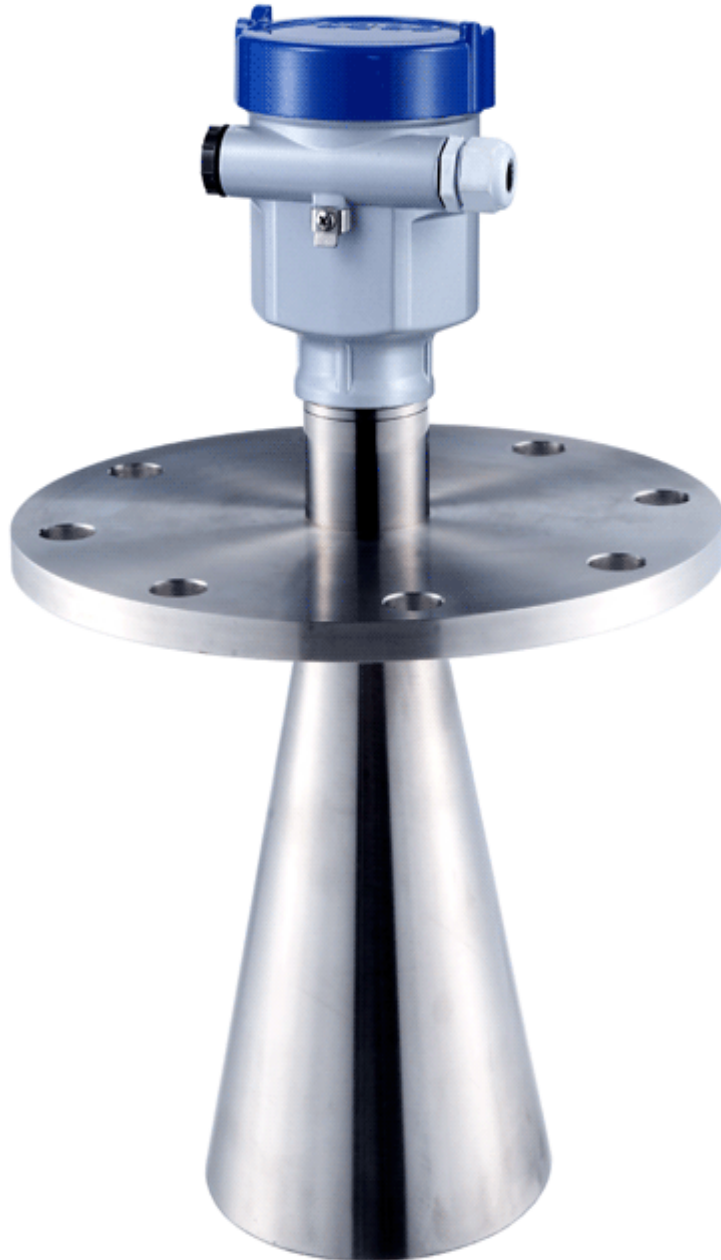


Rader Level Transmitter

[6.3GHz Type : RD-51/RD-52/RD-53/RD-54]



주)기연 이앤아이

KI-YEON E & I CO., LTD.

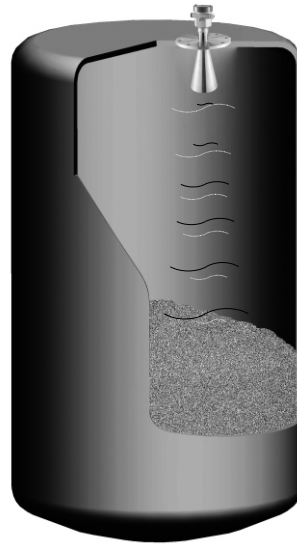
서울시 양천구 신월6동 559-2

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1. Measurement Principle



- Principle

The extremely narrow microwave pulse emitted by the antenna on radar level instrument can travel at the speed of light and part of its energy, which is reflected off the surface of target medium, is received by the very same antenna. The time lapse between pulse emission and reception by the antenna is proportional to the distance between the surface of target medium and the reference point on antenna. However, due to the fact that the electromagnetic wave is transmitted at extremely high speed, which leads to the tiny time lapse (nanosecond level) and makes it difficult to be identified, RD!5X series of radar level instrument have adopted a special demodulation technology, enabling itself to detect the time lapse between pulse emission and reception correctly, and eventually generate accurate measurement result.

- Features

Equipped with advanced microprocessor and unique EchoDiscovery echo processing technology, the radar level instrument can be used under various hazardous process conditions.

The false echo storage function enables the instrument to detect the true echo with the presence of multiple false echoes and eventually generate accurate measurement results.

There are multiple options available in choosing various process connection and detection component, which enables RD!5X series radar level instrument to be applied in a broad array of hazardous applications, such as high temperature, high pressure, small dielectric constant and so on.

The guided wave radar level instrument, with pulses as its working tool and extremely low emission power, can be mounted on various metal or nonmetal vessels, harmless towards the environment and human beings.

2 Product Overview

RD! 51



RD! 52



Application:

Level Measurement in liquids, especially erosive liquids, under easy process condition

Level Measurement in Liquids, especially strong erosive liquids under high temperature and pressure, easy process condition

Max Measurement Range:

30m

30m

Measurement Accuracy:

± 10mm

± 10mm

Process Connection:

G1½A, 1½NPT

PTFE Flange

Antenna Material:

PP/PTFE

PTFE

Process Temperature:

(-40~120)°C

(-40~150)°C

Process Pressure:

(-0.1~0.3) MPa

(-0.1~1.6) MPa

Frequency Range:

6" GHz

6" GHz

Signal Output:

(4~20)mA/HART

(4~20)mA/HART

Power

dual-wire (DC24V)

dual-wire (DC24V)

four-wire (DC24V/AC220V)

four-wire (DC24V/AC220V)

RD! 53



RD! 54



Application:

Storage/process vessels under hazardous process condition

Storage/process vessels under hazardous process condition, especially small electrical constant

Max Measurement Range:

35m

70m

Measurement Accuracy:

± 10mm

± 20mm

Process Connection:

Flange 316L

Flange 316L

Antenna Material:

Stainless Steel 316L/PTFE

Stainless Steel 316L/PTFE

Process Temperature:

(-40~200)°C

(-40~200)°C

Process Pressure:

(-0.1~4) MPa

(-0.1~4) MPa

Frequency Range:

6" GHz

6" GHz

Signal Output:

(4~20)mA/HART

(4~20)mA/HART

Power

dual-wire (DC24V)

dual-wire (DC24V)

four-wire (DC24V/AC220V)

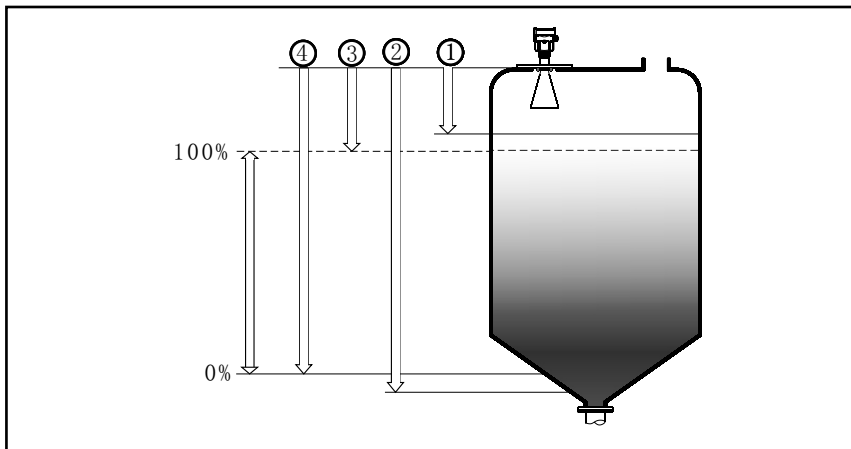
four-wire (DC24V/AC220V)

3. Mounting Requirements

- Basic Requirements

There is a certain existing beam angle while the antenna transmitting microwave pulses. There should be no barriers between the lower edge of antenna and surface of measured medium. Therefore it is highly recommended to avoid facilities inside vessels, such as ladders, limit switches, heating spirals, struts and etc, during the mounting process. "False echo learning" must be carried out during the installation in this case. Furthermore, microwave beams must NOT intersect the filling streams. Be cautious during the installation: the highest level of target medium must NOT enter into blanking zone; the instrument must keep certain distance to vessel walls; every possible measure needs to be taken to position the instrument so that the direction of antenna emission is perpendicular to the surface of measured medium. The installation of instruments in explosion proof area must abide by relevant local or federal safety regulations. Aluminum housing should be used for intrinsically safe explosion proof version, which is also applicable in explosion proof areas. The instrument must be connected with ground in this case.

- Illustrations

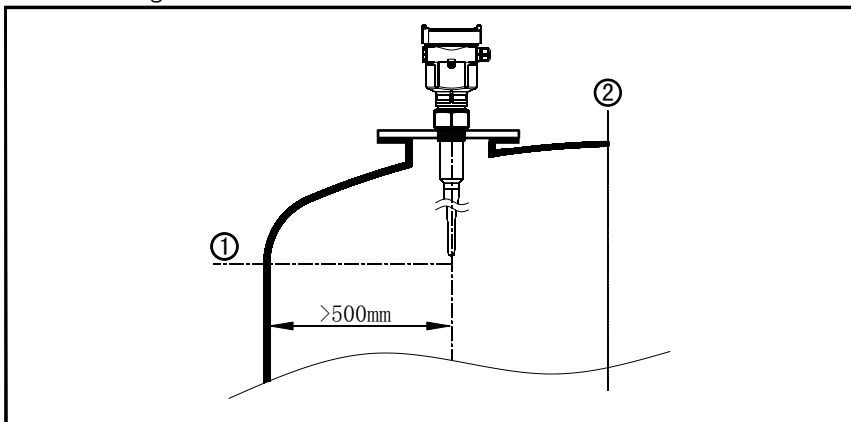


The reference plane is the thread or flange surface

1. Blanking Zone(menu1.9)
2. Empty(menu1.8)
3. Max. Adjustment(menu1.2)
4. Min. Adjustment(menu1.1)

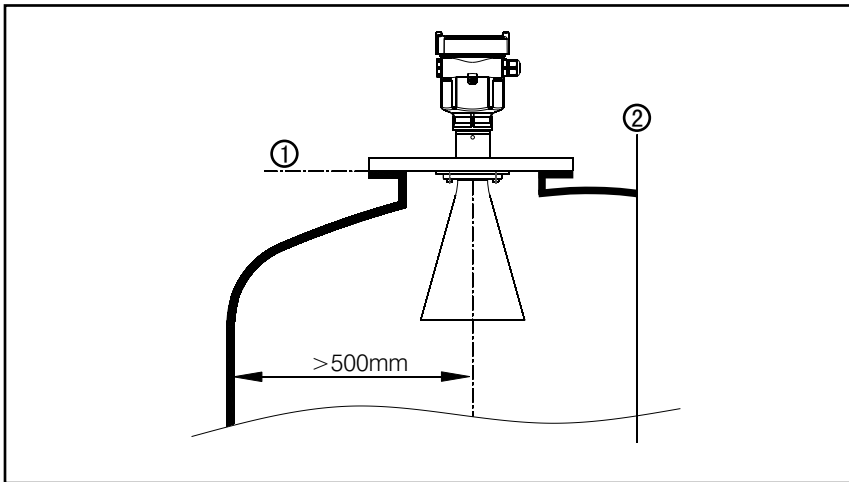
Note: The highest level of measured medium must not enter into blanking zone while radar level measurement instrument is in operation.

- Mounting Position

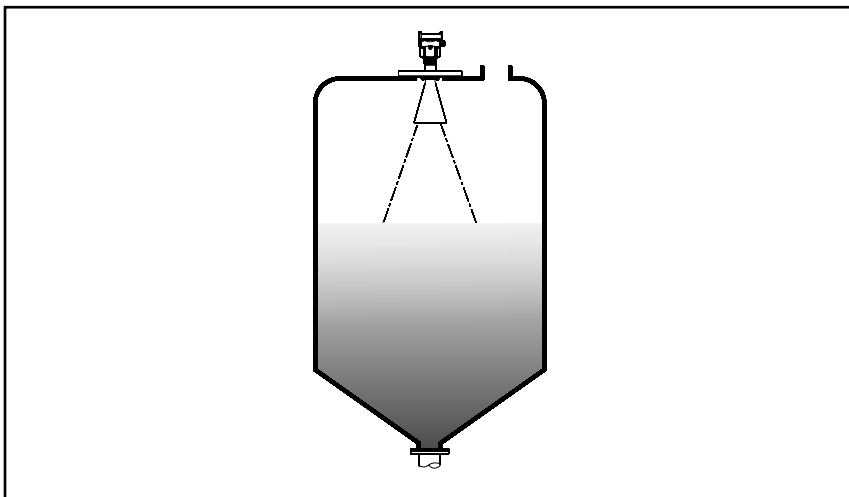


Minimum distance of 500mm between instrument and vessel wall during installation

1. Reference Plane
2. Center of Vessel or Symmetrical Axis

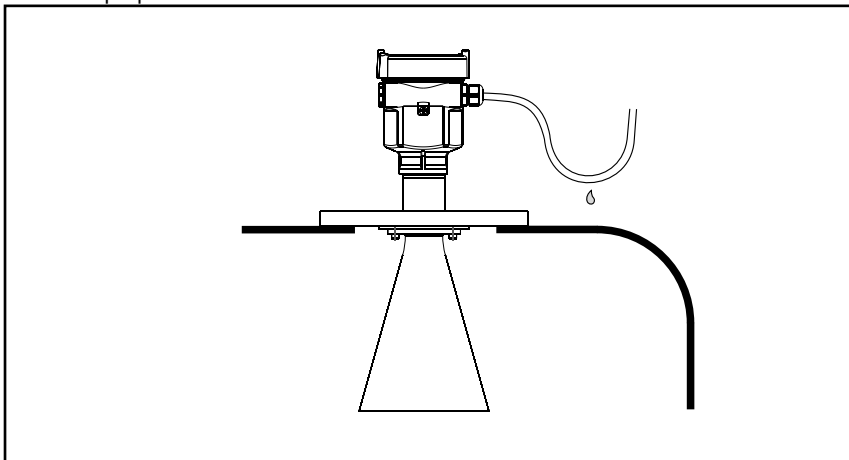


- 1. Reference Plane
- 2. Center of Vessel or Symmetrical Axis



The best mounting position for a conical vessel with flat top is the center of its top, as the effective measurement can reach the bottom of vessel.

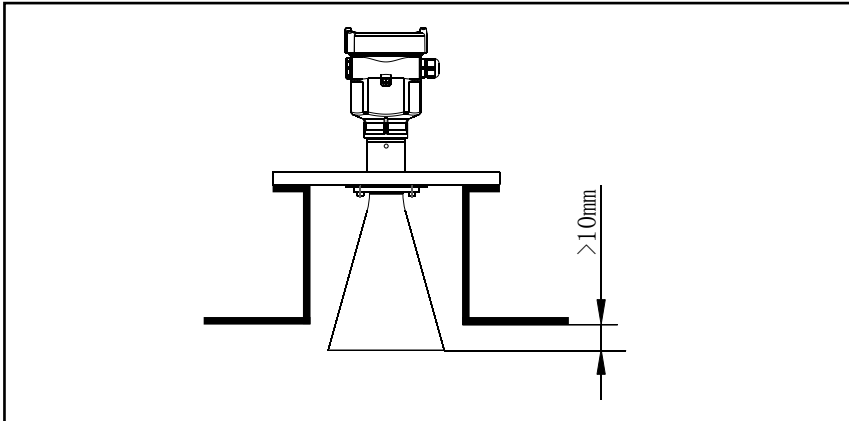
● Damp-proof



In order to avoid dampness under outdoor or humid indoor conditions or for those instruments mounted on cooling/heating vessels, seal rings used on cables should be screwed tight, plus the cable must be bended downward outside cable entry, indicated on the diagram below

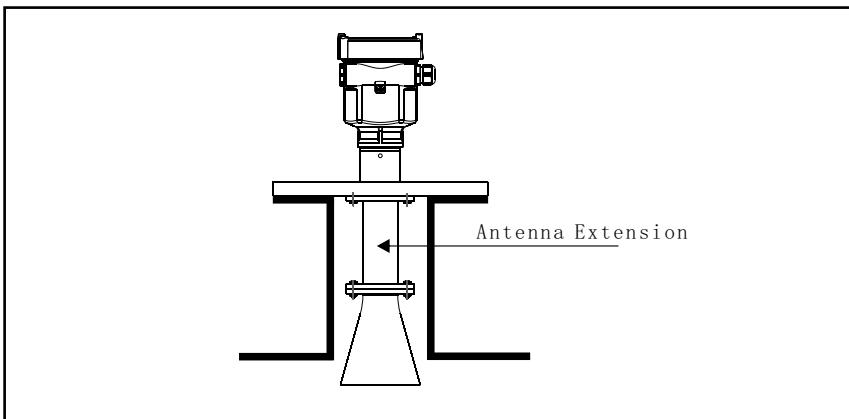
- Socket

Horn Antenna



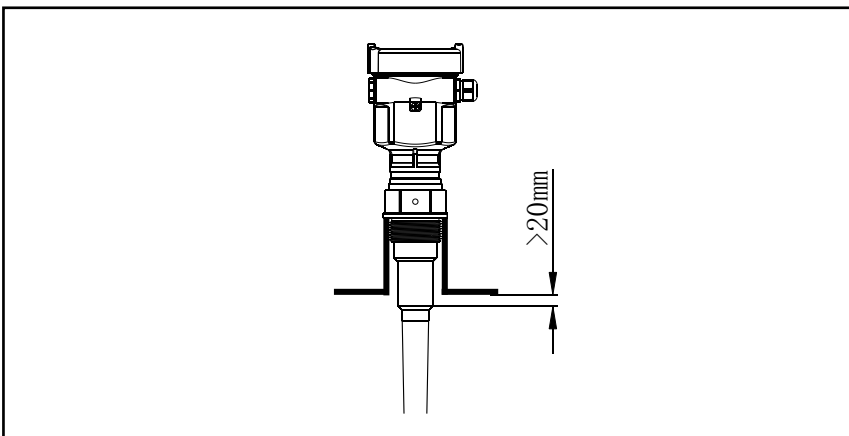
The transducer end must at least protrude 10mm out of socket.

Antenna Extension



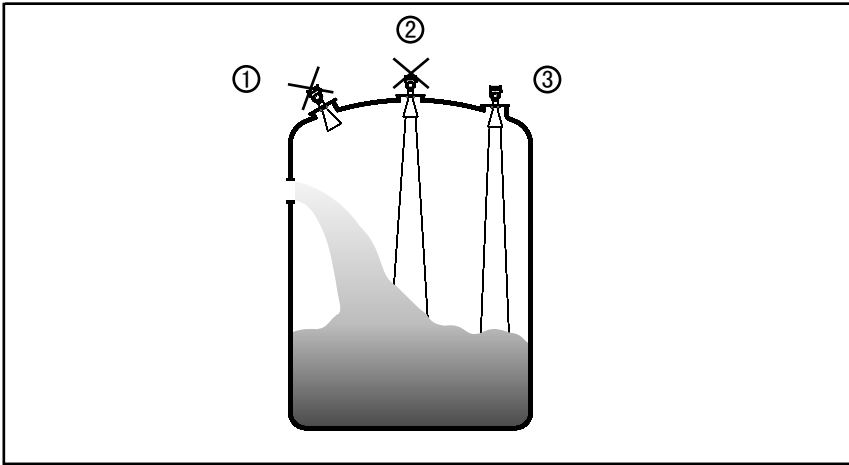
You are advised to use antenna extension if the antenna is shorter than socket.

Rod Antenna

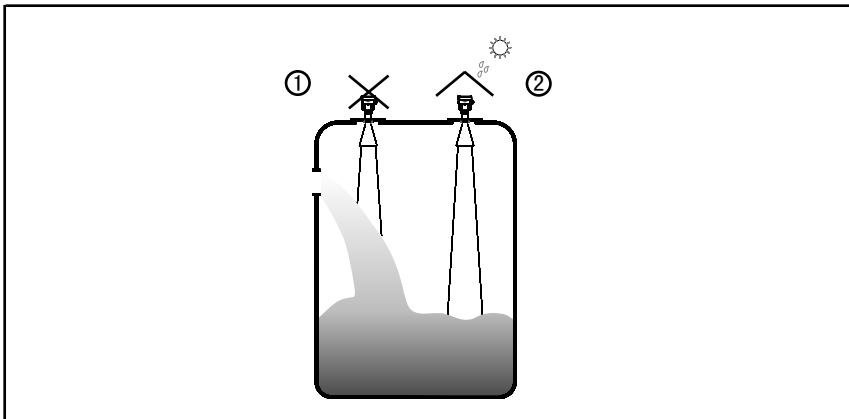


The working part of antenna ,ie. the cone-shaped body of antenna must be fully exposed from the socket. In order to meet the application requirement of various sockets, different radar level instruments of various sockets, different radar level instruments of variable length are available for customers to choose from(see Chapter 6 Dimensional Drawings).

● Rights and Wrongs in Mounting

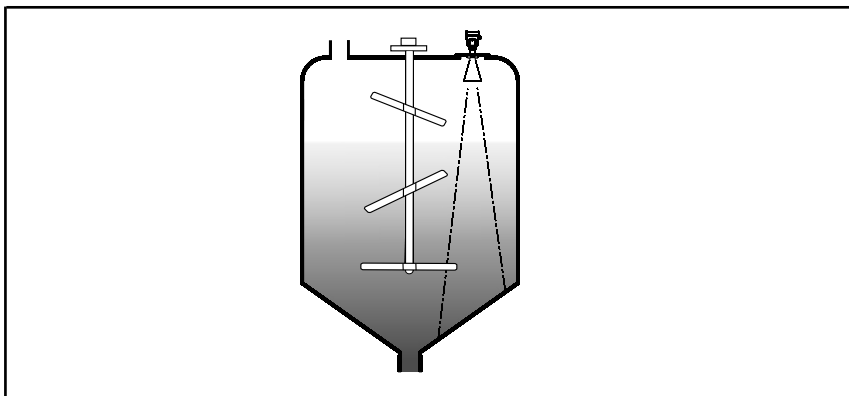


1. Wrong: Fail to turn the antenna perpendicular to the surface of target medium.
2. Wrong: Instruments are mounted in the center of concave or arched vessel tops, which results in multiple echoes.
3. Correct



1. Wrong: Mount the instrument in/above filling stream, which results in the measurement of filling stream not the target medium.
2. Correct:

Agitator



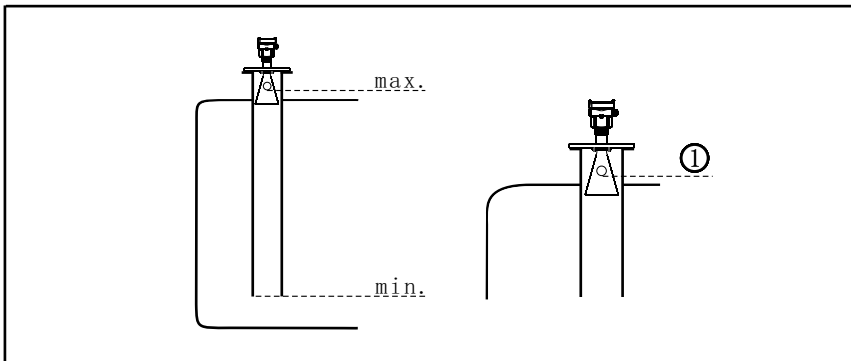
If there are agitators in vessels, instrument must be mounted as far away from agitators as possible. Once installation completed, a "false echo learning" should be carried out while agitators in motion to eliminate negative influence caused by false echo of agitators. You are advised to opt for installation with standpipe if foam or wave is generated due to the action of agitators.

- Foam

Due to the action of filling, stirring or other processes inside vessels, dense foams are formed on the surface of some liquid medium, which could attenuate emitting signals considerably. You are advised to mount the instrument inside a standpipe or opt for a guided wave radar level instrument if the generation of foam incurs measurement errors.

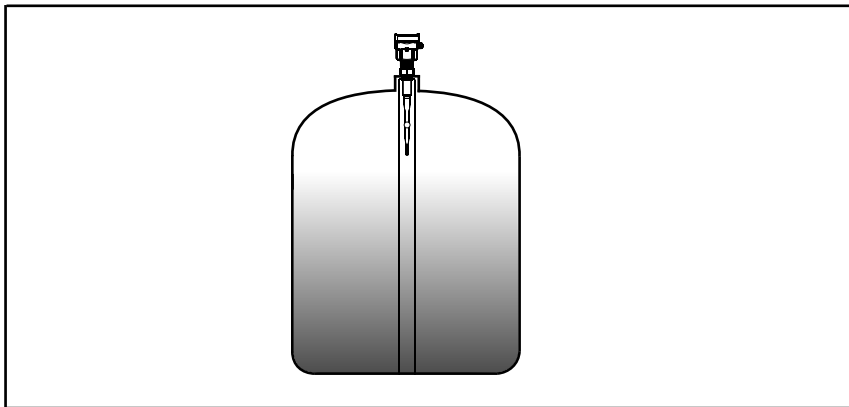
- Installation with Standpipe

By using standpipe, the influence of foams can be reduced.



Vent hole of diameter 5-10mm

If the measurement is undertaken by RD!5X inside a metal standpipe, the minimum inner diameter of standpipe should be 50mm. Avoid large cracks or welding seam when connecting standpipe. False echo storage must be carried out as well in this case. Note: You must NOT mount instrument inside standpipe while measuring adhesive medium.



Installation with a plastic standpipe can avoid the generation of multiple false echoes while the instrument being mounted on the center of vessel top. You are advised to use PP or PTFE if the measured medium is strong acidic or alkaline.

4 Electrical Connection

● Power Supply

20mA/HART(2-Wire) Power supply and current signal are carried by the same two-wire connection cable. See the Technical Specifications of this guide for detailed requirement on power supply. A safety barrier should be placed between power supply and instrument for intrinsically safe version.

20mA/HART(4-wire) Power supply and current signal are carried by two 2-wire connection cables respectively. See the Technical Specifications of this guide for detailed requirement on power supply. Earth-connected current output can be used for standard version of level instruments, while the explosion proof version must be operated with a floating current output. Both instruments and earth terminals should be connected with ground firmly and securely. Normally you can either choose to connect with the earth terminal on vessel or adjacent ground in case of plastic vessels.

● Cable Connection

General Introduction

4~20mA/HART

Standard 2-wire cable with outside diameter of 5...9mm, which assures the seal effect of cable entry, can be used as feeder cable. You are recommended to use screened cables in the event of electromagnetic Connection cable with special earth wire can be used as feeder cable.

Connection cable with special earth wire can be used as feeder cable.

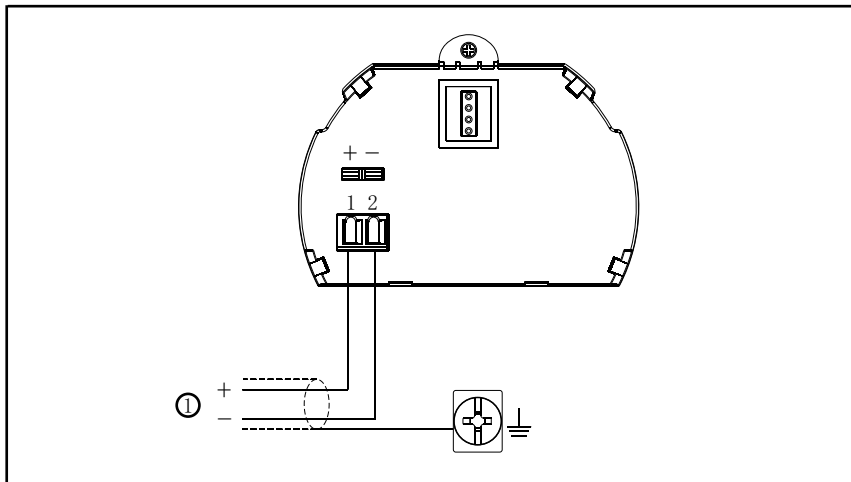
20mA/HART(4-wire)

Shielding & Grounding

The two ends of shielded cable must be connected with earth terminal. The shielded cable must be connected with inner earth terminal directly inside the transducer, while the outside earth terminal on housing must be connected with ground. In the event of earth-connected current, the shielding side of shielded cable must be connected to ground potential via a ceramic capacitor (e.g. : 1 μ F 1500V) in order to dampen the low frequency grounding current and avoid the disturbance caused by high frequency signals

● Wiring Diagram

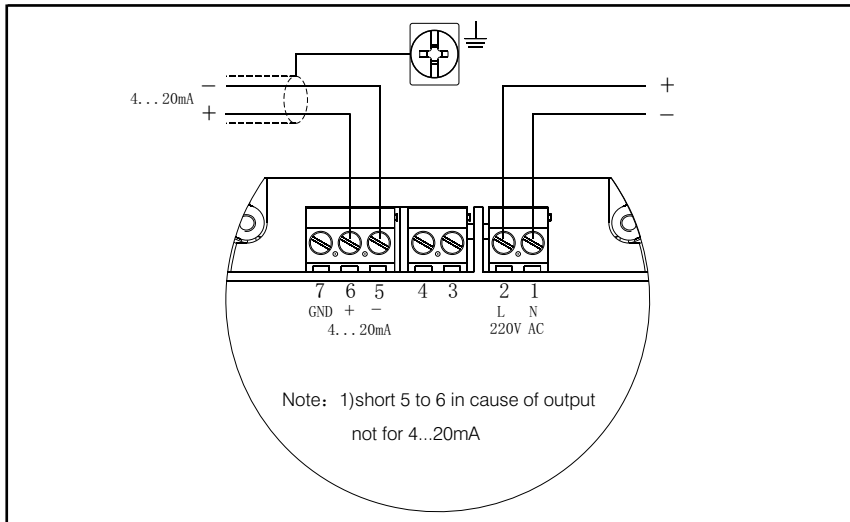
2-wire



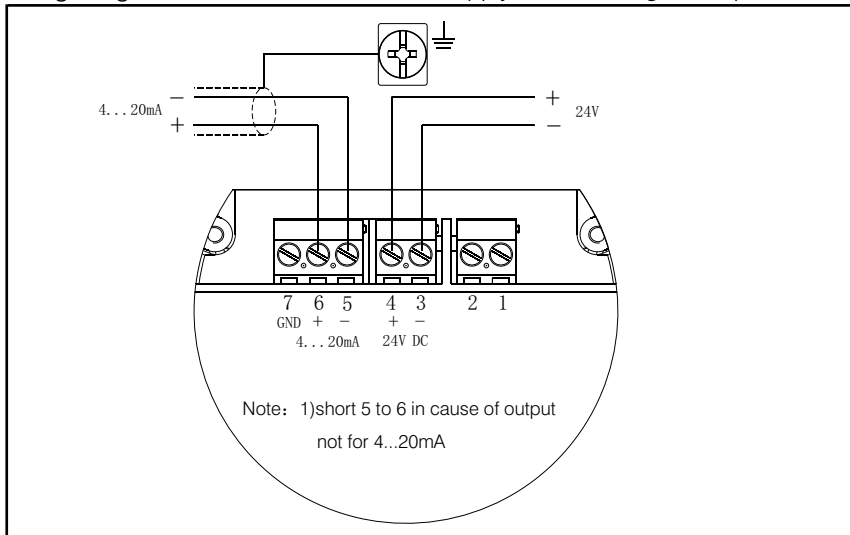
2-wire wiring used for HART
1) Power Supply and Signal Output

4-wire/2-chamber

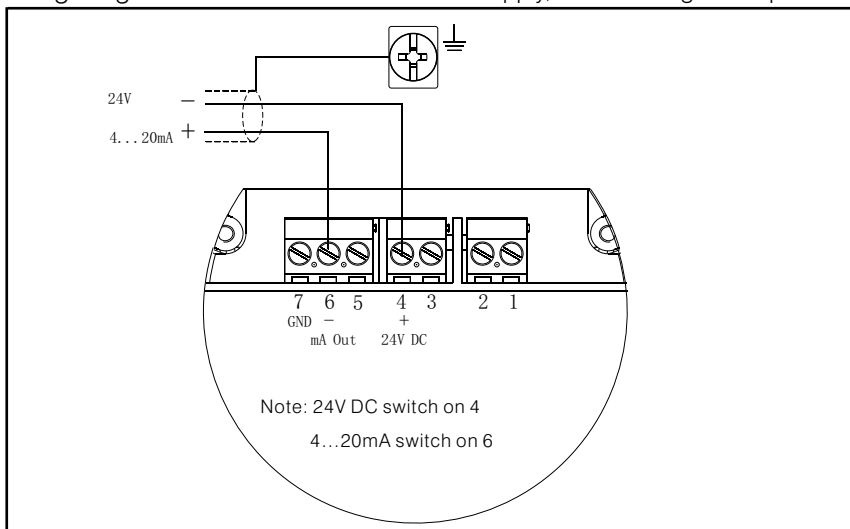
Wiring Diagram: 200V AC Power Supply, 4...20mA Signal Output



Wiring Diagram: 4-wire 24V DC Power Supply, 4...20mA Signal Output



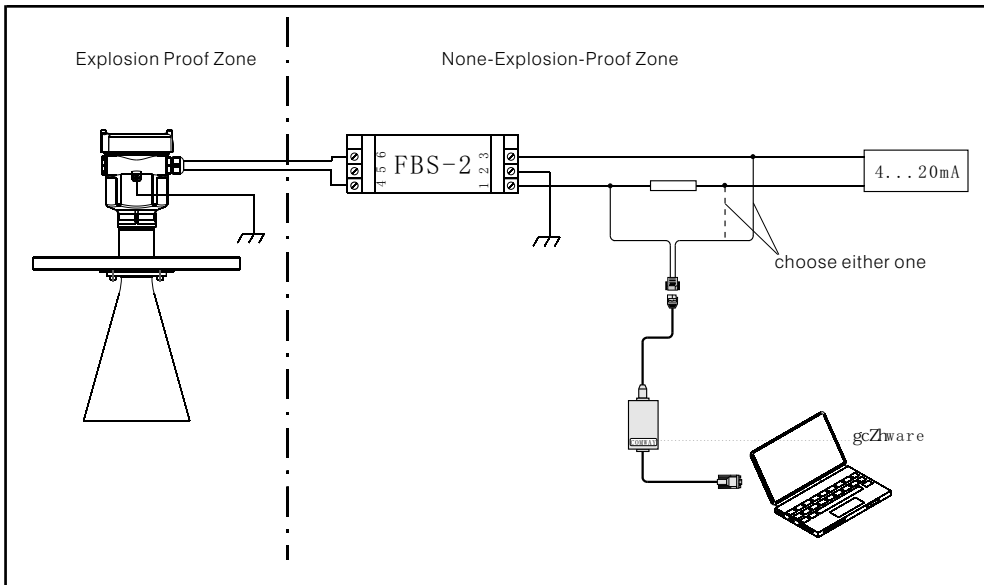
Wiring Diagram: dual-wire 24V DC Power Supply, 4...20mA Signal Output



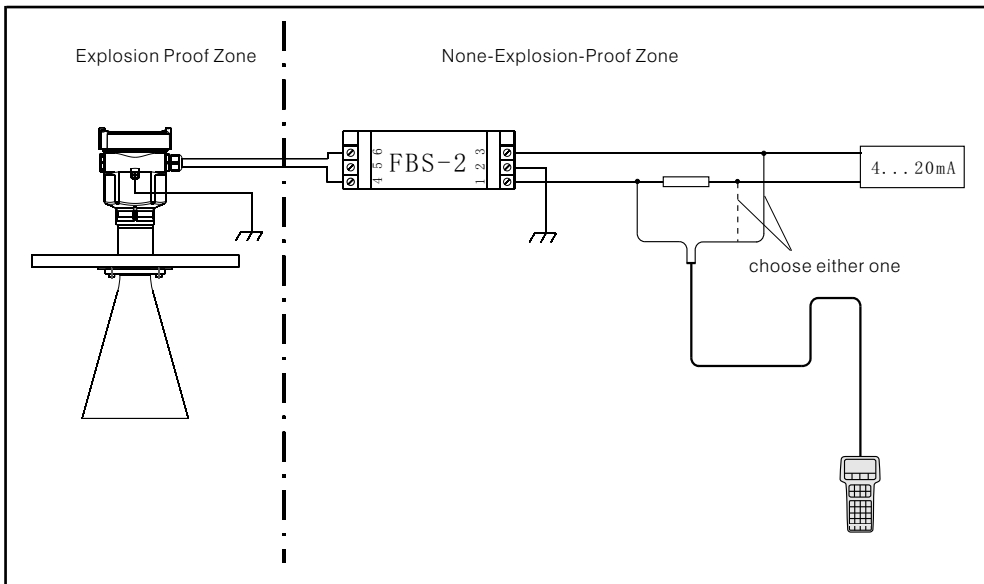
- Explosion Proof Connection

This product is an intrinsic safety explosion proof version (Exia II C T6) with aluminium housing and plastic-encapsulated internal structure aimed to prevent sparks resulted from transducer and circuit malfunction from leaking out. It is applicable for the non-contact continuous level measurement of flammable medium under the level of explosion proof inferior to Exia II c T6. You are required to use FBS-2 series (intrinsic safety explosion proof: [Exia] II C, voltage of power supply: 24V DC \pm 5%, short-circuit current: 135mA, operating current: 4...20mA) of safety barriers, which are supplementary to this product, for the power supply of this product.

All connection cables must be screened with max. length of 500m. Stray capacitor \leq 0.1 μ F/Km, stray inductance \leq 1mH/Km. The level measurement instrument must be connected to ground potential and unapproved supplementary devices are not allowed to use.



Adjust with gcZware



Adjust with HART handheld programmer

5 Adjustment Instructions

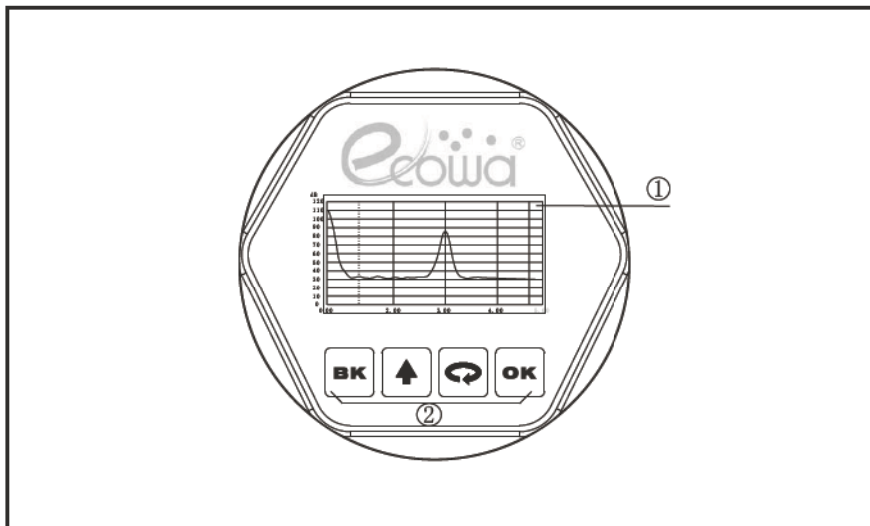
● Adjustment Methods

Three adjustment methods available for RD5X:

1. Display/Adjustment Module
2. Adjustment software Software
3. HART handheld programmer

ViewPoint is a pluggable display/adjustment module. The adjustment can be done through operating with four buttons on ViewPoint. Optional menu operation languages are available for selection. ViewPoint is only used for display after adjustment in that the measurement results can be seen clearly through the glass window.

Display/Adjustment Module



1 LCD 2 Adjustment Keypad

[OK]Keypad

- Enter programming mode;
- Confirm programming options;
- Confirm modifications to parameters.

[↻]Keypad

- Choose programming options;
- Choose the digit of parameters to edit;
- Display the contents of parameters.

[↑]Keypad

- Modify parameter values.

[BK]Keypad

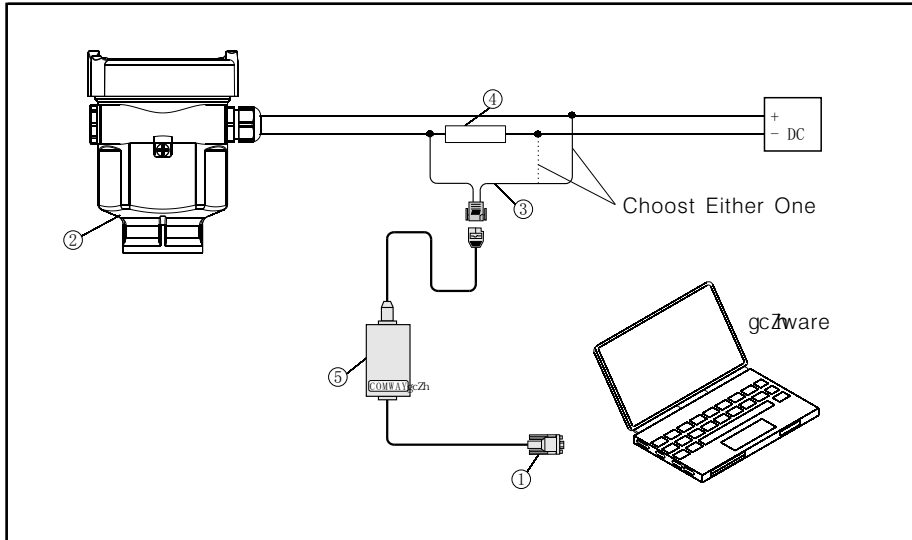
- Programming mode exit;
- Return to higher menu level.

Shortcut

[BK]Display Echo wave

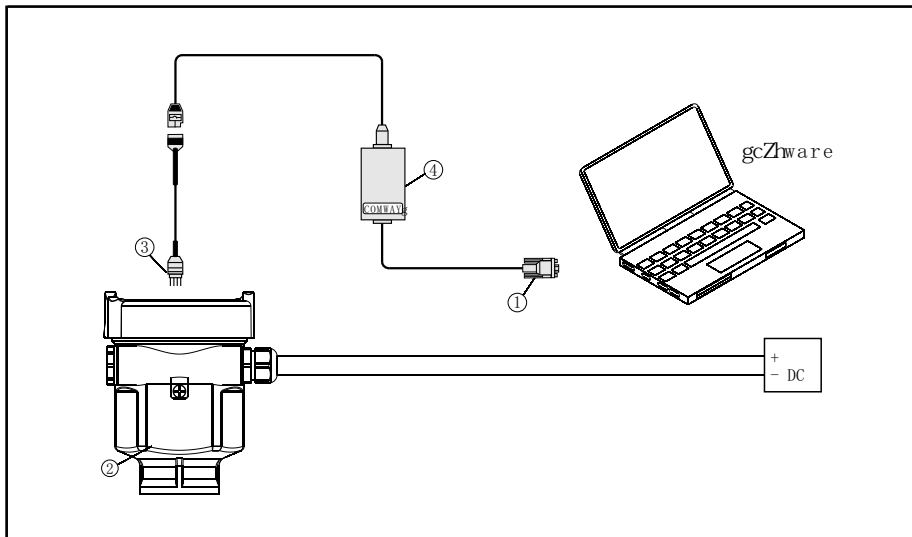
- GcZware

Connect with another unit through HART.



- 1 RS232 Connect Cable/USB port
- 2 RD15X
- 3 HATR pont adapter used on COMWAY convertor
- 4 250 ohm Resistance
- 5 COMWAY Convertor

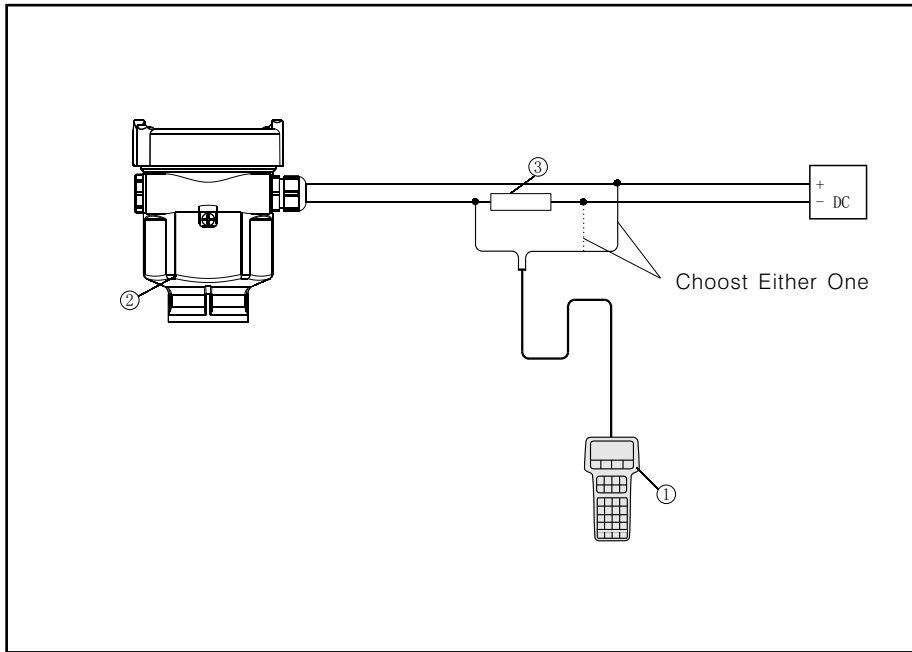
Connect with another unit through I²C. GcZh



- 1 RS232 Connect Cable/USB port
- 2 RD15X
- 3 I²C adapter pont used on MOMWAY convertor
- 4 COMWAY Convertor

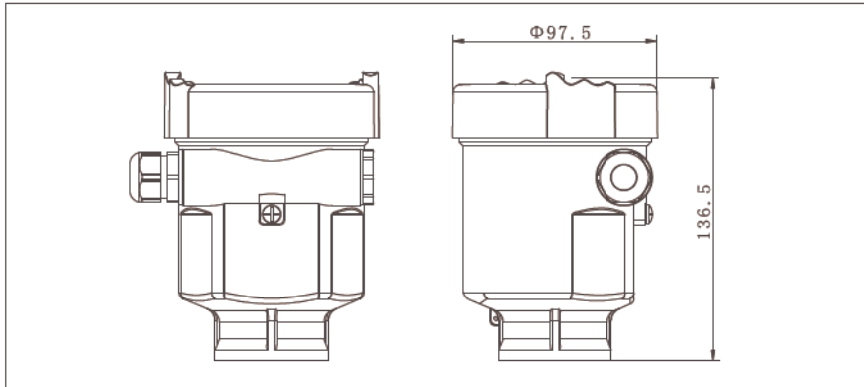
HART Handheld Programmer

Adjust RD!5X with HART Handheld Programmer

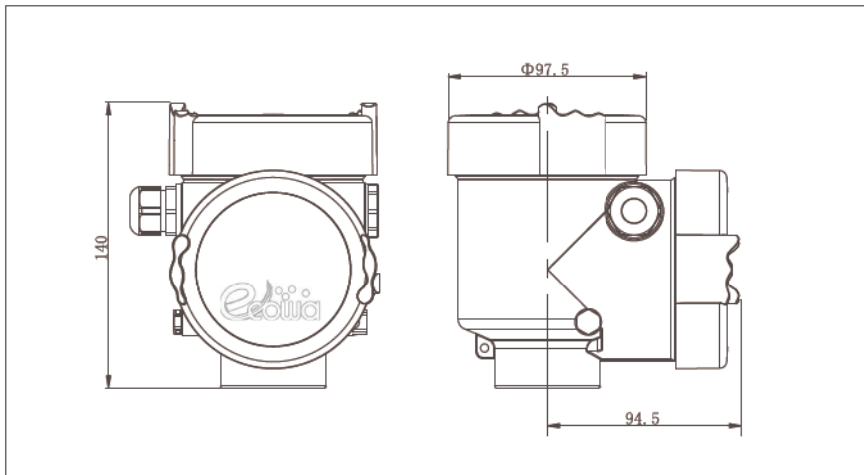


- 1 HART Handheld Programmer
- 2 RD!5X
- 3 250 ohm Resistance

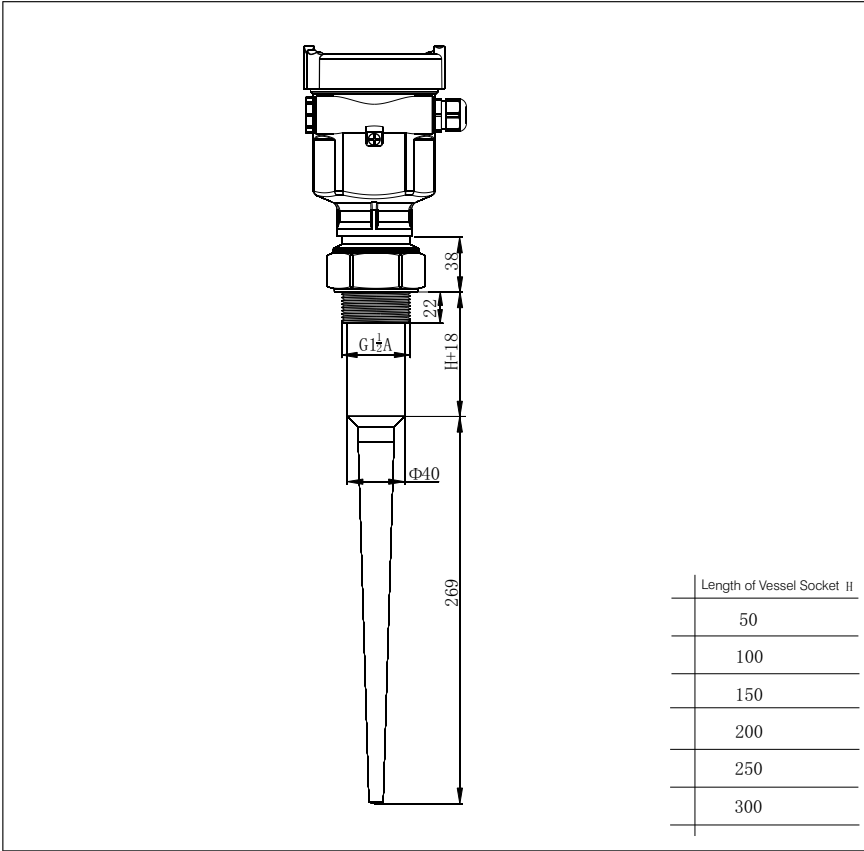
6 Dimension (Unit: mm)



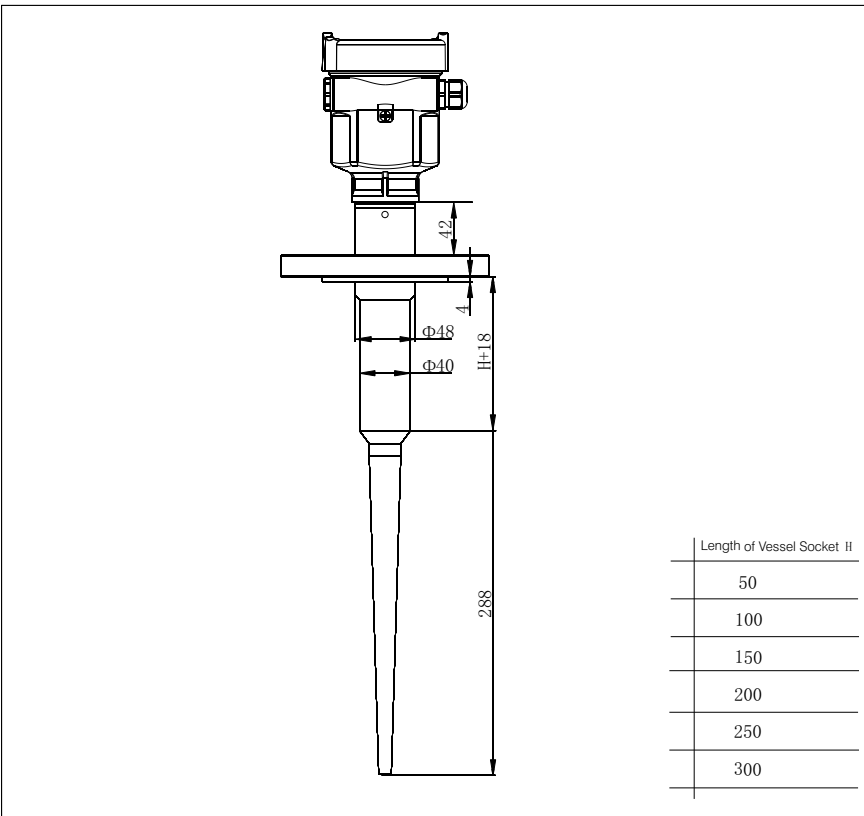
Housing
Material: PBT/AL/316L



Material: two-chamber

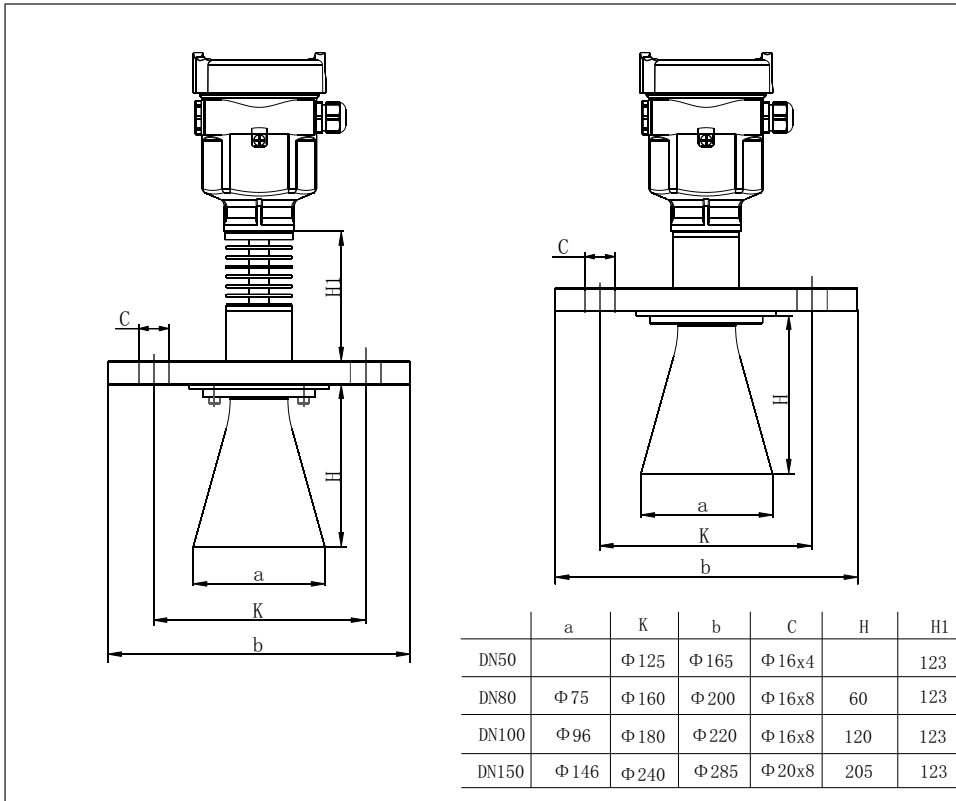


GDRD51 Threaded Vision

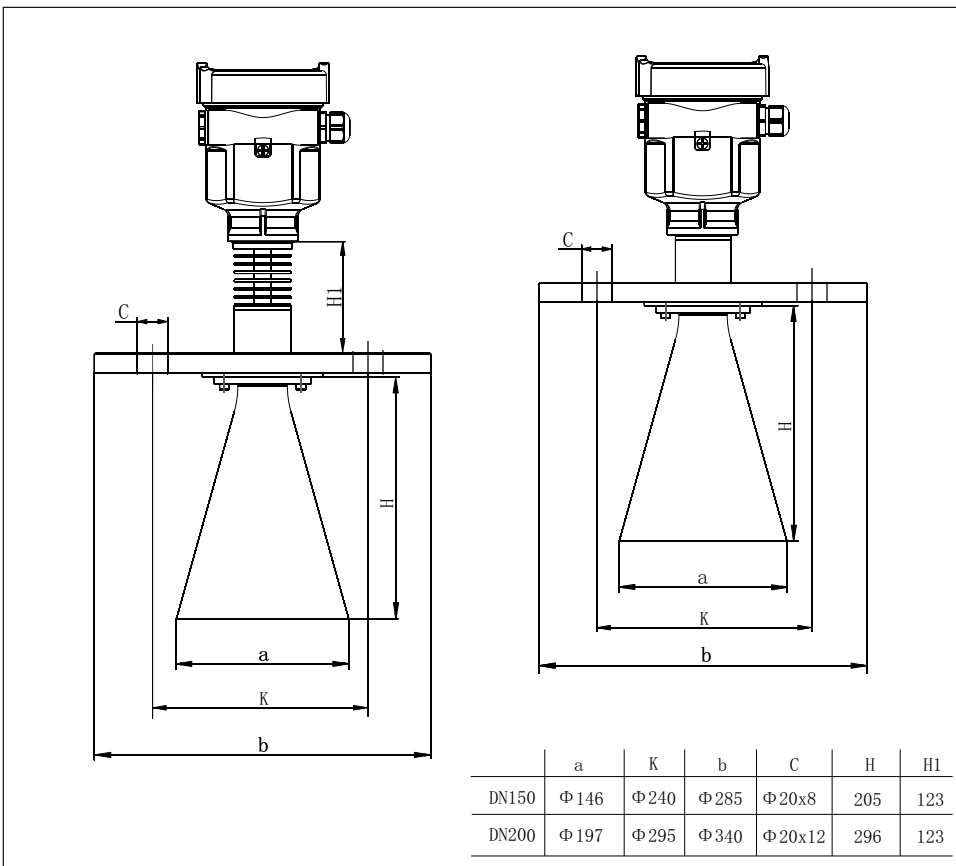


GDRD52 Flange Version

GDRD53 Flange Version



GDRD54 Flange Version

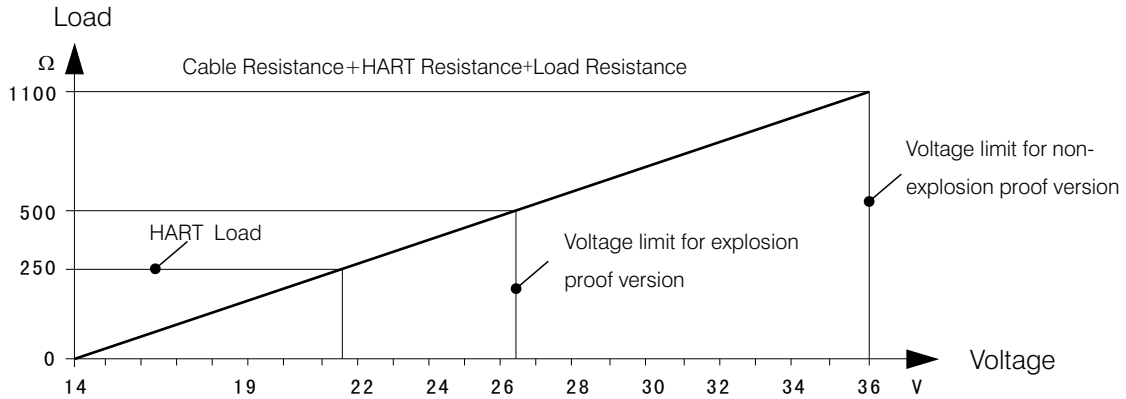


7 Technical Specifications

● General Parameters

| | | |
|---------------------|---|---|
| Process Connection | -RD!51 -RD!52、RD!53 and RD!54 | Thread G1½A Flange |
| Material | -Antenna -Flange -Housing -Seal ring between housing and housing cover -ViewPoint window on housing -Ground terminal | PTFE、PP Stainless Steel 316L Plastic PBT-FR; Aluminium,Stainless Steel 316L Silicone Polycarbonate Stainless Steel |
| Weight | -RD!51 -RD!52 -RD!53 -RD!54 | 2kg (Depend on process connections and housings) 5kg (Depend on process connections and housings) 6kg (Depend on process connections and housings) 10kg (Depend on process connections and housings) |
| Power 2-wire | Standard Version Intrinsic Safe Version Power Consumption Ripple Allowed —<100Hz —(100~100K) Hz | (16~36)V DC (21.6~26.4)V DC max.22.5mA Uss<1V Uss<10mV |
| 4-wire/2-chamber | Intrinsic Safe+Explosion-Proof Power Consumption | (22.8~26.4)V DC, (198~242)V AC max.1VA, 1W |
| Parameters on Cable | Cable Entry/Plug Spring Connection Terminal | One cable entry of M20x1.5 (cable diameter of 5~9mm) , one binding of M20x1.5 Applicable for cables with cross section of 2.5mm ² |
| Output | Output Signal Resolution Fault Signal -2-wire load resistance -4-wire load resistance Integration Time | 4~20mA/HART 1.6uA Constant current output: 20.5mA; 22mA; 3.9mA See diagram below Max. 500ohm 0~40sec, adjustable |

2-Wire Load Resistance Diagram



- Characteristic parameter
- Blanking Distance
- Max Measurement Distance
- -RD!51
- -RD!52
- -RD!53
- -RD!54
- Microwave Frequency
- Measurement Interval
- Adjustment Time ¹⁾
- Beam Angle
- End of Antenna
- RD!51 : 30m (liquid)
- RD!52 : 30m (liquid)
- RD!53 : 35m
- RD!54 : 70m
- 6" GHz
- About 1sec (Depend on parameter settings)
- About 1sec (Depend on parameter settings)
- See the diagram below

Stats on Beam Angle of Horn Antenna

| | | | | |
|-----------------|--------------|-------|------------|--------------|
| Size of Antenna | RD!53/F 8!54 | | | RD!51/F 8!52 |
| | Horn | | | Antenna |
| | DN150 | DN200 | DN200 (加长) | |
| Beam Angle a | 20° | 16° | 14° | 24° |

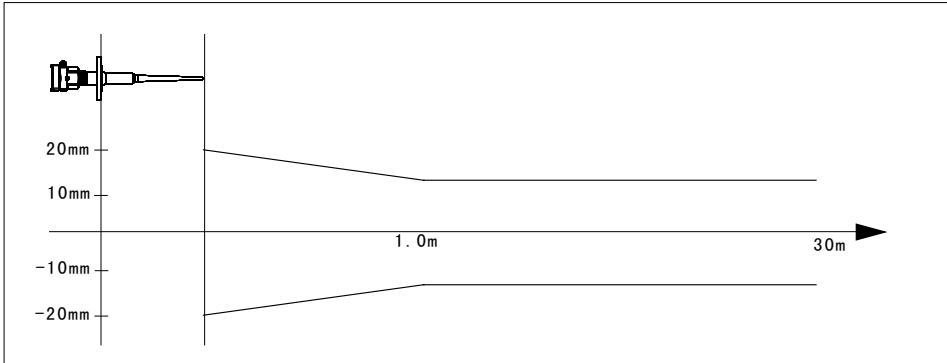
- Resolution of Display
- Accuracy
- Temperature for Storage/Transport
- Process Temperature (Probe)
- RD!51
- RD!52
- RD!53
- RD!54
- Relative Humidity
- Pressure
- Vibration Proof
- 1mm
- 10mm or <0.1% (See the accuracy illustration diagram below)
- 40~+80 °C
- 40~+120 °C
- 40~+150 °C
- 40~+200 °C
- 40~+200 °C
- <95%
- Max. 4MPa
- Mechanical vibration 10m/s 10m²/s , 10~150Hz

1) The generation of accurate measurement results needs longer time than usual in the event of drastic level changes(mx. Error 10%).

RD!51/F 8!52

Accuracy

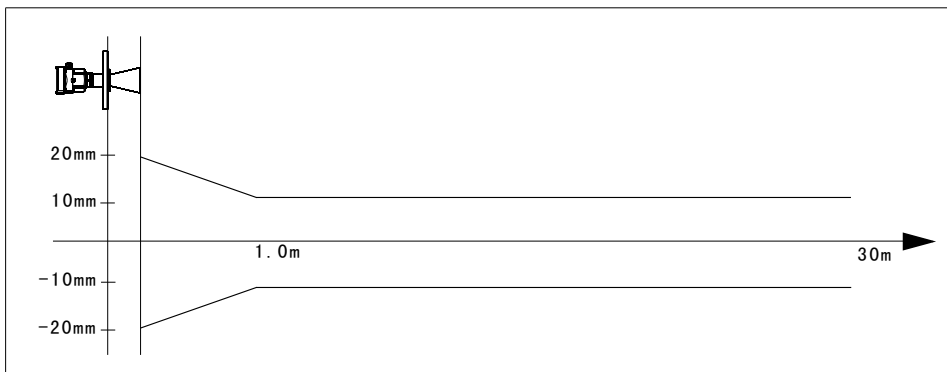
See the diagram below



RD!53

Accuracy

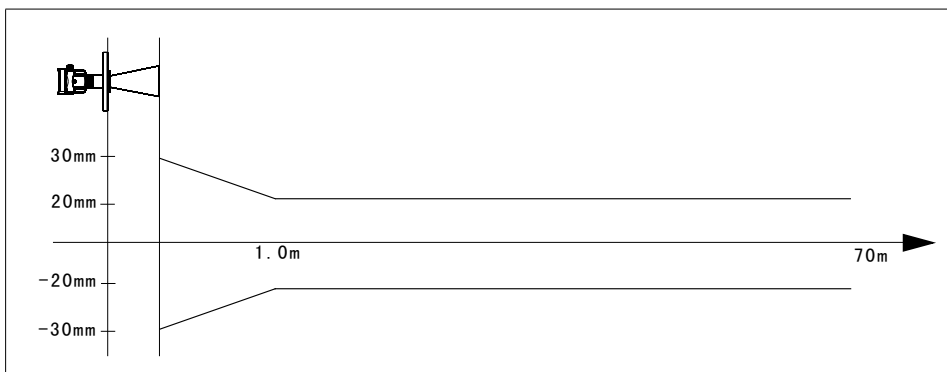
See the diagram below



RD!54

Accuracy

See the diagram below



8 Selection & Ordering Information

● RD! 51

| | |
|--|--|
| Explosion Proof Approval | |
| P | Standard (Without Approval) |
| I | Intrinsically Safe (Exia IIC T6) |
| C | Intrinsically Safe+Ship Approval (Exia IIC T6) |
| G | Intrinsically Safe+Flameproof Approval (Exd ia IIC T6) |
| Shape of Antenna/Material/Process Temperature | |
| A | Plastic Rod/PP/-40~+120 °C |
| B | Plastic Rod/PTFE/-40~+120 °C |
| Length of Vessel Socket | |
| A | 50mm |
| B | 100mm |
| C | 150mm |
| D | 200mm |
| E | 250mm |
| F | 300mm |
| X | Special Design |
| Process Connection/Material | |
| GP | Thread G1½A |
| NP | Thread 1½NPT |
| YP | Special Design |
| Electronic | |
| B | (4~20) mA/HART2-Wire |
| C | (4~20) mA/(22.8~26.4) V DC/HART2-Wire/4-Wire |
| D | (198~242) V AC/HART4-Wire |
| Housing/Protection | |
| A | Aluminium/IP67 |
| B | Plastic/IP66 |
| D | Aluminium (2-chamber)/IP67 |
| G | Stainless Steel316L/IP67 |
| Cable Entry | |
| M | M20x1.5 |
| N | ½NPT |
| Display/Programming | |
| A | Yes |
| X | No |

Note: Intrinsically Safe+Ship Approval (Exia IIC T6) be used for “A” and “B” must use “D” housing;
 Intrinsically Safe+Flameproof Approval (Exd [ia]ia IIC T6) must use “D” housing.

● RD! 52

| Explosion Proof Approval | |
|---|--|
| P | Standard (Without Approval) |
| I | Intrinsically Safe (Exia IIC T6) |
| C | Intrinsically Safe+Ship Approval (Exia IIC T6) |
| G | Intrinsically Safe+Flameproof Approval (Exd ia IIC T6) |
| Shape of Antenna/Material/Process Temperature | |
| B | Plastic Rod/PTFE/-40~+150°C |
| Antenna Extension | |
| A | 50mm |
| B | 100mm |
| C | 150mm |
| D | 200mm |
| E | 250mm |
| F | 300mm |
| X | Special Design |
| Process Connection | |
| FC | PTFE Loose Flange with Stud End DN50 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FD | PTFE Loose Flange with Stud End DN80 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FE | PTFE Loose Flange with Stud End DN100 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FK | PTFE Loose Flange with Stud End DN150 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| YP | Special Design |
| Electronic | |
| B | (4~20)mA/HART2-Wire |
| C | (4~20)mA/(22.8~26.4)V DC/HART2-Wire/4-Wire |
| D | (198~242)V AC/HART4-Wire |
| Housing/Protection I | |
| A | Housing/Protection I/IP67 |
| B | Plastic/IP66 |
| D | Aluminium (2-chamber)/IP67 |
| G | Stainless Steel316L/IP67 |
| Cable Entry | |
| M | M20x1.5 |
| N | ½NPT |
| Display/Programming | |
| A | Yes |
| X | No |

Note: Intrinsically Safe+Ship Approval (Exia IIC T6) be used for "A" and "B" must use "D" housing; Intrinsically Safe+Flameproof Approval (Exd [ia]ia IIC T6) must use "D" housing.

● RD! 53

| Explosion Proof Approval | |
|-----------------------------|--|
| P | Explosion Proof Approval |
| I | Intrinsically Safe (Exia IIC T6) |
| C | Intrinsically Safe+Ship Approval (Exia IIC T6) |
| G | Intrinsically Safe+Flameproof Approval (Exd ia IIC T6) |
| Shape of Antenna/Material | |
| C | Horn Φ 50mm/Stainless Steel316L (Only applicable for installation with standpipe) * |
| D | Horn Φ 80mm/Stainless Steel316L (Only applicable for installation with standpipe) * |
| E | Horn Φ 100mm/Stainless Steel316L |
| F | Horn Φ 150mm/Stainless Steel316L |
| G | Horn Φ 200mm/Stainless Steel316L |
| Antenna Extension | |
| A | No |
| B | 200mm |
| C | 500mm |
| D | 1000mm |
| E | 2000mm |
| X | Special Design |
| Process Connection/Material | |
| FA | Flange DN50 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FB | Flange D80 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FC | Flange DN100 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FD | Flange DN150 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FE | Flange Dn200 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| YP | Special Design |
| Seal/Process Temperature | |
| 2 | Viton/-40~+130 °C |
| 3 | Kalrez/-20~+130 °C |
| 4 | Viton/-40~+200 °Cwith radiator fins (Process Temperature >100 °C) |
| 5 | Kalrez/-20~+200 °Cwith radiator fins (Process Temperature >100 °C) |
| Electronic | |
| B | (4~20) mA/HART 2-Wire |
| C | (4~20) mA/(22.8~26.4) V DC/HART 2-Wire/4-Wire |
| D | (198~242) V AC/HART 4-Wire |
| Housing/Protection | |
| A | Housing/Protection/IP67 |
| B | Plastic/IP66 |
| D | Aluminium (2-chamber)/IP67 |
| G | Stainless Steel316L/IP67 |

| Cable Entry | |
|---------------------|---------|
| M | M20x1.5 |
| N | 1/2NPT |
| Display/Programming | |
| A | Yes |
| X | No |
| Huff | |
| A | Yes |
| X | No |

Note: Intrinsically Safe+Ship Approval (Exia IIC T6) be used for "A" and "B" must use "D" housing; Intrinsically Safe+Flameproof Approval (Exd [ia]ia IIC T6) must use "D" housing.

● RD! 54

| Explosion Proof Approval | |
|-----------------------------|--|
| P | Explosion Proof Approval |
| I | Intrinsically Safe (Exia IIC T6) |
| C | Intrinsically Safe+Ship Approval (Exia IIC T6) |
| G | Intrinsically Safe+Flameproof Approval (Exd ia IIC T6) |
| Shape of Antenna/Material | |
| F | Horn Φ150mm/Stainless Steel316L |
| G | Horn Φ200mm/Stainless Steel316L |
| H | Horn Φ200mm/Stainless Steel316L |
| Antenna Extension | |
| A | no |
| B | 200mm |
| C | 500mm |
| D | 1000mm |
| X | Special Design |
| Process Connection/Material | |
| FB | Flange DN150 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| FC | Flange Dn200 PN1.6 Stainless Steel316L(GB/T9119-2000) |
| YP | Special Design |
| Seal/Process Temperature | |
| 2 | Viton/-40~+130 °C |
| 3 | Kalrez/-20~+130 °C |
| 4 | Viton/-40~+200 °Cwith radiator fins (Process Temperature >100 °C) |
| 5 | Kalrez/-20~+200 °Cwith radiator fins (Process Temperature >100 °C) |
| Electronic | |
| B | (4~20)mA/HART 2-Wire |
| C | (4~20)mA/(22.8~26.4)V DC/HART 2-Wire/4-Wire |
| D | (198~242)V AC/HART 4-Wire |
| Housing/Protection | |
| A | Housing/ProtectionI/IP67 |
| B | Plastic/IP66 |
| D | Aluminium (2-chamber)/IP67 |
| G | Stainless Steel316L/IP67 |

| | |
|---------------------|---------|
| Cable Entry | |
| M | M20x1.5 |
| N | ½NPT |
| Display/Programming | |
| A | Yes |
| X | No |
| Huff | |
| A | Yes |
| X | No |

Note: Intrinsically Safe+Ship Approval (Exia IIC T6) be used for "A" and "B" must use "D" housing;
 Intrinsically Safe+Flameproof Approval (Exd [ia]ia IIC T6) must use "D" housing.