Technical Data Sheet

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GR

OPTISOUND 3010 C - 3030 C
Ultrasonic Level Gauge

for liquids



- Level measurement during processing and storage of liquids
- Sumps, water and wastewater basins
- Noncontact flow measurement and detection in open channels





Electromagnetic flowmeters
Variable area flowmeters
Mass flowmeters
Ultrasonic flowmeters
Vortex flowmeters
Flow controllers
Level measuring instruments
Pressure and temperature
Heat metering
Communications technology
Switches, counters, displays and recorders
Engineering systems & solutions

Subject to change without notice.

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Take note of safety instructions for Ex application

Please note the Ex specific safety information which you will find on our homepage www.krohne-mar.com and which come with the appropriate instrument. In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units. The sensors must only be operated on intrinsically safe circuits. The permissible electrical values are stated in the certificate.

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1 Description of the measuring principle



Measuring principle

Short ultrasonic pulses in the range of 35 kHz to 70 kHz are emitted by the transducer to the product surface, reflected there and received by the transducer. The pulses travel at the speed of sound - the elapsed time from emission to reception of the signals depends on the level in the vessel.

The latest microcomputer technology and the proven processing software select the level echo from among any number of false echoes and calculate the exact distance to the product surface. An integrated temperature sensor detects the temperature in the vessel and compensates the influence of temperature on the signal running time.

By simply entering the vessel dimensions, a level-proportional signal is generated from the distance. It is not necessary to fill the vessel for adjustment.

Wide application range

OPTISOUND 3010 C, 3020 C and 3030 C ultrasonic sensors are especially suitable for level measurement of liquids, but are also good for solids. The instruments differ in the measuring range, the transducer version and the process fitting. Through different, adapted emitting frequencies, levels in a measuring range of 5 … 15 m (16.4 … 49.2 ft) can be measured. Resistant materialsfor transducers and process fittings also allow applications in corrosive products (depending on the model). A practical mounting strap (option) enables easy orientation of OPTISOUND 3030 C.

Unaffected by product properties

Fluctuations in product composition or even complete product changes do not influence the measuring result. A fresh adjustment is not necessary.

Service and maintenance friendly

Thanks to the non-contact measuring principle, OPTISOUND sensors are particularly easy to service and maintain.

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1.1 Application examples

Open basins

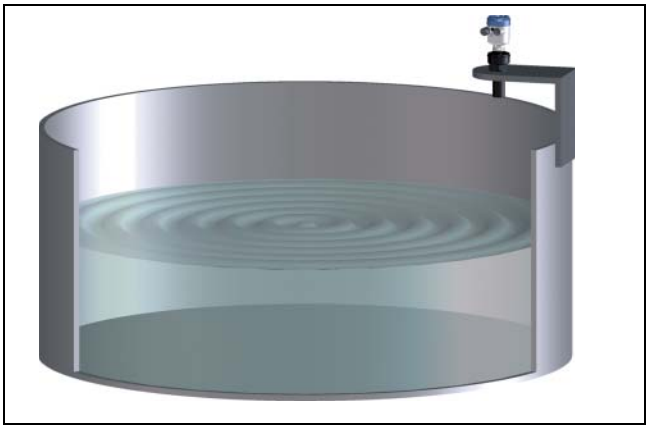


Fig. 1: Level measurement in an open basin with OPTISOUND 3010 C

A typical application for OPTISOUND 3010 C sensors is level measurement on open basins. Products such as rain water or sewage water, i.e. with impurities. Here is where the advantages of non-contact measurement with OPTISOUND come into their own: simple and maintenance-free. The degree of pollution of the water or an accumulation of mud in the basin is not important, because OPTISOUND measures the surface.

Sludge container

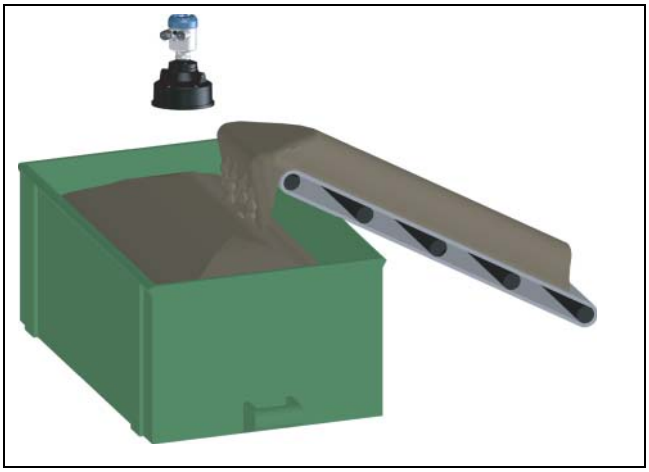


Fig. 2: Level measurement in a container with OPTISOUND 3030 C

In sewage treatment plants, the accumulated sludge is dewatered and transported via conveyor belts to containers. The OPTISOUND 3030 C sensor measures the filling of the container. An empty container can thus be readied in good time before the max. level is reached. Thanks to the metal transducer diaphragm, measurement functionality is also ensured even under conditions of fluctuating temperatures and steam generation.

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2 Type overview

	OPTISOUND 3010 C	OPTISOUND 3020 C
		
Applications:	liquids and solids in virtually all industries, particularly in water and waste water management	as OPTISOUND 3010 C
Measuring range:	Liquids: 0.25 ... 5 m (0.8 ... 16.4 ft) Solids: 0.25 ... 2 m (0.8 ... 6.6 ft)	Liquids: 0.4 ... 8 m (1.3 ... 26.2 ft) Solids: 0.4 ... 3.5 m (1.3 ... 11.5 ft)
Process fitting:	G1½A of PVDF	G2A of PVDF
Process temperature:	-40 ... 80°C (-40 … +176°F)	-40 ... 80°C (-40 … +176°F)
Process pressure:	-0.2 ... 2 bar (-20 ... 200 kPa)	-0.2 ... 2 bar (-20 ... 200 kPa)
	(-2.9 ... 29 psi)	(-2.9 ... 29 psi)
Signal output	two-wire/four-wire 4 … 20 mA/HART	two-wire/four-wire 4 … 20 mA/HART

OPTISOUND 3030 C



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OPTISOUND 3030 C



Applications:	liquids and solids in virtually all industries
Measuring range:	liquids: 0.6 ... 15 m (2 ... 49.2 ft) solids: 0.6 ... 7 m (2 ... 23 ft)
Process fitting:	compression flange DN 100 or mounting strap
Process temperature:	-40 ... 80°C (-40 … +176°F)
Process pressure:	-0.2 ... 1.0 bar (-20 ... 100 kPa) (-2.9 ... 14.5 psi)
Signal output	two-wire/four-wire 4 … 20 mA/HART

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Indicating and adjustment module



Housing



Plastic



Stainless steel



Aluminium



Aluminium (double chamber)

Electronics



4 … 20 mA/ HART



4 … 20 mA/ HART – four-wire

Sensors



Transducer 1½"



Transducer 2"



Transducer 4"

Approvals



Gas explosion protection

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3 Mounting information

Measuring range

The reference plane for the measurement is the lower edge of the transducer. All statements concerning the measuring range as well as the internal signal processing refer to this.

With all instruments, a min. distance from the lower edge of the flange - the so-called dead zone, in which measurement is not possible - must be maintained. The exact value of the dead zone, depending on the instrument version, is stated in the Technical data.

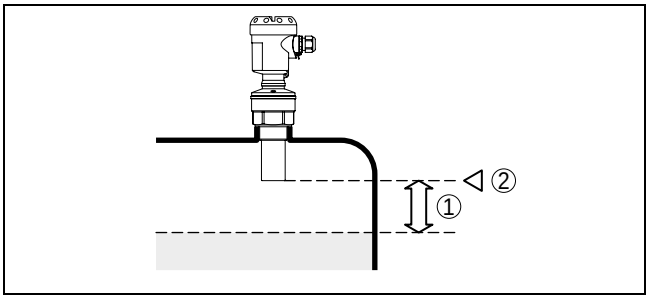


Fig. 3: Min. distance to the max. level

1 Dead zone
2 Reference plane for the measurement

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

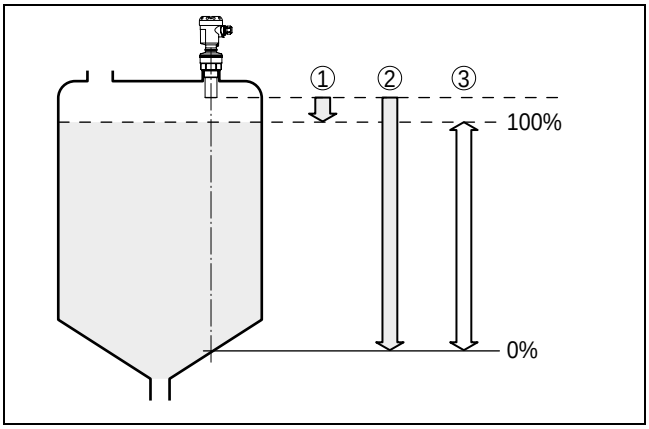


Fig. 4: Measuring range and max. measuring distance

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

Pressure/Vacuum

Gauge pressure in the vessel does not influence OPTISOUND. 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) use a different measuring principle, e.g. radar or guided radar (TDR).

Installation position

When mounting OPTISOUND, keep a distance of at least 200 mm to the vessel wall. If the sensor is installed in the center of dished or spherical vessel tops, multiple echoes can arise. These can, however, be faded out by an appropriate adjustment.

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If you cannot keep this distance, 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.

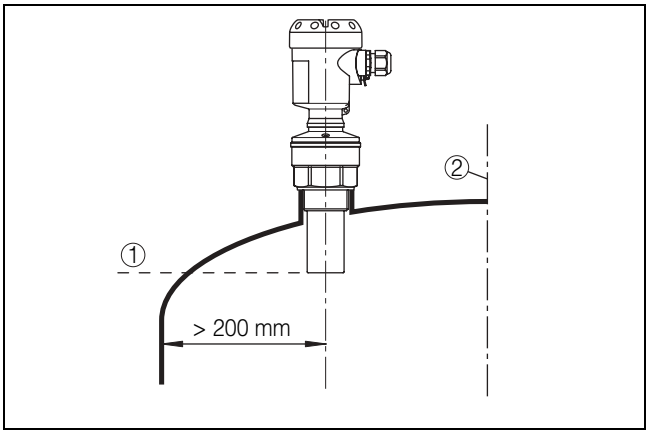


Fig. 5: Mounting on dished vessel tops

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.

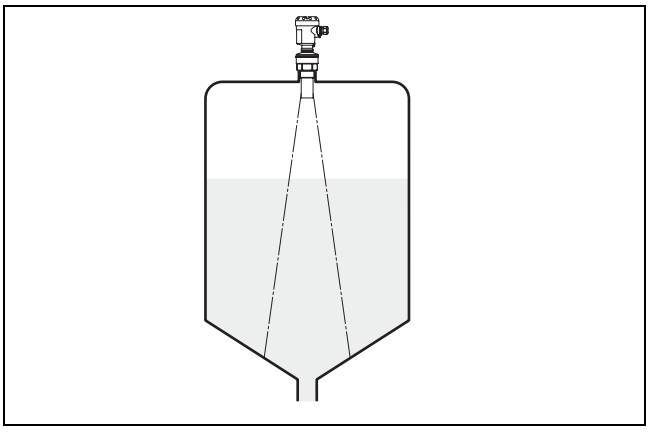


Fig. 6: Vessel with conical bottom

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.

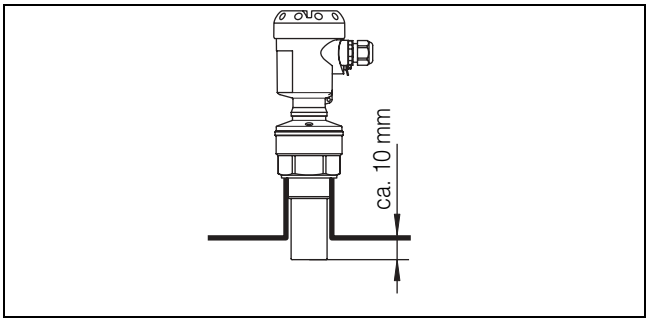
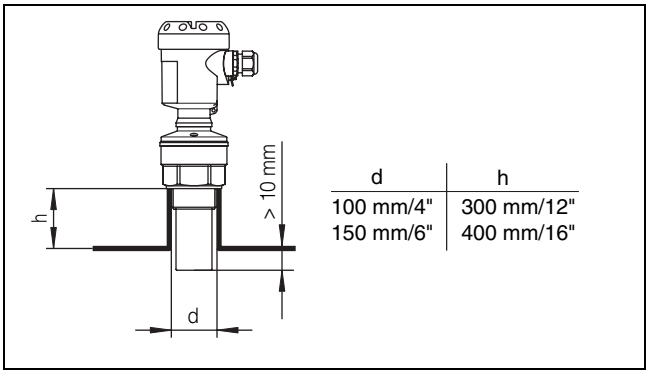


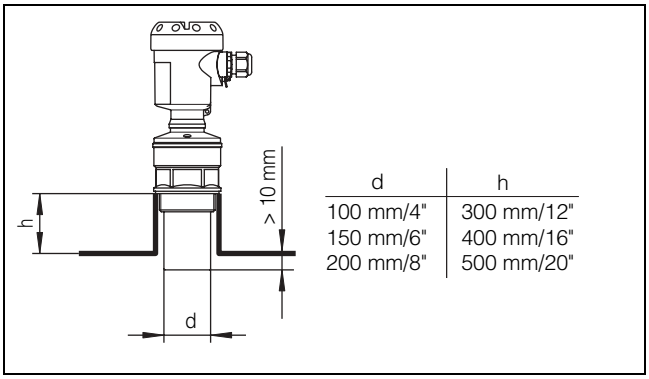
Fig. 7: Recommended socket mounting

If the reflective properties of the medium are good, you can mount OPTISOUND on sockets longer than the transducer. You will find recommended values of the socket heights in the following illustrations. The socket end should be smooth and burr-free, if possible also rounded. A false echo storage is recommended.



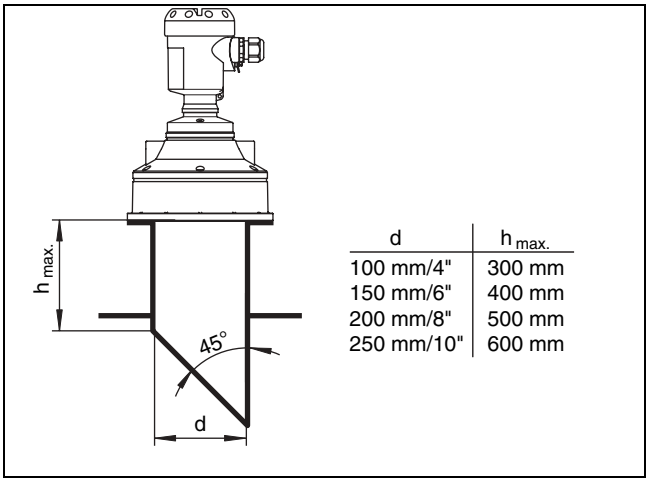
d	h
100 mm/4"	300 mm/12"
150 mm/6"	400 mm/16"

Fig. 8: Deviating socket dimensions with OPTISOUND 3010 C



d	h
100 mm/4"	300 mm/12"
150 mm/6"	400 mm/16"
200 mm/8"	500 mm/20"

Fig. 9: Deviating socket dimensions with OPTISOUND 3020 C



d	h max.
100 mm/4"	300 mm
150 mm/6"	400 mm
200 mm/8"	500 mm
250 mm/10"	600 mm

Fig. 10: Deviating socket dimensions with OPTISOUND 3030 C

Sensor orientation

With liquids, align the sensor as close to vertical as possible to achieve optimum measuring results.

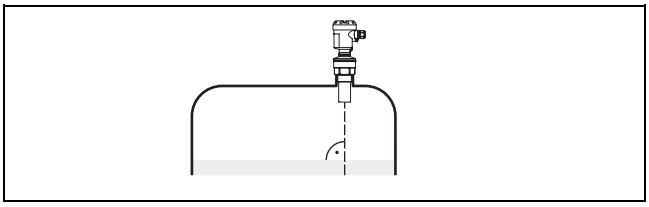


Fig. 11: Orientation in liquids

To reduce the min. distance to the medium, you can also mount OPTISOUND with a beam deflector of corrosion-resistant material. By doing this, it is possible to fill the vessel nearly to maximum. Such an arrangement is suitable primarily for open vessels such as e.g. overflow basins.

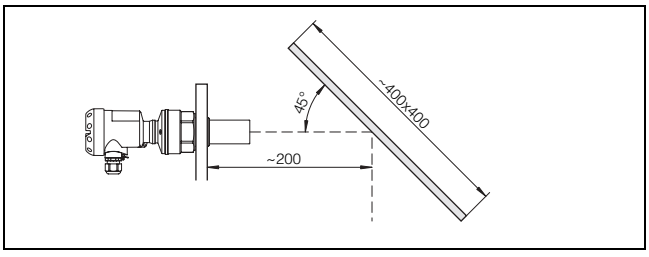


Fig. 12: Beam deflector

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 wanted echo. Make sure when planning your measuring location 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.

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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.

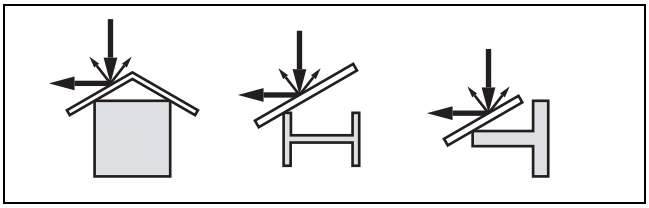


Fig. 13: Cover smooth profiles with deflectors

Inflowing material

The instruments must not be mounted in or above the filling stream. Make sure that the product surface and not the inflowing material is detected.

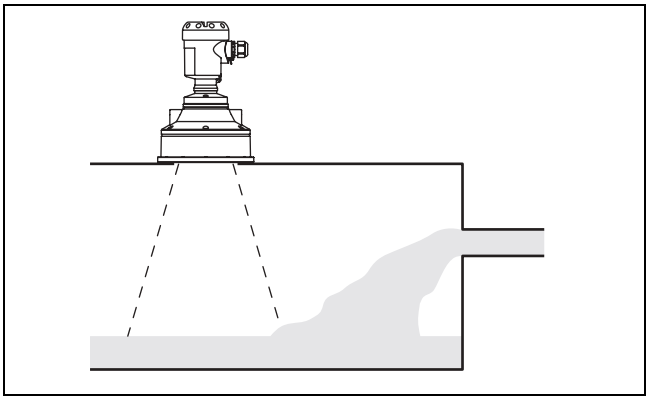


Fig. 14: Inflowing liquid

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 sensors with guided radar (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, you should mount OPTISOUND 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.

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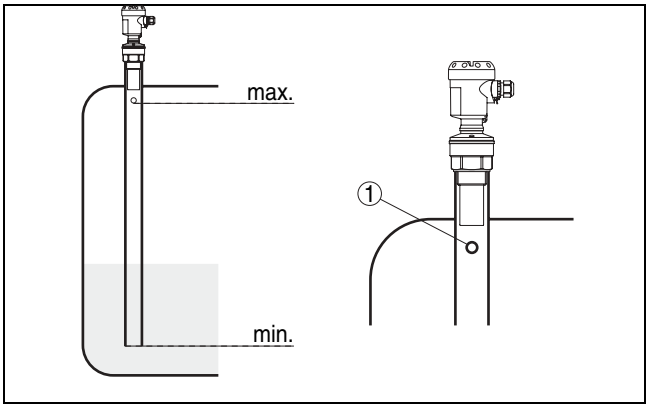


Fig. 15: Standpipe in a tank

1 Vent hole ø 5 … 10 mm

A standpipe measurement with OPTISOUND is possible with the following tube diameters:

- OPTISOUND 3010 C from 40 mm
- OPTISOUND 3020 C from 50 mm
- OPTISOUND 3030 C from 100 mm.

Avoid large gaps and thick welding joints when connecting the tubes. A false echo storage should always be carried out.

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

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4 Electrical connection

4.1 General requirements

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

Take note of country-specific installation standards (e.g. the VDE regulations in Germany) as well as prevailing safety regulations and accident prevention rules.

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

4.2 Supply voltage

4 … 20 mA/HART two-wire

Power supply and current signal are carried over the same two-wire connection cable. The requirements on the power supply are stated in the Technical data of this Product Information manual.

4 … 20 mA/HART four-wire

Power supply and current output are carried on two separate connection cables.

The standard version can be operated with an earth-connected current output, the Exd version must be operated with a floating output.

The instrument is designed in protection class I. To maintain this protection class, it is absolutely necessary that the ground conductor be connected to the internal ground conductor terminal.

4.3 Connection cable and installation

The sensors are connected with standard cable without screen. An outer cable diameter of 5 … 9 mm ensures the seal effect of the cable entry.

As an option, OPTISOUND are also available with standard plug connectors (see Technical data).

If strong electromagnetic interference is expected, screened cable should be used for the signal lines.

In Ex applications, the corresponding installation regulations must be noted for the connection cable.

4.4 Cable screening and grounding

If screened cable is required, the cable screen must be connected on both ends to ground potential. 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).

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4.5 Wiring plans

Single chamber housing

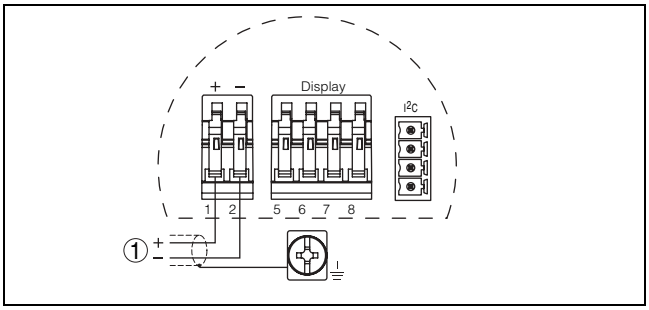


Fig. 16: Connection HART two-wire

1 Power supply and signal output

Double chamber housing – two-wire

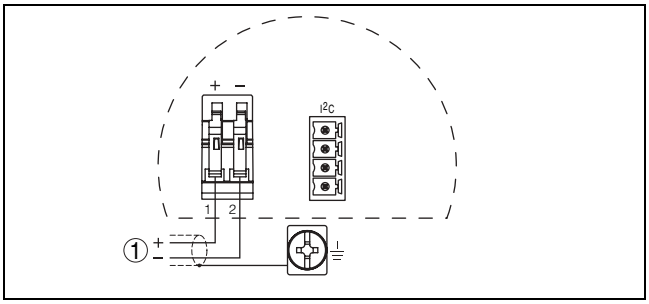


Fig. 17: Connection HART two-wire

1 Power supply and signal output

Double chamber housing – 4 … 20 mA/HART four-wire

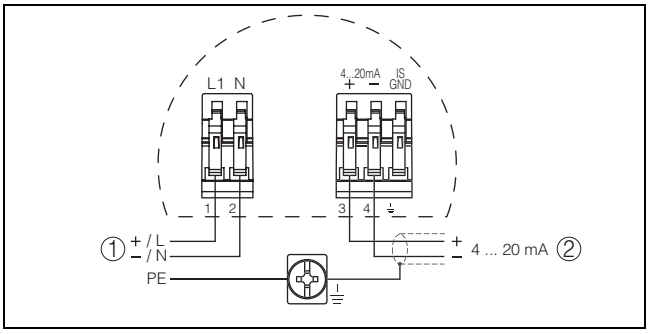


Fig. 18: Connection 4 … 20 mA/HART four-wire

1 Supply voltage
2 Signal output

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5 Adjustment

5.1 Adjustment, general

OPTISOUND can be adjusted with the following adjustment media:

- the indicating and adjustment module
- a HART handheld (4 … 20 mA/HART)

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

5.2 Compatibility acc. to NAMUR NE 53

OPTISOUND meet 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.

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5.3 Adjustment with the indicating/adjustment module

Setup and indication

The indication and adjustment module can be plugged into OPTISOUND sensors. It can be placed in four different positions on the instrument (each displaced by 90°). Indication and adjustment are made via four keys and a clear, graphic-capable dot matrix indication. The adjustment menu with language selection is clearly structured and enables easy setup. After setup, the indicating/adjustment module serves as indicating instrument: through the screwed cover with glass insert, measured values can be read directly in the requested unit and presentation.

Adjustment

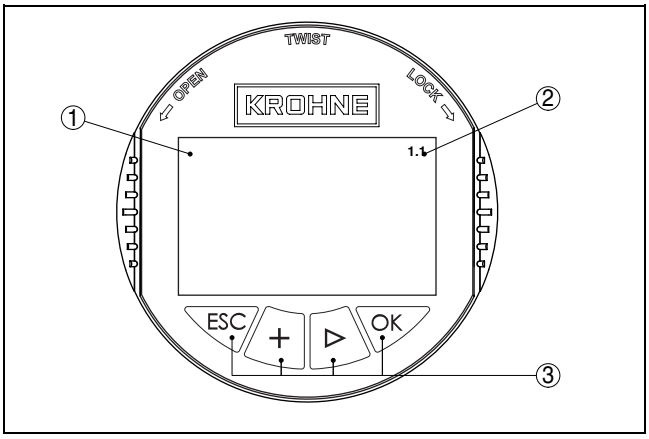


Fig. 19: Indicating and adjustment elements

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

6 Technical data

General data

OPTISOUND 3010 C and 3020 C

Materials, wetted parts	
– Process fitting	PVDF
– Transducer	PVDF
– Seal transducer/process fitting	EPDM

OPTISOUND 3030 C

Materials, wetted parts	
– Mounting strap	1.4301
– Process fitting	UP
– transducer diaphragm	1.4571
– Seal transducer/process fitting	EPDM
Materials, non-wetted parts	
– Compression flange (OPTISOUND 3010 C)	PPH, 1.4435
– Housing	plastic PBT (Polyester), Alu-die casting powder-coated, 316L (stainless steel 1.4435)
– Seal ring between housing and housing cover	NBR (stainless steel housing), silicone (Alu/plastic housing)
– Inspection window in housing cover for indicating/adjustment module	Polycarbonate
– Ground terminal	stainless steel 1.4571/1.4435
Weight	
– OPTISOUND 3010 C and 3020 C	1.8 … 4.0 kg (4.0 … 8.8 lbs), depending on process fitting and housing
– OPTISOUND 3030 C	2.7 … 5.7 kg (6 … 12.6 lbs), depending on process fitting and housing

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
Rise time	500 ms (ti: 0 s, 0 … 100 %)
Fulfilled NAMUR recommendation	NE 43
Integration time (63 % of the input variable)	0 … 999 s, adjustable
Rise time	500 ms (ti: 0 s, 0 … 100 %)

Input variable

Parameter	distance between lower edge of the transducer and product surface

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Dead zone	
– OPTISOUND 3010 C	0.25 m (0.8 ft)
– OPTISOUND 3020 C	0.4 m (1.3 ft)
– OPTISOUND 3030 C	0.6 m (2 ft)
Measuring range	
– OPTISOUND 3010 C	up to 5 m (16.4 ft) liquid/up to 2 m (6.6 ft) solid
– OPTISOUND 3020 C	up to 8 m (26.2 ft) liquid/up to 3.5 m (11.5 ft) solid
– OPTISOUND 3030 C	up to 15 m (49.2 ft) liquid/up to 7 m (23 ft) solid

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 characteristics[1)]

Average temperature coefficient of the zero signal (temperature error)	0.06 %/10 K
Resolution, general	max. 1 mm
Ultrasonic frequency	
– OPTISOUND 3010 C	70 kHz
– OPTISOUND 3020 C	54 kHz
– OPTISOUND 3030 C	35 kHz
Interval	>2 s (dependent on the parameter adjustment)
Beam angle	
– OPTISOUND 3010 C and 3020 C	5.5°
– OPTISOUND 3030 C	3°
Adjustment time[2)]	>3 s (dependent on the parameter adjustment)
OPTISOUND 3010 C Accuracy	better than 0.2 % or ±4 mm (see diagram)

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

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

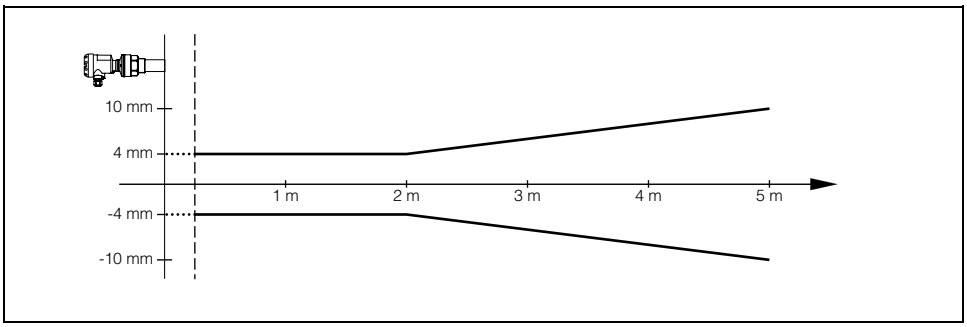


Fig. 20: Accuracy diagram OPTISOUND 3010 C

OPTISOUND 3020 C

Accuracy	better than 0.2 % or ±4 mm (see diagram)

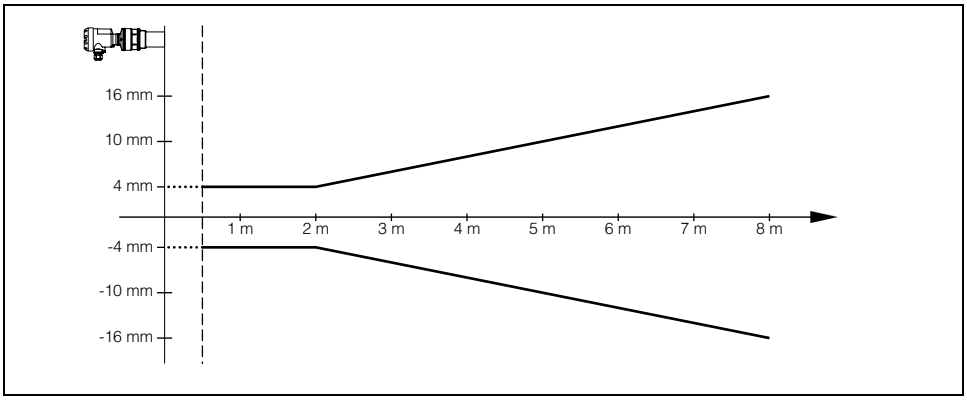


Fig. 21: Accuracy diagram OPTISOUND 3020 C

OPTISOUND 3030 C

Accuracy	better than 0.2 % or ±6 mm (see diagram)

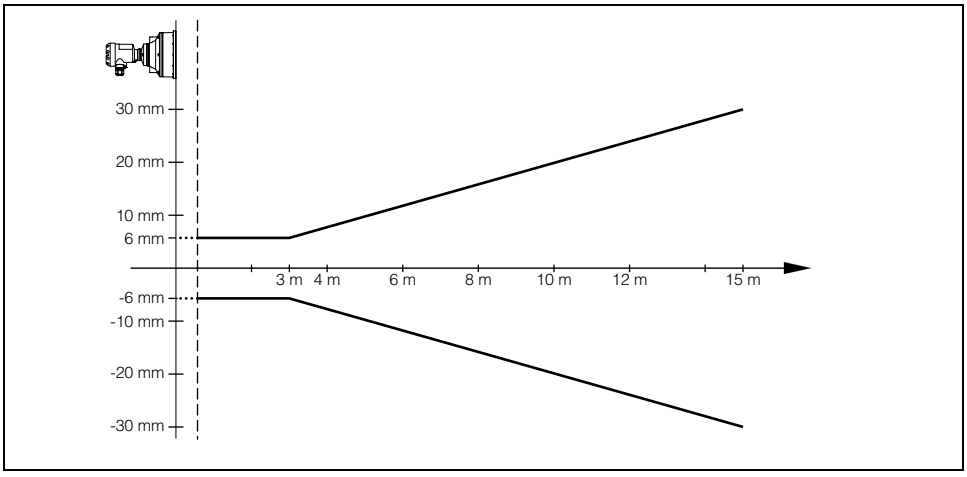


Fig. 22: Accuracy diagram OPTISOUND 3030 C

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Ambient conditions

Ambient, storage and transport temperature	
– without indicating and adjustment module	-40 … +80°C (-40 … +176°F)
– the indicating and adjustment module	-20 … +70°C (-4 … +158°F)
– Version IP 66/IP 68 1 bar with connection cable PE	-20 … +60°C (-4 … +140°F)

Process conditions

Vessel pressure	
– OPTISOUND 3010 C and 3020 C	-20 ... 200 kPa (-0.2 ... 2 bar)
– OPTISOUND 3030 C with compression flange	-20 ... 100 kPa (-0.2 ... 1 bar)
– OPTISOUND 3030 C with mounting strap	0 kPa (0 bar), because no sealing possibility
Process temperature (transducer temperature)	-40 ... +80°C (-40 … +176°F)
Vibration resistance	mechanical vibrations with 4 g and 5 … 100 Hz[3)]

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

[3)] Tested acc. to the regulations of German Lloyd, GL directive 2

Indicating and adjustment module

Power supply and data transmission	through sensor via gold-plated sliding contacts (I^2C 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

Supply voltage

Power supply – two-wire instrument	
– non-Ex instrument	14 ... 36 V DC
– EEx ia instrument	14 ... 30 V DC
Permissible residual ripple	
– < 100 Hz	Uss < 1 V
– 100 Hz ... 10 kHz	Uss < 10 mV
Load	see diagram

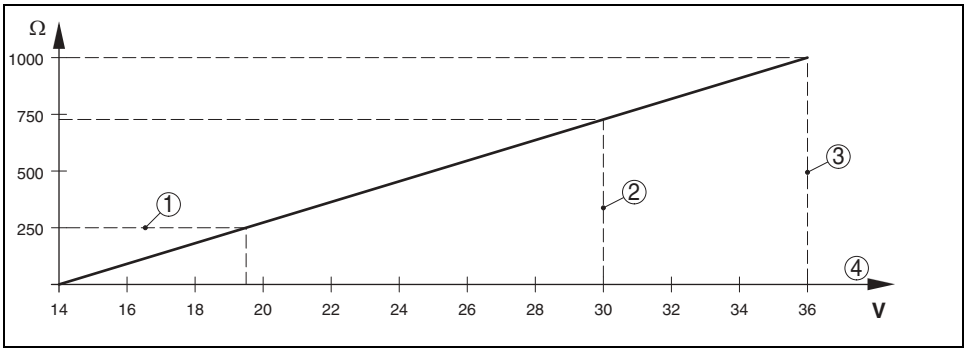


Fig. 23: Voltage diagram

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

Supply voltage – four-wire instrument	20 ... 72 V DC, 20 ... 253 V AC, 50/60 Hz
Power consumption – four-wire instrument	max. 4 VA; max. 2.1 W

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Electrical protective measures

Protection	IP 66/IP 68 (0.2 bar)
Overvoltage category	III
Protection class – Two-wire – four-wire	 II I

Approvals OPTISOUND 3010 C and 3020 C[4)5)]

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

CE conformity

EMC (89/336/EWG)	Emission EN 61326: 1997 (class A), susceptibility EN 61326: 1997/A1: 1998
LVD (73/23/EWG)	EN 61010-1: 2001

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

7 Dimensions

Housing

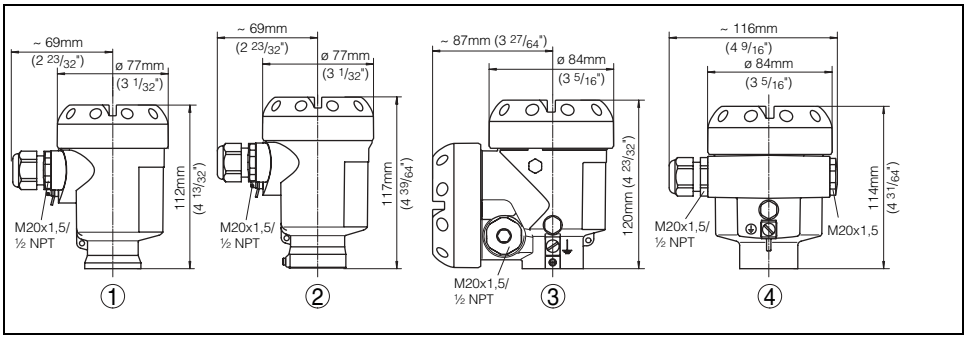


Fig. 24: Housing versions (with integrated indicating/adjustment module the housing height or width is increased by 9 mm/0.35 in)

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

OPTISOUND 3010 C

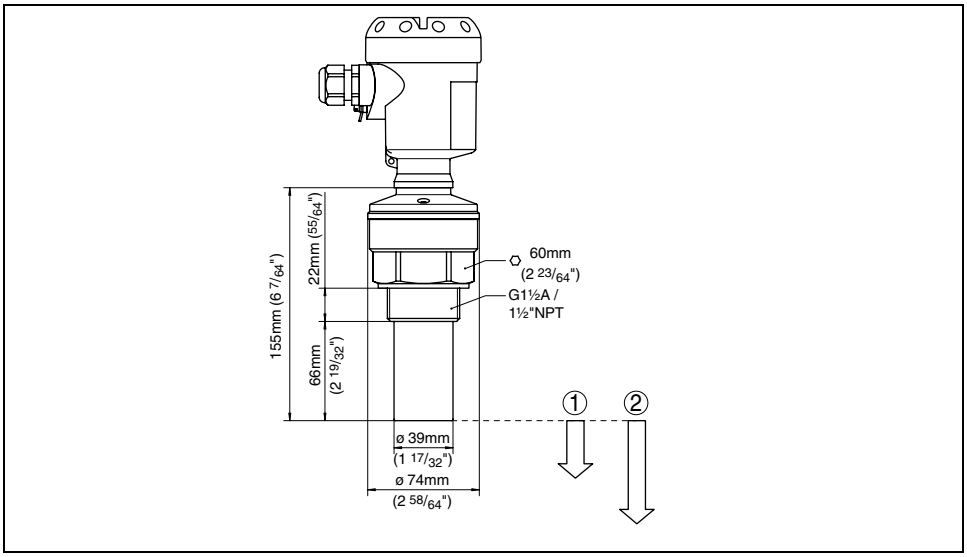


Fig. 25: OPTISOUND 3010 C

1 Dead band: 0.25 m (0.8 ft)
2 Meas. range: in liquids up to 5 m (16.4 ft), in solids up to 2 m (6.6 ft)

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OPTISOUND 3020 C

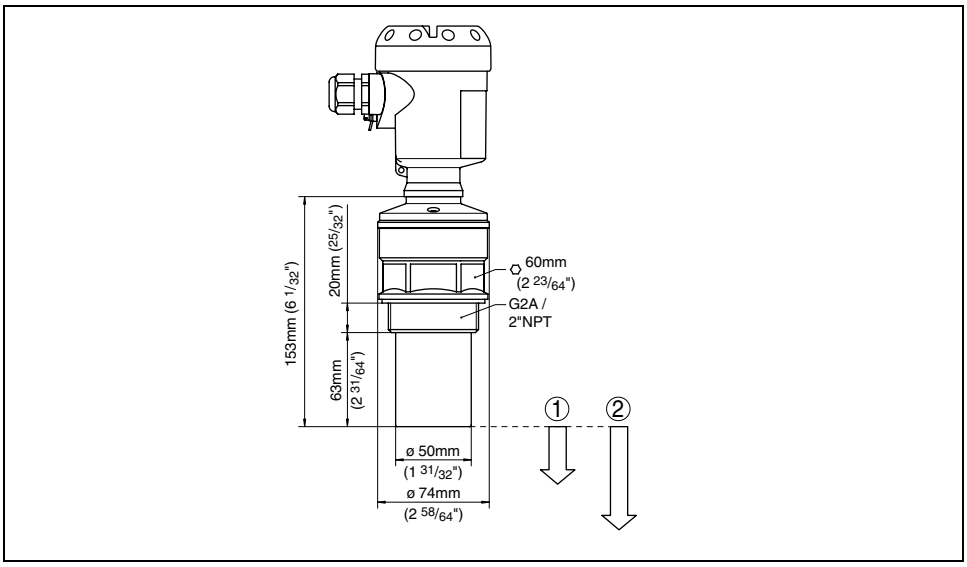


Fig. 26: OPTISOUND 3020 C

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)

OPTISOUND 3030 C

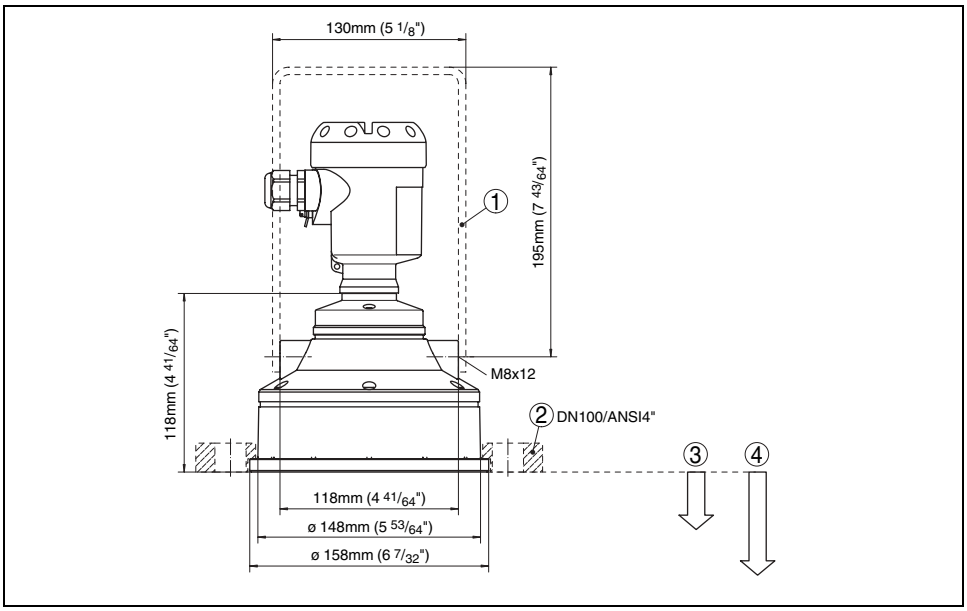


Fig. 27: OPTISOUND 3030 C

1 Mounting strap
2 Compression flange
3 Dead zone: 0.6 m (2 ft)
4 Meas. range: in liquids up to 15 m (49.2 ft), in solids up to 7 m (23 ft)

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