Evaluation Unit

DUO XPERT LB 470 Level

Operating Manual
56925BA2

Rev. No.: 04, 05/2020
Embedded software version as of vers. 1.4.0 (CU and MU)

BERTHOLD TECHNOLOGIES GmbH & Co. KG
Calmbacher Str. 22
75323 Bad Wildbad, Germany
www.berthold.com

Telephone +49 7081 177-0
Fax +49 7081 177-100
industry@berthold.com

Table of Contents

1 About this Operating Manual

1.1 Applicable Documents

This manual contains the following document:

- Informations sur la sécurité, 56925BA59 (see appendix)
- Technical Information, 56925TI1L (see appendix)

1.2 Some Prior Remarks

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

This operating manual illustrates how to:

- set up/install the product
- make electrical connections
- perform measurements
- apply software settings
- Install the extension module (optional)
- 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 refer to Berthold.

1.3 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.

1.4 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.

1.5 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 services are not performed by the manufacturer Berthold.

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

NOTICE

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

1.6 Structure of the Operating Manual

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

1.7 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.

1.8 Representation

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

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

1.9 Warning Notes

Warning notes are designed as follows:

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:** Specifies how the hazard can be avoided.
- **In case of emergency:** Specifies which actions are required in the event of the occurrence of risk.

1.9.1 Symbols used in the Operating Manual

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.

NOTICE

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

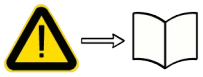
IMPORTANT

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.

1.9.2 Symbols used on the Device



Read 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.

Direct voltage

The device is operated with direct voltage and may only be connected with a direct voltage source.

Alternating voltage

The device is operated with alternating voltage and may only be connected with an alternating voltage source.

No domestic waste

The electric product must not be disposed of in domestic waste.

1.10 Conformity

The company Berthold hereby declares in its sole responsibility that the design of this product, which is brought to the market by Berthold, complies with relevant EU directives stated in the original declaration of conformity.

This statement shall become void in the case of changes not authorised by Berthold or improper use.

For the original declaration of conformity, please refer to Declaration of Conformity in Technical Information (see appendix).

2 Safety

2.1 Dangers and Safety Measures

- Read these instructions 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 evaluation unit DuoXpert LB 470 (EVU) measures the level together with compatible detectors and an appropriate radiation source and may only be used for this purpose.

The following constitutes proper use:

- Adhering strictly to the instructions and operation sequences and not undertaking any different, unauthorised practices which could endanger your safety and the operational reliability of the EVU!
- Observing the given safety instructions!
- Carrying out the prescribed maintenance measures or having them carried out for you!
- Only use accessories and spare parts from Berthold.

Improper use to be prevented:

- Failing to observe the specified safety instructions and instructions for the operation, maintenance and disposal in the operating manual.
- Any non-compliance with the present operating manual for the supplied products.
- Applying conditions and requirements which do not conform to those stated in the technical documents, data sheets, operation manuals and assembly instructions and other specific guidelines of the manufacturer.
- Use of the product if parts of it are damaged or corroded. This also applies for seals and used cables.
- Restructuring or changing the system components.
- The product is not suitable for use in potentially explosive areas and may therefore not be operated in such areas. The product is not explosion-proof.
- Operation ...
  - in a state where live parts are accessible.
  - in a wall housing with inadequately sealed glands and / or insufficiently tightened or damaged cable glands.
- Operation without the safety precautions provided by the manufacturer.
- Manipulation or avoidance of existing safety equipment.

Berthold shall only accept liability for / guarantee the correspondence of the device to its publicised specifications.

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

NOTICE

The device is not approved according to IEC 61508 “Functional safety of safety-related electric/electronic/programmable electronic systems”.

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.

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

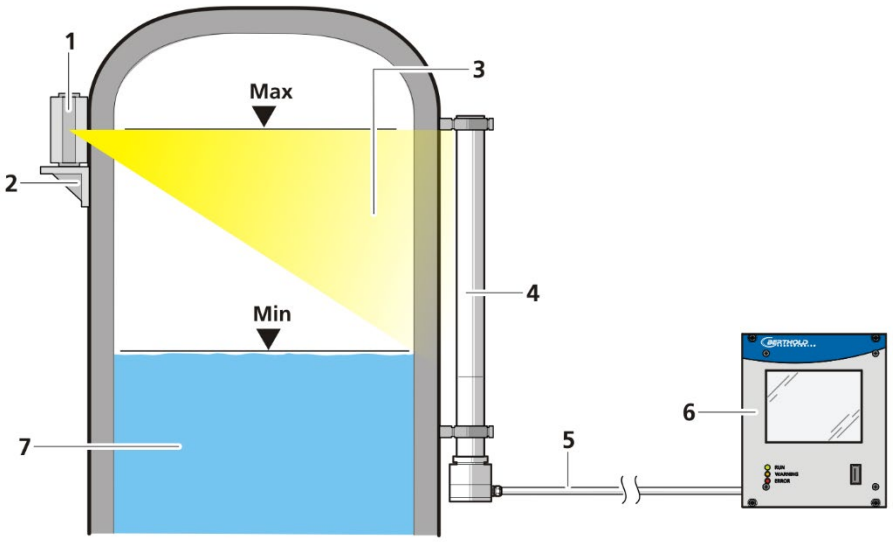
3.1 Overview

The level measuring device LB 470 is an industrial measuring system for the contactless and continuous determination of the level of a product in a container.

A complete measuring system consists of the following components:

- Evaluation unit DuoXpert LB 470
- Source
- Shields
- Point detector / rod detector(s)

These instructions concern the operation of the evaluation unit DuoXpert LB 470 (Fig. 1, item 6). The operation of other system components is part of the independent instructions of the respective system components. The EVUs are standard equipment in switch rooms with 19" subracks or switchboards.



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

Fig. 1 Example measurement arrangement

3.2 Measuring Principle

Gamma radiation is used to penetrate a medium in a container. The attenuation of the radiation is analysed to measure the level in the container.

The evaluation DuoXpert LB 470 (master EVU) is used for the evaluation, transmission and visualisation of measured values which it receives from the connected detectors.

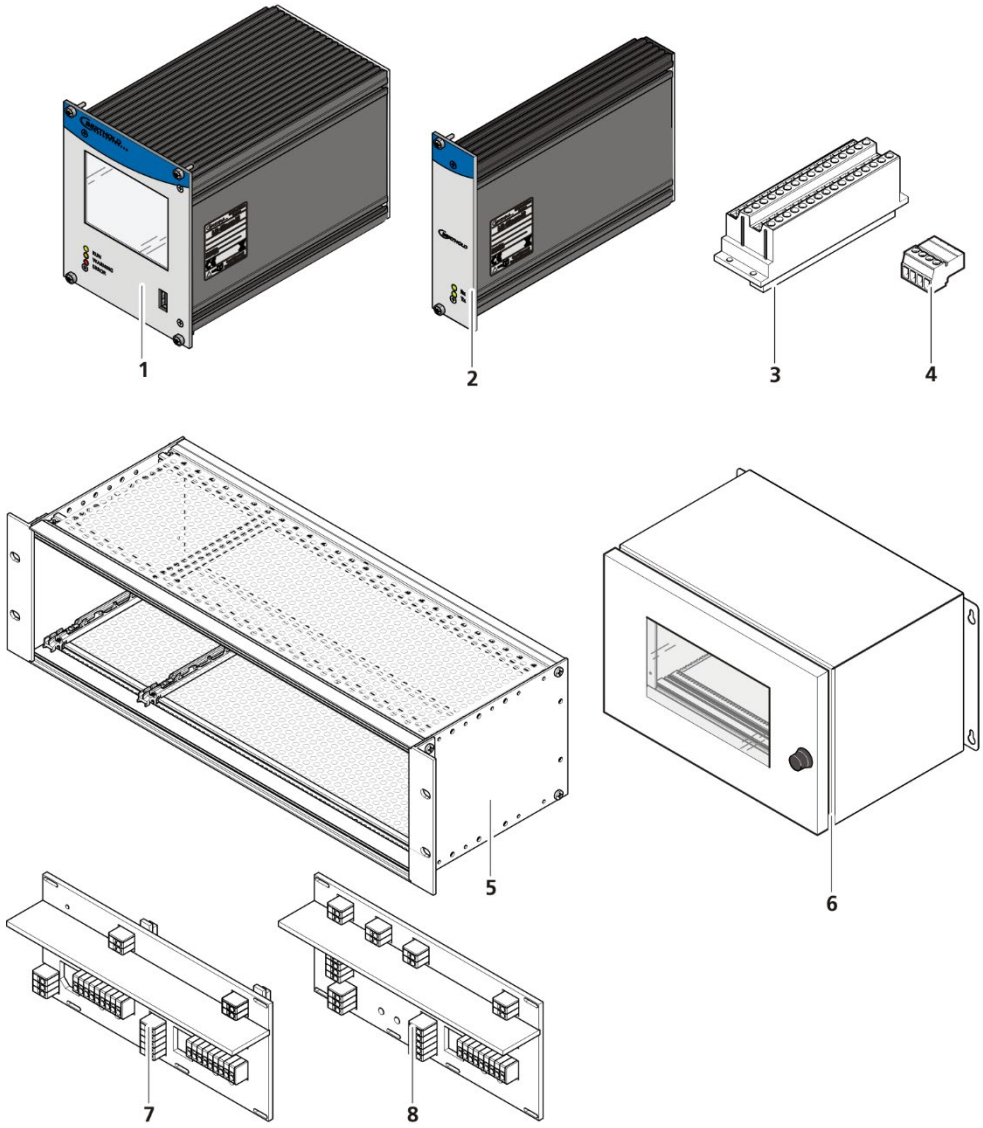
The EVU is an independent measurement channel. If several measurement channels are required, an independent EVU must be used for each channel.

For covering larger measuring ranges with level measurements, it is possible to connect multiple detectors on a level measuring device LB 470. To do this, an additional slave module is required (optional) for each additional detector after the first. A maximum of 16 slave modules can be connected per master EVU. A cascaded measurement system with a maximum of 17 detectors can be set up in this way.

Tip

Further information on the functional principle of the detectors can be found in the operating manual.

3.3 System Components



1 Master-EVU with wide range supply (100-240 V AC, 50/60 Hz)
Alternatively: Master-EVU with 24 V supply (18-32 V DC)
2 Slave module with wide range power supply (optional)
Alternatively: Slave module with 24 V supply (optional)
3 Clamp block for electrical connections (optional)
only for installation in subrack / switchboard)
4 Master/Slave connector
5 19" subrack (optional)
6 Wall housing (optional)
7 Backplane Master-Master with cover
8 Backplane Master-Slave with cover

Fig. 2 System components

3.3.1 Software

The EVU is delivered with pre-installed software. The revision status (version) of the software can be seen on the screen display when starting up the EVU or in the menu "Device information" (Chapter 7.1.2).

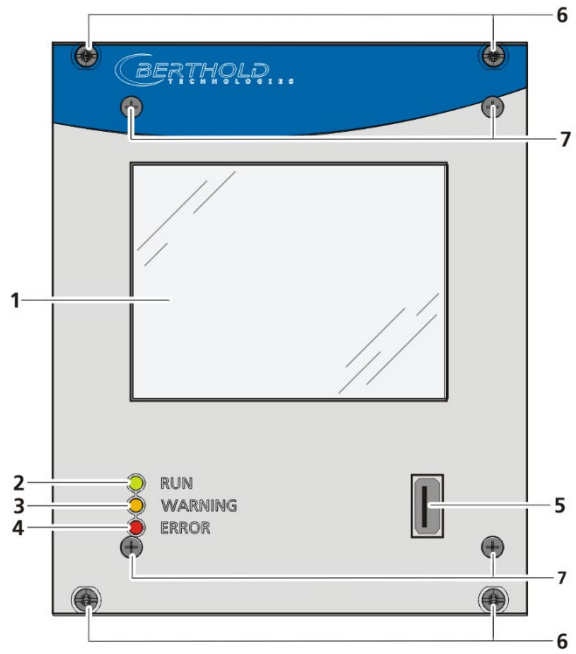
This operating manual describes the software version 1.4.0 (Control Unit / CU and Measurement Unit / MU).

3.3.2 Front/rear View Master EVU

Front View Master EVU

The following control elements are found on the front of the master EVU:

- LEDs for status display of individual operating states
- 3.5'' Touch display
- USB port.



1 3.5'' Touch display
2 RUN LED
3 WARNING LED
4 ERROR LED
5 USB port
6 Mounting screws
7 Screws front plate

Fig. 3 Front view of the master EVU

Operation Display / Touch Screen

The EVU is operated via the touch screen. Alternatively, the device can be connected to a mouse at the USB port. The mouse pointer automatically becomes visible when a mouse is inserted into the USB port. The device can also operated by remote control (see chap. 7.3.1).

NOTICE

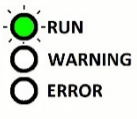
Damage to the touch screen

Pointed or sharp objects can damage the plastic surface of the touchscreen.

- ▶ Operate the touch screen only with your fingers or with a touch pen or connect a mouse.

Status Displays of the Master EVU

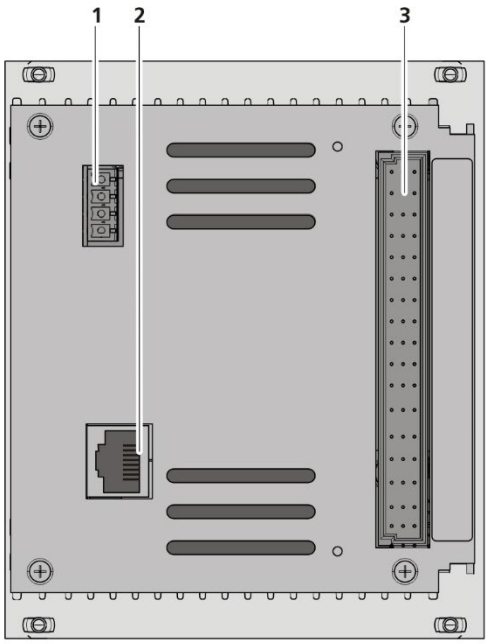
The LEDs (fig.1, items 2-4) below the touch display show the current operating status of the master EVU.

Display LED	Description
	**RUN** This LED lights up green if the device is in operation and fault-free.
	**RUN (flashing)** The RUN LED flashes green while the measurement is (held) in the STOP state by user actions (e.g. stop function, simulation mode, plateau recording).
	**WARNING** This LED lights up yellow when a system event of the type "Outside of specification","Maintenance required" or "Function check" is present. All system events are described in chapter 9.
	**ERROR** This LED lights up red if a system event of the type "Failure" is present. The current measurement is retained. Check the device settings. All system events are described in chapter 9.
	**RUN / WARNING / ERROR flashing** All three LEDS flash during the system test which is performed as part of the start up process.

Rear View Master EVU

The following connections are located on the back of the EVU:

- Master/slave connector, 4-pin
- RJ45 socket for Ethernet
- 32-pin plug connector



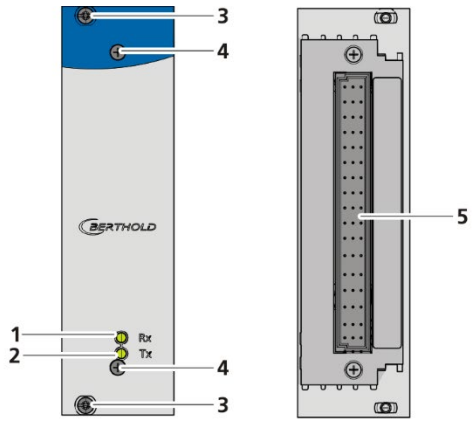
1 Master/slave 4-pin connector
2 RJ45 socket for Ethernet
3 32-pin plug connector

Fig. 4 Rear view master EVU

3.3.3 Front/rear View Slave Module

The LEDs Rx and Tx are found on the front of the slave module.

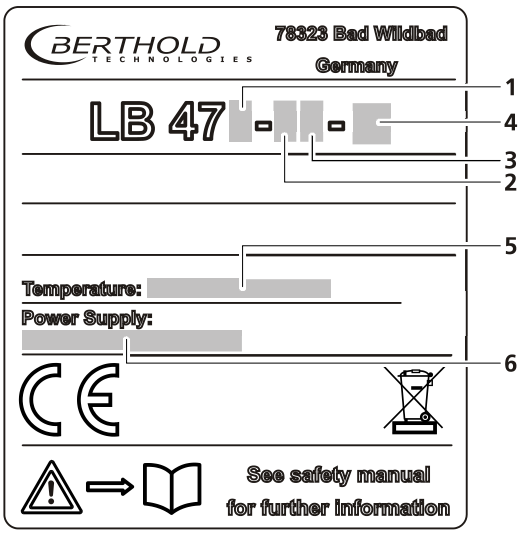
- The LED Rx flashes green when data is received.
- The LED Tx flashes green when data is sent.
- The 32-pin plug connector is found on the back side.



1 LED Rx
2 LED Tx
3 Mounting screws
4 Screws front plate
5 32-pin plug connector

Fig. 5 Front/rear view slave module

3.3.4 Type Plate



1 Application
2 Approval explosion protection (0 = no explosion approval)
3 Power supply (1 = 24 V DC; 2=100…240 V AC -10 +10%)
4 Master (M) or slave (S)
5 Permissible temperature range for operation (ambient temperature)
6 Power specifications

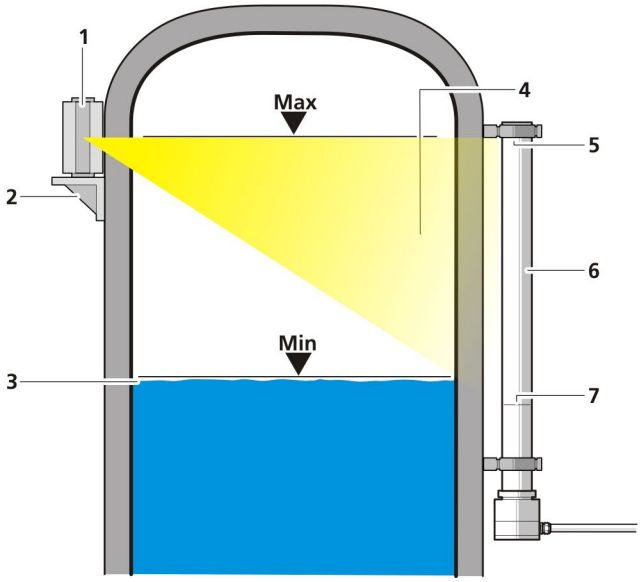
Fig. 6 Type plate

3.4 Measurement Arrangements

The detector and/or the source are rod-shaped for a radiometric level measurement, so as to form a triangular or rectangular useful beam field. The change of the measurement signal for different level results from the different sized covering of the radiation field.

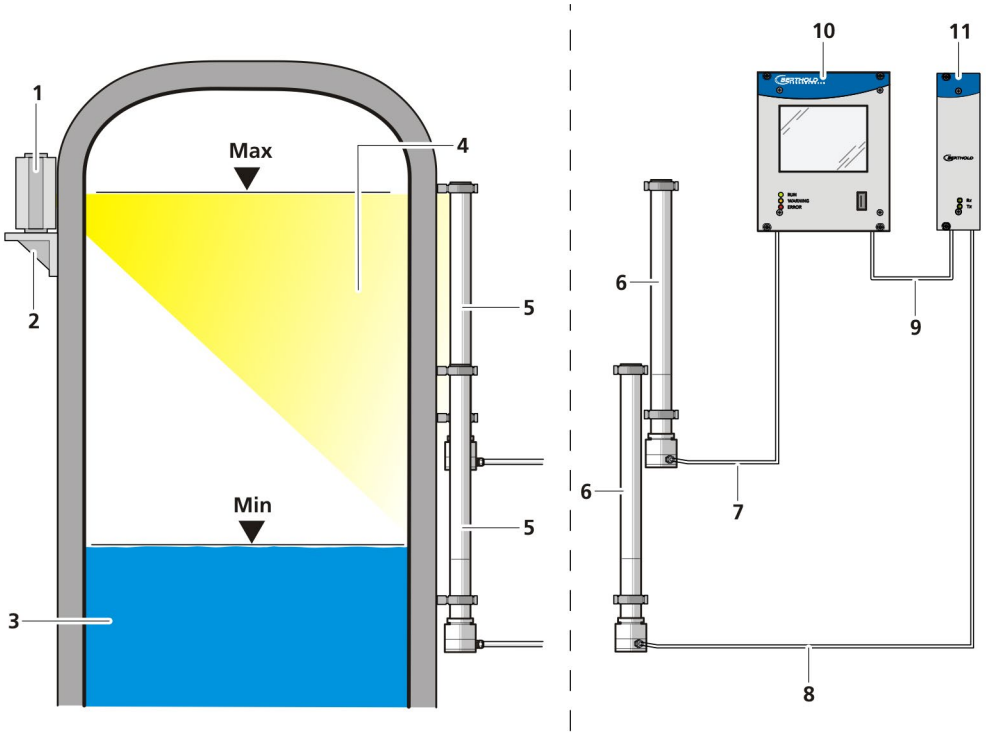
The marking grooves on the detector housing highlight the sensitive area of the detector. The detector must be mounted on the container so that the desired measuring range is covered by the sensitive area.

In a cascaded system (with multiple detectors), the lower marking groove of the 1st detector must match the upper of the 2nd detector etc. (Fig. 8).



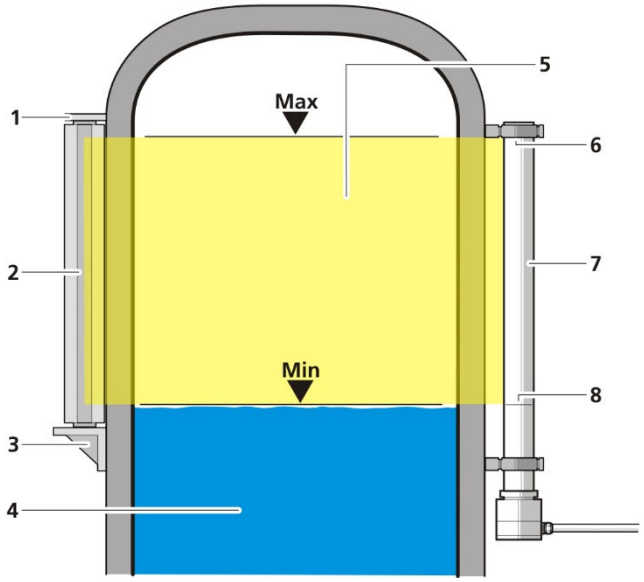
1 Point source / shield
2 Mounting base
3 Level
4 Radiation field
5 Upper marking groove
6 Rod detector
7 Lower marking groove

Fig. 7 Schema point source-rod detector



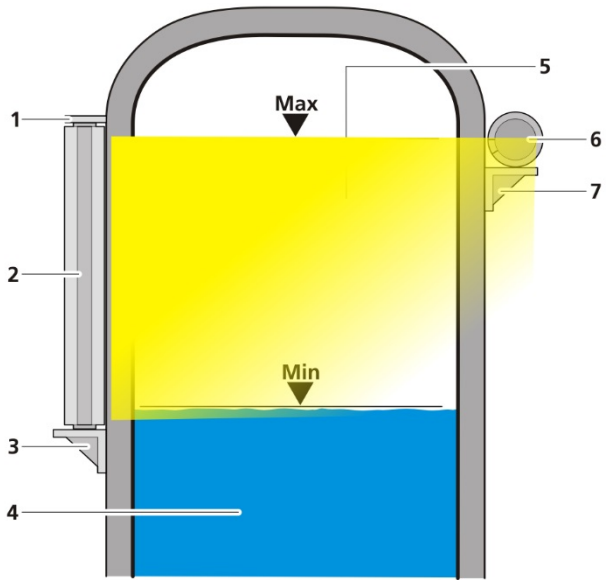
1 Point source / shield
2 Mounting base
3 min / max level
4 Radiation field
5 Rod detector 1 + 2
6 Rod detector 1 + 2 (side view)
7 Measurement line (1st detector - master EVU)
8 Measurement line (2nd detector - slave module)
9 Connection master EVU - slave module
10 Master EVU
11 Slave module

Fig. 8 Schema point source-rod detector cascaded



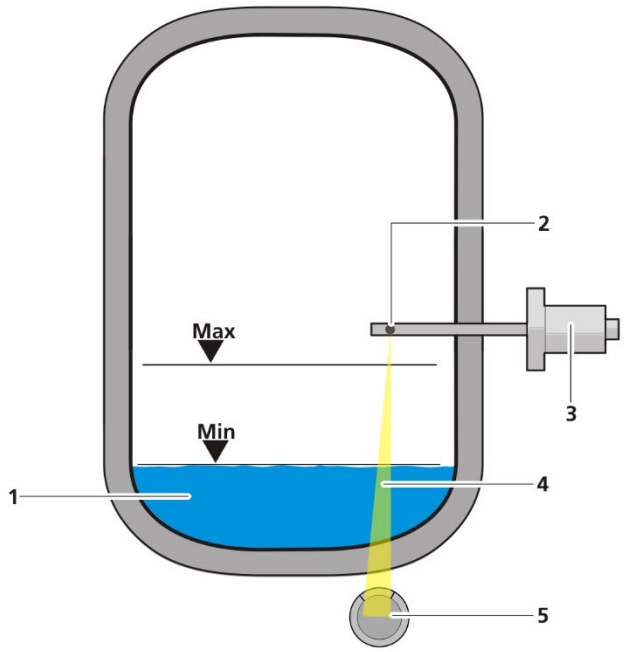
1 Mounting base
2 Rod source / shield
3 Mounting base
4 Min/max level
5 Radiation field
6 Upper marking groove
7 Rod detector
8 Lower marking groove

Fig. 9 Schema rod source - rod detector



1 Mounting base
2 Rod source / shield
3 Mounting base
4 Min/max level
5 Radiation field
6 Detector
7 Mounting base

Fig. 10 Schema rod source - point detector



1 Min / max level
2 Point source in the dip tube
3 Shield
4 Radiation beam
5 Detector

Fig. 11 Schema point source - point detector (absorption level measurement)

The detector and the source are usually formed as points in an absorption level measurement.

Based on the arrangement of source and detector (Fig. 11), the change in the measurement signal results from the different material thickness of the product being measured.

3.5 Storage

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

4 Installation

4.1 General Instructions

The applicable national regulations of the country of use have to be observed. Repair and maintenance on the devices may only be performed by experts (see chapter 2.3). In case of doubt, the complete device must be returned to Berthold for repair.

NOTICE

The Evaluation unit is not explosion protected and is not designed for hazardous environments.

Only mounting accessories approved by Berthold should be used for installation of the devices. The device should only be operated if firmly installed.

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 Installation Variants

See document “Technical Information” in the appendix.

4.4 Mounting the Wall Housing

Observe the permitted ambient conditions (refer to document "Technical Information" in the appendix).

NOTICE

- It is recommended that the wall housing be protected from direct sunlight in order to maintain maximum ambient temperature (refer to “Technical Information”).
- The wall housing must not be walked on, used as a climbing aid or otherwise used for other purposes (storage, attachment point).

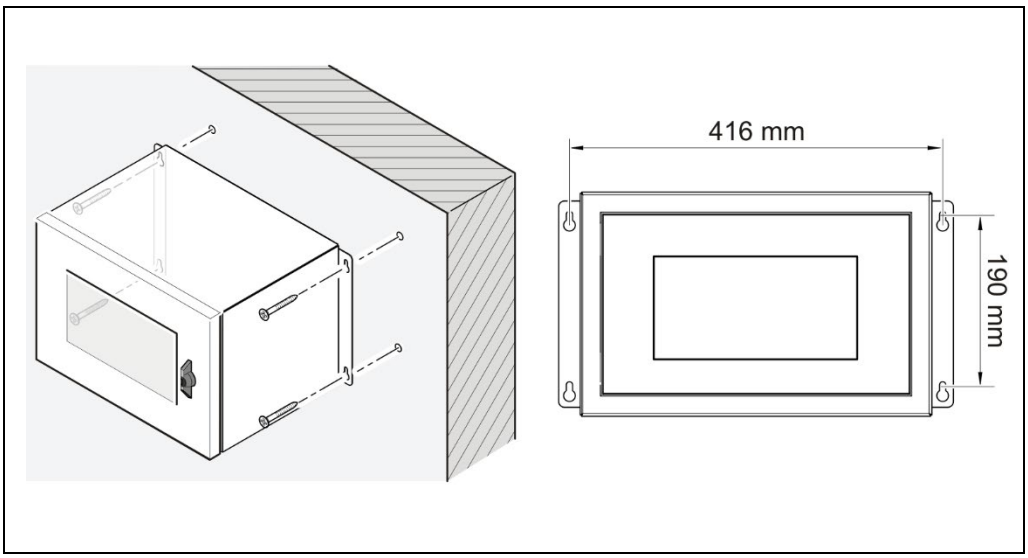


Fig. 12 Mounting the wall housing

1. Mount the wall housing horizontally and in user-friendly height.
2. Prepare the holes.
3. Use sufficient sized mounting material.
4. For the total weight of the wall housing, use adequately sized mounting hardware.
5. Screw the housing securely to the wall.

IMPORTANT

Make sure that only authorized personnel can open the wall housing.

- Keep the key of the wall housing in a place where only authorized persons have access.

- The wall housing is installed correctly.

4.5 Installation in the Wall Housing

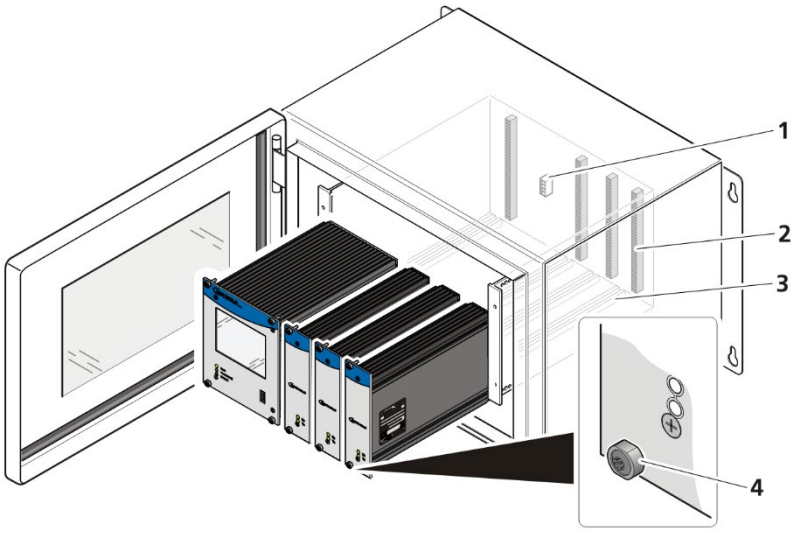
The wall housing may be equipped differently, depending on requirements (refer to document “Technical Information”). To do this, a corresponding terminal panel is located in the wall housing.

NOTICE

The master EVUs / slave modules must be secured against pulling out by fixing screws (Fig. 13, item 4).

- The device must be disconnected from the mains voltage before it is pulled out.

Installation of the Modules (Master-Slave)



1 Master-slave connector
2 Socket board
3 Guide rails
4 Fixing screws

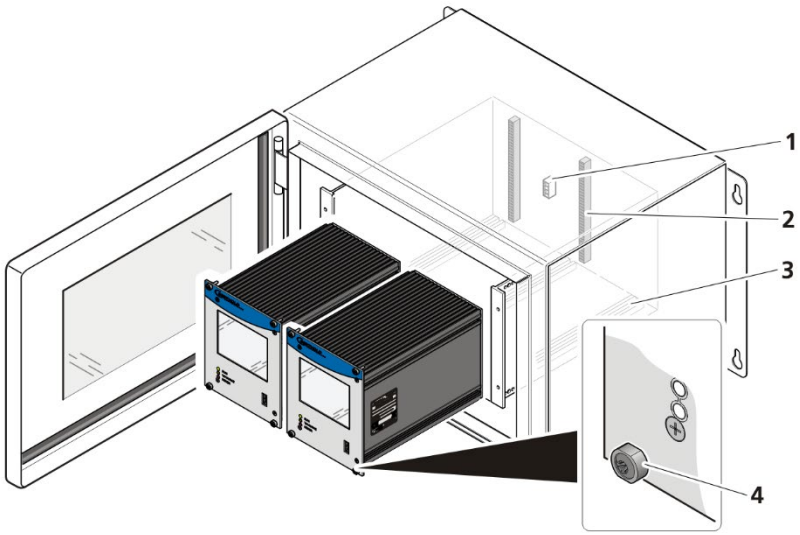
Fig. 13 Installation of the modules (Ex.: 1 master, 3x slave)

1. Set modules into the guide rails and push it gently until the plug connector of the module (Fig. 13, item 2) is inserted into the socket board.
2. Tighten all fixing screws (Fig. 13, item 4).

- The modules are installed correctly.

3. Unused slots must be covered with dummy panels.

Installation of the Modules (Master-Master)



1 Master-slave connector
2 Socket board
3 Guide rails
4 Fixing screws

Fig. 14 Installation of the modules (master-master)

1. Set modules into the guide rails and push it gently until the plug connector of the module (Fig. 14, item 2) is inserted into the socket board.
2. Tighten all fixing screws (Fig. 14, item 4).

▶ The modules are installed correctly.

3. Unused slots must be covered with dummy panels.

4.6 Installation in the 19" Subrack

The 19" subrack can be equipped differently, depending on requirements (see chap. 4.3 Installation Variants). The rear clamp blocks (Fig. 15, item 3) or terminal panels (Fig. 16, item 4) are used for the electrical connection.

NOTICE

The 19" subrack may only be installed in a dry environment.

The subrack is installed in a 19" control cabinet or a control panel (switchboard). The 4 side holes (Fig. 15, item 4) that should be provided with fitting screws are used to fasten the subrack.

NOTICE

The EVU is delivered equipped, depending on the order. The installation of the modules is only necessary if:

- another measurement channel is to be fitted.
- a defective module is to be replaced.

Installation with Clamp Blocks

⚠ DANGER

Danger to life from electric shock!

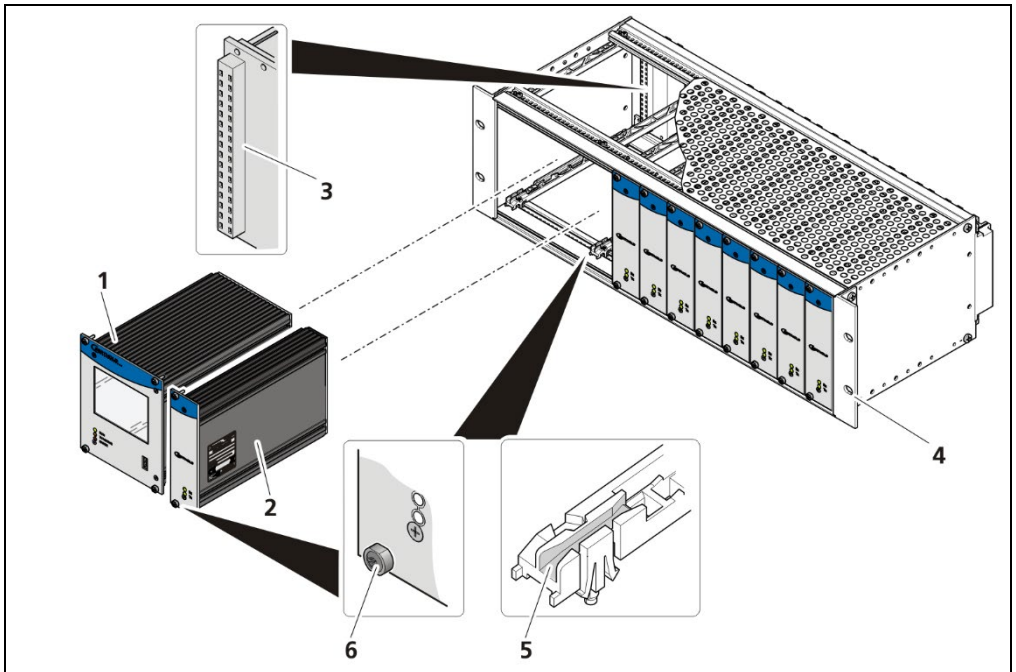
- Installation/maintenance may only be carried out if the device has been de-energised.
- Test of absence of harmful voltages when the front side is open.

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

NOTICE

The master's EVUs / slave modules must be secured against pulling out by fixing screws (Fig. 15, item 6).

- The device must be disconnected from the mains voltage before it is pulled out.



1	Master EVU	4	Drilling
2	Slave module	5	Guide rail
3	Clamp block	6	Fixing screw

Fig. 15 19" subrack with clamp block (Ex.: 1x Master, 9xSlave)

1. Set master EVU / slave module (Fig. 15, item 1, item 2) in the guide rails (Fig. Fig. 15, item 5).
2. Carefully slide module into the subrack until the plug connector is inserted into the clamp block.
3. Tighten fixing screws (Fig. 15, item 6).

- The EVU is correctly inserted and can be connected.

4. Unused slots must be covered with dummy panels.

Installed with Terminal Panels

⚠ DANGER

Danger to life from electric shock!

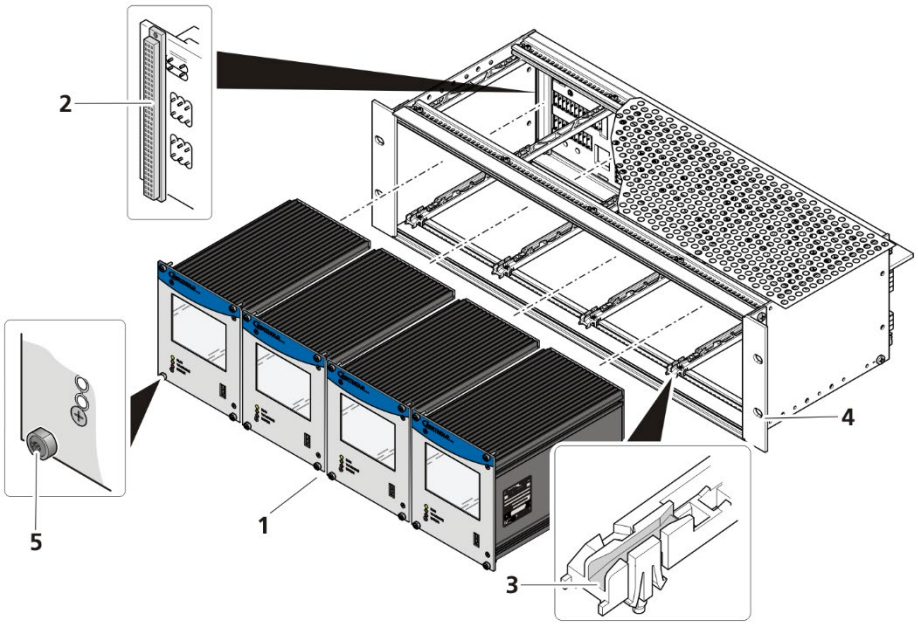
- Installation/maintenance may only be carried out if the device has been de-energised.
- Test of absence of harmful voltages when the front side is open.

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

NOTICE

The master's EVUs / slave modules must be secured against pulling out by fixing screws (Fig. 16, item 5).

- The device must be disconnected from the mains voltage before it is pulled out.



1 Master EVU
2 Socket board terminal panel
3 Guide rails
4 Drilling
5 Fixing screws

Fig. 16 19" subrack with terminal panel (Ex.: 4x master)

1. Set master EVU / slave module (Fig. 16, item 1) into the guide rails (Fig. 16, item 3).
2. Carefully slide module into the subrack until the plug connector is inserted into the socket board (Fig. 16, item 2).
3. Tighten fixing screws (Fig. 16, item 5).
- The EVU is correctly inserted and can be connected.
4. Unused slots must be covered with dummy panels.

5 Electric Installation

5.1 General Instructions

⚠ 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.
- Open the housing only in a dry environment and for installation, maintenance and servicing.
- During installation and servicing on the hardware as well as during wiring of the detector, the measuring system, connected relay contacts and all inputs and outputs must be de-energised.
- Connect only devices onto the product that comply with the applicable safety standards.

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

NOTICE

Apply the voltage of the specified and marked range only!

NOTICE

The relay of the LB 470 can only switch low voltages. Please note the specifications in appendix Technical Information.

The power source of 24 V DC version of the product must meet the requirements of the Low Voltage Directive and be equipped with double or reinforced insulation.

The voltage parameters of all devices connected to the outputs of the product (e.g. relay circuit, RS-485, current output) must comply with the limit values of the safety directives for electrical measurement, control, regulation and laboratory devices (DIN EN 61010-1) and be equipped with double or reinforced insulation. These protective measures are necessary to avoid the risk of contact with life-threatening voltages. Changing the installation without precise knowledge of this operating manual is not permitted.

General important points for installation

- Connect the earth conductor.
- Ground the housing.
- Please observe the information signs on the devices.

5.1.1 Circuit Breaker

A circuit breaker according to DIN EN 61010-1

- must be available,
- must be easily accessible for the maintenance personnel and
- is to be included in the company-internal documentation.

The master EVUs / slave modules are not equipped with a separate ON/OFF switch to connect or disconnect the voltage supply. Make sure that the system can be de-energised via the external power supply.

The circuit breaker can be installed as an automatic fuse or switch and has to comply with the requirements according to IEC 947-1 and IEC 947-3. If a fuse is applied, it must not be triggered under a current strength of 4 A per device.

IMPORTANT

The circuit breaker must be located near the device and be properly marked as belonging to it.

5.1.2 Cables and Lines

- Lines are to be connected with special care.
- Connection lines and routing must comply with the applicable regulations.
- When routing the cables, make sure that the cable insulation cannot be mechanically damaged by sharp edges or movable metal parts.
- Use the approved Berthold cable or a cable with equivalent specifications for the connection.

For intrinsically safe systems, the detector must be connected to the equipotential bonding of the system. The detector is connected via a 2-core (0.2 ... 2.5 mm²) cable with approx. 5 ... 10 mm diameter. A screened cable must be used in systems with extremely strong electrical noise. The screen may only be laid out on one side of the detector. The maximum cable length depends on the cable resistance, which may not exceed a total (there and back) of 40 ohms. For standard cables from Berthold (Id. no. 32024), this results in a cable length of 1000 m, from the evaluation unit to the detector.

When routing the connection lines, make sure that

- signal lines (detector cables, power signal cables) are not laid together with supply lines,
- no dirt or moisture reaches the connection room,
- the conductors are not damaged when the cable insulation is removed,
- the conductor insulation or the sleeve of the wire end ferrules reach into the housing of the terminal unit,
- blank, conductive segments of the lines (e.g. wires of a litz wire) do not reach outside the terminal unit,
- the wire end ferrule or the stripped wire have a length of 8 mm so that the wire is held securely in the clamp,
- the line insulation reaches into the sleeve of the wire end ferrule if these components are used,

- the admissible minimum bending radius for the respective line cross-section is not exceeded and
- the cables are laid out in a strain-relieved and friction-free manner.
- only use cables whose diameters are approved for the respective cable gland. The cables must comply with the requirements and cross-sections specified in the technical data.
- the connected cables must be suitable for a temperature that is at least 10°C above the maximum permissible ambient temperature.

5.1.3 Cable Glands and Blanking Elements

- The feeding of cables into the wall housing is only permitted via a cable entry.
- Cable glands must be suitable for the respective application.
- All cable glands must be assembled according to manufacturer's instructions and be tightened to the appropriate tightening torque.
- Cable glands that are not required for installation must be covered with suitable blanking elements.
- Line cross-sections must comply with the respectively used cables.
- Cable bushings and blanking elements must comply with the applicable IP protection class and with the requirements for the operational environment.
- We recommend ordering missing cable glands, blanking elements or adapters from Berthold.

5.1.4 Protective Earth and Equipotential Bonding

- The protective earth conductor has to be connected to the terminals marked with "PE".
- The housing must be connected to local equipotential bonding.

5.1.5 EIA-485 (RS-485) Network

For integration of EVU units into an EIA-485 (RS-485) network, all participants must be connected one after the other in the configuration Master-Master. Star connection is not permitted.

The first and last station (physical, independent of the master's position) on the network needs a terminating resistor of 121 Ω.

5.2 Exchange LB 44x to LB 47x

NOTICE

If you install a DuoSeries LB 47x transmitter, in order to replace a LB 44x, it is necessary to consider an incompatibility in the connecting terminals.

In the most unfavorable case a short circuit in the connected terminals can happen!

- ▶ Consider the following information.

When using the terminal blocks, the most important electrical connections are identical (detector connection, current output, voltage supply). Other terminals like the I/O connections are not compatible.

The following figure shows the terminal assignments of the DuoSeries LB 47x.

- Green: Identical connections LB 44x / DuoSeries LB 47x
- Red: Changed clamp assignment DuoSeries LB 47x in comparison to LB 44x

Signal	Pin	C	A	Pin	Signal
DETECTOR GND	C - 2			A - 2	DETECTOR +
not assigned	C - 4			A - 4	not assigned
not assigned	C - 6			A - 6	not assigned
not assigned	C - 8			A - 8	not assigned
RELAY 3 COM	C - 10			A - 10	RELAY 3 NO
RELAY 2 COM	C - 12			A - 12	RELAY 2 NO
RELAY 1 NC	C - 14			A - 14	RELAY 2 NC
RELAY 1 COM	C - 16			A - 16	RELAY 1 NO
DIGITAL IN 1	C - 18			A - 18	DIGITAL IN GND
DIGITAL IN 2	C - 20			A - 20	+ 24 V
CURRENT IN + (⎍)	C - 22			A - 22	CURRENT IN – (⊥)
RS 485 B	C - 24			A - 24	RS 485 A
CURRENT OUT –	C - 26			A - 26	CURRENT OUT +
not assigned	C - 28			A - 28	not assigned
100-240 V AC, 24 V DC –	C - 30			A - 30	100-240 V AC, 24 V DC +
Protective conductor PE	C - 32			A - 32	Protective conductor PE

Fig. 17 Assignment clamp block at exchange LB 44x -> LB 47x

NOTICE

Together with an exchange unit a terminal sticker is delivered that must be placed on the terminal block.

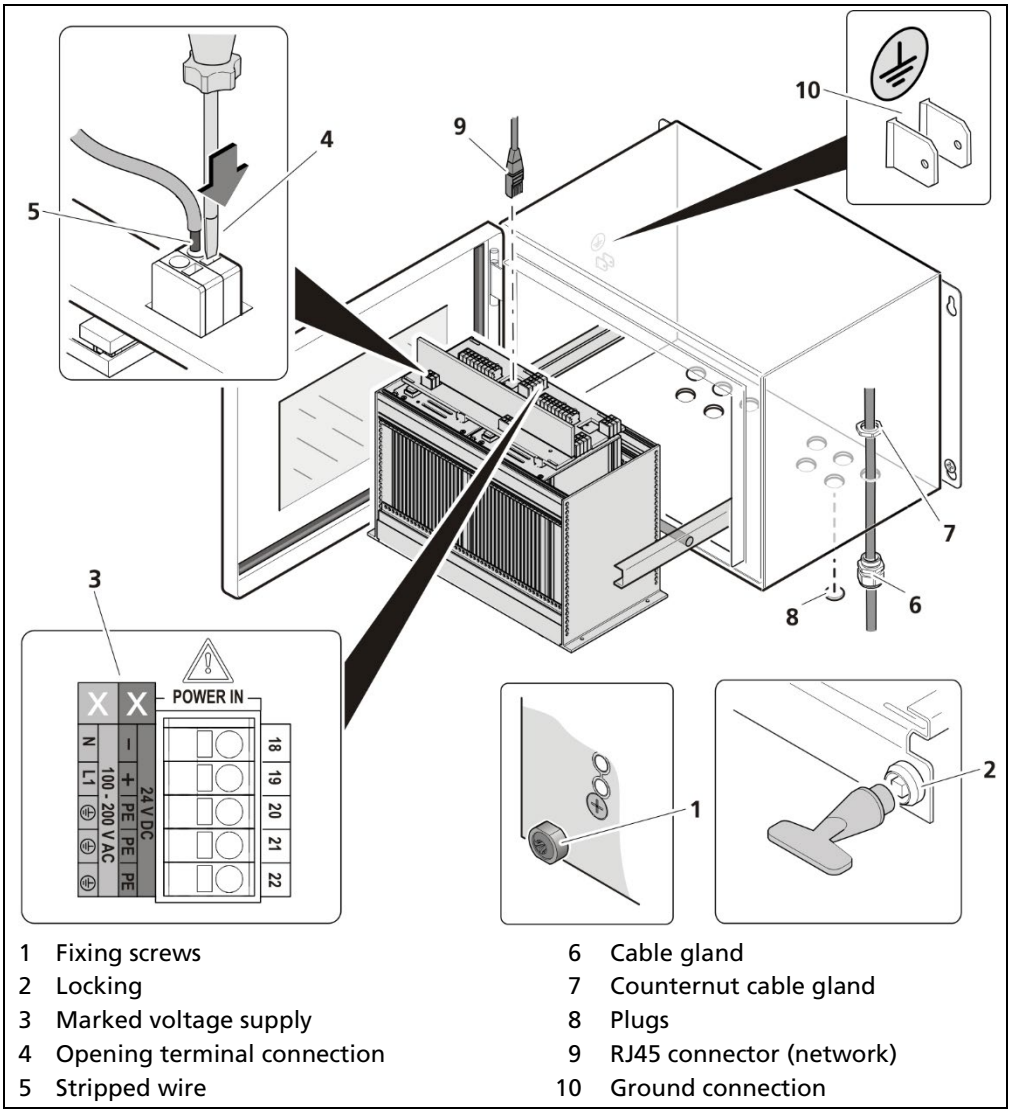
5.3 Electric Connection in the Wall Housing

⚠ 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.



1	Fixing screws	6	Cable gland
2	Locking	7	Counternut cable gland
3	Marked voltage supply	8	Plugs
4	Opening terminal connection	9	RJ45 connector (network)
5	Stripped wire	10	Ground connection

Fig. 18 Electrical connection in the wall housing (Example: master-master)

1. Make sure that the locking bolts (Fig. 18, item 1) of all modules are tightened in order to prevent slipping.
2. Loosen the lock (Fig. 18, item 2) using the supplied square key and pull the subrack out.
3. Fold the subrack downward cautiously.

4. Run the cables through the cable glands (Fig. 18, item 6) through the openings of the wall housing and through the counternut cable glands (Fig. 18, item 7).
5. Screw the the cable glands (Fig. 18, item 6) with the counternut cable glands (Fig. 18, item 7).

NOTICE

Apply the voltage of the specified and marked (Fig. 18, item 3) range only!

NOTICE

Note the specification relating to Cables, Protective earth, equipotential bonding and EIA-485 (RS-485) in chapter 5.1.

6. Connect the lines according to assignment (see document “Technical Information”) to the terminal board.
7. Open the terminal connection (Fig. 18, item 4) with an operating tool (slotted screwdriver) and insert the stripped wire (min. 8 mm) (Fig. 20,item 5). The terminal connection closes by pulling out the operating tool. The terminal connections are designed for the flexible wires:
   - 0.2 mm² … 2.5 mm² or AWG 24 …12 without end sleeve
   - 0.25 mm² ... 2.5 mm² with end sleeve without plastic sleeve
   - 0.25 mm² ... 1.5 mm² with end sleeve with plastic sleeve.
8. Plug the network plug into the RJ45 socket (Fig. 18, item 9) (optional).
9. Check the correct connection of the ground connection (Fig. 18, item 10).
10. Tighten all cable glands (Fig. 18, item 6) to ensure optimal sealing and tension relief until the gasket insert closes between screw down nut and cable.
11. Check tension relief of all cable glands by pulling the cables smoothly.

▶ The cables must not move. If necessary tighten the cap nuts of the cable glands.

12. Slide the subrack into the wall housing and lock it with the square wrench.

▶ The connection was made correctly.

NOTICE

The wall enclosure is supplied with blanking elements in all cable glands. It must be ensured that there are blanking elements in all unused cable glands. Otherwise, the IP protection is not given.

NOTICE

Only use cable that is suitable for connection to the corresponding terminals may be used. Detailed specifications can be found in the chapter 5.1.2 Cables and Lines.

Tip

The master/slave connections of the installed devices are already manufactured above the circuit board in the wall housing. If additional slave modules (e.g. from other wall housings) are connected, the terminals appropriate for use on the terminal board should be used.

5.4 Electrical Connection in a 19" Subrack with Terminal Board

⚠ 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.

NOTICE

Prior to initial start-up, the voltage range (Fig. 19, item 8) must be marked with chemical resistance on all input and output terminals!

Only cable that is suitable for connection to the corresponding terminals may be used. Detailed specifications can be found in the chapter 5.1.2 Cables and Lines.

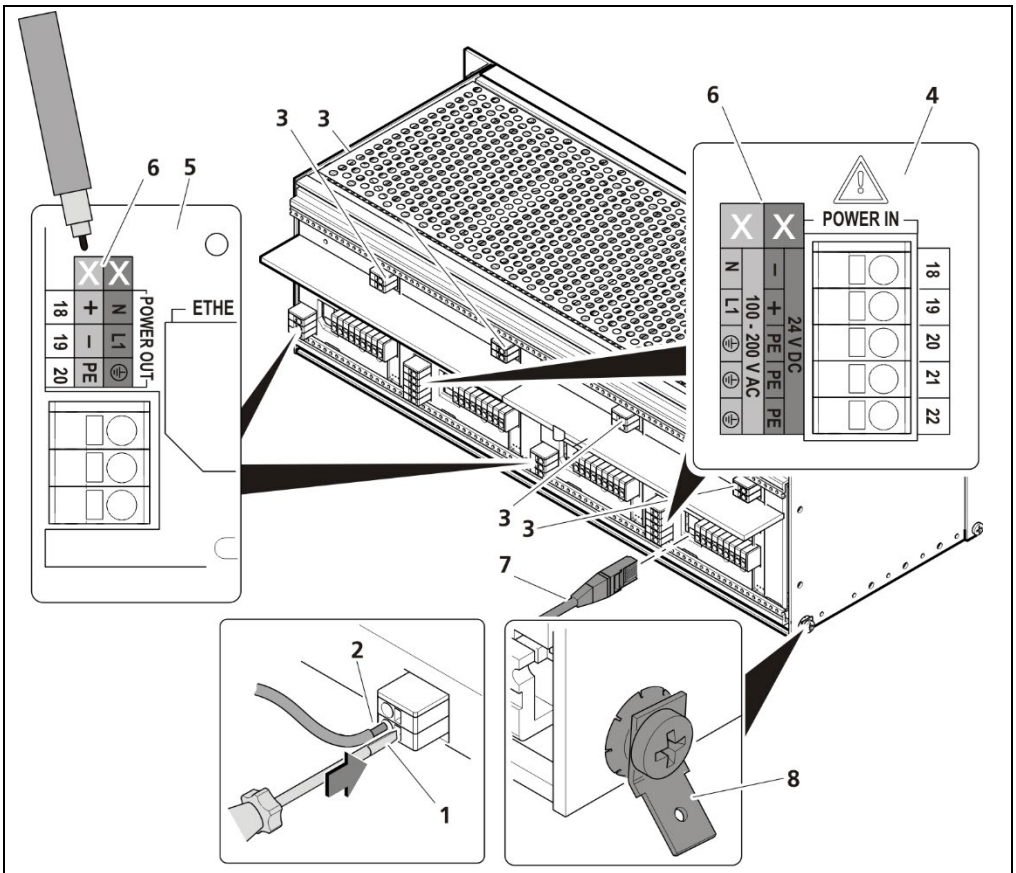
The 19" subrack must be accessible from the rear for the electrical installation.

The terminal board master/slave is used twice (Fig. 19, item 2) for the variant to install 2 master EVUs and 6 slave modules.

The terminal board master/master (Fig. 19, item 1) is used twice for the variant to install 4 master EVUs.

master / master
CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D

master / 3x slave
CHANNEL A
CHANNEL B



1	Opening terminal connection	5	Voltage output
2	Stripped wire	6	Marking supply voltage
3	Connection detector	7	RJ45 connector (network)
4	Supply voltage	8	PE connection

Fig. 19 Electrical connection in the 19" subrack

NOTICE

Apply the voltage of the specified and marked (Fig. 19, item 6) range only!

- Note the specification relating to Cables, Protective earth, equipotential bonding and EIA-485 (RS-485) in chapter 5.1.

1. Unused slots must be closed with blinds.
2. Label the voltage range permanently and chemically (Fig. 19, item 6).
3. Connect the lines according to assignment (see document "Technical Information") to the terminal board.
4. Open the terminal connection (Fig. 19, item 1) with an operating tool (slotted screwdriver) and insert the stripped wire (min. 8 mm) (Fig. 19, item 2). The terminal connection closes by pulling out the operating tool. The terminal connections are designed for the flexible wires:
   - 0.2 mm² … 2.5 mm² or AWG 24 …12 without end sleeve
   - 0.25 mm² ... 2.5 mm² with end sleeve without plastic sleeve
   - 0.25 mm² ... 1.5 mm² with end sleeve with plastic sleeve.
5. Plug the network plug into the RJ45 socket (Fig. 19, item 7) (optional).
6. Check the correct connection of the PE conductor (Fig. 19, item 8).

NOTICE

Note the specification relating to Protective earth and equipotential bonding in chapter 5.1.4.

- The connection was made correctly.

5.5 Electrical Connection in the 19” Subrack with Clamp Block

⚠ 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.

If the units are installed in the 19" subrack without terminal board, the electrical connections are made via clamp blocks. These clamp blocks are already installed in the 19" subracks and are also available as an optional accessory.

IMPORTANT

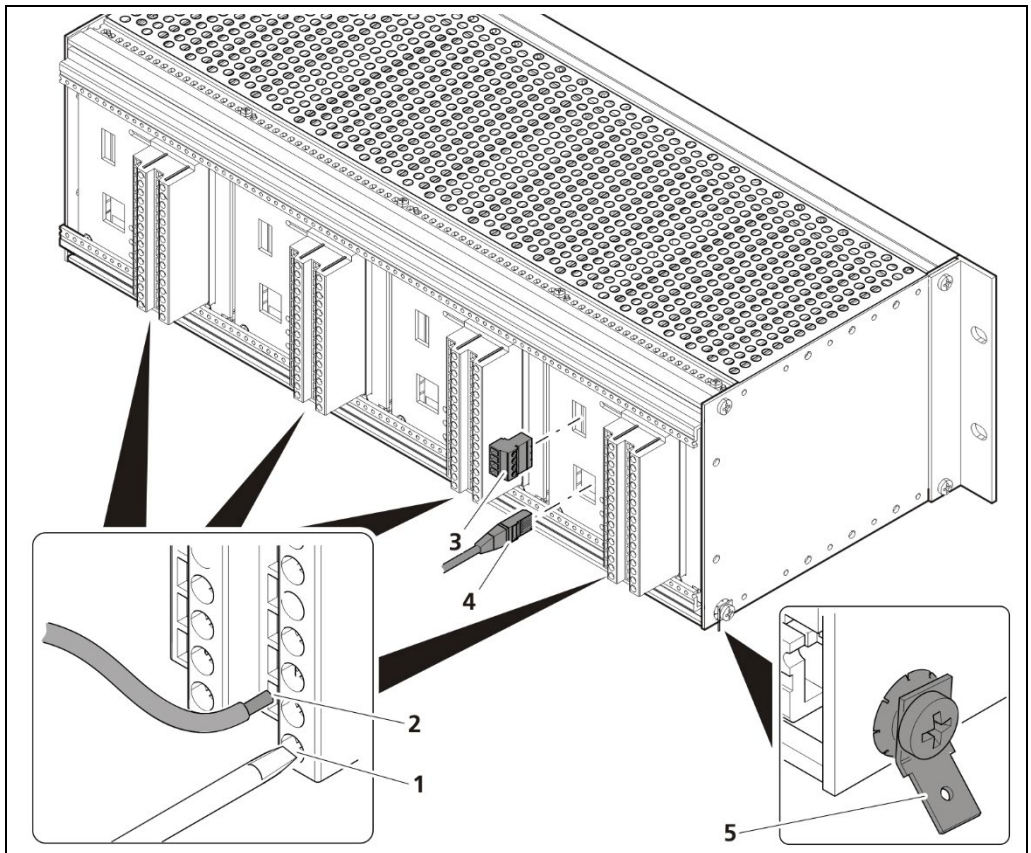
In the case of applications with clamp blocks a contact protection must be provided by the customer when voltage is applied. The cable connections of clamp blocks have to be in accordance with IEC 61010-1 (2010).

The connection between the master EVU and slave modules is made with a 4-pin master/slave plug (see chap. 5.6).

NOTICE

The LB 470 is restricted pin-compatible with the terminals of the LB 440. The pins for the power supply, the detector interface and the current output are at the same position. If only those ports are used, then a LB 440 can be replaced by a LB 470 without re-wiring.

- Note information in chapter 5.2 Exchange LB 44x to LB 47x.



1 Clamping screw (M2.5)
2 Opening terminal connection
3 4-pin master/slave plug (only master EVU) terminals 41-44
4 RJ45 connector (network)
5 PE connection

Fig. 20 Electrical connection in the 19" component rack (Ex.: 4x Master)

1. Unused slots must be closed with blinds.
2. Connect the lines to the clamp blocks according to assignment (see document "Technical Information"). To ensure protection against accidental contact in accordance with EN61010-1, the rear side with the terminals must be covered with a protective cover, e.g. with a door of a 19" cabinet.
3. Open the clamping screw (Fig. 20, item 1) and insert the stripped wire (min. 8 mm).

▶ The terminal connections are designed for wires with a conductor cross-section from 0.2 mm² to 2.5 mm².

4. Screw the terminal screws with a tightening torque of 0.4 - 0.5 Nm.
5. Plug in the master/slave plug and reconnect the lines in accordance with assignment (chap. 5.6).
6. Plug the network plug into the RJ45 socket (Fig. 20, item 4) (optional).
7. Check the correct connection of the PE conductor (Fig. 20, item 5).

NOTICE

Note the specification relating to Protective earth and equipotential bonding in chapter 5.1.4.

NOTICE

Only cable that is suitable for connection to the corresponding terminals may be used. For further specifications, see appendix “Technical Information”.

- The connection was made correctly.

5.6 Assignment Terminals Master/Slave Plug

Signal	Pin
TxD	41
RxD	42
RTS	43
GND	44

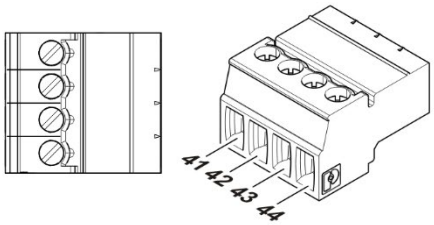


Fig. 21 Assignment Terminals master/slave plug

5.7 Switching Current Output

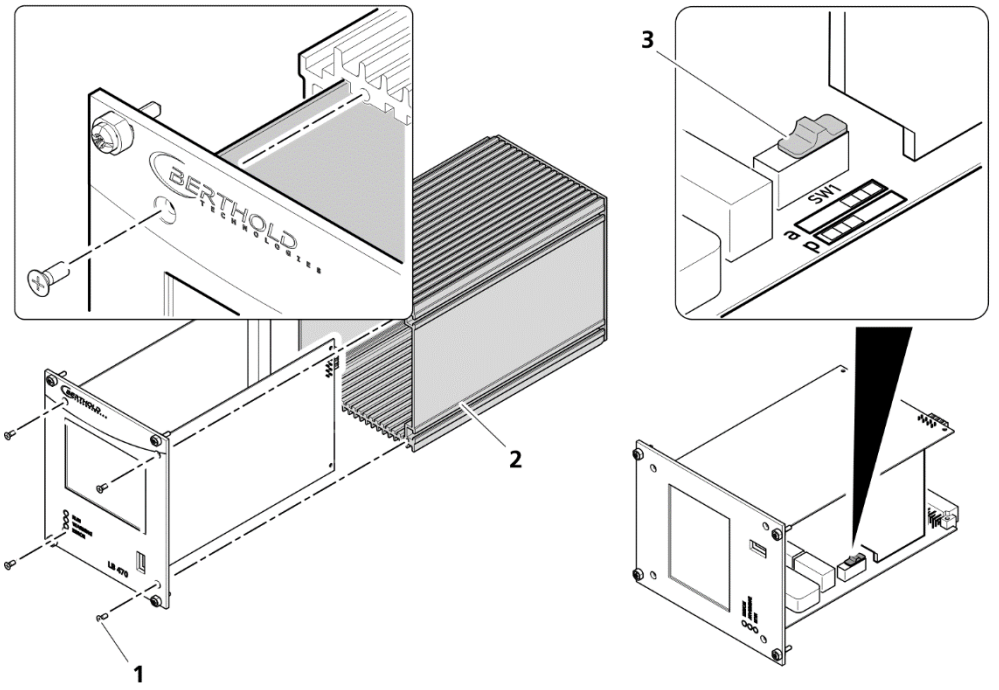
Switching between "SOURCE" (active) and "SINK" (passive) is possible using the slide switch on the I/O board. Factory setting EVU is delivered in "SOURCE" mode.

⚠ DANGER

Danger to life from electric shock!

- The switching may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Switching 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.



1 Screws
2 Housing
3 Slide switch (a=active "SOURCE"; p=passive "SINK")

Fig. 22 Switching of the current output

1. Loosen the four sunken screws on the front side of the EVU (Fig. 22, item 1).
2. Pull out the housing (Fig. 22, item 2) carefully.
3. Slide the switch (Fig. 22, item 3) to position *a* for "active" (SOURCE), to position *p* for "passive" (SINK).
4. Carefully insert the front panel into the housing. Pay attention to the correct guide rail!
5. Screw the front panel to the housing (Fig. 22, item 2) with the four screws (Fig. 22, item 1).

- The switching has been carried out correctly.

6 Operation of the Software

6.1 System Start

Fig. 23 Start screen with display of the software version

System Start with invalid application Software

A different menu structure is present in this mode.

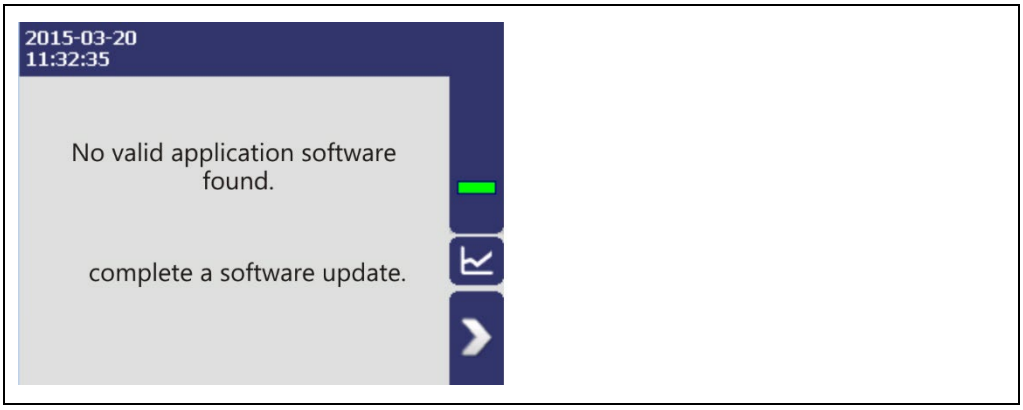


Fig. 24 Start screen (Invalid application software)

IMPORTANT

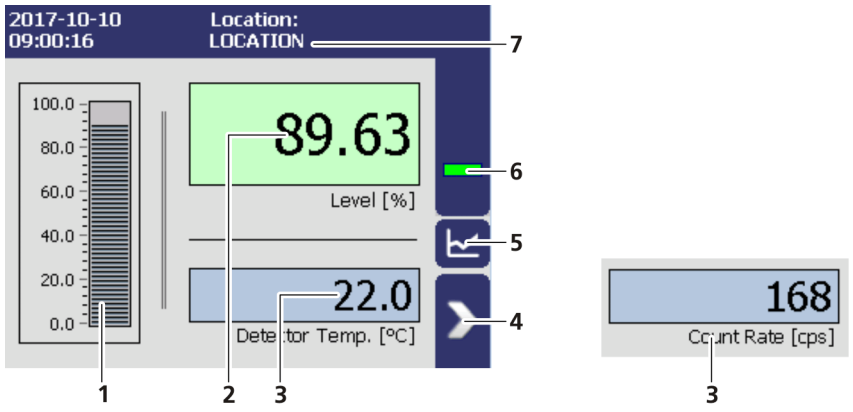
The communication between the sensor and EVU is limited to 1200 baud. Accordingly, there is a load time for data that are retrieved in the detector.

6.2 EVU Standard Display

IMPORTANT

Changing the language of the user interface is changed in menu Device Setup | Setup | System | Interfaces | Languages.

Click on the blue field in order to switch the display between detector temperature (Fig. 32, item 3) and count rate (Fig. 32, item 3). The designation of the measuring point (Fig. 32, item 7) can be changed in Chapter 7.1.1.

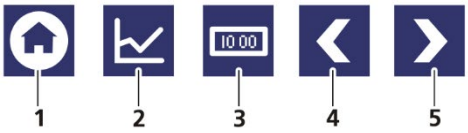


1 level scale [%]
2 level display [%]
3 Detector temperature / Count rate [cps]
4 Menu
5 Diagram display
6 Status information
7 Location of the measuring point

Fig. 25 Standard display of the EVU

Location	Name of the measuring point in the menu Device Setup | Identification.
Date and Time	The date and time displayed in the menu Device Setup | Setup | System | Date/Time was set.
Level scale	The scale range of the set PV value in the menu Device Setup | Setup | System | Calibration | Calibration Settings displayed.
Process value	The current process value with the set unit in the menu Device Setup | Setup | System | Calibration | Units displayed.
Count rate [cps]	The current count rate is displayed. Click on the blue field to switch between count rate, RID count rate and product temperature.
Temperature detector	Display of the current temperature of the detector with the in the menu Device Setup | Setup | System | Units selected unit.
Button "Menu"	The main menu opens
Button "Diagram"	The view changes to the diagrams
Status information	The current system status is displayed.

6.3 Navigation



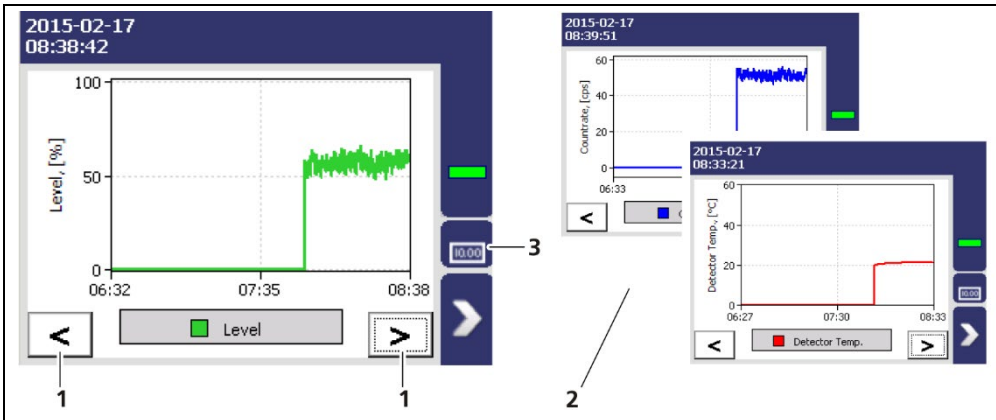
1 Home (standard display)
2 Diagram display
3 **Data**
4 One menu level back
5 One menu level forward

Fig. 26 Icons for navigation

6.3.1 Diagram Display

Clicking the diagram symbol (Fig. 25, item 5) changes the view to the diagram display. The arrow keys (Fig. 27, item 1) are used to switch between the diagrams Level– Count Rate – Detector Temperature.

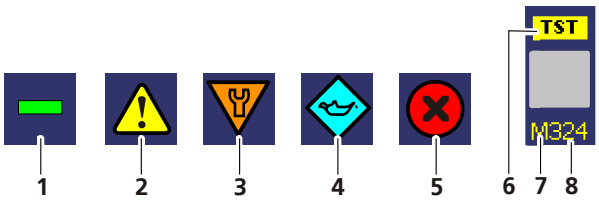
Clicking the display symbol (Fig. 27, item 3) changes the view to the standard display.



1 Arrow keys
2 Diagrams
3 Standard display

Fig. 27 Diagram display of the EVU

6.4 Status Messages



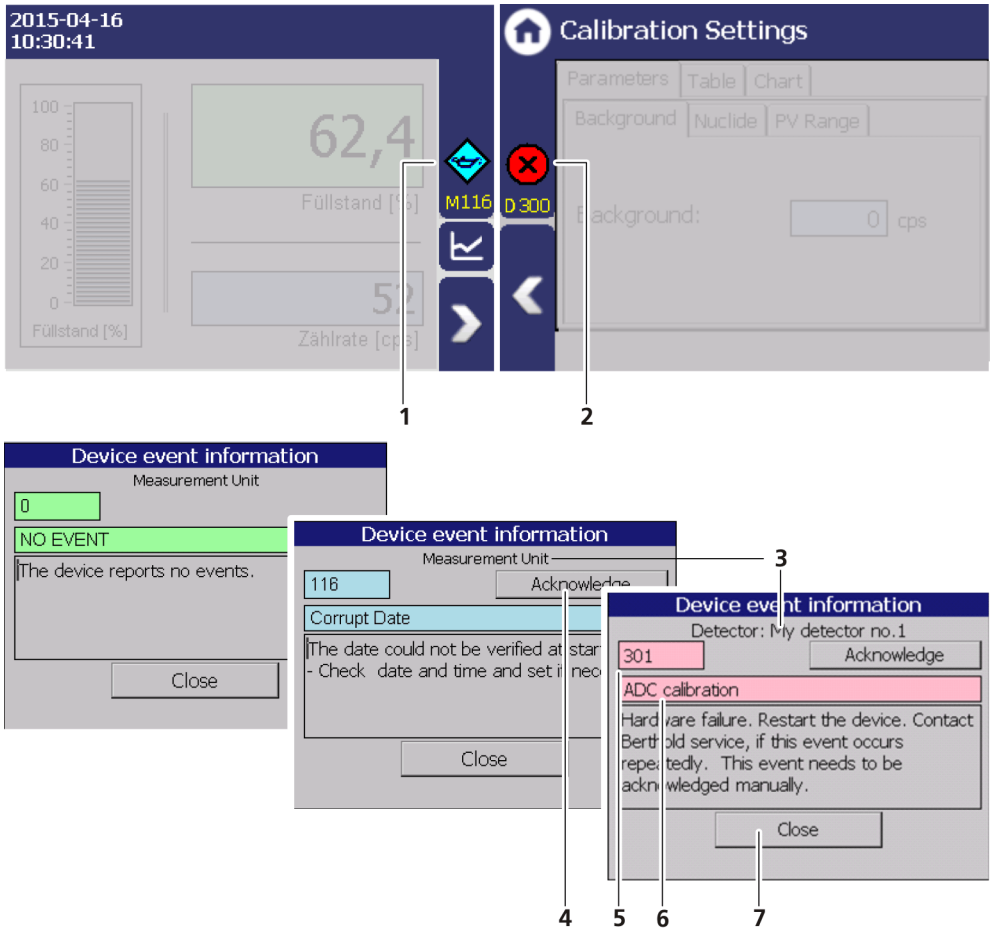
1 No event
2 Outside of specification
3 Function check
4 Maintenance required
5 Failure (error)
6 Information test (simulation)
7 Character D (detector) or M (measuring unit)
8 Event code

Fig. 28 Status information

6.4.1 Event Reports

Events are displayed in the standard display and in the submenus as a symbol. All events are displayed on the main screen. A specific “D” (for detector) indicates that a detector has an event, the prefix “M” (for measuring unit) indicates that there is an event in the LB 470 transmitter. In the event of a detector fault, the operating manual of the detector must be observed.

Only the event with the highest priority will be displayed. Refer to the menus Transmitter Events (chapter 8) and Detector Event Log "Detector-Service" (chapter 7.3.2) for additional information.



1 Event reporting in the standard display
2 Event message in the menu structure
3 Device concerned (detector / measuring instrument)
4 Button <Confirm>
5 Error number
6 Title of event report
7 Button <Close>

Fig. 29 Event reports (example)

1. Click on the icon (Fig. 29, item 1, item 2) to display detailed information about the event.
2. Click the button < Acknowledge > to confirm an event that requires a manual confirmation.

▶ The event description indicates the next event or reports no further events.

3. Click <Close> to return to the submenu or to the standard display.

- The icon disappears from the status information.

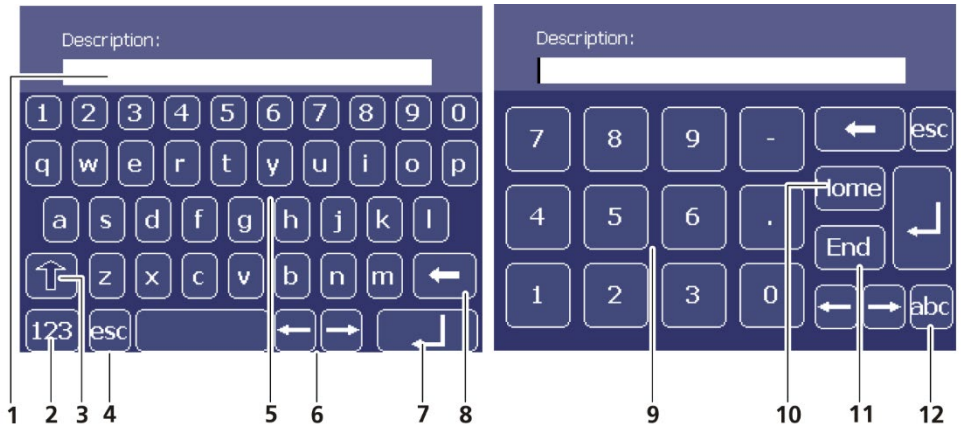
IMPORTANT

If you click the button <Close>, the event message is closed, the icon continues to be displayed.

6.5 Input Field

NOTICE

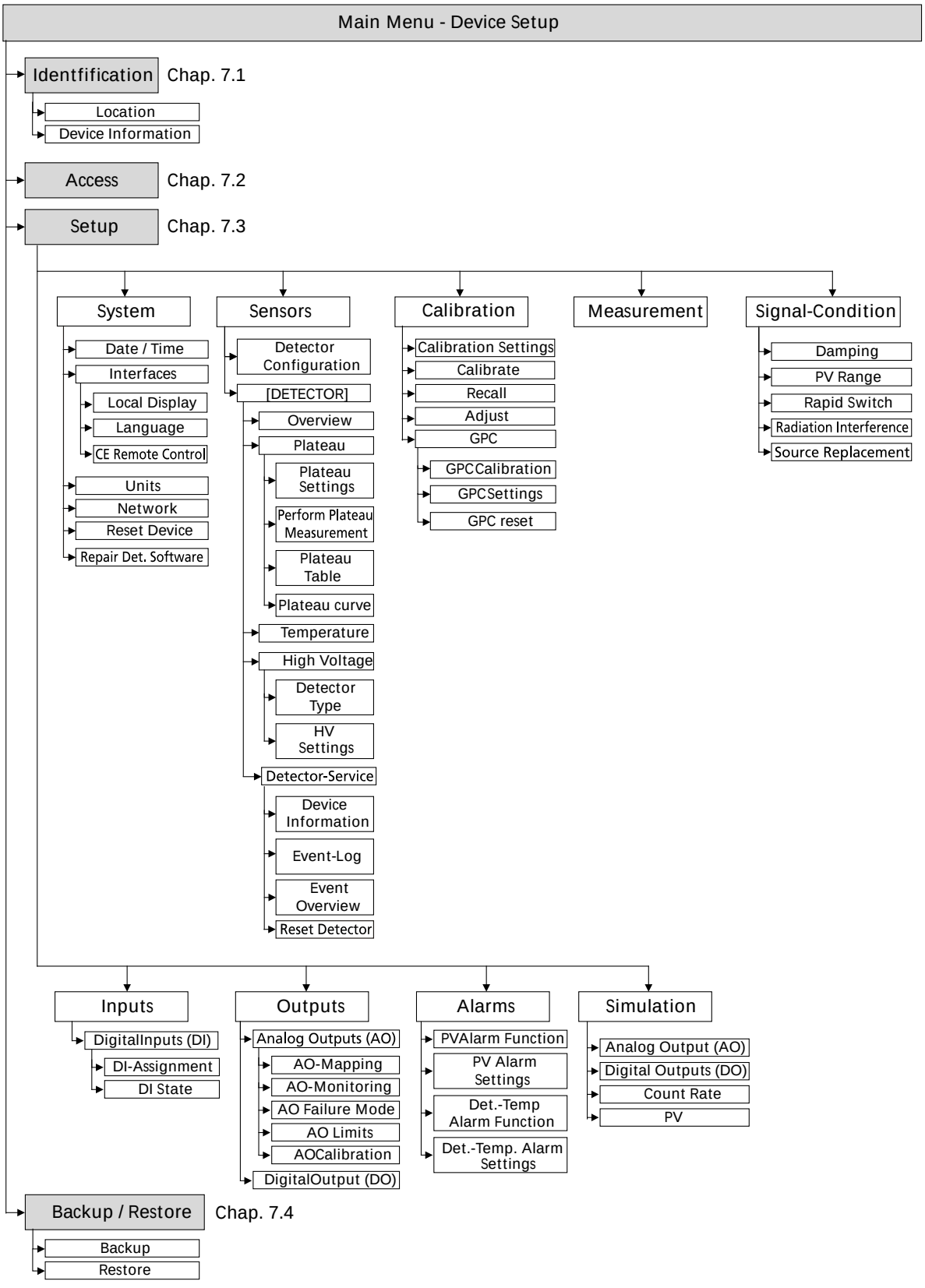
The input field appears by clicking on the blue display panels.



1	Input line	7	Input key
2	Shift key for numbers	8	Delete key
3	Shift to upper case characters	9	Number field
4	Escape key	10	Home (item1) key
5	Keypad	11	End key
6	Navigation buttons	12	Shift key for letters

Fig. 30 Screen keyboard

7 Main Menu Device Setup



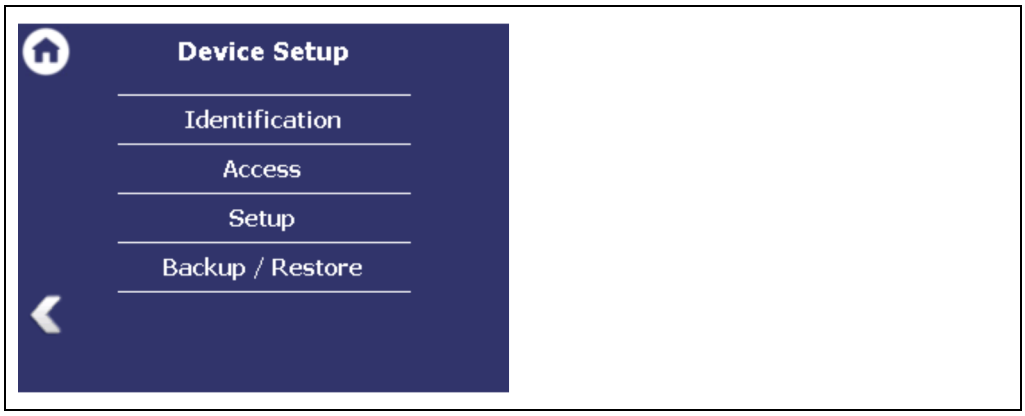


Fig. 31 Menu "Device Setup"

7.1 Menu Identification

Device Setup | Identification

You can make the following settings and read information in the Identification menu:

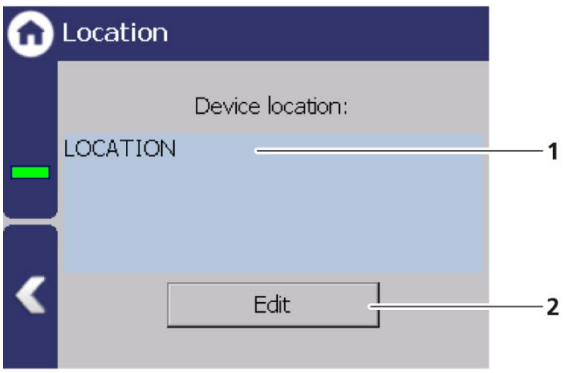
- Display and change the location name
- Display of hardware and software information

Fig. 32 Menu "Identification"

7.1.1 Location

Device Setup | Identification | Location

The location of the evaluation unit is displayed (Fig. 33, item 1) in the Location menu. The name can only be edited (7.2 Menu Access) in the access level "Standard". The Location is displayed on the EVU standard display (Fig. 25, item 7).



1 Name Device location
2 Button <Edit>

Fig. 33 Device location

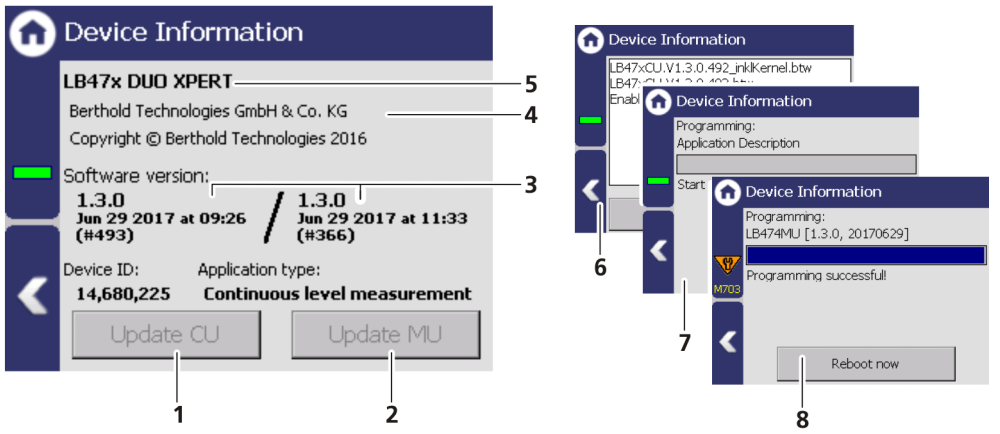
1. Click <Edit> (Fig. 39, item 2) to open the input field.
2. Enter a location name for the evaluation unit.
3. Confirm with the Enter key.

▶ The name has been changed.

7.1.2 Device Information

Device Setup | Identification | Device information

Information about hardware and software of the evaluation unit are displayed in the window "Device Information".



1	Update CU (Control Unit)	5	Device Information
2	Update MU (Measurement Unit)	6	Selection window update file
3	Software versions	7	Process window
4	Manufacturer	8	Result window

Fig. 34 Device Information

7.1.3 Perform Software Update

NOTICE

During an update where the first or second digit of the version changes, it is necessary to reset the EVU to factory settings.

NOTICE

Settings are deleted!

- Carry out a backup of the measuring channel settings before resetting and the update of the EVU (7.4.1 Backup).
- The secured settings should then be imported after the successful software update.

Tip

The current software versions can be downloaded from the Berthold website (www.berthold.com).

Perform CU Update

1. Save the current update file of the CU software on a USB storage device.
2. Connect a USB storage device to the front of the device (Fig. 3, item 5).
3. In the “Device Setup” menu, click on “Device Information” (Device Setup | Identification | Device information).

IMPORTANT

In order for the system to detect the update files it must not be located in a directory in the USB storage device.

4. The USB storage device is recognised by the system after a few seconds and the < CU Update > (Fig. 34, item 1) button can be clicked.

▶ The selection window “update file” (Fig. 34, item 6) opens.

5. Select the appropriate file and click on the button < CU Update > (Fig. 34, item 1). Confirm with < Yes >.

6. The update is performed and the measurement is interrupted.

▶ After the loading process, the message "also update MU Software?" appears

7. Click the Button < Yes > to carry out the MU update. Click the Button < No > reboot the EVU.

▶ The device restarts and the new CU software has been installed.

NOTICE

Berthold recommends calibrating the current outputs whenever a module has been installed/replaced or if a software update has been carried out.

Perform MU Update

1. Save the current update file of the MU software on a USB storage device.
2. Connect a USB storage device to the front of device (Fig. 3, item 5).
3. In the “Device Setup” menu, click on “Device Information” (Device Setup | Identification | Device information).
4. The USB storage device is recognised by the system after a few seconds and the < MU Update > (Fig. 34, item 2) button can be clicked.

▶ The selection window “update file” (Fig. 34, item 6) opens.

5. Select the appropriate file and click on the button < MU Update > (Fig. 34, item 1). Confirm with < Yes >.

▶ The update is performed and the measurement is interrupted.

6. Click the Button < Restart > to reboot the EVU.

▶ The device restarts and the new MU software has been installed.

NOTICE

Berthold recommends calibrating the current outputs whenever a module has been installed/replaced or if a software update has been carried out.

7.2 Access

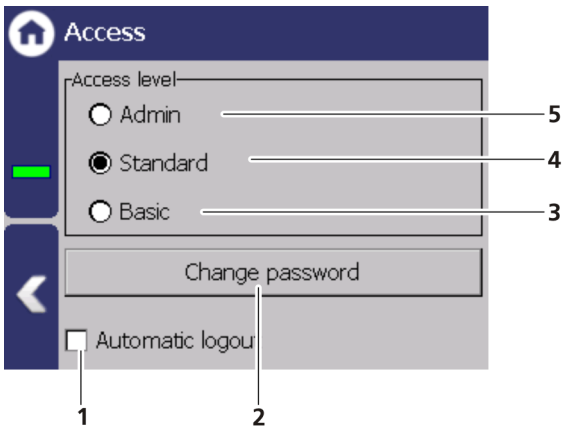
Device Setup | Access

You can set the user rights via the user levels and assign passwords in the window “Access”. After assigning a password the device is protected against unauthorized manipulation of the parameters.

IMPORTANT

Make sure that the password is known to you before you select the "Basic" access level and lock the device. The same applies if you set "Automatically logout".

If you do not know the password, you will not be able to unlock the device! If in doubt, enter a new password with "Change Password".



1 Check box "Automatic logout"
2 Change <Change password>
3 User level "Basic"
4 User level "Standard"
5 User level "Admin"

Fig. 35 Access

The following user levels are available to you:

User Level Basic

Select "Basic" to lock the device against unwanted manipulation. After the device has been locked, it is still possible to read all data, but changes to the data are no longer possible.

If "Basic" is already set, then the device is already in the locked state.

To unlock the device, select the access level "Standard".

User Level Standard

If the device is in the "Standard" access level, all parameters are accessible and can be changed.

If the device is in the "Basic" access level (locked), you can unlock the device with the "Standard" access level. The password will be asked for. You can unlock the device only if you enter the correct password.

User Level Admin	This access level is only intended for the system management by Berthold.
Automatic logout	Activating the selection box (Fig. 39 item 1) automatically resets the access level Standard to “Basic” when the system changes to the standard display after the timeout (Chap. 7.3.1).

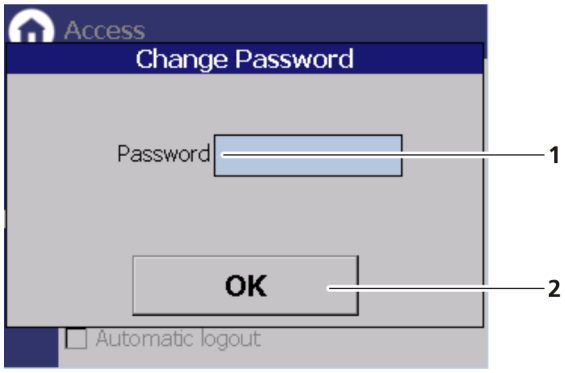
NOTICE

Incorrect measurement and calibration parameters can be set through unauthorised inputs. These can possibly lead to production losses and damage in the system.

- Protect the measuring system from unauthorised entries with a password and activate the function "Automatic logout".

Assign / Change Password

To set or change a password, select "Standard" (Fig. 42, item 4) and click on <Change password> (Fig. 42, item 2) to open the input field.



1 Text field
2 Button < OK >

Fig. 36 Change password

1. Click on the text field (Fig. 36, item 1.) to open the input field.
2. Enter a password (case-sensitive!).
3. Confirm with the Enter key.
4. Click <OK> (Fig. 36, item 2) to confirm.

- The password has been set / changed.

7.3 Menu Setup

Device Setup | Setup

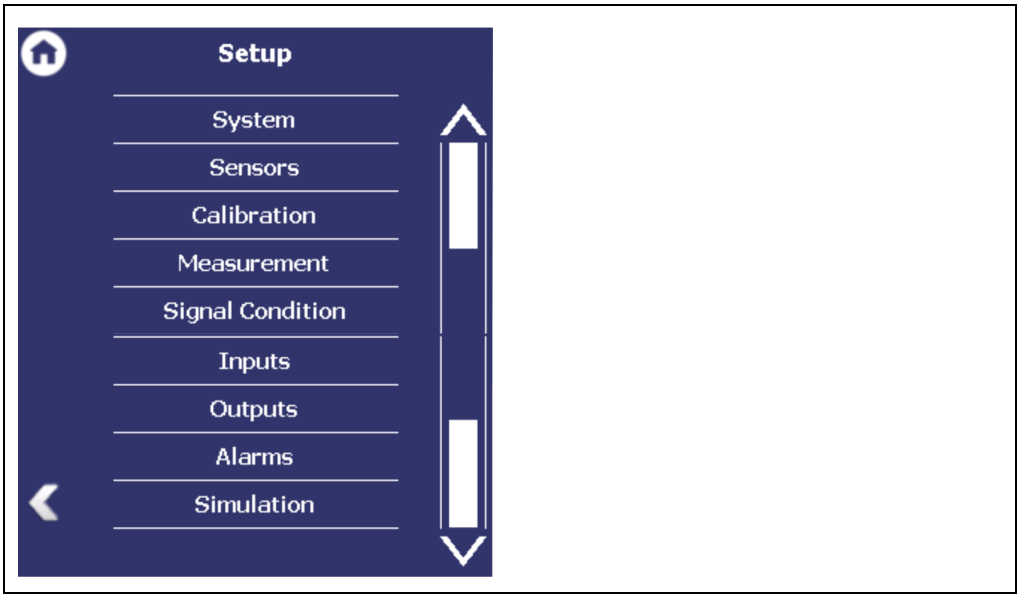


Fig. 37 Menu "Setup"

7.3.1 System (Date / Time, Interfaces, Units, Network, Reset EVU, Repair Detector Software)

Device Setup | Setup | System

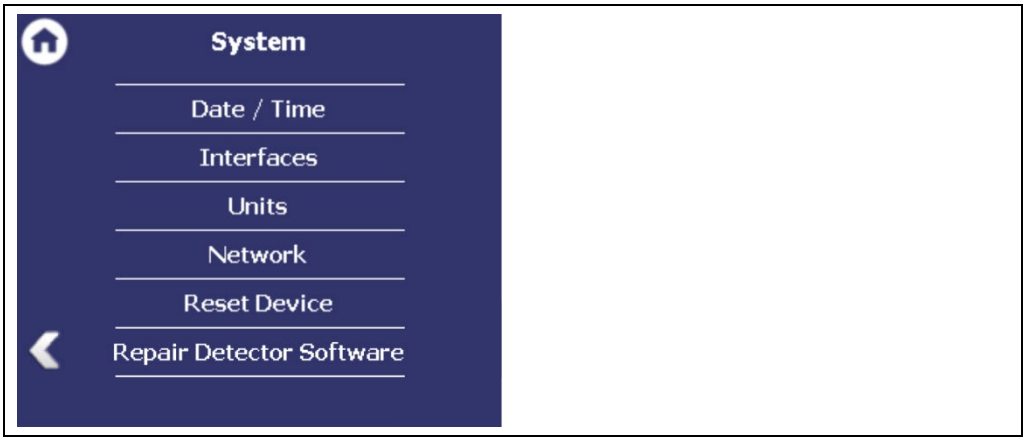


Fig. 38 Submenu "System"

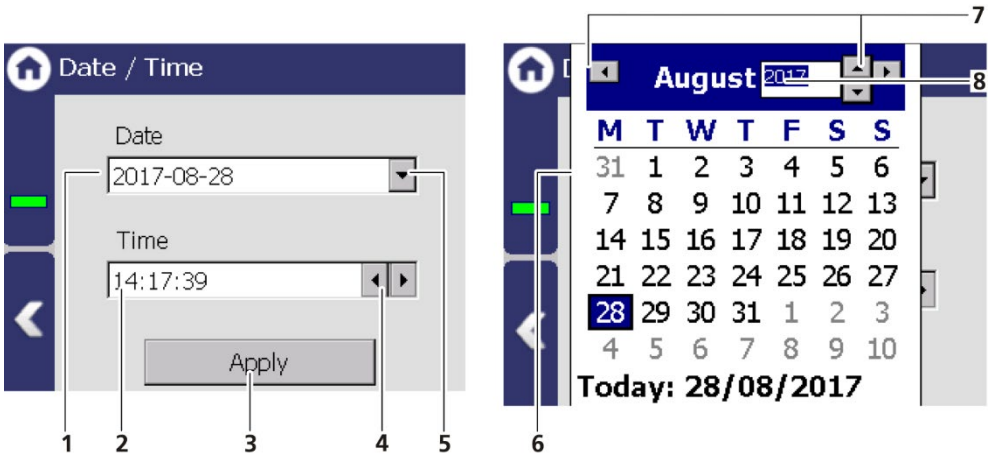
Set Date and Time

Device Setup | Setup | System | Date / Time

IMPORTANT

The date and time must always be set correctly so that all records (log files) have the correct metadata.

The correct date is also indispensable for the decay compensation.



1	Display date	5	Selection arrow Date
2	Display time	6	Calendar
3	Button <Apply>	7	Arrow keys Month
4	Arrow key Time	8	Input box Year

Fig. 39 Date / Time, calendar

1. Click on the arrow key (Fig. 39, item 5) in order to set the date.
   - ▶ The calendar is opened (Fig. 39, item 6).
2. Click on the year number (Fig. 39, item 8) in order to enter the year.
3. Set the month (Fig. 39, item 7) by clicking on the arrow keys.
4. Set the day by clicking on a number in the calendar.
5. Change the time by clicking on the arrow keys (Fig. 39, item 4).
6. Click on <Apply> (Fig. 39, item 3), to accept the date and time settings.
   - ▶ The date and time are set.

Interfaces

Device setup | Setup | System | interfaces

You can adjust the following settings in the submenu “Interfaces” (Fig. 40):

- Local Display
- Brightness / Touch
- Input / Output
- Language
- CE Remote control

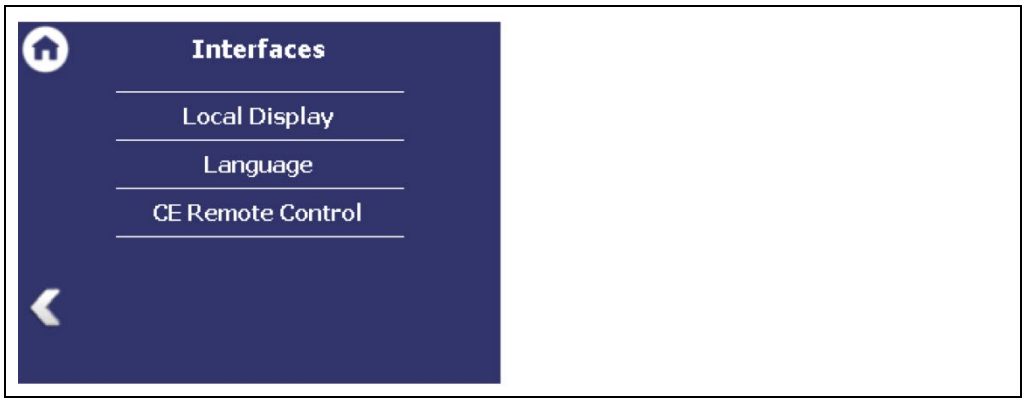


Fig. 40 Menu “Interfaces”

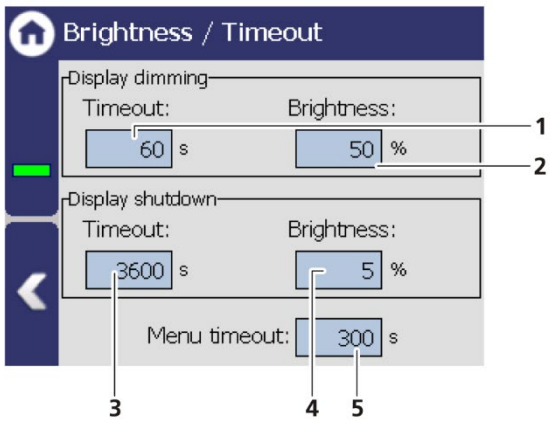
Local Display

Device setup | Setup | System | Interfaces | Local Display

Fig. 41 Submenu “Local Display”

Brightness / Timeout

Device Setup | Setup | System | interfaces | Local Display | Brightness / Timeout



1 Input field “Time out”
2 Input field “Dimming”
3 Input field Display switch off “Time out”
4 Input field Display switch off “Dimming”
5 Input field menu time out

Fig. 42 Brightness / Time out settings

“Time out” refers to the period of time during which the display is not operated. The value “Time out display brightness” cannot be set greater than the value at “Time out display switch-off”.

Display dimming In the field Display dimming, clicking the input fields allows the entering of the brightness (Fig. 42, item 2) in percent, that is set after expiry of the time (Fig. 42, item 1).

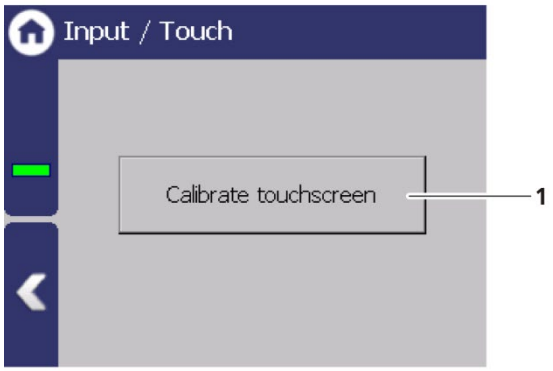
Display shutdown In the field Display shutdown, clicking the input fields allows the entering of the brightness (Fig. 42, item 4) in percent, that is set after expiry of the time (Fig. 42, item 3).

Menu Timeout Under "Menu Timeout" clicking on the input field (Fig. 42, item 5) changes the time period (seconds) in which the menu view changes to the standard view.

Input / Touch

Device Setup | Setup | System | Interfaces | Local Display | Input / Touch | Calibrate Touchscreen

If the touch position deviates, a calibration of the touch screen must be performed.



1 Button <Calibrate touch screen>

Fig. 43 Input/ Touch

Calibrate touch screen

The calibration may only be carried out with direct skin contact. Take gloves or any other protective equipment off your hands. Calibration via the remote control software is not possible.

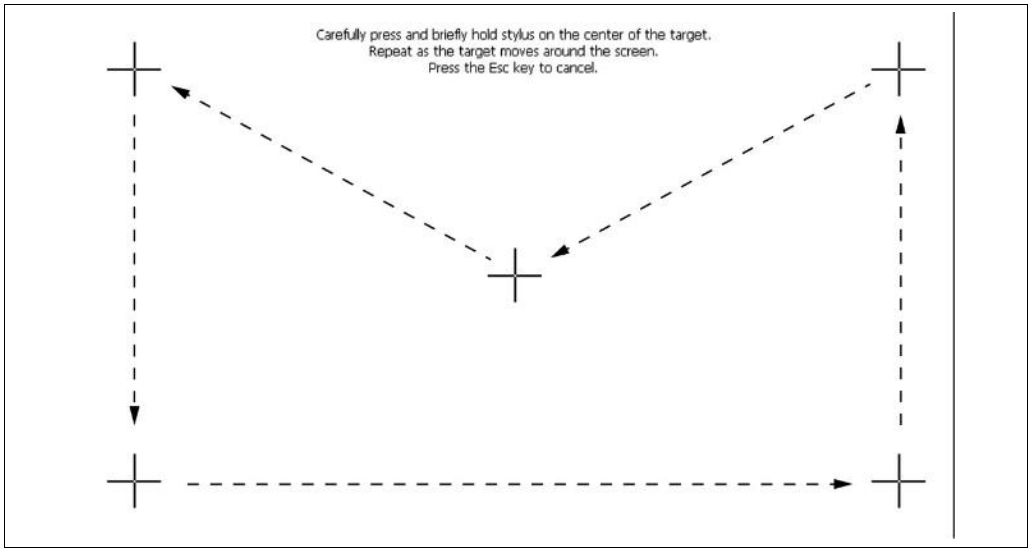


Fig. 44 System menu, Settings - Display (Calibrate touch display)

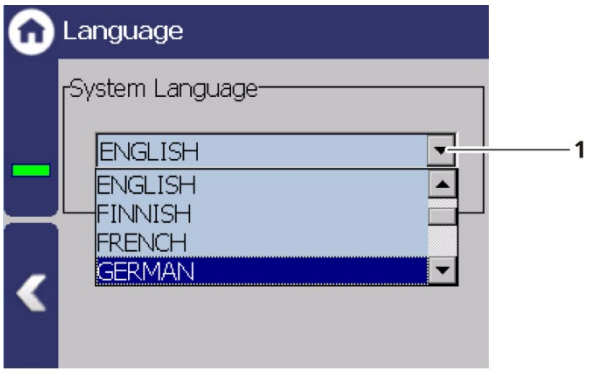
1. Click on <Calibrate touch screen>.
   - ▶ The calibration screen opens.
2. Press the middle of the displayed cross with your finger.
   - ▶ If you take your finger off the cross again, the cross jumps to the top left corner.
3. Repeat the process until the cross is no longer displayed and the calibration is finished.

4. Confirm the calibration by clicking on the white screen to go back to "Input/Touch"
5. Execute a restart of the EVU after prompting.

▶ The calibration of the touchscreen has been performed.

Language

Device Setup | Setup | System | interfaces | Language



1 Selection arrow

Fig. 45 Language

Change System Language

1. Click on the selection arrow (Fig. 45, item 1) and select a language.

▶ A message window “Restart” appears.

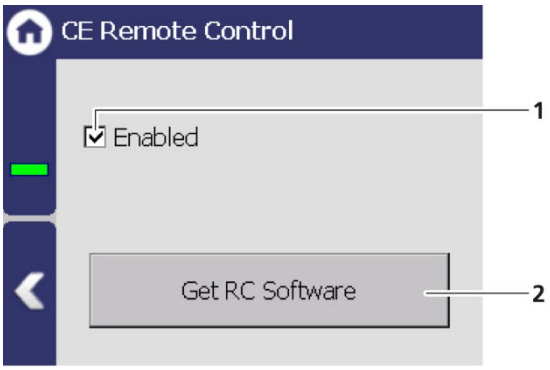
2. Confirm with “OK” to restart the device.

▶ The device is restarted and the language has been changed.

CE Remote Control

Device Setup | Setup | System | interfaces | Remote Control

By activating (Fig. 46, item 1) the CE Remote Control, the unit can be operated via the network connection. The software of the remote control (RC software) is stored on the device and can be copied to a USB storage device.



1 Check box remote control “Enabled”
2 Button <Get RC software>

Fig. 46 CE Remote Control

Copy RC Software

1. Connect a USB storage device to the device (Fig. 3, item 5).

▶ The USB storage device is recognised by the system after a few seconds and the button < Get RC Software > (Fig. 46, item 2) can be clicked.

2. Click on the button < Get RC Software > (Fig. 46, item 2).

▶ The software is copied to the USB storage device.

Information

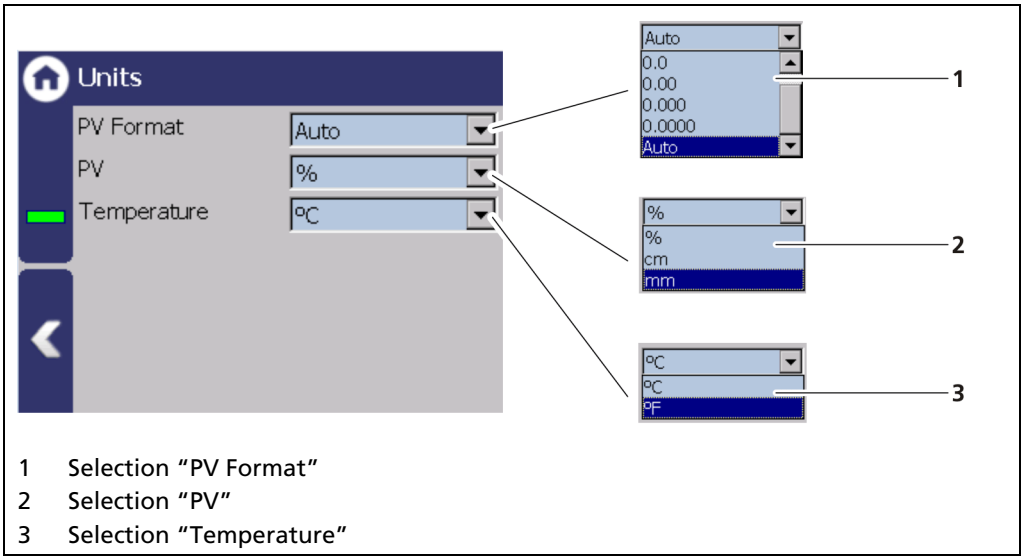
The RC software includes the file “LB47xRemoteControl.exe” and runs without installation.

Operation of the RC software is described in Chapter “Remote Control Software” (see next but one chapter).

Units

Device Setup | Setup | System | Units

Clicking on the individual selection arrow lists the available units for the measuring value. The selected unit is shown in the standard display.



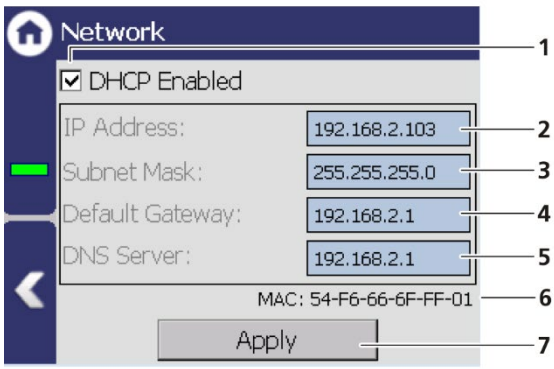
1 Selection “PV Format”
2 Selection “PV”
3 Selection “Temperature”

Fig. 47 Units

Network

Device Setup | Setup | System | Network

In the window “Network”, you can make changes to the network settings. The information can only be edited in the access level "Standard" (see chap. 7.2 Menu Access).



1 Check box “DHCP active”
2 IP address
3 Subnet mask
4 Standard gateway
5 DNS server
6 MAC address
7 Button < Apply >

Fig. 48 Network Settings

You can set the network address either manually or using DHCP (automatic assignment). To do this, check the "DHCP active" in the selection field (Fig. 48, item 1).

IMPORTANT

In the event of an automatic assignment of the IP address by a DHCP server, you can only look at the given IP address. A modification of the IP address is not possible. On this side, you can also read the MAC address of the device (Fig. 48, item 6).

Manual Settings

1. Click on the text field (Fig. 48, item 2 - 5) to open the input field.
2. Enter the appropriate network addresses.
3. Confirm with the Enter key.
4. Click on < Apply > (Fig. 48, item 7) to adopt the network settings.

IMPORTANT

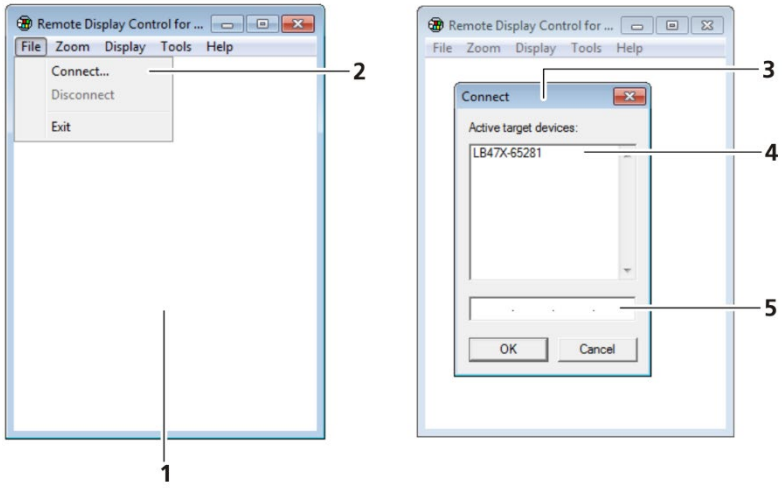
All settings performed must be confirmed by clicking on < Apply > so that the settings become real.

Remote Control Software

If the EVU is connected to a network at the RJ45 socket (Fig. 3, item 2), the EVU can be operated via a computer. The software can be loaded onto a USB storage device (see Chapter “CE Remote Control”). The connection to the EVU can only be established if a valid application software is installed on the EVU.

IMPORTANT

In order for the Remote Control to function, the selection check mark in the menu "CE Remote Control" must be set to "Active" (Fig. 46, item 1).



1 Programme Remote Control
2 Box <Connect…>
3 Window Connect
4 List of transmitters
5 Input box IP address

Fig. 49 Establishing connection to the EVU using the RC software

1. Click on “**LB47xRemoteControl.exe”**, to start the programme.

▶ The program starts (Fig. 49, item 1).

2. Click on the < File > tab and then on < Connect… > (Fig. 49, item 2), to establish a connection to the EVU.

▶ A new window “Connect” is opened (Fig. 49, item 3) and the connected transmitters are listed.

IMPORTANT

The IP address of the EVU must be in the same sub-network (Fig. 48, item 3) as the network adapter of the computer (see previous Chapter “Network”).

3. Click on the identifier of the transmitter (Fig. 49, item 4) or enter the IP address of the EVU in the input box (Fig. 49, item 5) (see Fig. 49, item 2).

4. Click on < OK >.

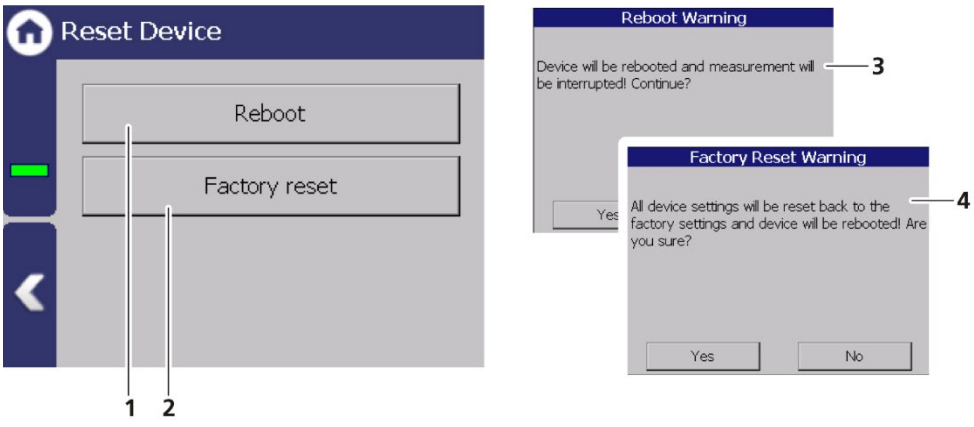
▶ The connection to the EVU is established.

5. You can enlarge the view in the “Zoom” menu (2x,3x).

Reset Device (Evaluation Unit)

Device settings | Setup | System | Reset Device

The evaluation unit can be restarted and reset to factory settings in the window "Reset Device".



1 Button Reboot
2 Button Factory settings
3 Window "Warning: Reboot"
4 Window "Warning: Factory Reset"

Fig. 50 Reset device

Restart the device

IMPORTANT

The measurement is interrupted during a restart!

1. To restart the device, click the button <Restart> (Fig. 50, item 1).
▶ A window with a warning "Restart" (Fig. 50, item 3) opens.
2. Click on <Yes> to confirm.
▶ The device is restarted.

Reset device (Factory Reset)

IMPORTANT

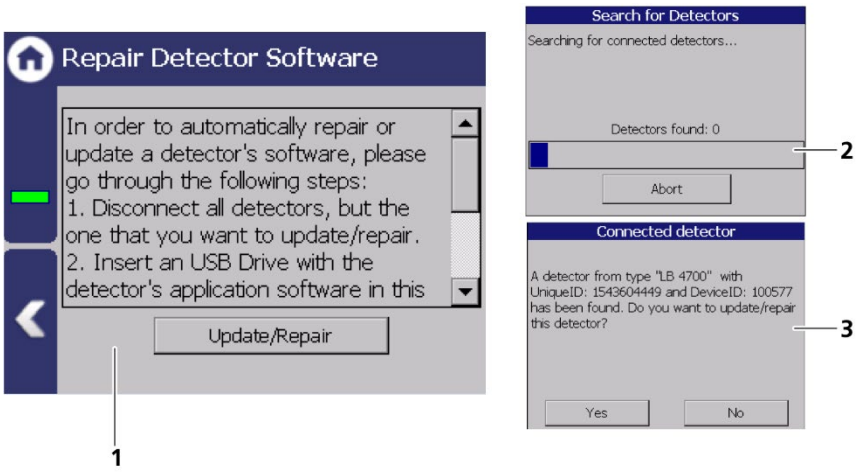
When there is a reset to factory settings, all data logs are deleted and all user-defined configuration settings are reset!

▶ If error M102 appear, the device possibly must be reset twice.

1. To reset the evaluation unit to the factory settings, click the button <Factory settings> (Fig. 50, item 2).
▶ A window with the warning "Factory settings" (Fig. 50, item 4) opens.
2. Click on <Yes> to confirm.
▶ The device is reset to factory settings and restarts.

Repair Detector Software

Device settings | Setup | System | Repair Detector Software



1 Description Update / Repair
2 Process “Search Detectors”
3 Search result

Fig. 51 Repair Detector Software

⚠ DANGER

Danger to life from electric shock!

- The repair may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.

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

If a communication interruption occurs during an update of the detector software, it is not possible to reinstall the software. With the "Repair detector software" function, the connection to the detector can be re-established and the update restarted. Corresponding information is displayed to the user in this menu.

Tip

The current software versions for the detectors can be downloaded from the Berthold website (www.berthold.com).

7.3.2 Sensors

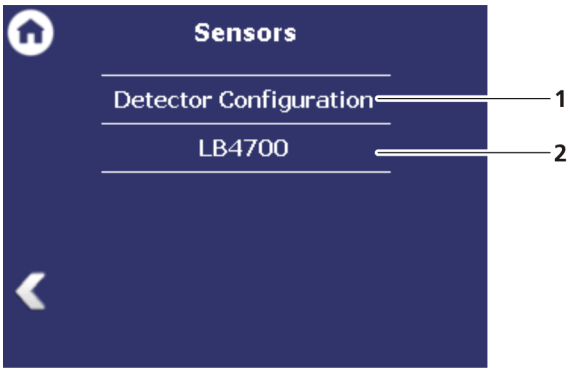
Device settings | Setup | Sensors

You can perform the following settings and read information in the submenu Sensors:

- Detector configuration (Fig. 52, item 1)
  - Add / Remove detectors
  - Settings of the detectors
- Configuration of the respective detector (Fig. 52, item 2)
  - Overview
  - Plateau
  - Temperature
  - High voltage
  - Detector Service

IMPORTANT

If the system does not detect a detector, then the sub-menu “Detector” cannot be selected.



1 Detector configuration
2 Detector name (as entered in the detector description)

Fig. 52 Menu “Sensors”

Detector Configuration

Device settings | Setup | Sensors | Detector configuration

In the sub-menu “Detector configuration” the detectors for the measuring system are added and configured. Only configured detectors are listed and shown in the menu (Fig. 52). When a detector is selected (Fig. 53, item 6), the detector type (Fig. 53, item 4) and measuring task (Fig. 53, item 5) are shown.

Clicking the box < Edit > (Fig. 53, item 3) selects the type of detector and changes the description. The boxes < + > and < - > can be used to add and remove detectors for cascading measurement.

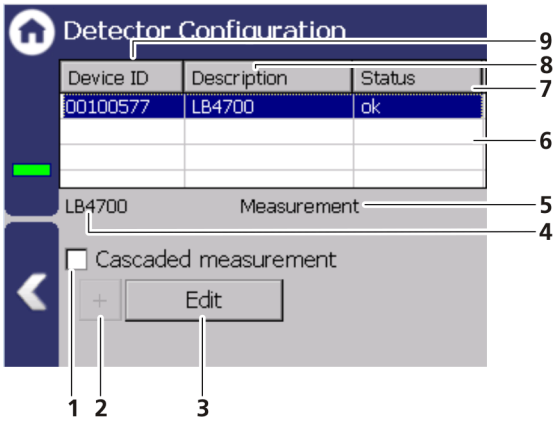
Evaluation of the measurement data from detectors type LB44xx and LB54xx is only possible with Master units.

Tip

Information and settings for the detector are in the individual detector menu (Fig. 56).

IMPORTANT

In systems with a single detector the device ID is determined automatically and listed. The description can be edited by clicking on <Edit> (Fig. 53, item 3).



1 Selection box “Cascaded measurement”
2 Button < + > to add Detector
3 Button < Edit >
4 Type of selected detector
5 Measuring task for the selected detector
6 List of the Detectors
7 Status of the Detector
8 Description of the Detector
9 Device ID of the detector

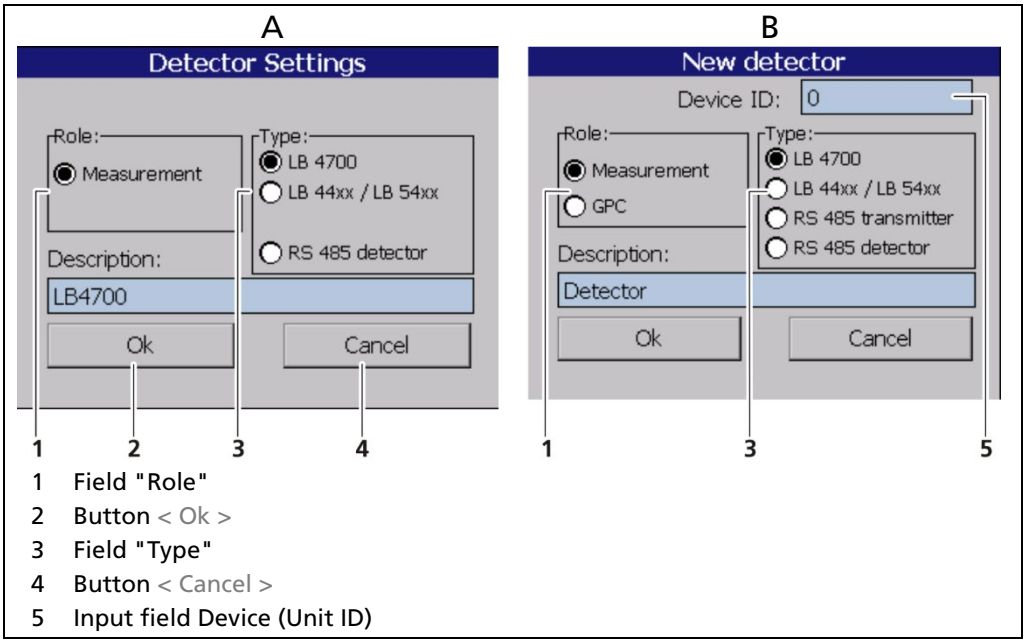
Fig. 53 Detector configuration

Detector Settings

The settings of a configured detector are edited by selecting and clicking on < Edit > (Fig. 53, item 3).

IMPORTANT

For systems with a single detector, window A is displayed. For cascaded systems, window B is displayed.



1 Field "Role"
2 Button < Ok >
3 Field "Type"
4 Button < Cancel >
5 Input field Device (Unit ID)

Fig. 54 Detector Settings

Measurement — The selection "Measurement" determines the level of the container.

GPC — The selection "GPC" (Gas Properties Compensation) determines the gas density in order to compensate these for a precise measurements.

LB4700 — Detector of type LB4700 (A LB 4700 detector can be connected either to the master unit itself or to a slave module).

LB44xx/LB54xx — Detector of the type LB44xx and LB54xx (no device ID; can capture measurement data only with master EVU)

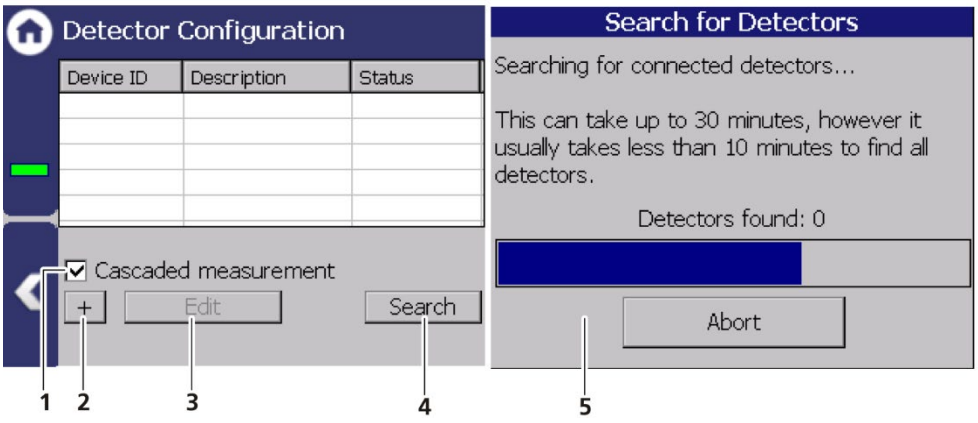
RS 485 transmitter — By selecting "RS 485 transmitter", other LB 470 master units can be used to perform cascaded measurements. This way multiple detectors of different designs can be integrated into a measurement system. Please refer to the instructions in the following chapters.

RS 485 detector — With the selection “RS 485 detector” it is possible to connect a specific detector via the RS 485 interface.

Description — Detector description. Also used for error messages, logs and in the menu structure (Fig. 52).

Configure a cascaded System

Note the arrangement of the system components during configuration (see chapter 3.2 Measuring Principle).



1 Selection box “Cascaded measurement”
2 Button < + >
3 Button < Edit >
4 Button < Search >
5 Window “Search Detectors”

Fig. 55 Configure cascaded system

1. If the connection to the EVU (Master-Slave) is correct, the detectors type LB47xx are detected and incorporated automatically. Click on the button < Search > to incorporate connected detectors.
2. Activate the selection box “Cascaded measurement” (Fig. 55, item1).
3. Set the appropriate function for each detector (Fig. 54).

Tip

Both LED (Rx, Tx) indicators flash with proper installation and configuration of a detector on the slave module.

Detector Settings

Device settings | Setup | Sensors | [NAME DETECTOR]

You can adjust the following settings and read information in the submenu of the respective detector:

- Overview of count rate, HV value and temperature
- Plateau
  - Plateau Settings
  - Plateau Measurement
  - Plateau Table
  - Plateau Curve
- Current temperature and extreme values
- High voltage
  - Detector Type
  - HV Settings
- Detector Service
  - Device information
  - Event Log
  - Event Overview
  - Reset Device

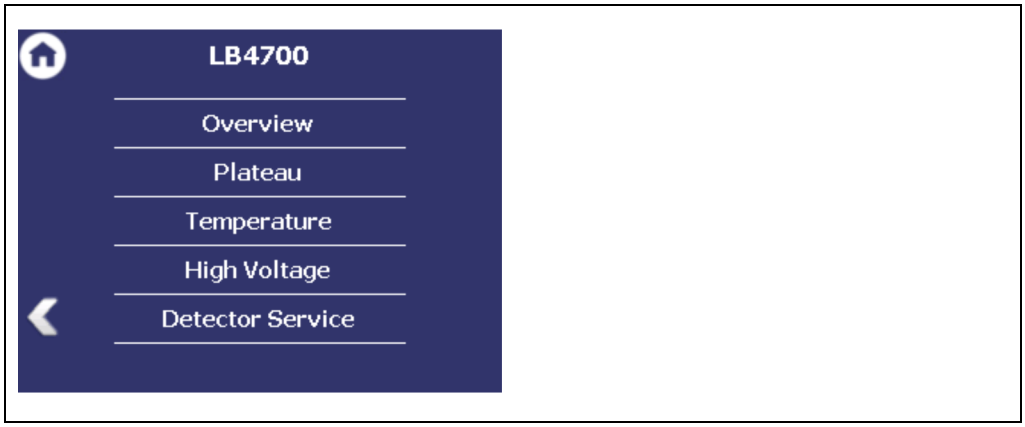
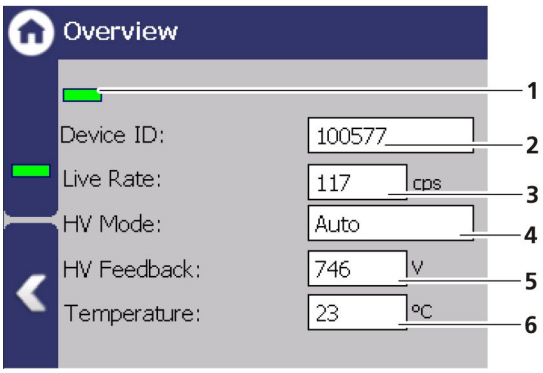


Fig. 56 Submenu "Detector"

Detector Settings: Overview

Device settings | Setup | Sensors | [NAME DETECTOR] | Overview

Important parameters and measured values of the detector are clearly displayed in the window "Overview".



1 Status information of the detector
2 Device ID
3 Live Rate [cps]
4 HV Mode
5 HV feedback [V]
6 Temperature [°C]

Fig. 57 Overview Detector Information

	A green bar appears with error-free status of the detector (Fig. 57, item 1).
Device ID	Shows the ID of the detector.
Live count rate	The "Live Rate" (Fig. 57, item 3) displays the current, unfiltered count rate.
HV mode	In the field "HV mode" (Fig. 57, item 4), the HV mode is displayed, which is chosen under Device settings | Setup | Sensors | | NAME DETECTOR] | High voltage | HV settings.
HV Feedback	The field "HV Feedback" (Fig. 57, item 5) displays the actual measured value in volts.
Temperature	The field "Temperature" (Fig. 57, item 6) indicates the current temperature of the detector in C°.

Detector Settings: Plateau

Device Settings | Setup | Sensors | [NAME DETECTOR] | Plateau

The plateau provides information on whether the detector is stable. A plateau measurement is therefore only carried out when the measured value drifts, or other doubts exist about the function of the detector. Plateau measurement can help narrow down the possible cause of the problem.

The high voltage necessary for the operation of the photomultipliers is increased stepwise for the plateau recording and the pulse rate measured after each increase. The determined plateau curve is displayed on a diagram. The pulse rate increases with increasing voltage. This must form a unique plateau. If a too short or too steep plateau is detected, the detector is operating in an unstable manner. The submenu "Plateau" (Fig. 58) leads to the plateau measuring and the display of plateau values.

Please contact your responsible service or sales partner, or Berthold directly, so that they can get a qualified assessment to the measured plateau.

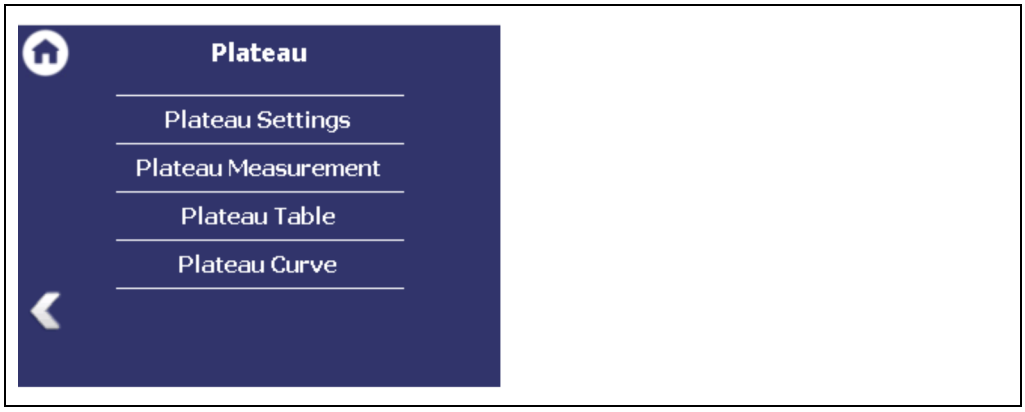


Fig. 58 Menu "Plateau"

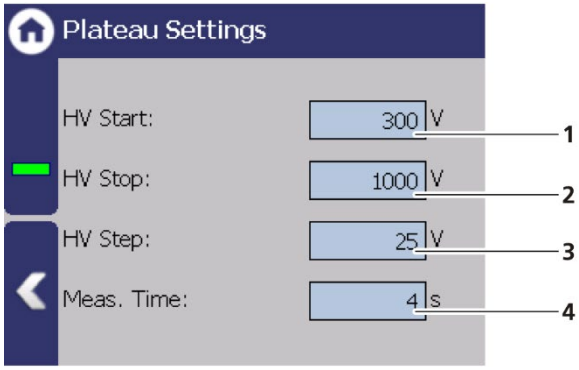
Plateau Settings

Device Settings | Setup | Sensors | [NAME DETECTOR] | Plateau | Plateau settings

The values in the window "Plateau settings" are pre-set by Berthold on delivery and can be used in most situations.

You have the following settings options in the window "Plateau Settings":

HV start / HV stop	Defining the range of the plateau recording.
HV step	Specifies the step (interval) between two measuring points.
Measuring time	Identifies the time that is used per measuring point for the counting of the count rate.



1 Input field HV start value in volts
2 Input field HV end value in volts
3 Input field HV increment in volts
4 Input field measuring time in seconds

Fig. 59 Plateau Settings

1. Click on the corresponding text field.

▶ The input field opens.

2. Change to the keypad and enter the value.
3. Confirm with the Enter key.

▶ The values for the recording plateau have been changed.

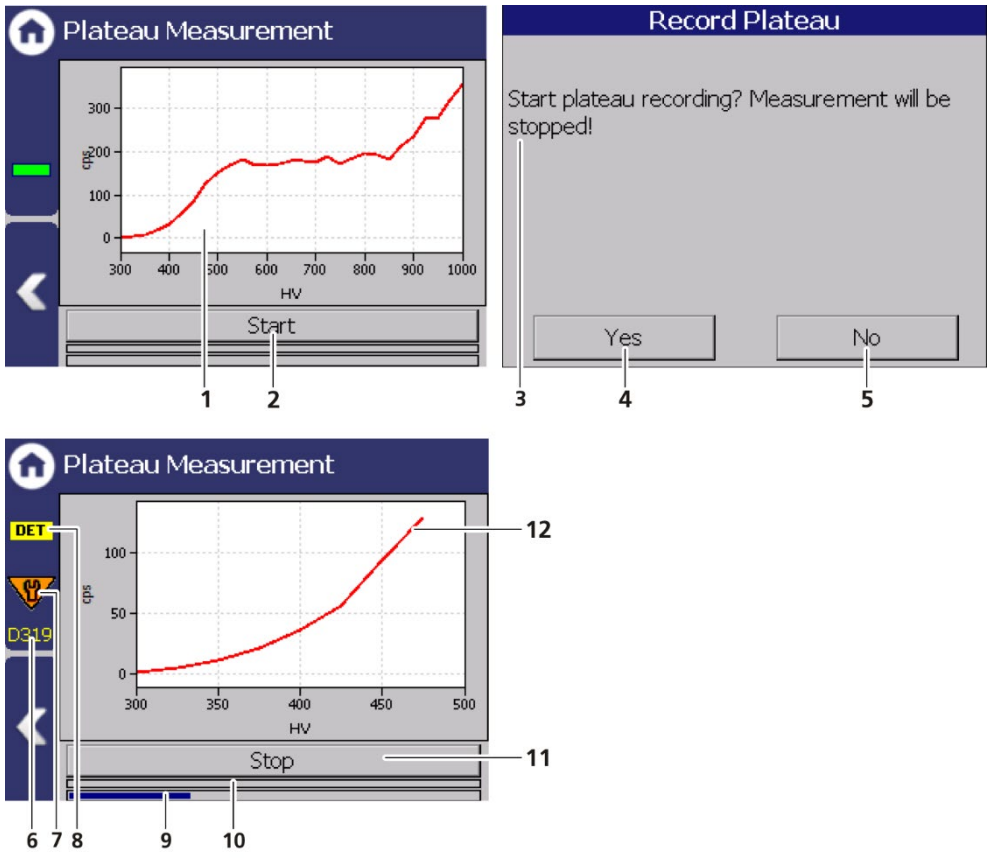
Perform Plateau Measurement

Device Settings | Setup | Sensors | [NAME DETECTOR] | Plateau | Plateau Measurement

IMPORTANT

The environmental conditions and the dose rate must be constant during the plateau recording.

Observe the operating manual of the detector!



1	Plateau curve	7	Notice Maintenance
2	Button < Start >	8	Notice DET
3	Window “Record plateau”	9	Progress bar measuring process
4	Button < Yes >	10	Progress bar measuring step
5	Button < No >	11	Button < Stop >
6	Event message code	12	New plateau curve

Fig. 60 Recording a plateau curve

1. Click on < Start > (Fig. 60, item 2) to perform a plateau measurement.

▶ The confirmation message "Record plateau" (Fig. 60, item 3) opens.

2. Confirm with < Yes > (Fig. 60, item 4).

▶ The EVU switches to mode "DET" (Fig. 60, item 8) and the current measurement is stopped.

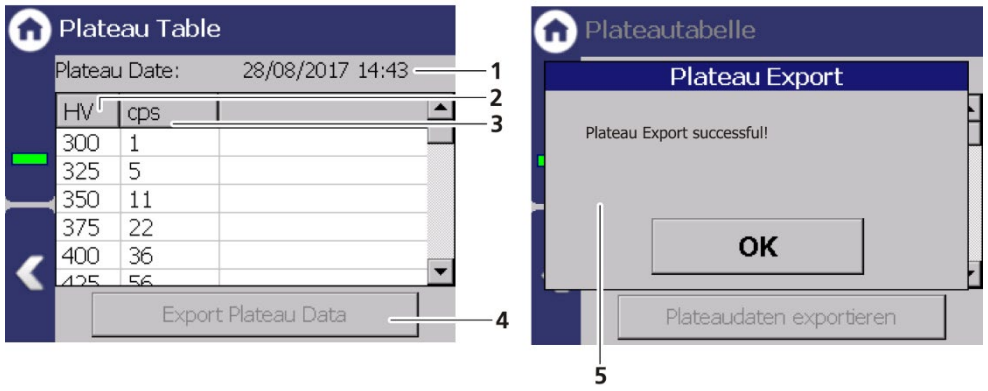
▶ The information (Fig. 60, item 6 - 8) from the plateau measurement are displayed in the status information. The LED Run flashes on the EVU during the plateau measurement. The LED "Warning" LED lights up at the same time.

- If you click on the < Stop > button during the measurement, the measuring process is interrupted. The measurement data are invalid and will be deleted.
- The recorded values are read and entered into the table (Fig. 61), the plateau curve (Fig. 62) is drawn and stored automatically.

Plateau Table

Device Settings | Setup | Sensors | [NAME DETECTOR] | Plateau | Plateau Table

The data from each measurement point are listed in the plateau table. The data from the plateau table can be exported to a USB memory device.



1 Date and time of measurement recording
2 High voltage (HV) in volts
3 Count rate in the measurement channel (cps)
4 Button < Export plateau data >
5 Window “Export successful”

Fig. 61 Plateau table

Export plateau data

1. Connect a USB storage device to the device (Fig. 3, item 5).
- The USB memory device is recognised by the system after a few seconds and the button < Export plateau data > can be clicked.
2. Click on the button < Export plateau data > (Fig. 61, item 4).
- The values of the plateau measurement have been stored in a .txt file.
3. Confirm the message with < OK >.

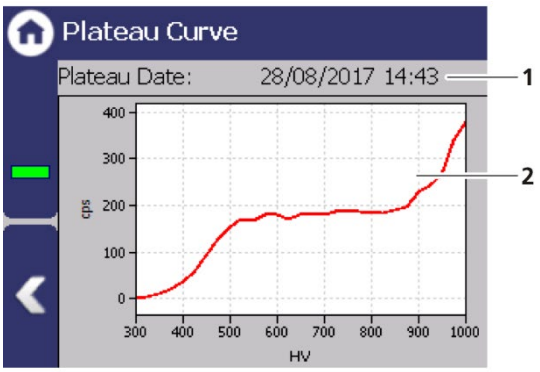
Information

The file name is derived from "Plateau", the date and time of the measurement process (PlateauYYYYMMDD_hr_min_sec.txt).

Plateau Curve

Device Settings | Setup | Sensors | [NAME DETECTOR] | Plateau | Plateau Curve

The mapped characteristic curve (Fig. 62, item 2) of the last complete plateau measurement is displayed in the window "Plateau Curve".



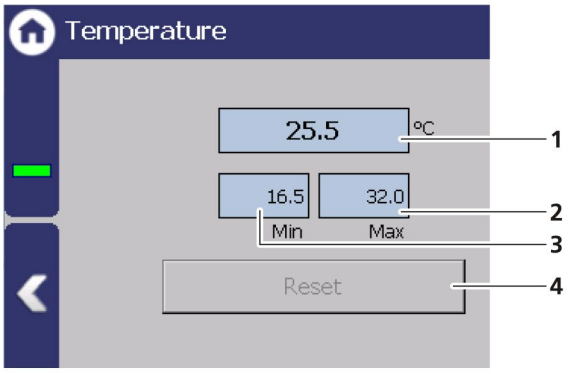
1 Date and Time of measurement recording
2 Characteristic curve

Fig. 62 Plateau Curve

Detector Settings: Temperature

Device Settings | Setup | Sensors | [NAME DETECTOR] | Temperature

The current temperature and the extreme values of the detector is displayed in the window "Temperature".



1 Current temperature of the detector [°C]
2 Maximum measured temperature [°C]
3 Minimum measured temperature [°C]

Fig. 63 Temperature display of the detector

Detector Settings: High Voltage

Device Settings | Setup | Sensors | [NAME DETECTOR] | High Voltage

You can select the detector code and make settings for high-voltage regulation in the submenu "High Voltage" of the respective detector.

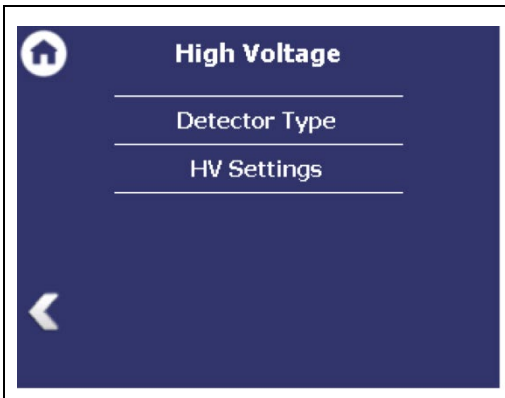


Fig. 64 Submenu "High Voltage"

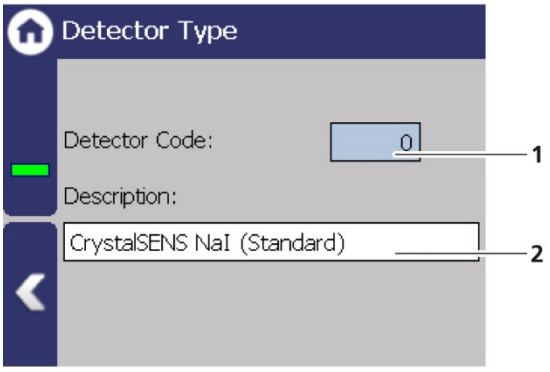
Detector Settings: High Voltage | Detector Type

Device Settings | Setup | Sensors | [NAME DETECTOR] | High Voltage | Detector Type

Internal device parameters are adjusted to suit the size of the used scintillator by setting the detector code. The correct detector code is already set at the factory and a change is not normally required.

IMPORTANT

A table with the detector code to be used is in the operating manual of the detector.

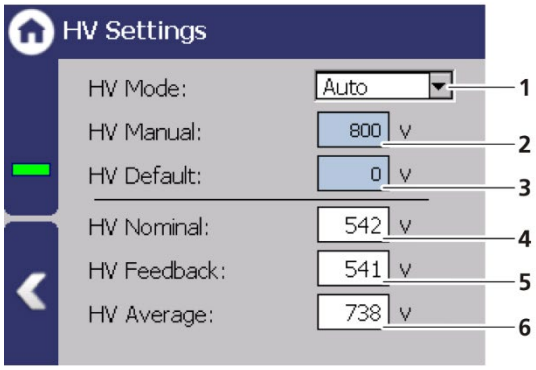


1 Input field Detector code
2 Description of the scintillator type

Fig. 65 Detector Code: Setting the scintillator type

Detector Settings: High voltage | HV Settings

Device Settings | Setup | Sensors | [NAME DETECTOR] | High Voltage | HV Settings



1 Selection High voltage mode "Auto" / "Manual"
2 Input field Manual high voltage
3 Input field HV Default (starting value of the high voltage regulation)
4 Display setting value high voltage
5 Display actual value high voltage
6 Display average high voltage

Fig. 66 HV Settings

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.

NOTICE

It is not recommended to use the "Manual" mode as a normal operating mode for high-voltage control. "Manual" should only be used for service purposes.

Make HV Settings

1. Click on the selection arrow (Fig. 66, item 1) 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 (Fig. 66, item 2).

2. Click in the input field "HV Default" (Fig. 66, item 3) to open the input field.
3. Enter the desired starting value for the high-voltage regulation.
4. Confirm with the Enter key.

- The values are set.

Detector Settings: Detector Service

Device Settings | Setup | Sensors | [NAME DETECTOR] | Detector Service

You can adjust the following settings and read information in the submenu "Service":

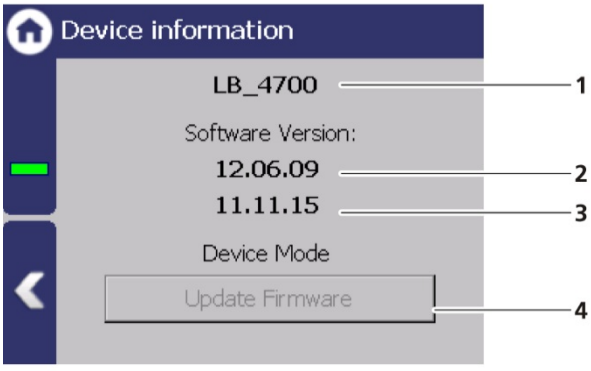
- Device information
- Event Log
- Event overview
- Reset Detector

Fig. 67 Menu "Detector Service"

Detector Settings: Service | Device information

Device Settings | Setup | Sensors | [NAME DETECTOR] | Detector Service | Device information

This window shows you the type of detector (Fig. 68, item 1) as well as an overview of the software version (Fig. 68, item 2, item 3) of the detector.



1 Detector type
2 Software version x
3 Software version
4 Button < Firmware Update >

Fig. 68 Device information

NOTICE

An update of the firmware of the detector may take 1 hour and may only be performed by qualified specialists.

Tipp

The current software versions can be downloaded from the Berthold website (www.berthold.com).

IMPORTANT

In order for the system to detect the update file it must not be located in a directory in the USB storage device.

Perform Firmware Update

1. Save the current update file of the firmware of the detector on a USB storage device.
2. Connect a USB storage device to the device (Fig. 3, item 5).
3. The USB storage device is recognised by the system after a few seconds and the < Firmware Update > (Fig. 68, item 4) button can be clicked.
4. Click on the button < Firmware Update > (Fig. 68, item 4).

▶ The update is performed.

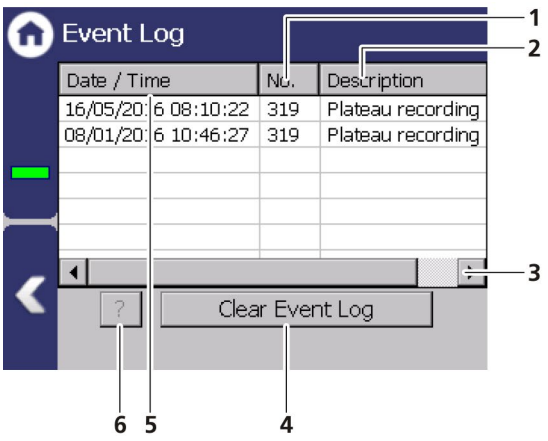
NOTICE

Berthold recommends a test or a calibrating the current outputs whenever if a software update has been carried out.

Detector Settings: Service | Event Log

Device Settings | Setup | Sensors | [NAME DETECTOR] | Detector Service | Event Log

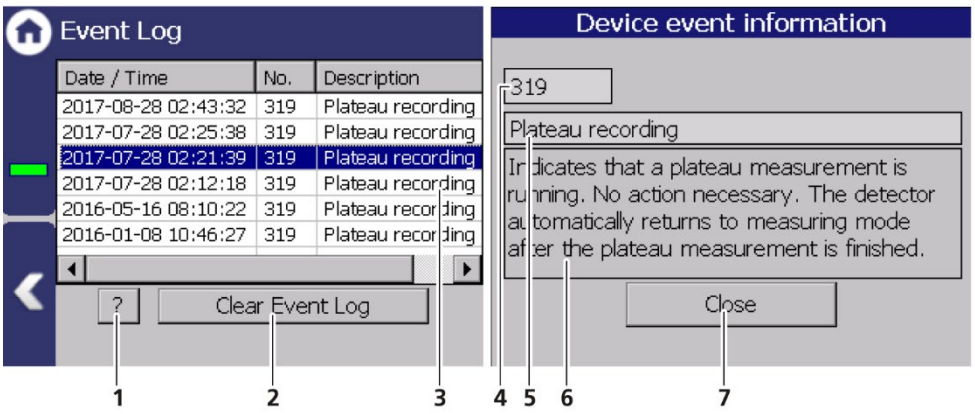
The last 25 events of the detector are displayed in the window "Event Log".



1 Date / time of the event
2 Event no.
3 Info (event title)
4 Button < ? > to display the detailed event description.
5 Button < Clear Event Log >

Fig. 69 Event Log (Detector)

Display Event Description



1 Button < ? >
2 Button < Clear Event Log >
3 Highlighted event
4 Event no.
5 Event title
6 Event description
7 Button < Close >

Fig. 70 Event Log

1. Click on a line in the list (Fig. 70, item 3).
2. Click on < ? > (Fig. 70, item 1)

▶ The event description appears.

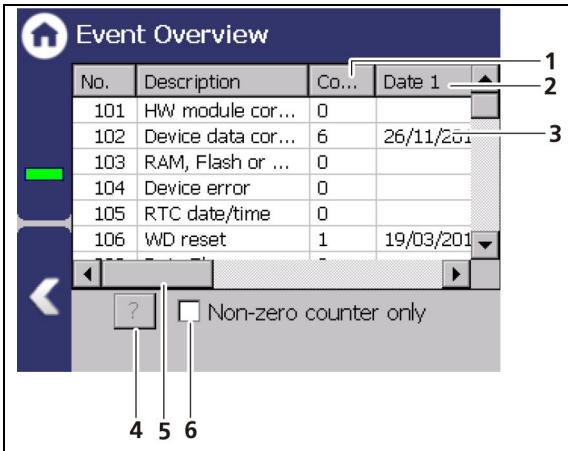
3. With the button < Close >, close the event description (Fig. 70, item 7).

▶ With the button < Clear event log > (Fig. 70, item 2) all events are deleted.

Detector Settings: Detector Service | Event Overview

Device Settings | Setup | Sensors | [NAME DETECTOR] | Detector Service | Event Overview

All events that can be logged are chronologically presented in tabular form in the window "Event overview". Activate the check box "Non-zero counter only" in order to display events that have occurred.



1	"Count" column	4	Button < ? >
2	"Date" column	5	Horizontal scroll bar
3	Event line	6	Display check box "Non-zero counter only"

Fig. 71 Event Overview

1. Click on a line in the list (Fig. 71, item 3).
2. Click on <? > (Fig. 71, item 4).

▶ The event description appears.

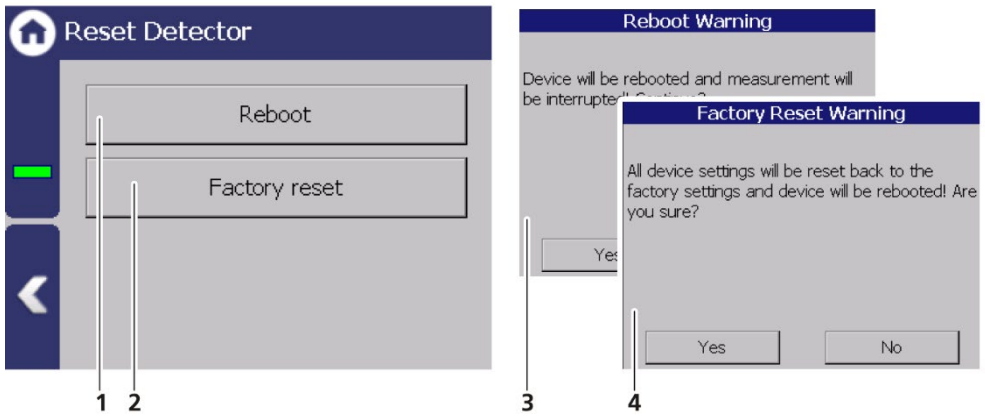
3. With the button < Close >, close the event description.
4. Slide the bar of the horizontal scroll bar (Fig. 71, item 5) to the right to see at what times (date, time) the event occurred.

▶ The last 5 time points are displayed.

Detector Settings: Detector Service | Reset Detector

Device settings | Setup | Sensors | [NAME DETECTOR] | Detector Service | Reset Detector

In the window “Reset Detector”, the detector can be restarted and be reset to the factory settings.



1 Button Restart
2 Button Factory settings
3 Window "Warning: Reboot"
4 Window "Warning: Factory Reset"

Fig. 72 Reset Detector

IMPORTANT

The measurement is interrupted during a restart!

1. To restart the Detector, click the button < Reboot > (Fig. 72, item 1).
▶ A window with a warning "Reboot" (Fig. 72, item 3) opens.
2. Click on < Yes > to confirm.
▶ The device is restarted.

IMPORTANT

All custom configuration settings will be lost with a reset to factory settings!

1. To reset the detector to the factory settings, click the button < Factory reset > (Fig. 72, item 2).
▶ A window with the warning Factory settings (Fig. 72, item 4) opens.
2. Click on < Yes > to confirm.
▶ The device is reset to factory settings and restarts.

7.3.3 Calibration

Device Settings | Setup | Calibration

The Calibration menu is used for the selection of the calibration and calculation method and for adaption of the measurement system to the respective environmental conditions, the actual radiation activity and the adaptation of the background radiation (background level).

NOTICE

Material damage to the device or the system!

Errors in calibration or in the parameter setting can lead to incorrect measurement results. This may possibly lead to loss of production or to damage in the system.

- We encourage you to have the calibration and commissioning performed by Berthold service.

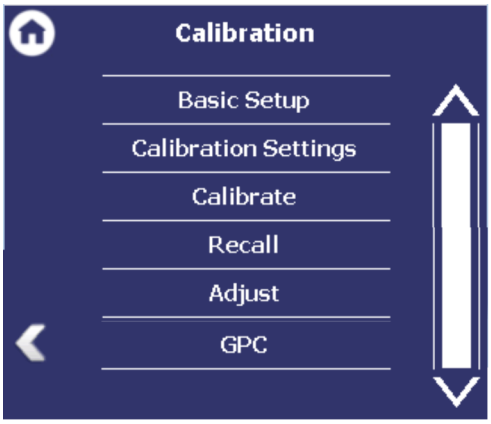
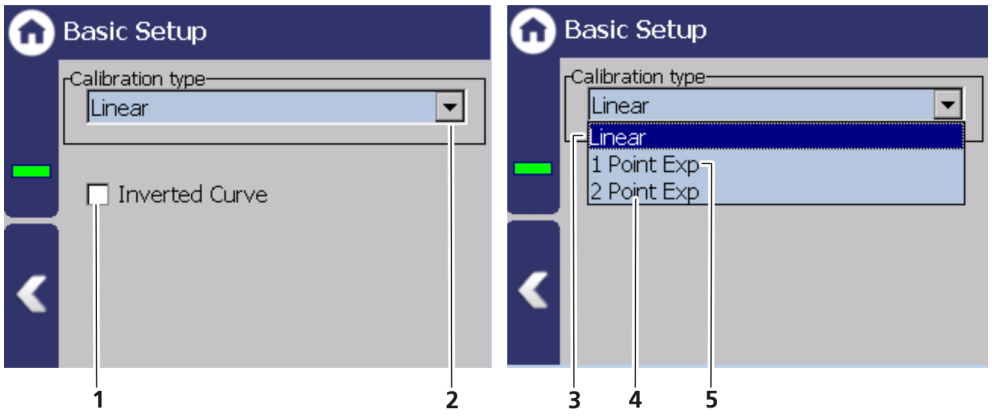


Fig. 73 Menu "Calibration"

Basic Setup

Device Setup | Setup | Calibration | Basic Setup



1 Checkbox "Inverted Curve"
2 Selection calibration Type
3 Calculation "Linear"
4 Calibration "1 Point Exp."
5 Calculation "2 Point Exp."

Fig. 74 Basic Setup

Calibration Method

The method by which the measuring system must be calibrated depends on the respective measuring arrangement.

Inverted Curve

If the check box "Inverted curve" (Fig. 74, item1) is activated, the monotony criterion of the validation changes is strictly ascending.

Linear

Two points (usually 0% and 100%) are required. The container is emptied and filled to determine the count rate at 0% or 100% level.

To increase the accuracy of measurement and take non-linearities of the characteristic curve into account, a larger number of measurement points can be used.

1 Point Exp.

The absorption coefficient, the measuring path and the product density must be known. The second calibration point is thereby calculated.

2 Point Exp.

Exactly two calibration points must be entered.

Calibration Settings: Background

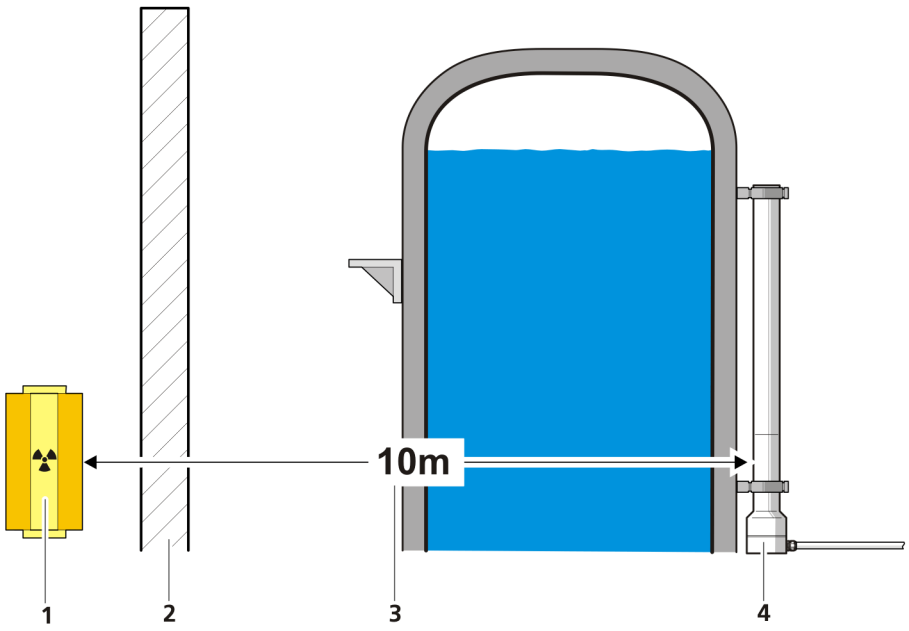
Device Settings | Setup | Calibration | Calibration Settings

The background count rate (Fig. 76, item 1) is the natural background radiation seen by the detector and must be measured at least for rod detectors. This count rate is compensated for by the system. The best approach for your background measurement is dependent on the situation on site and on the type of radiation source.

NOTICE

A closed shield also results in measurable residual radiation, which can falsify the measurement of background radiation. For this reason, it is recommended that the detector (Fig. 75, item 4) be determined at a suitable distance (approx. 10 m) or behind a thick concrete wall (Fig. 75, item 2).

- In the case of measuring arrangements with point sources, it is recommended to place the shield with spotlights at a suitable distance (approx. 10 m), or behind a thick concrete wall.

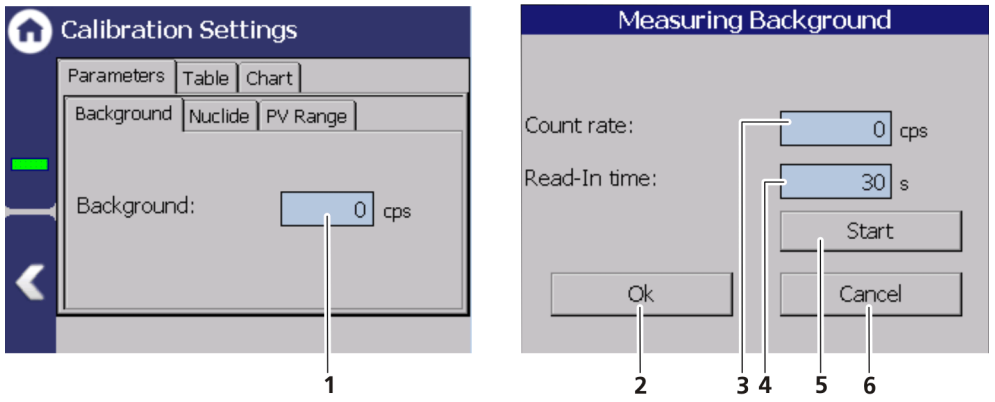


1 Radiation shield (closed)
2 Concrete wall
3 Distance
4 Rod detector

Fig. 75 Conditions during background determination

IMPORTANT

All entries and changes in the “Parameters” tab will take effect only when you click on the < Calibrate > button click in the Calibrate Submenu.



1 Input field Background [cps]
2 Button < Ok >
3 Input field count rate
4 Input field measuring Duration
5 Button < Start >
6 Button < Cancel >

Fig. 76 Calibration parameters: Background

Determine Background

Device Settings | Setup | Calibration | Calibration Settings

1. Click on the text field "Background" (Fig. 76, item 1).

▶ A new window "Background" opens to determine the background Count rate.

NOTICE

Influences from neighbouring sources must be excluded in order to avoid errors in the measurement of natural background radiation.

2. Click on the ”Read-In-Time” field and specify the duration of the measurement in seconds. The higher you set the measurement time, the more accurate the result.
3. Confirm with the Enter key and click on the button < Start > to start the measurement.

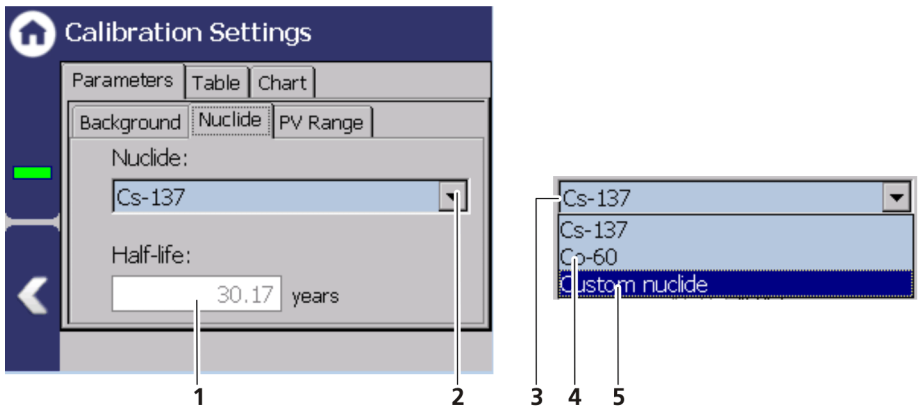
▶ The measurement is performed.

4. Click on < OK > to accept the count rate.

Calibration Settings: Nuclide

Device Settings | Setup | Calibration | Calibration Settings

The isotope used can be selected in the “Nuclide” tab. The half-life of the isotope is shown on the display field (Fig. 77, item 1).



1 Display field half-life [years]
2 Selection arrow Nuclide
3 Selection Caesium-137
4 Selection Cobalt-60
5 Custom nuclide

Fig. 77 Calibration Parameters: Nuclide

1. Click on the selection arrow (Fig. 77, item 2).
2. Select the isotope used. Cs-137 (Fig. 77, item 3) or Co-60 (Fig. 77, item 4). The isotope of the source is on the type plate of the screen (Fig. 78).
3. When selecting ”Custom nuclide” (Fig. 77, item 5), the half-life of the isotope can be entered.

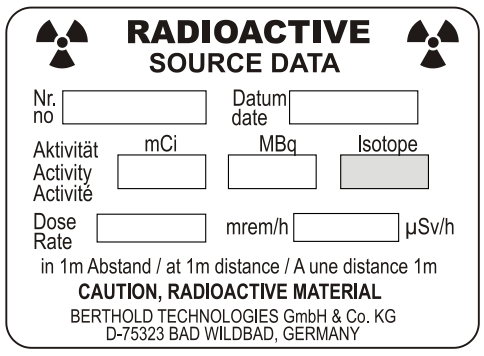
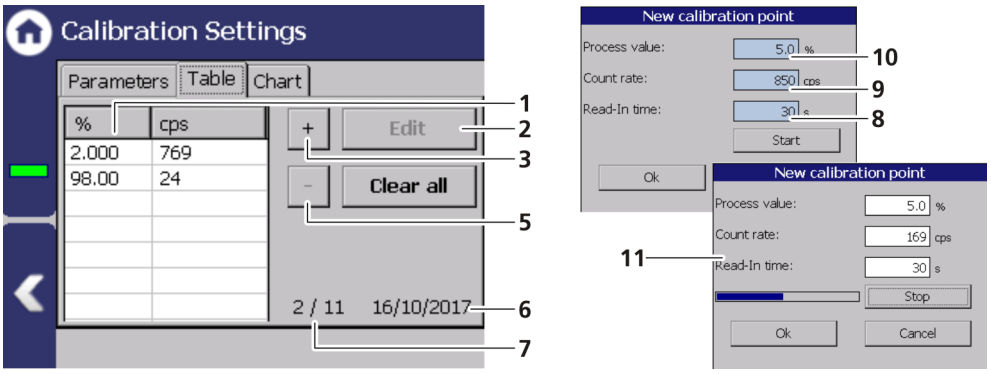


Fig. 78 Type plate source

Calibration Settings: Table (linear calibration type)

Device Settings | Setup | Calibration | Calibration Settings



1	Table calibration	7	Count of the calibration points (e.g. 2 of max. 11)
2	Button < Edit >	8	Measuring Duration [s]
3	Button Add measuring point < + >	9	Count rate [cps]
4	Button Completely delete points < Clear All >	10	Process value [%]
5	Button Delete point < - >	11	Determine new calibration point
6	Date of the last editing		

Fig. 79 Calibration Parameters (Table linear calibration type)

Add new Calibration Point

1. Click on the button < + > (Fig. 79, item 3).

▶ The window “New calibration point” (Fig. 79, item 8 - 10) opens.

2. Click on the input field “Process value” (Fig. 79, item 10) to open the input field.
3. Specify the current, actual level in percent and confirm with the Enter key.
4. Click on the input field “Read-In-Time” (Fig. 79, item 8) to open the input field.
5. Specify a measurement time and confirm with the Enter key.
6. Click on the button < Start >.

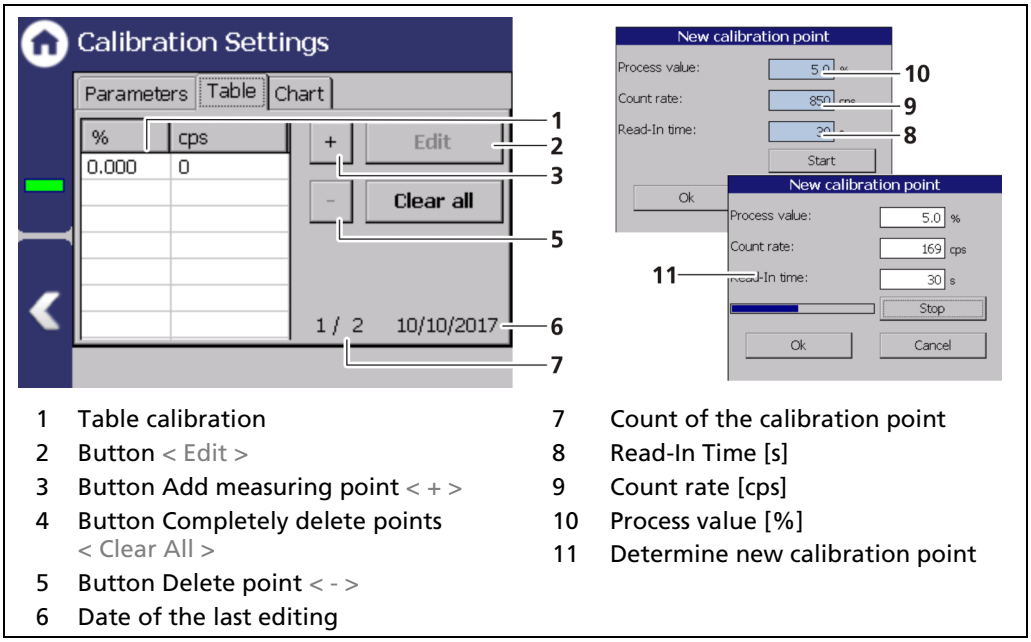
▶ The Window “New calibration Point” (Fig. 79, item 11) opens and the count rate is determined.

7. Click on < OK > to confirm the new calibration point.

▶ The new calibration point is recorded in the table.

Calibration Settings: Table (2 Point Exp. calibration type)

Device Settings | Setup | Calibration | Calibration Settings



1	Table calibration	7	Count of the calibration point
2	Button < Edit >	8	Read-In Time [s]
3	Button Add measuring point < + >	9	Count rate [cps]
4	Button Completely delete points < Clear All >	10	Process value [%]
5	Button Delete point < - >	11	Determine new calibration point
6	Date of the last editing		

Fig. 80 Calibration Parameters (Table 2 Point Exp. calibration type)

Add new Calibration Point

1. Click on the button < + > (Fig. 80, item 3).

▶ The window “New calibration point” (Fig. 80, item 11) opens.

2. Click on the input field “Process value” (Fig. 80, item 9) to open the input field.
3. Specify the current, actual level in percent and confirm with the Enter key.
4. Click on the input field “Read-In Time” (Fig. 80, item 10) to open the input field.
5. Specify a measurement time and confirm with the Enter key.
6. Click on the button < Start >.

▶ The Window “New calibration Point” (Fig. 80, item 11) opens and the count rate is determined.

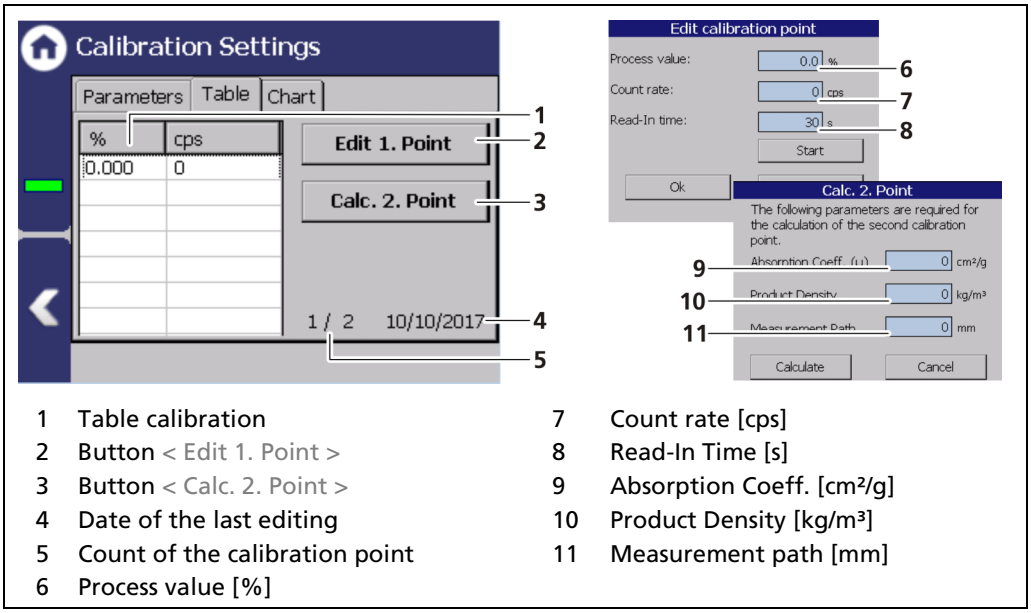
7. Click on < OK > to confirm the new calibration point.

▶ The new calibration point is recorded in the table.

Calibration Settings: Table (1 Point Exp. calibration type)

Device Settings | Setup | Calibration | Calibration Settings

The absorption coefficient, the measuring path and the product density must be known. The second calibration point is thereby calculated.



1	Table calibration	7	Count rate [cps]
2	Button < Edit 1. Point >	8	Read-In Time [s]
3	Button < Calc. 2. Point >	9	Absorption Coeff. [cm²/g]
4	Date of the last editing	10	Product Density [kg/m³]
5	Count of the calibration point	11	Measurement path [mm]
6	Process value [%]		

Fig. 81 Calibration Parameters (Table 1 Point Exp. calibration type)

Add new Calibration Point

1. Click on the button < Edit 1. Point > (Fig. 81, item 2).

▶ The window “Edit calibration point” (Fig. 81, item 6-8) opens.

2. Click on the input field “Read-In Time” (Fig. 80, item 8) to open the input field.
3. Specify a measurement time and confirm with the Enter key.
4. Click on the input field ”Process value” (Fig. 80, item 6) to open the input field. Specify the current, actual level in percent and confirm with the Enter key.
5. Click on the button < Start >.

▶ The count rate is determined.

6. Click on < OK > to confirm the new calibration point.
7. Click on the button < Calc. 2. Point > (Fig. 81, item 3).
8. Enter the absorption coefficient of the product (Fig. 81, item 9). Enter it with a negative prefix.
9. Enter the product density (Fig. 81, item 10).
10. Enter the measurement path (Fig. 81, item 11).
11. Click on the button < Calculate >.

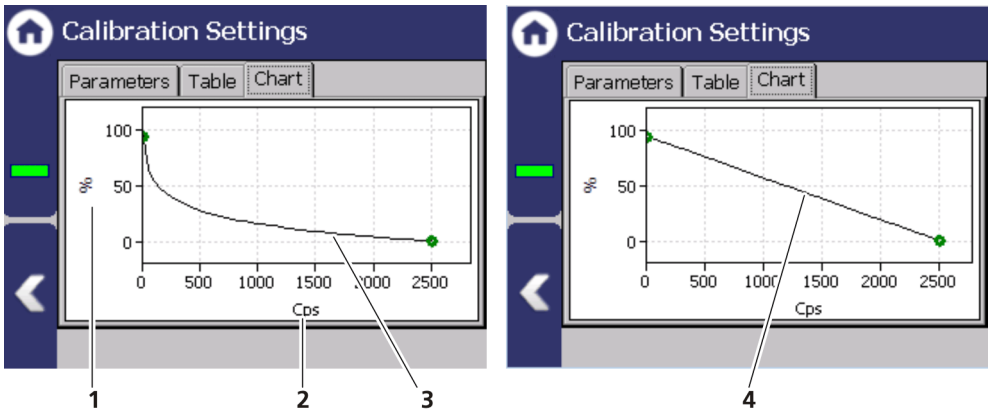
▶ The second Point was calculated.

12. Click on < OK > to confirm the new calibration point.

Calibration Settings: Chart

Device Settings | Setup | Calibration | Calibration Settings

The characteristic curve of the calibration performed is shown in the tab "Chart".



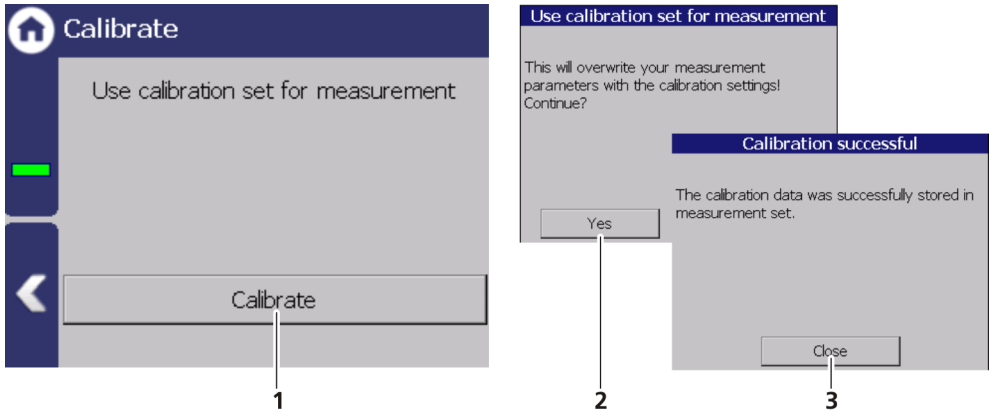
1 Axis level [%]
2 Axis count rate [cps]
3 Characteristic chart (exponential)
4 Characteristic chart (linear)

Fig. 82 Calibration Parameters (Chart)

Calibrate

Device Settings | Setup | Calibration | Calibrate

Data that are necessary for a complete measurement are found in the calibration parameter set. All the data of the calibration parameter set are transferred to the measurement parameter set when the button "Calibrate" is clicked. Only after this are they can be used for measurement value calculation.



1 Button < Calibrate >
2 Button < Yes >
3 Button < Close >

Fig. 83 Calibrate

1. Click on the button < Calibrate > (Fig. 83, item 1).

▶ A new window with the message "Use calibration set for measurement" appears.

2. Click on the < Yes > button (Fig. 83, item 2) to overwrite your measurement parameters with the calibration settings.

▶ A new window with the message "Calibration successful" appears.

3. Click on the < Close > button (Fig. 83, item 3)

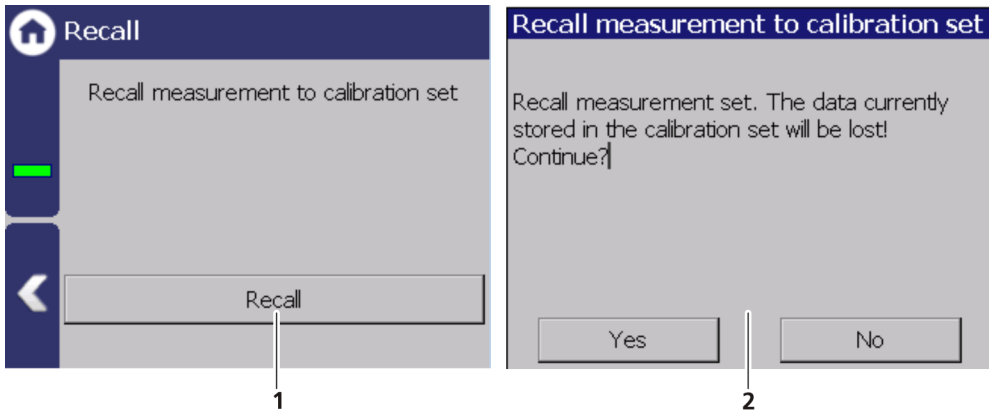
▶ The calibration was performed.

NOTICE

- ▶ Check your calibration by simulating a detector count rate. Use the test count rate in the simulation menu. As the value of the test count rates, e.g. the counting rates from the calibration points are used.
- ▶ Check whether the correct measured value is displayed at the respective test count rate.

Recall

Device Settings | Setup | Calibration | Recall



1 Button < Recall >
2 Window “Recall measurement to parameter set”

Fig. 84 Recall

Recall to Calibration Set

1. Click on the button < Recall > if you want to copy the measurement set into the calibration set.
2. The window with the message “Recall measurement to calibration set” appears.
3. Click on < Yes >.

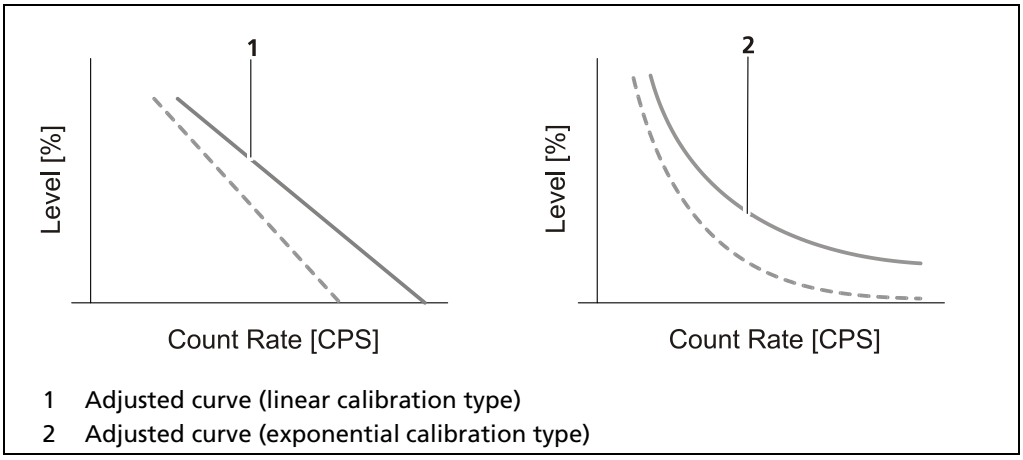
▶ The calibration parameter set was overwritten.

Adjust: Standard Adjust

Device Settings | Setup | Calibration | Adjust

Use the functionality after source exchange or after entering a theoretical, normalized multi-point calibration (e.g. a Radical calculation) to adjust the table in the measuring set.

That will keep the shape of the curve, because all calibration points are extrapolated as percentage of the difference between the old- and the new calibration points.

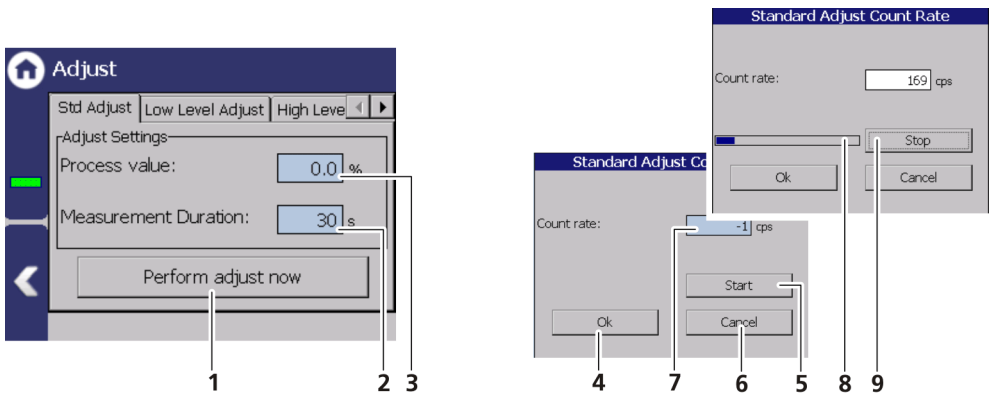


1 Adjusted curve (linear calibration type)
2 Adjusted curve (exponential calibration type)

Fig. 85 Adjusted curves

NOTICE

During the Standard Adjust, level and pressure must remain constant.



1 Button < Perform adjust now >
2 Input field “Measurement Duration” [s]
3 Input field “Process value” [%]
4 Button < Ok >
5 Button < Start >
6 Button < Cancel >
7 Input field “Count rate” [cps]
8 Process bar
9 Button < Stop >

Fig. 86 Standard adjustment

1. Click on the field "Process value" (Fig. 86, item 3) to open the input field.
2. Enter the process value % (acc. to standard display) and confirm.

3. Click on the “Read-In-Time” field (Fig. 86, item 2) and specify the duration of measurement in seconds. The higher you set the measurement time, the more accurate the result. Click
4. Click < Ok > to accept the value.
5. Click on the button < Perform adjust now > (Fig. 86, item 1).

▶ A new window opens (Standard Adjust Count Rate).

6. Click on the button < Start > (Fig. 86, item 5) to start the measurement.
7. Click < Ok > (Fig. 86, item 4) to accept the value.

▶ The standard adjust was performed

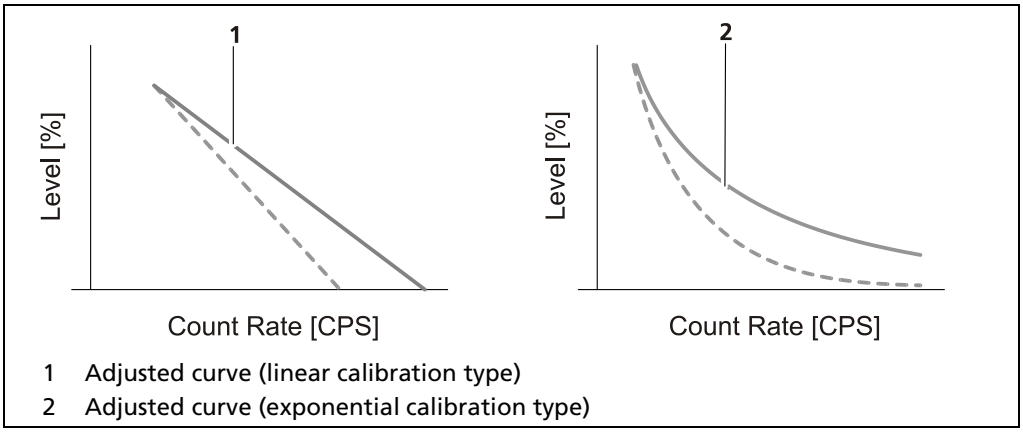
IMPORTANT

When executing an Adjust, the measurement parameter set was overwritten. If the system should be recalibrated, a Recall of the measurement parameter set to the calibration parameter must be performed (see sub chapter “Recall”). Otherwise the Adjust will become lost.

Adjust: Low Level Adjust

Device Settings | Setup | Calibration | Adjust

After calibration, a level adjustment can be performed. A level adjustment must be performed if the level shown is not the actual level. The lower adjustment can only be performed at a level < 50%. The count rate at 100% will be kept fixed, while all other points of the curve will be adjusted according to the adjusted count rate at the entered level value.

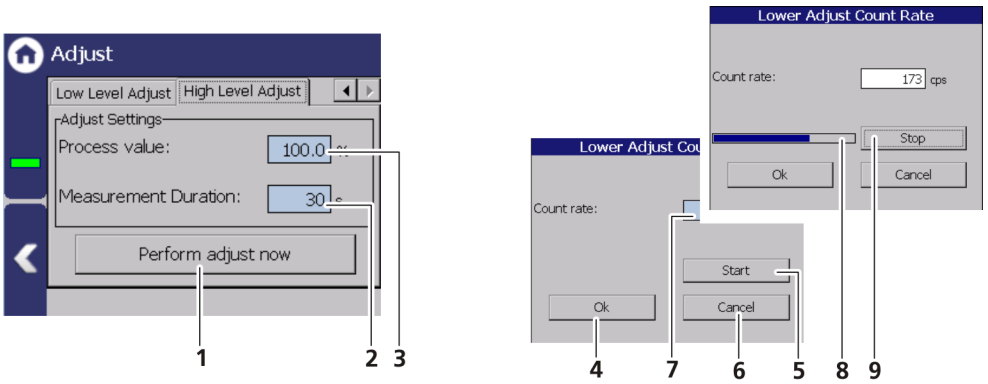


1 Adjusted curve (linear calibration type)
2 Adjusted curve (exponential calibration type)

Fig. 87 Adjusted curves (Low Level Adjust)

NOTICE

Make sure that the source is mounted and the beam path is open. The container must be empty, or be below the limit value.



1 Button < Perform adjustment >
2 Input field "Measuring Duration" [s]
3 Input field "Process value" [%]
4 Process bar
5 Button < Ok >
6 Display field "Count rate" [cps]
7 Button < Cancel >
8 Button < Start >
9 Button < Stop >

Fig. 88 Lower adjustment

1. Click on the field Process value (Fig. 88, item 3) to open the input field.
2. Specify a percentage value for the lower adjustment and confirm with the Enter key.
3. Click on the "Read-In-Time" field (Fig. 88, item 2) and specify the duration of measurement in seconds. The higher you set the measurement time, the

more accurate the result.

4. Click on the button < Perform adjust now > (Fig. 88, item 1).

▶ A new window opens.

5. Click on the button < Start > (Fig. 88, item 5).

▶ The measurement starts.

6. Click < Ok > to accept the value.

▶ The level has been adjusted to the process value (see standard display).

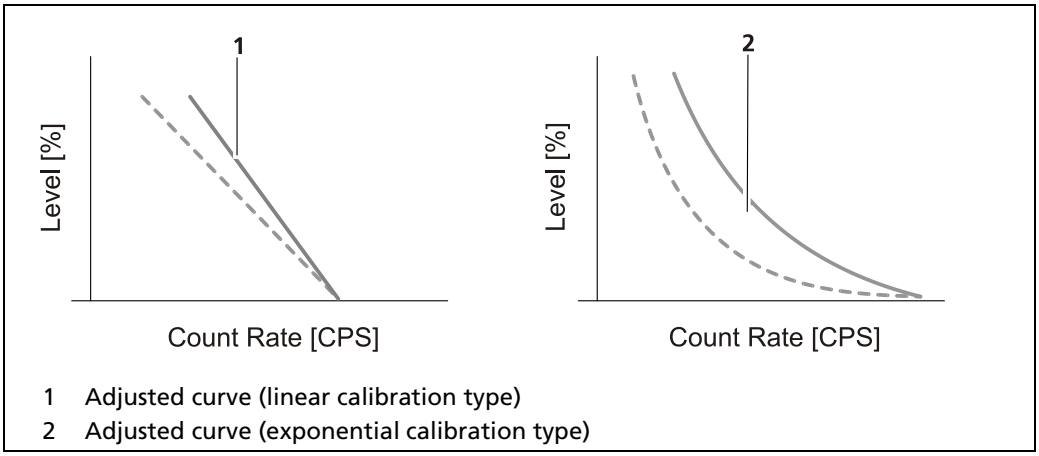
IMPORTANT

When executing an Adjust, the measurement parameter set was overwritten. If the system should be recalibrated, a Recall of the measurement parameter set to the calibration parameter must be performed. Otherwise the Adjust will become lost.

Adjust: High Level Adjust

Device Settings | Setup | Calibration | Adjust

The upper adjustment can only be performed at a level > 50%. The count rate at 0% will be kept fixed, while all other points of the curve will be adjusted according to the adjusted count rate at the entered level value.

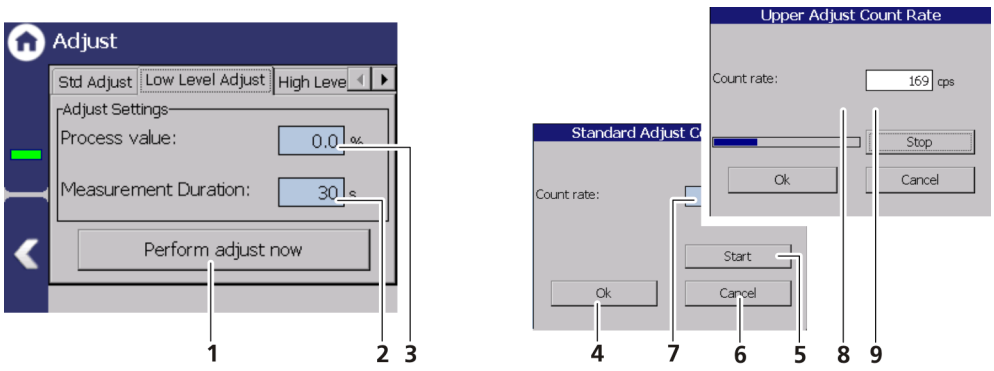


1 Adjusted curve (linear calibration type)
2 Adjusted curve (exponential calibration type)

Fig. 89 Adjusted curves (High Level Adjust)

NOTICE

Make sure that the source is mounted and the beam path is open. The container must be full during the upper adjustment.



1 Button < Perform adjustment >
2 Input field "Measuring time" [s]
3 Input field "Process value" [%]
4 Process bar
5 Button < Ok >
6 Display field "count rate" [cps]
7 Button < Cancel >
8 Button < Start >
9 Button < Stop >

Fig. 90 Upper adjustment

1. Click on the field Process value (Fig. 90, item 3) to open the input field.
2. Specify a percentage value for the upper adjustment and confirm with the Enter key.
3. Click on the "Read-In-Time" field (Fig. 90, item 2) and specify the duration of measurement in seconds. The higher you set the measurement time, the more accurate the result.
4. Click on the button < Perform adjust now > (Fig. 90, item 1).

5. Click on the < Start > button (Fig. 90, item 5).

▶ The measurement starts.

6. Click < Ok > to accept the value.

▶ The level has been adjusted to the process value (see standard display).

IMPORTANT

When executing an Adjust, the measurement parameter set was overwritten. If the system should be recalibrated, a Recall of the measurement parameter set to the calibration parameter must be performed (see cub chapter “Recall”). Otherwise the Adjust will become lost.

GPC[1]

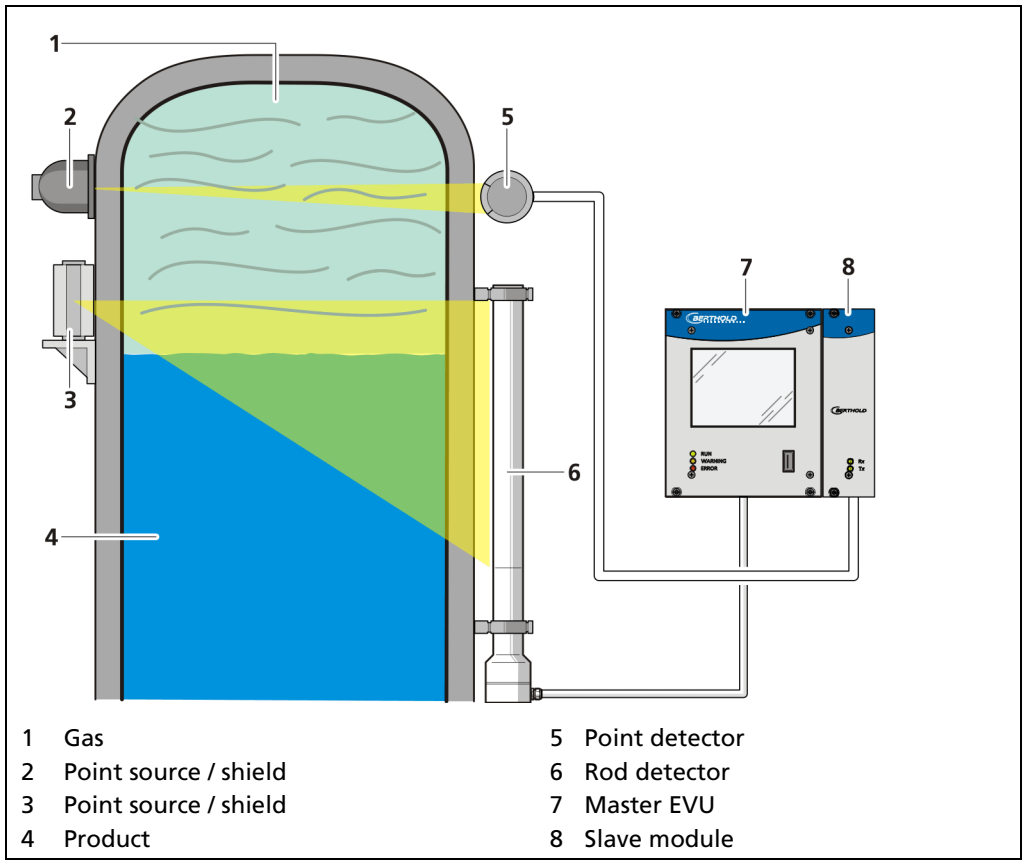
Device Settings | Setup | Calibration | GPC

If the container is operating under gas pressure and the gas pressure is not constant, then a continuous gas density compensation is recommended. For this purpose, an additional measurement is required which is located above the level measurement and which continuously measures the gas density in the container.

NOTICE

For the gas property compensation (GPC) an additional detector is mandatory to measure the gas density. This detector is connected with the LB 470 level evaluation unit, via a slave module, or via another LB 470 evaluation unit.

- Add this detector according the instructions in chapter 7.3.2 and activate it as GPC detector Fig. 54.



1	Gas	5	Point detector
2	Point source / shield	6	Rod detector
3	Point source / shield	7	Master EVU
4	Product	8	Slave module

Fig. 91 GPC example measurement arrangement

NOTICE

This functionality presuppose comprehensive knowledge and should only be activated by a Berthold service technician or a specially trained and instructed person.

[1] GPC = Gas Property Compensation

You can make the following settings in the submenu GPC (gas properties compensation) (Fig. 92):

- GPC calibration
  - Reference count rate
  - Background
  - Factor M
  - Max. GPC factor
  - GPC Time constant
- GPC settings
- Reset GPC

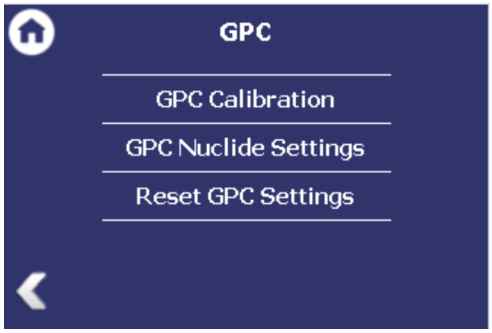
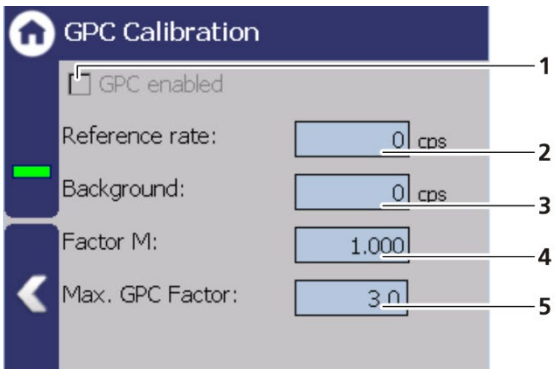


Fig. 92 Submenu "GPC"

GPC Calibration

Device Setup | Setup | Calibration | GPC | GPC calibration

The "GPC calibration" is used to adapt the measuring sensitivity of the gas density detector to that of the level detector. The check box "GPC enabled" (Fig. 93, item 1) can only be selected when a detector is configured for gas density measurement and the unit % is for "PV" selected.



1 Check box "GPC enabled"
2 Check box Reference count rate [cps] for the detector under calibration conditions[2]
3 Input field Background (background radiation) [cps]
4 Calibration menu for Factor M
5 Input field Max. GPC Factor

Fig. 93 GPC Calibration

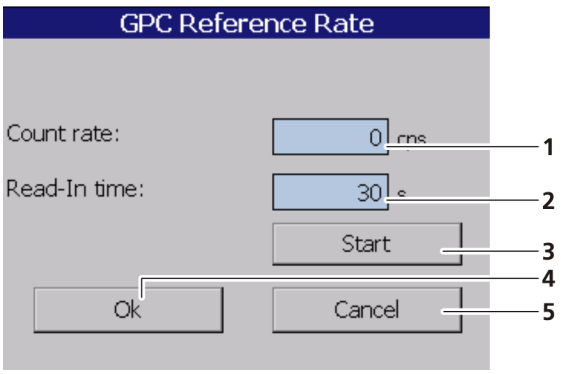
[2] Calibration conditions exist when the gas density is the same as in the calibration of the level measurement.

GPC Calibration: Reference Rate

The reference count rate of the connected density measurement must be recorded at the same pressure at which the level calibration table was recorded. Therefore, it is recommended to read in the reference count rate immediately after recording the empty level count rate. Click on the input field for the reference count rate (Fig. 93, item 2) to read in the reference count rate.

IMPORTANT

When determine the reference count rate of the GPC detector, the gas density in the vessel must be the same than during the level calibration.



1 Input field count rate [cps]
2 Input field measuring Duration [s]
3 Button < Start >
4 Button < Ok >
5 Button < Cancel >

Fig. 94 GPC Calibration: Reference Count Rrate

Determine reference Count Rate

1. Click on the text field "count rate" (Fig. 93, item 3).

▶ A new window "GPC reference rate" opens (Fig. 94).

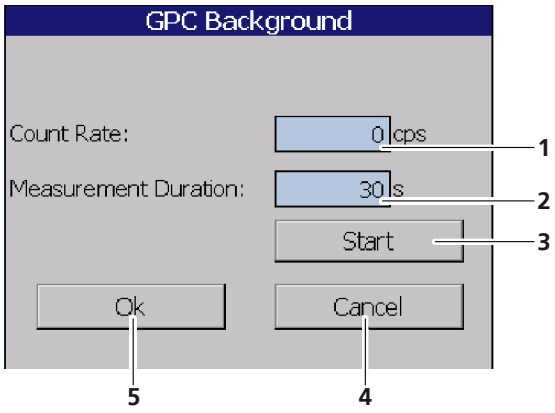
2. Click on the "Read-In-Time" field (Fig. 94, item 2) and specify the duration of measurement in seconds. The higher you set the measurement time, the more accurate the result.
3. Confirm with the Enter key and click on the button < Start > to start the measurement.

▶ The measurement is performed.

4. Click on < OK > to accept the count rate.

GPC Calibration: Background

The background count rate (Fig. 99, item 3) indicates the natural background radiation of the gas density detector if no radiation source is installed. This count rate is necessary for the internal decay compensation. The background must be taken if the GPC-detector is a rod detector and it can be taken if the GPC-detector is a point detector.



1 Input field count rate [cps]
2 Input field measuring Duration [s]
3 Button < Start >
4 Button < Ok >
5 Button < Cancel >

Fig. 95 GPC Calibration: Background

Determine background

1. Click on the text field "Background" (Fig. 93, item 3).

▶ A new window "Background" opens to determine the background radiation (Fig. 95).

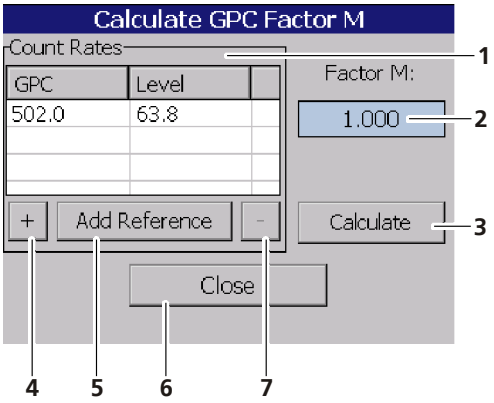
2. Click on the ”Read-In-Time” field and specify the duration of measurement in seconds. The higher you set the measurement time, the more accurate the result.
3. Confirm with the Enter key and click on the button < Start > to start the measurement.

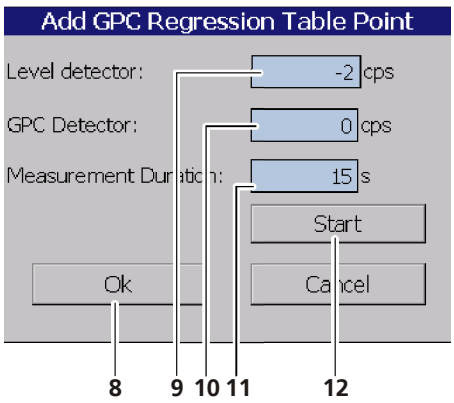
▶ The measurement is performed.

4. Click on < OK > to accept the count rate.

GPC Calibration: Factor M

To calculate the correct factor M, click on the input field for the factor M. In this table the first calibration point can be inserted directly from the available data with the button < Add Reference > (Fig. 96, item 5). At least one more point is required to calculate a factor M. This second point is ideally taken at the highest occurring gas density. Futher table points with other gas densities improve the accuracy of Factor M. With the button < Calculate > (Fig. 96, item 3) the factor M is calculated from the table values.





1 List GPC count rates
2 Input field Factor M
3 Button <Calculate>
4 Button <+> (manual adding count rates)
5 Button <Add Reference> (current calibration value)
6 Button <Close>
7 Button < - > (removal of the point)
8 Button <Ok>
9 Input field level detector
10 Input field GPC detector
11 Measuring Duration
12 Button <Start>

Fig. 96 GPC Calibration: Calculate factor M

Capturing the Count Rates

1. Click on < Add Reference > to take the first point from the already existing data.
   a) Click on the < + > button (Fig. 96, item 4) to add a new point. For this, the pressure in the container must be changed.
   b) Click on the input field "Read-In-Time" (Fig. 96, item 11) and enter a measurement time. Confirm with the Enter key.
2. Click on the button <Start> (Fig. 96, item 12). Make sure that the actual level in the container does not rise above 0% during the measurement time.
3. Repeat the capture for the maximum gas density or at least to a gas density as close as possible to maximum.

Calculate Factor M

After all values have been entered or calculated in the GPC calibration window, the GPC function can be activated with the "GPC activated" check box (Fig. 93, item 1).

The "Factor M" (Fig. 96, item 2) is close to 1 (default value) for standard applications.

1. Click the button < Calculate > (Fig. 96, item 3) to determine Factor M from the count rate table.

▶ Factor M has been calculated and is displayed in the input field (Fig. 96, item 2).

GPC Calibration: Max. GPC Factor

The maximum factor with which the level count rate may be compensated is specified in the field "Max. GPC Factor" (Fig. 99, item 5). The default value is 3.0.

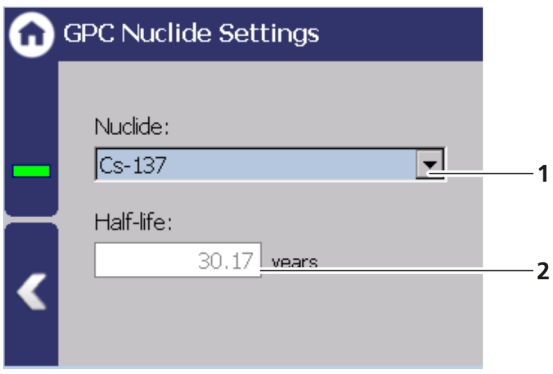
GPC Nuclide Settings

Device Settings | Setup | Calibration | GPC | GPC Nuclide Settings

Under "GPC Settings" the isotope of the source for gas density measurement can be selected (Fig. 97, item 1). The half-life time of the isotope is shown in the display field (Fig. 97, item 2).

NOTICE

The sources for level measurement and the sources of the GPC measurement must contain the same Nuclide (see Device Setup | Setup | Calibration | Calibration Settings tab "Nuclide).



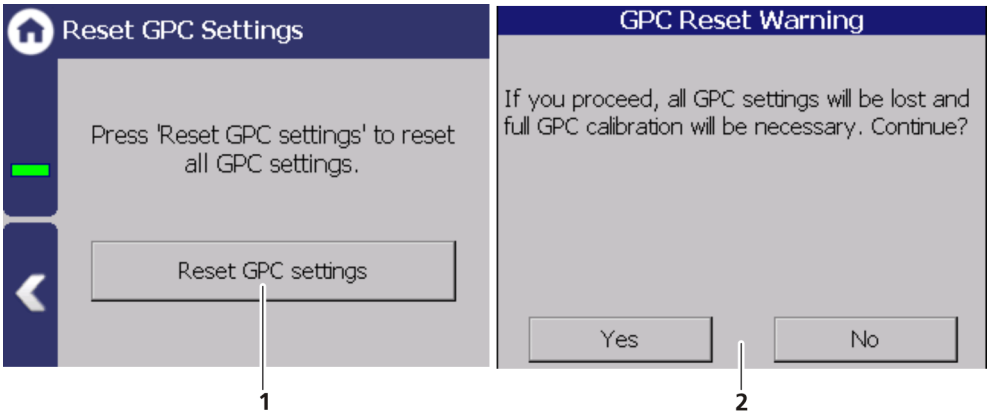
1 Selection arrow "Nuclide"
2 Display field "Half-life" [years]

Fig. 97 Submenu "GPC settings"

Reset GPC Settings

Device Settings | Setup | Calibration | GPC | Reset GPC

All GPC settings can be reset in the window "Reset GPC Settings".



1 Button <Reset GPC settings>
2 Window "Reset Warning"

Fig. 98 Reset GPC Settings

1. Click on the button Reset GPC (Fig. 98, item 1).

▶ A confirmation message (Fig. 98, item 2) appears.

2. Click on < Yes > to confirm, click on < No > to cancel.

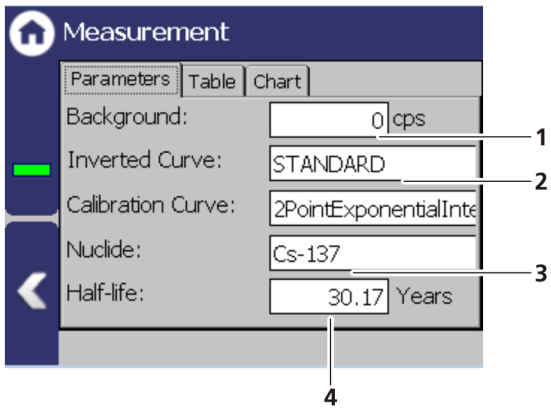
7.3.4 Measurement

Device Settings | Setup | Measurement

The window “Measurement” is used for an overview of the measurement parameters and calibration settings used.

Measurement: Parameter

The parameters used for the current measurement are displayed in the “Parameters” tab.

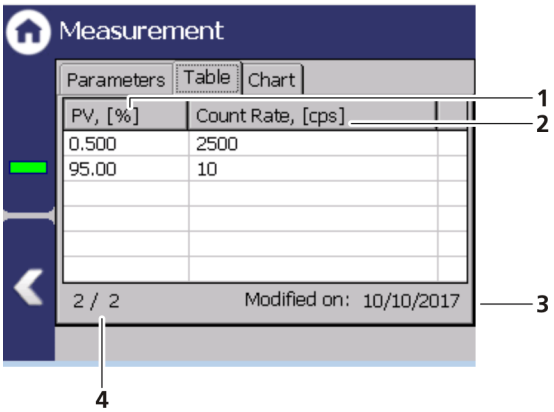


1 Background count rate [cps]
2 Characteristic curve (standard or inverted)
3 Nuclide (Cs-137 or Co-60)
4 Half-life [years]

Fig. 99 Measurement (Parameters)

Measurement: Table

The measurement points used for the current measurement are displayed in the “Table” tab.

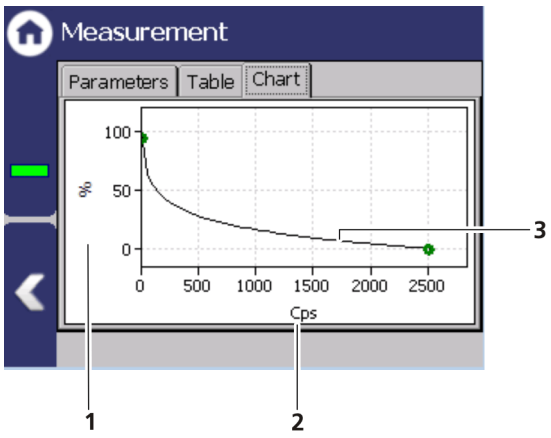


1 PV measurement point in percent [%]
2 Count rate [cps]
3 Date of last change of the measurement parameter set
4 Number of measuring points

Fig. 100 Measurement (Table)

Measurement: Chart

The characteristic curve of the current measurement is displayed in the “Graphics” tab.



1 Axis level [%]
2 Axis count rate [cps]
3 Characteristic curve

Fig. 101 Measurement (Chart)

7.3.5 Signal Condition

Device Settings | Setup | Signal Condition

You can perform the following settings and read information in the "Signal Condition" window:

- Damping (Time Constant)
- PV Range
- Rapid Switch
- XIP (X-Ray interference protection)
- Source Replacement

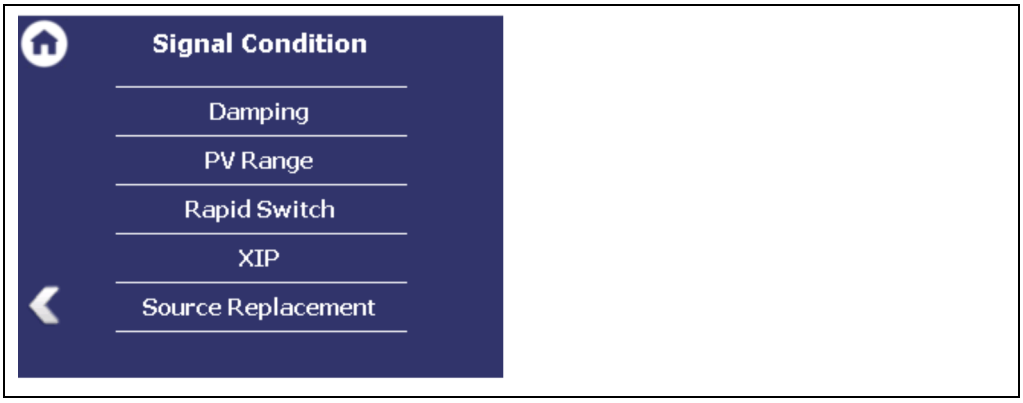


Fig. 102 Menu "Signal Condition"

Signal Processing: Damping

Device Settings | Setup | Signal Condition | Damping

The reaction time of the measured value display (standard display) can be set in the window ″Damping″. The measurement reacts quickly to rapid process changes (e.g. by agitators) for a small time constant (min. 1 sec). The measurement reacts correspondingly slower for a larger time constant. However, due to the stronger filtering, the statistical error is reduced with a larger time constant and the measurement is correspondingly less noisy. A typical time constant for radiometric level measurements is 20 seconds.

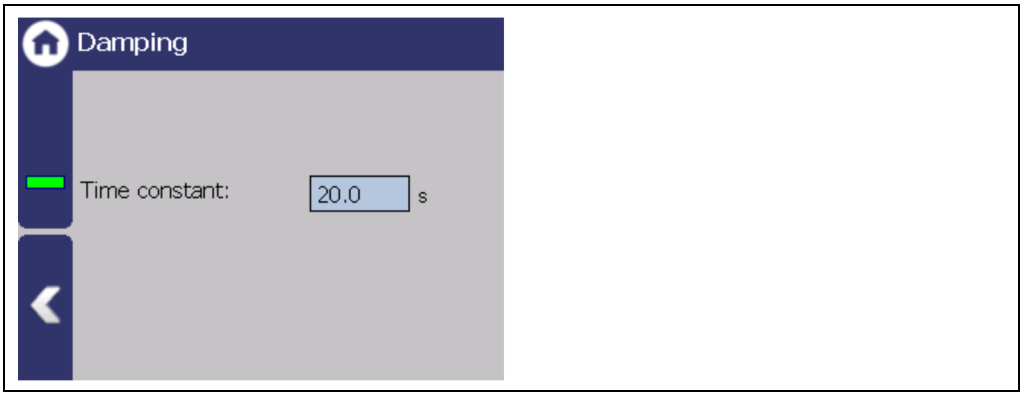


Fig. 103 Signal Condition (damping)

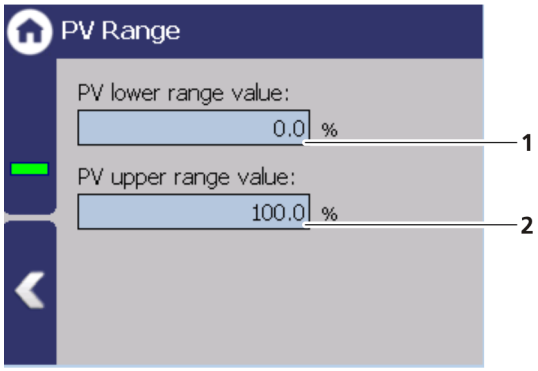
1. Click on the input field to change the time constant.
2. Confirm the value with the Enter key.

▶ The time constant has been changed.

Signal Condition: PV Range

Device Settings | Setup | Signal Condition | PV Range

The lower and upper limit of the process range of the active measuring parameter set can be set in the tab “PV Range” (Process Value Range). These limits define the signal range of the analog current output (4 ... 20 mA bzw. 0 ... 20 mA). The unit is displayed that is selected in the menu System | Units in the box "PV".



1 Input field lower value [%]
2 Input field upper value [%]

Fig. 104 Signal Condition (PV Range)

1. Click on the input field (Fig. 104, item 1) to enter, in percent [%], the level which should correspond to an output current of e.g. 4mA.
2. Confirm with the Enter key.
3. Click on the input field (Fig. 104, item 2) to enter, in percent [%], the level which should correspond to an output current of 20mA.
4. Confirm with the Enter key.

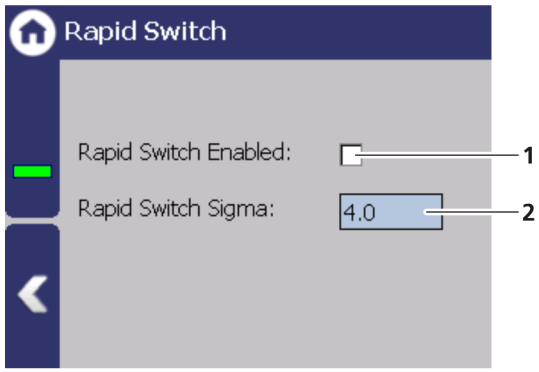
Signal Condition: Rapid Switch

Device Settings | Setup | Signal Condition | Rapid Switch

IMPORTANT

The use of the function "Rapid Switch" is recommended only for special applications where the output signal has to adapt rapidly to the new value, e.g. in case of measurements on small tanks and if sudden level changes occur.

When Rapid Switch (Fig. 108, item 1) is activated, there is a rapid reaction (Fig. 108, item 2) to a quick change in level. The time constant in this case is set to 1/10. After that, the time constant is reset to the original value. A change in level is considered to be a "rapid" change when the count rate is changing more than the entered sigma value within a short time. The sigma value can be adjusted to the process. A sigma of 4.0 is factory set at delivery.



1 Activate check box Rapid Switch Enabled
2 Input field Rapid Switch Sigma

Fig. 105 Signal Condition (Rapid Switch)

NOTICE

Rapid Switch and Interference detection must not be activated simultaneously.

Signal Condition: XIP[3] (Radiation Interference)

Device Settings | Setup | Signal Condition | XIP

This function allows you to take interference "XIP" into consideration. Measurement jumps that influence the process can arise through interference. Only rapid increases are considered.

If detection (Fig. 106, item 1) is activated, the last valid measured value is frozen.

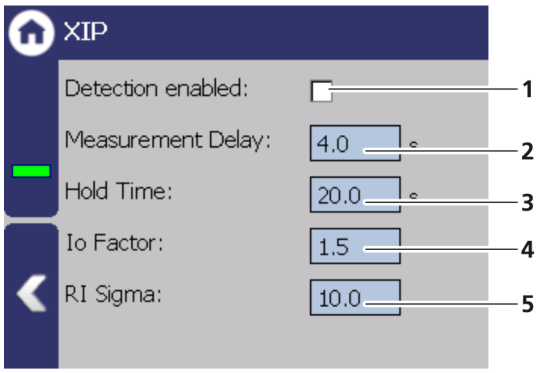
Cycle delay [s] — This value determines the wait time for the measured value generation. The change does not affect the measurement above this time.

Hold time [s] — The valid measurement value is frozen at this time after detection of interference.

I_0 factor — The "I_0 factor" determines the recognition criteria for interference.

RI Sigma — A sudden increase in the count rate is an indication of interference radiation. The smaller the value, the more sensitive the setting. To avoid false alarms, a value for RI Sigma >5 (e.g. 6) should be selected. In the case of turbulence and stirrers that cause the measured level value to fluctuate, the value must be set correspondingly higher.

If the level measurement is used as a limit switch with point source and point detector, then it is recommended to set the value to 999 and deactivate the sigma function.



1 Check box the "Activate detection"
2 Input field measurement delay
3 Input field hold time
4 Input field I_O factor
5 Input field RI Sigma

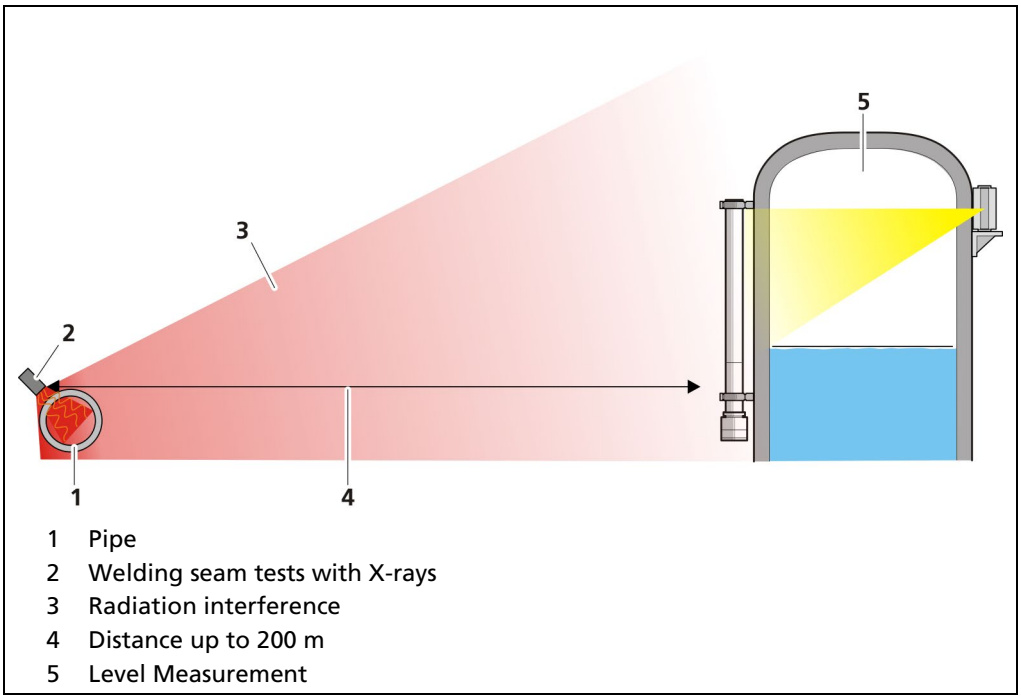
Fig. 106 Signal Condition (Radiation Interference)

NOTICE

Rapid Switch and Interference detection must not be activated simultaneously.

[3] XIP = X-Ray Interference Protection

Detecting Interference Radiation XIP



1 Pipe
2 Welding seam tests with X-rays
3 Radiation interference
4 Distance up to 200 m
5 Level Measurement

Fig. 107 Interference radiation during a weld inspection

Detecting Interference Radiation

The high Gamma sensitivity of scintillation detectors may cause a false reading. To detect interfering radiation, a double plausibility check can be enabled.

The alarm is triggered by:

Scenario A - Maximum possible count rate (empty calibration)

$$Is > Io * 1.5$$

Is = current count rate in cps integrated over one second
Io = maximum count rate at empty calibration

Scenario B - Mean value of current count rate monitored

The system sensitivity, i.e. the distance of the alarm thresholds is defined as the multiple of the mean statistical variations and can be entered as Sigma value as needed. The time constant is one second.

When reaching the alarm threshold, a message is output via the error relay and on the device display.

$$Is > Im + n * Sigma$$

Im = current count rate integrated over one second
n = multiple value of Sigma

Further information on scenario A

A relative limit value is monitored, i.e. the alarm threshold is reached when exceeding a maximum dose rate (calibration value at empty vessel) at the detector.

False alarms due to operative factors are not possible. However, only stronger interfering radiation is detected.

Further information on scenario B

A differential limit value is monitored, i.e. each fast rise of the dose rate triggers an alarm.

Even minor outside radiation is detected, when it occurs erratically. Operative factors such as fast emptying of the vessel or opening the shielding container may trigger false alarms.

To rule out false alarms with sufficient statistical safety, you should enter n > 5. The mathematical correlation shows that the distance of the alarm threshold is dependent upon the respective mean count rate In.

For calculation it holds:

$$\text{Sigma} = \sqrt{\text{Ips}}$$

Example:

Count rate Im = 300 cps, n = 6

$$Is = \text{Im} + n \times \sqrt{\text{In}}$$

$$Is = 300 + 6 \times \sqrt{300} = 404 \text{ Ips}$$

Thus, an alarm is signaled as soon as *Is* exceeds 404 cps.

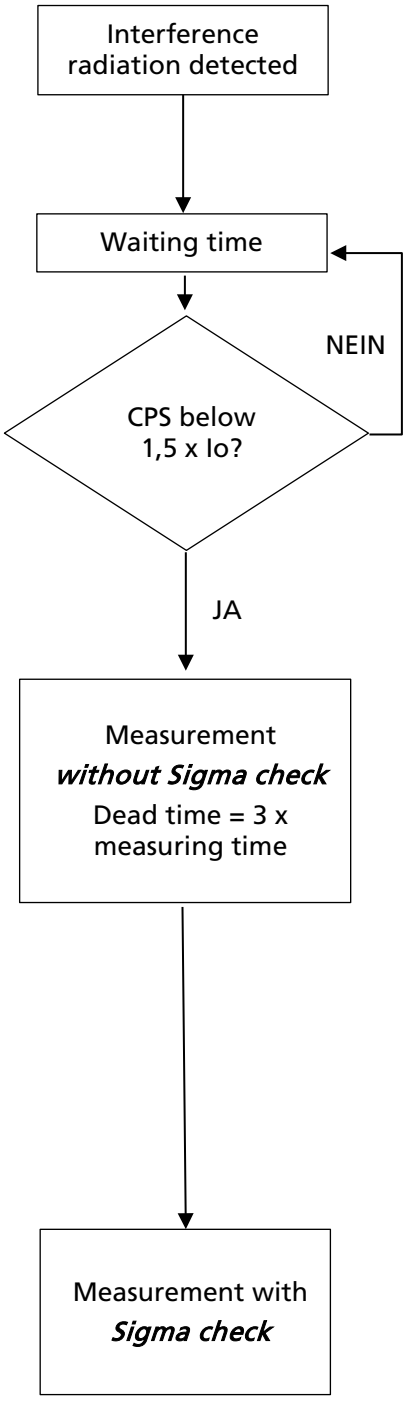
IMPORTANT

Due to the dynamic behavior of the interfering radiation detection, a quick increase of the pulse rate due to operational factors (e.g. very fast emptying of the vessel or large short-term level changes caused by agitators) can be interpreted as interfering radiation. Due to a high Sigma value, false triggering by these operating conditions can be suppressed. However, the radiation interference detection also becomes less sensitive.

For example, opening the useful beam channel on the shielding can also cause a quick increase of the count rate. You have to reset the alarm that is then triggered, or better, do not enable the interfering radiation detection at first. However, it would be better not to enable the interfering radiation detection at first. Enable the interfering radiation detection only after calibration.

Interference Radiation Detection Flow Chart

If radiation interference is detected, following will happen:



- Measured value and current output are "held".
- Error relay indicates alarm.

The measurement is "held" up to the end of the defined waiting time.

At the end of the waiting time the system checks if the arriving count rate is smaller than 1.5-times the calibrated empty count rate (Io) (see scenario A). If not, the waiting time starts again.

If the count rate is below 1.5-times the empty count rate, the measurement automatically switches to the RUN mode. Sigma detection (see scenario B) is disabled for 3 x measuring time (= dead time).

Example:

If the measurement time is 20 s, the dead time is 60 s. This time is needed for the measurement to adjust to a possibly changed level, without triggering interference radiation detection. During this time, interference radiation is detected only when the count rate has increased to 1.5-times the empty count rate.

At the end of the waiting time the system the sigma detection is reactivated.

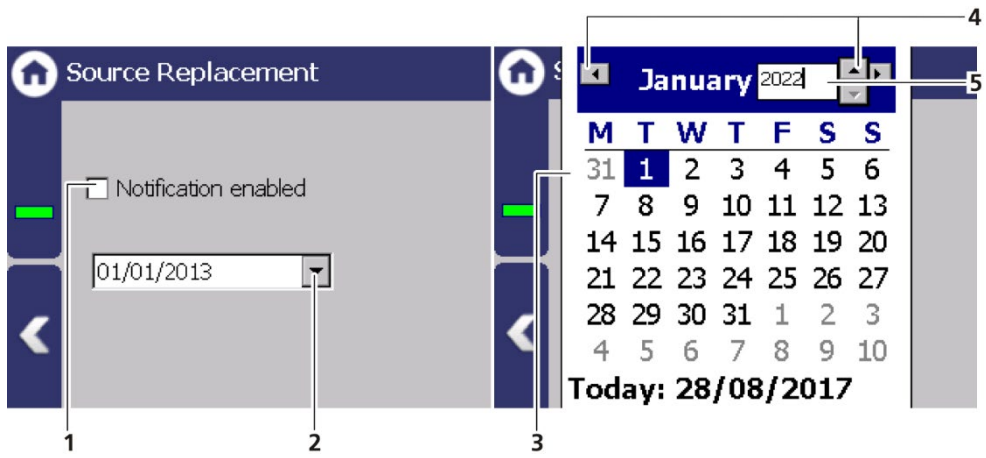
Signal Condition: Source Replacement

Device Settings | Setup | Signal Condition | Source replacement

Notification for a source replacement can be activated in this window. The maintenance message "Replace source" when this date is reached.

NOTICE

For radiation protection reasons, a source replacement is recommended after 15 years. After a source exchange, a standard adjust must be performed (see "Standard Adjust" in chapter 7.3.3 Calibration)



1 Selection box "Notification enabled"
2 Selection arrow Calendar
3 Month view Calendar
4 Selection arrow Month
5 Input Year number

Fig. 108 Source Replacement

Setting source replacement date

1. Activate the check box (Fig. 108, item 1).
2. Click on the arrow key (Fig. 108, item 2) in order to set the date.

▶ The calendar is opened.

3. Click on the year (Fig. 108, item 5) to select the year with the arrow keys.
4. Set the month and day in the calendar.

▶ The calendar retracts and the notification has been established.

7.3.6 Inputs

Device Settings | Setup | Inputs

The two digital inputs (DI) can be set, as well as displaying the DI status, in the submenu Inputs.

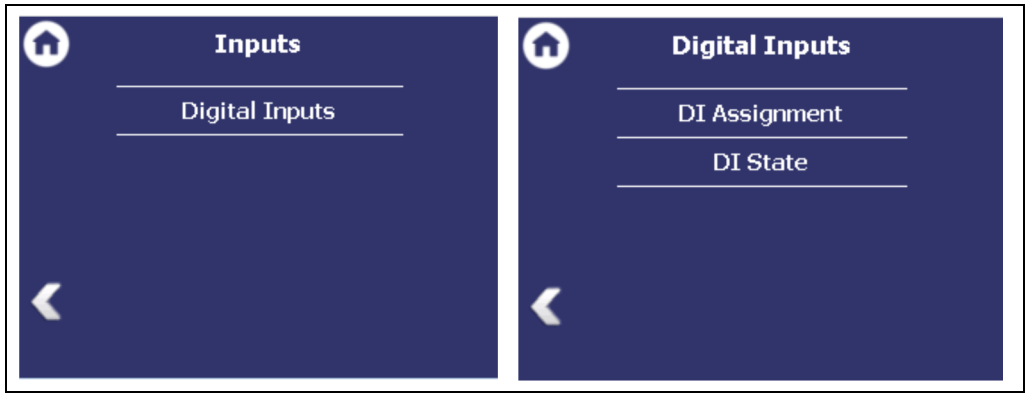


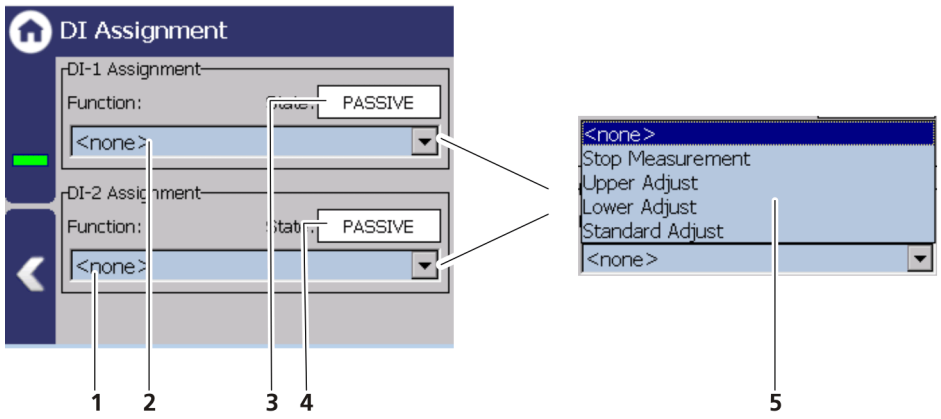
Fig. 109 Menu „Inputs“; Submenu „Digital Inputs (DI)“

Digital Inputs (DI) Assignment

Device Settings | Setup | Inputs | Digital Inputs | Assignment

The menu Assignment determines which function is executed when the digital input is switched. In the "ACTIVE" state, the selected function is executed. The active state is initiated by closing the digital input.

The functions Standard Adjust / Lower Adjust / Upper Adjust are used for external control of the adjustment. The parameters of the adjustment function are thereby used (Device settings | Setup | Calibration | Adjust).



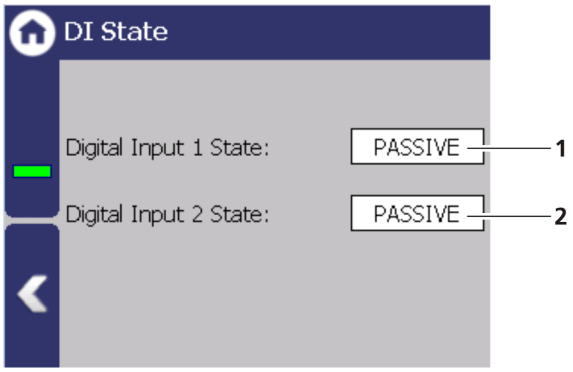
1 DI-2 Assignment: Selection of function
2 DI-1 Assignment: Selection of function
3 DI-1 Assignment state
4 DI-2 Assignment state
5 Selection box Function

Fig. 110 DI Inputs Assignment

DI State

Device Settings | Setup | Inputs | Digital Inputs | DI State

The states of the two digital inputs are displayed in the window “DI State”.



1 DI Input 1 state (ACTIVE / PASSIVE)
2 DI Input 2 state (ACTIVE / PASSIVE)

Fig. 111 DI inputs status

7.3.7 Outputs

Device Settings | Setup | Outputs

You can make the following settings and read information in the submenu "Outputs":

- Analog Outputs (AO)
  - Function
  - AO Monitoring
  - Failure Mode
  - Current Limits
  - Calibrate
- Digital Output (DO)
  - Alarm Assignment

Fig. 112 Menu “Outputs”

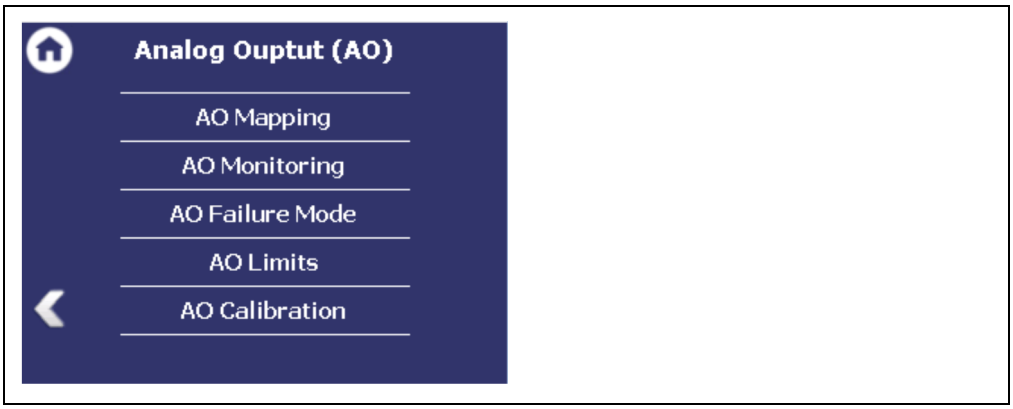
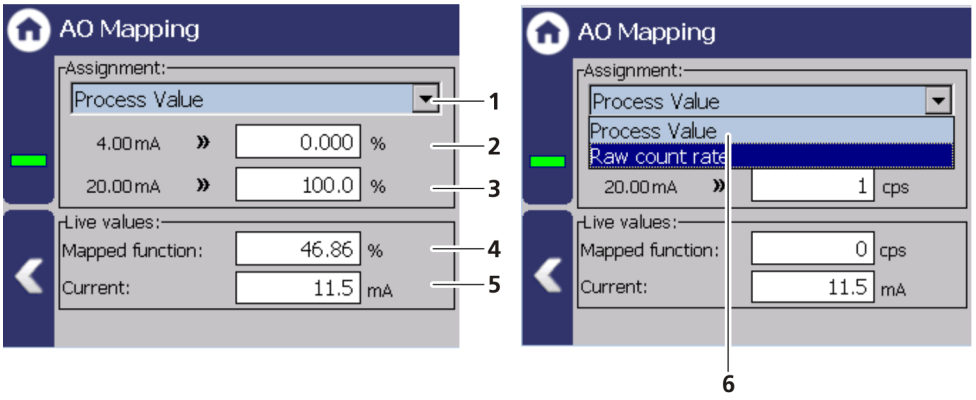


Fig. 113 Submenu “Analog Output”

Analog Output: AO Mapping

Device Settings | Setup | Outputs | Analog Output (AO) | AO Mapping

A function can be assigned to an analog output in the window “AO Mapping”. The current output signal is between 4 mA and 20 mA. The corresponding values (e.g. level) can be freely assigned.



1 Selection arrow “Assignment”
2 Input field lower value [%]
3 Input field upper value [%]
4 Display field Live value assigned function
5 Display field Live value current [mA]
6 Selection Assignment

Fig. 114 Analog Output Mapping (Assignment)

The value which is assigned to a current output signal of 4 mA must be smaller than the value which is assigned to that of 20 mA.

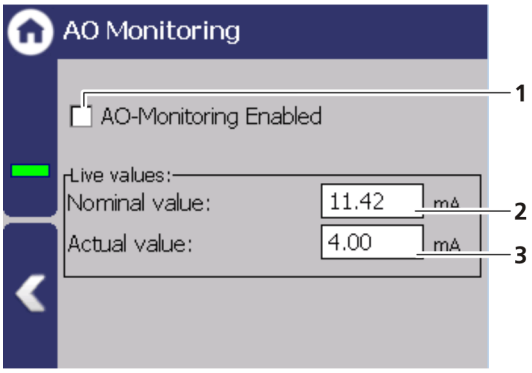
Process value	The values of the process value can be assigned in the menu Signal Condition | PV Range or in the calibration settings.
Raw count rate	Enter a count rate range that outputs the current count rate at the current output.

Analog Output: AO Monitoring

Device Settings | Setup | Output | Analog Output (AO) | AO Monitoring

If “AO Monitoring" is activated (Fig. 115, item 1), the current output will be monitored. It is continuously monitored whether the current value flowing in the current loop is correct.

In the event of a variation e.g. owing to an error in the hardware, too large a load or a disruption in the loop, an error message is triggered.



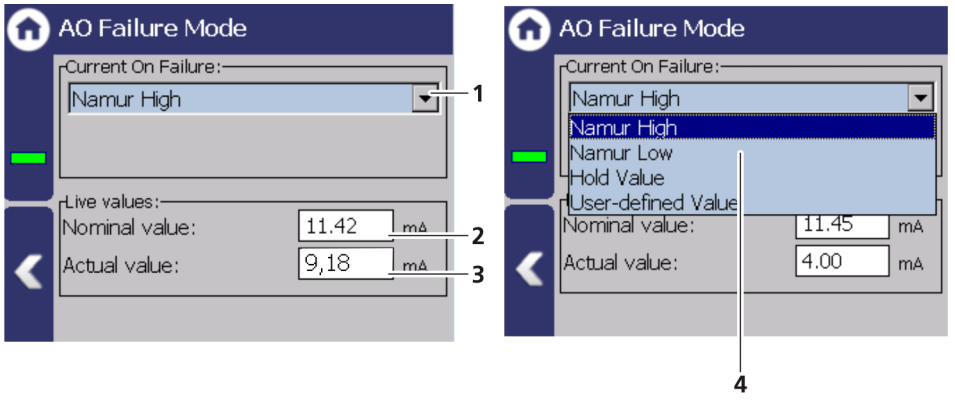
1 Activate check box "AO Monitoring Enabled"
2 Target value [mA]
3 Actual value [mA]

Fig. 115 Analog Output Monitoring

Analog Output: AO Failure Mode

Device Settings | Setup | Output | Analog Output (AO) | AO Failure Mode

The alarm function is set when an error is detected at the current output in the window “Error mode”.



1 Selection arrow Alarm function
2 Live target value [mA]
3 Live actual value [mA]
4 Selection of the alarm function

Fig. 116 Analog Output (AO Failure Mode)

The following behaviour of the current output can be assigned in case of error:

Namur High	22 mA (in error mode).
Namur Low	2 mA (in error mode).
Hold Value	Last value before the error.
User-defined value	The value can be set manually.

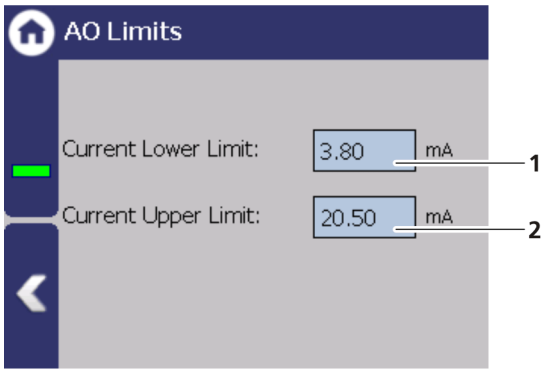
NOTICE

If the value “Hold Value” is set, it is recommended that the error relay is connected in order to allow device errors to be transmitted to the control system.

Analog Output: AO Limits

Device Settings | Setup | Output | Analog Output (AO) | AO Limits

By clicking on the input fields (Fig. 117, item 1, item 2), the values [mA] for the lower and upper current limit can be set. In addition to the default value of 3.8 mA, the lower current limit can be set to 0 mA in order to switch the current output from 4 ... 20 mA to 0 ... 20 mA.



1 Input field Lower current limit [mA]
2 Input field Upper current limit [mA]

Fig. 117 Analog Output (AO Limits)

NOTICE

If the measurement is operated according to Namur, the standard current values of 3.8 or 20.5 mA must be maintained.

Analog Output: Calibrate

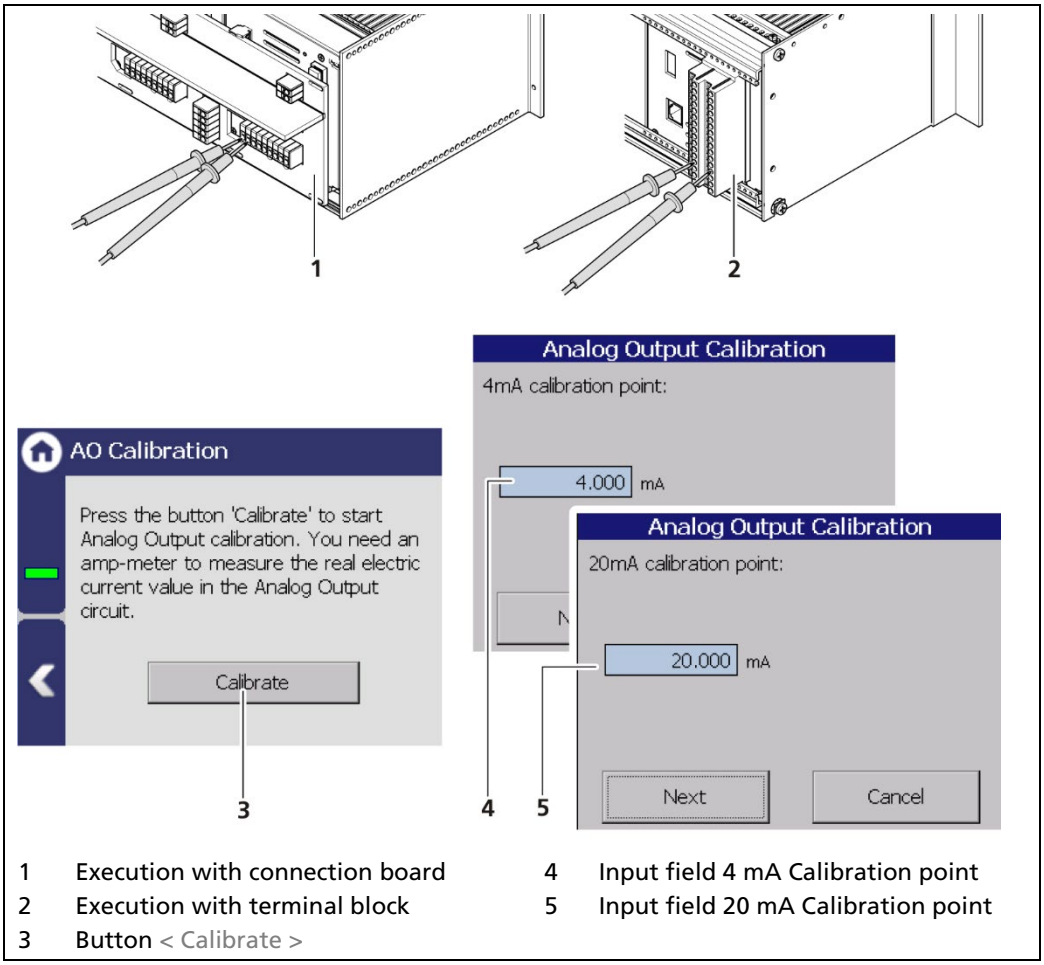
Device Settings | Setup | Output | Analog Output (AO) | AO Calibration

If there are any discrepancies between the target value and the actual value of the current signal, then the current output may be calibrated again.

NOTICE

For calibration of the current output, an ammeter (not included in the scope of delivery) is required, which is connected to the current output.

Berthold recommends calibrating the current outputs whenever a module has been installed/replaced or if a software update has been carried out.



1	Execution with connection board	4	Input field 4 mA Calibration point
2	Execution with terminal block	5	Input field 20 mA Calibration point
3	Button < Calibrate >		

Fig. 118 Analog Output (Calibration)

Perform Calibration

⚠ DANGER

Danger to life from electric shock!

- The calibration may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.

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

1. Connect the test leads of the ammeter to the analog current output terminals on the rear of the EVU.
2. Observe the terminal allocation in the document “Technical Information” for executions with connection boards (Fig. 118, item 1) or allocation with terminal block (Fig. 118, item 2).
3. Click on the button < Calibration >.

- The device switches to test mode and a new window (Analog output calibration) opens.
- The calibration point 4 mA is displayed and the current measuring instrument shows a value.

4. Enter the indicated value on the current measuring instrument in the input box (Fig. 118, item 4).
5. Click on the button < Continue >.

- The calibration point 20 mA is displayed and the current measuring instrument shows a value.

6. Enter the indicated value on the current measuring instrument in the input box (Fig. 118, item 5).
7. Click on the button < Continue >.

- A message appears “Calibration successful”.

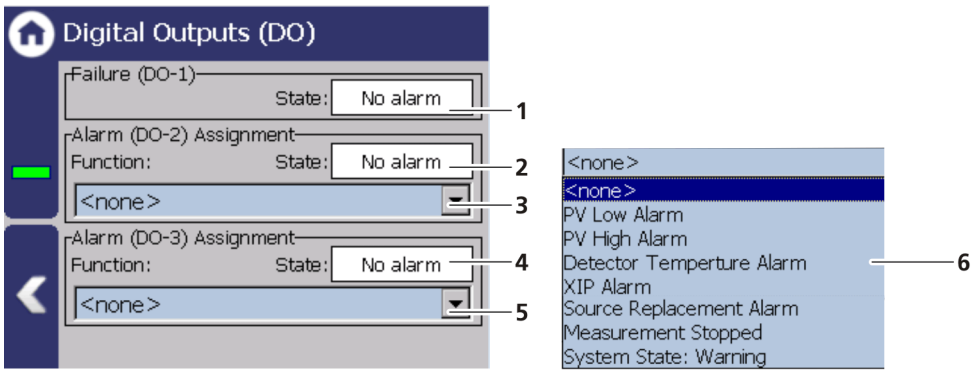
8. Click on the button < Continue >.

- The calibration of the analog output is concluded.

Digital Outputs (DO)

Device Settings | Setup | Output | Digital Outputs (DO)

The signals of the digital outputs are switched via potential-free relay contacts. The contacts are controlled “fail safe”, i.e, in the event of an alarm, the current at the relay coil drops and the NO contact (normally open) is opened. The wiring diagrams in the technical information show the relay contacts in the de-energized state.



1 State DO-1 (ACTIVE / PASSIVE)
2 State DO-2 (ACTIVE / PASSIVE)
3 Selection arrow Function DO-2
4 State DO-3 (ACTIVE / PASSIVE)
5 Selection arrow Function DO-3
6 Function selection

Fig. 119 Digital Outputs

The alarm relays 1 and 2 can be assigned to the following functions in the event of an alarm:

PV Low alarm
The relay is alarming when the value at Device Setup | Setup | Alarms | PV Alarm Settings is below the threshold.

PV High alarm
The relay is alarming if the value under Device Setup | Setup | Alarms | PV Alarm Settings is exceeded.

Detector temperature Alarm
The relay is alarming when values set at Device Setup | Setup | Alarms | Det.-Temp. Alarm function are exceeded or below the threshold.

XIP Alarm
The relay is alarming when detection is activated at Device settings | Setup | Signal processing | XIP and interference was detected.

Source Replacement Alarm
The relay is alarming when notification at Device settings | Setup | Signal processing | Source replacement is activated and interference is detected.

Measurement Stopped
The relay is alarming on during tests or other states where the measurement is stopped. For example, Simulation, plateau measurement, and detector update.

System State: Warning
The relay is alarming when the event message “Warning” is displayed.

7.3.8 Alarms

Device Settings | Setup | Alarms

You can make the following settings and read information in the submenu “Alarms”:

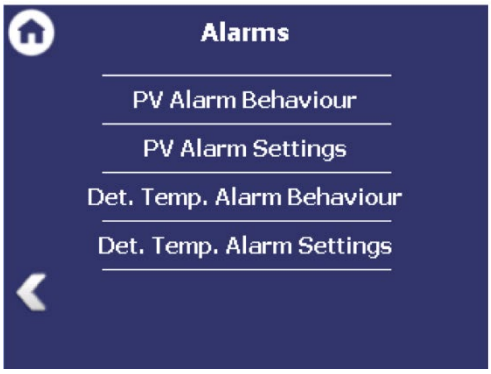
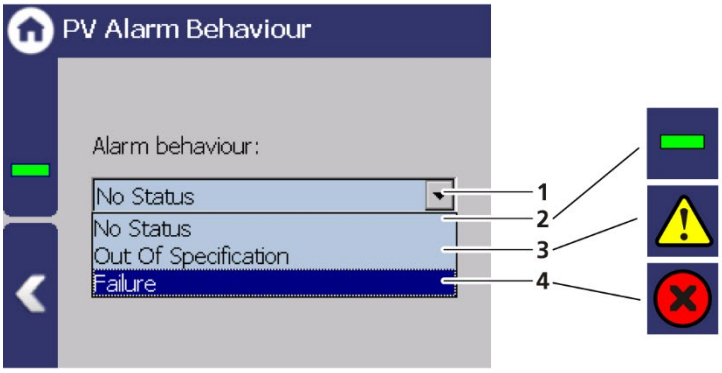


Fig. 120 Menu “Alarms“

PV Alarm Behaviour

Device Setup | Setup | Alarms | PV Alarm Behaviour

The behaviour in case of alarm (NE107 status) for the process value can be set in the window “PV alarm Behaviour”.



1 Selection arrow NE107 Status
2 Selection “No Status” (no Event Viewer, relay circuit)
3 Selection “Out of specification” (Event Viewer, relay circuit)
4 Selection “Failure” (Event Viewer, the relay circuit)

Fig. 121 PV Alarm Behaviour

NOTICE

If the PV alarm function is set to "Failure", the measurement for the occurrence of a PV alarm is switched to the error current. Monitoring of the PV in the master display is therefore no longer possible.

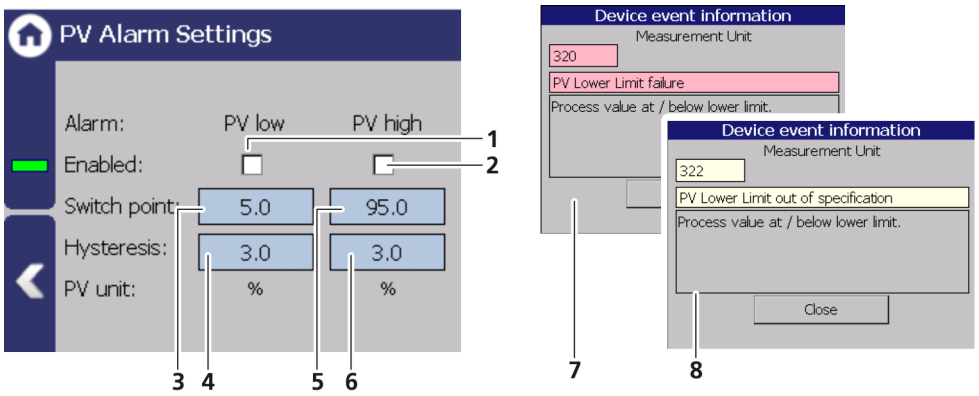
PV Alarm Settings

Device Settings | Setup | Alarms | PV Alarm Settings

You can set the values for the level alarms (max. and min.) and the hysteresis of these in the window "PV Alarm Settings".

When exceeding or falling below the switching point, an event message appears in the status display. If a digital output "min. level Alarm" or "max. level Alarm" is assigned under the function (Fig. 121, item 6), the relay alarmed.

Hysteresis is defined as the tolerance range of the alarm trigger which occurs at a predefined threshold of the process range.



1	Selection box "PV low"	5	Input box "Switch point High"
2	Selection box "PV high"	6	Input box "Hysteresis Low"
3	Input box "Switch point Low"	7	Event message "Failure"
4	Input box "Hysteresis Low"	8	Event message "Out of specification"

Fig. 122 PV Alarm Settings

Example: Tolerance range = 5%, Process range = 20% and 85%

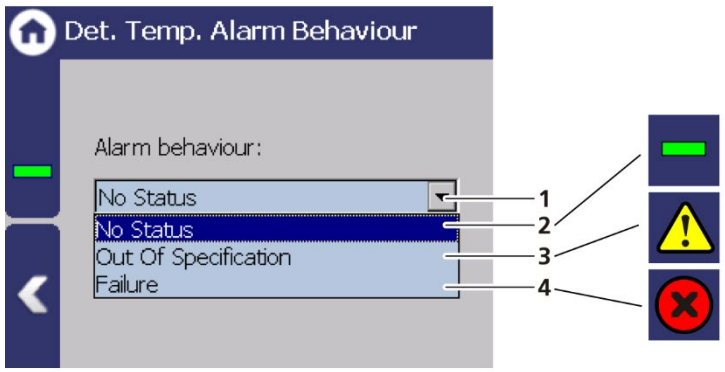
In the event of a rising process range, the max. alarm is triggered when a process range of 85% is exceeded. When the process range falls again, then the alarm does not switch off again until the process range falls below 85% - 5% = 80%.

In the event of a falling process range, the min. alarm is triggered when a process range falls below 20%. When the process range rises again, then the alarm does not switch off again until the process range rises above 20% + 5% = 25%.

Det.-Temp. Alarm Behaviour

Device Settings | Setup | Alarms | Det.-Temp. Alarm Behaviour

The behaviour in case of alarm (NE107 status) can be set for the detector temperature in the window “Det.-Temp. Alarm Behaviour”.



1 Selection arrow NE107 Status
2 Selection “No Status” (no Event Viewer, relay circuit)
3 Selecting “Out of specification” (Event Viewer, relay circuit)
4 Selection “Failure” (Event Viewer, the relay circuit)

Fig. 123 Det.-Temp. Alarm Behaviour

NOTICE

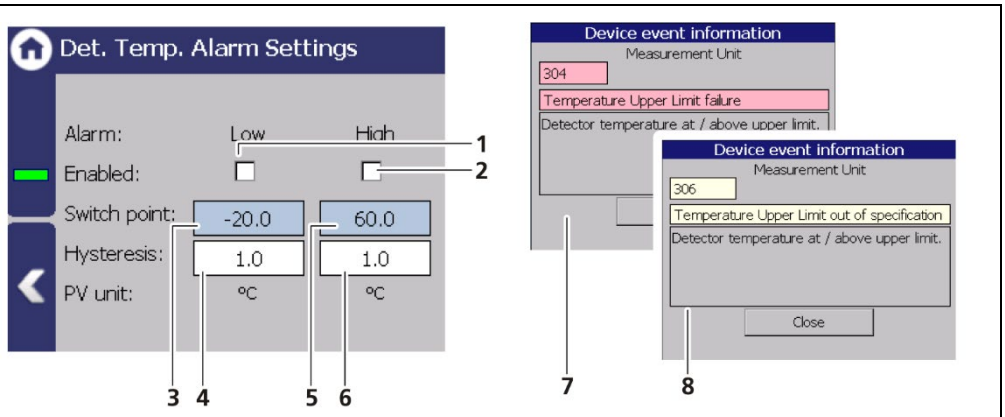
If the detector alarms are set to "Failure", the measurement is switched in the error current during the occurrence of a temperature alarm. Monitoring of the PV in the master display is therefore no longer possible.

Detector Temperature Alarm Settings

Device Settings | Setup | Alarms | Det.-Temp. Alarm Settings

The values for the detector temperature (max. and min.) can be set in the window "PV Det.-Temp. Alarm Settings".

When there is exceeding or falling below the switching point, an event message appears in the status display. If a digital output "Detector temperature alarm" is assigned under "Function", the relay alarms.



1	Selection box "Min. Active"	5	Input box "Switching point Max."
2	Selection box "Max. Active"	6	Input box "Hysteresis Max."
3	Input box "Switch point Min."	7	Event message "Error"
4	Input box "Hysteresis Min."	8	Event message "Outside the specification"

Fig. 124 Det.-Temp Alarm Settings

Setting max. temperature alarm:

1. Activate the check box (Fig. 124, item 1).
1. Click on the input field (Fig. 124, item 2) to enter a switching point.
2. Confirm with the Enter key

▶ The value was changed.

Set min. temperature alarm:

1. Activate the check box (Fig. 124, item 3).
2. Click on the input field (Fig. 124, item 4) to enter a switching point.
3. Confirm with the Enter key

▶ The value was changed.

7.3.9 Simulation

Device Settings | Setup | Simulation

A check for the following functions can be performed in the submenu “Simulation”:

- Analog Output (AO)
- Digital Outputs (DO)
- Count Rate

Fig. 125 Menu "Simulation"

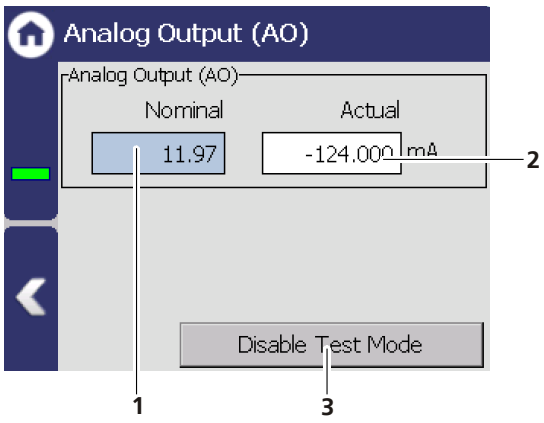
NOTICE

When starting a simulation, the measurement is stopped and a status message TST appears.

- The simulation mode is automatically terminated after about 5 minutes. If the simulation is to be reactivated, you must enter the value again in the input field.

Simulation Analog Output

Device Settings | Setup | Simulation | Analog Output



1 Input field "Nominal"
2 Display field "Feedback" [mA]
3 Button < Disable Test Mode >

Fig. 126 Simulation Analog Output

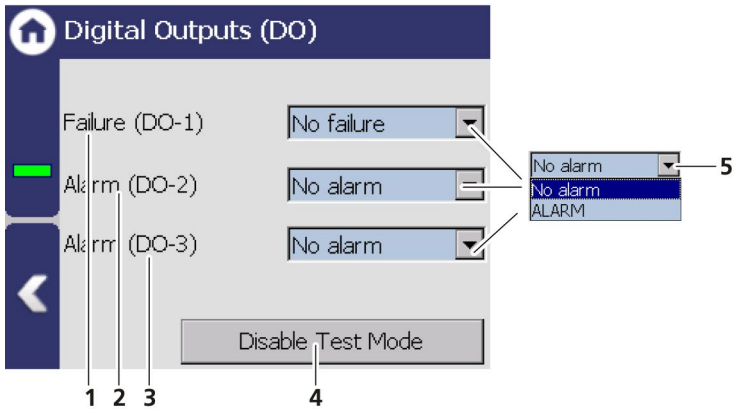
1. Click on the input field (Fig. 126, item 1) and enter the target value for the simulation.
2. Confirm with the Enter key.

▶ The test is performed, and a system event is displayed.

3. Click on the < Disable Test Mode > button (Fig. 126, item 3) to stop the simulation.

Simulation Digital Output

Device Settings | Setup | Simulation | Digital Output



1 ERROR (DO-1)
2 ALARM (DO-2)
3 ALARM (DO-3)
4 Button <Disable Test Mode>
5 Dropdown field

Fig. 127 Simulation Digital Outputs

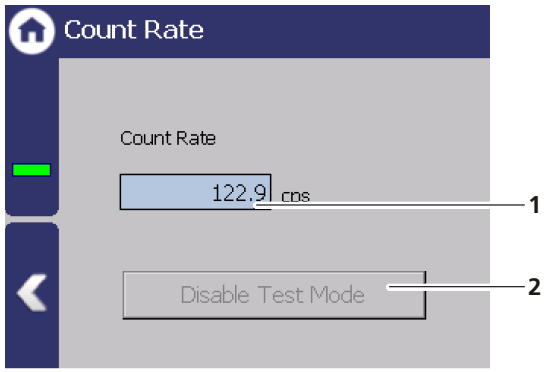
1. Click on the dropdown field (Fig. 127, item 5) and select "FAILURE" or "ALARM" for the simulation.

▶ The test is performed and a system event is displayed.

2. Click on the < Disable Test Mode > button (Fig. 127, item 4) to stop the simulation.

Simulation Count Rate

Device Settings | Setup | Simulation | Count Rate



1 Input field Dampened count rate
2 Button < Disable Test Mode >

Fig. 128 Simulation Count Rate

1. Click on the input field (Fig. 128, item 1) and enter count rate for the simulation.
2. Confirm with the Enter key.

▶ The test is performed, and a system event is displayed.

3. Click on the < Disable Test Mode > button (Fig. 128, item 2) to stop the simulation.

7.4 Menu Backup/Restore

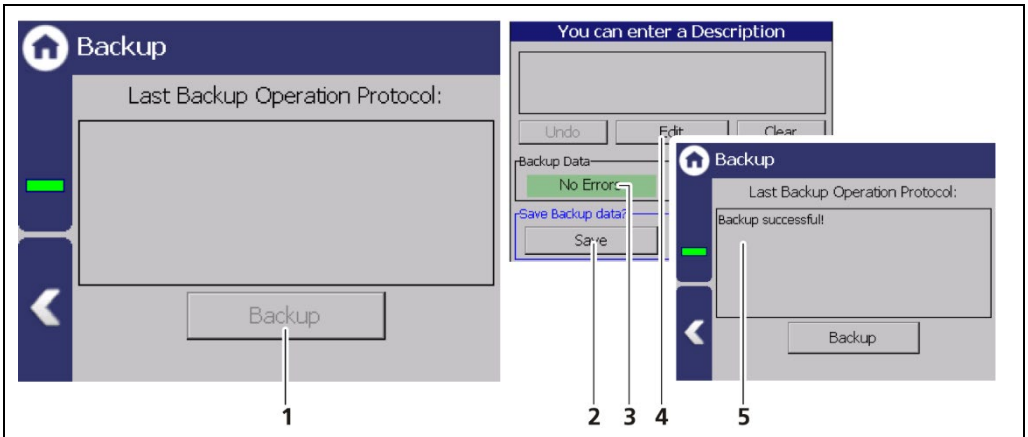
Device Settings | Backup/Restore

You can make a backup copy of the configuration data, and perform a recovery in the submenu Backup/Restore.

Fig. 129 Menu "Backup/Restore"

7.4.1 Backup

Device Settings | Backup/Restore | Backup



1 Button < Backup >
2 Button < Save >
3 Information about the backup data (error / error free)
4 Button < Edit >
5 Button < Clear > to delete all logs
6 Note "Backup successful!"

Fig. 130 Backup

Perform Backup

1. Connect a USB storage device to the device (Fig. 3, item 5).
2. The USB storage device is recognised by the system after a few seconds and the button < Backup > (Fig. 130, item 1) can be clicked.
3. Click on the button < Backup > (Fig. 130, item 1).

- The window “Enter description” appears.
- The message “Error free” (Fig. 130, item 3) appears in the field “Backup data” for error-free backup files.

4. Click the button < Edit >, enter a description, and confirm with the Enter key.
5. Click on the button < Save >.

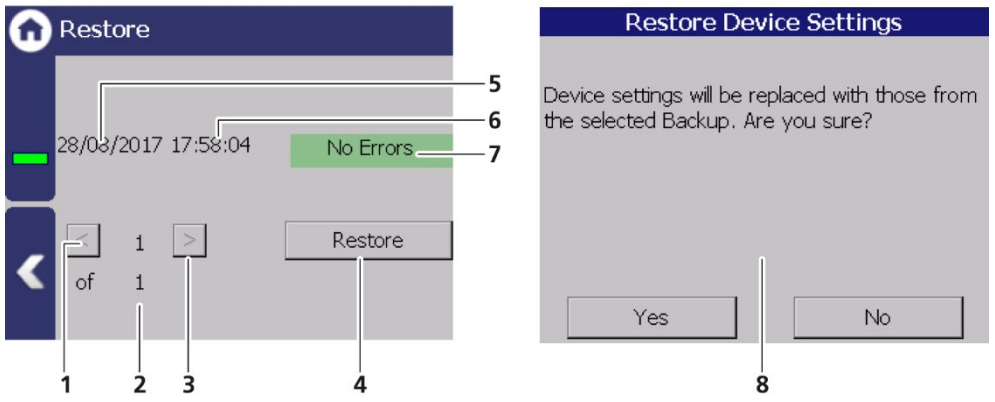
- The backup files are copied to the USB storage device.
- The message “Backup successful!” appears after a successful copy process (Fig. 130, item 6).

Information

The backup includes an XML file that is created in the folder ”Backup_LB4700”. The file name is derived from "Backup", the date and time (Backup_YYYYMMDD_ hr-min-sec).

7.4.2 Restore

Device Settings | Backup/Restore | Restore



1 Button < "previous"
2 Number of recovery files on the USB storage device
3 Button > "next"
4 Button < Restore >
5 Recording date of the backup file
6 Time of backup file recording
7 Information about the backup data (error / error free)
8 Confirmation window

Fig. 131 Restore

Executing Restore

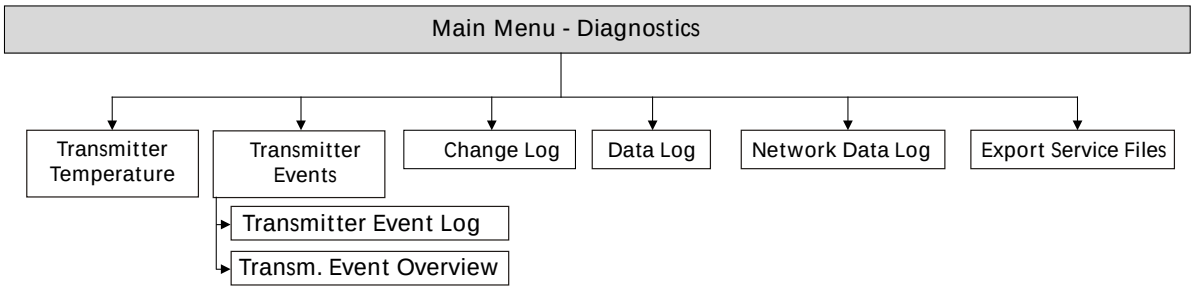
1. Connect a USB storage device to the device (Fig. 4, item 5).
2. Select the backup file with the buttons (Fig. 131, item 1,3)

▶ The date and time of the backup is displayed (Fig. 131, item 5, 6). Only error-free (Fig. 131, item 7) backup files can be loaded.

3. Click on the button < Restore > (Fig. 131, item 4).
4. A confirmation message (Fig. 131, item 8) appears.
5. Click on < Yes > to confirm, click on < No > to cancel.

▶ The restore of data is carried out.

8 Main Menu Diagnostics



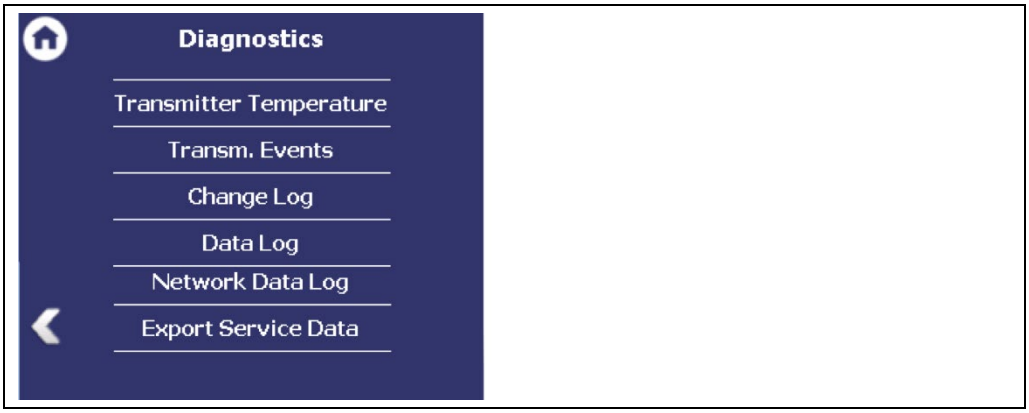
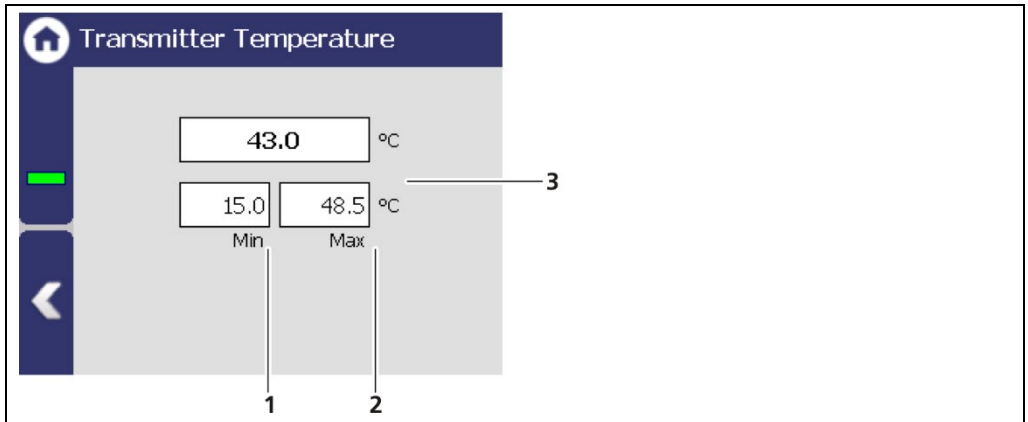


Fig. 132 Menu Diagnostics

8.1 Transmitter Temperature

Diagnostics | Transmitter Temperature

Temperature values from the evaluation unit (processor) are displayed in the menu item “Transmitter Temperature”.



1 Minimal extreme value [°C]
2 Maximum extreme value [°C]
3 Feedback [°C]

Fig. 133 Transmitter Temperature

8.2 Events

Diagnostics | Transm. Events

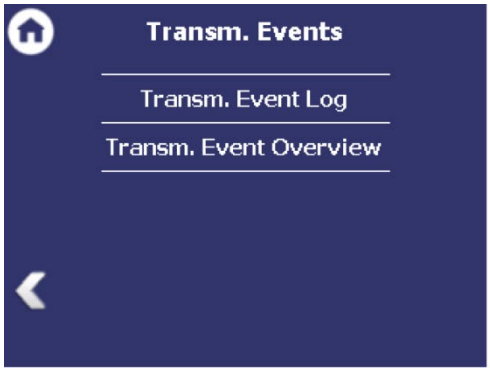


Fig. 134 Menu "Transm. Events"

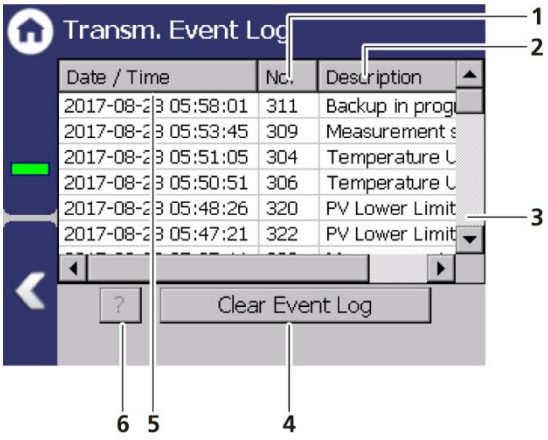
Information

Events of the respective detector can be seen at Device settings | Setup | Sensors | [NAME OF DETECTOR] | Detector Service.

8.2.1 EVU Event Log

Diagnostics | Transmitter Events | Transmitter Event Log

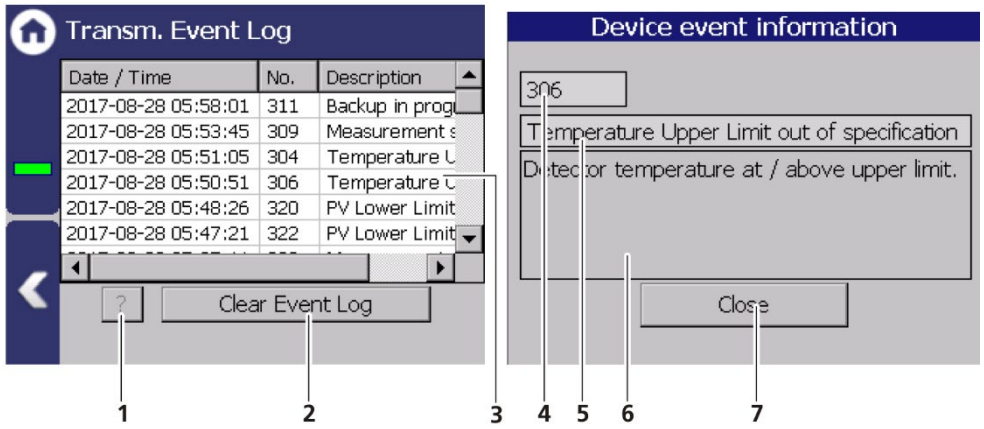
The last 25 events of the detector are displayed in the window "Event Log".



1 Event no.
2 Description (event title)
3 Scrollbar
4 Button < Clear event log >
5 Date / time of the event
6 Button < ? > (to display the detailed event description)

Fig. 135 Event Log (Transmitter)

Display Event Description



1 Button < ? >
2 Button < Clear event log >
3 Highlighted event
4 Event no.
5 Event title
6 Event description
7 Button < Close >

Fig. 136 display an event log

1. Click on a line in the list (Fig. 136, item 3).
2. Click on < ? > (Fig. 136, item 1).

▶ The event description appears.

3. With the button < Close >, close the event description (Fig. 136, item 7).

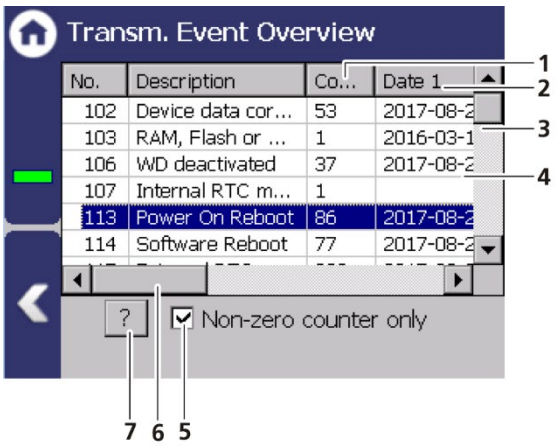
NOTICE

With the button < Clear event log > (Fig. 136, item 2) all events are deleted irrevocable.

8.2.2 Transm. Event Overview

Diagnostics | Transm. Events | Transm. Event Overview

All events that can be logged are chronologically presented in tabular form in the window "Event overview". Activate the check box ″Non-zero Counter only 0″ (Fig. 137, item 5) in order to display events that have occurred.



1 "Number" column
2 "Date" column
3 Vertical scroll bar
4 Event line
5 Check box ″Non Zero counter only″
6 Horizontal scroll bar
7 Button < ? >

Fig. 137 Event Overview (transmitter)

1. Click on a line in the list (Fig. 137, item 4).
2. Click on < ? > (Fig. 137, item 7).

▶ The event description appears.

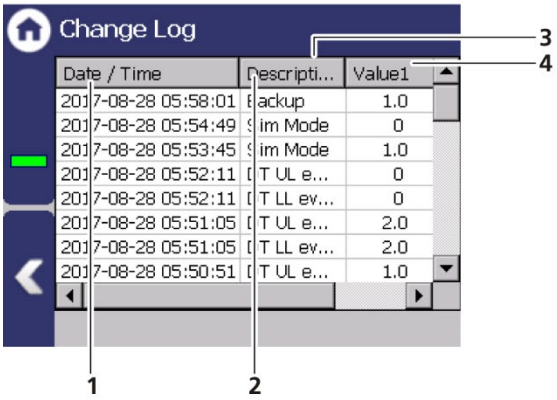
3. Close the event description (Fig. 137, item 7) with the button < Close >.
4. Slide the bar of the horizontal scroll bar (Fig. 137, item 6) to the right to see at what times (date, time) the event occurred.

▶ The last 5 time points are displayed.

8.3 Change Log

Diagnostics | Change Log

You can track changes that were performed on the device in the window “Change log”.



1 Time of the change
2 Short info of the change
3 Old state
4 New state

Fig. 138 Change Log (Transmitter)

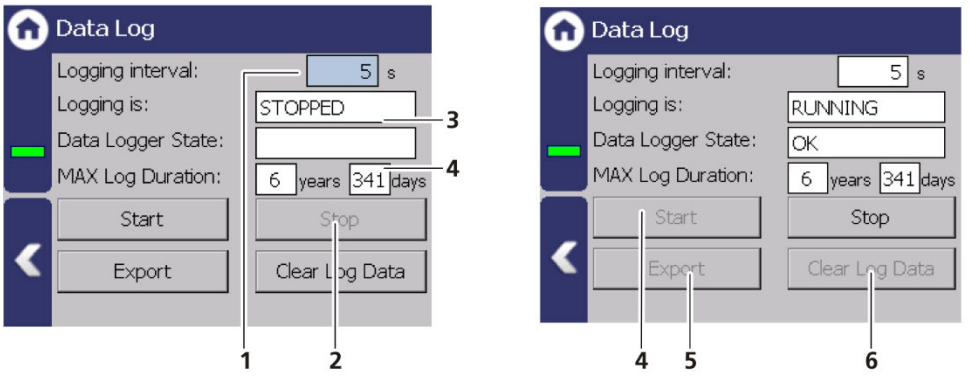
8.4 Menu Data Log

Diagnostics | Data Log

You can set the log interval as well as delete and export the log data in the sub-menu “Data log”.

IMPORTANT

The data cannot be viewed on the EVU Display or via Ethernet. The data must be exported to a USB storage device to view it on a PC.



1 Input field Log interval [s]
2 Button < Stop >
3 Display field
4 Button < Start >
5 Button < Export >
6 Button < Clear log data >

Fig. 139 Data Log

Change Log Interval

1. Click on the button < Stop > (Fig. 139, item 2) to stop the data log process.
2. Click on the input field ”Log interval” (Fig. 139, item 1) and enter the time in seconds.
3. Confirm with the Enter key.

▶ The interval was accepted

4. Click on the button < Start > (Fig. 139, item 4) to start the data log process.

Export Log Data

1. Click on the button < Stop > (Fig. 139, item 2) to stop the data log process.
2. Connect a USB storage device to the device (Fig. 3, item 5).
3. Click on the button < Export > (Fig. 139, item 5).

- The export process is started and can take several minutes to complete under certain circumstances.
- The message window ”Export successful!” appears with a successful export.

Information

The export includes a zip file that is created in the folder ”ExtendedLogExport”. The file name is derived from "ExtendedLogExport", the date and time (ExtendedLogExport_YYYYMMDD_hr-min-sec).

Exported Data Structure

1 Zip file
2 Folder “Year"
3 Folder “Month”
4 File “Day”

Fig. 140 Data structure

8.5 Network Data Log

Diagnostics | Network Data Log

In the window “Network Data Log”, the transmission of log data via the ethernet network can be started. With a log program, the data can be displayed on the PC.

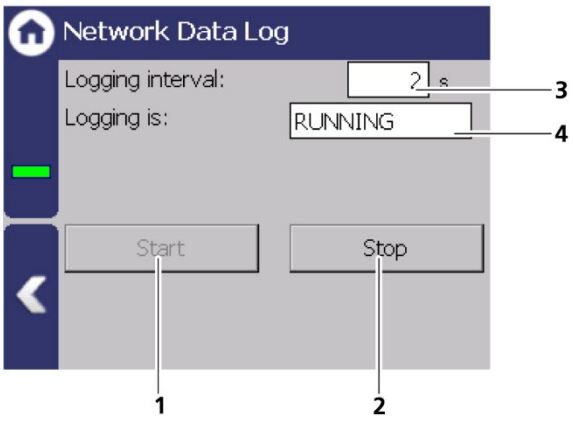
IMPORTANT

The PC and the LB 47x have to be in the same IP subnet!

- Observe the notes in chapter 7.3.1 – Network.

The network logger utilizes the Telnet protocol to send data over the local network. There are terminal emulator programs that can read this data and save it in a log file. Note the following links:

- https://support.microsoft.com/help/2801292
- https://social.technet.microsoft.com/wiki/contents/articles/38433.windows-10-enabling-telnet-client.aspx



1 Button < Start >
2 Button < Stop >
3 Input field “Interval”
4 Display field “State”

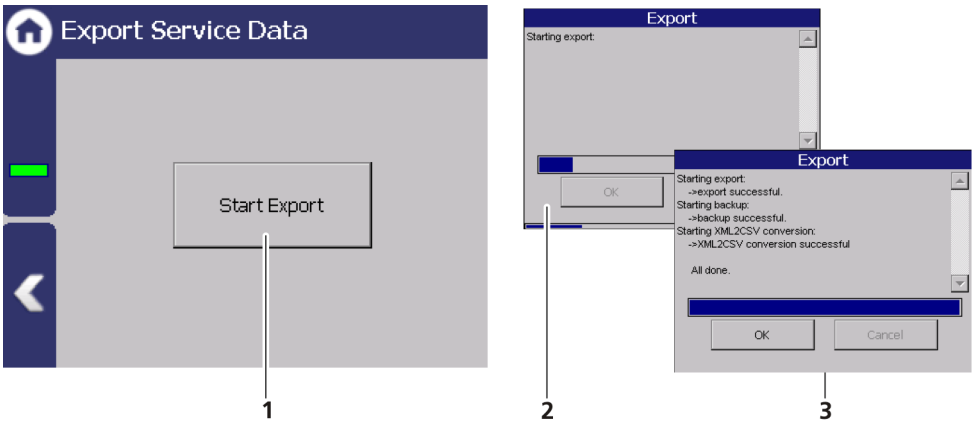
Fig. 141 Network Data Log (started)

1. Click on the entry field “Logging interval” (Fig. 142, item 3) and enter an interval.
2. Start the network data log (Fig. 142, item 1).
3. Make a note of the EVUs IP address (Device Settings | Settings | System | Network).
4. Enter the following input in the command line:
   > telnet "IP Address" "Port-Num" -f "LogFileName"

- The log data is displayed and saved in the created log file.

8.6 Export Service Data

Diagnostics | Export Service Data



1 Button < Export service data >
2 Process window
3 Confirmation message

Fig. 142 Export Service Data

1. Connect a USB storage device to the device (Fig. 3, item 5).
2. The USB storage is recognised by the system after a few seconds and the button < Export service data > (Fig. 142, item 1) can be clicked.
3. Click on the button < Export service data > (Fig. 142, item 1).

▶ The process window is displayed and the export of service data will be carried out (Fig. 142, item 2).

▶ After successful export a confirmation message Fig. 142, item 3) is displayed.

Four .txt files are copied to the USB drive when exporting:

- ChangeLog
- ErrorHistory
- ErrorSummary
- SystemInfo

A new folder "Backup_LB470" is created and the Backup-File (.xml) is copied when exporting.

9 Troubleshooting

9.1 Error Search

Problem	Cause	Measure
Master unit: Screen black; LEDs are not illuminated	EVU does not work	▶ Check power supply and fuses
Slave module: LEDs are not illuminated	Slave module not clamped properly	▶ Check cabling, contact sockets
No signal	Detector does not work	▶ Check the functioning of the detector
Count rate too low	Shield not opened or not opened correctly	▶ Check lock and ensure it is in OPEN position
	Incorrect focus of the effective radiation on the detector	▶ Correct and optimise the alignment
	Objects in the beam path	▶ Offset irradiation level
	Source at the end of its usable life span	▶ Replace source
No or incorrect level display	level value entry incorrect	▶ Check the calibration value and the level display
The level display deviates	Defect in detector	▶ Check detector
	Incorrect calibration	▶ Check calibration values
	Count rate too low (see above)	▶ Check source age and irradiation level, replace detector
Detector is not detected (software)	Terminals / wiring	▶ Check terminal connection; check terminal assignment
	Damaged line	▶ Check cable; examine with measurement device.
	Incorrect type LB44xx / LB54xx / LB4700 in the configuration	▶ Check type of detector (see type plate on the detector)

Error Search (continued)

Detector is not detected (software)	Incorrect ID in the configuration	▶ Check ID of the detector (see type plate on the detector)
Touch panel does not respond	Error in operating system	▶ Restart EVU
Buttons are missed when you click	Incorrect screen calibration	▶ Calibrate screen again

9.2 Error Codes of the Evaluation Unit

In the following tables you can find the EVU and detector error codes which give you exact information on how to fix them. The error codes of the detectors can be found in the operating instructions of the respective detectors.

System events are classified in

- FAILURE (F)
- OUT OF SPECIFICATION (S)
- FUNCTION CHECK (C)
- MAINTENANCE REQUIRED (M)

Failure (F)

Severe device error. The current output emits an error current. The error relay gives alarm (contact opens).

Out of specification (S)

The detector, one of its components or the process itself, are out of normal specification.

Function Check (C)

Indicates that entries are made at the detector or a function check/simulation is being performed.

9.2.1 System

Code	Message	NAMUR107	Help Text
M101	HW Module	F	Hardware electronics module corrupt. Restart the device. Contact Berthold service, if this event occurs repeatedly.
M102	Device data-set	F	Failure of the permanent memory. No parameter set found. Factory reset and / or restart the device. Contact Berthold service, if this event occurs repeatedly. The device possibly must be reset twice.
M103	RAM, Flash or CPU	F	Internal hardware failure. Restart the device. Contact Berthold service, if this event occurs repeatedly.
M104	WD Reboot	M	The Watchdog has caused the device to restart. Contact Berthold service, if this event occurs repeatedly. Check, if massive electromagnetic interferences have caused this event.
M105	WD Failure	F	Watchdog malfunction. Contact Berthold service, if this event occurs repeatedly.
M106	WD Off	M	Watchdog is inactive. Activate Watchdog

M107	Error in the internal real time clock	M	Malfunction of the real-time clock. Check Date and Time. If the event occurs frequently, contact Berthold Service.
M108	CPU temperature sensor	M	The temperature sensor of the device is defective. Contact Berthold Service. The hardware is defective and, if necessary, must be checked and replaced.
M109	Lower temperature limit: Maintenance required	M	The internal temperature of the device is close to the lower threshold value of the permissible operating temperature.
M110	Temp LL OOS	S	The internal temperature of the device is below the lower limit. The correct function of the device cannot be guaranteed. It is recommend to have the device checked by Berthold Service, even if it seems to work normally.
M111	Temp UL maintenance	M	The internal temperature of the device is close to the upper limit.
M112	Temp UL OOS	S	The internal temperature of the device is above the upper limit. The correct function of the device cannot be guaranteed. It is recommend to have the device checked by Berthold Service, even if it seems to work normally.
M113	Power On Reboot	C	The device was restarted e.g. due to a power failure.
M114	Software Reboot	C	The device was restarted by user input.
M115	Extern RTC malfunction	M	Failure of the external real time clock. Contact Berthold service, if this event occurs repeatedly.
M116	Corrupt Date	M	The date could not be verified at startup. Check date and time and set if necessary.

9.2.2 Application

Code	Message	NAMUR107	Help Text
M301	Default parameter set	M	Device not calibrated. Measurement with default parameters. Calibrate device
M302	Decay compensation	S	Decay compensation failed. Contact Berthold service, if this event occurs repeatedly.
M303	Det Temp LL failure	F	Detector temperature at / below lower limit.
M304	Det Temp UL failure	F	Detector temperature at / above upper limit.
M305	Det Temp LL OOS	S	Detector temperature at / below lower limit.
M306	Det Temp UL OOS	S	Detector temperature at / above upper limit.
M307	Stray radiation	S	Interference radiation detected. Measurement stopped.
M308	Source replacement	M	Source replacement date reached. Replace source.
M309	Application stopped	C	Measurement stopped
M310	PV calc not possible	S	Process value could not be calculated. Check measuring range and calibration.
M311	Backup process	C	Backup in process.
M312	Restore process	C	Restore in process.
M320	PV LL failure	F	Process value at / below lower limit.
M321	PV UL failure	F	Process value at / above upper limit.
M322	PV LL OOS	S	Process value at / below lower limit.
M323	PV UL OOS	S	Process value at / above upper limit.
M324	Level under 0%	S	Level below 0%. Check measuring range and calibration (till version 1.2.0).
M325	Level over 100%	S	Level above 100%. Check measuring range and calibration (till version 1.2.0).
M326	GPC out of spec	S	Compensation factor of Gas Properties Compensation has reached ist limit. Check process.
M327	No GPC detector	S	No detector for Gas Properties Compensation found. Connect / configure detector.
M399	Internal program err	F	Internal software failure. Restart the device. Contact Berthold service, if this event occurs repeatedly.

9.2.3 Detector

Code	Message	NAMUR107	Help Text
M501	Detector not found	F	Lost connection to at least one detector. Check detector settings and connections. It is recommend to have the device checked by Berthold Service, even if it seems to work normally.
M502	Detector comm. error	M	Temporarily lost connection to at least one detector. Check detector settings and connections. Contact Berthold service, if this event occurs repeatedly.
M503	Detector failure	F	At le Error only appears in the event log. Error only appears in the event log. The display shows the corresponding detector error instead.
M504	Detector out of spec.	S	At least one detector register "out of specification". Error only appears in the event log. The display shows the corresponding detector error instead.
M505	Detector function check	C	At least one detector register "function check". Error only appears in the event log. The display shows the corresponding detector error instead.
M506	Detector maintenance	M	At least one detector register "maintenance". Error only appears in the event log. The display shows the corresponding detector error instead.
M599	Internal program error	F	Internal system failure. Powercycle device. If the event remains it could be caused by a defective hardware. Contact Berthold service.

9.2.4 RS 485 Interface

Code	Message	NAMUR107	Help Text
M699	Internal program error	F	Internal software failure. Restart the device. Contact Berthold service, if this event occurs repeatedly.

9.2.5 Process Connection

Code	Message	NAMUR107	Help Text
M701	Current output	F	Deviation of analog output value from feeback value is too high. Calibrate analog output. Contact Berthold service, if this event occurs repeatedly.
M702	Current loop open	F	Current output loop open. Check cable connection.
M703	Software update	C	Indicates that a software update is running. No action necessary. The device automatically returns to measuring mode after the software update is finished.
M799	Internal program error	F	Internal software failure. Restart the device. Contact Berthold service, if this event occurs repeatedly.

10 Maintenance and Repair

The replacing of fuses and the cleaning of the EVU are described in the maintenance chapter.

IMPORTANT

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

Repair and servicing on the EVU may only be carried out by experts (see chapter 2.3). In case of doubt, the complete EVU is to be sent to Berthold.

NOTICE

Repair on electronic circuits on the circuit boards of a field device may only be carried out in the manufacturer's factory!

When working at electronic components, the relevant safety regulations must always be observed. Particularly observe the safety instructions in the chapter 2 Safety.

- De-energise the detector and potentially connected relay contacts as well as all inputs and outputs.

IMPORTANT

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

10.1 Replacing of Fuses

⚠ DANGER

Danger to life from electric shock!

Replacing of fuses 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.

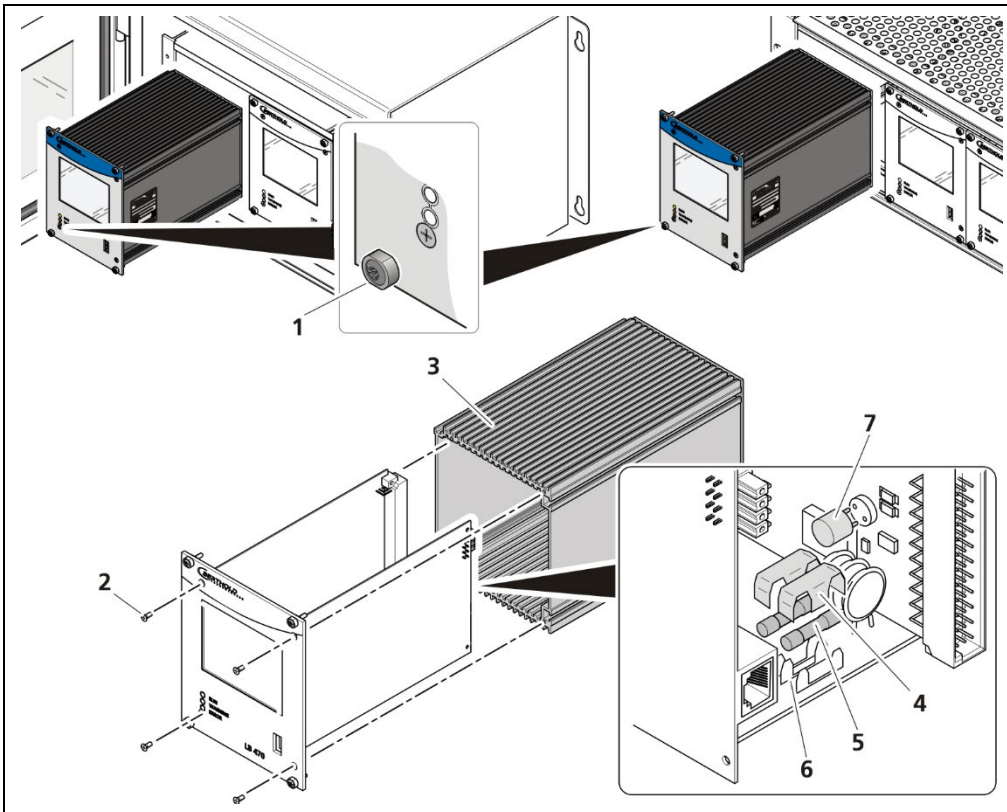
NOTICE

Damage to the device! Short circuit!

The EVU can be damaged if incorrect fuses are used.

- Only use fuses which correspond to the fuses on the circuit board of the module. Fuses:
  - Master EVU 250V 1A T (5x20 mm)
  - Master EVU 250V TR5 T80mA (Ø 8,5 mm)
  - Slave module 250V 315mA T (5x20 mm)

Replacing fuse in the master module



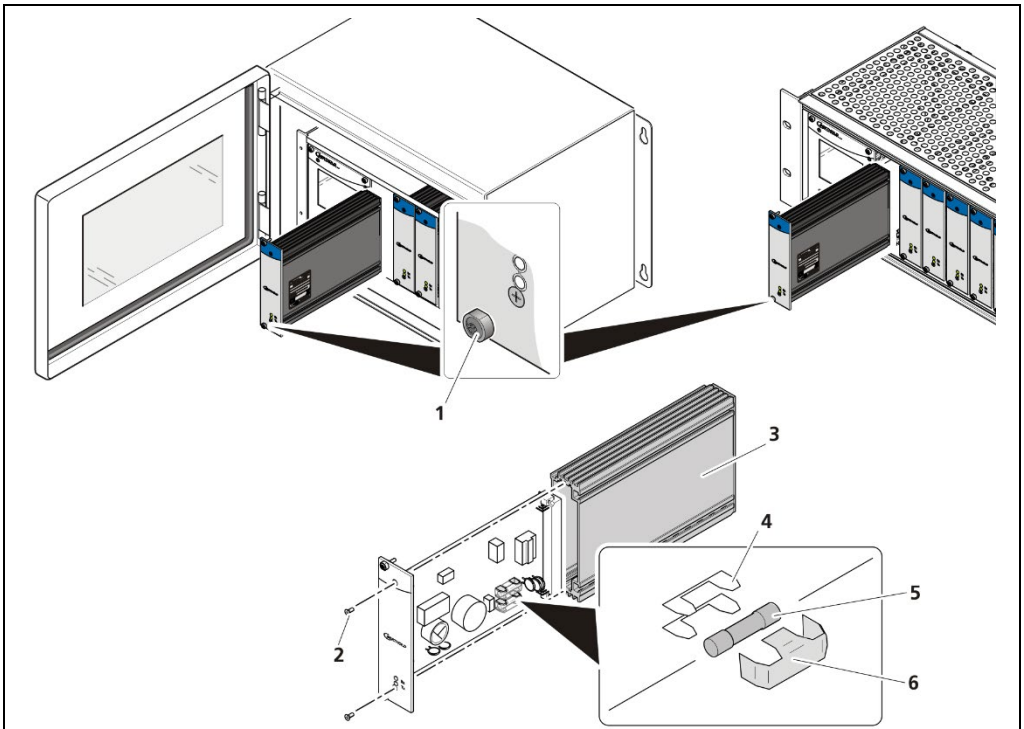
1	Fixing screws	5	Fuse 250V 1A T (5x20 mm)
2	screws	6	Base
3	Housing	7	Fuse 250V TR5 T80mA (Ø 8,5 mm)
4	Covering fuse		

Fig. 143 Replacing fuses master EVU

1. De-energise the device.
2. Loosen the four fixing screws (Fig. 143, item 1) and remove the EVU from the wall housing or subrack.
3. Loosen the four sunken screws on the front side of the EVU (Fig. 143, item 2).
4. Pull out the housing (Fig. 143, item 3) carefully.
5. Remove the protective covering of the fuse (Fig. 143, item 4)
6. Remove the fuse (Fig. 143, item 5, item 7).
7. Insert the new fuses and attach the protective covering again.
8. Carefully slide the circuit board into the housing.
9. Screw the front panel to the housing with the four screws (Fig. 143, item 2).
10. Set module into the guide rails and push it gently until the plug connector of the module is inserted into the socket board.
11. Tighten all fixing screws (Fig. 143, item 1).

▶ The fuse change was carried out correctly.

Replacing Fuse in the Slave Module



1 Fixing screws
2 screws
3 Housing
4 Socket
5 Fuse
6 Covering fuse

Fig. 144 Replacing fuses slave module

1. De-energise the device.
2. Loosen the two fixing screws (Fig. 144, item 1) and remove the EVU from the wall housing or subrack.
3. Loosen the two sunken screws on the front side of the slave module (Fig. 144, item 2).
4. Pull out the housing (Fig. 144, item 3) carefully.
5. Remove the protective covering of the fuse (Fig. 144, item 6)
6. Remove the fuse (Fig. 144, item 5).
7. Insert the new fuses and attach the protective covering again.
8. Carefully slide the circuit board into the housing.
9. Screw the front panel to the housing with the two screws.
10. Set module into the guide rails and push it gently until the plug connector of the module is inserted into the socket board.
11. Tighten all fixing screws (Fig. 144, item 1).

▶ The fuse change was carried out correctly.

10.2 Cleaning

The display is designed for maintenance-free operation. Make sure you keep the touch screen clean. Use a cleaning cloth dampened with a cleaning agent to clean the equipment. Only use water with a little liquid soap or a screen cleaning foam.

NOTICE

Unintentional reaction!

When cleaning the touchscreen, touching keys can trigger an unintentional reaction in the EVU.

- When cleaning, make sure that no unintentional reactions are triggered.

NOTE

Damage caused by unauthorized cleaning products!

The display may be damaged if compressed air, steam jet blowers, aggressive solvents or scouring powders are used for cleaning purposes.

- Clean the EVU with a cleaning cloth dampened with a cleaning agent

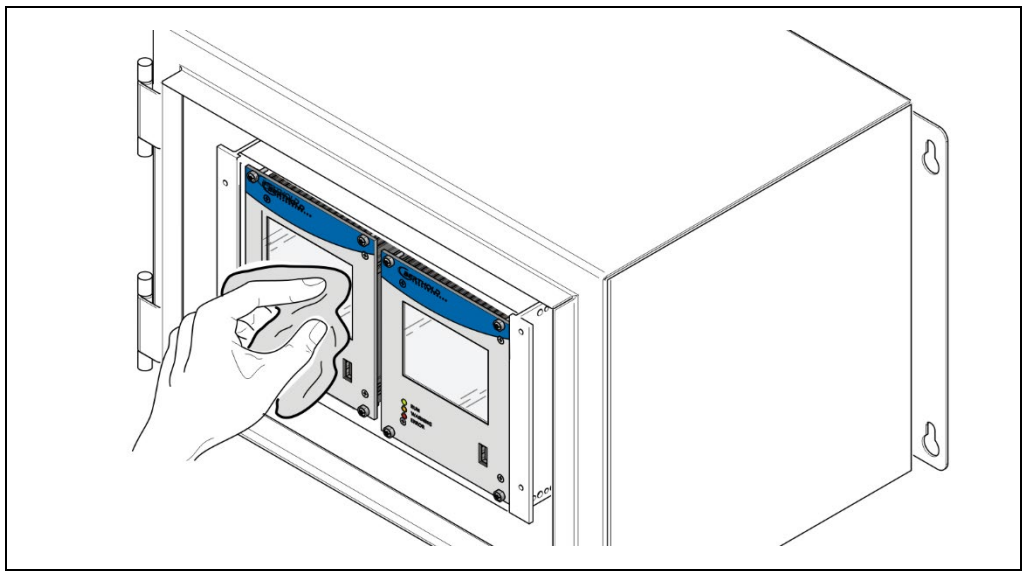


Fig. 145 Cleaning the display

1. If necessary, shut down the device.
2. Spray the cleaning solution onto a cleaning cloth.
3. Do not spray directly onto the display.
4. Clean the display.
5. When cleaning the display wipe from the screen edge inwards.

- The cleaning of the display was carried out correctly.

10.3 Data Backup

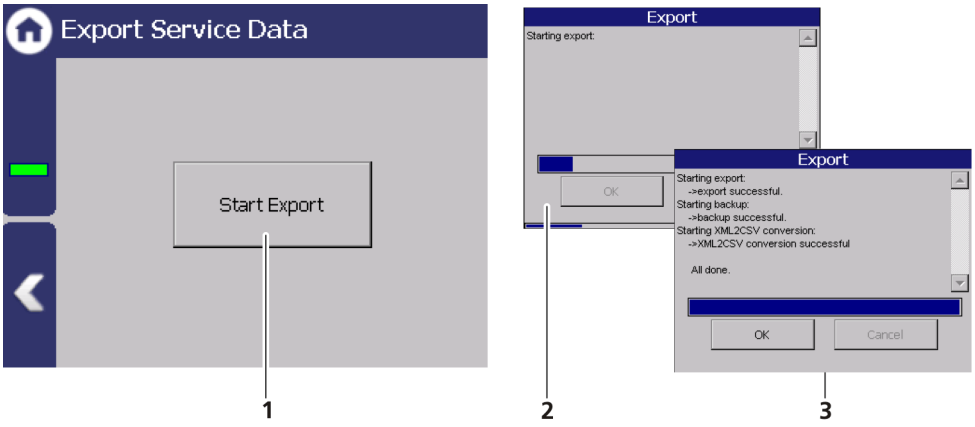
Activate the data log (see chapter 8.4) or the network data log (see chapter 8.5) so that all data are recorded. Perform a log data and service data backup at regular intervals.

Export Service Data

Diagnostics | Export Service Data

Four .txt files are copied to the USB drive when exporting service data:

- ChangeLog
- ErrorHistory
- ErrorSummary
- SystemInfo



1 **Button** < Export Service Data >
2 **Process window**
3 **Confirmation message**

Fig. 146 Export Service Data

1. Connect a USB storage device to the device (Fig. 3, item 5).
2. The USB storage is recognised by the system after a few seconds and the button < Export service data > (Fig. 146, item 1) can be clicked.
3. Click on the button < Export service data > (Fig. 146, item 1).

▶ The process window is displayed and the export of service data will be carried out (Fig. 146, item 2).

▶ After successful export a confirmation message (Fig. 146, item 3) is displayed. A new folder "Backup_LB470" is created and the Backup-File (.xml) is copied when exporting.

11 Decommissioning

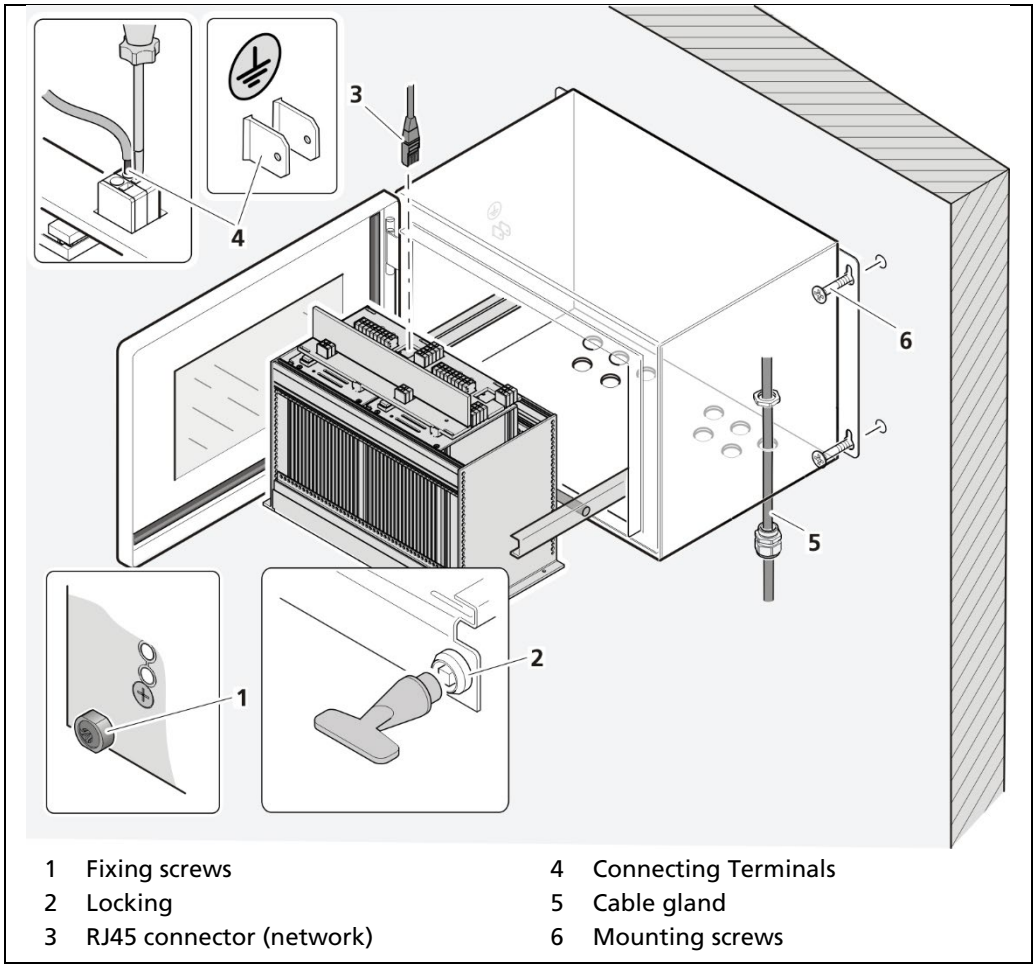
⚠ DANGER

Danger to life from electric shock!
Decommissioning may only be carried out by qualified electricians.

- Please adhere to the relevant safety regulations.
- Decommissioning 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.

11.1 Decommissioning Wall Housing



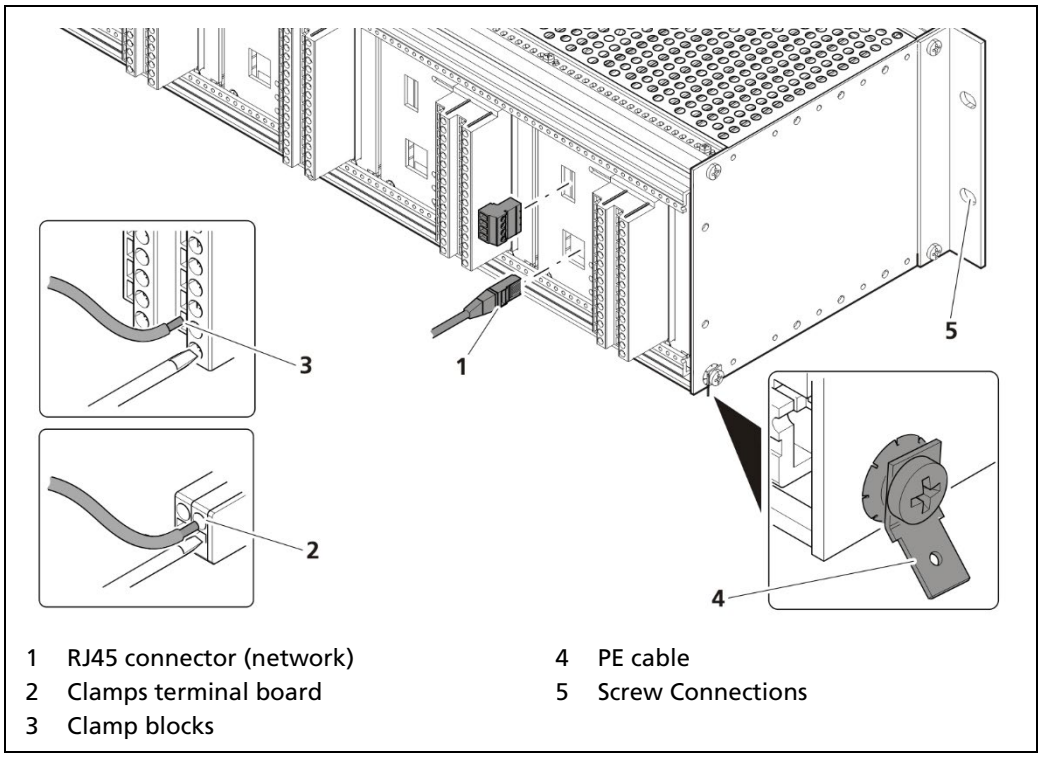
1	Fixing screws	4	Connecting Terminals
2	Locking	5	Cable gland
3	RJ45 connector (network)	6	Mounting screws

Fig. 147 Decommissioning wall housing

1. Make sure that the locking bolts (Fig. 147, item 1) of all modules are tightened in order to prevent slipping.

2. Loosen the lock (Fig. 147, item 2) using the supplied square key and pull the subrack out.
3. The subrack can be folded down by the folding mechanism.
4. Fold the subrack downward cautiously.
5. Remove the network plug (Fig. 147, item 3).
6. Remove all lines from the terminal board (Fig. 146, item 4).
7. Loosen the cable gland (Fig. 147, item 5) on the bottom side of the wall housing and pull all cables from the wall housing.
8. Slide the subrack into the wall housing and close the housing doors.
9. Loosen the mounting screws (Fig. 147, item 6) and remove the wall housing.

11.2 Decommissioning 19" Subrack



1 RJ45 connector (network)
2 Clamps terminal board
3 Clamp blocks
4 PE cable
5 Screw Connections

Fig. 148 Decommissioning 19” subrack

1. De-energise the device.
2. Remove the network plug (Fig. 148, item 1).
3. Remove all lines from the terminal board (Fig. 148, item 2) or the clamp blocks (Fig. 148, item 3).
4. Remove the PE cable (Fig. 148, item 4).
5. Remove the connections (Fig. 148, item 5) and pull the subrack from the 19" rack.

11.3 Disposal of Measurement System

⚠ CAUTION

Toxic!

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

- Disposal is to be carried out in accordance with the disposal regulations via a disposal expert.

If the device is to be decommissioned, have it disposed of according to legal regulations (e.g. RL 2012/19/EU) by a specialised waste management company.

12 Appendix

12.1 Setup Protocol

General data	
Date	
Measuring point	
Source No.	
Number of dectors	_____ LB44x _____ LB47x _____ LB54x
Activity	
Isotope	☐ Cs-137 ☐ Co-60
Container	
Product	
Cascaded measurement	☐ YES ☐ NO

Device configuration	
Model	
Installation variant	☐ Wall housing ☐ Subrack
Anschluss	☐ Platine ☐ Clamp block
Power supply	☐ 100-240V AC ☐ 18-32V DC
Number of Master EVU	
Number of modules	
Device ID	
Software Version	

Setup Protocol (Continued)

Parameters	
Password	_____
Language	☐ DE ☐ EN ☐ _____
CE Remote Control	☐ enabled
Network	☐ DHCP active IP Address _____ • _____ • _____ • _____ Subnet _____ • _____ • _____ • _____ Gateway _____ • _____ • _____ • _____ DNS-Server _____ • _____ • _____ • _____ MAC Address _____
Calibration Characteristic	☐ Linear ☐ Exponential ☐ inverted Curve
GPC	☐ enabled ☐ Cs-137 ☐ Co-60
Damping	_____s time constant
Process Value Range	min. Value 4,00 mA _____ % max. Value 20,00 mA _____ %
Rapid Switch (0 – 9,9999)	☐ Enabled Sigma _____
Radiation Interference (XIP)	☐ Detection enabled Measurement Delay _____ s Hold Time _____ s I_O Factor _____ RI Sigma _____
Source replacement	☐ Notification enabled
Digital inputs	DI-1 Assignment ☐ none ☐ Stop measurement ☐ Upper Adjust ☐ Lower Adjust ☐ Standard Adjust DI-2 Assignment ☐ none ☐ Stop measurem. ☐ Upper Adjust ☐ Lower Adjust ☐ Standard-Adjust
Analog output	AO Assignment ☐ Level ☐ Damped count rate ☐ Raw count rate ☐ Count rate (GPC detector) ☐ GPC Factor ☐ AO-Monitoring enabled AO-Failure Mode ☐ Namur High ☐ Namur Low ☐ Hold value ☐ User-def. Value

Setup Protocol (Continued)

Parameters	
Digital Outputs	Function DO-2 ☐ none ☐ Low level alarm ☐ High level alarm ☐ Det. temperature alarm ☐ Rad. interference alarm ☐ Source Replacement Alarm ☐ Measurement stopped ☐ System state: Warning Function DO-3 ☐ none ☐ Low level alarm ☐ High level alarm ☐ Det. temperature alarm ☐ Rad. Interference alarm ☐ Source replacement alarm ☐ Measurement stopped ☐ System state: Warning
PV Alarm Behaviour	NE 107 Status when Alarm ☐ No Status ☐ Out of Specification ☐ Failure
Detector Temperature Alarm Behaviour	NE 107 Status when Alarm ☐ No Status ☐ Out of Specification ☐ Failure

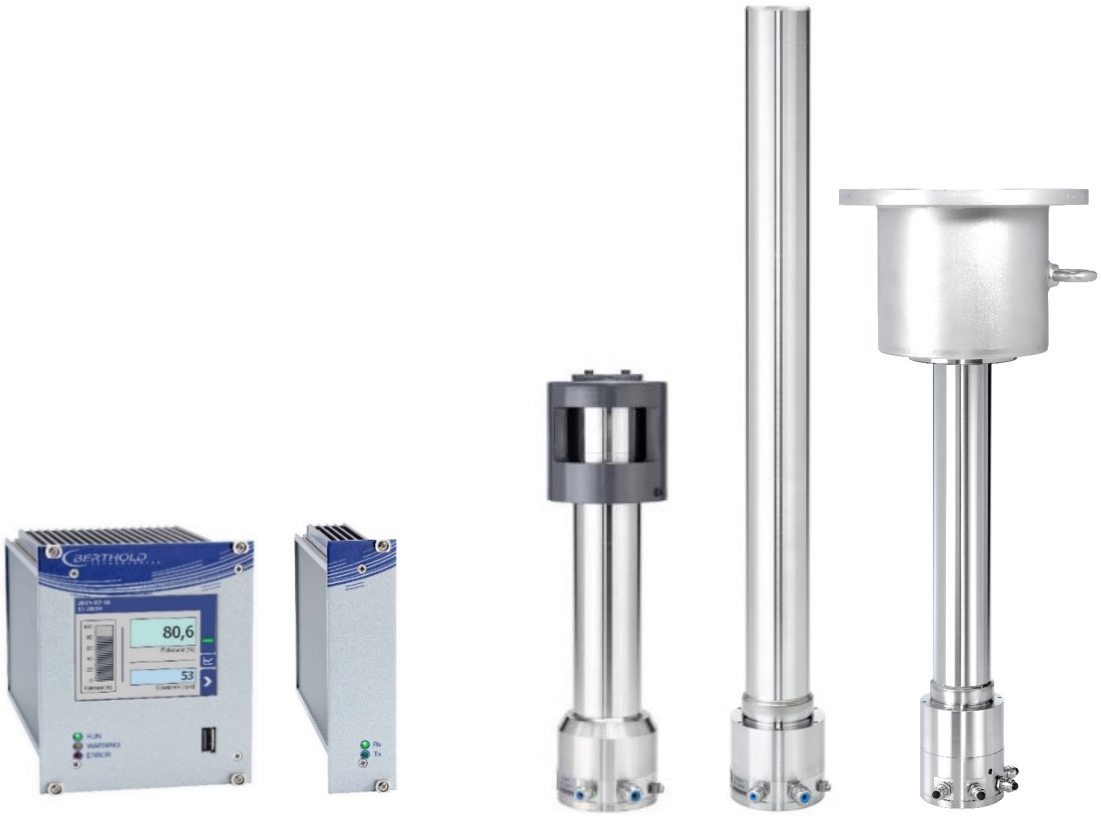
Modifications due to technical advancement reserved.

05/2020
Language: English
Rev. no.: 04
Printed in Germany

BERTHOLD TECHNOLOGIES GmbH & Co. KG

Calmbacher Str. 22
75323 Bad Wildbad
Germany
www.Berthold.com

Id.-No. 56925BA2



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 :

Signalement

Source et conséquence
Explication si requise
- ▶ Prévention

En cas de danger

- **Symboles d'alerte :** (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.

RECOMMANDATION

Si cette information n'est pas appliquée, un dysfonctionnement et/ou un dégât matériel peuvent apparaître.

IMPORTANT

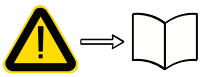
Les sections identifiées avec ce symbole signalent des informations importantes du produit ou de son fonctionnement.

Tip

Fournit des conseils sur l'application ou d'autres informations utiles.

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.
- Manoeuvre 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.

A 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.

Les employés avec connaissances générales sont, par exemple, des techniciens, des soudeurs, qui vont assurer différentes tâches lors du transport, de l'assemblage et de l'installation de l'appareil sous l'encadrement d'une personne autorisée. Il peut s'agir aussi de personnel de montage du site. Les personnes concernées doivent posséder une expérience dans la manipulation du produit.

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 règlements 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.

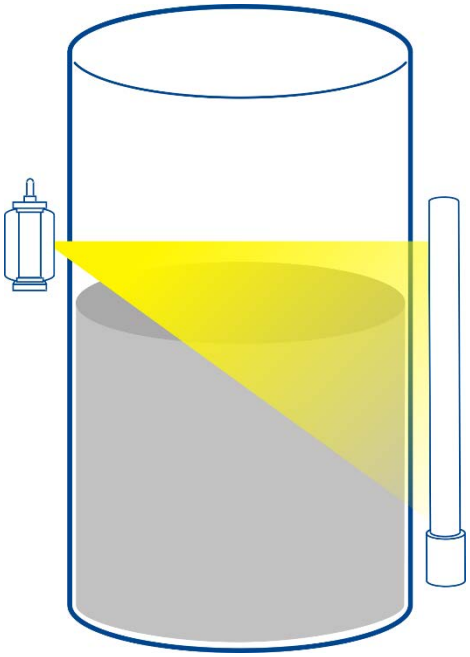
Sous réserve de modifications dans le cadre du progrès technique.

langue: Français
Imprimé en Allemagne
09/2019
Rev.-Nr.: 04

BERTHOLD TECHNOLOGIES GmbH & Co. KG

Calmbacher Str. 22
75323 Bad Wildbad
Germany
www.Berthold.com

Id.-Nr. 56925BA59



Level
Füllstand

Technical Information
Technische Information

56925TI1L
Rev. No.: 03, 05/2020

2 Wire Technology

The DuoSeries/DuoXPERT measuring system consists of a scintillation detector – CrystalSENS point detector or UniSENS rod 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) fpr detectors
- 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
- Optional Radiation Interference Discrimination (LB470RID)

2-Leiter Technologie

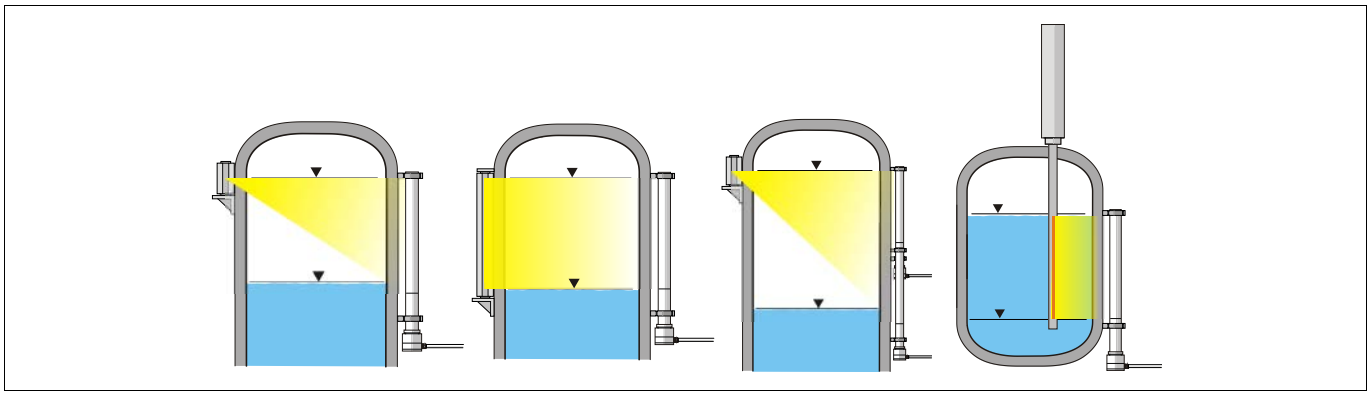
Das DuoSeries/DuoXpert Messsystem besteht aus einem Detektor mit Szintillator-Technolgie – CrystalSENS Punktdetektor oder UniSENS Stabdetektor – sowie einer separaten Auswerteeinheit zur Anzeige und Bedienung.

Die moderne Auswerteeinheit verfügt über ein 3,5" Touch Panel, eine starke Dual Core CPU und verschiedenen Bedien-Optionen. Erweiterte Funktionen zur Selbstdiagnose und Überwachung sorgen zudem für höchste funktionale Sicherheit der Messung im Betrieb. Darüber hinaus können die Betreiber die Daten-Log Funktionen für eine detaillierte Prozessanalyse nutzen und so zum Beispiel Trends entwickeln oder Prozessänderungen nachvollziehen.

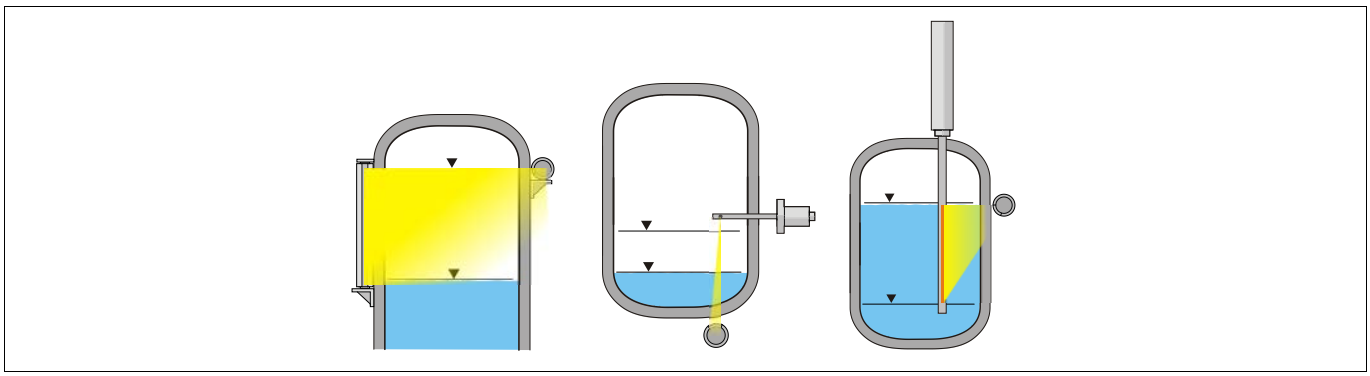
Hochentwickeltes Messsystem in 2-Leiter Technologie

- *Einzigartig: Radiometrische Messung mit eigensicherer Spannungsversorgung (Voll Ex-i) für den Detektor*
- *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, LB54xx und LB 47xx*
- *Optionale Störstrahlungserkennung (LB 470RID)*

Measurement Arragements Level
Messanordnungen Füllstand

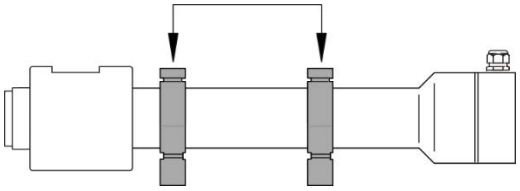


Measurement arrangements with rod detector
Messanordnungen mit Stabdetektor



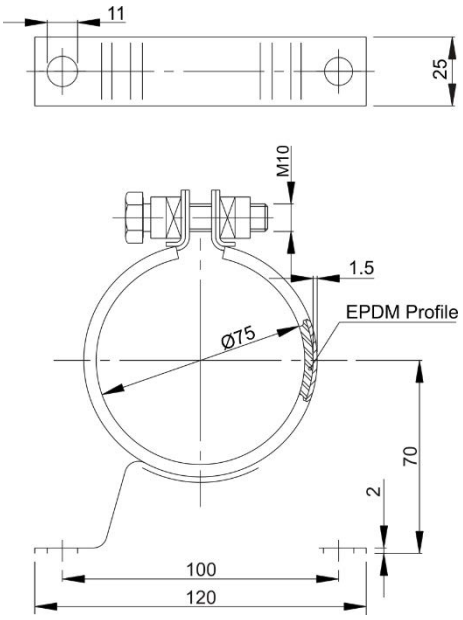
Measurement arrangements with point detector
Messanordnungen mit Punktdetektor

Mounting Clamps for Detector
Befestigungsschellen für Detektor



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

for Detectors without Water Cooling
für Detektoren ohne Wasserkühlung



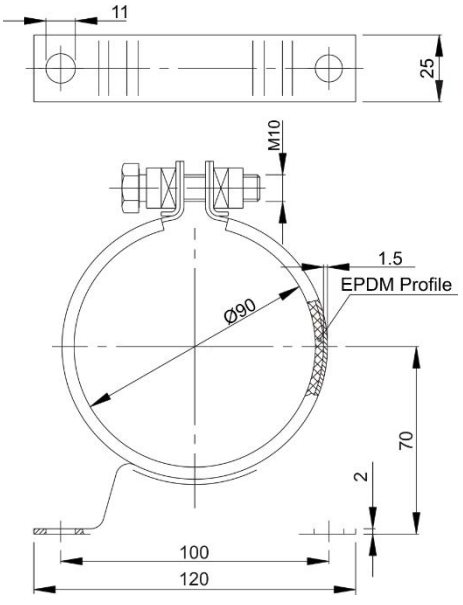
Dimensions in mm
Abmessungen in mm

Material: 316Ti 1.4571
Werkstoff: 316Ti 1.4571

Part No. 31346 (1 set = 2 clamps)
Id. Nr. 31346 (1 Set = 2 Schellen)

Part No. 31345 (single clamp)
Id. Nr. 31345 (einzelne Schelle)

for Detectors with Water Cooling
für Detektoren mit Wasserkühlung



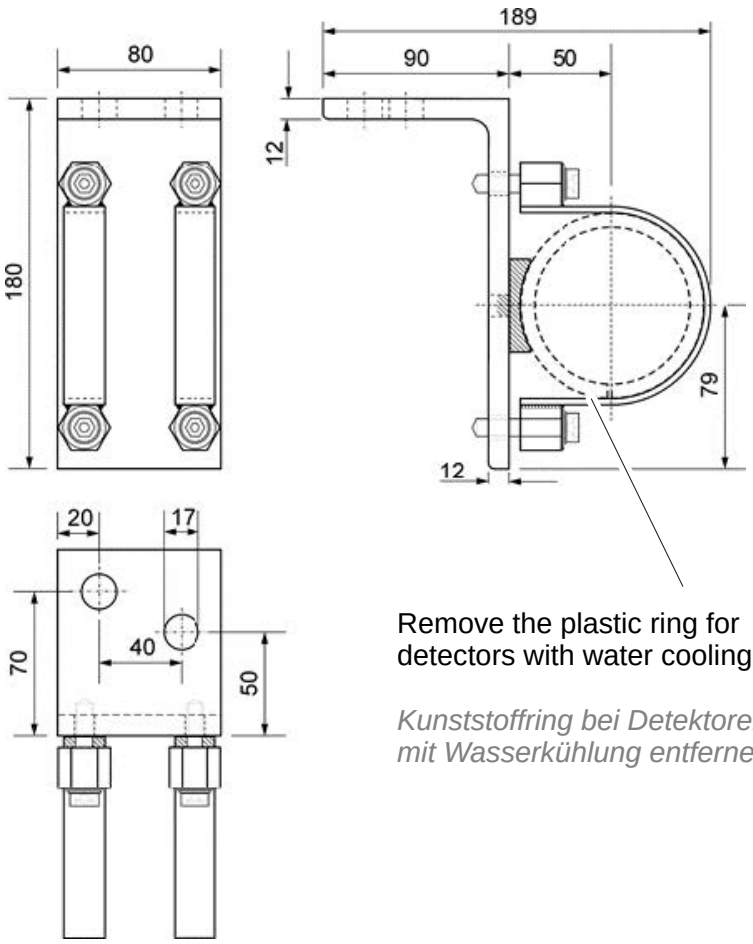
Dimensions in mm
Abmessungen in mm

Material: 316Ti 1.4571
Werkstoff: 316Ti 1.4571

Part No. 31347 (1 set = 2 clamps)
Id. Nr. 31347 (1 Set = 2 Schellen)

Part No. 31344 (single clamp)
Id. Nr. 31344 (einzelne Schelle)

Heavy Duty Detector Holder (Stainless Steel)
Robuste Detektor Halterung (Edelstahl)



Remove the plastic ring for detectors with water cooling.

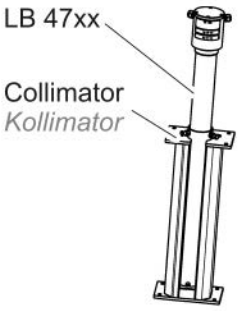
Kunststoffring bei Detektoren mit Wasserkühlung entfernen.

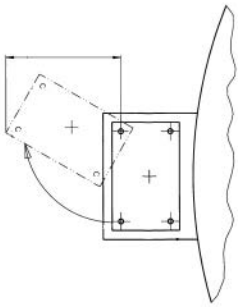
Part No. 39246 = without water cooling
Id. Nr. 39246 = ohne Wasserkühlung

Part No. 39247 = with water cooling
Id. Nr. 39247 = mit Wasserkühlung

Dimensions in mm
Abmessungen in mm

Collimator for Rod Detector
Kollimator für Stabdetektor

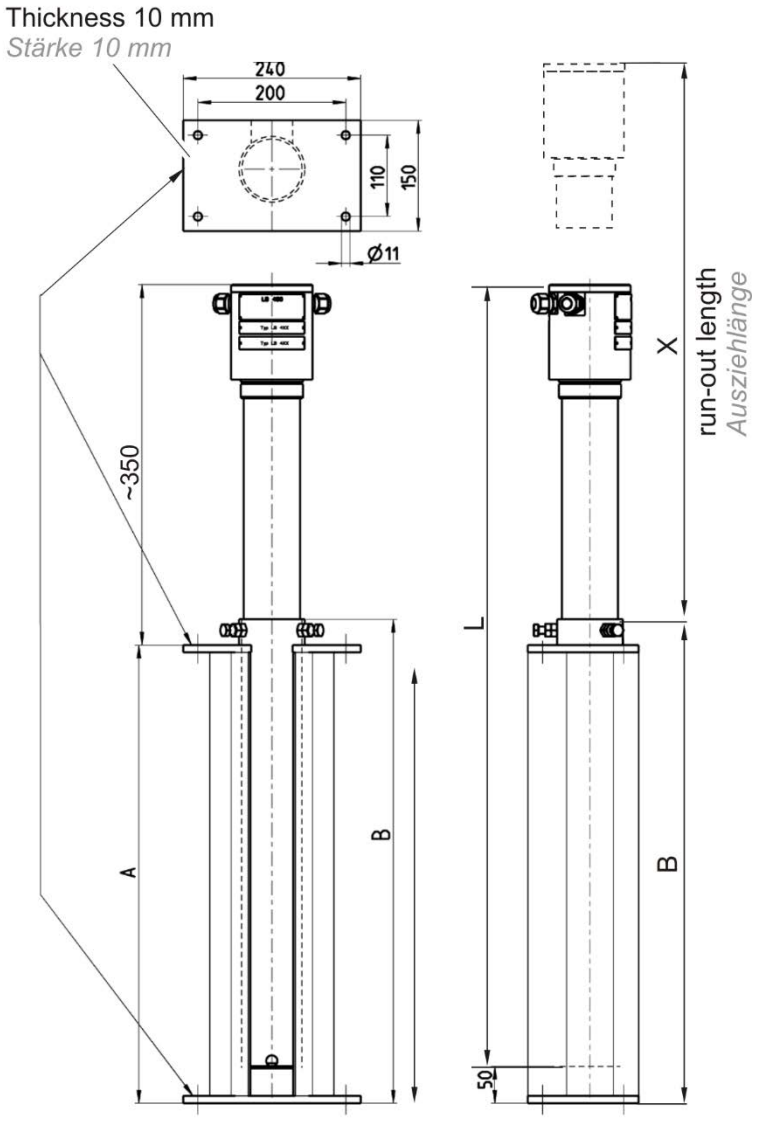




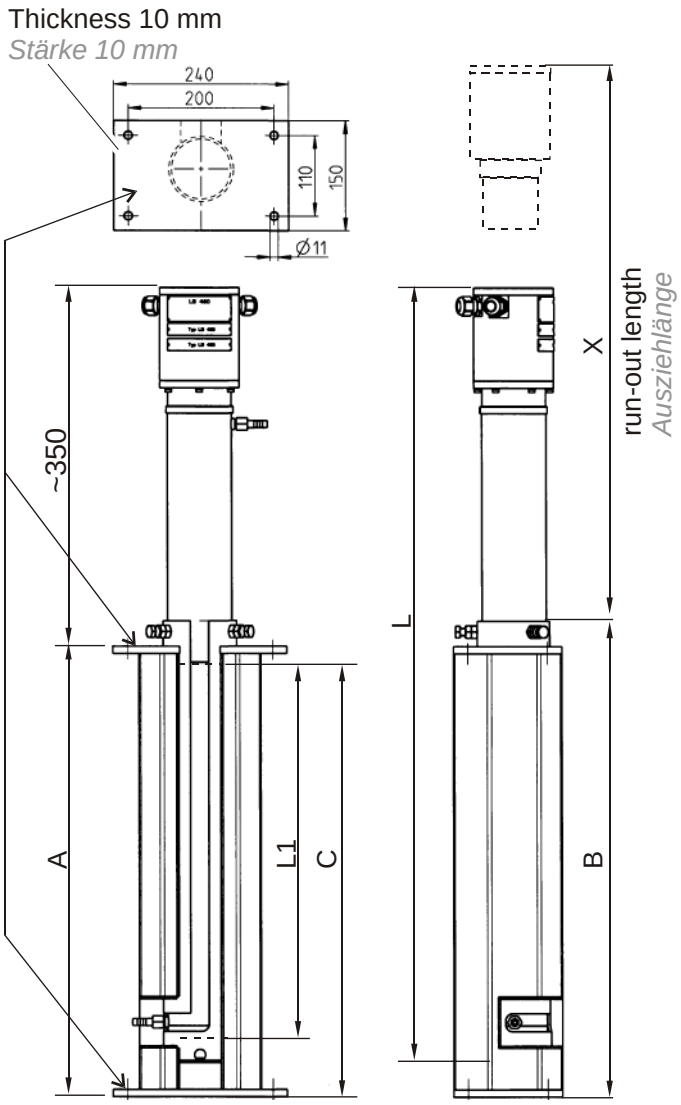
For installation/deinstallation, space for swiveling the collimator is recommended.

Empfohlener Installations-/ Deinstallationsraum zum Ausschwenken des Kollimators.

for Detectors without Water Cooling
für Detektoren ohne Wasserkühlung



for Detectors with Water Cooling
für Detektoren mit Wasserkühlung



Part No. *Id. Nr.*	for WC* *für WK**	L1 (sensitive length) *(empfindliche Länge)*	A	B	L (detector lenght) *(Detektorlänge)*	C	X	Weight (kg) *Gewicht (kg)*
59957-050	-	500	620	655	925	560	1000	110
59957-100		1000	1220	1155	1425	1090	1500	195
59957-150		1500	1620	1655	1925	1590	2000	280
59957-200		2000	2120	2155	2425	2090	2500	365
60085-050	✓	500	620	655	929	590	1000	100
60085-100		1000	1120	1155	1429	1090	1500	180
60085-150		1500	1620	1655	1929	1590	2000	255
60085-200		2000	2120	2155	2429	2090	2500	330

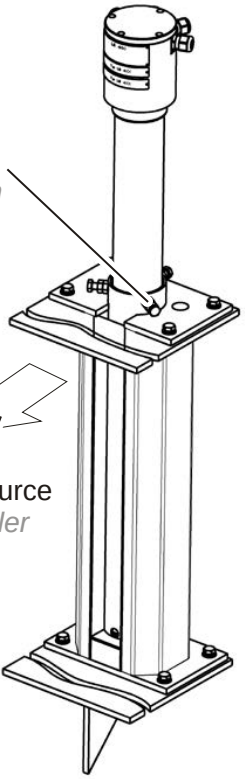
* Watercooling
** Wasserkühlung*

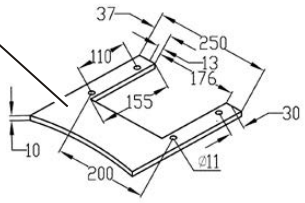
Collimator Mounting Devices
Kollimator Halterungen

Stabilizer
Kippsicherung

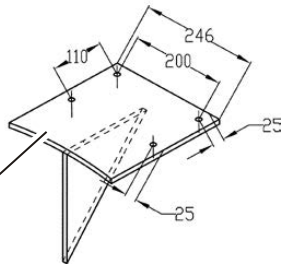
Stabilizer against tilting, installed by customer.
Bracket e.g. welded to the vessel or a special support.
Kippsicherung installiert vom Errichter.
Lasche z.B. angeschweißt am Behälter oder einer Tragekonstruktion.

Detector locking screws
with counter nuts.
Detektor Feststellschrauben mit Kontermuttern





Mounting direction to the source
Montagerichtung zum Strahler



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.

NOTICE / HINWEIS

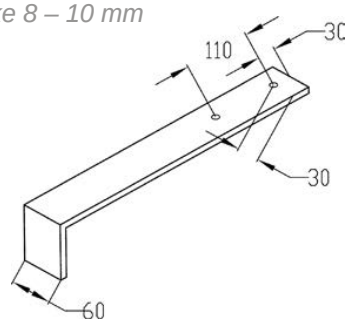
Alternative to the stabilizer against tilting, you can use a one-sided mounted angle bracket as a stabilizer too (see next drawing).

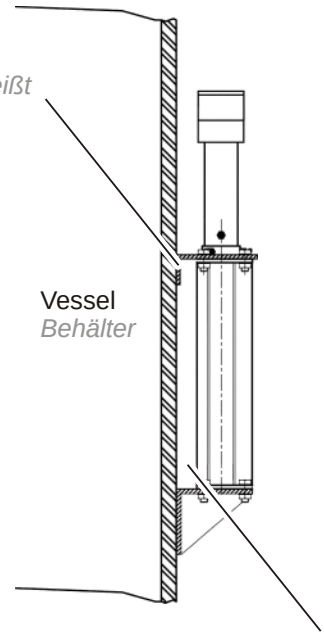
Alternativ zur Kippsicherung, können auch einseitig montierte Winkeleisen als Kippsicherung verwendet werden (siehe nächste Zeichnung).

Angle Bracket
Winkeleisen

angle bracket as tilt protection, welded.
Winkeleisen als Kippsicherung, angeschweißt

material thickness 8 – 10 mm
Materialstärke 8 – 10 mm

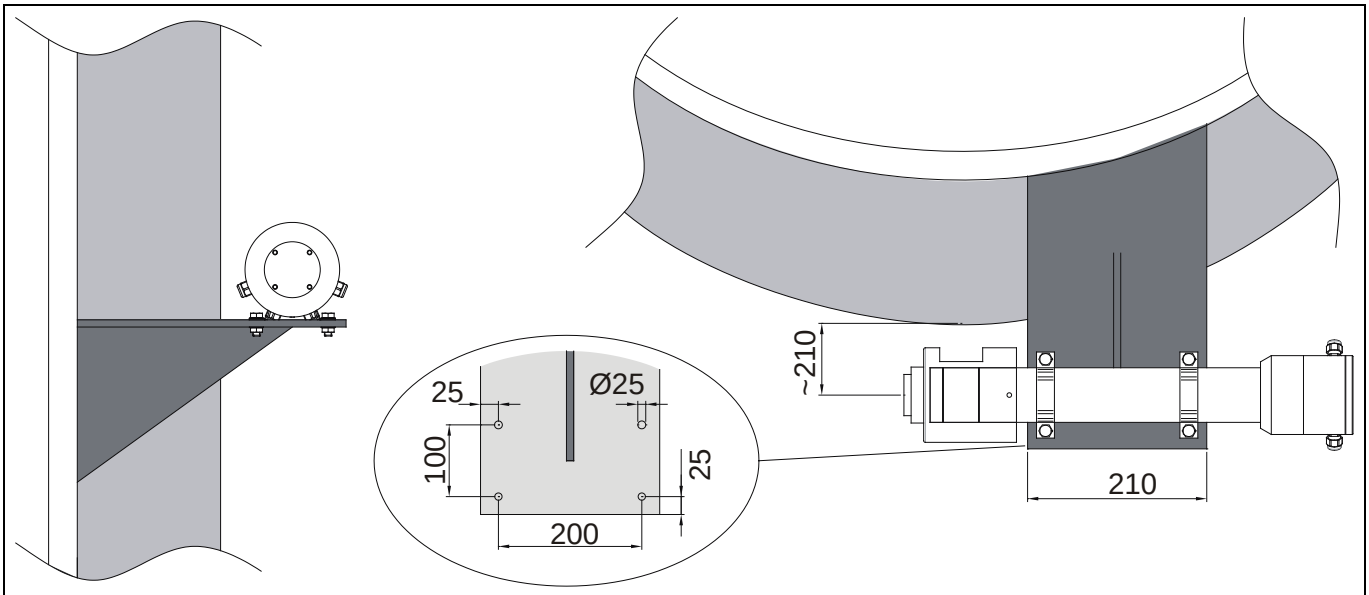




Distance to the vessel wall approx. 100 mm
Abstand zur Behälterwand ca. 100 mm

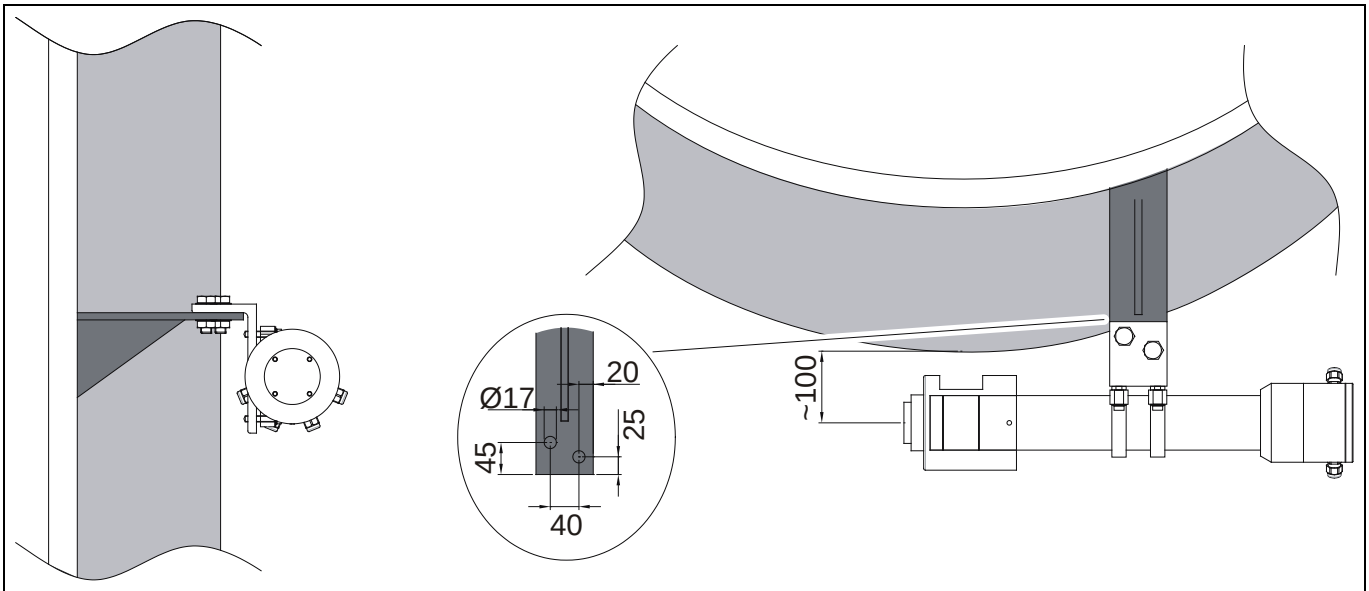
Mounting Point Detector
Befestigung Punktdetektor

Mounting with Clamps
Montage mit Schellen



Dimensions in mm
Abmessungen in mm

Mounting with Detector Holder
Montage mit Detektorhalterung



Dimensions in mm
Abmessungen in mm

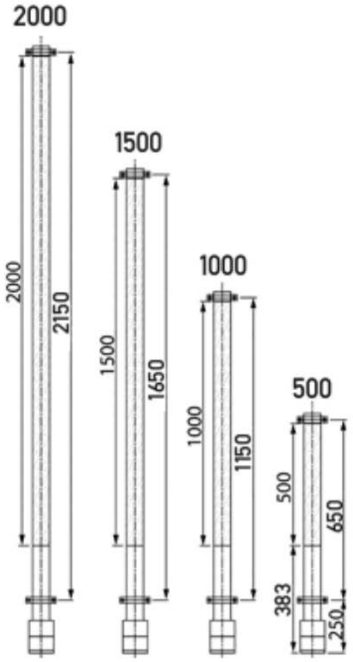
NOTICE / HINWEIS

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.

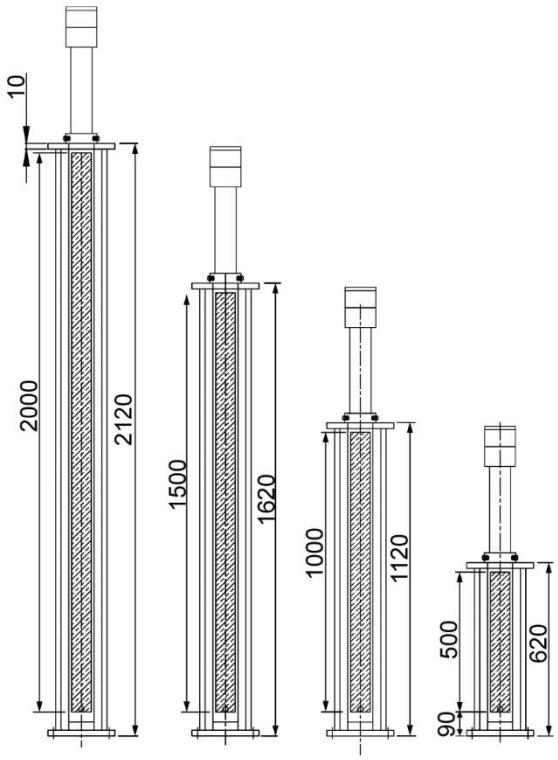
Wird durch Sonneneinstrahlung eine Detektortemperatur von über 50°C erreicht, so ist ein geeigneter Sonnenschutz zu montieren. Auch die Aufheizung des Detektors durch Wärmeabstrahlung vom Behälter kann durch ein dünnes Wärmeableitblech gemildert werden. Für jeden Detektor steht auch eine geeignete Wasserkühlung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

Clamping and Mounting Positions for Rod Detectors
Klemmenposition und Montageposition Stabdetektoren

Clamping Position for Rod Detectors
Klemmenposition für Stabdetektoren

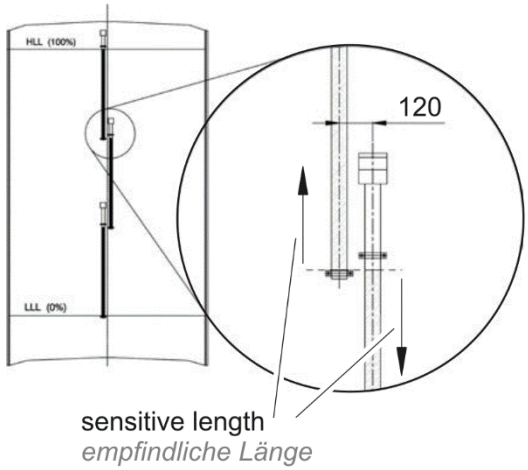


Mounting Position for Rod Detector Shieldings
Klemmenposition für Stabdetektorabschirmungen

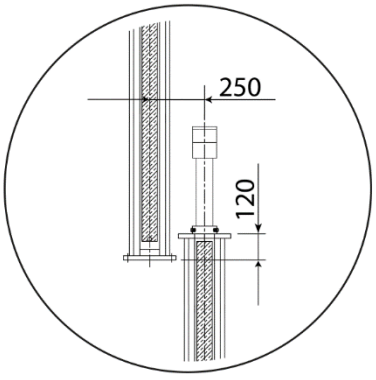


The drawings on this valid for Detectors with and without water cooling jacket.
Die Zeichnungen auf dieser Seite sind gültig für Detektoren mit und ohne Wasserkühlung.

Clamping Position for Multi Detector Arrangement
Klemmenposition für Multidetektor-Anordnung



Mounting Position for Rod Detector Shieldings
Klemmenposition für Stab-detektorabschirmungen



Dimensions in mm
Abmessungen in mm

Evaluation Unit
Auswerteeinheit

Evaluation Unit

The modules can be installed either in wall housings or 19" subracks. It can be equipped differently, depending on requirements. The rear clamp blocks or terminal panels are used for the electrical connection.

Auswerteinheit

Die Module können entweder in Wandgehäusen oder 19"-Baugruppenträgern eingebaut und kann je nach Bedarf unterschiedlich bestückt werden. Zum elektrischen Anschluss werden die rückwärtigen Klemmenblöcke oder Anschlussplatinen verwendet.

NOTICE / HINWEIS

Detector of the type LB44xx and LB54xx can capture measurement data only with master EVU.

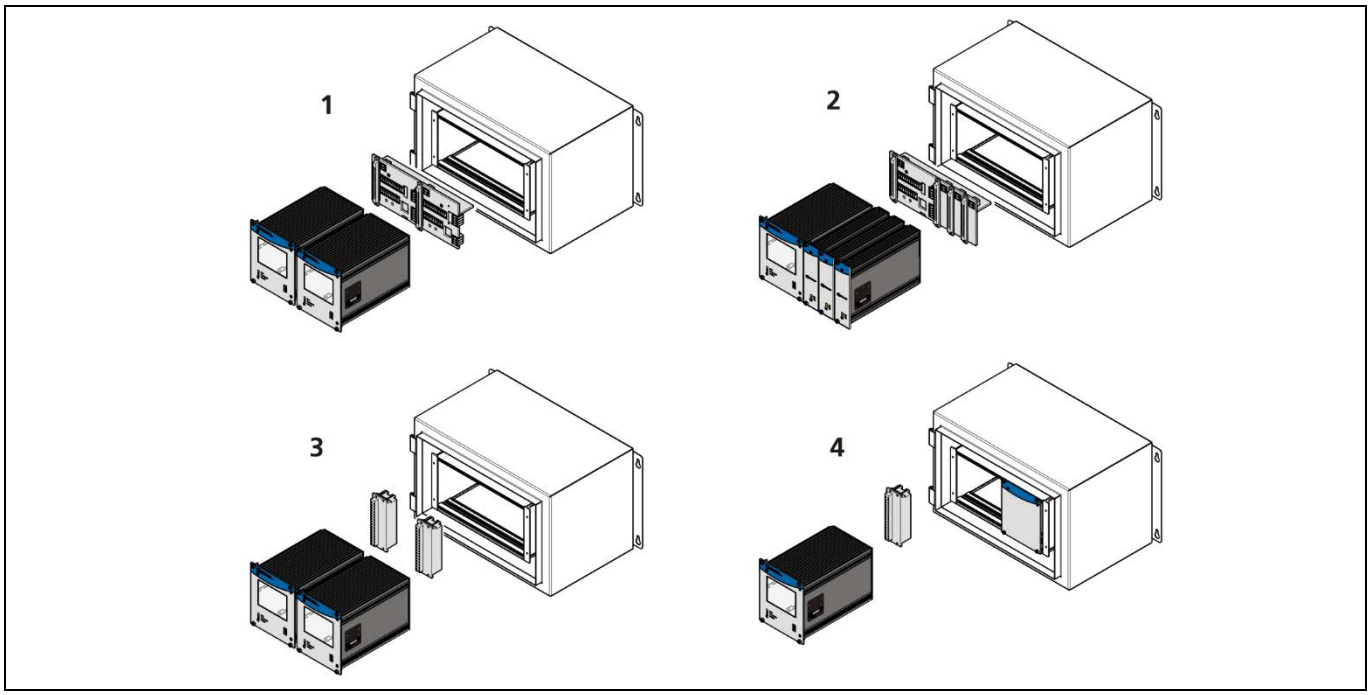
Messdaten der Detektoren vom Typ LB44xx und LB54xx können nur mit einem Master-Modul erfasst werden.

NOTICE / HINWEIS

The Evaluation unit is not explosion protected and is not designed for hazardous environments.

Diese Auswerteinheit ist nicht ex-geschützt ausgeführt und darf nicht in explosionsgefährdete Bereiche verwendet werden.

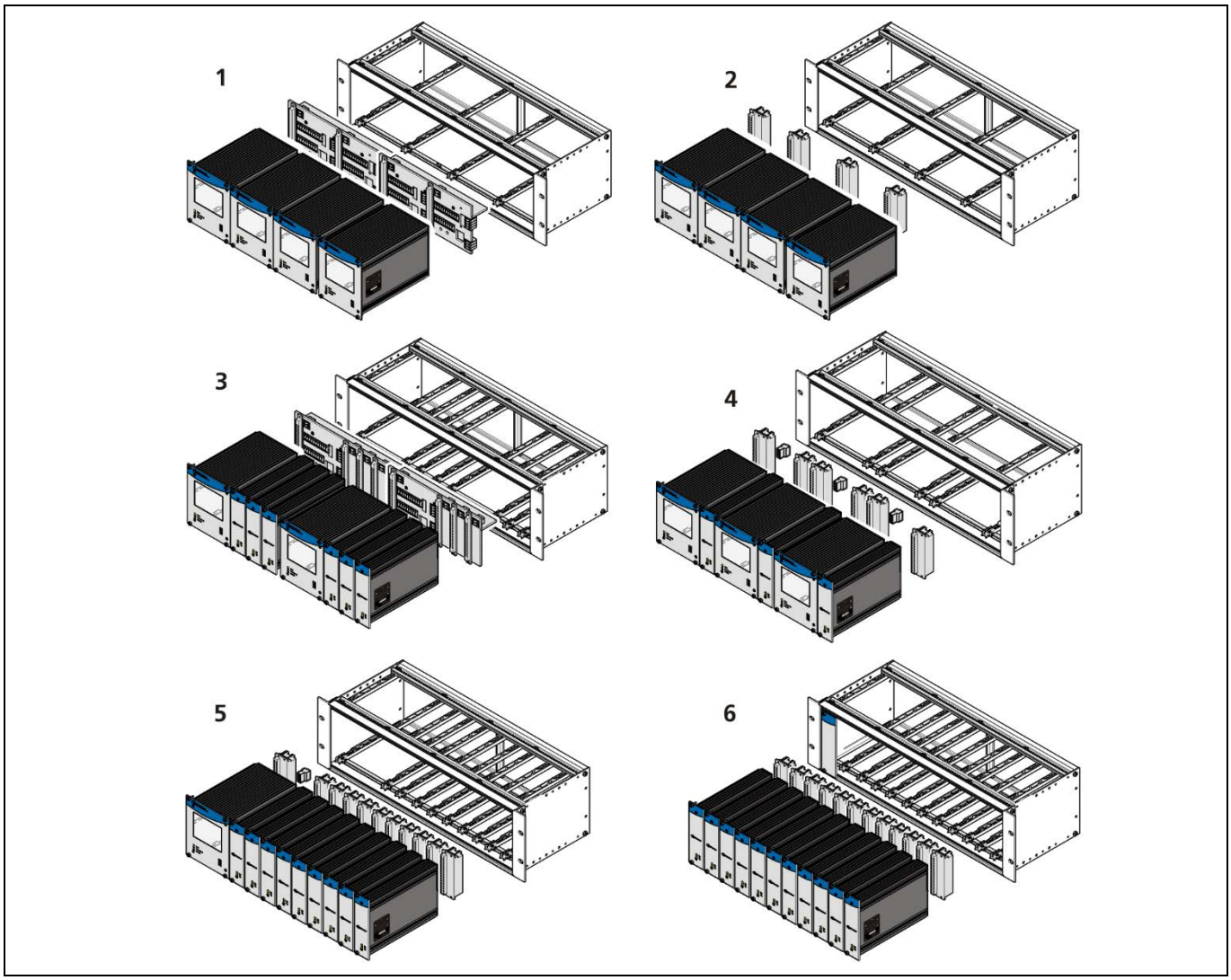
Installation Variants Wall Housing
Einbauvarianten Wandgehäuse



Item *Pos.*	Compontens *Komponenten*	Connection *Anschluss*
1	2 Master	1 Terminal panel master/master[1] *1 Anschlussplatine Master/Master[1]*
2	1 Master, 3 Slaves	1 Terminal panel master/slave[1] *1 Anschlussplatine Master/Slave[1]*
3	2 Master	2 Terminal blocks *2 Klemmenblöcke*
4	1 Master, 0 – 3 Slaves	1 Terminal block for master, 0 – 3 Terminal block for slave module *1 Klemmenblock für Master, 0 – 3 Klemmenblöcke für Slave Modul*

[1] NRTL certification US/CAN
NTRL Zertifikat US/CAN

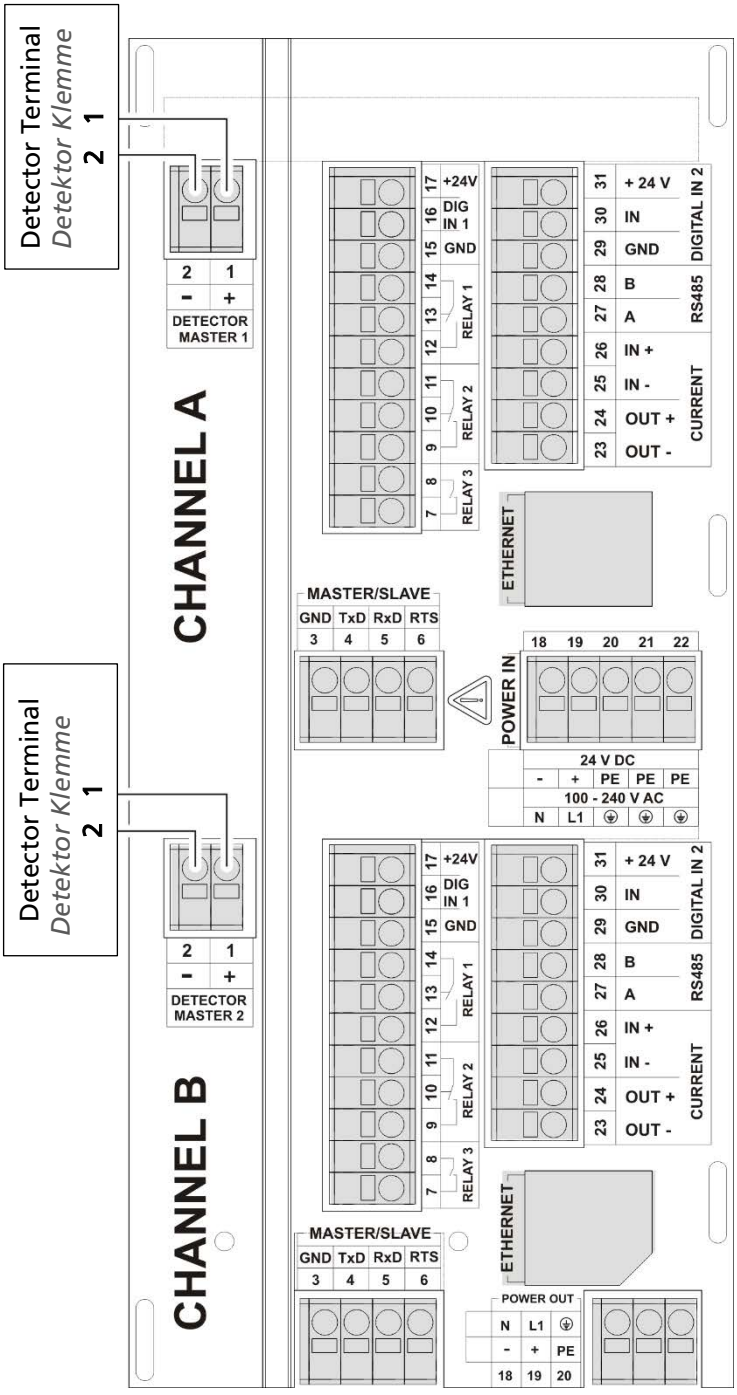
Installation Variants 19" Subrack
Einbauvarianten 19" Baugruppenträger



Item *Pos.*	Compontens *Komponenten*	Connection *Anschluss*
1	4 Master	2 Terminal panel master *2 Anschlussplatine Master*
2	4 Master [2]	4 Terminal blocks *4 Klemmenblöcke*
3	2x (1 Master, 3 Slaves)	2 Terminal panel master/slave *2 Anschlussplatinen Master/Slave*
4	4x (1 Master, 1 Slave) [2]	6 Terminal blocks; master/slave plugs *6 Klemmenblöcke; Master/Slave Stecker*
5	1 Master, 9 Slaves [2]	10 Terminal blocks; master/slave plug *10 Klemmenblöcke; Master/Slave Stecker*
6	11 Slaves [2]	11 Terminal blocks *11 Klemmenblöcke*

[2]Application example. The modules can be arranged arbitrarily with terminal blocks.
Anwendungsbeispiele. Mit Klemmenblöcken können Module frei zusammengestellt werden.

Connection Diagram Terminal Board Master/Master
Anschlussplan Anschlussplatine Master/Master

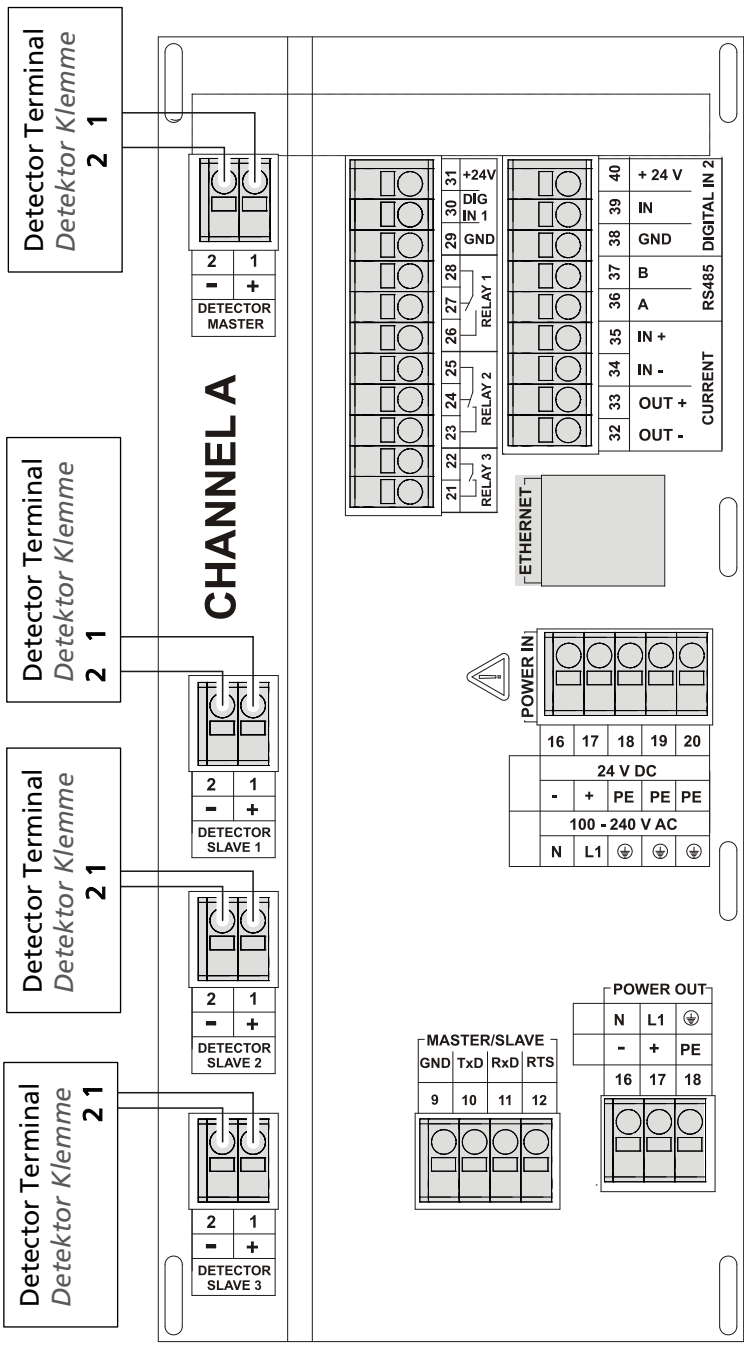


In a 19 "subrack for 4 masters (Id 59484), there is another one with Channel C / D next to the connector board for Channel A / B. The channel assignment of Channel C / D is identical to that of Channel A / B.

In einem 19" Baugruppenträger für 4 Master (Id.59484), ist neben der oben gezeigten Anschlussplatine für Channel A/B, eine weitere mit Channel C/D enthalten. Die Klemmenbelegung von Channel C/D ist identisch mit der von Channel A/B.

#	Connector *Anschluss*	Function *Funktion*
1	DETECTOR MASTER +	Connection Detector Verbindung Detektor LB 4700 / LB 44xx
2	DETECTOR MASTER -	
3	MASTER/SLAVE GND	Connection of additional slave units *Anschluss von weiteren Slave-Einheiten*
4	MASTER/SLAVE TxD	
5	MASTER/SLAVE RxD	
6	MASTER/SLAVE RTS	
7	RELAIS 3 NC	DIGITAL OUT
8	RELAIS 3 COM	
9	RELAIS 2 NC	DIGITAL OUT
10	RELAIS 2 NO	
11	RELAIS 2 COM	
12	RELAIS 1 NC	Error DIGITAL OUT *Fehler DIGITAL OUT*
13	RELAIS 1 NO	
14	RELAIS 1 COM	
15	DIGITAL IN 1 GND	GND
16	DIGITAL IN 1 IN	Logic Input
17	+ 24 V (GND -->15)	24 V out (max. 200 mA)
18	POWER DC 24 V – / AC N	24 V DC / 100-240 V AC
19	POWER DC 24 V + / AC L1	
20	PE	
21	PE	
22	PE	
23	CURRENT OUT –	4 mA … 20 mA
24	CURRENT OUT +	
25	CURRENT IN –	Not used for LB 474 *Wird bei LB 474 nicht verwendet*
26	CURRENT IN +	
27	RS 485 A	Communication and service interface (Master-Master) *Kommunikations- und Service-Schnittstelle (Master-Master)*
28	RS 485 B	
29	DIGITAL IN 2 GND	GND
30	DIGITAL IN 2 IN	Logic Input
31	+ 24 V (GND --> 29)	24 V out (max. 200 mA)

Connection Diagram Terminal Board Master/Slave
Anschlussplan Anschlussplatine Master/Slave

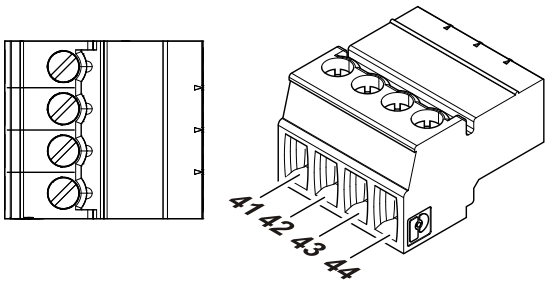


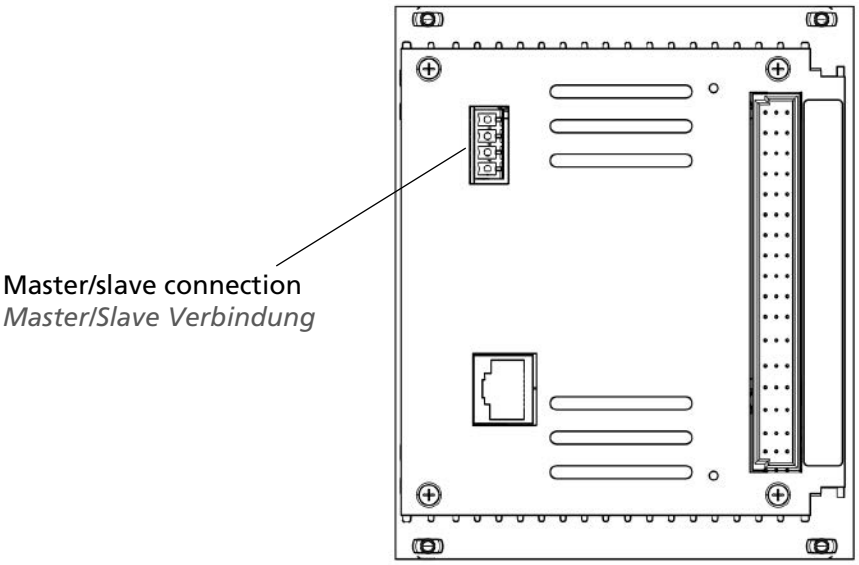
The connections master/slave A and master/slave B are identical.

Die Anschlüsse Master/Slave A und Master/Slave B sind identisch.

#	Connector *Anschluss*	Function *Funktion*
1	DETECTOR MASTER +	Connection Detector *Verbindung Det.* LB 4700 / LB 44xx
2	DETECTOR MASTER -	
1	DETECTOR SLAVE 1 +	Connection Detector *Verbindung Detektor* LB 4700 / LB 44xx
2	DETECTOR SLAVE 1 -	
1	DETECTOR SLAVE 2 +	
2	DETECTOR SLAVE 2 -	
1	DETECTOR SLAVE 3 +	
2	DETECTOR SLAVE 3 -	
9	MASTER/SLAVE GND	Connection of additional slave units *Anschluss von weiteren Slave-Einheiten*
10	MASTER/SLAVE TxD	
11	MASTER/SLAVE RxD	
12	MASTER/SLAVE RTS	
16	POWER DC 24 V – / AC N	24 V DC / 100-240 V AC
17	POWER DC 24 V + / AC L1	
18	PE	
19	PE	
20	PE	
21	RELAIS 3 NC	DIGITAL OUT
22	RELAIS 3 COM	
23	RELAIS 2 NC	DIGITAL OUT
24	RELAIS 2 NO	
25	RELAIS 2 COM	
26	RELAIS 1 NC	Error DIGITAL OUT *Fehler DIGITAL OUT*
27	RELAIS 1 NO	
28	RELAIS 1 COM	
29	DIGITAL IN 1 GND	GND
30	DIGITAL IN 1 IN	Logic Input
31	+ 24 V (GND --> 29)	24 V out (max. 200 mA)
32	CURRENT OUT –	4 mA … 20 mA
33	CURRENT OUT +	
34	CURRENT IN –	No used for LB 470 / LB 470RID *Keine Verwendung bei LB 470/LB470RID*
35	CURRENT IN +	
36	RS 485 A	Communication and service interface (Master-Master)
37	RS 485 B	
38	DIGITAL IN 2 GND	GND
39	DIGITAL IN 2 IN	Logic Input
40	+24 V (GND --> 38)	24 V out (max. 200 mA)

Assignment Terminals Master/Slave Plug
Klemmenbelegung Master/Slave Stecker





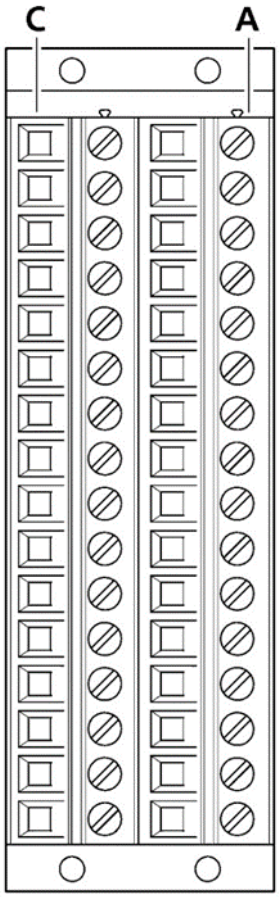
Signal	Pin
TxD	41
RxD	42
RTS	43
GND	44

The master/slave plug is not used by applications with terminal panels. The master/slave plug is contained in the purchase order terminal block (Part No. 59477). In the case of existing 19" subrack and retrofitting to LB470, the master-slave plug (Part No. 64608) must ordered separately.

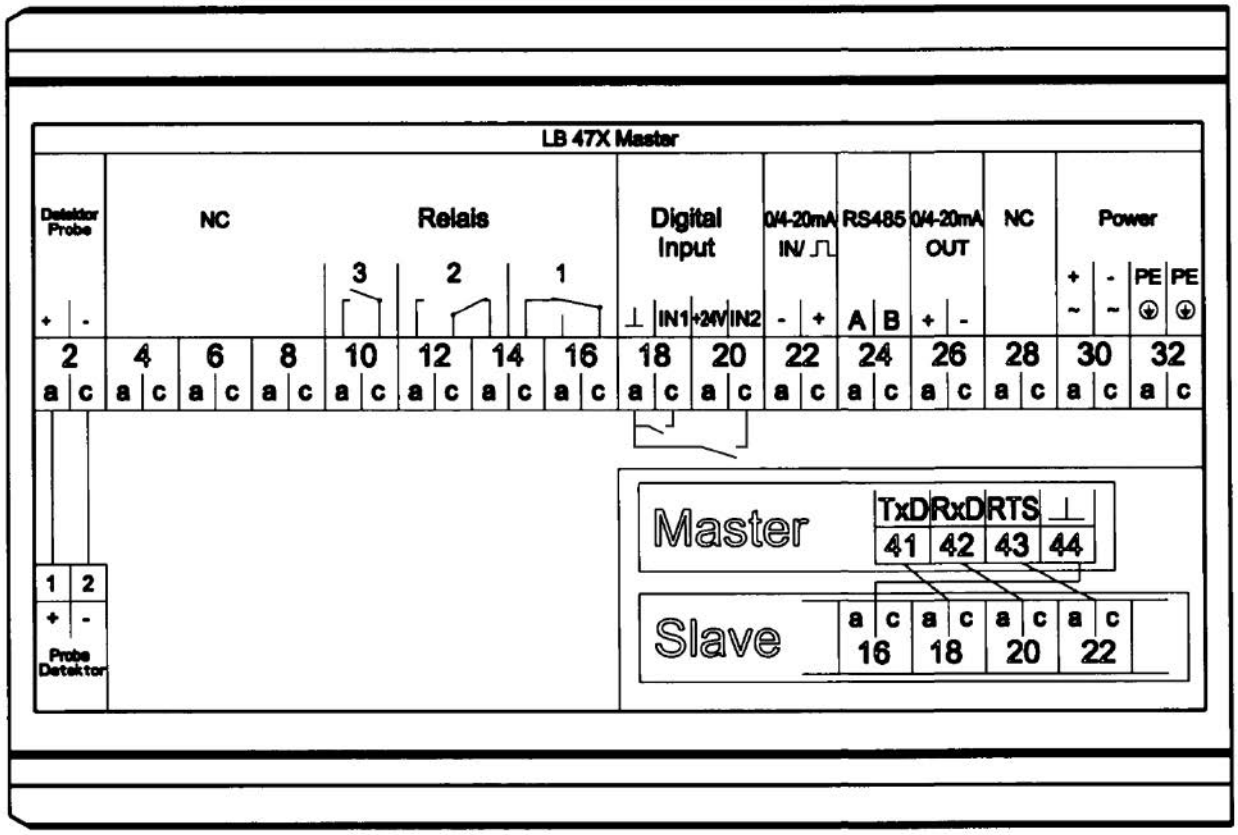
Der Master/Slave Stecker wird bei Einbauvarianten mit Anschlussplatinen nicht benötigt. Der Master/Slave Stecker ist im Lieferumfang des Klemmenblocks (Id. Nr. 59477) enthalten. Bei der Nachrüstung eines 19"Baugruppenträgers mit LB470 Modulen muss der Master-Slave Stecker (Id. Nr. 64608) gesondert bestellt werden

Assignment Terminal Block Master EVU
Belegung Klemmenblock Master AWE

Signal	Pin
DETECTOR GND	C - 2
not assigned *nicht belegt*	C - 4
not assigned *nicht belegt*	C - 6
not assigned *nicht belegt*	C - 8
RELAY *RELAIS* 3 COM	C - 10
RELAY *RELAIS* 2 COM	C - 12
RELAY *RELAIS* 1 NC	C - 14
RELAY *RELAIS* 1 COM	C - 16
DIGITAL IN 1	C - 18
DIGITAL IN 2	C - 20
CURRENT IN +	C - 22
RS 485 B	C - 24
CURRENT OUT –	C - 26
not assigned *nicht belegt*	C - 28
Main *Netz* N AC, DC 24 V (–)	C - 30
Protective conductor PE *Schutzleiter PE*	C - 32

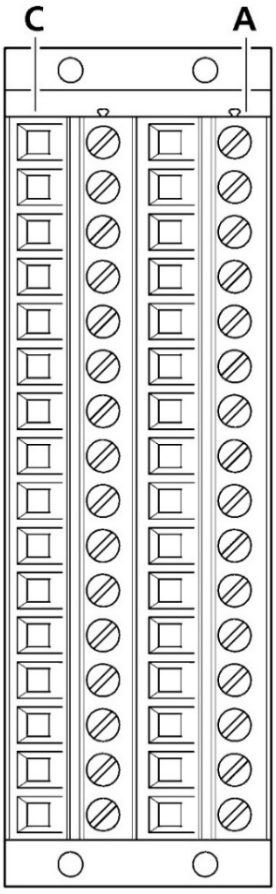


Pin	Signal
A - 2	DETECTOR +
A - 4	not assigned *nicht belegt*
A - 6	not assigned *nicht belegt*
A - 8	not assigned *nicht belegt*
A - 10	RELAY *RELAIS* 3 NO
A - 12	RELAY *RELAIS* 2 NO
A - 14	RELAY *RELAIS* 2 NC
A - 16	RELAY *RELAIS* 1 NO
A - 18	DIGITAL IN 1 GND
A - 20	+ 24 V (GND --> A-18)
A - 22	CURRENT IN –
A - 24	RS 485 A
A - 26	CURRENT OUT +
A - 28	not assigned *nicht belegt*
A - 30	Main *Netz* L1 AC, DC 24 V (+)
A - 32	Protective conductor PE *Schutzleiter PE*

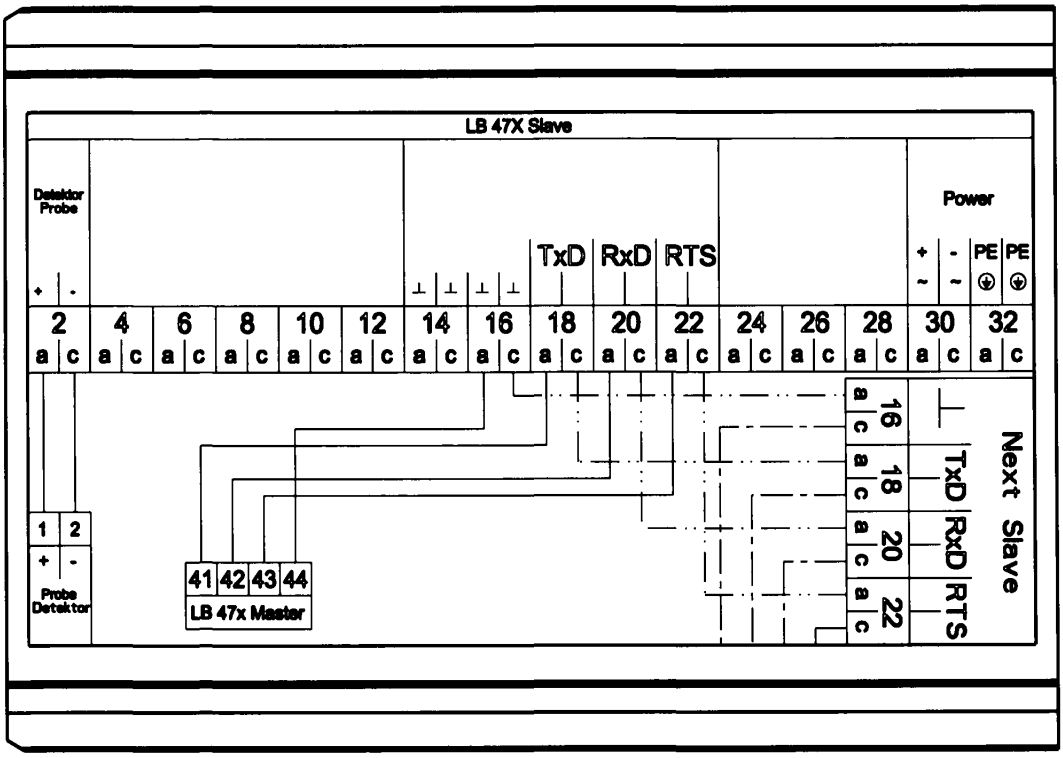


Assignment Terminal Block Slave Module
Belegung Klemmenblock Slave Modul

Signal	Pin
DETECTOR SLAVE GND	C - 2
not assigned *nicht belegt*	C - 4
not assigned *nicht belegt*	C - 6
not assigned *nicht belegt*	C - 8
not assigned *nicht belegt*	C - 10
not assigned *nicht belegt*	C - 12
GND	C - 14
GND	C - 16
TxD to the SLAVE	C - 18
RxD to the SLAVE	C - 20
RTS to the SLAVE	C - 22
not assigned *nicht belegt*	C - 24
not assigned *nicht belegt*	C - 26
not assigned *nicht belegt*	C - 28
Main *Netz* N AC, DC 24 V (–)	C - 30
Protective conductor PE *Schutzleiter PE*	C - 32

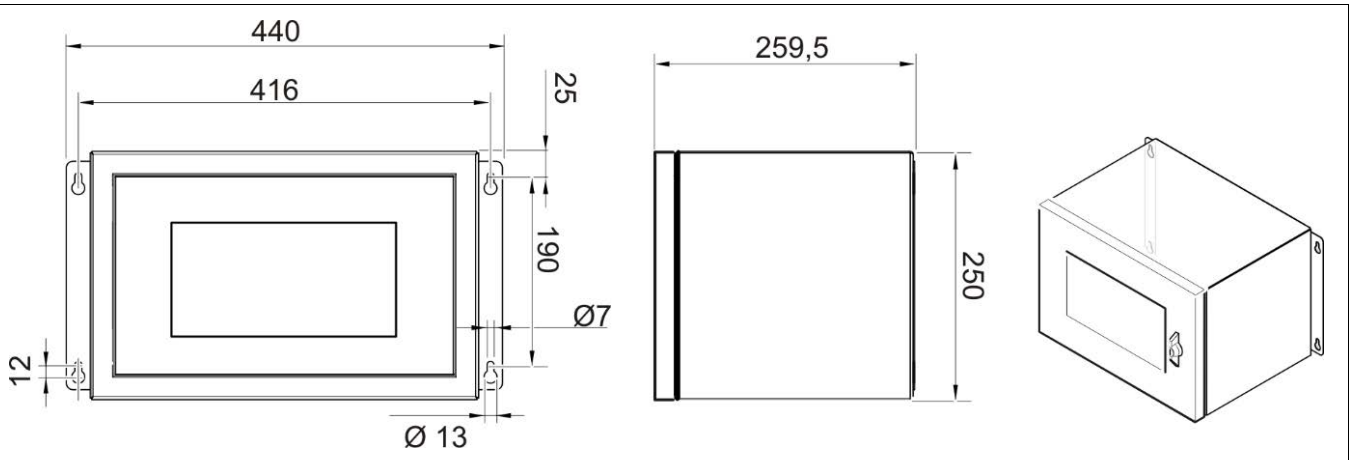


Pin	Signal
A - 2	DETECTOR SLAVE +15 V
A - 4	not assigned *nicht belegt*
A - 6	not assigned *nicht belegt*
A - 8	not assigned *nicht belegt*
A - 10	not assigned *nicht belegt*
A - 12	not assigned *nicht belegt*
A - 14	GND
A - 16	GND
A - 18	TxD to MASTER/SLAVE *
A - 20	RxD to the MASTER/SLAVE
A - 22	RTS to the MASTER/SLAVE
A - 24	not assigned *nicht belegt*
A - 26	not assigned *nicht belegt*
A - 28	not assigned *nicht belegt*
A - 30	Main *Netz* L1 AC, DC 24 V (+)
A - 32	Protective conductor PE *Schutzleiter PE*



* optional

Wall Housing
Wandgehäuse



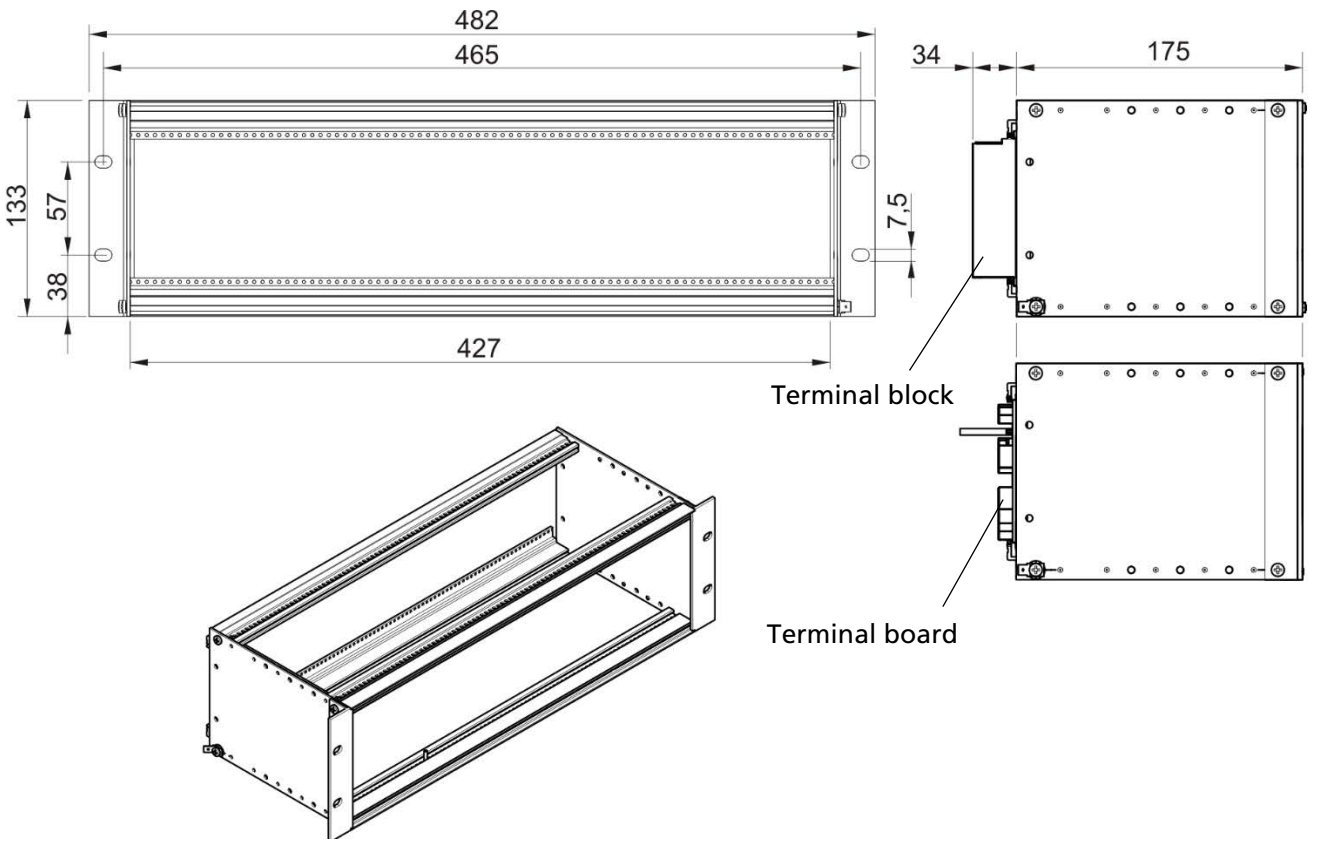
Dimensions in mm
Abmessungen in mm

Technical Data *Technische Daten*	
Dimensions *Abmessungen*	440x250x257mm (WxHxD)
Max. Assembly *Max. Bestückung*	- 2 Master with terminal board (master/master) [1] *- 2 Master mit Anschlussplatine (Master/Master) [1]* - 1 Master, 3 Slave with terminal board (master/slave) *- 1 Master, 3 Slave mit Anschlussplatine (Master/Slave)* - 2 Master with calmp blocks [2] *- 2 Master mit Klemmenblöcken [2]*
Weight (with circuit board, without modules) *Gewicht (mit Anschlussplatine, ohne Module)*	8.8 kg
Degree of protection *Schutzgrad*	IP65
Operational temperature Betriebstemperatur	-20°C … +40°C
User interface, colours *Oberfläche, Farbe*	powder coated, grey *pulverbeschichtet, grau*
Cable entry *Kabeleinführung*	8 x M16, 2 x M32

[1] NRTL certification US/CAN
NRTL Zertifikat US/CAN

[2] Kein Zertifikat
No certification

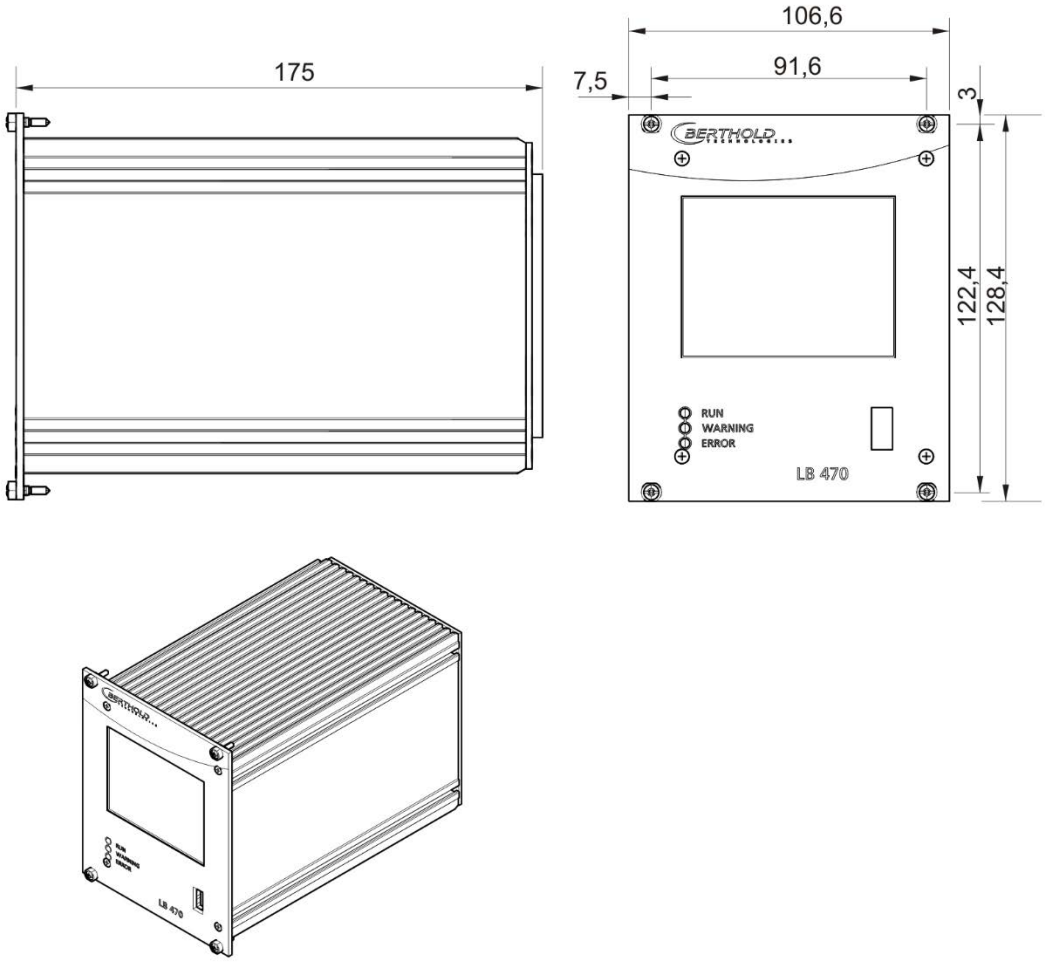
19" Subrack
19" Baugruppenträger



Dimensions in mm
Abmessungen in mm

Technical Data *Technische Daten*	
Dimensions *Abmessungen*	3HE/84TE/5T, 482x132x172mm (WxHxD)
Max. Assembly *Max. Bestückung*	- 3 Master, 3 Slave - 2 Master, 6 Slave - 4 Master - 1 Master, 9 Slave - 12 Slave
Weight (with circuit board, without modules) *Gewicht (mit Anschlussplatine, ohne Module)*	1.4 kg
Weight terminal block *Gewicht Klemmenblock*	220 g
Operational temperature *Betriebstemperatur*	-20°C … +50°C, not condensing *nicht kondensierend*
Storage temperature *Lagerungstemperatur*	-30°C … +60°C
Degree of protection *Schutzklasse*	IP20

Master EVU
Master AWE



Dimensions in mm
Abmessungen in mm

Technical Data *Technische Daten*	
Dimensions *Abmessungen*	117/128/172mm (WxHxD)
Weight *Gewicht*	1200 g
Operational temperature *Betriebstemperatur*	-20°C … +50°C, not condensing. Avoid direct sunlight. Unobstructed air circulation must be provided to the subrack. *-20°C … +50°C nicht kondensierend. Direkte Sonneneinstrahlung ist zu vermeiden. Für eine ungehinderte Luftzirkulation um den Baugruppenträger ist zu sorgen.*
Storage temperature *Lagerungstemperatur*	-20°C … +85°C
Degree of protection *Schutzgrad*	IP20

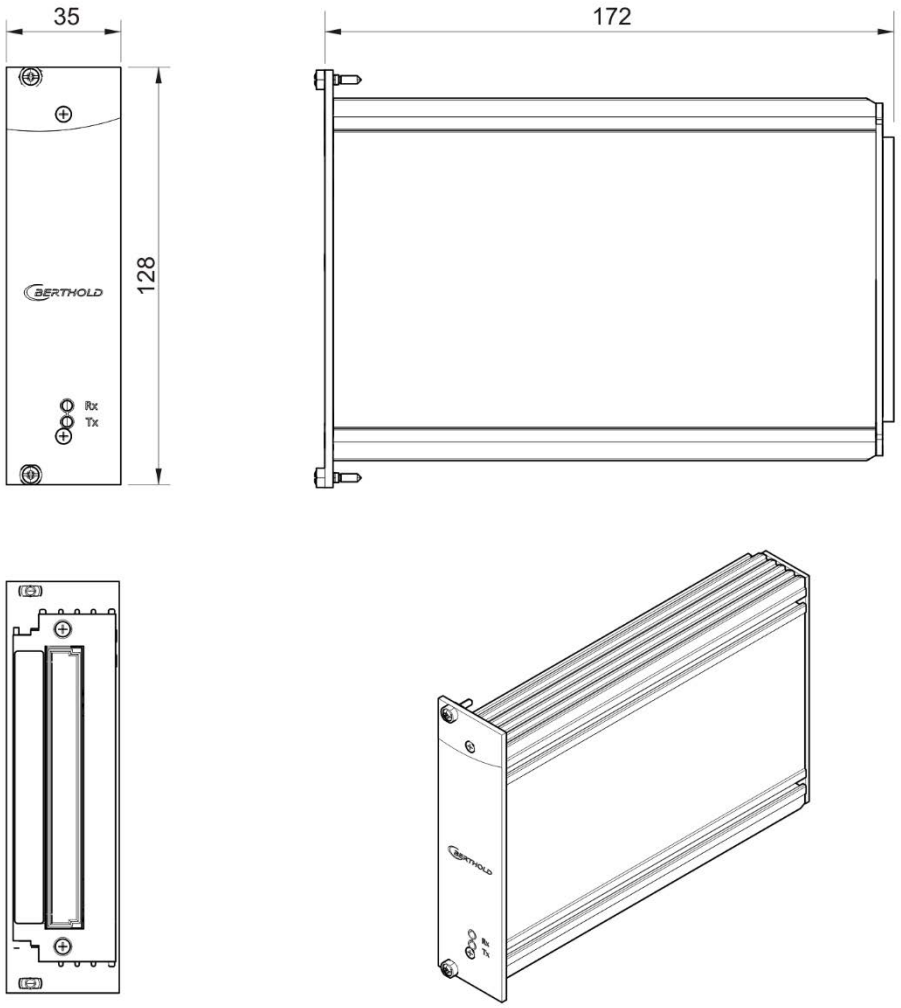
Connections *Anschlüsse*	- USB port for the connection to the USB storage medium - Master/slave connection (4-pin) and plug - RJ45 connection for Ethernet (on back wall) - 32-pin plug connector according to DIN 19465 Series C *- USB-Port zum Anschluss von USB-Speichermedium* *- Master/Slave Buchse (4-polig) und Stecker* *- RJ45-Buchse für Ethernet (an Rückwand)* *- 32 polige Stiftleiste nach DIN 19465 Baureihe C*
Display	- graphical LCD display - 320 x 240 points, 262,000 colours - Dimmable LED background lighting - Touch screen *- graphisches LCD-Display* *- 320 x 240 Punkte, 262.000 Farben* *- Dimmbare LED Hintergrundbeleuchtung* *- Touchscreen*
Computer core *Rechnerkern*	- Processor: Dual Core DSP/ARM Controller - clock frequency: 300 MHz internal (20 MHz external quartz) - ROM: 512 KByte - RAM: 64 MByte ext. SDRAM, 128 KByte int. shared RAM - FLASH: 8 MByte external serial *- Prozessor: Dual Core DSP/ARM Controller* *- Taktfrequenz: 300 MHz intern (20 MHz externer Quarz)* *- ROM: 512 KByte* *- RAM: 64 MByte ext. SDRAM, 128 KByte int. shared RAM* *- FLASH: 8 MByte extern seriell*

Power Supply *Stromversorgung*	
Voltage *Spannung*	100-240 V AC 50/60 Hz (wide range input) +/- 10% 21-32 V DC (24 V DC power input)
Power consumption *Leistungsaufnahme*	22 VA, 15 W
Fuses *Sicherungen*	Internal, 2 x 250 V, 1A delayed, 5x20 mm, 1500 A breaking capacity IEC 60127-2, 1x 250 V TR5 T80 mA (Ø 8,5 mm)

Interfaces *Schnittstellen*	
Current output *Stromausgang*	4-20mA internally switched from power source to sink current (according to NAMUR recommendation NE 006 and NE 043). Dip switch source/sink on the electronic board of the LB 47x. Standard setting is source current. Continuous short circuit proof and galvanically isolated (500 V). Internal resistance about 105 ohms max. Burden when operating as a power source: 850 ohm. Internal monitoring of the loop current and additional error signalling by hardware on detection of a fault condition. *4-20mA (nach Namur-Empfehlung NE 006 und NE 043) intern von Stromquelle auf Stromsenke umschaltbar. Dip-Schalter auf der Elektronik-Platine in der Auswerteeinheit. Standard-Einstellung ist aktiver Stromausgang.* *Dauerhaft kurzschlussfest und potentialgetrennt (500 V).* *Innenwiderstand ca. 105 Ohm max.* *Bürde bei Betrieb als Stromquelle: 850 Ohm.* *Interne Überwachung des Schleifenstroms und zusätzliche Fehlersignalisierung durch Hardware bei Erkennung eines Fehlerzustands.*
Current input *Stromeingang*	4-20 mA (according to NAMUR recommendation NE 006 and NE 043) switchable via software on frequency input, electrically isolated (500 V). Internal resistance approx. 300 ohm max. input voltage: 24 V DC *4-20 mA (nach Namur-Empfehlung NE 006 und NE 043) per Software umschaltbar auf Frequenzeingang, potentialgetrennt (500 V). Innenwiderstand ca. 300 Ohm max.* *Eingangsspannung: 24 V DC*
Impulse input *Impuls-eingang*	Frequency 0-100 kHz, Umax = 28 V, right angle signal form, low <1,5 V; high 4 – 28 V. Switchable to current input *Frequenz 0-100 kHz, Umax = 28 V,* *Rechteck-Signalform, Low <1,5 V; High 4 – 28 V.* *Umschaltbar auf Stromeingang*
Digital outputs *Digitale Ausgänge*	3 relays, Umax = 33 V ACeff, 46 V DC; Imax = 1 A functions: Relay 1: SPDT for error signalling Relay 2: SPDT assignable by software Relay 3: SPST assignable by software *3 Relais, Umax = 33 V ACeff, 46V DC; Imax = 1 A* *Funktionen: Relais 1: SPDT zur Fehlersignalisierung* *Relais 2: SPDT über Software zuweisbar* *Relais 3: SPST über Software zuweisbar*
Digital inputs *Digitale Eingänge*	2 x together electrically isolated (500 V) Switch between DigIn and GND, Uoutmax approx. 24 V Function configurable via software *2 x gemeinsam potentialgetrennt (500 V),* *Schalter zwischen DigIn und GND, Uoutmax ca. 24 V* *Funktion über Software konfigurierbar*
External supply Externe ersorgung	Output voltage: 24 V DC Output current: max. 150 mA *Ausgangsspannung: 24 V DC* *Ausgangsstrom: max. 150 mA*

RS485	for master/master communication, and testing and evaluation purposes. not isolated from main electronics and USB port electrically isolated from remaining I/Os (500 V) *für Master/Master Kommunikation und Prüf-und Testzwecke. Nicht potentialgetrennt von Hauptelektronik und USB-Anschluss potentialgetrennt von restlichen I/Os (500 V)*
USB port	1 x USB 2.0 Type A (Host) via front plate to the connection of an ext. mouse, keyboard or storage medium Uout = 5 V, Ioutmax = 0.5 A *1 x USB 2.0 Typ A (Host) über Frontplatte zum Anschluss einer ext. Maus, Tastatur oder Speichermedium* *Uout = 5 V, Ioutmax = 0,5 A*
Ethernet	RJ45 connection via back wall, 10 Mbit, DHCP supported, max. 3 m *RJ45-Buchse über Rückwand, 10 Mbit,* *DHCP unterstützt, max. 3 m*

Slave Module
Slave Modul

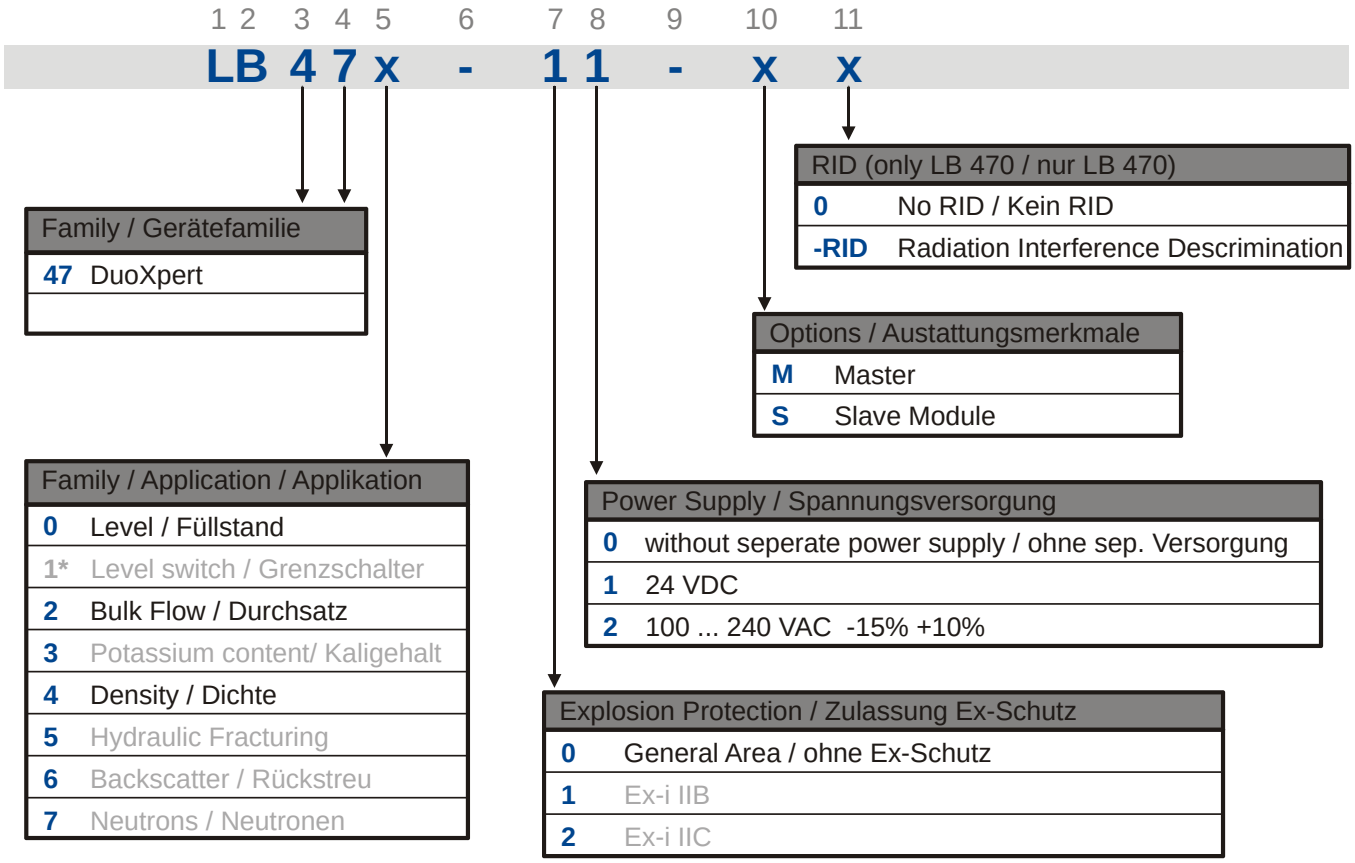


Dimensions in mm
Abmessungen in mm

Technical Data *Technische Daten*	
Dimensions *Abmessungen*	35/128/172 mm (WxHxD)
Weight *Gewicht*	600 g
Operational temperature *Betriebstemperatur*	-20 °C … +50 °C, not condensing. Avoid direct sunlight. Unobstructed air circulation must be provided to the subrack. *-20°C … +50°C nicht kondensierend. Direkte Sonneneinstrahlung ist zu vermeiden. Für eine un-gehinderte Luftzirkulation um den Baugruppenträger ist zu sorgen.*
Storage temperature *Lagertemperatur*	-20 °C … +60 °C
Degree of protection *Schutzgrad*	IP20

Electrical data *Elektrische Daten*	
Power consumption *Leistungsaufnahme*	6 VA, 5 W
Fuses *Sicherungen*	Internal, 2 x 250 V, 1 A delayed, 5x20 mm, 1500 A breaking capacity IEC 60127-2 *Intern, 2 x 250 V, 1 A träge, 5x20 mm, 1500 A Abschaltvermögen IEC 60127-2*
Connections *Anschlüsse*	- 32-pin plug connector *- 32 polige Stiftleiste*

Number Key LB 47x
Nummernschlüssel LB 47x



* used by othe hardware / belegt durch andere Hardware

Declaration of Conformity
Konformitätserklärung

BERTHOLD TECHNOLOGIES GmbH & Co. KG
Calmbacher Straße 22
75323 Bad Wildbad, Germany
Phone +49 7081 177-0
Fax +49 7081 177-100
info@Berthold.com
www.Berthold.com

EG-Declaration of Conformity (ORIGINAL) File.No.: CE20028-2

We, hereby declare under our sole responsibility that the design of the following products / systems / units / machines 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.

Product name: ***radiomatric evaluation system DuoXpert***

Type / model: ***LB 47x***

	directive	**applied standards**	
LVD	2014/35/EU	EN 61010-1	2010
RoHS	2011/65/EG		
EMC	2014/30/EU	EN 61326-1	2013
		EN 61000-4-2	
		EN 61000-4-3	
		EN 61000-4-4	
		EN 61000-4-5	
		EN 61000-4-6	
		EN 61000-4-11	
		EN 61000-3-2	
		Namur NE21	2012

This declaration is issued by the manufacturer

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

released by

Dr. Jürgen Briggmann

Head of R&D
Bad Wildbad, 1st of September, 2015

Registergericht / Court of Registration: Stuttgart HRA 330991
Persönlich haftende Gesellschafterin / Fully liable Associates: BERTHOLD TECHNOLOGIES Verwaltungs-GmbH
Registergericht / Court of Registration: Stuttgart HRB 331520
Geschäftsführung / Management: Horst Knauff, Dr. Dirk Mörmann
USt.-Id-Nr. / VAT Reg. No.: DE813050511
Deutsche Steuernummer / German Tax No.: 49038/08038
WEEE-Reg. No.: DE99468690

Sparkasse PF-CW 75323 Bad Wildbad Konto/Account No. 8 045 003 (BLZ 666 500 85) SWIFT-BIC PZHSDE66 IBAN: DE37 6665 0085 0008 0450 03
Volksbank 75119 Pforzheim Konto/Account No. 957 004 (BLZ 666 900 00) SWIFT-BIC VBPFDE66 IBAN: DE85 6669 0000 0000 9570 04
Commerzbank 75105 Pforzheim Konto/Account No. 6 511 120 (BLZ 666 800 13) SWIFT-BIC DRES DEFF 666 IBAN: DE05 6668 0013 0651 1120 00

BERTHOLD TECHNOLOGIES GmbH & Co. KG
Calmbacher Straße 22
75323 Bad Wildbad, Germany
Phone +49 7081 177-0
Fax +49 7081 177-100
info@Berthold.com
www.Berthold.com

EG-Konformitätserklärung (ORIGINAL)

Dok.Nr.: CE20028-1

Hiermit erklären wir in alleiniger Verantwortung, dass die Bauart des(r) nachfolgend bezeichneten Geräte / Systems / Anlage / Maschine 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: ***radiometrisches Auswertesystem DuoXpert***

Typenbezeichnung / Modell: ***LB 47x***

	Richtlinie (Fundstelle)	**angewendete Normen und weitere Spezifikationen**	
NSR	2014/35/EU	EN 61010-1	2010
RoHS	2011/65/EG		
EMV	2014/30/EU	EN 61326-1	2013
		EN 61000-4-2	
		EN 61000-4-3	
		EN 61000-4-4	
		EN 61000-4-5	
		EN 61000-4-6	
		EN 61000-4-11	
		EN 61000-3-2	
		Namur NE21	2012

Diese Erklärung wird verantwortlich für den Hersteller

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

abgegeben durch

Dr. Jürgen Briggmann

Leiter Entwicklung
Bad Wildbad, den 1. September 2015

Registergericht / Court of Registration: Stuttgart HRA 330991
Persönlich haftende Gesellschafterin / Fully liable Associates: BERTHOLD TECHNOLOGIES Verwaltungs-GmbH
Registergericht / Court of Registration: Stuttgart HRB 331520
Geschäftsführung / Management: Horst Knauff, Dr. Dirk Mörmann
USt.-Id-Nr. / VAT Reg. No.: DE813050511
Deutsche Steuernummer / German Tax No.: 49038/08038
WEEE-Reg. No.: DE99468690

Sparkasse PF-CW	75323 Bad Wildbad	Konto/Account No. 8 045 003 (BLZ 666 500 85)	SWIFT-BIC PZHSDE66	IBAN: DE37 6665 0085 0008 0450 03
Volksbank	75119 Pforzheim	Konto/Account No. 957 004 (BLZ 666 900 00)	SWIFT-BIC VBPFDE66	IBAN: DE85 6669 0000 0000 9570 04
Commerzbank	75105 Pforzheim	Konto/Account No. 6 511 120 (BLZ 666 800 13)	SWIFT-BIC DRES DEFF 666	IBAN: DE05 6668 0013 0651 1120 00

Certificates
Zertifikate

NRTL certification US/CAN wall-mounted housing
NTRL Zertifikat US/CAN Wandgehäuse

Nemko

Certificate of Compliance

Nemko-CCL, Inc.

Certificate: NA201610530 **Date Issued:** January 20, 2016

Project: 257087-7.1

Issued to: Berthold Technologies GmbH & Co. KG
Calmbacher Straße 22
75323 Bad Wildbad
Germany

The products listed below have been certified as being compliant with all applicable requirements of the specifications listed and are eligible to bear the following certification mark

c Nemko US

Issued by: Robert Keller, Senior Engineer/Safety Supervisor

Authorized by: Thomas Jackson, Certification Manager

PRODUCTS

MEASUREMENT, CONTROL, OR LABORATORY EQUIPMENT – Certified to US and Canada Standards

Product: Process measurement unit
Model: Wall-mounted LB 47x, 1M/3S; Wall-mounted LB 47x, 2M (x can be 0 to 8 and describes different software versions for the master and slave modules not affecting safety).
Ratings: Wall-mounted LB 47x, 1M/3S: 40VA 100-240V, 50/60Hz, Class I; Wall-mounted LB 47x, 2M: 44VA 100-240V, 50/60Hz, Class I

The certification system, as described in ISO/IEC Guide 67 (Conformity Assessment – Fundamentals of Product Certification), most closely resembles System 3

Nemko-CCL, Inc. 1940 West Alexander Street Salt Lake City, Utah 84119-2039 Tel (801) 972-6146 Fax (801) 972-8432

NFCC-002 Issue 2 May 2014 Page 1 of 3

NRTL certification US/CAN wall-mounted housing (continued)
NTRL Zertifikat US/CAN Wandgehäuse (Fortsetzung)

APPLICABLE REQUIREMENTS

UL Std. No. 61010-1 2nd Edition - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements

CAN/CSA-C22.2 No. 61010-1-04 Second Edition - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements

This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the above mentioned specifications and pursuant to the terms and conditions specified in the Certification Agreement.

The certification system, as described in ISO/IEC Guide 67 (Conformity Assessment – Fundamentals of Product Certification), most closely resembles System 3

Nemko-CCL, Inc. 1940 West Alexander Street Salt Lake City, Utah 84119-2039 Tel (801) 972-6146 Fax (801) 972-8432

NFCC-002 Issue 2 May 2014 Page 2 of 3

1

NRTL certification US/CAN wall-mounted housing (continued)
NTRL Zertifikat US/CAN Wandgehäuse (Fortsetzung)

Supplement to Certificate of Compliance

Certificate: NA201610530 **Project:** 257087-7.1

Nemko-CCL grants a license to the applicant to apply the Certification Mark to the certified products and that the mark shall only be affixed at the following factory locations

Factory Information

Factory Name	Location
Berthold Technologies GmbH & Co. KG	Calmbacher Straße 22 75323 Bad Wildbad Germany

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

Product Certification History

Project	Date	Description
257087-7.1	January 20, 2016	**Original Certification: Model:** Wall-mounted LB 47x, 1M/3S; Wall-mounted LB 47x, 2M (x can be 0 to 8 and describes different software versions for the master and slave modules not affecting safety). **Ratings:** Wall-mounted LB 47x, 1M/3S: 40VA 100-240V, 50/60Hz, Class I; Wall-mounted LB 47x, 2M: 44VA 100-240V, 50/60Hz, Class I

This Supplement forms an integral part of the Certificate of Compliance

The certification system, as described in ISO/IEC Guide 67 (Conformity Assessment – Fundamentals of Product Certification), most closely resembles System 3

Nemko-CCL, Inc. 1940 West Alexander Street Salt Lake City, Utah 84119-2039 Tel (801) 972-6146 Fax (801) 972-8432

NFCC-002 Issue 2 May 2014 Page 3 of 3

NRTL certification US/CAN DuoXpert LB 47x

NTRL Zertifikat US/CAN DuoXpert LB 47x

Nemko

Certificate of Compliance

Nemko-CCL, Inc.

Certificate: NA201510498 **Date Issued:** September 17, 2015

Project: 235982-14.1

Issued to: Berthold Technologies GmbH & Co. KG
Calmbacher Straße 22
75323 Bad Wildbad
Germany

The products listed below have been certified as being compliant with all applicable requirements of the specifications listed and are eligible to bear the following certification mark

c Nemko US

Issued by: Robert Keller — Robert Keller, Senior Engineer/Safety Supervisor

Authorized by: — Thomas Jackson, Certification Manager

PRODUCTS

MEASUREMENT, CONTROL, OR LABORATORY EQUIPMENT – Certified to US and Canada Standards

Product: Process measurement unit for building-in
Model: DuoXpert LB47x-02-M; DuoXpert LB47x-02-S (x can be 0 to 8 and describes different software versions for the master and slave modules not affecting safety)
Ratings: LB47x-02-M: 100-240V AC 22VA 50/60Hz; LB47x-02-S: 100-240V AC 6VA 50/60Hz

APPLICABLE REQUIREMENTS

UL Std. No. 61010-1 3rd Edition - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements

CAN/CSA-C22.2 No. 61010-1-12 Third Edition – Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements

This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the above mentioned specifications and pursuant to the terms and conditions specified in the Certification Agreement.

The certification system, as described in ISO/IEC Guide 67 (Conformity Assessment – Fundamentals of Product Certification), most closely resembles System 3

Nemko-CCL, Inc. 1940 West Alexander Street Salt Lake City, Utah 84119-2039 Tel (801) 972-6146 Fax (801) 972-8432

NFCC-002 Issue 2 May 2014 Page 1 of 2

NRTL certification US/CAN DuoXpert LB 47x (continued)
NTRL Zertifikat US/CAN DuoXpert LB 47x (Fortsetzung)

Supplement to Certificate of Compliance

Certificate: **NA201510498** **Project:** **235982-14.1**

Nemko-CCL grants a license to the applicant to apply the Certification Mark to the certified products and that the mark shall only be affixed at the following factory locations

Factory Information

Factory Name	Location
Berthold Technologies GmbH & Co. KG	Calmbacher Straße 22 75323 Bad Wildbad Germany

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

Product Certification History

Project	Date	Description
235982-14.1	September 17, 2015	**Original Certification:** **Model:** DuoXpert LB47x-02-M; DuoXpert LB47x-02-S (x can be 0 to 8 and describes different software versions for the master and slave modules not affecting safety) **Ratings:** LB47x-02-M: 100-240V AC 22VA 50/60Hz; LB47x-02-S: 100-240V AC 6VA 50/60Hz

This Supplement forms an integral part of the Certificate of Compliance

The certification system, as described in ISO/IEC Guide 67 (Conformity Assessment – Fundamentals of Product Certification), most closely resembles System 3

Nemko-CCL, Inc. 1940 West Alexander Street Salt Lake City, Utah 84119-2039 Tel (801) 972-6146 Fax (801) 972-8432

NFCC-002 Issue 2 May 2014 Page 2 of 2

Parts Overview
Übersicht Zubehör

ID. No. *Id. Nr.*	Description *Beschreibung*
63284	LB 470-01-M Level Transmitter (Master, 24 VDC) *LB 470-01-M Füllstandmessgerät (Master, 24 VDC)*
63283	LB 470-02-M Level Transmitter (Master, 100...240 VAC) *LB 470-02-M Füllstandmessgerät (Master, 100...240 VAC)*
68640	LB 470-01-M Level Transmitter with RID (Master, 24 VDC) *LB 470-01-M Füllstandmessgerät mit RID (Master, 24 VDC)*
68639	LB 470-02-M Level Transmitter with RID (Master, 100...240 VAC) *LB 470-02-M Füllstandmessgerät mit RID (Master, 100...240 VAC)*
63286	LB 470 Slave (24 VDC) *LB 470 Slave (24 VDC)*
63285	LB 470 Slave (100...240 VAC) *LB 470 Slave (100...240 VAC)*
56925BA1	Operating manual DuoSeries LB 470 Level, German *Betriebsanleitung Füllstand (deutsch)*
56925BA2	Operating manual DuoSeries LB 470 Level, English *Betriebsanleitung Füllstand (englisch)*
56925-1BA1	Operating manual DuoSeries LB 470RID Level, German *Betriebsanleitung DuoSeries LB 470RID Füllstand, Deutsch*
56925-1BA2	Operating manual DuoSeries LB 470RID Level, English *Betriebsanleitung DuoSeries LB 470RID Füllstand, Englisch*
63781	Wall-mounted Housing for LB 47x 1x Master / 3x Slave (24 VDC) *Wandgehäuse für LB 47x, 1x Master / 3x Slave (24 VDC)*
63782	Wall-mounted Housing for LB 47x 1x Master / 3x Slave (110...240 VAC) *Wandgehäuse für LB 47x, 1x Master / 3x Slave (110...240 VAC)*
63783	Wall-mounted Housing for 2x LB 47x Master (24 VDC) *Wandgehäuse für LB 47x, 2x Master (24 VDC)*
63784	Wall-mounted Housing for 2x LB 47x Master (110...240 VAC) *Wandgehäuse für LB 47x, 2x Master (110...240 VAC)*
64402	Wall-mounted Housing for 2x LB 47x Master (terminal blocks) *Wandgehäuse für LB 47x, 2x Master (Klemmblöcke)*
59484	19" rack for LB 47x, 4 x Master *19"-Baugruppenträger für LB 47x, 4 x Master*
59481	19" rack for LB 47x, 3x (1x Master & 1x Slave) *19"-Baugruppenträger für LB 47x, 3x (je 1x Master & 1x Slave)*
64607	19" rack, 84 HP / 3 RU for use with terminal blocks *19"-Baugruppenträger für den Einsatz mit Klemmblöcken*
59477	Terminal block for LB 47x, Master *Klemmenblock für LB 47x, Master*
59478	Terminal block for LB 47x, Slave *Klemmenblock für LB 47x, Slave (mit Führungsschienen)*
37526	Front Cover Plate 21 HP / 3 RU (Master) *Blindplatte 21TE / 3 HE (Master)*

59501	Front Cover Plate 7 HP / 3 RU (Slave) *Blindplatte 7TE / 3 HE (Slave)*
64608	Connector for LB 47x slaves when changing from LB 44x to LB 47x slaves *Stecker für LB 47x Slaves bei Umrüstung von LB44x auf LB47x Slaves*