FR-02

Pulse Radar Level Meter in 2-wire Technology

- **Uni-construction polypropylene rod antenna standard**
- **Operating range up to 20m**
- **Programmable with hand-held programmer**
- **Simple installation and commissioning**
- **For vaporizing and outgasing fluids**
- **Automatic fade-out for agitator or clutter**
- **Communication using HART®**

Description: The FR-02 is a level measuring device which operates according to the principle of Pulse-Radar measuring circuit. A polypropylene rod antenna screw fixed inside the process vessel emits cyclically a radar impulse in the direction of the media surface; subsequently, the electronics measure the time that is lapsed until the impulse is reflected by the surface and again received by the antenna. Here since the radar is concerned with a electromagnetic wave, it propagates, irrespective of the properties of the gaseous phase, above the fluid always at the same speed, with the result, that the distance between the antenna and the fluid can be directly derived from the measured time span. At the output of the FR-02 a 4 to 20mA output in 2-wire circuit is present which reflects linearly either the distance between the sensor and the surface or the fill height of the liquid. If merely a measurement of volume is desired, the electronics can calculate the volume based on the vessel form stored in the memory and the measured fill height and allocate it to the power output. If the vessels do not correspond to the standard geometry, the operator can ascertain the volume by means of base programming.

Range of application: The FR-02 is used as a radar-based level meter wherever the ultrasonic method of measuring has its limitations. In this, since electromagnetic and not sound waves are transmitted, temperature, pressure and material properties of the gaseous phase above the fluids being measured are hardly significant in regard to the quality of measurement. Besides, the signal quality is completely unaffected by dust and any foam layer on the surface can be easily circumvented without significantly attenuating the radar signal. In the case of fluids with a dielectric constant greater than $\varepsilon_r = 3$, operating ranges up to 20 meters can be tapped where the vessel in its standard version may indicate up to 3 bar pressure and up to 80°C temperature. For applications with higher requirements of pressure and temperature, optionally, versions with flange connection and resistant sealing material are available. Often, also measuring operations need to be executed in narrow flushing tubes or reference vessels; for this the FR-02 can be supplied as a customized version with a 80 mm strong horned antenna and DN80 stainless steel flange. If the vessels are small, or contain outgasing fluids or slurries or surfaces with dust or foam layers, the FR-02 pulse radar level meter presents the ideal solution. Key applications: tank farm, chemical storage, wastewater wet well.

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Versions:

Process connection: For the connection to the vessel a G11/2“ (BSPP), R11/2“ (BSPT) or a 11/2“-NPT-male thread can be selected. Also flange connections or sanitary couplings are available on request..

Housing material: The standard version of FR-02 has a plastic housing of PBT with a PEI lid. Optionally, a larger housing made of aluminium pressure casting is available. This type of metal housing is required for the ATEX approval „compression-proof capsule“.

Antenna shielding: As the threaded bushing may, under circumstances, negatively affect the emitted radio signal, the upper part of the rod antenna is shielded.
The standard length of this shielding is 100 mm, for longer muffs also 250 mm can be selected.

Cable insertion: As a standard the housing is provided with insertion openings for cable glands in M 20 x 1.5 or 1/2“-NPT with adapter. Normally, two such thread holes are available.

Explosion protection: The FR-02 can be provided with two different approvals for deployment in hazardous areas. In the intrinsically safe variant Ex ia IIC T4 the FR-02 is fully permitted to be installed in Zone 0, however, for the power supply a current repeater will be necessary.
In the compression-proof capsule version the inside of a vessel can be constructed as Zone 0 and the outside where the housing of FR-02 is located should be declared as Zone 1 or Zone 2

Hand-held programming device: The FR-02 is completely programmable by means of a hand-held programming device. If the FR-02 is delivered as an EX device, the hand-held programming device can be used even in EX area Zone 0.

Technical specifications:

Measuring principle:	Puls-Radar
Measuring frequency:	5.8 GHz
Operating range:	0.3 to 20 m
Accuracy:	± higher of 0.1 % of operating range or 10 mm
Temperature effect:	0.003% / K
Repeatability:	± 5 mm
Fade-out distance:	0.3 m (from reference point plus length of shield)
Ambient temperature:	-40°C to +80°C
Temperature in the vessel:	-40°C to +80°C
Pressure in the vessel:	3 bar max.
Installation category:	I
Degree of pollution:	4
Dielectric constant ε_r:	ε_r > 1,6 (for ε_r < 3, use stillpipe or Cone antenna, suitable for free-propagation and pipe, on request)
Material wet side:	polypropylene hermetically sealed (PTFE on request)
Housing:	PBT with PEI lid or aluminium, polyester powder-coated (mandatory for protection type „compression-proof capsule“)
Process connection:	G11/2“ (BSPP)-male or 11/2“-NPT-male or R11/2“ (BSPT)-male
Weight:	< 2 kg

Ordering codes:

Ordering number: **FR-02. 1. 1. 1. 2. 0. 1**

Pulse Radar Level Meter in 2-wire Technology

Process connection:
1 = G11/2“-male with PP rod antenna (BSPP)
2 = 11/2“ NPT-male with PP rod antenna
3 = R11/2“ (BSPT)

Housing:
1 = plastic
2 = aluminium pressure casting

Antenna shielding:
1 = 100 mm (standard)
2 = 250 mm

Cable insertion:
1 = 2 x 1/2“-NPT with adapter
2 = 2 x M20 x 1.5

Explosion protection:
0 = none
1 = with EX approval ATEX II 1G Ex ia IIC T4, intrinsically safe
2 = with EX approval ATEX II 1/2 G Ex dmbia IIC T4 Ga/Gb, compression-proof, with Al housing only

Hand-held programming device:
0 = none
1 = with hand-held programming device (intrinsically safe for Ex versions)

Electrical specifications:

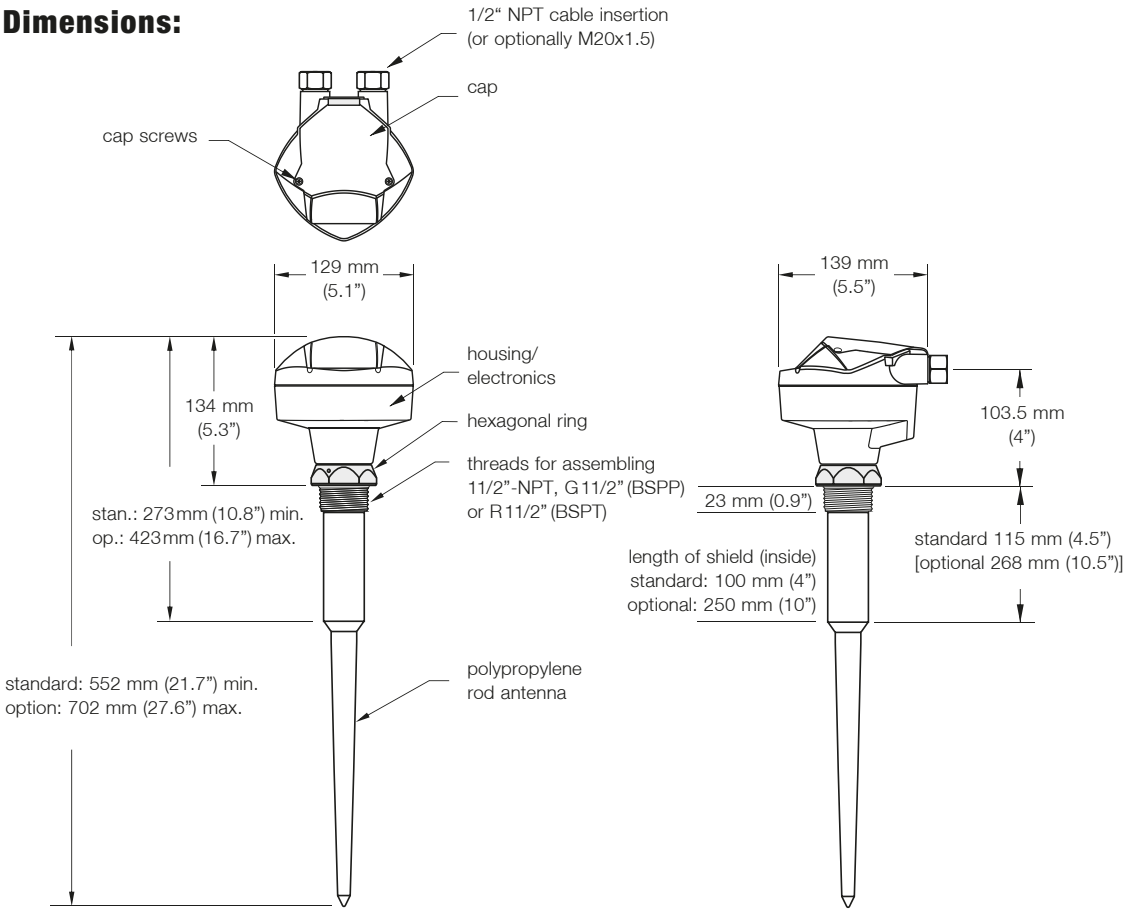
Supply voltage:	24 VDC (max. 30 VDC)
Load:	550 Ohm max. for normal or intrisically safe version, 250 Ohm max. for compression-proof version
Cable insertion:	2 x M20x1.5 or 2 x 1/2“-NPT with adapter
Output:	4 to 20 mA, 2-wire
Measuring span:	proportional or inversely proportional
Programming:	HART handheld programmer or PC
Communication:	HART (HART is a trademark of HART Communications Foundation)
Failsafe:	programmable on MAX, MIN or HALT (echo loss)
Display:	multi-segment, alphanumeric LC display, with bar graph for level
Protection class:	IP67 (IP68 on request)
Protection class for Ex version:	ATEX II 1 G Ex ia IIC T4 or ATEX II 1/2 G Ex dmbia IIC T4 Ga/Gb
Power circuit in intrinsically safe version:	Ui = 30 VDC, Ii = 120 mA, Pi = 0.8 W, Ci = 15 nF, Li = 0.1 mH

Hand-held programming device:

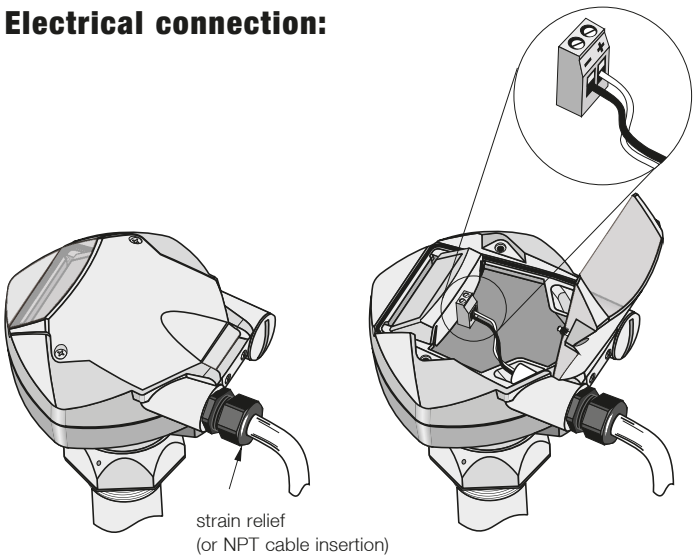
Approval for Ex version:	ATEX II 1GD EEx ia IIC T4
Ambient temperature:	-20°C to +40°C
Weight:	150 g
Supply:	3 Volt lithium battery

Options: Profibus PA Communication, flange connection, high pressure and temperature ranges

Dimensions:



Electrical connection:



Wire connection as shown in the diagram: The polarity is indicated on the terminals.

Tips

- As per IEC -1010-1 Appendix H DC terminals must receive supply from a protected low voltage source (SELV).
- All field connections must be insulated according to the connected input voltage.
- Use shielded cable with drilled pair of wires (wire gauge 0.34 to 2.08 mm² / 14-22 AWG).
- A separate cable layout may be necessary to meet the standard requirements for the connection or the electrical directives.

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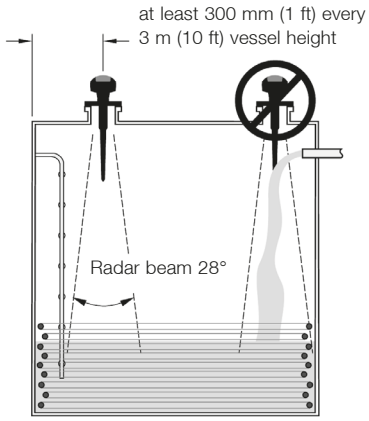
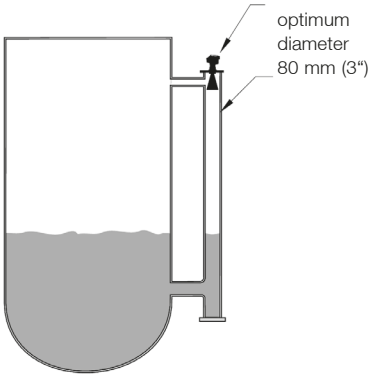
Assembly:

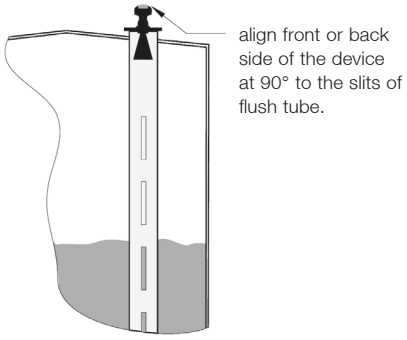


Assembly on bypass tube

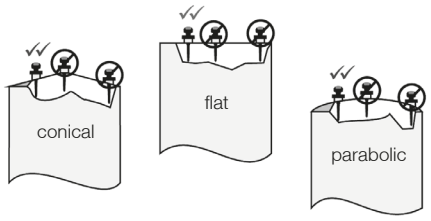
front or rear side of device at 90° angle for ventilation



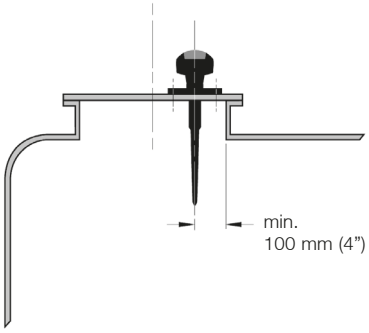
Assembly on measuring tube



Assembly on vessel



Assembly on manhole



Assembly on supports