

PART 1 GENERAL

- 1.1 Section includes:
- A. FMCW radar sensor for hydrometric applications for non-contact water level measurement. The water level detection is performed with automatic arithmetic averaging over 1...60 seconds to compensate for wave influence on the measurement.
- 1.2 Measurement Procedures
- A. The operation of the radar sensor is based on FMCW radar technology. The transmitting antenna emits a frequency-modulated continuous wave signal in the frequency range of 77 to 81 GHz. The distance measurement is performed by an indirect time-of-flight measurement through a frequency comparison of the received signal, reflected from the water surface to the transmitted signal. The actual water level of the waterway is then automatically calculated. During initial startup, there is the possibility to input the relevant measurement mode and a reference value.
- 1.3 Alternates
- A. Staff Level Gauges (manual read)
 - B. Contact Gauges (manual read)
 - C. Float-operated shaft encoder level sensor
 - D. Pressure level sensor
 - E. Bubbler sensor
- 1.4 System Description
- A. Performance Requirements
 - 1. Water Level
 - a. Measurement range: 0 ... 30 m; 0 ... 99 ft
 - b. Resolution: 0.001 m; 0.1 cm; 0.001 ft
 - c. Accuracy: ± 2 mm; ± 0.007 ft
 - d. Average temperature coefficient: < 3 mm / 10k max. 5mm
 - e. Units: m, cm, ft
 - 2. Relative Humidity in Sensor Housing:
 - a. Measurement range: 0 ... 100 % RH (non-condensing)
 - b. Resolution: 1 % RH
 - c. Accuracy:
 - 1) typically ± 2 % RH (10 ... 80 % RH);
 - 2) max. ± 3 % RH (0 ... 100 % RH)
 - d. Units: % RH
 - 3. Sampling Rate:
 - a. OTT RLS 500: 2 Hz
 - b. OTT RLS 500 HF: 2 Hz; 4 Hz; 8 Hz
 - c. Measurement interval: 1 ... 60 seconds
 - 4. Supply voltage: 5.5 ... 28.8 V DC, typically 12/24 V DC
 - 5. Current consumption
 - a. Measurement operation < 4 mA
 - b. Rest mode < 250 μ A
 - 6. Interfaces
 - a. SDI-12; Version 1.4
 - b. RS-485, two-wire; SDI-12 protocol
 - c. Modbus RTU
 - 7. Beam angle of antenna: $8^\circ (\pm 4^\circ)$

- 8. Radar Technology
 - a. Transmission frequency 77 ... 81 GHz
 - b. Frequency Band W-Band

- B. Measured Physical Quantities:
 - 1. Water level / distance
 - 2. Relative humidity in sensor housing
 - 3. Sensor orientation

- C. Measurement Data Processing:
 - 1. Average over a time interval
 - 2. Minimum value within a time interval
 - 3. Maximum value within a time interval
 - 4. Median over a time interval
 - 5. Standard deviation over a time interval
 - 6. Hydrological discharge (Q)

1.5 Certifications

- A. Performance classification in accordance with DIN EN ISO 4373
 - 1. Measurement reliability Performance class 1
 - 2. Temperature range Temperature class 1
 - 3. Relative humidity Class 1
- B. EMC limits and radio approvals
 - 1. CE (EU): This device complies with the essential requirements of the EMC Directive 2014/30/EU.
 - 2. FCC (US): This device complies with the requirements of Part 15 of the FCC regulations.
 - 3. IC (CN): Canadian Interference-Causing Equipment Regulations, ICES-003, Class B.

1.6 Environmental Requirements

- A. Operational Criteria
 - 1. Temperature range
 - 1) Operation $-40 \dots +60 \text{ }^{\circ}\text{C}$; $-40 \dots +140 \text{ }^{\circ}\text{F}$
 - 2) Storage $-40 \dots +85 \text{ }^{\circ}\text{C}$; $-40 \dots +185 \text{ }^{\circ}\text{F}$
 - 2. Type of protection IP 67
(submersion depth max. 1 m; 3.3 ft;
Submersion duration max. 48 h)
- B. Relative humidity 0 ... 100 %
- C. Materials
 - a. Housing AlMgSi1, ASA (UV-stabilized ABS)
 - b. Radom (front plate) TFM PTFE
 - c. Mounting 1.4301 (V2A)
- D. Weight (including mounting) approx. 0.75 kg; 1.65 lbs
- E. Cable connection: M9 subminiature connector

1.7 Warranty

- A. The product includes a one-year warranty from the date of shipment (EU: 2 years)

1.8 Maintenance Service

- A. Carrying out maintenance work
 - 1. The radar sensor is almost maintenance free. No setting or calibration work is necessary. There are likewise no parts that need replacing regularly.

PART 2 PRODUCTS

2.1 Manufacturer

A. OTT HydroMet GmbH

2.2 Manufactured Unit

A. The OTT RLS 500 is a radar level sensor for non-contact water level measurement at surface water locations. The sensor uses FMCW radar technology to determine the water level. This energy-efficient, non-contact measurement method means the OTT RLS 500 operates with no effect from temperature gradients, water pollution or sediment load and ensures exact measurements.

Its extremely low energy consumption, the large power supply range and standardized interfaces make the OTT RLS very flexible for different applications. It can easily be connected to any data logger and remote transmission system.

With a measurement range of up to a maximum of 30 m the RLS 500 also allows the measurement of large ranges. The OTT RLS 500 is mounted directly above the water surface to be measured, e.g. on bridges or auxiliary constructions. Its solid, relatively light and waterproof housing is easy to install. There is no requirement for complex construction, such as stilling wells or float shafts, as the OTT RLS 500 determines the water level measurements in a measurement cycle that compensates for wave or other rapid water level movements.

The OTT RLS is specifically designed for use in open air locations. The flat antenna construction, its minimal energy consumption and its compact, water-proof housing offer the user a system that is optimized for use at sites that have no requirement for mains power supply.

2.3 Equipment

A. Radar Sensor

1. Radar sensor OTT RLS 500
2. Connection cable, assembled at one end with M9 subminiature connector; available lengths: 5, 10, 30 and 50 meters.

2.4 Components

A. Standard Equipment

1. OTT RLS 500
2. Set of operating instructions
3. Factory acceptance test certificate (FAT)

B. Dimensions: L x W x H 137 mm x 134,5 mm x 90 mm · 5.2953 in x 4.5079 in x 3.3465 in

C. Shipping weight: approx. 0.75 kg; 1.65 lbs (excl. mounting)

2.5 Instrument Options

Must be selected at the time of order. Choose one or the other.

RS485 Communication Protocol

[] SDI12

[] Modbus

Units preset

- Metric
- Imperial

Connection/connecting cable

- M9 socket <-> open wire

Connection/connecting cable length

- 5 m / 33 ft
- 10 m / 99 ft
- 30 m / 165 ft
- 50 m / 329 ft

Installation accessories

- housing bracket

Operating Instructions

- German
- English
- Spanish
- French

2.6 Optional Accessories

Select as many as required

Swivel Mount:

- for mounting the OTT RLS 500
- the combination of housing and wall bracket enables the radar sensor to be mounted on a cardanic base
- Alignment to the water surface possible in two axes

Spare connection cable

OTT USB/SDI-12 Adapter

- for temporary connection of OTT sensors with SDI-12 or RS-485 interface to a PC
- including USB connection cable; USB plug A to USB plug B; 3 m

PART 3 EXECUTION

3.1 Preparation

A. Selecting a suitable mounting location

1. Possible mounting locations are, for example, bridges and auxiliary constructions directly above the waterway section to be measured.
2. No minimum distance between lower edge of the sensor and water surface
3. Select a mounting point high enough so that measurement is possible even with high water levels.
4. The mounting point must be steady. Vibrations and movement of the mounting point must be avoided. Bridges are affected by movements of several centimeters as a result of load changes and temperature

movements. If pillars are available, the sensor can be mounted to a stable positioned pillar with a suitable spacer.

5. The water surface must be as smooth as possible in the area of the sensor beam. Avoid turbulent areas, areas where foam is created, surge areas and waterway sections where obstructions or bridge piers cause changes in the water level. The measurement result cannot be used if there is ice or snow on the water surface!
6. Choose a mounting location that does not become dry at low water levels.
7. The area within the sensor beam must be completely free of obstructions.

3.2 Installation

A. Mounting

1. Assembling the housing bracket (and optional swivel mount)
2. Connecting the cable
3. Align the housing parallel (longitudinal and lateral axis) with the water surface

B. Connecting the OTT RLS 500 to any datalogger using an SDI-12 interface

1. Connect the OTT RLS 500 to an SDI-12 input of the datalogger. Follow the datalogger operating instructions when doing this.
2. The maximum length of the cable is 100 m; 330 ft.
3. Recommended wire cross-section: 0.5 mm² · AWG 20. With separate voltage supply and point-to-point connection (no SDI-12 bus operation) a cable length of up to 300 m · 985 ft is possible.

C. Connecting the OTT RLS 500 to any datalogger using an RS-485 interface

1. The upper limit for the cable length is 1,000 m

END OF SECTION