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JIWEI

Operating Instructions

JWrada Radar Level Meter

Shenzhen Jiwei Automations Ltd.

Catalog

1 Product Introduction

1.1 Product Overview

The JWrada 3X series radar level meters are available in five models to meet different application requirements: JWrada-31, JWrada-32, JWrada-33, JWrada-34, and JWrada-35. All models utilize 80 GHz millimeter-wave radar measurement technology combined with an integrated antenna design, with a maximum measuring range of up to 150 m.

By adopting advanced millimeter-wave radar technology and an intelligent echo processing algorithm, this series provides high accuracy, high stability, and high reliability in level measurement. In addition, the instruments are easy to operate and maintenance-free, significantly improving operational efficiency.

As millimeter-wave radar measurement is not affected by medium properties or process condition changes, JWrada radar level meters are particularly suitable for complex process environments such as reactors and storage tanks. Even in applications involving steam, foam, dust, agitation, weak echo signals, or strong interference, the instruments can still deliver stable and reliable level measurement performance.

1.2 Operating Principle

The radar level meter transmits high-frequency electromagnetic waves through the antenna. When the signal reaches the surface of the measured medium, it is reflected and received by the antenna. The instrument determines the distance between the radar antenna and the material surface by measuring the signal travel time (Time Domain Reflectometry, TDR) or by analyzing the center frequency variation of the intermediate frequency signal (Frequency Modulated Continuous Wave, FMCW). By combining these measurements with the speed of light, the device accurately calculates the level height.

This measurement method is non-contact, making it suitable for various media such as liquids, granules, and powders. It offers strong resistance to interference and is not affected by changes in temperature, pressure, or vapor conditions, ensuring high adaptability and reliable performance in different process environments.

1.3 Applications

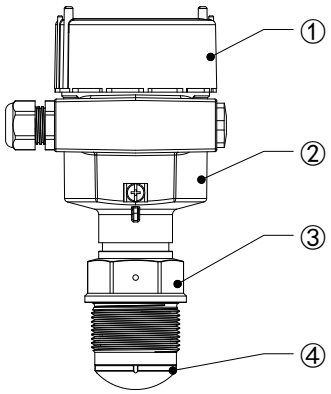
(1) Petrochemical: For tanks, reactors, and separators; performs reliably in high-temperature, high-pressure, and corrosive conditions.
(2) Power: Monitors coal bunkers, ash silos, and water tanks; strong resistance to dust and steam.
(3) Water Treatment: Measures sewage ponds, clean water tanks, and sedimentation basins; handles foam and turbidity well.
(4) Food & Pharma: Sanitary design for tanks with liquids or powders; meets hygiene standards.
(5) Metallurgy & Mining: Suitable for ore silos and slurry tanks in high-temp, dusty environments.

(6) Storage & Logistics: Continuous non-contact measurement in grain, cement, and powder silos; enhances safety and efficiency.

2 Structure and Features

2.1 Structure

As shown in Figure 1, the JWrada radar level meter consists of the following components:



① Housing Cover ② Housing with Electronic Module ③ Process Connection ④ Probe

Figure 1

2.2 Features

(1) High-Accuracy Measurement

Utilizes 80 GHz FMCW radar technology with a narrow beam angle and small dead zone for accurate measurement of liquids, powders, and bulk solids. Tested through over 50 rigorous tests for stable performance.

(2) Bluetooth Communication

Built-in Bluetooth 5.0 module supports the “JW Tools” APP for wireless commissioning, parameter setting, and monitoring.

(3) Intelligent Echo Processing

Self-developed echo processing algorithm enables accurate echo analysis, multiple echo identification, and stable measurement in complex conditions.

(4) Excellent Environmental Adaptability

Measurement is largely unaffected by temperature, pressure, vapor, or dust, ensuring stable operation.

(5) Strong Anti-Interference Capability

Maintains reliable measurement in environments with dust, vapor, foam, or agitation.

(6) Non-Contact Measurement

Non-contact operation avoids wear, corrosion, and contamination, reducing maintenance requirements.

(7) High Adaptability

Requires minimal installation space and performs well even in tanks with complex structures.

(8) Flexible Installation

Supports flange and threaded connections for convenient installation and commissioning.

(9) Communication Module

Integrated wireless communication module enables easy configuration and device management.

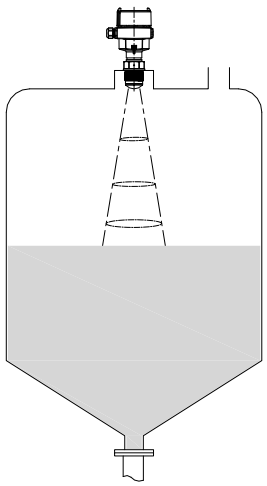
3 Installation

3.1 Pre-Installation Instructions

- Measuring Area: The radar level meter emits millimeter-wavelength electromagnetic waves as the measuring signal. When the radar signal reaches the surface of the measured object, it forms a measurement area. This area can be approximately represented as a circle, whose radius is proportional to the measuring distance. The radius of this circle is jointly determined by the distance from the radar antenna to the measured object and the radar antenna's beam angle. Within the plane of the measured object's surface, the radar signal energy density is highest in this measurement area.

Measuring Distance (m)	Beam Angle	Measurement Area Radius (m)
2	⩾3°	0.1m
5	⩾3°	0.25m
10	⩾3°	0.5m
20	⩾3°	1.0m
30	⩾3°	1.5m

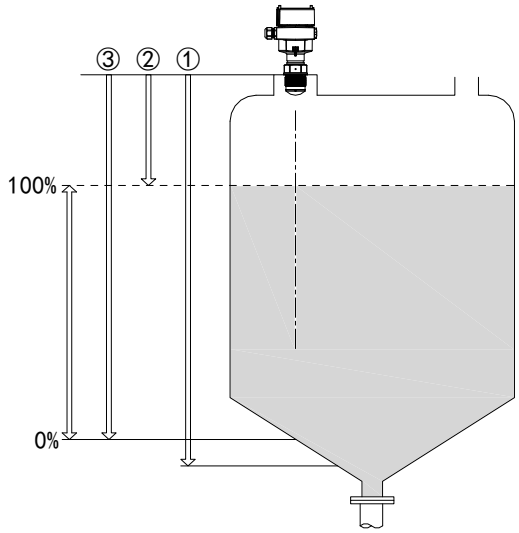
- The radar signal radiation area refers to the conical space with the radar antenna lens center as the apex and the measurement area as the base. Within this conical space, the radar signal energy density is highest.



Measurement Area Diagram

Figure 2

- Reference Surface: The measurement starting point of the radar level meter is from the contact surface between the device and the tank. This position serves as the reference surface for the radar level meter's measurement.
- The following parameters of the radar level meter—range, minimum adjustment, maximum adjustment, empty height, and material height—are all calculated starting from the reference surface.



The reference measurement surface is the contact surface between the instrument and the tank.

① Range setting

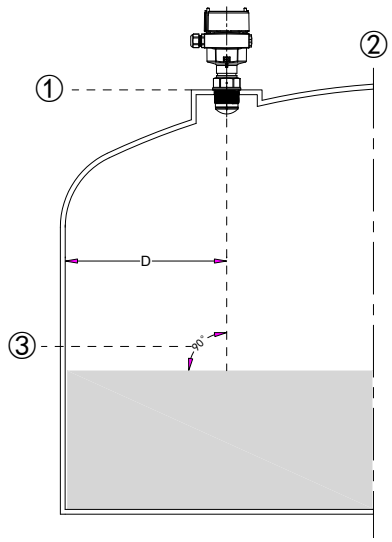
② High-level adjustment

③ Low-level adjustment

Figure 3

3.2 Radar Installation

- Radar Installation Calibration: The antenna angle of the radar level meter must be adjusted to ensure the antenna lens is perpendicular to the media surface. This alignment is essential for accurate and reliable measurement.
- Radar Installation: During installation, ensure that the radar level meter is positioned away from the container wall by at least 1/20 of the measuring range, with a minimum distance of 0.2 m. For instance, in a 10 m-high tank, the recommended safe measurement distance is 0.5 m.



When installing, ensure there is a minimum distance between the instrument and the container wall.
Calculation formula: D = Measuring range / 20

① Reference surface

② Center or symmetry axis of the container

③ Adjust the radar level meter antenna angle to align the antenna lens with the material surface.

Figure 4

- Interference Sources: The radar signal radiation area between the lower side of the radar level meter's antenna and the surface of the measured object should be free of obstacles as much as possible. Therefore, installation should avoid internal tank structures such as metal tank walls (which cause strong interference if too close to the radar), tank wall deposits or weld seams, ladders, limit switches, heating devices, supports, agitators, and similar equipment. If avoidance is not possible, echo learning function should be activated during commissioning to adapt to complex conditions.

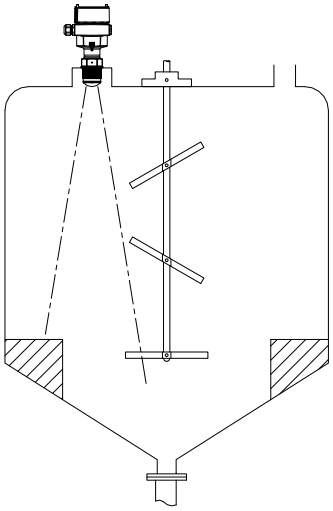


Figure 5

- Pipe Joint Installation — Short Joint: When connecting the radar instrument with a short pipe joint via threading, the radar antenna tip should extend at least 10mm beyond the pipe joint, as shown in Figure 6.

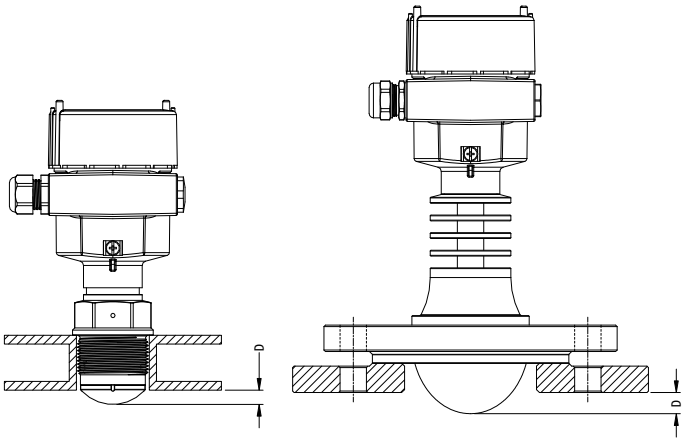


Figure 6

- Pipe Joint Installation — Long Joint: When connecting the radar instrument with a long pipe joint via threading, the length-to-diameter ratio of the pipe joint must be considered. The pipe joint length should be ≤ 5 times its diameter, as shown in Figure 7.

- A long pipe joint may weaken the radar signal strength received by the instrument. It is recommended to use the echo learning function during commissioning to adapt to complex conditions.

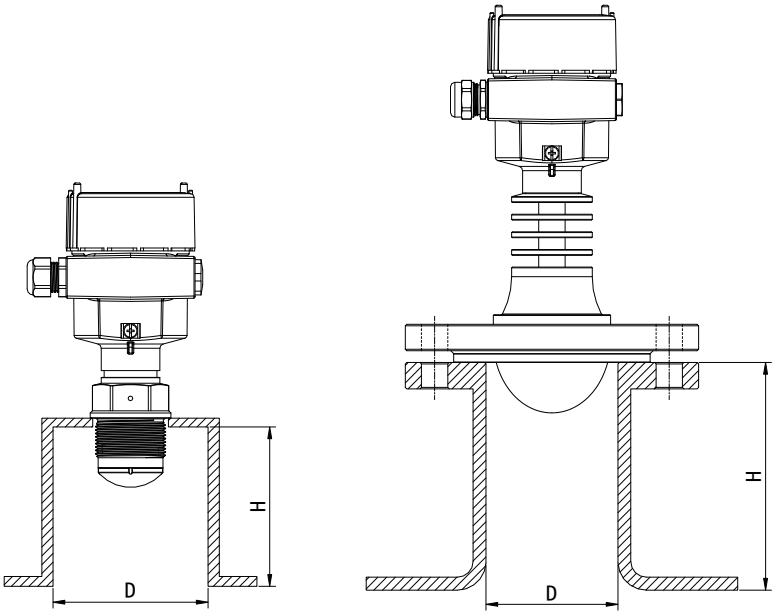
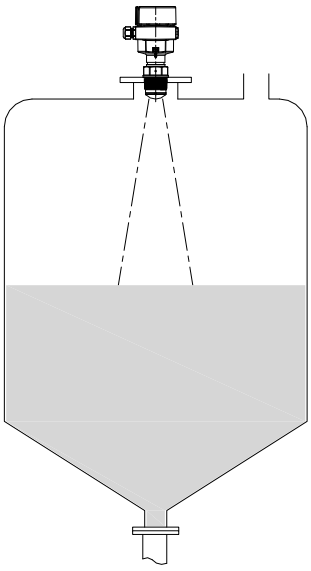
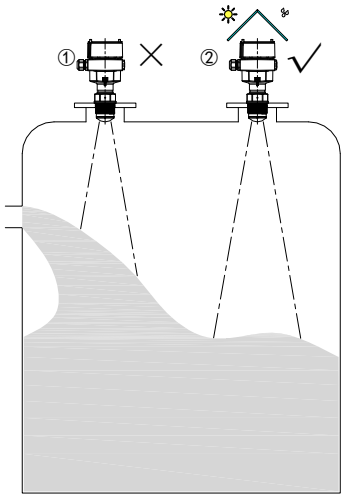


Figure 7



For conical containers with flat tank tops, the optimal installation position for the instrument is at the center of the container top, ensuring full measurement down to the bottom of the container.

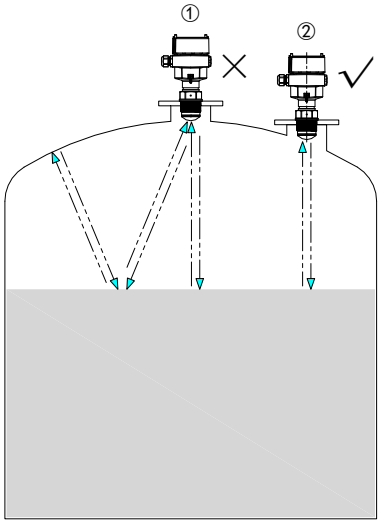
Figure 8



① Incorrect: Do not install the instrument directly above the material inlet, or it may detect the surface of the falling material instead of the actual medium level.

② Correct: For outdoor installation, take measures to protect against sunlight.

Figure 9



① Wrong: Installing the instrument at the center of a domed tank roof can cause multiple echo reflections and should be avoided.

② Correct: Install at half the tank radius from the center.

Figure 10

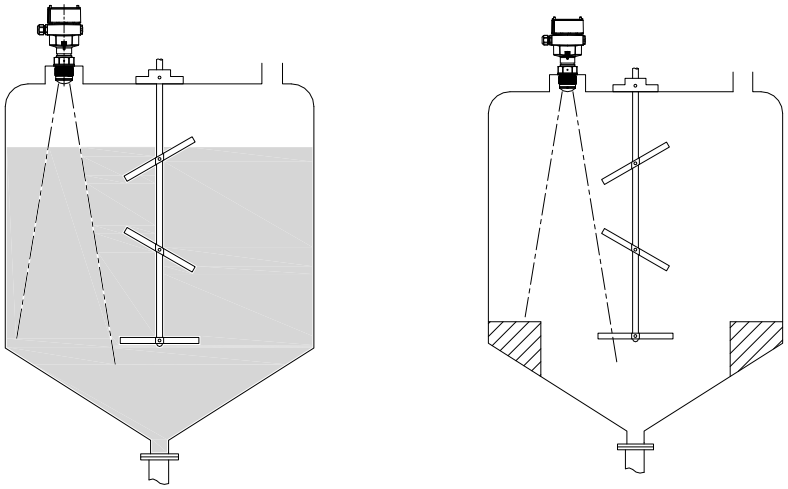


Figure 11

When there is an agitator in the tank, install the instrument as far from it as possible to avoid interference.

- With Universal Joint Mounting

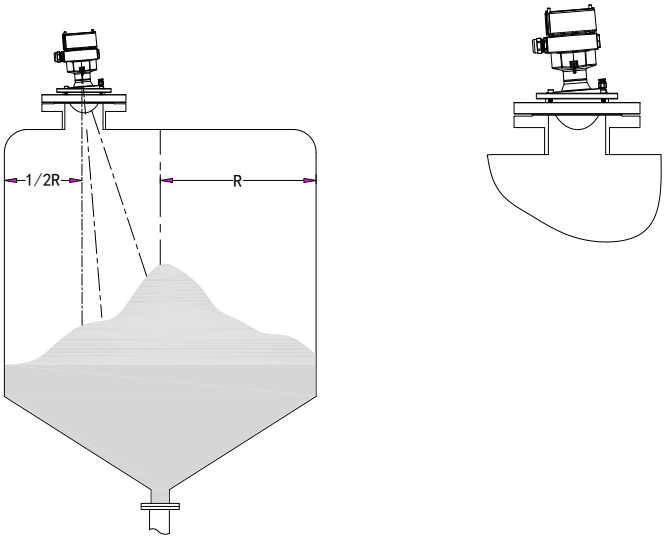


Figure 12

- For large feeding yards or stockpiles with multiple filling points, multiple radar level meters can be installed. For stockpiles filled using a mobile unloading vehicle, a narrow-beam radar level meter can be mounted on the vehicle to accurately scan the entire material surface during loading, providing reliable and accurate level readings.

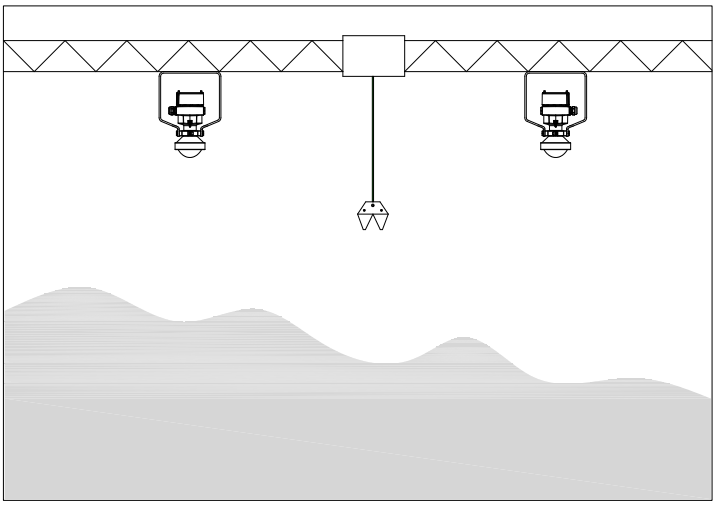


Figure 13

- Bypass Measurement

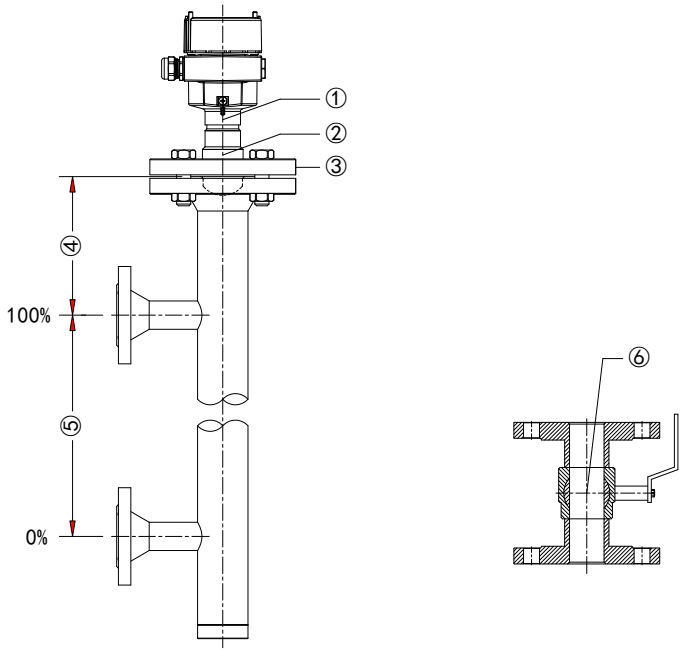


Figure 14

Note:

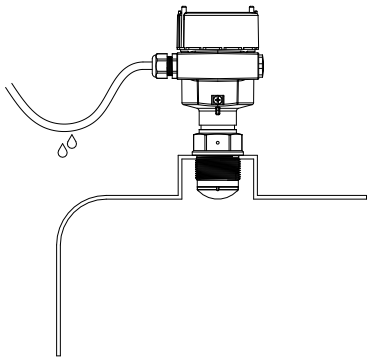
① Radar sensor
② Polarization mark
③ Instrument flange
④ Distance from sensor reference plane to upper pipe connection
⑤ Distance between pipe connections
⑥ Ball valve with full bore

Bypass Pipe Design Requirements:

1. Must be made of metal with a smooth inner surface.
2. If the inner surface is particularly rough, an additional insert pipe (pipe-in-pipe) should be used.
3. Flanges must be welded according to the polarization orientation.
4. Gap in the transition pipe ⩽ 1 mm (e.g., when using a single ball valve or intermediate flange in one pipe section).
5. Diameter must remain consistent along the entire length.

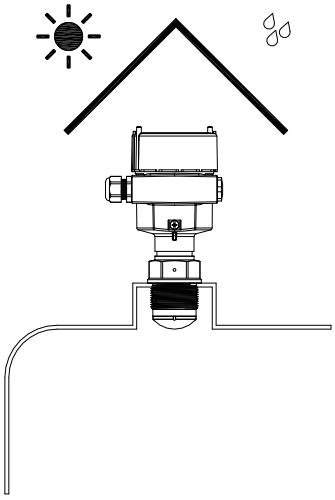
3.3 Moisture Protection

When the instrument is installed outdoors or in humid environments, such as during rain or condensation, water may flow downward along the device. Therefore, before connecting the cable, please bend the cable downward to prevent water or moisture from entering the instrument, as shown in the figure below.



3.4 Sun Protection

When the instrument is installed outdoors under intense sunlight and high temperatures, excessive heat may cause display screen malfunctions. Prolonged exposure to direct sunlight can also shorten the display screen's lifespan. For outdoor installations exposed to strong sunlight, it is recommended to install a sunshade cover as shown in the figure below.



4 Wiring

4.1 Safety Instructions

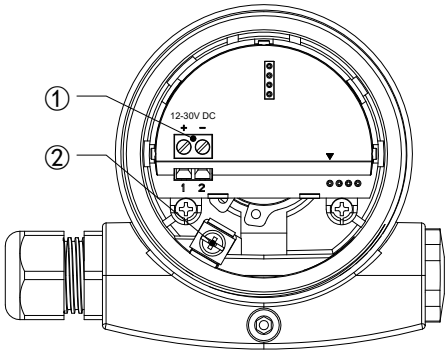
(1) For safety reasons, wiring must only be performed when the power is turned off.
(2) Do not open the cover while the device is energized.
(3) When wiring in hazardous areas, strictly follow explosion-proof wiring requirements.

4.2 Cable Entry

(1) The radar level meter generally uses round cross-section cables with a diameter of 5–9 mm. Cables outside this range may compromise the sealing performance of the cable entry.

(2) If cables of other specifications are required, please use matching cable entry bolts and ensure the sealing integrity of the cable entry after replacement.

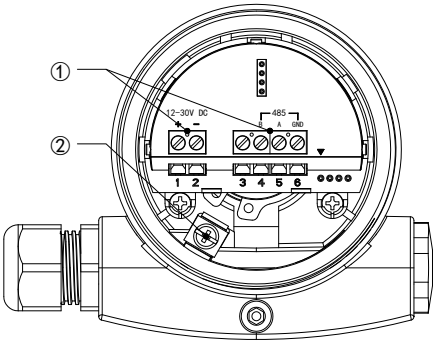
4.3 Wiring Diagram



Two-wire output

①： Power terminal

②: Ground Terminal

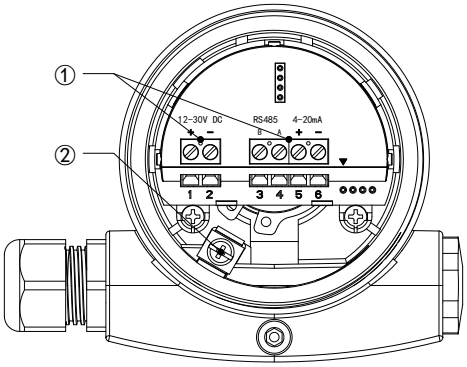


Four-wire output

①： Power terminal

②: Ground Terminal

Two-wire output



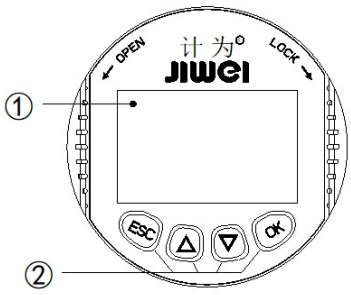
Six-wire output

①： Power terminal

②: Ground Terminal

5 Menu Interface and Operation Instructions

5.1 Menu Interface



① LCD Display Screen ② Operation Buttons

The four buttons on the panel allow for parameter configuration, commissioning, and diagnostics of the instrument.

【OK】Button:

-Enter the menu

-Confirm the selected menu item

-Confirm parameter modification

【▽】Button:

-Switch to display ETF curve

-Select menu items

-Select numeric values for parameters

【△】Button:

-Switch to display echo curve

-Select menu items

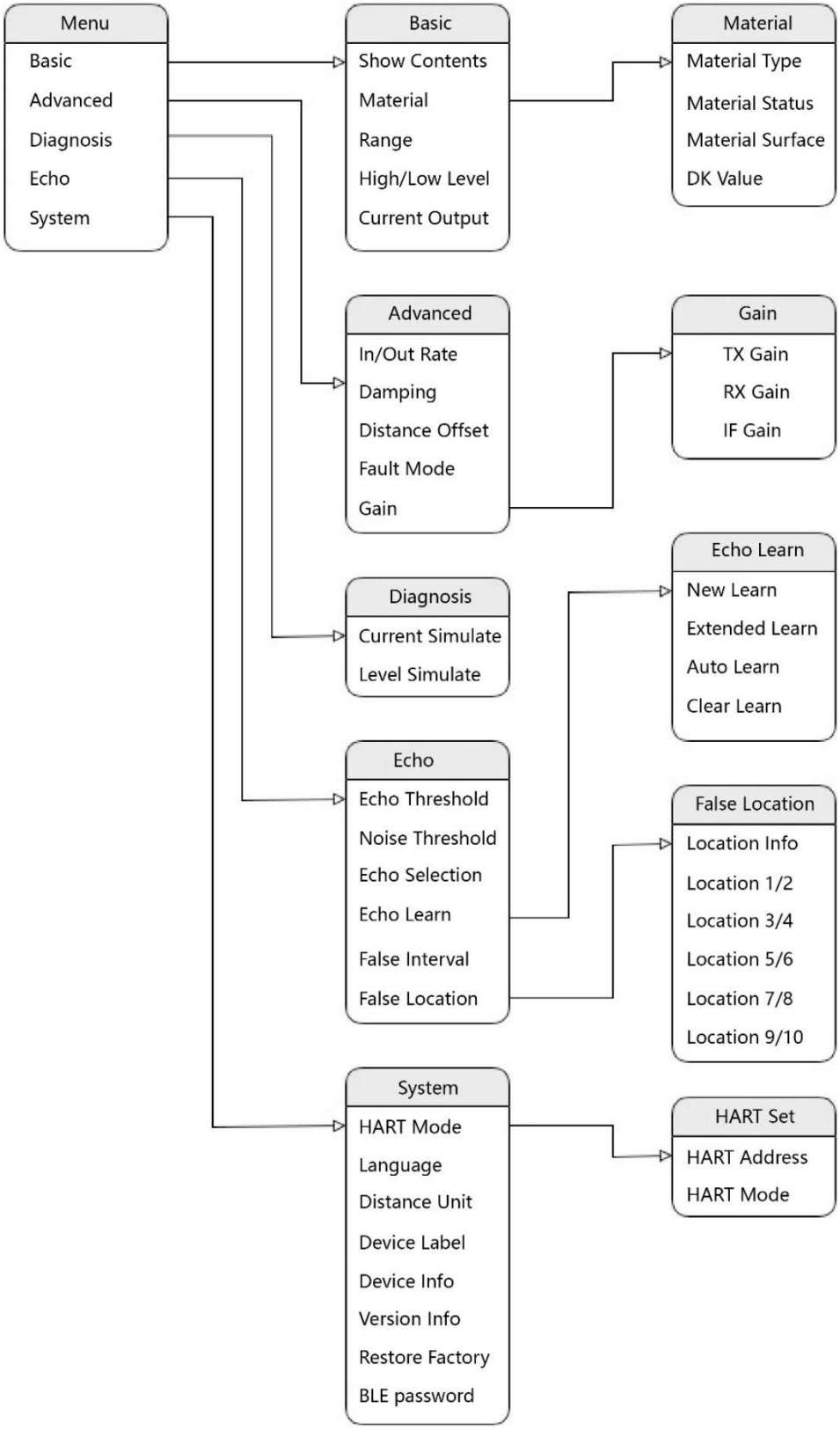
【ESC】Button:

-Exit curve display

-Return to previous menu level

-Exit parameter setting

5.2 Menu


Menu
Basic
Advanced
Diagnosis
Echo
System
Basic
Show Contents
Material
Range
High/Low Level
Current Output
Material
Material Type
Material Status
Material Surface
DK Value
Advanced
In/Out Rate
Damping
Distance Offset
Fault Mode
Gain
Gain
TX Gain
RX Gain
IF Gain
Diagnosis
Current Simulate
Level Simulate
Echo Learn
New Learn
Extended Learn
Auto Learn
Clear Learn
Echo
Echo Threshold
Noise Threshold
Echo Selection
Echo Learn
False Interval
False Location
False Location
Location Info
Location 1/2
Location 3/4
Location 5/6
Location 7/8
Location 9/10
System
HART Mode
Language
Distance Unit
Device Label
Device Info
Version Info
Restore Factory
BLE password
HART Set
HART Address
HART Mode

5.3 Menu Description

1【Basic】

Configure the basic parameters of the meter to enable quick setup and commissioning.

1.1【Material Display】

Set the type of real-time data to be shown on the main interface.

No.	Parameter	Description
1	Distance	
2	Level	Level = Low– Distance
3	Percentage	Percentage = Level / (Low – High)

1.2【Material Properties】

Configure material-related parameters for accurate measurement.

1.2.1【Material Type】

The meter integrates an adaptive algorithm optimized for both liquid and solid applications. Users can select the appropriate type based on the actual measurement medium.

No.	Parameter Option
1	Liquid
2	Solid

1.2.2【Material Status】

Set the physical status of the liquid or solid material being measured.

No.	**For Liquids：** Parameter Option
1	General
2	Volatilize
3	Crystal
4	Sticky

No.	**For Solids：** Parameter Option
1	Bulk
2	Grain
3	Dust

1.2.3【Material Surface】

Set the fluctuation state of the material surface.

No.	Parameter Item
1	Normal
2	Small
3	Middle
4	Big

1.2.4【DK Value (Small)】

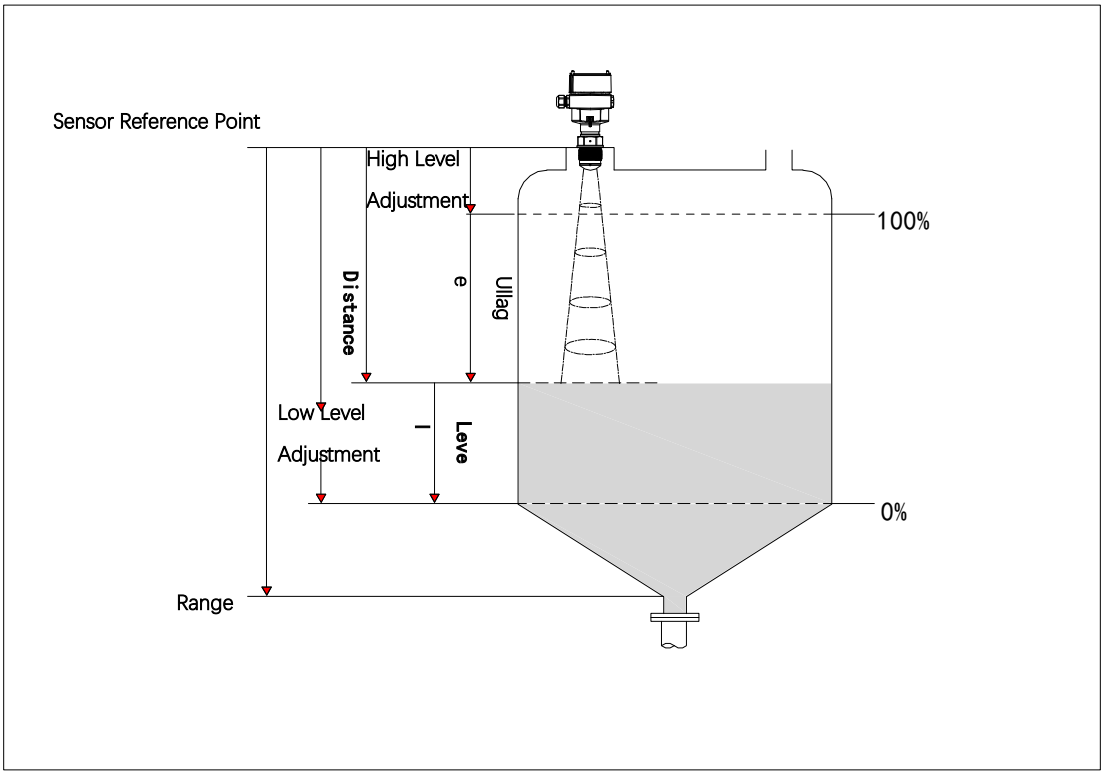
If the DK value of the material is small, this should be enabled.

1.3【Range】

Set the range of the instrument according to the diagram below. This is used to limit the calculation area of the instrument.

1.4【High/Low Level】

Set according to the diagram below: the high level corresponds to the full material position, and the low level corresponds to the empty tank position. The high and low levels correspond to current output (4-20mA).



1.5【Current Output】

Set the loop current output mode of the instrument.

No.	Parameter Item
1	4-20mA
2	20-4mA

2【Advanced】

Professional configuration of the instrument. **This menu requires operation by professional personnel.**

2.1【In/Out Rate】

Used to adjust the instrument's response rate to actual material level changes.

2.2【Damping】

Damping filter, used to smooth the measurement results of the instrument, prevent abrupt changes, and stabilize the output value. The larger the time, the smoother the output change.

2.3【Distance Offset】

Used to correct the overall deviation between the measured value and the actual value.

2.4【Fault Mode】

Current output mode when the instrument fails.

No.	Parameter Item
1	Unchanged
2	22mA
3	20.5mA
4	3.9mA

2.5【Gain】

Adjust related radio frequency parameters of the instrument.

2.5.1【TX Gain】

Adjust the strength of the radio frequency transmission signal.

No.	Parameter Item
1	TST (Strongest)
2	Normal
3	WKN (Weakened)
4	Weak

2.5.2【RX Gain】

Adjust the strength of the radio frequency receiving signal.

No.	Parameter Item
1	TST (Strongest)
2	Normal
3	WKN (Weakened)
4	Weak

2.5.3【IF Gain】

Adjust the strength of the intermediate frequency receiving signal.

2.6【E Tank H】

Set tank height.

2.7【Operating mode】

Set process condition properties.

2.8【Close Range E】

Adjust signal detection for short range.

3【Diagnosis】

Used to check whether the instrument's loop current is normal.

3.1【Current Simulate】

Simulate input of different current values to check whether the output loop current of the instrument is normal.

3.2【Level Simulate】

Simulate input of different material levels to check whether the output loop current of the instrument is normal.

4【Echo】

Used to adjust echo-related parameters of the instrument. This menu requires operation by professional personnel.

4.1【Echo Threshold】

Set the threshold value of the valid echo. Used to filter out interference and clutter.

4.2【Noise Threshold】

Set the threshold value of environmental noise.

4.3【Echo Selection】

When there are multiple echoes on site, the required echo needs to be set.

No.	Parameter Item
1	TST (Strongest)
2	ST (Stronger)
3	SST (Slightly Stronger)
4	Normal
5	WKN (Weakened)

4.4【Echo Learn】

4.4.1【New Learn】

Establish new false echo learning for a container with obstacles, based on the set low and high levels.

4.4.2【Extended Learn】

Continue false echo learning for a container with obstacles, based on the set low and high levels, on top of previous learning.

4.4.3【Auto Learn】

When the radar measurement distance is greater than the set position, the device will automatically learn false echoes in a container with obstacles.

4.4.4【Clear Learn】

Clear all false echo learning.

4.5【False Interval】

When there are false echoes on site, set the interval range to mask the false echoes.

4.6【False Location】

When there are false echoes on site, set the locations to be masked according to the position of the false echoes.

5【System】

Set the system parameters of the instrument.

5.1【HART Set】

When multiple instruments are connected to the host computer via the HART interface, it is necessary to set the HART address and set the instrument to HART multipoint working mode (4mA or 8mA).

5.1.1【HART Address】

Set the HART address. Address range: 0–15. When the address is not 0, HART mode needs to be set to 4mA or 8mA.

5.1.2【HART Mode】

Set the loop current of the instrument in HART multipoint mode.

No.	Parameter Item
1	Normal
2	4mA
3	8mA

5.2【Language】

Set the language for the instrument's LCD display.

No.	Parameter Item
1	Chinese
2	English

5.3【Distance Unit】

Set the unit displayed by the instrument.

No.	Parameter Item
1	m
2	ft

5.4【Device Label】

Set the label displayed on the main interface of the instrument.

5.5【Device Info】

Display the type, serial number, and manufacturing date of the instrument.

5.6【Version Info】

Display version information related to the instrument.

5.7【Restore Factory】

Restore the instrument parameters to the factory default settings.

5.8【BLE password】

View the Bluetooth name and set the connection password for the Bluetooth mini program. The default password is: 123456.

6 Technical

JWrada-3X Radar Level Meter		JWrada-31	JWrada-32	JWrada-35
Measurement Parameters	Frequency	80GHz		
	Measuring Range	5m	60m	150m
	Beam Angle	13°	6°	3°
	Accuracy	±1mm		
Material	Antenna	PFA、316L+PTFE、316L+PFA		
	Housing	Aluminum Alloy, Stainless Steel		
Installation	Process Connection	Thread	Thread, Flange, Bracket, Suspension	
Power Supply	DC Voltage	12~30V DC		
Signal Output	2-wire	4 ~ 20mA / HART		
	4-wire	RS485 / Modbus		
	6-wire	4 ~ 20mA/HART + RS485/Modbus		
	Bluetooth	Supported		
Operating Environment	Process Pressure	-1 ~ 30 bar	-1 ~ 10 bar (suitable for strongly corrosive liquids) -1 ~ 30 bar (suitable for high-pressure liquids)	
	Process Temperature	-40℃ ~ 150℃	Ambient type: -40℃ ~ 150℃ High-temperature type: -40℃ ~ 220℃	
	Ambient Temperature	-40℃ ~ 80℃		
	Storage	-40℃ ~ 80℃		
Safety Certification	Protection Level	IP66/67		
	Explosion-proof Certification	Ex db IIC T6 Gb；Ex ia IIC T6 Ga；Ex tb IIIC T80℃ Db；Ex ia IIIC T200 80℃ Da		
Cabling	Cable Entry	M20×1.5、1/2NPT		

Explosion-Proof Certification

The explosion-proof version of this instrument complies with relevant domestic explosion-proof standards. Certification documents related to explosion protection can be downloaded and verified from the company's official website: www.jiweiauto.com

Ingress Protection Rating

This instrument meets the IP66/67 protection standard and has passed the required tests by relevant authorities. The corresponding test reports can be downloaded and verified from the company's official website: www.jiweiauto.com.

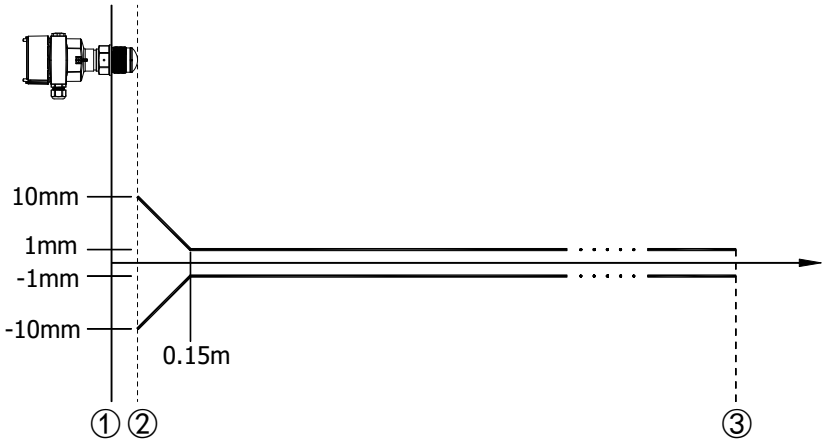
7 Measurement Deviation

7.1 Measurement Environment

Temperature:	+10°C ... +36°C
Relative Humidity:	42% ... 78%
Atmospheric Pressure:	1020 mbar

7.2 Measurement Conditions

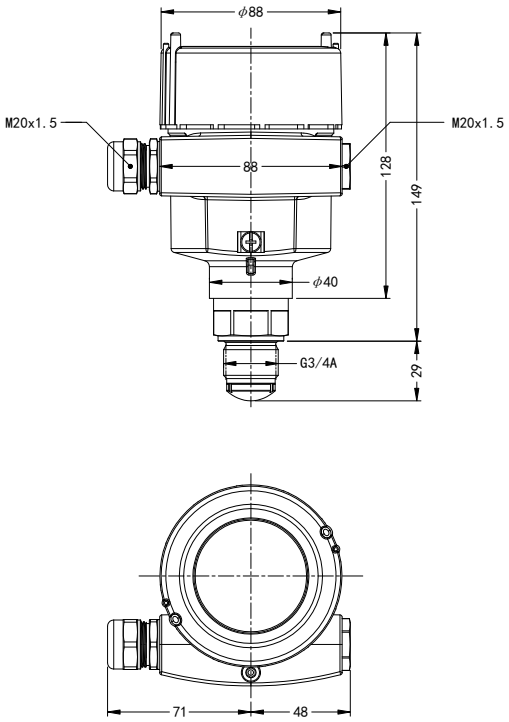
Minimum Distance Between Target and Lens:	0.15 m
Reflector	Flat Metal Plate
Measurement Deviation for Liquids:	< 1 mm (when measuring distance > 0.15 m and within the specified measurement range)



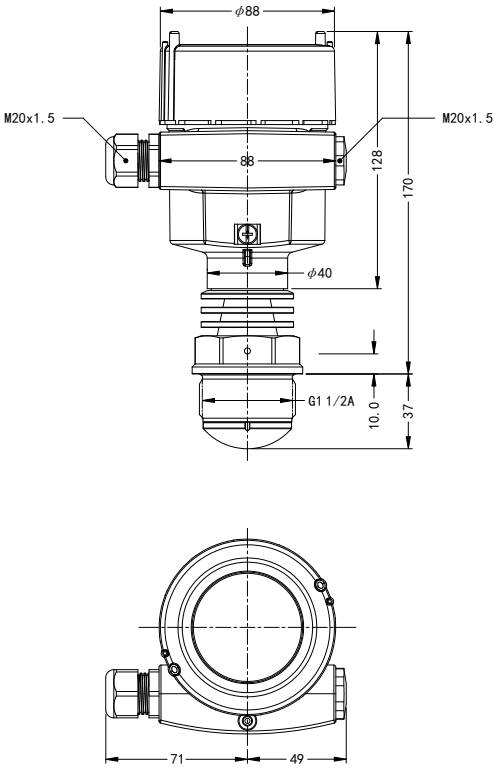
① Reference Plane ② Antenna End ③ Measurement Range

8 Dimension Drawings

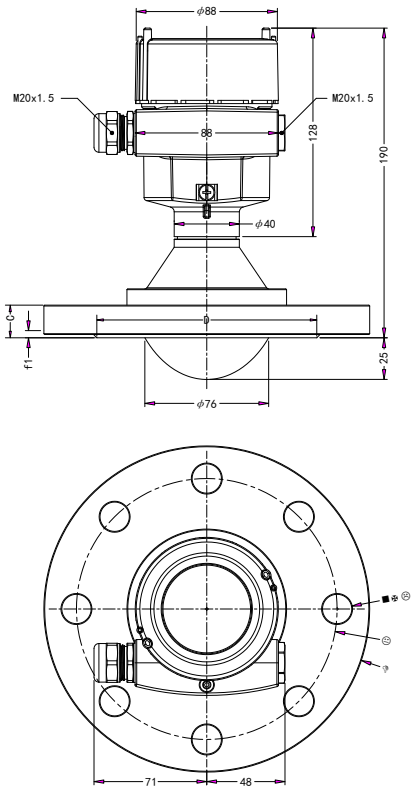
JWrada-31
Standard



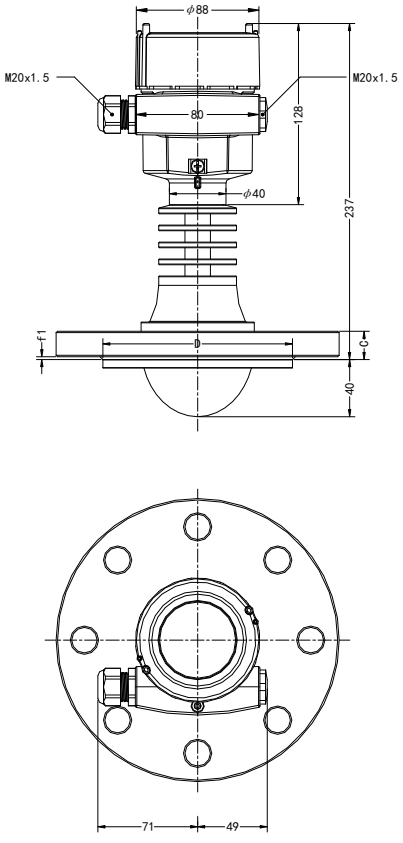
JWrada-32
High Temperature



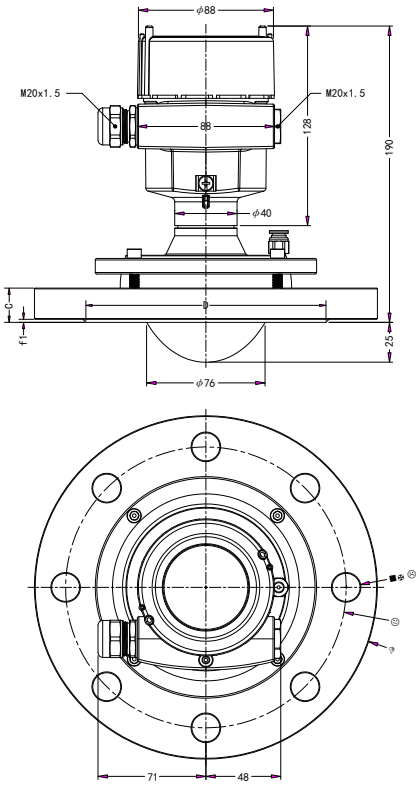
JWradar-35 Flange



JWradar-35 Flange
High-Temperature Corrosion-Resistant Type



JWradar-35 Omni-Directional Purge Type



9 Instrument Maintenance

We provide our customers with a range of services including technical consultation, user training, on-site installation and commissioning, product replacement and repair, as well as on-site technical support. Jiwei products come with a one-year warranty, during which repairs are free of charge. We also offer long-term technical support. Should you have any questions during use, please feel free to call our service hotline at +86 755 28407683. You may also visit www.jiweiauto.com to find more information about our services.

10 Storage and Transportation

10.1 Packaging

The instrument you purchase is protected by packaging materials during transportation to the place of use.

The instrument is packed in a cardboard box, which is environmentally friendly and recyclable. Please have the packaging materials recycled by professional recycling companies.

10.2 Transportation

Transportation should follow the instructions indicated on the packaging; otherwise, the instrument may be damaged.

Upon receiving the goods, please inspect the integrity of the packaging and check for any possible transportation damage. If any damage or hidden defects caused during transport are found, please provide feedback promptly.

10.3 Storage

When storing packaged items, please adhere to the following conditions:

(1) Avoid outdoor storage;

(2) Avoid storing in damp or dusty environments;

(3) Avoid contact with corrosive substances;

(4) Avoid direct sunlight exposure when storing radar level meters;

(5) There is a potential risk of static electricity; please use a damp cloth for cleaning;

(6) Avoid mechanical vibrations;

(7) Storage environment conditions: relative humidity 0–95%; storage temperature -20°C to 60°C.