Honeywell

# SLN 700
# SmartLine Level Transmitter
# Non-Contact Radar
# User's Manual

**34-SL-25-13**
**Revision 2**
**July 2023**

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**Revision 2.0, July 2023**



**Honeywell Process Solutions**

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# About This Manual

This manual is a detailed how to reference for installing, wiring, configuring, starting up, operating, maintaining, calibrating, and servicing Honeywell's family of SLN 700 SmartLine Non-Contact Radar Level Transmitters.
For details on the HART protocol, refer to the SLN 700 Series HART Option User's Manual, Document #34-SL-25-16.

The configuration of your Transmitter depends on the mode of operation and the options selected for it with respect to operating controls and mechanical installation. This manual provides detailed procedures to assist first-time users and it further includes keystroke summaries, where appropriate, as quick reference or refreshers for experienced personnel.

To digitally integrate a Transmitter with one of the following systems:

- For the Experion PKS, you will need to supplement the information in this document with the data and procedures in the Experion Knowledge Builder.
- For Honeywell's Total Plant Solutions (TPS), you will need to supplement the information in this document with the data in the PM/APM SmartLine Transmitter Integration Manual, which is supplied with the TDC 3000 book set. (TPS is the evolution of the TDC 3000).

## Revision History

SLN 700 SmartLine Level Non-Contact Radar Transmitter User's Manual, Document #34-SL-25-13.

| Version | Date released | History |
|---|---|---|
| Rev. 1.0 | October 2020 | First release |
| Rev. 2.0 | March 2023 | Second release |

## References

The following list identifies publications that may contain information relevant to the information in this document.

- SLN 700 SmartLine Non-Contact Radar Level Transmitter HART Option Manual,
  #34-SL-25-16
- SLN 700 SmartLine NCR Level Transmitter Specification, #34-SL-03-06
  SLN 700 SmartLine NCR Quick Start Guide (in the box), #34-SL-25-14

## Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Support website:

| | |
|---|---|
| Honeywell Corporate | www.honeywell.com |
| Honeywell Process Solutions | https://process.honeywell.com |
| Honeywell SmartLine Level | www.process.honeywell.com/level-transmitters |

## Telephone and Email Contacts

| Area | Organization | Phone Number |
|---|---|---|
| United States and Canada | Honeywell Inc. | 1-800-343-0228 Customer Service<br>1-800-423-9883 Global Technical Support |
| Global Email Support | Honeywell Process Solutions | hfs-tac-support@honeywell.com |

## Symbols Descriptions and Definitions

The following symbols may appear in this document.

| Symbol | Definition |
|---|---|
|  | ATTENTION: Identifies information that requires special consideration. |
|  | TIP: Identifies advice or hints for the user, often in terms of performing a task. |
| **CAUTION** | Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process. |
|  | CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.<br>CAUTION symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual. |
|  | WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death.<br>WARNING symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual. |
|  | WARNING, Risk of electrical shock: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible. |
|  | ESD HAZARD: Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices. |
|  | Protective Earth (PE) terminal: Provided for connection of the protective earth (green or green/yellow) supply system conductor. |
|  | Functional earth terminal: Used for non-safety purposes such as noise immunity improvement.<br>**Note:** This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements. |
|  | Earth Ground: Functional earth connection.<br>**Note:** This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements. |
|  | Chassis Ground: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements. |

| | |
|---|---|
|  | The Factory Mutual® Approval mark means the equipment has been rigorously tested and certified to be reliable. |
|  | The Canadian Standards mark means the equipment has been tested and meets applicable standards for safety and/or performance. |
|  | The Ex mark means the equipment complies with the requirements of the European standards that are harmonized with the 2014/68/EU Directive (ATEX Directive, named after the French "ATmosphere EXplosible"). |

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# 1 Introduction

## 1.1 Overview

The SLN 700 SmartLine 80 GHz Non-Contact Radar transmitter is an electronic instrument designed to measure levels of liquid and solid materials. Non-Contact Radar (NCR) transmitters use Frequency Modulated Continuous Wave (FMCW) radar signals that are reflected by the material to be measured. The difference in frequency between the received and transmitted signal is directly proportional to the distance to the liquid and can be measured with high precision. Its small beam angle and small antenna size makes it easy to install. In comparison to other level measurement technologies, NCR provides a highly accurate, cost-effective, reliable measurement in applications where Guided Wave Radar (GWR) are not suitable.

## 1.2 Transmitter Models

The SLN 700 SmartLine 80 GHz NCR transmitter is available as a part of the family of SLN700L models for liquid and SLN700S for solid applications. The pressure and temperature range is -40 to 200°C/-1 to 40 bar for both, and each model is available with a range of flange or threaded antenna, lens diameters, process connection, and accessories to suit most applications.

## 1.3 Transmitter Components

### 1.3.1 Overview of components

As shown in
Figure 1-1, the transmitter consists of:

- Electronics housing containing the core measurement module and optional display module
- Process connection
- RF antenna

**Figure 1-1 Components of the Level transmitter**

### 1.3.2 Electronics

The Electronics consists of 2 distinct modules: core measurement electronics module and an optional display module. Both are replaceable in the field.
To make changes to the transmitter setup or configuration without the use of an external device such as a handheld or PC, an optional 4-Button interface is available.

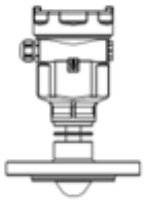
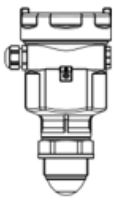
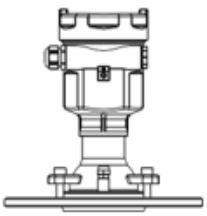
The Optional Display module has the following features.

- Echo stem plot for checking measurement accuracy
- Standard and custom engineering units
- Diagnostic alerts and diagnostic messaging
- English and Chinese language options

### 1.3.3 Process Connector

The 80 GHz non-contact radar transmitter has 3 different series of products and associated process connections.

**Table 1-1: Process Connector**

| Series | Medium | Applications | Process connections |
|---|---|---|---|
| 82 Series  | Liquid | Strong corrosive liquid vapors o foam | Flange options |
| 83 Series  | Liquid | Strong corrosive or pressure resistant liquid | Thread options |
| 87 Series  | Solid | Storage vessel/process vessel or high dust applications | Flange options |

For list of all options and accessories refer to the product specifications available at www.process.honeywell.com/level-transmitters.

## 1.4 Communicating with the Transmitter

Level monitoring is possible through either the analog current (4-20 mA) or HART. It is possible to configure a transmitter using HART© protocol or using the four-button interface and display. For more information on HART commands, refer SLN700 NCR HART Option Manual 34-SL-25-16.

## 1.5 SLN 700 Transmitter Label

The transmitter label is mounted on the side of the electronics housing (see Figure 1-2) and lists the following properties:

- Model number
- Physical configuration
- Power supply voltage
- Maximum working pressure rating
- Certification, if ordered (IECEx and CSA)

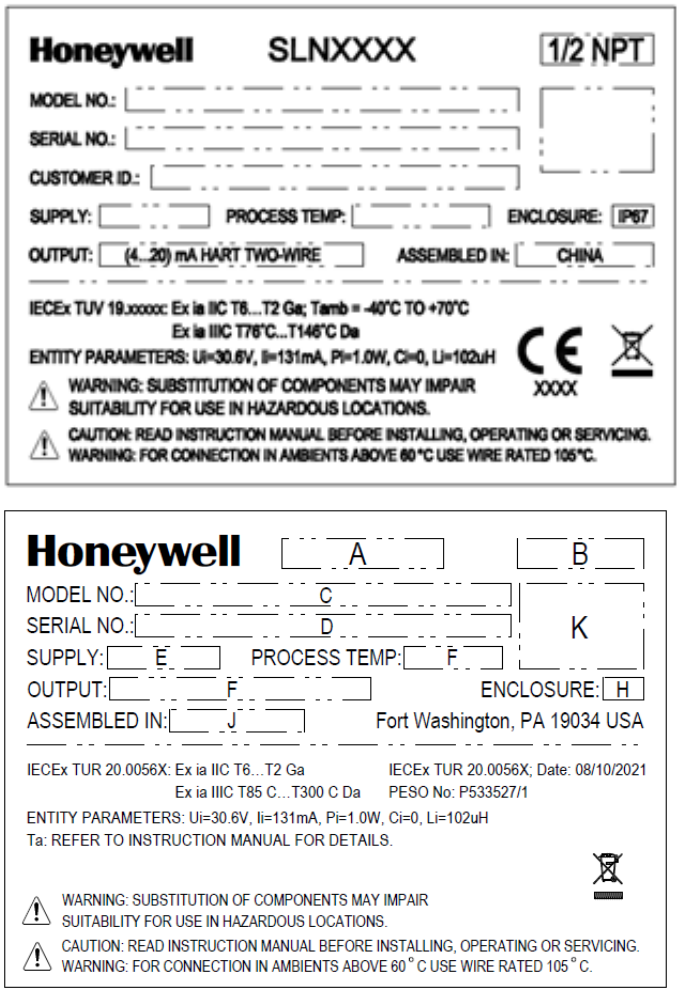



**Figure 1-2: SLN 700 Transmitter label example**

## 1.6 Transmitter Model Number Description

The model number is comprised from a number of selections and options that can be specified when ordering the transmitter. It includes a basic transmitter type such as **SLN700** (standard temperature, standard pressure) followed by a maximum of nine additional character strings that can be selected from a corresponding Table in the Model Selection Guide (MSG).

The basic model number structure is shown in Figure 1-3.

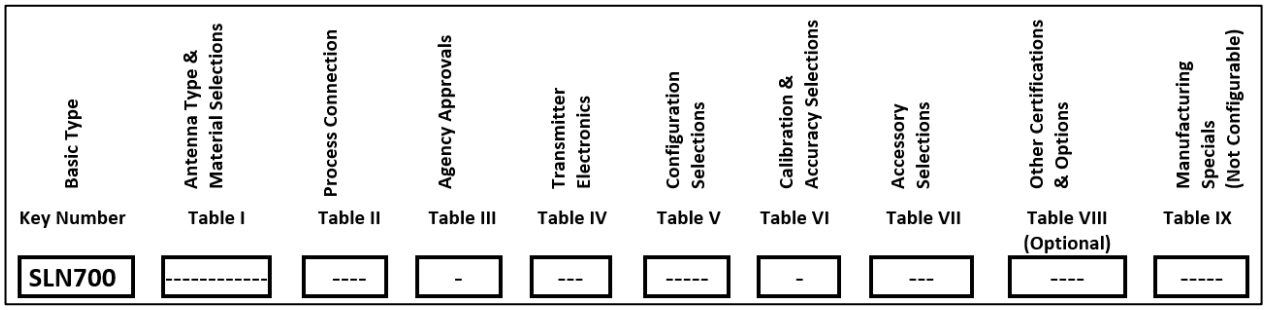



**Figure 1-3: Standard SLN 700 Model Number**

For a more complete description of the various configuration items and options, refer to the *SLN700 Product Specification (34-SL-03-06*) and *Model Selection Guide (34-SL-16-20).*

## 1.7 Safety Certification Information

SLN transmitter models are available for use in Intrinsic Safe locations, including IECEx, ATEX, INMETRO, and NEPSI approvals. See SLN700 Product Specification (34-SL-03-06) or SLN700 Quick Start Guide (34-SL-25-14) for details and other approvals.

# 2 Radar Level Measurement

## 2.1 Overview

This chapter describes the theory of operation of the transmitter and discusses how measurements are affected by tank and process conditions.

## 2.2 Theory of Operation

The fundamental principle of operation is level measurement through the reflection of frequency modulated radar waves (FMCW technique). The antenna emits a continuous wave of radiation near 80 GHz whose frequency linearly increases in time in a saw tooth pattern. When the return pulse is detected by the same antenna, the processing electronics use a Fourier Transform technique to calculate the difference between the frequency of the generated and reflected signal. This difference is proportional to the distance of reflection.

# 3 Mounting

Due to the finite beam angle and resulting transmission cone, there should be no obstacles in the area radiated by the transmitted microwave beam from the lower edge of the antenna to the material surface to be measured. Therefore, it is necessary to avoid these facilities in the tank during installation. These include ladders, limit switches, heating equipment, supports, etc.

If necessary, some of the obstacles can be removed from the measurement using background subtraction ("Virtual Echo Learning"). In addition, please note that the microwave beam should not intersect with tank fluid in or out flows. Please also note that the highest material level should not enter the near range (see Figure 3-1), the instrument should be kept at a certain distance from the wall of tank and the transmitting antenna should be perpendicular to the measured material surface as much as possible. The instruments installed in a hazardous classified area shall follow the local national installation regulations.
The reference plane for measurement is the sealing surface of threads or flanges.

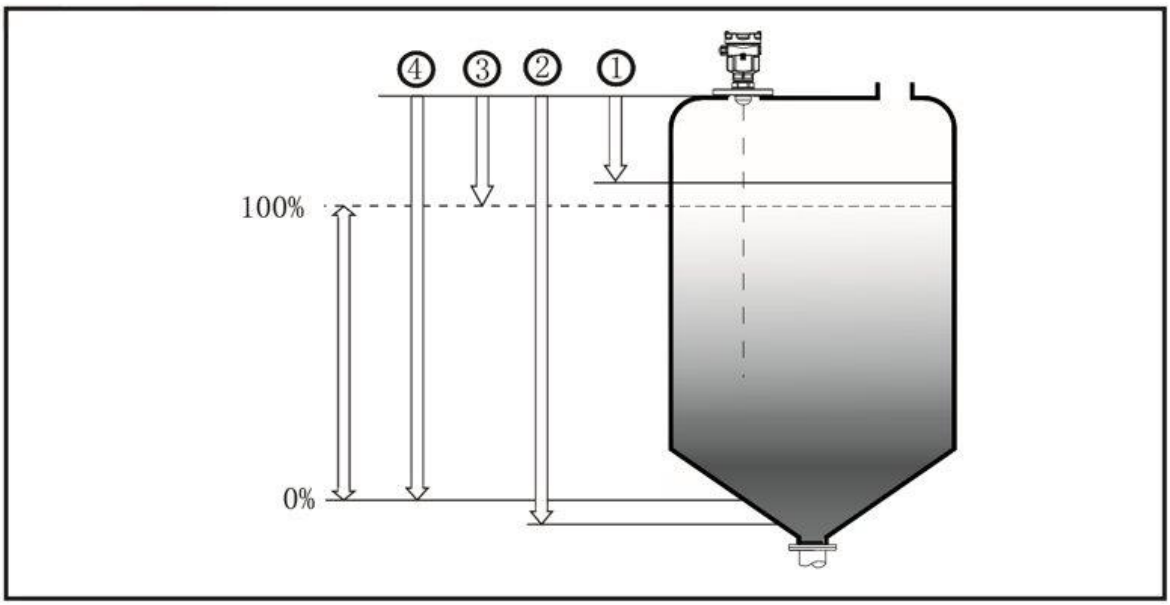



**Figure 3-1: Graphical illustration**

1. Near distance
2. Far distance
3. Distance at which sensor reads 100% level (or current)
4. Distance at which sensor reads 0 % level (or current)

### 3.1.1 Moisture-proof

For instruments that are installed outside, in a wet environment, and cooling or heating tanks, the cable gland must be tightened. The cable, at the cable gland entry, must be bent downward to prevent moisture as shown in Figure 3-2.

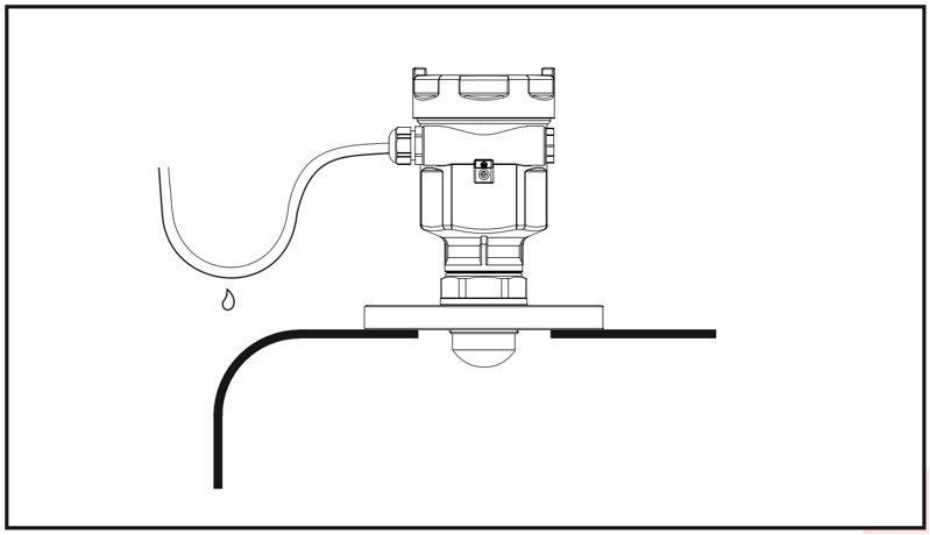


**Figure 3-2: Moisture-proof diagram**

### 3.1.2 Installation position

During the installation, please note that the instrument should be kept minimal distance to tank wall from the vessel wall. For different antenna, please refer to Table 3-1. However, the instrument must not under any circumstances be mounted closer than 200mm to the vessel wall or values calculated from Table 3-1.

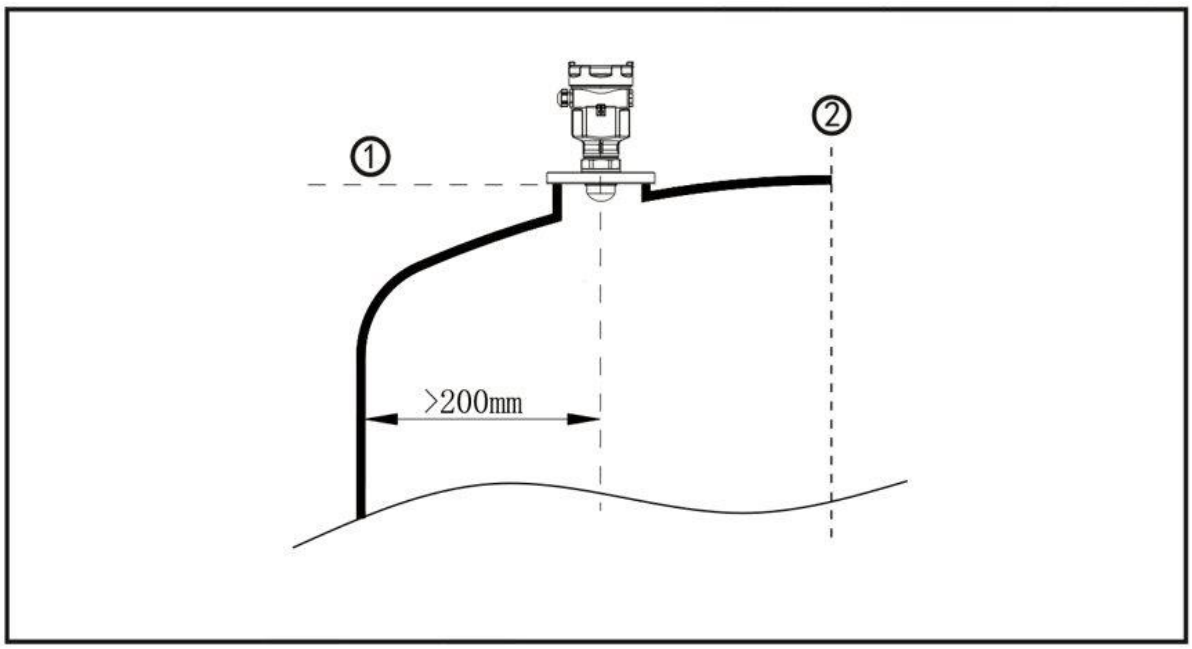



**Figure 3-3: Installation position, >200 mm**

1. Reference plane
2. Center of the vessel or symmetry axis.

**Table 3-1: Minimal distance to tank wall**

| SLN700 Model | Min distance to tank wall |
|---|---|
| 83A | 1/5 × Tank Height |
| 82A 82B 83B 83C | 1/10 × Tank Height |
| 82C 82D 83D 83E 87A 87B 87C 87D | 1/20 × Tank Height |

For the conical vessel with a flat tank top, the best installation position of instrument is the top center of the vessel, which ensures that the bottom of the container is measured.

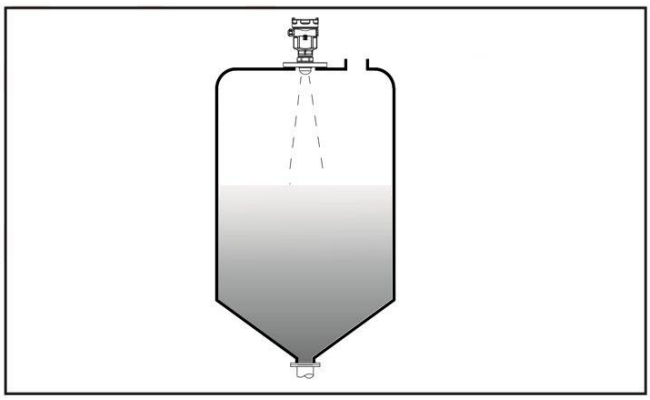


**Figure 3-4: Conical vessel installation**

### 3.1.3 Nozzle installations

In the case of a material with good reflection properties (high dielectric constant, DK), the sensor may be mounted on a nozzle. The background subtraction ("virtual echo learning") feature can further reduce false echoes from nozzle openings.
Table 3-2 shows detail of the size limitations of the nozzle.

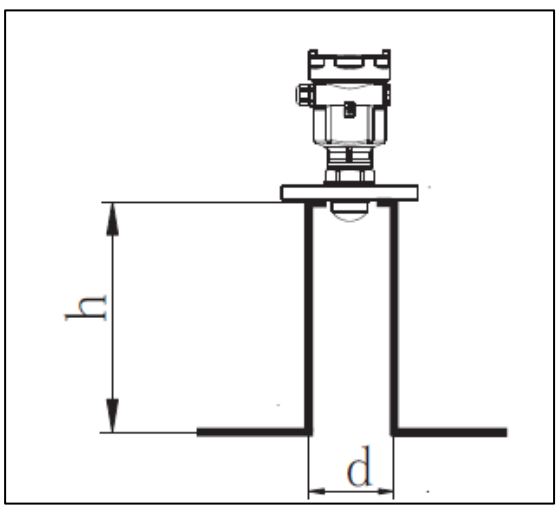



**Figure 3-5: nozzle specifications diagram**

**Table 3-2: nozzle specifications table**

| Nozzle Diameter d（mm） | Maximum Nozzle Height h（mm） | | | |
|---|---|---|---|---|
| | 83A | 82A 82B 83B 83C | 82C 82D 83D 83E | 87A 87B 87C 87D |
| 40 | 150 | NA | NA | NA |
| 50 | 150 | 150 | NA | NA |
| 80 | 200 | 200 | 200 | NA |
| 100 | 300 | 300 | 300 | 300 |
| 125 | 400 | 400 | 400 | 400 |
| 150 | 500 | 500 | 500 | 500 |

### 3.1.4 Correct and incorrect Installation position

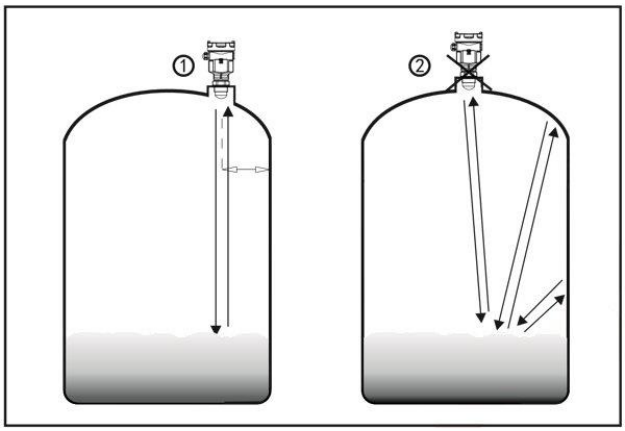



**Figure 3-6: Correct and incorrect installation position**

1. Correct
2. Incorrect: Instruments are installed in the arched or round top of the tank, which will result in multiple echoes. This should be avoided as much as possible during the installation.

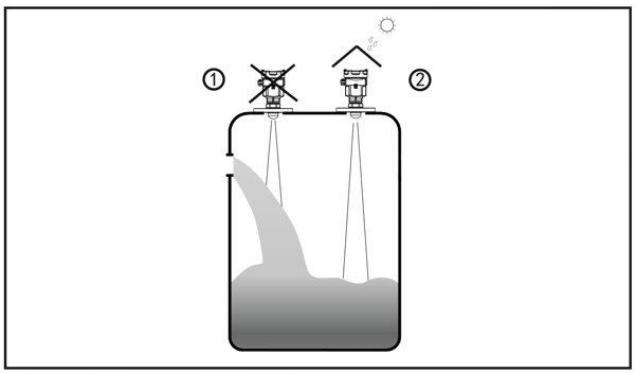



**Figure 3-7: Correct and incorrect installation position**

1. Incorrect: Instruments should not be installed above the fluid in-take, in order to ensure that the dielectric surface will be detected rather than the charging material flow.
2. Correct.

**Note:** Sun-shading and rain proof measures must be adopted for the outdoor installation.

### 3.1.5 Installation of reflecting plate

If there are barriers in the tank, the reflecting plate can be installed to reflect the echo wave away from the sensor. If necessary, "virtual echo learning" can be turned on.

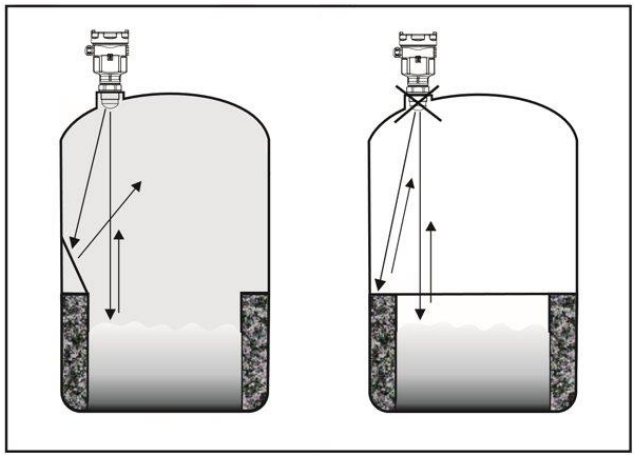


**Figure 3-8: Installation of reflecting plate**

### 3.1.6 Installations with Agitation

If there are agitators in the tank, the instrument should be installed as far away from these as possible. Once the installation is completed, the “virtual echo learning" should be carried out while the agitators are running. It will eliminate the influence of false echo generated by mixing blades. If foam or wave is generated due to agitation, then the customer should consider a guided wave radar sensor such as the Honeywell SLG-700 series.

Go to https://www.honeywellprocess.com/en-US/explore/products/instrumentation/process-level-sensors/Pages/smartline-guided-wave-level-transmitter.aspx

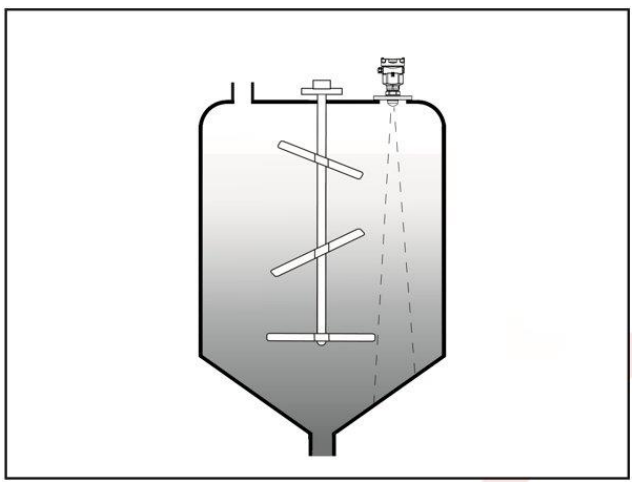


**Figure 3-9: Agitation**

# 4 Transmitter Installation

## 4.1 Supply voltage

**(4-20) mA / HART (2-Wire)**

Power supply and the output current signal are carried by the same 2-wire cable. The allowed supply voltage range is 12V to 30V depending on loop resistance. There must always be between 12V and 30V on the transmitter terminals, regardless of loop current. A safety barrier (refer to Table 3-1 for detailed specification) must be placed between the power supply and instrument for the intrinsically safe version.

The grounding mode of current output can be adopted for the standard instrument, while the floating current output should be adopted for the intrinsically safe instrument. Normally, the grounding terminals can be connected to the grounding point of tank or an available nearby ground in case of plastic tank.

**Maximum Loop Resistance (Ω)**

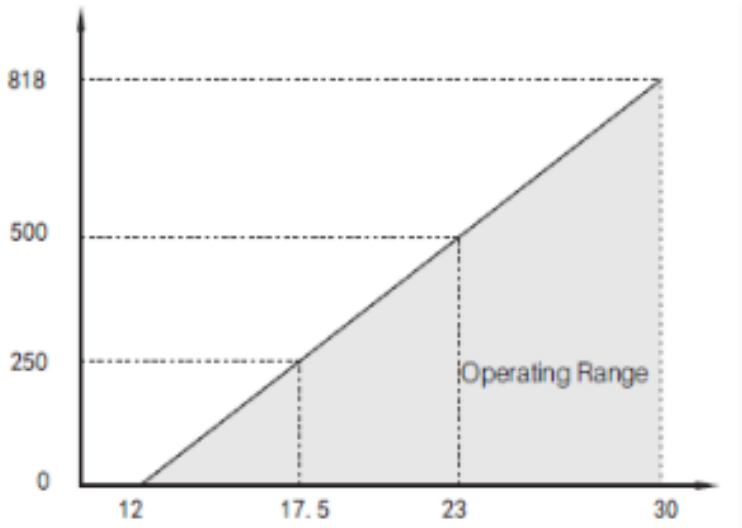



**Figure 4-1: Maximum Loop Resistance (Ω)**

**Table 4-1: Maximum Loop Resistance (Ω)**

| Supply Voltage (VDC) | Max. Loop Resistance (Ω) |
|---|---|
| 12 | 0 |
| 17.5 | 250 |
| 23 | 500 |
| 30 | 818 |

## 4.2 Installation of connecting cables

### 4.2.1 General introduction

**4-20 mA / HART (2-Wire)**

A regular two conductor cable can be used as the power supply cable, and the outside diameter of the cable should be (5-9) mm to ensure the sealing of cable entry. In case of potential electromagnetic interference, it is recommended to use a shielded cable.

**Shielding and wiring of cables**

The two ends of the shielded cable should be grounded only where allowed by the installation location. In hazardous locations, only one end of the cable can be shielded, typically on the non-hazardous side.

## 4.3 Wiring mode

### 4.3.1 2-Wire

2-wire wiring used for HART (electronic unit B)

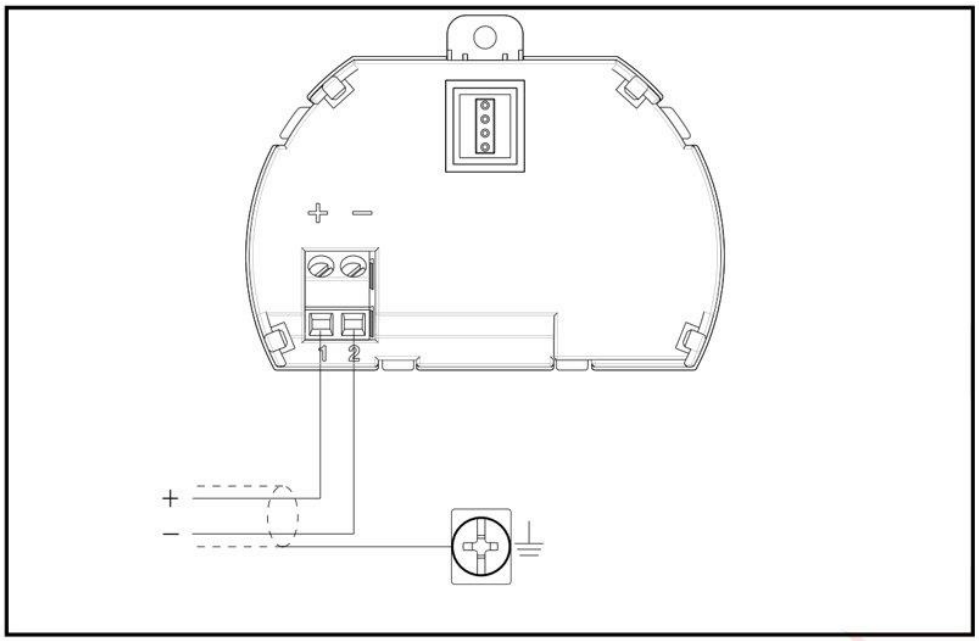



**Figure 4-2: 2-wire wiring for HART**

**Note:** For intrinsic safety installations, shield is normally terminated at one end only.

## 4.4 Hazardous Location – Intrinsic Safety

The hazardous location approved models of the product include intrinsically safe version. The working ambient temperature of the transmitter is (-25~80 °C). Under normal or fault conditions, the max temperature at any part of the surface will not exceed the values according to Table 4-4.

**Table 4-2: Hazardous Location Ratings**

| AGENCY | TYPE OF PROTECTION |
|---|---|
| IECEx | **Intrinsically Safe:**<br>Ex ia IIC T6…T2 Ga<br>Ex ia IIIC T85˚C...T300˚C Da |
| ATEX | **Intrinsically Safe:**<br>II 1 G Ex ia IIC T6…T2 Ga<br>II 1 D Ex ia IIIC T85˚C…T300˚C Da |
| CSA/ CSA-US | **Intrinsically Safe:**<br>Canada:<br>Class I, Division 1, Groups A,B,C,D T6…T2<br>Class II, Division 1, Groups E,F,G<br>T85°C…T300°C<br>Exia IIC T6…T2 Ga<br>Ex ia IIIC T85°C…T300°C<br>---<br>USA:<br>Class I, Division 1, Groups A,B,C,D T6…T2<br>Class II, Division 1, Groups E,F,G<br>T85°C…T300°C<br>Class I, Zone 0, AEx ia IIC T6…T2 Ga<br>Zone 20, AEx ia IIIC T85°C …T300°C Da |
| InMETRO<br>(Brazil) | **Intrinsically Safe:**<br>Ex ia IIC T6…T2 Ga<br>Ex ia IIIC T85°C …T300°C Da |
| CCoE<br>(India) | **Intrinsically Safe:**<br>Ex ia IIC T6…T2 Ga<br>Ex ia IIIC T85°C …T300°C Da |

**Table 4-3: Intrinsic Safety Entity Parameters**

| Intrinsic Safety Entity Parameter | 4-20mA version Terminal 1 & 2 | RS485 Version Terminal 1 & 2 | RS485 Version Terminal 4 & 5 |
|---|---|---|---|
| Ui | 30.6V | 26.4V | 6.5V |
| Ii | 131mA | 166mA | 68mA |
| Pi | 1.0W | 1.1W | 111mW |
| Ci | 0μF | 0 | 0 |
| Li | 102μH | 102μH | 0 |

**Table 4-4: Ambient & Process Temperatures Vs Temperature Class**

| Transmitter Ambient Temperature (℃) | Process Temperature at the Antenna (℃) | T class of entire equipment |
|---|---|---|
| -40 to +50 | -40 to +50 | T6/85℃ |
| -40 to +60 | -40 to +95 | T5/100℃ |
| -40 to +70 | -40 to +130 | T4/135℃ |
| | -40 to +195 | T3/200℃ |
| | -40 to +200 | T2/300℃ |

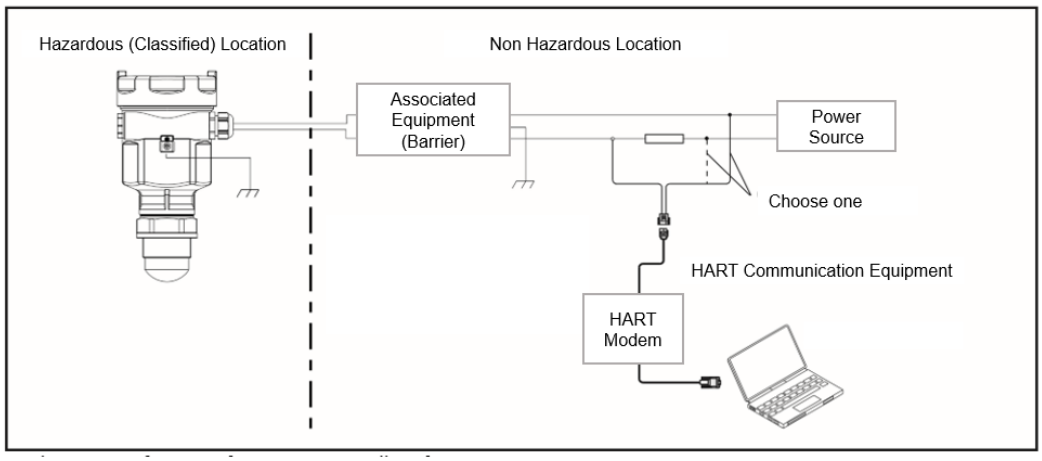



**Figure 4-3: Intrinsically Safe Wiring**

**WARNING:**

**Special Conditions for safe use:**

- Electrical connections and IS input parameters should be observed in accordance with Ex instruction
- WARNING – Potential Electrostatic Charging Hazard
- When the enclosure is made of aluminum alloy, impact or friction should be avoided to Control the mechanical spark
- The equipment shall be protected from sunlight to avoid the UV impact
- The temperature class depends on Ta and process temperature as per Table 4-4
- The radar level instrument shall use the suitable certified cable gland and blank element with Ts≥100˚C
- The equipment should be protected to avoid high risk from mechanical impact.
- Installation of the equipment shall follow IEC 60079-14 last edition or any national equivalent standards

## 4.5 Recycling and disposal of product

Consider recycling the product and packaging materials. The product should be disposed of in accordance with local and national regulations.

# 5 Operating the Transmitter

## 5.1 Functions of keys

There are 4 keys on the instrument panel, which can be used to operate the instrument. After setup, the measurement value is displayed on the LCD screen and can be read out clearly through the glass window. (SLN700 panel diagram)

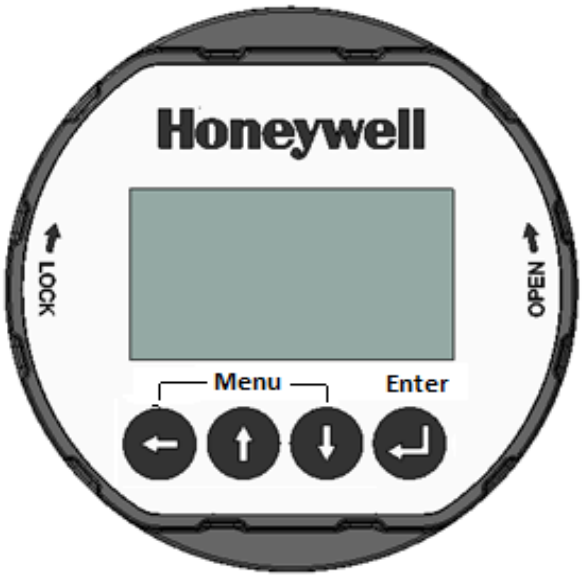



**Figure 5-1: Instrument panel 4-key**

**Table 5-1: Keys of LCD**

| Symbol | Use | Comment |
|---|---|---|
|  | Previous menu | • Exit the programming state.<br>• Back up to the upper menu.<br>• During operation, switch the measured value/echo waveform. |
|  | Previous choice or change number | • Modify the parameter value.<br>• Select the display mode. |
|  | Next choice or choose digit. | • Select the programming item.<br>• Select to edit the parameter.<br>• Parameter item content display. |
|  | Enter | • Enter the programming state.<br>• Verify the programming item.<br>• Confirm the parameter modification. |

| | |
|---|---|
| Programming instruction | The four keys on the panel can be used to set parameters, debug and test the instrument, etc. |
| Programming menu structure | The rightward transition to the horizontal arrow in the figure can be achieved by the key;  <br>The downward transition to the horizontal arrow in the figure can be achieved by the key.  <br>The leftward transition to the horizontal arrow in the figure can be achieved by the key.  |
| Programming sub-menu | |
| Basic settings | The basic settings include the following parameters of the meter: Tank medium, the unit of measurement, the near blanking distance, the range, the minimum adjustment, the maximum adjustment, the current output and the sensor tag. |
| Display | Display Value and Language settings of the meter. |
| Diagnosis | Diagnose and complete the instrument inspection and test function. For the following: Choose Curve, Show Curve, Start Simulation, Sensor Status, Measure Status, Peak values and Calibration Date. |
| Advanced settings | Options include False Echo Memory, Failure Mode, Reset to Factory Settings, Distance Adjust, Echo Threshold, Damping, Envelope Level, Hart Address and Multi Drop, Damp Time, Max Level Speed, First Echo, Multi Wave, IF Gain, Tx Power, Rx Gain, 4 mA Adjust, 20 mA Adjust, Low DK value, Dust. |
| System | Include meter information such as Info, Software Version, Latching Mode, Write Protect. |
| Programming method | When the meter is running, press  to enter the programming state and display the programming main menu. After each parameter is edited, the  key must be used to confirm, otherwise the edit is invalid. |
| Parameter editing method | After editing, press  to exit the programming state and return to the running state.<br>At any time of programming, press  to abandon programming and exit the programming state of the parameter item. |
| Character/ number parameter programming | When the menu switches to changing a numeric or character value, the first of those digits highlighted. At this point, you can press  key to change the character/number until the desired character/number appears. |

Press ↓ key and the next digit is highlighted in turn and can be modified.
After programming, press ↵ to confirm the new settings.

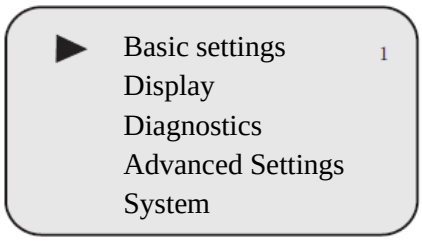
Optional parameter programming

Optional parameters are programming items with several selected parameters for the user to choose.
Use ↓ key to point the arrow to the desired parameter item and press ↵ to confirm the programming.

## 5.2 Programming menu description

1 Basic Settings

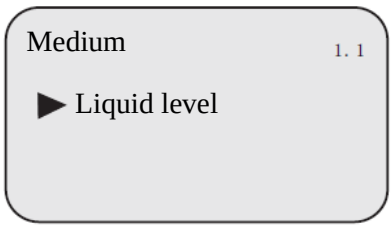
The basic settings include the settings of main instrument parameters, such as measuring range, material properties, etc. Press in ↵ the running state to enter the programming state, and the LCD will display the main menu.

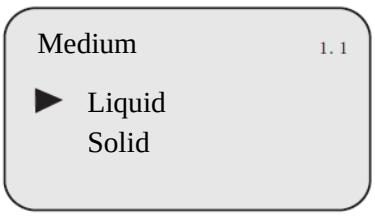



**Notes:** The upper right number (not shown above) is the menu number.

1.1 Medium

When the LCD menu number is 1, press ↓ key to enter the medium programming. Display in LCD is as follows.
Medium menu is used to select liquid or solid to further determine some other properties of the material that affect the measurement.



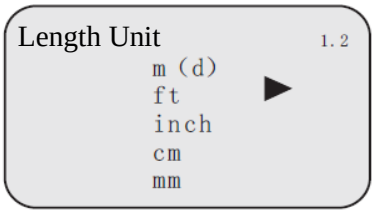




1.2 Length Unit

The length unit provides the user with the choice of measuring in metric or imperial system. When displaying the medium ↓

(menu number 1.1), press key to enter the unit of measurement setting menu.

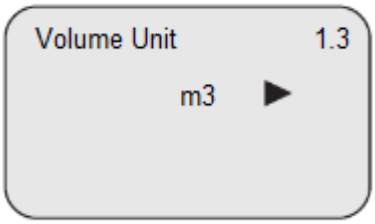
Display in LCD is as follows.



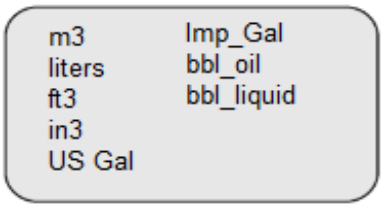

Press ↵ to enter the Length unit selection menu, then select the desired measuring unit.

### 1.3 Volume Unit

The Volume Unit provides the user with the choice of measuring in metric or imperial system. When displaying the medium (menu number 1.3), press ↵ key to enter the Volume unit of setting menu.

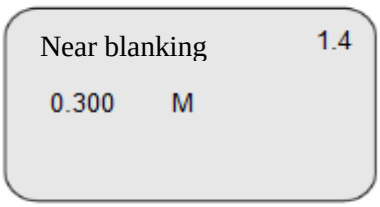



In the edit state, the LCD displays as follows. Press ↓ key to select the wanted item and press ↵ to confirm.




### 1.4 Near blanking

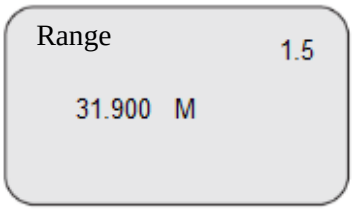
If the tank contains obstacles between the sensor reference plane and the maximum height of the material, a near blanking distance can be set to avoid false echo detection.
When displaying the menu number 1.3, press ↓ key to enter the near blanking setting menu. Display in LCD is as follows.




Press ↵ to enter the status of parameter editing.
After editing, press ↵ to confirm.

1.5 Range

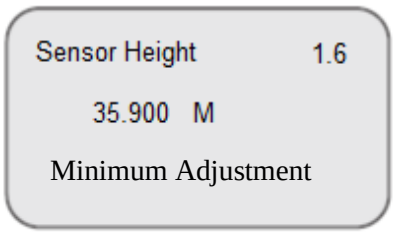
The maximum measuring range of the instrument should be set for every application. Press the button to enter the range setting menu when the menu number is 1.3. Display in LCD is as follows.




Press The corresponding parameter is highlighted.
Use ↑ or key ↓ to set parameters and press ↵ to confirm.

1.6 Sensor Height

Sensor Height is used to set the 4mA of the gauge current output when the level is at 0% measurement range (lowest liquid level). Together with Max Product Level, it determines the proportion of linear correspondence of current output.
When the menu number is 1.6, press ↵ to enter the basic settings sub-menu. Display in LCD is as follows.

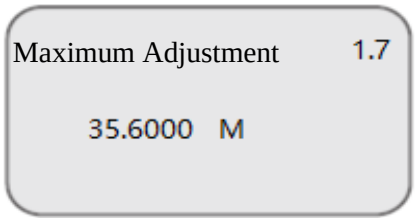



Press key to enter the low programming percentage. See the character/number parameter programming method in the preceding parameter editing method to edit the percentage value and distance value.
After editing, press ↵ to confirm, and press ← to ↵ abandon programming.

1.7 Max Product Level

Max Product Level is used to set the 20mA of gauge output when the level is at 100% measurement range (highest liquid level). Together with Sensor Height, it determines the proportion of linear correspondence of current output. Display in LCD is as follows.

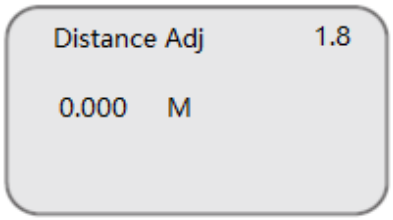
When the menu number is 1.7, press ↓ key to enter the Max Product Level. Display in LCD is as follows.

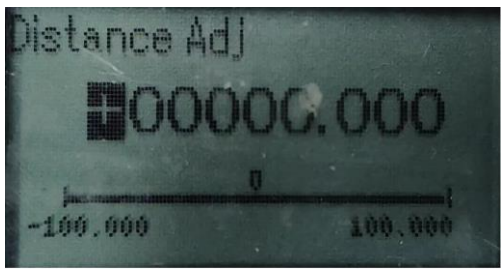



At this point, press to edit the Max Product Level. See the character/number parameter programming method in the preceding parameter editing method to edit the percentage value and distance value.
After editing, press to confirm, and press to abandon programming.

1.8 Distance Ajd

Distance Adjust setting can be used to as an additive correction to the measurement if the gauge output and true distance do not agree. When LCD displays the number menu (menu number 1.8), press key to enter the distance adjust menu setting. Display in LCD is as follows.
Press and to set the distance. Note that that the value should be modified prior to changing the sign of the offset.
Distance Offset = Actual Distance to product - Measured Distance to product



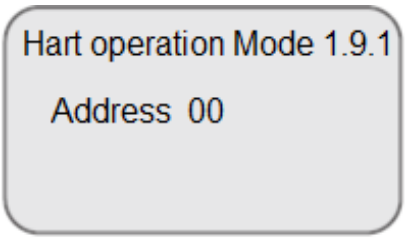

(Notes: This parameter is sign sensitive. Before committing the value ensure the -/+ sign is correctly selected. This menu needs to be operated by professionals)

1.9 Hart Config

This setting is used to set all the parameters about the HART protocol and output.the current output mode. Press to enter the HART Config menu for detail settings.

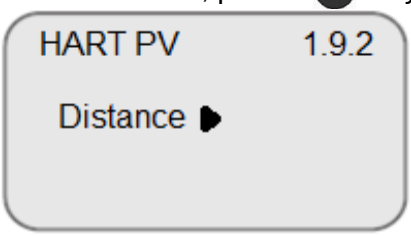

1.9.1 Hart Operation Mode

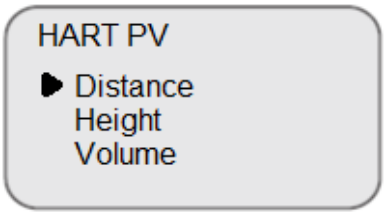
This setting is used to set HART Polling Address for multiple HART instruments in the HART loop. Press ↵ to enter the setting mode. Use ↓ or ↑ keys to set parameters. The default address is 00 and the maximum address reaches 63. After editing, press ↵ to confirm, and press ← to abandon programming.




1.9.2 Hart PV

This setting is used to set HART PV value. There are 3 options for this value: Distance/Height/Volume. When the menu number is 1.9.2, press ↵ key. Display in LCD is as follows.



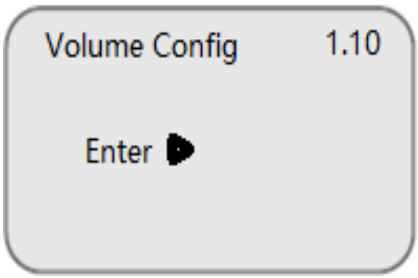




Press ↓ key to select the required item and press ↵ to confirm.

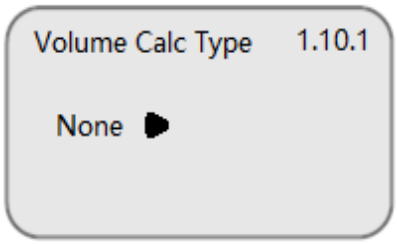
1.10 Volume Config

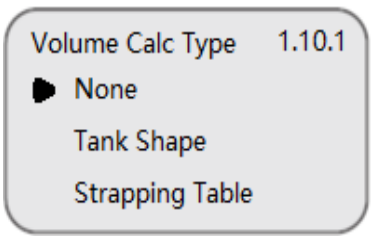
This setting is used to set parameters for Volume calculation. Press ↵ to enter the Volume configuration menu for detail settings and Display in LCD is as follows

Current Output




This setting is used to set Volume Calculation type. There are total 3 options: None/Tank Type/Strapping table. When the menu number is 1.10.1, press ↵ key. Display in LCD is as follows. The default option is None for non- volume calculation.

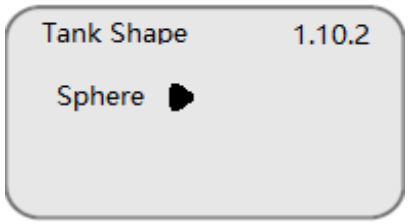



1.10.1 Volume Calc Type

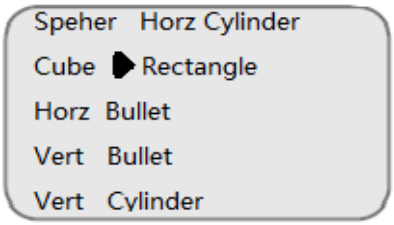
All 3 options are for Volume Calculation. None means no Volume calculation. Tank Shape means Volume calculation according to tank parameters such as diameter and height. Strapping table means Volume calculation according to supplied table. Detail settings for Strapping table is only for HART Communicator or Pactware DTM.
Press ↓ and ↑ to select the required item, press ↵ to confirm.

Select the Tank Shape and press ↓ to enter Menu 1.10.2. The Display in LCD is as follows.



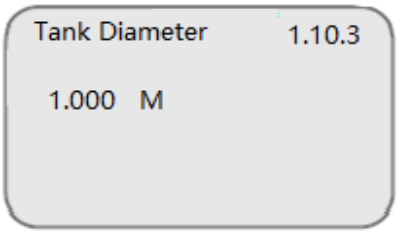

Press ↵ to enter the tank type selection. There are 7 types for selection. The Display in LCD is as follows

1.10.2 Tank Shape




Press ↓ and ↑ to select the required item. Press ↵ to confirm.

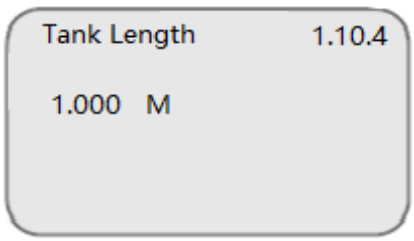
After confirmation of Tank Shape, press ↓ to enter the menu 1.10.3 for tank diameter input. Press ↵ to input the tank diameter. The Display in LCD is as follows.




1.10.3 Tank Diameter

Press ↓ and ↑ to set the diameter and press ↵ to confirm the setting.


After setting of Tank diameter, press ↓ and ↵ to enter the menu 1.10.4 for tank length input. The Display in LCD is as follows.

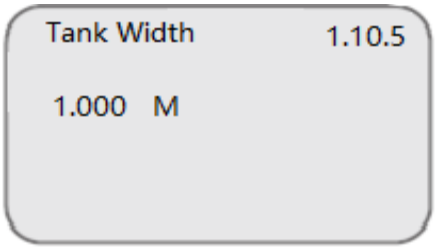


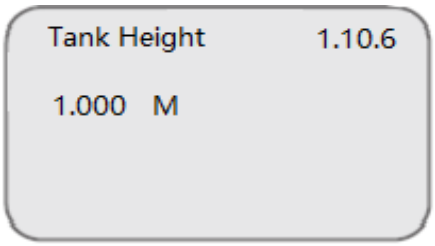

Press ↓ and ↑ to set the length and press to ↵ confirm the setting.

1.10.4 Tank Length

1.10.5~1.10.6 Tank Width & Height

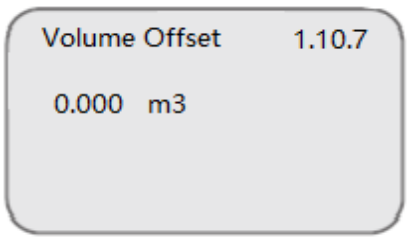
1.10.5 and 1.10.6 are the setting for tank width and height. It depends on tank shape configuration. The settings for 1.10.5 and 1.10.6 is similar to the previous 1.10.4 tank length settings.




1.10.7 Volume Offset

Volume Offset can be used to as an additive correction to the Volume calculation if the gauge output and true Volume do not agree. When LCD displays the 1.10.7 menu, press ↵ key to enter the Volume Offset menu setting. Display in LCD is as follows.




Press ↓ and ↑ to set the Volume offset. Note that that the volume value should be modified prior to changing the sign of the offset.

Volume Offset = Actual product Volume - calculated product Volume

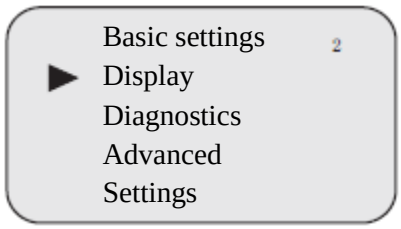

1.11 Sensor Tag

When the menu number is 1.10, press ↓ key to move the menu to the sensor tag display item. Display in LCD is as follows.


Press to enter the status of parameter editing.
After ↵ ↵ editing, press to confirm.
This is the end of the basic settings menu.

2 Display

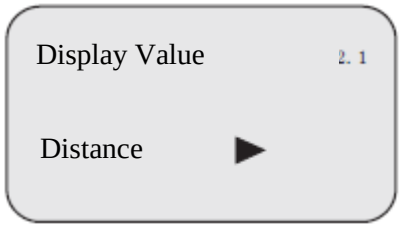
This feature is used for display programming.
When displaying the main menu, press ↓ key to move the arrow to the display item. Display in LCD is as follows.



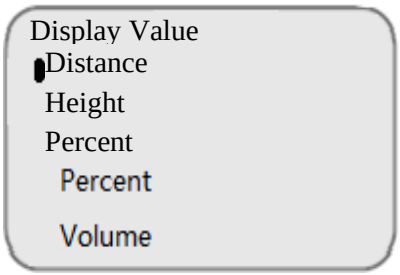

Press ↵ to enter display mode programming.

2.1 Display Value

Enter display mode programming. Display in LCD is as follows.



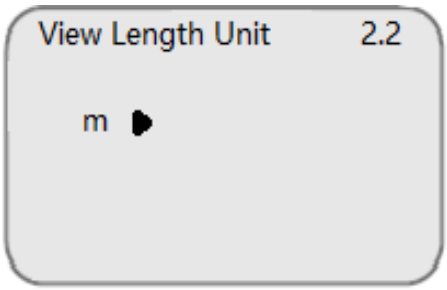

It indicates that the parameter of the current display content is the Distance, that is, the Distance value measured by the meter is displayed. Press ↵ to enter the edit state. Display in LCD is as follows.

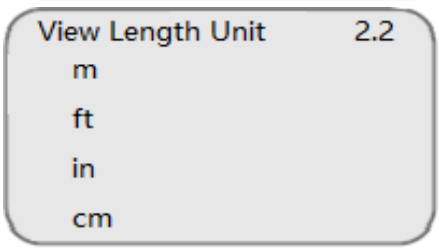



Use ↓ key to move the arrow to the wanted parameter and press ↵ to confirm. After editing, press ↓ to exit the display programming and return to the upper menu.

2.2 View Length Unit

Use key to move the 2.2 Menu: View length Unit. It indicates that length unit for LCD display when the previous display value is Distance or Height. Press to enter the edit state. Display in LCD is as follows.

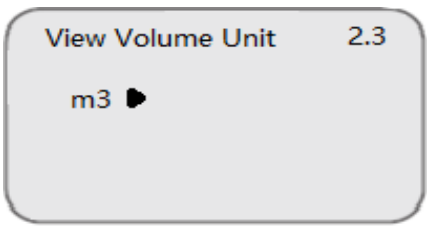


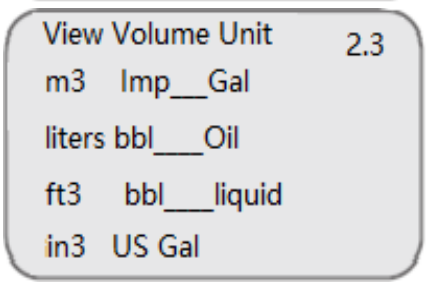




After selection, press to exit the display length unit setting and return to the upper menu.

2.3 View Volume Unit

Use key to move the 2.3 Menu: View Volume Unit. It indicates that Volume unit for LCD display when the previous display value is Volume.
Press to enter the edit state. Display in LCD is as follows.

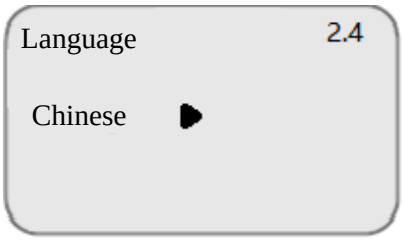



After selection, press to exit the display Volume unit setting and return to the upper menu.

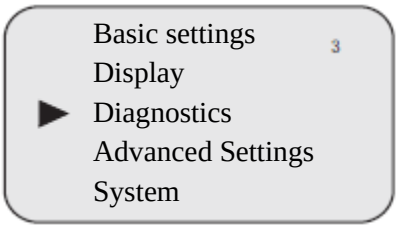
2.4 Language

Language options are current Chinese and English only. When LCD displays unit of Volume (menu number 2.3), press key to enter the language setting function. Display in LCD is as follows.




This is the end of the Display menu.

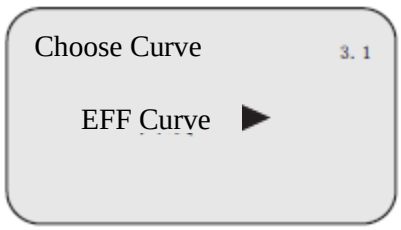
3 Diagnostics



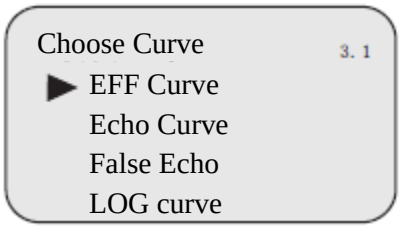

Diagnostics is used to test and debug the instrument and its components.
Press ↵ to enter the diagnostic function

3.1 Choose Curve

When the LCD displays menu number 3, press ↓ key to enter the echo curve display function. Display in LCD is as follows.




To select other curves, press ↵ to enter the select curves menu.
Display in LCD is as follows.




Use key to move the arrow to the curve you want to display.
Press ↓ to confirm the selection.

EFF Curve:
The EFF curve show the final analyzed echo curve in logarithm units Threshold setting is used to set the threshold size of the effective echo. The larger the threshold setting is, the stronger the

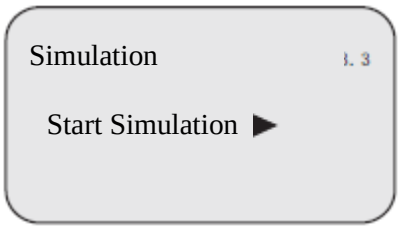
effective echo amplitude is required, and the more favorable it is to eliminate small signal clutter interference; But be careful: if the modified threshold value is larger than the effective echo amplitude, it will cause the result of misunderstanding echo. The default range of echo threshold is12DB

Echo Curve
The "Echo curve" shows the signal strength of the echoes over the measuring range in dB. This curve is for engineering purposes only and may be removed in future software versions.
False Echo:
The "False Echo" shows the false signal strength in dB of the obstruction reflections over the range specified by the user. The signal records an envelope of the false signal of the measurement (for example, the reflected signal from ladder of tank).

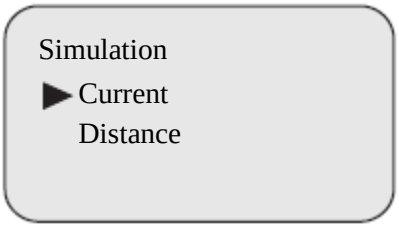
When the LCD displays menu number 3.1, press key. The selected curve is shown in LCD.

3.2 Start Simulation

Simulation is a function only for simulation of the 4...20 mA current output. It is used to check whether the current output function of the instrument is normal or not. When the liquid crystal displays menu number 3.2, press to enter the simulation state. Display in LCD is as follows.




Press to confirm the simulation function. Display in LCD is as follows.

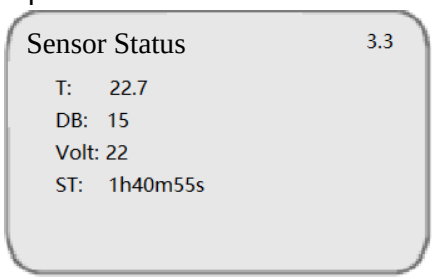



Choose the current output mapping mode by pressing key, and press to confirm. Enter the corresponding setting menu, and press to confirm after completing the value setting. From them on, the sensor current value is set to the corresponding value.
There are presently two options:

1. Current: Output current at a set current value.
   For example, 16.6 mA corresponds to the output of 16.6 mA.
2. Distance: Output current at given Distance value.
   The relationship between this value and current value is determined by item 1.5, the minimum adjustment and item 1.6 the maximum adjustment.

3.3 Sensor Status

Press ↓ key to enter the next diagnostics measurement status when the LCD displays menu number 3.2.
Operation status of the sensor is as follows.




T is current sensor temperature in °C;
DB is current signal strength in DB;
Volt is current power input voltage;
Service Time is device accumulated operation time.

3.4 Measure status Max Volt/Min Volt/ Min Volt Time

- Max Volt is maximum power input voltage since recent power on;
- Min Volt is minimum power input voltage since recent power on;
- Min Volt Time is the time when device received min voltage

Press “Enter” to select whether to reset the above values.

3.5 Peak Values Max Distance/Min Distance

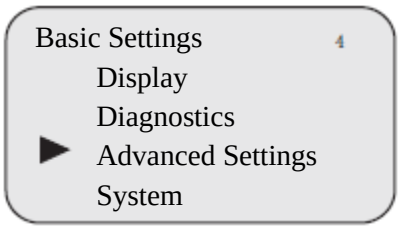
- Max Distance is the maximum distance during the measurement.
- Min Distance is the minimum distance during the measurement.

Press “Enter” to select whether to reset the above values.

3.6 Calibration Date The default value is calibration date from factory. User can enter the new date after they performed a calibration. That is the end of Diagnostics menu settings.

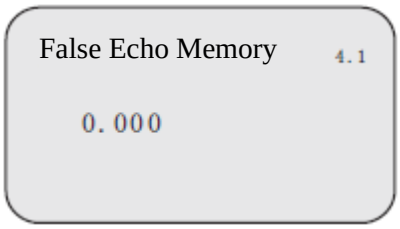
## 4 Advanced Settings

The advanced settings menu includes more specialized features for use by trained personnel. There are mainly false echo learning, reset and instrument parameter storage, etc. When the LCD displays the main menu, press ↓ key to move the arrow to the service item. Display in LCD is as follows.




## 4.1 False Echo Memory

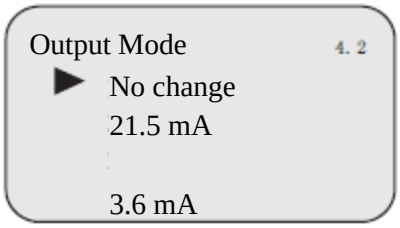
When fixed obstacles interfere with the measurement, the function of false echo learning (background subtraction) can be used to suppress false readings. When the LCD displays the main menu and the menu ↵ number is 4, press to enter the service sub-menu. Display in LCD is as follows.




Prompt to input the real echo distance value. After input the distance value, press ↵ to confirm. Please wait 30 seconds for the LCD display to update The meter is recording the false echo and will return to the false echo menu after completion.

## 4.2 Failure Mode

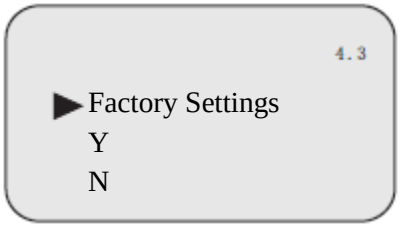
Failure Mode is used when there's an failure alarm, change the output current to 20.5 mA, 22 mA or < 3.8mA or previous measurement value.. When displaying the current output (menu number 4.1), press ↓ key to move the arrow to the failure mode. Press ↵ to confirm. Display in LCD is as follows.




Press ↓ the key and choose the desired setting and press to confirm ↵ your selection.

### 4.3 Reset to Factory Settings

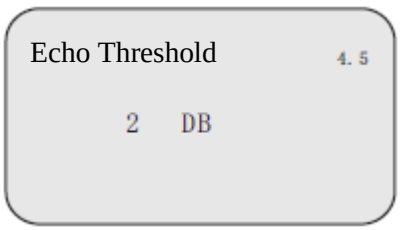
Reset function is used to revert the instrument parameters back to the initial factory settings. When displaying the current output (menu number 4.2), press key to enter the reset function. Display in LCD is as follows.



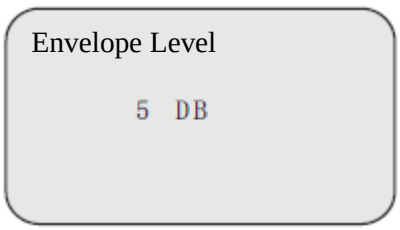

Press to enter the reset menu and select reset for factory settings.

### 4.4 Echo Threshold

Threshold setting is used to set the threshold limit of the effective echo. The higher the threshold setting is, the higher the echo amplitude required to trigger the level measurement. In turn, this eliminates small signal clutter interference. Note that if the modified threshold value is larger than the effective echo amplitude, no or false measurement might result. The default range of echo threshold is 8 DB. See Figure 5-2 for the definition of this parameter.



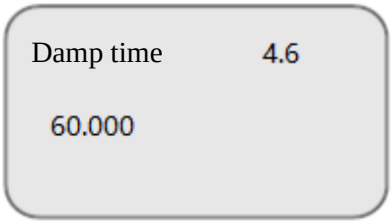

### 4.5 Envelope Level




Device will only read signal strength above Envelop level. Default envelop level DB value is 5. User can set different value by referring to EFF curve based on site situation. See Figure 5-2 for the definition of this parameter.

4.6 Damp Time

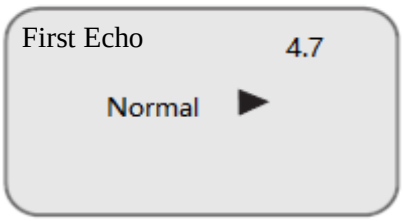
When the LCD menu number is 4.6, press ↵ key to enter the damp time setting menu. Display in LCD is as follows.





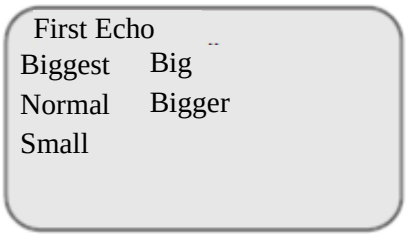
To damp process-dependent measured value fluctuations, set an integration time of -999.999 … +999.999 s in this menu item. Default setting is 60s.

In menu status of parameter editing. Use the key ↑ and key ↓ to set the number and the digits and signs. Press ↵ to confirm after the editing is completed.




Press ↵ to enter the first echo menu. Display in LCD is as follows.

4.7 First Echo




This (Engineering) parameter is used set probability of assigning the first echo as the correct reflection.

Usually, the position of the echo with the strongest amplitude is used as the output value. This option multiplies the amplitude of the first wave by a factor.

Big ： amplitude of the first wave*1.2

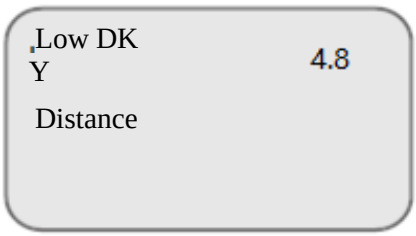
Small ： amplitude of the first wave*0.7

Normal: amplitude*1.0

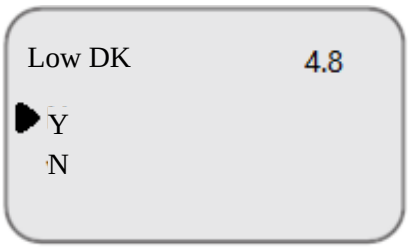
Bigger: amplitude*2
Biggest: amplitude*15

4.8 Low DK

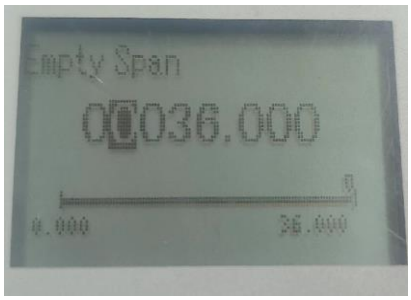
When the LCD displays 4.8, press to enter the DK value adjustment setting menu. Display in LCD is as follows.



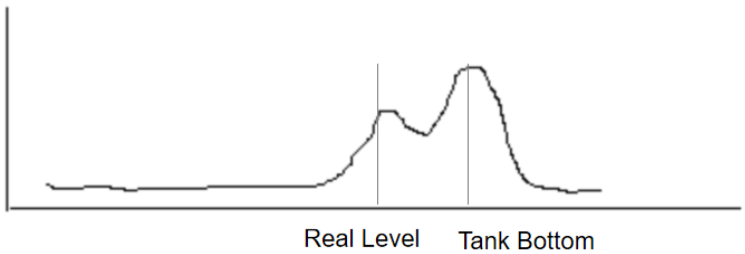

Press again to enter the DK value adjustment menu.




Press key to select “Yes”, used for the measuring setting when DK value is low (<=2.1).. Display in LCD is as follows.
At this time, it is necessary to manually input an accurate empty tank span value, which is used to determine the position of the tank bottom to reduce the reflection of the tank bottom.



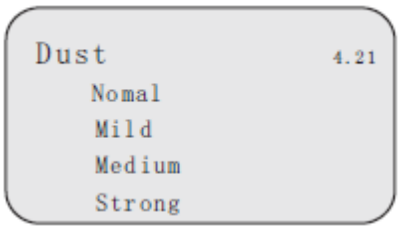

When measuring a medium with a low dielectric constant, in the tank bottom area, both the tank bottom and the medium form reflections, and the reflection of the tank bottom is even stronger than that of the medium as shown in the figure below



To identify the true medium level, turn on the Low DK option and set the Tank bottom distance.
After enabling this option, the system will execute the following algorithm.
When the **valid echo** appears in the range of the tank bottom area (tank bottom distance +-1m), the most front **valid echo** in the tank bottom area is output as the liquid level position.

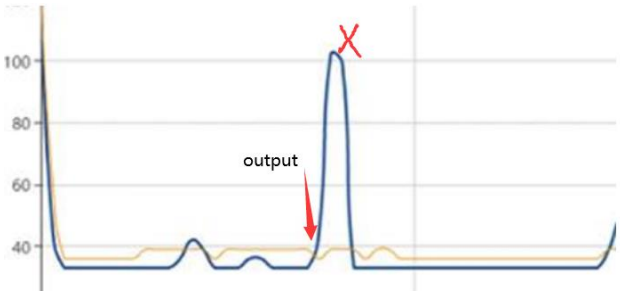
4.9 Dust or Agitation

Agitation state of material (liquid) Dust state of material (solid)




When the liquid level fluctuates greatly or the dust is large, the position and intensity of the wave peak are unstable.

After setting this option, the system will not take the peak of the valid echo for the actual level but take the starting point of the valid echo as the level measurement instead, so measurement accuracy will derate to 10mm-20mm




With different selections, the system will transmit/measure n times, and take the echo with the highest intensity for processing.

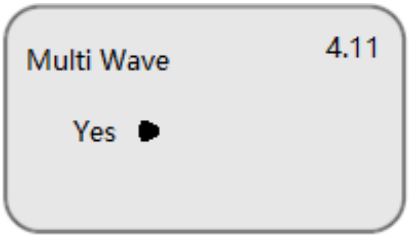
**Normal n=1, mild n=2, medium=3, strong n=4**

4.10 Echo Lost Timeout

Device will send out failure signal after setting time if there's no echo signal being received. Default setting is 300s.

4.11 Multi Wave

Sometimes, two echo echoes are superimposed together, turn on the option, the echo is decomposed into two echoes, and the off option is considered as one echo.
When the LCD displays 4.11, press ↵ to enter the Multi Wave setting menu. Display in LCD is as follows. The default setting is Yes.

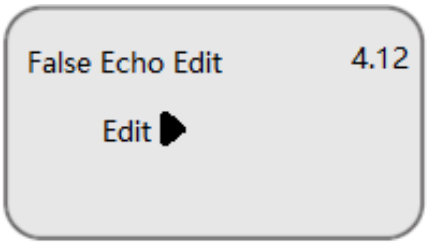



In some cases, the above graph will appear, and the valid echoe is above the envelope.
If MultiWave Option=disable, the system considers the above to be One valid echo, and the intensity is the highest point of the wave .
If MultiWave Option=Enalbe, the system separates the above wave and considers that there are two valid echoes.
System separates the above wave and considers that there are two valid echoes

### 4.12 False Echo Edit

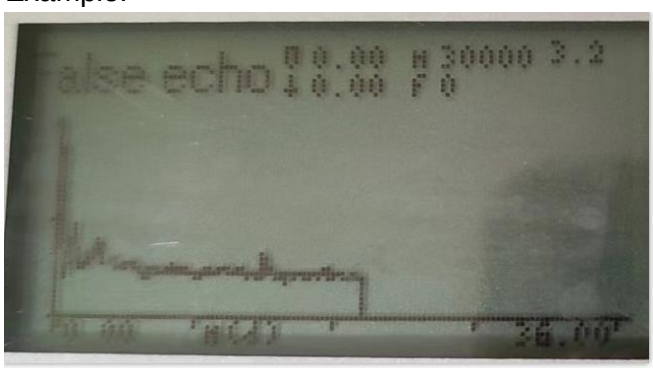
When the existing false echo curve still does not meet the requirements, the false echo curve can be edited.

When the LCD displays 4.12, press ↵ to enter the Multi Wave setting menu. Display in LCD is as follows.




Four values need to be input for each edit,
the starting point distance/the starting point Amplitude;
the ending point distance/the ending point Amplitude.

According to the input value, the system adds a straight line connecting two points to the existing false echo.
Example:



The system has stored a 0m - 20m false echo curve, as shown below

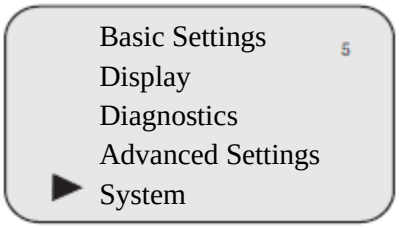
Use false echo editing:

start point distance=10m, start point Amplitude=135dB,
end point distance =15m, end point Amplitude=120db

The following false echoes are obtained.

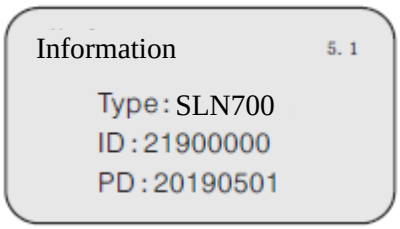

## 5 System

The system menu contains basic information about the meter production, such as Info, Software Version, Latching Mode, Write Protect, etc. When the LCD displays the main menu, press key to move the arrow to the information item. Display in LCD is as follows.




Press to enter the information display function. Display in LCD is as follows.

### 5.1 Info



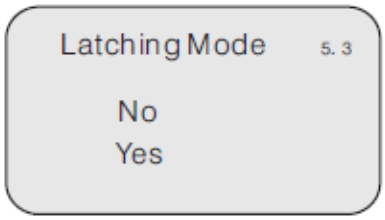

Product Type
Product Serial Number (ID)
Production date (PD)

5.2 Software Version


MB=Main Board; DSP=Digital Signal Processing; LCD;RF

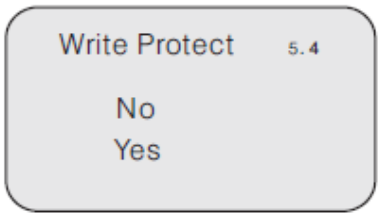
5.3 Latching Mode

Press ⬇ key. Display in LCD is as follows.




Latching Mode: This parameter allows selection of critical error behavior.
Latching: The transmitter will remain in a critical error state until a user performs a hardware / software reset.
Non-Latching: The transmitter exits critical error state automatically when causes of the critical error have been resolved.

5.4 Write Protect




If switching Yes to No, go to Unlock Password Input Menu
If switching No to Yes, go to set lock Password Input Menu.

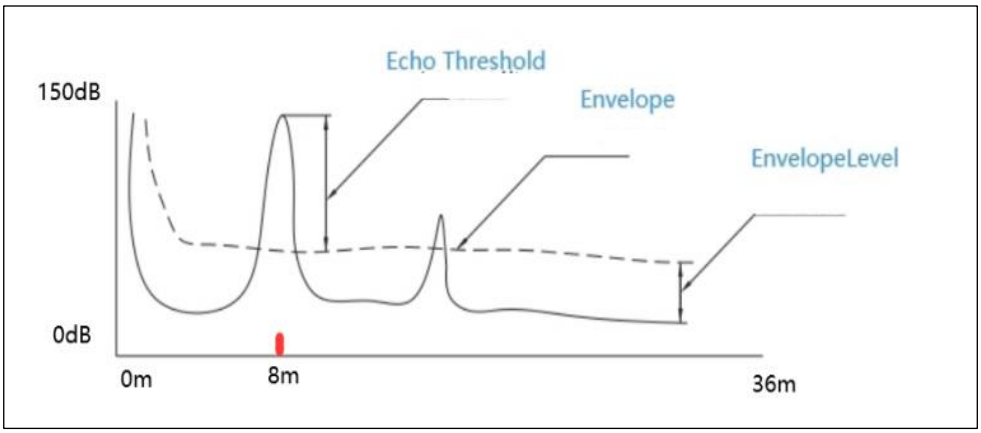



**Figure 5-2: Representation of an echo curve defining the Echo Threshold and the Envelope Offset quantities.**

# 6 Maintenance

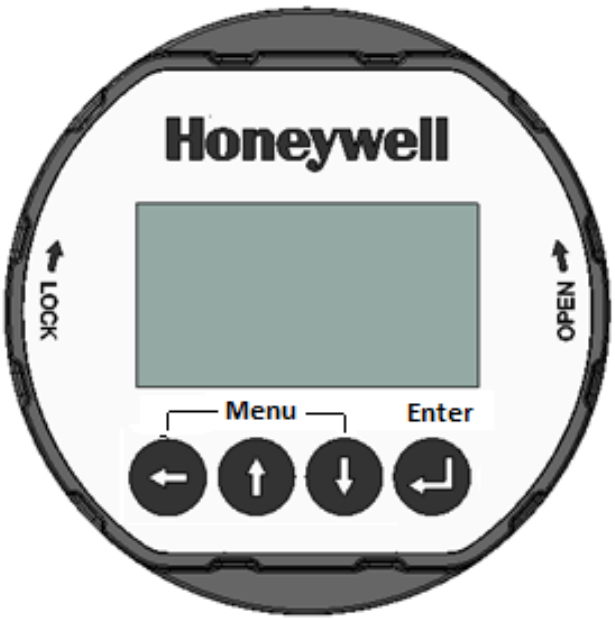
## 6.1 Configuration method

There are three debugging methods for SLN 700

1. Display/configuration module
2. Host PC
3. HART hand-held programmer

### 6.1.1 Configuration with Display

Display modular is a pluggable display/configuration tool. The configuration can be done through operating with 4 buttons on Display. The language for the configuration menu is optional. After exiting from configuration mode, display is only used for display in general, and the measurement value can be seen clearly through the glass window.




-Enter programming mode; -Confirm programming options;
-Confirm parameter modification.

[ ]Button
- Modify parameter values;

Shortcut keys
[ ]displays the frequency spectrum -Choose programming options; -Choose the parameter bit to edit; -Display of parameters.

[ ]Button
- Exit programming mode;
-Return to higher level menu.

### 6.1.2 Configuration

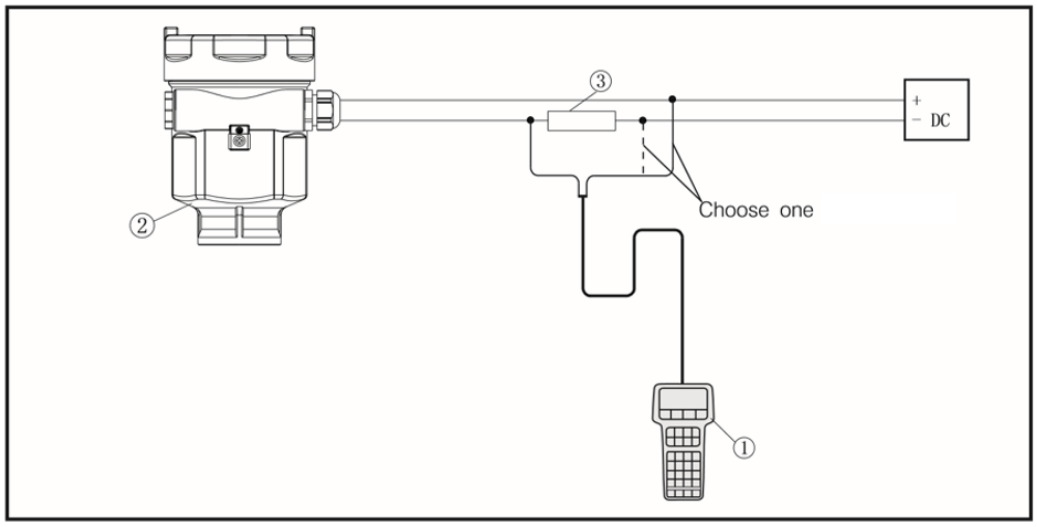



**Figure 6-1: Connect via HART hand-held**

1. HART handheld programmer
2. SLN700 level gauge
3. 250

## 6.2 Procedures

### 6.2.1 Output Check Procedures

The Output Check has the following procedures:

- The Loop Test procedure checks for continuity and the condition of components in the output current loop.
- The Trim DAC Current procedure calibrates the output of the Digital-to-Analog converter for minimum (0%) and maximum (100%) values of 4 mA and 20 mA, respectively. This procedure is used for Transmitters operating online in analog mode to ensure proper operation with associated circuit components (for example, wiring, power supply and, control equipment).
- Precision test equipment (an ammeter or a voltmeter in parallel with precision resistor) is required for the Trim DAC Current procedure.

The Transmitter does not measure the given PV input or update the PV output while it operates in the Output mode.

### 6.2.2 Constant Current Source Mode Procedure (Loop Test)

1. Establish communication with the Transmitter. For these procedures, the values of components in the current loop are not critical if they support reliable communication between the Transmitter and the PC Host/Handheld Configurator
2. On the Host visit Services Tab under Advanced Configuration menu.
3. Select the **Loop Test** button; the **LOOP TEST** box will be displayed.

4. Select the desired constant-level Output: 0%, 100%, or Other (any between 0% - 100%).
5. Select the Set button. A box will be displayed asking Are you sure you want to place the transmitter in output mode?

With the Transmitter in Analog mode, you can observe the output on an externally-connected meter or on a local meter.

6. Select the **Yes** button. Observe the output current at the percentage you selected in Step 5.
7. Select **Yes** to continue. This concludes the Startup procedure

### 6.2.3 Error Codes:

Following are the details of error codes with respective resolution. The error codes will show up on display screen during malfunction/error condition in device

| Error Code | Description | Solutions |
|---|---|---|
| 1 | Communication error between display and module | Need new display module |
| 2 | EEPROM Error | Return to Factory |
| 3 | PLL Failed, RF circuit failure | Return to Factory |
| 4 | Internal Operation Error or use during development, internal use only) | Return to Factory |
| 5 | Internal Command Error for use during development, internal use only) | Return to Factory |
| 6 | Authentication Failed | Return to Factory |
| 7 | SysBusy | Restart, if problems persist return unit to Factory |
| 8 | Low Power | Low power supply. Check power supply |
| 9 | Dsp Error | Return to Factory |
| 10 | Internal Command Parse Error (for use during development, internal use only) | Return to Factory |
| 11 | AD Error | AD sampling error, Return to Factory |
| 12 | Calibration Flash Error | RF Calibration Flash Error, Return to Factory |
| 13 | Dsp Authentication | Return to Factory |
| 14 | No Signal Error | No signal back, will see no reflective echo on echo curve<br>Check antenna aiming<br>Check if the application is having excessive vapor/steam |

# Glossary

## A

**Accuracy:** The closeness of the agreement between the result of the measurement and the true value of the quantity. Accuracy should not be confused with precision which relates to agreement between subsequent measurements. The quoted accuracy depends on the initial characterization, the reproducibility of the standard, and the stability of the measurement between calibrations. The actual accuracy also depends on the equipment performing and being operated to specification.

**Application and Validation Tool (AVT):** The online tool which allows users to input technical data about a specific process tank and to validate that the correct level transmitter application is delivered to the site ready to install.

**ATEX Directive:** Consists of two European Union directives which describe the acceptable equipment and work environment permitted in an environment with an explosive atmosphere.

## B

**Blocking Distance:** A zone where measurements are not performed.

**Burnout:** Transmitter burnout status indicates a critical sensor failure has occurred. In a HART transmitter, burnout status can be configured to set the analog output to ≤ 3.6mA (downscale) or ≥ 21.0mA (upscale).

## C

**Canadian Standards Association (CSA):** A not-for-profit standards organization which develops standards. The CSA registered mark shows that a product has been independently tested and certified to meet recognized standards for safety or performance.

**Cyclic Redundancy Check (CRC):** An error-detecting code commonly used in digital networks and storage devices to detect accidental changes to raw data.

## D

**Damping:** Applies digital filtering to suppress noise effects on the PV. The range is from 0.0 to 60.0 seconds.

**Digital to Analog Convertor (DAC):** A function that converts digital data (usually binary) into an analog signal (current, voltage).

**Device Description (DD):** Files describing the configuration of a transmitter for use by handheld or PC applications.

**Device Type Manager (DTM):** A Device Type Manager is part of the Field Device Tool (FDT) standard, and is a software component for a device that contains the device-specific data, functions and logic elements.

**Dielectric constant (Dk):** The ratio of the conductivity of a material to that of a vacuum. In level measurement, a high Dk indicates a non-conductive or insulating material.

## E

**Echo Lost Timeout:** This parameter allows adjustment of the time that the NCR Transmitter waits after echo loss before producing a critical fault alarm.

**Latching Mode:** This parameter allows the selection of the behavior of the NCR transmitter in the case of a critical error. If the Latching option is selected, the NCR transmitter will stay in the critical error state until a user performs a hardware or software reset. This parameter is only relevant to HART transmitters.

**Envelope Level:** Device will only read signal strength above Envelop level. Default envelop level DB value is 5. User can set different value by referring to EFF curve based on site situation

**Equivalent-Time Sampling (ETS):** Is a method of increasing the effective sampling rate. ETS constructs a repetitive signal by capturing small parts of the waveform from successive triggered acquisitions. This enables the accurate capture of signals whose frequency components are much higher than the maximum sample rate.

## F

**Factory Mutual (FM):** Provides third-party certification and approval of commercial and industrial products, including Hazardous Location Electrical Equipment.

**Field Device Tool (FDT):** A general purpose application / tool that allows users to manage many DTMs running their individual transmitters.

**First Echo:** This is used to differentiate between 2 echo's of similar amplitude and define the primary echo

**Flooded Interface measurement:** There is no air layer in the tank, there is only fluid from the process connector` to the interface.

## H

**HART® Communications Protocol:** Highway Addressable Remote Transducer (HART) is a digital industrial automation protocol that is modulated over legacy 4-20 mA analog instrumentation wiring

**Honeywell Experion:** An advanced distributed control system (DCS) and innovative software applications to improve users' business performance and ensures reliable performance.

**Honeywell Field Device Manager (FDM):** A centralized asset management system for remote configuration and maintenance of smart field devices based on HART, PROFIBUS and Fieldbus FOUNDATION protocols.

## I

**Interface Measurement:** Level measurements where to two liquids meet. For example, an oil layer on top of water. Where the two meet is referred to as the interface level.

**International Electrotechnical Commission Explosive Scheme (IECEx**): IECEx certification provides assurance that the strictest safety requirements of IEC International Standards are met. Designed to facilitate the international trade of electrical equipment used in explosive, hazardous environments.

## L

**Latching Mode:** A parameter in the Level transmitter Advanced Display which allows for the selection of the behavior of the Level transmitter in the event of a critical error. In this mode, the transmitter wills stay in the critical error state until a user performs a hardware or software reset.

**Lower Range Value (LRV):** A Basic configuration parameter which allows users to enter the measuring value for which the analog output will be scaled to 4 mA.

**Lower Product:** The heavier liquid when two liquids exist in a vessel (e.g. water in an oil/water measurement application).

## M

**Maintenance Mode:** A mode that the transmitter supports to communicate to external systems that it is not available for process measurement.

**Maximum Level Speed:** Used to define the Maximum rate of filling or emptying. Default setting is 0.2m/s.

## N

**NAMUR NE 43:** NAMUR is an international association of process instrumentation user companies. NE 43 is a NAMUR recommendation to promote a standardization of the 4-20mA signal level for failure information. Normal 2-wire transmitters use the 3.8 to 20.5mA signal range for measurement information, with ≥21mA or ≤3.6mA to indicate diagnostic failures.

**National Pipe Thread (NPT):** A U.S. standard for tapered threads used on threaded pipes and fittings.

**Non-Contact Radar (NCR):** A method commonly used to measure levels of liquid and solid materials. Low frequency microwave pulses are guided by a metal probe and reflected off a surface to determine levels in tanks.

## O

**Operating Range:** The range of conditions in which the transmitter is designed to operate**.**

## P

**PACTWare:** A software application for instruments that is based on FDT technology. It can be used to load and run a manufacturer's DTM for a specific instrument.

**Precision:** The closeness of agreement between the results obtained by applying a measurement procedure several times on identical materials and under prescribed measurement conditions. The smaller the random part of experimental error, the more precise the measurement procedure**.**

**Printed Wiring Assembly (PWA):** Also known as a printed circuit assembly. It is a populated electronics board.

**Process Variable (PV):** A dynamic feature of the process which may change rapidly and is measured. The PV is the only dynamic variable sent via analog signal, in HART transmitters, to the control system.

## Q

**Quaternary Variable (QV):** The fourth dynamic feature of the process which may change rapidly and is measured. (HART only).

## R

**Random Access Memory (RAM):** A type of computer data storage. Data is accessed randomly where any byte of memory can be accessed without touching the preceding byte.

**Reproducibility:** The closeness of agreement between independent results obtained in the normal and correct operation of the same method on identical test material, in a short space of time, and under the same test conditions (such as the same operator, same apparatus, same laboratory).

## S

**Safe Failure Fraction (SFF):** The fraction of the overall failure rate of a device that results in either a safe fault or a diagnosed unsafe fault.

**Safety Instrumented Function (SIF):** A set of equipment intended to reduce the risk due to a specific hazard (a safety loop).

**Safety Integrity Level (SIL):** A discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 has the highest level of safety integrity and Safety Integrity Level 1 has the lowest.

**Safety Instrumented System (SIS):** The implementation of one or more Safety Instrumented Functions and is composed of any combination of sensor(s), logic solver(s), and final element(s).

**Secondary Variable (SV):** A secondary dynamic feature of the process which may change rapidly and is measured. (HART only)

**Stillwell / Stilling well:** A chamber that enables level measurement in turbulent conditions.

## T

**Tertiary Variable (TV):** A tertiary dynamic feature of the process which may change rapidly and is measured. (HART only)

**Time-Domain Reflectometry (TDR):** For Level measurement, it is a measurement technique used to determine distance by measuring the time it takes to send electromagnetic measurement pulses along a probe (for example, a metallic probe), reflect off a surface (liquid or solid) and travel back to the source.

## U

**Upper Product:** The lighter liquid when two liquids exist in a vessel (e.g. oil in an oil/water measurement application)

**Upper Range Value (URV):** A Basic configuration parameter which allows users to enter the measuring value for which the analog output will be scaled to 20 mA (HART only).

# Index

## Sales and Service

For application assistance, current specifications, ordering, pricing, and name of the nearest Authorized Distributor, contact one of the offices below.

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