Operating Instructions

Radar sensor for continuous level measurement of liquids

CNCR-120

Modbus and Levelmaster protocol

CNCR-130

Modbus and Levelmaster protocol

BINMASTER

Document ID: 925-0394 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 will result 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-130 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

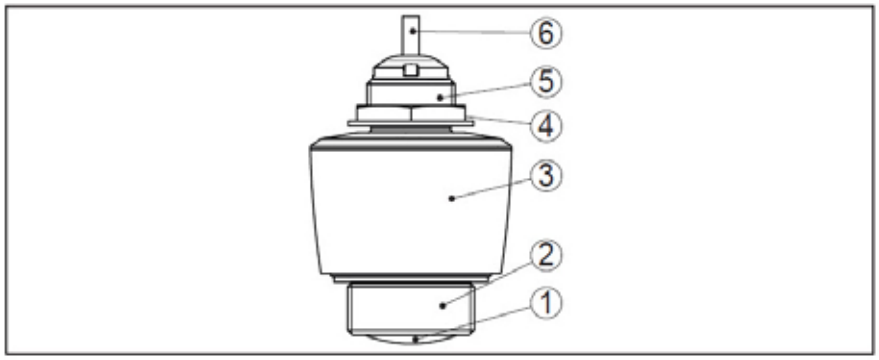
Inappropriate or incorrect use of this product can give rise to application-specific hazards, e.g. vessel overfill through incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result.

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



Constituent parts

Fig. 1: Components of CNCR-120

1 Radar antenna
3 Process fitting
3 Electronics housing
4 Mounting thread
5 Counter nut
6 Connection cable

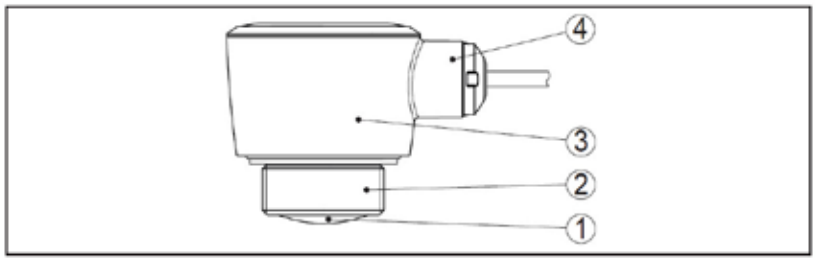


Fig. 2: Components of CNCR-130

1 Radar antenna
2 Process fitting
3 Electronics housing
4. Cable Outlet

3.2 Principle of operation

CNCR-130 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 through its antenna. The emitted signal is reflected by the material and received by the antenna as an echo with 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)

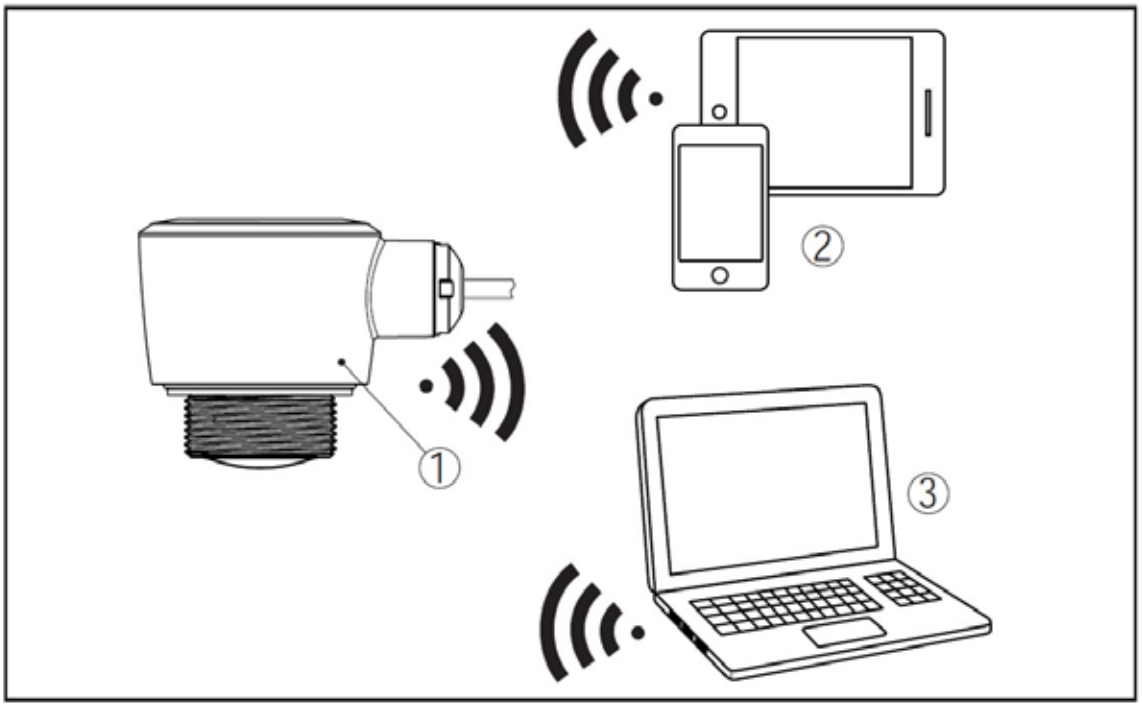


Fig. 3: Wireless connection to standard operating devices with integrated Bluetooth LE

1 Sensor
2 Smartphone/Tablet
3 PC/Notebook

Adjustment via an RS 485/USB interface adapter and a PC/notebook using DTM/PACTware.

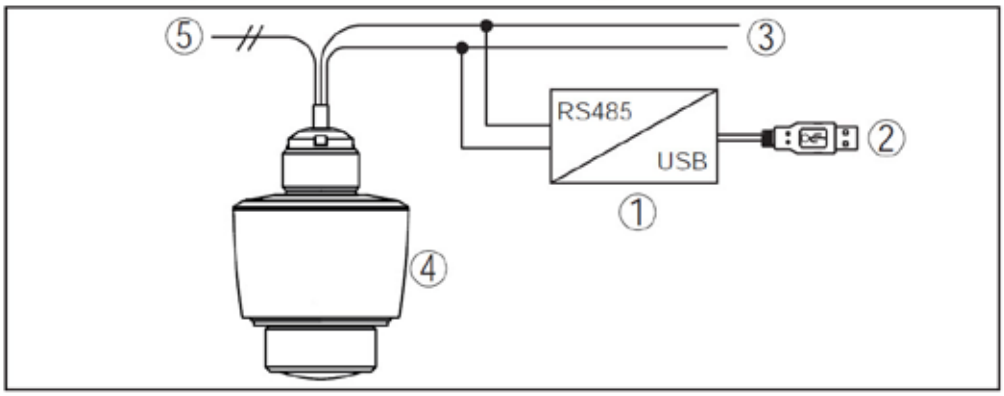


Fig. 4: Connecting the PC to the signal cable
1 Interface adapter RS 485/USB adapter
2 USB cable to the PC
3 RS 485 cable
4 Sensor
5 Voltage supply

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.

4.2 Mounting

A ceiling mounting bracket is a simple method of mounting the sensor. Take note of Figure 5 for the recommended minimum distance to the vessel wall.

The simplest mounting of the device is on the ceiling.

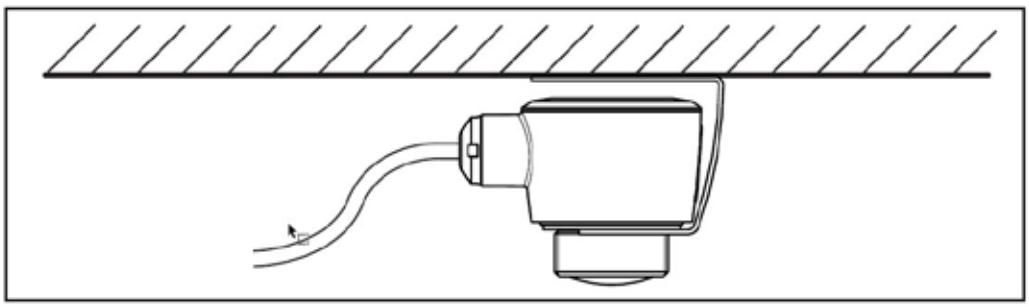


Fig. 5: Ceiling mounting

For the wall mounting, a mounting bracket with a 1.5” opening from BinMaster is recommended. The sensor is secured in the mount using a 1.5” plastic counter nut. Take note of Figure 5 for the recommended minimum distance to the vessel wall.

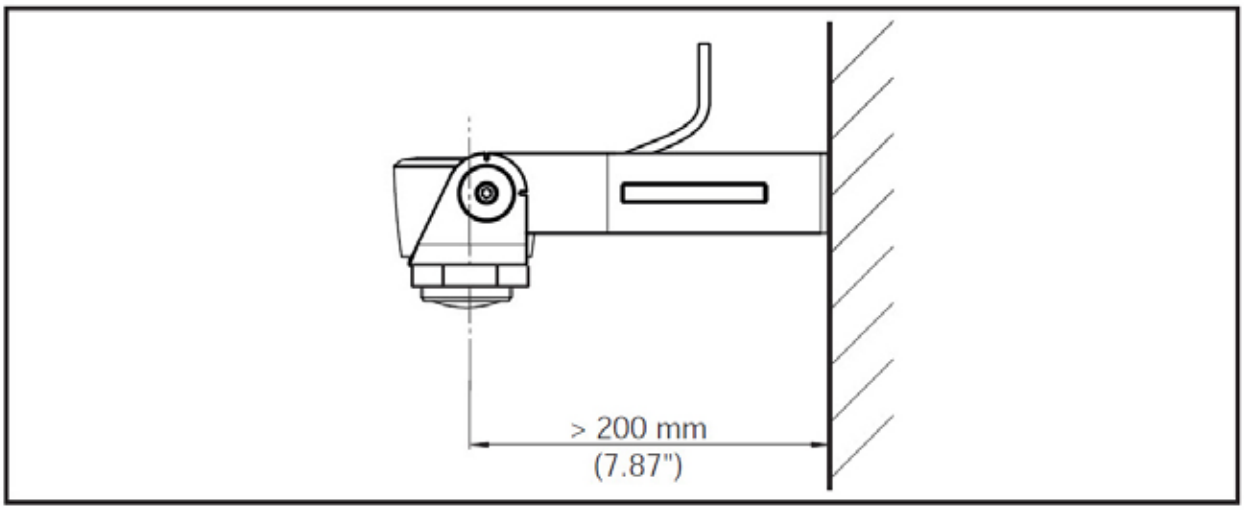


Fig. 6: Mounting via a mounting bracket

4.3 Mounting instructions

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

The narrow portion of the radar signal is in the middle of the printed label 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.

The position of the polarization is in the middle of the label on the instrument.

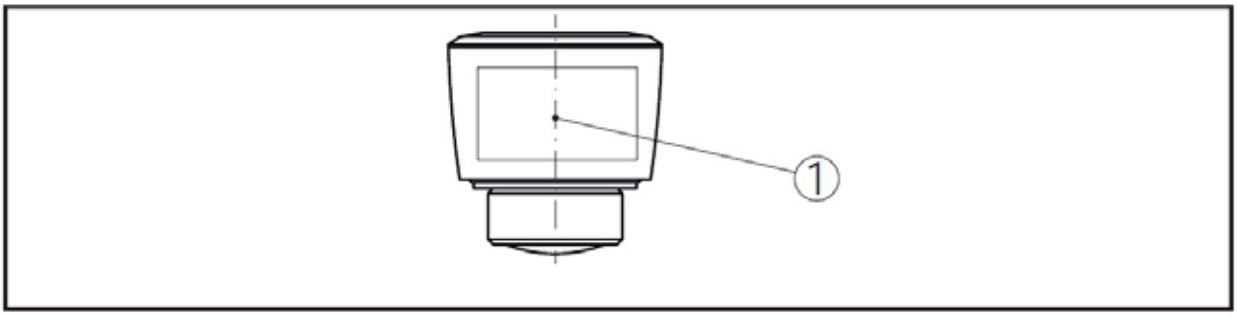


Fig. 7: Position of the polarization
1 Middle of the label

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 a round vessel top, 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.

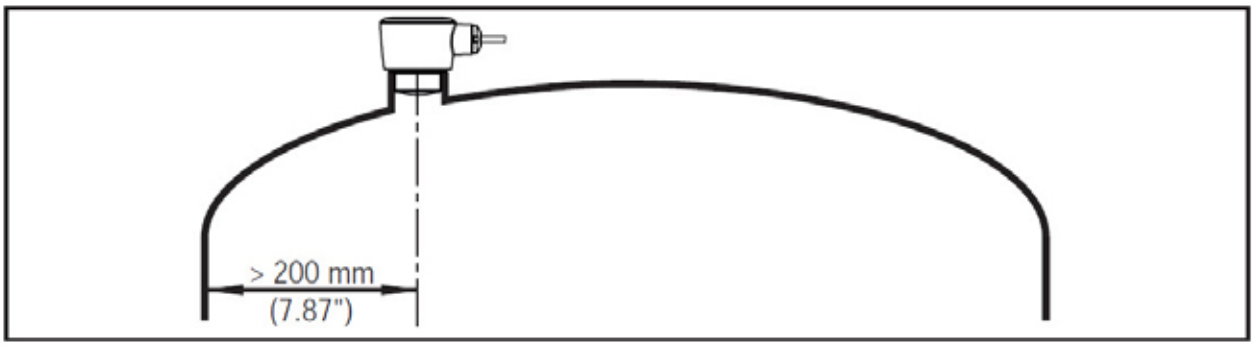


Fig. 8: Mounting of the radar sensor on round vessel tops

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

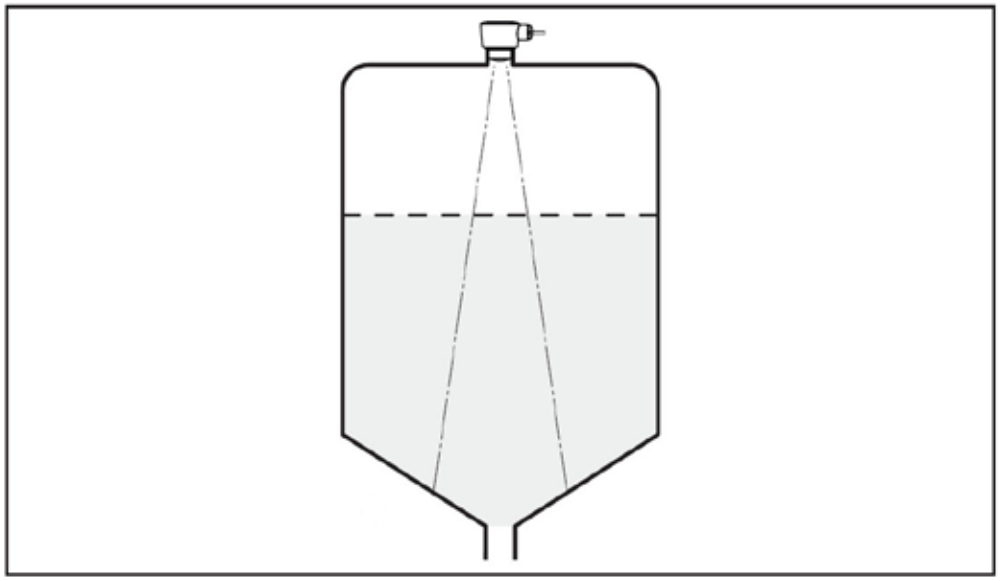


Fig. 9: Mounting the radar sensor with conical bottom

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

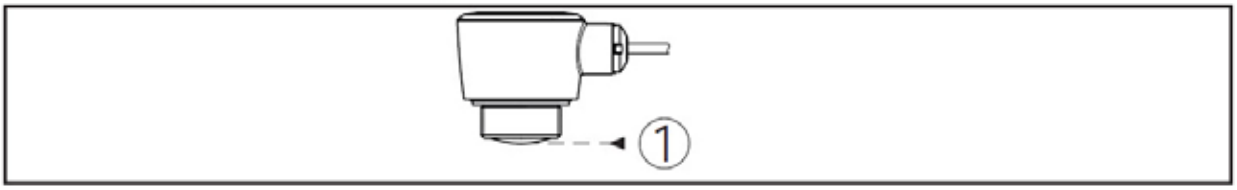


Fig. 10: Reference plane

1 Reference plane

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

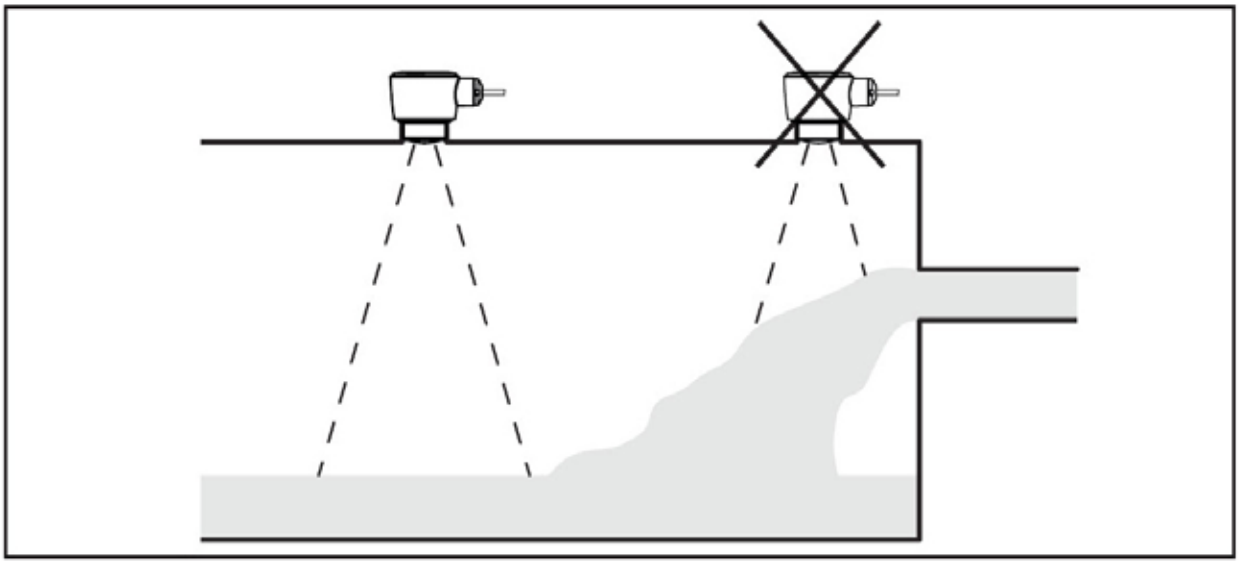


Fig. 11: Mounting of the radar sensor with inflowing material

For socket or stand pipe mount, the pipe should be as short as possible and its 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.

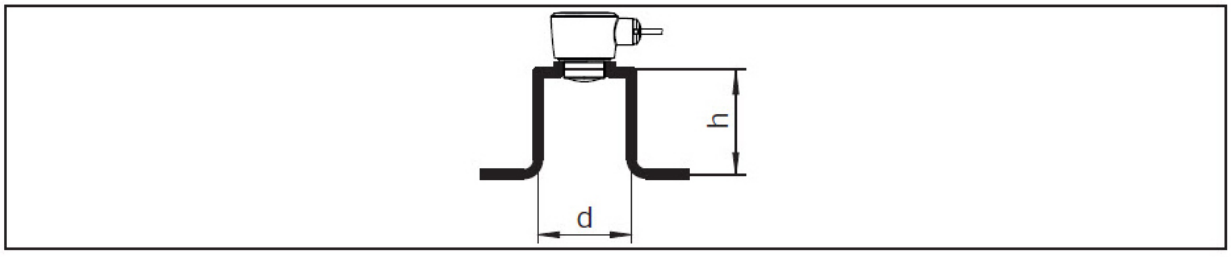


Fig. 12: Mounting the radar sensor with stand pipes

If the reflective properties of the material are good, you can mount CNCR-130 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 or stand pipes, 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.

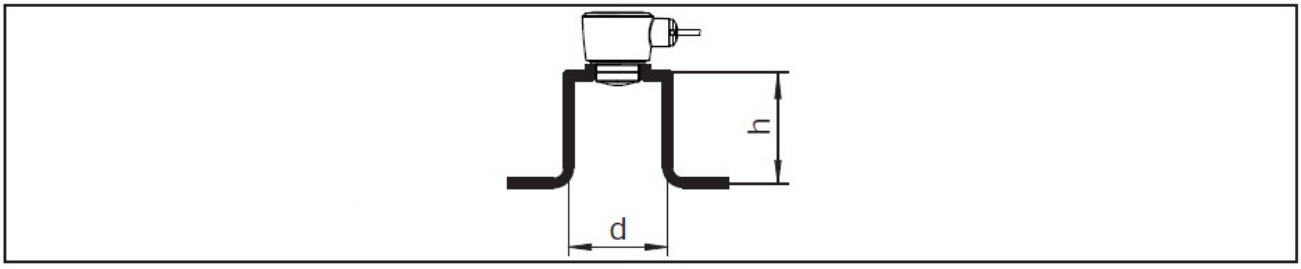


Fig. 13: Mounting the radar sensor with stand pipes.

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

The sensor should be mounted in a location where the radar signal is not interfered with by structure, such as ladders, braces or fill stream.

Make sure when planning the installation there is a clear, unobstructed view to the material to be measured. After installation, a false signal suppression should be carried out to minimize any reflections from the mount or nearby structure.

5 Connecting to power supply

5.1 Preparing the connection

Always keep in mind the following safety instructions:

- 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.

The operating voltage and the digital bus signal are routed via separate two-wire connection cables.
The data for power supply are specified in chapter "*Technical data".*

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

The device is supplied with a fixed cable. If an extension is required, twisted two-wire cable suitable for RS 485 should be used for the Modbus signal.

If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, shielded cable should be used.

Make sure that the entire installation is carried out according to the Fieldbus specification. In particular, make sure that the bus is terminated with suitable terminating resistors.

We recommend to connect the cable shield to ground at one end on the supply side when using shielded cable.

5.2 Wiring plan

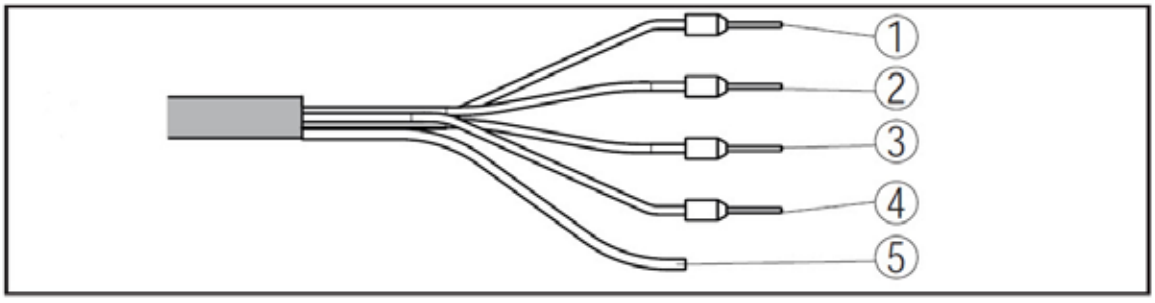


Fig. 14: Wire assignment in permanently connected connection cable

	Wire color	Function	Polarity
1	Brown	Voltage supply	Plus (+)
2	Blue	Voltage supply	Minus (-)
3	Black	Modbus signal D+	Plus (+)
4	White	Modbus signal D-	Minus (-)
5		Shielding	

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 smart-phone/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 smartphone/tablet 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 CNCR setup sheet enclosed in the device packaging.

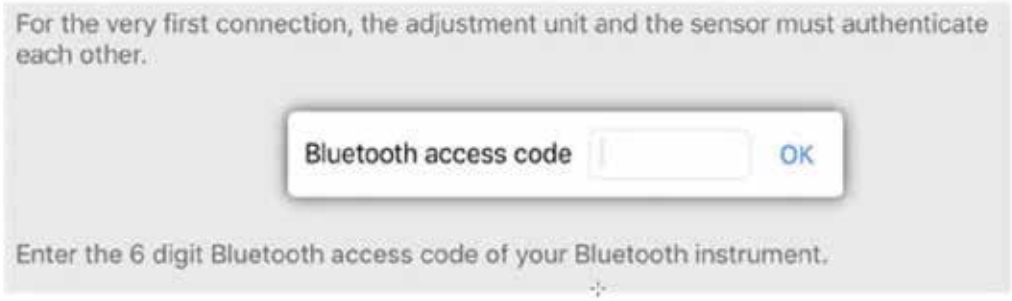


Fig. 15: Enter Bluetooth access code

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 smart-phone/tablet.

After connection, the sensor adjustment menu is displayed on the smart-phone/tablet.

If the Bluetooth connection is interrupted, e.g. due to a too large distance between the two devices, this is displayed on the adjustment tool. 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 adjustment tool.

- Navigation section
- Menu item display

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

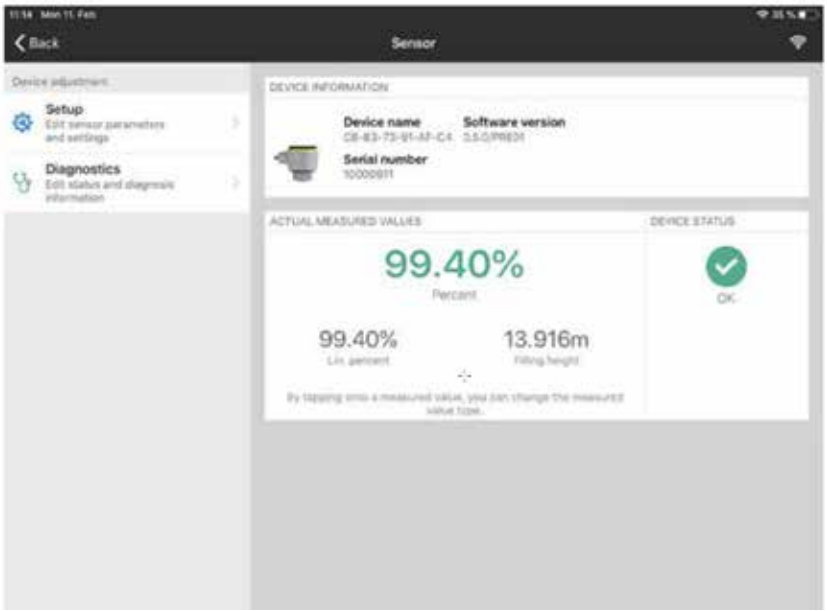


Fig. 16: Example of an app view - Setup sensor adjustment

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.

7 Menu overview

Menu item	Selection	Default settings
Measurement loop name	Alphanumeric characters	Sensor
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), stock-pile (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	**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**

Menu item	Selection	Default settings
Damping	Integration time	0 s
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	-
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, take measures 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
F013 No measured value available	No measured value in the boot up phase or during operation	Check or correct installation and/or parameter settings Clean the antenna system
F017 Adjustment span too small	Adjustment not within specification	Change adjustment according to the limit values (difference between min. and max. ≥ 10 mm)
F025 Error in the Linearization table	Linearization values are not continuously rising, for example illogical value pairs	Check Linearization table Delete table/Create new
F036 No operable software	Checksum error if software update failed or aborted	Repeat software update Send instrument in for repair
F040 Error in the electronics	Limit value exceeded in signal processing Hardware error	Restart instrument Send instrument in for repair
F080 General software error	General software error	Restart instrument
F105 Determine measured value	The instrument is still in the boot up phase, the measured value could not yet be determined	Wait for the end of the boot up phase Duration up to 3 minutes depending on the measurement environment and parameter settings
F260 Error in the calibration	Checksum error in the calibration values Error in the EEPROM	Send instrument in for repair
F261 Error in the instrument settings	Error during setup False signal suppression faulty Error when carrying out a reset	Repeat setup Reset instrument
F265 Measurement function disturbed	Program sequence of the measuring function disturbed	Device restarts automatically

Function check

Code Text message	Cause	Rectification
C700 Simulation active	A simulation is active	Finish simulation Wait for the automatic end after 60 min.

Out of specification

Code Text message	Cause	Rectification
S600 Impermissible electronics temperature	Temperature of the electronics non-specified range	Check ambient temperature Insulate electronics
S601 Overfilling	Danger of vessel overfilling	Make sure that there is no further filling Check level in the vessel
S603 Impermissible operating voltage	Terminal voltage too low	Check terminal voltage, increase operating voltage

Maintenance

Code Text message	Cause	Rectification
M500 Error in the delivery status		
M501 Error in the delivery status		
M504 Error at a device interface	Hardware defect	Check connections Exchanging the electronics Send instrument for repair
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
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
M508 Data error in program memory Bluetooth controller		
M509 Software update		
M510 No communication with the sensor		

9 Removal

9.1 Disposal

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
– Counter nut (depending on device version)	PP
– Process seal	FKM
Materials, non-wetted parts	
– Housing	PVDF
– Cable entry seal	NBR
– Connection cable	PVC
Weight	
– Instrument	0.7 kg (1.543 lbs)
– Connection cable	0.1 kg/m
Process fitting	Thread G1½, R1½, 1½ NPT
Mounting connection	Thread G1, R1, 1 NPT

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.

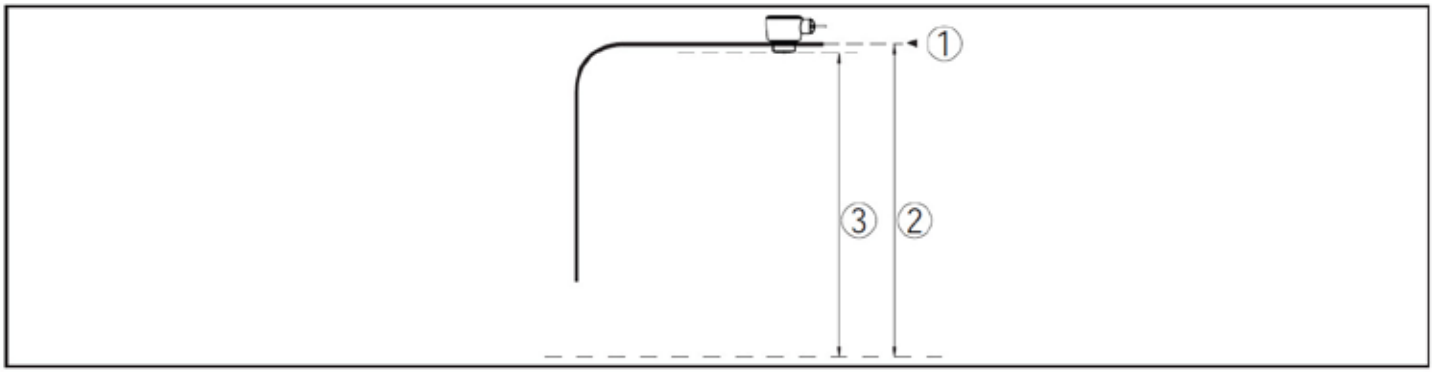


Fig. 17: Measurement Range

1 Reference plane

2 Measured value, max. measuring range

Max. measuring range	15 m (49.21 ft)
Recommended measuring range	up to 10 m (32.81 ft)

Output

- Physical layer	Digital output signal according to standard EIA-485
- Bus specifications	Modbus Application Protocol V1.1b3, Modbus over serial line V1.02
- Data protocols	Modbus RTU, Modbus ASCII, Levelmaster
Max. transmission rate	57.6 Kbit/s

Ambient conditions

Ambient temperature	-40 to +80 °C (-40 to +176 °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 +80 °C (-40 to +176 °F)
Process pressure	-1 to 3 bar (-100 to 200 kPa/-14.5 to 43.51 psig)

Voltage supply	
Operating voltage	8 to 30 V DC
Power	520 mW
Reverse voltage protection	Integrated

Electrical protective measures	
Protection rating	IP66/IP68 (3 bar) according to IEC 60529, Type 4P according. to UL 50
Altitude above sea level	5000 m (16404 ft)
Protection class	III
Pollution degree	4

11.2 Modbus device communication

The necessary device-specific details are shown. You can find further information of Modbus on *www.modbus.org.*

Parameters for the bus communication

The CNCR-130 is preset with the following default values:

Parameter	Configurable Values	Default Value
Baud Rate	1200, 2400, 4800, 9600, 19200	9600
Start Bits	1	1
Data Bits	7, 8	8
Parity	None, Odd, Even	None
Stop Bits	1, 2	1
Address Range Modbus	1 to 255	246

Start bits and data bits cannot be modified.

General configuration of the host

The data exchange with status and variables between field device and host is carried out via registers. For this, a configuration in the host is required. Floating point numbers with short prevision (4 bytes) according to IEEE 754 are transmitted with individually selectable order of the data bytes (byte transmission order). This *"Byte transmission order"* is determined in the parameter *"Format Code".* Hence the RTU knows the registers of the CNCR-130 which must be contacted for the variables and status information.

Format Code	Byte transmission order
0	ABCD
1	CDAB
2	DCBA
3	BADC

11.3 Levelmaster commands

The CNCR-130 is also suitable for connection to the following RTUs with Levelmaster protocol. The Levelmaster protocol is often called *“Siemens” “Tank protocol”.*

RTU	Protocol
ABB Totalflow	Levelmaster
Kimray DACC 2000/3000	Levelmaster
Thermo Electron Autopilot	Levelmaster

Parameters for the bus communication

The CNCR-130 is preset with the default values:

Parameter	Configurable Values	Default Value
Baud Rate	1200, 2400, 4800, 9600, 19200	9600
Start Bits	1	1
Data Bits	7, 8	8
Parity	None, Odd, Even	None
Stop Bits	1, 2	1
Address range Levelmaster	32	32

The Levelmaster commands are based on the following syntax:

- Capital letters are at the beginning of certain data fields
- Small letters stand for data fields
- All commands are terminated with *“<cr>”* (carriage return)
- All commands start with *“Uuu”,* whereby “uu” stands for the address (00-31)
- “*” can be used as a wild card for any position in the address. The sensor always converts this in its address. In case of more than one sensor, the wild card must not be used, because otherwise several slaves will answer
- Commands that modify the instrument return the command with *“OK“. “EE-ERROR”* replaces “OK” if there was a problem changing the configuration

Report Level (and Temperature)

	Parameter	Length	Code/Data
Request:	Report Level (and Temperature)	4 characters ASCII	Uuu?
Response:	Report Level (and Temperature)	24 characters ASCII	UuuDlll.llFtttEeeeeWwwww uu = Address lll.ll = PV in inches ttt = Temperature in Fahrenheit eeee = Error number (0 no error, 1 level data not readable) wwww = Warning number (0 no warning)

PV in inches will be repeated if “Set number of floats” is set to 2. Hence 2 measured values can be transmitted. PV value is transmitted as first measured value, SV as second measured value.

Information:

The max. value for the PV to be transmitted is 999.99 inches (corresponds to approx. 25.4 m).

If the temperature should be transmitted in the Levelmaster protocol, then TV must be set in the sensor to temperature.

PV, SV and TV can be adjusted via the sensor DTM.

Report Unit Number

	Parameter	Length	Code/Data
Request:	Report Unit Number	5 characters ASCII	U**N?
Response:	Report Level (and Temperature)	6 characters ASCII	UuuNnn

Assign Unit Number

	Parameter	Length	Code/Data
Request:	Assign Unit Number	6 characters ASCII	UuuNnn
Response:	Assign Unit Number	6 characters ASCII	UuuNOK uu = new Address

Set number of Floats

	Parameter	Length	Code/Data
Request:	Set number of Floats	5 characters ASCII	UuuFn
Response:	Set number of Floats	6 characters ASCII	UuuFOK

If the number is set to 0, no level is returned

Set Baud Rate

	Parameter	Length	Code/Data
Request:	Set Baud Rate	8 (12) characters ASCII	UuuBbbbb[b][pds] Bbbbb[b] = 1200, 9600 (default) pds = parity, data length, stop bit (optional) parity: none = 81, even = 71 (default), odd = 71
Response:	Set Baud Rate	11 characters ASCII	

Example: U01B9600E71

Change instrument on address 1 to baudrate 9600, parity even, 7 data bits, 1 stop bit

Set Receive to Transmit Delay

	Parameter	Length	Code/Data
Request:	Set Receive to Transmit Delay	7 characters ASCII	UuuRmmm mmm = milliseconds (50 up to 250), default = 127 ms
Response:	Set Receive to Transmit Delay	6 characters ASCII	UuuROK

Report Number of Floats

	Parameter	Length	Code/Data
Request:	Set Receive to Transmit Delay	4 characters ASCII	UuuF
Response:	Set Receive to Transmit Delay	5 characters ASCII	UuuFn n = number of measurement values (0, 1 or 2)

Report Receive to Transmit Delay

	Parameter	Length	Code/Data
Request:	Report Receive to Transmit Delay	4 characters ASCII	UuuR
Response:	Report Receive to Transmit Delay	7 characters ASCII	UuuRmmm mmm = milliseconds (50 up to 250), default = 127 ms

Error codes

Error Code	Name
EE-Error	Error While Storing Data in EEPROM
FR-Error	Erorr in Frame (too short, too long, wrong data)
LV-Error	Value out of limits

11.4 Modbus register

Holding Register

The Holding registers consist of 16 bits. They can be read and written. Before each command, the address (1 byte), after each command, a CRC (2 byte) is sent.

Register Name	Register Number	Type	Configurable Values	Default Value	Unit
Address	200	Word	1 to 255	246	–
Baud Rate	201	Word	1200, 2400, 4800, 9600,19200, 38400, 57600	9600	–
Parity	202	Word	0 = None, 1 = Odd, 2 =Even	0	–
Stopbits	203	Word	1 = None, 2 = Two	1	–
Delay Time	206	Word	10 to 250	50	ms
Byte Oder (Floating point format)	300	Word	0, 1, 2, 3	0	–

Input register

The input registers consist of 16 bits. They can only be read. The address (1 byte) is sent before each command, a CRC (2 bytes) after each command. PV, SV, TV and QV can be set via the sensor DTM.

Register Name	Register Number	Type	Note
Status	100	DWord	Bit 0: Invalid Measurement Value PV Bit 1: Invalid Measurement Value SV Bit 2: Invalid Measurement Value TV Bit 3: Invalid Measurement Value QV
PV Unit	104	DWord	Unit Code
PV	106		Primary Variable in Byte Order CDAB
SV Unit	108	DWord	Unit Code
SV	110		Secondary Variable in Byte Order CDAB
TV Unit	112	DWord	Unit Code
TV	114		Third Variable in Byte Order CDAB
QV Unit	116	DWord	Unit Code
QV	118		Quarternary Variable in Byte Order CDAB
Status	1300	DWord	See Register 100
PV	1302		Primary Variable in Byte Order of Register 3000
SV	1304		Secondary Variable in Byte Order of Register 3000
TV	1306		Third Variable in Byte Order of Register 3000
QV	1308		Quarternary Variable in Byte Order of Register 3000

Register Name	Register Number	Type	Note
Status	1400	DWord	See Register 100
PV	1402		Primary Variable in Byte Order CDAB
Status	1412	DWord	See Register 100
SV	1414		Secondary Variable in Byte Order CDAB
Status	1424	DWord	See Register 100
TV	1426		Third Variable in Byte Order CDAB
Status	1436	DWord	See Register 100
QV	1438		Quarternary Variable in Byte Order CDAB
Status	2000	DWord	See Register 100
PV	2002	DWord	Primary Variable in Byte Order ABCD (Big Endian)
SV	2004	DWord	Secondary Variable in Byte Order ABCD (Big Endian)
TV	2006	DWord	Third Variable in Byte Order ABCD (Big Endian)
QV	2008	DWord	Quarternary Variable in Byte Order ABCD (Big Endian)
Status	2100	DWord	See Register 100
PV	2102	DWord	Primary Variable in Byte Order DCBA (Little Endian)
SV	2104	DWord	Secondary Variable in Byte Order DCBA (Little Endian)
TV	2106	DWord	Third Variable in Byte Order ABCD DCBA (Little Endian)
QV	2108	DWord	Quarternary Variable in Byte Order DCBA (Little Endian)
Status	2200	DWord	See Register 100
PV	2202	DWord	Primary Variable in Byte Order BACD (Middle Endian)
SV	2204	DWord	Secondary Variable in Byte Order BACD (Middle Endian)
TV	2206	DWord	Third Variable in Byte Order BACD (Middle Endian)
QV	2208	DWord	Quarternary Variable in Byte Order BACD (Middle Endian)

Unit Codes for Register 104, 108, 112, 116

Unit Code	Measurement Unit
32	Degree Celsius
33	Degree Fahrenheit
40	US Gallon
41	Liters
42	Imperial Gallons
43	Cubic Meters
44	Feet
45	Meters
46	Barrels

Unit Code	Measurement Unit
47	Inches
48	Centimeters
49	Millimeters
111	Cubic Yards
112	Cubic Feet
113	Cubic Inches

11.5 Modbus RTU commands

FC3 Read Holding Register

With this command, any number (1-127) of holding registers is read out. The start register and the number of registers are transmitted.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x03
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	2 Bytes	1 to 127 (0x7D)
Response:	Function Code	1 Byte	0x03
	Start Address	2 Bytes	2*N
	Register Value	N*2 Bytes	Data

FC4 Read Input Register

With this command, any number (1-127) of input registers is read out. The start register and the number of registers are transmitted.

	Parameter	**Length**	**Code/Data**
Request:	Function Code	1 Byte	0x04
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	N*2 Bytes	1 to 127 (0x7D)
Response:	Function Code	1 Byte	0x04
	Start Address	2 Bytes	2*N
	Register Value	N*2 Bytes	Data

FC6 Write Single Register

This function code is used to write to a single Holding Register.

	Parameter	**Length**	**Code/Data**
Request:	Function Code	1 Byte	0x06
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Number of Registers	2 Bytes	Data

	Parameter	Length	Code/Data
Response:	Function Code	1 Byte	0x04
	Start Address	2 Bytes	2*N
	Register Value	2 Bytes	Data

FC8 Diagnostics

With this function code different diagnostic functions are triggered or diagnostic values are read.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x08
	Sub Function Code	2 Bytes	
	Data	N*2 Bytes	Data
Response:	Function Code	1 Byte	0x08
	Sub Function Code	2 Bytes	
	Data	N*2 Bytes	Data

Implemented function codes:

Sub Function Code	Name
0x00	Return Data Request
0x0B	Return Message Counter

With sub function codes 0x00 only one 16 bit value can be written.

FC16 Write Multiple Registers

This function code is used to write to several Holding Registers. In a request, it can only be written to registers that are in direct succession.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x10
	Start Address	2 Bytes	0x0000 to 0xFFFF
	Register Value	2 Bytes	0x0001 to 0x007B
	Byte Number	1 Byte	2*N
	Register Value	N*2 Bytes	Data
Response:	Function Code	1 Byte	0x10
	Sub Function Code	2 Bytes	0x0000 to 0xFFFF
	Data	2 Bytes	0x01 to 0x7B

FC17 Report Slave ID

With this function code, the Slave ID is queried.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x11
Response:	Function Code	1 Byte	0x11
	Byte Number	1 Byte	
	Slave ID	1 Byte	
	Run Indicator Status	1 Byte	

FC43 Sub 14, Read Device Identification

With this function code, the Device Identification is queried.

	Parameter	Length	Code/Data
Request:	Function Code	1 Byte	0x2B
	MEI Type	1 Byte	0x0E
	Read Device ID Code	1 Byte	0x01 to 0x04
	Object ID	1 Byte	0x00 to 0xFF
Response:	Function Code	1 Byte	0x2B
	MEI Type	1 Byte	0x0E
	Read Device ID Code	1 Byte	0x01 to 0x04
	Conformity Level	1 Byte	0x01, 0x02, 0x03, 0x81, 0x82, 0x83
	More follows	1 Byte	00/FF
	Next Object ID	1 Byte	Object ID number
	Number of Objects	1 Byte	
	List of Object ID	1 Byte	
	List of Object length	1 Byte	
	List of Object value	1 Byte	Depending on the Object ID

11.6 Configuration of typical Modbus hosts

Fisher ROC 809

With this command, any number (1-127) of holding registers is read out. The start register and the number of registers are transmitted.

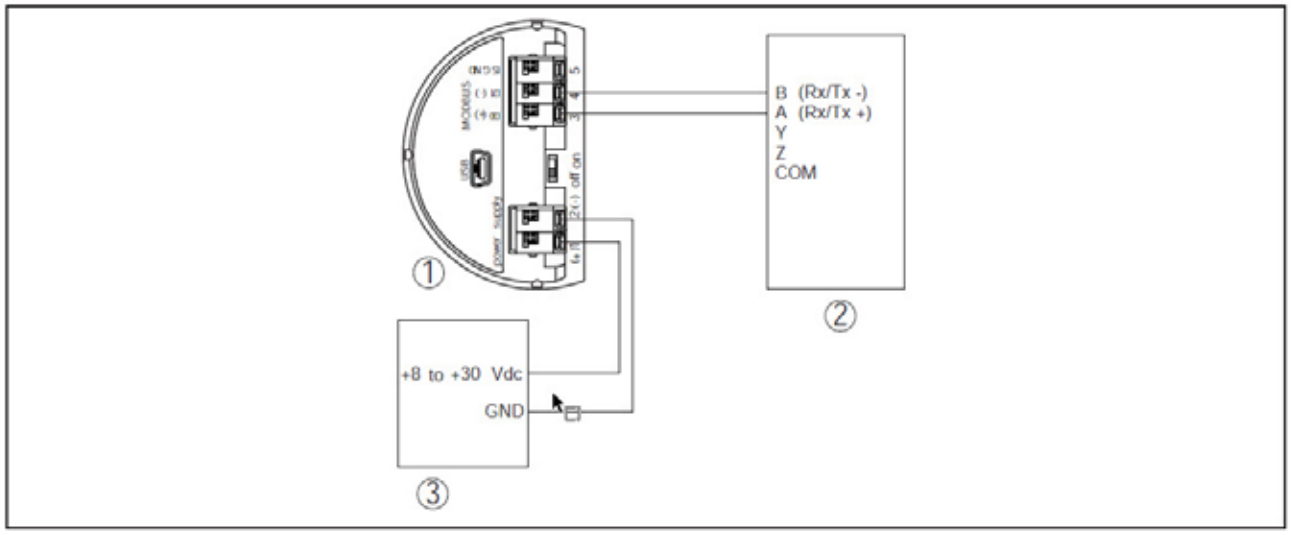


Fig. 18: Connection of CNCR-130 to RTU Fisher ROC 809

1 CNCR-130
2 RTU Fisher ROC 809
3 Voltage supply

Parameters for Modbus Hosts

Parameter	Value Fisher ROC 809	Value ABB Total Flow	Value Fisher Thermo Electron Autopilot	Value Fisher Bristol Control Wave Micro	Value Scada-Pack
Baud Rate	9600	9600	9600	9600	9600
Floating Point Format Code	0	0	0	2	(FC4) 0
RTU Data Type	Conversion Code 66	16 Bit M odicon	IEE Fit 2R	32-bit registers as 2 16-bit registers	Floating Point
Input Register Base Number	0	1	0	1	30001

The basic number of the input registers is always added to the input register address of CNCR-130. This results in the following constellations:

- Fisher ROC 809 - Register address for 1300 is address 1300

- ABB Total Flow - Register address for 1302 is address 1303
- Thermo Electron Autopilot - Register address for 1300 is address 1300
- Bristol ControlWave Micro - Register address for 1302 is address 1303
- ScadaPack - Register address for 1302 is address 31303

11.7 Dimensions

CNCR-120

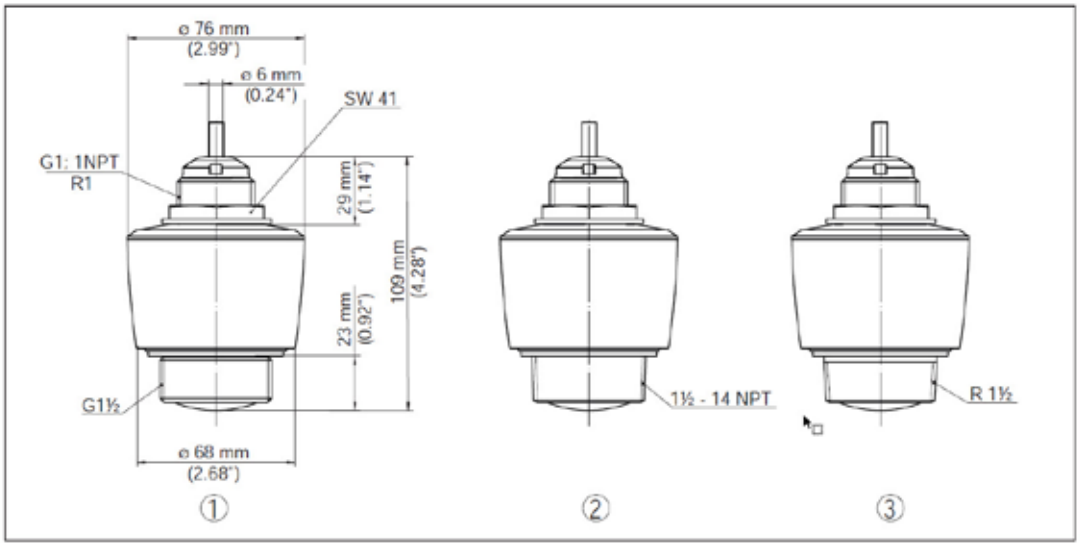


Fig. 19: Dimensions CNCR-120
1 Thread G1½
2 Thread 1½ NPT
3 Thread R1½

CNCR-130

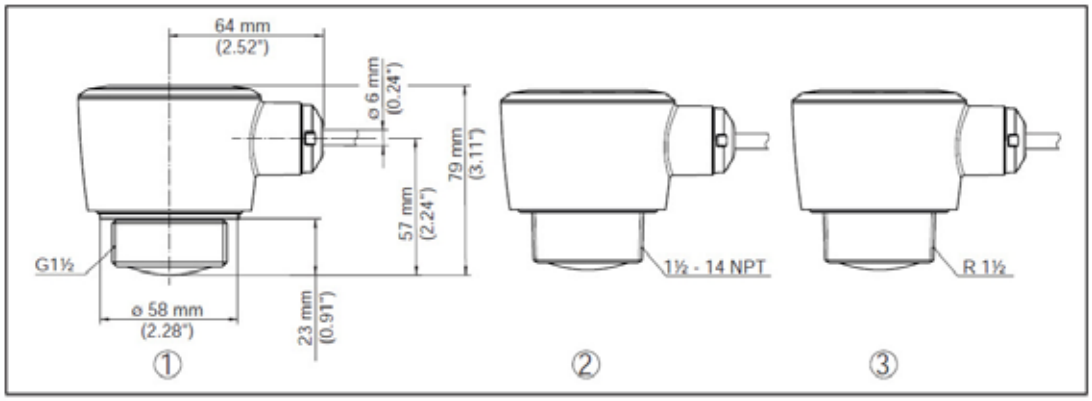


Fig. 20: Dimensions CNCR-130
1 Thread G1½
2 Thread 1½ NPT
3 Thread R1½

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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