# Ultrasonic Level Meter

# MANUAL

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# 1. Introduction

## 1.1 Application:

The series is an compact 2-wire series ultrasonic level instrument 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.

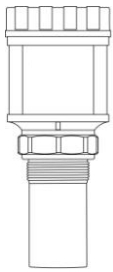
## 1.2 Features:

Continuous non-contact level measurement with compact version;

- Integrated design, installed conveniently;
- Protected in the excessive voltage and current , protected in the thunder and lightning;
- The big show window of LCD or LED is easy to debug and observe;
- Excellent anti-interference capability;
- 4-20mA output;
- Intellectual signal treatment technology, guarantee that the instrument meets various kinds of operating occasion
- All metal outer cover ( IP67 ), airproof and alkali-resisting, meet the abominable environment.

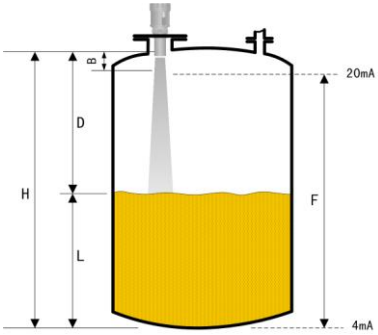
## 1.3 Structure:

The series is consists of sensor and electronic unit.



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

The sensor of the instrument pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The instrument measures the time t between pulse transmission and reception. The instrument 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 •t/2 . As the device knows the empty distance H from a user entry, it can calculate the level as follows: L = H – D .




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

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

**Blanking distance :** Span F may not extend into the blanking distance B. Level echo from the blanking distance cannot be evaluated due to the transient characteristics of the sensor.

## 1.5 Technical data:

1.5.1 Basic data

| | |
|---|---|
| Power supply | DC24V (±10%)　30mA |
| Display | 4 digit LCD |
| Accuracy | 0.2% of full span (in air) |
| Output current | 4-20mA |
| Output load | 0-500Ω |
| Temperature range | -40℃~75℃ |
| Pressure range | -0.04~+0.2MP (press definitely) |
| Measure cycle | 1 second (changeable ) |
| Beam angle | 8 ℉(3db)　for range :4m　6m　8m<br>5 ℉(3db)　for range :12m　15m　20m　30m |
| Parameter set up | 3 induction buttons |
| Cable connection | PG13.5 |
| Material | The electronic unit : metal<br>The sensor: ABS |
| Protect grade | IP67 |
| Fix | Screw or Flange |

1.5.2 The measuring range:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LIQUID | 4.00m | 6.00m | 8.00m | 12.00m | 15.00m | 20.00m | 30.00m |
| SOLID | | | 3.00m | 5.00m | 7.00m | 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 blacking distance:

| MODEL | 4 | 6 | 8 | 12 | 15 | 20 | 30 |
|---|---|---|---|---|---|---|---|
| Blacking distance | 0.20m | 0.25m | 0.30m | 0.50m | 0.60m | 0.80m | 1.20m |

# 2. Installation

Reasonable installation is critical factor of the 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 temperature of the process may not exceed 75℃， and the pressure may not exceed -0.04~+0.2MPa.
- 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 blacking distance, because the probe cannot detect any liquid or solid surface closer than the blacking distance to the probe's face.
- Install the instrument at right angles to 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°, 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 instrument) 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 normally a problem unless it is excessive.
- The effects of turbulence are minor, but excessive turbulence can be dealt with by advising the technical parameters or 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

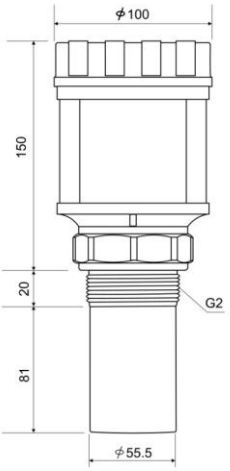
- Stirrers or agitators can cause a vortex. Mount the transmitter

off-center of any vortex to maximize the return echo.

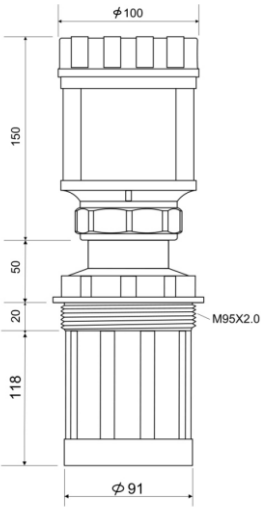
- In non-linear tanks with rounded or conical bottoms, mount the transmitter off-center. If needed, a perforated reflector plate can be installed on the tank bottom directly under the transmitter center line to ensure a satisfactory return echo.
- Avoid mounting the transmitter directly above pumps because 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 instrument ，make the sensor extend into the container, shun frost and icing .

## 2.2 Mounting

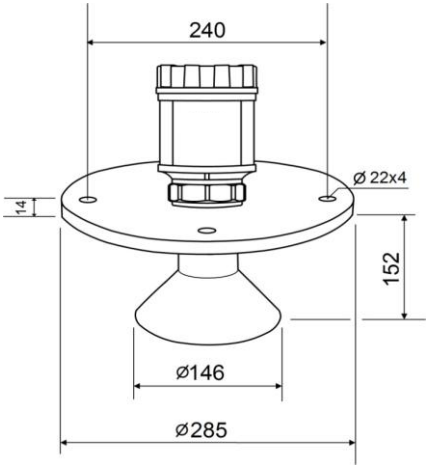
2.2.1 dimensions



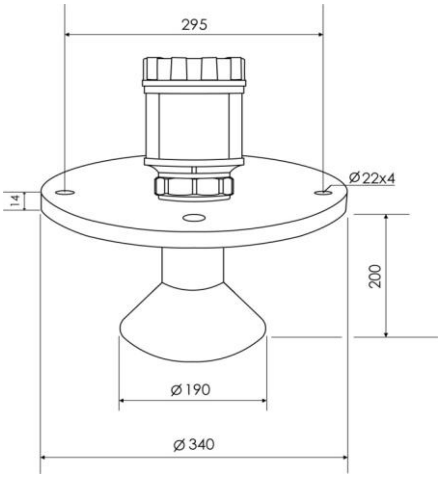

Model: 4m 6m 8m




Model: 12m




Model : 15m




Model : 20m 30m 40m

### 2.2.2 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: G2

  12m: M95*2.0

**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 15 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 15 m、20m、30m、40m probes must longer than the height of the nozzle or the thickness of the top. The probe must extend into the container.

The limit of nuzzle as follow:

| Measuring range | Min diameter | Max length |
|---|---|---|
| 4m、6m、8m | 65mm | 400mm |
| 12m | 80mm | 200mm |
| 15 m、20m、30m、40m | 200mm | 200mm |

**Bracket mounted**

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

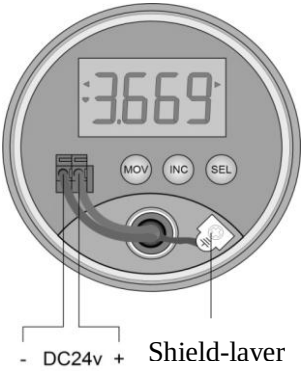
Hints: Always use the nut to screw the probe.

# 3. Wiring

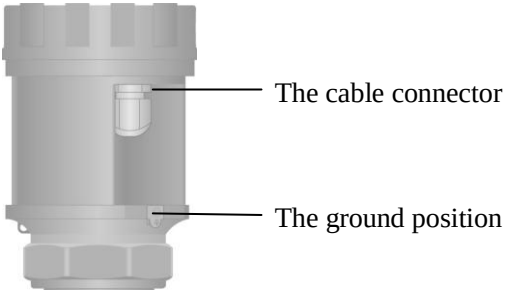
The series has one LCD and three keys and some terminal blocks, they are located within the host housing and can be operated when the cover is open.

### 3.1 Wiring diagram

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




### 3.2 The cable diagram




### 3.3 The cable

A cable comprising screened, twisted pairs is recommended.

# 4. Operation

### 4.1 display and keys

The series is displayed with 4 digit LCD.

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

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

### 4.2 Two working mode

The instrument has two working mode: running state and operating state.In running mode, the measurement is displayed. In programming mode, 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 empty 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 Mode | LCD |
|---|---|
| Thing Location Value |  |
| Distance Value |  |
| Temperature Value |  |

**Notes:** The output current is always corresponding to the level value, no matter which value disappears on the panel.

4.2.2 operating mode

In the operating mode data is displayed to assist with programming. When SEL and MOV keys are pressed simultaneously and then released, the instrument can enter or exit of the mode. Press SEL key to select the content. And the changeable contents and parainstruments will be shown in turn in operating mode, please pay attention to the alphabet in the following examples.

| Display Mode | LCD |
|---|---|
| Installation height |  |
| Level span |  |
| Inner password |  |

**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.
- Released the buttons quickly after pressing, and then the values can be changed. If the buttons are pressed for too long time, the instrument maybe restart.
- The operating modes are shown in turn.
- The installation height and the level span value are parameters must be set up by users.

Significance of the alphabet and the corresponding operating mode:

| The operating mode | Significance |
|---|---|
| Installation height | The distance from the surface of the probe to the bottom of the container |
| Level span | The full level range corresponding to the output 4-20mA |
| The inner password | The password for inner parameters operating. Users do not need to set up this parameter. |

# 5. Calibration

The level instrument should be calibrate indoor before installation to ensure the normal performance.

**5.1 General consideration**

- Let the probe be perpendicular to a wall, and make sure the measuring distance is larger than the blacking distance, 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. Advise the installation height value, the displayed level value and empty value should change accordingly.
- Advise the full distance value , and the output current should change, too. Because the output current is always in accordance with the level value.
- Advise the limit value, and test with a multi-instrument 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.<br>Wiring error. | Check the power supply.<br>Check the wiring. |
| The instrument doesn't work but with show. | The sensor doesn't aim at the liquid or the material.<br>The surface has great fluctuations.<br>Liquid surface with lots of foam.<br>The container is empty and the bottom is not flat.<br>Over the range. | Adjust the sensor and aim at the material.<br>Add a tube to the container.<br>Add a tube to the container<br>Use instrument with a lager range.<br>Use instrument with a lager range. |
| The instrument shows unstable or the measured value has a great deviation. | The level enters the blanking distance.<br>There is strong electromagnetic interference<br>There is Obstruction of the ultrasonic wave. | Increase the installation height of the instrument. or prevent the level too high.<br>Increase shielding to the instrument.<br>Change the installation site or using a plastic tube. |