Integrated 80Ghz Radar Level Sensor

Manual Book(Ver: 2.1)

SK-R800E

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

To satisfy RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation.

To ensure compliance, operations at closer than this distance is not recommended.

Catalogue

1. Warranty and service scope of radar level sensor

The warranty period of the radar level sensor is one year from the date of delivery. This warranty is only limited to the users of the original buyer or the designated dealer, and does not apply to users who use it wrongly due to human reasons, transform, neglect or damage it due to accidents and abnormal use.

For the faulty radar level sensor returned within the scope of warranty, free maintenance will be provided. To obtain warranty service, please contact the after-sales service department and attach the fault description. With the permission of our company, send the radar level sensor to the after-sales service department.

If the radar level sensor has expired the warranty period or it is confirmed that the failure is caused by misuse, modification, negligence, accident and abnormal conditions, the maintenance cost budget will be provided according to the relevant maintenance charge standard, and the maintenance will be carried out after it is approved. After the radar level sensor is repaired, it is sent back to the customer, and the customer needs to pay the maintenance and transportation costs.

2. Unpacking inspection and precautions

2.1 Unpacking inspection

- Instruction manual
- Certificate of conformity
- Packing list
- Radar Level Sensor
- Check the name, model and other contents on the nameplate
- Check whether the radar sensor housing is intact and observe
- Check the random items against the packing list
- Check whether the specifications, models and accessories are correct and complete according to the packing list of the radar level sensor. If there is any problem, please contact the customer service center in time for replacement.

2.2 Precautions

- Please check this manual before installing the radar level sensor.
- Modifications due to product upgrading are subject to change without notice. Please refer to the real object.

3. Storage and transportation

3.1 Storage conditions

- Temperature：–40℃ ～ +70 ℃ Better use the original packaging

3.2 Transport the product to the measuring place

- Use the original packaging to transport the radar sensor to the measuring

place.

- Collision, dampness and chemical erosion shall be prevented during transportation and storage.

4. Product introduction

4. 1 Product Overview

76-81Ghz frequency modulated continuous wave (FMCW) radar products (also known as millimeter wave radar) adopt the millimeter wave band with higher frequency than Ku-band radar. For important applications in long-range target detection, long-range imaging, multi-spectral imaging in strong smoke and dust environment, and can detect smaller targets than microwave radar and achieve more accurate positioning, with higher resolution and stronger confidentiality.

As a 80GHz band radar used in the field of industrial measurement, high-precision, non-contact level & liquid level measurement has incomparable advantages over other ordinary microwave pulse radars and guided wave radars. With extremely narrow beam and penetration ability, it can adapt to ultra complex working conditions better without weakening the measurement performance.

4.2 Technical parameters

Working Principle	FMCW
Working frequency band	76-81GHz
Power supply	Two-wire DC 24V (22V~30V)
Signal output	4～20mA
Applications	Water treatment, open-channel, river, lake, lift-stations...
Range	0～30m
Communication	Modbus/Bluetooth
Bluetooth parameters	BLE5.1
Output signal	Rs-485
Ambient temperature	-25℃～+60℃
Storage temperature	-40℃～+70℃
Ambient humidity	（0%～95%）RH
Process pressure	-1~3ba
Sizes	ϕ83mm×127mm
Mounting thread	G1.5”
0Accuracy	±0.02%FS
Migration(Offset)	±9.9m
Display	No display module, mobile phone APP - “RadarMe”
Beam Angle	±4°
Lens	PP
Debugging Methods	Mobile App (connect via Bluetooth), PC programme
Standard Accessories	1 m connecting cable
Optional Accessories	Mounting bracket/Mounting nuts
Protection	IP67
Sealing material	FKM
Housing	PP

4.3 Applications

4.3.1 Measured medium

In general, the dielectric constant of the measured medium is required to be greater than 4, so that it can have a good reflection cross section.

4.3.2 Ambient temperature of radar level sensor

The ambient temperature range of radar level sensor is: -25 ℃ ~ +60 ℃.

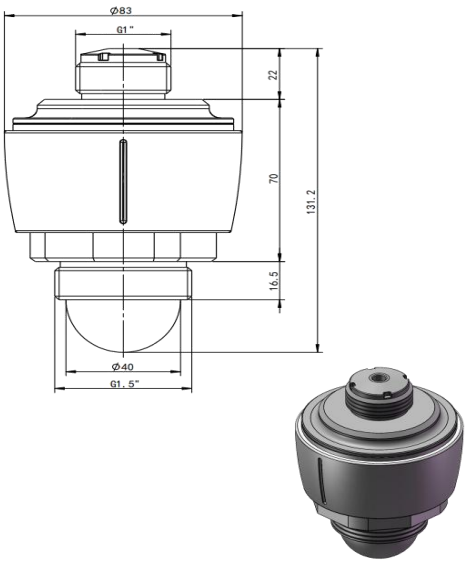
In areas with strong sunlight, it is recommended to install the instrument in a cool place or use a sunshade, which can not only avoid the excessive temperature in the instrument caused by exposure to the sun, but also provide good ventilation and heat dissipation.

4.3.3 Protection grade

Waterproof and dust proof grade: IP67.

5. Outline structure of radar level sensor

5.1 Outline structure diagram



P1. diagram for sizes & appearance structure

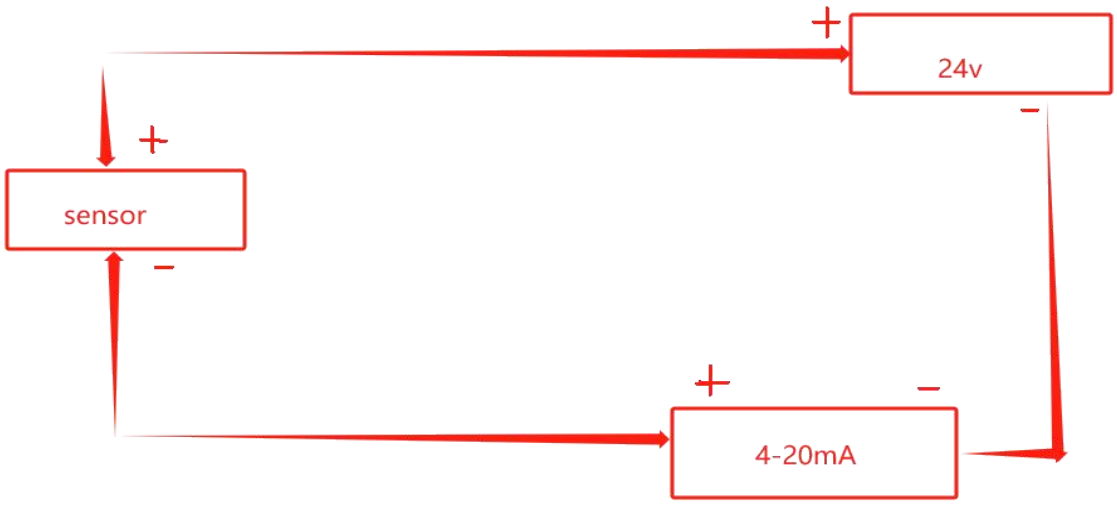
6. Terminal block of radar level sensor

The radar level sensor leads out two power cables, the red one is connected to the positive pole of the power supply, and the blue one is connected to the negative pole of the power supply.

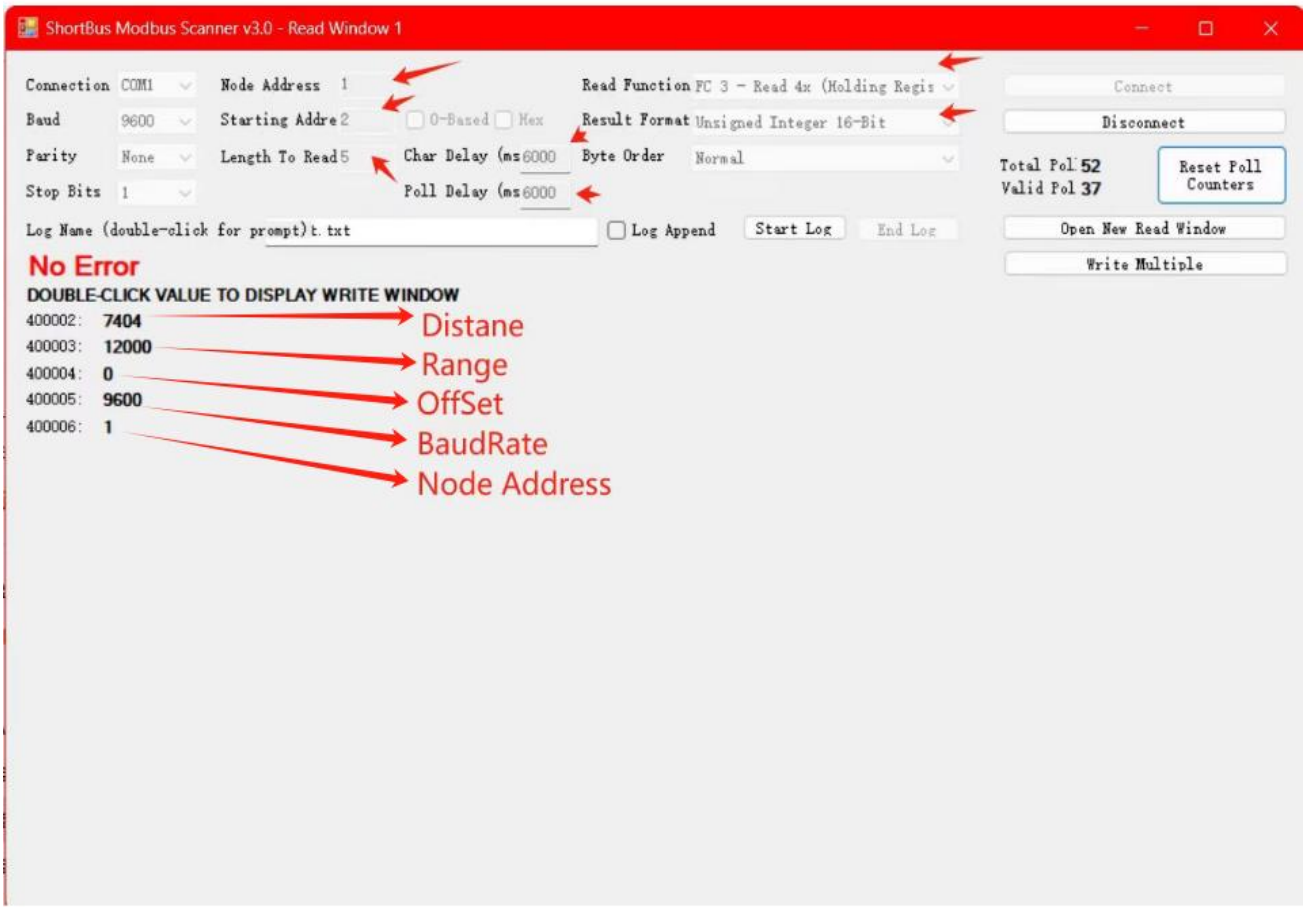
- Interface description

Lead wire	Explain
Red （+）	DC24V Positive of power supply
Blue （-）	DC24V Negative of power supply
Yellow （+）	RS - 485 communication positive
Green （-）	RS - 485 communication negative

7. Wire connection



8. Mod-bus (RS485) connection



1: Read Paras, Use Command 0x03

Register List:

Address	Description	Data Type	Remark
0002H	Current Level	16 bit uinsigned integer	Unit: mm
0003H	Measure Range	16 bit uinsigned integer	Unit: mm
0004H	Base Offset	16 bit signed integer	Unit: mm
0005H	Baudrate	16 bit uinsigned integer	Unit: bps
0006H	Device ID	16 bit uinsigned integer	Value: 1-255

2: Write Paras, Use Command 0x10

Register List:

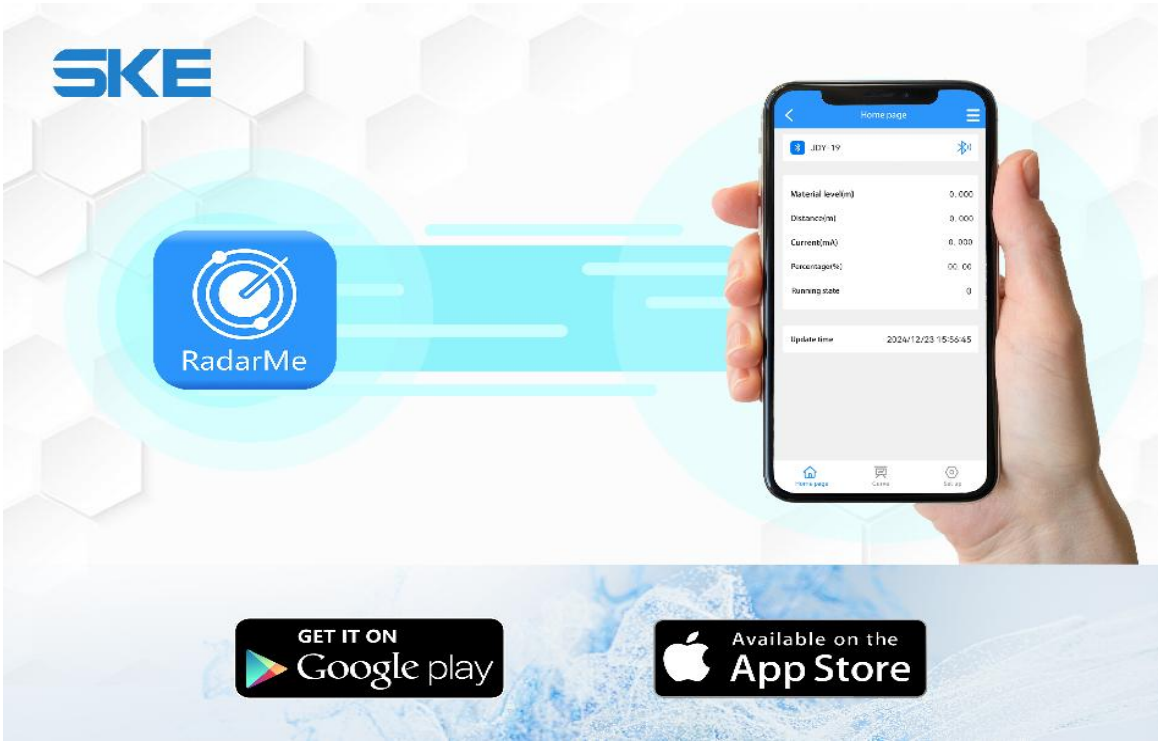
Address	Description	Data Type	Remark
0003H	Measure Range	16 bit uinsigned integer	Unit: mm
0004H	Base Offset	16 bit signed integer	Unit: mm
0005H	Baudrate	16 bit uinsigned integer	Unit: bps
0006H	Device ID	16 bit uinsigned integer	Value: 1-255

9. Description of radar debugging parameters

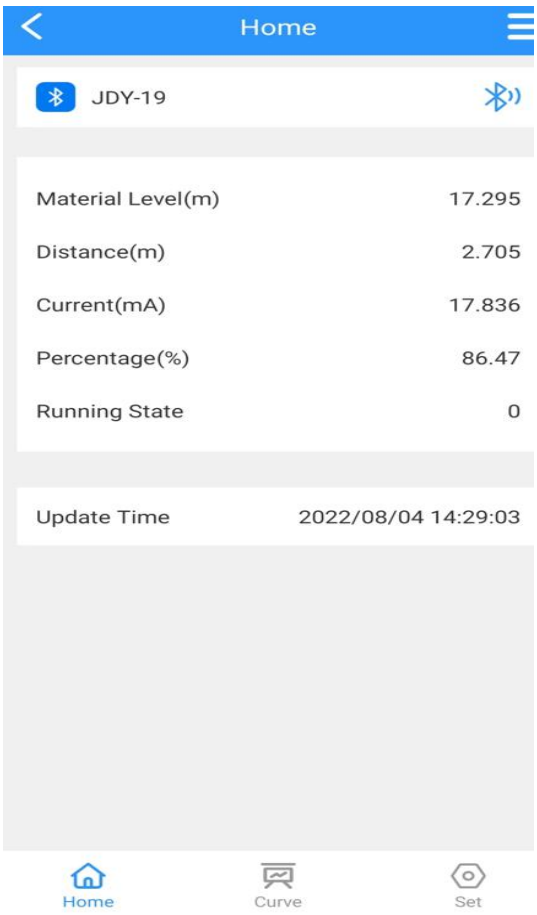
Welcome to download RadarMe on your mobile phone.

Android phone: Google Play.

iPhone: App Store.

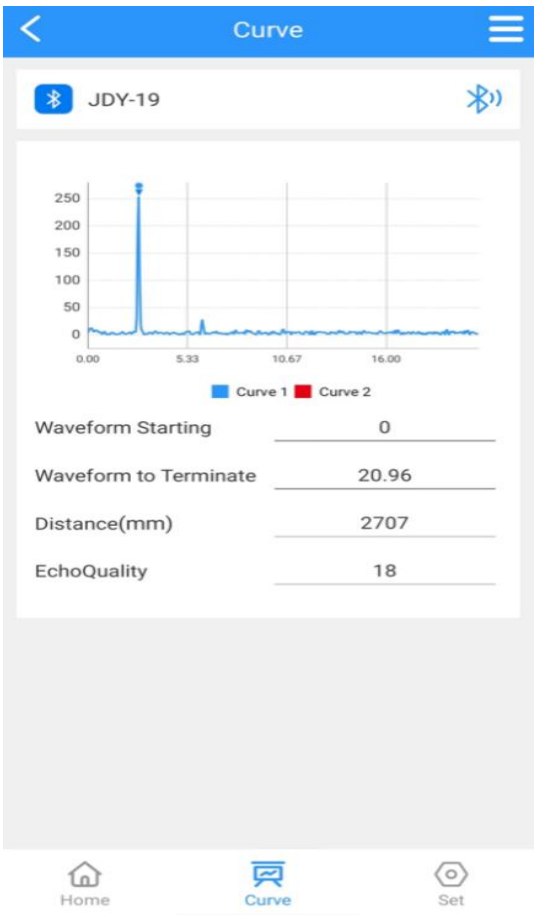


9.1 Radar level sensor mobile app main interface



P2. RadarMe main interface

9. 2 Waveform interface



P3. waveform interface

9. 3 Radar menu

9. 3. 1 User menu

Basic parameters	Measure range
	Migration/Offset
	4mA position
	20mA position

	Blind area
	Damping time
	Device address
	Baud rate
	Backup
	Restore

9.3.2 Setting range and definition of basic parameters

- Basic settings：

Range(500~50000)mm: It depends on the working condition; Indicates the longest distance that the level sensor can measure.

Migration(-9999~9999)mm: It depends on the specific working conditions.

4mA Position: 4mA Level corresponding to current output, Unit mm

20mA Position: 20mA Level corresponding to current output, Unit mm

Blind area: The range is 200mm to the measuring range, which is set according to the specific working conditions.

Damping time: In order to improve the stability of the measured output value, a larger [damping time] can be set to achieve the stability of the measured value and increase the anti-interference ability. For example, when the damping time is 10, the measured object level changes step at time “t”, and the measured output value follows the actual position of the measured object after 10 seconds.

Device address: During RS-485 communication, the slave address is the local

address (value range: 1-99, default value: 1).

Baud rate: The baud rate of this device during RS-485 communication is 9600 by default.

*Please note there is no need to change the default value.

- Backup user parameters:

After the working parameters are backed up, if you forget the original working parameters after manually modifying the parameters, you can "restore" them in the basic settings.

- Restore user parameters:

  used to restore the backed up parameters.

10. Radar installation and commissioning

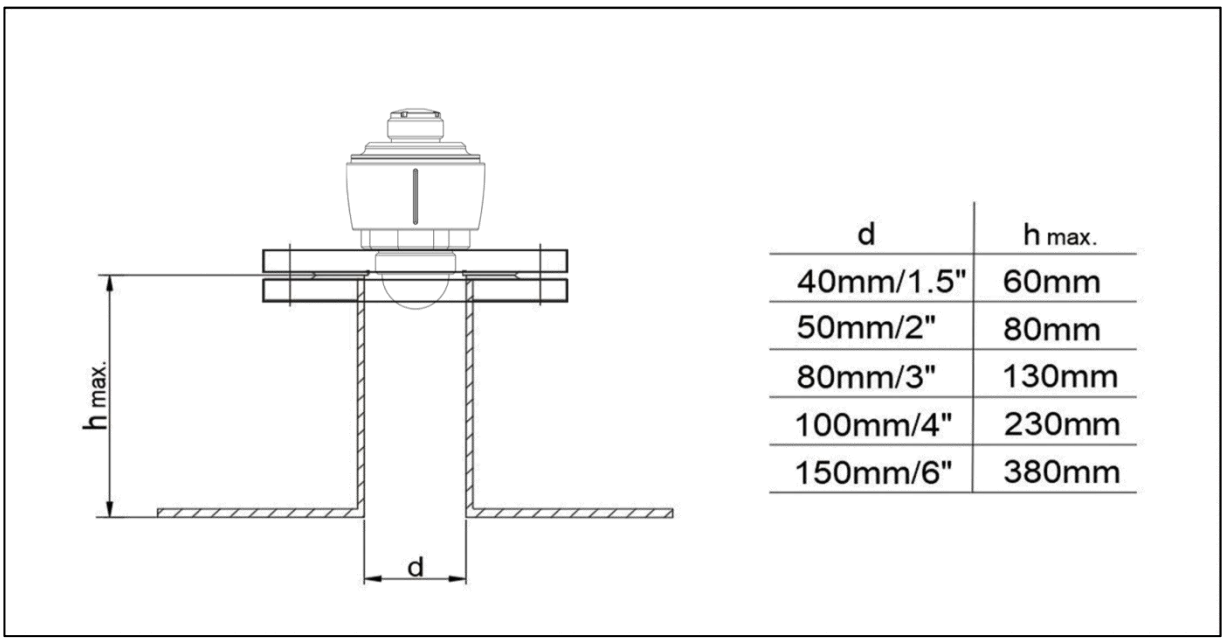
10.1 Preparations before installation

- Understand the installation location, structure, measuring range.
- Required tools: DC-24V power supply, etc.

When the tools are ready, unpack the products and check the packing list to determine whether the materials are complete.

10.2 Selection of radar installation position

Avoid installing the instrument in the center or close to the edge of the container, otherwise it is likely to produce wrong readings.



d	h max.
40mm/1.5"	60mm
50mm/2"	80mm
80mm/3"	130mm
100mm/4"	230mm
150mm/6"	380mm

P4. installation position

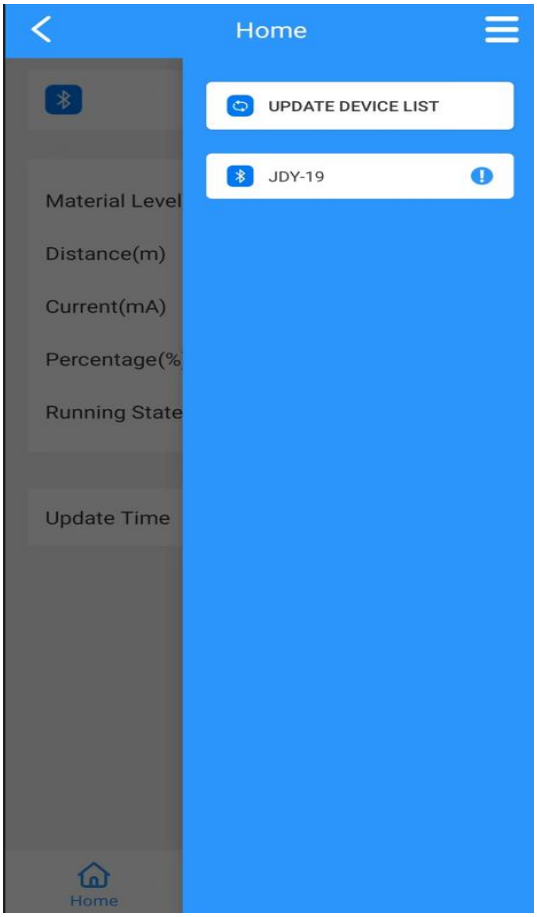
10. 3 Software configuration description

- Instrument connection

Connect the power cable to the DC 24V terminal of the instrument; Pay attention to the positive and negative poles, and do not connect them reversely.

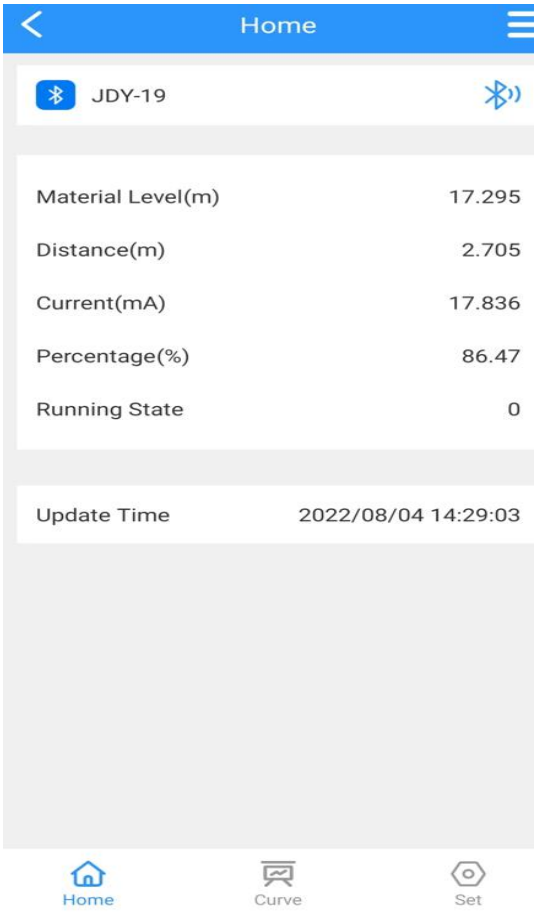
- Set instrument parameters

Open the mobile app to display the device connection interface. As shown in the following figure：



P5.

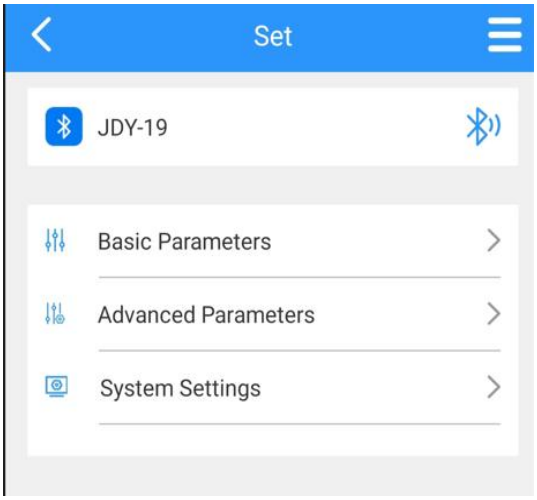
Click the device name to be set directly to enter the main interface, as shown in the following figure.



P6.

Click the **"Curve"** or **"Set"** button at the bottom of the screen to enter the echo curve interface and parameter setting interface respectively.

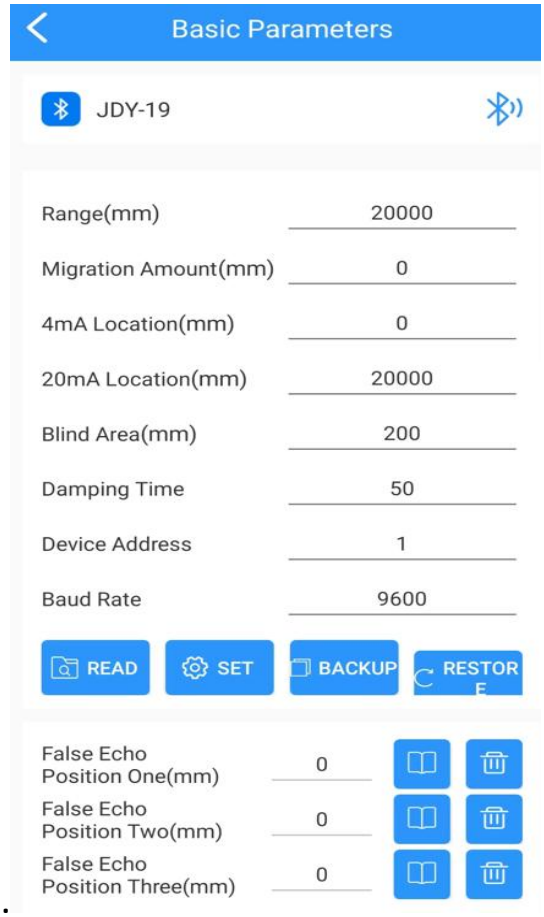
Click the **"Set"** button here to enter the parameter setting interface, as shown in the following figure.



P7.

Click **"Basic parameters"** to enter the basic setting interface. As shown in the

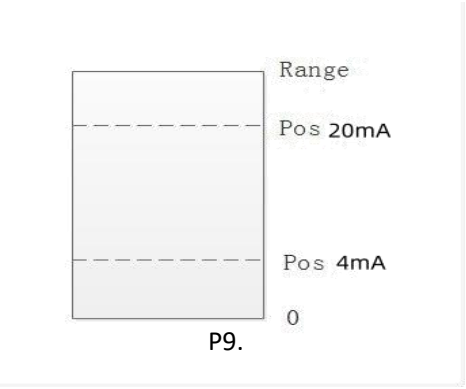
following figure.



P8.

Set the **"Range"** according to the working condition, directly click the following digital input box to modify, and the other parameters are modified in the same way. After the parameters are modified, you need to click the **"Set"** button to set it before it takes effect. You can click the **"Read"** button to refresh the parameters.

4mA position and 20mA position must be within the range. The relationship between 4mA position, 20mA position and range is shown in the following figure:



P9.

Note: If it appears to exceed 20mA, it is reporting an incorrect current, indicating a setting error, please check the parameter setting.

As shown in the figure, when the level is lower than 4mA, the main interface displays the level of “0”, and when the level is higher than 20mA, the main interface displays the level value of 20mA.

11. Maintenance and repair

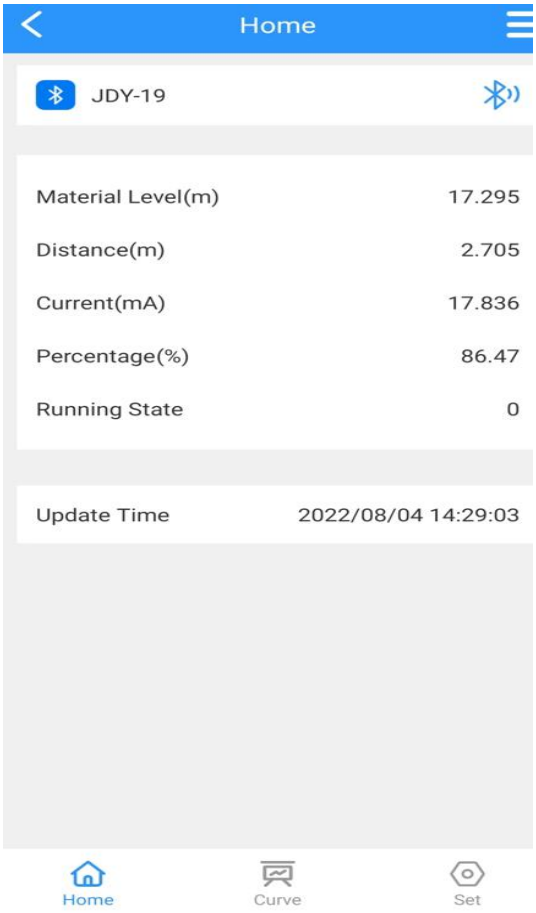
- We highly recommend to keep the radar sensor clean, and try to keep it in a waterproof, moisture-proof, corrosion-proof place, and avoid being violently collided and hit by other objects.
- Avoid direct sunlight on the main body of the radar sensor, keep away from heat sources and pay attention to ventilation. If the ambient temperature exceeds the rated temperature, corresponding cooling protection measures should be taken.
- When the ambient temperature is too low, the instrument protection box or other protective devices can be used for antifreeze protection, and pay attention to keeping the radar dry.
- Radar sensor should be detected regularly. (The detection cycle is determined by the user according to the specific situation).

12. Trouble Shooting

Trouble	Cause	Solution
No display	Power supply error	Check whether the DC 24V voltage and current meet the requirements.
	Wiring error	Check whether the wiring is correct.
Unstable indication	Too much fluctuation	Change the installation position of the radar or reduce the fluctuation of the object to be measured.
	Weak echo	Try angle calibration or rotate the radar installation position.
	Strong electromagnetic interference	Ground or shield the radar sensor.

13. Supplement

Manual Book of Bluetooth APP - RadarMe



Home

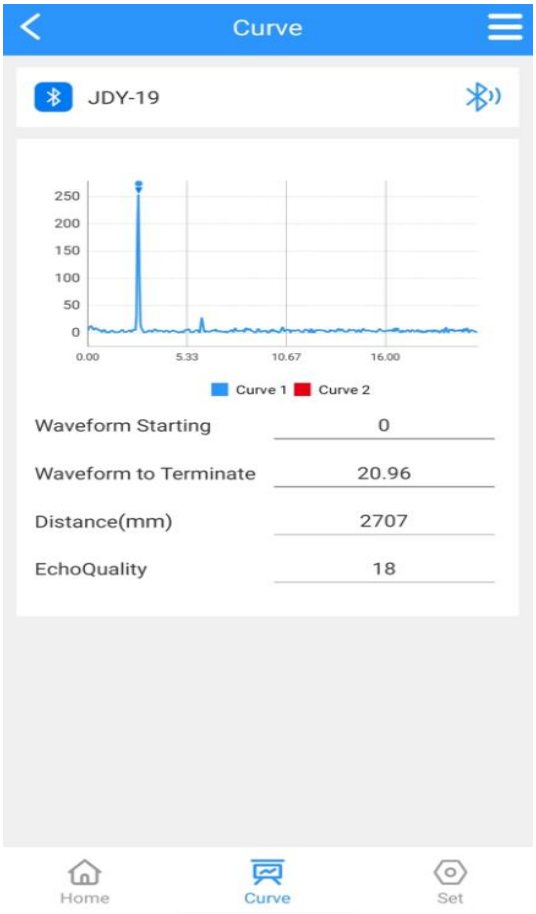
Material Level: Liquid Level Value.

Distance: The distance from radar sensor to the liquid surface.

Current: Analog signal output corresponding to liquid level.

Percentage: The percentage of liquid level and max range.

Running State: Working stage, ”0” is work well, “1” is error.



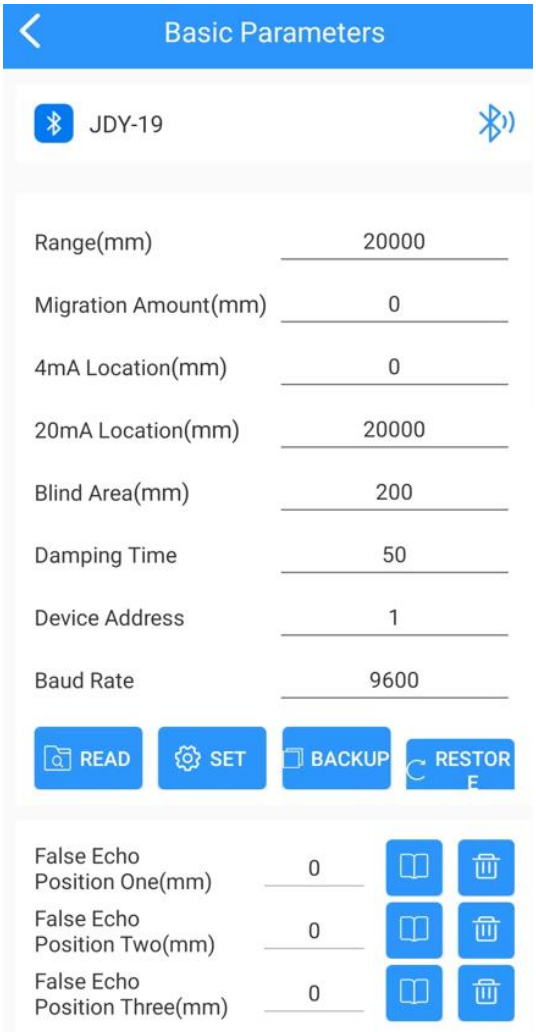
Curve

Waveform Starting: The starting position of the waveform.

Waveform to terminate: The stopping position of the waveform.

Distance: The distance from radar sensor to the liquid surface.

Echo Quality: The quality of Echo, unit is DB.



Basic Parameters

Range: Max Measure range.

Migration Amount: Range less then max measure range.

4mA Location: The liquid level value corresponding to 4mA.

20mA Location: The liquid level value corresponding to 20mA.

Blind Area: Areas that cannot be measured by radar sensor.

Damping Time: The speed at which the actual liquid level is displayed on the screen, the longer the damping time value, the slower the response. The value can not set “0”.

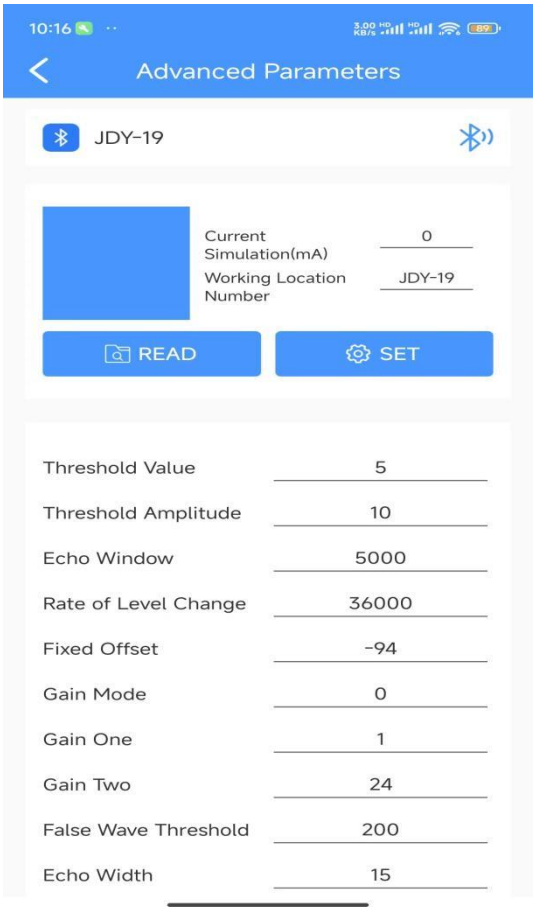
Device Address: Device No**.** It can be modified.

Baud Rate: Default Baud Rate is “9600”.

False Echo Position One: The location of the first false echo. If you know the location of the obstacle and input the level value, the system will automatically block this false echo.

False Echo Position Two: The location of the second false echo. If you know the location of the obstacle and input the level value, the system will automatically block this false echo.

False Echo Position Three: The location of the third false echo. If you know the location of the obstacle and input the level value, the system will automatically block this false echo.



Advanced Parameters

Threshold Value: The setting parameters used to distinguish between signals and noise. It is recommended to use default parameters.

Threshold Amplitude: The threshold value used to distinguish between signal and noise, with a minimum parameter setting of no less than “6”. It is recommended to use default parameters.

Echo Window: Represent setting an area centered around the echo signal, only searching for echo signals within the area, and echo signals outside the area are invalid. It is recommended to use default parameters.

Rate of Level Change: Indicates the maximum allowable level change rate for each detection. It is recommended to use default parameters.

Fixed Offset: It is recommended to use the default automatic gain mode and not modify it.

Gain Mode: The gain mode is divided into manual adjustment signal gain mode and automatic adjustment signal gain mode, When gain model=”0”, it is in automatic gain mode, Gain model=”1”, in manual gain mode automatic gain can be automatically adjusted based on the strength of the ADC signal.

It is recommended to use the default automatic gain mode and not modify it.

Gain One: The signal gain control value in the TIA gain chip is between “0-3”, and manual adjustment is not required in automatic gain mode.

It is recommended to use default parameters.

Gain Two: The signal gain control value in the VGA gain chip is between “0-24”, and manual adjustment is not required in automatic gain mode.

It is recommended to use default parameters.

False Wave Threshold: Used in conjunction with false echo position. The false wave threshold only takes effect when the false echo position is specified. The false wave threshold is a multiplier coefficient used to filter the height of false echoes. It is recommended to use default parameters.

Echo Width: Default parameters are not recommended for modification.

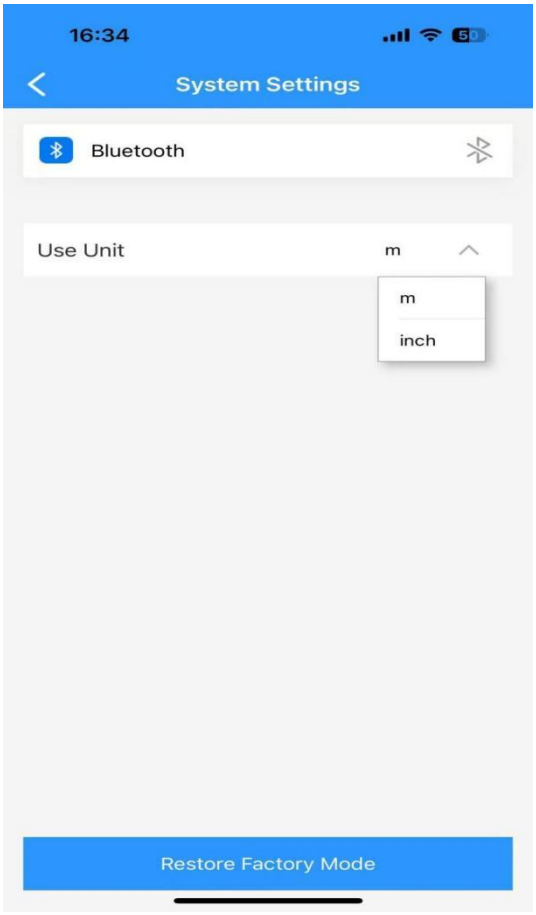
Power: When Power is configured to “0”, the PGA gain is adjusted first, and the TIA gain is not automatically increased. It is recommended to use the default of “0”. It is recommended to use default parameters.

Power One: This parameter is for the search target mode;

When Power one is set to “1”, it means that the target is the distance corresponding to the maximum amplitude of the echo that exceeds the set threshold, which is the maximum value search;

When Power one is set to “0”, it means that the target is identified as the distance corresponding to the target with the echo exceeding the set threshold and the farthest forward in distance;

It is recommended to use the default parameter “1” and search by the maximum value.



System Settings

Change display unit - (**m/inch**) from system settings.