Technical Note for the OTT RLS installation and site selection:

The OTT RLS radar level sensor accurately and efficiently measures surface water level.

The OTT RLS sensor technology is based on impulse radar. Two antennas are enclosed in a compact housing and transmit pulses toward the water surface, through a Teflon face plate. The transmitting antenna transmits short radar pulses. The receiving antenna receives the pulses reflected from the water surface to determine the distance between the face plate of the radar sensor and the water surface. The time delay from transmission to receipt is proportional to the distance between sensor and water surface. Approximately 16 individual measurements are conducted per second and averaged after 20 seconds to minimize wave influences.

Installation:

Please refer to the OTT RLS Operating Instructions for detailed information on power requirements, cable diameter, mounting of the sensor, and connecting the OTT RLS to a data logger.

1. The OTT RLS is a precision instrument and should not be jarred or dropped.
2. The OTT RLS should be mounted directly above the water surface, such that the radar beam is perpendicular to the water. The antenna of the OTT RLS should be aligned within 1° of vertical to prevent trigonometric-alignment measurement errors, please refer to table 1.
3. The OTT RLS requires secure mounting to prevent vertical displacement by wind or vibration. Any movement disturbs measure-ments and can result in vertical alignment errors.
4. Make certain the OTT RLS is mounted high enough to avoid being submerged during high water or flood conditions.

Site Selection:

To obtain reliable and correct measurements the following boundary conditions and installation guidelines should be observed when selecting an installation location for the OTT RLS.

1. The OTT RLS has a IP 67 rating and can be mounted outdoors in unprotected locations.
2. Avoid submerged obstructions such as rocks or bridge piers that disturb or influence the water level. Check for such obstructions when the water is at the lowest anticipated level.
3. To minimize the influences of wave action the water surface must be as smooth as possible in the area of the sensor beam. Avoid turbulent areas and areas where obstructions in the waterway or bridge piers cause changes in the water level (see figure 1 and 2). The smoother the surface of the water the more accurate water measurement is.
   Measurement sites with periodic wind may see wind driven waves that could cause noise in the measurement data. This is due to reflection of radar pulses off wave peaks and tends to occur when the water is shallow and there is a large distance between the water surface and the bottom of the sensor, e.g., 20m.
4. There should be a clear path between the sensor and the water to avoid false reflections. The OTT RLS's beam path should be free of excessive turbulence, splashing, waves, pipes, wires, and other obstructions that could disturb the measurement. False reflections may prevent the OTT RLS from completing a measurement.
5. The mounting location should also avoid horizontal structural surfaces such as beams, brackets, and side wall joints, these surfaces tend to reflect a strong false signal. A defined minimum horizontal clearance is required to avoid false signals. Refer to table 2, minimum horizontal clearance requirements.
6. Be aware that bridges and other large structures expand and contract with temperature. The bridge height can change several inches with diurnal temperature changes. Trucks and other traffic loads can cause transient changes to the bridge height which negatively affects water level measurements. To minimize these effects, the OTT RLS should be mounted near a bridge support point or a pillar, but not directly in the middle between such points (see figure 1). Select a suitable mounting location near a pillar, if possible, that meets the horizontal clearance requirement
7. Impulses transmitted from the OTT RLS are reflected off of the water surface. If the measuring site is prone to snow and ice cover, the impulses may be refracted and may not be

not received by the OTT RLS; resulting in a measurement error.

8. Measuring sites where foam is present should be avoided. Foam absorbs the transmitted impulse, preventing it from returning to the receiving antenna. The degree of absorption depends on the type of foam, its thickness and density. The impulse can be completely absorbed.
9. Rain does not affect measurements, except in the event of tropical rain fall or heavy rain, with intensities of more than 30 mm/h (1.18 inch/h)

Table 1: Alignment measurement error

Vertical Alignment offset	measurement error (approximate)
1°	0.3 mm 0.001 ft.
2.5°	0.9 mm per 1 m change 0.003 ft. per 3.3 ft change
5°	4 mm per 1 m change 0.013 ft. per 3.3 ft change

Table 2: Minimum horizontal clearance requirements

Distance to Water (m)	Required Horizontal Clearance / Beam Diameter (m)
1	0,2
2	0,4
3	0,6
4	0,9
5	1,1
6	1,3
7	1,5
8	1,7
9	1,9
10	2,1
11	2,3
12	2,6
13	2,8
14	3,0
15	3,2
16	3,4
17	3,6
18	3,8
19	4,0
20	4,3
21	4,5
22	4,7
23	4,9
24	5,1
25	5,3
26	5,5
27	5,7
28	6,0
29	6,2
30	6,4
31	6,6
32	6,8
33	7,0
34	7,2
35	7,4

Figure 1:
Mounting the OTT RLS on a bridge.
The projection of the sensor beam onto the water surface is virtually round.

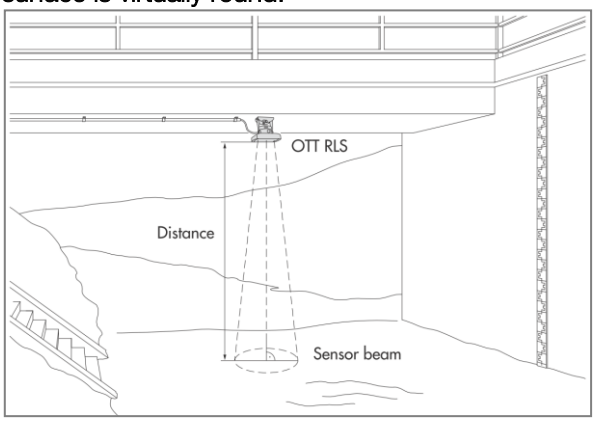
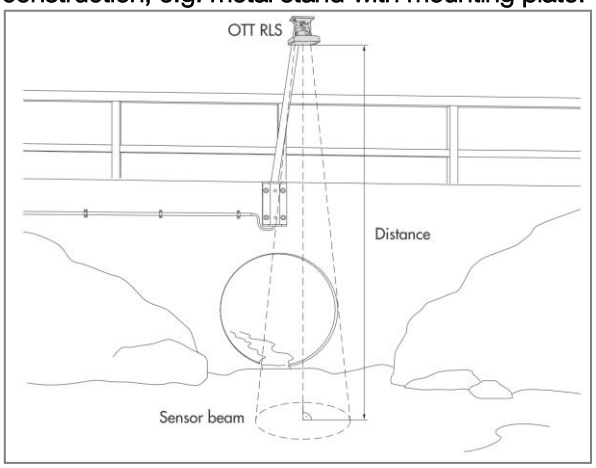


Figure 2:
Mounting the OTT RLS on an auxiliary construction, e.g. metal stand with mounting plate.



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