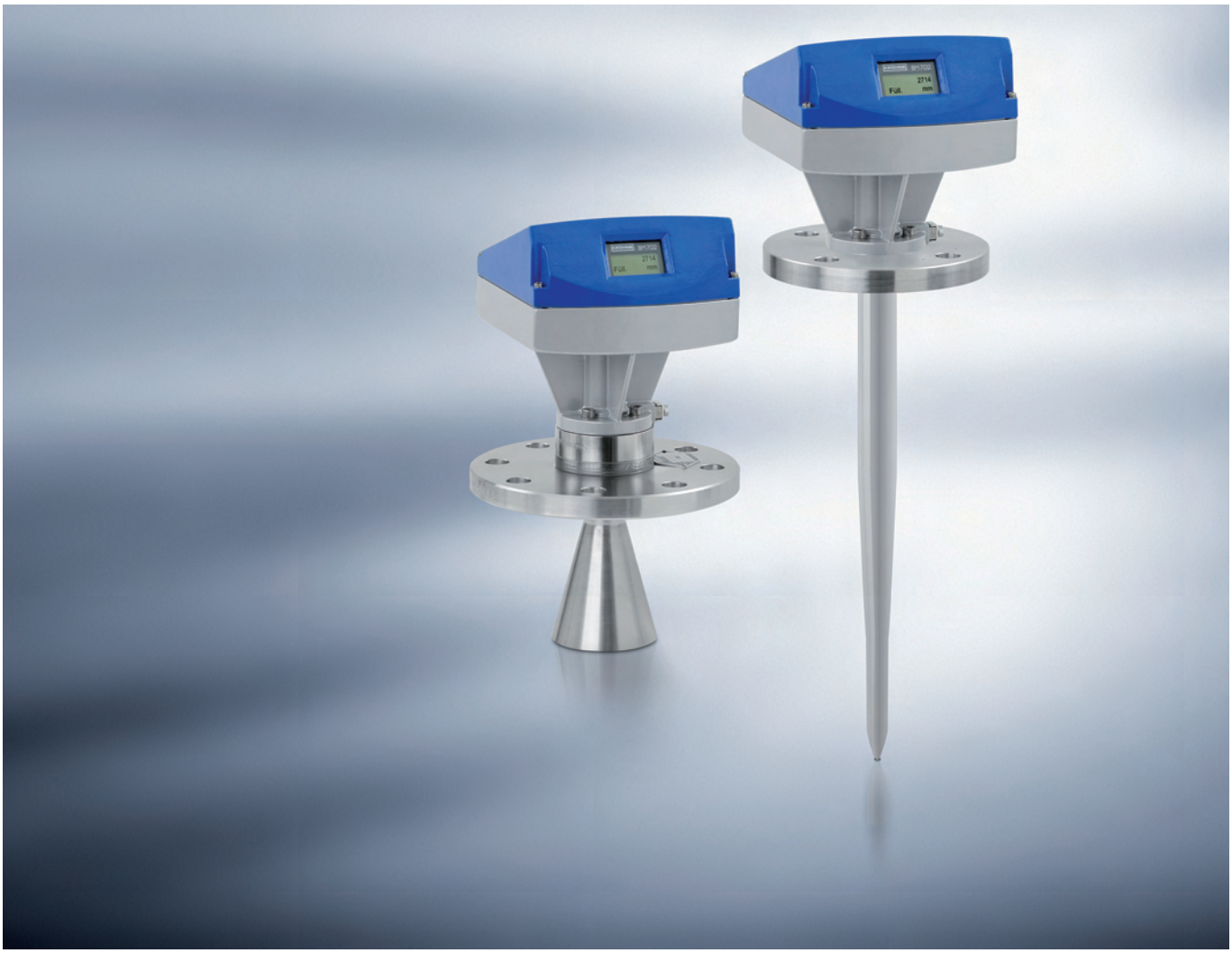


BM 702 A Technical Datasheet

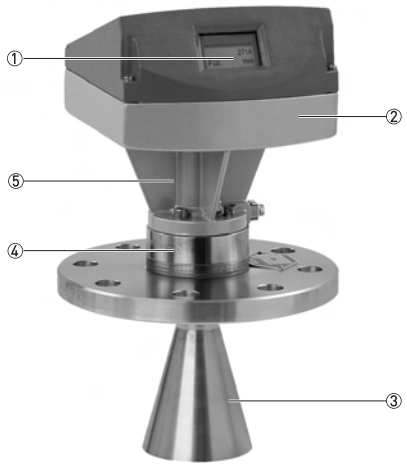
2-wire non-contact Radar (FMCW) level meter

- Level radar meter with 2-wire technology
- High accuracy and repeatability
- Maintenance-free

1.1 The 2-wire radar solution

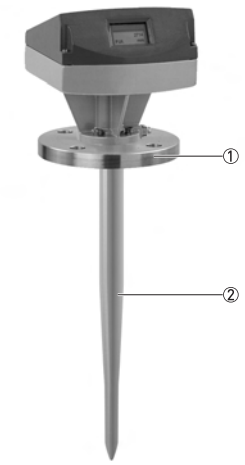
This device is a non-contact Radar (FMCW) level meter for distance, level and volume measurement of liquids, pastes and slurries. It gives a more robust and reliable measurement than pulse radar systems and is well suited to agitated process conditions.

The device can operate at process temperatures up to +250°C / +480°F if a version with HT (high-temperature) distances pieces is ordered.



(Horn antenna version)

① Optional display with 4 key operation
② 2-wire FMCW radar level meter
③ Metallic horn antenna in various materials (antenna extensions for long nozzles available)
④ Metaglas® barrier
⑤ Rotatable housing (90° steps)



(Wave-Stick version)

① Flange connection, optional threaded and hygienic connections
② Wave-Stick antenna (PP or PTFE)

Highlights

- Reliable measurement in difficult process conditions
- Measuring range up to 30 m / 98 ft (dep. on antenna version)
- Modular design allows the replacement of the converter under process conditions (without interruption of the process)
- Operates up to flange temperature of +250°C / +480°F and pressure of 1000 bar / 14504 psi
- Wave-Stick antenna for corrosive liquids (with optional PP/PTFE flange plate) and hygienic applications
- A variety of operating languages integrated as standard for the optionally equipped graphical display
- Antenna extension available to suit any nozzle length (straight, 90° bent and S-shaped)
- Purging system for cleaning, heating or cooling of antenna as option available
- ±10 mm / 0.4" standard accuracy, optional ±5 mm / 0.2"
- Excellent price/performance ratio

Industries

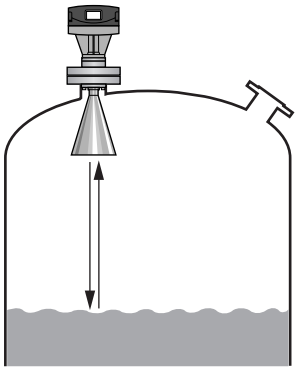
- Chemicals
- Food & Beverage
- Oil & Gas
- Petrochemicals
- Pulp & Paper
- Water & Wastewater

Applications

- Storage tanks
- Process tanks
- Stilling wells and bypass chambers

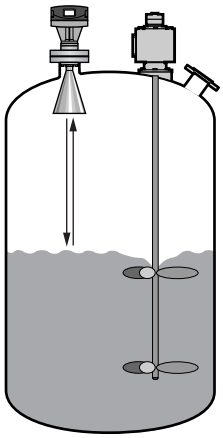
1.2 Applications

1. Level measurement of liquids in storage tanks



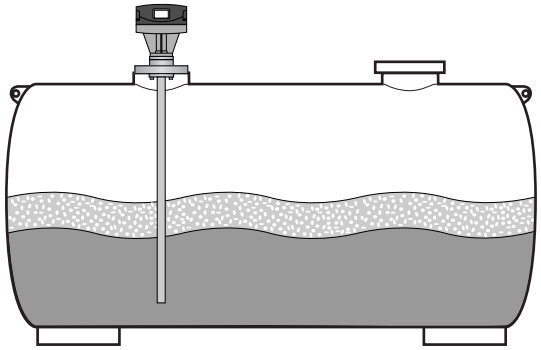
The level transmitter can measure the level of a wide range of liquid products on a large variety of installations, including LPG and LNG tanks. It does not require calibration or commissioning when installed. It can measure nearly any liquid within the stated pressure and temperature range, and distances up to 30 m / 98 ft.

2. Level measurement of liquids in process tanks



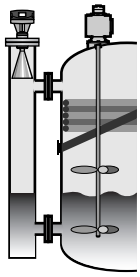
The level transmitter can measure level accurately under process conditions, such as near to vortexes caused by small agitators, and also where foam is present.

3. Level measurement in horizontal cylinders and spherical tanks



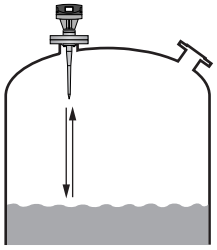
BM 702 A is able to measure the level in horizontal cylinders and spherical tanks. In this case the use of a stilling well or a Wave-Guide antenna is positively recommended to avoid multiple reflections.

4. Measurement of liquids in a bypass chamber



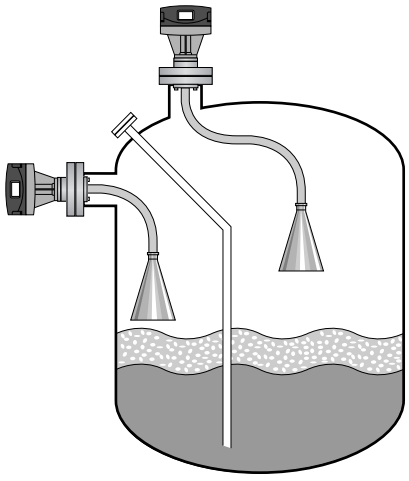
If the tank is full of obstructions such as agitators and reinforcements, we recommend installing the radar level transmitter in a bypass chamber or a stilling well. This solution is also available from us under the name BM 26 W. The BM 26 W combines the BM 26 A with the radar level transmitter. The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

5. Measurement of corrosive liquids with a Wave-Stick antenna



The Wave-Stick 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 Wave-Stick antenna with the PTFE or PP flange plate option.

6. Measurement with curved antenna extensions for difficult applications



Rectangular and S-shaped antenna extensions are available for particularly difficult application conditions. These extensions are used in cases where the antenna is exposed to high temperatures and where there are problems with space (e.g. around tank internals; positioning the antenna out of the centre of symmetry; mounting the signal converter on the side of the tank).

1.3 Measuring principle

A radar signal is emitted via an antenna, reflected on 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 df is calculated from the actual transmit frequency and the receive frequency. The difference is directly proportional to the distance. A large frequency difference corresponds to a large distance and vice versa. The frequency difference Δf 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.

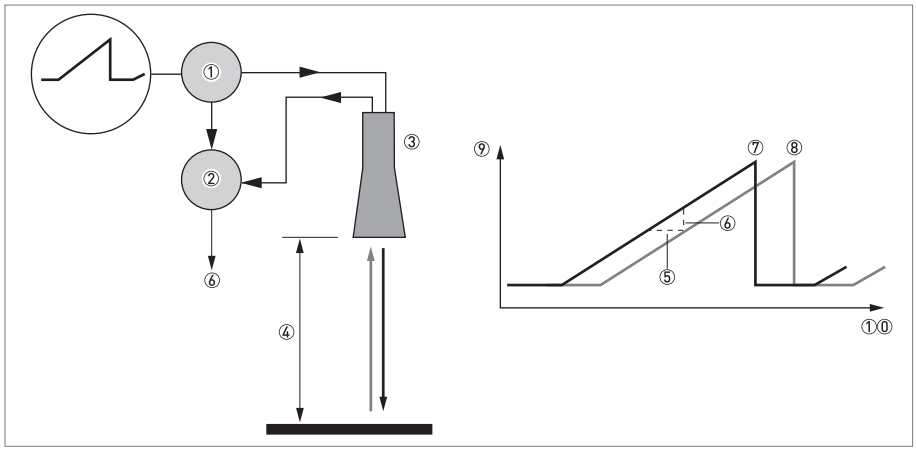


Figure 1-1: Measuring principle of FMCW radar

① Transmitter
② Mixer
③ Antenna
④ Distance to product surface, where change in frequency is proportional to distance
⑤ Differential time delay, Δt
⑥ Differential frequency, Δf
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 representative.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	2-wire loop-powered level transmitter; X-band FMCW radar
Application range	Level measurement of liquids, pastes and slurries
Primary measured value	Δf (change in frequency) between the emitted and received signal
Secondary measured value	Distance, level, volume and reflectivity

Design

Construction	The measurement system consists of a measuring sensor (horn or Wave-Stick antenna) and a signal converter which is available in a compact version.
Options	Integrated graphical display
	High-temperature version (max. +250°C / +480°F, dep. on used gaskets)
	Special version (with Silicone/FEP gaskets) for low temperatures (min. -60°C / -76°F)
	Version for food application with dairy screw or Tri-clamp connection
	Antenna purging system for horn antenna (supplied with ¼ NPTF connection)
	Wave-Guide antenna
	Wave-Stick: PTFE or PP flange plate
	Heated or cooled antenna for sticky products or high-temperature applications
Accessories	Weather protection
	Antenna extensions of 100 mm / 3.9" length; 90° bent; S-shaped
Max. measuring range	30 m / 98 ft
	Depends on the antenna option, dielectric constant of the product and installation type. Refer also to "Antenna selection".
Min. tank height	0.5 m / 19.7"
Min. block distance	0.2...0.5 m / 0.7...1.6 ft
Beam angle of antenna	Horn DN80 / 3", type 1: 16°
	Horn DN100 / 4", type 2: 12°
	Horn DN150 / 6", type 3: 8°
	Horn DN200 / 8", type 4: 6°
	Wave-Stick 25 mm / 1": 9°
	Wave-Guide / stilling well 25...200 mm / 1...8": Propagation only inside the stilling well
Display and user interface	
Display	Graphical display (64 x 128 pixels)
Interface languages	English, German, French, Italian, Spanish, Portuguese, Swedish
Measurement units	Lengths: m, cm, mm, inch, ft, %, free unit (customer defined) Volume: m^3, Liter, US Gal, GB Gal, ft^3, bbl, free unit (customer defined)

Measuring accuracy

Resolution	1 mm / 0.04"
Repeatability	≤ 0.5 x measuring error
Accuracy	Standard: ±10 mm / ±0.4", when distance ≤ 5 m / 16.4 ft or ±0.2% of measured distance, when distance > 5 m / 16.4 ft
	Option: ±5 mm / ±0.2", when distance ≤ 5 m / 16.4 ft or ±0.1% of measured distance, when distance > 5 m / 16.4 ft
Reference conditions acc. to EN 60770	
Temperature	+20°C ±5°C / +70°F ±10°F
Pressure	1013 mbar abs. ±20 mbar / 14.69 psig ±0.29 psig
Relative air humidity	60% ±15%
Target	Metal plate in an anechoic chamber

Operating conditions

Temperature	
Ambient temperature	-20…+55°C / -4…+130°F Functional range: -40...+70°C / -40...+160°F
Storage temperature	-40…+85°C / -40…+185°F
Process connection temperature	**V96 flange system with horn antenna or Wave-Guide:** Standard without HT distance piece (K6375 gasket): -20…+130°C / -5…+260°F (depending on the temperature limits of the gasket material. For other gasket materials see "Materials" in this table.) With HT distance piece (K6375 gasket): -20…+250°C / -5…+260°F (depending on the temperature limits of the gasket material. For other gasket materials see "Materials" in this table.)
	LP flange system with horn antenna or Wave-Guide: -20…+130°C / -4…+266°F (only available without HT distance piece)
	Wave-Stick: PTFE with or without flange plate: -20…+130°C / -5…+260°F (dep. on flange size and pressure rating. Refer to chapter "Pressure ratings".) PTFE with or without flange plate and HT distance piece: -20…+150°C / -5…+300°F (dep. on flange size and pressure rating. Refer to chapter "Pressure ratings".) PP without flange plate: -20…+100°C / -5…+210°F (only available without HT distance piece)
Thermal shock resistance	<40°C/s / <72°F/s
Pressure	
Operating pressure	**V96 flange system with horn antenna or Wave-Guide:** -1…40 bar / -14.5…580 psig (dep. on flange size and pressure rating. Refer to chapter "Pressure ratings".) Higher pressures on request.
	LP flange system with horn antenna, Wave-Guide or Wave-Stick without flange plate: -1…2 bar / -14.5…29 psig
	Wave-Stick with flange plate: -1...16 bar / -14.5...232 psig (dep. on temperature; Refer to chapter "Pressure ratings".)

Other conditions	
Physical properties	No effect on measurement results; for reliable measurements the relative permittivity should have the following values:
Dielectric constant (ε_r)	$\varepsilon_r \geq 1.5$;
	$\varepsilon_r < 3$: stilling well recommended;
	Wave-Stick immersed: $\varepsilon_r \geq 4$
Product limitations	Liquid ammonia (NH_3), liquid hydrogen (H_2), liquid helium (He)
Vibration resistance	IEC 60068-2-6 and EN 50178 (10...57 Hz: 0.075 mm / 57...150 Hz:1g)
Protection category	IP66/67 equivalent to NEMA 6-6X

Installation conditions

Installation requirement	For detailed information refer to chapter "Installation".
Process connection position	Make sure that there are not any obstructions directly below the process connection for the device.
Dimensions and weights	For detailed information refer to chapter "Dimensions and weights".

Materials

Signal converter housing	Aluminium with electrostatic powder coating
	Sight window: glass
Flange system (V96 and LP), antenna, antenna extension	Standard: Stainless Steel (1.4571 / 316 Ti)
	Option: Stainless Steel (1.4435 / 316 L), Hastelloy® C4 or B2, Titanium, Tantalum
	Information on other materials on request.
Wave-Stick	Flanges: Stainless Steel (1.4571 / 316 Ti)
	Flange plate: PP or PTFE
Gaskets	K4079 without HT distance piece: -20…+130°C / -5…+260°F K4079 with HT distance piece: -20…+250°C / -5…+480°F
	K2035 without HT distance piece: -20…+130°C / -5…+260°F K2035 with HT distance piece: -20…+210°C / -5…+410°F
	K6230 without HT distance piece: -20…+130°C / -5…+260°F K6230 with HT distance piece: -20…+210°C / -5…+410°F
	K6375 without HT distance piece: -20…+130°C / -5…+260°F K6375 with HT distance piece: -20…+250°C / -5…+480°F
	FPM without HT distance piece: -20…+130°C / -5…+260°F FPM with HT distance piece: -20…+200°C / -5…+390°F
	FPM/FEP without HT distance piece: -15…+130°C / +5…+260°F FPM/FEP with HT distance piece: -15…+200°C / +5…+390°F
	Silicone/FEP without HT distance piece: -30…+130°C / -20…+260°F Silicone/FEP with HT distance piece: -30…+200°C / -20…+390°F Special version: -60…+130°C / -75…+260°F
	PFA without HT distance piece: -30…+130°C / -20…+260°F PFA with HT distance piece: -30…+200°C / -20…+390°F
Weather protection (Option)	Stainless Steel (1.4301 / 304)

Process connections

Horn antenna or Wave-Guide	DN50...200, PN6...64 ASME B16.5: 2...8", 150/300 lbs/RF
Wave-Stick	DN50...150 ASME B16.5: 2...6", G1½, 1½NPT
Dairy screw connection	DIN 11851: DN50, DN65, DN80 SMS 1145: 51 mm, 63 mm, 76 mm
Tri-clamp	ISO 2852: 2...4"

Electrical connections

Power supply	Non-Ex / Ex i: 14.5…30 VDC
Cable entry	M20x1.5; ½NPT
	G½
Cable gland	Standard: M20x1.5
	Options: ½NPT, G½ adapter
Cable entry capacity (terminal)	0.5…1.5 mm^2 / AWG 20...16
U-clamp terminals (for PA and FE)	Max. 4 mm^2 / AWG 12

Output

Description of the used abbreviations	U_{ext} = external voltage; R_L = load + resistance
Current output	
Output data	Distance, level, volume and reflectivity
Measuring range	4…20 mA HART® or 3.8…20.5 mA acc. to NAMUR NE 43 ①
Load	Minimal 0 Ω; max. R_L = ($(U_{ext.}$ - 14.5 VDC) / 22 mA)
Temperature drift	≤ 150 ppm/K
Error signal	Acc. to NAMUR NE 43
	High value: 22 mA
	Low value: 3.6 mA
HART®	
Description	HART® protocol via current output
	HART® version: V5
Load	≥ 250 Ω at HART® test point; Note maximum load for current output!
Multidrop operation	Yes, current output = 4 mA
	Multidrop address adjustable in operation menu 1…15

Approvals and certifications

CE	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE marking.
ATEX	ATEX II 1/2 G Ex ia IIC T6...T1
Other standards and approvals	
EMC	EMC Directives 2004 / 108 / EC and 93 / 68 / EEC in conjunction with EN 61326-1 (2006).
LVD	Low-Voltage Directives 2006 / 95 / EC and 93 / 68 / EEC 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

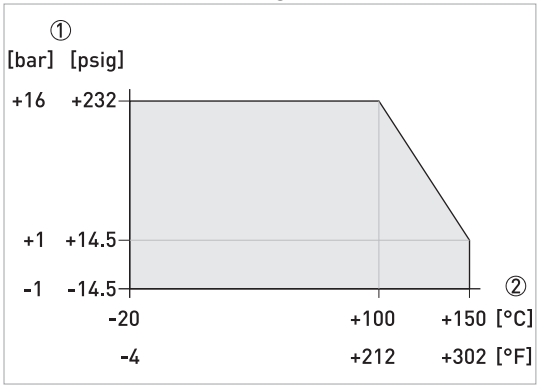
① HART® is a registered trademark of the HART Communication Foundation.

2.2 Pressure ratings

V96 flange system with horn antenna or Wave-Guide: max. allowable operating pressure

Nominal diameter		Flange rated pressure							
		PN16		PN25		PN40		PN64	
DN	inches	bar	psig	bar	psig	bar	psig	bar	psig
80	3	16	232	-	-	40	580	64	928
100	4	16	232	-	-	38	551	55	797
150	6	16	232	-	-	34	493	47	681
200	8	16	232	25	362	32	464	45	652

Wave-Stick with flange plate: pressure / temperature rating



① Pressure in [bar] or [psig]
② Temperature in [°C] or [°F]

2.3 Antenna selection

The graph below shows which antenna to select for the application.

Graph of tank height / measuring range against dielectric constant ε_r

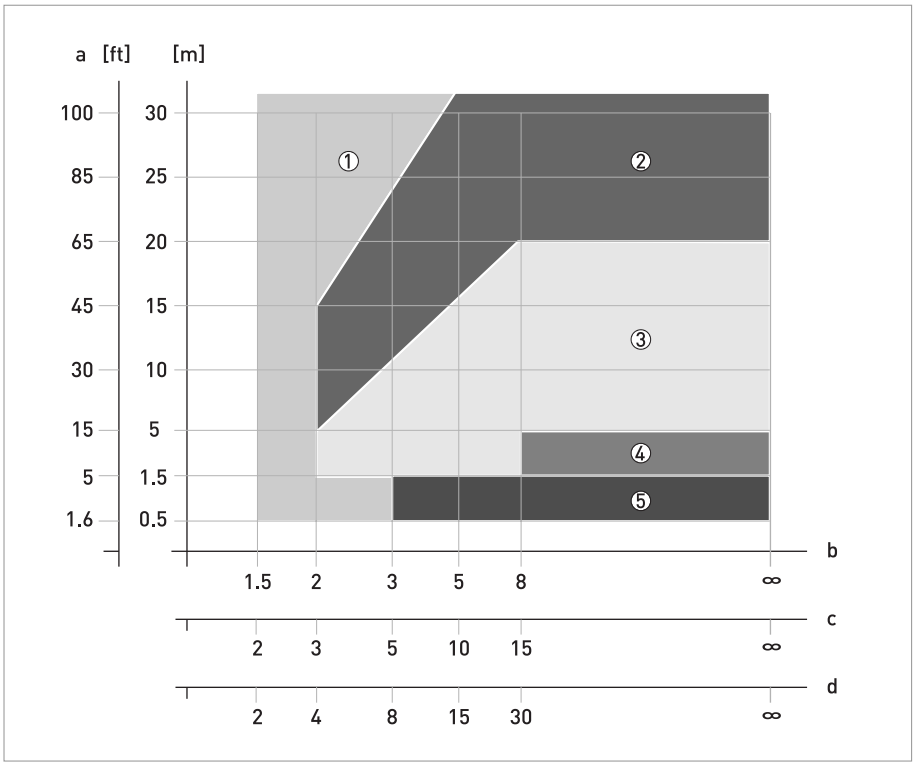


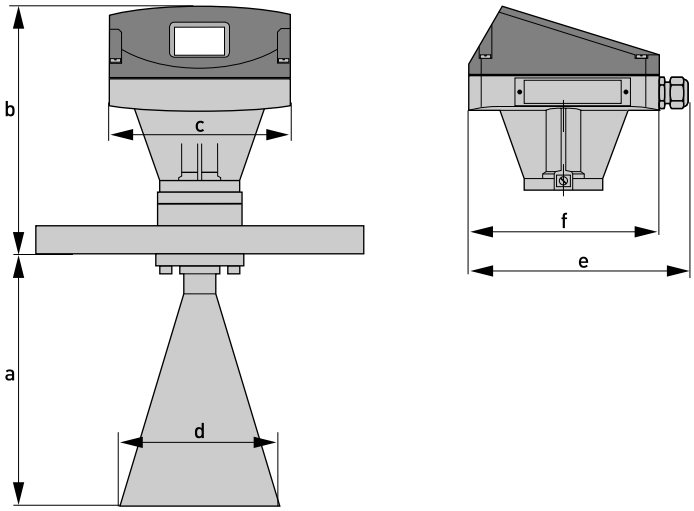
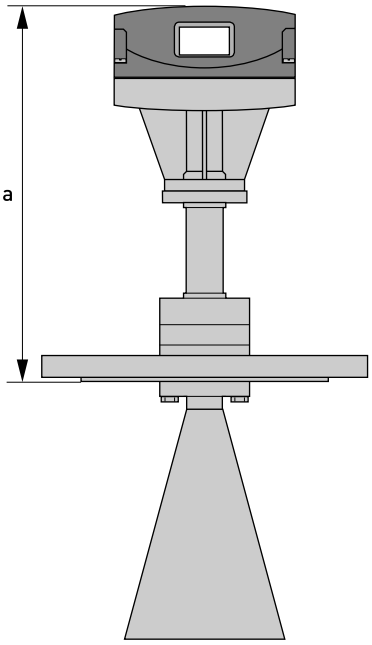
Figure 2-1: Selection of antenna

a = tank height / measuring range [ft / m]
b = ε_r for storage tanks with smooth product surface
c = ε_r for process tanks or foam
d = ε_r for agitator tanks with vortex

① Stilling well* (not for agitator tanks)
② Stilling well* (not for agitator tanks) or antenna type 4
③ Stilling well* (not for agitator tanks); Wave-Stick or antenna type 3 and type 4
④ Stilling well* (not for agitator tanks); antenna type 2, type 3 and type 4 or Wave-Stick
⑤ Stilling well* (not for agitator tanks) or Wave-Stick

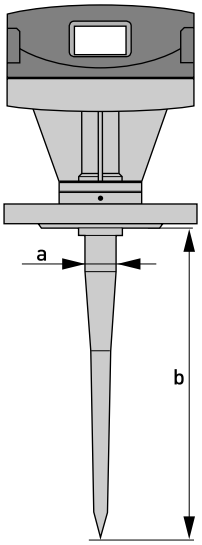
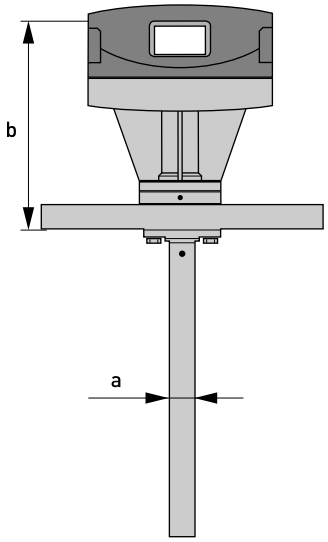
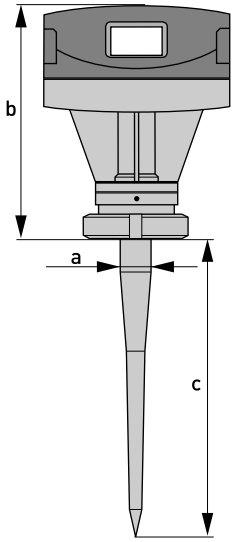
* Stilling well is equal to Wave-Guide antenna and bypass chamber

2.4 Dimensions

Horn antenna	High-temperature version
	
b = 215 mm / 8.5"	a = 355 mm / 14"
c = 155 mm / 6.1"	
e = 198 mm / 7.8"	
f = 172 mm / 6.8"	
For dimensions of a and Ød, see table below.	

Nominal size		Antenna	Dimensions [mm]				Approx. weight
DN [mm]	ASME [inches]	Type	Ød	a (SS 1.4571/ SS 316 Ti)	a (Hastelloy® C4)	a (Titanium, Tantalum)	[kg]
80	3	1	80	110	145	110	9
100	4	2	100	148	177	146	10
150	6	3	140	223	250	220	16
200	8	4	200	335	360	332	21

Nominal size		Antenna	Dimensions [inches]				Approx. weight
DN [mm]	ASME [inches]	Type	Ød	a (SS 1.4571/ SS 316 Ti)	a (Hastelloy® C4)	a (Titanium, Tantalum)	[lbs]
80	3	1	3.15	4.33	5.71	4.33	20
100	4	2	3.94	5.83	6.97	5.75	22
150	6	3	5.51	8.78	9.84	8.66	35
200	8	4	7.87	13.19	14.17	13.07	46

Wave-Stick	Wave-Guide	Wave-Stick Dairy screw connection
		
a = Ø25 mm / Ø1.0"	a = Ø30 mm / Ø1.2"	a = Ø25 mm / Ø1.0"
b = ≥270 mm / 10.6"	b = 215 mm / 8.5"	b = 205 mm / 8.1"
		c = ≥270 mm / 10.6"
Weight: approx. 6 kg / 13.2 lbs (DN50)	Weight: approx. 7 kg / 15.4 lbs (DN50, 1 m / 3.9")	Weight: approx. 4.4 kg / 8.8 lbs

3.1 Intended use

This radar level meter measures distance, level, mass and volume of liquids, pastes and slurries. It can be installed on tanks and reactors.

3.2 Pre-installation requirements

The following precautions must be taken to make sure it is correctly installed.

- Make sure that there is adequate space on all sides.
- Protect the signal converter from direct sunlight and install the weather protection accessory if necessary.
- 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.

To make sure that you install the device quickly, easily and safely, prepare the installation as given in the instructions that follow.

3.3 Theoretical data for nozzle position

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

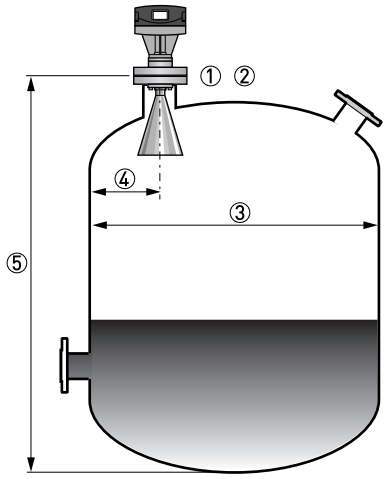


Figure 3-1: Recommended nozzle position for liquids, pastes and slurries

① Nozzles for DN150 or Wave-Stick antennas
② Nozzles for DN200 antennas
③ Tank diameter
④ Minimum distance of nozzle from the tank wall depending on:
  ① 1/7 x tank height
  ② 1/10 x tank height
  Maximum distance of nozzle from the tank wall depending on:
  ① 1/3 x tank diameter
  ② 1/3 x tank diameter
⑤ Tank height

If possible, do not put 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.

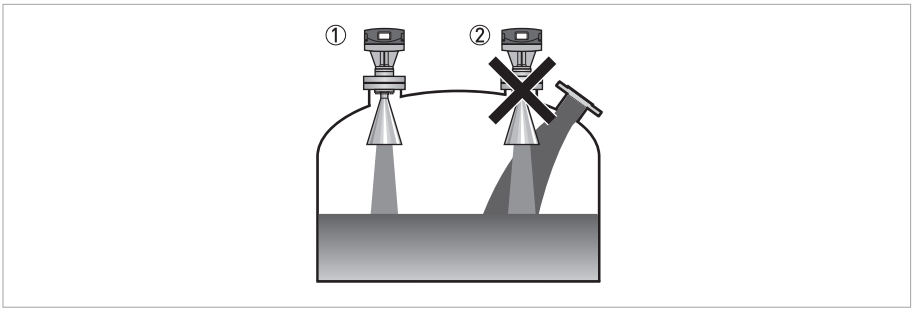


Figure 3-2: Product inlets

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

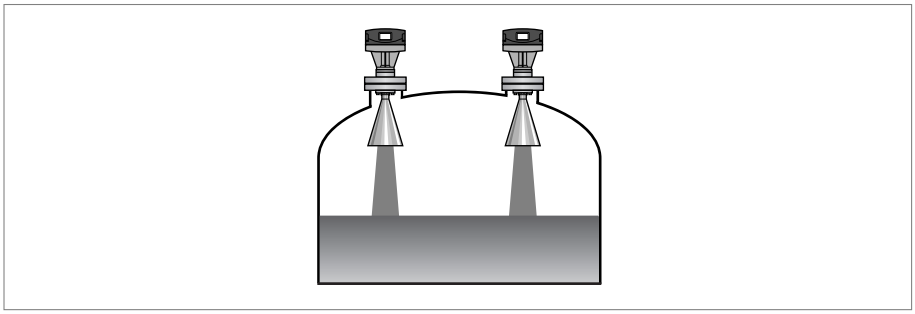


Figure 3-3: More than 1 FMCW radar level meter can be operated in a tank

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

3.4 Installation recommendations for liquids

3.4.1 General requirements

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

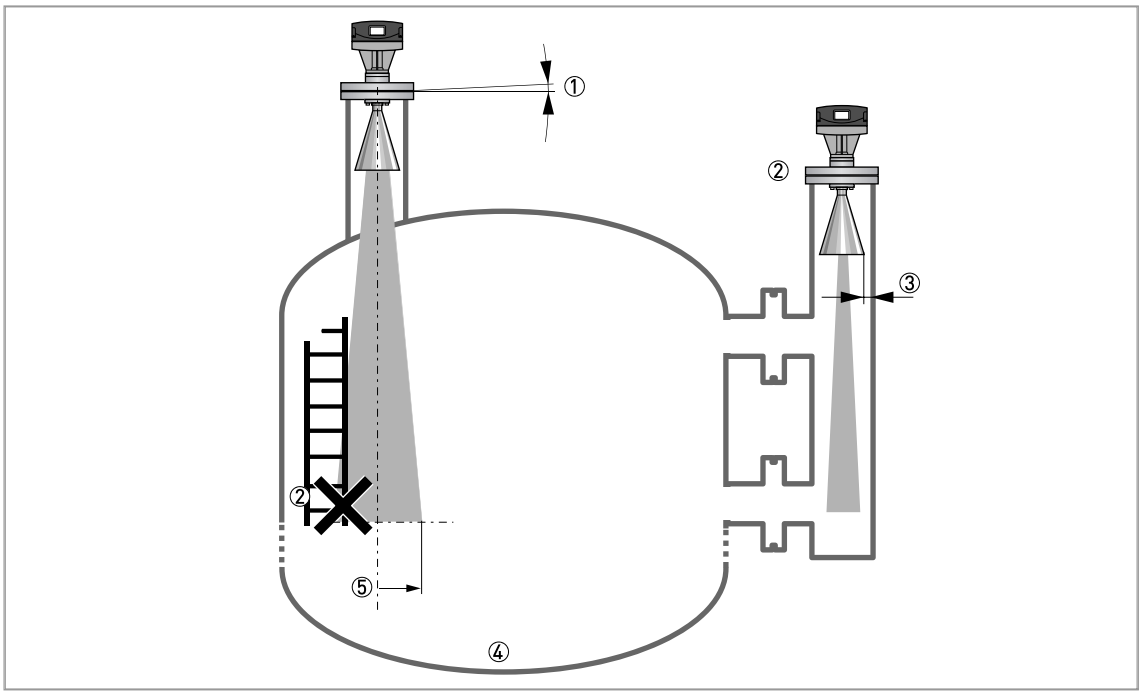


Figure 3-4: General Installation recommendations

① Do not tilt the device more than 2°.
② If there are too many obstacles in the radar beam, do an empty spectrum scan (refer to the handbook) or install a by-pass chamber or stilling well.
③ ≤5 mm / 0.2" max. for high-dielectric constant liquids
④ Curved and conical tank bottoms. Refer to the handbook for fine adjustment of the device.
⑤ Radius of radar footprint (DN80 Horn antenna): increments of 300 mm/m or 12"/ft (16°)
Radius of radar footprint (DN100 Horn antenna): increments of 220 mm/m or 9"/ft (12°)
Radius of radar footprint (DN150 Horn antenna): increments of 140 mm/m or 5.5"/ft (8°)
Radius of radar footprint (DN200 Horn antenna): increments of 100 mm/m or 4"/ft (6°)

3.4.2 Installation in stilling wells

Use a stilling well if:

- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.
- There are too many other obstacles near to the area where you want to install the device.
- The device is used to measure a liquid (petro-chemicals) in a tank with a floating roof.

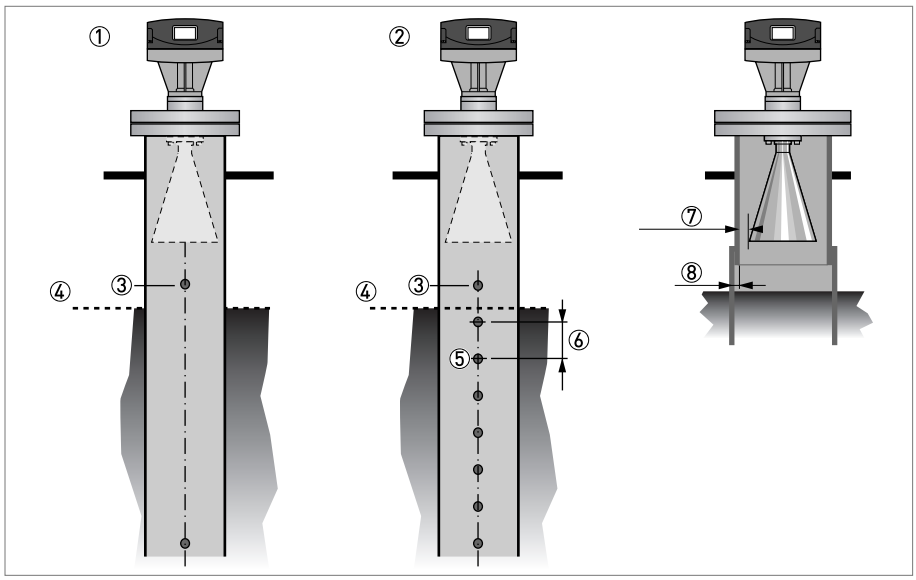


Figure 3-5: Installation recommendations for stilling wells

① Basic requirements for a stilling well
② Recommendations for tanks that have no foam
③ Air circulation hole (max. Ø10 mm / 0.4")
④ Maximum level of the liquid
⑤ Liquid circulation holes (max. Ø10 mm / 0.4")
⑥ Distance between holes ≥ 50 mm / 2"
⑦ Clearance between the antenna and the wall of the stilling well < 5 mm / 0.2"
⑧ Sudden change in well diameter < 1 mm / 0.04"

Installation requirements

- *The stilling well must be electrically conductive.*
- *The inside diameter of the bypass chamber must not be more than 10 mm / 0.4" over the diameter of the antenna.*
- *The stilling well must be straight.*
- *The stilling well must have a surface roughness of ±≤0.1 mm / 0.004" or better.*
- *There must be no sudden changes in internal diameter greater than 1 mm / 0.04".*

Installation in tanks containing one liquid and foam

- Drill a pressure equalization hole in the stilling well above the maximum level.
- Deburr the hole.

Installation in tanks containing one liquid or more without foam

- Drill a pressure equalization hole in the stilling well above the maximum level of the top liquid.

➲ These holes help the liquid to move freely between the stilling well and the tank.

- Deburr the holes.

Floating roofs

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

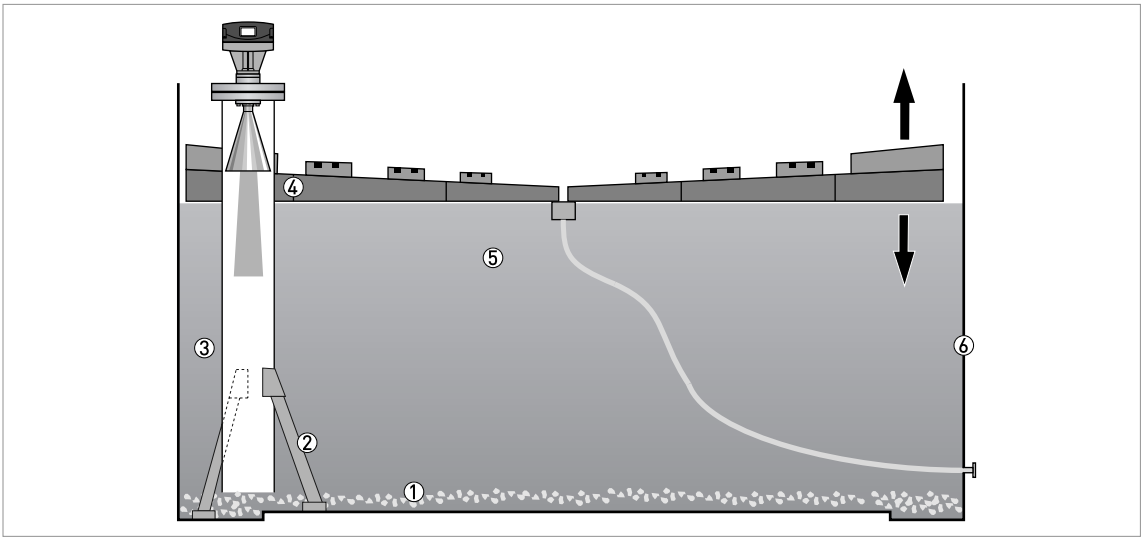


Figure 3-6: Floating roofs

① Sediment
② Support fixtures
③ Stilling well
④ Floating roof
⑤ Product
⑥ Tank

Horizontal cylindrical tanks

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,

we recommend that you install it in a stilling well.

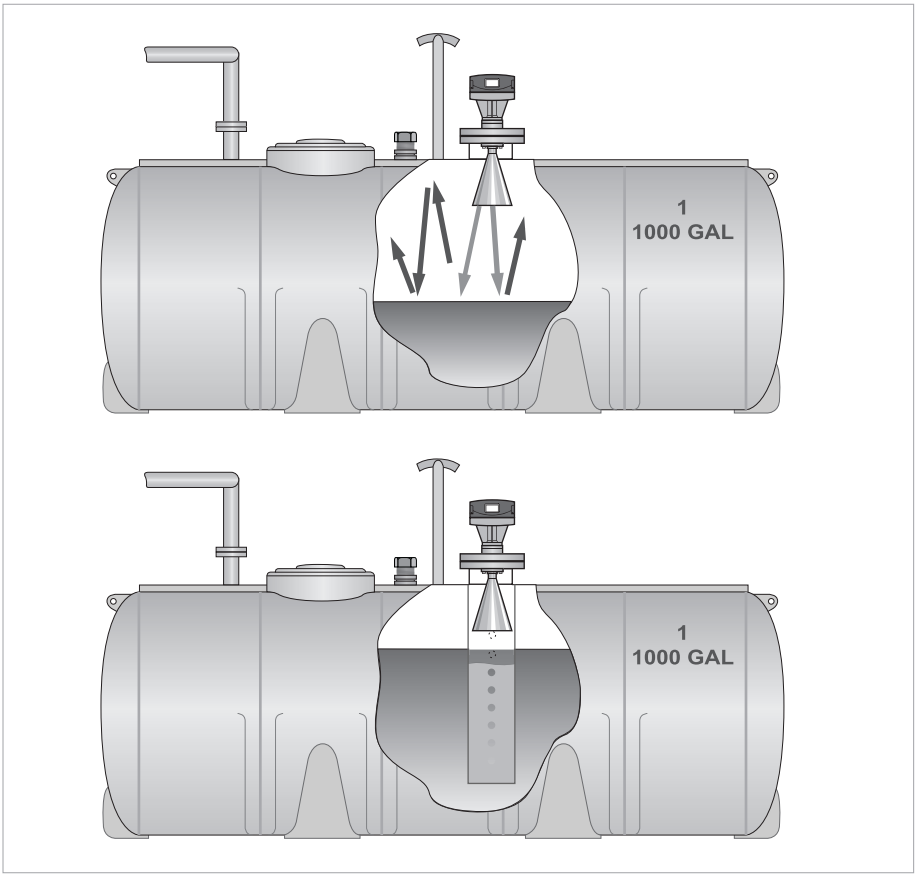


Figure 3-7: Horizontal cylindrical tanks

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* ***menu 3.0 Installation > 3.5 Application > 3.5.5 Multip. Refl.*** *to keep the effect of multiple reflections to a minimum. For more data, refer to "Function description" in the handbook.*

3.4.3 Bypass chambers

Install a bypass chamber next to the tank if:

- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.
- There are too many obstacles in the tank.

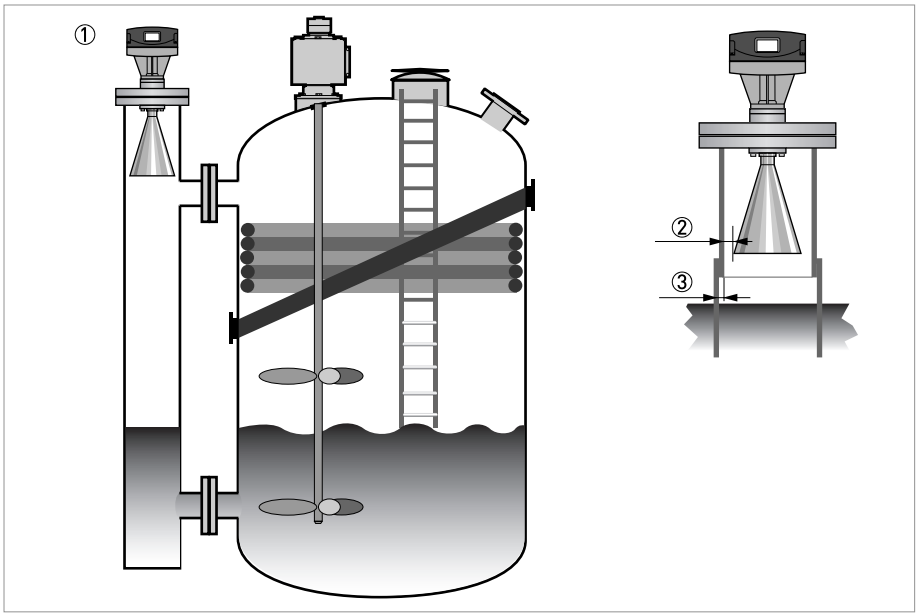


Figure 3-8: Installation recommendations for bypass chambers

① Bypass chamber
② Clearance between the antenna and the wall of the stilling well < 5 mm / 0.2"
③ Sudden change in well diameter < 1 mm / 0.04"

Installation requirements

- *The bypass chamber must be electrically conductive.*
- *The inside diameter of the bypass chamber must not be more than 10 mm / 0.4" over the diameter of the antenna.*
- *The bypass chamber must be straight.*
- *The bypass chamber must have a surface roughness of ±≤0.1 mm / 0.004".*
- *There must be no sudden changes in internal diameter greater than 1 mm / 0.04".*

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. These additional process connections must be separated by a distance equal to or less than the minimum level of the bottom liquid.

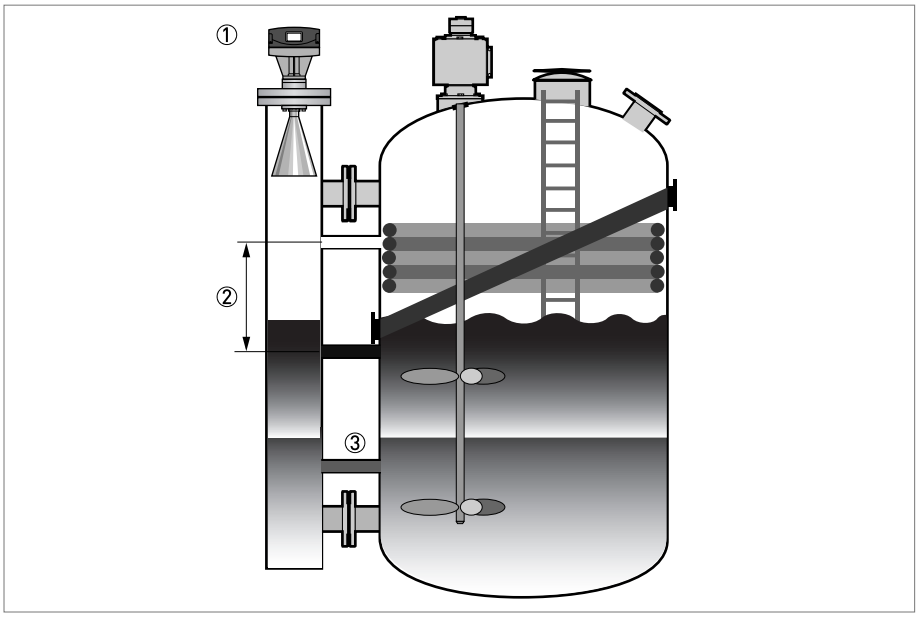


Figure 3-9: Installation recommendations for bypass chambers that contain more than one liquid

① Bypass chamber
② Distance between connections ≤ the minimum level of the bottom liquid.
③ Additional process connection

3.5 How to keep false reflections to a minimum

If there are false reflections, the device will not measure correctly.

False reflections are caused by:

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

If there are too many obstacles in the path of the radar beam, do an empty spectrum scan. Alternatively, install the device on a bypass chamber or stilling well.

False reflections

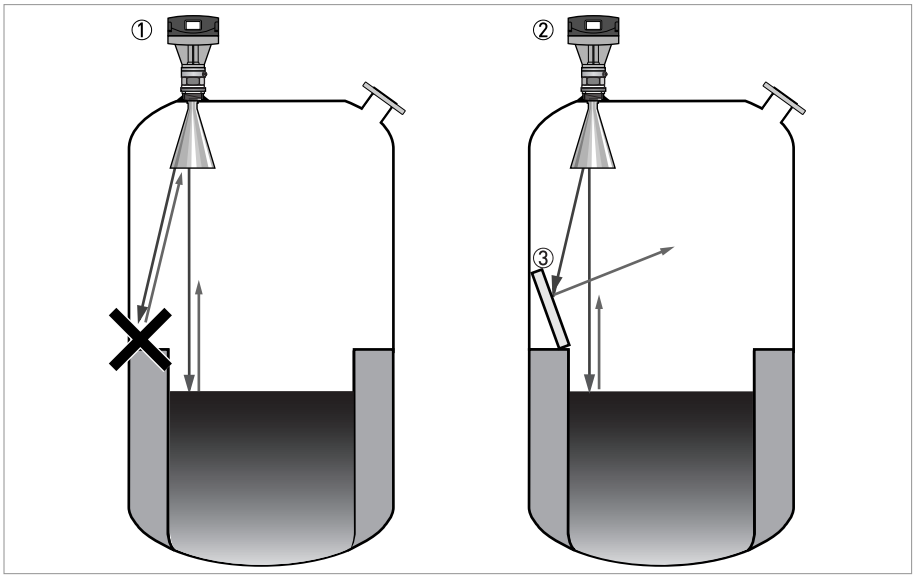


Figure 3-10: False reflections and deflector plates

① Sharp corners and sudden changes in tank diameter can cause the device to measure incorrectly
② Install a deflector plate to prevent false reflections
③ Deflector plate

3.6 How to install the device on the tank

3.6.1 How to install a device with a flange connection

Equipment needed:

- Device
- Gasket (not supplied)

Requirements for flange connections

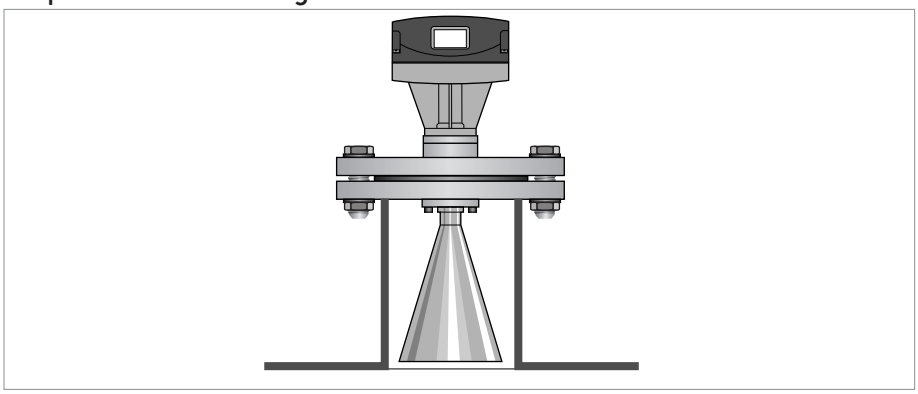


Figure 3-11: Flange connection

3.6.2 How to install a device with a threaded connection

Equipment needed:

- Device
- Gasket for G1½ or 1½NPT connection (not supplied)

Requirements for threaded connections

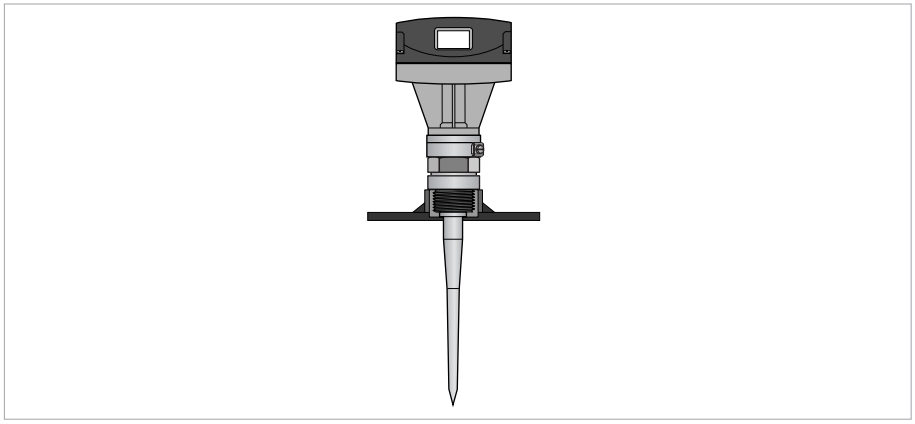


Figure 3-12: Threaded connection

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 of output

4.2.1 Non-Ex

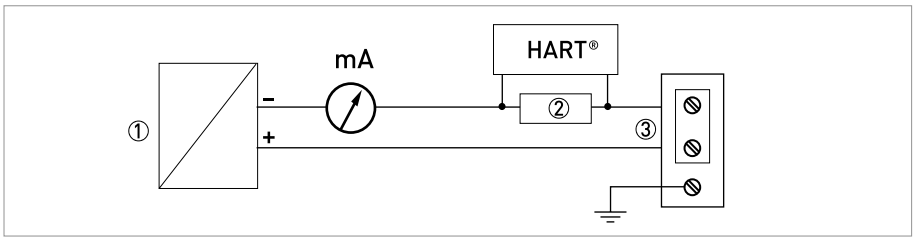


Figure 4-1: Electrical connections for non-Ex devices

① Power supply
② Resistor for HART® communication
③ 14.5...30 VDC for an output of 22 mA at the terminal

4.2.2 Ex i

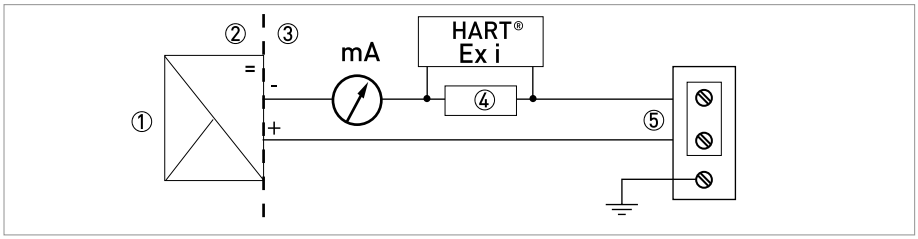


Figure 4-2: HART® connection to the Ex i circuit with a resistor

① Intrinsically-safe power supply
② Zone non-Ex
③ Zone Ex
④ Resistor for HART® communication
⑤ 14.5...30 VDC for an output of 22 mA at the terminal

If the barrier has a HART® terminal, you can connect HART® devices directly to the barrier without a resistor.

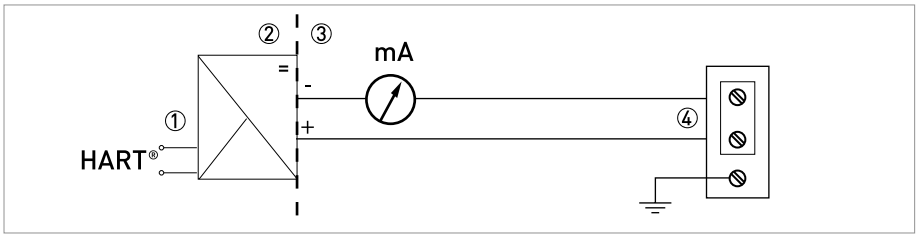


Figure 4-3: HART® connection to the Ex i barrier without a resistor

① Intrinsically-safe power supply
② Zone non-Ex
③ Zone Ex
④ 14.5...30 VDC for an output of 22 mA at the terminal

4.3 Protection category

The device fulfills all requirements per protection class IP 66/67 (equivalent to NEMA 6-6X).

Make sure the cable gland is watertight.

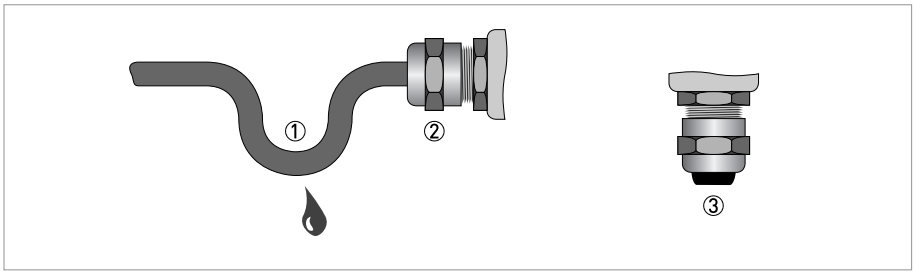


Figure 4-4: How to make the installation agree with protection category IP 67

- 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.

Output 1 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

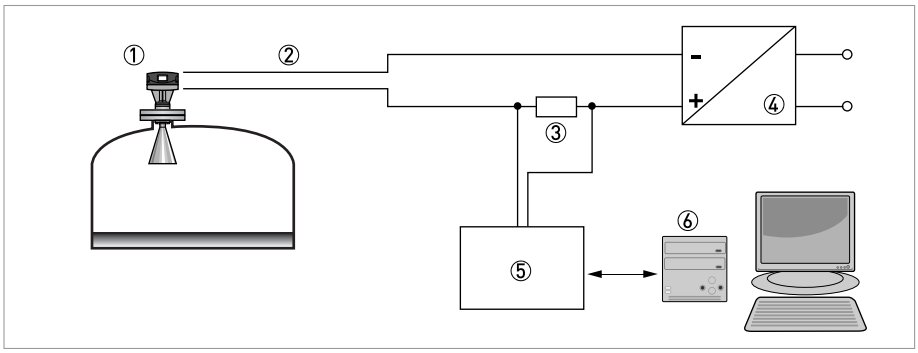


Figure 4-5: Point-to-point connection (non-Ex)

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

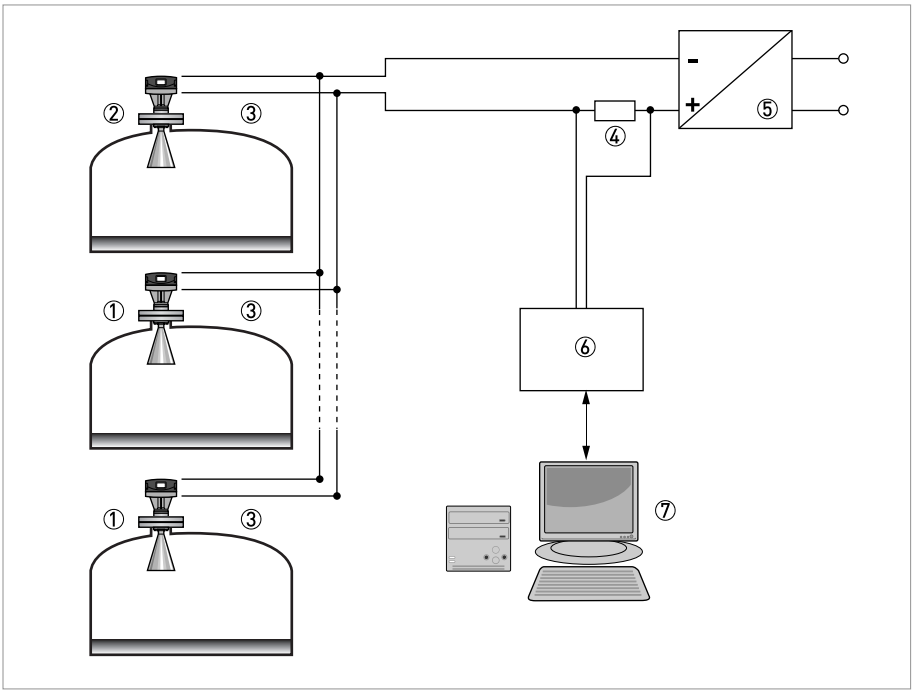


Figure 4-6: Multi-drop network (non-Ex)

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

You can help us to assist you as quickly as possible by giving us a few items of information.

Then just fax them to us. Your personal consultant will contact you within 24 hours.

5.1 Device data

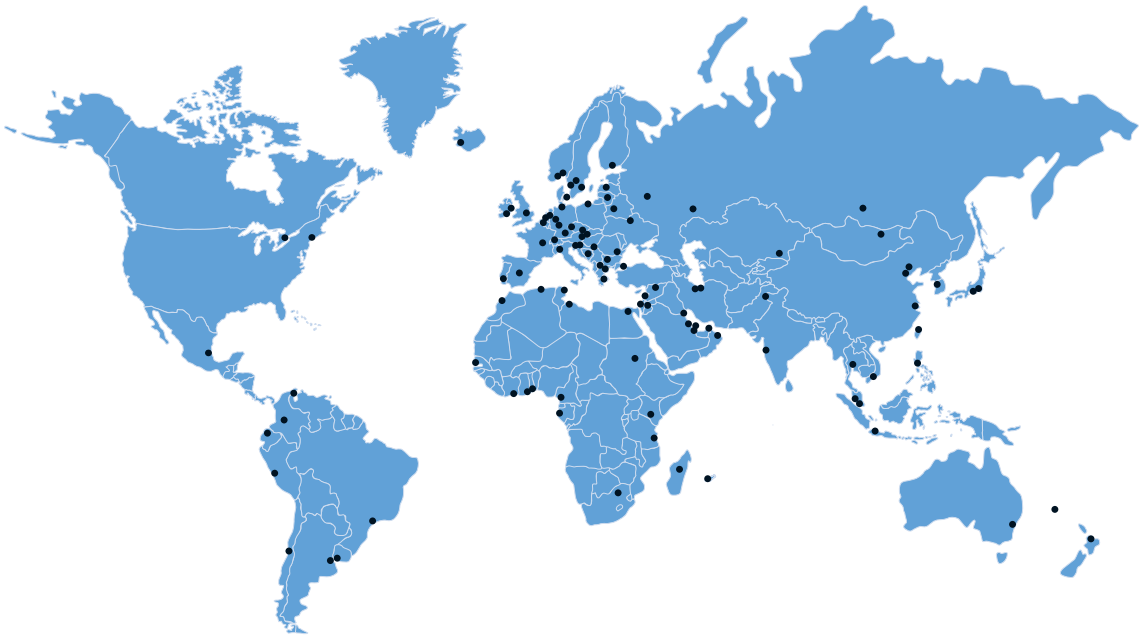
Connection type:	
Connection size:	
Connection material:	
Gasket:	
Display:	
User interface language:	
Approvals:	

5.2 Rating data

Product name:	
Operating pressure:	
Rated pressure:	
Process connection temperature:	
Ambient temperature:	
Operating density:	
Viscosity:	
Measurand (level, volume,...):	
Comments (indoors/outdoors, ...):	

5.3 Contact data

Company:	
Contact person:	
Telephone number:	
Fax number:	
E-mail:	



KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Measuring systems for the oil and gas industry
- Measuring systems for sea-going tankers

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KROHNE