

FMCW Radar Level Transmitter





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



LINEARITY DIAGRAM



Accuracy



FEATURES

- Non contact measuring
- Corrosive and toxic liquid, hydrocarbons, slurries
- Not affected by specific gravity, pressure, temperature, viscosity, foam, and dust
- 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.
- 26GHz JFR2 series could measure all kinds of material.

TEST STANDARDS

- High voltage : IEC60947-2
 - Isolated resistance : IEC60092-504

: IEC60092-504

: IEC61000-4-4

: IEC61000-4-11

- Power supply change
 - Power supply failure : IEC60092-504
- Electrical burst testing
 - Voltage DIPS
- Humidity •
- : IEC60068-2-30 High/Low temperature test : IEC60068-2-38
- IP protection rating : IEC60529

SPECIFICATION (26GHz 4-wire)

Dimensions (Unit:mm)	¢98 1/2"PF 1-1/2"PF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	¢98 1/2"PF 2"NPT or 2"PF PTFE ¢56					
Model	JFR-204	JFR-214					
Medium	General liquid and solid	General liquid /suitable for acid and alkaline in liquid					
Min. Dielectric constant (solid)	1.5						
Min. Dielectric constant (liquid)	1.4						
Measuring range	Liquid 30m Solid 20m Liquid 30m						
Accuracy	±3 mm						
Repeatability	±1 mm						
Digital communication	RS485 (Isolated)					
Ambient temperature	-40~90 °C(LCM<75°C)					
Operating temperature	-40~2	20 °C					
Operating pressure	0~40) bar					
Frequency	КВ	and					
Analog output	4~20mA	/ 4 Wire					
Protection rating	IP	67					
Power supply	9.5~3	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	50	0mm					

Dimensions (Unit:mm)	¢98 1/2" PF compressed air input 369 2"PF ¢100	1/2" PF compressed air input 2"PF 270 ↓ 476	1/2" PF 1-1/2" NPT 43 \$\phi 43			
Model	JFR-224	JFR-234	JFR-244			
Medium		General liquid and solid				
Suitable For	Long dlstance measurement	Corrosion type acid and alkaline liquid				
Min. Dielectric constant (solid)	1.5					
Min. Dielectric constant (liquid)	1.4					
Measuring range	Liquid 40m Solid 30m Liquid 70m Solid 50m		Liquid 20m Solid 15m			
Accuracy	±3 mm	n ±3 mm				
Repeatability		$\pm 1 \text{ mm}$				
Digital communication		RS485 (Isolated)				
Ambient temperature		-40~90 °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					

P.S. For JFR-224 and JFR-234, customer can connect the compressed air with 1/8"PT thread connector to avoid dust adhered. 3

SPECIFICATION (26GHz 2-wire)

Dimensions (Unit:mm)	¢98 1/2"PF 1-1/2"PF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	¢98 1/2"PF 2"NPT or 2"PF PTFE ¢56					
Model	JFR-202	JFR-212					
Medium	General liquid and solid General liquid /suitable for acid alkaline in liquid						
Min. Dielectric constant (solid)	1.5						
Min. Dielectric constant (liquid)	1.4						
Measuring range	Liquid 20m Solid 10m Liquid 20m						
Accuracy	±5mm						
Repeatability	± 3mm						
Digital communication	HART						
Ambient temperature	-40~90°C(I	LCM<75°C)					
Operating temperature	-40~2	200°C					
Operating pressure	0~40	0 bar					
Frequency	КВ	and					
Analog output	4~2	0mA					
Protection rating	IP	67					
Power supply	24Vdc	±10%					
Local display	5 digits LCM display						
Housing material	Alum	ninum					
Antenna type	Horn (43D) Lens (56D)						
Half-power beam width	±9°						
Antenna material	SUS 316 + PTFE	PTFE					
Blind distance	500 mm						

Dimensions (Unit:mm)		¢98 1/2" PF compressed air input 2"PF 270 ¢140	1/2" PF 1-1/2" NPT 43 \$				
Model	JFR-222	JFR-232	JFR-242				
Medium		General liquid and solid					
Suitable For	Long dlstance measurement	Super distance measurement	Corrosion type acid and alkaline liquid				
Min. Dielectric constant (solid)	1.5						
Min. Dielectric constant (liquid)	1.4						
Measuring range	Liquid 30m Solid 20m	Liquid 35m Solid 30m	Liquid 15m				
Accuracy	±5 mm	\pm 3mm @distance<40m \pm 0.01%F.S. @distance>40m	±5 mm				
Repeatability		±3mm					
Digital communication		HART					
Ambient temperature		-40~90°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		$24Vdc\pm10\%$					
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						

P.s. For JFR-222 and JFR-232, customer can connnect the compressed air with 1/8"PT thread connect o avoid dust adhered. 5

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

[ESC] Button

-Return

-Cancel

[] Button -Select Edit -Select parameter -Parameter



PARAMETER SETTING

Measurement bench-mark starts at contact surface of connection.

- 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)



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.



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 (Inch)
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 (Inch)	Length L (Inch)				
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 (Inch)
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".



 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.



 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

						09	10 (1	II)	(12)	(13)	(14)	(15)	16	(17)	(18)	(19)	20	(21)	22	23
	JFR 2	20	0	0 (0 -	•														
Montenna 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)																				
(i) (i) Antenna material – MA: SUS 304 MB: SUS 316 MC: SUS 316	 																			
21: PTFE coating																				
Connection ———]							

(13)(14)	15 16	17 18
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: PN16

- % (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 234,232 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

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

09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 JFR 2 0 0 0 0 -

19 29 Flange material -

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

② Output -

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

22 Accuracy -

A: ± 3 mm

B: ±5mm

C: ±10mm

D: ±20mm

2 Wire only option A: ± 5 mm or C: ± 10 mm

3 Measuring distance -

A: 10m

B: 20m

C: 30m

D: 40m

E: 70m

JFR Radar Level Transmitter

Customer Inforn	nation	Prepared by:	Date:	
Company:		Industry:		
E-mail [.]			Phone Number:	
_ mail:				
\ddress:				
Application Info	rmation			
B.1 Measuring M	laterial Informa	ation		
Application Description	on:			
Installation Area	□ Storage tank	Process tank	Open-air application	
Material Status :		Slurry/ Sludge/ Paste	□ Solid/ Granulate/Grain	Powder
			□ 1.4~1.9	4.0~10.0
Material Name :		Dielectric Constant	□ 2.0~2.5	□ > 10
			□ 2.6~4.0	🗆 Unknow
B.2 Power Supply	1			
DC		AC		
B.3 Output Signal				
Analog : $\Box 4 \sim 20$ n		$4 \sim 20 \text{ m} \Delta = 2 \text{ Wire}$		
		INARI		
B.4 Measuring rai	nge			
Measuring range:	n	neters		
B.5 Measuring Co	ondition			
Operating Tempera	ature			
Max:℃	Min:	_℃		
Abient Temperature	9	-		
Мах: °С	Min:	_ ℃		
Operating Pressure	9			

B.6	Connection	

Max: _____ Bar Min: _____ Bar

Connection:ThreadedImageSize and Standard:Flange Material:

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)		D3		D1 Nozzle		
Radar Distance to tank wall(D1):m			D			
Nozzle □ Yes Nozzle Diameter (L): m Nozzle Height (D): m □ NO		Ladder				
Ladder ☐ Yes Distance to rada (D3): m ☐ NO			W			
Heater Yes NO				H1		
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



Sensorsystem S.r.l. via Amendola, 35/B 20037 Paderno Dugnano (Mi) Tel. 02.9185051 Fax 02.99046839 www.sensorsystem.it info@sensorsystem.it