

# **USER MANUAL** **ULTRASONIC LEVEL METER PLUT**



# Table of contents

<b>1. Introduction.....</b>	<b>1</b>
1.1 Application:.....	1
1.2 Features:.....	1
1.3 Structure:.....	2
1.4 Measuring principle: Time-of-flight method.....	3
1.5 Technical data.....	4
<b>2.Installation.....</b>	<b>7</b>
2.1 Installation considerations.....	7
2.2 Mounting.....	9
<b>3.Wiring.....</b>	<b>11</b>
3.1 Wiring diagram.....	11
3.2 Terminal blocks.....	12
3.3 Cable.....	12
<b>4. Operation.....</b>	<b>13</b>
4.1 display and keys.....	13
4.2 Two working mode.....	13
<b>5. Calibration.....</b>	<b>21</b>
<b>6. Trouble-shooting.....</b>	<b>22</b>

# 1. Introduction

## 1.1 Application:

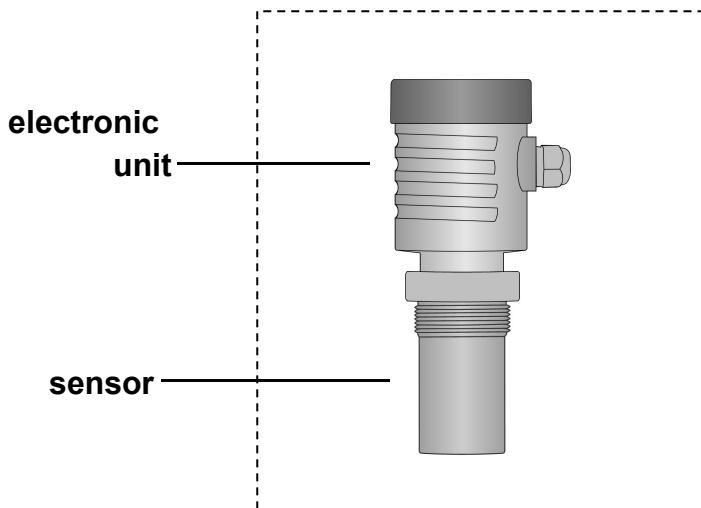
The PLUT series is a compact 2-wire ultrasonic level meter for continuous non-contact level measurement in liquids and solids. It consists of probe and electronic units, both of which are leak-proof structure. This series can be widely applied to the metallurgical, chemical, electricity and oil industries.

## 1.2 Features:

- Integrated design, installed conveniently;
- Protected from the excessive voltage and current , protected from the thunder and lightning;
- The big show window of LCD is easy to debug and observe;
- Excellent anti-interference capability;
- Intellectual signal treatment technology, guarantee that the instrument meets various kinds of operating occasion.
- All metal outer cover ( IP67 ), air-proof and alkali-resisting, meet the abominable environment.

### 1.3 Structure:

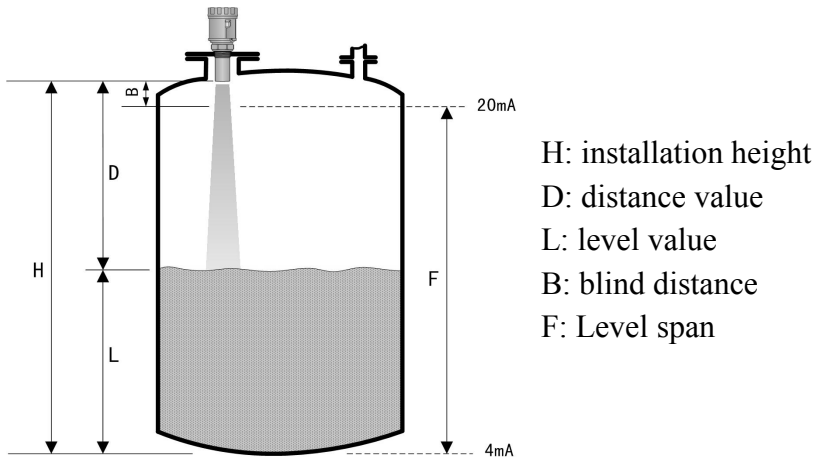
The series is consists of sensor and electronic unit.



### 1.4 Measuring principle: Time-of-flight method

The transducer generate the ultrasonic pulses toward the target medium. There, they are reflected back and received by the sensor. The meter measures the time  $t$  between pulse transmission and reception. The meter uses the time  $t$  (and the velocity of sound  $c$ ) to calculate the distance  $D$  between the sensor membrane and the product surface:  $D = c \cdot t/2$ . As the device knows the empty distance  $H$  from a user entry, it can calculate the level as follows:

$$L = H - D.$$



An integrated temperature sensor compensates for changes in the velocity of sound caused by temperature changes. Calibration Enter the empty distance H and the span F to calibrate the device.

**Blind zone:** Span F may not extend into the blind zone B. Level echo from the blind zone cannot be evaluated due to the transient characteristics of the sensor.

## 1.5 Technical data

### 1.5.1 Basic data

<b>Type</b>	2-wire series
<b>Power supply</b>	DC24V ( $\pm 10\%$ ) 30mA
<b>Display</b>	4 digit LCD
<b>Accuracy</b>	0.2% of full span (in air)
<b>Output current</b>	4-20mA
<b>Output load</b>	0-500 $\Omega$
<b>Temperature range</b>	electronic unit : -40°C~+75°C ( LCD: -20°C~+70°C ) Sensor(PVC/ABS): -20°C~+65°C Sensor(PTFE/PVDF): -40°C~+100°C
<b>Pressure range</b>	-0.1~+0.2MP (Relative atmospheric pressure)
<b>Measure cycle</b>	1.5 second (changeable )
<b>Beam angle</b>	8°(3db) for all range Planar probe
<b>Parameter set up</b>	3 induction buttons
<b>Cable connection</b>	PG13.5
<b>Material</b>	The electronic unit : PVC The sensor: ABS/PVC/PTFE/PVDF
<b>Protect grade</b>	IP67
<b>Fix</b>	Screw or Flange

### 1.5.2 The measuring range:

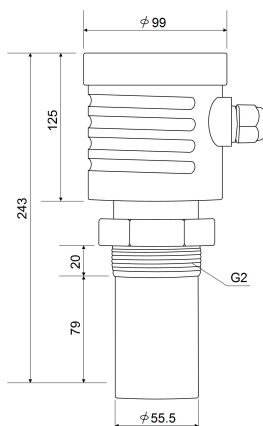
LIQUID	4.00m	6.00m	8.00m	12.00m	20.00m	30.00m
SOLID			3.00m	5.00m	10.00m	15.00m

**Note:** When using to measuring solid level, the most energy of ultrasonic is absorbed or scattered by solid level, so the back wave is very little, the valid measuring range of solid level is about 50% of liquid level. And the valid measuring range of solid level is determined by the installing location and rang.

### 1.5.3 The Blind Zone:

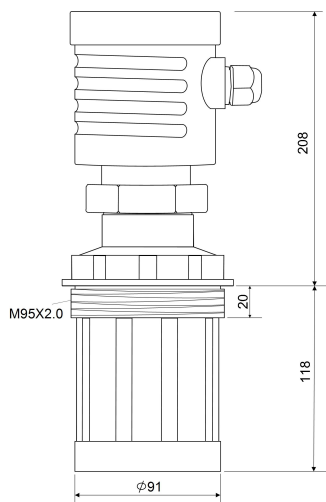
RANGE	4m	6m	8m	12m	20m	30m
Blind Zone	0.20m	0.25m	0.30m	0.50m	0.80m	1.20m

### 1.5.4 dimensions

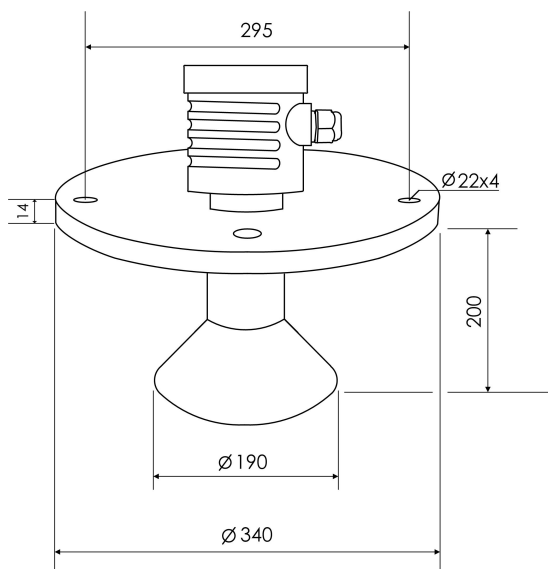


**Sensor:** PVC/ABS/PTFE

**Model:** 4m 6m 8m



**Model: 12m, 20m, 30m**



**Model : 20m, 30m ( Horn probe version)**



## **2. Installation**

Reasonable installation is the critical factor to realize instrument's normal working.

### **2.1 Installation considerations**

#### **2.1.1 General hints**

Installation must be carried out by trained person in accordance with the manual.

The use of metallic fittings or flanges is not recommended.

For exposed or sunny locations a protective hood is recommended.

Make sure the distance between the probe and the maximum level exceeds the blind zone, because the probe cannot detect any liquid or solid surface closer than the blind zone.

Install the instrument at right angles toward the surface of the measuring material.

Obstructions within the beam angle generate strong false echoes. Wherever possible, the transmitter should be positioned to avoid false echoes.

The beam angle is  $8^\circ$ , in order to avoid large echo loss and false echo, the probe should not be mounted closer than 1 m to the wall. It is advisable to maintain a distance of at least 0.6m from the center line of the probe for every foot (10cm per meter) range to the obstruction.

#### **2.1.2 Hints for liquid surface conditions**

Foaming liquids can reduce the size of the returned echo because foam is a poor ultrasonic reflector. Mount an ultrasonic transmitter over an area of clear liquid, such as near the inlet to a tank or well. In extreme conditions, or where this is not possible, the transmitter may be mounted in a vented stilling tube provided that the inside measurement of the stilling tube is at least 4 in. (100 mm) and is smooth and free from joints or protrusions. It is important that the bottom of the stilling tube stays covered to prevent the ingress of foams.

Avoid mounting the probe directly over any inlet stream.

Liquid surface turbulence is not a problem unless it is quite excessive. The effects of normal turbulence are minor; For excessive turbulence, we propose amplify level range or using a stilling tube.

### **2.1.3 Hints for solid surface conditions**

For fine-grained solids, the sensor must be aligned with the product surface.

### **2.1.4 Hints for in-tank effects**

Stirrers or agitators can cause a vortex. Mount the transmitter off-center of any vortex to maximize the return echo.

In non-linear tanks with rounded or conical bottoms, mount the transmitter off-center. If needed, a perforated reflector plate can be installed on the tank bottom directly under the transmitter center line to ensure a satisfactory return echo.

Avoid mounting the transmitter directly above pumps because the transmitter will detect the pump casing as the liquid falls away.

When install to the cold area, should choose the lengthen sensor of the level meter , make the sensor extend into the container, shun frost and icing .

## 2.2 Mounting

### 2.2.1 Mounting measures

There are several methods of mounting the instrument.

- Screw mounted.

This mounting type is applicable to 4m、6m、8m、10m、12m probes.

4m、6m、8m: G2A or 2"NPT/BSPT

12m、20m、30m: M95X2.0

**Hints:** Always use the nut to screw the probe.

- Flange mounted

If the maximum level to be measured falls within the blocking distance, the transmitter must be mounted on a nozzle using an adapter flange. And this mounting type is required for 12 m、20m、30m probes.

Hints:

a) Select as big a nozzle diameter as possible, but keep the height as small as possible.

b) The inner surface of the nozzle should be as smooth as possible (no edges or welding seams).

c) The 12 m、20m、30m probes must longer than the height of the nozzle or the thickness of the top. The probe must extend into the container.

d) The limit of nuzzle as follow:

Measuring range	Min diameter	Max length
4m、6m、8m	65mm(DN65)	500mm
12m	100mm(DN100)	150mm
20m、30m	200mm(DN200)	200mm

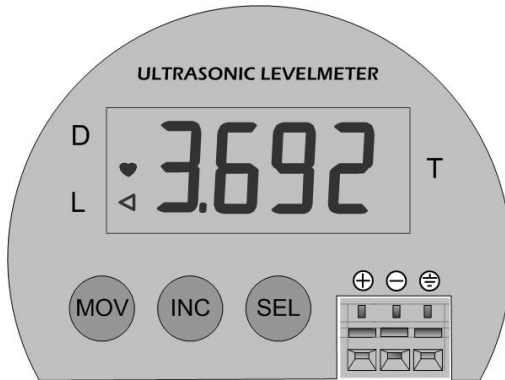
- Bracket mounted

The mounting bracket can be used on open tanks or above conveyor belts. The sensor is screwed into the socket provided.

**Hints:** Always use the nut to screw the probe.

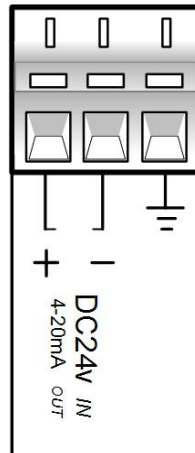
### 3. Wiring

This series has one LCD and three keys and some terminal blocks, they are located within the host housing and can be operated when the cover is open.



#### 3.1 Wiring diagram

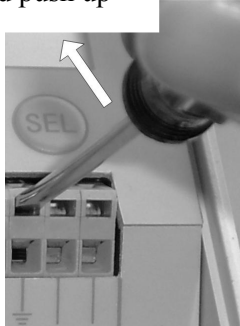
Remove the cover of the connection box, the terminal blocks are shown.



## 3.2 Terminal blocks

The terminal blocks are all self-tightening ones. Use a straight screwdriver to wire as follow.

Insert and push up



## 3.3 Cable

A cable comprising screened, twisted pairs is recommended.

## 4. Operation

### 4.1 display and keys

This series is displayed with 4 digit LCD.

This series has three keys, with its functions as follow:

Keys	Functions
<b>SEL</b>	Selection of the display content or parameter
<b>INC</b>	Changing the value of the certain digit from 0 to 9 in turn
<b>MOV</b>	Selection of the digit to be changed

### 4.2 Two working mode

The instrument has two working mode:

**running mode**

**operating mode**




In running mode, the measurement is displayed. In operating mode, parameter data is displayed to assist with programming.

#### 4.2.1 Running mode

When the power is turned on, the instrument takes several seconds to initialize and then show the running status. The **level** value、the **distance** value and the **temperature** value will be shown in turn. Choose the wanted shown value

through the **SEL** key.

To the left of the main display there will be an alphabet shown to indicate the selected duty. The instrument will show the measuring value in turn as follows in running mode. Please pay attention to the alphabet :

Display Value	LCD
<b>Level Value</b>	
<b>Distance Value</b>	
<b>Temperature Value</b>	

**Notes:** The output current is always corresponding to the PV value (level or distance), it can be selected.

### 4.2.2 Operating mode

In the **operating mode** parameters data is displayed to assist with programming. When **SEL** and **MOV** keys are pressed simultaneously, the instrument can enter or exit of the mode.

Press **SEL** key to select the content. And the changeable contents and parameters will be shown in turn in operating mode, please pay attention to the alphabet in the following examples.



Parameters	LCD
<b>Installation height</b>	6.278
<b>Full span</b>	6.000
<b>Zero span</b>	0.000
<b>PV select</b>	HL01
<b>Inner password</b>	00

Notes:

Push the buttons firmly, but not too hard, to avoid damaging the circuit boards. Also, to avoid entering incorrect data, do not push the buttons too fast.

The operating modes are shown in turn.

The **installation height and the full span value** are parameters must be set up by users, and others are optional ones.

## Significance of the alphabet and the corresponding Parameters:

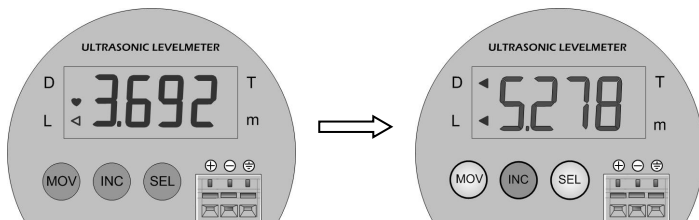
Parameters	Significance
<b>Installation height</b>	The distance from the surface of the probe to the bottom of the container
<b>Full span</b>	The 20mA output corresponding value setting
<b>Zero span</b>	The 4mA output corresponding value setting
<b>PV select</b>	Select the 4-20mA corresponding to the level or the distance value. When the setting is HL99 the current 4-20mA corresponding to the distance value. The any other values the current 4-20mA corresponding to the level value.
<b>The inner password</b>	The password for inner parameters operating. Users do not need to set up this parameter.

## Parameter Change

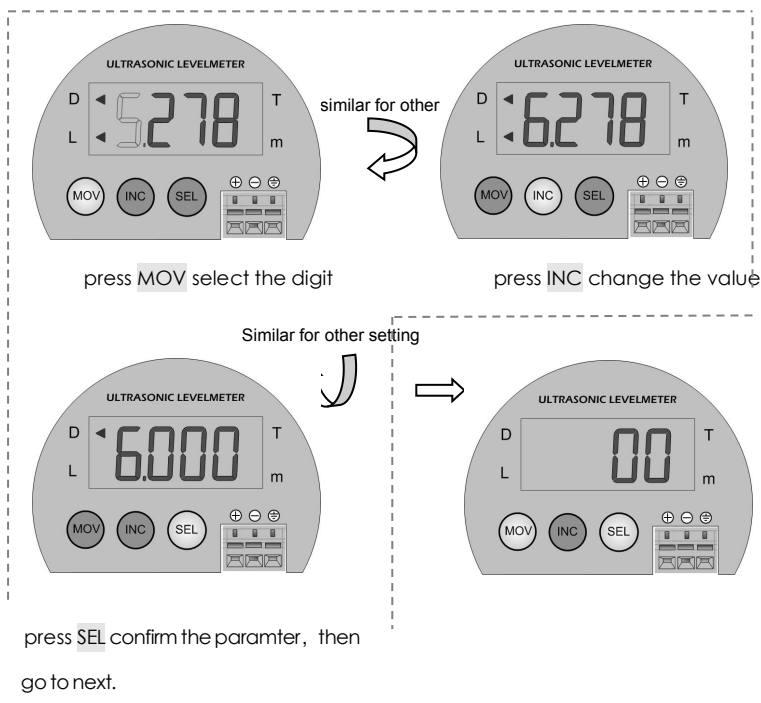


Press **SEL** key To select parameter , press **MOV** key to select one digit to make it darker, press **INC** to change 。 After change, press again **SEL** key, to confirm the parameter change.

Press **SEL**、**MOV** at the same time then release to exit the setting up mode, and store the parameter setted.



Press **MOV** **SEL** at the same time to enter setting mode, and setting the installation height.



After setting, Press **SEL**、**MOV** at the same time to exit the setting up mode

# Procedure of Parameter Setting

1. On measurement status, press **SEL**、**MOV** enter setting up mode



2. Press **MOV** from left to right to select the digit need to change, make it darker, press **INC**, to select the value(0~9)



3. Go on to press **MOV** select the installation height, the press **INC** to change



4. Press **SEL** confirm the change, then go to the next, to do **full span setting**.



5. Same as the above to change the full span value, which correspond to DC20mA.

6. Press **SEL** confirm, then go to next, do **0 setting**.



7. Same way to do 0 setting, and which correspond to DC4mA

output.

8. Press **SEL** to confirm, then go to next, to go on the setting of **PV** **select** or **address selection**. (If No hart, this parameter is **PV Select**).



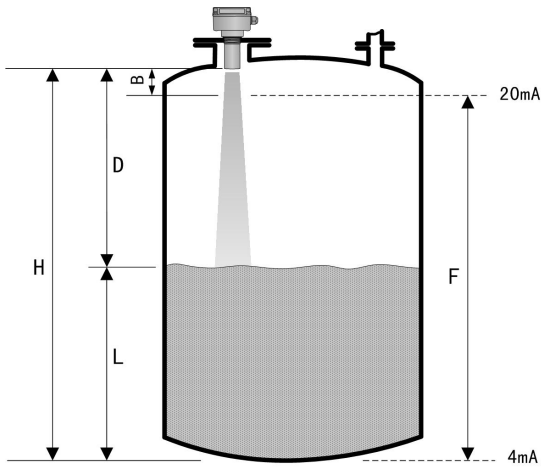
9. When set **HL99**, the output correspond to distance value, when set others, the output correspond to medium level value. Factory setting is usually HL00 or HL01.
10. Press **MOV and INC** to change, Press **SEL** to confirm, then go to next parameter.

11. The last parameter is **Inner Password**, User no need to change.



12. You also can press **SEL** to back to the parameter, the check the value setted.
13. Press **SEL**、**MOV** at the same time to exit the setting mode.

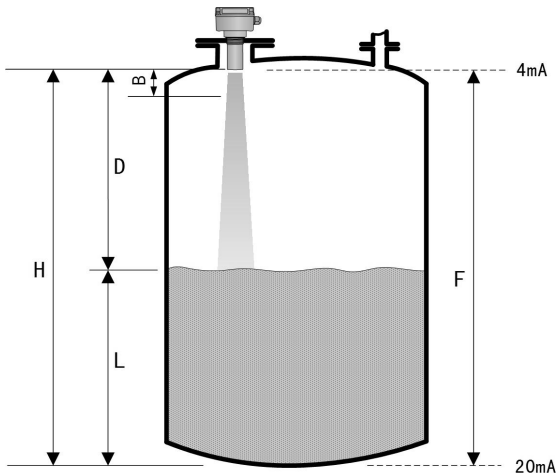
#### 4.2.3 The 4-20mA current corresponding to the level or the distance value



H: installation height  
D: distance value  
L: level value  
B: blind distance  
F: Level span  
 $L = H - D$

Current =  $\left[ \frac{(\text{level} - \text{Zero span})}{(\text{Full span} - \text{Zero span})} \right] * 16\text{mA} + 4\text{mA}$

**PV is level value (HL01)**



H: installation height  
D: distance value  
L: level value  
B: blind distance  
F: Level span

Current =  $\left[ \frac{(\text{distance} - \text{Zero span})}{(\text{Full span} - \text{Zero span})} \right] * 16\text{mA} + 4\text{mA}$

**PV is distance value (HL99)**

## 5. Calibration

The level meter should be calibrated indoor before installation to ensure the normal performance.

General consideration

Let the probe be perpendicular to a wall, and make sure the measuring distance is larger than the blind zone, and no barriers within the beam angle zone.

Wiring and connecting the instrument correctly according to the guideline.

Turn on the power and after a few seconds the instrument will enter the running mode. And check the level value 、 the empty value and the temperature value in turn through **SEL** key.

Move the probe slowly, the level value and the empty value should change slowly accordingly.

Press **SEL** and **MOV** keys simultaneously and then enter the operating mode. Advising the installation height value, the displayed level value and empty value should change accordingly.

Advising the full distance value, and the output current should change, too. The output current is always in accordance with the level value.

Advising the limit value, and test with a multi meter whether the relays act in correct time delay.

## 6. Trouble-shooting

Trouble Phenomenon	Trouble Reason	Solution
The instrument does not show, and does not work.	Power supply error. Wiring error.	Check the power supply. Check the wiring.
The instrument doesn't work but with show.	The sensor doesn't aim at the liquid or the material. The surface has great fluctuations. Liquid surface with lots of foam. The container is empty and the bottom is not flat. Over the range.	Adjust the sensor and aim at the material. Add a tube to the container. Add a tube to the container Use instrument with a lager range. Use instrument with a lager range.
The instrument shows unstable or the measured value has a great deviation.	The level enters the blanking distance. There is strong electromagnetic interference There is Obstruction of the ultrasonic wave.	Increase the installation height of the instrument. or prevent the level too high. Increase shielding to the instrument. Change the installation site or using a plastic tube.

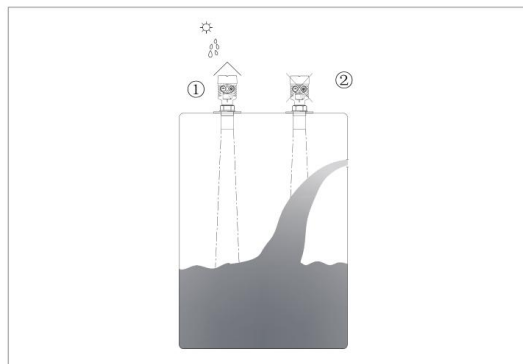


## 6.2 Installation Notice

6.2.1 Please take some methods to avoid the level meter from sun shading and rain.

Please do not install the meter on the top of material infusion entrance.

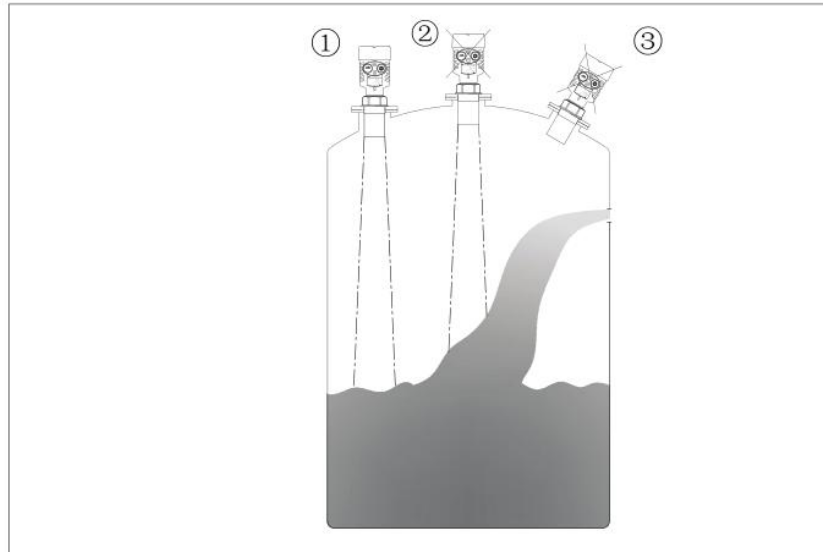
1. Correct  
2. Wrong



6.2.2 Energy transducer should be vertical to the measuring medium surface

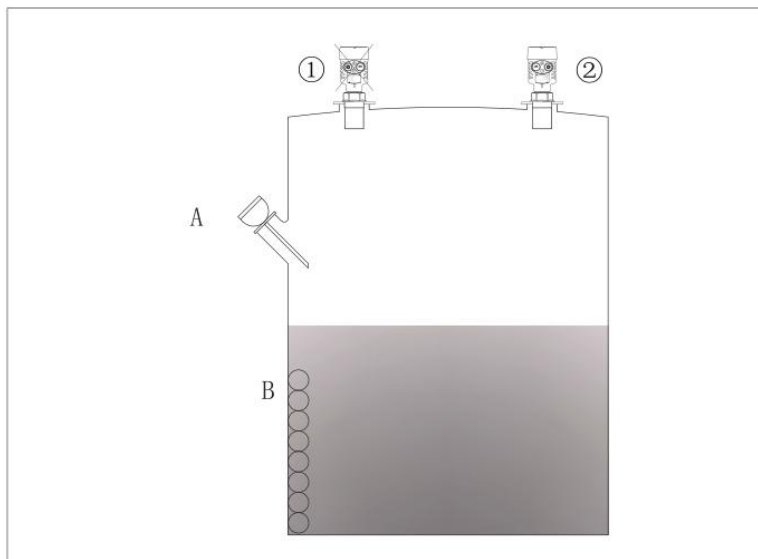
Please note meter can not be install in the middle of the tank(to avoid reflection echo)

1. Correct
2. Wrong
3. Wrong

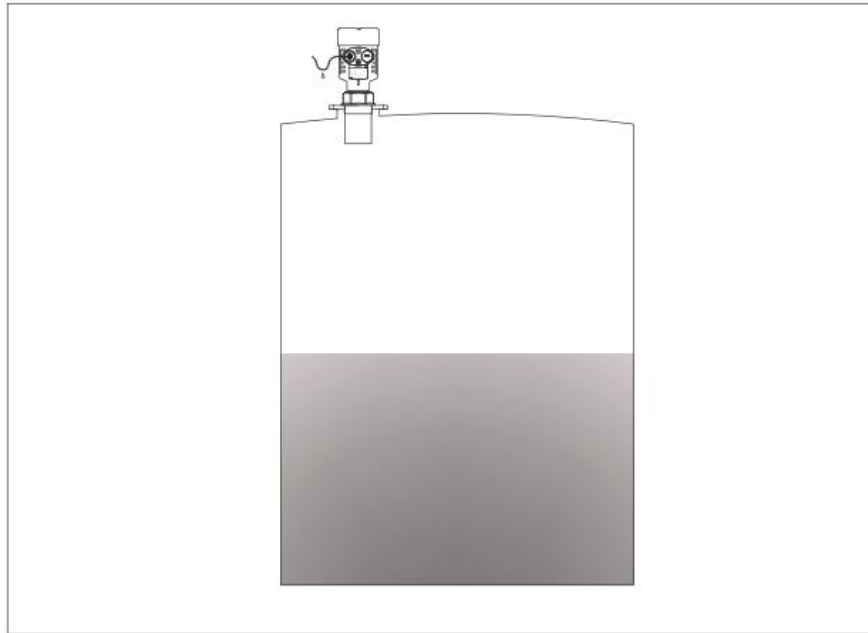


### 6.2.3 Meter Installation should be avoid A.B obstacle

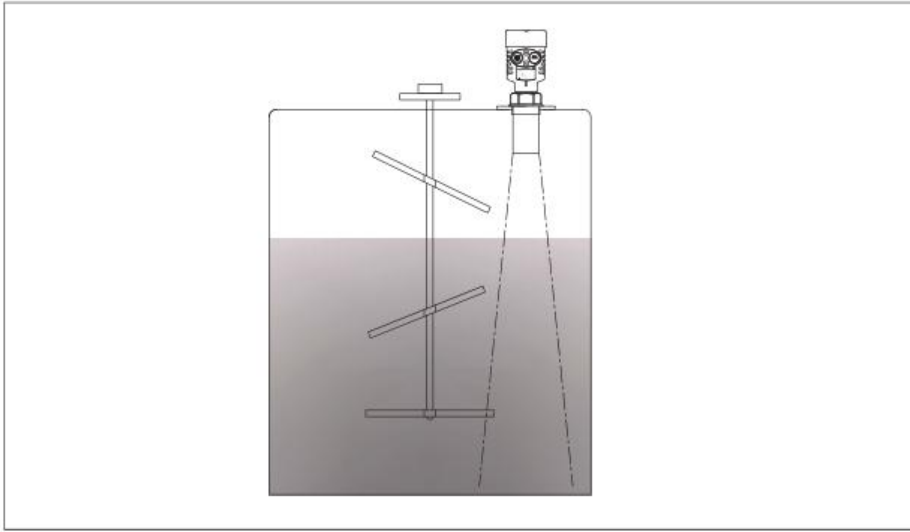
- 1.Wrong
- 2.Correct



6.2.4 If install outside or in moist environment, please tighten seal gland of the cable. Also please make the cable as "U" at the cable entrance.



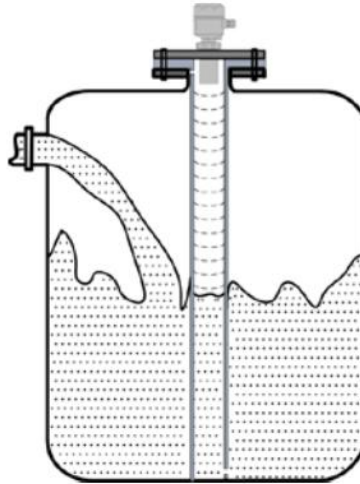
6.2.5 If there's mixing in the tank, please install meter far away from the mixer.  
Please use guide wave tube installation type if there's some foam or wave.



6.2.6 If that's closed tank, the flange and connection tube should be follow below:

Model	4m,6m,8m	12m	20m,30m
Requirement	Flange bore size should be bigger than 65mm; Flange connection tube should with smooth inner wall surface, and length shorter than 400mm.	Flange bore size should be bigger than 100mm; Flange connection tube should with smooth inner wall surface,and length shorter than 150mm.	Flange bore size should be not smaller than 200mm; Flange connection tube length is shorter than 200mm;Sensor should be out from installation mouth.

6.2.7 If there's big liquid wave fluctuation or there's float ball or other obstacle may reflect the wave,user can add a plastic tube inside the tank.Plastic tube can make the wave only transmit in the plastic tube and make sure the measurement stability. Plastic tube inner size should be larger than the outer size of sensor,with smooth inner wall surface,straightness,and full-face. Install the plastic tube from the flange mouth to the bottom of the tank. Please open a hole on the top and bottom of the tube to make sure to keep the same level inside and outside the tube.



6.2.8 When install to the cold area, should choose the lengthen sensor of the level meter ,make the sensor extend into the container, shun frost and icing.

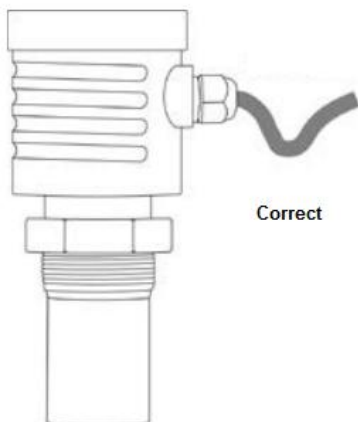


lengthen sensor of the level meter

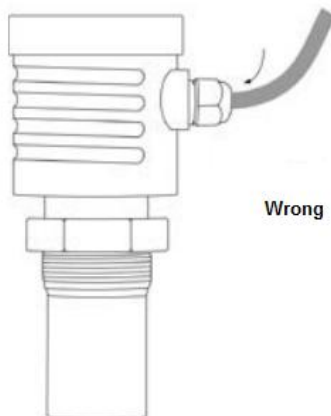


## 7. Seal

After setting parameters and level meter in normal operation, please tighten the cable entrance water-proof gland. The outer end of cable should be down warping to avoid rain water seeping into.



Correct



Wrong



SMERI s.r.l.  
Via Mario Idiomi 3/13  
20090 Assago MI  
Tel. +39 02 539 8941  
Fax +39 02 539 3521  
E-mail: [smeri@smeri.com](mailto:smeri@smeri.com)  
[www.smeri.com](http://www.smeri.com)