



# 80GHZ INTELLIGENT RADAR LEVEL TRANSMITTERS



**DANDONG VIRTUE RIVER TECHNOLOGY CO., LTD**

<http://www.v-river.com>



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## 1. Overview

### 1.1. Brief Introduction

80GHz radar level transmitter is a kind of high precision radar type water level measuring instrument, which use 80GHz millimeter radar wave as carrier signal. Based on the leading patented transducer technology and microsecond resolution ratio to achieve the millimeter-level measurement accuracy which makes the measuring results more accurate. Due to the high robustness, it will be not affected by any source of natural interference such as noise, dust, color, direct or diffuse light and, etc.

### 1.2. Working Principle

High frequency radar emits narrow microwave pulses which transmits down through the antenna. The microwave pulse will be reflected once it touches the surface of the measured medium (i. e the echo pulse), then such echo pulse will be received by the antenna system which will transmits these echo-pulse to electronic circuit section where they are automatically converted to water level signals. (Due to the tremendously fast velocity of the microwave transmission, the time for the microwave to take from reaching the target to returning the receiver via reflection is almost instantaneous.)

Note: When using the radar water level transmitter, must ensure that the highest water level could never enter the dead zone (refer to the area marked with E shown in Figure 1).

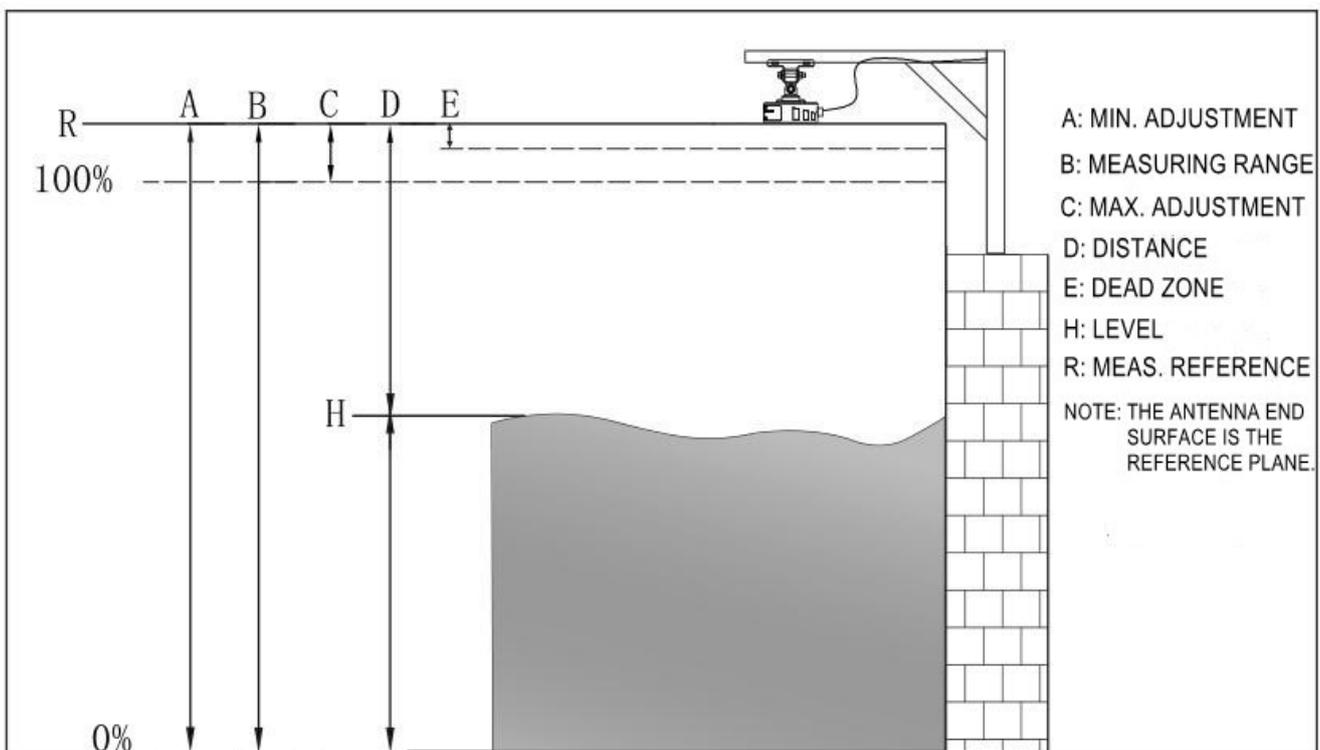


FIGURE 1: WATER LEVEL MEASUREMENT

### 1.3. Features

The radar level transmitter adapts the emitting frequency of 80GHz, which features as follows:

- Non-contact measurement, no abrasion, no contamination;
- Small antenna size, easy for installation;
- The beam angle is small, the energy is concentrated, the echo capability is enhanced, and at the same time, it is beneficial to avoid interference objects;
- Almost be unaffected by corrosion and foams;
- Almost be unaffected by changes of steam, temperature, and pressure in the atmosphere;
- High signal to noise ratio which makes the radar level transmitter achieve better performance even under wavy conditions.

### 2. Brief introduction

 <p>VRPWRD81HA</p>	<p>Features: Stable performance, with angle measurement function, equipped with a gradiener, small and light, easy installation, high precision, small beam angle, low power consumption, strong anti-interference capability, can be used for serial port debugging.</p> <p>Application: it is suitable for monitoring the level of the accumulated water on the roads in the low-lying areas or under bridges in a city; monitoring the water level in reservoirs, rivers, hydropower stations, monitoring water level in geological disaster and mudslides warning systems, and monitoring the water level in irrigation canals.</p> <p>Measuring range: 45m/85m</p> <p>Beam angle: 8°</p> <p>Accuracy: ±1mm</p> <p>Process connection: universal bracket</p> <p>Working temperature: -40 ~ +70℃</p> <p>Housing material: Aluminum</p> <p>Frequency: 80GHz</p> <p>Power supply: 6~30V DC</p> <p>Output: RS485 / Modbus</p> <p>Blueteech Setting: Optional</p> <p>Enclosure protection grade: IP68</p>
	<p>Features: stable performance, low power consumption, small beam angle, high precision, strong anti-interference capability, with angle measuring function, small and light, easy installation, can be used for serial port</p>

 <p>VRPWRD81HC</p>	<p>debugging</p> <p>Application: it is suitable for monitoring the level of the accumulated water on the roads in the low-lying areas or under bridges in a city; monitoring the water level in reservoirs, rivers, hydropower stations, monitoring water level in geological disaster and mudslides warning systems, and monitoring the water level in irrigation canals.</p> <p>Measuring range: 45m/85m</p> <p>Beam angle: 6°</p> <p>Accuracy: ±1mm</p> <p>Process connection: M66*2 thread / flange / bracket</p> <p>Working temperature: -40 - +70°C</p> <p>Housing material: ABS</p> <p>Frequency: 80GHz</p> <p>Power supply: 6 - 30V DC</p> <p>Output: RS485 / Modbus</p> <p>Bluetooth setting: Optional</p> <p>Enclosure protection grade: IP68</p>
 <p>VRPWRD81H</p>	<p>Features: Antenna integrated with a lens, small dead zone, high precision, easy installation.</p> <p>Application: Measuring water level in reservoirs, hydropower stations and rivers.</p> <p>Measuring range: 85m/120m</p> <p>Beam angle: 3°</p> <p>Accuracy: ±1mm</p> <p>Process connection: G3 1/2" thread / T- bracket</p> <p>Working temperature: -40 - +70°C</p> <p>Frequency: 80GHz</p> <p>Power supply: 6 - 30V DC</p> <p>Output: RS485 / Modbus</p> <p>Bluetooth Setting: Optional</p> <p>Enclosure protection grade: IP67 for plastic; IP68 for Aluminum</p>

### 3. Installation

Please pay attention to the following matters to ensure the correct installation of the instrument:

- ◆ Reserve enough space for installation;

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- ◆ Avoid the mounting place from strong vibration;
- ◆ When mounting the instrument, avoid any obstacle in the path of signal transmission;
- ◆ Ensure that the highest water level won't enter the measuring dead zone under any circumstance.

### 3.1. Installation Position

Calculate the length of the mounting bracket according to the beam angle and height of the water level instrument. The min length is 200mm. Please refer to the beam angle data on page 13-14.

### 3.2. Installation on a Pole

Water level measurement of the rivers with VRPWRD81HA

See the figure 3 below

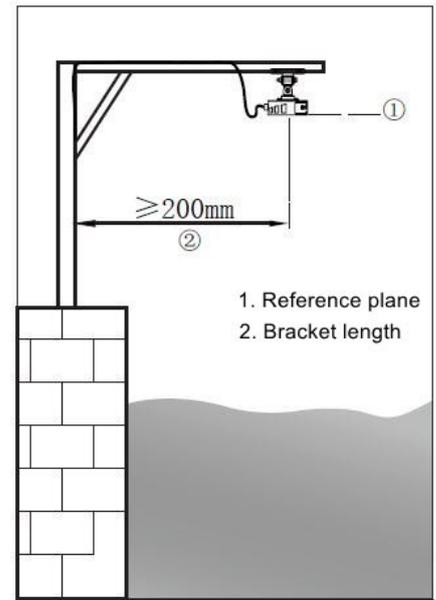


Figure 2. Mounting Position

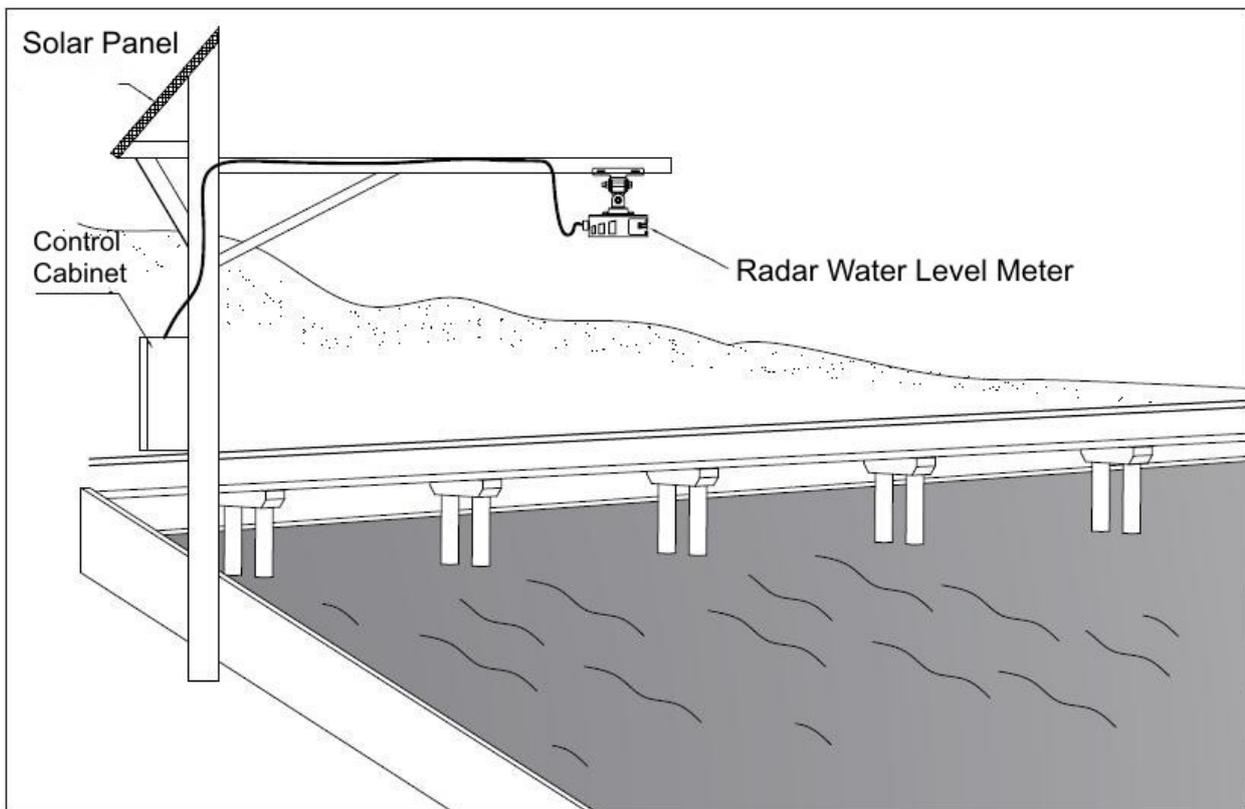


Figure 3

Water level measurement of the irrigation canals with VRPWRD81HC

See the figure 4 below

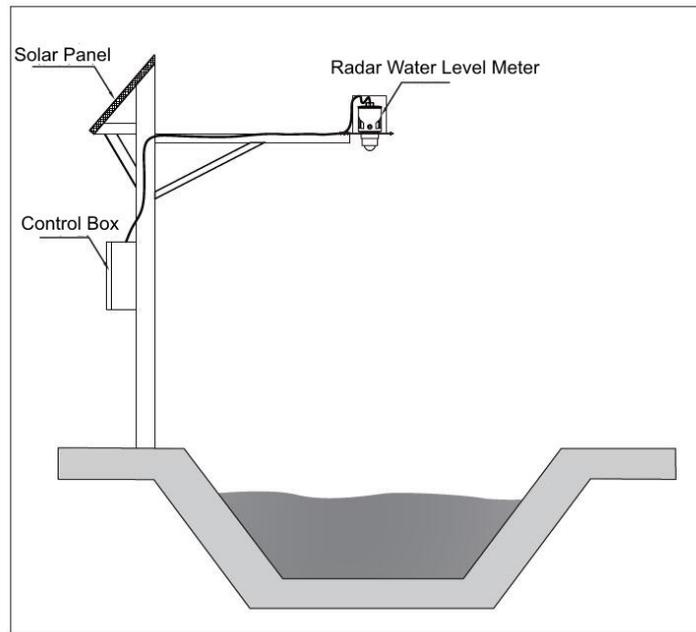


Figure 4

Water level measurement of the reservoirs with VRPWRD81H

See figure 5 below

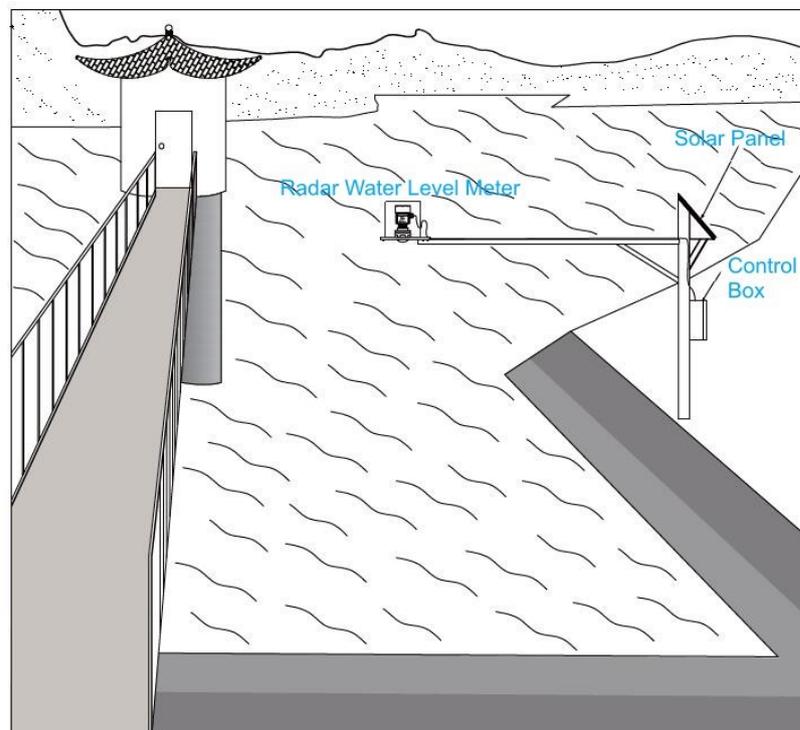


Figure 5

### 3.3. False Echo Storage

If there is any obstacle in the radiated area of the emitted signal beam, such as a step of well wall which will cause the interference the signal transmission, this will result in measurement error.

When this is the case, there will be necessity to create a new false echo storage to remove the interference, and keep the normal measurement.

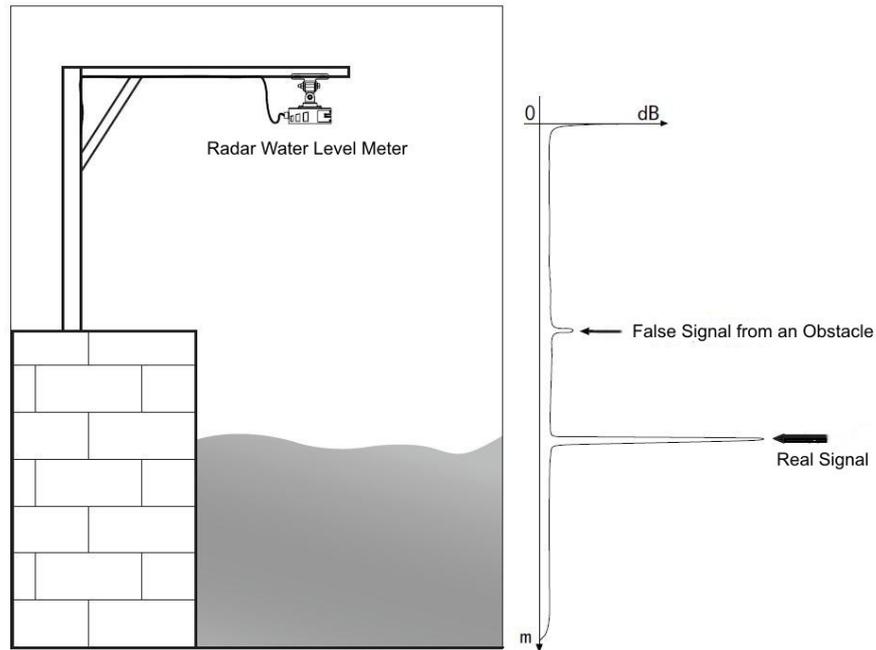


Figure 6

To get a normal echo from actual water level, the function of False Echo Storage can be used to create an envelope to cover all the false echoes caused by the obstacles from the reference point to the echo peak of the actual target signal to get the normal echo from the actual water level.

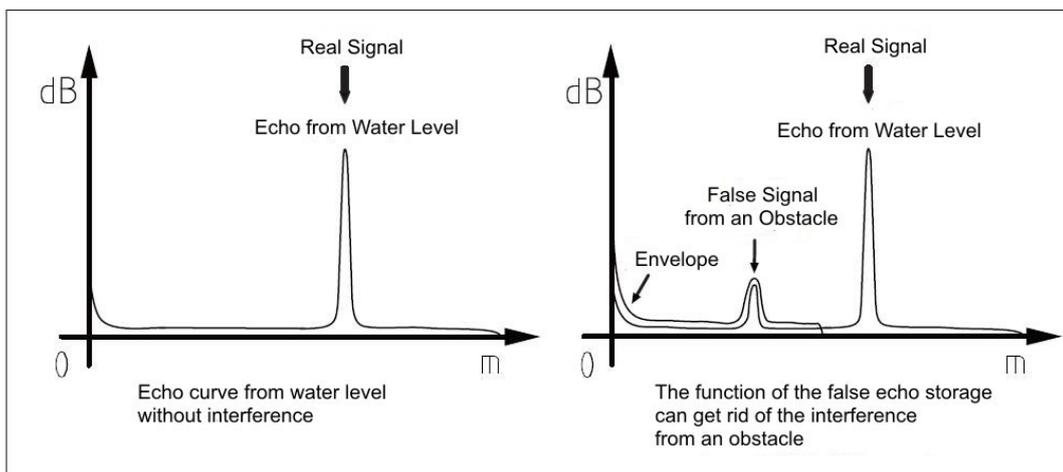


Figure 7. False Echo Storage

### 3.4. Zero Echo Processing

The comparison of the echo curve before and after the Zero Echo Processing

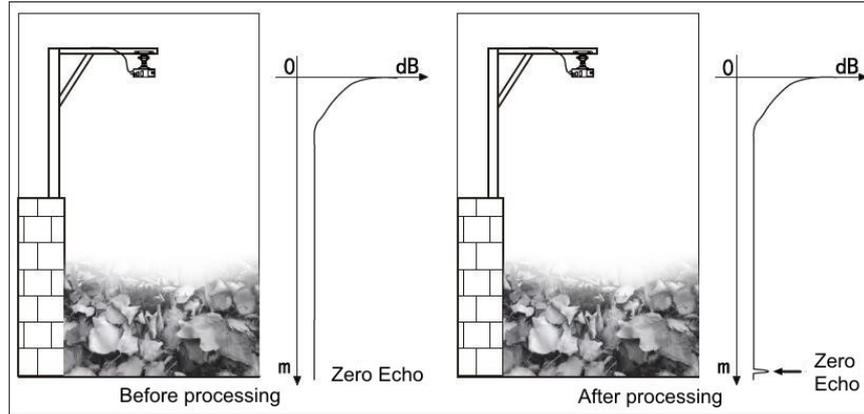


Figure 8. Zero Echo Processing

## 4. Electrical Wiring

### 4.1. Power supply / communication

Power supply: 6 - 30V DC

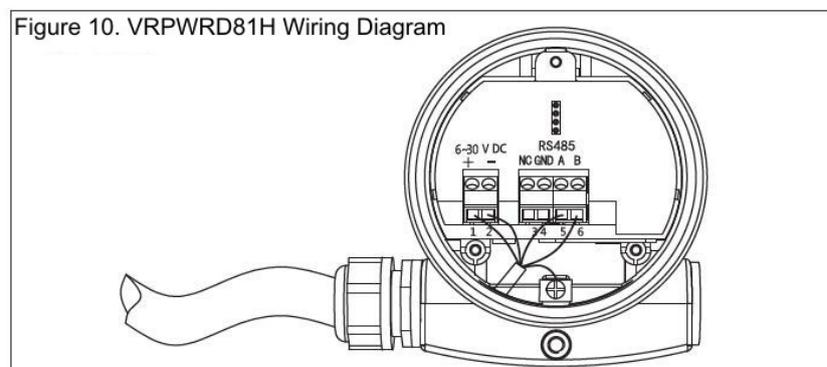
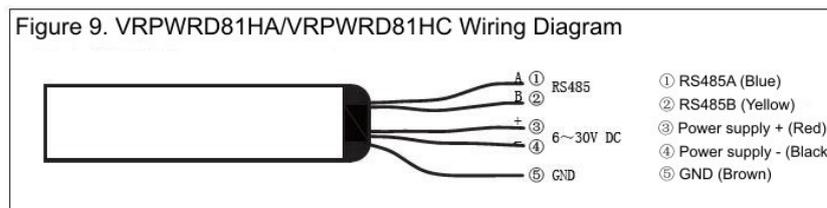
Communication: RS485 / Modbus communication protocol

### 4.2. Cable connection

Refer to the technical parameter on page 7.

Note: wiring generally adopts five-core cables. Since there possibly is the electromagnetic interference caused by electric driving equipment, power lines or remitting devices, therefore, the shielded cables should be used.

### 4.3. Wiring methods



### 4.4. Safety guidance

- All electrical connections must be made under the condition of power off. Please follow the <http://www.v-river.com>, Tel.: +86 – 415 – 6199871, E-mail: [daidsong@v-river.com](mailto:daidsong@v-river.com)



instructions in the instrument manual.

- Please follow the requirements of local electrical installation codes for instrument wiring.
- Follow the requirements of the local regulations on the operating personnel's health and safety. All operations of the electrical components of the instruments must be operated by the properly trained professionals.
- Please check nameplate of the instrument to ensure the product specifications meeting your requirements. Please make sure the power supply you use is in accordance with the one required on the nameplate.

## 5. Technical Specifications

Model No.		VRPWRD81HA	VRPWRD81HC	VRPWRD81H
General Data	Max. measuring range	45m/85m	45m/85m	85m/120m
	Dead zone	≤0.2m	≤0.1m	≤0.1m
	Working frequency	80GHz		
	Corresponding delay	About 1s (depend on settings)		
Electrical Parameter	Power supply	6~30V DC		
	Communication	RS485 Modbus protocol		
	Ripple allowed	<100Hz		U <sub>ss</sub> <1V
		(100~100K) Hz		U <sub>ss</sub> <10mV
Cable	Cable entry/plug	Insulated cable Cable diameter is 6mm	PG9 Cable diameter is 6mm	M20*1.5 Cable diameter is 7~9mm
Mechanical Features	Process connection	Universal bracket	M66*2 thread/bracket	G3½"A thread/T-bracket
	Encl. protection grade	IP68	IP68	Plastic: IP67 Aluminum: IP68
	Housing material	Aluminum	ABS	Plastic/Aluminum
	Antenna material	ABS	ABS	ABS
Ambient Environment	Storage & transport T	(-20 ~ +60)°C		
	Working temperature	(-40 ~ +70)°C		
	Relative humidity	<95%		
	Vibration resistance	Mechanical vibration 10m/s <sup>2</sup> , (10~150) Hz		

## 6. Calibration

### 6.1. Serial communication calibration



Hardware interface: RS485

Communication protocol: Modbus

Baud rate: 9600 (can be adjustable)

Data format: 8N1(can be adjustable)

Check CRC16: multinomial A001

### 6.1.1. Information frame format and description

The command format of the host consists of slave address, function code, register starting address, read points and CRC codes, which are shown in Table 1.

Host sends	Station Number (1B)	Function Code (1B)	Register Start Address (2B)	Read Points (2B)	CRC (2B)
	01	03	00 XX	00 XX	00 XX
	Station Number (1B)	Function Code (1B)	Register Start Address (2B)	Read Points (2B)	CRC (2B)
	01	06	00 XX	XX XX	XX XX

Table 1. Host Command

### 6.1.2. The detailed description of host commands

- ◆ Station number: Salve address (0-99);
- ◆ Function code: 03 means reading the value of the register address; 06 means changing the value of the register address;
- ◆ Register starting address: two bytes, refer to Table 3 for details;
- ◆ Read points: Two bytes. Set it into 0001 when read 16-bits integer data; set it into 0002 when read 32-bits integer data;
- ◆ Store data: Two bytes. Converting the stored data to hexadecimal with high bytes come first and low bytes follow behind;
- ◆ CRC: Check code, two bytes;

There are two salve responding formats: when the function code is 03, the format consists of station number, function code, data length, data section and CRC code as shown in Table 2; When the function code is 06, the format is the same as host command frame as shown in Table 1, i.e repeating the command sent from the host.

Salve Responding	Resting Stage	Station No (1B)	Function Code (1B)	Length of Returned Data	Data (nB)	CRC (2B)
	T1 T4	01	03	n	XX XX XX XX	XX XX XX XX

Table 2. Salve Responding

- ◆ Station No (address): One byte, return the address sent by the host;



- ◆ Function code: One byte, return the function code sent by the host;
- ◆ Response data bytes number: The data bytes number that follow;
- ◆ Data: the corresponding data returned according to host command, the high byte comes first and low byte follows behind;
- ◆ CRC: Check code, two bytes;

Detailed description of register address: the data in registers 0x0000~0x0003 are signed integer data, and are currently measured value; 0x0010 indicates the current status of the instrument which stands for whether there is any fault; 0x0011~0x0014 refers to the installation range, dead zone, zero point and full point of the water level of the slave.

Register Address	Description (non-continuously reading)
0x0000	Read the current distance value of the instrument in cm (read only)
0x0001	Read the current distance value of the instrument in mm (read only)
0x0002	Read the current water level value of the instrument in cm (read only)
0x0003	Read the current water level value of the instrument in mm (read only)
0x0010	Read measuring status (read only); “==0” is normal; “>0” means that there is an error
0x0011	Slave measuring range in cm (read only)
0x0012	Slave dead area in cm (read only)
0x0013	Slave low position adjustment in cm (read only)
0x0014	Slave high position adjustment in cm (read only)

Table 3 Register Address Specification

### 6.1.3. Examples

- ①. Read the water level value of the instrument in mm

Data sent by the host: 01 03 00 03 00 01 CRC16/01 03 00 03 00 02 CRC16

Response of the instrument: 01 03 02 XX XX CRC16/01 03 04 XX XX XX XX CRC16

- ②. Change the instrument's parameter to turn the measuring range into 10m (1000mm)

Date sent by the host: 01 06 00 11 03 e8 xx xx

Response of the instrument: 01 06 00 11 03 e8 xx xx, this indicates that the change is successful; When the return value is different, it means that the change is unsuccessful or the pre-set data exceeds the limit.

### 6.1.4. Examples of communication protocol

Command sent by the host when water level and distance are read under different station number addresses:



Station No.	Function Code	Starting Address	Read Points	Check Code	Meaning
01	03	0000	0002	c40b	Read the distance in cm
01	03	0001	0002	95cb	Read the distance in mm
01	03	0002	0002	65cb	Read water level value in cm
01	03	0003	0002	340b	Read water level value in mm
02	03	0000	0002	C438	Read the distance in cm
02	03	0001	0002	95f8	Read the distance in mm
02	03	0002	0002	65f8	Read water level value in cm
02	03	0003	0002	3438	Read water level value in mm
03	03	0000	0002	c5e9	Read the distance in cm
03	03	0001	0002	9429	Read the distance in mm
03	03	0002	0002	6429	Read water level value in cm
03	03	0003	0002	35e9	Read water level value in mm
04	03	0000	0002	c45e	Read the distance in cm
04	03	0001	0002	959e	Read the distance in mm
04	03	0002	0002	659e	Read water level value in cm
04	03	0003	0002	345e	Read water level value in mm

Table 4. Communication Protocol Examples

## 6.2. The PC Setting Software

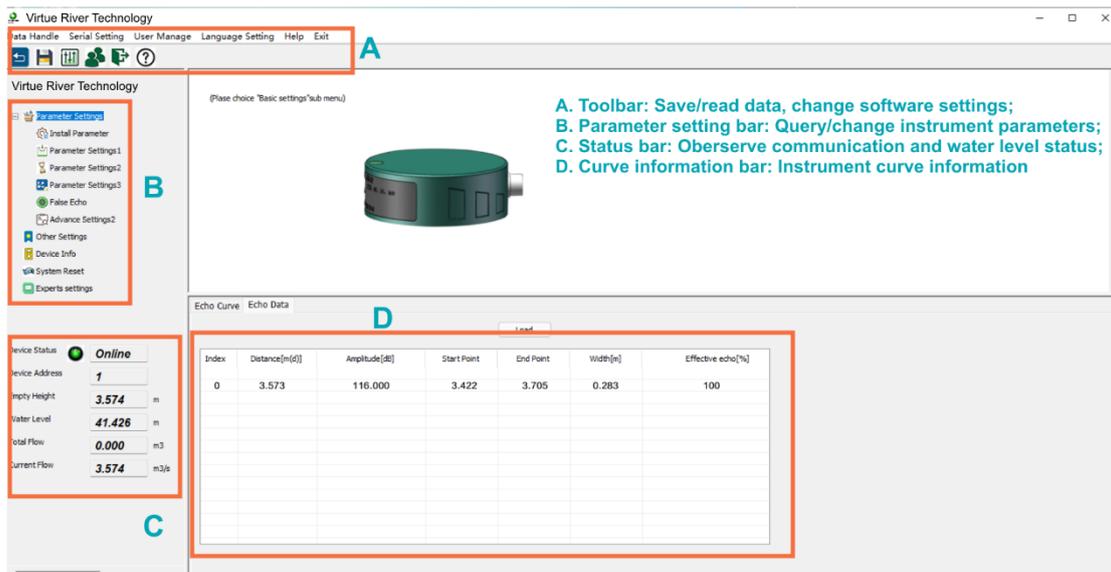
The parameters of radar flowmeter can be configured, adjusted, and diagnosed by the PC software

### 6.2.1. Log in on the PC software

After installing the PC software, enter the user name and password, you can log in the PC software.

### 6.2.2. The interface of the PC software

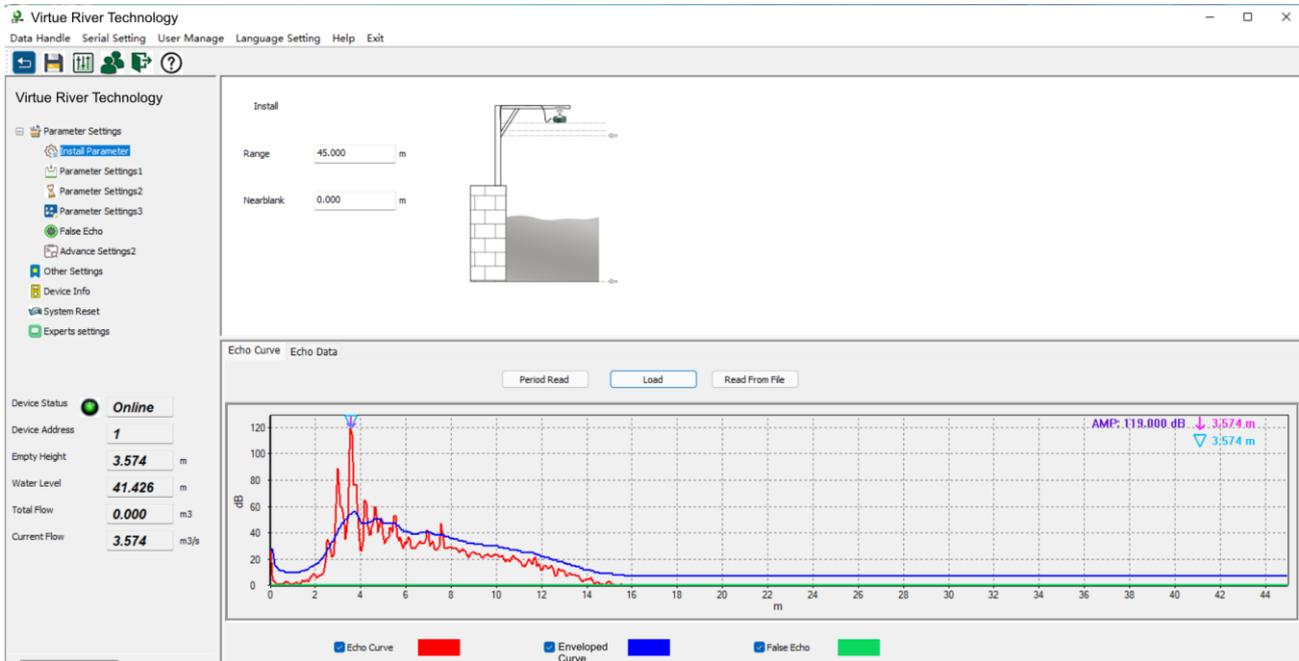
After the communication is successfully connected, the parameter setting page is displayed. The interface has toolbar, parameter setting, status indicator, measurement curve, echo data and other information. The information in the status bar is updated in real time. Other information needs to be manually read, or be manually saved after change, A dialog box is displayed after the parameters are successfully read or saved. The interface is shown as the figure below:



Setting Software Interface

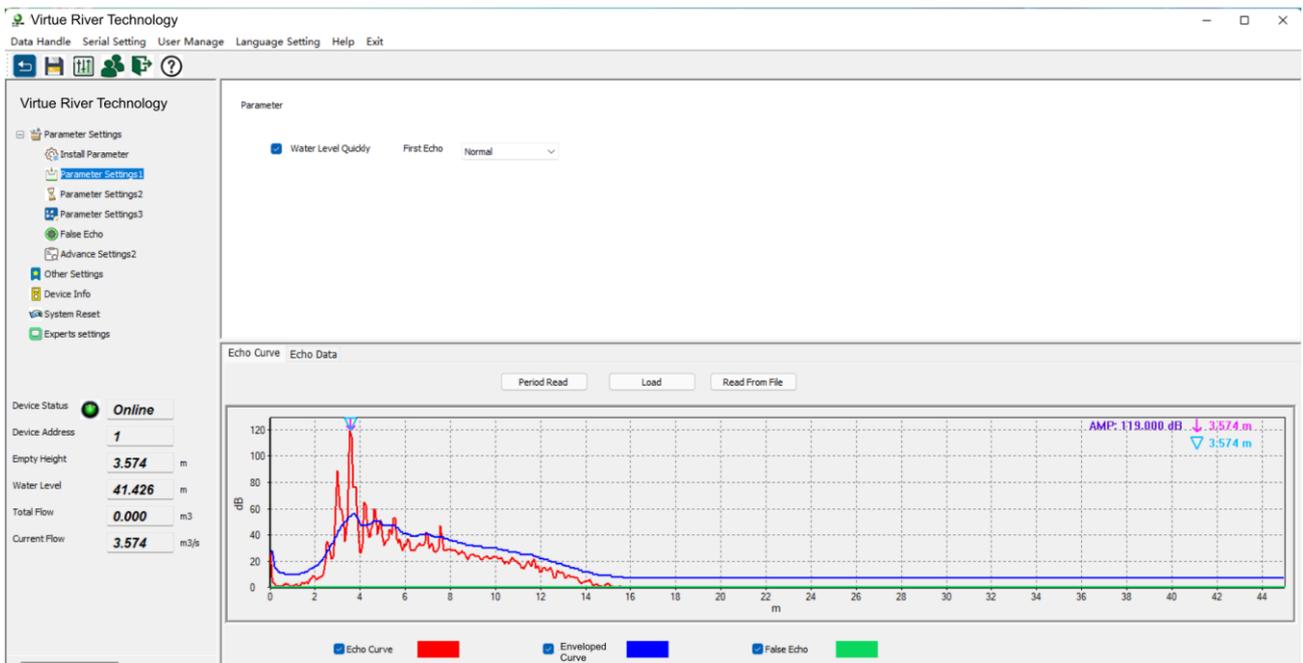
### 6.2.3. Parameter configuration

◆ The following interface shows the installation parameters. Set parameters based on the onsite installation. The interface is shown as follows:



Parameters for Installation

◆ The interface below shows parameter setting 1 and echo curve. The interface is shown as follows:

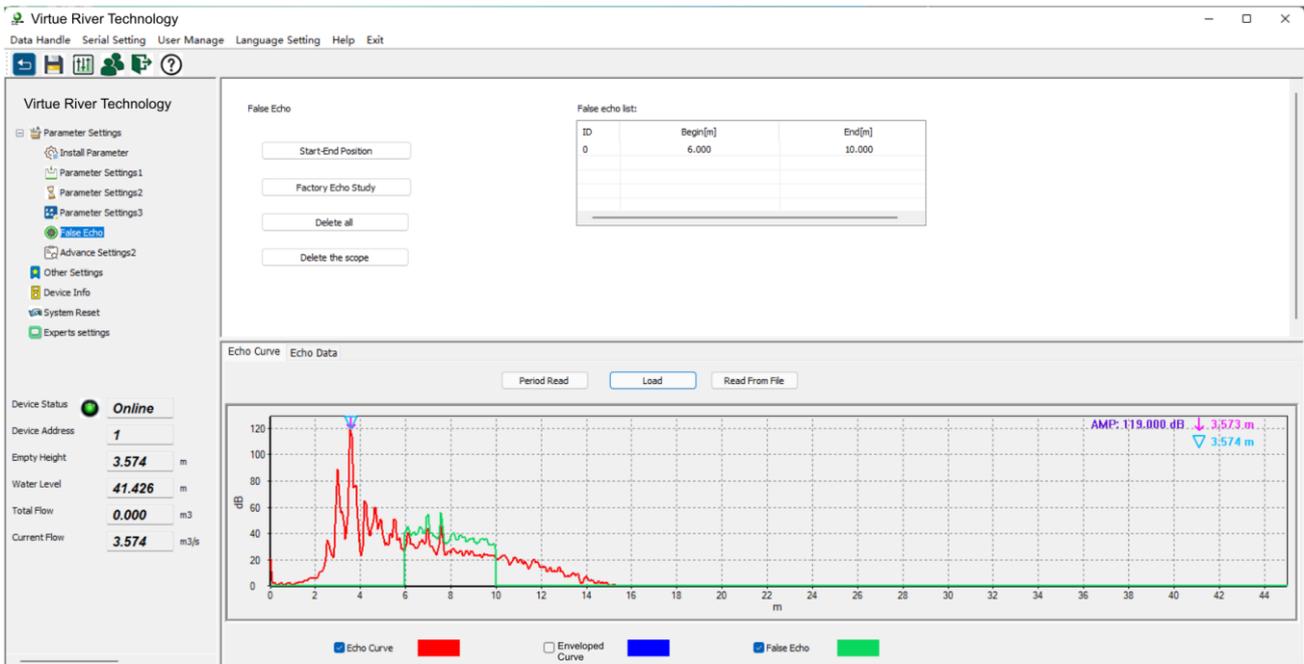


Parameter Setting 1



### 6.2.4. False echo storage function

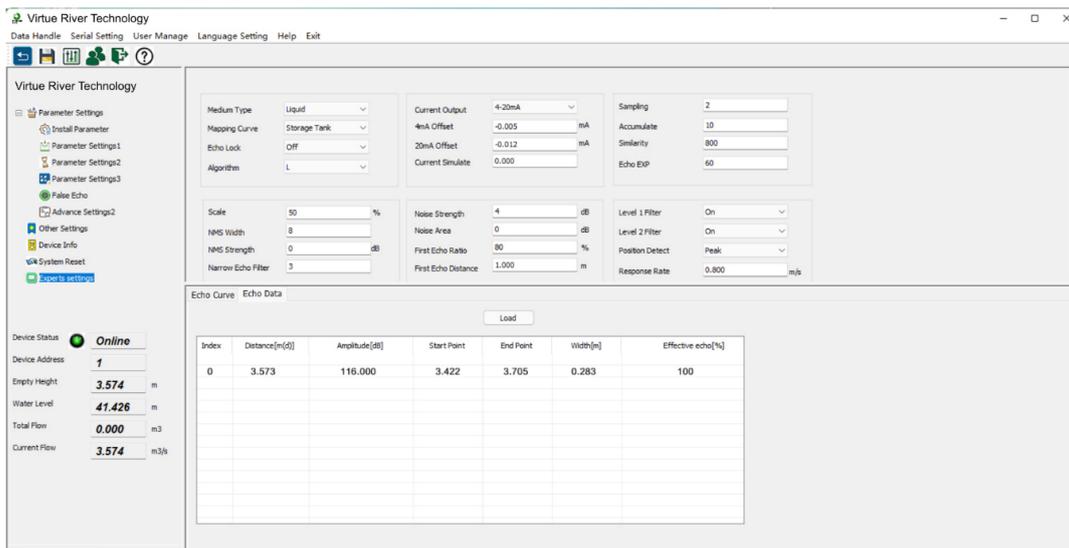
Read the echo curve of the instrument and establish the false echo storage, the interface is shown as follows:



False Echo Storage

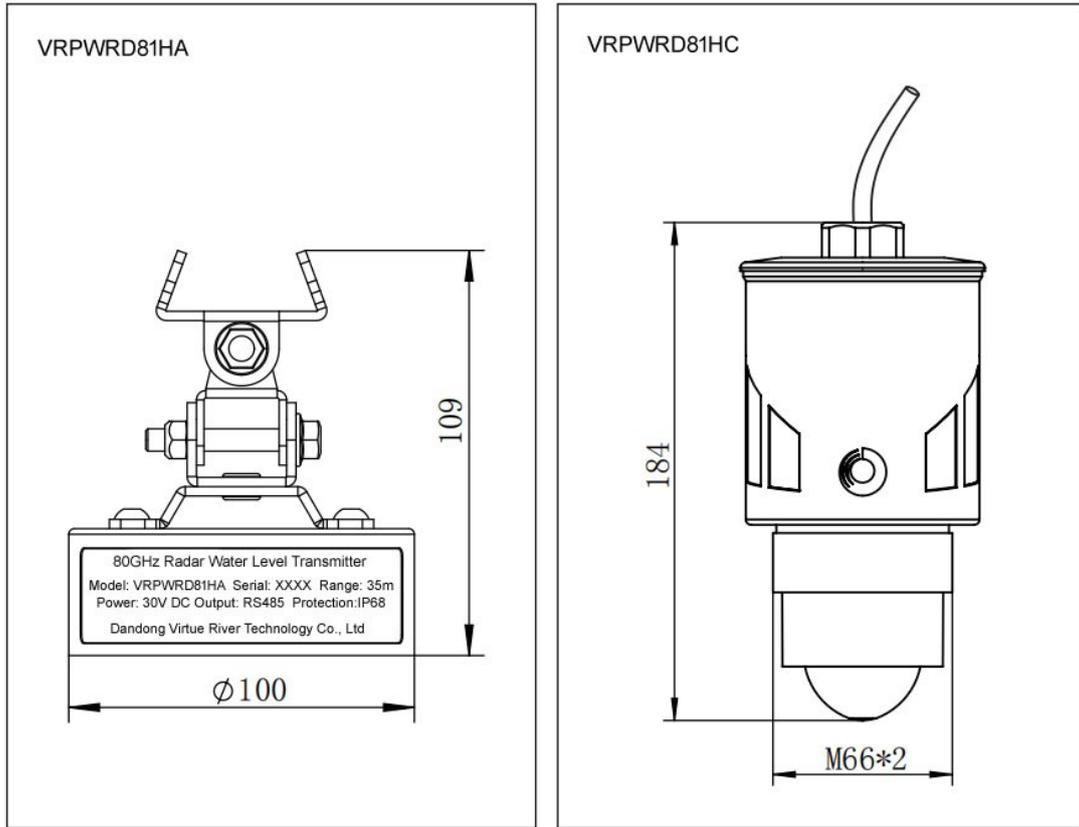
### 6.2.5. Expert setup

More specialized functions are included in the Expert Settings Interface for being used by the trained personnel. There are mainly the functions, which respectively are original accumulation, first level filtering, second level filtering, echo index, no-extreme value suppression, narrow wave filter, window setting, sampling and so on. The interface is shown as follows:

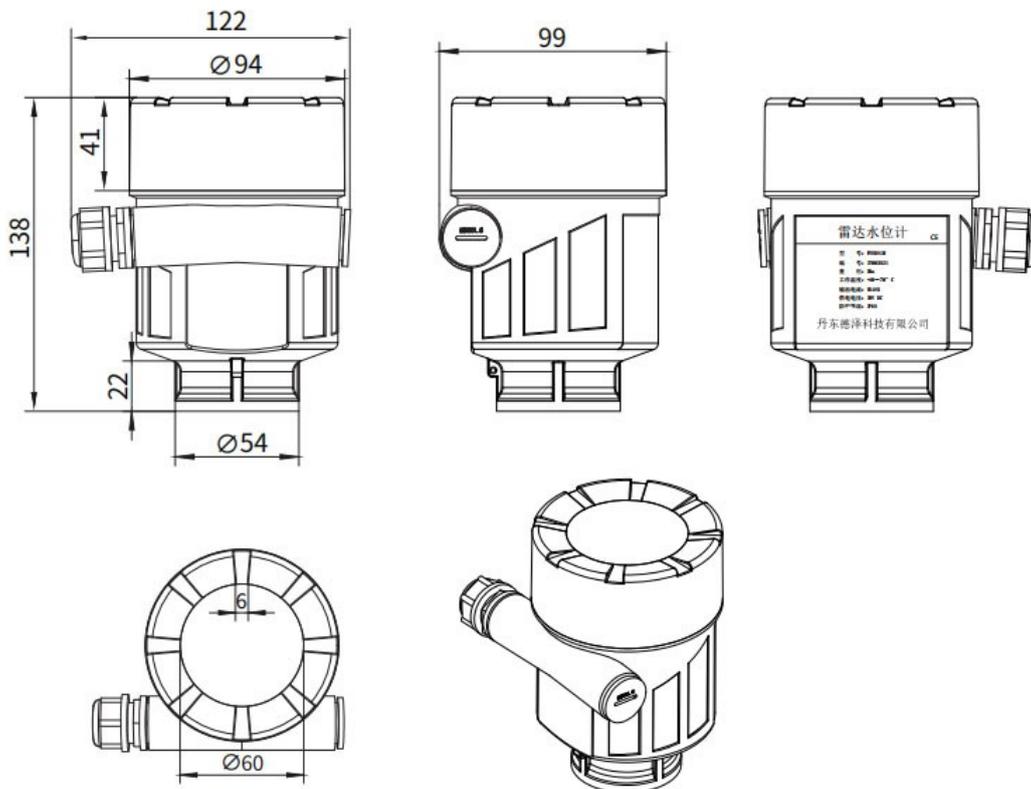


Expert Setting

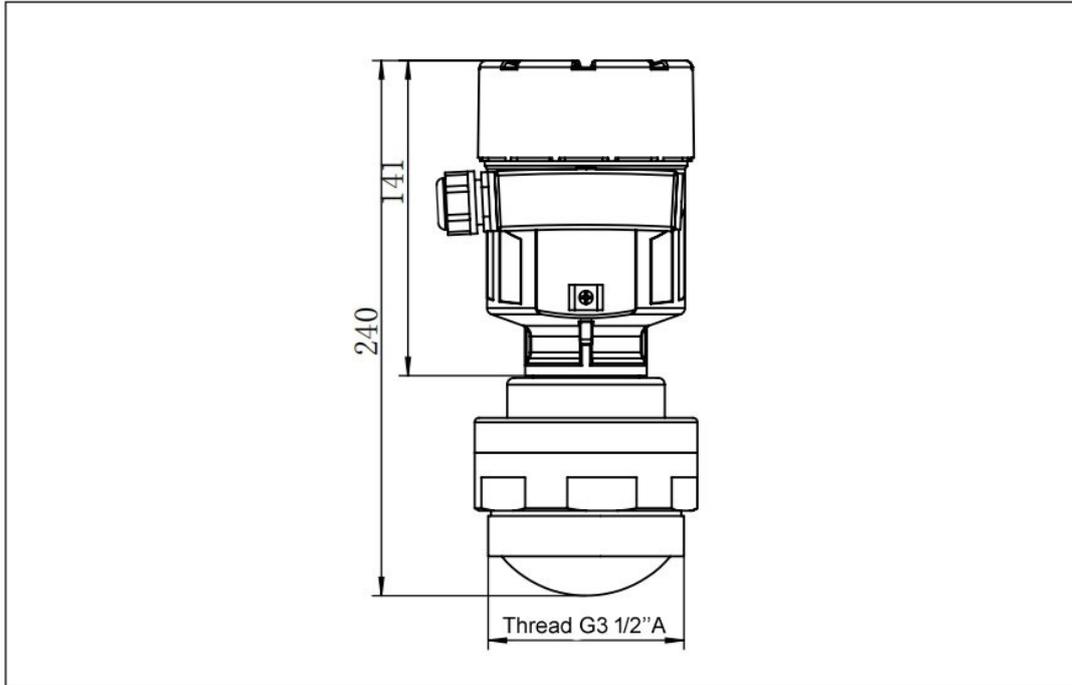
7. Structure and Dimensions (unit: mm)



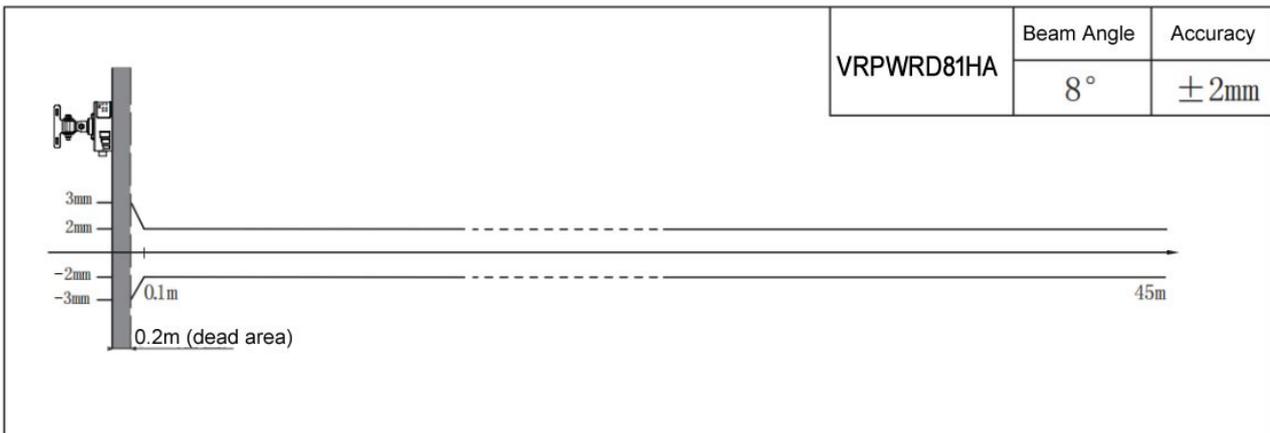
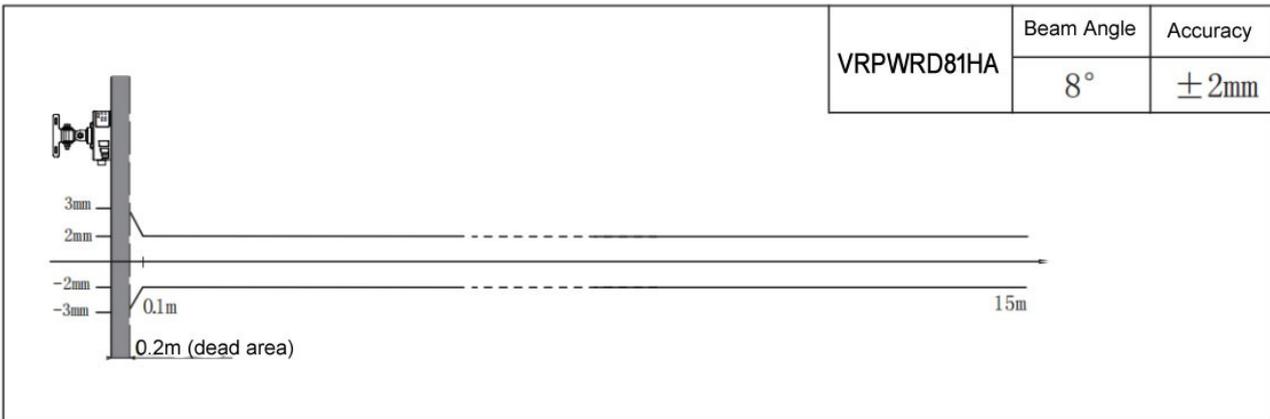
VRPWRD81H Housing Dimensions (material: plastic)

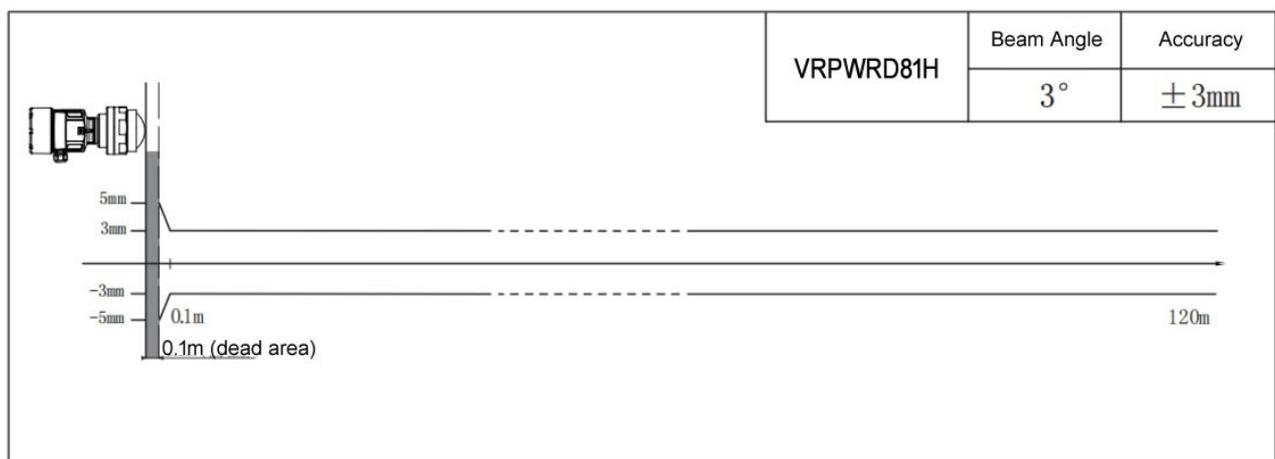
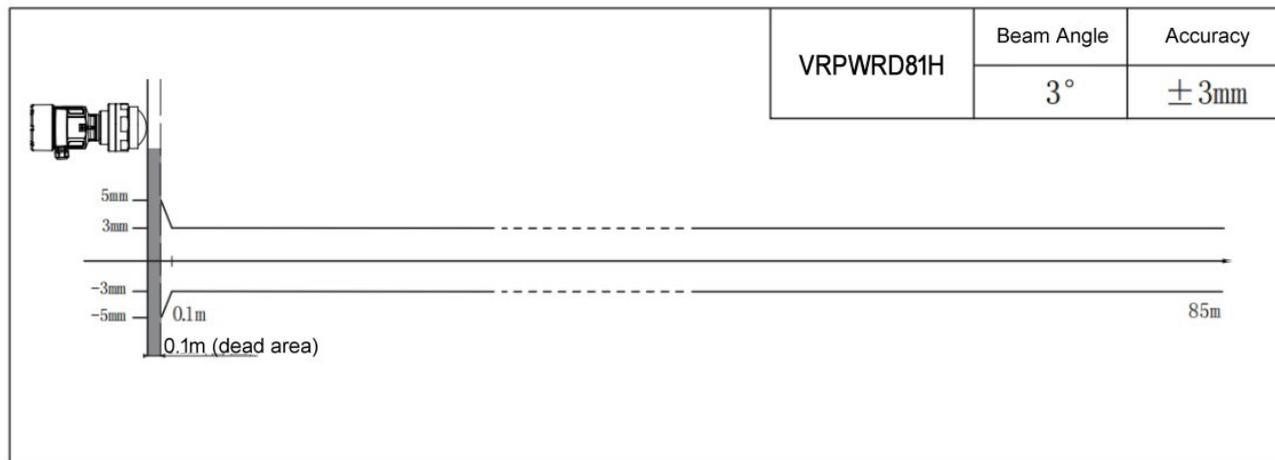
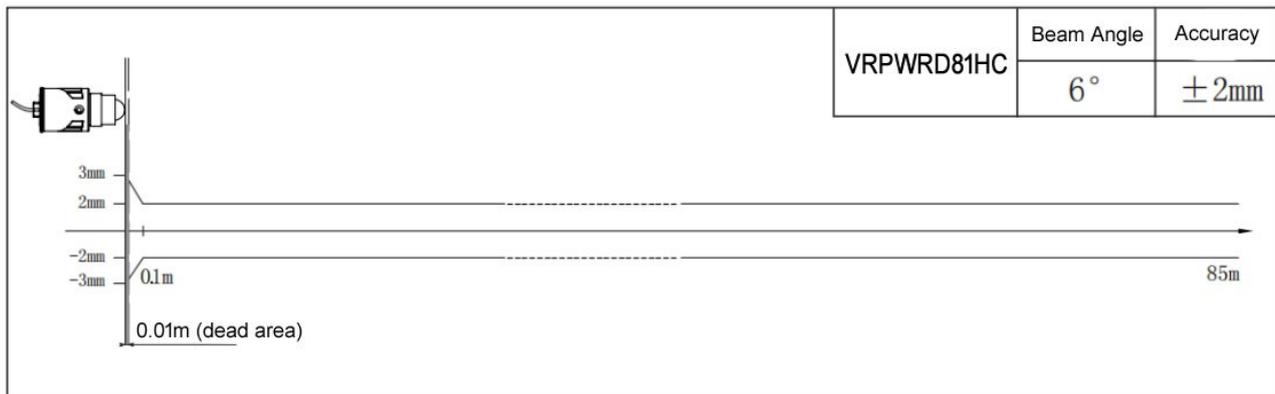
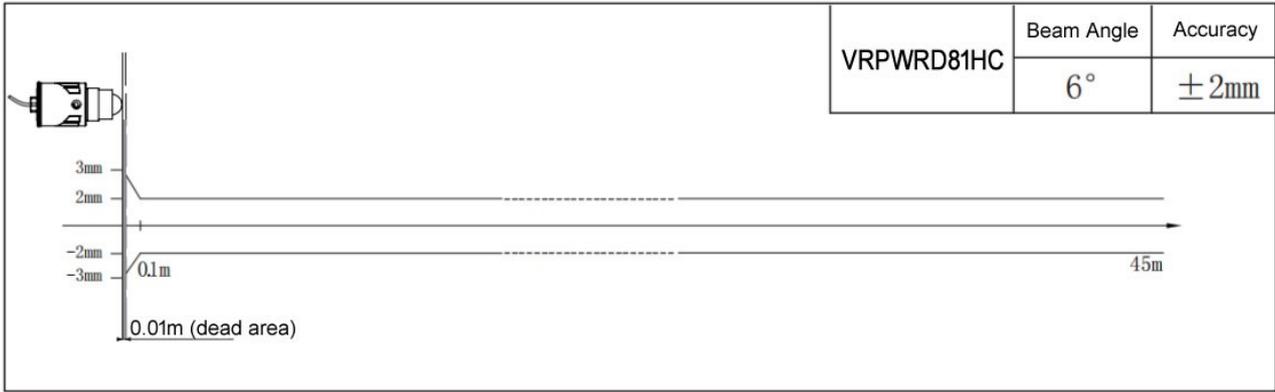


VRPWRD81H Outline Dimensions



8. Linearity and Beam Angle

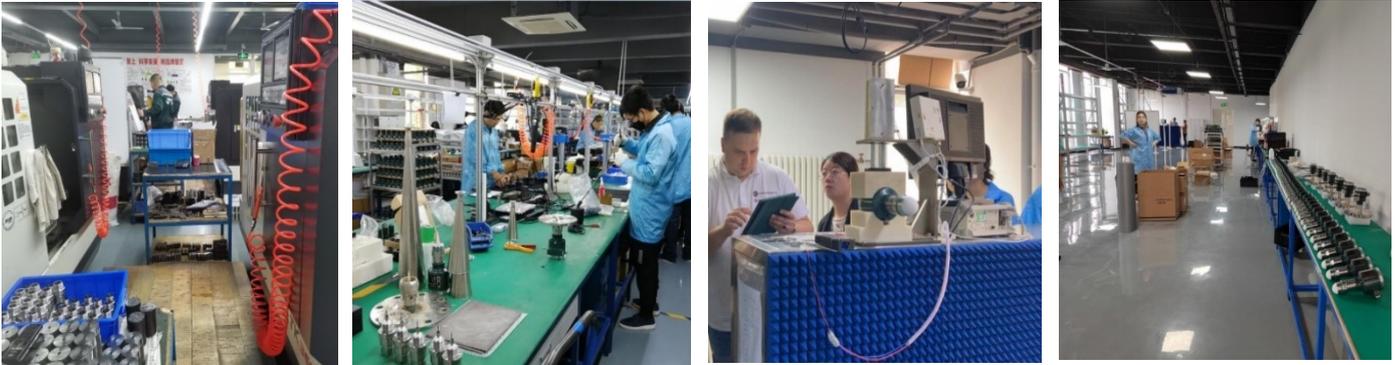




## 9. Transportation and Storage

The transportation and storage conditions of this series of radar water level transmitters should meet the following regulations in addition to the regulations of the standard JB/T9329:

- ①. During transportation, these water level gauges should be transported strictly according to the characteristics of the products and the requirements of their manual.
- ②. The water level meter should be stored in the dry and ventilated room with the ambient temperature of (-20 ~ +60)°C and the relative humidity of no more than 80%. Please keep the instrument away from any corrosive substance. Those instruments that have been stored for a long time should be tested before sold or used.





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Dandong Virtue River Technology Co., Ltd

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辽宁省丹东市沿江开发区滨江中路 132 号太阳世纪广场 B 栋 1801 室

R.M.1801, Building B, Solar Century Plaza, No. 132, Binjiang Road (M.S.),

Riverside Development Zone, Dandong City, 118002, Liaoning Province, P. R. China

Tel.:+86-415-6199 871, Fax:+86-415-3118 579, [davidsong@v-river.com](mailto:davidsong@v-river.com)