LoopSeries Detectors
LB 430

Operating Manual

69691BA2 Rev.00 01/2025

BERTHOLD

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1 General Information

1.1 Applicable Documents

Additional documents are available for the LoopSeries Detectors LB 430 that are not included in these operating manual:

- Safety Manual / Explosion Protection Manual, Id. No. 69691BA26
- Informations sur la sécurité, Id. No. 69691BA59
- Technical Information, Id. No. 69691TI2
- Software Manual, Id. No. 69691BA24
- Service Manual, Id. No. 69691BA29

1.2 Conformity

The company **Berthold Technologies GmbH & Co. KG** hereby declares in its sole responsibility that the design of this product in the distributed form complies with relevant EU directives stated in the original declaration of conformity.

This statement shall become void in the case of unauthorised changes or improper use.

For the original declaration of conformity, please refer to the Technical Information (69691TI2) and the Safety Manual / Explosion Protection Manual (69691BA26).

1.3 Approvals and certificates

For approvals and certificates, please refer to the Safety Manual / Explosion Protection Manual (69691BA26).

1.4 Symbols Used on the Device

Betriebsanleitung beachten

Beachten Sie die NOTICEe in dieser Betriebsanleitung.

Anschluss für Potentialausgleich

Schließen Sie an dieser Stelle den Potentialausgleich an.

Kein Hausmüll

Das Elektroprodukt darf nicht über den Hausmüll entsorgt werden.

Betriebsanleitung beachten!

Betriebsanleitung und alle projektrelevanten Dokumentationen beachten.

1.5 About this Operating Manual

The product is handed over to you by the manufacturer BERTHOLD TECHNOLOGIES GmbH & Co. KG (hereinafter referred to as Berthold) in a complete and functionally reliable condition.

This operating manual illustrates how to:

- set up/install the product
- establish the connections to the power supply
- carry out maintenance on the product
- disassemble the product
- dispose of the product

Read these instructions thoroughly and completely before working with the product. We have tried to compile all information for safe and proper operation for you. However, should questions arise which are not answered in this operating manual, please contact Berthold.

Store the instructions where they are accessible for all users at all times.

Validity of the Operating Manual

The operating manual is valid from the delivery of the Berthold product to the user until its disposal. Version and release date of this operating manual can be found in the bottom of each page. Modification service is not performed by the manufacturer Berthold.

The manufacturer reserves the right to make changes to this operating manual at any time without stating reasons.

NOTICE

The current revision of this operating manual replaces all previous versions.

Target Group

This operating manual is directed at qualified specialist personnel who are familiar with handling electrical and electronic assemblies as well as with communication and measuring techniques.

Specialist personnel refers to those who can assess the work assigned to them and recognise possible dangers through their specialist training, knowledge and experience as well as knowledge of the relevant regulations.

Storage Place

This operating manual as well as all product-related documentation relevant to the respective application must be accessible at all times near the device.

Copyright

1.5.1 Structure of the Operating Manual

This operating manual has been divided into chapters. The order of the chapters should help you to quickly and properly familiarise yourself with the operation.

Representation

Identifier	Meaning	Example
Quotation mark	Field in the software interface	"Calibrating"
Vertical line	Path specification	Settings | Selection
Pointed brackets	Keys and buttons	<Update>
Round brackets	Image reference	Connect the plug (Fig. 1, item 1)

In the software description, the term "clicking" is used if a process is to be activated. This also refers to the pressing of a button (key) or an area on the touch display if a mouse is not used for controlling.

Symbols Used

NOTICE

If this information is not observed, deterioration in the operation and/or property damage may occur.

IMPORTANT

Sections marked with this symbol point out important information on the product or on handling the product.

Tip

Provides tips on application and other useful information.

General warning symbol

Warning symbol electrical shock

Warning symbol Danger of crushing

Warning symbol heavy loads

Warning symbol suspended load

Warning symbol explosion hazard

Wear protective helmet

Wear safety shoes

1.5.2 Structure of Warnings

Signal Word

Source and consequence
Explanation, if required
▶ Prevention
In case of emergency

- **Warning symbols:** (warning triangle) draws attention to the hazard.
- **Signal word:** indicates the severity of danger.
- **Source:** specifies the type or source of danger.
- **Consequence:** describes the consequences of non-compliance.
- **Prevention:** states how one can avoid the hazard.
- **In case of emergency:** specifies which actions are required in the event of the occurrence of risk.

In this manual, warning instructions before instructions for action refer to risks of injury or damage to property. The hazard-prevention measures described must be observed.

DANGER

Indicates an **imminent**, major hazard, which will certainly result in serious injuries or even death if the hazard is not avoided.

WARNING

Indicates a **potential** hazard, which can result in serious injuries or even death if the hazard is not avoided.

CAUTION

Refers to a **potentially dangerous** situation, which can result in medium or minor physical injuries or damages to property, if it is not avoided.

2 Safety

When operating in areas with danger of explosion, observe the specific safety notes and installation instructions in the safety manual / explosion protection manual, see 1.1 Applicable Documents.

2.1 Dangers and safety measures

Assembly, Installation, Commissioning, Operation, and Maintenance
These tasks must only be carried out by authorized and properly trained personnel.

Before Assembly/Commissioning:

- Carefully read and fully understand this operating manual and all related documents before working with the product.

Keep the operating manual in a location where it is easily accessible at all times.

Ensure that the contents of the operating manual are fully understood by all personnel.

In case of doubt, please contact the manufacturer.

2.2 Proper Use

The LoopSeries LB 430 measuring system is a detector that, when used with an appropriate radiation source, is capable of measuring radiation intensity as part of a radiometric measurement. Depending on the configuration, it can be used for various measurement tasks:

- Level measurement
- Density measurement

The measuring system is used for continuous monitoring and detection of levels of liquids and bulk materials in containers, or for determining the density of liquids in containers and pipelines. The intended use is determined during the planning phase by Berthold. The delivered system may only be used for this purpose.

The following constitutes proper use

- Strictly adhering to the instructions and procedural sequences and perform no unauthorised third party actions that endanger your safety and the functional efficiency of the detectors!
- Observing the provided safety instructions!
- Carrying out the prescribed maintenance measures or having them carried out for you!

Improper Use

- Failing to observe the specified safety instructions and instructions for the operation, maintenance and disposal in the manual.
- Any non-compliance with the present manual for the supplied products.
- Applying conditions and requirements which do not conform to those stated in the technical documents, data sheets, operation and assembly instructions and other specific guidelines of the manufacturer.

- Using the product in a damaged or corroded condition.
- Restructuring or changing the system components.
- Repairs of detectors that are used in hazardous areas by persons who are not authorised by Berthold Technologies GmbH & Co. KG.
- Using the product with
  - open or not properly closed cover
  - improperly closed entries,
  - insufficiently tightened or damaged screw connections i.e. cable glands, adapters or blind plugs[1].
- Operation without the safety precautions provided by the manufacturer.
- Manipulation or avoidance of existing safety equipment.

Berthold shall only accept liability for/guarantee the conformity of the device to its published specifications.

If the product is used in a way which is not described in the present manual, the device's protection is compromised and the warranty claim becomes invalid.

2.3 Qualification of the Personnel

NOTICE

A minimum requirement for all work on or with the product would be employees with general knowledge who are instructed by an expert or authorised person.

At different parts in this operating manual, reference is made to groups of people with certain qualifications who can be entrusted with different tasks during installation, operation and maintenance.

These three groups of people are:

- Employees with General Knowledge
- Experts
- Authorised Persons.

Employees with General Knowledge

NOTICE

Employees with general knowledge must always be guided by an expert at the very least. When dealing with radioactive substances, a radiation safety officer must also be consulted.

Employees with general knowledge are e.g. technicians or welders, who can undertake different tasks during the transportation, assembly and installation of the product under the guidance of an authorised person. This can also refer to construction site personnel. The persons in question must have experience in handling the product.

Experts

Experts are persons who have sufficient knowledge in the required area due to their specialist training and who are familiar with the relevant national health and

[1] blanking elements acc. to IEC 60079

safety regulations, accident prevention regulations, guidelines and recognised technical rules.

Expert personnel must be capable of safely assessing the results of their work and they must be familiar with the content of this operating manual.

Authorised Persons

Authorised persons are those who are either designated for the corresponding task due to legal regulations or those who have been authorised by Berthold for particular tasks. When dealing with radioactive materials, a radiation safety officer must also be consulted.

2.4 Operator's Obligations

When integrating the product into a system, the operator is responsible for the permissible use and ensuring that valid safety standards are adhered to. The operator of the product must regularly train their personnel on the following topics:

- Adherence to and use of the operating manual as well as relevant legal regulations.
- Proper operation of the product.
- Compliance with the instructions from plant security and the operator's operational procedures.
- Regular inspection/maintenance of the product.

3 System Description

3.1 Overview

The **LoopSeries LB 430** detectors are used in industrial measurement systems to measure level, density, or interface level in various installation situations. The detectors of the **LoopSeries LB 430** are available in the following versions:

- Point detector (Scintillator NaI 50/50)

The detector is powered and communicates via a 4…20 mA current loop.

3.2 Measuring Principle

The radiometric measurement is based on the principle of interaction between ionizing radiation and matter. The basic measurement setup consists of a radioactive source with radiation intensity I0 (Fig. 1, Pos. 3) and a radiation detector (Fig. 1, Pos. 1), which are mounted on opposite sides of a container or pipeline containing the product to be measured (Fig. 1, Pos. 2). The radiation detector measures the radiation intensity I that has been attenuated by the product. The relationship between the two radiation intensities follows the absorption law according to:

$$I = I_0 \times e^{-\mu \times \rho \times d}$$

I = Radiation arriving at the detector
I_0 = Unattenuated radiation
μ = Mass attenuation coefficient (absorption coefficient) in cm²/g
ρ = Density of the absorbing material in g/cm³
d = Thickness of the absorbing material (Absorption path) in cm

By measuring the ratio of I/I0, level, product density, or concentrations can be determined.

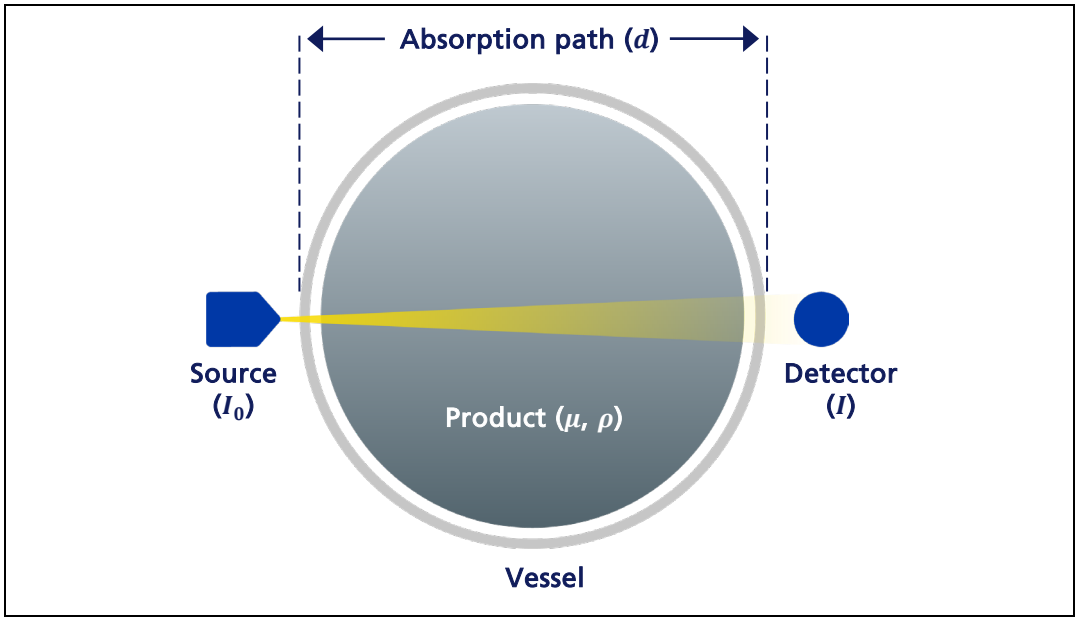


Fig. 1 Measuring Principle

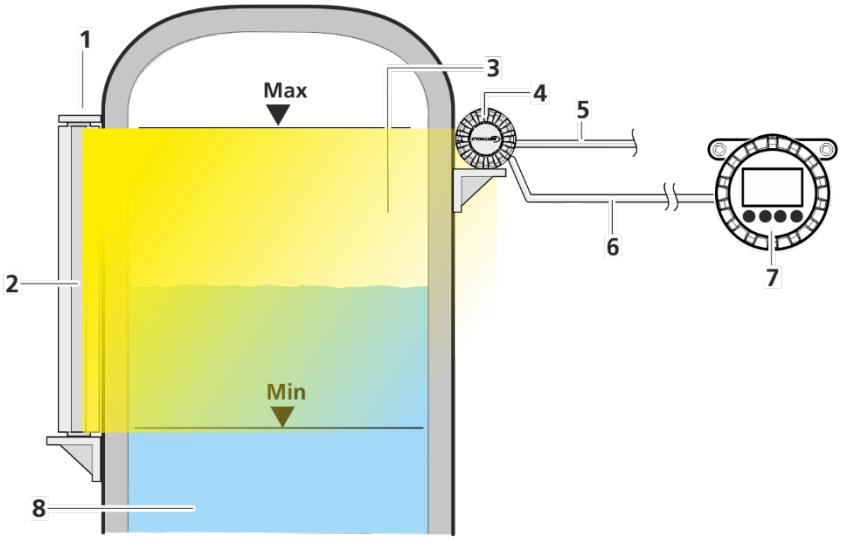
3.3 Measurement arrangement

For a complete measurement system, in addition to the LoopSeries LB 430 detectors (Fig. 2 Shows the basic arrangement on a container for level measurement. The measurement range can be extended by using multiple detectors., Pos.4 radiation sources and shield (Fig. 2 Shows the basic arrangement on a container for level measurement. The measurement range can be extended by using multiple detectors., Pos.1) are required. The operation of the shield is not covered in this manual but is part of a separate operating manual.

The configuration, parameterization, and calibration of the detectors, as well as the output and display of digital measurement values, are carried out via the 4…20 mA current loop (Fig. 2, Pos.5) erfolgen.

Process values and device status can be read via an optional display module (Fig. 1, Pos. 7)

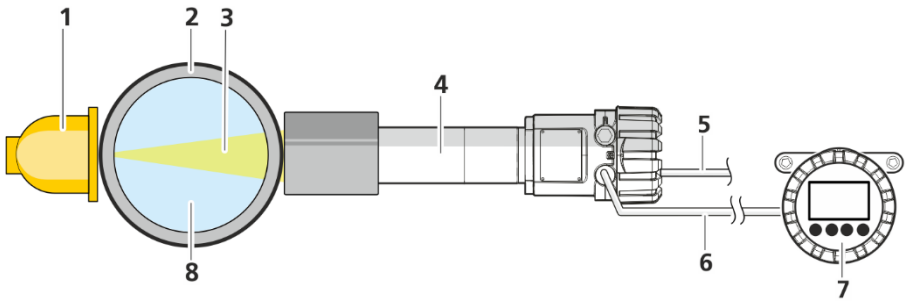
3.3.1 Level



1	Rod source shield	5	Measuring cable (current loop)
2	Socket	6	Display module cable
3	Radiation beam	7	Display module (optional)
4	Point detector (LoopSeries)	8	Product

Fig. 2 Shows the basic arrangement on a container for level measurement. The measurement range can be extended by using multiple detectors.

3.3.2 Density



1	Point source shield	5	Measuring cable (current loop)
2	Pipe	6	Display module cable
3	Radiation eam	7	Display module (optional)
4	Point detector (LoopSeries LB 430) with collimator	8	Product

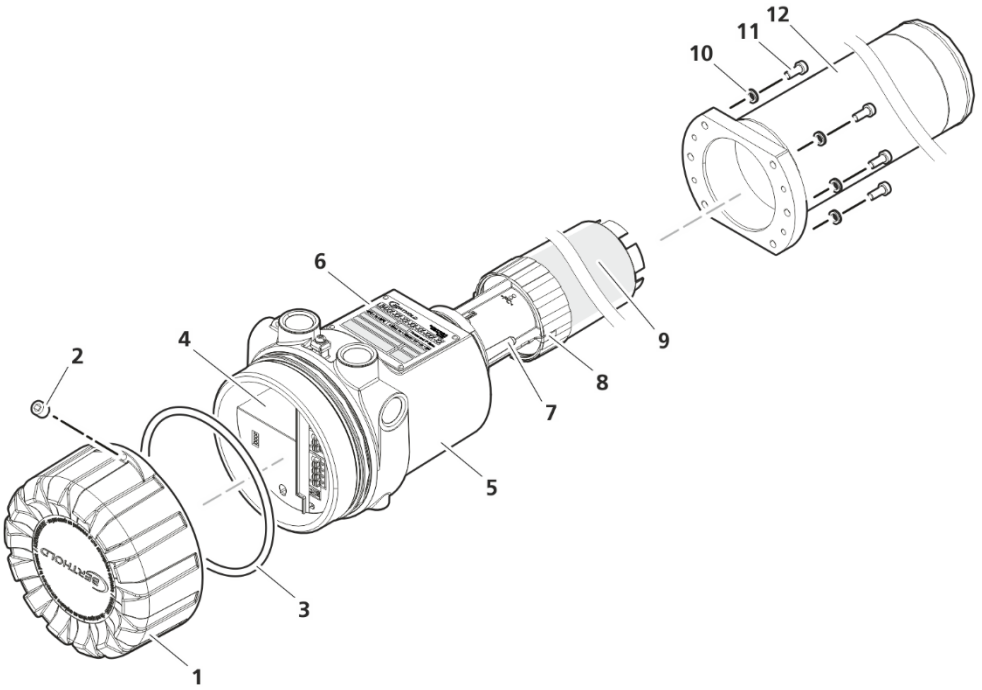
Fig. 3 Shows the basic arrangement on a pipeline with a 90° mounting fixture for density, concentration, and solid content measurement. To extend the measurement path, 45° and 30° mounting fixtures are also available. For small pipe diameters, an S-shaped or U-shaped measuring section can be used.

3.4 Storage

Keep devices in a dry (no condensation), dark (no direct sunlight), clean and lockable room. Stay within the temperature range for storage. Observe the permissible temperature range for storage (see document Technical Information).

3.5 System Components

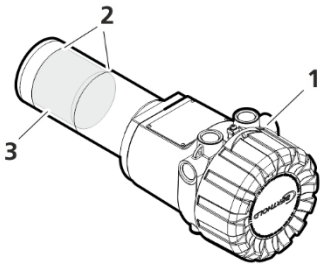
The detectors are made up of the components shown in Fig. 4. The display module, water cooling and collimator options are not listed in the view.



1	Detector head cover	7	Sensor electronics
2	Grub screw	8	Scintillator housing
3	O-ring	9	Scintillator
4	Connection compartment	10	Self-locking lock washer M5
5	Detector housing	11	Hex socket head screw M5x12
6	Type plate	12	Housing tube

Fig. 4 System components LoopSeries detector

Point detector



1 Detector head
2 Marking grooves
3 Sensitive area

Fig. 5 View of the LoopSeries detector (point detector)

3.5.1 Szintillator

The **LoopSeries** detectors differ in their external dimensions and the scintillators used (Fig. 4, Pos.9). A 50/50 mm (length/diameter) sodium iodide (NaI) scintillator (Fig. 4, Pos.9) is used.

3.5.2 Electronics

The sensor electronics include the photomultiplier (semiconductor-based silicon photomultiplier in the LB 430 LoopSeries) as well as the processing electronics. The photomultiplier detects the light flashes generated by the scintillator and converts them into electrical signals. The processing electronics then convert these electrical signals into the desired digital display values.

3.5.3 Connection Compartment

The connection area contains all the terminal connections required for the installation of the detector. Detailed information can be found in chapter 5 Electrical Installation.

3.5.4 Software

The **LoopSeries** detectors are delivered with pre-installed software. The operation via the communicator or PC software is described in detail in a separate operating manual (see 1.1 Applicable Documents 69691BA24).

3.5.5 Zubehör und Optionen

General information about accessories and options for the LoopSeries detectors can be found in the document Technical Information (69691TI2). Information regarding the installation and connection of accessories can be found in chapter 8 Accessories of this operating manual. Only accessories listed in this operating manual or the respective project documentation should be used.

- Collimators (Technical Information, chapter 4)
- Water Cooling (Technical Information, chapter 5)
- Overview of other accessories (Technical Information, chapter 10)

4 Installation

4.1 Safety Notes

The applicable national regulations of the country of use have to be observed! Repair and maintenance on the devices may only be performed by experts (see chapter 2.3).

⚠ WARNING

Danger of injury by falling loads!

- Never stand underneath a lifted or suspended load, keep at a safe distance.
- Only use tested sling gear components appropriate for the transport weight.
- Observe the marking for the centre of gravity on the outer packaging, if applicable.
- The bearing capacity of the vessel walls or the brackets must be suitable for installation of the detector.
- Wear head protection and safety shoes.

⚠ WARNING

Danger to life by explosion!

If the detector is located in a potentially explosive atmosphere, it is essential to observe the corresponding instructions and safety instructions in the safety manual / explosion protection manual, see 1.1 Applicable Documents.

⚠ CAUTION

Danger of injury caused by heavy and bulky system components!

- Heavy and bulky system components should only be handled using aids and by at least 2 persons.
- Observe the guidelines for safe handling of heavy loads.
- Ensure stability and use the provided fixing possibilities.

IMPORTANT

The applicable national regulations of the country of use have to be observed!

4.2 General Notes

NOTICE

- Transport the detector and components in the original packaging and protect the parts from vibrations.
- During installation, also observe the instructions in the safety manual / explosion protection manual, see 1.1 Applicable Documents.

NOTICE

- Only clamping devices approved by Berthold should be used to install the device.
- The device may only be operated if permanently installed.
- Do not operate the detector outside its electrical, thermal and mechanical parameters (see document Technical Information chapter 6 Technical Data).

Free space must be foreseen at the installation site for:

- Freedom of motion for delivery of the detector
- The electrical installation of the detector.
- Servicing and repair work, to install and dismantle parts.

4.3 Unpacking / Scope of Delivery

The product will be delivered completely configured according to the purchase order. Check your delivery for completeness and damage according to your order. Please report missing, defective or incorrect parts immediately.

4.4 Detector Protection

NOTICE

Risk of damage!

The detector may be damaged due to strong mechanical stress, heavy ibrations and high temperatures.

- Please refer to the document Technical information chapter 6 Technical Data.

Cooling

The ambient temperature must not exceed the values specified in the technical data. If temperatures exceeding 50° C are expected, you have to use a detector with water cooling system (see chapter 8.1 Water Cooling). Prevent heat transfer from the detector holder to the detector by using a suitable heat-neutralizing suspension.

Sun Protection

For open-air installation, a weather protection cover that provides protection against direct sunlight and associated heat should also be installed over the detector.

Avoidance of strong Mechanical Stress

When selecting the installation site, keep in mind that the detector should not be affected by strong mechanical stress or heavy vibrations, in order not to restrict its service life. If the measuring system is used in a heavy-duty environment, the detector and the shielding should be provided with an additional protective cover.

Precautions against strong Vibrations

Excessive vibrations or shocks on the detector shorten the service life. Mount the detector on a vibration-free support; you may also dampen possibly occurring vibrations or shocks using appropriate vibration absorbers.

Cleaning

For professional cleaning, follow the instructions in the chapter 7.5 Cleaning.

4.5 Application-specific Assembly

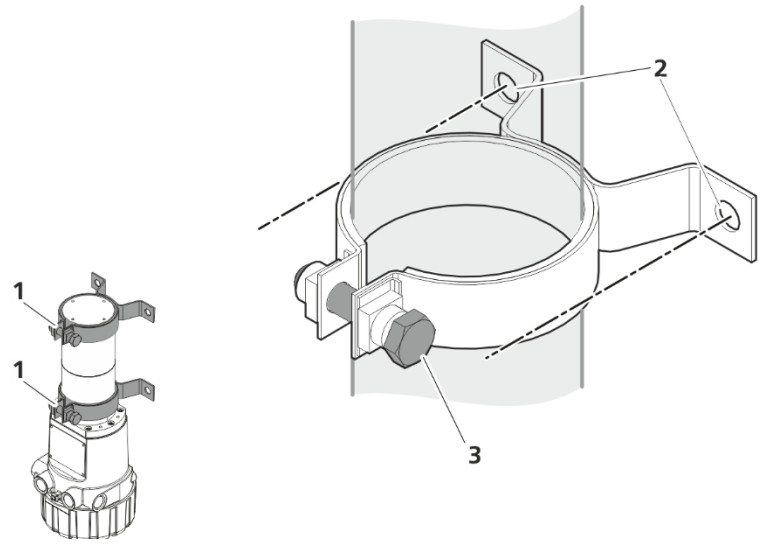
Application-specific specifications for installation are described in the following chapters.

4.5.1 Installation of Mounting Clamps

Mounting clamps (Fig. 6, Pos.1) are used to secure the detectors. These clamps are attached to mounting bases, crossbars, or similar structures provided by the operator (Fig. 6, Pos.2).

Optionally, a robust stainless steel bracket for detectors with or without water cooling is available. Further details can be found in the document Technical Information (69691TI2). These mounting clamps are suitable for both point and rod detectors.

Mounting Clamps Type 1



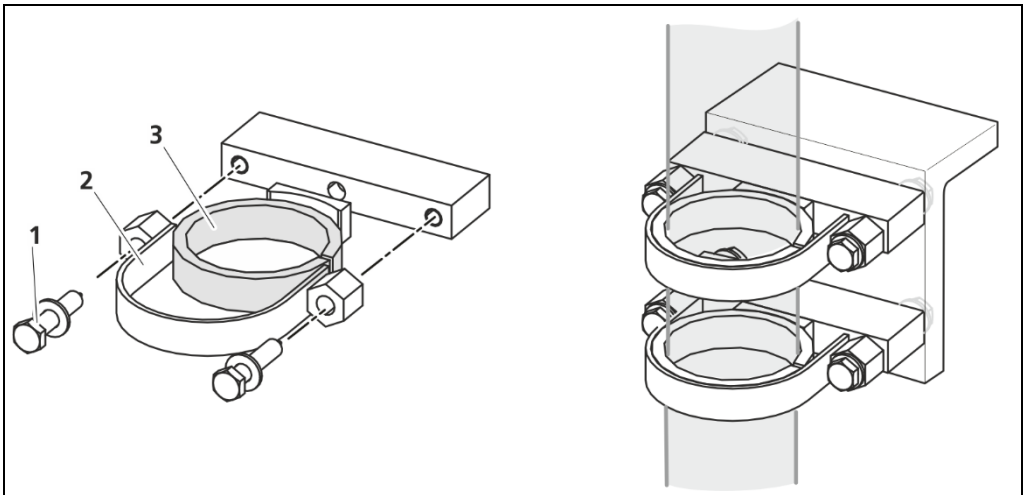
1 Hex Mounting clamp
2 Holes for mounting material
3 Hex screw M10

Fig. 6 Befestigungsschellen Typ 1

1. Unscrew the fastening screw (Fig. 6, Pos.3) on top of the mounting clamp.
2. Slide the clamp from over the detector housing.
3. Tighten the screw (Fig. 6, Pos.3) sufficiently so that the mounting clamp cannot slip on the detector.

▶ The assembly is complete

Mounting Clamps Type 2 and Detector Holder



1 Screw M10 incl. washer
2 Top part
3 Spacer ring

Fig. 7 U-clamp and detector holder stainless steel

1. Unscrew the two screws (Fig. 7, Pos.1) on the side of the mounting clamp.
2. Take off the top part (Fig. 7, Pos.2) of the mounting clamp.
3. If necessary, remove the spacer ring (Fig. 7, Pos.3) if a detector with water cooling system is to be installed.
4. Place the detector in the bottom part of the mounting clamp
5. Refit the top part and tighten the screws until the mounting clamp can no longer slip on the detector.

▶ The assembly is complete.

4.5.2 Installation on a Vessel

For mounting the detector on the vessel, the mounting clamps must first be mounted on the detector (see 4.5.1). Examples are shown in Fig. 8 and Fig. 9. Appropriate mounting fixtures (e.g. mounting brackets, platforms, etc.) are to be provided by the operator. The dimensions of the detector and the mounting clamps (see document Technical Information 69691TI2) should be observed. The orientation of the system components (radiator/shielding and detector) to each other and to the measuring range is described in detail in the operating manual of the corresponding transmitter.

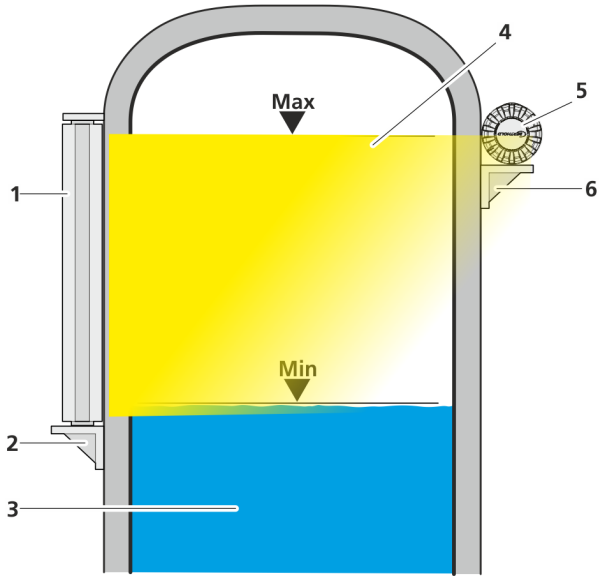
The cable bushing and cable inlet should be positioned so that no water can flow along on the cable into the bushing.

IMPORTANT

The distance from the middle of the detector to the vessel surface or surface of heat insulation should be approx. 100 mm.

Tip

Care should be taken during mounting to avoid as far as possible heat transfer from the vessel via the clamps to the detector.

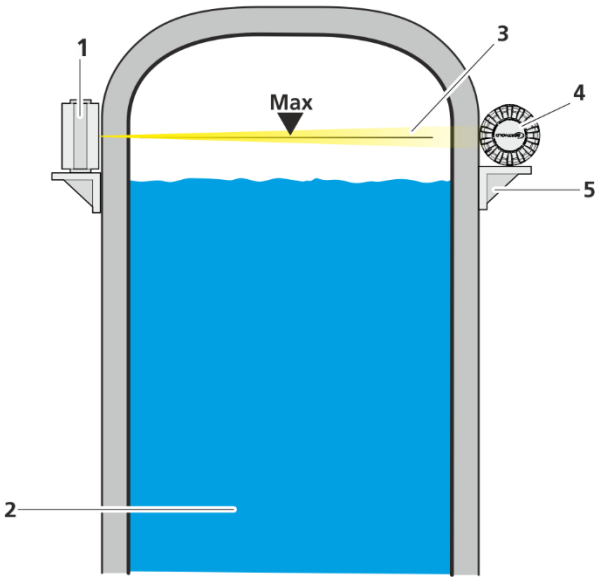


1 Rod source with shield
2 Mounting base
3 The product
4 Radiation beam
5 Point detector
6 Mounting base

Fig. 8 Installation the rod source - point detector arrangement

Measurement with point source

The combination of point detector and point radiation source is typically used to measure the point level. The detector is aligned at the same height as the radiation source.



1 Point source with shield
2 Product
3 Radiation beam
4 Point detector
5 Mounting base

Fig. 9 Mounting the point source - point detector arrangement

IMPORTANT

When mounting the point detector, ensure its correct alignment with the radiation source. The side opening (radiation window) in the optional collimator exposes the sensitive area of the detector and must be directed toward the radiation source.

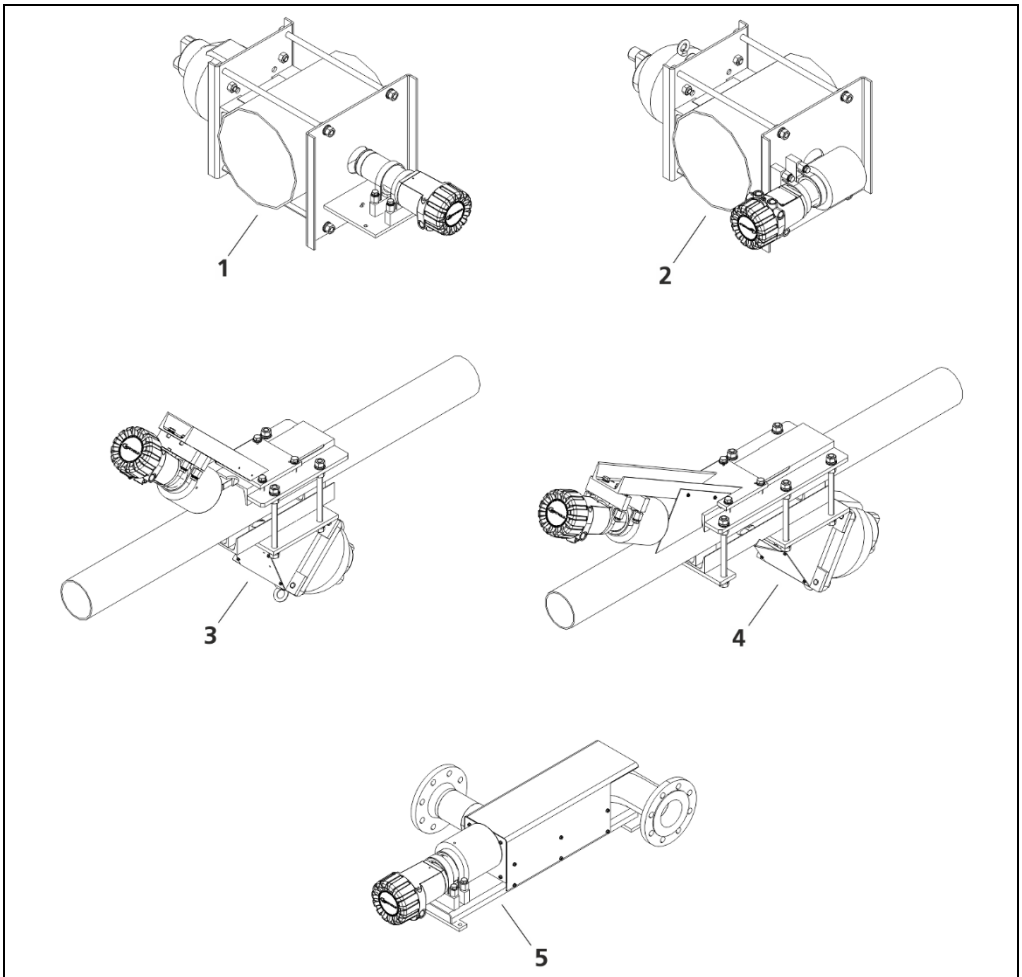
For mounting the point radiation source, a suitable mounting base (Fig. 8, Pos. 5) must be installed on the container, which is to be provided by the operator. The distance to the container surface or to any existing thermal insulation should be approximately 100 mm. The detector is mounted on the bracket using mounting clamps or a mounting kit.

If the bracket cannot be mounted directly on the container, it should be mounted on a nearby support. The technical drawings for the point detector and its accessories can be found in the document Technical Information (69691TI2).

4.5.1 Installation on a Pipeline

To install a detector on a pipeline, mounting fixtures are available for various pipe diameters and transmission angles. Some examples are shown in **Fig. 9**. A detailed description of the mounting fixtures and the associated dimension drawings can be found in the document Technical Information (69691TI2 chapter 2 and chapter 3.4).

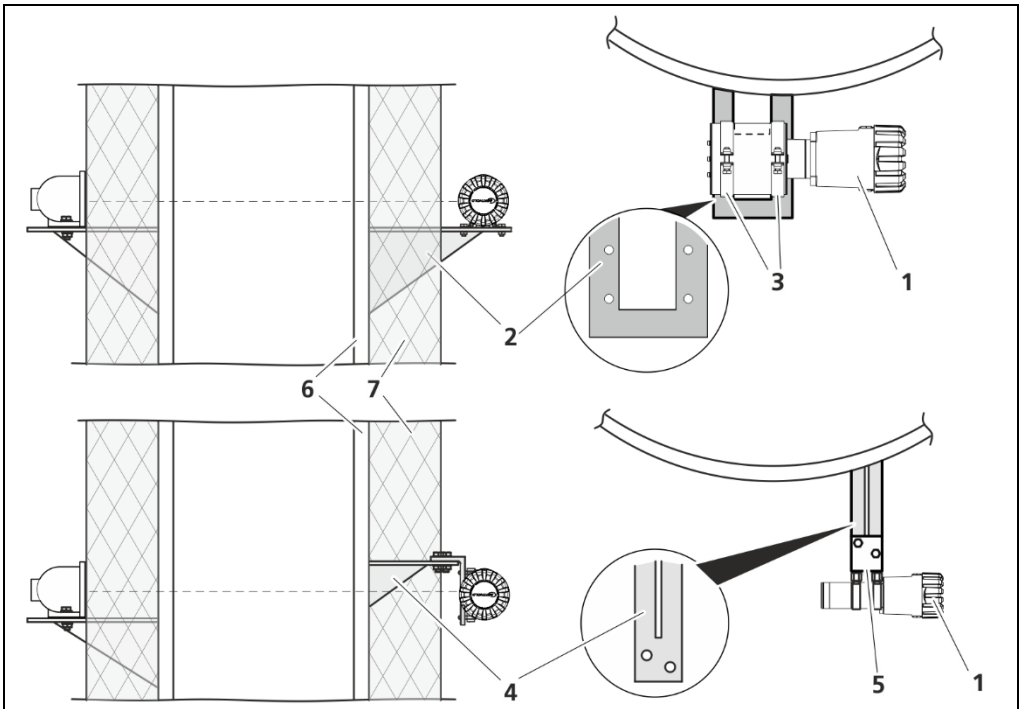
The mounting fixtures already come with mounting clamps. To mount the detector, please follow the instructions provided in the chapters 4.5.1 and 4.5.2.



1 Clamping device for a radiation angle of 90° and vertical detector mounting
2 Clamping device for a radiation angle of 90° and parallel detector mounting
3 Clamping device for a radiation angle of 45°
4 Clamping device for a radiation angle of 30°
5 S-shaped density measuring path

Fig. 10 Overview - Pipeline Installation

4.6 Installation Point Detectors on a Vessel



1 Point detector CrystalSENS
2 Mounting bracket
3 Mounting with clamps
4 Mounting bracket
5 Mounting with detector holder
6 Vessel wall
7 Insulation

Fig. 11 Mounting of point detector

With Point Source

The combination of CrystalSENS and point source is typically used to measure the limit level. The detector is aligned on the same height relative to the source.

With Rod Source

The size of the measurement range for continuous level measurement is defined by the radiation field received by the detector; this radiation field has to be taken into account during installation of detector and shielding. The installation situation is illustrated in the project drawings, sketches and descriptions.

IMPORTANT

When installing the CrystalSENS, please pay attention to the correct alignment relative to the source. The lateral opening (beam window) in the collimator releases the sensitive area of the detector and must be directed at the source.

The CrystalSENS is installed on the container using a bracket that is provided by the customer. The distance to the surface of the vessel or the surface of a thermal insulation should be about 100 mm. Clamps or an installation kit are used for installation of the detector on a bracket.

If the bracket cannot be mounted on the container, then it has to be mounted on a support in the vicinity. The technical drawings for CrystalSENS and its accessories can be found in the document Technical Information (69691TI2). Information on water cooling and collimators can be found in chapter 8 Accessories.

5 Electrical Installation

5.1 Safety Notice

⚠ DANGER

Danger to life from electric shock!

If the cover of the connection compartment is open, there is a risk of electric shock if the connection terminals are touched.

- The installation may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Connect only devices onto the product that comply with the applicable safety standards.

In case of an electric shock, carry out first aid measures and immediately call an emergency service.

⚠ WARNING

Danger to life by explosion!

- If the detector is located in a potentially explosive atmosphere, it is essential to observe the corresponding instructions and safety instructions in the safety manual / explosion protection manual, see 1.1 Applicable Documents.

NOTICE

Only open the connection compartment in dry ambient conditions, never in the rain. Moisture in the connection compartment can cause a short circuit with other cables.

5.2 General Instructions

The threads (cable entries and covers) must be greased all round with lubricant (recommendation: OKS 217) to seal against moisture and to prevent corrosion.

Cables and Wires

Use only cables with a diameter that is permissible for the respective cable gland. The cables must have the following wire cross-sections:

- HART 4 … 20 mA = 0,25 mm² (AWG24) bis 2,5 mm² (AWG12)
- Optional Display = 0,25 mm² (AWG24) bis 2,5 mm² (AWG12)

The connected cables must be suitable for a temperature at least 15°C higher than the maximum ambient temperature. Only use cables that are compatible with the cable glands being used. The connected cables must never be subjected to tensile stress and must be laid in a way that prevents strain.

Unused entries must always be properly sealed with blind plugs. Only shielded cables may be used.

Connecting the Cables

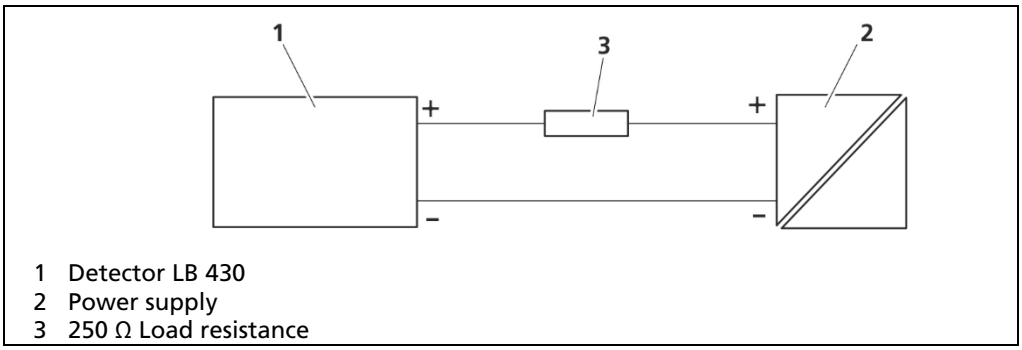
1. Pull the connection cables with the complete outer insulation through the cable gland into the connection area.
2. Ensure that the cable diameter of the cables used is suitable for the cable gland.
3. When laying the cables, make sure that mechanical damage to the wire insulation from sharp-edged or moving metal parts is avoided.
4. Keep the cable length sufficiently long to form a cable loop as strain relief before the cable enters the housing.
5. Lay the connection cables in the connection area so that:
   - Dirt and moisture are avoided in the connection area.
   - The wires are not damaged during stripping.
   - The wire insulation reaches up to the terminals during stripping.
   - The minimum bending radii permitted for the respective wire cross-section are not exceeded.
6. For stranded wires, strip 10 mm of insulation, and insert them only after the spring clamp has been opened using an appropriate tool (screwdriver with a blade width of about 3 mm). Ensure that all strands of the stranded wire are fully clamped, and no individual wire extends out of the clamp. The insulation of the wire must reach into the terminal entry hole.
7. Place the cable shields onto the terminals marked with **GND**. Lay the cable shield directly inside the gland.
8. Ensure that the wires are securely seated in the connection terminals.
9. Connect the terminal for potential equalization on the outside of the detector housing to the potential equalization bar.
10. For cable glands: Tighten the hex nuts of the cable entries so that the sealing of the connection area and strain relief protection for the connections are ensured. Follow the manufacturer's recommended torque settings.
11. If necessary, remove any loose metal particles, dirt, and moisture from the connection area.
12. Ensure that the cover seal (O-ring) is undamaged around its entire circumference.

5.3 Power Supply

The power supply for the device via the 4 … 20 mA interface must provide a maximum voltage of 30 V DC. According to IEC 61010-1, Section 9.4, it must not exceed an output current of 5 A.

5.4 4 ... 20 mA HART

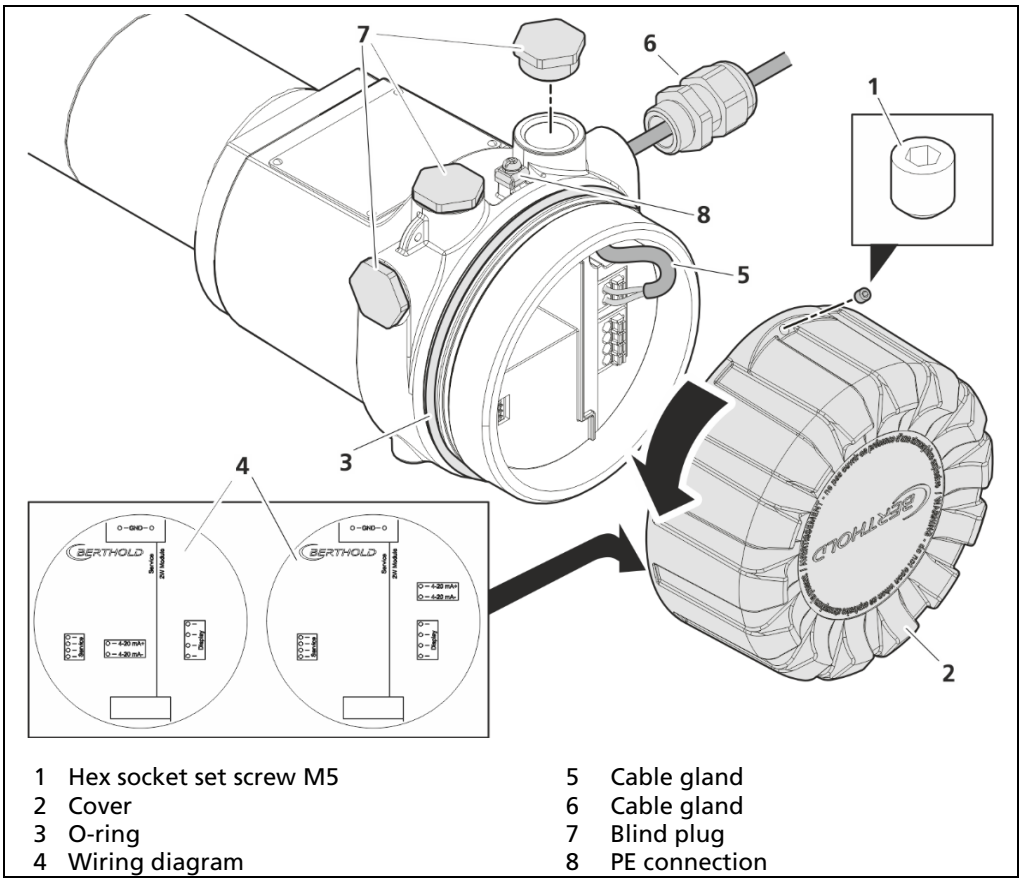
A minimum load resistance of 250 Ω must be taken into account for the 4 ... 20 mA HART current loop.



1 Detector LB 430
2 Power supply
3 250 Ω Load resistance

Fig. 12 Circuit diagram 4 ... 20 mA HART connection

5.5 Initial Start-up



1 Hex socket set screw M5
2 Cover
3 O-ring
4 Wiring diagram
5 Cable gland
6 Cable gland
7 Blind plug
8 PE connection

Fig. 13 Electrical connection

1. Make sure that the detector has been installed as described in chapter 4.

⚠ CAUTION

Risk of injury from falling cover!

- Hold the cover firmly with both hands when releasing it.

2. Loosen the set screw (Fig. 12, Pos. 1) and remove the cover (Fig. 12, Pos. 2) by turning it with both hands.

1. Screw in the required cable glands (Fig. 12, Pos. 6) according to the manufacturer's specifications.
2. Open the locknuts of the cable glands and insert the cable (Fig. 12, Pos. 5).
3. Connect the cable to the terminals in the connection area. Refer to the connection diagram (Fig. 12, Pos. 4), which is located inside the cover.
4. Tighten the locknuts of the cable glands with the torque specified by the manufacturer.
5. Unused entries must be sealed with the corresponding blind plugs (Fig. 12, Pos. 7). A tightening torque of 20 Nm is recommended.
6. Connect the detector to a local potential equalization (Fig. 12, Pos. 8).
7. Ensure that the O-ring (Fig. 12, Pos. 3) is properly seated around the entire circumference on the front face of the detector base.
8. Attach the cover (Fig. 12, Pos. 2). Turn the cover until it is securely seated on the detector housing.
9. Tighten the set screw (Fig. 12, Pos. 1).

▶ The electrical installation is complete.

5.6 Reuse of Detectors

NOTICE

If a detector has been used previously, please note the following: Detectors that have been used in a non-Ex area must not be used in an Ex area.

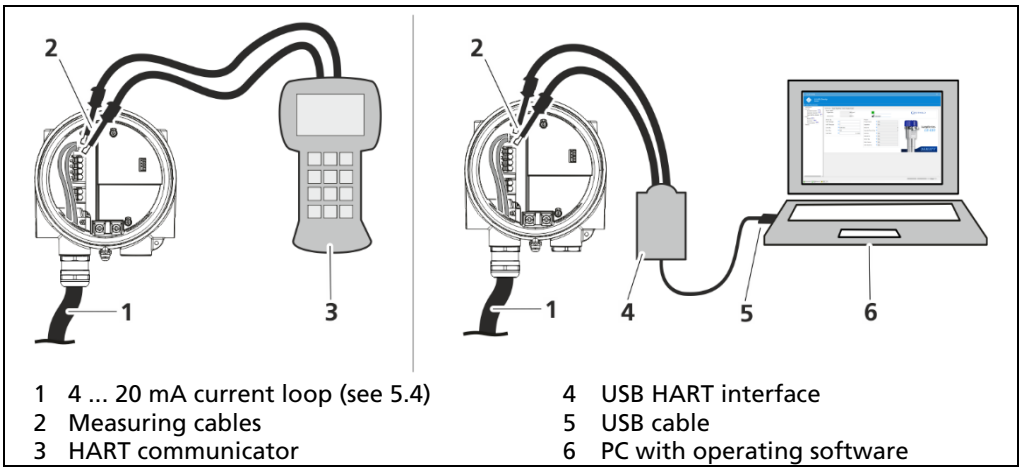
NOTICE

If an intrinsically safe detector has been used previously, please note the following: If intrinsically safe signals were connected to non-intrinsically safe circuits, they must not be connected to intrinsically safe circuits anymore.

6 Operating

6.1 Operating Concept

The detector is configured and parameterized via HART. Access is provided through a HART communicator (Fig. 13, Pos. 3) or a PC (Fig. 13, Pos. 6) with a USB-HART interface (Fig. 13, Pos. 4).



1 4 ... 20 mA current loop (see 5.4)
2 Measuring cables
3 HART communicator
4 USB HART interface
5 USB cable
6 PC with operating software

Fig. 14 Connection for operation

IMPORTANT

For a clear and user-friendly configuration, Berthold recommends using the operating software (PACTware) with DTM (Device Type Manager).
The software is described in a separate manual, see 1.1 Applicable Documents.

6.2 AMS Trex Device Communicator

The LoopSeries LB 430 detectors are compatible with the HART communicator model AMS Trex Device Communicator from Emerson Process Management GmbH & Co. OHG.

Other HART-compatible communicators that support Enhancements can also be used. The HART communicator uses the Bell 202 Frequency-Shift Keying technique to superimpose high-frequency digital communication signals onto the standard 4 … 20 mA current loop. The minimum load resistance on the 4 … 20 mA current loop must be 250 ohms.

The user manual of the AMS Trex Device Communicator provides information on the use of the keys, data entry, and interfaces.

7 Maintenance und Repair

7.1 Safety Notice

⚠ DANGER

Risk of electric shock!

Risk of injury from electric shock if moisture gets into the connection compartment.

- Only clean the appliance with the cover firmly closed.
- Do not clean the appliance with a high-pressure cleaner.

⚠ WARNING

Danger to life by explosion

- If the detector is located in a potentially explosive atmosphere, it is essential to observe the corresponding instructions and safety instructions in the Safety Manual / Explosion Protection Manual (1.1 Applicable Documents).

NOTICE

Observe national regulations in the respective country of use!

Repairs may only be performed by Berthold Service. Improper repairs may result in the loss of explosion protection, see Safety Manual / Explosion Protection Manual (1.1 Applicable Documents).

When working on electrical components, the relevant safety regulations must always be followed. In particular, observe the safety instructions in chapter 2 Safety of this manual. Ensure the detector and all inputs and outputs are potential-free.

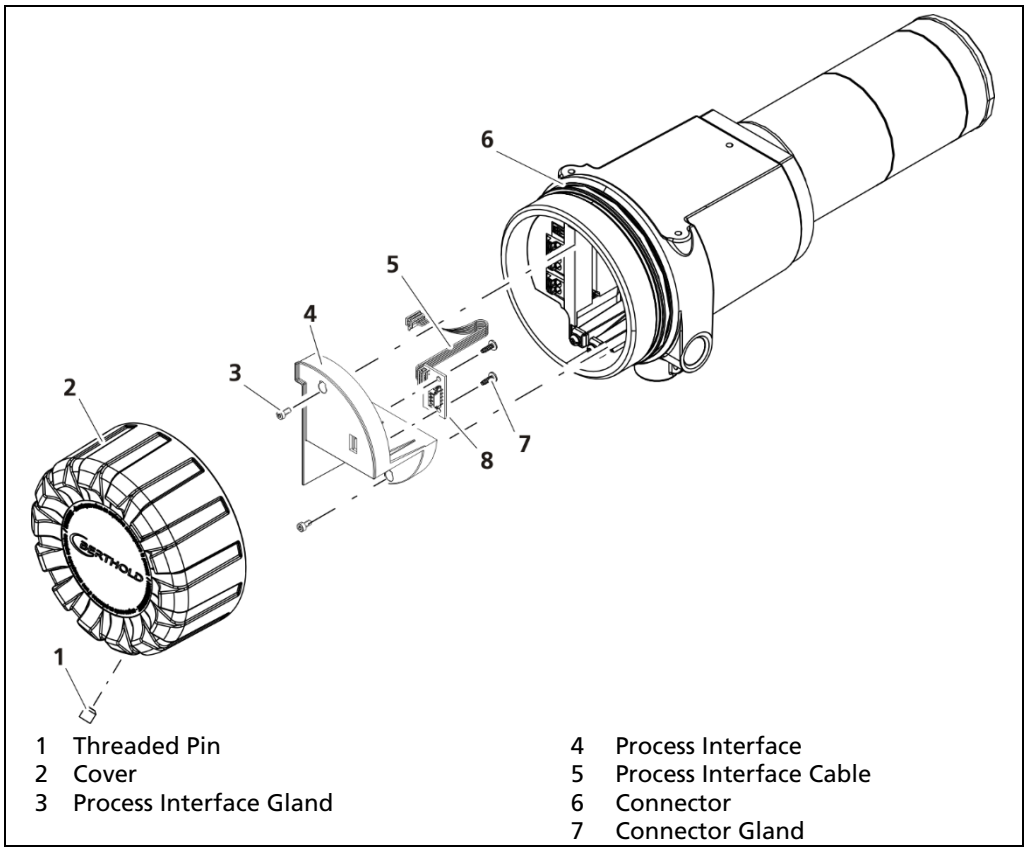
7.2 Visual Inspection of Housing and Cables

Check the cable glands at regular intervals for tightness and secure seating. Replace any leaking cable glands.

Inspect the cables and housing parts regularly for corrosion. Replace any corroded parts.
Check the cover at regular intervals for tightness and secure seating.

Replace any leaking covers. Inspect the cover seal (O-ring) around its entire circumference for integrity. Replace any damaged seals.

7.3 Replacement of the Process Interface



1 Threaded Pin
2 Cover
3 Process Interface Gland
4 Process Interface
5 Process Interface Cable
6 Connector
7 Connector Gland

Fig. 15 Replace process interface

1. Loosen the threaded pin (Fig. 14, Pos.1) and remove the cover (Fig. 14, Pos.2) by turning it with both hands.
2. Loosen the gland (Fig. 14, Pos.3) and remove the process interface (Fig. 14, Pos.4) from the connection area.
3. Disconnect the cable (Fig. 14, Pos.5) by possibly removing the connector (Fig. 14, Pos.6, Pos.7).
4. Connect the new process interface to the cable (Fig. 14, Pos.5) and reinsert the connected process interface into the connection area.
5. Tighten the new process interface (Fig. 14, Pos.3).
6. Ensure that the O-ring (Fig. 14, Pos.7) is seated properly around the entire circumference of the detector base.
7. Reattach the cover (Fig. 14, Pos.2). Turn the cover until it is tightly seated on the detector housing.
8. Tighten the threaded pin (Fig. 14, Pos.1).

▶ The process interface replacement is complete.

7.4 Replacement of the Complete Device

1. Perform a backup and create a .xml file using the software, see Software Manual (1.1 Applicable Documents).

Tip

Have the device output the parameter backup as a PDF file in addition to the .xml file. This way you can easily check the parameters afterwards.

2. Take the detector out of service as described in chapter 9 Decommissioning.
3. Install the new detector as described in chapter 4 Installation.
4. Perform the electrical installation as described in chapter 5 Electrical Installation.
5. Restore the parameters using the previously saved .xml file.
6. Verify the restored parameters using the PDF file that was previously generated.

NOTICE

No reuse in Ex areas!

If the detector has been previously used, please note that detectors which were used in non-Ex areas must not be used in Ex areas anymore!

Intrinsically safe detectors, whose intrinsically safe signals were connected to non-intrinsically safe circuits, must not be connected to intrinsically safe circuits anymore.

7.5 Cleaning

Ensure that cleaning procedures do not damage the cable glands and the name-plate.

NOTICE

Risk of damage from improper cleaning methods!

- Do not use organic solvents or abrasive additives.
- High-pressure cleaning is not allowed.
- Grinding, filing, or knocking off deposits with a hammer is not allowed.

Clean the surfaces of the detector only with water and a cloth or a brush.

8 Accessories

Available accessories are listed in the document Technical Information chapter 8 Parts Overview.

8.1 Water Cooling

To protect the scintillators against overly high temperatures, a water cooling system is optionally available. A water cooling system must be used if the detector temperature may exceed 55 °C. In this respect, ambient temperature, sun light, radiant heat of hot components and the transition of heat from installation fixtures should be considered. With water cooling, the detectors can be operated at higher ambient temperatures, see document Technical information (69691TI2).

NOTICE

When operating in areas with danger of explosion, observe the specific ambient temperature limits, which are specified in the Safety Manual / Explosion Protection Manual (69691BA26) and in the document Technical information (69691TI2).

NOTICE

If water remains in the water cooling systems at ambient temperatures below the frost point, the cooling water system can be damaged.

- ▶ If there is a risk of frost, empty the water cooling system.

NOTICE

Danger of overheating!

A failure of the cooling water system or an insufficient flow can overheat the detector and thereby cause damage.

- ▶ For cooling, exclusively use water of drinking water quality.
- ▶ The cooling water circuit must remain in operation even when the detector is switched off if the maximum operating temperature can be exceeded.

The maximum ambient temperatures are specified in the technical data (see document Technical Information chapter 6). Additionally, the following applies:

- In case of frost risk, the water cooling system must be emptied.
- Contaminated cooling water can clog the water cooling system, potentially causing the detector to overheat and be destroyed. Therefore, always use clean cooling water.
- The water pressure in the cooling jacket must not exceed 6 bar.

Water Cooling in Ex-Areas

For operating water cooling on detectors used in Ex areas, the ambient temperature specifications in the safety handbook for explosion protection apply (see Safety Manual / Explosion Protection Manual 69691BA26).

Detector Temperature Monitoring

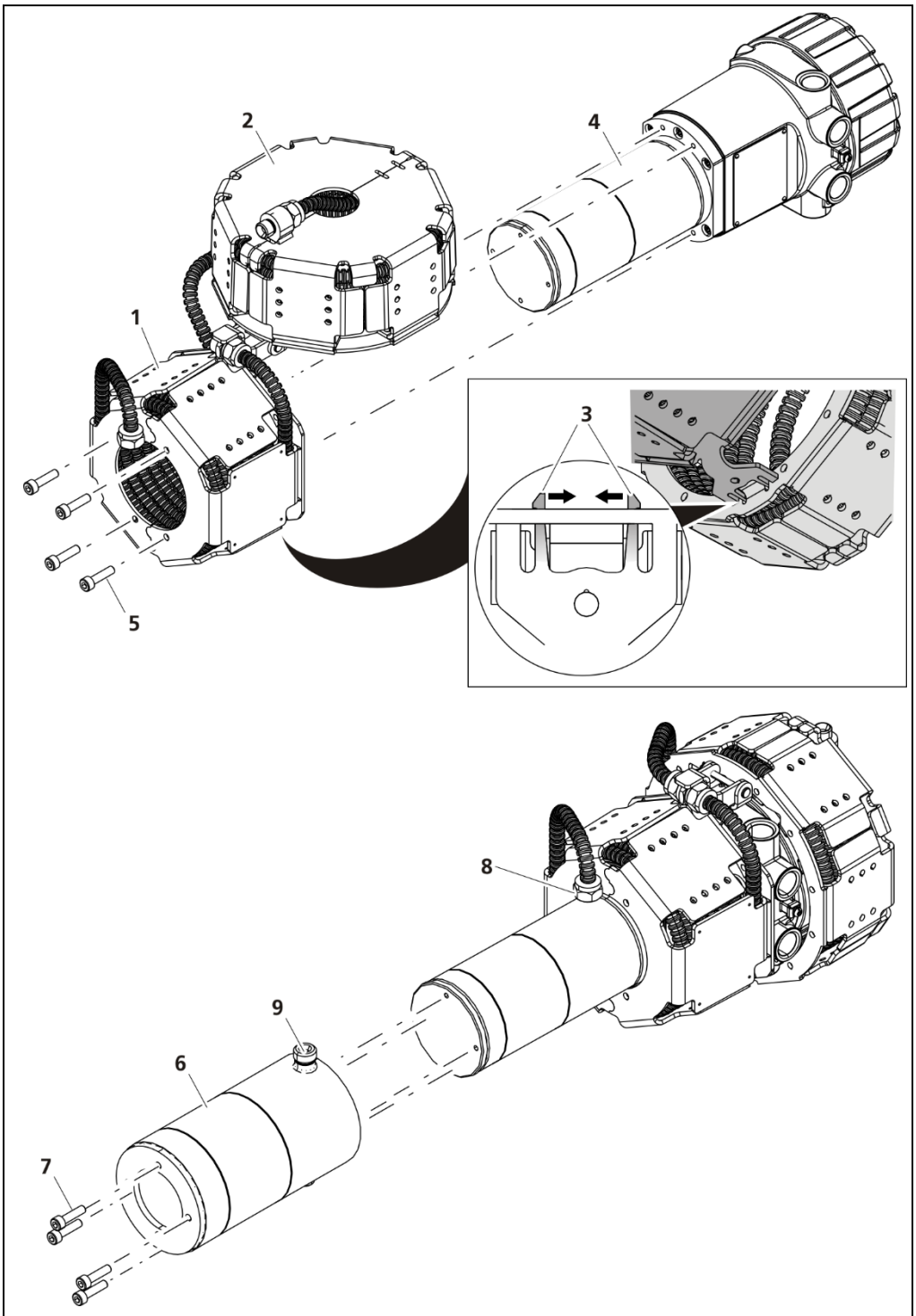
The detector is equipped with an internal temperature measurement system, which can trigger a pre-alarm in case of elevated temperatures. The alarm can be accessed as a HART variable (by default, set as QV). If you operate the water cooling system to keep the detector temperature below 40°C, you could shut down the detector prematurely if the temperature exceeds a set limit (e.g., 50°C), preventing damage from overheating.

Cooling Water Demand Curves

The required amount of cooling water depends on the possible heat transfer, cooling water temperature, and the detector type. The cooling water curves and further information can be found in the accompanying document Technical Information chapter 8 Cooling Water Demand.

8.1.1 Installation and Connection of the Water Cooling System

The water cooling system of the LoopSeries LB 430 detectors consists of a scintillator cooling system and an electronics cooling system. These two parts must be mounted separately and then connected.



1 Electronics cooling
2 Electronic cooling cover
3 Cover retaining clips
4 Detector tube
5 Screw connection for electronics cooling
6 Scintillator cooling
7 Screw connection for scintillator cooling
8 Cooling hose
9 Scintillator cooling connection

Fig. 16 Mounting the water cooling system

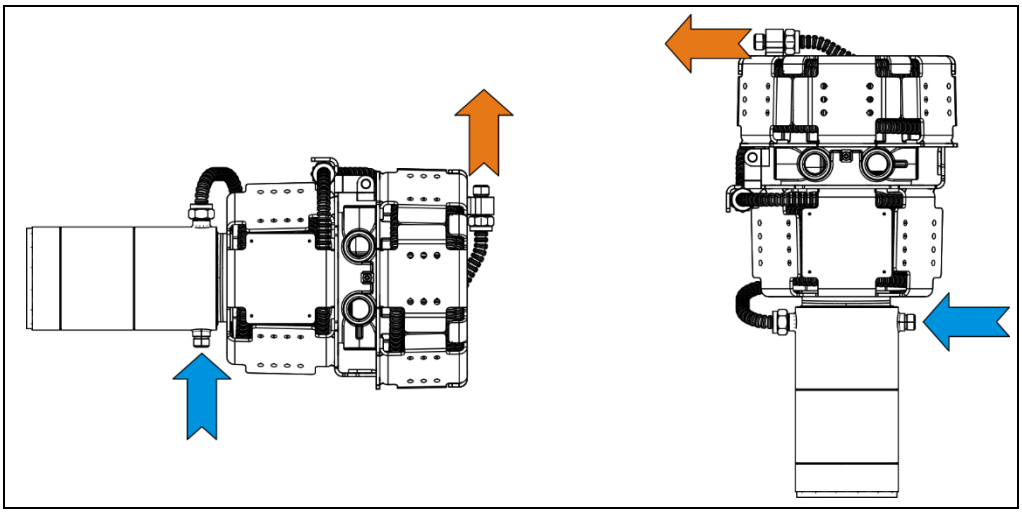


Fig. 17 Arrangement with water cooling (left: horizontal arrangement, right: vertical arrangement)

Installation of the Water Cooling System

If the detector is equipped with water cooling, the cooling connections must be aligned so that the water pipes can be connected without obstruction.

1. Open the electronics cooling cover (Fig. 15, Pos. 2) by pressing the retaining clip (Fig. 15, Pos. 3) on the cover together.

▶ The cover (Fig. 15, Pos. 2) can now be opened.

2. Slide the electronics cooling unit (Fig. 15, Pos. 2) over the detector tube (Fig. 15, Pos. 4) towards the connection area.
3. Attach the electronics cooling unit with the provided screws (Fig. 15, Pos. 5) to the detector tube (Fig. 15, Pos. 2).
4. Carefully close the electronics cooling cover (Fig. 15, Pos. 2) until the retaining clips (Fig. 15, Pos. 3) snap into place.

▶ The electronics cooling unit is correctly mounted.

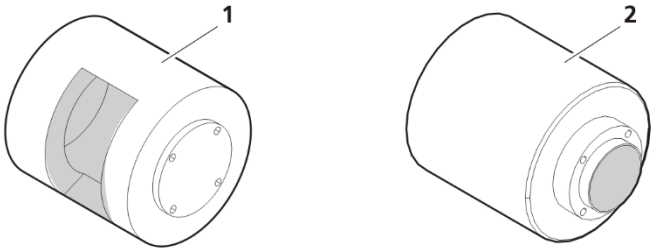
5. Slide the scintillator cooling unit (Fig. 15, Pos. 6) over the detector tube (Fig. 15, Pos. 2).
6. Attach the scintillator cooling unit with the provided screws (Fig. 15, Pos. 7) to the detector tube (Fig. 15, Pos. 2).
7. Connect the cooling hose (Fig. 15, Pos. 8) to the connection of the scintillator cooling (Fig. 15, Pos. 9).

▶ The scintillator cooling unit is correctly mounted.

– Ensure that the water pipes do not pass in front of the radiation window. To prevent air pockets from forming in the water cooling, the detectors must be mounted as follows:
  - If the detector is mounted horizontally, the lower connection (Fig. 16, left) must be used for the water inlet.
  - If the detector is mounted vertically (Fig. 16, right), the connection housing must be oriented upwards so that the connections are at the upper end of the water cooling system.

▶ The water cooling system is now properly installed.

8.2 Collimator



1 Collimator with side irradiation
2 Collimator with frontal irradiation

Fig. 18 Collimators

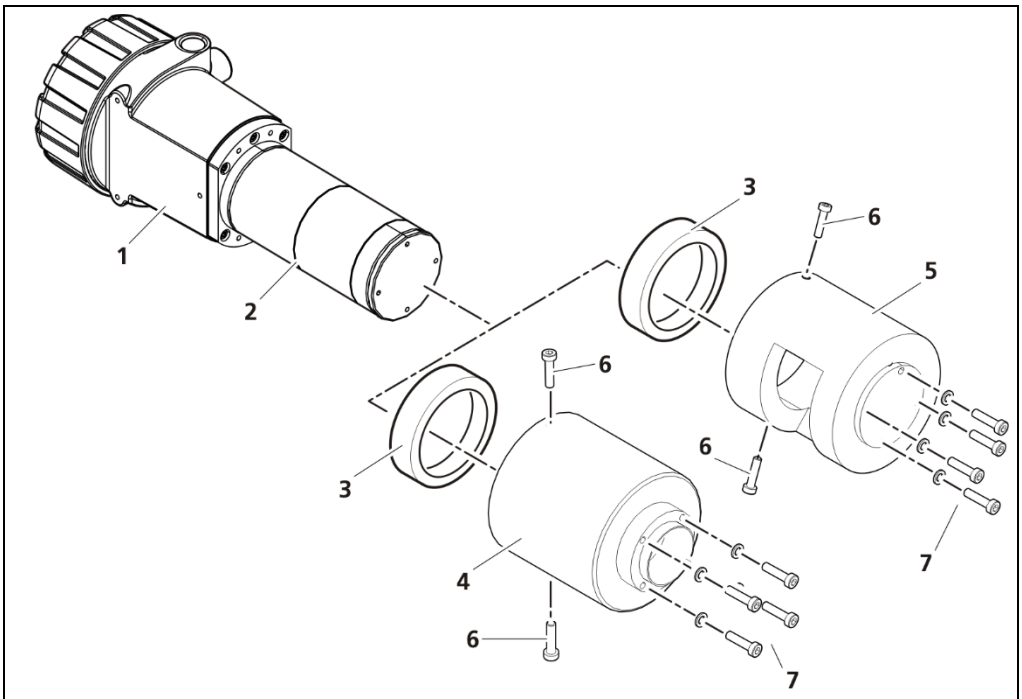
The optional lead collimator available for the point detector protects against disturbing background radiation and ensures higher reliability and measurement accuracy. It is available with a radial radiation window (lateral irradiation) or an axial radiation window (frontal irradiation).

The dimensions of the collimators can be found in the document Technical information chapter 4.

NOTICE

For the collimator with frontal irradiation and when the detector is mounted vertically, the collimator must be oriented upwards. If the collimator is oriented downwards, there is a risk of it filling with water, which could distort the measurement values.

8.2.1 Mounting the collimator without water cooling



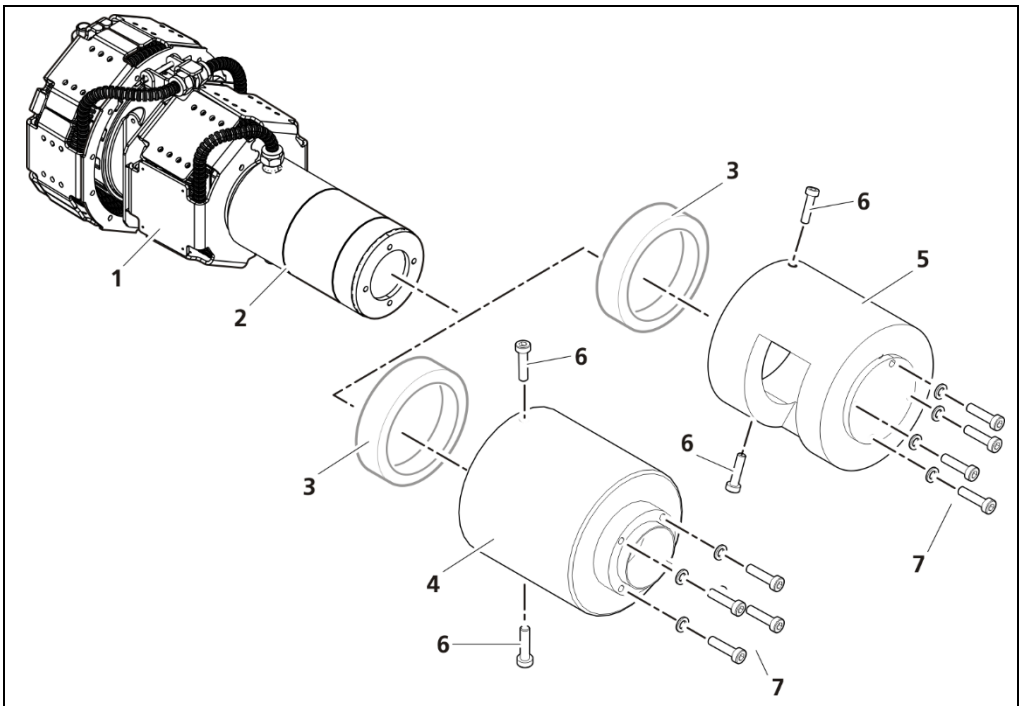
1 Point detector without water cooling
2 Marking groove
3 Spacer ring
4 Collimator with frontal irradiation
5 Collimator with side irradiation
6 Side screws
7 Frontal screws

Fig. 19 Mounting collimators without water cooling

The spacer ring must be inserted and screwed on the sides. The collimator is attached to the detector using the frontal screws.

Slide the collimator over the detector housing so that the radiation window is aligned with the emitter. Ensure that the collimator is positioned according to the bolt circle of the detector.

8.2.2 Montage Kollimator mit Wasserkühlung



1 Point detector with water cooling
2 Marking groove
3 Spacer ring
4 Collimator with frontal irradiation
5 Collimator with side irradiation
6 Side screws
7 Frontal screws

Fig. 20 Mounting collimators with water cooling

1. If necessary, remove the spacer ring from the collimator by loosening the side screws. The spacer ring is no longer required.
2. To attach the collimator to the cooling jacket, longer screws should be used, increasing the size from 3 mm to 5 mm.
3. Slide the collimator over the water cooling system so that the radiation window is aligned with the emitter. Position the collimator and the water cooling system according to the bolt circle of the detector. Make sure that the position of the connection nozzles is arranged in such a way that you will have unobstructed access for mounting the water supply later.

9 Decommissioning

⚠ DANGER

Danger to life from electric shock!

- The decommissioning may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Only open the device when free of voltage.

In case of an electric shock, carry out first aid measures and immediately call an emergency service.

⚠ WARNING




Danger of injury by falling loads!

- Never stand underneath a lifted or suspended load, keep at a safe distance.
- Only use tested sling gear components appropriate for the transport weight.
- Observe the marking for the centre of gravity on the outer packaging, if applicable.
- Wear head protection and safety shoes.

⚠ WARNING

Danger to life by explosion!

- If the detector is located in a potentially explosive atmosphere, it is essential to observe the corresponding instructions and safety instructions in the Safety Manual / Explosion Protection Manual (1.1 Applicable Documents).

⚠ CAUTION

Danger of injury caused by heavy and bulky system components!

- Heavy and bulky system components should only be handled using aids and by at least 2 persons.
- Observe the guidelines for safe handling of heavy loads.
- Ensure stability and use the provided fixing possibilities.

Follow this sequence for decommissioning:

1. Remove all cables from the detector.
2. Remove the detector with/without water cooling system out of its holder.
3. Remove the detector from the water cooling system if necessary.

9.1 Disposal

⚠ CAUTION

Toxic!

The product contains electronic components containing toxic substances that are harmful to health.

- The device is to be disposed of according to applicable legal regulations by a specialised waste management company.

If the product has been used, you can dispose of it through a waste management company in accordance with the statutory provisions.

Modifications due to technical advancement reserved.

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