Agrinovo

AGRINOVO-RLM-120

76–81 GHz FMCW Radar Level Meter

1. Overview

The AGRINOVO-RLM-120 is a frequency modulated continuous wave (FMCW) radar level meter operating at 76–81 GHz. Its high operating frequency and short wavelength make it particularly suitable for both liquid and solid level measurement applications, with a maximum range of up to 120 m.

Key Features

- 76–81 GHz FMCW technology
- Up to 120 m measuring range
- Accuracy: ±1 mm
- 3° / 8° beam angle
- HART and Modbus communication
- 4-20 mA / RS485 output
- Bluetooth configuration via mobile
- IP67, Ex d ia IIC T6

Applications

- Liquid level measurement in tanks and vessels
- Solid/powder level measurement in silos
- High-temperature and high-pressure process environments
- Chemical, petrochemical, and food industry

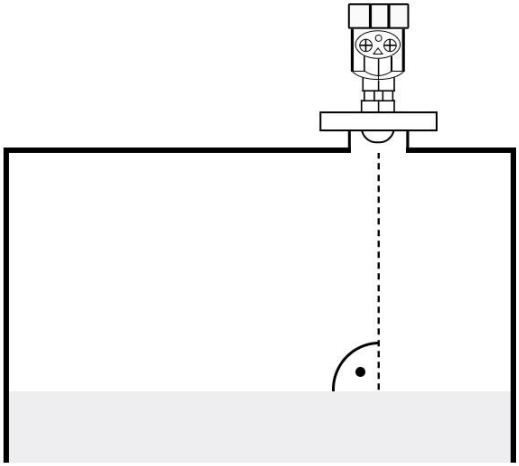
2. Specifications

Parameter	Specification
Frequency Range	76–81 GHz
Measuring Range	15 m / 35 m / 85 m / 120 m
Accuracy	±1 mm
Beam Angle	3°, 8°
Power Supply	14–28 VDC
Output Signal	4-20 mA, RS485
Communication	HART, Modbus
Fault Output	No change, 22 mA, 3.6 mA
Process Temperature	-30~80°C / -30~200°C / -30~1000°C
Process Pressure	-0.1~1.8 MPa
Operating Temp (Display)	-20~70°C
Measurement Interval	0.3 s minimum
Max Power Consumption	2-wire: 20 mA / 4-wire: 70 mA
Shell Material	Aluminum shell, stainless steel
Cable Entry	M20x1.5
Antenna Type	Lens antenna
Blind Area	0.08–0.5 cm
Protection Level	IP67
Explosion-Proof Grade	Ex d ia IIC T6
Connection Method	Thread, universal flange, anti-corrosion, high-temp/pressure
Humidity	< 95%

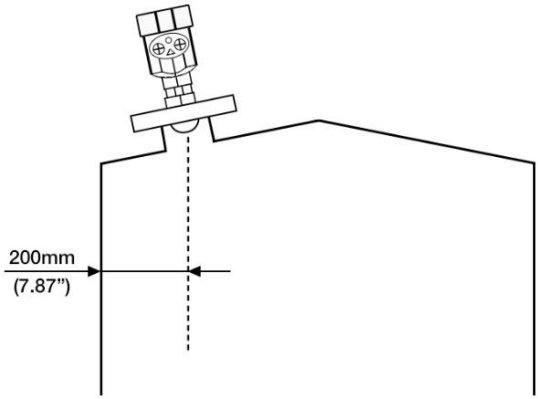
3. Installation

Position Selection

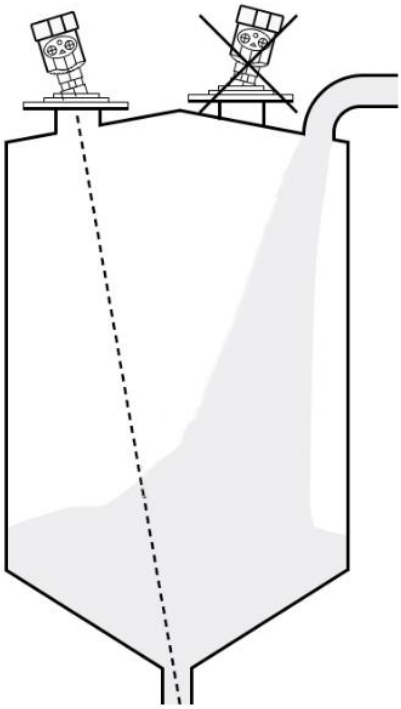
When measuring liquids, align the meter vertically with the medium surface for optimal measurement.



Install the instrument at least 200 mm away from the vessel wall.

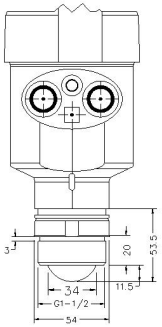


Position the antenna away from the feed inlet to obtain the best measurement results. If the tank wall is not smooth (corrugated steel, welds, joints, etc.), install the device as far away from the tank wall as possible. If necessary, use the antenna angle adjustment device to avoid interfering reflections.

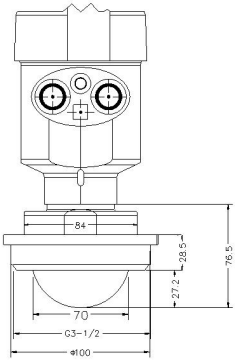


4. Dimensions

Threaded Connection



G1-1/2 thread (34 mm antenna)

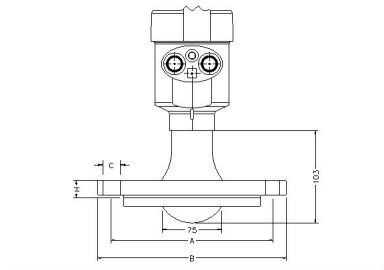


G3-1/2 thread (70 mm antenna)

Flange Connection

Anti-corrosion flange (PN16)

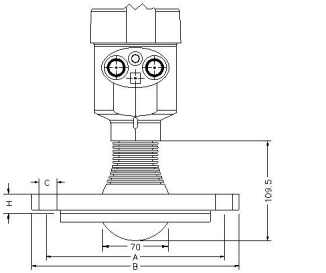
Size	A (mm)	B (mm)	C (mm)	H (mm)	N (bolts)
DN80	160	200	17.5	20	8
DN100	180	220	17.5	20	8



	A	B	C	H	N
DN80	160	200	17.5	20	8
DN100	180	220	17.5	20	8

PN16

Normal temperature



	A	B	C	H	N
DN80	160	200	17.5	20	8
DN100	180	220	17.5	20	8

PN16

High temperature (-30~200°C)

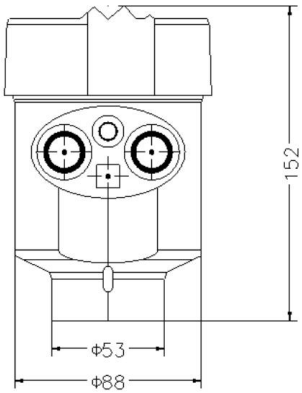
Small anti-corrosion flange (PN16)

Size	A (mm)	B (mm)	C (mm)	H (mm)	N (bolts)
DN50	125	165	17.5	20	4
DN65	145	185	18	20	4

Universal flange (PN16)

Size	A (mm)	B (mm)	C (mm)	H (mm)	N (bolts)
DN80	160	200	17.5	20	8
DN100	180	220	17.5	20	8

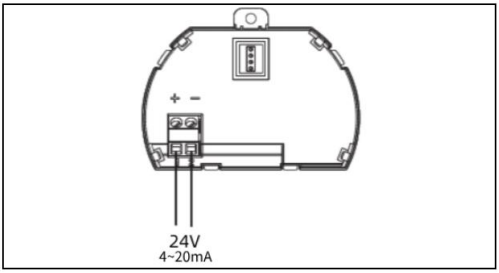
Aluminum Shell



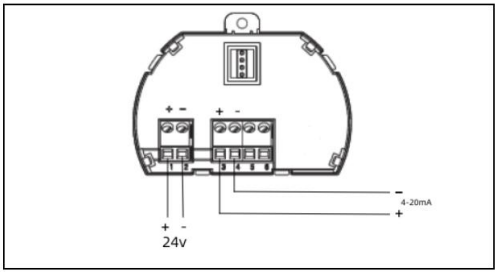
Shell dimensions: 152 mm height, 53 mm / 88 mm diameter

5. Electrical Connections

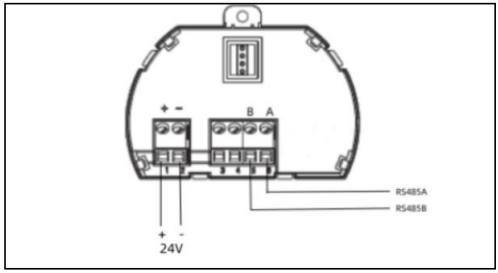
5.1 4-20 mA Two-Wire



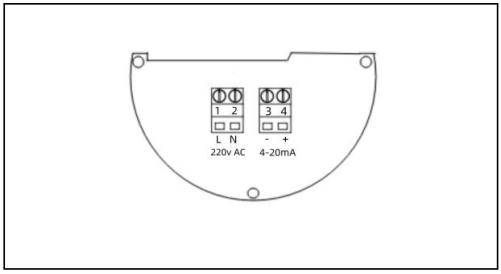
5.2 4-20 mA Four-Wire



5.3 RS485 Four-Wire



5.4 Dual-Chamber 220V AC (4-20 mA Four-Wire)



In four-wire applications, when 4-20 mA is not output, terminals 3–4 are shorted.

6. RS485 Modbus Communication (RS485 Version)

Communication Settings

Parameter	Value
Protocol	Modbus-RTU
Baud Rate	9600 bps (default)
Data Bits	8
Parity	None
Stop Bits	1
Default Address	0x01
Frame Interval Timeout	50 ms
Byte Order	CDAB (little-endian word swap)

Modbus Functions

- **0x03** — Read holding registers
- **0x10** — Write multiple registers

Register Map

All registers use base address 0x20 (decimal 32). Parameters occupying 2 registers use UINT32 format; parameters occupying 1 register use UINT16 format.

Measurement Registers (Function 0x03)

Address	Registers	Description	Unit
0x0000	2	Distance (empty height)	mm
0x0002	2	Level	mm
0x0004	1	Scale (ratio)	—

Basic Settings (Read 0x03 / Write 0x10)

Address	Reg	Description	Range
0x0020	2	Low calibration	100–35000 / 100–85000 / 100–120000 mm
0x0022	2	High calibration	0–35000 / 0–85000 / 0–120000 mm
0x0024	2	Range	100–35000 / 100–85000 / 100–120000 mm
0x0026	2	Blind zone	0–120000 mm
0x0028	1	Damping time	0–60000
0x0029	1	Media type	0 = Liquid, 1 = Solid
0x002A	1	Medium parameters	0 = >10, 1 = 3–10, 2 = <3
0x002B	1	Application scenario	0–4 (see table below)

Display Settings

Address	Reg	Description	Range
0x002C	1	Measurement mode	0 = Level, 1 = Distance, 2 = Scale
0x002D	1	Distance unit	0 = m, 1 = cm, 2 = mm
0x002E	1	Language	0 = Chinese, 1 = English
0x002F	1	LCD contrast	40–100

Advanced Settings

Address	Reg	Description	Range
0x0030	2	False echo start	0–85000 mm
0x0032	2	False echo end	0–85000 mm
0x0034	2	False echo intensity	0–200
0x0036	1	Distance offset	-10000–10000 mm
0x0037	1	HART address	0–32
0x0038	1	Modbus address	1–127
0x0039	1	Modbus baud rate	0 = 9600, 1 = 38400, 2 = 115200
0x003A	1	Output setting	0 = 4-20 mA, 1 = 20-4 mA
0x003B	1	Current simulation	4000–20000 (÷1000 = mA)
0x003C	1	Current function	0 = No change, 1 = 22 mA, 2 = 3.6 mA

Reading Measurement Data

All measurement values use **CDAB byte order** (little-endian word swap).

Read distance (empty height) in mm:

```
Request:  01 03 00 00 00 02 C4 0B
Response: 01 03 04 [XX XX] [XX XX] [CRC]
```

Read level in mm:

```
Request:  01 03 00 02 00 02 65 CB
Response: 01 03 04 [XX XX] [XX XX] [CRC]
```

Read scale (ratio):

```
Request:  01 03 00 04 00 01 C5 C8
Response: 01 03 02 [XX XX] [CRC]
```

Writing Configuration Example

Write low calibration to 35000 mm (byte order CDAB):

```
Request:  01 10 00 20 00 02 04 88 B8 00 00 5A 32
Response: 01 10 00 20 00 02 40 02
```

Decoding CDAB byte order: Data bytes `88 B8 00 00` are read as CDAB → value `0x000088B8` = 35000 mm.

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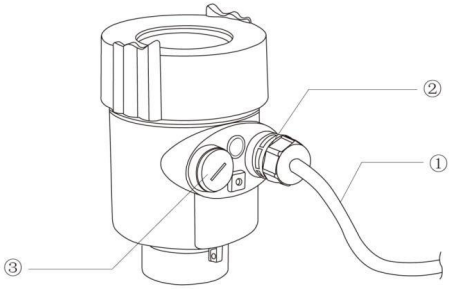
7. Safety and Protection

Safety Instructions

- Comply with local health and safety regulations
- All electrical work must be performed by trained professionals
- Check the instrument nameplate to verify product specifications
- Ensure supply voltage matches the instrument's nameplate requirements

IP67 Protection



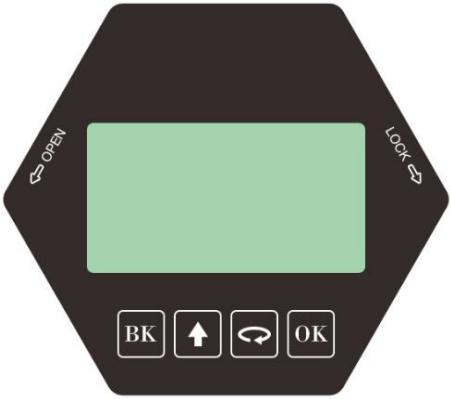
To ensure IP67 compliance:

- Ensure the sealing head is not damaged
- Ensure the cable is not damaged

- Use cable that meets electrical connection specifications
- Bend the cable downward before entering the electrical interface to prevent water ingress (1)
- Tighten the cable sealing head (2)
- Plug unused electrical interfaces with a blind plug (3)

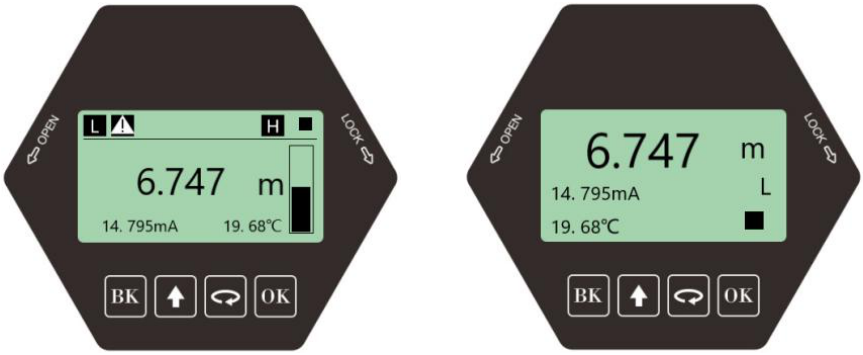
8. Instrument Operation

Button Description



Button	Function
BK	Exit programming mode / Return to previous menu / Switch to echo interface
Up	Modify instrument parameters / View instrument information
Cycle	Switch instrument interface / Select menu item / Select edit position
OK	Enter edit mode / Confirm parameter modification

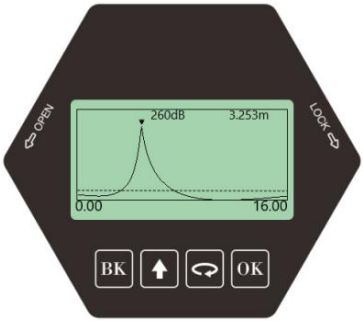
Main Interface



- **6.747**: Real-time measurement value
- **L**: Measurement mode — Level (L), Distance/empty height (H), Ratio (%)
- **H**: Communication method — HART (H), Modbus (R)
- **M**: Measurement unit
- **19.68°C**: Internal circuit temperature
- **Warning icon**: Fault code prompt (press Up key to view details)
- **Square indicator**: Communication status (flashing every 1 s = normal)

Echo Interface

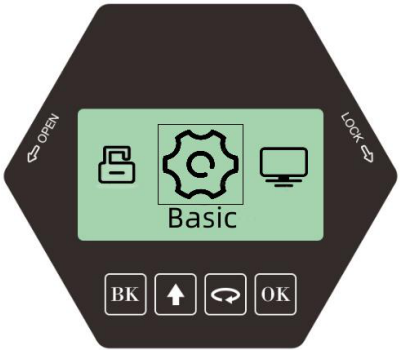
Press BK on the main interface to enter the echo display.



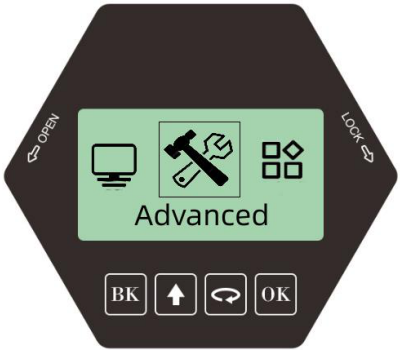
- **260 dB**: Echo strength
- **3.253 m**: Echo position
- **Black arrow**: Real-time measured distance
- **16.00**: Range setting value

Menu Structure

Press OK on the main interface to enter the menu.



Basic settings page



Advanced settings page

Menu	Contents
Basic Settings	Low/high calibration, range, blind zone, damping time, media type, medium parameters, application scenarios
Display	Measurement mode, distance unit, language, LCD contrast
Advanced Settings	False echo learning, distance offset, bus address, output mode, current simulation, current function
Service	Echo index, echo ratio, window settings, echo lock, primary/secondary filter, response rate, threshold setting
Factory Settings	Factory reset

9. Configuration Guide

Basic Settings

Low/High Calibration: The low position corresponds to the empty level, and the high position corresponds to the full level. For example, for a 10 m tank: set high position to 0 m and low position to 10 m.

Range: Set the range at least 2 m larger than the actual tank height so the instrument can obtain a complete echo. The range determines the echo processing window — echoes outside the range are ignored.

Blind Zone: Use the blind zone setting when a fixed obstacle near the sensor surface interferes with measurement and the maximum material level does not reach the obstacle.

Damping Time: Smooths sudden changes in measurement results to more accurately reflect the average material level position.

Media Type: Select Liquid or Solid. This automatically adjusts the application and medium parameter menus.

Medium Parameters:

Solid	Liquid
Chunk	Dielectric constant > 10
Nub	Dielectric constant 3–10
Dust	Dielectric constant < 3

Application Scenarios:

Solid	Liquid
Narrow and high type	Small container — fast response
Large capacity	Medium container — most conditions
Crusher	Large container — smooth output
Stockpile	Stirring — agitator applications
Demo	Demo

Display Settings

- **Measurement Mode:** Level, Distance (empty height), or Scale (ratio)
- **Distance Units:** m, cm, mm, ft, in (default: m)
- **Language:** Chinese, English, Korean, Russian
- **LCD Contrast:** 0–100 (higher = darker)

Advanced Settings

False Echo Learning: Shields interference echoes from obstacles inside the container. Set the start point, end point, and intensity to form a threshold curve.

Distance Offset: Corrects deviation between measured and actual values. Factory-calibrated by default.

Bus Address:

Protocol	Range	Notes
HART	0–32	When address differs from 0, current is fixed at 4 mA
Modbus	1–127	—

Output Mode: Select 4-20 mA or 20-4 mA output direction.

Current Simulation: Outputs a specific current value to verify the 4-20 mA loop accuracy. Exit to resume normal operation.

Current Function: Sets the output current value when a signal loss fault occurs (NULL, 22 mA, or 3.6 mA).

Service Settings

- **Echo Index:** Adjusts waveform change speed (higher = more stable)
- **Echo Ratio:** Percentage of echo outside the window being greater than the echo inside the window
- **Window Settings:** Search range before/after waveform is locked; timer controls arrow tracking speed
- **Echo Lock:** Lock to search within window range only; unlock to search the full range
- **Primary/Secondary Filtering:** Enable/disable based on measurement environment (enabled by default)
- **Response Rate:** Adjusts response rate to actual material level changes
- **Threshold Setting:** Higher threshold requires stronger effective echo amplitude, helping eliminate small signal clutter

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10. Fault Codes

Code	Hex	Description
1	0x0000	Normal operation
2	0x0001	Echo lost
3	0x0002	ADC or TR failure
4	0x0004	4-20 mA alarm
5	0x0008	Temperature sensor fault
6	0x0010	File system alarm

Combined codes indicate multiple simultaneous faults (e.g., 0x0003 = echo lost + ADC/TR failure).

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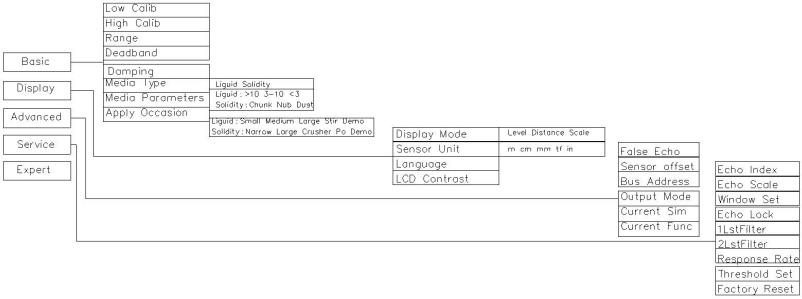
11. Communication and Debugging

The instrument can be configured on-site via the LCD panel or remotely through a PC. Communication methods:

- USB to TTL serial line (two-wire system)
- USB to RS485 serial line (four-wire system)
- USB to HART (two-wire system)
- Bluetooth via mobile phone

Menu Tree


Basic
Display
Advanced
Service
Expert
Low Calib
High Calib
Range
Deadband
Damping
Media Type
Media Parameters
Apply Occasion
Liquid Solidity
Liquid : >10 3~10 <3
Solidity : Chunk Nub Dust
Liquid : Small Medium Large Stir Demo
Solidity : Narrow Large Crusher Po Demo
Display Mode
Sensor Unit
Language
LCD Contrast
Level Distance Scale
m cm mm tf in
False Echo
Sensor offset
Bus Address
Output Mode
Current Sim
Current Func
Echo Index
Echo Scale
Window Set
Echo Lock
1LstFilter
2LstFilter
Response Rate
Threshold Set
Factory Reset