Operating Instructions for Simple Settings of Ultrasonic Level Meter Menus YW03

Notes: as the product is renewed continuously, it cannot be ensured that the product manual and installation manual are in line with the latest product. The Company cannot inform every client of the change (if any) in product itself and its operation instructions. Please directly contact the corporate sales personnel for any needs. The change includes but is not limited to the following:

Product blind area, performance parameters, functions, structure, shape, color, etc.

Software functions, structure, display mode, operating habit, etc.

Any operation on the hardware must be conducted after power off. Failures, like short circuit, caused by power-on operation are beyond the range of warranty.

The uncapping operations must be conducted after power off and no liquid is allowed to enter in the meter. Any failure caused by the entering in of liquid is beyond the range of warranty.

Normally the ultrasonic level meter produced by the company shall be installed as per the installation requirements of the manual and after that, the equipment can be normally used only after the following several parameters are set.

There are three buttons on the panel, via which the meter can be adjusted. The measured values are displayed on the LCD screen after the adjustment.

SET Button	▼ ▲ Button
◇Enter menu item	◇Move cursor
◇Confirm menu item	◇Choose menu item
◇Confirm parameter modification	◇Modify parameter

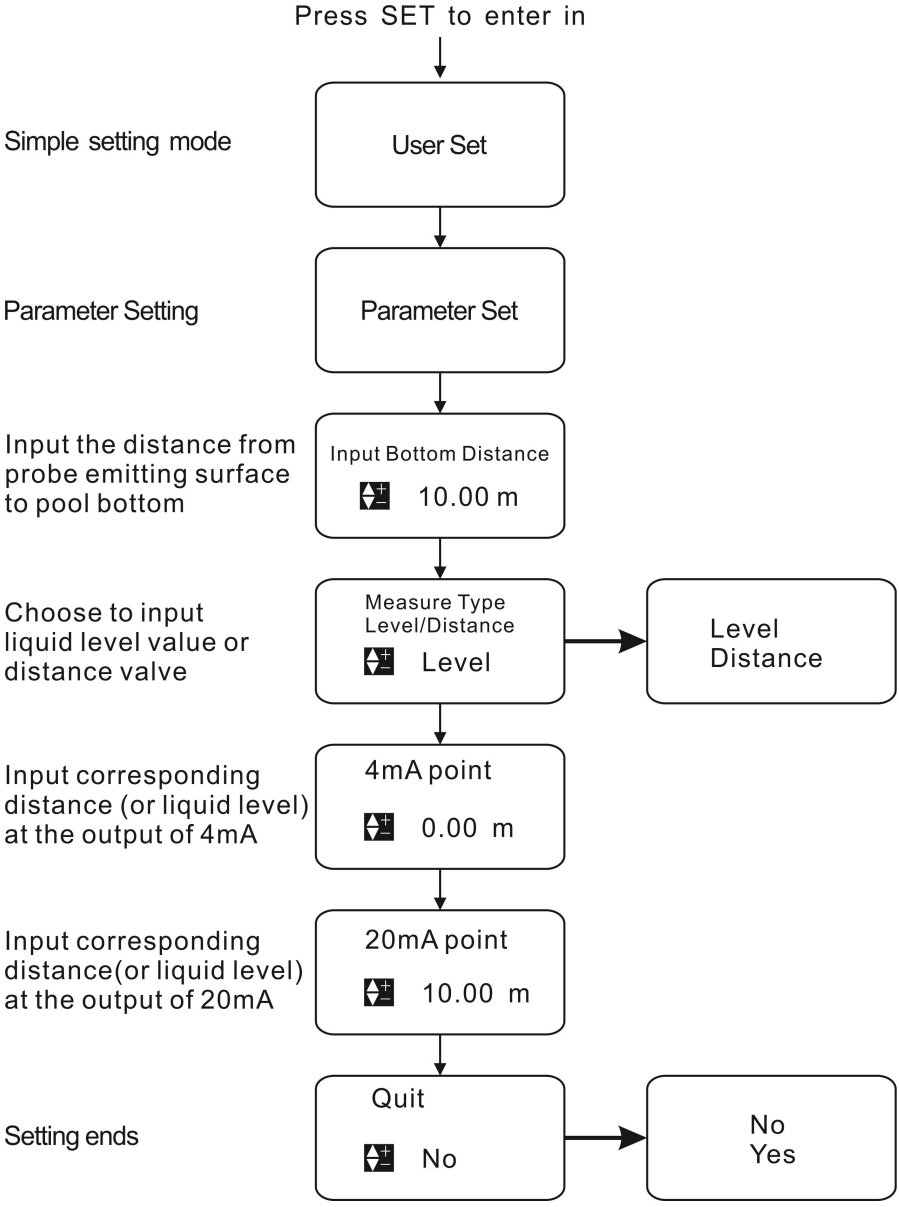
(1) After power-on display of the meter**, long press the set button (SET) for 2s to enter in the main menu.**

The menu modes include expert setting mode and simply setting mode.

The menu query table of simple setting mode is as shown in the table below.

Menu query table of simple setting mode

Note:long press SET for 2s to enter in the menu for the time.



The menu query table of expert setting mode is shown in "**VI. Menu Interface & Operating Instructions:** ".

(2) Select measuring mode:

Measuring modes are divided into distance measuring mode and material level measuring mode. And the factory default is material level measurement.

(3) Input **probe height value** to "**reference zero point**" (probe height is the distance from probe emitting surface to tank bottom or pool bottom).

① Under distance measuring mode, setting of **reference zero point** is meaningless and the positions of **maximum of measuring range** and **minimum of measuring range** are as shown in Fig. 1.1.

② Under material level measuring mode, the positions of **reference zero point, maximum of measuring range** and **minimum of measuring range** are as shown in Fig. 1.2.

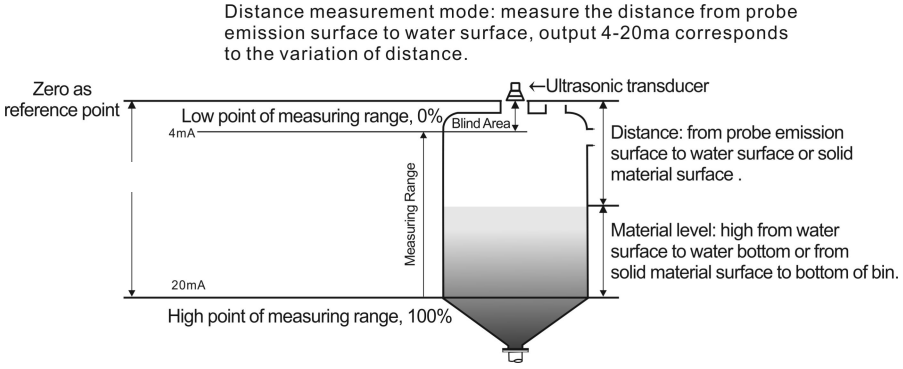


Fig. 1.1 Diagram of Distance Measurement

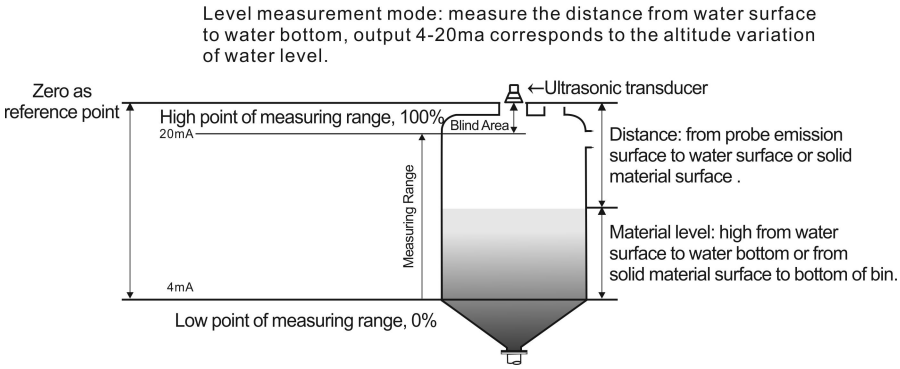


Fig. 1.2 Diagram of Material Measurement Level

Minimum of measuring range: it is the value of distance between the reference plane to the position, which is positive when the minimum of measuring range is above the reference plane and negative when the minimum of measuring range is below the reference plane. The output current is 4mA when the liquid level is at such position.

Maximum of measuring range: it is the value of distance between the reference plane to the position, which is positive when the maximum of measuring range is above the reference plane and negative when the maximum of measuring range is below the reference plane. The output current is 20mA when the liquid level is at such position.

(4)Operating with relay: enter in the alarm settings and set three parameters:

①Alarm mode: select high level alarm, low level alarm or off.

②Alarm value: high level alarm: alarm given when the liquid level is above the alarm value

Low value alarm: alarm given when the liquid level is below the alarm value

③Return difference value: it is used to prevent the repeated switching of alarm switch near the alarm point caused by measurement error.

High level alarm state: alarm cancelled when the liquid level is less than (alarm value - return difference value)

Low level alarm state: alarm cancelled when the liquid level is greater than (alarm value + return difference value)

(5)Please set the options of probe selection, parameter correction and algorithm selection under the instruction of professional technicians.

(6)The installed equipment must be grounded truthfully and independently and shall not share the public grounding with electrical cabinet or meter box.

(7)Suggestions: when the ultrasonic level meter is connected with the frequency converter, PLC and other equipment with interference, the power supply part shall be added with isolation transformer, signal part shall be added with signal isolator and reliable grounding shall be provided.

★The signal line shall not be wired in the same trunking with the power line and it shall be installed independently through metal tube or far away from the power line. If the signal line is not installed through tube independently, it shall be kept at least 1m away from the power line.

Diagram description:

★This is an important prompt which shall be carefully read and strictly followed as per the requirements.

▲This is a common prompt which needs to be carefully read to avoid troubles during use.

I. Product Introduction

Ultrasonic level meter (for material and liquid level measurement) is a non-contact highly reliable and cost-effective material level measuring instrument which is easily installed and maintained. It can meet most of the material level measurement requirements without touching the medium. It is a new generation ultrasonic level meter with fully independent property rights developed by the company via years of hard work.

II. Commissioning

As the meter installation site environment is different, the basic information of measurement to be done must be learnt before the operation of the ultrasonic level meter, such as the measuring range, zero point, full scale and site conditions. Therefore, the meter must be set before measurement and the specific settings are detailed in "**Operating Instructions for Simple Settings of Ultrasonic Level Meter Menus**" in Page 1.

Others: please do not modify probe selection, parameter correction and algorithm selection without permission.

III. Main Technical Indicators

Function	Integrated Type	Separate Type
Measuring range	5m, 10m, 15m, 20m, 30m, 40m, 50m, 60m	5m, 10m, 15m, 20m, 30m, 40m, 50m, 60m, 70m
Measurement accuracy	0.5%-1.0%	0.5%-1.0%
Resolution ratio	3mm or 0.1% (whichever is greater)	3mm or 0.1% (whichever is greater)
Display	English LCD	English LCD
Analog output	4-line system, 4~20mA/ 510Ω load 2-line system, 4~20mA/ 250Ω load	4~20mA/ 510Ω load
Relay output	2groups (i.e. AC 250V/ 8A or DC 30V/ 5A) optional, state programmable	2groups for single channel and 4 groups for double channels (optional) AC 250V/ 8A or DC 30V/ 5A, state programmable
Power supply	Standard configuration: 24VDC Optional: 220V AC±15% 50Hz	Standard configuration: 220V AC±15% 50Hz Optional: 24VDC 120mA Customized: 12VDC or battery powered
Ambient temperature	Display instrument: -20~+60ºC Probe: -20~+80ºC	Display instrument: -20~+60ºC Probe: -20~+80ºC
Communication	485, 232 communication (optional) (manufacturer agreement)	485, 232 communication (optional) (manufacturer agreement)
IP grade	Display instrument: IP66, probe: IP68	Display instrument: IP65, probe: IP68
Probe cable	None	100m available, standard configuration: 10m
Probe installation	Select type based on measuring range and probe	Select type based on measuring range and probe

Product power consumption	The power supply of separate type is 24V power and the electricity consumed for such type is 100mA without relay, 120mA with a replay, 145mA with 2 relays, 170mA with 3 relays and 190mA with 4 relays. Specific power consumed is shown in below: 24×100mA=2.4W for separate type without relay; 24×120mA=2.9W for separate type with a relay; 24×145mA=3.5W for separate type with 2 relays; 24×170mA=4.1W for separate type with 3 relays; 24×190mA=4.6W for separate type with 4 relays;
Product power consumption	The integrated type with four-wire system is powered by 24V power supply and its electricity consumed is 80mA without relay, 105mA with a relay and 130mA with 2 relays. Specific power consumed is shown in below: 24×80mA=1.9W for integrated type without relay; 24×105mA=2.5W for integrated type with a relay; 24×145mA=3.1W for integrated type with 2 relays;
Product power consumption	The integrated type with two-wire system is powered by 24V power supply. It cannot be equipped with relay and its electricity consumed is 30mA. Specific power consumed is shown in below: 24×30mA=0.72W for integrated type without relay;

Remarks: this series of ultrasonic probe can also be customized as per client's demand **and the customized probes are probes with special specification requirements, such as resistance to high pressure, resistance to high temperature, small diameter and small blind area.**

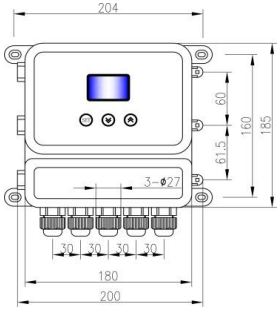
IV. Installation Guide

4.1 Installation dimension of level meter

(1) Standard separate-type ultrasonic level meter:



Object Picture



Structural Drawing

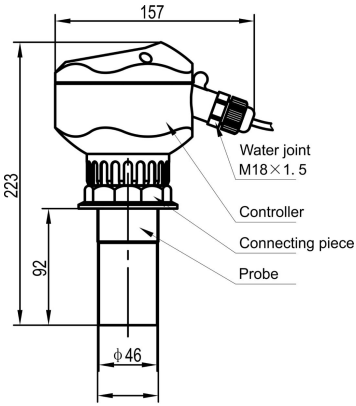
(2)Enhanced integrated-type ultrasonic level meter

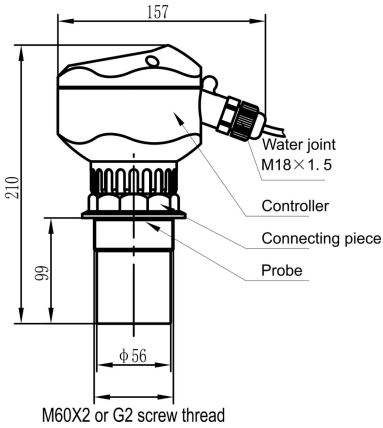


Object Side Picture

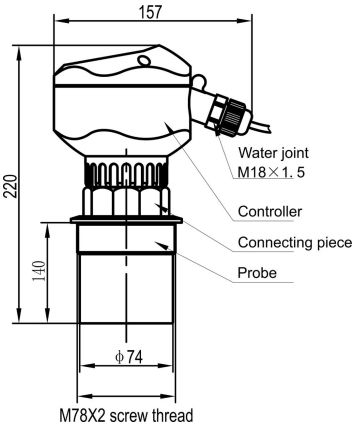


Object Front Picture



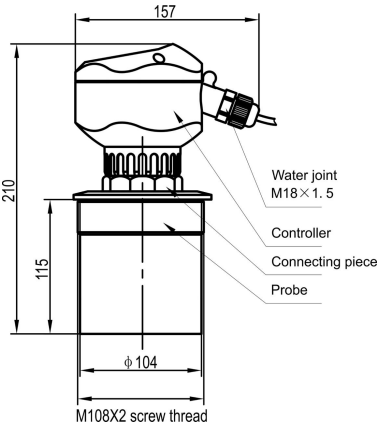


Thread M48×2 or G2 Sensor



Thread M78×2 Sensor

Thread M60×2 or G2 Sensor

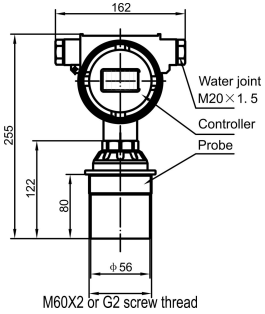


Thread M108×2 Sensor

(3)Explosion-proof integrated-type ultrasonic level meter



Object Picture

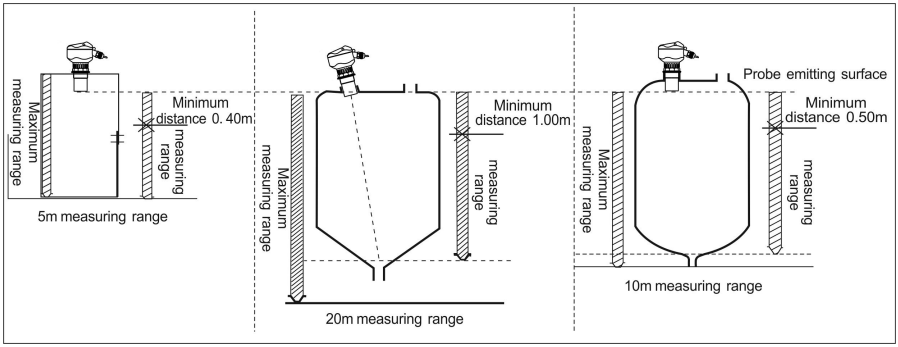


Structural Drawing

4.2 Installation Guide

4.2.1 Understand terminology

① Measuring range: the meaning of measuring range is very important for meter type selection. Please refer to the diagrams below.



② Emitting angle and false echo

Ultrasonic wave beam is gathered by the probe. The emitting of impulse wave beam is like the light beam of flashlight. The further it is from the probe, the greater the diffusion area is.

Any objects within the range of emitting angle, such as pipe, support, weld joint, reinforcing rib, mixing propeller and hanging object, will lead to strong false echo, specially the objects within the range of emitting angle which are near the probe.

For example, the false echo caused by the pipe at 6m from the probe is 9 times stronger than that caused by the same pipe at 18m from the probe.

★ Try every effort to make the sensor axis perpendicular to the medium surface and avoid any other object within the range of emitting angle, such as pipe and support.

4.2.2 Select measuring range

Measuring range is decided by the range of ultrasonic probe which is subject to the site working environment, object to be measured and temperature, etc. Decide the measuring range needed based on the table below.

Liquid Surface	Attenuation Multiple	Attenuation Percentage	Magnification of Measuring Range
Stable	0dB	0%	Magnification is unnecessary
Ripple	5...10dB	50～67%	1 times of the measuring range
Major fluctuation (for example, there is mixing blade)	10...20dB	90%	3 times of the measuring range

Solid Material Surface	Attenuation Multiple	Attenuation Percentage	Magnification of Measuring Range
Hard, rough (such as granular rubber)	40dB	99%	10 times of the measuring range
Soft (such as pulverized coal, cement and coal ash)	40...60dB	99～99.9%	Use not recommended

With Dust	Attenuation Multiple	Attenuation Percentage	Magnification of Measuring Range
None	0dB	0%	Magnification is unnecessary
Little	5dB	50%	1 times of the measuring range
Much	5...20dB	50～90%	3 times of the measuring range

With feedstock	Attenuation Multiple	Attenuation Percentage	Magnification of Measuring Range
None	0dB	0%	Magnification is unnecessary
Little	5...10dB	50～67%	1 times of the measuring range
Much	10...40dB	67～99%	3 times of the measuring

			range

With Mist	Attenuation Multiple	Attenuation Percentage	Magnification of Measuring Range
None	0dB	0%	Magnification is unnecessary
Little	5...10dB	50～67%	1 times of the measuring range
Much	10...20dB	67～90%	3 times of the measuring range

With Steam	Attenuation Multiple	Attenuation Percentage	Magnification of Measuring Range
None	0dB	0%	Magnification is unnecessary
Little	5...10dB	50～67%	1 times of the measuring range
Much	10...20dB	67～90%	3 times of the measuring range

Temperature Difference between Probe and Medium Surface	Attenuation Multiple	Attenuation Percentage	Magnification of Measuring Range
≤20℃	0dB	0%	Magnification is unnecessary
≤40℃	5...10dB	50～67%	1 times of the measuring range
≤80℃	10...20dB	67～90%	3 times of the measuring range

The calculation method of signal attenuation is to add all signal attenuation amounts if there are several conditions on site.

- With little feedstock 5...10dB
- With little steam 5...20dB
- Temperature difference between probe and medium surface ≤40ºC 5...10dB

Total minimum: 15dB, maximum: 40dB

Under such circumstances, if the actual maximum measuring range is 5m, ultrasonic level meter with measuring range of 50m shall be selected for the measurement.

4.2.3 Installation of thread at the bottom

▲It is recommended to use plastic flange to connect with the sensor during the installation.

◆ **Installation of thread at the bottom**

01.Install a flange on the object to be measured



02.Place a spacer of the same inner diameter on the flange



03.Align the transducer with flange hole



04.Place the transducer in flange hole



05.See from the flange bottom



06.Place a spacer of the same inner diameter under the flange



07.Tighten nuts to fix the transducer



08.Transducer installed



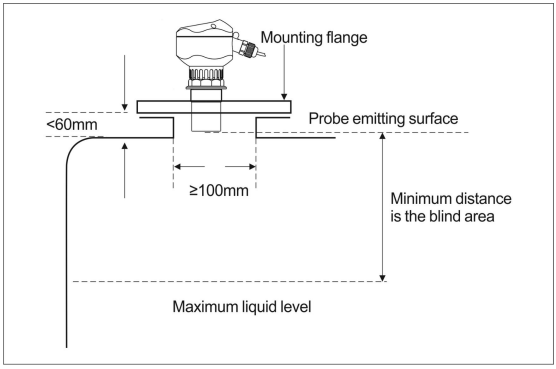
▲Installation on the tank, pool, cover plate and support is basically the same as above.

★After probe installation, the probe emission surface must be exposed from the cover plate or waveguide and it shall not be in the cover plate or waveguide.

4.2.5 Liquid measurement

4.2.5.1 Flat-top tank

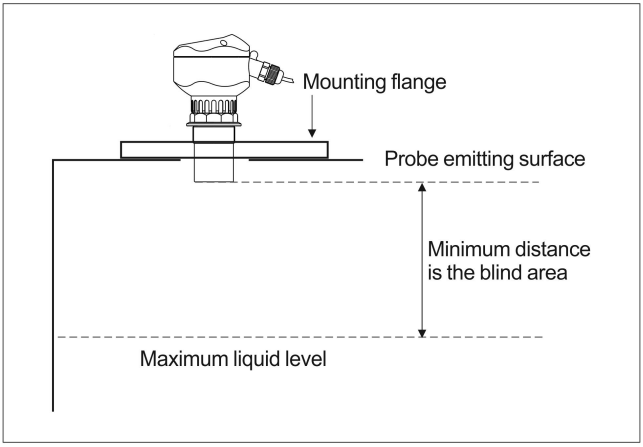
Normally, the flat-top tank has a short connecting pipe whose datum plane is the undersurface of flange. Under the premise that the connecting pipe length is ≤60mm, inner diameter is ≥100mm and inner wall is smooth and free of burr and bulges, the measurement can be carried out if the emitting surface of installed probe is 3cm below the flange undersurface.



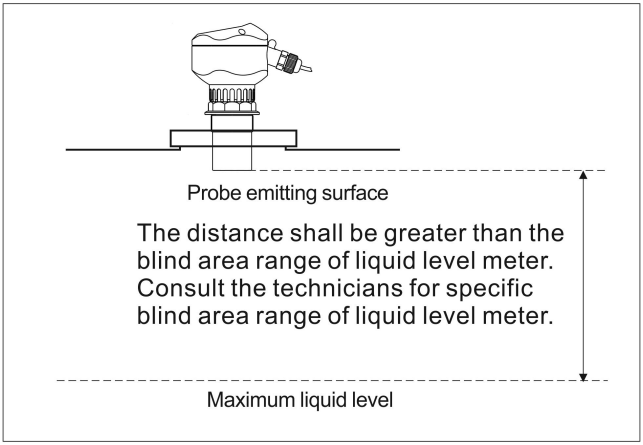
Flange installation in a short connecting pipe

The most ideal installation is to directly install the meter on the flat-top

container without using the connecting pipe and the round opening on the container is good enough for the fixing of mounting flange or cardan joint. The probe emitting surface is below the datum plane.

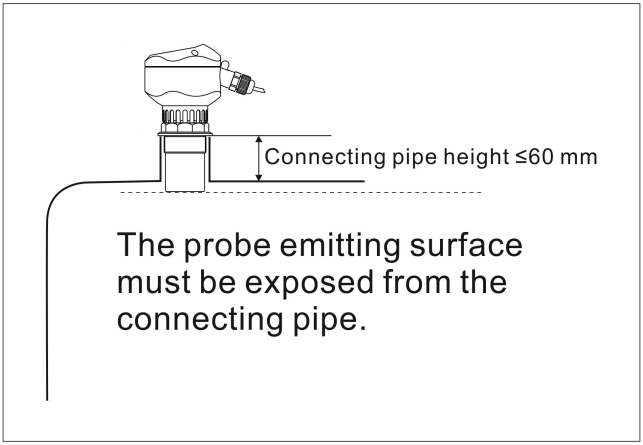


Flange-type (locking flange) installation on the flat-top tank



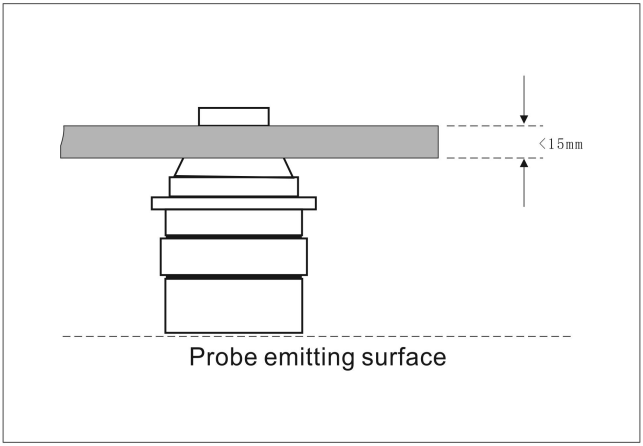
Flange-type installation on the flat-top tank without connecting pipe

In case of installation on nipple joint similar to a probe, the inner diameter of connecting pipe shall be identical to the external thread and the probe emitting surface must be exposed for at least 1cm from the connecting pipe and it shall not be inside the connecting pipe.



Probe installation on nipple joint

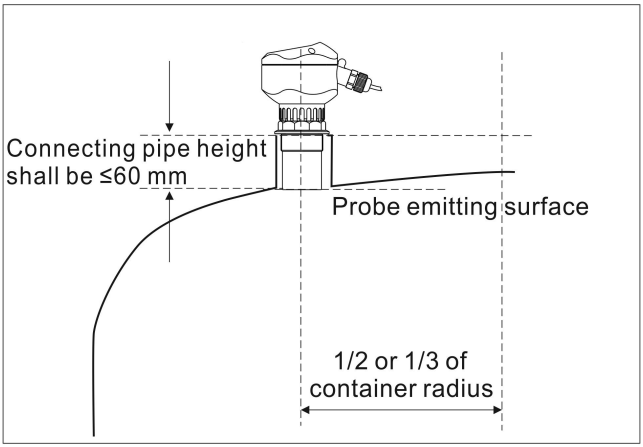
Similarly, the separate type sensor can be installed via top hoisting thread and the dimensions of hoisting thread include M30×1.5, M32×1.5 and M38×1.5.



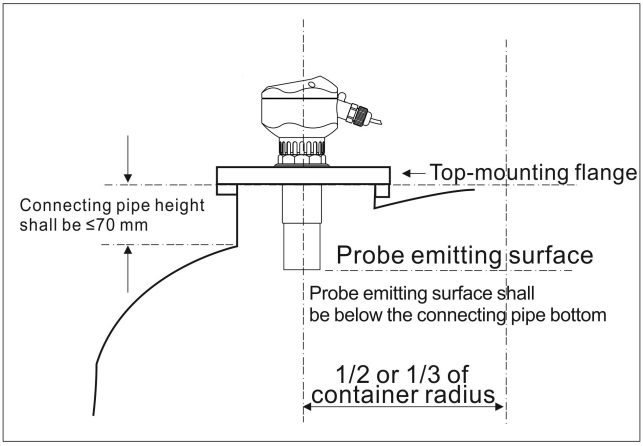
Hoisting thread connection at the separate type probe top

4.2.5.2 Arch tank top

For arch tank, it's better not to install the meter in the middle of the tank top. Instead, the meter shall be installed at 1/2 or 2/3 of the tank top radius (under the premise that certain distance from the tank wall is met). The arch tank top is like convex lens to the ultrasonic pulse. If the probe is installed at the focus of convex lens, it will receive all the false echoes. Therefore, the sensor shall not be installed in the middle of the arch tank top.



Installation on nipple joint – arch tank top



Installation on flange – arch tank top

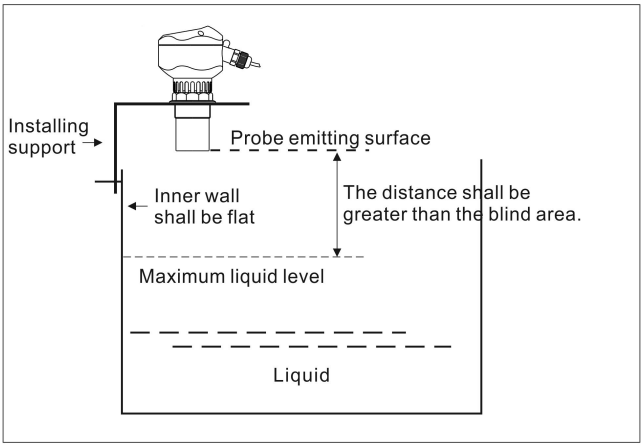
For most arch tanks, the length of connecting pipe plus flange on the top is 150-180mm. But the part below the probe thread of ultrasonic level meter is not so long (elongated probe is available for customization to make sure the probe emitting surface is below the connecting pipe bottom). In this case, the proportional relation between the diameter and length of connecting pipe shall be noted.

S/N	Length of Connecting Pipe	Minimum Inner Diameter of Connecting Pipe	Remarks
1	150mm	100mm	The inner wall of connecting pipe is free of burr and bulges and vertical and the weld joint shall be polished. The connection of connecting pipe and tank top shall be outwards polished at an oblique angle of 45º.
2	200mm	150mm	
3	250mm	180mm	
4	300mm	220mm	
5	400mm	280mm	

4.2.5.3 Open container

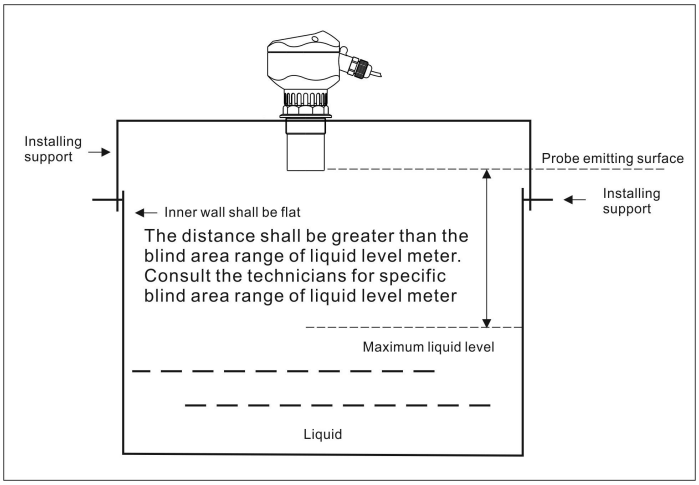
For open container, the support shall be used for installation. The bearing capacity of support shall be noted and certain distance shall be kept between the sensor and container wall. If the upper part and lower part of the open container or stock bin inner wall are flat and free of hanging objects and any other objects, the distance between the sensor and container wall is detailed as follows:

Maximum Measuring Range	Minimum Distance to Wall	Maximum Measuring Range	Minimum Distance to Wall	Maximum Measuring Range	Minimum Distance to Wall
5m	0.5m	10m	1.0m	15m	1.5m
20m	2.5m	30m	3.5m	40m	5m
50m	6m	60m	7m	70m	8m



Installation on open container – with top against the support at one side

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

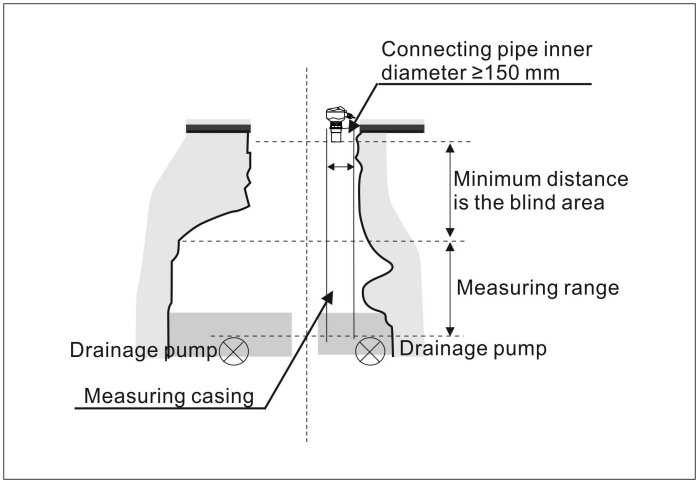


Installation on open container – with support at the top middle part

4.2.5.4 Draining well and common well

Normally, the wellhole and wellhead of drainage well are narrow and the well wall is uneven, which makes it difficult to conduct ultrasonic measurement. This can be solved by installing a section of connecting pipe or a whole measuring casing. Attention shall be paid to the fact that the blind area will be enlarged for about 50~100% after the sensor is put into the connecting pipe. So the factors for blind area expansion shall be considered.

Thus, when the connecting pipe is used, if the original probe blind area is 0.50m, it will be enlarged to 1.00m after the probe is put into the connecting pipe.



Connecting pipe and measuring casing used for drainage well measurement

For common well (including water source well and deep well), normally the diameter is small and the best measuring effect can be reached by installing measuring casing. The inner wall of measuring casing must be smooth (PVC and PE pipe can be used) and the inside diameter shall be ≥150mm (measuring range within 4m). The manufacturer shall be contacted for connecting pipe longer than 4m. The measurement can be carried out as long as the measuring casing is clean and free of attached medium and internal joint.

The measuring casing shall be soaked in the medium all the time, which can ensure the accurate measurement within the measuring casing.

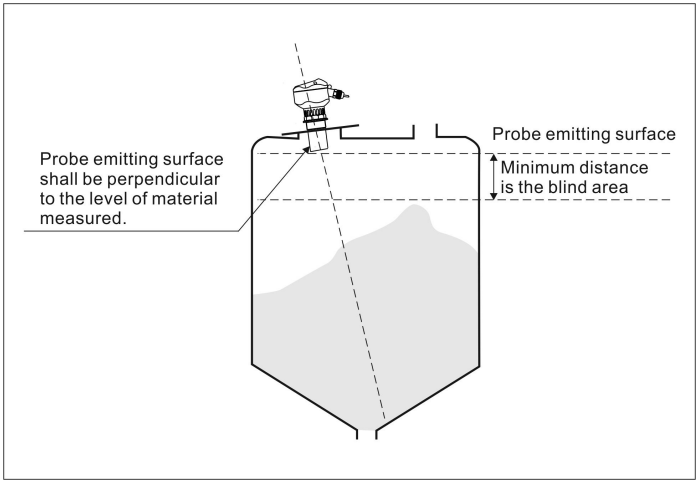
4.3.1 Solid measurement

4.3.1.1 Flange installation

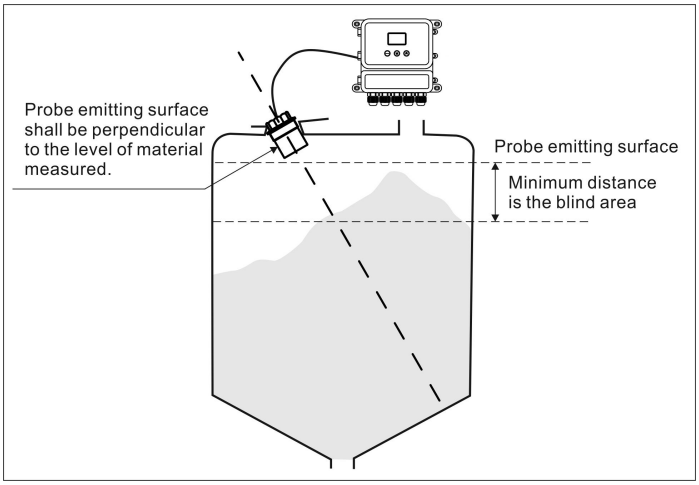
Similar to liquid medium measurement, the meter can be installed on the counter flange of container connecting pipe. The solid reflecting surface is different from that of the liquid and it is not a plane, which shall be considered during installation. The probe emitting surface shall be perpendicular to the surface of solid to be measured and the probe shall be exposed from the connecting pipe.

At the solid measurement site, in most cases, probe inside the connecting pipe will lead to pulsating of measured data or “wave loss”.

To solve the problem, the universal flange can be used. In this case, the probe emitting surface can easily be aligned to the reflecting surface of the solid to be measured merely by rotating the flange.



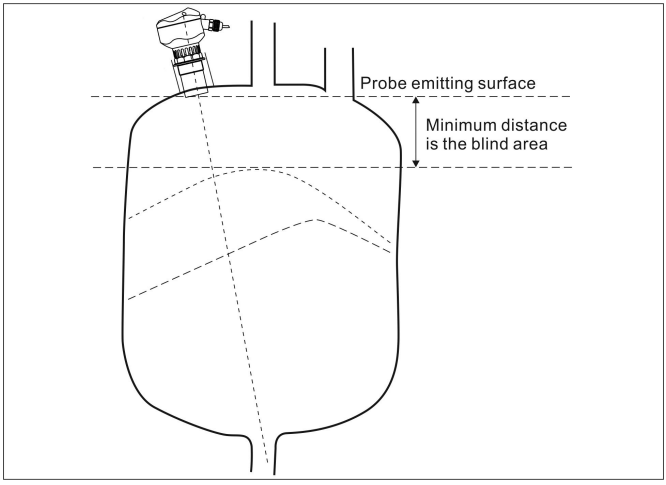
Integrated-type sensor installed on container flange



Separate-type sensor installed on container flange

4.3.1.2 Installation via nipple joint

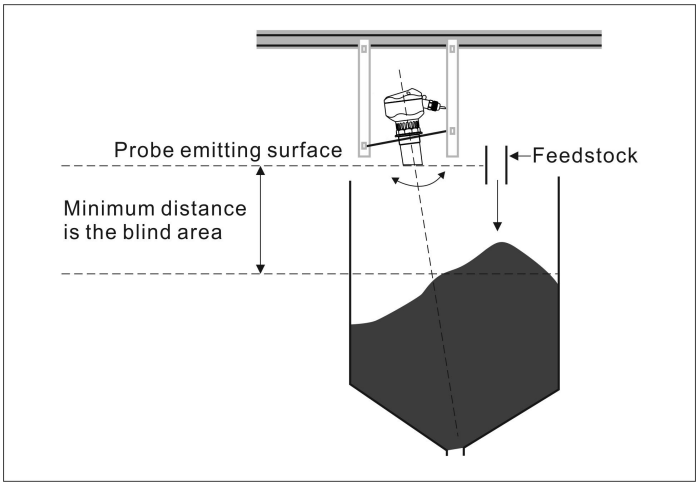
During installation via nipple joint, the probe must be exposed for at least 2cm above the connecting pipe bottom.



Integrated-type sensor – installation via nipple joint

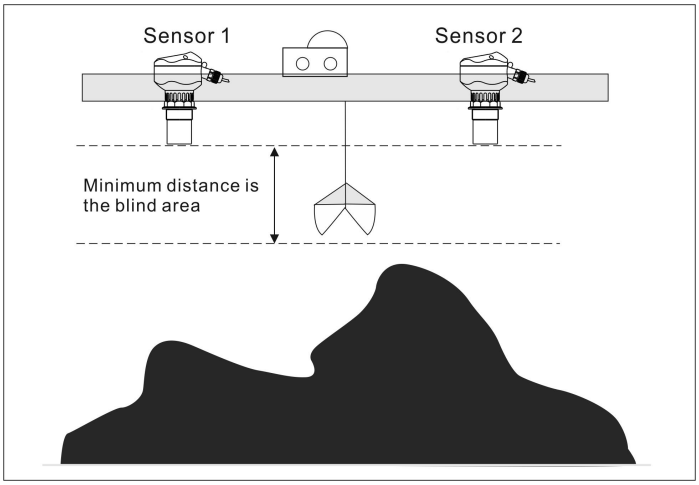
4.3.1.3 Doorframe installation

Doorframe installation can be applied for the open container and the axis of connecting pipe must be aligned to the container opening or perpendicular to the medium surface.



Integrated-type sensor – doorframe installation

During installation for material piles in the open air, several meters are required for the measurement of large material pile in the open air. The meters can be fixed on the hoist frame and sensor probe shall be aligned to the medium surface.



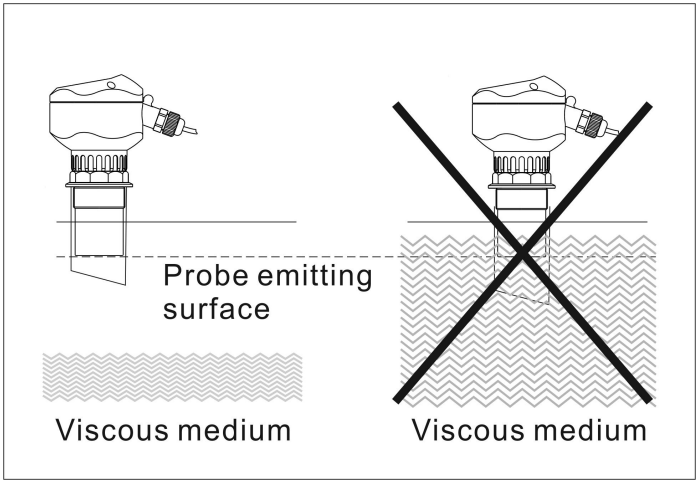
Measurement of material pile in the open air – installation on hoist frame

4.3.2 How to extend the connecting pipe for measurement

A minimum distance shall be kept between the probe of ultrasonic level meter and surface of measured medium, which is normally called the blind area. However, if the minimum distance cannot be ensured on site in some cases, an extended connecting pipe shall be installed on the container.

4.3.2.1 How to extend the connecting pipe for liquid measurement

The inner wall of the connecting pipe shall be kept smooth if possible. The connecting pipe cannot be soaked in the medium to prevent medium from polluting the connecting pipe or attaching to the inner wall of the pipe.

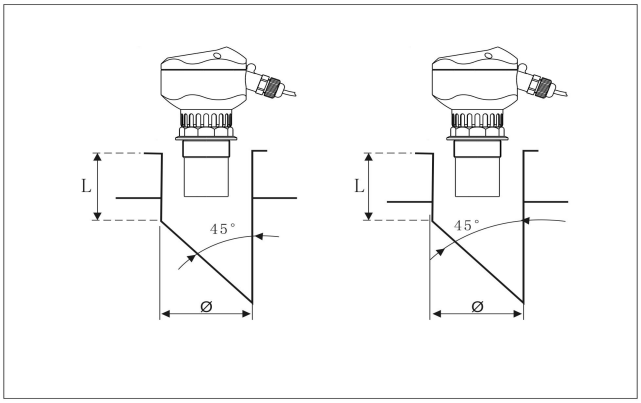


Connecting pipe cannot be soaked in the viscous medium

If it is non-adhesive medium, the extended connecting pipe can be soaked in the medium for a long time (as long as the pipe is not corroded by the liquid and no impurities are attached to the inner wall of the pipe). In this way, the measurement can be more accurate as it is not affected by other devices in the container.

The inner diameter of connecting pipe shall be as great as possible and the inclined cut shall be smooth. The relationship between the height L and inner diameter Φ of connecting pipe is as shown below.

S/N	Length (L) of Connecting Pipe	Minimum Inner Diameter (ϕ) of Connecting Pipe	Remarks
1	150mm	100mm	The inner wall of connecting pipe is free of burr and bulges and vertical and the weld joint shall be polished. The connection of connecting pipe and tank top shall be outwards polished at an oblique angle of 45º.
2	200mm	120mm	
3	250mm	150mm	
4	300mm	180mm	
5	400mm	240mm	



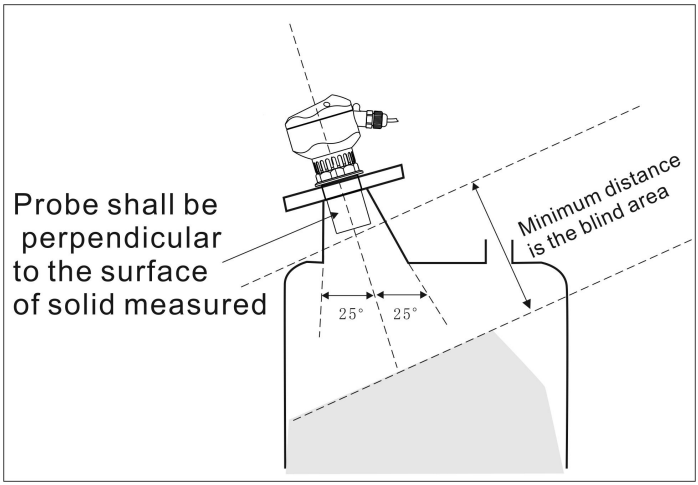
Extended connecting pipe not soaked in the medium

If the extended connecting pipe is installed all the way through the tank from top to the bottom, the relationship between the inner diameter of connecting pipe and sensor measurement distance is shown as follows.

Maximum Measuring Range	Minimum Inner Diameter of Connecting Pipe	Maximum Measuring Range	Minimum Inner Diameter of Connecting Pipe
5m	150mm	10m	200mm
15m	250mm	20m	300mm

4.3.3.2 How to extend the connecting pipe for solid measurement

Measurement of solid medium is different from that of liquid. The conical extended connecting pipe with an angle of 25°~30° shall be used.

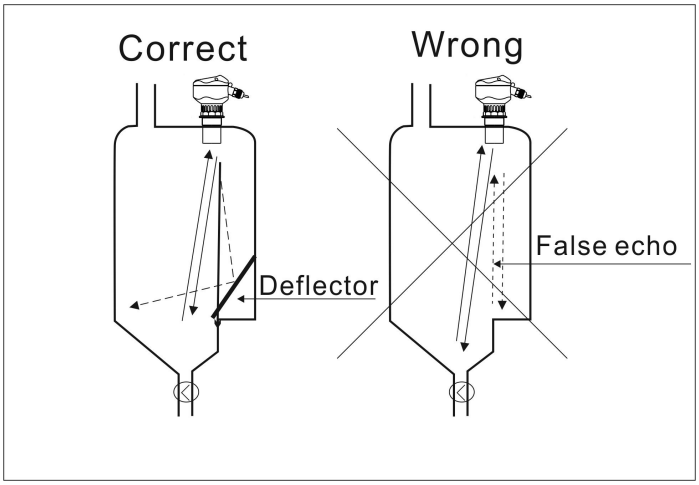


Extended connecting pipe for solid medium measurement

4.3.3Generation of false echo shall be avoided during the installation.

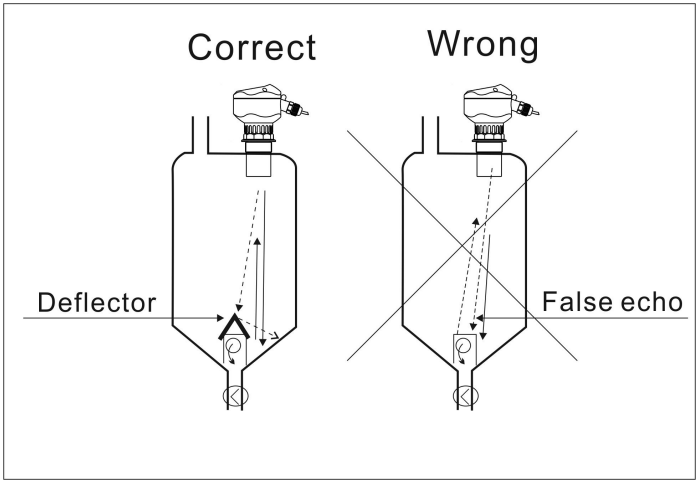
4.3.3.1 Devices and installation in the container

During sensor installation, it shall be ensured that the ultrasonic wave beam is not blocked by other devices or feedstock. The bulges on the plane or stair-like barriers in the container will have a great impact on the measurement and a deflector can be provided on the embossment to reflect the false echo so as to ensure accurate measurement.



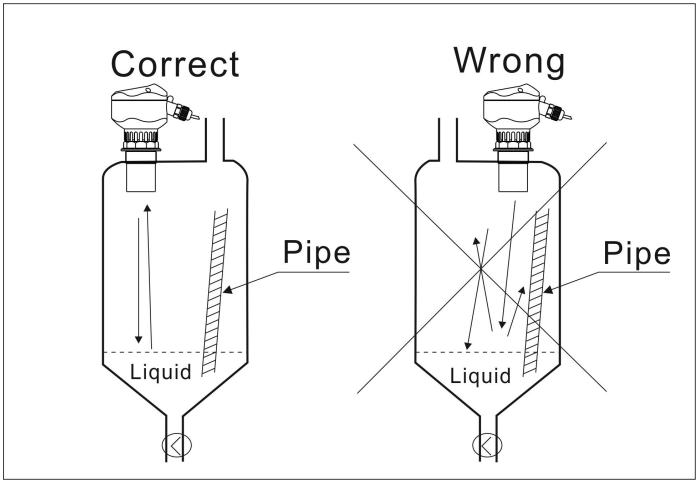
Stair-like barriers in the container – inclined deflector needed to reflect the false echo

If the upper surface of object at the lower part of the container is a plane, the inlet for various media must be covered with a deflector set at certain angle.



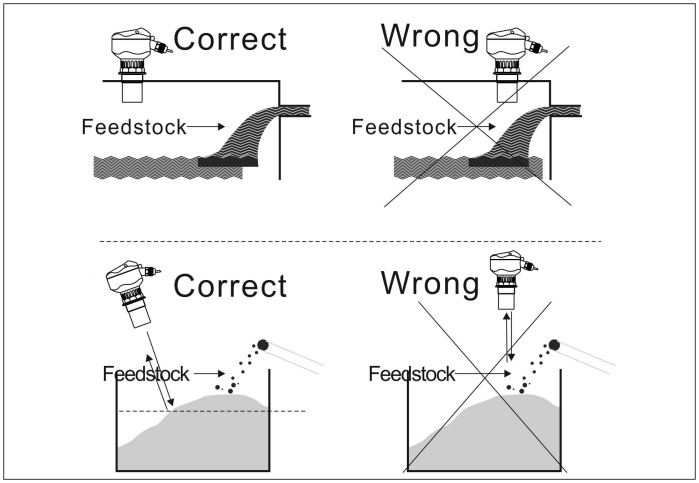
Flat-top bulge at the bottom of the container – deflector required

The devices in the container such as pipe and support will affect the measurement. For the design of measuring points, it must be ensured that no other devices are within the diffusion range of ultrasonic wave signal.



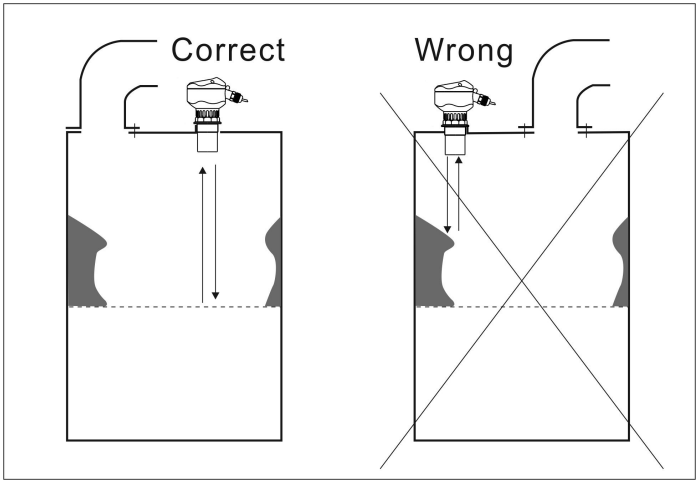
Barrier in the container - pipe

The sensor shall not be installed in or above the charging feedstock flow and it shall be kept from the feed inlet for certain distance.



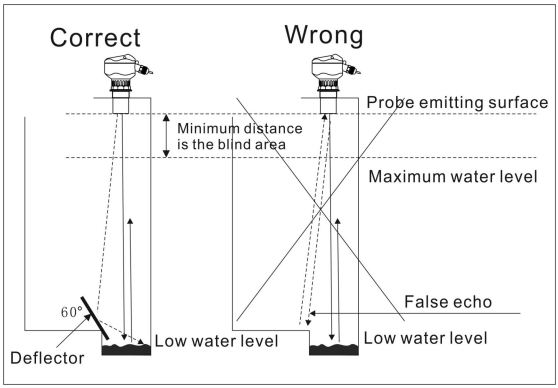
Sensor shall not be installed in or above the charging feedstock flow

Where there is viscous medium in the container, such as crude oil storage tank, mud tank, asphalt tank and cement mixing tank, if the sensor is installed close to the container wall, the medium attached to the container wall will lead to strong false echo. Therefore, certain distance must be kept between the sensor and the container wall.



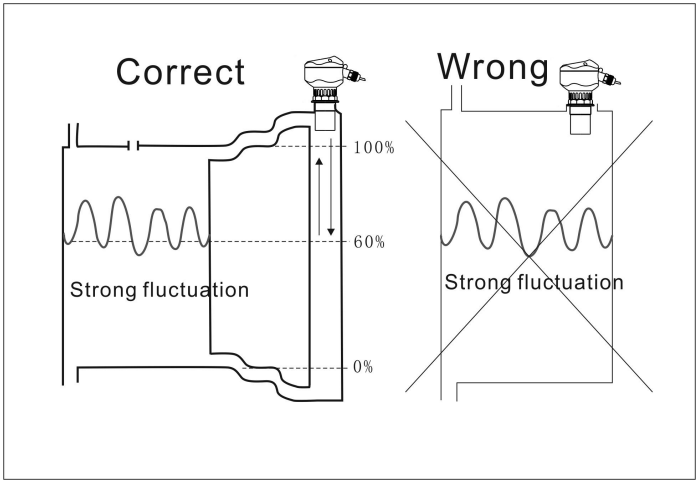
Attachment on container wall – certain distance must be kept from the attachment

In the water storage pool, the installation height is generally decided based on the maximum water level. The distance between maximum water level and probe must be noted. If the objects with elevation difference at the pool bottom are exposed in case of low water level, the edge shall be covered with a deflector.



Barriers at the pool bottom – reflect with a deflector

If there is strong eddy or vortex in the container, such as eddy caused by the stirrer or strong chemical reactions, the measurement can be difficult. The ideal method is to install the sensor probe in the waveguide or by-pass pipe for measurement.

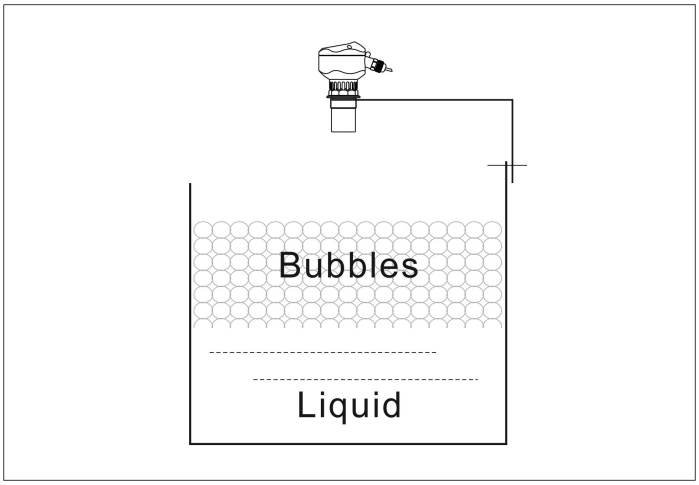


Great fluctuation at medium surface – use by-pass pipe or waveguide for measurement

4.3.3.2 Common installation errors

① Bubble: if the bubbles on the medium surface are large and the bubble layer is thick, measuring error is likely to take place and the reflected ultrasonic wave may even unable to be received. Measures shall be taken to prevent the generation of bubbles or the sensor shall be installed in the by-pass pipe for measurement.

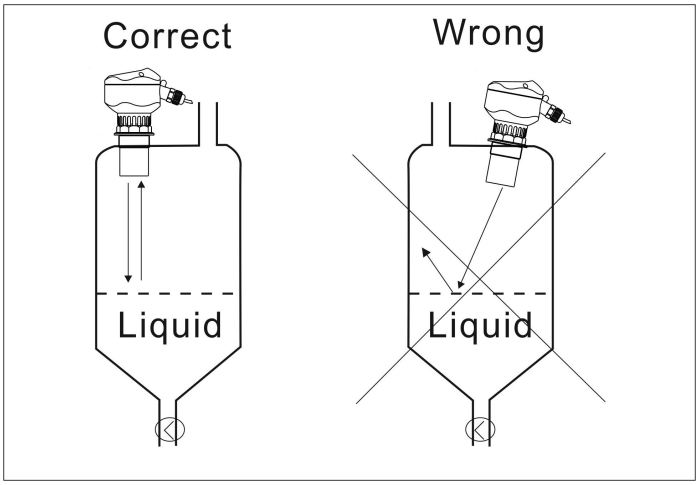
Other measuring meters can also be used, such as radar liquid level meter or magnetostrictive liquid level meter.



Occasions when bubbles are generated

② Incorrect installation direction of the sensor

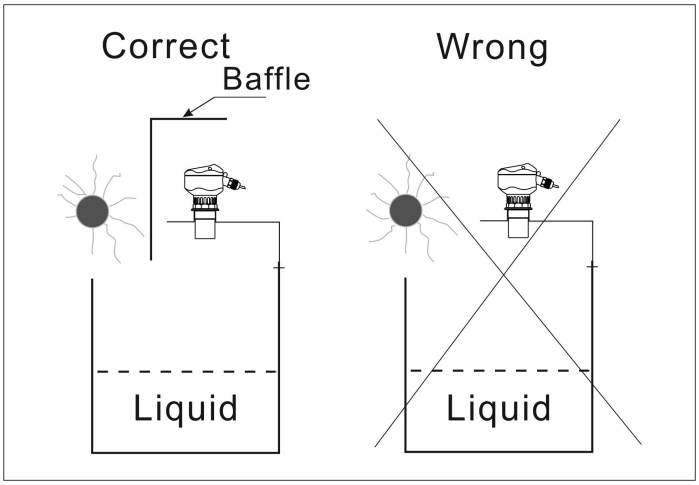
If the sensor is not installed aligned to the medium surface, the measuring signal will be weakened. To ensure the best measurement effect, the axis of sensor shall be aligned to the surface, i.e. perpendicular to the surface of measured interface.



Sensor probe shall be perpendicular to medium surface

③ Installed at positions with great temperature change

Measurement error is likely to take place at positions with great temperature change, such as place with strong sun illumination. The error will add by 2-4% on the basis of original measurement accuracy. Therefore, sun louver shall be installed to solve the problem.



Great temperature change – add sun louver or meter box

④ Minimum distance to medium less than the blind area

If the distance form probe to maximum level of the medium is less than the blind area of the meter, the measured values are wrong.

⑤ Sensor is too close to the container wall

If the sensor is installed too close to the container wall, strong false echo will be generated. The uneven inner surface of the container wall, attached medium, rivet, screw, reinforcing rib and joint weld on the container inner wall will lead to strong false echo which will be loaded on the effective echo signals. Therefore, the maximum distance shall be measured based on the requirements to keep the distance between the sensor and container wall, which is detailed as follows:

Maximum Measuring Range	Distance to Wall	Maximum Measuring Range	Distance to Wall	Maximum Measuring Range	Distance to Wall
5m	0.5m	10m	1.0m	15m	1.5m
20m	2.5m	30m	4m	40m	5m
50m	6m	60m	7.2m	70m	8.5m

Under worse measuring conditions, the distance between the sensor and the container wall shall be enlarged until no false echo occurs.

4.4 Electric wiring diagram

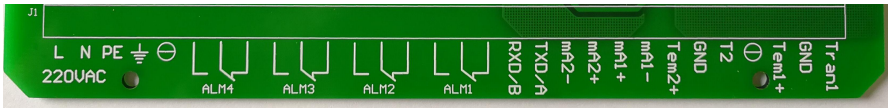
★ Prompt: make sure the connecting cable between the probe and meter body of separate-type ultrasonic level meter is long enough in advance. Connection with other cable for extension on site is not allowed as it will affect the signal transmission quality and strength.

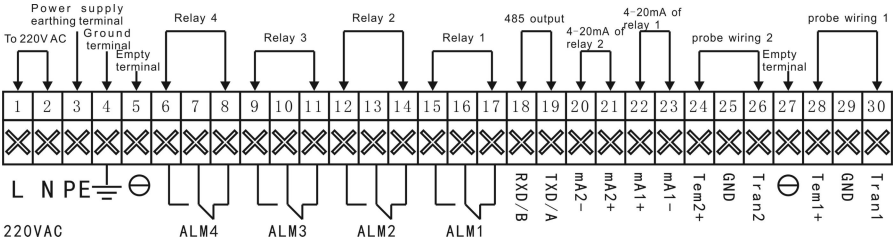
★ During power line connection, AC power line shall not be connected to any other terminals except AC terminals. Otherwise, the meter circuit or components and parts will be burnt.

★ 485, 232 and 4-20ma output terminals shall not be short-circuited as short circuit will lead to burning of internal circuits.

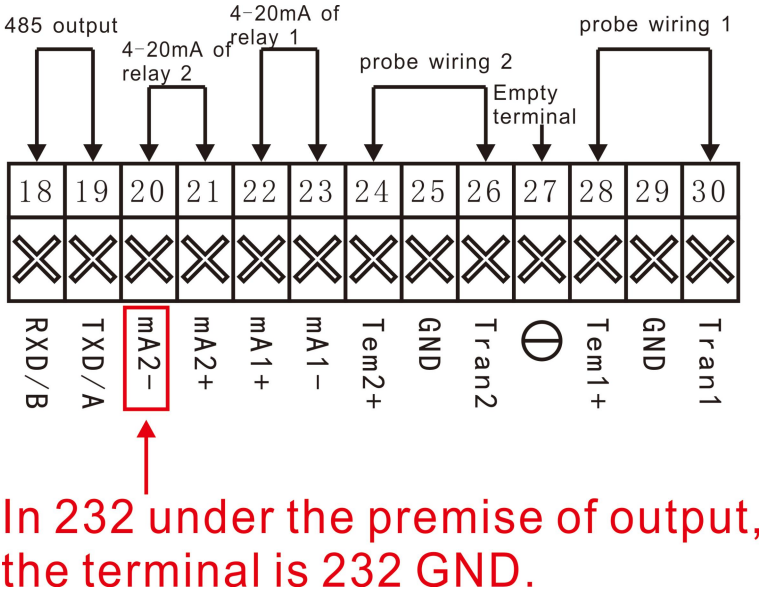
The cables connecting the sensor and main equipment shall not be put in a trun king with any alternating current. If it can not be prevented, the cables of senso r shall be protected by a cable conduit to completely shield the electromagnetic interference caused by alternating current.

4.4.1Anti-interference Electric wiring diagram of standard single-probe separate-type ultrasonic level meter:

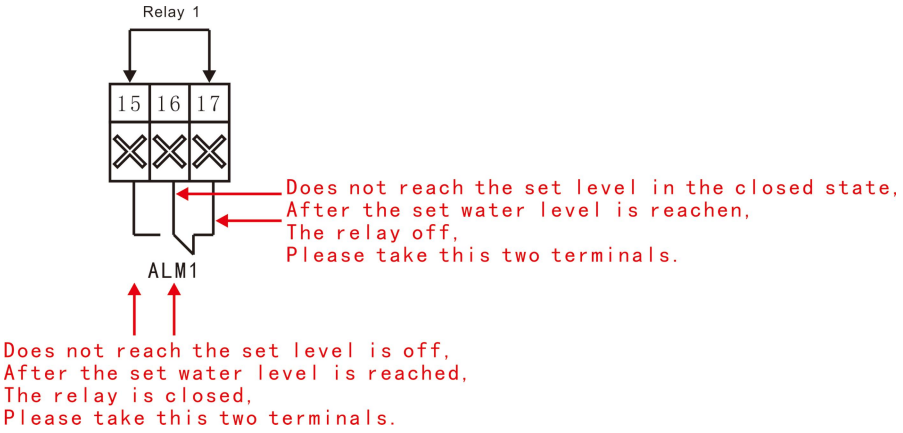




232 output wiring method



Wiring method of relay output

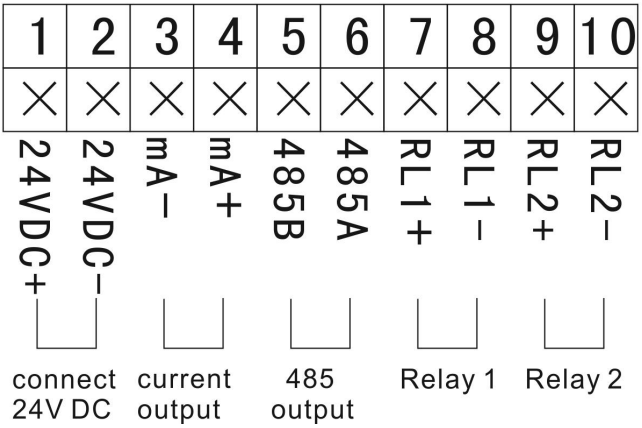


(3) Wiring diagram of integrated-type:

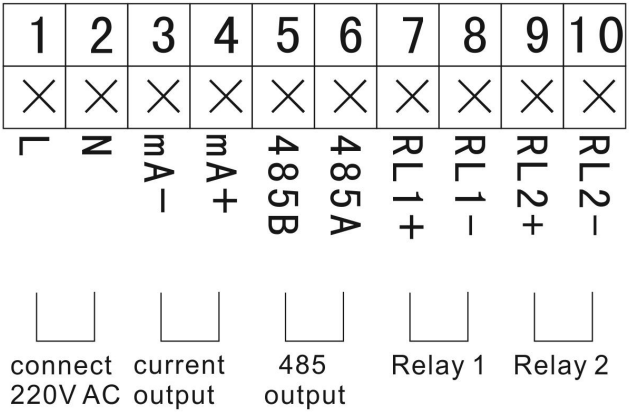
◆ **Enhanced integrated type with four-wire system**



Electric Wiring Diagram of Enhanced Integrated Type with Four-wire System



24VDC Power Supply Wiring Diagram of Four-wire System

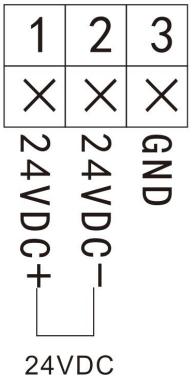


220VAC Power Supply Wiring Diagram of Four-wire System

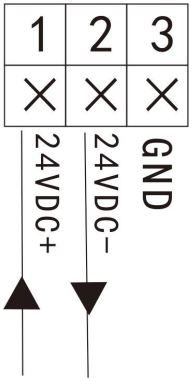
◆ **Enhanced integrated type with two-wire system**



Electric Wiring Diagram of Two-wire System

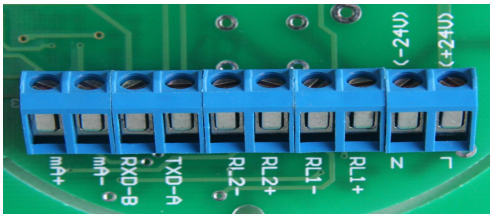


Wiring Diagram of Two-wire System

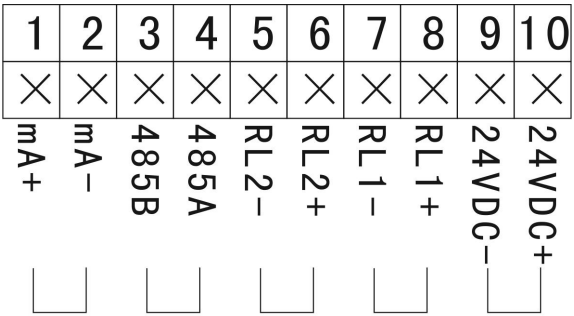


Ampere Meter Diagram of Two-wire System

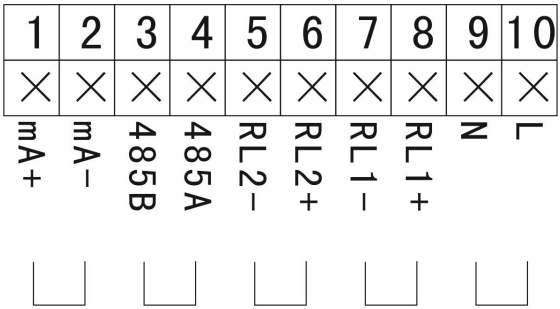
◆ **Explosion-proof integrated type with four-wire system**



Electric Wiring Diagram of Explosion-proof Integrated Type with Four-wire System



24VDC Power Supply Wiring Diagram of Four-wire System

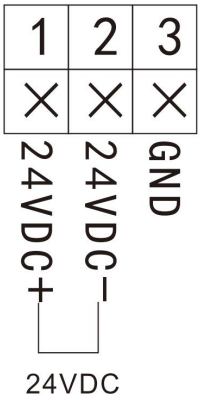


220VAC Power Supply Wiring Diagram of Four-Wire System

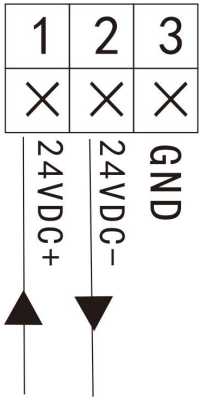
◆ **Explosion-proof integrated type with two-wire system**



24VDC Electric Wiring Diagram of Explosion-proof Integrated Type with Two-wire System



Wiring Diagram of Explosion-proof Integrated Type with Two-wire System



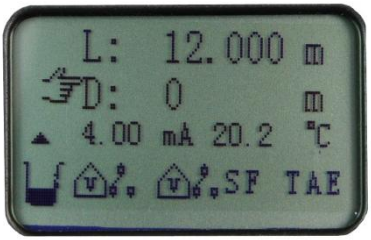
Connection of Explosion-proof Integrated Type with Two-wire System and Ampere Meter

V. Settings

5.1 Introduction of Interface of Operation Mode

Two working modes, operating and setting modes are provided for this series of ultrasonic level meter. After being powered on and initialized, the level meter will enter in the operating mode automatically, and start to measure data. Measurement at the time is under material level measurement mode and the relative output is 4~20mA. Output current is in direct proportion to the material level.

The interface of ultrasonic level meter under operating mode is as follows:



English Display Interface

VI. Menu Interface & Operating Instructions:

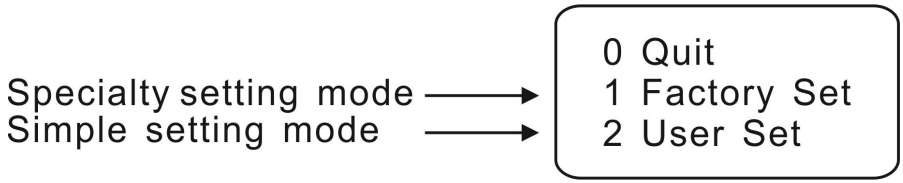
The menu modes include expert setting mode and simply setting mode.

See the homepage for menu query table of simply setting mode.

See the appendix for menu query table of expert setting mode.

Menu interface of expert setting mode and operating instructions are shown below:

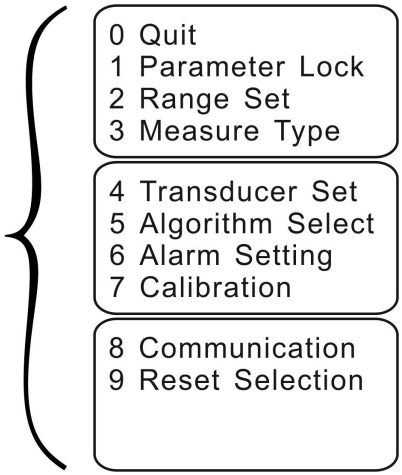
① Press SET in operating mode interface to enter in the "Mode selection "main menu:



② Descriptions of the main menu items:

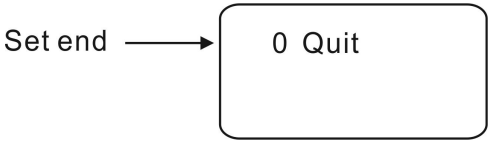
◆ Interface of the main menu with unlocked parameters:

1. Press "▲" or "▼" to select the menu to be modified, and then press "SET" to enter in this menu.
2. Press "SET" to exit from this menu.

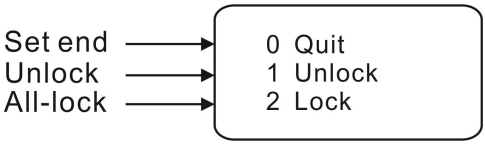


◆**"0 Set end"**

Chose this item, and press SET to exit to the operating mode interface.



◆ Interface of the main menu with locked parameters:



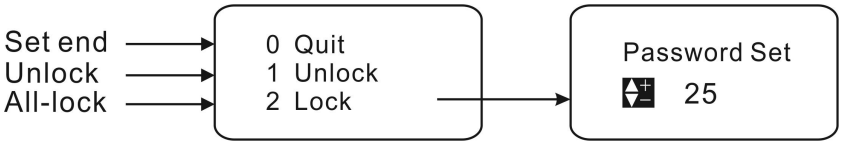
◆ **"1 Parameter locking"**

If you do not want other people to make random changes of the parameters, you can lock the menu, and the menu can be unlocked with passwords. The initial password of the level meter is 25, and users can change the initial password and set their own passwords randomly (tips: please remember your own password, otherwise you need to contact with the manufacturer).

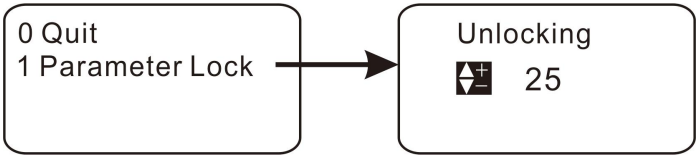
Descriptions:

Unlock: unlock, and all parameters of the menu can be changed randomly.

All-lock: for the conditions, the changes can be made only after entering password.



★ **If the parameters are locked, press SET and enter in the unlocking interface for parameter locking:**



◆ "2 Range Set "

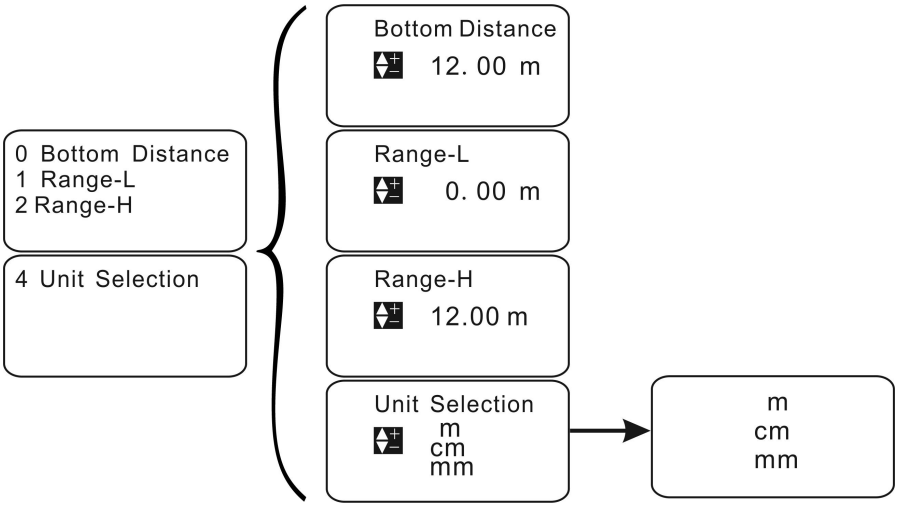
Set reference zero point, low range point, high range point and display unit.

1 Bottom Distance(Reference zero point): set the reference zero point of the level meter, and this value is only useful for material level measurement; the factory default is the maximum range.

2 Range-L(Low range point): set the output measurement value relative to 4mA of the level meter, and the factory default is 0.

3 Range-L(High range point): set the output measurement value relative to 20mA of the level meter, and the factory default is the maximum range.

4 Unit Selection(Display unit): there are three optional units, including m, cm and mm, wherein m stands for meter, cm for centimeter and mm for millimeter. The factory default is m.



◆ **"3 Measuring mode"**

1. Type Selection(Select mode): there are two optional items, i.e. distance measurement and material level measurement.

Distance measurement: the display value is the distance from the probe to the surface measured;

Material level measurement: the display value is the distance from the bottom to liquid surface, i.e. liquid level height.

The factory default is material level measurement.

2. Damping Rate(Response rate): there are three optional items, i.e. slow speed, medium speed and fast speed.

Slow speed: the response rate is slow and measuring accuracy is high, not easy to be disturbed;

Medium speed: the parameters are between those for slow speed and fast speed;

Fast speed: the response rate is fast and measuring accuracy is low, very easy to be disturbed. The factory default is medium speed.

3.Safe Level(Safe material level): there are four optional items, i.e. remaining, minimum value, maximum value and setting value.

Remaining: the display value is the final measured value before wave loss, and

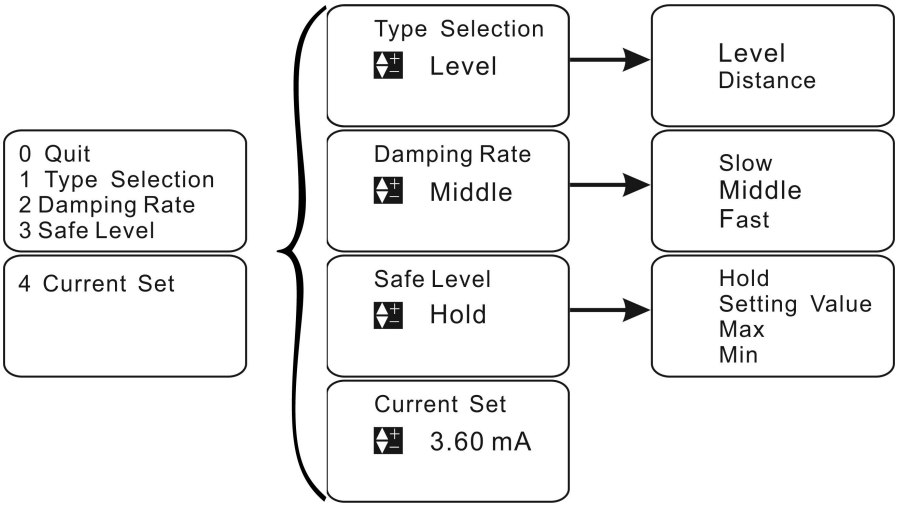
the current is the corresponding value;

Minimum: the display value is 4mA after wave loss, and the current 4mA;

Maximum: the display value is 20mA after wave loss, and the current 20mA;

Setting value: the display value is the final measured value after wave loss, and the current output is the setting value of setting current. The factory default is the remaining value.

4.**Current Set(Set current):** set the output current after wave loss, which shall be more than 3.6mA and less than 22mA, and become invalid in case of remaining/minimum/maximum values on reselection. The factory default is 3.6mA.



◆"4 Transducer Set(Set probe)" (do not modify this parameter)

Select probe and set relevant parameters.

1 Transducer Type(Probe selection): 1~9 options. Select the probe according to label on it. Factory default is 5.

2 Blanking(Blind area setting): set near-end blind area of probe; and factory default varies with the matched probe.

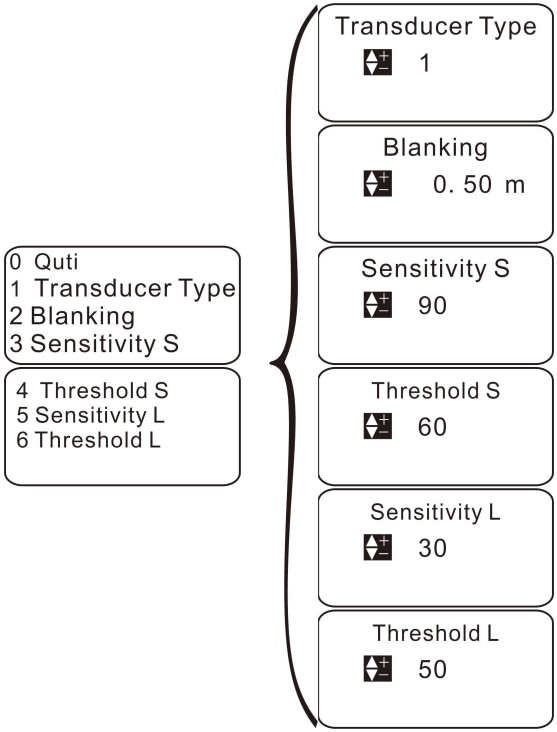
3 Sensitivity S(Short sensitivity): to be modified under the guidance of professional technical personnel only.

4 Threshold S(Short threshold value): to be modified under the guidance

of professional technical personnel only.

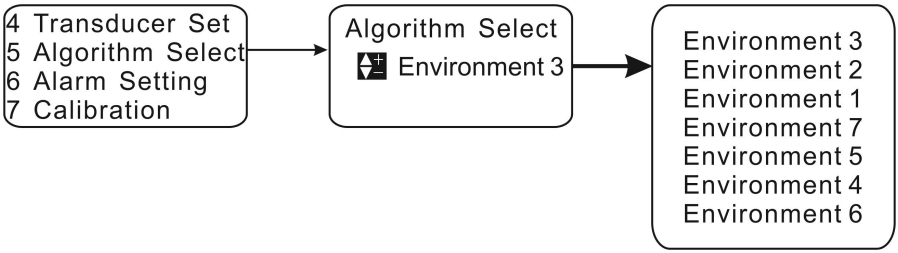
5 Sensitivity L(Long sensitivity): to be modified under the guidance of professional technical personnel only.

6 Threshold L(Long threshold value): to be modified under the guidance of professional technical personnel only.



◆"5 Algorithm Select(Set probe)" (do not modify this parameter)

Algorithm Select(Select algorithm): there are seven options, including special environment 1, special environment 2, special environment 3, special environment 4, special environment 5, special environment 6, and special environment 7.



◆**"6 Alarm setting"** Set alarm relay.

Alarm 1 mode: closed mode, low-level alarm and high-level alarm are optional. Closed: relay 1 is out of service; low-level alarm: relay 1 sends low-level alarm signal; and high-level alarm: relay 1 sends high-level alarm signal. Factory default is closed mode.

Alarm 1 value: the unit is m and factory default is 0.

Alarm 1 Diff(Alarm 1 return difference): the unit is m, and after being triggered, the alarm can be canceled only after the measured value reaches the alarm value +/- alarm return difference. Factory default is 0.

Setting method of alarm 2/3/4 mode is the same as above.

Example: (how to use a relay to control startup/shutdown of water pump)

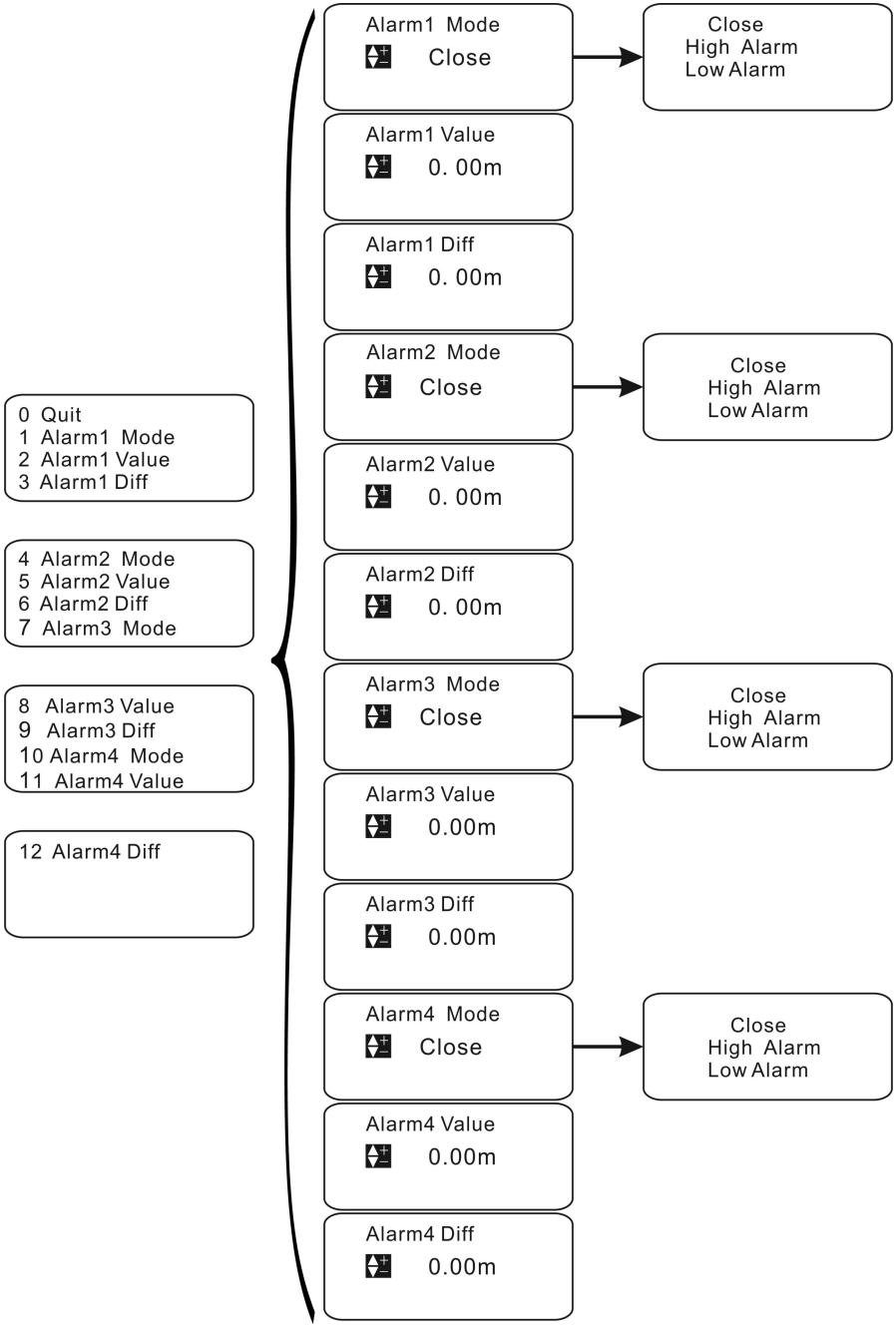
Through alarm return difference, one relay can control the whole working process of water pump from low level to high level.

For water drainage: when water level is below 1m, water pump stop draining; when water level rises to 5m, water pump start to drain water. Detailed settings are shown below:

Alarm 1 mode: high-level alarm. Alarm 1 value: 5.00m; alarm 1 return difference: 4.00m.

For water supply: when water level is below 1m, water pump start to feed water; when water level rises to 5m, water pump stop feeding water. Detailed settings are shown below:

Alarm 1 mode: low-level alarm. Alarm 1 value: 1.00m; alarm 1 return difference: 4.00m.


0 Quit
1 Alarm1 Mode
2 Alarm1 Value
3 Alarm1 Diff
4 Alarm2 Mode
5 Alarm2 Value
6 Alarm2 Diff
7 Alarm3 Mode
8 Alarm3 Value
9 Alarm3 Diff
10 Alarm4 Mode
11 Alarm4 Value
12 Alarm4 Diff
Alarm1 Mode
Close
Close
High Alarm
Low Alarm
Alarm1 Value
0. 00m
Alarm1 Diff
0. 00m
Alarm2 Mode
Close
Close
High Alarm
Low Alarm
Alarm2 Value
0. 00m
Alarm2 Diff
0. 00m
Alarm3 Mode
Close
Close
High Alarm
Low Alarm
Alarm3 Value
0.00m
Alarm3 Diff
0.00m
Alarm4 Mode
Close
Close
High Alarm
Low Alarm
Alarm4 Value
0.00m
Alarm4 Diff
0.00m

◆**"7 Calibration (Parameter correction)" (do not modify this parameter)**

Carry out correction of range, sound velocity, current output and reference level.

1.Range Adjust (Range correction): after input of the actual value, the system will correct the range automatically. Factory default is the measured value.

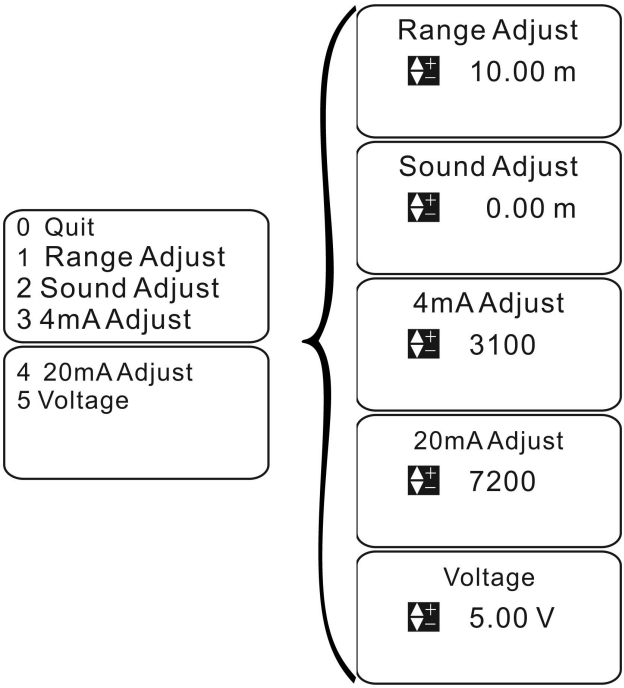
2.Sound Adjust (Sound velocity correction): after input of the actual value, the system will correct the sound velocity automatically, applied when gas composition is not air. For example, propagation velocity of sound is different in places with gasoline, acetone, ethyl alcohol and other volatile gas, so correction is necessary.

3.4mA Adjust (4mA correction): keep modifying the value until the actual output current reaches 4mA. Factory default is 3100.

When multimeter is connected to 4-20ma positive pole in series, this number shall be increased or decreased by 1 so that 4mA correction can be realized.

4.20mA Adjust (20mA correction): keep modifying the value until the actual output current reaches 20mA. Factory default is 7200.

5.**Voltage (Reference level):** input the measured voltage at relevant test point. Factory default is 5.00.

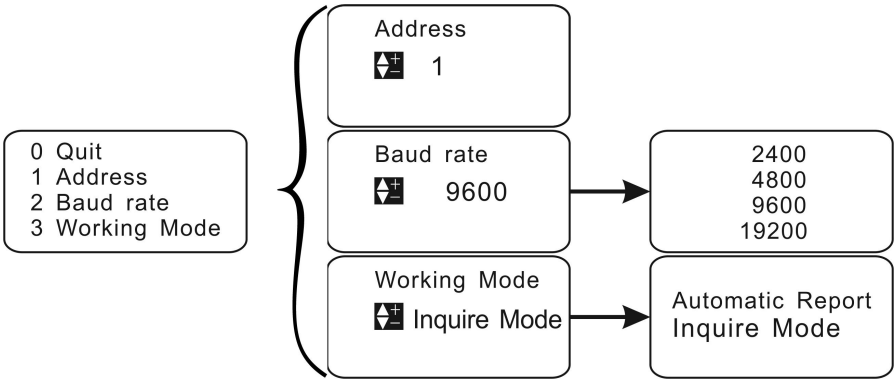


◆ **"8 Communication setting"**

1.Address (Communication address): select communication address; and the default is 1.

2.Baud rate: select communication frequency among 2400, 4800, 9600 and 19200; and the default is 9600.

3.Working Mode (Operating mode): select communication operating mode between "Automatic report mode" and "Inquiry mode"; and the default is "Automatic report mode".

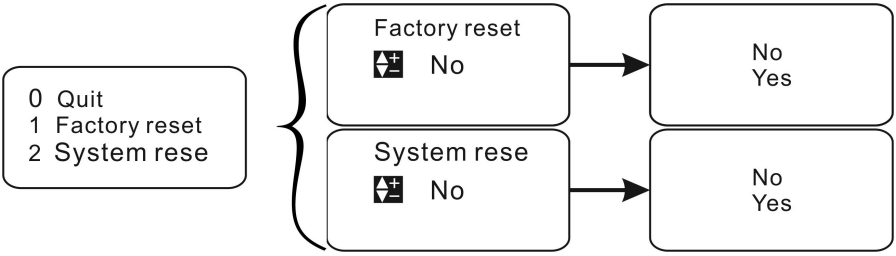


◆ **"9 Reset options"**

1.Factory reset: Yes: restore factory settings so that setting error can be resolved.

No: exit. Factory default is No.

2.**System reset:** Yes: restore system settings. No: exit. Factory default is No. (Do not modify this item.)



VII. Faults and Handling

If all wirings are normal through inspection in case of a fault, after ultrasonic level meter is grounded, you can keep pressing "▲", then press "SET" to show echo menu, take a photo of the echo menu and send it to us via MMS or picture. By this way, we can determine the possible electromagnetic interference, false echo, situation of entering a blind area, no echo signal received and other faults.

Faults	Causes	Handling
Level meter does not work.	Power supply is not well connected.	Inspect power line.
Level meter does not display data.	1.Power supply is not well connected. 2.Wiring between LCD and mainboard falls off or comes loose. 3.The LCD is damaged.	1.Inspect power line. 2.Inspect the wiring and connect it again. 3.Maintain it in the factory.
Level meter works but there is no change of trumpet icon ( ) on the LCD, which means that the system is in wave loss state.	1.The measured area is beyond the measuring range of level meter. 2.The measured medium has strong disturbance, vibration or heavy dust. 3.There are strong interference sources around such as frequency converter and motor. 4.The probe is not aligned to the measured surface. 5.There are redundant objects in the measured space, such as support rod and feed opening. 6.The liquid level is in a blind area. 7.The measured medium is soft powder or there is foam on liquid surface.	1.Replace the level meter with a level meter with greater measuring range. 2.The meter will restore the normal measurement automatically after the measured medium gets back to calm. 3.Check surrounding environment and realize good electromagnetic shielding. Do not share one power supply with frequency converter and motor, and make it grounded reliably. 4.Reinstall probe and make it perpendicular to liquid surface. 5.Select an appropriate position for installation and prevent an interfering object. 6.Raise the installation position of probe. 7.Check whether the medium is powder. If so, consult the manufacturer.

VIII.Ultrasonic Level Meter MODBUS Communication Protocol Version V1.4

MODBUS—RTU communication protocol

1、The hardware is adopted with RS-485, master-slave half-duplex communication, that is, the host calls the slave address, and the slave answers.

2、Data frame: 10 digits, 1 start bit, 8 data bits and 1 stop bit, without verification.
Baud rate: 2400, 4800, 9600 and 19200 (9600 by default).

3、Function code 03H: Read register value
Data sent by the host:

1	2	3	4	5	6	7	8
ADR	03H	High-order byte of initial register	Low-order byte of initial register	High-order byte of register number	Low-order byte of register number	Low-order byte of CRC code	High-order byte of CRC code

The first byte, ADR: address of slave machine (=001~254)
The second byte 03H: Read the register value function code
The third and fourth bytes: the start address of the register to be read
The fifth and sixth bytes: the number of the register to be read
The seventh and eighth bytes: CRC16 verification from byte 1 to byte 6

When the slave machine receives correctly, it will send back following values:

1	2	3	4、5	6、7		M-1、M	M+1	M+2
ADR	03H	Total number of bytes	Register data 1	Register data 2	。。。	Register data M	Low-order byte of CRC code	High-order byte of CRC code

The first byte, ADR: address of slave machine (=001~254)

The second byte 03H: Return to read function code
The third byte: Total number of bytes from 4 to M (included)
Byte from 4 to M: Register data
The M+1 and M+2 bytes: CRC16 verification from byte 1 to byte M

When the slave machine does not receive correctly, it will send back following values:

1	2	3	4	5
ADR	83H	Information code	Low-order byte of CRC code	High-order byte of CRC code

The first byte, ADR: address code of slave machine (=001~254)
The first byte 83H: Register value reading error
The third byte information code: See the table of information code
The fourth and fifth bytes: CRC16 verification from byte 1 to byte 3

4、 Function code 06H: Write a single register data

Data sent by the host:

1	2	3	4	5	6	7	8
ADR	06	High-order byte of register address	Low-order byte of register address	High-order byte of data	Low-order byte of data	Low-order byte of CRC code	High-order byte of CRC code

When the slave machine receives correctly, it will send back following values:

1	2	3	4	5	6	7	8
ADR	06	High-order byte of register	Low-order byte of register	High-order byte of data	Low-order byte of data	Low-order byte of CRC code	High-order byte of CRC code

When the slave machine does not receive correctly, it will send back following values:

1	2	3	4	5
ADR	86H	Error information code	Low-order byte of CRC code	High-order byte of CRC code

The first byte, ADR: address code of slave machine (=001~254)

The first byte 86H: function code of writing error of register number

The third byte information code: See the table of information code

The fourth and fifth bytes: CRC16 verification from byte 1 to byte 3

5、 Function code 10H: Write multiple register numbers in succession

Data sent by the host:

1	2	3	4	5	6	7
ADR	10H	High-order byte of initial register address	Low-order byte of initial register address	High-order byte of register number	Low-order byte of register number	Total number of data bytes

8、9	10、11	N、N+1	N+2	N+3
Register data 1	Register data 2	Register data M	Low-order byte of CRC code	High-order byte of CRC code

When the slave machine receives correctly, it will send back following values:

1	2	3	4	5	6	7	8
ADR	10H	High-order byte of initial register address	Low-order byte of initial register address	High-order byte of register number	Low-order byte of register number	Low-order byte of CRC code	High-order byte of CRC code

When the slave machine does not receive correctly, it will send back following values:

1	2	3	4	5
ADR	90H	Error information code	Low-order byte of CRC code	High-order byte of CRC code

The first byte, ADR: address code of slave machine (=001~254)
The first byte 90H: function code of writing error of register number
The third byte information code: See the table of information code
The fourth and fifth bytes: CRC16 verification from byte 1 to byte 3

6、Register Definition Table: (Note: Register address coding adopts hexadecimal system.)

Register address	Description	Read Only	Register address	Description	Read Only
0000	Distance/Level instantaneous value (2 bytes MSB first)	√	0001	Analog output instantaneous value (2 bytes MSB first)	√
0002	Instantaneous temperature (2 bytes MSB first)	√	0003	Reserved	
0004	Reserved		0005	Reserved	
0006	Reserved		0007	Reserved	
0008	Reserved		0009	Reserved	
000A	Reserved		000B	Reserved	
000C	Reserved		000D	Reserved	
000E	Reserved		000F	Reserved	
0010	Reserved		0011	Reserved	
0012	Reserved		0013	Reserved	
0014	Reserved		0015	Reserved	
0016	Reserved		0017	Reserved	
0018	Reserved		0019	Reserved	
001A	Reserved		001B	Reserved	
001C	Reserved		001D	Reserved	
001E	Reserved		001F	Reserved	
0020	Reserved		0021	Reserved	

0022	Alarm 1 value (2 bytes MSB first)		0023	Alarm 1 Diff (2 bytes MSB first)	
0024	Alarm 2 value (2 bytes MSB first)		0025	Alarm 2 Diff (2 bytes MSB first)	
0026	Alarm 3 value (2 bytes MSB first)		0027	Alarm 3 Diff (2 bytes MSB first)	
0028	Alarm 4 value (2 bytes MSB first)		0029	Alarm 4 Diff (2 bytes MSB first)	
002A	Bottom Distance (2 bytes MSB first)		002B	Range-H (2 bytes MSB first)	
002C	Range-L (2 bytes MSB first)		002D	Current set (2 bytes MSB first)	
002E	Blanking (2 bytes MSB first)		002F	Reserved	
0030	Reserved		0031	Reserved	
0032	Reserved		0033	Reserved	
0034	Reserved		0035	Reserved	
0036	Reserved		0037	Reserved	
0038	Reserved		0039	Reserved	
003A	Reserved		003B	Reserved	
003C	Reserved		003D	Reserved	
003E	Reserved		003F	Reserved	
0040	Reserved		0041	Reserved	
0042	Reserved		0043	Reserved	
0044	Reserved		0045	Reserved	
0046	Reserved		0047	Reserved	
0048	Reserved		0049	Reserved	
004A	Reserved		004B	Reserved	
004C	Reserved		004C	Reserved	
004E	Reserved		004F	Reserved	
0050	Reserved		0051	Reserved	
0052	Reserved		0053	Reserved	
0054	Reserved		0055	Reserved	
0056	Reserved		0057	Reserved	
0058	Reserved		0059	Reserved	
005A	Reserved		005B	Reserved	
005C	Alarm 1 mode Alarm 2 mode		005D	Alarm 3 mode Alarm 4 mode	
005E	Type Selection Unit selection		005F	Algorithm selection Safe level	
0060	Transducer Typ Damping Rate		0061	Factory reset System reset	
0062	Baud rate Working mode		0063	Reserved	
0064	Reserved		0065	Reserved	
0066	Reserved		0067	Reserved	
0068	Reserved		0069	Reserved	
006A			006B	Phenotype character Meter address	

Remarks:

①

It is indicated by 2 bytes, MSB: **(Note: floating-point numbers are rounded by 100 and expressed in hexadecimal)**

◆ The returned distance or level value is expressed in cm.

Example: The current instrument address is 1.

Send:

01 03 00 00 00 01 84 0A

Return:

01 03 02 00 10 b9 88

The two red bytes indicate that the current measurement is 0.16 m (0x0010)

Notes:

Positive and negative identifications: when the measured value and temperature are positive, the highest significant bit of the high byte is 0; when it is negative, the highest significant bit of the high byte is 1;

Examples:

When the current measurement is -0.16 m, figures 01 03 02 80 10 E8 06 **return.**

②

Measuring mode: 0 -- measuring distance; 1 -- measuring material level
Safe level: =0, hold; =55, minimum; =AA, maximum; =A5, set value
Alarm mode 1, 2, 3, 4: 0 -- close; 1 -- low alarm; 2 -- high alarm
Type Selection: = 0, mm; = 1, cm; = 2, m
Algorithm selection: 0 - special environment 1; 1 -- special environment 2; 2 -- special environment 3; 3 -- special environment 4; 4 -- special environment 5; 5 -- special environment 6; 6 -- special environment 7
Transducer Type: 0 -- option 1; 1 -- option 2; 2 -- option 3; 3 -- option 4; 4 -- option 5; 5 -- option 6; 6 -- option 7; 7 -- option 8; 8 -- option 9;
Damping Rate: 0 -- slow; 1, medium speed; 2 - fast;
Factory reset: 0-No; 1-Yes;
System reset: 0-No; 1-Yes;
Baud rate: 0-2400; 1-4800; 2-9600; 3-19200
Working mode: 0 -- automatic report mode; 1 -- Inquire Mode

③

Regional read-write operation of register
The first region: 0010 — 0021 read only

The second region: 0022 — 005B read-write
The third region: 005C — 004B read-write
Within the same region, a parameter can be read (or write) at a time, and all parameters in the region can be read (or write) in batch. It is not allowed to read and write parameters cross regions.
④
All reserved registers are currently undefined, reserved for upgrade compatibility.

7、 Information code table

Information code	Indication
01H	Invalid function code
02H	Invalid data address
03H	Invalid data value
04H	CRC16 verification error
05H	Correct reception
06H	Reception error
07H	Parameter error

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