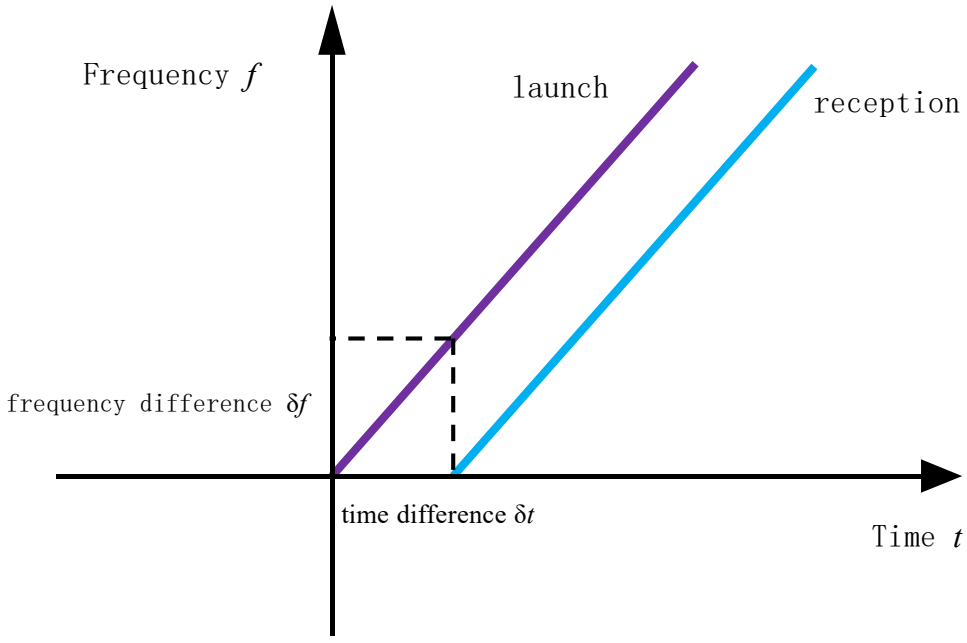
80GHz FMCW radar level meter use and selection instructions

contents

1 Product overview

1.1 Measurement Principles

The general principle of FMCW radar level meter is that the radar emits electromagnetic waves at the top of the tank, and the electromagnetic waves are received by the radar after they meet the medium reflection, and the frequency difference δf between the received signal and the transmitted signal is proportional to the distance R of the medium surface: R=C (speed) *δf (frequency difference) /2/K (frequency modulation slope). Because the speed of light C and the frequency slope K are known, the frequency difference δf can be estimated to obtain the distance R from the surface of the radar installation location, and then subtract the space distance from the radar to the surface by the known total height of the tank (referred to as the height of the air) to obtain the height of the material level.



time difference $\delta t=2R/C$

Distance $R=C\cdot \delta f/2/K$

frequency difference $\delta f=K\cdot \delta t$

Note: K is the FM slope

1.2 Product characteristics

1. The measurement accuracy of millimeter-wave radar can reach ± 1mm, and the measurement blind area is 50mm.

2. Smaller antenna size, to meet the more working conditions for measurement.

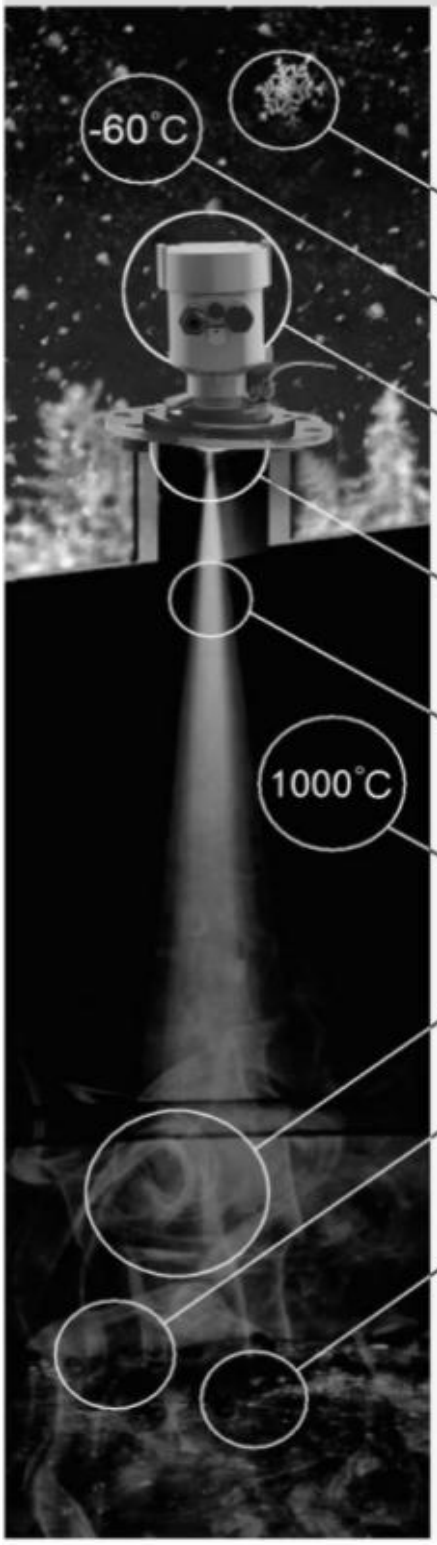
3.A variety of lens antennas, 3 emission Angle, more concentrated energy, stronger echo signal, under the same industrial and mining conditions, with higher reliability than other radar products.

4.With stronger penetration, it can also be used normally in the case of adhesion and condensation.

5.The dynamic signal range is larger and is more stable for measurements of low permittivity media.

6.Multiple measurement modes, and the radar reaction time is less than 1S in the rapid measurement mode.

1.3 The main advantage



Not affected by atmospheric precipitation

The ambient temperature is from-60 degrees Celsius

Device from the storage tank

The level-meter internal antenna consists of Fluorinated plastic lens heating protection

Measure the narrow rays Easy to install Measuring stability

Position measurement accuracy Not limited by the temperature in the container

Evaporation and dust will not affect the measurements

Boiling liquid position measurement

Position measurement of corrosive liquids,No contact, no corrosion

- - -stability measurement

80G FM radar level meter

Measurable product:

I Solid measurement

---powdered magnesium

---pulverized coal

---cement flour

---pulverized lime

II liquid measurement

---Reaction kettle fluid level

---Large steam level

---Foam product level

---Crystal product level

---Ultra-high temperature product liquid level

---Level of sanitary products

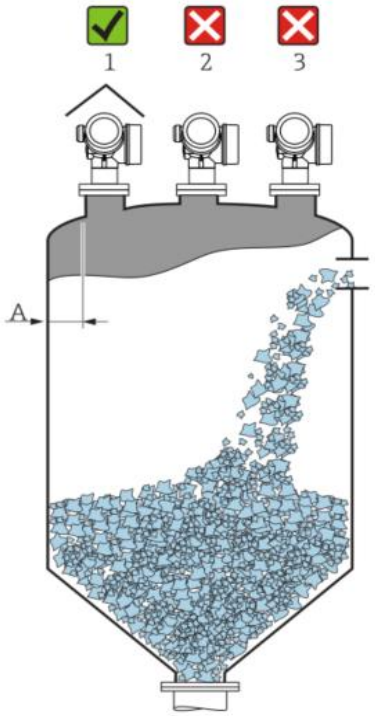
---Ultra-high pressure product liquid level

1.4 technical specifications

measuring principle	2 / 4 wire, FMCW radar
frequency range	W-band [76-81GHz]
maximum operating range	The maximum is 120 meters
certainty of measurement	±1mm
output form	4~20mA,RS-485
communication mode	HART,MODBUS
Power supply range	24±6V
Antenna form	Horn or lens antenna
Process joint	Flange starts from DN50 and thread starts from G3 / 4
Process pressure	-1···20 bar
Process temperature	-40~+200℃
Environmental storage temperature	-40~+80℃
incrustation	Casting aluminum / stainless steel
Seal between the housing and the housing cover	silicon rubber
Case window	polycarbonate
earth terminal	stainless steel
Cable inlet / plug	1 blind block M20×I.5/1 M 20xI.5 cable inlet
connecting terminal	Lead cross-section is 2.5mm²
breakdown signal	Current output is unchanged; 21mA; 3.6mA
integration time	(0 ~ 20)s, tunable
fade zone	0.05m/0.2m
Measurement interval	About 1 second (depending on the parameter settings)
governing time	About 1 second (depending on the parameter settings)
relative humidity	< 95%
shatter-proof	mechanical shock I0m/s² , (10 ~ 150)Hz
levels of protection	IP67
anti-hazard classification	ExdiaIICT6
way to install	Threaded or flange

2 Installation requirements

2.1 site selection



picture 1

The recommended distance A (the distance between the tank wall and the outer wall of the installed short pipe) is about 1 / 6 of the tank diameter, but the distance between the installed equipment and the tank wall should always be greater than 20 cm (7.87 in).

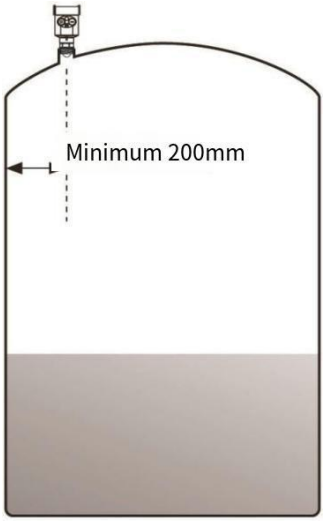
If the tank wall is not smooth (corrugated steel, weld, joint, etc.), it is recommended to install the equipment as far away as possible from the tank wall. If required, the antenna Angle adjustment device can be used to avoid interference reflection from the tank wall.

It is not recommended to install equipment in the tank center (2) because interference causes signal loss.

It is prohibited to install the device above the feed port (3).

2.2 way to install

❖ Installation mode 1: thread installation

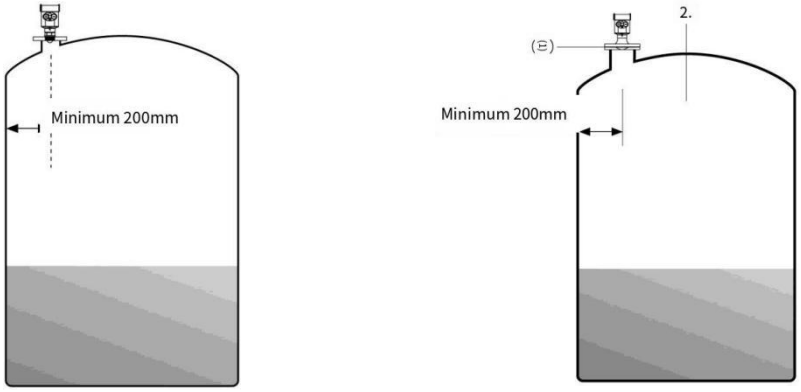


picture 2

❖ Installation method 2: Flange installation

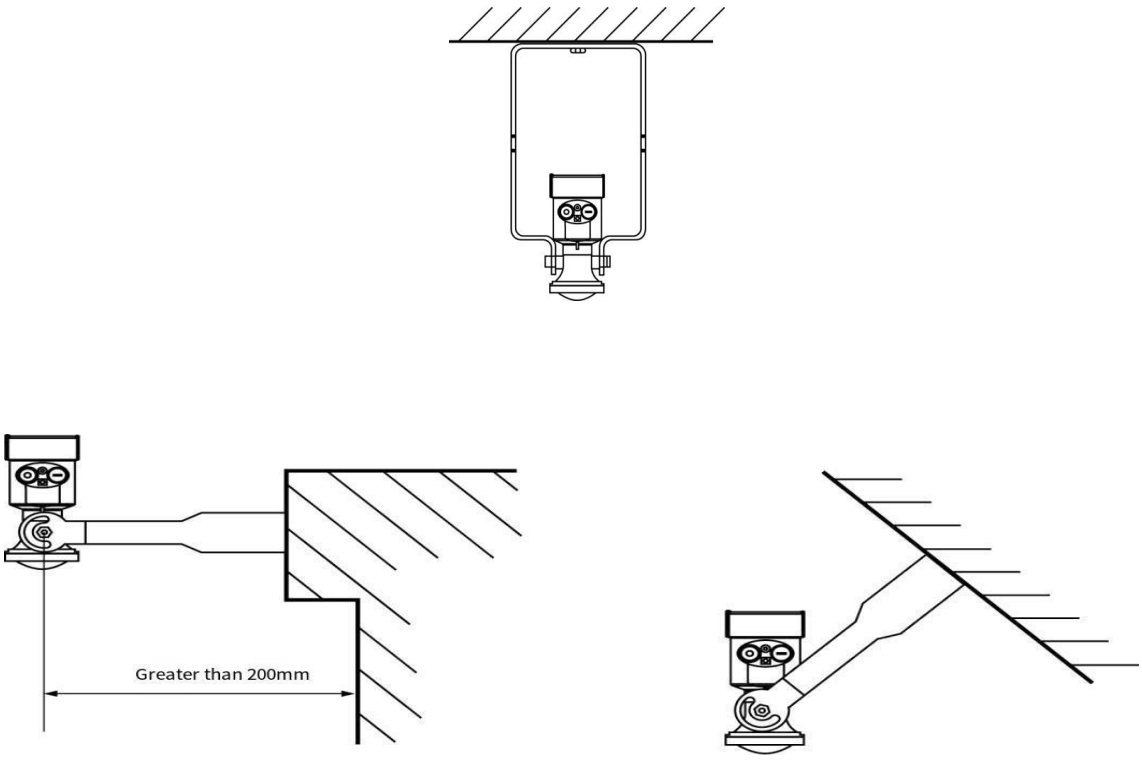
The minimum distance between instrument and tank wall should be 200mm when flange installation is adopted.

①datum surface ②Center of container or axis of symmetry



picture 3

❖ Installation method 3: hoisting (selected according to the specific installation conditions)

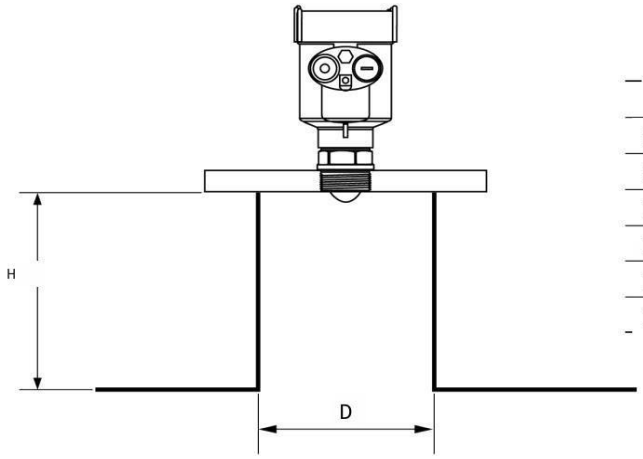


picture 4

2.3 Schematic diagram of the installation pipe：

The maximum height of H max depends on the diameter of D and the emission angle of the product. Too long the installation and takeover will affect the radar performance.

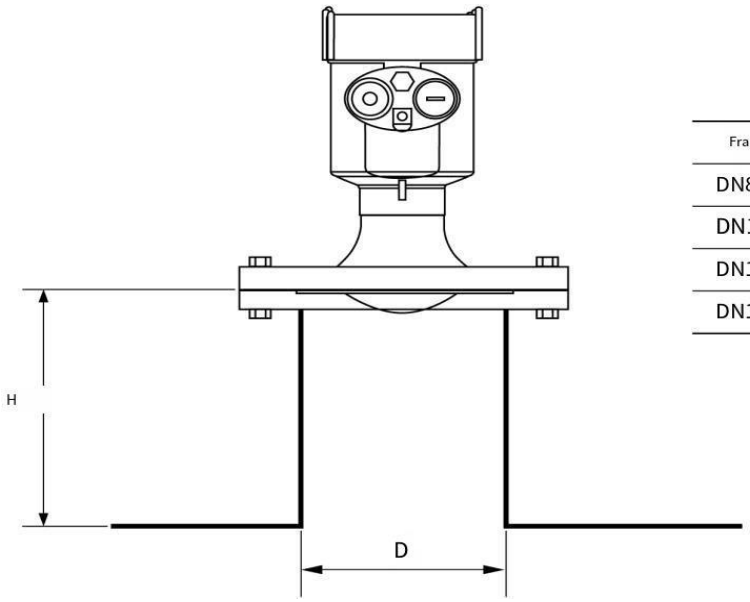
- 1.5-inch antenna, 8 emission Angle



Francois	D	H max
DN50	50mm (2") 65mm	300mm
DN65	(2.5")	450mm
DN80	80mm (3")	550mm
DN100	100mm (4")	700mm
DN125	125mm (5")	900mm
DN150	150mm (6")	1100mm

picture 5

➢ A 3.5-inch antenna, 3 emission Angle



Francois	D	H max
DN80	80mm (3")	1200mm
DN100	100mm (4")	1500mm
DN125	125mm (5")	2000mm
DN150	150mm (6")	2500mm

picture 6

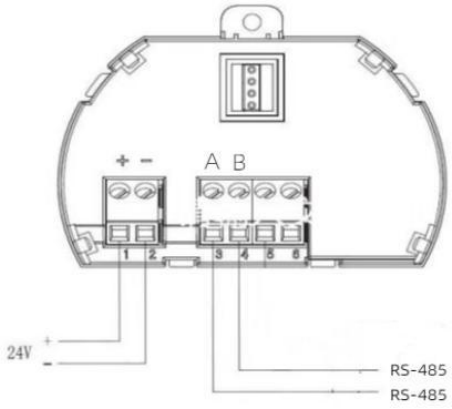
3 Electrical connection

- Supply voltage

(4~20) mA / HART / 24 ± 6V (two-wire system): the power supply and the output current signal share a two-core shielded cable.

- attended mode

➢ 24V The two-wire system wiring diagram is as follow:



picture 7

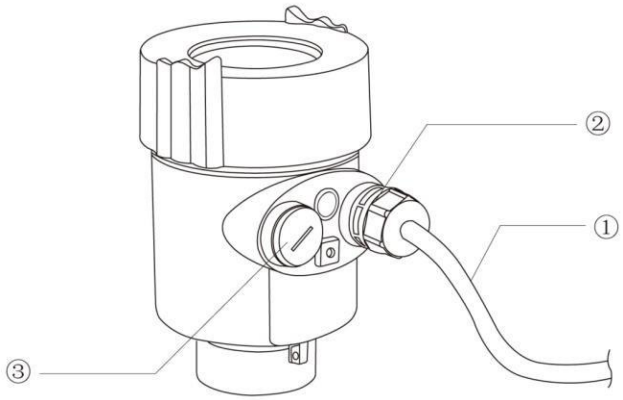
- Safety guidance

Please follow the local regulatory requirements for personnel health and safety. All operation of instrument electrical components must be performed by properly trained professionals.

Please check the nameplate of the instrument to ensure that the product specifications meet your requirements. Please ensure that the power supply voltage is consistent with the requirements on the instrument nameplate.

- levels of protection

This instrument fully meets the requirements of the protection grade IP66 / 67, please ensure the water resistance of the cable sealing head.as illustrated in following figure:



picture 8

How to ensure that the installation meets the IP67 requirements:

Please ensure that the seal head is not damaged.

Please ensure that the cable is not damaged.

Ensure that the cables used meet the electrical connection specification.

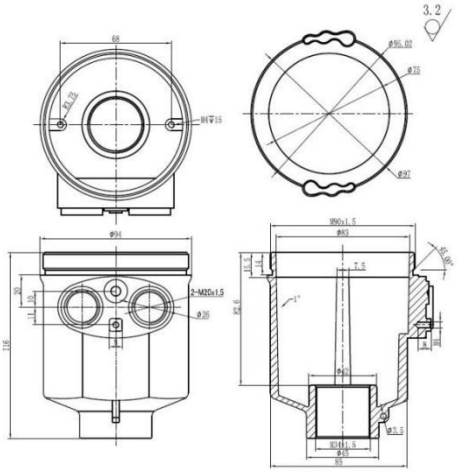
Before entering the electrical interface, bend the cable down to ensure that the water does not flow into the housing, see ① Tighten the cable seal head, see ②

Please blind the unused electrical interface, see ③

4 structure size

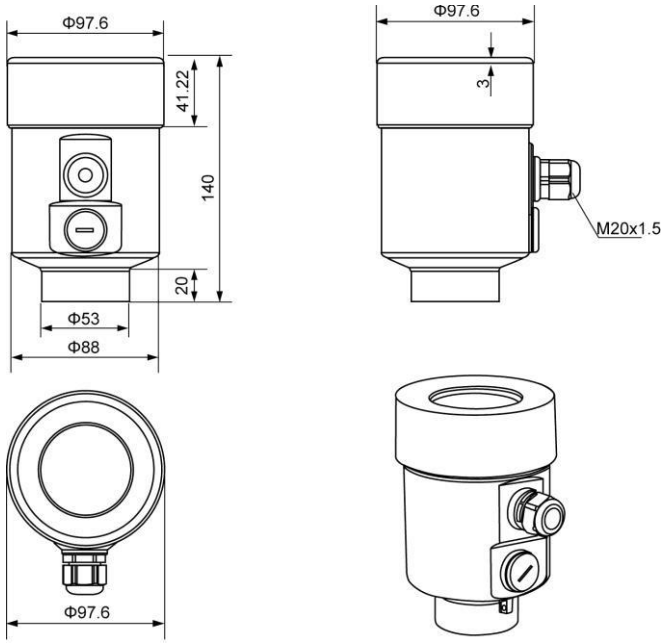
4.1 Table shell size

- Casting aluminum case



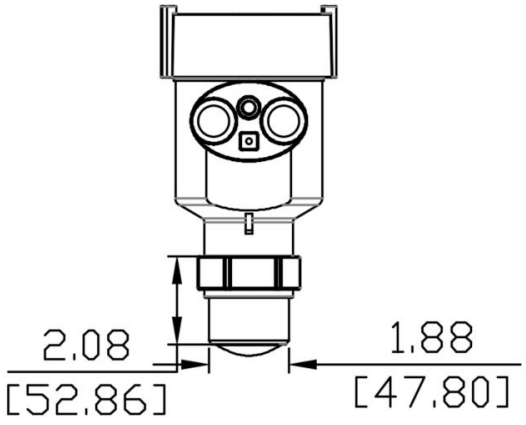
picture 9

- stainless steel watch case



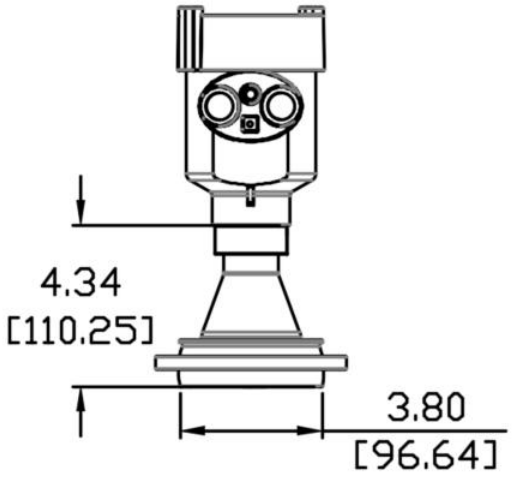
picture 10

4.2 Antenna size



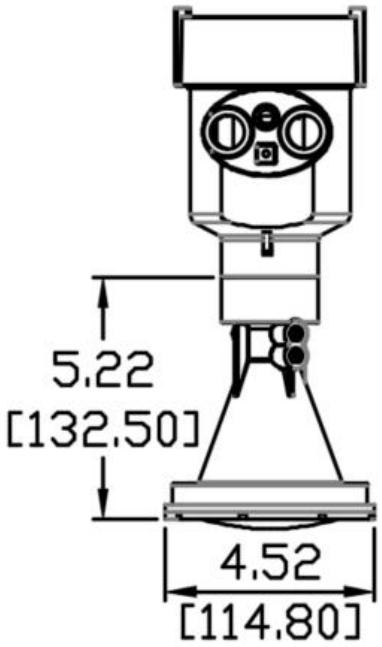
G1 1/2 Threaded antenna size

picture 11



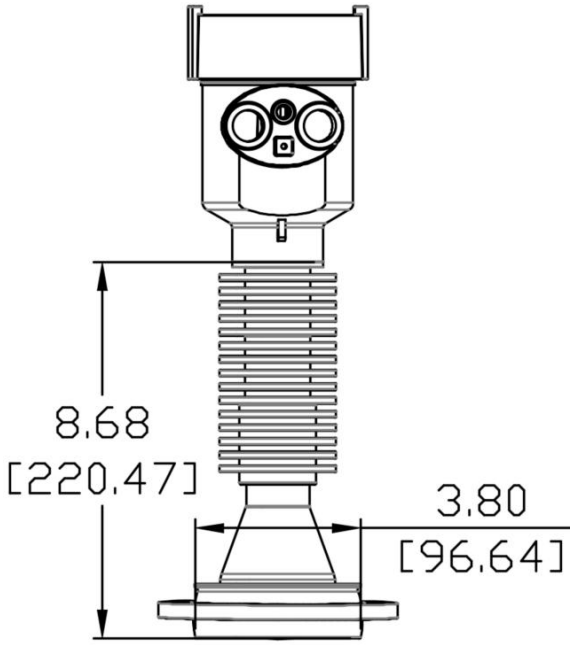
Universal horn lens antenna size

picture 12



Fixed-direction horn lens antenna dimensions

picture 13

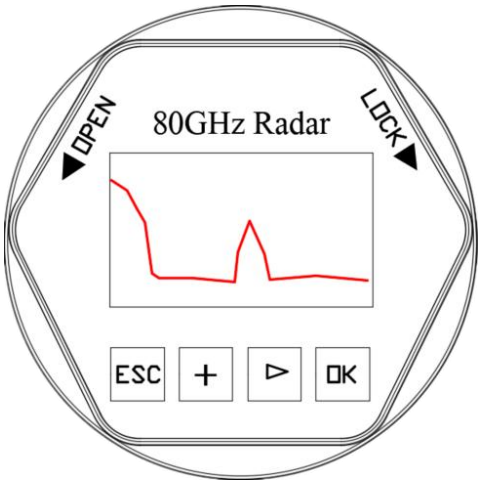


High-temperature universal horn lens antenna size

picture14

5 Debug with the Display and adjustment module

5.1 operation panel



picture 15 Field display and adjustment module

5.1.1 Button function

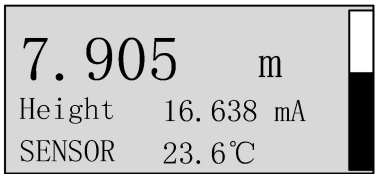
Key name	Key function
【ESC】	● Exit input ● Jump back to the previous menu ● Shortcuts switch the echo curve interface / main interface
【+】	● Change the parameter value ● Shortcut key switch the main interface shows the value of empty high / material high / current
【▶】	● Replace the display of the measurements ● Select the entry in the list ● Select menu items ● Select the edit location ● Shortcut key echo curve interface: displays / hide the envelope ● Main interface: displays the current setting parameters and running time
【OK】	● Switch to the Menu overview ● Confirm the selected menu ● Edit the parameters ● Store the value

Note: Press ESC and OK key at the same time for 5s to restart the device6.2 main interface

5.2 main interface

5.2.1 main interface

The running screen is the first screen after the device is powered on, that is, the main screen.

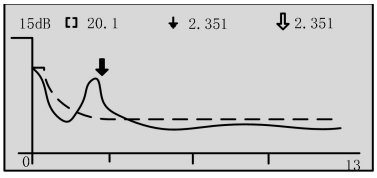


picture 16 main interface

- 7.905：indicating the current measurement value
- Material height：indicating that the current measurement value is the material level height
- SENSOR：Indicates the sensor label
- 16.638mA：Indicates the current output current
- 29.9℃：Indicates the current temperature
- M：Indicates the current unit of measurement value

5.2.2 The echo curve

At the main interface, press [ESC] to enter the echo curve interface.



picture 17 The echo curve

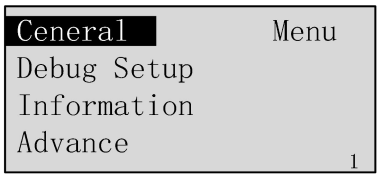
- 20.1：Indicates the current voltage
- Solid and hollow arrows indicate the current real-time measurement distance

and the main interface output distance, respectively

- 13：Indicates the abscissa measurement range
- 15 dB：Indicate the maximum echo power

5.3 Basic Settings

On the main interface, press [OK] to enter the main menu.

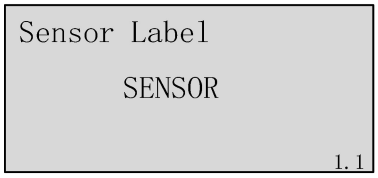


picture 18 primary menu

- Basic settings：General settings for the parameter settings
- Professional setting： Radar output characteristic setting
- Information：the hardware model and software model of the equipment
- Advanced：equipment upgrade and restore factory settings, etc

5.3.1 Sensor label

As shown is the sensor tag interface diagram.

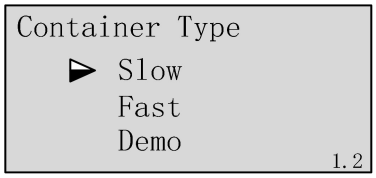


picture 19 Sensor label

- Location：The General 1.1 tab
- Function：in multiple radar equipment, mark each radar mark for distinguish
- Use:：type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.3.2 application scenarios

The interface diagram shows the application scenario.

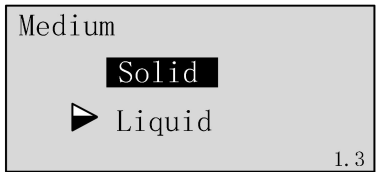


picture 20 application scenarios

- Location: The General 1.2 tab
- Function: Set up the application scenarios of radar work
- Use: type [OK] to operate and determine, and type [▸] to select

5.3.3 Medium characteristic

A diagram of the media characteristic interface is shown in Fig.

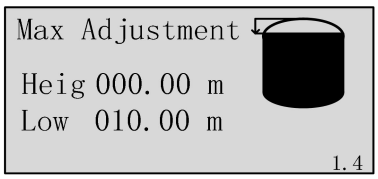


picture 21 media characteristics

- Location: The General 1.3 tab
- Function: Set up the characteristics of the radar measurement media
- Use: type [OK] to operate and determine, and type [▸] to select

5.3.4 Material position adjustment

The interface diagram of material level adjustment is shown in Fig.

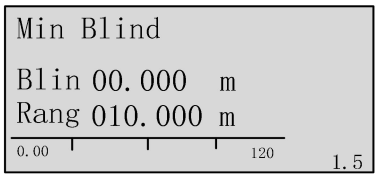


picture 22 Material adjustment

- Location: The General 1.4 tab
- Action: Distance and 4... 20 mA current mapping relationship
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.3.5 measuring range

An interface diagram of the measurement range is shown in Fig.

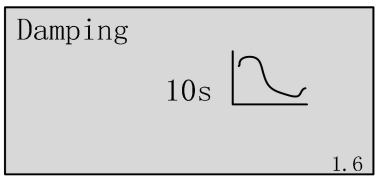


picture 23 measuring range

- Location: The General 1.5 tab
- Function: Set the longest distance and minimum blind area for radar measurement
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.3.6 Damping

The damped interface diagram is shown.



picture 24 Damping

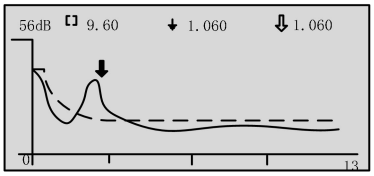
- Location: The General 1.6 tab
- Function: make the output of the measured value smoother, the larger the value, the smoother
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4 Professional Settings

5.4.1 debug

5.4.1.1 The echo curve

The interface diagram of the echo curve is shown.

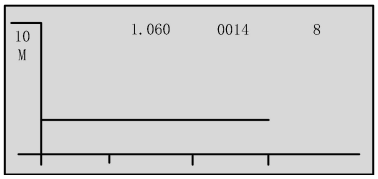


picture 25 The echo curve

- Location: The General 2.1.1 tab
- Action: View the current echo curve

5.4.1.2 Historical curve

A historical curve interface diagram is shown in Fig.



Picture 26 Historical curve

- Location: The General 2.1.2 tab
- Action: View historical measurements

5.4.1.3 Fault list

As shown in the fault list interface diagram.

Picture 27 fault list

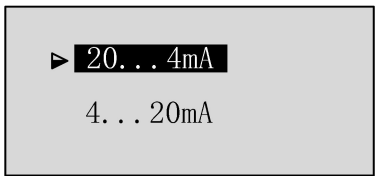
- Location: The General 2.1.3 tab
- Function: View the device history failure situation
- Fault code: See Attachment fault code

5.4.2 Settings

5.4.2.1 Current mode

- characteristic curve

The figure is the interface diagram of the characteristic curve in the current mode.

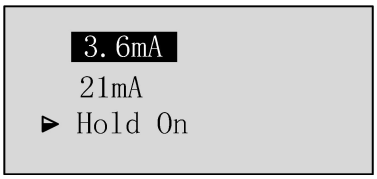


Picture 28 characteristic curve

- Location: The General 2.2.1.1 tab
- Function: the maximum set value and minimum set value and current mapping, as shown above, the maximum set value corresponds to 20 mA, the minimum set value corresponds to 4 mA
- Use: type [OK] to operate and determine, and type [▸] to select

- fault-pattern

he diagram is the interface diagram of the fault mode in the current mode.

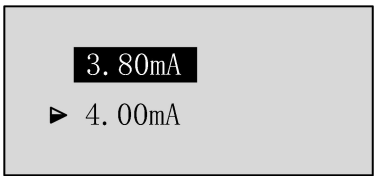


Picture 29 fault-pattern

- Location: The General 2.2.1.2 tab
- Action: When the device has an error, the output mode of the current, with the option shown above, maintains the current value when the device fails
- Use: type [OK] to operate and determine, and type [▸] to select

- minimum current

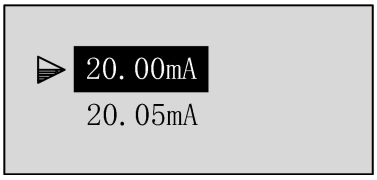
The current interface diagram shows the minimum current in the current mode.



Picture 30 minimum current

- Location: The General 2.2.1.3 tab
- Function: represents the minimum current output of the device
- Use: type [OK] to operate and determine, and type [▸] to select
- maximum current

Shown is the maximum current interface diagram in the current mode.

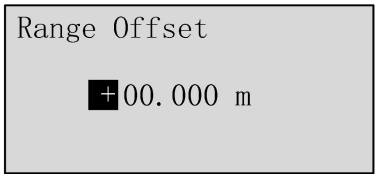


Picture 31 maximum current

- Location: The General 2.2.1.4 tab
- Function: represents the maximum current output of the device.
- Use: type [OK] to operate and determine, and type [▸] to select

5.4.2.2 Distance offset

As own is the distance offset interface diagram.

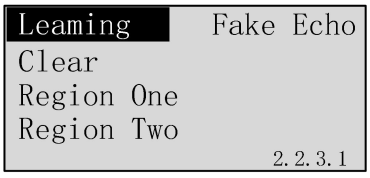


Picture 32 Distance offset

- Location: The General 2.2.2 tab
- Role: Calibrate the fixed deviation of the measured distance
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4.2.3 Suprious echo

The Suprious echo interface diagram is shown in Fig.

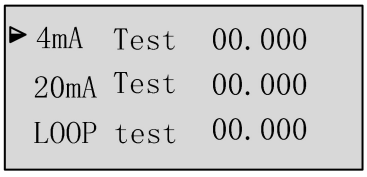


Picture 33 Suprious echo

- Location: The General 2.2.3 tab
- Function: When there is a distractor echo to be screened, false echo learning
- Use: type [OK] to operate and determine, and type [▸] to select
- First, choose echo learning, yes
- Then the false region one is set according to the false echo position
- If there are other false echo areas, set up the false area 2

5.4.2.4 Current calibration

The interface diagram of the current calibration is shown in Fig.



Picture34 current calibration

- Location: The General 2.2.4 tab
- Action: Fixed deviation of 20 mA and 4 mA calibrcalibration by simulation current
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4.2.5 language

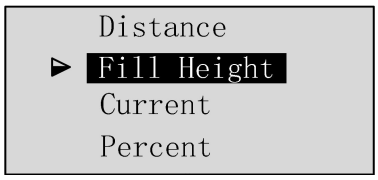
The language interface diagram is shown.

Picture 35 language

- Location: The General 2.2.5 tab
- Function: Menu language, including simplified Chinese and English
- Use: type [OK] to operate and determine, and type [▶] to select

5.4.2.6 Display

The display interface diagram is shown in Fig.

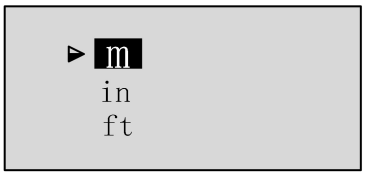


Picture 36 display

- Location: The General 2.2.6 tab
- Function: The main interface shows the meaning of the value, and the default is the material height display
- Use: type [OK] to operate and determine, and type [▶] to select

5.4.2.7 Unit

Unit interface diagram is shown in Fig.



Picture 37 Unit

- Location: The General 2.2.7 tab
- Function: Units of measurement value, including meters, inches, and feet
- Use: type [OK] to operate and determine, and type [▸] to select

5.4.2.8 Contrast

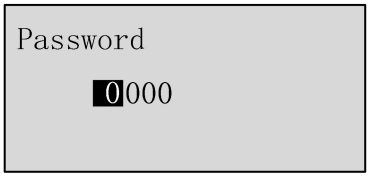
The contrast interface diagram is shown in Fig.

Picture 38 contrast

- Location: The General 2.2.8 tab
- Function: Select the appropriate contrast by adjusting the light / dark
- Use: type [OK] to operate and determine, type [+] brightening, type [▸] dimming

5.4.3 Experts

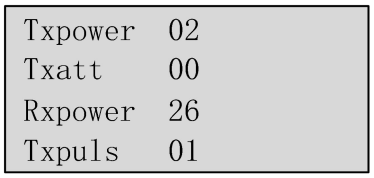
The figure shown is the expert interface diagram. Password 1000



Picture 39 Experts

5.4.3.1 Gain Adjustment

The gain-adjustment interface diagram is shown in Fig.

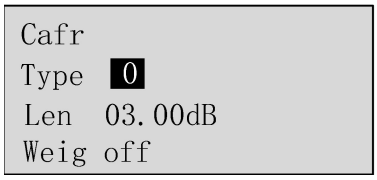


Picture 40 Gain Adjustment

- Location: The General 2.3.1 tab
- Function: Adjust the appropriate power according to the actual scenario
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4.3.2 Envelope line

The figure shows the interface diagram of the envelope line.

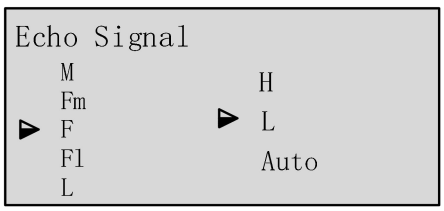


Picture 41 enveloping line

- Location: The General 2.3.2 tab
- Function: Envelope type 0, that is, the radar automatically calculates the envelope parameters, when the overall need to improve or reduce the envelope, the weight can be adjusted
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4.3.3 Echo Signal

As own is the echo signal interface diagram.

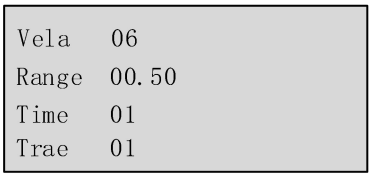


Picture 42 echo signal

- Location: The General 2.3.3 tab
- Function: Select the specific echo signals according to the actual situation of the site
- Use: type [OK] to operate and determine, and type [▸] to select

5.4.3.4 Material velocity

The interface diagram of material velocity is shown in the figure.

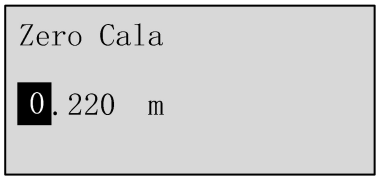


Picture 43 Material velocity

- Location: The General 2.3.4 tab
- Action: Smooth the measured value output by adjusting the material speed
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4.3.5 Zero Point Calibration

Shown is the zero cal calibration interface diagram.

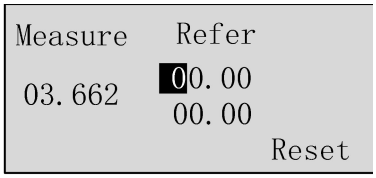


Picture 44 zero Point Calibaration

- Location: The General 2.3.5 tab
- Function: Calibrate the zero point before leaving the factory
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4.3.6 Range calibration

The interface diagram of distance calibration is shown in the figure.

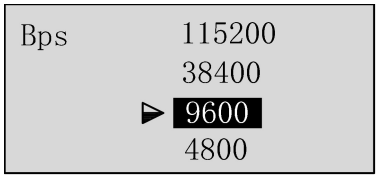


Picture 45 Range calibration

- Location: The General 2.3.6 tab
- Function: Calibrate the measured distance in the actual measurement
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

5.4.3.7 Baud rate

The baud rate interface is shown in the figure.

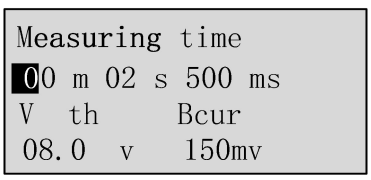


Picture 46 baud rate

- Location: The General 2.3.7 tab
- Function: the transmission rate during communication, the default is 9600
- Use: type [OK] to operate and determine, and type [▸] to select

5.4.3.8 Measuring time

The diagram of the measurement time interface is shown in Fig.



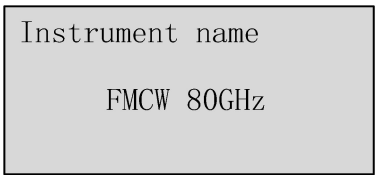
Picture 47 measuing time

- Location: The General 2.3.8 tab
- Action: Adjust the measurement time by changing the parameters
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▶] to select the edit location

5.5 Information

5.5.1 Instrument name

The interface diagram of instrument name is shown in the figure.

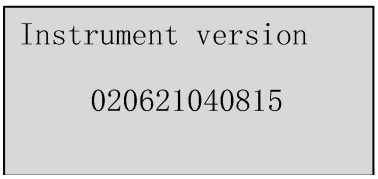


Picture 48 Instrument name

- Location: The General 3.1 tab

5.5.2 Instrument version

The interface diagram of the version is shown.

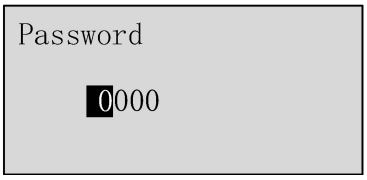


Picture 49 Instrument version

- Location: The General 3.2 tab

5.5.3 Other

Other interface drawings are shown as shown.



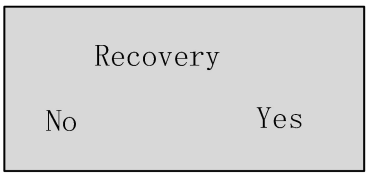
Picture 50 other

- Location: The General 3.3 tab
- Function: Use a reserved menu
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▶] to select the edit location

5.6 Senior

5.6.1 Factory recovery

As shown in the figure, the factory interface is restored.

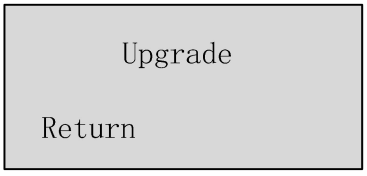


Picture 51 Factory recovery

- Location: The General 4.1 tab
- Action: Device parameters are returned to the default factory value
- Use: Type [OK] to operate and determine

5.6.2 Software Upgrade

A diagram of the software upgrade interface is shown.

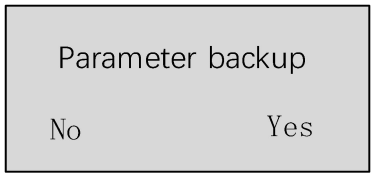


Picture 52 software upgrade

- Location: The General 4.2 tab
- Function: the device software upgrade
- Use: Type [OK] to operate and determine

5.6.3 Parameter backup

The figure shows the parameter backup interface.

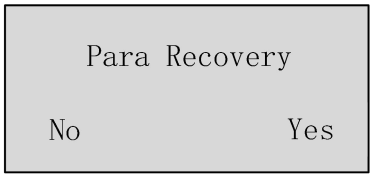


Picture 53 Parameter backup

- Location: The General 4.3 tab
- Action: Backup existing setting parameters
- Use: Type [OK] to operate and determine

5.6.4 Recovery Backup

The figure is the recovery backup interface diagram.

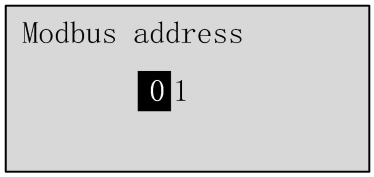


Picture 54 recovery backup

- Location: The General 4.4 tab
- Action: restore parameters for parameter backup
- Use: Type [OK] to operate and determine

5.6.5 MODBUS address

The Modbus address interface diagram is shown in Fig.



Picture 55 MODBUS address

- Location: The General 4.5 tab

- Function: The address communicated via the MODBUS protocol
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

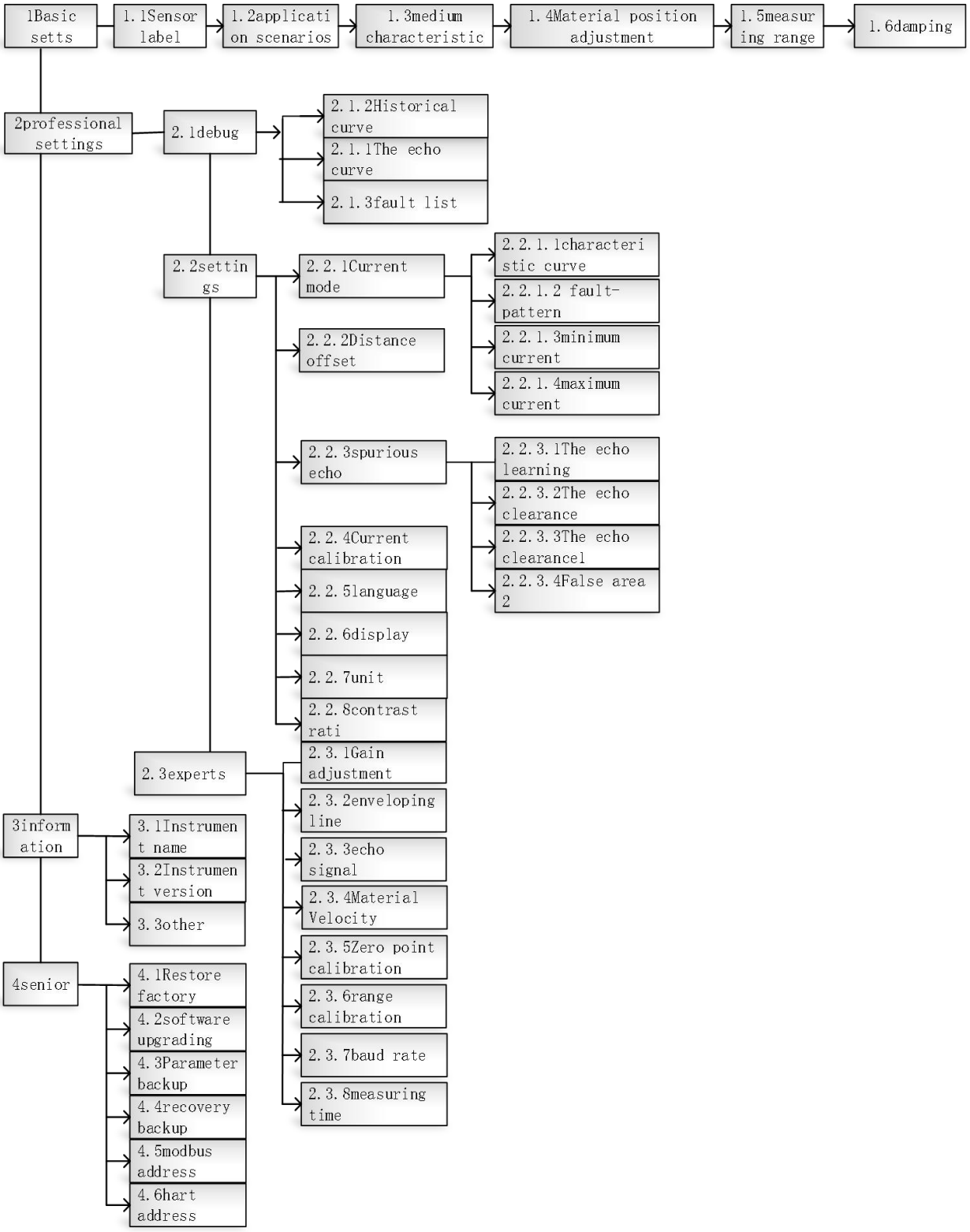
5.6.6 Hart address

The figure shows the Hart ID interface diagram.

Picture 56 Hart address

- Location: The General 4.6 tab
- Function: Switch and address to the communication via the HART protocol
- Use: type [OK] to operate and determine, type [+] to set the value size, and type [▸] to select the edit location

6 Menu tree


1Basic setts
1.1Sensor label
1.2application scenarios
1.3medium characteristic
1.4Material position adjustment
1.5measuring range
1.6damping
2professional settings
2.1debug
2.1.2Historical curve
2.1.1The echo curve
2.1.3fault list
2.2settings
2.2.1Current mode
2.2.1.1characteristic curve
2.2.1.2 fault-pattern
2.2.1.3minimum current
2.2.1.4maximum current
2.2.2Distance offset
2.2.3spurious echo
2.2.3.1The echo learning
2.2.3.2The echo clearance
2.2.3.3The echo clearancel
2.2.3.4False area 2
2.2.4Current calibration
2.2.5language
2.2.6display
2.2.7unit
2.2.8contrast rati
2.3experts
2.3.1Gain adjustment
2.3.2enveloping line
2.3.3echo signal
2.3.4Material Velocity
2.3.5Zero point calibration
2.3.6range calibration
2.3.7baud rate
2.3.8measuring time
3information
3.1Instrument name
3.2Instrument version
3.3other
4senior
4.1Restore factory
4.2software upgrading
4.3Parameter backup
4.4recovery backup
4.5modbus address
4.6hart address

7 error listing

code	Troubleshooting	Troubleshooting
E01	Internal data error	Check the internal connector for loosening
E02	Voltage is above 30V or below 10V	Wait for self-recovery or power outage to restart
E03	Temperature is above 100℃	Power off for a while and power back on again
E04	Internal data transfer failed	Wait for self-recovery or factory setting
E05	Data upload failed	Wait for self-recovery or factory setting
E07	Parameter configuration initialization failed	factory data reset
E08	The measured voltage is less than 12V	Wait for self-recovery or factory setting
E09	The on program self-test failed	Wait for the repeated self-test to pass

appendix:

Consulting the common parameters of radar level meter

Model of radar level meter:_____

Power supply requirements:_____

range:_____

Process temperature:_____

Process pressure:_____

media characteristics:_____

Antenna material requirements：_____

Other accessories requirements：_____

remarks: