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# RADARCONT® RP4

## Electronic Radar Sensor

with a free-space 122 GHz FMCW signal

for distance, level, and volume measurements

umn_fam_rp4_vs1.01_en
07/2026

senseca

# Contents

# 1 Notes on the Document

## 1.1 Document function

This manual describes the product's design, functions, and use, and helps ensure that the product is operated as intended.

Read the manual carefully before using the product. This will help you avoid potential injury, property damage, and damage to the device.

The operating manual is an integral part of the device and must be kept accessible at all times in the immediate vicinity of the operating site.

The information in this document reflects the knowledge available at the time of printing. Subject to change without notice.

## 1.2 Terms

**NOTE**

Information on how to prevent malfunctions, operational failures, and damage to the device or system.

**WARNING**

Failure to follow these instructions may result in serious or fatal injury.

**[04-5]**

Reference to a variant >> Product Code section

## 1.3 Additional documentation

In addition to this document, you can find additional documentation online.

# 2 Safety instructions

## 2.1 Authorized Personnel

Installation, electrical connection, commissioning, operation, maintenance, disassembly, and disposal of the device must be performed by a qualified and authorized specialist in accordance with the instructions in the operating manual and applicable standards.

This specialist must have read and understood the operating instructions, particularly the safety instructions. The required personal protective equipment must always be worn when working on or with the device.

## 2.2 Intended use

The device is an electronic radar sensor for measuring distances, levels, and volumes in liquid media.

The device is safe to operate only when used as intended. Improper or unintended use of this product may result in application-specific hazards, such as a container overflow due to incorrect installation or adjustment. This can result in property damage, personal injury, or environmental damage. Furthermore, this may impair the device's performance.

Improper use, failure to follow the operating instructions and technical regulations, the use of inadequately qualified personnel, unauthorized modifications, and damage to the device exclude the manufacturer's liability for any resulting damages. The manufacturer's warranty is void.

## 2.3 Operational safety

The device is designed and tested in accordance with the state of the art to ensure operational safety. It may only be operated when it is in technically sound and safe operating condition. The operator is responsible for ensuring the trouble-free operation of the device.

The device may only be used within the permissible operating limits. Any use outside these intended limits may result in significant hazards.

The materials must be checked for compatibility with the application requirements prior to use. An unsuitable material can lead to damage, malfunction, or destruction of the device and the resulting hazards.

The device must not be used as the sole means of preventing hazardous conditions on machines and systems.

For safety and warranty reasons, any modifications beyond the described operating procedures may only be performed by personnel authorized by the manufacturer. Unauthorized modifications or alterations are expressly prohibited. For safety reasons, only accessories specified by the manufacturer may be used.

The maximum transmitted power of the sensor does not exceed the permitted limits specified in ETSI EN 305550-2.

This device complies with Article 4(3) of EU Directive 2014/68/EU (Pressure Equipment Directive) and is designed and manufactured in accordance with good engineering practice.

The device meets the requirements of all relevant EU directives. This is confirmed by the CE marking affixed to the device. The corresponding EU Declaration of Conformity can be requested or downloaded from the website.

# 3 Product description

## 3.1 Function

The device is an electronic radar sensor for measuring distances, fill levels, and volumes in liquid media.

The device operates using a pulsed FMCW (Frequency Modulated Continuous Wave) radar and measures the distance to stationary objects without contact.

The sensor periodically transmits a radar signal with a linearly rising and falling frequency. The rate of change of the frequency over time remains constant. Objects within the detection range reflect the transmitted signal. The distance to the object is determined based on the time-of-flight shift and the frequency shift in the reflected signal.

The device is suitable for applications in virtually all industrial sectors and is ideal for use in tanks up to 10 m.

The narrow beam angle minimizes interference from foreign objects or internal components.

It is recommended for applications in which optical or ultrasonic sensors are unsuitable due to interfering factors such as temperature, the formation of gas or vapor layers, overpressure, underpressure, or vacuum, dust, wind, or incident light.

Depending on the type of application, radar technology enables:

- Measurement of liquids, even in the presence of gas stratification (e.g., ammonia) or foam formation
- Measurement of bulk solids
- Measurement through the container wall, e.g., IPC containers, or through protective windows, e.g., PTFE or PP

## 3.2 Design

### 3.2.1 Standard version – suspension cable – [01-S]

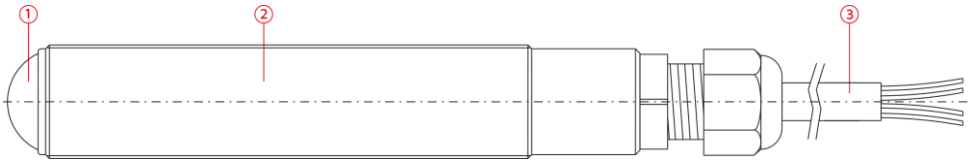


*Figure 3.1: grf00021_cmp_rp4sr*

(1) Sensor lens
(2) Process connection / connection housing
(3) Support cable with steel core
(4) The device is installed in the respective system via the process connection (2).

The radar signal is emitted and received via the sensor lens (1).

The signal is detected by the electronics integrated into the connection housing (2), processed according to the settings, and output via the connections on the connection cable (3).

The integrated evaluation electronics are conFigure d via Bluetooth® using the SmartConnect app (Android/iOS) or via the wired interface.

Length-stable support cable (3) with steel core and shielding braid.

Laser-etched labeling on the nameplate ensures the device can be identified throughout its entire service life.

### 3.2.2 Industrial version – M12 connector – [01-I]


*Figure 3.2: grf00022_cmp_rp4ir*

(1) Sensor lens
(2) Process connection / connection housing
(3) Connector

The device is installed in the respective system via the process connection (2).

The radar signal is transmitted and received via the sensor lens (1). The signal is detected by the electronics integrated into the connection housing (2), processed according to the settings, and output via the connectors (3).

The integrated evaluation electronics are conFigure d via Bluetooth® using the SmartConnect app (Android / iOS) or via the wired interface.

Laser engraving on the nameplate ensures the device can be identified throughout its entire service life.

## 3.3 Nameplate

The nameplate contains the most important information for identifying and using the device.

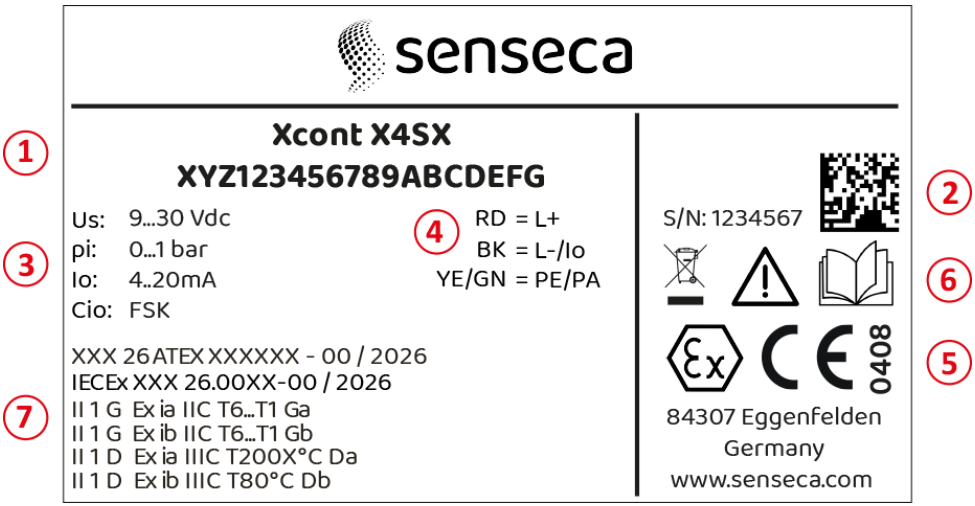


*Figure 3.3: grf00002_lab001*

(1) Product code
(2) Serial number
(3) Technical Specifications
(4) Electrical Connection
(5) Approvals
(6) Safety Instructions
(7) Type of Ignition Protection

## 3.4 Product code

RP4 [01][02][03][04][05][06][07][94][95][98]

| | Device | RP4 | Radar sensor |
|---|---|---|---|
| 01 | Application Type | S | Standard |
| 01 | | I | Industrial |
| 02 | Sensor | R | FMCW Radar |
| 03 | Certification | S | Standard |
| 04 | Process Connection | U | Thread DIN 13 – M30x1.5 |
| 05 | Electronics – Output | V | RS485 Modbus-RTU, 4-wire |
| 05 | | L | IO-Link, current 0/4…20 mA / 1x/2x switch PP, 3-/4-wire |
| 06 | Electronics – Function | 0 | without |
| 06 | | 3 | Temperature -20...+70 °C (-4…+158 °F) |
| 07 | Electrical connection | S | M12-A-4P connector |
| 07 | | 0 | PE cable, unassembled, assembly kit |
| 07 | | K | PE Cable, Strands Assembled |
| 07 | | H | PE Cable, Assembled Strands Hydrolog HLF4 |
| 80 | Length L1 | /###### | mm (≤ 300,000 mm) |
| 94 | Additional option | +SF | LABS-free, silicone-free / Paint-compatible version |
| 95 | Additional option | +ML | Measurement point designation / TAG - laser marking |
| 98 | Additional option | +KF | Configuration / Default Setting |

Variants are generally identified by the letter Y in the product code.

## 3.5 Dimensions

Dimensions in mm

The parameter di indicates the distance measurement value relative to the respective measurement reference point.

[07-K/H/L] = Specifications for pre-assembled cables

### 3.5.1 Standard version – suspension cable – [01-S]

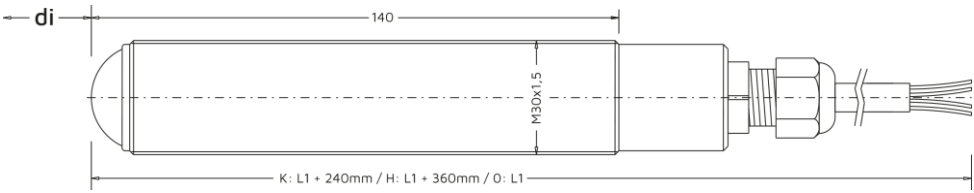


*Figure 3.4: grf00023_dim_rp4sr*

### 3.5.2 Industrial Version – M12 Connector – [01-I]

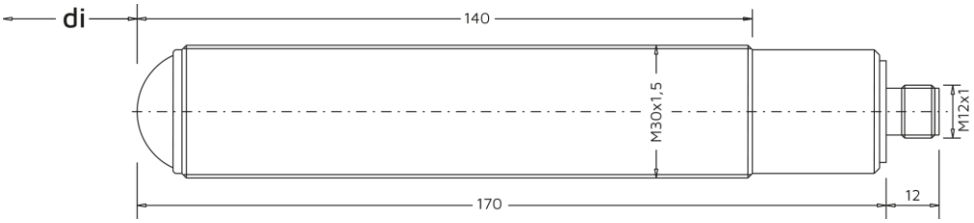


*Figure 3.5: grf00024_dim_rp4ir*

## 3.6 Packaging, Transport, Storage

The device is protected by packaging designed to withstand normal transport stresses. Transport must be carried out in accordance with the instructions on the shipping packaging. Failure to do so may result in damage to the device.

Upon receipt, the shipment must be inspected immediately for correctness, completeness, and any transport damage. Any transport damage or hidden defects found must be handled accordingly.

The packages must be kept sealed until installation and, unless otherwise specified, stored only under the following conditions:

- Do not store outdoors
- Store in a dry, dust-free area
- Do not expose to corrosive substances
- Protect from direct sunlight
- Avoid mechanical shocks
- Storage and transport temperature: -20…+85 °C
- Relative humidity 20…85 %

## 3.7 Accessories

A comprehensive range of accessories, optimally tailored to the device, is available for installation and electrical connection.

# 4 Installation

## 4.1 Ambient and process conditions

Correct operation of the device within the specified technical data can only be guaranteed if the permissible ambient and process conditions at the installation site (see the Technical Data section) are not exceeded. Therefore, before installation, ensure that all parts of the device in contact with the process (e.g., sensor lens, process connection, process seal, cable) are suitable for the prevailing process conditions (e.g., process pressure, process temperature, chemical properties of the media, abrasion, mechanical stresses).

The quality of the measurement result depends significantly on the properties of the medium being measured:

- Liquids with a refractive index (DK) of ≥ 4 can be measured.
- Filling, agitators, or other processes in the tank can cause very dense foams to form on the surface of the process medium, which may significantly attenuate the transmitted signal.
- Reduction of the maximum possible measurement range due to media with poor reflective properties, buildup, heavy condensation, foaming, or icing of the sensor.

## 4.2 Installation location

The distance measurement value refers to the measurement reference point (see the “Product Description – Dimensions” section).

No object detection occurs within the blind zone (for the minimum measuring range, see the Technical Data section).

The sensor may be mounted in any orientation.

Short connection pipes should be used so that the signal can propagate undisturbed in the near field.

Plastics are generally transparent to radar waves. Therefore, in plastic containers—such as IPC containers—the sensor can be mounted on the outside without damaging the container wall. Measurement through a protective barrier—e.g., made of PTFE or PP—is also possible in the presence of high temperatures or aggressive media. Certain materials, such as glass or , as well as mixtures containing glass or carbon fibers or graphite, can make measurement difficult or even impossible.

If the outer wall of the container is made of a non-conductive material (e.g., plastic, fiberglass-reinforced plastic), microwaves may also be reflected by external interference sources (e.g., metal pipes, ladders, gratings, etc.). Therefore, no such interference sources should be present within the beam cone outside the container.

Multiple radar sensors can be mounted side by side without the devices interfering with one another.

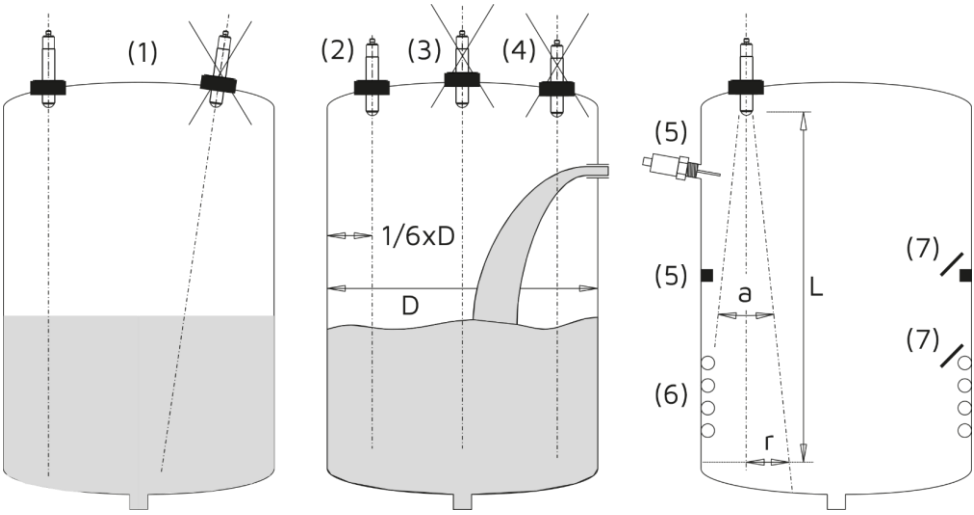


*Figure 4.1: grf00025_ins_rp4ir_1*

(1) The sensor must be mounted perpendicular to the surface of the material.

(2) The recommended mounting distance from the tank wall is 1/6 of the tank diameter.

(3) The sensor should not be mounted in the center of the tank.

(4) Avoid measuring through the filling flow.

(5) Avoid installing components such as limit switches or temperature sensors within the detection range.

(6) Symmetrical components such as heating coils or flow breakers can significantly interfere with the measurement.

(7) Interference reflections from internal components can be scattered or reduced by using metal screens mounted at an angle.

(8) The radius r of the detection area at a distance L and an opening angle a (see “Technical Data” section) can be determined using the following equation: r = tan (a / 2) * L

The cable end must terminate in a dry room or in a suitable junction box.

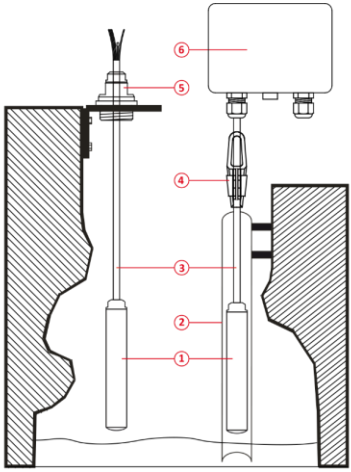


*Figure 4.2: grf00027_ins_rp4sr*

(1) Level Sensor
(2) Guide tube
(3) Support cable (bending radius > 80 mm)
(4) Tension clamp – see accessories
(5) Mounting screw – see accessories
(6) Panel enclosure – see accessories

## 4.3 Stand pipe

Using a standpipe can significantly improve signal quality.

This is recommended for in-tank installations or in cases of highly uneven tank walls, foaming, moving surfaces, and low DK values.

The standpipe should be made of metal or plastic with graphite or carbon fiber added.

In media prone to heavy buildup, measurement in the standpipe is not advisable; if necessary, the pipe must be cleaned regularly.

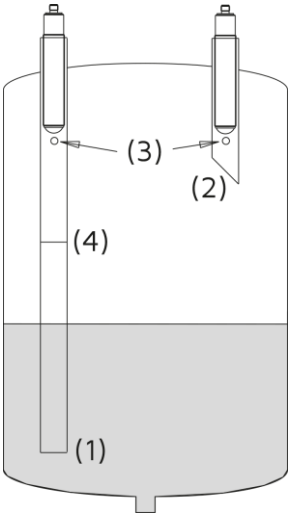


*Figure 4.3: grf00026_ins_rp4ir_2*

(1) Standpipes should extend deeper than the minimum fill level.

(2) For shorter tubes, the end of the tube on the medium side must be angled (45°).

(3) A vent opening (Ø 5–10 mm) must be provided in the dead zone, above the maximum fill level.

(4) Large gaps and thick weld seams inside the pipe when joining pipes must be avoided.

## 4.4 Installation instructions

**WARNING**

- Allow the system to cool sufficiently before installation. There is a risk from escaping, hazardous, and hot measured media.

Do not remove the packaging until immediately before installation, and inspect the device for any damage.

The protective cap attached to the process connection or the sensor lens must not be removed until immediately before installation. The sensor lens must not be damaged.

The mounting nuts must be tightened only on the hexagon using a suitable wrench, applying no more than the maximum permissible tightening torque (see the “Product Description – Dimensions” section).

# 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 a COMMON line (C/L-).

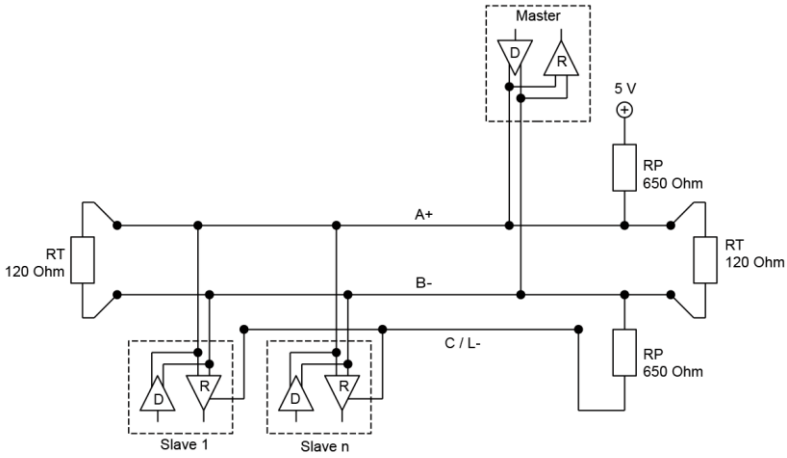


*Figure 5.1: grf00011_eac_modbus_line_termination*

A standard RS485 allows for the connection of 32 slaves in a single segment. The device has a load of only 1/8 of the standard load (Rin ≥ 96 kOhm), so that theoretically up to 256 of these devices can be operated in a single network segment. However, the number is limited to 247 by the Modbus address space.

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

The polarization network is required to ensure appropriate potentials when none of the devices are transmitting and the A+ and B- lines are therefore undefined (high-impedance). The value of RP depends, for example, on the bus load or the terminating resistors. Recommended values range from 450 to 650 ohms.

The use of a polarization network is recommended to ensure a stable network. Typically, the polarization resistors are built into the master device or can be enabled as needed.

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

### 5.1.2 Pin assignment

**Electrical Connection – Carrier Cable – [07-0/K/H]**

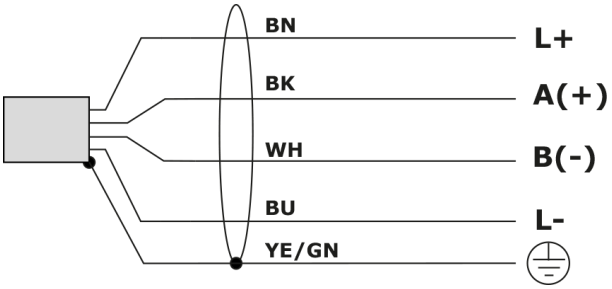


*Figure 5.2: grf00028_eac_cab_4p_4w_rs485_rp4*

Cable colors: BN = brown / WH = white / BK = black / BU = blue / YE/GN = yellow/green

**Electrical Connection – M12 Connector – [07-S]**

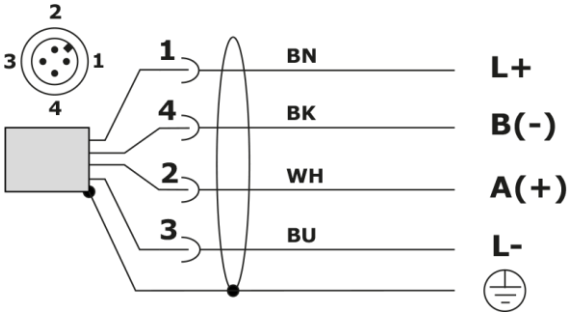


*Figure 5.3: grf00029_eac_m12_4p_4w_rs485*

Cable: M12 – A-coded, 1-BN = brown / 2-WH = white / 3-BU = blue / 4-BK = black

### 5.1.3 Connection cable

Use a 4-wire cable in accordance with the EIA485 recommendation:

| | |
|---|---|
| Impedance | 135…165 ohms @ 3…20 MHz |
| Cable capacitance | < 30 pF/m |
| Cable diameter | > 0.64 mm |
| Cable cross-section | 0.34 mm² / AWG 22 |
| Loop resistance | < 110 ohms/km |
| Shielding | Braided shield / shielding foil |
| Cable length | 38,400 baud ≤ 1,200 m |

### 5.1.4 Connection instructions

**WARNING**

▶ Install the device only when it is de-energized.

**NOTE**

Switch off all connected control devices before commissioning.

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

- Us = 6…35 Vdc

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

Route the cable separately from power-carrying lines; 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 communicating with sensors. It is a serial, bidirectional point-to-point connection.

IO-Link communication requires an IO-Link master.

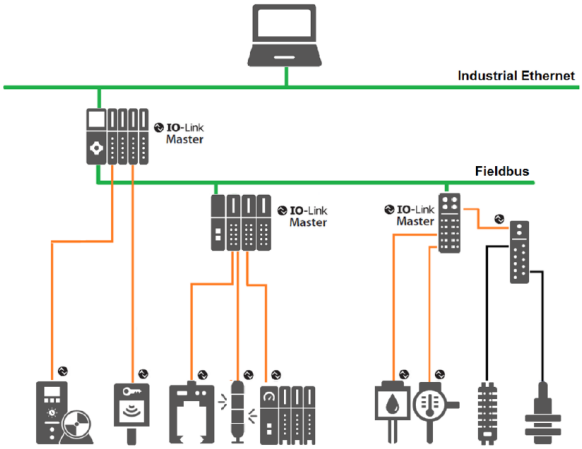


*Figure 5.4: grf00030_eac_io_link*

### 5.2.2 Pin Assignment

**Electrical Connection – Cable – [07-0/K/H]**


*Figure 5.5: grf00032_eac_cab_4p_4w_io*

Cable colors: BN = brown / WH = white / BK = black / BU = blue / YE/GN = yellow/green

**Electrical Connection – M12 Connector – [07-S]**

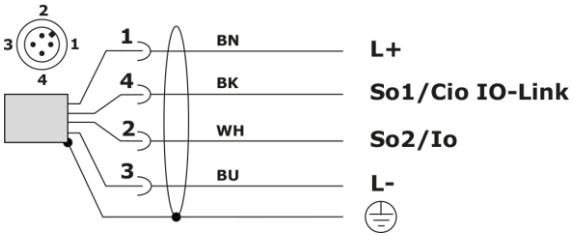


*Figure 5.6: grf00031_eac_m12_4p_4w_io*

Cable: M12 – A-coded, 1-BN = brown / 2-WH = white / 3-BU = blue / 4-BK = black

### 5.2.3 Connection cable

Cable: M12 – A-coded, 1-BN = brown / 2-WH = white / 3-BU = blue / 4-BK = black

Use a cable that is max. 20 m long, 3-wire or 4-wire, unshielded.

When using the analog output, a shielded cable must be used.

### 5.2.4 Connection Instructions

**WARNING**

▶ Install the device only when it is de-energized.

**NOTE**

Switch off all connected control devices before commissioning.

**NOTE**

Operate inductive loads (auxiliary contactors, solenoid valves) at the Switching outputs only with a free-wheeling diode or an RC circuit.

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, or alternatively via the cable shield.

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

**Out1 – IO-Link / Out2 – Current 0/4...20 mA**

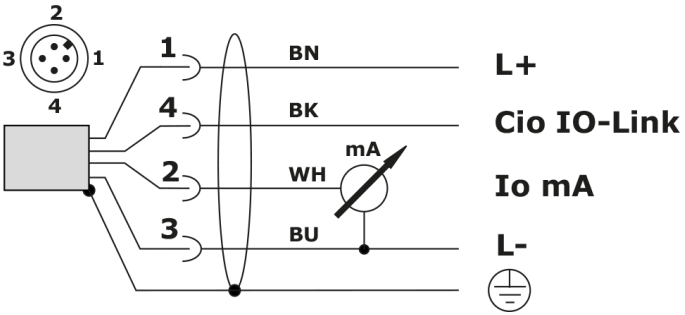


*Figure 5.7: grf00033_eac_m12_4p_4w_io_ma*

**Out1 – IO-Link / Out2 – p-contact switch**

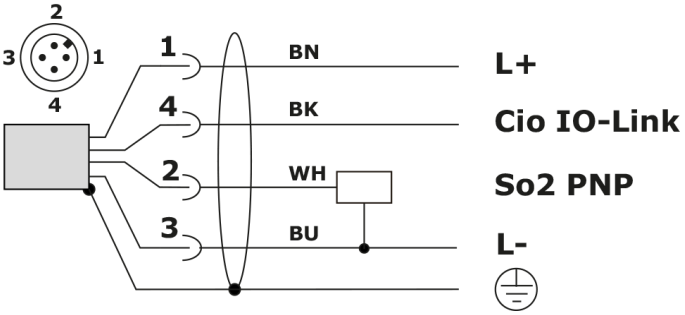


*Figure 5.8: grf00034_eac_m12_4p_4w_io_spnp*

**Out1 – IO-Link / Out2 – Normally Open Switch**

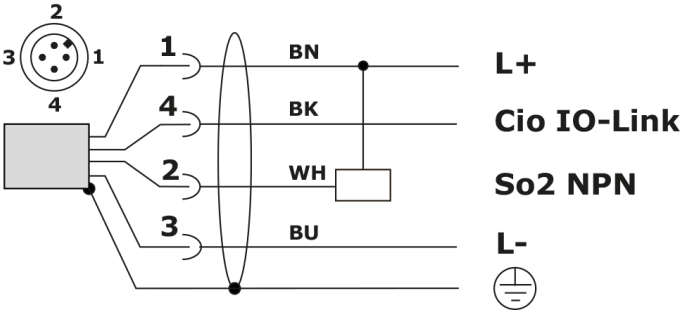


*Figure 5.9: grf00035_eac_m12_4p_4w_io_snpn*

**Out1 – Current 0/4...20 mA / Out2 – Normally Open Switch**

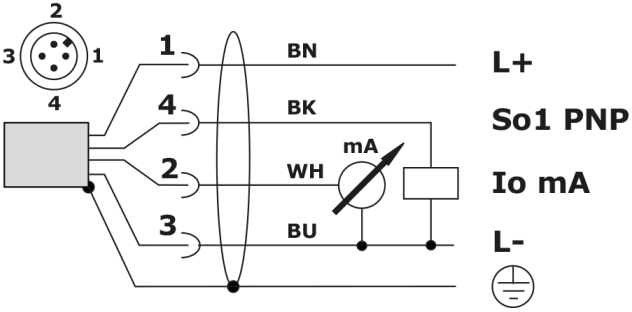


*Figure 5.10: grf00036_eac_m12_4p_4w_ma_spnp*

**Out1 – Current 0/4...20 mA / Out2 – n-contact switch**

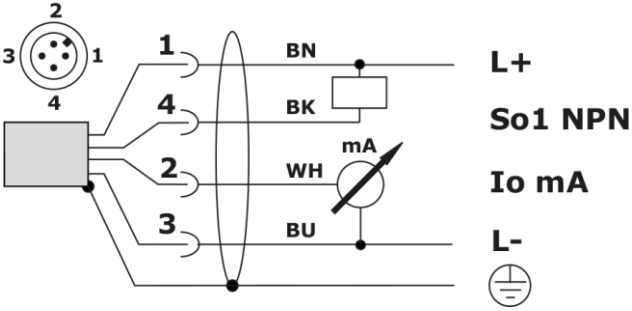


*Figure 5.11: grf00037_eac_m12_4p_4w_ma_snpn*

**Out1 – P-contact switch / Out2 – P-contact switch**

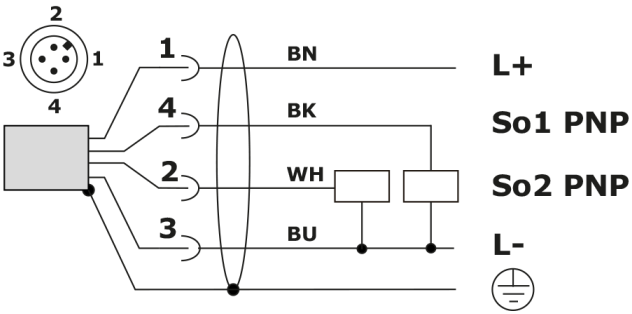


*Figure 5.12: grf00038_eac_m12_4p_4w_2spnp*

**Out1 – normally open switch / Out2 – normally open switch**

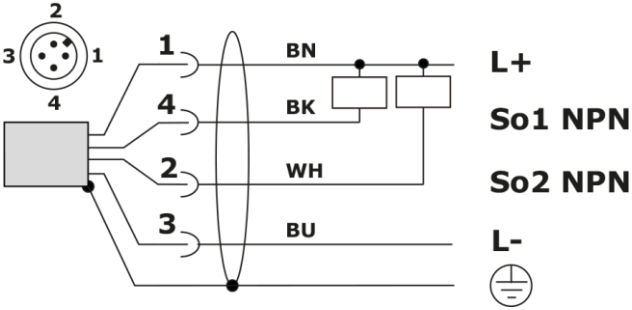


*Figure 5.13: grf00039_eac_m12_4p_4w_2snpn*

# 6 Operation

Operation is performed via the SmartConnect app (Android / iOS) or via the wired interface.

## 6.1 Measured variable

### 6.1.1 Distance

The distance from a detectable object to the sensor. This corresponds to the base measurement value.

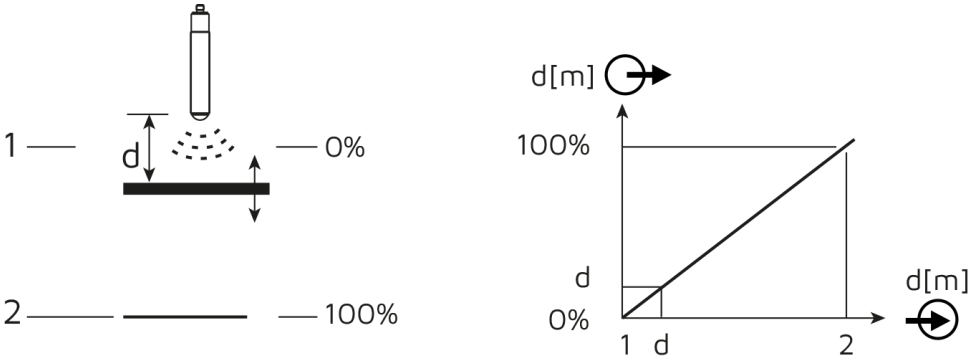


*Figure 6.1: grf00040_ope_rp4ir_distance_lin*

### 6.1.2 Level / Volume

The distance from a detectable liquid surface to the sensor can be converted into a level measurement value or a volume and, if necessary, linearized.

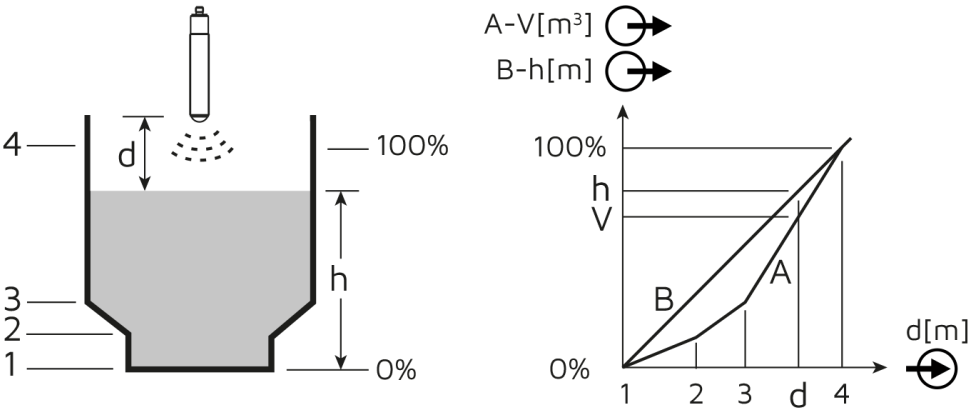


*Figure 6.2: grf00044_ope_rp4ir_volume_lin*

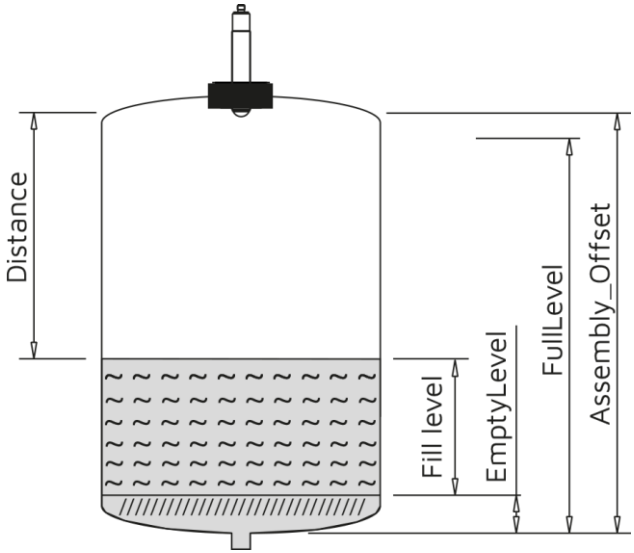


*Figure 6.3: grf00041_ope_rp4ir_level*

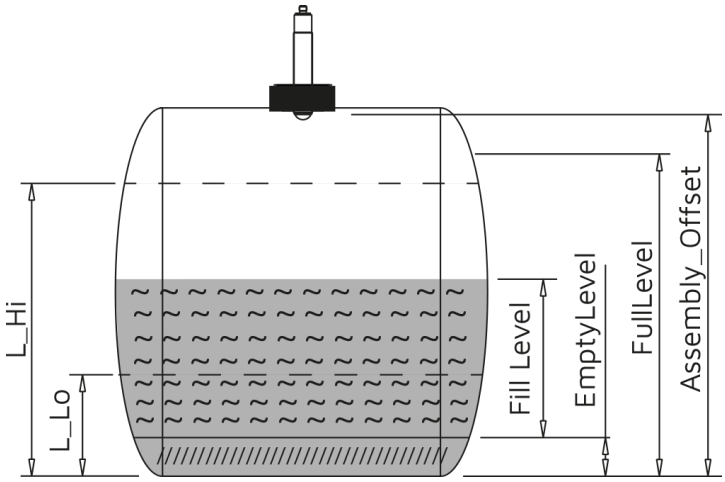


*Figure 6.4: grf00042_ope_rp4ir_level_active*

### 6.1.3 Echo signal curve

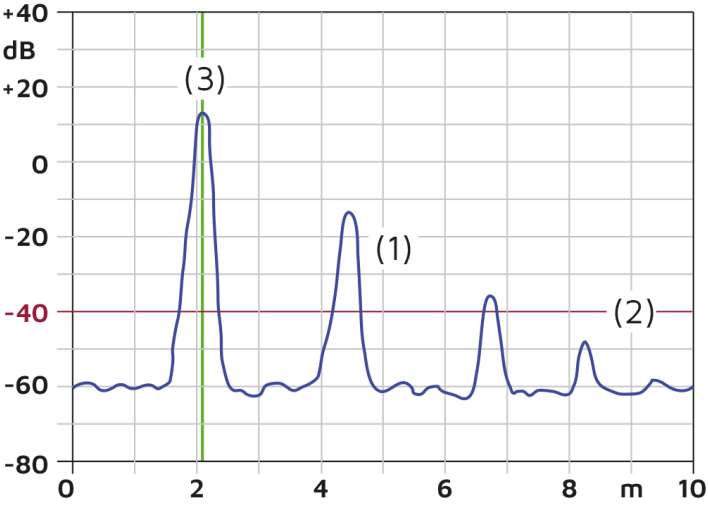


*Figure 6.5: grf00045_ope_echo_curve_radar*

(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: the first signal evaluated as valid - Figure 6.6 |
| | | Fast | Fast 0.5 m/s: Suppression of very rapid signal jumps |
| | | Slow | slow 1 m/s: Suppression of fast signal jumps |
| | | Max. Peak | Maximum value: strongest/highest signal – Figure 6.7 |

Signal filter: abrupt >> first valid value:

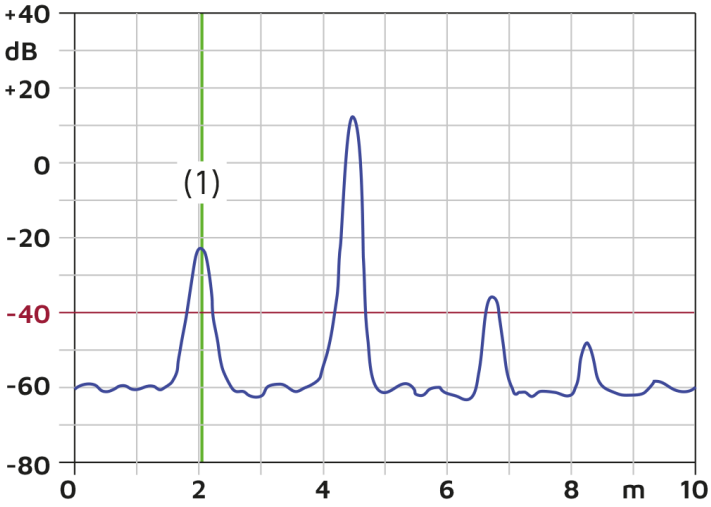


*Figure 6.6: grf00046_ope_echo_curve_radar_j*

Signal filter maximum value >> strongest, highest signal:

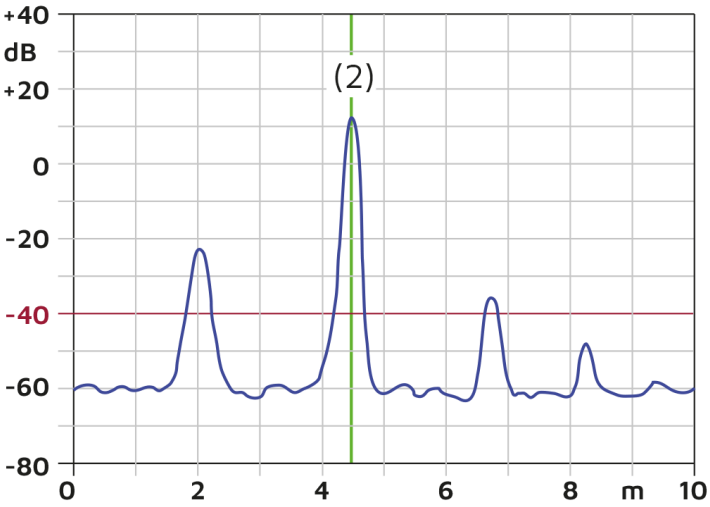


*Figure 6.7: grf00047_ope_echo_curve_radar_m*

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

Information regarding installation and use of the interface and operating software is not included in this manual.

### 6.2.1 Parameters

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

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

Information regarding installation and use of the interface and operating software is not included in this manual.

### 6.3.1 Parameters

The parameter file and description can be downloaded from the manufacturer's 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 Switching output So1, 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 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] less 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

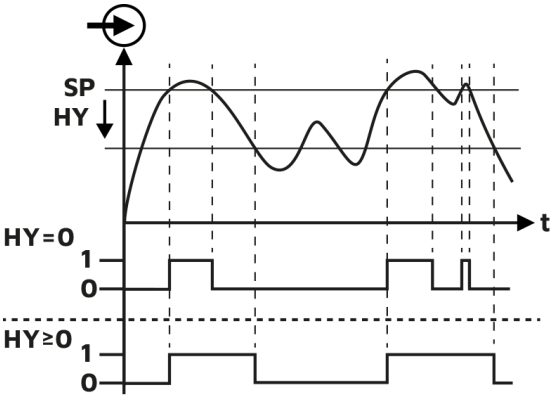


*Figure 6.8: grf00048_fun_sw_sp_no*

Operating Mode - Polarity: NC / Normally Open

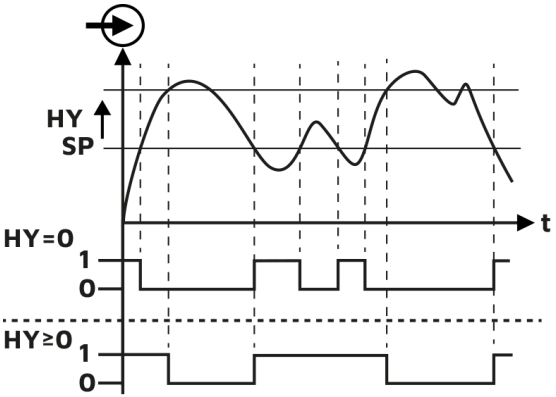


*Figure 6.9: grf00049_fun_sw_sp_nc*

**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

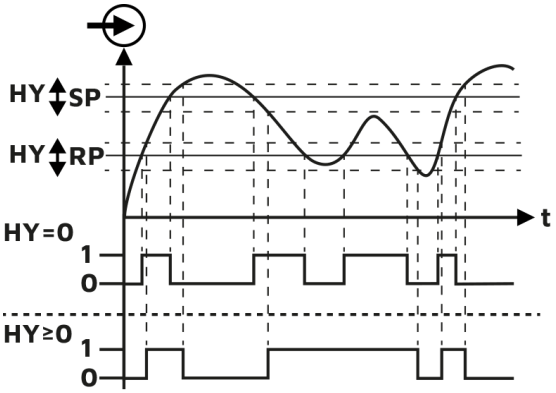


*Figure 6.10: grf00050_fun_sw_win_no*

Operating Mode - Polarity: NC / Normally Open

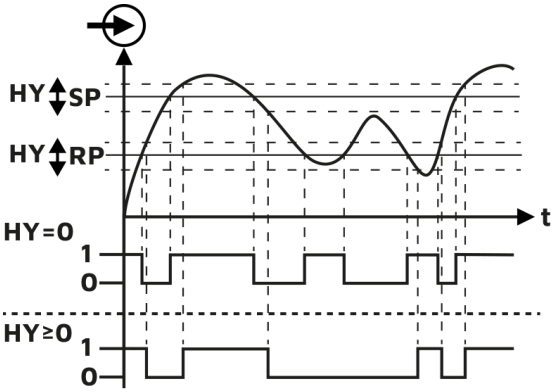


*Figure 6.11: grf00051_fun_sw_win_nc*

**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

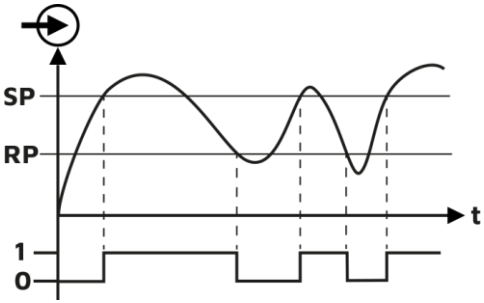


*Figure 6.12: grf00052_fun_sw_tp_no*

Operating Mode - Polarity: NC / Normally Closed

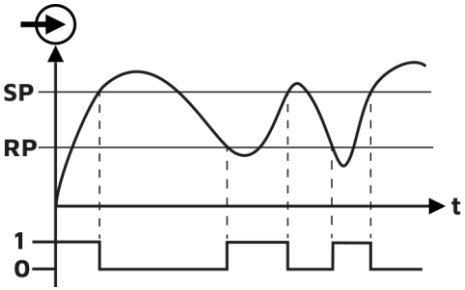


*Figure 6.13: grf00053_fun_sw_tp_nc*

**Fault Reporting Function**

The Switching output signals a detected functional error (see the section on Fault Diagnosis and Troubleshooting)

### 6.3.3 Analog 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) Output value held at 0 / 3.8 mA / 20.5 mA

(2) Step change ≤ 3.6 mA

(3) Step ≥ 21 mA (22 mA)

**Output signal 4–20 mA**

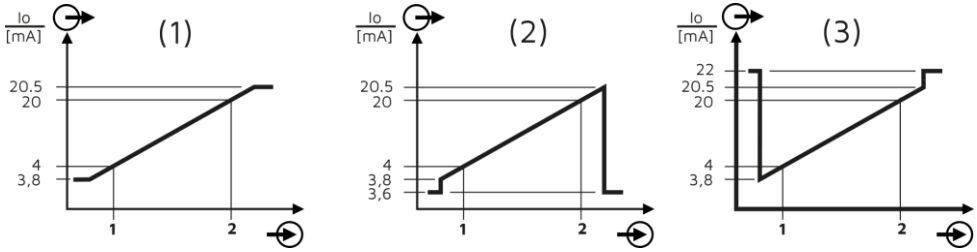


*Figure 6.14: grf00054_fun_iout_4_20_h_36_22*

**Output signal 0–20 mA**

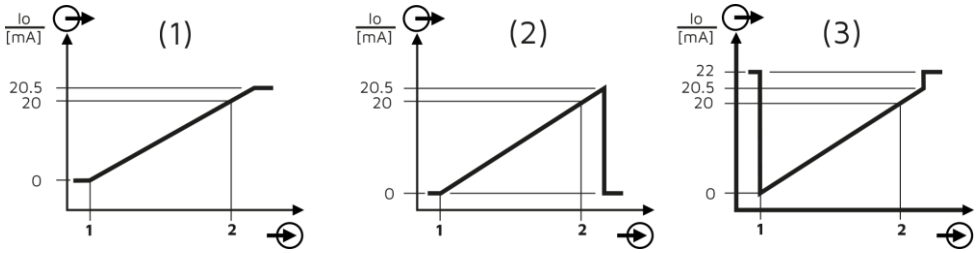


*Figure 6.15: grf00055_fun_iout_0_20_h_0_22*

# 7 Diagnostics and troubleshooting

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

Error Messages for electronic output – IO-Link – [03-L]:

| IO-Link Code | Description | Resolution |
|---|---|---|
| 20480 (0x5000) | Device hardware error | Replace or return the device |
| 35856 (0x8C10) | Measurement range exceeded | Check measurement range calibration |
| 35888 (0x8C30) | Measurement range undershoot | Check measurement range calibration |
| 36346 (0x8DFA) | Analog output error 3.6 mA | Check current output calibration |
| 36347 (0x8DFB) | Analog Output Error 22 mA | Check the calibration of the current output |

In the event of a fault, check:

| Component / Area | Test | Remedy |
|---|---|---|
| Housing | Damage | Replace or return the device |
| Sensor lens | Contamination | Clean the device or send it in |
| | 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 operating voltage |
| | Connection cable is damaged | Send the unit in for repair |

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

# 8 Maintenance

The device is maintenance-free when used as intended.

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 harsh chemicals.

# 9 Repair

The device is not intended for repair by the user. Repairs may only be performed by the manufacturer.

## 9.1 Disassembly

Wear appropriate protective clothing, such as safety goggles and gloves.

**WARNING**

- Allow the device and system to cool sufficiently before disassembly. There is a risk from hot surfaces as well as leaking, hazardous, and hot measured media.

**WARNING**

- Allow the device and system to cool sufficiently before disassembly. There is a risk from hot surfaces as well as leaking, hazardous, and hot measured media.

**WARNING**

- Disassemble the device only when it is de-energized.

**WARNING**

- Switch off all connected control units before disassembly.

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

## 9.2 Returns

Returns can only be accepted if the device is accompanied by a decontamination declaration.

The declaration is available for download on the website and must be fully completed 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), the 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 can be returned to the manufacturer for disposal. Returns are subject to the manufacturer's general terms and conditions or individually agreed terms.

# 10 Technical data

| | |
|---|---|
| Reference Conditions | Ta = +15...+25 °C (+59...+77 °F) / Pa = 860...1060 kPa / r.F. = 45...75 % |
| | Us = 24 Vdc ±0.1 V / ton = 240 s / vertical, sensor at the bottom |
| | Reflector: Metal plate with an edge length of ≥ 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 Input distance

| | |
|---|---|
| Sensor type | FMCW radar, pulsed |
| Frequency | 122...123 GHz |
| EIRP | ≤ 10 dBm |
| Beamwidth | 10° |
| Pulse rate | ≥ 10 Hz / ≤ 100 ms |
| Measurement 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 auxiliary power | ≤ ± 0.002% FSI/V |
| Temperature effect | ≤ ± 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** | |
|---|---|
| Specifications | RS485, bidirectional / Modbus-RTU / 9600 baud (4800...38400 baud) |
| Input resistance | 112 Ω |
| Time Response | Pressure/level signal: t90 ≤ 2 ms (td = 0 s) |
| | Temperature signal: t90 ≤ 60 s (td = 0 s) |
| Auxiliary power | |
| Supply voltage Us | 6···35 Vdc, reverse-polarity protected / residual ripple ≤ 2 Vpp |
| Input current Is | ≤ 10 mA (no load) |
| Turn-on delay time | ≤ 0.1 s (td = 0 s) |

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

| **Interface - Cio** | |
|---|---|
| Specifications | IO-Link V1.1 / Port Class A / Com2 (38.4 kBaud), Com3 (230.4 kBaud) |
| Cycle time | ≥ 2.3 ms |

| | |
|---|---|
| Time response t90-min | ≤ 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 |
| Temperature effect 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 time | ≤ 0.5 s (td = 0 s) |

## 10.4 Interface - Bluetooth®

| | |
|---|---|
| Standard | Bluetooth® 5.2 |
| Specification | 2 Mbit/s, Advertising Mode 2 s |
| Transmit Power | ≤ 0.1 W |
| Range | Outdoors: max. 200 m / Indoors: max. 40 m |
| 10.4 | Environmental conditions |
| Process temperature Tp | -20…+70 °C (-4…+158 °F) |
| Process pressure | -0.2…+0.5 bar |
| Ambient temperature Ta | -20…+70 °C (-4… +158 °F) |
| Protection rating | 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 | Class B equipment / industrial environment (EN/IEC 61326) |
| Surge protection | Integrated surge protection (EN/IEC 61000-4-5) |
| | Insulation voltage ≥ 50 Vdc / Rated discharge current 10 kA (8/20 µs) |
| Protection class | III |
| Pollution degree | 4 |
| Operating altitude | 2,000 m above sea level |
| MTTF | [05-V]: 213 years / [05-L]: 214 years |
| Weight | 0.2 kg + (L1 × 0.068 kg/m) |

## 10.6 Materials

| | |
|---|---|
| Not in contact with the process | PE-HD, POM, PA, FKM/FPM, PE, PUR, epoxy |
| Support cable | Breaking strength of steel shield: ≥ 920 N |
| | Bending radius: ≥ 100 mm |
| | Cross-sectional area of strands: 0.22 mm² |
| | Resistance: 90 ohms/km |

# 11 Revision

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

senseca.com

Senseca Germany GmbH
Lauterbachstr. 57 ½
84307 Eggenfelden
GERMANY
INFO.EGGENFELDEN@SSENSECA.COM