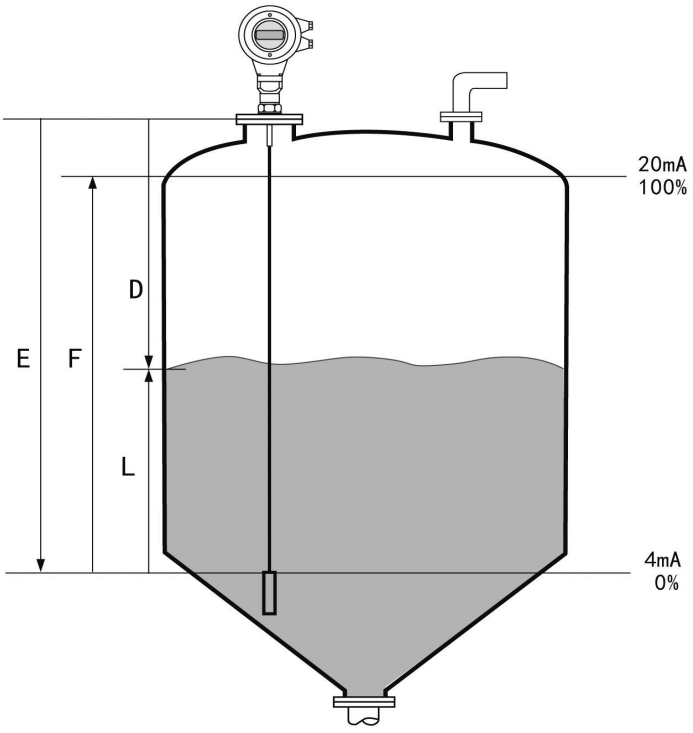
RD70X Guided Wave Radar Level Transmitter

RD70X Guided Wave Radar Level Transmitter is a level measuring instrument based on the principle of time travel. Radar waves operate at the speed of light, and the operating time can be converted into level signals through electronic components. The probe emits high-frequency pulses and propagates along the cable or rod probe. When the pulses encounter the material surface, they are reflected back and received by the receiver inside the instrument, converting the distance signal into a material level signal.



The reflected pulse signal is transmitted along the cable or rod probe to the electronic circuit part of the instrument, and the microprocessor processes this signal to identify the echo generated by the microwave pulse on the material surface. The correct recognition of echo signals is completed by pulse software, and the distance D from the material surface is proportional to the time travel T of the pulse:

$D=C\times T/2$

Where C is the speed of light

Since the distance E of the empty tank is known, the material level L is:

$L=E-D$

By inputting the empty tank height E (=zero point), full tank height F (=full range), and some application parameters, the application parameters will automatically adapt the instrument to the measurement environment. Corresponds to a 4-20mA output.

Measurement Explanation:

H - Measurement range

L - Empty tank distance

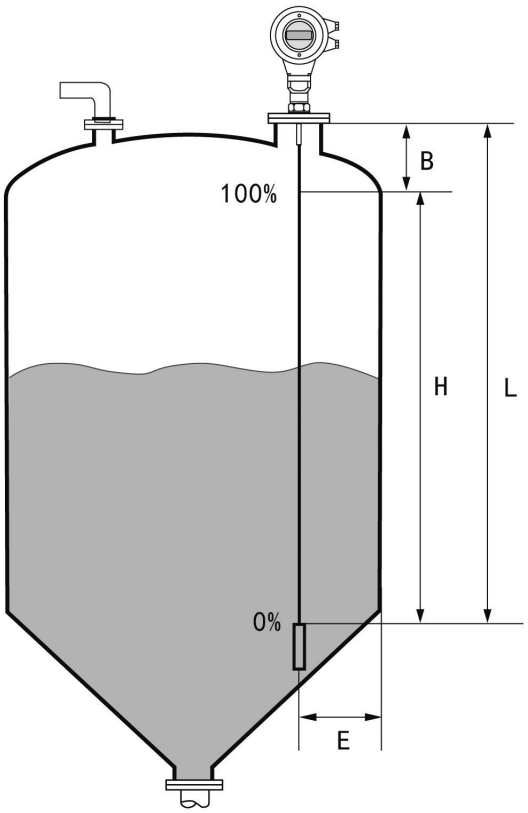
B - Top blind spot

E - Minimum distance from probe to tank wall

The top blind spot refers to the minimum distance between the highest material surface and the measurement reference point.

The bottom blind spot refers to a distance near the bottom of a cable that cannot be accurately measured.

There is a limited measurement distance between the top blind spot and the bottom blind spot. Only when the material is between the top blind zone and the bottom blind zone can reliable measurement of the level inside the tank be ensured.



1. Technical Description

1.1Technical Parameter

Working frequency ： 100MHz～1.8MHz

Measuring range: cable type 0～30m/rod, double rod, coaxial tube：0～6m

Repeatability:±2mm

Resolution:1mm

Precision:<0.1%

Sampling: echo sampling 55 times/s

Response speed:>0.2s（depending on the actual usage）

Output current signal:4～20mA

Communication interface: HART communication protocol

Process connection：G1½B Screw thread

DN50、DN80、DN100、DN150、DN200、DN250 Flange

Process pressure：-0.1MPa～2MPa

Power supply：24V DC（±10%）

Ripple voltage：1Vpp

Power consumption: max 22.5mA

Environmental conditions：-40℃～70℃

Anti-explosion：Exia ⅡC T6

Protection grade：IP67

Connection: instrument power supply and signal output share a core shielded cable （Two-wire）

Cable entry: two M20×1.5 or ½ NPT （ cable diameter：5～9mm）

The relationship between different categories of measured media and measurement distance

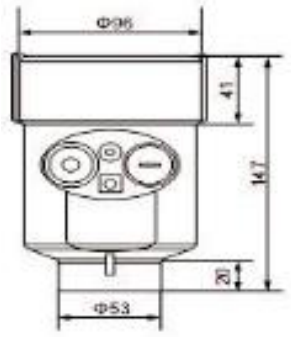
Medium group	DK(ε)	Solid particles	Liquid	Measuring range

1	1.4~16		Condensing gas	3m(refers only to the coaxial rod probe)
2	1.6~19	Plastic with particle, limestone、special cement sugar	LPG、Solvent、Freon 12、Freon、Palim	25m
3	1.9~25	Portland cement, gypsum	Mineral oil, fuel	30m
4	1.9~25	Grain、seed、stone、sand	Benzene、styrol、toluene, furan, Naphthalene	30m
5	2.5~4	Wet stone、mineral、salt	Chlorobenzene、chloroform、cellulose spray、isocyano	30m
6	>7	Metal powder、carbon black coal	Aqueous liquid, alcohol, liquid nitrogen	30m

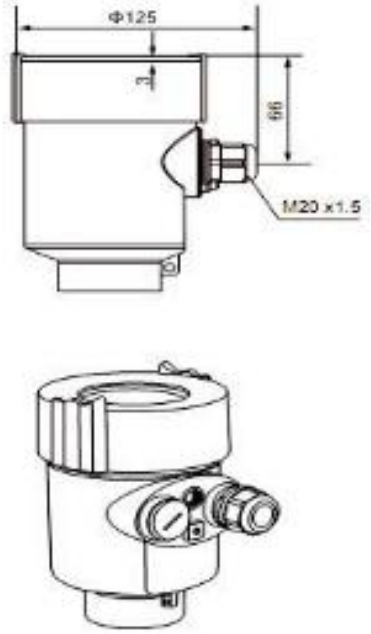
1.2 Dimension

Housing

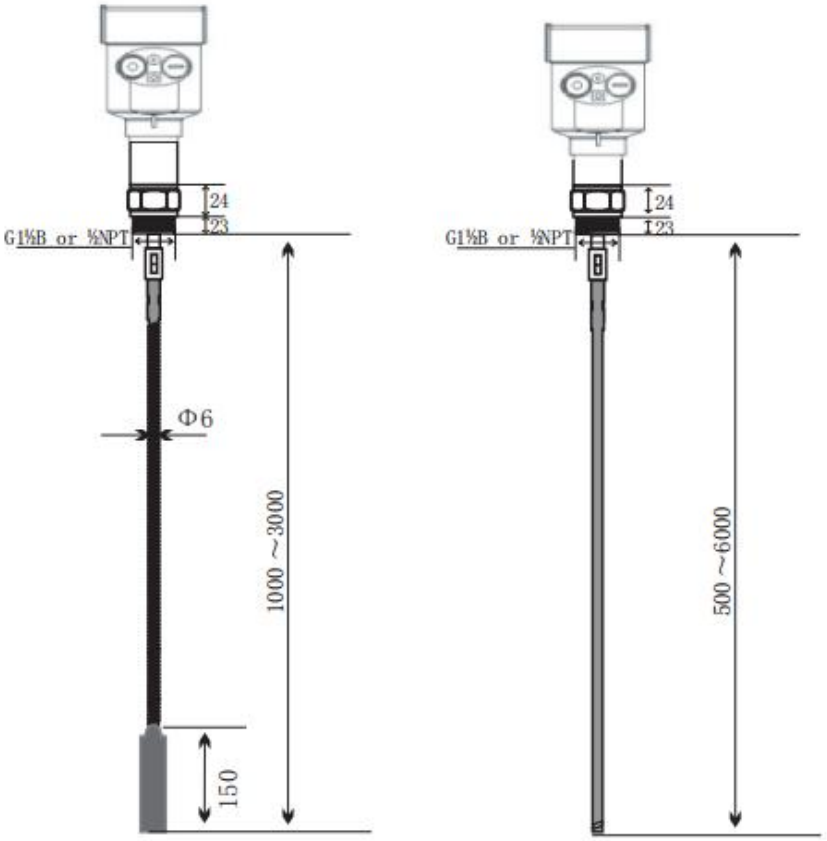
Material：AL/316L

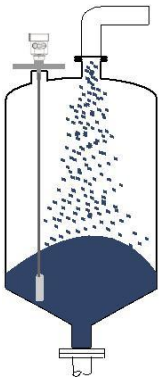


Cable type：



Rod type：





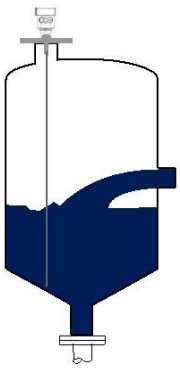
2 Installation and Debugging

2.1 Installation Guide

The following guidelines apply to the cable and the rod probe measurement of solid particles
and liquid mediums, coaxial tube probe is only applicable to the liquid material.

2.2 Installation Requirement

The right diagram is cable type radar installation, which is mainly used to measure solid particles.



▶ Best to stay far away from the discharge hole and the feeding hole.

▶ For metal tanks and plastic tanks, try not to touch the wall in whole measuring process and range. If it is metal tank, the level instrument can not be installed in the middle of tank.

▶The instrument should be installed at a quarter of the diameter of the tank.

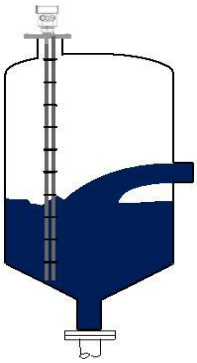
▶The minimum distance from the cable probe or rod probe is no less than 30mm.

▶The probe from the tank bottom is about 30mm. The minimum

▶The minimum distance from the probe to the tank obstacles is no less than 200mm

▶If the container bottom is tapered， the sensor can be installed in the middle of the tank to.

The right diagram is rod type radar installation, which is mainly used to measure liquids.



▶It can be used to measure any medium when the dielectric constant is equal or greater than 1.9. Usually it is used to measure the medium when the
▶Usually it is used to measure the medium when the viscosity is equal or less than 500cst, and not easy to produce adhesive.
▶The radar has a strong inhibition to steam and foam， which will not affect the measurement.

The right diagram is double rod type，which is mainly used to measure liquids.

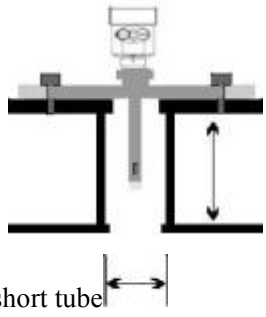
▶ When measuring low dielectric constant medium to maintain the accurate measurement. It can used double cable type
▶It can be used to measure any medium when the dielectric constant is equal or greater than 1.6.
▶ Usually it is used to measure the medium when the viscosity is equal or less than 500cst,and not easy to produce adhesive.
▶The radar has a strong inhibition to steam and foam. which will not affect the measurement.
▶ The maximum distance of double rod type radar is 6 meters

2.3 Installation Method

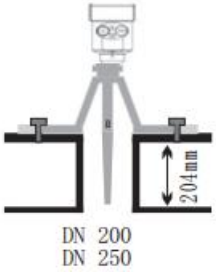
▶ Reasonable installation can ensure long-term usage and reliable, accurate measurement. when Instrument apply threaded connection, the thread length shall not exceed 150mm, and the short pipe installation can be applied. The short tube diameter should between 2 "to 6",and then the diameter of installation pipe should be less than 150mm.If it's installed on the longer pipe, cable probe should be fixed at the bottom of the bracket to avoid the probe cable in contact with the short end of the tube 。

Threaded installation:

Short tube installation:



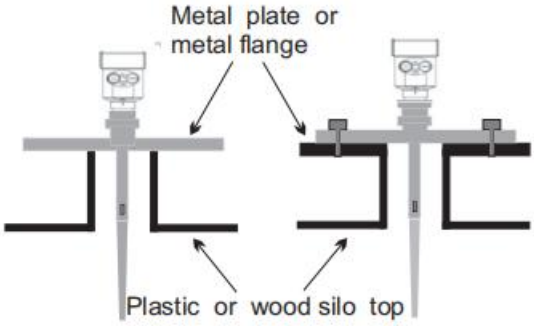
▶ Installation of DN200 or DN250 in the pipe When the meter needs to be installed in a short tube with greater than 200mm diameter, echo generated in the short tube wall, which will cause measurement errors in the situation of a low dielectric permittivity. Therefore, as for the pipe with diameter of 200mm or 250mm, it is needed the special flange with a "horn Interface".



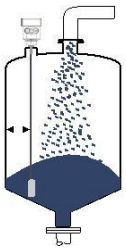
▶ Installed on plastic pot

Whether it is cable or rod-type instrument, the process connecting surfaces should be metal.

When it's installed on plastic pot, and the pot top is plastic or other non-conductive material, then metal flange is needed for the instrument, if adopt threaded connection, the metal plate should be equipped.



▶ Distance between the instrument probe and the tank wall



The distance between the meter probe and the tank wall is suggested to be 1/6~1/4 of the tank diameter(the mini. value is greater than 300mm, while it's at least 400mm for concrete tank) for probe length selection, the distance between the probe bottom and the tank bottom is about more than 30mm.

Note:

Do not install the radar at the next discharge port (Figure I)

Avoid other devices inside the tank to come into contact with the microwave conductivity components (Figure II)

Avoid cable to come into contact with short tube installation(Figure III)

Figure I

Figure II

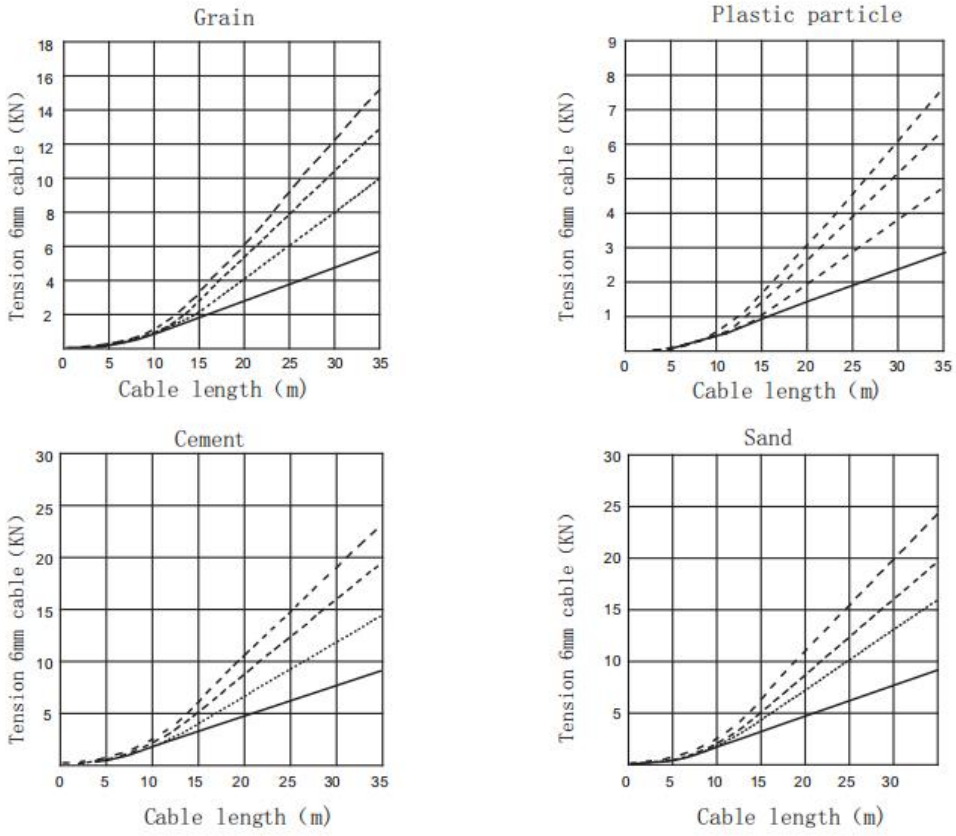
Figure III

The down pull suffered by cable

During the process of charging and discharging, the media will have down pull on the cable and the force strength depends on the following factors:

1. cable length 2. material density 3. silo diameter 4. Cable diameter.

The following is the pressure that generate by typical medium of 6mm cable probe:



Optimization of the interference

Interference echo suppression: The software can realized the suppression of the interference echo, and thus achieve the ideal measurement results.

The bypass pipe and waveguide pipe (for liquid only) :the bypass pipe, waveguide pipe or the tubular to avoid interference, if the viscosity is less than 500cst.

Corrosive media measurement

For corrosive media measurement, the rod probe can be selected with plastic sleeve or tetra fluoride sleeve.

Fixation of the guided wave radar probe ends

1.There's two fixed ways for the probe end to be applied in fixed occasions: one is insulated fixation; another is non-insulated fixation.

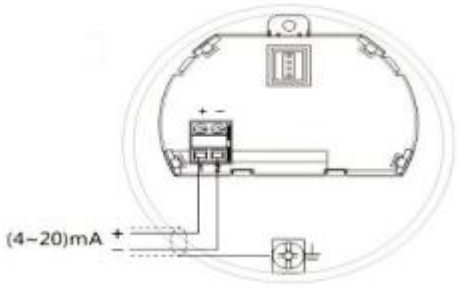
2.Insulation fixation indicate that the measured media with lower dielectric constant and fixed in metal tank bottom needs insulation fixed;

3.Non-insulated fixation refers to the measured media with high dielectric permittivity, the tank is non-metallic materials, low dielectric constant material and the material with similar dielectric permittivity that compared to the measured media, then non-insulation fixation can be applied.

Note: If the user cannot determine the dielectric constant of the medium and the tank, please contact the manufacturer.

2.4 Connection Mode

24V two-wire wiring diagram:



2.5 Instrument debugging

Display/ keypad

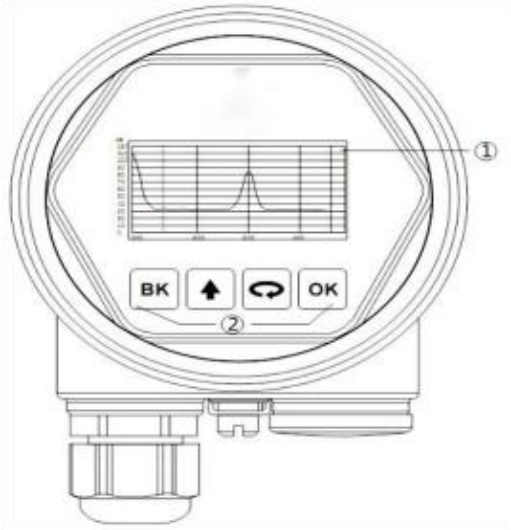
Upper computer debugging

HART handheld programmer

Display/ keypad

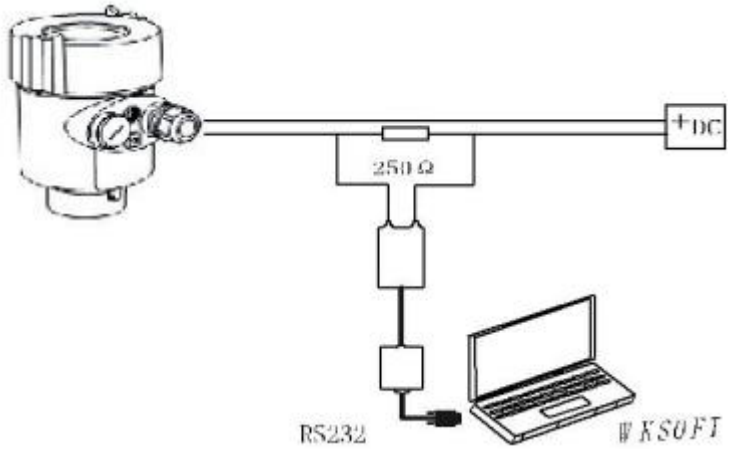
To debug by the four keys on the LCD of the instrument, the language is optional; after debugging, it is generally used for display. It's quite clear to read off the measured values (See instrument keypad setup instructions

Display/keypad: 1. LCD 2. Keypad

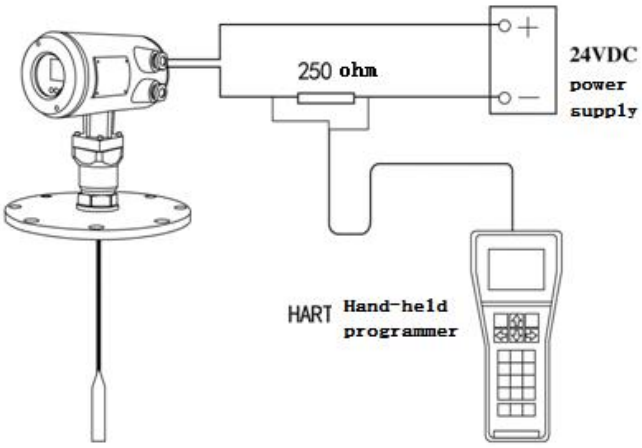


Upper computer debugging Connect with upper computer by HART

① RS232 / USB interface ② Radar Level Transmitter ③ HART adapter ④ 250Ω resistor



ART handheld programmer



① HART handheld programmer ② Radar Level Transmitter ③ 250Ω resistor

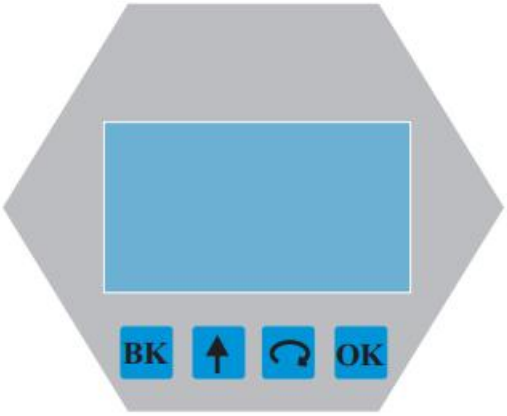
3 Key set the operating instructions Interface （keypad description）

BK :Exit settings return to the parent menu

OK :Enter the menu confirm the setting

:Move the cursor browse the menu

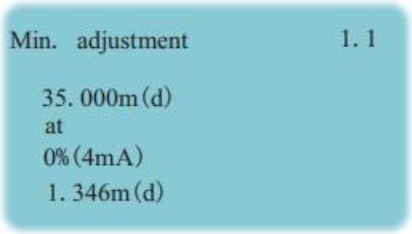
:Select parameters, modify the numbers



4 Operating Instruction

4.1 Min. Adjustment

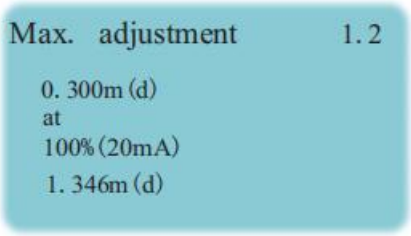
Min. adjustment is used to adjust the measuring range. It determines the corresponding relationship of output current with Max. adjustment. In the main menu, when the menu number displays 1, please press " OK" key to enter the basic setup sub menu, the LCD display as following:



Press ″OK″ key to enter programming lowest level percent and edit a percent value and distance according to the above characters or digital parameters in the parameter edit method of programming methods . If the editing is finished, please press ″ OK″ key to confirm, otherwise, press ″ BK″ key to give up programming.

4.2 Max. Adjustment

Max. adjustment is used to adjust the measuring range ， It determines the corresponding relationship of output current with Min. Adjustment .When the LCD display 1.1, please press the "↷" key to enter Max. Adjustment, the LCD display as following:

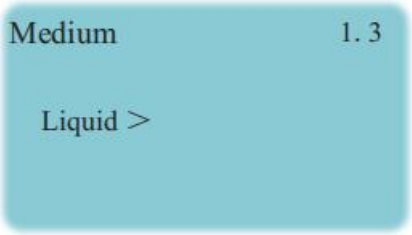


At this time, please press "OK" key to edit the Max. Adjustment, press "↷" key to choose character position ， and press "▲" key to edit number.

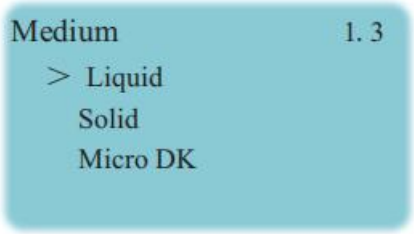
4.3 Medium

Medium menu is used to choose solid, liquid or micro DK, to further determine the other material natures which can affect the measurement.

When the LCD display 1.2, press "↷" key to the medium programming, the LCD display as following.



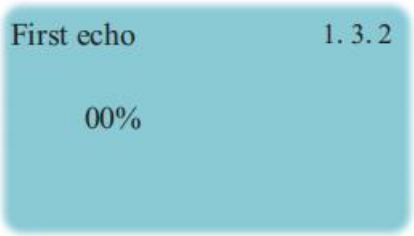
At this time, press "OK" key to edit the medium, press "↷" key to choose medium and press "OK" key to confirm. Press "" key to quit and back to previous menu.



4.3.1 Fast Level Change

When choosing solid or liquid medium, press "OK" key to enter fast change menu, the LCD display as following:

Then press " OK" key to enter fast change menu, modify the level of rise and fall's speed limits
The lase line is the speed control unit of rise(m/min)
The next line is the speed control unit of fall(m/min)
4.3.2 First echo
When choosing solid or liquid medium, the LCD menu display 1.3.1, press " ↓" key to choose the next menu, enter first echo selection menu, the LCD display as following:



Then press " OK" to enter first echo selection menu, modify first echo selection strength setting by percentage
0%:Don’t deal with first echo amplitude (default)
Can modify data 0～99
Means: compare the original signal strength multiply the percentage with previous signal strength
Eg: original signal is 60dB,first echo selection is 70%,compare the strongest signal, if previous signal is more than 42dB,the output level is first echo signal level

Product Selection

● RD71

Applicable medium: liquid, solid powder

Application: Liquid and solid powder measurement, complex process conditions

Explosion proof certification: Exia IIC T6 Ga/Exd ia IIC T6 Ga

Measurement range: liquid 30m, solid 15m

Frequency: 500MHz-1.8GHz

Antenna: single cable or single pole antenna

Measurement accuracy: ± 3mm

Process temperature: (-40~250) ℃

Process pressure: (-0.1~4) MPa

Signal output: (4-20) mA/HART/RS485 Modbus

On site display: four position LCD

Power supply: two wire system (DC24V)/four wire system (DC24V/AC220V)

Shell: Aluminum

Process connection: threaded/flange (optional)

● RD72

Applicable medium: liquids, especially highly corrosive liquids

Application: Measurement of acids, alkalis, or other corrosive media

Explosion proof certification: Exia IIC T6 Ga/Exd ia IIC T6 Ga

Measurement range: 20m

Frequency: 500MHz-1.8GHz

Antenna: fully PTFE sealed cable or pole antenna

Measurement accuracy: ± 10mm

Process temperature: (-40~180) ℃

Process pressure: (-0.1~4) MPa

Signal output: (4-20) mA/HART/RS485 Modbus

On site display: four position LCD

Power supply: two wire system (DC24V)/four wire system (DC24V/AC220V)

Shell: Aluminum

Process connection: threaded/flange (optional)

- **RD73**

Applicable medium: solid powder

Application: Measurement of cement silo powder; Measurement of fly ash powder

Explosion proof certification: Exia IIC T6 Ga/Exd ia IIC T6 Ga

Measurement range: 30m

Frequency: 500MHz-1.8GHz

Antenna: dual cable antenna

Measurement accuracy: ± 5mm

Process temperature: (-40~250) ℃

Process pressure: (-0.1~4) MPa

Signal output: (4-20) mA/HART/RS485 Modbus

On site display: four position LCD

Power supply: two wire system (DC24V)/four wire system (DC24V/AC220V)

Shell: Aluminum

Process connection: threaded/flange (optional)

- **RD74**

Applicable medium: Liquid, especially low dielectric constant liquid

Application: Measurement of liquids such as deionized water and deoxygenated water

Explosion proof certification: Exia IIC T6 Ga/Exd ia IIC T6 Ga

Measurement range: 6m

Frequency: 500MHz-1.8GHz

Antenna: coaxial tube antenna

Measurement accuracy: ± 3mm

Process temperature: (-40~250) ℃

Process pressure: (-0.1~4) MPa

Signal output: (4-20) mA/HART/RS485 Modbus

On site display: four position LCD

Power supply: two wire system (DC24V)/four wire system (DC24V/AC220V)

Shell: Aluminum

Process connection: threaded/flange (optional)

- **RD75**

Applicable medium: Liquid, especially in high-temperature and high-pressure environments

Application: Sealed tank, measuring liquids with high pressure

Explosion proof certification: Exia IIC T6 Ga/Exd ia IIC T6 Ga

Measurement range: 6m

Frequency: 500MHz-1.8GHz

Antenna: single pole or single cable type

Measurement accuracy: ± 10mm

Process temperature: (-40~400) ℃

Process pressure: (-0.1~40) MPa

Signal output: (4-20) mA/HART/RS485 Modbus

On site display: four position LCD

Power supply: two wire system (DC24V)/four wire system (DC24V/AC220V)

Shell: Aluminum

Process connection: threaded/flange (optional)

● RD71

License
P standard type (non explosion-proof) I Intrinsically Safe (Exia IIC T6 Ga) G Intrinsically safe+flameproof (Exd [ia] IIC T6 Ga)
Probe type/material
A-cable probe Φ 8mm/stainless steel 304 B-cable probe Φ 8mm/stainless steel 316L C-rod probe Φ 12mm/stainless steel 304 D-rod probe Φ 12mm/stainless steel 316L
Process Connection
G thread G1 ½″ A N thread 1 ½″ NPT C flange DN50 PN16/304 stainless steel D flange DN80 PN16/304 stainless steel E flange DN100 PN16/304 stainless steel F flange DN150 PN16C/304 stainless steel H flange DN200 PN16/304 stainless steel I flange DN50 PN16/316L stainless steel J flange DN80 PN16/316L stainless steel K flange DN100 PN16/316L stainless steel L flange DN150 PN16/316L stainless steel M flange DN200 PN16/316L stainless steel Y Special Customization
output signal
2 (4-20) mA/24V DC two wire system 3 (4-20) mA/24V DC/HART two wire system 4 (4-20) mA/220V AC/four wire system 5 RS485/Modbus
Sealing/Process Temperature
1. Ordinary type (-40~120) ℃ 2. High temperature type (-40~250) ℃
Shell/protection level
L aluminum/IP67 Q stainless steel 316L/IP67
Cable incoming line
M M 20 x 1.5 N ½″ NPT
Range (mm)

RD72

License
P standard type (non explosion-proof) I Intrinsically Safe (Exia IIC T6 Ga) G Intrinsically safe+flameproof (Exd [ia] IIC T6 Ga)
Probe type/material
A-cable probe Φ 8mm/PTFE B-rod probe Φ 12mm/PTFE
Process Connection
G thread G1 ½″ A N thread 1 ½″ NPT C flange DN50 PN16/304 stainless steel D flange DN80 PN16/304 stainless steel E flange DN100 PN16/304 stainless steel F flange DN150 PN16C/304 stainless steel H flange DN200 PN16/304 stainless steel I flange DN50 PN16/316L stainless steel J flange DN80 PN16/316L stainless steel K flange DN100 PN16/316L stainless steel L flange DN150 PN16/316L stainless steel M flange DN200 PN16/316L stainless steel Y Special Customization
output signal
2 (4-20) mA/24V DC two wire system 3 (4-20) mA/24V DC/HART two wire system 4 (4-20) mA/220V AC/four wire system 5 RS485/Modbus
Sealing/Process Temperature
1. Ordinary type (-40~120) ℃ 2. High temperature type (-40~250) ℃
Shell/protection level
L aluminum/IP67 Q stainless steel 316L/IP67
Cable incoming line
M M 20 x 1.5 N ½″ NPT
Range (mm)

● RD73

License
P standard type (non explosion-proof) I Intrinsically Safe (Exia IIC T6 Ga) G Intrinsically safe+flameproof (Exd [ia] IIC T6 Ga)
Probe type/material
A-cable probe Φ 8mm/stainless steel 304 B-cable probe Φ 8mm/stainless steel 316L
Process Connection
G thread G1 ½″ A N thread 1 ½″ NPT C flange DN50 PN16/304 stainless steel D flange DN80 PN16/304 stainless steel E flange DN100 PN16/304 stainless steel F flange DN150 PN16C/304 stainless steel H flange DN200 PN16/304 stainless steel I flange DN50 PN16/316L stainless steel J flange DN80 PN16/316L stainless steel K flange DN100 PN16/316L stainless steel L flange DN150 PN16/316L stainless steel M flange DN200 PN16/316L stainless steel Y Special Customization
Output signal
2 (4-20) mA/24V DC two wire system 3 (4-20) mA/24V DC/HART two wire system 4 (4-20) mA/220V AC/four wire system 5 RS485/Modbus
Sealing/Process Temperature
1. Ordinary type (-40~120) ℃ 2. High temperature type (-40~250) ℃
Shell/protection level
L aluminum/IP67 Q stainless steel 316L/IP67
Cable incoming line
M M 20 x 1.5 N ½″ NPT

Range (mm)

● RD74

License
P standard type (non explosion-proof)
I Intrinsically Safe (Exia IIC T6 Ga)
G Intrinsically safe+flameproof (Exd [ia] IIC T6 Ga)
Probe type/material
A-cable probe Φ 12mm/stainless steel 304
B-cable probe Φ 12mm/stainless steel 316L
Process Connection
G Thread G ½″ A
N thread 1 ½″ NPT
C flange DN50 PN16C/304 stainless steel
D flange DN80 PN16C/304 stainless steel
E flange DN100 PN16C/304 stainless steel
F flange DN150 PN16C/304 stainless steel
H flange DN200 PN16C/304 stainless steel
I flange DN50 PN16/316L stainless steel
J flange DN80 PN16/316L stainless steel
K flange DN100 PN16/316L stainless steel
L flange DN150 PN16/316L stainless steel
M flange DN200 PN16/316L stainless steel
Y Special Customization
output signal
2 (4-20) mA/24V DC two wire system
3 (4-20) mA/24V DC/HART two wire system
4 (4-20) mA/220V AC/four wire system
5 RS485/Modbus
Sealing/Process Temperature
1. Ordinary type (-40~120) ℃
Shell/protection level
L aluminum/IP67
Q stainless steel 316L/IP67
Cable incoming line
M M 20x1.5
N ½″ NPT

Range (mm)

- **RD75**

License
P standard type (non explosion-proof)
I Intrinsically Safe (Exia IIC T6 Ga)
G Intrinsically safe+flameproof (Exd [ia] IIC T6 Ga)
Probe type/material
A-cable probe Φ 12mm/stainless steel 304
B-cable probe Φ 12mm/stainless steel 316L
Process Connection
G thread G1 ½″ A
N thread 1 ½″ NPT
C flange DN50 PN16/304 stainless steel
D flange DN80 PN16/304 stainless steel
E flange DN100 PN16/304 stainless steel
F flange DN150 PN16/304 stainless steel
H flange DN200 PN16/304 stainless steel
I flange DN50 PN16/316L stainless steel
J flange DN80 PN16/316L stainless steel
K flange DN100 PN16/316L stainless steel
L flange DN150 PN16/316L stainless steel
M flange DN200 PN16/316L stainless steel
Y Special Customization
output signal
2 (4-20) mA/24V DC two wire system
3 (4-20) mA/24V DC/HART two wire system
4 (4-20) mA/220V AC/four wire system
5 RS485/Modbus
Sealing/Process Temperature
1. Ordinary type (-40~400) ℃
Shell/protection level
L aluminum/IP67
Q stainless steel 316L/IP67
Cable incoming line
M M 20 x 1.5
N ½″ NPT

Range (mm)