Technical Information

LRD 6 series radar level Meter

Apply

Continuous non-contact level measurement in liquids, slurries and sludges
• PTFE fully filled drop antenna
• Maximum measuring range: 120 m (393.7 ft)
• Temperature: -40... +200 °C (–40... +392 °F)
• Pressure: -1... +16 bar (- 14.5... +232 psi)
• Measuring accuracy: ± 2 mm (0.08 in)
• Provides three or five point linear calibration

Advantage

• Innovative PTFE water drop antenna
• Enhanced beam aggregation and small beam angles ensure reliable measurements, especially when multiple jamming devices are present inside the container
• Secure design with the highest security
• Intuitive user interface, simple guided device debugging
• Echo tracking technology guarantees the highest measurement reliability

V1.0

Contents

Function and system design

Principle of measurement

The 80G radar level meter uses frequency-modulated continuous wave (FMCW) technology. The antenna emits a high-frequency FM radar signal, and the frequency of the radar signal increases linearly. The transmitted radar signal is reflected by the measured medium and received by the same antenna. At the same time, the frequency difference between the transmitted signal frequency and the received signal frequency is proportional to the measured distance. The frequency difference signal is obtained by fast Fourier transform (FFT), and the distance of the target to be measured is calculated.

Characteristics

Compared with 26G or 6G radar, 80G radar has the characteristics of higher frequency, shorter wavelength, smaller beam Angle and more concentrated energy. Coupled with the application of FMCW technology, it has the following characteristics:
1. Large range, small blind area;
2. Small beam Angle, small antenna size, easy to install. Small influence by tank nozzle size and obstacles; 3. High measurement accuracy, strong anti-interference ability, high reliability.

Input

Measured variable

The measured variable is the distance between the reference point and the surface of the medium. Adjust the calculated level based on the input low.

range

Instrument model	Maximum measuring range
LRD601	30m（liquid）
LRD602	10m/30m/120m（liquid）
LRD603	30m（liquid）
LRD604	120m（Solid/liquid）

The effective measurement range depends on antenna size, dielectric reflection characteristics, installation location, and any possible interference reflections.
The following sections list the media groups and the corresponding effective measurement ranges. If the dielectric constant of the medium is unknown, refer to the data related to the dielectric constant in the Process Conditions section to ensure reliable measurement results.

Operating frequency

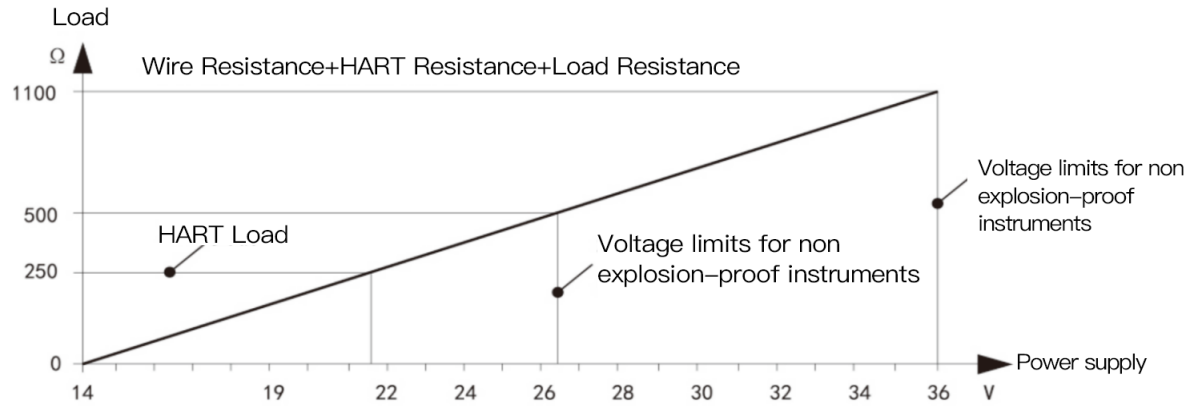
77 ~ 81GHz

Output

Output signal

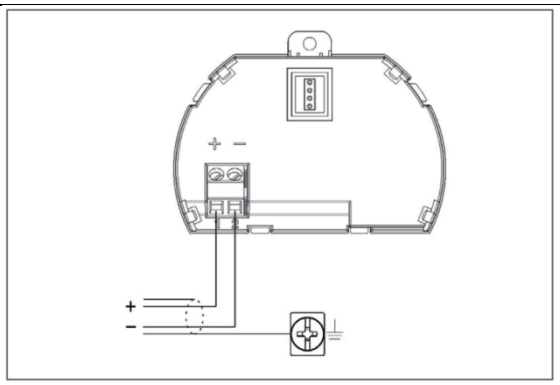
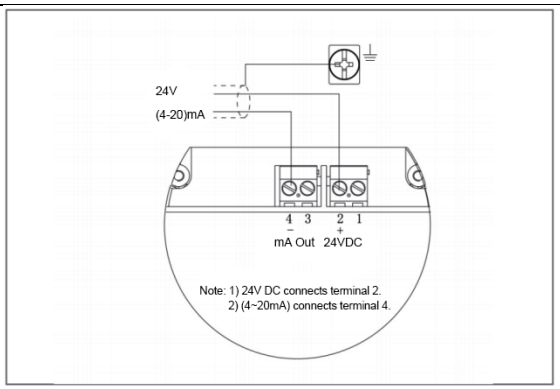
• (4 to 20)mA output, HART
Output, RS485 / MODBUS protocol
Resolution: 0.3 μA Fault signal: current output unchanged; 20.5mA; 22mA; 3.9 mA
Two-wire load resistance (see figure below)
Integration time: 0~40s, adjustable

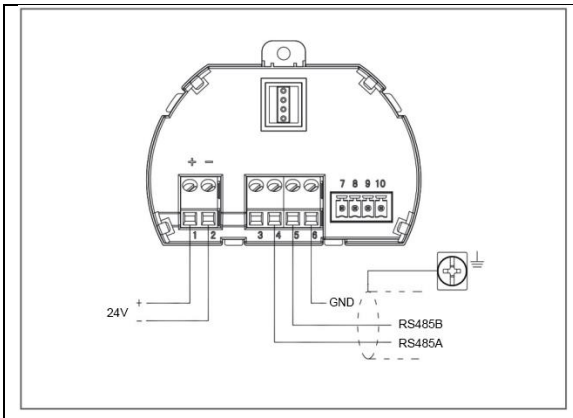
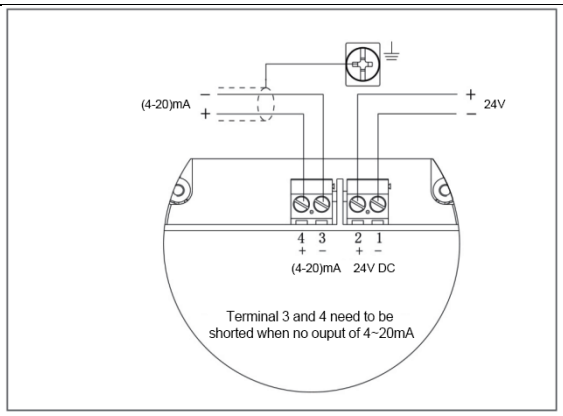
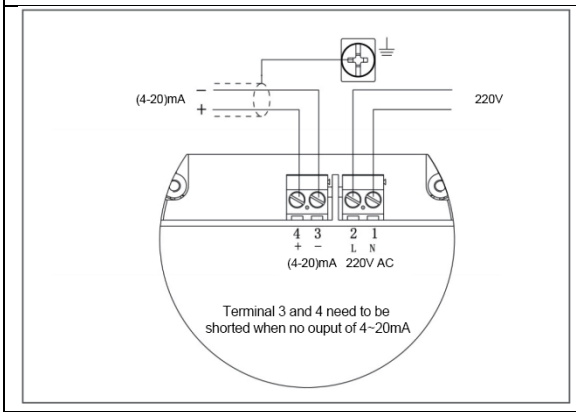
Two-wire load resistance diagram



Power supply

Terminal allocation

Two wire, single cavity	Two-wire, two-cavity
	
(4 to 20) mA output, HART; 24VDC power supply, two-wire system	(4 to 20) mA output, HART; 24VDC power supply, two-wire system
Four wire, single cavity	Four-wire, two-cavity

	
RS485/MODBUS protocol output; 24VDC power supply, four-wire system	(4 to 20) mA output, HART; 24VDC power supply, four-wire system
Four-wire, two-cavity	
	
(4 to 20) mA output, HART; 220VAC power supply, four-wire system	

Supply voltage

Two-wire (single cavity) (4-20mA)	Standard type	12～30VDC
	Intrinsic safety type	12～30VDC
	power dissipation	Max.22.5mA
	Allow ripple	
	≤100Hz	Uss < 1V
	-(100~100K) Hz	Uss < 10mV
Four-wire (single cavity) (RS485)	Standard type	9~27VDC
	power dissipation	Max.1.5W
	Intrinsic safety type	24（1±10%）VDC
	power dissipation	Max.12mA
Two-wire (two-cavity)（4-20mA)	Intrinsic safety+explosion-proof type	18~25VDC
	power dissipation	Max.22.5mA

Four-wire (two-cavity) (4-20mA)	Intrinsic safety+explosion-proof type	24VDC
	power dissipation	Max.30mA
Four-wire (two-cavity) (4-20mA)	Intrinsic safety+explosion-proof type	220VAC
	power dissipation	Max.18mA

Current consumption

HART	
Nominal current	3.6～22 mA，The startup current in multi-point mode can be set (factory setting: 3.6 mA)）
Fault signal	Can set：3.59～22.5 mA

Cable entry

One M20x1.5 cable entry, connecting a 5-9 mm cable
One blind plug M20x1.5
Terminal block: used for wire cross-section 2.5mm2

Cable specifications

The power supply cable can use a regular two core cable, and the outer diameter of the cable should be (5-9) mm to ensure the sealing of the cable entry. If there is electromagnetic interference, it is recommended to use shielded cables.
(4-20) mA/Hart (two wire system): The power cable can use a regular two core cable.
(4-20) mA/Hart (four wire system): Power cables should use cables with dedicated ground wires.

Shielding and wiring of cables

Both ends of the shielded cable should be grounded. Inside the sensor, the shielding must be directly connected to the internal grounding terminal. The external grounding terminal on the casing must be grounded. If there is grounding current, the shielding end of the shielded cable away from the instrument side must be grounded through a ceramic capacitor (such as 1nF/1500V) to isolate and bypass high-frequency interference signals.

Explosion proof connection

The explosion-proof form of this product is intrinsically safe/intrinsically safe+explosion-proof. The working environment temperature is (-40~60) ℃. Under normal and fault conditions, the maximum temperature of any part of its surface shall not exceed T2 (200 ℃), T3 (195 ℃), T4 (130 ℃), T5 (95 ℃), T6 (80 ℃). Explosion proof sign: II 1G Ex ia IIC T6 Ga/II 2G Ex db IIC T6 Gb. The shell material of the intrinsically safe level meter is made of plastic PBT, aluminum ADC12 or stainless steel 316L, while the shell material of the intrinsically safe+explosion-proof level meter is made of aluminum ADC12 or stainless steel 316L. Electronic components adopt a sealed structure to ensure that sparks generated in the event of circuit failure are not released. This product is suitable for continuous level measurement of combustible gases with explosion-proof levels of II 1G Ex ia IIC T6 Ga/II 2G Ex db IIC T6 Gb and below. When using intrinsically safe instruments, safety barriers must be used for power supply. The FBS-2 safety barrier is an associated equipment of this product, with an explosion-proof form of intrinsic safety. Explosion proof sign: [Ex ia] II C, power supply voltage 24VDC ± 5%, short-circuit current 130.5mA, working current (4-20) mA. All cables must be shielded, with a maximum length of 500m from the instrument to the safety barrier. Distributed capacitance ≤ 0.1 μ F/Km, distributed inductance ≤ 1mH/Km. The instrument must be grounded during installation. When using RS485 intrinsically safe instruments, communication input isolated safety barriers must be used for power supply.

ambient temperature(℃)	Medium temperature(℃)	Group	Explosion proof signs	
			Intrinsic safety type	Intrinsic safety+explosion-proof type
-40~60	195~200	T2	II 1G Ex ia IIC T6 Ga	II 2G Ex db IIC T6 Gb
	130~195	T3		
	95~130	T4		
	80~95	T5		
	-40~80	T6		
IP Protection level			IP67	
case			ADC12/stainless steel 316L	

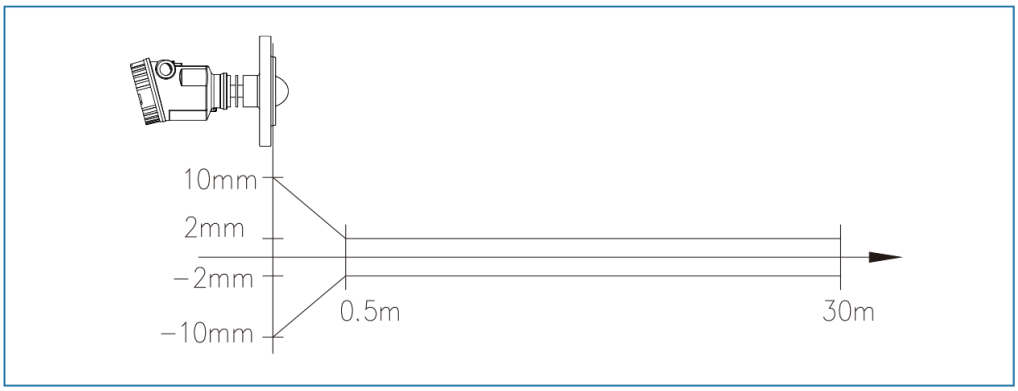
performance parameter

Reference operating conditions

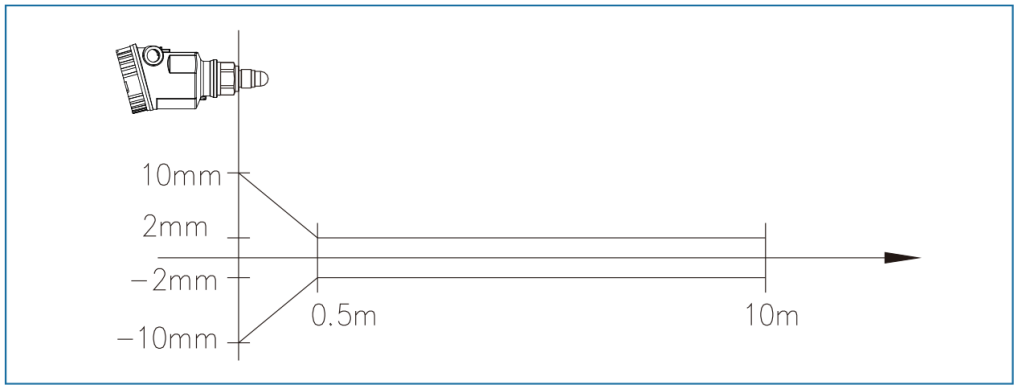
Environmental temperature: -40~80 ℃
Pressure: Max. 2.5MPa
Shock resistance: Mechanical vibration 10m2/s, 10-150Hz
Humidity: <95%

Reference measurement accuracy

LRD601 3dB emission angle
Lens diameter 50 6 °
Lens diameter 80 3 °
Accuracy as shown in the following figure

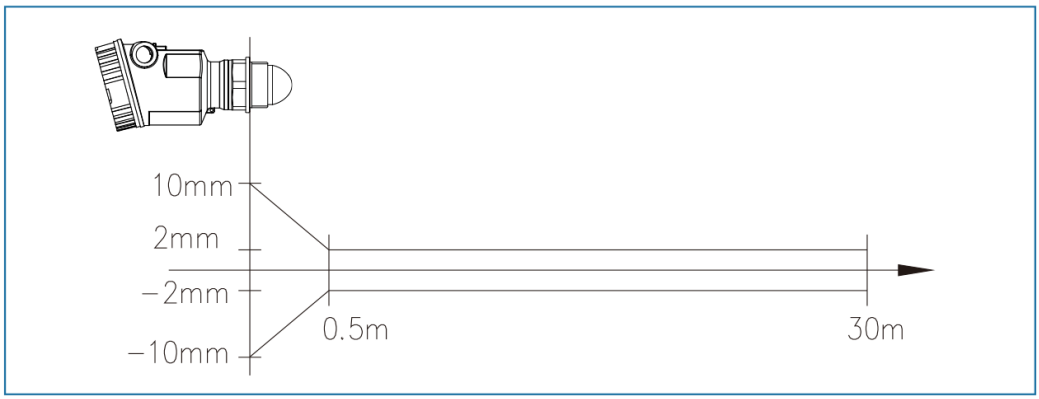


LRD602 3dB emission angle
Lens diameter3/4” 14°
Accuracy as shown in the following figure



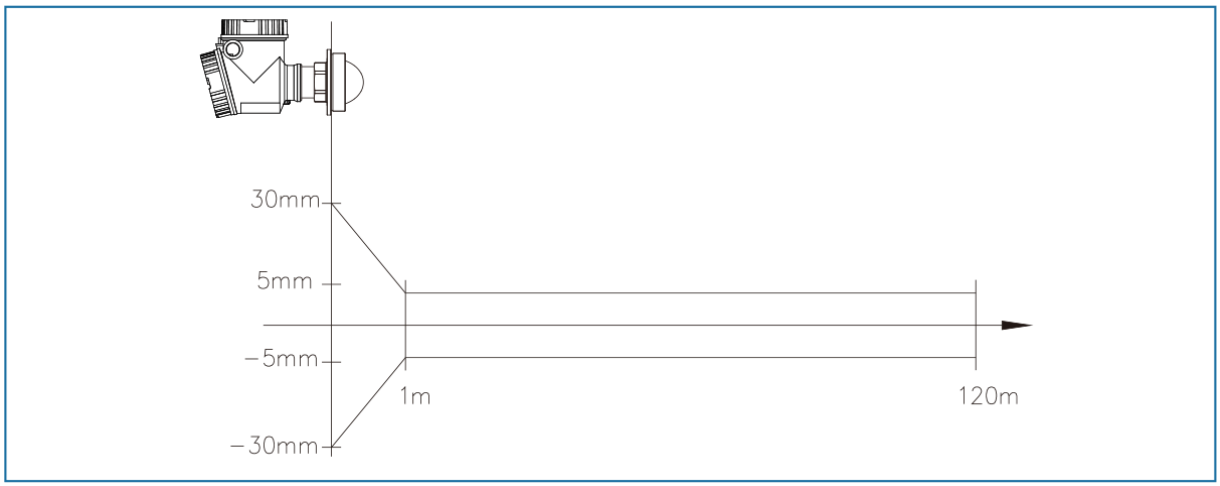
LRD602

3dB emission angle
Lens diameter 1 1/2” 6°
Accuracy as shown in the following figure



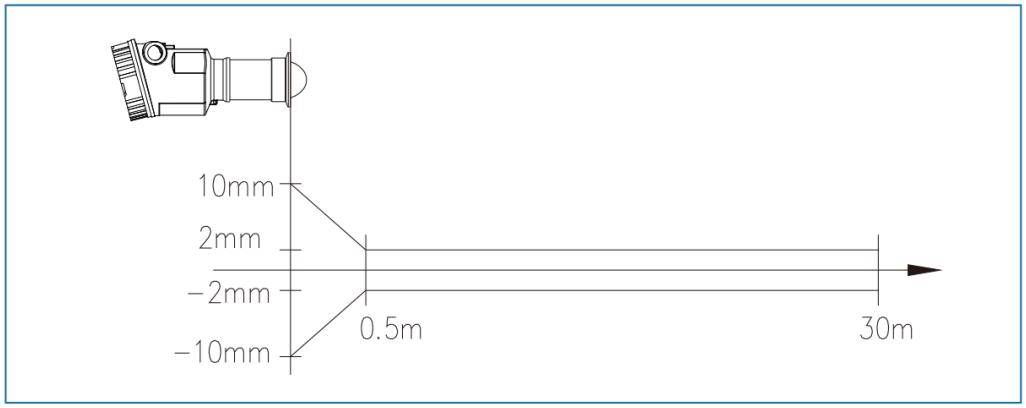
LRD602

3dB emission angle
Lens diameter 3” 3°
Accuracy as shown in the following figure

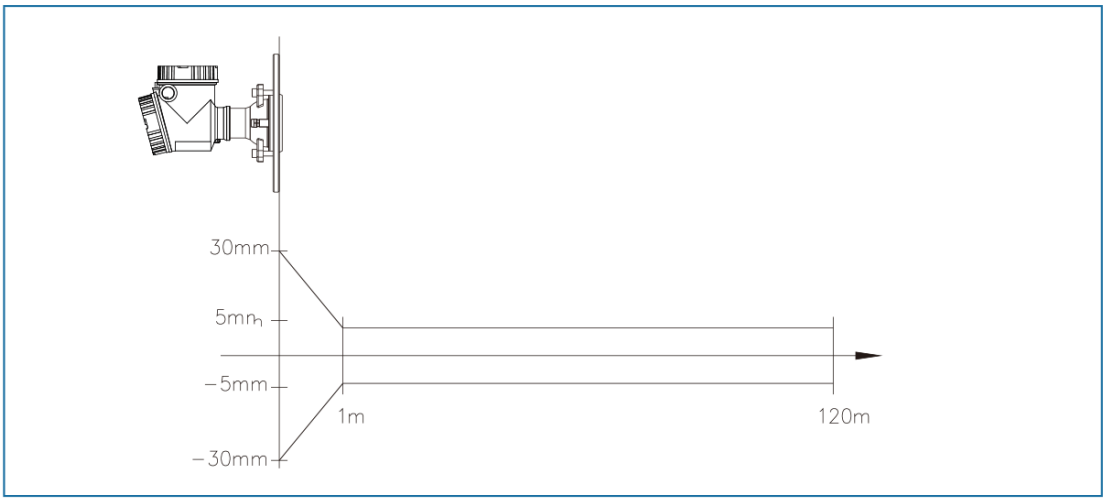


LRD603

3dB emission angle
Lens diameter 50 6°
Lens diameter 80 3°
Accuracy as shown in the following figure



LRD604	3dB emission angle	4°
	Accuracy	as shown in the following figure



Measurement resolution

Display: 1mm

Response time

Measurement interval: approximately 1 second (depending on parameter settings)Adjustment time ①: Approximately 1 second (depending on parameter settings)
① After a drastic change in material level, the time required to provide the correct material level (maximum 10% error)

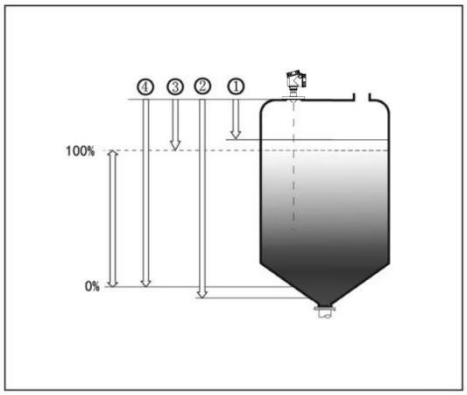
Install

Installation conditions

When the antenna emits microwaves, there is a certain transmission angle. There should be no obstacles in the area radiated by the microwave beam from the lower edge of the antenna to the surface of the tested medium. During installation, facilities inside the tank should be avoided as much as possible, such as ladders, limit switches, heating equipment, brackets, etc. If necessary, false echo learning must be performed. Additionally, it is important to note that the microwave beam should not intersect with the feed stream. When installing the instrument, it is also important to note that the highest material level must not enter the measurement blind spot; The instrument must maintain a certain distance from the tank wall; The installation of the instrument should strive to make the transmission direction of the antenna perpendicular to the surface

of the tested medium as much as possible. Instruments installed in explosion-proof areas must comply with the national installation regulations for explosion-proof hazardous areas. The shell material of intrinsically safe explosion-proof instruments is made of plastic PBT/aluminum ADC12; The shell material of the explosion-proof instrument is aluminum ADC12. Explosion proof instruments can be installed in situations with explosion-proof requirements, and the instruments must be grounded.

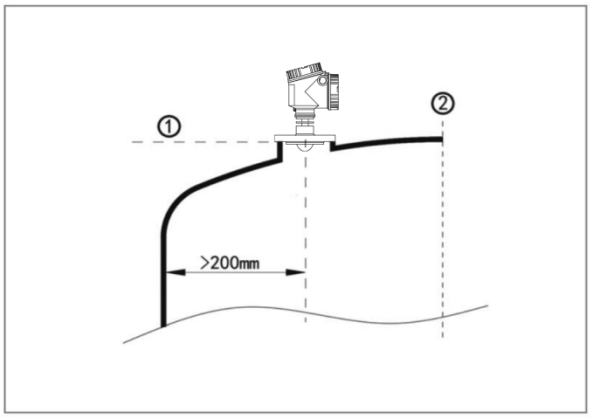
Illustrated Description



The reference surface for measurement is the sealing surface of the thread or flange.
1 Blind spot range
2 Range setting
3 High level adjustment
4 Low level adjustment

NOTE: When using radar level meter, it is important to ensure that the level gauge does not enter the measurement blind zone.

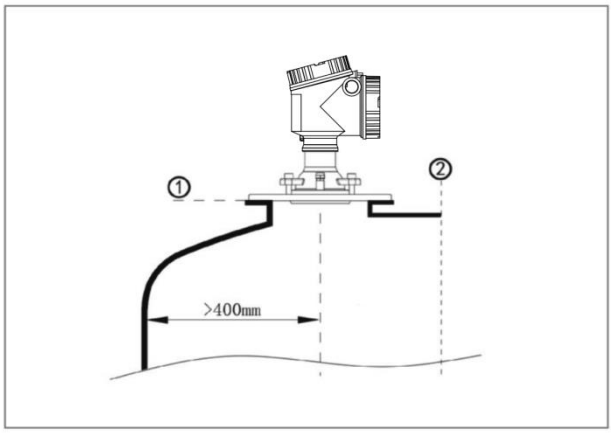
Installation location



During installation, pay attention to maintaining a distance of at least 200mm between the instrument and the container wall.

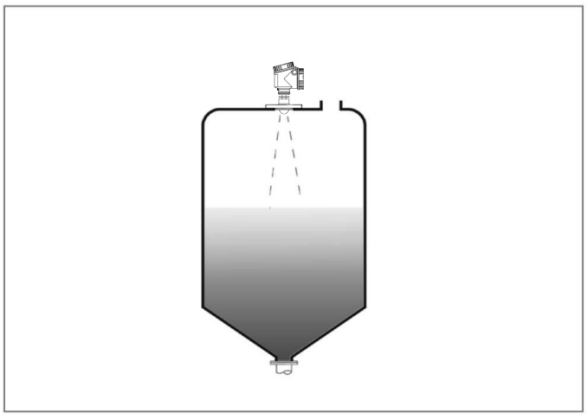
①Datum plane

②Center of container or axis of symmetry

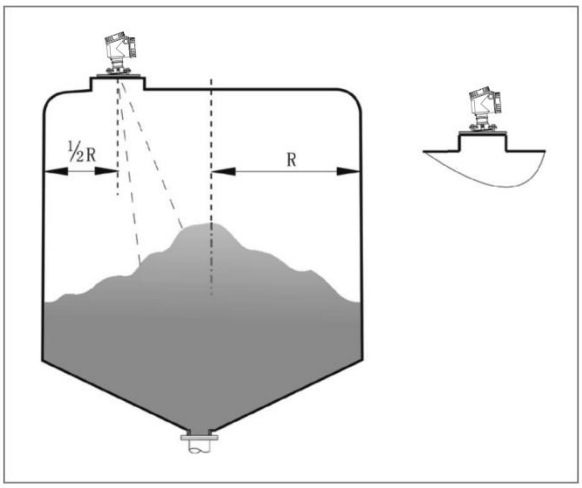


①Datum plane

②Center of container or axis of symmetry

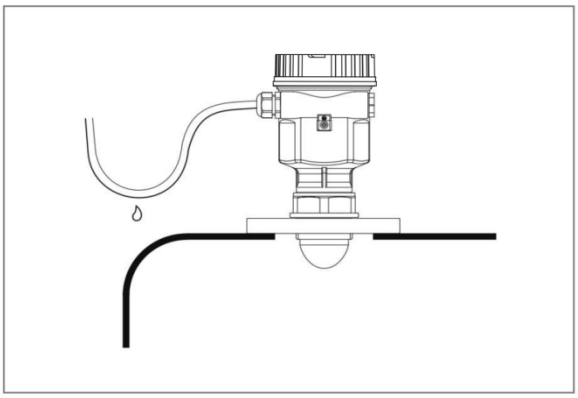


For conical containers with a flat top, the optimal installation position for the instrument is in the center of the top of the container, which ensures measurement to the bottom of the container.



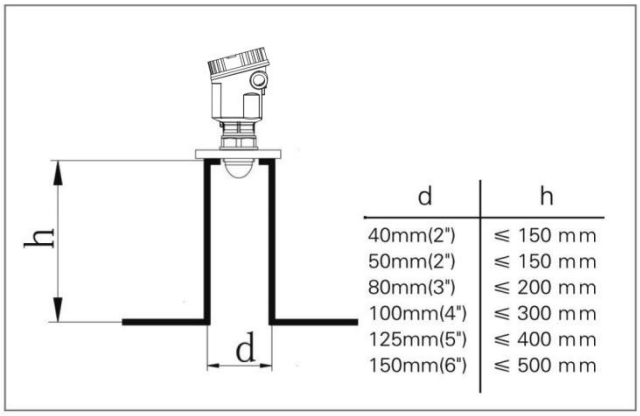
Installation with universal joint

Moisture-proof



For instruments installed outdoors or in damp indoor environments, as well as on cooling or heating tanks, in order to prevent moisture, the cable sealing sleeve should be tightened and the cable should be bent downwards at the inlet, as shown in the left figure.

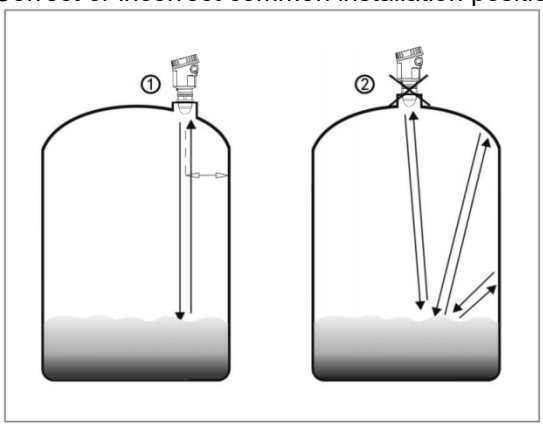
Container connection



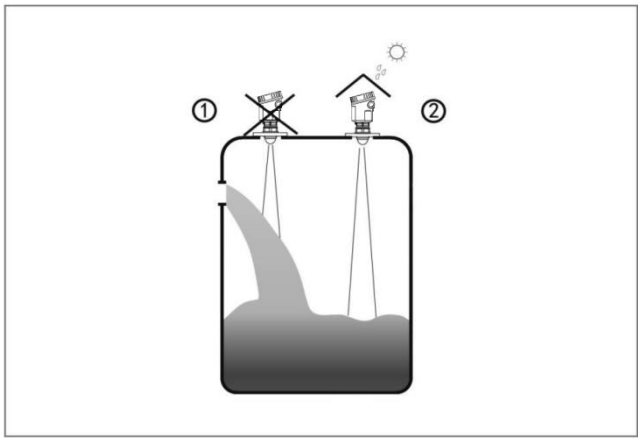
d	h
40mm(2")	⩽ 150 mm
50mm(2")	⩽ 150 mm
80mm(3")	⩽ 200 mm
100mm(4")	⩽ 300 mm
125mm(5")	⩽ 400 mm
150mm(6")	⩽ 500 mm

If the reflectivity of the tested medium is good, the container connection can also be longer than the antenna length. The standard length of container connections is shown in the table below. The end must be ground flat, and the "false echo learning" function should not be used to eliminate small pipe end reflections, which can also achieve good measurement results.

Correct or incorrect common installation positions

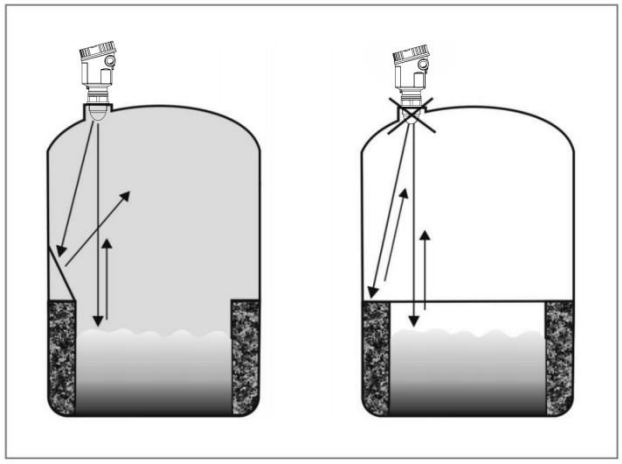


① Correct
②Error: Installing the instrument on an arched or circular tank top can cause multiple reflected echoes, which should be avoided as much as possible during installation.



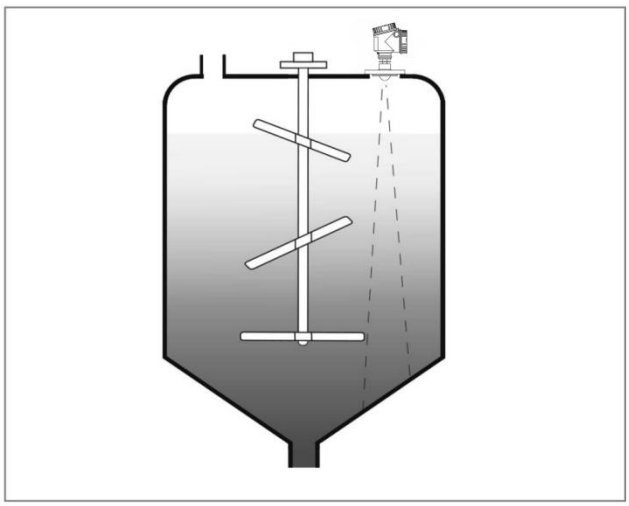
① Error: Do not install the instrument above the feed stream, ensuring that the surface of the measured medium is not the feed stream.
② Correct Attention: Sunshade and rainproof measures should be taken during outdoor installation。

Reflective plate installation



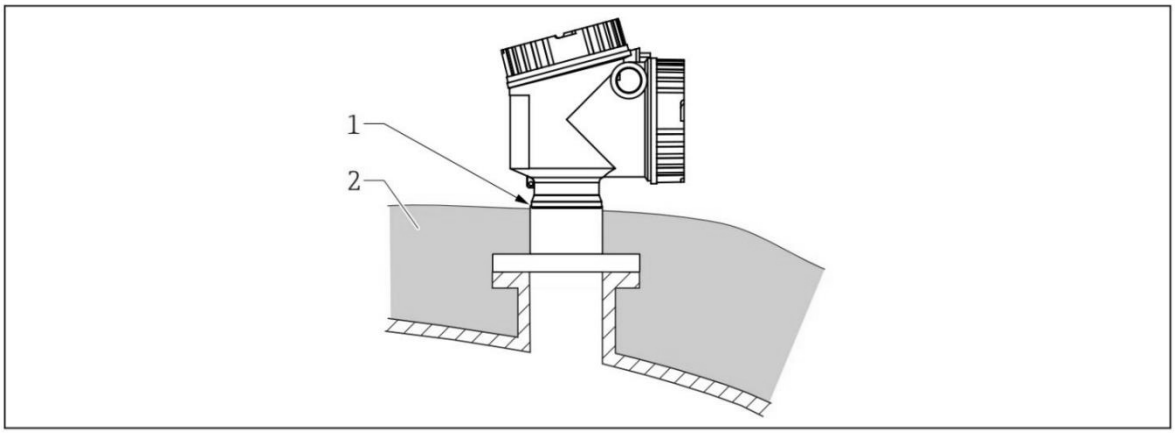
When there are obstacles in the tank that affect the measurement, a reflection plate can be installed to reflect the reflected waves of the obstacles elsewhere. If necessary, "false echo learning" can be performed

Mixing



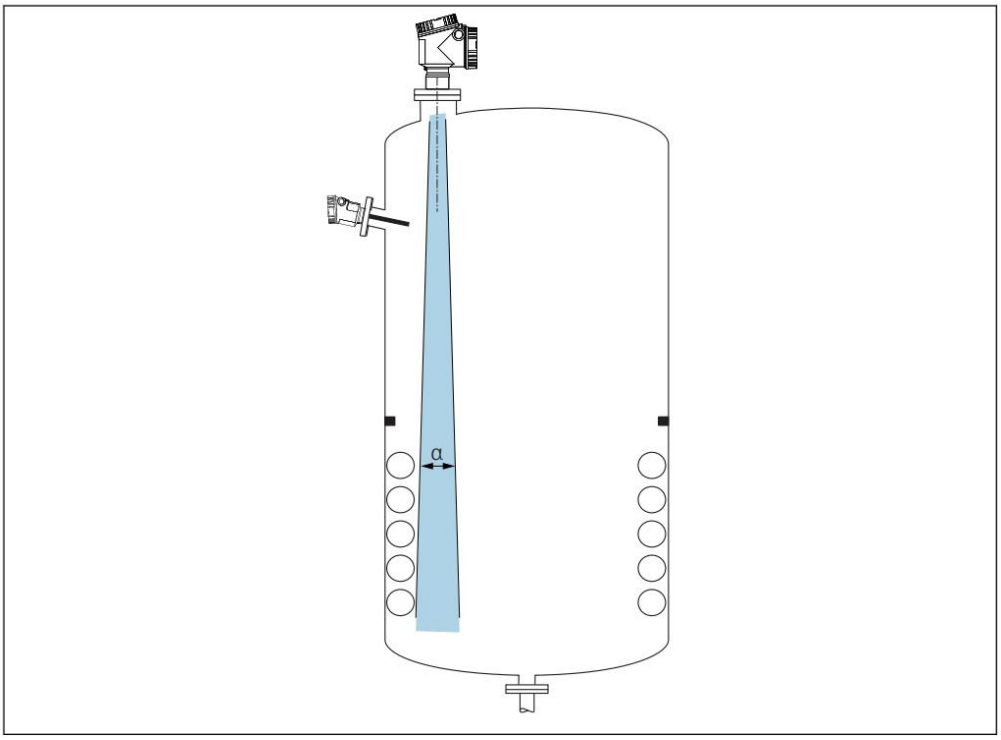
When there is stirring in the tank, if necessary, the instrument should be kept as far away from the mixer as possible. After installation, it is necessary to perform "false echo learning" in the mixing state to eliminate the influence of false echoes generated by the mixing blades.

Tank body with insulation layer



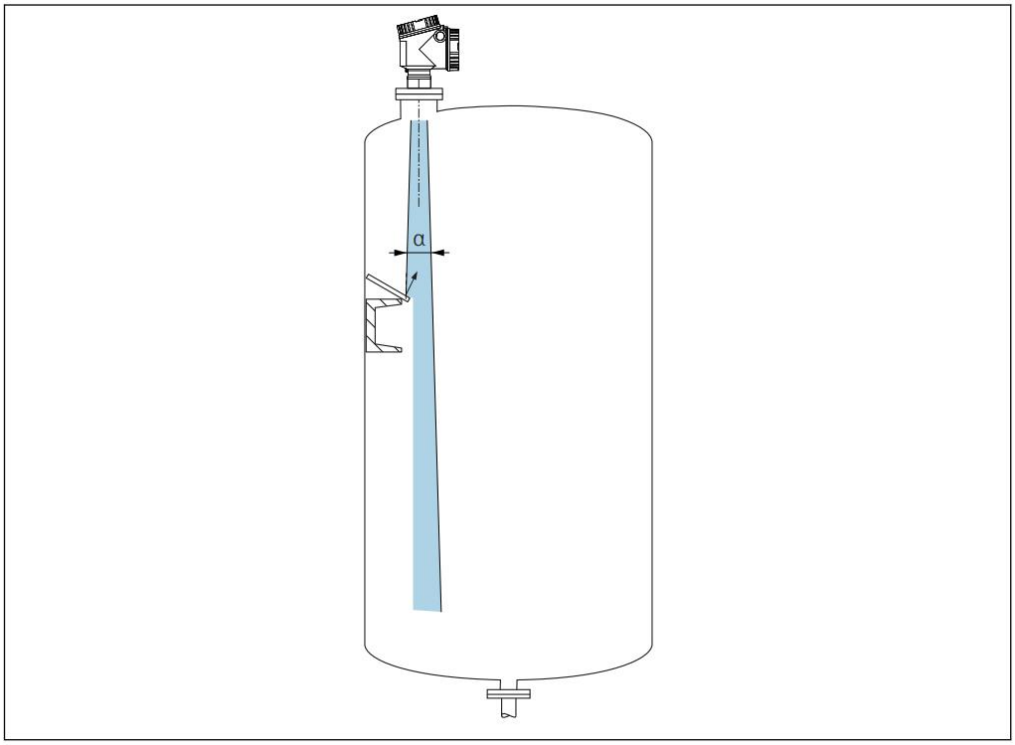
If the process temperature is very high, an insulation layer (2) must be installed outside the tank to avoid thermal radiation or convection causing internal electronic components of the instrument Overheating. The thickness of the insulation layer cannot exceed the neck of the equipment (1).

Internal device of tank body



Avoid installing any internal devices (limit switches, temperature sensors, bases, vacuum rings, heating coils, baffles, etc.) within the signal beam range. Pay attention to the beam angle.

To avoid interference echoes

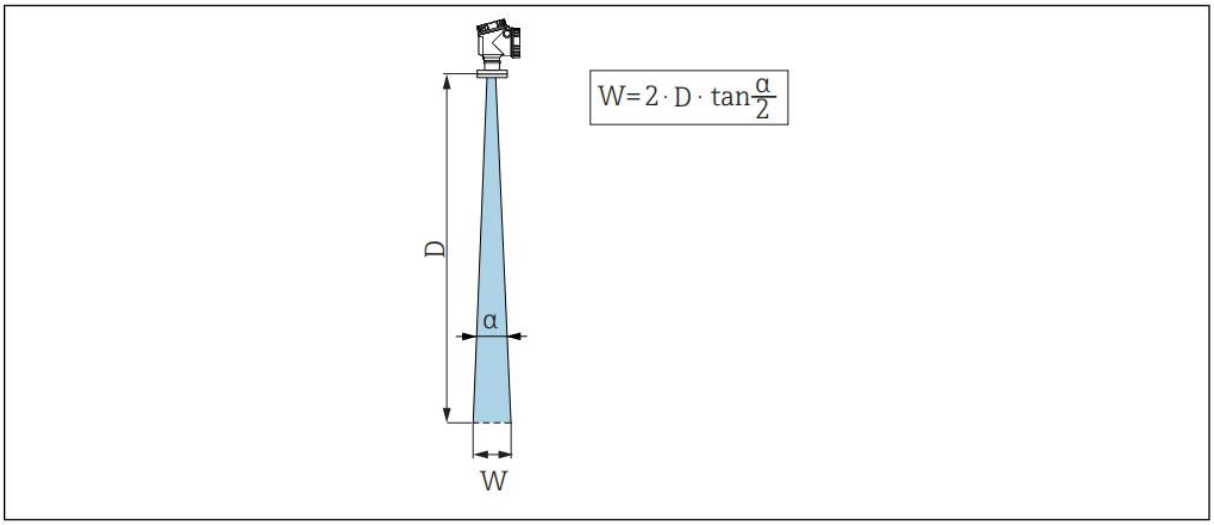


The tilted metal reflector plate can scatter radar wave signals, which helps to reduce interference echoes.

Best choice

• Antenna size
The larger the antenna size is, the smaller the beam Angle α is, and the less interference echoes are generated.
• Interference suppression
The measurement results are optimized by echo suppression of electronic interference.

Beam Angle



The beam Angle is the Angle of the beam when the energy density of the radar wave reaches half of its maximum (3dB width). Microwaves are emitted outside the range of the signal beam and can be reflected by jammers.

	LRD601		LRD602			LRD603		LRD604
Beam Angle α	3°	6°	3°	6°	14°	3°	6°	4°
Measuring distance（D）	**Beam width（W）**							
5m	0.26m	0.52m	0.26m	0.52m	1.22m	0.26m	0.52m	0.34m
10m	0.52m	1.04m	0.52m	1.04m	2.44m	0.52m	1.04m	0.68m
15m	0.78m	1.56m	0.78m	1.56m	3.66m	0.78m	1.56m	1.02m
20m	1.04m	2.08m	1.04m	2.08m	4.88m	1.04m	2.08m	1.36m
25m	1.30m	2.60m	1.30m	2.60m	6.10m	1.30m	2.60m	1.70m
30m	1.56m	3.12m	1.56m	3.12m	7.32m	1.56m	3.12m	2.04m
35m	-	-	1.82m	-	-	-	-	2.38m
40m	-	-	2.08m	-	-	-	-	2.72m
45m	-	-	2.34m	-	-	-	-	3.06m
50m	-	-	2.60m	-	-	-	-	3.40m
55m	-	-	2.86m	-	-	-	-	3.74m
60m	-	-	3.12m	-	-	-	-	4.08m
65m	-	-	3.38m	-	-	-	-	4.42m
70m	-	-	3.64m	-	-	-	-	4.76m
.....	-	-	.....	-	-	-	-	.....
120m	-	-	6.24m	-	-	-	-	8.16m

Environmental condition

The environment temperature range: -40 ~ 80℃
Storage temperature: -40 ~ 80℃
Climate grade: IEC60068-2-38
Protection level: IP66/IP67
Vibration resistance: mechanical vibration 10m2/s, 10 ~ 150Hz

Process condition

Process temperature and process pressure

Standard type: medium temperature (-40 ~ 80℃), process pressure (-1~40bar)

Explosion proof type:

The environment temperature（℃）	Medium temperature（℃）	Process pressure
-40 ~ 60℃	195 ~ 200℃	-1~25bar
	130 ~ 195℃	-1~25bar
	95 ~ 130℃	-1~40bar
	80 ~ 95℃	-1~40bar
	-40 ~ 80℃	-1~40bar

Dielectric constant（DC）

Dielectric grouping	Dielectric constant (DC(εr))	Living example
A0	1.2 ~ 1.4	Butane, liquid nitrogen, liquefied hydrogen
A	1.4 ~ 1.9	Non-conductive liquids, such as liquefied gases 1)
B	1.9 ~ 4	Non-conductive liquids, such as gasoline, petroleum, styrene, etc
C	4 ~ 10	Such as concentrated acids, organic solvents, fats, anilines, ethanol
D	> 10	Conductive liquid, aqueous solution, dilute acid and dilute base

1) For ammonia (NH3), the dielectric constant of group A medium is used

Minimum liquid level requirements for measuring low dielectric constant media

100 mm above tank bottom
• Minimum effective liquid level when the dielectric constant of the medium is εr ≤ 4.
• When the liquid level is low, the bottom of the tank may be visible, which will reduce the measurement accuracy.

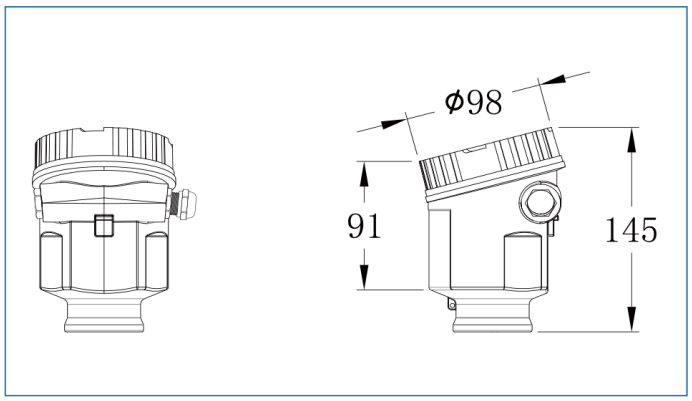
Mechanical structure

Dimensions of appearance

Case size

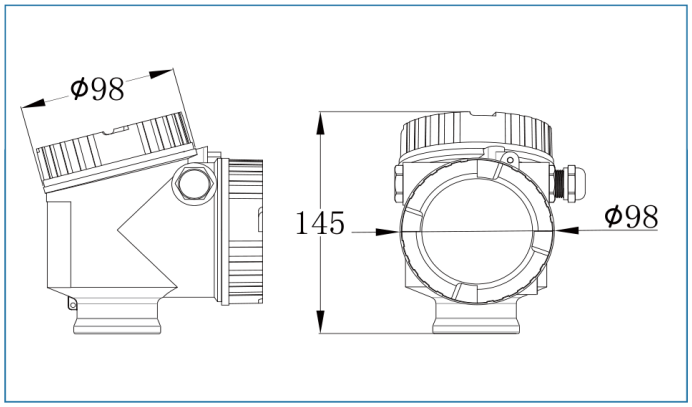
LRD6 Radar Level Meter

WINTERS Instruments
Excellence Since 1953



Single cavity A

Material: Aluminum ADC12



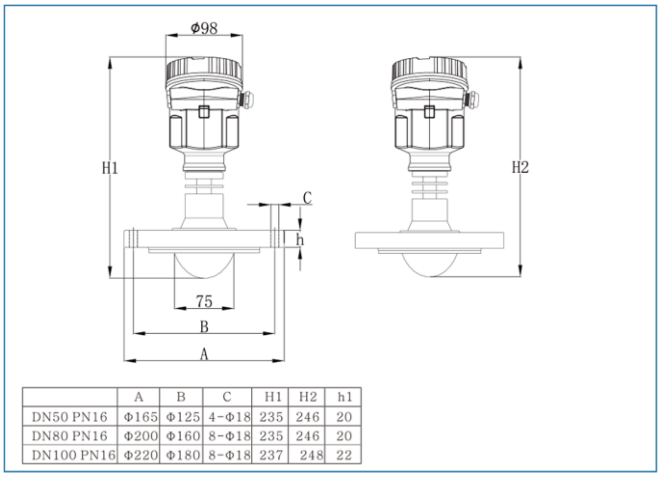
Double cavity D

Material: Aluminum ADC12 / Stainless steel 316L (to be customized)

Meter size

LRD601

Antenna form: DS, DQ
Case: A, D

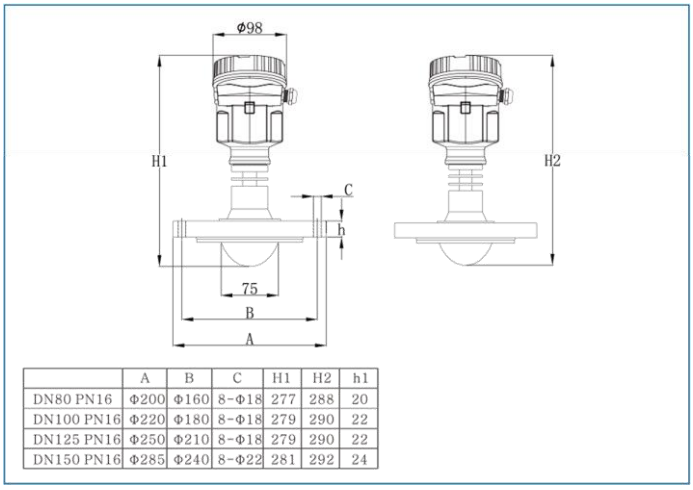


	A	B	C	H1	H2	h1
DN50 PN16	Φ165	Φ125	4-Φ18	235	246	20
DN80 PN16	Φ200	Φ160	8-Φ18	235	246	20
DN100 PN16	Φ220	Φ180	8-Φ18	237	248	22

LRD601

Antenna form：ES、EQ

Case：A、D



	A	B	C	H1	H2	h1
DN80 PN16	Φ200	Φ160	8-Φ18	277	288	20
DN100 PN16	Φ220	Φ180	8-Φ18	279	290	22
DN125 PN16	Φ250	Φ210	8-Φ18	279	290	22
DN150 PN16	Φ285	Φ240	8-Φ22	281	292	24

LRD602

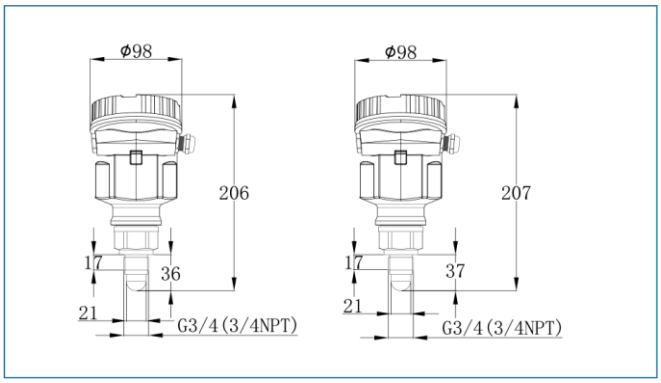
Antenna form：AP、AM

Case：A、D

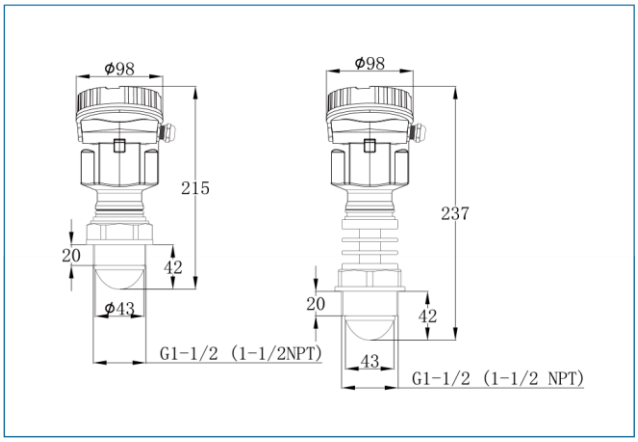
LRD602

Antenna form：FP/FM、FT

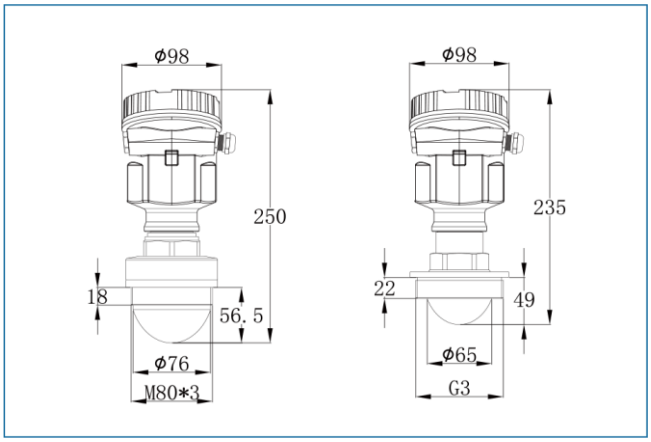
Case：A、D



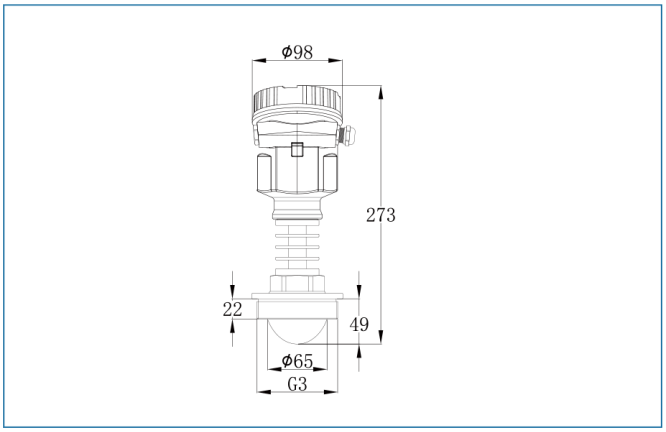
LRD602
Antenna form：GP、GM
Case：A、D



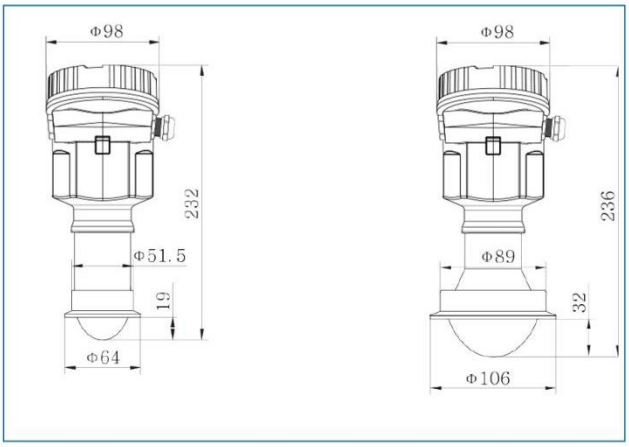
LRD602
Antenna form：GT
Case：A、D

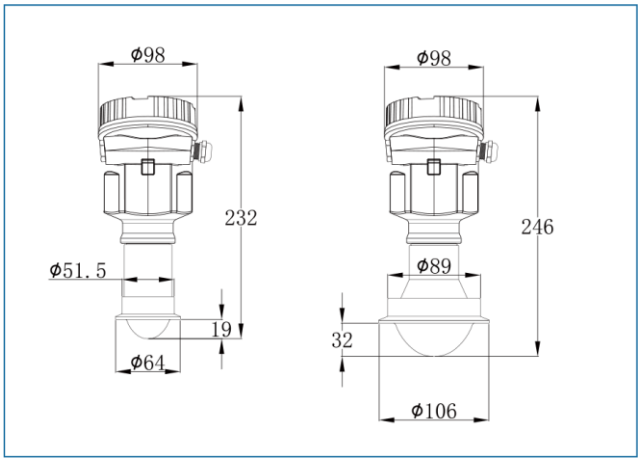


LRD603
Antenna form：KW、KQ
Case：A



LRD603
Antenna form：KW、KQ
Case：A、D

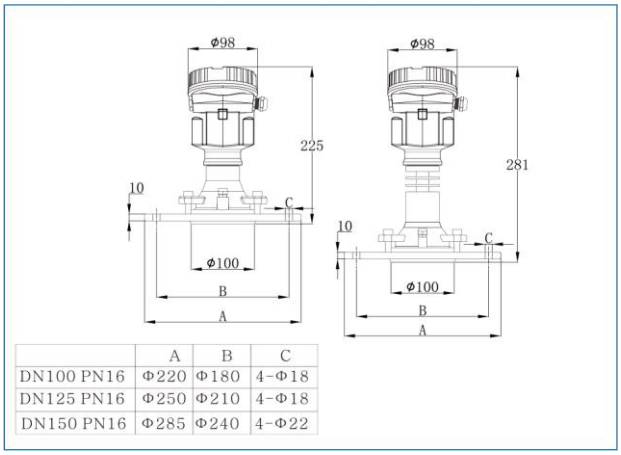




LRD604

Antenna form：MW/NW、RW

Case：A、D

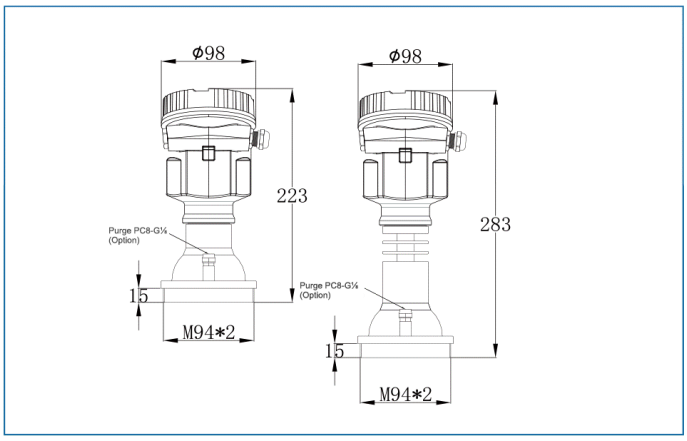


	A	B	C
DN100 PN16	Φ220	Φ180	4-Φ18
DN125 PN16	Φ250	Φ210	4-Φ18
DN150 PN16	Φ285	Φ240	4-Φ22

LRD604

Antenna form：JG、LG

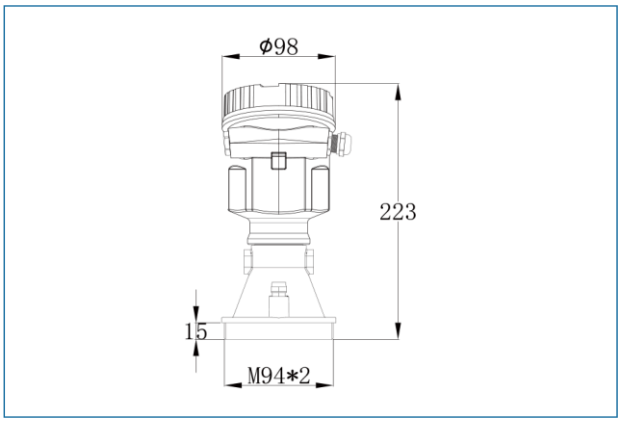
Case：A、D



LRD604

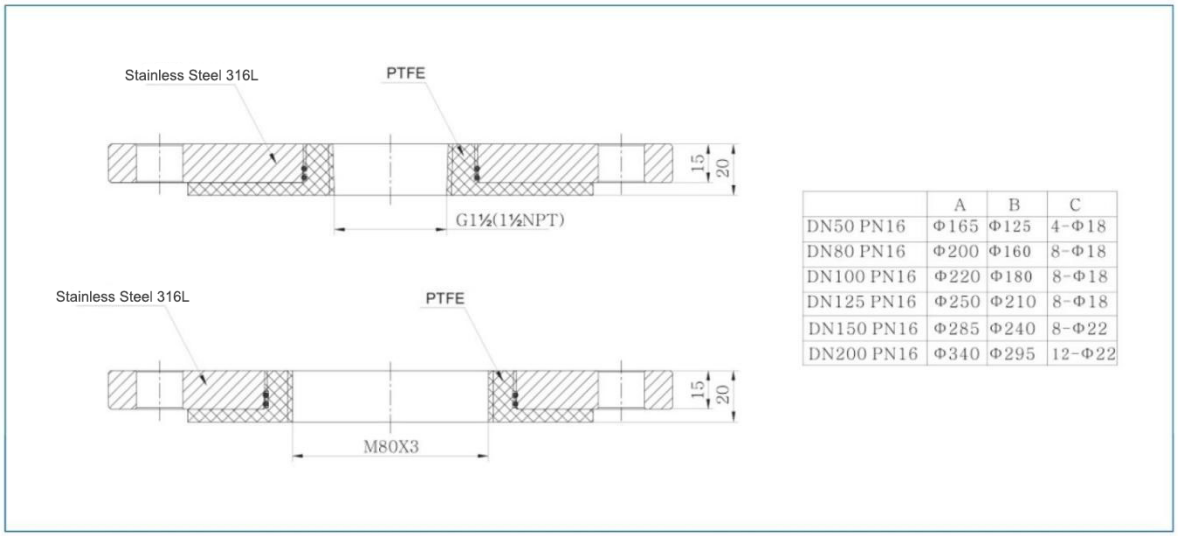
Antenna form：HG

Case：A、D



Compound flange

LRD602 antenna: "FP, GP" type, corrosive medium pressure (-0.1 ~ 0.1MPa), temperature (-40 ~ 130℃)



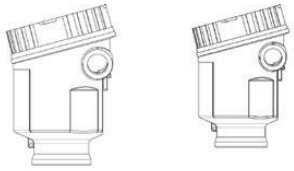
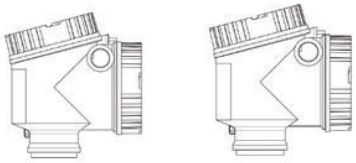
	A	B	C
DN50 PN16	Φ165	Φ125	4-Φ18
DN80 PN16	Φ200	Φ160	8-Φ18
DN100 PN16	Φ220	Φ180	8-Φ18
DN125 PN16	Φ250	Φ210	8-Φ18
DN150 PN16	Φ285	Φ240	8-Φ22
DN200 PN16	Φ340	Φ295	12-Φ22

Weight

LRD601:8.0kg (depends on antenna and housing)
LRD602:1.8kg (depends on antenna and housing)
LRD603:2.2kg (depends on antenna and housing)
LRD604:8.8kg (depends on antenna and housing)

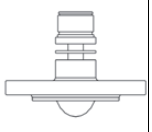
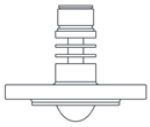
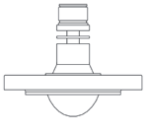
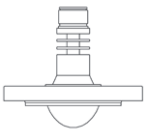
Material, process connection

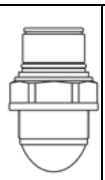
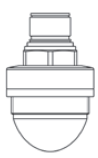
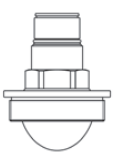
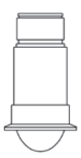
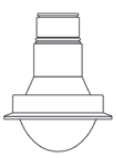
case: Aluminum ADC12, stainless steel 316L

		
Number	A	D
Materials	Aluminum ADC12 Intrinsic safety	Aluminum ADC12 flameproof
peculiarity	Single cavity	two-cavity

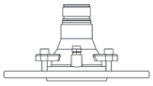
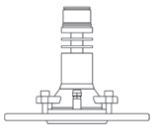
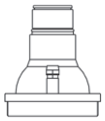
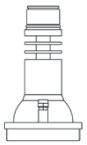
Seal between housing and housing cover: FKM
Case window: Transparent PC
Terminal: stainless steel

Antenna and process connection

							
Number	DS (LRD601)	DQ (LRD601)	ES (LRD601)	EQ (LRD601)	AP (LRD602)	AM (LRD602)	FP (LRD602)
Materials	316L+PTFE 316L+PFA	316L+PTFE	316L+PTFE 316L+PFA	316L+PTFE	PFA	316L+PTFE	PFA
Process connection	DN50 DN80 DN100	DN50 DN80 DN100	DN80 DN100 DN125 DN150	DN80 DN100 DN125 DN150	¾NPT	¾NPT	G1 ½A 1 ½NPT
peculiarity	Corrosion protection/High pressure 130℃	Corrosion protection/High pressure/heat dissipation 200℃	Corrosion protection/High pressure 130℃	Corrosion protection/High pressure/heat dissipation200℃	Corrosion protection 130℃	High pressure 130℃	Corrosion protection 130℃

							
Number	FM (LRD602)	FT (LRD602)	GP (LRD602)	GM (LRD602)	GT (LRD602)	KW (LRD603)	KQ (LRD603)

Materials	316L+PTFE	316L+PTFE	PFA	316L+PTFE	316L+PTFE	316L+PTFE	316L+PTFE
Process connection	G1 ½A 1 ½NPT	G1 ½A 1 ½NPT	M80×3	G3A	G3A	2”chuck	2”chuck
peculiarity	High pressure 130℃	High pressure heat dissipation 200℃	Corrosion protection 130℃	High pressure 130℃	High pressure heat dissipation 200℃	sanitary 130℃	Sanitary 130℃

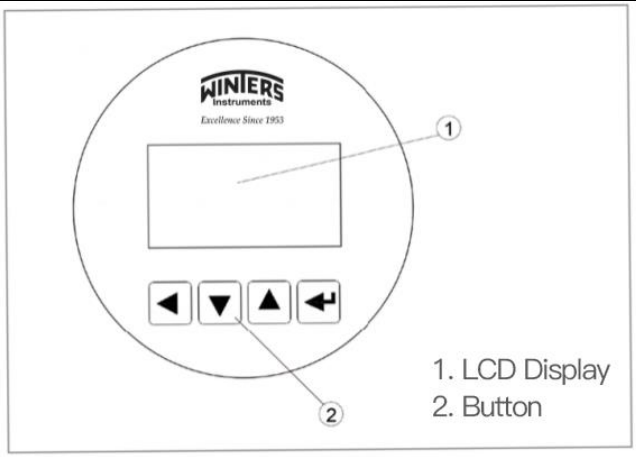
						
Number	MW (LRD604)	NW (LRD604)	RW (LRD604)	HG (LRD604)	JG (LRD604)	LG (LRD604)
Materials	Aluminium lined plastic+PTFE Aluminium lined plastic+PP	316L+PTFE 316L+PP	316L+PTFE	Aluminium lined plastic+PTFE Aluminium lined plastic+PP	316L+PTFE 316L+PP	316L+PTFE
Process connection	DN100 DN125 DN150	DN100 DN125 DN150	DN100 DN125 DN150 Hanger	DN80 DN100 DN125 DN150	DN100 DN125 DN150	DN100 DN125 DN150
peculiarity	Every Angle/Blowing 110℃	Every Angle/Blowing 130℃	Every Angle/Blowing heat dissipation 200℃	Thread/blow 110℃	Thread/blow 130℃	Thread/blow heat dissipation 200℃

Operability

Operation method

There are four debugging methods for the LRD6 series radar:
1 Display/Button (Viewpoint)
2 Hart handheld programmers
3 Bluetooth debugging (in preparation)

Display/Debug Module



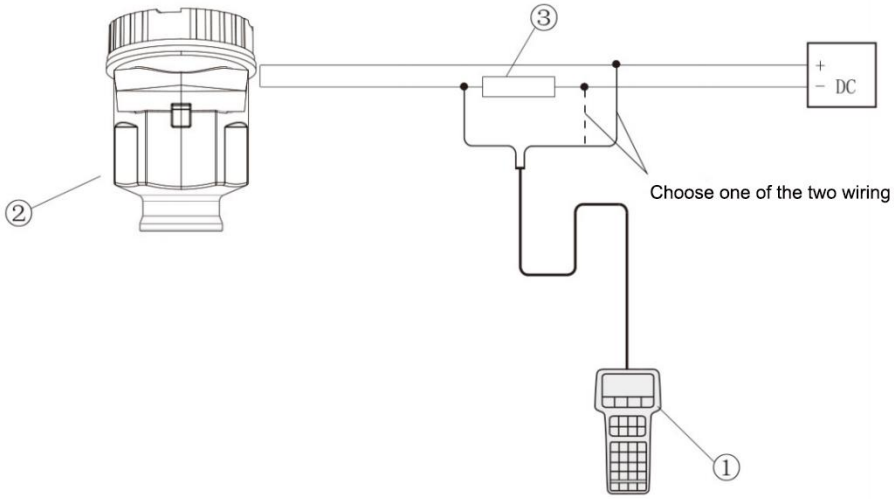
Shortcut

[◀]Button Display Echo Curve

[ ]Button -Enter programming status -Confirm programming items -Confirm parameter modification	[ ]Button -Select programming items -Select programming parameter bits -Parameter item content display
[ ]Button Modify parameter	[ ]Button -Exit programming status -Return to the previous menu

HART handheld programmer

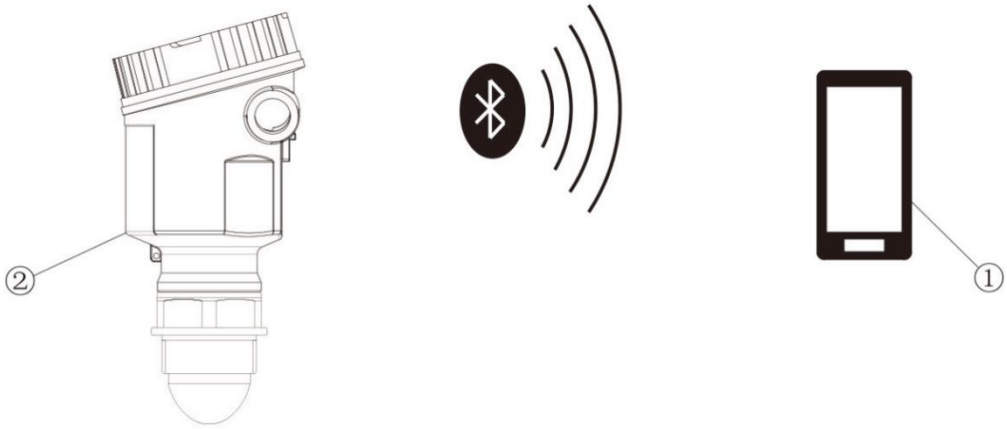
It can be programmed with HART handheld programmer



① RS232 interface /USB interface; ② Radar; ③ 250 ohm resistance

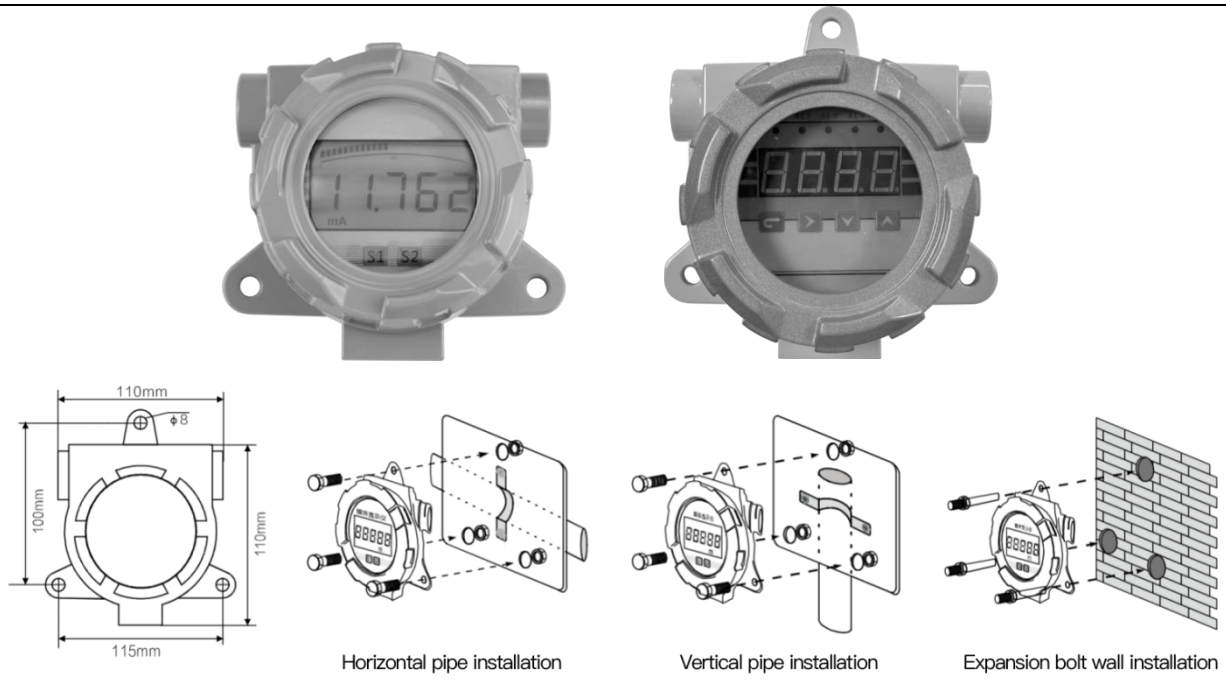
Bluetooth debugging

Bluetooth software can be used for debugging (in preparation)



① A mobile phone with Bluetooth; ② radar

Operation via separate display and operation unit DCU



Material: Cast aluminum
Protection level: IP66
Ambient temperature range: -30 ~ 50℃

Excellence Since 1953

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