OPERATING MANUAL

# Radarcont® RU4 | Compact electronic radar sensor with a free-space 122 GHz FMCW signal for distance and level measurements

umn_fam_ru4_vs1.01_en
07/2026

senseca

# Contents

# 1 About this documentation

## 1.1 Document function

These instructions for use describe the structure, functions and the use of the product and will help to operate the product as intended.

Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device.

The Operating manual is part of the device and must be kept always accessible nearest its installation location.

All statements within this document correspond to the information available at the time of printing. Subject to change without prior notice.

## 1.2 Terms

**NOTE**

Notes to prevent failures, malfunctions, damage to devices or plants.

**WARNING**

**Non-observance of the information may result in serious or fatal personal injury.**

**[04-5]**

Exemplary notice to a type variant (>> chapter Product description - Product code)

## 1.3 Other documents

Besides this document, further material can be found online, including IO-Link parameter list, EU Declaration of Conformity, certificates and 3D-CAD models.

# 2 Safety instructions

## 2.1 Authorized personnel

Installation, electrical connection, commissioning, operation, maintenance, dismounting and disposal of the device must be made by a qualified and authorized expert according to the information's in the Operating manual and the relevant standards and rules.

This expert must have read and understood the Operating manual and especially the safety instructions.

During work on and with the device, the required personal protective equipment must always be worn.

## 2.2 Intended use

The device is an electronic radar filling level sensor for continuous measurement of filling levels in liquid media.

The operational reliability of the device is ensured only at the intended use. Inappropriate or incorrect use of this product can give risk to application specific hazards, e.g. vessel overflow through incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result. Also, the characteristics of the instrument can be impaired.

An inappropriate use, disregarding the Operating manual and the technical rules, using under-qualified personnel, making unauthorized alterations as well as damage of the device releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

## 2.3 Operational safety

The device is safely built and tested according to state-of-the-art technology. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument.

The device may only be used within the permitted operation limits. Every use besides these limits as agreed can lead to serious dangers.

The materials of the device must be checked for compatibility with the respective application requirements before use. An unsuitable material can lead to damage, abnormal behavior or destruction of the device and to the resulting dangers.

The sensors may not be used as sole device for prevention of dangerous conditions in machines and plants.

The maximum transmission output of the sensor is within the approved limit values specified in ETSI EN 305550-2.

For safety and warranty reasons, any invasive work on the device beyond that described in the Operating manual may be carried out only by personnel authorized by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden. For safety reasons, only the accessory specified by the manufacturer must be used.

This measuring device meets article 4 (3) of the EU directive 2014/68/EU (pressure equipment device directive) and is designed and produced in good engineer practice.

The device meets the legal requirements of all relevant EU directives. This is confirmed by attaching the CE mark to the device. The associated EU-Declaration of Conformity can be ordered or downloaded from the homepage.

# 3 Product description

## 3.1 Function

The device is an electronic radar filling level sensor for continuous measurement of filling levels in liquid media.

The device operates with a pulsed FMCW radar (Frequency Modulated Continuous Wave) and detects contactless the distance to motionless objects.

The sensor outputs a periodic radar signal with linear frequency which varies upwards and downwards. The rate of change of frequency over time remains constant. Objects in the detection range reflect the transmitted signal. The change in the signal delay and frequency of the reflected signal are used to determine the distance to the object.

The device is suitable for applications in virtually all industries, optimally for use within containers up to 10m. Due to the small opening angle especially disturbances by foreign objects or internals will be reduced.

It is advisable for applications, where optical or ultrasonic sensors are unsuitable because of disruptive factors like temperature, gas or dust stratification, under or overpressure resp. vacuum, dust, wind or incidence of light.

The radar technology allows depending on the application:

Measurement of liquids, also at gas stratification (e.g. ammonia) or foaming

Measurement of bulk materials

Measurement through the container wall, e.g. IBC container or through a protection window, e.g. PTFE or PP

## 3.2 Construction

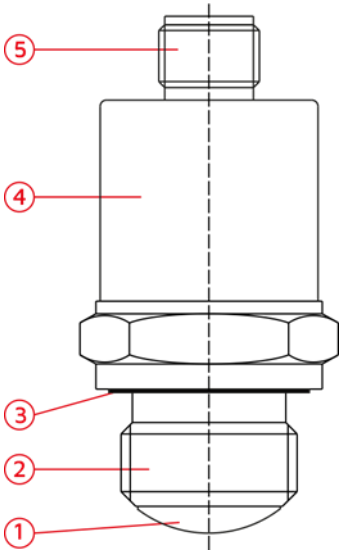


*Figure 3.1: grf00131_cmp_ru4sr*

1 Sensor lens
2 Process connection
3 Process gasket
4 Terminal enclosure
5 Plug connector

The device is installed into the plant by the process connection (2). The sealing of the process connection against the process is made by a suitable elastomer gasket (3).

The radar signal is radiated resp. received by the sensor lens (1). The signal is captured by the evaluation electronic, that is integrated within the terminal enclosure (4), processed according to the settings and transferred to the outputs at the plug connector (5). Parameterization and operation of the integrated evaluation electronic can be made by the wired interface.

## 3.3 Product label

A laser marking of the product label ensures the identifiability of the device throughout the entire lifetime.

The product label contains the most important data for identification and use of the instrument.

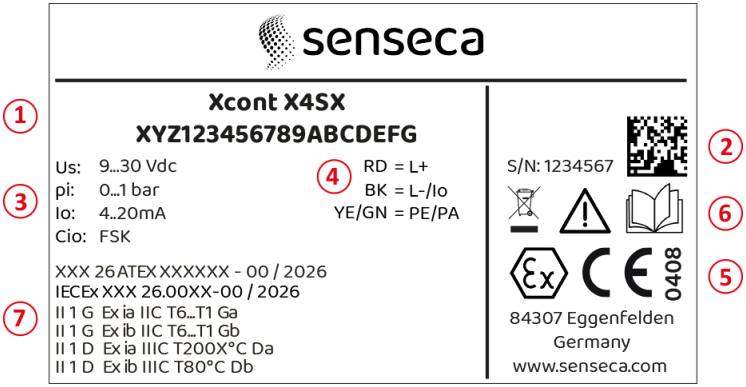


*Figure 3.2: grf00002_lab001*

**1** Product code
**2** Serial number
**3** Technical data
**4** Assignment
**5** Safety notes
**6** Approvals

## 3.4 Product code

RU4 [01][02][03][04][05][06][94][95][98]

| | | | |
|---|---|---|---|
| | Device | RU4 | Radar sensor compact |
| 01 | Application type | S | Standard |
| 02 | Sensor | R | Radar FMCW |
| 03 | Approval | S | Standard |
| 04 | Process connection | 9 | Thread ISO 228-1 - G1/2 A, DIN EN ISO 1179-2 E |
| 04 | Process connection | 8 | Thread ISO 228-1 - G3/4 A, DIN EN ISO 1179-2 E |
| 04 | Process connection | 5 | Thread ISO 228-1 - G1 A, DIN EN ISO 1179-2 E |
| 05 | Electronics - Output | V | RS485 Modbus RTU, 4-wire |

| | | | |
|---|---|---|---|
| 05 | Electronics - Output | L | IO-Link, current 0/4...20 mA / 1x/2x switching output PP, 3-/4-wire |
| 06 | Electrical connection | S | Plug M12-A-4P |

| | | | |
|---|---|---|---|
| 94 | Additional option | +SF | LABS-free, silicone-free / paint-compatible version |
| 95 | Additional option | +ML | Measuring point designation / TAG - laser marking |
| 98 | Additional option | +KF | Configuration / presetting |

## 3.5 Dimensions

Dimensions in mm. The parameter di characterizes the distance measuring value with the corresponding measuring reference point.

**Thread ISO 228-1 - G1/2, ISO 1179-2 E [04-9]**

Process pressure Pmax -1...10 bar

Torque Mmax 50Nm

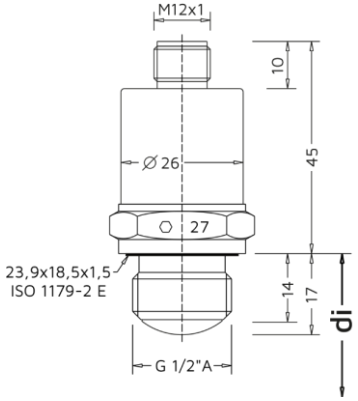


*Figure 3.3: grf00132_dim_ru4_04_9*

**Thread ISO 228-1 - G3/4, ISO 1179-2 E [04-8]**

Process pressure Pmax -1...10 bar

Torque Mmax 50Nm

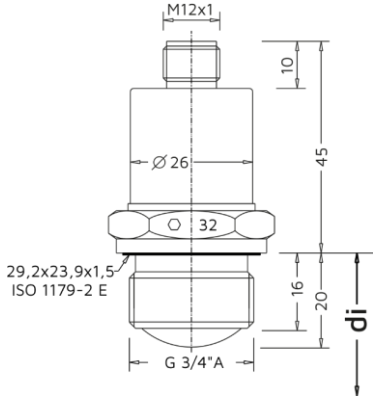


*Figure 3.4: grf00133_dim_ru4_04_8*

**Thread ISO 228-1 - G1, ISO 1179-2 E [04-5]**

Process pressure Pmax -1...20 bar

Torque Mmax 50Nm

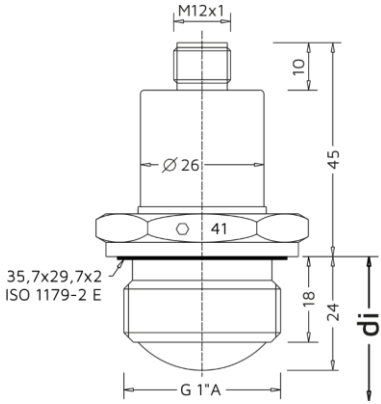


*Figure 3.5: grf00134_dim_ru4_04_5*

## 3.6 Packaging, transport, storage

The device is protected by packaging. It can handle normal loads during transport. Transport must be carried out in due consideration of the notes on the transport packaging. Non-observance of these instructions can cause damage to the device.

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Up to the time of installation, the packages must be left closed and, unless otherwise indicated, must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration
- Storage and transport temperature -20…+85°C
- Relative humidity 20…85%

## 3.7 Accessories

For installation and electrical connection, an extensive portfolio optimally matched to the device is available.

# 4 Installation

## 4.1 Ambient and process conditions

Correct function of the device within the specified technical data can only be ensured if the permissible ambient and process conditions at the installation location are not exceeded. Before installation, ensure that all parts of the device exposed to the process, such as the sensor lens, process connection and process seal, are suitable for the actual process conditions, for example process pressure, process temperature, chemical properties of the media, abrasion and mechanical influences.

The quality of the measured value depends significantly on the properties of the medium to be measured:

- Liquids with a dielectric constant DK >= 4 can be detected.
- Filling processes, agitators or other processes in the vessel may generate stable foam layers on the medium surface, which can strongly attenuate the transmitted signal.
- The maximum achievable measuring range may be reduced by media with poor reflection properties, buildup, heavy condensation, foam formation or icing on the sensor.

## 4.2 Installation location

The distance measured value refers to the measurement reference point; see section Product description - Dimensions.

No object detection takes place within the dead band; see minimum measuring range in section technical data.

The sensor may be installed in any orientation. Short mounting nozzles should be used so that the signal can propagate without obstruction in the near range.

Plastics are generally transparent to radar waves. Therefore, in plastic vessels such as IBC containers, top mounting is also possible without damaging the vessel wall. Measurement through a protective wall made of materials such as PTFE or PP is also possible at high temperatures or with aggressive media.

Certain materials, such as glass or admixtures of glass fiber, carbon fiber or graphite, may make through-wall measurement difficult or impossible. If the outer wall of the vessel is made of non-conductive material, e.g. plastic or GRP, microwaves may also be reflected by interference sources located outside the vessel, such as metallic pipes, ladders or gratings. Therefore, such interference sources should also be avoided within the beam cone outside the vessel.

Multiple radar sensors may be installed side by side without mutual interference.

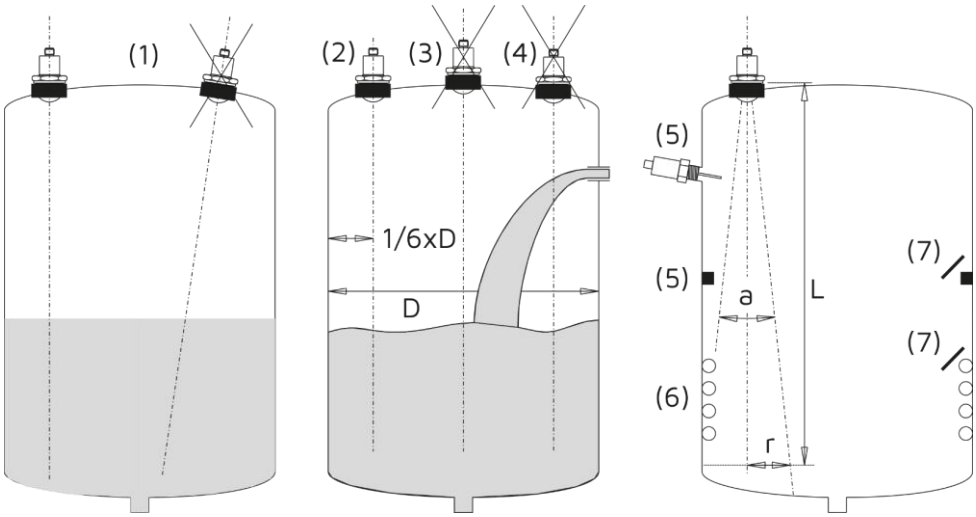


*Figure 4.1: grf00135_ins_ru4sr_1*

1 The sensor must be installed perpendicular to the medium surface.
2 The recommended installation distance from the vessel wall is one sixth of the vessel diameter.
3 The sensor should not be installed in the center of the vessel.
4 Measurement through the filling stream should be avoided.
5 Internal installations such as level switches or temperature sensors within the detection range should be avoided.
6 Symmetrical internal installations such as heating coils or baffles may impair measurement.
7 Interfering reflections from internal installations can be scattered or reduced by angled metallic baffles.
8 The radius r of the detection range at distance L with beam angle a can be calculated as follows: r = tan (a / 2) * L

## 4.3 Standpipe

Use of a stand pipe can significantly improve signal quality. This is recommended in the presence of internal installations or very uneven shaft walls, with foam formation, moving surfaces and low dielectric constants. The stilling tube should be made of metal or plastic with graphite or carbon fiber admixtures.

In media that tend to cause heavy buildup, measurement in a stilling tube is not suitable; the tube may need to be cleaned regularly.

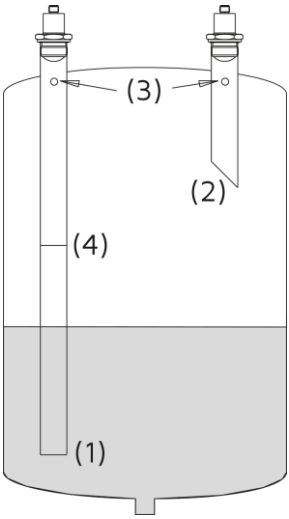


*Figure 4.2: grf00136_ins_ru4sr_2*

1 Stilling tubes should extend below the minimum level.
2 For shorter tubes, the process-side end of the tube should be beveled at 45°.
3 In the dead band above the maximum level, a vent hole (diameter 5...10 mm) must be provided.
4 Large gaps and pronounced weld seams inside the tube, especially at pipe joints, should be avoided.

## 4.4 Installation instructions

**WARNING**

**Before installation, allow the plant to cool down sufficiently. Escaping hazardous and hot media may cause danger.**

Remove the packaging only immediately before installation and inspect the device for possible damage.

The protective cap on the process connection or sensor lens must only be removed immediately before installation. The sensor lens must not be damaged.

Tightening of the fastening nut may only be performed on the hexagon using a suitable wrench and must not exceed the maximum permissible tightening torque; see section Product description - Dimensions.

# 5 Electrical connection

## 5.1 Electronic output - RS485 Modbus RTU [05-V]

### 5.1.1 Function

The Modbus protocol is a communication protocol based on a master/slave architecture. All devices are connected via two data lines (A+ / B-) and one COMMON line (C/L-).

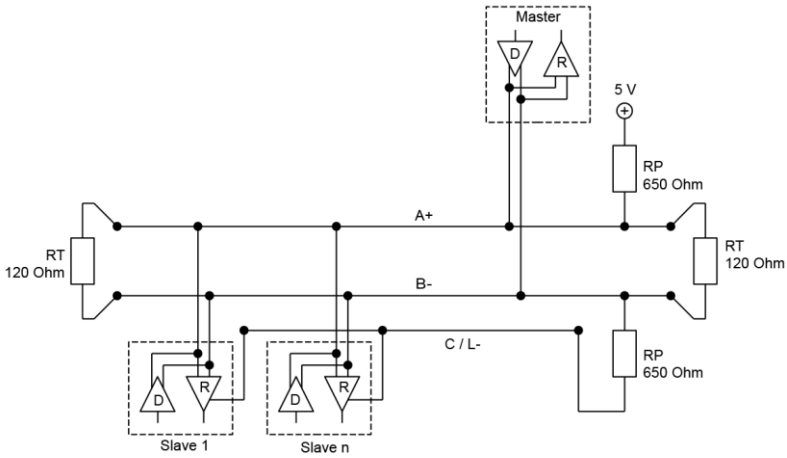


*Figure 5.1: grf00011_eac_modbus_line_termination*

A standard RS485 interface allows connection of 32 slaves in one segment. The device has a load of only one eighth of the standard load (Rin >= 96 kOhm), so that theoretically up to 256 devices can be operated in one network segment. However, the number is limited to 247 by the Modbus address space.

The two termination resistors RT prevent reflections on the data lines. The optimum resistance value depends on the characteristic impedance of the cable used; however, 120 Ohm is a common choice.

The biasing network is required to ensure suitable potentials when none of the devices is transmitting and the lines A+ and B- are undefined (high impedance). Recommended values for RP are 450...650 Ohm. Use of a biasing network is recommended to obtain a stable network. In most cases, the biasing resistors are integrated in the master device and can be enabled if required.

Arrange the devices in a bus topology (line). Avoid branch lines.

### 5.1.2 Pin assignment

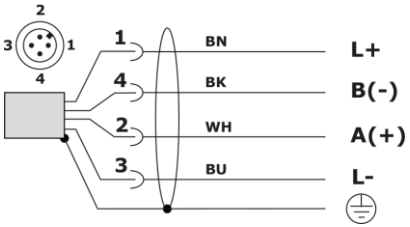


*Figure 5.2: grf00029_eac_m12_4p_4w_rs485*

### 5.1.3 Connection cable

| | |
|---|---|
| Cable | M12, A-coded, 1-BN = brown / 2-WH = white / 3-BU = blue / 4-BK = black |
| Impedance | 135...165 Ohm @ 3...20 MHz |
| Cable capacitance | < 30 pF/m |
| Conductor diameter | > 0.64 mm |
| Conductor cross-section | 0.34 mm2 / AWG 22 |
| Loop resistance | < 110 Ohm/km |
| Shielding | Braided shield / shield foil |
| Cable length | 38400 baud <= 1200 m |

### 5.1.4 Connection instructions

**WARNING**

**Install the device only when de-energized.**

**NOTE**

Switch off all connected control devices during commissioning.

Observe the maximum permissible supply voltage (Us) at the L+/L- terminals:

- Us = 6...35 Vdc

Ground the device, preferably via the metal process connection; alternatively, via the cable shield.

Route the cable separately from power-carrying lines, and ground the cable shield.

## 5.2 Electronic output [05-L] - IO-Link

### 5.2.1 Function

IO-Link is a globally standardized I/O technology for communication with sensors. It is a serial, bidirectional point-to-point connection. IO-Link communication requires an IO-Link master

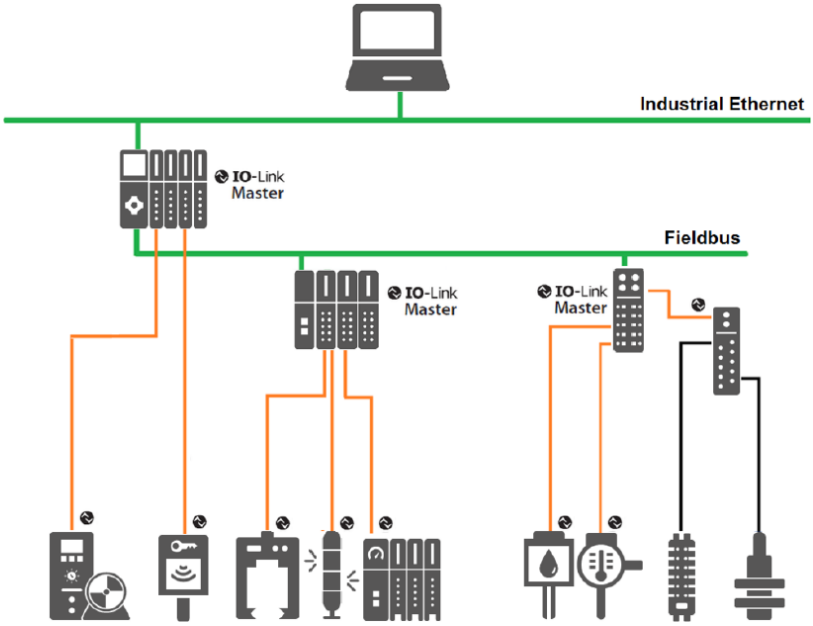

*Figure 5.3: grf00030_eac_io_link*

### 5.2.2 Pin assignment

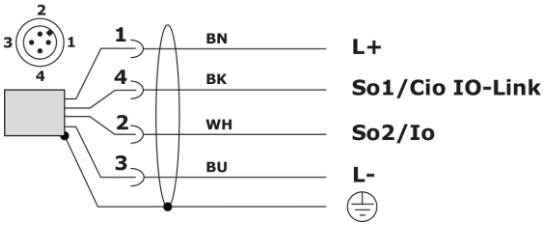


*Figure 5.4: grf00031_eac_m12_4p_4w_io*

### 5.2.3 Connection cable

| | |
|---|---|
| Cable | M12, A-coded, 1-BN = brown / 2-WH = white / 3-BU = blue / 4-BK = black |
| Specification | Use an unshielded 3-core or 4-core cable with maximum length 20 m. If the analog output is used, a shielded cable must be used. |

### 5.2.4 Connection instructions

**WARNING**

**Install the device only when de-energized.**

**NOTE**

Switch off all connected control devices during commissioning.

**NOTE**

Operate inductive loads connected to switching outputs only with a flyback diode or RC element.

Observe the maximum permissible supply voltage Us at the L+/L- terminals:

- Us = 9…35 Vdc
- Us = 18…30 Vdc, IO-Link

Observe the maximum permissible load resistance RL of the analog output:

- RL ≤ (Us – 8 V) / 22 mA

Ground the device, preferably via the metallic process connection; alternatively, via the cable shield.

Route cables separately from power-carrying lines and ground the cable shield.

Out1 / Out2 IO-Link / current output 0/4...20 mA

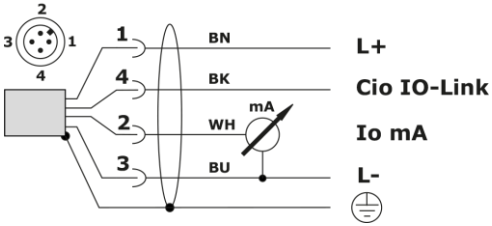


*Figure 5.5: grf00033_eac_m12_4p_4w_io_ma*

Out1 / Out2 IO-Link / PNP switching

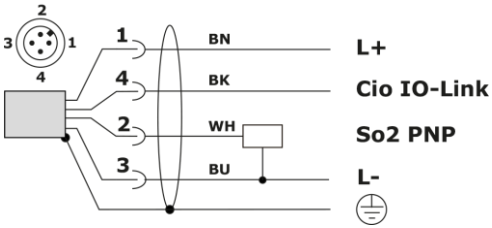


*Figure 5.6: grf00034_eac_m12_4p_4w_io_spnp*

Out1 / Out2 IO-Link / NPN switching

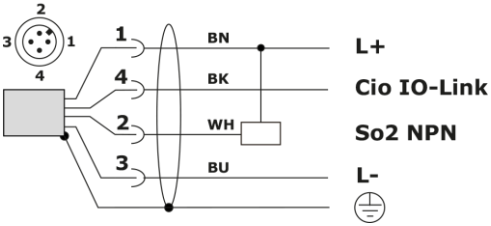


*Figure 5.7: grf00035_eac_m12_4p_4w_io_snpn*

Out1 / Out2 current output 0/4...20 mA / PNP switching

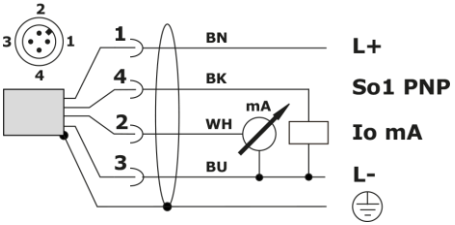


*Figure 5.8: grf00036_eac_m12_4p_4w_ma_spnp*

Out1 / Out2 current output 0/4...20 mA / NPN switching

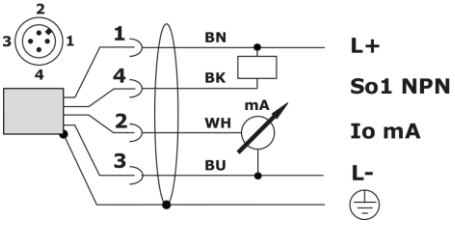


*Figure 5.9: grf00037_eac_m12_4p_4w_ma_snpn*

Out1 / Out2 PNP switching / PNP switching

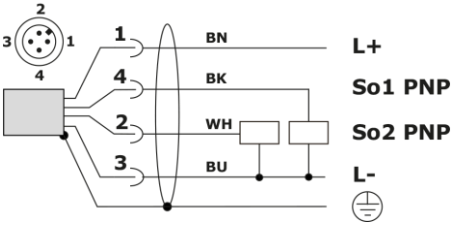


*Figure 5.10: grf00038_eac_m12_4p_4w_2spnp*

Out1 / Out2 NPN switching / NPN switching

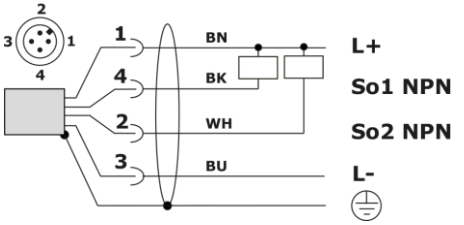


*Figure 5.11: grf00039_eac_m12_4p_4w_2snpn*

# 6 Operation

The device is operated via the wired interface.

## 6.1 Measured variable

### 6.1.1 Distance

Definition

The distance between a detectable object and the sensor. This corresponds to the basic measured value.

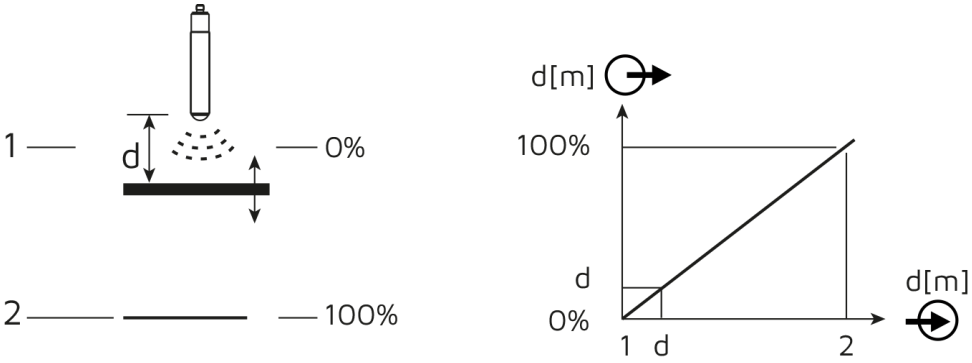


*Figure 6.1: grf000040_ope_rp4ir_distance_lin*

### 6.1.2 Level

Definition

The distance from a detectable liquid surface to the sensor can be converted into a level measured value.

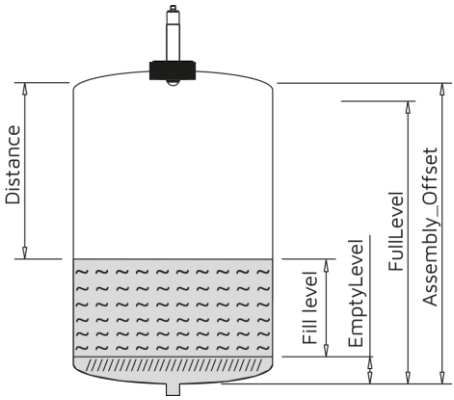


*Figure 6.2: grf000041_ope_rp4ir_level*

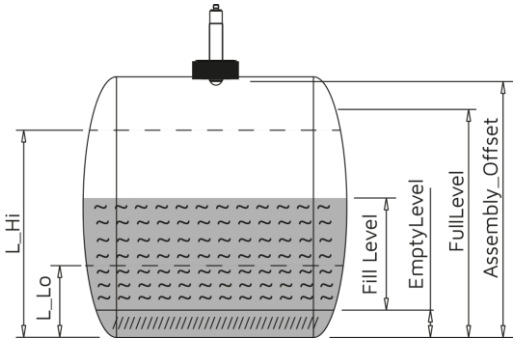


*Figure 6.3: grf00042_ope_rp4ir_level_active*

### 6.1.3 Echo signal curve

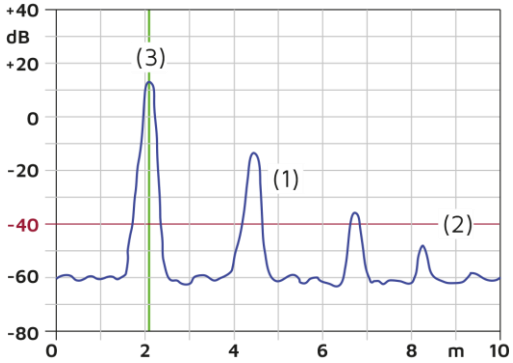


Figure 6.4: grf00045_ope_echo_curve_radar

1 Echo signal curve
2 Evaluation threshold
3 Process value

### 6.1.4 Signal filter

The signal filter allows you to define a correct measurement signal:

| Parameter | Default | Option | Description |
|---|---|---|---|
| Filter | Slow | Jumpy | Jumpy First signal evaluated as valid - see Figure 6.5 |
| | | Fast | Fast 0.5 m/s: suppression of very rapid signal jumps |
| | | Slow | Slow 1 m/s: suppression of rapid signal jumps |
| | | Max. Peak | Max. Peak: Strongest/highest signal - see Figure 6.6 |

Signal Filter: jumpy >> First Valid Value

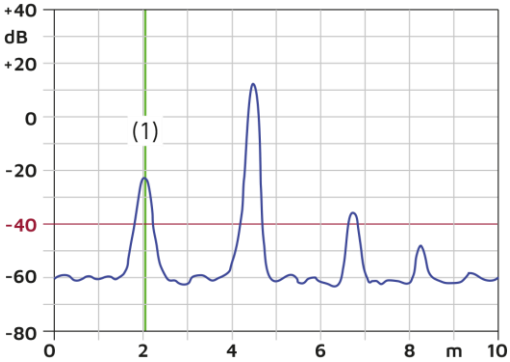


*Figure 6.5: grf00046_ope_echo_curve_radar_j*

Signal Filter: Maximum Value >> Strongest, Highest Signal

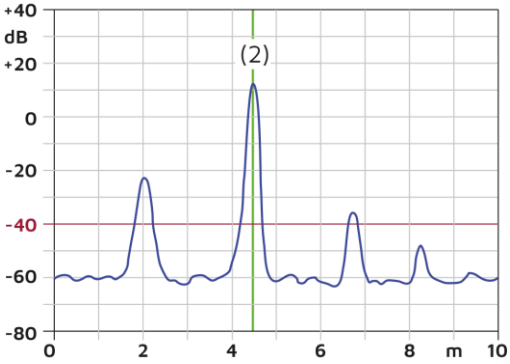


*Figure 6.6: grf00047_ope_echo_curve_radar_m*

## 6.2 Electronic output - RS485 Modbus RTU [05-V]

Information on installation and handling of the interface and operating software is not part of these instructions.

Parameter file

The parameter file and description can be downloaded from the manufacturer website. Setting ranges and default values are specified for all parameters.

## 6.3 Electronic output [05-L] - IO-Link

Information on installation and handling of the interface and operating software is not part of these instructions.

### 6.3.1 Parameters

Parameter file

The parameter file and description can be downloaded from the manufacturer website. Setting ranges and default values are specified for all parameters.

### 6.3.2 Switching output So

Operating Functions - Operation Mode

Depending on the function [O1_Conf/O2_Conf+Operation Mode], the output is switched differently:

- PP (Push-Pull) Auxiliary power supply +L <--> Auxiliary power supply -L
- NPN Auxiliary power supply -L <--> Off - high impedance
- PNP Auxiliary power supply +L <--> Off - high impedance

- Analog Out  Current output Io 0/4...20 mA

For the So1 switching output, only the PP operating mode can be selected.

Switching Functions - Switch Mode

Various switching functions [O1_Conf/O2_Conf+Switch Mode] can be set for the switching outputs:

Deactivated

The switching output is deactivated and therefore has a high impedance.

Single-Point Mode

The switching output is activated when the measured value exceeds the switching point [O1_SP/O2_SP] and the turn-on delay time [O1_dS/O2_dS] has elapsed.

The switching output is deactivated when the measured value falls below the switching point [O1_SP/O2_SP] and the deactivation delay time [O1_dR/O2_dR] has elapsed.

For polarity [O1_Conf/O2_Conf+Polarity+NO], the reset point is [O1_HY/O2_HY] lower than the set switching point [O1_SP/O2_SP]

For polarity [O1_Conf/O2_Conf+Polarity+NC], the actual switching point is greater than the set switching point [O1_SP/O2_SP] by the hysteresis [O1_HY/O2_HY]

Operating Mode - Polarity: NO / Normally Open

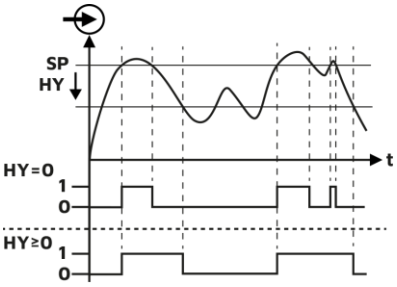


*Figure 6.7: grf00048_fun_sw_sp_no*

Operating Mode - Polarity: NC / Normally Closed

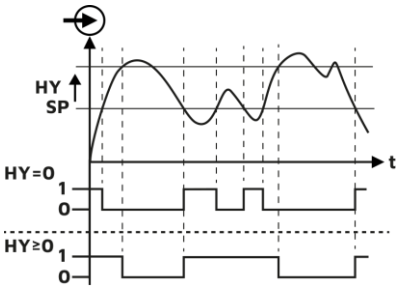


*Figure 6.8: grf00049_fun_sw_sp_nc*

Window Function - Window Mode

The switching range is defined by specifying the switching point [O1_SP/O2_SP] and the reset point [O1_RP/O2_RP].

The switching output is activated when the measured value lies within the range defined by the switching point [O1_SP/O2_SP] and the reset point [O1_RP/O2_RP], and the turn-on delay time [O1_dS/O2_dS] has elapsed.

The switching output is deactivated when the measured value is outside the range defined by the switching point [O1_SP/O2_SP] and the reset point [O1_RP/O2_RP], and the reset delay time [O1_dR/O2_dR] has elapsed.

The hysteresis [O1_HY/O2_HY] creates a switching offset symmetrical about the switching point [O1_SP/O2_SP] and the reset point [O1_RP/O2_RP].

Operating Mode - Polarity: NO / Normally Open

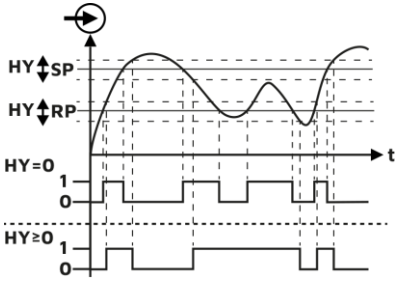


*Figure 6.9: grf00050_fun_sw_win_no*

Operating Mode - Polarity: NC / Normally Closed

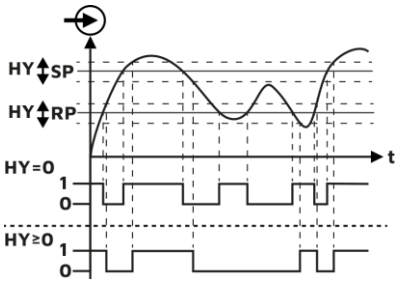


*Figure 6.10: grf00051_fun_sw_win_nc*

Two-Point Function - Two-Point Mode

The switching range is defined by specifying the switching point [O1_SP/O2_SP] and the reset point [O1_RP/O2_RP].

The switching output is activated when the measured value exceeds the switching point [O1_SP/O2_SP] and the turn-on delay time [O1_dS/O2_dS] has elapsed.

The switching output is deactivated when the measured value falls below the switching point [O1_SP/O2_SP] and the reset delay time [O1_dR/O2_dR] has elapsed.

Operating Mode - Polarity: NO / Normally Open

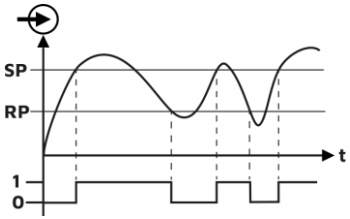


*Figure 6.11: grf00052_fun_sw_tp_no*

Operating Mode - Polarity: NC / Normally Closed

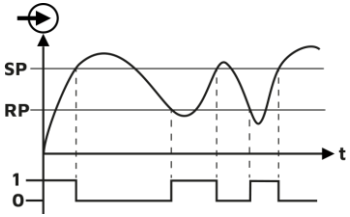


*Figure 6.12: grf00053_fun_sw_tp_nc*

Fault Indication Function

The switch output signals a detected malfunction (see the section on Fault Diagnosis and Troubleshooting)

### 6.3.3 nalog output Io

An analog current signal is output, which is assigned to the device's nominal measurement range:

- 0 – 20 mA Output signal range 0...20.5 mA
- 4 – 20 mA Output signal range 3.8...20.5 mA
- 20 – 0 mA Output signal range 20.5...0 mA
- 20 – 4 mA Output signal range 20.5... 3.8 mA

Free assignment to measurement input values within the nominal measurement range is possible.

Behavior of the output current value when the output signal range is exceeded, in accordance with NAMUR NE43:

1 Hold final value 0 / 3.8 mA / 20.5 mA

2 Step ≤ 3.6 mA

3 Step ≥ 21 mA (22 mA)

4–20 mA Output Signal

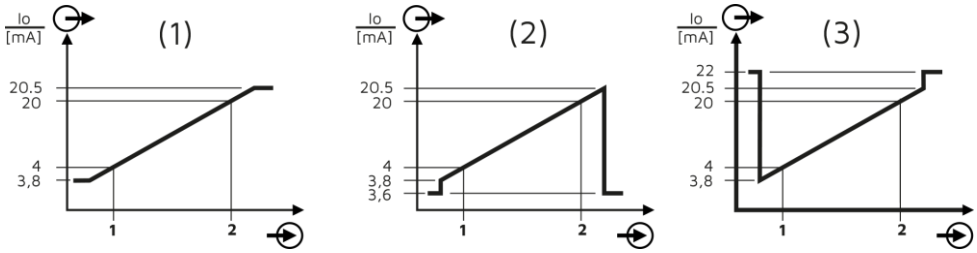


*Figure 6.13: grf00054_fun_iout_4_20_h_36_22*

0–20 mA Output Signal

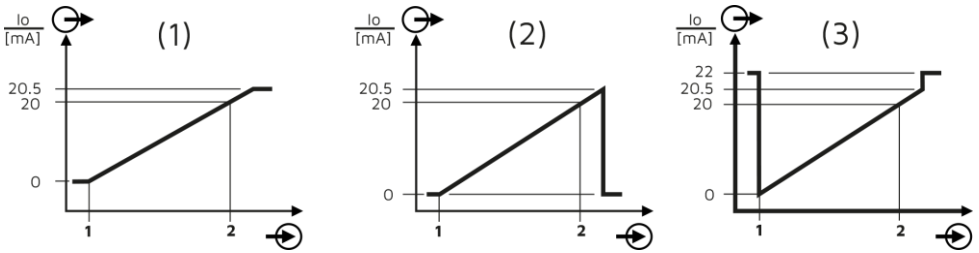


*Figure 6.14: grf00055_fun_iout_0_20_h_0_22*

# 7 Diagnostics and troubleshooting

The system operator is responsible for taking appropriate measures to resolve any malfunctions that occur.

Electronic Output Fault Messages – IO-Link – [03-L]:

| IO-Link Code | Description | Remedy |
|---|---|---|
| 20480 (0x5000) | Device hardware error | Replace or return the device |
| 35856 (0x8C10 | Measurement range exceeded | Check measurement range calibration |
| 35888 (0x8C30) | Measurement range not reached | Check measurement range calibration |
| 36346 (0x8DFA) | Analog output error 3.6 mA | Check current output calibration |
| 36347 (0x8DFB) | Analog output error 22 mA | Check current output calibration |

In case of a malfunction, check the following:

| Component / Area | Inspection | Remedy |
|---|---|---|
| Housing | Damage | Replace or return the device |
| Sensor lens | Contamination | Clean or return the device |
| | Damage | Replace or return the device |
| Process seals | Damage | Replace the process seal |
| | | Use a different sealing material if necessary |
| Supply voltage | Operating voltage present | Turn on the operating voltage |
| | | Check or repair the connection terminals |

| | | |
|---|---|---|
| | Operating voltage polarity reversed | Reverse the polarity of the operating voltage |
| | Operating voltage too low | Adjust or repair |
| | Operating voltage too high | Send the device in for repair |
| | Load resistance too high | Increase the operating voltage |
| | Connection cable damaged | Send the device in for repair |

If the malfunction cannot be resolved, please contact the manufacturer.

# 8 Maintenance

When used as intended, the device is maintenance-free.

Deposits adhering to the sensor lens can cause incorrect readings. In this case, clean the sensor lens regularly. Do not use sharp or hard tools, compressed air, or corrosive chemicals.

# 9 Repair

This device is not intended to be repaired by the user. Repairs may only be performed by the manufacturer.

## 9.1 Disassembly

Use appropriate protective clothing, such as safety glasses and gloves.

**WARNING**

**Allow the device and system to cool sufficiently before disassembly. There is a risk from hot surfaces and escaping, hazardous, and hot measured media.**

**WARNING**

**Install the device only when the system is depressurized. There is a risk from rapidly escaping measured media or water hammer.**

**WARNING**

**Only disassemble the device when it is de-energized.**

**WARNING**

**Switch off all connected control devices before disassembly.**

After disassembly, fit the sensor lens, process connection, and, if applicable, the connector with a protective cap.

## 9.2 Return

A decontamination declaration is enclosed.

The declaration is available for download on the website and must be completed in full and affixed to the outside of the packaging in a manner that protects it from the elements and during transport.

## 9.3 Disposal

*Figure 9.1: sym00001_weee_can*

In accordance with EU Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), this product is marked with the symbol shown to minimize the disposal of WEEE as unsorted household waste. These products must not be disposed of as unsorted household waste and may be returned to the manufacturer for disposal. Returns are subject to the manufacturer's general terms and conditions or individually agreed-upon terms.

# 10 Technical data

| | |
|---|---|
| Reference Conditions | Ta = +15...+25 °C (+59...+77 °F) / Pa = 860...1060 kPa / RH = 45...75 % |
| | Us = 24 Vdc ±0.1 V / ton = 240 s / vertical, sensor at the bottom |
| | Reflector: Metal plate with edge length ≥ 20 cm |
| | No significant interfering reflections within the beam cone |
| | Filter = Jumpy / Measurement interval = 0.05 / Attenuation = 0.00 |
| Measurement Deviation | EN/IEC 60770-1: Characteristic curve deviation – threshold point setting |

## 10.1 Distance input

| | |
|---|---|
| Sensor Type | FMCW radar, pulsed |
| Frequency | 122...123 GHz |
| EIRP | ≤ 10 dBm |
| Beamwidth | [04-9]: 10° / [04-8]: 8° / [04-5]: 8° |
| Pulse rate | ≥ 10 Hz / ≤ 100 ms |
| Measuring range | 0 ... 10 m (FSI) |
| Dead zone | ≤ 30 cm |
| Resolution | ≤ 1 mm |
| Characteristic curve deviation | ≤ ±0.1 %FSI (linearity + repeatability + hysteresis) |
| Linearity | ≤ ±0.1 %FSI |

| | |
|---|---|
| Repeatability | ≤ ± 2 mm |
| Hysteresis | negligible |
| Effect of supply voltage | ≤ ± 0.002 %FSI/V |
| Effect of temperature | ≤ ± 0.005 %FSI/K |
| Long-term drift | ≤ ± 0.02 %FSI/year |
| Effect of mounting orientation | none |

## 10.2 Outputs

### 10.2.1 Electronic output - RS485 Modbus RTU [05-V]

| **Interface - Cio** | |
|---|---|
| Specification | RS485, bidirectional / Modbus-RTU / 9600 baud (4800…38400 baud) |
| Input resistance | 112 kOhm |
| Time response | t90 ≤ 100 ms (td = 0 s) |
| **Auxiliary Power** | |
| Supply Voltage Us | 6⋯35 Vdc, reverse-polarity protected / residual ripple ≤ 2 Vpp |
| Input Current Is | ≤ 20 mA (no load) |
| Power-On Delay | ≤ 0.5 s (td = 0 s) |

### 10.2.2 Electronic output [05-L] – IO-Link

| | |
|---|---|
| **Interface - Cio** | |
| Specification | IO-Link V1.1 / Port Class A / Com2 (38.4 kBaud), Com3 (230.4 kBaud) |
| Cycle time | ≥ 2.3 ms |
| Time response | t90 ≤ 100 ms (td = 0 s) |
| **Switching Output - So** | |
| Specification | 2x PP (push-pull), switching to +L/-L |
| Output Signal Uo | ≤ 0.2...≥ (Us – 2 V) / Io = 0⋯200 mA (current-limited to ≤ 450 mA, short-circuit-proof) |
| Switching Delay Time | ≤ 30 µs (RL ≤ 3 kΩ / Io ≥ 4.5 mA) |
| Switching cycles | ≥ 100,000,000 |
| **Analog output – Io** | |
| Signal range | 4⋯20 mA: Signal range 3.8⋯20.5 mA, error ≤ 3.6 mA / ≥ 21 mA (22 mA) |
| | 0⋯20 mA: Signal range 0⋯20.5 mA, error ≤ 0.05 mA / ≥ 21 mA (22 mA) |
| Resolution | ≤ 1 µA |
| Permissible load RL | ≤ (Us – 8 V) / 22 mA |
| Effect of auxiliary power | ≤ ± 0.5 µA/V |
| Effect of temperature Ta | ≤ ± 0.5 µA/K |
| **Auxiliary power** | |
| Supply voltage Us | IO-Link inactive: 9⋯35 Vdc, reverse-polarity protected / residual ripple ≤ 2 Vpp |

| | |
|---|---|
| | IO-Link active: 18⋯30 Vdc, reverse-polarity protected / residual ripple ≤ 2 Vpp |
| Input current Is | ≤ 20 mA (Cio / So / Io = 0 mA) |
| Turn-on delay | ≤ 0.5 s (td = 0 s) |

## 10.3 Interface - Bluetooth®

| | |
|---|---|
| Standard | Bluetooth® 5.2 |
| Specifications | 2 Mbit/s, Advertising Mode 2 s |
| Transmit Power | ≤ 0.1 W |
| Range | Outdoors: max. 200 m / Indoors: max. 40 m |

## 10.4 Ambient conditions

| | |
|---|---|
| Process temperature Tp | -40…+85 °C (-40… +185 °F) |
| Process pressure | [04-9]: ≤ -1...10 bar / [04-8]: ≤ -1...10 bar / [04-5]: ≤ -1...20 bar |
| Ambient temperature Ta | -40…+85 °C (-40… +185 °F) |
| Protection class | IP65/IP67 (EN/IEC 60529) |
| Climate class | 4K4H (EN/IEC 60721-3-4) |
| Shock resistance | 50 g [1 ms] (EN/IEC 60068-2-27) |
| Vibration resistance | 20 g [10…2000 Hz] (EN/IEC 60068-2-6) |
| EMC | Equipment Class B / Industrial environment (EN/IEC 61326) |
| Protection class | III |
| Dust Protection Rating | 4 |
| Operating Altitude | 2000 m above sea level |

| | |
|---|---|
| MTTF | [05-V]: 213 years / [05-L]: 214 years |
| Weight | [04-9]: 0.08 kg / [04-8]: 0.10 kg / [04-5]: 0.15 kg |

## 10.5 Materials

| | |
|---|---|
| Process wetted | Steel1.4404/316L, PEEK, FKM/FPM |
| Not process wetted | CrNi-steel, PUR, FKM/FPM |

# 11 Revision

| Version | Changes |
| --- | --- |
| UMN07.26 | Initial release |

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