

GUIDED WAVE RADAR FOR CONTINUOUS LEVEL MEASUREMENTS RD500 SERIES

- Level measurement technology based on the TDR (Time Domain Reflectometry) principle
- Independent of density variations
- Measurements not affected by the interior of the reservoirs and turbulence in the process
- Easy installation and maintenance
- Accuracy up to ± 5 mm
- Excellent repeatability
- Supports DD, EDDL and FDT/DTM
- Volume calculation by linearization of irregular tanks
- Analog Input Function Blocks
- Local adjustment
- Multifunctional rotating display
- Specific sensitivity adjustment for each process (Sensor Threshold Level)



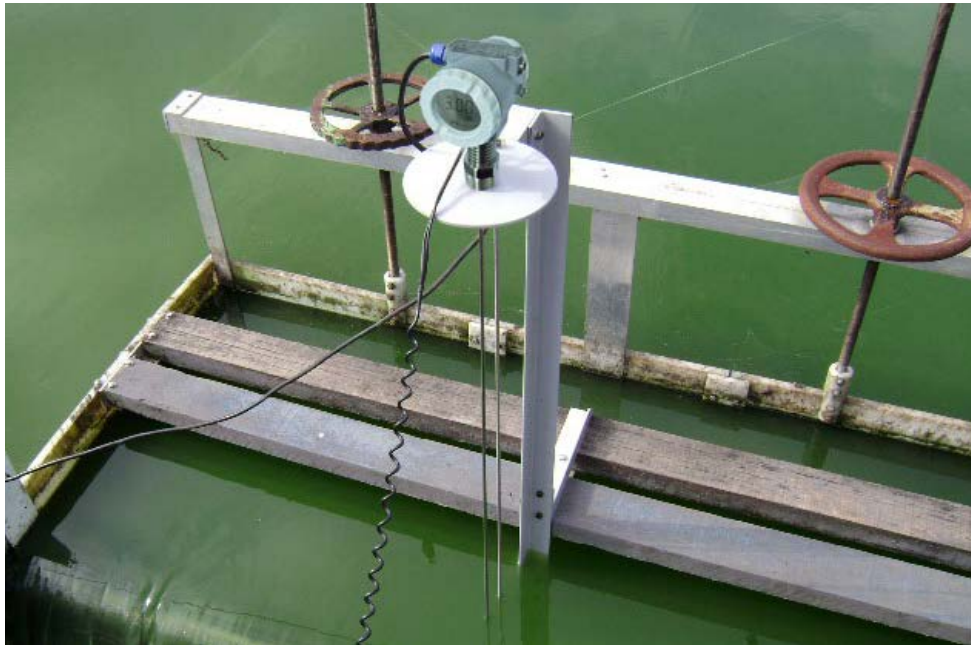
Guided Wave Radar

RD500 Series

The RD500 uses the principle of Time Domain Reflectometry (TDR) for direct measurement of level in industrial processes.

HART® - 4 a 20 mA

- Zero and span local adjustment;
- HART® protocol;
- Output current with 1.6 µA resolution;
- Easy to configure by Smar DevComDroid.



Equipment



Housing – Contain all the electronics, local adjustment, electrical connections and Liquid Crystal Display (LCD).

Isolator – Isolates the electronics from the probe, and contains the frequency generator, which sends and receives the waves that will be guided through the probe. Also allows the probe rotation, granting high tensions over it.

Probe – See figure “RD500 Probes”, page 3. The electromagnetic waves are guided through the probe immersed in the process.

RD500 components



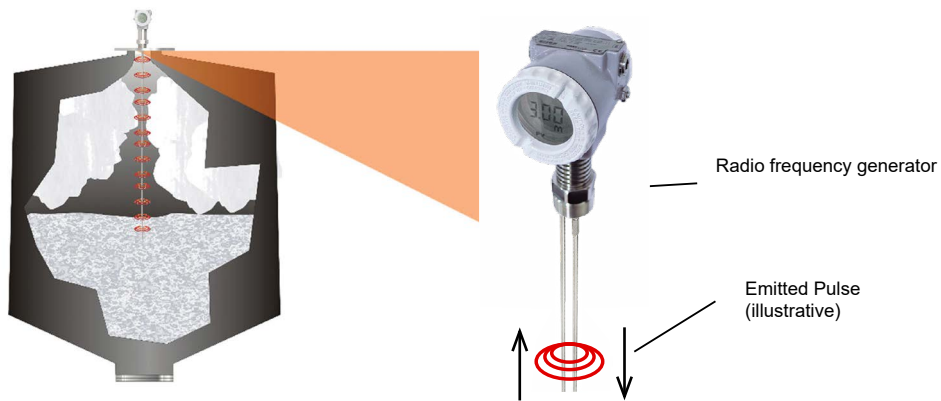
Smart **RD500** uses the TDR – Time Domain Reflectometry principle, usually applied on dielectric constant measurement of liquids, on fissures detection of concrete structures, concentration and humidity measurement and, among others, on direct level measurement in industrial processes.

By using a radio frequency generator, the equipment sends electromagnetic pulses which are guided through a probe in contact with the process. These waves, by reaching a different environment, return through the probe because of the environment's impedance changing. This parameter has a direct relation

with the dielectric constant of the process, and it will be decisive on waves reflection quality.

With a dedicated software, **RD500** calculates continuously the time between waves reflection. With waves' frequency, this software will calculate the real level desired.

The process variable, as well as monitoring and diagnostic information, are provided by digital communication of the HART protocol.



Pulses generation through Radio frequency emitter

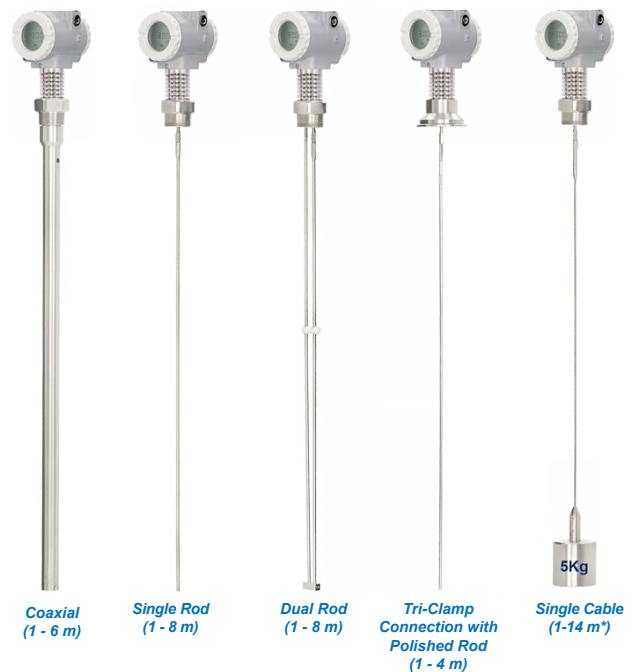
RD500 is two-wire power supplied with 4 to 20 mA/ HART® output signal. This signal is configurable by the user locally

via magnetic tool and can be seen on the equipment LCD indicator, or remotely via HART® configurators.

Probes

The **RD500** uses probes as coaxial, single flexible, single rigid and dual rigid, allowing larger flexibility to the user depending on the application characteristics.

- **Single Rod:** for measurement range up to 8 m in process with high dielectric constant (strong water presence, for example); installation in communicating vessel; polished food installations and with tri-clamp connection.
- **Dual Rod:** for measurement range up to 8 m in process where the dielectric constant is relatively low, as products with little water presence (example: grains constantly humid).
- **Single Cable:** for bigger ranges, up to 14 m* in process with high dielectric constant (strong water presence, for example) and turbulence situations which demand more flexibility and mechanical efforts of the probe.
- **Coaxial:** for measurement range up to 6 m in liquids process with dielectric constant very low (see Table from page 7), vapour, surface with high turbulence and presence of bubbles and foam. Ideal for applications with high EMC noise.



RD500 Probes

* Probes for measurements above 14 m (up to 25 m) are available only under consult.

Level Measurement

Levels of solids and liquids can be measured with precision in a lot of applications and temperature conditions, tanks geometry etc. The main parameter for the measurement is the dielectric constant of the product (consult our team for more information about dielectric constants).

Volume Calculation

RD500 calculates automatically volumes of typical tanks like vertical and horizontal cylinders or spherical tanks. Other tank shapes can be calculated with a strap table with a maximum of 16 points.

Probe Types

RD500 uses coaxial, single flexible, single rigid (polished with tri-clamp connection or not) and dual rigid, allowing larger flexibility to the user depending on the application characteristics.

Alarms

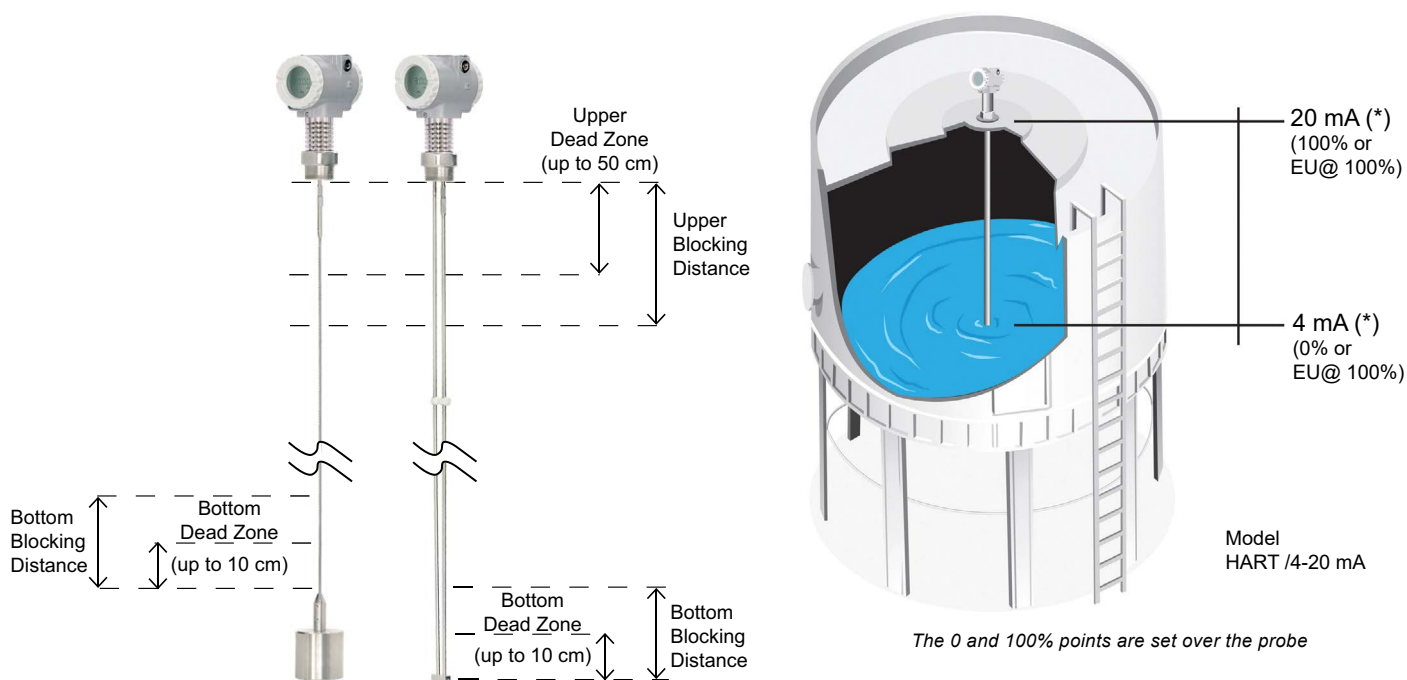
In addition to the 100% (High) and 0% (Low) output current saturation alarms, the **RD500** has the ability to retain the last value read immediately before entering this condition, triggering the alarm mode.

Local Adjustment

Many **RD500** parameters can be changed by using the local adjustment via magnetic tool – like range limits and tank configuration, for example.

Upper and Bottom Blocking Distances

RD500 can be configured to not consider distances at the top and at the bottom of the probe. It is very useful when internal obstacles generate noises which can interfere on the waves signal. Also, the equipment's upper (up to 50 cm) and bottom (up to 10 cm) dead zones must be considered.



RD500 measures process levels like:

- Various powdered and granular solids;
- Semi-solids;
- Liquids based or not on water.

The measurement will basically depend on the minimum dielectric constant of the process. This measurement generally not depend on density and temperature changing, foam on the surface, agitation, viscosity, and most part of internal obstacles which usually generate false echoes using other technologies.

Many tanks already have sockets at their upper part, in order to install equipment or simply verify the process. RD500 can be installed at these sockets, which is an advantage, considering that the structure will not be perforated again. **RD500** installation can be done by communicating vessel or over the tank (top mounting).

In underground tanks, for example, the access to them can be unviable sometimes, so hydrostatic pressure

transmitters become inapplicable. In this case, top mounting equipment are recommended.

For each process, its dielectric constant value and the type of **RD500** probe must be known to grant a better performance on the measurement.

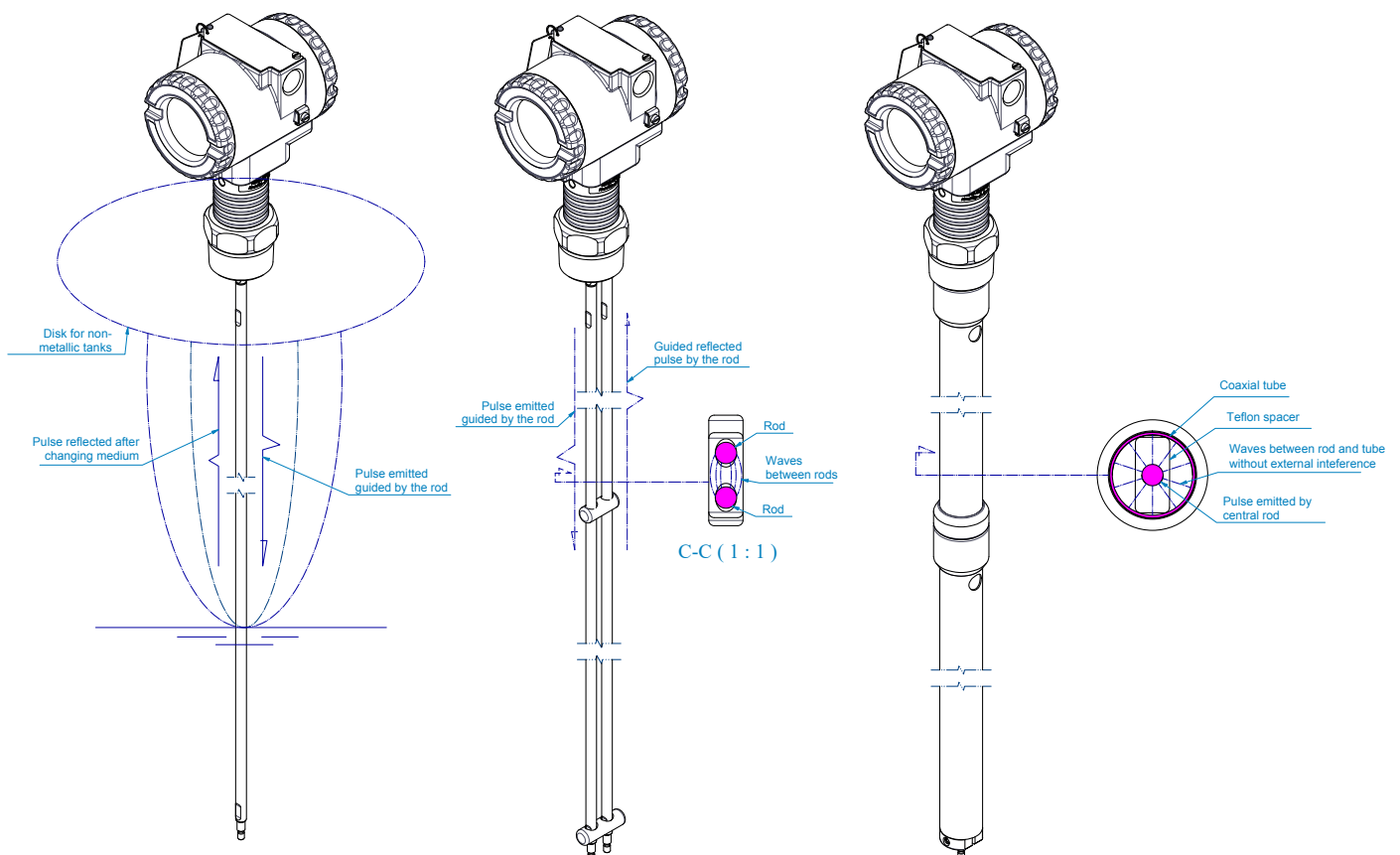


Top Mounting

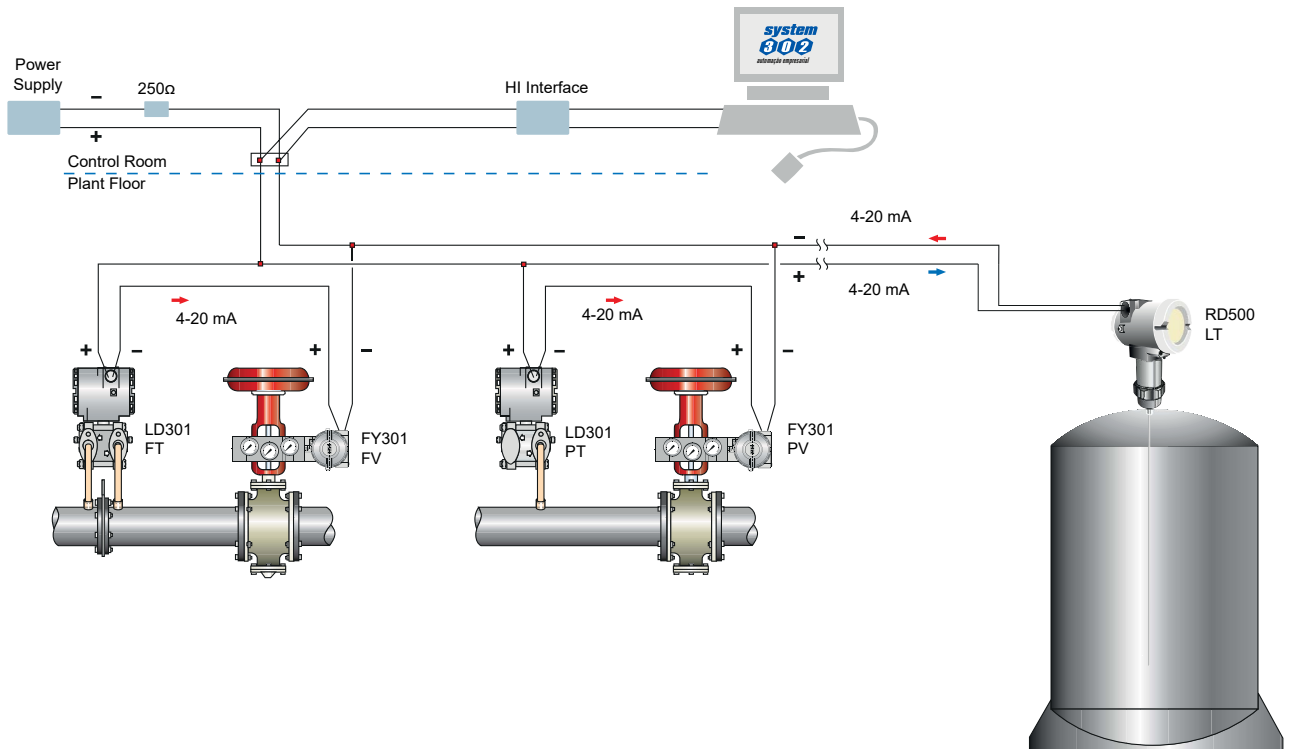


Installation in Communicating Vessel

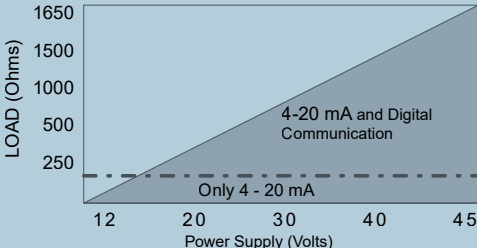
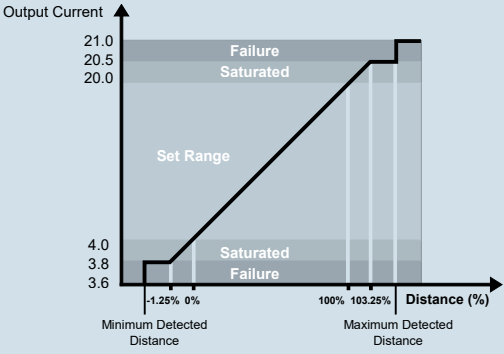
Electromagnetic Field over each Probe



HART®



Functional Specifications

<p>Power Supply</p>	<p>HART®/4-20mA: Non-Ex Instrument: 14 – 45 Vdc Ripple (AC Signal) Permissible Residual <100 Hz U_{ss} < 1V 100 Hz – 10 kHz U_{ss} < 10 mV</p>
<p>Output</p>	<p>HART®/4-20mA: Two wires, 4-20 mA according to NAMUR NE43, with superimposed digital communication (HART protocol). Resolution: 1.6 µA Current limit: 22 mA Load: See Figure below Burnout / Failure Alarm: 3.6 or 21 mA selectable Update Time: Aprox. 0.5 second.</p>
<p>Indication</p>	<p>4 1/2 -digit numerical and 5-character alphanumeric LCD indicator (optional).</p>
<p>Load Limitation</p>	
<p>Failure Alarm (Diagnostics)</p>	<p>HART®/4-20mA: In case of sensor or circuit failure, the self-diagnostics drives the output to 3.6 or 21.0 mA, according to the user's choice and NAMUR NE43 specification. Detailed diagnostic through HART® communication.</p> 
<p>Humidity Limits</p>	<p>0 to 100% (Relative Humidity).</p>

Pressure Limit	Flange ASME B 16.5																
	Class	150	300														
	Temperature	Limit Pressure (bar)															
	-29 to 38 °C	15.9 bar	41.4 bar														
	50 °C	15.3 bar	40.0 bar														
	100 °C	13.3 bar	34.8 bar														
	150 °C	12.0 bar	31.4 bar														
Pressure Limit	Flange DIN EN 1092-1																
	Temperature	-10 to 50 °C	100 °C	150 °C													
	PN	Limit Pressure (bar)															
	16	16	16.0 bar	14.5 bar													
	40	40	40.0 bar	3.3 bar													
Pressure Limit	Tri-Clamp (TC) (Bar) BS4825 p-3																
	DN	Normal Pressure															
		20 °C (68 °F)	120 °C (248 °F)														
	2"	28	17														
	3"	22	13														
Certification	Intrinsically Safe INMETRO, IECEx, ATEX, and FM (pending).																
Damping Adjustment	User configurable from 0 to 128 seconds (via digital communication).																
Zero and Span Adjustment	Non-interactive. Via digital communication or local adjustment. Local adjustment jumper with three positions: Simple, Disabled and Complete.																
Temperature Limit	<table border="1"> <tr> <td>Ambient (Housing and Electronic)</td> <td>-40 to 85 °C</td> </tr> <tr> <td></td> <td>-28 to 150 °C (Viton O-Ring)</td> </tr> <tr> <td></td> <td>-34 to 135°C (Buna N O-Ring)</td> </tr> <tr> <td>Ambient (Probe and Internal Sealing)</td> <td>-57 to 121 °C (EPDM O-Ring)</td> </tr> <tr> <td>Storage</td> <td>-40 to 80 °C</td> </tr> <tr> <td>Digital Display (LCD Indicator)</td> <td>-20 to 85 °C</td> </tr> <tr> <td>Transport</td> <td>-40 to 80 °C</td> </tr> </table>			Ambient (Housing and Electronic)	-40 to 85 °C		-28 to 150 °C (Viton O-Ring)		-34 to 135°C (Buna N O-Ring)	Ambient (Probe and Internal Sealing)	-57 to 121 °C (EPDM O-Ring)	Storage	-40 to 80 °C	Digital Display (LCD Indicator)	-20 to 85 °C	Transport	-40 to 80 °C
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Performance Specifications

Performance	Accuracy:	Up to ± 5 mm for rigid and flexible probes (for values within the configured measurement range)	
	Range:	0.5 m - 14 m* (Flexible Rod)	
		0.5 m - 8 m (Rigid Rod)	
		0.3 m - 6 m (Coaxial)	
	Repeatability:	< 1mm	
Minimum Dielectric Constant (ϵ)		Probe	ϵ Minimum
		Dual Rigid Rod	2.4
		Single Rigid Rod	3.0
		Single Flexible Rod	3.0
		Coaxial	1.7
Minimum Distance to Obstacles	Coaxial	0 mm	
	Single Probe	200 mm	
	Dual Probe	100 mm	
Measurement Limits (if $\epsilon > 10^{**}$)	Single Rod Dead Zone	Top: 500 mm Bottom: 30 mm	
	Dual Rod Dead Zone	Top: 500 mm Bottom: 20 mm	
	Single Cable Dead Zone	Top: 500 mm Bottom: Counter weight length + 30 mm	
	Coaxial Dead Zone	Top: 500 mm Bottom: 26 mm	

* Probes for measurements above 14 m (up to 25 m) are available only under consult.

**If $\epsilon < 10$, the bottom dead zone will be 200 mm. For values of Upper Dead Zone less than 500 mm, contact our representative.

Physical Specifications

Materials	Wetted Parts		
	Insulator O-Ring:	Viton, EPDM, and Buna N	
	Probe:	316 SST	
	Non-Wetted Parts		
	Housing:	Aluminum or 316 SST	
	Seal Ring (Cover and Neck):	Buna-N	
Probes	LCD Window:	Polycarbonate	
	Ground Terminal:	316 SST	
	Single Flexible Rod: 0.5 - 14 m*	Single Rigid Rod: 0.5 - 8 m	Coaxial: 0.3 - 6 m
	Dual Rigid Rod: 0.5 - 8 m		
Lateral Strength	Single Rigid Rod: 3 Nm, 0.1 kg to 4 m	Flexible Probe Angle: 0 to 90° from vertical axis	
	Dual Rigid Rod: 6 Nm, 0.2 kg to 4 m		
Tension Strength	Single Flexible Rod: 9 kN (Collapse Load)		

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RD500										GUIDED WAVE RADAR LEVEL TRANSMITTER															
COD.		Communication Protocol								H		HART®													
COD.		Safety Option								0		Standard – For use in measurement and control													
COD.		Process Connection								1		1 ½ NPT for Probe Type Rigid Rod and Probe Type Flexible Rod				3		2" Tri-Clamp							
		2		1 ½ NPT Special for Probe Type Coaxial				4		3" Tri-Clamp															
COD.		Probe Type								1		Single Rod													
		2		Dual Rod				3		Sanitary Rod				4		Coaxial Rod (1)									
		5		Single Cable																					
COD.		Probe Material								I		316 Stainless Steel													
COD.		Probe Length (2)								0		Up to 1 m		3		Up to 4 m		6		Up to 10 m (5)		Z		Specific length	
		1		Up to 2 m		4		Up to 6 m		7		Up to 12 m (5)													
		2		Up to 3 m		5		Up to 8 m (5)		8		Up to 14 m* (5)													
COD.		Weight for Flexible Rods – Weight and Material (3)								0		Without Weight				2		5.0 Kg in 316 SST							
		1		2.5 Kg in 316SST		3		Anchorage ring M8																	
COD.		O-Ring Material (Wet Part)								B		Buna N		E		EPDM		V		Viton					
COD.		Local Indicator								0		Without Indicator													
		1		With Indicator																					
COD.		Electrical Connection								0		1/2 – 14 NPT (9)								A		M20 X 1.5 (9)			
		1		3/4 – 14 NPT (with 316SST adapter for ½-14NPT) (11)				2		3/4 – 14 BSP (with 316SST adapter for ½-14NPT) (10)				B		PG 13.5 DIN (10)									
		3		1/2 – 14 BSP (with 316SST adapter for ½-14NPT) (10)																					
COD.		Certification Type								N		Without Certification													
		I		Intrinsic Safety																					
COD.		Certification Body								6		Without Certification Body													
COD.		Housing Material (7) (8)								H0		Aluminum (Default) (IP/Type)													
		H1		316 SST				H2		Aluminum for Saline Atmosphere (IPW/TypeX) (6)				H3		316 SST for Saline Atmosphere (IPW/TypeX) (6)		H4		Aluminum Copper Free (IPW/TypeX) (6)					
COD.		Painting								P0		Gray Munsell N 6,5													
		P1		Blue Safety – Immersion condition – Petrobras N1021				P2		Blue Safety – Atmospheric Zone – Petrobras N1021				P7		Beige Epoxy		P8		Without Painting (4)					
		P9		Blue Safety Epoxy – Electrostatic Painting				PH		Special painting															
COD.		Tag Plate								J0		With Tag, when specified (Default)													
		J1		Blank				J2		User's Specification															
COD.		Characteristics								Z0		SMAR													
		ZZ		User's Specification																					

RD500 - H - 0 - 1 - 1 - I - 1 - 1 - B - 1 - 0 - N - 6 - H0 - P0 - J0 - Z0 ← TYPICAL MODEL

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** Leave it blank if there are no optional items.

Notes:

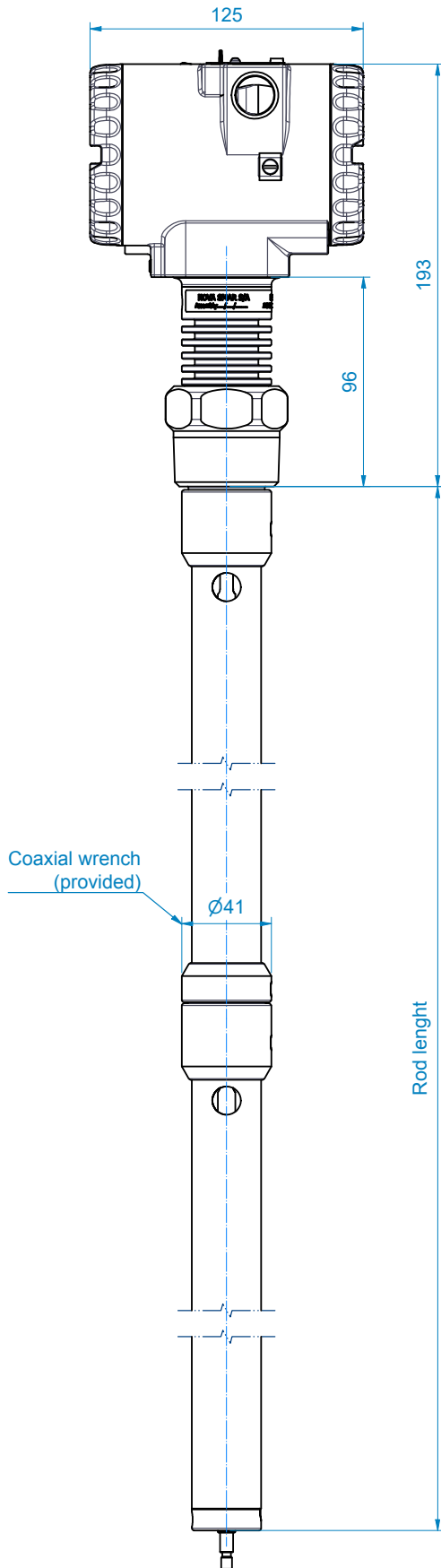
- (1) The coaxial probe is accompanied by a tightening wrench, if the rod is up to 3m long. If the rods are 4 or 6 m, two keys will be provided.
- (2) It is necessary to inform the probe length in meters, respecting the limits established in the field "Probe Length (meters)" of the ordering code table, according to the chosen probe type. For example: 2 correspond to a length up to 3 meters. Order a length immediately superior to the installation and adjust the probe length at the field. For more details consult Dimensional Drawings.
- (3) If the probe needs to be anchored in the bottom of the tank, the RD500 can be supplied with an anchorage ring, without counter-weight.
- (4) Not available for Aluminum Housing.
- (5) Not recommended with coaxial probe.
- (6) IPW / TypeX tested for 200 hours according to NBR 8094 / ASTM B 117 standard.
- (7) IPX8 tested in 10 meters of water column for 24 hours.

(8) Ingress Protection:

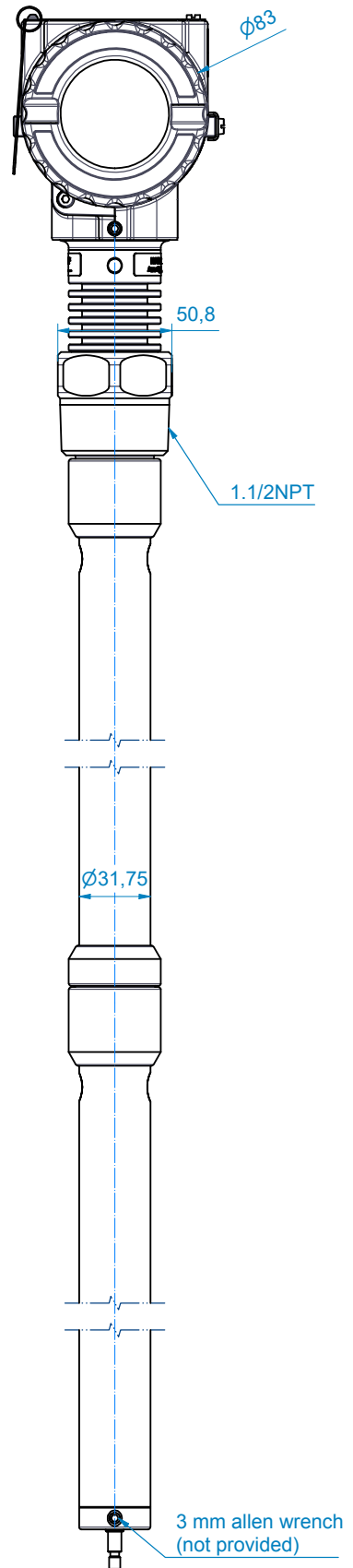
Product	CEPEL	FM
RD500	IP66/68/W	Type 4X/6P IP66/68

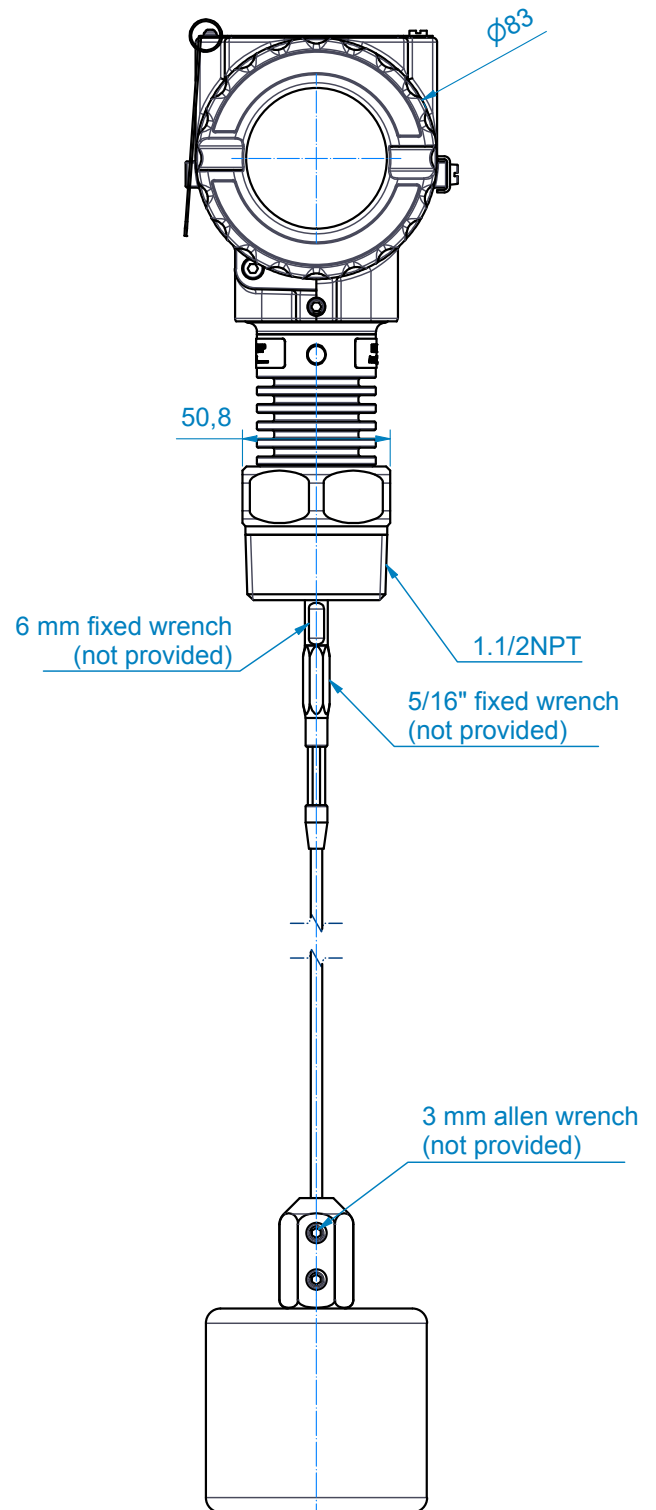
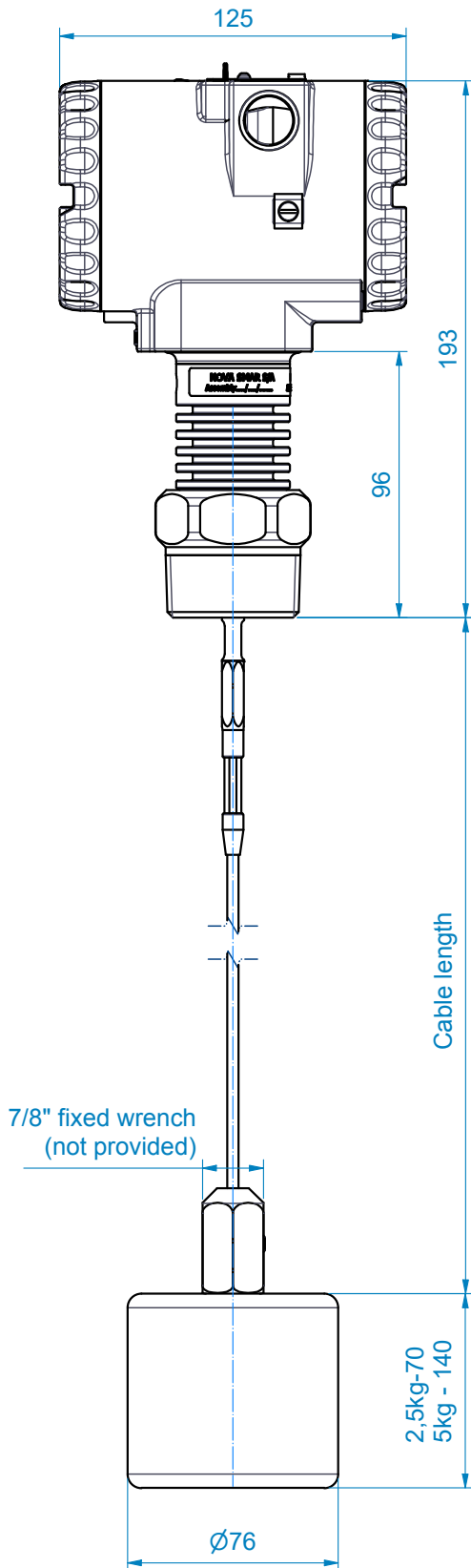
- (9) Certification Ex-d for FM / ATEX / INMETRO.
- (10) Options not certified for Explosive Atmosphere.
- (11) Certification Ex-d for INMETRO.

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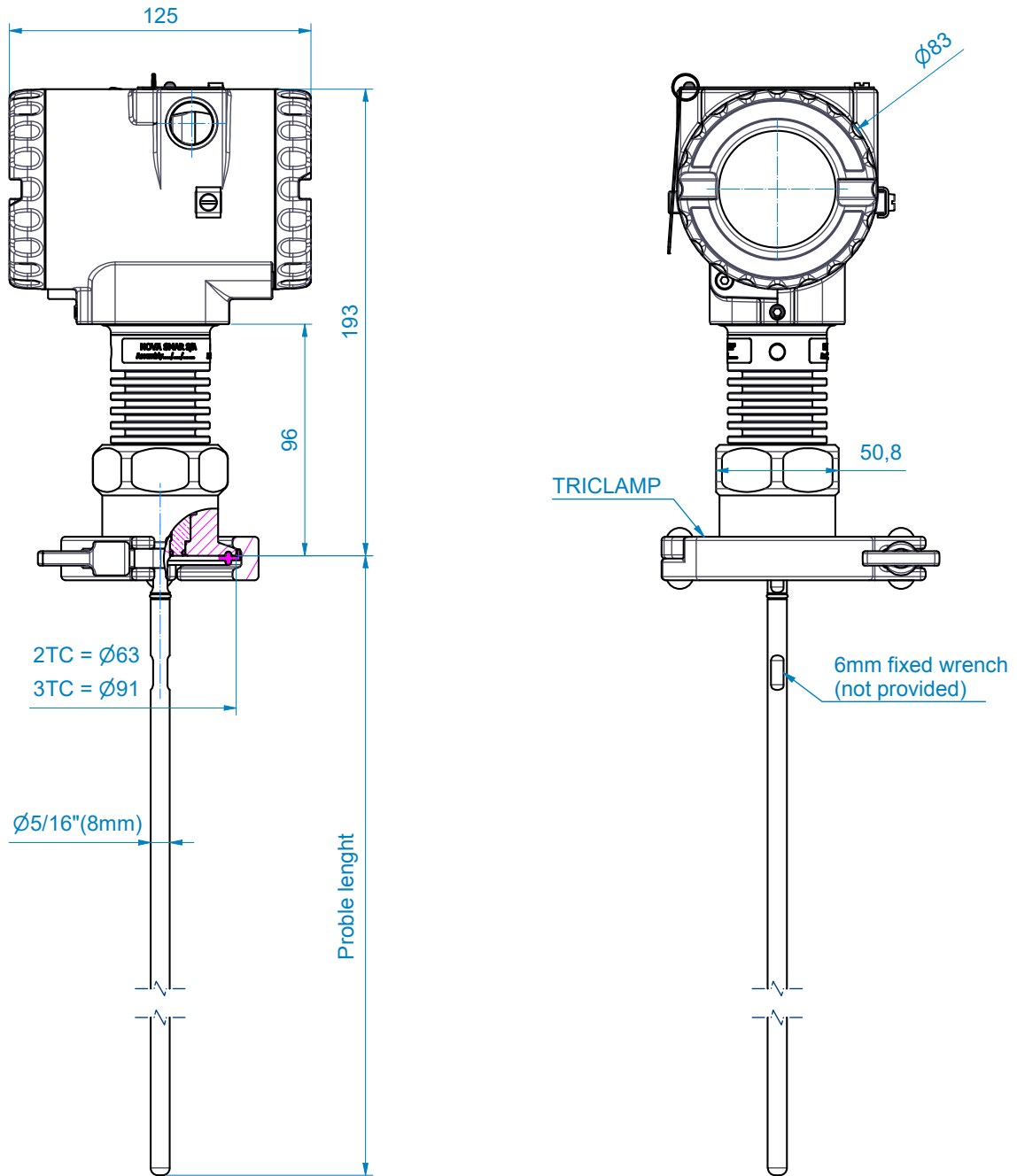


COAXIAL



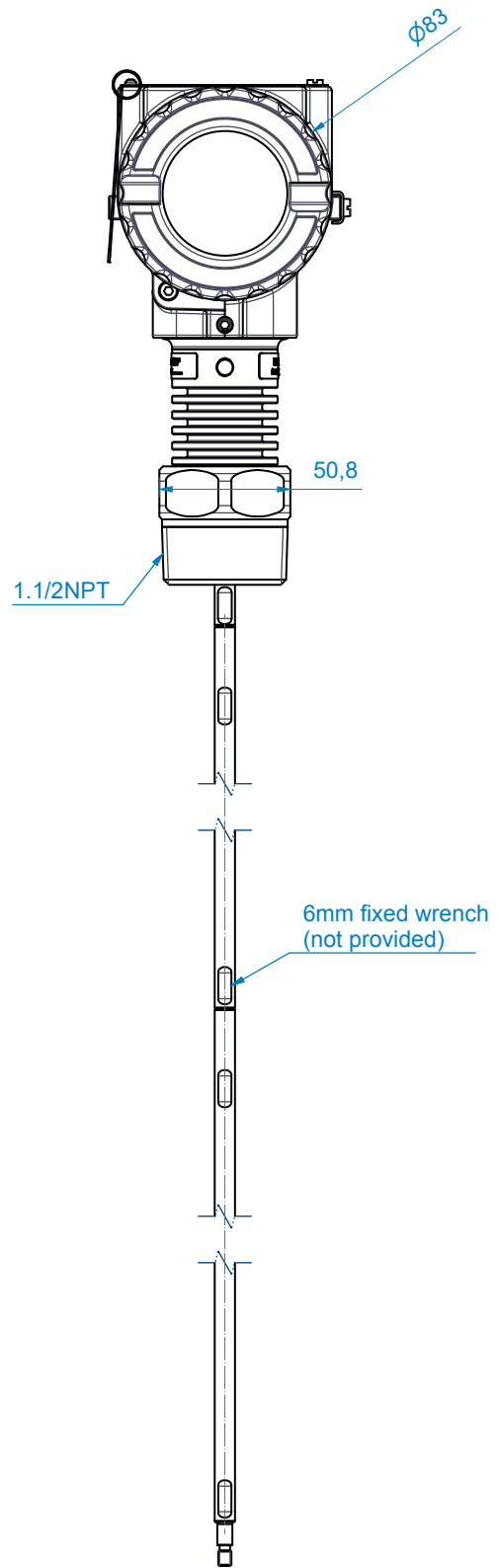
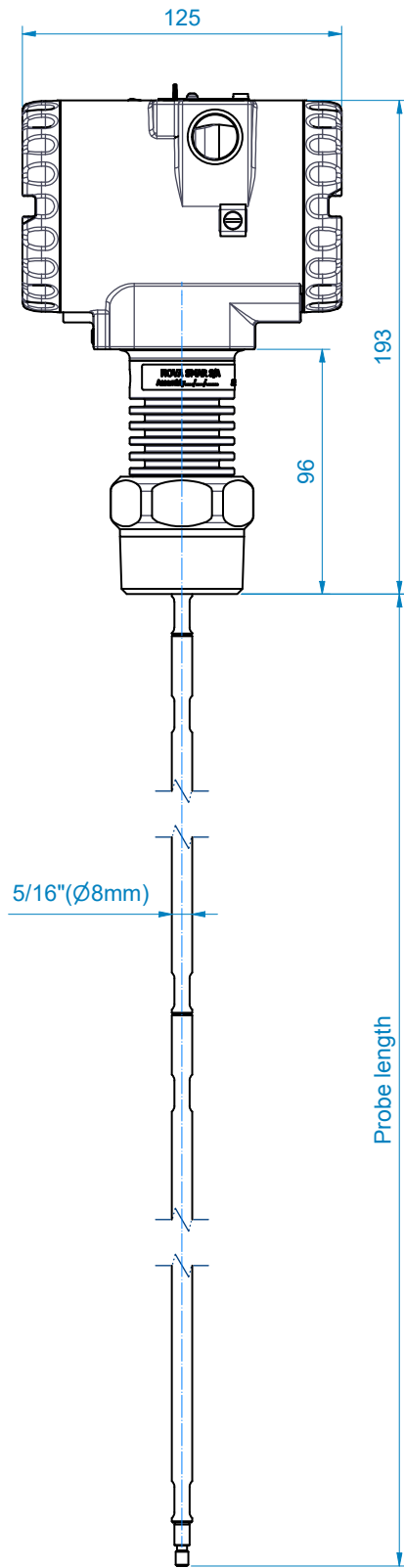


SINGLE FLEXIBLE CABLE

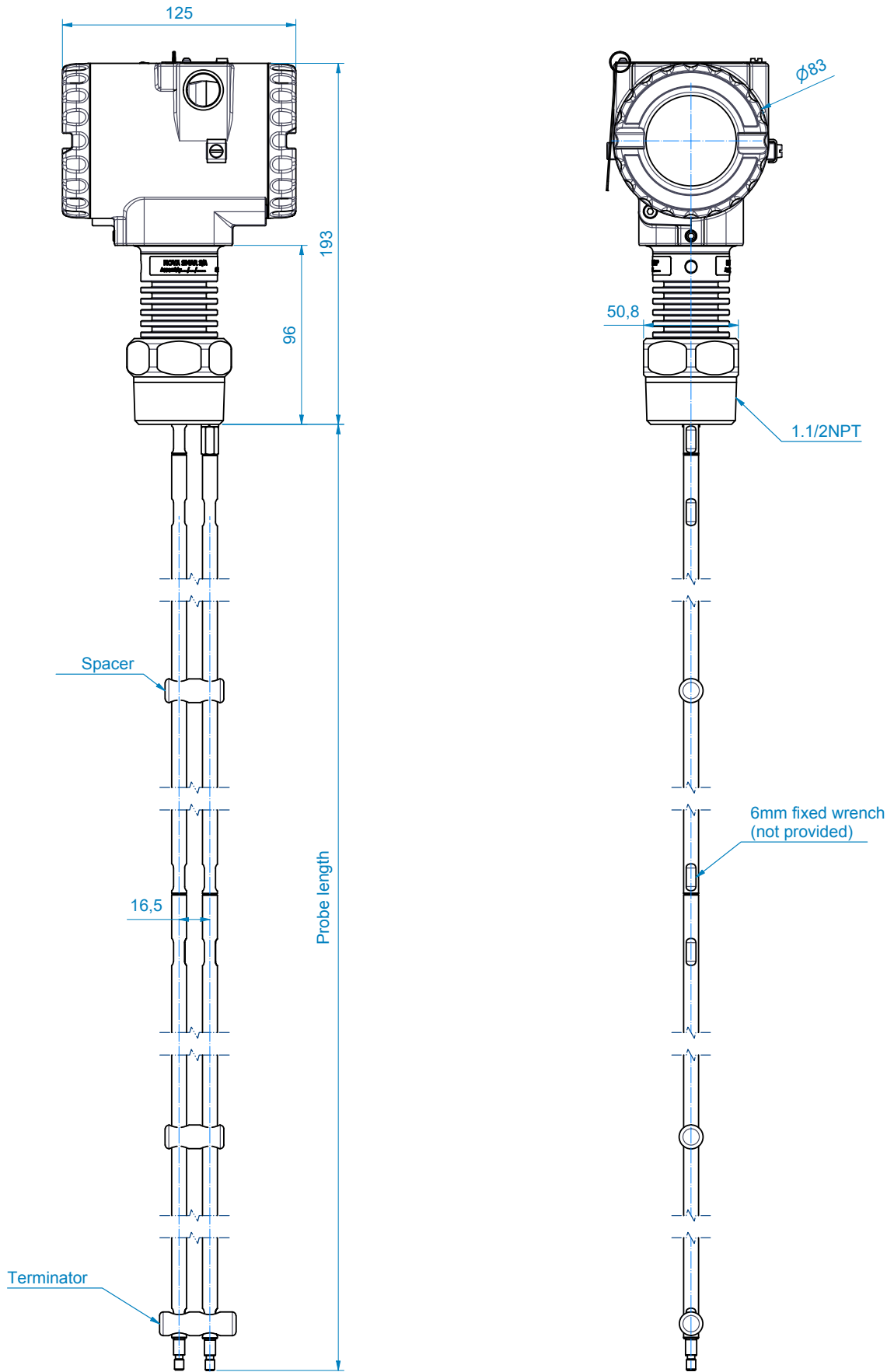


Polished rod, if possible, specify the exact length, if it is cut, it must have a round tip and a compatible finish.

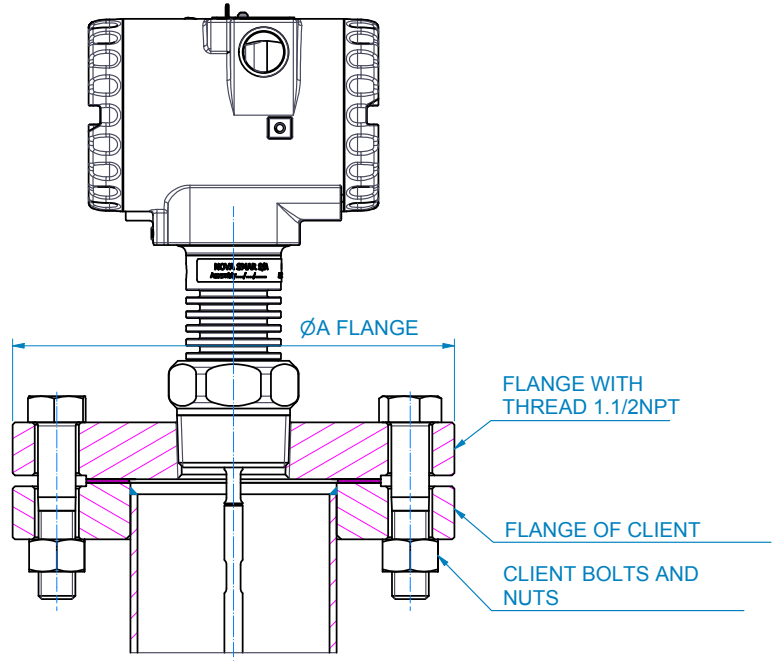
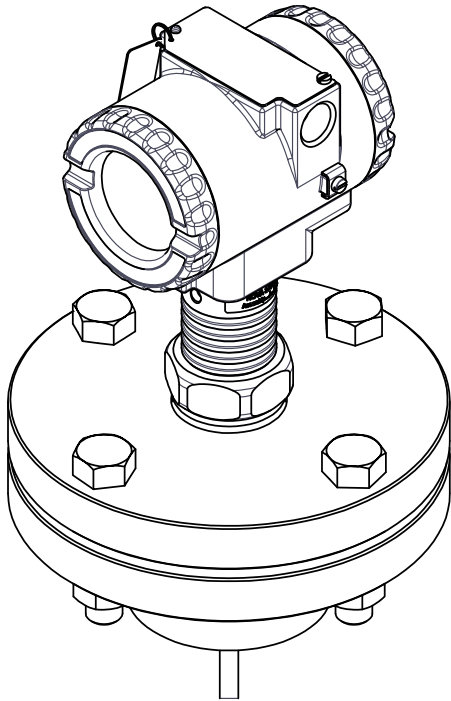
POLISHED SINGLE RIGID ROD TRI-CLAMP CONNECTION



SINGLE RIGID ROD



DUAL RIGID ROD

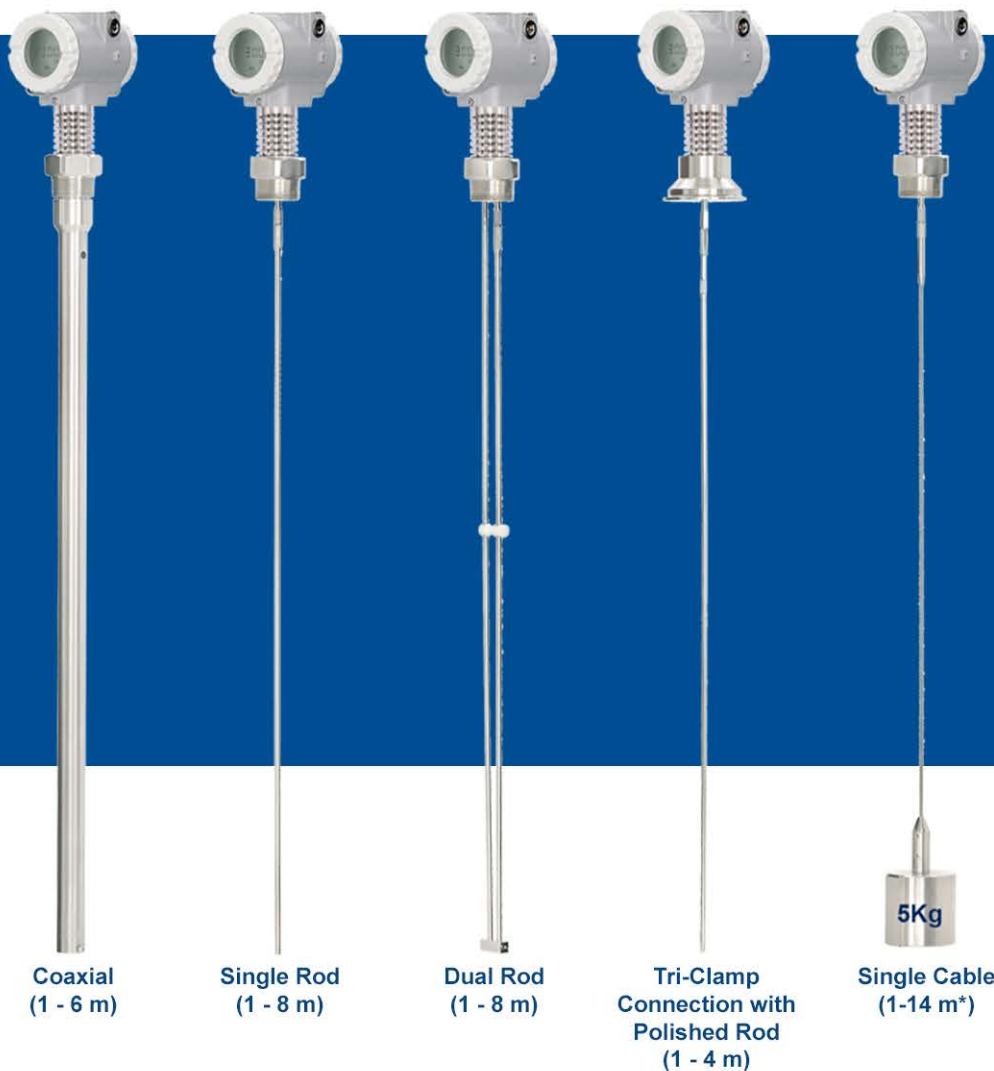


"A" FLANGE DIAMETER		
DIAMETER	CLASS	CLASS
ASME B16.5	150	300
2	150	165
3	190	210
4	230	255
6	280	--
EN 1092-1	PN16	PN40
50	--	165
80	--	200
100	220	235
150	285	--

MOUNTING WITH FLANGE

RD500 Series

Guided Wave Radar



Coaxial
(1 - 6 m)

Single Rod
(1 - 8 m)

Dual Rod
(1 - 8 m)

Tri-Clamp
Connection with
Polished Rod
(1 - 4 m)

Single Cable
(1-14 m*)

5Kg

Contact us



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