24 GHz Non-contact Radar (FMCW) Level Meter

for distance, level, volume and mass measurement of liquids
# CONTENTS

## 1 Safety instructions  
### 2.1 Intended use  
### 2.2 Scope of delivery  
### 2.3 Visual Check  
### 2.4 Storage  
### 2.5 Transport  
### 2.6 Pre-installation requirements  
### 2.7 How to prepare the tank before you install the device  
#### 2.7.1 Pressure and temperature ranges  
#### 2.7.2 Recommended mounting position  
#### 2.7.3 Theoretical data for hygienic applications  
### 2.8 Installation recommendations for liquids  
#### 2.8.1 General requirements  
#### 2.8.2 Standpipes (stilling wells and bypass chambers)  
### 2.9 How to install the device on the tank  
#### 2.9.1 How to install a device with a flange connection  
#### 2.9.2 How to install a device with a threaded connection  
#### 2.9.3 How to install a device with a hygienic connection  
#### 2.9.4 How to attach antenna extensions  
#### 2.9.5 How to turn or remove the signal converter  
#### 2.9.6 How to attach the weather protection to the device  
#### 2.9.7 How to open the weather protection  
## 2 Installation  
### 3 Electrical connections  
#### 3.1 Safety instructions  
#### 3.2 Electrical installation: outputs 1 and 2  
#### 3.2.1 Non-Ex devices  
#### 3.2.2 Devices for hazardous locations  
## 4 Technical data  
### 4.1 Technical data
SAFETY INSTRUCTIONS

WARNINGS AND SYMBOLS USED

DANGER!
This information refers to the immediate danger when working with electricity.

DANGER!
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator’s plant.

WARNING!
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator’s plant.

CAUTION!
Disregarding these instructions can result in damage to the device or to parts of the operator’s plant.

INFORMATION!
These instructions contain important information for the handling of the device.

HANDLING
• This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.
  RESULT
  This symbol refers to all important consequences of the previous actions.

SAFETY INSTRUCTIONS FOR THE OPERATOR

CAUTION!
Installation, assembly, start-up and maintenance may only be performed by appropriately trained personnel. The regional occupational health and safety directives must always be observed.

LEGAL NOTICE!
The responsibility as to the suitability and intended use of this device rests solely with the user. The supplier assumes no responsibility in the event of improper use by the customer. Improper installation and operation may lead to loss of warranty. In addition, the “Terms and Conditions of Sale” apply which form the basis of the purchase contract.

INFORMATION!
• Further information can be found on the supplied CD-ROM in the manual, on the data sheet, in special manuals, certificates and on the manufacturer’s website.
• If you need to return the device to the manufacturer or supplier, please fill out the form contained on the CD-ROM and send it with the device. Unfortunately, the manufacturer cannot repair or inspect the device without the completed form.
2.1 Intended use

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

It can be installed on tanks, reactors and open channels.

2.2 Scope of delivery

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

Scope of delivery – horn antenna

1. Signal converter and antenna in compact version
2. Antenna extensions (option)
3. Quick Start
4. CD-ROM (including Handbook, Quick Start, Technical Datasheet and related software)

Scope of delivery – Drop antenna

1. Signal converter and antenna in compact version
2. Antenna extensions (option) and O-ring for each antenna extension
3. Quick Start
4. CD-ROM (including Handbook, Quick Start, Technical Datasheet, and related software)
Scope of delivery – hygienic antenna

Figure 2-3: Scope of delivery – hygienic antenna

1. Signal converter and antenna in compact version
2. Quick Start
3. CD-ROM (including Handbook, Quick Start, Technical Datasheet, and related software)

INFORMATION!
No special tools or training required!
2.3 Visual Check

**WARNING!**
If the display screen glass is broken, do not touch.

**INFORMATION!**
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

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**Figure 2-4: Visual check**

1. Device nameplate (for more data, refer to the handbook)
2. Process connection data (size and pressure rating, material reference and heat number)
3. Gasket material data – refer to the illustration that follows

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**Figure 2-5: Symbols for the supplied gasket material (on the side of the process connection)**

1. EPDM
2. Kalrez® 6375

If the device is supplied with an FKM/FPM gasket, there is no symbol on the side of the process connection.

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**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

**INFORMATION!**
Compare the material references on the side of the process connection with the order.
2.4 Storage

**WARNING!**
Do not keep the device in a vertical position. This will damage the antenna and the device will not measure correctly.

![Figure 2-6: Storage conditions](image)

1. When you put the device into storage, do not keep it in a vertical position.
2. Put the device on its side. We recommend that you use the packaging in which it was delivered.
3. Storage temperature range: -40...+85°C / -40...+185°F

- Store the device in a dry and dust-free location.
- Keep the converter out of the sunlight.
- Store the device in its original packing.
2.5 Transport

Figure 2-7: How to lift the device

1. Remove the converter before you lift the device with a hoist.

**WARNING!**
*Lift the device carefully to prevent damage to the antenna.*

2.6 Pre-installation requirements

**INFORMATION!**
*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.
2.7 How to prepare the tank before you install the device

**CAUTION!**
To avoid measuring errors and device malfunction, obey these precautions.

2.7.1 Pressure and temperature ranges

![Image of pressure and temperature ranges](image-url)

2.7.1.1 Flange temperature
FKM/FPM gasket: -40...+200°C / -40...+390°F; Kalrez® 6375 gasket: -20...+200°C / -4...+390°F;
EPDM gasket: -50...+150°C / -58...+300°F
Depends on the antenna type. Refer to the table that follows.
Ex devices: see supplementary operating instructions

2.7.1.2 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

2.7.1.3 Ambient temperature
Non-Ex devices: -40...+80°C / -40...+175°F
Ex devices: see supplementary operating instructions

2.7.1.4 Process pressure
Depends on the antenna type. Refer to the table that follows.

**WARNING!**
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.

<table>
<thead>
<tr>
<th>Antenna type</th>
<th>Maximum process connection temperature</th>
<th>Maximum operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[°C]</td>
<td>[°F]</td>
</tr>
<tr>
<td>PP Drop</td>
<td>+100</td>
<td>+210</td>
</tr>
<tr>
<td>PTFE Drop</td>
<td>+150</td>
<td>+300</td>
</tr>
<tr>
<td>Hygienic</td>
<td>+150</td>
<td>+300</td>
</tr>
<tr>
<td>Horn / Sheet metal horn</td>
<td>+150 (+200) ①</td>
<td>+300 (+390) ①</td>
</tr>
</tbody>
</table>

① Standard max. process connection temperature: +150°C / +300°F. Optional max. process temperature: +200°C / +390°F.
② Standard operating pressure: 40 barg / 580 psig. Optional max. operating pressure: 100 barg / 1450 psig.
2.7.2 Recommended mounting position

**CAUTION!**
Follow these recommendations to make sure that the device measures correctly.

![Diagram](image)

Figure 2-9: Recommended nozzle position for liquids, pastes and slurries

1. Nozzles for DN40 or DN50 Horn antennas, or DN50 Hygienic antenna
2. Nozzles for DN80, DN100, DN150 or DN200 Horn antennas and DN80 or DN150 Drop antennas
3. Tank height
4. Tank diameter
5. Minimum distance of nozzle from the tank wall: \( \frac{1}{7} \times \text{tank height} \)
   Maximum distance of nozzle from the tank wall: \( \frac{1}{3} \times \text{tank diameter} \)
6. Minimum distance of nozzle from the tank wall: \( \frac{1}{10} \times \text{tank height} \)
   Maximum distance of nozzle from the tank wall: \( \frac{1}{3} \times \text{tank diameter} \)

**INFORMATION!**
If possible, do not install a nozzle on the tank centerline.

**CAUTION!**
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.
More than 1 FMCW radar level meter can be operated in a tank.

2.7.3 Theoretical data for hygienic applications

To make the cleaning of the antenna easier, attach the device to a short socket.

Figure 2-10: Product inlets
1. The device is in the correct position.
2. The device is too near to the product inlet.

Figure 2-11: More than 1 FMCW radar level meter can be operated in a tank

Figure 2-12: Requirements for hygienic applications
1. Maximum height of process connection: 50 mm / 2
2.8 Installation recommendations for liquids

2.8.1 General requirements

**INFORMATION!**

We recommend that you configure the device when the tank is empty.

![Figure 2-13: General Installation recommendations](image)

1. 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), or install a bypass chamber or stilling well.
3. 2.5 mm / 0.1” max. for high-dielectric constant liquids
4. Curved and conical tank bottoms. Refer to the handbook for fine adjustment of the device.
5. Beam radius (DN40 horn antenna): increments of 180 mm/m or 2.15’/ft (10°)
   - Beam radius (DN50 horn antenna or DN50 Hygienic antenna): increments of 130 mm/m or 1.55’/ft (7.5°)
   - Beam radius (DN80 horn antenna): increments of 90 mm/m or 1.1’/ft (5°)
   - Beam radius (DN100 horn antenna or DN80 Drop antenna): increments of 70 mm/m or 0.83’/ft (4°)
   - Beam radius (DN150 horn antenna): increments of 52.5 mm/m or 0.63’/ft (3°)
   - Beam radius (DN150 Drop antenna or DN200 horn antenna): increments of 35 mm/m or 0.42’/ft (2°)
2.8.2 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

For more data, refer to the Handbook.

Figure 2-14: Installation recommendations for standpipes (stilling wells and bypass chambers)

1. A stilling well solution
2. A bypass chamber solution
3. Air circulation hole
4. Level of the liquid
2.9 How to install the device on the tank

2.9.1 How to install a device with a flange connection

**Equipment needed:**
- Device
- Gasket (not supplied)
- Nuts and bolts (not supplied)
- Wrench (not supplied)

**Requirements for flange connections**

- Make sure the flange on the nozzle is level.
- Make sure that you use the applicable gasket for the flange dimensions and the process.
- Align the gasket correctly on the flange facing of the nozzle.
- Lower the antenna carefully into the tank.
- Tighten the flange bolts.

⚠️ Refer to local rules and regulations for the correct torque to apply to the bolts.

For more data, refer to the handbook.
2.9.2 How to install a device with a threaded connection

Equipment needed:
- Device
- Gasket for G 1½ connection (not supplied)
- 50 mm / 2” wrench (not supplied)

Requirements for threaded connections

- Make sure the tank connection is level.
- Make sure that you use the applicable gasket for the connection dimensions and the process.
- Align the gasket correctly.
- Lower the antenna carefully into the tank.
- Turn the threaded connection on the housing to attach the device to the process connection.
- Tighten the connection.

⚠️ Refer to local rules and regulations for the correct torque to apply to the connection.

For more data, refer to the handbook.
2.9.3 How to install a device with a hygienic connection

**INFORMATION!**
To make the cleaning of the antenna easier, attach the device to a short socket.

**BioControl®**

**Equipment needed:**
- Device with BioControl® adaptor
- Flange bolts
- Wrench (not supplied)

![Figure 2-17: BioControl® connection](image)

1. BioControl® connection on the tank
2. Flange bolts

**How to attach a device with a Biocontrol® connection**
- Make sure that the flange on the nozzle is level.
- Make sure that you use the applicable gasket for the process.
- Lower the antenna carefully into the tank.
- Tighten the flange bolts.
- Refer to local rules and regulations for the correct torque to apply to the bolts.
Tri-Clamp®

Equipment needed:
- Device with Tri-Clamp® adaptor
- Gasket (not supplied)
- Band clamp (not supplied)

Figure 2-18: Tri-Clamp® connection
① Tank socket
② Band clamp

- Make sure that the tank connection is level.
- Make sure that you use the applicable gasket for the connection dimensions and the process.
- Align the gasket correctly.
- Lower the device with the Tri-Clamp® adaptor carefully on the tank process connection.
- Attach the band clamp to the process connection.
- Tighten the band clamp.

DIN 11851

Equipment needed:
- Device with a DIN 11851 adaptor
- Gasket (not supplied)
- DIN 11851 nut

Figure 2-19: DIN 11851 connection
① Tank socket
② Nut for DIN 11851 connection
• Make sure that the tank connection is level.
• Make sure that you use the applicable gasket for the connection dimensions and the process.
• Align the gasket correctly.
• Lower the device with a DIIN 11851 adaptor carefully on the tank process connection.
• Turn the nut on the device process connection to attach the device to the tank.
• Tighten the connection.

Refer to local rules and regulations for the correct torque to apply to the connection.

**SMS**

**Equipment needed:**
• Device with a SMS adaptor
• Gasket [not supplied]
• SMS nut

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**VARIVENT®**

**Equipment needed:**
• Device with a VARIVENT® adaptor
• Clamp [not supplied]
• Make sure the tank connection is level.
• Lower the device with a VARIVENT® adaptor on the tank process connection.
• Attach the clamp to the process connection.
• Tighten the clamp.

2.9.4 How to attach antenna extensions

Horn antenna - antenna extensions

Equipment needed:
• 3 mm Allen wrench (not supplied)

For more data, refer to the handbook.

Drop antenna - antenna extensions
Equipment needed (not supplied):

- Torque wrench 200 Nm (for the H30 head of the Drop antenna sub-assembly)
- 3 mm Allen wrench

For more data, refer to the handbook.

2.9.5 How to turn or remove the signal converter

INFORMATION!

The converter turns 360°. The converter can be removed from the process connection assembly under process conditions.

CAUTION!

Drop antenna: Antenna extensions can only be attached below flanges without the PP/PTFE flange plate option.

Drop antenna: Make sure that there are not more than 5 antenna extensions attached to a device with a Drop antenna. If there are more than 5 antenna extensions, the device will not measure correctly.

CAUTION!

Drop antenna: Make sure that you put an O-ring into the groove at the top of each antenna extension.

Equipment needed (not supplied):

- Torque wrench 200 Nm (for the H30 head of the Drop antenna sub-assembly)
- 3 mm Allen wrench

INFORMATION!

The converter turns 360°. The converter can be removed from the process connection assembly under process conditions.

CAUTION!

If you remove the converter, put a cover on the wave guide hole on top of the process connection assembly.

When the converter is attached to the process connection assembly, tighten the lock screw.

Figure 2-24: How to turn or remove the signal converter

1. Tool: 5 mm Allen wrench (not supplied)
2. Cover for the wave guide hole on top of the process connection assembly (not supplied)
2.9.6 How to attach the weather protection to the device

Equipment needed:
- Device.
- Weather protection (option).
- 10 mm wrench (not supplied).

The overall dimensions of the weather protection are in "Dimensions and weight" in the handbook.

Loosen the bracket nuts on the weather protection.
- Remove the bracket.
- Lower the weather protection onto the device.
- Turn the weather protection so that the keyhole points forward.
- Attach the bracket.
- Lift the weather protection to the top of the housing support pillar.
- Hold the weather protection in the correct position and tighten the bracket nuts.
2.9.7 How to open the weather protection

Equipment needed:

- Weather protection attached to the device.
- Large slotted tip screwdriver [not supplied].

- Put a large slotted tip screwdriver into the keyhole at the front of the weather protection. Turn the screwdriver counterclockwise.
- Pull the top of weather protection up and forward.
- This will open the weather protection.

![Figure 2-26: How to open the weather protection](image)

1. Weather protection in its closed position
2. Weather protection in its open position. Minimum clearance in front of the device: 300 mm / 12".
3.1 Safety instructions

DANGER!
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

DANGER!
Observe the national regulations for electrical installations!

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

WARNING!
Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Electrical installation: outputs 1 and 2

Output 1 energizes the device and is used for HART® communication. If the device has the second current output option, use a separate power supply to energize output 2.
Procedure:

- Remove the housing terminal compartment cover ①.
- Connect the wires to the device. Obey the national electrical codes.
- Make sure that the polarity of the wires is correct.
- Attach the ground to ④ or ⑦. Both terminals are technically equivalent.

3.2.1 Non-Ex devices

Figure 3-2: Electrical connections for non-Ex devices (standard software)

- Power supply
- Resistor for HART® communication
- Output 1: 14...30 VDC for an output of 22 mA at the terminal
- Output 2: 10...30 VDC for an output of 22 mA at the terminal

Figure 3-3: Electrical connections for non-Ex devices (fast motion software option)

- Power supply
- Resistor for HART® communication
- Output 1: 14...30 VDC for a constant output of 16 mA at the terminal
- Output 2: 10...30 VDC for an output of 22 mA at the terminal

3.2.2 Devices for hazardous locations

DANGER!
For electrical data for device operation in hazardous locations, refer to the related certificates of compliance and supplementary instructions (ATEX, IECEx, FM, CSA 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).
3.3 Protection category

**INFORMATION!**
The device fulfils all requirements per protection category IP66 / IP67. It also fulfils all requirements per NEMA type 4X (housing) and type 6P (antenna).

**DANGER!**
Make sure that the cable gland is watertight.

![Diagram showing how to make the installation agree with protection category IP67](image)

- Make sure that the gaskets are not damaged.
- Make sure that the electrical cables are not damaged.
- Make sure that the electrical cables agree with the national electrical code.
- The cables are in a loop in front of the device \(^1\) so water does not go into the housing.
- Tighten the cable feedthroughs \(^2\).
- Close unused cable feedthroughs with dummy plugs \(^3\).
4.1 Technical data

**INFORMATION!**
- 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.

### Measuring system

<table>
<thead>
<tr>
<th>Measuring principle</th>
<th>2-wire loop-powered level transmitter; K-band (24...26 GHz) FMCW radar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application range</td>
<td>Level measurement of liquids, pastes and slurries</td>
</tr>
<tr>
<td>Primary measured value</td>
<td>Δf (change in frequency) between the emitted and received signal</td>
</tr>
<tr>
<td>Secondary measured value</td>
<td>Distance, level, volume, mass and reflectivity</td>
</tr>
</tbody>
</table>

### Design

<table>
<thead>
<tr>
<th>Construction</th>
<th>The measurement system consists of a measuring sensor (antenna) and a signal converter which is only available in a compact version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Options</td>
<td>Integrated LCD display with sun cover [-20...+60°C / -4...+140°F], if the ambient temperature is not in these limits, the display switches off</td>
</tr>
<tr>
<td></td>
<td>2nd current output</td>
</tr>
<tr>
<td></td>
<td>Fast motion software (5 measurements per second)</td>
</tr>
<tr>
<td></td>
<td>PTFE/PP flange plate protection (for Drop antennas without antenna extensions only)</td>
</tr>
<tr>
<td></td>
<td>Distance piece (for process connection temperature: +150...+200°C / +300...+390°F)</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Antenna purging system (supplied with a ¼ NPTF connection)</td>
</tr>
<tr>
<td>Accessories</td>
<td>Weather protection</td>
</tr>
<tr>
<td></td>
<td>Antenna extensions of 105 mm / 4.1” length (Max. length for Drop antenna versions: 525 mm / 20.7”; not available for the Hygienic antenna)</td>
</tr>
<tr>
<td></td>
<td>Discs (low-pressure flanges) with bolt hole dimensions and positions that agree with DN80...200 in PN2.5...40 or 3...8” in 150 lb for devices with the G 1½ threaded connection. Max. pressure: 1 barg / 14.5 psig at +20°C / +68°F.</td>
</tr>
<tr>
<td>Max. measuring range</td>
<td>80 m / 260 ft</td>
</tr>
<tr>
<td></td>
<td>Depends on the antenna option, dielectric constant of the product and installation type. Refer also to “Antenna selection”.</td>
</tr>
<tr>
<td>Min. tank height</td>
<td>0.2 m / 8” (1 m / 40” for hygienic antenna)</td>
</tr>
<tr>
<td>Max. change in level</td>
<td>Standard software: 1...10 m/minute / 3.3...32.8 ft/minute</td>
</tr>
<tr>
<td>Min. dead zone</td>
<td>Antenna extension length + antenna length + 0.1 m / 4” (200 mm / 8” for hygienic antenna)</td>
</tr>
</tbody>
</table>
## Beam angle of antenna

<table>
<thead>
<tr>
<th>Type</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horn DN40 / 1.5</td>
<td>±20°</td>
</tr>
<tr>
<td>Horn DN50 / 2</td>
<td>±15°</td>
</tr>
<tr>
<td>Horn / Sheet metal horn DN80 / 3</td>
<td>±10°</td>
</tr>
<tr>
<td>Horn / Sheet metal horn DN100 / 4</td>
<td>±8°</td>
</tr>
<tr>
<td>Sheet metal horn DN150 / 6</td>
<td>±6°</td>
</tr>
<tr>
<td>Sheet metal horn DN200 / 8</td>
<td>±4°</td>
</tr>
<tr>
<td>Drop DN80 / 3</td>
<td>±8°</td>
</tr>
<tr>
<td>Drop DN150 / 6</td>
<td>±4°</td>
</tr>
<tr>
<td>Hygienic DN50 / 2</td>
<td>±15°</td>
</tr>
</tbody>
</table>

## Measuring accuracy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>1 mm / 0.04&quot;</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±1 mm / ±0.04&quot;</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3 mm / ±0.12&quot;, when distance &lt; 10 m / 33 ft; ±0.03% of measured distance, when distance &gt; 10 m / 33 ft</td>
</tr>
</tbody>
</table>

## Reference conditions acc. to EN 60770

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>+20°C ±5°C / +70°F ±10°F</td>
</tr>
<tr>
<td>Pressure</td>
<td>1013 mbar ±20 mbar / 14.69 psia ±0.29 psi</td>
</tr>
<tr>
<td>Relative air humidity</td>
<td>60% ±15%</td>
</tr>
</tbody>
</table>

## Operating conditions

### Temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-40...+80°C / -40...+175°F [according to the temperature limits of the gasket material. Refer to “Materials” in this table.]</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40...+85°C / -40...+185°F</td>
</tr>
<tr>
<td>Process connection temperature</td>
<td><strong>Horn / Sheet metal horn antenna:</strong> Standard: -50...+150°C / -58...+300°F Option: -50...+200°C / -58...+390°F [the process connection temperature must agree with the temperature limits of the gasket material. Refer to “Materials” in this table.]</td>
</tr>
<tr>
<td>Drop antenna [PTFE]:</td>
<td>-50...+150°C / -58...+300°F [the process connection temperature must agree with the temperature limits of the gasket material. Refer to “Materials” in this table.]</td>
</tr>
<tr>
<td>Drop antenna [PP]:</td>
<td>-40...+100°C / -40...+210°F [the process connection temperature must agree with the temperature limits of the gasket material. Refer to “Materials” in this table.]</td>
</tr>
<tr>
<td>Hygienic antenna [PEEK]:</td>
<td>-20...+150°C / -4...+300°F [the process connection temperature must agree with the temperature limits of the gasket material. Refer to “Materials” in this table.]</td>
</tr>
</tbody>
</table>
## Pressure

<table>
<thead>
<tr>
<th>Type</th>
<th>Operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop antenna [PP]:</td>
<td>-1...16 barg / -14.5...232 psig; subject to process connection used and flange temperature</td>
</tr>
<tr>
<td>Drop antenna [PTFE]:</td>
<td>-1...40 barg / -14.5...580 psig; subject to process connection used and flange temperature</td>
</tr>
<tr>
<td>Hygienic antenna [PEEK]:</td>
<td>-1...10 barg / -14.5...145 psig; subject to process connection used and flange temperature</td>
</tr>
<tr>
<td>Horn / Sheet metal horn antenna:</td>
<td>Standard: -1...40 barg / -14.5...580 psig; Option: -1...100 barg / -14.5...1450 psig; subject to process connection used and flange temperature</td>
</tr>
</tbody>
</table>

## Other conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric constant ($\varepsilon$)</td>
<td>$\geq 1.5$</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>IEC 60068-2-6 and EN 50178 (10...57 Hz: 0.075 mm / 57...150 Hz: 1g)</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IP66/67 equivalent to NEMA type 4X (housing) and type 6P (antenna)</td>
</tr>
</tbody>
</table>

## Installation conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process connection size</td>
<td>The nominal diameter (DN) should be equal to or larger than the antenna diameter.</td>
</tr>
<tr>
<td></td>
<td>If the nominal diameter (DN) is smaller than the antenna, either:</td>
</tr>
<tr>
<td></td>
<td>– provide the means to adapt the device to a larger process connection on the tank (for example, a plate with a slot), or</td>
</tr>
<tr>
<td></td>
<td>– use the same process connection, but remove the antenna from the device before installation and fit it from inside the tank.</td>
</tr>
<tr>
<td>Process connection position</td>
<td>Make sure that there are not any obstructions directly below the process connection for the device.</td>
</tr>
<tr>
<td>Dimensions and weights</td>
<td>Refer to “Technical data: Dimensions and weights” in the Handbook.</td>
</tr>
</tbody>
</table>

## Materials

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>Standard: Polyester-coated aluminium</td>
</tr>
<tr>
<td></td>
<td>Option: Stainless steel [1.4404 / 316L]</td>
</tr>
<tr>
<td>Wetted parts, including antenna</td>
<td>Standard for Horn / Sheet metal horn antenna: Stainless steel [1.4404 / 316L]</td>
</tr>
<tr>
<td></td>
<td>Option for Horn antenna: Hastelloy® C-22® [2.4602]</td>
</tr>
<tr>
<td></td>
<td>Standard for Drop antenna: PTFE; PP</td>
</tr>
<tr>
<td></td>
<td>Option for Drop antenna: PP or PTFE flange plate protection</td>
</tr>
<tr>
<td></td>
<td>Hygienic antenna: PEEK – this material agrees with FDA regulations</td>
</tr>
<tr>
<td>Process connection</td>
<td>Standard for Horn, Sheet metal horn and Drop antennas: Stainless steel [1.4404 / 316L] – a PP or PTFE flange plate protection is also available for the Drop antenna</td>
</tr>
<tr>
<td></td>
<td>Standard for Hygienic antennas: Stainless steel [1.4404 / 316L]</td>
</tr>
<tr>
<td></td>
<td>Option: Hastelloy® C-22® [2.4602] – for Horn antennas only</td>
</tr>
<tr>
<td>Gaskets (and O-rings for the sealed antenna extension option)</td>
<td>Hygienic antenna: EPDM [-20°C...+150°C / -4°F...+300°F]; FKM/FPM [-20°C...+150°C / -4°F...+300°F]</td>
</tr>
<tr>
<td></td>
<td>PTFE Drop antenna: FKM/FPM [-40°C...+150°C / -40°F...+300°F]; Kalrez® 6375 [-20°C...+150°C / -4°F...+300°F]; EPDM [-50°C...+150°C / -58°F...+300°F]</td>
</tr>
<tr>
<td></td>
<td>PP Drop antenna: FKM/FPM [-40°C...+100°C / -40°F...+210°F]; Kalrez® 6375 [-20°C...+100°C / -4°F...+210°F]; EPDM [-50°C...+100°C / -58°F...+210°F]</td>
</tr>
<tr>
<td></td>
<td>Horn / Sheet metal horn antenna: FKM/FPM [-40°C...+200°C / -40°F...+390°F]; Kalrez® 6375 [-20°C...+200°C / -4°F...+390°F]; EPDM [-50°C...+150°C / -58°F...+300°F]</td>
</tr>
</tbody>
</table>
**Feedthrough**

- Standard: PEI (-50...+200°C / -58...+390°F) – max. range. The feedthrough temperature limits must agree with the temperature limits of the gasket material and antenna type. If the distance piece option is not attached, the maximum temperature is +150°C / +300°F.

- Option: Metaglas® (-30...+200°C / -22...+390°F – max. range. The feedthrough temperature limits must agree with the temperature limits of the gasket material and antenna type. If the distance piece option is not attached, the maximum temperature is +150°C / +300°F.)

**Weather protection [Option]**

- Stainless steel (1.4301 / 304)

### Process connections

<table>
<thead>
<tr>
<th>Thread</th>
<th>G 1½ (ISO 228); 1½ NPT (ASME B1.20.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flange version</strong></td>
<td></td>
</tr>
<tr>
<td>EN 1092-1</td>
<td>DN40...80 in PN40 [Type B1], DN100...200 in PN16 or PN40 [Type B1], DN40...150 in PN63 or PN100 [Type B1]; others on request</td>
</tr>
<tr>
<td>ASME B16.5</td>
<td>1½&quot;...8&quot; in 150 lb RF, 1½&quot;...6&quot; in 300 lb RF, 1½&quot;...4&quot; in 600 lb or 900 lb RF; 1½&quot;...2&quot; in 1500 lb RF; others on request</td>
</tr>
<tr>
<td>JIS B2220</td>
<td>40...100A in 10K; others on request</td>
</tr>
<tr>
<td>Hygienic</td>
<td>BioControl® DN50; Tri-Clamp® 2”; DIN 11851 DN50; SMS 51; VARIVENT® DN50; others on request</td>
</tr>
<tr>
<td>Other</td>
<td>Others on request</td>
</tr>
</tbody>
</table>

### Electrical connections

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Terminals output 1 – Non-Ex / Ex i / Ex d: 14...30 VDC; min./max. value for an output of 22 mA at the terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals output 2 – Ex d: 20...36 VDC; min./max. value for an output of 22 mA at the terminal</td>
<td></td>
</tr>
<tr>
<td>Terminals output 2 – Non-Ex / Ex i / Ex d: 10...30 VDC; min./max. value for an output of 22 mA at the terminal (additional power supply needed – output only)</td>
<td></td>
</tr>
<tr>
<td>Cable entry</td>
<td>M20×1.5; ½ NPT</td>
</tr>
<tr>
<td>G ½ [not for stainless steel housings]</td>
<td></td>
</tr>
<tr>
<td>Stainless steel housings: M20×1.5</td>
<td></td>
</tr>
<tr>
<td>Cable gland</td>
<td>Standard: none</td>
</tr>
<tr>
<td>Options: M20×1.5; others are available on request</td>
<td></td>
</tr>
<tr>
<td>Cable entry capacity [terminal]</td>
<td>0.5…1.5 mm²</td>
</tr>
</tbody>
</table>

### Input and output

<table>
<thead>
<tr>
<th>Current output (standard software)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal [Output 1] 4…20 mA HART® or 3.8…20.5 mA acc. to NAMUR NE 43</td>
</tr>
<tr>
<td>Output signal [Output 2 – optional] 4…20 mA [no HART® signal] or 3.8…20.5 mA acc. to NAMUR NE 43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output (fast motion software option)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal [Output 1] 16 mA HART®</td>
</tr>
<tr>
<td>Output signal [Output 2] 4…20 mA [no HART® signal] or 3.8…20.5 mA acc. to NAMUR NE 43</td>
</tr>
</tbody>
</table>
Resolution | ±3 µA
---|---
Temperature drift | Typically 50 ppm/K
Error signal | High: 22 mA; Low: 3.6 mA acc. to NAMUR NE 43

**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.

**Explosion protection**

- **ATEX**
  - KEMA 09ATEX0039 X ⑧
    - II 1 G, 1/2 G, 2 G Ex ia IIC T6...T3;
    - II 1 D, 1/2 D, 2 D Ex iaD 20 or Ex iaD 20/21 IP6X T70°C...T95°C;
    - II 1/2 G, 2 G Ex d[ia] IIC T6...T3;
    - II 1/2 D, 2 D Ex tD[iaD] A21/20 IP6X T70°C...T95°C;
    - II 3 G Ex nA II T6…T3 X

- **IECEx**
  - IECEx KEM 10.0079 X ⑧
    - Ga Ex ia IIC T6…T3; Ex iaD 20 IP6X T70°C…T 95°C;
    - Ga/Gb Ex d[ia] IIC T6…T3; Ex tD[iaD] A21/20 IP6X T70°C…T 95°C

- **FM – Dual Seal-approved ⑨**
  - NEC 500
    - XP-IS / CL I / Div. 1 / Gr. ABCD / T6-T1;
    - DIP / CL. II, III / Div. 1 / Gr. EFG / T6-T1;
    - IS / CL. I, II, III / Div. 1 / Gr. ABCDEFG / T6-T1;
    - NI / CL I / Div. 2 / Gr. ABCD / T6-T1
  - NEC 505
    - CL I / Zone 0 / AEx d[ia] / IIC / T6-T1;
    - CL I / Zone 0 / AEx ia / IIC / T6-T1;
    - CL I / Zone 2 / AEx nA[ia] / IIC / T6-T1
    - Hazardous (Classified) Locations, indoor/outdoor Type 4X and 6P, IP66, Dual Seal

- **CSA – Dual Seal-approved ⑨**
  - CEC Section 18 [Zone ratings]
    - CL. I, Zone 1, Ex d, IIC (Antenna: Zone 0) T6;
    - CL. I, Zone 0, Ex ia, IIC T6;
    - CL. I, Zone 2, Ex nA, IIC T6
  - CEC Section 18 and Annex J [Division ratings]
    - IS, CL. I, Div. 1, Gr. ABCD; CL. II, Div. 1, Gr. FG; CL. III, Div. 2 T6;
    - IS, CL. I, Div. 1, Gr. ABCD; CL. II, Gr. FG; CL. III T6
  - NEPSI GYJ111197/98 ⑧
    - Ex dia IIC T3–T6 DIP A21/A20 T A T70°C–T95°C IP6X;
    - Ex ia IIC T3–T6 DIP A21/A20 T A T70°C–T95°C IP6X

**Other standards and approvals**

- **EMC**

- **R & TTE**

- **FCC Rules**
  - Part 15

- **Industry Canada**
  - RSS-210

- **LVD**
  - Low-Voltage Directive 2006/95/EC in conjunction with EN 61010-1 [2001]
<table>
<thead>
<tr>
<th>NAMUR</th>
<th>NAMUR NE 21 Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NAMUR NE 43 Standardization of the Signal Level for the Failure Information of Digital Transmitters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CRN</th>
<th>This certification is for all Canadian provinces and territories. For more data, refer to the website.</th>
</tr>
</thead>
</table>

| Construction code | Option: NACE MR0175 / NACE MR0103 / ISO 15156 |

1. The device has a distance piece if it has the flange options that follow: DN100 PN100, DN150 PN63 or PN100, DN200 PN40, 6" in 300 lb, 3"...4" in 600 lb, 3"...4" in 900 lb, and 1½"...2" in 900 lb or 1500 lb
2. This option is not available for FM- or CSA-approved devices
3. Hastelloy® is a registered trademark of Haynes International, Inc.
4. Kalrez® is a registered trademark of DuPont Performance Elastomers L.L.C.
5. Metaglas® is a registered trademark of Herberts Industrieglas, GMBH & Co., KG
6. Tri-Clamp® is a registered trademark of Ladish Co., Inc. BioControl® is a registered trademark of Neumo-Ehrenberg-Group.
7. VARIVENT® is a registered trademark of GEA Tuchenhagen GmbH.
8. HART® is a registered trademark of the HART Communication Foundation
9. Ex ia and Ex iaD approvals are pending for the hygienic antenna option
10. This approval does not include the hygienic antenna option