ACCUMAX
INSTRUMENTS PVT. LTD.

ULTRASONIC LEVEL METER
USER MANUAL

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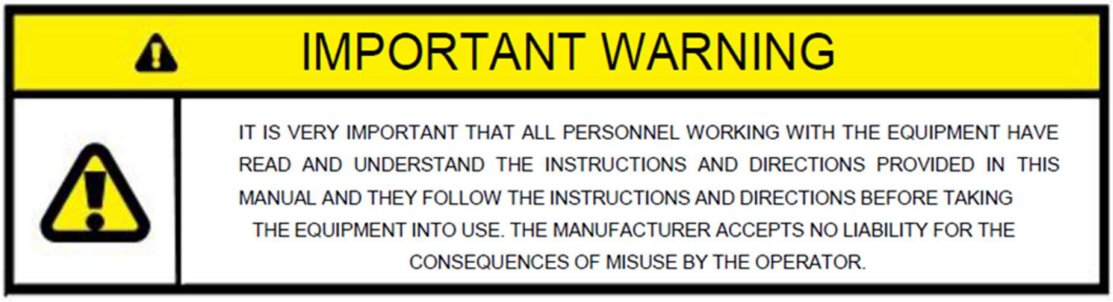


The operator shall bear responsibility for the suitability of the device for the specific purpose:

1. Improper installation and operation of the devices (systems) will cause warranty to be void
2. The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited direct, indirect, incidental, punitive and consequential damages.

Installation, connection, commissioning and service must be carried out by personnel who are qualified and authorized to do so.

Installation personnel must ensure that the measuring system is correctly connected in accordance with the connection diagram.

This device contains electrical components with an electrical current therefore installation, services and maintenance must be carried out by expert and qualified personnel, aware of all necessary precautions. Before opening any internal parts, please shut off the power supply.

Warning: Pay special attention to the important information linked to product or particular part in the operation manual.

- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at is-electric level, shielded, wires shall be located rationally, SPD surge protector shall be applied properly.
- If the product falls into the water, please cut off the power immediately, otherwise there will be leakage, electric shock or even a fire accident.
- 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, otherwise the product's protective device may be damaged.
- Don't use the instrument if it is found damaged or deformed at opening of package.
- Prevent dust, wire end, iron fines or other objects from entering the instrument during installation, otherwise, it will cause abnormal movement or failure.
- During operation, to modify configuration, signal output, start up, stop, operation safety shall be fully considered. Operation mistakes may lead to failure and even destruction of the instrument and controlled equipment.
- Each part of the instrument has a certain lifetime, which must be maintained and repaired on a regular basis for long-time use.
- The product shall be scrapped as industrial wastes, to prevent environment pollution.

1. PRELIMINARY NOTES

Ultrasonic level meter is an integrated measuring instrument, which is widely used in continuous non-contact level measurement of liquid, slurry, sludge, solid and other media.

The main parameters of the level meter are

Display	LCD display liquid level or space distance
Installation method	Threaded mounting/flange mounting
Protection	IP65
Measuring variable	Level / Distance
Measuring range	0~10M/ 0~20M
Accuracy	±0.3% (Standard condition)
Resolution	1 mm
Temperature	-20℃ ~ +60℃
Relative humidity	(10~85) %RH (no condensation)
Current output	4 ~ 20mA
Communication	RS485, Modbus communication interface or customized
Power supply	DC 24V/AC 220V, Lighting protection device built-in

2. Installation

Please read this section when installing this product.

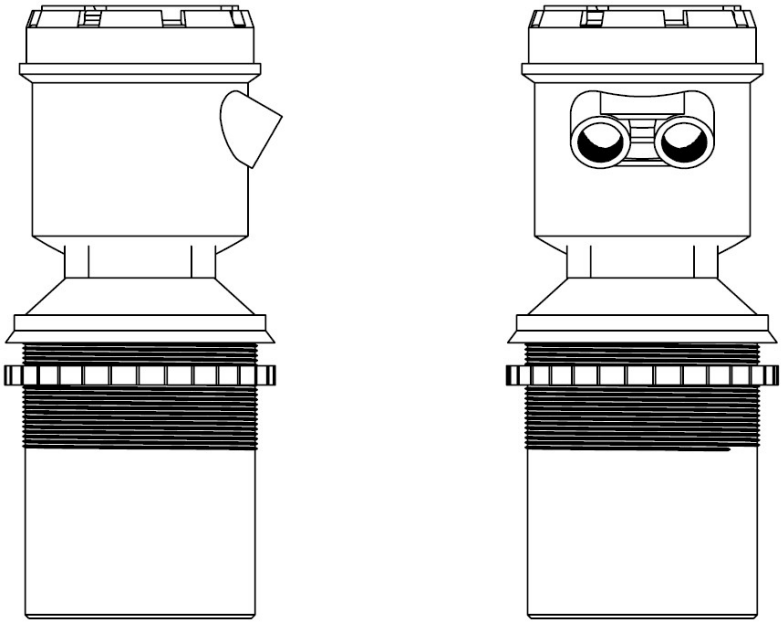
Installation precautions

- The installation method of this product is threaded installation/flange installation.
- In order to prevent the internal temperature of this product from rising, please install it in a well-ventilated location.

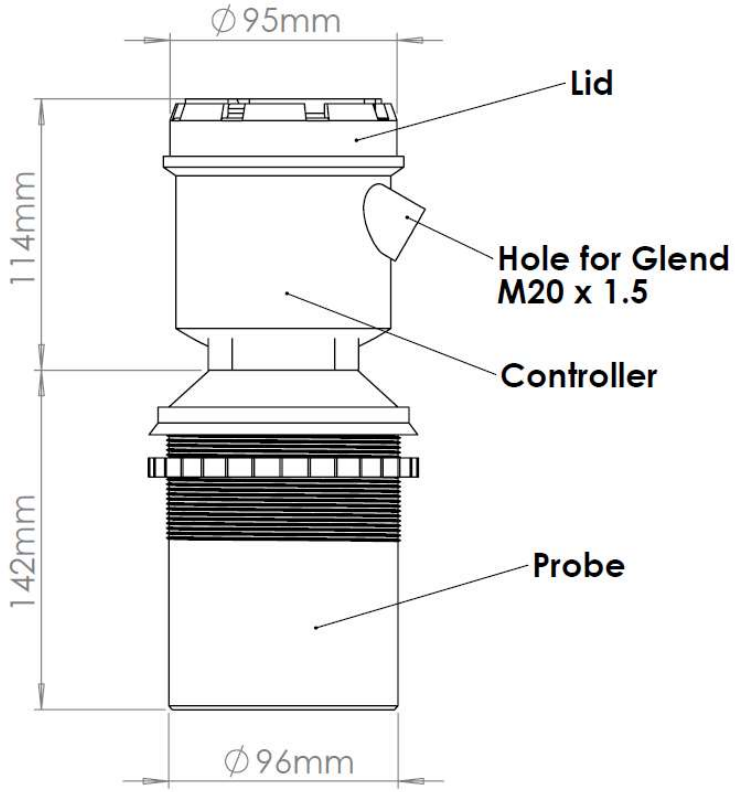
Avoid the following location during installation

- Location where sunlight directly hits and near hot appliances
- Location where the ambient temperature exceeds 60℃ during work
- Location where the ambient humidity exceeds 85% at work
- Near the electromagnetic generation source
- Location with strong mechanical vibration
- Location with high temperature changes and easy condensation
- Location with high quantities of lampblack, steam, moisture, dust and corrosive gases

2.1. Dimension



SIDE VIEW FRONT VIEW

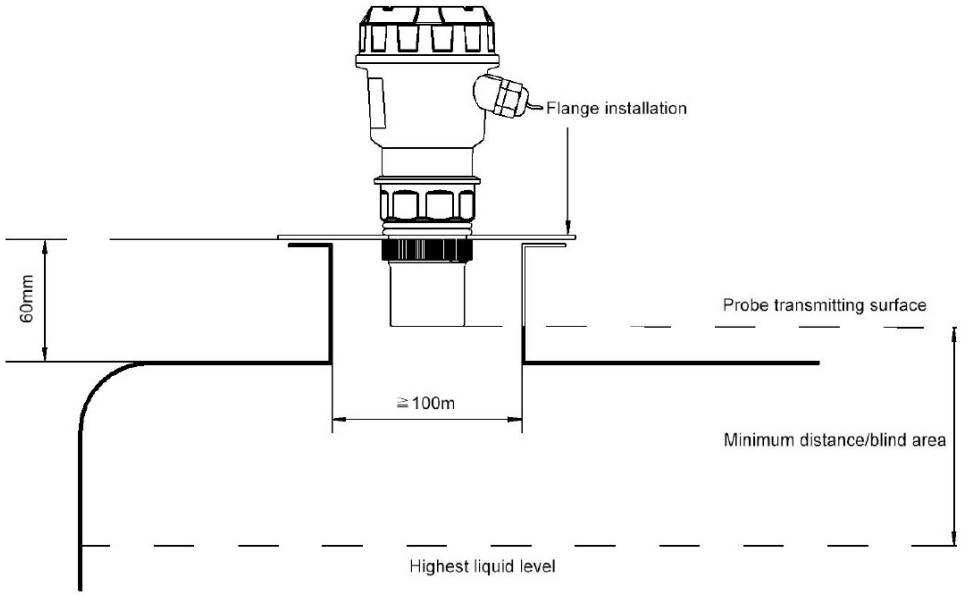


2.2. Installation guide

2.2.1. Measuring liquid

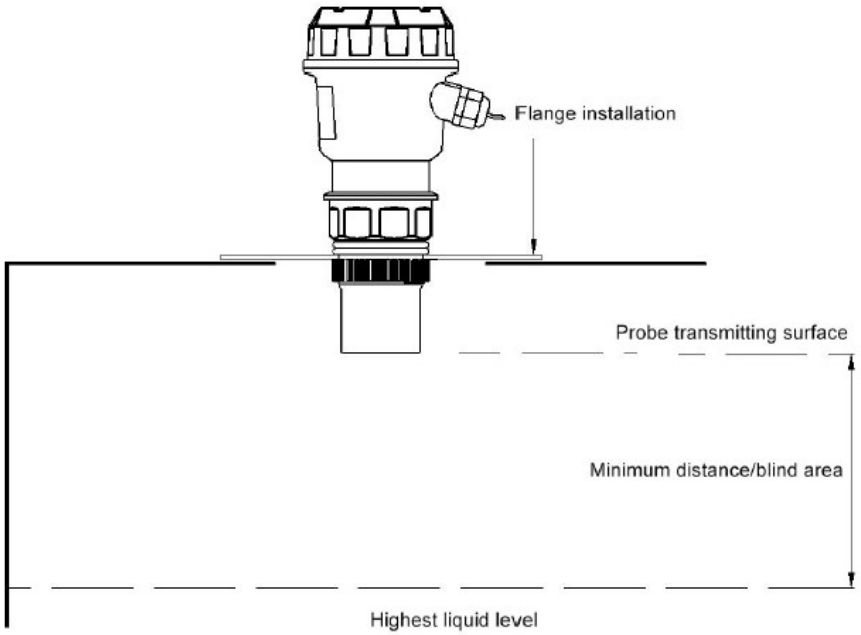
1. Flat-top tank

Flat-top tanks generally have a very short nozzle. The reference surface of the nozzle is the bottom surface of the flange. When the length of the nozzle is ≤60mm, the inner diameter of the nozzle is ≥100mm, and the inner wall of the nozzle is flat without burrs or protrusions, the probe is installed after installation. The emission surface can be measured 3cm below the bottom surface of the flange.

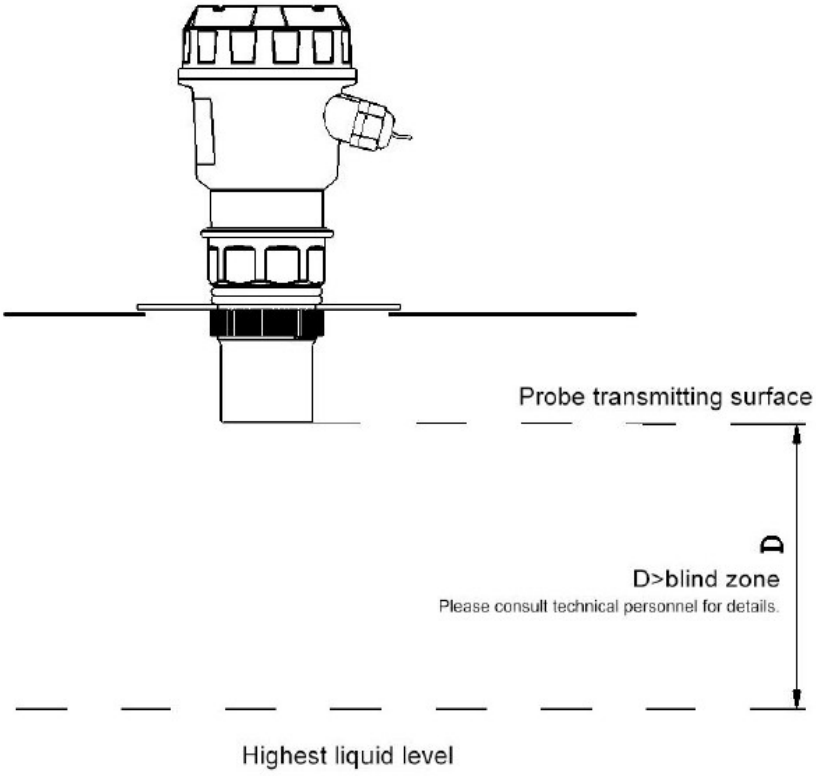


Flange installation - installed in a short nozzle

The most ideal installation is to directly install the instrument on a flat-top container. Without using a nozzle, the circular opening on the container can be sufficient to fix the flange or universal joint for installation. The emitting surface of the probe is below the reference plane.

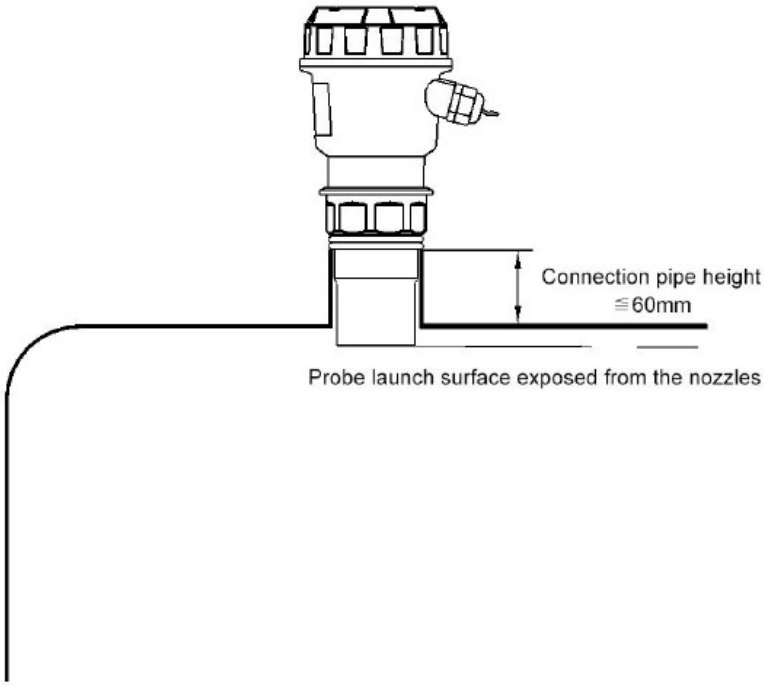


Flange Type (Locking Flange)-Installed on Flat Top Tank



Flange type is installed on flat head tank without nozzle

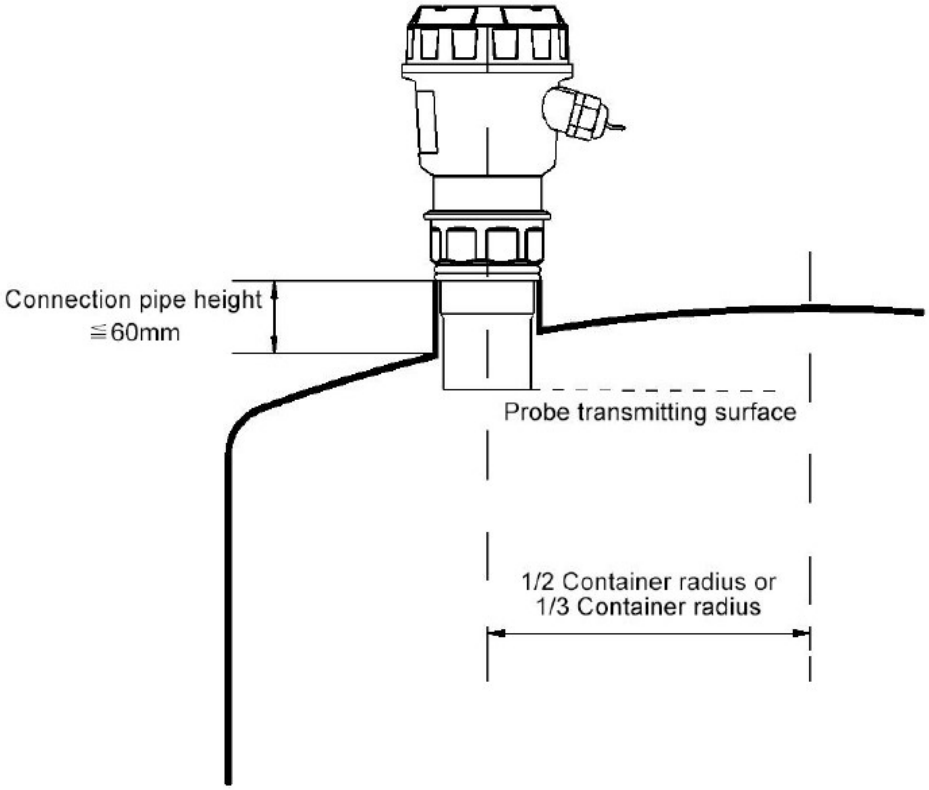
It is installed on the same threaded nozzle as the probe. In this case, the internal diameter of the nozzle is almost the same as the external thread of the probe. The emitting surface of the probe must extend more than 1cm beyond the nozzle and cannot be retracted into the nozzle.



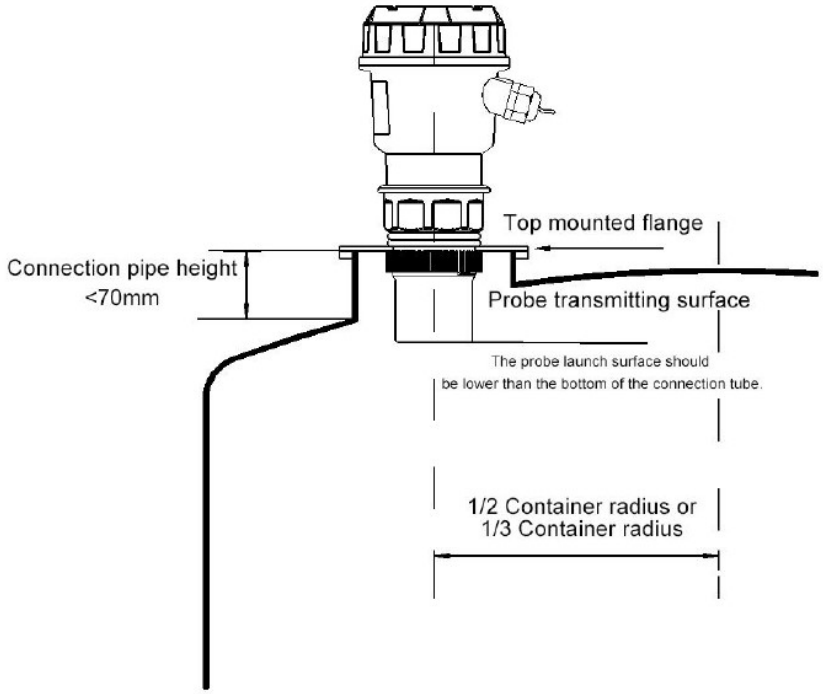
The probe is mounted on the threaded nozzle.

2. Arched tank top

For arched tanks, it is better to install the instrument not at the center of the tank top, but at 1/2 or 2/3 of the radius of the tank top (on the premise of satisfying a certain distance from the tank wall). For ultrasonic pulses, the dome-shaped tank top is like a convex lens. If the probe is mounted on the focal point of the convex lens, it will receive all false echoes. Therefore, it should be avoided as far as possible to install the sensor probe in the centre of the dome-shaped tank top.



Installed on threaded nipple-dome roof



Installed on flange-dome roof

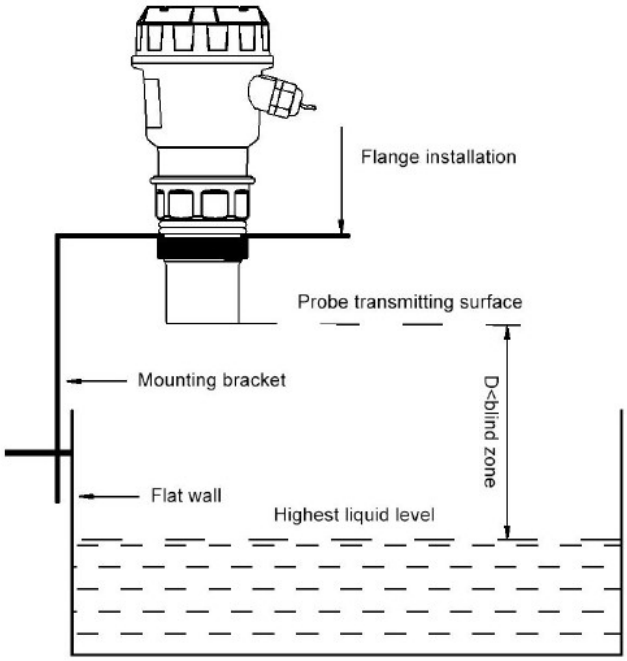
On the top of most arched tanks, the length of the nozzle plus flange is 150-180mm, while the probe thread in ultrasonic level meter is not as long as this (the extended probe can be customized to our company so that the emitting surface of the probe is lower than the bottom of the nozzle). Under such circumstances, we need to pay attention to the proportional relationship between the diameter and length of the nozzle.

Sr. No.	Nozzle Length	Minimum size of nozzle Inner diameter	Remarks
1	150 mm	100 mm	The inner wall of the nozzle is free of burrs and bulges, vertical from top to bottom, and the welding seam must be polished. The joint between the nozzle and the tank top shall be polished at an oblique angle of 45℃ from the inside to the outside of the nozzle.
2	200 mm	150 mm	
3	250 mm	180 mm	
4	300 mm	220 mm	
5	400 mm	280 mm	

3. Open tank

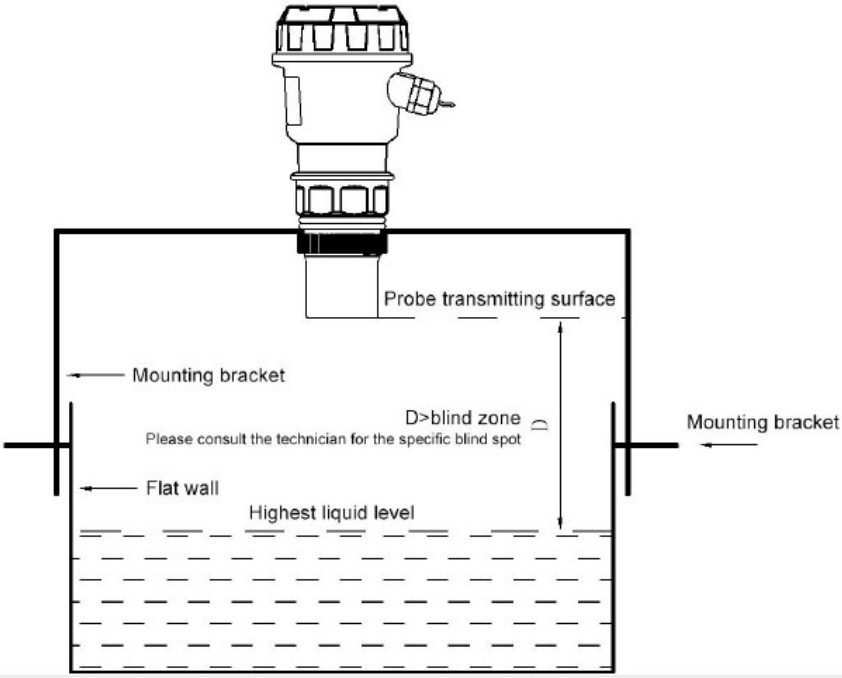
For open tank, the bracket can be used for installation. Attention should be paid to the bearing capacity of the bracket to keep a certain distance between the sensor and the container wall. If the inner wall of the open tank or silo is flat up and down, no hanging occurs, and no other objects are on the inner wall, then the distance between the sensor and the container wall is shown in the following table:

Maximum range	Minimum distance from wall	Maximum range	Minimum distance from wall
5M	0.5M	10M	1.0M
15M	1.5M	20M	2.5M



On the open tank - the top is mounted on one side bracket.

Since the open tank has no focusing effect, the sensor can be installed in the middle of the container.

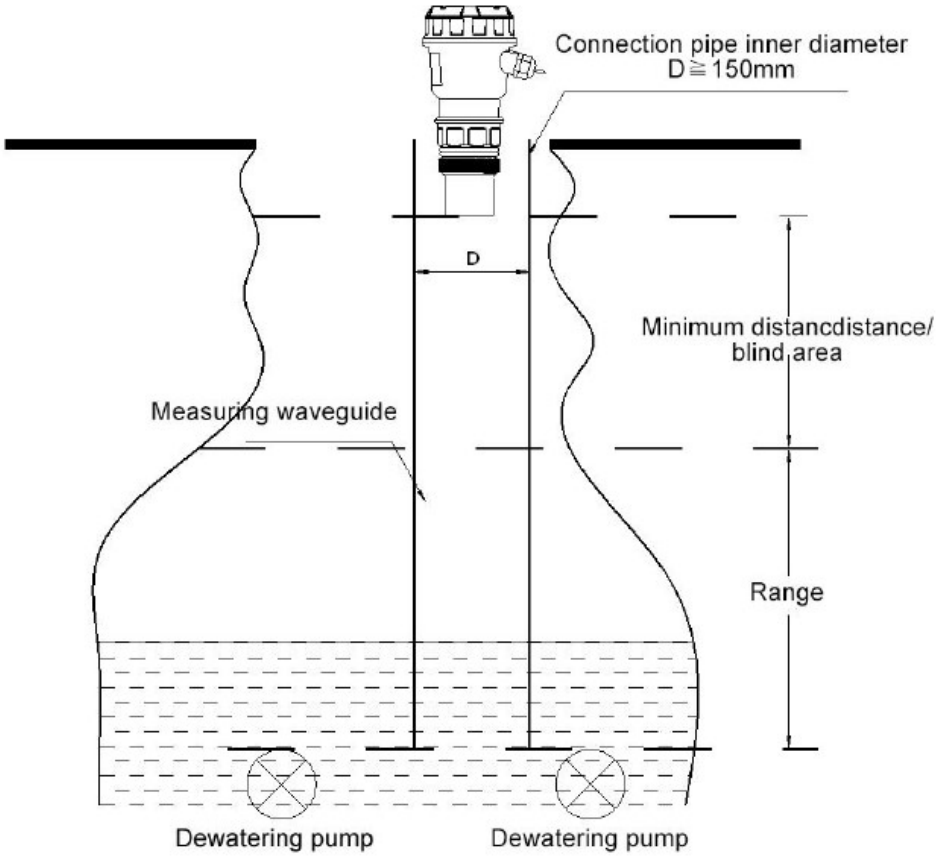


On Open tank -Top Center Bracket Installation

4. Drainage wells and ordinary wells

Drainage wells are usually narrow in shaft and wellhead, and the borehole wall is uneven, which makes ultrasonic measurement very difficult. This problem can be solved by installing a section of nozzle or installing the entire measuring sleeve. It should be noted that after the sensor is placed in the nozzle, the blind area will increase by about 50 ~ 100%, and the factor of increasing the blind area should be taken into account.

Therefore, if the original probe blind area is 0.50 meters when the nozzle is used, the blind area will increase to 1.00 meters when the nozzle is placed inside the nozzle.



Nozzle used for measuring drainage well.

Ordinary water wells (including water source wells and deep water wells) generally have small diameters, and measuring sleeves can be installed to achieve the best measuring effect. The inner wall of measuring sleeves must be smooth (e.g. PVC or PE waste water pipes) and the inner diameter ≥150mm (within the measuring range of 4 meters). If the takeover exceeds 4 meters, the manufacturer shall be consulted. As long as the measuring nozzle can be

kept clean, free of adhered media and free of seams inside, measurement can be made. The measuring sleeve shall be soaked in the medium all the time so as to ensure accurate measurement in the measuring nozzle.

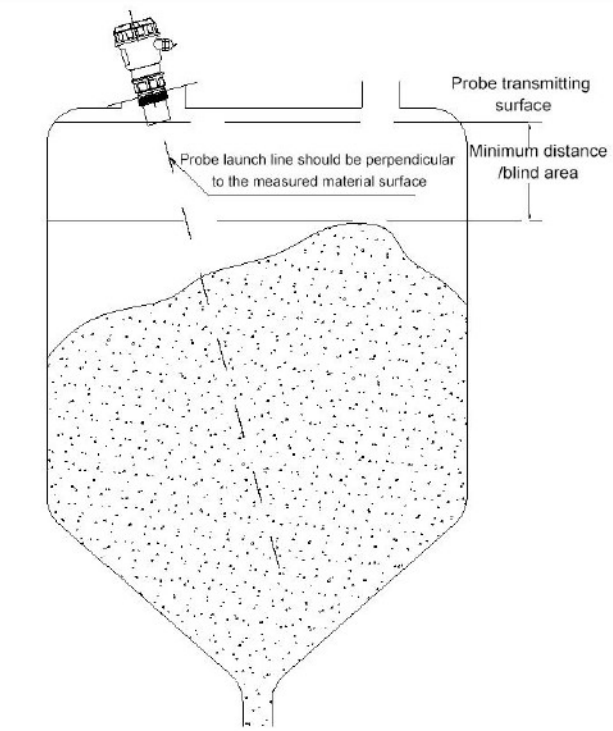
2.2.2. Solid measurement

1. Flange mounting

Like measuring liquid medium, the instrument can be installed on the butt flange of the container nozzle. Since the reflection surface of the solid is different from that of the liquid and is not a plane, this problem should be considered during installation. The emitting surface of the probe should be perpendicular to the surface of the solid to be measured, and the probe should be able to protrude from the nozzle.

In the field of measuring solid, if the probe is retracted into the nozzle, the measured data will jump or "wave drop" will occur in most cases.

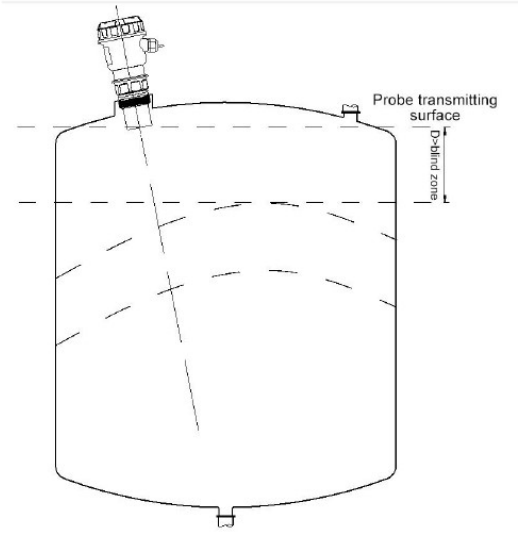
In order to solve this problem, a universal flange can be selected, so that as long as the flange is rotated, it is easy to align the emitting surface of the probe with the solid reflecting surface to be measured.



Installed on container flange

2. Threaded pipe installation

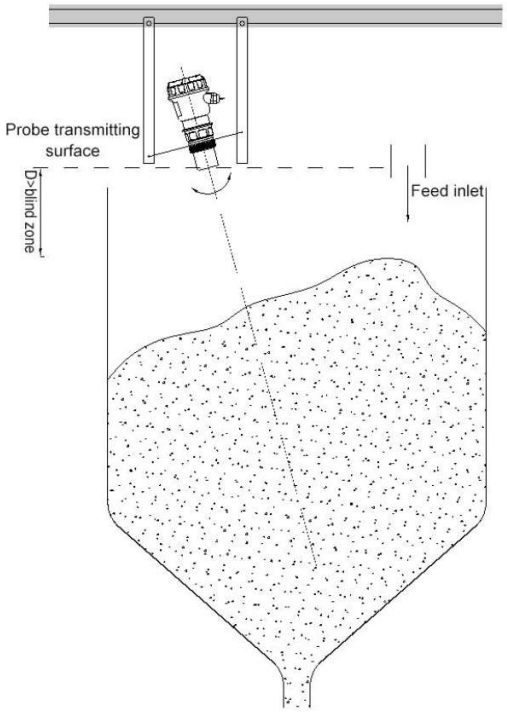
When installing with a threaded nipple, the probe must be exposed more than 2cm from the bottom of the nipple.



Threaded pipe installation

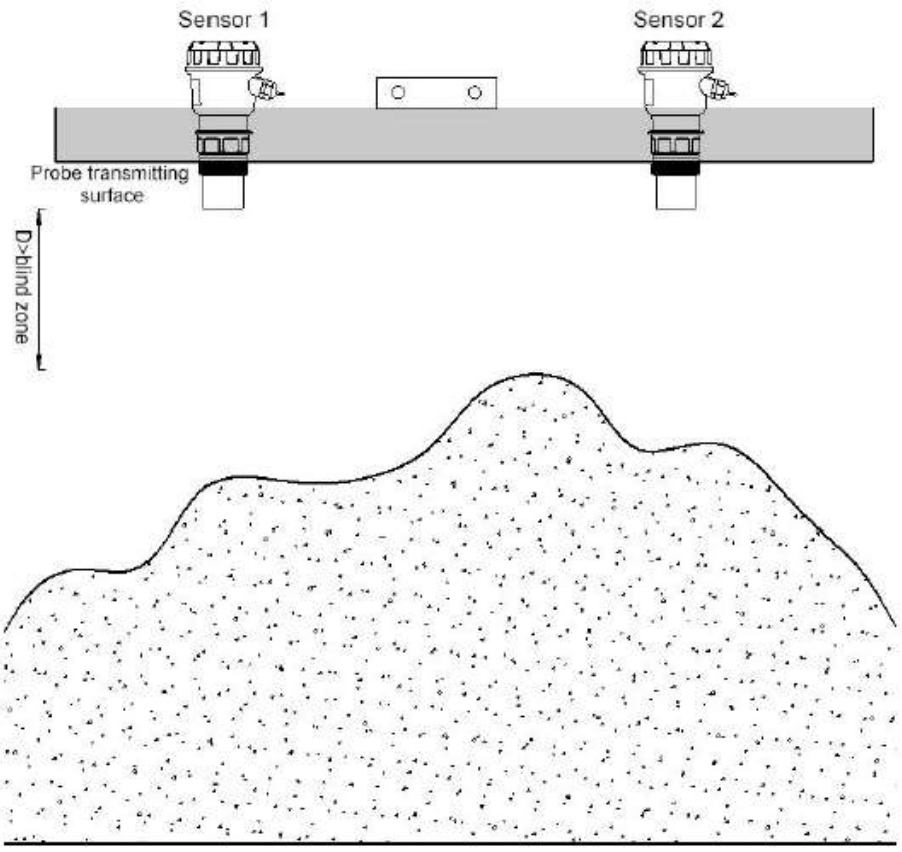
3. Installation of frame type

Gantry frame type installation can be adopted in open tank, and the axis of the nozzle must be aligned with the container outlet or perpendicular to the medium surface.



Installation of frame type

During the installation of the open-air material pile, the large open-air material pile needs to be measured by a plurality of meters, the meters can be fixed on the lifting frame, and the sensor probe should be aligned with the surface of the medium.

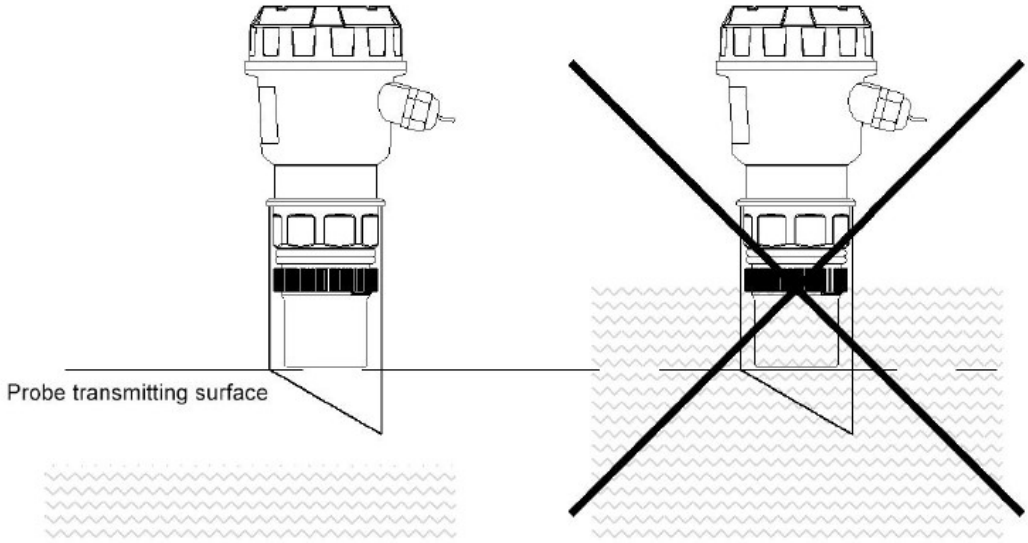


Measurement of open-air material pile-installation on lifting frame

2.2.3. Measuring nozzle extension method

A minimum distance between the probe of the ultrasonic level meter and the surface of the medium to be measured needs to be maintained, which is commonly referred to as blind area. However, sometimes the minimum distance cannot be guaranteed on site, so it is necessary to install an extended nozzle on the container.

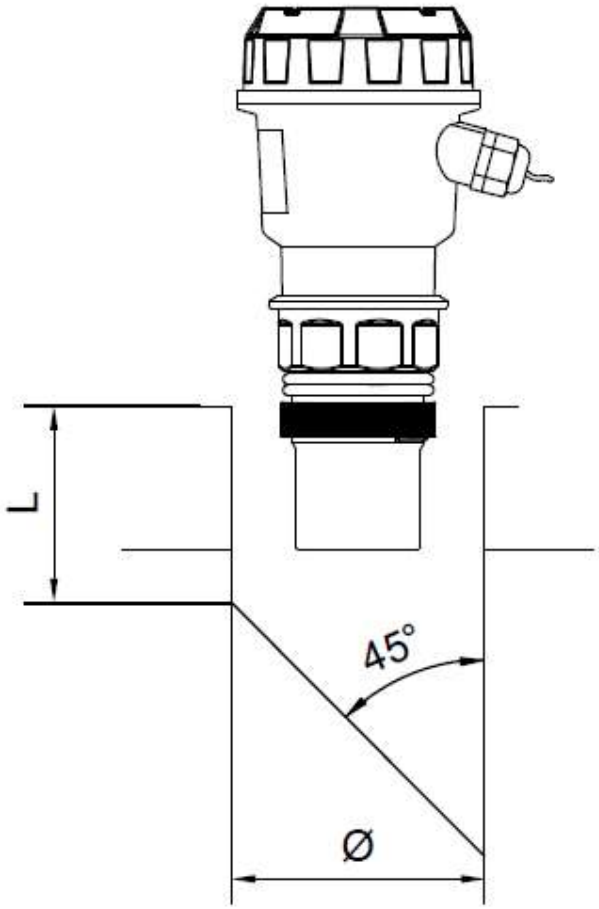
1. How to extend the nozzle.
The inner wall of the nozzle shall be kept smooth, and the nozzle shall not be immersed in the medium to prevent the medium from polluting the nozzle or adhering to the inner wall of the nozzle.



Nozzle cannot be soaked in adhesive medium, Viscous liquid or slurry

If it is a non-adhesive medium, the extension pipe can be soaked in the medium for a long time (if it cannot be corroded by liquid or foreign matters cannot adhere to the inner wall of the pipeline), so the measurement will be more accurate, because the measurement will not be affected by other devices in the container. The inside diameter of the nozzle should be as large as possible, and the chamfered cut should be kept smooth. The relationship between the nozzle height L and the nozzle inner diameter φ in the following figure is shown in the following table.

Sr. No.	Nozzle Length	Minimum size of nozzle Inner diameter	Remarks
1	150 mm	100 mm	The inner wall of the nozzle is free of burrs and bulges, vertical from top to bottom, and the welding seam must be polished. The joint between the nozzle and the tank top shall be polished at an oblique angle of 45℃ from the inside to the outside of the nozzle.
2	200 mm	150 mm	
3	250 mm	180 mm	
4	300 mm	220 mm	
5	400 mm	280 mm	



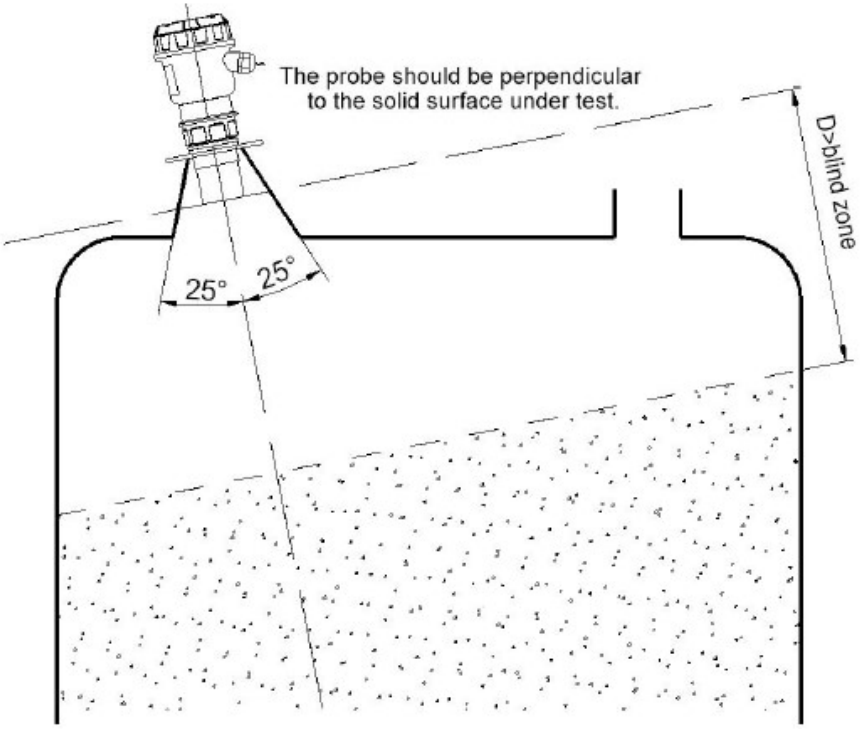
Extension nozzle not immersed in medium

If the extension nozzle is installed from the top of the tank to the bottom of the tank, please refer to the following table for the relationship between the inner diameter of the nozzle and the distance measured by the sensor.

Maximum range	The minimum inner diameter of the nozzle can be larger than this inner diameter.	Maximum range	Minimum internal diameter of nozzle
5M	150 mm	10M	200 mm
15M	250 mm	20M	300 mm

2. Measure how long the solid connection is extended.

If it is measuring solid medium, unlike measuring liquid, it is necessary to use a tapered extension pipe with an angle of 25°～30°.

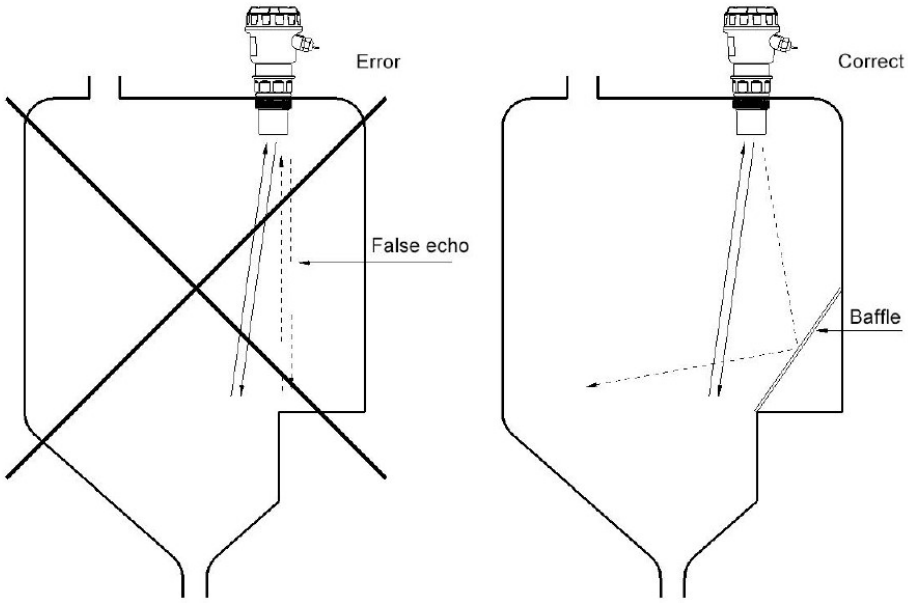


Extension nozzle for measuring solid medium

2.2.4. False echo blocking method

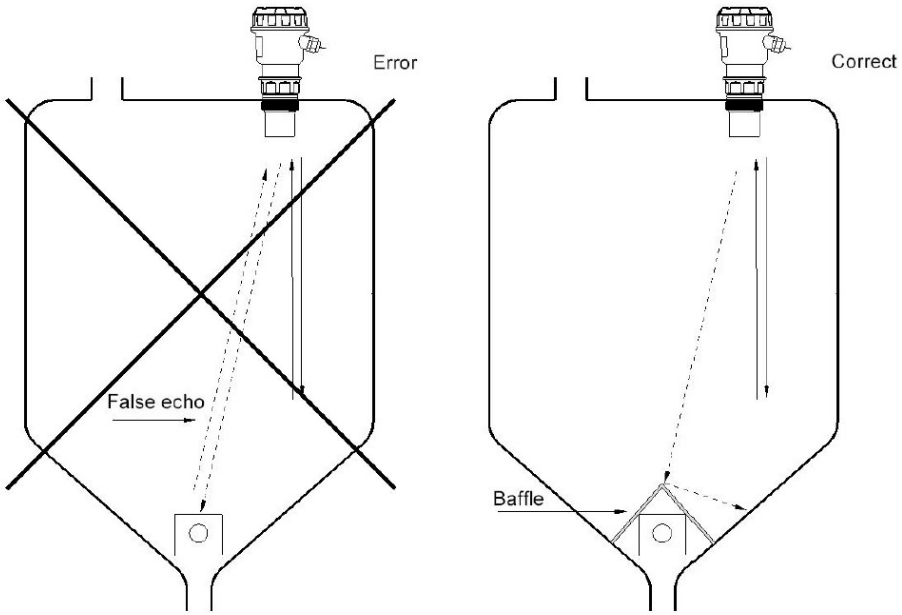
1. Device and Installation in Container

When installing the sensor, care must be taken not to have other devices or materials blocking the ultrasonic beam. Protrusions on the inner plane of the container or obstacles like steps will have a great impact on the measurement. A refraction plate can be blocked at the protrusion to refract the false echo, thus ensuring the accuracy of the measurement.



Step-like obstacles in the container-need to add inclined horizontal plates to refract false echoes away.

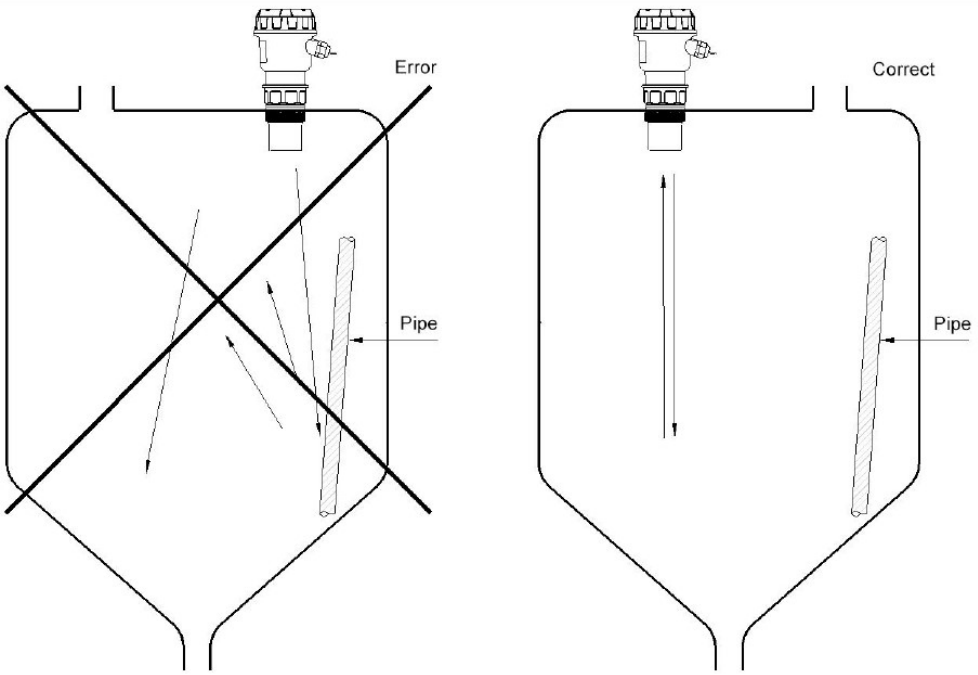
If the upper surface of any object on the lower part of the container is flat, it must be blocked by a refraction plate with a certain angle for water inlet of various media.



A projection with a flat top at the bottom of the container-a refracting plate should be added.

Devices inside the container, such as pipes and brackets, will affect the measurement. In the design of measuring points, attention must be paid to the

fact that there cannot be other devices within the diffusion range of ultrasonic signals.



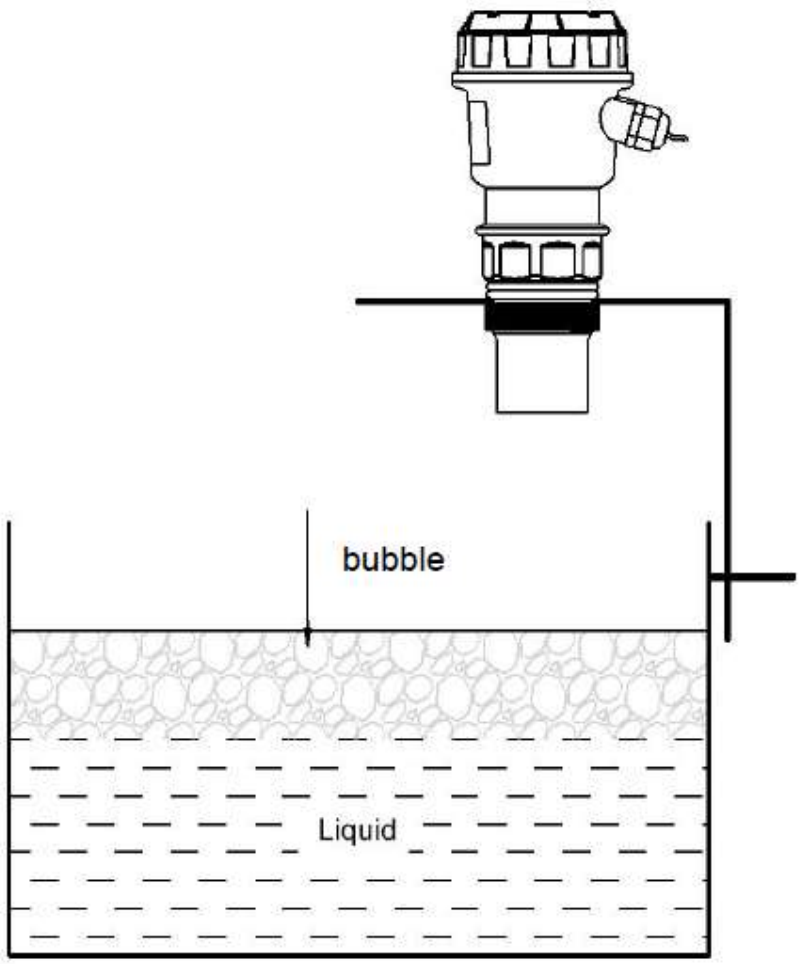
Obstacles in containers-pipes

The container wall has adherents-a certain distance from the adherents

2. Common installation errors

- **Bubble**

If the bubbles on the surface of the medium are large and the bubble layer is thick, measurement errors will be caused and even reflected ultrasonic waves will not be received. Please take measures to prevent bubble generation, or install the sensor in the bypass pipe for measurement. Other measuring instruments can also be used, such as radar level gauge or magnetostrictive level gauge.



Location with bubbles

- **The sensor installation direction is wrong**

If the sensor is not installed on the surface of the medium, the measurement signal will be weakened. In order to ensure the best measurement effect, please align the axis of the sensor with the surface of the medium, that is, perpendicular to the surface of the measured interface.

- **Installed in a position with large temperature change**

In locations with large temperature changes, such as intense solar radiation, measurement errors will be caused. This error will increase by 2-4% over the original measurement accuracy. Please install a sun visor to solve this problem.

- **The minimum distance to the medium is less than the blind area**

If the distance between the probe and the highest position of the medium is smaller than the blind area of the meter, the measured values are all wrong.

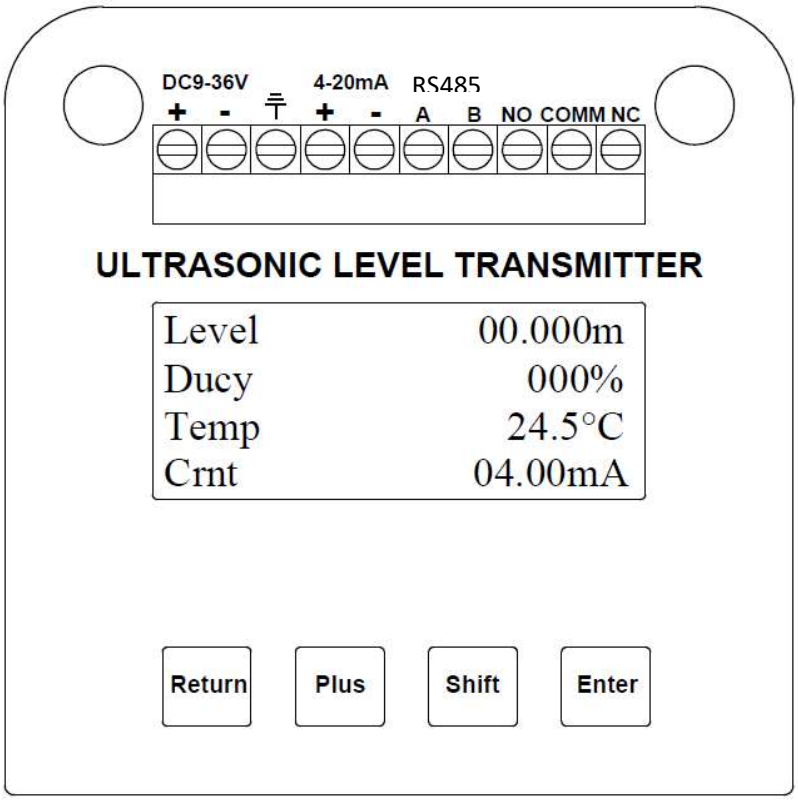
- **The sensor is too close to the container wall**

If the sensor is installed too close to the container wall, it will produce strong false echo. The uneven inner surface of the container wall, the adhered medium, rivets, screws, reinforcing ribs and welds on the inner wall of the container will all cause strong false echoes, which will be loaded on the effective echo signals. Therefore, please note: keep the distance between the sensor and the container wall according to the maximum distance to be measured. See the details in the figure below.

Maximum range	Minimum distance from wall	Maximum range	Minimum distance from wall
5M	0.5M	10M	1.0M
15M	1.5M	20M	2.5M

For more severe measurement conditions, the distance between the sensor and the container wall should continue to be enlarged until no false echo appears.

3. Wiring



3.1. Menu

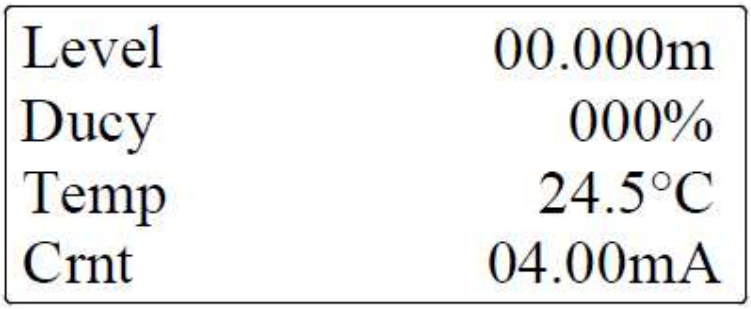
Note: It takes about 30 seconds to prepare this product from start-up to normal measurement.

3.2. Navigation keys

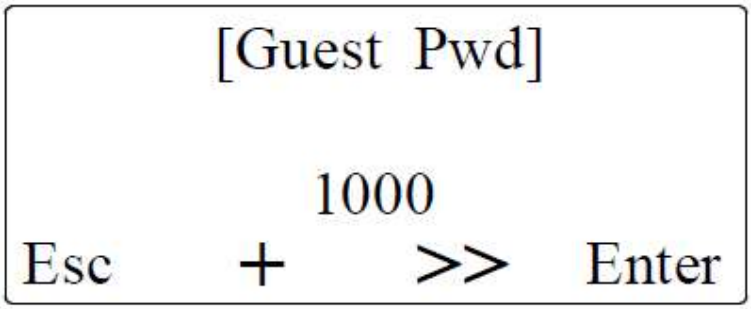
Identification	Name	Function
ENTER	Set key	1. Enter the parameter setting
		2. Switch to display each parameter item
		3. Confirm and save the new parameter values after modifying and setting the parameters
SHIFT	Shift key	1. Move the cursor position
		2. In the main menu interface, select the setting parameter item down
PLUS	Upward key	1, make the parameter cursor position cycle from 0 to 9 or switch options
		2. Select the setting parameter item upwards in the main menu interface
RETURN	Exit key	1. Exit the parameter setting interface and return to the main interface

4. Operational menu

MAIN MENU



Press the ENTER key to enter the main menu, as shown in the following figure:

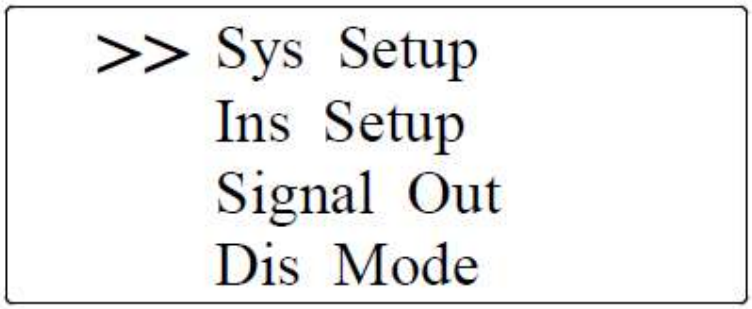


PASSWORD MENU

In the main menu interface, you can move the cursor up and down by pressing the PLUS key or SHIFT key to switch the cursor to the parameter item to be modified, and then press the ENTER key to enter. The factory parameters and calibration settings can only be entered by entering the correct password. You can return to the main interface by pressing the ESC key.

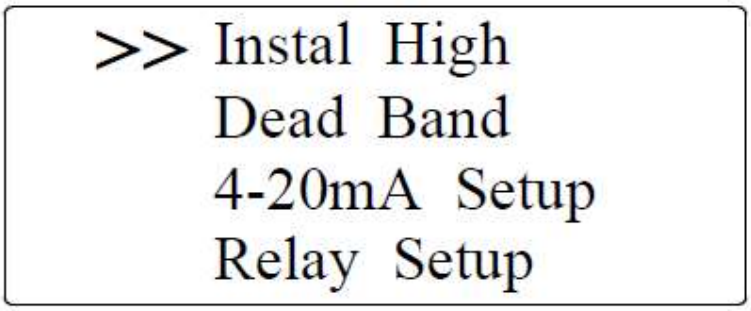
SYSTEM MENU

This is an administrator password, which the customer cannot access. This is only for the use of the manufacturer.

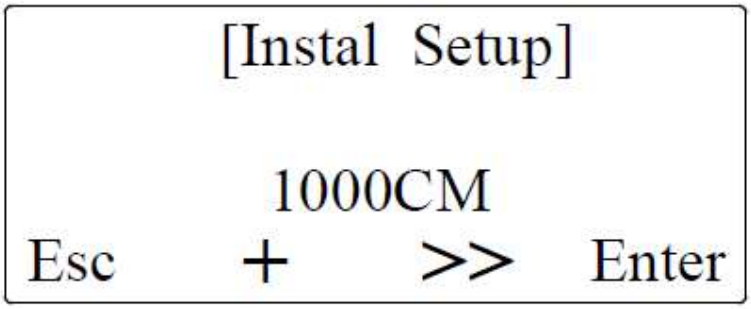


INSTALLATION MENU

When you enter the correct password you will see the above menu.
You can select any setting by pressing the PLUS key or SHIFT key, and then press the ENTER key to enter. On selecting SYS SETUP. The following menu appears:

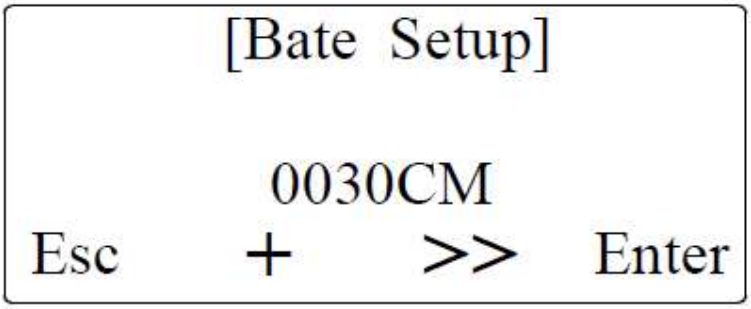


INSTALLATION MENU

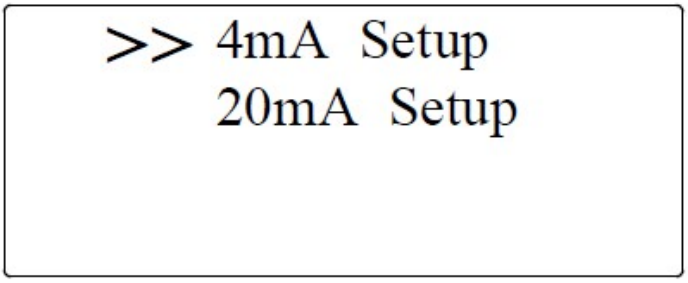


The vertical distance between the bottom of the tank or tha pool and the probe surface of the instruments. The above menu appears.
To set up use PLUS key or SHIFT key, and then press the ENTER key to enter.

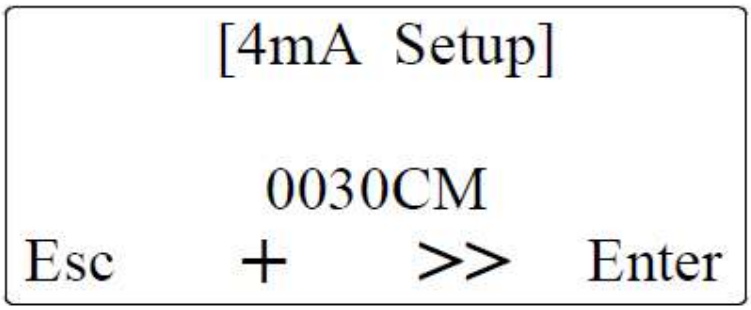
BATE SETUP



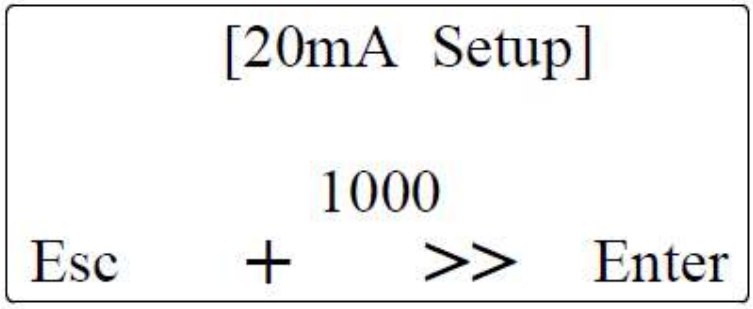
4-20mA Setting:



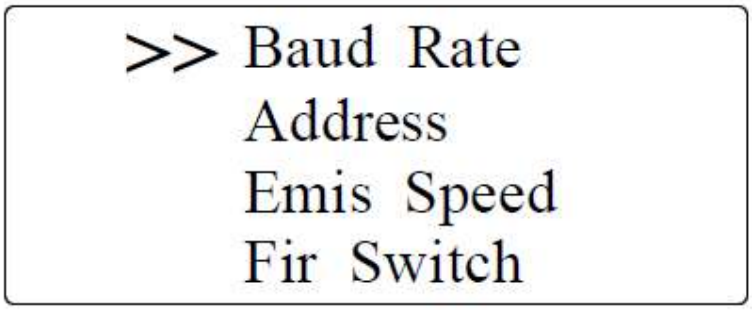
The current output range is set, with the low position corresponding to the value of 4mA current.



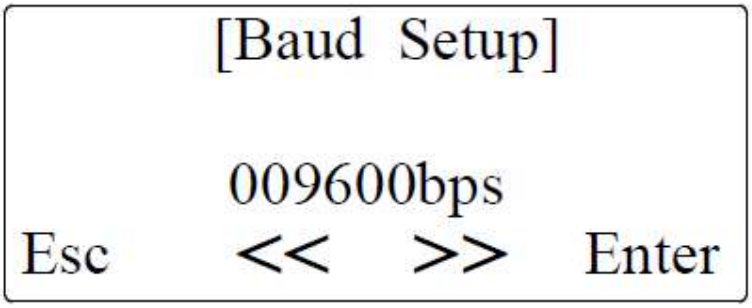
The high position corresponding to the value of 20mA current.



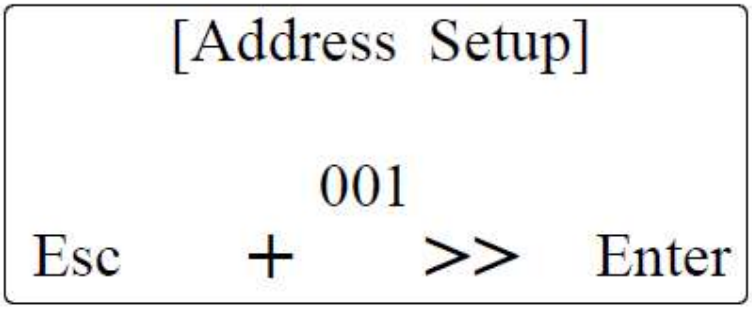
BAUD RATE:



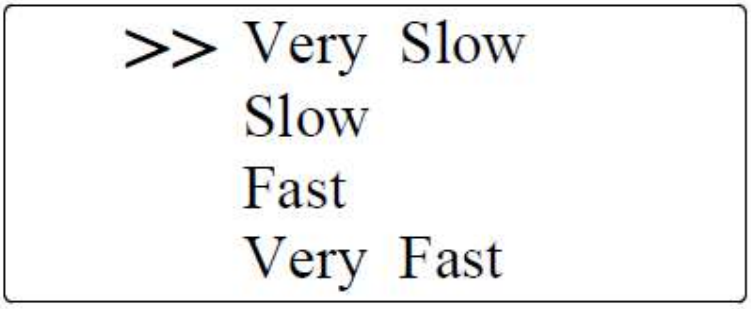
Baud rate setting: 2400, 4800, 9600, 14400
If you need to change the baud rate, press the ENTER key to enter the menu at this level. After selecting the baud rate, press the enter key to return to the menu at the higher level.



To setup the address of the baud rate. Default address is 001



To setup the speed of the baud rate.



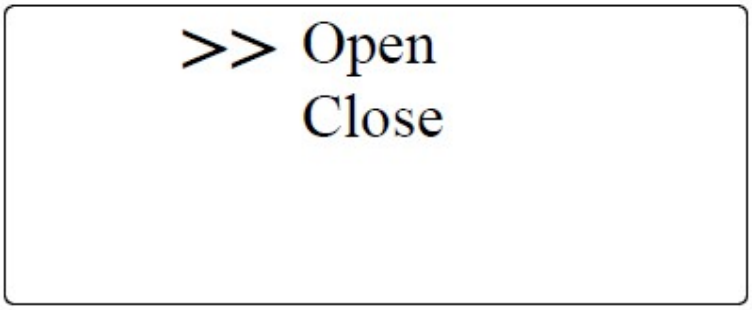
Modbus Configurations

Connection:

- Baud rate: 9600

- Word Length: 8
- Parity: None
- Stop bit: 1
- Transmission mode: Standard RTU
- Slave response time out: 2000 ms
- Delay between polls: 1000 ms
- Default Device ID: 1
- Default Data: Float: Most significant register first
- Starting Address: 0001 (40001)
- Length: 6
- Register: Holding Register
    - 40001: Level in meter
- Unit of Flow: Level in Meter (only)

FIR SWITCH



The default current mode is (4-20) mA. FIR Switch is used to reserve the output without changing the actual the current level setting.
If you need to select (20-4), press the Enter key to return to the superior menu.

5. Troubleshooting

Display	Reason	Remedies
No display	• The power supply is not connected properly • The LCD panel and the motherboard are disconnected or loosened • LCD screen damaged	• Check the power line • Check the wiring and reconnect it • Return to factory for maintenance

Display	Reason	Remedies
If the meter is not working properly.	• The measured distance exceeds the measuring range of the level meter • The measured medium has strong disturbance, vibration or serious dust. • There are strong interference sources such as frequency converters and motors nearby. • The probe is not aligned with the measured plane. • There are redundant objects in the measured space, such as support rods, blanking openings, etc. • Liquid level enters blind area. • The tested medium is soft powder. • There is foam on the surface of the tested liquid, and the foam coverage area exceeds 30% within the ultrasonic irradiation range	• Consider replacing a level meter with a larger measuring distance than the existing one • After waiting for the measured medium to recover calm, the equipment will automatically resume normal measurement. • Check the surrounding environment, do a good job of electromagnetic shielding. Do not use the same power supply as the frequency converter and the motor, but also be grounded reliably. • Reinstall the probe perpendicular to the liquid level • Re-select the appropriate installation location to avoid interference as much as possible. • Raise the probe installation position • Consult the manufacturer if it is powder. • It is necessary to filter the foam in the water inlet part or place the ultrasonic level gauge in the waveguide to measure, so as to avoid the influence of foam.