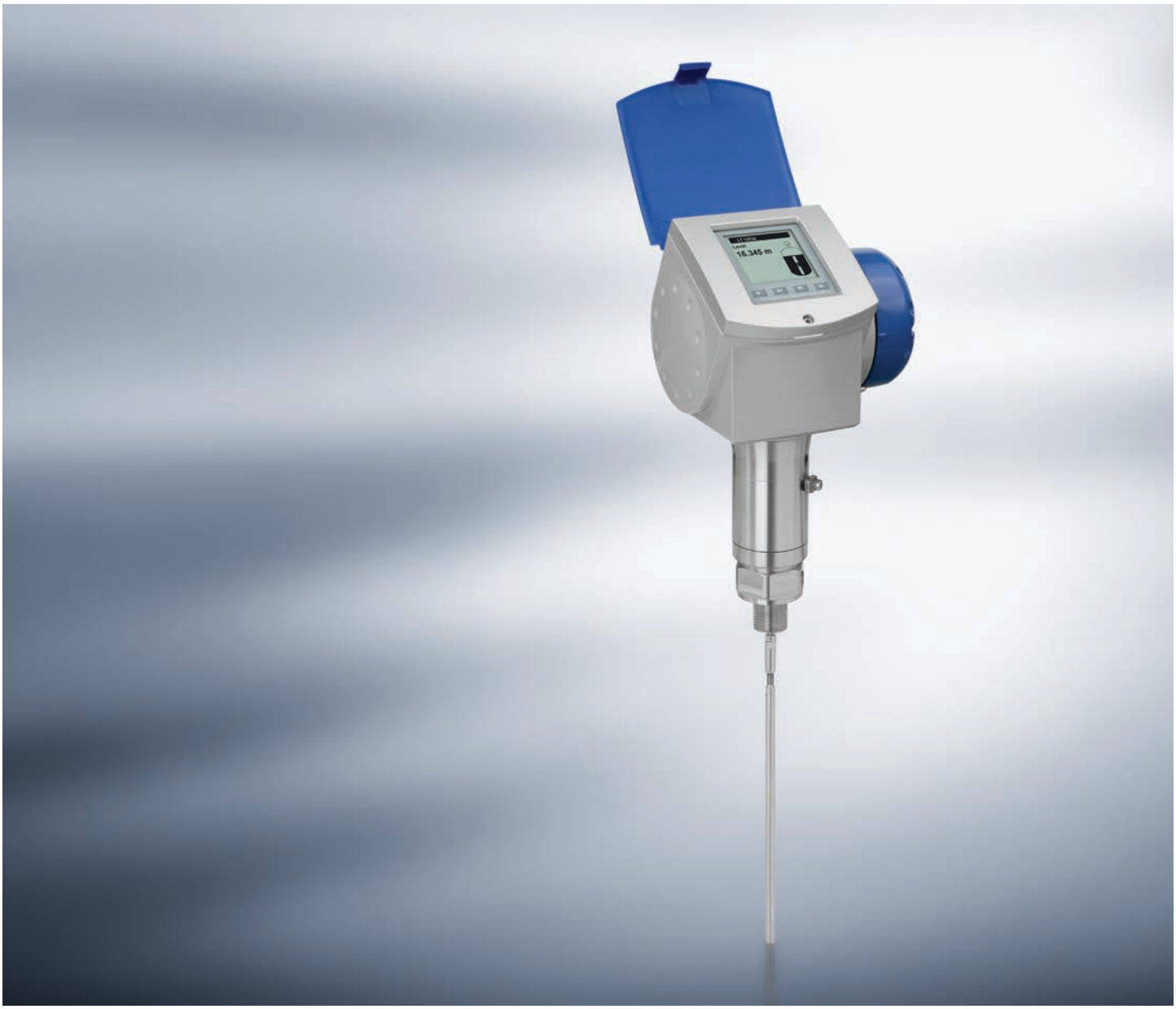


OPTIFLEX 1300 C

Handbook

Guided Radar (TDR) Level Meter

KROHNE

IMPRINT

1.1 Intended use

This TDR level transmitter measures distance, level, mass and volume of liquids, pastes, slurries, granulates and powders. It can also measure level and interface of liquids at the same time.

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

1.2 Certification

CE

In accordance with KROHNE's commitment to customer service and safety, the level transmitter described in this handbook 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 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.

1.3.2 Product liability and warranty

TDR level transmitters from KROHNE are designed solely for measuring the distance, level, interface, mass and volume of liquids, pastes, slurries, granulates and powders.

Responsibility as to suitability and intended use of these level transmitters rests solely with the operator. The supplier does not accept any liability resulting from misuse by the operator. Improper installation and operation of the level transmitters may lead to loss of warranty. In addition, the “General conditions of sale“ which forms the basis of the purchase agreement are applicable.

1.3.3 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 the manufacturer 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.

1.3.4 Display conventions

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

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.

DANGER!
This symbol designates safety advice on handling electricity.

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 cardboard box.

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

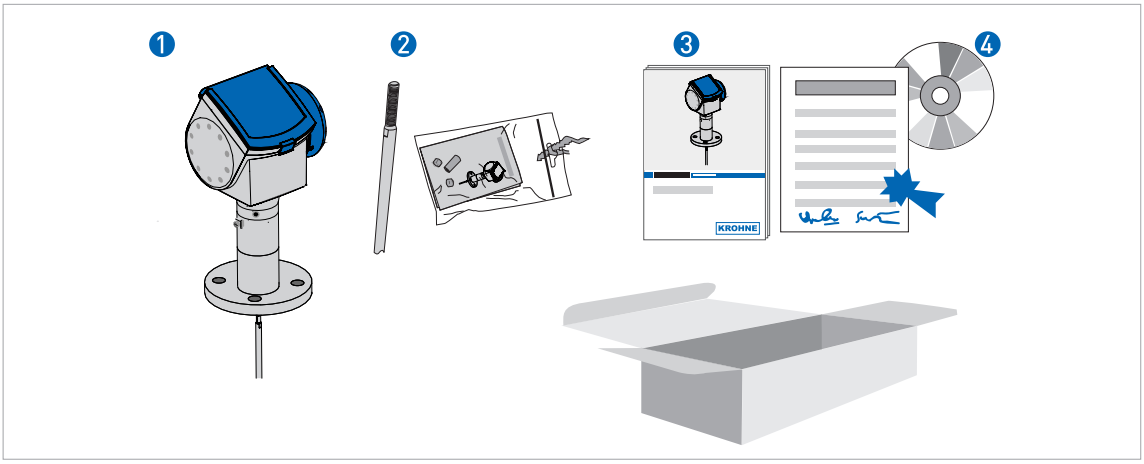


Figure 2-1: **Scope of delivery for compact version**

1. Signal converter and probe - compact version
2. Probe. If a single rod probe is ordered, this is supplied not attached to the instrument. The assembly instructions and small parts are in a bag attached to the housing
3. Quick Start
4. CD-ROM. This contains the Handbook, the Quick Start, the Technical Datasheet and related software.

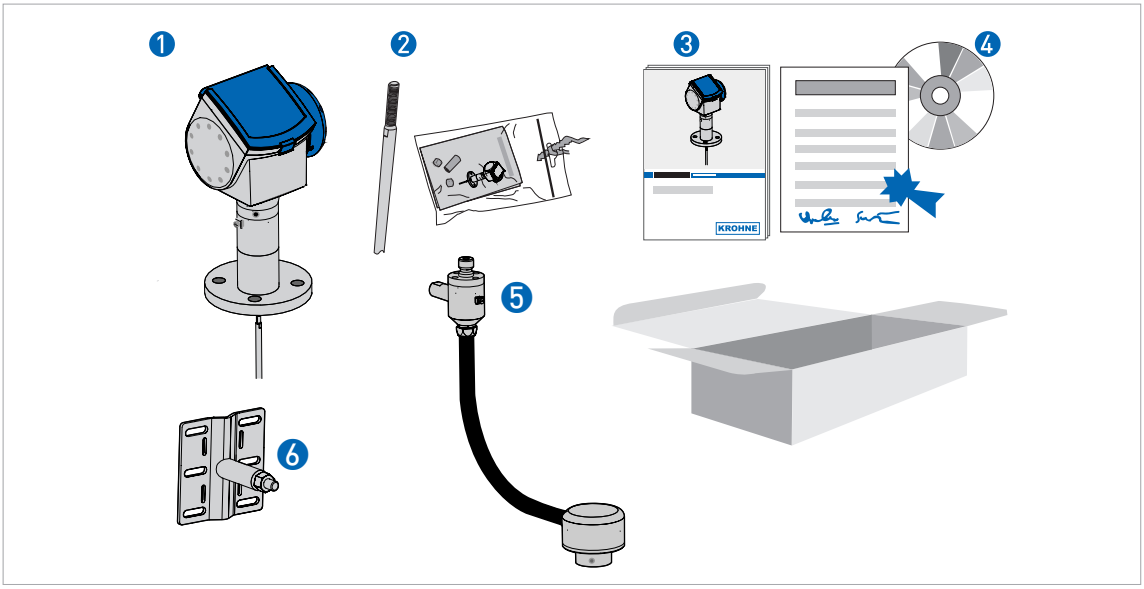


Figure 2-2: **Scope of delivery for the remote housing version**

1. Signal converter and probe
2. Probe. If a single rod probe is ordered, this is supplied not attached to the instrument. The assembly instructions and small parts are in a bag attached to the housing
3. Quick Start
4. CD-ROM. This contains the Handbook, the Quick Start, the Technical Datasheet and related software.
5. Flexible conduit
6. Wall bracket (also for installation on pipes)

INFORMATION!
No special tools, no training required!

2.2 Instrument description

The OPTIFLEX 1300 C is a TDR level transmitter. It is designed to measure the distance, level, interface, mass and volume of liquids, pastes, slurries, granulates and powders.

TDR level transmitters use a probe to guide a signal to the surface of the measured product. OPTIFLEX 1300 C has a choice of 6 probes. Thus, it can measure most products in difficult conditions. For more data, refer to *Technical data* on page 137.

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

You can order these accessories:

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

- USB/HART® converter.

INFORMATION!
For more data on accessories, refer to List of accessories on page 132.

2.3 Nameplate

2.3.1 Visual Check

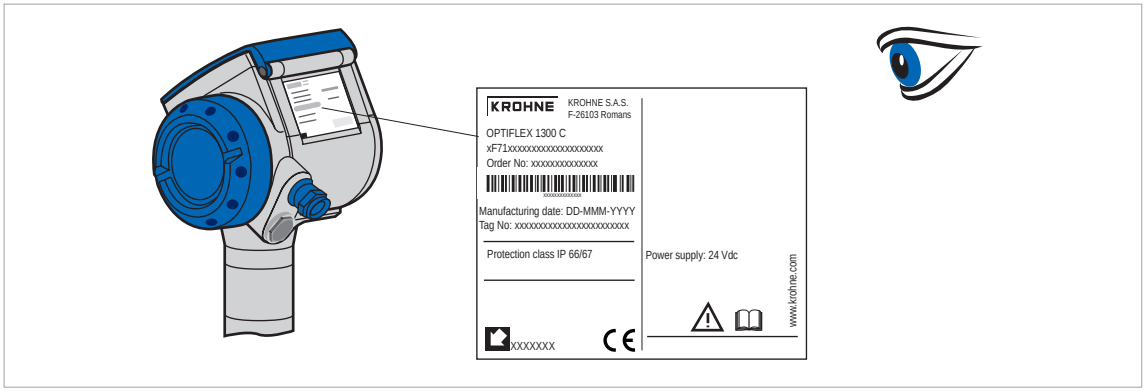


Figure 2-3: **Visual check**

- 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.

WARNING!
If the instrument has to measure the level of dangerous products (ammonia etc.), make sure that the instrument has the METAGLAS® seal option.

WARNING!
If the instrument has to measure the level of products where there is a risk of electrostatic discharge, make sure that the instrument has the supplementary ESD protection option.

2.3.2 Non-Ex nameplate

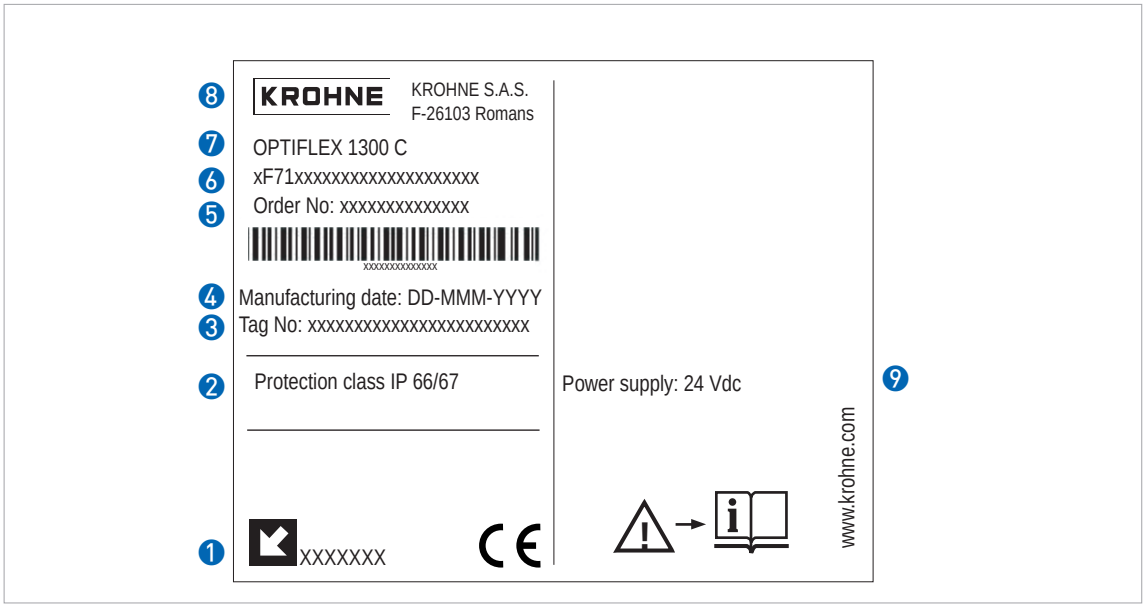


Figure 2-4: **Non-Ex nameplate**

1. Indicator arrow to cable entry / cable entry size
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 more data, refer to *Non-Ex* on page 51.

3.1 Pre-installation requirements

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

3.2 General installation notes

Before you install the instrument:

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

3.2.1 How to assemble the single rod probe

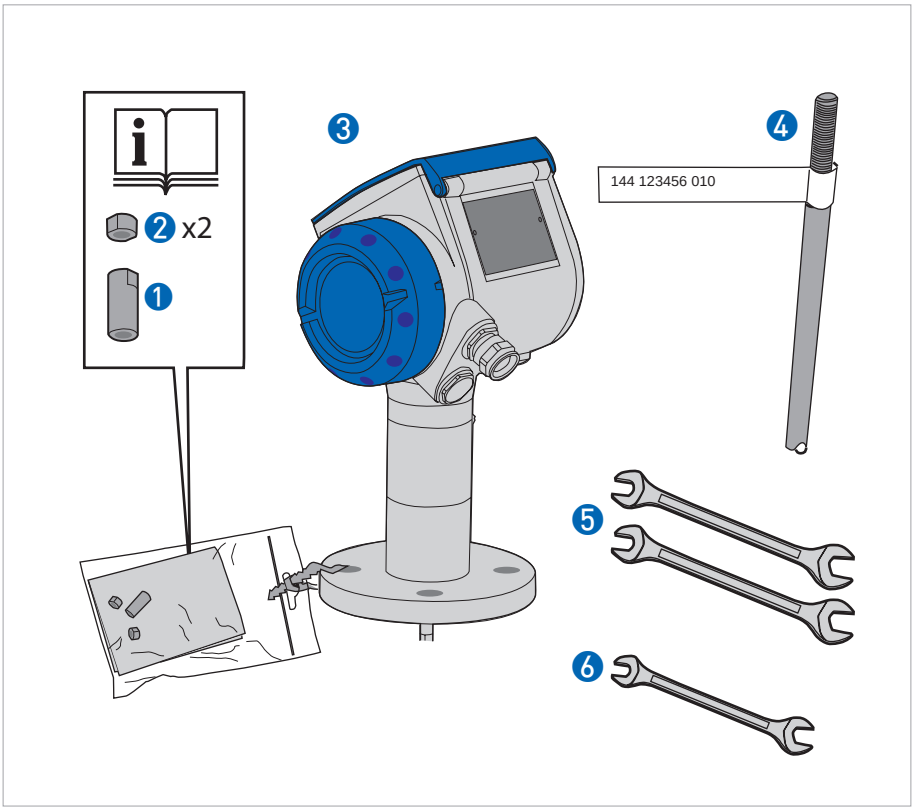


Figure 3-1: **Equipment needed to assemble the instrument**

1. Union nut
2. 2 locking nuts
3. Housing assembly
4. Single rod probe
5. Tools: two 8 mm wrenches (not supplied)
6. Tools: one 7 mm wrench (not supplied)

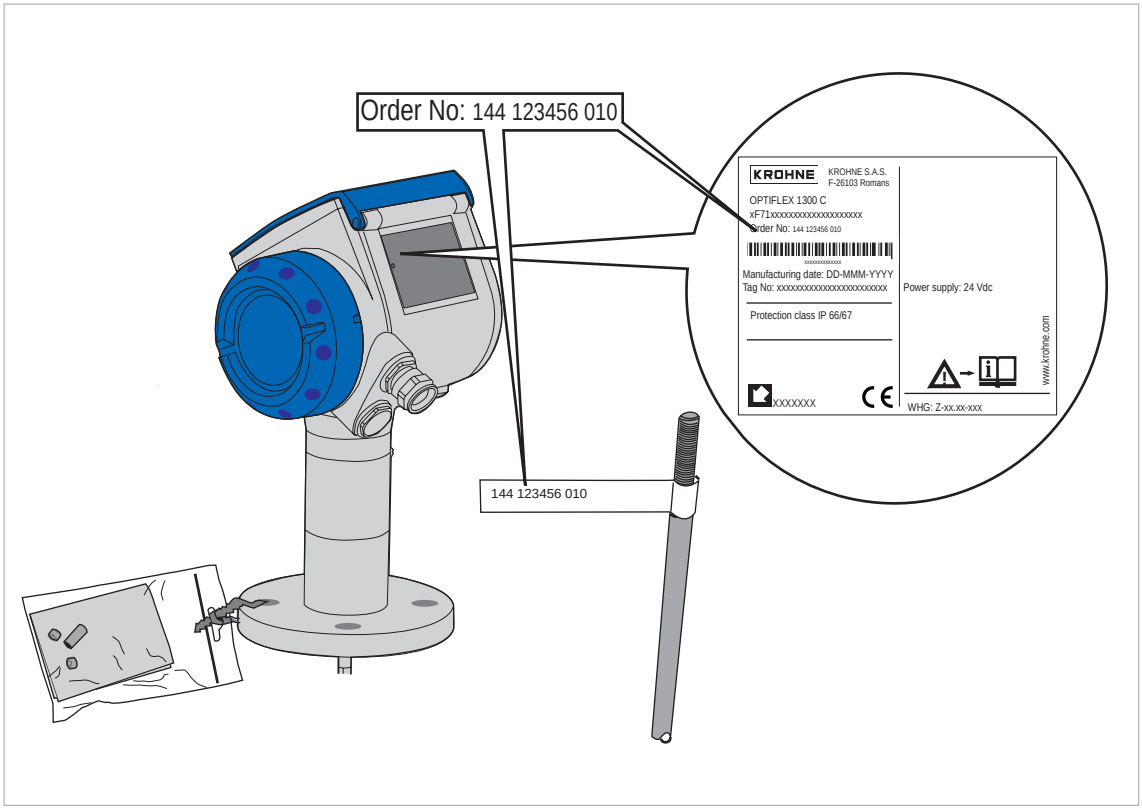


Figure 3-2: **Check the order number on each component**

- Make sure that the housing assembly and the single rod have the same ID numbers.
- Remove the sticker from the probe.

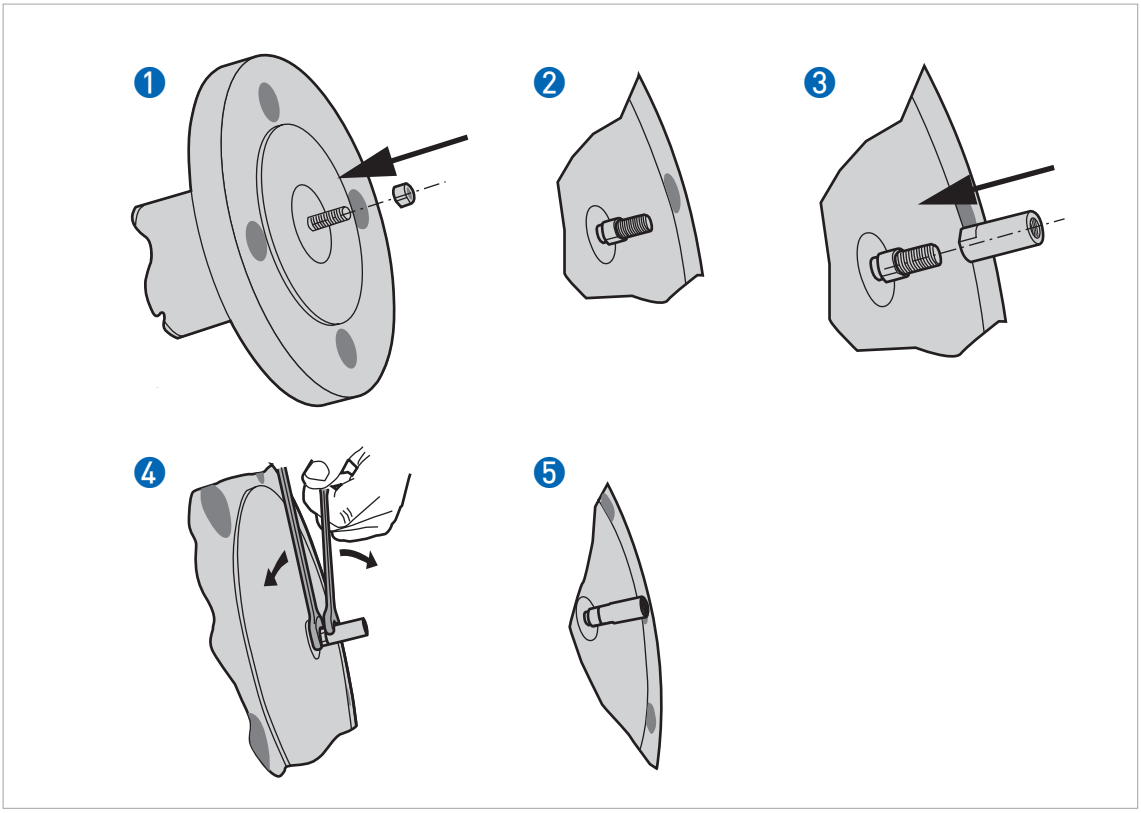


Figure 3-3: **How to attach the locking nut and union nut**

- Attach a locking nut and the union nut to the housing assembly.
- Tighten these nuts with the two 8 mm spanners.

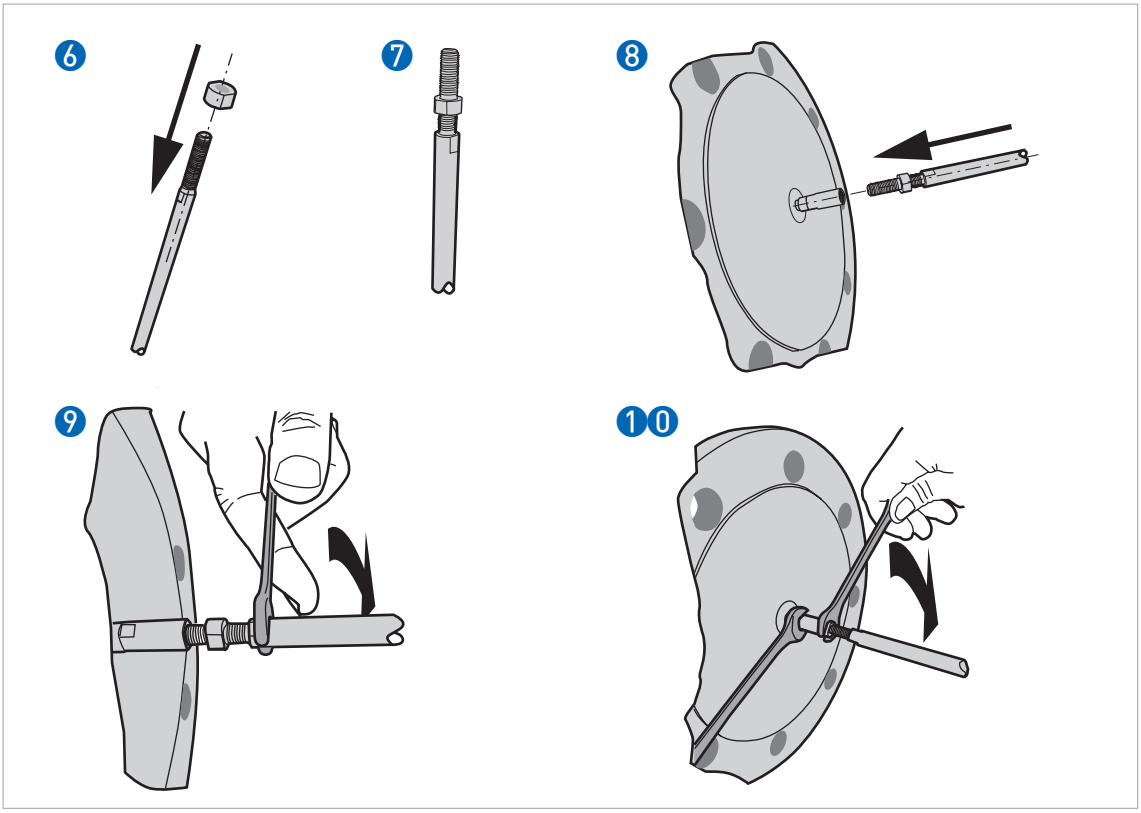


Figure 3-4: **How to attach the single rod probe to the flange assembly**

CAUTION!
Support the probe.

- Attach a locking nut to the single rod.
- Attach the single rod to the union nut. Make sure the probe touches the housing assembly.
- Tighten the single probe with a 7 mm spanner (step 9).
- Tighten the locking nut against the union nut with two 8 mm spanners (step 10).

3.2.2 How to turn or remove the signal converter

NOTE!
The converter turns 360°. Remove the signal converter to lift the instrument with a hoist.

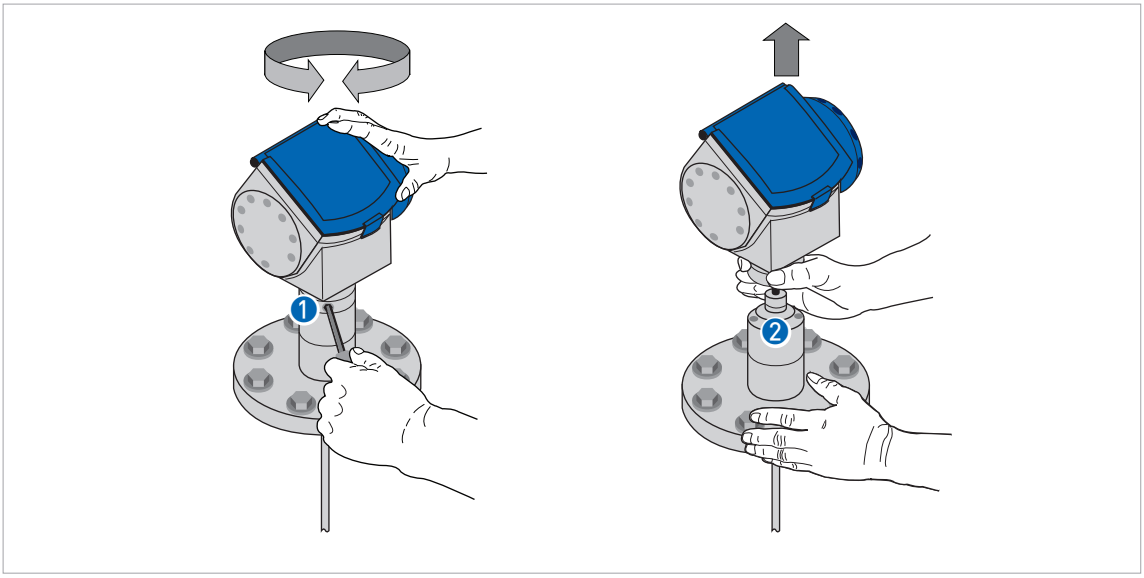


Figure 3-5: **How to turn or remove the signal converter**

- 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.
- Tighten the housing locking screw 1.

CAUTION!
If you remove the housing, put a cover on the coaxial hole on top of the flange assembly 2.

3.2.3 How to assemble the remote housing

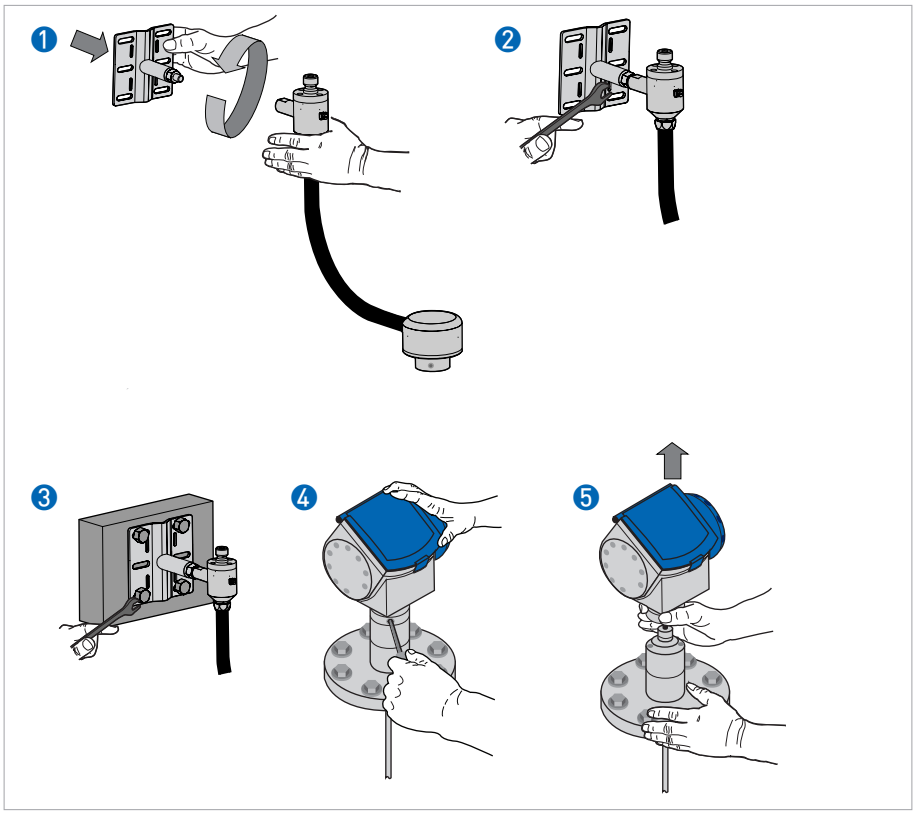


Figure 3-6: **Part 1 of assembly procedure**

- Attach the wall bracket to the flexible conduit.
- Tighten the locking nut 2 with a 24 mm wrench.
- Attach the wall bracket to a wall or pipe (DN50...100 / 2"...4").
- Loosen the housing locking screw 4 with a 5 mm Allen wrench.
- Remove the housing.

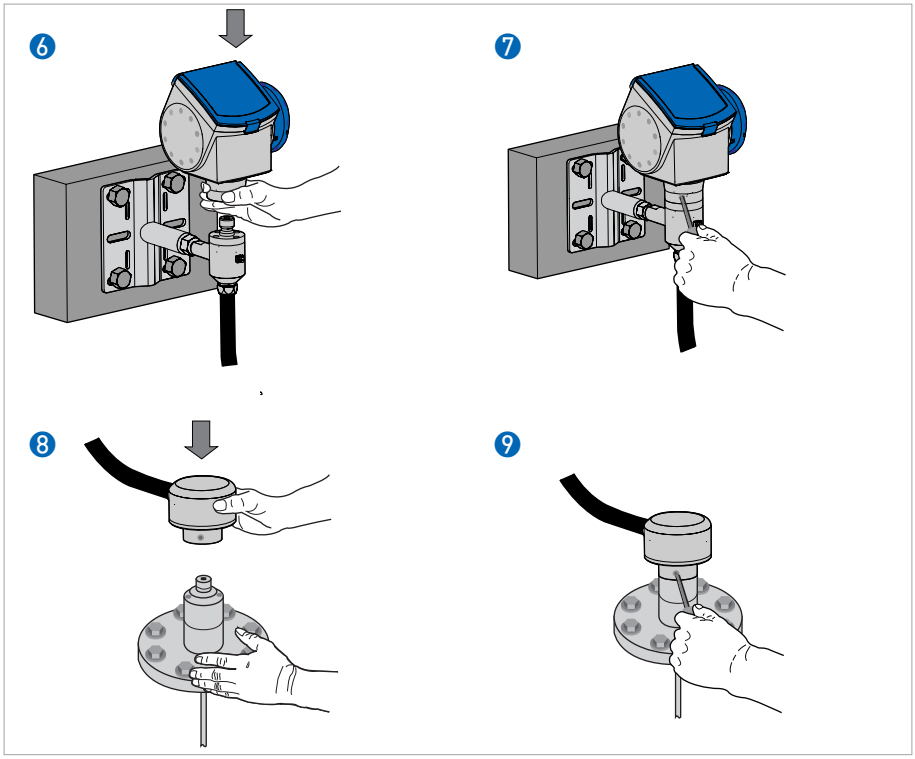


Figure 3-7: **Part 2 of the assembly procedure**

- Attach the housing to the flexible conduit.
- Tighten the housing locking screw.
- Attach the flexible conduit to the probe.
- Tighten the flexible conduit locking screw.

You can attach the wall bracket to a wall or pipe. These are the dimensions:

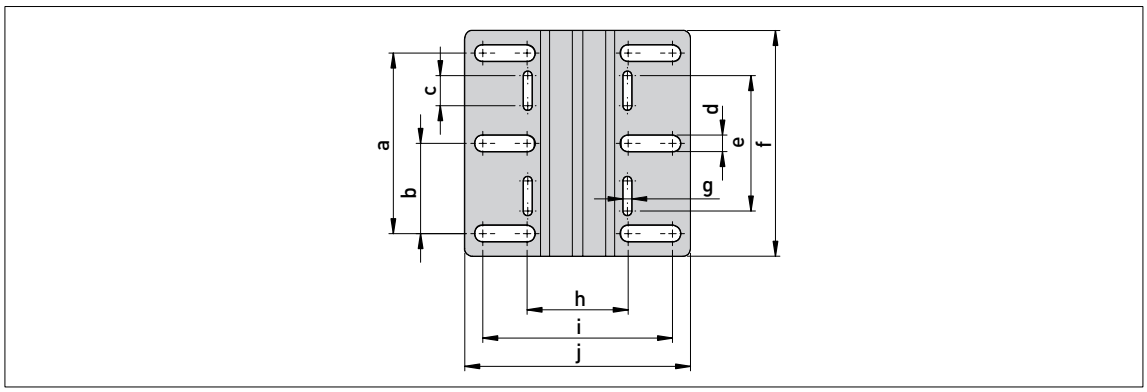


Figure 3-8: **Dimensions of the wall bracket**

	Dimensions [mm]									
	a	b	c	d	e	f	g	h	i	j
Wall bracket	120	60	20	11	90	150	6	67.4	126.4	150.4

	Dimensions [inches]									
	a	b	c	d	e	f	g	h	i	j
Wall bracket	4.7	2.4	0.8	0.4	3.5	5.9	0.2	2.65	4.98	5.92

3.3 Storage

WARNING!
Do not keep the instrument in a vertical position. This will damage the probe and the instrument will not measure correctly.

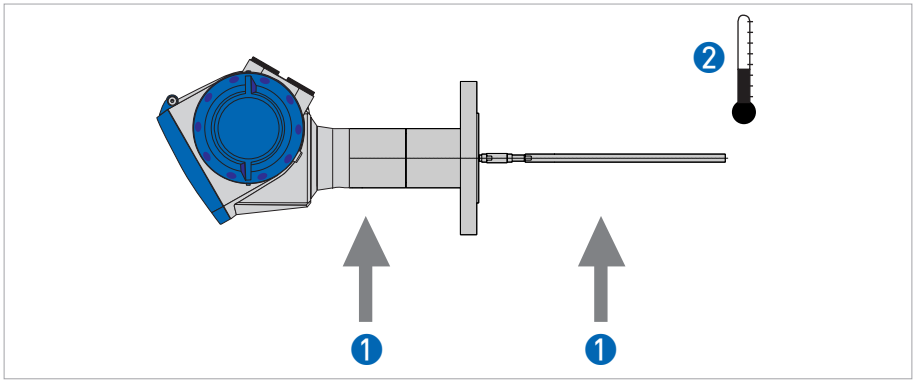


Figure 3-9: **Storage conditions**

1. Do not bend rod and coaxial probes - support here
2. Storage temperature range: -40...85°C / -40...185°F

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

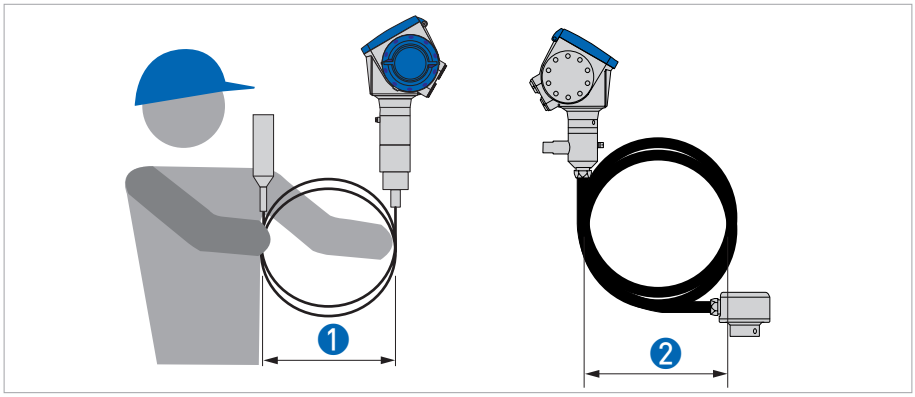


Figure 3-10: **Wind cable probes and flexible conduits carefully**

1. Do not wind cable probes less than 400 mm / 16" in diameter.
2. Do not wind the flexible conduit less than 330 mm / 13" in diameter.

3.4 Transportation

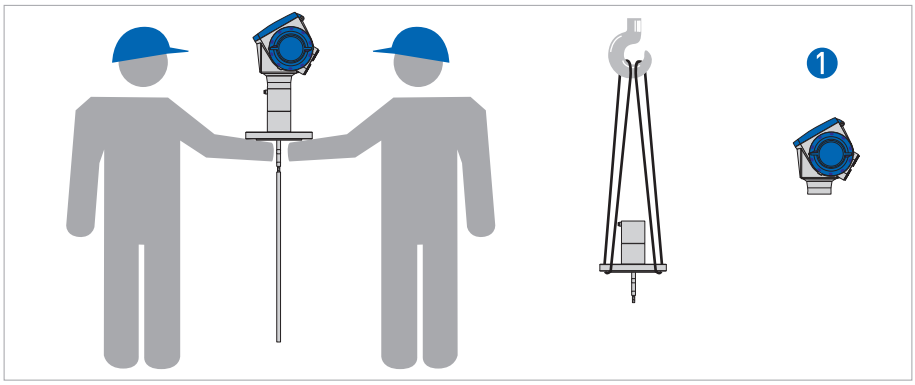


Figure 3-11: **How to hold the instrument**

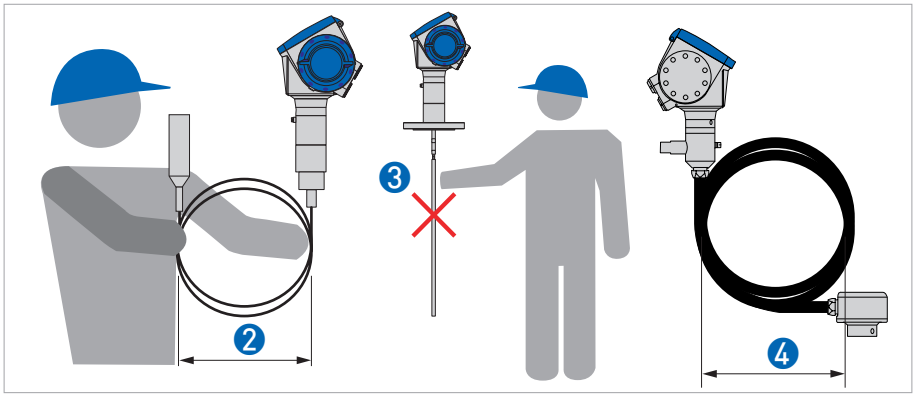


Figure 3-12: **How to hold the instrument**

1. Remove the converter before you lift the instrument with a hoist.
2. Wind cable probes greater than 400 mm / 16" in diameter.
3. Do not hold the probe when you lift the instrument.
4. Wind the flexible conduit greater than 330 mm / 13" in diameter.

WARNING!
If you do not lift the instrument carefully, you can cause damage to the probe.

3.5 How to prepare the tank before you install the instrument

CAUTION!
To avoid measuring errors and instrument malfunction, obey these precautions.

3.5.1 Pressure and temperature ranges

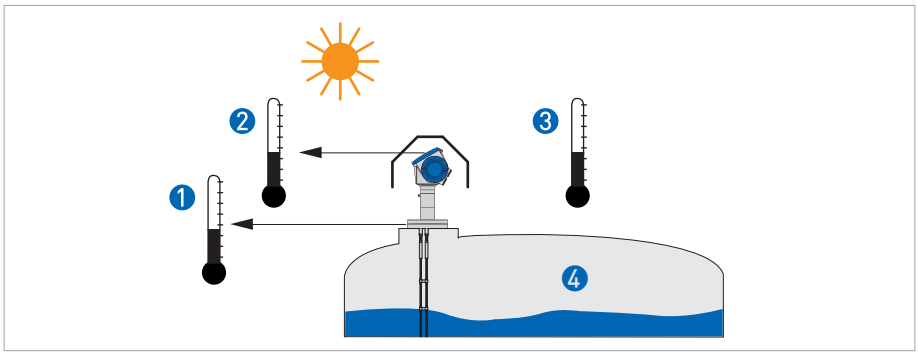


Figure 3-13: **Pressure and temperature ranges**

1. Process connection temperature
   All probes except Ø2 mm single cable probe and single rod probes with protective sheathes: FKM/FPM: -40...200°C / -40...390°F; Kalrez 6375: -20...200°C / -4...390°F
   Ø2 mm single cable probe (standard) : -40...150°C / -40...300°F (refer to *Pressure/temperature table for probe selection* on page 141).
   Single cable probe with a protective sheath: PP: -40...+90°C / -40...+194°F; PVDF: -50...+150°C / -58...+302°F; PVC: -15...+80°C / +5...+176°F
   Ex instruments: 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 instruments: see supplementary operating instructions
4. Process pressure
   All probes except Ø2 mm single cable probe:-1...40 bar / -14.5...580 psig (refer to *Pressure/temperature table for probe selection* on page 141).
   Ø2 mm single cable probe (standard version) : -1...10 bar / -14.5...145 psig (refer to *Pressure/temperature table for probe selection* on page 141).
   Ø2 mm single cable probe (high-pressure version) : -1...300 bar / -14.5...4350 psig (refer to *Pressure/temperature table for probe selection* on page 141).

3.5.2 General information for nozzles

CAUTION!
Follow these recommendations to make sure that the instrument measures correctly.

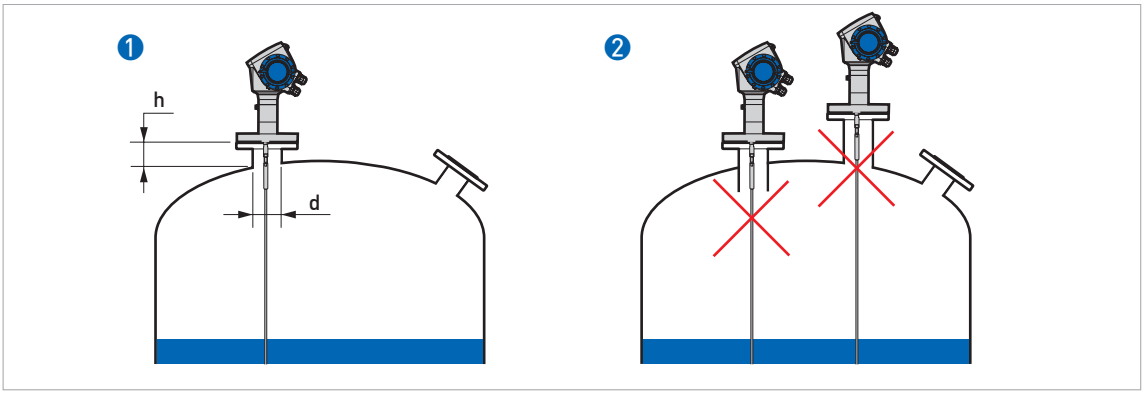


Figure 3-14: **Recommended nozzle dimensions**

1. Recommended conditions: h ≤ d, where h is the height of the tank nozzle and d is the diameter of the tank nozzle.
2. The end of the nozzle must not have an extension into the tank. Do not install the instrument on a high nozzle.

CAUTION!
If h > d, then the top dead zone (TDZ) is:
$TDZ_{total} = h + TDZ_{probe}$, where the TDZ is measured from the face of the flange. refer to Measurement limits on page 142.

CAUTION!
If the instrument is installed on a high nozzle, make sure that the probe does not touch the side of the nozzle (attach the probe end, ...).

INFORMATION!
It is possible to measure in these conditions with a minimum top dead zone. Use the snapshot function to filter the parasite signals from long nozzles. Refer to How to use the snapshot function to filter parasite signals that do not move on page 97.

CAUTION!
Do not put the process connection near to the product inlet. If the product that enters the tank touches the probe, the instrument will measure incorrectly.

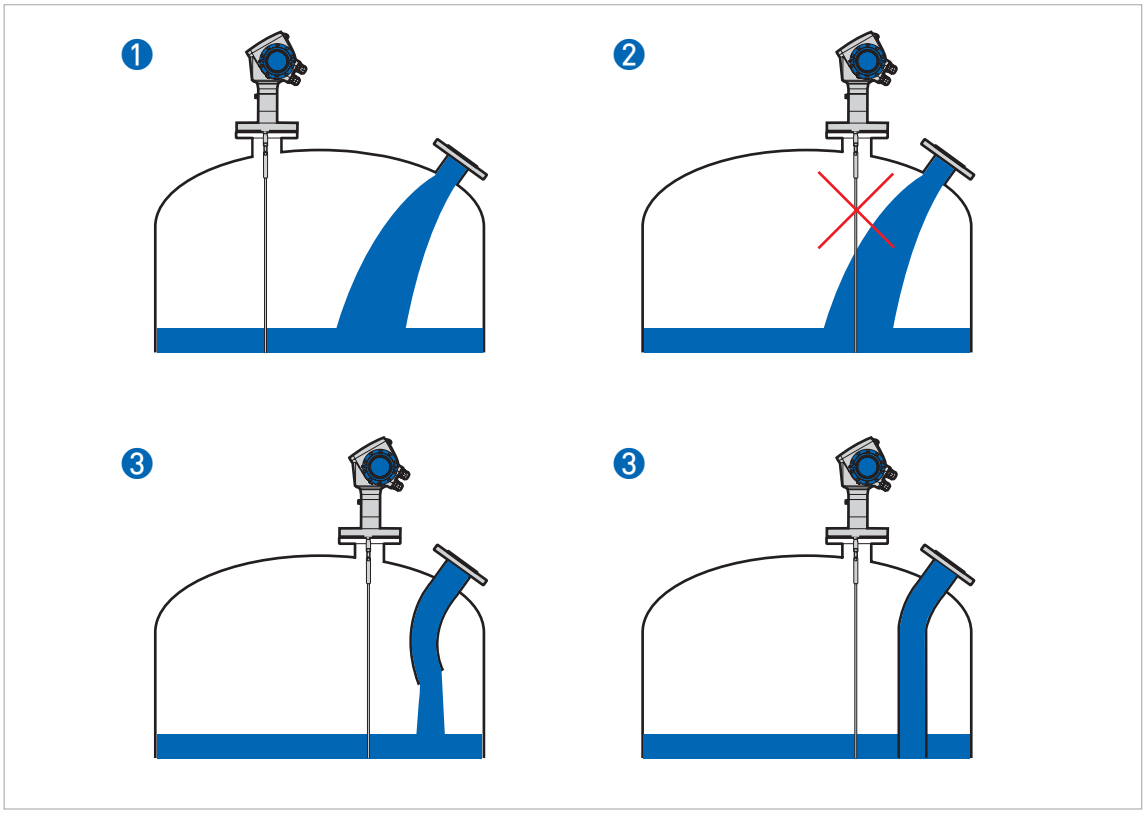


Figure 3-15: **Do not put the instrument near to a product inlet**

1. The instrument is in the correct position.
2. The instrument is too near to the product inlet.
3. If it is not possible to put the instrument in the recommended position, install a deflector pipe.

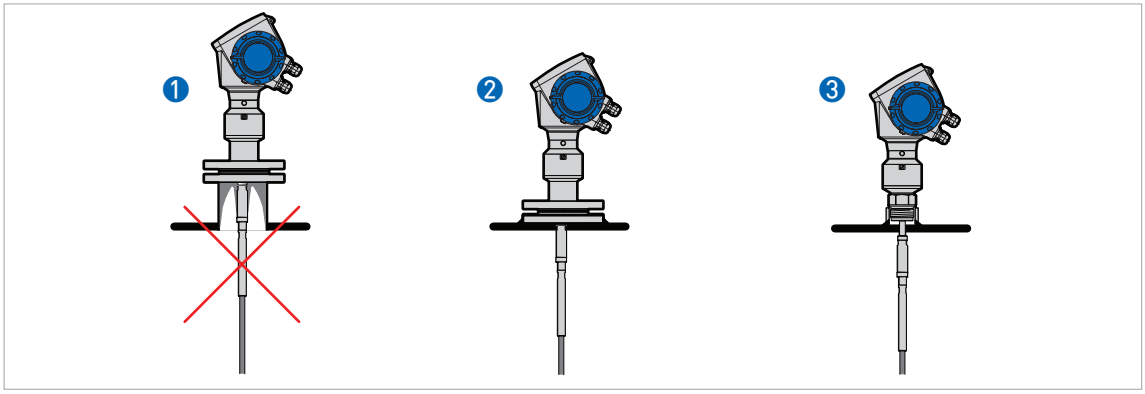


Figure 3-16: **How to prevent build up of product around the process connection**

1. If product particles are likely to collect in holes, a nozzle is not recommended.
2. Attach the flange directly to the tank.
3. Use a thread connection to attach the instrument to the tank.

3.5.3 Installation requirements for concrete roofs

CAUTION!
Follow these recommendations to make sure that the instrument measures correctly.

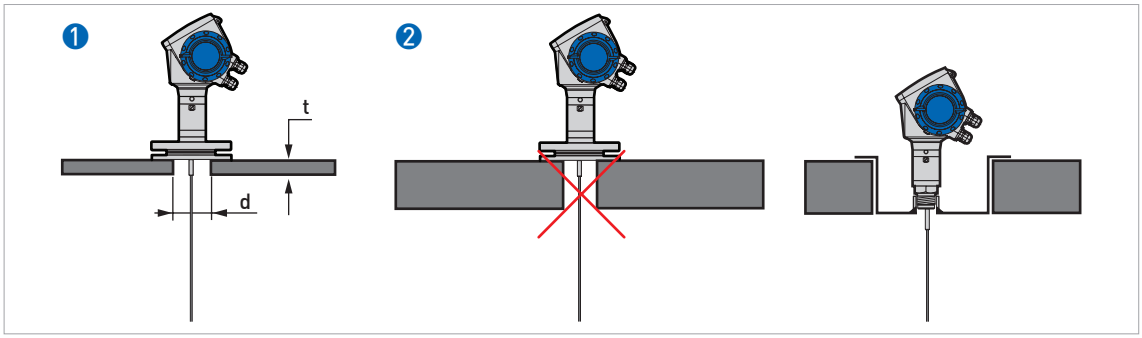


Figure 3-17: **Installation on a concrete roof**

1. The diameter, d, of the hole must be greater than the thickness, t, of the concrete.
2. If the thickness, t, of the concrete is greater than the diameter, d, of the hole, install the instrument in a recess.

3.6 Installation recommendations for liquids

3.6.1 General requirements

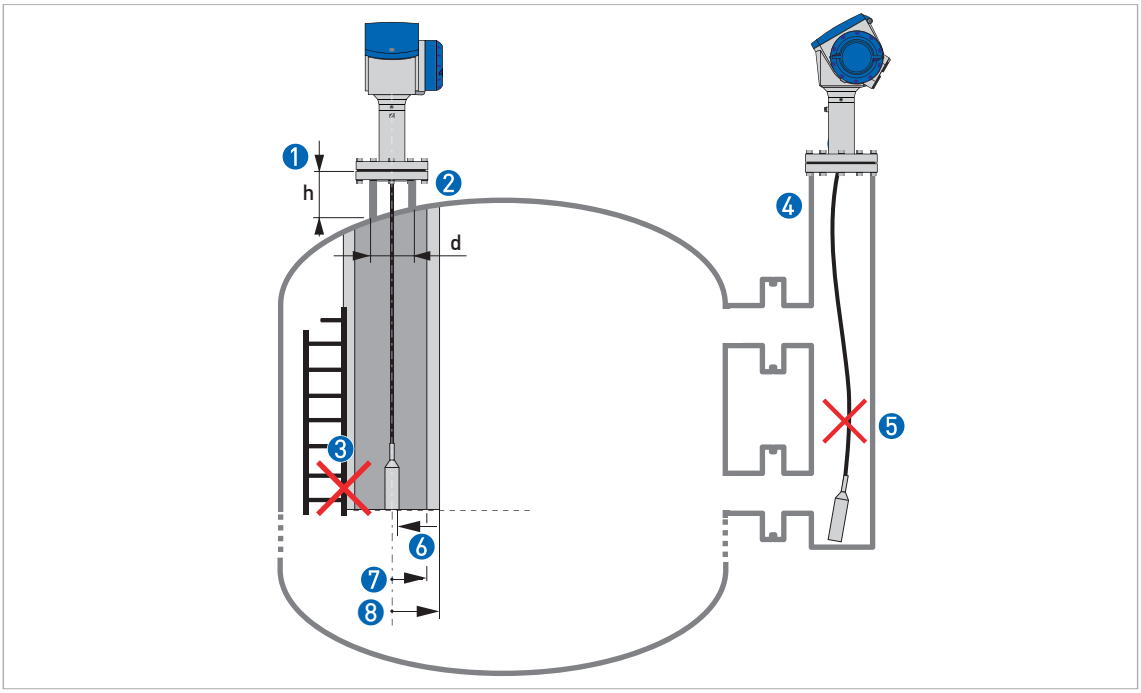


Figure 3-18: **Installation recommendations for liquids**

1. h ≤ d, where h is the height of the tank nozzle and d is its diameter.
2. Make sure that the probe does not touch the nozzle. Attach the probe if the liquid is turbulent.
3. The electromagnetic (EM) field generated by the instrument. It has a radius of R_{min}. Make sure that the EM field is clear of objects and product flow. Refer to the table that follows.
4. If there are too many objects in the tank, install a bypass chamber or stilling well.
5. Keep the probe straight.
6. Empty space is not necessary for coaxial probes. Refer to the table that follows.
7. Empty space necessary for double probes. Refer to the table that follows.
8. Empty space necessary for single probes. Refer to the table that follows.

NOTE!
If your instrument has a coaxial probe, you can ignore these installation recommendations.

CAUTION!
Install coaxial probes in clean liquids that are not too viscous.

WARNING!
If the instrument has to measure the level of dangerous products (ammonia etc.), make sure that the instrument has the METAGLAS® seal option.

Clearance between the instrument probe and other objects in the tank

Probe type	Empty space (radius, R_{min}), around the probe	
	[mm]	[inches]
Coaxial 6	0	0
Double rod 7 Double cable Ø4 mm/0.15" 7	100	4
Single rod 8 Single cable Ø4 mm/0.15" 8 Single cable Ø2 mm/0.08" 8	300	12

3.6.2 How to attach probes to the bottom of the tank

CAUTION!
Keep the probe straight

If the liquid is agitated or turbulent, you can attach the probe to the bottom of the tank. The procedure to attach the probe depends on the type of probe used:

Double rod Ø8 mm/0.3"

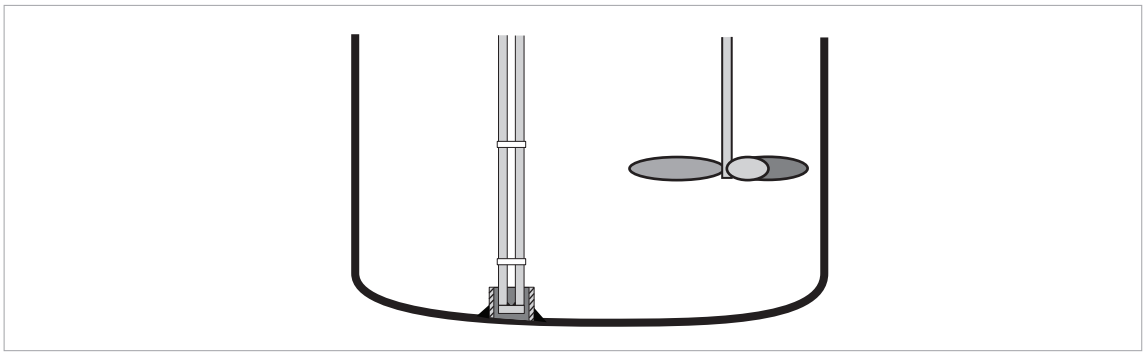


Figure 3-19: **How to attach a double rod probe to keep it straight**

- Weld a tube with an internal diameter of 28...30 mm / 1.1...1.2" to the bottom of the tank.

➲ Make sure the tube aligns with the process connection at the top of the tank.

- Lower the probe into the tank.

- Put the end of the probe into the tube.

Double cable Ø4 mm/0.15"

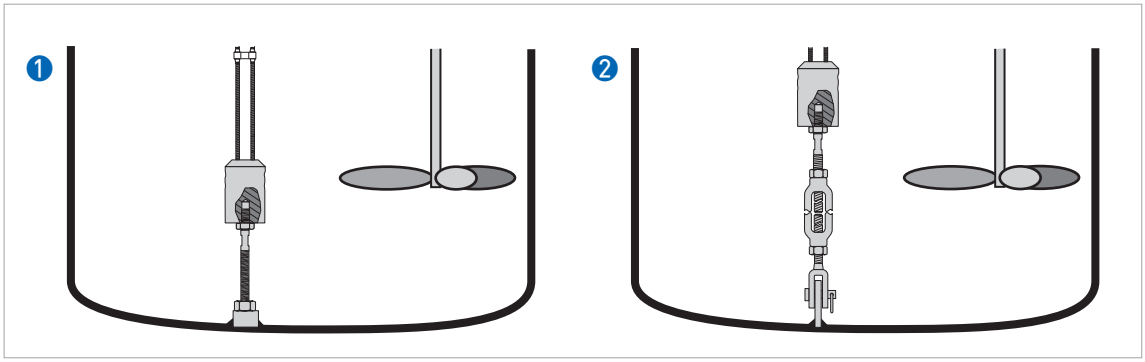


Figure 3-20: **How to attach a double cable probe to keep it straight**

The probe counterweight has a hole with an M8 internal thread. You can also select the appropriate options and attach:

1. An anchoring rod
2. A turnbuckle

For more data, contact your supplier.

Single rod Ø8 mm/0.3"

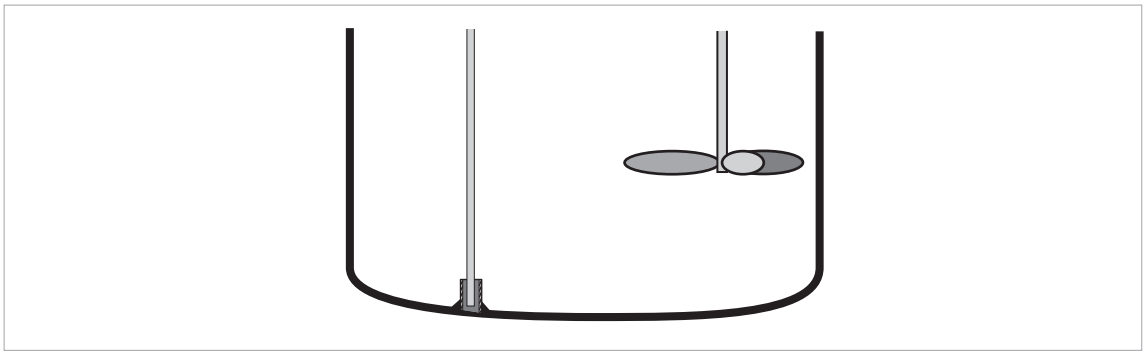


Figure 3-21: **How to attach a single rod probe to keep it straight**

- Weld a tube with an internal diameter of 12 mm / 0.5" to the bottom of the tank.
- ➲ Make sure the tube aligns with the process connection at the top of the tank.
- Lower the probe into the tank.

- Put the end of the probe into the tube.

Single cable Ø4 mm/0.15"

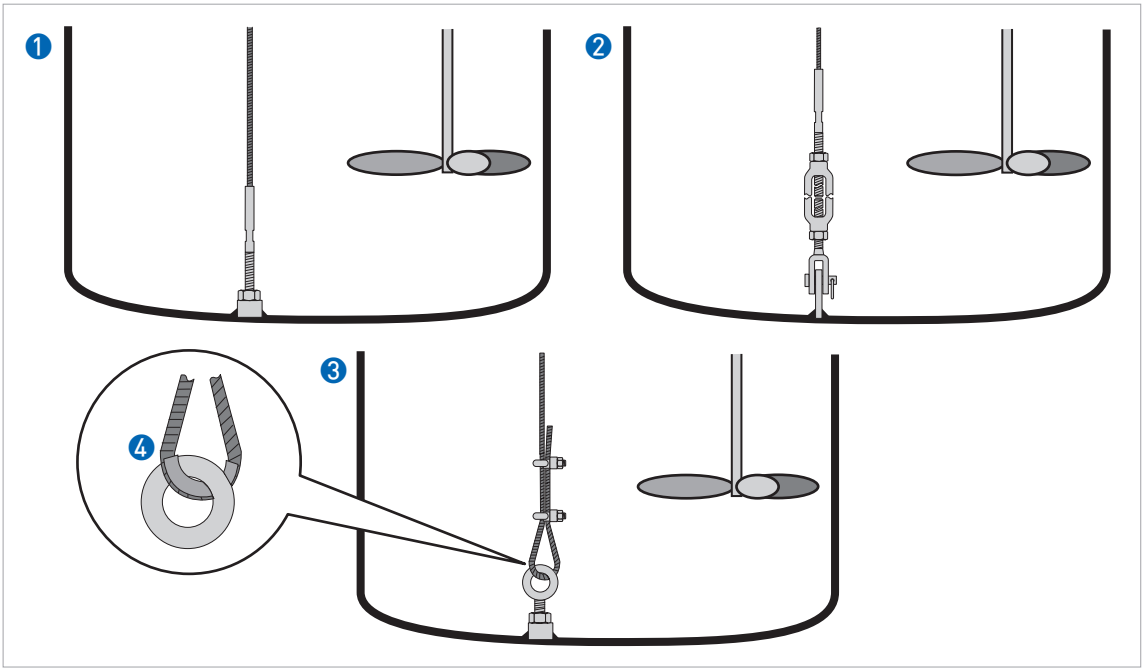


Figure 3-22: **How to attach a Ø4 mm/0.15" single cable probe to keep it straight**

The probe counterweight has a hole with an M8 internal thread. You can also select the appropriate options and attach:

1. A threaded end
2. A turnbuckle
3. A chuck
4. A ferrule (not supplied) at the bottom of the chuck

If you chose a chuck to anchor the probe, we recommend that you fit a ferrule (metal sheath) at the bottom of the loop to prevent cable wear. For more data, contact your supplier.

Single cable Ø2 mm/0.08"

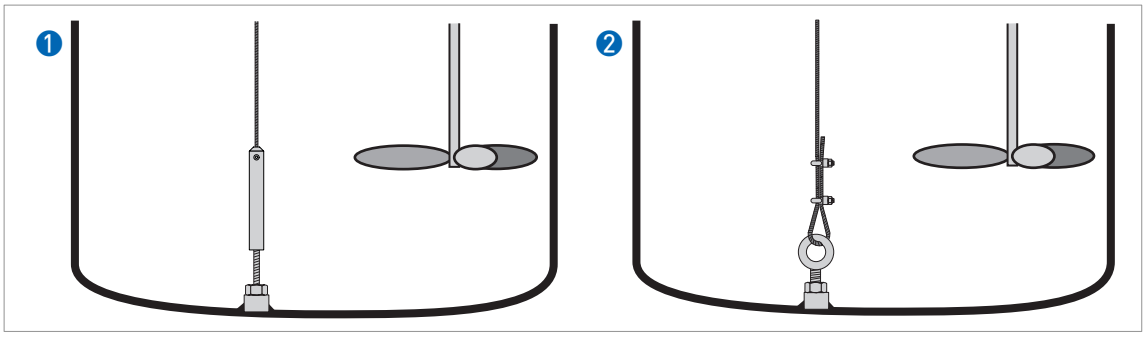


Figure 3-23: **How to attach a Ø2 mm/0.08" single cable probe to keep it straight**

The probe counterweight has a hole with an M8 internal thread. You can attach:

1. A threaded end
2. A chuck

If you chose a chuck to anchor the probe, we recommend that you fit a ferrule (metal sheath) at the bottom of the loop to prevent cable wear. For more data, contact your supplier.

Coaxial Ø21.3 mm/0.8"

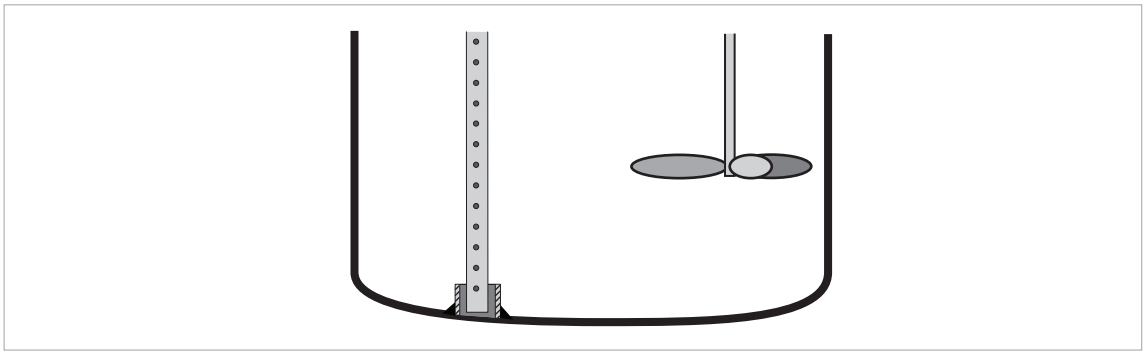


Figure 3-24: **How to attach a coaxial probe to keep it straight**

- Weld a tube with an internal diameter of 23...25 mm / 0.91...1" to the bottom of the tank.

➲ Make sure the tube aligns with the process connection at the top of the tank.

- Lower the probe into the tank.
- Put the end of the probe into the tube.

If this is not possible, you can attach braces to the probe.

3.6.3 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 objects near to the area where you want to install the instrument.
- The instrument is measuring a liquid (petro-chemicals) in a tank with a floating roof.

NOTE!
Stilling wells are not necessary for instruments with coaxial probes.

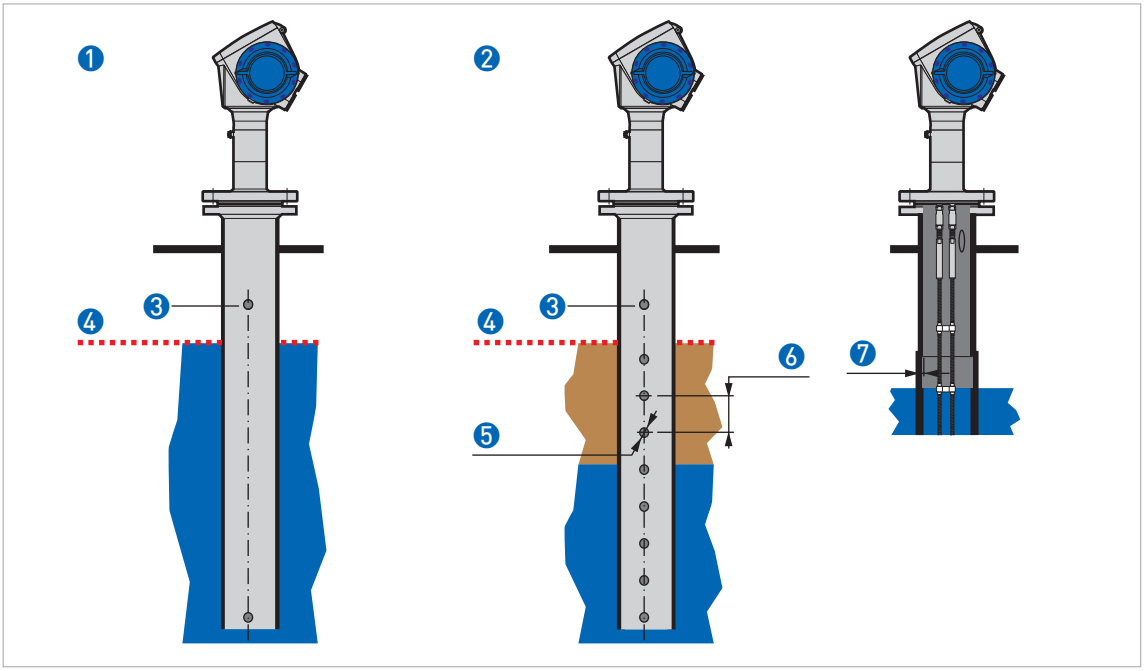


Figure 3-25: **Installation recommendations for stilling wells**

1. Stilling well in tanks containing one liquid
2. Stilling well in tanks containing more than one liquid
3. Air circulation hole
4. Maximum level of the liquid
5. Hole diameter Ø10 mm/0.4"
6. Distance between holes 100 mm/4"
7. Recommended sudden change in well diameter <1 mm/0.04"

CAUTION!

Installation requirements

- *The stilling well must be electrically conductive.*
- *The stilling well must be straight.*
- *Recommended surface roughness: <±0.1 mm/0.004".*
- *The bottom of the stilling well must be open.*
- *Adjust the probe to the center of the stilling well.*

Installation in tanks containing one liquid and foam

- Drill a pressure equalization hole in the stilling well above the maximum level.
- Deburr the hole.
- If the probe has a counterweight, make sure that there is enough space between the counterweight and the wall of the stilling well.

Installation in tanks containing more than one liquid

- 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 liquids to move freely.

- Deburr the holes.
- If the probe has a counterweight, make sure that there is enough space between the counterweight and the wall of the stilling well.

Floating roofs

If the instrument is for a tank with a floating roof, install it in a stilling well.

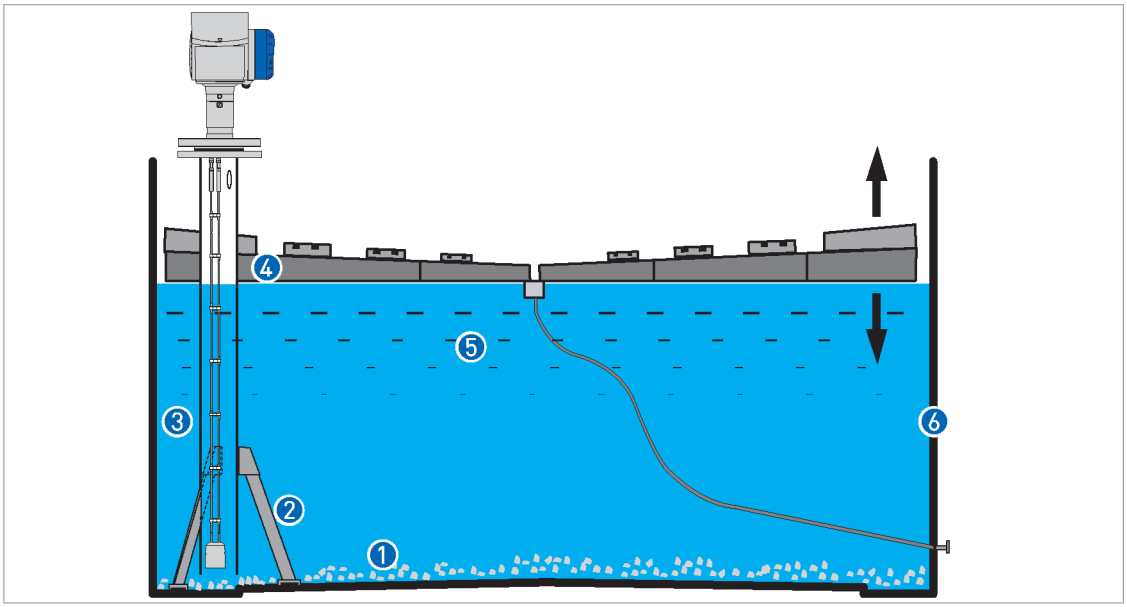


Figure 3-26: **Floating roofs**

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

3.6.4 Installation in 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 other objects in the tank.

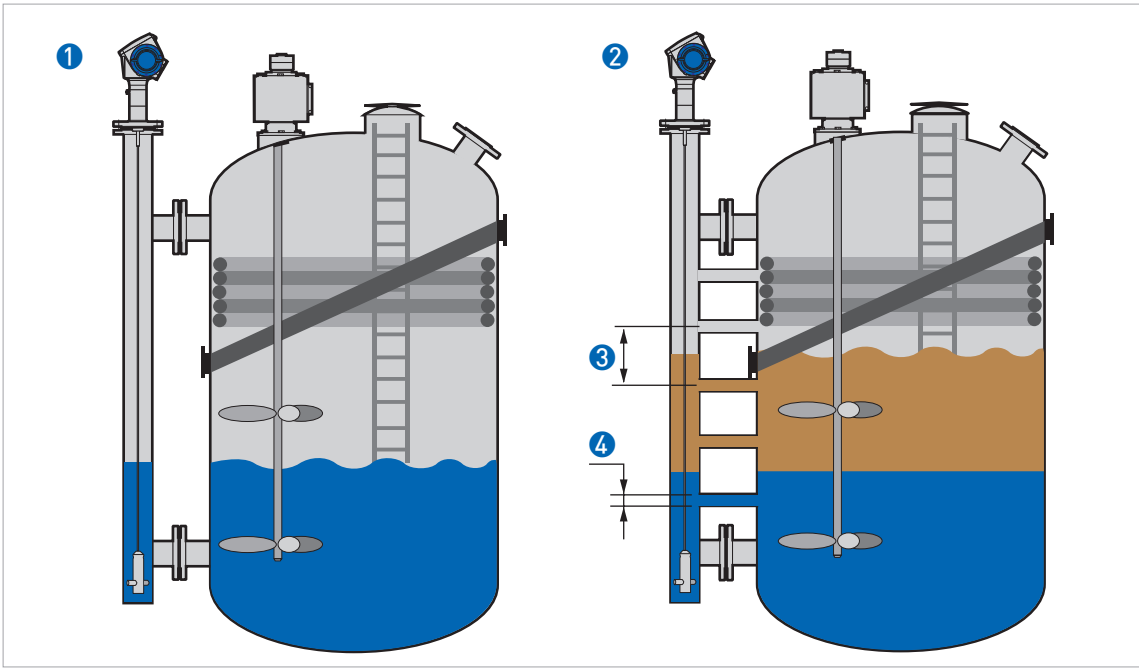


Figure 3-27: **Installation recommendations for bypass chambers**

1. Bypass chamber for tanks that contain one liquid
2. Bypass chamber for tanks that contain more than one liquid
3. Distance between holes 100 mm/4"
4. Hole diameter Ø25 mm/1"

CAUTION!

Installation requirements

- *The bypass chamber must be electrically conductive. If the bypass chamber is not made of metal, we recommend a minimum diameter of 100 mm/4".*
- *The bypass chamber must be straight.*
- *The bypass chamber must have a surface roughness of ±0.1 mm/0.004".*
- *There must be no sudden changes in internal diameter greater than 1 mm/0.04"*
- *Adjust the probe to the center of the bypass chamber.*

Installation next to tanks containing one liquid and foam

- The bypass chamber must have a process connection that is above the maximum level of liquid.
- The bypass chamber must have a process connection that is below the lowest measured level of liquid.

Installation next to tanks containing more than one liquid

- The bypass chamber must have a process connection that is above the maximum level of liquid.

- The bypass chamber must have a process connection that is below the lowest measured level of liquid.
- There must be more process connections 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 holes.
- If the probe has a counterweight, make sure that there is enough space between the counterweight and the wall of the stilling well.
- If the interface liquid does not have a layer of air above it, fit a vent at the top of the bypass chamber. Refer to the illustration that follows:

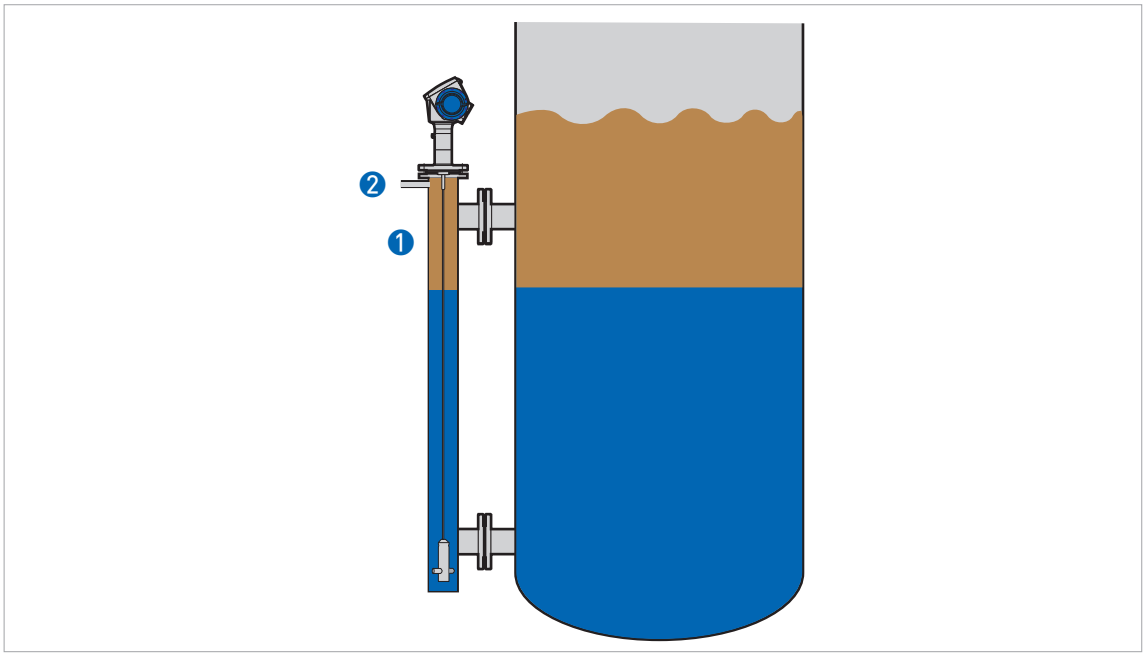


Figure 3-28: **Installation recommendations for bypass chambers with no air gap**

1 Bypass chamber with no air gap
2 Air vent

3.6.5 Typical applications

Spherical tanks

The instrument can measure liquid petroleum gas (LPG). This product is stocked in spherical tanks

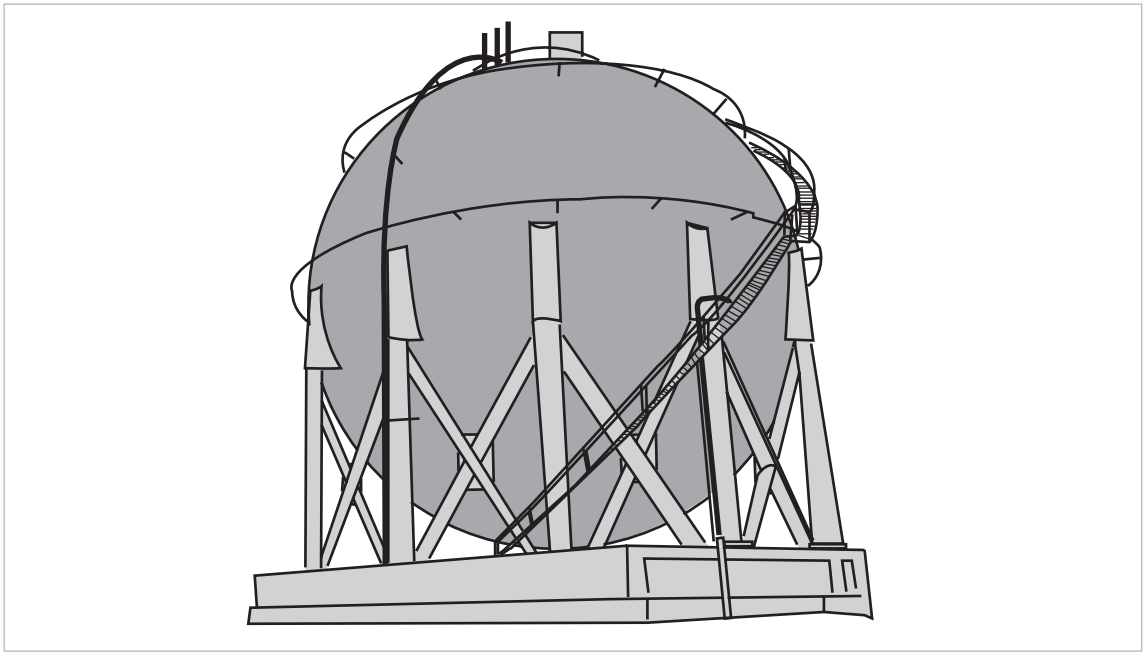


Figure 3-29: **A spherical tank**

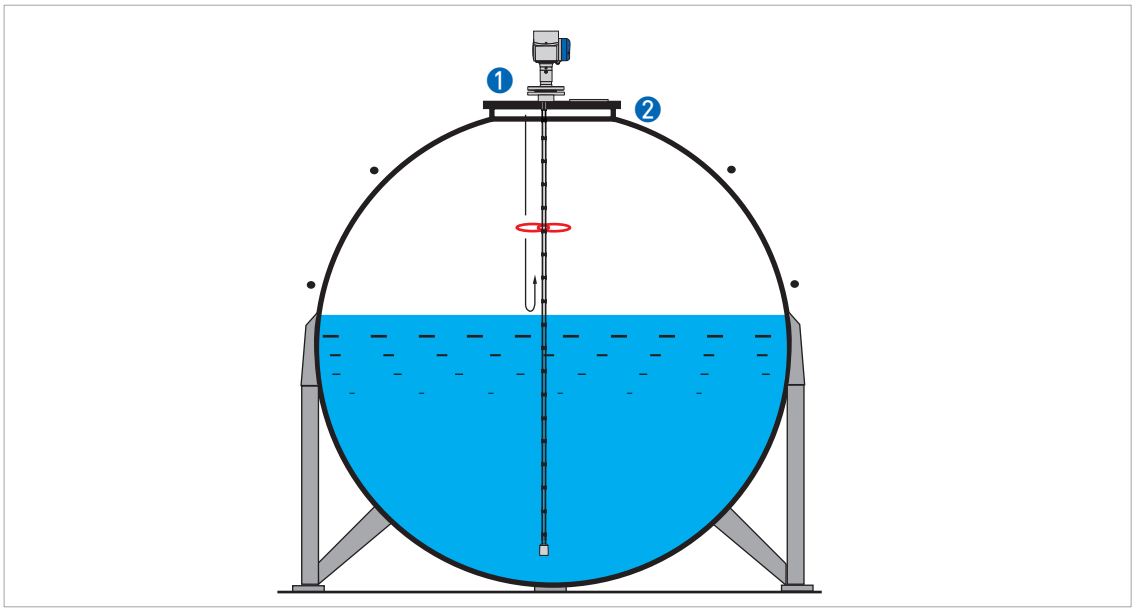


Figure 3-30: **How to install the instrument on a spherical tank**

1. Install the instrument on top of the tank
2. If the top platform has the shape of a nozzle, do not install the process connection too near to the wall. For further information, refer to *General requirements* on page 28.

Horizontal cylindrical tanks

Obey the instructions for installation in vertical tanks. These procedures are also applicable to horizontal cylindrical tanks.

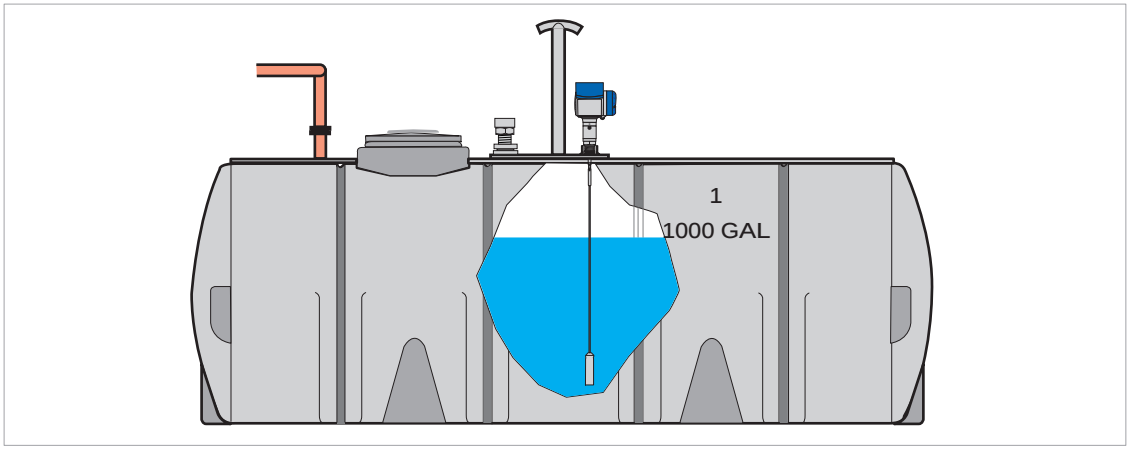


Figure 3-31: **How to install the instrument in a horizontal cylindrical tank**

3.7 Installation recommendations for solids

3.7.1 Nozzles on conical silos

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

DANGER!
Risk of electrostatic discharge (ESD). The instrument is resistant to electrostatic discharges of up to 15 kV (30 kV with the supplementary ESD protection option - recommended for solid applications), but it is the fitter's and the user's responsibility to prevent ESD.

CAUTION!
Install the nozzle in the correct position to measure correctly and prevent too much bending and traction.

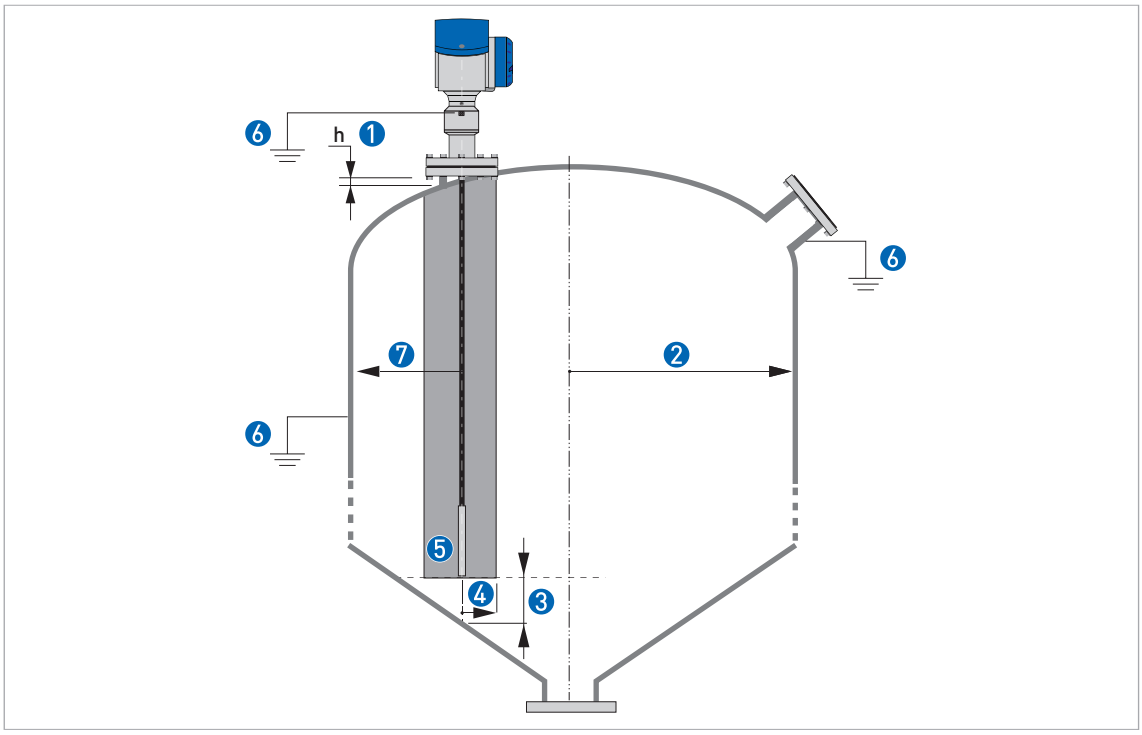


Figure 3-32: **Installation recommendations for liquids**

1. We recommend installation without a nozzle. If not, h ≤ 50 mm / 2".
2. Radius of the tank, r
3. The end of the probe must be more than 300 mm / 12" above the tank bottom.
4. Empty space (radius, R_{min}) around the probe.
5. The electromagnetic (EM) field generated by the instrument. It is also the measurement zone of the probe. Make sure that the EM field is clear of objects and product flow.
6. Ground the tank, the product and the probe (if attached).
7. Position of the process fitting from the tank wall, r/2.

Clearance between the instrument probe and other objects in the tank

Probe type	Empty space (radius, R_{min}) around the probe	
	[mm]	[inches]
Single cable Ø4 mm/0.15" ④	300	12
Single cable Ø8 mm/0.3" ④	300	12

NOTE!
If the probe is longer than 10 m/33 ft, we recommend that you do not attach the end of the probe.

3.7.2 Traction loads on the probe

Traction load depends on:

- The height and shape of the tank.
- The particle size and density.
- The rate at which the tank is emptied.

CAUTION!
Risk of damage to the cable probe. High loads can break the cable.
If the load on the Ø8 mm/0.3" single cable probe is more than 3500 kg/7700 lbs, contact your supplier.

CAUTION!
Make sure that the tank roof is resistant to deformation at high loads.

Estimated traction load on the probe

Material	Probe length, 10 m	Probe length, 20 m	Probe length, 30 m
	[kg]		
Cement	1000	2000	3000
Fly ash	500	1000	1500
Wheat	300	500	1200

Estimated traction load on the probe

Material	Probe length, 33 ft	Probe length, 65 ft	Probe length, 98 ft
	[lbs]		
Cement	2200	4410	6520
Fly ash	1100	2200	3300
Wheat	660	1320	2650

3.8 How to install the instrument on the tank

3.8.1 How to install an instrument with a flange connection

Equipment needed:

- Instrument
- Gasket (not supplied)
- Wrench (not supplied)

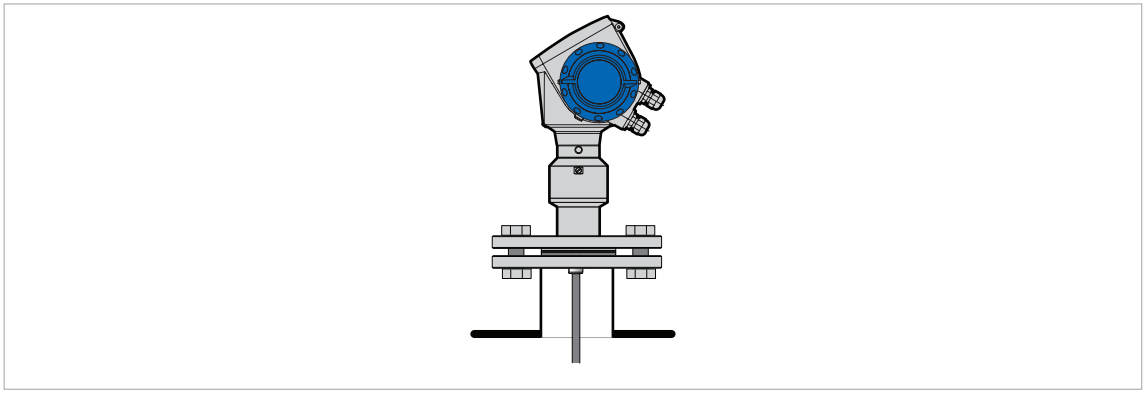


Figure 3-33: **Flange connection**

- Make sure the flange on the nozzle is level.
- Make sure that you use the applicable gasket for the flange and the process.
- Align the gasket correctly on the flange facing of the nozzle.
- Lower the probe carefully into the tank.

➲ For more data on cable probes, refer to *How to install a cable probe in the tank* on page 44.

- Tighten the flange bolts.

➲ Refer to local rules and regulations for the correct torque to apply to the bolts.

3.8.2 How to install an instrument with a threaded connection

Equipment needed:

- Instrument
- Gasket (not supplied with G (ISO 228) threaded connections)
- 50 mm/2" wrench (not supplied)

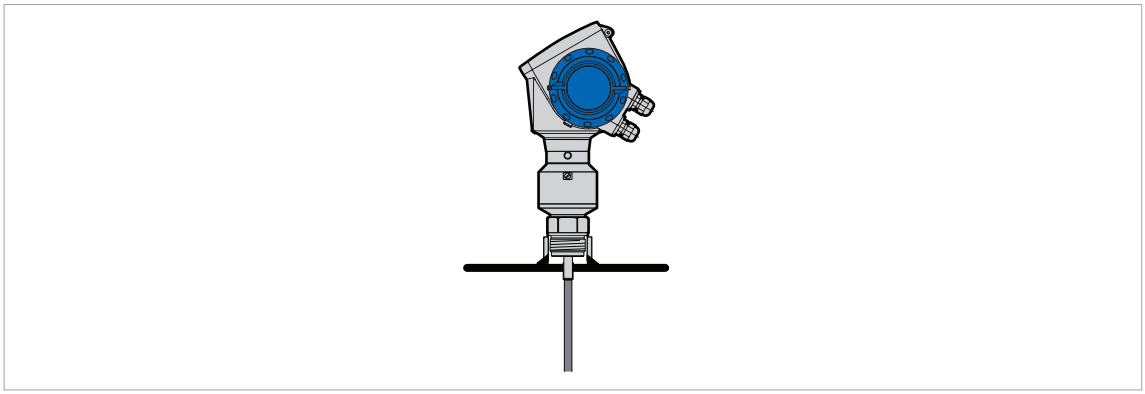


Figure 3-34: **Threaded connection**

- Make sure the tank connection is level.
- Make sure that you use the applicable gasket for the connection and the process.
- Align the gasket correctly.
- If installed on a tank made of plastic or other non-conductive material, refer to *Installation recommendations for non-metallic tanks and pits* on page 45.
- Lower the probe carefully into the tank

➲ For more data on cable probes, refer to *How to install a cable probe in the tank* on page 44.

- Turn the nut on the housing to attach the instrument to the process connection
- Tighten the nut.

➲ Refer to local rules and regulations for the correct torque to apply to the connection.

INFORMATION!
If there is not sufficient clearance to install the instrument, remove the housing. Install the process connection and then put the housing back on the process connection. For more data, refer to How to turn or remove the signal converter on page 17.

3.8.3 How to install a cable probe in the tank

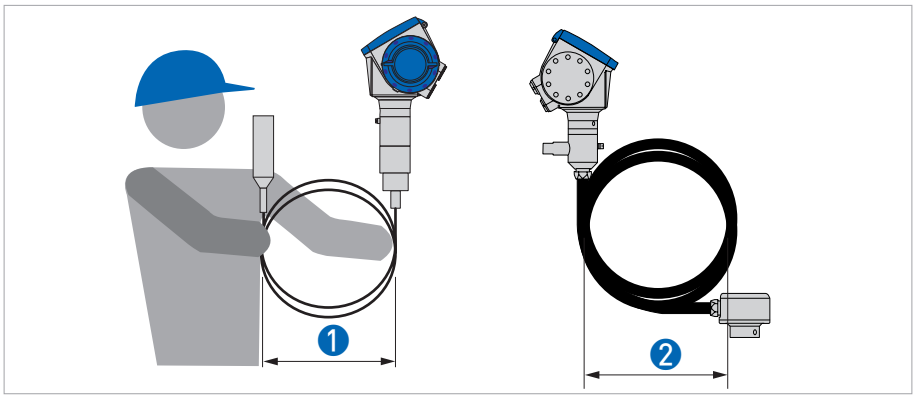


Figure 3-35: **Wind cable probes and flexible conduits carefully**

1. Do not wind cable probes less than 400 mm / 16" in diameter.
2. Do not wind the flexible conduit less than 330 mm / 13" in diameter.

- Do not wind cable probes less than 400 mm / 16" in diameter

WARNING!
If you bend the probe too much, you will damage the instrument and it will not measure accurately.

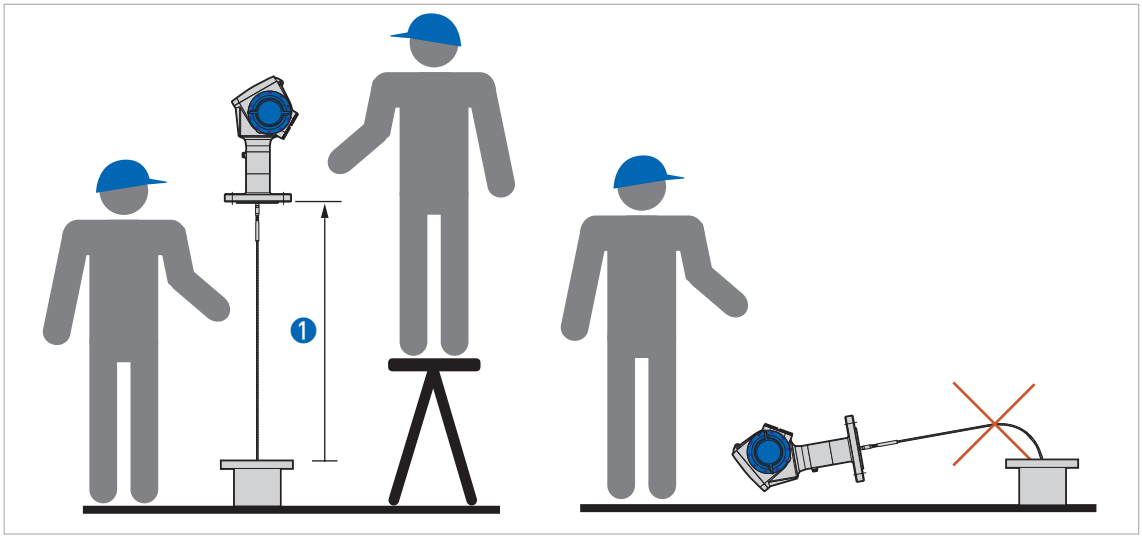


Figure 3-36: **Installation of instruments with cable probes**

1. >1 m / 3½ ft.

- Use two persons to lift the housing and the probe above the process connection.
- Hold the instrument 1 m / 3½ ft. above the tank.

- Unwind the probe carefully into the tank.

3.8.4 Installation recommendations for non-metallic tanks and pits

If you have an instrument with a rod or a cable probe and a thread connection, obey these instructions:

- Put a metal sheet between the instrument and the process connection.

➲ It must have a diameter greater than 200 mm / 8".

- Make sure that the metal sheet is in contact with the thread stop on the instrument.

We recommend that you use DN≥200 / ≥8" for flange connections.

If you have an instrument with a double rod, double cable or coxial probe, you can ignore these instructions.

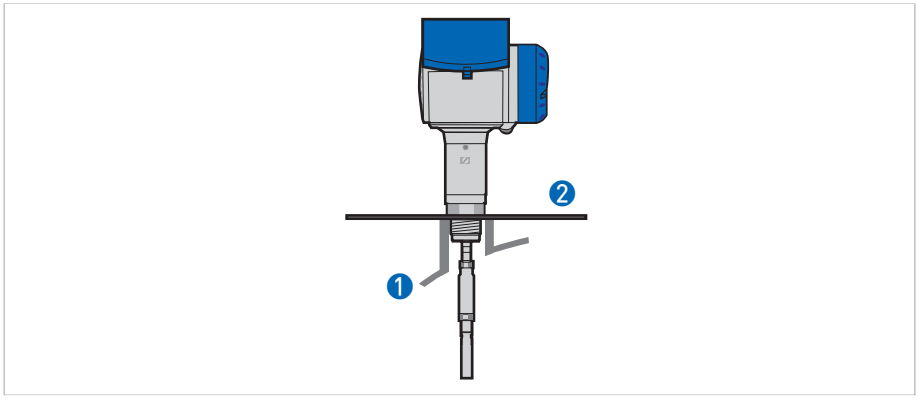


Figure 3-37: **Installation in a non-metallic tank or pit with a thread connection**

1. Non-metallic (plastic...) tank or pit
2. Metal sheet, Ø ≥200 mm / 8"

CAUTION!
When the instrument is installed, make sure that the tank roof has no deformation. If there is deformation, the instrument will not measure accurately.

3.8.5 How to attach the weather protection to the instrument

Equipment needed:

- Instrument
- Weather protection (option)
- 10 mm wrench (not supplied)

The overall dimensions of the weather protection are on page 147.

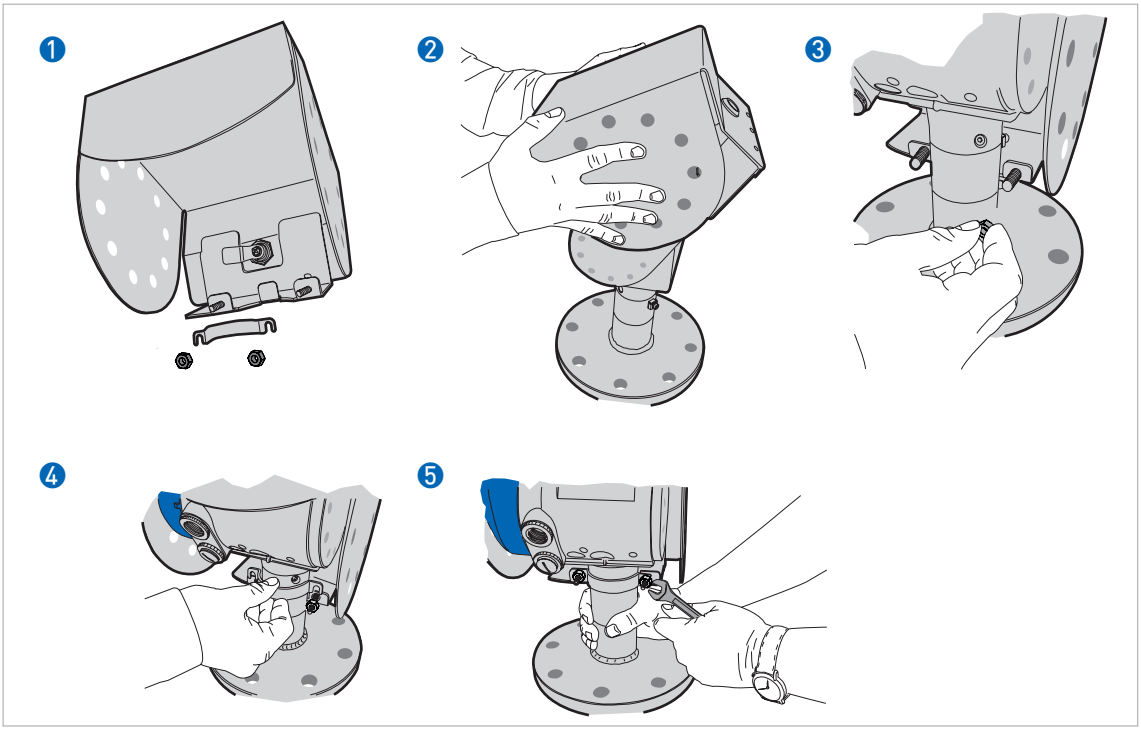


Figure 3-38: **Installation of the weather protection**

- Loosen the bracket nuts on the weather protection.
- Remove the bracket .
- Lower the weather protection onto the instrument.
- 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.

3.8.6 How to open the weather protection

Equipment needed:

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

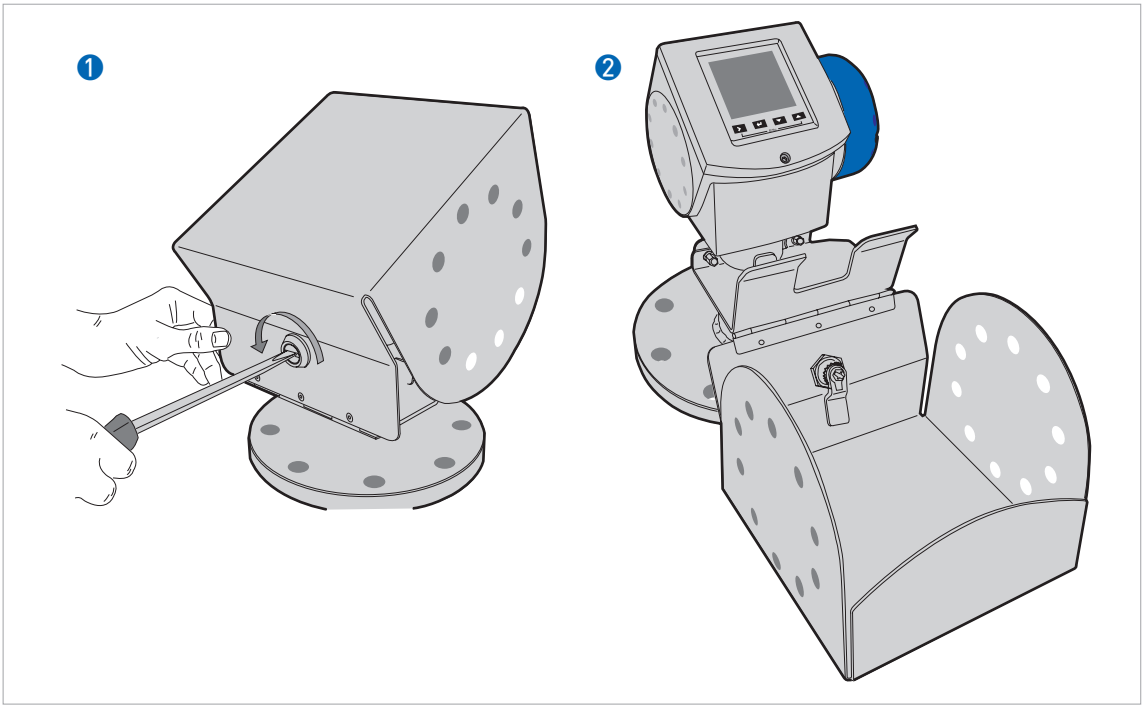


Figure 3-39: **How to open the weather protection**

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

- Put a large 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.

3.9 Electromagnetic compatibility

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

You can install the instrument on open-air tanks and tanks that are not made of metal. This agrees with Immunity and Emissions requirements for industrial environments.

NOTE!

Instrument operation agrees with residential-class (class B) immunity and emissions requirements if the probe is:

- *Used in a closed tank made of metal.*
- *A coaxial probe.*

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

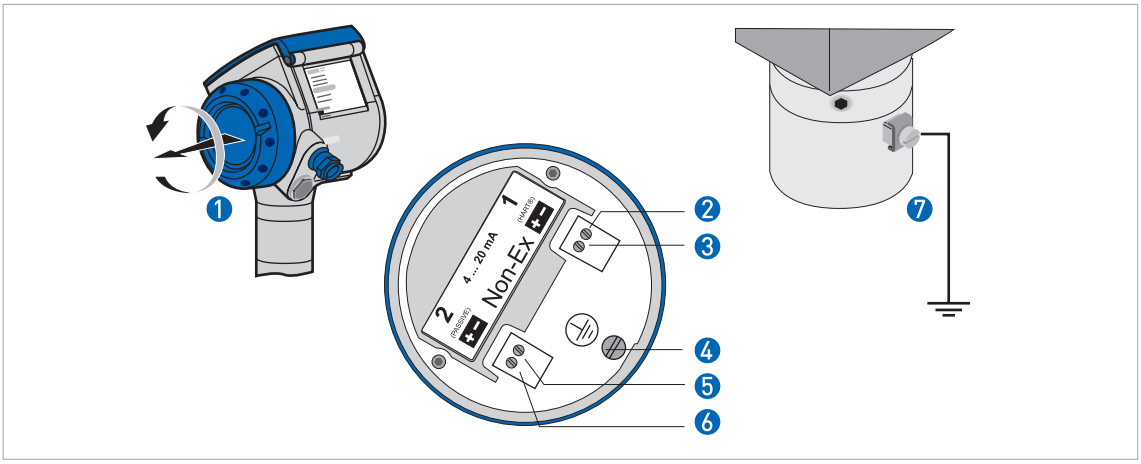


Figure 4-1: **Electrical installation**

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 on the connection piece between sensor and converter

NOTE!
If the instrument has the second current output option, use a separate power supply to energize terminal 2.

Procedure:

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

4.3 Electrical connection for current output

4.3.1 Non-Ex

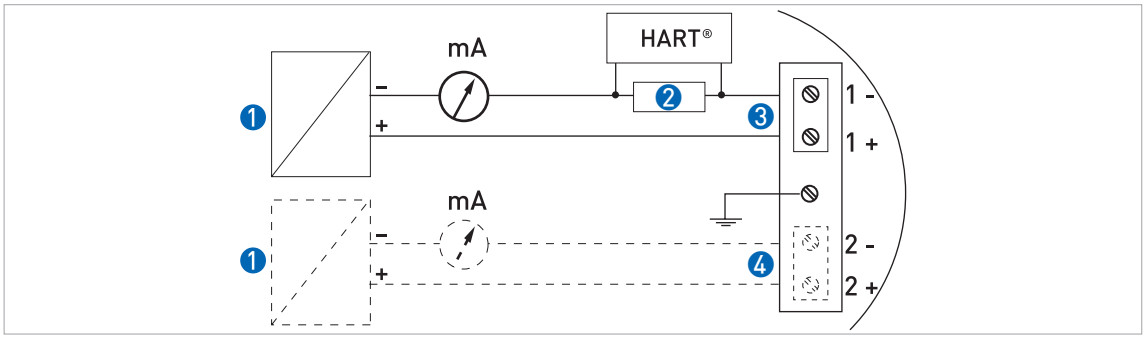


Figure 4-2: **Electrical connections for non-Ex instruments**

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

4.3.2 Ex i

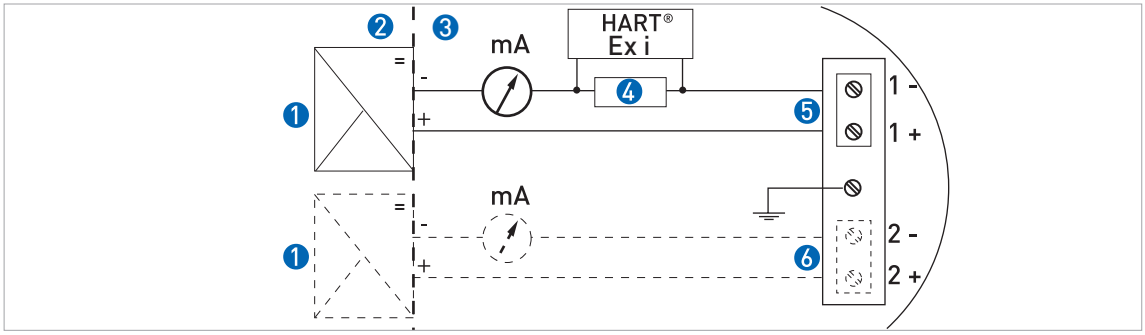


Figure 4-3: **HART® connection to the Ex i circuit with a resistor**

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 22mA at the terminal
6. 10...30 VDC for an output of 22mA at the terminal

NOTE!

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

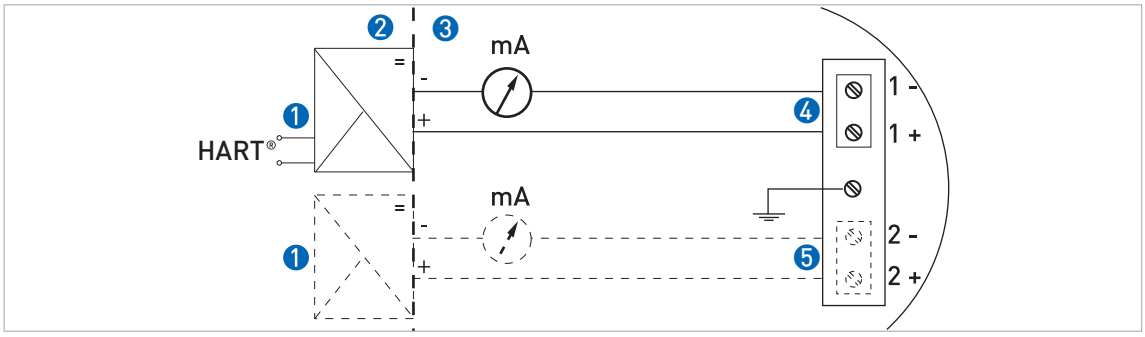


Figure 4-4: **HART® connection to the Ex i barrier without a resistor**

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

4.3.3 Ex d

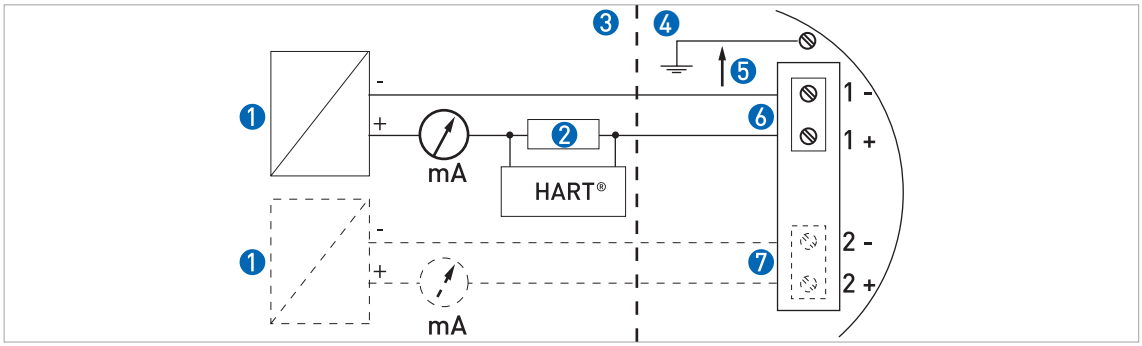


Figure 4-5: **Electrical connections for an Ex d-approved instrument**

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

4.4 Protection category

NOTE!
The instrument fulfills all requirements per protection class IP 67.

DANGER!
Make sure the cable gland is watertight.

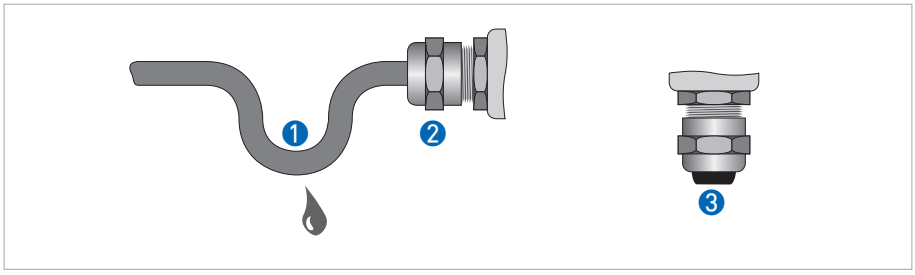


Figure 4-6: **How to make the installation agree with protection category IP 67**

- 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 instrument ❶ so water cannot enter the housing.
- Tighten the cable feedthroughs ❷.
- Close unused cable feedthroughs with a dummy plug ❸.

4.5 Networks

4.5.1 General information

The instrument uses the HART® communication protocol in networks. This protocol agrees with the HART® Communication Foundation standard. The instrument operates in either point-to-point or multi-drop networks of up to 15 instruments.

Output 1 is factory-set to communicate in point-to-point networks. Also refer to *Network configuration* on page 86 for the procedure to change the communication mode from **point-to-point** to **multi-drop**.

4.5.2 Point-to-point networks

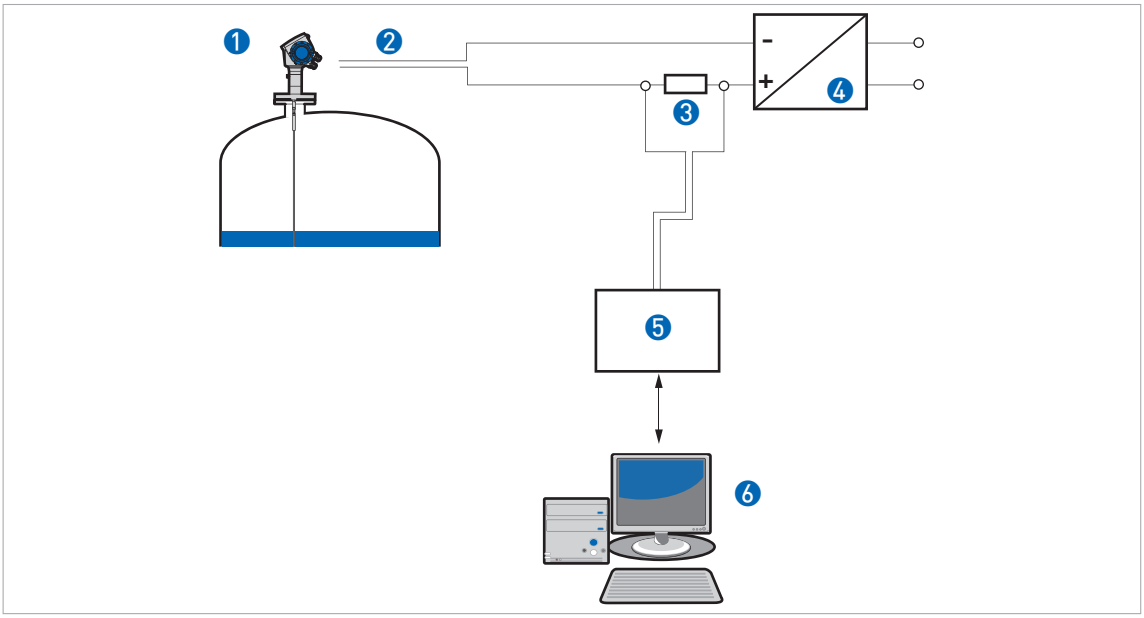


Figure 4-7: **Point-to-point connection (non-Ex)**

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

4.5.3 Multi-drop networks

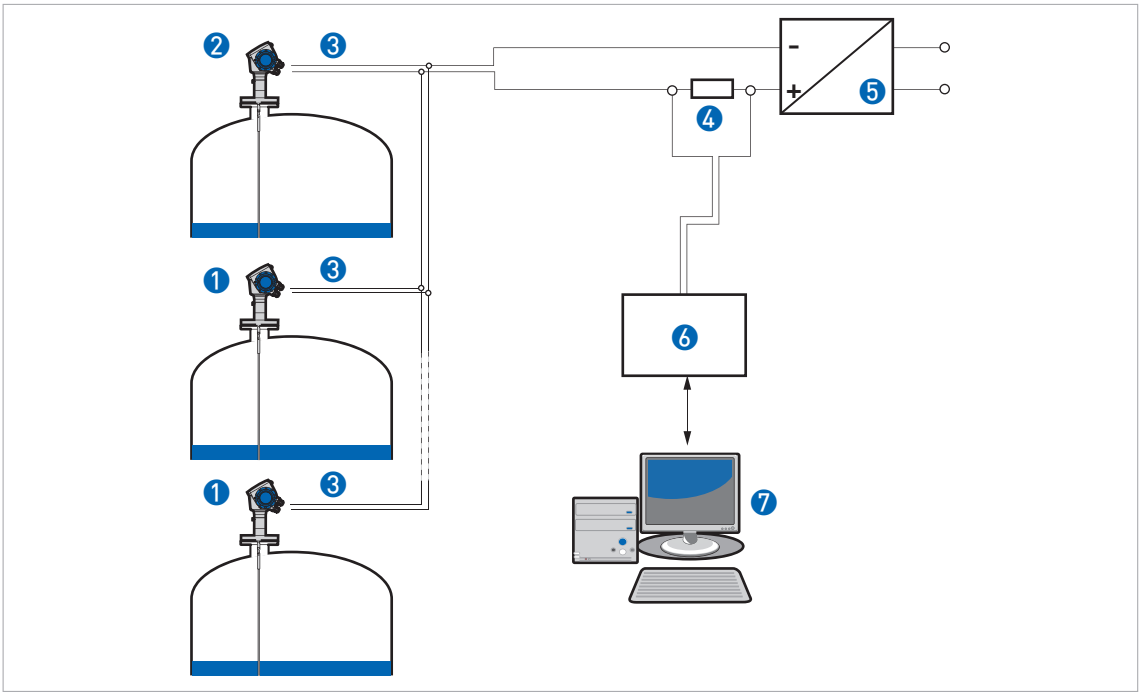


Figure 4-8: **Multi-drop network (non-Ex)**

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

5.1 Start-up checklist

Check these points before you energize the instrument:

- Are all the wetted components (probe, 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 instrument on the tank?
- Do the electrical connections agree with the national electrical codes?

DANGER!
Before you energize the instrument, make sure that the polarity and the supply voltage are correct.

DANGER!
Make sure that the instrument 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 workstation or PC with PACTware™. You can download the Device Type Manager (DTM) file from our download centre.
- Connection to a workstation or PC with AMS™. You can download the Device Description (DD) file from our download centre.

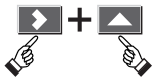
5.3 Digital display screen

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 will tell you how to configure the instrument. 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 instrument

- 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 instrument will start to display readings.

➲ Measurements agree with specifications given in the customer order.

CAUTION!
If the manufacturer received information about the installation, the instrument 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 instrument from a remote location. It is an Open Source, open configuration software for all field instruments. It uses Field Device Tool (FDT) technology. FDT is a communication standard for sending information between the system and the field instrument. This standard agrees with IEC PAS 62453. Field instruments are easily integrated. Installation is supported by a user-friendly Wizard.

Install this software:

- Microsoft® .NET Framework version 1.1 or later
- PACTware 3.0
- HART® interface module (USB, RS232...)
- The Device Type Manager (current DTM Version 1.0.0.34) for the instrument

The sofware and installation instructions are given on the CD-ROM supplied with the instrument.

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

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

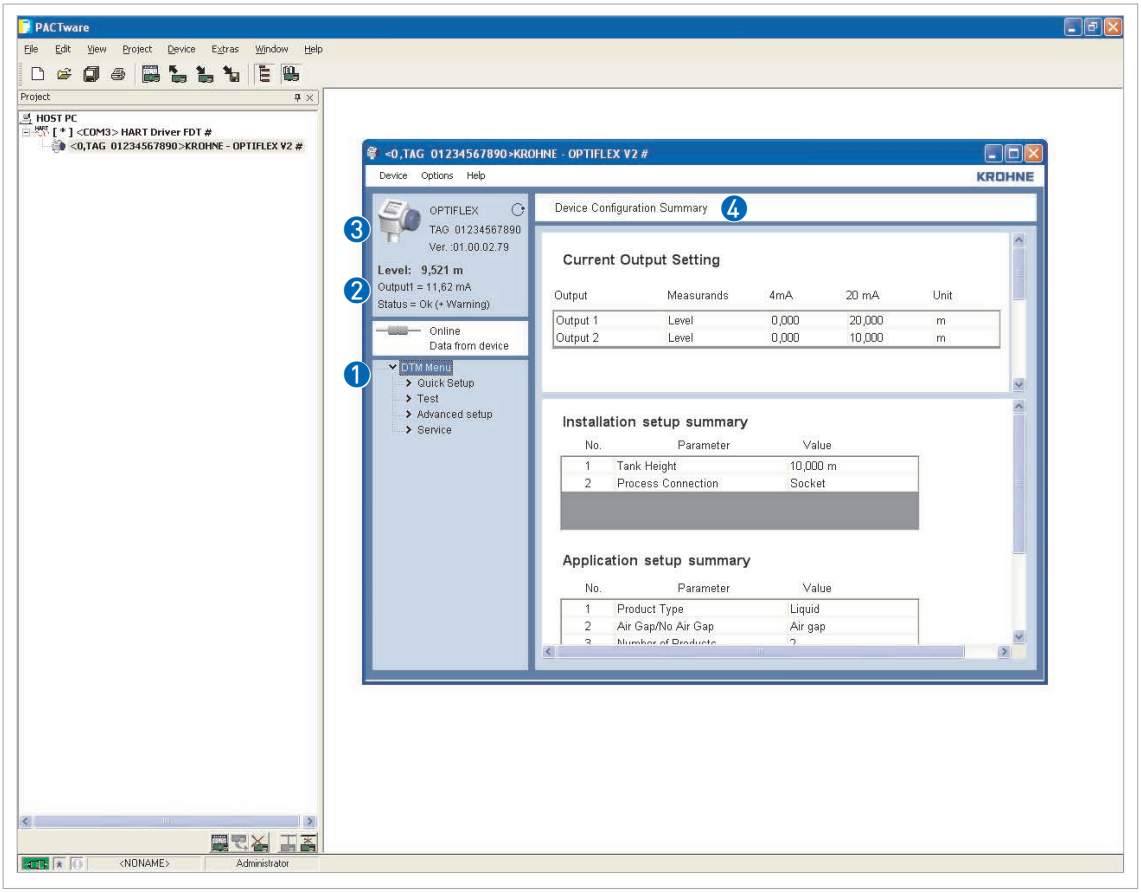


Figure 5-2: **Screen from the PACTware™ user interface**

1. DTM menu
2. Basic measurement information: level, current output and instrument status
3. Information for instrument 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 instrument.
- Support HART® and FOUNDATION Fieldbus™ instruments.
- 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 instrument. You can also download it from our download centre.

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 instrument 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 ❶	Enter program mode ❷
	Enter	-	Enter signal screen editing mode ❸
	Down	Change measurement parameter ❹	The screen shown at this time becomes the default screen ❷
	Up	Change measurement parameter ❹	Display language will change to English ❺
	Esc (Escape)	-	-

❶ value, value and picture, or value and bar graph
❷ when you press this button for 1 second
❸ only when the signal screen is selected. For more data, refer to section 6.4.8.
❹ level, distance, volume etc.
❺ when you press this button for 3 seconds. Press the button again and it will go back to the original language.

Information screens for one output

Text screen	Go to	Text and image screen	Go to	% current output screen	Go to
△		△		△	
Level	>	Level	>	Level	> (Text)
△ ▽		△ ▽		△ ▽	
Interface level ❶	>	Interface level ❶	>	Interface level ❶	> (Text)
△ ▽		△ ▽		△ ▽	
Distance	>	Distance	>	Distance	> (Text)
△ ▽		△ ▽		△ ▽	
Interface distance ❶	>	Interface distance ❶	>	Interface distance ❶	> (Text)
△ ▽		△ ▽		△ ▽	
Layer ❶	>	Layer ❶	>	Layer ❶	> (Text)
△ ▽		△ ▽		△ ▽	
Volume ❷	>	Volume ❷	>	Volume ❷	> (Text)
△ ▽		△ ▽		△ ▽	
Mass ❸	>	Mass ❸	>	Mass ❸	> (Text)
△ ▽		△ ▽		△ ▽	
Interface volume ❶	>	Interface volume ❶	>	Interface volume ❶	> (Text)
△ ▽		△ ▽		△ ▽	
Ullage volume ❷	>	Ullage volume ❷	>	Ullage volume ❷	> (Text)
△ ▽		△ ▽		△ ▽	
Layer volume ❷	>	Layer volume ❷	>	Layer volume ❷	> (Text)
△ ▽		▽		▽	
Signal screen ❹		Back to the top of the list		Back to the top of the list	
▽					
Back to the top of the list					

❶ instruments for interface applications only
❷ only available if you created a volume table. Refer to the conversion quicksetup menu in supervisor mode.
❸ only available if you created a mass table. Refer to the conversion quicksetup menu in supervisor mode.
❹ shows voltage amplitude of return signals against distance. This is used for finding level and interface when there are interference signals. Press > to move the cursor from one signal peak tro another.

Information screens for two outputs

Text screen	Go to	Text and image screen	Go to	% current output screen	Go to
△		△		△	
Level Interface level	>	Level Interface level	>	Level Interface level	>(Text)
△ ▽		△ ▽		△ ▽	
Distance Interface distance	>	Distance Interface distance	>	Distance Interface distance	>(Text)
△ ▽		△ ▽		△ ▽	
Layer ❶	>	Layer ❶	>	Layer ❶	>(Text)
△ ▽		△ ▽		△ ▽	
Volume Interface volume ❷	>	Volume Interface volume ❷	>	Volume Interface volume ❷	>(Text)
△ ▽		△ ▽		△ ▽	
Mass ❸	>	Mass ❸	>	Mass ❸	>(Text)
△ ▽		△ ▽		△ ▽	
Ullage volume ❷	>	Ullage volume ❷	>	Ullage volume ❷	>(Text)
△ ▽		△ ▽		△ ▽	
Layer volume ❷	>	Layer volume ❷	>	Layer volume ❷	>(Text)
△ ▽		▽		▽	
Signal screen ❹		Back to the top of the list		Back to the top of the list	
▽					
Back to the top of the list					

❶ instruments for interface applications only
❷ only available if you created a volume table. Refer to the conversion quicksetup menu in supervisor mode.
❸ only available if you created a mass table. Refer to the conversion quicksetup menu in supervisor mode.
❹ shows voltage amplitude of return signals against distance. This is used for finding level and interface when there are interference signals. Press > to move the cursor from one signal peak tro another.

6.3 Supervisor mode

6.3.1 General notes

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

- Use the **quick setup** menus to configure your instrument quickly. For more data, refer to *A. Quick Setup* on page 68.
- Use the **advanced setup** menu to find single items for instrument configuration. For more data, refer to *C. Advanced setup* on page 77.

- Save **quicklinks** for items that you use regularly. For more data, refer to *A. Quick Setup* on page 68 (menu items A.2 to A.6).
- Do error finding and troubleshooting procedures in the **test** menu. For more data, refer to *B. Test* on page 75.

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 instrument displays the message "Login successful" and then the main menu for supervisor mode.

You can change the password for the supervisor mode. For further information, refer to *Function description* on page 68, menu item C.5.2.2.

The main menu shows:

- Quick Setup menus.
- 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 a 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 ❶
C.3	output 1 (HART)
C.4	output 2 (passive) ❷
C.5	device setup
C.6	reset

❶ input/output options. This menu is not available at this time.
❷ optional

6.3.4 Push-button functions

Menu navigation

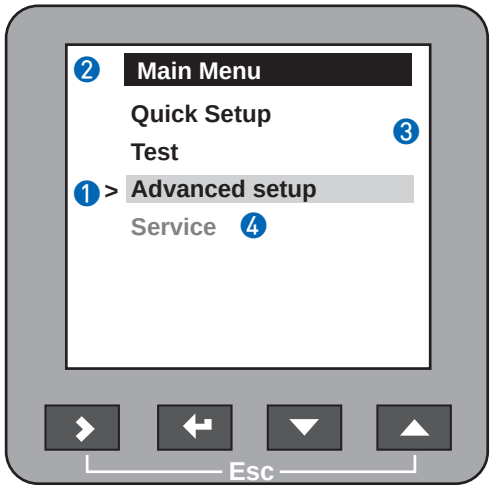
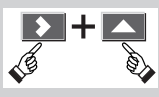


Figure 6-1: **Menu navigation**

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

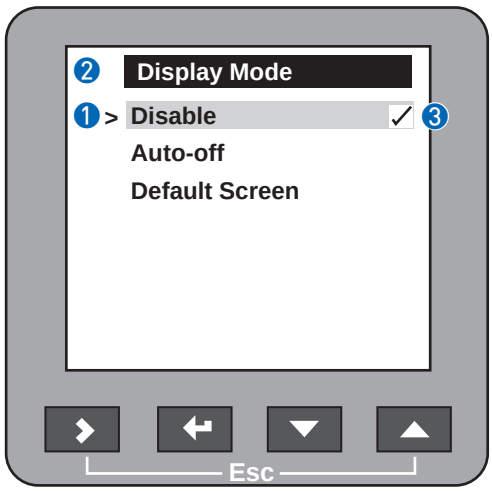
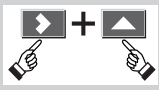


Figure 6-2: **Lists of parameters in menu items**

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 select a new parameter

Values in menu items

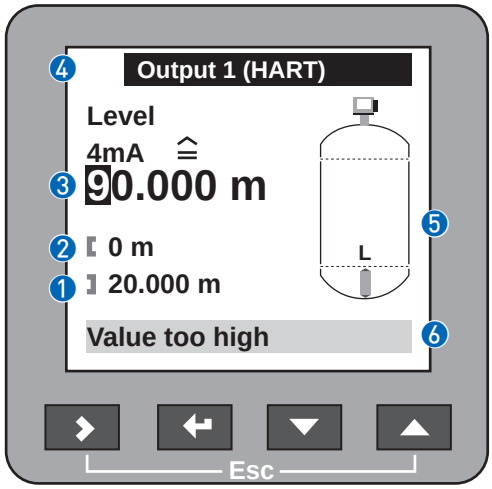


Figure 6-3: **Values in menu items**

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:

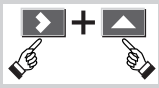
Function of push-buttons in menu items that have values

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 select 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 ❶
	Enter	-
	Down	-
	Up	Screen displays information in the default language ❷
	Esc (Escape)	Go back to the operator mode

❶ select a menu item from the Advanced Setup menu list
❷ press this push-button for 3 seconds

How to save settings

- When you have changed parameters in all the necessary menu items, press ↵ to accept the new parameter.
- Press > and △ at the same time to go back to the **Save settings** screen.
- The instrument 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		application	Follow this procedure to describe the tank contents.		
	1	information: probe type		read only	
	2	product type	The application.	liquid, solid	
	3	air gap / no air gap?	This tells the instrument whether or not there is air or gas above the product.	air gap, no air gap ❶	air gap
	4	number of products	The number of products in the tank.	1, 2, >2 ❶	1
	5	top product class		liquid: alcohol, base, hydrocarbon, liquid gas, mineral oil, solvent, aqueous solution, other solid: cereals, minerals, plastic, other	
	6	application type		level, interface, level and interface ❷	
	7	mixed / unmixed?	If there are 2+ liquids in the tank, is there an emulsion in the tank. This tells the instrument to look for the interface when the two liquids have settled.	mixed, unmixed	unmixed
	8	settings summary			
	9	save / cancel		save, cancel ❸	

Menu No.	Step	Function	Function description	Selection list	Default
A.1.3		installation	Follow this procedure to describe the process connection.		
	1	tank height	The distance from the tank connecting flange face/thread stop down to the tank bottom.	min-max: 0.165…60 m / 0.54…196.86 ft	❹
	2	type of process connection	The installation on the tank for the instrument.	socket, stillwell, nozzle	nozzle
	3A	stillwell height	The height from the tank connecting flange face/thread stop to the bottom of the stillwell.	min-max: 0…60 m / 0…196.86 ft	1.5 m / 4.92 ft
	4A	stillwell diameter	The inner diameter of the stillwell.	min-max: 0.2…1000 mm / 0.79…39.37 in	100 mm / 3.94 in
	3B	nozzle height	The height from the tank connecting flange face/thread stop to the bottom of the nozzle.	min-max: 0…60 m / 0…196.86 ft	0.1 m / 0.33 ft
	4B	nozzle diameter	The inner diameter of the nozzle.	min-max: 0.2…1000 mm / 0.79…39.37 in	100 mm / 3.94 in
	5	settings summary			
	6	save / cancel		save, cancel ❸	

Menu No.	Step	Function	Function description	Selection list	Default
A.1.4		conversion	Follow this procedure to set the instrument 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/m3	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	flat
	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
	2	customer length unit	A non-standard length unit for the conversion table. This is defined by the supervisor.		LEN_ FREE_
	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 ❸	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.	1 solid/liquid: level, distance, volume (mass), ullage volume; 2+ liquids: interface level, interface distance, interface volume, layer, layer 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. **Hold** means that the output current stays at the value where the error occurred. **Hold** is not available if 3.8...20.5 mA (NAMUR) is the output range.	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 5	Select an output function to scale the current values . This is not displayed in the operator mode.	1 liquid: level, distance, volume (mass), ullage volume; 2+ liquids: interface level, interface distance, interface volume, layer, layer volume	interface level
	9	output 2: 4 mA setting 5	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 5	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 5	This sets the effective range of output 2 with or without over-run.	3.8...20.5 mA (NAMUR), 4...20 mA	4...20 mA

Menu No.	Step	Function	Function description	Selection list	Default
	12	output 2: error handling ❺	This sets the behaviour of current output 2 if an error occurs. **Hold** means that the output current stays at the value where the error occurred. **Hold** is not available if 3.8…20.5 mA (NAMUR) is the output range.	3.6 mA, 22 mA, Hold	22 mA
	13	settings summary		read only	
		save / cancel		save, cancel ❸	save
A.1.6		snapshot	Use this to find and filter out parasite signals in user-defined areas along the probe. Empty the tank before you do this procedure.		
		Warning: the level should be out of the snapshot area.			
	1	snapshot start distance		min-max: detection delay...sensor length	0.1 m / 0.328 ft
	2	snapshot end distance		Sensor length	Sensor length
	3	snapshot recording	Is the tank empty? If not, empty the tank before taking a snapshot.	yes/no	yes
	4	snapshot recording in progress…			
	5	snapshot activation	Use this data to filter out parasite signals.	yes/no	yes
	6	settings summary			
A.1.7		auto probe length	Use this to correct the length of the probe if it was shortened on site.		
		Warning: this function should be used only when the tank is empty.			
	1	settings summary	A summary of probe data (probe type, counterweight type, probe end pulse).		
	2	auto probe length	Do you want to start the scan?	yes/no	yes
	3	auto probe length in progress…			
	4	probe length	Save the new value.	yes/no	yes

Menu No.	Step	Function	Function description	Selection list	Default
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
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. first option only for solid
2. level only for tanks with one product. Interface only for tanks with 2 or more products and no air gap.
3. step ignored if complete setup selected
4. customer specification or probe length
5. optional

B. Test

Menu No.	Function	Function descritpion	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	

Menu No.	Function	Function descritpion	Selection list	Default
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		
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,CPLD-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	?	TAGNO0123 4567890
B.2.6	Sensor length	The distance from the flange face/thread stop down to the bottom end of the probe (including counterweight for cable versions). The factory set value for probe length is displayed. If probe length has been modified, the new value is shown.	read only (blocking distance...60 m / 197 ft)	
B.2.7	Probe type	The mechanical design of the probe. The factory installed probe type is displayed.	read only	
B.2.8	counterweight type	The mechanical design of a cable probe's bottom end. The device will not measure below the top of the counterweight. The factory-installed counterweight type is displayed.	read only	
	Temperature	Temperature of the electronics block.	read only	
B.2.9	calculated ε_r value	dielectric constant [ε_r] is a major parameter for TDR level measurement devices. This device is able to automatically calculate and display here the ε_r of the top product.	read only	

Menu No.	Function	Function descritpion	Selection list	Default
B.2.10	snapshot information	A summary of snapshot data used by the instrument. Go to **snapshot** setup menu to update this data.	read only	
B.2.11	application mode	This displays the application description of the measurement algorithm applied for the measurement function and application conditions.Configured in the **application** setup menu.	read only	
B.2.12	error records	A log of instrument errors. Scroll down the list and press ↵ to display the error details. Opening a log will remove the error icon if it appeared in operator mode.	read only	
B.2.14	customer length unit	A 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.2.15	customer conversion unit	A 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 instrument.		
C.1	installation setup			
C.1.1	installation type	The installation on the tank for the instrument.	socket, stillwell, nozzle	nozzle
C.1.2	tank height	The distance from the tank connecting flange face/thread stop down to the tank bottom.	min-max: 0.165…60 m / 0.54…196.86 ft	3 m / 9.84 ft
C.1.4	nozzle/still well height	The height from the tank connecting flange face/thread stop to the bottom of the nozzle or...the height from the tank connecting flange face/thread stop to the bottom of the stillwell	min-max: 0…60 m / 0…196.86 ft	100 mm / 3.94 in

Menu No.	Function	Function description	Selection list	Default
C.1.5	nozzle/still well diameter	The inner diameter of the nozzle or stillwell.	min-max: 0.2...1000 mm / 0.79...39.37 in	100 mm / 3.94 in
C.1.6	probe length	Probe length is the distance from the flange face / thread stop of the device down to the bottom end of the probe (including counterweight for cable versions). If probe length has been modified, enter the new value here. For more data, refer to *How to decrease the length of probes* on page 100.	min-max: blocking distance...max. probe length for that type (single/double rod: 4 m / 13 ft, coaxial: 6 m / 20 ft, single cable: 35 m / 115 ft, double cable: 8 m / 26 ft)	Depends on the probe type
C.1.9	blocking distance	The non-measuring range at the top of the probe. It depends on the probe type and the installation.	min-max: 0...(probe length) m / 0...(probe length) ft	Depends on the probe type. For more data, refer to *Measurement limits* on page 142.
	detection delay	This forces the instrument not to analyse reflections in a defined zone immediately below the flange. Increase blocking distance to increase the maximum value.	min-max: 0...(blocking distance) m / 0...(blocking distance) ft	Depends on "blocking distance". See C.1.9 (blocking distance)
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. For more data, refer to *Distance measurement* on page 88.	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. For more data, refer to *Level measurement* on page 89.	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: 0 to 100 seconds	20 seconds for solids 5 seconds for liquids

Menu No.	Function	Function description	Selection list	Default
C.1.13	measuring mode	In **Direct** mode, the instrument measures the time it takes to receives a reflection of the signal from the surface of the tank contents. In **TBF** mode, the instrument measures the time it takes to receives a reflection of the signal from the end of the probe. TBF mode is used to measure one product with a low ε_r. **Automatic** mode automatically switches the measuring mode between Direct and TBF mode. This is sufficient for most applications. We recommend that you use Direct mode for products with an $\varepsilon_r \geq 1.6$ (this depends on the probe type). If $\varepsilon_r \leq 1.4$, use TBF mode.	automatic; direct; TBF	automatic
C.1.14	product ε_r	This function is available if TBF mode is selected in C.1.13. If possible, type in the exact value of the product's dielectric constant. If you do not know the exact value, use the default value. A new product ε_r that is too low will mean that level will read higher than its true value.	min-max: 1.10 to 115.00	2.4
C.1.15	gas ε_r	A major parameter for TDR level measurement devices. If there is too much dust in the tank, set the ε_r value of the air/gas.	min-max: 0.8...115	1
C.1.16	level threshold	If it is difficult to identify the level signal (for example: too many parasite signals), you can increase the level threshold and the amplification (Gain) of the signal. For more data, refer to *Thresholds and parasite signals* on page 94.	7 Gains, min-max: 0...+1.25 V.	Depends on Gain
C.1.17	interface threshold	Instruments for interface applications only. If it is difficult to identify the interface signal (for example: too many parasite signals), you can increase the interface threshold and the amplification (Gain) of the signal. For more data, refer to *Thresholds and parasite signals* on page 94.	7 Gains, min-max: 0...+1.25 V.	Depends on Gain

Menu No.	Function	Function description	Selection list	Default
C.1.18	probe end threshold	Instruments for low dielectric applications only. If it is difficult to identify the probe end signal (for example: too many parasite signals), you can increase the probe end threshold and the amplification (Gain) of the signal. For more data, refer to *Thresholds and parasite signals* on page 94.	7 Gains, min-max: 0...+1.25 V or -1.25...0 V.	Depends on Gain.
	snapshot	Starts or stops the snapshot signal filter. Obey the instructions in the quick setup menu to get snapshot data. For more data, refer to *How to use the snapshot function to filter parasite signals that do not move* on page 97.	yes/no	no
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 unit instrument 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 unit instrument 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 calculate mass. 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 instrument uses this table to display volume and mass readings. Give the number of entries on the table. Press ↵. Type in the height and the corresponding volume / mass values. For more data, refer to *How to correctly configure the instrument to measure volume or mass* on page 90.	Number of entries min.-max: 0...50	2. Table units are selected in menu items C.1.19.1 and C.1.19.2.
C.1.22	linearisation table	The instrument 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 instrument reading. For more data, refer to *Linearisation* on page 87.	Number of entries min.-max: 0...50	2

Menu No.	Function	Function description	Selection list	Default
C.2	I/O	For fieldbus. Not yet available.		
C.3	output 1 (HART)			
C.3.1	output function	Select an output function to scale the current values . This is not displayed in the operator mode.	1 solid/liquid: level, distance, volume/mass, ullage volume; 2+ liquids: interface level, interface distance, interface volume, layer or layer volume	level
C.3.2	4 mA setting	This gives a measurement value to 4 mA	min.-max: 0…20 mA setting ❶	0 m / 0 ft
C.3.3	20 mA setting	This gives a measurement value to 20 mA	min.-max: ❷	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	This sets the behaviour of current output 1 if an error occurs. **Hold** means that the output current stays at the value where the error occurred. **Hold** is not available if 3.8…20.5 mA (NAMUR) is the output range.	3.6 mA, 22 mA, Hold	22 mA
	error handling delay	The time after which the instrument shows there is a measurement error.	min.-max: 0…900 seconds	60 seconds
C.3.6	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
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.	1 solid/liquid: level, distance, volume/mass, ullage volume; 2+ liquids: interface level, interface distance, interface volume, layer or layer volume	level
C.4.2	4 mA setting	This gives a measurement value to 4 mA	min.-max: 0…20 mA setting ❶	0 m / 0 ft
C.4.3	20 mA setting	This gives a measurement value to 20 mA	❷	depends on the output function
C.4.4	output range	Sets the effective range of output 2 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	This sets the behaviour of current output 2 if an error occurs. **Hold** means that the output current stays at the value where the error occurred. **Hold** is not available if 3.8…20.5 mA (NAMUR) is the output range.	3.6 mA, 22 mA, Hold	22 mA

Menu No.	Function	Function description	Selection list	Default
	error handling delay	The time after which the instrument 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.		
C.5.1.1	language		English, French, German, Italian, Japanese, Mandarin, Portuguese, Russian, Spanish	
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 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.		FREE_UNIT
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.		FREE_UNIT
C.5.2	Passwords	To change user passwords, refer to these menu items.		

Menu No.	Function	Function description	Selection list	Default
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 instrument to default settings, refer to these menu items.		
C.6.3	restart	If the instrument does not operate correctly, start the unit again. Press ↵ to confirm.		

❶ units and range depend on the output function, length unit and volume unit selected. See also the table of data dependencies for the 4 mA settings in this section.

❷ units and range depend on the output function, length unit and volume unit selected. See also the table of data dependencies for the 20 mA settings in this section.

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 m³	<20 mA setting for volume	0 m³
Mass	0.00 kg	<20 mA setting for mass	0 kg
Distance	0 m	<20 mA setting for distance	0 m
Interface level	0 m	<20 mA setting for interface level	0 m
Interface distance	0 m	<20 mA setting for interface distance	0 m
Interface volume	0.00 m³	<20 mA setting for interface volume	0 m³
Interface mass	0.00 kg	<20 mA setting for interface mass	0 kg
Ullage volume	0.00 m³	<20 mA setting for ullage volume	0 m³
Ullage mass	0.00 kg	<20 mA setting for ullage mass	0 kg
Layer	0 m	<20 mA setting for layer	0 m
Layer volume	0.00 m³	<20 mA setting for layer volume	0 m³
Layer mass	0.00 kg	<20 mA setting for layer mass	0 m³

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 ❶	Tank height + TBO - BD ❷
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

Output function	Minimum value	Maximum value	Default
Distance	>4 mA setting for distance	Tank height + TBO + RO ❸	Tank height + RO ❹
Interface level	>4 mA setting for interface level	Tank height + TBO + RO ❶	Tank height + TBO - BD ❺
Interface distance	>4 mA setting for interface distance	Tank height + TBO + RO ❶	Tank height + RO ❻
Interface volume	>4 mA setting for interface volume	Max. value in the volume table	Max. value in the volume table
Interface mass	>4 mA setting for interface mass	Max. value in the mass table	Max. value in the mass table
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
Layer	>4 mA setting for layer	Tank height + TBO + RO ❶	Tank height - BD ❼
Layer volume	>4 mA setting for layer volume	Max. value in the volume table	Max. value in the volume table
Layer mass	>4 mA setting for layer mass	Max. value in the mass table	Max. value in the mass table

❶ TBO = Tank Bottom Offset (C.1.9). RO = Reference Offset (C1.10).
❷ TBO = Tank Bottom Offset (C.1.9). BD = Blocking Distance (C.1.11).
❸ TBO = Tank Bottom Offset (C.1.9). RO = Reference Offset (C1.10). BD = Blocking Distance (C.1.11).
❹ RO = Reference Offset (C1.10).
❺ TBO = Tank Bottom Offset (C.1.9). Blocking Distance (C.1.11).
❻ RO = Reference Offset (C1.10)
❼ BD = Blocking Distance (C.1.11).

6.4 Further information on instrument 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**.

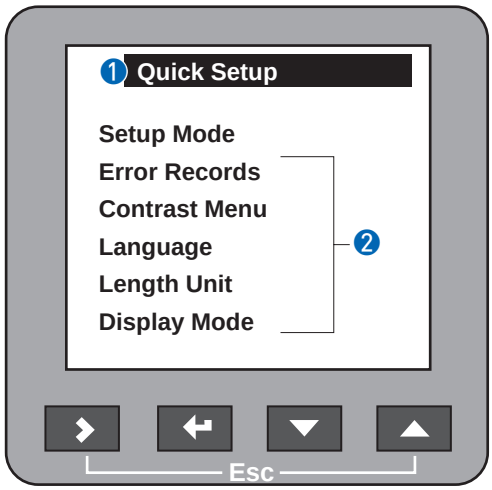


Figure 6-4: **The list of quick links**

1. Menu name
2. Quick links

How to create a Quick Link

- Go to **Supervisor Menu > Advanced Setup**.
- Select a menu item with the △ and ▽ push buttons.
- Press the **>** push button for one second.

➲ The instrument 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 △ and ▽ push buttons.
- Press the > push button.

➲ This opens the menu item. You can configure the instrument.

6.4.2 Protection of the instrument 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 instrument will display the error message "Password mismatch". Press > + △ at the same time and type in the new 6-character password again.

- Press > and △ (Esc) at the same time to exit to the "save settings" window.
- Select **Save** and press ↵.

➲ The instrument 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 54.

The instrument uses HART® communication to send information to HART®-compatible equipment. It can operate in either point-to-point or multidrop mode. The instrument will communicate in multi-drop 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 (see the caution below).
- Press the Escape buttons(> + △) 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 instrument 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**.
- Press the Escape buttons(> + △) 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 instrument 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 steps 3 thru 5 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 instrument will go back to operator mode.

6.4.5 Distance measurement

The instrument 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)
- detection delay

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 you give a distance value for the 4 and 20 mA current output settings.

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

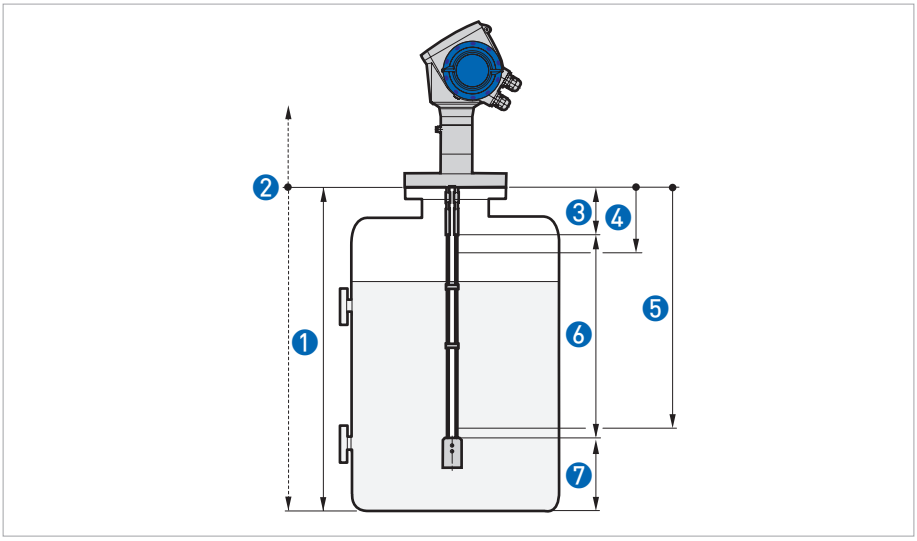


Figure 6-5: **Distance measurement**

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 more data about the menu items, refer to *C. Advanced setup* on page 77.

6.4.6 Level measurement

The instrument 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)
- detection delay

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 you give a level value for the 4 and 20 mA current output settings.

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

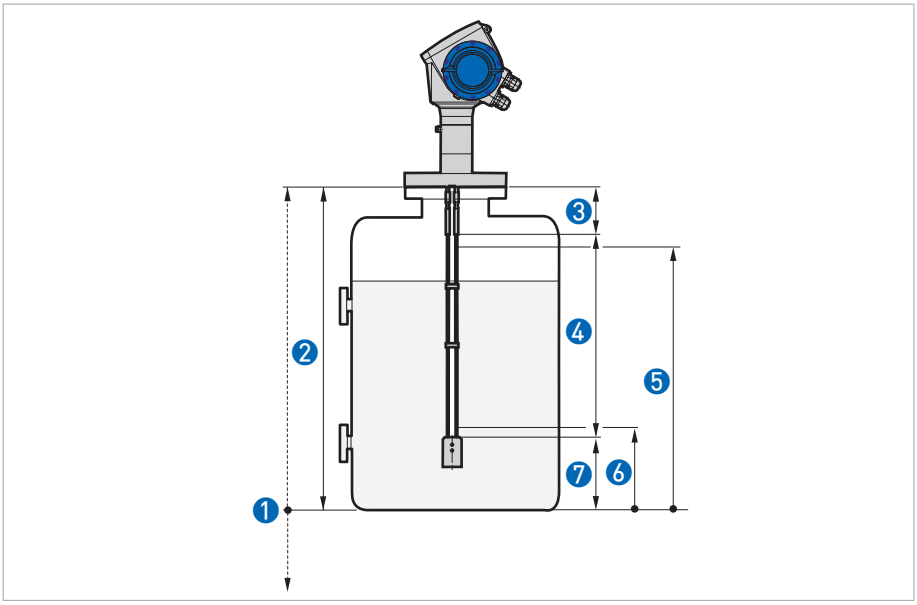


Figure 6-6: **Level measurement**

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 the menu items, refer to *C. Advanced setup* on page 77.

6.4.7 How to correctly configure the instrument to measure volume or mass

The instrument can be configured to measure volume or mass. The procedure for doing this is given in the instrument'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 instrument 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.

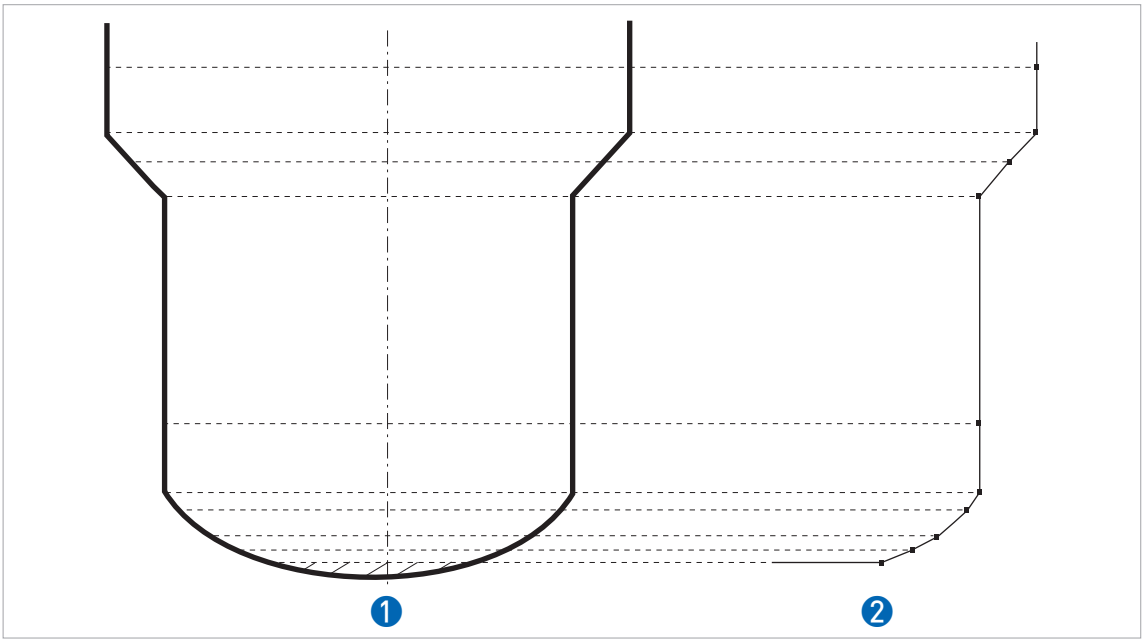


Figure 6-7: **A plot of points for a volume or mass table**

1 Tank with reference points
2 Tank model with plotted points

6.4.8 How to make the instrument follow the correct level or interface signal

If the distance measurement stays on one value when the level of the product changes, the instrument has probably selected a parasite signal as the level signal. You can set the instrument to the correct value with the **distance input** function.

The **distance input** function, used with the signal screen, makes the instrument look for the level or the interface (if the the instrument is configured for interface applications) at the correct point along the probe. A distance value must be given by the supervisor.

NOTE!
The distance is measured from the facing of the process connection to the surface of the product.

CAUTION!
Do not give a distance value that is in the dead zones of the instrument. For more data, refer to Measurement limits on page 142.

INFORMATION!
The signal screen is divided into 4 areas, as shown in the illustration that follows:

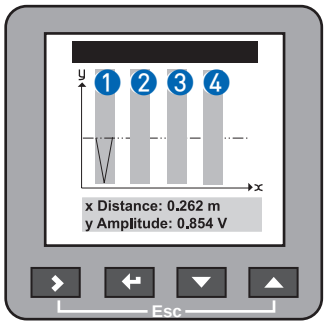


Figure 6-8: **Areas on the signal screen**

1. Reference signal area (the value cannot be changed)
2. Level signal area (use the distance input function to change the level value)
3. Interface signal area (use the distance input function to change the interface value)
4. Probe end area (in TBF mode only - this value cannot be changed)

Figure 6-9: **How to make the instrument follow the correct level signal**

How to adjust the distance value to make the instrument measure level correctly

- Go to the signal screen in operator mode. For more data, refer to *Operator mode* on page 60.
- Press **>** one time to move the cursor right to select the level signal ❶.
- Make a note of the distance value on the signal screen.
- Press ↵ for three seconds.

➲ The program mode screen is displayed.

- Move the cursor to **Supervisor** and press ↵❷.

➲ Type in the supervisor password, if this is necessary. For more data, refer to *How to get access to the supervisor mode* on page 63.

- Type in the distance value ❸.

➲ The selected signal is the level signal.

- Press ↵ to accept your new value or press > and △ at the same time to reject it.

➲ The display goes back to the signal screen.

How to adjust the interface distance value to make the instrument measure interface correctly (instruments for interface measurement only).

- Go to the signal screen in operator mode. For more data, refer to *Operator mode* on page 60.
- Press **>** 2 times to move the cursor right to select the interface signal.
- Make a note of the distance value on the signal screen.
- Press ↵ for three seconds.

➲ The program mode screen is displayed.

- Select **Supervisor** and press ↵❷.

➲ Type in the supervisor password, if this is necessary.

- Type in the new interface distance value ❸.

➲ The selected signal is the interface signal.

- Press ↵ to accept your new value or press **>** and △ at the same time to reject it.

➲ The display goes back to the signal screen.

INFORMATION!

If the instrument continues to select the parasite signal for level or interface measurement, use the snapshot function to filter the signal. For more data, refer to How to use the snapshot function to filter parasite signals that do not move on page 97. If you cannot find the correct signal on the signal screen, contact the supplier.

6.4.9 Thresholds and parasite signals

General notes

The low-power electromagnetic signal from the instrument goes down the probe. The surface of the process and objects in the tank make reflections. These reflections go back up the probe to the signal converter. The signal converter converts the reflections into voltage amplitudes. Reflections from objects in the tanks show as interference signals (parasites).

How thresholds work

Thresholds let the instrument ignore reflections with small amplitudes and monitor changes in level or interface. The voltage amplitude of signals depends on the distance of the reflection from the signal converter. Because the voltage amplitude decreases as distance increases, the threshold decreases logarithmically. The instrument uses largest signal that goes across the threshold.
The instrument uses the menu items that follow:

- Level threshold (C.1.16) to monitor the level signal
- Level threshold (C.1.16) and interface theshold (C.1.17) to monitor level and interface signals
- Probe end threshold (C.1.18) to monitor the probe end signal in TBF mode. If the instrument operates in TBF mode or must calculate the ε_r of the product, there must be a good probe end signal.

The electronics of the instrument amplify the signal. The amplification factor (level of Gain) depends on the strength of the signal. There are 7 levels (1 to 7). A strong signal is given Gain 1, while a weak signal is given Gain 7. When you fill or empty the tank, the instrument usually identifies the signal. It automatically changes the Gain to monitor the position of the signal. But the instrument cannot monitor the correct signal if:

- There are too many objects in the tank.
- There is an object that makes a large reflection in the tank.

NOTE!
Also refer to How to use the snapshot function to filter parasite signals that do not move on page 97 to use the snapshot function to filter parasite signals. For more data on menu items, refer to *C. Advanced setup* on page 77.

How to use thresholds

NOTE!
Although the data that follows refers to the level threshold, it is applicable for interface threshold and probe end thresholds.

If there is a parasite above the level and the threshold is too low, the instrument can incorrectly use it as the level signal.

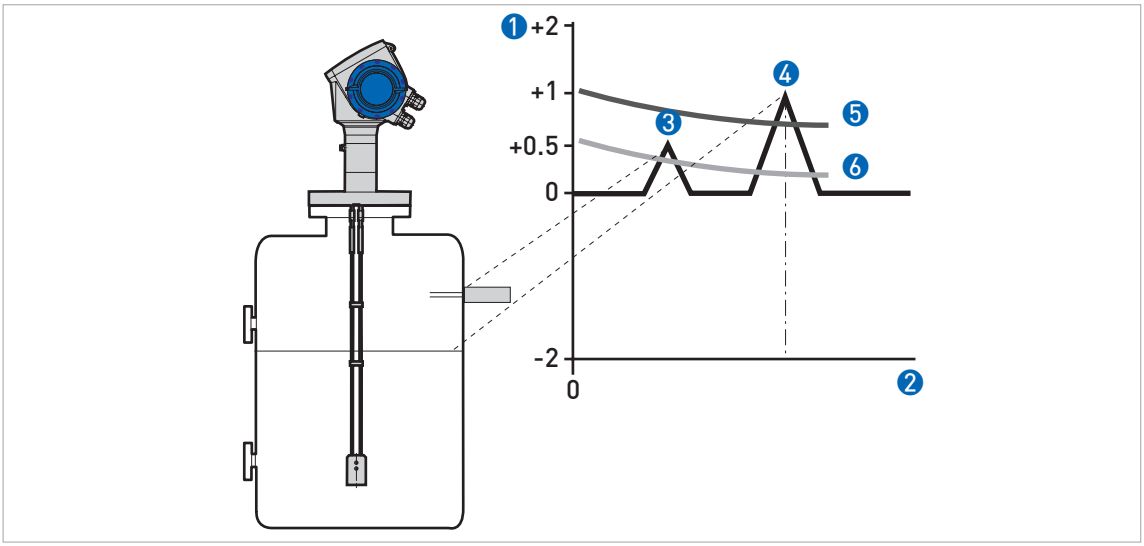


Figure 6-10: **Voltage/distance graph: thresholds**

1. Voltage amplitude of the signal in Volts
2. Distance from the process connection
3. Parasite signal (from a level switch)
4. Level signal of the tank contents
5. The level threshold is correct. The instrument ignores the parasite signal and measures level correctly.
6. The level threshold is too low. The instrument can use the parasite signal as the level signal.

If the parasite is smaller than the correct level, you can manually change the threshold to find the signal. This procedure tells you how to change the level threshold to find the correct signal:

- Look at the signal screen in operator mode.

➲ Find the likely position of the parasite and the level signals. Make a note of the ampltitude of each signal in volts.

- Go to **supervisor mode > advanced setup > installation setup > level threshold**

➲ You will see this screen:

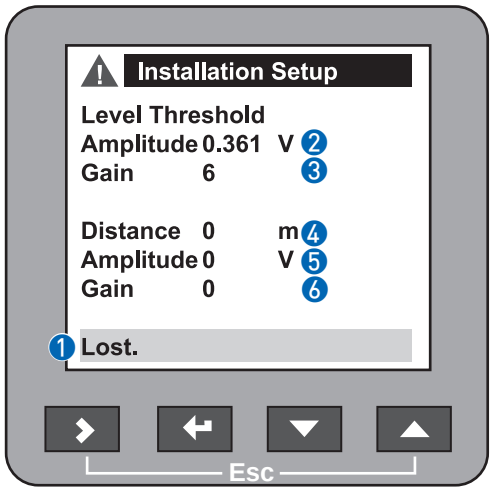


Figure 6-11: **Threshold data on the instrument display screen**

1. Error message "Lost" if the instrument cannot find a signal
2. Amplitude of the threshold (in volts)
3. Gain of the threshold
4. Distance of the monitored signal from the signal converter
5. Amplitude of the monitored signal (in volts)
6. Gain of the monitored signal

- Increase the amplitude of the level threshold.

➲ This value must be more than the incorrect signal. We recommend that you set the level threshold at half the amplitude of the correct signal.

- Use the same gain as that used for the instrument.
- Save the settings.

➲ The threshold increases. It ignores the parasite signal and uses the first signal it finds.

INFORMATION!
If 2 or >2 products are selected in the application quicksetup menu, then the level is the first signal that goes across the level threshold.

Interface threshold

NOTE!
If the instrument is set at the factory to measure interface, you can change the interface threshold.

When there is more than one liquid in the tank, the instrument uses a second threshold to measure interface.
The interface threshold identifies:

- The level signal (the first signal that goes across the level threshold).
- The interface signal (the next largest signal)

This instrument uses this data to monitor the interface signal. When you change the interface threshold, refer to **How to use thresholds** in this section.
For more data about the interface threshold, refer to *C. Advanced setup* on page 77 (menu item C.1.17).

Probe End threshold

NOTE!
If the instrument is set at the factory to measure in tank bottom following (TBF) mode or automatic mode, you can change the probe end threshold.

Use this threshold when the instrument operates in tank bottom following mode. The instrument uses TBF mode to measure the level of products with low dielectic constants. It uses the probe end as a reference. If the reflection is very weak, change the probe end threshold to ignore parasites. Refer to the procedure in **How to use thresholds** to change the probe end threshold.

For more data about the probe end threshold, refer to *C. Advanced setup* on page 77 (menu item C.1.18) .

6.4.10 How to use the snapshot function to filter parasite signals that do not move

The thresholds cannot find the level of the tank contents if it is below a large parasite. This shows the signals as you can see them on an oscilloscope:

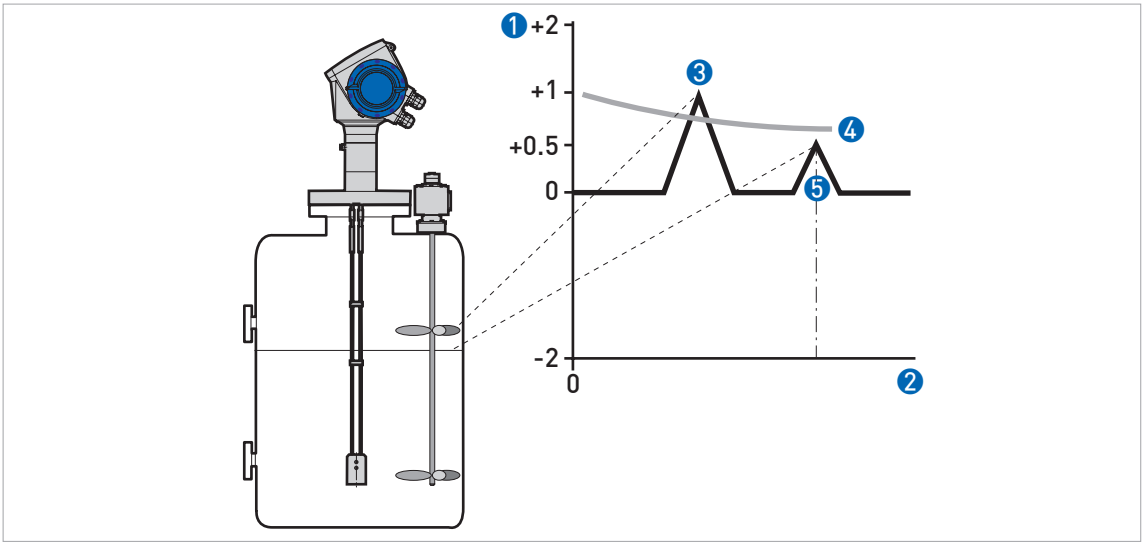


Figure 6-12: **Voltage/distance graph: level below a large interference signal**

1. Voltage amplitude of the signal in Volts
2. Distance from the process connection
3. Large parasite signal (an agitator in this example)
4. Threshold
5. Level signal

But you can filter a parasite or an area of parasites with the snapshot function. This procedure tells you how to use the snapshot filter:

- Look at the signal screen in operator mode.

➲ Find the likely position of the parasite.

- Look in the tank or at a drawing of internal tank parts.

➲ Get the dimensions and position of the object that shows as the parasite.

- Empty the tank.
- Go to **supervisor mode > quick setup > setup mode > snapshot**
- Do the procedure.
- Save the settings.
- Make sure that the snapshot filter is on.
- Fill the tank.

➲ The instrument will ignore the large parasite signal and use the first signal it finds.

6.4.11 How to measure products with a low dielectric constant (ε_r)

The instrument can measure the level of liquids and solids with low dielectric constants. The minimum value depends on the probe type and the measuring mode.

Measuring mode limits

Measuring mode	Probe type	Minimum dielectric constant
Direct	Coaxial	1.4
	All other probes	1.6
TBF	All probes	1.1

In direct mode, the instrument directly receives the reflection of the signal from the surface of the tank contents.

TBF mode lets the instrument measure one product with low ε_r. Unlike direct mode, the signal travels through the liquid or solid to the end of the probe. It is reflected back to the electronics. The liquid or solid must have a stable dielectric constant for accurate measurement.

How to prepare an installation for an instrument that measures in TBF mode

- If the probe end is not attached, the minimum distance between the probe end and the tank bottom must be 300 mm / 12".
- There must be no objects in a diameter of 600 mm / 24" around the probe (except coaxial probes).

How to configure the instrument to measure in TBF mode

- Go to **Supervisor > Advanced setup > Installation setup > Measuring mode**.
- Select TBF from the menu. Press ↵.
- If you know the exact value of the product's dielectric constant, go to **Supervisor > Advanced setup > Installation setup > Product Er**.
- Type in the exact value. Press ↵.

CAUTION!
Do not change the product ε_r value in Product ε_r (menu item C.1.14) unless the new value is known. If an incorrect value is used, the instrument will not measure accurately.

INFORMATION!
*The instrument usually measures in **automatic measurement mode**. If it cannot find a signal in **direct mode**, the instrument will switch automatically to **TBF mode**.*

6.4.12 How to decrease the length of probes

INFORMATION!
This information is for :
- *Ø4mm/0.15" double cable,*
- *single rod,*
- *Ø2 mm/0.08" single cable and*
- *Ø4 mm/0.15" single cable probes only*

WARNING!
Do not change the length of coaxial, Ø8 mm/0.3" single cable and double rod probes. This will damage the probe.

How to decrease the length of single rod probes

- Measure the length of the rod from the flange facing.
- Cut the rod to the correct length.
- Go to **Supervisor > Advanced setup > Installation > Probe length**.
- Type in the new value. Press ↵.
- Press > and △ (Esc) at the same time to exit to the "save settings" window.
- Select **Save** and press ↵.

INFORMATION!
*If you cannot measure the length of the probe, you can use **Quick Setup > Setup Mode > Auto Probe Length** as an alternative. But you must do this procedure when the tank is empty.*

How to decrease the length of cable probes

- Loosen the socket set screws that hold the counterweight.

➲ Use a 3 mm allen wrench.

- Remove the counterweight.
- Measure the length of the cable from the flange facing.

➲ Add the length of the counterweight to get the total probe length. Subtract the length of the cable engaged in the counterweight. Refer to the diagram after this procedure.

- Cut the cable to the correct length.
- Attach the cable to the counterweight. Tighten the socket set screws.

➲ Use a 3 mm allen wrench.

- Go to **Supervisor > Advanced setup > Installation > Probe length**.
- Type in the new value. Press ↵.
- Press > and △ (Esc) at the same time to exit to the "save settings" window.
- Select **Save** and press ↵.

INFORMATION!
*If you cannot measure the length of the probe, you can use **Quick Setup > Setup Mode > Auto Probe Length** as an alternative. But you must do this procedure when the tank is empty.*

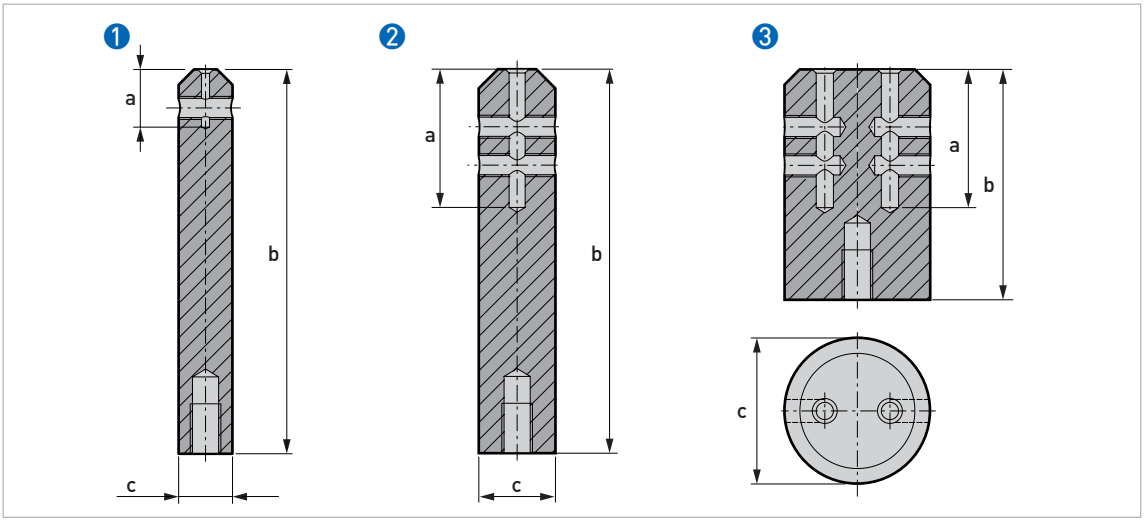


Figure 6-13: **Dimensions of the counterweights**

1. Ø2 mm/0.08" single cable probe
2. Ø4 mm/0.15" single cable probe
3. Ø4 mm/0.15" double cable probe

Dimensions in mm

Probe type	Dimensions [mm]		
	a	b	Øc
Single cable Ø2 mm	15	100	14
Single cable Ø4 mm	36	100	20
Double cable Ø4 mm	36	60	38

Dimensions in inches

Probe type	Dimensions [inches]		
	a	b	Øc
Single cable Ø0.08"	0.6	3.9	0.5
Single cable Ø0.15"	1.4	3.9	0.8
Double cable Ø0.15"	1.4	2.4	1.5

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 KROHNE for further information.

6.6 Errors

6.6.1 General information

Indication of errors

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

Figure 6-14: **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.

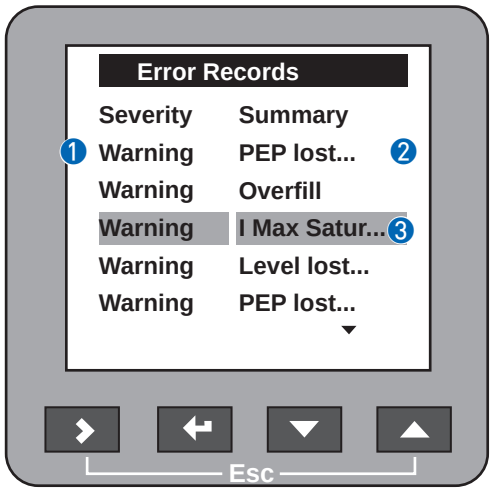


Figure 6-15: **Error records in supervisor mode**

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 *General information* on page 102.

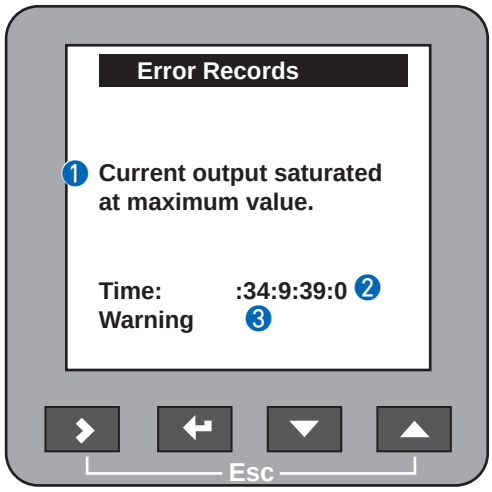


Figure 6-16: **Description of the error**

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

The time since the error occured is measured in **Days:Hours:Minutes:Seconds**. It only includes the time when the instrument is energized. The error is saved in the memory of the instrument when it is switched off. The counter continues when the instrument 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.2.12), the measured value is not correct. The output current goes to the value set in menu items C.3.5 Error Handling (Ouput 1) and C.4.5 Error Handling (Output 2). For more data about the menu items, refer to *C. Advanced setup* on page 77.
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 is 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 instrument until the ambient temperature is back in the given range. If the problem continues, contact the supplier.
Self-test manager			
Self Test has failed	E	The instrument did not self-test correctly.	Contact the supplier.

Error Message	Error code	Description	Corrective action

Measurement status

Level measurement lost	E ❶	The instrument can no longer find the product surface. The measurement is held at the last measured value in the blocking distance.	Check the tank contents using another method of measurement. If the tank is empty (the level is below the end of the probe), then fill the tank until product level is in the measurement range. If the tank is full (the level is in the blocking distance), then remove the contents from the tank until the level is back in the measuring range. If the product was lost and the tank is neither full nor empty, wait for the instrument to find the level again.
		When the level return signal and the probe end return signal are lost. This is applicable to automatic (direct/TBF) measurement mode only.	If the instrument is in direct mode, adjust the level threshold (menu item C.1.16). If the instrument is in TBF mode, adjust the probe end threshold (menu item C.1.18). For more data, refer to *Thresholds and parasite signals* on page 94.
Level measurement low	W	The product is in the empty area. The measurement is held at the the sensor length.	Fill the tank to at least the bottom of the measuring range to continue measurement.
		The product is outside the measuring range. The measurement is incorrect or held at the last measured value by the instrument.	
Measurement old	E	This error occurs if the power supply is not sufficient to operate the instrument correctly for 1 minute. After 1 minute the error message "Measurement old" is recorded. You can change this time in supervisor mode. Go to **advanced setup > output 1 > error handling delay** (5...300 seconds).	Make sure that the power supply for terminal 1has a min./max. value of 14...30 VDC (10...30 VDC for terminal 2) when current output is at 22 mA.

Error Message	Error code	Description	Corrective action
Interface measurement lost ❷	W ❸	The device can no longer find the interface.	Check the tank contents using another procedure. If the interface is too low (the interface is below the end of the probe), then fill the tank with interface product until it is in the measurement range. If the interface too high (the interface is in blocking distance), then remove the contents from tank until the interface is back in the measuring range. If it is none of these two, then there is possibly an emulsion at the interface. Wait for the instrument to find the interface again.
Interface measurement low ❷	W	The product is lost in the empty area. The measurement is held at the sensor length.	Fill the tank to at least the bottom of the measuring range to continue measurement.
Layer measurement low ❷	W	The layer is less than 50 mm / 2" thick.	Fill the tank with top product until it is at least 50 mm (2") thick.

Signal status

Reference pulse low amplitude	W	Reference amplitude is less than reference threshold 1. This fault occurs because of electrostatic discharge in solid applications.	Check device and tank installation and earthing points immediately. For more data, refer to *Installation* on page 14.
Reference pulse lost	E	Reference amplitude is less than reference threshold 2. This fault occurs because of electrostatic discharge in solid applications.	Contact your supplier to check that the electronics are still functioning correctly. Make sure that your installation has ESD protection. For more data, refer to *Nozzles on conical silos* on page 40.
Level pulse lost	W	This shows that the instrument lost the level signal in direct mode but finds the signal for the end of the probe. It will continue to measure level in tank bottom following (TBF) mode. This warning is only displayed in automatic measurement mode.	The instrument continues to measure in TBF mode. If the instrument does not measure correctly, make sure the amplitude of the level threshold is correct. For more data, refer to *Thresholds and parasite signals* on page 94.

Error Message	Error code	Description	Corrective action
Probe end pulse lost	W	The probe end pulse amplitude is less than the probe end threshold. This means the instrument cannot find the probe end to measure level in TBF mode. The instrument uses direct mode as an alternative to TBF mode. This error is only displayed in automatic measurement mode.	The dielectric constant of the tank contents is too high. Check that the **measurement mode** is set to **Direct** or **Automatic**.

Operating status

Overfill	W ❸	The tank is full. The level or the interface signal is lost in the full area. The measurement is held at the blocking distance value.	This is also used for applications with WHG approval. Danger of overflow! Remove the contents from the tank until it is at a safe level.
Dielectric constant out of range	W	The dielectric constant, ε_r, calculated by the instrument is outside the given range. This only occurs if the dielectric constant is automatically calculated (not set by default).	Check that the probe does not touch the process connection (short circuit). Attach the end of the probe or install it in a stilling well or bypass chamber.
			Check the programmed probe length in supervisor mode. Go to **Supervisor > Test > Information > Probe length**. If the setting does not agree with the real value,change this value in Supervisor mode. Go to **Supervisor > Advanced setup > Installation setup > Probe length modif.**.

Hardware status

Front end out of order	E	The instrument's hardware is defective.	Contact your supplier.
5 volts faulty	E	The instrument's hardware is defective.	Contact your supplier.
Time base fault or not running	E	The instrument's hardware is defective.	Contact your supplier.
Electronic offset	W	The instrument's hardware is defective.	Contact your supplier.
Time out measurement cycle	E	The instrument's hardware is defective.	Contact your supplier.

❶ can be set to warning code (W) in the service menu
❷ interface application only
❸ can be set to error code (E) in the service menu

7.1 General safety information

7.1.1 Scope of the document

These instructions are applicable only to the explosion-protection version of the OPTIFLEX 1300 C TDR level transmitter. For all other data, use the Quick Start and other chapters of the Handbook. If you do not have these documents, please contact the nearest KROHNE office or download them from KROHNE's website www.krohne.com.

INFORMATION!
The information in this chapter only contains the data applicable to explosion protection. The technical data for the non-Ex version in the Handbook shall be valid in its current version, provided that it is not rendered invalid or replaced by this chapter.

WARNING!
Installation, commissioning and maintenance may only be carried out by "Personnel trained in explosion protection".

7.1.2 Instrument description

The OPTIFLEX 1300 C TDR (Time Domain Reflectometry) level meter measures the level, distance, volume and mass of liquids, liquid gases, pastes, powders, slurries and granular products. It is also suitable for the continuous and simultaneous measurement of level and interface of 2 liquids. Measurements are displayed via a DTM (device type manager) for remote communication or an optional integrated display screen with wizard-driven setup and online help functions.

The OPTIFLEX 1300 C is approved for use in potentially explosive atmospheres when equipped with the appropriate options.

7.1.3 Standards and approvals

DANGER!
In compliance with European Directive 94/9/EC (ATEX 100a), the ATEX version of the instrument described in these Supplementary Instructions conforms to European Standards EN 50014 +A1 +A2, EN 50018 +A1, EN 50020, EN 50281-1-1 +A1, EN 50284 and EN 60079-15. The EEx ia and EEx d [ia] versions are certified for use in hazardous areas by the KEMA Quality B.V. under KEMA 04ATEX1219 X. The EEx nA version is certified for use in zone 2 under our sole responsibility.

WARNING!
Carefully read the ATEX approval certificate for the OPTIFLEX 1300 C. Obey the boundary conditions.

7.1.4 ATEX nameplates

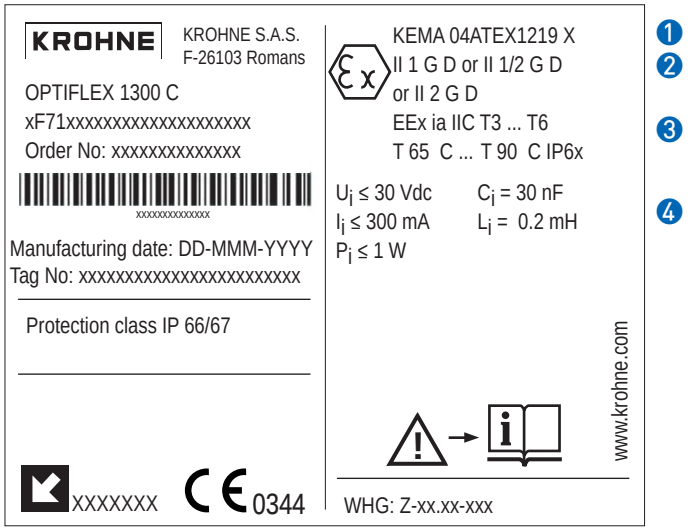


Figure 7-1: **EEx ia nameplate**

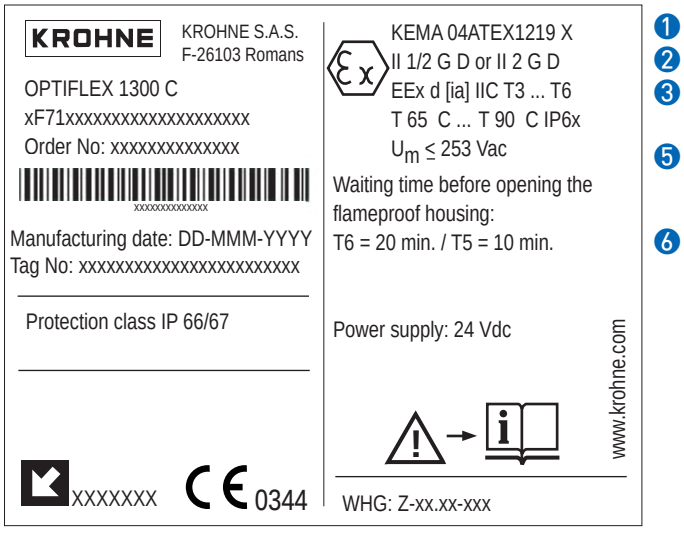


Figure 7-2: **EEx d[ia] nameplate**

1. ATEX certifcation agency code. Refer also to **temperature classes**.
2. Equipment approval categories
3. Types of device protection including approved Gas Groups (IIA, IIB or IIC) and temperature classes for hazardous areas and maximum surface temperature (please refer to the certificate)
4. Intrinsically-safe circuit data
5. Maximum voltage in accordance with EN 50014
6. Minimum waiting time after power-off before it is safe to open the terminal compartment

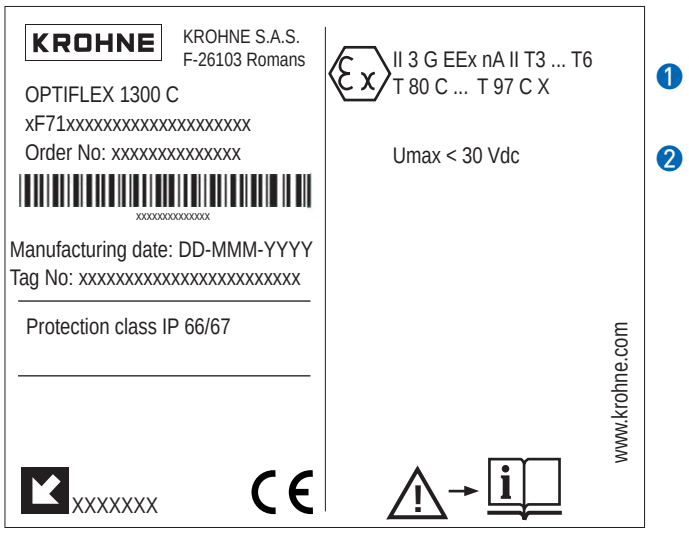


Figure 7-3: **EEx nA nameplate**

1. Equipment approval categories, types of device protection including approved Gas Groups (II) and temperature classes for hazardous areas and maximum surface temperature (please refer to the certificate)
2. Maximum voltage in accordance with EN 50014

7.2 Installation

7.2.1 Precautions

General notes

WARNING!
When you install the device, obey the conditions in the EC-Type Examination certificate. These conditions include:

- *The special conditions for safe use.*
- *The Essential Health and Safety Requirements.*

DANGER!
This installation must agree with EN 60079-14: Electrical installations in hazardous areas.

Electrostatic discharge

DANGER!
Risk of electrostatic discharge from the blue plastic sun cover and the conduit of the remote housing option. Make sure that all personnel and equipment are correctly grounded.

Take the necessary antistatic precautions if you:

- handle,
- install or
- use

the instrument in potentially explosive atmospheres. Do not install in a location (near to ventilation systems, for example) where the electrostatic charge can increase.

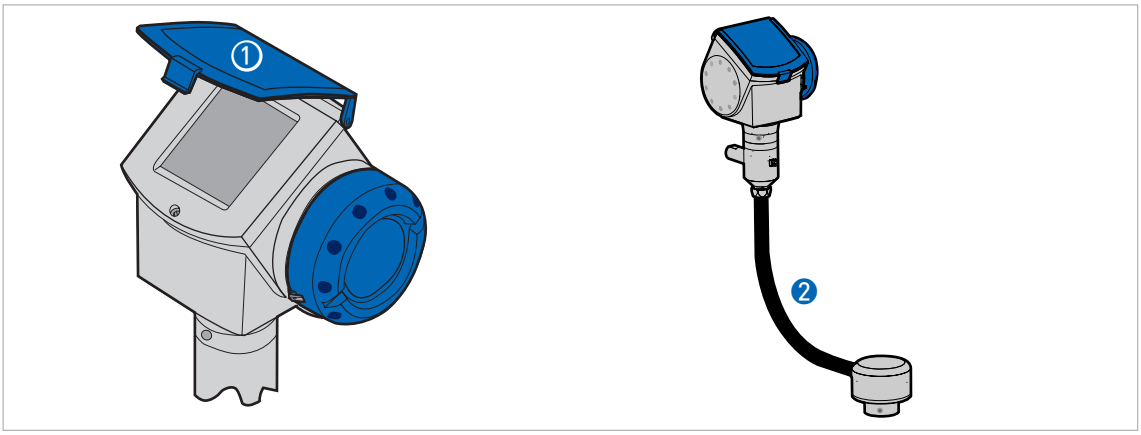


Figure 7-4: **Risk of ESD: sun cover and remote housing conduit**

1 Sun cover
2 Conduit of the remote housing option

Special conditions

WARNING!
Aluminium housing: Possible source of ignition in a potentially explosive atmosphere.

The housing is made of either aluminium alloy or stainless steel. If the instrument has an aluminium alloy housing, make sure that iron/steel objects do not hit or rub against the instrument.

NOTE!
If the instrument is approved for operation in zone 2, the display agrees with the low-energy impact test requirements for this certification.

7.2.2 Operating conditions

The allowable ambient temperature and corresponding flange temperature range for the instrument depends on the ATEX equipment category and temperature classes marked on the nameplate.

Ambient and flange temperature

The ATEX equipment category and temperature class give the ambient temperature and related flange temperature ranges for the instrument.

Equipment category II 1 G (EEx ia instruments only)

Temperature class	Ambient temperature		Flange temperature	
	[°C]	[°F]	[°C]	[°F]
T6	-20...+60	-4...+140	-20...+60	-4...+140

Equipment category II 1/2 G

Temperature class	Ambient temperature		Flange temperature	
	[°C]	[°F]	[°C]	[°F]
T6	-40...+60	-40...+140	-20...+60	-4...+140
T5	-40...+75	-40...+167	-20...+60	-4...+140
T4	-40...+85	-40...+185	-20...+60	-4...+140

Equipment category II 2 G

Temperature class	Ambient temperature				Flange temperature	
	Ø2 mm/Ø0.08" single cable probe		All other probes			
	°C	°F	°C	°F	°C	°F
T6	-40...+60	-40...+140	-40...+60	-40...+140	-40...+60	-40...+140
	-40...+54	-40...+129	-40...+55	-40...+131	-40...+80	-40...+176
T5	-40...+75	-40...+167	-40...+75	-40...+167	-40...+75	-40...+167
	-40...+69	-40...+156	-40...+70	-40...+158	-40...+95	-40...+203
T4	-40...+85	-40...+185	-40...+85	-40...+185	-40...+85	-40...+185
	-40...+77	-40...+171	-40...+80	-40...+176	-40...+110	-40...+230
	-40...+70	-40...+158	-40...+75	-40...+167	-40...+135	-40...+275
T3	-40...+65	-40...+149	-40...+70	-40...+158	-40...+150	-40...+302
	-	-	-40...+65	-40...+149	-40...+180	-40...+356
	-	-	-40...+60	-40...+140	-40...+200	-40...+392

Equipment category II 3 G (not applicable for Ø2 mm / Ø0.08" single cable probe - pending)

Temperature class	Ambient temperature		Flange temperature	
	°C	°F	°C	°F
T6	-40...+61	-40...+142	-40...+85	-40...+185
T5	-40...+76	-40...+169	-40...+100	-40...+212
T4	-40...+76	-40...+169	-40...+110	-40...+230
	-40...+70	-40...+158	-40...+135	-40...+275
T3	-40...+66	-40...+151	-40...+150	-40...+302
	-40...+57	-40...+135	-40...+180	-40...+356
	-40...+52	-40...+126	-40...+200	-40...+392

Equipment category II 1 D (EEx ia instruments only), II 1/2 D and II 2 D

Ambient temperature		Flange temperature	
[°C]	[°F]	[°C]	[°F]
-40...+60	-40...+140	-40...+200	-40...+392

Maximum surface temperature of the housing

Equipment category II 1 D, II 1/2 D and II 2 D

Max. ambient temperature				Max. flange temperature		Max. surface temperature	
Ø2 mm/Ø0.08" single cable probe		All other probes					
°C	°F	°C	°F	°C	°F	°C	°F
+54	+129	+55	+131	+80	+176	+65	+149
+69	+156	+70	+158	+95	+203	+80	+176
+77	+171	+80	+176	+110	+230	≤+90	≤+194
+70	+158	+75	+167	+135	+275		
+65	+140	+70	+158	+150	+302		
-	-	+60	+140	+200	+392		

Equipment category II 3 G
(not applicable for Ø2 mm / Ø0.08" single cable probe - pending)

Max. ambient temperature		Max. flange temperature		Max. surface temperature	
°C	°F	°C	°F	°C	°F
+61	+142	+85	+176	+80	+176
+76	+169	+100	+212	+95	+203
+76	+169	+110	+230	+97	+207
+70	+158	+135	+275	+97	+207
+66	+151	+150	+302	+97	+207
+57	+135	+180	+356	+97	+207
+52	+126	+200	+392	+97	+207

Process pressure

Equipment category	Allowable process pressure	
	[kPa]	[psi]
1 G, 1 D, 1/2 G or 1/2 D	80...110 ❶	11.6...16 ❶
Others	As per non-Ex instrument	As per non-Ex instrument

❶ atmospheric pressure

7.3 Electrical connections

7.3.1 General notes

WARNING!

- *De-energize the circuit.*
- *Do not use the earth terminal in the wiring compartment. Use the equipotential bonding system. Refer to the **EEx d [ia] equipment: electrical schema** section.*
- *If ambient temperature >70° C, use heat-resistant cables and cable glands certified for continuous operation above 85° C.*

7.3.2 Terminal compartment

How to open the terminal compartment

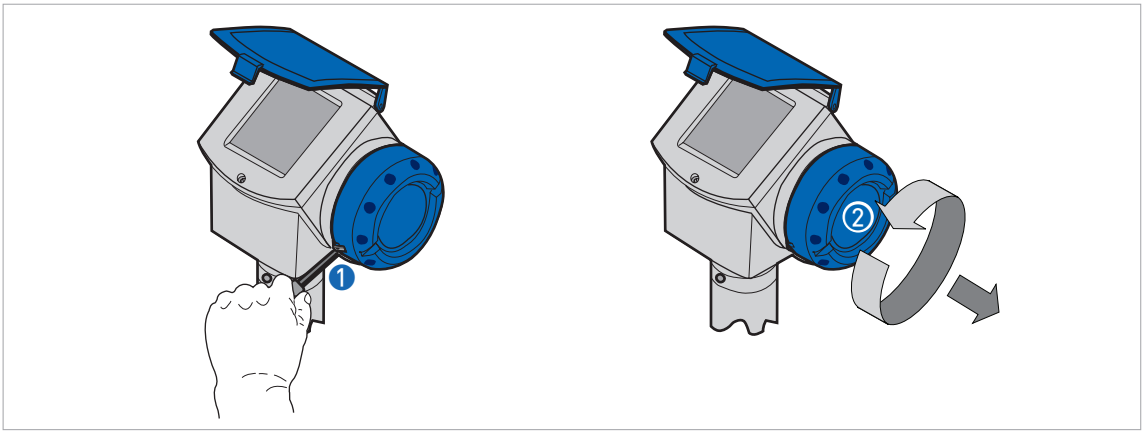


Figure 7-5: **How to open the terminal compartment**

1 Cover stop
2 Terminal compartment cover

WARNING!
Do not remove the terminal compartment cover while the electrical power is connected.

- De-energize the circuit.
- If the instrument is not isolated, do not remove the terminal compartment cover immediately.
- After the time given in the table that follows, remove the cover stop 1.

➲ Use a 3 mm allen wrench.

- Remove the terminal compartment cover 2.

Time necessary to de-energize an Ex d [ia]-approved instrument

Temperature class	Time to de-energize the Ex d [ia]-approved instrument [minutes]
T6	20
T5	10
T4, T3	Not necessary

How to close the terminal compartment

WARNING!
Ex d [ia] applications: obey the instructions that follow:

1. Attach the terminal compartment cover 2.
   - ➲ Turn the terminal compartment cover carefully to prevent damage to the thread and the gasket.
2. Make sure that the terminal compartment cover is tight.
3. Attach the cover stop 1.
   - ➲ Use a 3 mm allen wrench.
4. Make sure that the cover stop 1 screw is tight.

7.3.3 Terminal tightening capacity

The terminal tightening capacity for terminals 1 and 2 is:

Type of wire	Terminal tightening capacity	
	[mm²]	[inches²]
Rigid	4	0.0062
Flexible	2.5	0.0039

7.3.4 EEx ia equipment

How to connect the electrical cables

INFORMATION!
- *Cable entries are supplied on customer demand. If you supply the cable entries, this part must have a degree of ingress protection IP≥6x (EN 60529).*

- Use the electrical connection procedure in the Handbook.
- If possible, use galvanically-isolated equipment.
- Supply the EEx i equipment connected to the instrument. Use only certified intrinsically-safe equipment.
- Connect only to separate certified, intrinsically-safe circuits. Make sure that the electrical circuit characteristics are not more than the values below.

Maximum intrinsically-safe values for the electrical circuit

- $U_i \leq 30$ V
- $I_i \leq 300$ mA
- $P_i \leq 1$ W
- $C_i = 30$ nF
- $L_i = 0.2$ mH

Supply voltage

Terminal	Minimum voltage at terminal [VDC]	Maximum voltage at terminal [VDC]
1 (U_{S1})	14 ❶	30 ❶
2 (U_{S2}) ❷	10 ❶	30 ❶

❶ for an output of 22 mA
❷ use a second power supply. This power supply energizes terminal 2 only.

Electrical schema

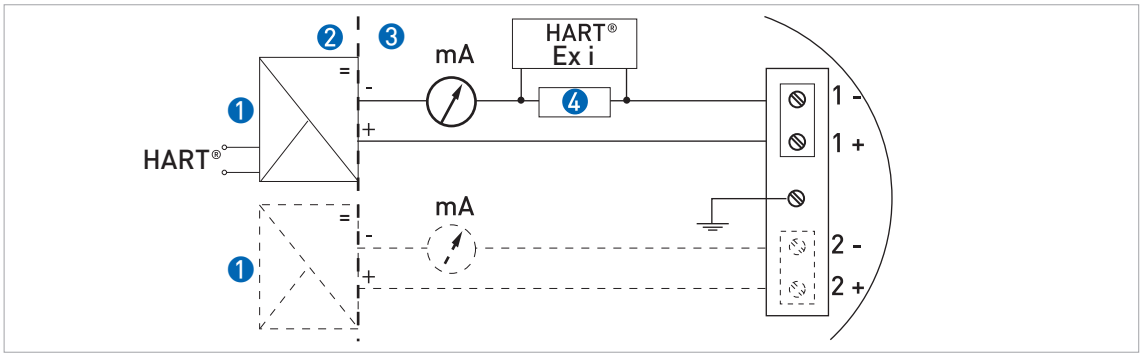


Figure 7-6: **Electrical schema for Ex i-approved equipment**

❶ Intrinsically-safe power supply (use second power supply for optional terminal 2)
❷ Non-Ex zone
❸ Ex zone
❹ Resistor for HART® communication

7.3.5 EEx d [ia] equipment

General notes

EEx d [ia]-approved equipment have two separate compartments. The electronics block compartment is Ex ia-approved and the terminals compartment is Ex d-approved.

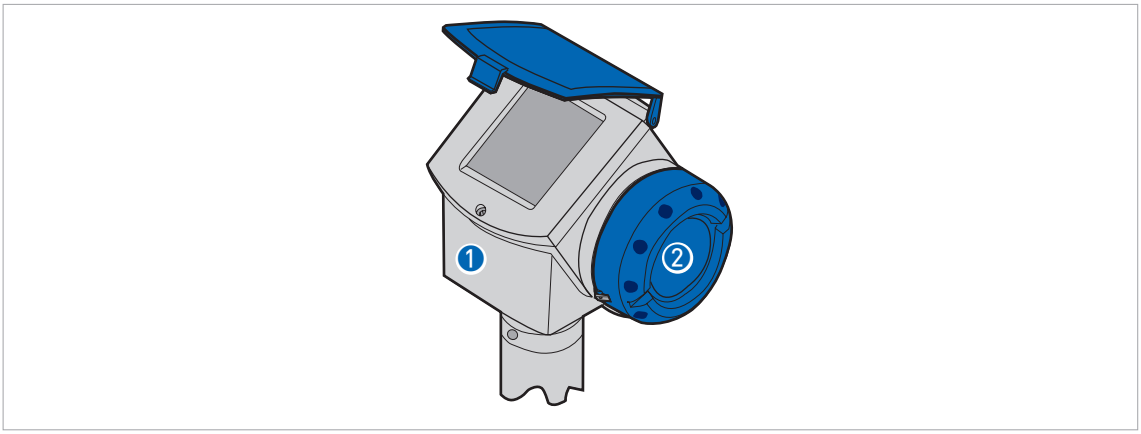


Figure 7-7: **Compartments in EEx d [ia]-approved equipment**

1. Ex ia compartment
2. Terminal (Ex d) compartment

NOTE!
If you must open the Ex ia compartment and remove the electronics blocks for servicing, it is not necessary to disconnect the wires in the Ex d compartment.

How to connect the electrical cables

INFORMATION!
Cable entries are supplied on customer demand. If you supply the cable entries, this part must have a degree of ingress protection IP≥6x (EN 60529).

- Use only flameproof and EEx d-approved cable entries and plugs.
- If you use only one cable entry, seal the other one with an EEx d-approved plug.
- All EEx d-approved installations must agree with European standard EN 50018.

Conduit entries

- Connect the instrument to an EEx d-approved conduit system.
- Install the applicable EEx d-approved sealing device. For more data, refer to European Standard EN 50018.

- If you use only one cable entry, seal the other one with an EEx d-approved plug.

Load resistor

- Connect the load resistor to the positive terminal of the power supply.
- Ground the negative connection.
- If the load resistor has to be connected to the negative terminal, the loop resistance must not be more than 250 ohms.

CAUTION!
Do not ground the positive connection.

Supply voltage

Terminal	Minimum voltage at terminal [VDC]	Maximum voltage at terminal [VDC]
1 (U_{S1})	20 ❶	36 ❶
2 (U_{S2}) ❷	10 ❶	30 ❶

❶ for an output of 22 mA
❷ use a second power supply. This power supply energizes terminal 2 only.

Electrical schema

CAUTION!
Make sure that you connect the load resistor to the positive side.

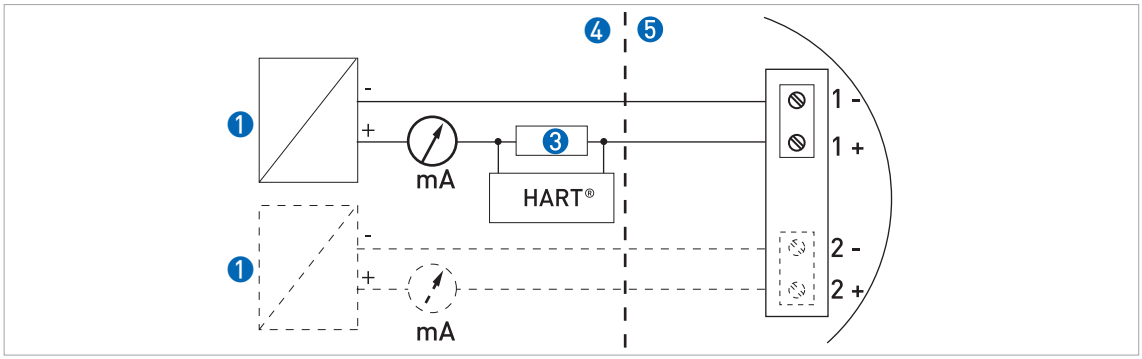


Figure 7-8: **Electrical schema for Ex d [ia]-approved equipment (with galvanic isolation)**

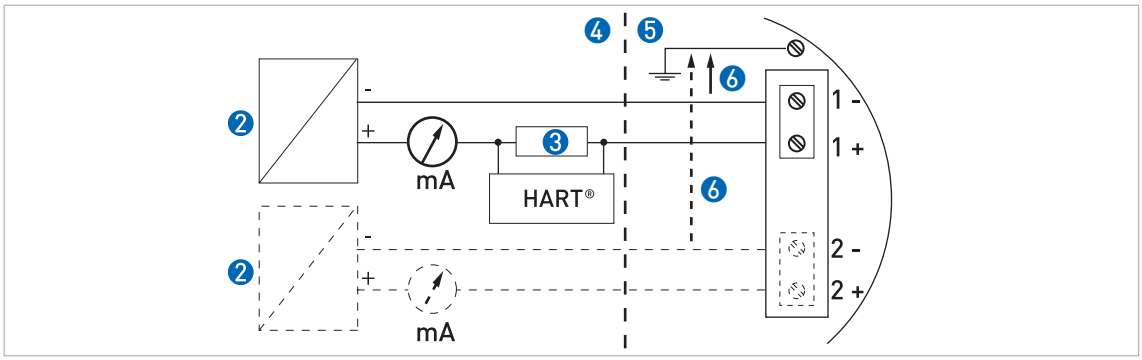


Figure 7-9: **Electrical schema for Ex d [ia]-approved equipment (without galvanic isolation)**

1. Galvanically-isolated power supply (use a second power supply for optional terminal 2)
2. Power supply (use a second power supply for optional terminal 2)
3. Resistor for HART® communication
4. Non-Ex zone
5. Ex zone
6. |U| < 5 V

7.3.6 EEx nA equipment

How to connect the electrical cables

INFORMATION!

- *Cable entries are supplied on customer demand. If you supply the cable entries, this part must have a degree of ingress protection IP≥54 (EN 60529).*

- Use the electrical connection procedure in the Handbook.
- If you use only one entry, seal the other one with a plug.

Supply voltage

Terminal	Minimum voltage at terminal [VDC]	Maximum voltage at terminal [VDC]
1 (U_{S1})	14 ❶	30 ❶
2 (U_{S2}) ❷	10 ❶	30 ❶

❶ for an output of 22 mA
❷ use a second power supply. This power supply energizes terminal 2 only.

Electrical schema

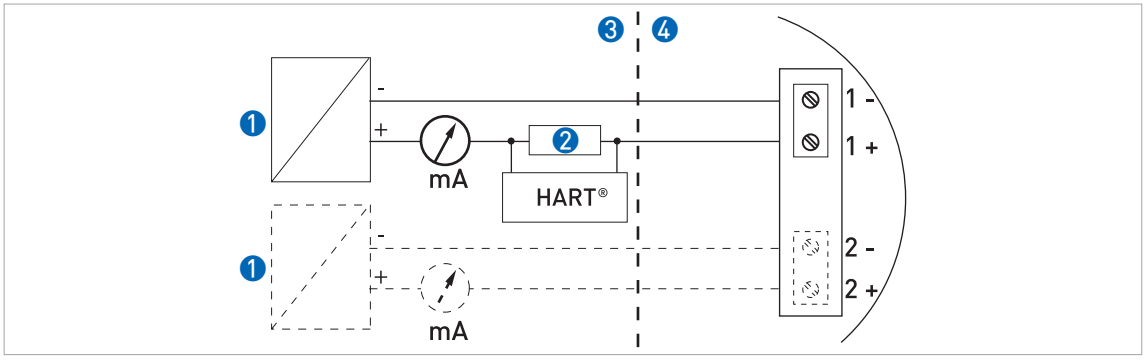


Figure 7-10: **Electrical schema for Ex nA-approved equipment**

❶ Power supply (use a second power supply for optional terminal 2)
❷ Resistor for HART® communication
❸ Non-Ex zone
❹ Ex zone

7.4 Start-up

WARNING!
Make sure that it is safe to supply electrical power. Do a start-up check:

- Are the wetted components (gasket, flange and probe) resistant to corrosion by the tank product?
- Does the information given on the nameplate agree with the application?
- Did you connect the equipotential bonding system correctly?
- **EEx d applications:** Are the cable entries, plugs and adaptors EEx d-approved?
- **EEx i applications:** Are you using an intrinsic barrier within the correct parameters? For more data, refer to *EEx ia equipment* on page 116. The electrical circuit characteristics must not be more than the maximum intrinsically-safe values.
- Did you install the correct cable entries? Is the terminal compartment correctly sealed?

7.5 Service

For service data, refer to *Service* on page 123.

8.1 Periodic maintenance

No maintenance is necessary.

8.2 Keep the instrument clean

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

DANGER!
Risk of electrostatic discharge from the blue plastic sun cover and the conduit of the remote housing option.

Obey these instructions:

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

8.3 How to replace instrument components

8.3.1 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 17.
- The removal and installation of the back end and the front end / high frequency (HF) combined module.
- 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 KROHNE-authorized service staff to repair the instrument.

8.3.2 Replacement of the display cover

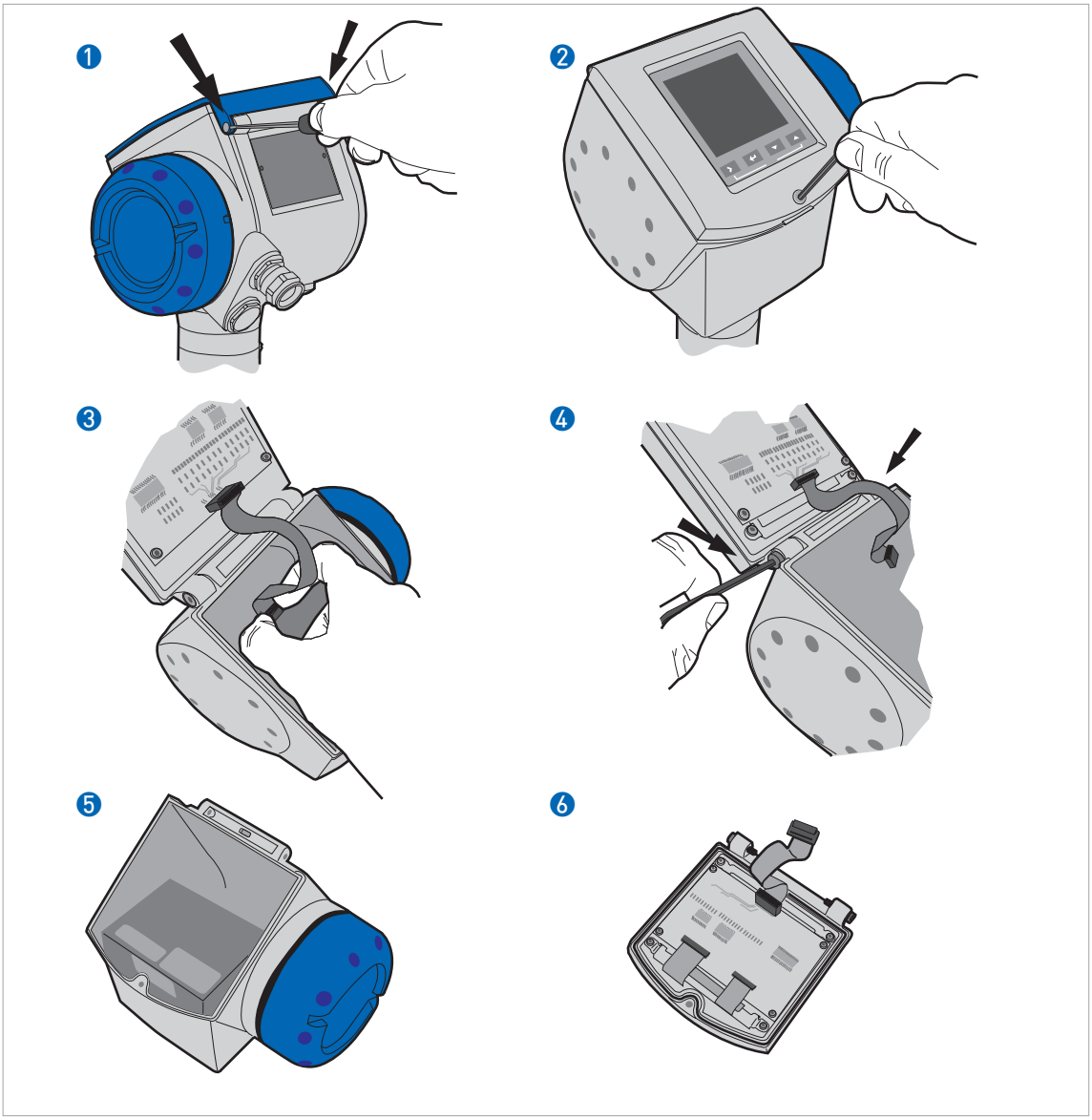


Figure 8-1: **Removal of the instrument display cover**

Equipment needed (not supplied):

- Flat 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 flat screwdriver. Remove the blue 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 blue sun cover. Attach the 2 pins that keep the blue sun cover attached to the housing.

8.3.3 Replacement of the combined back end and high-frequency unit

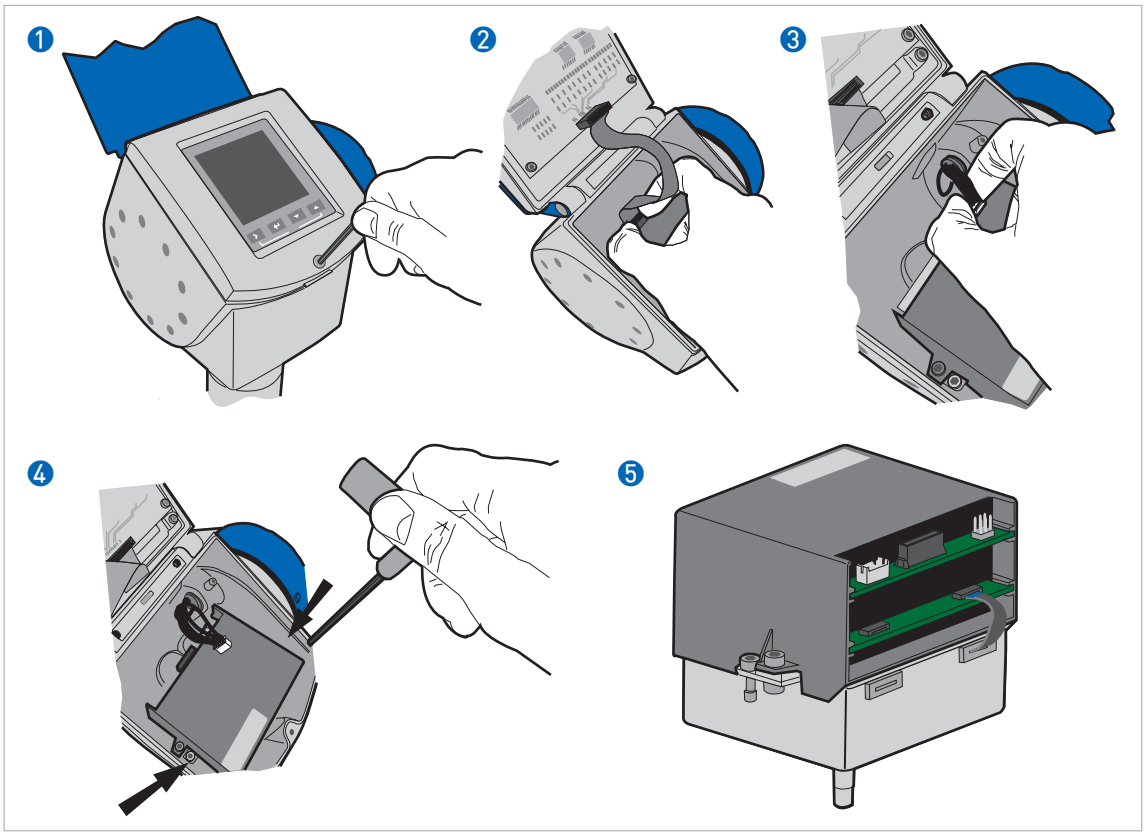


Figure 8-2: **Removal of the combined back end and high-frequency unit**

Equipment needed (not supplied):

- 3 mm Allen wrench (for step 4).

How to remove the combined back end and high-frequency units

1. Loosen the screw on the display. Open the display.
2. Disconnect the ribbon cable from the back end electronics block.
3. Disconnect terminal block wires 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 combined back end and high-frequency unit from the housing. Send the electronics block to an authorized agent for maintenance.

How to attach the combined back end and high-frequency 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 terminal block wires to the back end electronics block.
- Connect the ribbon cable to the back end electronics block.
- Close the display. Tighten the screw on the display.

8.3.4 Replacement of the terminal module

WARNING!
Disconnect the power supply.

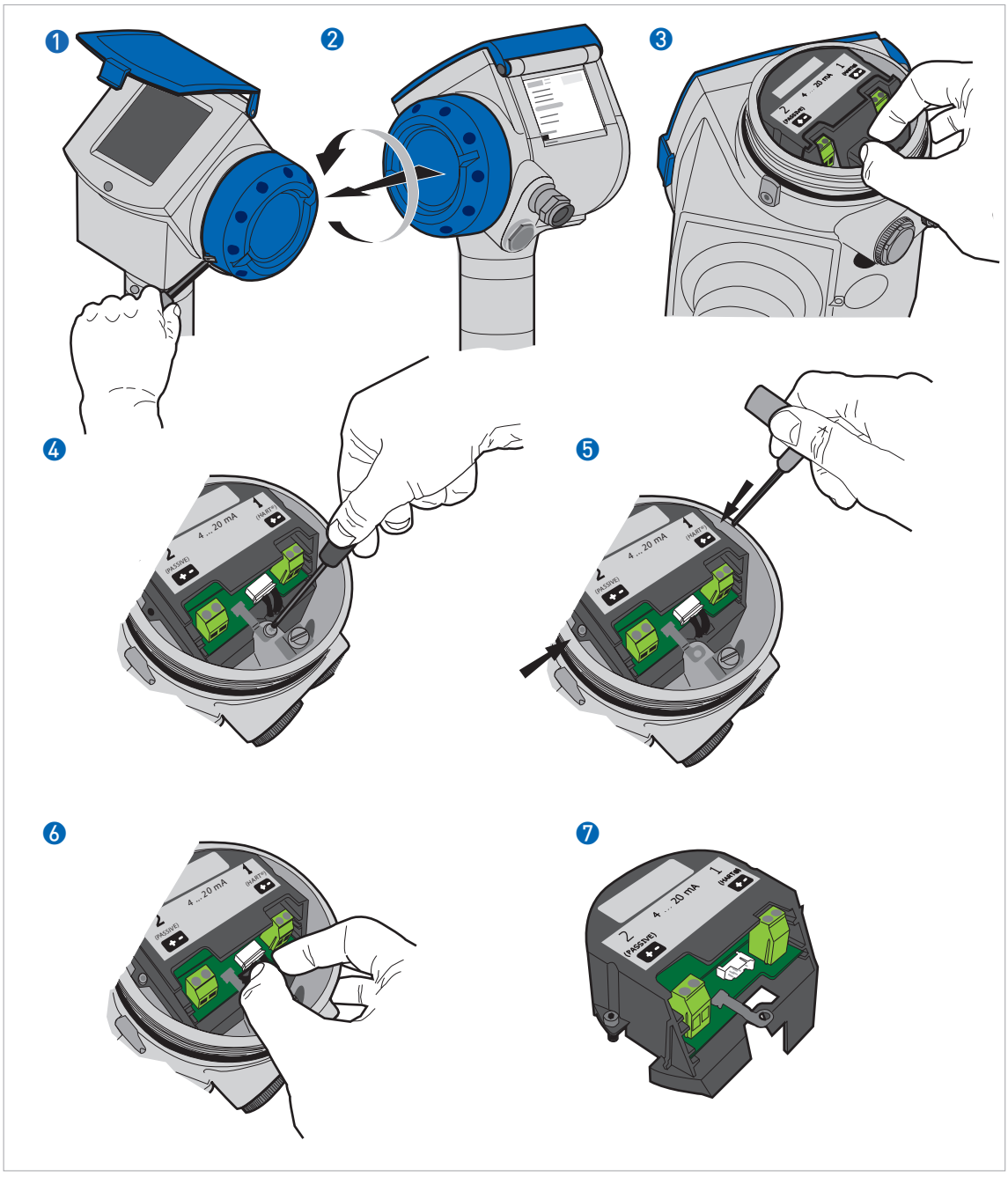


Figure 8-3: **Removal of the terminal module**

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.

8.4 Spare parts availability

8.4.1 General notes

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

8.4.2 List of spare parts

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

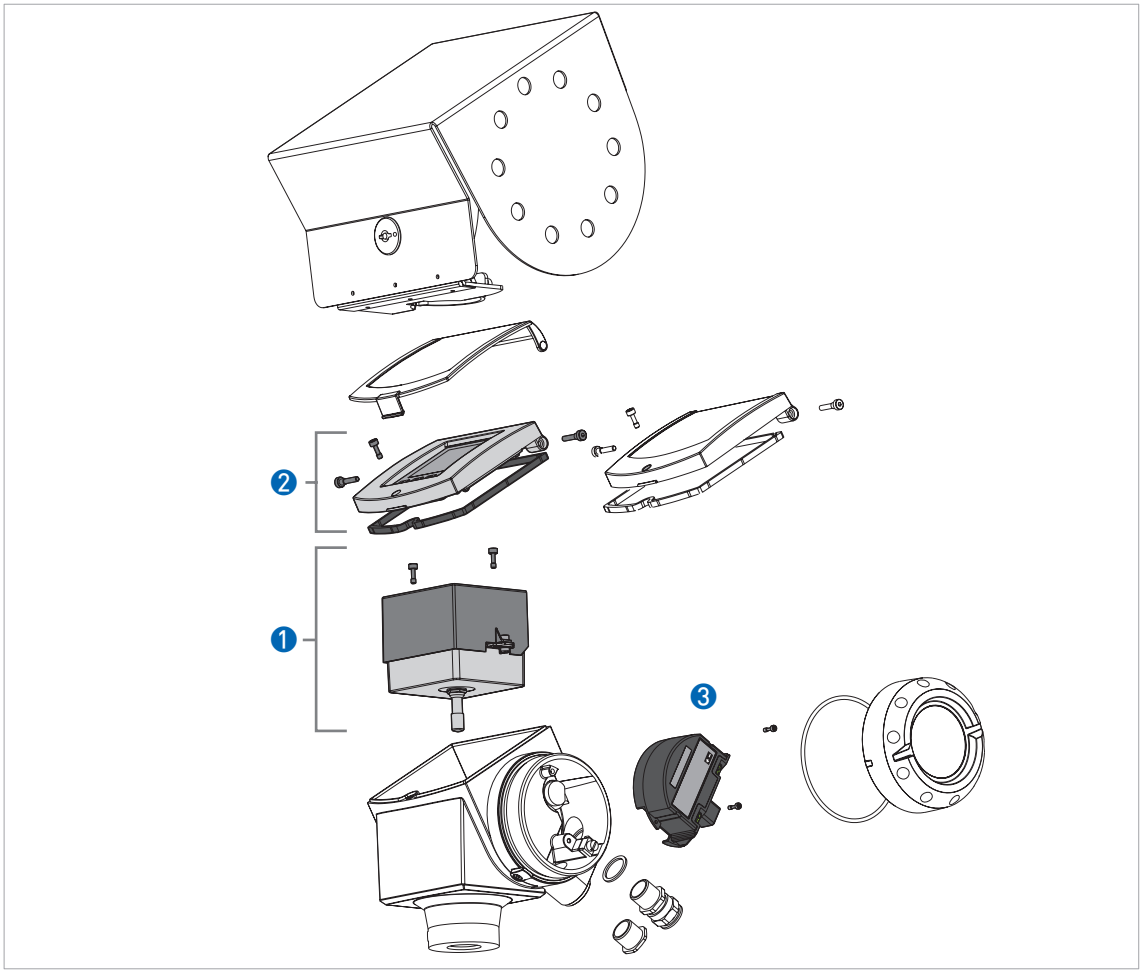


Figure 8-4: **Spare parts**

Part numbers for spare parts

Item number	Description	Quantity	Part reference
❶	Combined backend and high-frequency modules ❶	1	F2139590100
	Screws for the combined back end and HF modules	2	F3177360000
❷	HMI cover and cable ❷	1	XF7040000000050300
❸	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

❶ the customer must send the original back end and HF module to the repair centre. Refer to the replacement procedure in this section. If the instrument is for an interface application, give this information in your request.

❷ this reference includes the gasket and screws

8.4.3 List of accessories

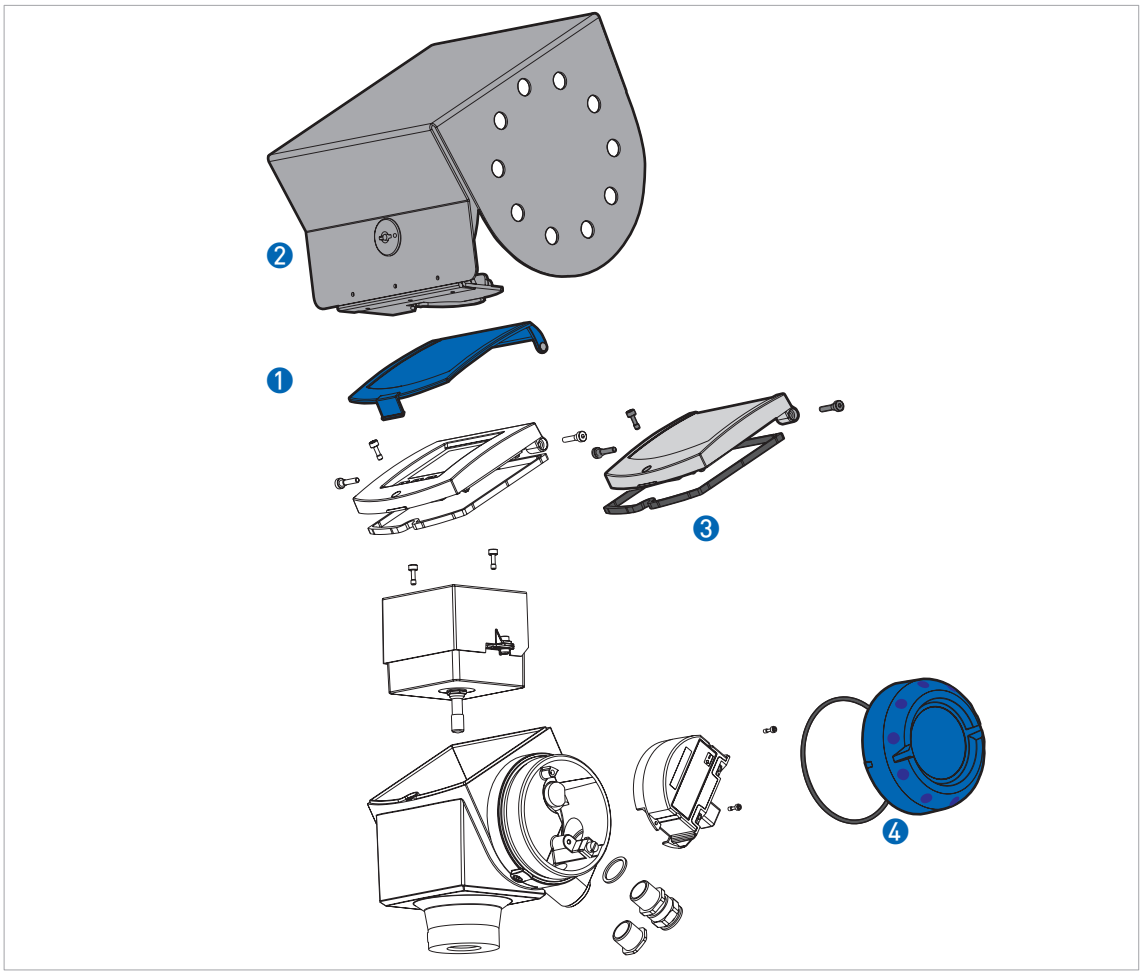


Figure 8-5: **Accessories**

Part numbers for accessories

Item number	Description	Quantity	Part reference
❶	Blue plastic sun cover	1	F3179980000
	Pins for the blue plastic sun cover	2	F3179990000
❷	Stainless steel weather protection	1	F2096340000
❸	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
❹	Wiring compartment cover	1	F3177260100
	Gasket for the wiring compartment cover	1	F5091150000
n/a	Converter VIATOR RS232 / HART® ❶	1	F50919500000
	Converter USB / HART® ❶	1	F50779300000

❶ for HART® or PACTware™ communication

8.5 Service availability

KROHNE provides a variety of services to support its customers after warranty expiration.

Repair, technical support and training can be provided.

NOTE!
For detailed information please contact your local KROHNE representative.

8.6 Returning the device to the manufacturer

8.6.1 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.*

8.6.2 Form (for copying) to accompany a returned instrument

Company:		Address:
Department:		Name:
Tel. No.:		Fax No.:
The meter enclosed, type:		
KROHNE Commission or Series No.:		
has been operated with the following liquid:		
Because this liquid is:		hazardous to water
		toxic
		caustic
		flammable
		We have checked that all cavities in the unit are free from such substances.
		We have flushed out and neutralized all cavities in the unit.
We herewith confirm that in returning this unit there is no risk to man or environment through any residual liquid contained in it.		
Date:		Company stamp:
Signature:		

8.7 Disposal

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

9.1 Technical data

Input

Function	Time Domain Reflectometry (TDR)
Parameter	Level, distance, volume and/or interface
Max. measuring range	
Double rod Ø8 mm / 0.3"	4 m / 13 ft
Single rod Ø8 mm / 0.3"	4 m / 13 ft
Coaxial Ø22 mm / 0.9"	6 m / 20 ft
Double cable Ø4 mm / 0.15"	8 m / 26 ft
Single cable Ø2 mm / 0.08"	35 m / 115 ft
Single cable Ø4 mm / 0.15"	35 m / 115 ft
Single cable Ø8 mm / 0.3"	35 m / 115 ft

Output

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

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%

Accuracy

Resolution	1 mm / 0.04“
Repeatability	±1 mm / ±0.04“
Accuracy (in direct mode)	
Liquids	±3 mm / ±0.12", when distance < 10 m / 33 ft; ±0.03% of measured distance, when distance > 10 m / 33 ft
Powders	±20 mm / ±0.8“
Interface	±10 mm / ±0.4" (εr constant)
Accuracy (in TBF mode)	±20 mm / ±0.8" (εr constant)
Minimum layer (interface)	50 mm / 2"

Process conditions

Ambient temperature	-40...+80°C / -40...+175°F (EEx i: see supplementary operating instructions or approval certificates)
Storage temperature	-40...+85°C / -40...+185°F
Flange temperature	-40...+200°C / -40...+390°F (EEx i: see supplementary operating instructions or approval certificates) ❷
Thermal shock resistance	100°C/min
Operating pressure	-1...300 bar / -14.5...4350 psig; subject to process connection temperature and the probe used ❸
Dielectric constant (εr)	
Level in direct mode	≥1.4 for coaxial probe; ≥1.6 for single and double probes
Interface in direct mode	εr(interface) >> εr(level)²
Level in TBF mode	≥1.1
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

Material

Housing	Aluminium; Stainless steel
Single rod	Stainless steel (1.4404 / 316 L); Hastelloy® C-22 (2.4602)
Double rod	Stainless steel (1.4404 / 316 L); Hastelloy® C-22 (2.4602)
Coaxial	Stainless steel (1.4404 / 316 L); Hastelloy® C-22 (2.4602)
Single cable	Stainless steel (1.4401 / 316); Hastelloy® C-22 (2.4602) (only cable Ø4 mm / 0.15") ❹
Double cable	Stainless steel (1.4401 / 316)
Process fitting	Stainless steel (1.4404 / 316L); Hastelloy ® C-22 (2.4602)
Gaskets	FKM/FPM (-40...+200°C / -40...+390°F); Kalrez® 6375 (-20...+200°C / -5...+390°F) EPDM (-50...+175°C / -60...+345°F)
Weather protection (Option)	Stainless steel (1.4301 / 304)
Protective sheath (Option for single rod only)	PP (-40...+90°C / -40...+194°F); PVC (-15...+80°C / +5...+176°F); PVDF (-50...+150°C / -58...+302°F)
Conduit for remote housing (Option)	Zinc-coated steel in a PVC sheath (-40...+105°C/-40...+220°F)

Process connections

Thread, single cable Ø2 mm / 0.08"	G ½; ½ NPT

Thread, single cable Ø8 mm / 0.3"	G 1½; 1½ NPT
Thread, all other probes	G ¾…1½; ¾…1½ NPT
Flange, single cable Ø8 mm / 0.3"	DN40…150 (PN40 / PN16); 1½"…8" (150 lb / 300 lb); 10K (40…100A) 5
Flange, all other probes	DN25…150 (PN40 / PN16); 1"…8" (150 lb / 300 lb); 10K (40…100A) 5

Electrical connections

Terminals output 1 - Non-Ex / EEx i	14…30 VDC 6
Terminals output 1 - EEx d	20…36 VDC 6
Terminals output 2 - Non-Ex/ EEx i/ EEx d	10…30 VDC 7
Cable entry	M20x1.5; ½ NPT; G ½(not for FM- and CSA-approved devices)
Terminals	0.5…1.5 mm²

User interface

Display	9 lines, 160 x 160 pixels in 8-step greyscale with a 4-button keypad
Operating languages	English, German, French, Italian, Spanish, Portuguese, Japanese, Chinese (Mandarin) and Russian

Approvals

ATEX	ATEX II 1, 1/2, 2 G/D EEx ia IIC T6...T3; ATEX II 1/2, 2 G/D EEx d [ia] IIC T6...T3; ATEX II 3 G EEx nA IIC T6…T3
IECEx	Ex iaD 21 T65…T90 IP 6X; Ex ia IIC T6…T4 IP 66
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 (pending)	In conformity with the German Federal Water Act §19
Other approvals	Gosstandard; PESO (India)

Options and Accessories

Options	Integrated LCD display with sun cover (-20...+60°C / -4...+140°F); ❽
	2nd current output;
	ESD protection (max. 30 kV);
	Secondary METAGLAS seal for dangerous products (ammonia, chlorine, ...);
	Remote housing connected to the probe via a flexible conduit Standard lengths: 2 m / 6.6 ft, 4.5 m / 14.8 ft, 9.5 m / 31.2 ft and 14.5 m / 47.6 ft
Accessories	Weather protection

❶ optional
❷ refer to the pressure/temperature table for probe selection. 315°C / 599°F pending for the high-temperature (HT) version of the Ø2 mm / 0.15" single cable probe.
❸ refer to the pressure/temperature table for probe selection
❹ Hastelloy® C-22 (2.4602) on request for the Ø2 mm / 0.15" single cable probe
❺ others on request
❻ min./max. value for an output of 22 mA at the terminal
❼ min/max. value for an output of 22 mA at the terminal (additional power supply needed - output only)
❽ if the ambient temperature is not in these limits, the display switches off

9.2 Pressure/temperature table for probe selection

Ensure that the transmitters are used within their operating limits. Observe the following requirements.

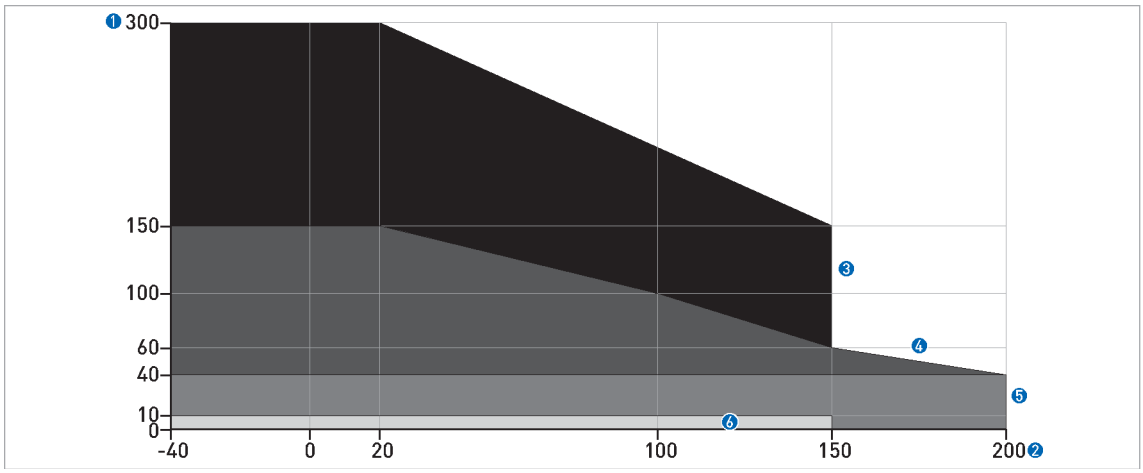


Figure 9-1: **Pressure/temperature table for probe selection**

1. Process pressure, P_s [bar]
2. Flange temperature, T [°C]
3. High-pressure (HP) version of the Ø2 mm single cable probe
4. Double rod, double cable, single rod, Ø4 mm single cable and coaxial probes
5. Ø8 mm single cable probe
6. Standard version of the Ø2 mm single cable probe

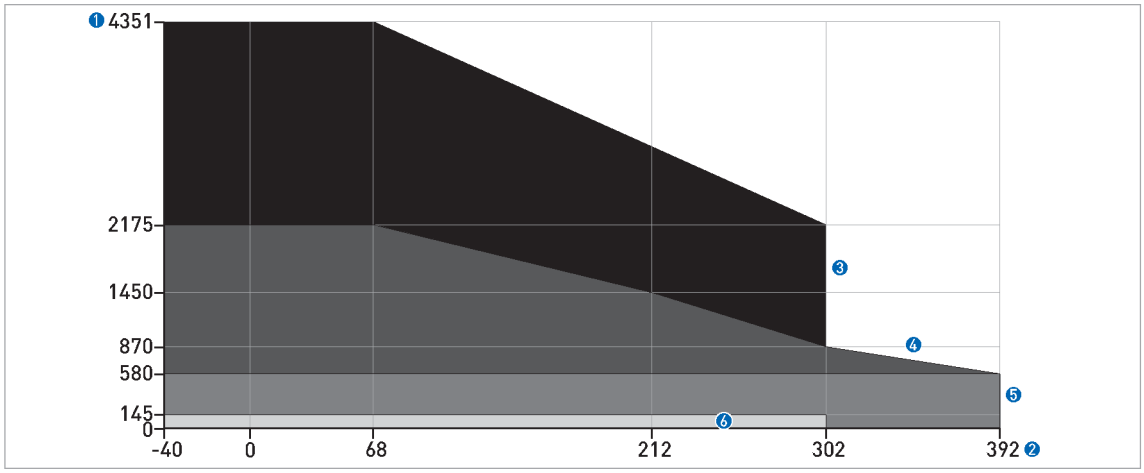


Figure 9-2: **Pressure/temperature table for probe selection**

1. Process pressure, P_s [psi]
2. Flange temperature, T [°F]
3. High-pressure (HP) version of the Ø0.08" single cable probe
4. Double rod, double cable, single rod, Ø0.15" single cable and coaxial probes
5. Ø0.3" single cable probe
6. Standard version of the Ø0.08" single cable probe

9.3 Measurement limits

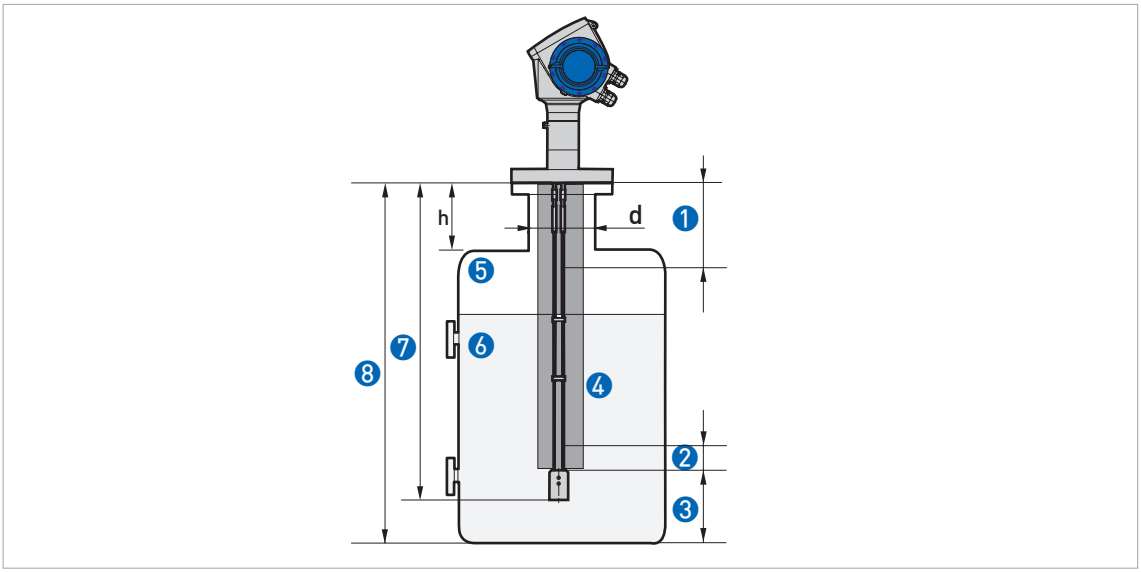


Figure 9-3: **Measurement limits**

1. **A1, Top dead zone:** Distance from the flange to the top limit of measuring range. Refer to the notes and table that follow.
2. **A2, Bottom dead zone:** Length at the end of the probe, where measurement is not linear.
3. **D, non measurement zone:** Zone where measurement cannot be taken.
4. **Electromagnetic (EM) field:** The EM field generated by the instrument. Keep the EM field clear of objects and product flow. Refer to **Installation recommendations for liquids** in this document for the empty space (R_{min}) around the probe.
5. **Gas (Air)**
6. **Product 1**
7. **L, Probe length:** Length specified by customer in the order. This is also the maximum measuring length for some probe types in direct mode and all instruments that operate in TBF mode. refer to *Dimensions and weight* on page 144.
8. **Tank Height**

INFORMATION!
***h** is the height of the nozzle. **d** is the diameter of the tank nozzle.*

NOTE!
*If **h < d**, then the top dead zone (A1) is equal to the top dead zone for the probe only. Refer to the table that follows.*
*If **h** ≥ δ, then the top dead zone (A1) is equal to the tank nozzle height plus the top dead zone for the probe.*

NOTE!
The dimensions of the tank nozzle have no effect on the top dead zone of the coaxial probe.

Measurement limits in mm

Probes	Top dead zone, A1 ε_r = 80	Bottom dead zone, A2 ε_r = 80	Top dead zone, A1 ε_r = 2.3	Bottom dead zone, A2 ε_r = 2.3
	[mm]			
Double rod	125	10	165	50
Single rod	200	10	250	50
Coaxial	10	10	10	50
Double cable	125	10	165	50
Single cable Ø8 mm	200	10	250	50
Single cable Ø4 mm	200	10	250	50
Single cable Ø2 mm	200	10	250	50

80 is ε_r of water; 2.3 is ε_r of oil

Measurement limits in inches

Probes	Top dead zone, A1 ε_r = 80	Bottom dead zone, A2 ε_r = 80	Top dead zone, A1 ε_r = 2.3	Bottom dead zone, A2 ε_r = 2.3
	[inches]			
Double rod	4.90	0.40	6.50	1.95
Single rod	7.90	0.40	9.90	1.95
Coaxial	0.40	0.40	0.40	1.95
Double cable	4.90	0.40	6.50	1.95
Single cable Ø0.3"	7.90	0.40	9.90	1.95
Single cable Ø0.15"	7.90	0.40	9.90	1.95
Single cable 0.08"	7.90	0.40	9.90	1.95

80 is ε_r of water; 2.3 is ε_r of oil

9.4 Dimensions and weight

Standard housing

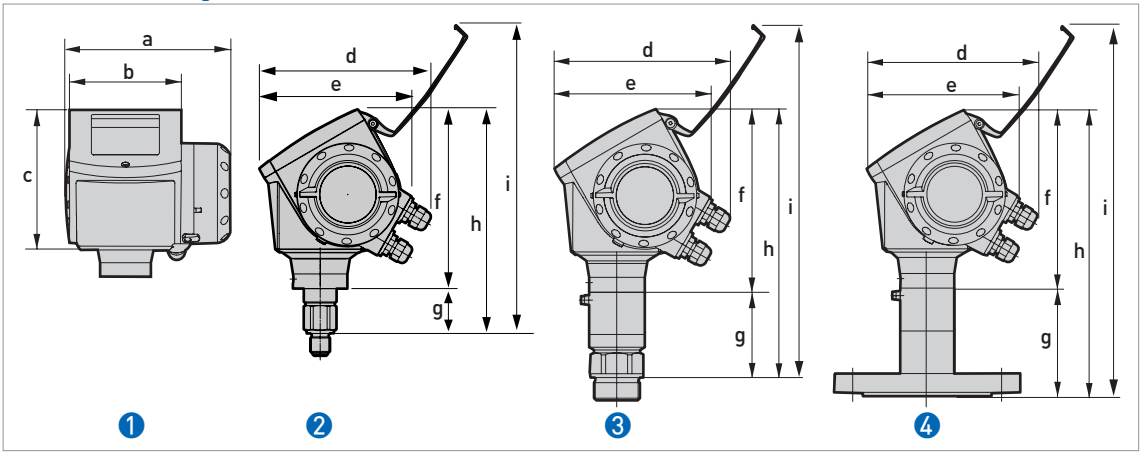


Figure 9-4: **Housing dimensions**

1. Converter (front view)
2. Thread version for Ø2 mm/0.08" single cable probe (right side)
3. Thread version for all other probes (right side)
4. Flange version (right side)

Note:

- Cable glands are delivered on demand with non-Ex, EEx i- and EEx d-approved devices.
- Non-Ex and EEx i fittings are plastic and EEx d fittings are metallic. Non-Ex fittings are black and EEx i fittings are blue.
- The diameter of the outer sheath of the cable must be 6...12 mm or 0.2...0.5".
- Cable glands for FM- or CSA-approved devices must be supplied by the customer.

Dimensions and Weight in mm and kg

	Dimensions [mm]									Weight [kg]
	a	b	c	d	e	f	g	h	i	
Housing	180	122	158.5	182 ❶	170	-	-	-	-	3.3
Flange DN25…80	180	122	158.5	182 ❶	170	190	126.5	316.5 ❷	353.5 ❸	4…7
Flange DN100…150	180	122	158.5	182 ❶	170	190	126.5	316.5 ❷	353.5 ❸	7…12
Thread, single cable Ø2	180	122	158.5	182 ❶	170	190	48	238 ❹	275 ❺	4
Thread, all other probes	180	122	158.5	182 ❶	170	190	99	289 ❻	326 ❼	3

❶ if fitted with standard cable glands
❷ with option for 30 kV ESD protection: 415.5 mm. With secondary METAGLAS seal option: 359.5 mm.
❸ with option for 30 kV ESD protection: 452.5 mm. With secondary METAGLAS seal option: 396.5 mm.
❹ with option for 30 kV ESD protection: 337 mm. With secondary METAGLAS seal option: 281 mm.
❺ with option for 30 kV ESD protection: 374 mm. With secondary METAGLAS seal option: 318 mm.
❻ with option for 30 kV ESD protection: 388 mm. With secondary METAGLAS seal option: 332 mm.
❼ with option for 30 kV ESD protection: 425 mm. With secondary METAGLAS seal option: 369 mm.

Dimensions and Weight in inches and lbs

	Dimensions [inches]									Weight [lbs]
	a	b	c	d	e	f	g	h	i	
Housing	7.1	4.8	6.2	7.2 ❶	6.7	7.5	-	-	-	7.3
Flange ASME1…3	7.1	4.8	6.2	7.2 ❶	6.7	7.5	5.0	12.5 ❷	13.9 ❸	8.8…15.4
Flange ASME4…8	7.1	4.8	6.2	7.2 ❶	6.7	7.5	5.0	12.5 ❷	13.9 ❸	15.4…26.5
Thread, single cable Ø0.08	7.1	4.8	6.2	7.2 ❶	6.7	7.5	1.9	9.4 ❹	10.8 ❺	8.8
Thread, all other probes	7.1	4.8	6.2	7.2 ❶	6.7	7.5	3.9	11.4 ❻	12.8 ❼	6.6

❶ if fitted with standard cable glands
❷ with option for 30 kV ESD protection: 16.4". With secondary METAGLAS seal option: 14.2".
❸ with option for 30 kV ESD protection: 17.8". With secondary METAGLAS seal option: 15.6".
❹ with option for 30 kV ESD protection: 13.3". With secondary METAGLAS seal option: 11.1".
❺ with option for 30 kV ESD protection: 14.7". With secondary METAGLAS seal option: 12.5".
❻ with option for 30 kV ESD protection: 15.2". With secondary METAGLAS seal option: 13.1".
❼ with option for 30 kV ESD protection: 16.7". With secondary METAGLAS seal option: 14.5".

Weather protection option

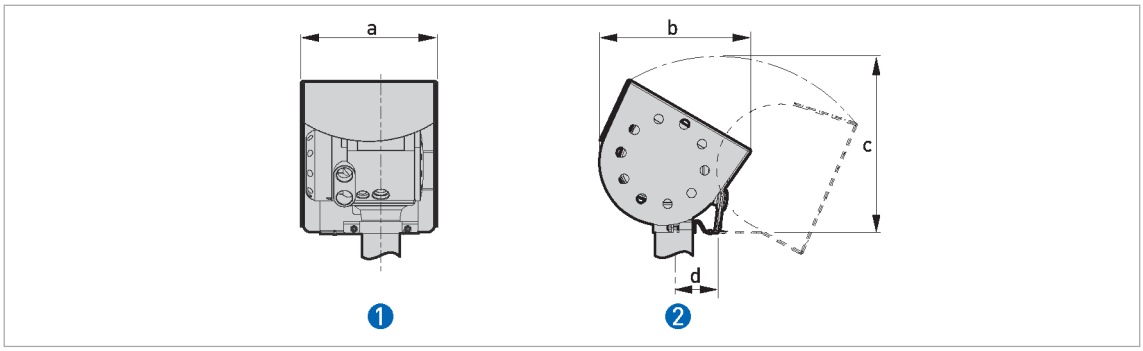


Figure 9-5: **Weather protection option**

1 Weather protection (rear view)
2 Weather protection (left side)

Dimensions and Weight in mm and kg

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

❶ radius

Dimensions and Weight in inches and lbs

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

❶ radius

ESD protection and secondary METAGLAS seal options

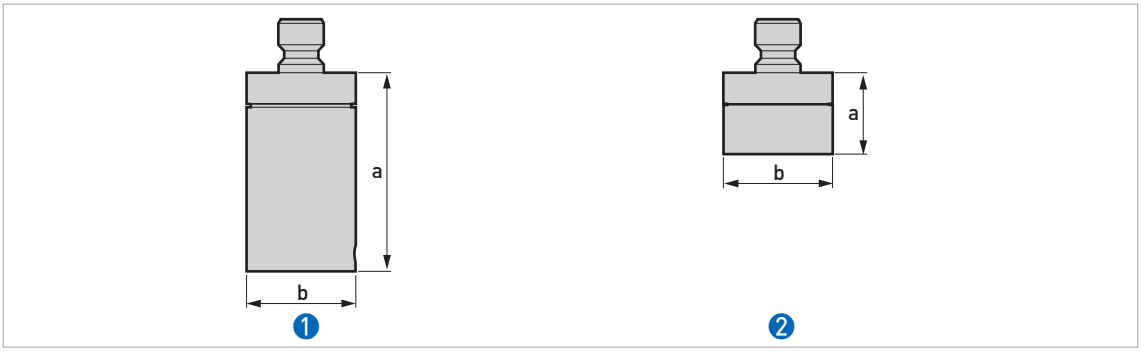


Figure 9-6: **ESD protection and secondary METAGLAS seal options**

1. Optional ESD protection (30 kv) for solid applications
2. Optional secondary METAGLAS seal for dangerous products

Note:

- The ESD protection and the secondary METAGLAS seal cannot be fitted to the same instrument.

Special options: Dimensions and weight in mm and kg

Options	Dimensions [mm]		Weight [kg]
	a	b	
ESD protection 30 kV	99	Ø58	0.85
Secondary METAGLAS seal	43	Ø58	0.83

Special options: Dimensions and weight in inches and lbs

Options	Dimensions [inches]		Weight [lbs]
	a	b	
ESD protection 30 kV	3.9	Ø2.3	1.87
Secondary METAGLAS seal	1.7	Ø2.3	1.82

Remote housing

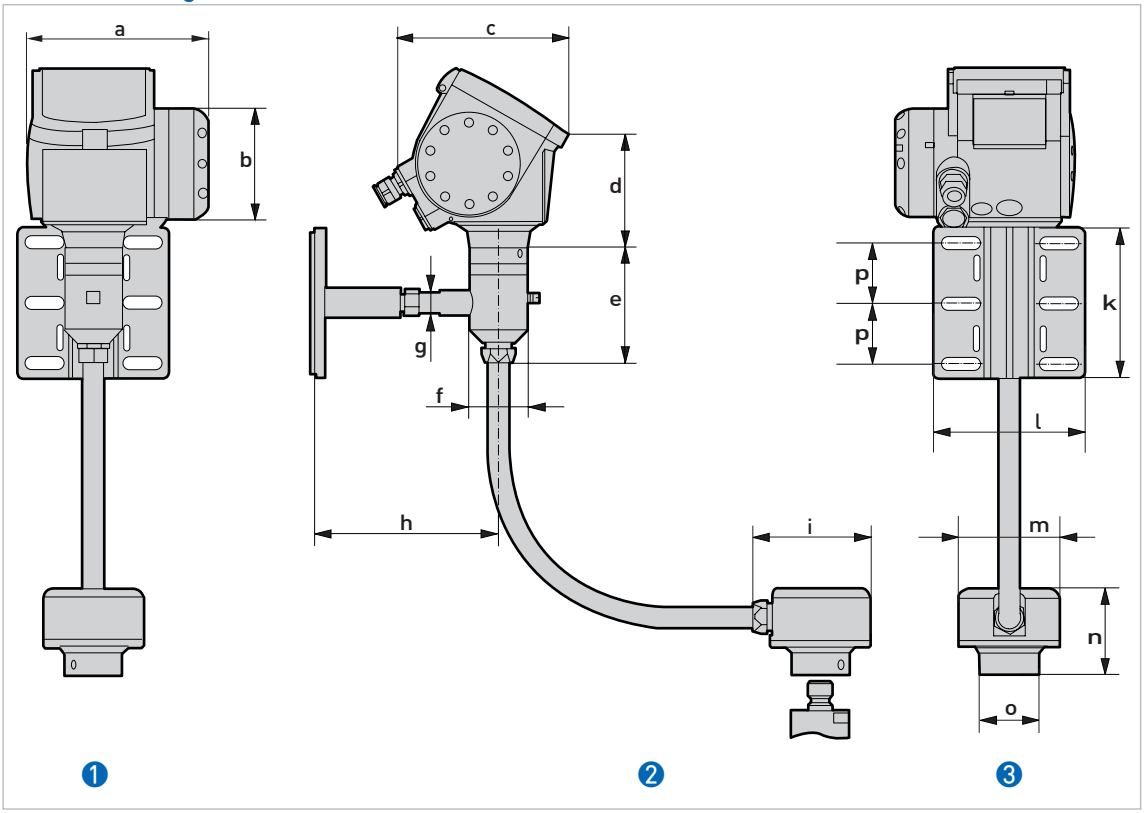


Figure 9-7: **Remote housing dimensions**

1. Front view
2. Left side
3. Rear view

Note:

- Refer to "ESD protection and secondary METAGLAS seal options" for the height to add to dimension "n".

Dimensions and Weights in mm and kg

	Dimensions [mm]															Weight [kg]
	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	
Remote version	180	109	165	193	98.5	58	21	183	117	150	150.4	100	86	58	60	6.6... 12.85 1

1 wall bracket (1.4 kg) + housing support (1.5 kg) + remote probe housing (2.7 kg) + flexible conduit (2 m: 1 kg; 4.5 m: 2.25 kg; 9.5 m: 4.75 kg; 14.5 m: 7.25 kg)

Dimensions and Weights in inches and lbs

	Dimensions [inches]															Weight [lbs]
	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	
Remote version	7.1	4.3	6.5	7.6	3.9	2.3	0.8	7.2	4.6	5.9	5.9	3.9	3.4	2.3	2.4	14.6... 28.3 (1)

(1) wall bracket (3.1 lbs) + housing support (3.3 lbs) + remote probe housing (6.0 lbs) + flexible conduit (6.6 ft: 2.2 lbs; 14.8 ft: 5.0 lbs; 31.2 ft: 10.5 lbs; 47.6 ft: 16.0 lbs)

Remote version limits

- For interface and solid (powder, granulate) applications the maximum extension length is 4.5m / 14.8 ft.
- For liquid level applications, the maximum measuring range is reduced according to the length of the electric cable between the flange and the converter (extension length).

Extension length		Max. measuring range (or sensor length, L)	
[m]	[ft]	[m]	[ft]
2	6.6	30	98
4.5	14.8	25	82
9.5	31.2	15	29
14.5	47.6	5	16.4

Applications

- Tank with a lot of vibration
- Limited space on the top of the tank or limited access (due to the size of the compact converter)
- Remote display at the bottom of the tank

Single probes

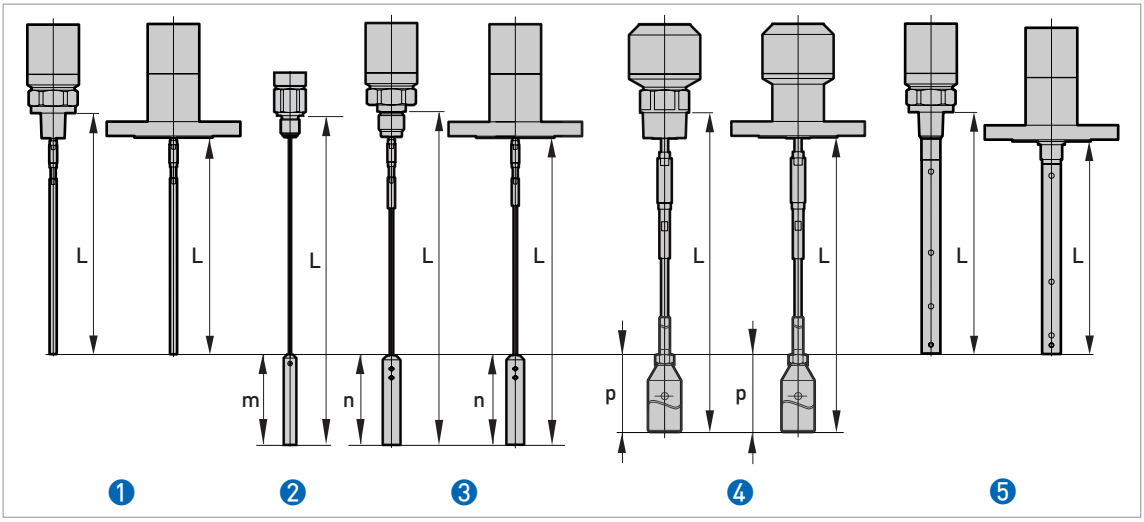


Figure 9-8: **Single probe dimensions**

1. Single rod Ø8 mm / Ø0.3" (thread and flange versions)
2. Single cable Ø2 mm / Ø0.08" (thread version)
3. Single cable Ø4 mm / Ø0.15" (thread and flange versions)
4. Single cable Ø8 mm / Ø0.3" (thread and flange versions - flange version can also have a PP, PVDF or PVC protective sheath of Ø16 mm / 0.63")
5. Coaxial Ø22 mm / Ø0.9" (thread and flange versions)

Double probes

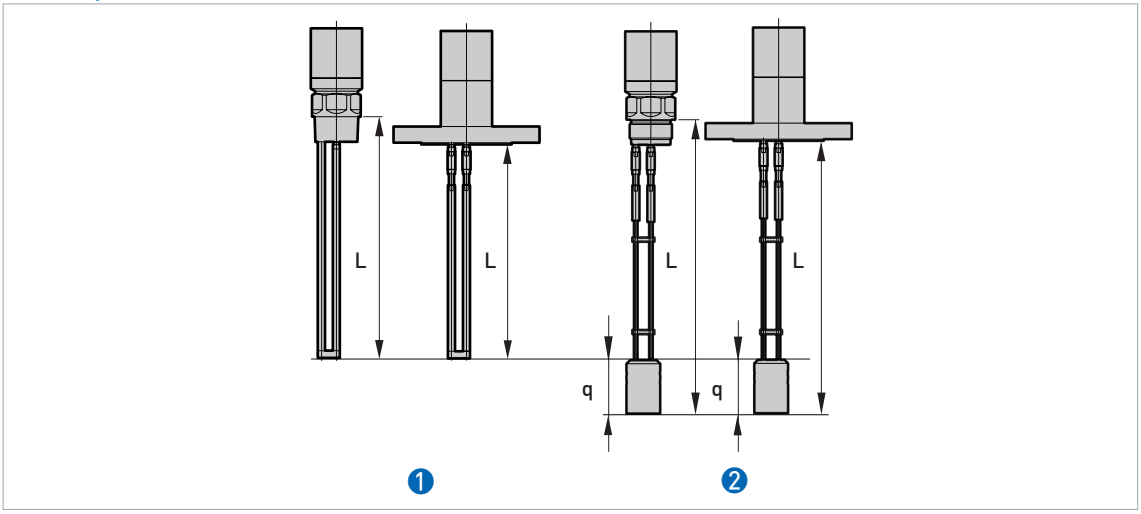


Figure 9-9: **Double probe dimensions**

1. Double rod Ø8 mm / Ø0.3" (thread and flange versions)
2. Double cable Ø4 mm / Ø0.15" (thread and flange versions)

Note:

A wide range of counterweights and anchoring solutions are available. Contact KROHNE for further information.

Single probes: Dimensions in mm

Probes	Dimensions [mm]			
	L max.	m	n	p
Single rod Ø8 mm	4000	-	-	-
Single cable Ø2 mm	35000	100	-	
Single cable Ø4 mm	35000	-	100	-
Single cable Ø8 mm	35000	-	-	0 (1)
Coaxial Ø22 mm	6000	-	-	-

(1) for Ø12 mm counterweight. If Ø38 mm counterweight ordered: 245 mm

Single probes: Dimensions in inches

Probes	Dimensions [inches]			
	L max.	m	n	p
Single rod Ø0.3"	158	-	-	-
Single cable Ø0.08"	1378	3.9		
Single cable Ø0.15"	1378	-	4.0	-
Single cable Ø0.3"	1378	-	-	0 (1)
Coaxial Ø0.9"	236	-	-	-

(1) for Ø0.5" counterweight. If Ø1.5" counterweight ordered: 9.6"

Double probes: Dimensions in mm

Probes	Dimensions [mm]	
	L max.	q
Double rod Ø8 mm	4000	-
Double cable Ø4 mm	8000	60

Double probes: Dimensions in inches

Probes	Dimensions [inches]	
	L max.	q
Double rod Ø0.3"	158	-
Double cable Ø0.15"	315	2.4

Probe weight

Probes	Min. process connection size		Weight	
	Thread	Flange	[kg/m]	[lbs/ft]
Single cable Ø2 mm / 0.08"	G ½A; NPT ½	-	0.016	0.035
Single cable Ø4 mm / 0.15"	G ¾A; NPT ¾	DN25 PN40; 1" 150 lb; 1½" 300 lb	0.12	0.08
Single cable Ø8 mm / 0.3"	G 1½A ; NPT 1½	DN40 PN40; 1½" 150 lb; 1½" 300 lb	0.41	0.28
Double cable Ø4 mm / 0.15"	G 1½A ; NPT 1½	DN50 PN40; 2" 150 lb; 2" 300 lb	0.24	0.16
Single rod Ø8 mm / 0.3"	G ¾A; NPT ¾	DN25 PN40; 1" 150 lb; 1½" 300 lb	0.41	0.28
Double rod Ø8 mm / 0.3"	G 1½A ; NPT 1½	DN50 PN40; 2" 150 lb; 2" 300 lb	0.82	0.56
Coaxial Ø22 mm / 0.9"	G ¾A; NPT ¾	DN25 PN40; 1" 150 lb; 1½" 300 lb	0.79	0.53

10.1 Glossary

C

Cable

This is a wire rope. It is used as a measurement pulse guide.

D

Dielectric constant

An electrical property of the product to be measured used in TDR measurement. Also known as εr, DK and relative permittivity. This gives the strength of the measurement pulse reflected back to the device's signal converter.

Direct mode

The instrument sends a signal along the probe. It receives the reflection of the signal from the surface of the tank contents. The instrument uses an algorithm to convert the time it takes to receive the signal into a distance. This is for products with a dielectric constant >1.6 (this depends on the probe type). Refer also **TBF mode**.

Discontinuities

These are objects or parts of objects (including the tank) that are in the tank, are possibly in the probe's free space and can potentially influence the electromagnetic field around the probe. This can cause a measurement error. Also refer to *General requirements* on page 28.

Distance

This is a display option. It is the distance from the face of flange to the level (1 product) or the surface of the top product (2 or more products). Refer to the diagrams at the end of this section.

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.

Electromagnetic field This is a physical field that is produced by electrically-charged objects and which may affect the behaviour of other objects near to the field.

Emulsion These are small particles of one liquid that readily disperse in another liquid. Usually An emulsion is usually a dispersion of water in an oil or a dispersion of oil in water. Possible causes are mixing or tank filling. Emulsions usually separate back into their constituent parts over time. For accurate interface measurement to be possible, the top product and emulsion must have stable dielectric constant values. The way the instrument measures interface will depend on the type of emulsion:
If the emulsion is a constant mix of more than 5 % water, the instrument measures interface from the top of the emulsion.
If the emulsion separates gradually from 0 to 100% water, the instrument measures interface at the bottom of the emulsion.

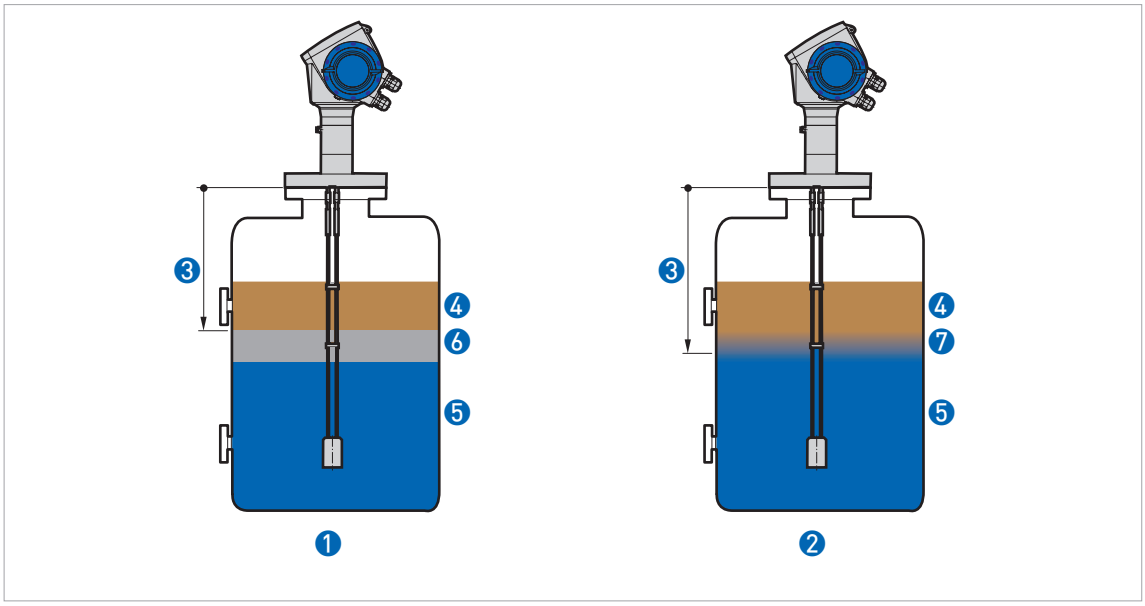


Figure 10-1: **Types of emulsion**

1. Constant-mix emulsion
2. Gradually mixed emulsion
3. Interface distance
4. Oil
5. Water
6. Emulsion (constant mix, >5% of water)
7. Emulsion (gradually mixes with water)

F

Free space

A minimum diameter around a probe that should have no objects in it for the instrument to work correctly. This depends on the probe type. Refer to **Installation** for more details.

G

Gain

This is an amplification factor given by the signal converter to a signal goes back to the instrument. The instrument can then use the signal to measure the product.

Refer to **Threshold** for more details. Also refer to *Thresholds and parasite signals* on page 94.

H

Hazardous area

An area with a potentially explosive atmosphere. Trained personnel can install and use an instrument in this area. The instrument 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

Interface

A surface where two liquids meet.

Interface distance

This is a display option. It is the distance from the face of the flange to the interface. See the diagram at the end of this section.

Interface level

This is a display option. It is the height from the bottom of the tank (user-defined) to the interface (or tank height - interface distance). See the diagrams at the end of this section.

L

Layer

This is a display option. It gives the thickness of top product. The layer must be more than 50mm or 2" for accurate measurement of level and/or interface. Refer to the diagrams at the end of this section.

Level

This is a display option. It is the height from the bottom of the tank (user-defined) to the surface of the top product (Tank height – distance). Refer to the diagrams at the end of this section.

M

Mass

This is a display option. It shows the total mass of tank contents.

Measurement pulse

The instrument transmits a short, low-powered electrical pulse or wave transmitted down a guide to the process. The process (or the probe end if in TBF measurement mode) reflects the pulse back to the instrument.

O

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

P

Probe This is either a metallic cable or rod used to guide the measurement pulse to the process.

Probe Length Ordered length of probe, L, from the face of the flange to end of the guide. If you ordered a cable probe, this includes the counterweight. See the diagrams at the end of this section.

S

Sensor length Length, L', of from the face of the flange to end of the guide. If you ordered a cable probe, this does not include the counterweight. Refer to the diagram at the end of this section.

Supervisors Users who can configure the instrument in supervisor mode. They cannot configure the instrument in service mode.

T

TBF mode Tank Bottom Following (TBF) mode. If the product has a low dielectric constant, use this mode. TBF mode uses the end of the probe to indirectly measure the tank contents.

TDR Time domain reflectometry (TDR). The principle used by the instrument to measure level and interface.

Top dead zone The distance from the flange to the top limit of the measuring range. Also refer to *Measurement limits* on page 142.

Threshold A number of limits set either manually or automatically by the signal converter to identify the reflected measurement pulses from the level, the interface and the probe end. Also refer to *Thresholds and parasite signals* on page 94.

U

Ullage mass

This is a display option. It shows empty mass or mass of the product that can be put into the tank. Refer to the diagrams at the end of this section.

Ullage volume

This is a display option. It shows the unfilled volume. Refer to the diagrams at the end of this section.

V

Volume

Total volume of tank contents.

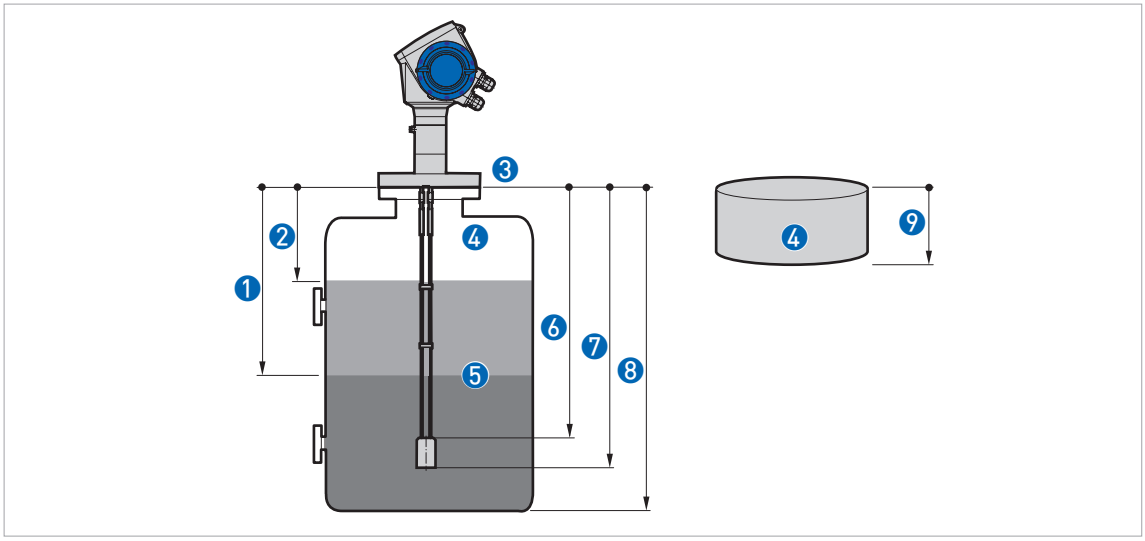


Figure 10-2: **Measurement definitions 1**

1. Interface distance
2. Distance
3. Flange facing
4. Gas (Air)
5. Interface
6. Sensor length, L'
7. Probe length, L
8. Tank height
9. Ullage volume or mass

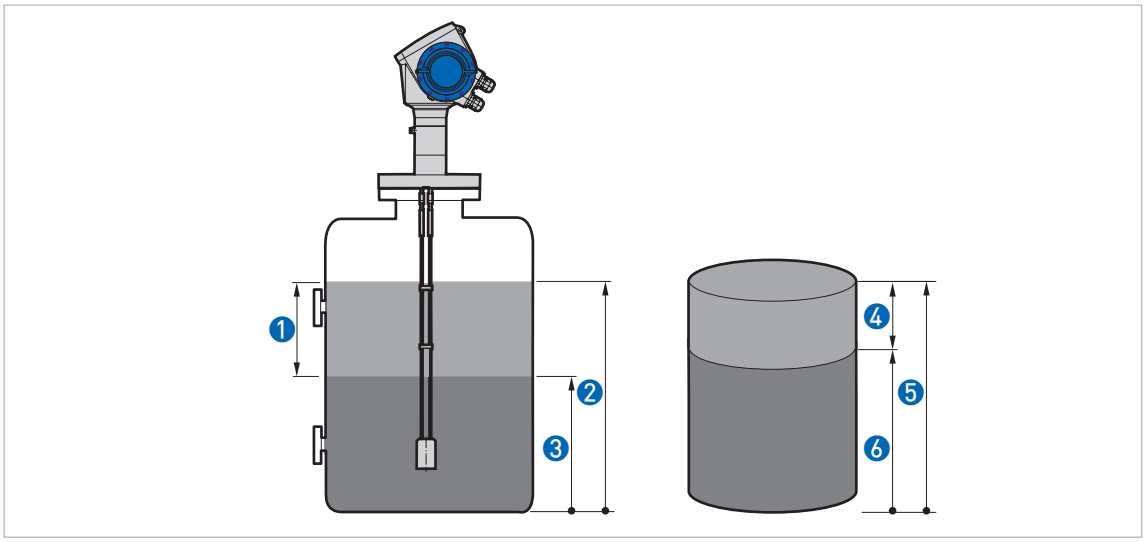


Figure 10-3: **Measurement definitions 2**

1. Layer
2. Level
3. Interface level
4. Layer volume or mass
5. Volume or mass
6. Interface volume or mass

10.2 EC declaration of conformity

KROHNE

CE

DECLARATION OF CONFORMITY

Konformitätserklärung **Déclaration de Conformité**

KROHNE S.A.S., Les Ors – BP 98, F-26103 Romans Cedex, France

We declare herewith under sole responsibility that the product(s):
Wir erklären hiermit unter alleiniger Verantwortung, dass das Produkt / die Produkte:
Nous déclarons sous notre seule responsabilité que le(s) produit(s):

OPTIFLEX 1300 C

Guided Radar (TDR) Level Transmitters are in conformity with the protection requirements of Council Directives. The stipulated safety and public health safety requirements are fulfilled in accordance with the harmonized standards or mentioned technical specifications (as far as applicable) :
Füllstandmessgerät mit geführtem Radar konform sind mit den Schutzzielen der Richtlinien des Europäischen Parlaments. Der geforderte Sicherheits- und Gesundheitsschutz wird erfüllt in Übereinstimmung mit den harmonisierten Standards oder den angeführten technischen Normen (sofern zutreffend) :
Transmetteurs de niveau TDR sont conformes avec les conditions de protection des directives du parlement européen. La protection de santé/ sécurité exigée est réalisée en accord avec les normes harmonisées ou les spécifications techniques mentionnées (autant qu'applicable) :

Directive / Richtlinie /Directive		harmonized Standards / harmonisierte Standards / normes harmonisées	
89/336/EEC	EMC Directive EMV Richtlinie Directive CEM	EN 61326 :1997+A1+A2 (Class B / Klasse B / Classe B)*	
94/9/EC	ATEX Directive Ex Richtlinie Directive ATEX	EN 50014 :1997+A1+A2 EN 60079-15 :2003 EN 50020 :2002	EN 50281-1-1:1998+A1 EN 50284 :1999
2006/95/EC	Low Voltage Directive Niederspannungs Richtlinie Directive Basse Tension	EN 61010-1 :2001	

* in enclosed metallic tanks / in geschlossenem Metalltank / dans un reservoir métallique clos

The equipment type plates contain due to these directives the following :
Die Kennzeichnung des Gerätes enthält entsprechend den zutreffenden Richtlinien folgende Angaben :
L'inscription de type de l'équipement contient selon les directives les informations suivantes :

		Marking / Kennzeichnung / Repères				
Directive / Richtlinie Directive	Assessment Konformitätsbewertung Evaluation de conformité	EC Type Approval Reg. No Agrément de type CE	Category Kategorie Catégorie	Notified Body benannte Stelle Organisme reconnu	No. N° Nr.	
89/336/EEC	Module A	n.a.		n.a.	n.a.	CE
94/9/EC	Module B + D IIC, IIB or IIA (EEx ia)	KEMA 04ATEX1219X	II 1 GD, II 1/2 GD, II 2 GD	KEMA	0344	CE
	Module B + D IIC, IIB or IIA (EEx d[ia])	KEMA 04ATEX1219X	II 1/2 GD, II 2 GD	KEMA	0344	CE
	Module A	n.a.	II 3 G	n.a.	n.a.	CE

Romans, 18.10.2007

Mr Jacques van den Bosch
Managing Director

KROHNE S.A.S., Les Ors – BP 98, 26103 Romans Cedex, France, Tel: +33 (0)475 054 400, Fax: +33 (0)475 050 048, www.krohne.com
S.A.S. au capital de 4000014 €, 436380133 RCS Romans, N° d'identification TVA FR 87 436380133, NAF 332B
Directeur Général: Jacques van den Bosch

DOC-CE-OPTIFLEX1300-rev4E

Figure 10-4: **EC declaration of conformity**

10.3 ATEX approval certificate

KEMA

(1) **EC-TYPE EXAMINATION CERTIFICATE**

(2) Equipment and protective systems intended for use in potentially explosive atmospheres - Directive 94/9/EC

(3) EC-Type Examination Certificate Number: **KEMA 04ATEX1219 X** Issue Number: **2**

(4) Equipment: **Guided Radar Level Transmitter OPTIFLEX 1300 C Type VF71 4 ..... and Type SF71 9 .....**

(5) Manufacturer: **Krohne S.A.S.**

(6) Address: **Les Ors, 26103 Romans, France**

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA Quality B.V., notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the directive.

The examination and test results are recorded in confidential test report number 2103937/1.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014 : 1997 + A1, A2 **EN 50018 : 2000 + A1** **EN 50020 : 2002**
EN 50281-1-1 : 1998 + A1 **EN 50284 : 1999**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment according to the Directive 94/9/EC. Further requirements of the directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

Ex

II 1 G D or **II 1/2 G D** or **II 2 G D**
EEx ia IIC or **EEx ia IIB** or **EEx ia IIA T6 ... T3 T 65 °C ... T 90 °C IP 6X**
or
II 1/2 G D or **II 2 G D**
EEx d[ia] IIC or **EEx d[ia] IIB** or **EEx d[ia] IIA T6 ... T3**
T 65 °C ... T 90 °C IP 6X

This certificate is issued on 12 April 2007 and, as far as applicable, shall be revised before the date of cessation of presumption of conformity of (one of) the standards mentioned above as communicated in the Official Journal of the European Union.

KEMA Quality B.V.

C.G. van Es
Certification Manager

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PRODUCTS RvA C 001

KEMA Quality B.V. Utrechtseweg 310, 6812 AR Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
T +31 26 3 56 20 00 F +31 26 3 52 58 00 customer@kema.com www.kema.com Registered Arnhem 09085396

Experience you can trust.

Figure 10-5: **ATEX certificate, page 1 of 5**

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 04ATEX1219 X** Issue No. **2**

(15) **Description**

The Guided Radar Level Transmitters OPTIFLEX 1300 C Type VF71 4 ..... and Type SF71 9 ..... are used for continuous level measurement of flammable or non-flammable liquids or solid particles, granulates or powders within storage or process tanks or in a stilling well. The distance between the transmitter and the surface of the process medium is measured using a probe system (e.g. cable or rod) that guides electromagnetic pulses that are reflected by the surface of the process medium.
The 2-wire transmitter is loop powered. The output signal is a 4 - 20 mA current signal with digital communication (HART protocol).

Either the Guided Radar Level Transmitter OPTIFLEX 1300 C is completely in type of protection intrinsic safety "i" or the transmitter is provided with the power supply compartment in type of protection flameproof enclosure "d". In the latter version a zener barrier circuit board is integrated in the power supply module.

Optionally, the transmitter may be provided with a second 4 - 20 mA current output and with display and adjustment capabilities (HMI option).

Optionally, the transmitter may be constructed as a remote version. The length of the cable conduit between transmitter housing and sensor is less than 15 m.

The ambient temperature range and the flange temperature range, depending on the equipment category required in the area where the transmitter is installed, are as listed in the following table:

Equipment category	Ambient temperature range	Flange temperature range
II 1 G	-20 °C ... +60 °C	-20 °C ... +60 °C
II 1/2 G	-40 °C ... +85 °C	-20 °C ... +60 °C
II 2 G	-40 °C ... +85 °C	-40 °C ... +200 °C
II 1 D, II 1/2 D, II 2 D	-40 °C ... +85 °C	-40 °C ... +200 °C

The temperature class depending on the ambient temperature and the flange temperature is for the different versions as listed in following table:

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Figure 10-6: **ATEX certificate, page 2 of 5**

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 04ATEX1219 X** Issue No. **2**

Equipment category	Max. ambient temperature	Max. flange temperature	Temperature class
II 1 G	60 °C	60 °C	T6
II 1/2 G	60 °C	60 °C	T6
	75 °C	60 °C	T5
	85 °C	60 °C	T4
II 2 G	60 °C	60 °C	T6
	55 °C	80 °C	
	75 °C	75 °C	T5
	70 °C	95 °C	
	85 °C	85 °C	T4
	80 °C	110 °C	
	75 °C	135 °C	
	70 °C	150 °C	T3
	65 °C	180 °C	
	60 °C	200 °C	

The maximum surface temperature of the electronics enclosure "T", depending on the ambient temperature and the flange temperature, is as listed in following table:

Max. ambient temperature	Max. flange temperature	Surface temperature "T"
55 °C	80 °C	65 °C
70 °C	95 °C	80 °C
75 °C	135 °C	86 °C
60 °C	200 °C	90 °C

The enclosure provides a degree of protection of at least IP6X as per EN 60529.

Electrical data

Apparatus in type of protection intrinsic safety "i"

Supply and output circuit (terminals output 1, + and -):
in type of protection intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit, with the following maximum values:
U_i = 30 V; I_i = 300 mA; P_i = 1W; C_i = 30 nF; L_i = 200 µH.

Output circuit (terminals output 2, + and -):
in type of protection intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit, with the following maximum values:
U_i = 30 V; I_i = 300 mA; P_i = 1W; C_i = 30 nF; L_i = 200 µH.

The optional second current output circuit is infallibly galvanically isolated from the supply and output circuit and from the earthed parts of the transmitter.

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Figure 10-7: **ATEX certificate, page 3 of 5**

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 04ATEX1219 X** Issue No. **2**

Apparatus in type of protection flameproof enclosure "d"

Power supply ..... max. 36 Vdc
Output ..... 4 - 20 mA
Intrinsically safe circuits ..... Um = 253 V

Installation instructions

Apparatus in type of protection intrinsic safety "i"

When the Guided Radar Level Transmitter is used in explosive atmospheres caused by air/dust mixtures, cable entry devices shall be used that provide a degree of protection of at least IP 6X, that are suitable for the application and are correctly installed.

Apparatus in type of protection flameproof enclosure "d"

When used in a potentially explosive atmosphere, requiring the use of apparatus of equipment category 2G, flameproof certified cable entry devices shall be used that are suitable for the application and correctly installed. With the use of conduit, a suitable certified sealing device such as a stopping box with setting compound shall be provided immediately at the entrance to the flameproof enclosure.

When used in a potentially explosive atmosphere, requiring the use of apparatus of equipment category 2D, certified cable entry devices shall be used that provide a degree of protection of at least IP 6X, that are suitable for the application and are correctly installed.

Unused openings shall be closed with suitable certified blanking elements.

When the ambient temperature exceeds 70 °C, the cables, cable entry devices and blanking elements shall be suitable for at least 85 °C.

Routine tests

Routine tests according to Clause 16 of EN 50018 are not required since the type test has been made at a static pressure of four times the reference pressure.

(16) **Test Report**

KEMA No. 2103937/1

(17) **Special conditions for safe use**

For the version of enclosure of the Guided Radar Level Transmitter made of aluminium alloy, when used in a potentially explosive atmosphere requiring the use of apparatus of equipment category
1 G, the apparatus must be installed so, that even in the event of rare incidents, an ignition source due to impact or friction between the enclosure and iron/steel is excluded.

Also, see description and installation instructions above.

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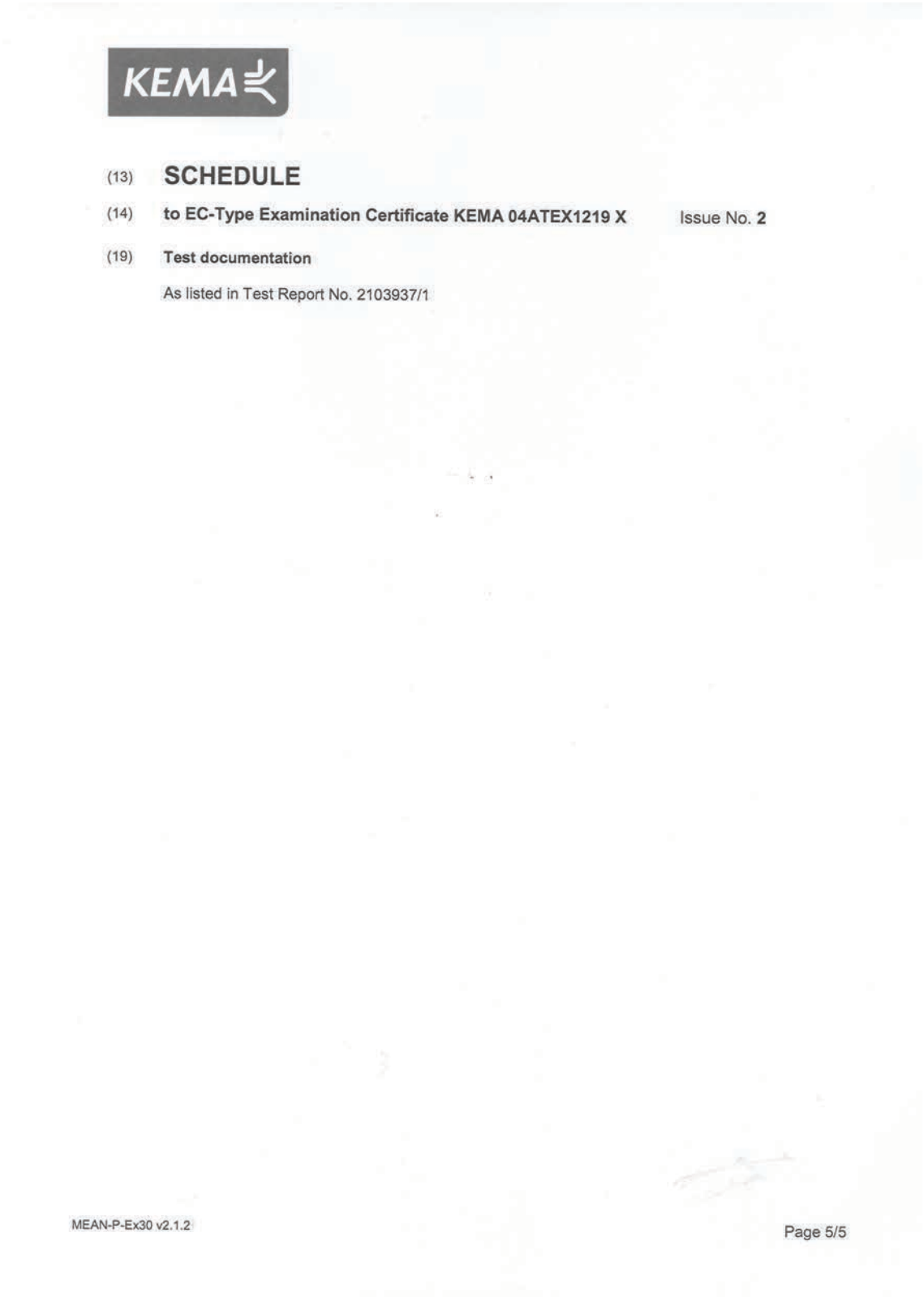
Figure 10-8: **ATEX certificate, page 4 of 5**



KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 04ATEX1219 X** Issue No. **2**

(19) **Test documentation**

As listed in Test Report No. 2103937/1

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Figure 10-9: **ATEX certificate, page 5 of 5**

MANUFACTURER DECLARATION

Manufacturer: **Krohne S.A.S - Les Ors - F-26103 Romans**

Product: **OPTIFLEX 1300 C VF 714.A* and SF 719.A***

Marking: **II 3 G EEx nA II T3…T6 T80°C… T97°C X**

We declare under our sole responsibility that the above specified equipment is in conformity with the harmonized standard EN 60079-15:2003 following the provision of the Directives 94/9/EC.

The "X" behind the marking code notifies that special ambient temperature ranges apply and that devices equipped with glass cover comply with low level impact test.

SAFETY INFORMATION

When instructions given in the Installation and operating instructions manual and safety information hereafter are respected, the equipment covered by this document fulfils all requirements necessary to be used with a satisfactory level of safety in an explosive gas atmosphere declared as zone 2. The equipment is not intended for use in a specific explosive gas atmosphere and is classified as Group II. Under normal operating conditions, the equipment does not produce any spark/arc or develop a surface temperature in excess of the maximum value appropriate for a chosen temperature class as long as the following conditions are met:

Temperature class	Ambient temperature	Maximum process temperature	Maximum surface temperature
T6	-40°C…61°C	-40°C…85°C	80°C
T5	-40°C…76°C	-40°C…100°C	95°C
T4	-40°C…76°C	-40°C…110°C	97°C
	-40°C…70°C	-40°C…135°C	97°C
T3	-40°C…66°C	-40°C…150°C	97°C
	-40°C…57°C	-40°C…180°C	97°C
	-40°C…52°C	-40°C…200°C	97°C

COMMISSIONING

This declaration is only valid if the following requirements are respected:
- the instrument operates within permissible operating voltage
- the equipotential bonding system of the instrument is connected to the ground
- electrostatic charges are not expected
- cable entries are tight and strain relieved
- the outer diameters of the cables are adapted to the cable entries
- the surface temperature doesn't exceed the ignition temperature of the concerned explosive atmosphere
- input wires are connected/disconnected only when power has been switched off unless the area is known to be non hazardous
- repairs are not carried out by the user.

Authorized Signatory: _____ **Date:** 10/10/07

Name/Title: J. van den Bosch, Managing director

Figure 10-10: Declaration for ATEX zone 2

10.4 IECEx approval certificate

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx KEM 06.0024X issue No.:1

Certificate history:
Issue No. 1 (2007-10-25)
Issue No. 0 (2006-5-8)

Status: **Current**

Date of Issue: **2007-10-25** Page 1 of 5

Applicant: **Krohne S.A.S.**
Les Ors
26103 Romans
France

Electrical Apparatus: **Guided Radar Level Transmitter OPTIFLEX 1300 C Type VF71 4 ... and Type SF71 9 ...**
Optional accessory:

Type of Protection: **Intrinsic Safety (gas and dust)**

Marking: **Zone 0 Ex ia IIC T6 ... T3**
Ex iaD 20 IP6X T65 °C ... T90 °C

Approved for issue on behalf of the IECEx Certification Body: T. Pijpker

Position: Certification Manger

Signature:
(for printed version) _____

Date: _____

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

KEMA Quality B.V.
Utrechtseweg 310
6812 AR Arnhem
The Netherlands

Figure 10-11: **IECEx certificate, page 1 of 5**

IECEx Certificate of Conformity

Certificate No.: IECEx KEM 06.0024X

Date of Issue: **2007-10-25** Issue No.: **1**

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Manufacturer: **Krohne S.A.S.**
Les Ors
26103 Romans
France

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacture'rs quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2004 Edition: 4.0	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
IEC 60079-11 : 1999 Edition: 4	Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety 'i'
IEC 60079-26 : 2004 Edition: 1	Electrical apparatus for explosve gas atmospheres - Part 26: Construction, test and marking of Group II Zone 0 electrical apparatus
IEC 61241-0 : 2004 Edition: 1	Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements
IEC 61241-11 : 2005 Edition: 1	Electrical apparatus for use in the pressence of combustible dusts - Part 11: Protection by intrinsic safety 'iD'

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

NL/KEM/ExTR06.0023/00
NL/KEM/ExTR07.0038/00

Quality Assessment Report:
NL/KEM/QAR06.0017/00

Figure 10-12: **IECEx certificate, page 2 of 5**

IECEx Certificate of Conformity

Certificate No.: IECEx KEM 06.0024X

Date of Issue: **2007-10-25** Issue No.: **1**

Page 3 of 5

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

Description

The Guided Radar Level Transmitters OPTIFLEX 1300 C Type VF71 4 ..... and Type SF71 9 ..... are used for continuous level measurement of flammable or non-flammable liquids or solid particles, granulates or powders within storage or process tanks or in a stilling well. The distance between the transmitter and the surface of the process medium is measured using a probe system (e.g. cable or rod) that guides electromagnetic pulses that are reflected by the surface of the process medium.
The 2-wire transmitter is loop powered. The output signal is a 4 - 20 mA current signal with digital communication (HART protocol).

Optionally, the transmitter may be provided with a second 4 - 20 mA current output and with display and adjustment capabilities (HMI option).

Optionally, the transmitter may be constructed as a remote version. The length of the cable conduit between transmitter housing and sensor is less than 15 m.

The degree of protection of the enclosure is at least IP6X in accordance with IEC 60529.

Ambient temperature range -40 °C to +85 °C; maximum flange temperature +200 °C.

CONDITIONS OF CERTIFICATION: YES as shown below:

Cable entries and closing elements shall be used that provide a degree of protection of at least IP6X in accordance with IEC 60529, that are suitable for the application and that are correctly installed.

Figure 10-13: **IECEx certificate, page 3 of 5**

IECEx Certificate of Conformity

Certificate No.: IECEx KEM 06.0024X

Date of Issue: **2007-10-25** Issue No.: **1**

Page 4 of 5

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above):

Added intrinsically safe versions of the transmitter for use in explosive gas atmospheres; added versions with separately mounted probe (connected via a cable with a length of maximum 15 m).

Figure 10-14: **IECEx certificate, page 4 of 5**

IECEx Certificate of Conformity

Certificate No.: IECEx KEM 06.0024X

Date of Issue: **2007-10-25** Issue No.: **1**

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Additional information:

The temperature class, depending on the ambient temperature and the flange temperature is as listed in the following table:

Max. ambient temperature	Max. flange temperature	Temperature class
60 °C	60 °C	T6
75 °C	75 °C	T5
70 °C	95 °C	T5
85 °C	85 °C	T4
80 °C	110 °C	T4
75 °C	135 °C	T4
70 °C	150 °C	T3
65 °C	180 °C	T3
60 °C	200 °C	T3

The maximum surface temperature of the electronics enclosure "T", depending on the ambient temperature and the flange temperature, is as listed in the following table:

Max. ambient temperature	Max. flange temperature	Surface temperature "T"
55 °C	80 °C	65 °C
70 °C	95 °C	80 °C
75 °C	135 °C	86 °C
60 °C	200 °C	90 °C

Electrical data

Supply and output circuit (terminals output 1, + and -), intrinsically safe with entity parameters:
Ui = 30 V, Ii = 300 mA, Pi = 1 W, Ci = 30 nF, Li = 200 µH.

Optional 2nd output circuit (terminals output 2, + and -), intrinsically safe with entity parameters:
Ui = 30 V, Ii = 300 mA, Pi = 1 W, Ci = 30 nF, Li = 200 µH.

The optional second current output circuit is infallibly galvanically isolated from the supply and output circuit and from the earthed parts of the transmitter.

Figure 10-15: **IECEx certificate, page 5 of 5**

10.5 FM Certificate of compliance and control drawings

FM Approvals
Member of the FM Global Group

FM Approvals
1151 Boston-Providence Turnpike
P.O. Box 9102 Norwood, MA 02062 USA
T: 781 762 4300 F: 781 762 9375 www.fmglobal.com

CERTIFICATE OF COMPLIANCE

HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

VF70 4abcdefghijklm0nopqr or SF70 9abcdefghijklm0nopqr. Optiwave 7300C Radar Level Transmitter

XP-IS / I / 1 / ABCDEFG / T6 Ta = 60°C – F08209505.19; I / 0 / AEx d [ia] IIC T6 Ta = 60° C – F08209505.19; DIP / II, III / 1 / EFG / T6 Ta = 60°C; IS / I, II, III / 1 / ABCDEFG / T6 Ta = 60° C – F08209505.18; I / 0 / AEx ia IIC T6 Ta = 60°C – F08209505.18; Entity; NI / I / 2 / ABCD / T6 Ta = 60°C; I / 2 / AEx IIC T6 Ta = 60°C; S / II, III / 2 / FG; NEMA Type 4X (enclosure) and 6P (antenna); IP 66.

Entity Parameters:
Ui = 30Vdc, Ii = 300mA, Pi = 1 W, Ci = 30 nF, Li = 200µH

a = Approvals Options 6, 7, or 8.
b = Material Process Connection Options 0, 1, or 2.
c = Antenna Options 0, 1, 2, 3, 4, 5, 6, 7, 8, A, B or C.
d = Antenna Extension Options 0, 1, 2, 3, 4, 5, 6, 7, 8, A, or B.
e = Feedthrough /Temperature/Sealing Options 0, 1, 2 or 3.
f = Process Connection EN Options 0.
g = Process Connection ASME Options 0, 3, 5, 6, 7, 8, A, B, C, D, E or F.
h = Process Connection Other Options 0, 5, 6, 7 or 8.
i = Output Options 0 or 2.
j = Housing/ Cable Entry / Cable gland Options 0, 1, 3, or 4.
k = Housing Options 0 or 2.
l = HMI Options 0, 1, 2, 3, 4, 5, 6, 7, 8 or A.
m = Version Options 0, 5 or 8.
n = Material Certificate Options 0, 1, 2, 3, 4, or 5.
o = Pressure Test Certificate Options 0, 2, or 3.
p = Calibration Certificate Options 0, 1, 2 or 3.
q = Miscellaneous Certificate Options 0 or 1.
r = Drawing / TAG Number Options 0, 1, 2 or 3.

VF71 4abcdefghijklm0opqrs or SF71 9abcdefghijklm0opqrs. Optiflex 1300C Guided Radar Level Transmitter.

XP-IS / I, / 1 / ABCDEFG / T6 Ta = 60°C – F08209505.17; I / 0 / AEx d [ia] IIC T6 Ta = 60° C – F08209505.17; DIP / II, III / 1 / EFG / T6 Ta = 60°C; IS / I, II, III / 1 / ABCDEFG / T6 Ta = 60°C – F08209505.16; I / 0 / AEx ia IIC T6 Ta = 60°C – F08209505.16; NI / I / 2 / ABCD / T6 Ta = 60°C; S / II, III

Figure 10-16: FM certificate of compliance, page 1 of 3

/ 2 / FG; NEMA Type 4X (enclosure) and 6P (probe); IP 66.

Entity Parameters:
Ui = 30Vdc, Ii = 300mA, Pi = 1 W, Ci = 30 nF, Li = 200µH

a = Approvals Options 6, 7, or 8.
b = Material Process Connection Options 0, 1, or 2.
c = Probe Options 0, 1, 2, 3, 4, 5, A, B, C, D or E.
d = Probe End Type Options 0, 1, 2, 3, 4, A, B, C, D or E.
e = Feedthrough /Temperature/Sealing Options 0 or 1.
f = Process Connection EN Option 0.
g = Process Connection ASME Options 0, 1, 2, 3, 4, 5, 6, 7, 8, A, B, C, D, E or F.
h = Process Connection Other Options 0, 5, 6, 7 or 8.
i = Output Options 0, 1, 2, or 3.
j = Housing / Cable Entry / Cable Gland Options 0, 1, 3, or 4
k = Housing Options 0, 2, 3, 4, 5, or 6.
l = HMI Options 0, 1, 2, 3, 4, 5, 6, 7, 8 or A.
m = Version Options 0.
o = Material Certificate Options 0, 1, 2, 3, 4 or 5.
p = Pressure Test Certificate Options 0, 2, or 3.
q = Calibration Certificate Options 0, 1, 2 or 3.
r = Miscellaneous Certificate Options 0 or 1.
s = Drawing / TAG Number Options 0, 1, 2 or 3.

Equipment Ratings:

Explosionproof-Intrinsically Safe for Class I, Division 1, Groups A, B, C and D; Temperature Class T6 Ta = 60°C; Explosionproof-Intrinsically Safe for use in Class I, Zone 0, AEx d[ia] IIC T6 Ta = 60°C Intrinsically Safe (Entity) for use in Class I, II and III, Division 1, Groups A, B, C, D, E, F and G; Temperature Class T6 Ta = 60°C in accordance with Control Drawing No.F08209505.18; Intrinsically safe (Entity) for use in Class I, Zone 0, AEx ia IIC T6 Ta = 60°C; in accordance with Control Drawing No.F08209505.18; Nonincendive for use in Class I, Division 2, Groups A, B, C, and D; Temperature Class T6 Ta = 60; Suitable for use in Class II and III, Division 2, Groups F and G; Temperature Class T6 Ta = 60°C; indoor and outdoor, Type 4X and 6P, IP66 Hazardous (Classified) Locations.

FM Approved for:

Krohne Inc.
Peabody, MA 01960

1/06 3018833
Page 2 of 3

Figure 10-17: FM certificate of compliance, page 2 of 3

FM Approvals
Member of the FM Global Group

This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

Class 3600	1998
Class 3610	1999
Class 3611	2004
Class 3615	1989
Class 3810	1989
Supplement 1	1995
ANSI/NEMA 250	1991
ANSI/ISA 12.22.01	2002
ANSI/ISA 12.00.01	2002
IEC 60529	1989
A1	1999

Original Project ID: 3018833 Approval Granted: March 3, 2005

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date
053105	July 6, 2005		
050718	August 12, 2005		
050926	October 5, 2005		
051129	December 21, 2005		
060321	April 13, 2006		
060502	June 3, 2006		
060616	September 13, 2006		
061205	December 21, 2006		
072507	11/15/07		

FM Approvals LLC

D. W. Styrcula

David W. Styrcula
Technical Team Manager

1-17-08
Date

1/06

3018833
Page 3 of 3

Figure 10-18: FM certificate of compliance, page 3 of 3

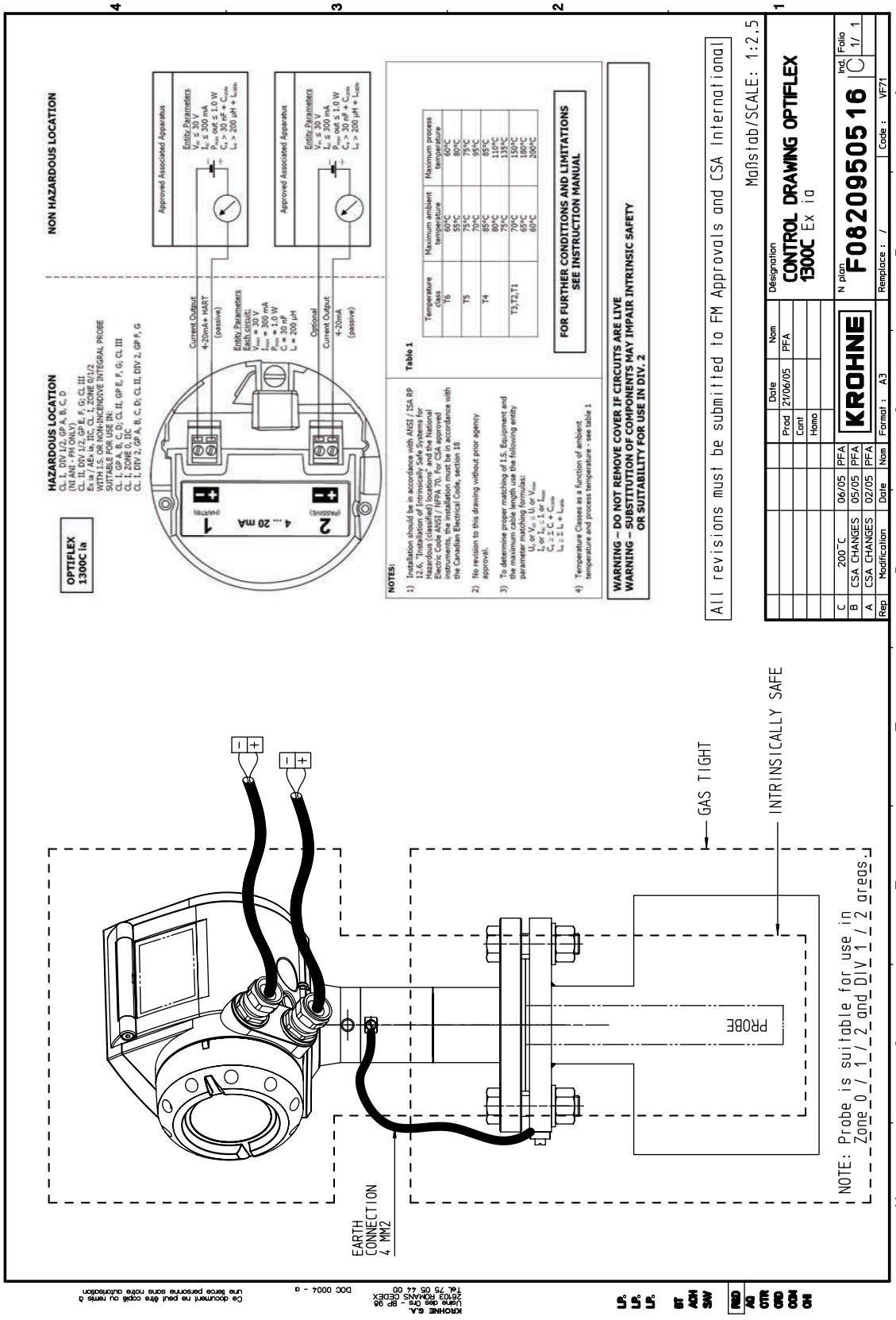


Figure 10-19: **FM control drawing, page 1 of 2**

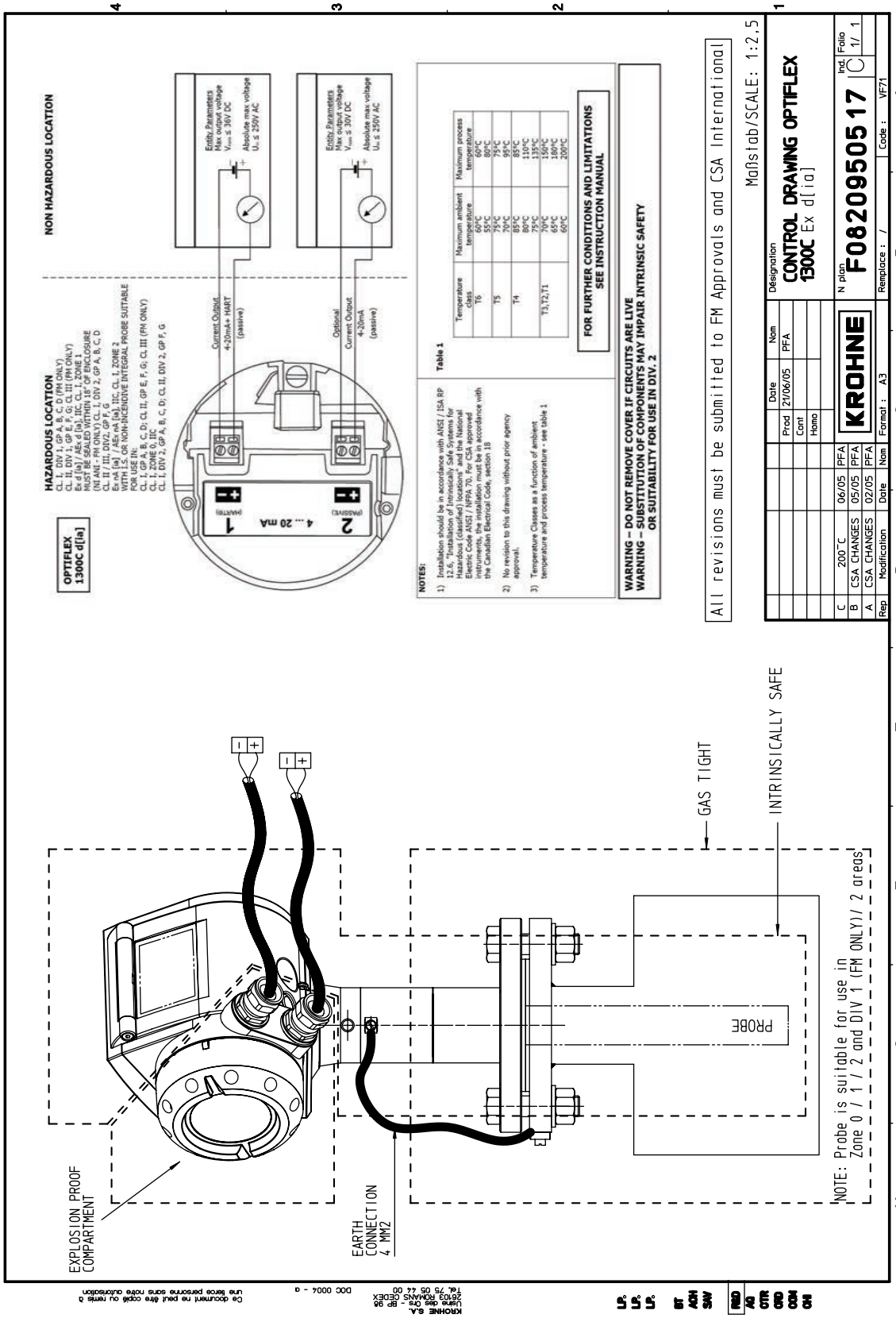


Figure 10-20: **FM control drawing, page 2 of 2**

10.6 CSA Certificate of compliance and control drawings

CSA INTERNATIONAL

Certificate of Compliance

Certificate: 1632432 (LR105802) **Master Contract:** 162767

Project: 1877172 **Date Issued:** 2007/02/12

Issued to: **KROHNE, Inc.**
7 Dearborn Rd
Peabody, MA 01960
USA
Attention: Mr. Rick Loiselle

The products listed below are eligible to bear the CSA Mark shown

Issued by: Joe da Silva, C.E.T.

Authorized by: Patricia Pasemko, Operations Manager

PRODUCTS

CLASS 2258 02 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations

CLASS 2258 02 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations

Cl. I, Zone 1, Ex d [ia], IIC:

Cl. I, Div. 2, Gps. A, B, C and D; Cl.II, Div. 2, Gps. F and G; Cl. III, Div. 2; Class I, Zone 2, Ex nA [ia], IIC:

Radar Level Detector system series OPTIWAVE 7300C and series OPTIFLEX 1300C; rated 36Vdc, 22mA, Encl. Type 4X (enclosure) and 6P (antenna), IP66; Maximum operating and Temperature Code as per installation drawing; Radar Level Detector provides intrinsically safe or non-incendive output to integral antenna such that antenna is suitable for use in Class I, Zone 0, IIC and Class I, Div. 2, Gps A-D and Gps. F

DQD 507 Rev. 2004-06-30

Figure 10-21: CSA certificate of compliance, page 1 of 3

CSA INTERNATIONAL

Certificate: 1632432 (LR105802) **Master Contract:** 162767

Project: 1877172 **Date Issued:** 2007/02/12

and G when installed as per submittor's control drawing F08209505 17 or F08209505 19.

CLASS 2258 04 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe Entity - For Hazardous Locations

Cl. I, Zone 0, Ex ia, IIC:

Cl. I, Gps. A, B, C and D; Cl.II, Gps. E, F and G; Cl.III:

Radar Level Detector system series OPTIWAVE 7300C and series OPTIFLEX 1300C; rated 36Vdc, 22mA, Encl. Type 4X (enclosure) and 6P (antenna), IP66; Maximum operating ambient and Temperature Code as per installation drawing; Radar Level Detector provides intrinsically safe output to integral antenna when installed as per submittor's control drawing F08209505 16 or F08209505 18.

APPLICABLE REQUIREMENTS

CSA Std C22.2 No. 25-1966 - Enclosures for Use in Class II, Groups E, F and G Hazardous Locations

CSA Std C22.2 No. 30-M1986 - Explosion-Proof Enclosures for Use in Class I Hazardous Locations

CAN/CSA-C22.2 No. 94-M91 - Special Purpose Enclosures

CSA Std C22.2 No. 142-M1987 - Process Control Equipment

CAN/CSA-C22.2 No. 157-92 - Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations

CSA Std C22.2 No.213-M1987 - Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations

CAN/CSA-E60079-0-02 - Electrical Apparatus for Explosive Gas Atmospheres Part 0: General Requirements

CAN/CSA-E60079-1-02 - Electrical Apparatus for Explosive Gas Atmospheres—Part 1:Construction and Verification Test of Flameproof Enclosures of Electrical Apparatus

CAN/CSA-E60079-11-02 - Electrical Apparatus for Explosive Gas Atmospheres Part 11: Intrinsic Safety "i"

CAN/CSA-E60079-15-02 - Electrical Apparatus for Explosive Gas Atmospheres Part 15: Electrical Apparatus with Type of Protection "n"

CAN/CSA-C22.2 No. 60529:05 – Degrees of Protection Provided by Enclosures (IP Code)

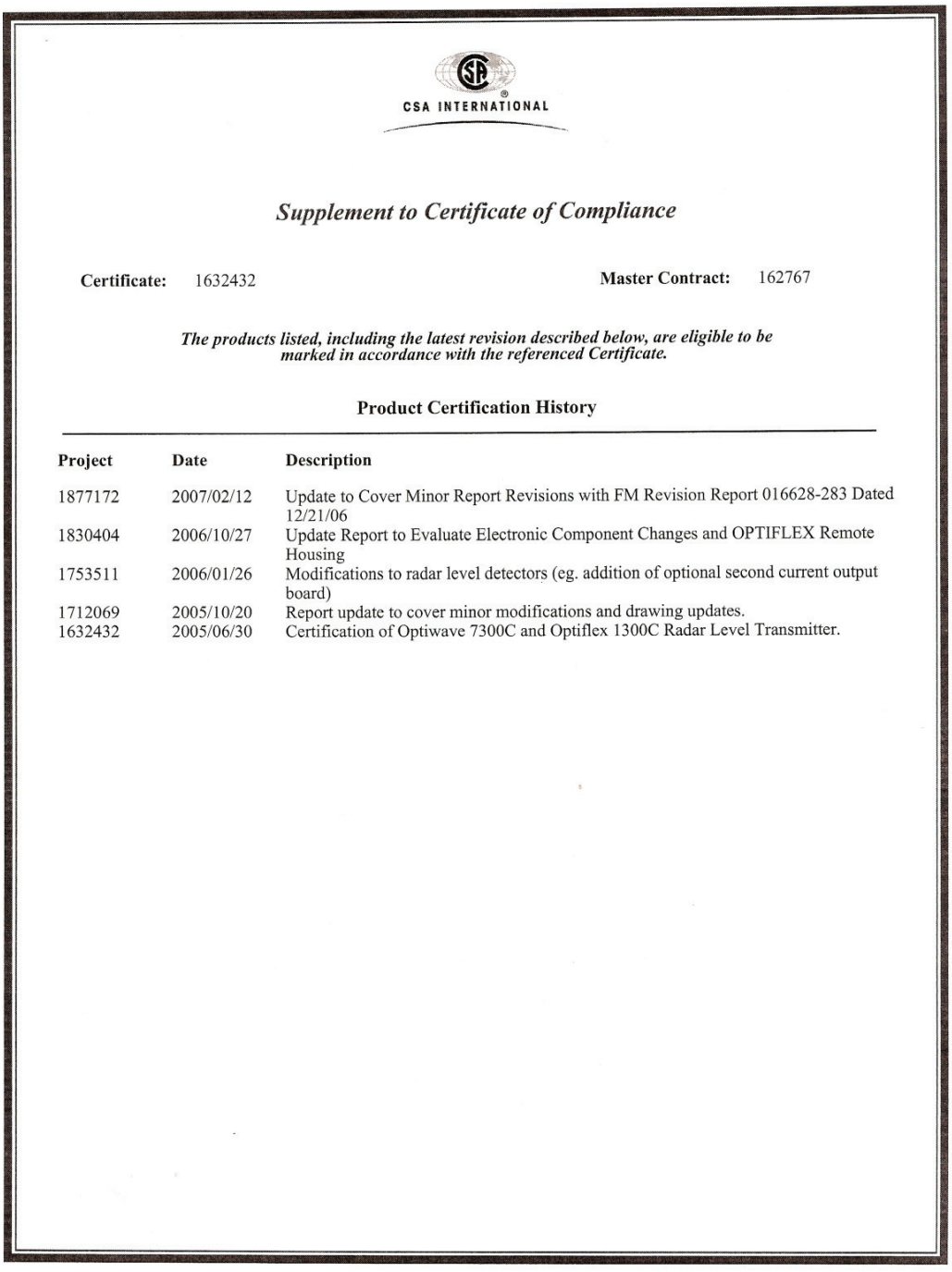
MARKINGS

- Submittor's name

- Model number

DQD 507 Rev. 2004-06-30

Figure 10-22: CSA certificate of compliance, page 2 of 3



CSA INTERNATIONAL

Supplement to Certificate of Compliance

Certificate: 1632432 **Master Contract:** 162767

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
1877172	2007/02/12	Update to Cover Minor Report Revisions with FM Revision Report 016628-283 Dated 12/21/06
1830404	2006/10/27	Update Report to Evaluate Electronic Component Changes and OPTIFLEX Remote Housing
1753511	2006/01/26	Modifications to radar level detectors (eg. addition of optional second current output board)
1712069	2005/10/20	Report update to cover minor modifications and drawing updates.
1632432	2005/06/30	Certification of Optiwave 7300C and Optiflex 1300C Radar Level Transmitter.

Figure 10-23: CSA certificate of compliance, page 3 of 3

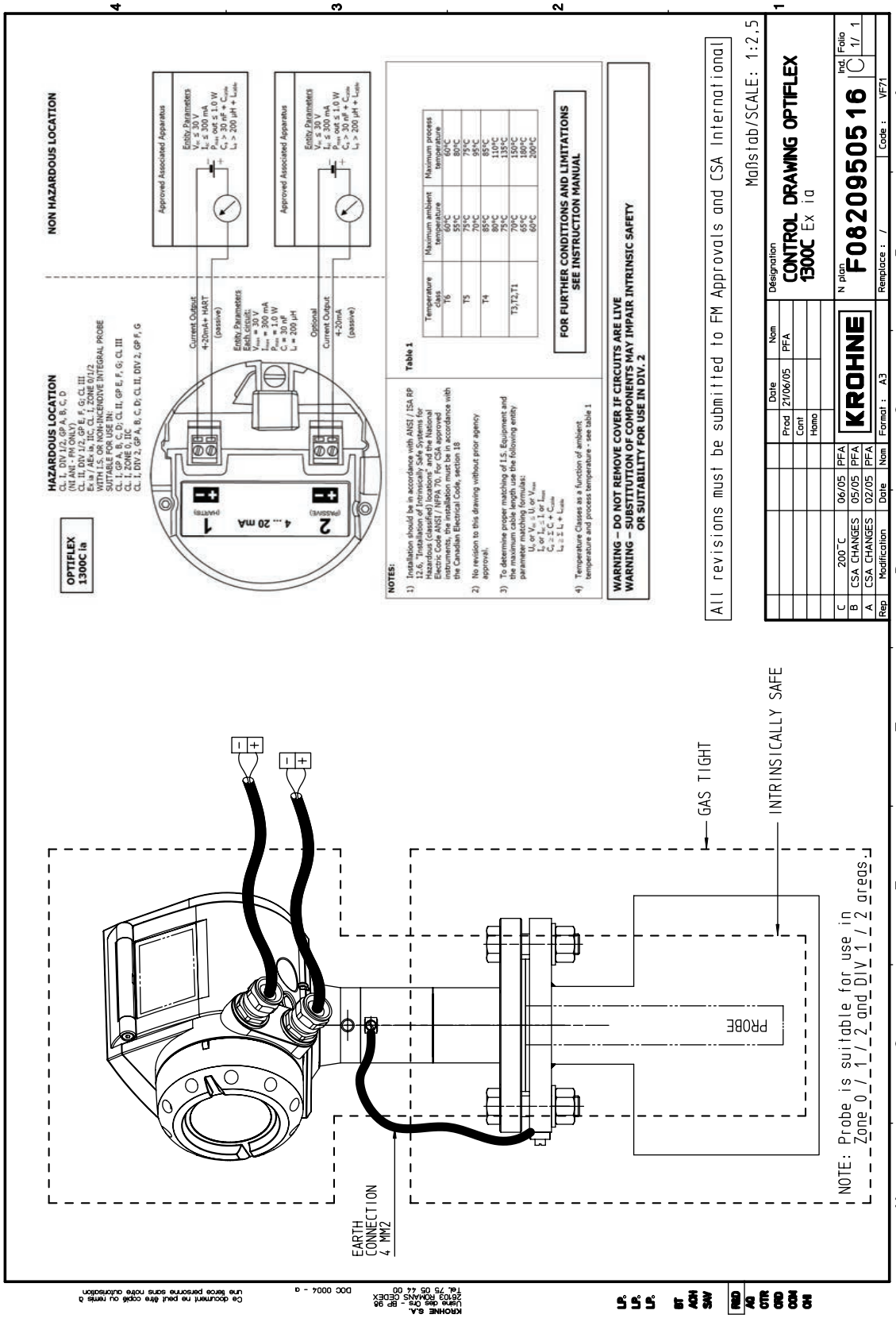


Figure 10-24: CSA control drawing, page 1 of 2

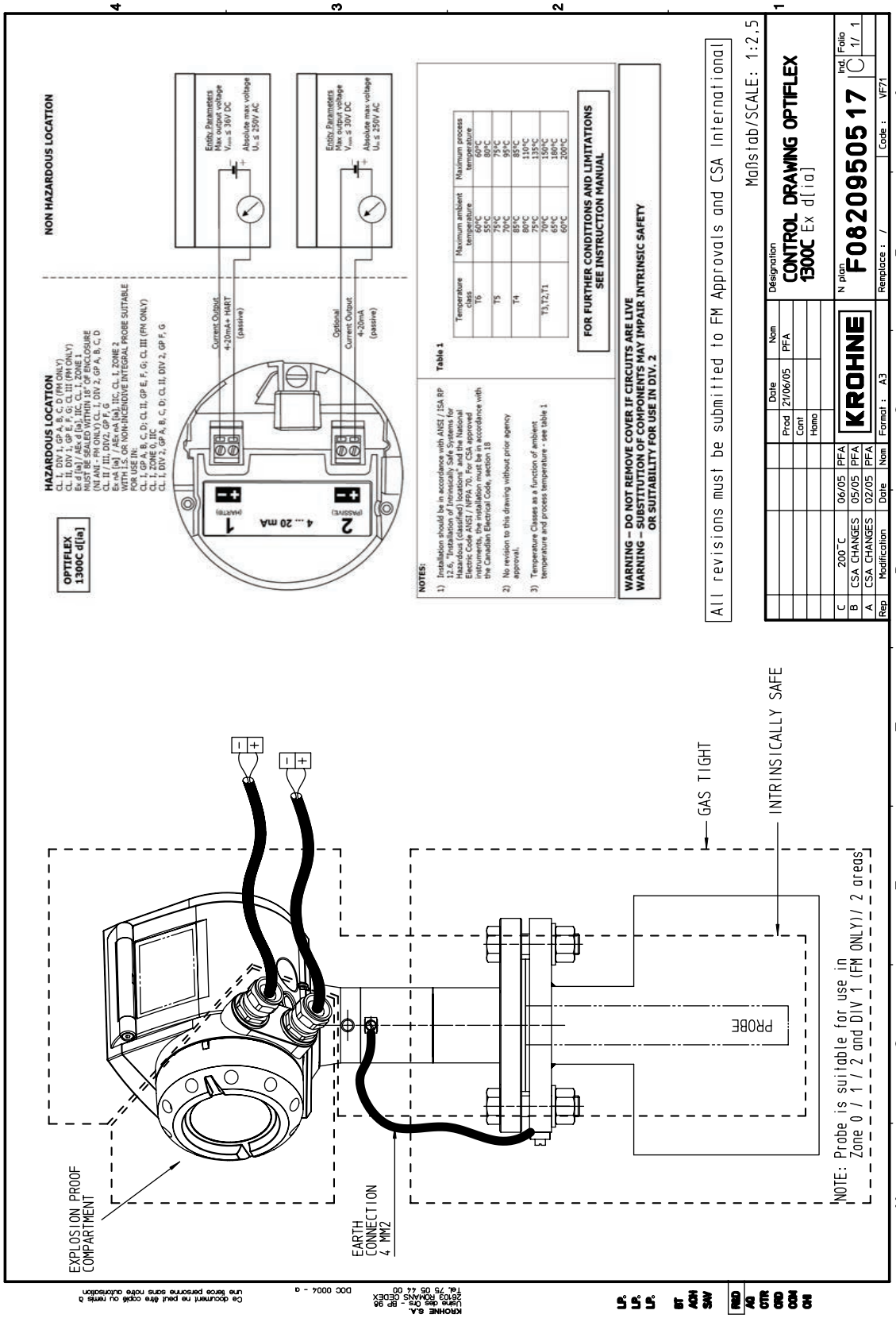


Figure 10-25: CSA control drawing, page 2 of 2

10.7 Republic of Belarus certificates

КОМИТЕТ ПО СТАНДАРТИЗАЦИИ,
МЕТРОЛОГИИ И СЕРТИФИКАЦИИ
ПРИ СОВЕТЕ МИНИСТРОВ
РЕСПУБЛИКИ БЕЛАРУСЬ

COMMITTEE FOR STANDARDIZATION,
METROLOGY AND CERTIFICATION
UNDER COUNCIL OF MINISTERS
OF THE REPUBLIC OF BELARUS

СЕРТИФИКАТ

ОБ УТВЕРЖДЕНИИ ТИПА СРЕДСТВА ИЗМЕРЕНИЙ

PATTERN APPROVAL CERTIFICATE
OF MEASURING INSTRUMENT

НОМЕР СЕРТИФИКАТА:
CERTIFICATE NUMBER: 3105

ДЕЙСТВИТЕЛЕН ДО:
VALID TILL: 25 ноября 2009 г.

Настоящий сертификат удостоверяет, что на основании положительных результатов государственных испытаний утвержден тип

уровнемеры Reflex-Radar Optiflex 1300C,
фирма "Krohne S.A.S.", Франция (FR),

который зарегистрирован в Государственном реестре средств измерений под номером **РБ 03 07 2375 04** и допущен к применению в Республике Беларусь.

Описание типа средства измерений приведено в приложении и является неотъемлемой частью настоящего сертификата.

Председатель Комитета В.Н. Корешков
9 декабря 2004 г.

Figure 10-26: **Pattern approval certificate of measuring instruments**

10.8 Republic of Kazakhstan certificates

КОМИТЕТ ПО СТАНДАРТИЗАЦИИ, МЕТРОЛОГИИ И СЕРТИФИКАЦИИ ПРИ СОВЕТЕ МИНИСТРОВ РЕСПУБЛИКИ БЕЛАРУСЬ

COMMITTEE FOR STANDARDIZATION, METROLOGY AND CERTIFICATION UNDER COUNCIL OF MINISTERS OF THE REPUBLIC OF BELARUS

СЕРТИФИКАТ

ОБ УТВЕРЖДЕНИИ ТИПА СРЕДСТВА ИЗМЕРЕНИЙ

PATTERN APPROVAL CERTIFICATE OF MEASURING INSTRUMENT

НОМЕР СЕРТИФИКАТА: CERTIFICATE NUMBER: 3105

ДЕЙСТВИТЕЛЕН ДО: VALID TILL: 25 ноября 2009 г.

Настоящий сертификат удостоверяет, что на основании положительных результатов государственных испытаний утвержден тип

уровнемеры Reflex-Radar Optiflex 1300C,

фирма "Krohne S.A.S.", Франция (FR),

который зарегистрирован в Государственном реестре средств измерений под номером **РБ 03 07 2375 04** и допущен к применению в Республике Беларусь.

Описание типа средства измерений приведено в приложении и является неотъемлемой частью настоящего сертификата.

Председатель Комитета

В.Н. Корешков
9 декабря 2004 г.

Figure 10-27: **Pattern approval certificate of measuring instruments**

10.9 Russian Federation certificates

ФЕДЕРАЛЬНОЕ АГЕНТСТВО
ПО ТЕХНИЧЕСКОМУ РЕГУЛИРОВАНИЮ И МЕТРОЛОГИИ

СЕРТИФИКАТ

об утверждении типа средств измерений

PATTERN APPROVAL CERTIFICATE
OF MEASURING INSTRUMENTS

DE.C.29.006.A № 21031

Действителен до
" 01 " июля 2010 г.

Настоящий сертификат удостоверяет, что на основании положительных результатов испытаний утвержден тип уровнемеров OPTIFLEX 1300 C
наименование средства измерений ,
Фирма "KROHNE", Германия
наименование предприятия-изготовителя ,
,
который зарегистрирован в Государственном реестре средств измерений под № 29509-05 и допущен к применению в Российской Федерации.

Описание типа средства измерений приведено в приложении к настоящему сертификату.

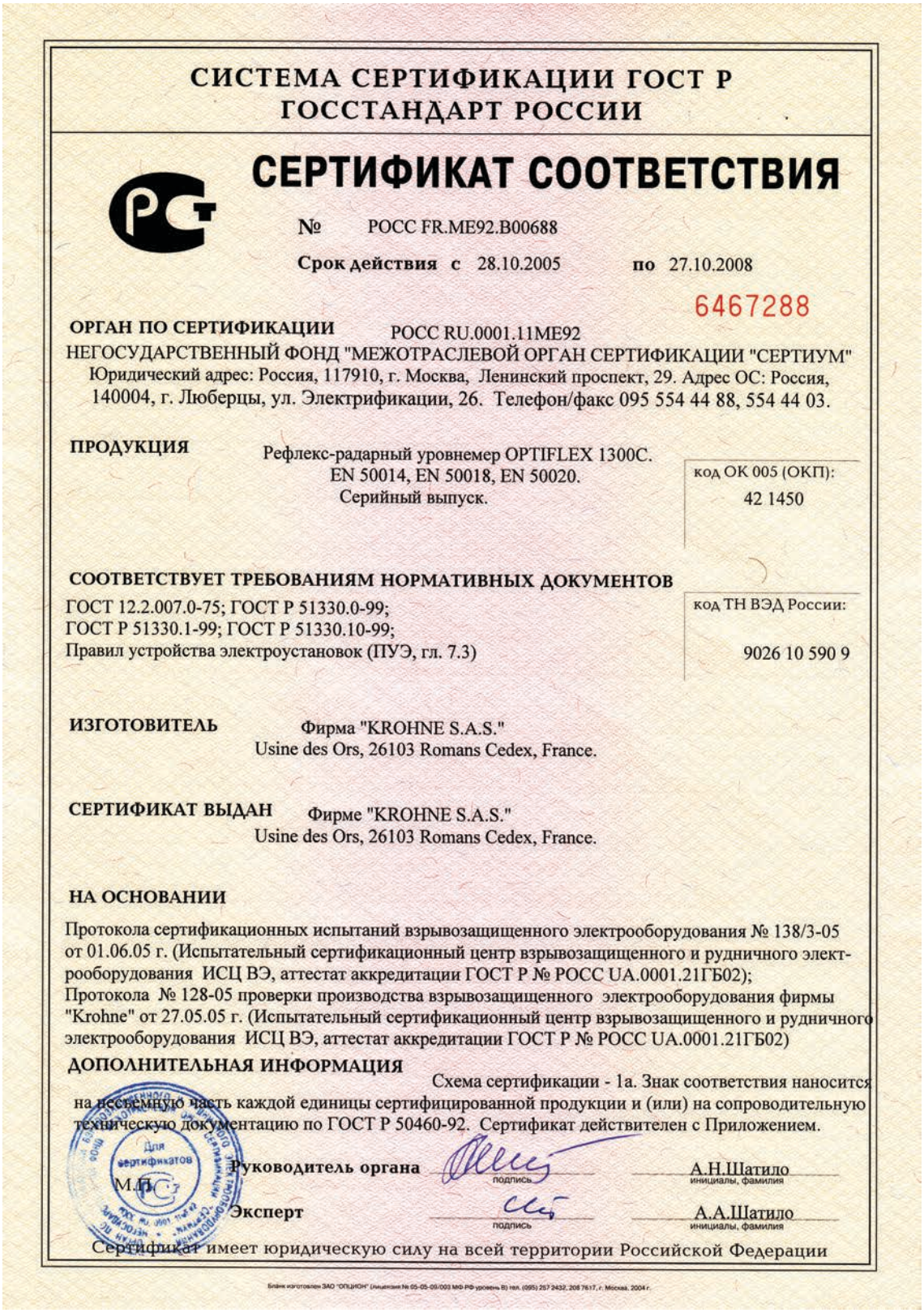
Заместитель Руководителя В.Н.Крутиков
" 20 " 07 2005 г.

Продлен до
" " г.

Заместитель Руководителя
" " 200 г.

210031

Figure 10-28: Pattern approval certificate of measuring instruments



СИСТЕМА СЕРТИФИКАЦИИ ГОСТ Р
ГОССТАНДАРТ РОССИИ

СЕРТИФИКАТ СООТВЕТСТВИЯ

№ РОСС FR.ME92.B00688

Срок действия с 28.10.2005 **по** 27.10.2008

6467288

ОРГАН ПО СЕРТИФИКАЦИИ РОСС RU.0001.11ME92
НЕГОСУДАРСТВЕННЫЙ ФОНД "МЕЖОТРАСЛЕВОЙ ОРГАН СЕРТИФИКАЦИИ "СЕРТИУМ"
Юридический адрес: Россия, 117910, г. Москва, Ленинский проспект, 29. Адрес ОС: Россия, 140004, г. Люберцы, ул. Электрификации, 26. Телефон/факс 095 554 44 88, 554 44 03.

ПРОДУКЦИЯ Рефлекс-радарный уровнемер OPTIFLEX 1300C.
EN 50014, EN 50018, EN 50020.
Серийный выпуск.

код ОК 005 (ОКП): 42 1450

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ НОРМАТИВНЫХ ДОКУМЕНТОВ
ГОСТ 12.2.007.0-75; ГОСТ Р 51330.0-99;
ГОСТ Р 51330.1-99; ГОСТ Р 51330.10-99;
Правил устройства электроустановок (ПУЭ, гл. 7.3)

код ТН ВЭД России: 9026 10 590 9

ИЗГОТОВИТЕЛЬ Фирма "KROHNE S.A.S."
Usine des Ors, 26103 Romans Cedex, France.

СЕРТИФИКАТ ВЫДАН Фирме "KROHNE S.A.S."
Usine des Ors, 26103 Romans Cedex, France.

НА ОСНОВАНИИ
Протокола сертификационных испытаний взрывозащищенного электрооборудования № 138/3-05 от 01.06.05 г. (Испытательный сертификационный центр взрывозащищенного и рудничного электрооборудования ИСЦ ВЭ, аттестат аккредитации ГОСТ Р № РОСС UA.0001.21ГБ02);
Протокола № 128-05 проверки производства взрывозащищенного электрооборудования фирмы "Krohne" от 27.05.05 г. (Испытательный сертификационный центр взрывозащищенного и рудничного электрооборудования ИСЦ ВЭ, аттестат аккредитации ГОСТ Р № РОСС UA.0001.21ГБ02)

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ
Схема сертификации - 1а. Знак соответствия наносится на неснемную часть каждой единицы сертифицированной продукции и (или) на сопроводительную техническую документацию по ГОСТ Р 50460-92. Сертификат действителен с Приложением.

М.П. **Руководитель органа** подпись А.Н.Шатило инициалы, фамилия

Эксперт подпись А.А.Шатило инициалы, фамилия

Сертификат имеет юридическую силу на всей территории Российской Федерации

Figure 10-29: GOST-R certificate

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ЭКОЛОГИЧЕСКОМУ, ТЕХНОЛОГИЧЕСКОМУ И АТОМНОМУ НАДЗОРУ

РАЗРЕШЕНИЕ

№ РРС 00-17178

На применение

Оборудование (техническое устройство, материал):
Рефлекс-радарный уровнемер OPTIFLEX 1300 C с маркировкой взрывозащиты ExiaIICT3...T6 X или 1Exd[ia]IICT3…T6 X.

Код ОКП (ТН ВЭД): 42 0000 (9026 10 590 0)

Изготовитель (поставщик): Фирма "KROHNE S.A." (Франция).

Основание выдачи разрешения: Заключение ИСЦ ВЭ № 515/Р-2005 от 01.06.2005 г. (рег. № 13-01-ТУ-00158-2005).

Условия применения:
1. Применять на поднадзорных производствах и объектах в соответствии с Техническим описанием, а также требованиями главы 7.3 ПУЭ.
2. Внесение изменений в техническую документацию и конструкцию технических устройств возможно только по согласованию с аккредитованной испытательной организацией и Федеральной службой по экологическому, технологическому и атомному надзору.

Срок действия разрешения до 02.08.2008

Дата выдачи 02.08.2005

ВРИО Руководителя
А.Б. Малышев

001847

Бланк изготовлен ЗАО "Опцион" (лицензия № 05-05-09/003 МФ РФ, уровень В) тел.: 257-2432, 208-7617, г. Москва, 2004 год

Figure 10-30: Ex approval (Permission of Rostechnadzor)

10.10 Ukraine certificates

ДЕРЖАВНИЙ КОМІТЕТ УКРАЇНИ З ПИТАНЬ
ТЕХНІЧНОГО РЕГУЛЮВАННЯ ТА СПОЖИВЧОЇ ПОЛІТИКИ

Серія В № 002845

СЕРТИФІКАТ ВІДПОВІДНОСТІ
засобів вимірювальної техніки затвердженому типу

№ UA-MI/2-1860-2006 Виданий 14 лютого 2006 р.
Чинний до 9 грудня 2008 р.

Цей сертифікат засвідчує, що ідентифіковані належним чином рівнеміри рефлексні OPTIFLEX 1300C, код УКТ ЗЕД 9026 10 59 00, які виробляє фірма KROHNE, Німеччина, Франція, відповідають затвердженому типу, який зареєстровано в Державному реєстрі засобів вимірювальної техніки за номером У1222-05, а також вимогам ГОСТ 28725-90 та технічній документації фірми-виробника.

Сертифікат виданий виробнику на підставі позитивних результатів державних контрольних випробувань, проведених Національним науковим центром "Інститут метрології" (акт від 9 грудня 2005 р.), за рішенням Науково-технічної комісії з метрології Державного комітету України з питань технічного регулювання та споживчої політики (протокол № 6 від 21 грудня 2005 р.).

Виробник зобов'язаний забезпечити відповідність рівнемірів рефлексних OPTIFLEX 1300C затвердженому типу та вимогам нормативних документів, зазначених у цьому сертифікаті.

Сертифікат є чинним з урахуванням терміну гарантії виробника на конкретний зразок засобу вимірювальної техніки.

Заступник Голови *В. Дрогомирецький*

Figure 10-31: **UA certificate**

ДВСЦ ВЕ
Державний випробувальний
сертифікаційний центр
вибухозахищеного та рудникового
електрообладнання
ДОНЕЦЬК

СВІДОЦТВО

про вибухозахищеність електрообладнання (електротехнічного пристрою)

№ 776

Свідоцтво, видане фірмі KROHNE S.A.S. (Франція), посвідчує, що виготовлені підприємством рефлекс-радарні рівнеміри OPTIFLEX 1300 C є вибухозахищеними та відповідають нормативно-правовим актам з охорони праці щодо загальних вимог з електробезпеки.

На підставі проведених в ДВСЦ ВЕ експертизи технічної документації, огляду та випробувань на вибухозахищеність указані вироби відповідають вимогам ГОСТ 12.2.007.0, ГОСТ 22782.0, ГОСТ 22782.5, ГОСТ 22782.6 і їм присвоєне маркування вибухозахисту:

0ExiaIICT3...T6 X або 1ExdiaIICT3...T6 X

Указані вироби можуть бути рекомендовані для застосування на території України та повинні використовуватись згідно з «Умовами використання», що є невід`ємною частиною цього свідоцтва.

Свідоцтво дійсне до **1 червня 2010 р.**

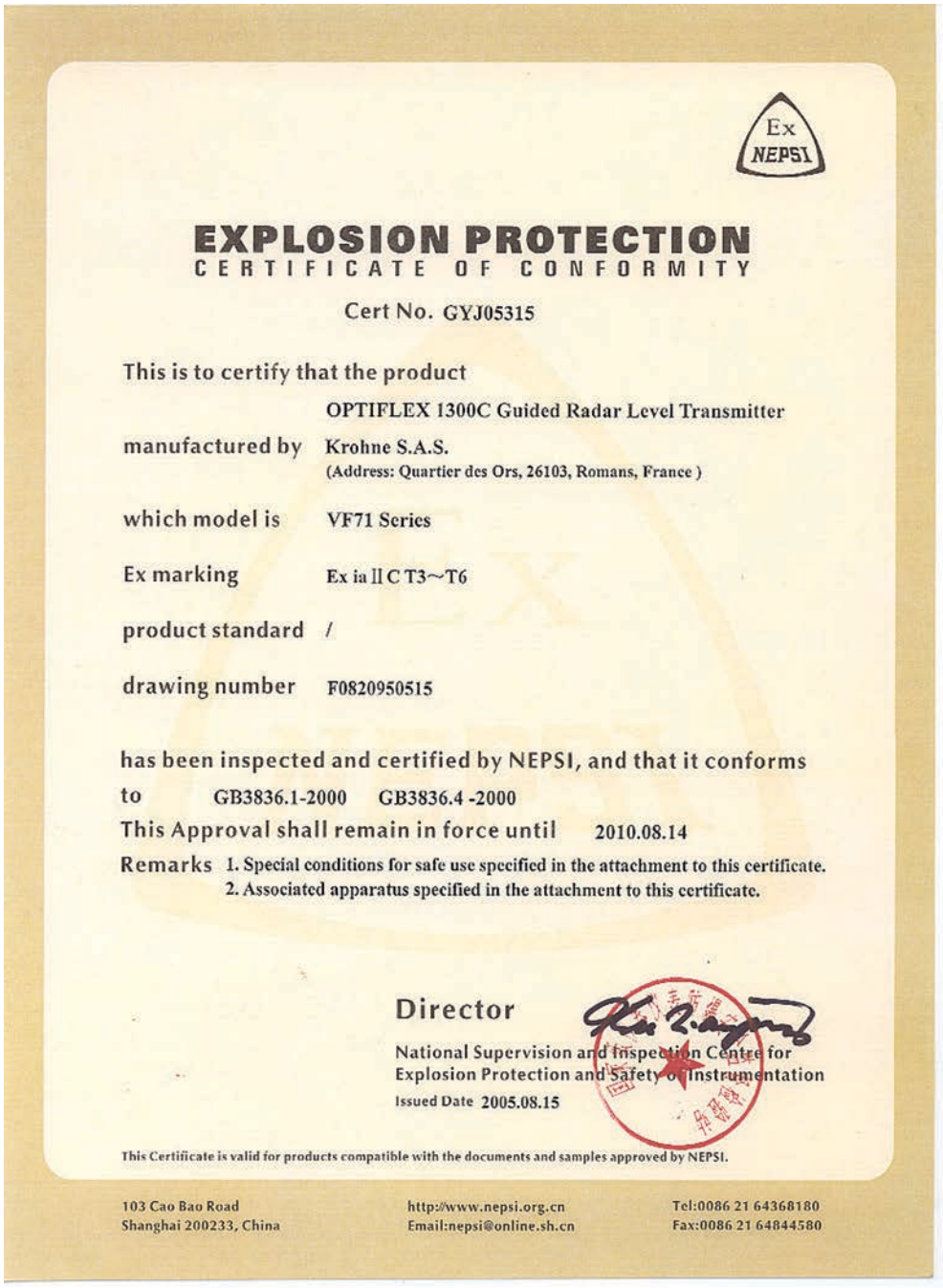
Чинність свідоцтва продовжена до _____

Керівник ДВСЦ ВЕ **А.Є.Погорельський**

М.П.

В цьому свідоцтві пронумеровано і скріплено печаткою 3 аркуш(а)

Figure 10-32: **UAEx certificate**



Ex NEPSI

EXPLOSION PROTECTION
CERTIFICATE OF CONFORMITY

Cert No. GYJ05315

This is to certify that the product

OPTIFLEX 1300C Guided Radar Level Transmitter

manufactured by Krohne S.A.S.
(Address: Quartier des Ors, 26103, Romans, France)

which model is VF71 Series

Ex marking Ex ia IIC T3~T6

product standard /

drawing number F0820950515

has been inspected and certified by NEPSI, and that it conforms to GB3836.1-2000 GB3836.4 -2000

This Approval shall remain in force until 2010.08.14

Remarks 1. Special conditions for safe use specified in the attachment to this certificate.
2. Associated apparatus specified in the attachment to this certificate.

Director

National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation

Issued Date 2005.08.15

This Certificate is valid for products compatible with the documents and samples approved by NEPSI.

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http://www.nepsi.org.cn
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Tel:0086 21 64368180
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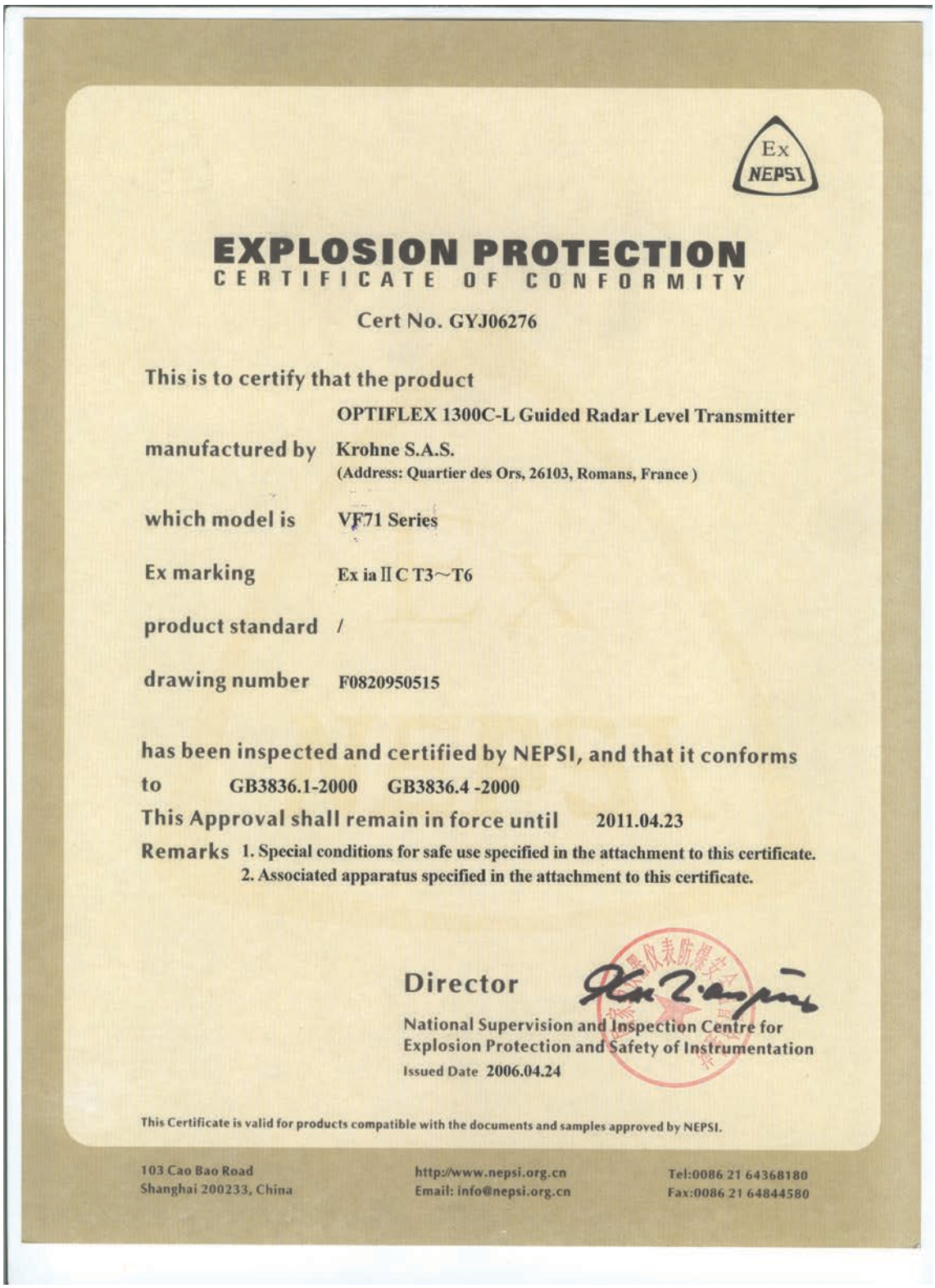
Figure 10-33: NEPSI certificate, Ex ia approval



Ex
NEPSI

EXPLOSION PROTECTION
CERTIFICATE OF CONFORMITY

Cert No. GYJ06276

This is to certify that the product

OPTIFLEX 1300C-L Guided Radar Level Transmitter

manufactured by Krohne S.A.S.
(Address: Quartier des Ors, 26103, Romans, France)

which model is VF71 Series

Ex marking Ex ia II C T3~T6

product standard /

drawing number F0820950515

has been inspected and certified by NEPSI, and that it conforms to GB3836.1-2000 GB3836.4 -2000

This Approval shall remain in force until 2011.04.23

Remarks 1. Special conditions for safe use specified in the attachment to this certificate.
2. Associated apparatus specified in the attachment to this certificate.

Director

National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation
Issued Date 2006.04.24

This Certificate is valid for products compatible with the documents and samples approved by NEPSI.

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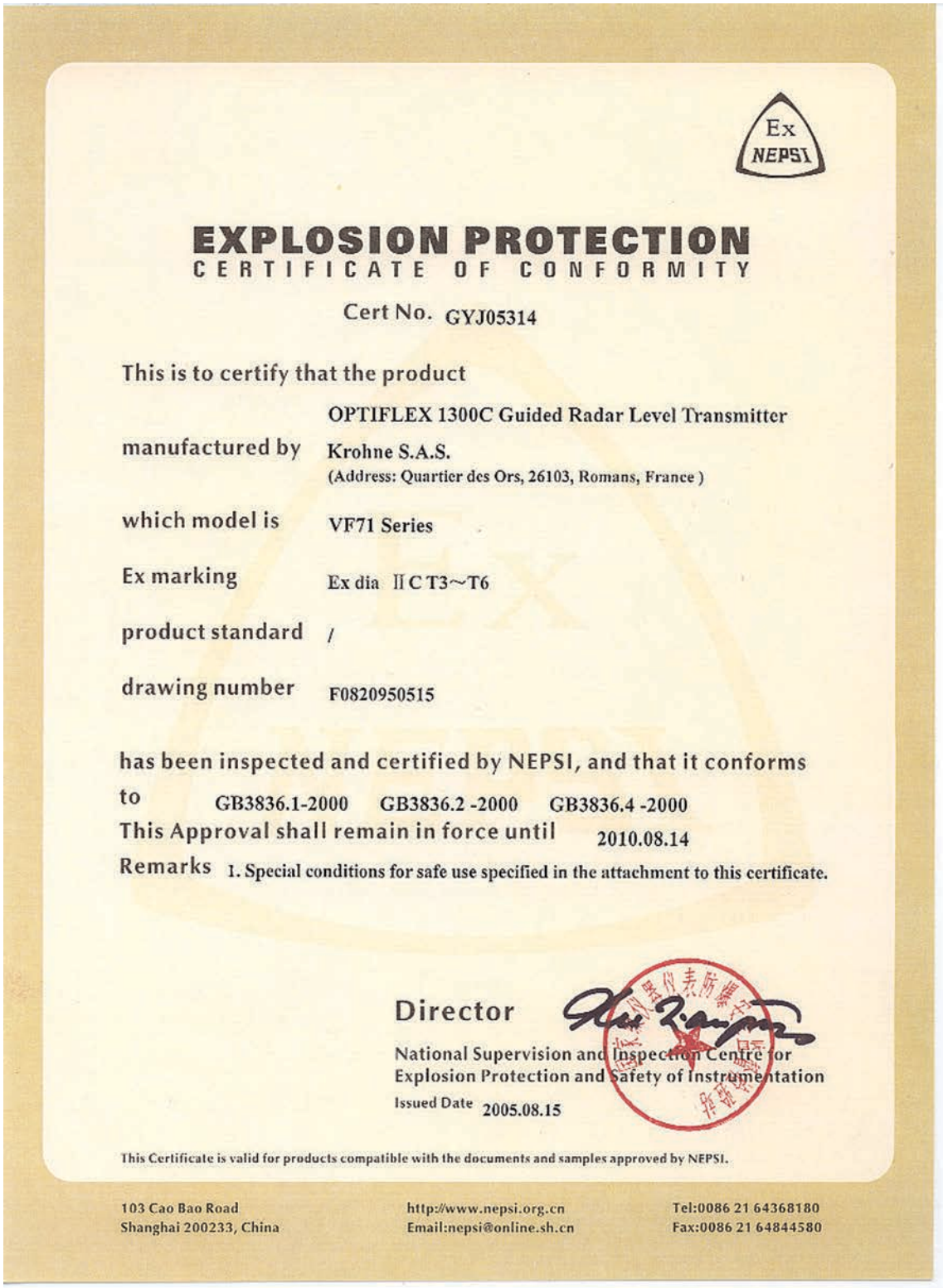
Tel:0086 21 64368180
Fax:0086 21 64844580

Figure 10-34: NEPSI certificate, Ex ia approval (for liquid applications only)



Ex
NEPSI

EXPLOSION PROTECTION
CERTIFICATE OF CONFORMITY

Cert No. GYJ05314

This is to certify that the product

OPTIFLEX 1300C Guided Radar Level Transmitter

manufactured by Krohne S.A.S.
(Address: Quartier des Ors, 26103, Romans, France)

which model is VF71 Series

Ex marking Ex dia ⅡC T3~T6

product standard /

drawing number F0820950515

has been inspected and certified by NEPSI, and that it conforms to GB3836.1-2000 GB3836.2 -2000 GB3836.4 -2000

This Approval shall remain in force until 2010.08.14

Remarks 1. Special conditions for safe use specified in the attachment to this certificate.

Director

National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation

Issued Date 2005.08.15

This Certificate is valid for products compatible with the documents and samples approved by NEPSI.

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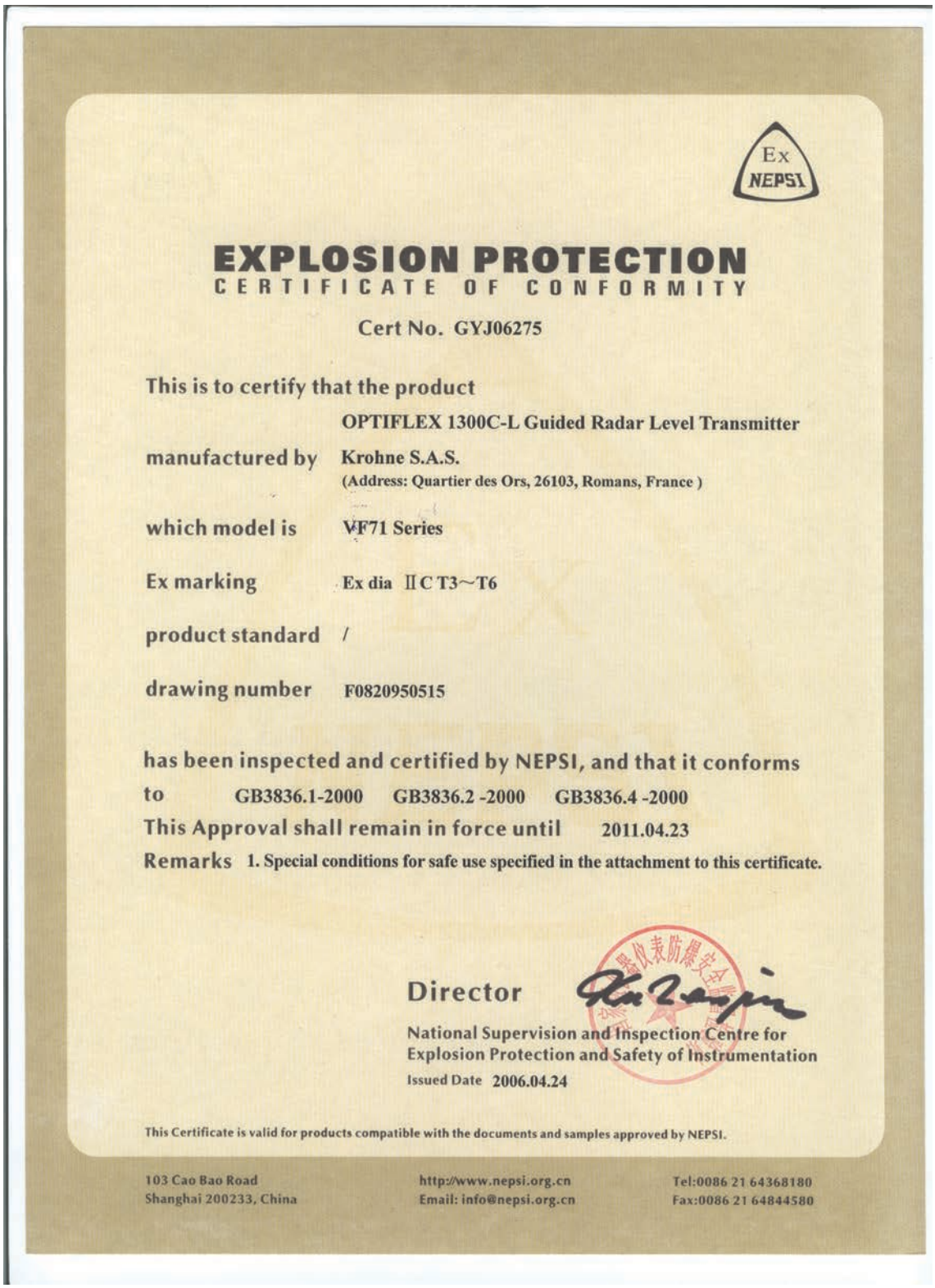
Figure 10-35: NEPSI certificate, Ex dia approval



Ex NEPSI

EXPLOSION PROTECTION
CERTIFICATE OF CONFORMITY

Cert No. GYJ06275

This is to certify that the product

OPTIFLEX 1300C-L Guided Radar Level Transmitter

manufactured by Krohne S.A.S.
(Address: Quartier des Ors, 26103, Romans, France)

which model is VF71 Series

Ex marking Ex dia ⅡC T3~T6

product standard /

drawing number F0820950515

has been inspected and certified by NEPSI, and that it conforms to GB3836.1-2000 GB3836.2 -2000 GB3836.4 -2000

This Approval shall remain in force until 2011.04.23

Remarks 1. Special conditions for safe use specified in the attachment to this certificate.

Director

National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation

Issued Date 2006.04.24

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Figure 10-36: NEPSI certificate, Ex dia approval (for liquid applications only)

KROHNE measuring technology - Product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Mass flowmeters
- Ultrasonic flowmeters
- Vortex flowmeters
- Flow controllers
- Level measuring instruments
- Temperature measuring instruments
- Pressure measuring instruments
- Analysis
- Oil and gas industry

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