Intelligent Ultrasonic Level Meter

Installation Manual

V2.23

Non-contact measurement for the distance and material level of the liquid, pasty and small particle materials

Contents

Welcome

Sincerely thank you for buying ultrasonic level meter manufactured by our company!

Production and operation basis of this product is JJG 971-2002 “Verification Regulation of the Liquid Level Measuring Devices”.

This manual introduces the application, feature, function, installation and setup of ultrasonic level meter, so users can know, install, use and maintain this instrument.

Application

- Continuous and non-contact measurement for the material level of the liquid, pasty and small particle materials
- Maximum measuring distance of the instrument

Measuring Range / Measuring Medium	Maximum Measuring Distance			
Liquid and Fluid	5m	10m	15m	20m
High Temperature with Water Vapor*	3m	6m	9m	12m
Solid (Particle>4mm)*	2m	4m	6m	8m

* Note: The maximum measuring distance of the ultrasonic level meter is affected by operating conditions. The data in the above table are for reference only.

Features

- Display the liquid level and distance;
- Automatic detection of on-site electrical interference, and interference suppression;
- Internal integrated temperature sensor, and real-time temperature compensation for sound velocity;
- Have 4-20 mA current simulation, RS485 communication test, and other functions;
- Use the keys to carry out on-site parameter setting;
- All input and output lines have the overvoltage and overcurrent protection;
- Non-contact measurement, and long service life;

Technical Parameters

Type / Content	Two-wire system	Three/four-wire system
Measuring Range	0.15m~2m, 0.3m~5m, 0.35m~10m, 0.5m~15m, 0.8m~20m	
Blind Zone	0.15m~0.8m (Depend on the measuring range)	
Measuring Precision	±0.3%FS* (Standard conditions*)	
Resolution	1mm	
Instrument Display	Display liquid level, distance and relay status	
Supply Voltage	DC12V~36V / 22mA	DC12V~36V / 70mA or AC100V～240V / 5W
Analog Output	4~20mA loop current output (Load < 400Ω)	4~20mA / bit12 current output (Load < 500Ω)
Digital Output	-	RS485 interface / Modbus-RTU protocol
On-off Output	-	2-channel SPST relay Contact power 3A 250VAC / 5A 30VDC
Transmitter Material	ABS engineering plastics	
Probe Material	ABS / ETFE / PTFE	
Electrical Interface	PG11 Interface	PG11 Interface
Process Interface	G2"(Customize G1 / $2\frac{1}{2}$ "NPT screw thread)	
Environmental Temperature	-35℃ ~ +70℃* (If the temperature below -20℃, it is required to indicate the requirements at the time of ordering)	
Process Temperature	-40℃ ~ +80℃	
Waterproofing Grade	IP67	
	The instrument is in the humid environment all the year round. It is recommended to apply the glass cement to the waterproof joints	
Process Pressure	0.8~3bar/altitude < 2,000 m	

*FS: Full scale;

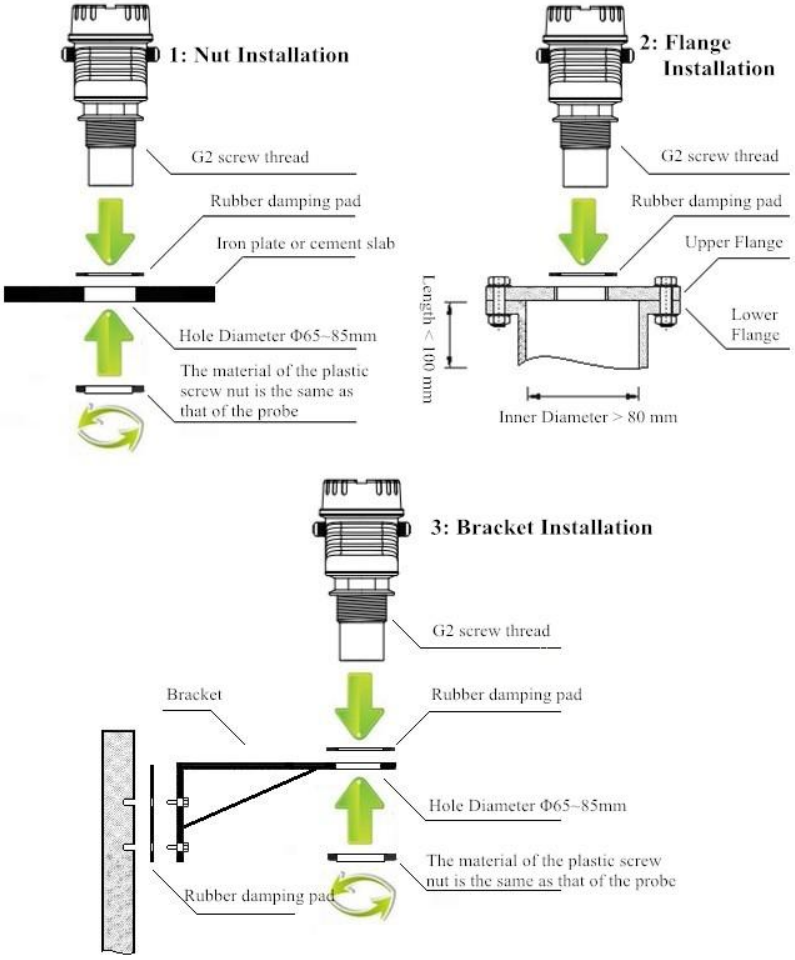
*Standard Conditions: Operate the instrument in the air, with the temperature of 20℃±5℃, humidity of 45%~75%, and atmospheric pressure of 1 bar, and no wind around.

* LCD display will fail (recoverable) when the ambient temperature is lower than -20℃ or higher than 60℃; Avoid direct sunlight on the LCD;

*Sunshade is preferred on the instrument;

Installation Methods

The ultrasonic liquid meter involves three instrument installation methods. Please reasonably select them according to the on-site conditions!

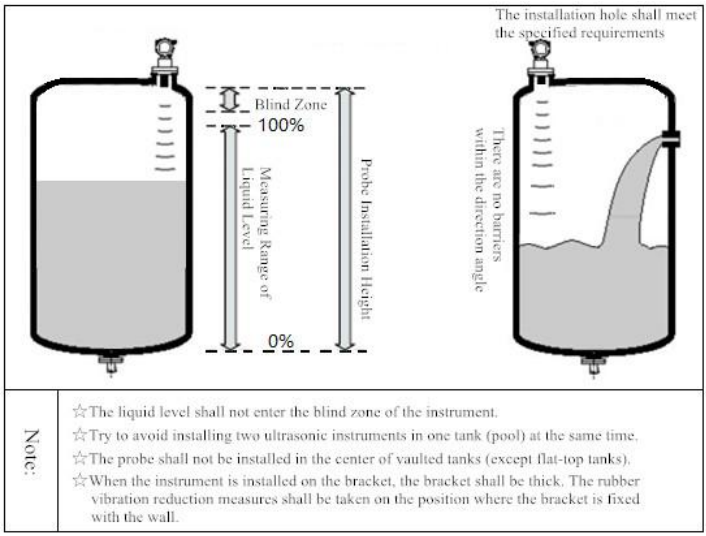


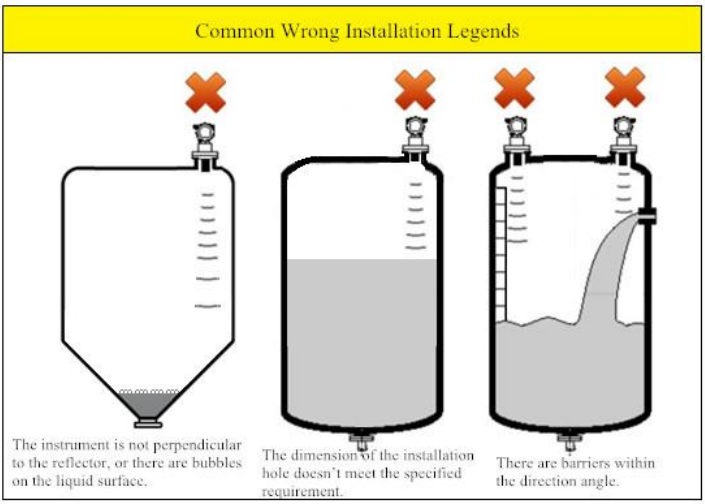
Note:

- The instrument is provided with plastic screw nuts. The flange with various specifications may be customized according to the user requirements.
- To prevent the bracket from shaking, the bracket shall be thick. The vibration reduction measures shall be considered on the position where the bracket is fixed with the pool wall.
- The recommended arm length of the bracket is 30~50 cm.

Installation Location

The reason why many ultrasonic liquid meters are not operated normally is that the installation location and operating conditions don't meet the requirements of the instrument. It is particularly important to choose the reasonable installation location for ultrasonic liquid meters.





Note: The blind zone varies with the measuring range of the instrument. The blind zone of the instrument will be indicated on the label.

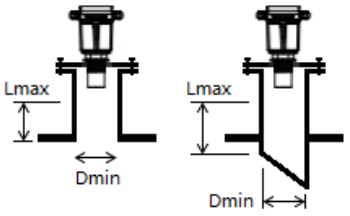
Installation Hole (Extension Tube) Requirements

The diameter and length of the installation hole shall meet the requirements of the instrument.

If the liquid / material level can enter the blind zone of the instrument, then it is required to install the extension tube and raise the installation height of the probe. The diameter and length of the extension tube shall meet the requirements of the instrument.

The related requirements are shown in the right figure.

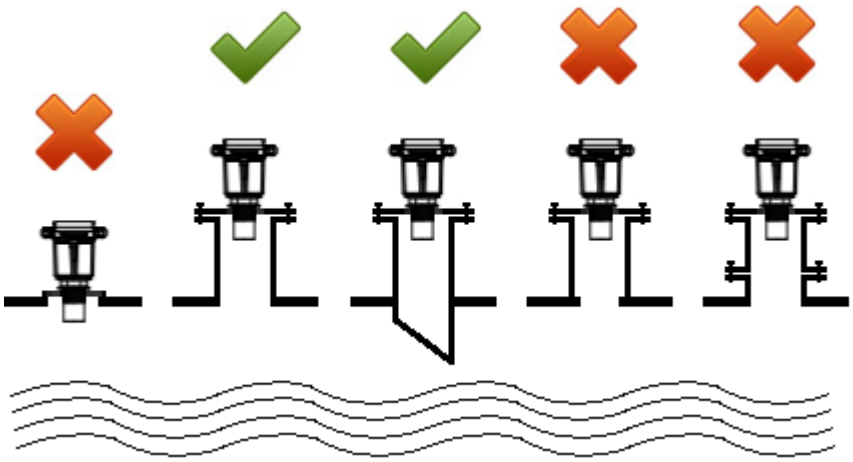
Please determine the size of Lmax and Dmin according to the actual conditions.



Dmin	Lmax
80mm	100mm
100mm	150mm
150mm	200mm
200mm	250mm
250mm	300mm

Note:

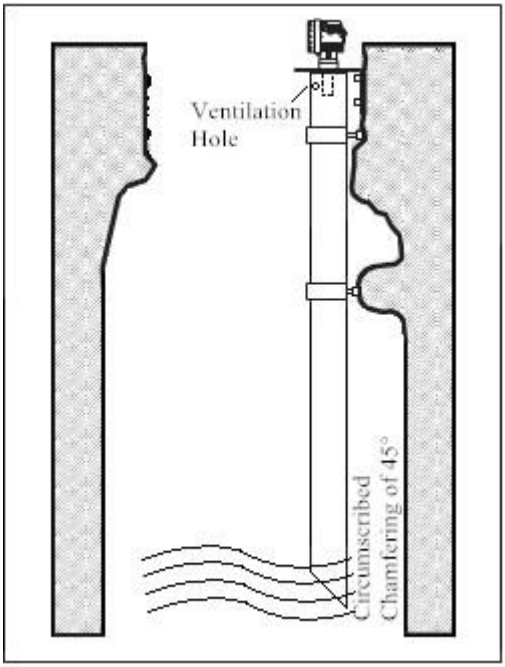
- The inner wall of the extension tube shall be smooth (without welding seams or butt seams). If there are butt seams, they need to be filled with gypsum.
- The lower nozzle of the extension tube shall be smooth, without burrs. It is better that the chamfering is 45°.



Liquid level enter the blind zone	Raise the probe with an extension tube	Preferred extension tube	The lower nozzle has burrs or scraping	The inner wall is not smooth, with butt seams

Waveguide Tube

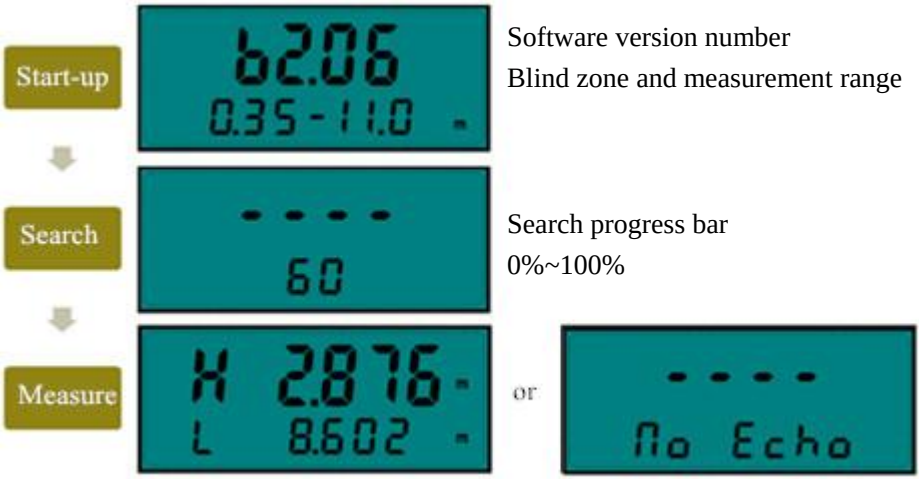
If there is strong echo interference (such as narrow shafts, steps that cannot be avoided, and agitating vanes), or a large number of bubbles exist on the liquid surface, then it is recommended to use the PE or PVC tube with the diameter of over 100 mm as the waveguide tube of ultrasound.



Note:

- There is a ventilation hole on the top, to ensure that the internal and external liquid levels of the tube are consistent.
- The inner wall of the waveguide tube shall be smooth (without welding seams or butt seams).
- The nozzle of the waveguide tube shall be smooth. It is better that the chamfering is 45°.
- When the waveguide tube is fixed, it is required to consider the vibration reduction measures, so as to prevent the existence of acoustic interference in the tube.
- In order to ensure that there is no material hanging on the inner wall of the waveguide tube, it is necessary to regularly clean/check the waveguide tube.

Start-up Display



Software version number
Blind zone and measurement range

Search progress bar
0%~100%

Display of measurement result

No Echo

Note:

- The measurement range and version number may not be consistent with the above figure, and the actual display of the instrument shall prevail.
- After power outage for more than 5-10s, the instrument shall be powered on; otherwise, the LCD screen is prone to messy code or inverted display.

Key Description

[SET] Key

◇ Enter/quit the menu

[OK] Key

◇ Enter editing

◇ Confirm/quit editing

[▲] Key

◇ Roll to the next menu

◇ Modify the number at cursor/list selection

[▶] Key

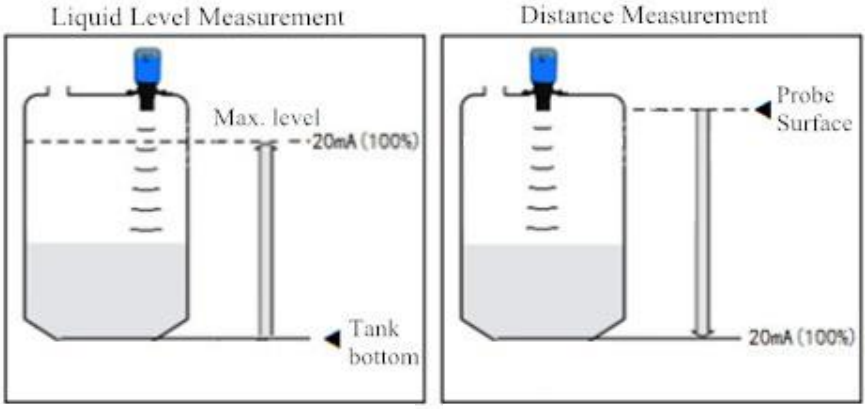
◇ Move cursor

◇ Roll to the previous menu

Basic Parameters (enter into basic parameter menu, the password is "1000")

P02: 20mA Setup (Measuring Range)

Menu	P02: Input the distance between high point and zero point of measurement range.	
Value	Value range	0m~+20.000m
	Default value	10.000m



Zero scale refers to tank/pool bottom.

When the liquid level is 0.000m, the current output is 4mA.

When the liquid level is at P02, the current output is 20mA.

Zero scale refers to probe surface.

When the distance is 0.000m, the current output is 4mA.

When the distance is at P02, the current output is 20mA.

P03: Display Mode

Menu	P03			4-20mA Output
Parameter	H - L	Display liquid level and distance	Default	Liquid Level
	L - F	Display liquid level and temperature		Distance
	H - C	Display liquid level and current		Liquid Level
	L - C	Display distance and current	2wire system	Distance
	H - A	Display liquid level and relay status	4wire system	Liquid Level

P04: Probe Height

Menu	P04: Input the distance between probe surface and bottom of the tank	
Value	Value range	0m ~ 20.000m
	Default value	10.000m

P05: Change Rate

Menu	P05: Choose the response rate of the instrument based on the change rate of liquid level/distance		
Parameter	FAFA	Most Fast	Default
	FA	Normal	
	SL	Slow (change rate is less than 50cm/min.)	
	SLSL	Slowest	

Note:

- The response rate of the instrument should be higher than the liquid level change rate.
- The slower the response rate, the better the stability of the data, but the corresponding data changes slowly.

P06: Dead Band (Blind Zone)

Menu	P06: Input the distance from the nozzle, step and beam to the probe surface.	
Value	Value range	0~10.000m
	Default value	0.35m

Dead band: the instrument suppresses the echo within this range that will affect the normal measurement. By setting the dead band, the influence of the nozzle, steps and beams of the extension pipe on the instrument measurement can be suppressed.

Reminder: When the dead band is less than the nominal bland zone of the probe, the dead band is invalid. See the label on the instrument for the nominal bland zone.

Liquid level is prohibited from entering blind zone of the instrument!

The distance between liquid level and probe surface shall not be less than dead band!

The manufacturer isn't responsible for accidents of abnormal instrument operation since liquid level enters dead band/blind zone!

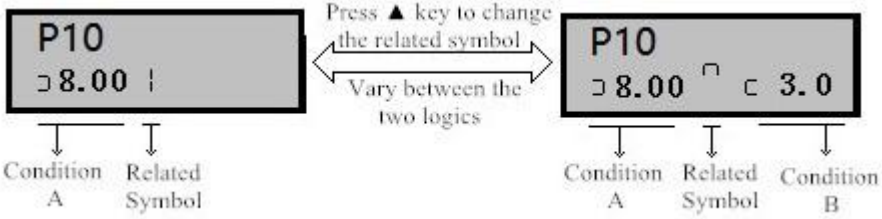
P09: Simulation Current

Parameter	4.000mA	Force the instrument to output 4.000mA current	
	12.000mA	Force the instrument to output 12.000mA current	
	20.000mA	Force the instrument to output 20.000mA current	

P10-P11: Relay Logic 1-2

Parameter	Value range	0m~10.000m	Parameter
	Default value	> 9.90m	

The instrument has two types of relay control logics, including simple logic (one logic) and complicated logic (two logics), as shown in the following figure:



When the liquid level meets Condition A, the relay is sucked.

When Condition A is not satisfied, the relay is disconnected.

When the liquid level meets Condition A, the relay is sucked.

When the liquid level meets Condition B, the relay is disconnected.

When the liquid level does not meet Condition A and Condition B, the relay status is maintained.

For example (*It is assumed that the relay buffer is 0.030m*):

Example 1: "> 8.00 m" indicates that, the relay is sucked when the liquid level is more than 8.00m, and the relay is disconnected when the sludge level is less than 7.97m.

Example 2: "< +8.00 m" indicates that, the relay is sucked when the liquid level is less than 8.00m, and the relay is disconnected when the sludge level is more than 8.03m.

Example 3: "> +8.00 ^ < +3.0" indicates that, the relay is sucked when the liquid level is more than 8.00m, and the relay is released when the liquid level is reduced to 3.00m. This logic can be used for drainage wells.

Example 4: "< +3.00 ^ > +8.0" indicates that, the relay is sucked after the liquid level is reduced to 3.00m, and the relay is released after the liquid level rises to 8.00m. This logic can be used for inlet wells.

P16: Relay Buff

In order to reduce the frequent actions of relay's critical liquid level, relays will not be started unless the liquid level exceeds/falls below the logical value, which is the relay buff.

Parameter	Value range	00-99 (Unit: mm)
	Default value	30 (Unit: mm)
Related Menu	P10-P11: Relay Logic 1-2	

Advanced Parameters

To enter advanced parameter menu, the password is "0101".

Setting of advanced parameters shall be guided by the manufacturer!

P40: Damping Time

Value	Value range	0~30s
	Default value	12s

Note: The less the damping is, the poorer the stability of the data; the more the damping is, the better the stability of the data. Please choose this parameter reasonably.

P43: Threshold Voltage

If instrument earthing cannot solve interference, set a threshold voltage to increase its immunity from interference.

Parameter	0.3v	Ignore echo below 0.3v	Default
	0.6v	Ignore echo below 0.6v	
	0.9v	Ignore echo below 0.9v	
	1.2v	Ignore echo below 1.2v	

P44: Output Power

Parameter	Value range	Grade 1-6
	Default value	Grade 4

P50: Communication ID

Value	Value range	1~99#
	Default value	1#

P51: Band Rate

Parameter	1200Bd	Band Rate 1200Bd	
	2400Bd	Band Rate 2400Bd	
	4800Bd	Band Rate 4800Bd	Default
	9600Bd	Band Rate 9600Bd	

P52: Communication Protocol

Parameter	1. buS	Modbus-RTU, data format floating-point number	Default
	2. buS-10	Modbus-RTU, data format decimal	
	3. buS-Cn	Modbus-RTU, data format hexadecimal	
	4. buS-nn	Modbus-RTU, data format hexadecimal	

Details please refer to Appendix 1: Modbus-RTU Communication Protocol

P53: Sequence of Floating Point Numbers

Parameter	1234	Sequence of 4-byte floating point numbers is 1234.	Default
	4321	Sequence of 4-byte floating point numbers is 4321.	
	3412	Sequence of 4-byte floating point numbers is 3412.	
	2143	Sequence of 4-byte floating point numbers is 2143.	

Pay attention to the requirements of DCS/PLC for the sequence of 4-byte floating point numbers. The floating point number sequence of instrument and DCS/PLC should be consistent.

P54: UART Test

Display the first 7 bytes of data received by the instrument in hexadecimal.

P99: Load Def.

Parameter	No	Don’t restore	Default
	Yes	Restore factory defaults	

Appendix 1: Modbus-RTU Communication Protocol

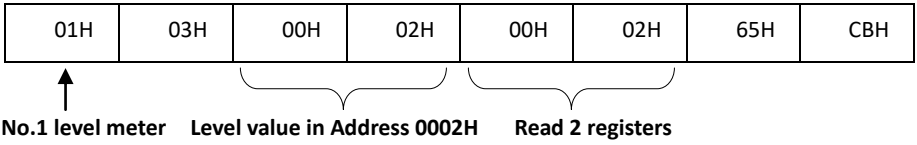
Note:

1. The data type of buS is REAL4 and IEEE754 floating-point number format (4 bytes, see below for details);
2. The data type of buS-10 is USHORT and decimal number (2 bytes, address 0000H). The first byte stands for meters, and the second byte stands for centimeters. For example, the liquid level of 2.352m is expressed as 02 35;
3. The data type of buS-Cn is USHORT and hexadecimal number (2 bytes, address 0000H). The data is in centimeters. For example, the liquid level of 2.352m (that is, 235cm) is expressed as 00H EBH;
4. The data type of buS-nn is USHORT and hexadecimal number (2 bytes, address 0000H). The data is in millimeters. For example, the liquid level of 2.352m (that is, 2352mm) is expressed as 09H 30H.

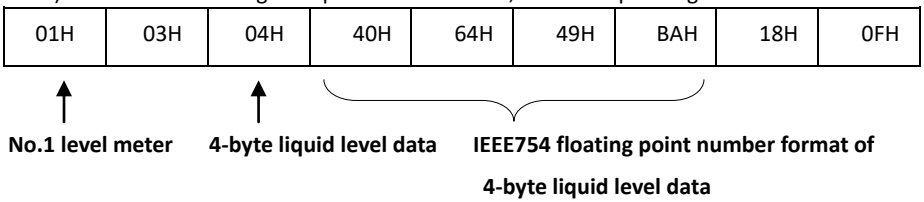
Characteristics of data serial port: RS485 interface, with default baud rate of 4800, 1 stop bit and no parity bit.

1. buS protocol: Register address: 0002H for level value, 0004H for air draft, and 0006H for temperature (each data has 4 bytes and occupies 2 registers, in IEEE754 floating-point number format).

E.g.: Get liquid level data from No.1 level meter. The query data frames are

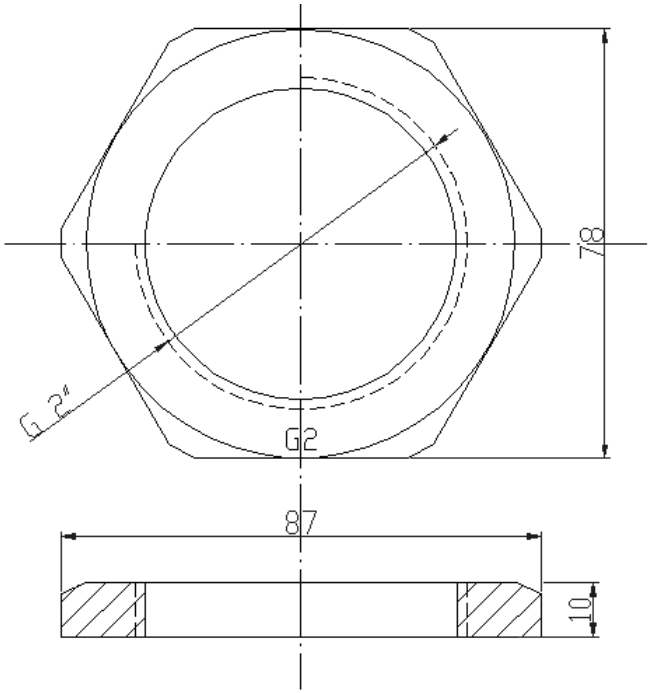


The response data frame contains slave address, function code, number of data, data (4 bytes each) and CRICK check. E.g.: If liquid level is 3.567m, the corresponding data are



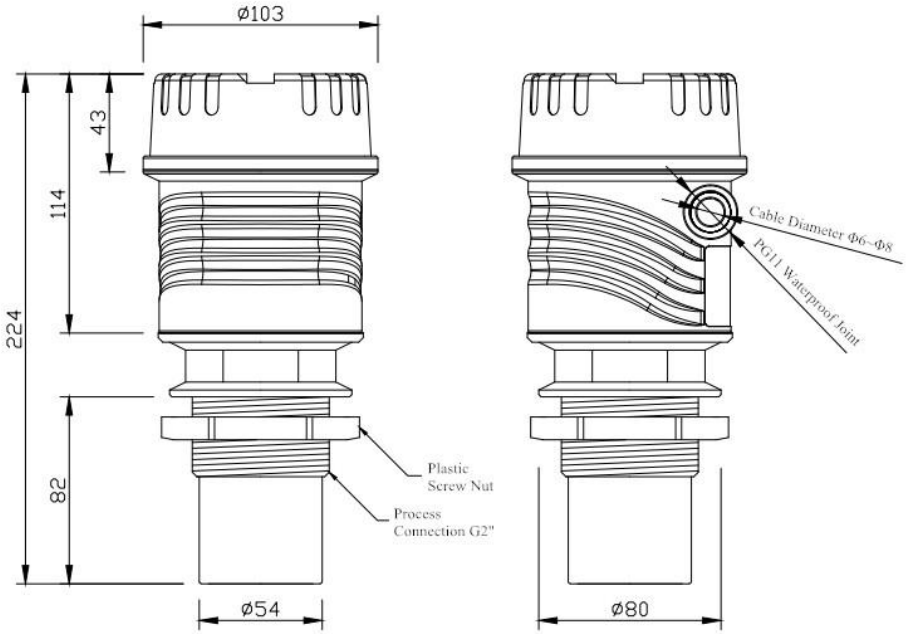
Note: 0x406449BA is the floating point number of liquid level of 3.567m. For adjustment of sequence, see the advanced parameter P53.

Appendix 2: Size of Plastic Screw Nut



Note: The screw nut is a standard accessory made of the same material as the probe.

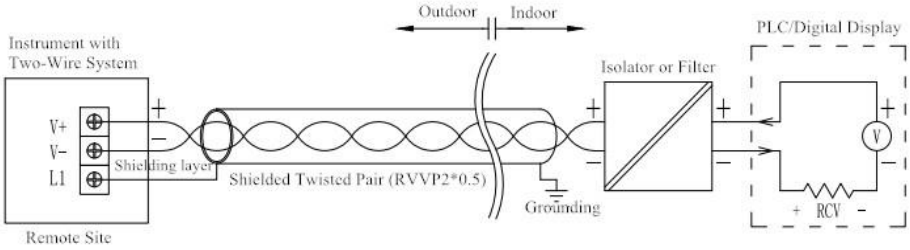
Appendix 3: Instrument Dimension Diagram



Note:

- The instrument is in the humid environment all the year round. It is recommended to apply the glass cement to the cable inlet and instrument cover seam.
- The transducer is made of ABS engineering plastics. The recommended cable diameter is 6-8 mm. Unused cable inlets should be sealed.

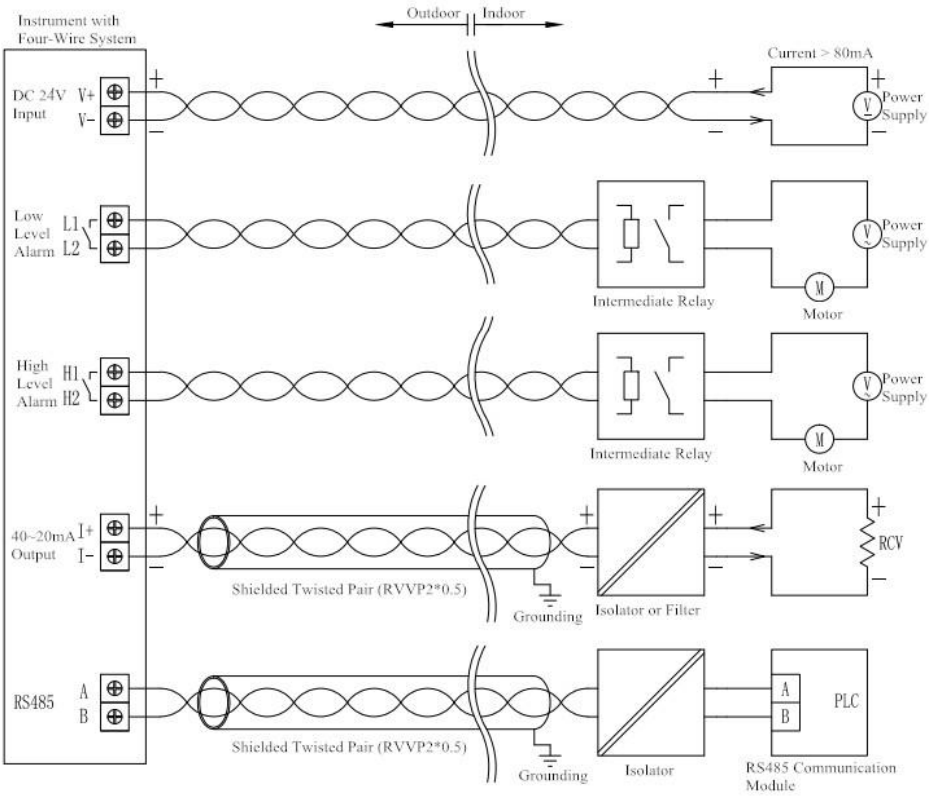
Appendix 4: Instrument Wiring Diagram (Two-wire System)



Note:

- The ultrasonic liquid meter belongs to the instrument with weak current, having high magnification, so instrument grounding is very important.
- The wire shall adopt RVVP 2×0.5 shielded cable, the control room side of the shielding layer should be grounded, and shall not run parallel to the power cable.
- The PLC analog input module connected to the two-wire system instrument should be kept away from frequency converters and motors, and shall not use the same power supply as the frequency converter.
- The instrument is in the humid environment all the year round. It is recommended to apply the glass cement to the cable inlet and instrument cover seam. Unused cable inlets should be sealed.

Appendix 5: Instrument Wiring Diagram (Four-wire System)



Note:

- The ultrasonic liquid meter belongs to the instrument with weak current, having high magnification, so instrument grounding is very important.
- 4-20mA wire and RS485 communication wire shall adopt RVVP 2×0.5 shielded cable, and shall not run parallel to the power cable.
- The instrument shall be kept away from frequency converters and motors, and shall not use the same power supply as the frequency converter.
- The instrument is in the humid environment all the year round. It is recommended to apply the glass cement to the cable inlet and instrument cover seam. Unused cable inlets should be sealed.

Packing List

No.	Equipment or Accessory Name	Unit	Quantity	Remark
1	Ultrasonic Liquid Meter	Set	1	
2	Plastic Nut (Default) DN32 Flange or Bracket (Optional)	Piece	1	
3	Operation Manual	Piece	1	
4	Product Qualification Certificate	Piece	1	

Attentions

- During operation and transportation, please do not violently shake or hit the equipment.
- During instrument transportation and storage, the environmental temperature shall not be less than -40 ℃ or more than +70℃, the relative humidity shall not be more than 85%, and there is no corrosive gas or strong electromagnetic field around it; the original packaging box shall be used during transportation.

Return Receipt of Warranty Card

User Name			
Address			
Contact Person		**Telephone**	
Product Model		**Product No.**	
Ex-factory Date		**Installation Manager**	

……

Warranty Card Description

Product Model		**Product No.**	
Ex-factory Date		**Installation Manager**	

Warranty Period: The product warranty period of the company is 24 months from the ex-factory date. The company may provide the paid service of extending the warranty period.

The following circumstances are not within the free warranty scope:

- The product or its parts have exceeded the free warranty period.
- The hardware failure is generated because the operating environment doesn't meet the use requirements of the product.
- The fault or damage is generated because the power supply environment is poor or the foreign matters enter the equipment.
- The fault is generated because the user cannot carry out the operation according to the use methods and attentions described in the operation manual.
- The fault is caused by force majeure events, such as thunder & lightning, flood, fire, and other natural factors. The failure or damage is caused by unauthorized disassembly for repair, unauthorized modification, or abuse.

Restriction Description:

- The interpretation right of the warranty card shall be owned by the company. The company has the right to modify the content of the card, without prior notice.