

## Content

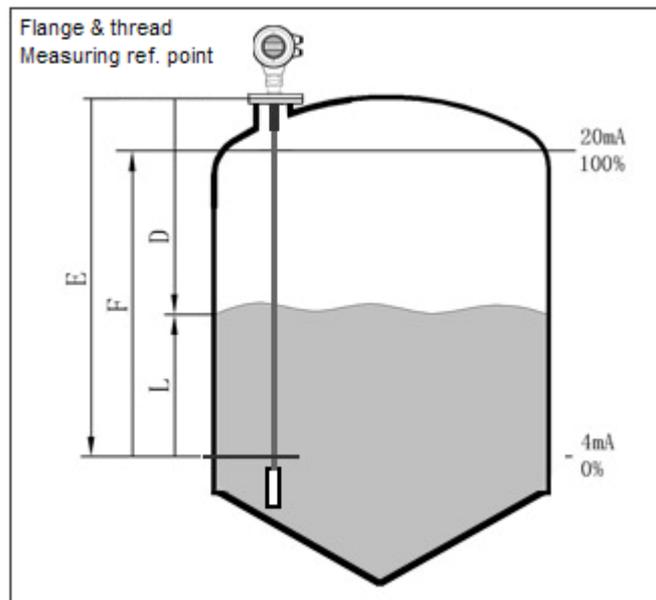
### **Guided Wave Radar Level Meter**

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## Guided Wave Radar Level Meter

### Measurement Principle

Guided Wave Radar Level Transmitter is the kind of measuring instrument that is based on the principle of time travel. The radar wave travels at the speed of light, and its running time can be converted into a level signal by the electronic components. The probe emits high-frequency pulses which spread along the cable, and the pulses are reflected back when they encounter the material surface and received by the receiver inside the meter. The distance signal is then converted to the level signal.



### Input

The reflected pulse signal is conducted along the cable back to the electronic circuit of the meter, and the microprocessor processes this signal to identify the echo produced by the microwave pulses at the material surface. The recognition of the correct echo signal is done by the intelligent software. The distance  $D$  to 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

As the distance  $E$  of the empty tank is known, the level  $L$  is:

$$L=E-D$$

## Output

Set accordingly to the empty tank height E (= the zero point), the full tank height F (= the full scale) and some application parameters. The application parameters will automatically make the instrument adapt to the measurement environment, corresponding to the output of 4 ~ 20mA.

## Product Overview:

<b>HGRD700 Guided Wave Radar Level Meter</b>			
	<b>Model</b>	<b>HGRD701</b>	<b>HGRD702</b>
<b>Explosion-Proof</b>	Yes	Yes	Yes
<b>Measuring Range</b>	30m	6m	6m
<b>Process Connection</b>	Whorl, Flange	Whorl, Flange	Whorl, Flange
<b>Process Temperature</b>	-40-250℃	-40-250℃	-40-250℃
<b>Process Pressure</b>	-1.0-40bar	-1.0-40bar	-1.0-40bar
<b>Accuracy</b>	±1mm	±1mm	±1mm
<b>Frequency Range</b>	100MHZ-1.8GHZ	100MHZ-1.8GHZ	100MHZ-1.8GHZ
<b>Explosion-proof /Protection Class</b>	EXiaIICT6/IP68	EXiaIICT6/IP68	EXiaIICT6/IP68
<b>Signal Output</b>	4...20mA/HART(Double-cable)	4...20mA/HART(Double-cable)	4...20mA/HART(Double-cable)

## Measurement Range

### Symbol explanation:

H---- Measurement range

L---- Empty tank distance

B---- The blind area at the top

E---- The minimum distance between the probe and the tank wall

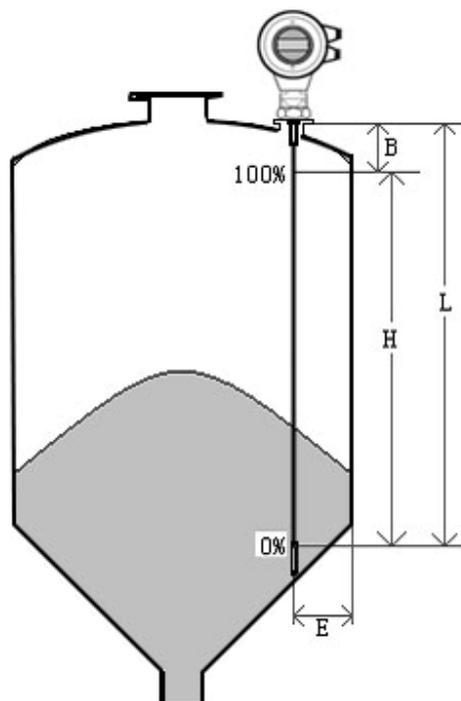
The blind area refers to the minimum distance between the highest level of the material surface and the measurement reference point.

The bottom blind area refers to the distance near the cable bottom that cannot be precisely measured.

The effective distance is the one between the top blind area and the bottom blind area.

### Note:

Only when the material level is at between the top and bottom blind areas can a reliable measurement of the material level be guaranteed.



### Installation Guide

The following installation guide is suitable for that of cable and rod probes for measurement of solid particles and liquid. The coaxial tubular probe is applied only to the liquid object.

#### Installation position:

Try to stay away from the outlet and inlet.

The meter should not touch the tank internal wall for metal tanks and plastic tanks. If it is a metal tank, the material level meter should not be installed at the center of the tank.

It is proposed to install at 1/4 of the silo diameter.

Probes of cable or rod types should keep a distance away from the tank wall not less than 30cm.

The probe bottom should be about 30mm to the tank bottom.

The probe should keep a distance not less than 200mm from the obstacles within the tank.

The sensor can be installed at the center of the tank top, if the bottom of the container is a cone, so the measurement can be taken to the tank bottom.

The picture on the right shows the rod-type radar installation diagram, mainly used for liquid level measurement.

#### Characteristics:

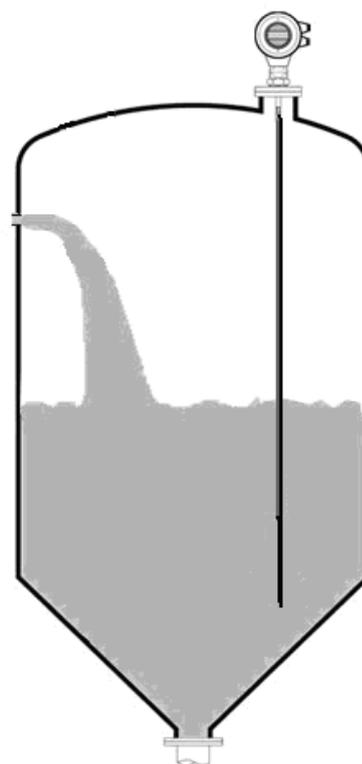
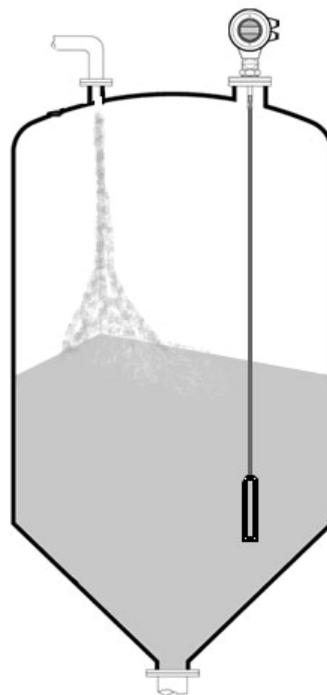
Can measure any material of which the dielectric constant is greater than or equal to 1.4.

Generally used for measuring the material of which the viscosity is less than or equal to 500cst and less likely to produce adhesion.

The maximum range of rod-type radar can reach 6m.

Have strong inhibiting ability to the steam and foam so the measurement is not affected.

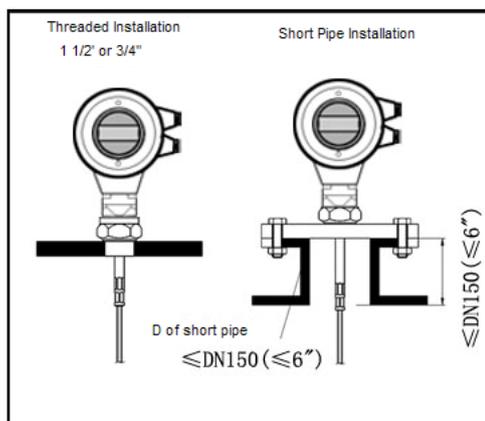
The double-rod measurement method can be taken for the liquid material of which the dielectric constant is relatively small in order to guarantee the good measurement accuracy.



### Installation Method

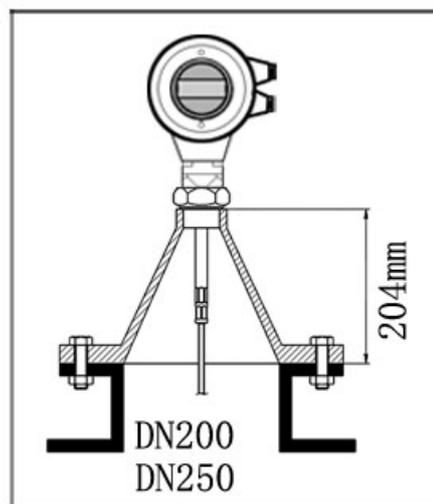
**Reasonable installation can ensure long-term reliable and accurate measurement.**

The meter can be connected by whorls of which length should not exceed 150mm. The meter also can be used in the short pipe installation. Ideal short pipe is less than 150mm in diameter, height less than 150mm. If installed in a longer short pipe, the meter should be fixed to the bottom of a cable or the stent to avoid contacts of the cable and pipe end.



### DN200 or DN250 installation should be done on the short pipe

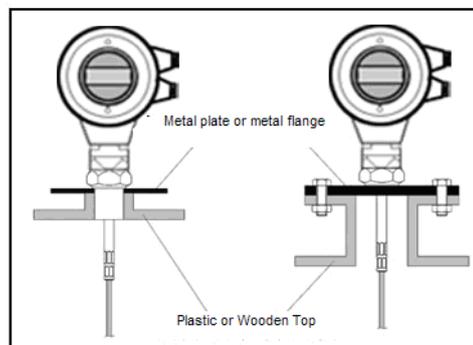
When the meter needs to be installed on the short pipe of which diameter is more than 200mm, echo could be generated within the pipe wall, which will cause measurement error when the dielectric constant is low. Therefore, for a pipe whose diameter is 200mm or 250mm, a special flange of "horn interface" is needed. Try to avoid installing on the pipe whose diameter is greater than the 250mm.



### Installation on the plastic tank

#### Note!

The process connection surface should be metal if you want the meter, either cable- or rod-type, to work correctly. When the meter is installed in a plastic tank and when the tank top is plastic or other non-conductive materials, the meter needs the metal flange. If they are connected with whorls, a piece of metal sheet is needed.



### The down-pulling force applied to the cable

When charging and discharging, the material will generate down-pulling force to the cable, which is

determined by the following factors:

- cable length
- material density
- tank diameter
- cable diameter

### **Installation guide for liquid measurement**

The installation guide below applies to rod- and cable-type probes. The tubular probe measurement is not related with the installation method.

#### **Installation position**

- Distance to the tank wall is suggested as the  $1/6 \sim 1/4$  of tank diameter (300mm at least, 400mm at least for concrete tank)
- Do not install at the metal tank center
- Do not install at the outlet
- Remember the probe bottom should keep a distance greater than 30mm when select the probe length.
- Pay attention to the medium temperature.

#### **Obstacles within tank**

- Probe should keep a distance not less than 200mm away from the obstacles.

#### **Interference removal**

- Interference suppression: The software could suppress the interference echo, so as to achieve the ideal effect of measurement.
- Bypass, wave guide pipes or tubes could be used to suppress the interference when the viscosity is not greater than 500cst.

#### **Liquid standard installation**

Tubular probe is the best solution for the medium of which the viscosity is less than or equal to 500cst and which is not easy to adhesion. The features are as follows:

- Excellent reliability
- Can be used in any medium of which the dielectric constant is greater than or equal to 1.4, and the measurement is irrelevant to the medium conductivity.
- Obstacles within tank and the short pipe size do not affect the measurement.
- Withstand more lateral pressure than rod-type probe
- Rod-type probe is suggested for medium of high viscosity.

#### **Instrument installation in horizontal tanks and vertical tanks**

- Tube- and rod-type probes can reach up to 6m. The 8mm cable-type probe can be chose for tanks deeper than 6m.
- Installation and fixation methods are the same with those for the solid powder storehouse measurement.
- The distance to the tank wall is not limited as long as the probe does not touch the tank wall.
- If there are too many obstacles or if they are too close to the probe, please select the tube-type probe.

### Corrosive medium measurement

- When measuring the corrosive medium, rod-type probe with a plastic casing can be chose for measurement.

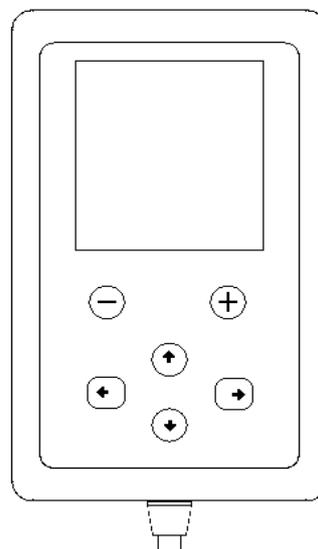
### Debugging

HGRD can be debugged in three ways:

- through the display adjustment module HGPM
- through HGSOFT the debugging software
- through the HART handheld programmer

#### Debugging through HGPM

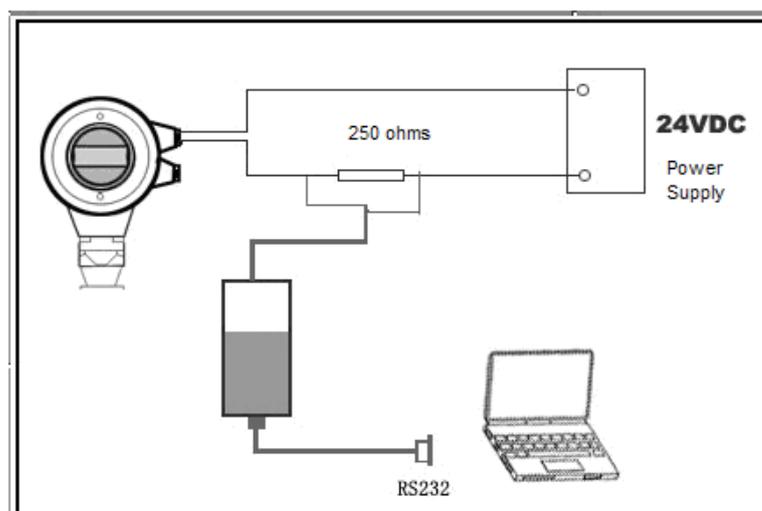
HGPM programmer is composed of 6 keys and a LCD display, and can display the adjustment menu and parameter setting. Its function is equivalent to an analysis instrument.



**HGPM**

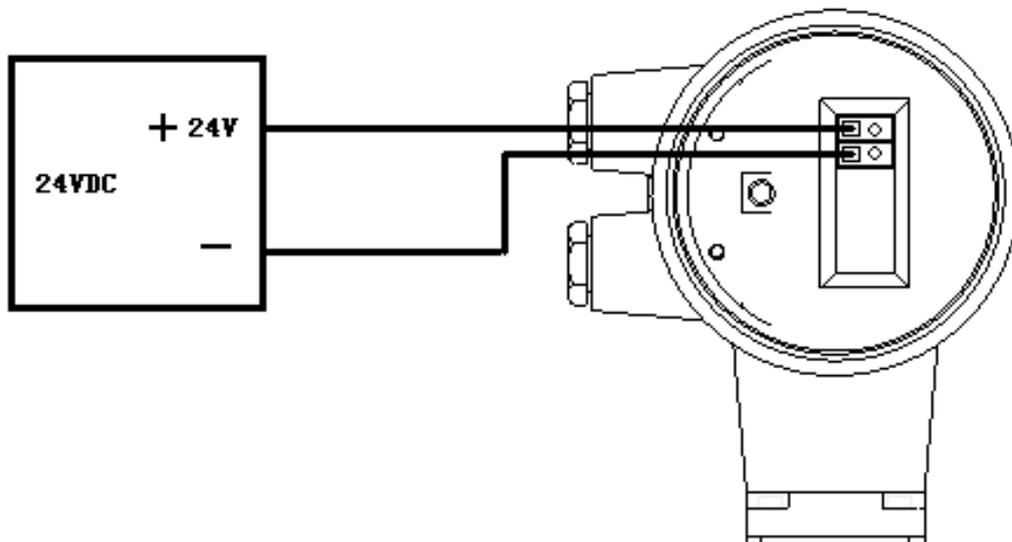
### Debugging through HGSOFT

All the radar sensors can be debugged with the HGSOFT software which requires an instrument CONNECTCAT drive.

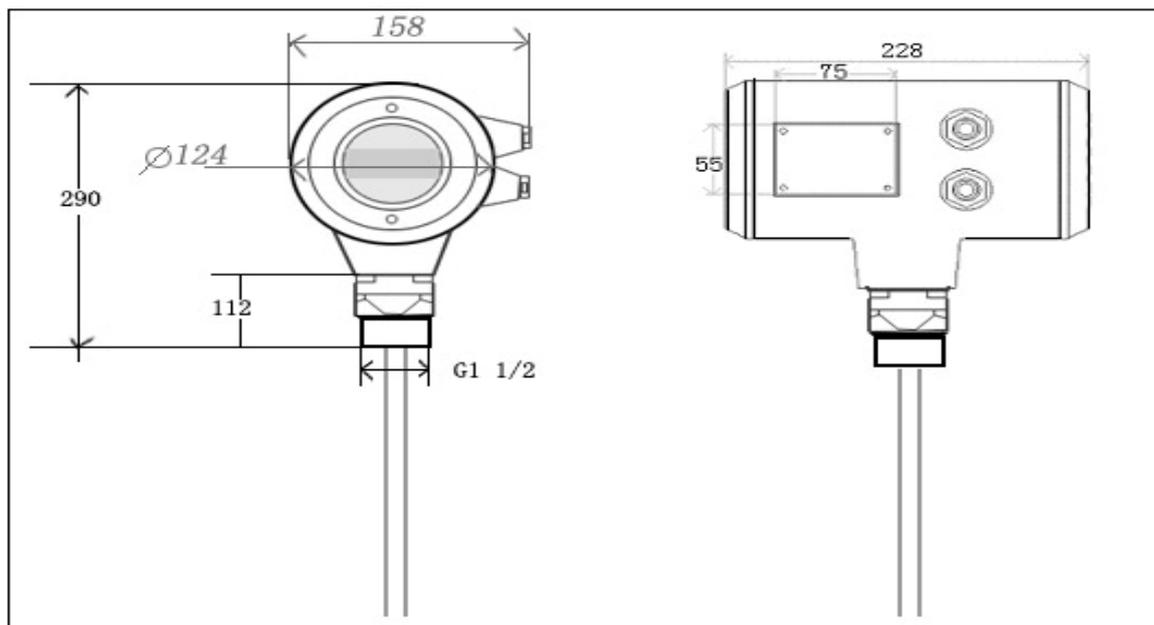


When debugging with the software, the radar instrument should be supplied with power of 24VDC, and a resistor of 250 Ohms should be added to the HART adapter. If the power meter is of integral-type HART resistor (with internal resistance of 250 Ohms), it does not need additional external resistor and the HART adapter can be connected with 4 ... 20mA lines in parallel.

## Wiring



## Meter Size



## Technical Parameters

Parameters	<p>Frequency: 100MHZ-1.8GHZ</p> <p>Measuring range:-cable :0-30m; rod, coaxial :0-6m</p> <p>Repeatability: <math>\pm 3</math>mm</p> <p>Resolution: 1mm</p> <p>Sampling: echo 55 samples / s</p> <p>Response speed: 0.2S (depending on the actual usage)</p> <p>Output current signal :4-20mA</p>
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	Accuracy: <0.1%
<b>Communication Interface</b>	HART communication protocol
<b>Process connection</b>	G1-1/2 Flange DN50, DN80, DN100, DN150
<b>Process pressure</b>	-1 ~ 40bar
<b>Power</b>	Power: 24VDC (± 10%), ripple voltage: 1Vpp Power consumption: max 22.5mA
<b>Environmental conditions</b>	temperature -40 °C ~ +80 °C
<b>Housing protection grade</b>	IP68
<b>Explosion levels</b>	EXiallCT6
<b>Instrumentation power supply and signal output wire connection</b>	Sharing a two-core shielded cable Cable entry: 2 M20 × 1.5 (the cables diameter of 5 - 9mm)

### Measurement Distance

The following table lists the relationship between the different categories of the measured medium and the measuring distance

Medium Index	DK(ε)	Solid Particles	Liquid	Measuring Range
1	1.4...1.6		— Condensing gas, e.g. N <sub>2</sub> CO <sub>2</sub>	3m (Refers only to the coaxial rod probe)
2	1.6...1.9	— Plastic belt particles — Lime stone, special cement — Sugar	— Liquefied petroleum gas, e.g. propane — Solvent — Freon 12 / Freon — Palm oil	25m
3	1.9...2.5	— Ordinary cement, Plaster	— Mineral oil, Fuel	30m
4	2.5...4	— Cereals, Seed — Stone — Sand	— Benzene, Styrene, Toluene — Furan — Naphthalene	30m
5	4...7	— Wet stone, ore — Salt	- Chlorobenzene, chloroform - Cellulose spray - Isocyanurate hydrochloric acid, amine	30m
6	>7	- Metal powder - Carbon black - Coal	- Aqueous liquids - Alcohol - Liquid ammonia	30m

## Model Selection

HGRD	Guided Wave Radar Level Meter						
	701	6mm cable probe 30000 mm stainless steel				Basic type	
	702	10mm rod probe 6000 mm stainless steel					
	703	Two-rod probe 6000mm stainless steel (Flange mounting)					
		P	Non-explosion proof (Plain type) Signal output (4-20mA) HART protocol			Explosion Output	
		I	Intrinsic safety (EXiaIICT6) Signal output (4-20mA) HART protocol				
			1	Common seal -20...150°C			Structure
			2	High temperature seal -40-250°C with heat sink			
			A	G 1-1/2 thread	PN16	316L stainless steel	Electrode Material
			B	Flange DN50	PN16	316L stainless steel	
			C	Flange DN80	PN16	316L stainless steel	
			D	Flange DN100	PN16	316L stainless steel	
			E	Flange DN150	PN16	316L stainless steel	
			F	1-1/2NPT thread	PN16	316L stainless steel	
				F	IP68		Protection Class
				M	M20*1.5		Cable Entry
				N	1/2NPT		
				B	with		Programmer
				X	without		
				L	Probe Length (m)		Span