

Operating Instructions

OPTISOUND 3020 C

4 ... 20 mA/HART



Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications engineering

Engineering systems & solutions

Switches, counters, displays and recorders

Heat metering

Pressure and temperature

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30507-EN-050914

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Supplementary operating instructions manuals**Information:**

OPTISOUND 3020 C is available in different versions and is supplied order-specifically. Depending on the selected version, supplementary operating instructions manuals come with the shipment. The supplementary operating instructions are stated in paragraph "3. *Product description*".

1 About this document

1.1 Function

This operating instructions manual has all the information you need for quick setup and safe operation of OPTISOUND 3020 C. Please read this manual before you start setup.

1.2 Target group

This operating instructions manual is directed to trained personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used



Information, tip, note

This symbol indicates helpful additional information.



Caution, warning, danger

This symbol informs you of a dangerous situation that could occur. Ignoring this cautionary note can impair the person and/or the instrument.



Ex applications

This symbol indicates special instructions for Ex applications.



List

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



Action

This arrow indicates a single action.



Sequence

Numbers set in front indicate successive steps in a procedure.

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained, specialised personnel authorised by the operator. For safety and warranty reasons, any internal work on the instruments must be carried out only by personnel authorised by the manufacturer.

2.2 Appropriate use

OPTISOUND 3020 C is a sensor for continuous level measurement.

2.3 Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

OPTISOUND 3020 C is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

2.5 CE conformity

OPTISOUND 3020 C is in CE conformity with EMC (89/336/EWG), fulfils the NAMUR recommendation NE 21 and is in CE conformity with LVD (73/23/EWG).

Conformity has been judged acc. to the following standards:

- EMC:
 - Emission EN 61326: 1997 (class A)
 - Susceptibility EN 61326: 1997/A1: 1998
- LVD: EN 61010-1: 2001

2.6 Compatibility acc. to NAMUR NE 53

OPTISOUND 3020 C meets NAMUR recommendation NE 53.

The parameter adjustment of the basic sensor functions is independent of the software version. The range of available functions depends on the respective software version of the individual components.

The software version of OPTISOUND 3020 C can be determined as follows:

- on the type label of the electronics
- via the indicating/adjustment module.

You can find all software histories on our website www.krohne.com.

2.7 Safety information for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- OPTISOUND 3020 C ultrasonic sensor
- Documentation
 - this operating instructions manual
 - Ex-specific safety instructions (with Ex versions) and, if necessary, further certificates
 - Operating instructions manual "*Indicating and adjustment module*" - optional

Components

OPTISOUND 3020 C consists of the following components:

- Process fitting with transducer
- Housing with electronics
- Housing cover, optionally available with indicating/adjustment module

The components are available in different versions.

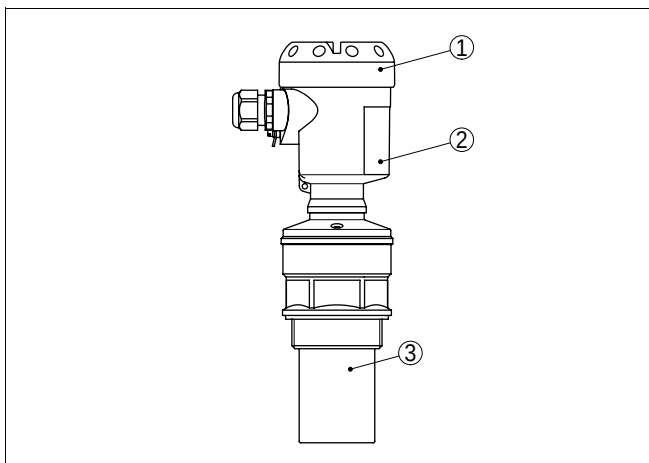


Fig. 1: OPTISOUND 3020 C, version with plastic housing

- 1 Housing cover, optionally available with indicating/adjustment module
- 2 Housing with electronics
- 3 Process fitting with transducer

3.2 Principle of operation

Area of application

OPTISOUND 3020 C is an ultrasonic sensor for continuous level measurement. It is suitable for liquids and solids in virtually all industries, particularly in water and waste water management.

Physical principle

The transducer of the ultrasonic sensor emits short ultrasonic pulses to the measured product. These pulses are reflected by the product surface and received by the transducer as echoes. The running time of the ultrasonic pulses from emission to reception is proportional to the distance and hence to the level. The determined level is converted into an appropriate output signal and outputted as measured value.

Power supply

Two-wire electronics 4 ... 20 mA/HART for power supply and measured value transmission on the same cable.

The power supply range can differ depending on the instrument version. The exact range is stated in the "*Technical data*" in the "*Supplement*".

3.3 Adjustment

OPTISOUND 3020 C can be adjusted with two different adjustment media:

- the indicating/adjustment module
- a HART handheld

The entered parameters are generally saved in OPTISOUND 3020 C, optionally also in the indicating/adjustment module.

3.4 Storage and transport

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test acc. to DIN EN 24180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Storage and transport temperature

- Storage and transport temperature see "*Supplement – Technical data – Ambient conditions*"
- Relative humidity 20 ... 85 %

4 Mounting

4.1 General instructions

Installation position

Select an installation position you can easily reach for mounting and connecting as well as later retrofitting of an indicating and adjustment module. The housing can be rotated by 330° without the use of any tools. You can also install the indicating and adjustment module in four different positions (each displaced by 90°).

Moisture

Use the recommended cable (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give your OPTISOUND 3020 C additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to mounting outdoors, in areas where moisture is expected (e.g. by cleaning processes) or on cooled or heated vessels.

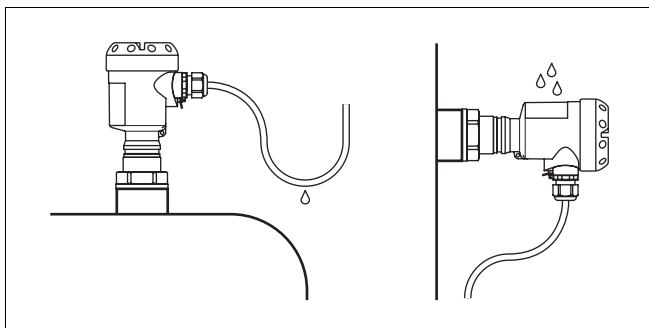


Fig. 2: Measures against moisture penetration

Measuring range

The reference plane for the measuring range is the lower edge of the transducer.

Make sure that the min. distance, corresponding to the so called dead band, is maintained below the reference plane - measurement is not possible in this areas. The exact value of the dead band is stated in chapter "*Technical data*" in the Supplement.

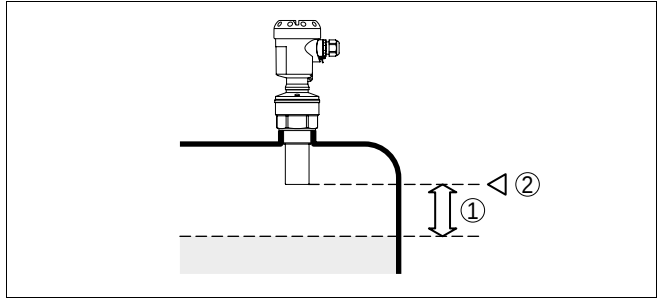


Fig. 3: Min. distance to the max. level

- 1 Dead zone
- 2 Reference plane



Information:

If the product reaches the transducer, buildup can form on it over a period of time and later cause measurement errors.

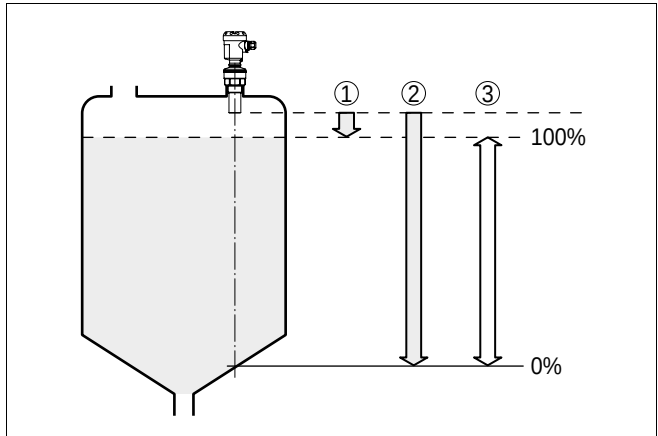


Fig. 4: Measuring range (operating range) and max. measuring distance

- 1 full
- 2 empty (max. measuring distance)
- 3 Measuring range

Pressure/Vacuum

Gauge pressure in the vessel does not influence OPTISOUND 3020 C. Low pressure or vacuum, however, damp the ultrasonic pulses. This influences the measuring result, particularly if the level is very low. With pressures under - 0.2 bar (-20 kPa) you should use a different measuring principle, e.g. radar or guided radar (TDR).

4.2 Mounting information

Screwing in

Screw OPTISOUND 3020 C into the mounting socket with an appropriate spanner applied to the hexagon of the process fitting. Max. torque see chapter "*Technical data*".



Warning:

The housing must not be used to screw the instrument in! Applying tightening force to the housing can damage its internal mechanical components.

Installation position

When mounting OPTISOUND 3020 C, keep a distance of at least 200 mm (7.9 in) to the vessel wall. If the sensor is installed in the center of dished or rounded vessel tops, multiple echoes can arise. These can, however, be faded out by an appropriate adjustment (see chapter "*Setup*").

If this distance cannot be maintained, a false echo storage should be carried out during setup. This applies particularly if buildup on the vessel wall is expected. In this case, we recommend repeating the false echo storage later on with existing buildup.

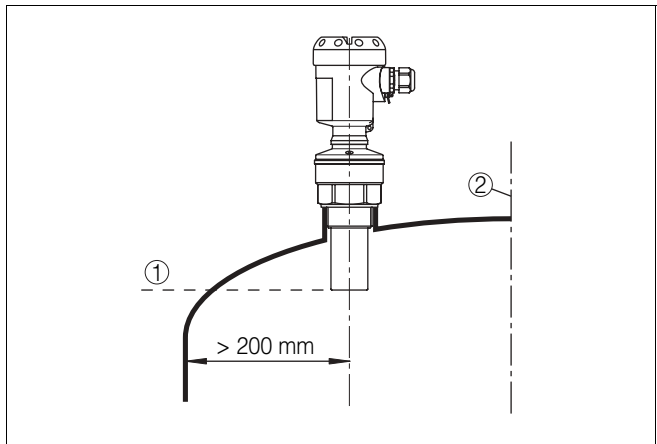


Fig. 5: Mounting on dished vessel tops

- 1 Reference plane
- 2 Vessel center or symmetry axis

In vessels with conical bottom it can be advantageous to mount the sensor in the center of the vessel, as measurement is then possible down to the lowest point of the vessel bottom.

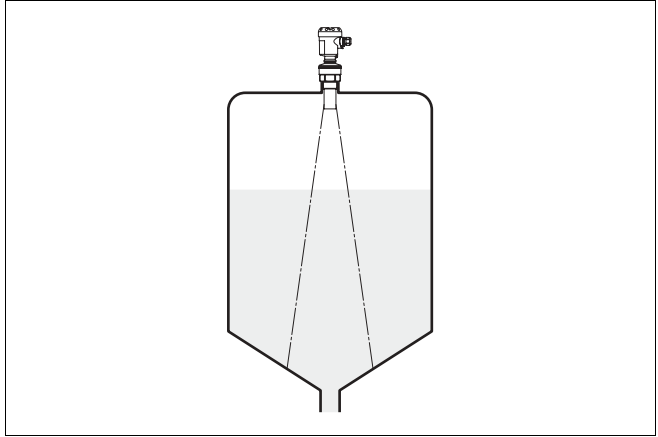


Fig. 6: Vessel with conical bottom

Socket

The mounting socket should preferably be dimensioned to allow the lower edge of the transducer to protrude at least 10 mm out of the socket.

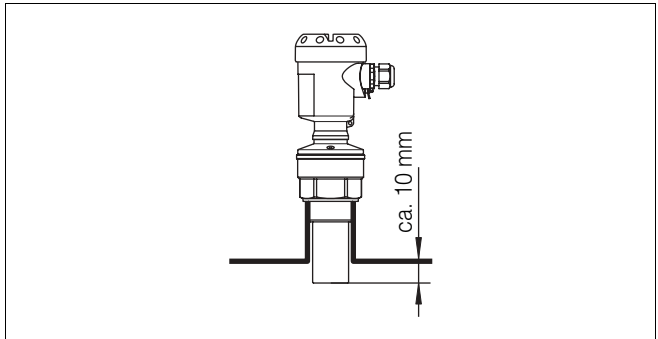


Fig. 7: Recommended socket mounting

If the reflective properties of the medium are good, you can mount OPTISOUND 3020 C on sockets higher than the transducer length. You will find recommended values for socket heights in the following illustration. The socket end should be smooth and burr-free, if possible also rounded. Carry out a false echo storage.

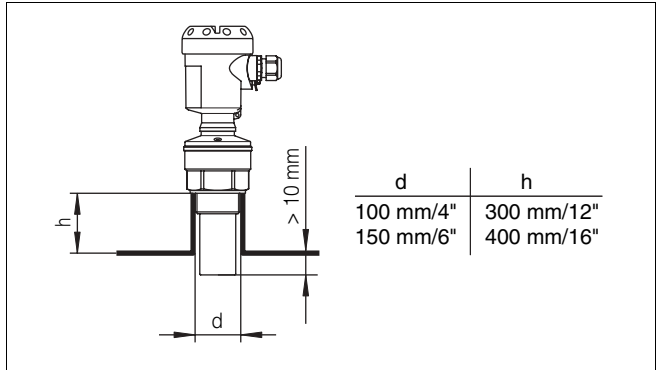


Fig. 8: Deviating socket dimensions

Sensor orientation

In liquids, direct the sensor as perpendicular as possible to the product surface to achieve optimum measurement results.

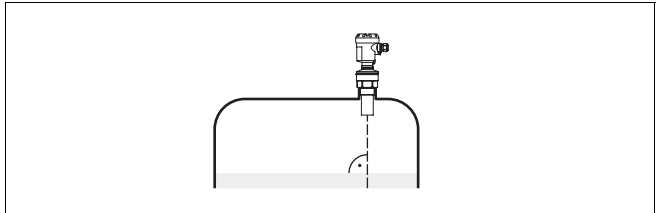


Fig. 9: Orientation in liquids

To reduce the min. distance to the medium, you can also mount OPTISOUND 3020 C with a beam deflector. By doing this, it is possible to fill the vessel nearly to maximum. This arrangement is particularly suitable for open vessels such as e. g. overflow basins.

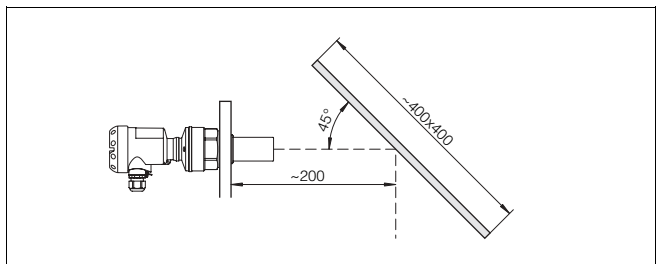


Fig. 10: Beam deflector

Vessel installations

The ultrasonic sensor should be installed at a location where no installations cross the ultrasonic beam.

Vessel installations such as for example, ladders, limit switches, heating spirals, struts etc. can cause false echoes superimposed on the useful echo. Make sure when planning your measuring site that the ultrasonic signals have "free access" to the measured product.

If there are existing vessel installations, a false echo storage should be carried out during setup.

If large vessel installations such as struts or supports cause false echoes, these can be attenuated through supplementary measures. Small, inclined sheet metal or plastic baffles above the installations scatter the ultrasonic signals and avoid direct false echoes.

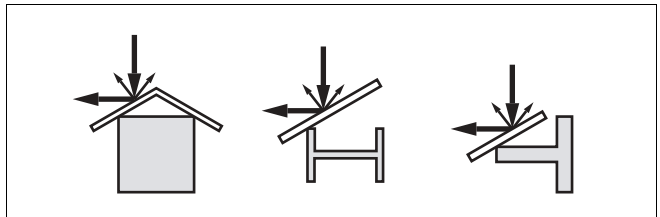


Fig. 11: Cover smooth profiles with deflectors

Agitators

If there are agitators in the vessel, a false echo storage should be carried out with the agitators in motion. This ensures that the interfering reflections from the agitators are saved with the blades in different positions.

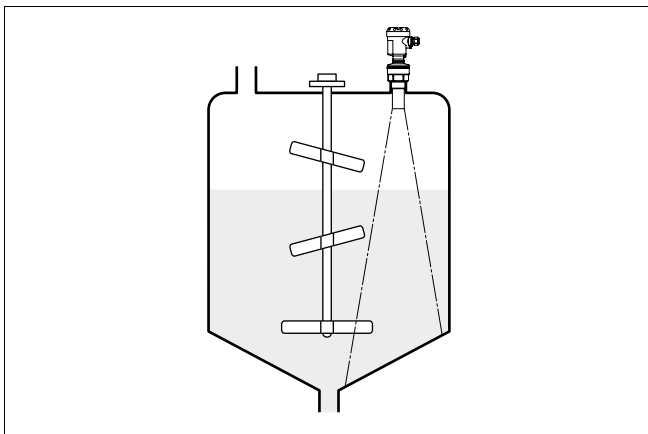


Fig. 12: Agitators

Inflowing material

Do not mount the instruments in or above the filling stream. Make sure that you detect the product surface and not the inflowing product.

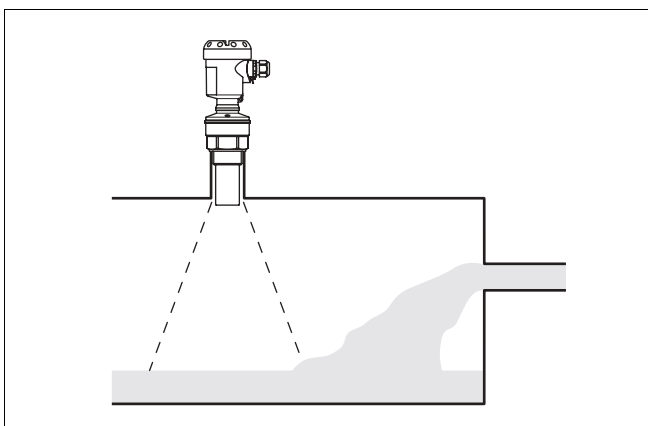


Fig. 13: Inflowing liquid

Foam

Through the action of filling, stirring and other processes in the vessel, dense foams which considerably damp the emitted signals may form on the product surface.

If foams are causing measurement errors, the sensor should be used in a standpipe or, alternatively, the more suitable guided radar sensors (TDR) should be used.

Guided radar is not influenced by foam generation and is particularly suitable for such applications.

Air flow

If there are strong air currents in the vessel, e.g. due to strong winds in outdoor installations, or because of air turbulence, e.g. through cyclone exhausting, you should mount OPTISOUND 3020 C in a standpipe or use a different measuring principle, e.g. radar or guided radar (TDR).

Standpipe measurement

By using a standpipe (surge or bypass tube), the influence of vessel installations, foam generation and turbulence is excluded.

Standpipes must extend all the way down to the requested min. level, as measurement is only possible within the tube.

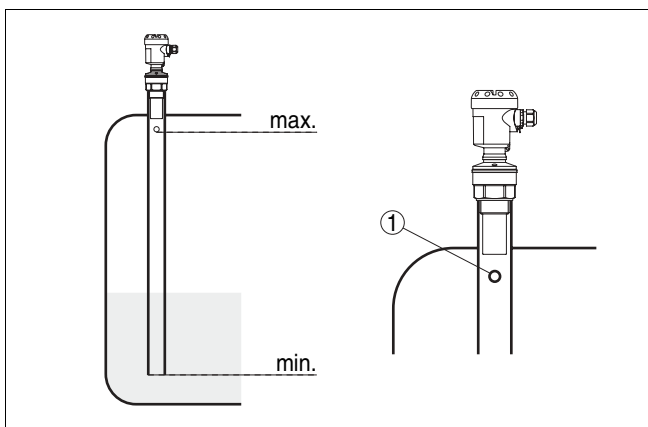


Fig. 14: Standpipe in a tank
1 Vent hole $\varnothing$ 5 ... 10 mm

OPTISOUND 3020 C can be used from tube diameters from 50 mm.

Avoid large gaps and thick welding joints when connecting the tubes. Generally carry out a false echo storage.

Measurement in a standpipe is not recommended for very adhesive products.

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always observe the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltages are expected, overvoltage arresters should be installed.

Take note of safety instructions for Ex applications



In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units.

Select power supply

Power supply and current signal are transmitted via the same two-wire connection cable. The power supply range can differ depending on the instrument version. The exact range is stated in the "*Technical data*" in the Supplement.

Provide a reliable separation between the supply circuit and the mains circuits acc. to DIN VDE 0106 part 101.

Bear in mind the following factors regarding supply voltage:

- the reduction of the output voltage of the power supply unit under nominal load (with a sensor current of 20.5 mA or 22 mA in case of fault signal)
- the influence of additional instruments in the circuit (see load values in *Technical data*).

Selecting the connection cable

OPTISOUND 3020 C is connected with standard two-wire cable without screen. An outer cable diameter of 5...9 mm ensures the seal effect of the cable entry. If electromagnetic interference is expected, we recommend the use of screened cable.

Cable screening and grounding

Connect the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal outside on the housing must be connected to the potential equalisation (low impedance).

If potential equalisation currents are expected, the connection on the evaluation side must be made via a ceramic capacitor (e.g. 1 nF, 1500 V). The low frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

**Select connection
cable for Ex applica-
tions**

Take note of the corresponding installation regulations for Ex applications. In particular, make sure that no potential equalisation currents flow over the cable screen. In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation.

5.2 Connection procedure

Proceed as follows:

- 1 Unscrew the housing cover
- 2 If an indicating and adjustment module is installed, remove it by turning it slightly to the left.
- 3 Loosen compression nut of the cable entry
- 4 Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) insulation from the ends of the individual wires
- 5 Insert the cable into the sensor through the cable entry
- 6 Lift the opening levers of the terminals with a screwdriver (see following illustration)
- 7 Insert the wire ends into the open terminals according to the wiring plan
- 8 Press down the opening levers of the terminals, you will hear the terminal spring closing
- 9 Check the hold of the wires in the terminals by lightly pulling on them
- 10 Connect the screen to the internal ground terminal and the external ground terminal to potential equalisation
- 11 Tighten the compression nut of the cable entry, the seal ring must completely encircle the cable
- 12 Screw the housing cover back on

The electrical connection is finished.

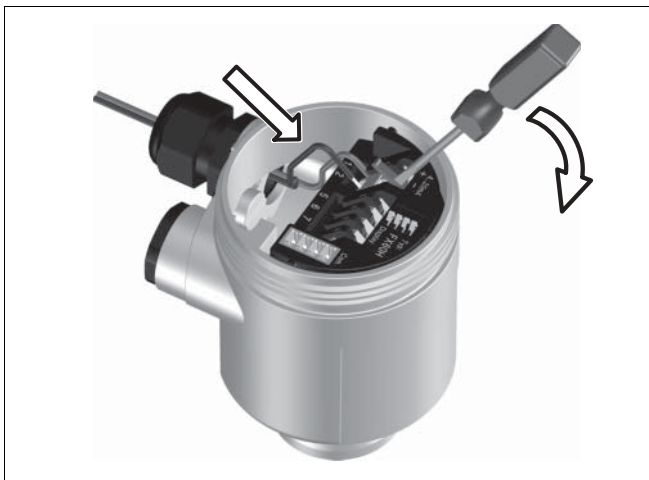


Fig. 15: Connection steps 6 and 7

5.3 Wiring plans, single chamber housing



The following illustrations apply to the non-Ex as well as to the Ex ia version.

Housing overview

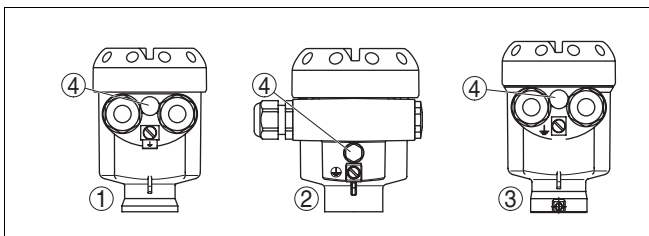


Fig. 16: Material versions, single chamber housing

- 1 Plastic
- 2 Aluminium
- 3 Stainless steel
- 4 Filter element for pressure compensation

Electronics and connection compartment

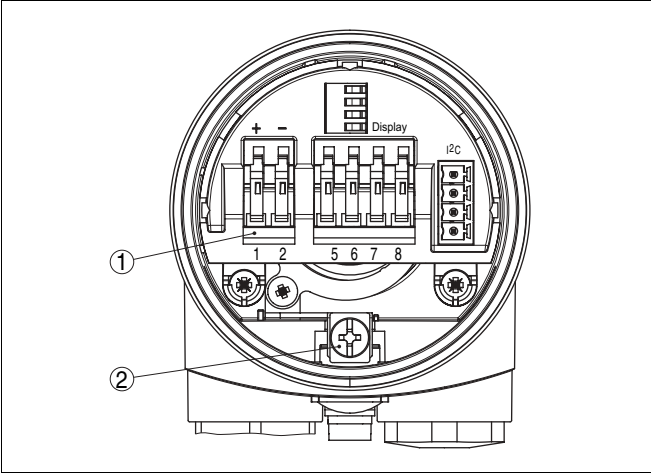


Fig. 17: Electronics and connection compartment, single chamber housing
1 Spring-loaded terminals for power supply
2 Ground terminal for connection of the cable screen

Wiring plan

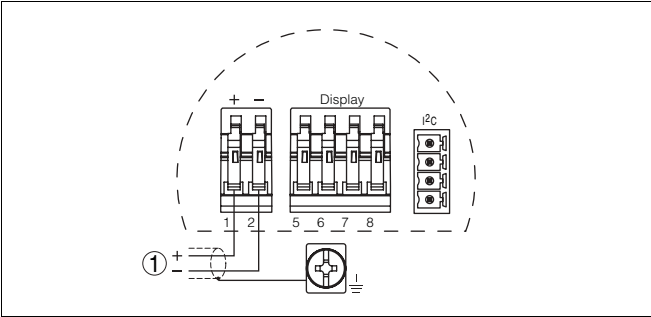


Fig. 18: Wiring plan, single chamber housing
1 Power supply/Signal output

5.4 Wiring plans, double chamber housing



The following illustrations apply to the non-Ex as well as to the EEx ia version.

Housing overview

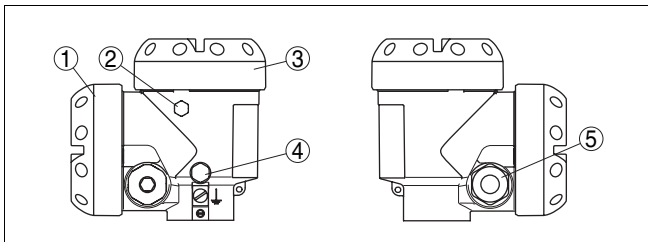


Fig. 19: Double chamber housing

- 1 Housing cover, connection compartment
- 2 Blind stopper
- 3 Housing cover, electronics compartment
- 4 Filter element for pressure compensation
- 5 Cable gland

Electronics compartment

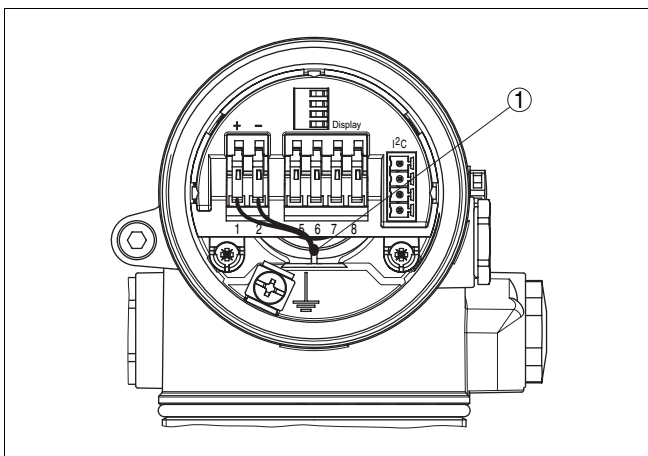


Fig. 20: Electronics compartment, double chamber housing

- 1 Internal connection cable to the connection compartment

Connection compartment

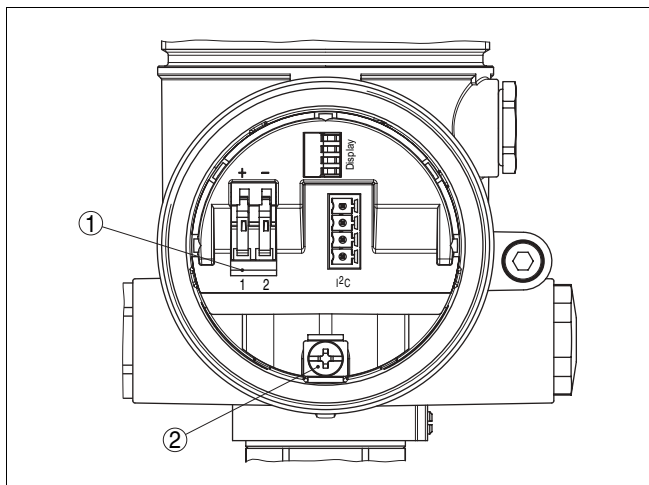


Fig. 21: Connection compartment, double chamber housing

- 1 Spring-loaded terminals for power supply
- 2 Ground terminal for connection of the cable screen

Wiring plan

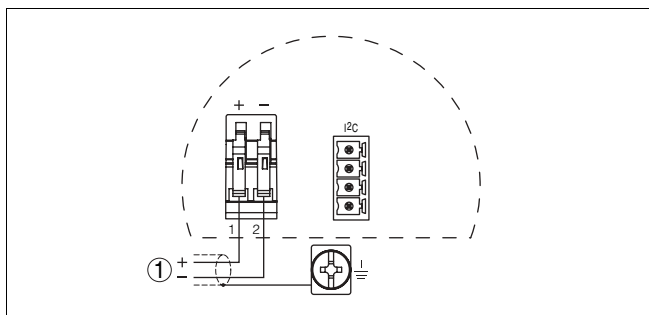


Fig. 22: Wiring plan, double chamber housing

- 1 Power supply/Signal output

5.5 Switch on phase

Switch on phase

After OPTISOUND 3020 C is connected to power supply, the instrument carries out a self-test for approx. 30 seconds. The following steps are carried out:

- Internal check of the electronics
- Indication of the instrument type, the firmware version as well as the sensor TAGs (sensor name)
- Output signal jumps briefly (approx. 10 seconds) to the set fault current

Then the actual measured value is displayed and the corresponding current is transmitted to the cable.¹⁾

¹⁾ The values correspond to the actual level as well as to the settings already carried out, e.g. default setting.

6 Setup with the indicating/adjustment module

6.1 Short description

The indicating/adjustment module is used for measured value display, adjustment and diagnosis. It can be mounted in all sensors of the OPTISOUND instrument family, in the single as well as double chamber housing (optionally in the electronics or connection compartment).

6.2 Installation of the indicating/adjustment module

The indicating/adjustment module can be inserted or removed at any time. It is not necessary to interrupt the power supply.

To mount, proceed as follows:

- 1 Unscrew the housing cover
- 2 Place the indicating/adjustment module in the desired position on the electronics (you can choose any one of four different positions - each displaced by 90°)
- 3 Press the indicating and adjustment module onto the electronics and turn it to the right until it snaps in.
- 4 Screw housing cover with inspection window tightly back on

Removal is carried out in reverse order.

The indicating/adjustment module is powered by the sensor, an additional connection is not necessary.

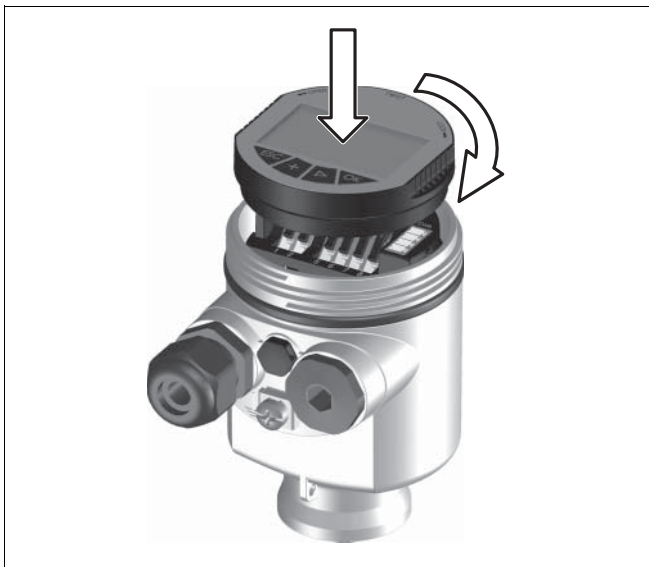


Fig. 23: Installation of the indicating/adjustment module



Note:

If you intend to retrofit OPTISOUND 3020 C with an indicating/adjustment module for continuous measured value indication, a higher cover with an inspection glass is required.

6.3 Adjustment system

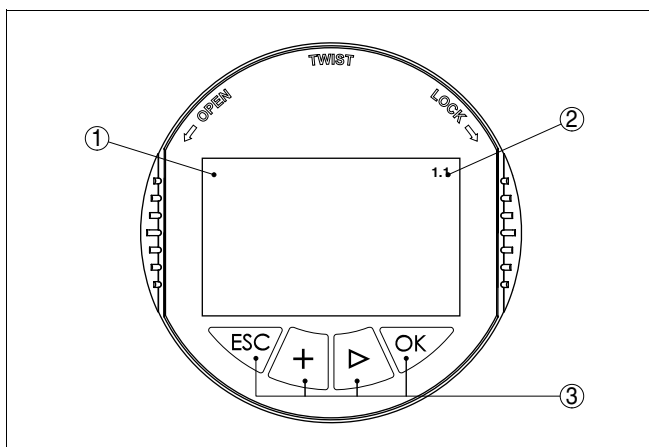


Fig. 24: Indicating and adjustment elements

- 1 LC display
- 2 Indication of the menu item number
- 3 Adjustment keys

Key functions

- **[OK]** key:
 - move to the menu overview
 - confirm selected menu
 - edit parameter
 - save value
- **[>]** key to select:
 - menu change
 - list entry
 - editing position
- **[+]** key:
 - modify value of a parameter
- **[ESC]** key:
 - interrupt input
 - jump to the next higher menu

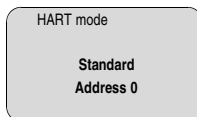
Adjustment system

The sensor is adjusted via the four keys of the indicating and adjustment module. The LC display indicates the individual menu items. The functions of the individual keys are shown in the above illustration. Approx. 10 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with **[OK]** will not be saved.

6.4 Setup procedure

Address setting HART-Multidrop

In HART-Multidrop mode (several sensors on one input) the address must be set before continuing with the parameter adjustment. You will find a detailed description in the operating instructions manual of the indicating/adjustment module.



Parameter adjustment

Because OPTISOUND 3020 C is a distance measuring instrument, its primary task is to measure the distance from the sensor to the product surface. In order to indicate the actual filling level, the measured distance must be allocated to a specific height percentage. To make this adjustment, the full and empty distances in the vessel are entered. If these values are not known, it is also possible to carry out the adjustment with other distances, e.g. 10 % and 90 %. The origin of these distance values is always the lower edge of the flange (with flange versions) or the lower edge of the transducer (all other versions).

The actual level is then calculated on the basis of these entered values. At the same time, the operating range of the sensor is limited from maximum range to the requested range.

The real product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

In the main menu item "Basic adjustment", the individual submenu items should be selected one after the other and provided with the correct parameter values.

Start your parameter adjustment with the following menu items of the basic adjustment:

Carrying out min. adjustment

Proceed as follows:

- 1 Move from the measured value display to the main menu by pushing **[OK]**.

► Basic adjustment
Display
Diagnostics
Service
Info

- 2 Select the menu item "Basic adjustment" with **[→]** and confirm with **[OK]**. Now the menu item "Min. adjustment" is displayed.

Min. adjustment
0.00 %
=
5.000 m(d)
4.000 m(d)



- 3 Prepare the % value for editing with **[OK]** and set the cursor to the requested position with **[→]**. Set the requested percentage value with **[+]** and save with **[OK]**. The cursor jumps now to the distance value.
- 4 Enter the appropriate distance value in m (corresponding to the percentage value) for the empty vessel (e.g. distance from the sensor to the vessel bottom).
- 5 Save the settings with **[OK]** and move to "Max. adjustment" with **[→]**.

Carrying out max. adjustment Proceed as follows:

Max. adjustment
100.00 %
=
1.000 m(d)
2.000 m(d)

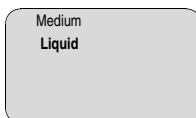


- 1 Prepare the % value for editing with **[OK]** and set the cursor to the requested position with **[→]**. Set the requested percentage value with **[+]** and save with **[OK]**. The cursor jumps now to the distance value.
- 2 Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. Keep in mind that the max. level must lie below the dead band.
- 3 Save the settings with **[OK]** and move to "Medium selection" with **[→]**.

Medium selection

Each product has different reflective properties. In addition, there are various interfering factors which have to be taken into account: agitated product surfaces and foam generation (with liquids); dust generation, material cones and echoes from the

vessel wall (with solids). To adapt the sensor to these different conditions, you should first select in this menu item "*Liquid*" or "*Solid*".



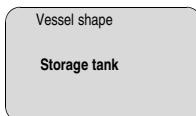
With solids, you can also choose between "*Powder/Dust*", "*Granular/Pellets*" or "*Ballast/Pebbels*".

Through this additional selection, the sensor is adapted perfectly to the product and measurement reliability, particularly in products with bad reflective properties, is considerably increased.

Enter the requested parameter via the appropriate keys, save your settings and jump to the next menu item with the **[→]** key.

Vessel shape

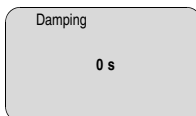
Apart from the medium also the vessel form can influence the measurement. To adapt the sensor to these conditions, this menu item offers (depending on either liquid or solid is detected) different options. For *Liquid* these are *Storage tank*, *Stilling tube*, *Open vessel* or *Stirred vessel*, for *Solid* *Silo* or *Bunker*.



Enter the requested parameter via the appropriate keys, save your settings and jump to the next menu item with the **[→]** key.

Damping

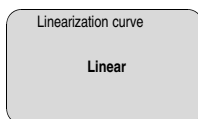
To suppress fluctuation in the measured value display, e.g. caused by a turbulent product surface, an integration time can be set. This time can be between 0 and 999 seconds. Please note that the reaction time of the entire measurement will be longer and the sensor will react to quick changes of the measured value with a corresponding delay. In general, a time of a few seconds is sufficient to smooth the measured value display.



Enter the requested parameter via the appropriate keys, save your settings and jump to the next menu item with the **[→]** key.

Linearization curve

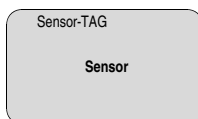
A linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level – e.g. in a cylindrical or spherical tank – and the indication or output of the volume is requested. Corresponding linearization curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume. By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item "Display".



Enter the requested parameter via the appropriate keys, save your settings and jump to the next menu item with the **[→]** key.

Sensor-TAG

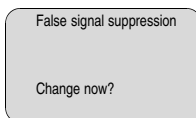
In this menu item you can enter an unambiguous designation for the sensor, e.g. the measurement loop name or the tank or product designation. In digital systems and in the documentation of larger plants, a singular designation should be entered for exact identification of individual measuring sites.



With this menu item, the Basic adjustment is finished and you can now jump to the main menu with the **[ESC]** key.

False signal suppression

High sockets or vessel installations, such as e.g. struts or agitators as well as buildup and weld joints on the vessel walls cause interfering reflections which can impair the measurement. A false signal suppression detects, marks and saves these false signals, so that they are no longer taken into account for the level measurement. This false signal suppression should be created with empty vessel so that all potential interfering reflections will be detected.



Proceed as follows:

- 1 Move from the measured value display to the main menu by pushing **[OK]**.
- 2 Select the menu item "Service" with **[→]** and confirm with **[OK]**. Now the menu item "False signal suppression" is displayed.
- 3 Confirm "False signal suppression - Change now" with **[OK]** and select in the below menu "Create new". Enter the actual distance from the sensor to the product surface. All false signals in this area are detected by the sensor and saved after confirming with **[OK]**.



Note:

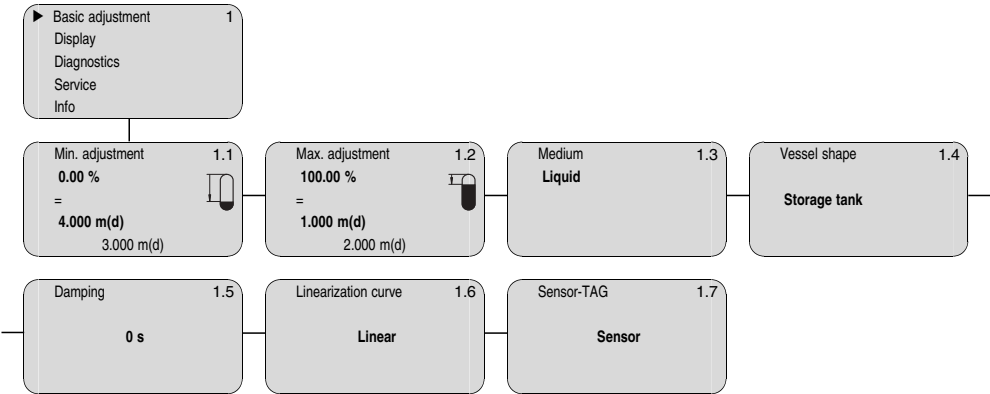
Check the distance to the product surface, because if an incorrect (too large) value is entered, the existing level will be saved as false signal. The filling level would then no longer be detectable in this area.

Optional settings

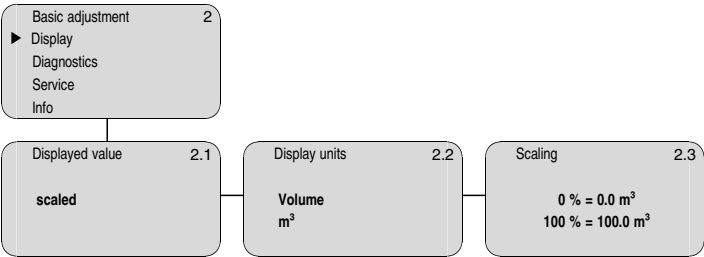
Additional adjustment and diagnosis options such as e.g. scaling, simulation or trend curve presentation are shown in the following menu schematic. You will find a detailed description of these menu items in the operating instructions manual of the indicating and adjustment module.

6.5 Menu schematic

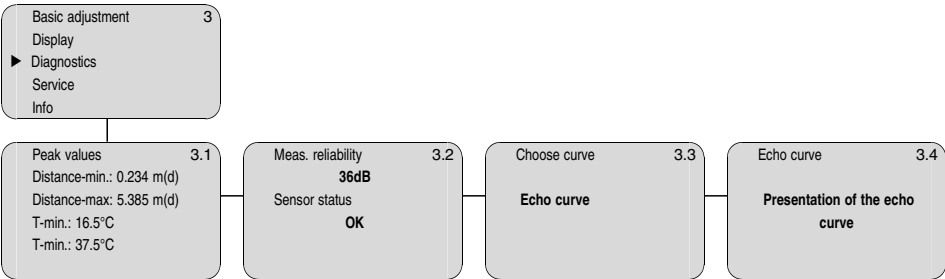
Basic adjustment



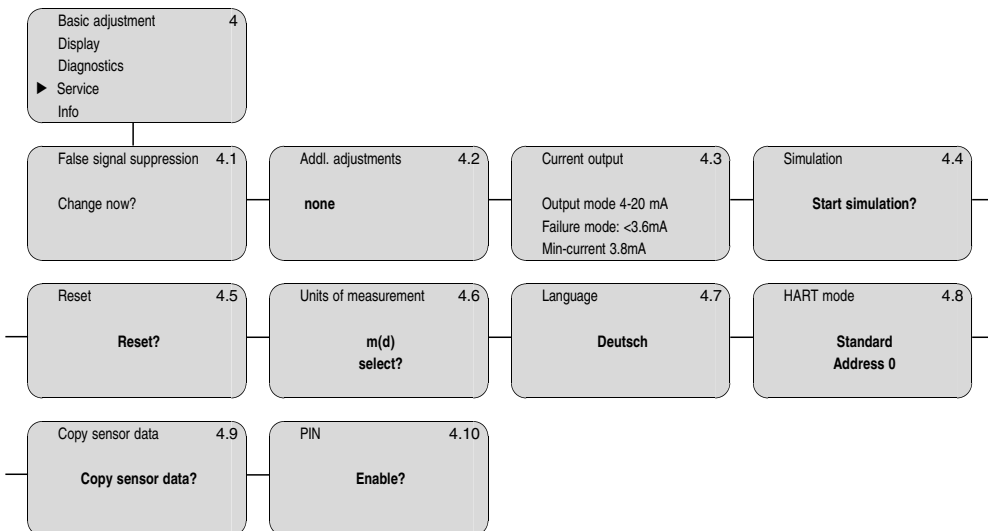
Display



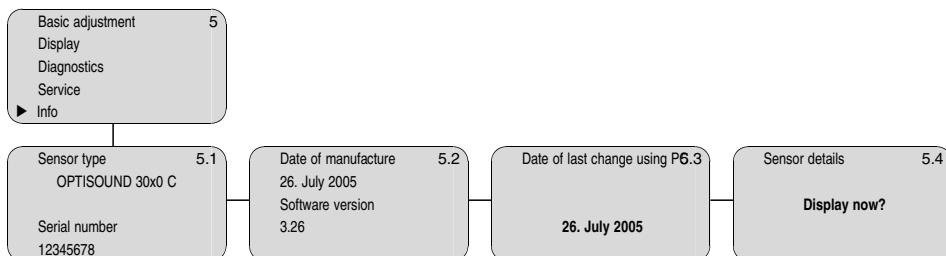
Diagnostics



Service



Info



7 Maintenance and fault rectification

7.1 Maintenance

When used as directed in normal operation, OPTISOUND 3020 C is completely maintenance-free.

7.2 Fault rectification

Causes of malfunction

OPTISOUND 3020 C offers maximum reliability. Nevertheless faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Power supply
- Signal processing.

Fault rectification

The first measures to be taken are to check the output signal and evaluate fault messages via the indicating/adjustment module. The procedure is described below.

Checking the 4 ... 20 mA signal

Connect a hand-held multimeter with a suitable measuring range acc. to the wiring plan.

? 4 ... 20 mA signal not stable

- level fluctuations
- set integration time via the indicating/adjustment module

? 4 ... 20 mA signal missing

- incorrect connection to power supply
- Check connection acc. to chapter "*Connection procedure*" and correct, if necessary, acc. to chapter "*Wiring plans*"
- no power supply
- check cables for line break, repair, if necessary
- supply voltage too low or load resistance too high
- check and adapt, if necessary

- ? Current signal greater than 22 mA or less than 3.6 mA
- Electronics module defective
- Exchange instrument or return it for repair



In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

Fault messages via the indicating/adjustment module

- ? E013
- no measured value available
- sensor in boot phase
- sensor does not find an echo, e.g. because of faulty installation or incorrect parameter adjustment
- ? E017
- adjustment span too small
- Carry out a fresh adjustment and increase the distance between min. and max. adjustment
- ? E036
- no operable sensor software
- carry out a software update or return instrument for repair
- ? E041
- hardware error, electronics defective
- Exchange instrument or return it for repair

7.3 Exchanging the electronics

If the electronics module is defective, it can be replaced by the user.



In Ex applications, only instruments and electronics modules with appropriate Ex approval may be used.

If there is no electronics module available on site, it can be ordered from the responsible Krohne agency.

7.4 Instrument repair

If a repair is necessary, please proceed as follows:

You can download a return form from our Internet homepage http://www.krohne-mar.com/fileadmin/media-lounge/PDF-Download/Specimen_e.pdf.

By doing this you help us carry out the repair quickly and without having to call back for needed information.

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument.

8 Dismounting

8.1 Dismounting procedure

**Warning:**

Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

8.2 Disposal

OPTISOUND 3020 C consists of materials which can be recycled by specialised recycling companies. We have purposely designed the electronic modules to be easily separable. Mark the instrument as scrap and dispose of it according to national government regulations (e.g. in Germany acc. to the EU Directive on Waste Electrical and Electronic Equipment, WEEE).

Materials: see "*Technical data*"

If you cannot dispose of the instrument properly, please contact us about disposal methods or return.

9 Supplement

9.1 Technical data

General data

Materials, wetted parts

- | | |
|--------------------------|----------------------------|
| – Process fitting | thread G2A and 2 NPT: PVDF |
| – Transducer | PVDF |
| – seal transducer/thread | EPDM |

Materials, non-wetted parts

- | | |
|---|---|
| – Housing | plastic PBT (Polyester), Alu-die casting powder-coated, 316L (1.4435) |
| – Seal ring between housing and housing cover | NBR (stainless steel housing), silicone (Alu/plastic housing) |
| – Inspection window in housing cover | Polycarbonate |
| – Ground terminal | 316Ti/316L (1.4571/1.4435) |

Weight	1.8 ... 4.0 kg (4.0 ... 8.8 lbs), depending on process fitting and housing
--------	--

Max. torque mounting boss	25 Nm
---------------------------	-------

Output variable

- | | |
|---|--|
| Output signal | 4 ... 20 mA/HART |
| Resolution | 1.6 µA |
| Fault signal | current output unchanged; 20.5 mA; 22 mA; <3.6 mA (adjustable) |
| Current limitation | 22 mA |
| Load | see load diagram in Power supply |
| Integration time (63 % of the input variable) | 0 ... 999 s, adjustable |
| Fulfilled NAMUR recommendation | NE 43 |

Input variable

- | | |
|-----------------|---|
| Parameter | distance between lower edge of the transducer and product surface |
| Dead zone | 0.4 m (1.3 ft) |
| Measuring range | |
| – Liquids | up to 8 m (26.2 ft) |
| – Solid | up to 3.5 m (11.5 ft) |

Accuracy (similar to DIN EN 60770-1)

Reference conditions acc. to DIN EN 61298-1

– Temperature	18 ... +30°C (64 ... +86°F)
– Relative humidity	45 ... 75 %
– Atmospheric pressure	860 ... 1060 mbar (86 ... 106 kPa/ 12.5 ... 15.4 psi)

Characteristic curve deviation and measurement characteristics²⁾

Average temperature coefficient of the zero signal (temperature error)	0.06 %/10 K
Resolution, general	max. 1 mm
Ultrasonic frequency	55 kHz
Interval	> 2 s (dependent on the parameter adjustment)
Beam angle at -3 dB	5.5°
Adjustment time ³⁾	>3 s (dependent on the parameter adjustment)
Accuracy	better than 0.2 % or ± 4 mm (see diagram)

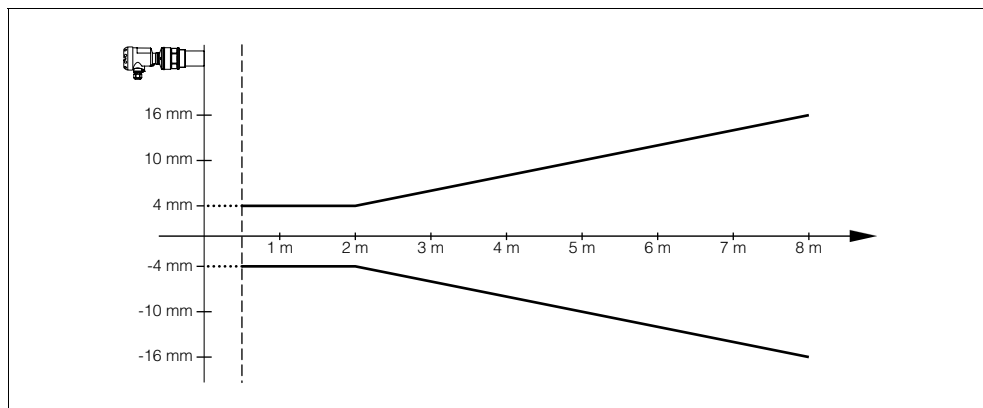


Fig. 25: Accuracy OPTISOUND 3020 C

²⁾ Relating to the nominal range, incl. hysteresis and repeatability, determined acc. to the limit point method.

³⁾ Time to output the correct level (with max. 10 % deviation) after a sudden level change.

Ambient conditions

Ambient, storage and transport temperature

- without indicating/adjustment module -40 ... +80°C (-40 ... +176°F)
- the indicating/adjustment module -20 ... +70°C (-4 ... +158°F)

Process conditions

- Vessel pressure -20 ... 200 kPa (-0.2 ... 2.0 bar/-2.9 ... 29 psi)
- Process temperature (transducer temperature) -40 ... +80°C (-40 ... +176°F)
- Vibration resistance mechanical vibrations with 4 g and 5 ... 100 Hz⁴⁾

Electromechanical data

Cable entry

- Single chamber housing
 - 1x cable entry M20x1.5 (cable-ø 5 ... 9 mm), 1x blind stopper M20x1.5

or:

 - 1x closing cap ½ NPT, 1x blind stopper ½ NPT
- Double chamber housing
 - 1x cable entry M20x1.5 (cable-ø 5 ... 9 mm), 1x blind stopper M20x1.5

or:

 - 1x closing cap ½ NPT, 1x blind stopper ½ NPT

Spring-loaded terminals for wire cross sections up to 2.5 mm²

Indicating and adjustment module

- Power supply and data transmission through sensor via gold-plated sliding contacts (I²C bus)
- Indication LC display in full dot matrix
- Adjustment elements 4 keys
- Protection
- unassembled IP 20
- mounted into the sensor without cover IP 40
- Materials
- Housing ABS
- Inspection window Polyester foil

⁴⁾ Tested acc. to the regulations of German Lloyd, GL directive 2

Supply voltage

Supply voltage

- non-Ex instrument 14 ... 36 V DC
- EEx ia instrument 14 ... 30 V DC

Permissible residual ripple

- <100 Hz $U_{ss} < 1 \text{ V}$
- 100 Hz ... 10 kHz $U_{ss} < 10 \text{ mV}$

Load

see diagram

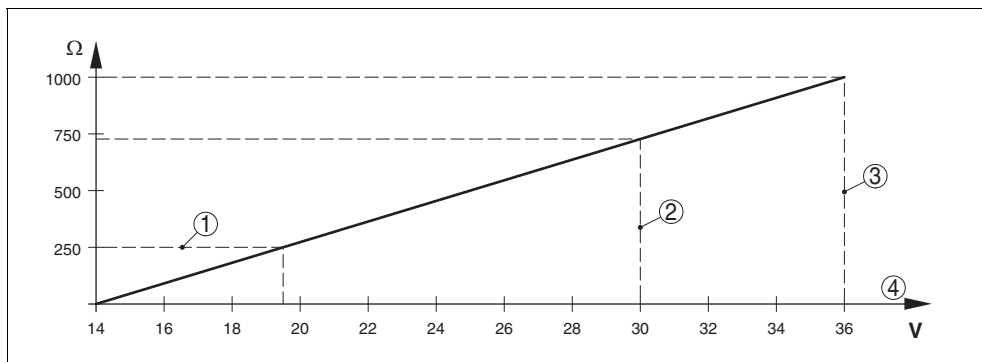


Fig. 26: Voltage diagram

- 1 HART load
- 2 Voltage limit EEx ia instrument
- 3 Voltage limit non-Ex instrument
- 4 Supply voltage

Electrical protective measures

Protection

- Plastic housing IP 66/IP 67
- Alu and stainless steel housing IP 66/IP 68 (0.2 bar)⁵⁾

Overvoltage category

III

Protection class

II

⁵⁾ Requirement to maintain the protection is the suitable cable.

Approvals⁶⁾⁷⁾

ATEX

ATEX II 1G, 1/2G, 2G EEx ia IIC T6

⁶⁾ Deviating data with Ex applications: see separate safety instructions.
⁷⁾ Depending on order specification.

9.2 Dimensions

Housing

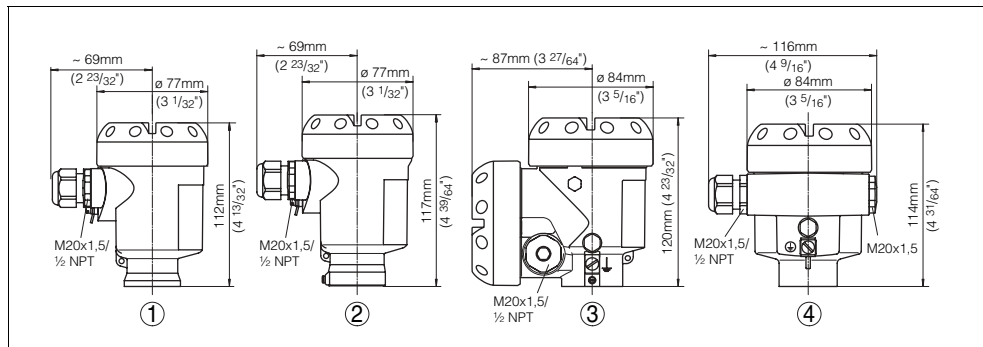


Fig. 27: Housing versions in protection IP 66/IP 67 and IP 66/IP 68, 0.2 bar (with integrated indicating and adjustment module the housing height or width increases by 9 mm/0.35 in)

- 1 Plastic housing
- 2 Stainless steel housing
- 3 Aluminium double chamber housing
- 4 Aluminium housing

OPTISOUND 3020 C

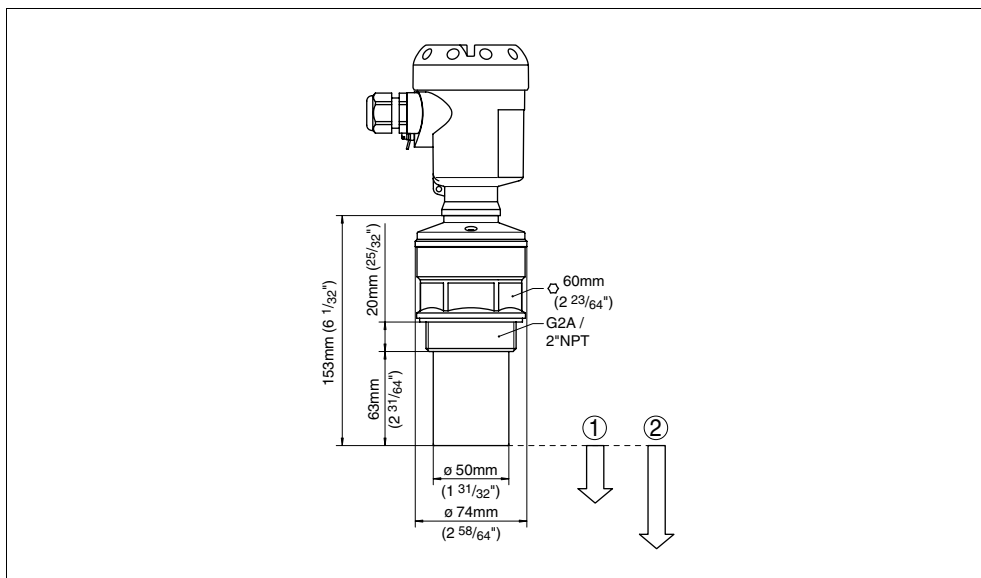


Fig. 28: OPTISOUND 3020 C

1 Dead zone: 0.4 m (1.3 ft)

2 Meas. range: in liquids up to 8 m (26.2 ft), in solids up to 3,5 m (11.5 ft)

9.3 Certificates

CE declaration of conformity



Konformitätserklärung

Declaration of conformity
Déclaration de conformité

KROHNE

Krohne S.A.S.
Les Ors BP 98
F-26103 Romans Cedex

erklärt in alleiniger Verantwortung, daß das Produkt / declare under
our sole responsibility that our product / déclare sous sa seule
responsabilité que le produit

**OPTISOUND 3010 C, OPTISOUND 3020 C, OPTISOUND 3030 C
4...20mA HART**

auf das sich diese Erklärung bezieht, mit den folgenden Normen
übereinstimmt / to which this declaration relates is in conformity
with the following standards / auquel se réfère cette déclaration
est conforme aux normes

Emission / Emission / Emission → EN 61326 : 1997 / A1 : 1998 (Klasse A)
Immision / Susceptibility / Immission → EN 61326 : 1997 / A1 : 1998
EN 61010 – 1 : 2001

gemäß den Bestimmungen der Richtlinien / following the provision
of Directives / conformément aux dispositions des Directives

73/23 EWG
89/336 EWG

14.03.2005

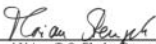

 i.V./p.p./P.O. Florian Stengele

Fig. 29: CE declaration of conformity

Manufacturer declaration

KROHNE	
Manufacturer declaration no. 24658	
Messrs.	Krohne S.A.S. Les Ors BP 98 F-26103 Romans Cedex
declares that the	Ultrasonic sensor type OPTISOUND 3010 C, 3020 C, 3030 C with electronic 4 ... 20 mA/HART
in accordance with DIN/EN 60079-14/2004 paragraph 5.2.3 item c 1	
and when used correctly under the condition that the operator follows the instructions in the documents listed:	
- Mounting and operating instructions in the Operating Instructions manual - Data and instructions of this manufacturer declaration - Installation regulations	
are suitable for use in Zone 2	
The max. surface temperature increase* during operation is 23K.	
With an ambient temperature of 70°C on the housing and a process temperature of 70°C, the max. surface temperature* is 93°C during operation.	
<u>Measures to maintain the explosion protection during operation:</u>	
- This declaration is only applicable if OPTISOUND is operated within the stated electrical threshold values. - Permissible operating voltages: 14...36V DC - The instrument must be installed and operated in such a way that no danger of ignition is expected due to electrostatic charge (depending of the version, the process fitting, the plastic coated probe part or the housing are made of electrically non-conductive plastic). - The availability, the perfect quality and the correct position of the seal between the lower part of the housing and the cover must be ensured; the cover must be screwed on tightly. - If the instrument is operated with opened cover, the indicating/adjustment module for OPTISOUND sensors is mounted or its keys are pushed, it must be ensured that no explosive atmosphere is present. - Make sure that the cable entry is tight and strain-relieved; the outer diameter of the connection cable must be adapted to the cable entry; the pressure screw of the cable entry must be tightened carefully. - Free openings for cable and cable entries must be covered tightly. - OPTISOUND must be mounted in such a way that contact of the sensor to the vessel wall can be excluded by taking vessel installations and flow conditions in the vessel into account. - The surface temperature must not exceed the ignition temperature of the concerned explosive atmosphere.	
*Single component in the instrument	
This instrument was judged by a person meeting the requirements acc. to DIN/EN 60079-14.	
Krohne S.A.S. Romans Cedex, den 31.05.05	
	
i.V. Stengele	

Fig. 30: Manufacturer declaration

Subject to change without notice