

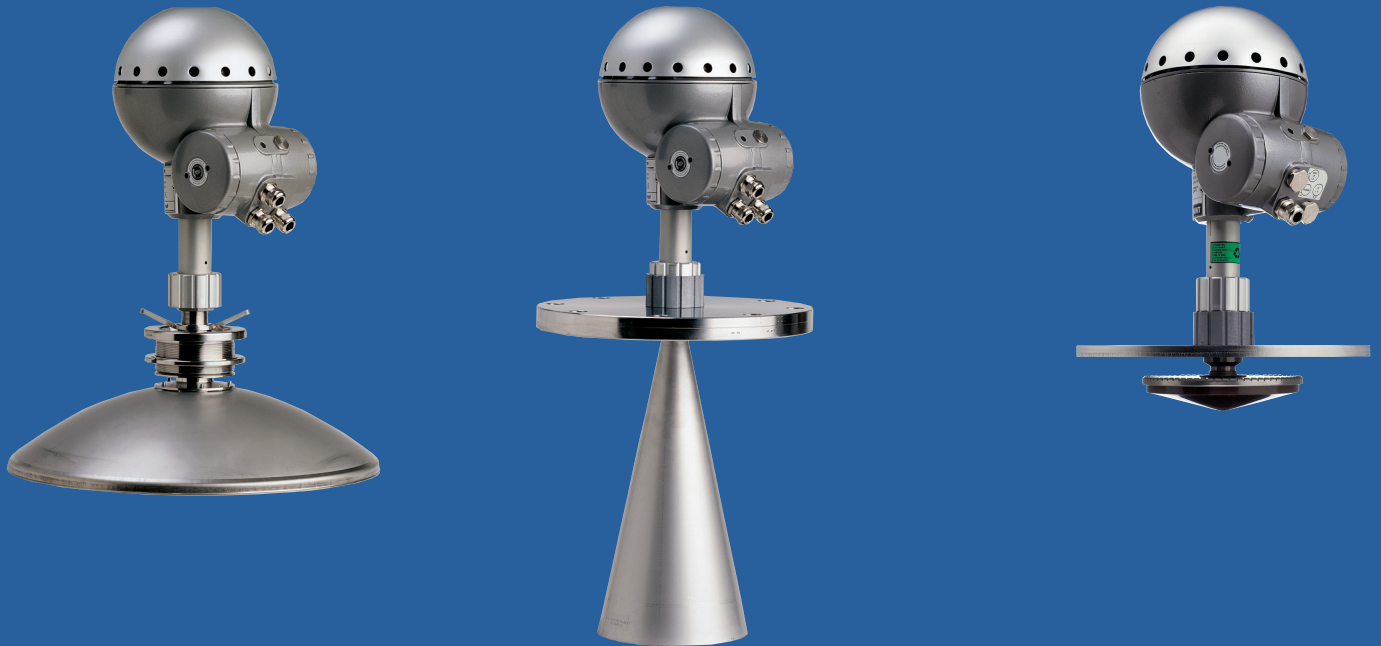
Technical Description

501026En, Ed. 4, Rev A

February 2012

Rosemount TankRadar PRO

Radar Level Gauge



ROSEMOUNT[®]
Tank Gauging

www.rosemount-tg.com


EMERSON[™]
Process Management

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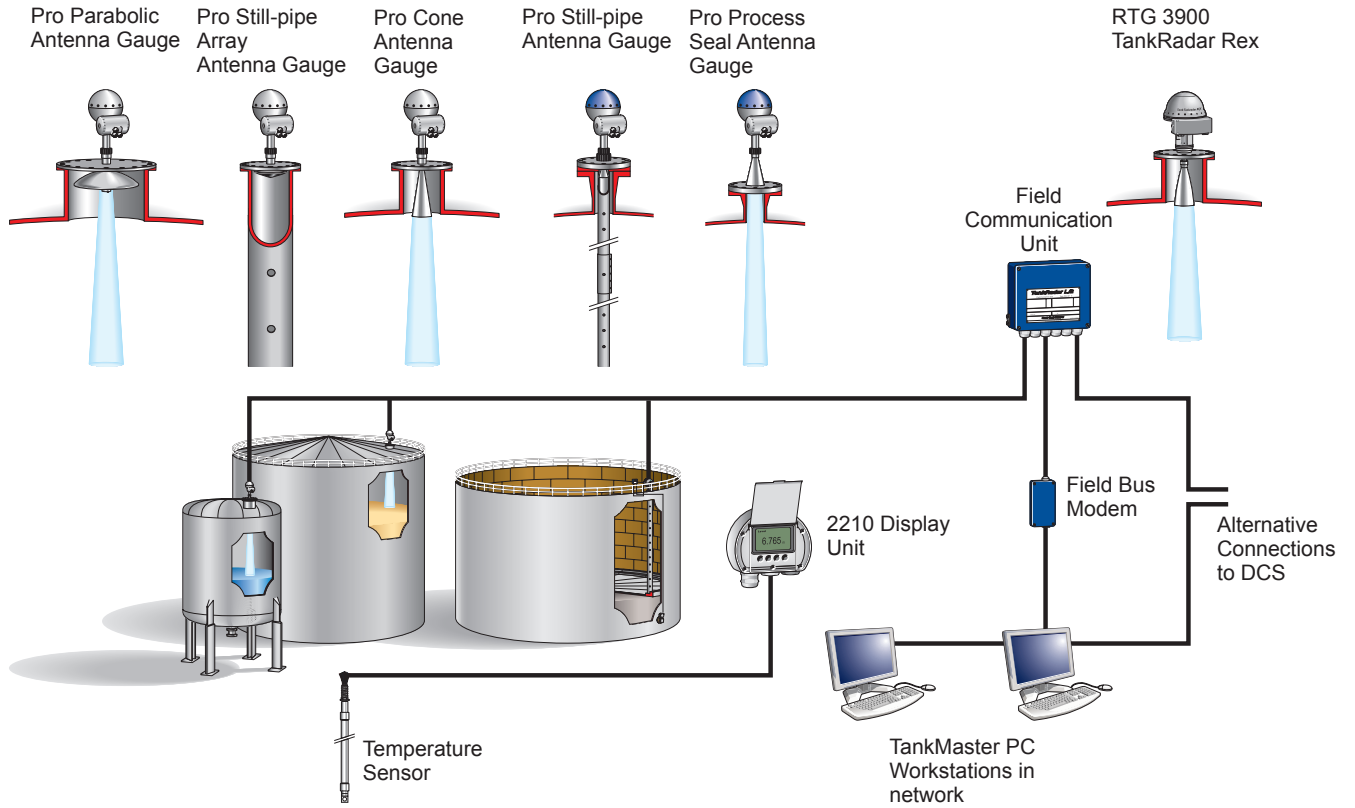
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TankRadar Pro

System overview



TankRadar Pro

Features

- Multi-purpose radar level gauge
- No moving parts and no contact with the liquid
- No maintenance
- Highest reliability
- Easy installation
- High accuracy
- Handles difficult tank conditions due to ultra-high sensitivity and unique signal processing features
- High flexibility with interchangeable Transmitter Heads and antennas
- A wide array of antennas and versions for best performance in all applications
- Interactive setup with Windows based PC software or via display unit
- Analog 4-20 mA superimposed with HART, and digital Profibus DP, TRL2, or RS485 fieldbus outputs

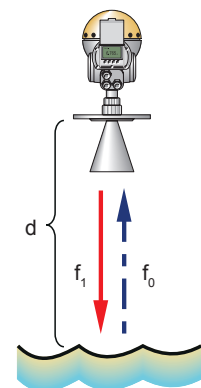
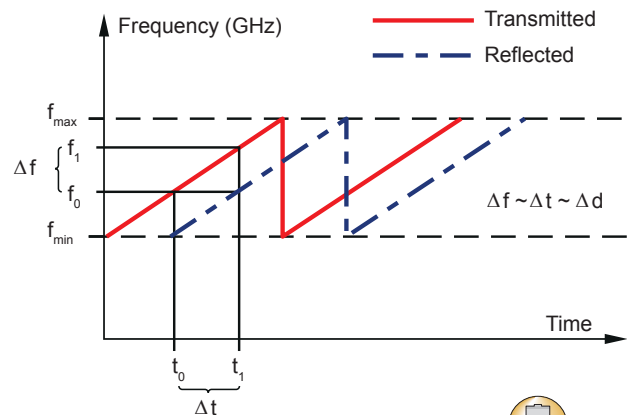


TankRadar Pro with its flexible configuration is suitable for both stand-alone applications and large-scale plant installations with various tank types.

Measurement principle

The level of the liquid (or solid) is measured by radar signals transmitted from the antenna at the tank top. After the radar signal is reflected by the liquid surface the echo is picked up by the antenna. As the signal is varying in frequency the echo has a slightly different frequency compared to the signal transmitted at that moment. The difference in frequency is proportional to the distance to the liquid, and can be accurately calculated. This method is called FMCW (Frequency Modulated Continuous Wave) and is used in all high performance radar gauges.

TankRadar Pro uses the 10 GHz frequency band to get optimum balance between beamwidth and sensitivity to antenna contamination.



The FMCW method is based on a radar sweep with continuous changes in frequency.

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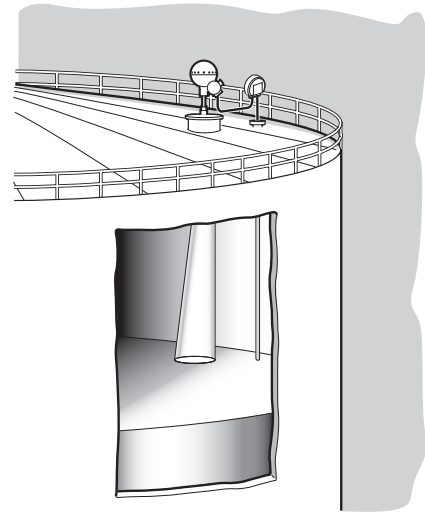
TankRadar Pro

Applications

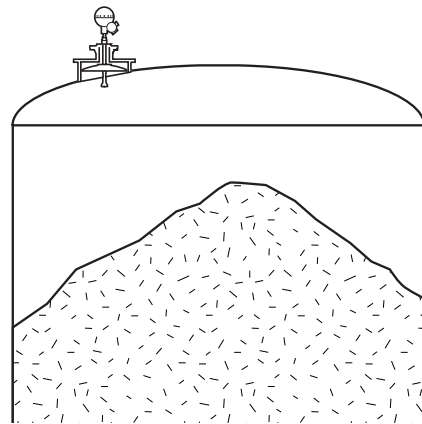
TankRadar Pro uses state-of-the-art microwave technology to get highest reliability and precision. It measures the level of liquids, slurries as well as many solids. The gauge operates in a wide range of temperatures, pressures, vapor gas mixtures and various process conditions.

The applications include:

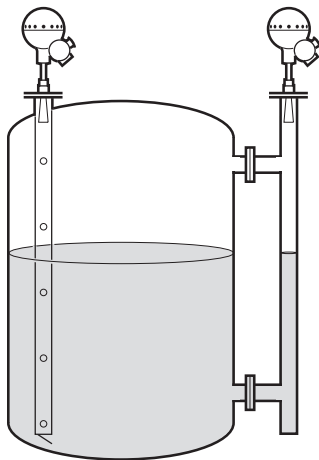
- Storage tanks at refineries and tank terminals
- LPG storage
- Power plants
- Chemical & petrochemical industry
- Pharmaceutical
- Food and beverage
- Water and sewage treatment
- Hydroelectric power generation and dams
- Cement, powder, wood chips and other solid material applications



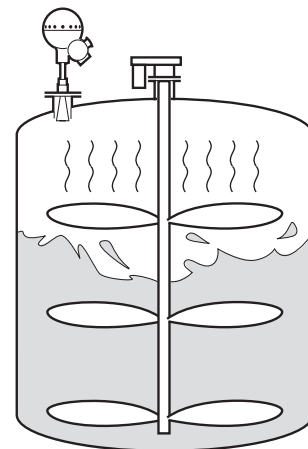
TankRadar Pro parabola and cone versions provide free propagation, high accuracy level measurement in storage tanks.



Solid materials, like cement, often give extremely small radar reflections, requiring the most sensitive antenna, the 20" parabolic.



Still-pipe or bridle mounting is recommended for LPG applications, where the surface sometimes is boiling, and for some extremely turbulent conditions. The pipe reduces foam and turbulence and also increases surface reflection.



Applications in tanks with agitators require a radar gauge with TankRadar Pro's high sensitivity and advanced signal processing to separate the measuring signal from noise created by disturbances.

TankRadar Pro

Select the right Pro gauge

A TankRadar Pro gauge consists of a Transmitter Head and a tank connection including antenna. The Transmitter Head, as well as the electronics inside, is interchangeable without opening the tank.

Transmitter Head versions

The Transmitter Head is available in four basic versions:

- **Lite**

Intended for applications in non-hazardous areas only. Suitable for tanks without internal structures and agitators, e.g. certain storage tanks, water, dam applications etc. The Lite version has FFT calculations enabled providing an instrument accuracy of ± 10 mm (± 0.4 in.). Echofixer, FFAST™ and MET™ are available as options.

- **Standard**

For hazardous applications in most tanks (also spherical or bullet tanks, and tanks with internal structures). The Standard version includes the Echofixer software which more accurately than standard FFT maps all microwave interference sources. The Standard instrument accuracy is ± 10 mm (± 0.4 in.) which can be improved to ± 5 mm (± 0.2 in.) using the optional FFAST™ software module.

- **Gold**

Gold is the most advanced version for difficult applications in tanks with agitators, heating coils and other disturbances. It includes the Echofixer software, FFAST™ software for increased accuracy plus MET™ software for further increased disturbance echo handling. Instrument accuracy is ± 5 mm (± 0.2 in.).

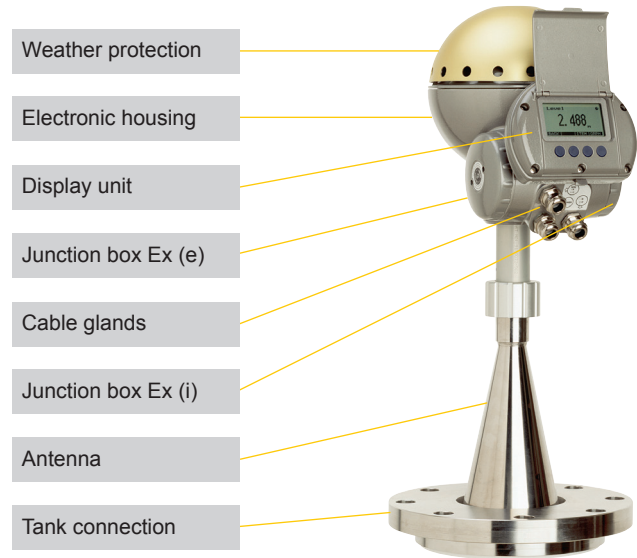
- **Platinum**

For high accuracy tank gauging applications, Platinum is the best TankRadar Pro choice. It includes the FFAST™ software and selected hardware for maximum performance. Instrument accuracy is ± 3 mm (± 0.12 in.) for parabolic, still-pipe array and 8-in. cone antennas.

Volume calculation for symmetrical tanks is included in all versions. Strapping table for non-symmetrical tanks is available as an option.

Software modules in available Pro versions

	Explosion approval	FFT	FFAST™ Increased accuracy	Echofixer Disturbance echo handling	MET™ Improved resolution
Lite	-	X	Option	Option	Option
Standard	X	X	Option	X	Option
Gold	X	X	X	X	X
Platinum	X	X	X	Option	-



Software modules

Various options make it possible to optimize the gauge for different applications:

- **Fast Fourier Transformation (FFT)**

Fast Fourier Transformation is a signal processing technique used to map the echo structure of the tank.

- **Echofixer**

A software module that makes it possible to measure on the surface in spite of strong disturbance echoes from mechanical structures such as agitators and baffles.

- **Fast High Accuracy Signal Technology (FFAST™)**

A module that improves the efficiency of the signal processing by limiting the region to be analyzed around the surface. This results in an improved accuracy of ± 5 mm (± 0.2 in.).

- **Multiple Echo Tracking (MET™)**

Improves the resolution and accuracy in echo disturbed regions and close to the tank bottom. Continuous measurement on multiple disturbing echoes facilitates identification of the actual surface echo.

All software options are possible to upgrade in the field without any changes in electronics. Upgrades are made by entering a new start code in the gauge and can be done on a temporary basis for trial purposes.

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Antenna versions

TankRadar Pro can be equipped with different antennas to fulfill various requirements. The tank connection, including antenna, is the only part exposed to the tank atmosphere. The cone antenna is most commonly used. When selecting antenna dimension, it is generally recommended to use as large antenna diameter as possible.



The thin antenna plate prevents the flange from exposure to the tank environment.

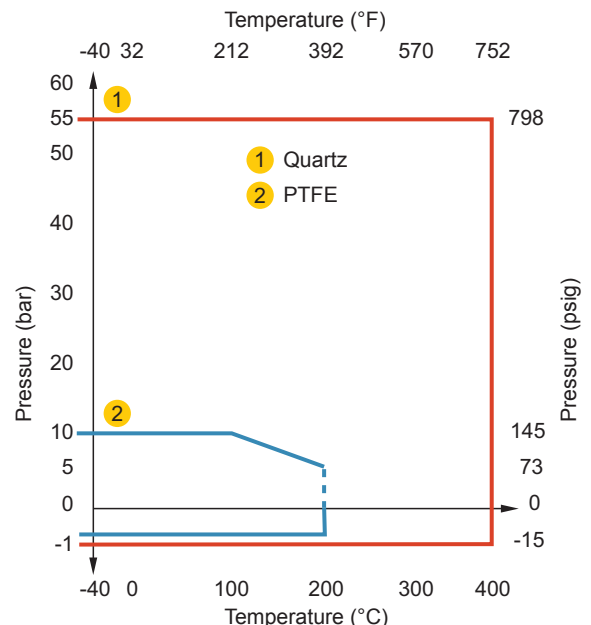
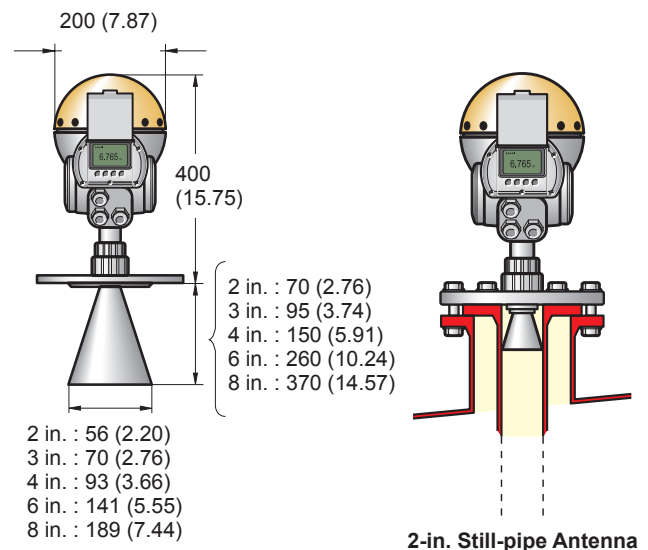
Cone antenna

The cone antenna is suitable for liquid applications. It can be used for both free propagation and still-pipe mounted installations. Thanks to the unique flange clamp solution the existing tank flange can be used as tank connection. The gauge can also be delivered with flange included.

- Standard cone antennas for 3-, 4-, 6- and 8-in. tank openings. The 3-, 4- and 6-in. cones can be extended to fit long tank nozzles. See pages 23-30, "Ordering Information", for standard flange options.
- A 1- and 2-in. version is available together with a still-pipe solution.
- For larger pipes, use the still-pipe array antennas.
- Materials exposed to the tank atmosphere:
Sealing in PTFE or quartz. Antenna in Stainless Steel, Hastelloy C-22, Titanium gr. 2, Monel 400 or Tantalum. O-ring in Viton fluoroelastomer or Kalrez perfluoroelastomer.
- Accuracy up to ± 5 mm (± 0.2 in.) using the FFAST™ software option.
- Accuracy with 8-in. cone up to ± 3 mm (± 0.12 in.) using the Platinum version.

See page 17 for description of still-pipe installations. For pressure and temperature restrictions depending on flange and O-ring selection, see page 20.

mm (inch)



The relation between temperature and maximum pressure for cone antennas.

TankRadar Pro

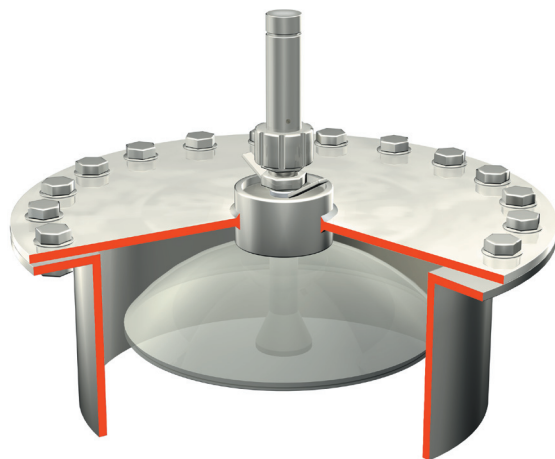
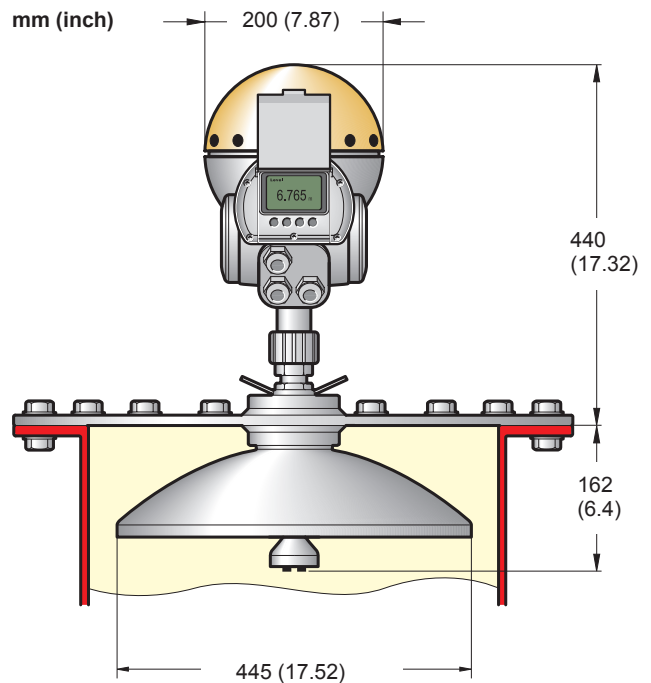
Parabolic antenna

The parabolic antenna is suitable for both liquid and solid applications. As it has the largest diameter it has the most narrow radar beam and can be used for extremely long measuring distances.

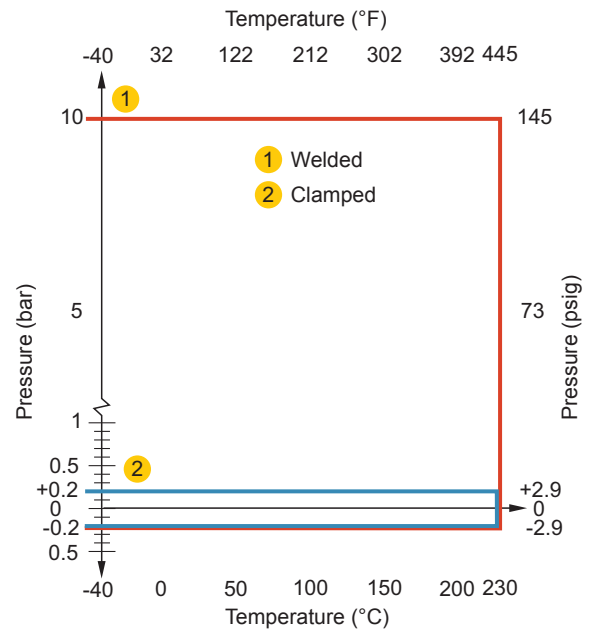
The parabolic is also the antenna type most insensitive to contamination. It can be used in applications with severe antenna condensation like asphalt and liquid sulphur.

Two versions are available: the very easily installed version with clamped mounting of flanges with a 96 mm (3.78-in.) diameter hole in flange (low pressures) and a welded version (high pressures).

- Suitable in all tanks with 450 mm (18 in.) or larger openings.
- Exposed parts in tank: Stainless steel and FEP/PTFE fluoropolymer.
- Best installed accuracy for inventory applications.
- Highest antenna gain.
- Withstands heavy contamination.
- Flexible PTFE protective cover available for dusty applications.
- Suitable for long range measurement up to 100 m (330 ft).
- ± 3 mm (± 0.1 in.) accuracy for platinum version.



Parabolic antenna welded to tank opening.



The relation between temperature and maximum pressure for parabolic antennas.

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Still-pipe Array antenna

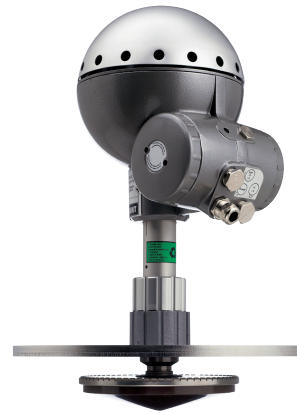
The Still-pipe Array Antenna with its small-sized antenna is designed for mounting on existing still-pipes. Typical applications are crude oil tanks with floating roofs and gasoline/product tanks with or without inner floating roofs.

The gauge uses a unique patented Low Loss Mode to transmit the radar waves in the center of the pipe. This virtually eliminates degradation of the accuracy due to rust and product deposits inside the pipe.

The Still-pipe Array Antenna is available in two models, the fixed and the hinged-lid version.

The still-pipe must be vertical within 0.5° (0.2 m over 20 m) to obtain highest measurement accuracy.

- Suitable for mounting on existing still-pipes.
- Small-sized antenna for 5-, 6-, 8-, 10- or 12-in. still-pipes.
- Exposed parts in tank:
Antenna in Polyphenylensulfid (PPS).
Sealing in PTFE.
O-ring in Fluorosilicone.
Flange in Acid Proof Steel EN 1.4404 (AISI 316L).
- ± 3 mm (± 0.1 in.) accuracy.

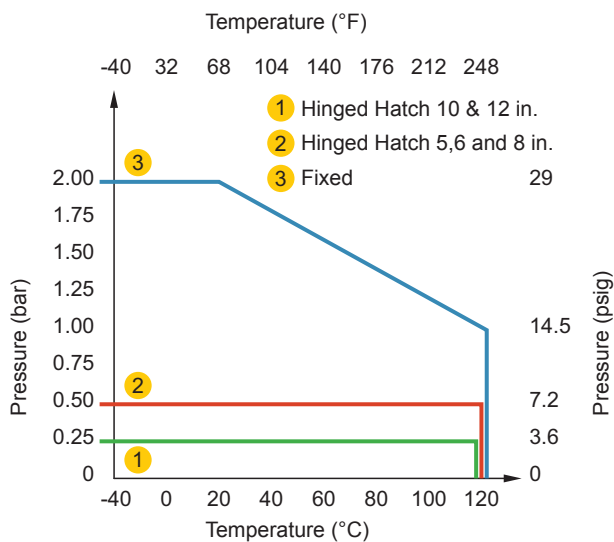
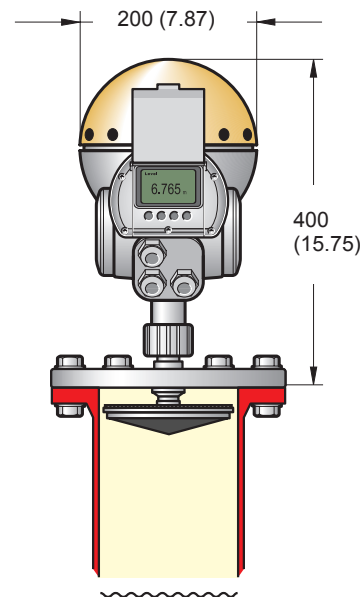


Pro Still-pipe Array Antenna, fixed version.



Pro Still-pipe Array Antenna, hinged-lid version with design that enables hand-dipping.

mm (inch)



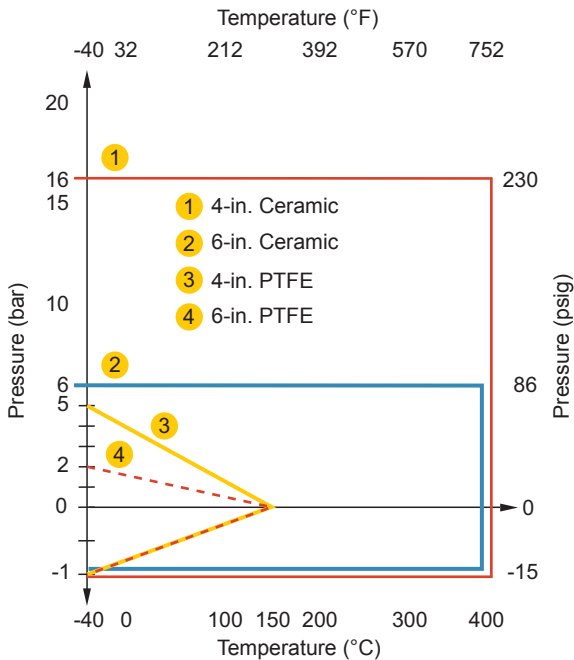
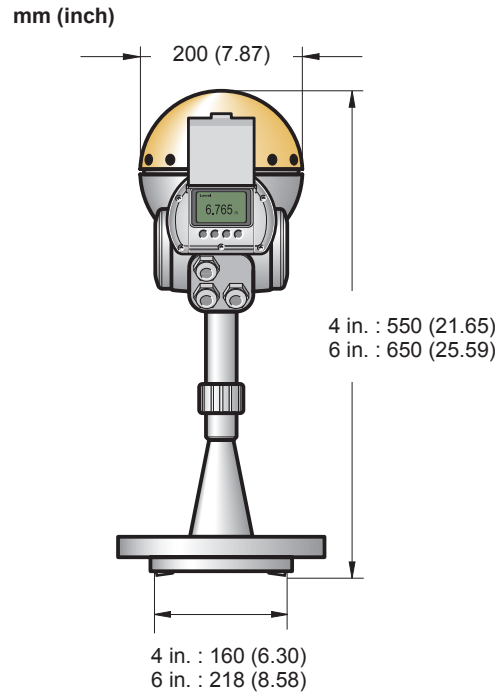
The relation between temperature and maximum pressure for array antennas.

TankRadar Pro

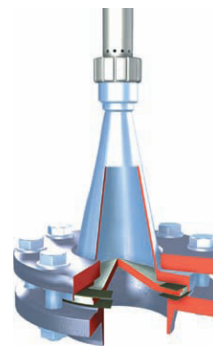
Process seal antenna

The dish made of PTFE or ceramics seals off the cone shaped antenna from the tank atmosphere. This combines the benefits of using a cone antenna with the advantage of only exposing material suitable for hygienic or corrosive applications.

- Suitable in hygienic or aggressive tank atmospheres
- Cone antenna protected from the tank atmosphere by a ceramic or PTFE sealing
- Ceramic seal withstands high pressures and temperatures
- 4- and 6-in. versions
- 4-in. version for hazardous applications
- ± 10 mm (± 0.4 in.) accuracy



The relation between temperature and maximum pressure for process seal antennas.



Flanges

Flanges are available in DIN, ANSI or JIS standards. Flange material is hot-dipped galvanized carbon steel or stainless steel. For complete listing of available standard flanges, see page 18 “Specification” and pages 23-30 “Ordering Information”.

NOTE: Pressure rating for the different antennas may be lower depending on flange selection. Minimum / maximum flange temperature depends on O-ring selection.

Measuring range

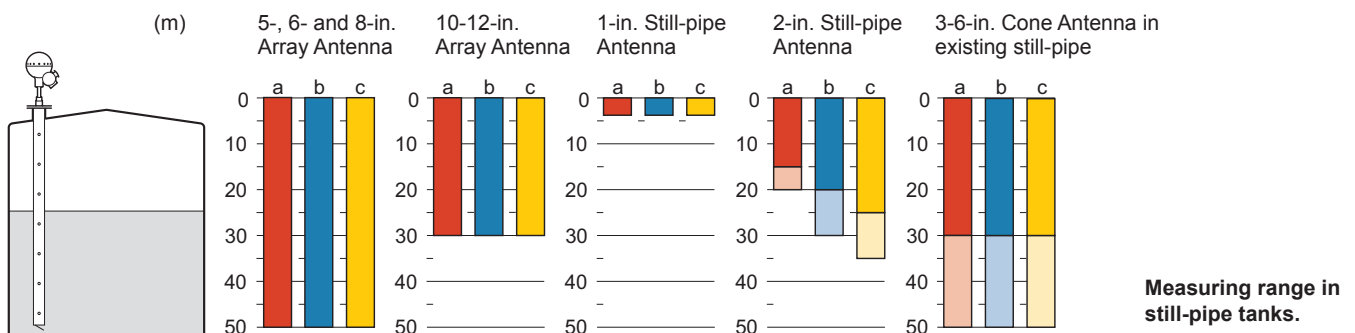
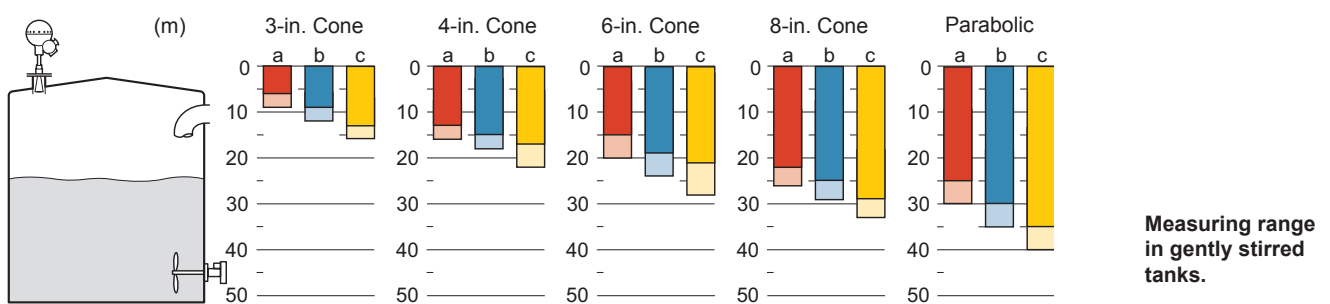
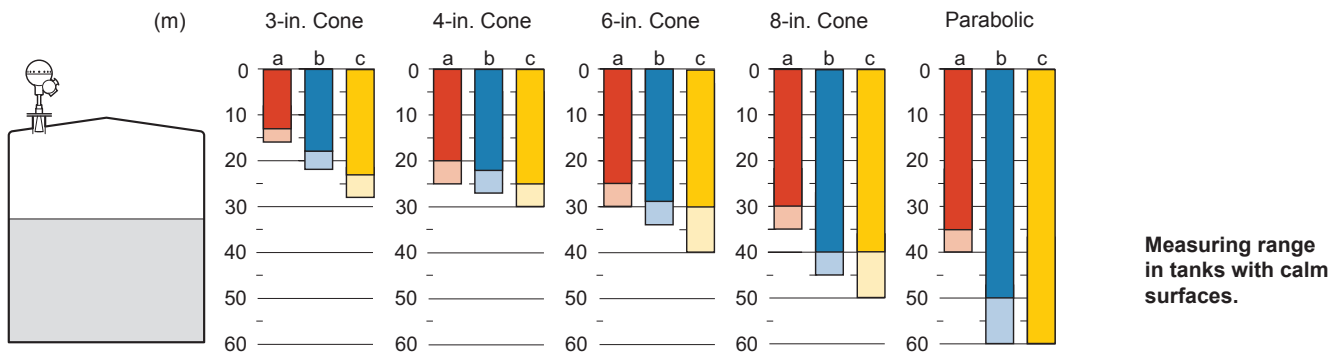
The diagrams below show how the measuring range is influenced by the antenna type, dielectric constant of the liquid (ϵ_r) and the process conditions. For optimum performance the maximum measuring distance should be kept within the range indicated with darker colour in the diagrams. To increase the measuring range further in turbulent tanks, a still-pipe can be used.

- **a:** Oil, petrochemicals, gasoline and other hydrocarbons ($\epsilon_r=1.9-4.0$).
- **b:** Alcohols, concentrated acids, organic solvents, oil/water mixtures and acetone ($\epsilon_r=4.0-10$).
- **c:** Conductive liquids, e.g. water based solutions, dilute acids and alkalis ($\epsilon_r > 10$).

For still-pipe mounted Pro gauges the typical measuring range is 35-50 m (115-160 ft) also in turbulent tanks with liquids having ϵ_r less than 1.9.

NOTE:

- For liquids with ϵ_r smaller than 1.9, such as liquefied gas, an 8-in. or bigger antenna is recommended for free propagation measurements. In this case, the typical measuring range is 15 m (50 ft).
- The measuring range for 4- and 6-in. process seal antennas equals about 60% of that for 4- and 6-in. cone antennas.
- For array antennas, the measuring range depends on still-pipe slot size.
- The values below are valid for clean antennas.
- Max. product level should be kept 20 mm (0.8 in.) from the antenna end.



TankRadar Pro

System integration

TankRadar Pro can be equipped with a number of different output alternatives such as 4-20 mA HART, Profibus DP, the Rosemount Modbus based TRL2 field bus or RS485. Any or multiple of the calculated values such as level, volume, average temperature or signal strength can be assigned to the signal output.

Data are displayed on the optional 2210 Display Unit mounted on the gauge or separately. Via the remotely mounted display, up to six temperature sensors can be connected.

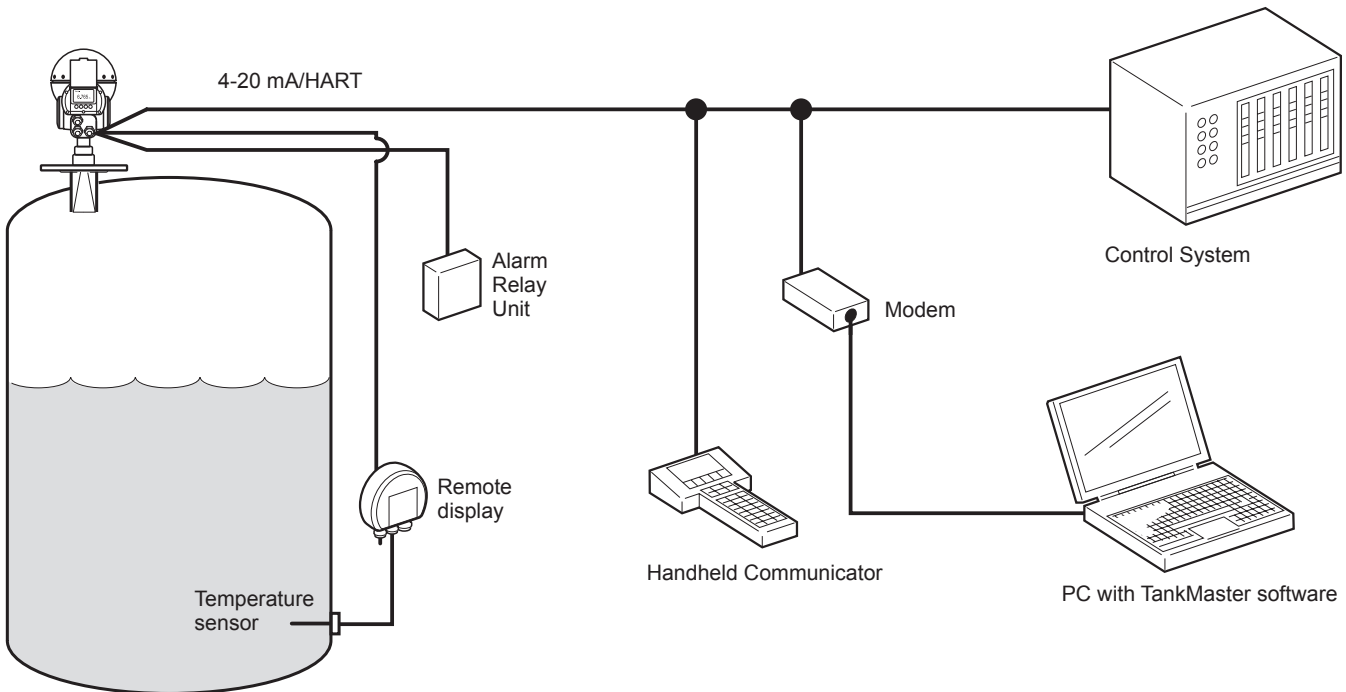
TankRadar Pro is easily configurable on the 4-key display keyboard or via a PC using the windows based TankMaster Winsetup software package.



The intrinsically safe 2210 Display Unit shows level (m or ft) and temperature (°C or °F), and it can be used for gauge configuration.

4-20 mA HART systems

The 4-20 mA HART analog outputs are either passive for connection to powered cables or active providing signal power for external display units etc. The analog outputs can also be specified to be intrinsically safe. Configuration can also be done from a Rosemount AMS™ system or a 375/475 Handheld Communicator.



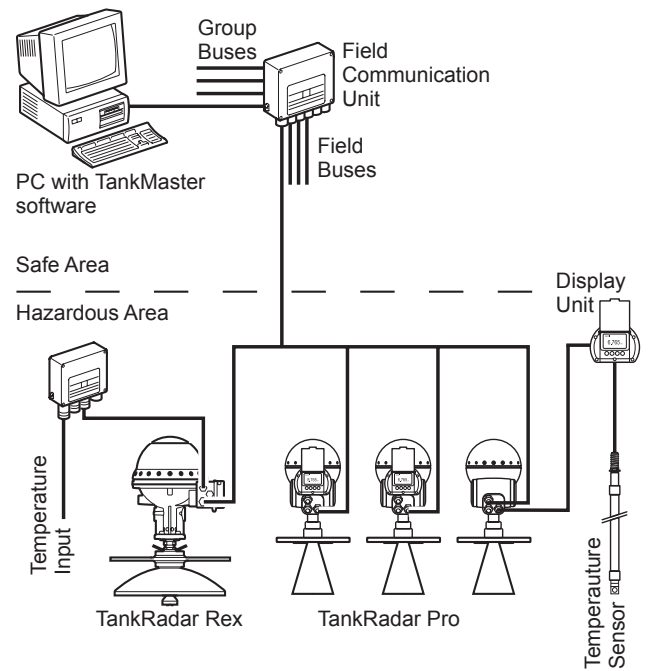
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TRL2 fieldbus systems

When using the digital TRL2 field bus outputs, up to 12-15 gauges can be connected to each two-wire field bus, maintaining a high data updating speed. Each field bus is connected to a Field Communication Unit (FCU) that handles up to four field buses with data from maximum 32 tanks. Several FCU's can be installed to handle a large number of tanks. From the FCU, data can be transmitted on RS232/485 or TRL2 bus formats to host computers (DCS, PC or PLC). Pro gauges with TRL2 bus output can also be connected to the TankMaster operator software providing an OPC server that can be linked to the plant network.



TankRadar Pro

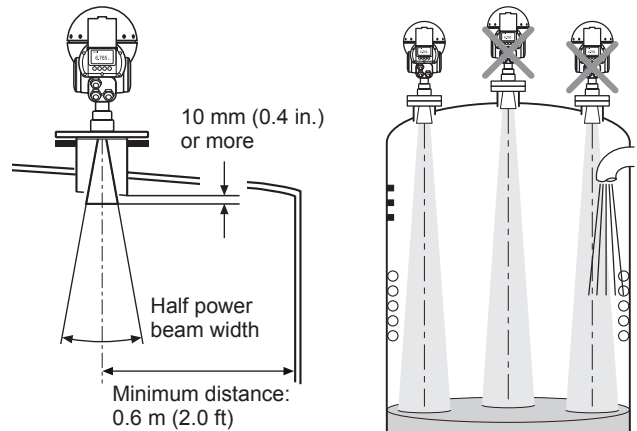
Mechanical mounting

The TankRadar Pro gauge is easily carried to the tank top and mounted on a suitable nozzle or pipe.

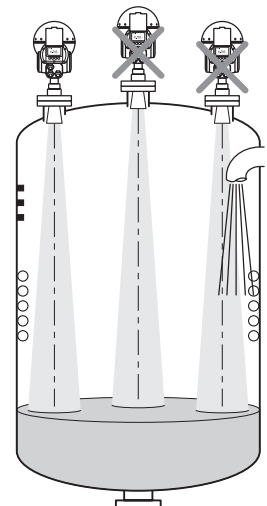
Free propagation

The gauge should be installed as follows:

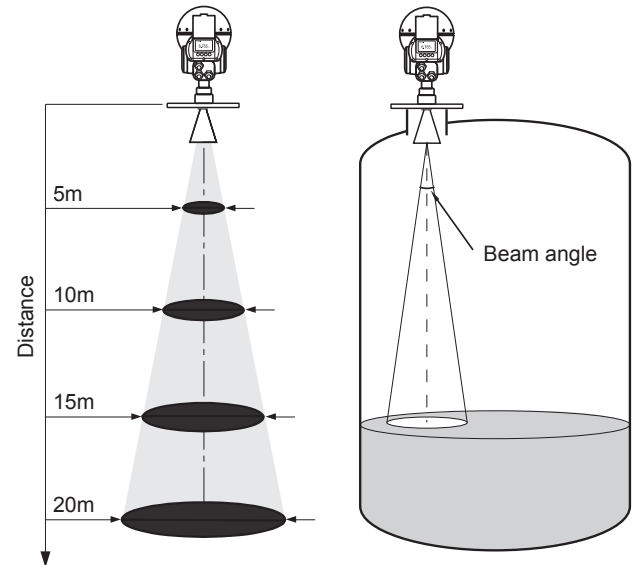
- Antenna oriented perpendicular to a horizontal surface.
- The gauge should be mounted with as few disturbing objects as possible within the beam angle.
- Filling inlets creating turbulence should preferably be kept at a distance.
- Choose as large antenna diameter as possible. A larger receiving area concentrates the radar beam and ensures maximum antenna gain. Increased antenna gain means greater margin for weak surface echoes.
- The cone antenna may be inclined 1-2° towards the center of the tank to increase the accuracy (applicable for tanks higher than 10 m).



For best measurement performance the nozzle height should be shorter than the antenna



Best practice for mechanical mounting of free propagation radar level gauge.



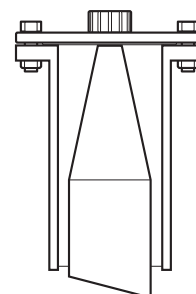
Beam Diameter and Beam Angle for TankRadar Pro antennas

Beam Diameter and Beam Angle					
Distance, m (ft)	3-in. Cone	4-in. Cone / 4-in. Process Seal	6-in. Cone / 6-in. Process Seal	8-in. Cone	Parabolic type
Beam angle	25°	21°	18°	15°	10°
5 (16)	2.2 (7.2)	1.9 (6.2)	1.6 (5.2)	1.3 (4.3)	0.9 (3.0)
10 (33)	4.4 (14)	3.7 (12)	3.1 (10)	2.6 (8.5)	1.7 (5.6)
15 (49)	6.7 (22)	5.6 (18)	4.7 (15)	3.9 (13)	2.6 (8.5)
20 (66)	8.9 (29)	7.4 (24)	6.3 (21)	5.3 (17)	3.5 (11)

The flat tank wall can be located within the antenna beam angle, as long as there is a minimum distance from the gauge to the tank wall, see picture above.

An extended cone (picture on the right) can be used for long nozzles.

The standard length of the extended cone is 500 mm (20 in.) for 3-, 4- or 6-in. cone antennas. Longer cones are available on request.



Cone Antenna Extension

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Pipe installation

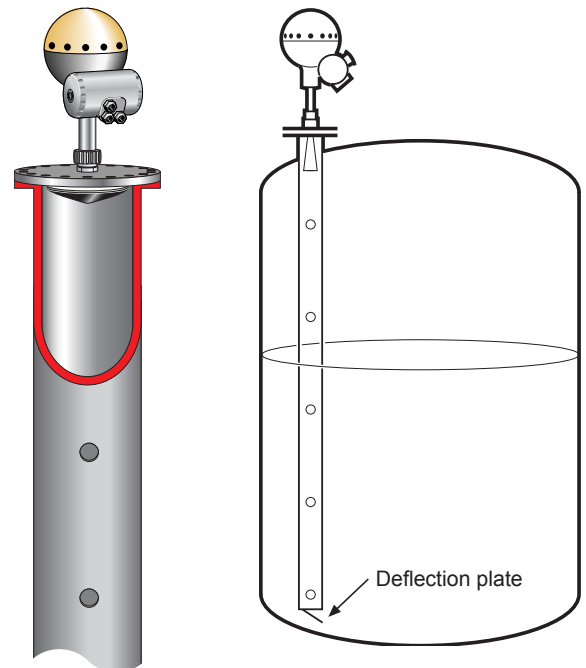
Still-pipe installation is particularly suitable for applications with highly turbulent liquids or liquids with very low ϵ_r giving weak radar reflections, such as LPG. 2-, 3-, 4- and 6-in cone antennas can be mounted in existing still-pipes.

Used pipes must generally be clean inside, without irregularities, rust or excessive holes.

Also available is a 1-in. still-pipe and antenna assembly with a maximum range of 3 m (10 ft). The 1- and 2-in. still-pipe gauges are suitable for clean liquids only and can be delivered complete with still-pipe, deflection plate and fittings without any need for welding.

It is also possible to use the Still-pipe Array antenna for measurement inside an existing still-pipe. This antenna is available in 6-, 8-, 10- and 12-in., fixed and hinged-hatch designs.

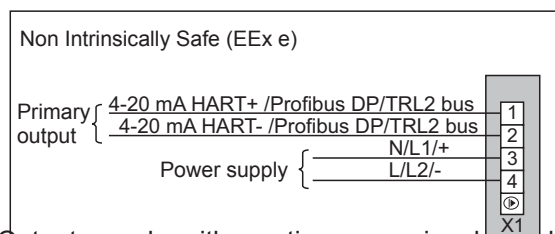
Consult Emerson Process Management / Rosemount Tank Gauging or an authorized distributor for installation advice.



TankRadar Pro measures level in 1- to 12-in. still-pipes

Electrical connections

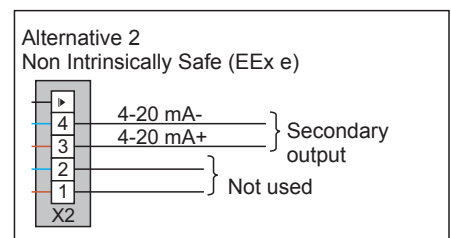
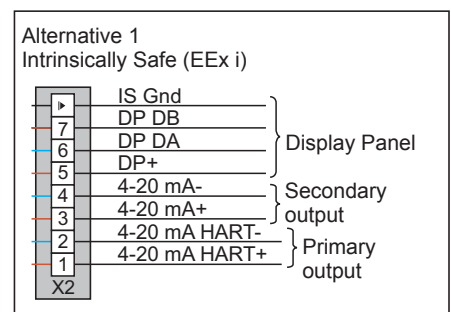
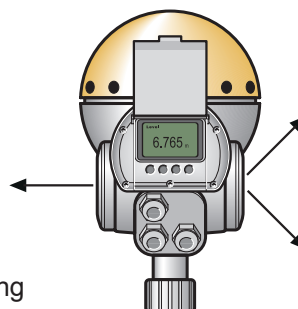
The Transmitter Head has two separate junction boxes. One is for a non-intrinsically safe primary signal output and power supply cables. The other is normally used for intrinsically safe (IS) HART/analog outputs or optionally for a non-IS analog output.



Outputs can be either active or passive depending on required options.

Cables are twisted and shielded pairs, minimum 0.5 mm² (AWG 20), 1/2-in. NPT (threaded) for cable glands or male conduit fittings.

For complete installation instructions, see the Reference Manual for TankRadar Pro (306010E).



TankRadar Pro

Specification

General		
Product designation	TankRadar Pro: Lite, Standard, Gold or Platinum	
Operating principle	10 GHz FMCW radar	
Beam angle	See page 16	
Microwave output power	Max 1.0 mW	
Internal calibration	Integrated digital reference for automatic compensation of radar sweep	
Signal processing	Digital signal processing using FFT, FFAST™, MET™ and Echofixer	
Temperature measurement	1-3 spot elements, PT100 or CU100, or 6 spot elements with common return. Input accuracy ± 0.5 °C (± 0.9 °F)	
Display / Configuration		
Display (factory mounted on gauge)	<ul style="list-style-type: none"> • 6-digit graphical LCD display, 128 x 64 pixels • For display and configuration • 4 control soft-keys • 7 text lines with 16 characters/line • Weather/dirt protection cover. Protection class IP67 	
Display (mounted separately)	Same as above, mounted in separate enclosure, Protection class IP67 Max cable length, display - radar gauge: 100 m (330 ft) Cable type: 4 wire shielded instrument cable, min 0.5 mm ² , (AWG 20) Optional: Temperature measurement 1-3 spot elements PT100 or CU100 (see above)	
HART device	375/475 handheld communicator Rosemount Asset Management Solutions software (AMS™)	
PC/remote configuration	TankMaster WinSetup software	
Mechanical		
Antennas	Cone, Parabolic, Still-pipe Array, and Process Seal antennas	
Antenna material exposed to tank atmosphere	Cone Antenna (PTFE sealing)	Antenna Material, alt 1: Stainless Steel 316L, alt 2: Hastelloy C-22, alt 3: Tantalum, alt 4: Monel 400 O-rings: Viton fluoroelastomer or Kalrez perfluoroelastomer Sealing: PTFE fluoropolymer
	Cone Antenna (Quartz sealing)	Antenna Material, alt 1: Stainless Steel 316L, alt 2: Hastelloy C-22, alt 3: Tantalum, alt 4: Monel 400 O-rings: Viton fluoroelastomer or Kalrez perfluoroelastomer Sealing: Quartz
	Parabolic Antenna	Stainless Steel 316L, FEP/PTFE fluoropolymer
	Process Seal Antenna	PTFE fluoropolymer or Al ₂ O ₃ (Aluminium oxide)
	1- and 2 in. Still-pipe Antennas	Antenna Material: Stainless Steel 316L O-rings: Viton fluoroelastomer or Kalrez perfluoroelastomer Sealing: PTFE fluoropolymer or Quartz
	Still-pipe Array Antenna	Antenna Material: Polyphenylensulfid (PPS) O-ring: Fluorosilicone Sealing: PTFE fluoropolymer
Antenna dimensions	See pages 9-12	
Antenna extension	Dimensions	See page 16
	Material	Extended cone antennas available in Stainless steel 316L
Flushing connection	1/2-in. NPT	
Housing/enclosure	Permanent mould cast aluminium, chromed and 120 µm powder painted	
Flanges	DIN, ANSI and JIS standard, Material: Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404	
Weight, excl. flange	Approximately 8 kg (18 lbs), depending on antenna selection	
Height above flange	400 mm (15 in.)	

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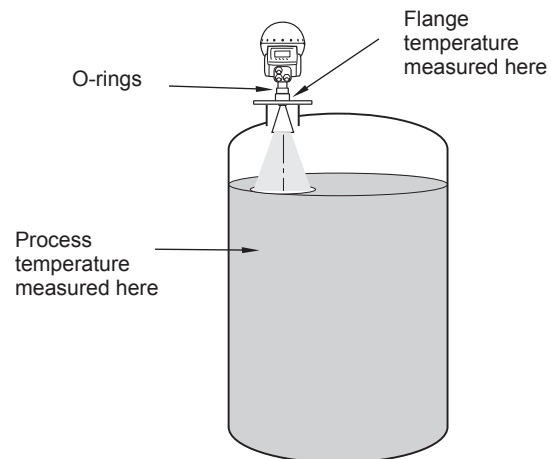
Electrical		
Power supply	Ultra-wide 24–240 V DC or AC 0-60 Hz	
Power consumption	Maximum 10 W, nominal 5 W	
Outputs	Primary output (for level, volume etc)	Alt. 1: HART + 4–20 mA current loop (IS option) Alt. 2: TRL2 Bus (FSK with Modbus protocol) Alt. 3: Profibus DP
Analog output characteristics	Secondary output (Optional, for volume, signal quality, temperature etc.)	Analog 4–20 mA current loop, active or passive. Optional: IS version.
	Type	Analog 4–20 mA Current Loop, active (with) or passive (without loop supply).
	Galvanic isolation	> 1500 V RMS or DC
	Accuracy	± 300 µA at 4 mA ± 600 µA at 20 mA
	Range	4-20 mA
	Alarm level	3.8 mA, 22 mA or freeze; software selectable
	Resolution	0.5 µA (0.003%)
	Linearity	± 0.01%
	Temperature drift	± 50 ppm/°C (± 28 ppm/°F)
	Output impedance	> 10 MΩ
	Voltage compliance	7-30 V (passive output)
	External loop resistance	< 700 Ω (passive output with 24 V external supply) < 300 Ω (active output)
Output cabling	Twisted and shielded pair, min. 0.5 mm ² (AWG 20)	
Cable entries	3 x ½-in. NPT, for cable glands or conduit entries. Optional: Cable gland kit, including 3 x EEx e approved (ATEX) ½-in. NPT cable glands. Optional: 3 x EEx e approved, including 3 x EEx e (ATEX) adapters ½-in. NPT/M20	
Relay output	Optional equipment, mounted in separate enclosure. Potential free contacts, normally open or normally closed, selectable. Switching capacity: 100-260 VAC 3 A or 24-48 VDC 3 A Function: alarm limits and hysteresis set at radar gauge.	

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Measuring performance	
Instrument accuracy	± 3 mm (± 0.12 in.), ± 5 mm (± 0.2 in.) or ± 10 mm (± 0.4 in.) depending on model
Resolution	1 mm (0.04 in.)
Temperature stability	± 500 ppm of measured distance within the ambient temperature range
Repeatability	± 1 mm (± 0.04 in.)
Measuring range	0-50 m (0-165 ft) default, 0-99 m (0-325 ft) special configuration
Update time	100 ms
Optional disturbance echo handling	Echofixer and MET™ Multiple Echo Tracking
Ex approval transmitter head (Standard, Gold and Platinum versions)	See pages 21-22
Overfill prevention	TÜV approval, BPG-US 99/6001
Environment	
Pressure/temperature at antenna	See diagrams on pages 9-12
Ambient temperature	-40 °C to 70 °C (-40 °F to 158 °F)
Tank temperature	-40 °C to 400 °C (-40 °F to 752 °F)
Pressure	See pages 9-12
Emission approvals	FCC: K8CPRO, K8CPROX. R&TTE: E813268O-CC
Humidity	IEC 60068-2-3
Climatic class/corrosion class	IEC 68-2-1, IEC 60068-2-52 test KB severity 2
Ingress protection	IP65, IP66, NEMA 4
Vibration	IEC 721-3-4 class 4M4
UV protection	ISO 4892-2
Electromagnetic compatibility	EN61326-1:2006 incl. A1:1998 and A2:2001, Immunity EN50081-2, Emission EN50081-1
Lightning protection	EN61326, EN61000-4-5, IEC801-5, level 2 kV
Power supply fluctuation	IEC 92 Part 504 sec 3.5
Boiler Approval	CSA B51-97: Compliance

NOTE: Pressure rating for the different antennas may be lower depending on flange selection. Minimum / maximum flange temperature depends on O-ring selection according to the table below.

O-ring Material	Min. Temperature °C (°F) in air	Max. Temperature °C (°F) in air
Viton	-15 (5)	200 (392)
Kalrez 6375	-20 (-4)	275 (527)



Flange temperature depends on mounting conditions, such as nozzle position, distance to max product level, nozzle height, presence of insulation etc.

Product certificates

Approved Manufacturing Locations

Rosemount Tank Radar AB – Gothenburg, Sweden

European Union Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount Tank Gauging website at www.rosemount-tg.com. A hard copy may be obtained by contacting our local sales representative.

ATEX Directive (94/9/EC)

Rosemount Tank Radar AB complies with the ATEX Directive.

Ordinary Location Certification for Factory Mutual

As standard, the gauge has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM.

TankRadar Pro European ATEX Directive Information

The Special Safety Instruction for TankRadar Pro, which includes ATEX Directive information, is delivered together with the gauge. It lists specific requirements which have to be fulfilled to secure a safe installation and use of TankRadar Pro in a hazardous area. Omission may jeopardize safety, and Rosemount Tank Radar AB will not take any responsibility if requirements as listed below are not fulfilled.

Canadian Registration Number (CRN)

The product design of the Cone Antenna has been accepted and registered for use in Canada.

CRN: 0F0610.9C.

ATEX approvals

TankRadar Pro

Certificate Number: Sira 03ATEX 1294X

With Intrinsically Safe Outputs and IS Display Output

Ⓔ II (2) (1) 1/2 GD

Ex de [ib] [ia] IIC T6 Ga/Gb (-40° to +70°C)

Ex t IIIC T85°C Db IP65

Shall be installed in accordance with installation drawing 9150074-935.

With Non-IS Primary Output and IS Display Output

Ⓔ II (1) 1/2 GD

Ex de [ia] IIC T6 Ga/Gb (-40° to +70°C)

Ex t IIIC T85°C Db IP65

Shall be installed in accordance with installation drawing 9150074-936.

With Non-IS Primary and/or Non-IS Secondary Outputs

Ⓔ II 1/2 GD

Ex de IIC T6 Ga/Gb (-40° to +70°C)

Ex t IIIC T85°C Db IP65

Max supply voltage: 55 VDC

Passive analog output 4-20 mA,

Label identification = HART passive.

Voltage compliance 7-30V:

$U_i < 30 \text{ V}$

$I_i < 200 \text{ mA}$

$P_i < 1.3 \text{ W}$

$C_i = 0 \text{ } \mu\text{F}$

$L_i = 0 \text{ mH}$

Active analog output 4-20 mA,

Label identification = HART active.

Max load 300Ω:

$U_o < 23.1 \text{ V}$

$I_o < 125.7 \text{ mA}$

$P_o < 0.726 \text{ W}$

$C_{\text{ext}} < 0.14 \text{ } \mu\text{F}$

$L_{\text{ext}} < 2.2 \text{ mH}$

2210 Display Unit

Certificate Number: Sira 00ATEX 2062

ATEX Category Marking Ⓔ II 1/2 G

Without Temperature Inputs

ATEX Marking: Ⓔ II 1/2 G

Safety Coding: EEx ib IIC T4 (T_{amb} -40 °C, +70 °C)

With Temperature Inputs

ATEX Marking: Ⓔ II 1/2 G

Safety Coding: EEx ib [ia] IIC T4 (T_{amb} -40 °C, +70 °C)

IECEx approvals

TankRadar Pro

Certificate Number: IECEx SIR 05.0024X

With Intrinsically Safe Outputs and IS Display Output

Ex de [ib] [ia] IIC T6 Gb/Ga (-40° to +70°C)

Ex t IIIC T85°C Db IP65

With Non-IS Primary Output and IS Display Output

Ex de [ia] IIC T6 Gb/Ga (-40° to +70°C)

Ex t IIIC T85°C Db IP65

With Non-IS Primary and/or Non-IS Secondary Outputs

Ex de IIC T6 Gb/Ga (-40° to +70°C)

Ex t IIIC T85°C Db IP65

TankRadar Pro

Max supply voltage: 55 VDC
 Passive analog output 4-20 mA,
 Label identification = HART passive.
 Voltage compliance 7-30V:

$U_i = 30 \text{ V}$
 $I_i = 200 \text{ mA}$
 $C_i = 0 \text{ }\mu\text{F}$
 $L_i = 0 \text{ mH}$
 $U_o = 0 \text{ V}$
 $I_o = 0 \text{ mA}$
 $U_m = 250 \text{ Vrms}$

Active analog output 4-20 mA,
 Label identification = HART active.

Max load 300Ω:

$U_o = 23.1 \text{ V}$
 $I_o = 125.7 \text{ mA}$
 $P_o = 0.726 \text{ W}$
 $C_o = 0.14 \text{ }\mu\text{F}$
 $L_o = 2.2 \text{ mH}$
 $C_i = 0 \text{ }\mu\text{F}$
 $L_i = 0 \text{ mH}$

2210 Display Unit

Certificate Number: IECEx SIR 05.0021

Without Temperature Inputs

Safety Coding: Ex ib IIC T4 (T_{amb} -40 °C, +70 °C)

With Temperature Inputs

Safety Coding: Ex ib [ia] IIC T4 (T_{amb} -40 °C, +70 °C)

Factory Mutual (FM) approvals

TankRadar Pro

Certificate Number: 4D5A9.AX

With Intrinsically safe outputs

(all versions except those listed below)

Explosion proof with IS outputs for HAZLOC
 Class I, Division 1, Group A, B, C and D

Max operating temperature +70 °C

Dust ignition proof for use in Class II/III,
 Division 1, Groups E, F, and G.

Use conductors rated at least 85 °C

Shall be installed in accordance with
 System control drawing 9150074-994.

With Non-IS Secondary Outputs

Explosion proof
 Class I, Division 1, Group A, B, C and D

Max operating temperature +70 °C

Dust ignition proof for use in Class II/III,
 Division 1, Groups E, F, and G.

Use conductors rated at least 85°C

2210 Display Unit

Certificate: 4D5A9.AX

All Versions

Intrinsic Safe for HAZLOC
 Class I, Division 1, Group A, B, C and D T4

Max operating temperature +70 °C

Shall be installed in accordance with
 System control drawing 9150074-997.

Canadian Standards Association (CSA) approvals

TankRadar Pro

Certificate Number: 2003.153280-1346169

With Non-IS Primary and/or Secondary Outputs

Explosion proof Ex de IIC T6

Shall be installed in accordance with
 System control drawing 9150074-937.

Factory seal, conduit seal not required.

With IS Display Outputs, IS Primary and/or Secondary Outputs

Explosion proof Ex de [ib/ia] IIC T6

Shall be installed in accordance with
 System control drawing 9150074-939.

Factory seal, conduit seal not required.

2210 Display Unit

Certificate Number: 2003.153280-1346165

Without Temperature Inputs

Intrinsically safe EEx ib IIC T4 (T_{amb} -40 °C, +70 °C)

With Temperature Inputs

Intrinsically safe EEx ib [ia] IIC T4 (T_{amb} -40 °C, +70 °C)

Shall be installed in accordance with
 System control drawing 9150074-944.

Ordering information

Transmitter Head

Pos	Item	Code	Description	Note		
1	Transmitter Head	A	Platinum ⁽¹⁾	Ex approved. Includes FFAST™. ± 3 mm (± 0.12 in.) accuracy		
		G	Gold	Ex approved. Includes Echofixer, FFAST™, MET™. ± 5 mm (± 0.2 in.) accuracy		
		S	Standard	Ex approved. Includes Echofixer. ± 10 mm (± 0.4 in.) accuracy		
		L	Lite ⁽²⁾	Non-Ex. ± 10 mm (± 0.4 in.) accuracy		
2	Optional Software	0	No optional software			
		E	Echofixer ⁽³⁾			
		F	FFAST™ ⁽⁴⁾			
		G	FFAST™ + Echofixer ⁽⁵⁾			
		H	FFAST™ + MET™ ⁽⁴⁾			
3	Ex Certification	L	FFAST™ + MET™ + Echofixer ⁽⁵⁾			
		0	No Ex approval			
		C	ATEX	See pages 21-22		
		F	FM	See pages 21-22		
		I	IECEX	See pages 21-22		
4	Power Supply	S	CSA	See pages 21-22		
		4	Power Supply	P	Ultra-wide Input Range (24-240 V DC/AC)	
		5	Primary Output	0	None	
				1A	4-20 mA HART, active output	
				1B	4-20 mA HART, active output, IS ⁽⁶⁾	
1C	4-20 mA HART, passive output					
1D	4-20 mA HART, passive output, IS ⁽⁶⁾					
2A	TRL2 Bus, Modbus protocol					
3A	Profibus DP					
8A	RS485, Modbus protocol					
6	Display Panel	0	None			
		P	Display panel. Mounted on gauge in factory			
		R	Display panel for remote mounting			
		T	Display panel for remote mounting, with temperature inputs			
7	Secondary Output	0	None			
		A	4-20 mA, active output ⁽⁷⁾⁽¹⁰⁾			
		B	4-20 mA, active output, IS ⁽⁶⁾⁽⁹⁾⁽¹⁰⁾			
		C	4-20 mA, passive output ⁽⁷⁾⁽¹⁰⁾⁽¹¹⁾			
8	Volume Calculation	D	4-20 mA, passive output, IS ⁽⁶⁾⁽⁹⁾⁽¹⁰⁾⁽¹¹⁾			
		0	Three pre-configured tank shapes included (vertical and horizontal cylinder plus sphere)			
		S	Strapping table (up to 100 points)			
		9	Measuring Range	0	0-50 m (0 to 164 ft) default	0-99 m (0-325 ft) with special configuration
10	Special Information	0	None			
		G	Cable glands (½ in. NPT)			
		T	Factory test certificate			
		U	FCC Approval			
		K	TÜV overfill prevention ⁽⁸⁾			
		S	Stainless steel tag for unit identification			
X	Special information specified in order					

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- (1) Requires Pos 11 "Antenna Type" code 2 and Pos 12 "Antenna Size" code 8 or Pos 11 "Antenna Type" code 4 or Pos 11 "Antenna Type" code B.
- (2) Requires Pos 3 "Ex Certification" code 0.
- (3) Requires Pos 1 "Transmitter Head" code L or A.
- (4) Requires Pos 1 "Transmitter Head" code L or S.
- (5) Requires Pos 1 "Transmitter Head" code L.
- (6) Not available with Pos 3 "Ex Certification" code 0.
- (7) Requires Pos 6 "Display Panel" code 0 and Pos 5 "Primary Output" code 0, 1A, 1C, 2A, 3A or 4A.
- (8) Requires Pos 7 "Secondary Output" code A or B.
- (9) Not available with Pos 3 "Ex Certification" code S in combination with Pos 5 "Primary Output" code 1A, 1B, 1C or 1D.
- (10) If the Pos 5 "Primary Output" code is either 3A, 4A or 4B, configuration via the sensor bus is required for the Secondary Output.
- (11) Not available with Pos 5 "Primary Output" code 1A, 1B, 1C or 1D.

Antennas

Cone antenna

Pos	Item	Code	Description	Note
11	Antenna Type	2	Cone antenna	
12	Antenna Size	3	3 in. (DN 80)	
		4	4 in. (DN 100)	
		6	6 in. (DN 150)	
		8	8 in. (DN 200)	
13	Antenna Material	S	Stainless steel EN 1.4436 (AISI 316L)	
		H	Hastelloy C-22	
		M	Monel 400	
		T	Titanium	
		Z	Tantalum	
14	Sealing	P	PTFE fluoropolymer	
		Q	Quartz	
15	O-ring Material	V	Viton fluoroelastomer	
		K	Kalrez perfluoroelastomer	
16	Special	0	None	
		X	Other specified in order	
17	Flange	00	None	
		2A	DN100 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2B	DN150 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2C	DN200 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2D	ANSI 3 in. 300 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2E	ANSI 4 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2F	ANSI 6 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2G	ANSI 8 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2H	ANSI 3 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		XX	Customer specific flange or material	

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Cone antenna, extended

Pos	Item	Code	Description	Note
11	Antenna Type	7	Extended Cone antenna	
12	Antenna Size	3	3 in. (DN 80)	
		4	4 in. (DN 100)	
		6	6 in. (DN 150)	
13	Antenna Material	S	Stainless steel EN 1.4436 (AISI 316L)	
14	Sealing	P	PTFE fluoropolymer	
		Q	Quartz	
15	O-ring Material	V	Viton fluoroelastomer	
		K	Kalrez perfluoroelastomer	
16	Special	0	Antenna Length 500 mm (20 in.)	
		1	Antenna Length 1000 mm (40 in.)	
		2	Antenna Length 1500 mm (60 in.)	
		M	Material certificate EN 10204, 3.1 B	
		X	Other specified in order	
17	Flange / Connection	00	None	
		2A	DN100 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2B	DN150 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2C	DN200 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2D	ANSI 3 in. 300 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2E	ANSI 4 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2F	ANSI 6 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2H	ANSI 3 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		XX	Customer specific flange or material	

Cone antenna with integrated purging

Pos	Item	Code	Description	Note
11	Antenna Type	9	Cone antenna with integrated purging	
12	Antenna Size	4	4 in. (DN 100)	
		6	6 in. (DN 150)	
		8	8 in. (DN 200)	
		A	10 in. (DN 250)	
13	Antenna Material	S	Stainless steel EN 1.4436 (AISI 316L)	
14	Sealing	P	PTFE fluoropolymer	
		Q	Quartz	
15	O-ring Material	V	Viton fluoroelastomer	
		K	Kalrez perfluoroelastomer	
16	Special	0	None	
		M	Material certificate EN 10204, 3.1 B	
		X	Other specified in order	
17	Flange / Connection	00	None	
		9A	DN 100 PN 16 (Standard). MAWP 5 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9B	DN 150 PN 16 (Standard). MAWP 6 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9C	DN 200 PN 16 (Standard). MAWP 6 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9D	DN 250 PN 16 (Standard). MAWP 5 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9E	ANSI 4 in. 150 lb (Standard). MAWP 7 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9F	ANSI 6 in. 150 lb (Standard). MAWP 10 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9G	ANSI 8 in. 150 lb (Standard). MAWP 10 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9H	ANSI 10 in. 150 lb (Standard). MAWP 8 Bar @ 200 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9J	DN 100 PN 16 (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9K	DN 150 PN 16 (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9L	DN 200 PN 16 (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9M	DN 250 PN 16 (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9N	ANSI 4 in. 150 lb (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9O	ANSI 6 in. 150 lb (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9P	ANSI 8 in. 150 lb (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		9Q	ANSI 10 in. 150 lb (Special). MAWP 10 Bar @ 400 °C.	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		XX	Customer specific flange or material	

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Parabolic antenna

Pos	Item	Code	Description	Note
11	Antenna Type	4	Parabolic antenna	
12	Antenna Size	5	Ø=440 mm. Clamped installation for low pressure applications, -0.2 to 0.2 Bar (-2.9 to 2.9 psig)	
		6	Ø=440 mm. Welded installation for high pressure applications, -0.2 to 10 Bar (-2.9 to 145 psig)	
13	Antenna Material	S	Stainless steel EN 1.4436 (AISI 316L)	
14	Sealing	P	PTFE fluoropolymer	
15	O-ring Material	V	Viton fluoroelastomer and FEP fluoropolymer. Only FEP is exposed to tank atmosphere.	
16	Special	0	None	
		M	Material certificate EN 10204, 3.1 B	
		X	Other specified in order	
17	Flange / Connection	00	None	

Note: The parabolic antenna is available with a protective cover made of PTFE fluoropolymer on request.

1- and 2-in. Still-pipe antennas

Pos	Item	Code	Description	Note
11	Antenna Type	5	2-in. still-pipe antenna	
		6	1-in. still-pipe antenna	Antenna and 3 m still-pipe integrated
12	Antenna / Nozzle Size	0	2 ½ in. (DN65), plate ⁽²⁾	
		2	2 in. (DN50), plate ⁽²⁾	
		3	3 in. (DN80), plate	
		4	4 in. (DN100), plate	
		6	6 in. (DN150), plate ⁽¹⁾	
		8	8 in. (DN200), plate ⁽¹⁾	
13	Antenna Material	S	Stainless steel EN 1.4436 (AISI 316L)	
14	Sealing	P	PTFE fluoropolymer	
		Q	Quartz	
15	O-ring Material	V	Viton fluoroelastomer	
		K	Kalrez perfluoroelastomer	
16	Special	0	None (excluding still-pipe) ⁽¹⁾	
		1	3 m (9.8 ft) still-pipe ⁽³⁾	
		2	6 m (19.7 ft) still-pipe ⁽¹⁾	
		3	9 m (29.5 ft) still-pipe ⁽¹⁾	
		4	12 m (39.4 ft) still-pipe ⁽¹⁾	
X	Other specified in order			
17	Flange / Connection	00	None	
		2A	DN100 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2B	DN150 PN16	HStainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2C	DN200 PN16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2D	ANSI 3 in. 300 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2E	ANSI 4 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2F	ANSI 6 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2G	ANSI 8 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2H	ANSI 3 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2M	ANSI 2 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404 ⁽²⁾
		2N	ANSI 2 in. 300 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404 ⁽²⁾
		2P	DN 50 PN 16-40	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2Q	DN 80 PN 16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		2R	DN 80 PN 40	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404 ⁽²⁾
		XX	Other specified in order	

(1) Not available with Pos 11 "Antenna Type" code 6.

(2) Not available with Pos 11 "Antenna Type" code 5.

(3) Required for Pos 11 "Antenna Type" code 6.

Technical Description

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TankRadar Pro

Still-pipe Array antenna

Pos	Item	Code	Description	Note
11	Antenna Type	B	Still-pipe Array antenna	
12	Antenna Size	5	5 in.	
		6	6 in.	
		8	8 in.	
		A	10 in.	
		B	12 in.	
13	Antenna Material	S	Stainless steel EN 1.4404 (AISI 316L) and PPS	
14	Mounting	F	Fixed (flange mounted)	
		H	Hinged lid mounted (enables hand-dipping)	
15	O-ring Material	0	Not applicable	
16	Special	0	None	
		C	Clamp Flange	
17	Flange / Connection	00	None	
		BJ	Hole pattern according to ANSI 5 in. Class 150 ⁽¹⁾ . EN 1.4404 / AISI 316L	
		BK	Hole pattern according to ANSI 6 in. Class 150 / DN 150 PN 16 ⁽¹⁾ . EN 1.4404 / AISI 316L	
		BL	Hole pattern according to ANSI 8 in. Class 150 / DN 200 PN 10 ⁽¹⁾ . EN 1.4404 / AISI 316L	
		BM	Hole pattern according to ANSI 10 in. Class 150 / DN 250 PN 16 ⁽¹⁾ . EN 1.4404 / AISI 316L	
		BN	Hole pattern according to ANSI 12 in. Class 150 ⁽¹⁾ . EN 1.4404 / AISI 316L	
		XX	Customer specific flange or material	

(1) Flat faced flange with 12 mm (0.47 in.) thickness.

Process Seal antenna

Pos	Item	Code	Description	Note
11	Antenna Type	3	Process Seal antenna	
12	Antenna / Nozzle Size	4	4 in. (DN 100)	
		6	6 in. (DN 150)	
13	Antenna Material	0	Not applicable	
14	Sealing	P	PTFE fluoropolymer	
		A	Ceramic	
15	O-ring Material	0	Not applicable	
16	Special	0	None	
		X	Other specified in order	
17	Flange / Connection	3A	DN100 PN6	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3B	DN100 PN10/16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3C	DN100 PN25/40	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3D	DN150 PN6	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3E	DN150 PN10/16	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3F	ANSI 4 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3G	ANSI 4 in. 300 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3H	ANSI 6 in. 150 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		3I	ANSI 6 in. 300 lb	Stainless Steel A182 Gr. F 316L and EN 10222-5-1.4404
		XX	Customer specific flange or material	

Model Code Example

This example is for a TankRadar Pro, platinum version gauge, with a parabolic antenna:

TH - Antenna & Flange: A E C P 1B P B S 0 K - 4 5 S P V M 00

TankRadar Pro

Technical Description

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February 2012

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