



## OPTIWAVE 7300 C Technical Datasheet

### 24 GHz Non-contact Radar (FMCW) Level Meter

- For liquid applications
- The only guarantee for measuring accurately in difficult conditions
- Antenna options (Drop, Hygienic, etc.) designed for specific purposes



1	Product features	3
1.1	The radar solution for liquids	3
1.2	Applications	5
1.3	Measuring principle	7
2	Technical data	8
2.1	Technical data	8
2.2	Antenna selection	14
2.3	Guidelines for maximum operating pressure	15
2.4	Dimensions and weights	17
3	Installation	29
3.1	Intended use	29
3.2	Pre-installation requirements	29
3.3	How to prepare the tank before you install the device	30
3.3.1	Recommended mounting position	30
3.3.2	Theoretical data for hygienic applications	31
3.4	Installation recommendations for liquids	32
3.4.1	General requirements	32
3.4.2	Standpipes (stilling wells and bypass chambers)	33
3.5	How to install the device on the tank	37
3.5.1	How to install a device with a flange connection	37
3.5.2	How to install a device with a threaded connection	37
3.5.3	How to install a device with a hygienic connection	38
4	Electrical connections	41
4.1	Safety instructions	41
4.2	Electrical installation: outputs 1 and 2	41
4.2.1	Non-Ex devices	42
4.2.2	Devices for hazardous locations	42
4.3	Protection category	43
4.4	Networks	44
4.4.1	General information	44
4.4.2	Point-to-point connection	44
4.4.3	Multi-drop networks	45
5	Order information	46
5.1	Order code	46

## 1.1 The radar solution for liquids

This device is a non-contact Radar (FMCW) Level Meter for distance, level, volume and mass measurement of liquids, pastes and slurries. It gives a stabler measurement than pulse radar and is well suited to agitated process conditions. The device can operate at very low and very high process temperatures as long as the process connection temperature limits are observed.



- ① Optional touch screen with 4-button operation
- ② 2-wire level meter
- ③ One converter for all applications
- ④ Stainless steel horn, PTFE/PP Drop or PEEK Hygienic antenna
- ⑤ Antenna extension (for long nozzles)
- ⑥ Optional Metaglas® barrier
- ⑦ Rotatable housing
- ⑧ One converter for all applications

### Highlights

- $\pm 3$  mm /  $\pm 0.12$ " standard accuracy
- Optionally equipped with a 4-button touch screen display and an easy-to-use setup wizard
- Reliable measurement in difficult process conditions
- Operates up to a process connection temperature of  $+200^{\circ}\text{C}$  /  $+390^{\circ}\text{F}$  and 100 barg / 1450 psig for standard applications, and up to  $+570^{\circ}\text{C}$  /  $+1058^{\circ}\text{F}$  for molten salt applications
- Measuring range up to 80 m / 260 ft
- Horn and Drop antenna versions can be extended to suit any nozzle length
- Drop antenna for corrosive liquids (with optional PTFE/PP flange plate) or where product build-up is likely to occur
- Sealed Drop antenna extension option for pressurized tanks
- Hygienic antenna for processes where stringent hygiene standards must be obeyed
- PACTware and DTMs included as standard
- Optional second current output
- Directly-accessible graphic touchscreen/wizard (option)
- Converter rotates  $360^{\circ}$
- Triple barrier gas-tight protection available for working with dangerous gases (using pre-stressed fused glass)
- Fast motion software that can measure 5 times per second for wave height measurement

### Industries

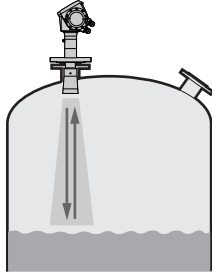
- Chemicals
- Food & Beverage
- Oil & Gas
- Petrochemicals
- Pharmaceutical
- Pulp & Paper
- Water & Wastewater

### Applications

- Tanks with agitators
- Process tanks
- Storage tanks
- Torpedo ladles (foundries)
- Wave height

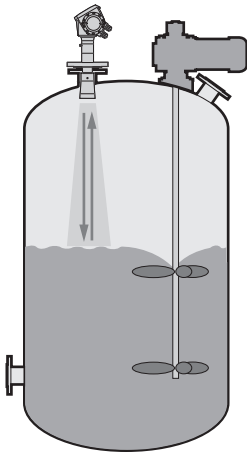
## 1.2 Applications

### 1. Level measurement of liquids in storage tanks



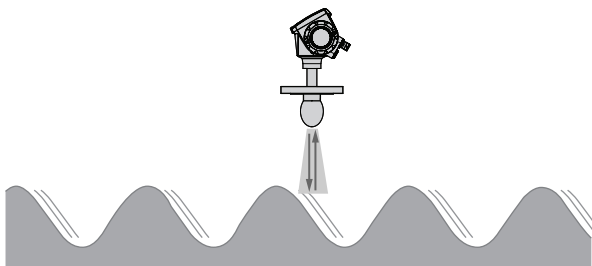
The level transmitter can measure the level of a wide range of liquid products on a large variety of installations, including LPG and LNG tanks. It does not require calibration or commissioning when installed. It can measure any liquid within the stated pressure and temperature range, and distances up to 80 m / 260 ft.

### 2. Level measurement of liquids in process tanks



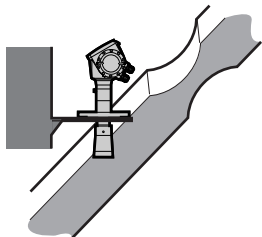
The level transmitter can measure level accurately in agitated conditions, such as near to vortices caused by agitators, and also where foam is present.

### 3. Wave height measurement



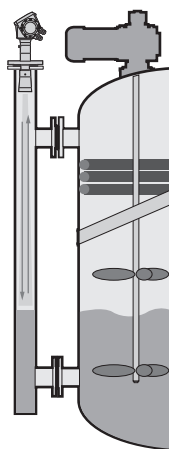
The fast motion software option permits the device to measure 5 times per second. The device can follow fast changes in the height of surface waves in oceans and lakes. This software also permits the device to monitor torpedo ladle filling operations in steel mills.

#### 4. Open channel metering or flow



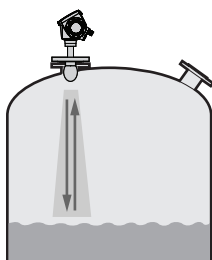
The level transmitter can measure level in an open channel and convert this measurement into flow values if the characteristics of the channel are known. This solution is the high-end alternative to ultrasonic and hydrostatic pressure transmitters.

#### 5. Measurement of liquids in a bypass chamber



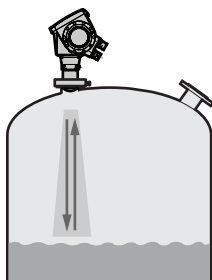
If the tank is full of obstructions such as agitators and reinforcements, we recommend installing the radar level transmitter in a bypass chamber or a stilling well. This solution is also available from us under the name BM 26 W. The BM 26 W combines the BM 26 A with the radar level transmitter. The device includes a permanent, local indication without a power supply. Please refer to the BM 26 W documentation for further information.

#### 6. Measurement of corrosive liquids with a Drop antenna



The Drop antenna option combines a relatively small radar beam for more precise measurement and a shape that avoids product build-up. If the tank contains corrosive liquids such as acids and alkaline solutions, we recommend the DN80 / 3" Drop antenna with the PTFE or PP flange plate protection option.

#### 7. Measurement of liquids with a Hygienic antenna



The Hygienic antenna option is made of materials that agree with FDA regulations. It is suitable for level measurement in processes that require hygienic equipment (such as the food, beverage and pharmaceutical industries).

### 1.3 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 tank height and measuring distance.

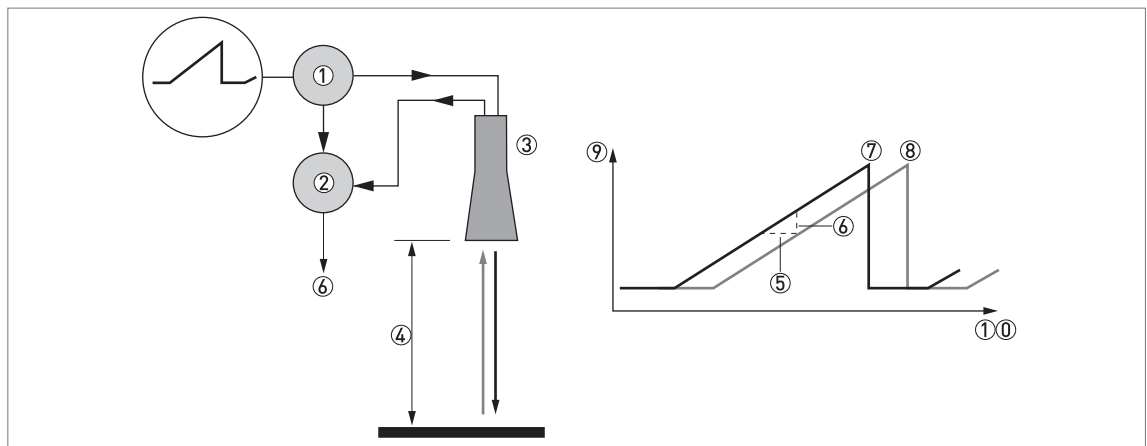


Figure 1-1: Measuring principle of FMCW radar

- 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

## 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 (Download Center).*

### Measuring system

Measuring principle	2-wire loop-powered level transmitter; K-band (24...26 GHz) FMCW radar
Application range	Level measurement of liquids, pastes and slurries
Primary measured value	$\Delta f$ (change in frequency) between the emitted and received signal
Secondary measured value	Distance, level, volume, mass and reflectivity

### Design

Construction	The measurement system consists of a measuring sensor (antenna) and a signal converter which is only available in a compact version
Options	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
	2nd current output
	Fast motion software (5 measurements per second)
	PTFE/PP flange plate protection (for Drop antennas without antenna extensions only)
	Distance piece (for process connection temperature: +150...+200°C / +300...+390°F) ①
Antenna purging system (supplied with a ¼ NPTF connection)	
Accessories	Weather protection
	Antenna extensions of 105 mm / 4.1" length (Max. length for Drop antenna versions: 525 mm / 20.7"; not available for the Hygienic antenna)
	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.
Max. measuring range	80 m / 260 ft
	Depends on the antenna option, dielectric constant of the product and installation type. Refer also to "Antenna selection".
Min. tank height	0.2 m / 8" (1 m / 40" for hygienic antenna)
Max. change in level	Standard software: 1...10 m/minute / 3.3...32.8 ft/minute
	Fast motion software: The device uses strongest signal in the measuring range to calculate the distance for each measurement cycle. The menu item for tracing velocity is available, but the function is disabled and changes have no effect on the performance of the device.
Min. dead zone	Antenna extension length + antenna length + 0.1 m / 4" (200 mm / 8" for the hygienic antenna)



Beam angle of antenna	Horn DN40 / 1.5": 20°
	Horn DN50 / 2": 15°
	Horn / Sheet metal horn DN80 / 3": 10°
	Horn / Sheet metal horn DN100 / 4": 8°
	Sheet metal horn DN150 / 6": 6°
	Sheet metal horn DN200 / 8": 4°
	Drop DN80 / 3": 8°
	Drop DN150 / 6": 4°
Hygienic DN50 / 2": 15°	
<b>Display and user interface</b>	
Display	LCD display
	9 lines, 160 × 160 pixels in 8-step grayscale with 4-button keypad
Interface languages	English, German, French, Italian, Spanish, Portuguese, Japanese, Simplified Chinese and Russian

### Measuring accuracy

Resolution	1 mm / 0.04"
Repeatability	±1 mm / ±0.04"
Accuracy	±3 mm / ±0.12", when distance < 10 m / 33 ft; ±0.03% of measured distance, when distance > 10 m / 33 ft
<b>Reference conditions acc. to EN 60770</b>	
Temperature	+20°C ±5°C / +70°F ±10°F
Pressure	1013 mbara ±20 mbar / 14.69 psia ±0.29 psi
Relative air humidity	60% ±15%
Target	Metal plate in an anechoic chamber

### Operating conditions

<b>Temperature</b>	
Ambient temperature	-40...+80°C / -40...+175°F (according to the temperature limits of the gasket material. Refer to "Materials" in this table.) Ex: see supplementary operating instructions or approval certificates
Storage temperature	-40...+85°C / -40...+185°F
Process connection temperature	<b>Horn / Sheet metal horn antenna:</b> 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.) Ex: see supplementary operating instructions or approval certificates
	<b>Drop antenna (PTFE):</b> -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.) Ex: see supplementary operating instructions or approval certificates
	<b>Drop antenna (PP):</b> -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.) Ex: see supplementary operating instructions or approval certificates
	<b>Hygienic antenna (PEEK):</b> -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.) Ex: see supplementary operating instructions or approval certificates

Pressure	
Operating pressure	<b>Drop antenna (PP):</b> -1...16 barg / -14.5...232 psig; subject to process connection used and flange temperature
	<b>Drop antenna (PTFE):</b> -1...40 barg / -14.5...580 psig; subject to process connection used and flange temperature
	<b>Hygienic antenna (PEEK):</b> -1...10 barg / -14.5...145 psig; subject to process connection used and flange temperature
	<b>Horn / Sheet metal horn antenna:</b> Standard: -1...40 barg / -14.5...580 psig; Option: -1...100 barg / -14.5...1450 psig; subject to process connection used and flange temperature
Other conditions	
Dielectric constant $\{\epsilon_r\}$	$\geq 1.5$
Vibration resistance	IEC 60068-2-6 and EN 50178 (10...57 Hz: 0.075 mm / 57...150 Hz: 1g)
Ingress protection	IP66/67 equivalent to NEMA type 4X (housing) and type 6P (antenna)

### Installation conditions

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

### Materials

Housing	Standard: Polyester-coated aluminium
	Option: Stainless steel (1.4404 / 316L) ②
Wetted parts, including antenna	Standard for Horn / Sheet metal horn antenna: Stainless steel (1.4404 / 316L)
	Option for Horn antenna: Hastelloy® C-22® (2.4602) ③
	Standard for Drop antenna: PTFE; PP
	Option for Drop antenna: PP or PTFE flange plate protection
	Hygienic antenna: PEEK – this material agrees with FDA regulations
Process connection	Standard for Horn, Sheet metal horn and Drop antennas: Stainless steel (1.4404 / 316L) – a PP or PTFE flange plate protection option is also available for the Drop antenna Standard for Hygienic antenna: Stainless steel (1.4404 / 316L)
	Option: Hastelloy® C-22® (2.4602) – for Horn antennas only
Gaskets (and O-rings for the sealed antenna extension option)	<b>Hygienic antenna:</b> EPDM (-20°C...+150°C / -4...+300°F); FKM/FPM (-20...+150°C / -4...+300°F)
	<b>PTFE Drop antenna:</b> FKM/FPM (-40...+150°C / -40...+300°F); Kalrez® 6375 (-20...+150°C / -4...+300°F); EPDM (-50°C...+150°C / -58...+300°F) ④
	<b>PP Drop antenna:</b> FKM/FPM (-40...+100°C / -40...+210°F); Kalrez® 6375 (-20...+100°C / -4...+210°F); EPDM (-40°C...+100°C / -40...+210°F) ④
	<b>Horn / Sheet metal horn antenna:</b> FKM/FPM (-40...+200°C / -40...+390°F); Kalrez® 6375 (-20...+200°C / -4...+390°F); EPDM (-50°C...+150°C / -58...+300°F) ④

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.) ⑤
Weather protection (Option)	Stainless steel (1.4301 / 304)

### Process connections

Thread	G 1½ (ISO 228); 1½ NPT (ASME B1.20.1)
<b>Flange version</b>	
EN 1092-1	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 Optional flange facing: Types C, D, E and F
ASME B16.5	1½"...8" in 150 lb RF, 1½"...6" in 300 lb RF, 1½"...4" in 600 lb or 900 lb RF; 1½"...2" in 1500 lb RJ; others on request Optional flange facing: RJ (Ring Joint)
JIS B2220	40...100A in 10K; others on request
Hygienic	BioControl® DN50; Tri-Clamp® 2"; DIN 11851 DN50; SMS 51; VARIVENT® DN50; others on request ⑥
Other	Others on request

### Electrical connections

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

### Input and output

<b>Current output (standard software)</b>	
Output signal (Output 1)	4...20 mA HART® or 3.8...20.5 mA acc. to NAMUR NE 43 ⑦
Output signal (Output 2 – optional)	4...20 mA (no HART® signal) or 3.8...20.5 mA acc. to NAMUR NE 43
<b>Current output (fast motion software option)</b>	
Output signal (Output 1)	16 mA HART® ⑦
Output signal (Output 2)	4...20 mA (no HART® signal) or 3.8...20.5 mA acc. to NAMUR NE 43

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.
<b>Explosion protection</b>	
ATEX KEMA 04ATEX1218 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 06.0025 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	<b>NEC 500</b>
	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
	<b>NEC 505</b>
	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	<b>CEC Section 18 (Zone ratings)</b>
	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
	<b>CEC Section 18 and Annex J (Division ratings)</b>
	XP-IS, Cl. I, Div. 2, Gr. ABCD; Cl. II, Div. 2, Gr. FG; Cl. III, Div. 2 T6;
	IS, Cl. I, Div. 1, Gr. ABCD; Cl. II, Gr. FG; Cl. III T6
NEPSI GYJ111193/94 ⑨	Ex dia IIC T3~T6 DIP A21/A20 T <sub>A</sub> T70°C~T95°C IP6X;
	Ex ia IIC T3~T6 DIP A21/A20 T <sub>A</sub> T70°C~T95°C IP6X
DNV / INMETRO DNV 12.0043 X ⑨	Ex ia IIC T6...T3 Ga; Ex ia IIIC T70°C...T95°C Da IP6X;
	Ex d [ia Ga] IIC T6...T3 Ga/Gb; Ex tb [ia Da] IIIC T70°C...T95°C Db IP6X
KGS 11-GA4B0-0324X 11-GA4B0-0329X ⑨	Ex ia IIC T6~T3; Ex iaD 20 IP6X T70°C~T95°C;
	Ex d[ia] IIC T6~T3; Ex tD[iaD] A21/20 IP6X T70°C~T95°C

Other standards and approvals	
EMC	Electromagnetic Compatibility Directive 2004/108/EC in conjunction with EN 61326-1 (2013)
R & TTE	Radio Equipment and Telecommunications Terminal Equipment Directive 1999/5/EC in conjunction with ETSI EN 302 372-2 (2011) and ETSI EN 302 729-2 (2011)
FCC Rules	Part 15
Industry Canada	RSS-210
LVD	Low-Voltage Directive 2006/95/EC in conjunction with EN 61010-1 (2001)
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
WHG Z-65.16-425	In conformity with the German Federal Water Act, §9
CRN	This certification is for all Canadian provinces and territories. For more data, refer to the website.
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. VARIVENT® is a registered trademark of GEA Tuchenhausen GmbH.
- ⑦ HART® is a registered trademark of the HART Communication Foundation
- ⑧ Ex ia and Ex iaD approvals are pending for the hygienic antenna option
- ⑨ This approval does not include the hygienic antenna option

## 2.2 Antenna selection

The graphs below show which antenna to select for the application based on:

- D, the measuring range,
- $\epsilon_r$ , is the dielectric constant of the product being measured

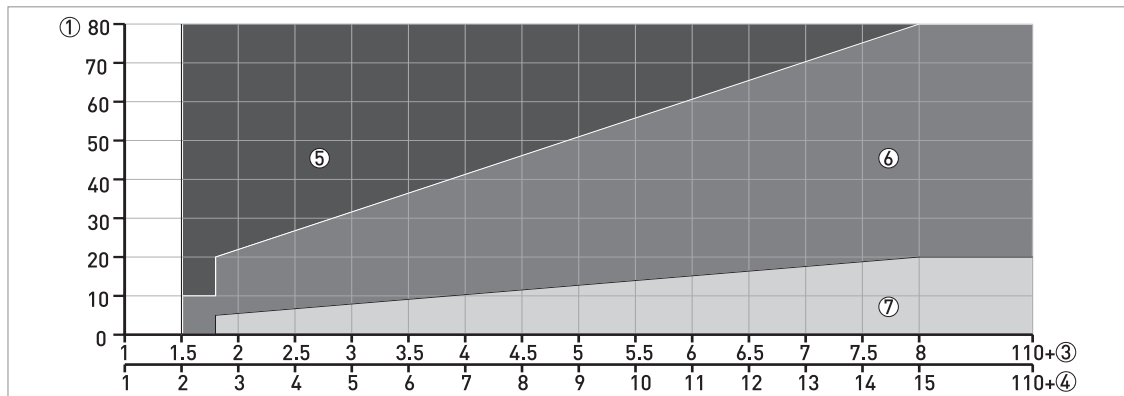


Figure 2-1: Selection of antenna for liquid applications (graph of distance in m against  $\epsilon_r$ )

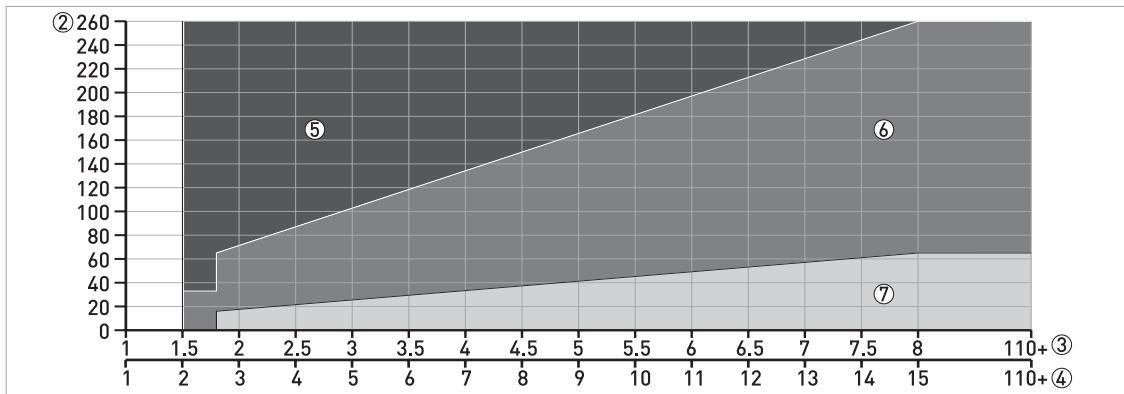


Figure 2-2: Selection of antenna for liquid applications (graph of distance in ft against  $\epsilon_r$ )

- ① Distance, D [m]
- ② Distance, D [ft]
- ③ Dielectric constant ( $\epsilon_r$ ) range for storage/still well applications
- ④ Dielectric constant ( $\epsilon_r$ ) range for process/agitator applications
- ⑤ DN80, DN100, DN150 or DN200 Horn antenna with a still well, or DN150 or DN200 Horn antenna without a still well
- ⑥ DN80, DN100, DN150 or DN200 Horn antenna with or without a still well, or DN80 or DN150 Drop antenna without a still well
- ⑦ DN40, DN50, DN80, DN100, DN150 or DN200 Horn antenna with or without a still well, DN80 or DN150 Drop antenna without a still well or Hygienic antenna

## 2.3 Guidelines for maximum operating pressure

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

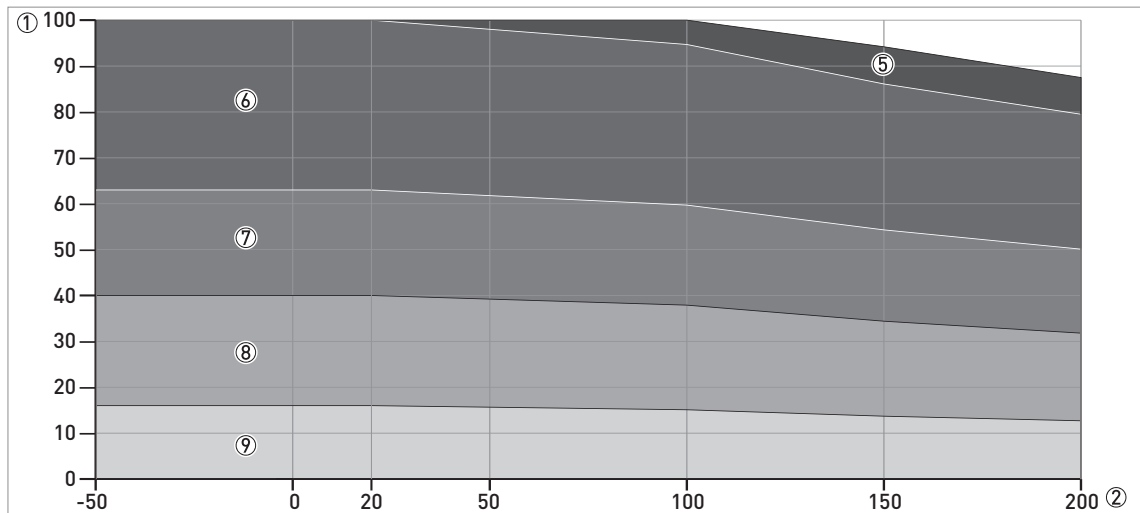


Figure 2-3: Pressure / temperature de-rating (EN 1092-1), flange and threaded connection, in °C and barg

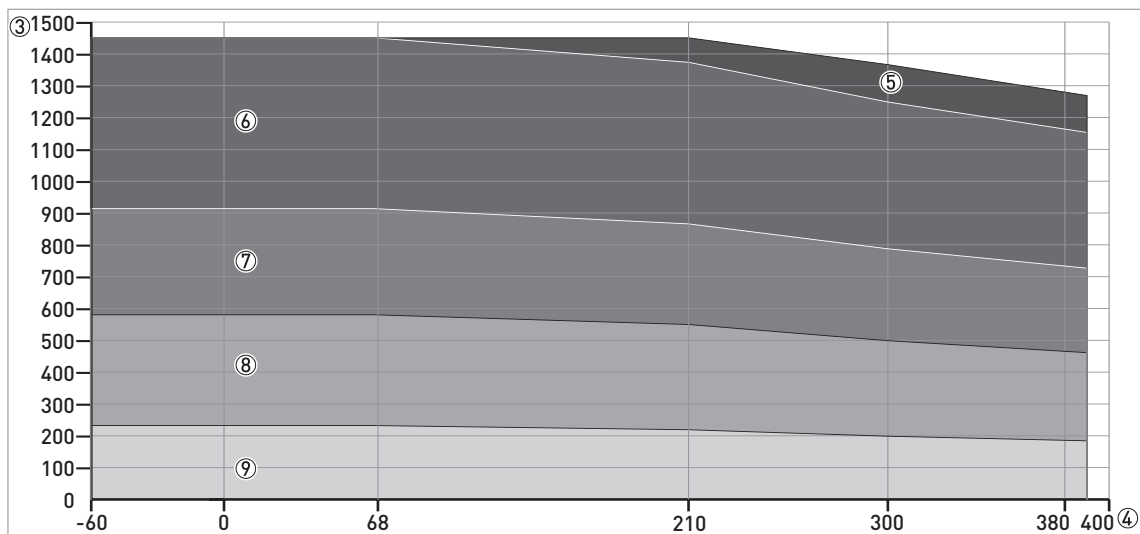


Figure 2-4: Pressure / temperature de-rating (EN 1092-1), flange and threaded connections, in °F and psig

- ① p [barg]
- ② T [°C]
- ③ p [psig]
- ④ T [°F]
- ⑤ Threaded connection, G (ISO 228-1)
- ⑥ Flange connection, PN100
- ⑦ Flange connection, PN63
- ⑧ Flange connection, PN40
- ⑨ Flange connection, PN16

**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.

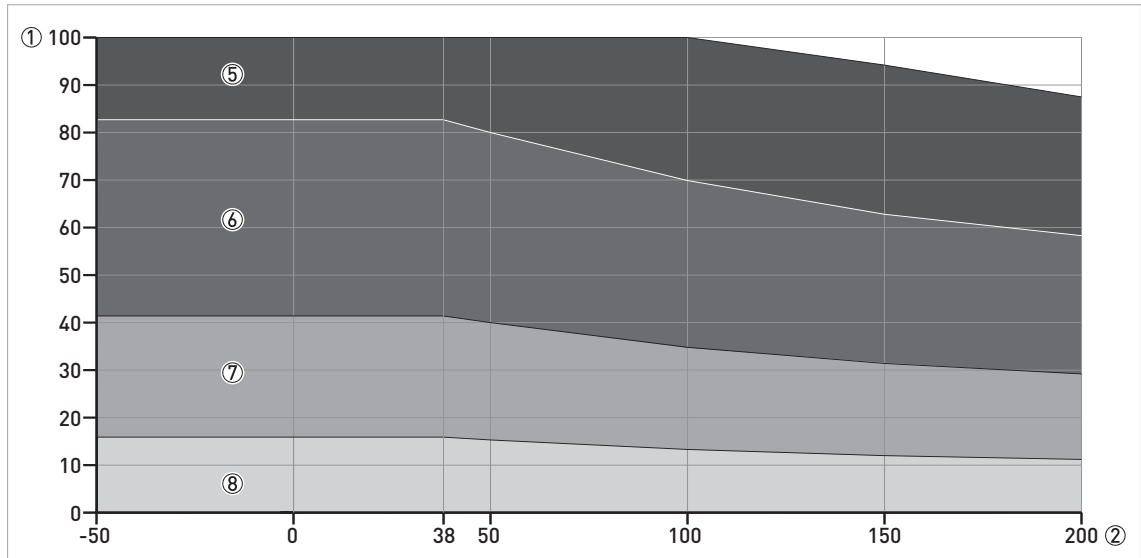


Figure 2-5: Pressure / temperature de-rating (ASME B16.5), flange and threaded connections, in °C and barg

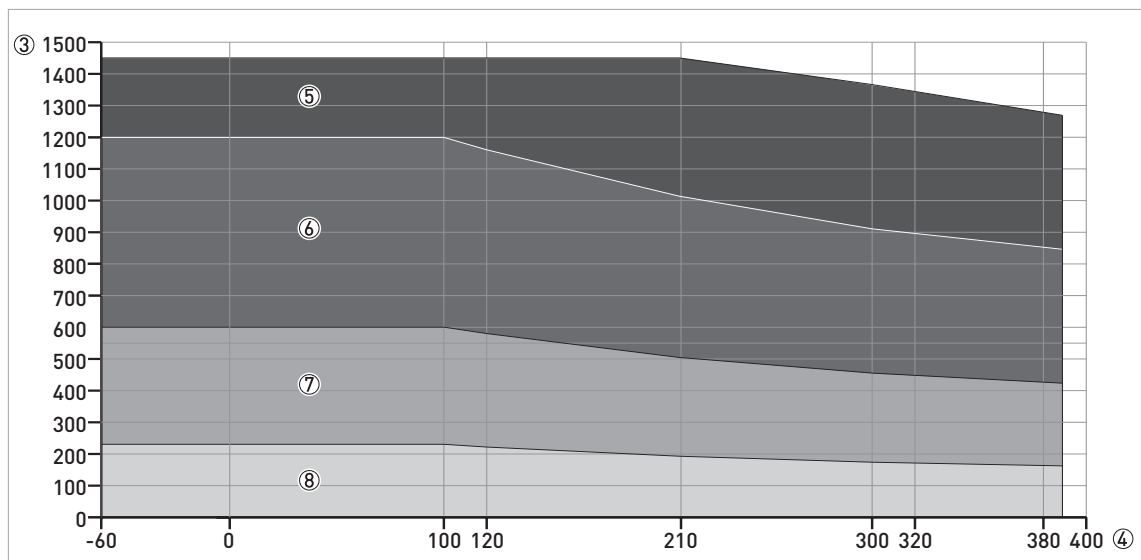


Figure 2-6: Pressure / temperature de-rating (ASME B16.5), flange and threaded connections, in °F and psig

- ① p [barg]
- ② T [°C]
- ③ p [psig]
- ④ T [°F]
- ⑤ Flange connection, Class 900 and Class 1500. Threaded connection, NPT (ASME B1.20.1).
- ⑥ Flange connection, Class 600
- ⑦ Flange connection, Class 300
- ⑧ Flange connection, Class 150



## 2.4 Dimensions and weights

### Housing

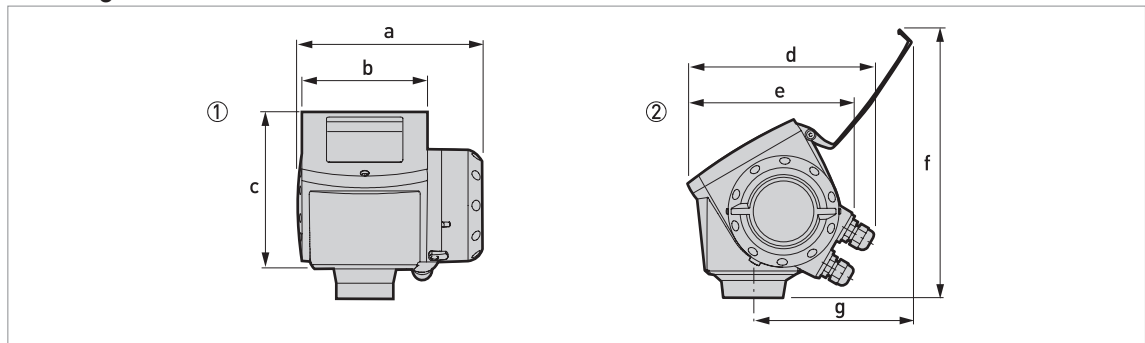


Figure 2-7: Housing dimensions

- ① Housing front view
- ② Housing side view

### Dimensions and weights in mm and kg

	Dimensions [mm]							Weights [kg]
	a	b	c	d	e	f	g	
Housing	180	122	158.5	182 ①	167	277	155	3.3

① If fitted with standard cable glands

### Dimensions and weights in inches and lb

	Dimensions [inches]							Weights [lb]
	a	b	c	d	e	f	g	
Housing	7.1	4.8	6.2	7.2 ①	6.5	10.9	6.1	7.3

① If fitted with standard cable glands

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

Weather protection

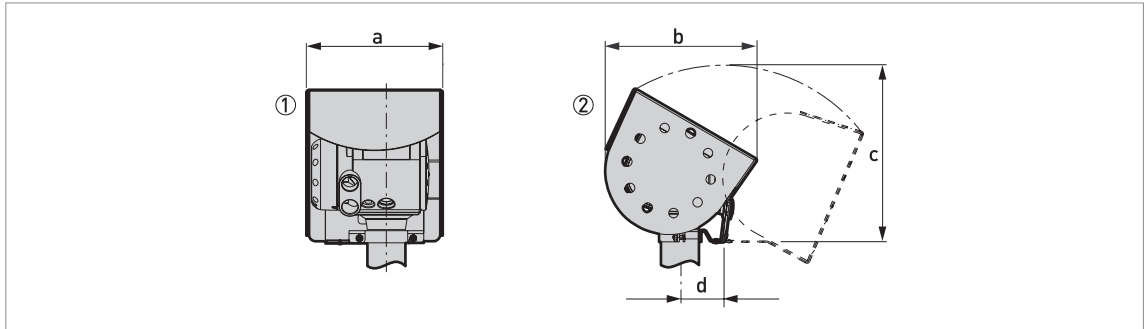


Figure 2-8: Dimensions of the weather protection option

- ① Weather protection, back view
- ② Weather protection, left side view

Dimensions and weights in mm and kg

	Dimensions [mm]				Weights [kg]
	a	b	c	d	
Weather protection	208	231.5	268 ①	66	2.9

① Radius

Dimensions and weights in inches and lb

	Dimensions [inches]				Weights [lb]
	a	b	c	d	
Weather protection	8.2	9.1	10.6 ①	2.6	6.4

① Radius

## DN40/1.5" horn antenna versions

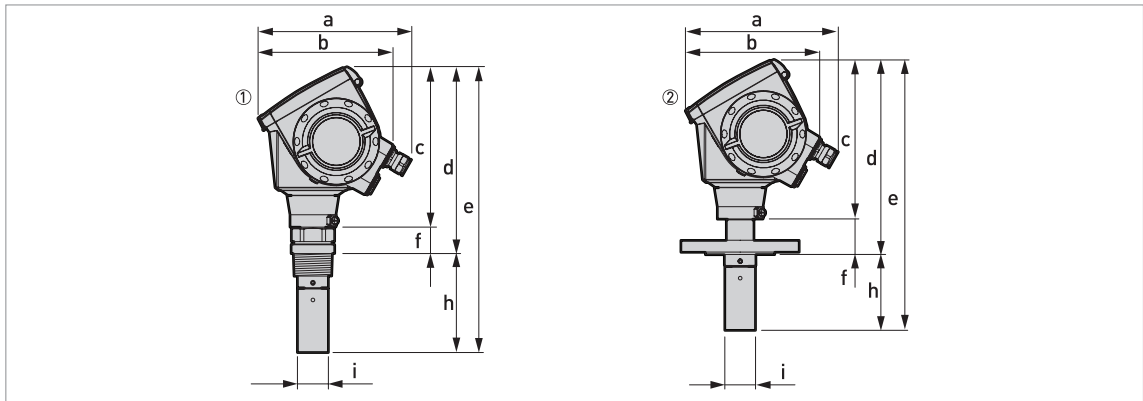


Figure 2-9: DN40 or 1.5" horn antenna versions

- ① DN40/1.5" horn antenna with G 1½ or 1½ NPT thread connection  
 ② DN40/1.5" horn antenna with flange connection

## Dimensions and weights in mm and kg

	Dimensions [mm]								Weights [kg]
	a	b	c	d	e	f	h	Øi	
Thread connection	194 ①	170	201	233	359	32	126 ②	39	5.1
Flange connection	194 ①	170	201	246 ③	342 ③	45 ③	96 ②	39	6.6...14.1

① If fitted with standard cable glands

② Additional antenna extensions of Ø39 × length 105 mm are available

③ With ¼ NPTF purge connection option: add 17 mm to this dimension. With distance piece option: add 71 mm to this dimension.

## Dimensions and weights in inches and lb

	Dimensions [inches]								Weights [lb]
	a	b	c	d	e	f	h	Øi	
Thread connection	7.6 ①	6.7	7.9	9.2	14.1	1.3	4.9 ②	1.5	11.2
Flange connection	7.6 ①	6.7	7.9	9.7 ③	13.5 ③	1.8 ③	3.8 ②	1.5	14.4...31.1

① If fitted with standard cable glands

② Additional antenna extensions of Ø1.5 × length 4.1" are available

③ With ¼ NPTF purge connection option: add 0.7" to this dimension. With distance piece option: add 2.8" to this dimension.

DN50/2" horn antenna versions

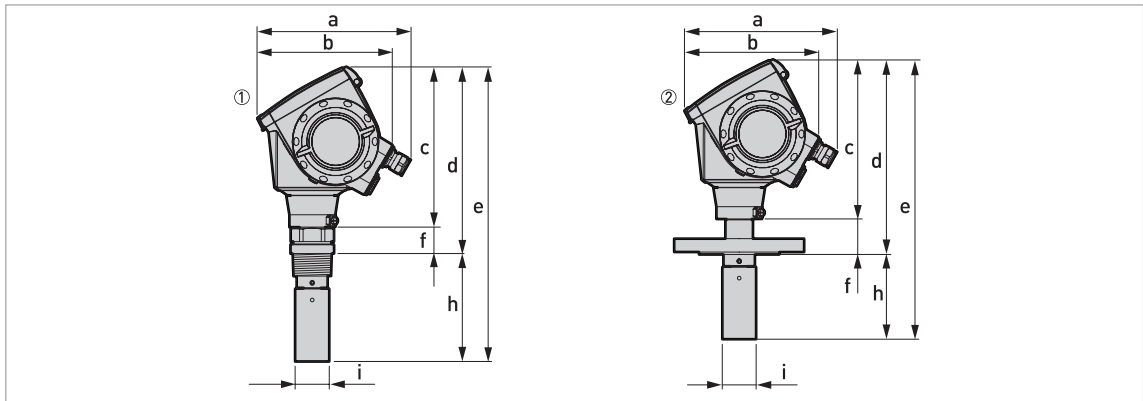


Figure 2-10: DN50/2" horn antenna versions

- ① DN50/2" horn antenna with G 1 1/2 or 1 1/2 NPT thread connection
- ② DN50/2" horn antenna with flange connection

Dimensions and weights in mm and kg

	Dimensions [mm]								Weight [kg]
	a	b	c	d	e	f	h	Øi	
Thread connection	182 ①	167	201	234	370	32	136 ②	43	5.3
Flange connection	182 ①	167	201	246 ③	353 ③	45 ③	107 ②	43	6.8...14.3

- ① If fitted with standard cable glands
- ② Additional antenna extensions of Ø39 × length 105 mm are available
- ③ With 1/4 NPTF purge connection option: add 17 mm to this dimension. With distance piece option: add 71 mm to this dimension.

Dimensions and weights in inches and lb

	Dimensions [inches]								Weights [lb]
	a	b	c	d	e	f	h	Øi	
Thread connection	7.2 ①	6.5	7.9	9.2	14.5	1.3	5.3 ②	1.7	11.6
Flange connection	7.2 ①	6.5	7.9	9.7 ③	13.9 ③	1.8 ③	4.2 ②	1.7	14.8...31.5

- ① If fitted with standard cable glands
- ② Additional antenna extensions of Ø1.5 × length 4.1" are available
- ③ With 1/4 NPTF purge connection option: add 0.7" to this dimension. With distance piece option: add 2.8" to this dimension.

## DN80/3" horn antenna versions

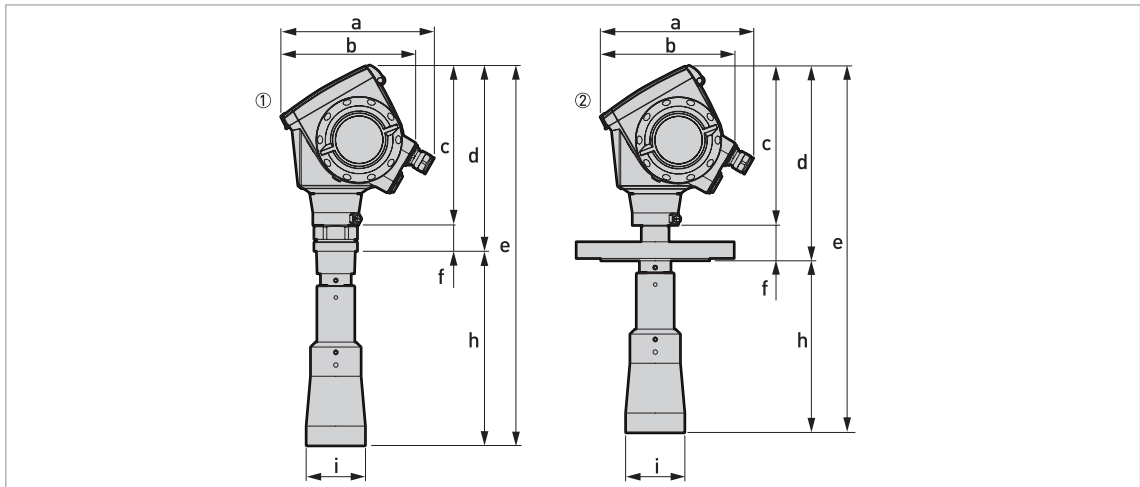


Figure 2-11: DN80/3" horn antenna versions

- ① DN80/3" horn antenna with G 1½ or 1½ NPT thread connection  
 ② DN80/3" horn antenna with flange connection

## Dimensions and weights in mm and kg

	Dimensions [mm]								Weights [kg]
	a	b	c	d	e	f	h	Øi	
Thread connection	182 ①	167	201	233	479	32	246 ②	75	6.8
Flange connection	182 ①	167	201	246 ③	463 ③	45 ③	217 ②	75	11.1...18.9

① If fitted with standard cable glands

② Additional antenna extensions of Ø39 × length 105 mm are available

③ With ¼ NPTF purge connection option: add 17 mm to this dimension. With distance piece option: add 71 mm to this dimension.

## Dimensions and weights in inches and lb

	Dimensions [inches]								Weights [lb]
	a	b	c	d	e	f	h	Øi	
Thread connection	7.2 ①	6.5	7.9	9.2	18.9	1.3	9.7 ②	3	15
Flange connection	7.2 ①	6.5	7.9	9.7 ③	18.2 ③	1.8 ③	8.5 ②	3	24.4...41.5

① If fitted with standard cable glands

② Additional antenna extensions of Ø1.5 × length 4.1" are available

③ With ¼ NPTF purge connection option: add 0.7" to this dimension. With distance piece option: add 2.8" to this dimension.

## DN100/4" horn antenna versions

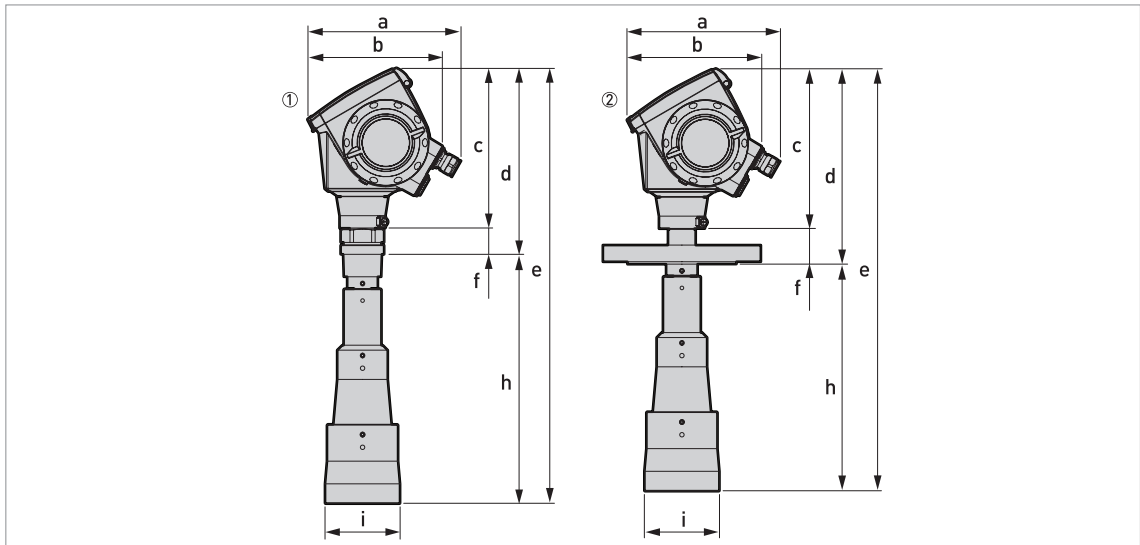


Figure 2-12: DN100/4" horn antenna versions

- ① DN100/4" horn antenna with G 1½ or 1½ NPT thread connection
- ② DN100/4" horn antenna with flange connection

## Dimensions and weights in mm and kg

	Dimensions [mm]								Weights [kg]
	a	b	c	d	e	f	h	Øi	
Thread connection	182 ①	167	201	233	548	32	315 ②	95	7.2
Flange connection	182 ①	167	201	246 ③	532 ③	45 ③	286 ②	95	11.6...28.2

① If fitted with standard cable glands

② Additional antenna extensions of Ø39 × length 105 mm are available

③ With ¼ NPTF purge connection option: add 17 mm to this dimension. With distance piece option: add 71 mm to this dimension.

## Dimensions and weights in inches and lb

	Dimensions [inches]								Weights [lb]
	a	b	c	d	e	f	h	Øi	
Thread connection	7.2 ①	6.5	7.9	9.2	21.6	1.3	12.4 ②	3.7	15.8
Flange connection	7.2 ①	6.5	7.9	9.7 ③	20.9 ③	1.8 ③	11.3 ②	3.7	25.6...62.2

① If fitted with standard cable glands

② Additional antenna extensions of Ø1.5 × length 4.1" are available

③ With ¼ NPTF purge connection option: add 0.7" to this dimension. With distance piece option: add 2.8" to this dimension.

## Sheet metal horn antenna versions

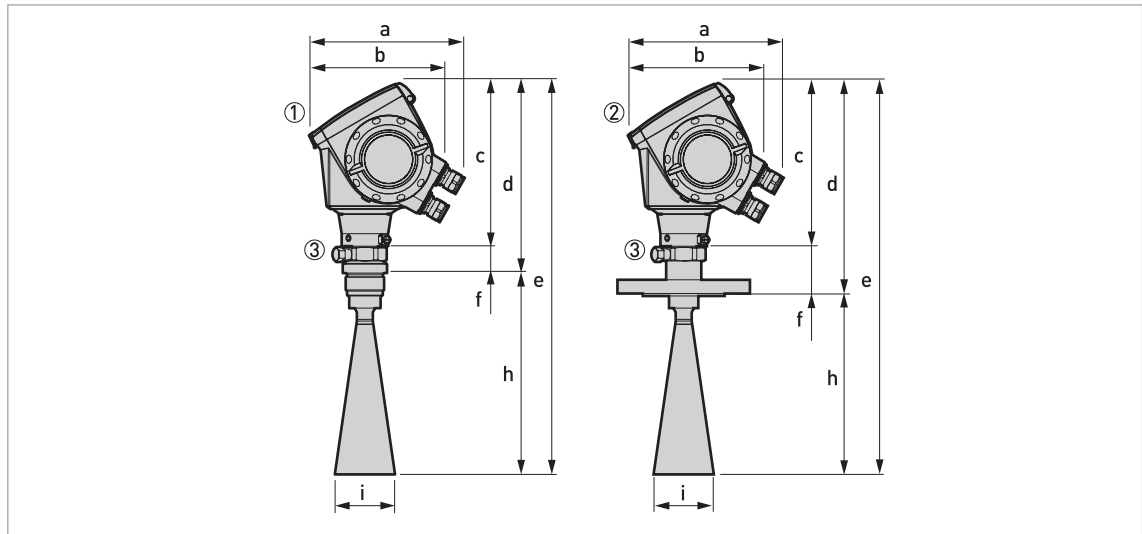


Figure 2-13: DN80/3", DN100/4", DN150/6" and DN200/8" sheet metal horn antenna versions

- ① Sheet metal horn antenna (DN80/3", DN100/4", DN150/6" or DN200/8") with G 1½ or 1½ NPT thread connection
- ② Sheet metal horn antenna (DN80/3", DN100/4", DN150/6" or DN200/8") with flange connection
- ③ Antenna purging system option (supplied with ¼ NPTF connection)



## Dimensions and weights in mm and kg

		Dimensions [mm]								Weights [kg]
		a	b	c	d	e	f	h	Øi	
Thread connection	DN80/3"	182 ①	167	201	234	483	33	249 ②	75	4.9
	DN100/4"	182 ①	167	201	234	552	33	318 ②	95	5.1
	DN150/6"	182 ①	167	201	234	720	33	486 ②	144	5.5
	DN200/8"	182 ①	167	201	234	878	33	644 ②	190	6.1
Flange connection	DN80/3"	182 ①	167	201	246 ③	467 ③	45 ③	221 ②	75	9.2
	DN100/4"	182 ①	167	201	246 ③	536 ③	45 ③	290 ②	95	9.5
	DN150/6"	182 ①	167	201	246 ③	704 ③	45 ③	458 ②	144	14.4
	DN200/8"	182 ①	167	201	246 ③	862 ③	45 ③	616 ②	190	15.0

① If fitted with standard cable glands

② Additional antenna extensions of Ø39 × length 105 mm are available

③ With ¼ NPTF purge connection option: add 17 mm to this dimension. With distance piece option: add 71 mm to this dimension.

## Dimensions and weights in inches and lb

		Dimensions [inches]								Weights [lb]
		a	b	c	d	e	f	h	Øi	
Thread connection	DN80/3"	7.2 ①	6.5	7.9	9.2	19.0	1.3	9.8 ②	3.0	10.8
	DN100/4"	7.2 ①	6.5	7.9	9.2	21.7	1.3	12.5 ②	3.7	11.1
	DN150/6"	7.2 ①	6.5	7.9	9.2	28.3	1.3	19.1 ②	5.7	12.2
	DN200/8"	7.2 ①	6.5	7.9	9.2	34.6	1.3	25.4 ②	7.5	13.4
Flange connection	DN80/3"	7.2 ①	6.5	7.9	9.7 ③	18.4 ③	1.8 ③	8.7 ②	3.0	20.2
	DN100/4"	7.2 ①	6.5	7.9	9.7 ③	21.1 ③	1.8 ③	11.4 ②	3.7	20.8
	DN150/6"	7.2 ①	6.5	7.9	9.7 ③	27.7 ③	1.8 ③	18.0 ②	5.7	31.6
	DN200/8"	7.2 ①	6.5	7.9	9.7 ③	33.9 ③	1.8 ③	24.3 ②	7.5	32.9

① If fitted with standard cable glands

② Additional antenna extensions of Ø1.5 × length 4.1" are available

③ With ¼ NPTF purge connection option: add 0.7" to this dimension. With distance piece option: add 2.8" to this dimension.

DN80/3" Drop antenna versions

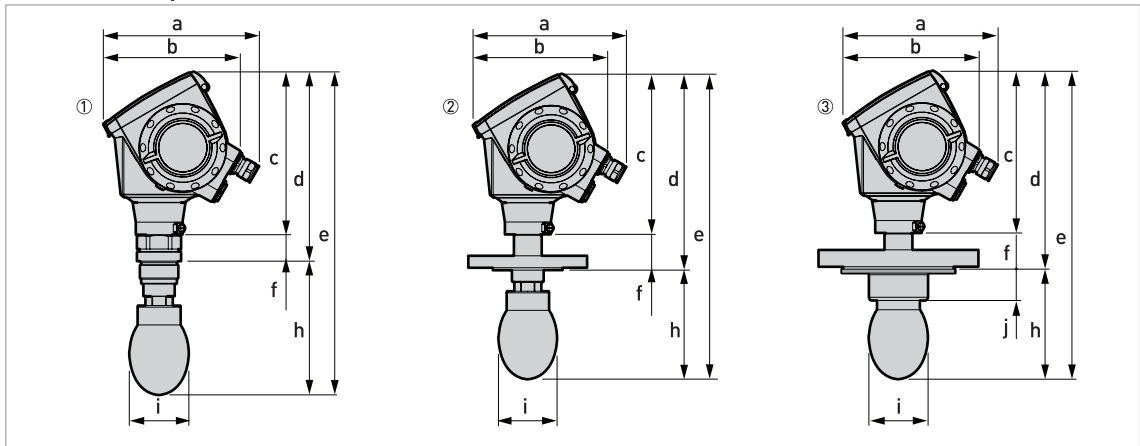


Figure 2-14: DN80/3" Drop antenna versions

- ① DN80/3" Drop antenna with G 1½ or 1½ NPT thread connection
- ② DN80/3" Drop antenna with flange connection
- ③ DN80/3" Drop antenna, with PP or PTFE flange plate protection option

Dimensions and weights in mm and kg

	Dimensions [mm]									Weights [kg]
	a	b	c	d	e	f	h	Øi	j	
Thread connection	182 ①	167	201	234	399	33	165 ②	74	—	5.7...6.1
Flange connection	182 ①	167	201	246	383	45	137 ②	74	—	6.3...26
Flange connection with flange plate protection option	182 ①	167	201	246	383	45	137	74	39	6.6...26.8

① If fitted with standard cable glands

② Additional antenna extensions of Ø39 × length 105 mm are available. Do not attach more than 5 antenna extensions.

Dimensions and weights in inches and lb

	Dimensions [inches]									Weights [lb]
	a	b	c	d	e	f	h	Øi	j	
Thread connection	7.2 ①	6.5	7.9	9.2	15.7	1.3	6.5 ②	2.9	—	12.6...13.4
Flange connection	7.2 ①	6.5	7.9	9.7	15.1	1.8	5.4 ②	2.9	—	13.9...57.3
Flange connection with flange plate protection option	7.2 ①	6.5	7.9	9.7	15.1	1.8	5.4	2.9	1.5	13.9...59.1

① If fitted with standard cable glands

② Additional antenna extensions of Ø1.5 × length 4.1" available. Do not attach more than 5 antenna extensions.

## DN150/6" Drop antenna versions (PP material option only)

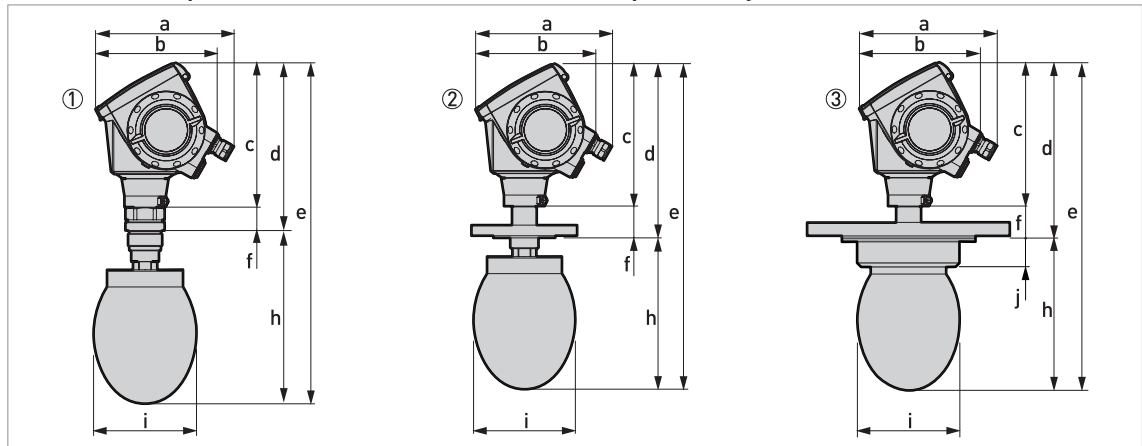


Figure 2-15: DN150/6" Drop antenna versions (PP material option only)

- ① DN150/6" Drop antenna with flange connection
- ② DN150/6" Drop antenna with thread connection
- ③ DN150/6" Drop antenna, with flange plate protection option

## Dimensions and weights in mm and kg

	Dimensions [mm]										Weights [kg]
	a	b	c	d	e	f	h	Øi	j	k	
Thread connection	182 ①	167	201	234	476	33	242 ②	144	—	—	7.4
Flange connection	182 ①	167	201	246	460	45	214 ②	144	—	—	8...27.3
Flange connection with flange plate protection option	182 ①	167	201	246	460	45	214	144	39	—	27.6

① If fitted with standard cable glands

② Additional antenna extensions of Ø39 × length 105 mm are available. Do not attach more than 5 antenna extensions.

## Dimensions and weights in inches and lb

	Dimensions [inches]										Weights [lb]
	a	b	c	d	e	f	h	Øi	j	k	
Thread connection	7.2 ①	6.5	7.9	9.2	18.7	1.3	9.5 ②	5.7	—	—	16.3
Flange connection	7.2 ①	6.5	7.9	9.7	18.1	1.8	8.4 ②	5.7	—	—	17.6...60.2
Flange connection with flange plate protection option	7.2 ①	6.5	7.9	9.7	18.1	1.8	8.4	5.7	1.5	—	60.8

① If fitted with standard cable glands

② Additional antenna extensions of Ø1.5 × length 4.1" are available. Do not attach more than 5 antenna extensions.

DN50/2" Hygienic antenna versions

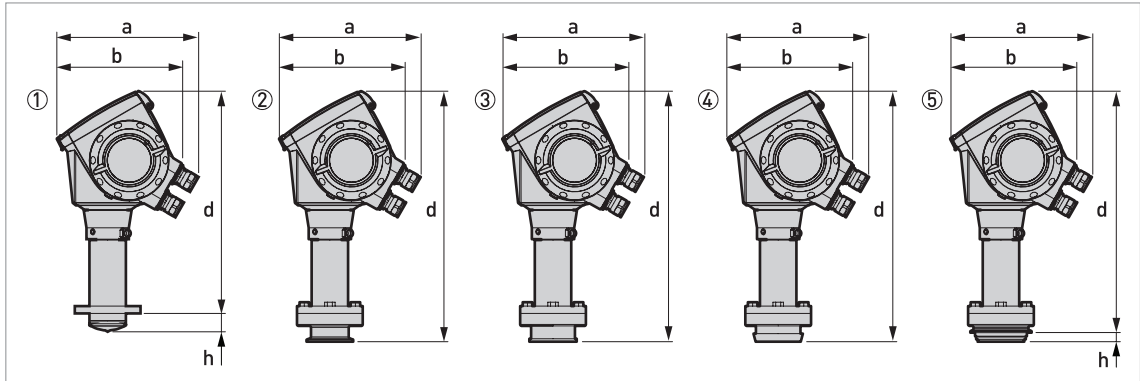


Figure 2-16: DN50/2" Hygienic antenna versions

- ① DN50/2" Hygienic antenna with Neumo BioControl® connection
- ② DN50/2" Hygienic antenna with Tri-Clamp® connection
- ③ DN50/2" Hygienic antenna with SMS connection
- ④ DN50/2" Hygienic antenna with DIN 11851 connection
- ⑤ DN50/2" Hygienic antenna with VARIVENT® connection

Dimensions and weights in mm and kg

	Dimensions [mm]				Weights [kg]
	a	b	d	h	
Neumo BioControl® connection	182 ①	167	303	25	5.7
Tri-Clamp® connection	182 ①	167	341	—	6.4
SMS connection	182 ①	167	341	—	6.4
DIN 11851 connection	182 ①	167	341	—	6.4
VARIVENT® connection	182 ①	167	341	12	6.4

① If fitted with standard cable glands

Dimensions and weights in inches and lb

	Dimensions [inches]				Weights [lb]
	a	b	d	h	
Neumo BioControl® connection	7.2 ①	6.5	11.9	25	12.7
Tri-Clamp® connection	7.2 ①	6.5	13.4	—	14.1
SMS connection	7.2 ①	6.5	13.4	—	14.1
DIN 11851 connection	7.2 ①	6.5	13.4	—	14.1
VARIVENT® connection	7.2 ①	6.5	13.4	0.5	14.1

① If fitted with standard cable glands

### 3.1 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.

### 3.2 Pre-installation requirements

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

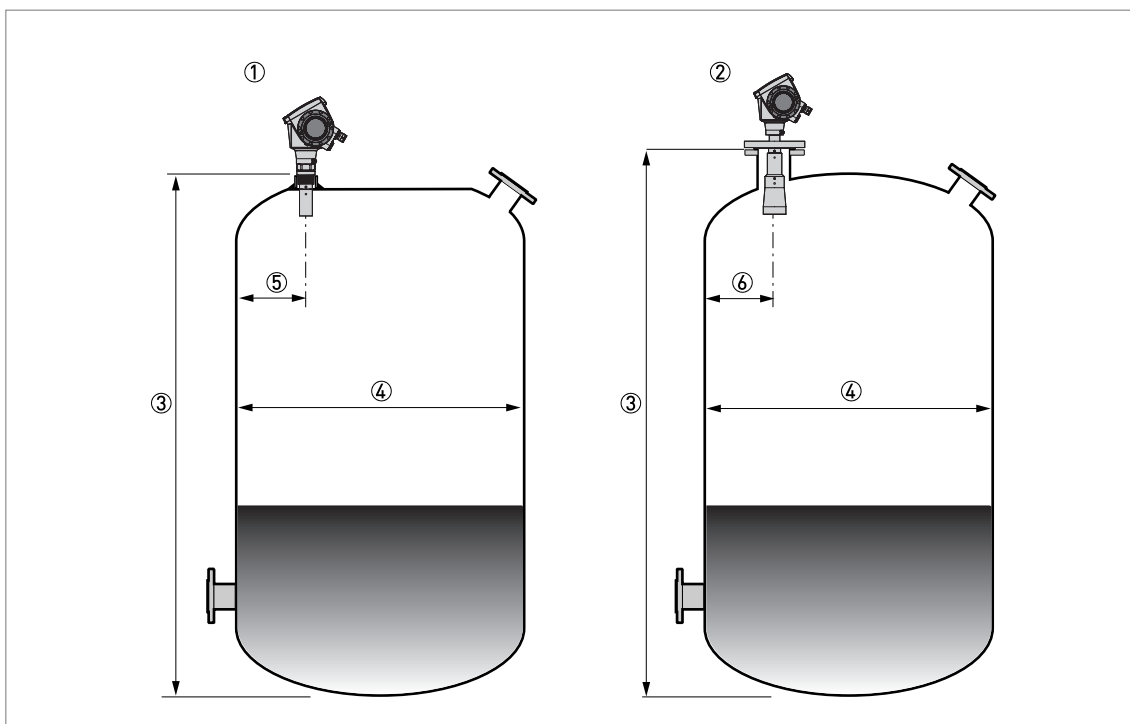
- Make sure that there is sufficient space on all sides.
- Protect the signal converter from direct sunlight. If necessary, install the weather protection accessory.
- Do not subject the signal converter to heavy vibrations. The devices are tested for vibration and agree with EN 50178 and IEC 60068-2-6.

### 3.3 How to prepare the tank before you install the device

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

#### 3.3.1 Recommended mounting position

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



**Figure 3-1: 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 :  $1/7 \times$  tank height  
Maximum distance of nozzle from the tank wall :  $1/3 \times$  tank diameter
- ⑥ Minimum distance of nozzle from the tank wall :  $1/10 \times$  tank height  
Maximum distance of nozzle from the tank wall :  $1/3 \times$  tank diameter

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

*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.*

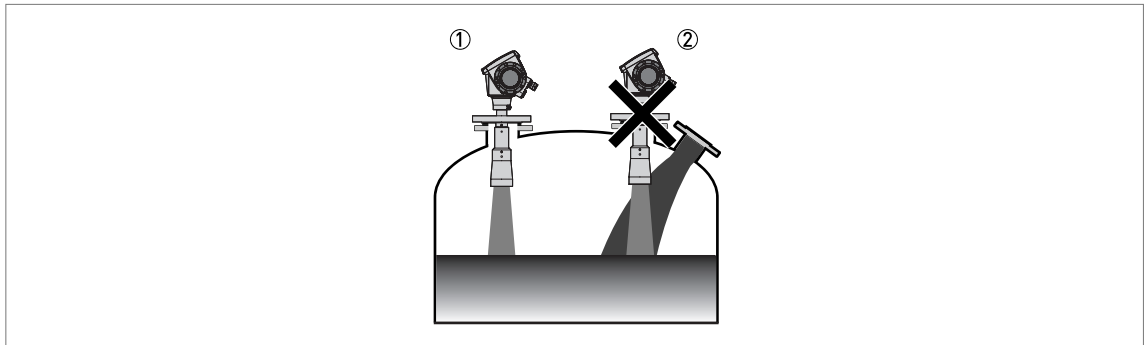


Figure 3-2: Product inlets

- ① The device is in the correct position.
- ② The device is too near to the product inlet.

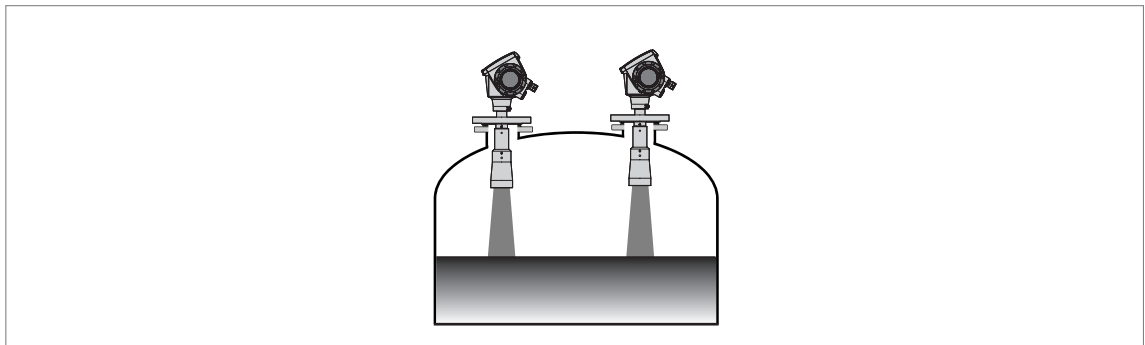


Figure 3-3: More than 1 FMCW radar level meter can be operated in a tank

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

### 3.3.2 Theoretical data for hygienic applications

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

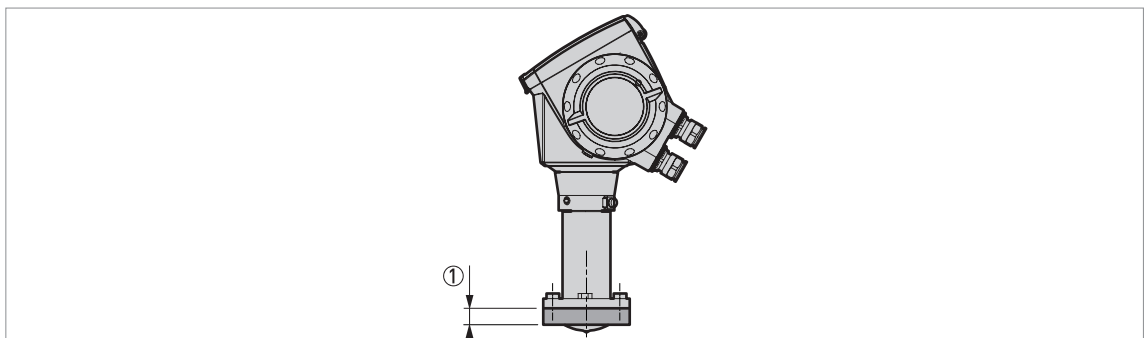


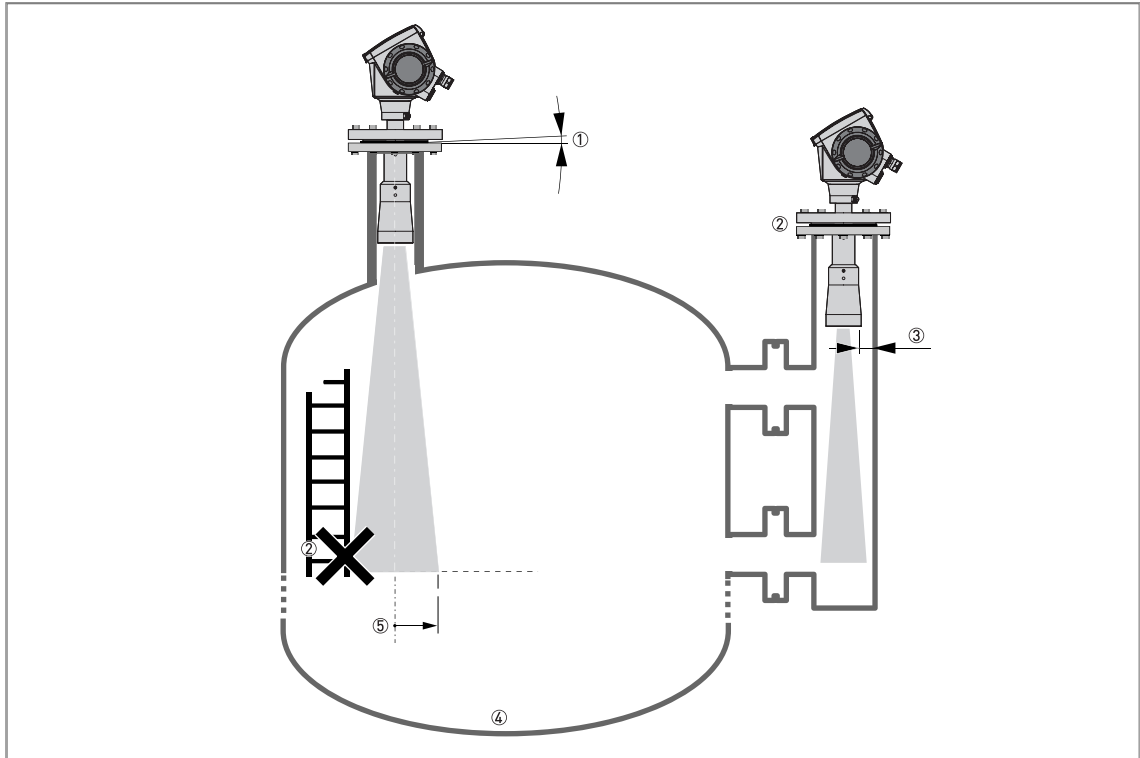
Figure 3-4: Requirements for hygienic applications

- ① Maximum height of process connection: 50 mm / 2"

## 3.4 Installation recommendations for liquids

### 3.4.1 General requirements

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



**Figure 3-5: General Installation recommendations**

- 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°)



### 3.4.2 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 (refer to the end of this section)

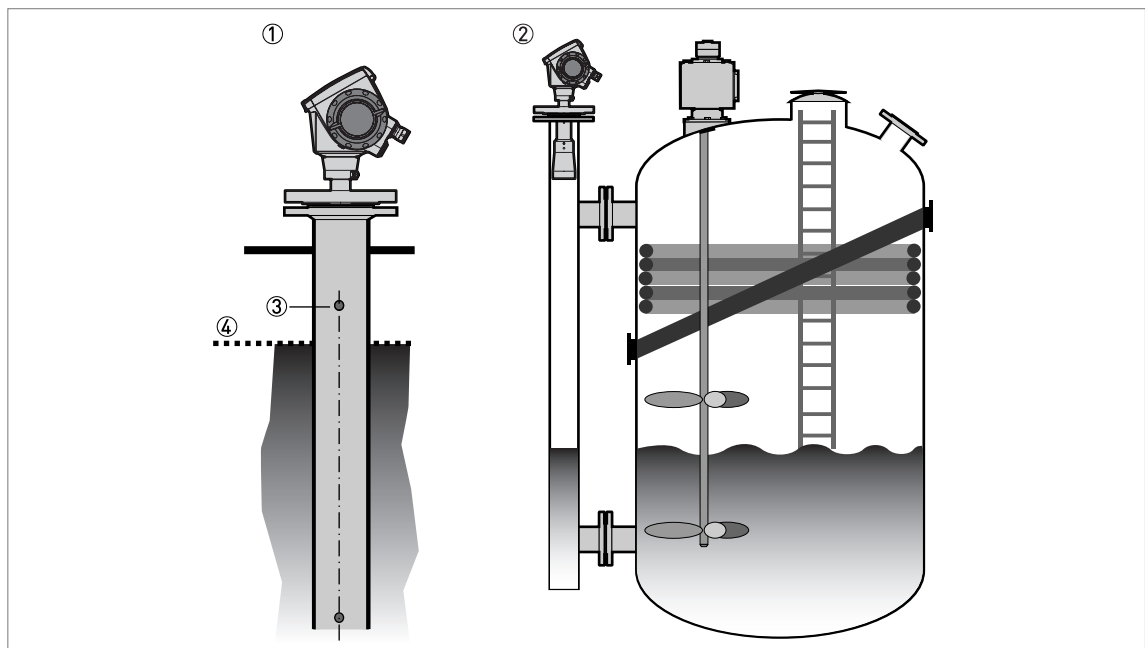


Figure 3-6: Installation recommendations for standpipes (stilling wells and bypass chambers)

- ① A stilling well solution
- ② A bypass chamber solution
- ③ Air circulation hole
- ④ Level of the liquid

- *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:  $\leq \pm 0.1 \text{ mm} / 0.004"$ .*
- *Stilling well only: The bottom of the stilling well must be open.*
- *Make sure that there are no deposits at the bottom of the standpipe.*
- *Make sure that there is liquid in the standpipe.*

### Stilling wells: floating roofs

If the device must be installed on a tank with a floating roof, install it in a stilling well.

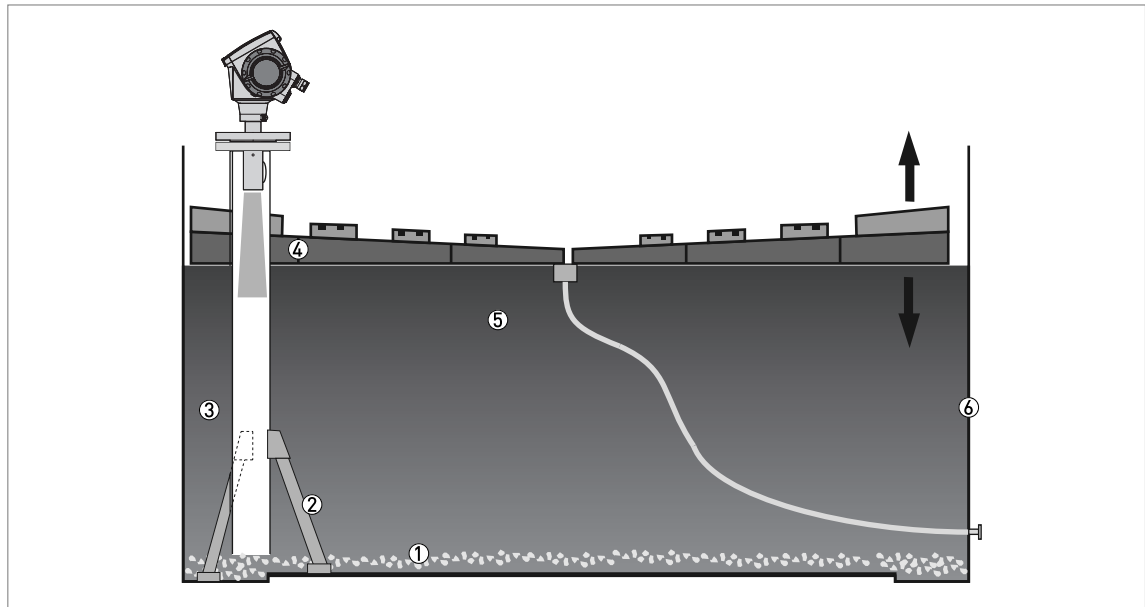


Figure 3-7: Floating roofs

- 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.

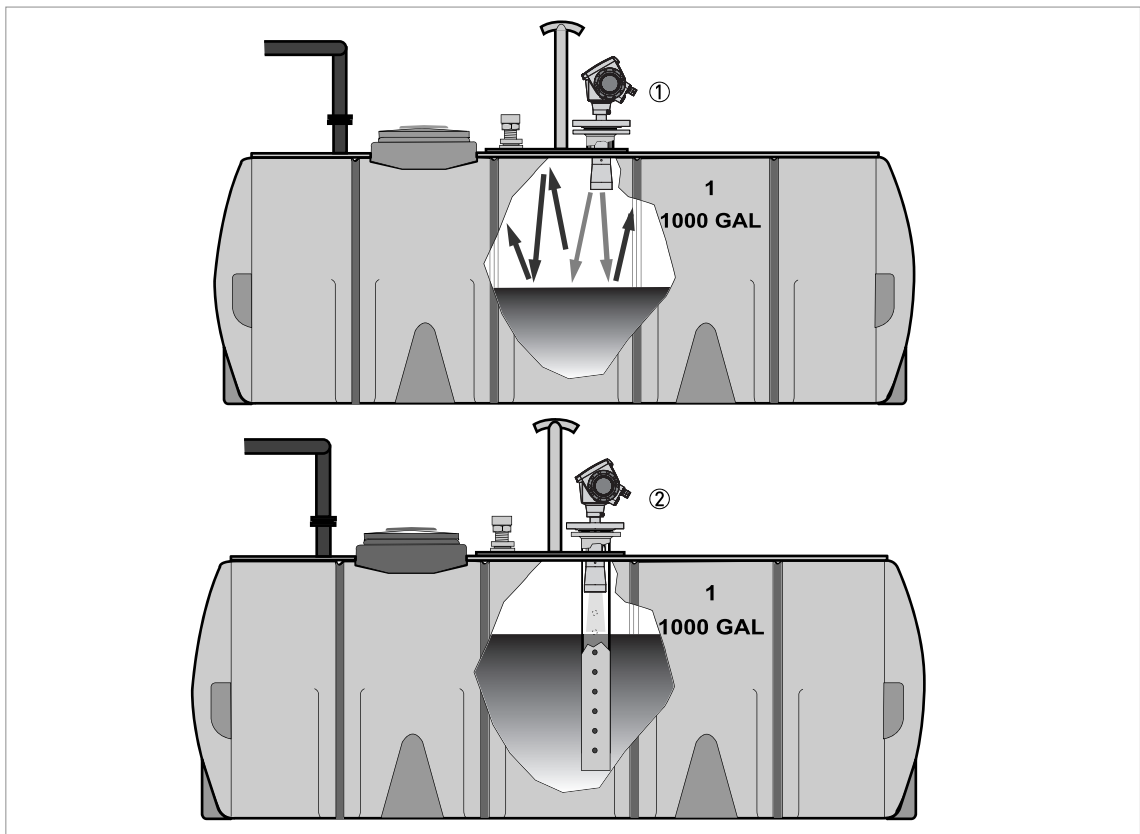


Figure 3-8: Horizontal cylindrical tanks

- 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 **Multiple Reflections** function in **Supervisor > Advanced Setup > Installation Setup** 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.

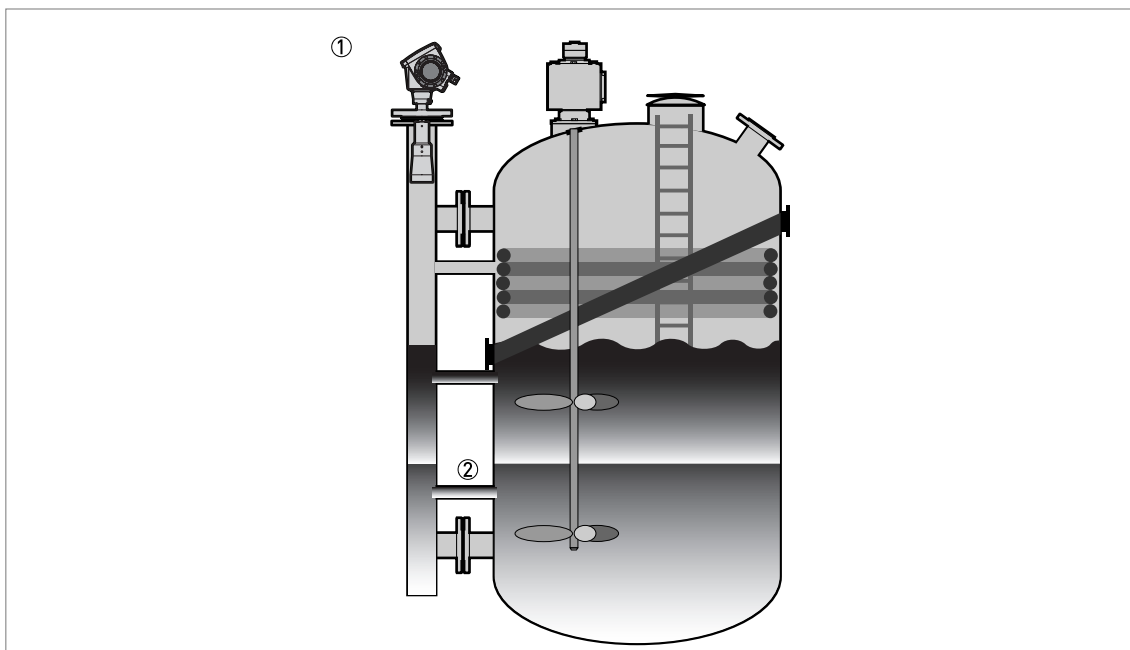


Figure 3-9: Installation recommendations for bypass chambers that contain more than one liquid

- ① Bypass chamber
- ② Additional process connection

## 3.5 How to install the device on the tank

### 3.5.1 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

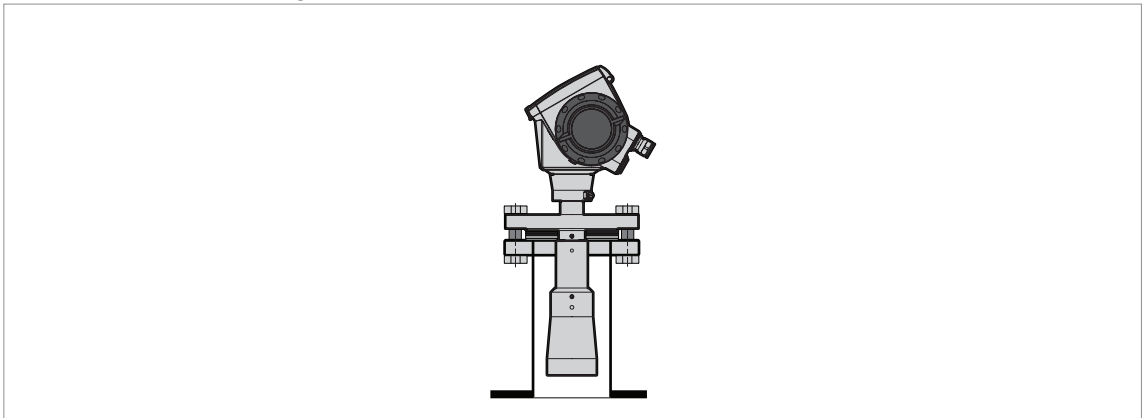


Figure 3-10: Flange connection

For more data, refer to the handbook.

### 3.5.2 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

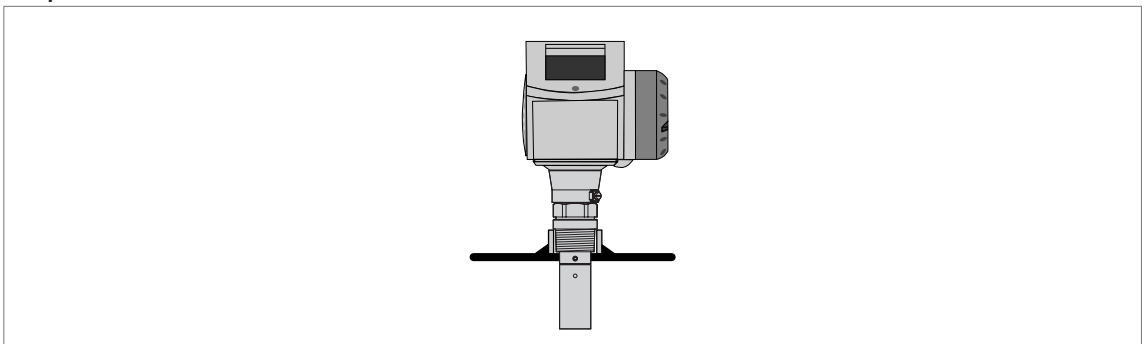


Figure 3-11: Threaded connection

For more data, refer to the handbook.

### 3.5.3 How to install a device with a hygienic connection

*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)

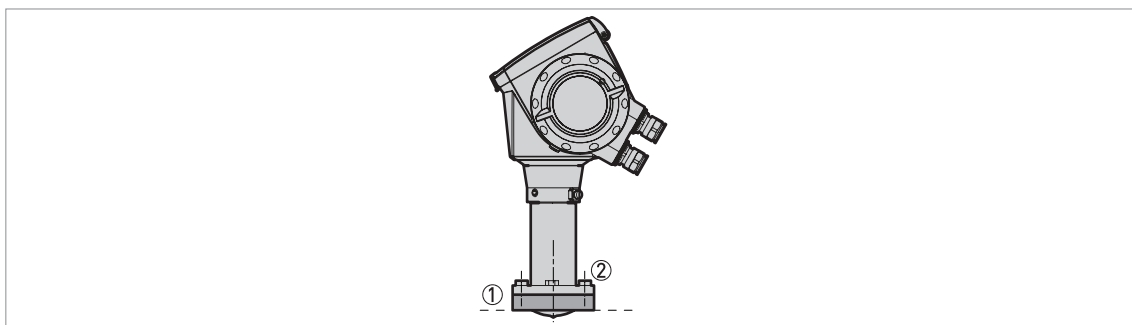


Figure 3-12: BioControl® connection

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

#### Tri-Clamp®

##### Equipment needed:

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

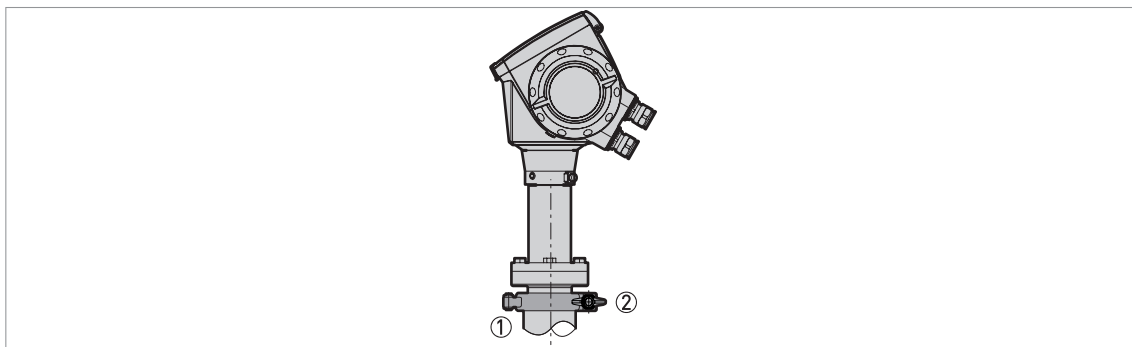


Figure 3-13: Tri-Clamp® connection

- ① Tank socket
- ② Band clamp

## DIN 11851

### Equipment needed:

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

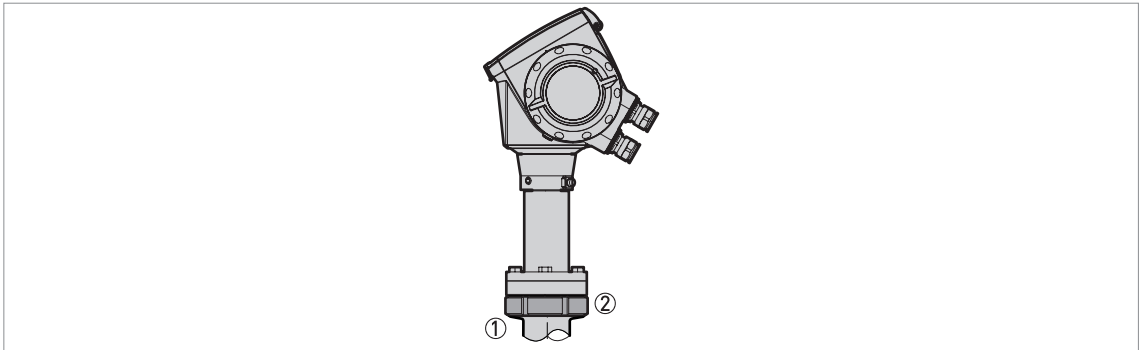


Figure 3-14: DIN 11851 connection

- ① Tank socket
- ② Nut for DIN 11851 connection

## SMS

### Equipment needed:

- Device with a SMS adaptor
- Gasket (not supplied)
- SMS nut

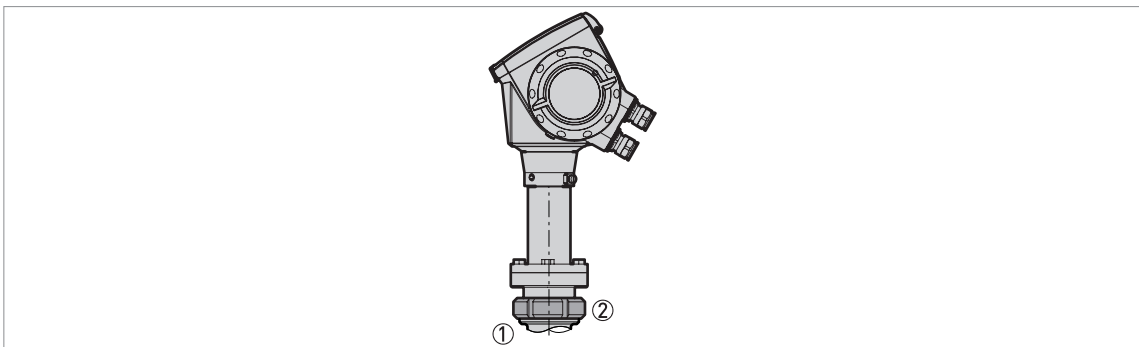


Figure 3-15: SMS connection

- ① Tank socket
- ② Nut for SMS connection

**VARIVENT®****Equipment needed:**

- Device with a VARIVENT® adaptor
- Clamp (not supplied)

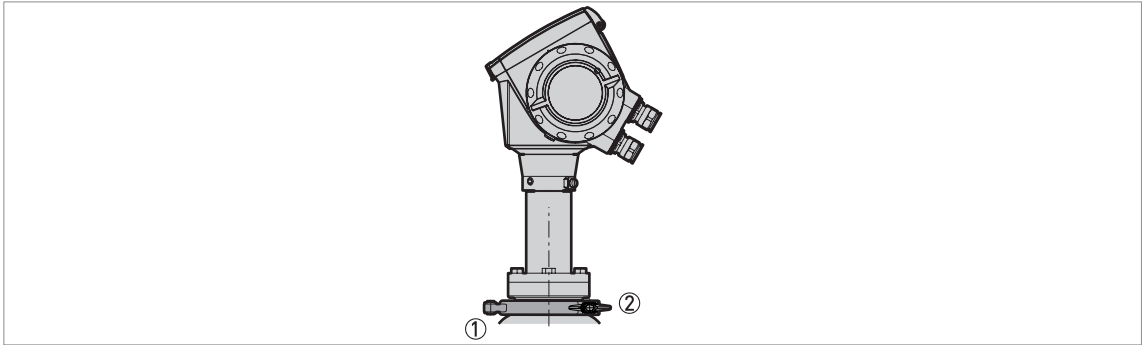


Figure 3-16: VARIVENT® connection

- ① Tank socket (VARIVENT® Access Unit – not supplied)



## 4.1 Safety instructions

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

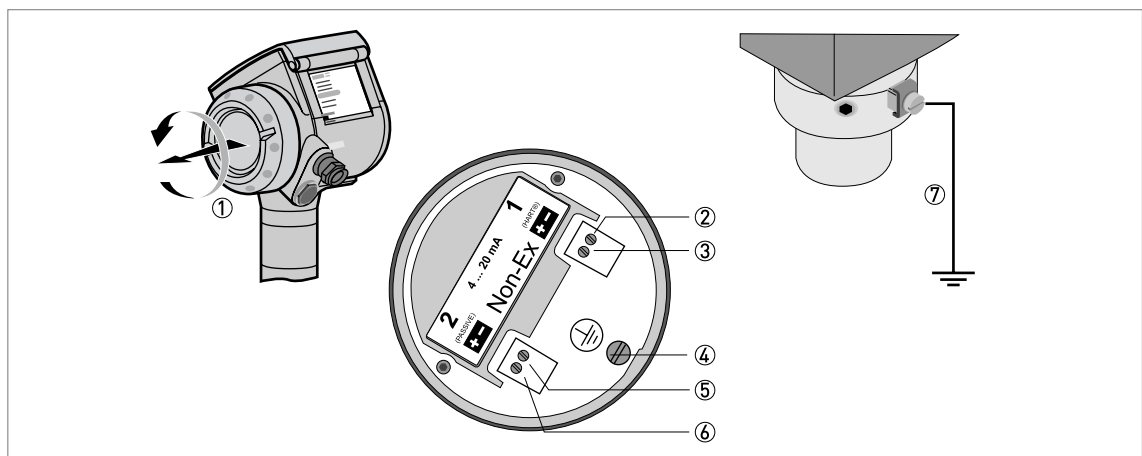
*Observe the national regulations for electrical installations!*

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

*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.*

*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.*

## 4.2 Electrical installation: outputs 1 and 2



**Figure 4-1: Electrical installation**

- ① Terminal compartment cover
- ② Output 1: current output -
- ③ Output 1: current output +
- ④ Grounding terminal in the housing
- ⑤ Output 2: current output - (option)
- ⑥ Output 2: current output + (option)
- ⑦ Grounding terminal between the process connection and the converter

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

## 4.2.1 Non-Ex devices

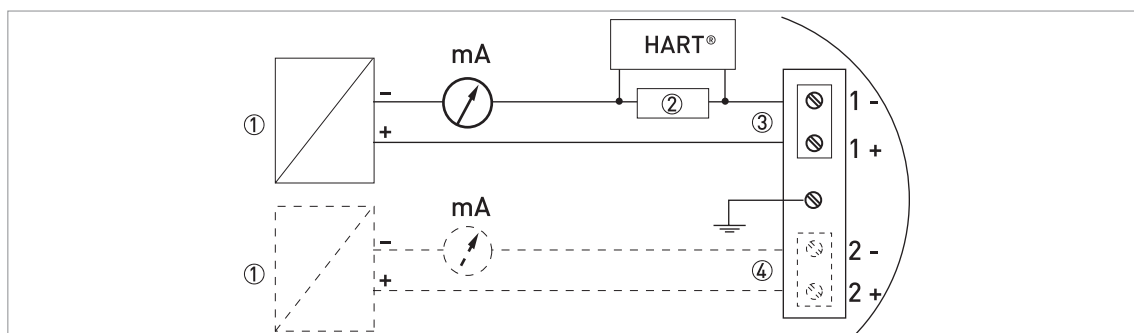


Figure 4-2: Electrical connections for non-Ex devices (standard software)

- ① Power supply
- ② Resistor for HART® communication
- ③ Output 1: 14...30 VDC for an output of 22 mA at the terminal
- ④ Output 2: 10...30 VDC for an output of 22 mA at the terminal

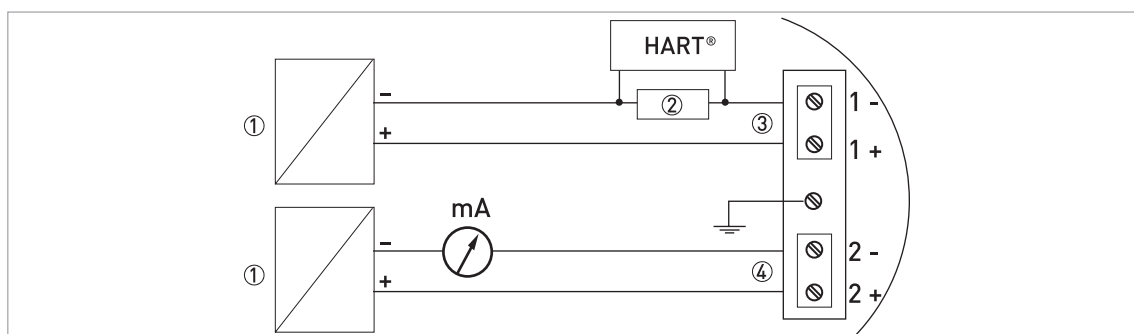


Figure 4-3: Electrical connections for non-Ex devices (fast motion software option)

- ① Power supply
- ② Resistor for HART® communication
- ③ Output 1: 14...30 VDC for a constant output of 16 mA at the terminal
- ④ Output 2: 10...30 VDC for an output of 22 mA at the terminal

## 4.2.2 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, 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).*

### 4.3 Protection category

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

*Make sure that the cable gland is watertight.*

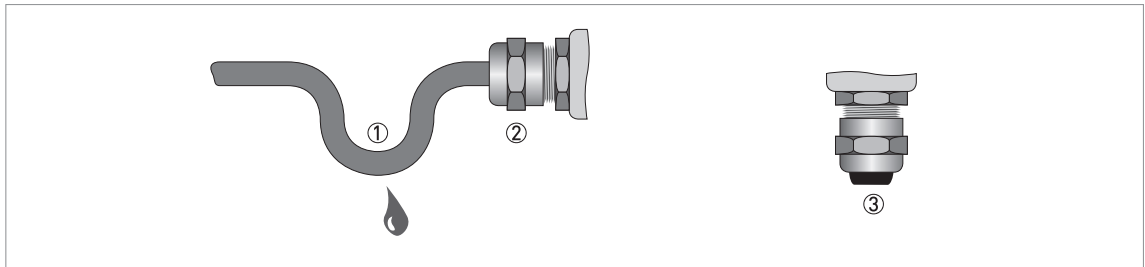


Figure 4-4: How to make the installation agree with protection category IP 67

- 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.

## 4.4 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 operate in a multi-drop network of up to 15 devices.

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

### 4.4.2 Point-to-point connection

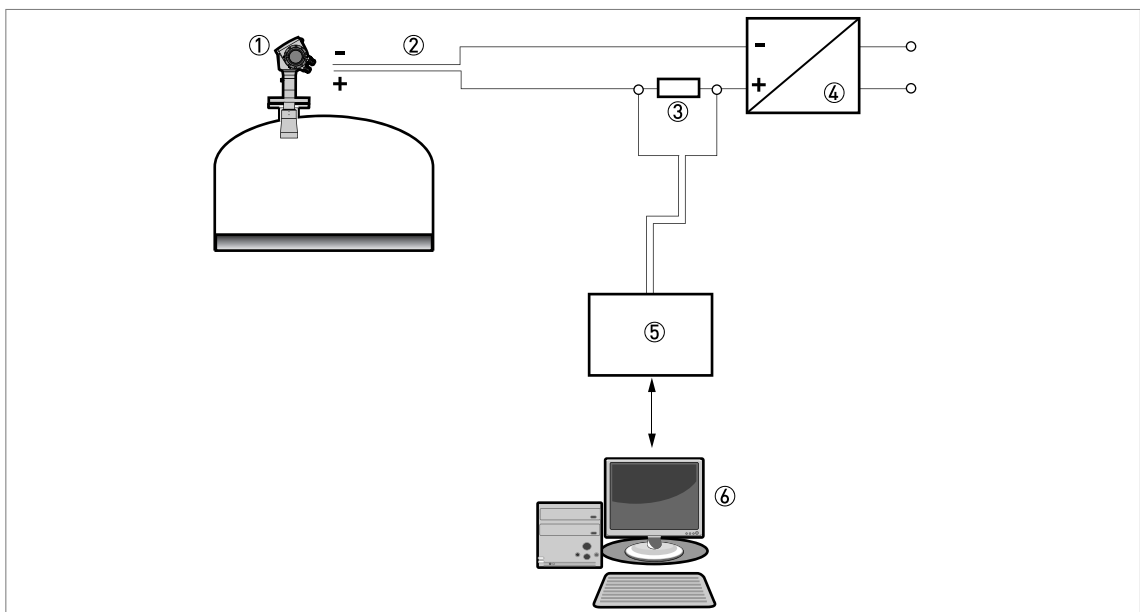


Figure 4-5: Point-to-point connection (non-Ex)

- 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

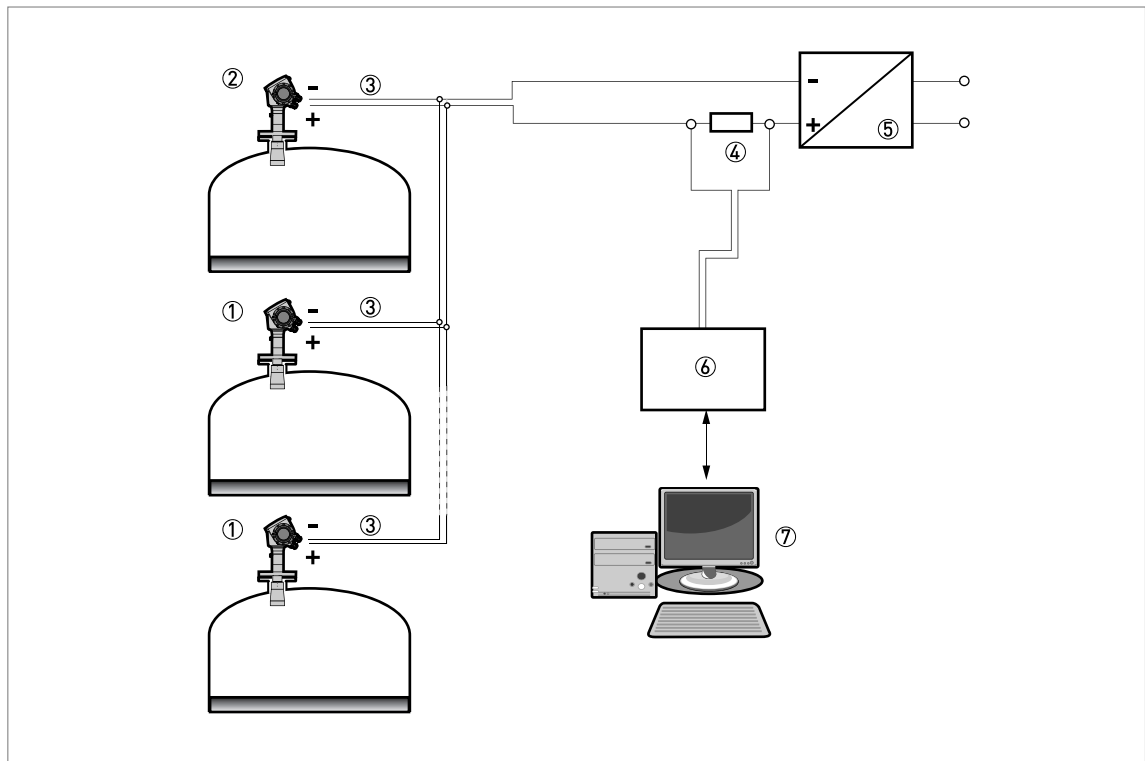


Figure 4-6: Multi-drop network (non-Ex)

- ① Address of the device (n+1 for multidrop networks)
- ② Address of the device (1 for multidrop networks)
- ③ 4 mA + HART®
- ④ Resistor for HART® communication
- ⑤ Power supply
- ⑥ HART® converter
- ⑦ HART® communication software

## 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.

VF70	4	<b>OPTIWAVE 7300 C 24 GHz Non-contact Radar (FMCW) level meter for liquids</b>
		<b>Approval</b>
	0	Without
	1	WHG (overfill protection) ①
	2	ATEX Ex ia IIC T3...T6 + DIP ②
	3	ATEX Ex d[ia] IIC T3...T6 + DIP ②
	4	ATEX Ex ia IIC T3...T6 + DIP + WHG ③
	5	ATEX Ex d[ia] IIC T3...T6 + DIP + WHG ③
	6	FM IS CL I/II/III, DIV 1, GPS A-G; CL I, Zone 0, AEx ia IIC T3...T6
	7	FM XP-IS/DIP CL I/II/III, DIV 1, GPS A-G; CL I, Zone 0, AEx d [ia] IIC T3...T6
	A	ATEX 3G Ex nA II T3...T6
	B	INMETRO Ex ia IIC T3...T6 + DIP ②
	C	INMETRO Ex d ia IIC T3...T6 + DIP ②
	E	NEPSI Ex ia IIC T3 ~ T6 + DIP ②
	F	NEPSI Ex d ia IIC T3 ~ T6 + DIP ②
	H	CSA IS CL I/II/III, DIV 1, GPS A-G; CL I, Zone 0, Ex ia IIC T3...T6
	K	CSA XP-IS/DIP CL I/II/III, DIV 2, GPS A-D, F, G; CL I, Zone 0, Ex d IIC T3...T6
	M	IECEx Ex ia IIC T2...T6 + DIP ②
	N	IECEx Ex d ia IIC T2...T6 + DIP ②
	R	KGS Ex ia IIC T3 – T6 + DIP ②
	S	KGS Ex d[ia] IIC T3 – T6 + DIP ②
		<b>Material of Process Connection / Antenna type and material (pressure)</b>
	0	316L (1.4404) / Horn 316L (40 barg / 580 psig) – Drop PTFE (40 barg / 580 psig) – Drop PP (16 barg / 232 psig) – Hygienic PEEK (10 barg / 145 psig)
	1	Hastelloy® C-22® (2.4602) / Horn HC22 (40 barg / 580 psig) ④
	2	316L (1.4404) / Horn 316 L (100 barg / 1450 psig)
	3	Hastelloy® C-22® (2.4602) / Horn HC22 (100 barg / 1450 psig) ④
VF70	4	<b>Order code (complete this code on the pages that follow)</b>

			<b>Antenna type</b>
		3	Horn DN80 (Ø75 mm / 2.95") – long
		4	Horn DN40 (Ø39 mm / 1.54") – long
		5	Horn DN50 (Ø43 mm / 1.69") – long
		6	Horn DN80 (Ø75 mm / 2.95") – long – with purging system
		7	Horn DN40 (Ø39 mm / 1.54") – long – with purging system
		8	Horn DN50 (Ø43 mm / 1.69") – long – with purging system
		F	Horn DN100 (Ø95 mm / 3.74") – long
		G	Horn DN100 (Ø95 mm / 3.74") – long – with purging system
		H	PEEK Hygienic antenna (FDA conform)
		L	Horn for BM26 W (Ø65.4 mm / 2.58")
		N	Horn for BM 26 ADVANCED – with purging system
		P	Drop PTFE DN80 (Ø75 mm / 2.95") – long / -50...+150°C (-58...+302°F)
		R	Drop PP DN150 (Ø144 mm / 5.67") – long / -40...+100°C (-40...+212°F)
		S	Drop PP DN80 (Ø75 mm / 2.95") – long / -40...+100°C (-40...+212°F)
		T	Sheet metal horn DN 200 (Ø190 mm / 7.48") – long – with purging system
		U	Sheet metal Horn DN80 (Ø75 mm / 2.95") – long
		V	Sheet metal horn DN100 (Ø95 mm / 3.74") – long
		W	Sheet metal horn DN80 (Ø75 mm / 2.95") – long – with purging system
		X	Sheet metal horn DN100 (Ø95 mm / 3.74") – long – with purging system
		Y	Sheet metal horn DN150 (Ø144 mm / 5.67") – long – with purging system
			<b>Antenna extension</b>
		0	Without
		1	Extension 105 mm (4.13")
		2	Extension 210 mm (8.27")
		3	Extension 315 mm (12.40")
		4	Extension 420 mm (16.54")
		5	Extension 525 mm (20.67")
		6	Extension 630 mm (24.80") ⑤
		7	Extension 735 mm (28.94") ⑤
		8	Extension 840 mm (33.07") ⑤
		A	Extension 945 mm (37.21") ⑤
		B	Extension 1050 mm (41.34") ⑤
			<b>Flange plate protection</b>
		P	Flange plate protection (PP) DN80, DN100, 3", 4", 80A, 100A ⑥
		R	Flange plate protection (PP) DN150, 6", 8" ⑥
		S	Flange plate protection (PTFE) DN80, DN100, 3", 4", 80A, 100A ⑥
		T	Flange plate protection (PTFE) DN150, 6", 8" ⑥
<b>VF70</b>	<b>4</b>		<b>Order code (complete this code on the pages that follow)</b>

							<b>Feedthrough / Temperature / Sealing</b>
							Non-Ex devices with a Drop antenna
					X		Standard / -40...+150°C (-40...+302°F) / FKM/FPM
					Y		Standard / -50...+150°C (-58...+302°F) / EPDM
							Other devices
					0		Standard / -40...+150°C (-40...+302°F) / FKM/FPM
					1		Standard / -20...+150°C (-4...+302°F) / Kalrez 6375
					2		Metaglas® / -30...+150°C (-22...302°F) / FKM/FPM
					3		Metaglas® / -20...+150°C (-4...+302°F) / Kalrez 6375
					4		Standard / -50...+150°C (-58...302°F) / EPDM
					5		Metaglas® / -30...+150°C (-22...+302°F) / EPDM
					B		Standard / -20...+150°C (-4...+302°F) / EPDM – for hygienic connections
					C		Standard / -20...+150°C (-4...+302°F) / FKM/FPM – for hygienic connections
					F		Standard / -40...+200°C (-40...+392°F) / FKM/FPM with distance piece included
					G		Standard / -20...+200°C (-4...+392°F) / Kalrez 6375 with distance piece included
					H		Metaglas® / -30...+200°C (-22...+392°F) / FKM/FPM with distance piece included
					K		Metaglas® / -20...+200°C (-4...392°F) / Kalrez 6375 with distance piece included
							<b>Process connection EN</b>
					0		Without
					3		G 1½A ISO 228 ⑦
					5		DN40 PN40 Type B1 EN 1092-1
					6		DN50 PN40 Type B1 EN 1092-1
					7		DN80 PN40 Type B1 EN 1092-1
					8		DN100 PN16 Type B1 EN 1092-1
					A		DN100 PN40 Type B1 EN 1092-1
					B		DN150 PN16 Type B1 EN 1092-1
					C		DN150 PN40 Type B1 EN 1092-1
					D		DN50 PN63 Type B1 EN 1092-1
					E		DN80 PN63 Type B1 EN 1092-1
					F		DN100 PN63 Type B1 EN 1092-1
					L		DN40 PN63/PN100 Type B1 EN 1092-1
					M		DN50 PN100 Type B1 EN 1092-1
					N		DN80 PN100 Type B1 EN 1092-1
					P		DN100 PN100 Type B1 EN 1092-1
					R		DN150 PN63 Type B1 EN 1092-1
					S		DN150 PN100 Type B1 EN 1092-1
					U		DN 200 PN 16 Type B1 EN 1092-1
					V		DN 200 PN 40 Type B1 EN 1092-1
<b>VF70</b>	<b>4</b>						<b>Order code (complete this code on the pages that follow)</b>



									<b>Process connection ASME</b>	
									0	Without
									3	1½ NPT
									5	1½" 150 lb RF ASME B16.5
									6	1½" 300 lb RF ASME B16.5
									7	2" 150 lb RF ASME B16.5
									8	2" 300 lb RF ASME B16.5
									A	3" 150 lb RF ASME B16.5
									B	3" 300 lb RF ASME B16.5
									C	4" 150 lb RF ASME B16.5
									D	4" 300 lb RF ASME B16.5
									E	6" 150 lb RF ASME B16.5
									F	8" 150 lb RF ASME B16.5
									G	6" 300 lb RF ASME B16.5 (distance piece included)
									L	2" 300 lb RF ASME B16.5 / BM 26 W
									N	1½" 600 lb RF ASME B16.5
									P	2" 600 lb RF ASME B16.5
									R	3" 600 lb RF ASME B16.5 (distance piece included)
									S	4" 600 lb RF ASME B16.5 (distance piece included)
									U	1½" 900/1500 lb RJ ASME B16.5 (distance piece included)
									V	2" 900/1500 lb RJ ASME B16.5 (distance piece included)
									W	3" 900 lb RF ASME B16.5 (distance piece included)
									X	4" 900 lb RF ASME B16.5 (distance piece included)
0	Without									
3	RJ (ASME B16.5) ring joint									
5	10K 40A RF JIS B2220									
6	10K 50A RF JIS B2220									
7	10K 80A RF JIS B2220									
8	10K 100A RF JIS B2220									
B	Tuchenhagen VARIVENT® DN50									
C	NEUMO BioControl® DN50									
F	Tri-Clamp® 2"									
L	DIN 11851 DN50									
P	SMS 51									
V	Type C (EN 1092-1) tongue									
W	Type D (EN 1092-1) groove									
X	Type E (EN 1092-1) spigot									
Y	Type F (EN 1092-1) recess									
<b>VF70</b>	4								<b>Order code (complete this code on the pages that follow)</b>	



																				0	<b>Other approval</b>				
																					0	Without			
																					B	EAC Russia			
																					C	EAC Belarus			
																					K	EAC Kazakhstan			
																					0	<b>Calibration certificate</b>			
																						0	Without		
																						1	Calibration certificate 2 factory-default points for an accuracy of $\pm 3$ mm / $\pm 0.12$ "		
																						2	Calibration certificate 5 factory-default points for an accuracy of $\pm 3$ mm / $\pm 0.12$ " points (minimum distance of first point: 300 mm / 11.81")		
																							<b>Construction</b>		
																							0	Without	
																							3	NACE-Design (MR 0175 / MR 0103 / ISO 15156)	
																								<b>Tag N°</b>	
																								0	Without
																								2	Tag N° on stainless steel plate (16 characters max.)
<b>VF70</b>	4																				0	0		<b>Order code</b>	

- ① The WHG approval is available for devices with an antenna diameter equal to or larger than DN80 / 3"
- ② DIP= Dust Ignition Proof
- ③ DIP= Dust Ignition Proof. The WHG approval is available for devices with an antenna diameter equal to or larger than DN80 / 3".
- ④ On request
- ⑤ This option is not available for devices with a Drop antenna
- ⑥ This option is available if the flange has a flange face Type B1 or Raised Face (RF)
- ⑦ This option can be attached to a stainless steel flange with a low pressure rating. For more data, refer to the list of accessories in the handbook.



## KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature assemblies
- Pressure transmitters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

Head Office KROHNE Messtechnik GmbH  
Ludwig-Krohne-Str. 5  
47058 Duisburg (Germany)  
Tel.: +49 203 301 0  
Fax: +49 203 301 103 89  
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at:  
[www.krohne.com](http://www.krohne.com)

**KROHNE**