Detectors

**DUO SERIES LB 4700**

Operating Manual
56926BA2
Rev. No.: 03, 02/2021
Embedded Software as of vers. 12.00.00
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1 General Information

1.1 Applicable Documents

This manual contains the following documents:

- Safety Manual / Explosion Protection Manual, Id. No. 56926BA26
- Informations sur la sécurité, Id. No. 56925BA59
- Technical Information, Id. No. 56926TI

Additional documents are available for the InlineSENS Measuring Path that are not included in these operating manual:

- Operating Manual Id. No. 56926-5BA2
- Technical Information, Id. No. 56926-5TI

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 and safety manual / explosion protection manual.

1.3 Approvals and certificates

For approvals and certificates, please refer to the safety manual / explosion protection manual.

1.4 Symbols Used on the Device

Observe the operating manual

Please observe the instructions in this operating manual.

Electrostatic discharge

Please note the handling instructions. Electrostatically endangered components. Please observe the instructions in this operating manual.
Protective earth connection
At this position, connect the protective earth conductor (PE).

Equipotential bonding connection
At this position, connect the equipotential bonding conductor.

No domestic waste
The electric product must not be disposed of in domestic waste.
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
- perform measurements
- apply software settings
- install accessories
- carry out maintenance on the product
- fix errors
- 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 TECHNOLOGIES GmbH & Co. KG.

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

This operating manual contains copyright-protected information. None of the chapters may be copied or reproduced in any other form without prior authorisation from the manufacturer.
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

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quotation mark</td>
<td>Field in the software interface</td>
<td>&quot;Calibrating&quot;</td>
</tr>
<tr>
<td>Vertical line</td>
<td>Path specification</td>
<td>Settings</td>
</tr>
<tr>
<td>Pointed brackets</td>
<td>Keys and buttons</td>
<td>&lt;Update&gt;</td>
</tr>
<tr>
<td>Round brackets</td>
<td>Image reference</td>
<td>Connect the plug (Fig. 1, item 1)</td>
</tr>
</tbody>
</table>

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**
1 General Information

- 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.

2.1 Dangers and safety measures

- Read these instructions and all applicable documents thoroughly and completely before working with the product.
- Store the instructions where they are accessible for all users at all times.

2.2 Proper Use

The detectors are used along with an appropriate evaluation unit of BERTHOLD TECHNOLOGIES GmbH & Co. KG and an appropriate radiation source to measure the radiation intensity as part of a radiometric measurement.

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,
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 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.

1 blanking elements acc. to IEC 60079
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

The operator of the product must regularly train his personnel in the following topics:

- Observation and use of the operating manual and the legal provisions.
- Intended operation of the product.
- Observation of the plant security instructions and the operating instructions of the operator.
- Regular monitoring/maintenance of the product.
3 System Description

3.1 Measuring Principle

The detectors of the DuoSeries are used in industrial measuring systems for measuring the level, density or mass flow in different installation situations. In addition to the detectors of DuoSeries, additional system components such as transmitters, radioactive sources and shieldings are required for a complete measuring system. Usage of these system components is not subject of this operating manual. Please refer to the individual manuals of the respective system components.

The detectors of the DuoSeries supply measurement signals for further processing and visualisation of LB 47x or LB 44x transmitters. Each detector is connected to either an LB 47x/44x transmitter or a 47x slave module.

![Exemplary measuring arrangement](image)

Fig. 1 Exemplary measuring arrangement

1  Point source shield
2  Mounting socket
3  Radiation beam
4  Rod detector
5  Measurement line to master EVU
6  Master EVU
7  Product
3.2 Storage

Keep devices in a dry (no condensation), dark (no direct sunlight), clean and lockable room. Stay within the temperature range for storage.
3.3 System Components

3.3.1 Overview XP variant (Class/Division)

The detectors XP variant (Class/Division) consist of the following components.

Fig. 2 View of the DuoSeries detectors XP variant (Class / Division)

1 Screw lid
2 Sealing
3 Base unit with detector electronics
4 Photomultiplier holder
5 Photomultiplier
6 Scintillator
7 Stainless steel housing (housing tube)

Not visible on the view are the optional water cooling system and collimator.
3.3.2 Overview ATEX/IECEEx variant

The detectors consist of the following components.

![Diagram of detector components](image)

1. Screws cover
2. Spring washers
3. Cover
4. Sealing
5. Socket unit with detector electronics
6. Photomultiplier holder
7. Photomultiplier
8. Scintillator
9. Stainless steel housing (housing tube)

Fig. 3 View of DuoSeries detectors (ATEX / IECEx variant)

Not visible on the view are the optional water cooling system and collimator.
3.3.3 **Rod and point detector**

Fig. 4  View of the DuoSeries detectors

3.3.4 **Scintillator**

The DuoSeries detectors differ in their external dimensions and the scintillators used. Point detectors are equipped either with a 50/50, 40/35 or 25/25 (diameter x length) NaI scintillator or a 50/60 polymer scintillator. Polymer scintillators are used in the rod detectors (models are available with the sensitive lengths of 500 mm, 750 mm, 1000 mm, 1250 mm, 1500 mm and 2000 mm). The size of the scintillator determines the size of the sensitive area (the area that is used for the measurement). Marking grooves (Fig. 3) on the detector housing mark size and position of the sensitive area.
3.3.5 **Software**

The DuoSeries detectors are distributed with software already installed. For the revision level (version) of the software, refer to the submenu of the evaluation unit software (Device settings | Setup | Sensors | [NAME DETECTOR] | Detector Service | Device information) or the PC software (see chap. 6.4.2).

The software as of version 12.00.00 is described in this operating manual. A software update is performed with the detector service modem (see chap. 8.2).

### Change Log

<table>
<thead>
<tr>
<th>Software Version LB 4700</th>
<th>Release Date</th>
<th>Display in LB 47xx-Systems</th>
<th>Significant changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.06.09</td>
<td>12/2015</td>
<td>1.13</td>
<td>• Error message on LB 44x eliminated after restart</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Faults are reported to LB 44x with 1V HV</td>
</tr>
<tr>
<td>12.06.10</td>
<td>02/2016</td>
<td>1.14</td>
<td>RID possible with LB 44x</td>
</tr>
<tr>
<td>12.06.11</td>
<td>03/2017</td>
<td>1.15</td>
<td>HV error is now detected on LB 471</td>
</tr>
</tbody>
</table>

3.3.6 **Accessories and Options**

For accessories and options for the DuoSeries detectors, see chapter 9 in these instructions.
4 Installation

4.1 Safety Instructions

⚠️ 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.

⚠️ 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 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.
4.3 General Instructions

**NOTICE**

The detectors of the DuoSeries contain a photomultiplier with glass enclosure and possibly a fragile scintillation crystal. Proceed carefully with the detectors in order to prevent breakage or chipping of the photomultiplier or scintillator.

- During installation, also observe the instructions in the safety manual / explosion protection manual.

**NOTICE**

- Only clamping devices approved by Berthold should be used to install the device.
- The device may only be operated if permanently installed.
- For open-air installation, a weather protection cover that provides protection against direct sunlight and associated heat should also be installed over the detector.

4.4 Installation of Mounting Clamps

Mounting clamps are used to fasten the detectors. These clamps are installed on a mounting base, cross beams or similar which are to be provided by the operator. A robust stainless steel holder is optionally available for detectors with and without water cooling system (Fig. 6). For more details, please refer to document technical information.

These mounting clamps are suitable for point and rod detectors.

**IMPORTANT**

At least two mounting clamps must be used for each detector. The two clamps have to be mounted as far apart as possible (observe the installation situation). Neither of the two clamps may be mounted in the sensitive area of the detector (indicated by marking grooves on the housing).
Mounting Clamps Type 1

1. Unscrew the screw on top of the mounting clamp.
2. Slide the clamp from the bottom over the detector housing.
3. Tighten the screw sufficiently so that the mounting clamp cannot slip on the detector.

Mounting Clamps Type 2 and Detector Holder

1. Unscrew the two screws on the side of the mounting clamp.
2. Take off the top part of the mounting clamp.
3. If necessary, remove the spacer ring 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.
4.5 **Installation on a Pipeline**

There are clamping devices for different pipe diameters and irradiation angles for installing a detector on a pipeline. Some examples are shown in Fig. 7. For the detailed description of the clamping devices and the associated dimension drawings, refer to the operating manual of the corresponding transmitter.

The various types of clamping devices already include mounting clamps. To mount the detector, please follow the instructions in chapter 4.3.

---

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. 7   Overview - Pipeline Installation
4.6 Installation on a Vessel

For mounting the detector on the vessel, the mounting clamps must first be mounted on the detector (see chap. 4.3). Examples are shown in Fig. 8, Fig. 9 and Fig. 10. 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 Appendix) 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.

---

**Fig. 8 Fastening of Rod Detector**

1. Point source with shielding
2. Radiation beam
3. Upper mounting clamp
4. Marking groove on the detector
5. Level
6. Rod detector
7. Lower mounting clamp
Fig. 9  Fastening of Point Detector

Fig. 10  Mounting of Point Detector
4.7 Installation on a Conveyor Belt

Various measuring frames are available for the installation of detectors on conveyor belts. Some examples are shown in Fig. 11. For the detailed description of the measuring frame and the associated dimension drawings, refer to the operating manual of the corresponding transmitter.

The measuring frames already have mounting clamps. To mount the detector, please follow the instructions from 4.3.

1 Measuring frame for one point detector
2 Measuring frame for two point detectors
3 Measuring frame for one rod detector
4 Measuring frame for two rod detectors

Fig. 11 Overview Mounting on Conveyor Belt
5 Electric Installation

5.1 Initial Start-up

**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. Make sure that the detector was mounted as described in chapter 4.
2. Loosen the screws on the cover and open the cover.
3. Connect the cable which connects the detector to the evaluation unit to terminals 1 and 2 in the terminal compartment. Also observe the operating manual for the evaluation unit LB 47X. The screws for fixing the conductors must be tightened with a torque of 1.2 Nm at the stud-type bushings.
4. Optional: Connect the connection cable of a Pt100 resistance thermometer (for measuring the medium temperature) to terminals 3 and 4 in the terminal compartment with a torque of 1.2 Nm.
5. If a shielded cable is used, connect the shield on terminal 5 on the terminal compartment. Make sure that the shield is sufficiently isolated from contact with other current-carrying conductors.
6. Connect the detector to a local equipotential bonding.
7. Attach the O-ring to the groove on the face of the socket.
8. Attach the lid. For all threads fat must be used, OKS 217 is recommended. To ensure the sealing function, the grease must be thickly applied to NPT threads. 
   - The cover screws (cylinder head screws ISO 4762 - M5x16-A2-70) for the ATEX / IECEx variant must be underlaid with self-locking lock washers (NL5 SS from Nordlock®) and tightened with a torque of 4 Nm.
   - The screw cap of the NEC / CEC version must be tightened on the hexagon (spanner size SW 19) with a torque of 15 Nm.
9. Unused entries must be closed with the plugs listed (1/2 "NPT fitting) A tightening torque of 20 Nm is recommended.
   - The electrical installation is complete.
Fig. 12  Terminal compartment XP variant (Class / Division)

1 Signal and supply circuit +
2 Signal and supply circuit -
3 Pt100 +
4 Pt100 -
5 Potential equalization
6 Potential equalization
7 Cable glands
8 Sealing
9 Screw cap

Fig. 13  Terminal compartment ATEX/IECEx variant

1 Signal and supply circuit +
2 Signal and supply circuit -
3 Pt100 +
4 Pt100 -
5 Potential equalization
6 Potential equalization
7 Cable glands
8 Sealing
9 Cover
10 Spring washers
11 Screws cover
5.2 Reuse of Detectors

**NOTICE**
If a detector was previously used, then please observe the following:
Detectors that were used in non-explosive areas may no longer be used in an explosive area.

**NOTICE**
If an intrinsically safe detector was previously used, then please observe the following:
If intrinsically safe signals were connected to non-intrinsically safe circuits, these may no longer be connected to intrinsically safe circuits.
6 Operation

6.1 Operating Concept

For operation, different user interfaces are available

1. Evaluation unit LB 47x
2. Evaluation unit LB 44x
3. PC software (via detector service modem)

The detector internal diagnostic functions and data are not available when operating the detector with the transmitters LB 471 and LB 44x.

The operation and parameterisation is described solely by the example of the PC software. For information on the operation of the detector with the transmitters LB 47x and LB 44x, please refer to the respective operating manual of the transmitters.
6.2 PC Software

The following system requirements have to be met:

<table>
<thead>
<tr>
<th>System requirements</th>
<th>Menu language: English</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Windows XP or higher</td>
</tr>
<tr>
<td></td>
<td>512 MB RAM</td>
</tr>
<tr>
<td></td>
<td>1 gigahertz processor</td>
</tr>
<tr>
<td></td>
<td>USB port</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connections</th>
<th>USB port</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-pin FSK interface to the detector</td>
</tr>
</tbody>
</table>

Fig. 14 Detector Service Modem

**NOTICE**
If the detector service modem is used on intrinsically safe detectors, the detector service modem with intrinsically safe FSK interface must be used.

1. Install the driver by running the driver file "BertholdRS485.exe" before connecting the detector service modem.

2. Execute the installation file "Setup.exe" in order to install the operating software "LB 4700 PC".
   - Access to the detector is possible with the operating software "LB 4700 PC".

3. Connect the detector to the 2-pin FSK connector of the detector service modem (Fig. 14 item 4).

4. Connect the detector service modem via the supplied USB cable (Fig. 14 item 3) to an available USB port on your PC.

5. Connect the detector service modem via the supplied power adapter to the
power supply.

6. Start the program "LB-4700 PC PC-Software.exe".
   - The program opens.

7. Click on the tab <USB> (Fig. 15, item 1).

8. In the selection menu (Fig. 15, item 2), select a baud rate of **1200**.

9. Click on <Connect> (Fig. 15, item 3).
   - Die Startseite des Programms LB-4700 PC öffnet sich.

---

**Fig. 15**  Connection Window, Operating Software "LB-4700 PC"

1  USB tab
2  Selection of baud rate
3  Connect button
10. In order to return to the start screen from another menu, click on the tab <Monitor>.
6.3 Operating the PC Software

The following figures show the structural design of the PC software screen and the control options.

- Navigator with tree structure
- Input fields, buttons, and selection lists
- Tabs

Fig. 17 User Interface of the PC Software

1. Navigate in the navigator with a double click on the corresponding submenu (Fig. 17, item 1).
2. Once opened submenus remain open and can be viewed by clicking on the appropriate tab. (Fig. 17, item 2).
3. Open selection lists by clicking on the arrow button on the right side of the list field (Fig. 17, item 3).
4. Click in the input field to enter the desired values (Fig. 17, item 4). A red outline indicates the clicked box.
6.4 The PC Software Menu

The schematic structure of the detector menu of the PC software is displayed in Fig. 18.

- The Process menu gives you an overview of the most important measurement data and the system status. In addition, you can also adjust the detector’s internal date and time.

- In the Device Setup menu, you can read and set all system and measurement parameters, as well as perform the plateau recording.

- The Diagnostics menu provides information about the event history and data log.

![System Menu, LB-4700 PC PC-Software](image)

Fig. 18 System Menu, LB-4700 PC PC-Software
6.4.1 Monitor

The most important measurement data and the system status (work mode) are displayed in an overview in this submenu. In addition, you can set the date and time. Date and time are used to date events and log data.

![Monitor Submenu]

1. Work Mode Display (System Status)
2. Meas. Display Ch [cps] (count rate in the measuring channel)
3. Actual HV Display (current high voltage)
4. Date and Time Setting
5. Temperature Display
6. Pt 100 [°C] Display
7. Date and Time Display

Fig. 19 Process | Monitor
Set Date and Time

Fig. 20 Window to Set the Date/Time

1. Click on the button <Set ...>. (Fig. 19, item 4), to make changes to the date and time.
   ▶ A window opens.

2. Make the changes.

3. Confirm with <OK>.
6.4.2 Identification

This submenu shows you an overview of the software version of the detector and the PC program as well as the device ID.

Open the Identification submenu in the menu group Device Setup of the navigator by double-clicking on <Identification> (Fig. 21).

Fig. 21  Device Setup | Identification
6.4.3 Reset

In this submenu, you can restart the detector or reset it to the factory settings.

- Open the Reset submenu in the menu group Device Setup of the navigator by double-clicking on <Reset>.

![Device Setup | Reset](image)

1. **Button <Software Reset>** performs a restart of the detector.
2. **Button <Factory-Reset>** resets the detector to the factory settings and performs a restart.

Fig. 22 Device Setup | Reset
Perform Reset and Factory Reset

**NOTICE**

During the restart, the detector is not ready for measurement!
All settings made, such as plateau recordings and event logs, are lost when the
detector is reset to factory settings.

![Warning message]

**Fig. 23** Warning message

1. Click on the desired Reset Button in the Reset submenu of the menu group
   **Device Setup**.
   - A warning message appears.

2. Confirm the warning message by clicking on **<OK>**.
   - During the restart, the PC-program loses the connection to the detector for
     a few seconds. The connection is automatically restored after the restart.
     After restart, the detector is ready to measure again.
6.4.4 **Overview**

Open the submenu Overview in the menu group Device Setup | Sensor of the navigator by double-clicking on <Overview> (Fig. 24). You can select the detector code and set preferences for high voltage control here.

| 1 | Detector code selection |
| 2 | High-voltage mode selection Manual/Auto |
| 3 | Temperature values display |
| 4 | Display count rate in the measuring channel |
| 5 | Display count rate in the control channel |
| 6 | Display count rate in the auxiliary channel |
| 7 | Display count rate in the RID channel |
| 8 | Display current high voltage |
| 9 | Manual high voltage |
| 10 | Default HV (starting value of the high voltage control) |

Fig. 24  Device Setup | Sensor | Overview
Setting the Detector Code

Internal device parameters are adjusted to suit the used scintillator size by setting the detector code. The correct detector code is set at the factory and a change is not normally required. A table with the detector codes to be used is found below:

<table>
<thead>
<tr>
<th>Detector code</th>
<th>Scintillator type and size</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>NaI (50x50 / 40x35 / 25x25)</td>
</tr>
<tr>
<td>2</td>
<td>NaI (44x5) Am-241 (Soft Vers. &gt;=12.06.12)</td>
</tr>
<tr>
<td>3</td>
<td>NaI (44x5) Cm-244, 0 ... 60°C, high stability (Soft Vers. &gt;=12.06.12)</td>
</tr>
<tr>
<td>4</td>
<td>NaI (44x5) Cm-244, -40 ... 60°C (Soft Vers. &gt;=12.06.12)</td>
</tr>
<tr>
<td>6</td>
<td>Polymer (50x60) [valid for LB 44x and LB 47x]</td>
</tr>
<tr>
<td>7</td>
<td>NaI (125x50) K2O/KCL, 0 ... 60°C, high stability (Soft Vers. &gt;=12.06.12)</td>
</tr>
<tr>
<td>8</td>
<td>NaI (50x50 / 40x35 / 25x25) low background (Soft Vers. &gt;=12.06.12)</td>
</tr>
<tr>
<td>9</td>
<td>NaI (125x50) K2O/KCL, -40 ... 60°C (Soft Vers. &gt;=12.06.12)</td>
</tr>
<tr>
<td>52</td>
<td>Polymer (50x60) [valid for LB 47x]</td>
</tr>
<tr>
<td>10</td>
<td>Polymer (1500 and 2000 mm)</td>
</tr>
<tr>
<td>13</td>
<td>Polymer (1000 and 1250 mm)</td>
</tr>
<tr>
<td>22</td>
<td>Polymer (500 and 750 mm)</td>
</tr>
<tr>
<td>23</td>
<td>Polymer (150x150) SuperSENS (Soft Vers. &gt;=12.06.12)</td>
</tr>
</tbody>
</table>

**NOTICE**

An incorrect setting may have a negative impact on the long-term stability of the device or may lead to other forms of malfunction.
Setting the Detector Code (continued)

Click on the arrow button (Fig. 24, item 1) in order to set the desired detector code.

Fig. 25   Device Setup | Sensor | Overview | Detector Code
Setting the High Voltage Control

Click on the selection arrow (Fig. 24, item 2) in order to set the desired HV mode (auto or manual).

**AUTO**
The optimum high-voltage supply of the photomultiplier is automatically determined and set by the device.

**MANUAL**
The high voltage is maintained at a fixed, user-entered value (manual HV, Fig. 24, item 9).

Click in the input field "Default HV" (Fig. 24, item 10) in order to enter the desired starting value for the high voltage control.

![Figure 26](image)

**NOTICE**
Default HV is preset by BERTHOLD. A subsequent change is not usually necessary. The default value HV = 0 may only be set for testing purposes. An incorrect setting may cause malfunction.
6.4.5 Plateau

Open the submenu Plateau in the menu group Device Setup | Sensor of the navigator by double-clicking on <Plateau> (Fig. 27).

Here you can read the saved plateau curve on the detector, set the parameters for plateau recording, and perform the plateau recording by clicking on <Start Plateau>.

The plateau curve is used for diagnostic purposes and must not be recorded during normal operation.

![Plateau Setup](image)

1 Display of the plateau curve
2 Display of the high-voltage values and the corresponding measured values of the count rate.
3 Button Start Plateau
4 Button Plateau Setup

Fig. 27 Device Setup | Sensor | Plateau
Setting the Parameters for the Plateau Recording

Click on <Plateau Setup> (Fig. 27, item4), in order to set the parameters.

![Plateau Setup Dialogue Window](image)

Fig. 28 Settings Dialogue Window for "Plateau Setup"

- **Start HV**  
  Start value of the high voltage for a plateau measurement

- **Stop HV**  
  End value of the high voltage for a plateau measurement

- **Step HV**  
  Step size between two points during plateau measurement

- **Meas. Time**  
  Measurement time for each plateau measurement point
6.4.6 Pt 100

Open the submenu Pt 100 in the menu group Device Setup | Sensor of the navigator by double-clicking on <Pt 100>. (Fig. 29).

The current temperature of the thermometer is displayed for the associated Pt 100 thermometer in this submenu. You can also calibrate the temperature measurement.

Fig. 29 Device Setup | Sensor | Pt 100
Calibrate Pt 100 Temperature Measurement

1. Click on the button <Adjustment> (Fig. 29, item 1) in order to calibrate the Pt 100 temperature measurement.
   ▶ A window opens. The Pt100 wizard guides you through the calibration process.

2. Connect a resistance of 100 ohms at terminals 3 and 4 in the terminal compartment of the detector.

3. Click on <Accept> in order to calibrate the 0 °C point.
   ▶ The product temperature should now be displayed at about 0 °C.
4. Click on <Next> in order to proceed to the next step.

5. Connect a defined resistance (> 100 ohms) to terminals 3 and 4 in the terminal compartment of the detector and enter the corresponding temperature value under "Real Temperature". Alternatively, you can also use a Pt 100 sensor with a known temperature signal. In this case, enter the known Pt 100 temperature.

6. Click on <Accept>.
   - The measured product temperature should now roughly match the entered value.

7. Click on <Next>, in order to proceed to the next step.
8. Click on <Finish> in order to complete the process or, if necessary, end the process with <Cancel> in order to cancel the calibration.

Fig. 33 Last Step of the Pt100 Wizard
6.4.7 Event Log

Open the submenu Event Log in the menu group Device Setup | Diagnostics of the navigator by double-clicking on <Event Log> (Fig. 34). The submenu "Event Log" logs the last 25 events that have occurred with date, time and description.

1. If you want to clear the event list, click <Clear> (Fig. 34, item 3).
2. In order to print the event list, click <Print> (Fig. 34, item 4).
   - This will open the "Print Preview" window.
   - Printing the event list using the dialogue window "Print Preview" generates a PDF.
3. Click <Refresh> (Fig. 34, item 5), in order to load the list of events from the detector.
4. Click <Acknowledge> (Fig. 34, item 6), when an event requires an acknowledgement.
6.4.8 Event Counter

Open the submenu Event Counter in the menu group Device Setup | Diagnostics of the navigator by double-clicking on <Event Counter>. (Fig. 35).

This submenu displays, sorted by groups, for each event, the counter of how often the event occurred, and the time stamp of the last five events.

Fig. 35  Diagnostics | Event Counter

1. If you want to clear the event list, click <Clear> (Fig. 35, item 2).
2. In order to print the event list, click <Print> (Fig. 35, item 3).
   ▶ This will open the "Print Preview" window. Printing the event list via the "Print Preview" generates a PDF.
3. Click <Refresh> (Fig. 35, item 4) in order to load the list of events from the detector.
6.4.9  Data Log

Open the submenu Data Log in the menu group Device Setup | Diagnostics of the navigator by double-clicking on <Data Log> (Fig. 36). The current count rate and high voltage of the detector are shown graphically in this.

In addition, you can output the recorded chart values as a text file (.txt) and save on the connected PC.

![Graphical representation of the count rate and high voltage curve](image)

| 1 | Graphical representation of the count rate and high voltage curve |
| 2 | Display and control panel “Recording” |
| 3 | Buttons to start recording and stop recording |
| 4 | Select output directory (output location of the log file) |
| 5 | Display actual file (name of the current log file) |
| 6 | Display recording started (date/time for the start of recording) |
| 7 | Display Free Space (free hard disk space on the connected PC) |
| 8 | Selection keys Sample Rate (log interval of the data logs) |

Fig. 36  Diagnostics | Data Log

1. To zoom, hold down the left mouse button in the chart box and highlight the area to be zoomed.
2. Right-click in the chart box to open a window with the following settings:
   - Copy: Copies the current chart view to the clipboard of PC
   - Save Image as: Saves the current chart view on the PC
   - Page Setup: Page settings for printing function.
   - Print: Prints the current chart view.
o Show Point Values: Enables/disables the display of measurement points on the chart when they are highlighted with the cursor.

o Un-Zoom: Undoes the last zoom operation.

o Undo all Zoom/Pan: Sets the zoom back to the start value.

o Set Scale to Default: Adjusts the axis scaling to the fluctuation of the measured values.

3. In order to start the recording of log data on the PC, click on Recording | <Record-Start> (Fig. 36, item 4).

4. In order to stop the recording, click on <Record-Stop> (Fig. 36, item 3).

5. Click on the selection arrows or click in the field <Sample Rate> (Fig. 36, item 8) in order to select or enter the log interval.
7 Troubleshooting

7.1 System Events

A list of all possible device event messages with troubleshooting options is provided below. Event messages are automatically hidden if the cause of the event is no longer present. Exceptions are marked in the list. In this case, the event, as described in chapter 6.4.7, must be manually acknowledged.

System events can lead to the following system statuses:
- Shutdown
- Failure
- Out of Specification
- Function Check

**Shutdown (Namur107: F)**

A critical error has occurred. The detector will shut down to prevent damage. The measurement is stopped.

**Failure (Namur107: F)**

A serious error has occurred and the accuracy of the measurement results is not ensured. The measurement is continued.

If the detector is operated with an LB 44x/LB 471 transmitter, then the count rate is set to 0 by the system status "Failure" in order to signal the system status. In this case, the measurement is interrupted.

**Out of Specification (Namur107: S)**

The detector, one of its components or the environmental conditions are not within the normal specifications. The measurement is continued.

**Function Check (Namur107: C)**

Indicates that entries are made at the detector or a function check/simulation is being performed.
<table>
<thead>
<tr>
<th>Code</th>
<th>Text</th>
<th>Description</th>
<th>Namur107</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D101</td>
<td>HW module corrupted</td>
<td>Corrupt hardware electronics module</td>
<td>F</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td>D102</td>
<td>Device data-set</td>
<td>Permanent memory error, no parameter set was found</td>
<td>F</td>
<td>Perform a factory reset and/or restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td>D103</td>
<td>RAM error</td>
<td>Error in RAM</td>
<td>F</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td>D104</td>
<td>Device error</td>
<td>System error</td>
<td>F</td>
<td>If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td>D105</td>
<td>RTC date/time</td>
<td>Error in the real-time clock.</td>
<td>F</td>
<td>Reset the date and time. Restart the device. The event must be confirmed manually.</td>
</tr>
<tr>
<td>D106</td>
<td>WD Reset</td>
<td>The watchdog has triggered a restart of the device</td>
<td>S</td>
<td>If the event occurs frequently, contact Berthold. Verify whether massive electromagnetic disturbances have triggered the event.</td>
</tr>
<tr>
<td><strong>Main Board</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D200</td>
<td>Data flow</td>
<td>Error during execution of the software</td>
<td>F</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td>D201</td>
<td>Supply 5.0V</td>
<td>Hardware error</td>
<td>F</td>
<td>Contact Berthold. The hardware is defective and, if necessary, must be checked and replaced.</td>
</tr>
<tr>
<td>D202</td>
<td>Supply -5.0V</td>
<td>Hardware error</td>
<td>F</td>
<td>Contact Berthold. The hardware is defective and, if necessary, must be checked and replaced.</td>
</tr>
<tr>
<td>D203</td>
<td>Pt100 Temperature</td>
<td>Error when reading the Pt100 input. The last valid temperature value is kept.</td>
<td>F</td>
<td>Restart the device. If the event occurs frequently, contact Berthold. The event must be confirmed manually.</td>
</tr>
<tr>
<td><strong>Detector</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D300</td>
<td>Data flow</td>
<td>Error during execution of the software</td>
<td>F</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td>D301</td>
<td>ADC calibration</td>
<td>Hardware error</td>
<td>S</td>
<td>Restart the device. If the event occurs frequently, contact Berthold. The event must be confirmed manually.</td>
</tr>
<tr>
<td>Code</td>
<td>Text</td>
<td>Description</td>
<td>Name107</td>
<td>Correction</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------</td>
<td>------------------------------------</td>
<td>---------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>D302</td>
<td>DAC calibration</td>
<td>Hardware error</td>
<td>S</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The event must be confirmed manually.</td>
</tr>
<tr>
<td>D303</td>
<td>Cps Zero (Meas)</td>
<td>No count rate in the measuring</td>
<td>F</td>
<td>The photomultiplier may be defective. Check the photomultiplier or contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D304</td>
<td>Cps Zero (Ctrl)</td>
<td>No count rate in the control</td>
<td>S</td>
<td>The photomultiplier may be defective. Check the photomultiplier or contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D305</td>
<td>Cps Zero (Aux)</td>
<td>No count rate in the auxiliary</td>
<td>S</td>
<td>The photomultiplier may be defective. Check the photomultiplier or contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D306</td>
<td>Cps averaging</td>
<td>The count rate fluctuates more</td>
<td>F</td>
<td>If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>than permissible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D307</td>
<td>Threshold (Meas)</td>
<td>The voltage of the measuring</td>
<td>F</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>channel deviates from the admissible set value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D308</td>
<td>Threshold (Ctrl)</td>
<td>The voltage of the control channel</td>
<td>S</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>deviates from the admissible set</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D309</td>
<td>Threshold (Aux)</td>
<td>The voltage of the auxiliary channel deviates more than allowed from the control value</td>
<td>S</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D310</td>
<td>Threshold (RID)</td>
<td>The voltage of the RID channel</td>
<td>S</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>deviates from the admissible set</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D311</td>
<td>HV voltage - PMT</td>
<td>An error in the high-voltage</td>
<td>F</td>
<td>Check detector electronics and photomultiplier. If necessary, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>supply of the photomultiplier was</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>detected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D312</td>
<td>HV limited</td>
<td>The current high voltage deviates</td>
<td>F</td>
<td>Check detector electronics and photomultiplier. If necessary, contact Berthold.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>from the average high voltage by</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>more than 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Text</td>
<td>Description</td>
<td>NaN</td>
<td>Correction</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----</td>
<td>------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>D313</td>
<td>Lower Avg. HV limit</td>
<td>The average HV is more than 20% lower than the Default-HV.</td>
<td>F</td>
<td>Check Default HV for plausibility and change if necessary. Check detector electronics and photomultiplier. If necessary, contact Berthold.</td>
</tr>
<tr>
<td>D314</td>
<td>Upper Avg. HV limit</td>
<td>The average HV exceeds the Default-HV by more than 40%.</td>
<td>S</td>
<td>Check Default HV for plausibility and change if necessary. Check detector electronics and photomultiplier. If necessary, contact Berthold.</td>
</tr>
<tr>
<td>D315</td>
<td>Temperature sensor</td>
<td>The temperature sensor of the detector is defective.</td>
<td>S</td>
<td>Contact Berthold. The hardware is defective and, if necessary, must be checked and replaced.</td>
</tr>
<tr>
<td>D316</td>
<td>Temperature warning</td>
<td>The internal detector temperature is close to the upper or lower limit of the permissible operating temperature.</td>
<td>S</td>
<td>If the detector is too hot: Install/check water cooling system. If the detector is too cold: Install/check heating.</td>
</tr>
<tr>
<td>D317</td>
<td>Temperature alarm</td>
<td>The internal detector temperature has exceeded the upper limit of the permissible operating temperature or dropped below the lower.</td>
<td>F</td>
<td>Proper function of the device can no longer be guaranteed. It is recommended to have the device checked by Berthold Technologies, even if it still seems to work properly.</td>
</tr>
<tr>
<td>D318</td>
<td>Detector malfunction</td>
<td>An error in the state machine of the detector has occurred</td>
<td>F</td>
<td>Restart the device. If the event occurs frequently, contact Berthold.</td>
</tr>
<tr>
<td>D319</td>
<td>Plateau Recording</td>
<td>Indicates that plateau recording is running.</td>
<td>C</td>
<td>No action is required. The detector returns automatically to measurement mode after plateau recording is finished.</td>
</tr>
<tr>
<td>D320</td>
<td>HV too high</td>
<td>The actual HV has reached the upper HV limit (HV &gt; 1287V, bzw. HV &gt; 1300V - 1%)</td>
<td>F</td>
<td>Contact BERTHOLD. Detector must be checked and replaced if necessary.</td>
</tr>
<tr>
<td>D321</td>
<td>HV too low</td>
<td>The actual HV has reached the lower HV limit (HV &lt; 303V, bzw. HV &lt; 300V + 1%)</td>
<td>F</td>
<td>Contact BERTHOLD. Detector must be checked and replaced if necessary.</td>
</tr>
</tbody>
</table>
8

Maintenance and Repair

8.1 Safety Instructions

**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.

**NOTICE**

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

Maintenance work on the detectors may only be performed by qualified personnel. For detectors that will be used in explosion hazardous areas, repairs should only be performed by the service of Berthold Technologies GmbH & Co. KG. Improper repairs may lead to the loss of explosion protection.

**NOTICE**

Repairs to electronic circuits on the boards of a DuoSeries detector may only be performed by the manufacturer.

The relevant safety regulations should be observed when working on electrical components. Particularly observe the safety instructions in the chapter of 2 this operating manual. Disconnect the detector from the power supply.

**IMPORTANT**

To achieve optimum measuring accuracy, we recommend recalibrating the measuring system after a repair (not after changing the housing).

For devices that are **NOT** used in hazardous areas, the following parts may be replaced at your own risk and loss of any currently existing warranty against Berthold Technologies GmbH & Co. KG:

- the complete electronics system of the detector
- the scintillator
- the multiplier (photomultiplier)
- the multiplier/scintillator combination
- the detector housing

Berthold recommends that detectors are only repaired by the Service of Berthold Technologies GmbH & Co. KG or by persons authorised to do so by Berthold Technologies GmbH & Co. KG.

Only original spare parts from Berthold may be used.
Perform a visual inspection and a test of the terminal compartment after repair, maintenance or servicing. To do this, use the check lists in Safety Manual / Explosion Protection Manual.

8.2 Software Update

The following chapter describes the process of a software update of the device with the Detector Service Modem.

**WARNING**

Danger to life by explosion

- If the detector service modem is to be used on intrinsically safe detectors, the intrinsically safe version of the modem should be used.

**NOTICE**

For software updates, Flash Loader version 2.1.0 or higher is required.

1. Install the drivers by executing the driver file. "BertholdRS485.exe" before connecting the detector service modem.
2. Run the installation file "Setup.exe" to install the service program "FLASH Loader". The software of the detector can be updated with the service program "FLASH Loader".
3. Connect the detector to the 2-pin FSK interface of the "detector service modem" (Fig. 14, item 4).
4. Connect the "detector service modem" via the supplied USB cable (Fig. 14, item 2) to an available USB port on your PC.
5. Connect the detector service modem via the supplied AC adapter to the power supply (Fig. 14, item 1).
6. Start the program "FlashLoader.exe"
7. Click on the tab <USB> (Fig. 37, item 1).
8. Select a baud rate of 1200 in the selection menu (Fig. 37, item 2).
9. Click on <Connect> (Fig. 37, item 3).

Fig. 37  Connection Window "Flash Loader"
10. In the menu "Settings", set the value "Timeout" to 1200 and the value "Synchronisation" to 3.

11. Click on the button <detect device> (Fig. 39, item1).
   - The program establishes a connection to the detector.
12. Click on the button <Enter Flash Mode> (Fig. 40, item 1).

13. Click on the button <Program Flash> (Fig. 41, item 1).
A dialogue window is opened.

14. Select the corresponding file for the software update.
The detector is programmed with the respective software.
**NOTICE**

Make sure that the detector is only programmed with compatible software.

15. Click on the button *<Start Application>* (Fig. 40Fig. 41, item 2) after the programming has ended.

**NOTICE**

Reset the detector to the factory default settings if the first or second digit of the software version has changed. Make a note of the settings before the factory reset and enter them again after the reset is completed.
8.3 Visual Inspection of Scintillator and Photomultiplier

⚠️ DANGER ⚠️

Danger to life from electric shock!

- The installation may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Installation/maintenance may only be carried out if the device has been de-energised.
- 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.

Errors on the scintillator and/or photomultiplier manifest themselves by a too small or too steep plateau (see chapter 6.4.5). Such errors can often already be recognized in a visual inspection. To do so, the scintillator and the photomultiplier must be disassembled.

The scintillator has to be crystal clear on the inside and neither have any cracks nor dull spots. A clear yellow to brown discolouration indicates a thermal overload and requires replacing the scintillator.

The window of the photomultiplier has a deposited film as a photocathode. This layer causes the window to have a slightly brownish or smoked glass colour. If this layer is no longer present or is stained, the cathode is damaged (e.g. through overheating, broken glass or light). In this case, the multiplier has to be replaced.

Fig. 42  Representation of the Scintillator and the Photomultiplier
8.4 Replacing the Entire Detector

To replace the detector, proceed as follows:

1. Document all software parameters of the installed detector
2. Take the old detector out of operation as described in chapter “Decommissioning”.
3. Install the new detector as described in chapter “Installation”.
4. Perform the electrical installation as described in chapter “Electric Installation”.
5. Transfer the software parameters of the old detector to the new one.

**NOTICE**

If the detector has been previously used, please note that detectors that were used in non-hazardous areas must no longer be used in a hazardous area!

Intrinsically safe detectors whose intrinsically safe signals were connected to non-intrinsically safe circuits must not be connected to intrinsically safe circuits.
8.5 Replacing the Electronics Module

⚠️ DANGER

Danger to life from electric shock!
- The installation may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Installation/maintenance may only be carried out if the device has been de-energised.
- 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 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.

NOTICE

The removal and installation of parts of the DuoSeries detector must be performed in clean workshop environment.
8.5.1 Disassembling the Electronics Module

1. Document all software parameters of the installed detector
2. Disconnect the detector from the power supply and de-energise it and any potentially connected peripherals.
3. Loosen the four screws of the housing cover and remove the cover (Fig. 43, item 2).
4. Loosen the six screws that hold the detector housing to the socket.
5. Carefully pull out the electronics module and the scintillator/multiplier combination on the socket.

6. Remove the holder (Fig. 43, item7) with the scintillator/multiplier combination of the electronics by loosening the four Phillips screws on the side of the holder.

7. Pull the scintillator/multiplier combination out of the connection socket.

8. Now, the complete electronics module can be replaced.

8.5.2 Installing the Electronics Module

To assemble the electronics module, proceed in reverse order.

1. Replace the O-ring which seals the housing.

2. Make sure that no humidity or metal chippings are inside the terminal compartment.

3. Carefully insert the electronics module on the socket with the scintillator/multiplier combination forward back into the housing.

4. Fasten the socket again on the detector housing. Tighten the screws alternating and equally on both sides.

5. Check and replace, if necessary, the O-ring that seals the terminal compartment.

6. Carefully close the terminal compartment with the lid. To do this, fit the housing cover onto the housing and tighten the Allen bolts with the specified torque: depending on the model M5 with 4 Nm (standard values).

If you have installed a new electronics module:

- Remove the adhesive label with the Dev. ID and attach the supplied new adhesive label.
- Reconnect the supply voltage to the detector.
- Now set the software parameters based on the list that you noted at the beginning.
8.6 Replacing the Scintillator

⚠️ DANGER

Danger to life from electric shock!
- The installation may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Installation/maintenance may only be carried out if the device has been de-energised.
- 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 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.

8.6.1 Disassembling the Scintillator

The multiplier should not be subject to bright light during the following working steps.

1. Remove the electronics module through the action steps 1 - 7 as described in the chapter 8.5.1.
2. Point detectors: Carefully screw off the scintillator from the photomultiplier.
   Rod detectors: Remove the scintillator carefully from photomultiplier.
3. Clean the optical contact surfaces with a soft cloth from silicon oil residues.

8.6.2 Installing the Scintillator

1. Before assembly, apply a drop pure silicon oil (BERTHOLD ID no. 18844) between the scintillator and the multiplier and slightly distribute it by rubbing to ensure a good optical connection between the two components.
2. Reassemble the scintillator and the multiplier and install the holder by retightening the 4 Phillips screws.
8.7 Replacing the Scintillator/Multiplier Combination

⚠️ DANGER

Danger to life from electric shock!
- The installation may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Installation/maintenance may only be carried out if the device has been de-energised.
- 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 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.

1. Remove the electronics module through the action steps 1 - 7 as described in the chapter 8.5.1.

2. Insert the new crystal/multiplier combination in the socket. Please observe the coding lug.

3. Insert the electronics module again, see chapter 8.5.1.

4. Check the measuring function. Should there be discrepancies, perform a new calibration (see operating instructions of the associated evaluator device).
## Accessories

### Available accessories

<table>
<thead>
<tr>
<th>Part number</th>
<th>Accessory part</th>
</tr>
</thead>
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<tr>
<td>61087</td>
<td>Water cooling system for point detectors</td>
</tr>
<tr>
<td>61231</td>
<td>Water cooling system for rod detector 500 mm</td>
</tr>
<tr>
<td>61235</td>
<td>Water cooling system for rod detector 1000 mm</td>
</tr>
<tr>
<td>61238</td>
<td>Water cooling system for rod detector 1500 mm</td>
</tr>
<tr>
<td>61241</td>
<td>Water cooling system for rod detector 2000 mm</td>
</tr>
<tr>
<td>11814</td>
<td>Collimator with frontal irradiation</td>
</tr>
<tr>
<td>04506</td>
<td>Collimator with side irradiation</td>
</tr>
<tr>
<td>61624</td>
<td>Cable gland set for extended temperature range</td>
</tr>
<tr>
<td>31346</td>
<td>Set of mounting clamps for detectors without water cooling system</td>
</tr>
<tr>
<td>31347</td>
<td>Set of mounting clamps for detectors with water cooling system</td>
</tr>
<tr>
<td>39246</td>
<td>Holder for point detectors without water cooling system</td>
</tr>
<tr>
<td>39247</td>
<td>Holder for point detectors with water cooling system</td>
</tr>
<tr>
<td>32024</td>
<td>Signal cable</td>
</tr>
<tr>
<td>46413</td>
<td>Signal cable for intrinsically safe detectors</td>
</tr>
</tbody>
</table>

**IMPORTANT**

If you have any questions regarding accessories or spare parts, please contact the service department of Berthold:

BERTHOLD SERVICE, Calmbacher Str.22, 75323 Bad Wildbad, www.berthold.com, Tel.: +49 7081-177-0, Fax: +49 7081-177-100, industry@berthold.com.
9.1 **Water Cooling System**

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 +60 °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 a maximum ambient temperature of 100 °C.

For the minimum cooling water requirement, please refer to the document technical information.

**NOTICE**

When operating in areas with danger of explosion, observe the specific ambient temperature limits, which are specified in the safety manual and in the document technical information.

---

**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**

If there is a risk that the maximum operating temperature is exceeded, the cooling water circuit must remain in operation even if the detector is switched off.

---

**NOTICE**

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.

---

1 Marking grooves on the water cooling system of the rod detector
2 Water supply
3 Water discharge
4 Marking grooves on the water cooling system of the point detector

Fig. 44  Water Cooling System Point Detector/Rod Detector
9.1.1 Installation and Connection of the Water Cooling System

If the detector is equipped with a water cooling system, the cooling water nozzles must be aligned so that the water supply lines can be connected freely. Make sure that the water lines do not run in front of the radiation window. So that no air pockets form in the cooling water, the detectors must be mounted as follows:

![Diagram of Point Detector with Water Cooling System]

1. Slide the water cooling system (Fig. 45, item 6) with the connection nozzles pointing forward towards the terminal compartment.
2. Attach the water cooling system with the provided screws at the pipe of the detector.

If the detector is mounted horizontally, the bottom connector (Fig. 45, item 5) must be used as a water supply.

If the detector is mounted vertically, the terminal compartment must be oriented upward, so that the connections are located at the upper end of the water cooling system.
Fig. 46  Rod Detector with Water Cooling System

1. Slide the water cooling system (Fig. 46, item 5) with the connecting flange (Fig. 46, item 6) in the direction of the connection chamber

2. Fasten the water cooling system on the detector socket with the enclosed screws.

Depending on the detector assembly, (horizontally or vertically, terminal compartment on top or at the bottom) the respective lower cooling water connection should be used as a feed, so that no air pockets form in the cooling water.
9.2 **Conversion Kit for Extended Temperature Range**

If DuoSeries detectors are operated in the extended temperature range of -40°C to +100°C (with additional water cooling), a conversion kit is required per detector. The conversion kit includes metal cable glands, which are certified for operation in the extended temperature range.

**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, and in the technical information.
9.3 Collimator

The optional lead collimator for the point detector protects against interfering background radiation and ensures higher reliability and accuracy. The collimator is available with a radial (irradiation from the side) or axial (irradiation from the front) radiation window.
9.3.1 Collimator Assembly with Water Cooling System

**NOTICE**

For collimators with frontal irradiation and perpendicular detector mounting, the collimator must be aligned upwards. If the collimator is aligned downwards, there is a risk of incorrect readings due accumulation of water.

---

**Fig. 48 Assembly Collimator with Water Cooling**

1. Remove the spacer ring from the collimator by unscrewing the screws on the side.
2. For fixing collimator with water cooling must be used longer screws. 3 mm -> 5 mm.
3. Slide the collimator over the water cooling system so that the radiation window is positioned in the direction of the source. To do so, position the collimator and the cooling water system so that the pattern of their fastening holes matches the one of the detector. Make sure that the position of the connection nozzles does not obstruct later installation of the water supply.
9.3.2 Collimator Assembly without Water Cooling System

Slide the collimator over the detector housing so that the radiation window is positioned in the direction of the source. To do so, position the collimator so that the pattern of its fastening holes matches the one of the detector.

![Collimator Diagram](image)

1. Detector
2. Marking groove
3. Collimator

Fig. 49 Assembly Collimator without Water Cooling
10 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.

⚠️ 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.
10.1 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.
Unité d'évaluation

*Duo* SERIES
LB 47x

Détecteurs

*Duo* XPERT
LB 4700

Informations sur la sécurité
56925BA59

Rev. No.: 04, 09/2019
1 A propos de ce manuel d’utilisation

1.8 Avertissement

Les avertissements sont identifiés comme suit :

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<thead>
<tr>
<th>Symbole</th>
<th>Signification</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Attention</td>
</tr>
</tbody>
</table>

- Symbole : (triangle d’alerte) attire l’attention sur le risque.
- Signalement : Indique la sévérité du danger.
- Source : Précise le type ou la source de danger.
- Conséquence : Décrit les conséquences d’un non respect.
- Prévention : Précise comment le risque peut être écarté.
- En cas de danger : Précise quelles actions sont requises en cas d’occurrence du risque.

1.8.1 Symboles employés dans le manuel d’utilisation

Dans ce manuel, les avertissements indiqués avant les instructions d’utilisation se réfèrent aux risques de blessures ou de dégâts matériels. Les mesures de prévention de danger décrites doivent être respectées.

**DANGER**

*Indique un danger majeur imminent, qui entraînera certainement des blessures sérieuses ou la mort s’il n’est pas évité.*

**AVERTISSEMENT**

*Indique un danger potentiel qui peut entraîner des blessures sérieuses ou la mort s’il n’est pas évité.*

**PRUDENCE**

*Se réfère à une situation potentiellement dangereuse qui peut entraîner des blessures physiques mineures ou graves, ou des dégâts matériels si elle n’est pas évitée.*
Informations sur la sécurité

1.8.2 Symboles utilisés sur l’appareil

Lire le manuel d’utilisation

Veuillez suivre les instructions dans ce manuel d’utilisation.

Décharge électrostatique

Veuillez noter les instructions de manipulation. Composants sensibles aux décharges électrostatiques. Veuillez suivre les instructions de ce manuel d’utilisation.

Connexion de mise à la terre

Raccorder le conducteur de mise à la terre à cet endroit.

Raccordement equipotentiel

Raccorder le conducteur d’équipotentialité à cet endroit

Tension continue

L’appareil fonctionne en tension continue et ne doit être raccordé qu’à une source de tension continue.

Tension alternative

L’appareil fonctionne en tension alternative et ne doit être raccordé qu’à une source de tension alternative.

Déchet non domestique

Cet appareil électrique ne doit pas être éliminé avec les déchets domestiques.
1.9 Conformité

La société Berthold déclare par la présente, sous son entière responsabilité, que la conception de ce produit mis sur le marché par Berthold est conforme aux directives EU indiquées dans la déclaration de conformité originale.

Cette disposition devient nulle en cas de modifications non autorisées par Berthold ou dans le cas d'une utilisation impropre.

Pour la déclaration de conformité originale, se «Technical information».
2 Sécurité

2.1 Dangers et mesures de sécurité

- Lire ces instructions entièrement et avec attention avant d’utiliser l’appareil.
- Stocker ces instructions dans un endroit accessible à tous les utilisateurs en permanence.

2.2 Utilisation appropriée

Ce qui suit constitue une utilisation appropriée :

- Se conformer strictement aux instructions et séquences d’utilisation mentionnées. Ne pas procéder à des pratiques différentes non autorisées qui pourraient engager votre sécurité et la fiabilité fonctionnelle de l’EVU !
- Suivre les instructions de sécurité mentionnées !
- Effectuer les opérations de maintenance prescrites ou les faire réaliser pour vous !
- Utiliser uniquement les accessoires et pièces de rechange Berthold.

Utilisation inappropriée à éviter:

- Ne pas suivre les instructions de sécurité et les instructions pour l’utilisation, la maintenance et la mise au déchet indiquées dans le manuel.
- Un non respect quelconque avec le présent manuel d’utilisation pour le produit délivré.
- Appliquer des dispositions et conditions non conformes à celles mentionnées dans les documents techniques, feuilles de spécifications, manuels d’utilisation et instructions de montage, ou tout autre document spécifique du constructeur.
- Utiliser l’appareil si des éléments sont endommagés ou corrodés. Ceci s’applique aussi aux joints et aux câbles.
- Modification ou changement des éléments du système.
- L'appareil ne doit pas être installé en atmosphère explosive et de ce fait, ne peut pas être utilisé dans une telle atmosphère. Il n’est pas antidéflagrant.
- Utilisation...
  - où les éléments sous tension sont accessibles.
  - dans un boîtier mural avec presse-étoupes insuffisamment étanches et/ou non adaptés pour le passage des câbles.
- Utilisation sans les précautions de sécurité recommandées par le constructeur.
- Manœuvre inappropriée ou oubli des équipements de sécurité présents.
Berthold assume la responsabilité de la garantie seulement dans le cadre de ses spécifications publiées.

Si le produit est utilisé dans des conditions autres que celles décrites dans le présent manuel, la sécurité du produit est compromise et la garantie devient nulle.

**RECOMMANDATION**

L'appareil n'est pas conforme à IEC 61508 « Sureté de fonctionnement des systèmes comportant des composants électriques, électroniques ou électroniques programmables »

### 2.3 Qualification du personnel

**RECOMMANDATION**

Le minimum requis pour intervenir sur nos appareils ou pour les utiliser est un personnel avec des connaissances générales complétées par une formation d'un expert ou d'une personne autorisée.

À plusieurs endroits dans ce manuel d'utilisation, il est fait références à des groupes de personnes avec des qualifications particulières et à qui différentes tâches peuvent être confiées pendant l'installation, l'utilisation et la maintenance.

*Les trois groupes de personnes sont :
  - Employés avec des connaissances générales
  - Experts
  - Personnes autorisées

**Employés avec connaissances générales**

**RECOMMANDATION**

Les employés avec des connaissances générales doivent être guidés par un expert pour le moins. Lors de la mise en œuvre de matières radioactives, la personne compétente en radioprotection doit être consultée.


**Experts**

Les experts sont des personnes avec des compétences suffisantes dans le domaine requis, dues à leur formation spécialisée et qui sont familiers avec les lois nationales relatives à la santé et la sécurité, les réglements concernant la prévention des accidents, et les usages techniques applicables.

Le personnel expert doit être capable de déterminer et d’évaluer le résultat de ses tâches et doit être très familier avec le contenu de ce manuel d’utilisation.

**Personnes autorisées**

Les personnes autorisées sont celles désignées pour les tâches correspondantes dans le cadre de dispositions réglementaires, ou celles dûment autorisées par Berthold pour des tâches particulières. Lors de la mise en œuvre de matières radioactives, la personne compétente en radioprotection doit être consultée.
2.4 Les obligations de l'opérateur

L’opérateur de ces appareils doit régulièrement former son personnel sur les sujets suivants :

- Connaissance et utilisation **du manuel d’utilisation et des clauses légales**.
- Utilisation prévue de l’appareil.
- Respect des instructions de sécurité du site et des conditions d’utilisation de l’opérateur.
- Gestion régulière de la maintenance du produit.
Sous réserve de modifications dans le cadre du progrès technique.

LB 4700-...-1B (ATEX / IECEx / NEC / CEC)
LB 4700-...-IB (ATEX / IECEx / NEC / CEC)
LB 4700-...-FA (NEC / CEC)

56926BA26
Rev. No.: 07, 02/2021
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Safety instructions for use in potentially explosive areas. This safety manual is available also in the official languages of the European Community.
EU-Declaration of Conformity  

We hereby declare under our sole responsibility that the design of the following products / systems / units brought into circulation by us comply with the relevant harmonized rules of the EU.

This declaration loses its validity should modifications or unsuitable and improper use take place without our authorization.

Description: detector for radiometrical measurement system in hazardous environments  

Typ: LB 4700-xx-ee-xx-xx-xxx  

<table>
<thead>
<tr>
<th>directive</th>
<th>applied standards</th>
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<td>EN 61326-1 2013</td>
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<tr>
<td>RoHS 2011/65/EG</td>
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<td>ATEX 2014/34/EU</td>
<td>EN 60079-0 2018</td>
</tr>
<tr>
<td>EPS 13 ATEX 1 547 X</td>
<td>EN 60079-1 2014</td>
</tr>
<tr>
<td></td>
<td>EN 60079-7 2015</td>
</tr>
<tr>
<td></td>
<td>EN 60079-11 2012</td>
</tr>
<tr>
<td></td>
<td>EN 60079-31 2014</td>
</tr>
</tbody>
</table>

notified body: 0102 PTB Braunschweig, Germany

This declaration is issued by the manufacturer:

BERTHOLD TECHNOLOGIES GmbH & Co. KG  
Calmbacher Str. 22, D-73323 Bad Wildbad, Germany

released by:

Dr. J. Briggmann  
Head of R&D  
Bad Wildbad, 23rd of May, 2019
2 General Instructions

This safety manual provides operating instructions in accordance with directive 2014/34/EU and explosion protection standards named in the declaration of conformity, the National Electrical Code (NEC: ANSI/NFPA 70) and the Canadian Electrical Code (CEC).

National responsible authorities can claim additional requests.

Observe the safety manual unconditionally to avoid personal injury and property damage and to ensure safe operation.
3 Proper Use

The detectors are used along with an appropriate evaluation unit of Berthold Technologies GmbH & Co. KG and an appropriate radiation source to measure the radiation intensity as part of a radiometric measurement.

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!

3.1 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 plugs1.
- Operation without the safety precautions provided by the manufacturer.
- Manipulation or avoidance of existing safety equipment.

Berthold Technologies GmbH & Co. KG 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.

1 blanking elements acc. to IEC 60079
4 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 manual, reference is made to personnel with certain qualifications who can be entrusted with different tasks during installation, usage 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 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 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 Technologies GmbH & Co. KG for particular tasks. When dealing with radioactive materials, a radiation safety officer must also be consulted.
5 Operator's Obligations

The operator of the product must regularly train his personnel in the following topics:

- Observation and use of the manual and the legal provisions.
- Intended operation of the product.
- Observation of the plant security instructions and the operating instructions of the operator.
6 Safety Instructions

Safety Instructions for Installation and Operation Staff

**NOTICE**

**Assembly, installation, commissioning, operation and maintenance may only be carried out by authorised and properly trained personnel!**

Before assembly/commissioning:

- Read safety manual
- Read operating instructions
- Train assembly and operating personnel sufficiently
- Make sure that the contents of the safety manual and the operating manual are fully understood by the personnel.

If in doubt, please contact the manufacturer.

**NOTICE**

**Repair of explosion-proof components**

Spare parts may only be fitted by the service of Berthold Technologies GmbH & Co. KG or by persons authorised by Berthold. If this is not possible, you must replace the entire detector or send it in for repair to the manufacturer.

Specific Condition of Use: The flamepath joints are not intended to be repaired.

**WARNING**

**Danger to life by explosion!**

- Repair of variants (LB 4700-1x-Ix) with intrinsically safe circuits.
- Substitution of components may impair intrinsic safety.
Explosion protection and temperature limits

| Inspection documents | EPS 13 ATEX 1 547 X  
|                       | IECEx EPS 13.0008X |
| Degree of protection  | IP66 / IP67 according to IEC 60529  
|                       | Type 4X |
| Air pressure          | 80 kPa (0.8 bar) to 110 kPa (1.1 bar)  
|                       | Oxygen content of the air, usually: 21% (Vi/V) |

**WARNING**

Danger to life by explosion!

- Strictly maintain the permissible ambient temperature ($T_a$).
- Make sure that the maximum permissible surface temperature is not exceeded.
- The versions of the InlineSENS LB 4700 5x-1x are not approved for the use of media with explosive substances in the pipe.
- In case of non-intrinsically safe installation and in explosive atmosphere, deenergize and wait 2 minutes!
6.1 Overview of explosion protection concepts

Zones: Not Intrinsically Safe

<table>
<thead>
<tr>
<th>Variants</th>
<th>CrystalSENS: LB 4700-1x-1x</th>
<th>UniSENS: LB 4700-2x-1x</th>
<th>SuperSENS: LB 4700-3x-1x</th>
<th>TowerSENS: LB 4700-4x-1x</th>
<th>InlineSENS: LB 4700-5x-1x</th>
</tr>
</thead>
</table>

Signal Circuits | Not intrinsically Safe

Explosion Protection Concept of the Compartments

- All Compartments: Ex "t" (dust protection)
- Electronics Compartment (Housing): Ex "d" (flameproof enclosure)
- Terminal Compartment: Ex "e" (increased safety)

Ambient Temperature

| Ta min. | -40 °C |

| Temperature class¹) (Ta max.) / max. surface temperature | T1-T5 (Ta ≤ +80 °C) / 85°C | T6 (Ta ≤ +75 °C) / 80 °C | T1-T6 (Ta ≤ +65 °C) / 80 °C |

II 2 G (Zone 1) | Ex db eb IIC T1-T6 Gb |
II 2 D (Zone 21) | Ex tb IIIC T85 °C Db |

NEC

| Temperature class¹) (Ta max.) / max. surface temperature | T1-T6 (Ta ≤ +75 °C) / 80°C | T1-T6 (Ta ≤ +65 °C) / 80 °C |

Class I, Zone 1 | AEx db eb IIC T1-T6 Gb |
Zone 21 |

CEC

| Temperature class¹) (Ta max.) / max. surface temperature | T1-T6 (Ta ≤ +75 °C) / 80°C | T1-T6 (Ta ≤ +65 °C) / 80 °C |

Class I, Zone 1 | Ex db eb IIIC T1-T6 Gb |
Zone 21 | Ex tb IIIC T85 °C Db |

Protection Principle | Ex "d"/*e"/*t" |

¹) Temperature Class: Equipment Temperature Class and Installation Temperature Class

²) Must not be used for highly charge-generating processes in Zone 21 installations.
### Zones: Intrinsic Safety

<table>
<thead>
<tr>
<th>Variants</th>
<th>CrystalSENS: LB 4700-1x-1x</th>
<th>SuperSENS: LB 4700-3x-1x</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UniSENS:LB 4700-2x-1x</td>
<td>TowerSENS: LB 4700-4x-1x</td>
</tr>
<tr>
<td></td>
<td>InlineSENS:LB 4700-5x-1x</td>
<td></td>
</tr>
</tbody>
</table>

**Signal Circuits**  
intrinsically safe

**Explosion Protection Concept of the Compartments**

<table>
<thead>
<tr>
<th></th>
<th>Electronics Compartment (Housing)</th>
<th>Terminal Compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Compartments</td>
<td>Ex &quot;t&quot; (dust protection)</td>
<td>Ex &quot;i&quot; (intrinsic safety)</td>
</tr>
</tbody>
</table>

**Ambient Temperature**

| T_a min. | -40 °C |

<table>
<thead>
<tr>
<th>Temperature class¹) (T_a max.) / max. surface temperature</th>
<th>T1-T5 (T_a &lt;= +80 °C) / 85 °C</th>
<th>T1-T6 (T_a &lt;= +65 °C) / 80 °C</th>
<th>T6 (T_a &lt;= +75 °C) / 80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 2 G (Zone 1)</td>
<td>Ex db [ib] IIIC T1-T6 Gb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II 2 D (Zone 21)</td>
<td>Ex tb [ib] IIIC T85 °C Db</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NEC**

<table>
<thead>
<tr>
<th>Temperature class¹) (T_a max. / max. surface temperature</th>
<th>T1-T6 (T_a &lt;= +75 °C) / 80 °C</th>
<th>T1-T6 (T_a &lt;= +65 °C) / 80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I, Zone 1</td>
<td>AEx db ib IIIC T1-T6 Gb</td>
<td></td>
</tr>
<tr>
<td>Zone 21</td>
<td>AEx tb ib IIIC T85 °C Db</td>
<td></td>
</tr>
</tbody>
</table>

**CEC**

<table>
<thead>
<tr>
<th>Temperature class¹) (T_a max.) / max. surface temperature</th>
<th>T1-T6 (T_a &lt;= +75 °C) / 80 °C</th>
<th>T1-T6 (T_a &lt;= +65 °C) / 80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I, Zone 1</td>
<td>Ex db ib IIIC T1-T6 Gb</td>
<td></td>
</tr>
<tr>
<td>Zone 21</td>
<td>Ex tb ib IIIC T85 °C Db</td>
<td></td>
</tr>
</tbody>
</table>

**Protection Principle**  
Ex "d"*/"i"*/"t"*  

---

¹) Temperature Class: Equipment Temperature Class and Installation Temperature Class  
²) Must not be used for highly charge-generating processes in Zone 21 installations.
**Safety Instructions**

**Class, Divisions: "DIP"/"XP"**

<table>
<thead>
<tr>
<th>Variants</th>
<th>CrystalSENS: LB 4700-1x-Fx</th>
<th>UniSENS: LB 4700-2x-Fx</th>
<th>Super-SENS: LB 4700-3x-Fx</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal Circuits</strong></td>
<td>Not Intrinsically Safe</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Explosion Protection Concept of the Compartments**

- All Compartments:
  - DIP (Dust Ignition Proof)
  - XP (Explosion Proof)

**Ambient Temperature**

<table>
<thead>
<tr>
<th>Temperature class (T_a) (\text{max.}) / max. surface temperature</th>
<th>T6 (T_a \leq +75 , ^\circ\text{C}) / 80 °C</th>
<th>T6 (T_a \leq +65 , ^\circ\text{C}) / 80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEC – Class I, Division 1&amp;2</td>
<td>A,B,C,D</td>
<td></td>
</tr>
<tr>
<td>(T_a) min.</td>
<td>-50 °C</td>
<td>-40 °C</td>
</tr>
<tr>
<td>NEC – Class II/III, Division 1&amp;2</td>
<td>E,F,G</td>
<td></td>
</tr>
<tr>
<td>(T_a) min.</td>
<td>-40 °C</td>
<td></td>
</tr>
<tr>
<td>CEC – Class I, Division 1&amp;2</td>
<td>B,C,D</td>
<td></td>
</tr>
<tr>
<td>(T_a) min.</td>
<td>-50 °C</td>
<td>-40 °C</td>
</tr>
<tr>
<td>CEC – Class II/III, Division 1&amp;2</td>
<td>E,F,G</td>
<td></td>
</tr>
<tr>
<td>(T_a) min.</td>
<td>-40 °C</td>
<td></td>
</tr>
</tbody>
</table>

**Protection Principle**

"DIP"/"XP"

1) Temperature Class: Equipment Temperature Class and Installation Temperature Class.

**NOTICE**

Please note that the detector can be damaged in case of failure of the water cooling system at an ambient temperature greater than 60 °C.
## Electric parameters for the supply

<table>
<thead>
<tr>
<th>Terminal 1+, 2–</th>
<th>Supply and signal circuit (FSK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>max. input voltage $U_N$</td>
<td>15 V</td>
</tr>
<tr>
<td>max. input power $P_{\text{max}}$</td>
<td>5 W</td>
</tr>
</tbody>
</table>

## Electrical safety parameters for the associated equipment

<table>
<thead>
<tr>
<th>Terminal 1+, 2–</th>
<th>Supply and signal circuit (FSK)</th>
<th>Rectangular characteristic curve</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gas group</strong></td>
<td>IIC</td>
<td></td>
</tr>
<tr>
<td>max. input voltage $U_i$</td>
<td>17.64 V</td>
<td></td>
</tr>
<tr>
<td>max. input current $I_i$</td>
<td>81 mA</td>
<td></td>
</tr>
<tr>
<td>max. input power $P_i$</td>
<td>1.4 W</td>
<td></td>
</tr>
<tr>
<td>max. internal inductance $L_i$</td>
<td>2.7 $\mu$H</td>
<td></td>
</tr>
<tr>
<td>max. internal capacitance $C_i$</td>
<td>2.42 nF</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Signal output (terminal 3, 4)</th>
<th>Thermometer circuit (PT100) linear characteristic curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>max. output voltage $U_o$</td>
<td>16.8 V</td>
</tr>
<tr>
<td>max. output current $I_o$</td>
<td>33.3 mA</td>
</tr>
<tr>
<td>max. output power $P_o$</td>
<td>139 mW</td>
</tr>
<tr>
<td><strong>Maximum concurrently permissible external values of jointly acting reactance ($C_i, L_i$ already considered)</strong></td>
<td>IIC</td>
</tr>
<tr>
<td>$L_o$</td>
<td>15 mH</td>
</tr>
<tr>
<td>$C_o$</td>
<td>0.19 $\mu$F</td>
</tr>
</tbody>
</table>

**IMPORTANT**

The above ranges for ambient temperature ($T_a$) only apply to free-standing mounted detectors. If the detector is not free-standing, this can lead to an additional increase in surface temperature (e.g. by reflection of heat). In this case, the ambient temperature ($T_a$) must be accordingly reduced in order to make sure that the maximum surface temperature is not exceeded.

**IMPORTANT**

See chapter 7 for the “Control Drawing” and details on the explosion concept.
6.2 Installation

- Observe the installation and safety instructions of the operating manual.
- Install in accordance with manufacturer’s specifications and the relevant standards and rules.
- Do not operate the device outside of its electrical, thermal and mechanical parameters.
- Professionally install the housing cover and the screw connections (cable glands, adapters and blind plugs\(^2\)) to maintain the degree of protection of the housing.
- Unused entries must always be sealed with a blind plug\(^3\).
- Also observe the installation instructions for the screw connections in this safety manual.
- The O-ring between the housing cover and socket must be inserted for sealing the terminal compartment (hereafter referred as terminal compartment) in the groove on the front surface of the socket.
- The cover screws (cylinder screw ISO 4762 - M5x16-A2-70) of the LB 4700-xx-1x / LB 4700-xx-Ix must be underlaid with self-locking lock washers (NL5 SS of Nordlock®) and tightened with a torque of 4 Nm.
- The screw cap of the LB 4700-xx-Fx must be tightened on the hexagon (size SW 19) with a torque of 15 Nm.
- The 1/2”NPT fitting must be tightened to a torque of 20 Nm.
- Grease must be used on all threadings, OKS 217 is recommended.
- Unused entries must be closed with listed stopping plugs. A tightening torque of 20 Nm is recommended.
- Before the installation of an intrinsically safe circuit, verification of intrinsically safe circuits must be provided (see IEC 60079-14).
- The detector must be connected to an equipotential bonding system.
- The intrinsically safe circuit is connected to the probe on the PA.
- Sufficient insulation of >500 V between signal / power supply circuit (FSK) and thermometer circuit (PT100) must be ensured.
- The intrinsically safe circuit is galvanically separated with an insulation >1.5 kV in the evaluation unit.
- When using a screen, make sure:
  - Connect the screen on the detector side.
  - Insulation between screen, line and evaluation unit > 500 V respectively.
  - DO NOT connect the screen on the evaluation side.
- The temperature of the entry / branching point can exceed 60 °C, select cable entries that are suitable for the expected temperature.
- Use suitable connecting cable for the ambient conditions.
- Connecting cables (conductors and insulation) must be suitable for a continuous service temperature ≥ \(T_a + 15\) K.

\(^2\) blanking elements acc. to IEC 60079
Before the use of connection cables, they have to be checked for the possibility of gas migration (especially if changes of the ambient and/or operating conditions can occur).

- Connected lines must be strain-relieved.
- Conductor must be placed in an U-shape around the screw of the saddle clamp.
- Do **not** disassemble the detector housing (Fig. 6, Pos. 1) from the socket (Fig. 6, Pos. 2) by opening the Torx screws in the terminal compartment.
- The detectors are to be used exclusively for fixed location installation.
- Devices that were used in "non-hazardous conditions" must not be used in hazardous areas.
- The plan for the control of the terminal compartment (check list on page 27) should be completed before commissioning and after each opening of the terminal compartment.
- Devices with intrinsically safe circuits may no longer be connected to intrinsically safe circuits if they were not previously used in an intrinsically safe manner.
6.3 Terminal Compartment

Screw Connections

**NOTICE**

If it cannot be excluded that the cable gland might have suffered damage (e.g. by a mechanical shock), then the cable gland and in particular the threads should be checked for damage and replaced if necessary.

- Non-metallic screw connections may only be used for the temperature range of 
  
  \[-20 \, ^\circ\text{C} \leq T_a \leq +60 \, ^\circ\text{C}\].

- For ambient temperatures of \(-20 \, ^\circ\text{C} \leq T_a \leq +60 \, ^\circ\text{C}\), only such screw connections should be permitted that at least technically meet the standard level listed on the cover page of LB 4700 EC-type examination certificate. For outside of this temperature range, only use screw connections that are approved by Berthold Technologies GmbH & Co. KG.

- Screw connections must have at least degree of protection IP66 / IP68.

- Only use screw connections that are suitable for the cable type (armoured, non armoured, ...) and the cable cross section.

- When using adapters for thread adjustment (e.g. thread reduction), only one adapter may be used in any entry.

- Only replace screw connections with those of the same type.

Connecting Terminals

- Permissible max. conductor cross section: 2.5 mm² (AWG 21 - 14 flexible or rigid).

- Both fine stranded conductors and rigid conductors are allowed.

- Lay the connecting cables in the terminal compartment so that
  
  - no dirt and humidity gets into the terminal compartment.
  - the conductors are not damaged when the cable insulation is removed.
  - the distances between bare conductors comply with the clearance and creepage distances.
  - the conductors are placed U-shape around the screw of the connection terminal.
  - clamped conductors in the connection terminals meet a pull-out test according to IEC 60947-1 for 1 minute:
    - 30 N pull-out force for 0.5 mm² cross section and
    - 50 N pull-out force for 2.5 mm² cross section

- The connection of superfine stranded conductors of class 6, according to IEC 60228, is not permitted.

- If the bushing loosens while opening/closing the connecting terminal of the bushing, the device must be returned for repair.
6.4 Operation

Further operation is not allowed if:

- the detector is damaged.
- threads on the housing are corroded.
- the housing of the detector is heavily corroded.
- sealing plugs are badly corroded or damaged.
- cable glands are corroded or damaged.
- adapters are heavily corroded or damaged.
- seals are damaged and/or have a visible ageing effect or movement.

Protection principle Ex-d/-e/-t / XP

- Do not open the terminal compartment while there is voltage
- If an explosive atmosphere is present: Waiting time before opening the electronics compartment after turning off the supply: 2 minutes.

Protection principle Ex-d/-i/-t

- The housing cover may be opened for a short time for repair and maintenance purposes.
7 Control drawing

Hazardous Location
(Class I) Zone 1 / Zone 21
Class I Division 1, Groups B,C,D (A: US only)
Class II Division 1, Groups E,F,G, Class III

Non Hazardous Location

- For non intrinsically safe installation
  "Denergize and wait 2 minutes before opening."
- LB 4700-...-F. detectors:
  A seal shall be installed within 18 inch of enclosure
  Maintain the type 4X degree of protection of the enclosure.
  Use only listed conduits or cable glands.
- LB 4700-..-1 or LB 4700-..-I. detectors:
  To maintain ingress protection install with IP66 / IP68.
- Install acc. valid local rules (directive 2014/34/EU, NEC or CEC, national authorities).
- Warning: Repair only by persons authorized by Berthold Technologies.
- Connection cable must be suitable for a continuous operating temperature ≥ T_a + 15 K
- Entity Installations must satisfy: U_O ≤ U_i, I_O ≤ I_i, P_O ≤ P_i, L_I ≥ ΣL_i, C_O ≥ ΣC_i + C_C

Non Inherently Safe Installation
"Denergize and wait 2 minutes before opening."
- Mains Supply must not generate over 250 V,AC.
- Short circuit current of mains supply must not exceed 1.5 kA.

LB 47x System – 2019-01-08 – Control Drawing, Rev. 00

Fig. 1 Control Drawing
Explosion Protection Design

The electronics are located in compartment (item 1), which is enclosed by the housing and the base (socket) in the protection type “d” (Ex-d).

The cables are led into the terminal compartment through the entries (Pos.3) using approved cable glands, either in protection type “e” (Ex-e) or “i” (Ex-i). The conductors are connected directly to approved feed through connectors of the protection type Ex-d.

![Diagram of Explosion Protection Design](image)

**Fig. 2** Explosion Protection Design LB 4700-xx-1x / LB 4700-xx-ix

![Diagram of Explosion Protection Design](image)

**Fig. 3** Explosion Protection Design LB 4700-xx-Fx
8.1 Terminal Compartment

**IMPORTANT**

Observe the specifications in the chapter during assembly and electrical installation in chapter 6.2 Installation.

Fig. 4 Terminal Compartment LB 4700-xx-1x / LB 4700-xx-1x

<table>
<thead>
<tr>
<th>1</th>
<th>Signal and power supply circuit +</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Signal and power supply circuit -</td>
</tr>
<tr>
<td>3</td>
<td>Pt100 +</td>
</tr>
<tr>
<td>4</td>
<td>Pt100 -</td>
</tr>
<tr>
<td>5</td>
<td>Equipotential bonding</td>
</tr>
<tr>
<td>6</td>
<td>Equipotential bonding</td>
</tr>
</tbody>
</table>

Fig. 5 Terminal Compartment LB 4700-xx-Fx

<table>
<thead>
<tr>
<th>1</th>
<th>Signal and power supply circuit +</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Signal and power supply circuit -</td>
</tr>
<tr>
<td>3</td>
<td>Pt100 +</td>
</tr>
<tr>
<td>4</td>
<td>Pt100 -</td>
</tr>
<tr>
<td>5</td>
<td>Equipotential bonding</td>
</tr>
<tr>
<td>6</td>
<td>Equipotential bonding</td>
</tr>
</tbody>
</table>
8.2 Cable Entries into the Terminal Compartment

The cable glands may only be used for connection of permanently laid lines.

**IMPORTANT**

If cable glands or cables that were not tested by Berthold Technologies GmbH & Co. KG are used, the torques for fixing may need to be redefined.

The specified torques in the table are guidelines for the cable glands listed in the table, but essentially depend on the cable used. The pressure screw and the fitting body must be tightened so that the IP protection is securely guaranteed.

Only metallic cable glands may be used outside the temperature range \(-20 \, ^\circ\text{C} \leq T_a \leq +60 \, ^\circ\text{C}\), which are listed in the following tables.

Note the torques, cross sections and protective types of screw connections in the table of the attached manuals.

The following table shows the installed threading for the cable entry:

<table>
<thead>
<tr>
<th>Detector Variant</th>
<th>Threaded Entries into Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB 4700-xx-xx-xx-xx-xx0</td>
<td>M12x1.5, M16x1.5 (radial)</td>
</tr>
<tr>
<td>LB 4700-xx-xx-xx-xx-xx1</td>
<td>2x 1/2&quot; NPT (radial)</td>
</tr>
<tr>
<td>LB 4700-xx-xx-xx-xx-xx2</td>
<td>M16x1.5 (axial)</td>
</tr>
<tr>
<td>LB 4700-xx-xx-xx-xx-xx3</td>
<td>M20x1.5 (axial)</td>
</tr>
<tr>
<td>LB 4700-xx-xx-xx-xx-xx4</td>
<td>M25x1.5 (axial)</td>
</tr>
<tr>
<td>LB 4700-xx-xx-xx-xx-xx5</td>
<td>M32x1.5 (axial)</td>
</tr>
<tr>
<td>LB 4700-xx-xx-xx-xx-xx6</td>
<td>1/2&quot; NPT (axial)</td>
</tr>
</tbody>
</table>
8.3 Stopping (Blanking) Plugs

<table>
<thead>
<tr>
<th>Material</th>
<th>Size</th>
<th>ID No.</th>
<th>Ex Code / Type of Protection</th>
<th>Wrench Size</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless steel</td>
<td>M12 x 1.5</td>
<td>68462</td>
<td>approved with the detector</td>
<td>16 mm (outer hexagon)</td>
<td>6 Nm silicone</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>M16 x 1.5</td>
<td>68463</td>
<td></td>
<td>20 mm (outer hexagon)</td>
<td>8 Nm silicone</td>
</tr>
</tbody>
</table>

- Grease must be used on all threadings, OKS 217 is recommended. To ensure the sealing function, the grease must be thickly applied to NPT threads.
- Unused entries must be closed with listed stopping plugs with an appropriate protection (at least IP66 / IP68 or type 4X).
- For 1/2" NPT threading, a tightening torque of 20 Nm is recommended.
Maintenance and Visual Inspection

**NOTICE**
For detectors that are used in areas of explosion risk, the six screws that connect the detector housing with the socket may only be opened by the service of Berthold Technologies GmbH & Co. KG or by persons authorised by Berthold.

**IMPORTANT**
During commissioning, maintenance or repair, always use the check lists in chapter 10 and 11, in order to document the accuracy and completeness of your work.
Visual Inspection

Regularly perform a visual inspection at least once every three years. We recommend to use the checklist from chapter 10. Initiate immediate appropriate measures if you discover damage during visual inspection. If necessary, immediately disconnect the detector from the power supply.

When determining the intervals for the visual inspection, the following conditions are to be considered:

- ambient conditions (temperature, humidity, corrosive atmosphere, shock and vibration).
- operating conditions (utilization, incorrect operation).
- major changes in the whole system (e.g. changes in the classification of explosion protection zones).

Seals

If the cover or the housing is opened, the corresponding seals should be examined and replaced if necessary.

**NOTICE**

Do not install other seals. If seals need to be replaced, contact Berthold for replacement, otherwise the approval for Explosions Protection is void.

Cleaning

Make sure that the cable glands and the name plates are not damaged during cleaning. Cleaning measures that may cause damage, such as grinding, filing, etc., are not permitted.
# 10 Plan for Visual Inspection of the Detector

**IMPORTANT**

If you answer any of these questions with "No", you must make a note of the measures you have taken to remedy this deficiency in the last column. Before you take the detector into operation, make sure to verify the correctness of the measures with your explosion protection officer again.

<table>
<thead>
<tr>
<th>Date:...............</th>
<th>Name:..........................</th>
<th>Yes</th>
<th>No</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General examination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the housing free from corrosion, dents, cracks, holes and deformation?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the cover of the detector mounted firmly?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the safety-relevant temperatures (ambient temperature and temperature classes) met according to chapter 6?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the outer terminals of the equipotential bonding intact?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the surface of the detector free from contact with other, non-alloy steel parts?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the connected cables mounted strain-relieved?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is a circuit break installed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the circuit break easily accessible by maintenance personnel?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Examination of the screw connections (cable glands, adapters, sealing plugs)

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are the screw connections suitable for the environmental conditions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For the normal ambient temperature range between -20 °C and +60 °C, do the screw connections used technically correspond to at least the specified standards of the cover page of the EC-type examination certificate, and are screw connections used which are approved by Berthold Technologies GmbH &amp; Co. KG for use on the detector?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the permissible temperature range of the screw connections suitable for the temperatures involved?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the screw connections for the required degree of protection (min. IP65) suitable?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the screw connections corrosion free?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is no more than one adapter (reducer or extension piece) used?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the total length of the cable gland plus possibly used adapter less than 10 cm?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the cable diameters of the cable used within the specified range for cable glands?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the connecting cables suitable for the environmental conditions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the connecting cables suitable for a temperature which is 15 °C above the maximum ambient temperature?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the screw connections undamaged?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you confident about the sealing of the screw connections?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the cables firmly fixed in the cable glands?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the screw connections tight?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are all unused entries closed?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the screw connections suitable for the required explosion group?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11 Plan for the Control of the Connection

**IMPORTANT**

If you answer any of these questions with "No", you must make a note of the measures you have taken to remedy this deficiency in the last column. Before you take the detector into operation, make sure to verify the correctness of the measures with your explosion protection officer again.

<table>
<thead>
<tr>
<th>Date:……………………</th>
<th>Yes</th>
<th>No</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:……………………..</td>
<td>-----</td>
<td>----</td>
<td>----------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Examination in the terminal compartment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the interior (terminal compartment) in good condition?</td>
<td></td>
</tr>
<tr>
<td>Is the interior dry, clean and free of debris?</td>
<td></td>
</tr>
<tr>
<td>Are the clamped conductors firmly seated?</td>
<td></td>
</tr>
<tr>
<td>Are the terminals in good condition?</td>
<td></td>
</tr>
<tr>
<td>Is the interior free from corrosion?</td>
<td></td>
</tr>
<tr>
<td>Is the insulation free of damage or creepage paths?</td>
<td></td>
</tr>
<tr>
<td>Is the mechanical attachment of the components intact?</td>
<td></td>
</tr>
<tr>
<td>Is the detector properly installed according to EN 60079-14?</td>
<td></td>
</tr>
<tr>
<td>For fine wired strands: Are all the wires from the terminals covered and clamped? The connection of superfine stranded lead of class 6, according to IEC 60228, is not permitted.</td>
<td></td>
</tr>
<tr>
<td>Is the equipotential bonding properly connected?</td>
<td></td>
</tr>
<tr>
<td>Is the screen properly isolated electrically (e.g. with shrink tubing)?</td>
<td></td>
</tr>
</tbody>
</table>
### Checking Sealing

<table>
<thead>
<tr>
<th>Question</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the sealing for the cover in the terminal compartment undamaged and free of cracks and subsidence?</td>
<td></td>
</tr>
</tbody>
</table>
12 ATEX Certificate

EU - Type Examination Certificate


(2) EU - Type Examination Certificate Number

EPS 13 ATEX 1 S47 X

(3) Equipment:

Scintillation measuring unit Type LB 4700

(4) Manufacturer:

Berthold Technologies GmbH & Co. KG

(5) Address:

Calmbracher Str. 22, 73323 Bad Wildbad, Germany

(6) Bureau Veritas Consumer Products Services Germany GmbH, notified body No. 2004 in accordance with Article 21 given in the Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014, certifies that this equipment has been found to comply with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II of the Directive. The examination and test results are recorded in the confidential documentation under the reference number 12710493.

(7) This equipment and any acceptable variation thereto are specified in the annex to this certificate and the documentation therein referred to.

(8) EN 60079-0:2018

EN 60079-1:2014

EN 60079-31:2014

EN 60079-7-2015/AC:2018

EN 60079-11:2012

(9) Compliance with the essential health and safety requirements has been assured by compliance with:

EN 60079-11:2012

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

(11) This EU - Type Examination Certificate relates only to the design and examination of the specified equipment in accordance with Directive 2014/34/EU. Further requirements of this Directive apply to the manufacturer of this equipment and its placing on the market. These requirements are not covered by this certificate.

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

II 3G Ex db IIC T1-T6 Gb
II 2D Ex db IICT65°C / T85°C Db
II 2G Ex db [ib] IIC T1-T6 Gb
II 2D Ex db [ib] IIIC T98°C Db

Hamburg, 2020-11-20

H. Schaffert
Annex

EU - Type Examination Certificate EPS 13 ATEX 1 547 X

Description of equipment:
The radiation measuring unit of the Series 4700 is part of a measuring system for monitoring industrial processes. It is used for continuously measuring the level in tanks or bins that contain liquid, granular, viscous or encapsulation-forming media, and for measuring conveyor belt charges and the density of liquids, suspensions, slurries and bulk solids. It is also used for continuously measuring level, weight per unit area, wtt, sulphur, hydrogen and other specific application. The measuring principle is based on the absorption of gamma rays. This radiation source does not form part of the measuring unit and is therefore not included in the above type approval either. The field of application is the installation in Zone 1 or 2 (Dust 21 or 22, resp.). The unit consists of a radiation detector with the required analysing electronics, which is housed in a flameproof enclosure with connection terminal in increased safety room. The enclosure can be provided with a water-cooling system to be able to cool the electronics system.

Additional options with gas feed through separate enclosure: SuperSENS: LB 4700-3x...; TowerSENS: LB 4700-4x...; MiniSENS: LB 4700-6x...

Electrical data:
\[ U_{\text{aux}} = 16.8 \text{ V} \]
\[ P_{\text{aux}} = 5.0 \text{ W} \]

For devices Type LB 4700 - IST 1B with \( \text{IST} = 11-16,1A,1B,2A \text{ to } 2L,31,32,41 \text{ to } 44 \)

Intrinsic safety type (II), electrical ratings:

For devices Type LB 4700 - IST 1C with \( \text{IST} = 11-16,1A,1B,2A \text{ to } 2L,31,32,41 \text{ to } 44 \)

Power supply (FSK):

II B: \( U_i = 17.64 \text{ V}; I_i = 118 \text{ mA}; P_i = 2.0 \text{ W}; L_i = 2.7 \mu\text{H}; C_i = 2.42 \text{ nF} \)

II C: \( U_i = 17.64 \text{ V}; I_i = 81 \text{ mA}; P_i = 1.4 \text{ W}; L_i = 2.7 \mu\text{H}; C_i = 2.42 \text{ nF} \)

P100 circuit:

II B and II C: \( U_o = 16.8 \text{ V}; I_o = 33 \text{ mA}; P_o = 139 \text{ mW}; L_o = 2.7 \mu\text{H}; C_o = 2.42 \text{ nF} \)

Highest permissible values for outer resistances:

<table>
<thead>
<tr>
<th>( \text{L} [\mu\text{H}] )</th>
<th>( \text{II B} )</th>
<th>( \text{II C} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.000</td>
<td>1.000</td>
<td>0.500</td>
</tr>
<tr>
<td>5.000</td>
<td>1.000</td>
<td>0.500</td>
</tr>
<tr>
<td>1.000</td>
<td>2.000</td>
<td>2.000</td>
</tr>
<tr>
<td>0.290</td>
<td>0.320</td>
<td>0.290</td>
</tr>
</tbody>
</table>

Certificate without signature and seal are void. This certificate is allowed to be distributed only if not modified. Excerpts or modifications must be authenticated by Bureau Veritas Consumer Products Services Germany GmbH: EPS 13 ATEX 1567 X, Revision 8.
(15) **Reference number:** 12TH0483

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

- Only certified components defined by manufacturer can be used.
- Repair of flameproof joints is not allowed according to table values of IEC 60079-1.

The ambient temperature range is given by the following table:

<table>
<thead>
<tr>
<th>Ambient temperature range</th>
<th>Temperature class</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40°C ≤ Ta ≤ +75°C</td>
<td>T6 / T80°C</td>
</tr>
<tr>
<td>-40°C ≤ Ta ≤ +80°C</td>
<td>T1.35 / T85°C</td>
</tr>
<tr>
<td>-20°C ≤ Ta ≤ +100°C</td>
<td>T1.6 / T100°C</td>
</tr>
</tbody>
</table>

When using non-metallic cable glands.

For dust Ex applications high electrostatic charge generating processes shall be excluded.

(18) **Essential health and safety requirements:**

Met by compliance with standards.

[Signature]
Hamburg, 2020-11-20

---

Certificates without signature and seal are void. This certificate is allowed to be distributed only if not modified. Extracts or modifications must be authorized by Bureau Veritas Consumer Products Services Germany GmbH, CBS 12 ATEX 1 IM, Revision 6.

BUREAU VERITAS
Consumer Products Services Germany GmbH

---

BERTHOLD

569268A26, Rev.07, 02/2021
13 IECEx Certificate

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification System for Explosive Atmospheres

Certificate No.: IECEx EP8 13.00008X
Status: Current
Date of Issue: 2020-11-20
Applicant: Berthold Technologies GmbH & Co. KG
Carmanacarstr. 32
78523 Bad Wildbad
Germany
Equipment: Scintillation measuring unit LB 4700
Type of Protection: "eB", "eB", "eB", "eB"
Marking: Ex d l IIC T1-T6 Gb
Ex t HIC T90 °C | T85 °C Db
or
Ex d[ia][ib] IIC T1-T6 Gb
Ex t [ia] HIC T85 °C Db

Certificate Issued by:
Bureau Veritas Consumer Products Services Germany GmbH
Businesspark A96
85642 Turmheim
Germany

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The status and authenticity of this certificate may be verified by visiting www.berthold.com or use of this QR Code.
IECEx Certificate of Conformity

Certificate No.: IECEx EPS 13.0008X
Date of issue: 2020-11-20
Manufacturer: Berthold Technologies GmbH & Co. KG
Cathinbeer Str. 22
78923 Bad Wilsnack
Germany

Additional manufacturing locations:

The certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx G2 and Operational Documents as amended.

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

IEC 60079-0:2017 Explosive atmospheres - Part 0: Equipment - General requirements
Edition 7.0
Edition 7.0
IEC 60079-11:2011 Explosive atmospheres - Part 11: Equipment protection by intrinsically safe “i”
Edition 9.0
IEC 60079-31:2013 Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure “t”
Edition 2
IEC 60079-7:2017 Explosive atmospheres - Part 7: Equipment protection by increased safety “e”
Edition 5.1

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

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

Test Report:
DEEPS/EXTR15.00505/06

Quality Assessment Report:
DE/PTB/QAR06.0011/06
IECEx Certificate of Conformity

Certificate No.: IECEx EPS 13.0008X

Data of issue: 2020-11-20

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

The LB 4730 Series is a wireless measuring unit for measuring of filling level, charge and density of different materials. The electronics is constructed with an Ex-ia connection space and electronics are fitted in Ex-ia room. Water cooling can be provided for cooling of electronics.

Optional glass window module can be fitted.

Ex-ia electrical ratings:
- $U_i = 10 V$
- $P = 5 W$

Intrinsic safe type (b), electrical ratings:
- Power supply (-SK):
  - $I_B = 0.15 A$, $P_i = 2.3 W$, $L_i = 2.7 \mu H$, $C_i = 2.42 \mu F$
  - $I_C = 0.05 A$, $I = 8.1 A$, $P = 1.4 W$, $L = 2.7 \mu H$, $C = 2.44 \mu F$

For 1903 circuit:
- $U_B = 16.0 V$, $I_0 = 33 mA$, $P_0 = 139 mW$, $L_i = 2.7 \mu H$, $C_i = 2.42 \mu F$
- $L = 30 mH$
- $C_0 = 3800 \mu F$

These are maximum values for only inductance or capacitance circuit. For combined values clause 10.1.5.2 of IEC 60079-11 must be considered.

SPECIFIC CONDITIONS OF USE: YES as shown below:

Only certified components defined by manufacturer can be used.

Repair of flameproof joints is not allowed according to values of table 3 of IEC 60079-1.

- Ambient temperature range:
  - $-40 ^\circ C \leq T_a \leq 75 ^\circ C$ (C1 / T3g)
  - $-25 ^\circ C \leq T_a \leq 60 ^\circ C$ (C1 / T1)

For dust Ex applications high electrostatic charge generating processes shall be excluded.
IECEx Certificate of Conformity

Certificate No.: IECEx EPS 13.0038X
Date of Issue: 2020-11-20

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above)
Addition of variants: SuperSENS: LB 4700-3x..., TowerSENS: LB 4700-4x..., InlineSENS: LB 4700-6x...
Certificate of Compliance

Certificate: 70131654  
Project: 70131654  
Master Contract: 215040  
Date Issued: February 07, 2019

Issued to: Berthold Technologies GMBH & CO KG  
Calmubacher Str 22  
Bad Wildbad, 75323  
GERMANY

Attention: Juergen Betzel

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

Issued by: Jens Ensminger

PRODUCTS

CLASS C225882 - PROCESS CONTROL EQUIPMENT-For Hazardous Locations - Certified to US Standards
CLASS C225802 - PROCESS CONTROL EQUIPMENT-For Hazardous Locations-

Ex db eb IIC T1-T6 Gb  
Class I, Zone 1 AEx db eb IIC T1-T6 Gb

Ex tb IIC T80 °C / T85 °C Db  
Zone 21 AEx tb IIC T80 °C / T85 °C Db

Scintillation measuring unit, model LB 4700-xx-1B-xx-xx-xxx  
Uᵣ = 15.0 V, I = 90.9 mA

<table>
<thead>
<tr>
<th>Variant</th>
<th>Type</th>
<th>Ambient temperature range</th>
</tr>
</thead>
</table>
| A1, B1  | LB 4700-1x-1B-xx-xx-xxx  
LB 4700-2x-1B-xx-xx-xxx | −40 °C ≤ Tᵣ ≤ +75 °C (T1-T6 / T85 °C)         |
| C1      | LB 4700-3x-1B-xx-xx-xxx  
LB 4700-4x-1B-xx-xx-xxx | −40 °C ≤ Tᵣ ≤ +65 °C (T1-T6 / T80 °C)         |
Ex db ib IIC T1-T6 Gb  
Class I, Zone 1 AEx db ib IIC T1-T6 Gb

Ex tb ib IIC T80 °C / T85 °C Db  
Zone 21 AEx tb ib IIC T80 °C / T85 °C Db

Scintillation measuring unit, model LB 4700-xx-IC-xx-xx-xxx  
Ratings for associated intrinsically safe models, supplied by an intrinsically safe source:

<table>
<thead>
<tr>
<th>Terminals (number and designation)</th>
<th>Electrical data</th>
</tr>
</thead>
</table>
| 1 Signal and power supply circuit + (FSK) | For group IIC and IIIIC  
Ui = 17.64 V  
Ii = 81 mA  
Pii = 1.4 W  
Internal inductance and capacitance  
Ci = 2.42 nF  
Li = 2.7 μH |
| 2 Signal and power supply circuit - (FSK) | |
| 3 Pt100 +  
4 Pt100 - | For group IIC and IIIIC  
Uo = 16.8 V  
Io = 33 mA  
Po = 139 mW  
Maximum permissible external inductance and capacitance for circuits containing both (mixed circuits):  
Lo = 15 mH  
Co = 190 nF |
| 5 Equipotential bonding  
6 Equipotential bonding | Equipotential bonding |

<table>
<thead>
<tr>
<th>Variant</th>
<th>Type</th>
<th>Ambient temperature range</th>
</tr>
</thead>
</table>
| A1, B1  | LB 4700-1x-IC-xx-xx-xxx  
LB 4700-2x-IC-xx-xx-xxx | −40 °C ≤ Ta ≤ +75 °C (T1-T6 / T85 °C) |
| C1      | LB 4700-3x-IC-xx-xx-xxx  
LB 4700-4x-IC-xx-xx-xxx | −40 °C ≤ Ta ≤ +65 °C (T1-T6 / T80 °C) |
NEC/CEC HazLoc Certificate


Certificate: 70131654
Project: 70131654

Class I, Division 1, Group B,C,D T1-T6 (Canada)
Class I, Division 1, Group A,B,C,D T1-T6 (USA)
Class II, Division 1, Group E, F, G
Class III, Division 1

Scintillation measuring unit, model LB 4700-xx-FA-xx-xx-xxx
Ratings: \[ U_s = 15.0 \text{ V}, I = 90.9 \text{ mA} \]

<table>
<thead>
<tr>
<th>Variant</th>
<th>Type</th>
<th>Ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4, B4</td>
<td>LB 4700-1x-FA-xx-xx-xxx</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LB 4700-2x-FA-xx-xx-xxx</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>LB 4700-3x-FA-xx-xx-xxx</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LB 4700-4x-FA-xx-xx-xxx</td>
<td></td>
</tr>
</tbody>
</table>

\[ -50 \degree C \leq T_a \leq +75 \degree C \text{ (T1-T6 / T85 \degree C)} \]
\[ -40 \degree C \leq T_a \leq +65 \degree C \text{ (T1-T6 / T80 \degree C)} \]

Conditions of Acceptability:
- Equipment is only to be installed by manufacturer trained personnel.
- Equipment is to be fixed by either U-bolt, strap or similar fixing method, which the stability is to be considered at end application.
- If at any time, there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.
- The equipment shall be supplied from Limited Energy Circuit, NEC Class 2, LPS or Limited Power Source only, except the equipment marked with “Ex db ib” or “Ex tb ib”, which shall be supplied from an intrinsically safe power source.
- Approved or recognized cable glands rated 4X or better shall only be used in the equipment to maintain the Enclosure Type Rating 4X.
- Cable glands rated IP66/68 shall only be used in the equipment to maintain Degree of Protection IP66/68 of the enclosure.
- The Scintillation measuring unit, Variant C4 shall be connected to an extension module or end cap, which protects the window from mechanical impacts and thermal shocks.
### APPLICABLE REQUIREMENTS

- CAN/CSA-C22.2 No. 60079-0:15 Ed. 5: Explosive Atmospheres - Part 0: Equipment - General requirements
- CAN/CSA-C22.2 No. 60079-7:12: Explosive Atmospheres – Part 7: Equipment protection by increased safety “e”
- CAN/CSA-C22.2 No. 60079-31:15: Explosive Atmospheres – Part 31: Equipment dust ignition protection by enclosure “t”
- C22.2 No. 25 -1966 (reaffirmed 2014): Enclosures for Use in Class II Groups E, F, and G Hazardous Locations
- C22.2 No. 30-M1986 (reaffirmed 2012): Explosion-proof enclosures for use in class I hazardous locations
- UL 60079-0 Sixth Edition: Electrical Apparatus for Explosive Gas Atmospheres - Part 0: General Requirements
- UL 60079-7 Fourth Edition: Explosive Atmospheres - Part 7: Equipment protection by increased safety “e”
- FM 3615-2006-08: Approval Standard for Explosionproof Electrical Equipment General Requirements
MARKINGS

The manufacturer is required to apply the following markings:

- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standard(s) may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.

The products listed are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and U.S. Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only.

Markings are on stainless steel nameplates at the enclosure body and the warnings appear at the cover. The following marking details appear:

- CSA Monogram with C-US indicator.
- Submittor Identification with master contact number
- Certificate reference CSA17CA70131654
- Model Number
- Serial Number, Date Code or Month and Year of Manufacture
- Electrical Ratings as per product listing, Intrinsically Safe Ratings can be located in the instruction manual/control drawing
- Hazardous Location Designation as per product listing
- Ambient temperature range as per product listing
- Ingress Protection: IP66 / IP68
- Enclosure Type Rating: 4X

The following warnings shall be applied in English and French at the cover:

- **WARNING:** In case of non-intrinsically safe installation and in explosive atmosphere, deenergize and wait 2 minutes!
  **AVERTISSEMENT:** Dans une installation à sécurité intrinsèque et présence d’une atmosphère explosives, après mise hors tension attendre 2 minutes!

- See safety manual for further information
  Voir le manuel de sécurité pour plus de reseignements!

The equipment with intrinsically safe marking “ib” shall additional be marked with the following:

- Install as per “Control Drawing” §7
  Installer selon le “dessin de contrôle” §7
  (marking in both languages must be located adjacent to the manual icon)

The Class I, Division 1 enclosure shall additional be marked with the following:

- A seal shall be installed within 18 inches of the enclosure.
  Un scellement doit être installé à moins de 18 pouces du boîtier.
The following warnings shall be applied in English and French in the safety manual:

- **WARNING:** THE TEMPERATURE OF THE ENTRY / BRANCHING POINT CAN EXCEED 60°C, SELECT CABLE ENTRIES THAT ARE SUITABLE FOR THE EXPECTED TEMPERATURES.
  **ATTENTION:** LA TEMPERATURE D’ENTRÉE / POINT DE BRANCHEMENT PEUT DÉPASSER 60 °C, SELECTIONNER LES ENTRÉES DE CÂBLE ADAPTEES AUX TEMPERATURES ATTENDUES.

- **WARNING:** REPAIR OF FLAMEPROOF JOINTS IS NOT ALLOWED.
  **ATTENTION:** LES JOINTS ANTIDÉFLAGRANTS NE SONT PAS DESTINÉS À ÊTRE RÉPARÉS.

- **WARNING:** SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
  **ATTENTION:** LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSEQUE.
Certificate of Compliance

Certificate: 70161752
Project: 70165124
Issued to: Berthold Technologies GmbH & Co. KG
Calmbacher Str. 22,
75323 Bad Wildbad
GERMANY

Attention: Juergen Betzelt

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and US Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only

Issued by: R. Rosales

CLASS 2252 06 - PROCESS CONTROL EQUIPMENT
CLASS 2252 86 - PROCESS CONTROL EQUIPMENT (Certified to U.S. Standards)

Scintillation measuring device, Model LB 4700 Series. Rated 16.8Vdc, 5.0W.

Notes:
1. The above model is permanently connected, Pollution Degree 2, Measurement Category II.
2. Mode of operation: Continuous
3. Environmental Conditions: Normal: 5 to 40 C, 2000 m max, 80% to temperatures up to 31 °C decreasing linearly to 50% rH at 40 °C; and Extended: -20 °C to +60 °C (standard), -50 °C to +60 °C (metallic cable glands) and -50 °C to +100 °C (with water cooling).
4. Rated IP66 / IP68, Enclosure Type Rating 4X
5. Indoor and outdoor use
6. Weighing 9 to 27kg, depending on the configuration.
CONDITIONS OF ACCEPTABILITY

(1) Equipment is only to be installed by manufacturer trained personnel.
(2) Equipment is to be fixed by either U-bolt, strap or similar fixing method, which the stability is to be considered at end application.
(3) If at any time, there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.
(4) Any other accessory/ies to be used with the equipment has to be checked and complied with the relevant standard (i.e., radiation, etc).
(5) The equipment shall be supplied from Limited Energy Circuit, NEC Class 2, LPS or Limited Power Source only.
(6) This assessment covers the basic safety of the equipment only. It does not cover reliable function, performance, or other properties of the equipment not related to safety.
(7) Approved or recognized cable glands rated 4X or better shall only be used in the equipment to maintain the Enclosure Type Rating 4X.
(8) Cable glands rated IP66/68 shall only be used in the equipment to maintain Degree of Protection IP66/68 of the enclosure.

APPLICABLE REQUIREMENTS

CAN/CSA-C22.2 No. 61010-1-12 3rd Edition (Update 1 & 2, April 2016) - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
UL Std. No. 61010-1, 3rd Edition (Rev up to April 2016) - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements
UL Std. No. 50E, 2nd Edition (October 2015) - Enclosures for Electrical Equipment, Environmental Considerations
CSA C22.2 No. 94.2-15, 2nd Edition (October 2015) - Enclosures for Electrical Equipment, Environmental Considerations

MARKINGS

The manufacturer is required to apply the following markings:

- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standard(s) may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.
The following markings appear on the product:

1. Submitter's identification (company name and/or file number and/or registered tradename);
2. Marking on the unit that indicates the manufacturing location if the equipment is manufactured at more than one factory location;
3. Model designation;
4. Electrical rating;
5. Date of manufacture: Month and year of manufacture or date code. If a serial number is used instead of date of manufacture, a record of serial numbers shall be kept traceable to date of manufacture. (Not related to date of sale).

Copy of the Marking:

![Marking Image]

**Type Plate**

**Font Size>=1.5mm**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Symbol</th>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td><img src="image" alt="Symbol" /></td>
<td>ISO 7000-0434A</td>
<td>Caution</td>
</tr>
</tbody>
</table>

Marking Method: The above markings are made via engraving or laser.
Modifications due to technical advancement reserved.
LB 4700 Detectors

Technische Information

56926TI
Rev. No.: 02, 02/2021
2 wire technology

The DuoSeries/DuoXPERT measuring system consists of a scintillation detector – CrystalSENS point detector, UniSENS rod detector or SuperSENS point detector – and a sophisticated evaluation unit (DuoXPERT) for display and operation. The evaluation unit is a state-of-the-art control unit with robust 3.5" TFT touch panel, powerful Dual Core CPU and diverse operator interfaces. Advanced self diagnostics and monitoring features ensure a safe function of the system. Furthermore the data logging functionality allows operators to analyze their processes in depth, e.g. develop trends, track process changes etc.

Sophisticated measuring system in 2 wire technology

- Unique: Radiometric system with intrinsically safe power supply (Full Ex-i)
- Real 2-wire technology, only 2 wires in the field
- Advanced self diagnostics and monitoring features
- Easy to use touch screen panel for local display and operation
- Integrated gas density compensation feature
- Direct replacement of predecessor model LB 440
- Interfaces with all 2-wire detectors LB 44xx, LB 54xx and LB 47xx

2-Leiter Technologie


Hochentwickeltes Messsystem in 2-Leiter Technologie

- Einzigartig: Radiometrische Messung mit eigensicherer Spannungsversorgung (Voll Ex-i)
- Echte 2-Leiter Technik, nur 2 Adern im Feld
- Verbesserte Diagnosefunktionen und Selbstüberwachung
- Einfache, intuitive Bedienung über Touch-Screen
- Integriertes Feature zur Kompensation von Gas-Phasen Schwankungen
- Volle Kompatibilität zum Vorgängermodell LB 440
- Kompatibel zu alle 2-Leiter Detektoren LB 44xx, LB 54xx und LB 47xx
CrystalSENS LB-4700-1x

Without water-cooling
Ohne Wasserkühlung

Collimator front irradiation
Kollimator frontale Einstrahlung

Collimator side irradiation
Kollimator seitliche Einstrahlung

With water cooling
Mit Wasserkühlung

Collimator front irradiation
Kollimator frontale Einstrahlung

Collimator side irradiation
Kollimator seitliche Einstrahlung

Possible clamping range
Möglicher Klemmbereich

Cable Entry
Leitungseinführung M12 und M16
sealed with screw plugs
mit Verschlussschrauben verschlossen

Dimensions in mm
Abmessungen in mm

<table>
<thead>
<tr>
<th>Water-cooling</th>
<th>Collimator</th>
<th>Total Length (approx.)</th>
<th>Weight (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>---</td>
<td>452 mm</td>
<td>9.4 kg</td>
</tr>
<tr>
<td></td>
<td>Front irradiation</td>
<td>491 mm</td>
<td>21.1 kg</td>
</tr>
<tr>
<td></td>
<td>Side irradiation</td>
<td>471 mm</td>
<td>19.2 kg</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>467 mm</td>
<td>12.3 kg</td>
</tr>
<tr>
<td></td>
<td>Front irradiation</td>
<td>496 mm</td>
<td>23.0 kg</td>
</tr>
<tr>
<td></td>
<td>Side irradiation</td>
<td>475 mm</td>
<td>21.7 kg</td>
</tr>
</tbody>
</table>
CrystalSENS: Water Cooling Installation Instruction

**Horizontal Detector Installation**
*Horizontale Detektor Installation*

In order to fill the entire water cooling jacket, incoming water must enter from the bottom.

*Damit sich die Wasserkühlung vollständig mit Wasser füllt, muss der Wasserzufluss von unten erfolgen.*

---

**Vertical Detector Installation**
*Vertikale Detektor Installation*

Install the Detector with the connection at the top.

*Installieren Sie den Detektor mit dem Anschlussgehäuse oben.*
UniSENS LB 4700-2x

**Without water-cooling**

*Ohne Wasserkühlung*

**With water cooling**

*Mit Wasserkühlung*

---

### Dimensions in mm

<table>
<thead>
<tr>
<th>L (sensitive area)</th>
<th>Water-cooling</th>
<th>Total Length (approx.)</th>
<th>Weight (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L (sensibler Bereich)</td>
<td>Wasserkühlung</td>
<td>Gesamtlänge (ca.)</td>
<td>Gewicht (ca.)</td>
</tr>
<tr>
<td>500 mm</td>
<td>-</td>
<td>925 mm</td>
<td>13.7 kg</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>934 mm</td>
<td>19.5 kg</td>
</tr>
<tr>
<td>750 mm</td>
<td>-</td>
<td>1175 mm</td>
<td>15 kg</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>1184 mm</td>
<td>23 kg</td>
</tr>
<tr>
<td>1000 mm</td>
<td>-</td>
<td>1425 mm</td>
<td>16.8 kg</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>1434 mm</td>
<td>26.3 kg</td>
</tr>
<tr>
<td>1250 mm</td>
<td>-</td>
<td>1675 mm</td>
<td>19.3 kg</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>1684 mm</td>
<td>31.5 kg</td>
</tr>
<tr>
<td>1500 mm</td>
<td>-</td>
<td>1925 mm</td>
<td>22.7 kg</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>1934 mm</td>
<td>35.7 kg</td>
</tr>
<tr>
<td>2000 mm</td>
<td>-</td>
<td>2425 mm</td>
<td>26.5 kg</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>2434 mm</td>
<td>42.8 kg</td>
</tr>
</tbody>
</table>
In order to fill the entire water cooling jacket, incoming water must enter from the bottom.

*Damit sich die Wasserkühlung vollständig mit Wasser füllt, muss der Wasserzufluss von unten erfolgen.*
SuperSENS

without water-cooling (side irradiation)

*ohne Wasserkühlung (seitliche Einstrahlung)*

Dimensions in mm

*Abmessungen in mm*
SuperSENS

with water-cooling (side irradiation)

*mit Wasserkühlung (seitliche Einstrahlung)*

Dimensions in mm

*Abmessungen in mm*
SuperSENS

without water-cooling (frontal irradiation)

*ohne Wasserkühlung (frontale Einstrahlung)*

Dimensions in mm

*Abmessungen in mm*
SuperSENS

with water-cooling (frontal irradiation)

mit Wasserkühlung (frontale Einstrahlung)

Dimensions in mm
Abmessungen in mm
SuperSENS: Water Cooling Installation Instruction

SuperSENS: Anweisung zur Installation der Wasserkühlung

Water Inlet
Wassereinlass

Water Outlet
Wasserauslass
The detector version for divisions (NEC/CEC) differs only in the terminal housing, compared to the standard version illustrated above. The dimensions of this terminal housing are illustrated in this drawing.

Divisions versions are available for all detectors with the following exceptions:

- Am / Cm detector  
- CrystalSENS 125/50

**Versions for Class, Divisions: “DIP” / “XP” LB 4700-xx-Fx**

Die Detektor-Version mit Ex-Zulassung für Divisions (NEC/CEC) unterscheidet sich ausschließlich im Anschlusskopf, verglichen mit der oben aufgeführten Standardvariante. Die Abmessungen für den Anschlusskopf sind aus dieser Zeichnung zu entnehmen.

Ex-Zulassungen gibt es für alle Detektoren mit folgenden Ausnahmen:

- Am/Cm Detektor  
- CrystalSENS 125/50
Detector for Low Energy Isotopes, like Am-241 or Cm-244

Detektor für niederenergetische Isotope, wie Am-241 oder Cm-244

Dimensions in mm
Abmessungen in mm
Mounting Clamps for Detector
Befestigungsschellen für Detektor

for Detectors without water cooling
für Detektoren ohne Wasserkühlung

for Detectors with water cooling
für Detektoren mit Wasserkühlung

Material
316Ti
1.4571

Position for the clamps, see detector drawing
Position für die Schellen-Befestigung
siehe Detektor-Zeichnung

Id. Nr. 31346 (1 set = 2 clamps) (1 Satz = 2 Schellen)
Id. Nr. 31345 (single clamp) (einzelle Schelle)

Id. Nr. 31347 (1 set = 2 clamps) (1 Satz = 2 Schellen)
Id. Nr. 31344 (single clamp) (einzelle Schelle)

Heavy Duty Detector Holder (stainless steel)
Robuste Detektor Halterung (Edelstahl)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Id. Nr.</th>
<th>for Detector</th>
<th>für Detektor</th>
</tr>
</thead>
<tbody>
<tr>
<td>39246</td>
<td></td>
<td>without water cooling</td>
<td>ohne Wasserkühlung</td>
</tr>
<tr>
<td>39247</td>
<td></td>
<td>with water cooling</td>
<td>mit Wasserkühlung</td>
</tr>
</tbody>
</table>

Dimensions in mm
Abmessungen in mm

Remove the plastic ring for detectors with water cooling.
Kunststoffring bei Detektoren mit Wasserkühlung entfernen.
Mounting Point Detector
*Befestigung Punktdetektor*

Mounting with Clamps
*Montage mit Schellen*

Mounting with Detector Holder
*Montage mit Detektorhalterung*
NOTICE  HINWEIS

Direct sun radiation can overheat the detector. If the detector temperature can reach more than 50°C, a suitable sun roof must be installed. The heating of the detector by thermal radiation from the vessel can also be moderated by a thermal sheet, e.g. by a thin metal plate.

For each detector a water cooling (option) is available!

Wird durch Sonneneinstrahlung eine Detektortemperatur von über 50°C erreicht, so ist ein geeigneter Sonnenschutz zu montieren. Auch die Aufheizung des Detektors durch Wärmeabstrahlung vom Behälter kann durch ein dünnes Wärmeableitblech gemildert werden. Für jeden Detektor steht auch eine geeignete Wasserkühlung (Option) zur Verfügung.
Potassium Measurement, Examples for Arrangements inside the Vessel

**Dip Pipe from the Top**

*Tauchrohr von oben*

- **125...135 mm**
  - CrystalSENS 50/50 NaI

- **78...85 mm**
  - CrystalSENS 50/50 NaI

**Dip Pipe from the side**

*Tauchrohr von der Seite*

- **175...185 mm**
  - SuperSENS 150/150 Polymer

- **230 mm**
  - CrystalSENS 125/50 NaI

Dimensions in mm

*Abmessungen in mm*
Potassium, Examples for Surface Measuring Arrangements
Kali, Beispiele von Oberflächen Messanordnungen

Measurement at Pipe
Messung an der Rohrleitung

SuperSENS 150/150 Polymer frontal Collimator
Ø > 500 mm

Suitable mounting frames can be ordered from Berthold.
Passende Montagevorrichtungen für SuperSENS über Berthold erhältlich.

Installation example see below
Installationsbeispiel siehe unten

Measurement at Vessel
Messung am Behälter

CrystalSENS 125/50 NaI with shield

Installation example see below
Installationsbeispiel siehe unten

Measurement at Pipe
Messung an der Rohrleitung

CrystalSENS 125/50 NaI
Ø > 500 mm

Installation example see below
Installationsbeispiel siehe unten

Measurement at Conveyor
Messung am Förderorgan

CrystalSENS 125/50 NaI

Installation example see below
Installationsbeispiel siehe unten

Dimensions in mm
Abmessungen in mm
CrystalSENS 125/50

**Shield for CrystalSENS, part no. 11516**

*Abschirmung für CrystalSENS, Id-Nr. 11516*

- **Screws for detector installation**
  *Schrauben für Detektorbefestigung*

- **Shield Effect:** approx. 55 mm lead
  *Abschirmungswirkung: ca. 55 mm Blei*

- **Lifting Eyebolt, inner diameter 25 mm**
  *Ringschraube, Innendurchmesser 25 mm*

- **Weight approx. 100 kg**
  *Gewicht ca. 100 kg*

- **Material:** steel painted
  *Material: Stahl lackiert*

**Dimensions in mm**

*Abmessungen in mm*
CrystalSENS 125/50 installed in Shield

CrystalSENS 125/50 eingebaut in Abschirmung

Installation Example for CrystalSENS 125/50 with Shield (to be made by the customer)

Installationsbeispiel für CrystalSENS 125/50 mit Abschirmung (vom Kunden anzufertigen)

Weight approx. 121 kg
Gewicht ca. 121 kg

Dimensions in mm
Abmessungen in mm

Divide the top flange ring into two half shells
Oberer Flanschring in zwei Halbschalen teilen

Unscrew the eybolts and use the threated hole to fix the flange
Ringösen demontieren und Gewindebohrung für Flanscbefestigung verwenden

Weld the pipe at the vessel or install it at a appropriate support
Rohr an den Behälter schweißen oder auf eine passende Stütze montieren
SuperSENS Detector for Dip Pipe

SuperSENS Detector für Tauchrohr

LB 4700-31-00-80-01-100
56926-101

Dimensions in mm
Abmessungen in mm

Weight approx. 21 kg
Gewicht ca. 21 kg
SuperSENS Detector with Water-Cooling for Dip Pipe

SuperSENS Detector mit Wasserkühlung für Tauchrohr

LB 4700-31-IB-80-01-100
56926-113

Dimensions in mm
Abmessungen in mm
Extension Shield für SuperSENS with Frontal Irradiation
Zusatzabschirmung für SuperSENS mit frontaler Einstrahlung

Extension Shield 49825
Zusatzabschirmung 49825

Shield Effect: approx. 45 mm lead
Abschirmungswirkung: ca. 45 mm Blei

Weight approx. 114 kg
Gewicht ca. 114 kg

Extension Shield installed on SuperSENS
Zusatzabschirmung installiert auf SuperSENS

Dimensions in mm
Abmessungen in mm

Total shield effect: approx. 70 mm lead
Gesamte Abschirmungswirkung: ca. 70 mm Blei

Weight approx. 124 kg
Gewicht ca. 124 kg
Collimators

Collimator for CrystalSENS detectors

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Id Nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collimator for frontal irradiation</td>
<td>11814</td>
</tr>
<tr>
<td></td>
<td>Collimator für frontale Einstrahlung</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collimator for side irradiation</td>
<td>4506</td>
</tr>
<tr>
<td></td>
<td>Collimator für seitliche Einstrahlung</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions in mm
Abmessungen in mm

Notice

For collimators with frontal irradiation and perpendicular detector mounting, the collimator must be aligned upwards. If the collimator is aligned downwards, there is a risk of incorrect readings due accumulation of water.

Reinforced Collimator for CrystalSENS detectors (side irradiation)

Verstärkter Kollimator für CrystalSENS Detektoren (seitliche Einstrahlung)

Dimensions in mm

Abmessungen in mm

Part. No. 48925
Id. Nr. 48925
Reinforced Collimator for CrystalSENS detectors (frontal irradiation)
Verstärkter Kollimator für CrystalSENS Detektoren (frontale Einstrahlung)

Dimensions in mm
Abmessungen in mm

Part. No. 48254
Id. Nr. 48254

Gewicht ca. 60 kg
Weight approx. 60 kg
Collimator for UniSENS detectors without water-cooling

Kollimator für UniSENS Detektoren ohne Wasserkühlung

Plate thickness: 10 mm
Plattenstärke: 10 mm

Lead thickness 36 mm
Bleidicke 36 mm

Dimensions in mm
Abmessungen in mm

<table>
<thead>
<tr>
<th>Part No.</th>
<th>L1 sensitive length</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>X</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>59957-050</td>
<td>500</td>
<td>620</td>
<td>655</td>
<td>590</td>
<td>960</td>
<td>110</td>
</tr>
<tr>
<td>59957-100</td>
<td>1000</td>
<td>1120</td>
<td>1155</td>
<td>1090</td>
<td>1460</td>
<td>195</td>
</tr>
<tr>
<td>59957-150</td>
<td>1500</td>
<td>1620</td>
<td>1655</td>
<td>1590</td>
<td>1960</td>
<td>280</td>
</tr>
<tr>
<td>59957-200</td>
<td>2000</td>
<td>2120</td>
<td>2155</td>
<td>2090</td>
<td>2460</td>
<td>365</td>
</tr>
</tbody>
</table>
Collimator for UniSENS detectors with water-cooling

Kollimator für UniSENS Detektoren mit Wasserkühlung

<table>
<thead>
<tr>
<th>Part No.</th>
<th>L1 sensitive length</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>X</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60085-050</td>
<td>500</td>
<td>620</td>
<td>655</td>
<td>590</td>
<td>960</td>
<td>100</td>
</tr>
<tr>
<td>60085-100</td>
<td>1000</td>
<td>1120</td>
<td>1155</td>
<td>1090</td>
<td>1460</td>
<td>180</td>
</tr>
<tr>
<td>60085-150</td>
<td>1500</td>
<td>1620</td>
<td>1655</td>
<td>1590</td>
<td>1960</td>
<td>255</td>
</tr>
<tr>
<td>60085-200</td>
<td>2000</td>
<td>2120</td>
<td>2155</td>
<td>2090</td>
<td>2460</td>
<td>330</td>
</tr>
</tbody>
</table>

Plate thickness: 10 mm
Plattenstärke: 10 mm

Dimensions in mm
Abmessungen in mm

Required space for mounting
Platzbedarf bei Montage

Lead thickness 36 mm
Bleidicke 36 mm
Examples for Mounting Devices and the Installation at the Collimator

Beispiele für die Halterung und Montage des Kollimators

Detector locking screws with counter nuts
Detektor Feststell­schrauben mit Kontermuttern

Stabilizer against tilting, installed by customer. Bracket e.g. welded to the vessel or a special support. Kippsicherung installiert vom Errichter. Lasche z.B. angeschweißt am Behälter oder einer Tragekonstruktion.

For installation/deinstallation, space for swiveling the collimator is recommended. Empfohlener Installations-/ Deinstallationsraum zum Ausschwenken des Kollimators.

Alternative to the stabilizer against tilting in the drawing on the left, you can use a one-sided mounted angle bracket as a stabilizer too. Alternative zur in der neben stehend dargestellten Kippsicherung, kann auch ein einseitig anmontierter Winkel als Kippsicherung montiert werden.

Assembly platform installed by customer; must carry the total load of the collimator and the detector. It is e.g. welded to the vessel or on a special support. Montage-Plattform installiert vom Errichter; sie trägt das komplette Gewicht des Kollimators und des Detektors. Sie ist z.B. angeschweißt am Behälter oder einer Tragekonstruktion.

Vessel
Behälter

Distance to the vessel wall approx. 100 mm
Abstand zur Behälterwand ca. 100 mm

Angle bracket as tilt protection, welded
Winkeleisen als Kippsicherung, angeschweißt

Material thickness
Materialstärke
8 - 10mm

Mounting direction to the source
Montagerichtung zum Strahler

Dimension depends on the on-site conditions, e.g. insulation thickness
Maß abhängig von örtlichen Gegebenheiten, z.B. Isolationsstärke.
Collimators for UniSENS detectors
*Kollimatoren für UniSENS Detektoren*

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>59957-050</td>
<td>Rod detector shield L=500</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=500</td>
</tr>
<tr>
<td>59957-100</td>
<td>Rod detector shield L=1000</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=1000</td>
</tr>
<tr>
<td>59957-150</td>
<td>Rod detector shield L=1500</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=1500</td>
</tr>
<tr>
<td>59957-200</td>
<td>Rod detector shield L=2000</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=2000</td>
</tr>
<tr>
<td>60085-050</td>
<td>Rod detector shield L=500, with water-cooling</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=500, mit Wasserkühlung</td>
</tr>
<tr>
<td>60085-100</td>
<td>Rod detector shield L=1000, with water-cooling</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=1000, mit Wasserkühlung</td>
</tr>
<tr>
<td>60085-150</td>
<td>Rod detector shield L=1500, with water-cooling</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=1500, mit Wasserkühlung</td>
</tr>
<tr>
<td>60085-200</td>
<td>Rod detector shield L=2000, with water-cooling</td>
</tr>
<tr>
<td></td>
<td>Stabdetektorabschirmung L=2000, mit Wasserkühlung</td>
</tr>
</tbody>
</table>
Clamping Position for UniSENS detectors
Klemmposition für UniSENS Detektoren

The drawings on this page are valid for Detectors with and without water cooling jacket.
Die Zeichnungen auf dieser Seite sind gültig für Detektoren mit und ohne Wasserkühlung

Clamping Position for Rod Detectors
Klemmenposition für Stabdetektoren

Mounting Position for Rod Detector Shieldings
Klemmenposition für Stabdetektorabschirmungen

Clamping Position for Multi Detector Arrangement
Klemmenposition für Multidetektor-Anordnung

Mounting Position for Rod Detector Shieldings
Klemmenposition für Stabdetektorabschirmungen
Water Cooling Jacket and Adaptor Fittings

Fitting adaptor for standard water cooling
Rp ¼" → ½" NPT female, stainless steel 1.4301 (AISI 304), part no: 47189

Adapter für Standard-Wasserkühlung
Rp½" →½" NPT Innengewinde, Edelstahl 1.4301 (AISI 304), Id. Nr.: 47189

Further fitting adaptors for standard water cooling jacket:
Rp ¼" → ¼" NPT male, stainless steel 304, part no: 6352
Rp ¼" → ¼" NPT male, stainless steel 304, part no: 6349

Weitere Adapter für die Standard-Wasserkühlung:
Rp¼" →¼" NPT Außengewinde, 1.4301, Id. Nr.: 6352
Rp¼" →¼" NPT Außengewinde, 1.4301, Id. Nr.: 6349
<table>
<thead>
<tr>
<th>Fitting Connection</th>
<th>Part No. (material)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R ¼&quot; pipe connection, male European standard Whitworth pipe thread</td>
<td>included in standard water cooling jacket</td>
</tr>
<tr>
<td>R ¼&quot; Außengewinde für Rohrverschraubung europäisches Standard Whitworth-Rohrgewinde</td>
<td>enthalten bei Standard-Wasserkühlungen</td>
</tr>
<tr>
<td>10 mm hose connection for water hose connection ID 10 mm</td>
<td></td>
</tr>
<tr>
<td>Schlauchstutzen für Schlauch-Innendurchmesser 10 mm</td>
<td></td>
</tr>
<tr>
<td>fitting adaptor ½&quot; NPT female</td>
<td>47189 (304/1.4301)</td>
</tr>
<tr>
<td>Adapter mit ½&quot; NPT Innengewinde</td>
<td></td>
</tr>
<tr>
<td>fitting adaptor ¼&quot; NPT female</td>
<td>46743 (304/1.4301)</td>
</tr>
<tr>
<td>Adapter mit ¼&quot; NPT Innengewinde</td>
<td></td>
</tr>
<tr>
<td>fitting adaptor ½&quot; NPT male</td>
<td>6352 (304/1.4301)</td>
</tr>
<tr>
<td>Adapter mit ½&quot; NPT Außengewinde</td>
<td></td>
</tr>
<tr>
<td>fitting adaptor ¼&quot; NPT male</td>
<td>6349 (304/1.4301)</td>
</tr>
<tr>
<td>Adapter mit ¼&quot; NPT Außengewinde</td>
<td></td>
</tr>
</tbody>
</table>
## Technical Data
### Mechanical Design
#### Operating Temperature
**extended temperature range with metallic cable glands:**
-40 ... +60 °C (-40 ... +140 °F)

**extended temperature range with water cooling system:**
-40 ... +100 °C (-40 ... +212 °F)

Observe the max. permissible ambient and surface temperatures for explosion protection (see Safety Manual / Explosion Protection Manual).

#### Housing material
Stainless steel ISO 1.4301/AISI 304 (other materials on request)
Edelstahl ISO 1.4301 / AISI 304 (andere Materialien auf Anfrage)

#### Environmental Testing
- **IEC 60068-2-27:** mechanical shock (30 g)
- **IEC 60068-2-6:** Vibration (1.9 g at resonance, sinusoidal)
- **IEC 60068-2-38:** Climate testing (-10 ... +65 °C; relative humidity >90%)
- **IEC 60068-2-14 NA:** Temperature shock (-45 °C ... 65 °C in 10 s)

#### Environmental Testing
**Umweltprüfungen**
- **IEC 60068-2-27:** mechanischer Schock (30 g)
- **IEC 60068-2-6:** Vibration (1,9 g bei Resonanz, sinusförmig)
- **IEC 60068-2-38:** Klimalagerung
(-10 ... +65 °C; rel. Luftfeuchte >90%)
- **IEC 60068-2-14 NA:** Temperatur-Schock (-45 °C ... 65 °C in 10 s)

#### Water cooling system
Optional, stainless steel ISO 1.4301/AISI 304
Water pressure up to 6 bar
Tube connection R1/4", d=10 mm
Weight approx. 3 kg

**Wasserkühlung**
Optional, Edelstahl ISO 1.4301 / AISI 304
Wasserdruck bis 6 bar
Schlauchanschluss R1/4" bzw. d = 10 mm
Gewicht ca. 3 kg

#### Collimator
Optional, lead, painted
Frontal or lateral radiation
To reduce background radiation
Weight approx. 10 kg

**Kollimator**
Optional, Blei, lackiert
Frontale oder seitliche Einstrahlung
Zur Reduzierung der Hintergrundstrahlung
Gewicht ca. 10 kg
## Electrical Design

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>by the connected evaluation unit: LB 44x or LB 47x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Versorgungspannung</td>
<td>durch die angeschlossene Auswerteeinheit: LB 44x oder LB 47x</td>
</tr>
</tbody>
</table>

### EMC

<table>
<thead>
<tr>
<th>Emissions:</th>
<th>according to EN 61326-1, Electrical Equipment Class B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunity:</td>
<td>according to EN 61326-1, according to EN 61326-3 (SIL2)</td>
</tr>
<tr>
<td></td>
<td>according to NAMUR NE21</td>
</tr>
</tbody>
</table>

#### EMV

- Störaussendung: nach EN 61326-1, Betriebsmittel der Klasse B
- Störfestigkeit: nach EN 61326-1, nach EN 61326-3 (SIL2) nach NAMUR NE21

### Core cross-section for the screw terminals

<table>
<thead>
<tr>
<th>Aderquerschnitt für die Schraubklemmen</th>
<th>0.75 mm² to 2.5 mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.75 mm² bis 2,5 mm²</td>
</tr>
</tbody>
</table>

### Max. cable length between detector and evaluation unit

<table>
<thead>
<tr>
<th>Max. Kabellänge zwischen Detektor und Auswerteeinheit</th>
<th>1000 m with BERTHOLD cables:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Id. Nr. 32024: Signal cable, 2x1.0 mm², black</td>
</tr>
<tr>
<td></td>
<td>Id. Nr. 46413: Signal cable Ex i, 2x1.0 mm², blue</td>
</tr>
<tr>
<td></td>
<td>Leitungsbelag kleiner 20 Ohm/km</td>
</tr>
</tbody>
</table>

### Count rate

<table>
<thead>
<tr>
<th>Zählrate</th>
<th>max. 1,000,000 CPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>max. 1.000.000 cps</td>
</tr>
</tbody>
</table>

### Temperature stability

<table>
<thead>
<tr>
<th>Temperatur Stabilität</th>
<th>≤ 0,01 %/°C (-40 ...+60 °C) for rod detectors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 0,002 %/°C (-40 ...+60 °C) for point detectors</td>
</tr>
</tbody>
</table>

### Pt100 input

<table>
<thead>
<tr>
<th>Pt100 Eingang</th>
<th>-40°C to 200°C, 0,24°C accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-40 °C bis 200 °C, Genauigkeit 0,24 °C</td>
</tr>
</tbody>
</table>
### Mechanical Design

| **Weights** | UniSENS Duo, 50 x 500 (polymer): approx. 13 kg  
with rod detector water cooling 500 mm (optional):  
additional approx. 6 kg  
UniSENS Duo, 50 x 1000 (polymer): approx. 17 kg  
with rod detector water cooling 1000 mm (optional):  
additional approx. 10 kg  
UniSENS Duo, 50 x 1500 (polymer): approx. 21 kg  
with rod detector water cooling 1500 mm (optional):  
additional approx. 13 kg  
UniSENS Duo, 50 x 2000 (polymer): approx. 27 kg  
with rod detector water cooling 2000 mm (optional):  
additional approx. 16 kg |
| **Gewichte** | UniSENS Duo, 50 x 500 (Polymer): ca. 13 kg  
mit Stabdetektor Wasserkühlung 500 mm (Option):  
zusätzlich ca. 6 kg  
UniSENS Duo, 50 x 1000 (Polymer): ca. 17 kg  
mit Stabdetektor Wasserkühlung 1000 mm (Option):  
zusätzlich ca. 10 kg  
UniSENS Duo, 50 x 1500 (Polymer): ca. 21 kg  
mit Stabdetektor Wasserkühlung 1500 mm (Option):  
zusätzlich ca. 13 kg  
UniSENS Duo, 50 x 2000 (Polymer): ca. 27 kg  
mit Stabdetektor Wasserkühlung 2000 mm (Option):  
zusätzlich ca. 16 kg |
| **Installation Lengths** | UniSENS Duo, 50 x 500 (polymer): approx. 930 mm  
UniSENS Duo, 50 x 1000 (polymer): approx. 1430 mm  
UniSENS Duo, 50 x 1500 (polymer): approx. 1930 mm  
UniSENS Duo, 50 x 2000 (polymer): approx. 2430 mm  
with rod detector water cooling (optional):  
additional approx. 10 mm  
| **Einbautenlängen** | UniSENS Duo, 50 x 500 (Polymer): ca. 930 mm  
UniSENS Duo, 50 x 1000 (Polymer): ca. 1430 mm  
UniSENS Duo, 50 x 1500 (Polymer): ca. 1930 mm  
UniSENS Duo, 50 x 2000 (Polymer): ca. 2430 mm  
mit Stabdetektor Wasserkühlung (Option):  
zusätzlich ca. 10 mm |
Point detectors CrystalSENS

**Mechanical Design**

| Weights | CrystalSENS Duo, 50 x 50 (NaI/Tl): approx. 9 kg  
|         | CrystalSENS Duo, 50 x 60 (polymer): approx. 9 kg  
|         | with collimator (optional): additional approx. 10 kg  
|         | with point detector water cooling (optional): additional approx. 3 kg |

| Installation Lengths | CrystalSENS Duo, 50 x 50 (NaI/Tl): approx. 460 mm  
|                      | CrystalSENS Duo, 50 x 60 (polymer): approx. 460 mm  
|                      | with collimator (optional): additional approx. 40 mm  
|                      | with point detector water cooling (optional): additional approx. 15 mm |

Point detectors SuperSENS

**Mechanical Design**

| Weights | SuperSENS with side irradiation: approx. 50 kg  
|         | SuperSENS with frontal irradiation: approx. 60 kg  
|         | with water cooling (optional): additional approx. 7 kg |

| Installation Lengths | SuperSENS with side irradiation: approx. 639 mm  
|                      | SuperSENS with frontal irradiation: approx. 619 mm |

---

**Technical Information – LB 4700 Detectors**

**Technische Information – LB 4700 Detektoren**

**Point detectors CrystalSENS**

**Punktdetektoren CrystalSENS**

**Mechanical Design**

**Mechanischer Aufbau**

| Weights | CrystalSENS Duo, 50 x 50 (NaI/Tl): ca. 9 kg  
|         | CrystalSENS Duo, 50 x 60 (Polymer): ca. 9 kg  
|         | mit Kollimator (Option): zusätzlich ca. 10 kg  
|         | mit Punktdetektor Wasserkühlung (Option): zusätzlich ca. 3 kg |

| Installation Lengths | CrystalSENS Duo, 50 x 50 (NaI/Tl): ca. 460 mm  
|                      | CrystalSENS Duo, 50 x 60 (Polymer): ca. 460 mm  
|                      | mit Kollimator (Option): zusätzlich ca. 40 mm  
|                      | mit Punktdetektor Wasserkühlung (Option): zusätzlich ca. 15 mm |

**Point detectors SuperSENS**

**Punktdetektoren SuperSENS**

**Mechanical Design**

**Mechanischer Aufbau**

| Weights | SuperSENS mit seitlicher Einstrahlung: ca. 50 kg  
|         | SuperSENS mit frontaler Einstrahlung: ca. 60 kg  
|         | mit Wasserkühlung (Option): zusätzlich ca. 7 kg |

| Installation Lengths | SuperSENS mit seitlicher Einstrahlung: ca. 639 mm  
|                      | SuperSENS mit frontaler Einstrahlung: ca. 619 mm |

---
### Scintillator

#### Mechanical Design

<table>
<thead>
<tr>
<th>Scintillator</th>
<th>Point detectors:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NaI(Tl) crystal 50x50 mm</td>
</tr>
<tr>
<td></td>
<td>NaI(Tl) Crystal 40x35 mm</td>
</tr>
<tr>
<td></td>
<td>NaI(Tl) Crystal 25x25 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer scintillator 50x60 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer scintillator 150x150 mm</td>
</tr>
<tr>
<td>Rod detectors:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Polymer scintillator 50x500 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer scintillator 50x1000 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer scintillator 50x1500 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer scintillator 50x2000 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Szintillator</th>
<th>Punktdetektoren:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NaI(Tl) Kristall 50x50 mm</td>
</tr>
<tr>
<td></td>
<td>NaI(Tl) Kristall 40x35 mm</td>
</tr>
<tr>
<td></td>
<td>NaI(Tl) Kristall 25x25 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer-Szintillator 50x60 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer Szintillator 150x150 mm</td>
</tr>
<tr>
<td>Stabdetektoren:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Polymer-Szintillator 50x500 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer-Szintillator 50x1000 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer-Szintillator 50x1500 mm</td>
</tr>
<tr>
<td></td>
<td>Polymer-Szintillator 50x2000 mm</td>
</tr>
</tbody>
</table>

#### Typical sensitivity (Cs-137)

| Point detectors: |
| CrystalSENS Duo, 50 x 50 (NaI/Tl): ≥1200 cps / μSv/h |
| CrystalSENS Duo, 40 x 35 (NaI/Tl): ≥600 cps / μSv/h |
| CrystalSENS Duo, 20 x 20 (NaI/Tl): ≥200 cps / μSv/h |
| CrystalSENS Duo, 50 x 60 (polymer): ≥700 cps / μSv/h |
| SuperSENS Duo, 150 x 150 (NaI/Tl): ≥8200 cps / μSv/h |

| Rod detectors: |
| UniSENS Duo, 50 x 500 (polymer): ≥6,000 cps / μSv/h |
| UniSENS Duo, 50 x 1000 (polymer): ≥11,000 cps / μSv/h |
| UniSENS Duo, 50 x 1500 (polymer): ≥17,000 cps / μSv/h |
| UniSENS Duo, 50 x 2000 (polymer): ≥25,000 cps / μSv/h |

| Punktdetektoren: |
| CrystalSENS Duo, 50 x 50 (NaI/Tl): ≥1200 cps/ μSv/h |
| CrystalSENS Duo, 40 x 35 (NaI/Tl): ≥600 cps / μSv/h |
| CrystalSENS Duo, 20 x 20 (NaI/Tl): ≥200 cps / μSv/h |
| CrystalSENS Duo, 50 x 60 (polymer): ≥700 cps / μSv/h |
| SuperSENS Duo, 150 x 150 (NaI/Tl): ≥8200 cps / μSv/h |

| Stabdetektoren: |
| UniSENS Duo, 50 x 500 (Polymer): ≥6.000 cps/ μSv/h |
| UniSENS Duo, 50 x 1000 (Polymer): ≥11.000 cps/ μSv/h |
| UniSENS Duo, 50 x 1500 (Polymer): ≥16.000 cps/ μSv/h |
| UniSENS Duo, 50 x 2000 (Polymer): ≥25.000 cps/ μSv/h |
Cooling Water Demand
Kühlwasserbedarf

Cooling Water Demand point detector
Kühlwasserbedarf Punkt detector

![Graph showing cooling water demand point detector](image)

Cooling Water Demand rod detector 500mm
Kühlwasserbedarf Stab detector 500mm

![Graph showing cooling water demand rod detector 500mm](image)
Cooling Water Demand rod detector 1000mm
*Kühlwasserbedarf Stabdetektor 1000mm*

Cooling Water Demand rod detector 1500mm
*Kühlwasserbedarf Stabdetektor 1500mm*
Cooling Water Demand rod detector 2000mm

Kühlwasserbedarf Stabdetektor 2000mm

Diagram showing the relationship between ambient temperature and water flow rate for different cooling water inlet temperatures (10°C, 20°C, 30°C).
Technical Information – LB 4700 Detectors

**Notice**: HINWEIS

Only by the LB Number Key, the detector can be uniquely identified (Scintillator, size, certification, etc.).

Nur durch den LB-Nummernschlüssel kann der Detektor eindeutig identifiziert werden (Szintillator Größe, Zertifikate, etc.).

---

### Number Key LB 4700 Detectors

**Nummernschlüssel LB 4700 Detektoren**

#### Device family / Gerätefamilie

<table>
<thead>
<tr>
<th>Number</th>
<th>4700</th>
<th>DuoSeries</th>
</tr>
</thead>
</table>

---

#### Scintillator

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1</td>
<td>50/50 NaI CrystalSENS</td>
</tr>
<tr>
<td>1 2</td>
<td>50/50 NaI CrystalSENS with WC</td>
</tr>
<tr>
<td>1 3</td>
<td>40/35 NaI CrystalSENS with WC</td>
</tr>
<tr>
<td>1 4</td>
<td>40/35 NaI CrystalSENS</td>
</tr>
<tr>
<td>1 5</td>
<td>25/25 NaI CrystalSENS with WC</td>
</tr>
<tr>
<td>1 6</td>
<td>25/25 NaI CrystalSENS</td>
</tr>
<tr>
<td>1 7</td>
<td>44/5 Am/Cm CrystalSENS</td>
</tr>
<tr>
<td>1 A</td>
<td>50/60 polymer CrystalSENS</td>
</tr>
<tr>
<td>1 B</td>
<td>50/60 polymer CrystalSENS with WC</td>
</tr>
<tr>
<td>2 A</td>
<td>500 mm UniSENS</td>
</tr>
<tr>
<td>2 B</td>
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</tr>
<tr>
<td>2 C</td>
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<td>2 D</td>
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<tr>
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<td>2 F</td>
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<tr>
<td>2 G</td>
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<td>2 H</td>
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<tr>
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<tr>
<td>2 J</td>
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<tr>
<td>2 K</td>
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</tr>
<tr>
<td>2 L</td>
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</tr>
<tr>
<td>3 1</td>
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</tr>
<tr>
<td>3 2</td>
<td>150/150 Super-Sens+WC</td>
</tr>
<tr>
<td>3 8</td>
<td>125/50 NaI CrystalSENS</td>
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<tr>
<td>4 1</td>
<td>1000 mm Tower-Sens</td>
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<tr>
<td>4 2</td>
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<tr>
<td>4 3</td>
<td>2000 mm Tower-Sens</td>
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<tr>
<td>4 4</td>
<td>2000 mm Tower-Sens+WC</td>
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#### Temperature regime

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#### Housing Material

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<td>316L</td>
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#### Collimator

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<tr>
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<td>none</td>
</tr>
<tr>
<td>a</td>
<td>front</td>
</tr>
<tr>
<td>r</td>
<td>side</td>
</tr>
<tr>
<td>8</td>
<td>without separate supply</td>
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#### Openings

<table>
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<tr>
<td>0</td>
<td>1x M12x1.5; 1xM16; radial</td>
</tr>
<tr>
<td>1</td>
<td>2x 1/2&quot;NPT; radial</td>
</tr>
<tr>
<td>2</td>
<td>M16x1.5; axial</td>
</tr>
<tr>
<td>3</td>
<td>M20x1.5; axial</td>
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<tr>
<td>4</td>
<td>M25x1.5; axial</td>
</tr>
<tr>
<td>5</td>
<td>M32x1.5; axial</td>
</tr>
<tr>
<td>6</td>
<td>1/2*NPT; axial</td>
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</tbody>
</table>

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#### Certification: class: signal

<table>
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<tr>
<td>0 0</td>
<td>No explosion certificate; passive</td>
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<tr>
<td>1</td>
<td>ATEX (IECEEx/Ex-d/e/t; passive resp. Slave</td>
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<tr>
<td>F</td>
<td>Division (NEC/CEC); XP, passive resp. Slave</td>
</tr>
<tr>
<td>I</td>
<td>Zones (ATEX / IECEEx / NEC / CEC); Ex-di/i/t; passive resp. Slave</td>
</tr>
</tbody>
</table>

---

**Berthold**

56926TI Rev.02, 02/2021
EU Declaration of Conformity

We, hereby declare under our sole responsibility that the design of the following products / systems / units brought into circulation by us comply with the relevant harmonized rules of the EU.

This declaration loses its validity should modifications or unsuitable and improper use take place without our authorisation.

Description: detector for radiometrical measurement system in non hazardous environments

Typ: LB 4700-xx-00-xx-xx-xxx

x = all letters

directive | applied standards
---|---
EMC 2014/30/EU | EN 61326-1 2013
RoHS 2011/65/EG | EN 50581 2012

This declaration is issued by the manufacturer

BERTHOLD TECHNOLOGIES GmbH & Co. KG
calmbacher Str. 22, D-75323 Bad Wildbad, Germany
released by

Dr. J. Brüggmann

Head of R&D
Bad Wildbad, 23rd of May, 2019
Konformitätserklärung

EU-Konformitätserklärung (Original)  Dok. Nr.: CE20027-7

Hiermit erklären wir in alleiniger Verantwortung, dass die Bauart das(r) nachfolgend bezeichneten Geräte / Systems / Anlage in der von uns in den Verkehr gebrachten Ausführung den unten genannten einschlägigen Harmonisierungsvorschriften der EU entsprechen.

Durch nicht mit uns abgestimmte Änderungen oder nicht bestimmungsgemäßen Gebrauch verliert diese Erklärung ihre Gültigkeit.

Produktbezeichnung: Detektor für radiometrische Messsysteme in nicht explosionsgefährdeten Bereichen

Typenbezeichnung: LB 4700-xx-00-xx-xx-xxx

x = beliebiges Zeichen

<table>
<thead>
<tr>
<th>Richtlinie</th>
<th>angewendete Normen und weitere Spezifikationen</th>
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<tbody>
<tr>
<td>EMV 2014/30/EU</td>
<td>EN 61326-1 2013</td>
</tr>
<tr>
<td>RoHS 2011/65/EG</td>
<td>EN 50581 2012</td>
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</table>

Diese Erklärung wird verantwortlich für den Hersteller

BERTHOLD TECHNOLOGIES GmbH & Co. KG
Calmbacher Str. 22, D-75323 Bad Wildbad
abgegeben durch

Dr. J. Briggmann
Leiter Entwicklung
Bad Wildbad, den 23. Mai 2019

Registriergenrt / Court of Registration: Stuttgart HRA 330991
Personlich haftende Gesellschafterin / Fully liable Associates: Berthold Technologies
Registriergenrt / Court of Registration: Stuttgart HRA 331520
Geschäftsführung / Management: Andreas Doeratz
Deutsche Steuernummer / German Tax No.: DE81305051
WEEE-Reg. No.: DE99909090
Bankverbindung / Bank Details: BANZ. 922
Konto / Account: 09038/08030
Sparkasse Pforzheim-Calw
Volkbank Pforzheim
CommerzBank Pforzheim

detect and identify

56926Ti Rev.02, 02/2021