76-81 GHz CW FM Radar Level Meter

Product instructions

1. INTRODUCTION of Product Introduction

1.1 Application function

RD80 The 76-81 GHz FM radar (also known as millimeter-wave radar), because of its higher frequency than Ku band radar, has important applications in remote target detection, strong smoke dust environment, long-range imaging, multispectral imaging and so on, and can detect smaller targets and achieve more accurate positioning than microwave radar, with higher resolution and greater confidentiality.

What is millimeter wave electromagnetic wave: the electromagnetic wave in frequency domain (wavelength 1~10 mm) of 30-300 GHz is usually called millimeter wave, which is located in the wavelength range of overlapping microwave and far infrared wave, so it has two kinds of characteristics. GHz 76-81 band of this product is the region with the least understanding and application development so far, with the following characteristics.

- Good transient performance: the pulse width of the electromagnetic pulse in this band can be narrow at sub picosecond (ps) level. Therefore, it can be used to study the time resolution of various materials and measure the molecular structure. It can effectively suppress the interference of far red background noise by sampling and measuring technology.

- There is a wide band: the current pulse source usually requires only a few cycles of electromagnetic wave oscillation, which is close to the band of the vibrational and rotational energy levels of many biological macromolecules, dielectric, semiconductor, superconducting, thin film materials. Therefore, this band spectrum can be used as an effective means to detect the information of materials in millimeter wave band. It is very suitable for measuring the absorption spectrum of materials and can be used for qualitative identification applications.

- Coherent: coherent current driven dipole oscillation or coherent laser pulse nonlinear differential frequency effect;

- Low energy: millimeter wave photon energy is only a few millivolt volts, there will be no X ray ionization and destruction of substances to be detected, so it is not easy to destroy substances to be detected.

- Strong penetration: for non-polar substances have a strong penetration, many non-metallic non-polar materials to this band of radiation absorption is small, therefore, can be used to detect the internal structure of materials. For example, ceramics / cardboard / plastic products / foams are transparent to this band of electromagnetic radiation and can also be used for airport / station safety monitoring, such as the detection of machinery / explosives and drugs, or for circuit board welding detection.

- Easy to be absorbed by polar molecules: this band has less scattering in heterogeneous substances and can detect and measure water vapor content. They can also be analyzed by their characteristic spectrum to study the composition of substances or quality control.

As a 78 GHz band radar used in the field of industrial measurement, it has the advantages of high precision, non-contact object level and liquid level measurement, which can not be compared with other ordinary microwave pulse radar and guided wave radar. The narrow beam and penetration ability can adapt to super complex working conditions without weakening the measurement performance.

1.2 Application areas suitable for products

- Electromagnetic wave emission angle is less than 3°, suitable for narrow space or guided wave pipeline measurement
- products can reach 150 M measuring range, suitable for measuring super large storage tanks
- product measurement blind area in 7-8 CM range, suitable for small storage tank measurement
- The product has extremely high measurement accuracy and is suitable for high precision dosimeter measurement
- The product has rich echo processing algorithm and experience data of all kinds of working conditions, and has unique advantages for storage tanks with strong dust, steam and other extremely bad working conditions or special processes such as stirring and heating rods.

1.3 Product characteristics

- 76GHz-81GHz Frequency Modulation Radar
- 5GHz frequency width of ultra-large frequency modulation scan
- Supports standard HART、RS485/MODBUS bus protocols
- Support host computer software, can side table operation mode

- 24VDC supply
- Simple installation structure, suitable for various installation forms on site

2. |SPECIFICATIONS technical specifications

Table 2-1 Technical Specification for Bitometers

Launch frequency	76GHz~81 GHz, FM scan frequency width 5 GHz
Scope of measurement	0.08~150 m
Measurement resolution	3 cm 3
Measuring accuracy	mm ±1
Beam angle	3°
Use of dielectric constant ranges	>=2
Power supply range	21~24 VDC,4-wire system (<1 W)
Mode of communication	HART/MODBUS bus
Signal output	~20 mA (with Hart bus) or RS-485
Fault output	3.8 mA、4mA,20mA,22mA, Maintenance
Field operations/programming	128×64 dot matrix display screen/4 key Configure Upper Locator Setup Software
Industrial temperature/humidity	-4~85℃≤95 per cent
Shell material	Aluminum alloy, stainless steel
Type of antenna	Lens antenna with lens antenna shield / antiseptic antenna / antenna radiator / quartz isolation flange
Process pressure	-0.1~2 MPa
Product size	Ø100*270mm
Cable entrance	M 20*1.5
Recommended cable	AWG18 or 0.75 mm²
Protection level	IP68
Explosion proof rating	
Installation mode	Thread or flange
Net/Gross weight	Kg/2.995Kg 2.480
Box size	600*300*300 mm

3. |INSTALL of installation

3. 1 Installation location

- Avoid installing the instrument in a central position or near the edge of the container, otherwise it is likely to produce an error reading.

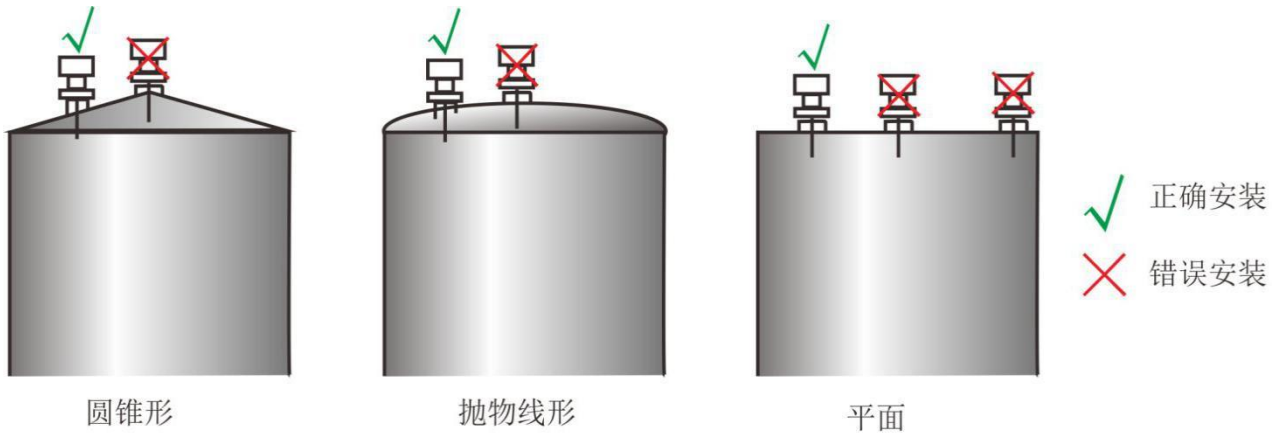


Figure 3-1 schematic diagram of the installation position of the instrument

- Examples of avoiding false echoes

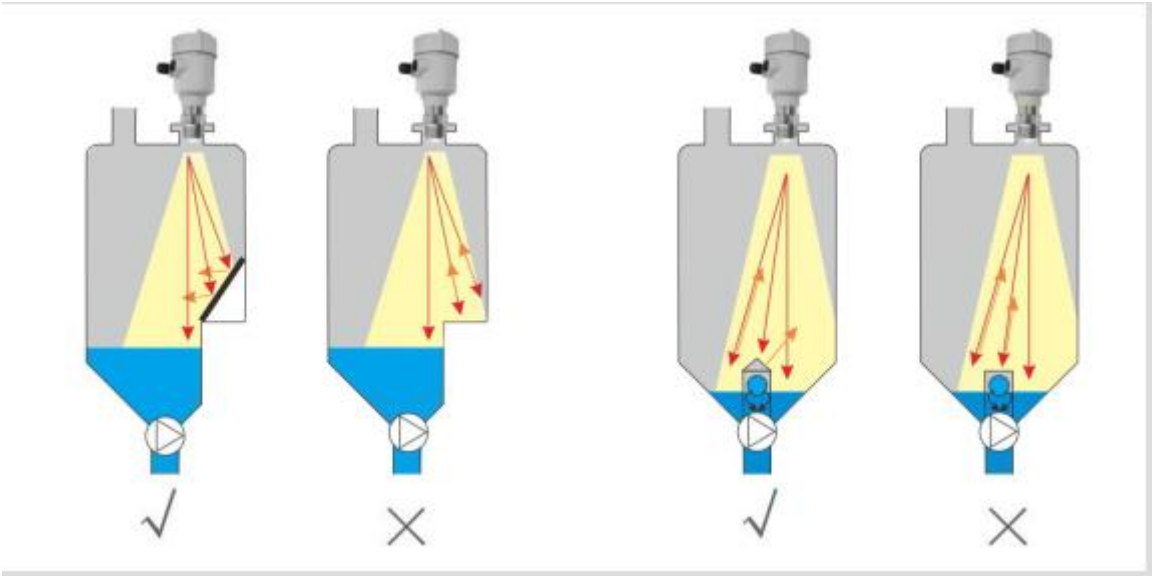


Figure 3-2 Schematic illustration of avoiding false echoes

■ Ladder and grille tank handling

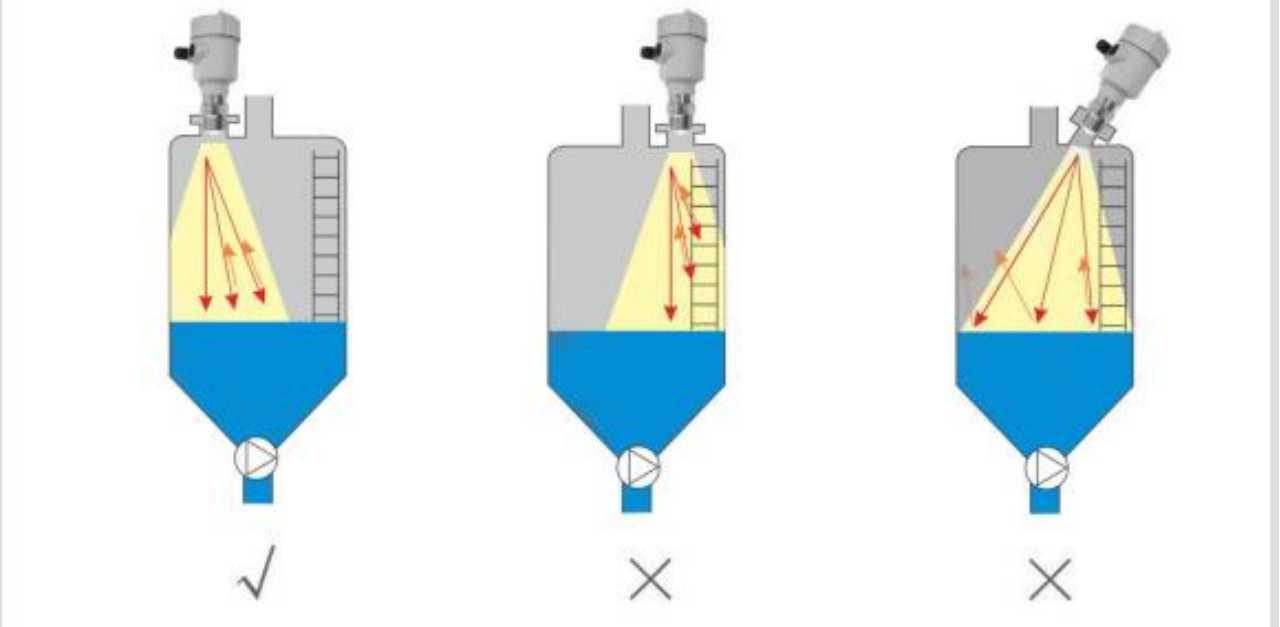


Figure 3-3 Staircase and grille tank handling

■ Wall and grille tank treatment

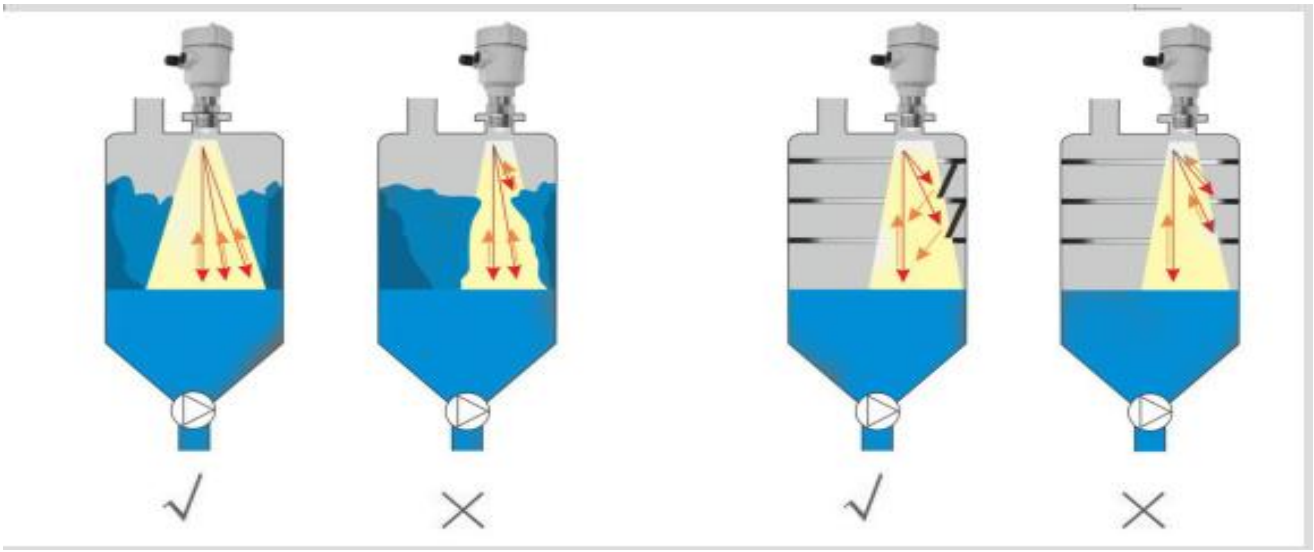


Figure 3-4 Wall and grille tank treatment

3. 2 Installation angle

■ Beam scattering: due to the polarization effect of microwave signal and container wall, the

height of the container is guaranteed every 3 m when installed, and the distance between the instrument and the side wall is not less than 20 mm.

- Polarization effects:

1） the launch cone encounters planar obstacles and vertical struts that cause huge false reflections. These obstacles reflect large amplitude radar signals. The surface of circular obstacle scatters the reflected wave of radar signal and produces false reflection with small amplitude.

2） To obtain the minimum false reflection, the optimal signal (the lowest false echo amplitude) is obtained by rotating the instrument first, and then the false echo curve is established.

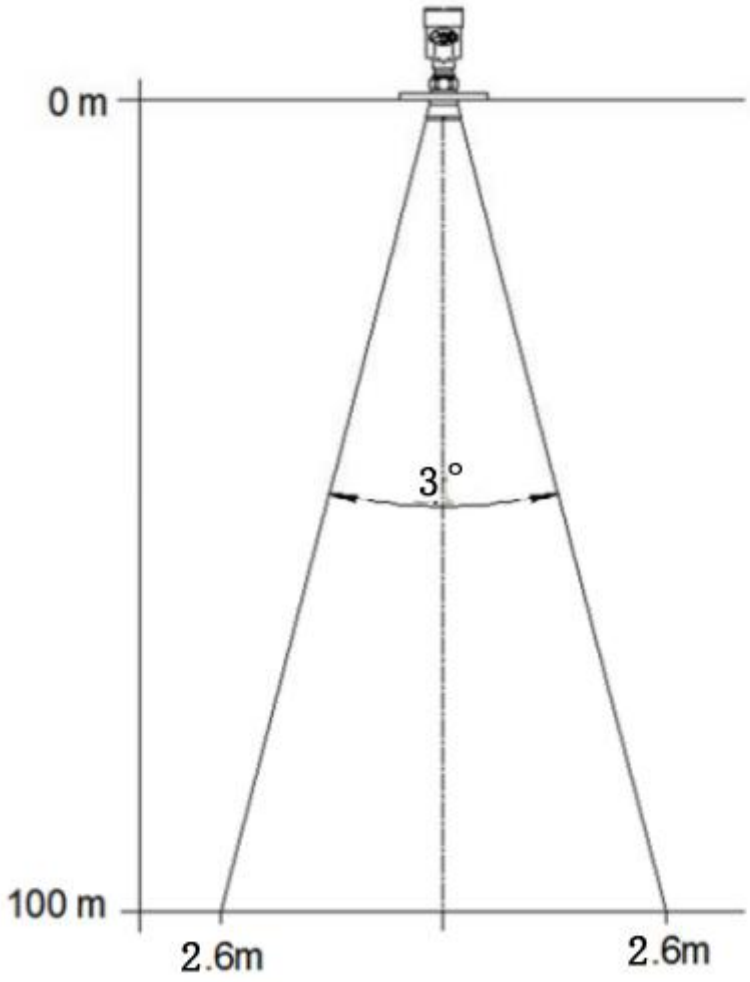


Figure 3-5 Schematic illustration of radar beam space geometry for instrumentation

- FM resolution

LM7820 FM bandwidth B=5.1 GHz, minimum range resolution $Sres = \frac{C}{2 * B} = 2.94cm$

The LM7820 intermediate frequency signal is analyzed by its own algorithm, and the measurement accuracy is 0.1 mm.

- Distance resolution (Range Resolution)

The popular explanation is that distance resolution refers to the distance between two objects

together, the object radar can distinguish two objects rather than one object and can measure their respective distances.

If the distance between two objects is less than the range resolution of the object radar, then the radar can only measure one distance value, which is not equal to the distance value of any of the objects, but the synthesis of the distance value of the two objects.

- Accuracy of measurement (Accuracy)

If there is only one object and the object moves a small distance, can the object radar recognize the distance change. The index that distinguishes the moving distance of a single object is called precision.

|DIMENSIONS 4. Structure Size

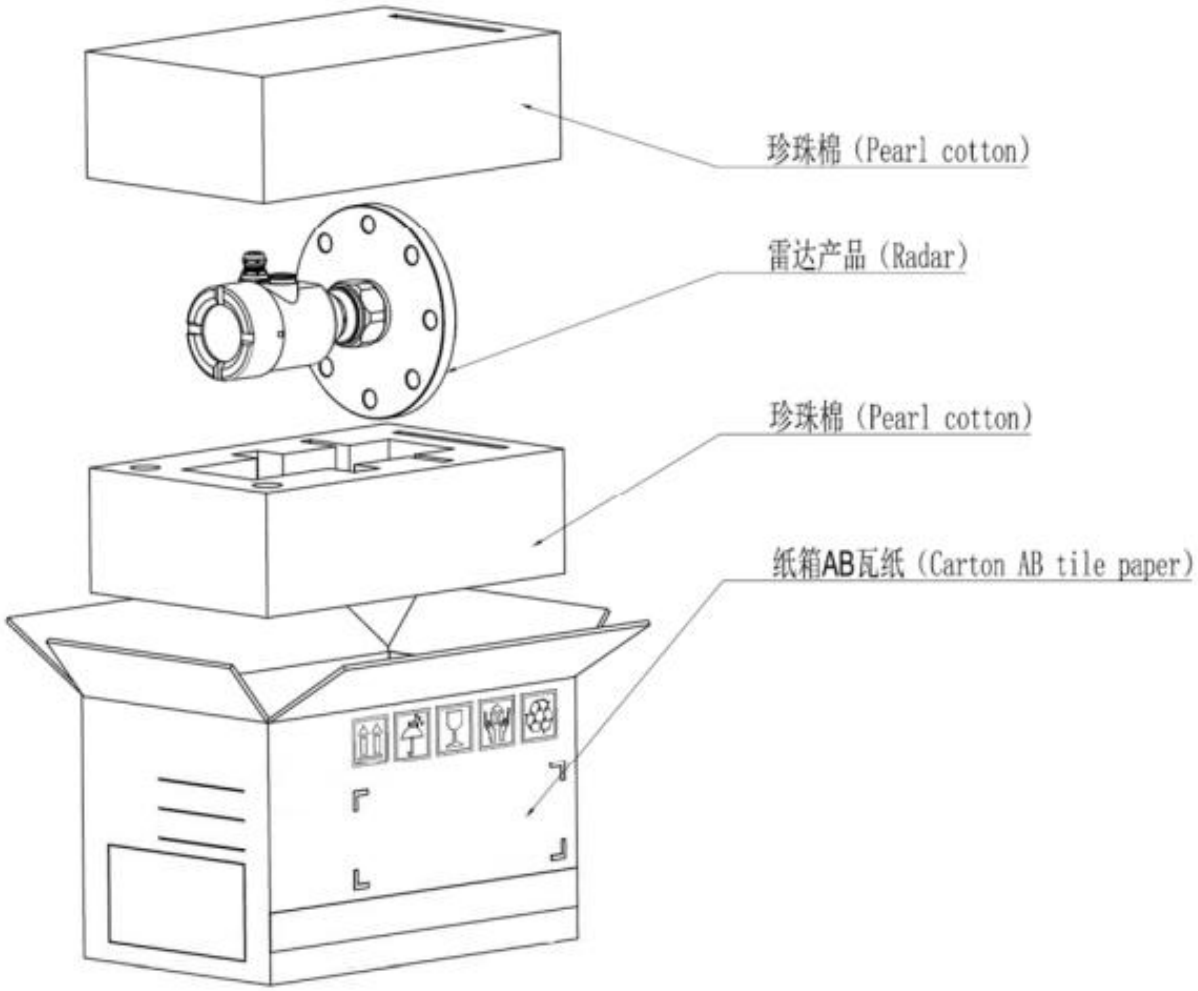
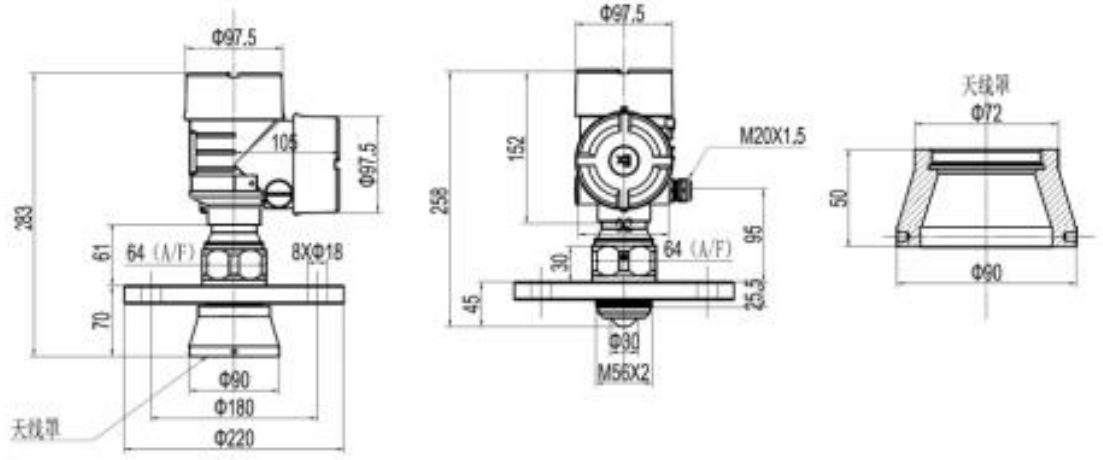
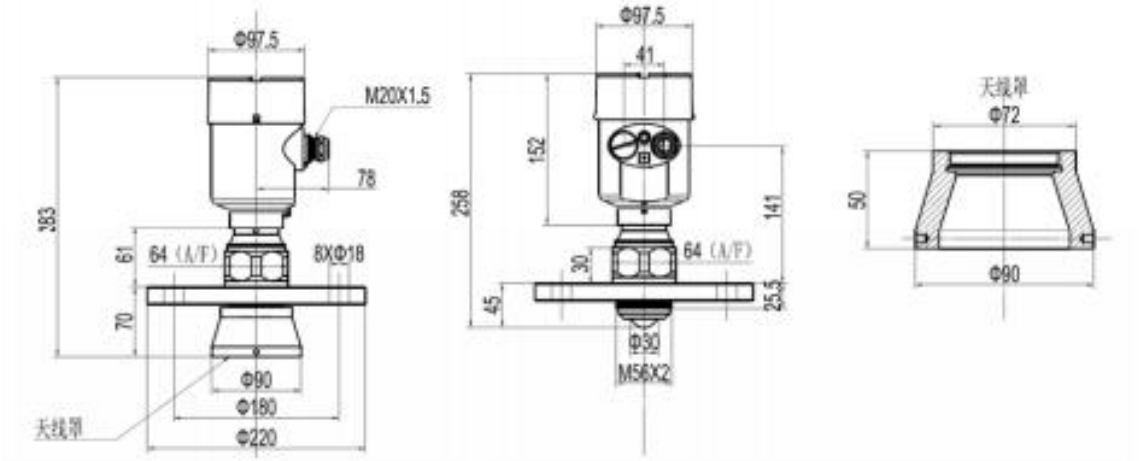


Fig .4-1 Schematic diagram of instrument packing

双腔外壳尺寸：



单腔外壳尺寸：



石英玻璃隔离法兰尺寸：

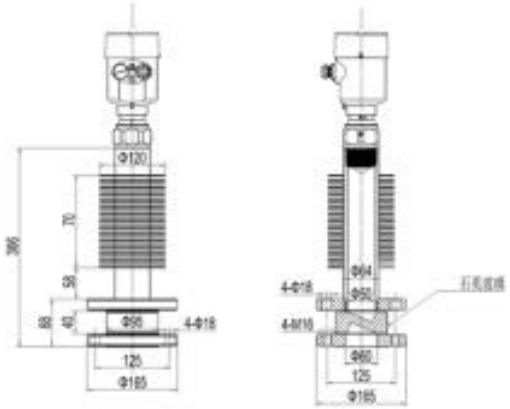


Fig .4-2 Structure and Dimensions

5. connection |CONNECTION

5.1 Single-cavity housing 24 VDC Product wiring diagram

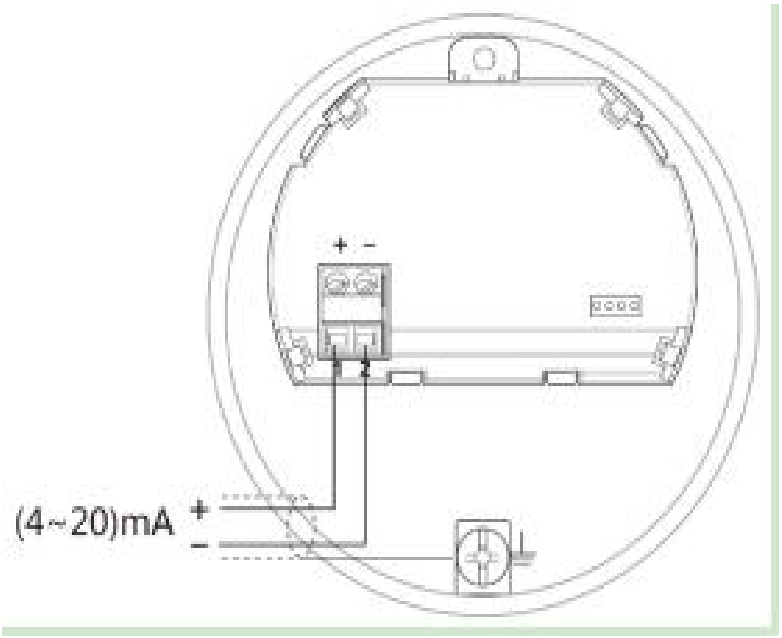


Figure 5-1 Single-cavity housing 24 VDC Product wiring diagram

Note :24 V can do two-wire system or four-wire system 220 v can only do four-wire system.

5.2 24VDC Power Supply Product Interface Description

Description of the power supply product interface VDC instrument 24

PIN1	24VDC(+) Positive end of power cord
PIN2	24VDC(-) power cord negative end
PIN3	HART(+), or 4-20 mA(HART(+),4-20 mA current output positive end
PIN4	HART(-), is 4-20 mA(-),4-20mA current output negative end
PIN5	RS485(A),485 communication output

PIN6	RS485(B),485 communication output