
<td>204</td>
<td>120</td>
</tr>
</tbody>
</table>

Dimensions and weights in inches and lb

<table>
<thead>
<tr>
<th>Weather protection</th>
<th>Dimensions [inches]</th>
<th>Weights [lb]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Antenna housing</td>
<td>8.0</td>
<td>4.7</td>
</tr>
</tbody>
</table>
## Converter and antenna housing weights

<table>
<thead>
<tr>
<th>Type of housing</th>
<th>Aluminium housing</th>
<th>Stainless steel housing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[kg]</td>
<td>[lb]</td>
</tr>
<tr>
<td>Non-Ex / intrinsically-safe (Ex i / IS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compact converter</td>
<td>3.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Remote converter</td>
<td>2.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Antenna housing</td>
<td>2.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Explosion proof (Ex d / XP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compact converter</td>
<td>3.2</td>
<td>7.1</td>
</tr>
<tr>
<td>Remote converter</td>
<td>2.9</td>
<td>6.40</td>
</tr>
<tr>
<td>Antenna housing</td>
<td>2.0</td>
<td>4.4</td>
</tr>
</tbody>
</table>

1. The remote version of the device has a “remote converter” and an “antenna housing”. For more data, refer to “Housing dimensions” at the start of this section.

### Antenna option weights

<table>
<thead>
<tr>
<th>Antenna options</th>
<th>Min./Max. weights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[kg]</td>
</tr>
<tr>
<td>PTFE Wave Horn antenna with flange connection</td>
<td>3.7</td>
</tr>
<tr>
<td>PTFE Wave Horn antenna with flange connection, with 100 mm / 3.94” antenna extension</td>
<td>3.78</td>
</tr>
<tr>
<td>PTFE Wave Horn antenna with flange connection, with 200 mm / 7.87” antenna extension</td>
<td>3.86</td>
</tr>
<tr>
<td>PTFE Wave Horn antenna with flange connection, with 300 mm / 11.81” antenna extension</td>
<td>3.94</td>
</tr>
<tr>
<td>PP Wave Horn antenna with threaded connection</td>
<td>0.7</td>
</tr>
<tr>
<td>DN65 / 2.5” Metallic Horn antenna with flange connection – only for the RC W5200 reference chamber</td>
<td>5.35</td>
</tr>
<tr>
<td>DN80 / 3” Metallic Horn antenna with flange connection, standard length</td>
<td>5.6...37.1</td>
</tr>
<tr>
<td>DN100 / 4” Metallic Horn antenna with flange connection, standard length</td>
<td>9.1...37.2</td>
</tr>
<tr>
<td>DN150 / 6” Metallic Horn antenna with flange connection, standard length</td>
<td>13.6...37.5</td>
</tr>
<tr>
<td>DN200 / 8” Metallic Horn antenna with flange connection, standard length</td>
<td>14.0...37.8</td>
</tr>
<tr>
<td>Wave Guide antenna with flange connection, 1...6 m / 3.28...19.68 ft</td>
<td>1.6...9.9</td>
</tr>
</tbody>
</table>

### Antenna extension options

<table>
<thead>
<tr>
<th>Straight extension options</th>
<th>Min./Max. weights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[kg]</td>
</tr>
<tr>
<td>Straight extension, length 100 mm / 3.94” ①</td>
<td>+0.76</td>
</tr>
<tr>
<td>Straight extension, length 200 mm / 7.87” ①</td>
<td>+0.94</td>
</tr>
<tr>
<td>Straight extension, length 300 mm / 11.81” ①</td>
<td>+1.12</td>
</tr>
<tr>
<td>Straight extension, length 400 mm / 15.75” ①</td>
<td>+1.30</td>
</tr>
<tr>
<td>Straight extension, length 500 mm / 19.69” ①</td>
<td>+1.48</td>
</tr>
<tr>
<td>Straight extension, length 1000 mm / 39.37” ①</td>
<td>+2.38</td>
</tr>
</tbody>
</table>
### Antenna options

<table>
<thead>
<tr>
<th>Antenna options</th>
<th>Min./Max. weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-bend extension (1)</td>
<td>+1.56 [kg]</td>
</tr>
<tr>
<td></td>
<td>+3.44 [lb]</td>
</tr>
<tr>
<td>L-bend (right-angle) extension (1)</td>
<td>+1.48 [kg]</td>
</tr>
<tr>
<td></td>
<td>+3.26 [lb]</td>
</tr>
<tr>
<td>HT extension (2)</td>
<td>+0.98 [kg]</td>
</tr>
<tr>
<td></td>
<td>+2.16 [lb]</td>
</tr>
</tbody>
</table>

1. This option is for Metallic Horn and Wave Guide antenna options
2. This component is only for the Metallic Horn and Wave Guide antennas. It is attached between the signal converter and the flange if the process connection temperature is +150...+250°C / +302...+482°F.
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, flow rate (in open channels) and reflectivity of liquids, pastes and slurries. It does not touch the measured product.

3.2 Installation

3.2.1 Pressure and temperature ranges

*If the ambient temperature is more than +70° C / +158° F, there is a risk of injury if you touch the device. Use a protective cover or metallic grid to prevent injury.*

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

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...+60°C / -4...+140°F
   - If the ambient temperature is not between these limits, the display screen switches off automatically. The device continues to operate.
3. Ambient temperature
   - Non-Ex devices: refer to the ambient temperature / flange temperature graphs in this section
   - 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.*
<table>
<thead>
<tr>
<th>Antenna type</th>
<th>Process connection</th>
<th>Seal</th>
<th>Process connection temperature</th>
<th>Process pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>[°C]</td>
<td>[°F]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[barg]</td>
<td>[psig]</td>
</tr>
<tr>
<td>PP Wave Horn</td>
<td>G 1½...2; 1½...2 NPT</td>
<td>—</td>
<td>-20...+100</td>
<td>-4...+212</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1...16</td>
<td>-14.5...232</td>
</tr>
<tr>
<td>PTFE Wave Horn</td>
<td>Flange with PTFE plate</td>
<td>—</td>
<td>-50...+150</td>
<td>-58...+302</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1...40</td>
<td>-14.5...580</td>
</tr>
<tr>
<td>Metallic Horn Wave Guide</td>
<td>Flange</td>
<td>Metaglas® with FKM/FPM</td>
<td>-40...+200</td>
<td>-40...+392</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1...40</td>
<td>-14.5...580</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metaglas® with Kalrez® 6375</td>
<td>-20...+250</td>
<td>-4...+482</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>-1...40</td>
<td>-14.5...580</td>
</tr>
<tr>
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<td></td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metaglas® with PFA</td>
<td>-60...+130</td>
<td>-76...+266</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1...40</td>
<td>-14.5...580</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metaglas® with EPDM</td>
<td>-50...+130</td>
<td>-58...+266</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1...40</td>
<td>-14.5...580</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

1. Higher temperature on request
2. Higher pressure on request

For more data on pressure ratings, refer to Pressure ratings on page 20
PP Wave Horn: compact and remote versions

Ambient temperature / flange temperature, flange and threaded connection, in °C

Figure 3-2: Ambient temperature / flange temperature, flange and threaded connection, in °C

Ambient temperature / flange temperature, flange and threaded connection, in °F

Figure 3-3: Ambient temperature / flange temperature, flange and threaded connection, in °F

① Maximum ambient temperature, °C
② Maximum flange temperature, °C
③ Maximum ambient temperature, °F
④ Maximum flange temperature, °F
⑤ Compact and remote versions of the device with the PP Wave Horn antenna
⑥ Remote version of the device with the PP Wave Horn antenna
PTFE Wave Horn: compact and remote versions
Ambient temperature / flange temperature, flange and threaded connection, in °C

Figure 3-4: Ambient temperature / flange temperature, flange and threaded connection, in °C

Ambient temperature / flange temperature, flange and threaded connection, in °F

Figure 3-5: Ambient temperature / flange temperature, flange and threaded connection, in °F

1. Maximum ambient temperature, °C
2. Maximum flange temperature, °C
3. Maximum ambient temperature, °F
4. Maximum flange temperature, °F
5. Compact and remote versions of the device with the PTFE Wave Horn antenna
6. Compact version of the device with the PTFE Wave Horn antenna

*When the process temperature is -50°C / -58°F, there is a de-rating for the ambient temperature. The minimum ambient temperature is -36°C / -32.8°F.*
Metallic Horn and Wave Guide: compact and remote versions
Ambient temperature / flange temperature, flange and threaded connection, in °C

Figure 3-6: Ambient temperature / flange temperature, flange and threaded connection, in °C

Ambient temperature / flange temperature, flange and threaded connection, in °F

Figure 3-7: Ambient temperature / flange temperature, flange and threaded connection, in °F

1. Maximum ambient temperature, °C
2. Maximum flange temperature, °C
3. Maximum ambient temperature, °F
4. Maximum flange temperature, °F
5. Compact and remote versions of the device with the Metallic Horn or Wave Guide antenna
6. Compact version of the device with the Metallic Horn or Wave Guide antenna

When the process temperature is -50°C / -58°F and the device has an EPDM gasket, there is a de-rating for the ambient temperature. The minimum ambient temperature is -35°C / -31°F.
Metallic Horn and Wave Guide: compact and remote versions with the high-temperature (HT) extension

Ambient temperature / flange temperature, flange and threaded connection, in °C

![Diagram](image)

Figure 3-8: Ambient temperature / flange temperature, flange and threaded connection, in °C

Ambient temperature / flange temperature, flange and threaded connection, in °F

![Diagram](image)

Figure 3-9: Ambient temperature / flange temperature, flange and threaded connection, in °F

- ① Maximum ambient temperature, °C
- ② Maximum flange temperature, °C
- ③ Maximum ambient temperature, °F
- ④ Maximum flange temperature, °F
- ⑤ Compact and remote versions of the device with the Metallic Horn or Wave Guide antenna, the HT extension and EPDM and PFA gaskets
- ⑥ Compact and remote versions of the device with the Metallic Horn or Wave Guide antenna, the HT extension and a PFA gasket

When the process temperature is -50°C / -58°F and the device has an EPDM gasket, there is a de-rating for the ambient temperature. The minimum ambient temperature is -39°C / -38.2°F.

When the process temperature is -60°C / -76°F and the device has a PFA gasket, there is a de-rating for the ambient temperature. The minimum ambient temperature is -37°C / -34.6°F.
3.2.2 Recommended mounting position

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

![Figure 3-10: Recommended mounting position for liquids, pastes and slurries](image)

1. Sockets for the PP Wave Horn antenna
2. Nozzles for the PTFE Wave Horn antenna
3. Nozzles for DN150 or DN200 Metallic Horn antennas
4. Nozzles for Wave Guide antennas
5. Tank diameter
6. Minimum distance of the nozzle or socket from the tank wall (depends on the antenna type and size - refer to items 1, 2, 3 and 4 in this list):
   - PP/PTFE Wave Horn (1) and (2): 1/7 × tank height
   - Metallic Horn (3): 1/10 × tank height
   - Wave Guide (4): There is no minimum distance from the Wave Guide antenna to metallic walls and other metal objects
7. Tank height

Maximum distance of nozzle from the tank wall (depends on the antenna type and size - refer to items 1, 2 and 3 in this list):
   - PP/PTFE Wave Horn (1) and (2): 1/3 × tank diameter
   - Metallic Horn (3): 1/3 × tank diameter
   - Wave Guide (4): There is no maximum distance from the Wave Guide antenna to metallic walls and other metal objects

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.
Figure 3-11: A maximum of 4 FMCW radar level meters can be operated in a tank

Figure 3-12: Tanks with dish-shaped or conical bottoms
Dish-shaped or conical bottoms have an effect on the measuring range. The device cannot measure to the bottom of the tank.

① Axis of radar beam
② Minimum level reading
3.2.3 Mounting restrictions

*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.

**Mounting restrictions: General data**

![Diagram of mounting restrictions](image)

- **Do not tilt the device more than 2°**
- **We recommend that you do an empty spectrum recording if there are obstacles in the radar beam (refer to Operation).**
  - If necessary, install a bypass chamber or stilling well or use an S-bend antenna extension or an L-bend antenna extension (the device must be installed on the side of the tank) to move the device away from obstacles.
- **2.5 mm / 0.1” max. for high-dielectric constant liquids**
- **Beam radius (DN80 [3”] Metallic Horn antenna): increments of 290 mm/m or 3.4”/ft [16°]**
  - Beam radius (DN100 [4”] Metallic Horn antenna): increments of 210 mm/m or 2.6”/ft [12°]
  - Beam radius (DN150 [6”] Metallic Horn antenna): increments of 140 mm/m or 1.7”/ft [8°]
  - Beam radius (DN200 [8”] Metallic Horn antenna): increments of 100 mm/m or 1.3”/ft [6°]
  - Beam radius (PP Wave Horn and PTFE Wave Horn antenna): increments of 176 mm/m or 2.1”/ft [10°]
Obstacles in the tank

Figure 3-14: Obstacles in the tank

Do not put the device directly above obstacles (agitator, support beams, heating tubes etc.). Parasitic signals from obstacles will cause the device to measure incorrectly.

1. Solution 1: Put the device on another process connection away from obstacles
2. Solution 2: Use the same process connection, but also use an S-bend extension
3. Solution 3: Attach the device to the side of the tank and use an L-bend (right angle) extension

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 3-15: Product inlets

1. The device is in the correct position.
2. The device is too near to the product inlet.
The antenna must project out of the nozzle. If necessary, use an antenna extension. But if the tank roof is flat and the tank fitting is symmetrical, it is not necessary for the antenna to project out of the nozzle. Thus, the device can have a larger measuring range.

**Devices with Metallic Horn antenna**

![Diagram of devices with Metallic Horn antenna]

Figure 3-16: Devices with Metallic Horn antenna

1. If the roof is not flat, the antenna must project out of the nozzle
2. Short tank nozzle
3. Long tank nozzle (device with an antenna extension)
4. If the roof is flat and the tank fitting is symmetrical, it is not necessary for the antenna to project out of the nozzle. Thus, the device can have a larger measuring range.

**Devices with PTFE or PP Wave Horn antenna**

![Diagram of devices with PTFE or PP Wave Horn antenna]

Figure 3-17: Devices with PTFE or PP Wave Horn antenna

Recommended height of tank process connection, \( a = 44...200 \text{ mm} / 1.7...7.8" \)

1. Device with a PTFE Wave Horn antenna and a flange connection. There are antenna extension options available (100 mm / 4", 200 mm / 8" and 300 mm / 12") for long nozzles.
2. Device with a PP Wave Horn antenna and a thread connection

Do not install devices with Wave Horn antennas on plastic nozzles that have a diameter of 50 mm / 2".

If there are parasitic signals, the device will not measure correctly. Parasitic signals are caused by:
- Objects in the tank.
- 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 an Empty Spectrum recording (refer to Operation) to remove parasitic signals with a filter.
3.2.4 Standpipes (stilling wells and bypass chambers)

Use a standpipe if:

- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.
- There are too many other objects in the tank.
- The device is measuring a liquid (petro-chemicals) in a tank with a floating roof.
- The device is installed in a horizontal cylindrical tank (refer to the end of this section).

![Figure 3-18: Installation recommendations for standpipes (stilling wells and bypass chambers)](image)

- The standpipe must be electrically conductive.
- The inside diameter of the standpipe must not be more than 5 mm / 0.2" over the diameter of the antenna (for a high-dielectric constant liquid).
- The standpipe must be straight. There must be no sudden changes in internal diameter greater than 1 mm / 0.04".
- The standpipe must be vertical.
- Recommended surface roughness: <±0.1 mm / 0.004".
- Make sure that there are no deposits at the bottom of the standpipe.
- Make sure that there is liquid in the standpipe.

You can drill an air circulation hole if the stilling well is in a closed space (a metallic container). This condition is necessary to obey TLPR standards. For more data, refer to the handbook.
Installation in tanks containing one liquid and foam

- Drill an air circulation hole (max. Ø10 mm / 0.4") in the stilling well above the maximum level.
- Remove the burr from the hole.

Installation in tanks containing one liquid or more without foam

- Drill an air circulation hole (max. Ø10 mm / 0.4") in the stilling well above the maximum level.
- Drill 1 or more liquid circulation holes in the stilling well (if there is more than 1 liquid in the tank).
  
  ➔ These holes help the liquid to move freely between the stilling well and the tank.
- Remove the burr from the hole.

Stilling wells – reference point

We recommend that you attach a flat cruciform target at the bottom of the stilling well. It must have a width of 1/3 of the internal diameter of the stilling well tube. This target is the limit of the measuring range in the stilling well.

![Figure 3-19: Reference point in the stilling well](image)

\[ a \geq \frac{1}{3} \times \varnothing D \]
Stilling wells: floating roofs
If the device must be installed on a tank with a floating roof, install it in a stilling well.

Figure 3-20: Floating roofs
1 Sediment
2 Support fixtures
3 Stilling well
4 Floating roof
5 Product
6 Tank
Stilling wells: horizontal cylindrical tanks

We recommend that you install the device in a stilling well if the device:

- is for a horizontal cylindrical tank,
- is in a metallic tank,
- measures a product with a high dielectric constant and
- is on the centerline of the tank.

![Figure 3-21: Horizontal cylindrical tanks](image)

1. The device is installed without a stilling well. There are multiple reflections. Refer to the CAUTION! that follows.
2. The device is installed in a stilling well and measures correctly.

If the device is installed in horizontal cylindrical tank that contains a high dielectric constant liquid without a stilling well, do not put it on the tank centerline. This will cause multiple reflections and the device will not measure accurately. Use the 2.3.12 Multiple Reflections function in Supervisor > Basic Parameters to keep the effects of multiple reflections to a minimum. For more data, refer to “Function description” in the handbook.
Bypass chambers

Installation next to tanks containing one liquid and foam

• The top process connection of the bypass chamber must be above the maximum level of liquid.
• The bottom process connection of the bypass chamber must be below the lowest measured level of liquid.

Installation next to tanks containing more than one liquid

• The top process connection of the bypass chamber must be above the maximum level of liquid.
• The bottom process connection of the bypass chamber must be below the lowest measured level of liquid.
• Additional process connections are necessary for the liquids to circulate freely along the length of the bypass chamber.
4.1 Electrical installation: 2-wire, loop-powered

4.1.1 Compact version

Terminals for electrical installation

![Figure 4-1: Terminals for electrical installation](image)

1. Grounding terminal in the housing (if the electrical cable is shielded)
2. Current output -
3. Current output +
4. 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.*

4.1.2 Remote version

Terminals for electrical installation

![Figure 4-2: Terminals for electrical installation](image)

1. Grounding terminal in the housing (if the electrical cable is shielded)
2. Current output -
3. Current output +
4. Location of the external grounding terminal (on the wall support)

*Electrical power to the output terminal energizes the device. The output terminal is also used for HART® communication.*
Connections between the remote converter and the antenna housing

Figure 4-3: Connections between the remote converter and the antenna housing

1. Remote converter
2. Antenna housing
3. Power supply: voltage in -
4. Power supply: voltage in +
5. Signal cable B
6. Signal cable A
7. Shielding wire (attached to Faston connectors in the housings of the remote converter and the antenna housing)

For more electrical installation data, refer to Compact version on page 51.

4.2 Non-Ex devices

Figure 4-4: Electrical connections for non-Ex devices

1. Power supply
2. Resistor for HART® communication
3. Optional connection to the grounding terminal
4. Output: 11.5...30 VDC for an output of 22 mA at the terminal
5. 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

![Diagram of point-to-point connection](image)

Figure 4-5: 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
4. Power supply
5. HART® converter
6. HART® communication software
4.4.3 Multi-drop networks

Figure 4-6: 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
4. Power supply
5. HART® converter
6. HART® communication software
4.4.4 Fieldbus networks

For more data, refer to the supplementary instructions for FOUNDATION™ fieldbus and PROFIBUS PA.

**FOUNDATION™ fieldbus network (non-Ex)**

Figure 4-7: FOUNDATION™ fieldbus network (non-Ex)

1. Field device
2. Junction box
3. H1 network
4. H1/HSE converter
5. High Speed Ethernet (HSE)
6. Workstation
PROFIBUS PA/DP network (non-Ex)

1. Field device
2. Bus termination
3. PROFIBUS PA bus segment
4. Segment coupler (PA/DP link)
5. PROFIBUS DP bus line
6. Control system (PLC / Class 1 master device)
7. Engineering or operator workstation (Control tool / Class 2 master device)
5.1 Order code

Make a selection from each column to get the full order code. The characters of the order code highlighted in light grey describe the standard.

<table>
<thead>
<tr>
<th>VF50</th>
<th>4</th>
</tr>
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<tbody>
<tr>
<td>OPTIPLATFORM 5200 C/F 10 GHz Radar (FMCW) Level Transmitter for liquids in storage and process applications</td>
<td></td>
</tr>
</tbody>
</table>

**Converter version (Housing material – protection category)**

1. OPTIPLATFORM 5200 C: Compact version [Aluminium – IP66/67]
2. OPTIPLATFORM 5200 C: Compact version [Stainless steel – IP66/67]

**Approval**

0. Without

1. ATEX II 1/2 G Ex ia IIC T6 Ga/Gb + II 1/2 D Ex ia IIC Da/Db
2. ATEX II 1/2 G Ex d ia IIC T6 Ga/Gb + II 1/2 D Ex ia tb IIC Da/Db
4. ATEX II 3 G Ex ic IIC T6 Gc + II 3 D Ex ic IIC Dc (Zone 2 & 22)
6. IECEEx Ex ia IIC T6 Ga/Gb + Ex ia IIC Da/Db
7. IECEEx Ex d ia IIC T6 Ga/Gb + Ex ia tb IIC Da/Db
8. IECEEx Ex ic IIC T6 Gc + Ex ic IIC Dc (Zone 2 & 22)

A. cFMus IS CL I/II/III DIV 1 GPS A–G + CL I zone 0/20 Ex ia IIC/IIC T6
B. cFMus XP-AIS/DIP CL I/II/III DIV 1 GPS A–G [A not for Canada] + CL I zone 0/20 Ex d[ia]/tb[ia] IIC/IIC T6 (2)
C. cFMus NI CL I/II/III DIV 2 GPS A–G + CL I zone 2 Ex nA IIC T6
L. NEPSI Ex ia IIC T6 Ga/Gb + DIP A20/A21 (2)
M. NEPSI Ex d ia IIC T6 Ga/Gb + DIP A20/A21 (2)
R. INMETRO Ex ia IIC T6 Ga/Gb + Ex ia IIC Da/Db
S. INMETRO Ex d ia IIC T6 Ga/Gb + Ex ia tb IIC Da/Db
T. INMETRO Ex ic IIC T6 Gc + Ex ic IIC Dc (Zone 2 & 22)

**Other approval**

0. Without

1. SIL 2 – only available for the OPTIPLATFORM 5200 C (compact version) with a 4…20 mA output
4. CRN (Canadian Registration Number)
5. CRN + SIL 2 – only available for the OPTIPLATFORM 5200 C (compact version) with a 4…20 mA output
A. WHG – must be supplied with a calibration certificate
B. EAC Russia
C. EAC Belarus
D. EAC Russia + SIL 2 – only available for the OPTIPLATFORM 5200 C (compact version) with a 4…20 mA output
E. EAC Belarus + SIL 2 – only available for the OPTIPLATFORM 5200 C (compact version) with a 4…20 mA output
K. EAC Kazakhstan
L. EAC Kazakhstan + SIL 2 – only available for the OPTIPLATFORM 5200 C (compact version) with a 4…20 mA output

**VF50 | 4**

Order code [complete this code on the pages that follow]
## Order Information

### Process Seal – Temperature / Pressure / Material / Remarks (higher flange temperature and process pressure on request)

<table>
<thead>
<tr>
<th>Code</th>
<th>Temperature</th>
<th>Pressure</th>
<th>Material</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-40...+150°C [-40...+302°F]</td>
<td>-1...40 barg [-14.5...580 psig]</td>
<td>FKM/FPM / Metaglas® for Metallic Horn and Wave Guide</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-50...+130°C [-58...+266°F]</td>
<td>-1...40 barg [-14.5...580 psig]</td>
<td>EPDM / Metaglas® for Metallic Horn and Wave Guide</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-20...+150°C [-4...+302°F]</td>
<td>-1...40 barg [-14.5...580 psig]</td>
<td>Kalrez® 6375 / Metaglas® for Metallic Horn and Wave Guide</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>-60...+130°C [-76...+266°F]</td>
<td>-1...40 barg [-14.5...580 psig]</td>
<td>PFA / Metaglas® for Metallic Horn and Wave Guide</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>-40...+200°C [-40...+392°F]</td>
<td>-1...40 barg [-14.5...580 psig]</td>
<td>FKM/FPM / Metaglas® for Metallic Horn and Wave Guide with distance piece</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>-20...+250°C [-4...+482°F]</td>
<td>-1...40 barg [-14.5...580 psig]</td>
<td>Kalrez® 6375 / Metaglas® for Metallic Horn and Wave Guide with distance piece</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>-20...+100°C [-4...+212°F]</td>
<td>-1...16 barg [-14.5...232 psig]</td>
<td>PP / for PP Wave Horn with G and NPT threaded connections</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-50...+150°C [-58...+302°F]</td>
<td>-1...40 barg [-14.5...580 psig]</td>
<td>PTFE / for PTFE Wave Horn with Type B1 [EN 1092-1] or Raised Face (ASME B16.5) flange facing</td>
<td></td>
</tr>
</tbody>
</table>

### Antenna

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>Without</td>
</tr>
<tr>
<td>1</td>
<td>Metallic Horn [sheet metal] DN80 [3&quot;] L= 110 mm [4.33&quot;] / 316L ③</td>
</tr>
<tr>
<td>2</td>
<td>Metallic Horn [sheet metal] DN100 [4&quot;] L= 148 mm [5.83&quot;] / 316L ③</td>
</tr>
<tr>
<td>3</td>
<td>Metallic Horn [sheet metal] DN150 [6&quot;] L= 223 mm [8.78&quot;] / 316L</td>
</tr>
<tr>
<td>4</td>
<td>Metallic Horn [sheet metal] DN 200 [8&quot;] L= 335 mm [13.19&quot;] / 316L</td>
</tr>
<tr>
<td>5</td>
<td>Metallic Horn (machined) DN65 [2.5&quot;] L= 86 mm [3.38&quot;] for RC W5200 ④</td>
</tr>
<tr>
<td>G</td>
<td>Wave Horn Ø43 mm [1.69&quot;] L= 322 mm [12.68&quot;] / PP</td>
</tr>
<tr>
<td>H</td>
<td>Wave Horn Ø43 mm [1.69&quot;] L= 296 mm [11.65&quot;] / PTFE</td>
</tr>
<tr>
<td>L</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤1 m [3.28 ft] / 316L</td>
</tr>
<tr>
<td>M</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤1.5 m [4.92 ft] / 316L</td>
</tr>
<tr>
<td>N</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤2 m [6.56 ft] / 316L</td>
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<tr>
<td>P</td>
<td>Metallic Wave Guide Ø30 mm [1.2&quot;] ≤2.5 m [8.20 ft] / 316L</td>
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<tr>
<td>R</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤3 m [9.84 ft] / 316L</td>
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<tr>
<td>S</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤3.5 m [11.48 ft] / 316L</td>
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<tr>
<td>T</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤4 m [13.12 ft] / 316L</td>
</tr>
<tr>
<td>U</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤4.5 m [14.76 ft] / 316L</td>
</tr>
<tr>
<td>V</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤5 m [16.40 ft] / 316L</td>
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<tr>
<td>W</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤5.5 m [18.05 ft] / 316L</td>
</tr>
<tr>
<td>X</td>
<td>Metallic Wave Guide Ø30 mm [1.18&quot;] ≤6 m [19.69 ft] / 316L</td>
</tr>
</tbody>
</table>

**Order code** (complete this code on the pages that follow)
<table>
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<th>Antenna extension</th>
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<tr>
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<tr>
<td>6</td>
<td>100 mm (3.94&quot;) L= 396 mm (15.59&quot;) / PTFE (for the PTFE Wave Horn antenna)</td>
</tr>
<tr>
<td>7</td>
<td>200 mm (7.87&quot;) L= 496 mm (19.53&quot;) / PTFE (for the PTFE Wave Horn antenna)</td>
</tr>
<tr>
<td>8</td>
<td>300 mm (11.81&quot;) L= 596 mm (23.47&quot;) / PTFE (for the PTFE Wave Horn antenna)</td>
</tr>
<tr>
<td>E</td>
<td>100 mm (3.94&quot;) / 316L (for the Metallic Horn antenna)</td>
</tr>
<tr>
<td>F</td>
<td>200 mm (7.87&quot;) / 316L (for the Metallic Horn antenna)</td>
</tr>
<tr>
<td>G</td>
<td>300 mm (11.81&quot;) / 316L (for the Metallic Horn antenna)</td>
</tr>
<tr>
<td>H</td>
<td>400 mm (15.75&quot;) / 316L (for the Metallic Horn antenna)</td>
</tr>
<tr>
<td>K</td>
<td>500 mm (19.69&quot;) / 316L (for the Metallic Horn antenna)</td>
</tr>
<tr>
<td>R</td>
<td>1000 mm (39.37&quot;) / 316L (for the Metallic Horn antenna)</td>
</tr>
<tr>
<td>W</td>
<td>S-bend extension / 316L</td>
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<tr>
<td>X</td>
<td>L-bend [right angle] extension / 316L</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process connection (size / pressure rating / flange face)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0</td>
<td>Without</td>
</tr>
<tr>
<td>Threaded – ISO 228</td>
<td></td>
</tr>
<tr>
<td>G P 0</td>
<td>G 1½ A – for the PP Wave Horn antenna</td>
</tr>
<tr>
<td>H P 0</td>
<td>G 2 A – for the PP Wave Horn antenna</td>
</tr>
<tr>
<td>Threaded – ASME B1.20.1</td>
<td></td>
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<tr>
<td>G A 0</td>
<td>1½ NPT – for the PP Wave Horn antenna</td>
</tr>
<tr>
<td>H A 0</td>
<td>2 NPT – for the PP Wave Horn antenna</td>
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<tr>
<td>EN / DIN flanges – EN 1092-1</td>
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<tr>
<td>H E 1</td>
<td>DN50 PN16 – Type B1</td>
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<tr>
<td>H G 1</td>
<td>DN50 PN40 – Type B1</td>
</tr>
<tr>
<td>L E 1</td>
<td>DN80 PN16 – Type B1</td>
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<tr>
<td>L G 1</td>
<td>DN80 PN40 – Type B1</td>
</tr>
<tr>
<td>M E 1</td>
<td>DN100 PN16 – Type B1</td>
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<tr>
<td>M G 1</td>
<td>DN100 PN40 – Type B1</td>
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<td>DN150 PN16 – Type B1</td>
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<tr>
<td>P G 1</td>
<td>DN150 PN40 – Type B1</td>
</tr>
<tr>
<td>R E 1</td>
<td>DN200 PN16 – Type B1</td>
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<tr>
<td>R G 1</td>
<td>DN200 PN40 – Type B1</td>
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<tr>
<td>ASME B16.5 / ANSI flanges</td>
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</tr>
<tr>
<td>H 1 A</td>
<td>2&quot; 150 lb RF</td>
</tr>
<tr>
<td>H 2 A</td>
<td>2&quot; 300 lb RF</td>
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<tr>
<td>L 1 A</td>
<td>3&quot; 150 lb RF</td>
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<tr>
<td>L 2 A</td>
<td>3&quot; 300 lb RF</td>
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<tr>
<td>M 1 A</td>
<td>4&quot; 150 lb RF</td>
</tr>
<tr>
<td>M 2 A</td>
<td>4&quot; 300 lb RF</td>
</tr>
<tr>
<td>P 1 A</td>
<td>6&quot; 150 lb RF</td>
</tr>
<tr>
<td>P 2 A</td>
<td>6&quot; 300 lb RF</td>
</tr>
<tr>
<td>R 1 A</td>
<td>8&quot; 150 lb RF</td>
</tr>
<tr>
<td>R 2 A</td>
<td>8&quot; 300 lb RF</td>
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</tbody>
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| VF50 4 | Order code [complete this code on the pages that follow] |
**ORDER INFORMATION**

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<tr>
<th>JIS B2220 flanges</th>
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<tbody>
<tr>
<td>H U P 10K 50A RF</td>
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<td>L U P 10K 80A RF</td>
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<tr>
<td>M U P 10K 100A RF</td>
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<tr>
<td>P U P 10K 150A RF</td>
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<td>R U P 10K 200A RF</td>
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**Alternative flange faces**

2 Type B2, EN 1092-1 (surface roughness must be specified in the order)
3 Type C, EN 1092-1 [Tongue]
4 Type D, EN 1092-1 [Groove]
5 Type E, EN 1092-1 [Spigot]
6 Type F, EN 1092-1 [Recess]
B FF, ASME B16.5 [Flat face]

**Output**

1 2-wire / 4...20 mA passive HART
A 2-wire / FOUNDATION™ fieldbus
B 2-wire / PROFIBUS PA

**Cable entry / cable gland**

1 M20×1.5 / Without
2 M20×1.5 / Plastic
3 M20×1.5 / Nickel-plated brass
4 M20×1.5 / Stainless steel
A ½ NPT [nickel-plated brass] / Without
B ½ NPT [stainless steel] / Without

**Housing – Orientation / Display / Weather protection**

1 Horizontal / Without / Without – for the compact version
2 Horizontal / Display on side / Without – for the compact version
3 Horizontal / Without / With – for the compact version
4 Horizontal / Display on side / With – for the compact version
A Vertical / Without / Without
B Vertical / Display on top / Without
C Vertical / Display on side / Without (not available for Ex d ia and cFMus-approved devices)
D Vertical / Without / With
E Vertical / Display on top / With
F Vertical / Display on side / With (not available for Ex d ia and cFMus-approved devices)

**Order code [complete this code on the pages that follow]**

VF50 4
### Display language

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</tr>
<tr>
<td>1</td>
<td>English</td>
</tr>
<tr>
<td>2</td>
<td>German</td>
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<td>3</td>
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<td>Italian</td>
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<tr>
<td>5</td>
<td>Spanish</td>
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<tr>
<td>6</td>
<td>Portuguese</td>
</tr>
<tr>
<td>7</td>
<td>Japanese</td>
</tr>
<tr>
<td>8</td>
<td>Chinese (simplified)</td>
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<tr>
<td>A</td>
<td>Russian</td>
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### Version

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<tbody>
<tr>
<td>0</td>
<td>Standard orders and orders for solid applications in China</td>
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<tr>
<td>6</td>
<td>Orders with FCC radio approval (FCC Part 15 and RSS-210)</td>
</tr>
<tr>
<td>A</td>
<td>Orders for liquid applications in China</td>
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</tbody>
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### Options for the remote version (OPTIWAVE 5200 F)

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<tbody>
<tr>
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<tr>
<td>6</td>
<td>Signal cable 10 m (32.81 ft) / grey (non-Ex) or blue (Ex)</td>
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<tr>
<td>7</td>
<td>Signal cable 25m (82.02 ft) / grey (non-Ex) or blue (Ex)</td>
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<td>8</td>
<td>Signal cable 50m (164.04 ft) / grey (non-Ex) or blue (Ex)</td>
</tr>
<tr>
<td>A</td>
<td>Signal cable 75m (246.06 ft) / grey (non-Ex) or blue (Ex)</td>
</tr>
<tr>
<td>B</td>
<td>Signal cable 100m (328.08 ft) / grey (non-Ex) or blue (Ex)</td>
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### Adaptor for BM 70 A, BM 700 and BM 702 A process connections

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### Calibration certificate

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<tbody>
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<tr>
<td>1</td>
<td>Calibration certificate ±5 mm 2 factory default points for accuracy of ±5 mm (0.2&quot;)</td>
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### TAG Number

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<tr>
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<td>Tag No. stainless steel plate (18 characters max.)</td>
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| VF50 | 4 |

*Order code (complete this code on the pages that follow)*
<table>
<thead>
<tr>
<th>Other constructions</th>
<th>Order code</th>
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<tbody>
<tr>
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<tr>
<td>1 NACE design [MR0175 / MR0103 / ISO 15156]</td>
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<tr>
<td>3 Heating / Cooling (X)</td>
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</tr>
<tr>
<td>5 Purging with liquid (X)</td>
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</tr>
<tr>
<td>6 Purging with liquid + Heating / Cooling (X)</td>
<td></td>
</tr>
<tr>
<td>A Purging with gas (X)</td>
<td></td>
</tr>
<tr>
<td>B Purging with gas + Heating / Cooling (X)</td>
<td></td>
</tr>
</tbody>
</table>

1. For more data, refer to the Technical data section (Approvals and certification)
2. DIP= Dust Ignition Proof
3. Only for a standpipe (bypass chamber or stilling well)
4. The device is installed on top of a BM 26 A. The device must have a 2” 300 lb RF (ASME B16.5) flange without an antenna extension. Refer to the BM 26 A technical data sheet to make a selection of options for the measuring chamber.
5. For device dimensions, refer to the “Dimensions and weights” section
6. Refer to the accessory list to attach a low-pressure stainless steel flanges to the threaded connection
7. Other flange faces are available. Refer to your local supplier for more data. Flanges with the PTFE Wave Horn antenna option have a slip on-type design with an anti-blowout feature.
8. Minimum flange size for the PTFE Wave Horn antenna. This is not available for the Metallic Horn antenna.
9. Minimum flange size for the PTFE Wave Horn antenna. This flange is also available with the DN65 Metallic Horn antenna for the RC W5200 reference chamber.
10. For DN150 and DN200 Metallic Horn antenna only
KROHNE – Process instrumentation and measurement solutions

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

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Fax: +49 203 301 10389
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com