EN

Competence in Solids

SWR engineering

Nico 15/30

Radar sensor for the continuous level measurement of solids

Operating Instructions

SWR engineering Messtechnik GmbH

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Safety instructions for potentially explosive atmospheres

Refer to the specific explosion protection instructions for use in potentially explosive atmospheres. These are an integral part of the operating instructions and are supplied with every device licensed for operation in potentially explosive atmospheres.

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1. About this document

1.1 Function

This operating instructions provides you with the information you need for the installation, connection and setup work and also contains important information about maintenance and troubleshooting.
You should therefore read it carefully before setup and keep it as an integral part of the product in the immediate vicinity of the device so that it is accessible at all times.

1.2 Target group

This operating instructions is aimed at trained personnel.
The content of this manual must be made accessible to the personnel and implemented by them.

1.3 Symbols used

Information, Tip, Note
This symbol is used to mark helpful additional information.

Caution Failure to observe this warning may result in faults or malfunctions.

Warning Failure to observe this warning may result in personal injury and/or serious damage to the device.

Danger Failure to observe this warning may result in serious personal injury and/or the destruction of the device.

Applications in potentially explosive atmospheres
This symbol is used to mark special information for applications in potentially explosive atmospheres.

- **List**
The initial dot denotes a list with no binding order.

→ **Action**
This arrow denotes a single action.

1 **Action sequence**
Preceding numbers denote actions to be performed in sequence.

Battery disposal
This symbol is used to mark special information for the disposal of batteries.

2. For your safety

2.1 Authorised personnel

All the actions described in this operating instructions may only be carried out by trained personnel who have been authorised by the system owner/operator.
The requisite personal protection equipment must be worn at all times when work on and with the device.

2.2 Intended use

The Nico 15/30 is a sensor for the continuous measurement of fill levels.
Detailed information about its area of application is provided in the section entitled "*Product description*".
The device is only safe to use if it is used for the purpose for which it is intended and as described in the operating instructions and any supplementary manuals.

2.3 Warning about misuse

If the device is not used correctly or is used for purposes other than that for which it is intended, it may cause danger, for example the overflow of the vessel or damage to system parts due to incorrect installation or setting.

2.4 General safety information

The device is state of the art and complies with the relevant directives and regulations. It may only be used if it is in perfect technical condition and safe. The owner/operator is responsible for the trouble-free device operation.

The owner/operator also undertakes to establish the compliance of the required safety measures with the latest version of the relevant regulations throughout the service life of the device and to comply with any new directives.

The user must comply with the safety instructions in this operating instructions, national installation standards and the latest safety and accident prevention regulations.

For safety and warranty reasons, any work which goes beyond the action described in this operating instructions may only be carried out by trained personnel who have been authorised by the manufacturer. Unauthorised modifications or changes are expressly prohibited.

In addition the safety symbols and information on the device must be observed.

Depending on the version of the device, the transmission frequencies of the radar sensors may be in the C or K band range.
The low transmission power requirements are well below the internationally permitted limit values.
If used correctly the device is not expected to cause any health problems.

2.5 CE conformity

The device satisfies the requirements of the relevant EC directives. We confirm that it has been tested successfully by applying the CE mark.

The device is designed for use in an industrial environment.
During such operation cable-based and radiated interference must be expected as is normal from a Class A device to EN 61326-1.
If the device is used in a different environment, its electromagnetic compatibility with other devices must be ensured by taking suitable precautions.

2.6 Radio approval for Europe

The device is approved for use in sealed vessels pursuant to EN 302372-1/2 (2006-04).

3. Product description

3.1 How it works

Range of application

The Nico 15/30 is a radar sensor for the continuous measurement of solids even in difficult process conditions. It is ideal for measuring fill levels in tall silos and large bunkers.

Function principle

Short radar pulse with a duration of approx. 1 ms are transmitted by the radar sensor antenna. These are reflected by the solids and received by the antenna in the form of echoes. The time taken by the radar pulse from transmission to reception is the distance and therefore proportionate to the fill level. The fill level found in this way is converted into a corresponding output signal and output as a measurement value.

Quick start

The quick start enables you to start the device quickly for many applications.
See the relevant sections of the operating instructions for further information.

Installation

1. Distance from the vessel wall ＞200 mm, the antenna should project into the vessel by more than 10 mm.

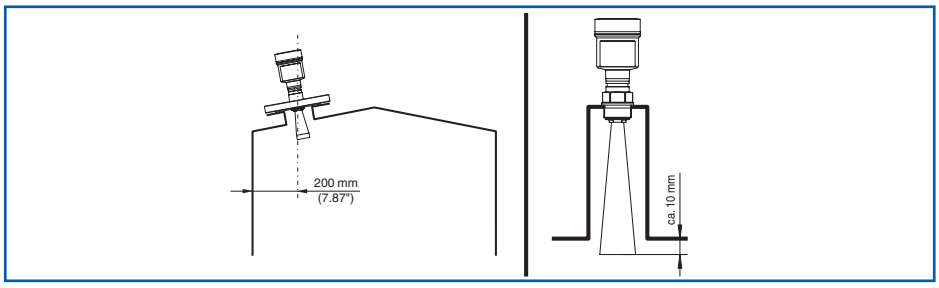


Fig. 1: Distances between the antenna and the vessel wall / roof

2. Ensure that you do not fall below the minimum socket diameter depending on the socket length.
3. Follow the sealing instructions.

For further information see the section entitled "*Installation*".

Electrical connection

1. Ensure that the voltage supply is identical to the details on the model plate.
2. Connect the device as shown in the following figure:

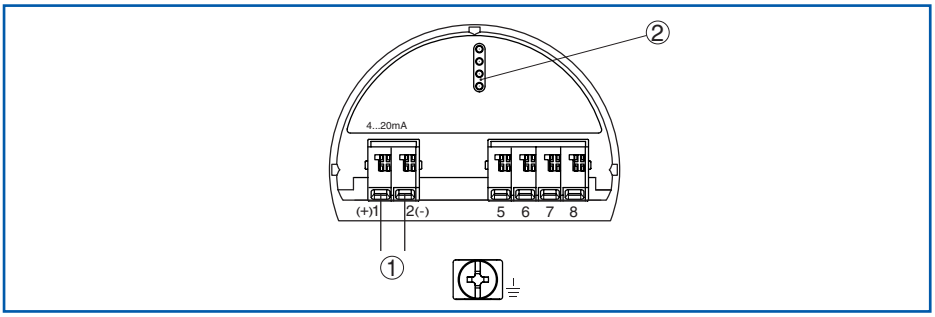
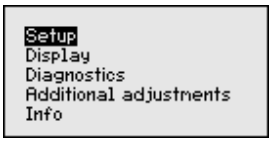


Fig. 2: Connection chamber for twin chamber housing for mains voltage
1 Internal connection to connection chamber
2 For display and control module or interface adapter

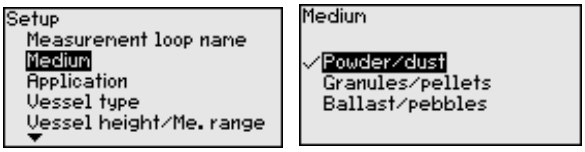
For further information see the section entitled "*Connect to the voltage supply*".

Set the parameters

1. Go to the "*Setup*" menu using the display and control module.

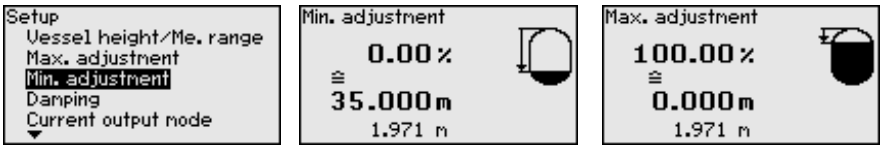


2. Using the "*Medium*" menu point select the medium for your application, for example "*Powder / Dust*".



3. In the "*Application*" menu select the application and the vessel form, for example storage tank.

4. Complete the adjustment in the "*Min. adjustment*" and "*Max. adjustment*" menu points.



Example parameterisation

The radar sensor is a distance measuring instrument and as such measures the distance from the sensor to the surface of the solids. To display the actual fill level the measured distance must be assigned to the percentage height.

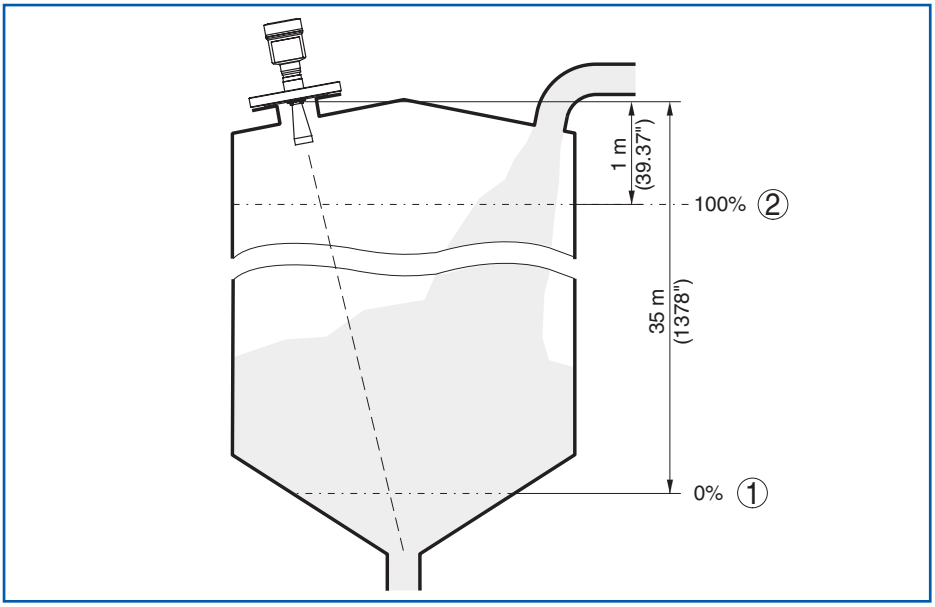


Fig. 3: Parameterisation example

1 Min. level ≙ max. measuring distance
2 Max. level ≙ min. measuring distance

For this adjustment the distance must be entered for the minimum and maximum fill level. If you do not know these values, it is also possible to make the adjustment using distances, for example of 10 % and 50 %. The starting point for these distance details is always the sealing surface of the thread or flange.

Further steps

1. Set the required damping of the output signal in the "Additional adjustments" menu, "*Damping*" menu point.
2. Select the output curve in the "*Current output*" menu point.

This completes the quick start process. For further information see the section entitled "*Parameterisation*".

4. Installation

4.1 General instructions

Securing

On devices with a process connection thread the hexagon must be tightened using suitable tools.

Warning
Do not use the housing for securing purposes. Tightening may damage the rotary mechanism of the housing.

Moisture

Use the recommended cables (see section entitled "*Connect to the voltage supply*") and secure the cable screw connection.

You can also protect your device from the ingress of moisture by routing the connection cable downwards in front of the cable screw connection. This will allow rainwater and condensation to drip off it.
This particularly applies if the device is installed outdoors, in rooms in which moisture occurs (for example by cleaning processes) or on cooled or heated vessels.

Suitability for the process conditions

Ensure that all the parts of the devices in the process, particularly the measuring part, process seal and process connection are suitable for the process conditions they are likely to encounter. These conditions particular include the process pressure, process temperature and the chemical properties of the media.

Details of these are set out in the section entitled "*Technical data*" and on the model plate.

4.2 Installation preparations – horn antenna

The device is also supplied in versions in which the antenna has a larger diameter than the process connection (thread or flange). Before installation, therefore, the antenna must be removed from the process connection. Proceed as follows:

1. Undo the Allen bolts (3) on the antenna base socket using an Allen key (size 3).
2. Remove the antenna (4).

Note:
The plastic cone must not be pulled out of the antenna socket.

3. Push the antenna into the vessel socket from underneath and secure it to prevent it falling.
4. Resecure the antenna to the antenna socket using the Allen bolts; max. tightening torque 2.5 Nm (1.8 lbf ft)

Note:
The radar sensor with a purge air connection or an antenna extension has a mark on the antenna socket. This marking notch must line up with the marking on the process connection (the marking indicates the position of the plane polarisation of the radar signal).

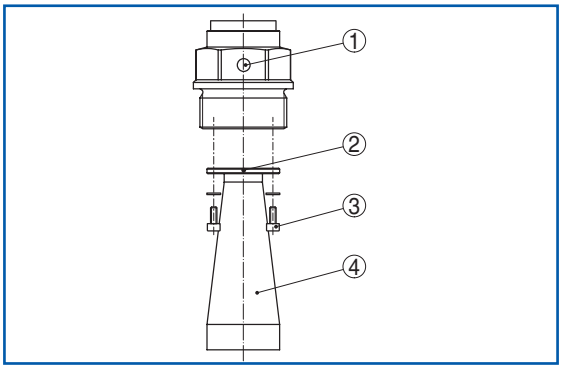


Fig. 4: Removing the horn antenna
1 Mark for the plane polarisation
2 Mark on the antenna socket
3 Allen bolts on the antenna socket
4 Antenna

4.3 Installation instructions

Polarisation

The radar pulses transmitted by the radar sensor are electromagnetic waves. The plane polarisation is the direction of the electrical content. By turning the device in the connection flange or screw-in socket, the polarisation can be used to reduce the effects of interference echoes.

The location of the plane polarisation is marked on the devices process connection.

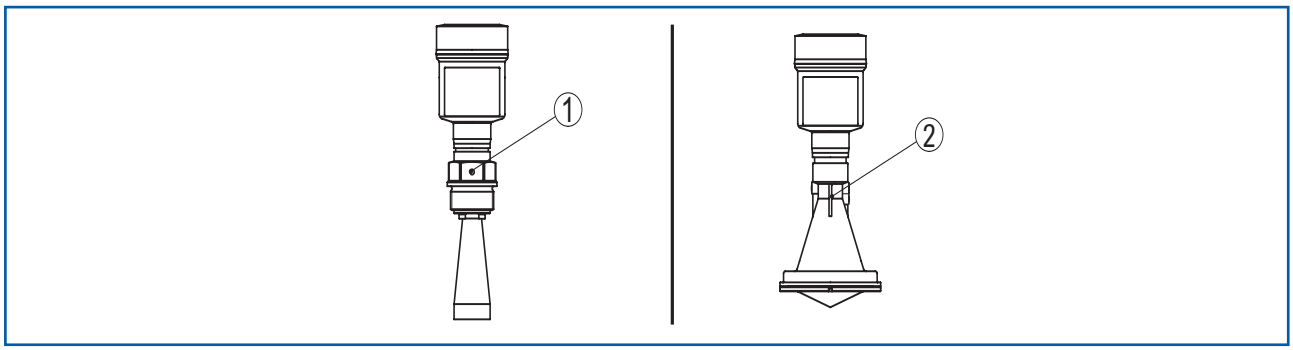


Fig. 5: Location of the plane polarisation
1 Mark on the threaded version
2 Marking bar

Installation position

Install the sensor in a position which is at least 200 mm from the vessel wall.

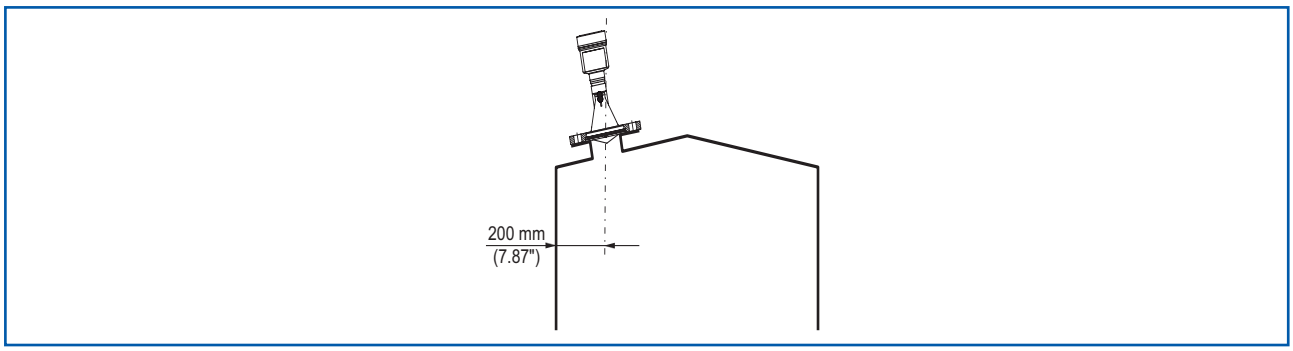


Fig. 6: Radar sensor installation in the vessel roof

If you are unable to install it this far away from the wall, you should save the interference signal during the commissioning procedure. This particularly applies if you expect material to accumulate on the vessel wall. In this case we recommend that process of saving the interference signal is repeated at a later date when material has accumulated.

Inflowing solids

The installation must not be too close to the inflow of solids since they could otherwise cause microwave signal interference. The perfect installation position is opposite the filling point.
To prevent heavy built-up it should be placed as far as possible from a filter or dust extractor.

4.4 Installation bar

Installation bar (Nico 15)

The installation bar allows the sensors to be installed easily on the silo wall or roof. It is suitable for installation on walls, roofs or an arm. Above all for open vessels this is a very simple and effective way of aligning the sensor to the surface of the solids.

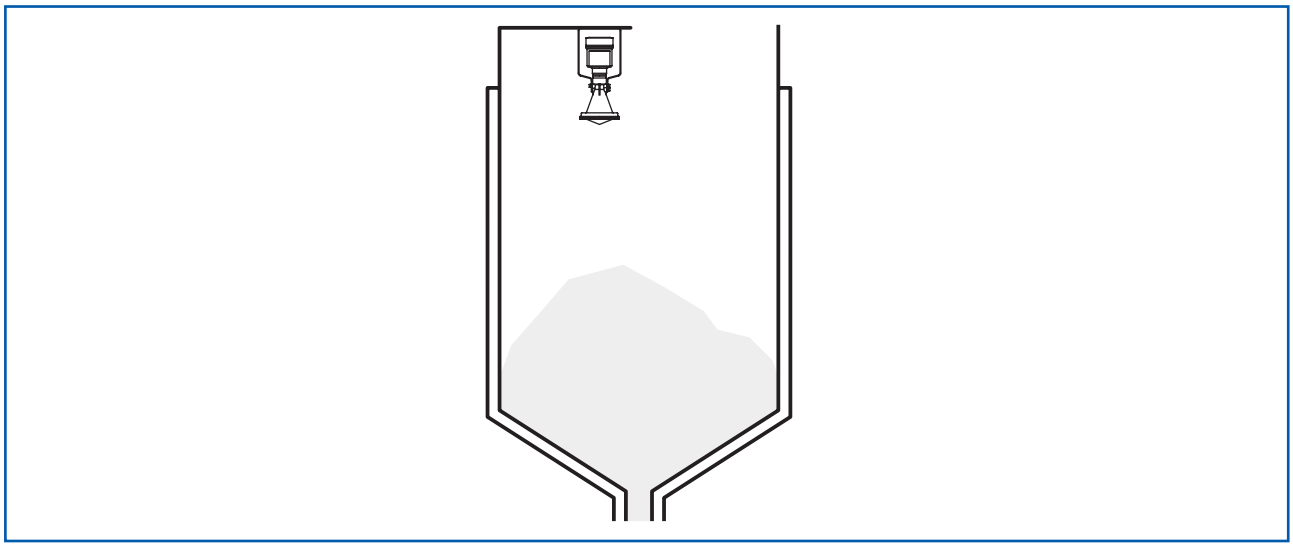


Fig. 7: Radar sensor with installation bar

The bar is supplied loose and must be mounted on the sensor before commissioning using the three Allen bolts M5 x 10 and spring washers. For details of the maximum tightening torque see the section entitled "*Technical data*". Tools required: Allen key, size 4

There are two methods of securing the bar to the sensor.
Depending on the method you choose the sensor can be swung in the bar as follows:

Single-chamber housing
- Tilt angle 180°, infinite
- Tilt angle in three settings 0, 90° and 180°

Single-chamber housing
- Tilt angle 90°, infinite
- Tilt angle in two settings 0 and 90°

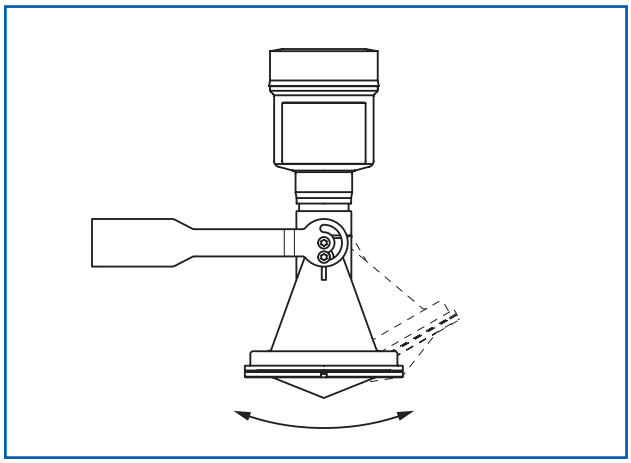


Fig. 8: Adjusting the tilt angle

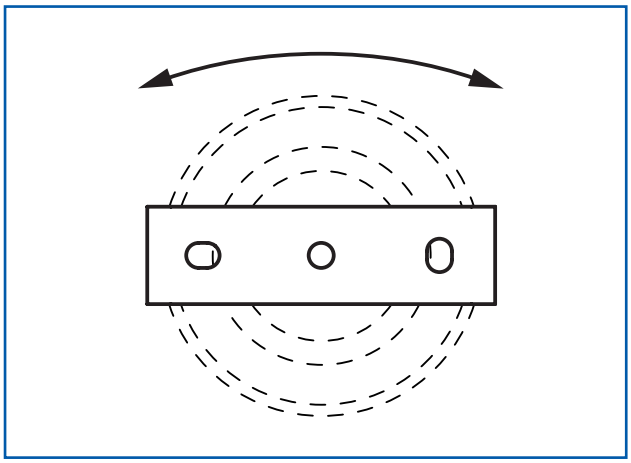


Fig. 9: Turning when secured in the centre

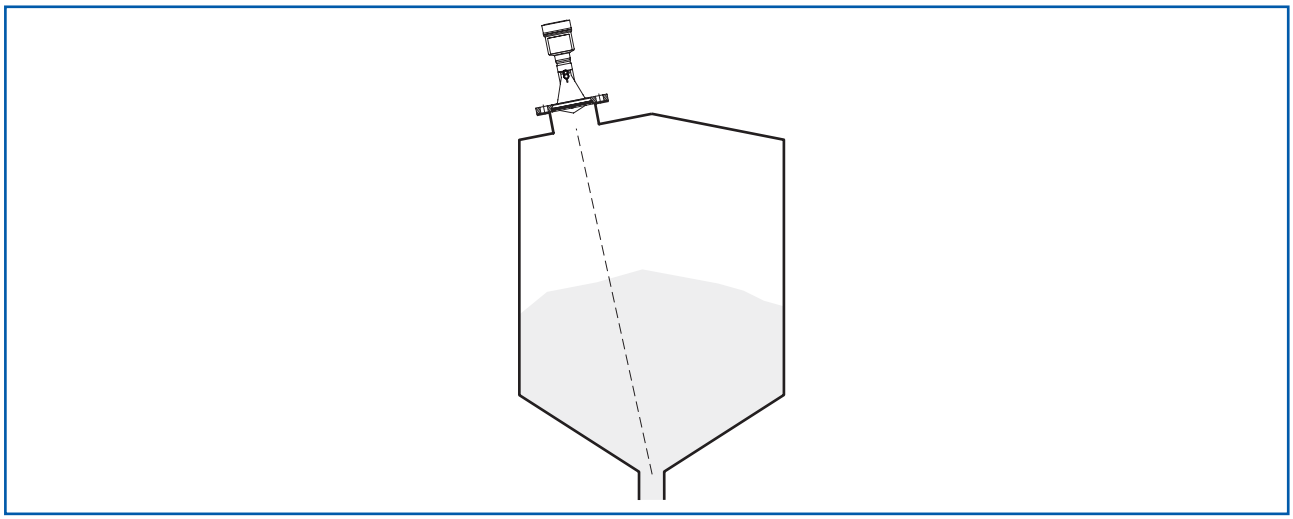


Fig. 10: Alignment in silos

Alignment

To ensure that the sensor can cover as much of vessel volume as possible the sensor should be aligned so that the measuring beam reaches the lowest vessel level, in other words the discharge.

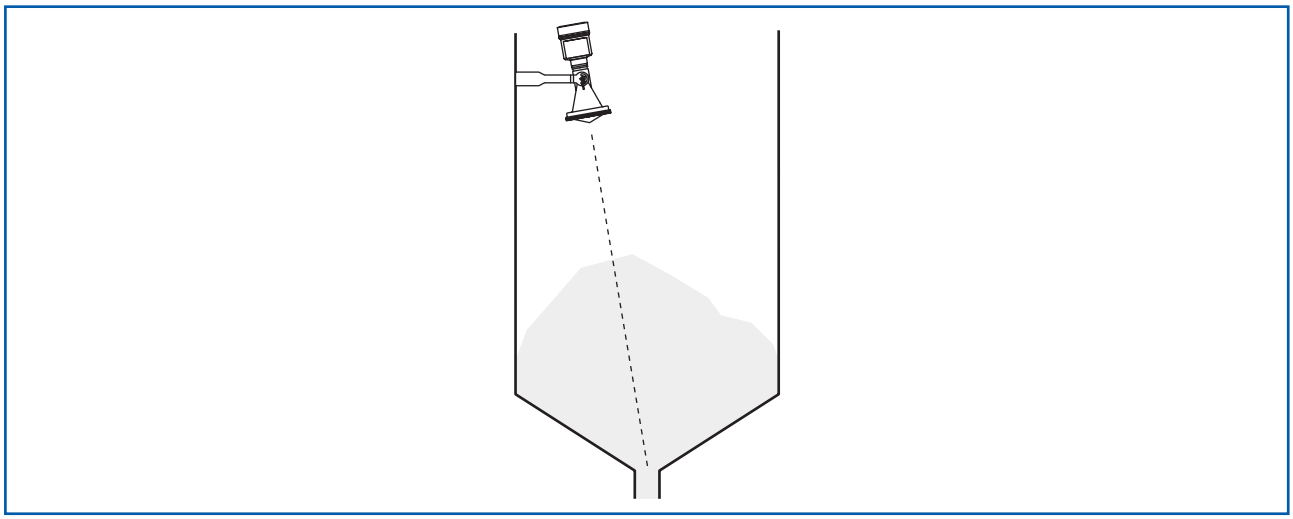


Fig. 11: Installation in an open vessel

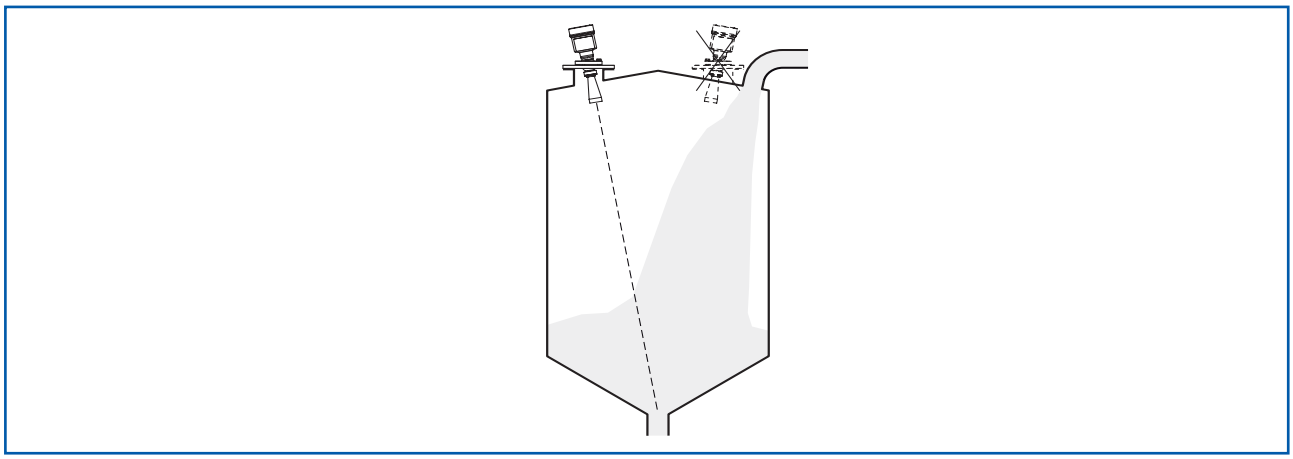


Fig. 12: Radar sensor installation with inflowing solids

The sensor must not be installed in the stream of inflowing solids in silos with a side pneumatic filling system since the microwave signal will otherwise suffer interference. To prevent heavy built-up it should be placed as far as possible from a filter or dust extractor.

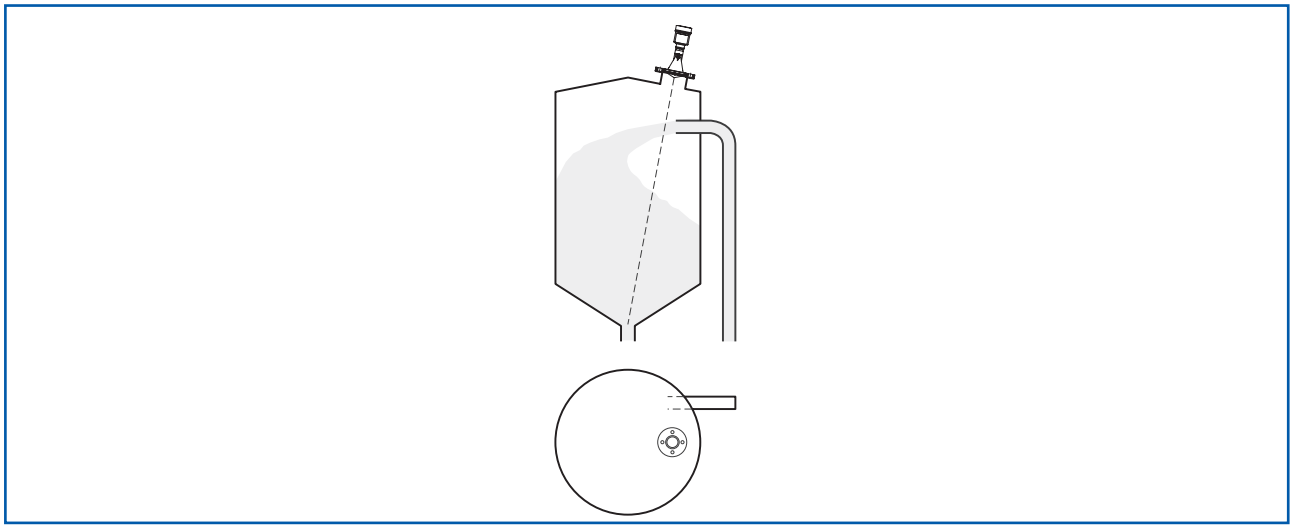


Fig. 13: Radar sensor installation with inflowing solids

Socket for plastic antenna

A union flange for DN 80 and a suitable adapter flange are available for installing the Nico 15 on a socket.

The collar flange may be mounted directly above the housing on the aluminium single-chamber housing version. Retrofitting is not possible on the aluminium twin-chamber housing version, the type of installation must be defined in the purchase order.

Information

The socket should be as short as possible and the end of the socket should be rounded. This will minimise the interference reflections through the vessel socket.

Socket for horn antenna

Ideally you should design the pipe socket so that the edge of the antenna projects slightly out of the socket.

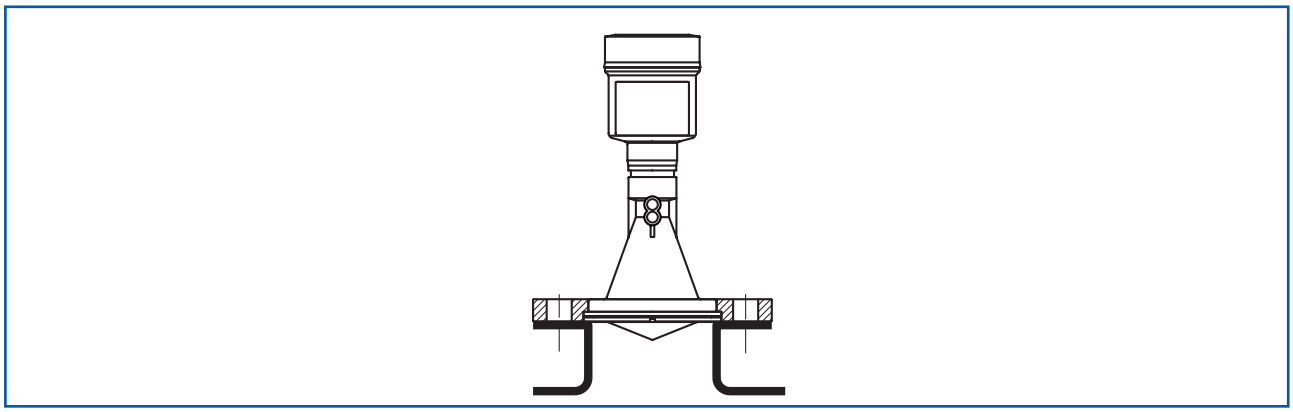


Fig. 14: Recommended pipe socket installation

If the solids have good reflective properties you can also install the Nico 15 on longer pipe sockets. Guide values for socket heights are shown in the figure below. After this you must also save the interference signal.

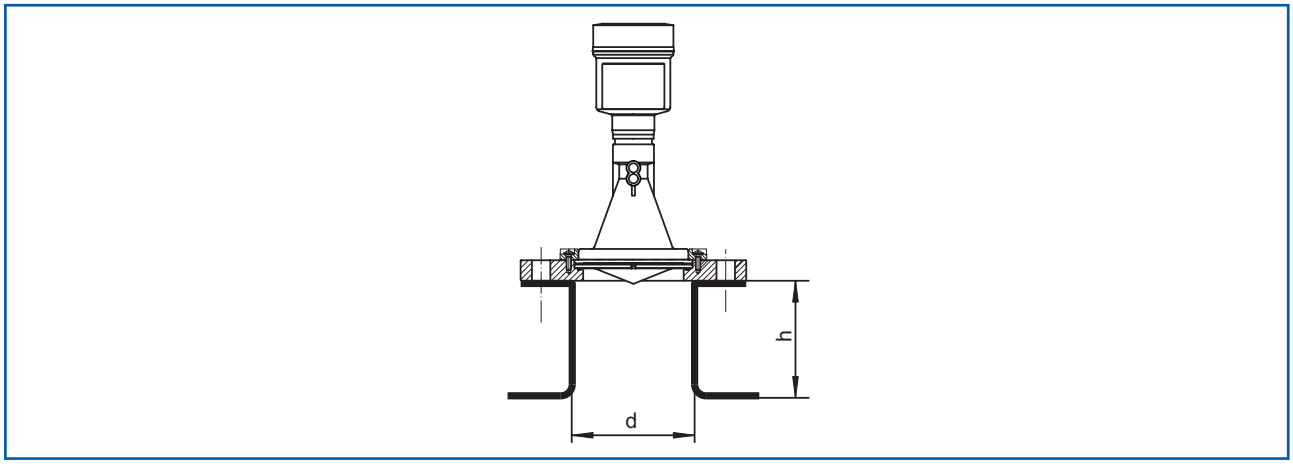


Fig. 15: Installation with a longer socket

The tables below show the maximum pipe socket length h dependent on the diameter d.

Socket diameter d	**Socket length h**
80 mm	300 mm
100 mm	400 mm
150 mm	500 mm

Tip:
For new systems it is a good idea to angle the vessel socket towards the discharge. This results in less interference reflection from the vessel wall and measurements are possible right into the conical discharge.

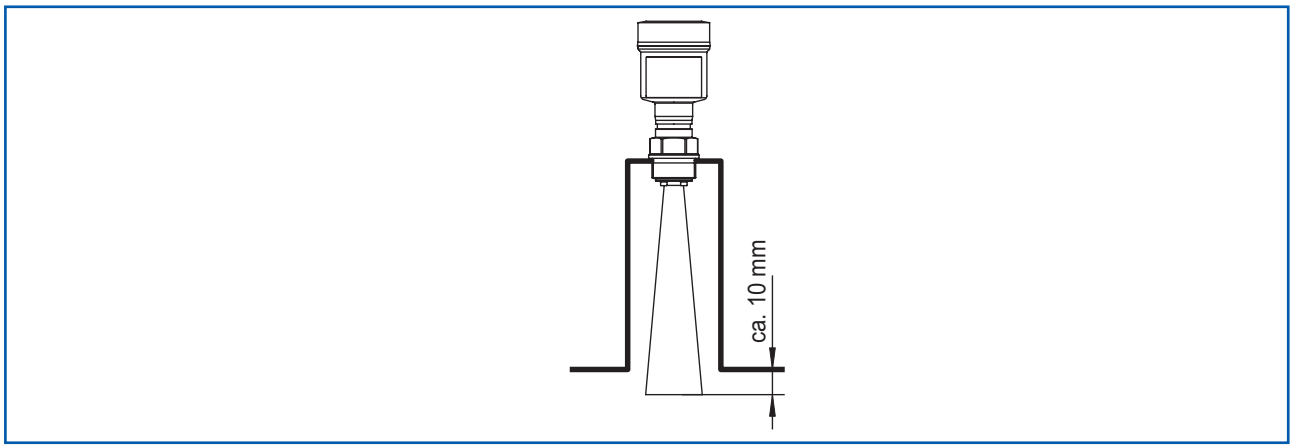


Fig. 16: Recommended pipe socket installation for horn antenna

If a swivel mounting is used, you should note that the distance between the antenna and the socket is reduced by angling the sensor. This may create additional interference reflection which may adversely affect the measurement result for short distances.

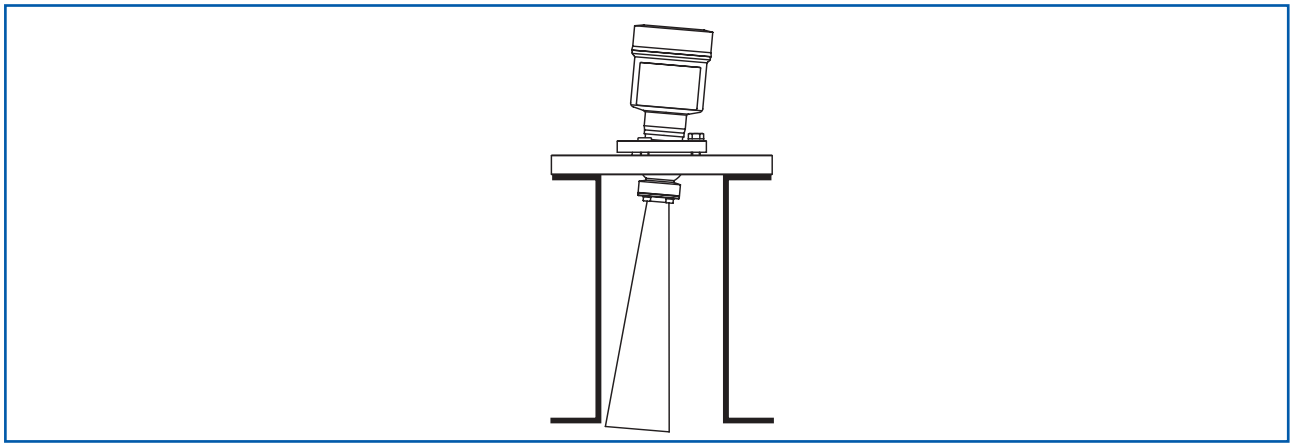


Fig. 17: Distance between the antenna and socket for horn antenna

If the solids have good reflective properties you can also install the Nico 30 with a horn antenna on longer pipe sockets. Guide values for socket heights are shown in the figure below.
After this you must also save the interference signal.

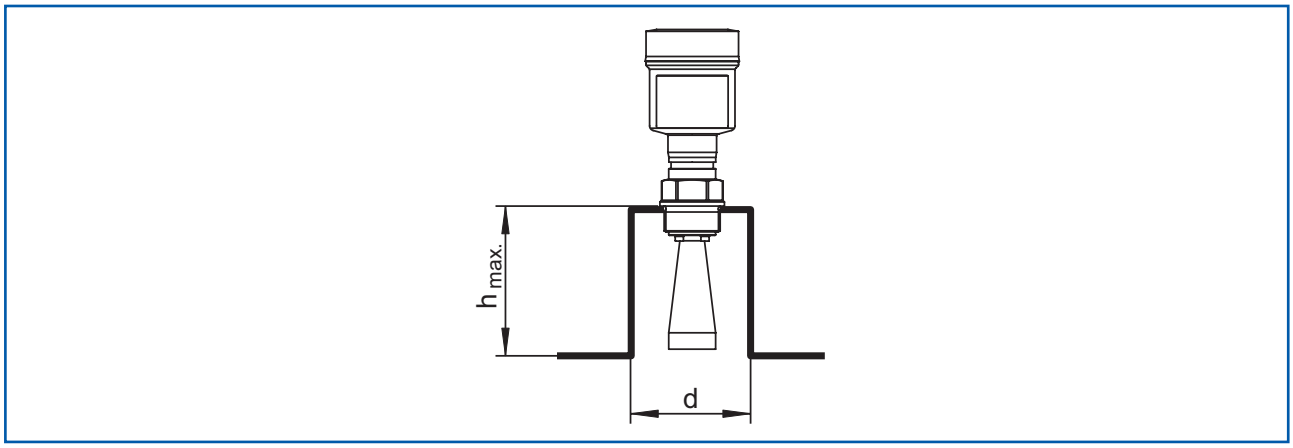


Fig. 18: Different pipe socket dimensions

Socket diameter d	Socket length h
40 mm	100 mm
50 mm	150 mm
80 mm	250 mm
100 mm	500 mm
150 mm	800 mm

Tip:
As an option the device is also available with an antenna extension. This enables the antenna length to be selected ex-works or retrospectively so that the antenna end projects slightly over the end of the socket. However, the antenna extension will also cause interference reflection close to it. This may result in a greater minimum distance, particularly for poorly reflective media such as plastic powder. A clean socket with the socket end rounded if necessary results in less interference in practice than an antenna extension.

Alignment

To ensure that the sensor can cover as much of vessel volume as possible the sensor should be aligned so that the measuring beam reaches the lowest vessel level. In a cylindrical silo with a conical discharge it must be installed on a socket. This should be positioned on one-third to one-half of the vessel radius.

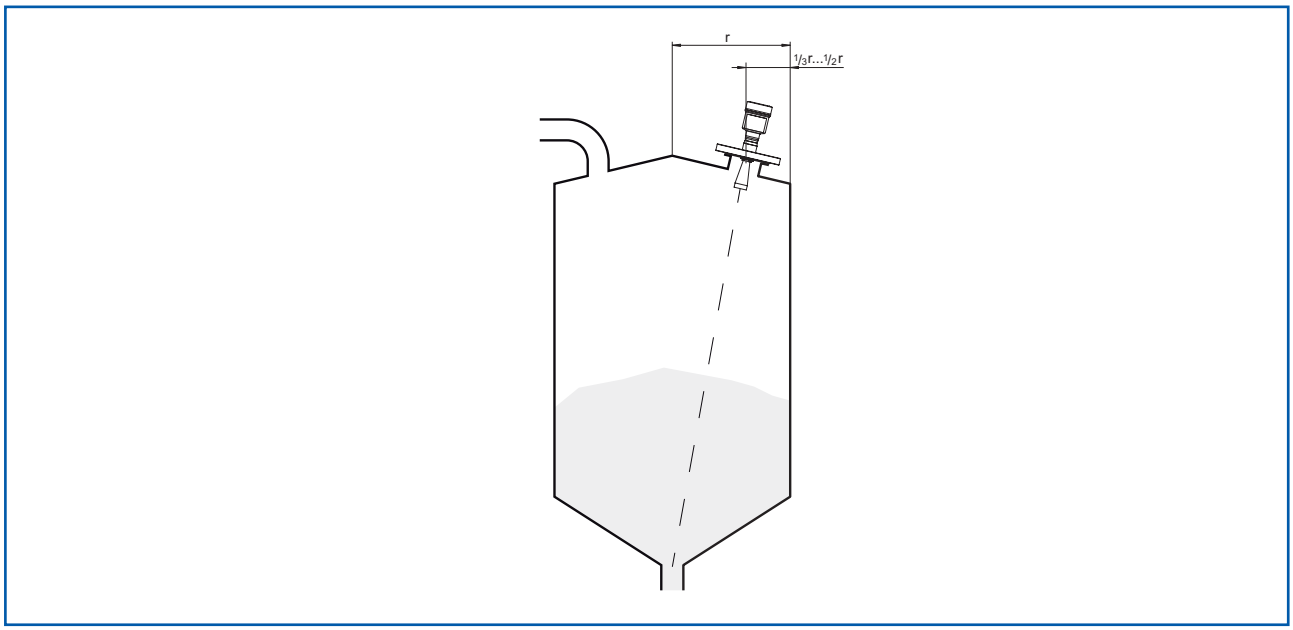


Fig. 19: Alignment

If it is not possible to install the sensor in the centre of the silo, it can be directed towards the centre using an optional pivot-mounted bracket. The description below provides a simple overview of how to determine the required angle.

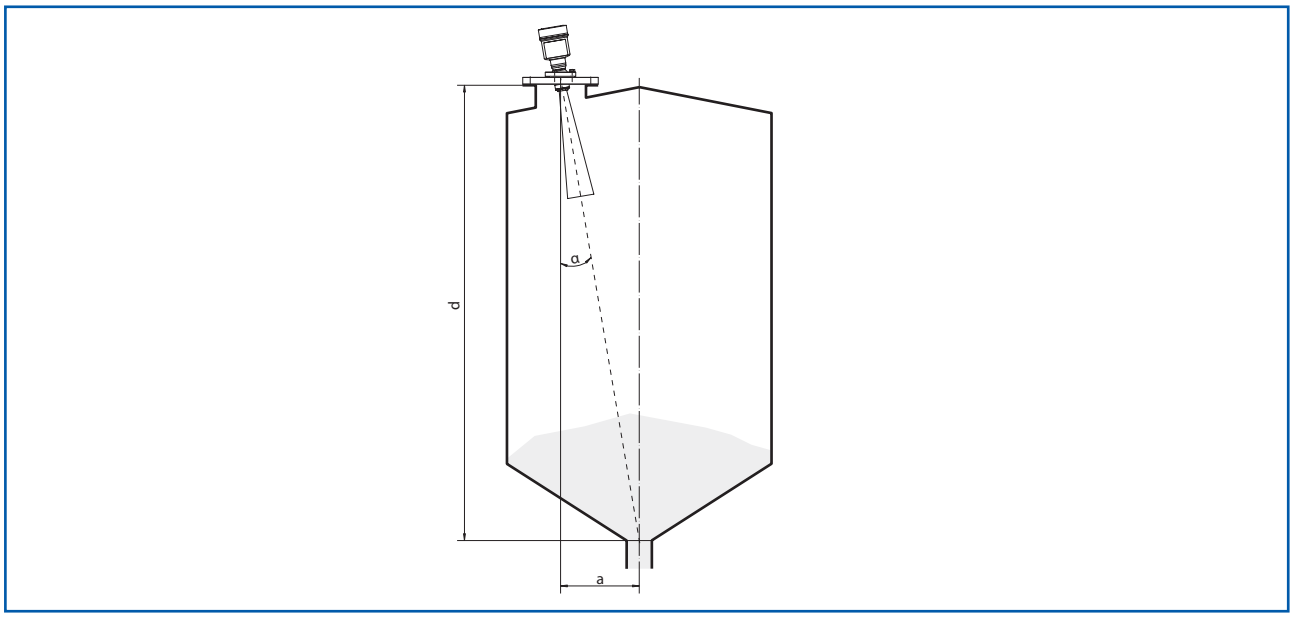


Fig. 20: Suggestion for installation after alignment of the Nico 30

The tilt angle depends on the vessel dimensions. It may be checked using a suitable spirit level on the sensor.

The table below shows the distance "a" between the installation position and the centre of the vessel depending on the measurement distance for a tilt angle of 2° - 10°.

Distance d (m)	2°	4°	6°	8°	10°
2	0.1	0.1	0.2	0.3	0.4
4	0.1	0.3	0.4	0.6	0.7
6	0.2	0.4	0.6	0.8	1.1
8	0.3	0.6	0.8	1.1	1.4
10	0.3	0.7	1.1	1.4	1.8
15	0.5	1.0	1.6	2.1	2.6
20	0.7	1.4	2.1	2.8	3.5
25	0.9	1.7	2.6	3.5	4.4
30	1.0	2.1	3.2	4.2	5.3

Example:

For a 20 m high vessel the installation position for the sensor is 1.4 m from the centre of the vessel.

The required tilt angle of 4° can be taken from the table.

Proceed as follows to set the tilt angle using the swivel mounting:

1. Undo the clamp screw on the swivel mounting using a 13 mm open-ended spanner.
2. Align the sensor and check the tilt angle.

Information

The maximum tilt angle of the swivel mounting is approx. 15°.

3. Tighten the clamp screw, max. tightening torque 20 Nm.

Information

The Allen bolts do not have to be undone.

Vessel fittings

The installation position of the radar sensor should be selected such that no fittings cross the microwave signals.

Vessel fittings such as ladders, limit switches, heating coils, vessel bracing, etc. can cause interference echoes and adversely affect the useful echo. When planning your measuring point you should ensure that the radar signals have as "clear a view" as possible of the solids.

If there are fittings in the vessel, you should save the interference signal during the commissioning procedure.

If large vessel fittings such as bracing and supports cause interference echoes these can be damped by additional measures. Small sheet metal covers installed at angles over the fittings will "scatter" the radar signals and thus effectively prevent direct interference echo reflection.

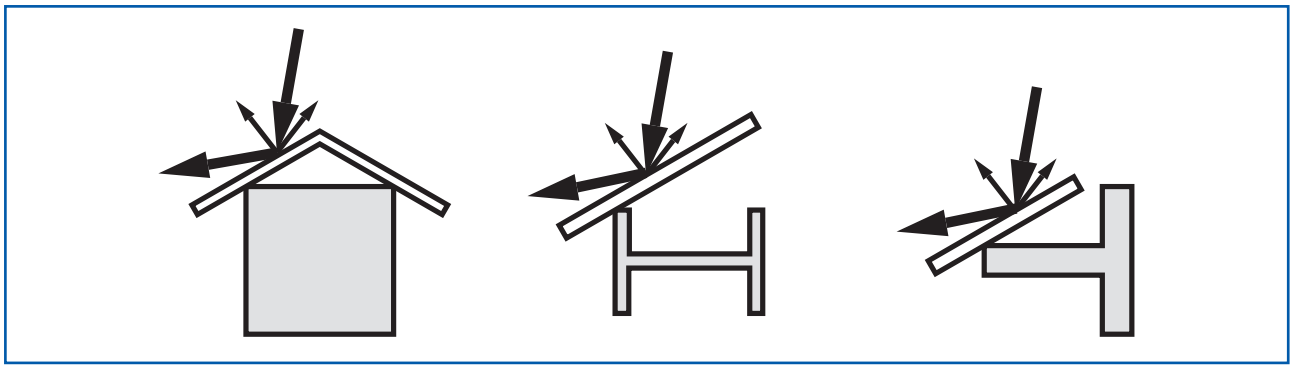


Fig. 21: Cover smooth sections with plates to scatter the signal

Mixer units

If there is a mixer unit in the vessel, you should complete a false signal suppression process whilst the mixer unit is operating. This will ensure that the interference reflections from the mixer unit are saved in various positions.

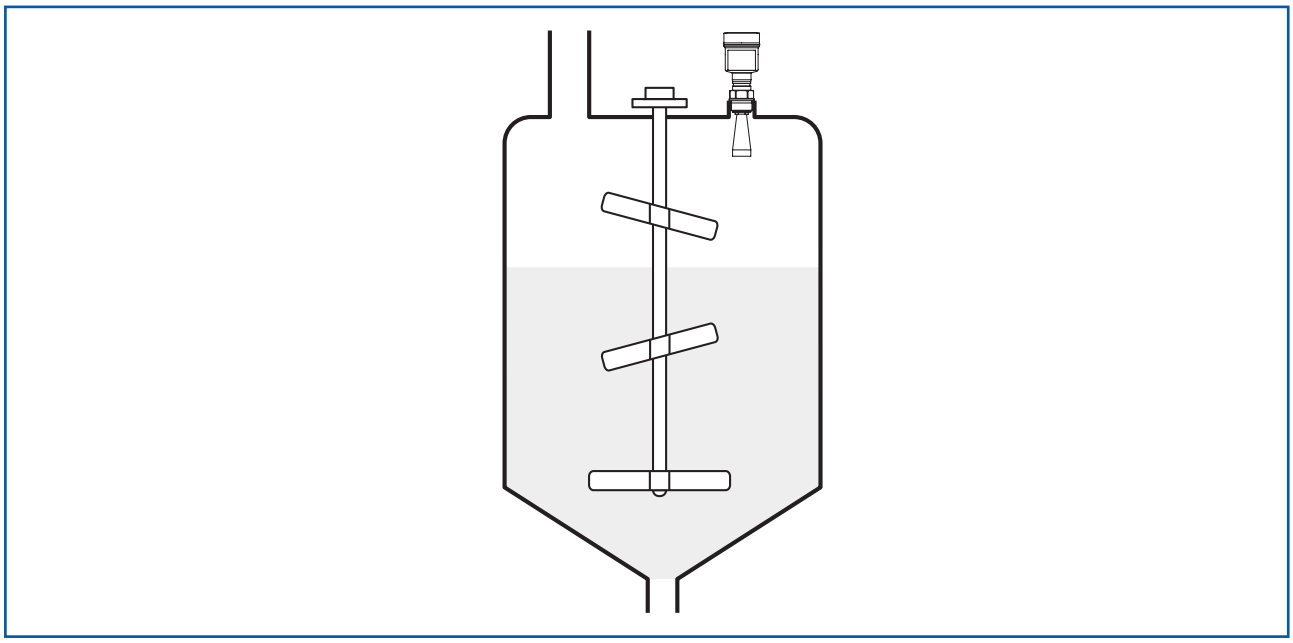


Fig. 22: Mixer units

Material heaps

You can detect large material heaps using several sensors which you can installed on crane beam, for example. For material cones it is a good idea to align the sensors as perpendicular as possible to the surface of the solids. The sensors will not affect each other.

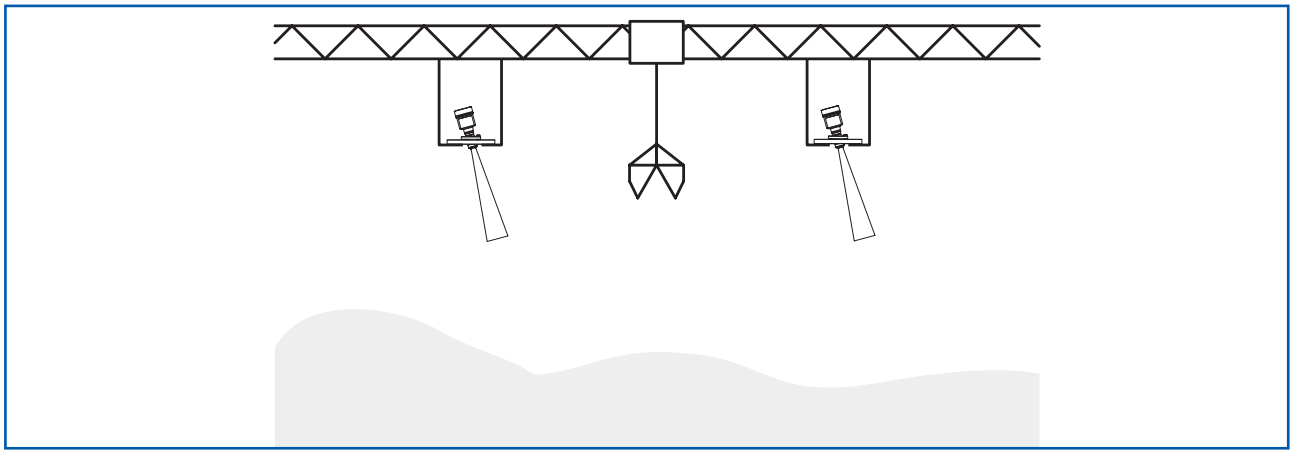


Fig. 23: Radar sensors on a crane beam

Information

For these applications you should remember that the sensors are designed for relatively slow changes of level. If the Nico 30 is used on a moving arm, you should note the maximum measuring rate (see section entitled "*Technical data*").

Installation in the vessel insulation

Devices for a temperature range up to 250 °C or up to 450 °C have a spacer between the process connection and electronic housing. This is designed to ensure the thermal isolation of the electronic system from the high process temperatures.

Information

The spacer may only be inserted into the vessel insulation by a maximum of 50 mm. This is the only way to ensure reliable thermal isolation.

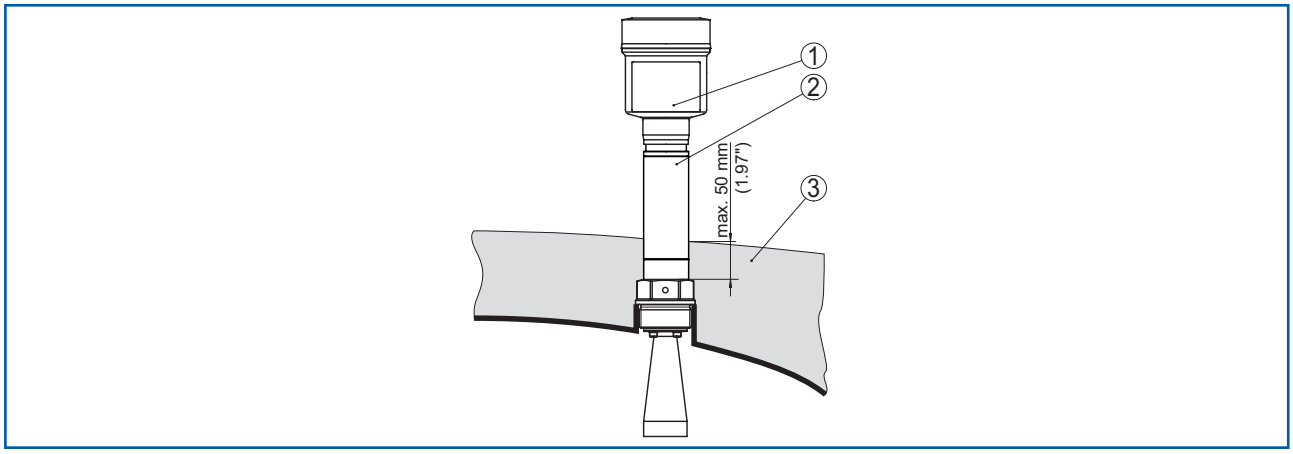


Fig. 24: Device installation on insulated vessels

1 Electronic housing

2 Spacer

3 Vessel insulation

Installation in underfloor boxes

The sensors are often installed in protective boxes for taking level measurements in concrete silos. These may, for example, take the form of metallic sealed underfloor boxes.

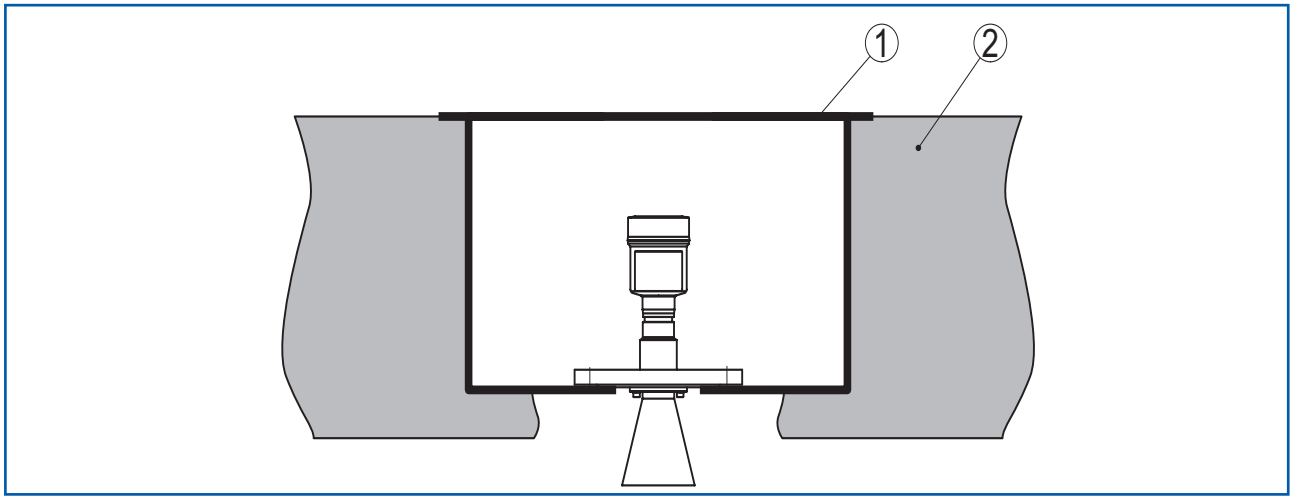


Fig. 25: Device installation in an underfloor box

1 Underfloor box

2 Concrete floor

For this application the minimum scattered radiation of the sensor may be reflected and amplified by the walls of the underfloor box. On sensors with plastic housings this may result in interference. The use of a sensor with an aluminium or stainless steel housing prevents this.

Installation in a multi-chamber vessel

The silo walls in multi-chamber silos are often profile walls made of trapezoidal sheet metal, for example, to provide the required strength. If the radar sensor is installed very close to a heavily textured vessel wall, it may suffer serious interference reflections. The sensor should therefore be installed at as great a distance as possible from the partition wall. It should ideally be installed on the external wall of the silo with the sensor aligned towards the discharge in the centre of the silo.

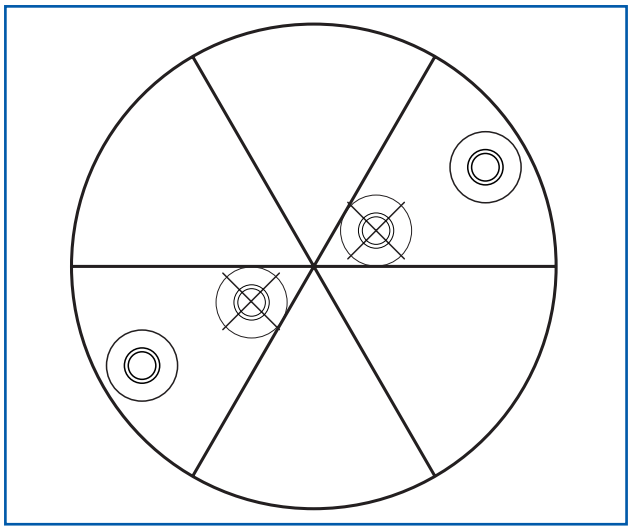


Fig. 26: Installation in multi-chamber silos

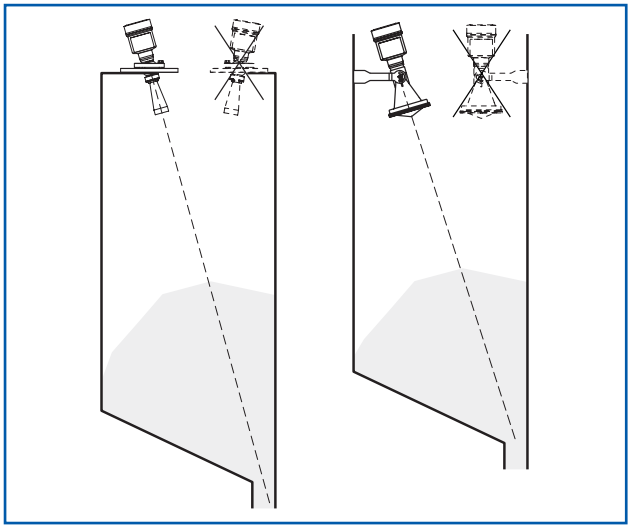


Fig. 27: Alignment to the discharge in the centre of the silo

Dust deposits on the Nico 30

The sensor should not be installed directly at the vessel's dust extraction port to prevent heavy material accumulations and dust deposits in the antenna system.

The Nico 30 with a purge air connection may be used for applications which involve extreme dust deposits in the antenna system. In this version the air is distributed through ducts in the antenna system and keeps it relatively free of dust deposits.

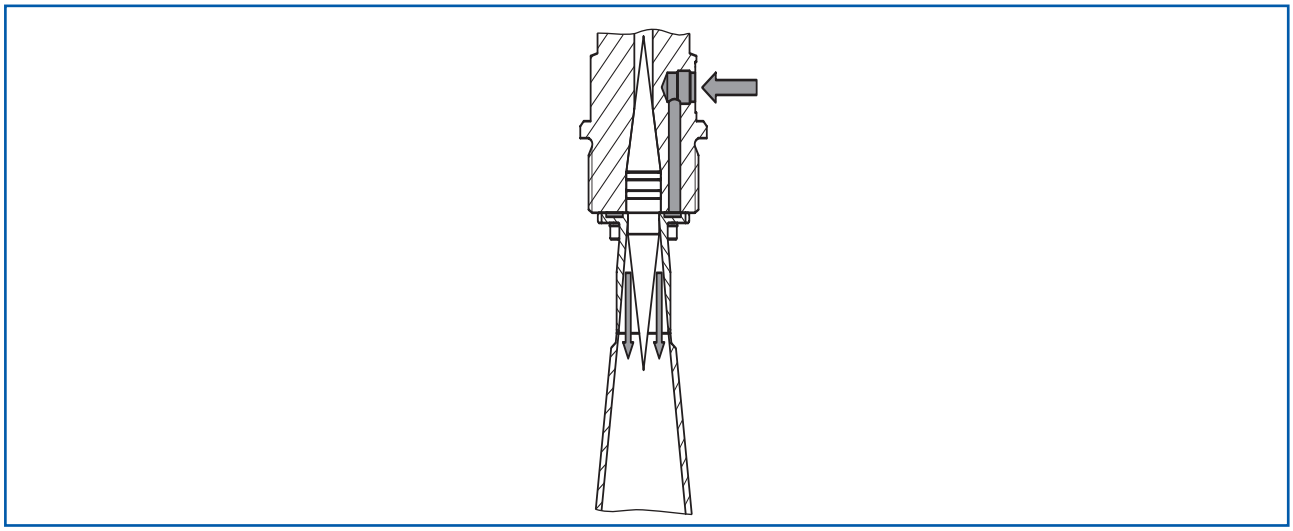


Fig. 28: Purge air connection for horn antenna

In practice it has been found that a pressure of approx. 0.1 - 1 bar creates an adequate air flow.

External air purge on the Nico 15

Since the Nico 15 does not have a direct purge air connection, a separate air purge connection must be installed in the installation socket. Tilting this connection upwards will make the cleaning of the antenna cover particularly effective.

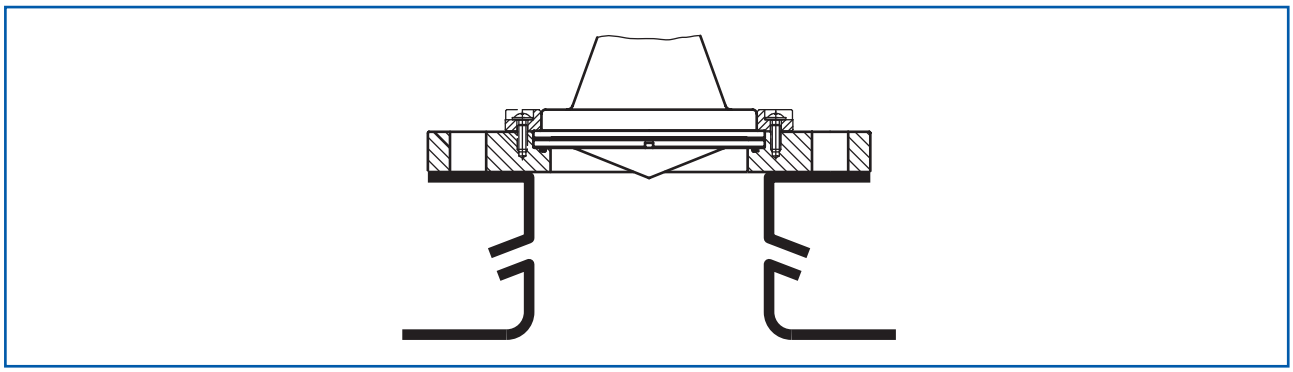


Fig. 29: Air purge connection

5. Connect to the voltage supply

5.1 Preparing the connection

Safety instructions

Always obey with the following safety instructions.

- Make only connections when the system is not live.
- If surge voltages are expected, install surge voltage protection devices.

Cable shielding and grounding

In this case the device is designed in protection class II. Always connect the device to the vessel earth (equipotential bonding system) or, in the case of plastic vessels, to the nearest earth potential.
There is an earth terminal on the side of the device housing for this purpose.

If a shielded cable is required, connect the cable shield at both sides to the earth potential. The shield must be connected to the internal earth terminal in the sensor. The external earth terminal on the housing must be connected to the equipotential bonding system with low impedance.

If equipotential bonding currents are expected, the connection must be made on the evaluation side using a ceramic capacitor (for example 1 lF, 1500 V). The low frequency equipotential bonding currents will now be suppressed but the protective effect for high frequency interference signals will be retained.

Warning

There are large potential differentials inside the galvanic system and in vessels with cathodic corrosion protection. In this case the two-sided shield earthing may result in considerable equalising currents over the cable shield.

To prevent this the cable shield may be connected to just one side of the earth potential in the control cabinet for these applications. The cable shield must not be connected to the internal earth terminal in the sensor and the external earth terminal on the housing must not be connected to the equipotential bonding system.

Information

The metallic parts of the device (process connection, pick-up, sleeve tube, etc.) have a conductive connection to the internal and external earth terminals on the housing. This connection is either directly metallic or, on devices with an external electronic system, via the shield on the special connection cable.

Details of the potential connections inside the device are provided in the section entitled "*Technical data*".

5.2 Connection

Connection equipment

The voltage supply and signal output are connected using spring terminals in the housing.

The connection to the display and control module and to the interface adapter is made using contact pins in the housing.

Information

The terminal block is a plug-in unit and can be disconnected from the electronic system. To do this raise the terminal block with a small screwdriver and pull it out. It must audibly lock into position when it is reconnected.

Connection procedure

Proceed as follows:

1. Unscrew the housing cover
2. Remove any existing display and control module by turning it gently anti-clockwise
3. Undo the union nut on the cable screw connection
4. Strip the connection cable over a length of approx. 10 cm (4 in), strip the core ends over a length of approx. 1 cm (0.4 in)
5. Push the cable through the cable screw connection into the sensor
6. Place the core ends into the terminals as shown in the connection diagram

Fig. 30: Connection steps 5 and 6

Information

Solid cores and flexible cores with wire-end ferrules may be inserted straight into the terminal openings. Flexible cores without end ferrules should be pressed on to the terminal head with a small slotted screwdriver to release the terminal opening. Removing the slotted screwdriver will close the terminals again.

Further information about the maximum core cross-section is available in the sections entitled "*Technical data / Electromechanical data*"

7. Check that the cables are correctly positioned in the terminals by pulling them gently.
8. Connect the shield to the internal earth terminal and the external earth terminal to the equipotential bonding system.
9. Tighten the union nut on the cable screw connection The sealing ring must completely surround the cable.
10. Reinstall any existing display and control module.
11. Screw on the housing cover.

This completes the electrical connection.

5.3 Single-chamber housing connection diagram

The following figure apples to both versions for non-potentially explosive atmospheres and also for the Ex-ia version for potentially explosive atmospheres.

Electronic chamber

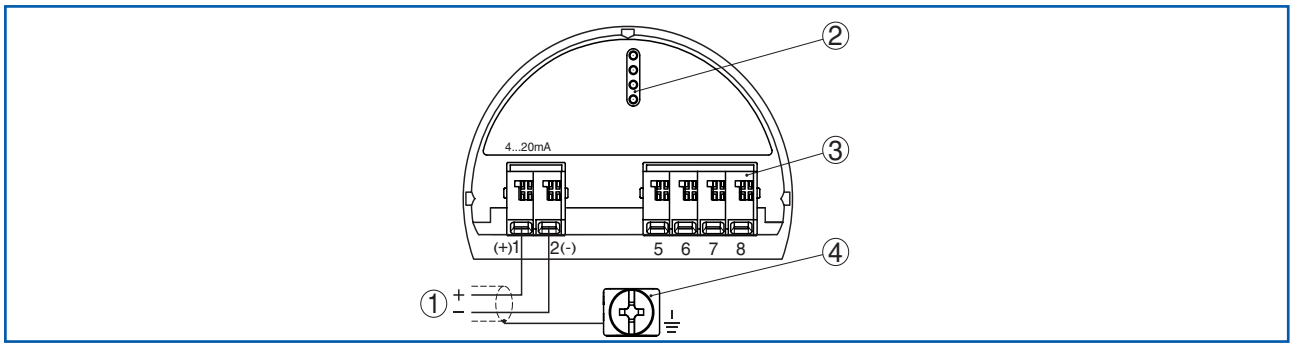


Fig. 31: Electronic and connection chamber in single-chamber housing

1 Voltage supply, signal output
2 For display and control module or interface adapter
3 For an external display and control module
4 Earth terminal for connecting the cable shield

5.4 Switch-on phase

After the device has been connected to the voltage supply or after the voltage supply has been restored, the device will conduct a self-test for approx. 30 seconds:

- Internal test of the electronic system
- Show the device type, hardware and software version, measuring point name on the display or PC
- Show the status message "*F 105 Found measurement*" on the display or PC
- The output signal will jump to the set interference current

As soon as a plausible measurement value has been found the relevant current will be output on the signal cable. This value corresponds to the current fill level and the settings that have already been made, for example the factory adjustment.

6. Commissioning with the display and control module

6.1 Fitting the display and control module

The display and control module can be fitted in the sensor and removed again at any time.
Four positions can be selected at intervals of 90°. The voltage supply does not have to be interrupted for this purpose.

Proceed as follows:

1. Unscrew the housing cover.
2. Place the display and control module in the required position on the electronic system and turn it clockwise to secure it.
3. Secure the housing cover with the inspection window.

Proceed in reverse to remove it.

The display and control module is supplied by the sensor, no other connection is required.

Fig. 32: Fit the display and control module in the electronic system chamber in a single-chamber housing

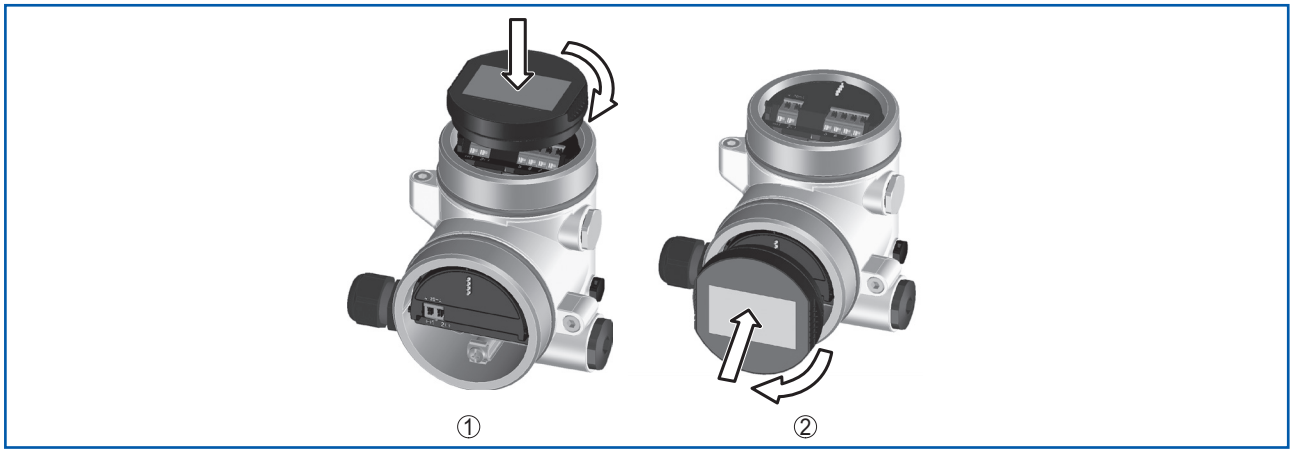


Fig. 33: Fit the display and control module in a twin-chamber housing

1 In the electronic system chamber

2 In the connection chamber (not possible on Ex-d-ia versions)

Note:

If you wish to retrofit the device with a display and control module which permanently displays the measurement values, a higher cover with an inspection window will be required.

6.2 Control system

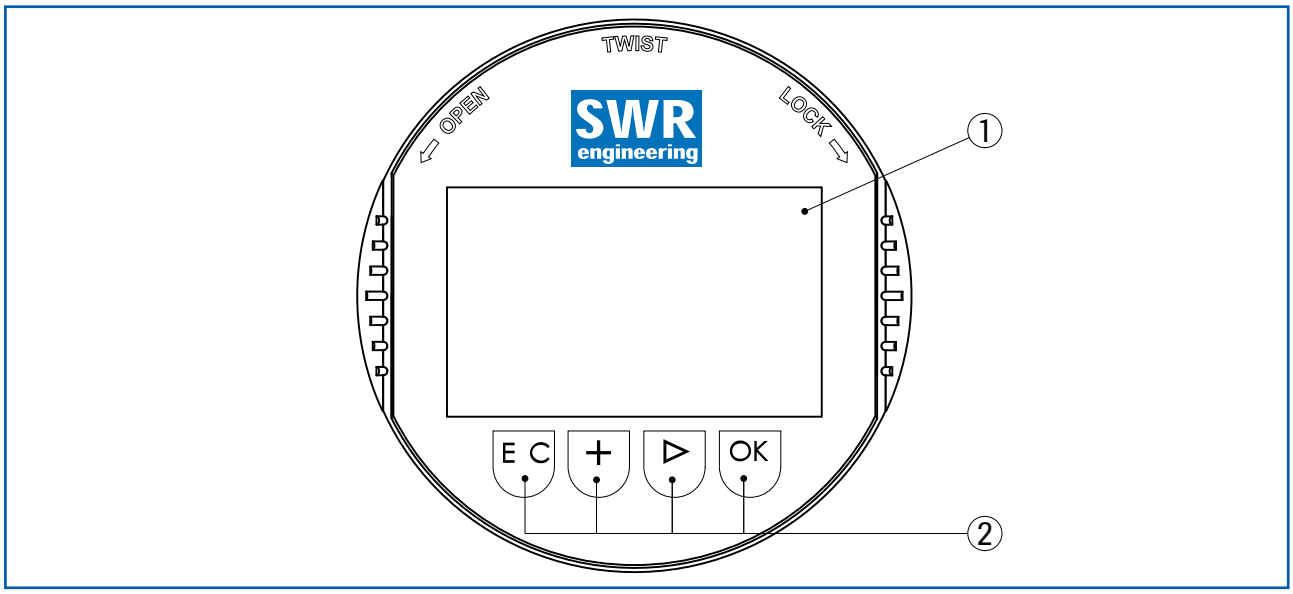


Fig. 34: Display and control elements

1 LC display

2 Control keys

Key functions

- ***[OK]*** key:
  - Go to the menu list
  - Confirm selected menu
  - Edit parameters
  - Save value
- ***[->]*** key:
  - Go to the measurement value display
  - Select list entry
  - Select editing position
- ***[+]*** key:
  - Change the value of a parameter
- ***[ESC]*** key:
  - Cancel entry
  - Return to the higher level menu

Control system

You can control the sensor using the four keys on the display and control module. The various menu points are displayed on the LC display. The functions of the various keys are shown above. Approximately 10 minutes after the last key was pressed the system will automatically return to the measurement value display. Any values which have not yet been confirmed by pressing ***[OK]*** will be lost.

Quick start

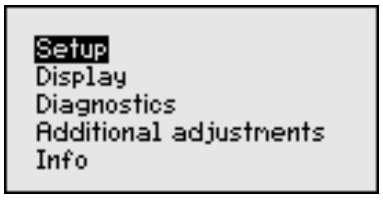
Menu	Menu point	Default value
Setup	Measuring point name	Sensor
	Medium	Liquid / Water solution Solids / Aggregate
	Application	Storage tank / Silo
	Vessel form	Dished vessel base Dished vessel cover
	Vessel height / Measuring range	Received measuring range, see "*Technical data*" in the annex
	Min. adjustment	Received measuring range, see "*Technical data*" in the annex
	Max. adjustment	0.000 m(d)
	Damping	0.0 s
	Current output Mode	4…20 mA, < 3.6 mA
	Min. / Max. current output	Min. current 3.8 mA, Max. current 20.5 mA
	Disable control	Released
Display	Language	As per order
	Display value	Distance
	Display unit	m
	Scaling value	Volume l
	Scaling	0.00 lin %, 0 l - 100.00 lin %, 100 l
	Light	Switched off
Additional adjustments	Distance unit	m
	Temperature unit	°C
	Measuring probe length	Length of pipe ex-works
	Linearization curve	Linear
	HART mode	Default address 0

6.3 Parameterisation

The parameterisation adjusts the device to the conditions in which it is used. The parameterisation process takes place in a control menu.

Main menu

The main menu is divided into five sections with the following functionalities:



Setup: Settings, for example measuring point name, application, vessel, adjustment and signal output

Display: Settings, for example language, measurement value display and light

Diagnostics: Information, for example device status, drag indicator, measuring accuracy, simulation and echo curve

Additional adjustments: Device unit, false signal suppression, linearization curve, reset, date / time, reset and copy function

Info: Device name, hardware and software version, calibration date and device features

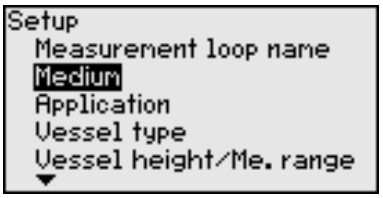
In the "*Setup*" main menu point the various sub-menu points should be selected in sequence and the appropriate parameters entered for them to ensure that the measured is set perfectly.

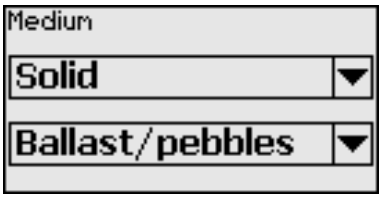
The procedure is described below.

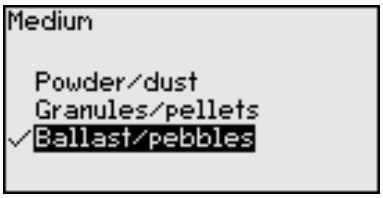
Setup / Medium

Each medium has different reflection properties. Other factors for solid include the dust development, material cone and additional echoes from the vessel wall.

The "*Solid*" selection should be made first in this menu point to adjust the sensor to these different measurement conditions.







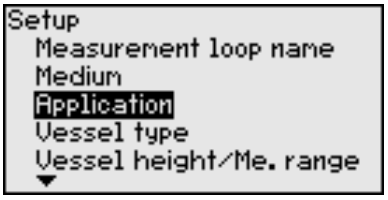
This selection will adjust the sensor perfectly to the product and significantly increase measurement accuracy, primarily for media with poor reflection properties.

Enter the required parameters using the appropriate keys, save them by pressing ***[OK]*** and then go to the next menu point by pressing ***[ESC]*** and ***[->]***.

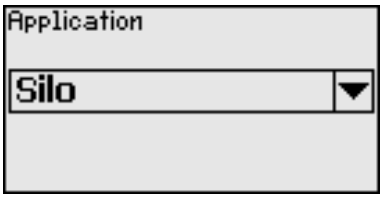
Setup / Application

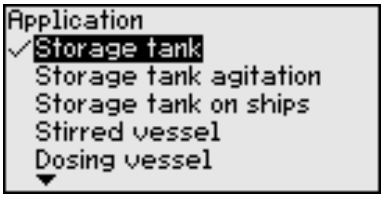
In addition to the medium the application or place of use can also affect the measurement.

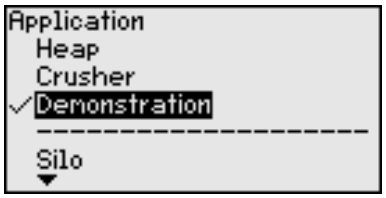
This menu point enables you to adjust the sensor to the measuring conditions.



The following selections are available for "*Solid*":







The applications are based on the following features:

Silo (slim and tall):

- Metal vessel: Welds
- Process / Measuring conditions
  - Filling close to the sensor
  - System noise increased when the silo is completely empty
  - Automatic interference signal hiding for partly filled vessel

Bunker (large volume):

- Concrete or metal vessel:
  - Textured vessel walls
  - Fittings present
- Process / Measuring conditions
  - Large distance to medium
  - Large heap angle

Bunker with fast filling system:

- Concrete or metal vessel, also multi-chamber silo:
  - Textured vessel walls
  - Fittings present
- Process / Measuring conditions
  - Measurement value jumps, for example due to filling by truck
  - Large distance to medium
  - Large heap angle

Heap:

- Sensor installation on moving conveyor belt
- Record the heap profile
- Height recording during filling process
- Process / Measuring conditions
  - Measurement value jumps, for example due to the profile of the heaps and beams
  - Large heap angle
  - Measurement close to the filling inflow

Crusher:

- Vessel: Fittings, wearing and safety equipment present
- Process / Measuring conditions
  - Measurement value jump, for example due to filling by truck
  - Fast reaction speed
  - Large distance to medium

Demonstration:

- Setting for all applications which are not typical level measurements
- The sensor will accept any change of measurement value within the measuring range immediately
- Typical applications:
  - Device demonstration
  - Object detection / monitoring (additional settings required)

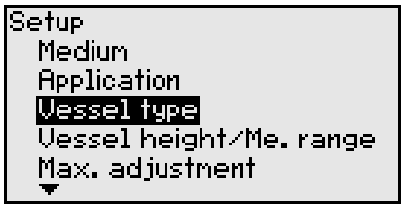
This selection will adjust the sensor perfectly to the application or the place of use and significantly increase measurement accuracy in various outline conditions.

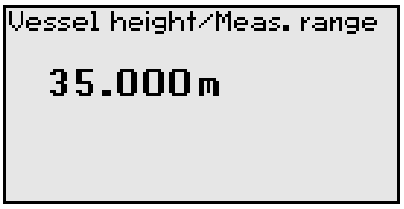
Enter the required parameters using the appropriate keys, save them by pressing ***[OK]*** and then go to the next menu point by pressing ***[ESC]*** and ***[->]***.

Setup / Vessel height, measuring range

This selection will adjust the sensor's operating range to the vessel height and significantly increase measurement accuracy in various outline conditions.

Regardless of this the minimum adjustment described below must be completed.

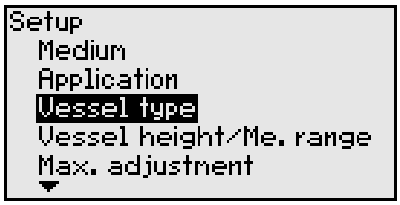


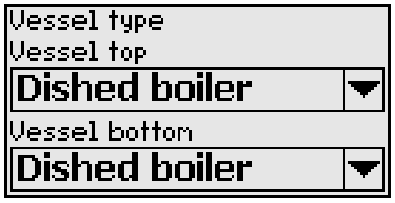


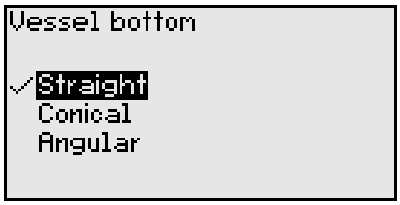
Enter the required parameters using the appropriate keys, save them by pressing [OK] and then go to the next menu point by pressing [ESC] and [->].

Setup / Vessel form

In addition to the medium and the application, the vessel form can also affect the measurement. This menu point provides a range of options for the vessel floor and roof for certain applications to adjust the sensor to these different measurement conditions.







Enter the required parameters using the appropriate keys, save them by pressing [OK] and then go to the next menu point by pressing [ESC] and [->].

Setup / Adjustment

Since the radar sensor is a distance measuring instrument, it measures the distance from the sensor to the surface of the solids. To display the actual fill level the measured distance must be assigned to the percentage height.

To complete this adjustment the distance must be entered for the minimum and maximum fill level, see example below:

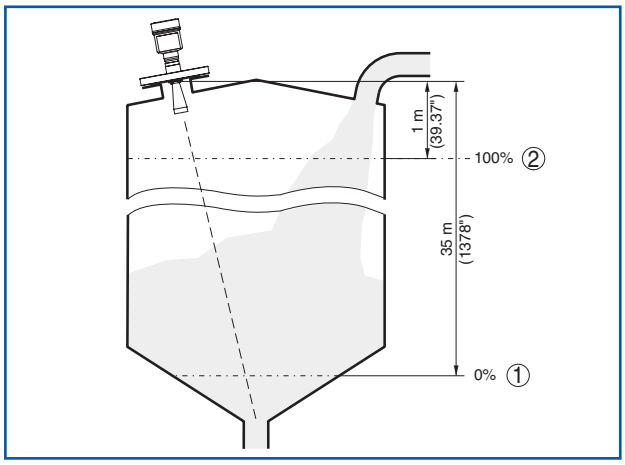


Fig. 35: Parameterisation example for Min. / Max. adjustment

1 Min. level = Max. measuring distance

2 Max. level = Min. measuring distance

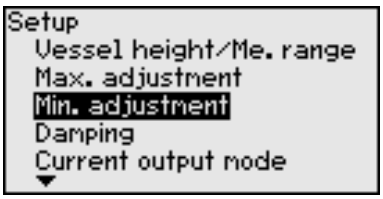
If you do not know these values, it is also possible to make the adjustment using distances, for example of 10 % and 50 %. The starting point for these distance details is always the sealing surface of the thread or flange. The actual fill level is then calculated on the basis of these entries.

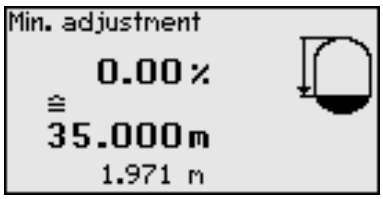
The current fill level is not important for this adjustment, the Min./Max. adjustment is always carried out without changing the solids. This means that these settings can be completed in advance without the device having to be installed.

Setup / Min. adjustment

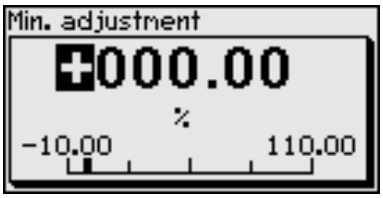
Proceed as follows:

1. Select menu point "*Setup*" using ***[->]*** and confirm your selection with ***[OK]***. Now select menu point "*Min. adjustment*" using ***[->]*** and confirm your selection with ***[OK]***.

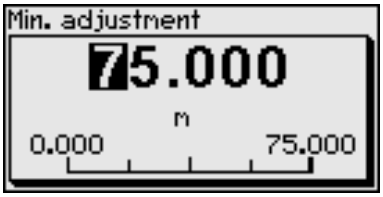




2. Edit the percentage value using ***[OK]*** and place the cursor in the required position using ***[->]***.



3. Edit the required percentage value using ***[+]*** and save it using ***[OK]***. The cursor will now go to the distance value.

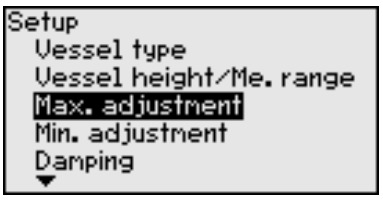


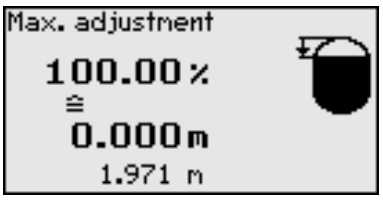
4. Enter the distance value in metres for the empty vessel to match the percentage value (for example distance from sensor to vessel floor).
5. Save your settings using ***[OK]*** and go to the Max. adjustment using ***[ESC]*** and ***[->]***.

Setup / Max. adjustment

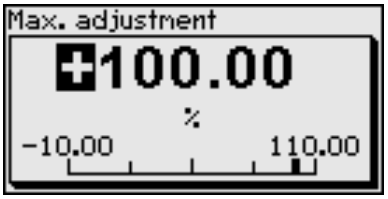
Proceed as follows:

1. Select menu point "Max. adjustment" using ***[->]*** and confirm your selection with ***[OK]***.

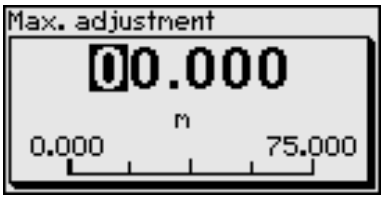




2. Prepare the percentage value for editing using ***[OK]*** and place the cursor in the required position using ***[->]***.



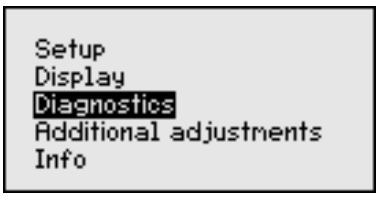
3. Edit the required percentage value using ***[+]*** and save it using ***[OK]***. The cursor will now go to the distance value.

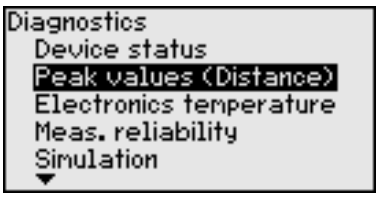


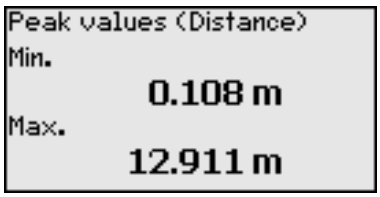
4. Enter the distance value in metres for the full vessel to match the percentage value.
   Please note for this purpose that the maximum fill level must be underneath the minimum distance to the edge of the antenna.
5. Save your settings using ***[OK]***

Diagnostics / Peak values

The minimum and maximum measurement values are saved in the sensor. The values are displayed in the "*Peak values*" menu point.

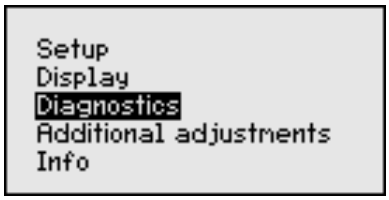


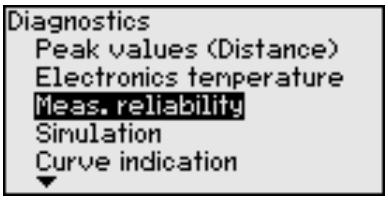


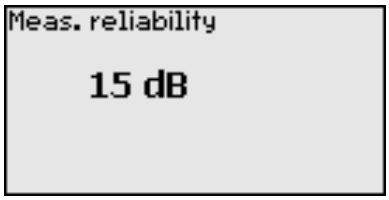


Diagnostics / Measurement reliability

If level sensors which operate without contact are used the measurement can be affected by the process conditions. The measurement reliability of the fill level echo is displayed as a dB value in this menu point. The measurement reliability is the signal strength minus noise. The greater the value, the more accurate the measurement. For a functional measurement the values are in excess of 10 dB.

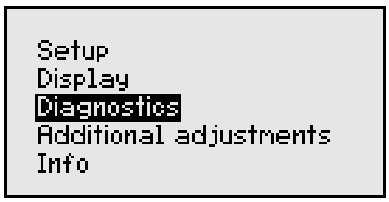


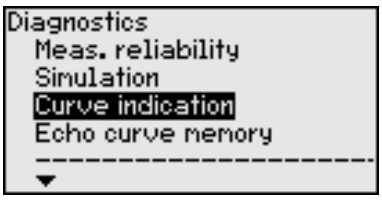


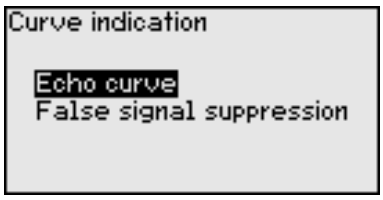


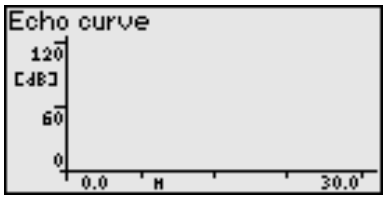
Diagnostics / Curve indication

The "*Echo curve*" represents the signal strength of the echo over the measuring range in dB. The signal strengths allows the quality of the measurement to be assessed.

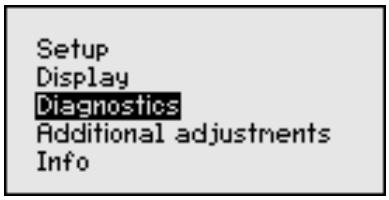


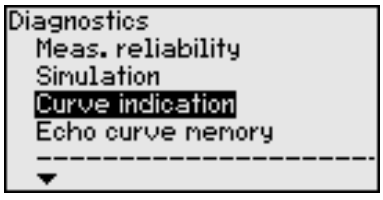


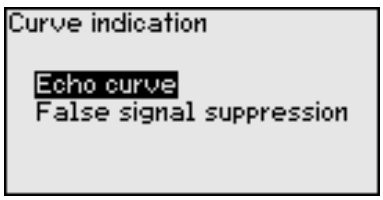


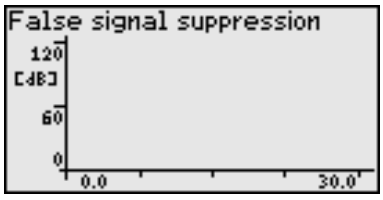


The "*False signal suppression*" represents the saved interference echoes (see "*Additional adjustments*" menu) for the empty vessel with the signal strength in "*dB*" over the measuring range.







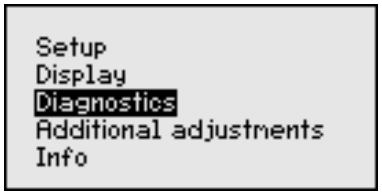


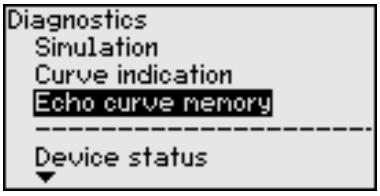
A comparison of the echo curve and false signal suppression enables a more precise assessment of the measurement reliability to be made. The selected curve is updated continuously. The ***[OK]*** key can be used to open a sub-menu with zoom functions:

- "*X zoom*": Magnification function for the measuring distance
- "*Y zoom*": 1, 2, 5 and 10-fold magnification of the signal in "*dB*"
- "*Unzoom*": Reset the display to the nominal measuring range with single magnification

Diagnostics / Echo curve memory

The "*Echo curve memory*" enables you to save the echo curve during the commissioning procedure. This is generally recommended and may even be compulsory if you wish to use the asset management functionality. The value should be saved with a low fill level if possible.





Additional adjustments / False signal suppression

The following conditions cause interference reflections and can adversely affect the measurement:

- High sockets
- Vessel fittings, such as bracing
- Mixer units
- Accumulations or welds on vessel walls

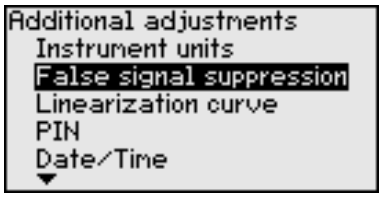
Note:

A false signal suppression records, marks and saves these interference signals so that they are not taken into consideration for measuring the fill level.

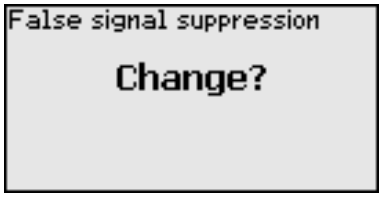
This should be done at a low fill level so that any existing interference reflections can be recorded.

Proceed as follows:

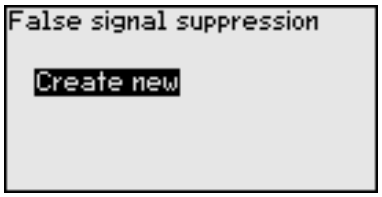
1. Select menu point "*Additional adjustments*" using ***[->]*** and confirm your selection with ***[OK]***. Use ***[->]*** to select the "*False signal suppression*" menu point and confirm your selection using ***[OK]***.



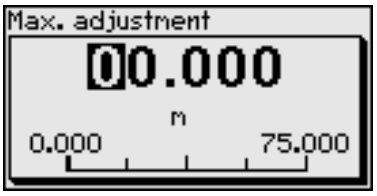
2. Confirm again using ***[OK]***.



3. Confirm again using ***[OK]***.



4. Confirm again using ***[OK]*** and enter the actual distance from the sensor to the surface of the solids.

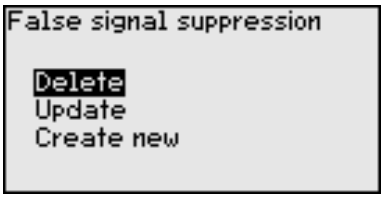


5. After you have confirmed this using ***[OK]*** all the interference signals that exist in this zone will now by recorded by the sensor and saved.

Note:

Check the distance to the surface of the goods since if you enter an incorrect (excessive) value the current fill level will be saved as an interference signal. This will mean that the level cannot be recorded in this zone.

If a false signal suppression has already been created in the sensor the following menu window will appear when you select "*False signal suppression*":



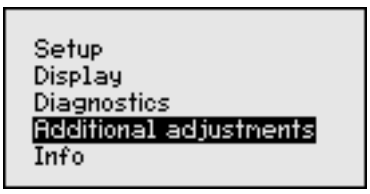
The "*Delete*" menu point can be used to delete a complete false signal suppression which has already been created. This is a good idea if the created false signal suppression no longer matches the measuring conditions in the vessel.

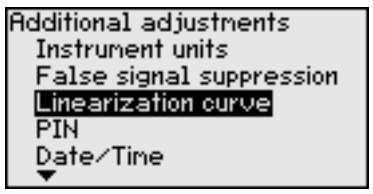
The "*Update*" menu point can be used to extend a false signal suppression which has already been created. This is a good idea if a false signal suppression was saved at too high a fill level which means that it was not possible to record all the interference echoes. If you select "*Update*" the distance to the surface of the solids in the created false signal suppression will be displayed. This value can now be changed and the false signal suppression can be extended to this range.

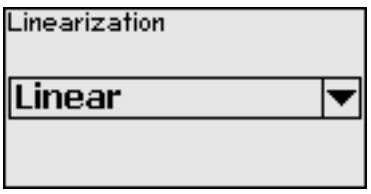
Additional adjustments / Linearization curve

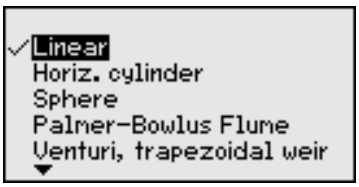
Linearization is required for all vessels whose vessel volume does not increase on a linear basis with the fill level, for example a horizontal round tank or spherical tank, and if the user wants to display or output its volume. The system has linearization curves for these vessels.
They show the relationship between percentage fill level height and the vessel volume.

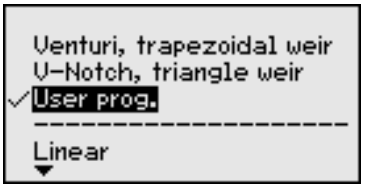
If the appropriate curve is activated the system can display the percentage vessel volume.
If the volume should not be shown in percent but, for example in litres or kilograms, it is also possible set a scaling value, for examplein the "*Display*" menu point.











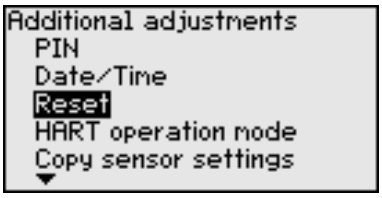
Enter the required parameters using the appropriate keys, save your entries and then go to the next menu point by pressing the ***[ESC]*** and ***[->]*** keys.

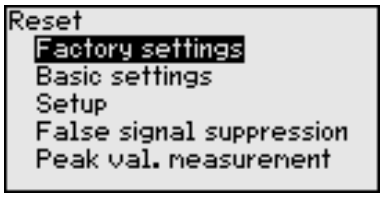
⚠ Caution

If you select a linearization curve the measurement signal will no longer necessarily be proportional to the fill level. The must be taken into account by the user, particularly when setting the switch point at the limit signal transducer.

Additional adjustments / Reset

This function resets various parameter settings made by the user.





The following reset functions are available:

Factory settings Restore the parameter settings on the date of delivery from the factory including the settings specific to the order. Any created false signal suppression, freely programmed linearization curve or measurement value memory will be deleted.

Basic settings Reset the parameter settings including special and laboratory parameters to the default values for the specific device. Any created false signal suppression, freely programmed linearization curve or measurement value memory will be deleted.

Setup Reset the parameter settings made in the Commissioning menu point to the default values for the specific device. Any created false signal suppression, freely programmed linearization curve, measurement value memory or even memory will be retained. The linearization will be set to linear.

False signal suppression Delete any previously created false signal suppression. The false signal suppression created at the factory will be retained.

Peak val. measurement Reset the measured min. and max. distances to the current measurement value. The following table shows the default values for the device. Depending on the device version, not all menu points may be available or may have different settings.

7. Diagnostic, asset management and service

7.1 Maintenance

If the device is used for the purpose for which it is designed ii normal conditions, no maintenance work is required.

For some applications material accumulations may occur on the antenna system and affect the measurement result. Depending on the sensor and application, you should therefore take precautions to prevent the antenna system becoming excessively dirty. The antenna system should be cleaned at certain intervals if necessary.

7.2 Asset management function

The device has a self-monitoring and diagnostic system which complies with NE 107 and VDI/VDE 2650. Detailed error messages can be viewed in the "*Diagnostic*" menu point using the display and control module for the status messages shown in the tables below.

Status messages

The status messages are divided into the following categories:

- Failure
- Function check
- Out of specification
- Maintenance and clarified by pictograms

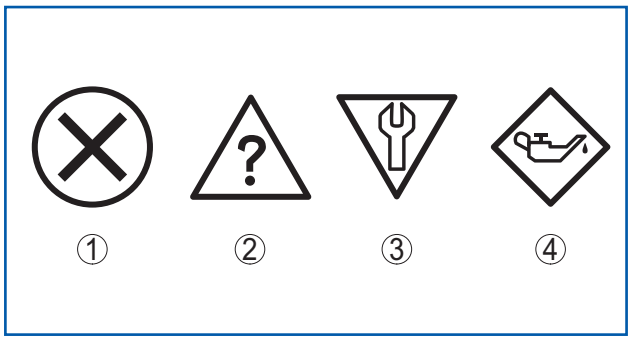


Fig. 35: Status message pictograms
1 Failure - red
2 Function check - orange
3 Out of specification - yellow
4 Maintenance - blue

Failure The device will output a fault message if it detects a malfunction.
This status message will be active at all times. The user is unable to deactivate it.

Function check
Work is being carried out on the device, the measurement value is temporarily invalid (for example during a simulation). The default status of this status message is inactive.

Out of specification
The measurement value is uncertain since the device specification has been exceeded (for example electronic system temperature). The default status of this status message is inactive.

Maintenance
Extreme influences have restricted the function of the device.
The measurement is affected but the measurement value is still valid. Schedule maintenance on the device since you should expect it to fail in the foreseeable future (for example due to material accumulations).
The default status of this status message is inactive.

7.3 Troubleshooting

Action to take in the event of faults

It is the responsibility of the system owner/operator to take suitable action to rectify any faults which occur.

Troubleshooting procedure

The first action to take is as follows:

- Evaluate the error messages, for example on the display and control module
- Check the output signal on 4…20 mA devices
- Treatment of measurement errors

Check 4 … 20 mA signal

Connect a manual multimeter to in the appropriate measuring range as shown on the connection diagram. The following table describes possible errors in the current signal and helps to rectify them:

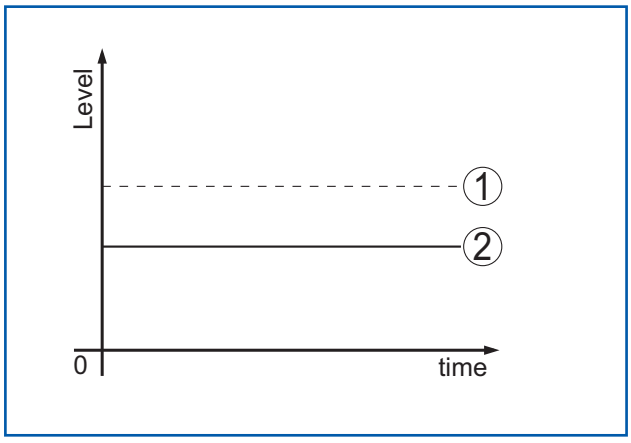
Error	Cause	Remedy
4 … 20 mA signal not stable	- Level fluctuations	- Set the damping to suit the device using the display and control module
No 4 … 20 mA signal	- Electrical connection faulty	- Test the connection using the section entitled Connecting and, if necessary correct it using the section entitled Connection diagram
	- No voltage supply	- Check cables for continuity and repair them if necessary
	- Operating voltage too low or load resistance too high	- Check and adjust if necessary
Current signal higher then 22 mA or lower than 3.6 mA	- Electronic system in sensor defective	- Replace device or return for repair

Treatment of measurement errors on solids

The table below contains typical examples of application-based measurement errors on solids.
A distinction is made between measurement errors in the following states:

- Constant level
- Filling
- Discharging

The figures in the column headed "*Error pattern*" each show the actual level in a broken line and the level shown by the sensor in an unbroken line.

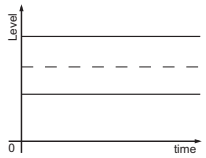
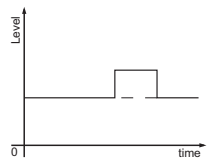


1 Actual level
2 Level indicated by the sensor

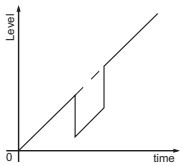
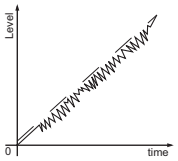
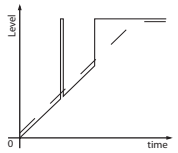
Notes:

- Whenever the sensor shows a constant value, the cause could also be the fault setting of the current output to "*Hold value*"
- If the level shown is too low the cause could also be excessive cable resistance.

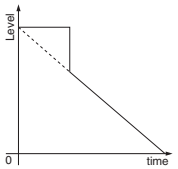
7.4 Measurement errors with a constant level

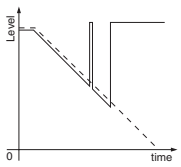
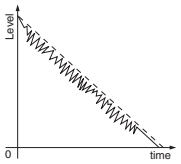
Error description	Error pattern	Cause	Remedy
1. Measurement value shows level too low or too high		- Min. / Max. adjustment incorrect	- Correct Min. / Max. adjustment
		- Linearization curve incorrect	- Adjust linearization curve
2. Measurement value jumps towards 100 %		- The amplitude of the product echo falls due to the process - The false signal suppression process has not been completed	- Complete false signal suppression process
		- The amplitude or location of an interference echo has changed (for example condensate or product deposits); the false signal suppression is no longer correct	- Find the cause of the changed interference echo and complete a false signal suppression process with condensate, for example

7.5 Measurement errors during filling

Error description	Error pattern	Cause	Remedy
3. Measurement value jumps towards 0 % during filling		- The amplitude of a multiple echo (vessel roof - product surface) is greater than the level echo	- Check the application parameters, particularly the vessel roof, medium type, dished floor and high dielectric index, and adjust them if necessary
		- The level echo cannot be distinguished from the interference echo at an interference echo point (jumps to a multiple echo)	- Eliminate / Reduce interference echo: Minimise interference fittings by changing the polarisation direction - Select a better installation position
		- Cross reflection at a discharge hopper, amplitude of the echo of the cross reflection greater than the level echo	- Align the sensor to the opposite wall of the hopper, prevent crossing with the filling inflow
4. Measurement value fluctuates by 10 - 20 %		- Various echoes from a surface of the goods which is not flat, for example from a material cone	- Check the medium application parameter and adjust it if necessary - Improve the installation position and sensor alignment
		- Reflections from the surface of the goods via the vessel wall (deviation)	- Select a better installation position, improve the sensor alignment, for example using a swivel mounting
5. Measurement value jumps sporadically towards 100 % during filling		- Varying condensate or dirt on the antenna	- Complete a false signal suppression process or increase false signal suppression with condensate / dirt near the sensor by editing - Use a radar sensor with an air purge connection or flexible antenna cover for solids

7.6 Measurement errors during discharge

Error description	Error pattern	Cause	Remedy
6. Measurement value remains static during discharge process near the sensor		- Interference echo greater than level echo - Level echo too low	- Eliminate interference echoes near the sensor Also check the following: The antenna must project out of the socket - Remove dirt from the antenna - Minimise interference fittings near the sensor by changing the polarisation direction - After eliminating the interference echoes the false signal suppression must also be deleted Complete a fresh false signal suppression signal process

Error description	Error pattern	Cause	Remedy
7. Measurement value jumps during discharge process towards 100 %		- Varying condensate or dirt on the antenna	- Complete a false signal suppression process or increase false signal suppression near the sensor by editing - Use a radar sensor with an air purge connection or flexible antenna cover for solids
8. Measurement value fluctuates by 10 - 20 %		- Various echoes from a surface of the goods which is not flat, for example at the discharge hopper - Reflections from the surface of the goods via the vessel wall (deflection)	- Check the medium type application parameter and adjust it if necessary - Improve the installation position and sensor alignment

Action after fault has been remedied

Depending on the cause of the fault and the action taken, the steps described in the section entitled "*Setup*" may have to be repeated or checked to ensure that they are plausible and complete.

8. Annex

8.1 Technical data

General data

316L corresponds to 1.4404 or 1.4435	
Materials in contact with media	
- Process connection	316L
- Process seal	On site (for devices with screw-in thread: Klingersil C-4400 supplied)
- Antenna	316L, 316L electropolished, 316L Safecoat-coated
- Antenna adjusting cone	PTFE TFM 1600 or PTFE INOFLON M290, PEEK
- Antenna system seal	FKM (SHS FPM 70C3 GLT), FFKM (Kairez 6375), FFKM (Kalrez 2035), FFKM (Kalrez 6230 - FDA)
Materials not in contact with media	
- Die cast aluminium housing	Die cast aluminium AlSi10Mg, powder-coated - Base: Polyester
- Seal between housing and housing roof	
- Inspection window in housing roof (optional)	Polycarbonate
- Earth terminal	316L
Conductive connection	Between earth terminal, process connection and antenna
Pipe thread, cylindrical (ISO 228 T1)	G1½ A to DIN 3852-A
- American pipe thread, tapered	1½ NPT, 2 NPT
- Flanges	DIN from DN 25, ANSI from 1“
Weights	
- Device (depending on housing, process connection and antenna)	approx. 2 … 17.2 kg (4.409 … 37.92 lbs)
- Antenna extension	1.6 kg/m (1.157 lbs/ft)
Max. length of antenna extension	5.85 m (19.19 ft)
Tightening torque for NPT cable screw connector and conduit tubes	max. 50 Nm (36.88 lbf ft)

Inlet size

Measuring value	The measuring value is the spacing between the process connection and the sensor and the surface of the solids. The reference plane is the sealing surface on the hexagon or underside of the flange.
Max. measuring range	30 m (98.43 ft)
Recommended measuring range depending on antenna diameter	
- ø 40 mm (1.575 in)	to 15 m (49.21 ft)
- ø 48 mm (1.89 in)	to 20 m (65.62 ft)
- ø 75 mm (2.953 in), 95 mm (3.74 in)	to 30 m (98.43 ft)

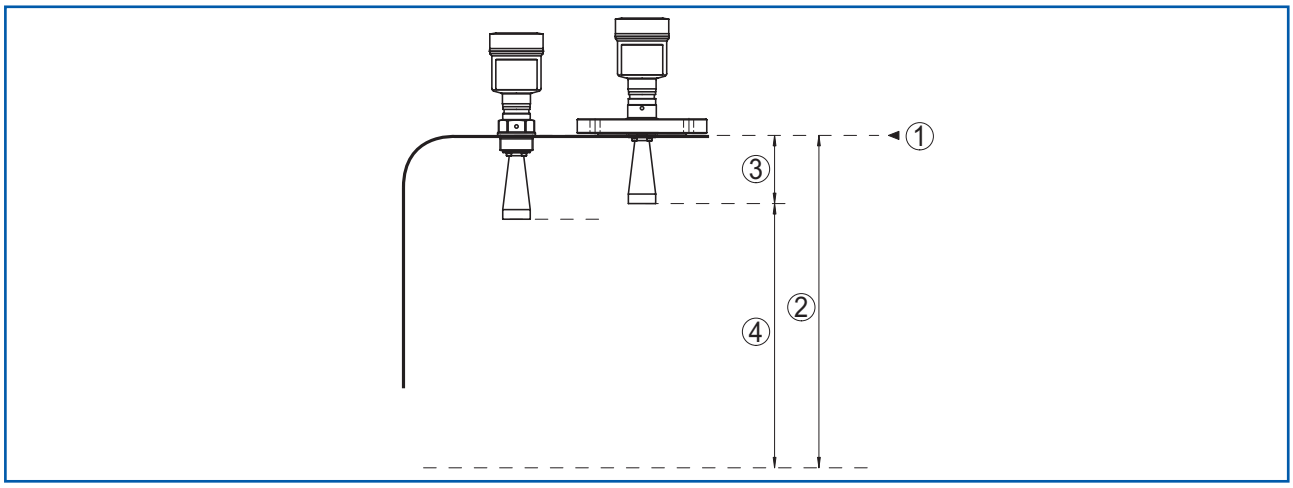


Fig. 36: Details for inlet size

1 Reference plane
2 Measuring value, max. measuring range
3 Antenna length
4 Useful measuring range

Output value

Output signals	4 … 20 mA/HART - active; 4 … 20 mA/HART - passive
Passive terminal voltage	9 … 30 V DC
Short-circuit protection	Provided
Electrical isolation	Provided
Signal resolution	0.3 µA
Current output failure signal (adjustable)	mA value unchanged, 20.5 mA, 22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	≤ 3.6 mA
Load (4 … 20 mA/HART - active)	< 500 Ω
Damping (63 % of input value)	0 … 999 s, adjustable

Measurement accuracy (to DIN EN 60770-1)

Process reference conditions to DIN EN 61298-1	
- Temperature	+18 - +30 °C (+64 - +86 °F)
- Relative humidity	45 - 75 %
- Air pressure	860 - 1060 mbar / 86 - 106 kPa (12.5 - 15.4 psig)
Installation reference conditions	
- Minimum distance from components	> 200 mm (7.874 in)
- Reflector	Flat panel reflector
- Interference reflections	Max. interference signal 20 dB less than useful echo
Measurement deviation for solids	The values are heavily dependent on the application. It is therefore not possible to provide binding details.
Measurement deviation under EMC influence	≤ ±30 mm

Measurement characteristics and power data

Measuring frequency	K band (26 GHz technology)
Irradiated HF power (depending on parameterisation)[1)]	
- Max. power density at a distance of 1 m	< 1 µW/cm²

Ambient conditions

- Temperature	-40 ... +80 °C (-40 ... +176 °F)

Seal	Antenna adjustment cone	Process temperature (measured at process connection)
FKM (Viton)	PTFE	-40 . . . + 130 °C (- 40 . . . + 266 °F)
FFKM (Kalrez 6375)	PFFE	-20 . . . + 130 °C (- 4 . . . + 266 °F)
	PEEK	-20 . . . + 250 °C (- 4 . . . + 482 °F)
FFKM (Kalrez 2035)	PFFE	-15 . . . + 130 °C (- 5 . . . + 266 °F)
	PEEK	-15 . . . + 210 °C (- 5 . . . + 410 °F)
FFKM (Kalrez 6230)	PFFE	-15 . . . + 130 °C (- 5 . . . + 266 °F)
	PEEK	-15 . . . + 250 °C (- 5 . . . + 482 °F)

Vessel pressure - horn antenna	
- Air pressure cone adapter PTFE	-1 - 40 mbar / -100 - 4000 kPa (-14.5 - 580 psig)
- Air pressure cone adapter PEEK	-1 - 100 mbar / -100 - 10000 kPa (-14.5 - 1450 psig)
- Vessel pressure with swivel mounting	-1 - 1 mbar / -100 - 100 kPa (-14.5 - 14.5 psig)
Vibration strength	4 g at 5 … 200 Hz to EN 60068-2-6 (vibration from resonance)
Shock strength	100 g, 6 ms to EN 60068-2-27 (mechanical shock)

Electromechanical data - version IP 66 / IP 68 (1 bar)

Cable inlet options	
- Cable screw connection with integral connection cable	M20 x 1.5 (cable: ø 5 - 9 mm)
- Cable inlet	½ NPT
- Blind plug	M20 x 1.5; ½ NPT
Connection cable	
- Cable cross-section	0.5 mm² (AWG 20)
- Core resistance	< 0.036 Ω/m
- Tensile strength	< 1200 N (270 lbf)
- Standard length	5 m (16.4 ft)
- Max. length	180 m (590.6 ft)
- Min. bending radius	25 mm (0.984 in) at 25 °C (77 °F)
- Approx. diameter	8 mm (0,315 in)
- Colour - non-ex-rated version	Blue
- Colour - ex-rated version	Blue

[1)] EIRP: Equivalent Isotropic Radiated Power

Voltage supply

Operating voltage	
- Version for extra-low voltage	9.6 … 48 V DC, 20 … 42 V AC, 50/60 Hz
Polarity reversal protection	Integrate
Max. power consumption	4 VA; 2.1 W

Electrical protection measures

Protection type, depending on housing version	IP 66 / IP 68 (0.2 bar)[2)]
Surge voltage category	III
Protection class	III

[2)] The requirements for compliance with the protection type are the appropriate cable and correct installation.

8.2 Dimensions

The following dimension drawings are only a selection of the possible versions.

Nico 15, version with collar flange

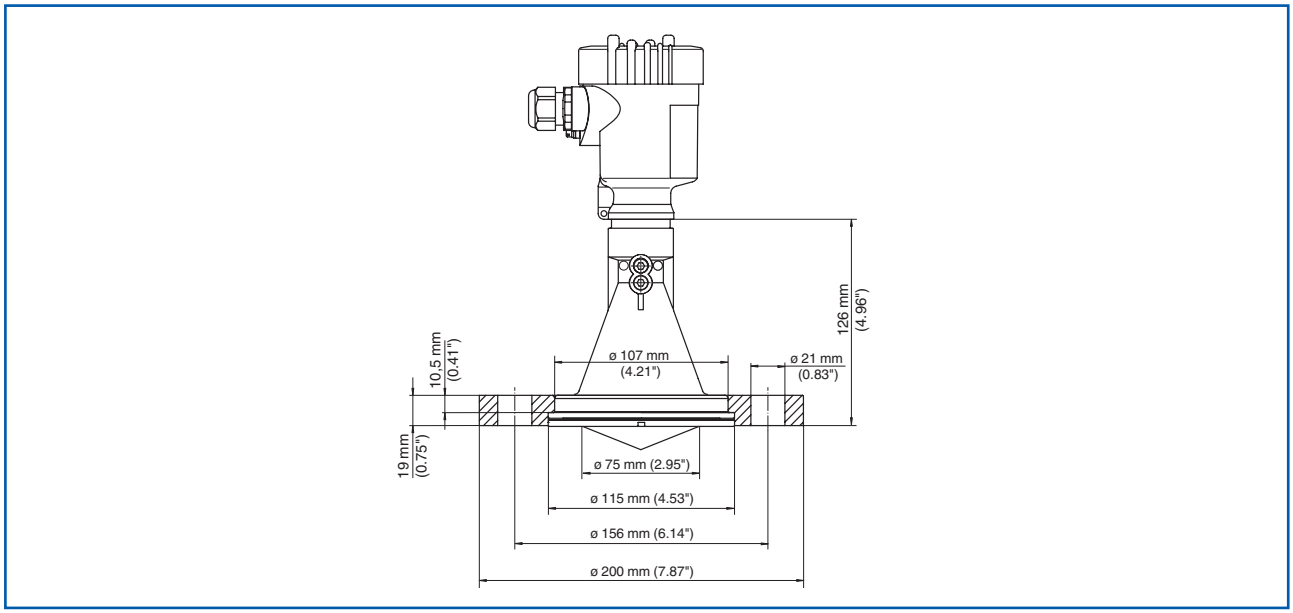


Fig. 38: Nico 15, collar flange to match DN 80 PN 16 / ASME 3" 150lbs/JIS80 10K

Nico 15, version with adapter flange

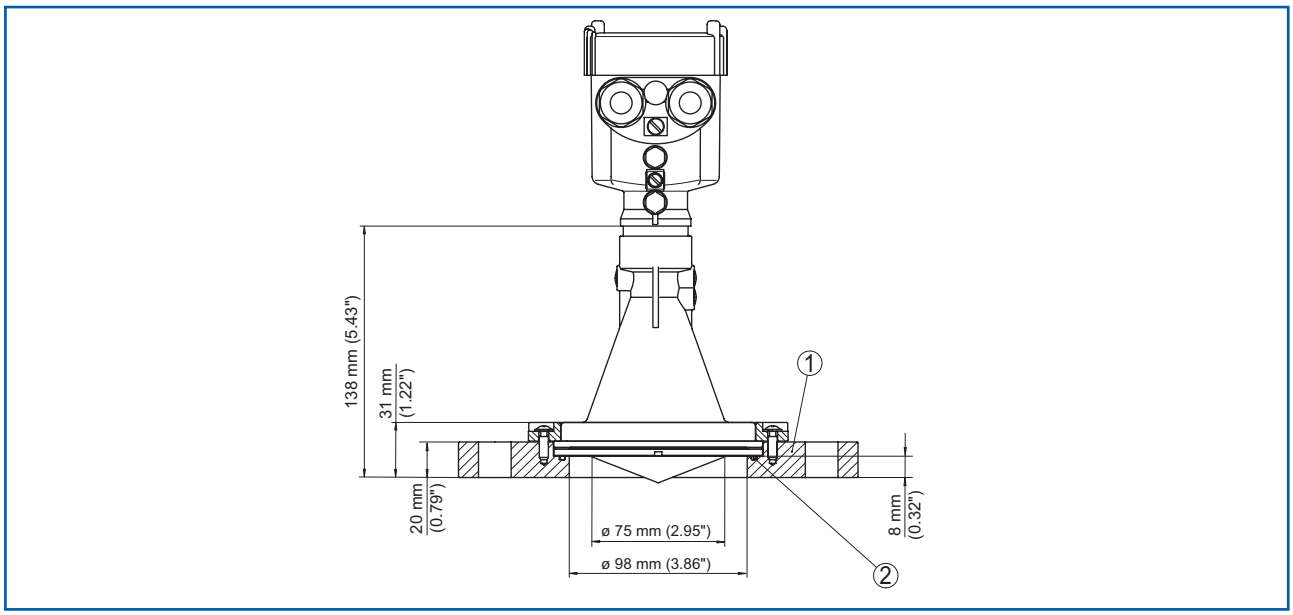
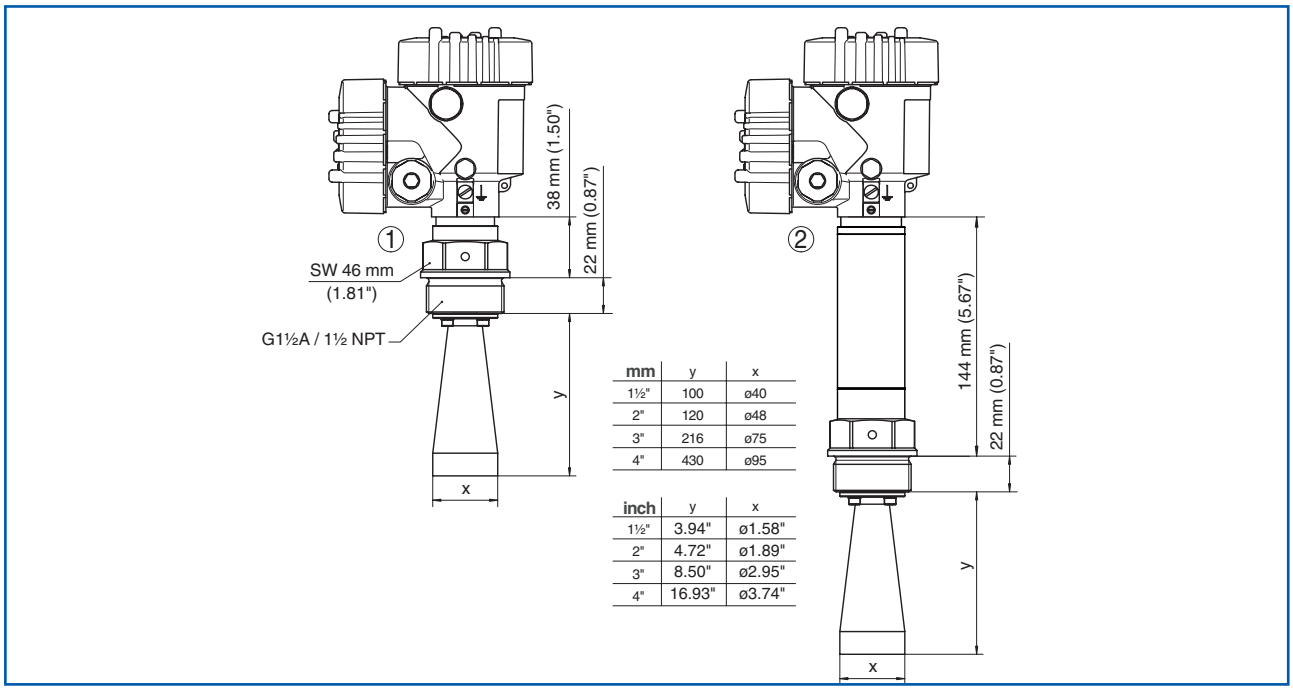


Fig. 39: Nico 15, adapter flange
1 Adapter flange
2 Seal

Nico 30, horn antenna in threaded design



mm	y	x
1½"	100	ø40
2"	120	ø48
3"	216	ø75
4"	430	ø95

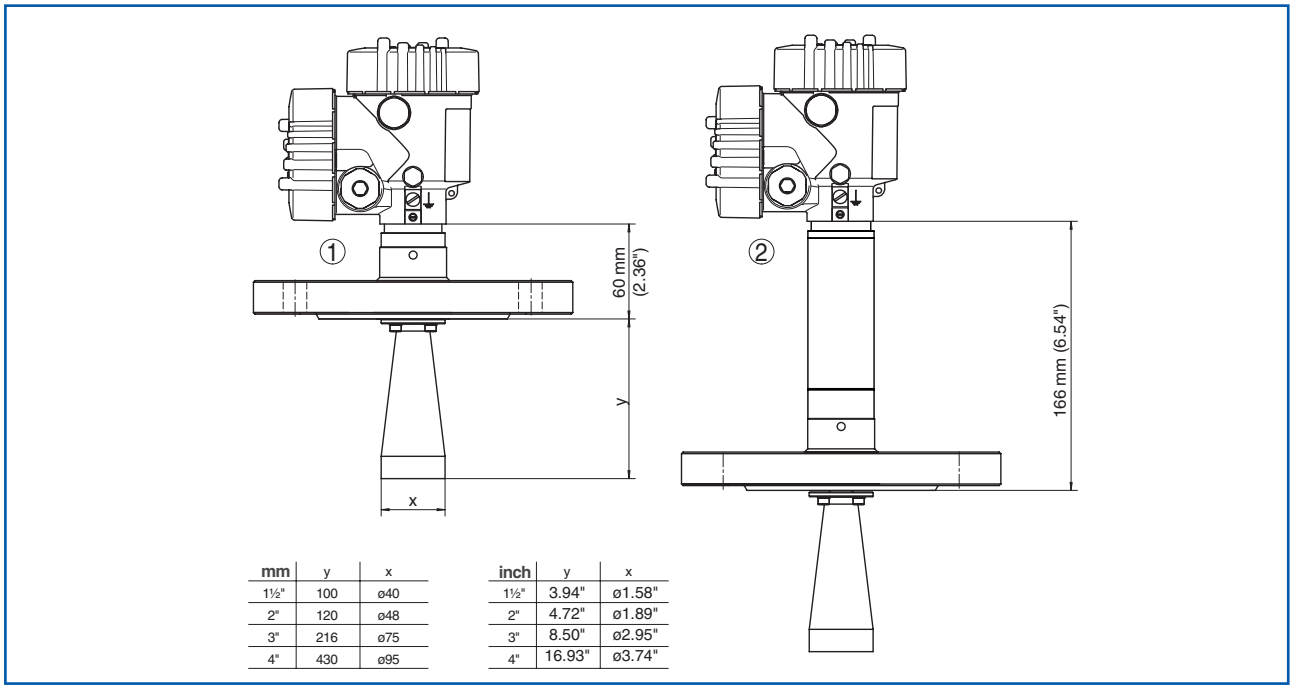
inch	y	x
1½"	3.94"	ø1.58"
2"	4.72"	ø1.89"
3"	8.50"	ø2.95"
4"	16.93"	ø3.74"

Fig. 40: Nico 30, horn antenna in threaded design

1 Standard

2 With intermediate temperature piece up to 250 °C

Nico 30, horn antenna in flange design



mm	y	x
1½"	100	ø40
2"	120	ø48
3"	216	ø75
4"	430	ø95

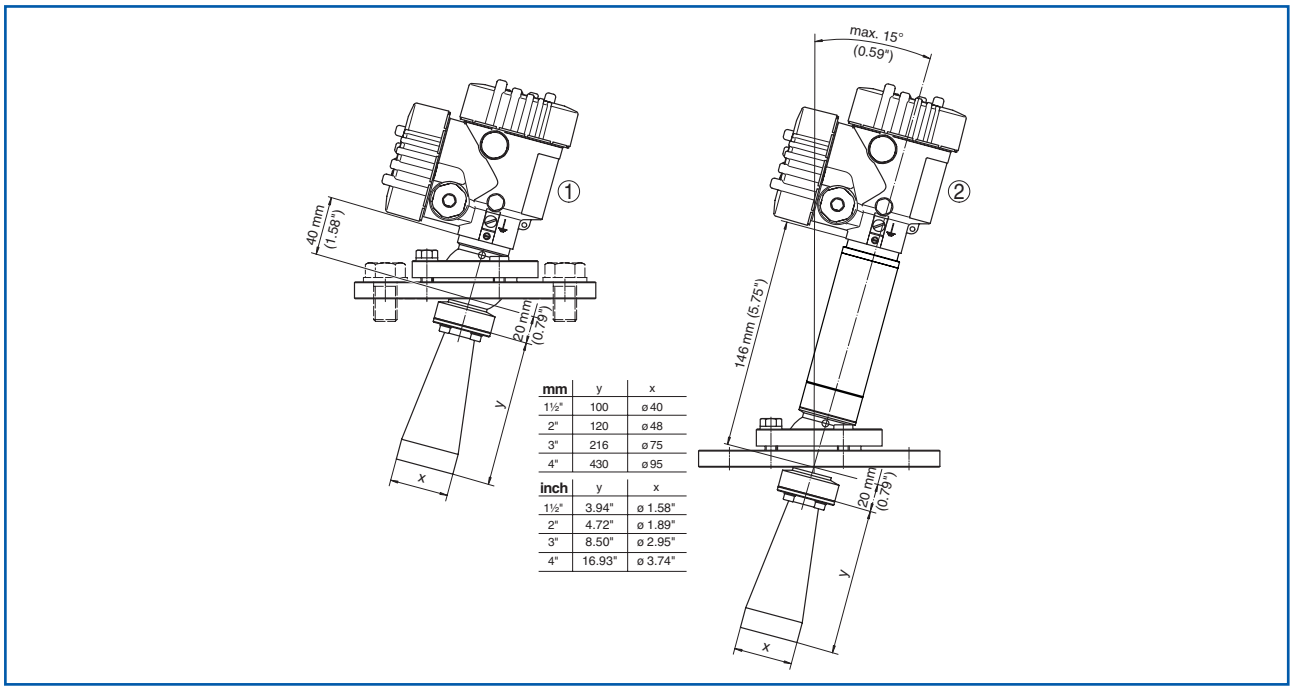
inch	y	x
1½"	3.94"	ø1.58"
2"	4.72"	ø1.89"
3"	8.50"	ø2.95"
4"	16.93"	ø3.74"

Fig. 41: Nico 30, horn antenna in flange design

1 Standard

2 With intermediate temperature piece up to 250 °C

Nico 30, horn antenna and swivel mounting



mm	y	x
1½"	100	ø 40
2"	120	ø 48
3"	216	ø 75
4"	430	ø 95

inch	y	x
1½"	3.94"	ø 1.58"
2"	4.72"	ø 1.89"
3"	8.50"	ø 2.95"
4"	16.93"	ø 3.74"

Fig. 42: Nico 30, horn antenna and swivel mounting

1 Standard

2 With intermediate temperature piece up to 250 °C

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