FMCW Radar Level Transmitter

FineTek

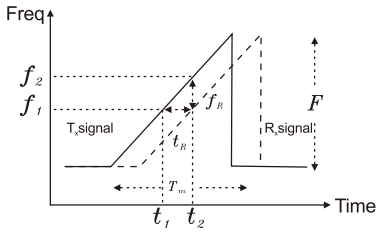
Innovation · Quality · Sharing

PRODUCT INTRODUCTION

FMCW Radar level transmitter is a non contact measuring device, which is suitable for high temp., high pressure, and corrosive applications. It is easy to install and free of maintenance, especially for the high accuracy requirement environment.

PRINCIPLE

FMCW radar adopts a high frequency signal, which is emitted via an antenna and swipe frequency increment by 0.5GHz during the measurement, reflected by the target surface and received at a time delay. The frequency difference, which is calculated from the transmitting frequency and the received frequency, which is directly proportional to the measured distance (or material surface).
The frequency difference then is processed by Fast Fourier Transformation (FFT) to identify the signal in Intermedium Frequency (IF). This FMCW radar is innate with signal / noise enhancement and filtering of echo-back via Phase-Lock Loop (PLL) circuit that is the best solution for complex environment and high accuracy measurement.

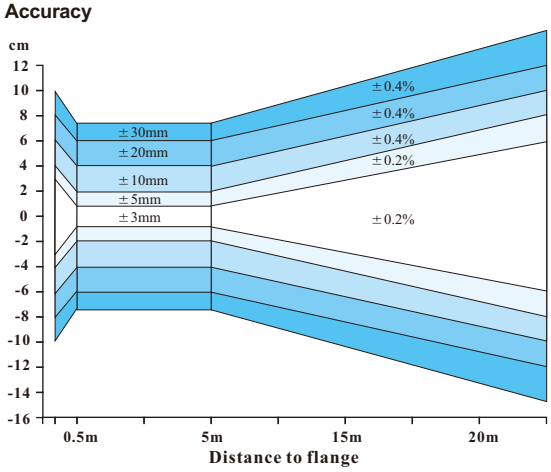


Design formula

$$Slop = \frac{F}{T_m} = \frac{f_R}{t_R} = \frac{f_R}{\frac{2R}{c}} \qquad t_R = \frac{2R}{c}$$

$$R = \frac{F_R \times c \times T_m}{2F}$$

LINEARITY DIAGRAM



FEATURES

- Non contact measuring
- Corrosive and toxic liquid, hydrocarbons, slurries
- Not affected by specific gravity, pressure, temperature, viscosity, foam
- 5 digits LCM display
- Indicate signal wave inside the silo.
- Selection of Different Measurement unit(m, cm, mm, inch, Ft, %, mA)
- Measuring distance and actual level.
- Language selection of traditional Chinese, simplified Chinese, English.
- 4-20mA / 4 wires / 2 wires
- Modbus RS-485 to enhance isolation and easy for remote control.
- CE standards for isolation(EFT 2000V, B class or better)
- Suitable for mid-range signal
- 4mA, 20mA output
- Isolated circuit design.

TEST STANDARDS

- High voltage : IEC60947-2
- Isolated resistance : IEC60092-504
- Power supply change : IEC60092-504
- Power supply failure : IEC60092-504
- Electrical burst testing : IEC61000-4-4
- Voltage DIPS : IEC61000-4-11
- Humidity : IEC60068-2-30
- High/Low temperature test : IEC60068-2-38
- IP protection rating : IEC60529

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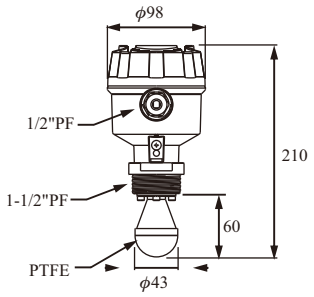
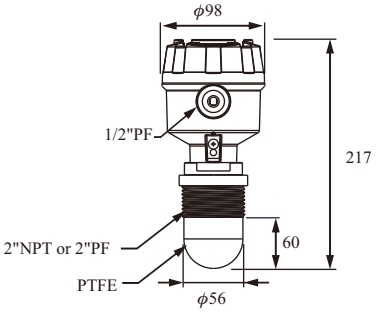
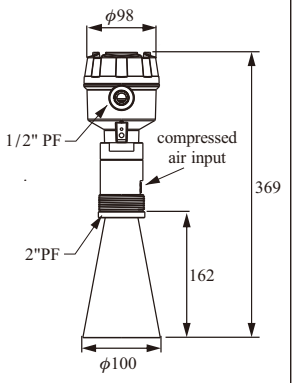
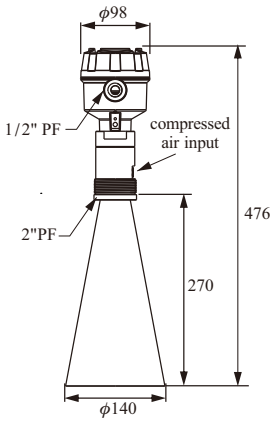
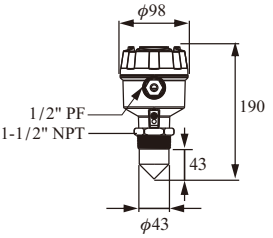
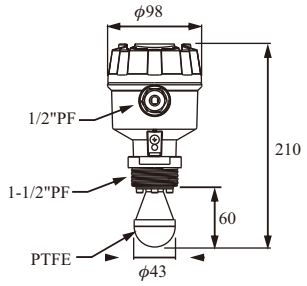
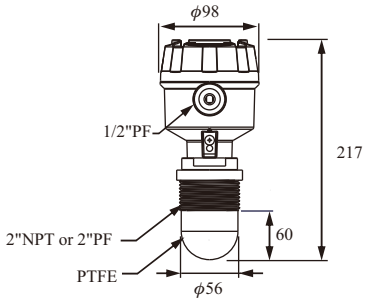
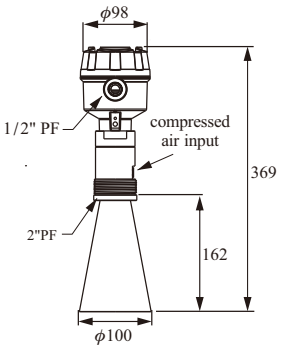
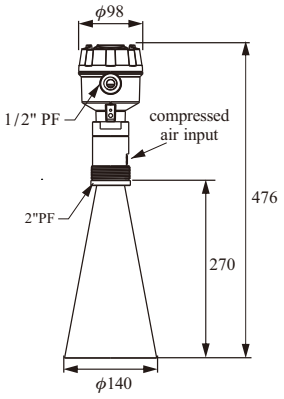
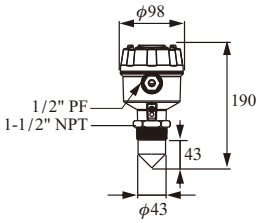
SPECIFICATION (26GHz 4-wire)

Dimensions (Unit:mm)		
Model	**JFR-204**	**JFR-214**
Medium	General liquid	General liquid /suitable for acid and alkaline in liquid
Min. Dielectric constant (liquid)	1.4	
Measuring range	30m	
Accuracy	±3 mm	
Repeatability	±1 mm	
Digital communication	RS485 (Isolated)	
Ambient temperature	-40~80 °C(LCM<75°C)	
Operating temperature	-40~200 °C	
Operating pressure	0~40 bar	
Frequency	K Band	
Analog output	4~20mA / 4 Wire	
Protection rating	IP67	
Power supply	9.5~30Vdc	
Local display	5 digits LCM display	
Housing material	Aluminum	
Antenna type	Horn (43D)	Lens (56D)
Half-power beam width	±9°	
Antenna material	SUS316+PTFE	PTFE
Blind distance	500mm	

Dimensions (Unit:mm)			
Model	**JFR-224**	**JFR-234**	**JFR-244**
Medium	General liquid		
Suitable For	Long dlstance measurement	Super dlstance measurement	Corrosion type acid and alkaline liquid
Min. Dielectric constant (liquid)	1.4		
Measuring range	40m	70m	20m
Accuracy	±3mm @distance≤30m, ±0.01% F.S.@distance>30m		±3 mm
Repeatability	±1 mm		
Digital communication	RS485 (Isolated)		
Ambient temperature	-40~80 °C(LCM<75°C)		
Operating temperature	-40~200 °C		
Operating pressure	0~40 bar		
Frequency	K Band		
Analog output	4~20mA / 4 Wire		
Protection rating	IP67		
Power supply	9.5~30 Vdc		
Local display	5 digits LCM display		
Housing material	Aluminum		
Antenna type	High gain horn (100)	High gain horn (140)	Lens(43DS)
Half-power beam width	±5°	±3°	±10°
Antenna material	SUS 316		PTFE
Blind distance	500 mm		

SPECIFICATION (26GHz 2-wire)

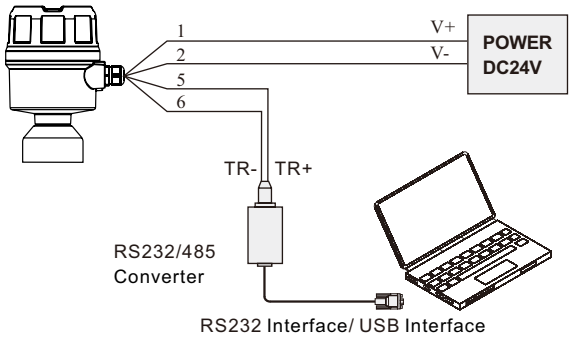
Dimensions (Unit:mm)		
Model	**JFR-202**	**JFR-212**
Medium	General liquid	General liquid /suitable for acid and alkaline in liquid
Min. Dielectric constant (liquid)	1.4	
Measuring range	20m	
Accuracy	±5mm	
Repeatability	±3mm	
Digital communication	HART	
Ambient temperature	-40~80°C(LCM<75°C)	
Operating temperature	-40~200°C	
Operating pressure	0~40 bar	
Frequency	K Band	
Analog output	4~20mA	
Protection rating	IP67	
Power supply	24Vdc±10%	
Local display	5 digits LCM display	
Housing material	Aluminum	
Antenna type	Horn (43D)	Lens (56D)
Half-power beam width	±9°	
Antenna material	SUS 316 + PTFE	PTFE
Blind distance	500 mm	

Dimensions (Unit:mm)			
Model	**JFR-222**	**JFR-232**	**JFR-242**
Medium	General liquid		
Suitable For	Long dlstance measurement	Super dlstance measurement	Corrosion type acid and alkaline liquid
Min. Dielectric constant (liquid)	1.4		
Measuring range	30m	35m	15m
Accuracy	±5mm @distance≤20m, ±0.025% F.S.@distance>20m		±5 mm
Repeatability	±3mm		
Digital communication	HART		
Ambient temperature	-40~80°C(LCM<75°C)		
Operating temperature	-40~200°C		
Operating pressure	0~40 bar		
Frequency	K Band		
Analog output	4~20mA		
Protection rating	IP67		
Power supply	24Vdc±10%		
Local display	5 digits LCM display		
Housing material	Aluminum		
Antenna type	High gain horn (100D)	High gain horn (140D)	Lens (43DS)
Half-power beam width	±5°	±3°	±10°
Antenna material	SUS 316		PTFE
Blind distance	500 mm		

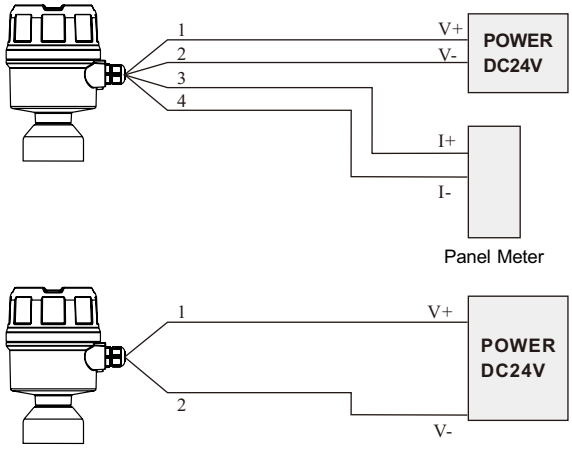
WIRING/CALIBRATION

WIRING INFORMATION

RS485 wiring

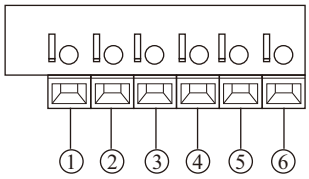


JFR Series and Indicator(External Power)

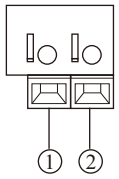


WIRING DIAGRAM

JFR-2X4



JFR-2X2

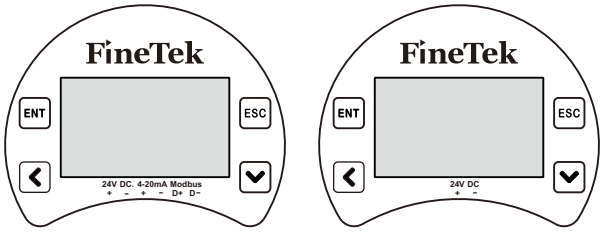


① Power Supply: V+
② Power Supply: V-
③ Analog Output: I+ (4~20mA)
④ Analog Output: I- (4~20mA)
⑤ Communication: TR+ (RS485)
⑥ Communication: TR- (RS485)

CALIBRATION

Two ways to calibrate the JFR Series:
4-wire:
1. Display/Adjustment module
2. By pcbased fas soft ware
2-wire:
1. Display/Adjustment module
2. HART

Adjustment module is an adjustment tool with 4 buttons to click on. It also has a transparent window to allow display reading.



5 digits LCM displat

[ENT] **Button**
-Enter Edit status
-Confirm Edit
-Confirm parameter modification

[‹] **Button**
-Select Edit
-Select parameter
-Parameter

[ESC] **Button**
-Return
-Cancel

[⌄] **Button**
-Increase
-Select

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PARAMETER SETTING

Measurement bench-mark starts at contact surface of connection.

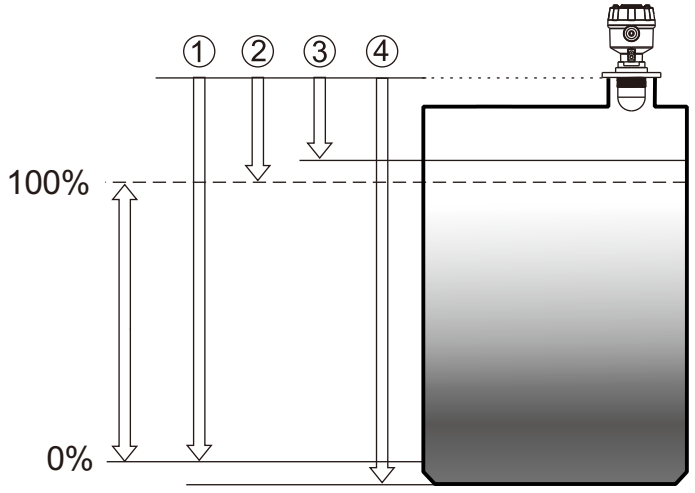
① Low level calibration

② High level calibration

③ Blind Distance

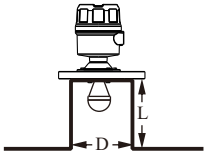
④ Measuring Distance Setup

Note: Be aware of blind distance when measuring material high level.(Shown in ③)



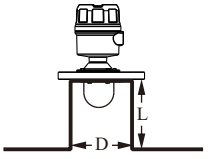
INSTALLATION

1. JFR-20x can be hidden in the extension tube, the recommendation of the tube diameter D and length L are shown in the table.



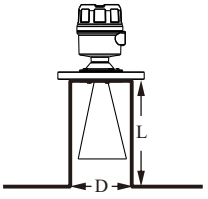
Diameter D (Inch)	Length L (mm)
2"	L≤160
4"	L≤300
5"	L≤400
6"	L≤500

2. JFR-21x can be hidden in the extension tube, the recommendation of the tube diameter D and length L are shown in the table.



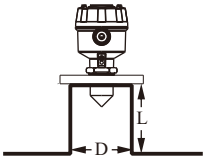
Diameter D (Inch)	Length L (mm)
3"	L≤200
4"	L≤300
5"	L≤400

3. JFR-22X and JFR-23X can be hidden in the extension tube, the recommendation of the tube diameter D and length L are shown in the table.



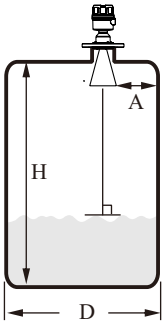
Model	Diameter D (mm)	Length L (mm)
JFR-22X	D>100	L≤150
JFR-23X	D>140	L≤270

4. JFR-24x can be hidden in the extension tube, the recommendation of the tube diameter D and length L are shown in the table.

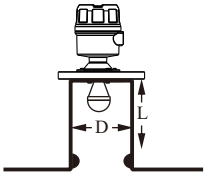


Diameter D (Inch)	Length L (mm)
2"	L≤100
4"	L≤200
5"	L≤300
6"	L≤400

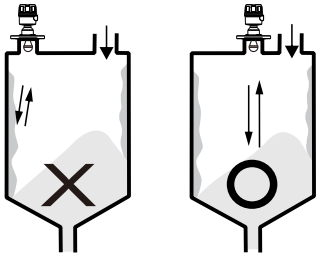
5. Installation recommendations are as follows :
   (1) Antenna installation angle to be perpendicular to the Horizontal.
   (2) JFR installation position with the drum wall suggestions Are as follows :
   Installation location A should be less than 1/6D
   Range with A relation is as follows :
   a.H<10m, A>300mm
   b.10m<H<20m, A >600mm
   c.H>20m, A>900mm



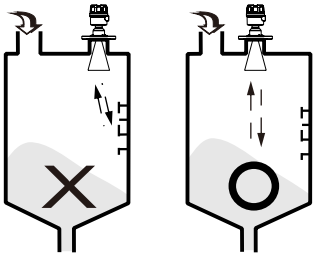
   (3) Extended tube is suggested to do the welding process from outside; welding process from inside, the bulges might affect the signal transmission. The joint part of extended tube cannot be less than “D”.



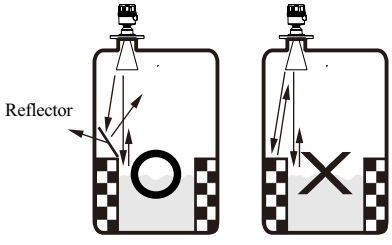
2. Radar installation should not be too close to the drum wall, avoid the drum wall attachment material reflection interference.



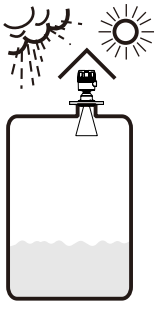
3. Radar installation not too close to the drum bracket to avoid reflection is incorrect



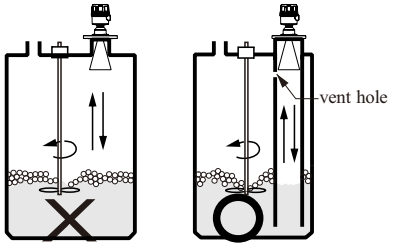
4. When obstructions inside the tank, tank be fitted with eflectors, steer clear of the error echo reflected to the receiver, causing radar miscalculation.



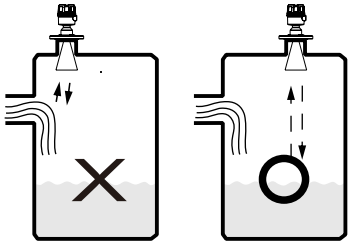
5. Outdoor installation should take shade or rain-proof measures.



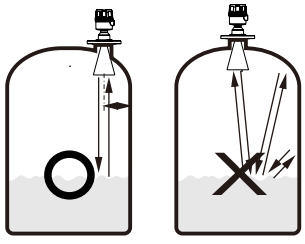
6. If drum internal agitator will have a strong vortex and foam, drum must increase waveguide, the upper waveguide drill vent holes to ensure the correctness of the measured value.



7. Installation should be avoided in the feed inlet position, avoid material interference or obstacles interference.



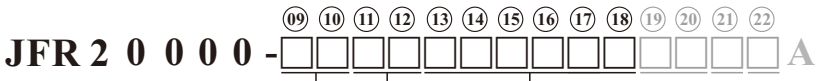
8. Installation should be avoided in the top center of the arch or round barrel will cause multiple echo reflections.



MODEL NUMBER / ORDER CODE COMPARISON TABLE

Model Number	Order Code
JFR-204	JFR20000-A1MB
JFR-214	JFR20000-A521
JFR-224	JFR20000-A2
JFR-234	JFR20000-A3MA
JFR-244	JFR20000-A421
JFR-202	JFR20000-A1
JFR-212	JFR20000-A5
JFR-222	JFR20000-A2
JFR-232	JFR20000-A3
JFR-242	JFR20000-A4

ORDER INFORMATION



⑨⑩ Antenna type

A1：Horn(43D)
A2：Horn(100D/162L)
A3：Horn(140D/270L)
A4：Lens(43DS)
A5：Lens(56D)
B1：Horn(100D/126L)
B2：Horn(140D/202L)

⑪⑫ Antenna material

MA: SUS 304
MB: SUS 316
MC: SUS 316L
21: PTFE coating

Connection

⑬⑭	⑮⑯	⑰⑱
Flange	B1：1-1/2"	03：PF male
AK：JIS-FF	B2：2"	07：NPT male
AN：ANSI-RF	B4：2-1/2"	40：5 kg/cm^2
AS：DIN-FF	B5：3"	42：10 kg/cm^2
	B7：4"	48：150 Lbs
Thread	B8：5"	49：300 Lbs
AA：JIS	B9：6"	57：PN10
AC：ANSI	E3：DN65	58：PN16
	E4：DN80	59：PN25
		60：PN40

※ (1) JFR-202,204 thread connection 1-1/2" PF only
(2) JFR-212,214 thread connection 2" PF, NPT only
(3) JFR-222,224 thread connection 2" PF only
(4) JFR 234,232 thread connection 2"PF only
(5) JFR 244,242 thread connection 1-1/2"NPT only
(6) Please do check Radar antenna can be direct fitted in flange connection and nozzle below is the suggestion
(7) 2"Flang is applicable in open area

Type	Opening	Flange size
JFR-21X	56mm	2-1/2"
JFR-22X	100mm	4"
JFR-23X	140mm	6"
JFR-24X	44mm	2"

⑲⑳ Flange material

MA: SUS 304
MB: SUS 316
MC: SUS 316L
MD: SS41 zinc coating
18: PP
21: PTFE
00: None

㉑ Output

A: Loop Power 24 Vdc with HART
B: 4-Wire 9.5~30Vdc 4~20mA with RS-485
C: Loop Power 24 Vdc, 4~20mA

㉒ Accuracy

A: ±3mm
B: ±5mm
C: ±10mm
D: ±20mm
※2 Wire only option B: ±5mm or C: ±10mm

JFR Radar Level Transmitter

Customer Information

Prepared by: _____ Date: _____

Company: _____ Industry: _____

E-mail: _____ Phone Number: _____

Address: _____

Application Information

B.1 Measuring Material Information				
Application Description:				
Installation Area:	☐ Storage tank	☐ Process tank	☐ Open-air application	
Material Status :	☐ Liquid	☐ Slurry/ Sludge/ Paste		
Material Name :		Dielectric Constant	☐ 1.4~1.9	☐ 4.0~10.0
			☐ 2.0~2.5	☐ >10
			☐ 2.6~4.0	☐ Unknow

B.2 Power Supply

☐ DC : _____ ☐ AC : _____

B.3 Output Signal

Analog : ☐ 4~20mA 4-Wire ☐ 4~20mA 2-Wire

Digital : ☐ RS-485 ☐ HART ☐ Other

B.4 Measuring range

Measuring range: _____meters

B.5 Measuring Condition

Operating Temperature

Max: _____℃ Min: _____℃

Abient Temperature

Max: _____ ℃ Min: _____ ℃

Operating Pressure

Max: _____ Bar Min: _____ Bar

B.6 Connection

Connection: ☐ Threaded ☐ Flange

Size and Standard:_____ Flange Material:_____

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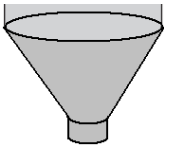
B.7 Tank Information

Tank Shape	☐ Vertical Cylinder	☐ Horizontal Cylinder	☐ Spherical	
	☐ Cubical/rectangular	☐ Other: _____		
Tank Material	☐ Cubical	☐ Plastic	☐ Cement	☐ Other_____
Tank Bottom	☐ Metal			
	☐ Plastic			
	☐ Cement			
	☐ Other	_____		

Tank
Tank Height (H):_____ m
Tank Diameter (W):_____ m
Cone Height (H1): _____ m
(Ignore cone height with flat/disk bottom)

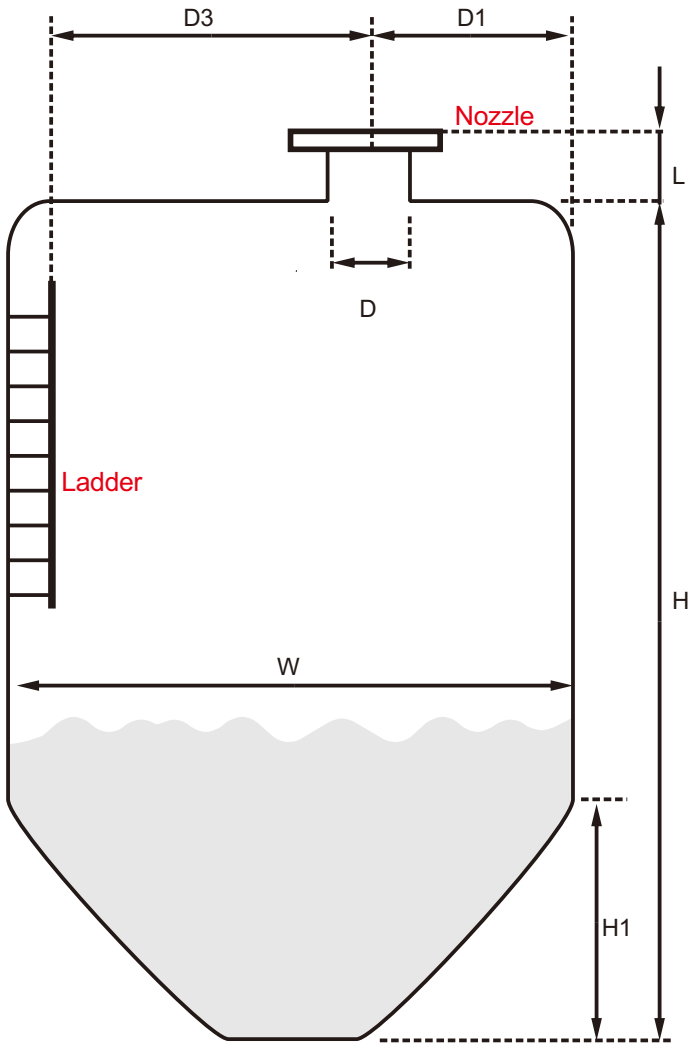
Radar
Distance to tank wall(D1):_____m

Nozzle
☐ Yes
Nozzle Diameter (L):_____ m
Nozzle Height (D):_____ m
☐ NO

Ladder
☐ Yes
Distance to rada (D3):_____m
☐ NO

Heater
☐ Yes
☐ NO

Other Internal Obstacles
☐ Yes
☐ NO



Power plant
port wave height edtection

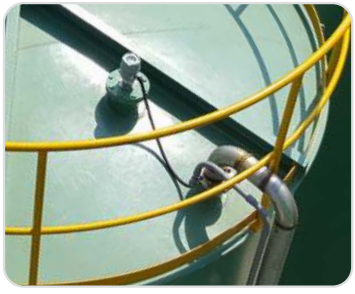
Oil Factory
Process Oil Detection

Government agencies
flood prevention and control

Pharmaceutical Factory
Boiler Liquid Detection

Feed industry
butter storage detection

Oil Factory
Soybean oil level detection

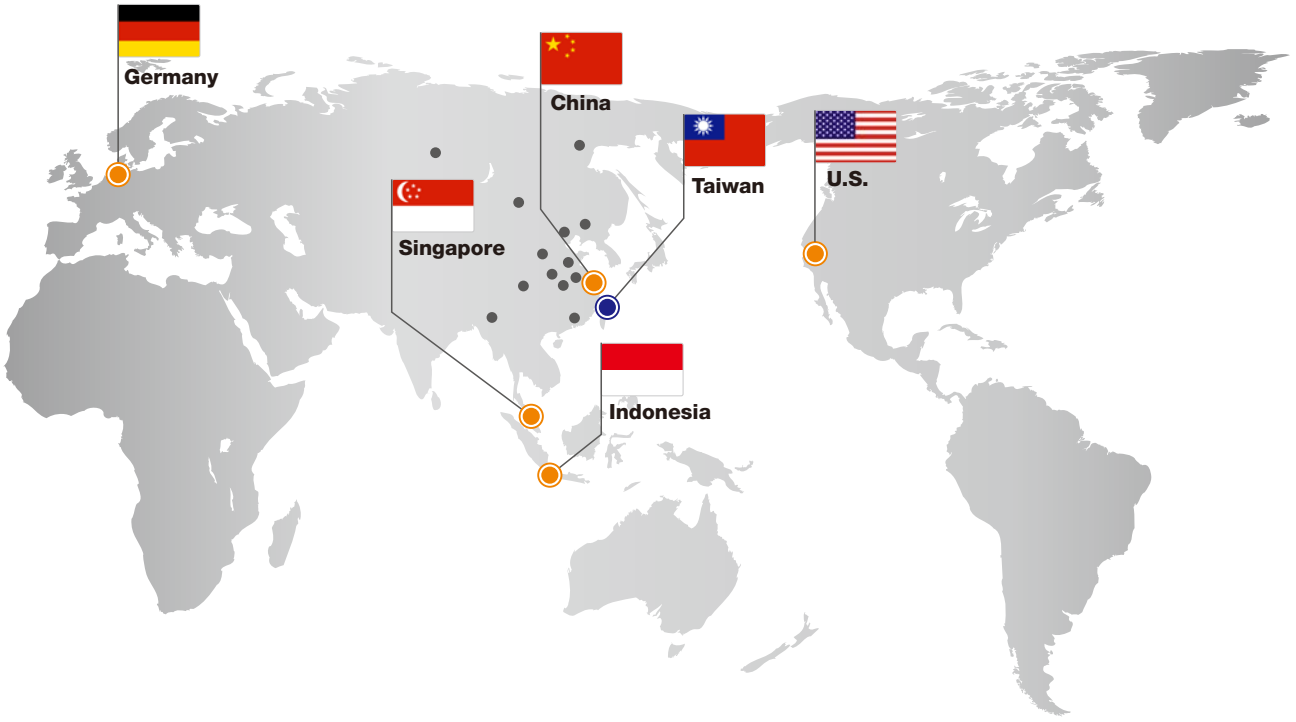


Plastic industry
chemical detection

Feeding plant
Corn storage tank detection

FineTek

Global Network



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