

Technical Description

Saab LoopRadar[™]

Loop-powered Microwave Level Gauge



SAAB
Saab Tank Control

Saab LoopRadar™

Features

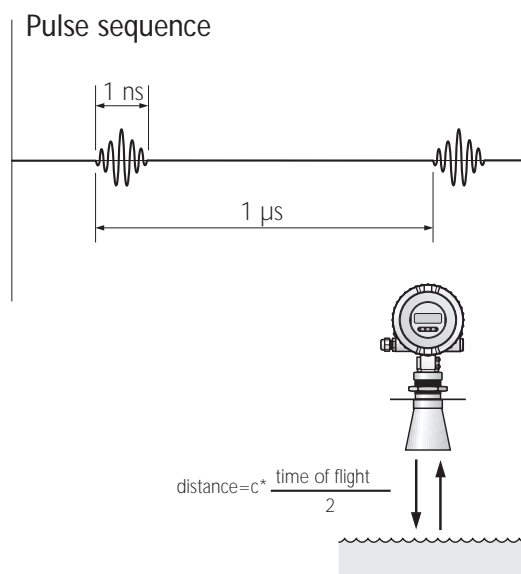


- No moving parts and no contact with the liquid
- No maintenance and high reliability
- High sensitivity
- Loop-powered
- Analog 4 - 20mA and digital HART® outputs
- High flexibility with interchangeable gauge heads and antennas
- Different antennas available for best performance in various applications
- High accuracy
- Interactive setup on PC with Windows based software, HART® communicator or via gauge-mounted keyboard/display

Measurement principle

The level of the liquid is measured by short radar pulses which are transmitted from the antenna at the tank top towards the liquid. After the radar pulses are reflected by the liquid surface the antenna picks them up again. The distance (d) from the gauge to the liquid is proportional to the time of flight (t) of the microwave pulse.

Saab LoopRadar uses a frequency of 5,8 GHz (6,3 GHz in the US) which gives high immunity against condensation and antenna contamination.



Pulse technology measurement is based on very short radar pulses which are reflected by the surface

Applications

Saab LoopRadar measures the level of liquids, slurries and the like in standard applications. Use it without agitators or other internal structures, where the sophistication of Saab TankRadar Pro or Rex would not be necessary.

Microwave technology offers the highest reliability and precision, which ensure that that measurements are virtually unaffected by temperature, pressure, vapor gas mixtures, density and other product properties.

Use it on storage and buffer tanks in areas such as:

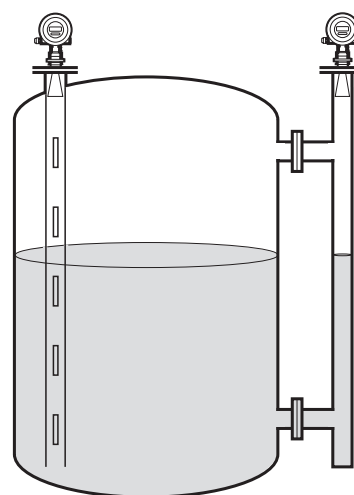
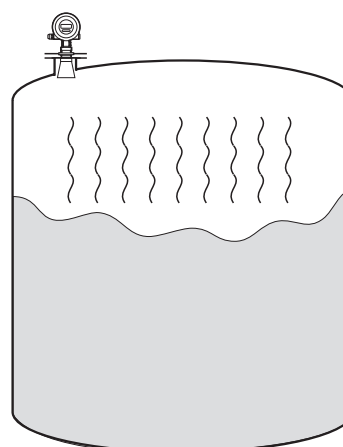
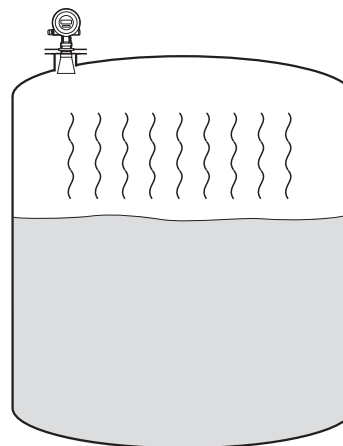
- Chemical & petrochemical industry
- Pharmaceutical plants
- Food and beverage industry
- Refinery process vessels

Applications also include level control and flow measurement in areas like:

- Water and sewage treatment
- Hydroelectric dams and power plants

If the surface is turbulent and for liquids with dielectric constant (ϵ_r) smaller than 1,9 such as liquefied gases, a still pipe is recommended for reliable measurements.

(in preparation)



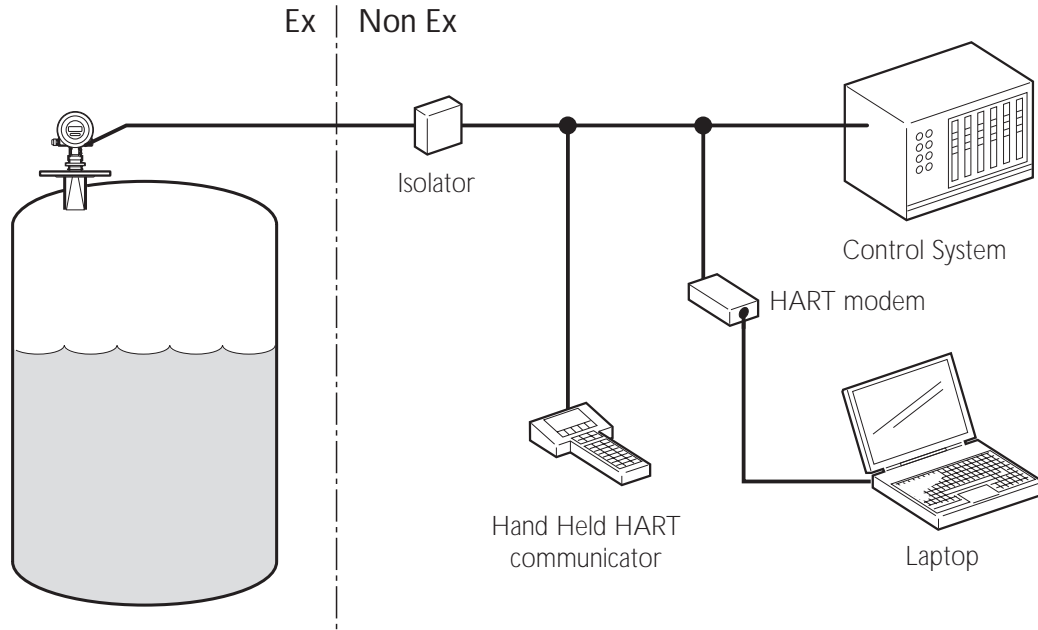
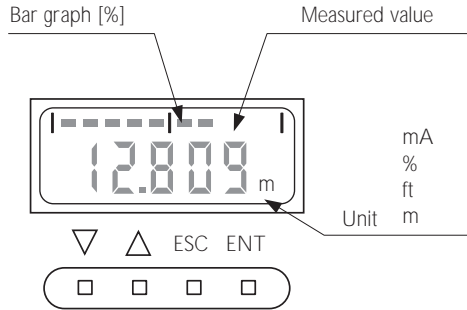


System Integration

Saab LoopRadar is loop-powered and uses the same two wires for both power supply and output signal. Level values are transmitted from the gauge as an analog 4-20 mA signal with a superimposed digital HART® signal. The gauge is intrinsically safe and for operation in Ex areas an IS-barrier providing ia-circuit shall be used.

Data are displayed on the 5-digit LCD display mounted in the gauge. Configuration is easily done on the 4-key display keyboard.

Configuration can also be done on a PC using the Windows based setup software package, or with a HART® communicator (device descriptor in preparation)



Measuring range

Different parameters affect the echo, and therefore the maximum measuring range may differ depending on application, as shown in the following basic rules:

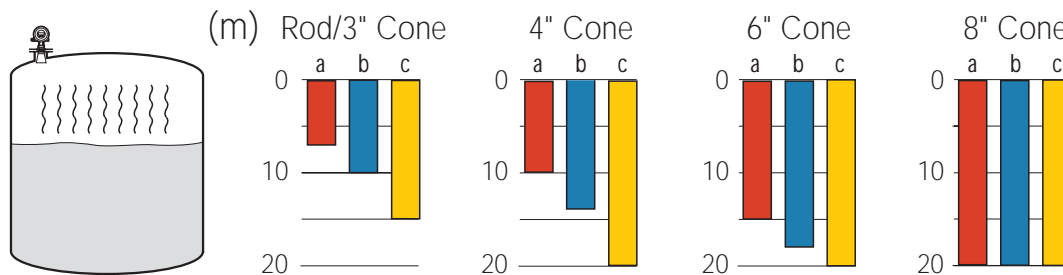
- High dielectric constant (ϵ_r) of the media gives better reflection and a longer measuring range.
- A large antenna gives more reliable measurements and longer measuring range.
- A calm surface gives better reflection than a turbulent surface. The measuring range when turbulent surface may therefore be reduced.
- Contamination on the antenna, foam on the surface, particles in the tank atmosphere are also circumstances that may affect the measuring performance.

Saab Loopradar has a high sensitivity which makes it very able to cope with the above circumstances. However, for reliable measurements the maximum measuring distance should be kept within the range indicated in the diagrams below.

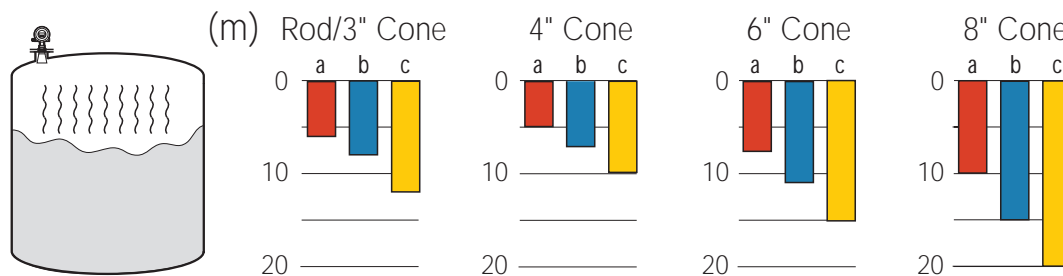
If the surface is turbulent and for liquids with ϵ_r smaller than 1.9, such as liquefied gases, a still pipe is recommended for reliable measurements.

The liquids are divided into the following categories:

- **a** Oil, gasoline and other hydrocarbons, petrochemicals (dielectric constant, $\epsilon_r = 1.9-4.0$)
- **b** Alcohols, concentrated acids, organic solvents: ($\epsilon_r = 4.0-10$)
- **c** Water based liquids, dilute acids, acetone, ($\epsilon_r > 10$)



Measuring range in tanks with calm surface.



Measuring range in tanks with turbulent surface.

Antenna versions

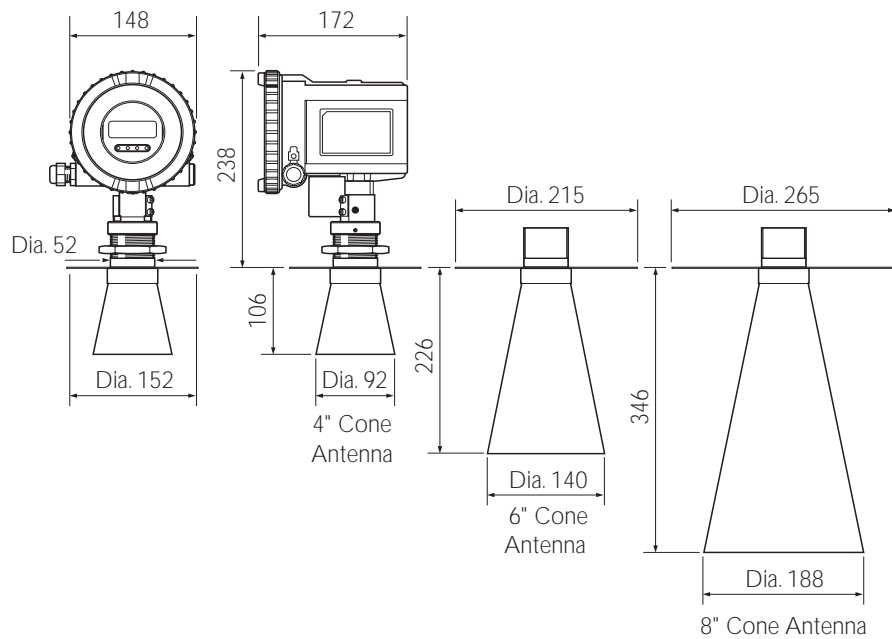
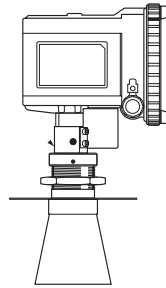
Saab LoopRadar can be equipped with different antennas to fulfill various requirements. The antenna is the only part exposed to the tank atmosphere.

Cone antenna

Cone antennas are suitable for a large range of applications, both for free propagation and still-pipe mounted installations. 4", 6" and 8" diameter tank connections are available.

Materials exposed to the tank atmosphere are PTFE sealing, antenna in stainless steel (316L) and o-rings in Viton.

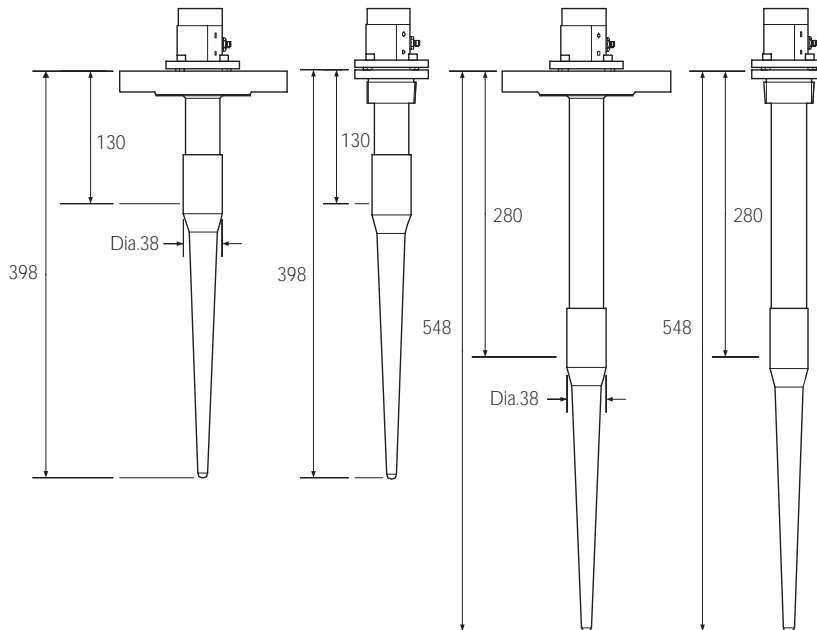
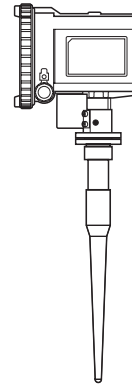
Thanks to the unique flange clamp solution the existing customer flange can be used as process connection. Either the existing flange is used, or a flange can be included in the delivery (optional).



Rod Antenna
(in preparation)

The rod antenna is made of Teflon® (PFA), which makes it easy to clean and gives a good resistance to aggressive chemicals and condensation. The rod antenna has an inactive length of 100 or 250 mm in order to ensure that measurements are unaffected by the mounting nozzle. Maximum nozzle height is the same as the inactive length of the antenna.

The rod antenna is available with 1½ threaded or flanged connection, for flexibility in tank mounting.



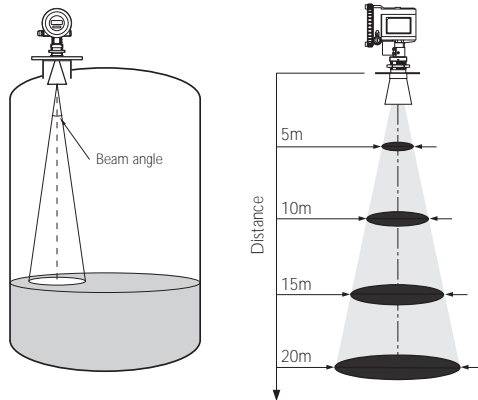
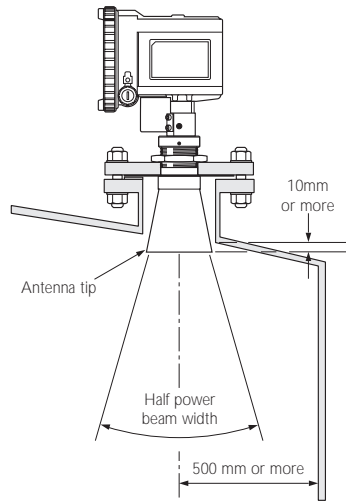
Mechanical mounting

Saab LoopRadar is easily carried to the tank top and mounted on a suitable nozzle or pipe.

To get best possible performance installation should be made:

- With antenna oriented perpendicular to an horizontal surface
- The gauge should be mounted without fittings or other disturbing objects within the radiated area as specified below
- 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 offers greater margin for weak surface echoes

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



Diameter of radiated area

Distance, m (ft)	Diameter, m (ft)			
Antenna type	Cone 4"	Cone 6"	Cone 8"	Rod
Beam angle*	34°	22°	17°	23°
5 (16)	2.9 (9.5)	1.9 (6.2)	1.5 (4.9)	2.0 (6.6)
10 (33)	5.8 (19)	3.8 (12)	3.0 (9.8)	4.0 (13)
15 (49)	8.8 (29)	5.7 (19)	4.4 (14)	6.0 (20)
20 (66)	11.7 (38)	7.6 (25)	5.9 (19)	8.0 (26)

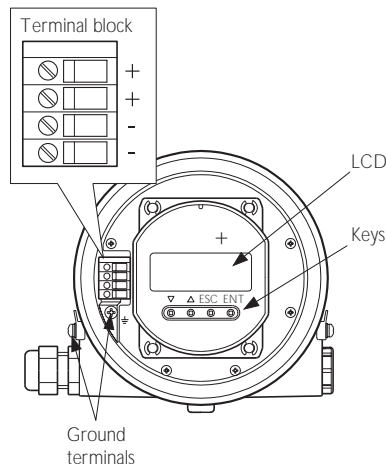
* Half power (3 dB) beam angle

Electrical connections

Saab LoopRadar uses the same two wires for both power supply and output signal. The input voltage is 18-36V DC (18-30V DC in Ex applications). Recommended cables are twisted, shielded pairs.

Saab LoopRadar is intrinsically safe and for operation in Ex areas a safety isolator providing ia-circuits must be used. The supply safety description is $U_i = 30\text{ V}$, $I_i = 110\text{ mA}$, $P_i = 0,825\text{ W}$.

For complete installation instruction, see Users Guide.





Specifications

General	
Product designation	Saab LoopRadar
Measurement principle	Time of flight of radar pulses
Operating frequency	5.8 GHz (6,3 GHz in the US)
Half power beam angle	Rodantenna 23°, 4" cone antenna 34°, 6" cone 22°, 8" cone 17°
Microwave output power	Maximum 1µW
Reference conditions	Free-space reflection from flat metal surface, ambient temperature 25°C (77°F), atmospheric pressure

Display / Configuration	
Local display	5 digit LCD display with 4 configuration buttons. Level, ullage, volume, current or amplitude output
HART® hand-held communicator	Rosemount hand-held communication RS 275 (device description in preparation)
PC / remote configuration	Loop setup, powerful Windows based configuration software

Electric	
Power supply	Loop-powered, 18-36 VDC (18-30 VDC in Ex applications)
Output	Analog 4-20mA, HART®
Output variable	Level, ullage, volume, amplitude
Output unit	Level and ullage in m or decimal ft, volume in % and amplitude in dB
Output resolution	Analog: 4 mA Digital: 1mm
Signal on alarm	Hold / low (3,9mA) / high (22mA)
Ex parameters	Ui = 30V, Ii = 110mA, Pi = 825 mW
Cable entry	M20 x 1.5, NPT1/2"

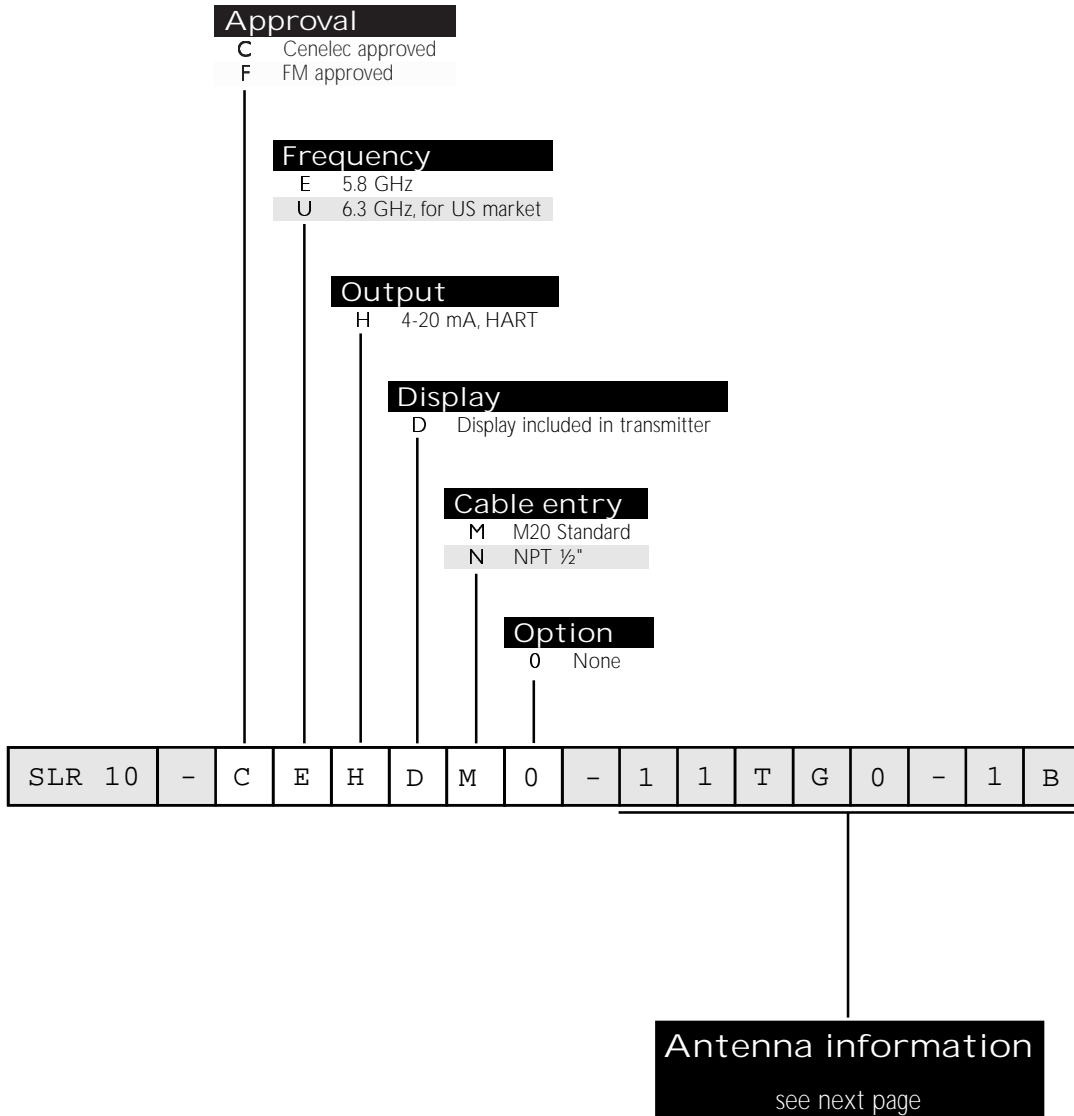
Mechanical	
Antennas	Rod antenna, 4", 6", 8" cone antennas
Antenna Material exposed to tank atmosphere	Rod antenna: PFA (cladded version), PFA and stainless steel (uncladded version) Cone antennas: Stainless steel 316L, PTFE, Viton
Antenna dimensions	See pages 6-7
Housing / Enclosure	Aluminium
Flanges (optional)	DIN and ANSI standard, Material: Carbon Steel
Weight	3,9 - 4,9 kg (8,6-10,8 lbs) depending on antenna
Height above flange	230 mm (9")

Environment	
Maximum pressure	10 bar (145 Psi)
Ambient Temperature	-40°C to +70°C (-40°F to +158°F), LCD display -20°C to +70°C
Storage temperature	-40°C to + 80°C (-40°F to +176°F)
Tank temperature	-40°C to +150°C (-40°F to +302°F)
Emission approvals	BZT (in preparation) FCC (in preparation)
Ingress protection	Designed for IP 65, NEMA4
Vibration resistance	IEC 68-2-6 / 1G
Electromagnetic compatibility	Emission: EN 50081-1, Immunity: EN 50082-2
Ex approval	ATEX II 1 G EEx ia IIC T4 FM CL.I Div1 Groups A-D T4 (in preparation)

Measuring performance	
Instrument accuracy	+/- 10 mm (0.4") (reference conditions)
Repeatability	+/- 10 mm (0.4") (reference conditions)
Linearity	+/- 10 mm (0.4") (reference conditions)
Ambient temperature effect	+/- 0,01% / 10 K (ambient temp -20 °C to +70 °C)
Update interval	1s
Measuring range	Maximum 20m (65'). Also see diagram, page 5

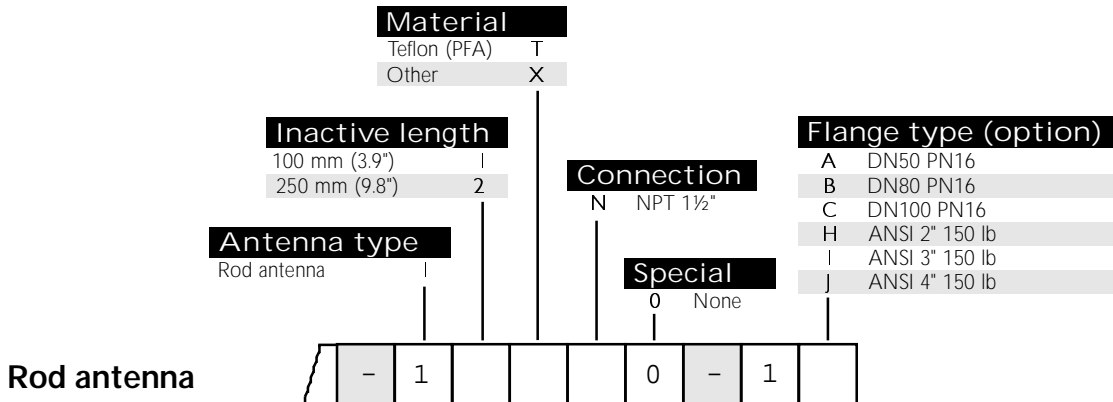
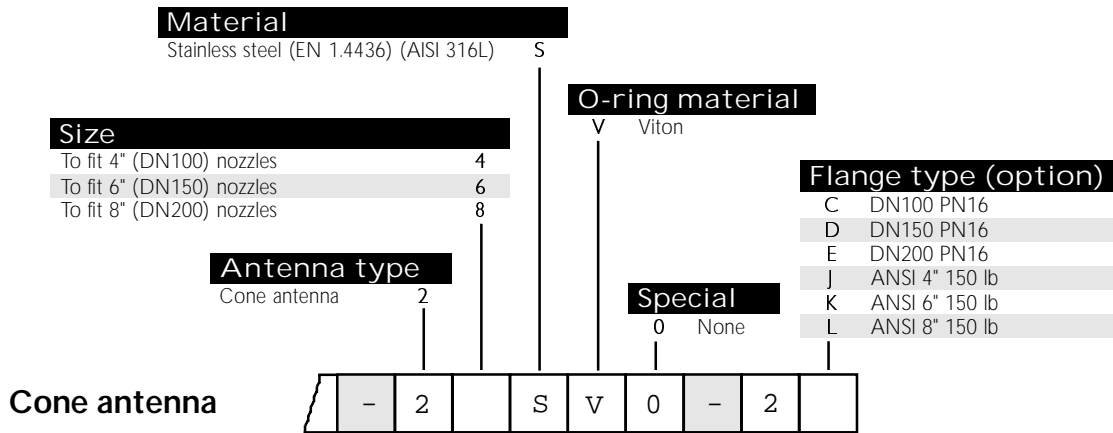


Ordering information





Antenna information



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