

LR64 Free Space Radar



24 GHz Radar (FMCW) Level Transmitter for solids from granulates to rocks

- ▶ Ideal for dry bulk solids; unaffected by angle of repose
- ▶ Proven PP and PTFE Drop antenna insensitive to product build-up
- ▶ Built-in configurations for different surface profiles

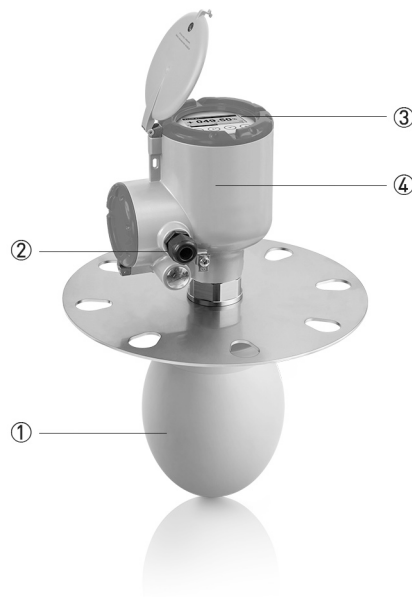
Equipment should be installed, operated, serviced, and maintained only by qualified personnel.

No responsibility is assumed by Schneider Electric for any consequences arising from the use of this material.

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1.1 The FMCW radar level transmitter for solids from granulates to rocks

This device is a non-contact radar level transmitter that uses FMCW technology. It measures distance, level and volume of powders, granulates, rocks, cereals and all other types of solids. It is ideal for measuring the level of solids from granulates to rocks.



- ① Drop antenna with small beam angle. Its ellipsoidal shape and smooth surface minimizes scaling.
- ② 2-wire 24 GHz FMCW radar level transmitter
- ③ Large, backlit LCD screen with 4-button keypad can be used with a bar magnet without opening the housing cover. The software has a quick setup assistant for easy commissioning. 12 languages are available.
- ④ Aluminium or stainless steel housing

- The first non-contact 2-wire FMCW Radar 24-26 GHz designed for solids
- Extremely high dynamics with considerable signal-to-noise ratio for clear vision in dusty atmospheres
- One user interface for all applications
- Proven Drop antenna design made of solid PP or PTFE. Ellipsoidal shape minimizes scaling, making purging systems obsolete.
- Highly focused beam with small beam angle (4° for DN150 / 6" PTFE Drop antenna), no need for huge parabolic antennas which are difficult to install
- No need for antenna aiming kits. A slanted flange can be installed if necessary.
- Low-cost low-pressure disc flange

Industries

- Metals, Minerals & Mining
- Chemical market
- Power
- Agri-food

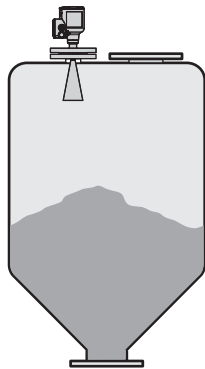
- Wastewater
- Pulp & Paper

Applications

- Finished and raw products (buffer silos, hoppers, stock piles, bulk storage containers, rock crushers, blast furnace, conveyor belts etc.)

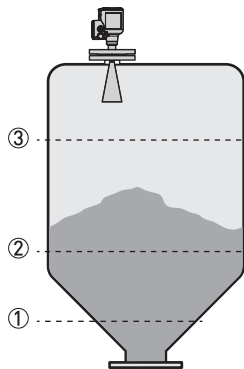
1.2 Applications

1. Level measurement of solids



The level transmitter can measure the level of a wide range of solid products on a large variety of installations within the stated pressure and temperature range. It does not require any calibration: it is only necessary to do a short configuration procedure.

2. Mass (volume) measurement



A strapping table function is available in the configuration menu for volume or mass measurement. Up to 50 mass (volume) values can be related to level values. For example:
 Level ① = 2 m / Mass ① = e.g. 100 kg
 Level ② = 10 m / Mass ② = e.g. 500 kg
 Level ③ = 20 m / Mass ③ = e.g. 1000 kg

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

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

1.3 Product family

LevelWave LR01 (10 GHz) for liquids in storage and process applications



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

The device agrees with SIL2 requirements for safety-related systems (as per IEC 61508). Output options include HART®, FOUNDATION™ fieldbus and PROFIBUS PA industrial communication protocols.

LR54 Free Space Radar (24 GHz) for liquids in basic process applications



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

The LR54 can measure in process conditions with temperatures up to +130°C / +266°F and pressures up to 16 barg / 232 psig. The antenna options permit to measure distances up to 100 m / 328 ft. The device can be installed in high nozzles (≤ 1 m / 3.28 ft) when it is fitted with antenna extensions.

LR74 Free Space Radar (24 GHz) for agitated and corrosive liquids



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

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

LR75 Free Space Radar (80 GHz) for liquids in narrow tanks with internal obstructions



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

There is an extensive choice of process connections starting from $\frac{3}{4}$ ". Flanges have an optional PEEK plate protection for corrosive tank contents. The LR75 operates in process conditions with temperatures up to +150°C / +302°F and pressures up to 40 barg / 580 psig. It measures distances up to 100 m / 328 ft and a 112 mm / 4.4" extension is available for high nozzles.

LR64 Free Space Radar (24 GHz) for solids from granulates to rocks



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

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

LR65 Free Space Radar (80 GHz) for powders and dusty atmosphere



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

The LR65 operates in process conditions with temperatures up to +200°C / +392°F and pressures up to 40 barg / 580 psig. It offers an extensive choice of threaded ($\geq 1\frac{1}{2}$ ") and flanged ($\geq \text{DN}50 / 2$ ") process connections. The antenna options permit the device to measure distances up to 100 m / 328 ft. A 112 mm / 4.4" extension is available for high nozzles.

1.4 Measuring principle

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

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

For further signal processing the difference Δf 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 Δf is transformed via a Fast Fourier Transform (FFT) into a frequency spectrum and then the distance is calculated from the spectrum. The level results from the difference between the tank height and the measured distance.

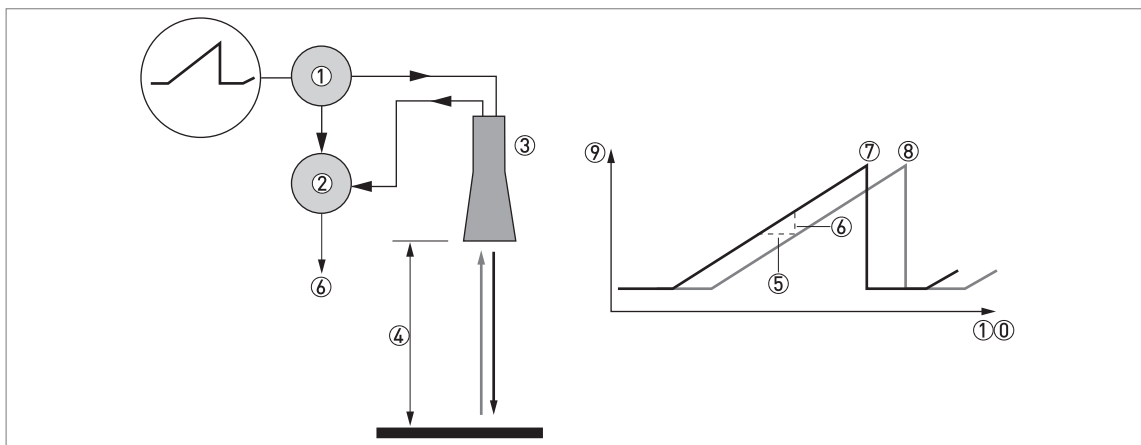


Figure 1-1: Measuring principle of FMCW radar

- 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

Measurement modes

"Direct" mode

The device uses the largest radar signal to monitor level.

"Direct Plus" mode

If it is possible there will be an interference signal in the measurement zone that is larger than the level signal, select "Direct Plus" mode. If you select "Direct Plus" mode, the device locks on the level signal and monitors changes in level. If the device then finds larger reflections in the silo, it will only monitor the largest signal in a small search zone around the first reflection found and ignore all other reflections. The interference signal must not be near to the level signal.

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.*

Measuring system

Measuring principle	2-wire loop-powered level transmitter; FMCW radar
Frequency range	K-band (24...26 GHz)
Max. radiated power (EIRP)	< -41.3 dBm according to ETSI EN 302 372 (TLPR) and ETSI EN 302 729 (LPR)
Application range	Level measurement of solids from granulates to rocks
Primary measured value	Distance and reflection
Secondary measured value	Level, volume and mass

Design

Construction	The measurement system consists of a measuring sensor (antenna) and a signal converter
Options	Integrated LCD display [-20...+70°C / -4...+158°F]; if the ambient temperature is not in these limits, then this condition can stop the display
	Straight antenna extensions (length 105 mm / 4.1") Max. extension length, Metallic Horn antenna: 1050 mm / 41.3" Max. extension length, Drop antenna: 525 mm / 20.7"
	Antenna purging system for Metallic Horn antennas (supplied with a 1/8 NPTF connection)
	2° slanted PP flange (for all antennas)
	Weather protection
Max. measuring range (antenna)	Metallic Horn, DN80 (3"): 25 m / 82 ft
	Metallic Horn, DN100 (4"): 40 m / 131.2 ft
	Metallic Horn, DN150 (6"): 80 m / 262.5 ft
	Metallic Horn, DN200 (8"): 100 m / 328 ft
	PP or PTFE Drop, DN80 (3"): 25 m / 82 ft
	PP or PTFE Drop, DN100 (4"): 40 m / 131.2 ft
	PP or PTFE Drop, DN150 (6"): 100 m / 328.1 ft
	Refer also to "Measuring accuracy" on page 16
Min. tank height	1 m / 40"
Recommended minimum blocking distance	Antenna extension length + antenna length + 0.3 m / 12"
Min. distance for reflection measurement	1 m / 3.3 ft

Beam angle (antenna)	Metallic Horn, DN 80 (3"): 9°
	Metallic Horn, DN 100 (4"): 8°
	Metallic Horn, DN150 (6"): 6°
	Metallic Horn, DN200 (8"): 5°
	PP Drop, DN80 (3"): 9°
	PP Drop, DN100 (4"): 7°
	PP Drop, DN150 (6"): 5°
	PTFE Drop, DN80 (3"): 8°
	PTFE Drop, DN100 (4"): 7°
	PTFE Drop, DN150 (6"): 4°
Display and user interface	
Display	Backlit LCD display
	128 × 64 pixels in 64-step greyscale with 4-button keypad
Interface languages	English, French, German, Italian, Spanish, Portuguese, Chinese (simplified), Japanese, Russian, Czech, Polish and Turkish

Measuring accuracy

Resolution	1 mm / 0.04"
Repeatability	±1 mm / ±0.04"
Accuracy	Standard: ±2 mm / ±0.08", when distance ≤ 10 m / 33 ft; ±0.02% of measured distance, when distance > 10 m / 33 ft. For more data, refer to <i>Measuring accuracy</i> on page 16.
Reference conditions acc. to EN 61298-1	
Temperature	+15...+25°C / +59...+77°F
Pressure	1013 mbara ±50 mbar / 14.69 psia ±0.73 psi
Relative air humidity	60% ±15%
Target	Metal plate in an anechoic chamber. The device has specified settings.

Operating conditions

Temperature	
Ambient temperature	-40...+80°C / -40...+176°F Ex: see supplementary operating instructions or approval certificates
Relative humidity	0...99%
Storage temperature	-40...+85°C / -40...+185°F
Process connection temperature (higher temperature on request)	Metallic Horn antenna: -50...+130°C / -58...+266°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
	Drop antenna (PTFE): -50...+130°C / -58...+266°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
	Drop antenna (PP): -40...+100°C / -40...+212°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	
Process pressure	-1...16 barg / -14.5...232 psig Subject to the process connection used and the process connection temperature. For more data, refer to the handbook.
Other conditions	
Dielectric constant (ϵ_r)	≥ 1.4
Ingress protection	IEC 60529: IP66 / IP68 (0.1 barg / 1.45 psig) NEMA 250: NEMA type 4X - 6 (housing) and type 6P (antenna)
Maximum rate of change	60 m/min / 196 ft/min

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. For more data, refer to the handbook.
Dimensions and weights	For dimensions and weights data, refer to <i>Dimensions and weights</i> on page 21.

Materials

Housing	Polyester-coated aluminium Option: Stainless steel (1.4404 / 316L) – non-Ex devices only. Ex approvals will be available in the second quarter of 2020.
Wetted parts, including antenna	Metallic Horn antenna: Stainless steel (1.4404 / 316L) Drop antenna: PTFE; PP
Process connection	Stainless steel (1.4404 / 316L)
Gaskets (and O-rings for the sealed antenna extension option)	PTFE Drop antenna: FKM/FPM (-40...+130°C / -40...+266°F); Kalrez® 6375 (-20...+130°C / -4...+266°F); EPDM (-50°C...+130°C / -58...+266°F) ① PP Drop antenna: FKM/FPM (-40...+100°C / -40...+212°F); Kalrez® 6375 (-20...+100°C / -4...+212°F); EPDM (-40°C...+100°C / -40...+212°F) ① Metallic Horn antenna: FKM/FPM (-40...+130°C / -40...+266°F); Kalrez® 6375 (-20...+130°C / -4...+266°F); EPDM (-50°C...+130°C / -58...+266°F)
Feedthrough	PEI (-50...+130°C / -58...+266°F) This is the maximum range. The feedthrough temperature limits must agree with the temperature limits of the gasket material and antenna type.
Cable gland	Standard: none Options: Plastic (Non-Ex: black, Ex i-approved: blue); nickel-plated brass; stainless steel; M12 (4-pin connector)
Weather protection (Option)	Stainless steel (1.4404 / 316L)

Process connections

Thread	G 1 A...1½ A (ISO 228); 1...1½ NPT (ASME B1.20.1)
Flange version	
EN 1092-1	Low-pressure flanges: DN80...200 in PN01; Standard flanges: DN80...200 in PN10, PN16 and PN40 (Type B1); others on request Optional flange facing for standard flanges: Type A
ASME B16.5	Low-pressure flanges: 3"...8" in 150 lb (max. 15 psig); Standard flanges: 3"...8" in 150 lb RF and 300 lb RF; others on request Optional flange facing for standard flanges: FF (Flat Face)
JIS B2220	80...200A in 10K RF; others on request
Other	Others on request

Electrical connections

Power supply	Terminals output – Non-Ex / Ex i: 12...30 V DC; min./max. value for an output of 21.5 mA at the terminals Terminals output – Ex d: 16...36 V DC; min./max. value for an output of 21.5 mA at the terminals
Maximum current	21.5 mA
Current output load	Non-Ex / Ex i: $R_L [\Omega] \leq ((U_{ext} - 12 V) / 21.5 \text{ mA})$. For more data, refer to <i>Minimum power supply voltage</i> on page 18. Ex d: $R_L [\Omega] \leq ((U_{ext} - 16 V) / 21.5 \text{ mA})$. For more data, refer to <i>Minimum power supply voltage</i> on page 18.
Cable entry	Standard: M20×1.5; Options: ½ NPT; 4-pin male M12 connector
Cable gland	Standard: none Options: M20×1.5 (cable diameter: 7...12 mm / 0.28...0.47"); others are available on request
Cable entry capacity (terminal)	0.5...3.31 mm² (AWG 20...12)

Input and output

Current output	
Output signal	Standard: 4...20 mA Options: 3.8...20.5 mA acc. to NAMUR NE 43; 4...20 mA (reversed); 3.8...20.5 mA (reversed) acc. to NAMUR NE 43
Output type	Passive
Resolution	±5 µA
Temperature drift	Typically 50 ppm/K
Error signal	High: 21.5 mA; Low: 3.5 mA acc. to NAMUR NE 43
HART®	
Description	Digital signal transmitted with the current output signal (HART® protocol) ②
Version	7.4
Load	≥ 250 Ω
Digital temperature drift	Max. ±15 mm / 0.6" for the full temperature range
Multi-drop operation	Yes. Current output = 4 mA. Enter Program mode to change the polling address (1...63).

Available drivers	FC475, AMS, PDM, FDT/DTM
PROFIBUS PA (pending)	
Type	PROFIBUS MBP interface that agrees with IEC 61158-2 with 31.25 kbit/s; voltage mode (MBP = Manchester-Coded, Bus-Powered)
Function blocks	1 × Transducer Block Level (TB-Level), 1 × Physical Block (PB), 4 × Analog Input Block (AI), 1 × Totalizer Function Block (TOT)
Device power supply	9...32 V DC – bus powered; no additional power supply required
Polarity sensitivity	No
Basic current	18 mA
FOUNDATION™ fieldbus (pending)	
Physical layer	FOUNDATION™ fieldbus protocol that agrees with IEC 61158-2 and FISCO model; galvanically isolated
Communication standard	H1
ITK version	6.3
Function blocks	1 × Enhanced Resource Block (RB), 1 × Customer Level Transducer Block (LEVELTB), 1 × Customer Converter Transducer Block (CONVTB), 1 × Customer Diagnosis Transducer Block (DIAGTB), 4 × Analog Input Block (AI), 1 × Digital Input (DI), 1 × Integrator Block (IT), 1 × Proportional Integral Derivate Block (PID), 1 × Arithmetic Block (AR)
	Analog Input Block: 10 ms
	Digital Input Block: 20 ms
	Integrator Block: 15 ms
	Proportional Integral Derivate Block: 25 ms
Device power supply	Not intrinsically safe: 9...32 V DC
	Intrinsically safe: 9...24 V DC
Basic current	18 mA
Maximum error current FDE	25.5 mA (= basic current + error current = 18 mA + 7.5 mA)
Polarity sensitivity	No
Minimum cycle time	250 ms
Output data	Level, distance, volume, ullage volume, mass, ullage mass
Input data	None
Link Active Scheduler	Supported
NAMUR NE 107 data	Supported with FF field diagnosis (FF-891)

Approvals and certification

CE	The device meets the essential requirements of the EU Directives. The manufacturer certifies successful testing of the product by applying the CE marking.
	For more data about the EU Directives and European Standards related to this device, refer to the EU Declaration of Conformity. This document is supplied with the device. You can also download this document free of charge from the website.
Vibration resistance	EN 60068-2-6 and EN 60721-3-4 (1...9 Hz: 3 mm / 10...200 Hz: 1g, 10g shock ½ sinus: 11 ms)

Explosion protection	
ATEX (EU Type Approval)	II 1/2 G Ex ia IIC T6...T* Ga/Gb; ③
	II 1/2 D Ex ia IIIC T85°C...T*°C Da/Db; ④
	II 1/2 G Ex db ia IIC T6...T* Ga/Gb; ③
	II 1/2 D Ex ia tb IIIC T85°C...T*°C Da/Db ④
ATEX (Type Approval)	II 3 G Ex ic IIC T6...T* Gc; ③
	II 3 D Ex ic IIIC T85°C...T*°C Dc ④
IECEx	Ex ia IIC T6...T* Ga/Gb; ③
	Ex ia IIIC T85°C...T*°C Da/Db; ④
	Ex db ia IIC T6...T* Ga/Gb; ③
	Ex ia tb IIIC T85°C...T*°C Da/Db; ④
	Ex ic IIC T6...T* Gc; ③
	Ex ic IIIC T85°C...T*°C Gc ④
cQPSus	Division ratings
	XP-IS, Class I, Div 1, GPS ABCD, T6...Tx;
	DIP, Class II, III, Div 1, GPS EFG, T85°C...T*°C ; ④
	IS, Class I, Div 1, GPS ABCD, T6...Tx;
	IS, Class II, III, Div 1, GPS EFG, T85°C...T*°C; ④
	NI, Class I, Div 2, GPS ABCD, T6...Tx;
	NI, Class II, III, Div 2, GPS FG, T85°C...T*°C ④
	Zone ratings
	Class I, Zone 1, AEx db ia [ia Ga] IIC T6...T* Gb (US) – antenna suitable for Zone 0; Ex db ia [ia Ga] IIC T6...T* Gb (Canada) – antenna suitable for Zone 0; ③
	Class I, Zone 0, AEx ia IIC T6...T* Ga (US); Ex ia IIC T6...T* Ga (Canada); ③
	Zone 20, AEx ia IIIC T85°C...T*°C Da (US); Ex ia IIIC T85°C...T*°C Da (Canada); ④
	Zone 21, AEx ia tb [ia Da] IIIC T85°C...T*°C Db (US) – antenna suitable for Zone 20 Ex ia tb [ia Da] IIIC T85°C...T*°C Db (Canada) – antenna suitable for zone 20 ④
NEPSI - pending	Ex ia IIC T*~T6 Ga/Gb; ③
	Ex d ia IIC T*~T6 Ga/Gb; ③
	Ex iaD 20/21 T85...T* IP6X; ④
	Ex iaD 20/21 tD A21 IP6X T85°C...T*°C ④
Other standards and approvals	
Electromagnetic compatibility	EU: Electromagnetic Compatibility directive (EMC)
Radio approvals	EU: Radio Equipment directive (RED)
	FCC Rules: Part 15
	Industry Canada: RSS-211

Electrical safety	EU: Agrees with the safety part of the Low Voltage directive (LVD)
	USA and Canada: Agrees with NEC and CEC requirements for installation in ordinary locations
NAMUR	NAMUR NE 21 Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment
	NAMUR NE 43 Standardization of the Signal Level for the Failure Information of Digital Transmitters
	NAMUR NE 53 Software and Hardware of Field Devices and Signal Processing Devices with Digital Electronics
	NAMUR NE 107 Self-Monitoring and Diagnosis of Field Devices
CRN	Pending. This certification is applicable for all Canadian provinces and territories. For more data, refer to the website.
Construction code	Option: ASME B31.3

- ① Kalrez® is a registered trademark of DuPont Performance Elastomers L.L.C.
- ② HART® is a registered trademark of the HART Communication Foundation
- ③ T* = T5 or T4. For more data, refer to the related Ex approval certificate.
- ④ T*°C = 100°C or 130°C. For more data, refer to the related Ex approval certificate.

2.2 Measuring accuracy

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

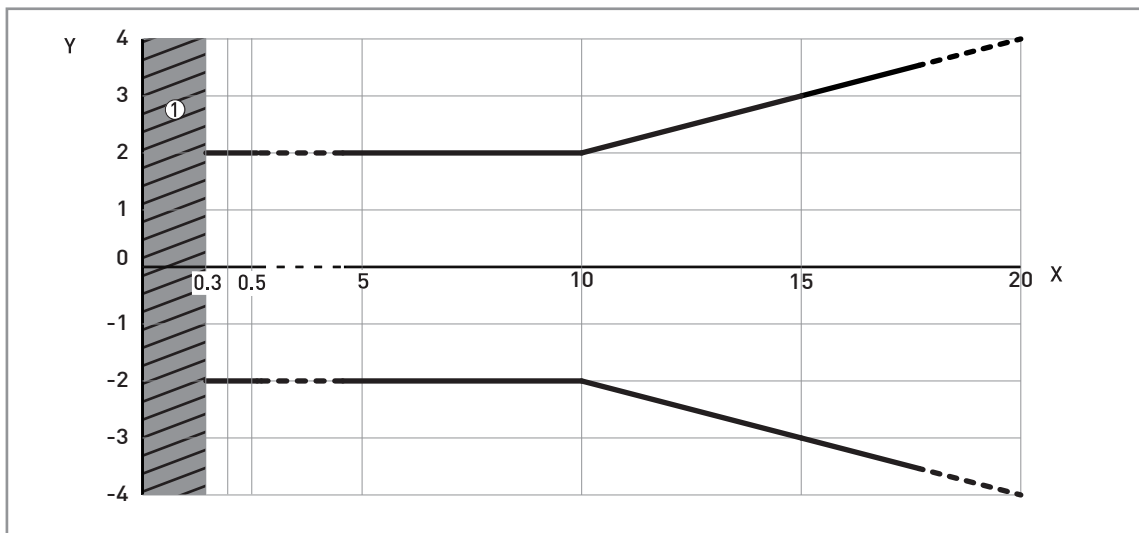


Figure 2-1: Measuring accuracy (graph of measuring accuracy in mm against measuring distance in m)

X: Measuring distance from the thread stop or flange facing of the process connection [m]

Y: Measuring accuracy [+yy mm / -yy mm]

① Minimum recommended blocking distance = antenna extension length + antenna length + 300 mm

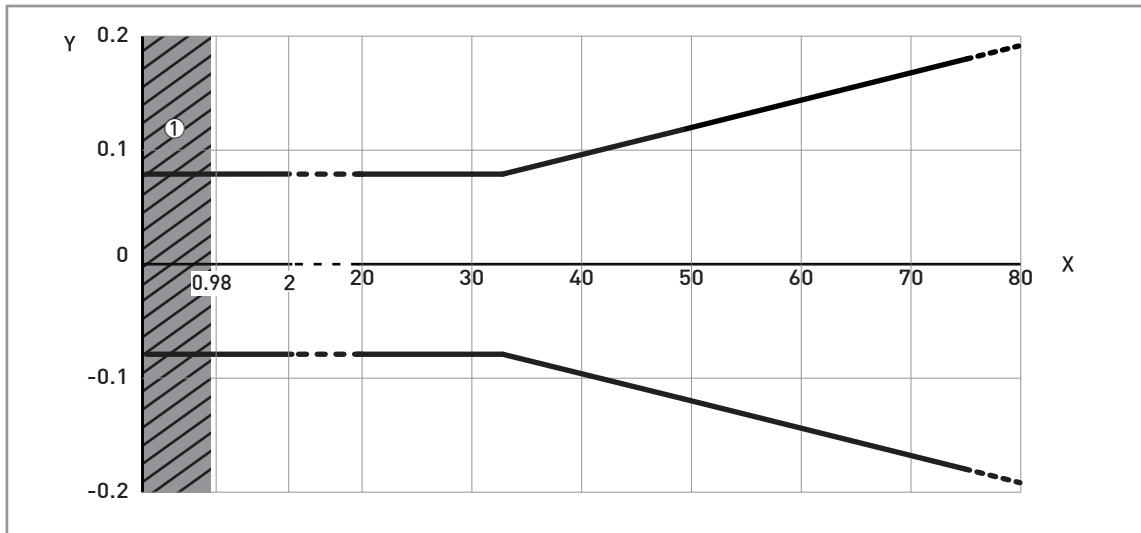


Figure 2-2: Measuring accuracy (graph of measuring accuracy in inches against measuring distance in ft)

X: Measuring distance from the thread stop or flange facing of the process connection [ft]

Y: Measuring accuracy [+yy inches / -yy inches]

① Minimum recommended blocking distance = antenna extension length + antenna length + 11.81"

To calculate the accuracy at a given distance from the antenna, refer to Technical data on page 10 (measuring accuracy).

2.3 Minimum power supply voltage

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

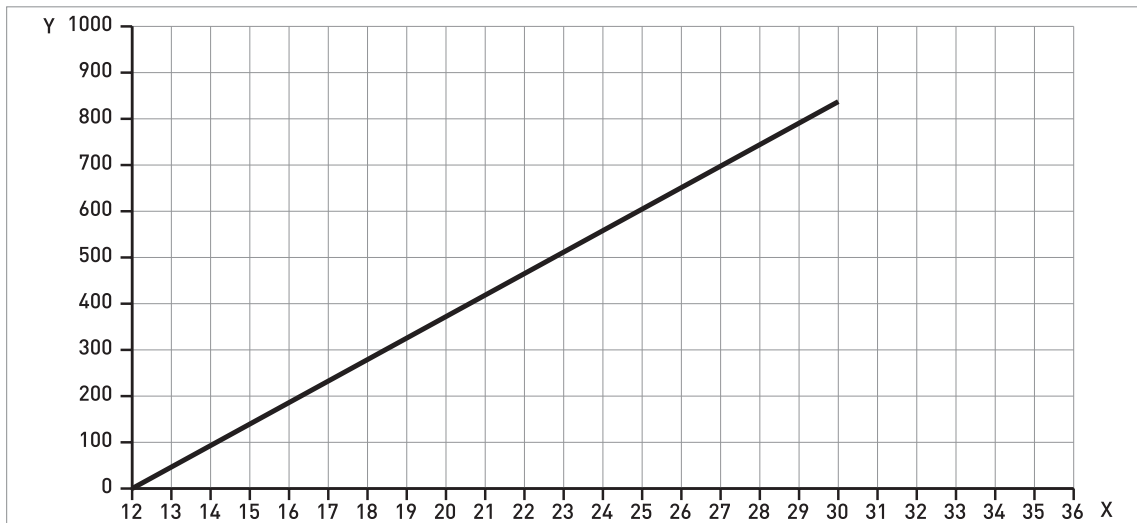


Figure 2-3: Minimum power supply voltage for an output of 21.5 mA at the terminals (Non-Ex and Hazardous Location approval (Ex i / IS))

X: Power supply U [V DC]
 Y: Current output load R_L [Ω]

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

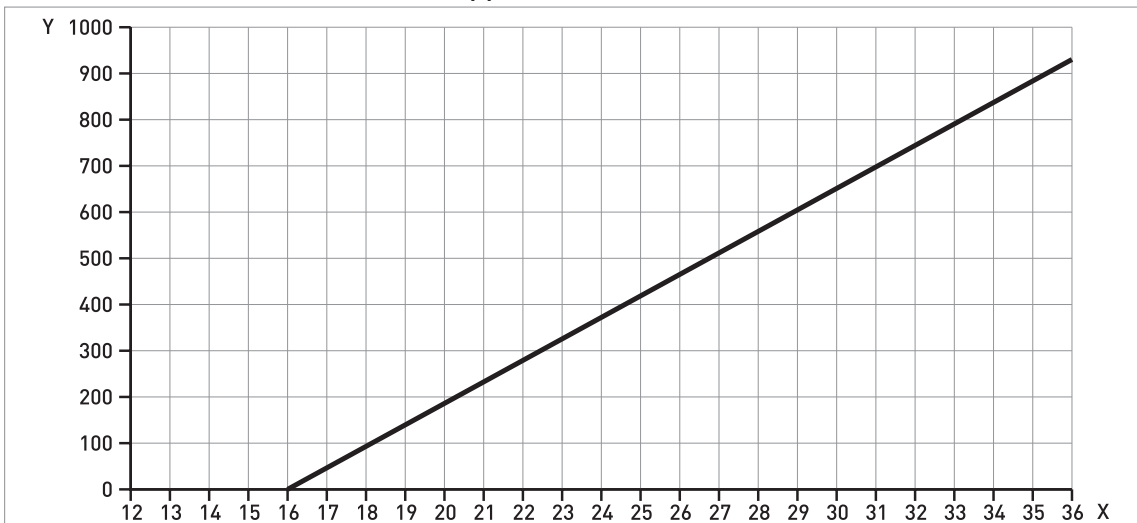


Figure 2-4: Minimum power supply voltage for an output of 21.5 mA at the terminals (Hazardous Location approval (Ex d / XP/NI))

X: Power supply U [V DC]
 Y: Current output load R_L [Ω]

2.4 Guidelines for maximum operating pressure

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

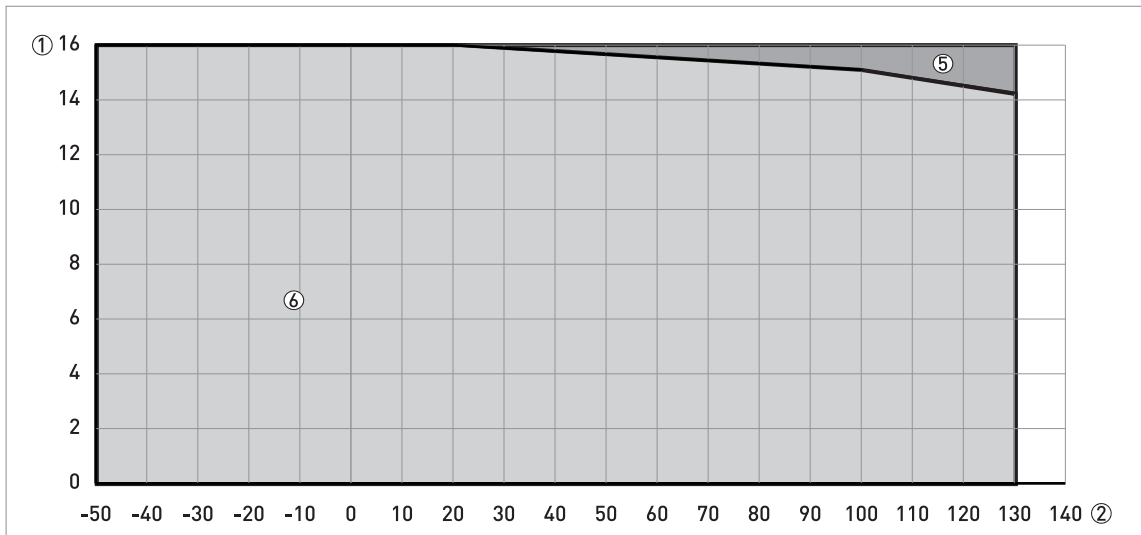


Figure 2-5: Pressure / temperature de-rating (EN 1092-1), flange and threaded connection, in °C and barg

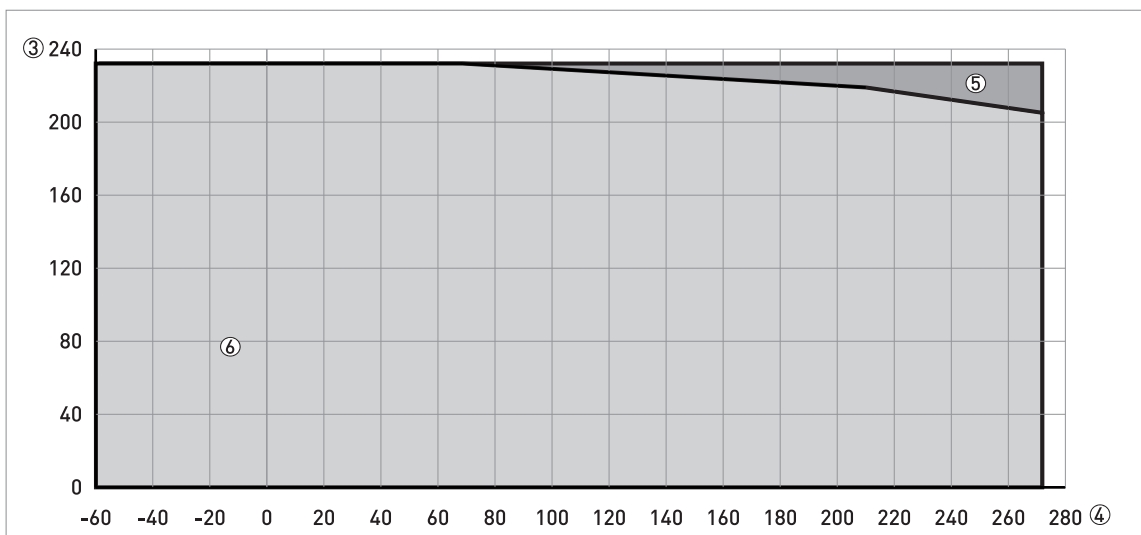


Figure 2-6: Pressure / temperature de-rating (EN 1092-1), flange and threaded connections, in °F and psig

- ① Process pressure, p [barg]
- ② Process connection temperature, T [°C]
- ③ Process pressure, p [psig]
- ④ Process connection temperature, T [°F]
- ⑤ Threaded connection, G (ISO 228-1)
- ⑥ Threaded connection, G (ISO 228-1). Flange connection, PN40.
- ⑦ Flange connection, PN16

CRN certification (pending)

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.

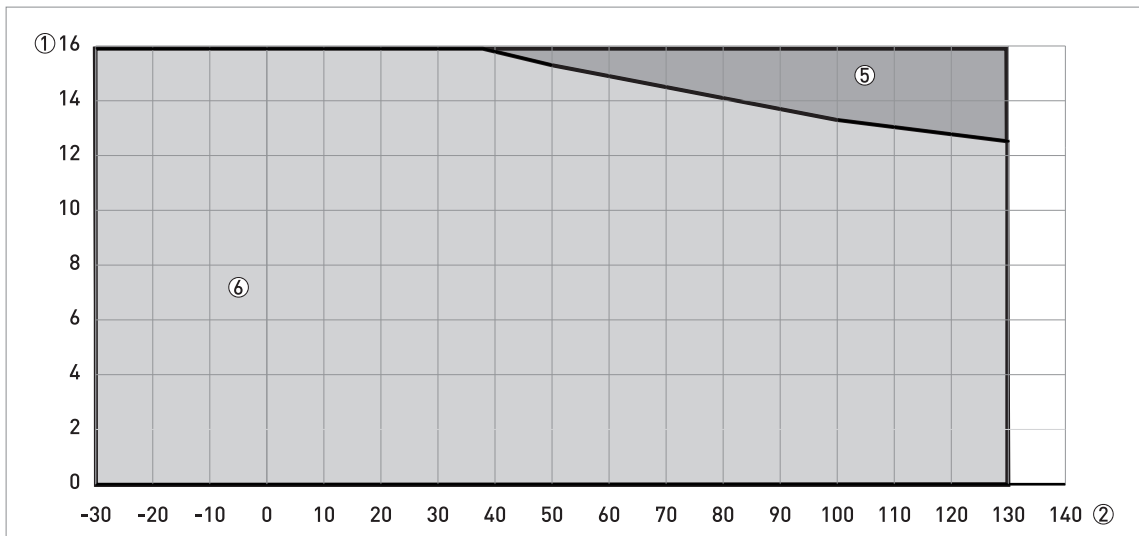


Figure 2-7: Pressure / temperature de-rating (ASME B16.5), flange and threaded connections, in °C and barg

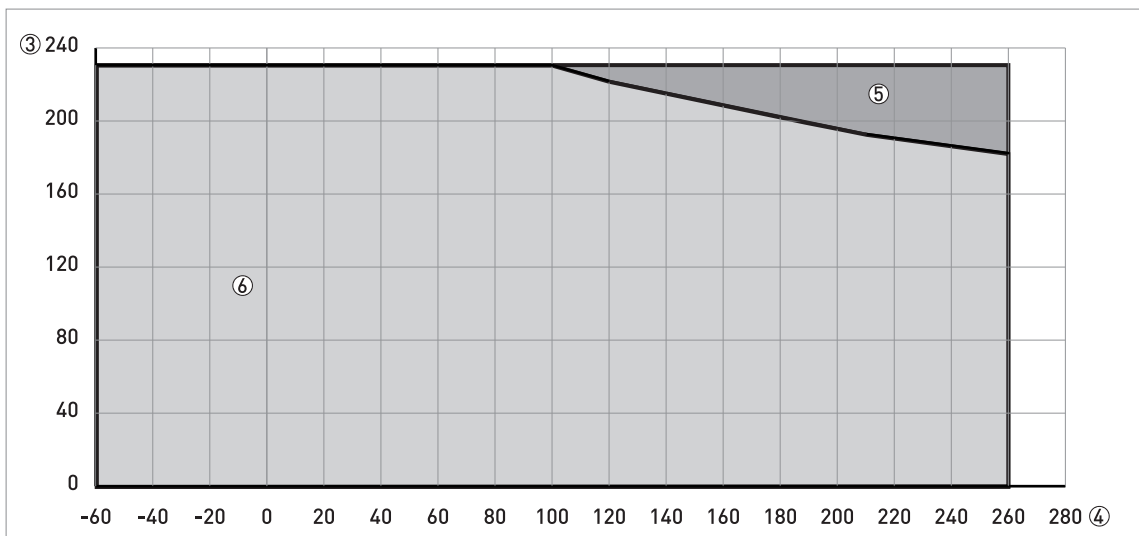


Figure 2-8: Pressure / temperature de-rating (ASME B16.5), flange and threaded connections, in °F and psig

- ① Process pressure, p [barg]
- ② Process connection temperature, T [°C]
- ③ Process pressure, p [psig]
- ④ Process connection temperature, T [°F]
- ⑤ Threaded connection, NPT (ASME B1.20.1). Flange connection, Class 300.
- ⑥ Flange connection, Class 150

2.5 Dimensions and weights

Metallic Horn antennas with threaded connections

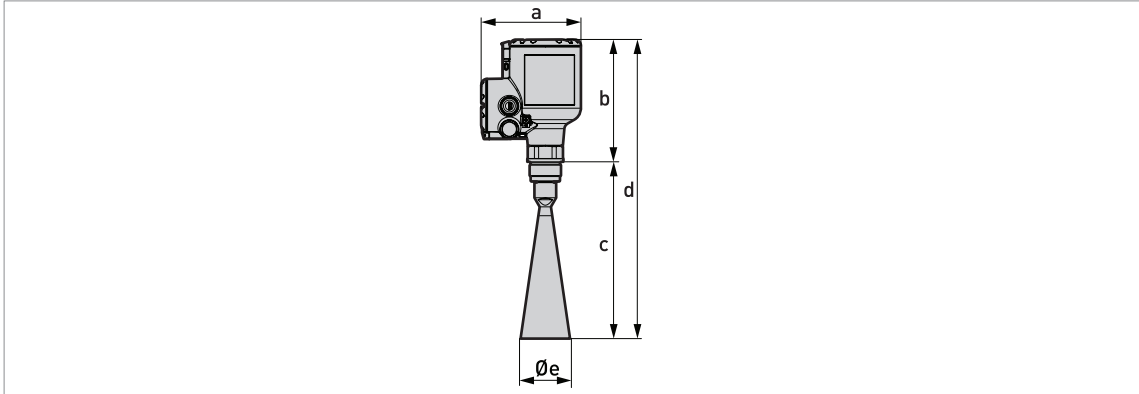


Figure 2-9: Metallic Horn antennas with G or NPT threaded connections

- The diameter of the outer sheath of the cable must be 7...12 mm or 0.28...0.47".
- Cable glands for cQPSus-approved devices must be supplied by the customer.
- A weather protection cover is available as an accessory with all devices.

Metallic Horn antennas with threaded connections: Dimensions in mm

Horn antenna version	Dimensions [mm]				
	a	b	c	d	Øe
DN80/3"	151	185	267 ①	452 ①	75
DN100/4"	151	185	335 ①	520 ①	95
DN150/6"	151	185	490 ①	675 ①	140
DN200/8"	151	185	662 ①	847 ①	190

① This is the dimension without the antenna extension option. A maximum of 10 antenna extensions are available. Each antenna extension is 105 mm long.

Metallic Horn antennas with threaded connections: Dimensions in inches

Horn antenna version	Dimensions [inches]				
	a	b	c	d	Øe
DN80/3"	5.94	7.28	10.51 ①	17.80 ①	2.95
DN100/4"	5.94	7.28	13.19 ①	20.47 ①	3.74
DN150/6"	5.94	7.28	19.29 ①	26.57 ①	5.51
DN200/8"	5.94	7.28	26.06 ①	33.35 ①	7.48

① This is the dimension without the antenna extension option. A maximum of 10 antenna extensions are available. Each antenna extension is 4.1" long.

Metallic Horn antenna versions with standard flange connections

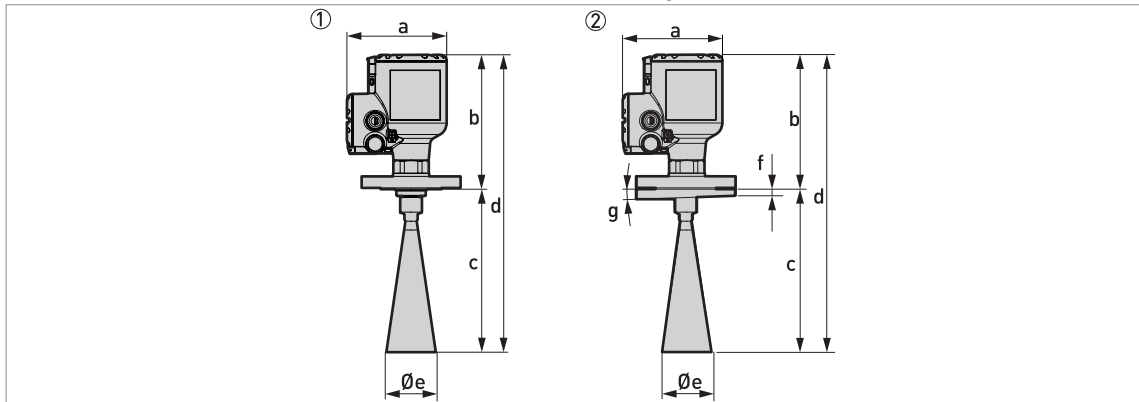


Figure 2-10: Metallic Horn antennas with standard flange connections

- ① Metallic Horn antenna with a flange connection
- ② Metallic Horn antenna with a flange connection and the 2° slanted flange option

- The diameter of the outer sheath of the cable must be 7...12 mm or 0.28...0.47".
- Cable glands for cQPSus-approved devices must be supplied by the customer.
- A weather protection cover is available as an accessory with all devices.

Metallic Horn antennas with standard flange connections: Dimensions in mm

Horn antenna version	Dimensions [mm]						[°]
	a	b	c	d	Øe	f	g
DN80/3"	151	205...215.6	256...267 ①	461...482 ①	75	10 ②	2° ②
DN100/4"	151	205...215.6	324...335 ①	529...550 ①	95	10 ②	2° ②
DN150/6"	151	205...215.6	479...490 ①	684...705 ①	140	10 ②	2° ②
DN200/8"	151	205...215.6	651...662 ①	856...877 ①	190	10 ②	2° ②

- ① These are the minimum and maximum values without the antenna extension option. A maximum of 10 antenna extensions are available. Each antenna extension is 105 mm long.
- ② If the device has the 2° slanted flange option.

Metallic Horn antennas with standard flange connections: Dimensions in inches

Horn antenna version	Dimensions [inches]						[°]
	a	b	c	d	Øe	f	g
DN80/3"	5.94	8.07...8.49	10.08...10.51 ①	18.15...18.98 ①	2.95	0.39 ②	2° ②
DN100/4"	5.94	8.07...8.49	12.76...13.19 ①	20.83...21.65 ①	3.74	0.39 ②	2° ②
DN150/6"	5.94	8.07...8.49	18.86...19.29 ①	26.93...27.76 ①	5.51	0.39 ②	2° ②
DN200/8"	5.94	8.07...8.49	25.63...26.06 ①	33.70...34.53 ①	7.48	0.39 ②	2° ②

- ① These are the minimum and maximum values without the antenna extension option. A maximum of 10 antenna extensions are available. Each antenna extension is 4.1" long.
- ② If the device has the 2° slanted flange option.

Metallic Horn antenna versions with low-pressure flange connections

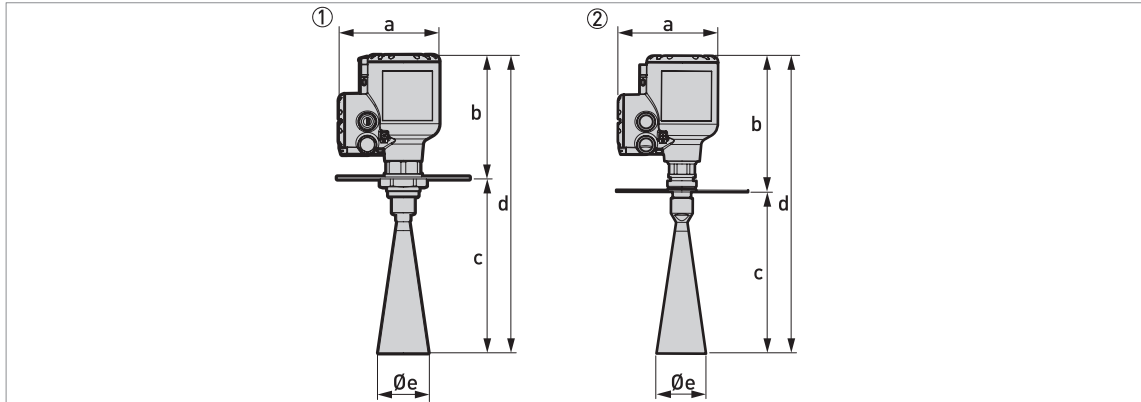


Figure 2-11: Metallic Horn antennas with low-pressure flange connections

- ① Metallic Horn antenna with a low-pressure flange attached to a G threaded connection (ISO 228-1)
- ② Metallic Horn antenna with a low-pressure flange attached to an NPT threaded connection (ASME B1.20.1)

- The diameter of the outer sheath of the cable must be 7...12 mm or 0.28...0.47".
- Cable glands for cQPSus-approved devices must be supplied by the customer.
- A weather protection cover is available as an accessory with all devices.

Metallic Horn antennas with low-pressure flange connections: Dimensions in mm

Horn antenna version	Dimensions [mm]						Øe
	a	b		c	d		
		G	NPT		G	NPT	
DN80/3"	151	215	247	262 ①	452 ①	509 ①	75
DN100/4"	151	215	247	331 ①	521 ①	578 ①	95
DN150/6"	151	215	247	486 ①	675 ①	733 ①	140
DN200/8"	151	215	247	657 ①	847 ①	904 ①	190

① This is the dimension without the antenna extension option. A maximum of 10 antenna extensions are available. Each antenna extension is 105 mm long.

Metallic Horn antennas with low-pressure flange connections: Dimensions in inches

Horn antenna version	Dimensions [mm]						Øe
	a	b		c	d		
		G	NPT		G	NPT	
DN80/3"	5.94	8.46	9.72	10.31 ①	17.79 ①	20.04 ①	2.95
DN100/4"	5.94	8.46	9.72	13.03 ①	20.51 ①	22.76 ①	3.74
DN150/6"	5.94	8.46	9.72	19.13 ①	26.57 ①	28.86 ①	5.11
DN200/8"	5.94	8.46	9.72	25.87 ①	33.35 ①	35.63 ①	7.48

① This is the dimension without the antenna extension option. A maximum of 10 antenna extensions are available. Each antenna extension is 4.1" long.

Drop antennas with threaded connections

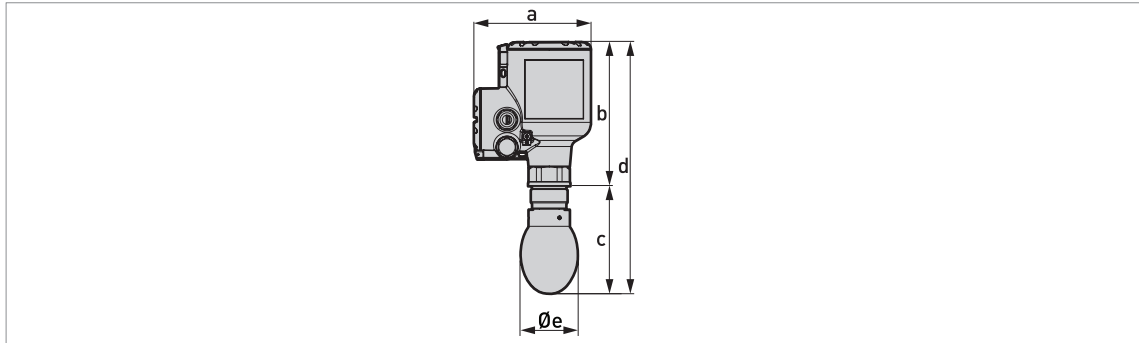


Figure 2-12: Drop antennas with threaded connections

- *The diameter of the outer sheath of the cable must be 7...12 mm or 0.28...0.47".*
- *Cable glands for cQPSus-approved devices must be supplied by the customer.*
- *A weather protection cover is available as an accessory with all devices.*

Drop antennas with threaded connections: Dimensions in mm

Drop antenna version	Dimensions [mm]				
	a	b	c	d	Øe
DN80/3" PP	151	185	137 ①	322 ①	74
DN80/3" PTFE	151	185	139 ①	324 ①	74
DN100/4" PP	151	185	160 ①	345 ①	94
DN100/4" PTFE	151	185	163 ①	348 ①	94
DN150/6" PP	151	185	216 ①	401 ①	144
DN150/6" PTFE	151	185	221 ①	406 ①	144

① This is the dimension without the antenna extension option. A maximum of 5 antenna extensions are available. Each antenna extension is 105 mm long.

Drop antennas with threaded connections: Dimensions in inches

Drop antenna version	Dimensions [inches]				
	a	b	c	d	Øe
DN80/3" PP	5.94	7.28	5.39 ①	12.68 ①	2.91
DN80/3" PTFE	5.94	7.28	5.47 ①	12.76 ①	2.91
DN100/4" PP	5.94	7.28	6.30 ①	13.58 ①	3.70
DN100/4" PTFE	5.94	7.28	6.42 ①	13.70 ①	3.70
DN150/6" PP	5.94	7.28	8.50 ①	15.79 ①	5.67
DN150/6" PTFE	5.94	7.28	8.70 ①	15.98 ①	5.67

① This is the dimension without the antenna extension option. A maximum of 5 antenna extensions are available. Each antenna extension is 4.1" long.

Drop antennas with standard flange connections

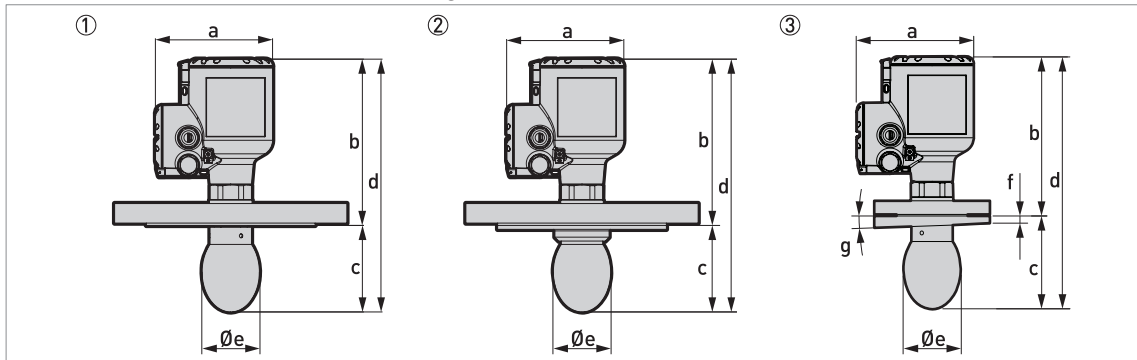


Figure 2-13: Drop antennas with standard flange connections

- ① Drop antenna with a flange connection
- ② Drop antenna with a flange connection and a flange plate protection option
- ③ Drop antenna with a flange connection and a 2° slanted flange option

- *The diameter of the outer sheath of the cable must be 7...12 mm or 0.28...0.47".*
- *Cable glands for cQPSus-approved devices must be supplied by the customer.*
- *A weather protection cover is available as an accessory with all devices.*

Drop antennas with standard flange connections: Dimensions in mm

Drop antenna version	Dimensions [mm]						[°]
	a	b	c	d	Øe	f	g
DN80/3" PP	151	205...215.6	126...136 ①	331...352 ①	74	②	③
DN80/3" PTFE	151	205...215.6	128...139 ①	333...355 ①	74	②	③
DN100/4" PP	151	205...215.6	149...159 ①	354...375 ①	94	②	③
DN100/4" PTFE	151	205...215.6	152...162 ①	357...378 ①	94	②	③
DN150/6" PP	151	205...215.6	205...216 ①	410...431 ①	144	②	③
DN150/6" PTFE	151	205...215.6	210...221 ①	415...436 ①	144	②	③

① These are the minimum and maximum values without the antenna extension option. A maximum of 5 antenna extensions are available. Each antenna extension is 105 mm long.

② If the device has the PP or PTFE flange protection option, then f = 20 mm. If the device has the 2° slanted flange option, then f = 10 mm.

③ If the device has the 2° slanted flange option, then g = 2°

Drop antennas with standard flange connections: Dimensions in inches

Drop antenna version	Dimensions [inches]						[°]
	a	b	c	d	Øe	f	g
DN80/3" PP	5.94	8.07...8.49	4.96...5.35 ①	13.03...13.98 ①	2.91	②	③
DN80/3" PTFE	5.94	8.07...8.49	5.04...4.47 ①	13.11...13.98 ①	2.91	②	③
DN100/4" PP	5.94	8.07...8.49	5.87...6.26 ①	13.94...14.76 ①	3.70	②	③
DN100/4" PTFE	5.94	8.07...8.49	5.98...6.38 ①	14.06...14.88 ①	3.70	②	③
DN150/6" PP	5.94	8.07...8.49	8.07...8.50 ①	16.14...16.97 ①	5.67	②	③
DN150/6" PTFE	5.94	8.07...8.49	8.27...8.70 ①	16.34...17.16 ①	5.67	②	③

① These are the minimum and maximum values without the antenna extension option. A maximum of 5 antenna extensions are available. Each antenna extension is 4.1" long.

② If the device has the PP or PTFE flange protection option, then f = 0.79". If the device has the 2° slanted flange option, then f = 0.39".

③ If the device has the 2° slanted flange option, then g = 2°

Drop antennas with low-pressure flange connections

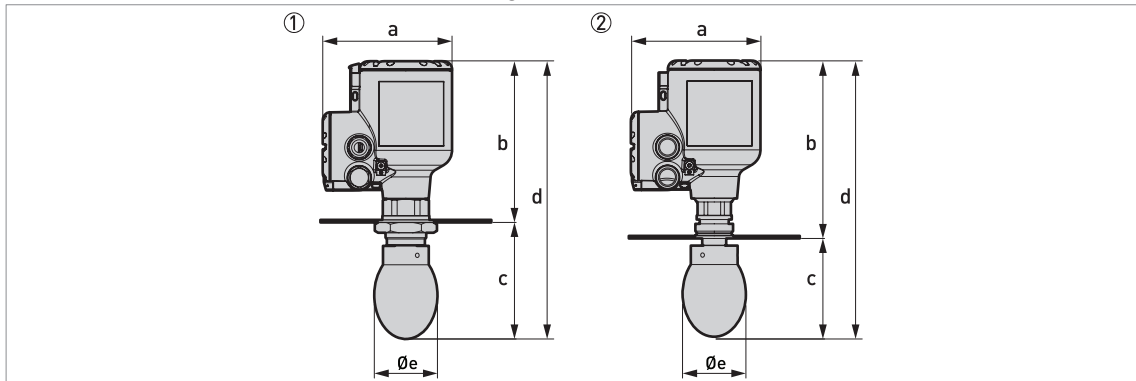


Figure 2-14: Drop antennas with low-pressure flange connections

- ① Metallic Horn antenna with a low-pressure flange attached to a G threaded connection (ISO 228-1)
- ② Metallic Horn antenna with a low-pressure flange attached to an NPT threaded connection (ASME B1.20.1)

- The diameter of the outer sheath of the cable must be 7...12 mm or 0.28...0.47".
- Cable glands for cQPSus-approved devices must be supplied by the customer.
- A weather protection cover is available as an accessory with all devices.

Drop antennas with low-pressure flange connections: Dimensions in mm

Drop antenna version	Dimensions [mm]						Øe
	a	b		c	d		
		G	NPT		G	NPT	
DN80/3"	151	188	220	136 ①	324 ①	356 ①	74
DN100/4"	151	188	220	159 ①	347 ①	379 ①	94
DN150/6"	151	188	220	217 ①	405 ①	437 ①	144

① This is the dimension without the antenna extension option. A maximum of 5 antenna extensions are available. Each antenna extension is 105 mm long.

Drop antennas with low-pressure flange connections: Dimensions in inches

Drop antenna version	Dimensions [mm]						Øe
	a	b		c	d		
		G	NPT		G	NPT	
DN80/3"	5.94	7.40	8.66	5.35 ①	12.76 ①	14.01 ①	2.91
DN100/4"	5.94	7.40	8.66	6.26 ①	13.66 ①	14.92 ①	3.70
DN150/6"	5.94	7.40	8.66	8.54 ①	15.94 ①	17.20 ①	5.67

① This is the dimension without the antenna extension option. A maximum of 5 antenna extensions are available. Each antenna extension is 4.1" long.

Purging option

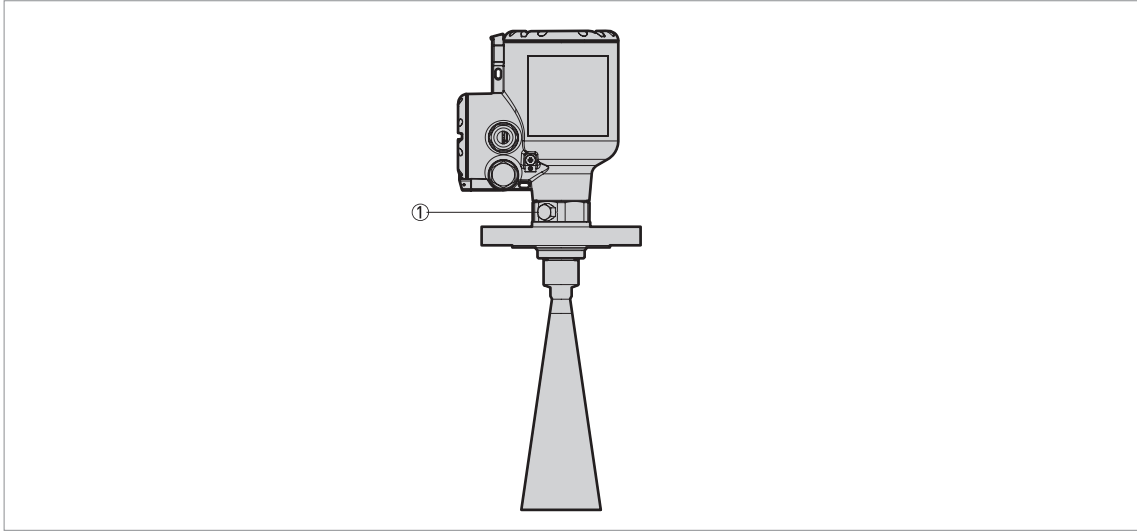


Figure 2-15: Purging options

- ① 1/8 NPTF threaded connection for purging system (the plug is supplied by the manufacturer)

Purging system

This option is available for all Metallic Horn antennas. Flange connections must have a pressure rating of PN16 (EN 1092-1), PN40 (EN 1092-1), Class 150 (ASME B16.5), Class 300 (ASME B16.5), or must be a low-pressure flange (PN01 / 15 psig).

Weather protection option

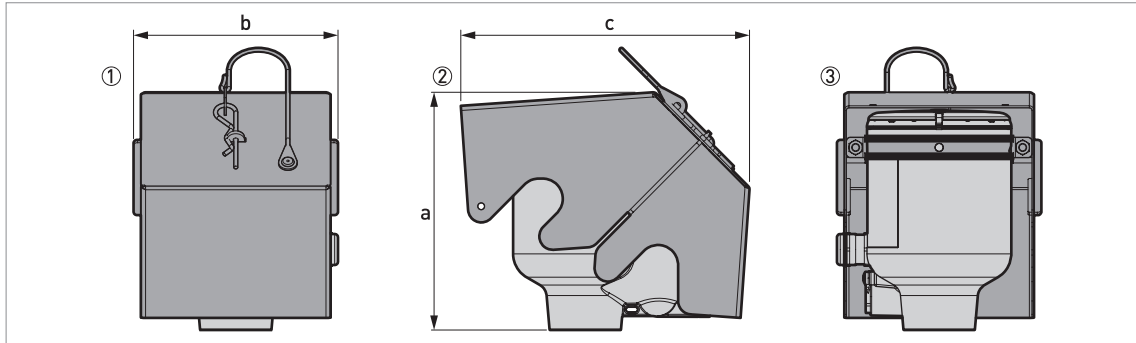


Figure 2-16: Weather protection option

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

Weather protection: Dimensions and weights

	Dimensions						Weights [kg]	
	a		b		c		[kg]	[lb]
	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]		
Weather protection	177	6.97	153	6.02	216	8.50	1.3	2.9

Converter weight

Type of housing	Weights	
	[kg]	[lb]
Compact aluminium housing	2.1	4.6
Compact stainless steel housing	4.5	9.9

Antenna option weights

Antenna options	Min./Max. weights	
	[kg]	[lb]

Standard options, without converter

DN80 / 3" Metallic Horn antenna with process connection, standard length ①	2.5...58.9	5.5...129.6
DN100 / 4" Metallic Horn antenna with process connection, standard length ①	2.6...59	5.7...129.8
DN150 / 6" Metallic Horn antenna with process connection, standard length ①	3...59.4	6.6...130.7
DN200 / 8" Metallic Horn antenna with process connection, standard length ①	3.7...60	8.1...132
DN80 / 3" PP Drop antenna with process connection, standard length ①	2.7...59.1	5.9...130
DN100 / 4" PP Drop antenna with process connection, standard length ①	3.1...59.5	6.8...131.2
DN150 / 6" PP Drop antenna with process connection, standard length ①	4.5...60.9	9.9...134

Antenna options	Min./Max. weights	
	[kg]	[lb]
DN80 / 3" PTFE Drop antenna with process connection, standard length ①	3.1...59.2	6.8...130.9
DN100 / 4" PTFE Drop antenna with process connection, standard length ①	3.8...60.2	8.4...132.7
DN150 / 6" PTFE Drop antenna with process connection, standard length ①	7.2...63.6	15.8..139.9

Antenna extension options

Straight extension, length 105 mm / 4.13" ②	+0.92	+2.03
Straight extension, length 210 mm / 8.27" ②	+1.84	+4.06
Straight extension, length 315 mm / 12.40" ②	+2.76	+6.08
Straight extension, length 420 mm / 16.54" ②	+3.68	+8.11
Straight extension, length 525 mm / 20.67" ②	+4.60	+10.14
Straight extension, length 630 mm / 24.80" ③	+5.52	+12.17
Straight extension, length 735 mm / 28.94" ③	+6.44	+14.20
Straight extension, length 840 mm / 33.07" ③	+7.36	+16.23
Straight extension, length 945 mm / 37.20" ③	+8.28	+18.25
Straight extension, length 1050 mm / 41.34" ③	+9.20	+20.28

Other options

Flange plate option, DN80 / 3" PP Drop antenna	+0.1	+0.22
Flange plate option, DN100 / 4" PP Drop antenna	+0.2	+0.44
Flange plate option, DN150 / 6" PP Drop antenna	+0.3	+0.66
Flange plate option, DN80 / 3" PTFE Drop antenna	+0.3	+0.66
Flange plate option, DN100 / 4" PTFE Drop antenna	+0.5	+1.10
Flange plate option, DN150 / 6" PTFE Drop antenna	+0.7	+1.54

① Standard length = without antenna extensions

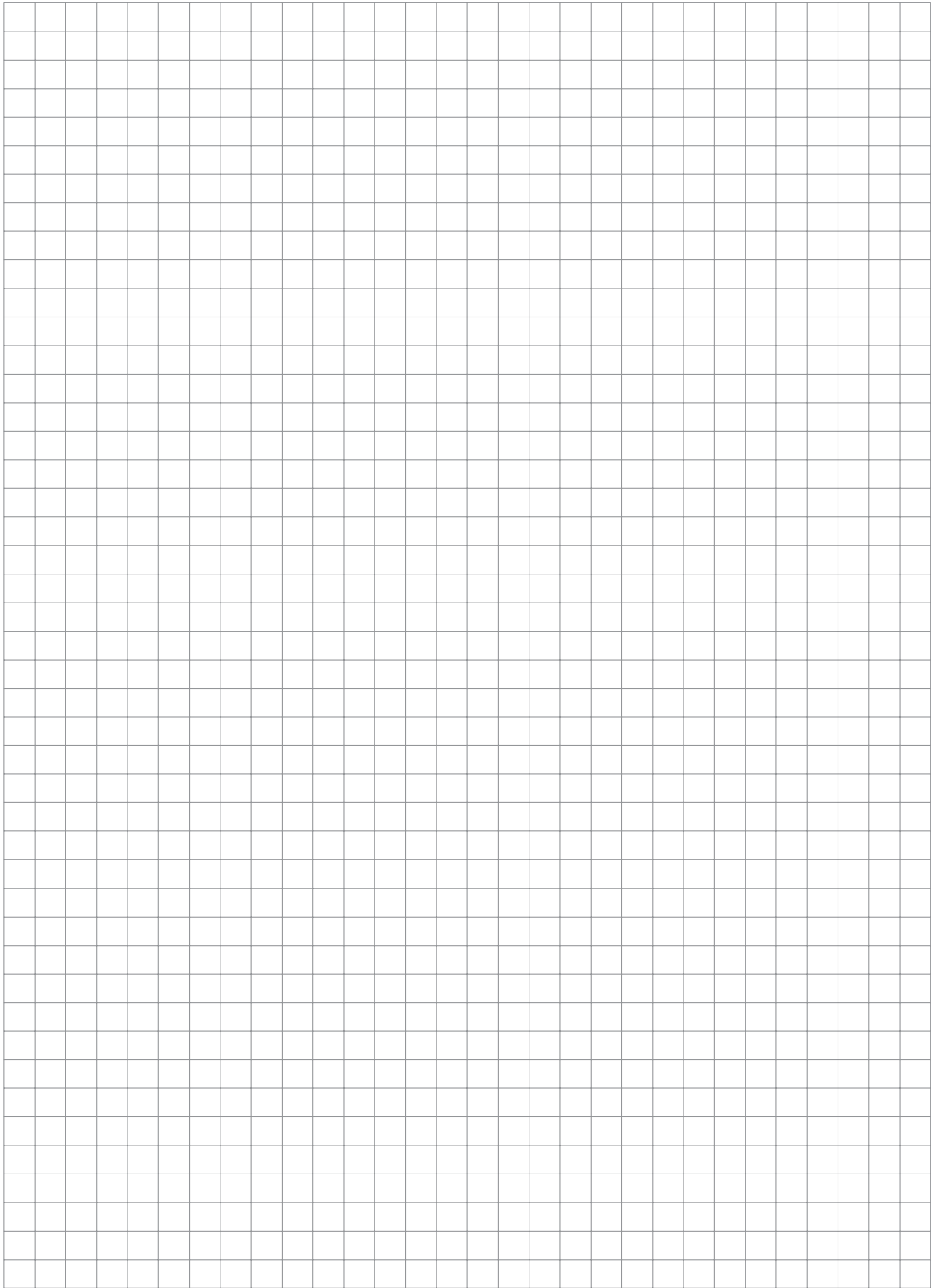
② This option is for Metallic Horn and Drop antennas

③ This option is for Metallic Horn antennas

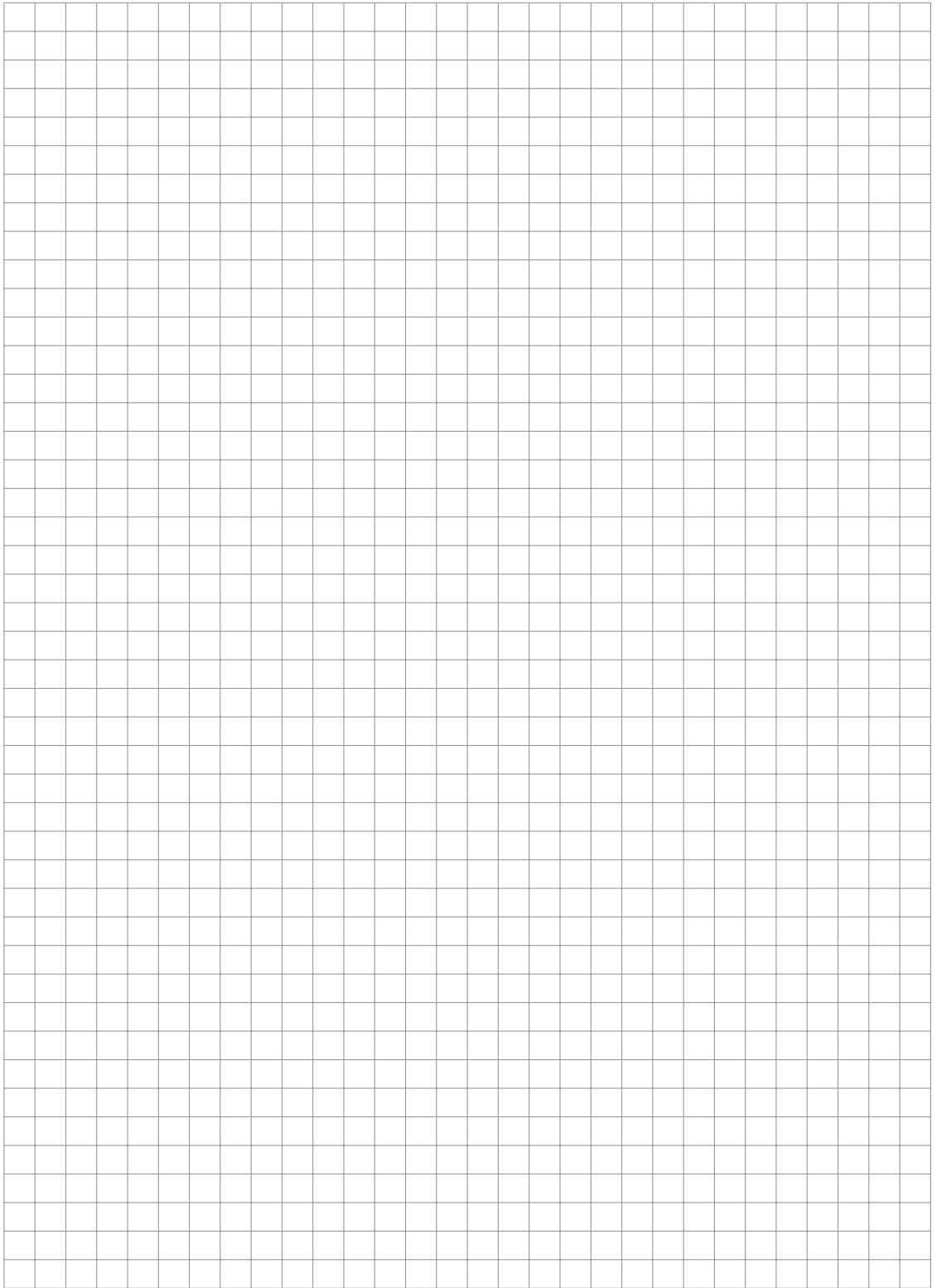
3.1 Order code

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

LR64	4	F	LR64 Free Space Radar - 24 GHz radar (FMCW) level transmitter for solids from granulates to rocks (up to 16 barg (232 psig) and 130°C (266°F))
			Regional directives
			1 Europe
			2 China
			3 USA
			4 Canada
			5 Brazil
			6 Australia
			A Russia
			B Kazakhstan
			C Belarus
			W Worldwide
			Ex approvals
			0 Without
			1 ATEX II 1/2 G Ex ia IIC T6...T5 or T6...T4 Ga/Gb + II 1/2 D Ex ia IIIC T85°C...T100°C or T85°C...T130°C Da/Db
			2 ATEX II 1/2 G Ex db ia IIC T6...T5 or T6...T4 Ga/Gb + II 1/2 D Ex ia tb IIIC T85°C...T100°C or T85°C...T130°C Da/Db
			3 ATEX II 3 G Ex ic IIC T6...T5 or T6...T4 Gc + II 3 D Ex ic IIIC T85°C...T100°C or T85°C...T130°C Dc
			5 NEPSI Ex ia IIC T6...T5 or T6...T4 Ga/Gb + Ex iaD 20/21 T85...T100 or T85...T130 ①
			6 NEPSI Ex d ia IIC T6...T5 or T6...T4 Ga/Gb + Ex iaD 20/21 tD A21 IP6X T85°C...T100°C or T85°C...T130°C ①
			A cQPSus IS CL I/II/III DIV 1 GP A-G + CL I Z0 AEx ia/Ex ia IIC T6...T5 or T6...T4 Ga + Z20 AEx ia/Ex ia IIIC T85°C...T100°C or T85°C...T130°C Da
			B cQPSus XP-IS/DIP CL I DIV 1 GP A-G + CL I Z1 AEx db ia/Ex db ia IIC T6...T5 or T6...T4 Gb + Z21 AEx ia tb/Ex ia tb IIIC T85°C...T100°C or T85°C...T130°C Db ②
			C cQPSus NI CL I/II/III DIV 2 GP ABCDFG
			K IECEX Ex ia IIC T6...T5 or T6...T4 Ga/Gb + Ex ia IIIC T85°C...T100°C or T85°C...T130°C Da/Db
			L IECEX Ex db ia IIC T6...T5 or T6...T4 Ga/Gb + Ex ia tb IIIC T85°C...T100°C or T85°C...T130°C Da/Db
			M IECEX Ex ic IIC T6...T5 or T6...T4 Gc + Ex ic IIIC T85°C...T100°C or T85°C...T130°C Dc
			0 Construction
			0 Without
			2 CRN / ASME B31.3 ①
			4 ASME B31.3
			Converter version (Housing material / IP class)
			2 C / Compact version (aluminium housing – IP66/68 0.1 barg)
			3 C / Compact version (stainless steel housing – IP66/68 0.1 barg) ③
LR64	4	F	0 Order code (complete this code on the pages that follow)







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