

USER MANUAL
LEVEL MEASUREMENT

HOLYKELL.COM

76-81GHz FM Continuous Wave

Radar Level Sensor



Model HR80G

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1. Product Introduction

1.1 Features:

The 76-81GHz frequency modulated radar level gauge is a non-contact level measurement instrument based on millimeter-wave radar (FMCW) technology. It is suitable for continuous level monitoring of liquids, slurries, particles, powders, and solid materials. Its core advantages lie in its ultra-high frequency (76-81GHz), extremely narrow beam angle, and strong anti-interference capability. It can achieve millimeter-level high-precision measurement under complex working conditions (such as high temperature, high pressure, strong dust, steam, or corrosive environments), and is widely used in industries such as petrochemicals, power, metallurgy, food and pharmaceuticals, and environmental protection.

The product utilizes Bluetooth wireless technology for safe and convenient on-site configuration and maintenance. On-site debugging and operation tasks are accomplished through a user-friendly and intuitive graphical interface on a mobile phone.

1.2 Working Principle:

Signal Transmission: The radar antenna transmits a 76-81 GHz high-frequency continuously modulated microwave signal.

Reflection and Reception: The signal is reflected after encountering the surface of the measured medium and is captured by the radar receiver.

Frequency Difference Calculation: By measuring the frequency difference (Δf) between the transmitted and reflected waves and combining it with the time difference (Δt), the material level distance is accurately calculated.

Intelligent Signal Processing: A built-in DSP digital signal processor automatically compensates for changes in temperature and medium characteristics, ensuring stable and reliable measurement.

1.3 Communication and Debugging:

The instrument can be debugged on-site via the LCD screen or via PC software. The 80GHz radar level gauge series products can communicate with the PC in the following ways:

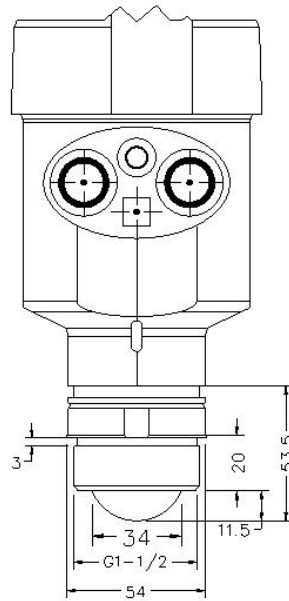
1. USB to RS485 serial cable (four-wire);
2. USB to TTL serial cable (two-wire);
3. USB to Hart-modem (two-wire);
4. Bluetooth debugging via mobile phone, making on-site debugging safer and more convenient;
5. 4G network, remote debugging via remote module.

2. Technical specification

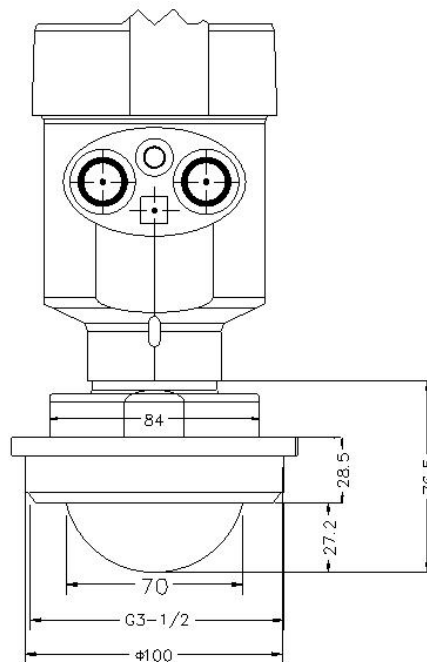
Frequency range	76GHz-81GHz
Measuring range	15m 35m 85m 120m
Measurement accuracy	±1mm
Communication	HART, MODBUS
Output signal	4-20mA, RS-485, TTL
Power supply range	18-28VDC
Output Fault	No change, 22mA,3.6mA
Display and control working temperature	-20~70°C
Cable entry	M20x1.5
Cable recommend	AWG18 or 0.75mm ²
Shell material	Aluminum shell, stainless steel
Process temperature	1:-30~80°2: -30~200°3: -30~1000°
Measurement interval:	Fastest 300ms
Maximum power consumption	4-20mA 2wire (20mA) 4-20m 4wire (70mA)
Beam Angle	3°, 6°
Protection level	IP68
Explosion-proof grade	Ex d ia IIC T6
Installation	Thread, universal
Antenna material	PTFE
Antenna method	Lens Antenna
Display/Debug	128*64 dot matrix screen / 4 buttons PC host computer iOS Android
Wireless communication	Bluetooth
Bluetooth range	12M
Bluetooth standard	Bluetooth 5.0
Blind area range	0.08-0.5m
Process pressure	-0.1~1.8MPa
Measurement interval	Fastest 0.3s (the faster, the greater the power consumption)
Connection method	Threaded type, universal type, anti-corrosion type, chuck type, high temperature and high pressure type
Application scope	Liquid, stirring, water vapor condensation, strong dust, solid, lumpy, powder

Note: The measurement blind zone is related to the selected antenna and the reflection characteristics of the object under test. Laboratory blind zone testing is based on a water surface or a metal plate.

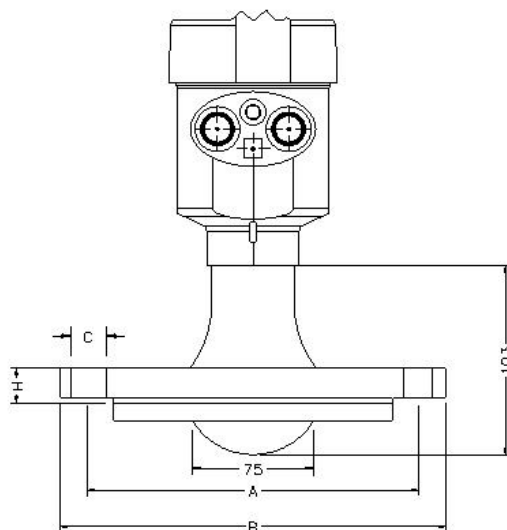
3. Dimensions



Schematic diagram of threaded connection structure dimensions



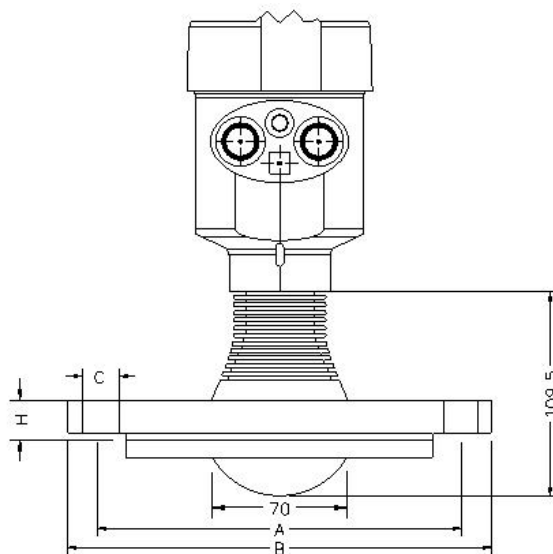
Schematic diagram of threaded connection structure dimensions



	A	B	C	H	N
DN80	160	200	17.5	20	8
DN100	180	220	17.5	20	8

PN16

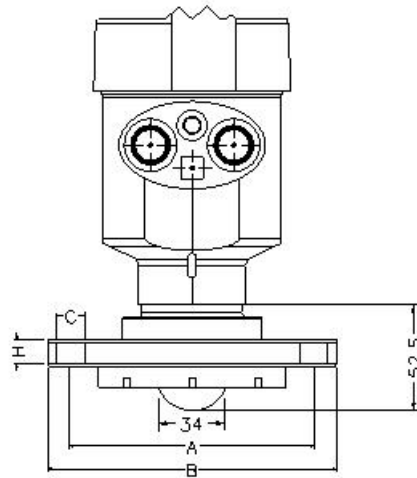
Schematic diagram of normal temperature anti-corrosion flange structure dimensions



	A	B	C	H	N
DN80	160	200	17.5	20	8
DN100	180	220	17.5	20	8

PN16

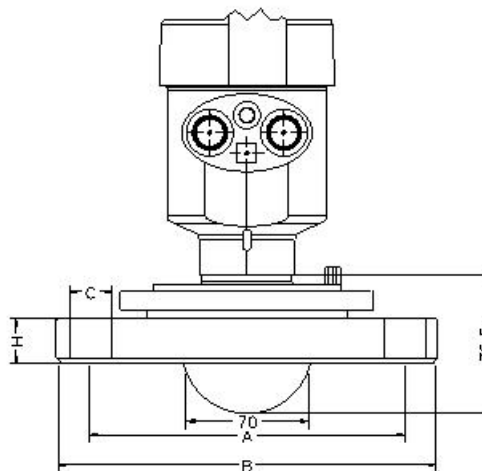
High temperature (-30~200°C) anti-corrosion flange structural dimensions diagram



	A	B	C	H	N
DN50	125	165	17.5	20	4
DN65	145	185	18	20	4

PN16

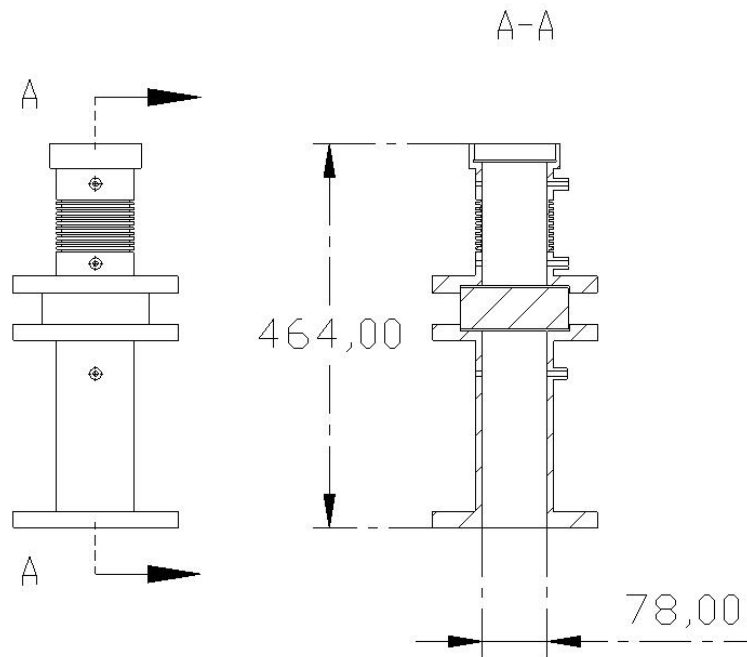
Schematic diagram of normal temperature anti-corrosion flange structure dimensions



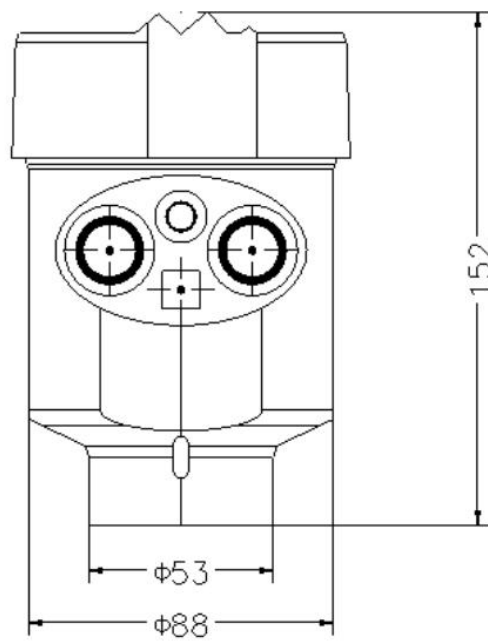
	A	B	C	H	N
DN80	160	200	17.5	20	8
DN100	180	220	17.5	20	8

PN16

Schematic diagram of the structure and dimensions of the universal flange at room temperature



Schematic diagram of the structural dimensions of the heat insulation flange (-30~1200°).



Aluminum shell size diagram

4. Installation

Before installing the radar level gauge, please follow the installation location recommendations below.

4.1 Safety Instructions

Please comply with local health and safety regulations.

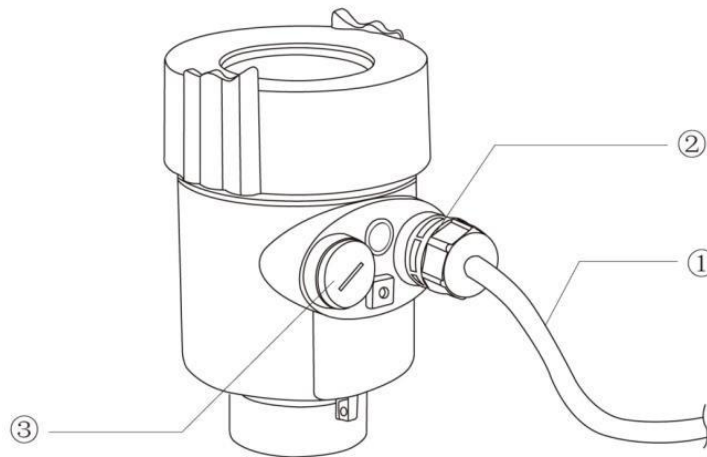
All operations involving the instrument's electrical components must be performed by properly trained professionals.

Please check the instrument's nameplate to ensure the product specifications meet your requirements.

Please ensure the power supply voltage matches the requirements on the instrument's nameplate.

4.2 Protection Rating

This instrument fully meets the requirements of protection rating IP66/IP68. Please ensure the cable seals are waterproof.



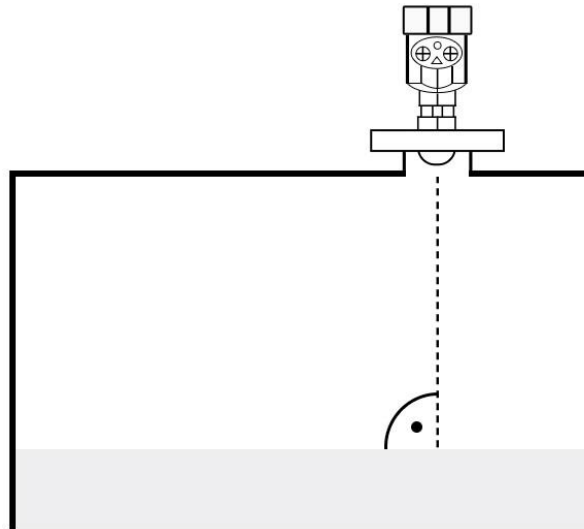
How to ensure installation meets IP68 requirements:

- **Ensure the sealing head is undamaged.**
- **Ensure the cable is undamaged.**
- **Ensure the cable used complies with electrical connection specifications.**
- **Bend the cable downwards before entering the electrical interface to prevent water from entering.**
- **Tighten the cable sealing head.**
- **Seal any unused electrical interfaces with blind plugs.**

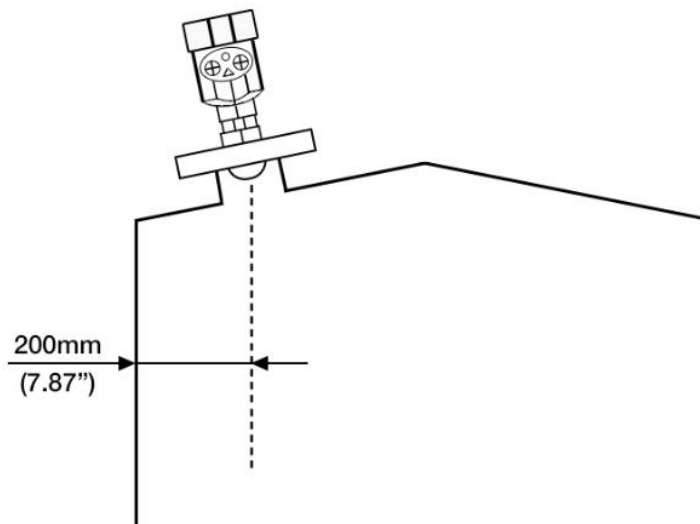
Installation precautions

Horizontal and Aspect Adjustment in Liquids

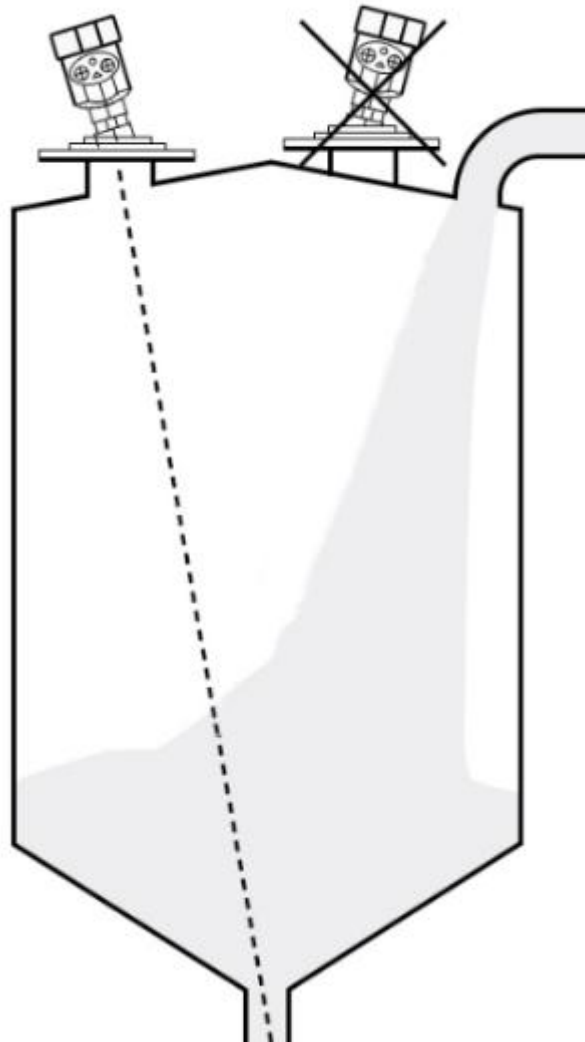
Radar level gauges should be installed vertically to ensure good echo from the product surface. A maximum tilt angle of 3° is recommended. It is important to check whether the flange connection face is horizontal. If it is not horizontal, necessary measures should be taken to adjust it. This is especially important in liquid applications, particularly for tall tanks. The radar level gauge should be as perpendicular as possible to the surface of the liquid medium to obtain the best measurement results.



The minimum distance (L) between the radar level sensor installation point and the tank wall needs to be greater than 30 cm, and the recommended distance is 1/2 of the tank radius. In solid applications, it is recommended to aim the radar level gauge antenna beam at the discharge port area of the tank for optimal measurement results.

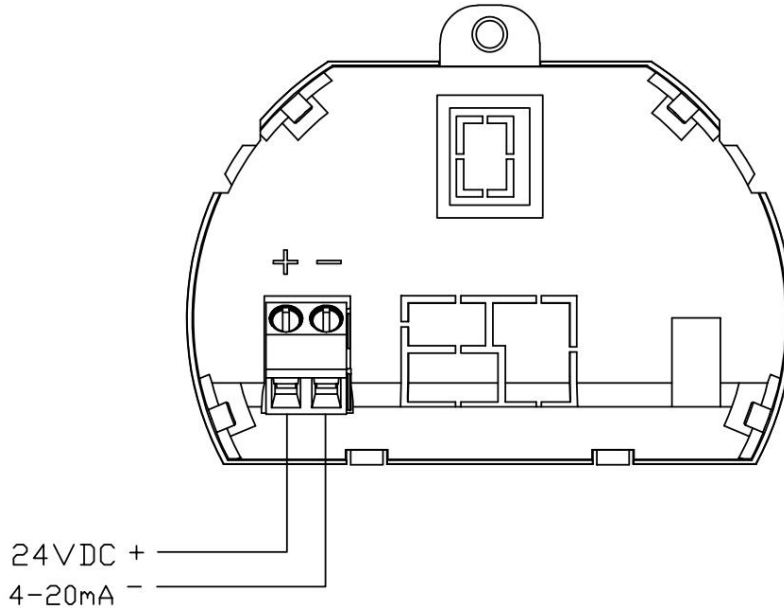


The instrument installation should ensure that the antenna beam avoids the feed inlet, as shown in the figure.

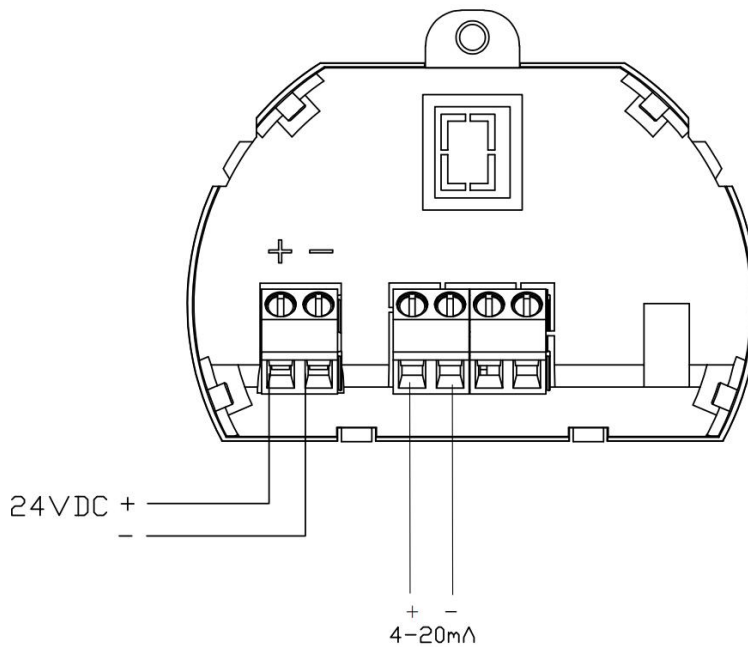


5. Connect to power supply

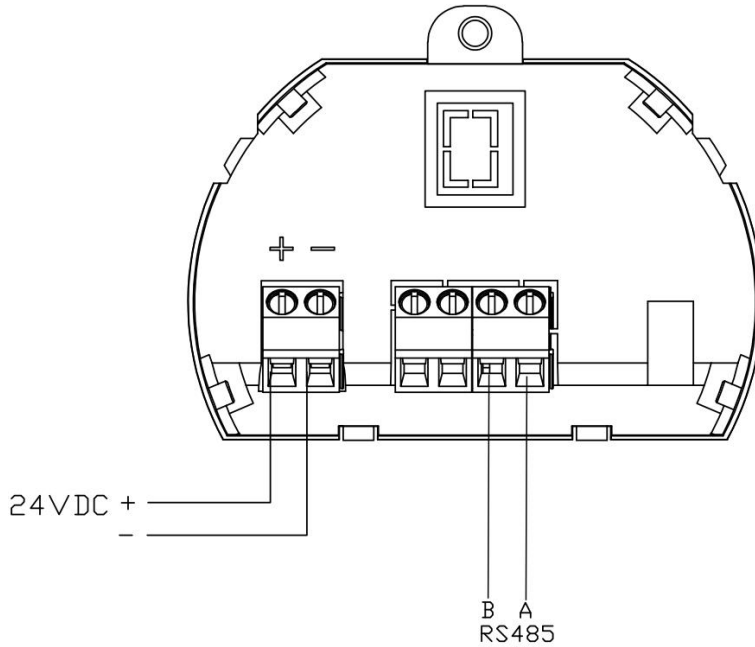
5.1 Wiring diagram for single-chamber housing, 24VDC power supply, two-wire product



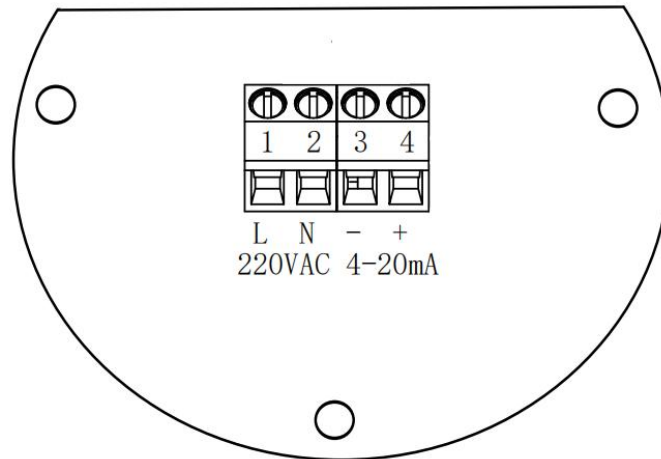
5.2 Wiring diagram for single-chamber housing 24VDC 4-20mA power supply four-wire product



5.3 Wiring diagram for single-chamber housing 24VDC RS485 power supply four-wire product



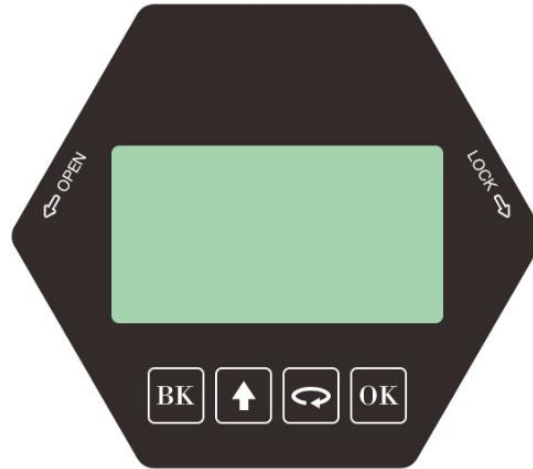
5.4 Wiring diagram for a dual-chamber housing 220VAC (4-20mA) four-wire power supply product



In a four-wire application, when not outputting 4-20mA, pins 3 and 4 are shorted.

6. Instrument debugging

6.1 Instrument Display Unit



There are 4 buttons on the instrument panel, through which the instrument can be debugged. The language of the debugging menu is optional. After debugging, the LCD screen displays the measured value, and the measured value can be read very clearly through the glass window. (Panel diagram)

[BK] key
 Exit programming mode
 Return to the previous menu
 Return to the main interface, switch to echo interface

[↑]key
 Modify instrument parameters

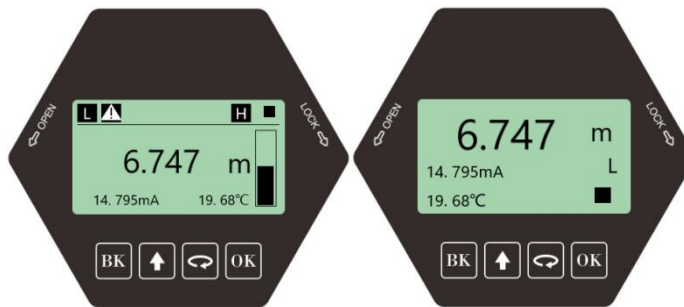
[↻] key
 Switch instrument interface
 Select menu item
 Select edit position

[OK] key
 Enter edit mode
 Confirm parameter modification

6.2 Display debugging

6.2.1 Interface Introduction

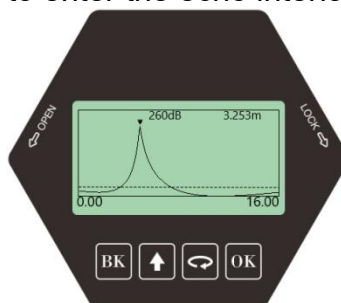
The running interface is the first interface entered after the device is turned on, that is, the main interface.



- 6.747: Real-time measurement value
- L: Measurement unit (L, level) (H, empty height) (% , ratio)
- H: Communication method (H, HART) (R, MODBUS)
- M: Measurement unit
- 19.68°C: Internal circuit temperature of the instrument
- : Fault code prompt (fault information can be viewed by pressing the key on the main interface)
- 14.795mA: Output current value
- : Communication status, flashing once every 1s indicates normal communication, if not flashing, there is a communication fault

6.3 Echo Interface

In the main interface, press (BK key) to enter the echo interface

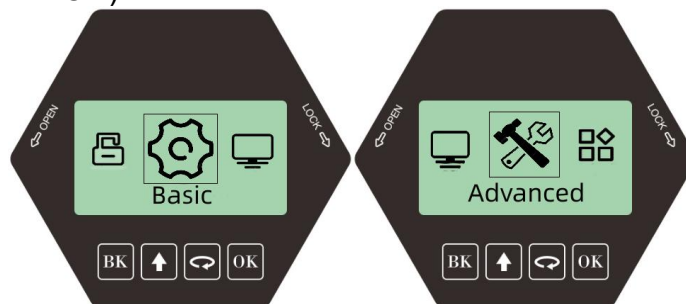


- 260dB: echo strength
- 3.253m: echo position
- The black arrow is the real-time measured distance
- 16.00: range setting value

6.4 Menu Interface

button	Functions
BK	- Enter echo interface
↑	Enter parameter overview interface
↶	Simplified main interface
OK	Enter menu interface

In the main interface, (press OK) to enter the menu interface

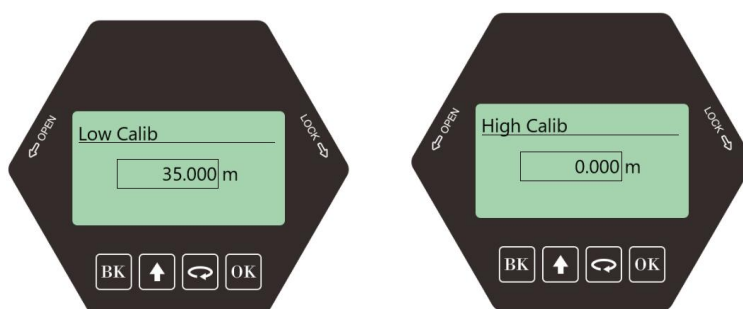


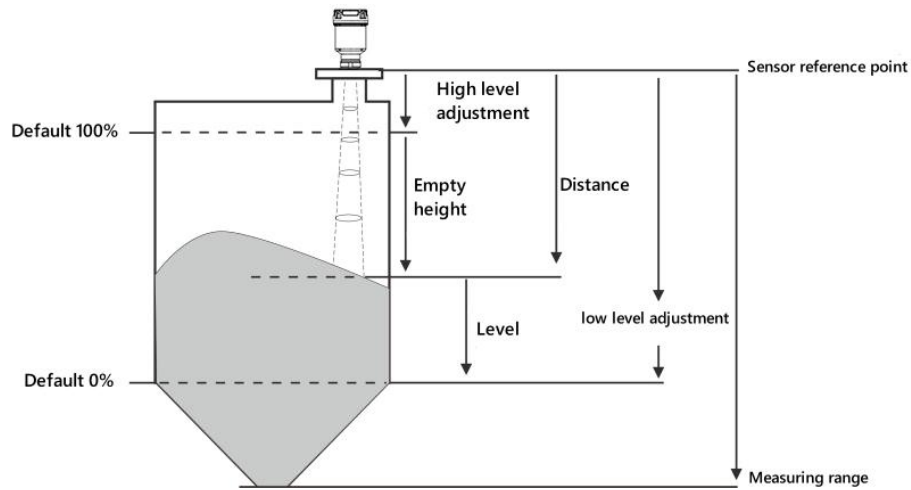
Basic Settings	Low position setting, high position setting, range setting, blind zone setting, damping time, medium type medium parameters, application occasions
Display	Measurement mode, distance unit, language, LCD contrast
Advanced Settings	False echo learning, distance offset, bus address, output position, current simulation, current function
Service	Echo index, echo ratio, window setting, echo lock, primary filter, secondary filter, response rate, threshold setting
Factory settings	None

6.4.1 Basic Settings

6.4.1.1 Low/High Position Setting

【Low Position Setting】 【High Position Setting】 High position corresponds to the full material position, and low position corresponds to the empty hopper position, as shown in the figure below. Low Position - High Position = DCS System Range





6.4.1.2 Range Setting

The range is used to define the operating area of the algorithm, not the instrument's remote measurement limit or the DCS system range. The algorithm ignores echoes outside the range during processing. Properly setting the range can avoid multiple reflections and interference signals outside the possible range.

The range should be 2m larger than the actual tank height, especially for conical-bottomed tanks, to ensure the instrument obtains complete echo characteristics.



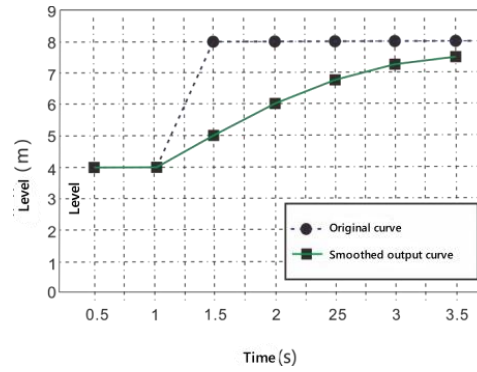
6.4.1.3 Blind zone setting

When there is a fixed obstacle close to the sensor surface that interferes with the measurement, and the maximum material level does not reach the obstacle, the blind zone setting function can be used to avoid measurement errors.



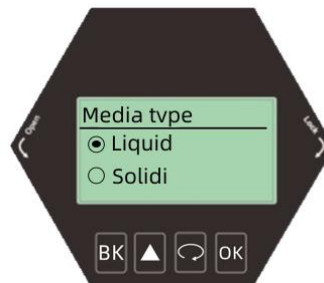
6.4.1.4 Damping time

The function of the damping time is to smooth the sudden changes in the measurement results and more accurately reflect the average position of the material level.



6.4.1.5 Media Type

The instrument integrates a rich adaptive algorithm for solid and liquid types, and can be configured accordingly according to actual measurements on site. After configuration, the (application) and (medium parameters) menus will be automatically adjusted.

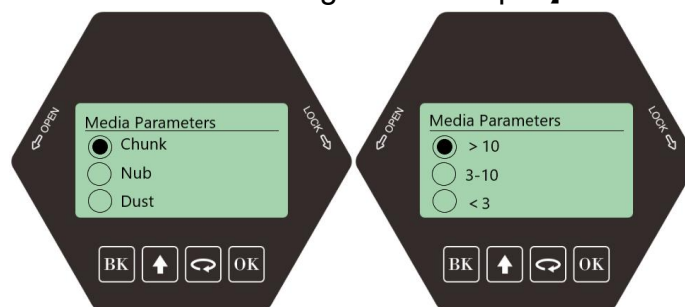


6.4.1.6 Medium parameters

Different measurement media will produce different echo characteristics, and the media parameter options in the instrument are for customers to set.

When the customer switches the (media type) option, the (media parameter) option will automatically switch.

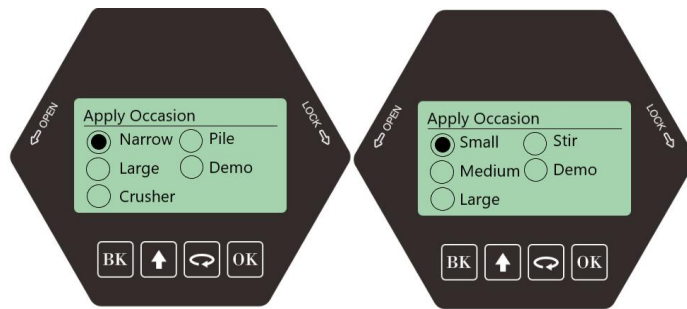
[In the picture, the left side is solid and the right side is liquid]



6.4.1.7 Application scenarios

Built-in multiple radar working modes to adapt to different field applications, and also provides a convenient demonstration mode for customers

[In the picture, the left side is solid and the right side is liquid]



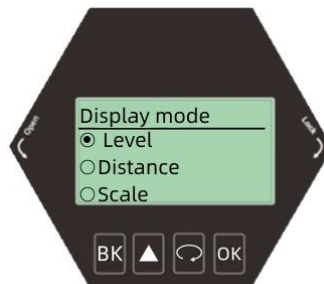
Name	Applications
Small Container	Very small damping, suitable for fast response conditions
Medium container	Medium damping, suitable for most working conditions
Large container	Very large damping, this mode outputs smoothly
Stirring	Application in agitator
Demo	Quickly understand the characteristics of the instrument

6.4.2 Display

6.4.2.1 Measurement mode

Selecting the measurement mode will change the real-time value of the main interface, but will not change the output current type.

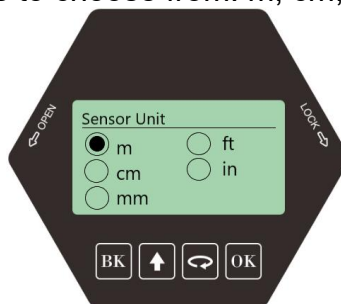
There are three modes: empty height, level, and ratio for customers to choose from.



6.4.2.2 Distance units

Selecting the distance unit will change the unit of the real-time value on the main interface.

There are five options for customers to choose from: m, cm, mm, ft, in, and the default is m.



6.4.2.3 Language

The display language of all interfaces is suitable for users from different countries, supporting four languages: Chinese, English, Korean, and Russian. The default language is Chinese.



6.4.2.4 LCD Contrast

Used to debug display contrast, 0-100, the larger the value, the darker the display color.



6.4.3 Advanced Settings

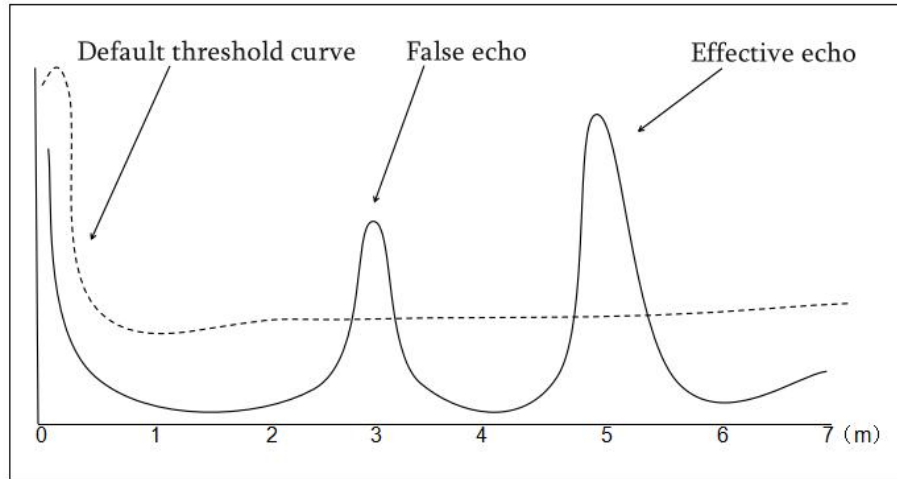
6.4.3.1 False Echo Learning

It can block interference echoes caused by objects in the container and form a threshold curve. It only performs spurious echo learning within a set area. After selecting "Select Area," you need to further input the "Start," "End," and "Intensity" points for the area. The menu is shown in the following figure:

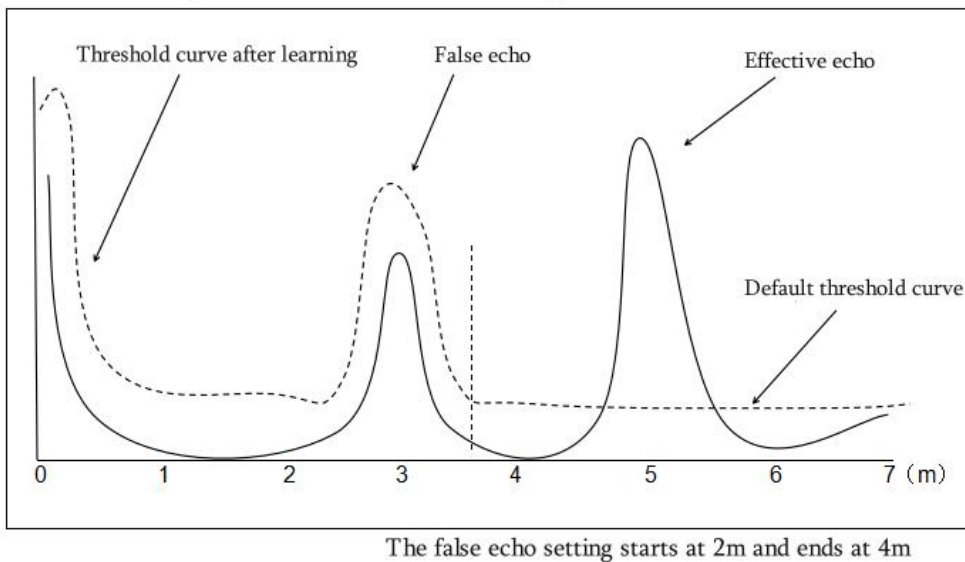


1: False echo learning sets the start point to 2m, the end point to 5m, and the intensity to 28dB. Click OK to save.

Schematic diagram before false echo learning

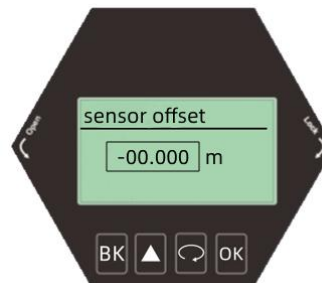


Schematic diagram after false echo learning



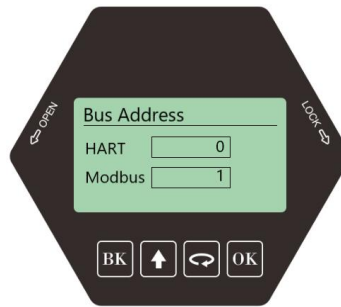
6.4.3.2 Distance offset

Used to correct the deviation between the measured value and the actual value of the sensor. The default parameters of the instrument are calibrated at the factory.



6.4.3.3 Bus address

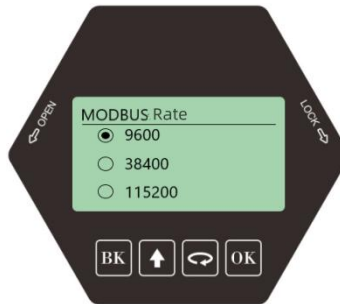
According to the communication protocol supported by the instrument, set the specific bus address, which is displayed as follows:



Name	HART Address	Modbus
Parameter range	0-32	1-127
default value	0	1
Option meaning	Configure Hart communication for the instrument	Configure the instrument's RS485 communication
Special precautions	When the Hart short address is not 0, the current is fixed at 4mA output.	/

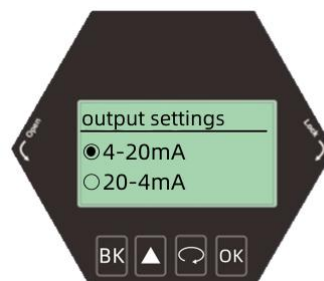
6.4.3.4 MODBUS Baud Rate

The instrument's baud rate can be manually changed according to field requirements. The default baud rate is 9600. The change will take effect after the instrument is restarted.



6.4.3.5 Output location

The output position determines whether the bus is 4-20mA or the output is 20-4mA.



Example: For an oil tank under test with a height of 5m, the high-level value is set to 0, and the low-level value is set to 5. If the 4-20m position is set to 4-20mA, the empty tank current output is 4mA, and the full tank output is 20mA; if the 4-20mA position is set to 20-4mA, the empty tank current output is 20mA, and the full tank output is 4mA.

6.4.3.6 Current simulation

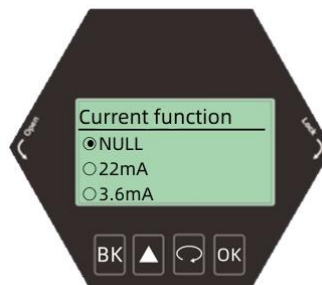
Current simulation makes the current output a specific current value, which is used to check whether the 4-20mA loop current is accurate.

Exit this option to accept orders and the analog output will resume working status.



6.4.3.7 Current function

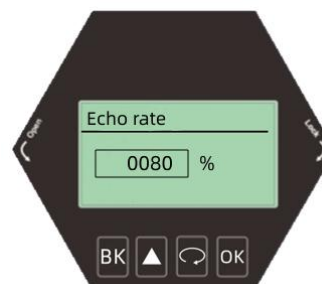
The current function can set the actual output current value when the instrument encounters a wave loss fault.



6.4.4 Services

6.4.4.1 Echo Index

The echo rate is used to adjust the speed of waveform change. The larger the value, the slower and more stable the waveform changes. Conversely, the smaller the value, the faster the waveform changes.



6.4.4.2 Echo ratio

The percentage of the echo outside the window being greater than the echo inside the window. Enter [Service] and select [Echo Ratio], which is displayed as follows:



6.4.4.3 Window Settings

Used to search the range before and after the waveform is locked. After the current echo is locked, it will search for the strongest echo within the set range. If the current echo is lost, or the material is loaded and unloaded too quickly and the echo is not tracked, it will search for the strongest echo throughout the whole process and confirm the current echo. If the previously lost echo is restored, the previously lost echo will not be confirmed. Time is the speed of arrow tracking. Enter [Service], select [Window Settings], and it will be displayed as follows:



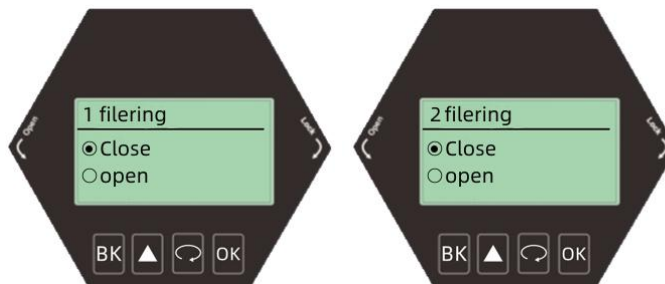
6.4.4.4 Echo Lock

If you choose to lock, you will search for signals within this window range (the window range here refers to the parameters set in the previous window). If you unlock, you will search for signals throughout the entire process. Enter [Service] and select [Echo Lock], which will be displayed as follows:



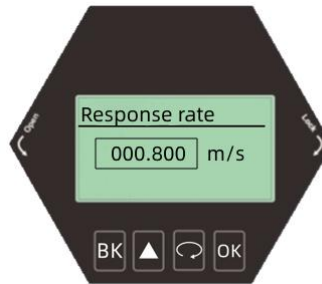
6.4.4.5 Primary Filtering/Secondary Filtering

The first and second level filters can be turned on or off according to the echo status in the measurement environment. Under normal circumstances, it is turned on by default.



6.4.4.6 Response Rate

Used to adjust the instrument's response rate to the actual material level. When the rate and time settings are changed, the response rate will automatically change. Enter [Service], select [Response Rate], and the display will be as follows:



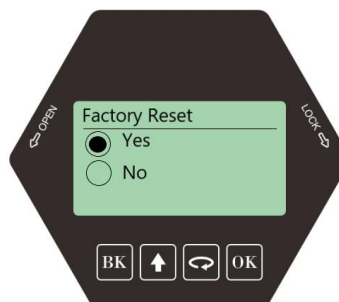
6.4.4.7 Threshold Setting

Set the threshold value of effective echo. The larger the threshold value is set, the stronger the effective echo amplitude is required on site, which is conducive to eliminating the interference of small signal clutter. Enter [Service] and select [Threshold Setting], which is displayed as follows:

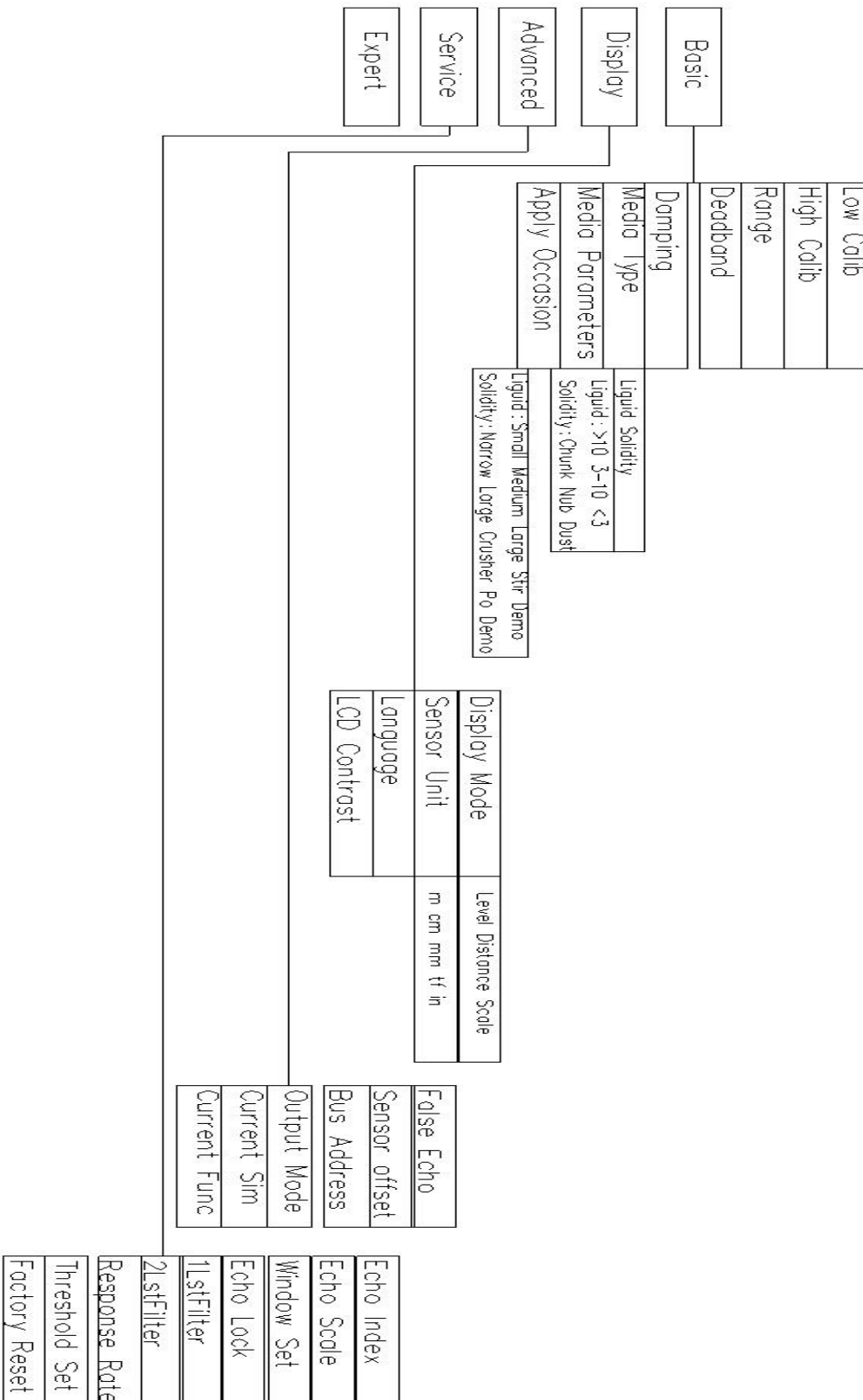


6.4.4.8 Factory Reset

Used to restore the instrument to factory settings.



7. Menu Tree



8. Fault code

The hexadecimal status code is displayed on the LCD

serial number	Hexadecimal representation	Fault description
1	0000	Works normally
2	0001	The echo is lost
3	0002	ADC or TR failure
4	0004	4-20mA alarms
5	0008	The temperature sensor is faulty
6	0010	File system alarms

If it is not listed in the table, there may be multiple errors occurring together, for example, (0003), indicating that status 2 and 3 occur together