Radar Level Transmitter

Supmea

Headquarters

5th floor, Building 4, Singapore Hangzhou Science Technology Park, No. 6 street, Hangzhou Economic Development Area, Hangzhou 310018, China

Singapore

2 Venture Drive #11-30 Vision Exchange Singapore

✉ info@ supmea. com

🌐 www.supmea.com

Supmea Automation Co.,Ltd.

Preface

Thank you for purchasing this radar level transmitter. To ensure proper operation and prevent potential losses due to improper use, please read this manual thoroughly before using the device.

Note

- The contents of this manual are subject to change without notice due to real-time factors such as function upgrading.
- We strive to ensure the accuracy of the manual. Nevertheless, if you identify any errors or inaccuracies, please contact us.
- Unauthorized reprinting or copying of this manual is strictly prohibited.

Version

U-SUP-WSR201-EN2

Safety Precautions

For the safe operation of this product, please strictly follow the outlined safety precautions.

About this manual

- Please ensure the instrument operators have a careful reading of this manual.
- Prior to operation, please study this manual in detail to ensure a thorough comprehension of the device's functionality.
- This manual only describes the product's functions. The responsibility as to the device 's suitability for any specific purpose lies solely in the operator.

Precautions for product protection, safety, and modification

- For your safety and the normal operation of the product and its controlling systems, the guidelines and precautions specified in this manual are supposed to be fully observed. Operating the instrument in ways not specified in this manual may compromise its protective features. Our company shall not be liable for any malfunctions or accidents resulting from non-compliance with the precautions described.
- When equipped the product and its controlling systems with lightning protection or separate safety protection circuits, it needs to be implemented by other devices.
- If you need to replace components or fittings of the product, please use the model specified by the company.
- This product is not designed for use in systems directly related to personal safety, such as nuclear power facilities, radioactive equipment, railway systems, aviation equipment, marine equipment, and medical equipment. If applied, it is the user's responsibility to implement additional equipment or systems to ensure personal safety.
- Do not modify this product.
- The following safety symbols are used in this manual:

 Hazard: Failure to take appropriate precautions may result in serious personal injury, product damage, or major property loss.

 Warning: Pay special attention to critical information related to the product or specific sections of this user manual.

- Confirm whether the supply voltage is consistent with the rated voltage before operation.
- Do not use the instrument in a flammable and combustible or steam area.
- To prevent electric shock and operation errors, ensure proper grounding protection is in place.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at the correct electric level, shielded, with wires properly routed, and an SPD surge protector applied as needed.
- Some internal components may carry high voltage. To avoid the risk of electric shock, do not open the front square panel unless it is being handled by trained personnel or maintenance staff authorized by our company.
- To avoid electric shock, disconnect the power before performing any checks.
- Check the condition of the terminal screws regularly. If loose, please tighten them before use.
- Unauthorized disassembly, modification, or repair of the product is not allowed, as it may lead to malfunctions, electric shock, or fire hazards.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine, or other organic solvents, and avoid exposing the product to any liquids. If the product falls into the water, please cut off the power immediately to prevent leakage, electric shock, or fire hazards.
- Please check the grounding protection regularly. Do not operate the

product if you think that the protection, such as grounding protection and fuses, is inadequate.

● Ventilation holes on the product housing must be kept clear to avoid malfunctions due to high temperatures, abnormal operation, shortened life, and fire.

● Please strictly follow the instructions in this manual; failure to do so may damage the product's protective devices.

⚠️

● Do not use the instrument if it is found damaged or deformed upon opening the package.

● Prevent dust, wire end, iron fines, or other objects from entering the instrument during installation, as this may cause abnormal operation or failure.

● During operation, to modify the configuration, signal output, startup, stop, and operation safety shall be fully considered. Improper operation may lead to failure and even destruction of the instrument and control equipment.

● Each part of the instrument has a certain service life, which must be maintained and repaired on a regular basis for long-term use.

● If the product comes to the end of its service life, it should be disposed of as industrial waste as a way of environmental protection.

● Disconnect the instrument when it is not in use.

● If you find smoke from the product, smell odor, abnormal noise, etc., please turn off the power switch immediately and contact the company in time.

Disclaimer

- The company does not make any guarantees for the terms beyond the scope of this product warranty.
- This company is not responsible for damage to the instrument or loss of parts or unpredictable damage caused directly or indirectly by improper operation of the user.

No.	Name	Quantity	Note
1	Radar level transmitter	1	
2	User manual	1	
3	Certificate	1	

After opening the box, please confirm the scope of delivery before starting the operation. If you find that the model and quantity are incorrect or there is physical damage in the product's appearance, please contact us.

Contents

1 Introduction

1.1 Overview

With high-frequency microwave radar technology, the 60G radar level transmitter is designed for real-time monitoring and precise measurement of hydrological information. Compared to traditional hydrological monitoring methods, radar technology offers benefits such as high measurement accuracy, strong real-time performance, and broad applicability. It features low beam energy, ensuring safety to humans or the environment. Additionally, this product, requiring no on-site calibration, is also unaffected by changes in density, and dielectric constant of the medium to be measured. All make it ideal for hydrological monitoring in natural waters such as rivers, reservoirs, lakes, irrigation channels, and waterways.

1.2 Measuring Principle

The fundamental operating principle of this transmitter is Pulsed Coherent Radar (PCR), which determines the measured distance by calculating the time of flight （ToF）. The sensor transmits the signal in short pulses, which travel through the air, are reflected back by the surface of the material to be measured, and subsequently make their way back to the radar receiver. By measuring the time between pulse transmission and reception, the radar level transmitter determines the distance between the medium surface and the sensor.

1.3 Features

- 60GHz PCR technology for higher resolution, better accuracy, and more stable performance.
- Detection up to 15m with a minimum blocking distance of 0.15m.
- The narrow beam angle and concentrated energy offer strong anti-interference capability, high measurement accuracy, and excellent reliability.
- Effective working in harsh environments; unaffected by light, rain, snow, dust, or water mist.
- Multiple output circuit interfaces are available.
- Low radar transmission power ensures safety for humans and the environment.
- Bluetooth commissioning via phone makes on-site maintenance quick and easy.

2 Technical Parameters

Table 1 Technical parameters

Measured variable	Level	
Measuring range	5m/10m/15m	
Blocking distance	≤ 0.15m	
Modulation waveform	PCR	
Transmission frequency	57GHz~64GHz	
Beam angle	6°	
Accuracy	±5mm (5m/10m) ±0.1%FS (15m)	
Resolution	1mm	
Refresh rate	≥500ms	
Transmission output	(4~20)mA, current output accuracy 0.2% F.S 2-Wire: R_L=(U-18V)/0.021A 4-wire: R_L=(U-9V)/0.021A **Note**: U is supply voltage, unit in V	
Digital communication	RS485, Modbus-RTU	
Wireless communication	Bluetooth	
Power supply	2-wire	Supply voltage: 18-36V DC Supply current: ≤25mA, 24V DC
	4-wire	Supply voltage: 9-36V DC Supply current: ≤80mA, 24V DC
Power consumption	2-wire	≤1W
	4-wire	≤1.9W
Dielectric constant	≥3	
Process pressure	(-0.1~0.3) MPa	
Process temperature	(-40~85)°C	
Protection degree	IP68	

3 Structure and Dimensions

3.1 Dimensions
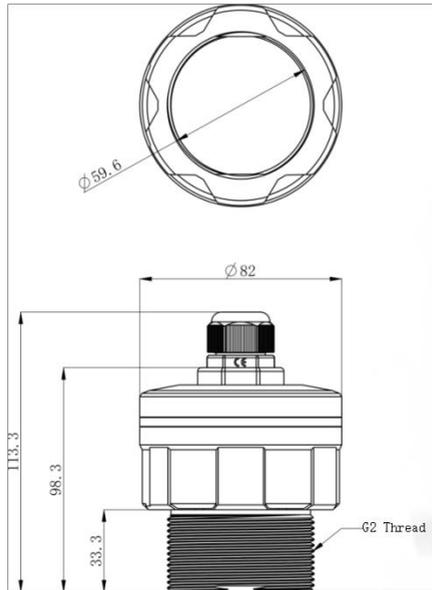
Fig.1 Dimensions (unit: mm)

3.2 Material

Housing and process connection material: Polycarbonate PC

Antenna material: PTFE

4 Installation

Please read the following instructions carefully before installation and ensure sufficient space is reserved for proper radar installation.

4.1 Unpacking and Inspecting

Upon receiving the delivery, users shall first inspect the condition of the packaging. The packaging box should be intact with clear labeling. If any visible damage to the packaging is found, please promptly contact the logistics department for investigation and responsibilities clarification. Contact our company at the same time. If no damage or other issues are detected, proceed to unbox the product and verify the completeness of its components.

4.2 Installation Precautions

The radar level transmitter is typically used to measure liquid levels in tanks or monitor water levels in rivers and reservoirs. The installation diagram is shown below:
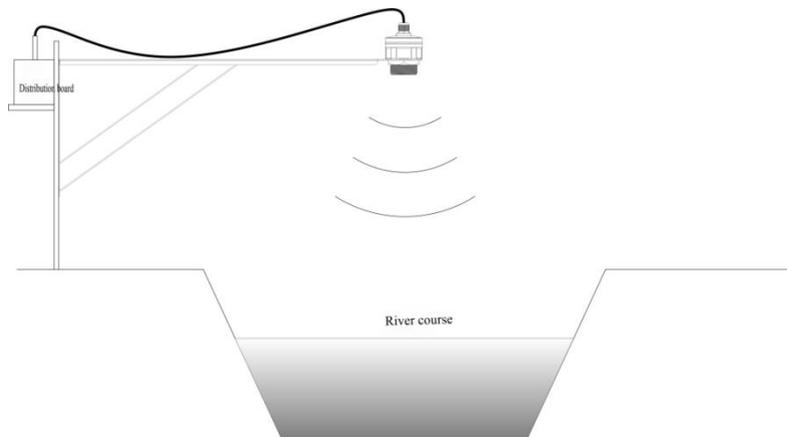
Fig.2 Installation diagram

4.3 Installation Methods

The radar can be installed according to the actual on-site condition. It can be securely fastened to the mounting bracket with expansion screws or hoops (hoops are not supplied). The installation details are shown in the diagram below.
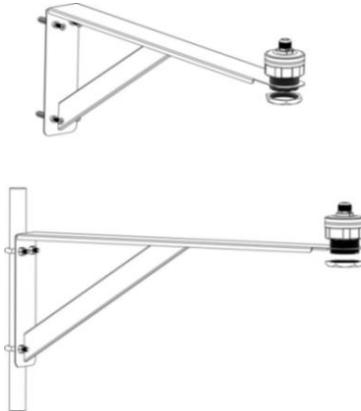

Fig.3 Installation methods

4.4 Installation Requirements

In liquids, direct the device as perpendicular as possible to the medium surface to achieve optimum measurement results, as shown in the figure below.
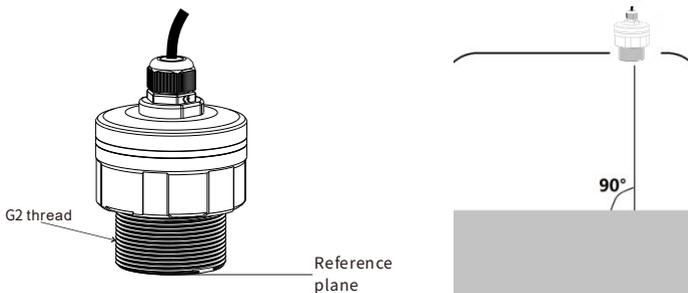

Fig.4 Liquid level measurement method

4.5 Installation Location

See the following points for its working conditions:

(1) Ensure that the level transmitter is installed perpendicular to the liquid surface. Any tilt will weaken the signal amplitude, affecting normal distance measurement.
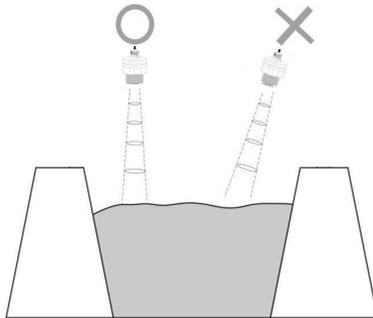

Fig.5

(2) Ensure that there is no interference within the beam range, such as riverbanks.
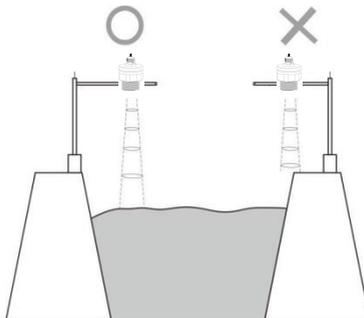
Fig.6

(3) The device shall be installed at least 20cm away from the side wall. For underground pipeline networks, it should be as close to the center of the sewer well as possible. Otherwise, interference signals may arise from the well wall, affecting measurement accuracy, as shown in Figure 7.
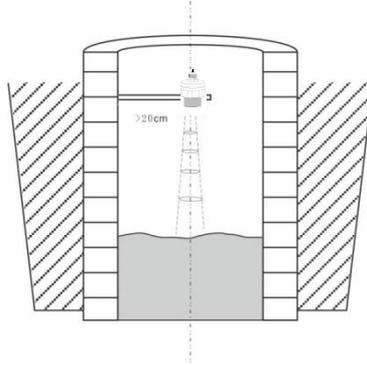
Fig.7

4.6 Installation Check

Table 2 Post-installation check

Checking Items	Results
Is the device free from damage (visual inspection)?	☐
Does the measuring device comply with the measuring point specifications? For example: measuring range, dielectric constant, process pressure, temperature, etc.?	☐
Is the instrument mounted and fixed correctly?	☐

5 Electrical Connection

The radar level transmitter is powered by a wide voltage range (4-wire: 9~36VDC; 2-wire:18~36VDC). Since the wiring for the radar level transmitter is typically extended over a long distance (Note: users are not recommended to extend the cable themselves), there will be a voltage drop along the wiring. Therefore, a 24VDC power supply is recommended.

5.1 2-Wire/Bluetooth:

Red : U+
Black : U-
Blue : RS485 A
Green : RS485 B
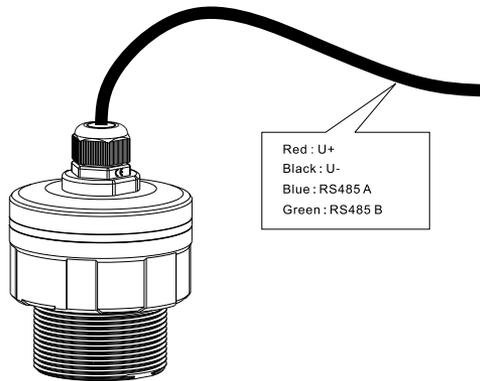
Fig.8 Diagram of 2-wire version

Table 3 Terminal description

| Line color	Definitions
Red	U+, (4~20) mA output +
Black	U-, (4~20) mA output -
Blue	RS485 - A (for commissioning only)
Green	RS485 - B (for commissioning only)

5.2 4-Wire/RS485/Bluetooth:

Red : U+
Black : U-
White : Iout
Yellow : Icom
Blue : RS485 A
Green : RS485 B
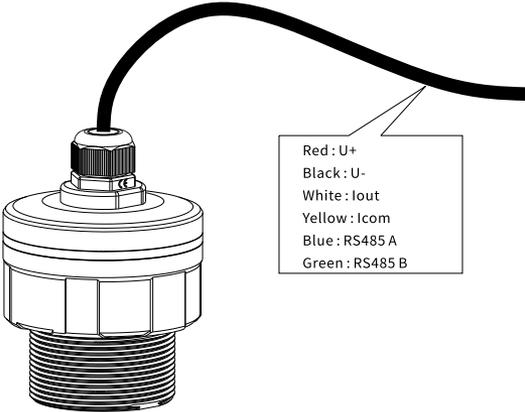
Fig.9 Diagram of 4-wire cable

Table 4 Terminal description

Line color	Definitions
Red	U+
Black	U-
White	Iout, (4~20) mA output + (Active)
Yellow	Icom, (4~20) mA output - (Active)
Blue	RS485 - A
Green	RS485 - B

5.3 Wiring Precautions

This instrument fully meets the requirements of ingress protection, rating IP68. Please ensure the waterproof integrity of the cable sealing head:

All housing screws, covers, and cable entry glands must be tightened.

All wiring shall be provided with drip protection, meaning the cable entry of the level transmitter, the cables, and the conduit should be bent downward to prevent water ingress, which may otherwise cause a short circuit.
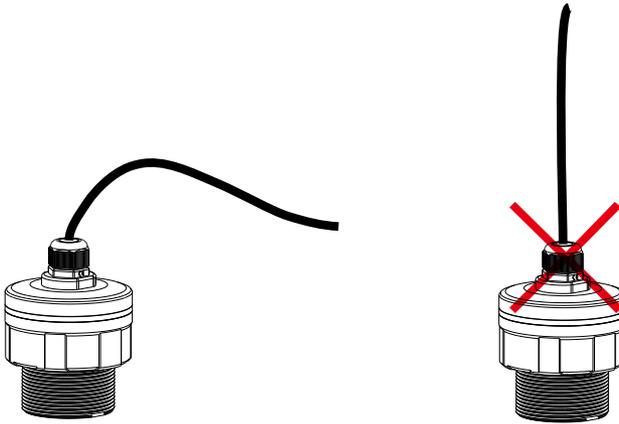

Fig.10 Drip protection

6 Commissioning

All models of the radar level transmitter come standard with Bluetooth, allowing for connection to the device via a WeChat mini program for viewing measurement data and configuring parameters. Additionally, the transmitter is also equipped with an RS485 interface, enabling users to operate the radar device using the product communication protocol.

Note: It is recommended to power on the radar device for 1 minute before commissioning.

6.1 WeChat Mini Program

(1) Scan the QR code with WeChat to access the commissioning mini-program:

Fig.11 Commissioning mini-program

(2) Login Page

Launch the mini program and enter the login interface.
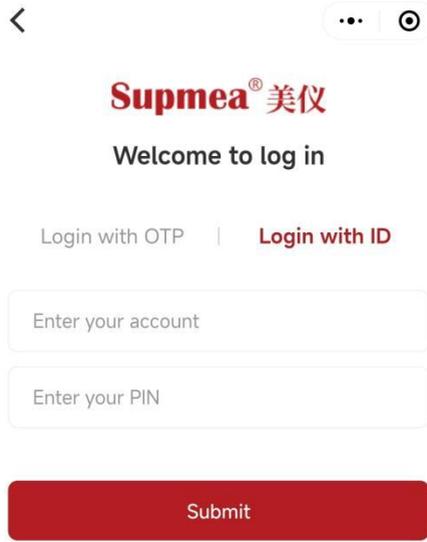
Fig.12 Login page

(3) There are two ways to log in: login with OTP or login with ID.

Login Types:

- **Login with OTP**: For general users to log in, please enter your phone number, click **Get OTP** button, input the received OTP code, and click Submit. For users whose phones cannot receive the OTP code, please enter your account and PIN to log in (Account: User / PIN: 123456) from Login with ID interface.

- **Login with ID**: For the administrator to log in, please enter the ID account and password **PIN**. This method is intended for development, testing, and maintenance personnel.

(4) Connecting the Device

After login, please follow the prompts to enable your phone's Bluetooth. After clicking the button **Connect the device**, the program automatically searches for nearby radar devices (default Bluetooth name: WSR+SN code), and you can click on the device you wish to connect to.
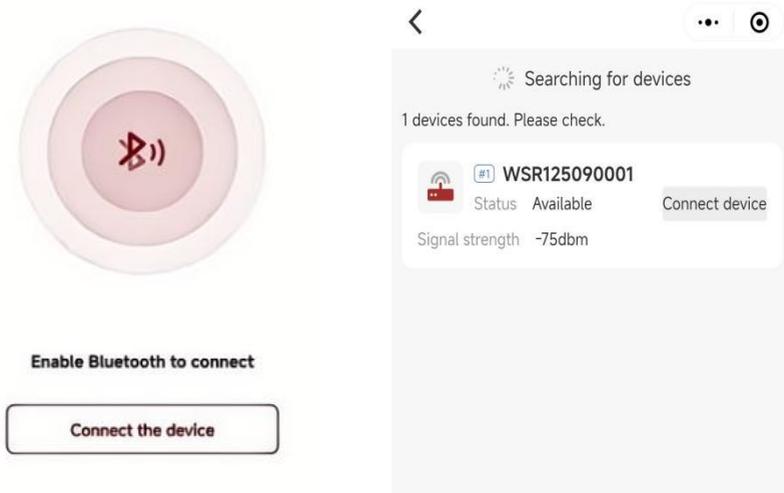

Fig.13 Device connection

(5) Device information

If the device is successfully connected, the home page is displayed as shown below. You can view the current device information: measuring mode, measured value, (4~20)mA current output, error information, Bluetooth connected status, echo strength, and historical curve.

Fig.14 The home page

6.2 Device Commissioning

6.2.1 Settings

To ensure the normal operation of radar, basic configuration shall be carried out first. The parameters that can be configured include: sensor mode, empty distance, blocking distance, blocking distance current, applications, vessel type, dielectric constant, 4mA and 20mA setpoints, damping time, and range set.
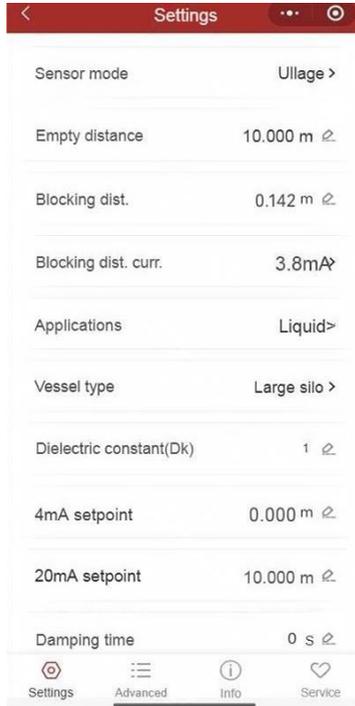
Fig.15 Settings menu

Sensor mode: You can choose between level or distance.

Empty distance: refers to the empty tank height (=empty distance). The empty distance must be set in level mode, where level = empty distance – ullage (measured distance).

Blocking distance: 0.15m by default.

Blocking distance current: Set the blocking distance current, which can be either 21mA or 3.8mA.

Applications: You can choose either liquid or solid.

Vessel types: You can choose between large silo, medium silo, narrow silo, rapid fill (for solids only), or agitator tanks (for liquids).

Dielectric constant: 1 by default.

4mA/20mA: Set the distance value corresponding to the 4mA/20mA current output.

Damping time: Damping time is used to adjust the rate at which the radar display value and output signal change. The adjustable range is from 0s to 100s.

Range set: 5.000m, 10.000m or 15.000m.

6.2.2 Advanced Menu

The advanced menu displays more professional parameters configuration. Thus it is only reserved for trained personnel. Misused operation and configuration may result in failure to measure the distance and level value!
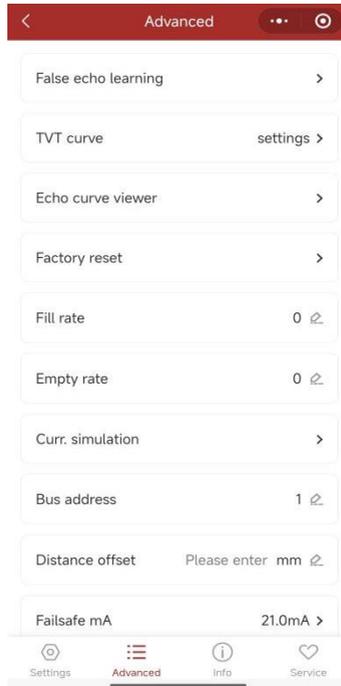

Fig.16 Advanced menu

(1)TVT curve settings (Time Varying Threshold Curve)

Threshold curve function: it is recommended that the threshold curve be set at the zero point(the empty tank height) or established when an obstacle is measured:

Step 1: Click the **TVT curve** to enter the TVT curve setting interface. Select the button **New** to set the TVT offset value, and click the button **OK**. As shown in the figure below:
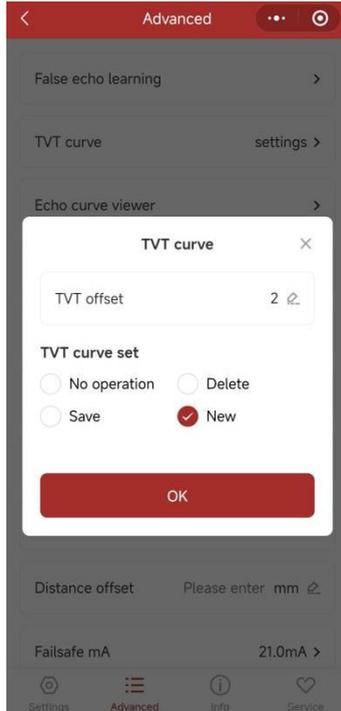

Fig.17 Reset TVT curve

Step 2: After the exit is confirmed, wait for more than 10 seconds, click again to enter the TVT curve setting interface, select the button **Save**, and click button **OK**. As shown in the figure below:
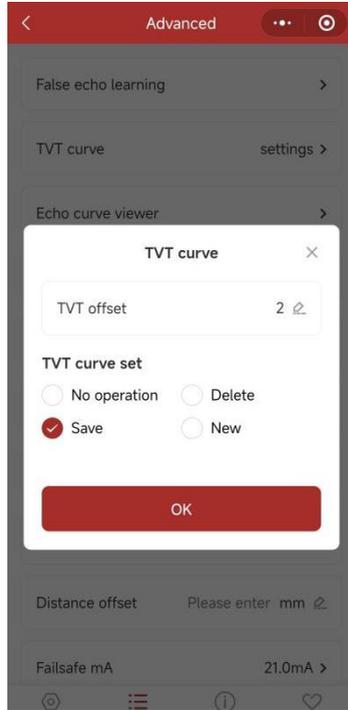
Fig.18 TVT curve

Step 3: TVT Curve. Click the **Echo curve viewer** to see the blue curve, as shown in the following figure:
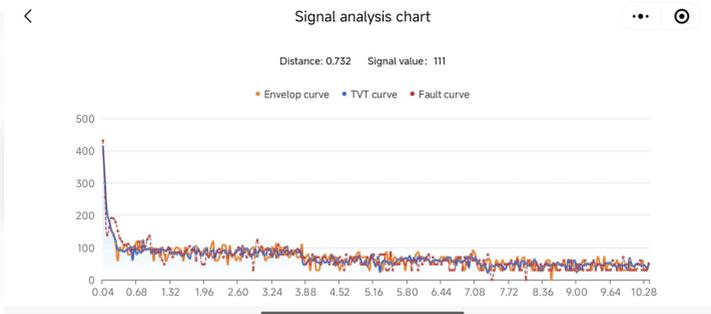

Fig.19 Echo profile chart

(2) False Echo Learning

The false echo function requires the TVT curve function to be enabled and can only be activated when the TVT curve is properly configured. It is recommended to use the TVT Curve function and the False Echo Learning function to make adjustment when abnormal measurements occur in the field device.

Click on the **False echo learning** to enter its page. As shown in the figure below:
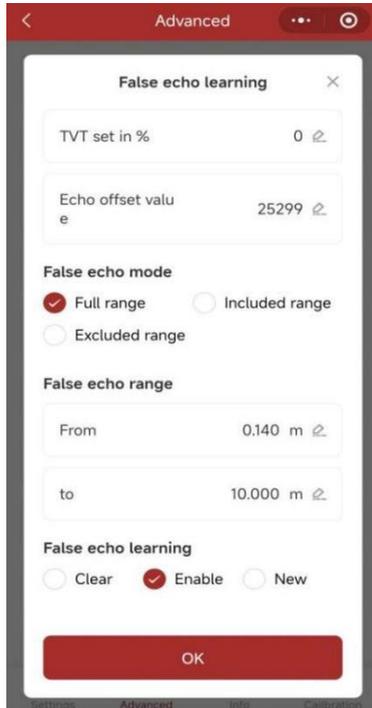
Fig.20 Enable false echo learning

False echo learning is enabled by default. The false echo modes are divided into **Full Range**, **Included range,** and **excluded range**. Assuming that the overall curve value of the TVT curve is V, the TVT percentage is set to A, the false echo offset value is B; then the False Echo Range is set from S1 to S2.

● In the full range mode: the starting and ending values of false echo range are invalid. The whole waveform will make a new threshold curve at the value V of

the threshold curve (V(1+A%) +B).

- In the included range mode: the threshold at the distance from S1 to S2 is adjusted to V_{s1-s2} (1+A%) +B.
- In the excluded range mode: the threshold from 0 to S1 and from S2 to the empty distance (the empty tank height) is adjusted to V(1+A%) +B

The false echo learning function is to adjust the TVT curve in a small area to avoid obstacles.

As shown in the figure below:
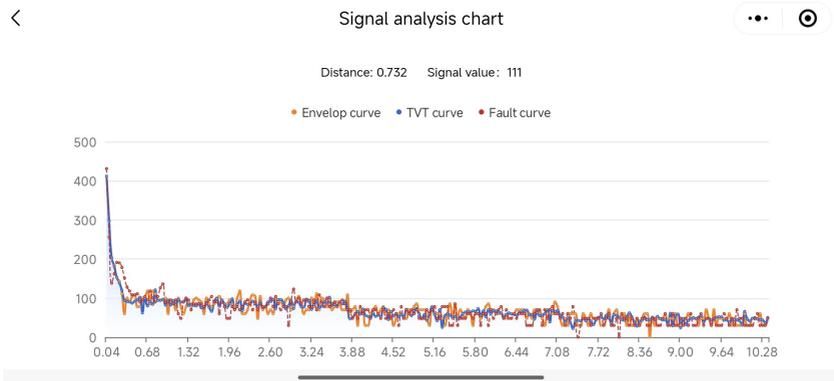
Fig.21 False echo learning

In the Included range mode of false echo, set the adjustment range between 2m~5m, the offset percentage to 10, and the offset value to 50. After making these adjustments, click button **New** to apply the new settings.
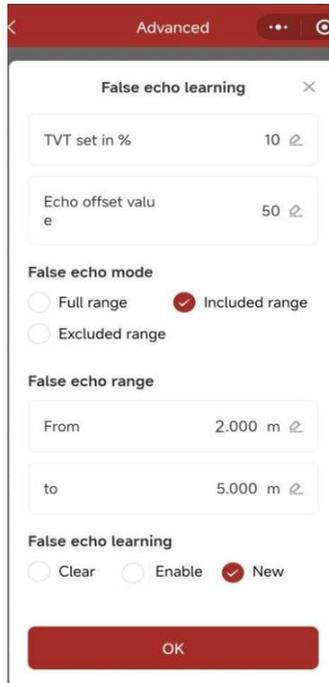
Fig.22 False echo learning

Click the **Echo curve viewer** again, and the value of the TVT curve at 2m~5m will obviously increase, as shown in the following figure:
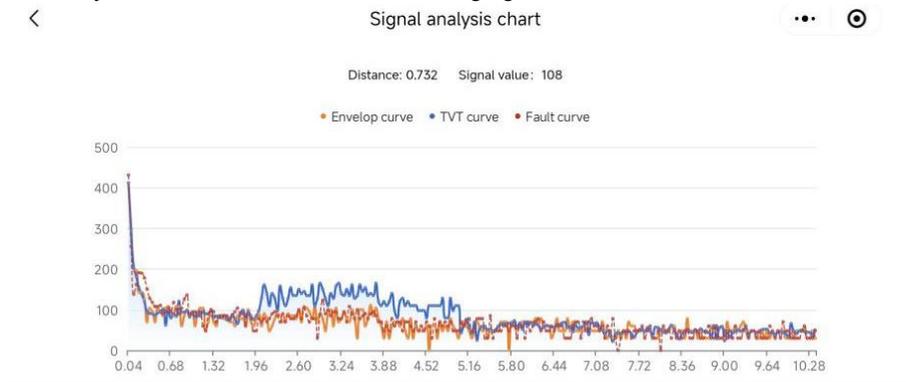
Fig.23 After false echo learning

7 Maintenance

This radar transmitter is highly advanced and requires a deep level of expertise. Thus, before use, a thorough reading of the user manual and related documents is necessary.

Usage precautions:

- Please strictly follow the guidelines of specs and use the power supply model that comes standard with the transmitter to avoid damage to the radar's mainboard and measuring accuracy.
- The radar shall be fixed and installed to avoid errors in measurement data caused by vibration during operation.
- Please carefully review the radar's specifications and parameters before use. Do not operate the radar beyond its specified range.
- Parameter configuration of this transmitter should be performed under the guidance of trained personnel.

8 Warranty & After-sales service

We promise that during the warranty period, any product with quality issues will be covered under our unconditional "Three Guarantees" service, which includes free repair, replacement, or return. All non-customized products are eligible for return or exchange within 7 days (excluding products damaged by misoperation). For customized products, the warranty terms will be based on the agreement specified in the contract.

Disclaimer:

During the warranty period, product malfunction caused by the following reasons are not in the scope of the "Three Guarantees" service:

(1)　Product malfunction resulting from improper use by customers.

(2)　Quality issues caused by disassembly, repairing, and refitting the product.

Appendix A Communication Protocol

A.1 Register address

Note: OR means only read; OW means only write; R/W means write and read.

Table 5 Communication parameters

Register address	Name	Data	Number of registers	Number of bytes	W/R	Description
0x1100	Address	uint8_t	1	2	W/R	1~247, 1 by default
0x1101	Baud rate	uint8_t	1	2	W/R	1 = 2400, 2= 9600 (by default), 3= 14400, 4= 19200 5= 38400
0x1102	Serial port	uint8_t	1	2	W/R	1= N81 (by default) 2 = N82, 3 = E81, 4 = O81 N: No verification E: Even parity O: Odd parity 8: Data bit 8 bits 1: Stop bit 1 2: Stop bit 2
0x1103	Data Format	uint8_t	1	2	W/R	0: 3-2-1-0 1: 2-3-0-1 2: 1-0-3-2 (by default) 3: 0-1-2-3

Table 6 Level register

Register address	Name	Data type	Number of registers	Number of bytes	W/R	Description
0x2000	Protocol version	uint16_t	1	2	OR	0x0200, 2.0 Protocol
0x2001	Device type	uint16_t	1	2	OR	Model: 0x0B01 means radar device WSR201
0x2002	Distance value	float	2	4	OR	Unit in m
0x2004	Reserved	float	2	4	OR	Reserved
0x2006	Ullage value	float	2	4	OR	Unit in m
0x2200	Error code	long	2	4	OR	Reserved
0x2302	Distance offset value	float	2	4	R/W	0.0 by default
0x240B	Filter coefficient	uint8_t	1	2	R/W	0~100 can be set, 0 by default, no filtering
0x2410	Restore to factory default	uint8_t	1	2	OW	Write 1 device to restore the factory default

Table 7 Level parameter register

Address	Register Name	Data Type	Number of registers	Number of bytes	R/W	Description
0x2500	Span	float	2	4	OR	0:10m 1: 5m 2: 15m
0x2502	Empty distance	float	2	4	R/W	Greater than the blocking distance, the default blocking distance is 0.145m
0x2504	Work Mode	uint8_t	1	2	R/W	0: Ullage mode 1: Distance mode
0x2505	4mA setpoint	float	2	4	R/W	The unit is m. When set to Distance mode, the current value represents the corresponding measured distance; When set to Level mode, the current value represents the corresponding level.
0x2507	20mA setpoint	float	2	4	R/W	The unit is m. When set to distance mode, the current value represents the corresponding measured distance; When set to Ullage mode, the current value represents the corresponding level.
0x2509	Output Current setting under abnormal conditions	uint16_t	1	2	R/W	0xfffc: Self-holding value 0xfffe: 21.0mA 0xfffd: 3.8mA
0x250A	Installation conditions	uint16_t	1	2	R/W	Large, medium, and narrow silos Rapid fill (solids only) Agitator vessel (liquid)

A.2 Error code

Table 8 Error Code

Error Code	Description
Bit 0	Configuration information storage error
Bit 1	Calibration information storage error
Bit 2	TVT curve storage error
Bit 3	Virtual curve storage error
Bit 4	Fault curve storage error
Bit 5	Calibration not completed
Bit 6-Bit 7	Reserved
Bit 8	Distance not calibrated
Bit 9	Reserved
Bit 10	Current not calibrated
Bit 11	Reserved
Bit 12	Reserved
Bit 13	Radar board communication error
Bit 14	Radar board measurement error
Bit 15	Reserved
Bit 16	Current calibration ON
Bit 17	Current simulation ON
Bit 18	Bluetooth module error
Bit 19	Power supply error
Bit 20	Current calibration data error
Bit 21	Distance calibration data error
Bit 22-Bit 31	Reserved