

80GHz Radar Water Level Meter

Product Manual



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1. Product Introduction

The radar water level meter series operates within the 76–81 GHz frequency range, utilizing Frequency Modulated Continuous Wave (FMCW) radar technology. The product offers a maximum measurement range of 65 meters and a blind zone of 10 cm. With a higher operating frequency and wider bandwidth, it delivers improved measurement accuracy. The product supports bracket mounting, enabling convenient and straightforward installation without the need for on-site wiring.

Key Advantages of the Radar Liquid Level Meter Series:

- 1: Millimeter-wave RF chip enables a more compact RF architecture, higher signal-to-noise ratio, and smaller blind zones.
- 2: 5 GHz operating bandwidth ensures higher measurement resolution and accuracy.
- 3: Narrowest 6° antenna beam angle minimizes the impact of interference from installation environments, simplifying installation.
- 4: Integrated lens design with a compact form factor.
- 5: Low-power operation with a lifespan exceeding 3 years.
- 6: Supports mobile Bluetooth debugging, facilitating on-site maintenance.

Measurement Principle

The radar liquid level meter emits frequency-modulated continuous wave signals (76–81 GHz) through its antenna. These signals propagate at the speed of light and reflect upon encountering the measured medium's surface. The same antenna receives the reflected signals. The frequency difference between the transmitted and received signals is proportional to the measured distance. The collected frequency difference signals undergo Fast Fourier Transform (FFT), producing a reflected echo spectrum from which the distance to the target is calculated.

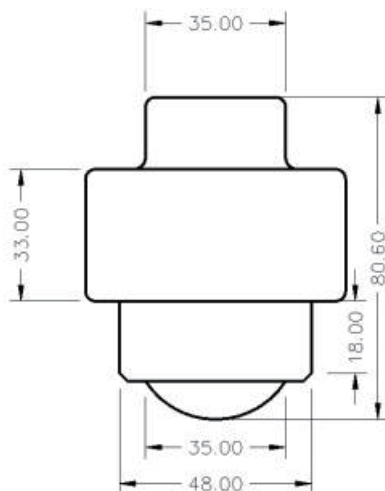
2. Technical Specifications

Parameter	Specification
Emission Frequency	76 GHz–81 GHz
Measurement Range	(0.1 – 65) m
Measurement Accuracy	±3 mm
Beam Angle	6°
Power Supply Range	RS485: (9–36) VDC; (4–20) mA: (18–28) VDC
Output Modes	RS485/Modbus-RTU bus; (4–20) mA/HART (optional)
Ambient Temperature/Humidity	(-40–85) °C; ≤95% RH
Housing Material	PP/Stainless Steel (optional)
Antenna Type	Lens Antenna
Recommended Cable Size	(0.5–0.75) mm ²
Protection Rating	IP67
Mounting Method	Bracket/Thread

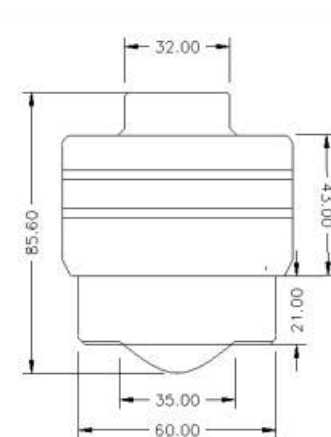
3. Dimensional Drawings

Warning:

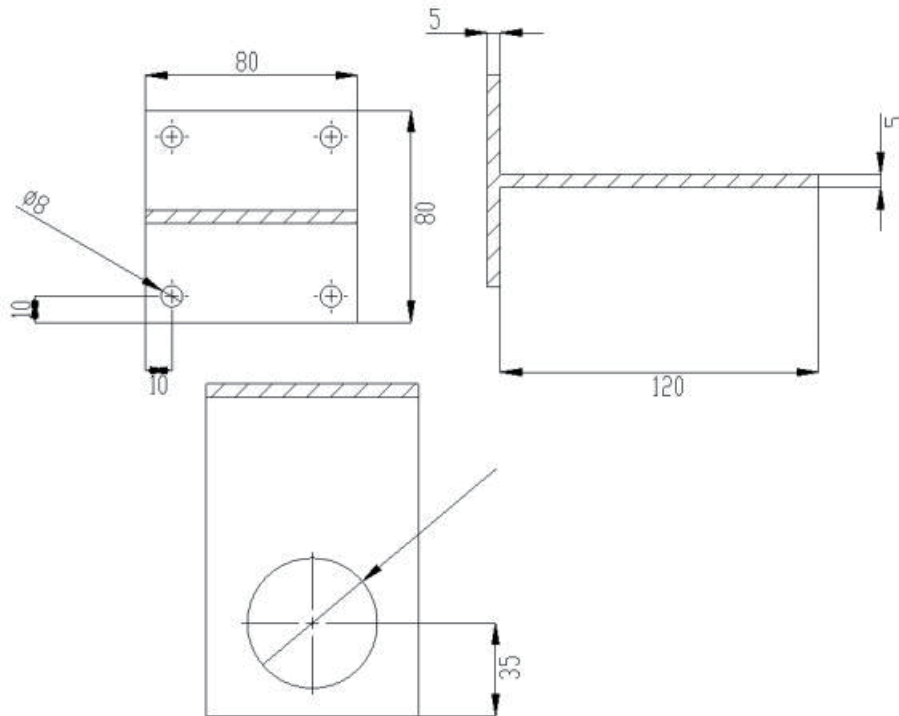
RS485 and 4-20mA output signals cannot be used simultaneously.



PP Antenna Dimensional Drawing



Stainless Steel Antenna Dimensional Drawing



T-Bracket Dimensional Drawing

4. Installation

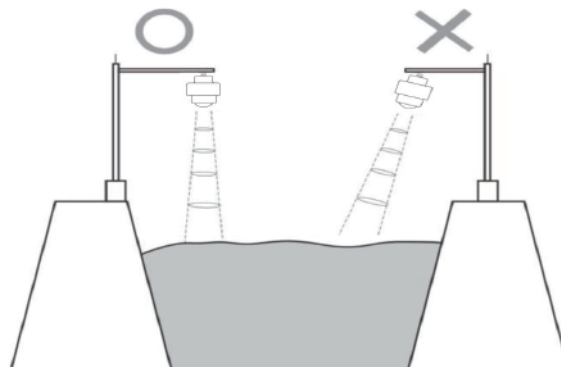
Installation Guidelines:

- 1: Ensure the device is perpendicular to the water surface.
- 2: Avoid directing the radar beam towards obstructions to prevent false echoes.

Typical Installation Scenarios:

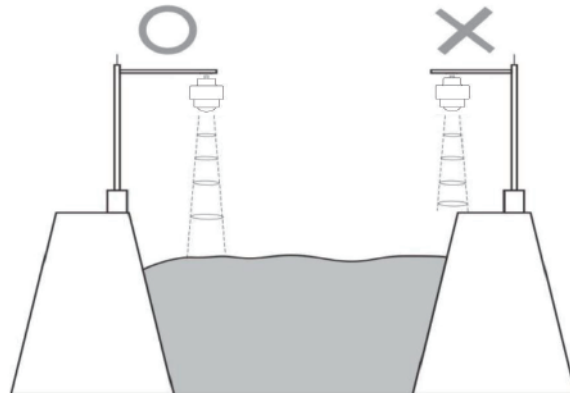
- 1: Ensure the water level meter is installed vertically to the water surface.

Tilting the device will weaken the signal amplitude, impacting accurate distance measurement.



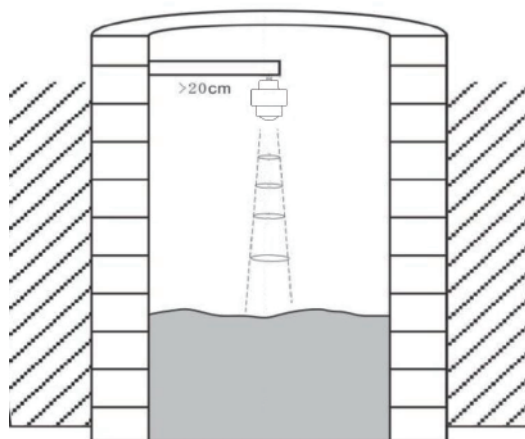
Instrument Installation Location Diagram

2: Avoid obstructions within the radar beam's range, such as riverbanks or nearby structures.



Instrument Installation Location Diagram

3: Maintain at least 20 cm distance from the container wall.
For underground pipeline networks, place the device close to the center of the sewer well to avoid interference from the well walls, which could affect measurement accuracy.



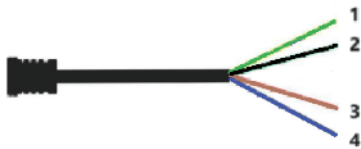
Install at least 20cm away from the container wall

5. Wiring

1: Correctly connect the device as per the interface definitions shown in the table. Ensure the power supply is within the specified range.

2: Use an RS485/HART-to-USB converter to connect the device to a computer.

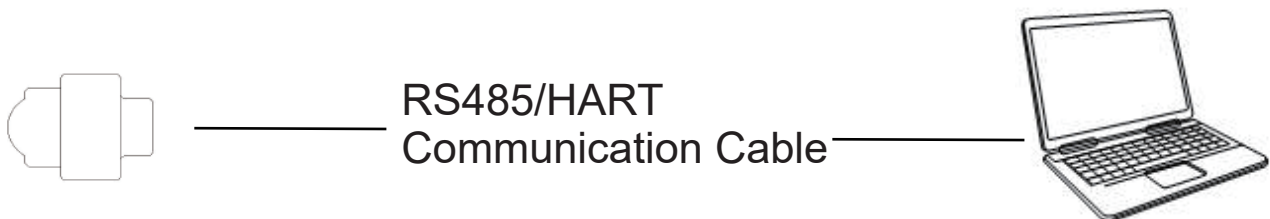
3: Power on the device and open the host computer software for device debugging.



No.	Color	Wiring Definition
1	Green	RS485-A
2	Black	RS485-B
3	Brown	Power · Positive
4	Blue	Power · Negative



No.	Color	Wiring Definition
1	Brown	Power · Positive / (4-20)mA+ / HART
2	Blue	Power · Negative / (4-20)mA- / HART



Wiring for (4–20) mA Output Products:

Follow the label instructions on the instrument's nameplate.

6. Bluetooth Operation Instructions (Optional)

6.1 Bluetooth App Download Instructions

For Android Users:
Scan the QR code below
to download the app.



For iOS Users: Search and download
the app via the App Store.

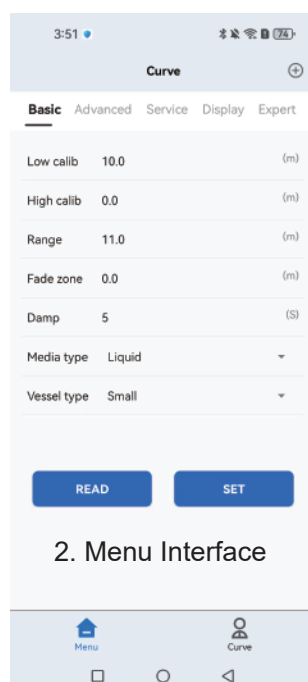
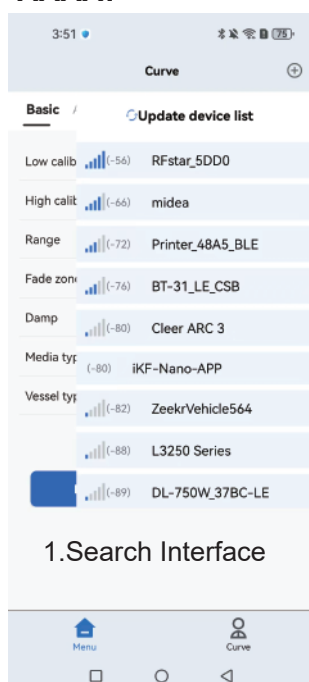
App Name:
IoT-Connected Radar Level Meter



6.2 Bluetooth App Interface Description

After downloading the app, open it and click the box in the upper-right corner of the interface. The app will display all devices under the current user account. Click on the device name to successfully connect and operate.

Device Information: The Bluetooth name is displayed as "RFstar-xxxx."



6.3 Parameter Description

Low-Level Setting:

Refers to the distance from the front of the water level meter to the bottom of the water level (at the lowest water level). The low-level setting directly affects the corresponding high-level output value of the water level meter.

Range: 0.1–65 meters

Default Value: 65 meters

Range Setting:

Any echo outside the set range will be ignored during algorithm processing. Proper range settings can help avoid multiple reflection interferences and signals outside the measurement range. The range must be greater than or equal to the low-level setting + 1 meter.

Range: 0.1–65 meters

Default Value: 65 meters

Blind Zone Setting:

The blind zone setting, along with the range setting, determines the echo algorithm's processing area within the instrument. Any echoes within the blind zone are ignored, which can help eliminate near-end interference signals.

Damping Time:

To improve the stability of output values, a larger damping time can be set to stabilize the measurement output.

Medium Type:

Integrated with adaptive algorithms for solids and liquids. Users can select the appropriate mode based on the actual measurement conditions on-site.

Container Type

Built-in multiple modes to adapt to field applications with different material in/out rates.

Container Type	Associated Options (Options can still be adjusted individually)	Remarks
Large Tank	Fixed wave rate: 83%, Damping time: 10s, Emission power: High	Higher averaging, smoother curve curvature, ideal for filled tanks over 10m
Small Tank	Fixed wave rate: 80%, Damping time: 5s, Emission power: Medium	Moderate averaging, smoother curve curvature, ideal for tanks under 10m
Quick	Fixed wave rate: 70%, Damping time: 3s, Emission power: Low	Less averaging, suitable for scenarios with rapid material changes
Test	Fixed wave rate: 50%, Damping time: 0s, Emission power: Low	Very short damping time, suitable for market demonstrations

Table 6-1: Advanced Parameters

False Echo Learning:

The instrument can learn false echoes caused by known obstacles inside the container and create a background noise filtering curve (threshold curve).

Example: For obstacles at a distance of 0.5 m with liquid levels above 1 m, set the start value to 0, the end value to 0.7, and the intensity to 18 dB.

Bus Address:

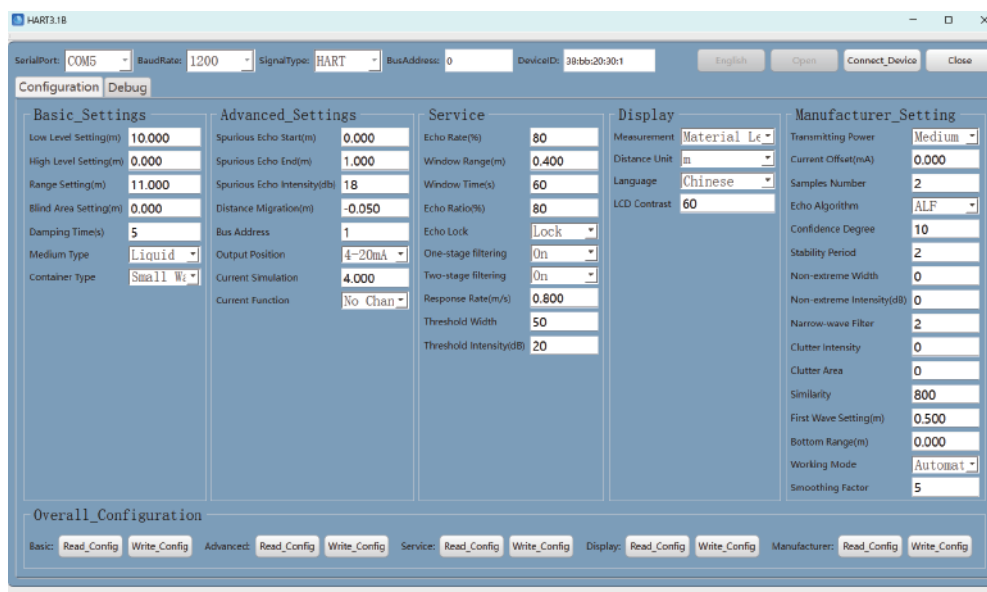
Can be modified in the instrument's advanced settings menu. Applicable only for RS485/Modbus communication.

Factory Default: 01

7. PC Software Interface Description

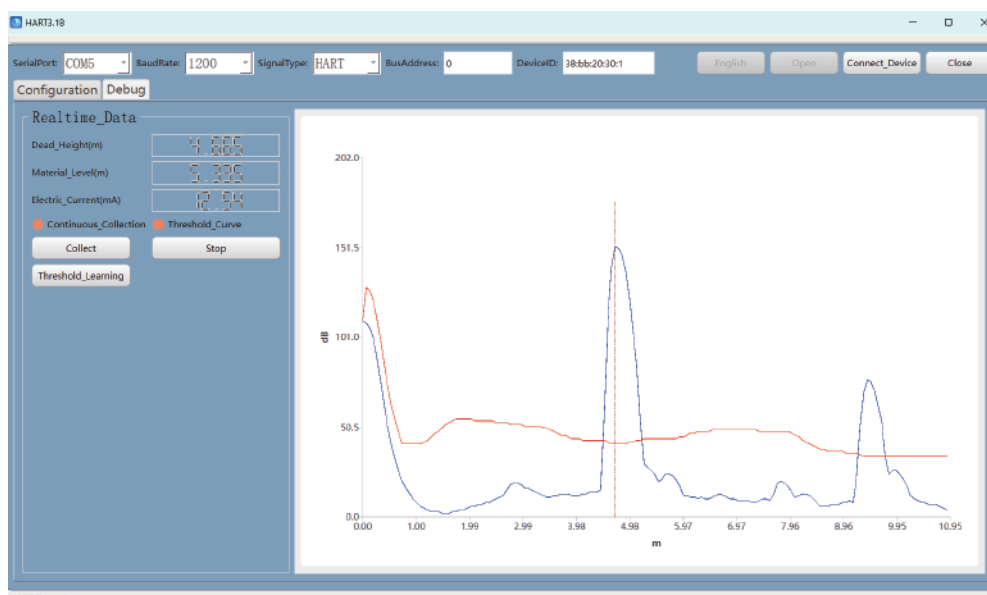
7.1 Software Configuration

Configure the serial port parameters according to the order shown in the figure. The baud rate is set to 9600. After a successful connection, click "Read Configuration" to read or set the parameters.



7.2 Echo Curve

The software allows visualization of the echo curve, providing insight into signal strength and measurement stability. This feature assists in diagnosing issues and optimizing installation configurations.



8. Parameter Description

For standard debugging, only the parameters in the basic settings menu need to be adjusted. Other menu items do not require modification unless specific issues arise.

Location	Menu Item	Description
Basic Settings	Low Level Setting	Definition: Starting point of the water meter measuring range (with no liquid) = bottom of the tank.
		1. When set at the tank bottom, liquid level directly corresponds to the actual value. 2. Setting a different starting point restricts the valid range of output current (4-20mA) to 0-15m.
	High Level Setting	Definition: Endpoint of the water meter measuring range (full liquid level) = top of the tank.
		1. When set at the tank top, liquid level directly corresponds to the actual value. 2. Setting a different endpoint restricts the valid range of output current (4-20mA) to match the 20mA signal level.
	Range Setting	Definition: Measurement range = high level - low level, applicable for valid water meter range. Unit: meters. Default: 0.0-15m.
	Dead Zone Setting	Definition: Non-measurable areas combining high and low dead zones.
	Fine Adjustment Setting	Definition: Adjust unused range areas to prevent interference. Purpose: Optimize the valid measurement area.
Advanced Settings	Damping Time	Set delay response time to avoid false signal interference. Default: 5s.
	Container Type	Adjust liquid level measurement parameters for different storage types (large/small).
	False Echo Learning	Record and filter interference signals to optimize stability.
	Distance Correction	Correct for environmental effects or installation errors. Range: 0.0-0.18m.
Service	Fixed Wave Ratio	Percentage setting for wave rate. Default: 83%.
	Fixed Wave Speed	Adapts to changes in material feed rates. Default: 0.
	Low Wave Speed	Low response speed for slowly changing levels. Default: 70%.

9.1 Basic Information

Name	Specification
Hardware Interface	RS485 Serial Port
Serial Port Level	TTL
Baud Rate	9600 bps (Unmodifiable)
Data Format	RTU 8N1
Data Bits	8
Parity Bit	None
Stop Bits	1
Checksum & Byte Order	CRC16 (Low byte first), A001
Data Type	Unsigned Integer
Device Address	01~127 (Default: 01)
	Modified via instrument advanced settings menu or RS485 serial port

9.2 RTU Mode Data Format

The data format in RTU mode adheres to the Modbus protocol, ensuring reliable communication and compatibility with standard Modbus systems.

Host Sent Data Format

Device Address	Function Code	Starting Register Address	Number of Registers to Read	CRC Low Byte	CRC High Byte
1B	1B	2B	2B	1B	1B

Instrument Returned Data Format

Device Address	Function Code	Data Length	Returned Register Values	CRC Low Byte	CRC High Byte
1B	1B	1B	(2 * N) B	1B	1B

9.3 Reading Measurement Data

Function Code 03 (Device Address 01):

Device Address	Function Code	Starting Register Address	Number of Registers to Read	CRC Checksum	Meaning
1	3	00 00	00 01	84 0A	Empty Distance (cm)
1	3	00 01	00 01	D5 CA	Empty Distance (mm)
1	3	00 02	00 01	25 CA	Material Height (cm)
1	3	00 03	00 01	74 0A	Material Height (mm)

Example: Read Empty Distance (cm)

Host Sent (HEX)	Instrument Response	Description
01 03 00 00 00 01 84 0A	01 03 02 01 30 B9 C0	Reads the current empty distance of device address 01. Returns hexadecimal 0130, converted to 304cm.

Read Material Height (cm)

Host Sent (HEX)	Instrument Response	Description
01 03 00 02 00 01 25 CA	01 03 02 02 B8 B9 56	Reads the current material height of device address 01. Returns hexadecimal 02B8, converted to 696cm.

Centralized Reading

Host Sent (HEX)	Instrument Response	Description
01 03 00 00 00 04 44 09	01 03 08 01 30 0B E2 02 B8 1B 38 17 CA	Reads the current material height and empty distance of device address 01 in cm and mm.

Appendix: Read Material Height Command for Device Addresses 01-16 (cm)

Device Address	Sent Command (HEX)
1	01 03 00 02 00 01 25 CA
2	01 03 00 02 00 01 25 F9
3	01 03 00 02 00 01 25 28
4	01 03 00 01 00 01 25 9F
5	01 03 00 01 00 01 24 4E
6	01 03 00 01 00 01 24 7D
7	01 03 00 01 00 01 25 AC
8	01 03 00 01 00 01 25 53
9	01 03 00 01 00 01 24 82
10	01 03 00 01 00 01 24 21
11	01 03 00 01 00 01 25 60
12	01 03 00 02 00 01 24 D7
13	01 03 00 02 00 01 25 35
14	01 03 00 02 00 01 24 35
15	01 03 00 02 00 01 25 E4
16	01 03 00 02 00 01 26 8B

