

SMARTLINE[®] RM70 (FMCW)

Handbook

Non-contact Radar (FMCW) Level Meter



Honeywell

Notices and Trademarks

Copyright 2008 by Honeywell

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Honeywell Field Solutions
512 Virginia Drive
Fort Washington, PA 19034

Abstract

This document provides descriptions and procedures for the Installation, Configuration, Operation, and Troubleshooting of your device.

Contacts

World Wide Web:

The following lists Honeywell's World Wide Web sites that will be of interest to our customers.

Honeywell Organization

Corporate

Field Solutions

Technical tips

WWW Address (URL)

<http://www.honeywell.com>

<http://www.honeywell.com/ps>

<http://content.honeywell.com/ipc/faq>

Telephone:

Contact us by telephone at the numbers listed below.

Organization

United States and
Canada

Honeywell

Phone Number

Tech. Support: 1-800-423-9883
Service: 1-800-525-7439

1	Safety instructions	9
1.1	Intended use	9
1.2	Certification	9
1.3	Safety instructions from the manufacturer	10
1.3.1	Copyright and data protection	10
1.3.2	Disclaimer	10
1.3.3	Product liability and warranty	11
1.3.4	Information concerning the documentation	11
1.3.5	Display conventions	12
1.4	Safety instructions for the operator	12
2	Device description	13
2.1	Scope of delivery	13
2.2	Device description	15
2.3	Nameplate	16
2.3.1	Visual Check	16
2.3.2	Non-Ex nameplate	17
3	Installation	19
3.1	Pre-installation requirements	19
3.2	General installation notes	19
3.2.1	How to attach antenna extensions (long antennas only)	20
3.2.2	How to turn or remove the signal converter	22
3.3	Storage	23
3.4	Transport	24
3.5	How to prepare the tank before you install the device	25
3.5.1	Pressure and temperature ranges	25
3.5.2	Theoretical data for nozzles	26
3.6	Installation recommendations for liquids	28
3.6.1	General requirements	28
3.6.2	Installation in stilling wells	29
3.6.3	Bypass chambers	33
3.7	Installation recommendations for solids	35
3.8	How to keep false reflections to a minimum	36
3.9	How to install the device on the tank	37
3.9.1	How to install a device with a flange connection	37
3.9.2	How to install a device with a threaded connection	38
3.9.3	How to attach the weather protection to the device	39
3.9.4	How to open the weather protection	40
3.10	Electromagnetic compatibility	40
3.11	Radio approvals	41
3.11.1	European union (EU)	41

3.11.2 U.S.A.....	42
4 Electrical connections	43
4.1 Safety instructions	43
4.2 Electrical installation: outputs 1 and 2.....	44
4.2.1 Non-Ex	45
4.2.2 Ex i.....	45
4.2.3 Ex d.....	47
4.3 Protection category.....	47
4.4 Networks	48
4.4.1 General information	48
4.4.2 Point-to-point connection	48
4.4.3 Multi-drop networks.....	49
5 Start-up	51
5.1 Start-up checklist	51
5.2 Operating concept.....	51
5.3 Digital display screen.....	52
5.3.1 Local display screen layout	52
5.3.2 Push-button functions	52
5.3.3 Help screens.....	52
5.3.4 How to start the device.....	53
5.4 Remote communication with PACTware™	53
5.5 Remote communication with the AMST™ Device Manager	54
6 Operation	55
6.1 User modes	55
6.2 Operator mode	55
6.3 Supervisor mode	57
6.3.1 General notes	57
6.3.2 How to get access to the supervisor mode	57
6.3.3 Menu overview	58
6.3.4 Push-button functions	59
6.3.5 Function description	62
6.4 Further information on device configuration	76
6.4.1 Quick Links	76
6.4.2 Protection of the device settings.....	77
6.4.3 Network configuration.....	78
6.4.4 Linearisation	79
6.4.5 Distance measurement	79
6.4.6 Level measurement.....	80
6.4.7 How to configure the device to measure volume or mass	82
6.4.8 How to measure correctly in tanks with curved bottoms.....	83
6.5 Service mode.....	84

6.6	Errors	85
6.6.1	General information	85
6.6.2	Error handling	87
7	Service	91
7.1	Periodic maintenance	91
7.2	Keep the device clean	91
7.3	How to replace device components	91
7.3.1	Service warranty	91
7.3.2	Replacement of the display cover	92
7.3.3	Replacement of the back end and microwave unit	93
7.3.4	Replacement of the terminal module	95
7.4	Spare parts availability	97
7.4.1	General notes	97
7.4.2	List of spare parts	97
7.4.3	List of accessories	99
7.5	Service availability	100
7.6	Returning the device to the manufacturer	101
7.6.1	General information	101
7.6.2	Form (for copying) to accompany a returned device	102
7.7	Disposal	102
8	Technical data	103
8.1	Technical data	103
8.2	Antenna selection	106
8.2.1	Liquid applications	106
8.2.2	Solid applications	108
8.3	Dimensions and Weight	109
9	Appendices	117
9.1	Glossary	117
10	Contact	120

1.1 Intended use

This radar level transmitter measures distance, level, mass, volume and reflectivity of liquids, pastes, slurries, granulates and powders.

It can be installed on tanks, silos and open channels.

1.2 Certification



In accordance with the commitment to customer service and safety, the level transmitter described in this document meets the following safety requirements:

- EMC Directive 89 / 336 / EEC and 93 / 68 / EEC in conjunction with EN 61326-1 (1997) and A1 (1998), A2 (2001).
- Low-Voltage Directives 2006 / 95 / EC and 93 / 68 / EEC in conjunction with EN 61010-1 (2001).

All devices are based on the CE marking and meet the requirements of NAMUR Guideline NE 21 / 04.

1.3 Safety instructions from the manufacturer

1.3.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to German copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.3.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect, incidental, punitive and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.3.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation and operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.3.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of underneath icons.

1.3.5 Display conventions

The following symbols are used to help you navigate this documentation more easily:



DANGER!

This symbol designates safety advice on handling electricity.



WARNING!

These warning signs must be observed without fail. Even only partial disregarding such warnings can result in serious health damage, damage to the device itself or to parts of the operator's plant.



CAUTION!

These warnings must be observed without fail. Even only partial disregarding such warnings can lead to improper functioning of the device.



LEGAL NOTICE!

This symbol designates information on statutory directives and standards.



NOTE!

This symbol designates important information for the handling of the device.



• **HANDLING**

This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.



CONSEQUENCE

This symbol designates all important consequences of the previous actions.

1.4 Safety instructions for the operator



WARNING!

In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

**INFORMATION!**

Check the packing list to see if you have received all that you require.
The level transmitter will arrive in one box.

**NOTE!**

Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to your local office.

Scope of delivery - horn antenna

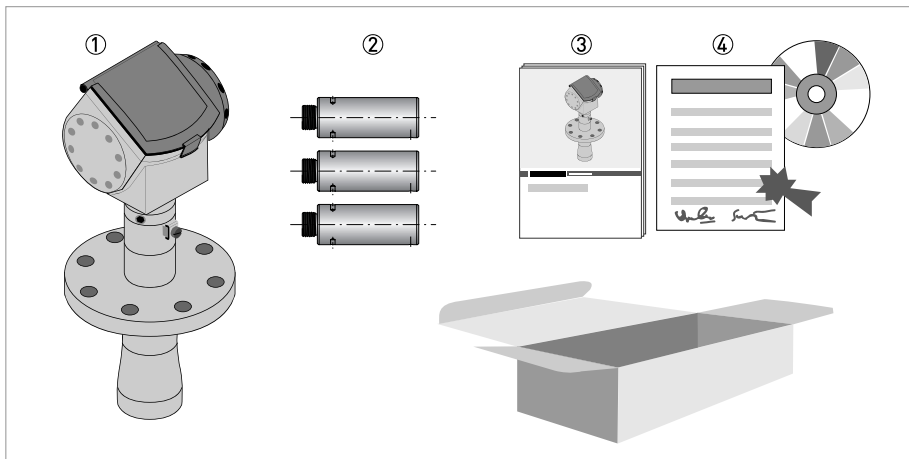


Figure 2-1: Scope of delivery - horn antenna

- ① Signal converter and antenna in compact version
- ② Antenna extensions for the long antenna (option)
- ③ Quick Start
- ④ CD-ROM (including Handbook, Quick Start, Technical Datasheet and related software)

Scope of delivery - drop antenna

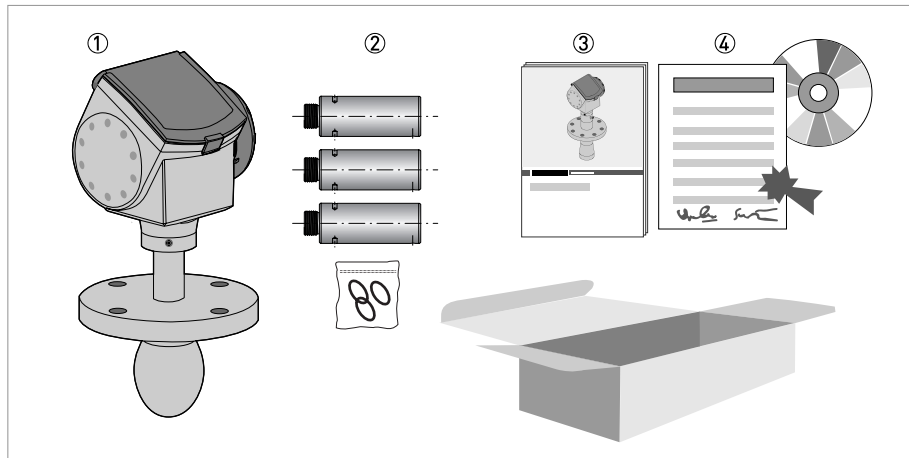


Figure 2-2: Scope of delivery - drop antenna

- ① Signal converter and antenna in compact version
- ② Antenna extensions (option) and o-ring for each antenna extension (sealed antenna extension option)
- ③ Quick Start
- ④ CD-ROM (including Handbook, Quick Start, Technical Datasheet, and related software)

**INFORMATION!**

No special tools or training required!

2.2 Device description

This device is an FMCW-radar level transmitter. It is a non-contact technology. It is designed to measure the distance, level, mass, volume and reflectivity of liquids, pastes, slurries, granulates and powders. If it is ordered with the applicable option, it can be certified for overfill protection as given in WHG.

Radar level transmitters use an antenna to guide a signal to the surface of the measured product. The device has many antennas available. Thus, it can measure most products even in difficult conditions. Also refer to *Technical data* on page 103.

The device has a setup wizard, fully-potted electronic circuit boards and online help functions. You usually will not need this Handbook to install, setup and operate the device.

These accessories are available:

- stainless steel weather protection.
- RS232/HART® converter (VIATOR).
- USB/HART® converter.



INFORMATION!

For more data on accessories, refer to List of accessories on page 99.

2.3 Nameplate

2.3.1 Visual Check

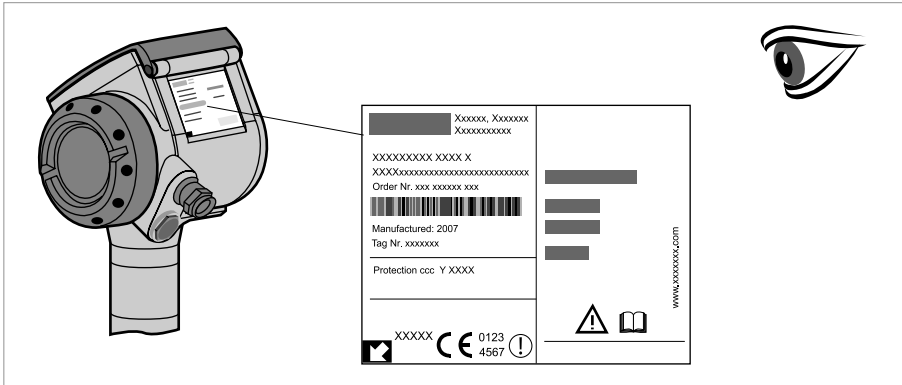


Figure 2-3: Visual check



- Check the delivery for damage.
- Compare the data on the nameplate with your order data.



WARNING!
If the display screen glass is broken, do not touch.

2.3.2 Non-Ex nameplate

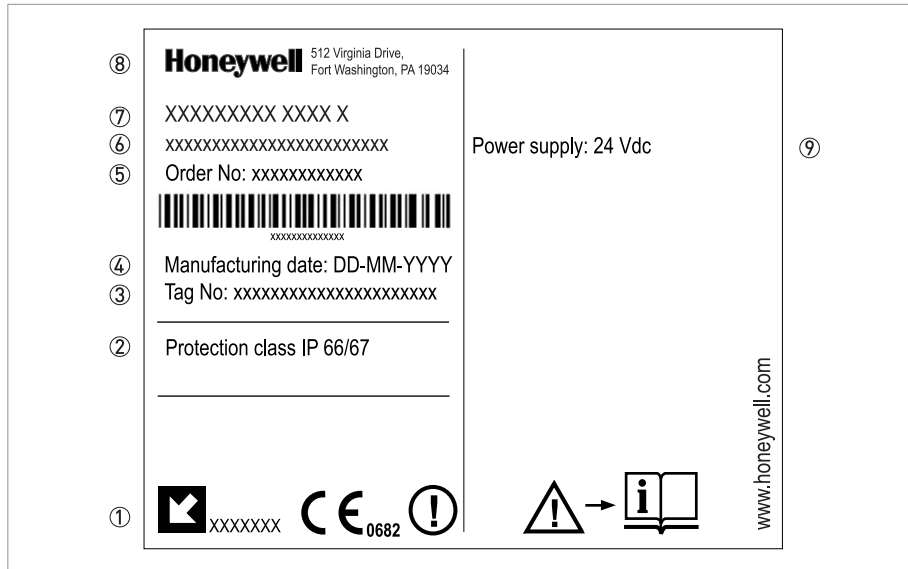


Figure 2-4: Non-Ex nameplate

- ① Indicator arrow to cable entry / cable entry size. Notified body for radio approval.
- ② Degree of ingress protection (according to EN 60529 / IEC 529)
- ③ Customer tag number
- ④ Date of manufacture
- ⑤ Order number
- ⑥ Type code (defined in order)
- ⑦ Model name and number
- ⑧ Company name and address
- ⑨ Nominal voltage for operation. For further information, refer to *Non-Ex* on page 45.

3.1 Pre-installation requirements

**NOTE!**

The following precautions must be taken to ensure reliable installation.

- Make sure that there is adequate space to the sides.
- Protect the signal converter from direct sunlight and install a sun shade if necessary.
- Signal converters installed in control cabinets require adequate cooling, for example fans or heat exchangers.
- Do not subject the signal converter to heavy vibrations. The devices are tested for vibration and agree with EN 50178 and IEC 60068-2-6.

To make sure that you install the device quickly, easily and safely, prepare the installation as given in the instructions that follow.

3.2 General installation notes

**Before you install the device:**

- Check the packing and the device for any damage.
- Compare your order specification with the scope of delivery.
- Check the nameplates on the device.

3.2.1 How to attach antenna extensions (long antennas only)

Horn antenna - antenna extensions

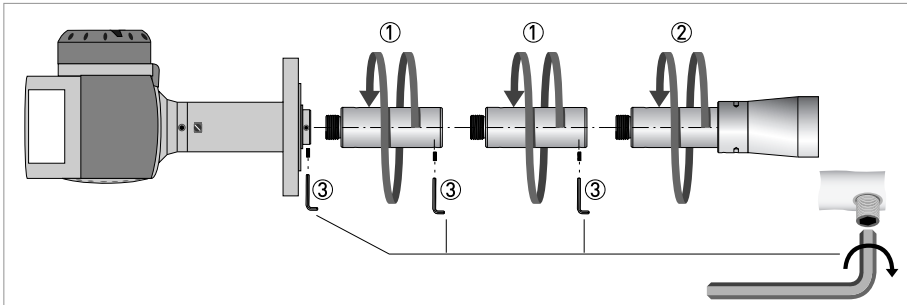


Figure 3-1: Horn antenna - how to attach antenna extensions



- Attach the antenna extensions ① below the flange.
- Attach the antenna ②.
- Make sure the antenna extensions are fully engaged.
- Use a 3 mm Allen wrench to tighten the locking screws ③.
- If you attach more or less extensions than were initially ordered, change the antenna extension value in the program mode. Use the display screen or PACTware™.
- ➡ Antenna extension = antenna extension length x number of extensions
- If you attach more extensions than were initially ordered, change the blocking distance value in the user interface.
- ➡ Minimum blocking distance = antenna length + (antenna extension length x number of extensions) + 0.1 m / 4"

Drop antenna - antenna extensions

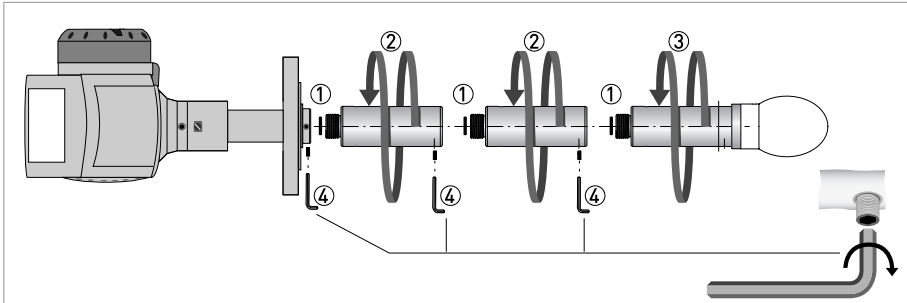


Figure 3-2: Drop antenna - how to attach antenna extensions



NOTE!

Antenna extensions can only be attached below flanges without the PP/PTFE flange plate option



- Remove the o-rings from the plastic sachet supplied with the device. Put an o-ring ① into the groove at the top of each antenna extension.
- Attach the antenna extensions ② below the flange.
- Attach the antenna ③.
- Make sure the antenna extensions are fully engaged.
- Use a 3 mm Allen wrench to tighten the locking screws ④.
- If you attach more or less extensions than were initially ordered, change the antenna extension value in the program mode. Use the display screen or PACTware™.
- ➡ Antenna extension = antenna extension length x number of extensions
- If you attach more extensions than were initially ordered, change the blocking distance value in the user interface.
- ➡ Minimum blocking distance = antenna length + (antenna extension length x number of extensions) + 0.1 m / 4"

3.2.2 How to turn or remove the signal converter

**NOTE!**

The converter turns 360°. Remove the signal converter before you lift the device with a hoist.

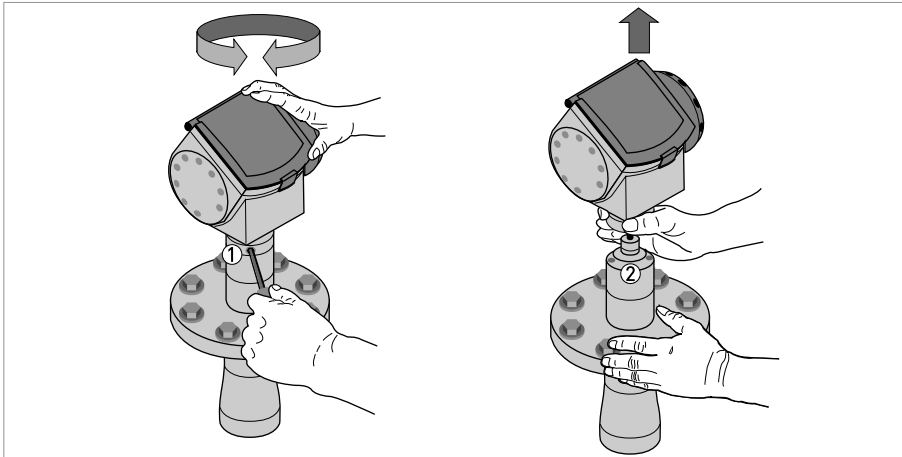


Figure 3-3: How to turn or remove the signal converter

- Tool: 5 mm Allen wrench

**How to turn the signal converter**

- Loosen the housing locking screw ① with a 5 mm Allen wrench.
- Turn the housing to the correct position.
- Tighten the housing locking screw ①.

**How to remove the signal converter**

- Loosen the housing locking screw ① with a 5 mm Allen wrench.
- Remove the housing.
- Tighten the housing locking screw ①.

**How to attach the signal converter**

- Loosen the housing locking screw ① with a 5 mm Allen wrench.
- Attach the housing to the flange system.
- Tighten the housing locking screw ①.

**CAUTION!**

If you remove the housing, put a cover on the wave guide hole in the flange assembly ②.

3.3 Storage

**WARNING!**

Do not keep the device in a vertical position. This will damage the antenna and the device will not measure correctly.

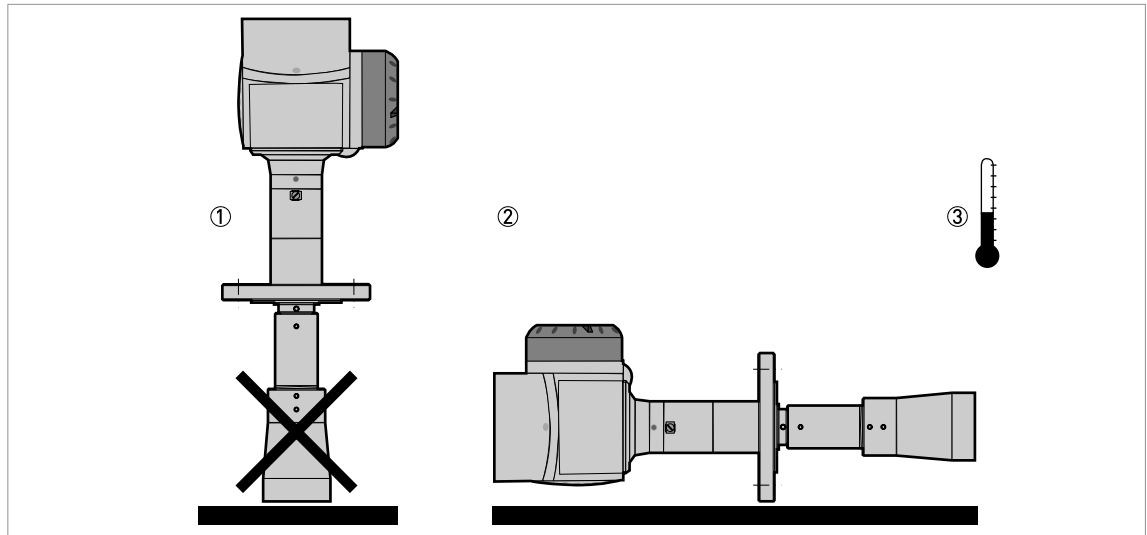


Figure 3-4: Storage conditions

- ① When you put the device into storage, do not keep it in a vertical position
- ② Put the device on its side. We recommend that you use the packaging in which it was delivered.
- ③ Storage temperature range: -40...+85°C / -40...+185°F

- Store the device in a dry and dust-free location.
- Keep the converter out of the sunlight.
- Store the device in its original packing.

3.4 Transport

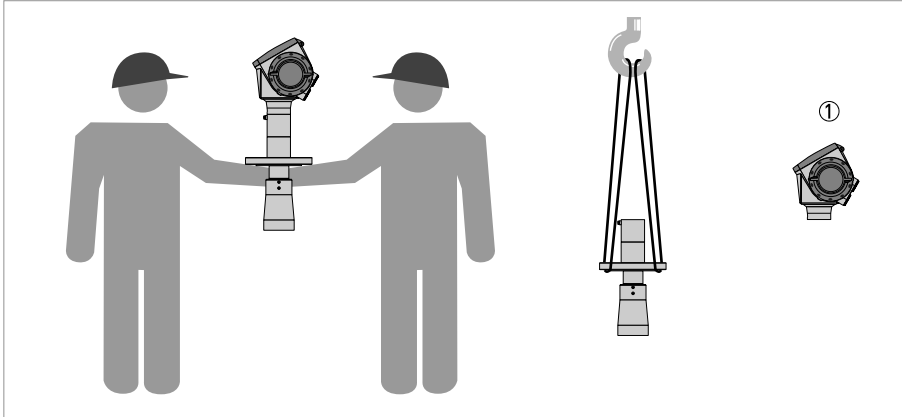


Figure 3-5: How to lift the device

- ① Remove the converter before you lift the device with a hoist.



WARNING!

Lift the device carefully to prevent damage to the antenna.

3.5 How to prepare the tank before you install the device



CAUTION!

To avoid measuring errors and device malfunction, obey these precautions.

3.5.1 Pressure and temperature ranges

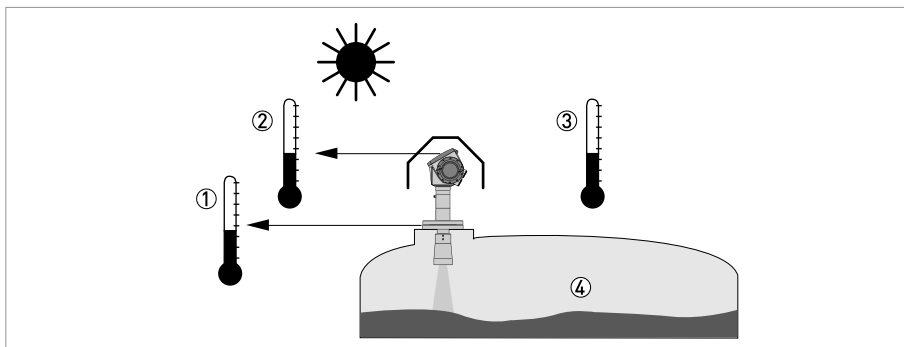


Figure 3-6: Pressure and temperature ranges

- ① Flange temperature
FKM/FPM gasket: -40...200°C / -40...390°F; Kalrez 6375 gasket: -20...200°C / -4...390°F;
EPDM gasket: -50...+150°C / -58...+300°F
Ex devices: see supplementary operating instructions
- ② Ambient temperature for operation of the display
-20...+60°C / -4...+140°F
If the ambient temperature is not between these limits, the display screen switches off automatically
- ③ Ambient temperature
Non-Ex devices: -40...80°C / -40...175°F
Ex devices: see supplementary operating instructions
- ④ Process pressure
PP drop antenna option: -1...16 bar / -14.5...232 psig
All other antenna options: -1...40 bar / -14.5...580 psig



WARNING!

Maximum process temperature:

PTFE Drop antenna option: +150°C / +300°F

PP Drop antenna option: +100°C / 210°F

3.5.2 Theoretical data for nozzles

**CAUTION!**

Follow these recommendations to make sure that the device measures correctly.

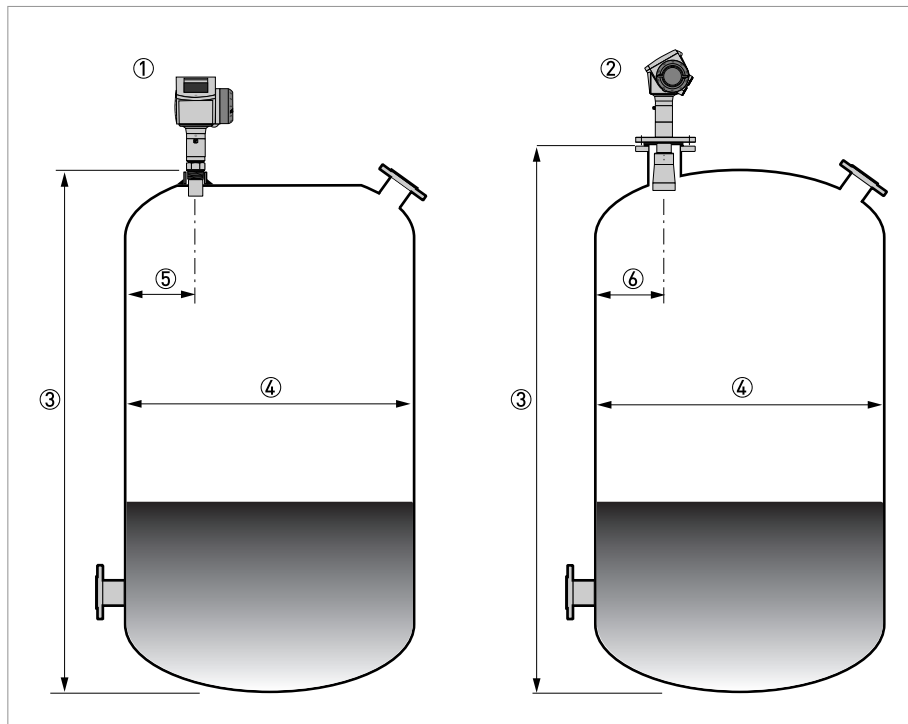


Figure 3-7: Recommended nozzle position

- ① Nozzles for DN40 or DN50 Horn antennas
- ② Nozzles for DN80 or DN100 Horn antennas, or DN80 Drop antenna
- ③ Tank height
- ④ Tank diameter
- ⑤ Minimum distance of nozzle from the tank wall : $1/7 \times$ tank height
Maximum distance of nozzle from the tank wall : $1/3 \times$ tank diameter
- ⑥ Minimum distance of nozzle from the tank wall : $1/10 \times$ tank height
Maximum distance of nozzle from the tank wall : $1/3 \times$ tank diameter

**CAUTION!**

Do not put the device near to the product inlet. If the product that enters the tank touches the antenna, the device will measure incorrectly. If the product fills the tank directly below the antenna, the device will also measure incorrectly.

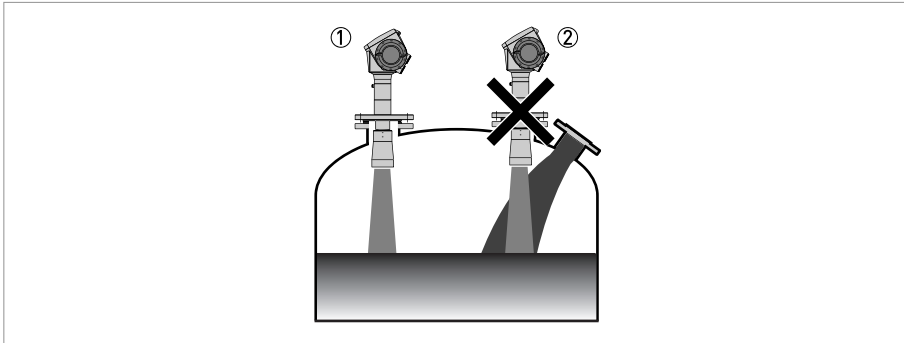


Figure 3-8: Product inlets

- ① The device is in the correct position.
- ② The device is too near to the product inlet.

3.6 Installation recommendations for liquids

3.6.1 General requirements

We recommend that you prepare the installation when the tank is empty.

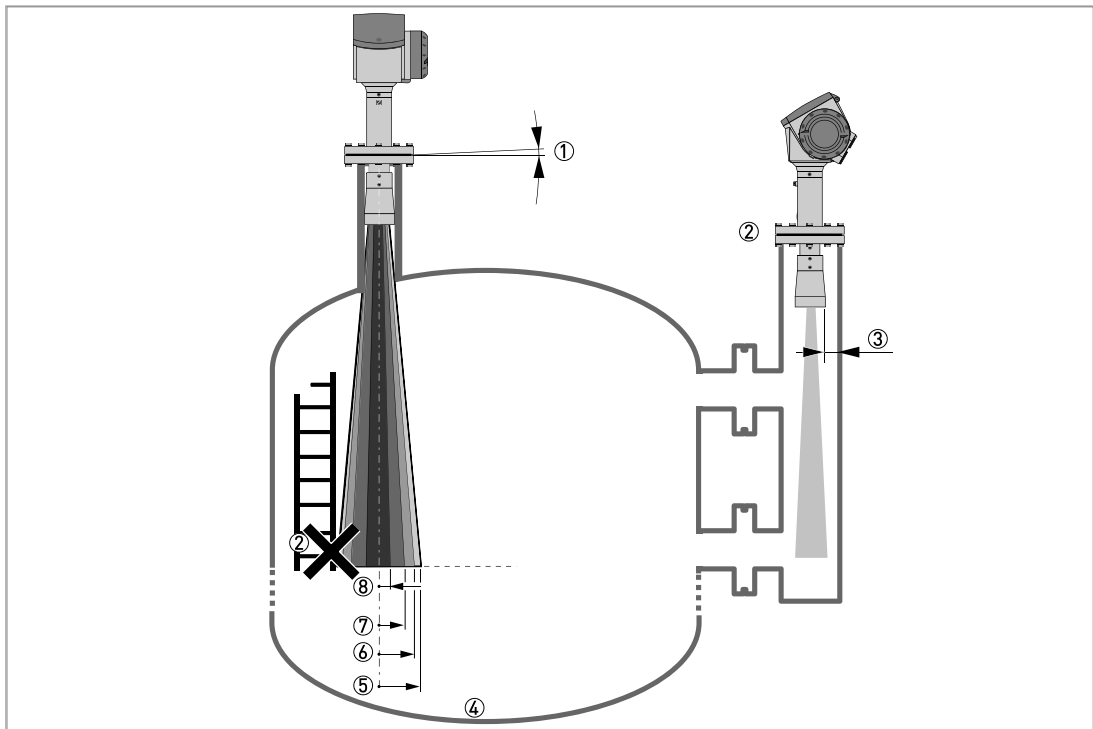


Figure 3-9: General Installation recommendations

- ① Do not tilt the device more than 2°
- ② If there are too many obstacles in the radar beam, do an empty spectrum scan (refer to **Operation**) or install a bypass chamber or stilling well
- ③ 2.5 mm / 0.1" max. for high-dielectric constant liquids
- ④ Curved and conical tank bottoms: Refer to **Operation** for fine adjustment of the device
- ⑤ Radius of radar footprint (DN40 Horn antenna): increments of 180 mm/m or 2.15"/ft (10°)
- ⑥ Radius of radar footprint (DN50 Horn antenna): increments of 130 mm/m or 1.55"/ft (7.5°)
- ⑦ Radius of radar footprint (DN80 Horn antenna): increments of 90 mm/m or 1.1"/ft (5°)
- ⑧ Radius of radar footprint (DN100 Horn antenna and DN80 Drop antenna): increments of 70 mm/m or 0.83"/ft (4°)

3.6.2 Installation in stilling wells

Use a stilling well if:

- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.
- There are too many other obstacles near to the area where you want to install the device.
- The device is used to measure a liquid (petro-chemicals) in a tank with a floating roof.

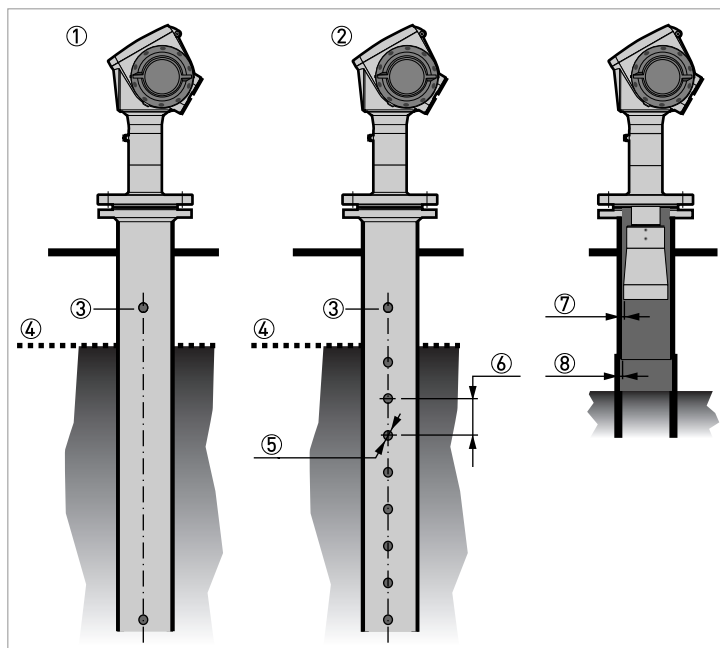


Figure 3-10: Installation recommendations for stilling wells

- ① Basic requirements for a stilling well
- ② Recommendations for tanks that have no foam
- ③ Air circulation hole
- ④ Maximum level of the liquid
- ⑤ Hole diameter $\varnothing 10 \text{ mm}/0.4''$
- ⑥ Distance between holes $100 \text{ mm}/4''$
- ⑦ Clearance between the antenna and the wall of the stilling well $<2.5 \text{ mm}/0.1''$ for a high-dielectric constant liquid
- ⑧ Sudden change in well diameter $<1 \text{ mm}/0.04''$



CAUTION!

Installation requirements

- *The stilling well must be electrically conductive.*
- *The inside diameter of the bypass chamber must not be more than $5 \text{ mm}/0.2''$ over the diameter of the antenna (for a high-dielectric constant liquid).*
- *The stilling well must be straight.*
- *The stilling well must have a surface roughness of $\pm 0.1 \text{ mm}/0.004''$.*
- *There must be no sudden changes in internal diameter greater than $1 \text{ mm}/0.04''$.*
- *The bottom of the stilling well must be open.*



Installation in tanks containing one liquid and foam

- Drill a pressure equalization hole in the stilling well above the maximum level.
- Deburr the hole.



Installation in tanks containing one liquid without foam

- Drill a pressure equalization hole in the stilling well above the maximum level of the top liquid.
- Drill more holes along the length of the stilling well. The holes have a minimum diameter of 10 mm/0.4" with a minimum distance of 100 mm/4" between the holes.
- ➔ These holes help the liquid to move freely between the stilling well and the tank.
- Deburr the holes.

Floating roofs

If the device must be installed on a tank with a floating roof, install it in a stilling well.

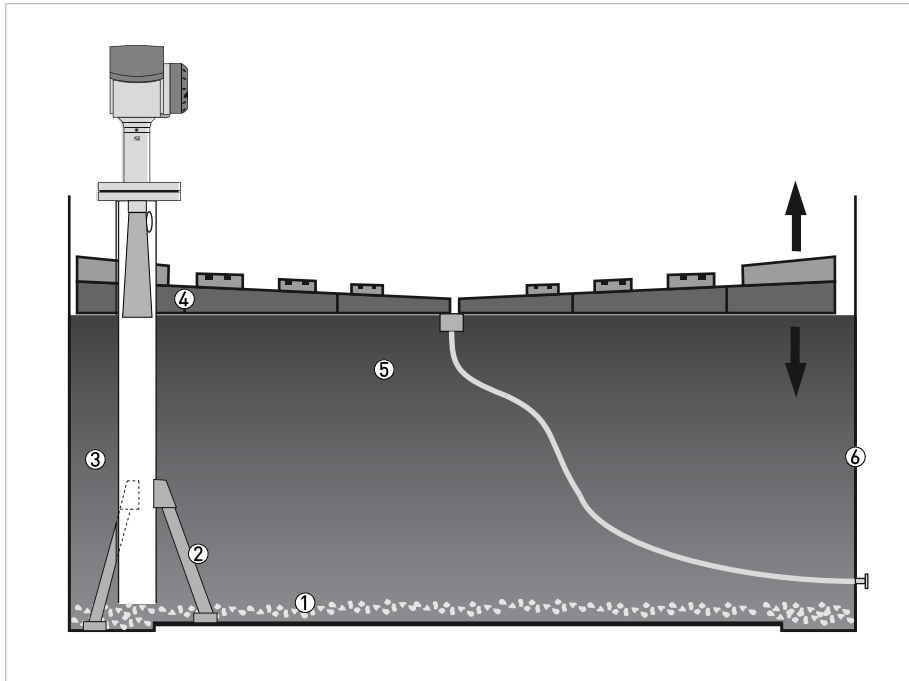


Figure 3-11: Floating roofs

- ① Sediment
- ② Support fixtures
- ③ Stilling well
- ④ Floating roof
- ⑤ Product
- ⑥ Tank

Horizontal cylindrical tanks

If the device:

- is for a horizontal cylindrical tank,
- is in a metallic tank,
- measures a product with a high dielectric constant and
- is on the centerline of the tank,

we recommend that you install it in a stilling well.

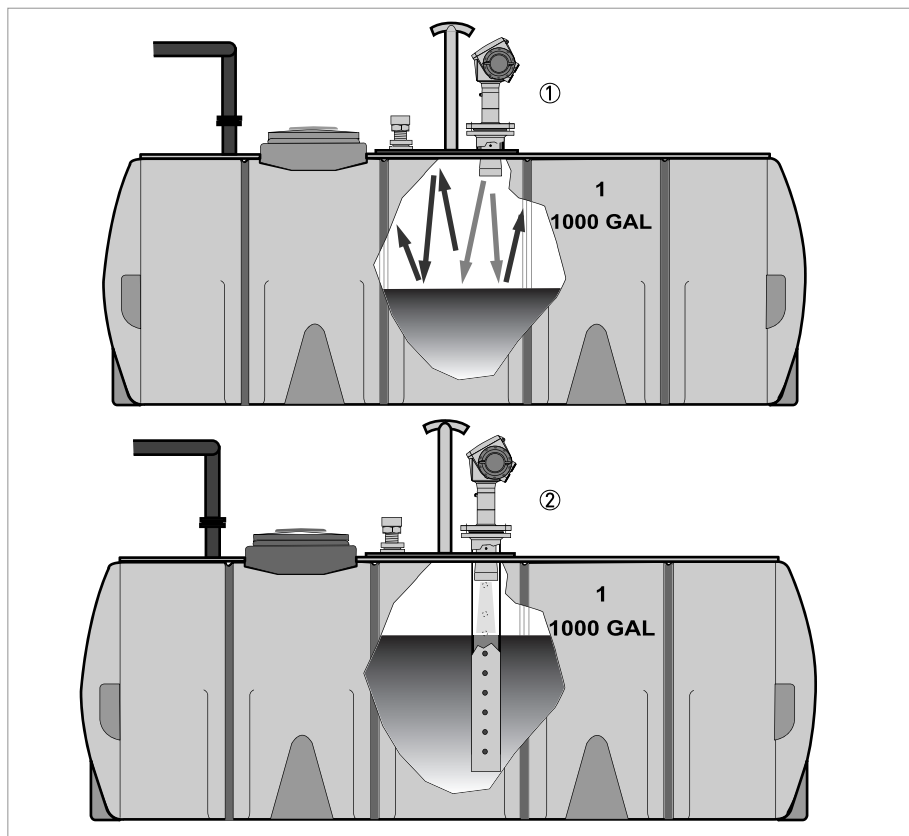


Figure 3-12: Horizontal cylindrical tanks

- ① The device is installed without a stilling well. There are multiple reflections. Refer to the CAUTION! that follows.
 ② The device is installed in a stilling well and measures correctly.



CAUTION!

If the device is installed in horizontal cylindrical tank without a stilling well, do not put it on the tank centerline. This will cause multiple reflections and the device will not measure accurately. Use the **multiple reflections** function in **supervisor mode > advanced setup > Installation setup** to keep the effects of multiple reflections to a minimum. For more data, refer to C. Advanced setup on page 69.

3.6.3 Bypass chambers

Install a bypass chamber next to the tank if:

- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.
- There are too many obstacles in the tank.

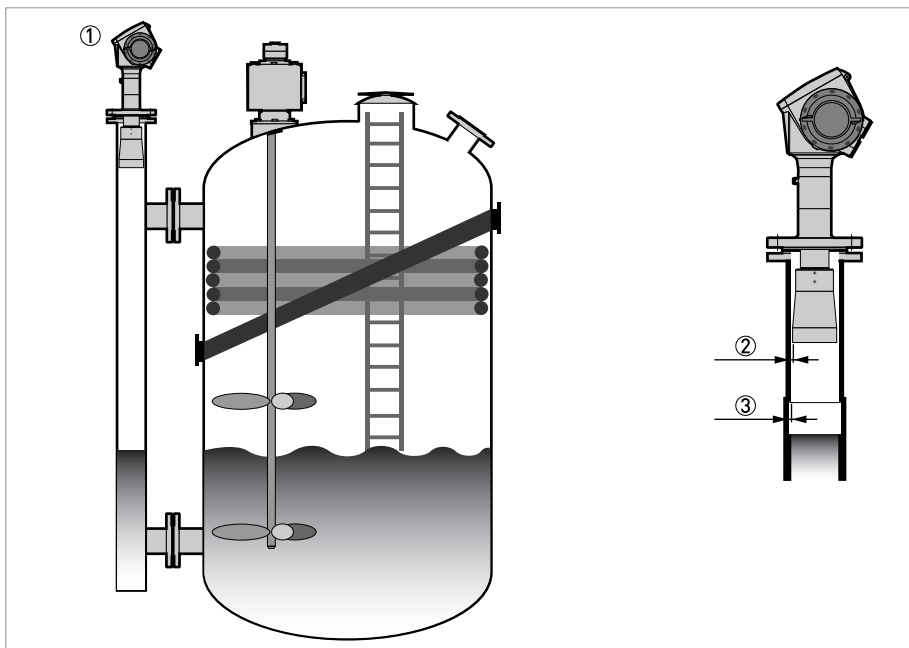


Figure 3-13: Installation recommendations for bypass chambers

- ① Bypass chamber
- ② Clearance between the antenna and the wall of the stilling well <math>< 2.5 \text{ mm} / 0.1''</math> for a high-dielectric constant liquid
- ③ Sudden change in well diameter <math>< 1 \text{ mm} / 0.04''</math>



CAUTION!

Installation requirements

- *The bypass chamber must be electrically conductive.*
- *The inside diameter of the bypass chamber must not be more than 5 mm / 0.2'' over the diameter of the antenna (for a high-dielectric constant liquid).*
- *The bypass chamber must be straight.*
- *The bypass chamber must have a surface roughness of $\pm 0.1 \text{ mm} / 0.004''$.*
- *There must be no sudden changes in internal diameter greater than 1 mm / 0.04''.*

Installation next to tanks containing one liquid and foam

- The top process connection of the bypass chamber must be above the maximum level of liquid.
- The bottom process connection of the bypass chamber must be below the lowest measured level of liquid.

Installation next to tanks containing more than one liquid

- The top process connection of the bypass chamber must be above the maximum level of liquid.
- The bottom process connection of the bypass chamber must be below the lowest measured level of liquid.
- Additional process connections are necessary for the liquids to circulate freely along the length of the bypass chamber. These must have a minimum diameter of 25 mm/1" with a minimum distance of 100 mm/4" between the connections.

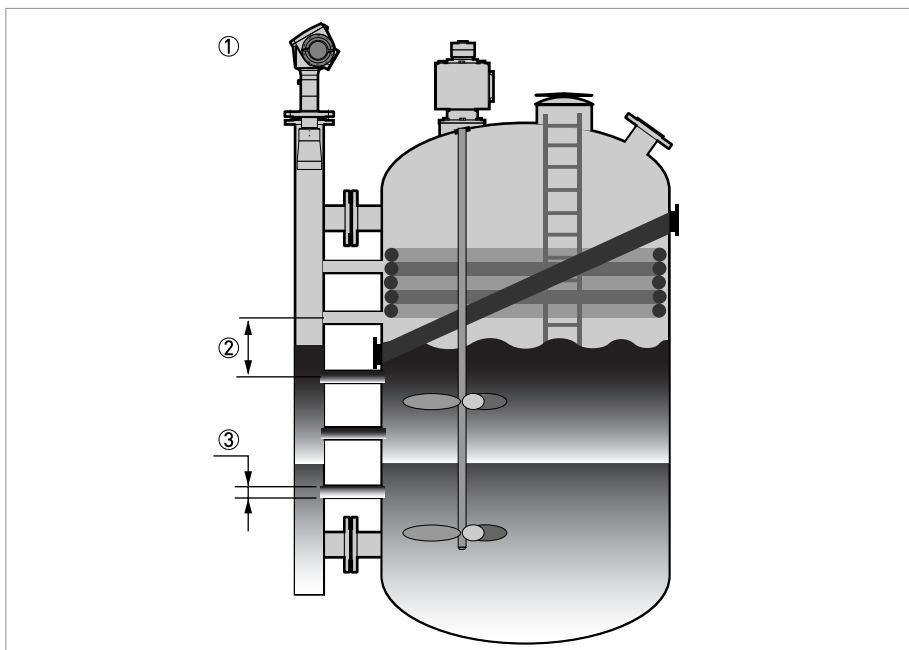


Figure 3-14: Installation recommendations for bypass chambers that contain more than one liquid

- ① Bypass chamber
- ② Distance between connections 100 mm/4"
- ③ Connection diameter $\varnothing 25$ mm/1"

3.7 Installation recommendations for solids

We recommend that you prepare the installation when the silo is empty.

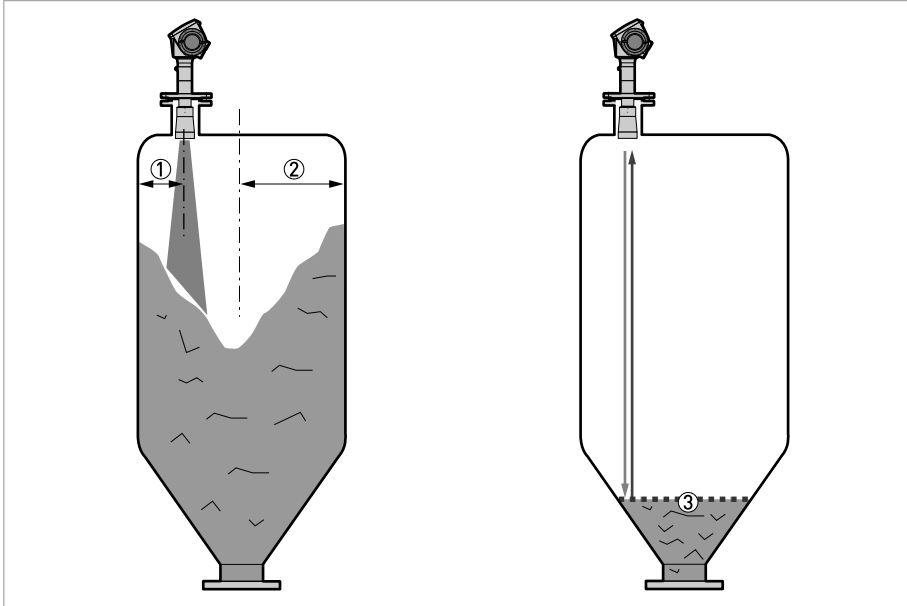


Figure 3-15: Installation recommendations for solids

- ① Position of the process fitting from the silo wall, $r/2$
- ② Radius of the silo, r
- ③ The minimum measured level for a silo with a conical base

3.8 How to keep false reflections to a minimum



CAUTION!

If there are false reflections, the device will not measure correctly.

False reflections are caused by:

- Objects in the tank.
- Sharp corners that are perpendicular to the path of the beam.
- Sudden changes in tank diameter in the path of the beam.

If there are too many obstacles in the path of the radar beam, do an empty spectrum scan (refer to *Function description* on page 62, menu item A.1.3) or install a bypass chamber or stilling well.

False reflections

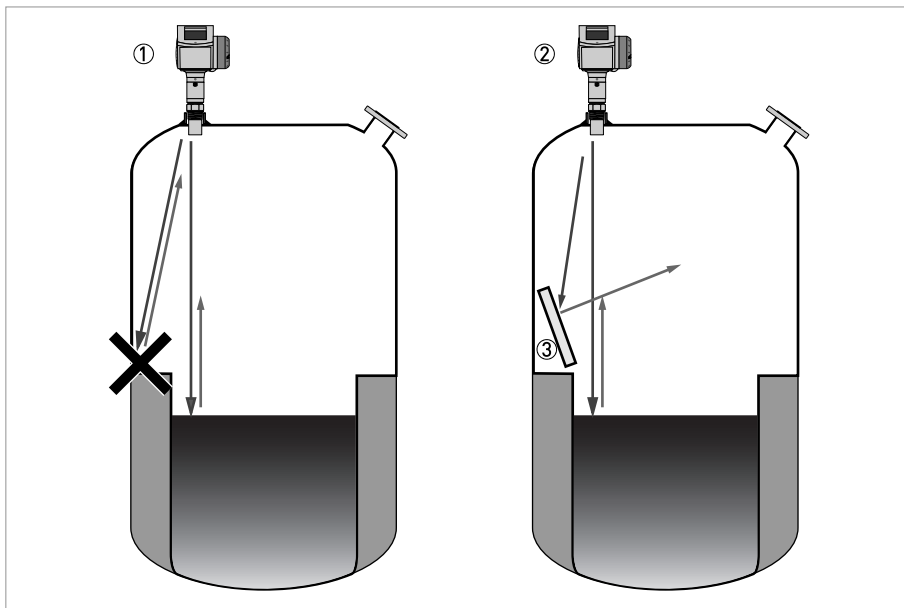


Figure 3-16: False reflections and deflector plates

- ① Sharp corners and sudden changes in tank diameter can cause the device to measure incorrectly
- ② Install a deflector plate to prevent false reflections
- ③ Deflector plate

3.9 How to install the device on the tank

3.9.1 How to install a device with a flange connection

Equipment needed:

- Device
- Gasket (not supplied)
- Wrench (not supplied)

Requirements for flange connections

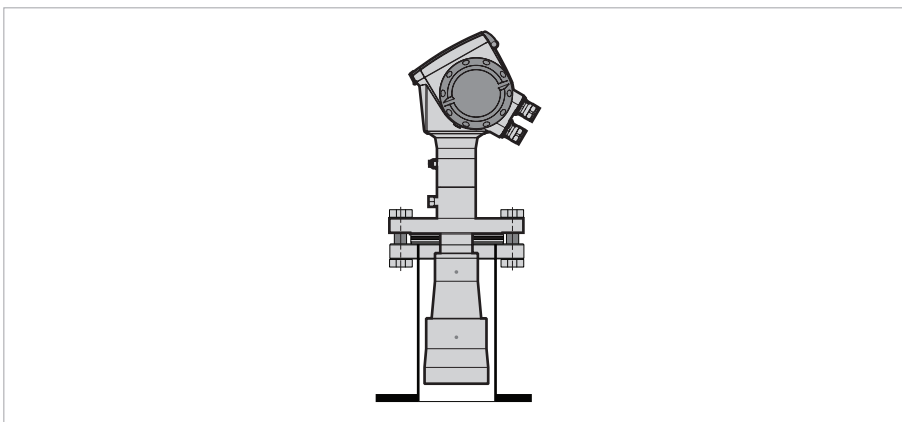


Figure 3-17: Flange connection



- Make sure the flange on the nozzle is level.
- Make sure that you use the applicable gasket for the flange dimensions and the process.
- Align the gasket correctly on the flange facing of the nozzle.
- Lower the antenna carefully into the tank.
- Tighten the flange bolts.
- ➔ Refer to local rules and regulations for the correct torque to apply to the bolts.

3.9.2 How to install a device with a threaded connection

Equipment needed:

- Device
- Gasket for G 1½ connection (not supplied)
- 50 mm / 2" wrench (not supplied)

Requirements for threaded connections

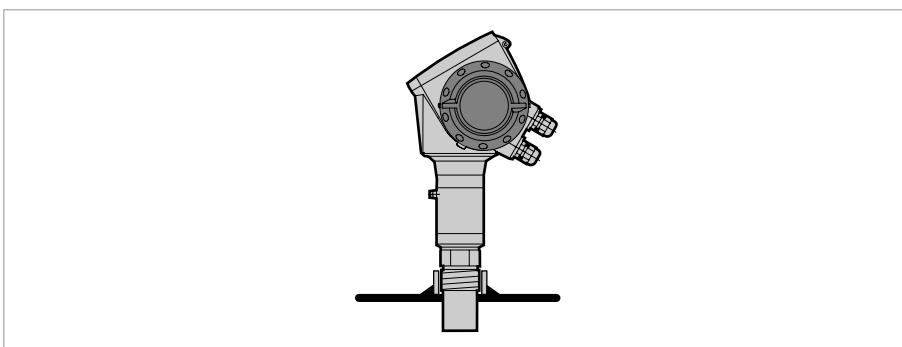


Figure 3-18: Threaded connection



- Make sure the tank connection is level.
- Make sure that you use the applicable gasket for the connection dimensions and the process.
- Align the gasket correctly.
- Lower the antenna carefully into the tank.
- Turn the threaded connection on the housing to attach the device to the process connection.
- Tighten the connection.
- ➔ Refer to local rules and regulations for the correct torque to apply to the connection.

3.9.3 How to attach the weather protection to the device

Equipment needed:

- Device.
- Weather protection (option).
- 10 mm wrench (not supplied).

The overall dimensions of the weather protection are on page 110.

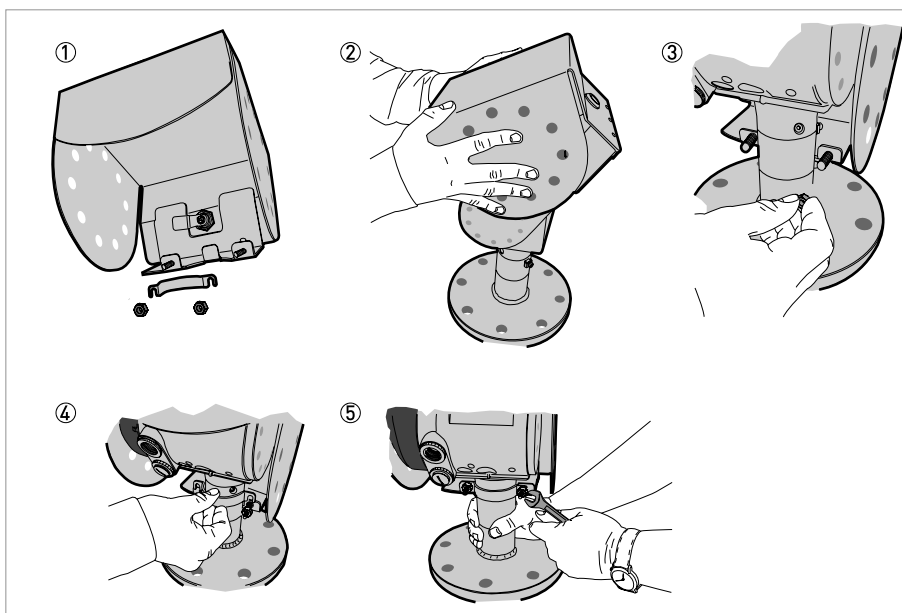


Figure 3-19: Installation of the weather protection



- Loosen the bracket nuts on the weather protection.
- Remove the bracket.
- Lower the weather protection onto the device.
- Turn the weather protection so that the keyhole points forward.
- Attach the bracket.
- Lift the weather protection to the top of the housing support pillar.
- Hold the weather protection in the correct position and tighten the bracket nuts.

3.9.4 How to open the weather protection

Equipment needed:

- Weather protection.
- Large slotted tip screwdriver (not supplied).

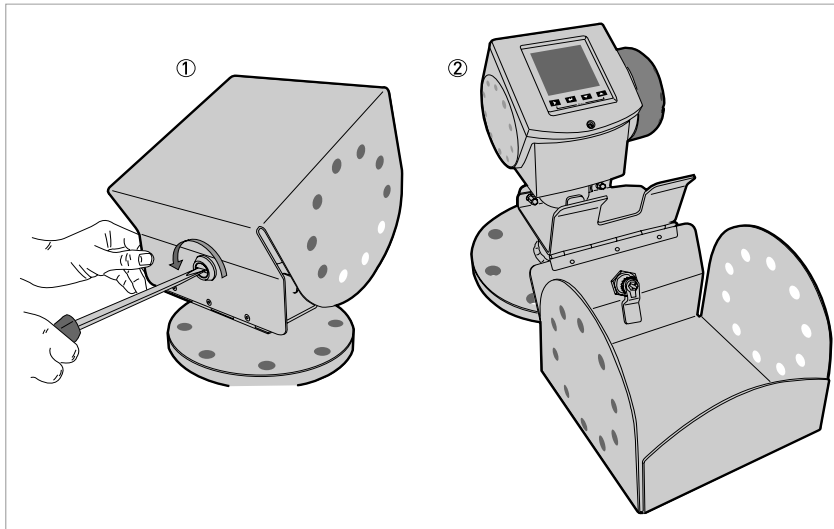


Figure 3-20: **How to open the weather protection**

- ① Weather protection in its closed position
- ② Weather protection in its open position. Minimum clearance in front of the device: 300 mm / 12".



- Put a large slotted tip screwdriver ① into the keyhole at the front of the weather protection.
- Turn the screwdriver counterclockwise.
- Pull the top of weather protection up and forward.
- ➡ This will open the weather protection.

3.10 Electromagnetic compatibility

The device design agrees with European Standard EN 61326-1 A1+A2.

You can install the device on open-air tanks and tanks that are not made of metal. But refer to *Radio approvals* on page 41. This agrees with Immunity and Emissions requirements for industrial environments.



NOTE!

Device operation agrees with residential-class (class B) immunity and emissions requirements if the antenna is used in a closed tank made of metal.

3.11 Radio approvals

3.11.1 European union (EU)

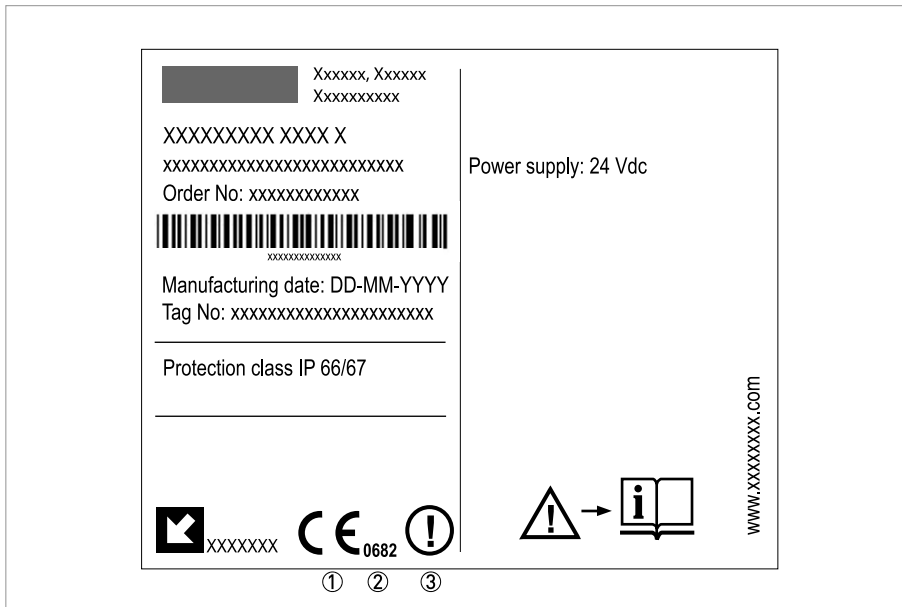


Figure 3-21: Radio approval information on the nameplate

- ① CE sign
- ② Notified body number (0682 = CETECOM)
- ③ Class II identifier

According to EN 300 440 (2001-09), the radiated power outside a metallic tank is less than - 30 dBm.

Use in open-air pits and non-metallic tanks

The device is set to an ISM band (24...24.25 GHz).

Refer also to the radio approval certificate on the internet site. The radio approval report is given on the CD-ROM supplied with the device.

3.11.2 U.S.A.



LEGAL NOTICE!

When installed in totally enclosed metal tanks, this device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference which may cause undesired operation.

This legal information is shown on a label on the rear side of the device. Refer to item 3 of the illustration that follows.

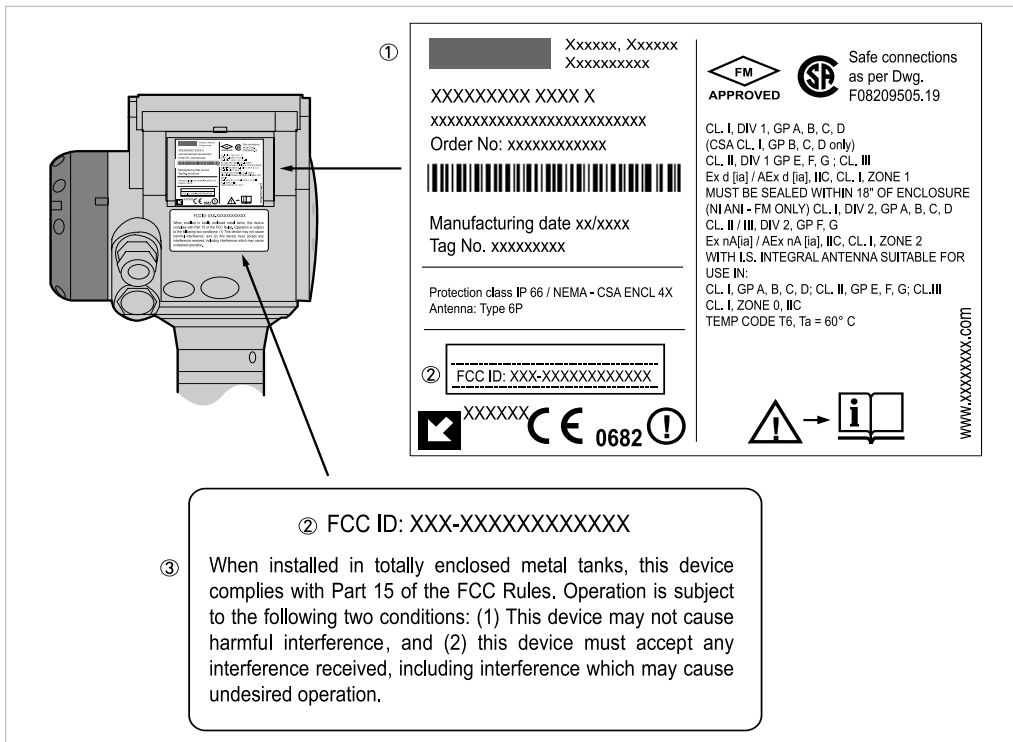


Figure 3-22: Radio approval information for the USA

- ① Nameplate for the USA
- ② FCC identification code
- ③ FCC Label. It shows that if the device is used correctly, it agrees with Part 15 of USA FFC Rules.

Use in open-air pits and non-metallic tanks

Do not use the device in open-air pits and non-metallic tanks.

The radio approval report is given on the CD-ROM supplied with the device. You can also download it from the internet site.

4.1 Safety instructions



CAUTION!

Only trained personnel can do electrical work. Obey regional occupational health and safety directives and safety regulations.



DANGER!

Disconnect the power before you work on electrical connections. Refer to the voltage data on the nameplate.



DANGER!

Obey national electrical codes!

4.2 Electrical installation: outputs 1 and 2

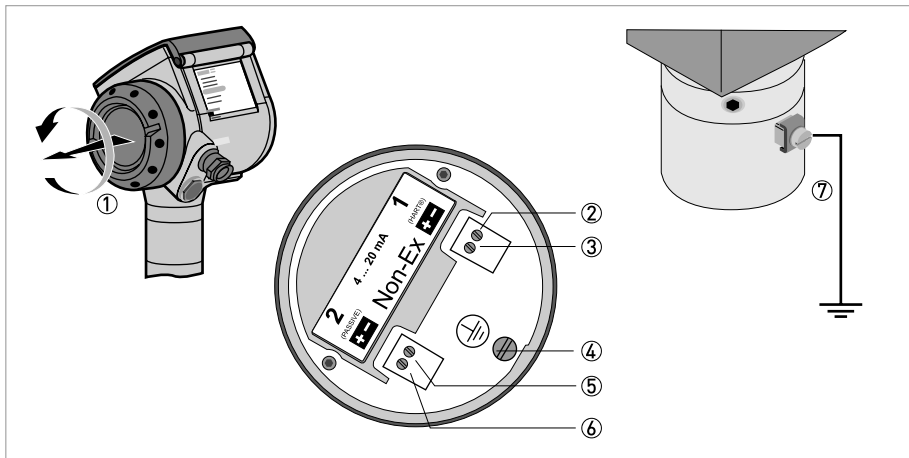


Figure 4-1: Electrical installation

- ① Terminal compartment cover
- ② Terminal 1 current output -
- ③ Terminal 1 current output +
- ④ Grounding terminal in the housing
- ⑤ Terminal 2 current output -
- ⑥ Terminal 2 current output +
- ⑦ Grounding terminal between the process connection and the converter



Procedure:

- Remove the housing lid ① of the electric terminal compartment.
- Connect the wires to the device. Obey the national electrical codes.
- Make sure that the polarity of the wires is correct.
- Attach the ground to ④ or ⑦. Both terminals are technically equivalent.

4.2.1 Non-Ex

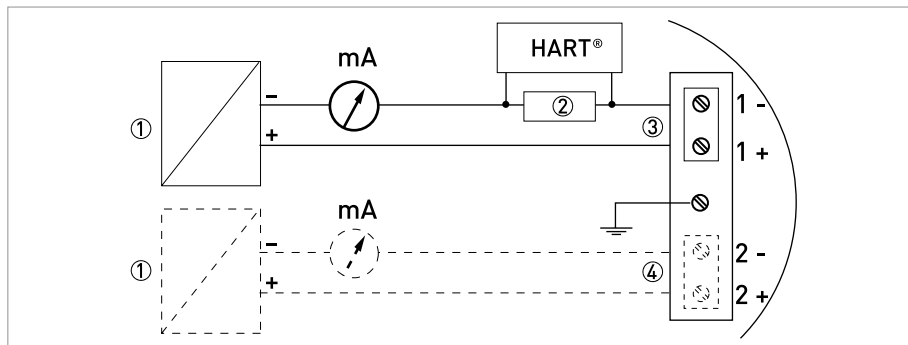


Figure 4-2: Electrical connections for non-Ex devices

- ① Power supply
- ② Resistor for HART® communication
- ③ 14...30 VDC for an output of 22 mA at the terminal
- ④ 10...30 VDC for an output of 22 mA at the terminal

4.2.2 Ex i

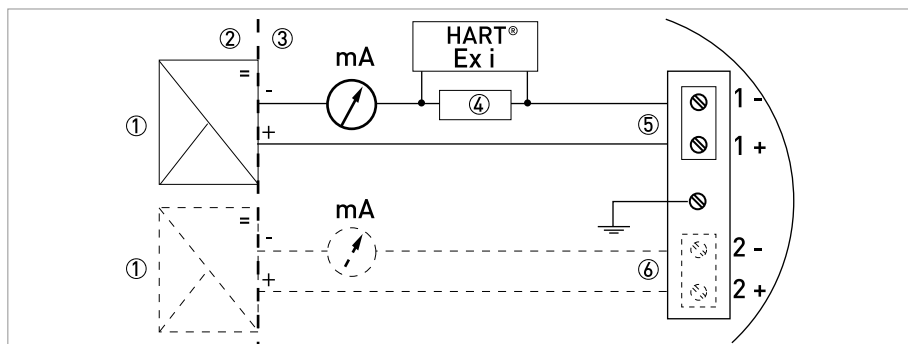


Figure 4-3: HART® connection to the Ex i circuit with a resistor

- ① Intrinsically-safe power supply
- ② Zone non-Ex
- ③ Zone Ex
- ④ Resistor for HART® communication
- ⑤ 14...30 VDC for an output of 22 mA at the terminal
- ⑥ 10...30 VDC for an output of 22 mA at the terminal



NOTE!

If the barrier has a HART® terminal, you can connect HART devices directly to the barrier without a resistor.

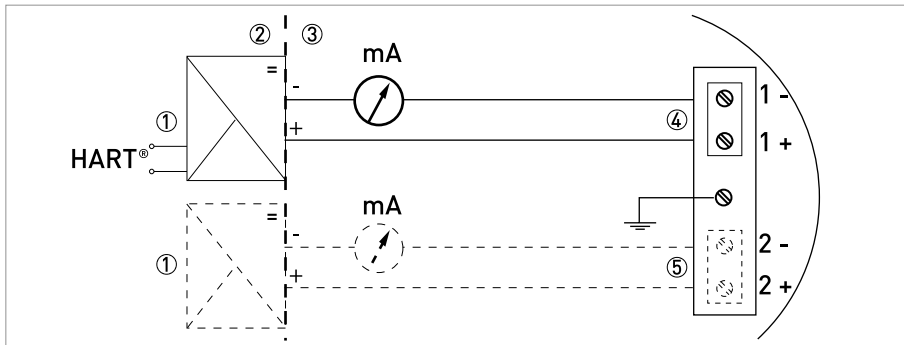


Figure 4-4: HART® connection to the Ex i barrier without a resistor

- ① Intrinsically-safe power supply
- ② Zone non-Ex
- ③ Zone Ex
- ④ 14...30 VDC for an output of 22 mA at the terminal
- ⑤ 10...30 VDC for an output of 22 mA at the terminal

4.2.3 Ex d

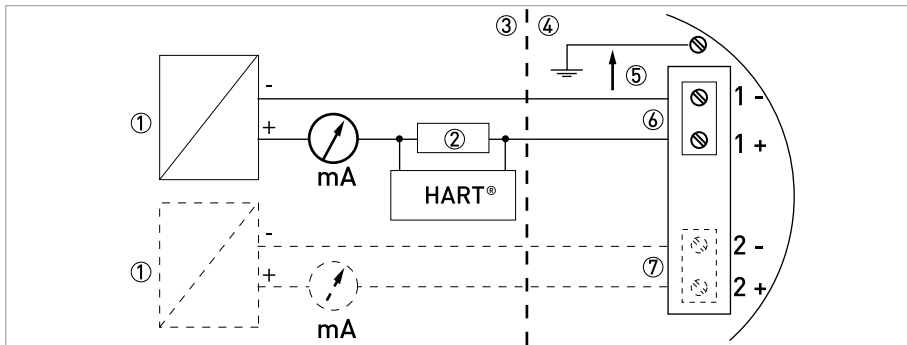


Figure 4-5: Electrical connections for an Ex d-approved device

- ① Power supply
- ② Resistor for HART® communication
- ③ Non-Ex zone
- ④ Ex zone
- ⑤ $|U| \leq 5\text{ V}$
- ⑥ 20...36 VDC for an output of 22 mA at the terminal
- ⑦ 10...30 VDC for an output of 22 mA at the terminal

4.3 Protection category



NOTE!

The device fulfills all requirements per protection class IP 67.



DANGER!

Make sure the cable gland is watertight.

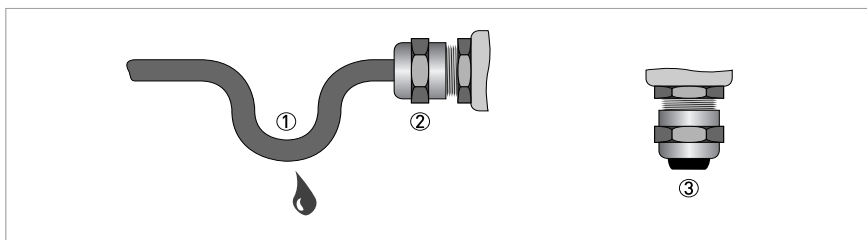


Figure 4-6: How to make the installation agree with protection category IP 67



- Make sure that the gaskets are not damaged.
- Make sure that the electrical cables are not damaged.
- Make sure that the electrical cables agree with the national electrical code.
- The cables are in a loop in front of the device ① so water does not go into the housing.
- Tighten the cable feedthroughs ②.
- Close unused cable feedthroughs with dummy plugs ③.

4.4 Networks

4.4.1 General information

The device uses the HART® communication protocol. This protocol agrees with the HART® Communication Foundation standard. The device can be connected point-to-point. It can also operate in a multi-drop network of up to 15 devices.

Output 1 is factory-set to communicate point-to-point. To change the communication mode from **point-to-point** to **multi-drop**, refer to *Network configuration* on page 78.

4.4.2 Point-to-point connection

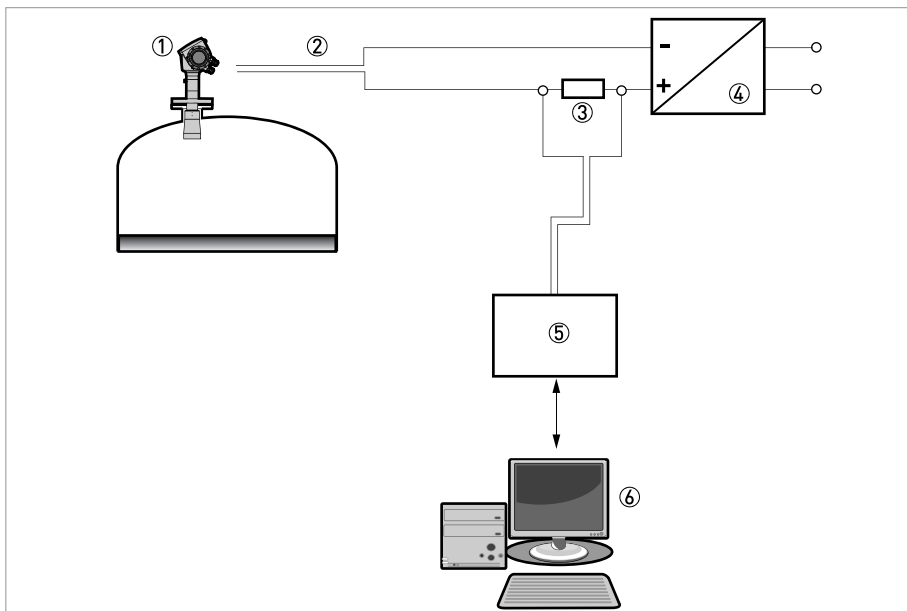


Figure 4-7: Point-to-point connection (non-Ex)

- ① Address of the device (0 for point-to-point connection)
- ② 4...20 mA + HART®
- ③ Resistor for HART® communication
- ④ Power supply
- ⑤ HART® converter
- ⑥ HART® communication software

4.4.3 Multi-drop networks

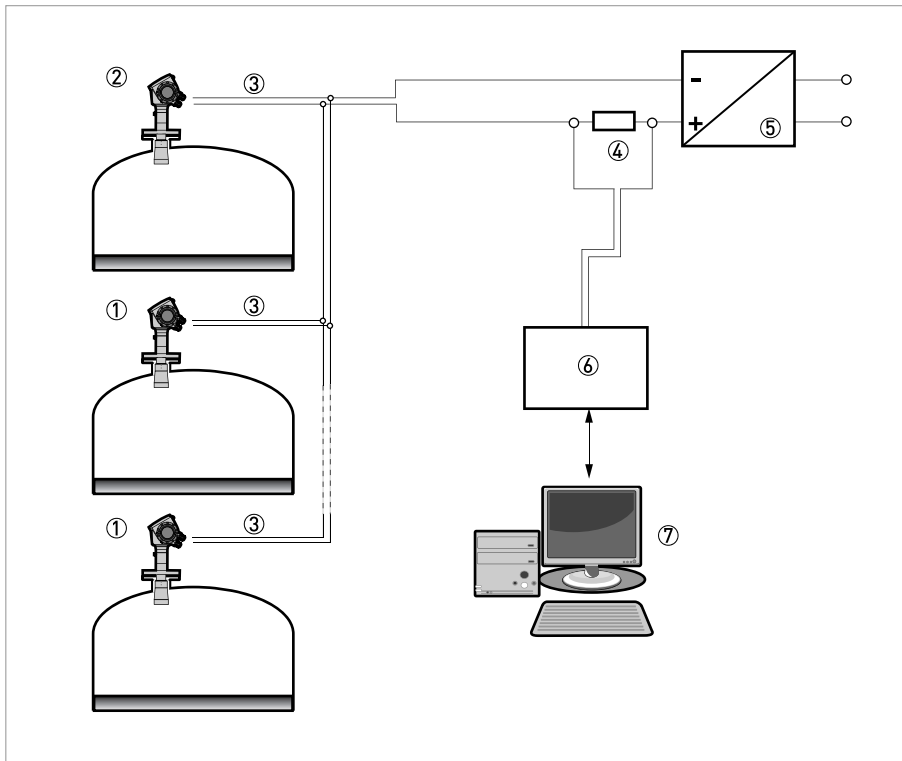


Figure 4-8: Multi-drop network (non-Ex)

- ① Address of the device (n+1 for multidrop networks)
- ② Address of the device (1 for multidrop networks)
- ③ 4 mA + HART®
- ④ Resistor for HART® communication
- ⑤ Power supply
- ⑥ HART® converter
- ⑦ HART® communication software

5.1 Start-up checklist

Check these points before you energize the device:

- Are all the wetted components (antenna, flange and gaskets) resistant to the product in the tank?
- Does the information on the signal converter nameplate agree with the operating data?
- Did you correctly install the device on the tank?
- Do the electrical connections agree with the national electrical codes?



DANGER!

Before you energize the device, make sure that the supply voltage and polarity are correct.



DANGER!

Make sure that the device and the installation agrees with the requirements of the Ex certificate of compliance.

5.2 Operating concept

You can read measurements and configure the device in 3 ways:

- Digital display screen (optional).
- Connection to a system or PC with PACTware™. You can download the Device Type Manager (DTM) file from the internet site
- Connection to a system or PC with AMS™. You can download the Device Description (DD) file from the internet site.

5.3 Digital display screen

5.3.1 Local display screen layout

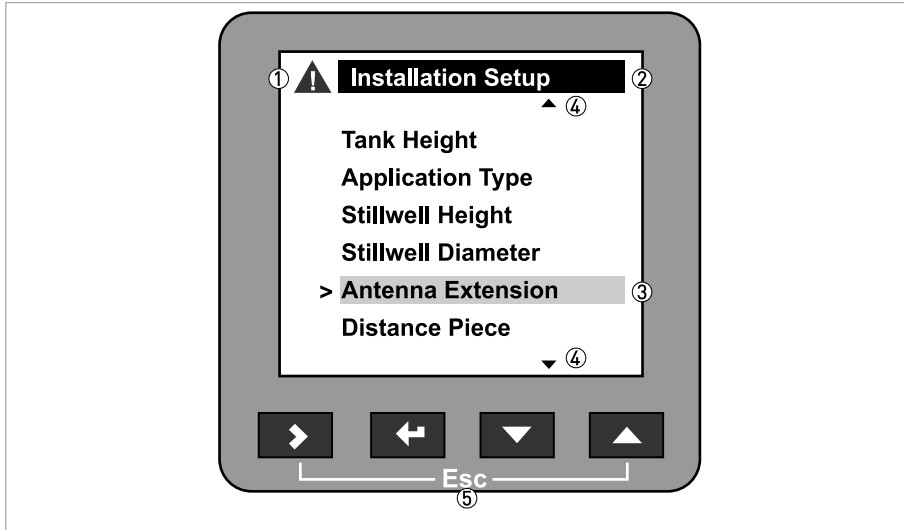


Figure 5-1: Local display screen layout

- ① Error icon
- ② Tag number or menu name
- ③ Selected menu item
- ④ △ ▽ : scroll up/scroll down
- ⑤ Push buttons (refer to the table below)

5.3.2 Push-button functions

Push button	Description
	Left
	Return
	Down
	Up
	Esc (Escape)

5.3.3 Help screens

When you are in supervisor mode, the local display helps you to configure the device. If you do not touch any keys after 30 seconds, a help message is displayed. This will explain what the menu is and what the parameters do. Press > and △ (Esc) at the same time to go back to the menu. If you do not touch the display for another 30 seconds, the message is shown again.

5.3.4 How to start the device



- Connect the converter to the power supply.
- Energize the converter.
- ➔ After 30 seconds the screen will display "booting up", "starting up" and then the default screen will appear.
- The device will display readings.
- ➔ Measurements agree with specifications given in the customer order.

**CAUTION!**

If the manufacturer received information about the installation, the device will display readings correctly. If not, refer to the quick setup procedures.

5.4 Remote communication with PACTware™

PACTware™ displays measurement information clearly and lets you configure the device from a remote location. It is an Open Source, open configuration software for all field devices. It uses Field Device Tool (FDT) technology. FDT is a communication standard for sending information between the system and the field device. This standard agrees with IEC PAS 62453. Field devices are easily integrated. Installation is supported by a user-friendly Wizard.

Install this software:

- Microsoft® .NET Framework version 1.1 or later.
- PACTware 3.6.
- HART® converter (USB, RS232...).
- The Device Type Manager (current DTM Version 1.0.0.34) for the device.

The software and installation instructions are given on the CD-ROM supplied with the device.

You can also download PACTware™ and the DTM from our internet site.

Refer also to the PACTware™ consortium site at http://www.pactware.de/index_en.htm.

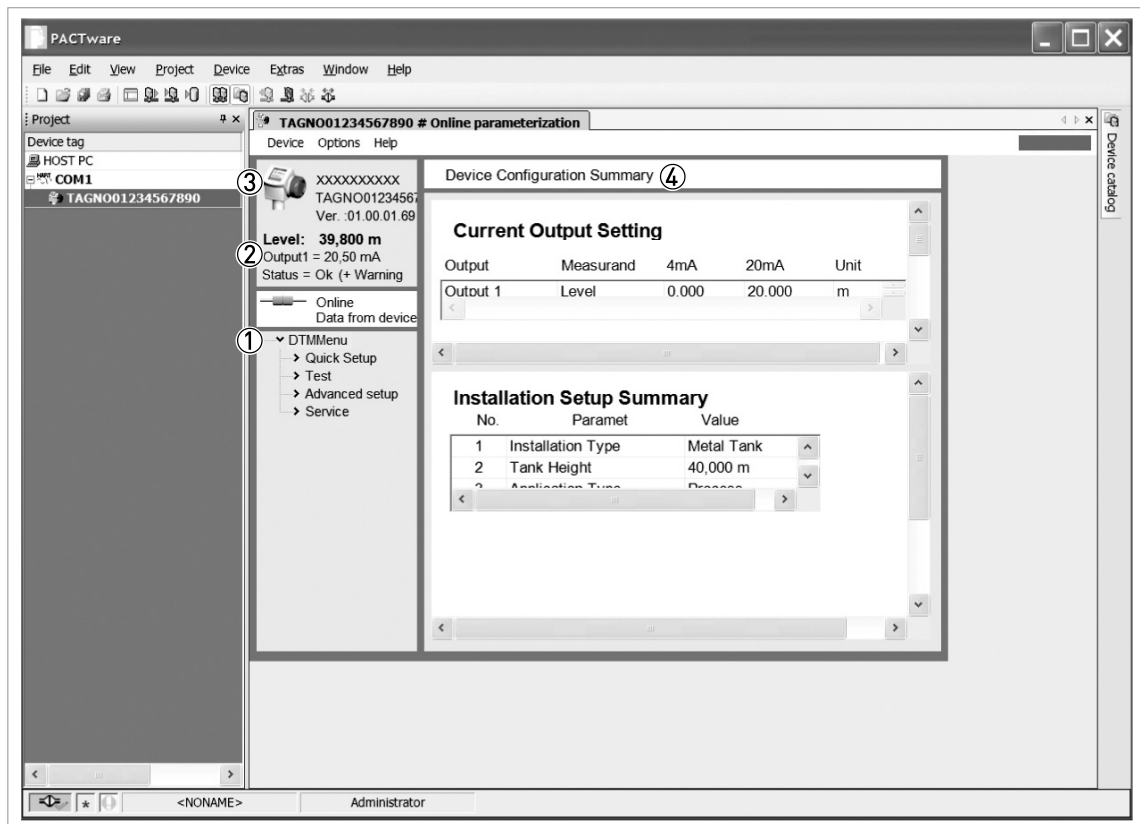


Figure 5-2: Screen from the PACTware™ user interface

- ① DTM menu
- ② Basic measurement information: level, current output and device status
- ③ Information for device identification
- ④ Configuration summary

5.5 Remote communication with the AMS™ Device Manager

The AMS™ Device Manager is an industrial Plant Asset Management (PAM) software tool. Its role is to:

- Store configuration information for each device.
- Support HART® and FOUNDATION Fieldbus™ devices.
- Store and read process data.
- Store and read diagnostic status information.
- Help plan preventive maintenance to reduce a plant's downtime to a minimum.

The DD file is given on the CD-ROM supplied with the device. You can also download it from our internet site.

6.1 User modes

There are 3 modes of operation:

- Operator.
- Supervisor.
- Service.

6.2 Operator mode





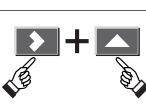
The operator can choose what information to display.

This section shows you:

- What each button does in operator mode.
- What special function each button has if it pressed for more than 1 second.
- How to move from one screen of information to another.

Some data will only be available if the device is correctly configured by the supervisor, as described below.

Push button functions in operator mode

Push button	Description	Normal function	"Hot key" function
	Right	Change display style ①	Enter program mode ②
	Enter	-	-
	Down	Scroll down the list of measurement parameters ③	The screen shown at this time becomes the default screen ②
	Up	Scroll up the list of measurement parameters ③	Display language will change to English ④
	Esc (Escape)	-	-

① value, value and picture, or value and bar graph

② when you press this button for 1 second

③ level, distance, volume etc.

④ when you press this button for 3 seconds. Press the button again and it will go back to the original language.

Screens in operator mode

Text and image screen	Go to	% current output screen	Go to	Text screen	Go to
△		△		△	
Level	>	Level	>	Level	> (Text and image)
△ ▽		△ ▽		△ ▽	
Distance	>	Distance	>	Distance	> (Text and image)
△ ▽		△ ▽		△ ▽	
Volume ①	>	Volume ①	>	Volume ①	> (Text and image)
△ ▽		△ ▽		△ ▽	
Mass ②	>	Mass ②	>	Mass ②	> (Text and image)
△ ▽		△ ▽		△ ▽	
Ullage volume ①	>	Ullage volume ①	>	Ullage volume ①	> (Text and image)
▽		▽		△ ▽	
Back to the top of the list		Back to the top of the list		Reflectivity ①	
				△ ▽	
				Signal screen ③	
				▽	
				Back to the top of the list	

- ① only available if you created a volume table. Refer to the conversion quicksetup menu in supervisor mode.
- ② only available if you created a mass table. Refer to the conversion quicksetup menu in supervisor mode.
- ③ shows a graph of discrete radar reflection signals against distance. This is used to view reflections measured by the device. Press > to move the cursor from one signal peak to another.

6.3 Supervisor mode

6.3.1 General notes

Configure your device in **supervisor mode**. You can:

- Use the **quick setup** menus to configure your device quickly. For more data about quick setup menus, refer to *A. Quick setup* on page 62.
- Use the **advanced setup** menu to find single items for device configuration. For more data about menu items, refer to *C. Advanced setup* on page 69.
- Save **quicklinks** for items that you use regularly. For more data about quicklinks (menu items A.2 to A.6), refer to *A. Quick setup* on page 62.
- Error finding and troubleshooting procedures are described in the **test** menu. For more data, refer to *B. Test* on page 68.

6.3.2 How to get access to the supervisor mode



Do the steps that follow:

- Press the push button **>** for one second.
- ➡ This displays the login screen.
- Press the push buttons **△** or **▽** to select **supervisor** from the list.
- Press the push button **←**.
- ➡ The screen displays where to type in the password.
- Type in the password. The factory-set password is **> ← ▽ △ > ←**.
- ➡ The device displays the message "Login successful" and then the main menu for supervisor mode.

You can change the password for the supervisor mode (menu item C.5.2.2). For more data, refer to *C. Advanced setup* on page 69.

The main menu shows:

- Quick Setup menu.
- Test menu.
- Advanced Setup menu.

The Service menu is "greyed out" as you cannot select it in supervisor mode.

If you go back to operator mode, you will have access to the supervisor mode, without password security, for 30 minutes.

6.3.3 Menu overview

A quick setup

A.1	setup mode
A.2	quick Link 1
A.3	quick link 2
A.4	quick link 3
A.5	quick link 4
A.6	quick link 5

B test

B.1	test
B.2	information

C advanced setup

C.1	installation setup
C.2	I/O ①
C.3	output 1 (HART)
C.4	output 2 (passive) ②
C.5	device setup
C.6	reset

① input/output options. This menu is not available at this time.

② optional

6.3.4 Push-button functions

Menu navigation

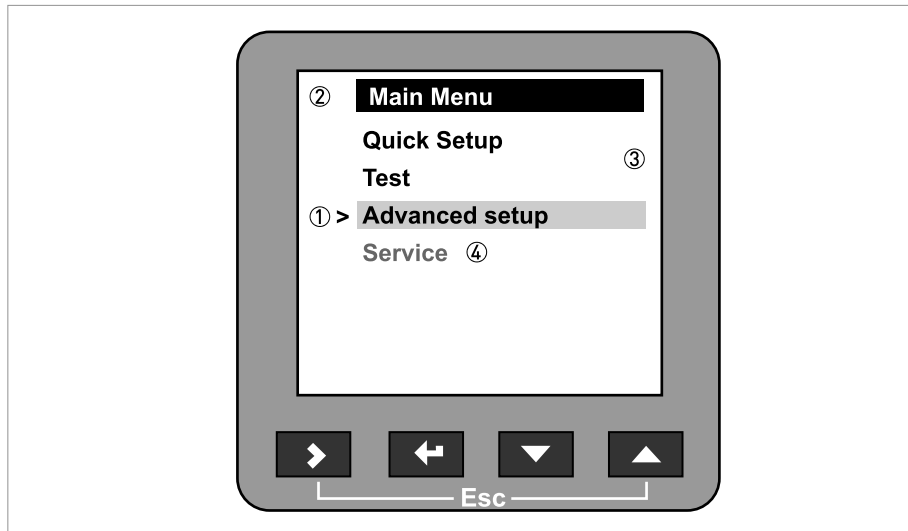


Figure 6-1: Menu navigation

- ① Menu selection bar
- ② Header bar
- ③ Menu list
- ④ Menu item that is not available (in grey text)

This is what you see when you are in the list of menus in supervisor mode. The functions of the push-buttons are given in the table that follows:

Functions of push-buttons in the menu lists

Push button	Description	Function
	Right	Go to the next menu level
	Enter	-
	Down	Move the menu selection bar down the list
	Up	Move the menu selection bar up the list
	Esc (Escape)	Go back to the menu level you were on before

Lists of parameters in menu items

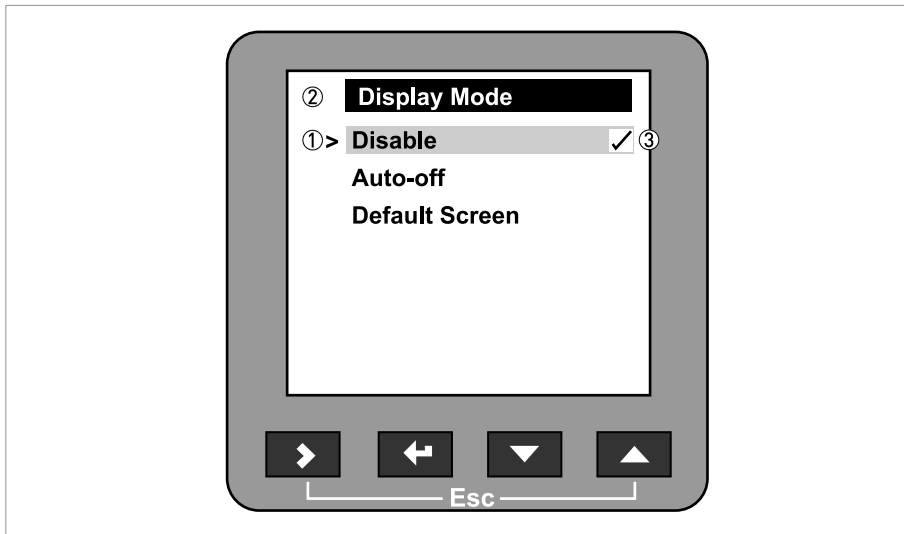


Figure 6-2: Lists of parameters in menu items

- ① Parameter selection bar
- ② Menu name
- ③ Parameter used at this time

This is what you see when you choose a menu item that has a list of parameters. The functions of the push-buttons are given in the table that follows:

Function of push-buttons in menu items that have a list of parameters

Push button	Description	Function
	Right	-
	Enter	Select the parameter and go back to the menu
	Down	Move the menu selection bar down the list
	Up	Move the menu selection bar up the list
	Esc (Escape)	Go back to the menu ①

① this does not confirm that you selected a new parameter

Values in menu items

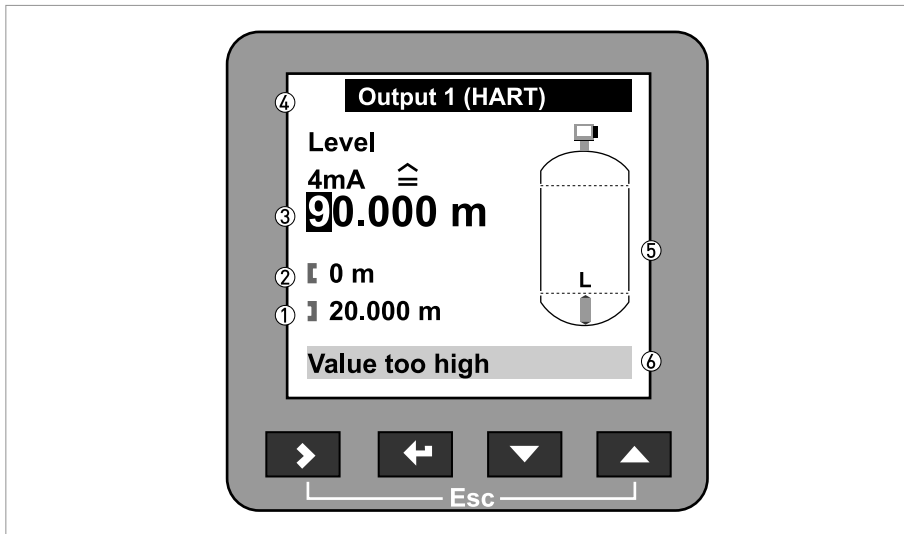


Figure 6-3: Values in menu items

- ① Maximum value
- ② Minimum value
- ③ Cursor on the digit to be changed
- ④ Menu name
- ⑤ Picture of menu item
- ⑥ Error message

This is what you see when you choose a menu item that has a value. The functions of the push-buttons are given in the table that follows:





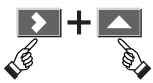
Function of push-buttons in menu items that have values

Push button	Description	Function
	Right	Move the cursor to the next digit on the right
	Enter	Select the parameter and go back to the menu
	Down	Increase the digit value
	Up	Decrease the digit value
	Esc (Escape)	Go back to the menu ①

① this does not confirm that you selected a new parameter

If you press the push-buttons for 1 second, you can use these hotkey functions:

Hotkey functions in supervisor mode

Push button	Description	Function
	Right	Create a quick link ①
	Enter	-
	Down	-
	Up	Screen displays information in English ②
	Esc (Escape)	Go back to the operator mode

① select a menu item from the Advanced Setup menu list

② press this push-button for 3 seconds

How to save settings



- When you have changed parameters in all the necessary menu items, press \leftarrow to accept the new parameter.
- Press $>$ and Δ at the same time to go back to the **Save settings** screen.
- The device will ask you to save or cancel your settings. Select **Save** to accept the new settings or **Cancel** to reject them.
- ➡ The display goes back to operator mode.

6.3.5 Function description

A. Quick setup

Menu No.	Step	Function	Function description	Selection list	Default
A.0		quick setup			
A.1		setup mode			
A.1.1		complete	This follows the steps given in the application, installation, conversion and output setup modes.		

Menu No.	Step	Function	Function description	Selection list	Default
A.1.2		installation	Follow this procedure to describe the tank and the product.		
	1	installation type	The tank material.	metal tank; plastic tank; free air application	metal tank
	2	tank height	The distance from the tank connecting flange face/thread stop to the tank bottom.	min-max: 0.20...80 m / 0.54...262 ft	20 m
	3A	application type	The conditions in which the device is used. If the surface of the product is flat, select "storage". If the surface of the product is disturbed, select "process". If the surface of the product is agitated with vortexes and foam, select "agitator". If the device is installed in a still well, select "still well + ...".	process; storage; agitator; process + stillwell; storage + stillwell; agitator + stillwell	process or stillwell + process
			The conditions in which the device is used. For free air applications only. If the surface of the product is flat, select "no disturbance". If the surface of the product is disturbed, select "medium disturbance". If there are bubbles on the surface of the product and also vortexes and foam, select "heavy disturbance".	no disturbance; medium disturbance; heavy disturbance	no disturbance
	4A	stillwell diameter	The inner diameter of the stillwell. Step 4 is available if you set "stillwell" in step 3.	min-max: 8...200 mm / 0.31...7.88"	100 mm / 3.94"
	4B	stillwell height	The height of the stillwell. Step 4 is available if you set "stillwell" in step 3.	min-max: 0...80 m / 0...196.86 ft	10 m / 32.81 ft
	5	blocking distance	A zone given by the user where it is not possible to measure. We recommend at least 100 mm / 4" below the antenna.	antenna extension (C.1.6)...tank height (C.1.2) ①	①
	6	settings summary			
	7	save / cancel		save, cancel ②	

Menu No.	Step	Function	Function description	Selection list	Default
A.1.3		empty spectrum	Fixed and moving objects in the tank cause interference signals. Put them through this filter to correctly measure the tank contents.		
	1	do you have a completely filled tank?	If the tank is full, it is not possible to complete this procedure. The tank must be partially filled or empty.	yes; no	yes
	2	are all moving parts in the tank in motion?	We recommend that you switch on agitators and other moving equipment to filter all interference signals.	yes; no	yes
	3	is your tank partially filled or empty?	If the tank is partially filled, the device must include the tank contents when it filters the signal.	partially filled; empty	partially filled
	4	distance	If the tank is partially filled, type in a distance shorter than that between the flange and the tank contents.	min-max: 0...tank height	10 m / 32.808 ft
	5	do you want to consider average or maximum value for recording?	Use the average value for tanks which contain fixed objects only. Use the maximum value for tanks which contain many objects or moving objects.	average; maximum	0.1 m / 0.33 ft
	6	empty spectrum recording is in progress	...	...	...
	7	empty spectrum graph	...	...	...
	8	do you want to save the spectrum?	If you save this data, the device will use it when it measures the tank contents.	save, cancel ②	save

Menu No.	Step	Function	Function description	Selection list	Default
A.1.4		conversion	Follow this procedure to set the device up to display readings in volume, mass or user-defined units.		
sub-menu		conversion submenu [volume]			
	1	free unit		yes, no	no
	2	table length unit		m, cm, mm, inch, ft, free unit	m
	3	conversion wizard		volume	
	4	product type		solid, liquid	liquid
	5	tank shape	This sub-procedure uses the information given here to find the volume. You have to type in the tank shape, height, width and length.	...	...
	6	conversion unit	The displayed unit in operator mode.	m ³ , L, US gal, GB gal, ft ³ , bbl	m ³
	7	conversion table	A table that converts product level to product volume.		

Menu No.	Step	Function	Function description	Selection list	Default
sub-menu		conversion submenu [mass]		-	
	1	free unit		yes, no	no
	2	table length unit		m, cm, mm, inch, ft, free unit	m
	3	conversion wizard		mass	m
	4	type in product density?		yes, no	yes
	5	product density		min-max: 0...20000 kg/m ³	0
	6	type of product		solid, liquid	
	7	tank shape	This sub-procedure uses the information given here to find the volume. You have to type in the tank shape, height, width and length.	...	...
	8	conversion unit	The conversion unit is given as a volume if the product density is given. If not, choose a mass unit.	m ³ , L, US gal, GB gal, ft ³ , bbl or Tons, kg, US Tons, GB Tons	m ³ or Tons
	9	conversion table	A table that converts product level to product mass.		
sub-menu		conversion submenu [free unit]	If you cannot find the units or tank shape in the menu, you can customize the conversion table.	-	
	1	free unit		yes, no	no
	2	customer length unit	A non-standard length unit for the conversion table. This is defined by the supervisor.		LEN_FR EE_
	3	customer length ratio	The conversion factor between the length unit selected in C.5.1.4 (length unit) and C.5.1.7 (customer length unit). This ratio is a multiple of 1 mm.	min-max: 1...99999	1
	4	customer conversion unit	A non-standard conversion unit for the conversion table. This is defined by the supervisor.		CO_FR_UN
	5	No. Of LVM Entries	The number of lines in the conversion table.	min-max: 0...50	2
	6	conversion table	A table that converts product level to another physical parameter.		
	...	save / cancel		save, cancel ②	save

Menu No.	Step	Function	Function description	Selection list	Default
A.1.5		outputs	Follow this procedure to describe the output characteristics.	-	
	1	output 1: function	Select an output function to scale the current values . This is not displayed in the operator mode.	level, distance, volume (mass), ullage volume	level
	2	output 1: 4 mA setting	This assigns a measurement value to 4 mA.	min.-max: 0...20 m / 0...65.62 ft	0 m / 0 ft
	3	output 1: 20 mA setting	This assigns a measurement value to 20 mA.	min.-max: 0...90 m / 0...295.29 ft	depends on the output function
	5	output 1: output range	This sets the effective range of output 1 with or without over-run.	3.8...20.5 mA (NAMUR), 4...20 mA	4...20 mA
	6	output 1: error handling	This sets the behaviour of current output 1 if an error occurs.	3.6 mA, 22 mA, Hold	22 mA
	7	output 1: HART® address	Any HART® address greater than 0 will activate HART® multidrop mode. Current output stays constant at 4 mA.	min.-max: 0...15	0
	8	output 2: function ③	Select an output function to scale the current values . This is not displayed in the operator mode.	level, distance, volume (mass), ullage volume	level
	9	output 2: 4 mA setting ③	This assigns a measurement value to 4 mA.	min.-max: 0...20 m / 0...65.62 ft	0 m / 0 ft
	10	output 2: 20 mA setting ③	This assigns a measurement value to 20 mA.	min.-max: 0...90 m / 0...295.29 ft	depends on the output function
	11	output 2: output range ③	This sets the effective range of output 1 with or without over-run.	3.8...20.5 mA (NAMUR), 4...20 mA	4...20 mA
	12	output 2: error handling ③	This sets the behaviour of current output 1 if an error occurs.	3.6 mA, 22 mA, Hold	22 mA
	13	settings summary		read only	
		save / cancel		save, cancel ②	save
A.2		quick link 1	Direct link to an item in the advanced setup menu	go to a function in the advanced setup menu and press > for 1 second. You can store up to 5 functions in this way.	error records

Menu No.	Step	Function	Function description	Selection list	Default
A.3		quick link 2	Direct link to an item in the advanced setup menu	go to a function in the advanced setup menu and press > for 1 second. You can store up to 5 functions in this way.	contrast menu
A.4		quick link 3	Direct link to an item in the advanced setup menu	go to a function in the advanced setup menu and press > for 1 second. You can store up to 5 functions in this way.	language
A.5		quick link 4	Direct link to an item in the advanced setup menu	go to a function in the advanced setup menu and press > for 1 second. You can store up to 5 functions in this way.	length unit
A.6		quick link 5	Direct link to an item in the advanced setup menu	go to a function in the advanced setup menu and press > for 1 second. You can store up to 5 functions in this way.	display mode

① depends on other user functions

② step ignored if complete setup selected

③ optional

B. Test

Menu No.	Function	Function description	Selection list	Default
B.0	test			
B.1	test	This checks the device outputs and performs common device tests.		
B.1.1	show output 1	This displays analogue output 1 value [mA].	read only	
B.1.2	set output 1	This sets analogue output 1 to a test value [mA] selected from a list. Output will change to the selected value, independent of the measured value.	3.6, 4, 6, 8, 10, 12, 14, 16, 18, 20 or 22 mA	4 mA
B.1.3	show output 2	This displays analogue output 2 value [mA].	read only	
B.1.4	set output 2	This sets analogue output 2 to a test value [mA] selected from a list. Output will change to the selected value, independent of the measured value.	3.6, 4, 6, 8, 10, 12, 14, 16, 18, 20 or 22 mA	4 mA
B.1.5	internal test	This initiates the hardware test. The device displays the results.	read only	
B.2	information	a summary of information relating to the device		

Menu No.	Function	Function description	Selection list	Default
B.2.1	outputs	analogue output settings. This includes assigned functions, 4 ... 20 mA scale settings, error handling and HART® parameters.	read only	
B.2.2	15 minute log	a log of output values for the last 15 minutes. A log is taken every 10 seconds and displayed on a graph.	read only	
B.2.3	device identification	This displays device order no, V-no, service no, firmware 1 version, firmware 2 version, firmware 3 version and Ex approval details.	read only	
B.2.4	quick setup summary	a summary of the parameters entered in the quick setup menu	read only	
B.2.5	TAG number	The TAG number can be seen and updated here	?	TAGN00 1234567 890
B.2.6	error records	a log of device errors. Scroll down the list and press \leftarrow to display the error details. Opening a log will remove the error icon if it appeared in operator mode.	read only	
B.2.7	customer length unit	non-standard length unit for the conversion table. This is defined by the supervisor. Go to supervisor > advanced setup > device setup > display settings > customer length unit or follow the conversion quick setup procedure.	read only	
B.2.9	customer conversion unit	non-standard conversion unit for the conversion table. This is defined by the supervisor. Go to supervisor > advanced setup > device setup > display settings > customer conversion unit or follow the conversion quick setup procedure.	read only	

C. Advanced setup

Menu No.	Function	Function description	Selection list	Default
C.0	advanced setup	Select single menu items to fine-tune the device.		
C.1	installation setup			
C.1.1	installation type	The installation on the tank for the device.	metal tank; plastic tank; free air application	metal tank

Menu No.	Function	Function description	Selection list	Default
C.1.2	tank height	The distance from the tank connecting flange face/thread stop down to the tank bottom.	min-max: 0.20...80 m / 0.54...262 ft	20 m / 65.61 ft
C.1.3	application type	The conditions in which the device is used. If the surface of the product is flat, select "storage". If the surface of the product is disturbed, select "process". If the surface of the product is agitated with vortexes and foam, select "agitator". If the device is installed in a still well, select "still well + ...".	process; storage; agitator; process + stillwell; storage + stillwell; agitator + stillwell	process or stillwell + process
		The conditions in which the device is used. For free applications only. If the surface of the product is flat, select "no disturbance". If the surface of the product is disturbed, select "medium disturbance". If there are bubbles on the surface of the product and also vortexes and foam, select "heavy disturbance".	no disturbance; medium disturbance; heavy disturbance	no disturbance
C.1.4	stillwell height	The height of the stillwell. This is available if you set "stillwell" in item C.1.3 application type.	min-max: 0...80 m / 0...196.86 ft	10 m / 32.81 ft
C.1.5	stillwell diameter	The inner diameter of the stillwell. This is available if you set "stillwell" in item C.1.3 application type..	min-max: 8...200 mm / 0.31...7.88"	100 mm / 3.94"
C.1.6	antenna extension	Optional antenna extension for long versions of the device. These are attached between the flange and the antenna. Each part is 105 mm / 4.1" long.	min-max: 0...5000.00 mm / 0...196.85"	0 mm / 0"
C.1.7	distance piece	Optional distance piece between the converter and the process connection.	min-max: 0...5000.00 mm / 0...196.85"	0 mm / 0"
C.1.8	overflow detection	If this function is switched on, the device will monitor the level even if it is in the blocking distance. The displayed output stays fixed at the blocking distance, but an error message will warn the user that the tank is overflowing.	yes; no	no

Menu No.	Function	Function description	Selection list	Default
C.1.9	blocking distance	The distance from the flange to the top limit of the measuring range. If the distance is less than the blocking distance, the device continues to display the blocking distance.	min-max: 0.220 m...tank height / 0.72 ft...tank height	0.3 m / 1 ft
C.1.10	reference offset	Offset relating to a reference location (distance). This value is positive when the reference location is above the device flange face and negative if below.	min-max: -tank height...50 m / -tank height...164.05 ft	0 m / 0 ft
C.1.11	tank bottom offset	Offset relating to a reference location (level). The device reference point for this parameter is the bottom of the tank (set in menu item C.1.2.0). This value is positive when the reference location is below the tank bottom and negative if above.	min-max: -tank height...3000 m / -tank height...9843 ft	0 m / 0 ft
C.1.12	time constant	Using this function, the device processes several measurement readings to filter out disturbances. Increasing the time constant will smoothen the integrated readings, decreasing will roughen the readings.	min-max: 1...100 seconds	3 seconds
C.1.13	measuring mode	The device uses the dielectric constant of the tank contents to monitor level. If ϵ_r is low and the bottom of the tank is flat, select "TBF partial" mode. If you install the device in a process tank, select "TBF full". For other uses, select "direct measuring"	direct measuring; TBF partial; TBF full	direct measuring
C.1.14	product ϵ_r	The device automatically calculates the level based on the product ϵ_r . If you select "TBF partial" or "TBF full" in item C.1.13, you can change this value manually to adjust readings.	min-max: 1.01...99.90	4
C.1.15	tracing velocity	This function sets the maximum rate of change of level. The measured value cannot change faster than the tracing velocity.	min-max: 0.001...10.000 m/min / 0.003...32.8 ft/min	0.5 m/min / 1.64 ft/min

Menu No.	Function	Function description	Selection list	Default
C.1.16	multiple reflections	Multiple reflections will cause the device to display smaller readings. Objects in the tank, sharp corners, installation of the device on a large nozzle or at the centre of a dome roof can cause multiple reflections. A very calm surface or a tank with a small convex or flat roof can also cause multiple reflections.	yes; no	no
C.1.17	empty spectrum on/off	This function starts and stops interference signal filter. Interference signals are the result of fixed and moving obstacles inside the tank. If you must use do a spectrum analysis, record an empty spectrum first. This is done in the Quick setup menu under empty spectrum (A.1.3.0).	on; off	off
C.1.19	units for tables	Sub-menu for volume and mass conversion operations.		
C.1.19.1	table length unit	The length unit used in the conversion table. If "free unit" is selected, the device uses the unit name in menu item C.5.1.7.	m, cm, mm, inch, ft, free unit	m
C.1.19.2	conversion unit	The volume or mass unit used in the conversion table. If "free unit" is selected, the device uses the unit name in menu item C.5.1.9.	m3, L, US gal, GB gal, ft3, bbl, Tons, Kg, US Tons, GB Tons, free unit	m3
C.1.20	product density	A value greater than 0 that is used with a volume conversion table to start the mass calculation. This menu item is not available if you have selected a mass unit.	0...20000 kg/m3	0
C.1.21	volume/mass table	The device uses this table to display volume and mass readings. Give the number of entries on the table. Press \leftarrow . Type in the level and corresponding volume/ mass values.	Number of entries min.-max: 0...50	0. Table units are selected in menu items C.1.19.1 and C.1.19.2.
C.1.22	linearisation table	The device uses this table to increase on-site accuracy. Give the number of entries plotted. Fill the tank. Make a reference measurement and type in the correct value next to the device reading.	Number of entries min.-max: 0...50	0
C.2	I/O	For fieldbus. Not yet available.		
C.3	output 1 (HART)			

Menu No.	Function	Function description	Selection list	Default
C.3.1	output function	Select an output function to scale the current values . This is not displayed in the operator mode.	level; distance; volume/mass; ullage volume; reflection	level
C.3.2	4 mA setting	Give a measurement value to 4 mA.	min.-max: depends on other functions. Refer to the dependency tables below.	0 m / 0 ft
C.3.3	20 mA setting	Give a measurement value to 20 mA.	min.-max: depends on other functions. Refer to the dependency tables below.	depends on the output function
C.3.4	output range	Sets the effective range of output 1 either with or without over-run.	min.-max: 3.8...20.5 mA (NAMUR), 4...20 mA	4...20 mA
C.3.5	error handling	Sets the behaviour of current output 1 if an error occurs.	3.6 mA, 22 mA, Hold	22 mA
	error handling delay	The time after which the device shows there is a measurement error.	min.-max: 0...900 seconds	10 seconds
C.3.6	HART address	any HART® address greater than 0 will activate HART® multidrop mode. The current output stays constant at 4 mA.	min.-max: 0...15	0
C.4	output 2 (passive)			
C.4.1	output function	Select an output function to scale the current values . This is not displayed in the operator mode.	level; distance; volume/mass; ullage volume; reflection	level
C.4.2	4 mA setting	Give a measurement value to 4 mA.	min.-max: depends on other functions. Refer to the dependency tables below.	0 m / 0 ft
C.4.3	20 mA setting	Give a measurement value to 20 mA.	min.-max: depends on other functions. Refer to the dependency tables below.	depends on the output function
C.4.4	output range	Sets the effective range of output 1 either with or without over-run.	min.-max: 3.8...20.5 mA (NAMUR), 4...20 mA	4...20 mA
C.4.5	error handling	Sets the behaviour of current output 1 if an error occurs.	3.6 mA, 22 mA, Hold	22 mA
	error handling delay	The time after which the device shows there is a measurement error. This value is set in the output 1 menu.	read only	10 seconds
C.5	device setup	This menu covers all items directly related to the display of information and access to the supervisor menu.		
C.5.1	display settings	To display the information you need, refer to these menu items.		

Menu No.	Function	Function description	Selection list	Default
C.5.1.1	language		English, French, German, Italian, Japanese, Mandarin, Portuguese, Russian, Spanish	Factory set
C.5.1.2	display mode	The display screen status will change after the time given in C.5.1.3. (time delay). None switches off this functionality, Auto-off switches off the display automatically and Default screen will show the selected default screen. To reset to the default screen, press ▽ for 1 second in the operator mode.	disable, auto-off, default screen.	disable
C.5.1.3	time delay	The time after which the display will switch to the status set in C.5.1.2 (display mode).	1, 3, 5, 10 minutes	1 minute
	contrast menu	The contrast control for the display screen. You can select a shade of grey between light grey (level 1) and black (level 9).	min.-max: level 1...9	level 5
C.5.1.4	length unit	The length unit displayed in operator mode.	m, cm, mm, inch, ft, ft+inch+1/18inch, ft+inch+1/32inch, free unit	m
C.5.1.5	volume unit	The volume unit displayed in operator mode.	m ³ , L, US gal, GB gal, ft ³ , bbl	m ³
C.5.1.6	mass unit	The mass unit displayed in operator mode.	Tons, kg, US tons, GB tons	kg
C.5.1.7	customer length unit	A non-standard length unit for the conversion table. This is defined by the supervisor.		LEN_FREE –
C.5.1.8	customer length ratio	The conversion factor between the length unit selected in C.5.1.4 (length unit) and C.5.1.7 (customer length unit). This ratio is a multiple of 1 mm.	min.-max: 1...99999	1
C.5.1.9	customer conversion unit	non-standard conversion unit for the conversion table. This is defined by the supervisor.		CO_FR_UN
C.5.2	Passwords	To change user passwords, refer to these menu items.		
C5.2.2	supervisor	This changes the supervisor password. Press the push buttons up to six times in any order. This will be the new password. To confirm the change, enter the new password a second time.		>◀▽△>◀
C.6	reset	To reset the device to default settings, refer to these menu items.		

Menu No.	Function	Function description	Selection list	Default
C.6.2	clear error record	Erase the error record in menu item B.2.6. Press \leftarrow to confirm.		
C.6.3	restart	If the device is not functioning properly, this menu item will restart the device. Press \leftarrow to confirm.		

Data dependencies for the 4 mA settings of outputs 1 and 2

Output function	Minimum value	Maximum value	Default
Level	0 m	<20 mA setting for level	0 m
Volume	0.00 m ³	<20 mA setting for volume	0 m ³
Mass	0.00 kg	<20 mA setting for mass	0 kg
Distance	0 m	<20 mA setting for distance	0 m
Ullage volume	0.00 m ³	<20 mA setting for ullage volume	0 m ³
Ullage mass	0.00 kg	<20 mA setting for ullage mass	0 kg

Data dependencies for the 20 mA settings of outputs 1 and 2

Output function	Minimum value	Maximum value	Default
Level	>4 mA setting for level	Tank height + TBO + RO ①	Tank height + TBO - BD ②
Volume	>4 mA setting for volume	Max value in the volume table	Max value in the volume table
Mass	>4 mA setting for mass	Max value in the mass table	Max value in the mass table
Distance	>4 mA setting for distance	Tank height + TBO + RO ③	Tank height + RO ④
Ullage volume	>4 mA setting for ullage volume	Max value in the volume table	Max value in the volume table
Ullage mass	>4 mA setting for ullage mass	Max value in the mass table	Max value in the mass table

① TBO = Tank Bottom Offset [C.1.9]. RO = Reference Offset [C1.10].

② TBO = Tank Bottom Offset [C.1.9]. BD = Blocking Distance [C.1.11].

③ TBO = Tank Bottom Offset [C.1.9]. RO = Reference Offset [C1.10]. BD = Blocking Distance [C.1.11].

④ RO = Reference Offset [C1.10].

6.4 Further information on device configuration

6.4.1 Quick Links

If you frequently use a menu item, you can create a Quick Link. This lets you quickly find and configure items in the advanced setup menu. Five Quick Link memory spaces are available in the **Quick setup** submenu. Go to **Supervisor Menu > Quick Setup**.

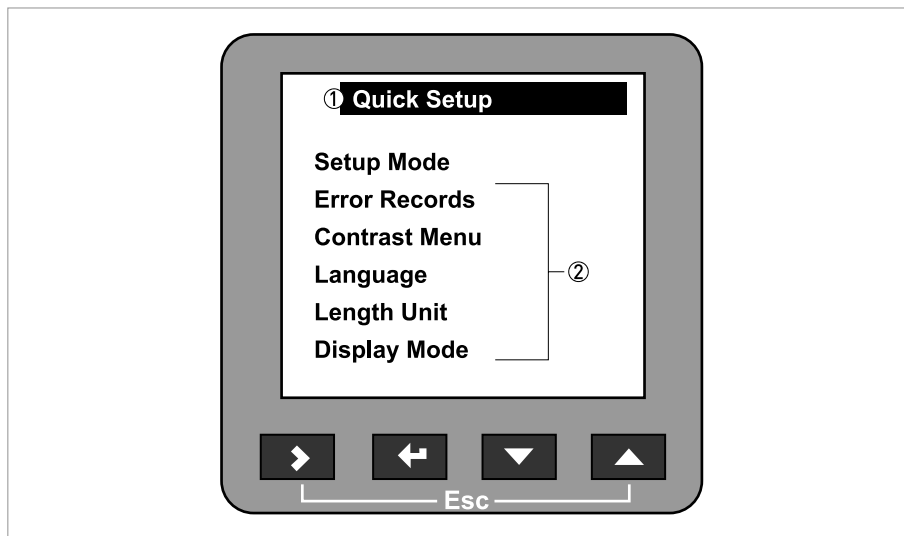


Figure 6-4: The list of quick links

- ① Menu name
- ② Quick links



How to create a Quick Link

- Go to **Supervisor Menu > Advanced Setup**.
- Select a menu item with the Δ and ∇ push buttons.
- Press the \blacktriangleright push button for one second.
- ➡ The device saves this menu item as a Quick Link. Example text: Mass Unit has been assigned to Quick Link 2



NOTE!

The Quick Links are saved to one of the five memory spaces. They are saved in sequence. The first Quick Link is saved to Quick Link 1, the second to Quick Link 2 and so on. If you have already saved five Quick Links, the next Quick Link will be saved to Quick Link 1.



How to open a Quick Link

- Go to **Supervisor Menu > Quick Setup**.
- Select a Quick Link with the Δ and ∇ push buttons.
- Press the \blacktriangleright push button.
- ➔ This opens the menu item. You can configure the device.

6.4.2 Protection of the device settings

The **Passwords** menu lets you change the supervisor password.



How to change the supervisor password

- Go to **Supervisor > Advanced setup > Device setup > Passwords > Supervisor**.
- Type in the new 6-character password.
- ➔ Press the 4 buttons in any sequence.
- Type in the new 6-character password again.
- ➔ If the second entry is not the same as the first, the device will display the error message "Password mismatch". Press \blacktriangleright + Δ at the same time and type in the new 6-character password again.
- Press \blacktriangleright and Δ (Esc) at the same time to exit to the "save settings" window.
- Select **Save** and press \blacktriangleleft .
- ➔ The device will go back to operator mode.



NOTE!

Make a note of the password and keep it in a safe place. If you lose the password, please contact your supplier.

6.4.3 Network configuration

**INFORMATION!**

For more data, refer to *Networks* on page 48.

The device uses HART® communication to send information to HART®-compatible equipment. It can operate in either point-to-point or multidrop mode. The device will communicate in multidrop mode if you change the HART® address of output 1.

**How to change from point-to-point to multidrop mode**

- Enter supervisor mode.
 - Go to **Advanced Setup > Output 1 (HART) > HART Address**.
 - Enter a value between 1 and 15 and press **↵** to confirm (see the caution below).
 - Press the Escape buttons(**> + Δ**) until you get the save/cancel screen.
 - Select save.
 - Press **↵**.
- ⇒ Output 1 switches to multidrop mode.

**CAUTION!**

Make sure that the HART® address for this device is different from others in the multidrop network.

**How to change from multidrop to point-to-point mode**

- Enter supervisor mode.
 - Go to **Advanced Setup > Output 1 (HART) > HART Address**.
 - Enter the value **0** and then press **↵** to confirm.
 - Press the Escape buttons(**> + Δ**) until you get the save/cancel screen.
 - Select save.
 - Press **↵**.
- ⇒ Output 1 switches to point-to-point mode.

6.4.4 Linearisation

You can use the linearisation table given in function to make sure that readings are consistently accurate.



- Go to **Supervisor > Advanced setup > Installation setup > Linearisation table**.
- Type in the number of reference points (up to 50 points). Press **↵**.
- ➡ This shows the linearisation table with default values.
- Press **>** to type in new data. The device reading is given on the second line **Device distance**.
- Fill the tank to any given level.
- Make an appropriate reference measurement. Type this data on the line **Real distance**.
- Repeat these steps until all the cells in the linearisation table are completed.
- Press **↵**.
- Press **>** and **△** (Esc) at the same time to exit to the "save settings" window.
- Select **Save** and press **↵**.
- ➡ The device will go back to operator mode.

6.4.5 Distance measurement

The device displays distance measurements when an output is set to distance. Menu items related to distance measurement are:

- output function (C.3.1 or C.4.1).
- tank height (C.1.2).
- blocking distance (C.1.9).

Use the flange facing as the reference point for the 4 and 20 mA current output settings. The 4 and 20 mA current output settings are the minimum and maximum points of the measurement scale. You can change the reference point from which distance is measured. Use this menu item:

- reference offset (C.1.10).



NOTE!

If you move the reference point above the flange, add this value when give a distance for the 4 and 20 mA current output settings. If you move the reference point below the flange, subtract this value when give a distance for the 4 and 20 mA current output settings.



CAUTION!

If the distance for the 4 mA is set in the blocking distance, the device will not be able to use the full current output range.

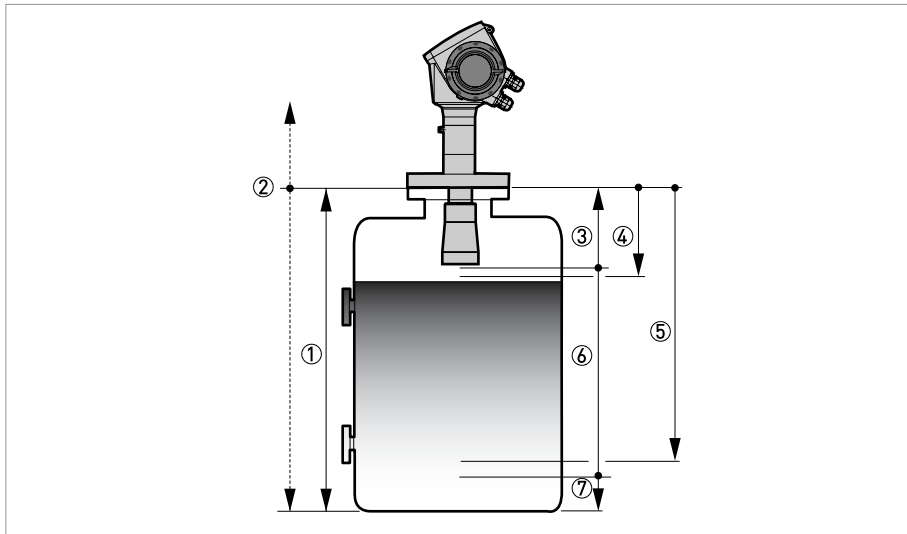


Figure 6-5: Distance measurement

- ① Tank height [C.1.2]
- ② Reference offset [C.1.10]
- ③ Blocking distance [C.1.9]
- ④ 4 mA setting [C.3.2 or C.4.2]
- ⑤ 20 mA setting [C.3.3 or C.4.3]
- ⑥ Maximum effective measuring range
- ⑦ Non-measurement zone

For further information, refer to *Function description* on page 62, table C. Advanced setup. This gives more data on the menu items.

6.4.6 Level measurement

The device displays level measurements when an output is set to level. Menu items related to level measurement are:

- output function [C.3.1 or C.4.1].
- tank height [C.1.2].
- blocking distance [C.1.9].

Use the tank bottom as the reference point for the 4 and 20 mA current output settings. The 4 and 20 mA current output settings are the minimum and maximum points of the measurement scale. You can change the reference point from which level is measured. Use this menu item:

- tank bottom offset [C.1.11].



NOTE!

If you move the reference point below the tank bottom, add this value when give a level for the 4 and 20 mA current output settings. If you move the reference point above the tank bottom, subtract this value when give a level for the 4 and 20 mA current output settings.

**CAUTION!**

If the level for the 20 mA is set in the blocking distance, the device will not be able to use the full current output range.

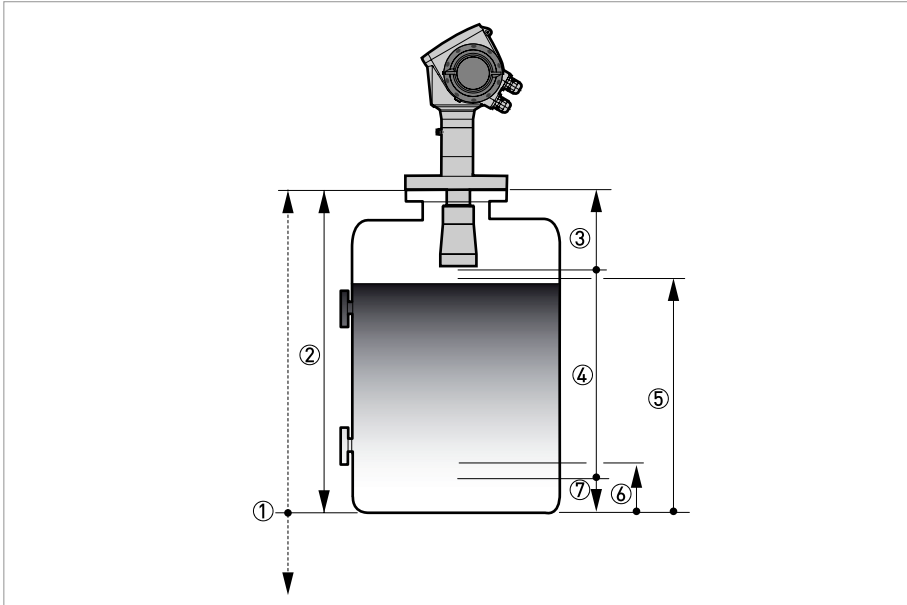


Figure 6-6: Level measurement

- ① Tank bottom offset (C.1.11)
- ② Tank height (C.1.2)
- ③ Blocking distance (C.1.9)
- ④ Maximum effective measuring range
- ⑤ 20 mA setting (C.3.3 or C.4.3)
- ⑥ 4 mA setting (C.3.2 or C.4.2)
- ⑦ Non-measurement zone

For more data about menu items, refer to *C. Advanced setup* on page 69.

6.4.7 How to configure the device to measure volume or mass

The device can be configured to measure volume or mass. The procedure for doing this is given in the device's **Quick Setup** menu.



How to create a volume or mass table.

- Go to **Supervisor > Quick setup > Setup mode > Conversion.**
- Complete all the steps in the setup procedure.

The device creates a table of up to 50 pairs of data (level - volume or level - mass). The reference point for the table is the tank bottom (as given in menu item C.1.2 Tank height.).



INFORMATION!

You can also create customized length and conversion units (free units) in the **Conversion** setup procedure.



INFORMATION!

When you create a table, get more conversion data for parts of the tank where there are:

- Surfaces with curves.
- Sudden changes in the cross section.

This will make volume measurement more accurate.

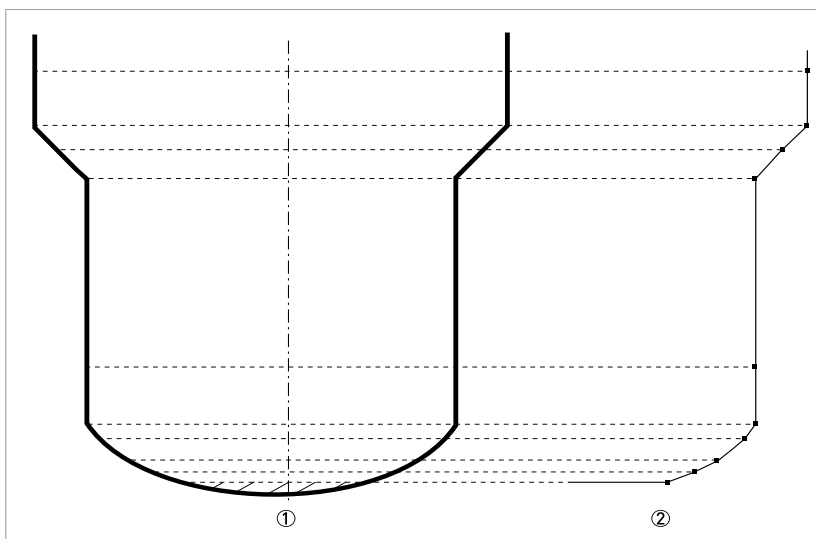


Figure 6-7: A plot of points for a volume or mass table

- ① Tank with reference points
- ② Tank model with plotted points

6.4.8 How to measure correctly in tanks with curved bottoms

It is possible that the device cannot find the bottom of the tank if it is installed in a tank with a dish-shaped bottom. The form of the tank bottom causes a delayed radar reflection and the device will display the error message "Measurement is lost in the tank bottom".

You can offset the tank bottom reference point to find the delayed radar reflection. Obey the instructions that follow:



- Empty the tank.
- Increase the tank height in menu C.1.2.
- Go to the **signal screen** in operator mode.
- ➔ You will see a graph of reflections.
- Press > to move the cursor to the reflection with the largest amplitude (given in dB).
- Make a note of the distance of the reflection measured by the device.
- ➔ The distance to the reflection will be the new tank height.
- Subtract the distance to the reflection from the true tank height.
- Go to **Supervisor > Advanced setup > Installation setup > Tank bottom offset**.
- Type in the difference you calculated as a negative value.
- ➔ A negative value will move the reference point above the tank bottom (as given in menu item C.1.2 Tank height).
- Press ←.
- Press > and △ (Esc) at the same time to exit to the "save settings" window.
- Select **Save** and press ←.
- ➔ The device will go back to operator mode.

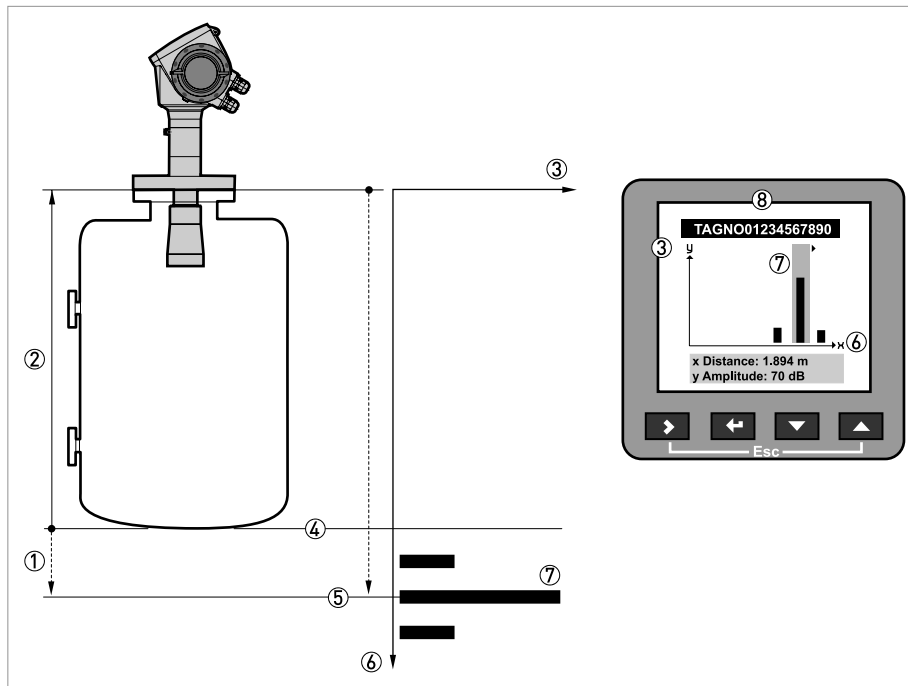


Figure 6-8: Signal screen and the tank bottom reflection

- ① Tank bottom offset (menu item C.1.11)
- ② Tank height (menu item C.1.2)
- ③ Signal amplitude (in dB)
- ④ True position of the tank bottom
- ⑤ Offset position of the tank bottom
- ⑥ Distance of the reflection from the device flange
- ⑦ Delayed reflection of the tank bottom
- ⑧ Signal screen on the device display



NOTE!

For more data on menu items, refer to Function description on page 62, table C. Advanced setup.

6.5 Service mode

Service personnel use this mode to change advanced settings, particularly for difficult applications.



CAUTION!

If you are not an authorized service technician, do not change any values in the service mode menu.

This mode is locked with a password. Only approved persons are permitted to have the password for the service menu. Please contact your local sales office for further information.

6.6 Errors

6.6.1 General information

Indication of errors

When the device senses an error condition, it displays an error symbol in the top left corner of the display screen.



Figure 6-9: Indication of errors

① Error symbol



How to identify errors

- Enter supervisor mode.
- Go to **Test > Information > Error records**.
- Use ▾ and ▲ to scroll the error list. There are 5 error messages per page.

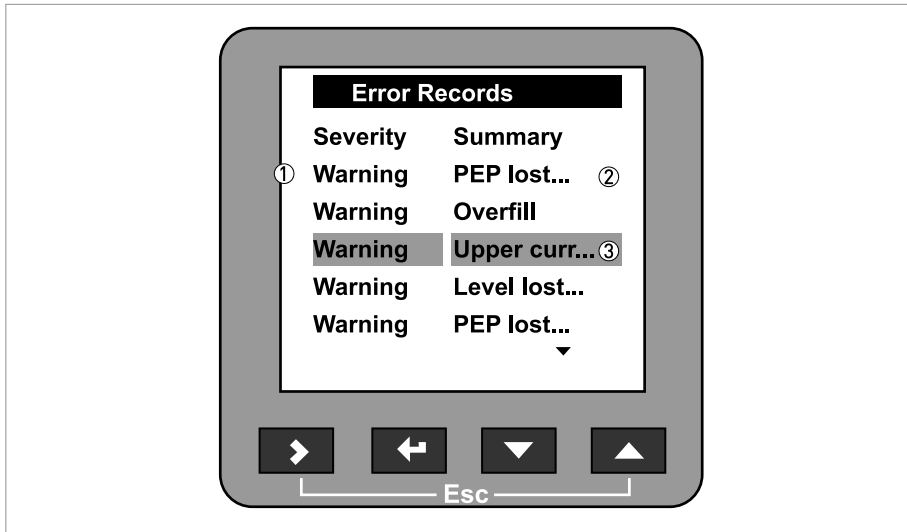


Figure 6-10: Error records in supervisor mode

- ① Type of error.
- ② Short description of the error
- ③ Selection bar



How to get more data about the error

- Select an error log and press ← to read the help text.
- ➡ Typical data is given in the illustration that follows.
- For solutions to the problem, refer to *Error handling* on page 87.



Figure 6-11: Description of the error

- ① Description of the error
- ② Time since error occurred in Days:Hours:Minutes:Seconds
- ③ Type of error

The time since the error occurred is measured in **Days:Hours:Minutes:Seconds**. It only includes the time when the device is energized. The error is saved in the memory of the device when it is switched off. The counter continues when the device is switched back on.

The error symbol is no longer displayed after you read the error record.

6.6.2 Error handling

Types of error message

Type of error	Error code	Description
Error	E	If an error message is displayed in the error record (menu item B.2.6), the measured value is not correct. The output current goes to the value set in menu items C.3.5 Error Handling (Output 1) and C.4.5 Error Handling (Output 2). For more data; refer to <i>C. Advanced setup</i> on page 69.
Warning	W	If a warning message continues, the measured value will no longer be correct.

Description of errors and corrective actions

Error Message	Error code	Description	Corrective action
---------------	------------	-------------	-------------------

Current output

Current output saturated at maximum value.	W	The output is at its maximum output value (20 or 20.5 mA) because the measured value is now out of the measurement range.	Fill the tank or remove some of the product until the level is back in the configured range.
Current output saturated at minimum value.	W	The output is at its minimum output value (4 or 3.8 mA) because the measured value is now out of the measurement range.	Fill the tank or remove some of the product until the level is back in the configured range.

External influences

Temperature out of range for NAND Flash	W	The ambient temperature is outside the given range. This can cause loss or corruption of data.	Switch off the device until the ambient temperature is back in the given range. If the problem continues, contact the supplier.
---	---	--	---

Error Message	Error code	Description	Corrective action
---------------	------------	-------------	-------------------

Self-test manager

Self Test has failed	E	The device's self-test failed. This can occur if the ambient temperature is not between -40...+80°C / -40...+175°F.	Energize the device when the ambient temperature is between -40...+80°C / -40...+175°F. If the device does not operate correctly, contact the supplier.
----------------------	---	---	---

Measuring status

Measurement is old	W	This is a temporary error message. If the device cannot get a measurement in this time limit, the displayed measurement is no longer correct. The voltage is possibly too low. If the device continues to show the message "spectrum quality is bad", then this message is also shown.	Check the voltage at the device terminals. Refer also to the error message "Spectrum quality is bad".
Level has reached the blocking distance (tank overflow)	W	The level is in the blocking distance. There is a risk that the product will overflow and/or cover the device.	Remove some of the product until the level is below the blocking distance.
Measurement is lost in the tank bottom	W	The device got the last valid measurement near to the tank bottom, but it can no longer find the signal. This is common in tanks with dished bottoms (DIN28011 or similar). The device will display tank bottom measurement.	The tank is possibly empty. If you fill the tank, the device will measure again.

Electronics failures

Microwave check failed	E	A microwave board check failed.	If the problem continues, contact the supplier.
Peripheral Failure	E	Hardware peripheral devices on the DSP board failed.	If the problem continues, contact the supplier.

Error Message	Error code	Description	Corrective action
---------------	------------	-------------	-------------------

Peak and spectrum

Spectrum quality is bad	W	The quality of the spectrum is poor. If this message is temporarily shown, this will not affect the performance of the device. If this message is continuously shown, the measured values can be incorrect. The error message "Measurement is old" will then be displayed. Possible causes are foam, vortices, turbulent product surface and internal tank elements.	Check the installation and the process. Reconfigure the device and record a new empty spectrum. If necessary, contact the supplier.
Empty spectrum is invalid	W	The Empty Spectrum stored in the device does not agree with the installation. If you change the device configuration (tank height etc.), this message will be displayed. The recorded empty spectrum will not be used by the device while this error message is displayed.	Check the installation and the process. Reconfigure the device and record a new empty spectrum. If necessary, contact the supplier.
Plausible peak is not available	W	The signal peak is not found within the measuring window that filters the signals received by the antenna. The measurement is not correct. The device will automatically increase this window to find the correct signal.	Check the installation and the process. Reconfigure the device and record a new empty spectrum. If necessary, contact the supplier.

Software error

Unable to load DSP firmware	E	The download of the DSP Firmware did not download correctly to the DSP board.	Restart the device. If the problem continues, contact the supplier.
-----------------------------	---	---	---

7.1 Periodic maintenance

No maintenance is necessary.

7.2 Keep the device clean



WARNING!

Do not let more than 5 mm/0.2" of dust collect on the top of the device. This is a possible source of ignition in a potentially explosive atmosphere.



DANGER!

Risk of electrostatic discharge from the blue plastic sun cover.



Obey these instructions:

- Keep the thread of the terminal compartment cover clean.
- If dirt collects on the device, clean it. Wipe the plastic sun cover with a damp cloth.

7.3 How to replace device components

7.3.1 Service warranty

Maintenance is not necessary for most applications.

Servicing by the customer is limited by warranty to

- The removal and installation of the signal converter housing. For more data, refer to *How to turn or remove the signal converter* on page 22.
- The removal and installation of the back end and the front end assembled to the microwave board.
- The removal and installation of the terminal module.
- The removal and installation of the HMI cover.

This housing can be detached from the flange system under process conditions.

Use only authorized service staff to repair the device.

7.3.2 Replacement of the display cover

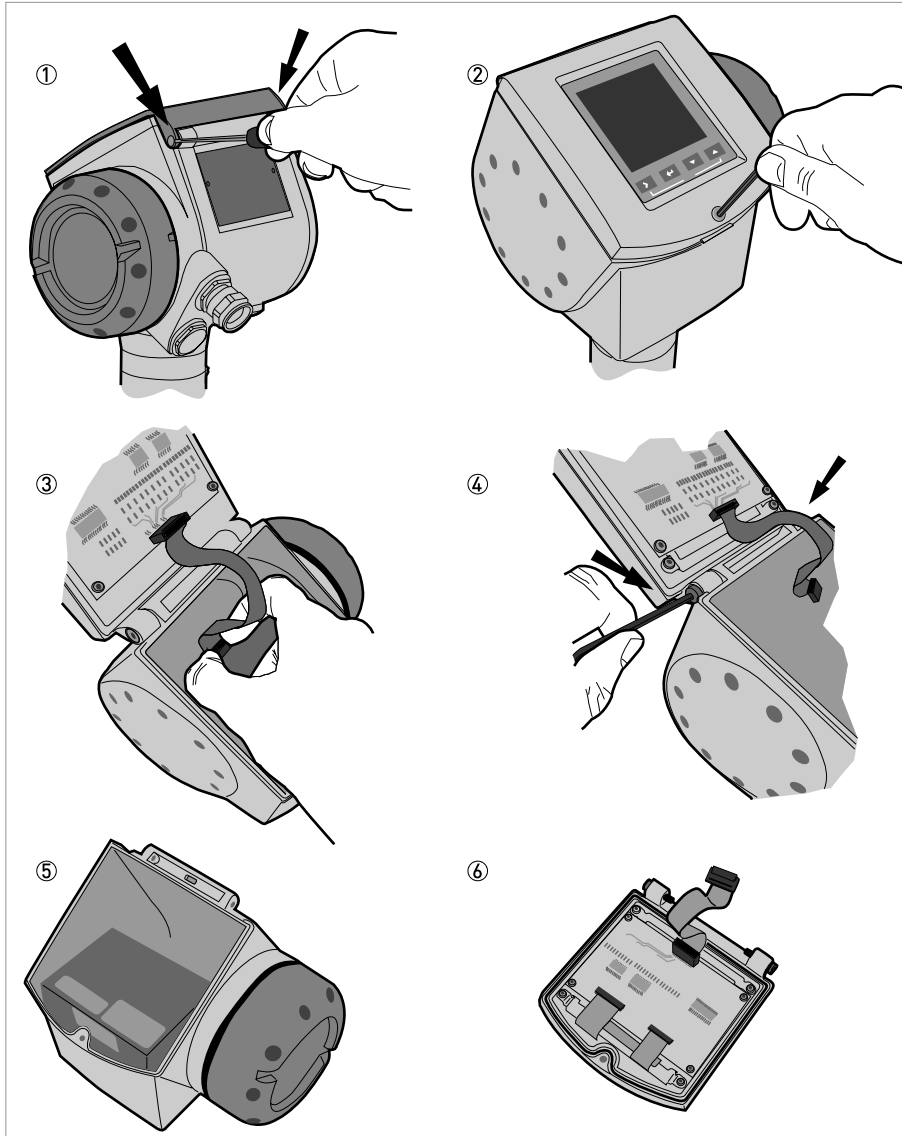


Figure 7-1: Removal of the device display cover

Equipment needed (not supplied):

- Slotted tip screwdriver.
- 3 mm Allen wrench (for steps 2 and 4).



How to remove the display

- ① Remove the 2 pins on the blue sun cover with a slotted tip screwdriver. Remove the sun cover.
- ② Loosen the screw on the display screen cover. Open the display.
- ③ Disconnect the ribbon cable from the back end electronics block.
- ➔ Keep the ribbon cable connected to the display screen cover.
- ④ Remove the 2 screws that keep the display attached to the housing.
- ⑤ Keep the remaining assembly and put it into storage. Make sure that the top of the housing has a protective cover.
- ⑥ Send the display to an authorized agent for maintenance.



How to attach the display

- Attach the display. Attach the 2 housing screws.
- Connect the ribbon cable to the back end electronics block.
- ➔ Make sure the connector is correctly turned. Do not use force to connect the ribbon cable.
- Close the display. Tighten the screw on the display.
- Attach the sun cover. Attach the 2 pins that keep the sun cover attached to the housing.

7.3.3 Replacement of the back end and microwave unit

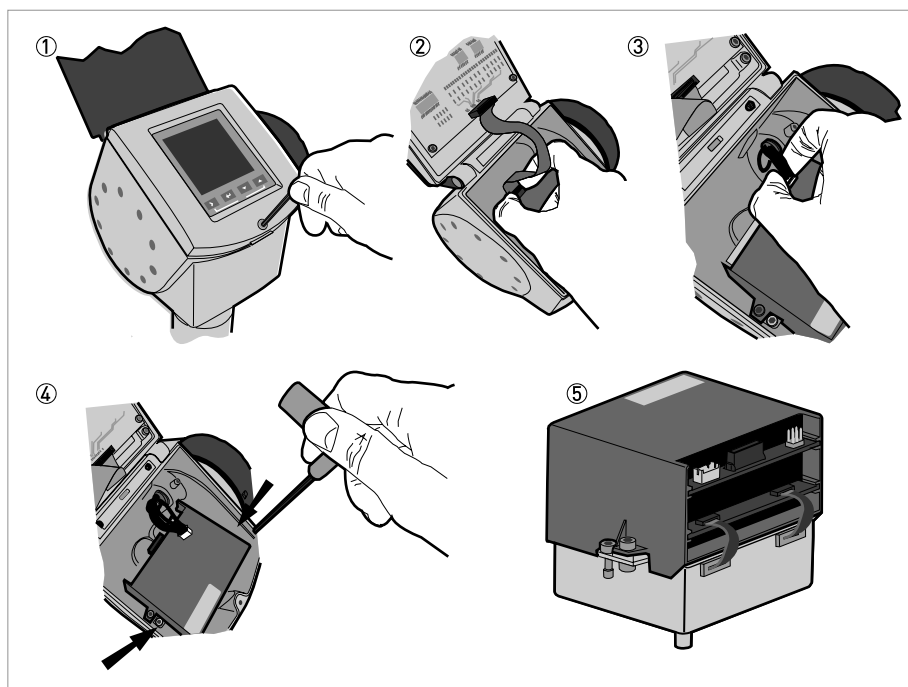


Figure 7-2: Removal of the back end and microwave unit

Equipment needed (not supplied):

- 3 mm Allen wrench (for steps 1 and 4).

**How to remove the back end and microwave unit**

- ① Loosen the screw on the display. Open the display.
- ② Disconnect the display ribbon cable from the back end electronics block.
- ③ Disconnect the power supply connector from the electronics block.
- ④ Loosen the 2 screws shown in the illustration.
- ➡ Do not loosen the other screws. You will disassemble the electronics block into 2 pieces. It is then difficult to remove these pieces from the housing.
- ⑤ Remove the back end and microwave unit from the housing. Send the electronics block to an authorized agent for maintenance.

**How to attach the back end and microwave unit**

- Open the display.
- Put the electronics block into the housing. Make sure that the connector engages in the mating part.
- Tighten the 2 screws to attach the electronics block to the bottom of the housing.
- Connect power supply connector to the back end electronics block.
- Connect the display ribbon cable to the back end electronics block.
- Close the display. Tighten the screw on the display.

7.3.4 Replacement of the terminal module



WARNING!
Disconnect the power supply.

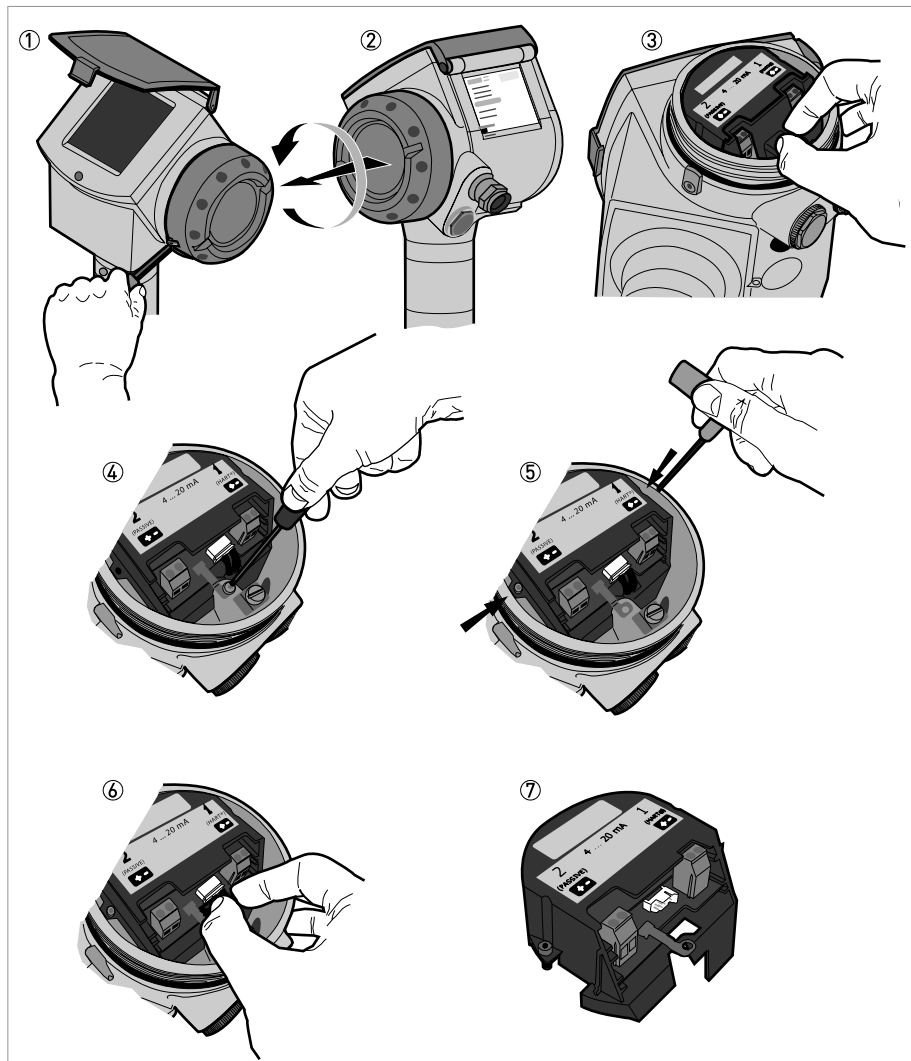


Figure 7-3: Removal of the terminal module

Equipment needed (not supplied):

- 3 mm Allen wrench (for step 1).
- TORX T10 wrench (for step 4).
- 2.5 mm Allen wrench (for step 5).

**How to remove the terminal module**

- ① Loosen the cover stop screw on the terminal compartment cover.
- ② Remove the terminal compartment cover.
- ③ Remove the plastic terminal cover.
- ④ Loosen the screw for the earth terminal connection.
- ⑤ Loosen the 2 screws shown in the illustration.
- ⑥ Disconnect the wire connector from the back end electronics compartment.
- ⑦ Remove the terminal block from the housing. Send it to an authorized agent for maintenance.

**How to attach the terminal module**

- Connect the wire connector from the back end electronics compartment.
- Push the wires into the slot below the connector on the terminal block.
- Turn the terminal block one time to twist the wires.
- Put the terminal block into the housing. Make sure that you push the wires away from the screw holes.
- Attach the terminal block to the housing with 2 screws supplied.
- Attach the earth terminal connection to the housing with the screw supplied.
- Attach the plastic terminal cover.
- Attach the terminal compartment cover.
- Tighten the cover stop screw.

**WARNING!**

If you do not push the wires away from the screw holes when you attach the terminal block, there is a risk of damage to the wires.

7.4 Spare parts availability

7.4.1 General notes

We supply spare parts and accessories for this device. When you order a spare part or accessory, please give the reference numbers that follow:

7.4.2 List of spare parts

We supply spare parts and accessories for this device. When you order a spare part or accessory, please give the reference numbers that follow:

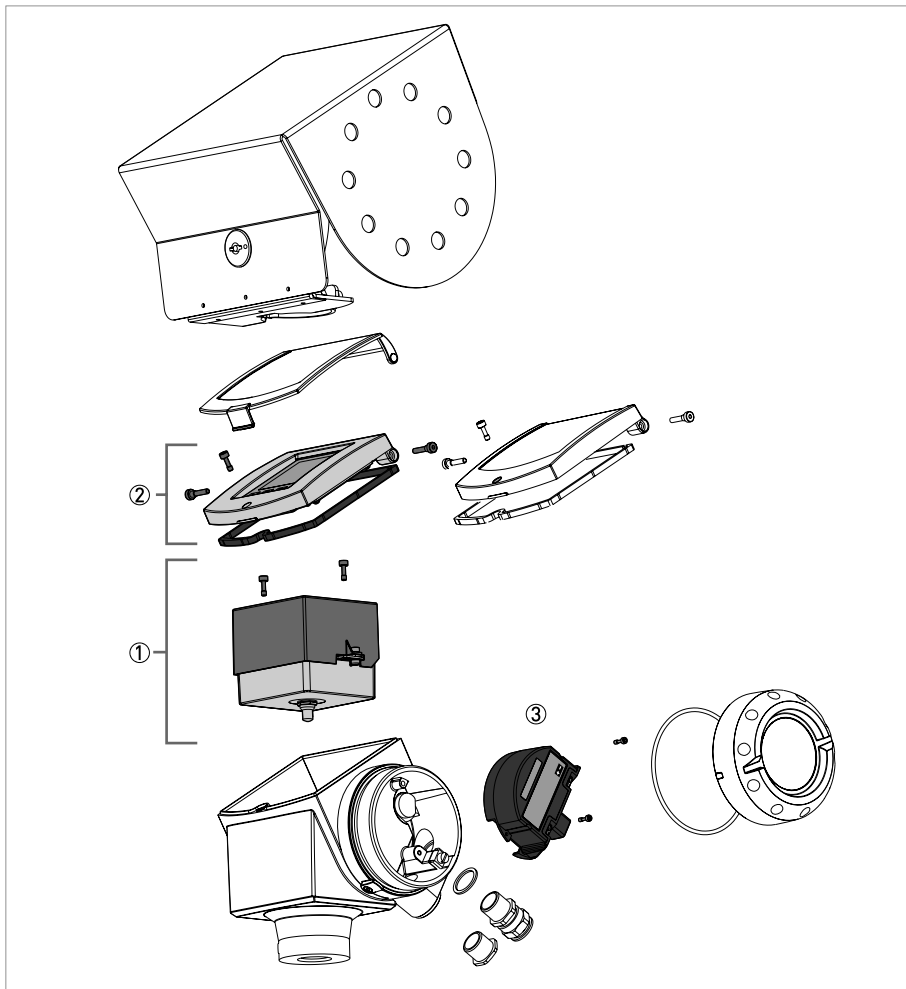


Figure 7-4: Spare parts

Part numbers for spare parts

Item number	Description	Quantity	Part reference
①	Combined backend and high-frequency modules ①	1	F2139580100
	Screws for the combined back end and HF modules	2	F3177360000
②	HMI cover and cable ②	1	XF7040000000050300
③	Terminal module with 1 output (non-Ex)	1	F2139620200
	Terminal module with 1 output (Ex ia)	1	F2139620100
	Terminal module with 1 output (Ex d [ia])	1	F2139950100
	Terminal module with 2 outputs (non-Ex)	1	F2139630200
	Terminal module with 2 outputs (Ex ia)	1	F2139630100
	Terminal module with 2 outputs (Ex d [ia])	1	F2139640100
	Screws for the terminal module	2	F3177350000

① the customer must send the original back end and HF module to the repair centre. Refer to the replacement procedure in this section.

② this reference includes the gasket and screws

7.4.3 List of accessories

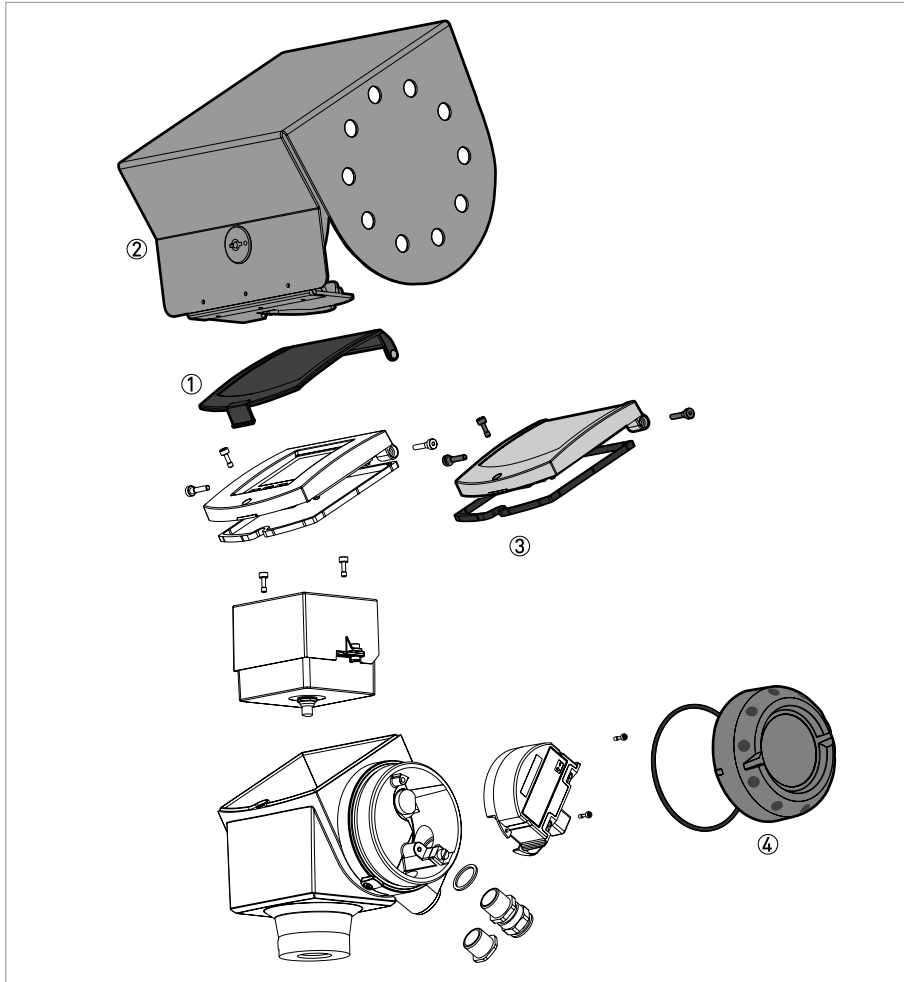


Figure 7-5: Accessories

Part numbers for accessories

Item number	Description	Quantity	Part reference
①	Plastic sun cover	1	F3179980000
	Pins for the plastic sun cover	2	F3179990000
②	Stainless steel weather protection	1	F2096340000
③	Blind cover (with a gasket and screws)	1	F3177240100
	Gasket for the blind cover	1	F3177420000
	Hinge screws for the blind cover	2	F3177340000
	Lock screw for the blind cover	1	F3177360000
④	Wiring compartment cover	1	F3177260100
	Gasket for the wiring compartment cover	1	F5091150000
n/a	Converter VIATOR RS232 / HART® ①	1	F50919500000
	Converter USB / HART® ①	1	F50779300000

① for HART® or PACTware™ communication

7.5 Service availability

The manufacturer provides a variety of services to support its customers before and after warranty expiration.

Repair, technical support and training can be provided.



NOTE!

For detailed information please contact the local sales representative.

7.6 Returning the device to the manufacturer

7.6.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.



CAUTION!

Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*



CAUTION!

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

7.6.2 Form (for copying) to accompany a returned device

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no.:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	water-hazardous		
	toxic		
	caustic		
	flammable		
	We checked that all cavities in the device are free from such substances.		
	We have flushed out and neutralized all cavities in the device.		
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.			
Date:		Signature:	
Stamp:			

7.7 Disposal



CAUTION!

Disposal must be carried out in accordance with legislation applicable in your country.

8.1 Technical data

Measuring system

Measuring principle	2-wire loop-powered level transmitter; K-band FMCW radar
Application range	Measurement of level, distance, volume and reflectivity of liquids, pastes, slurries, powders and granulates

Design

Options	Integrated LCD display with sun cover [-20..+60°C / -4...+140°F]; if the ambient temperature is not in these limits, the display switches off
	2nd current output;
	Antenna purging system (supplied with ¼ NPTF connection)
	PTFE/PP flange plate (for Drop antenna without antenna extensions only)
Accessories	Weather protection
	Antenna extensions of 105 mm/4.1" length (for long horn antenna and drop antenna versions only)
Max. measuring range	80 m / 260 ft. Depends on the antenna option, dielectric constant of the product and installation type. Refer also to Antenna selection: liquid applications and Antenna selection: solid applications .
Min. tank height	0.2 m / 8"
Dead zone	Antenna extension length + antenna length + 0.1 mm / 4"
Beam angle of antenna	
Horn DN40 / 1.5"	20°
Horn DN50 / 2"	15°
Horn DN80 / 3"	10°
Horn DN100 / 4"	8°
Drop DN80 / 3"	8°
Display and User interface	
Display	9 lines, 160 x 160 pixels in 8-step greyscale with 4-button keypad
Interface languages	English, German, French, Italian, Spanish, Portuguese, Japanese, Chinese (Mandarin) and Russian

Measuring accuracy

Resolution	1 mm / 0.04"
Repeatability	±1 mm / ±0.04"
Accuracy	±3 mm / ±0.12", when distance < 10 m / 33 ft; ±0.03% of measured distance, when distance > 10 m / 33 ft

Reference conditions acc. to EN 60770	
Temperature	+20°C ±5°C / +70°F ±10°F
Pressure	1013 mbar abs. ±20 mbar / 14.69 psig ±0.29 psig
Relative air humidity	60% ±15%
Target	Metal plate in an anechoic chamber

Operating conditions

Ambient temperature	-40...+80°C / -40...+175°F (Ex i: see supplementary operating instructions or approval certificates)
Storage temperature	-40...+85°C / -40...+185°F
Flange temperature	
Horn antenna	-50...+200°C / -58...+390°F (Ex i: see supplementary operating instructions or approval certificates)
Drop antenna (PTFE)	-50...+150°C / -58...+300°F (Ex i: see supplementary operating instructions or approval certificates - Ex approvals pending)
Drop antenna (PP)	-50...+100°C / -58...+210°F (Ex i: see supplementary operating instructions or approval certificates - Ex approvals pending)
Thermal shock resistance	<40°C/s / <72°F/s
Operating pressure	
Drop antenna (PP)	-1...16 bar / -14.5...232 psig; subject to process connection used and flange temperature
All other antennas	-1...40 bar / -14.5...580 psig; subject to process connection used and flange temperature
Other conditions	
Dielectric constant (ε _r)	≥1.5
Vibration resistance	IEC 68-2-6 and EN 50178 (10...57 Hz: 0.075 mm / 57...150 Hz: 1g)
Protection category	IP 66/67 equivalent to NEMA 6-6X

Installation conditions

Process connection size	The process connection should be larger than the antenna diameter.
	If the process connection on the device is smaller than the antenna, either: - provide the means to adapt the device to a larger process connection on the tank (for example, a plate with a slot), or - use the same process connection, but remove the antenna from the device before installation and fit it from inside the tank.
Process connection position	Make sure that there are not any obstructions directly below the process connection for the device.

Materials

Housing	Aluminium; Stainless steel
Wetted parts, including antenna	Stainless steel (1.4404 / 316L); Hastelloy® C-22 (2.4602); PTFE; PP (a PP or PTFE flange plate option is also available)
Process fitting	Stainless steel (1.4404 / 316L); Hastelloy® C-22 (2.4602)
Gaskets (and o-rings for the sealed antenna option)	FKM/FPM (-40...+200°C / -40...+390°F); Kalrez® 6375 (-20...+200°C / -5...+390°F); EPDM (-50°C...+150°C / -58...+300°F)
Feedthrough	PEI/standard (-50...+200°C / -58...+390°F); Metaglas® (-30...+200°C / -20...+390°F)
Weather protection (Option)	Stainless steel (1.4301 / 304)

Process connections

Thread	G 1½"; 1½" NPT
Flange	DN40...150 (PN40 / PN16); 1½"...8" (150 lb / 300 lb); 10K (40...100A)

Electrical connections

Power supply	Terminals output 1 - Non-Ex / Ex i
	14...30 VDC min./max. value for an output of 22 mA at the terminal
	Terminals output 1 - EEx d
	20...36 VDC min./max. value for an output of 22 mA at the terminal
Cable entry	Terminals output 2 - Non-Ex/ Ex i/ Ex d
	10...30 VDC min./max. value for an output of 22 mA at the terminal (additional power supply needed - output only)
Cable entry	M20x1.5; ½NPT; G ½ (not for FM- and CSA-approved devices)
	M25x1.5 (for stainless steel housings only)
Terminals	0.5...1.5 mm²

Input and output

Output signal (Output 1)	4...20 mA HART® or 3.8...20.5 mA acc. to NAMUR NE 43
Output signal (Output 2 - optional)	4...20 mA (no HART® signal) or 3.8...20.5 mA acc. to NAMUR NE 43
Resolution	±3 µA
Temperature drift	Typically 50 ppm/K
Error signal	High: 22 mA; Low: 3.6 mA acc. to NAMUR NE 43

Approvals

ATEX	ATEX II G 1, 1/2, 2 Ex ia IIC T6...T3; ATEX II D 1, 1/2, 2 Ex iaD 20 or Ex iaD 20/21 or Ex iaD 21 IP6X T65°C...T90°C; ATEX II G 1/2, 2 Ex d [ia] IIC T6...T3; ATEX II D 1, 1/2, 2 Ex tD[iaD] A21/20 or Ex tD[iaD] A21 IP6X T65°C...T90°C; ATEX II G 3 Ex nA IIC T6...T3
IECEX	Zone 0 Ex ia IIC T6...T3; Ex iaD 20 IP6X T65°C...T 90°C
FM or CSA	NEC 500/ CEC Cl. I, Div . 1, Gr. ABCD (IS); Cl. I, Div . 1, Gr. ABCD (FM only) (XP); Cl. I, Div . 2, Gr. ABCD (XP/NI); Cl. II, Div . 1, Gr. EFG; Cl. III (FM only) (XP); Cl. II Div . 1, Gr. EFG; Cl. III (IS); Cl. II/III, Div . 2, Gr. FG (XP/NI) NEC 505/ CEC Cl. I, Zone 0 AEx ia Gr. IIC (CSA: Ex ia) (IS); Cl. I, Zone 1 AEx d [ia] Gr. IIC (XP); Cl. I, Zone 2, AEx nA [ia], Gr. IIC (CSA: Ex nA [ia]) (IS)
NEPSI	Ex dia IIC T3...T6; Ex ia IIC T3...T6
WHG	Certificate Z-65.16-425. In conformity with the German Federal Water Act, §9

8.2 Antenna selection

8.2.1 Liquid applications

The graphs below show which antenna to select for the application based on:

- D, the measuring range,
- ϵ_r , is the dielectric constant of the product being measured and
- the application.

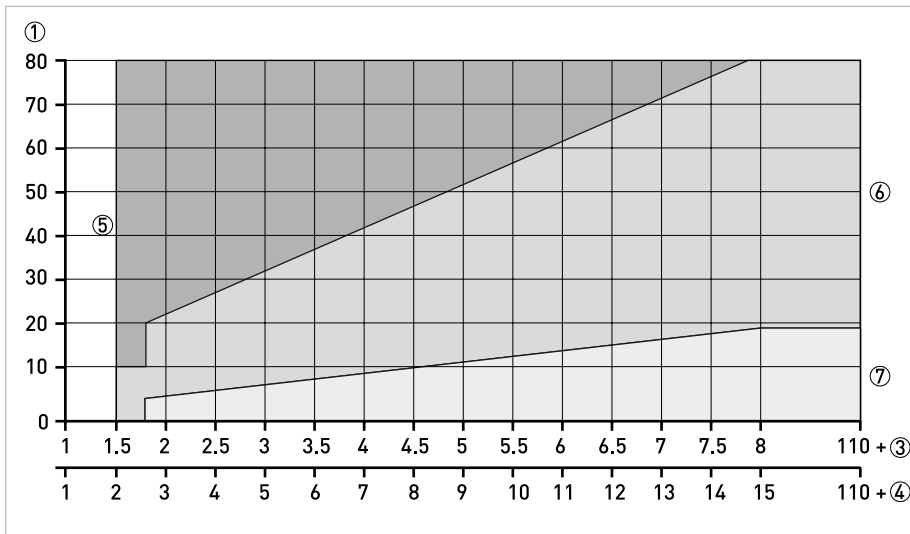


Figure 8-1: Selection of antenna for liquid applications (graph of distance in m against ϵ_r)

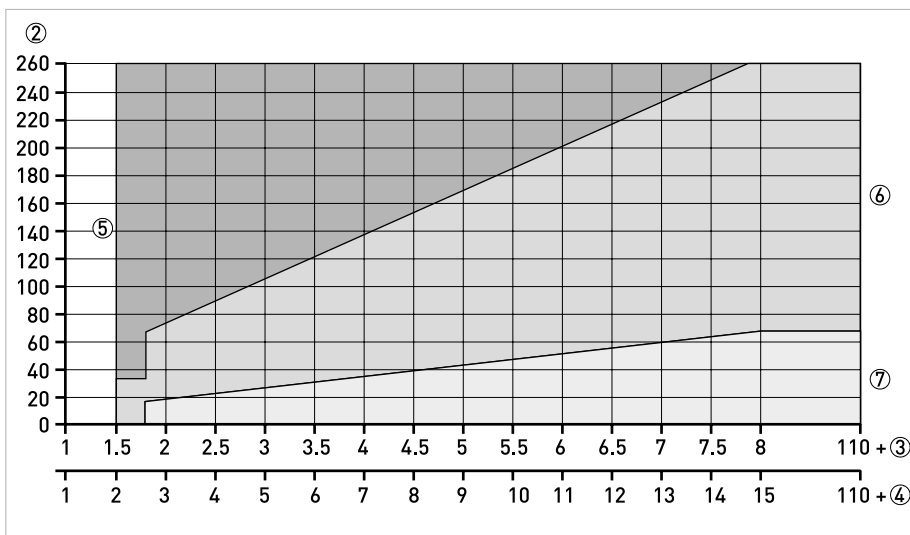


Figure 8-2: Selection of antenna for liquid applications (graph of distance in ft against ϵ_r)

- ① Distance, D [m]
- ② Distance, D [ft]
- ③ Dielectric constant (ϵ_r) range for storage/stillwell applications
- ④ Dielectric constant (ϵ_r) range for process/agitator applications
- ⑤ DN 80 or DN 100 horn antenna in a still well
- ⑥ DN 80 or DN 100 horn antenna with or without a still well, or DN 80 drop antenna without a still well
- ⑦ DN40, DN 50, DN 80 or DN 100 horn antenna with or without a still well, or DN 80 drop antenna without a still well

8.2.2 Solid applications

This graph shows which antenna to select for the application based on:

- D, the measuring range,
- ϵ_r , is the dielectric constant of the product being measured and
- the application.

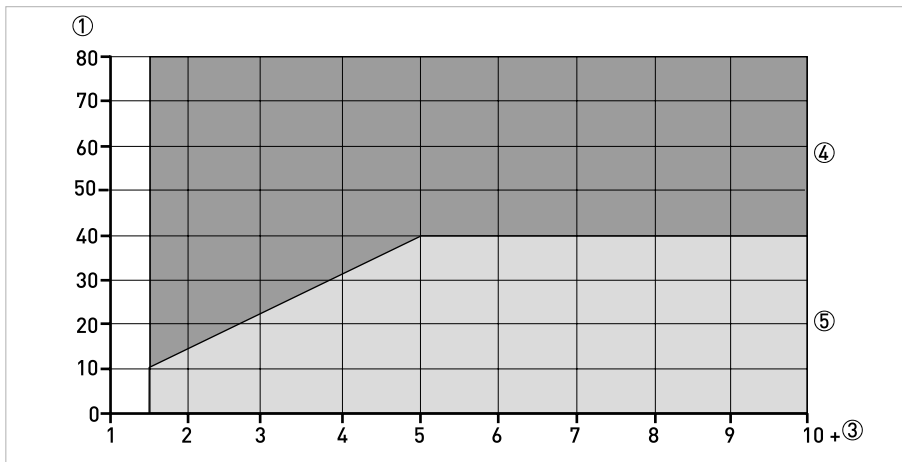


Figure 8-3: Selection of antenna for solid applications (graph of distance in m against ϵ_r)

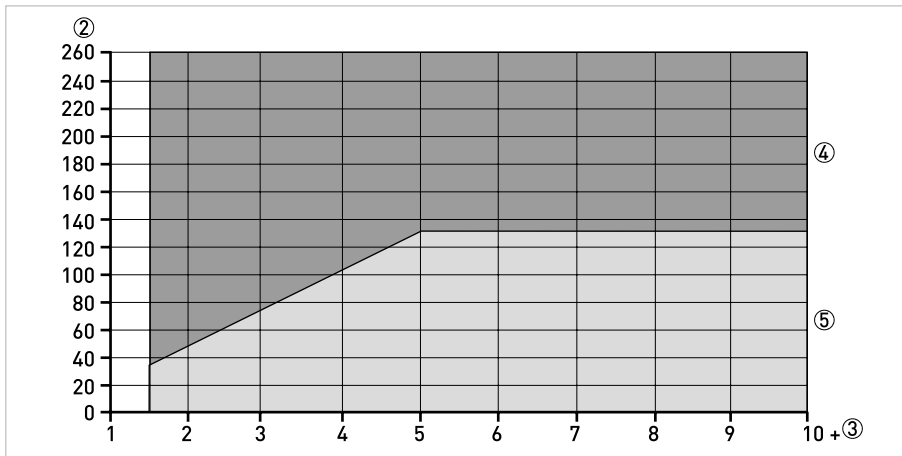


Figure 8-4: Selection of antenna for solid applications (graph of distance in ft against ϵ_r)

- ① Distance, D [m]
- ② Distance, D [ft]
- ③ Dielectric constant (ϵ_r)
- ④ On request
- ⑤ DN 80 or DN 100 horn antenna

8.3 Dimensions and Weight

Housing

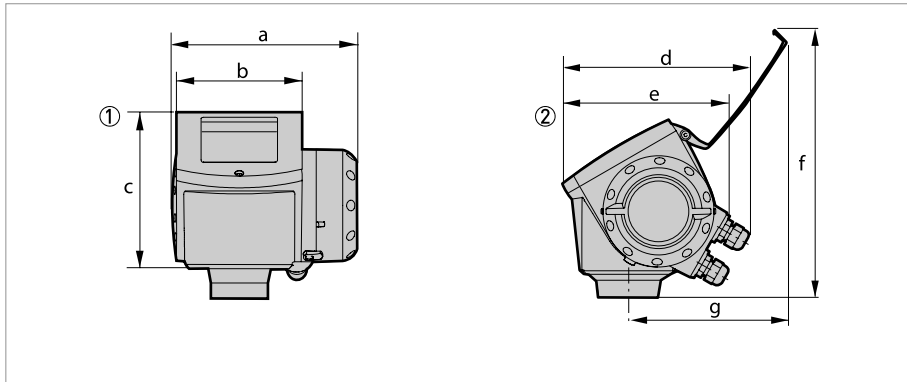


Figure 8-5: Housing dimensions

- ① Housing front view
- ② Housing side view

Dimensions in mm and kg

	Dimensions [mm]							Weight [kg]
	a	b	c	d	e	f	g	
Housing	180	122	158.5	182 ①	167	277	155	3.3

① if fitted with standard cable glands

Dimensions in inches and lbs

	Dimensions [inches]							Weight [lbs]
	a	b	c	d	e	f	g	
Housing	7.1	4.8	6.2	7.2 ①	6.7	10.9	6.1	7.3

① if fitted with standard cable glands

Note:

- Cable glands are delivered on demand with non-Ex, Ex i- and Ex d-approved devices.
- Cable glands for FM- or CSA-approved devices must be supplied by the customer.
- A weather protection cover is delivered on demand with all devices.

Weather protection

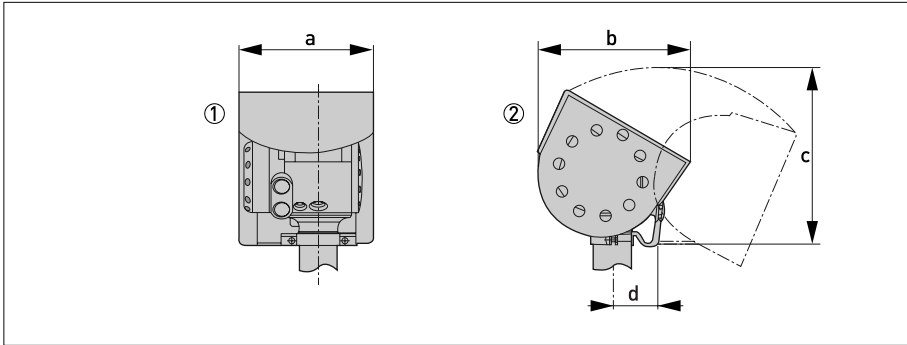


Figure 8-6: Dimensions of the weather protection option

- ① Weather protection, back view
- ② Weather protection, left side view

Dimensions and Weight in mm and kg

	Dimensions [mm]				Weight [kg]
	a	b	c	d	
Weather protection	208	231.5	268 ①	66	2.9

① radius

Dimensions and Weight in inches and lbs

	Dimensions [inches]				Weight [lbs]
	a	b	c	d	
Weather protection	8.2	9.1	10.6 ①	2.6	6.4

① radius

Horn antenna with thread connection

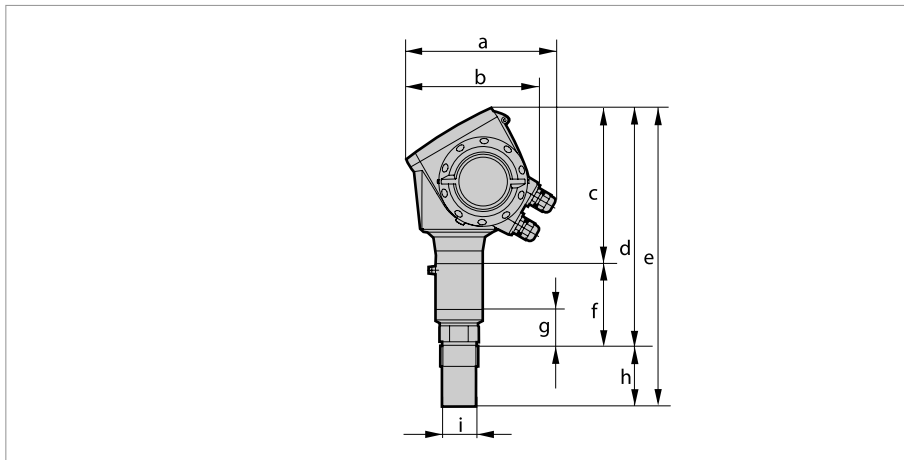


Figure 8-7: Horn antenna with thread connection

Dimensions and Weight in mm and kg

	Dimensions [mm]									Weight [kg]
	a	b	c	d	e	f	g	h	i	
DN50 standard	182 ①	167	190	278	355	88	44.5	77	43 ②	6

① if fitted with standard cable glands

② 1½ NPT or G process connections available

Dimensions and Weight in inches and lbs

	Dimensions [inches]									Weight [lbs]
	a	b	c	d	e	f	g	h	i	
2" standard	7.2 ①	6.5	7.5	11.0	14.0	3.5	1.8	3.0	1.7 ②	13.2

① if fitted with standard cable glands

② 1½ NPT or G process connections available

DN40/50 horn antenna versions

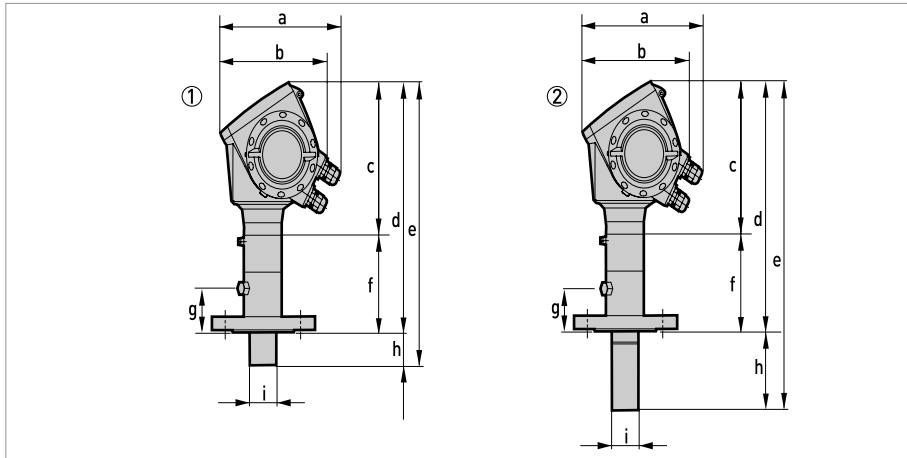


Figure 8-8: DN40/50 horn antenna versions

- ① DN40/50 standard horn antenna
- ② DN40/50 long horn antenna

Dimensions and Weight in mm and kg

	Dimensions [mm]									Weight [kg]
	a	b	c	d	e	f	g	h	i	
DN40 standard	182 ①	167	190	305	344	115	50 ②	39	39	8
DN40 long	182 ①	167	190	305	590	115	50 ②	95 ③	39	9
DN50 standard	182 ①	167	190	305	355.5	115	50 ②	50.5	43	8
DN50 long	182 ①	167	190	305	411	115	50 ②	106 ③	43	9

- ① if fitted with standard cable glands
- ② antenna purging system delivered on demand (NPTF ¼ connection)
- ③ additional antenna extensions of 105 mm length are available

Dimensions and Weight in inches and lbs

	Dimensions [inches]									Weight [lbs]
	a	b	c	d	e	f	g	h	i	
1.5" standard	7.2 ①	6.5	7.5	12.0	13.5	4.5	2.0 ②	1.5	1.5	17.6
1.5" long	7.2 ①	6.5	7.5	12.0	23.2	4.5	2.0 ②	3.7 ③	1.5	19.8
2" standard	7.2 ①	6.5	7.5	12.0	14.0	4.5	2.0 ②	2.0	1.7	17.6
2" long	7.2 ①	6.5	7.5	12.0	16.2	4.5	2.0 ②	4.2 ③	1.7	19.8

- ① if fitted with standard cable glands
- ② antenna purging system delivered on demand (NPTF ¼ connection)
- ③ additional antenna extensions of 4.1" length are available

DN80 horn antenna versions

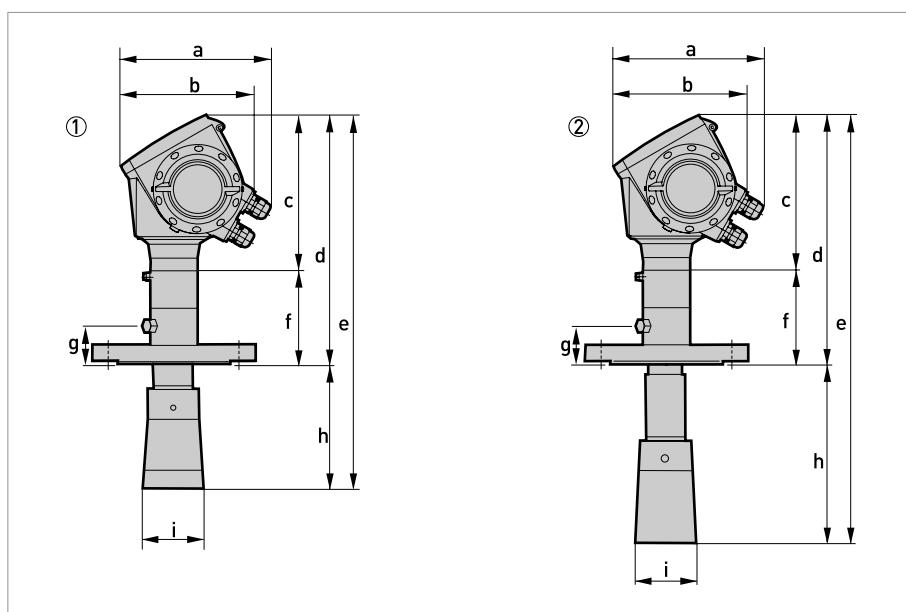


Figure 8-9: DN80 horn antenna versions

- ① DN80 standard horn antenna
- ② DN80 long horn antenna

Dimensions and Weight in mm and kg

	Dimensions [mm]									Weight [kg]
	a	b	c	d	e	f	g	h	i	
DN80 standard	182 ①	167	190	305	465	115	50 ②	160.5	75	11
DN80 long	182 ①	167	190	305	523	115	50 ②	216 ③	75	12

- ① if fitted with standard cable glands
- ② antenna purging system delivered on demand (NPTF ¼ connection)
- ③ additional antenna extensions of 105 mm length are available

Dimensions and Weight in inches and lbs

	Dimensions [inches]									Weight [lbs]
	a	b	c	d	e	f	g	h	i	
3" standard	7.2 ①	6.5	7.5	12.0	18.3	4.5	2.0 ②	6.3	3.0	24.3
3" long	7.2 ①	6.5	7.5	12.0	20.5	4.5	2.0 ②	8.5 ③	3.0	26.5

- ① if fitted with standard cable glands
- ② antenna purging system delivered on demand (NPTF ¼ connection)
- ③ additional antenna extensions of 4.1" length are available

DN100 horn antenna versions

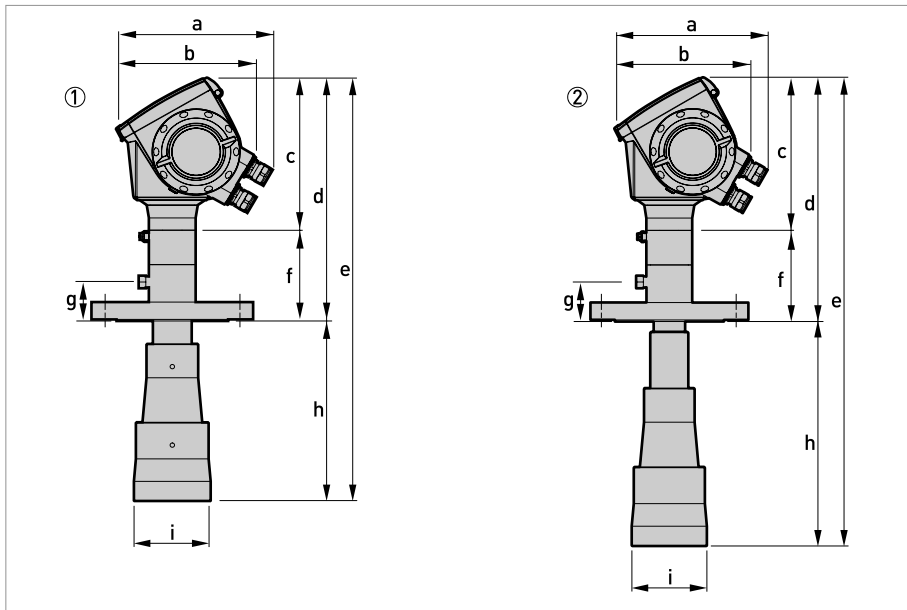


Figure 8-10: DN100 horn antenna versions

- ① DN100 standard horn antenna
- ② DN100 long horn antenna

Dimensions and Weight in mm and kg

	Dimensions [mm]									Weight [kg]
	a	b	c	d	e	f	g	h	i	
DN100 standard	182 ①	167	190	305	465	115	71.5 ②	229	95	18
DN100 long	182 ①	167	190	305	523	115	71.5 ②	284 ③	95	19

- ① if fitted with standard cable glands
- ② antenna purging system delivered on demand (NPTF ¼ connection)
- ③ additional antenna extensions of 105 mm length are available

Dimensions and Weight in inches and lbs

	Dimensions [inches]									Weight [lbs]
	a	b	c	d	e	f	g	h	i	
4" standard	7.2 ①	6.5	7.5	12.0	18.3	4.5	2.8 ②	9.0	3.7	40
4" long	7.2 ①	6.5	7.5	12.0	20.5	4.5	2.8 ②	11.2 ③	3.7	42

- ① if fitted with standard cable glands
- ② antenna purging system delivered on demand (NPTF ¼ connection)
- ③ additional antenna extensions of 4.1" length are available

DN80 Drop antenna versions

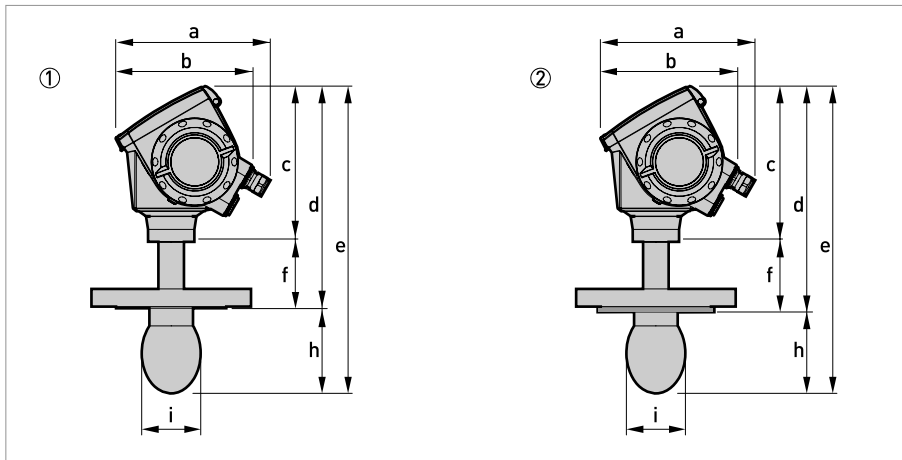


Figure 8-11: DN80 drop antenna options

- ① DN80/3" Drop antenna
- ② DN80/3" Drop antenna, with PP or PTFE flange plate option

Dimensions and Weight in mm and kg

	Dimensions [mm]									Weight [kg]
	a	b	c	d	e	f	g	h	Øi	
DN80 drop antenna	182 ①	167	193	276 ②	382	83 ③	71.5	106 ④	74	11

- ① if fitted with standard cable glands
- ② 281 mm, with the PP/PTFE flange plate option
- ③ 88 mm, with the PP/PTFE flange plate option
- ④ 101 mm with the PP/PTFE flange plate option. Additional antenna extensions of 105 mm length are available for drop antenna without the flange plate option.

Dimensions and Weight in inches and lbs

	Dimensions [inches]									Weight [lbs]
	a	b	c	d	e	f	g	h	Øi	
3" drop antenna	7.2 ①	6.5	7.6	10.9 ②	15.0	3.3 ③	2.8	4.2 ④	2.9	24.3

- ① if fitted with standard cable glands
- ② 11.1", with the PP/PTFE flange plate option
- ③ 3.5", with the PP/PTFE flange plate option
- ④ 4" with the PP/PTFE flange plate option. Additional antenna extensions of 4.1" length are available for drop antenna without the flange plate option.

9.1 Glossary

D

Dielectric constant	An electrical property of the product to be measured used in Radar measurement. Also known as ϵ_r , DK and relative permittivity. Defines the strength of the measurement pulse reflected back to the device's signal converter.
Distance	The distance from the face of flange to the level (1 product) or the surface of the top product (2 or more products). See the diagrams at the end of this section.
Drop antenna	A new generation of plastic antenna. It has an ellipsoidal shape for a more precise emission of radar signals.
DTM	Device Type Manager. A driver for use in the PACTware™ program. All data and functions of the device are included in it.

E

Electromagnetic compatibility	Defines how much a device influences or is influenced by other devices that generate electromagnetic fields during operation. Refer to European standard EN 61326-1 A1+A2 for further details.
--------------------------------------	--

F

FMCW	Frequency-modulated continuous-wave radar technology. The signal is continuously present, but the frequency is modulated, usually in successive linear ramps over time (frequency sweeps).
-------------	--

H

Horn (cone) antenna	A common antenna for most applications. It is used for the controlled emission and collection of radar signals.
Hazardous area	An area with a potentially explosive atmosphere. Trained personnel can install and use an device in this area. The device must be ordered with the appropriate options. The device requires approvals (ATEX, IEC Ex, FM, CSA, NEPSI etc.) related to site specifications. You can find more data about hazardous areas in the Ex Manuals and Ex Certificates of Compliance.

I

Interference signals	False radar reflections.
-----------------------------	--------------------------

L

Level	Height from the bottom of the tank (user-defined) to the surface of the top product (Tank height – distance). See the diagrams at the end of this section.
--------------	--

M

Mass Total mass of tank contents.

O

Operators Users who can choose how to display measurements. They cannot configure the device in supervisor mode.

P

PACTware™ Software that operates and configures field devices from a remote workstation. It is not necessary to use fieldbus software or programs developed by the manufacturer.

R

Radar reflection Signal reflected from the surface of the tank contents.

S

Signal converter A set of electronic components in the device that send the reflected measurement pulse through some signal filters. They identify and measure the level of the tank contents.

Supervisor Users who can configure the device in supervisor mode. They cannot configure the device in service mode.

T

TBF Tank Bottom Following (TBF) mode is an alternative measurement mode. It allows the device to measure tank contents with low dielectric constants. TBF mode uses the reflection of the tank bottom to indirectly measure the level of the tank contents.

U

Ullage volume Unfilled volume. See the diagrams at the end of this section.

V

Volume Total volume of tank contents.

W

Waveguide A PTFE component that is used to guide the emitted radar waves correctly into the horn antenna.

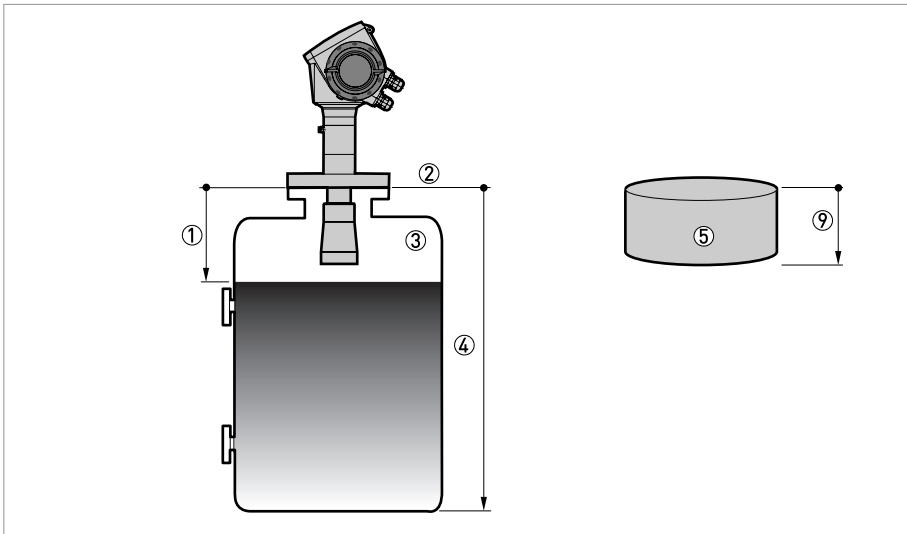


Figure 9-1: Measurement definitions: distance

- ① Distance
- ② Flange facing
- ③ Gas (Air)
- ④ Tank height
- ⑤ Ullage volume or mass

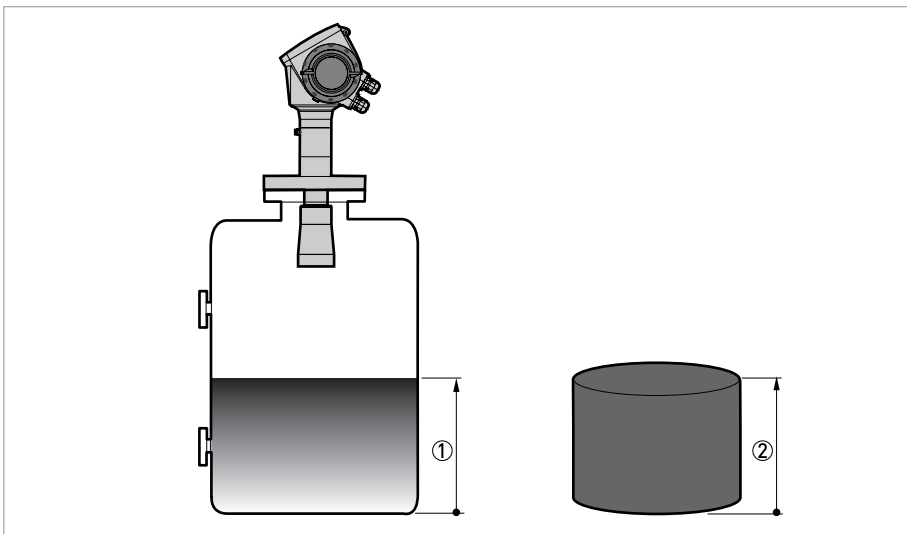


Figure 9-2: Measurement definitions: level

- ① Level
- ② Volume or mass

**Honeywell Field Solutions
512 Virginia Drive
Fort Washington, PA 19034
www.honeywell.com/ps**