

KWL801 Radar Water Level Sensor User Manual



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1. Product Introduction

The KWL801 radar level sensor is a non-contact liquid level measurement instrument based on high-frequency millimeter-wave technology, designed for applications requiring high-precision water level monitoring. Using advanced FMCW (Frequency Modulated Continuous Wave) radar technology, it offers high measurement accuracy, strong anti-interference capability, and excellent environmental adaptability. It is widely used in hydrology and water resources, urban drainage, and industrial process control.

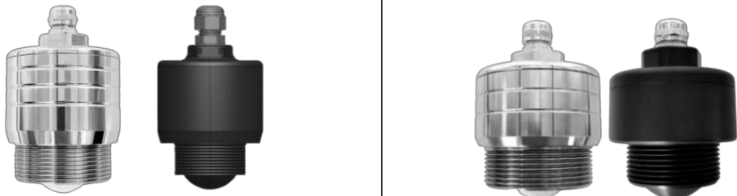
The product adopts a high-performance circularly polarized antenna design, integrating the housing and antenna into a single structure, which greatly enhances the sealing performance of the wetted area. Bluetooth wireless technology enables safe and convenient on-site configuration and maintenance. With an intuitive and efficient mobile app interface, users can easily perform on-site setup, debugging, and operation tasks.



2. Product Features

- Shorter wavelength provides better signal reflection, smaller beam angle, concentrated energy, and enhanced echo strength while minimizing interference.
- Less susceptible to environmental interference and easier to install.
- Integrated lens design with a compact and streamlined structure.
- Very small blind zone, especially suitable for short-range measurements.
- High signal-to-noise ratio ensures excellent performance even under unstable surface conditions.
- Intelligent features designed for ease of use, enabling communication and convenient on-site maintenance via Bluetooth wireless technology.

3. Product Technical Specifications

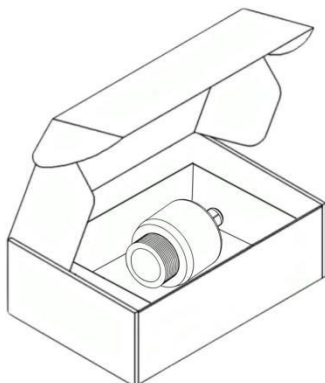
Model	4-20mA Level Sensor	RS485 Level Sensor
Installation Method	Bracket, Thread	
Appearance		
Frequency Range	76 – 81 GHz	
Measuring Range	65 m	
Measuring Accuracy	± 1 mm	
Communication Method	4-20 mA / HART	RS485 / MODBUS
Power Supply	18-28 V DC	9-28 V DC
Cable	10 m cable	
Housing Material	Aluminum alloy, Stainless steel, PP	Stainless steel, PP
Process Temperature	-30 to 70° C	
Process Pressure	-0.1 to 0.1 MPa	
Measurement Interval	800 ms	500 ms
Maximum Power Consumption	20 mA (4-20 mA / HART)	15 mA (RS485 / MODBUS)
Beam Angle	6°	
Protection Level	IP68	
Blind Zone	0.1 – 12 m / 0.3 – 65 m	
Configuration / Debugging	PC Software / Android	
Wireless Communication	Bluetooth	
Bluetooth Range	12m	
Bluetooth Standard	Bluetooth 5.0	
Package Size	27×23×11 cm	
Application Areas	Rivers, lakes, reservoirs, water tanks, wells, and troughs.	

4. Model Selection

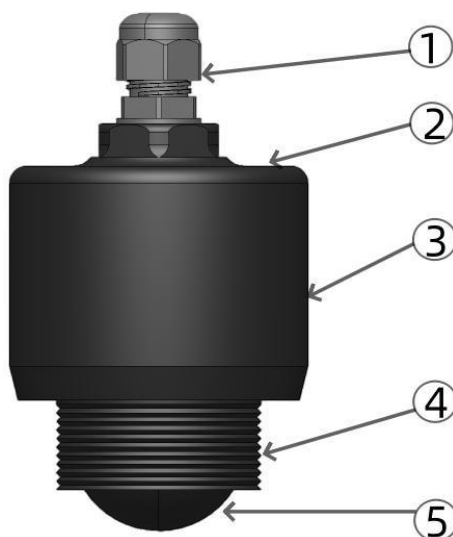
KWL801	A	PP casing		
	B	Stainless steel casing		
	C	Aluminum casing		
	D	Customizable PTFE material		
		20mA	4-20mA Output	
		485	RS485 Output	
			T	Bluetooth
			NT	Without Bluetooth
KWL801	B	20mA	T	Example: KWL801-B-20mA-T

5. Product Appearance

5.1 Packaging



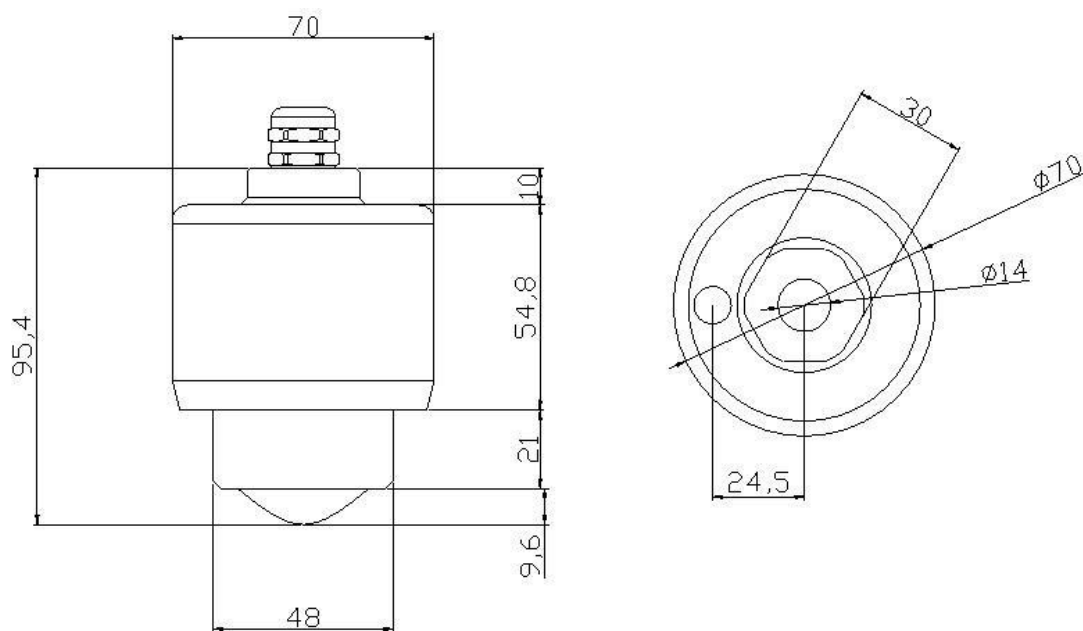
5.2 Appearance



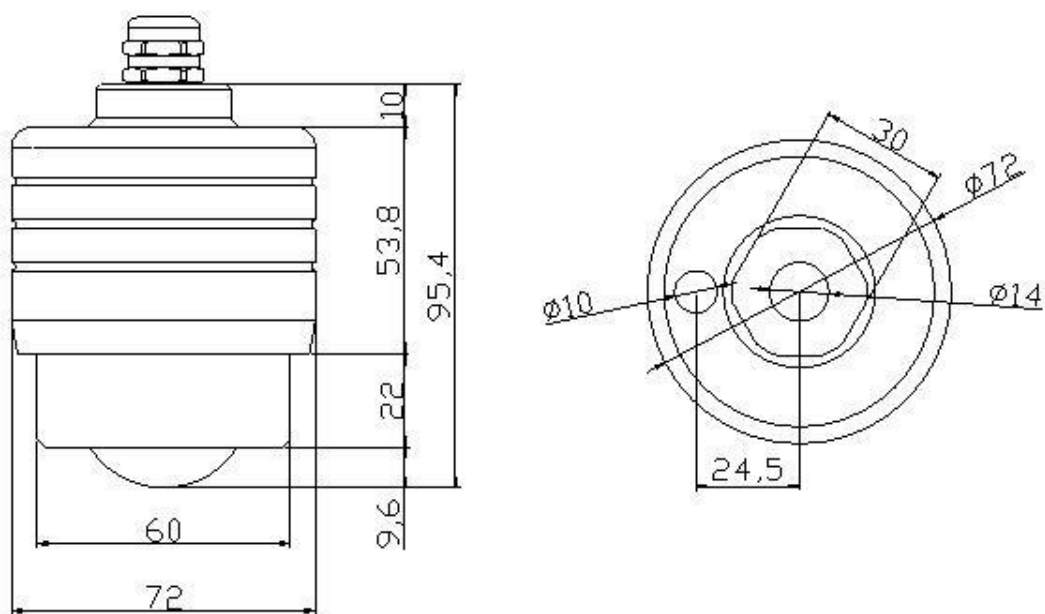
Appearance Structure	
1	Cable Entry Interface
2	Level Indicator
3	Casing
4	PP (G1-1/2 Thread) Stainless Steel (G2 Thread)
5	Antenna Section
Stainless Steel Casing	

6. Dimension

(1) 4-20 mA PP Appearance Structure Diagram



(2) 4-20 mA Stainless Steel Appearance Structure Diagram



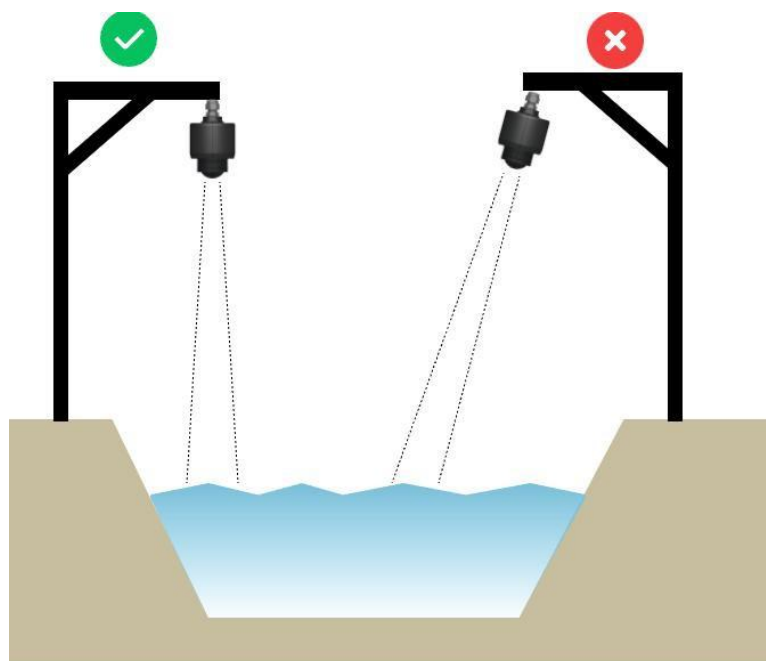
7. Installation

Two points to note during installation:

- (1) Ensure the instrument is perpendicular to the water surface.
- (2) Avoid the transmitted beam hitting obstacles, which may cause false echoes.

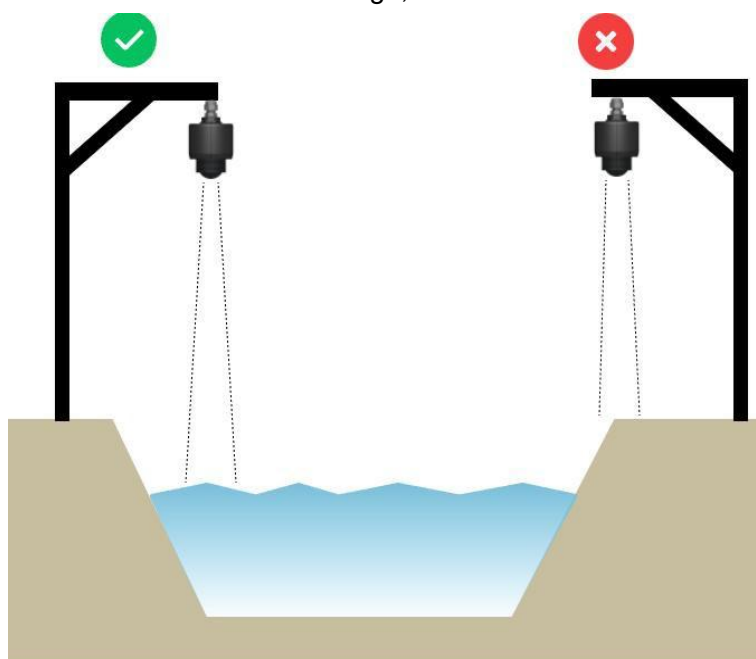
Typical operating conditions are as follows:

Ensure the level sensor is installed vertically to the water surface; tilting will weaken the received signal amplitude and affect normal distance measurement.



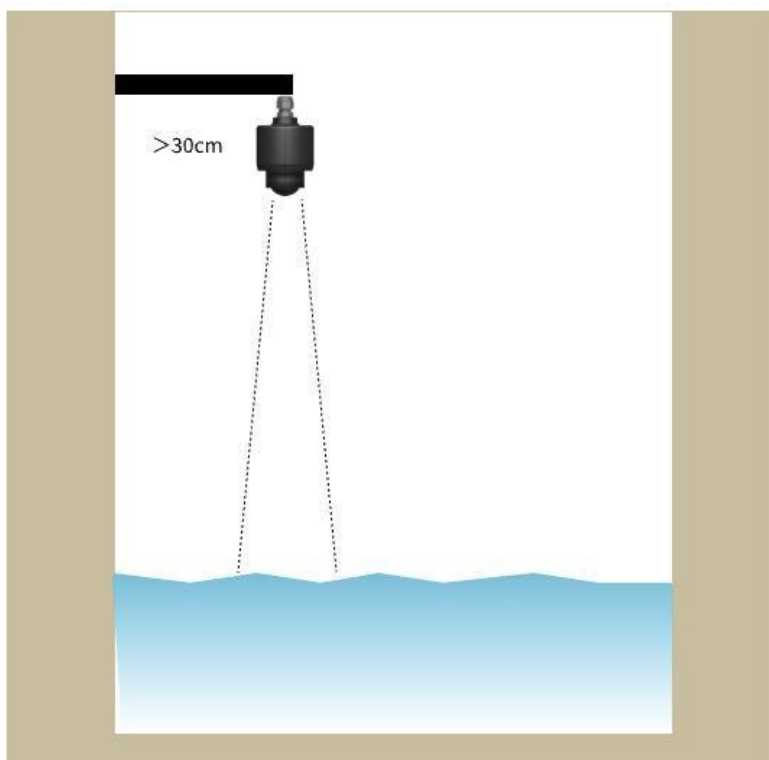
Instrument Installation Location Diagram

Ensure there are no obstacles within the beam range, such as riverbanks.



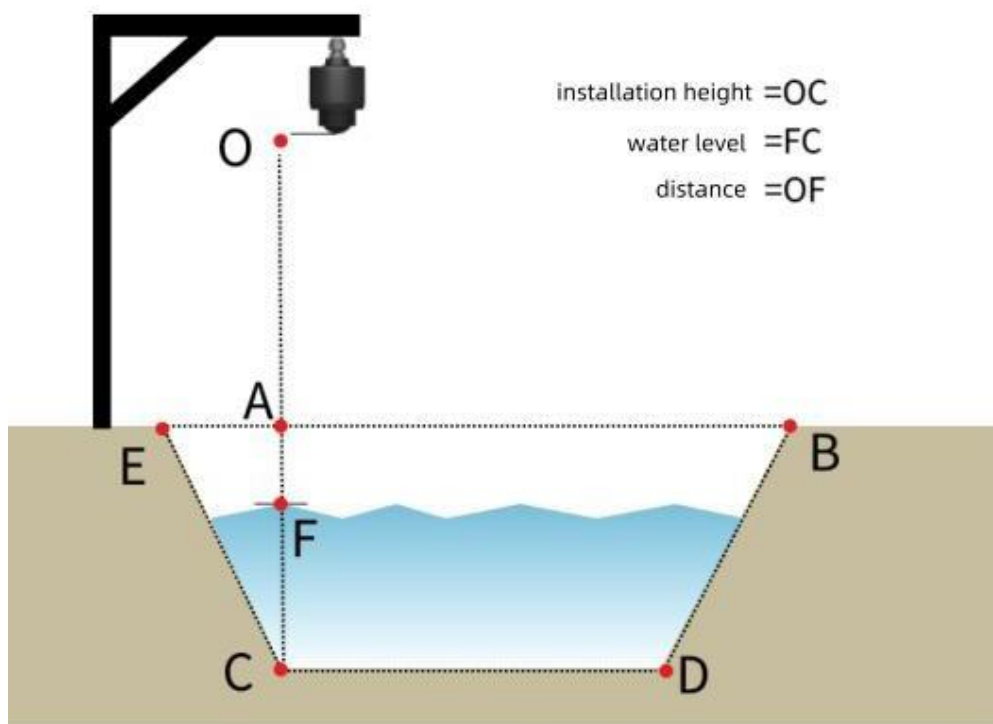
Instrument Installation Location Diagram

The instrument should be installed at least 30 cm away from side walls. For underground pipe networks, install as close to the center of the manhole as possible; otherwise, the manhole walls may cause interference signals, affecting measurement accuracy.



Install at least 30 cm away from the container wall

Key Points for Product Measurement



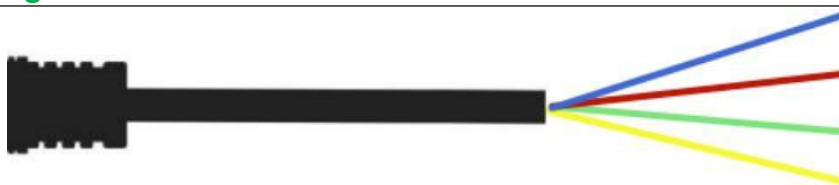
8. Connection to Power Supply

8.1 4-20 mA Wiring



Color	Function
Yellow	Ground
Red	Power Input (+)
Blue	Power Input (-)
Supply Voltage: 18–28VDC (Recommended: 24VDC)	

8.2 RS485 Wiring



Color	Function
Green	RS485 A
Yellow	RS485 B
Red	Power Input (+)
Blue	Power Input (-)
Supply Voltage: 9 – 28VDC (Recommended: 12VDC)	

9. Operation Method

9.1 Operation via Bluetooth Wireless Technology

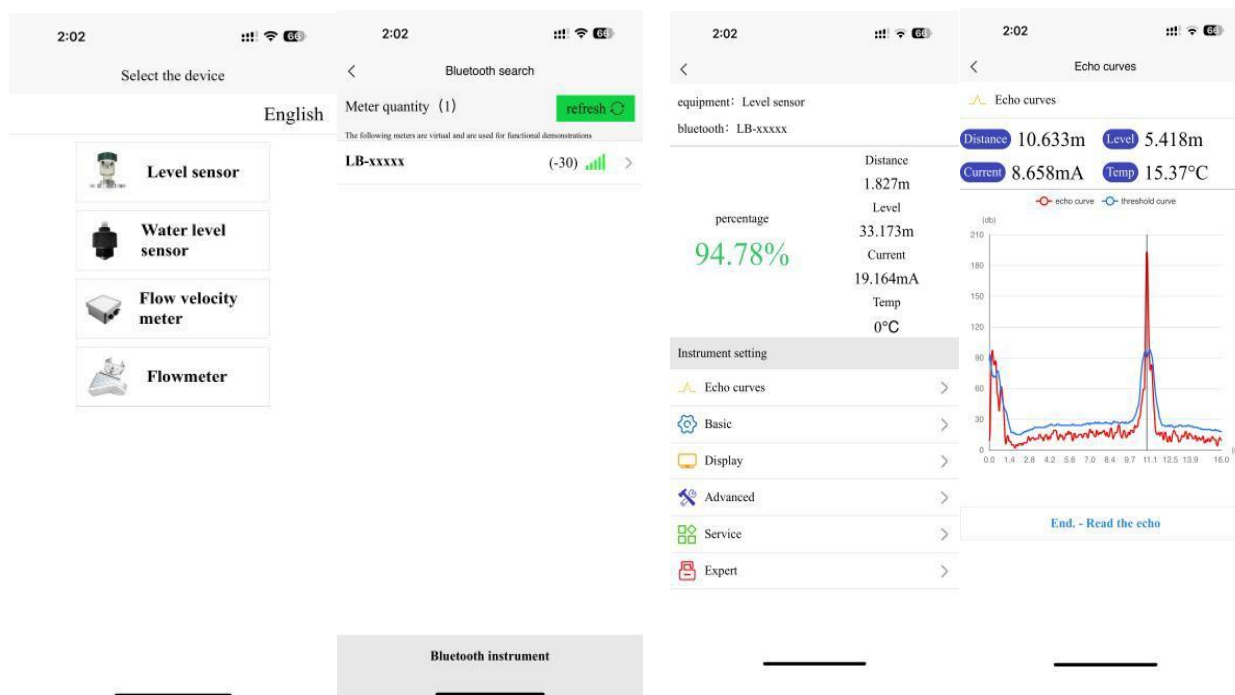
Prerequisites:

- The device must be equipped with Bluetooth functionality.
- A smartphone with the Radar Tools app installed.
- The effective Bluetooth transmission range is 12 m. The range depends on environmental conditions, such as fixed installations, walls, or ceilings.

Download / Install / Launch

- ① Contact us to obtain the software installation package.
- ② Install successfully and launch the software.
- ③ Android devices: Turn on location information (GPS) (Not required for iOS devices).
- ④ Select the device to connect from the device selection list.
- ⑤ Select the device to connect from the selection list.
- ⑥ After successful connection, you can configure the instrument parameters.

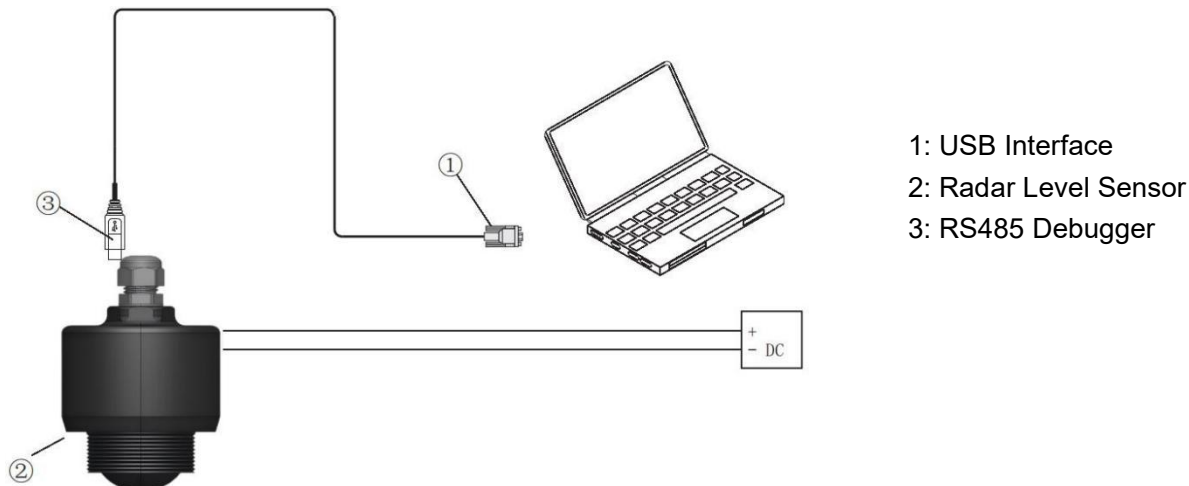
As shown in the figure:



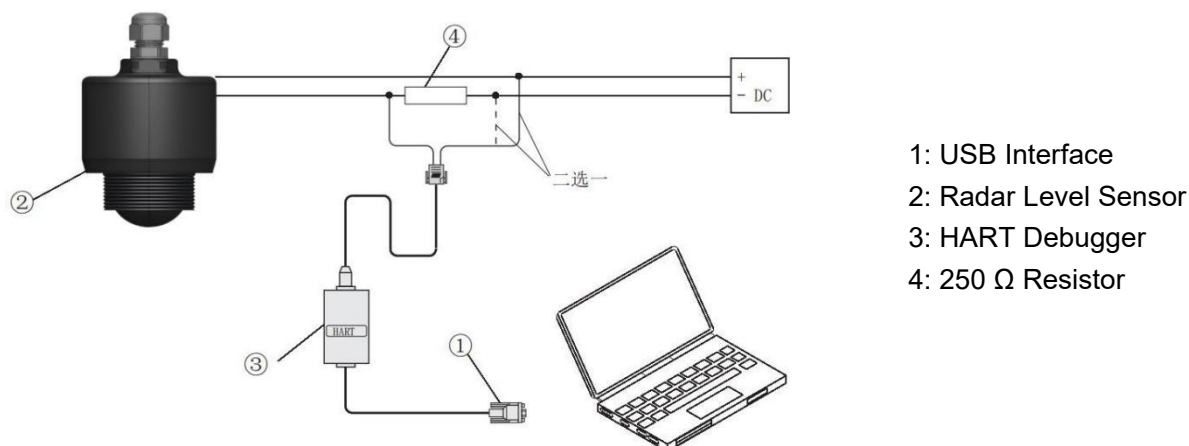
9.2 Operation via PC Software

PC version requirement: Windows 10 or higher.

Connect to the host computer via RS485-to-USB.

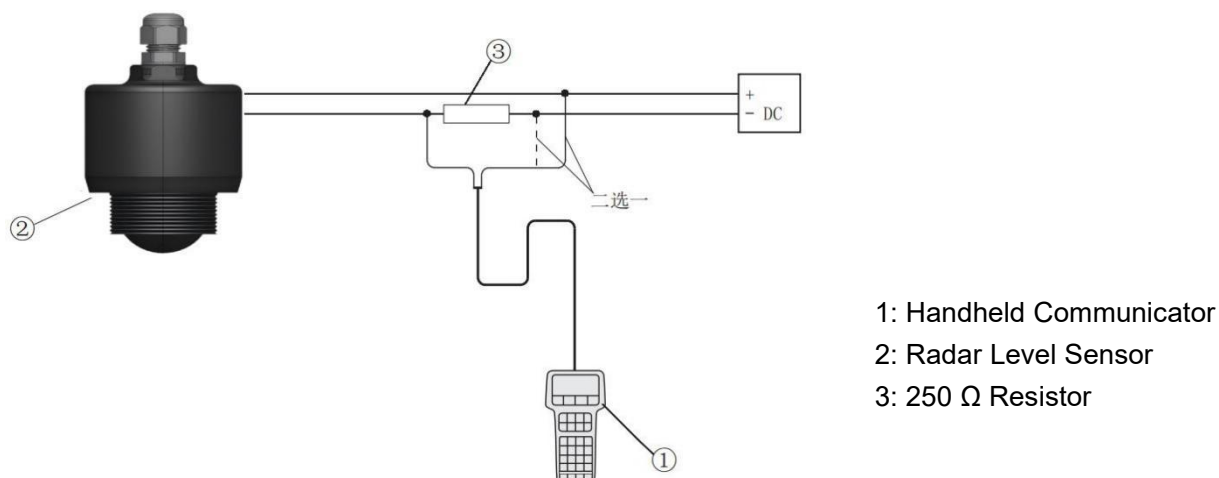


Connect to the host computer via HART



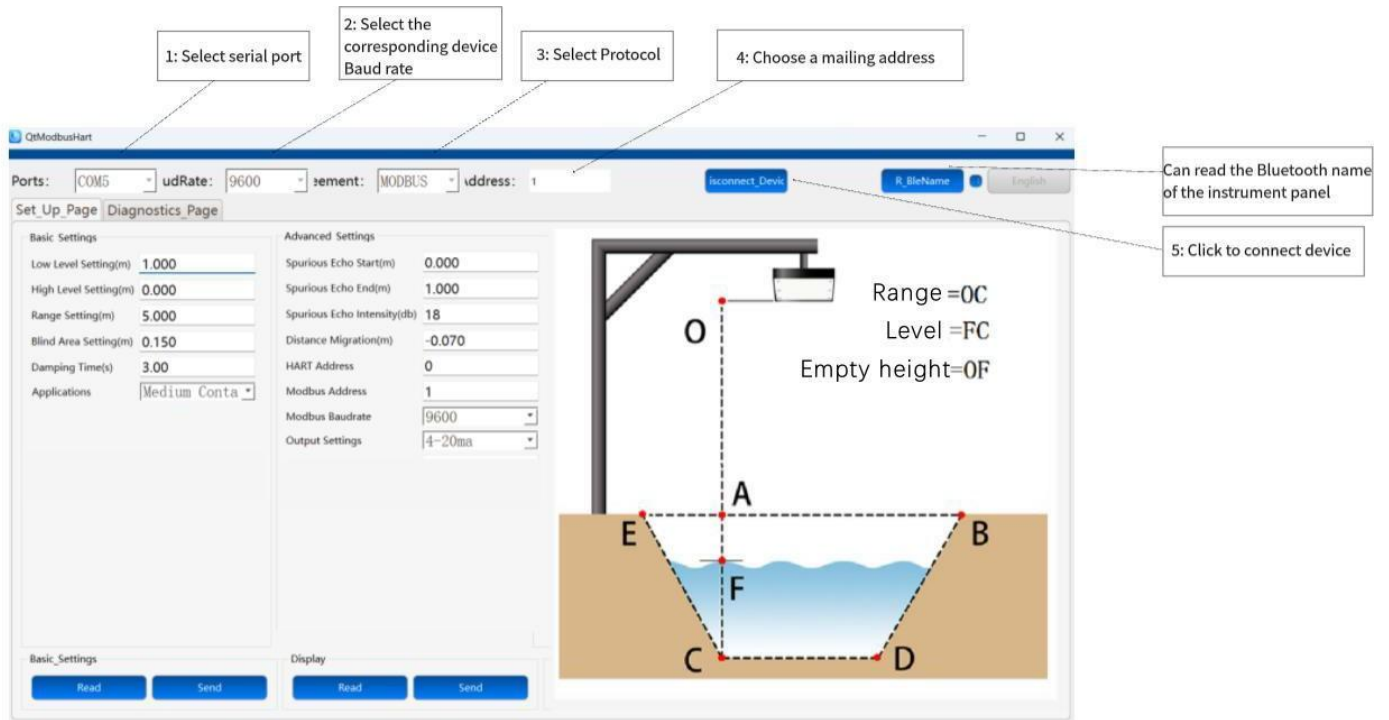
Note: The HART debugger comes with a 24V power supply and can be directly connected to positive and negative power.

Can be edited using a HART handheld communicator



Note: The HART handheld communicator comes with a 24V power supply and can be directly connected to positive and negative power.

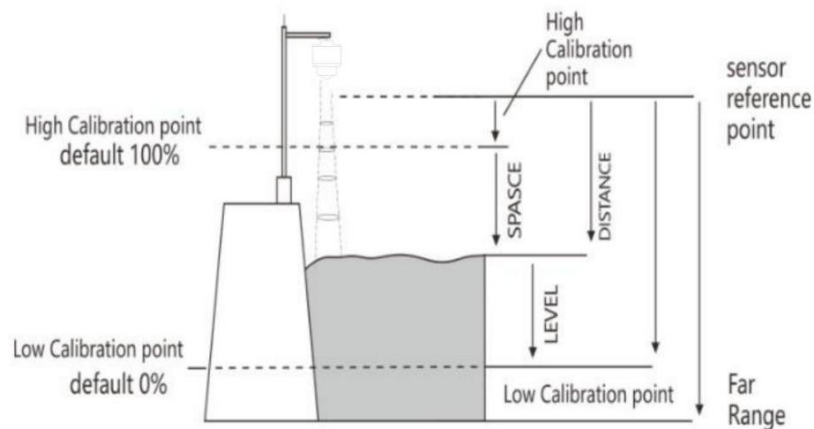
9.3 Parameter Setting via PC Host Software



9.4 Parameter Introduction

9.4.1 Low Level Setting

[Low position setting] refers to the low adjustment point. For a specific definition, see the figure below.



Parameter Name	Low level setting
Parameter Range (m)	0.1 ~ full scale
Default Value (m)	65 m
Associated Configuration	If the low level setting < (high level setting + 0.1), Then low level setting = (high level setting + 0.1)
Special Notes	The low level adjustment point is independent of the full scale and only affects the level calculation

9.4.2 High Level Setting

[High Level Setting] refers to the high adjustment point. For the specific meaning, see the figure.

Parameter Name	High level setting
Parameter Range (m)	0 ~ (low level setting - 0.1)
Default Value (m)	0
Associated Configuration	If the high level setting > (low level setting - 0.1), Then high level setting = (low level setting - 0.1)
Special Notes	The high level setting is independent of the blind zone setting and only affects the calculation of empty height

9.4.3 Full Scale Setting

To obtain accurate measurements, the full scale range of the instrument must be set. The specific meaning is shown in the table below.

Parameter Name	Full scale setting
Parameter Range (m)	1 ~ 65 m
Default Value (m)	65 m
Associated Configuration	If the full scale < (blind zone + 0.1 m), the full scale is automatically set to (blind zone + 0.1 m).
Option Meaning	During algorithm processing, echoes beyond the full scale are ignored. Proper full scale setting can avoid multiple reflection interference and possible out-of-range signals.
Special Notes	This full scale does not represent the instrument's maximum measuring range; it is only used to define the algorithm region. For the instrument's measurement limit, please refer to the technical specifications section.

Note: The blind zone and full scale determine the specific range of the algorithm. By setting them appropriately, interference and false echoes can be avoided, enabling fast and stable measurements.

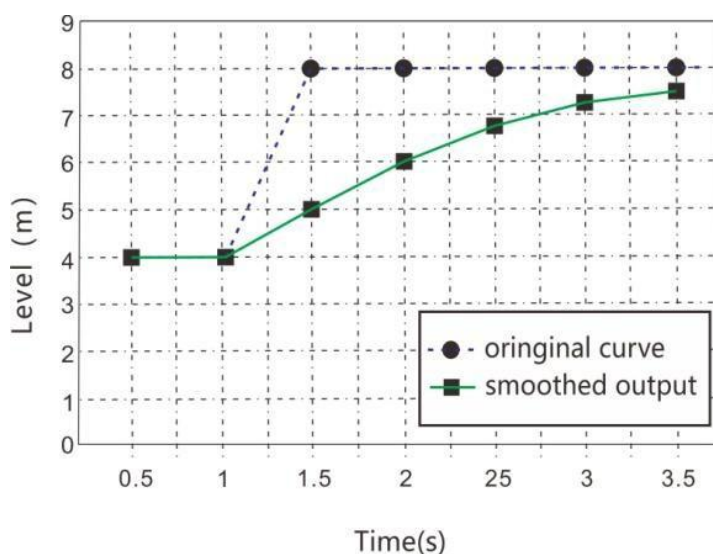
9.4.4 Blind ZoneSetting

For the specific meaning, see the table below.

Parameter Name	Blind Zone Setting
Parameter Range (m)	0 ~ (Full Scale - 0.1)
Default Value (m)	0
Associated Configuration	If the blind zone > (Full Scale - 0.1), then Blind Zone = (Full Scale - 0.1).
Option Meaning	During algorithm processing, echoes within the blind zone are ignored. This option can help avoid near-end interference signals.
Special Notes	This blind zone does not represent the instrument's near-end measuring limit; it is only used to define the algorithm region. For the instrument's measurement limit, please refer to the Technical Specifications section.

9.4.5 Damping Time

The purpose of **[damping time]** is to smooth sudden changes in measurement results, acting as a damping filter. For example, if the damping time is 2 seconds and the measured object's position undergoes a step change at time t, the measured output value will change gradually. Within the first 2 seconds, it completes 63.2% of the change, and by the 10th second (5 times the set value), it follows the actual position, as shown in the figure below.



Parameter Name	Damping Time
Parameter Range (s)	0 ~ 300
Default Value (s)	0
Associated Configuration	None
Option Meaning	Dampens the output to improve signal stability
Special Notes	This parameter is not used temporarily due to the short measurement time

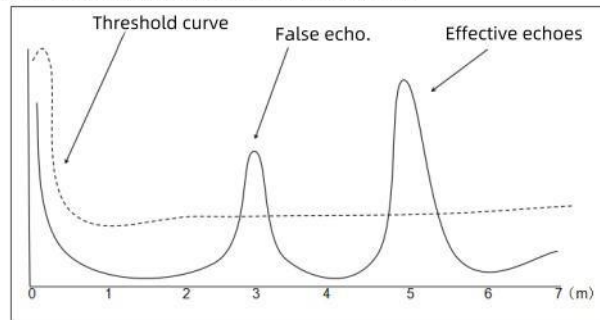
9.4.6 False Echo Learning

[False echo learning] can suppress interference echoes caused by obstacles in the container and generate a threshold curve. When this setting is selected as "Select Area", it is necessary to further input the "Start", "End", and "Intensity" points. The menu is displayed as shown in the figure below.

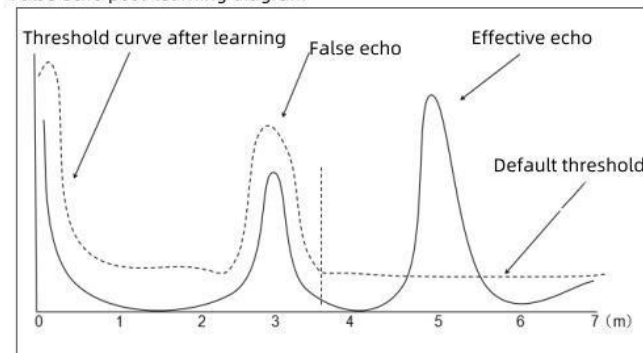
For example, if there are interference signals within the 2 m–4 m range from the instrument, a new threshold curve needs to be created to suppress the interference. The specific operation steps are summarized as follows:

In the **[False echo area]**, the start is set to 2 m and the end to 4 m.

Schematic diagram of false echo before learning



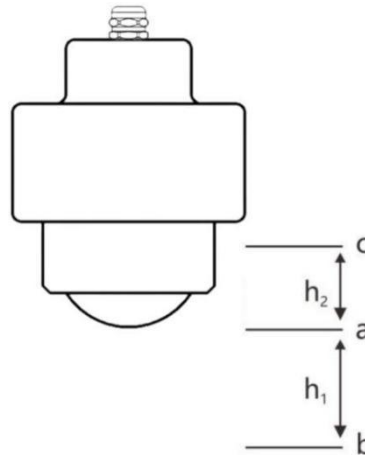
False echo post-learning diagram



False echo setting starts at 2m and ends at 4m

9.4.7 Distance Offset

[Distance offset] is used to adjust the sensor's reference point. The instrument's default reference point is calibrated at point a as shown in the figure at the factory. If you want to adjust the reference point downward to point b, enter h1 in the settings.



9.4.8 /Modbus Address

According to the communication protocol supported by the instrument, set the specific bus address to integrate the instrument into the field bus. The display is shown as follows:

Name	MODBUS
Parameter Range	1–127
Default Value	1
Option Meaning	Set the instrument's RS485 communication
Special Notes	None

10. Modbus Protocol

10.1 Communication Protocol Hardware Interface Parameters

The level sensor uses serial communication. The default parameters are as follows:

Communication	Parameter	Baud Rate (bps)	Parity	Data Length (bit)	Stop Bit (bit)
Serial Port	485 USB	9600	none	8	1

Inter-frame Timeout: 50 ms

10.2 Communication Protocol Format

The communication uses the Modbus RTU protocol. Each complete data frame consists of: Address Field, Function Code, Data, and Checksum. The checksum is the CRC16 of the data frame, with the low byte first and the high byte last. The default factory address of the radar level sensor is 1.

The request command format and radar response data format are as follows:

(1) Query Parameter Format: Function Code 0x03

Request:

Device Address	Function Code	Starting Address	Number of Registers	CRC
(1 byte)	(1 byte)	(2 bytes)	(2 bytes)	(2 bytes)

Reply:

Device Address	Function Code	Data Length	Register Values	CRC
(1 byte)	(1 byte)	(1 byte)	(2×N bytes)	(2 bytes)

N: Number of Registers

(2) Parameter Setting Format: Function Code 0x10

Request:

Device Address	Function Code	Starting Address	Number of Registers	Data Length	Register Values	CRC
(1 byte)	(1 byte)	(2 bytes)	(2N bytes)	(1 byte)	(2N bytes)	(2 bytes)

Reply:

Device Address	Function Code	Starting Address	Number of Registers	CRC
(1 byte)	(1 byte)	(2 bytes)	(2 bytes)	(2 bytes)

10.3 Communication Protocol Command Description

The following provides detailed descriptions for each command: Write Command:

Function Code 0x10

Read Command: Function Code 0x03

Starting Address: 0x2000

Function Name	Setting Range	Register Count	Address
Low Level Adjustment	0–35000, 0–85000, 0–120000	2	8192
High Level Adjustment	0–35000, 0–85000, 0–120000	2	8194
Range Setting	0–35000, 0–85000, 0–120000	2	8196
Blind Zone Setting	0–35000, 0–85000, 0–120000	2	8198
Damping Time	0–100	1	8200
Medium Type	0–Liquid, 1–Solid	1	8201
Container Type	0–Large, 1–Small, 2–Fast, 3–Test	1	8202

False Echo Start	0-35000, 0-85000, 0-120000	2	8203
False Echo End	0-35000, 0-85000, 0-120000	2	8205
Distance Offset	-10000 – 10000	1	8209
Bus Address	1-127	1	8210
Output Position	0-4-20mA, 1-20-4mA	1	8211
Current Simulation	—	1	8212
Current Function	0-No Change, 1-22mA, 2-3.6mA	1	8213
Measurement Mode	0-Level, 1-Empty Height	1	8224
Distance Unit	0-M, 1-CM, 2-MM	1	8225
Language	0-Chinese, 1-English	1	8226
LCD Contrast	0-100	1	8227

Note: Each parameter occupies one register address, and the data is in U16 or I16 format.

Example:

The command to read Low Level Adjustment is as follows:

Device Address	Function Code	Starting Address	Number of Registers	CRC
0x01	0x03	0x2000	1	(2 bytes)

The command to write Low Level Adjustment is as follows:

Device Address	Function Code	Starting Address	Number of Registers	Data Length	Data Value	CRC
0x01	0x10	0x2000	1	(1 byte)	(2N bytes)	(2 bytes)

10.4 Example of Reading Measurement Data:

Data Sent by Host:

No.	Function Code	Starting Address	Number of Points	CRC	Meaning
01	03	0000	0001	840A	Read empty height, unit: cm
01	03	0001	0001	D5CA	Read empty height, unit: mm
01	03	0002	0001	25CA	Read liquid level, unit: cm
01	03	0003	0001	740A	Read liquid level, unit: mm

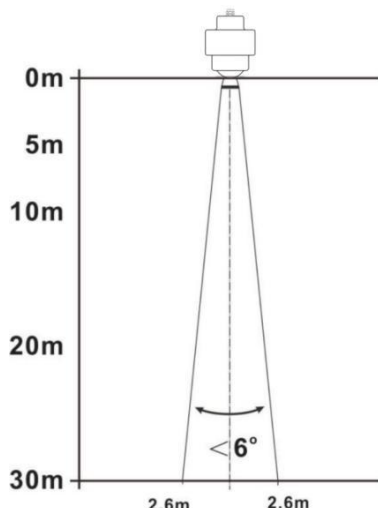
For ranges above 65 m, the command is sent as follows:

(Parsing order: from high byte to low byte)

No.	Function Code	Starting Address	Number of Points	CRC	Meaning
01	03	0000	0002	C40B	Read empty height, unit: mm
01	03	0002	0002	65CB	Read liquid level, unit: mm

11. Appendix B: Glossary

Beam Angle: The beam width defined by the points that are 3 dB below the maximum. The radar level sensor series has a beam angle of 6° , as shown in the figure.



Schematic diagram of the radar beam spatial geometry of the instrument

Distance Resolution: Distance resolution refers to the minimum distance between two adjacent objects at which the level radar can distinguish them as two separate objects rather than one and measure their respective distances. If the distance between two objects is smaller than the radar's distance resolution, the radar will detect only one distance value, which is not equal to either object's distance but a composite of the two. For the radar level sensor, with a frequency-modulated bandwidth $B=5$ GHz, and the minimum distance resolution = light speed/working bandwidth/2 ≈ 3 cm.

Measurement Accuracy: If there is only one object and it moves a very small distance, whether the level radar can detect this change. The ability to detect the movement of a single object is called accuracy. The radar level sensor analyzes the intermediate frequency (IF) signal with proprietary algorithms, achieving a measurement accuracy of 0.5 mm.

Blind Zone: Refers to the near-end measurement limit of the instrument. Within the blind zone, the instrument cannot measure echoes; that is, the radar cannot receive reflected signals.

Transmitting Cone: The extension of the antenna beam angle.

False Echo: Any echo not generated by the desired target. Generally caused by obstacles in the container.

Multiple Echoes: Multiple reflected echoes appearing at the target distance, possibly 2 or 3 times.

Range: (1) Refers to the farthest measurement limit of the instrument.

(2) Special case: the manually set maximum distance, beyond which the instrument ignores signals during data processing.

Repeatability: The deviation between multiple measurements of the same variable under identical conditions.

Threshold Curve: A time-varying curve used as a threshold; echoes exceeding this curve are considered valid.