Operating Instructions

Radar sensor for continuous level measurement

CNCR-210

Two-wire 4–20 mA

CNCR-220

Two-wire 4–20 mA/HART

BINMASTER

Document ID: 925-0395 Rev C

Contents

1 About this document

Information, note, tip: This symbol indicates helpful additional information and tips.

Note: This symbol indicates notes to prevent failures, malfunctions, damage to devices or facility.

Caution: Non-observance may result in personal injury.

Warning: Non-observance may result in serious or fatal personal injury.

Danger: Non-observance of the information marked with this symbol results in serious or fatal personal injury.

Ex applications
This symbol indicates special instructions for Ex applications.

List
The dot set in front indicates a list with no implied sequence.

1 **Sequence of actions**
Numbers set in front indicate successive steps in a procedure.

Battery disposal
This symbol indicates special information about the disposal of batteries and accumulators.

2 For your safety

2.1 Authorized personnel

All operations described in this documentation must be carried out only by trained, qualified personnel authorized by the plant operator. Required personal protective equipment must always be worn when working on or with the device.

2.2 Appropriate use

CNCR-210/220 is a sensor for continuous level measurement. Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions.

2.3 Warning about incorrect use

Inappropriate or incorrect use of this product can result in application-specific hazards, e.g. vessel overfill by incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result.

Safety instructions for Ex areas

Take note of the Ex specific safety instructions for Ex applications. These instructions are attached as documents to each instrument with Ex approval and are part of the operating instructions.

3 Product Description

3.1 Configuration

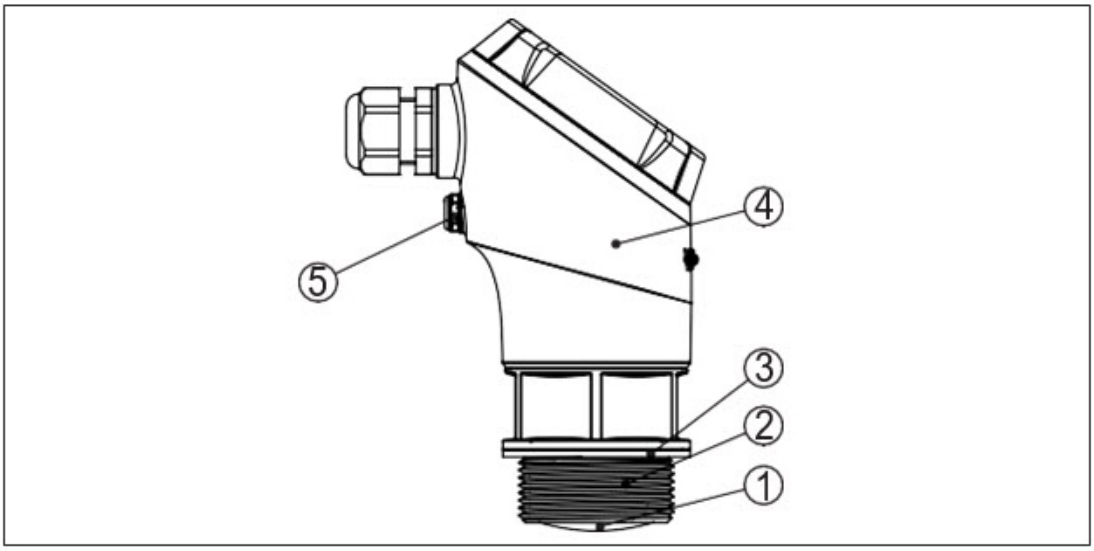

Fig. 1: Components of CNCR-210/220

1 *Radar antenna*
2 *Process fitting*
3 *Process seal*
4 *Electronics housing*
5 *Ventilation/pressure compensation*

3.2 Principle of operation

CNCR-210/220 is a radar sensor for continuous level measurement. It is suitable for liquids and solids in practically all industries.

The instrument emits a continuous, frequency-modulated radar signal from its antenna. The emitted signal is reflected by the material and received by the antenna as an echo with a modified frequency. The frequency change is proportional to the distance to the material.

3.3 Adjustment

Devices with integrated Bluetooth module can be adjusted wirelessly via software adjustment tools:

- Smartphone/tablet (iOS or Android operating system)
- PC/notebook with Bluetooth USB adapter (Windows operating system)

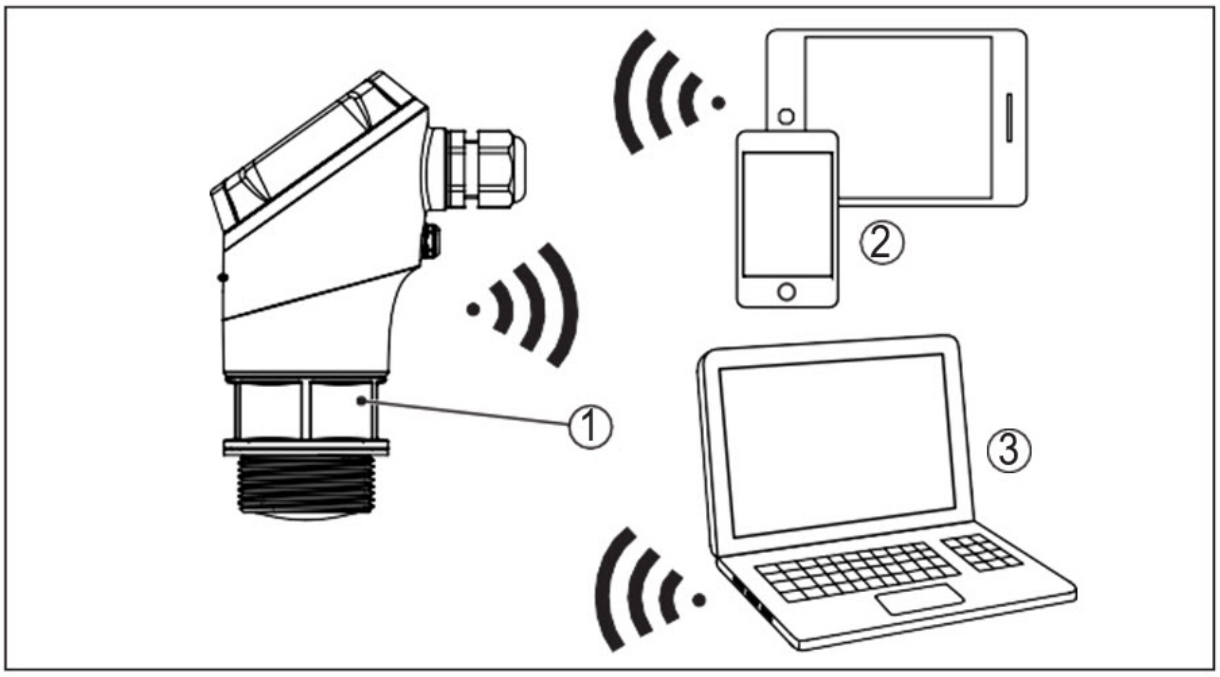

Fig. 2: Wireless connection to standard operating devices with integrated Bluetooth LE

1 Sensor
2 Smartphone/Tablet
3 PC/Notebook

4 Mounting

4.1 General instructions

The instrument is suitable for standard and extended ambient conditions according to DIN/EN/IEC/ANSI/ISA/UL/CSA 61010-1. It can be used indoors as well as outdoors.

Protect your instrument against moisture ingress through the following measures:

- Use a suitable connection cable
- Tighten the cable gland or plug connector firmly
- Face the cable connection or conduit entry downward, never upward

This applies mainly to outdoor installations, in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

4.2 Mounting

The radar emits pulses of electromagmetic waves which are polarized. By adjusting the rotation of the instrument the polarization can be changed to reduce false echoes.

The narrow portion of the radar signal is in the middle of the conduit entry on the instrument. This should be pointed towards the center of the vessel or any obstacle that may cause any unwanted reflections to minimize false echos, for example, the sidewall or vessel structure.

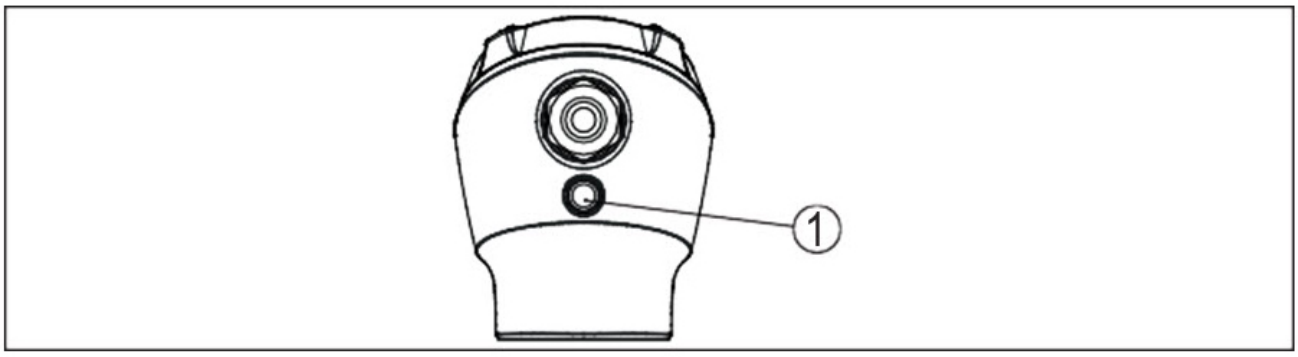

Fig. 3: Polarization position
Cable / conduit entry

Note:
When the housing is rotated, the direction of polarization changes and hence the influence of the false echo on the measured value. Please keep this in mind when mounting or making changes later.

When mounting the sensor, *distance it at least 200 mm (7.874 in)* from the vessel wall. If the sensor is installed in the center of dished or round vessel tops, multiple echoes can arise. However, these can be suppressed by a false signal suppression (see chapter “Setup”).

If you cannot maintain this distance, you should carry out a false signal suppression during initial setup. This applies particularly if buildup on the vessel wall is expected. If this is the case, we recommend repeating the false signal suppression later with the additional buildup.

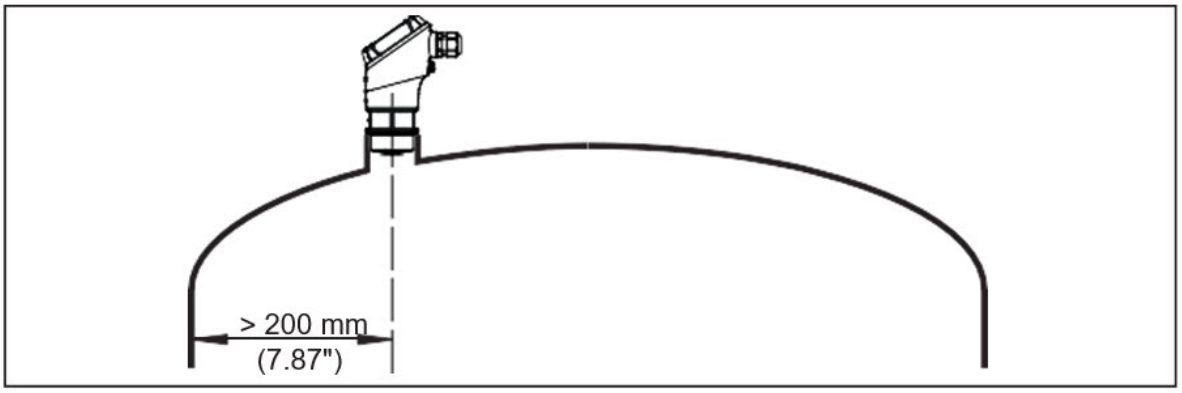

Fig. 4: Mounting the radar sensor on round vessel tops

In vessels with cone bottoms, the sensor can be mounted in the center of the vessel to measure material down to the outlet.

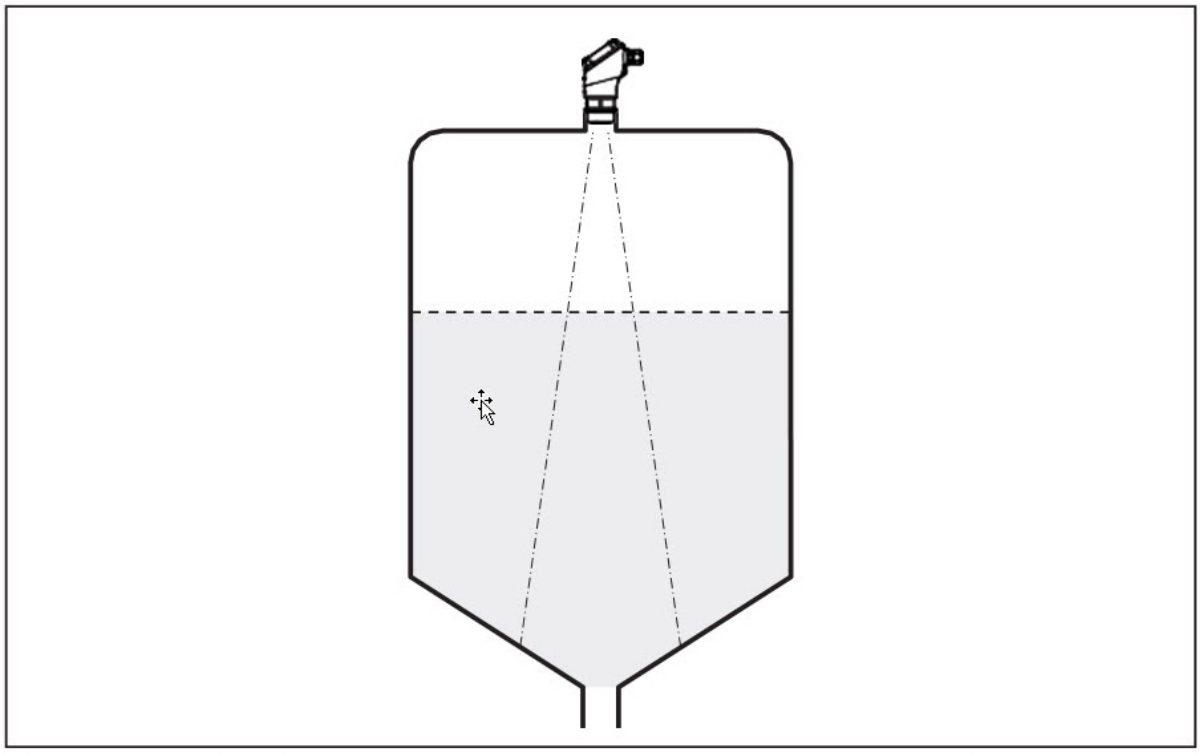

Fig. 5: Mounting the radar sensor with conical bottom

The lower side of the radar antenna is the reference plane for the min./max. adjustment, see following diagram:

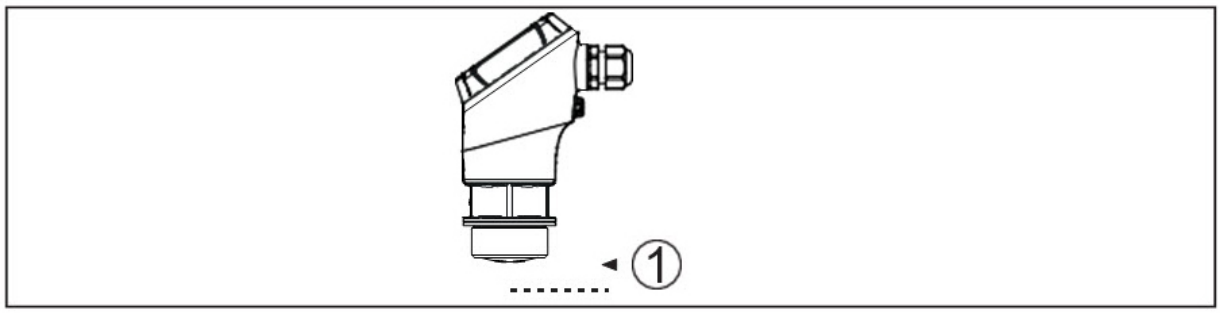

Fig. 6: Reference plane
1 Reference plane

Do not mount the instrument in or above the fill stream. Make sure that it is pointed towards the material surface, not the fill stream.

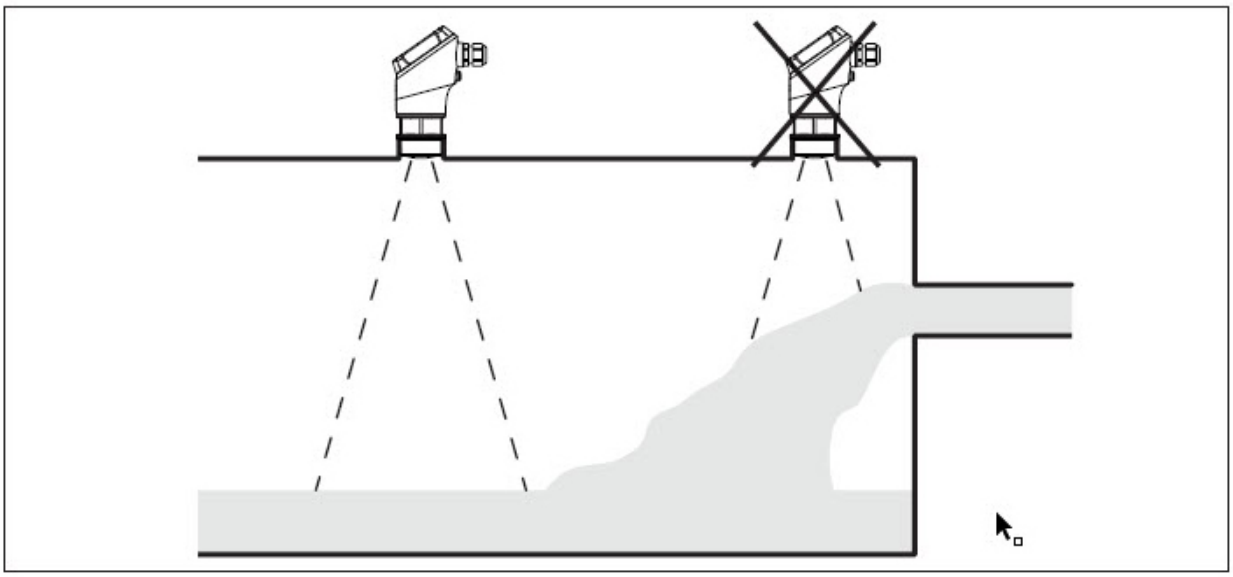

Fig. 7: Mounting the radar sensor with inflowing material

For socket or stand pipe mount, the pipe should be as short as possible and its bottom end rounded to reduce false reflections from the end of the pipe.

When using a threaded coupling, the antenna end should protrude at least 5 mm (0.2 in) out of the coupling.

If the reflective properties of the material are good, you can mount the CNCR-210 on sockets or stand pipes longer than the antenna. The pipe end should be smooth, burr-free and the end rounded.

Note:
When mounting on longer sockets, we recommend carrying out a false signal suppression after install (see chapter “Parameter adjustment”).

Recommended values for socket or stand pipe lengths and heights are in the following table. The values come from typical applications.

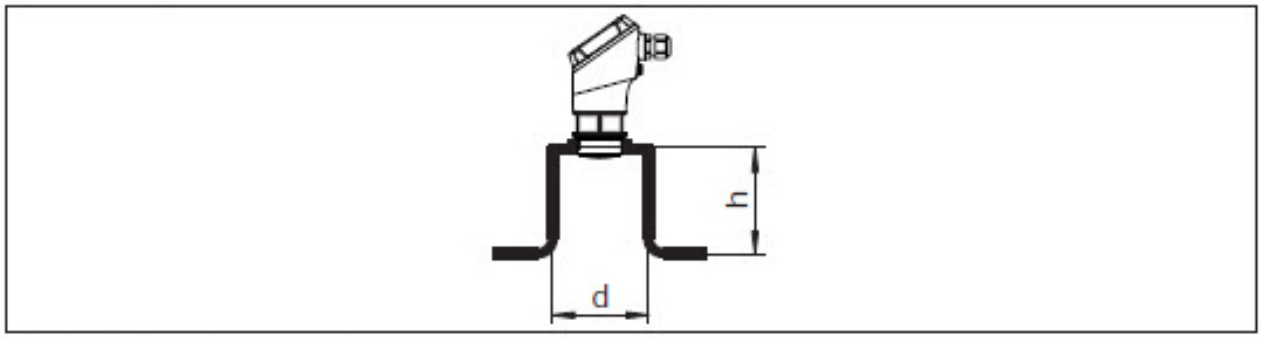

Fig. 8: Mounting the radar sensor with stand pipes

Socket diameter d		Socket length h	
40 mm	1½”	≤ 150 mm	≤ 5.9 in
50 mm	2”	≤ 200 mm	≤ 7.9 in
80 mm	3”	≤ 300 mm	≤ 11.8 in
100 mm	4”	≤ 400 mm	≤ 15.8 in
150 mm	6”	≤ 600 mm	≤ 23.6 in

5 Connecting to power supply

5.1 Preparing the connection

- Electrical connection should be completed by trained, qualified personnel authorized by the plant operator.
- If overvoltage surges are expected, overvoltage arresters should be installed.

Warning:
Only connect or disconnect in de-energized state.

Note:
Power the instrument via an energy-limited circuit (power max. 100 W) according to IEC 61010-1, e.g.

- Class 2 power supply unit (acc. to UL1310)
- SELV power supply unit (safety extra-low voltage) with suitable internal or external limitation of the output current

Use round cable to ensure effective sealing of the cable gland to the appropriate IP rating and check the cable diameter versus the cable gland before wiring for proper fit.

The instrument is connected with standard two-wire cable.
If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, shielded cable should be used.

Note:
If the temperatures are too high, the cable insulation can be damaged.

5.2 Connecting

Fig. 9: Connection

Connect the instrument as described in the following wiring plan.

5.3 Wiring plan

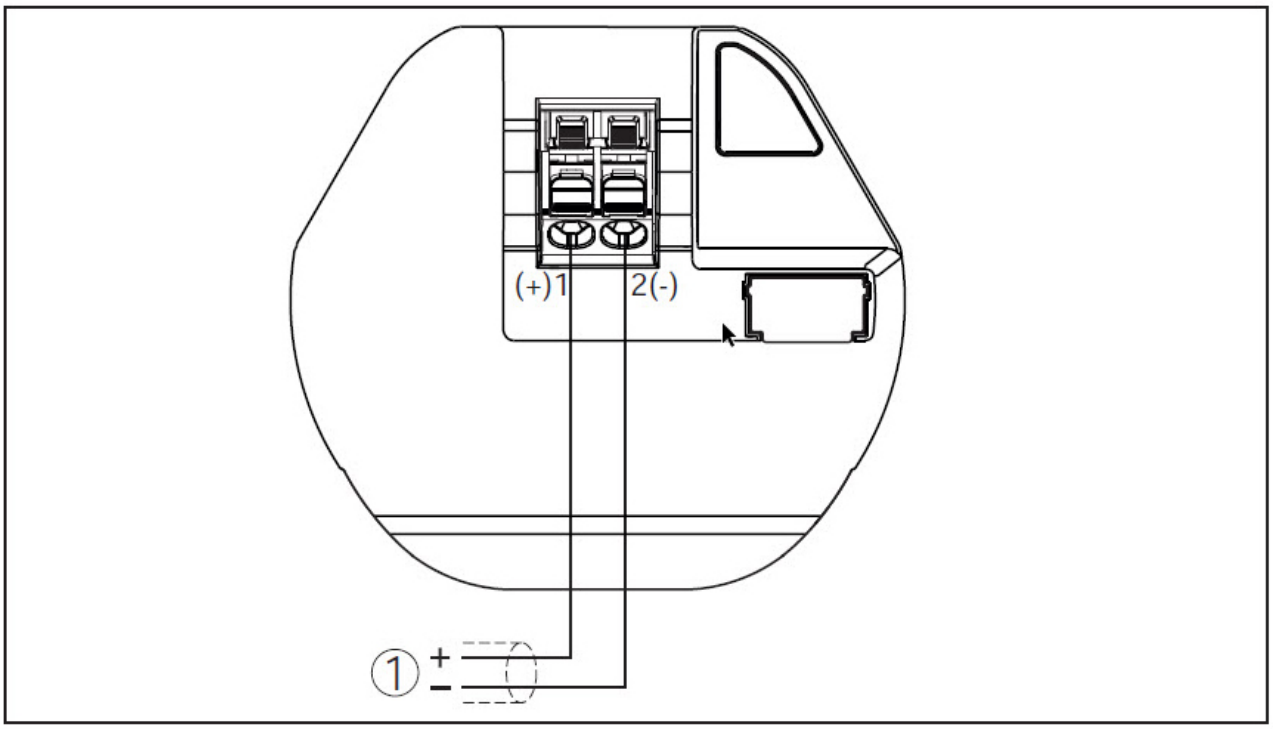

Fig. 10: Connection compartment CNCR-210/220
1 Voltage supply +24 VDC, signal output

6 Setup with smartphone/tablet (Bluetooth)

6.1 Preparations

Make sure that your smartphone/tablet meets the following system requirements:

- Operating system: iOS 8 or newer
- Operating system: Android 5.1 or newer
- Bluetooth 4.0 LE or newer

Download the Wireless Device Configurator app from the “Apple App Store” or “Google Play Store” to your smartphone or tablet. To enable the Bluetooth software enter the BinMaster company ID code BMYQXZ.

6.2 Connecting

Start the adjustment app and select the function “Setup”. The smartphone/tablet searches automatically for Bluetooth-capable instruments in the area.

The message “*Connecting …*” is displayed.
The devices found are listed and the search is automatically continued.
Select the requested instrument in the device list.

When establishing the connection for the first time, the operating tool and the sensor must authenticate each other. After the first correct authentication, each subsequent connection is made without a new authentication query.

For authentication, enter the 6-digit Bluetooth access code in the next menu window. You can find the code on the outside of the device housing and on the setup information sheet in the device packaging.

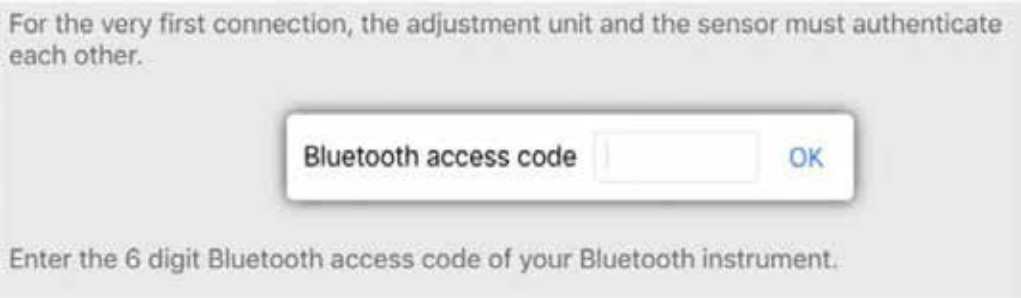

Fig. 11: Enter Bluetooth access code

Note:
If an incorrect code is entered, the code can only be entered again after a delay time and the delay gets longer after each incorrect entry.

The message “Waiting for authentication” is displayed on the smartphone/tablet.

After connection, the sensor adjustment menu is displayed on the smartphone/tablet.

If the Bluetooth connection is interrupted, e.g. due to a too large distance between the two devices, this is displayed on the smartphone/tablet. The message disappears when the connection is restored.

Parameter adjustment of the device is only possible if the parameter protection is deactivated, which is default. Parameter protection can be activated later if desired.

6.3 Parameter adjustment

The sensor adjustment menu is divided into two areas, which are arranged next to each other or one below the other, depending on the smartphone/tablet.

- Navigation section
- Menu item display

The selected menu item can be recognized by the color change.

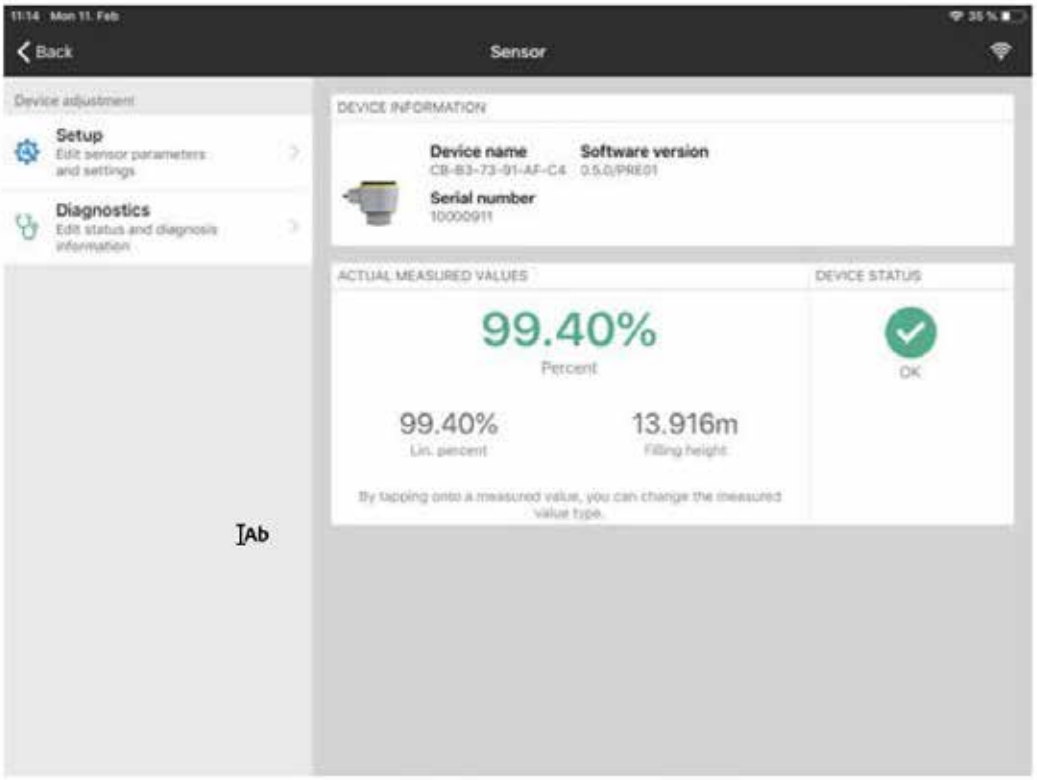

Fig. 12: Example of an app view - Setup sensor adjustment

Enter the requested parameters and confirm via the keyboard or the editing field. The settings are then active in the sensor.

Close the app to terminate connection.

Note

If the CNCR fails to connect to the Wireless Device Configuration App (WDCA) via Bluetooth, close the (WDCA), power cycle the CNCR and attempt to reconnect.

If further action is required, power cycle the Bluetooth on your device, and repeat the steps above.

7 Menu overview

Menu item	Selection	Default settings
Measurement loop name	Alphanumeric characters	Sensor
Medium	Liquid Bulk solid	Liquid
Application liquid	Storage tank, agitator tank, dosing tank, pumping station/ pump shaft, rain overflow basin, tank/ collection basin, plastic tank (measurement through tank top), mobile plastic tank (IBC), level measurement in waters, flow measurement flume/over- flow, demonstration	Storage tank
Application bulk solid	Silo (slim and high), bunker (large volume), stockpile (point measurement/ profile detection), crusher, demonstration	Silo (slender and high)
Units	Distance unit of the device Temperature unit of the instrument	Distance in ft. Temperature in °F
Adjustment CNCR-210	**Max. adjustment (distance A) - 20mA (100%)** **Min. adjustment (distance B) - 4mA (0%)**	**Distance from sensor** **Max. adjustment 0.0 m** **Min. adjustment 8.0 m**
Adjustment CNCR-220	**Max. adjustment (distance A) - 20mA (100%)** **Min. adjustment (distance B) - 4mA (0%)**	**Distance from sensor** **Max. adjustment 0.0 m** **Min. adjustment 15.0 m**

Menu item	Selection	Default settings
Damping	Integration time	0 s
Current output	Output characteristics	4 to 20 mA = 0% to 100%
	Current range	Min. current 4 mA and max. current 20.5 mA
	Reaction when malfunctions occur	Failure mode < 3.6 mA
Linearization	**Linearization type**	**Linear**
Scaling	Scaling size Scaling unit Scaling format	0% correspond to 0 l 100% correspond to 100 l
Display	Menu language Displayed value Backlight	English Distance On
Access protection	Bluetooth access code	-
	Parameter Protection	Deactivated
False signal suppression	False signal suppression	0 m
	Sounded distance to the material	0 m
Reset	Delivery status, basic settings	-

Menu item	Selection	Default settings
Status	Sensor status Measured value status Status output Status additional measured values	-
Echo curve	Indication of echo curve	-

8 Diagnostics and servicing

8.1 Maintenance

If the device is used properly, no special maintenance is required in normal operation.

In some applications, buildup on the antenna system can influence the measurement. Depending on the sensor and application, be careful to avoid heavy soiling of the antenna system. If necessary, clean the antenna system periodically.

8.2 Status messages

The status messages are divided into the following categories:

- Failure
- Function check
- Out of specification
- Maintenance required

Failure

Code Text message	Cause	Rectification	DevSpec State in CMD 48
F013 no measured value available	Sensor does not detect an echo during operation Antenna system dirty or defective	Check or correct installation and/or parameter settings Clean or exchange process component or antenna	Byte 5, Bit 0 of Byte 0-5
F017 Adjustment span too small	Adjustment not within specification	Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm)	Byte 5, Bit 1 of Byte 0-5
F025 Error in the linearization table	Index markers are not continuously rising, for example illogical value pairs	Check linearization table Delete table/Create new	Byte 5, Bit 2 of Byte 0-5
F036 No operable software	Failed or interrupted software update	Repeat software update Check electronics version Exchanging the electronics Send instrument for repair	Byte 5, Bit 3 of Byte 0-5
F040 Error in the electronics	Hardware defect	Exchanging the electronics Send instrument for repair	Byte 5, Bit 4 of Byte 0-5
F080 General software error	General software error	Disconnect operating voltage briefly	Byte 5, Bit 5 of Byte 0-5
F105 Determine measured value	The instrument is still in the start phase, the measured value could not yet be determined	Wait for the end of the switch-on phase Duration up to approx. 3 minutes depending on the version and parameter settings	Byte 5, Bit 6 of Byte 0-5

Failure

Code Text message	Cause	Rectification	DevSpec State in CMD 48
F113 Communication error	EMC interference	Remove EMC influences	Byte 4, Bit 4 of Byte 0-5
F125 Impermissible electronics temperature	Temperature of the electronics in the non-specified range	Check ambient temperature Insulate electronics Use instrument with higher temperature range	Byte 5, Bit 7 of Byte 0-5
F260 Error in the calibration	Error in the calibration carried out in the factory Error in the EEPROM	Exchanging the electronics Send instrument for repair	Byte 4, Bit 0 of Byte 0-5
F261 Error in the instrument settings	Error during setup False signal suppression faulty Error when carrying out a reset	Repeat setup Carry out a reset	Byte 4, Bit 1 of Byte 0-5
F264 Installation/Setup error	Adjustment not within the vessel height/measuring range Max. measuring range of the instrument not sufficient	Check or correct installation and/or parameter settings Use an instrument with bigger measuring range	Byte 4, Bit 2 of Byte 0-5
F265 Measurement function disturbed	Sensor no longer carries out a measurement Operating voltage too low	Check operating voltage Carry out a reset Disconnect operating voltage briefly	Byte 4, Bit 3 of Byte 0-5

Function check

Code Text message	Cause	Rectification	DevSpec State in CMD 48
C700 Simulation active	A simulation is active	Finish simulation Wait for the automatic end after 60 mins.	“Simulation Active” in “Standardized Status 0”

Out of specification

Code Text message	Cause	Rectification	DevSpec State in CMD 48
S600 Impermissible electronics temperature	Temperature of the electronics in the non-specified range	Check ambient temperature Insulate electronics	Byte 23, Bit 4 of Byte 14-24
S601 Overfilling	Danger of vessel overfilling	Make sure that there is no further filling Check level in the vessel	Byte 23, Bit 5 of Byte 14-24
S603 Impermissible operating voltage	Terminal voltage too small	Check terminal voltage, increase operating voltage	Byte 23, Bit 6 of Byte 14-24

Maintenance

Code Text message	Cause	Rectification	DevSpec State in CMD 48
M500 Error during the reset “delivery status”	The data could not be restored during the reset to delivery status	Repeat reset Load XML file with sensor data into the sensor	Byte 24, Bit 0 of Byte 14-24
M501 Error in the nonactive linearization table	Hardware error EEPROM	Exchanging the electronics Send instrument for repair	Byte 24, Bit 1 of Byte 14-24
M502 Error in the event memory	Hardware error EEPROM	Exchanging the electronics Send instrument for repair	Byte 24, Bit 2 ofByte 14-24
M503 Measurement reliability too low	The echo/noise ratio is too small for reliable measurement Antenna dirty or defective	Check installation and process conditions Change polarization direction Use instrument with higher sensitivity Clean the antenna	Byte 24, Bit 3 of Byte 14-24
M504 Error at a device interface	Hardware defect	Check connections Exchanging the electronics Send instrument for repair	Byte 24, Bit 4 of Byte 14-24
M505 No echo available	Sensor does not detect an echo during operation Antenna dirty or defective	Clean the antenna Use a more suitable antenna/ sensor Remove possible false echoes Optimize sensor position and orientation	Byte 24, Bit 5 of Byte 14-24
M506 Installation/Setup error	Error during setup	Check or correct installation and/or parameter settings	Byte 24, Bit 6 ofByte 14-24
M507 Error in the instrument settings	Error during setup Error when carrying out a reset False signal suppression faulty	Carry out reset and repeat setup	Byte 24, Bit 7 of Byte 14-24

9 Removal

The device is made of recyclable materials that can be disposed of by specialty recycling companies. Observe the applicable local regulations for proper disposal.

10 Certificates and approvals

10.1 Radio licenses

Radar

The device has been tested and approved in accordance with the current edition of the applicable country-specific norms or standards.

Bluetooth

The Bluetooth radio module in the device has been tested and approved according to the current edition of the applicable country-specific norms or standards.

11 Supplement

11.1 Technical data

Note for approved instruments

The technical data in the respective safety instructions which are included are valid for approved instruments (e.g. with Ex approval). These data can differ from the data listed herein, for example regarding the process conditions or the voltage supply.

Materials and weights	
Materials, wetted parts	
– Antenna, process fitting	PVDF
– Process seal	FKM
Materials, non-wetted parts	
– Housing	Plastic PBT (Polyester)
– Housing seals	O-rings (silicone)
– Cable gland	PA
– Sealing, cable gland	NBR
– Blind plug, cable gland	PA
– Weight	0.7 kg (1.543 lbs)

Torques	
Max. torque mounting boss	7 Nm (5.163 lbf ft)
Max. torque for NPT cable glands and conduit tubes	10 Nm (7.376 lbf ft)

Measurement Range	
Measurement Range	The measurement range is the distance between the antenna face of the sensor and the material surface. The antenna face is also the reference plane for the measurement.
CNCR-210	
Max. measuring range	8 m (26.25 ft)
Recommended measuring range	up to 5 m (16.4 ft)
CNCR-220	
Max. measuring range	15 m (49.21 ft)
Recommended measuring range	up to 10 m (32.81 ft)

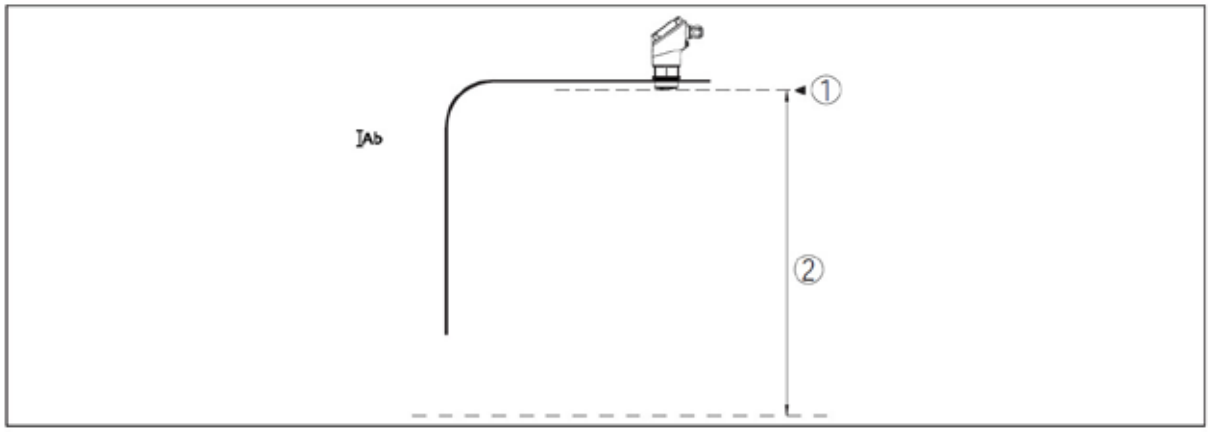

Fig. 13: Measurement Range
1 Reference plane
2 Measured variable, max. measuring range

Output	
Output signal	4 to 20 mA
Range of the output signal	3.8 to 20.5 mA (default setting)
Signal resolution	0.3 µA
Resolution, digital	1 mm (0.039 in)
Fault signal, current output (adjustable)	≤ 3.6 mA, >=21 mA, last valid measured value
Max. output current	22 mA
Load	See load resistance under Power supply
Starting current	≤ 3.6 mA; ≤ 10 mA for 5 ms after switching on
Damping (63 % of the input variable), adjustable	0 to 999 s

Ambient conditions	
Ambient temperature	-40 to +60 °C (-40 to +140 °F)
Storage and transport temperature	-40 to +80 °C (-40 to +176 °F)

Process conditions	
For the process conditions, please also note the specifications on the printed label. The lowest value (amount) always applies.	
Process temperature	-40 to +60 °C (-40 to +140 °F)
Process pressure	-1 to 3 bar (-100 to 200 kPa/-14.5 to 43.51 psig)

Voltage supply	
Operating voltage UB	
– at 4 mA	12 to 35 V DC
– at 20 mA	9 to 35 V DC
Reverse voltage protection	Integrated

Electrical protective measures	
Altitude above sea level	5000 m (16404 ft)
Protection class	III
Pollution degree	4

11.2 Dimensions

CNCR-210/220

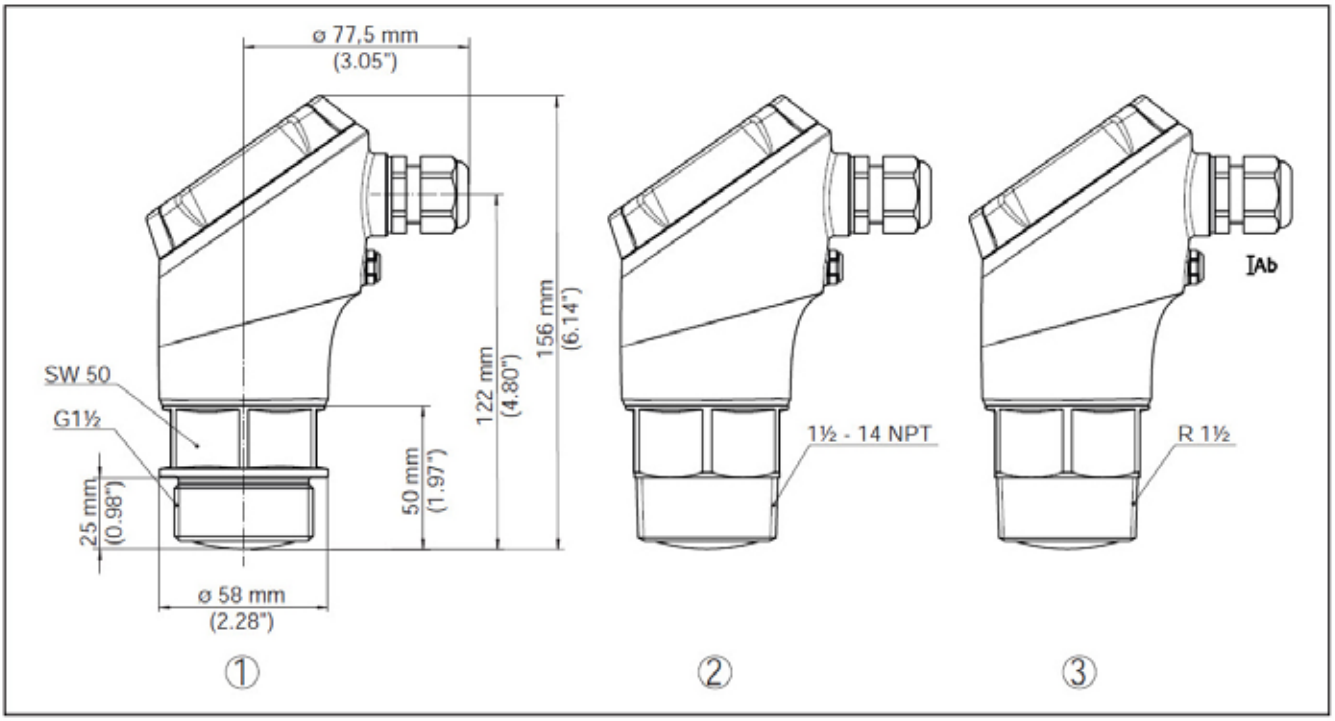

Fig. 14: Dimensions CNCR-210/220

1 Thread G1½

2 Thread 1½ NPT

3 Thread R1½

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.

Subject to change without prior notice.

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