DuoXpert
LB 476 Level+

Operating Manual

BERTHOLD

56925-6BA2 Rev.01 08/2023
Embedded software version of EVU as of version 1.6.1 (CU and MU)
Embedded software version of Current Output/HART and 7-Wire/RS485-Repeater as of version 1.0.0

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Table of Contents

1 About this Operating Manual

1.1 Applicable Documents

This manual contains the following documents:

- Technical Information, 56925TI2LP (see appendix)
- Informations sur la sécurité, 56925BA59 (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. The current revision of this operating manual replaces all previous revisions.

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

1.8 Representation

Identifier	Meaning	Example
Quotation mark	Field in the soft-wareuser interface	"Calibrate"
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 touchscreen 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 the document “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 DuoXpert LB 476 Level+ evaluation unit (EVU) is used together with compatible detectors and appropriate sources to measure the level, and is especially suitable for processes where product buildup may occur, which the system can compensate for to ensure reliable level measurement.

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 evaluation unit 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, 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 measuring device LB 476 Level+ is an industrial measuring system for the contactless and continuous determination of product level in a container whereby the measurement is optimized by a Product Buildup Compensation (PBC).

A complete measuring system consists of the following components:

- Evaluation unit DuoXpert LB 476 Level+
- Rod detector(s) TowerSENS LB 4700 or LB 480
- Two point detectors LB 4700 or LB 480
- Source(s)
- Shield(s)

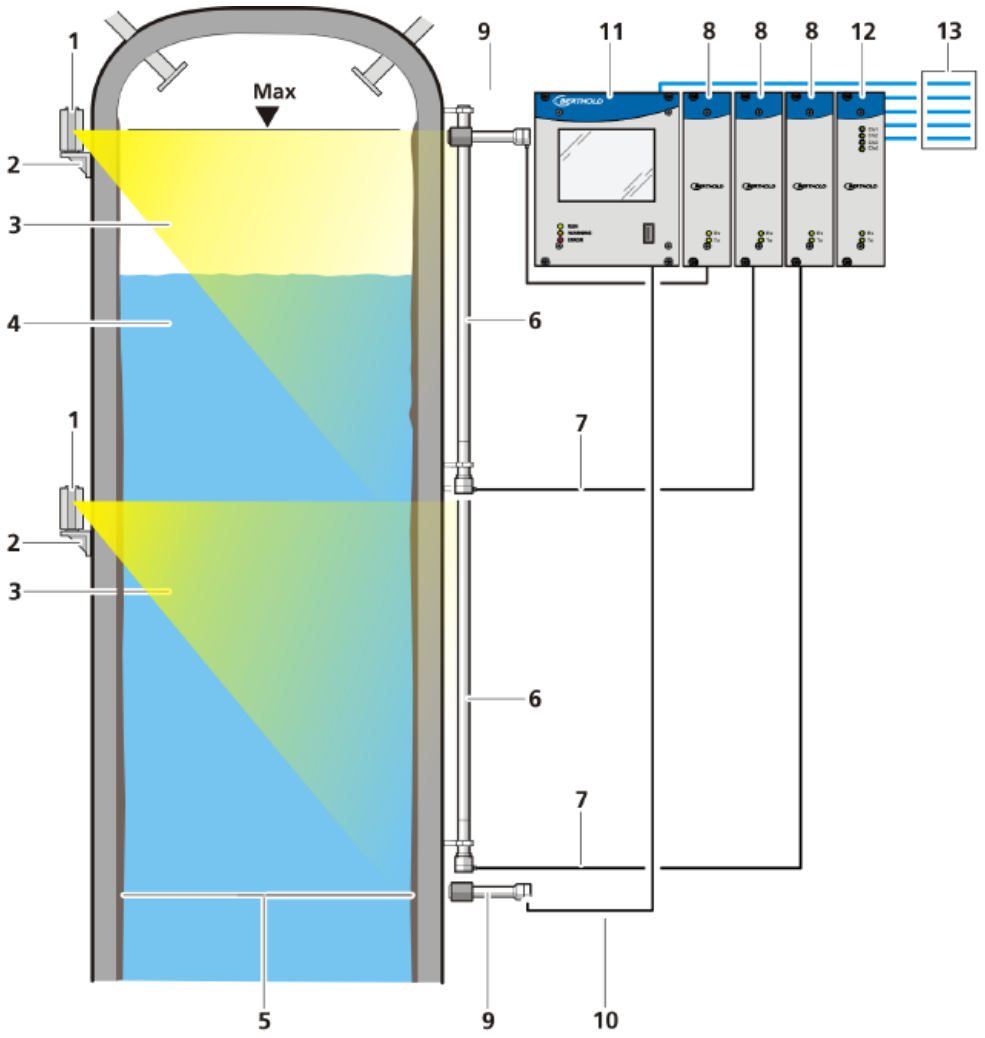
These instructions concern the installation of the modules (Fig. 1, item 8, item 11 and item 12, Fig. 2, item 10, item 11 and item 12) and the operation of the evaluation unit DuoXpert LB 476 (Fig. 1, item 11). The operation of other system components is part of the independent instructions of the respective system components. The modules are standard equipment in switch rooms with 19" subracks or switchboards.

Depending on the measuring task and the composition of the measuring product and containers, different arrangements and system components are require. Note the project-specific drawings and documentations.

IMPORTANT

When using RS485 detectors (e.g. LB 480), only the count rate is transmitted to the LB 476 EVU and is calculated internally to a level value. A calibration of the detector itself must be carried out directly at the connected detector.

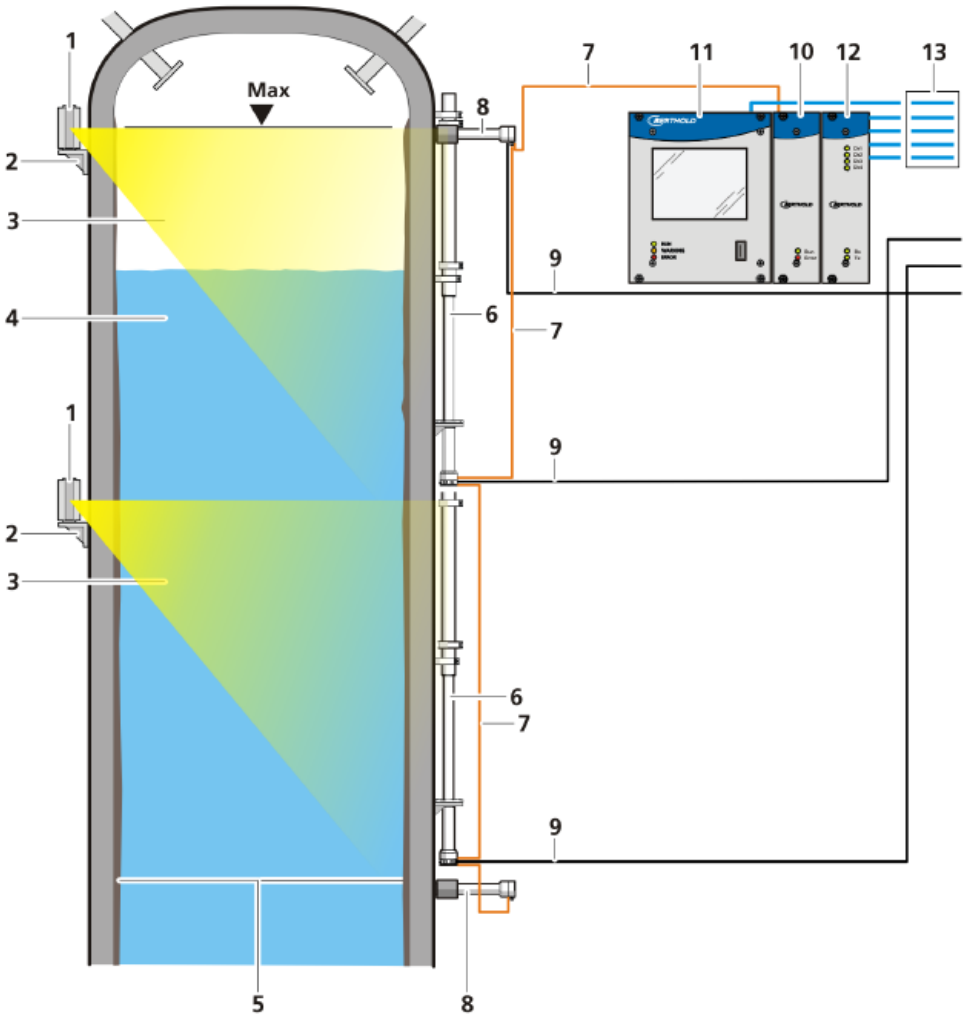
3.1.1 Measurement Arrangement LB 4700 Detectors



1	Point source shield	8	Slave module
2	Mounting base	9	Point detector LB 4700
3	Radiation beam	10	Measurement line to LB 476
4	Product	11	LB 476
5	Product buildups	12	Current Output/HART module
6	Rod detector TowerSENS LB 4700	13	5 analog outputs to DCS
7	Measurement line to slave module		

Fig. 1 Example measurement arrangement with LB 4700 detectors

3.1.2 Measurement Arrangement LB 480 Detectors



1	Point source shield	8	Point detector LB 480
2	Mounting base	9	Measurement line 4 … 20mA to DCS (option)
3	Radiation beam	10	7-Wire/RS485-Repeater module
4	Product	11	LB 476
5	Product buildups	12	Current Output/HART module
6	Rod detector TowerSENS LB 480	13	5 analog outputs to DCS
7	RS485 measurement line		

Fig. 2 Example measurement arrangement with LB 480 detectors

The LB 480 detectors have their own evaluation electronics (see operating manual SENSseries LB 480 54733-10BA2L and 54733-30BA2D) For the LB 476 Level+ measurement arrangement, only the count rate is transmitted to the LB 476 evaluation unit.

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 unit DuoXpert LB 476 Level+ (master EVU) is used for the evaluation, transmission and visualisation of measured values which it receives from the connected detectors.

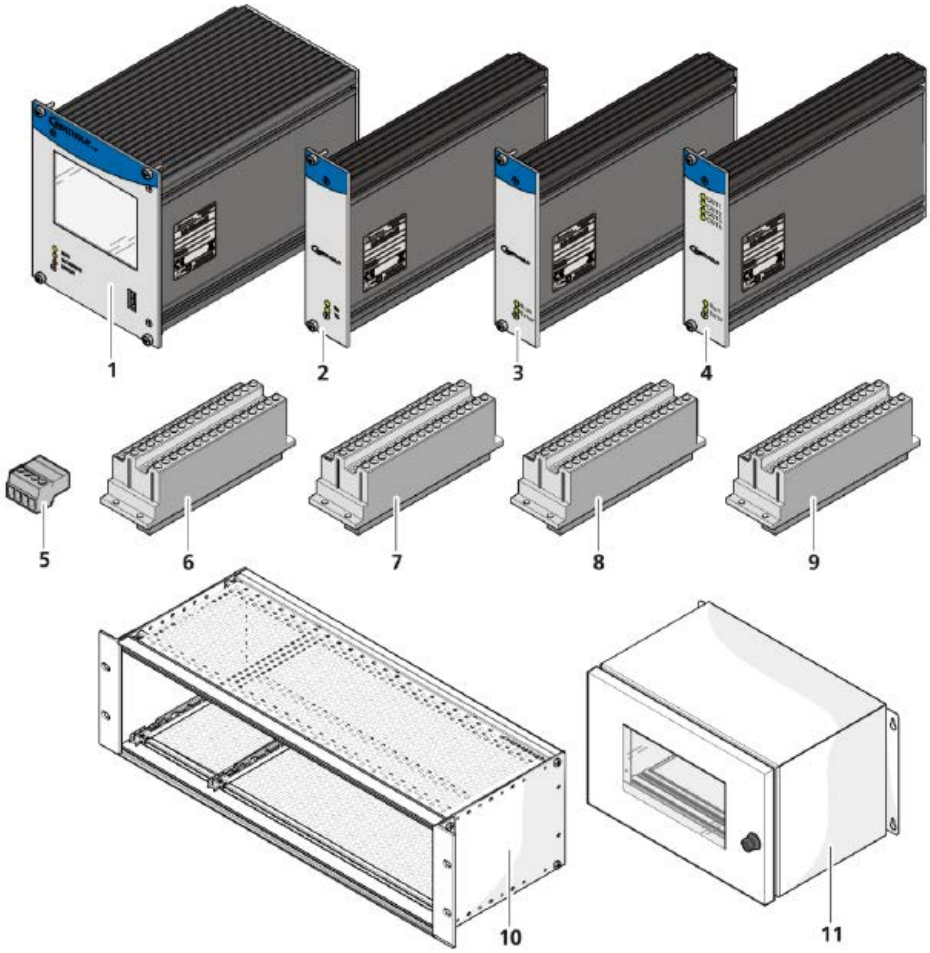
With the help of algorithms and calculations that are established in the LB 476 evaluation unit, product buildups and gas pressure fluctuations in the container can be compensated for.

Tip

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

3.3 System Components

The master EVU and the slave module Fig. 3, item 1, item 2) are available with a wide range (100-240 V AC, 50/60 Hz) or with a 24 V supply (18-32 V DC). The 7-Wire/RS485-Repeater module and the Current Output/HART module are available in 100-240 V AC or 24 V DC versions.



1	Master EVU	7	Terminal block LB 47x Slave
2	Slave module	8	Terminal block 7-Wire/RS485
3	7-Wire/RS485-Repeater module	9	Terminal block Current Output/HART
4	Current Output/HART module	10	19“ subrack
5	Master/Slave plug	11	Wall housing
6	Terminal block LB 47x Master		

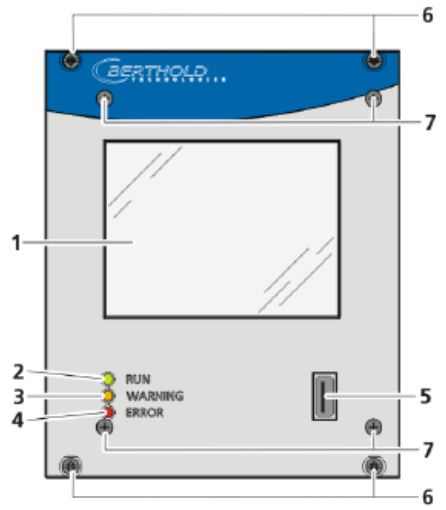
Fig. 3 System components

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" (Chapt. 7.1.2).

This operating manual describes the software version 1.6.1 (Control Unit / CU) and 1.6.1 (Measurement Unit / MU) and the following versions.

3.3.2 Master EVU



1	3.5'' touchscreen	6	Mounting screws
2	RUN LED	7	Screws front plate
3	WARNING LED	8	Master/Slave 4-pin connector
4	ERROR LED	9	RJ45 socket for Ethernet
5	USB port	10	32-pin plug connector

Fig. 4 Front/rear view of the master EVU

Operation Display / Touchscreen

The EVU is operated via the touchscreen. Alternatively, the device can be connected to a mouse at the USB port. The device can also be operated by remote control (see chap. 7.3.1).

NOTICE

Damage to the touchscreen

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

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

Status displays of the master EVU

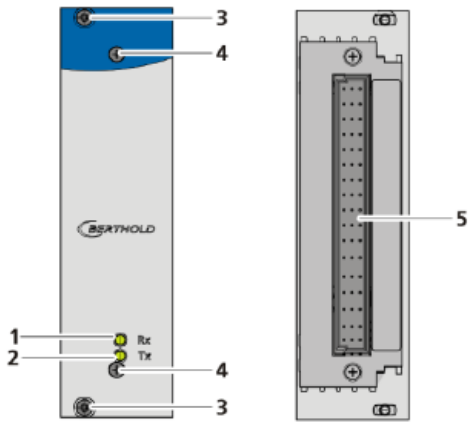
The LEDs (Fig. 4, items 2-4) below the touchscreen show the current operating status of the master EVU.

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 "Out of specification", "Maintenance required" or "Function check" is present. All system events are described in chapter 9.2.
	**ERROR** This LED lights up red if a system event of the type "Failure" is present. The current measurement is retained. Check the Device Setup. All system events are described in chapter 9.2.
	**RUN / WARNING / ERROR flashing** All three LEDs flash during the system test which is performed as part of the start-up process.

3.3.3 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.



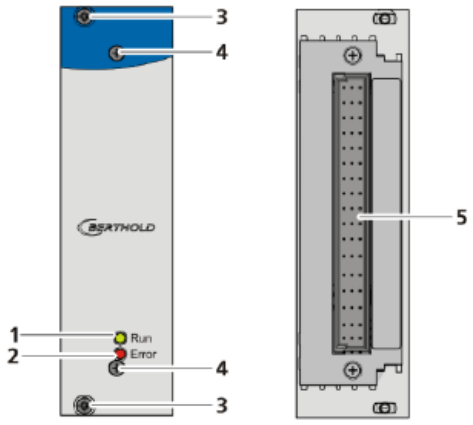
1 LED Rx
2 LED Tx
3 Mounting screws
4 Screws front plate
5 32-pin plug connector

Fig. 5 Front and rear view slave module

3.3.4 View 7-Wire/RS485-Repeater Module

The LEDs “Run” and “Error” are found on the front of the 7-Wire/RS485-Repeater module.

- The LED “Run” lights up green when the device is in operation and fault-free.
- The LED “Error” lights up red, if the module detects an internal error.



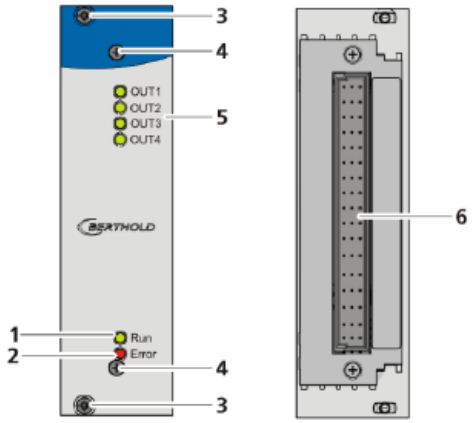
1 LED „Run“
2 LED „Error“
3 Mounting screws
4 Screws front plate
5 32-pin plug connector

Fig. 6 Front and rear view 7-Wire/RS485-Repeater module

3.3.5 Current Output/HART Module

The LEDs “Run”, “Error” as well as the status LEDs of the current outputs (OUT 1 to OUT 4) are found on the front of the Current Output/HART module.

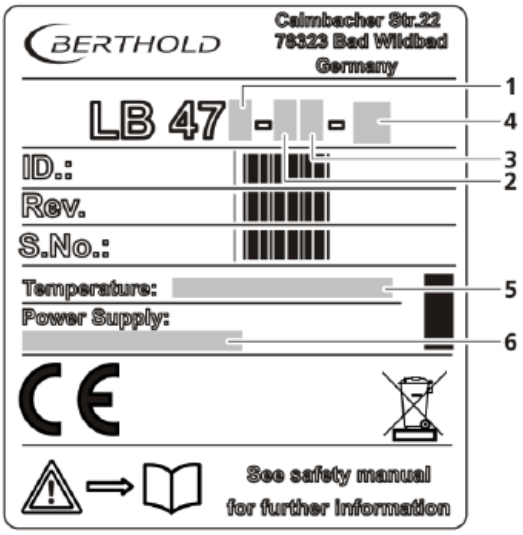
- The LED “Run” (Fig. 7, item 1) lights up green when the device is in operation and fault-free.
- The LED “Error” (Fig. 7, item 2) lights up red, if the module detects an internal error.
- The individual LED of a current output (Fig. 7, item 5) lights up green when the output current is in the range of 3.8 ... 20.5 mA.
- The individual LED of a current output (Fig. 7, item 5) remains off when no function is assigned to this current output.
- The individual LED of a current output (Fig. 7, item 5) flashes red if there is an error current.
- The individual LED of a current output (Fig. 7, item 5) and the LED "Error"(Fig. 7, item 2) light up red when the module detects an internal error on the corresponding current output or when the individual current output loop is open.



1	LED „Run“	4	Screws front plate
2	LED „Error“	5	LEDs current output
3	Mounting screws	6	32-pin plug connector

Fig. 7 Front and rear view Current Output/HART module

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), Slave (S), 7-Wire/RS485-Repeater (B), 4x Current Output/HART (A)
5 Permissible temperature range for operation (ambient temperature)
6 Power specifications

Fig. 8 Type plate

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 document “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.

⚠ DANGER

Danger to life from electric shock!

- Installation/maintenance may only be carried out if the device has been de-energized.
- 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.

⚠ WARNING

Danger to life due to explosion!
The installation of the evaluation unit / the wall housing / the 19" subrack in the hazardous area is not permitted

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 Mounting of the Wall Housing

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

NOTICE

- It is recommended that the wall housing is to 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).

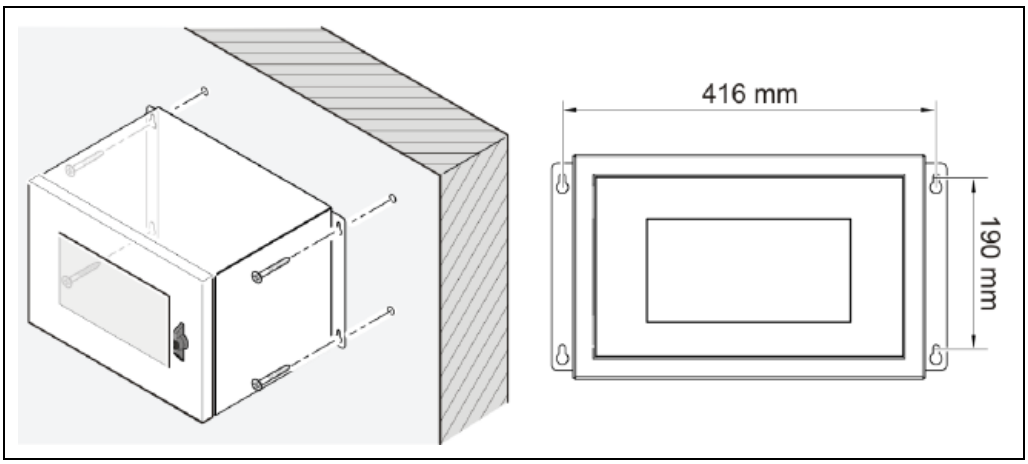


Fig. 9 Mounting the wall housing

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

- The wall housing is installed correctly.

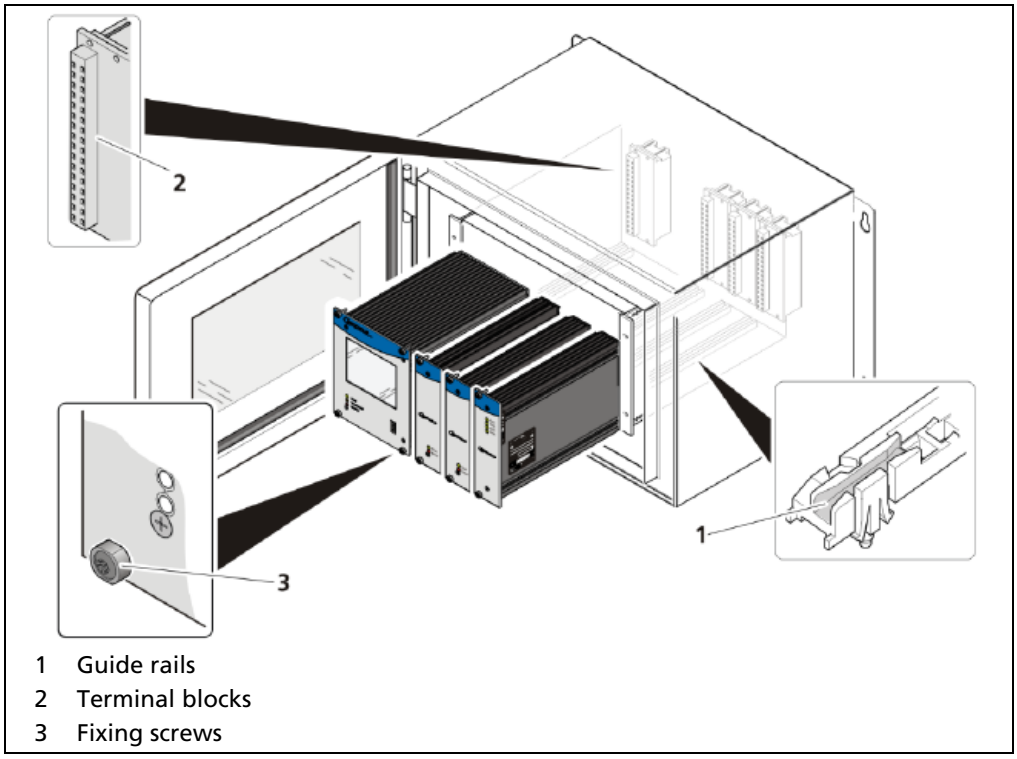
4.4 Installation in the Wall Housing with Terminal Blocks

The wall housing may be equipped differently, depending on requirements (refer to document “Technical Information”). Corresponding guide rails and terminal blocks are located in the wall housing for this purpose.

NOTICE

- The master EVUs, slave modules, 7-Wire/RS485-Repeater modules and Current Output/HART modules must be secured against falling out by fixing screws (Fig. 10, item 4).
- The device must be disconnected from the mains voltage before pulling out the modules.

Installation of the modules



1 Guide rails
2 Terminal blocks
3 Fixing screws

Fig. 10 Installation of the modules (example)

1. Set modules into the guide rails (Fig. 10, item 1) and push it gently until the plug connector of the module is inserted into the terminal block (Fig. 10, item 2).
2. Tighten all fixing screws (Fig. 10, item 3).
3. Unused slots must be covered with dummy panels.

- The modules are installed correctly.

4.5 Installation in the 19" Subrack with Terminal Blocks

The 19" subrack can be equipped differently, depending on requirements (see customer-specific project documentation). The rear terminal blocks (Fig. 11, item 3) are used for the electrical connection. The subrack is installed in a 19" control cabinet or a control panel (switchboard). The 4 side holes (Fig. 11, item 4) that should be provided with fitting screws are used to fasten the subrack.

NOTICE

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

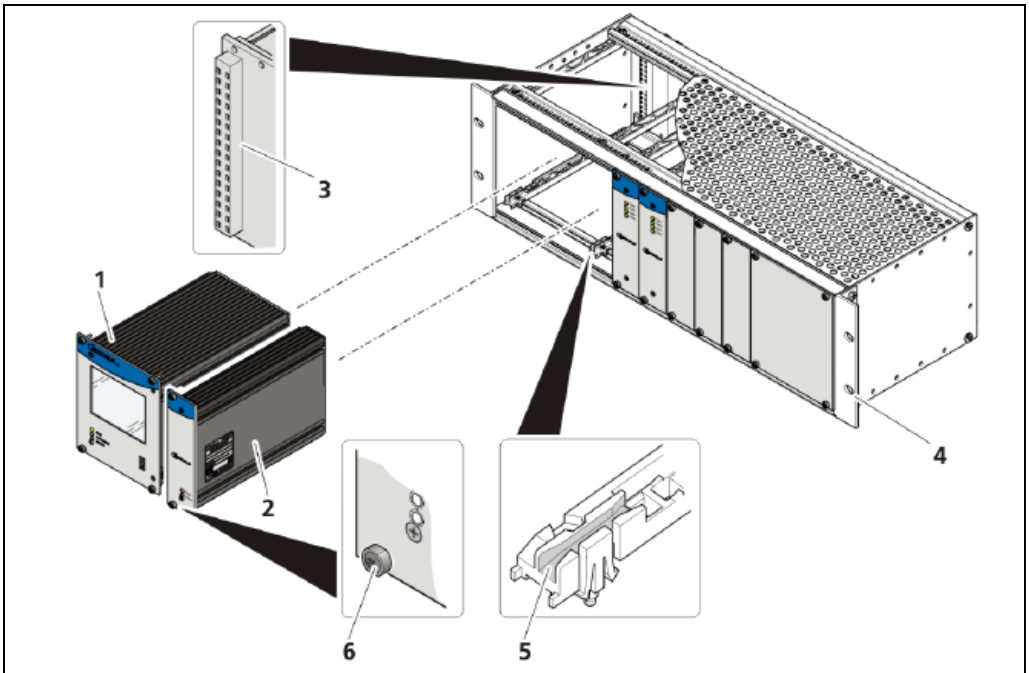
- additional modules, such as Current Output/HART module, are to be fitted.
- a defective module is to be replaced.

NOTICE

- The master's EVUs, slave modules, 7-Wire/RS485-Repeater module und Current Output/HART module must be secured against pulling out by fixing screws (Fig. 11, item 6).
- The device must be disconnected from the mains voltage before it is pulled out.

NOTICE

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



1	Master EVU	4	Drilling
2	7-Wire/RS485-Repeater module	5	Guide rail
3	Terminal block	6	Fixing screw

Fig. 11 19" subrack with terminal block (for example equipped with 1x master, 1x 7-Wire/RS485-Repeater module, 2x Current Output/HART modules)

1. Place the required modules (e.g. Master EVU, 7-Wire/RS485-Repeater module, Current Output/HART module) in the guide rails (Fig. 11, item 5).

2. Carefully slide the module into the subrack until the plug connector is inserted into the terminal block.
3. Tighten fixing screws (Fig. 11, item 6).
4. Unused slots must be covered with dummy panels.

▶ The modules are correctly inserted and can be connected.

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 of the hardware as well as during wiring of the detector, the measuring system, connected relay contacts and all inputs and outputs must be de-energized.
- 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!

The relay of the LB 47x 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, RS485, 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 / 7-Wire/RS485-Repeater module and Current Output/HART module are not equipped with a separate ON/OFF switch to connect or disconnect the voltage supply. Make sure that the system can be de-energized 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 60947-1 and IEC 60947-3. 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.

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 EIA485 (RS485) Network

For integration of EVU units into an EIA485 (RS485) network, all participants must be connected one after the other in the configuration Master/Master. Star distribution is not permitted.

The first and last station (physical, independent of the master's position) of the RS485 network between Master EVU and Master EVU / modules needs a terminating resistor of 120 Ω. No termination is required for the RS485 network between the 7-Wire/RS485 Repeater module and the LB 480 detector.

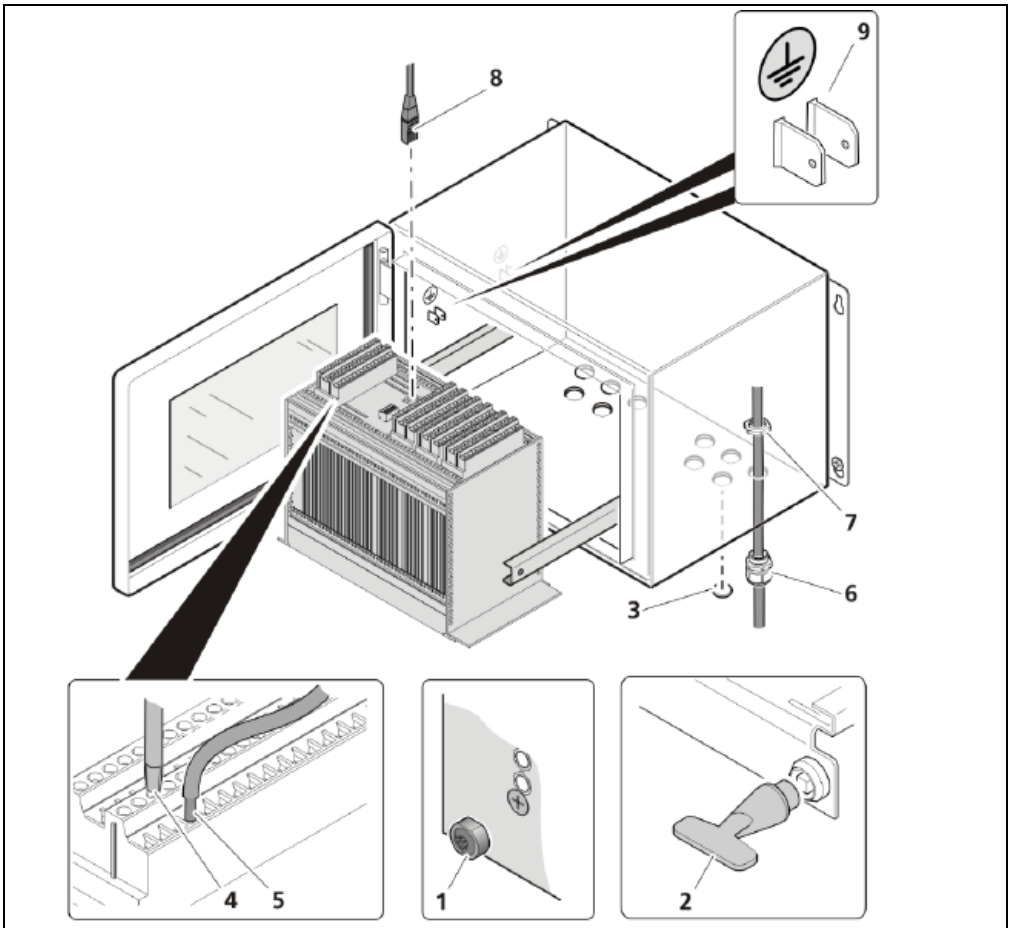
5.2 Electric Connection in the Wall Housing with Terminal Blocks

⚠ 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-energized.
- 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	Blind plug	8	RJ45 connector (network)
4	Opening terminal connection	9	Ground connection
5	Stripped wire		

Fig. 12 Electrical connection in the wall housing

1. Make sure that the locking bolts (Fig. 12, item 1) of all modules are tightened in order to prevent slipping.
2. Loosen the lock (Fig. 12, 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. 12, item 6) through the openings of the wall housing and through the counternut cable glands (Fig. 12, item 7).
5. Screw the cable glands (Fig. 12, item 6) with the counternut cable glands (Fig. 12, item 7).

NOTICE

Only the voltage specified on the type plate may be applied!

NOTICE

Note the specification relating to cables, protective earth, equipotential bonding and EIA485 (RS485) in chapter 5.1.

6. Connect the lines according to the assignments (see chapter 2 Connection Diagrams in document "Technical Information"). The ground connection must be connected to all connections marked PE.
7. Open the terminal screw (Fig. 12, item 4) and insert the stripped wire (min. 8 mm) (Fig. 12, item 5).

▶ The terminals are designed for wires with a conductor cross-section of 0.2 mm² to 2.5 mm².

8. Screw the terminal screws with a tightening torque of 0.4 - 0.5 Nm.
9. Plug the network plug into the RJ45 socket (Fig. 12, item 8) (optional).
10. Tighten all cable glands (Fig. 12, 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. 11. Close all unused openings with the appropriate blind plugs (Fig. 12, item 3).
13. Check the correct connection of the ground connection (Fig. 12, item 9).
14. Slide the subrack into the wall housing and lock it with the square wrench.

NOTICE

The wall enclosure is supplied with blind plugs 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.

▶ The connection was made correctly.

5.3 Electrical Connection in the 19” Subrack with Terminal Blocks

⚠ DANGER

Danger to life from electric shock!

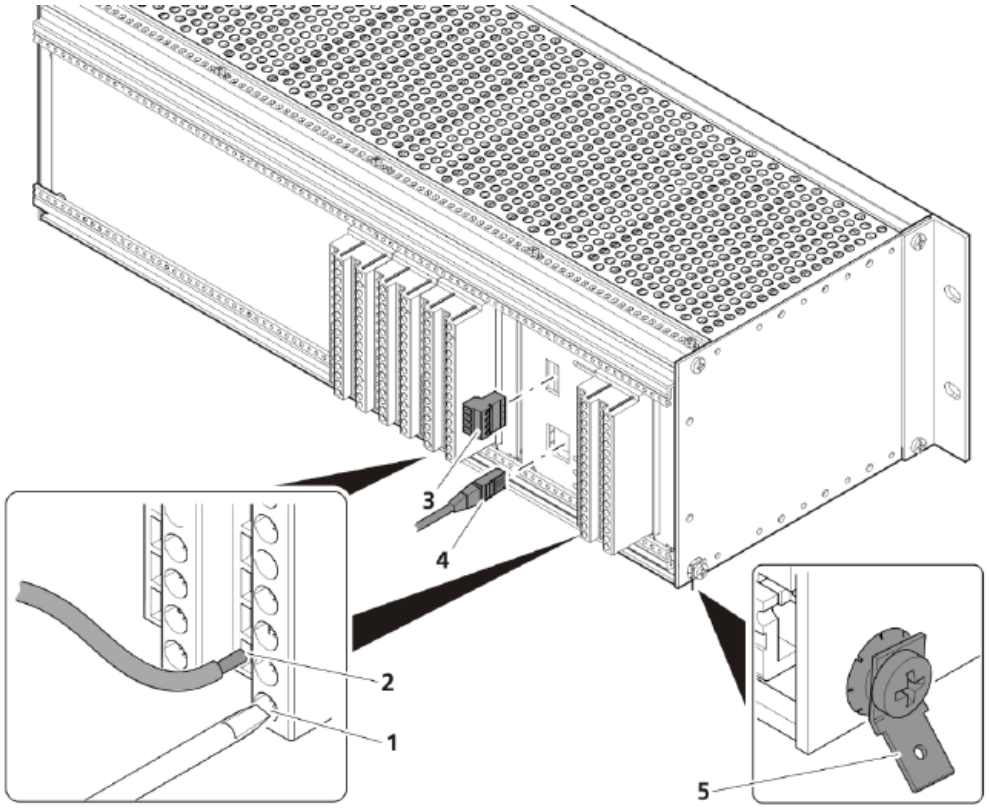
- The installation may only be carried out by a qualified electrician.
- Please adhere to the relevant safety regulations.
- Installation/maintenance may only be carried out if the device has been de-energized.
- Only open the device when free of voltage.

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

IMPORTANT

When using terminal blocks a contact protection must be provided by the customer when voltage is applied. The cable connections of terminal 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. 5.3.1).



1 Terminal 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. 13 Electrical connection in the 19" component rack

1. Unused slots must be closed with blinds.
2. Connect the lines to the terminal blocks according to assignment (see chapter 2 Connection Diagrams in 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 terminal screw (Fig. 13, 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 screw with a tightening torque of 0.4 - 0.5 Nm.
5. When using LB 4700 detectors: Plug in the master/slave plug and reconnect the lines in accordance with assignment (chap. 5.3.1).
6. Plug the network plug into the RJ45 socket (Fig. 13, item 4) (optional).
7. Check the correct connection of the PE conductor (Fig. 13, item 5).

NOTICE

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

▶ The connection was made correctly.

5.3.1 Master/Slave Plug

The master/slave plug is only required when using LB 4700 detectors and slave modules. Further information on the connection can be found in the appendix “Technical Information”.

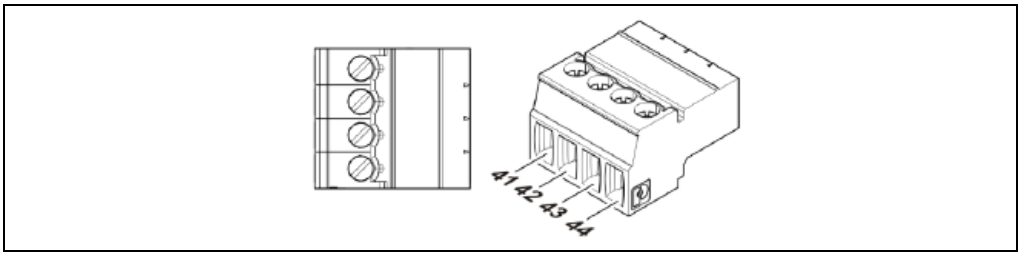


Fig. 14 Assignment Terminals master/slave plug

5.4 Switching Current Output

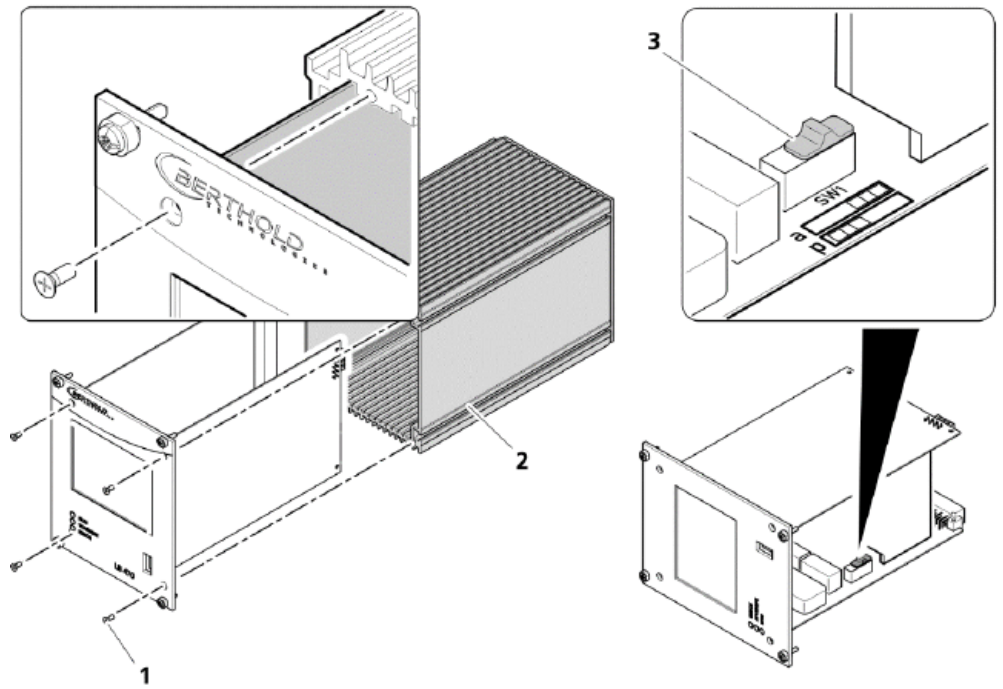
Switching between "SOURCE" (active) and "SINK" (passive) is possible using the slide switch on the I/O board of the EVU. Ex works the EVU is in "SOURCE" mode. Please note that the polarity at the current output must be inverted as soon as the current output is switched at the switch.

⚠ 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-energized.
- 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. 15 Switching of the current output

8. Loosen the four sunken screws on the front side of the EVU (Fig. 15, item 1).
9. Pull out the housing (Fig. 15, item 2) carefully.
10. Slide the switch (Fig. 15, item 3) to position ***a*** for "active" (SOURCE), to position ***p*** for "passive" (SINK).
11. Carefully insert the front panel into the housing. Pay attention to the correct guide rail!
12. Screw the front panel to the housing (Fig. 15, item 2) with the four screws (Fig. 15, item 1).

- The switching has been carried out correctly.

6 Operation of the Software

6.1 System Start

Fig. 16 Start screens with display of the software version

IMPORTANT

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

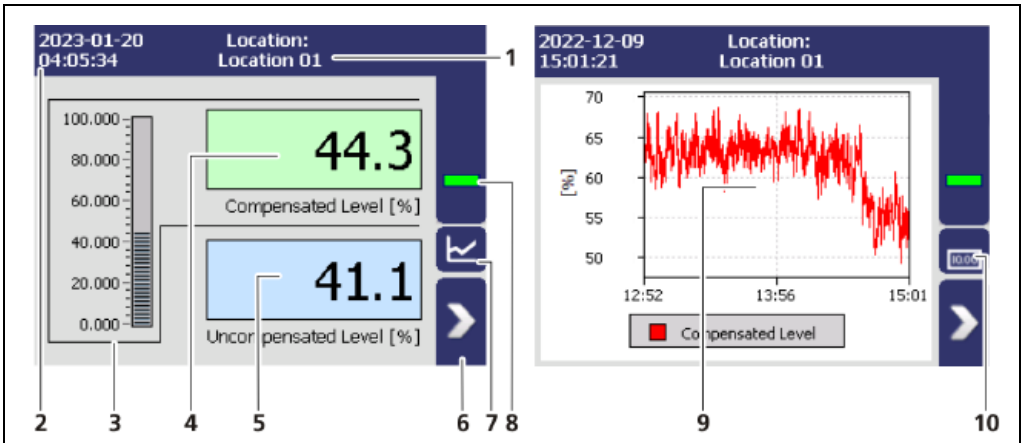
All set values as well as the calibration data are stored in a non-volatile memory.

The real-time clock for date and time is buffered via a capacitor and continues to run for up to approx. 4 weeks even when the device is switched off. See also "Date and time" on page 50.

6.2 EVU Display

IMPORTANT

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

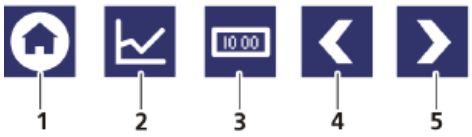


1	Description of the measuring location	6	Button “Menu”
2	Date and time	7	Button “Diagram display”
3	Compensated level scale	8	State information
4	Compensated level value	9	Diagram display
5	Uncompensated level value	10	Button “Standard display”

Fig. 17 Display of the EVU (left: standard display; right: diagram display)

Location	Name of the measuring location. Setting in: Device Setup | Identification.
Date and Time	Actual date and time. Setting in: Device Setup | Setup | System | Date/Time.
Compensated level scale	The scale range of the compensated level.
Compensated level value	The current compensated level value in %.
Uncompensated level value	The current uncompensated level value in %.
Button “Menu”	The main menu opens.
Button “Diagram display”	The view changes to the diagram display.
Button “Standard display”	The view changes to the standard display.

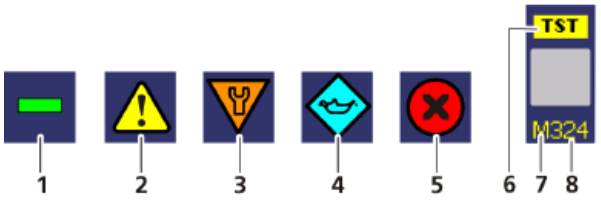
6.3 Navigation



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

Fig. 18 Icons for navigation

6.4 Status Messages



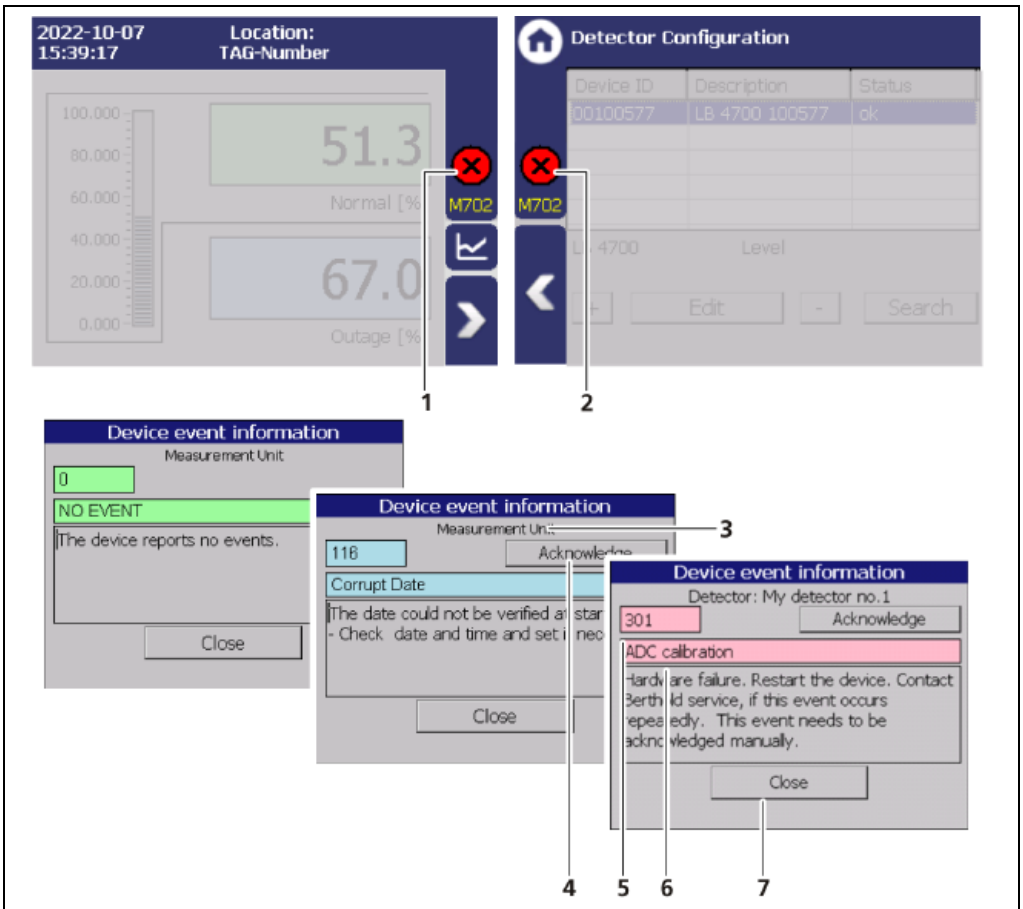
1 No event
2 Out of specification
3 Function check
4 Maintenance required
5 Failure (error)
6 Information test (simulation)
7 Character D (detector) or M (measuring unit)
8 Event code

Fig. 19 Status messages

6.5 Event Reports

Events are displayed in the standard display and in the submenus and windows as a symbol. All events are displayed on the main screen. A specific “D” (only with connected LB 4700 detectors) indicates that a detector has an event, the prefix “M” (for measuring unit) indicates that there is an event in the LB 476 Level+ evaluation unit. In the event of a detector (LB 4700) 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 (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 <Acknowledge>
5 Error number
6 Title of event report
7 Button <Close>

Fig. 20 Event reports (examples)

1. Click on the icon (Fig. 20, item 1 or item 2) to display detailed information about the event.
2. Click the button <Acknowledge> (Fig. 20, item 4) to confirm an event that requires a manual confirmation.

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

3. Click <Close> (Fig. 20, item 4) to return to the submenu or to the standard display.

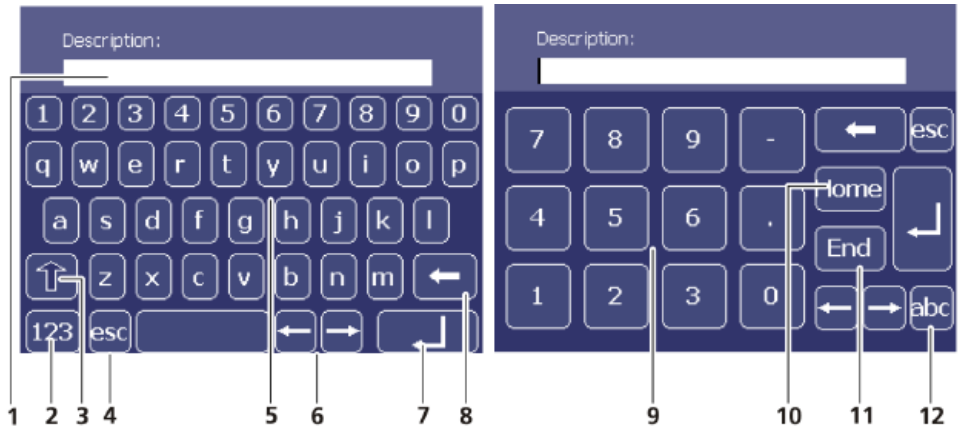
▶ The icon disappears from the status information.

IMPORTANT

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

6.6 Input Field

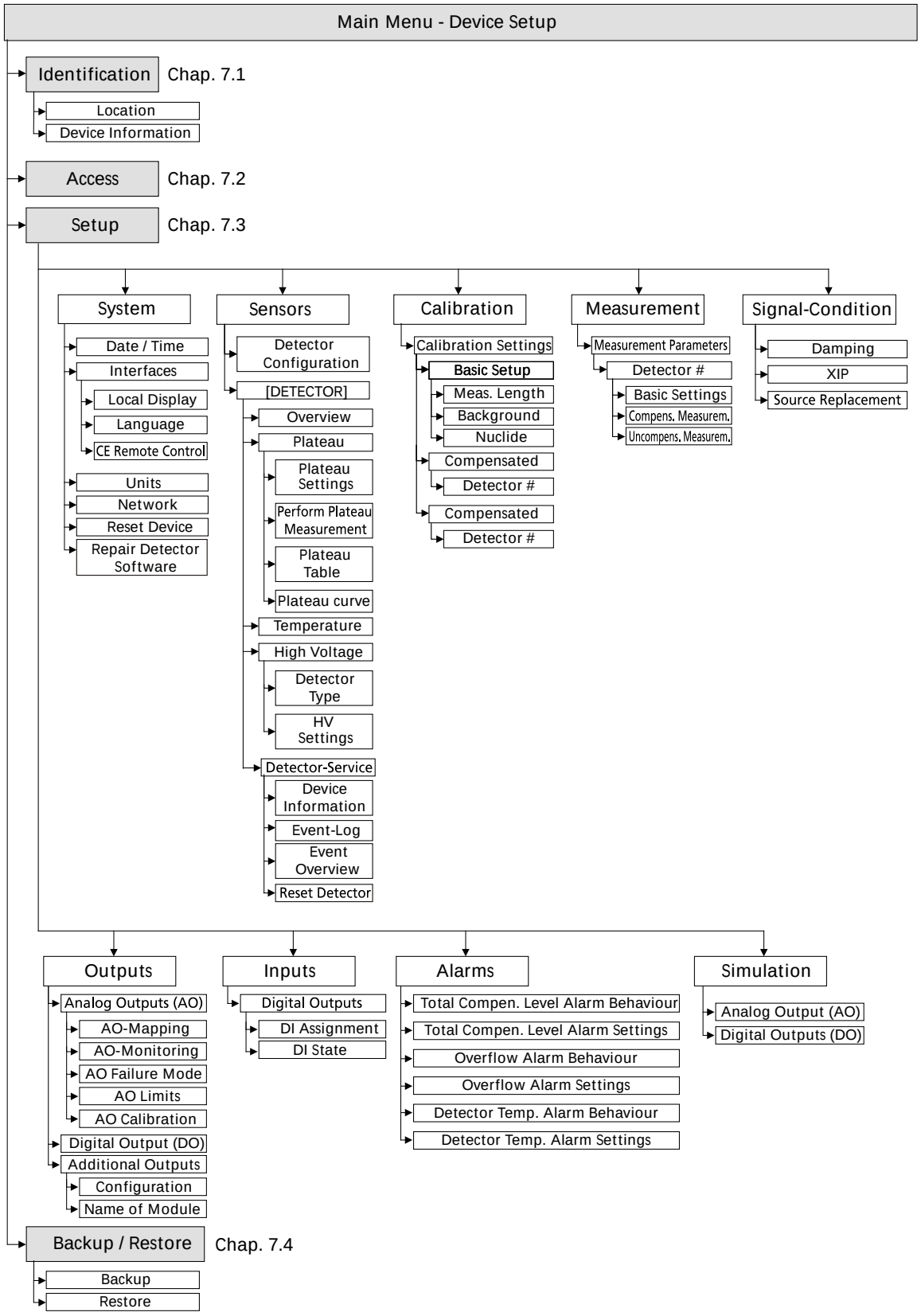
The input field appears by clicking on the blue display panels. When using the remote control software (see chapter 7.3.1 “Remote Control Software”), the keyboard of the PC can be used.



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 key
5	Keypad	11	End key
6	Navigation buttons	12	Shift key for letters

Fig. 21 Screen keyboard

7 Main Menu Device Setup



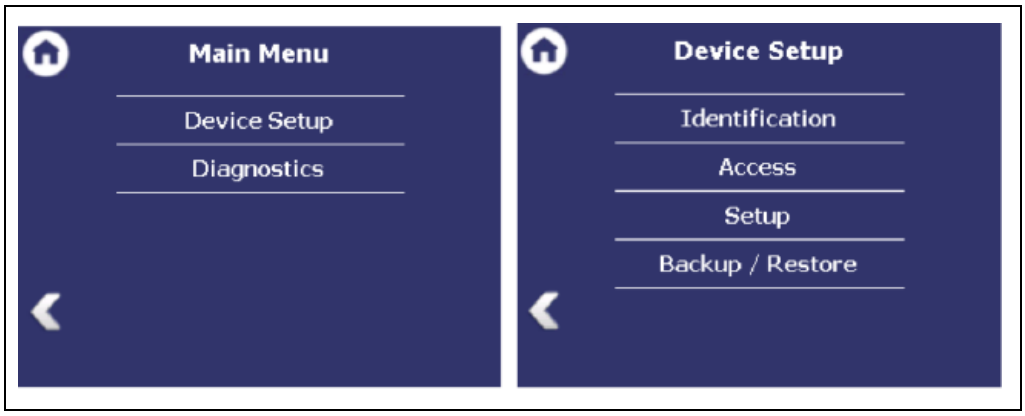


Fig. 22 Menu “Main Menu”, "Device Setup"

7.1 Menu Identification

Device Setup | Identification

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

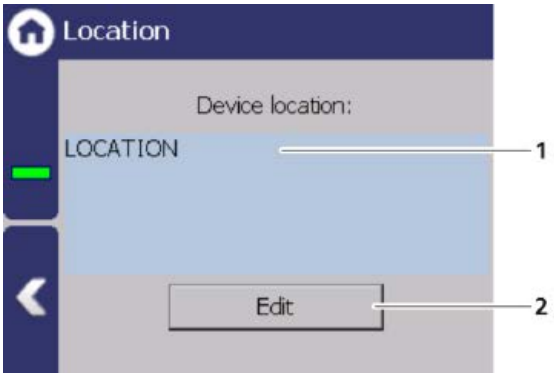
- Display and change of the location name
- Display of hardware and software information
- Perform software update

Fig. 23 Menu "Identification"

7.1.1 Location

Device Setup | Identification | Location

The location of the evaluation unit is displayed (Fig. 24, 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. 17, item 1).



1 Name Device location
2 Button <Edit>

Fig. 24 Device Location

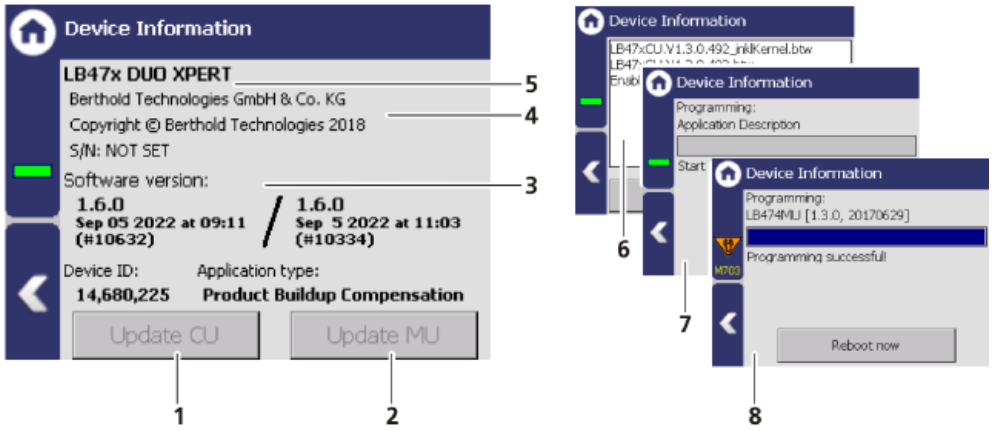
1. Click <Edit> (Fig. 24, item 2) to open the input field.
2. Enter a location name for the evaluation unit.
3. Confirm with the Enter key.

▶ The name has been changed and is shown in the standard display.

7.1.2 Device Information

Device Setup | Identification | Device Information

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



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

Fig. 25 Device Information

Tip

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

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 settings before resetting and the update of the EVU.
- 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. 4, item 5).

IMPORTANT

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

3. In the “Device Setup” menu, click on “Device Information” (Device Setup | Identification | Device Information).
4. The USB storage device is recognized by the system after a few seconds and the <CU Update> (Fig. 25, item 1) button can be clicked.

- The selection window “update file” (Fig. 25, item 6) opens.

5. Select the appropriate file and click on the button <CU Update> (Fig. 25, 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. 4, item 5).
3. In the “Device Setup” menu, click on “Device Information” (Device Setup | Identification | Device Information).
4. The USB storage device is recognized by the system after a few seconds and the <MU Update> (Fig. 25, item 2) button can be clicked.

▶ The selection window “update file” (Fig. 25, item 6) opens.

5. Select the appropriate file and click on the button <MU Update> (Fig. 25, item 2). 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

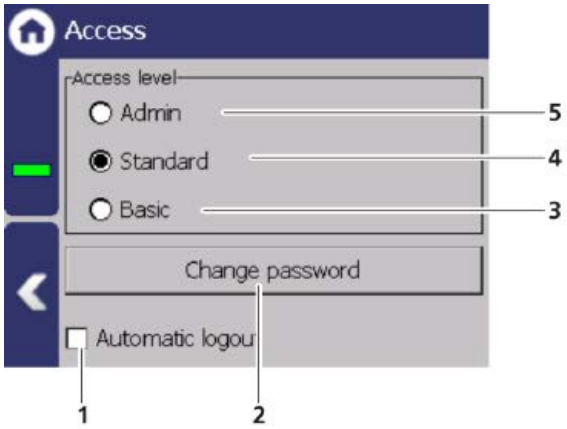
Device Setup | Access

You can set the user rights via the access 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 Button <Change password>
3 User level "Basic"
4 User level "Standard"
5 User level "Admin"

Fig. 26 Access

The following user levels are available:

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 configuration 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. 26, item 1) automatically resets the access level “Standard” to “Basic” when the system changes to the standard display after the timeout.

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" (Fig. 26, item 1).

Assign / change password

To set or change a password, select "Standard" (Fig. 26, item 4) and click on <Change password> (Fig. 26, item 2) to open the input field.

1 Input field
2 Button <OK>

Fig. 27 Change password

1. Click on the text field (Fig. 27, item 1) to open the input field.
2. Enter a password (case-sensitive!).
3. Confirm with the Enter key.
4. Click <OK> (Fig. 27, item 2) to confirm.

- The password has been set / changed.

7.3 Menu Setup

Device Setup | Setup

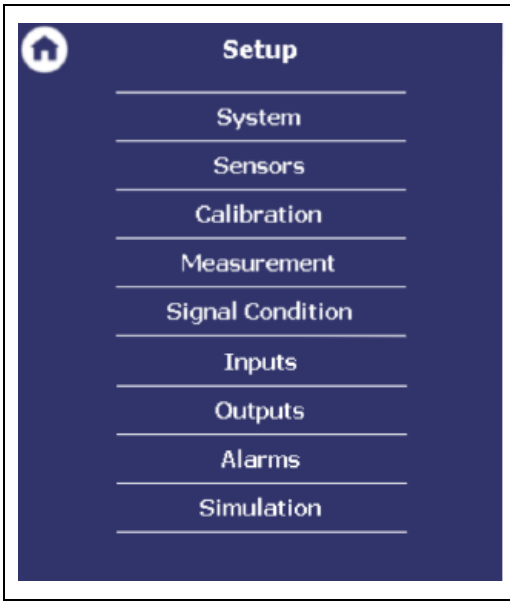


Fig. 28 Menu "Setup"

7.3.1 System (Date / Time, Interfaces, Units, Network, Reset, Repair Det. Software)

Device Setup | Setup | System

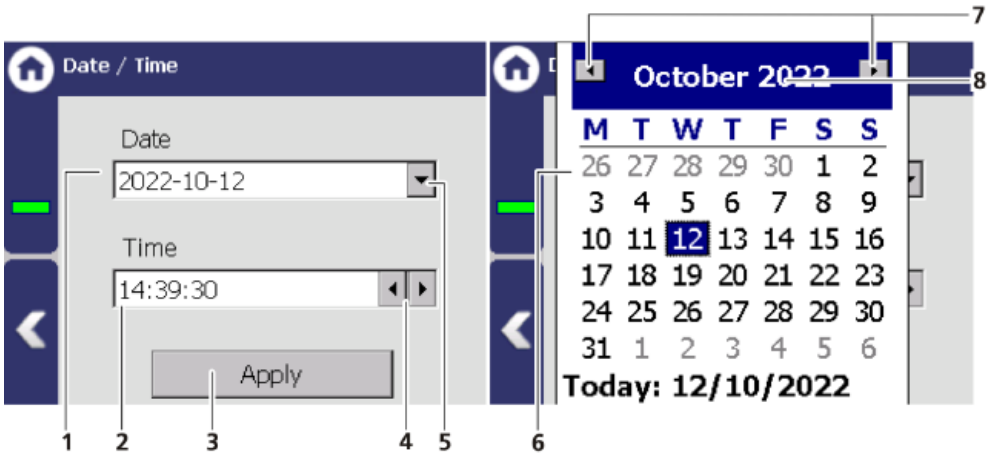
Fig. 29 Submenu "System"

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. 30 Date / Time, calendar

1. Click on the arrow key (Fig. 30, item 5) in order to set the date.

▶ The calendar is opened (Fig. 30, item 6).

2. Click on the year number (Fig. 30, item 8) in order to enter the year.
3. Set the month (Fig. 30, 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. 30, item 4).
6. Click on <Apply> (Fig. 30, item 3), to accept the date and time settings.

▶ Date and the time have been set.

NOTICE

The real-time clock for date and time is buffered via a capacitor and continues to run for up to approx. 4 weeks even when the device is switched off.

▶ If the device has been out of operation for more than 4 weeks, error M116 appears. The date and time must then be reset.

Interfaces

Device setup | Setup | System | interfaces

You can adjust the following settings in the submenu “Interfaces” (Fig. 31):

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

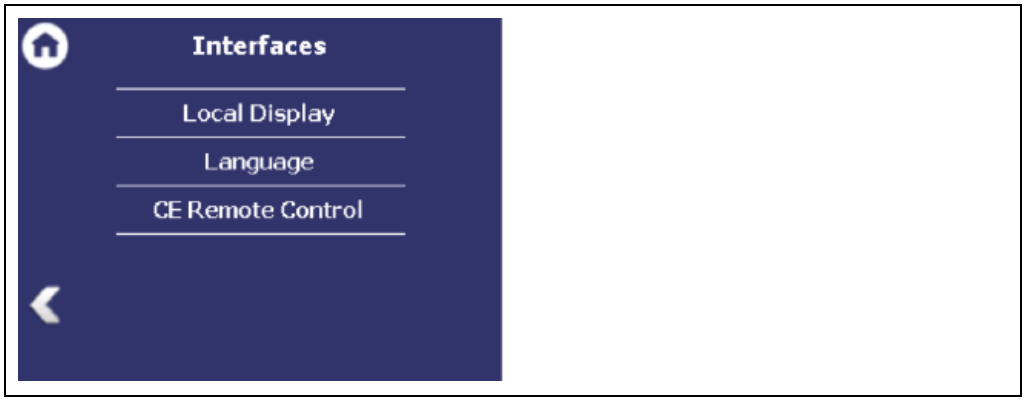


Fig. 31 Menu “Interfaces”

Local Display

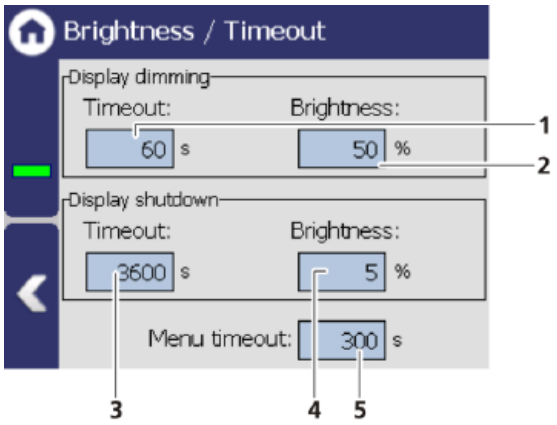
Device setup | Setup | System | Interfaces | Local Display

Fig. 32 Submenu "Local Display"

Brightness / Timeout

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

“Timeout” refers to the period of time during which the display is not operated. The value “Timeout” in “Display dimming” cannot be set greater than the value “Timeout” in “Display shutdown”.



1 Input field Display dimming “Timeout”
2 Input field Display dimming “Brightness”
3 Input field Display switch off “Timeout”
4 Input field Display shutdown “Brightness”
5 Input field “Menu timeout”

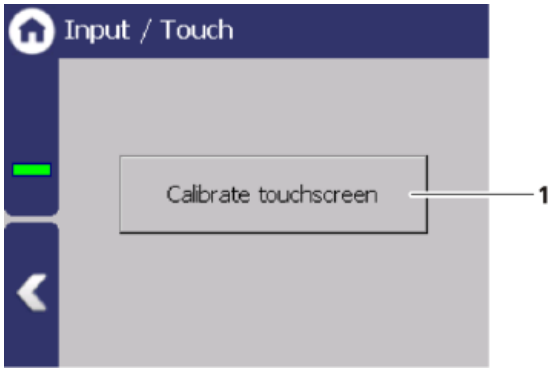
Fig. 33 Brightness / Timeout

Display dimming	In the field Display dimming, clicking the input fields allows the entering of the brightness (Fig. 33, item 2) in percent, that is set after expiry of the time (Fig. 33, item 1).
Display shutdown	In the field Display shutdown, clicking the input fields allows the entering of the brightness (Fig. 33, item 4) in percent, that is set after expiry of the time (Fig. 33, item 3).
Menu timeout	Under "Menu timeout" clicking on the input field (Fig. 33, 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

The mouse pointer automatically becomes visible when a mouse is inserted into the USB port.



1 Button <Calibrate touchscreen>

Fig. 34 Input/ Touch

Calibrate Touchscreen

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.

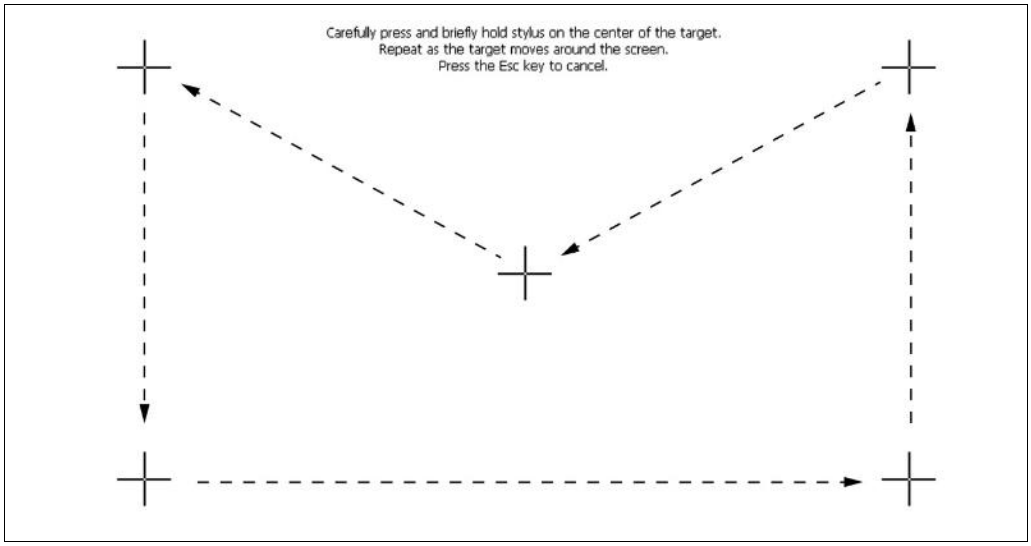


Fig. 35 Calibrate touchscreen

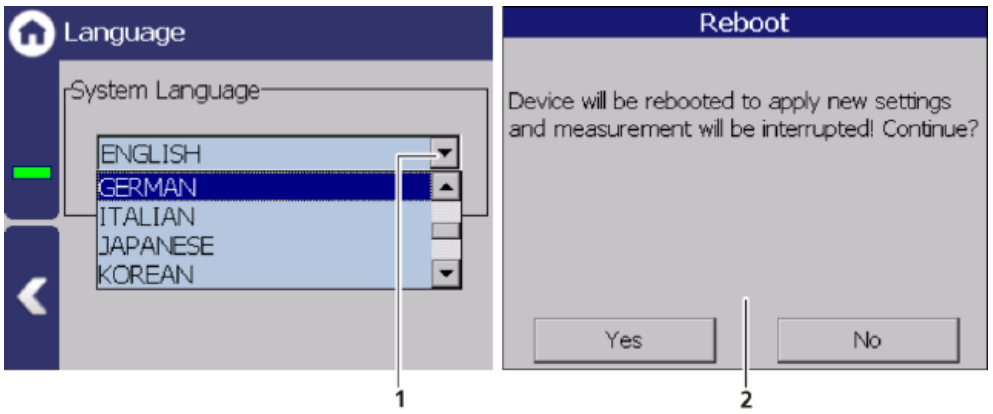
1. Click on <Calibrate touchscreen> (Fig. 34, item1).
   - ▶ The calibration screen (Fig. 35) opens.
2. Press the middle of the displayed cross with your finger.
   - ▶ If you take your finger off the cross again, the cross jumps to the top left corner.
3. Repeat the process until the cross is no longer 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 touchscreen is calibrated.

Language

Device Setup | Setup | System | interfaces | Language



1 Selection arrow
2 Information window

Fig. 36 Language

Change System Language

1. Click on the selection arrow (Fig. 36, item 1) and select a language.

▶ An information window “Reboot” (Fig. 36, item 2) appears.

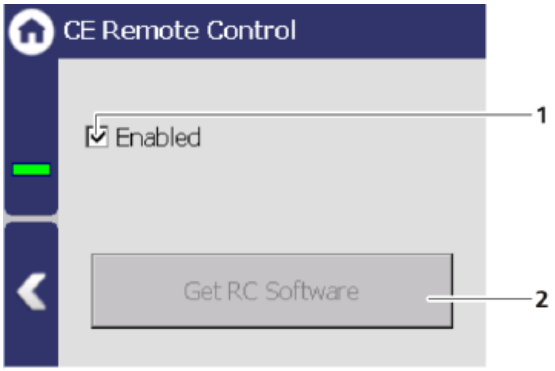
2. Confirm with <Yes> to restart the device.

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

CE Remote Control

Device Setup | Setup | System | interfaces | Local Display | Remote Control

By activating (Fig. 37, 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. 37 Remote Control

Copy RC software

1. Insert a USB storage device into the USB port (Fig. 4, item 5).

▶ The USB storage device is recognized by the system after a few seconds and the button <Get RC software> (Fig. 37, item 2) can be clicked.

2. Click on the button <Get RC software> (Fig. 37, item 2).

▶ The software („LB47xRemoteControl.exe“) is copied to the USB storage device.

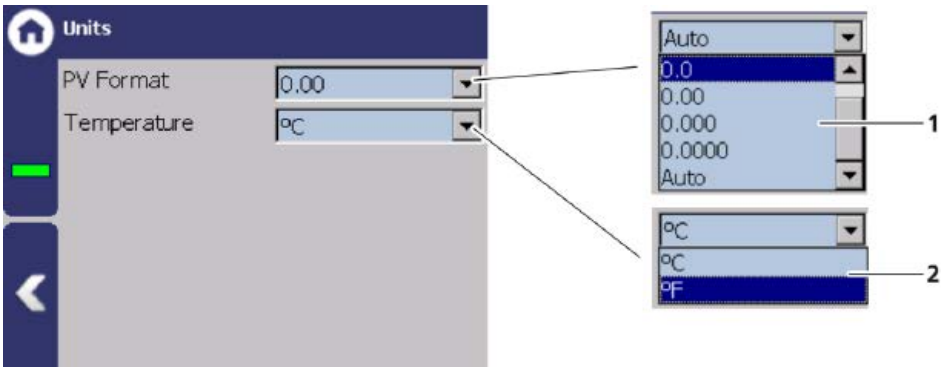
Information

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 Page 56).

Units

Device Setup | Setup | System | Units

Clicking on the selection arrows lists the available units for the temperature value and the process value format. The selected unit is shown in the standard display and used in the calibration settings.



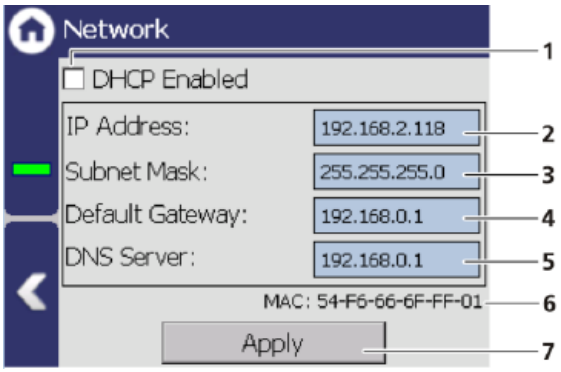
1 Selection “PV Format”
2 Selection “Temperature”

Fig. 38 Units

Network

Device Setup | Setup | System | Network

In the Network settings window, you can make changes to the network settings. The information can only be edited in the access level "Standard" (see page 48).



1	Check box "DHCP Enabled"	5	DNS Server
2	IP Address	6	MAC Address
3	Subnet Mask	7	Button <Apply>
4	Default Gateway		

Fig. 39 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. 39, item 1).

IMPORTANT

The PC and the LB 47x have to be in the same IP subnet.
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. 39, item 6).

Manual Setting

1. Click on the text field (Fig. 39, 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. 39, item 7) to adopt the network settings.

IMPORTANT

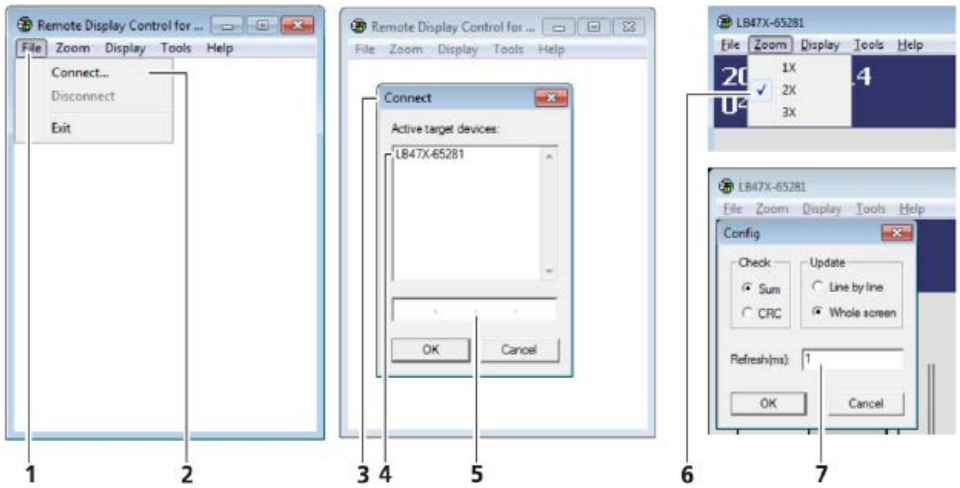
All settings performed must be confirmed by clicking on <Apply> so that the settings become real.

Remote Control Software

If the EVU is connected to a network at the RJ45 socket (Fig. 4, item 9), the EVU can be operated via a computer. The software can be loaded onto a USB storage device (see chapter “CE Remote Control”).

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. 37, item 1).



1	Programme Remote Control	5	Input box IP address
2	Box <Connect…>	6	Zoom
3	Window Connect	7	Number of Refresh in milliseconds
4	List of transmitters		

Fig. 40 Establishing connection to the EVU using the RC software

1. Click on "LB47xRemoteControl.exe", to start the program.
   - ▶ The program starts (Fig. 40, item 1).
2. Click on the <File> tab and then on <Connect…> (Fig. 40, item 2), to establish a connection to the EVU.
   - ▶ A new window “Connect” is opened (Fig. 40, item 3) and the connected transmitters are listed.

IMPORTANT

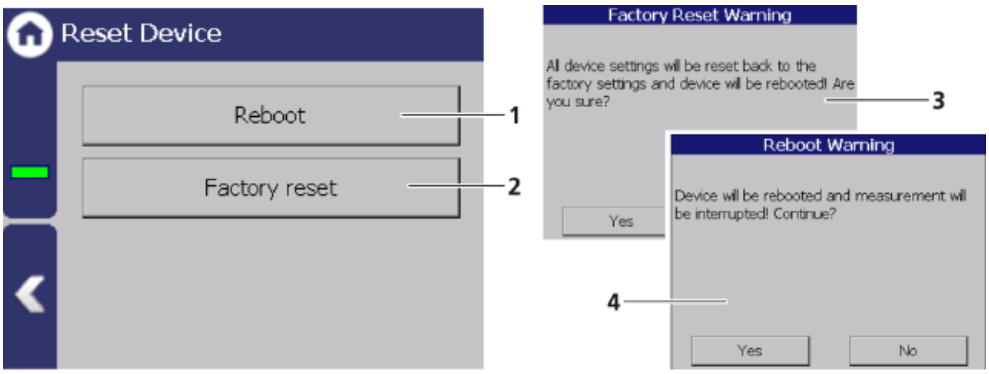
The IP address of the EVU must be in the same sub-network (Fig. 39, item 3) as the network adapter of the computer (see previous Chapter “Network”).

3. Click on the identifier of the transmitter (Fig. 40, item 4) or enter the IP address of the EVU in the input box (Fig. 40, item 5) (see Fig. 40, 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) and in the menu "Tools | Config“ change the number of refreshs for a fluent view.

Reset Device (Evaluation Unit)

Device Setup | 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. 41 Reset device

Restart Device

IMPORTANT

The measurement is interrupted during a restart!

1. To restart the device, click the button <Restart> (Fig. 41, item 1).
   - A window with a warning "Restart" (Fig. 41, item 3) opens.
2. Click on <Yes> to confirm.
   - The device is restarted.

Reset Device (Factory Reset)

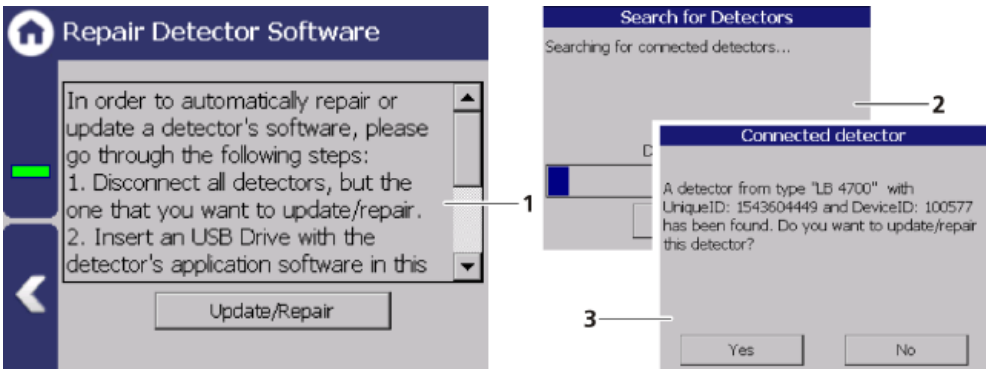
IMPORTANT

- 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. 41, item 2).
   - A window with the warning "Factory settings" (Fig. 41, item 4) opens.
2. Click on <Yes> to confirm.
   - The device is reset to factory settings and restarts.

Repair Detector Software

Device Setup | Setup | System | Repair Detector Software



1 Description Update / Repair
2 Process "Search for Detectors"
3 Search result

Fig. 42 Repair Detector Software

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 re-started. 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

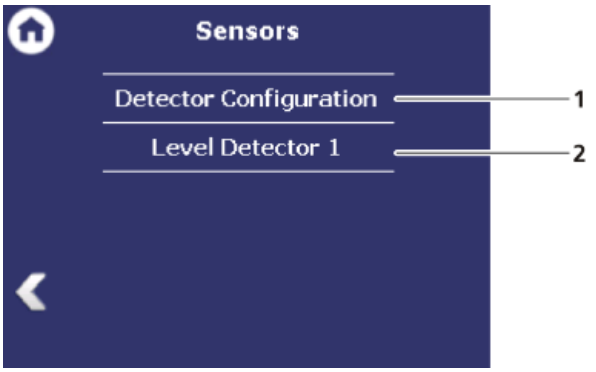
Device Setup | Setup | Sensors

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

- Detector configuration (Fig. 43, item 1)
  - Add / Remove detectors
  - Settings of the detectors
- Configuration of the respective detector (Fig. 43, item 2)
  - Overview
  - Plateau
  - Temperature
  - High Voltage
  - Detector Service

IMPORTANT

If the system does not detect a detector, then the detector submenu cannot be selected.



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

Fig. 43 Menu "Sensors"

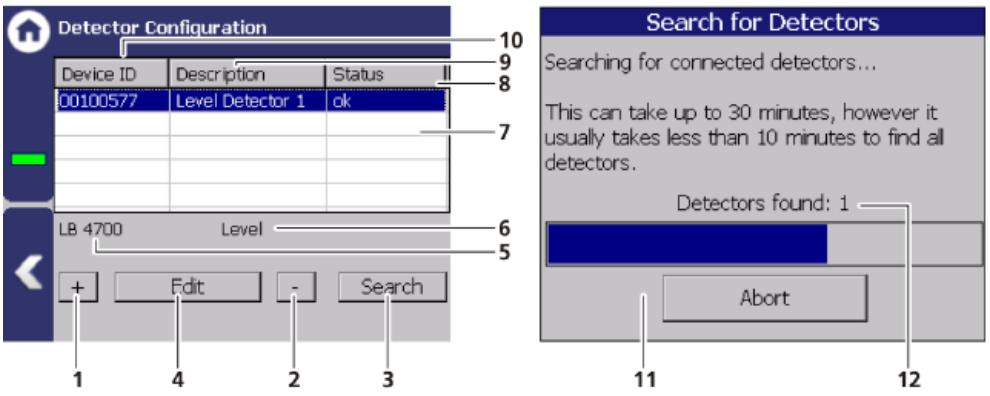
Detector Configuration

Device Setup | Setup | Sensors | Detector Configuration

In the window “Detector Configuration” the detectors for the measuring system are added and configured. Only configured detectors are listed and shown in the menu (Fig. 43). When a detector is selected (Fig. 44, item 7), the detector type (Fig. 44, item 5) and measuring task (Fig. 44, item 6) are shown.

Information

Information and settings for the detector are in the individual detector menu (Fig. 46).



1	Button < + > to add Detector	7	List of the Detectors
2	Button < - > to remove Detector	8	Status of the Detector
3	Button < Search >*	9	Description of the Detector
4	Button < Edit >	10	Device ID of the detector
5	Type of selected detector	11	Window “Search for Detectors”
6	Measuring task for the selected detector	12	Number of detectors found

Fig. 44 Detector Configuration

*only for LB 4700 detectors

Detectors can be added manually with the button <+> (Fig. 44, item 1), provided their device ID and their roles are known. Detectors can be removed with the button <-> (Fig. 44, item 2). Clicking the button <Edit> (Fig. 44, item 4) opens the setting of the selected detector.

By clicking the button <Search> (Fig. 44, item 3), all LB 4700 detectors connected to the measuring system are identified and listed (Fig. 44, item 7).

IMPORTANT

Evaluation of the measurement data from LB 480 detectors is only possible with 7-Wire/RS485-Repeater modules (Fig. 3, item 3).
LB 480 detectors are not found using the "Search" function. To add <+> (Fig. 44, item 1) LB 480 detectors, the corresponding device IDs must be known (see detector type plate) which is entered in the input field (Fig. 45, item 7).

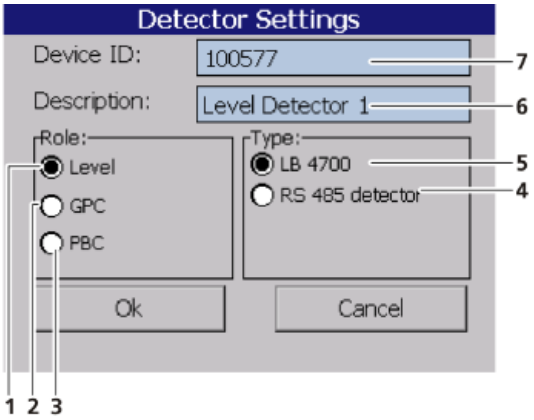
Detector Settings

The settings of a configured detector are edited by selecting and clicking on <Edit> (Fig. 44, item 4).

IMPORTANT

The role of the selected detector must correspond the measurement task of the detector (Fig. 44, item 7).

- Note the Device ID of the Detector.



1 Role “Level”
2 Role “GPC”
3 Role “PBC”
4 Type selection “RS485 Detector”
5 Type selection “LB 4700 Detector”
6 Input field “Description”
7 Input field “Device ID”

Fig. 45 Detector Settings

Role “Level”	The option “Level” must be selected if the detector is used for level measurement.
Role “GPC”	The option “GPC” (Gas Properties Compensation) must be selected if the detector is used to determine the gas density.
Role “PBC”	The option “PBC” (Product Buildup Compensation) must be selected if the detector is used as PBC trigger detector.
LB 4700	The option "LB 4700" must be selected if a LB 4700 is used (a LB 4700 detector can be connected either to the master unit itself or to a slave module).
RS485 detector	With the selection “RS485 detector” it is possible to connect a LB 480 detector via the 7-Wire/RS485-Repeater module.
Description	Detector description. Also used for error messages, logs and in the menu structure (Fig. 43).

If a LB 4700 detector is correctly installed and configured on the slave module both LED displays (Rx, Tx, see Fig. 5) flash.

Detector Settings

Device Setup | 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 / Bias Voltage (LB 480)
  - Detector Type
  - HV Settings
- Detector Service
  - Device information
  - Event Log
  - Event Overview
  - Reset Device

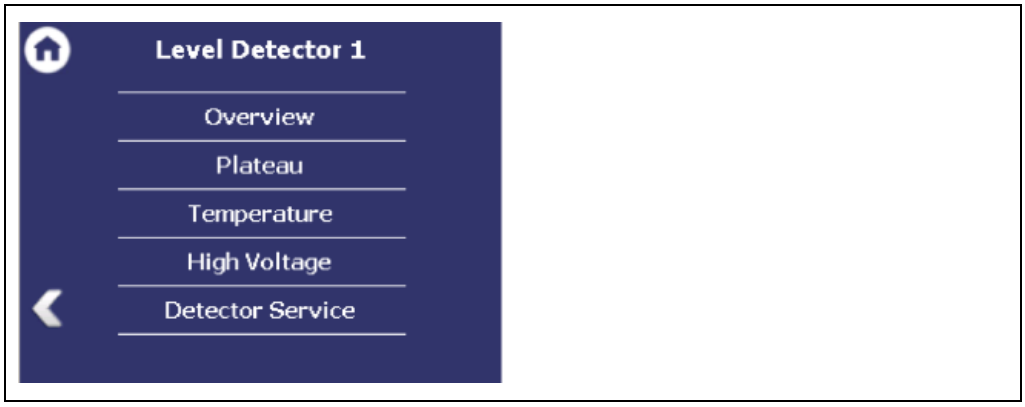
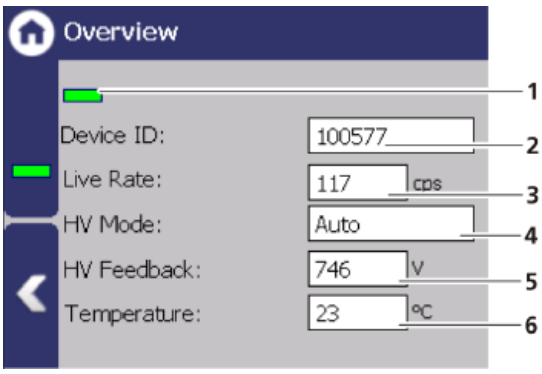


Fig. 46 Submenu “Detector”

Detector Settings: Overview

Device Setup | 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. 47 Overview Detector Information

	A green bar appears with error-free status of the detector (Fig. 47, item 1).
Device ID	Shows the ID (Fig. 47, item 2) of the detector.
Live Rate	The "Live Rate" (Fig. 47, item 3) displays the current, unfiltered count rate.
HV Mode	In the field “HV mode” (Fig. 47, item 4), the HV mode is displayed, which is chosen under Device Setup | Setup | Sensors | *NAME DETECTOR* | High Voltage | HV Settings.
HV Feedback	The field “HV Feedback” (Fig. 47, item 5) displays the actual measured value in volts.
Temperature	The field “Temperature” (Fig. 47, item 6) indicates the current temperature of the detector in C°.

Detector Settings: Plateau

Device Setup | 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, which is necessary for the operation of the photomultipliers, is increased stepwise during plateau recording and the pulse rate is 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. 48) 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.

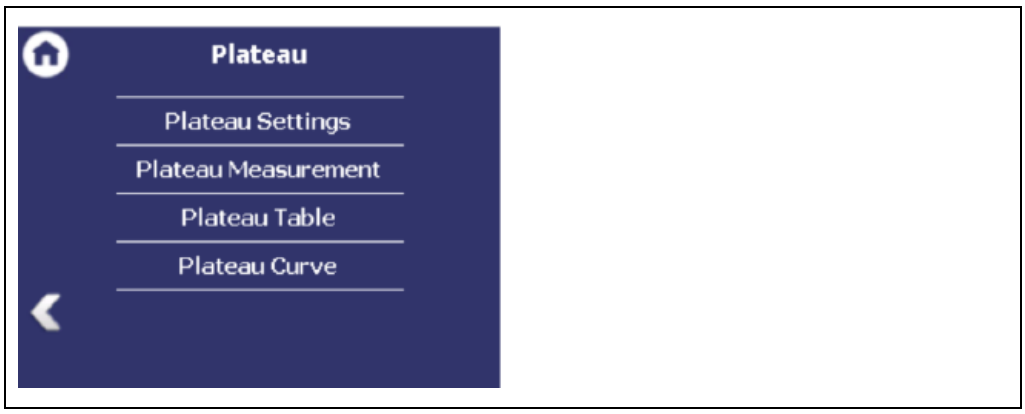
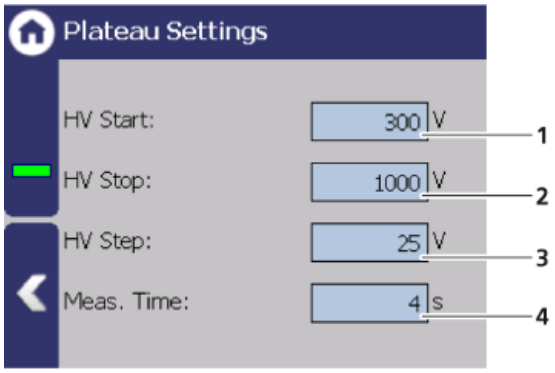


Fig. 48 Menu "Plateau"

Plateau Settings

Device Setup | 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.



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. 49 Plateau Settings

You have the following setting 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. Click on the corresponding input field (Fig. 49, item 1-4).

▶ 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.

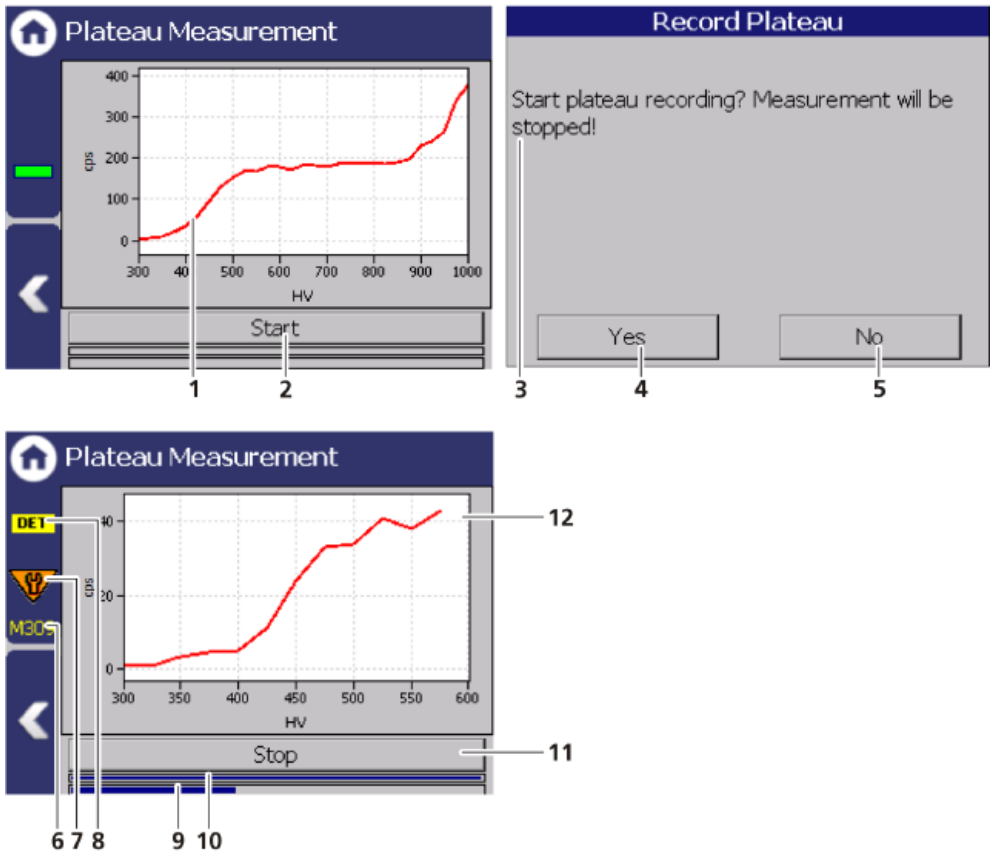
Perform Plateau Measurement

Device Setup | 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. 50 Recording a plateau curve

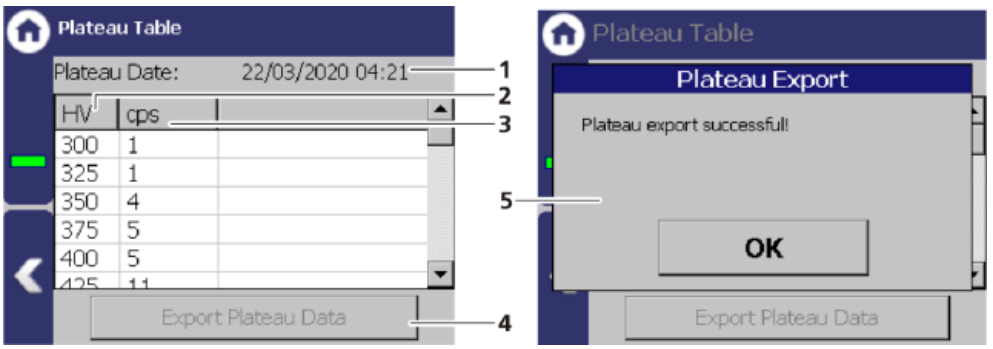
1. Click on <Start> (Fig. 50, item 2) to perform a plateau measurement.
- The confirmation message "Record plateau" (Fig. 50, item 3) opens.
2. Confirm with <Yes> (Fig. 50, item 4).
- The EVU switches to mode "DET" (Fig. 50, item 8) and the current measurement is stopped.
- The information (Fig. 50, 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. 51), the plateau curve (Fig. 52) is displayed and stored automatically.

Plateau Table

Device Setup | 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. 51 Plateau Table

Export Plateau Data

1. Connect a USB flash drive to the USB port of the EVU.
- The USB memory device is recognized 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. 51, item 4).
- The values of the plateau measurement have been stored in a .txt file.
3. Confirm the message with <OK>.

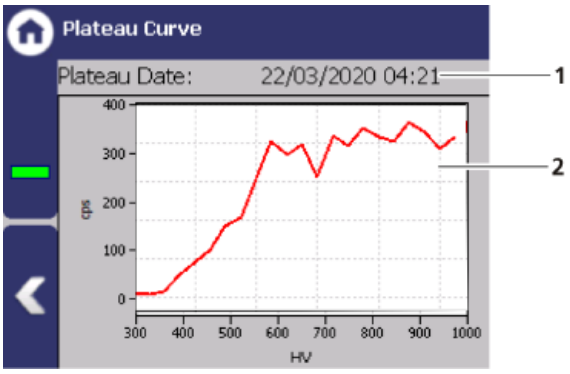
Information

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

Plateau Curve

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

The mapped characteristic curve (Fig. 52, item 2) of the last complete plateau measurement is displayed in the window “Plateau Curve”.



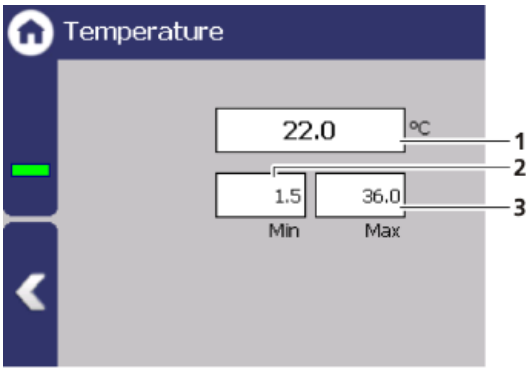
1 Date and Time of measurement recording
2 Characteristic curve

Fig. 52 Plateau Curve

Detector Settings: Temperature

Device Setup | 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. 53 Temperature display of the detector

Detector Settings: High Voltage

Device Setup | 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.

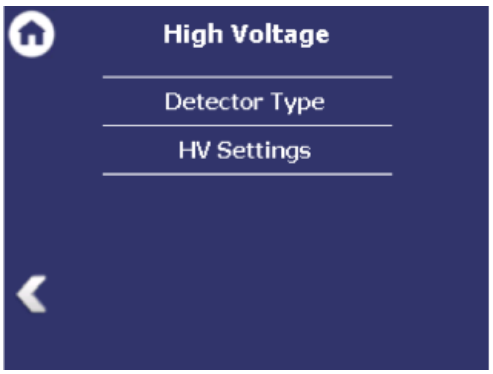


Fig. 54 Submenu “High Voltage”

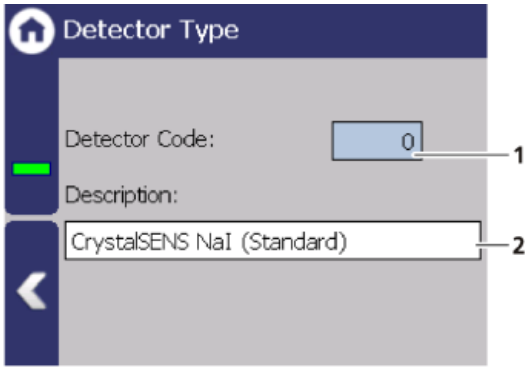
Detector Settings: High Voltage | Detector Type

Device Setup | 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 normally not required.

IMPORTANT

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

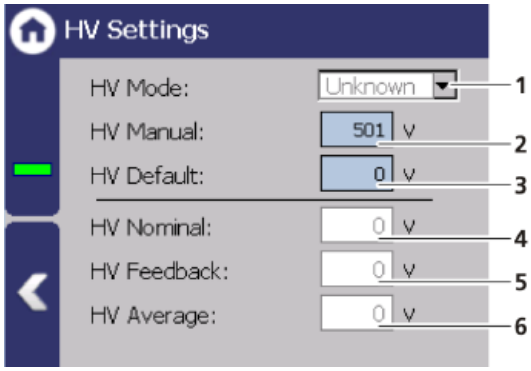


1 Input field “Detector Code”
2 Description of the scintillator type

Fig. 55 Detector Code: Setting the scintillator type

Detector Settings: High Voltage | HV Settings

Device Setup | 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 field setting value high voltage
5 Display field actual value high voltage
6 Display field average high voltage

Fig. 56 HV Settings

NOTICE

Default HV is preset by Berthold. A subsequent change is usually not 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. 56, 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. 56, item 2).
2. Click in the input field "HV Default" (Fig. 56, 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 start value has been changed.

Detector Settings: Detector Service

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

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

- Device Information
- Event Log
- Event overview
- Reset Detector

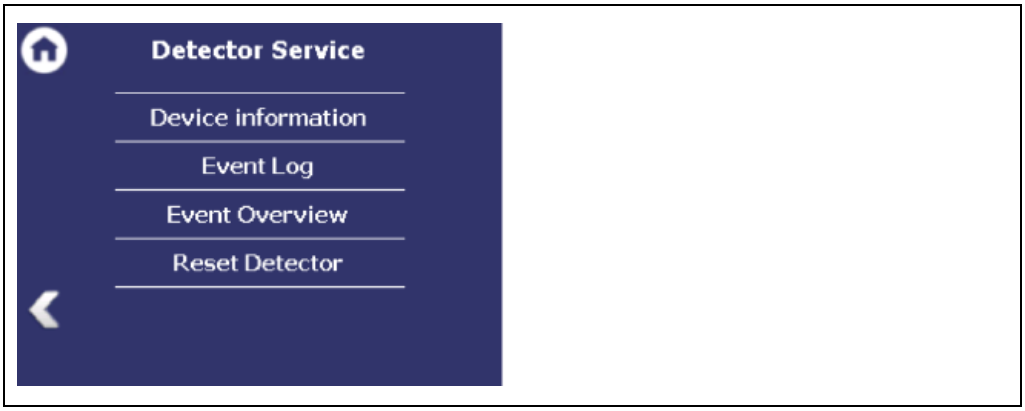
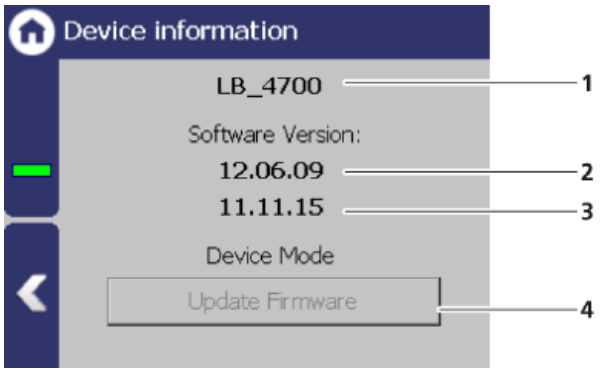


Fig. 57 Menu “Detector Service”

Detector Settings: Service | Device information

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

This window shows you the type of detector (Fig. 58, item 1) as well as an overview of the software version (Fig. 58, item 2, item 3) of the detector.



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

Fig. 58 Device information

Perform Firmware Update

NOTICE

An update of the firmware of the detector may take 1 hour.

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 may not be located in an index in the USB storage device.

1. Save the update file of the firmware of the detector on a USB storage device.
2. Connect a USB storage device to the EVU (Fig. 4, item 5).
3. The USB storage device is recognized by the system after a few seconds and the < Update Firmware > (Fig. 58, item 4) button can be clicked.
4. Click on the button < Update Firmware > (Fig. 58, item 4).
   - ▶ A warning message appears (Fig. 58, item 5).
5. Confirm with <Yes>.
   - ▶ After a searching process, the "Select firmware file" window appears.
6. Select the file and click on <Update>.
   - ▶ The old firmware is deleted and the new version is installed automatically. After the update is finished, an update log is displayed.

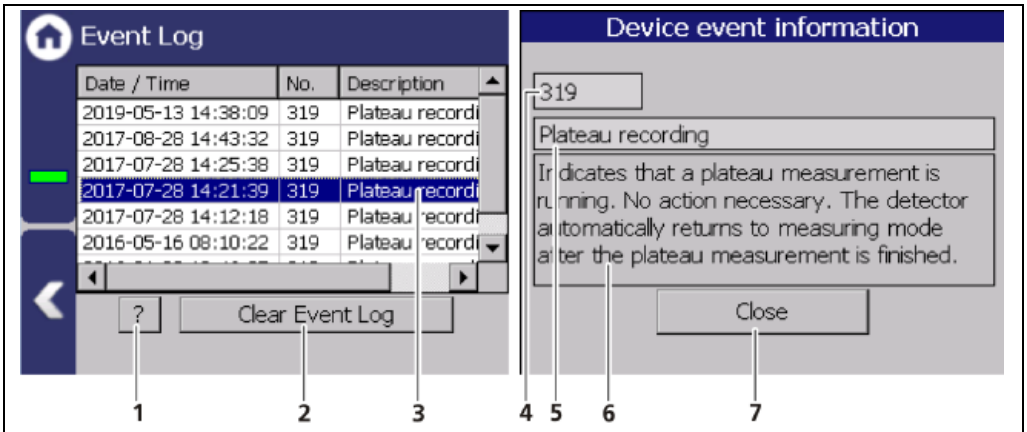
NOTICE

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

Detector Settings: Service | Event Log

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

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



1 Button <?> to display the detailed event description.
2 Button <Clear Event Log>
3 Highlighted event
4 Event No.
5 Event title
6 Event description
7 Button <Close>

Fig. 59 Event Log

Display Event Description

1. Click on a line in the list (Fig. 59, item 3).
2. Click on <? > (Fig. 59, item 1)

▶ The event description appears.

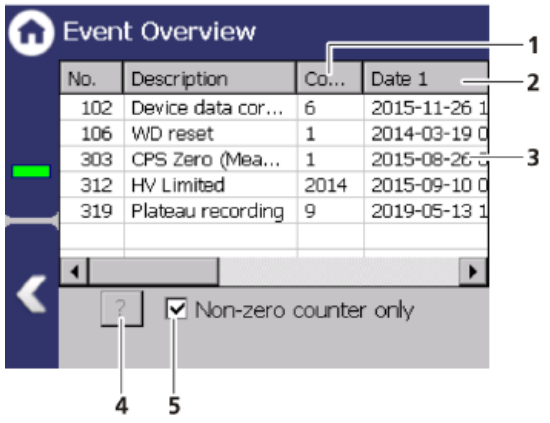
3. With the button <Close>, close the event description (Fig. 59, item 7).

▶ With the button <Clear Event Log> (Fig. 59, item 2), delete all events permanently.

Detector Settings: Detector Service | Event Overview

Device Setup | 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
2 “Date” column
3 Event line
4 Button <?>
5 Display check box "Non-zero counter only"

Fig. 60 Event Overview

1. Click on a line in the list (Fig. 60, item 3).
2. Click on <? > (Fig. 60, item 4).

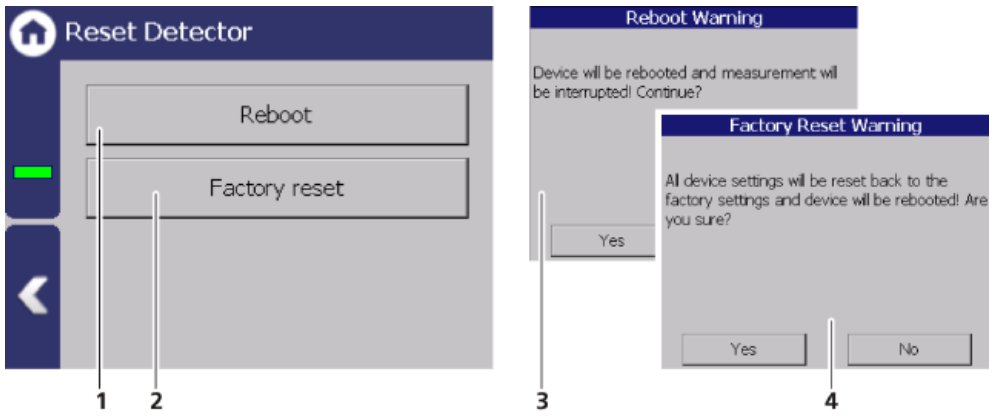
▶ The event description appears.

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

Detector Settings: Detector Service | Reset Detector

Device Setup | 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 < Reboot >
2 Button < Factory reset >
3 Window "Reboot Warning"
4 Window "Factory Reset Warning"

Fig. 61 Reset Detector

IMPORTANT

The measurement is interrupted during a restart!

1. To restart the Detector, click the button <Reboot> (Fig. 61, item 1).
   ▶ A window with “Reboot Warning” (Fig. 61, 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!

3. To reset the detector to the factory settings, click the button <Factory reset> (Fig. 61, item 2).
   ▶ A window with “Factory Reset Warning” (Fig. 61, item 4) opens.
4. Click on <Yes> to confirm.
   ▶ The device is reset to factory settings and restarts.

7.3.3 Calibration

Device Setup | Setup | Calibration

The calibration menu is used for adaption of the measurement system to the respective environmental conditions, the actual radiation source activity and the adaptation of the background radiation (background level). In that menu the two individual calibration curves can be created. Furthermore, important settings can be made in the context of the compensation features "Product Buildup Compensation (PBC)" and "Gas Property Compensation (GPC)".

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 a loss of production or to damage in the system.
- We encourage you to have the calibration and commissioning performed by Berthold service.

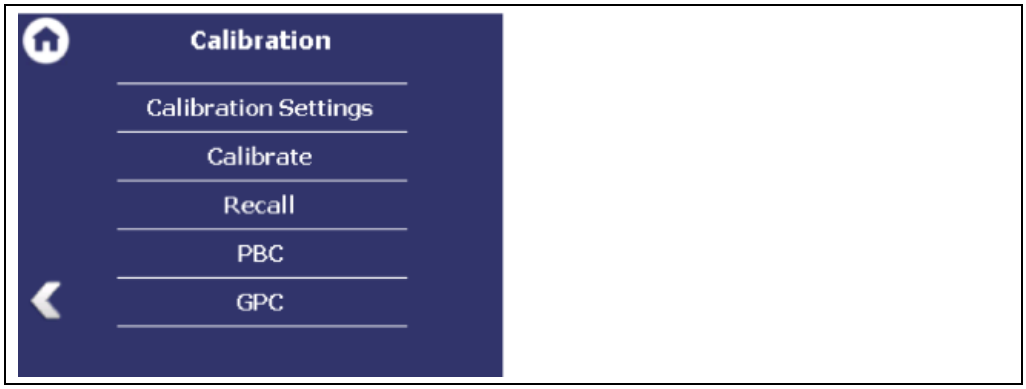


Fig. 62 Menu “Calibration”

Calibration Settings

Device Setup | Setup | Calibration | Calibration Settings

This menu is divided into "Basic Setup", "Compensated Level" and "Uncompensated Level". In "Basic Setup", general settings such as the measuring length, the background count rate and the nuclide are entered or counted in, while in "Compensated Level" and "Uncompensated Level" the settings of the two individual calibration curves are made.

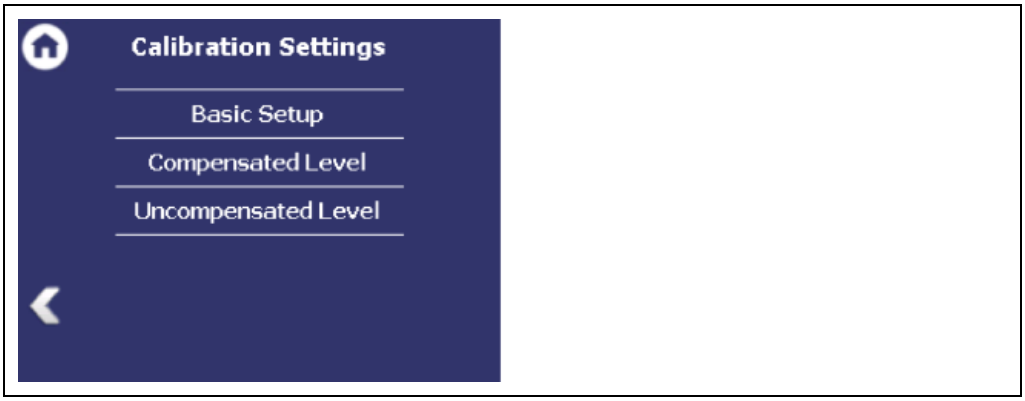


Fig. 63 Calibration Settings

Basic Setup

Device Setup | Setup | Calibration | Calibration Settings | Basic Setup

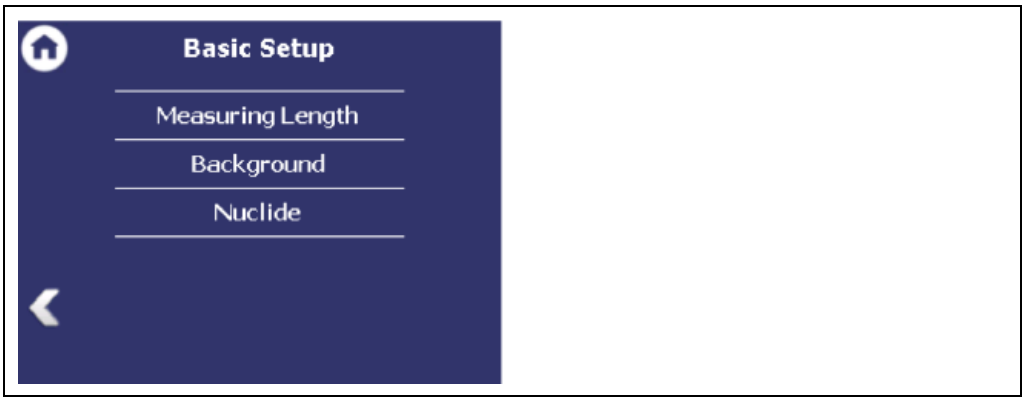


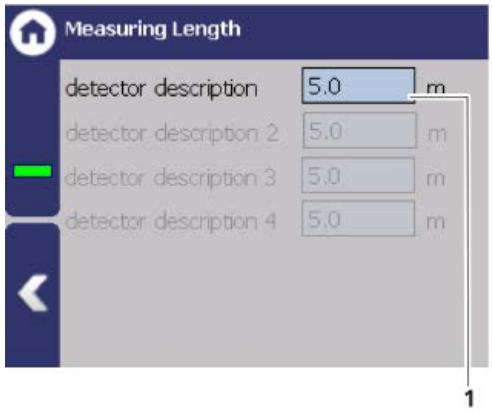
Fig. 64 Basic Setup

Basic Setup: Measuring Length

Device Setup | Setup | Calibration | Calibration Settings | Basic Setup | Measuring Length

In this menu the length of the scintillator of the individual detector (when using a rod detector) or the measuring length assigned to the individual detector (when using a rod source / point detector arrangement) is entered (Fig. 65, item 1). For the correct entry, note the dimensions in the Technical Information of the respective detector or source. In case of a TowerSENS detector, the total scintillator length including the lengths of the installed extension modules needs to be entered.

In this menu the measuring length of each level detector, which was added to the system (see 7.3.2), needs to be set. For this purpose, a dedicated field is displayed for each registered level detector (indicated in Fig. 65).



1 Input field “Measuring length” [m]

Fig. 65 Measuring length

If more than one level detector is configured, they are listed one below the other with the respective input fields as in Fig. 65 shown transparently.

Basic Setup: Background

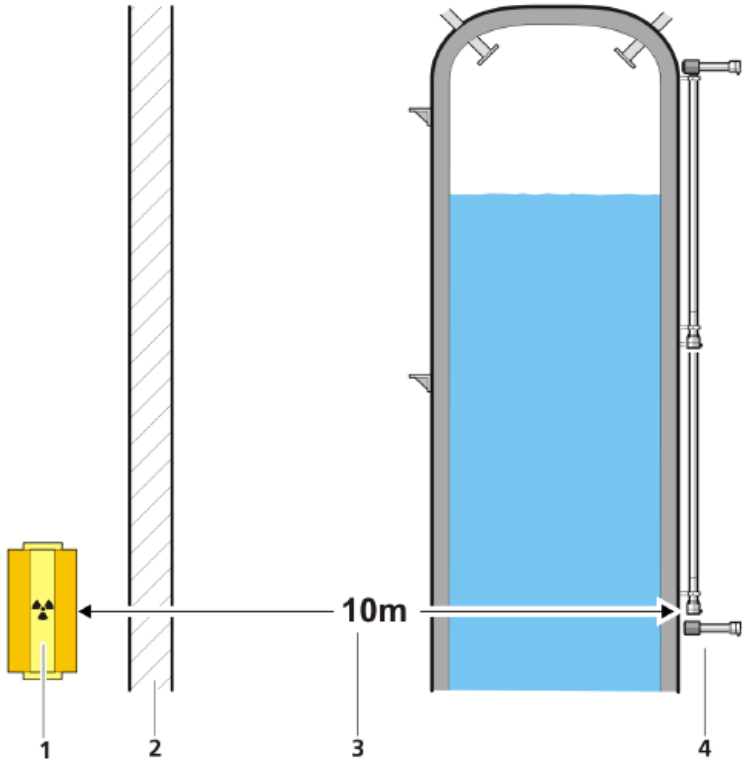
Device Setup | Setup | Calibration | Calibration Settings | Basic Setup | Background

The background count rate (Fig. 67, item 1) is the natural background radiation detected by the detector. This count rate is compensated for by the system and must be determined for every added level detector (see Fig. 70).

NOTICE

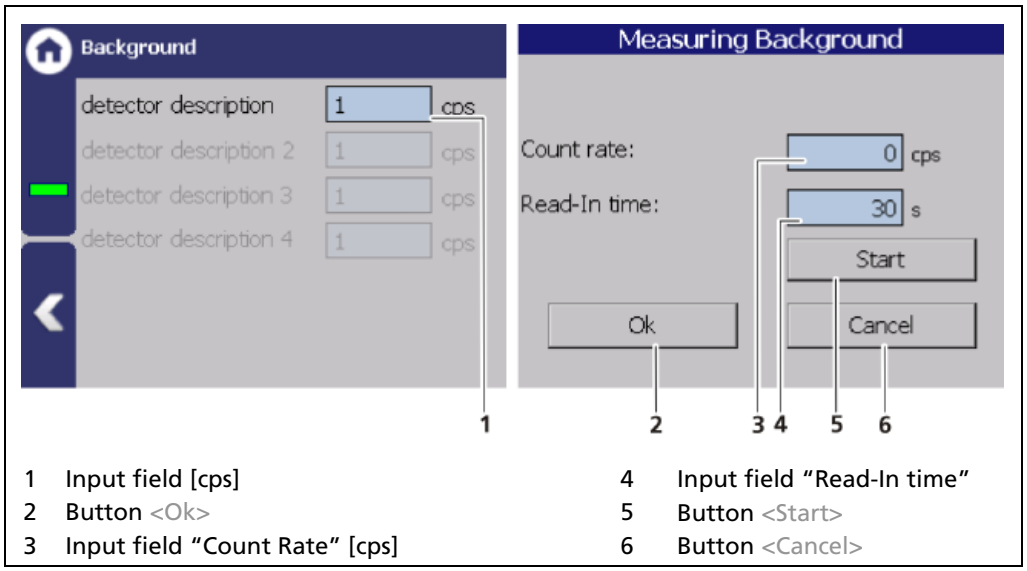
A closed shield results in measurable residual radiation, which can falsify the measurement of the background radiation.

- In the case of measuring arrangements with point sources, during the determination of the background, it is recommended to place the shield including the source at a suitable distance (approx. 10 m), or behind a thick concrete wall.
- To avoid calibration errors, it must be ensured that during calibration and commissioning of the measuring equipment no welding tests are being done on site, even at long distance.



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

Fig. 66 Conditions during background determination



1	Input field [cps]	4	Input field “Read-In time”
2	Button <Ok>	5	Button <Start>
3	Input field “Count Rate” [cps]	6	Button <Cancel>

Fig. 67 Calibration Parameters: Background

If more than one level detector is configured, they are listed one below the other with the respective input fields as in Fig. 67 shown transparently.

Determine Background

1. Click on the input field (Fig. 67, item 1).

▶ A new window “Measuring Background” opens to determine the background count rate of the individual level detector.

NOTICE

Influences from neighboring 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.

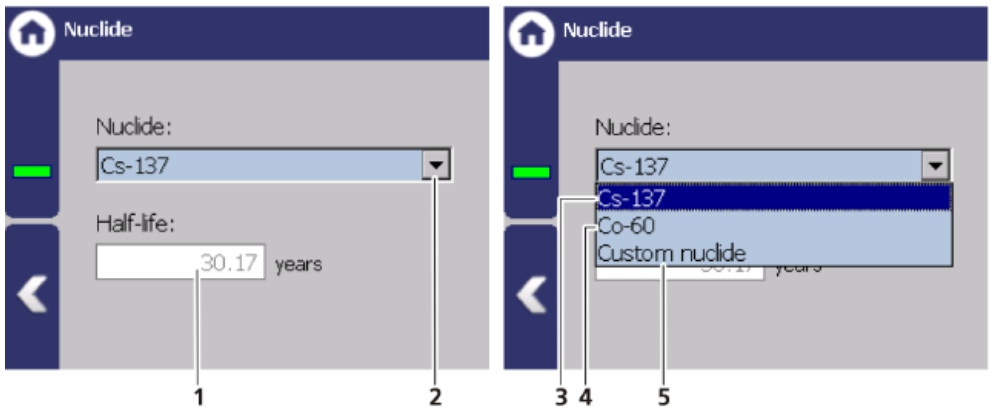
▶ The window closes and the values are accepted.

▶ The background count rate must be determined for each level detector.

Basic Setup: Nuclide

Device Setup | Setup | Calibration | Calibration Settings | Basic Setup | Background

The isotope used for the level measurement can be selected in the “Nuclide” tab. This selected isotope is also used in the software for decay compensation of the count rate measured at the PBC trigger detector, if used. The half-life of the isotope is shown on the display field (Fig. 68, item 1).



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

Fig. 68 Calibration Parameters: Nuclide

1. Click on the selection arrow (Fig. 68, item 2).
2. Select the isotope used. Cs-137 (Fig. 68, item 3) or Co-60 (Fig. 68, item 4). The isotope of the source is on the type plate of the source (Fig. 69). Note the operating manual of the shield.
3. When selecting “Custom nuclide” (Fig. 68, item 5), the half-life of the isotope can be entered.

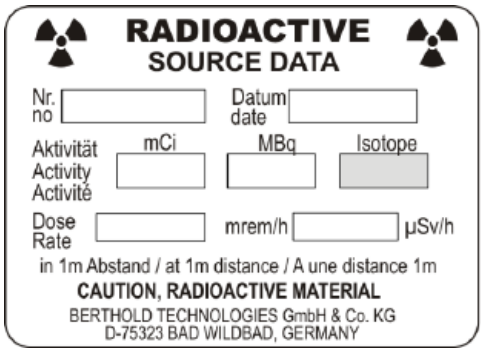


Fig. 69 Type Plate Source

Calibration Settings: Table

Device Setup | Setup | Calibration | Calibration Settings | Compensated Level | Detector

Device Setup | Setup | Calibration | Calibration Settings | Uncompensated Level | Detector

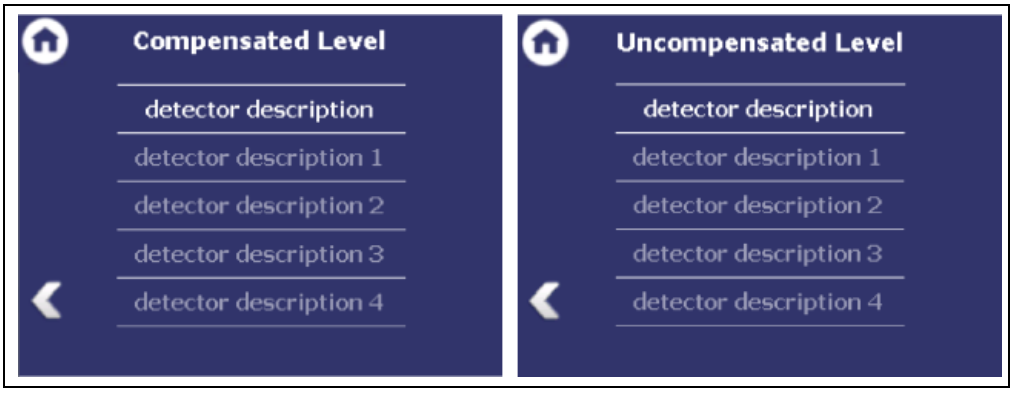


Fig. 70 Submenus Compensated Level / Uncompensated Level (list of configured level detectors)

General Information

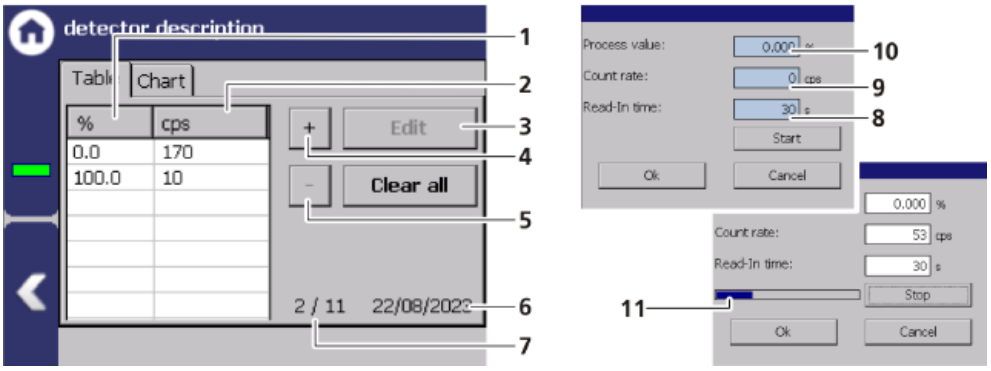
To monitor both, the "Compensated Level" and the "Uncompensated Level", the calibration points must be set for every connected level detector in both submenus “Compensated Level” and “Uncompensated Level”.

NOTICE

To avoid calibration errors, it must be ensured that during calibration and commissioning of the measuring equipment no welding tests are being done on the site, even at long distance.

IMPORTANT

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



1	Column count rate [%]	7	Number of calibration points (max.11)
2	Column count rate [cps]	8	Read-In-Time [s]
3	Button <Edit>	9	Count rate [cps]
4	Button Add measuring point < + >	10	Process value [%]
5	Button Delete point < - >	11	Measuring process (elapsed measuring time)
6	Date of the last editing		

Fig. 71 Parameters for Compensated and Uncompensated Level (Table)

Add new calibration point

1. Click on the button < + > (Fig. 71, item 4).

▶ A window with input fields (Fig. 71, item 8-10) opens.

2. Click on the input field “Process value” (Fig. 71, item 10) to open the input field.
3. Specify the current, actual level in percent (0% or 100 %) and confirm with the Enter key.
4. Click on the input field “Read-In-Time” (Fig. 71, item 10) to open the input field.
5. Specify a read-in time and confirm with the Enter key.
6. Click on the button <Start>.

▶ The count rate is determined and the elapsed measuring time is shown (Fig. 71, item 11).

▶ The count rate is transferred to the field “Count Rate” (Fig. 71, item 9) after the measurement time has elapsed.

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

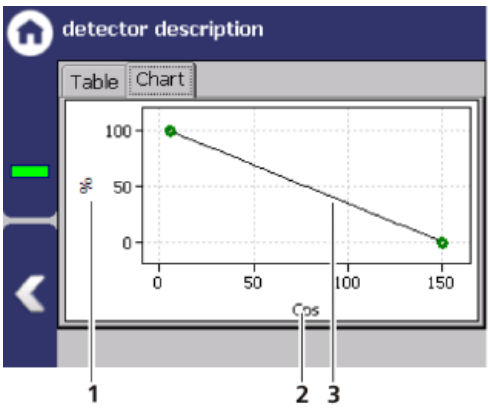
▶ The new calibration point is recorded in the table. Add further measuring points (max. 11) to the table in the same way.

Calibration Settings: Chart

Device Setup | Setup | Calibration | Calibration Settings | Compensated Level | detector description

Device Setup | Setup | Calibration | Calibration Settings | Uncompensated Level | detector description

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



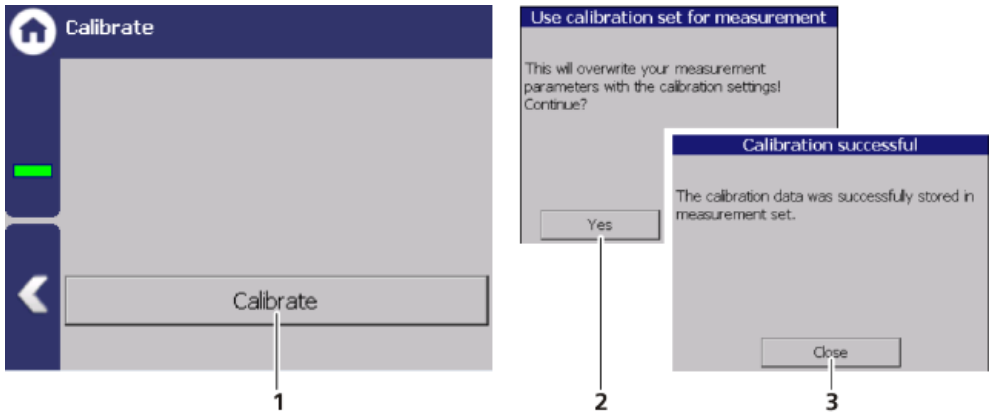
1 Axis level [%]
2 Axis count rate [cps]
3 Characteristic chart

Fig. 72 Calibration Parameters (exemplary chart)

Calibrate

Device Setup | Setup | Calibration

All the data and selections entered and set in the "Calibration Settings" are transferred to the measurement parameter set when the button “Calibrate” is clicked. Only after this action the settings can be used for measurement value calculation.



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

Fig. 73 Calibrate

1. Click on the button <Calibrate> (Fig. 73, item 1).
   - A new window with the message “Use calibration set for measurement” appears.
2. Click on the <Yes> button (Fig. 73, 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. 73, item 3)
   - The calibration was performed.

NOTICE

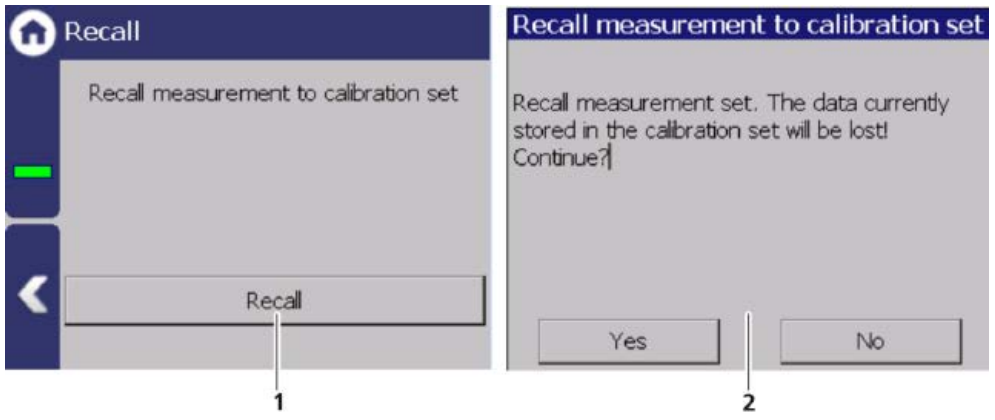
Check your calibration by simulating a detector count rate. Use the test count rate in the simulation menu.

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 Setup | Setup | Calibration | Recall

In the "Recall" menu, the saved measurement parameters can be loaded into the calibration set.



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

Fig. 74 Recall

Recall to calibration set

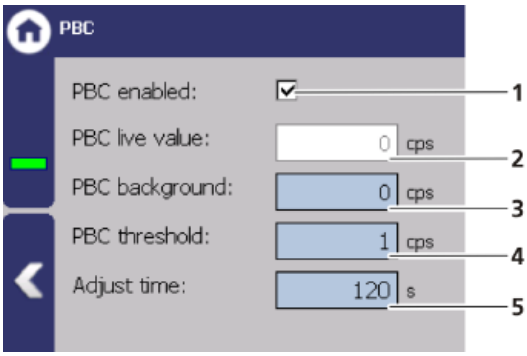
1. Click on the button <Recall> if you want to copy the measurement set into the calibration set.
2. The window with the message “Recall measurement to calibration set” appears.
3. Click on <Yes>.

▶ The calibration set was overwritten.

PBC

Device Setup | Setup | Calibration | PBC

In the “PBC” menu, the Product Buildup Compensation can be activated, the background can be determined and the parameters of the PBC trigger detector are set.

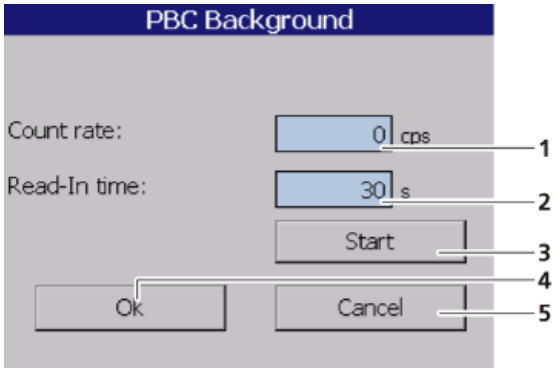


1 Checkbox “PBC enabled”
2 Display field “PBC live value”
3 Input field “PBC background”
4 Input field “PBC threshold”
5 Input field “Adjust time”

Fig. 75 PBC

PBC enabled	If the check box “PBC enabled” (Fig. 78, item 1) is activated, product buildups will be compensated.
PBC live value	Display field of the currently measured values of the PBC trigger detector.
PBC threshold	Input field for the count rate at which the PBC trigger detector is triggered. Only when the threshold count rate is exceeded (e.g. when the vessel is empty) the PBC trigger detector signals the connected level detectors the command to do a lower adjust. The detectors repeat to do lower adjustments as long as the threshold at the PBC trigger detector is exceeded. When selecting this threshold, potential product buildup on the walls of the vessel must be taken into account. Accordingly, the threshold should not be set too high, since product buildups would reduce the count rate at the detector. Thus, a count rate that is set too high could become unattainable during operation and the lower adjust would not be triggered.
PBC background	The background count rate indicates the natural background radiation measured by the PBC trigger detector if no radiation source is installed. This count rate is compensated by the system.
Adjust time	Input field for the time interval of the lower adjustment. When the adjust is performed, the measurement parameter set was overwritten. After each time interval a lower adjust at the level detectors is performed. This process is repeated as long as the PBC threshold count rate is exceeded.

Determine PBC Background



1 Input field count rate [cps]
2 Input field Read-In time [s]
3 Button <Start>
4 Button <Cancel>
5 Button <Ok>

Fig. 76 PBC Background

1. Click on the input field "PBC background" (Fig. 75, item 3).

▶ A new window "PBC Background" opens to determine the background radiation (Fig. 76).

2. Click on the “Read-In time” fiel d 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.

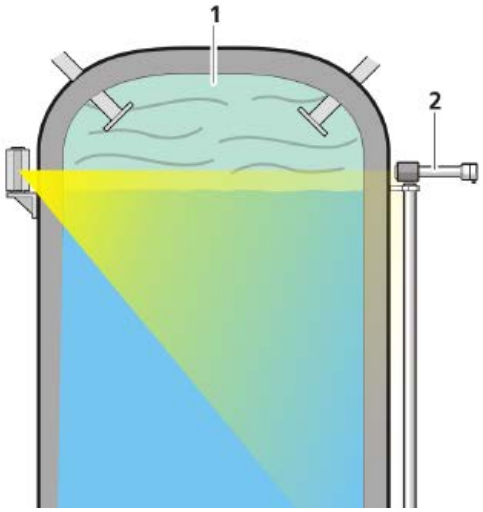
IMPORTANT

The value of the count rate can be entered manually (Fig. 76, item 1), if a determination of background radiation without interference radiation effects is not possible.

GPC[1]

Device Setup | Setup | Calibration | GPC

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



1 Gas
2 Point detector (GPC)

Fig. 77 GPC measurement with point detector

NOTICE

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

You can make the following settings in the submenu GPC (gas properties compensation) (Fig. 78):

- GPC Calibration
  - Reference rate
  - Background
  - GPC Time constant
  - Factor M Calibration
- GPC Nuclide Settings
- GPC Auto-Deactivation
- Reset GPC Settings

NOTICE

An additional compatible Berthold detector for measuring the Gas Density is absolutely necessary for the Gas Property Compensation. The detector is connected to the level measurement via a slave module or a 7-Wire/RS485-repeater module.

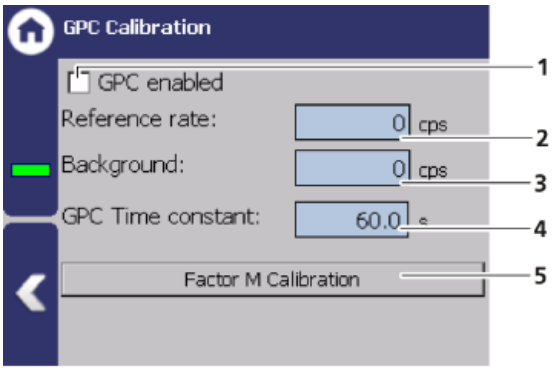
[1] GPC = Gas Property Compensation

Fig. 78 Submenu „GPC“

GPC Calibration

Device Setup | Setup | Calibration | GPC | GPC Calibration

"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. 79, item 1) can only be selected when a detector is configured for gas density measurement.



1 Check box “GPC enabled”
2 Input field “Reference rate” [cps] for the detector under calibration conditions[2]
3 Input field Background (background) [cps]
4 GPC Time constant [s]
5 Factor M Calibration

Fig. 79 GPC Calibration

NOTICE

The vessel must be empty during the entire process of GPC calibration!

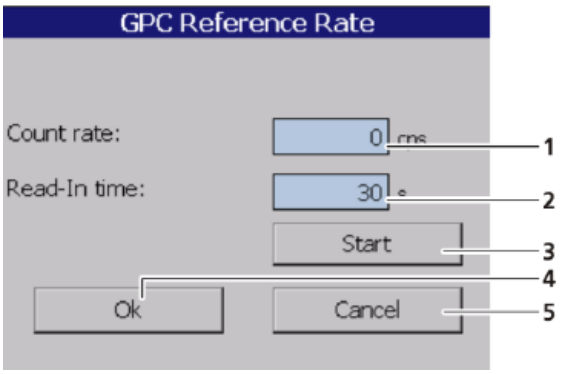
[2] Calibration conditions exist when the gas density is the same as in the calibration of the level measurement.

GPC Calibration: Reference Rate

The reference count rate measured at the GPC detector 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 (Fig. 79, item 2) to read in the reference count rate.

NOTICE

To determine the reference count rate of the GPC detector, there must be a constant gas density (calibration conditions) in the vessel.



1 Input field count rate [cps]
2 Input field Read-In time [s]
3 Button <Start>
4 Button <Cancel>
5 Button <Ok>

Fig. 80 GPC Reference Rate

Determine Reference Rate

1. Click on the input field “Reference rate” (Fig. 79, item 2).

▶ A new window “GPC Reference Rate” opens (Fig. 80).

2. Click on the “Read-In time” field (Fig. 80, 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.

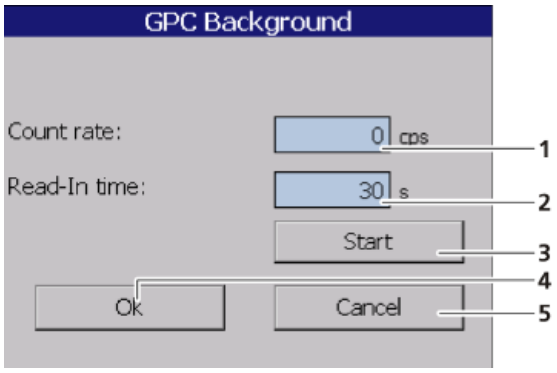
4. Click on <OK> to accept the count rate.

IMPORTANT

The value of the count rate may be entered manually (Fig. 80, item 1), if a determination of the unique reference count rate is not possible.

GPC Calibration: Background

The background count rate (Fig. 79, item 3) indicates the natural background radiation of the gas density detector if no radiation source is installed. This count rate is compensated by the system.



1 Input field count rate [cps]
2 Input field Read-In time [s]
3 Button <Start>
4 Button <Cancel>
5 Button <Ok>

Fig. 81 GPC calibration background

Determine Background

5. Click on the input field "Background" (Fig. 79, item 3).

▶ A new window "Background" opens to determine the background radiation (Fig. 81).

6. 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.

7. Confirm with the Enter key and click on the button <Start> to start the measurement.

▶ The measurement is performed.

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

IMPORTANT

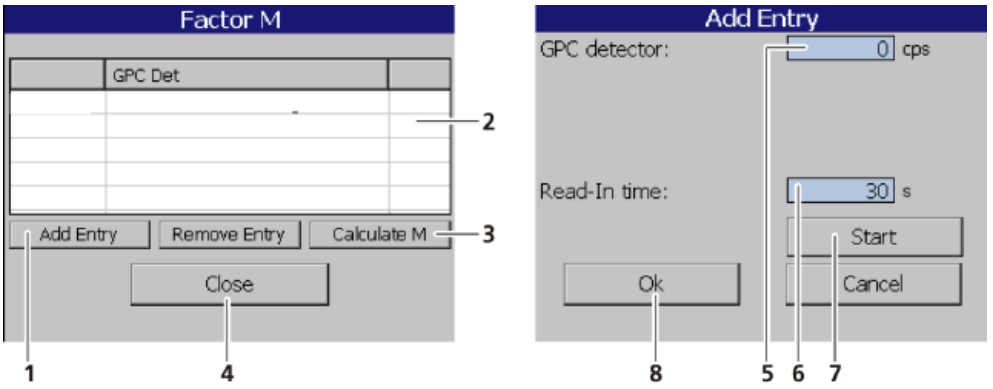
The value of the count rate can be entered manually (Fig. 81, item 1) if a determination of background radiation without interference radiation effects is not possible.

GPC Calibration: GPC Time Constant

The reaction time of the measured value can be set in the input field "GPC Time Constant" (Fig. 79, item 4). The measurement reacts quickly to rapid process changes for a small time constant. 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.

GPC Calibration: Factor M Calibration

To calculate the correct factor M, click on the button “Factor M Calibration” (Fig. 79, item 5). In this table the first calibration point can be inserted directly from the available data with the button <Add Entry>. At least one more point is required to calculate a factor M. This second point is ideally taken at the highest occurring gas density. Further calibration points with other gas densities improve the accuracy of Factor M. With the button <Calculate M> the factor M is calculated from the table values. No adjustment needs to be performed for standard applications.



1 Button <Add Entry>
2 List GPC count rates
3 Button <Calculate M>
4 Button <Close>
5 Input field “GPC detector” (manual adding count rate)
6 Read-In time [Seconds]
7 Button <Start>
8 Button <Ok>

Fig. 82 GPC calibration: calculate Factor M

Read in the Count Rates

IMPORTANT

If it is not possible to capture the count rates, the values may be entered manually into the input field (Fig. 82, item 5).

1. Click on the <Add Entry> button (Fig. 82, item 1) to add a new point.

▶ A new window “Add Entry” appears.

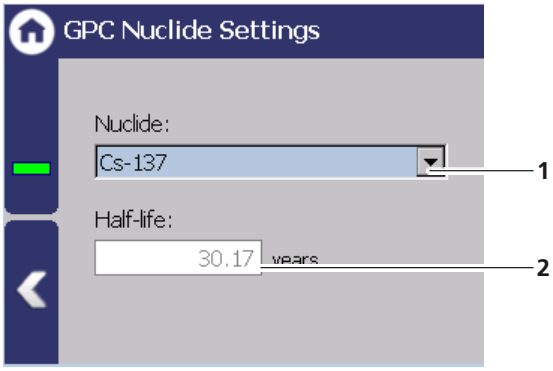
2. Enter a count rate value into the input field (Fig. 82, item 5).
3. Click on the input field “Read-In time” (Fig. 82, item 6) and enter a measurement time. Confirm with the Enter key.
4. Click on the button <Start> (Fig. 82, item 7). Make sure that the vessel is empty.
5. Repeat the capture for at least another gas density/gas pressure.
6. Click the button <Calculate M> (Fig. 82, item 3) to determine Factor M from the count rate.

▶ 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. 79, item 1).

GPC Nuclide Settings

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

Under "GPC Settings" the isotope of the source for gas density measurement can be selected (Fig. 83, item 1). The half-life time of the isotope is shown in the display field (Fig. 83, item 2). It is possible to set different nuclides for GPC and level measurement.



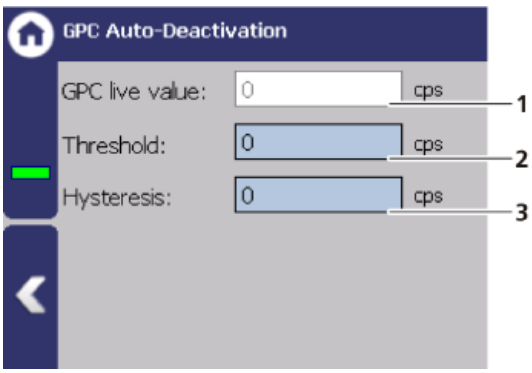
1 Selection arrow “Nuclide”
2 Display field “Half-life” [years]

Fig. 83 GPC Nuclide Settings

GPC Auto-Deactivation

Device Setup | Setup | Calibration | GPC | GPC Auto-Deactivation

With the GPC Auto-Deactivation function, the GPC is disabled (Fig. 79, item 1) when the count rate determined by the GPC detector is below the set threshold.



1 Display field “GPC live value”
2 Threshold
3 Hysteresis

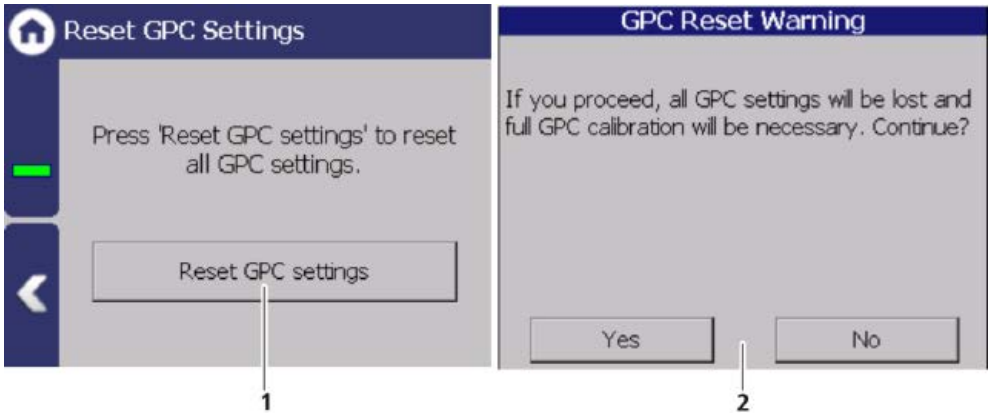
Fig. 84 GPC Auto-Deactivation

GPC Auto-Deactivation threshold	Input field for the count rate at which GPC Auto-Deactivation should be triggered. The GPC feature, if activated, is automatically deactivated, when the count rate measured by the GPC detector drops below the set threshold.
GPC Auto-Deactivation hysteresis	The GPC Auto-Deactivation hysteresis is defined as the tolerance range which occurs at a predefined threshold of the count rate.

Reset GPC Settings

Device Setup | Setup | Calibration | GPC | Reset GPC Sttings

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



1 Button <Reset GPC settings>
2 Window “GPC Reset Warning”

Fig. 85 Reset GPC Settings

1. Click on the button <Reset GPC settings> (Fig. 85, item 1).

▶ A confirmation message (Fig. 85, item 2) appears.

2. Click on <Yes> to set all values to “Default”, click on <No> to cancel.

7.3.4 Measurement

Device Setup | Setup | Measurement

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

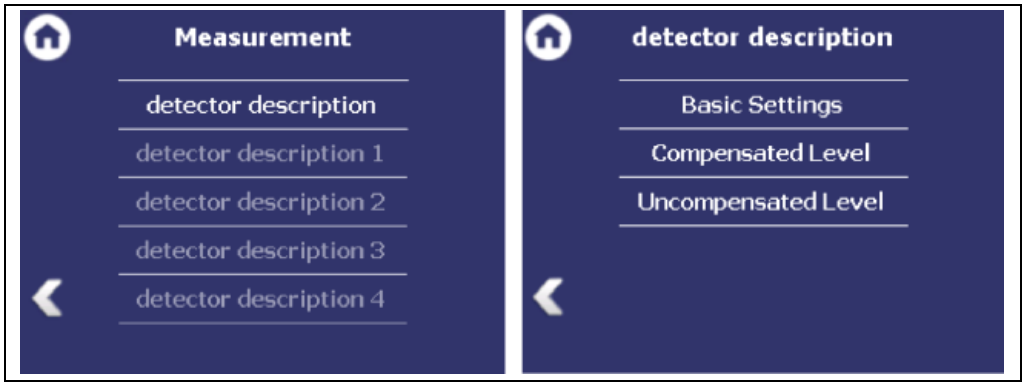
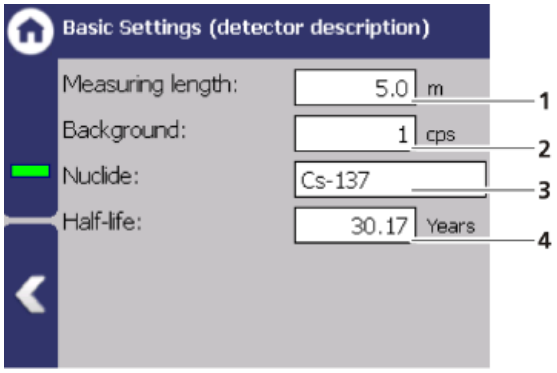


Fig. 86 Menu “Measurement” (list of configured level detectors) and submenus

Basic Settings

The parameters and values of the measuring length, the background, the nuclide and the associated half-life are displayed in this submenu.



1 Display field “Measuring length”
2 Display field “Background”
3 Display field “Nuclide”
4 Display field “Half-life”

Fig. 87 Basic Settings

Measurement: Parameters, Table, Chart

The parameters used for the current measurement are displayed in the submenus “Compensated Level“ and “Uncompensated Level“. The parameters in all tabs are entered and set in the “Calibration” menu (see chapter 7.3.3)

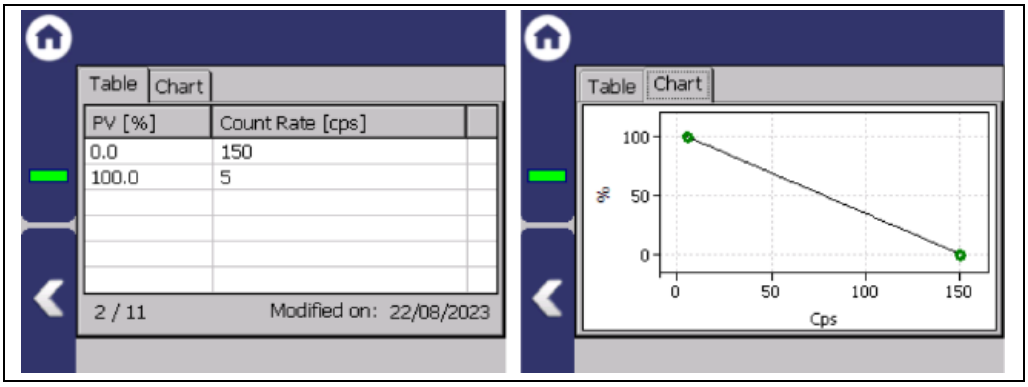


Fig. 88 Measurement (Table, Chart)

7.3.5 Signal Condition

Device Setup | Setup | Signal Condition

You can perform the following settings and read information in the “Signal Condition” submenu:

- Damping (Time Constant)
- XIP (X-Ray interference protection)
- Source Replacement

Fig. 89 Menu “Signal Condition”

Signal Condition: Damping

Device Setup | Setup | Signal Condition | Damping

The reaction time of the measurement can be set in the window “Damping”. The measurement reacts quickly to rapid process changes 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.

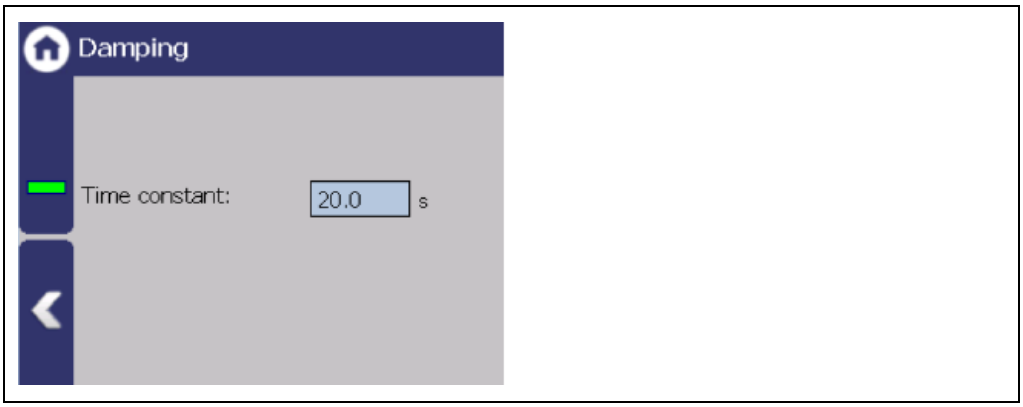
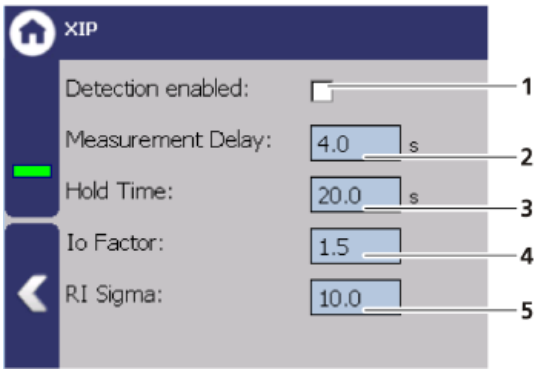


Fig. 90 Damping

Signal Condition: XIP (X-Ray Inteference Protection)

Device Setup | Setup | Signal Condition | XIP

Radiation interference is X-ray or gamma radiation from any source other than the one intended for the measurement. Radiation interference can cause process value falsification. To protect the measurement from radiation interfenrece the function XIP can be activated. Rapid and strong count rate increases are considered in this cause. If the detection is activated (Fig. 91, item 1), the last valid process value is frozen during the event of radiation interference. Once no more radiation interference is detected, the value is released again.

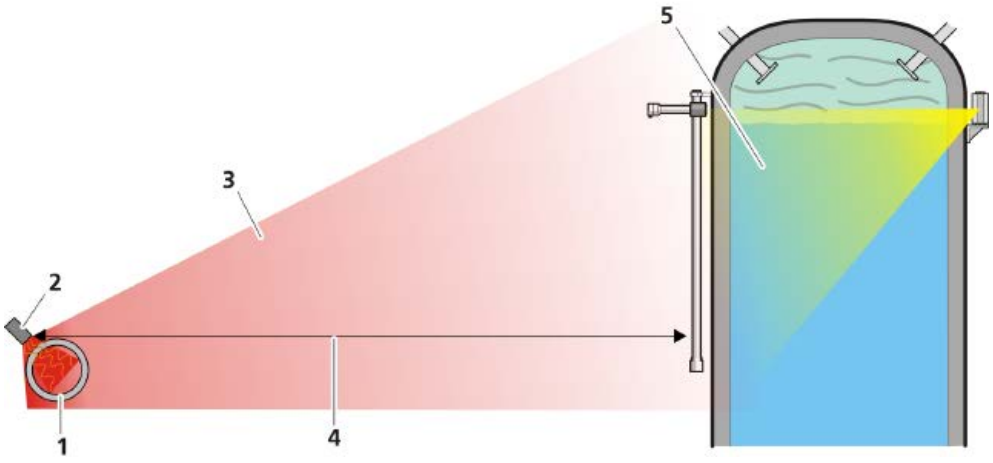


1 Check box the “Activate detection”
2 Input field measurement delay
3 Input field hold time
4 Input field I_O factor
5 Input field RI Sigma

Fig. 91 XIP

Measurement delay [s]	To avoid early measurement falsification due to radiation interference, not the most current value can be displayed. The delay time is freely selectable between 0 and 5 seconds.
Hold time [s]	The last valid measurement value is frozen for a given time after detection of radiation interference.
I_0 factor	The “I_0 factor” determines the threshold value (multiple of the empty count rate or low calibration point) in order to detect strong radiation interference.
RI Sigma	A sudden increase in the count rate is an indication of radiation interference. The sensitivity in detection of this sudden increase can be set in this menu. 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 for a level switch measurement with point source and point detector, then it is recommended to set the value to 999 to deactivate the sigma function. Otherwise it is possible that an XIP alarm is triggered when the value falls below the level value.

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. 92 Interference radiation during weld inspection

Detecting Interference Radiation

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

The alarm is triggered by:

Scenario A - Maximum possible count rate (multiple of the empty or low calibration)

$$I_s > I_0 * 1.5$$

I_s = current count rate in cps integrated over one second
I_0 = maximum count rate at empty or low 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.

$$I_s > I_m + n * \text{Sigma}$$

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

Further information on scenario A

A relative level value is monitored, i.e. the alarm threshold is reached when exceeding a maximum dose rate (multiple of calibration value at empty vessel or of low calibration point) at the detector.

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

Further information on scenario B

A differential level value is monitored, i.e. each rapid increase 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:

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

Example:

Count rate I_m = 300 cps, n = 6

$$I_s = I_m + n \times \sqrt{I_m}$$

$$I_s = 300 \text{ cps} + 6 \times \sqrt{300 \text{ cps}} = 404 \text{ cps}$$

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

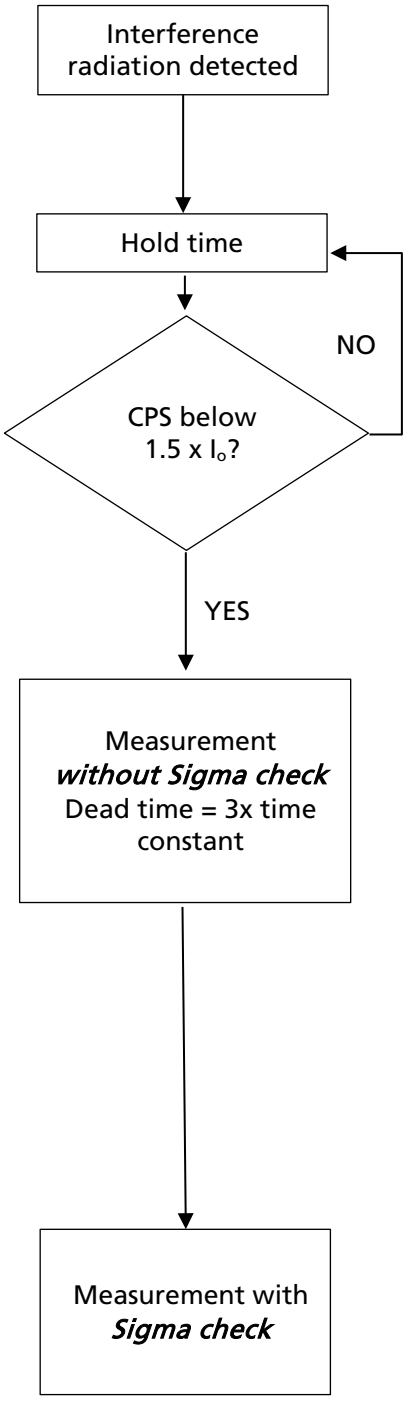
IMPORTANT

Due to the dynamic behavior of XIP, 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 radiation interference. 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 radiation 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 XIP at first, but only after the 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 hold time.

At the end of the hold time the system checks if the detected count rate is smaller than the set multiple of the calibrated empty count rate (I_o) (see scenario A). If not, the set hold time starts again.

If the count rate is below the multiple of the empty count rate, the measurement automatically switches to the RUN mode. Sigma detection (see scenario B) is disabled for 3-times the set time constant (Signal Conditions: Damping) (=dead time).

Example:
If the time constant 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 exceeds the multiple of the empty count rate or the low calibration point.

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

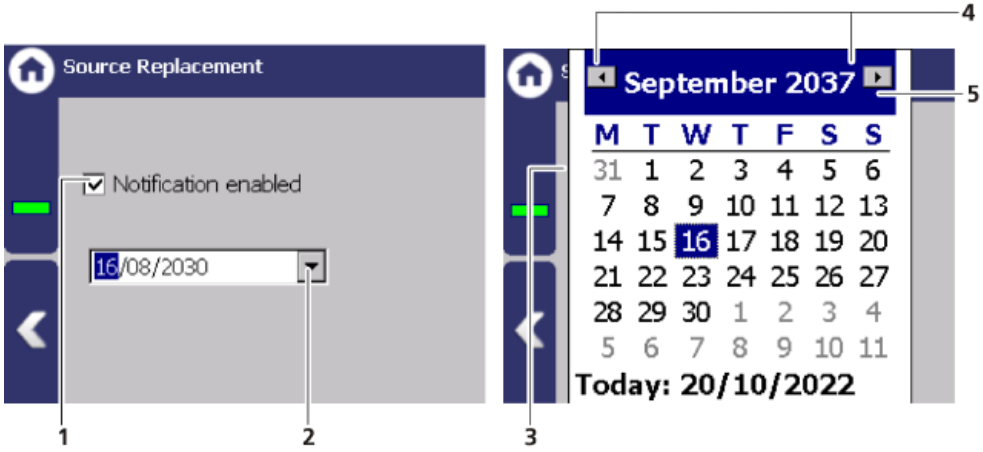
Signal Condition: Source Replacement

Device Setup | Setup | Signal Condition | Source Replacement

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

NOTICE

For radiation protection reasons, a source replacement is recommended after 15 years.



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

Fig. 93 Source replacement

Setting Source Replacement Date

1. Activate the check box (Fig. 93, item 1).
2. Click on the arrow key (Fig. 93, item 2) in order to set the date.

▶ The calendar is opened.

3. Click on the year (Fig. 93, item 5) to select the year by using 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 Setup | Setup | Inputs

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

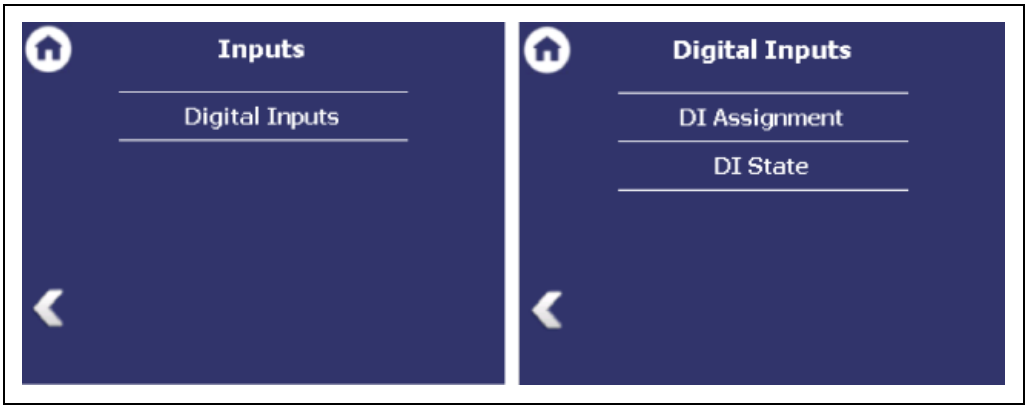
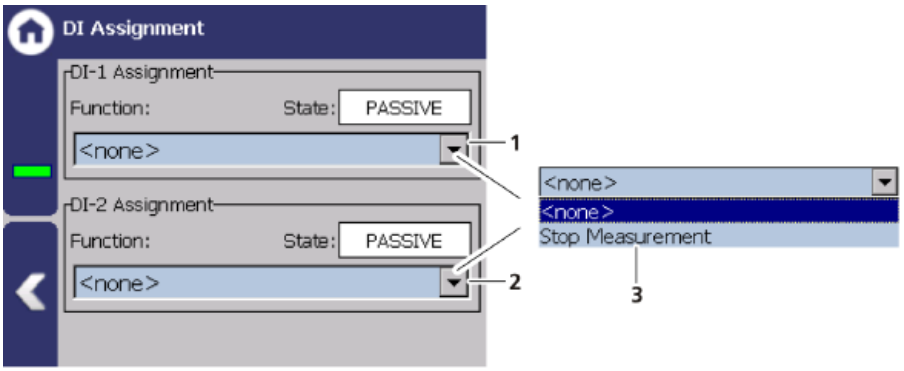


Fig. 94 Menu "Inputs"; Submenu "Digital inputs (DI)"

Digital Inputs Assignment

Device Setup | Setup | Inputs | Digital Inputs | DI 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.



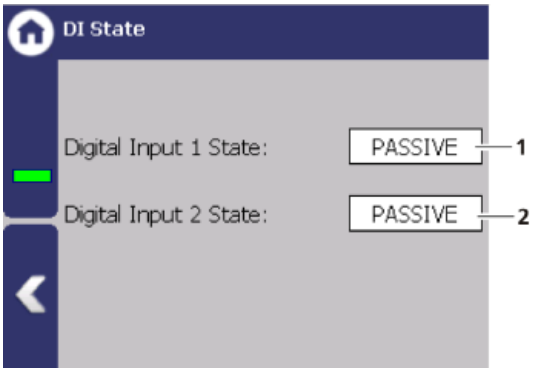
1 DI-2 Assignment: Selection of function
2 DI-1 Assignment: Selection of function
3 Function "Stop Measurement"

Fig. 95 DI Inputs Assignment

Digital Inputs State

Device Setup | 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. 96 DI Input State

7.3.7 Outputs

Device Setup | Setup | Outputs

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

- Analog Output (AO)
  - AO Mapping
  - AO Monitoring
  - AO Failure Mode
  - AO Limits
  - AO Calibration
- Digital output (DO)
  - Alarm DO-2 Assignment
  - Alarm DO-3 Assignment
- Additional Outputs

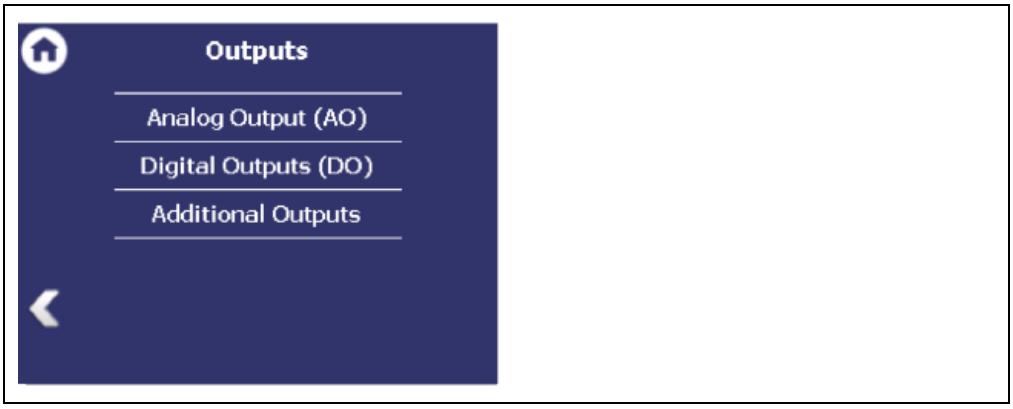


Fig. 97 Menu “Outputs”

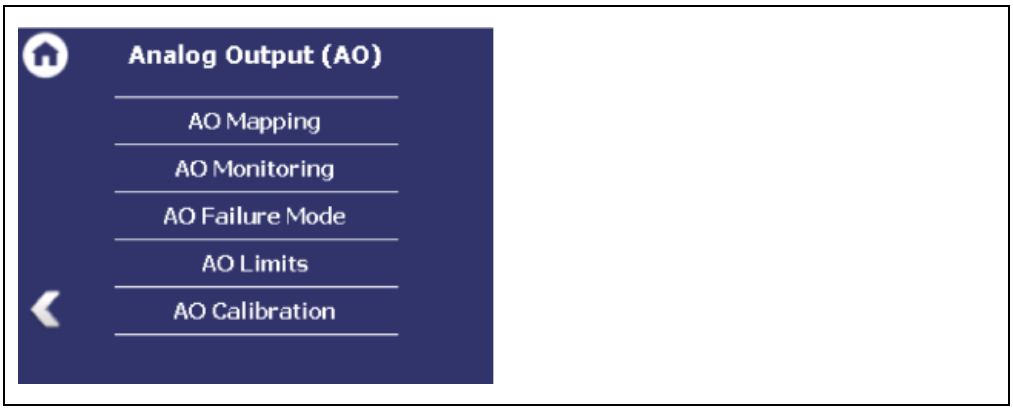
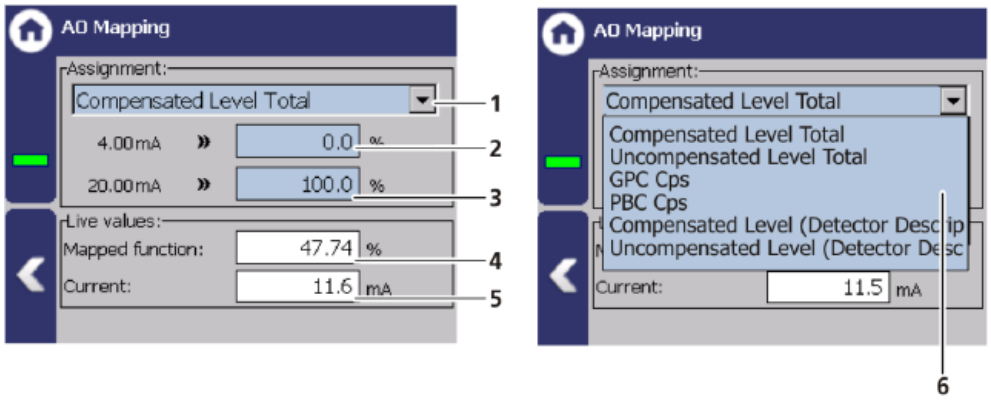


Fig. 98 Submenu “Analog Output (AO)”

Analog Output: AO Mapping

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

A function can be assigned to an analogue output in the window “AO Mapping”. The current output signal is between 4 mA and 20 mA. The corresponding percent value (e.g. Compensated Level Total) can be freely assigned.



1 Selection arrow “Assignment”
2 Input field 4.00 mA [%]
3 Input field 20.00 mA [%]
4 Display field “Live value” Mapped function [%]
5 Display field “Live value” Current [mA]
6 Selection Assignment[3]

Fig. 99 Analog Output Mapping (Assignment)

The lower and upper limit of the process range can be set in input field (Fig. 99, Item 2, item 3). These limits define the signal range of the analog current output (4 ... 20 mA). If required, the current output can also be set inversely (e.g. 4 mA = 100%, 20 mA = 0%).

Compensated Level Total	The lower and upper limit of the total compensated level measurement.
Uncompensated Level Total	The lower and upper limit of the total uncompensated level measurement.
GPC Cps	Enter a Cps range that outputs the GPC count rate at the current output.
PBC Cps	Enter a Cps range that outputs the PBC count rate at the current output.
Compensated Level Detector (detector description)	The lower and upper limit of the level detector measurement.
Uncompensated Level Detector (detector description)	The lower and upper limit of the level detector measurement.

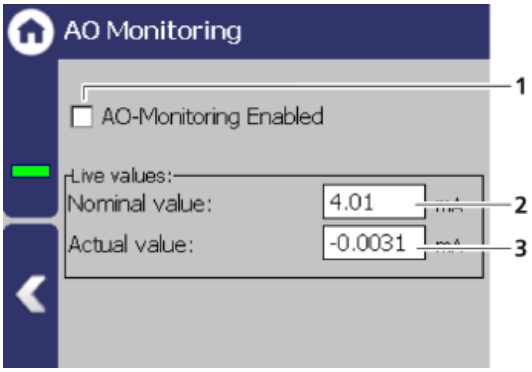
[3] The selection expands by each additional connected level detector.

Analog Output: AO Monitoring

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

If “AO Monitoring” is activated (Fig. 100, 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 current loop, an error message is triggered.



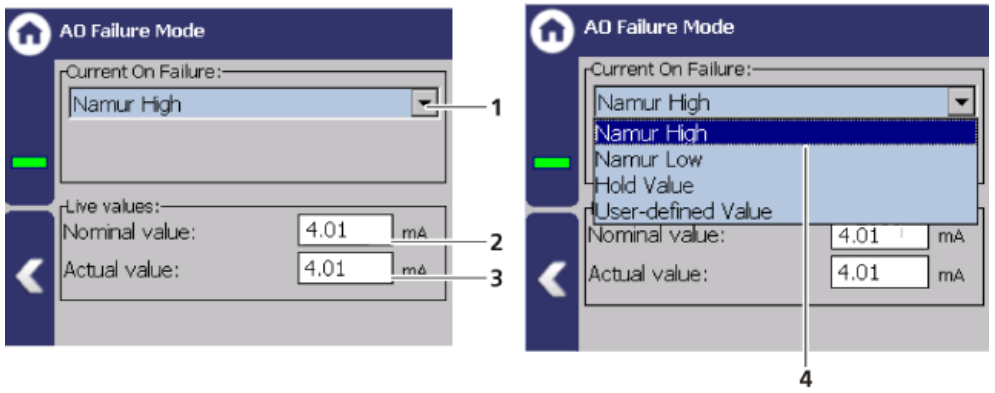
1 Activate check box “AO-Monitoring Enabled”
2 Target value [mA]
3 Actual value [mA]

Fig. 100 Analog Output Monitoring

Analog Output: AO Failure Mode

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

The alarm function is set when an error is detected at the current output in the window “AO Failure Mode”.



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

Fig. 101 Analog Output (AO Failure Mode)

The following behavior 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	If "user-defined" is selected, an input field appears under the drop-down menu in which the value [mA] can be entered 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.

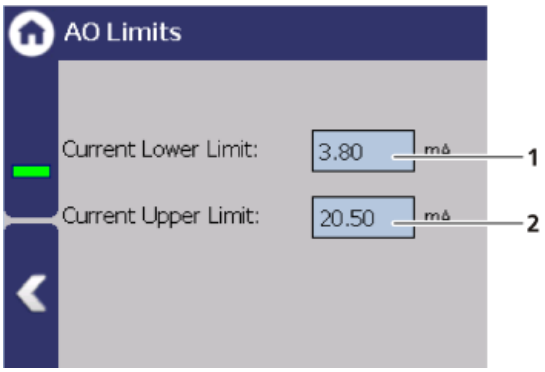
NOTICE

The set behavior is automatically applied to the current outputs of the Current Output/HART module.

Analogue Output: AO Limits

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

By clicking on the input fields (Fig. 102, 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 Current lower limit [mA]
2 Input field Current upper limit [mA]

Fig. 102 Analog Output (AO Limit)

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

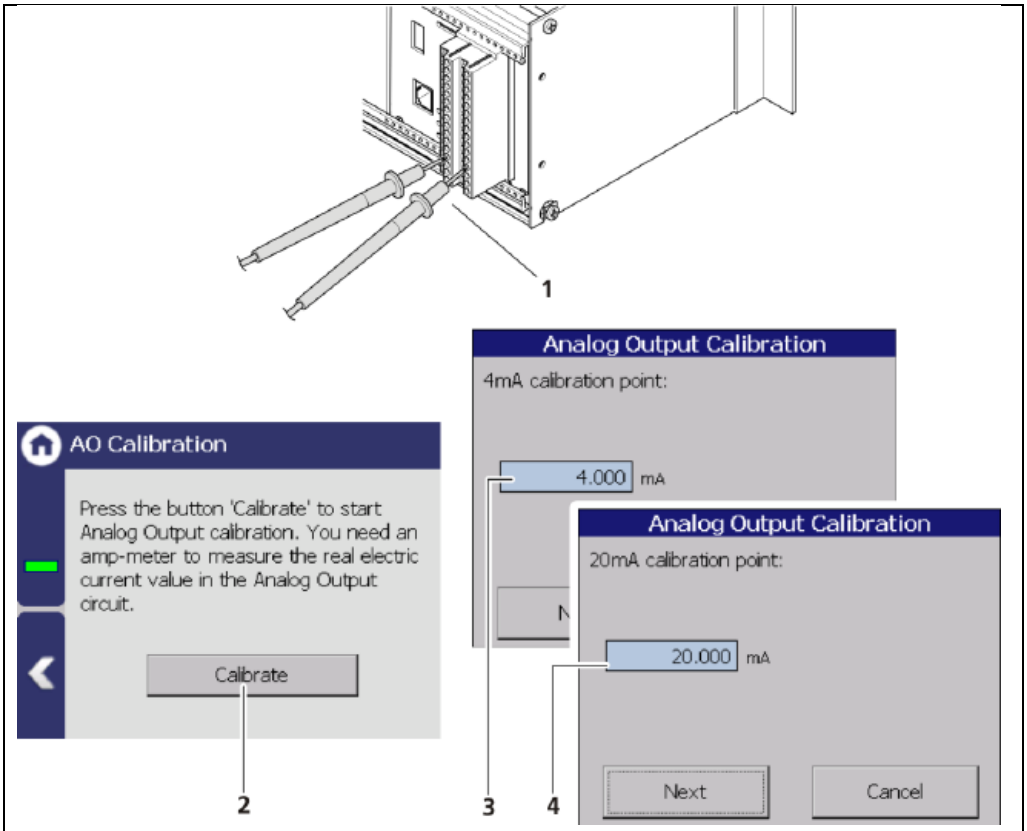
Device Setup | Setup | Outputs | Analog Output (AO) | AO Calibration

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	Test leads at the terminal block	3	Input field 4 mA Calibration point
2	Button <Calibrate>	4	Input field 20 mA Calibration point

Fig. 103 Analog Output (Calibration)

Perform Calibration

⚠ DANGER

Danger to life from electric shock!

- The calibration may only be carried out by a qualified electrician.
- Observe the relevant safety regulations.
- Only open the device when free of voltage.

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

1. Connect the test leads (Fig. 103, item 1) of the ammeter to the analog current output terminals on the rear of the EVU. Observe the terminal allocation in chapter 2.1 in the document “Technical Information”.

2. Click on the button <Calibration> (Fig. 103, item 2).

▶ 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.

3. Enter the indicated value on the current measuring instrument in the input box (Fig. 103, item 3).

4. Click on the button <Next>.

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

5. Enter the indicated value on the current measuring instrument in the input box (Fig. 103, item 4).

6. Click on the button <Next>.

▶ A message appears “Calibration successful”.

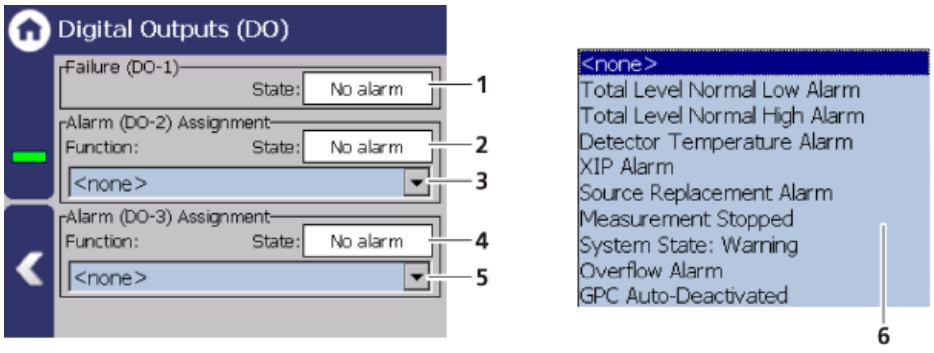
7. Click on the button <Next>.

▶ The calibration of the analog output is completed.

Digital Outputs (DO)

Device Setup | 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 (normally open) contact is opened. The wiring diagrams in the document “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. 104 Digital Outputs

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

Total Compensated Level Low Alarm	The relay alarms when the value at Device Setup | Setup | Alarms | Total Comp. Level Alarm | Settings is below the threshold.
Total Compensated Level High Alarm	The relay alarms if the value under Device Setup | Setup | Alarms | Total Comp. Level Alarm | Settings is exceeded.
Detector Temperature Alarm	The relay alarms when values set at Device Setup | Setup | Alarms | Det.-Temp. Alarm Settings are exceeded or below the threshold.
XIP Alarm	The relay alarms when detection is activated at Device Setup | Setup | Signal processing | XIP and radiation interference was detected, so that the measurement was frozen. See subchapter "Signal Condition: XIP (X-Ray Interference Protection)" in chapter 7.3.5 Signal Condition.
Source Replacement Alarm	The relay alarms when notification at Device Setup | Setup | Signal processing | Source replacement is activated and interference is detected.
Measurement Stopped	The relay alarms on during tests or other states where the measurement is stopped. For example, simulation and detector update.
System State: Warning	The relay alarms when the event message “Warning” is displayed. (Warning includes “Out of specification”, “Function check” and “Maintenance required”).

Overflow Alarm	The relay alarms if the switch point under Device Setup | Setup | Alarms | Overflow Alarm Settings is exceeded taking into account the entered hysteresis.
GPC-Auto-Deactivated	The relay alarms when a threshold is triggered under Device Setup | Setup | Calibration | GPC | GPC Auto-Deactivation

Additional Outputs

Device Setup | Setup | Output | Additional Outputs

The Current Output/HART module is addressed and controlled by the LB 476 system via RS485. 4 current outputs are available, whereby the first current output has HART (read only). Only configured Current Output/HART modules are listed and shown in the menu (Fig. 105).

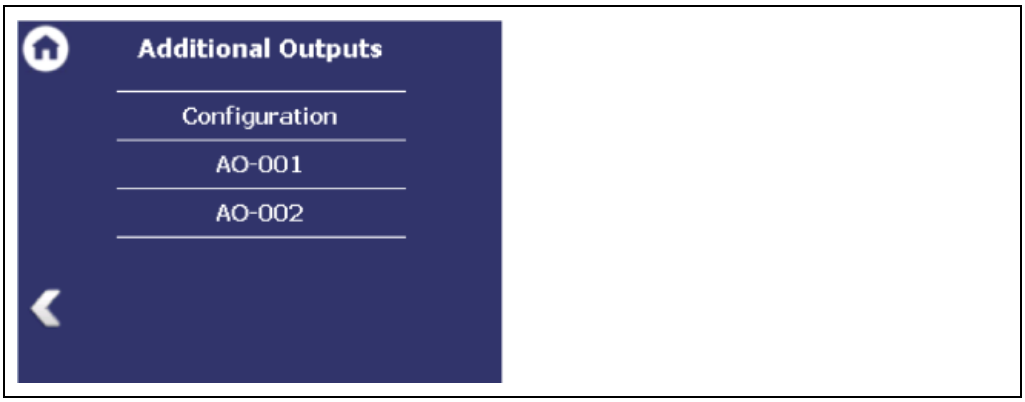
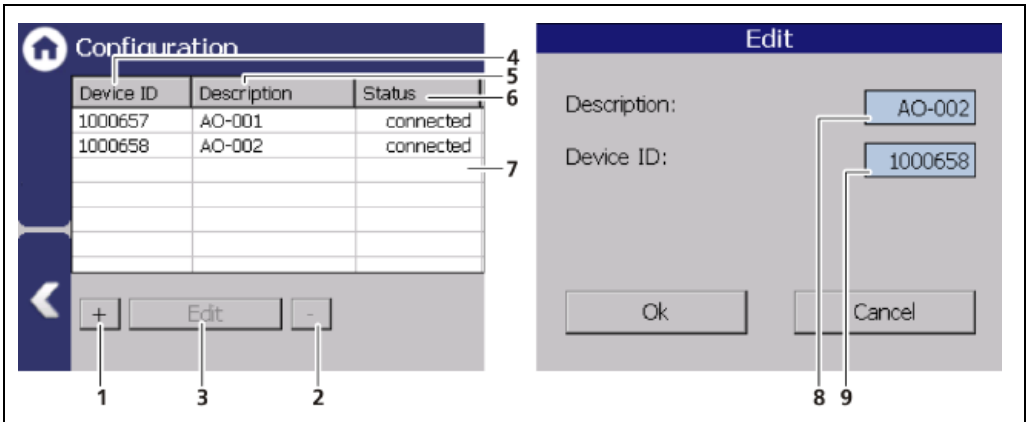


Fig. 105 Menu “Additional Outputs”

Configuration Additional Outputs

Device Setup | Setup | Output | Additional Outputs | Configuration

In the window “Configuration” the Current Output/HART modules for the measuring system are added and configured. Configured Current Output/HART modules are listed and shown in the menu (Fig. 105).



1 Button <+> to add module
2 Button <-> to delete module
3 Button <Edit>
4 Device ID of the module
5 Description of the module
6 Status of the module
7 List of the Current Output/HART modules
8 Input field “Description”
9 Input field “Device ID”

Fig. 106 Configuration Additional Outputs

Clicking the button <Edit> (Fig. 106, item 3) opens the setting of the selected module. Current Output/HART modules can be added manually with the button <+> (Fig. 106, item 1) with their device ID (see type plate on the housing of the Current Output/HART module). Current Output/HART modules can be removed with the button <-> (Fig. 44, item 2).

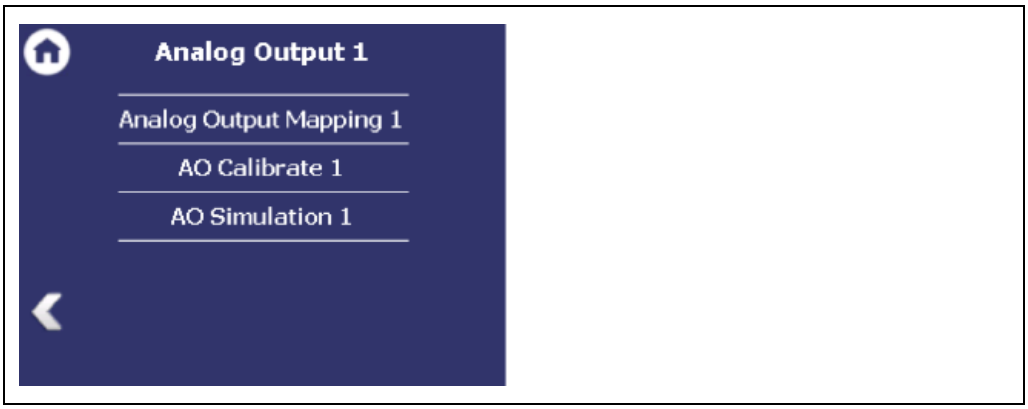


Fig. 107 Submenu Additional Output “Analog Output 1”

The submenus of the additional outputs are identical to the AO submenus Fig. 99 Analog Output Mapping (Assignment) and Fig. 103 Analog Output (Calibration).

7.3.8 Alarms

Device Setup | Setup | Alarms

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

- Total Compensated Level Alarm Behaviour
- Total Compensated Level Alarm Settings
- Overflow Alarm Behaviour
- Overflow Alarm Settings
- Detector Temperature Alarm Behaviour
- Detector Temperature Alarm Settings

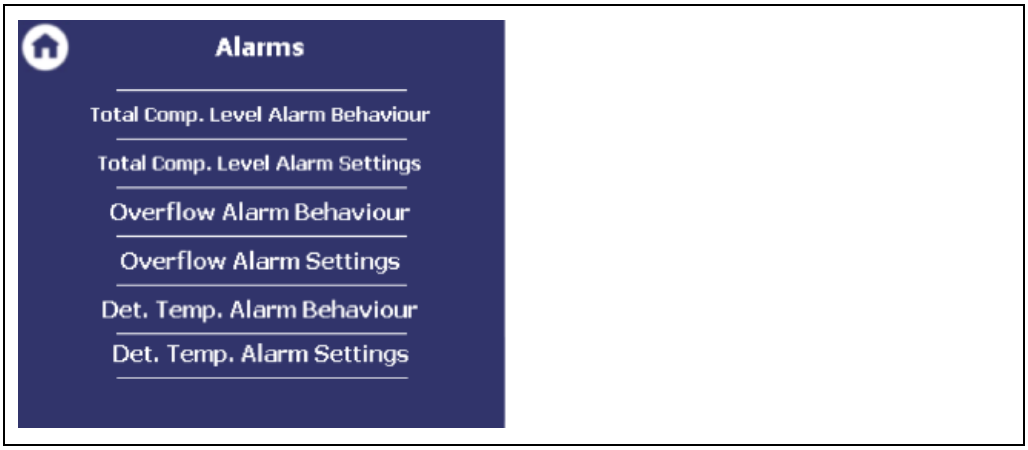
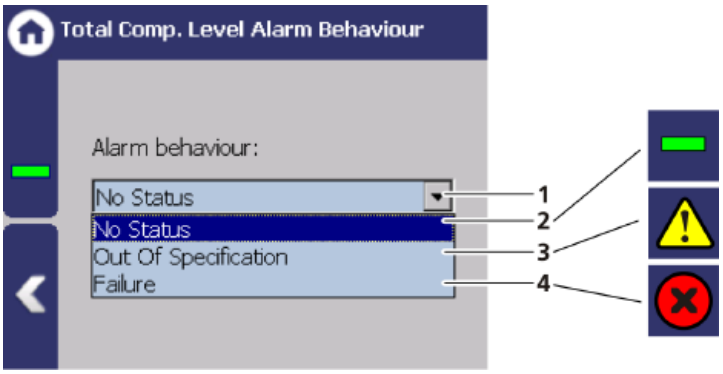


Fig. 108 Menu "Alarms"

Total Compensated Level Alarm Behaviour

Device Setup | Setup | Alarms | Total Compensated Level Alarm Behaviour

The behavior in case of alarm (NE107 Status) for the process value can be set in the window “Total Compensated Level 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 , error current)

Fig. 109 Total Compensated Level Alarm Behaviour

NOTICE

If the alarm function is set to “Failure”, the measurement for the occurrence of an alarm is switched to the error current. Monitoring of the compensated level in the master display is therefore no longer possible.

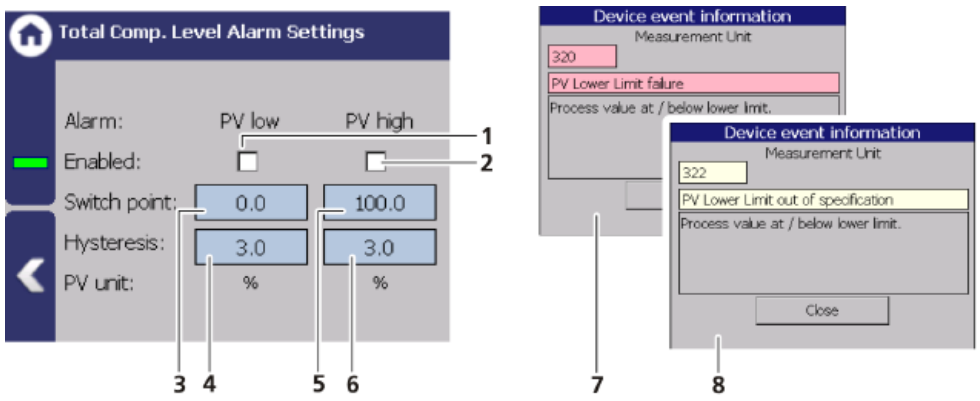
Total Compensated Level Alarm Settings

Device Setup | Setup | Alarms | Total Compensated Level Alarm Settings

You can set the values for the level alarms (max. and min.) and the hysteresis of these in the window “Total Compensated Level Alarm 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. 104, item 6), the relay alarms.

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. 110 Total compensated level alarm settings

Example

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

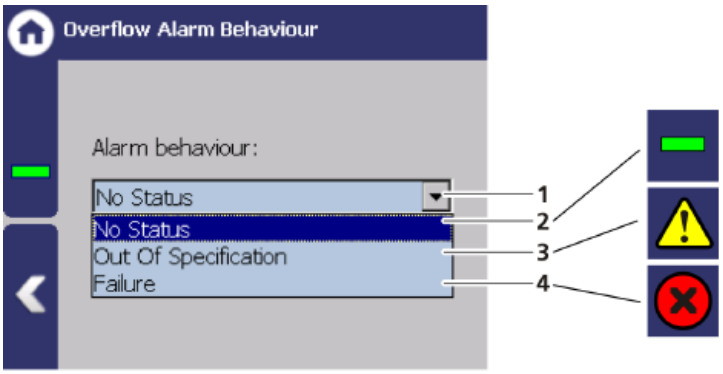
In the event of a rising total compensated level, the max. alarm is triggered when a total compensated level of 85% is exceeded. When the total compensated level falls again, then the alarm does not switch off again until the total compensated level falls below 85% - 5% = 80%.

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

Overflow Alarm Behaviour

Device Setup | Setup | Alarms | Overflow Alarm Settings

The behavior in case of alarm (NE107 Status) for the overflow alarm can be set in the window “Overflow Alarm Behaviour”.



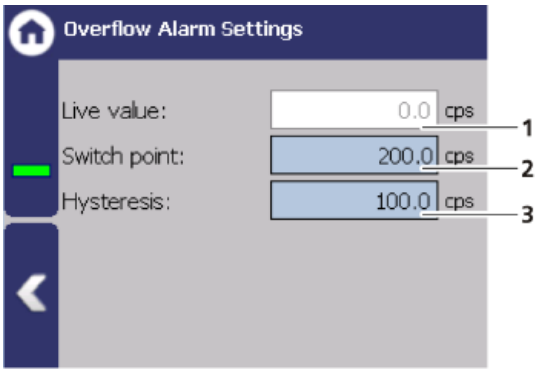
1 Selection arrow NE107 Status
2 Selection “No Status” (no Event Viewer, relay circuit)
3 Selecting “Out Of Specification” (Event Viewer, relay circuit)
4 Selection “Failure” (Event Viewer, the relay circuit , error current)

Fig. 111 Overflow alarm behaviour

Overflow Alarm Settings

Device Setup | Setup | Alarms | Overflow Alarm Settings

When the count rate at the GPC detector falls below the switching point, an event message appears in the status display. If a digital output “Overflow Alarm” is assigned under the function (Fig. 104, item 6), the relay alarms. Hysteresis is defined as the tolerance range of the alarm trigger which occurs at a predefined threshold of the process range.



1 Display field “Live value” [cps]
2 Input field “Switch point” [cps]
3 Input field “Hysteresis” [cps]

Fig. 112 Overflow alarm settings

Example

Switch point = 200 cps, Hysteresis = 100 cps

In the event of an overflow, the overflow alarm is triggered when the count rate of the GPC detector falls below 200 cps. When the count rate rises again, then the alarm does not switch off again until the count rate rises above 200 cps + 100 cps = 300 cps.

Use the following formula to calculate optimal switch point:

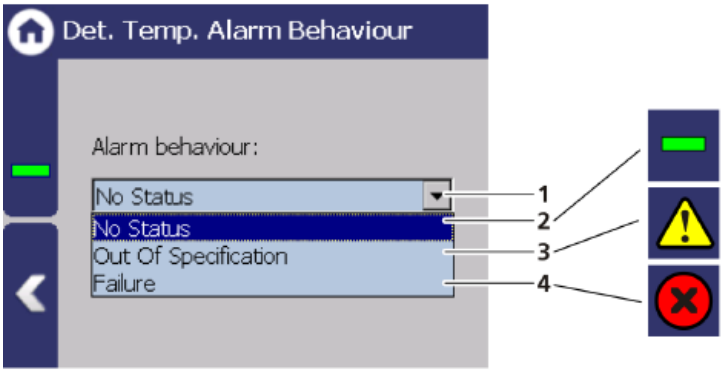
$$I_{SP} = \sqrt{(I_{full} \times I_{empty})}$$

I_{SP} = count rate of switch point
I_{full} = count rate when the vessel is full
I_{empty} = count rate when the vessel is empty

Det.-Temp. Alarm Behavior

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

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



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, errror current)

Fig. 113 Det.-Temp. Alarm Behavior

NOTICE

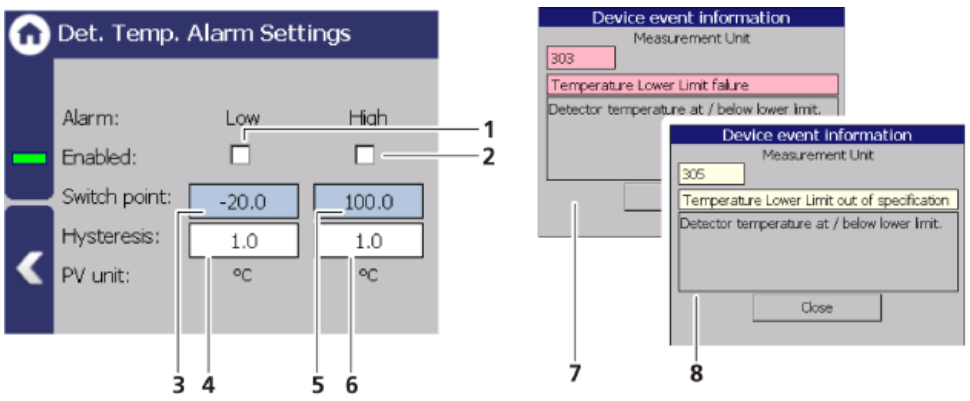
If the detector alarms are set to “Failure”, the measurement is switched in the error current during the occurrence of a temperature alarm. Monitoring of the PV in the master display is therefore no longer possible.

Detector Temperature Alarm Settings

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

The values for the detector temperature (max. and min.) can be set in the window “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 field “Switch point Max.”
2	Selection box “Max. Active”	6	Display field “Hysteresis Max.”
3	Input field “Switch point Min.”	7	Event message “Error”
4	Display field “Hysteresis Min. “	8	Event message “Out of specification”

Fig. 114 Det.-Temp Alarm Settings

Setting max. Temperature Alarm

1. Activate the check box (Fig. 114, item 1).
2. Click on the input field (Fig. 114, item 2) to enter a switching point.
3. Confirm with the Enter key

▶ The value was changed.

Set min. Temperature Alarm

1. Activate the check box (Fig. 114, item 3).
2. Click on the input field (Fig. 114, item 4) to enter a switching point.
3. Confirm with the Enter key

▶ The value was changed.

7.3.9 Simulation

Device Setup | Setup | Simulation

A check for the output functions can be performed in the submenu “Simulation”.

Fig. 115 Menu "Simulation"

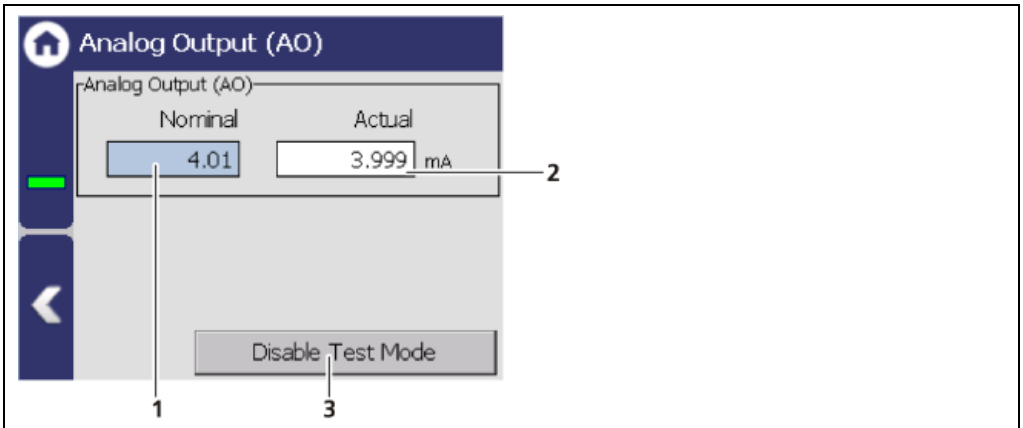
NOTICE

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 (AO)

Device Setup | Setup | Simulation | Analog Output (AO)



1 Input field “Nominal”
2 Display field “Actual” [mA]
3 Button <Disable Test Mode>

Fig. 116 Simulation Analog Output

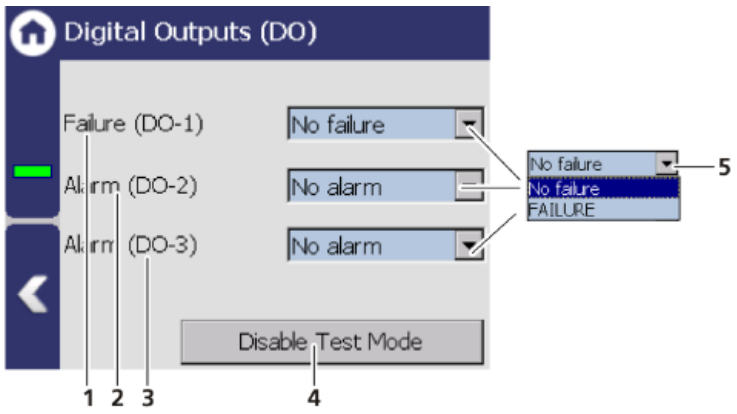
1. Click on the input field (Fig. 116, item 1) and enter the target value for the simulation.
2. Confirm with the Enter key.

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

3. Click on the <Disable Test Mode> button (Fig. 116, item 3) to stop the simulation.

Simulation Digital Outputs (DO)

Device Setup | Setup | Simulation | Digital Outputs (DO)



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

Fig. 117 Simulation Digital Outputs

1. Click on the dropdown field (Fig. 117, item 5) and select "FAILURE" or “ALARM” for the simulation.

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

2. Click on the <Disable Test Mode> button (Fig. 117, item 4) to stop the simulation.

7.4 Menu Backup/Restore

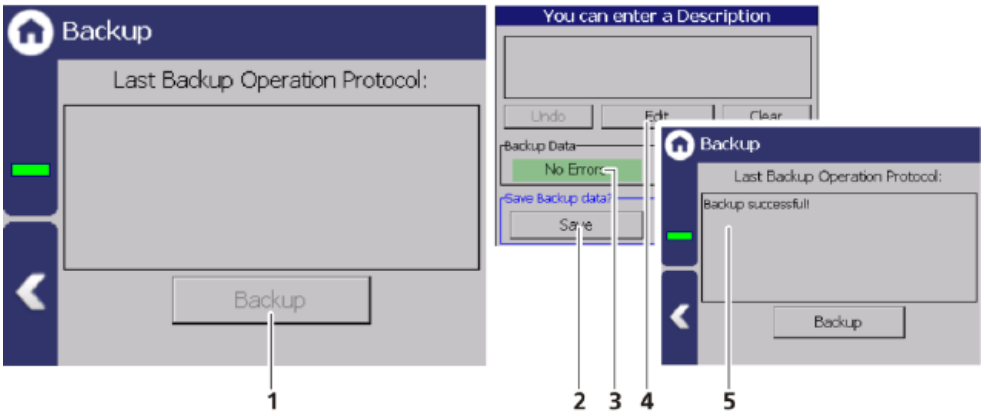
Device Setup | Backup/Restore

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

Fig. 118 Menu "Backup/Restore"

7.4.1 Backup

Device Setup | Backup/Restore | Backup



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

Fig. 119 Backup

Perform Backup

1. Connect a USB storage device to the device.
2. The USB storage device is recognized by the system after a few seconds and the button <Backup> (Fig. 119, item 1) can be clicked.

▶ The read-in time of the USB storage device can be longer if the storage capacity of the USB storage device and the number of data records are high.

3. Click on the button <Backup> (Fig. 119, item 1).

▶ The window "Enter description" appears.

- The message “No Errors” (Fig. 119, item 3) appears in the field “Backup data” for error-free backup files.

4. Click the button <Edit> (Fig. 119, item 4), enter a description, and confirm with the Enter key.
5. Click on the button <Save> (Fig. 119, item 2).

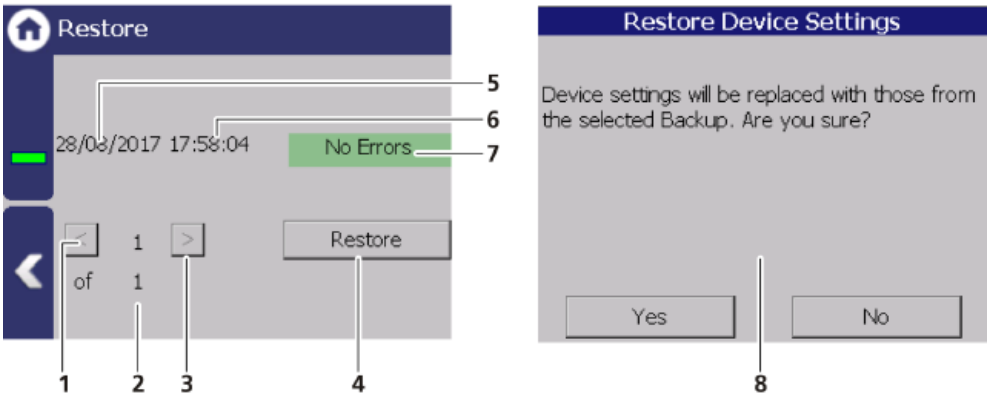
- The backup files are copied to the USB storage device.
- The message “Backup successful” appears after a successful copy process (Fig. 119, item 5).

Information

The backup includes an XML file that is created in the folder “../LB47x/Export/Location_DevID_xxxxxx/LB47x_Backup”. The file name is derived from “Backup”, the date and time (Backup_YYYYMMDD_ hr-min-sec).

7.4.2 Restore

Device Setup | 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. 120 Restore

Executing restore

1. Connect a USB storage device to the device.
2. Select the backup file with the buttons (Fig. 120, item 1,3)

▶ The date and time of the backup is displayed (Fig. 120, item 5, 6). Only error-free (Fig. 120, item 7) backup files can be loaded.

3. Click on the button "Restore" (Fig. 120, item 4).
4. A confirmation message (Fig. 120, item 8) appears.
5. Click on <Yes> to confirm.

▶ The restore of data is carried out.

8 Main Menu Diagnostics

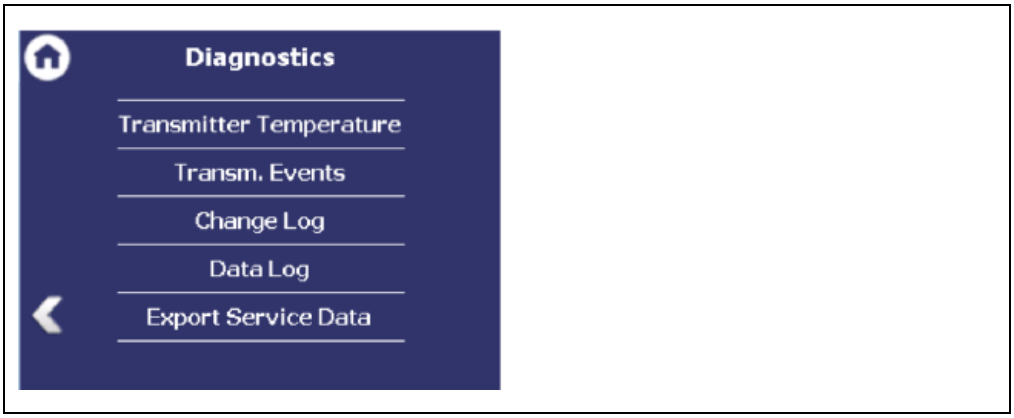
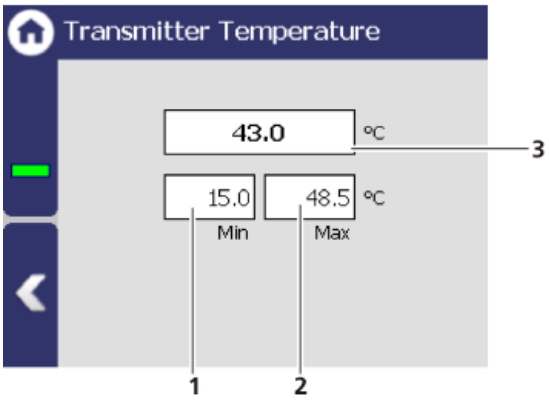


Fig. 121 Menu "Diagnostics"

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 Current value [°C]

Fig. 122 Transmitter Temperature

8.2 Events

Diagnostics | Transm. Events

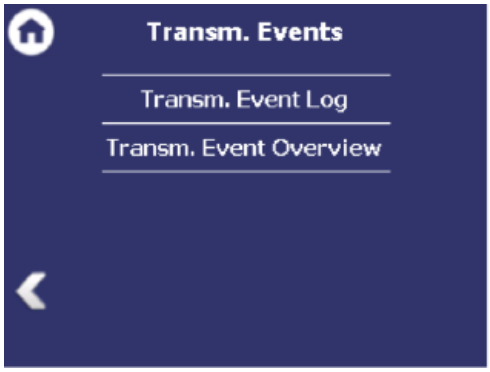


Fig. 123 Menu "Transmitter Events"

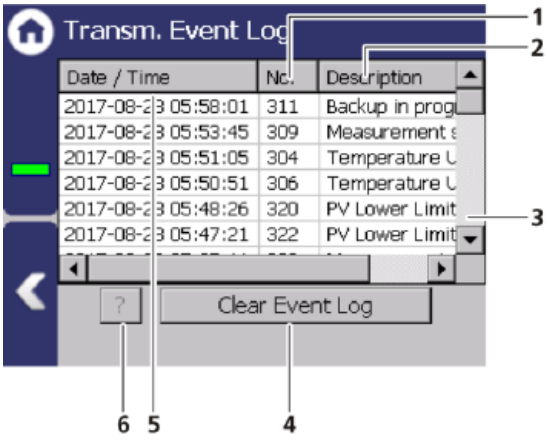
Information

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

8.2.1 Transmitter Event Log

Diagnostics | Transmitter Events | Transmitter Event Log

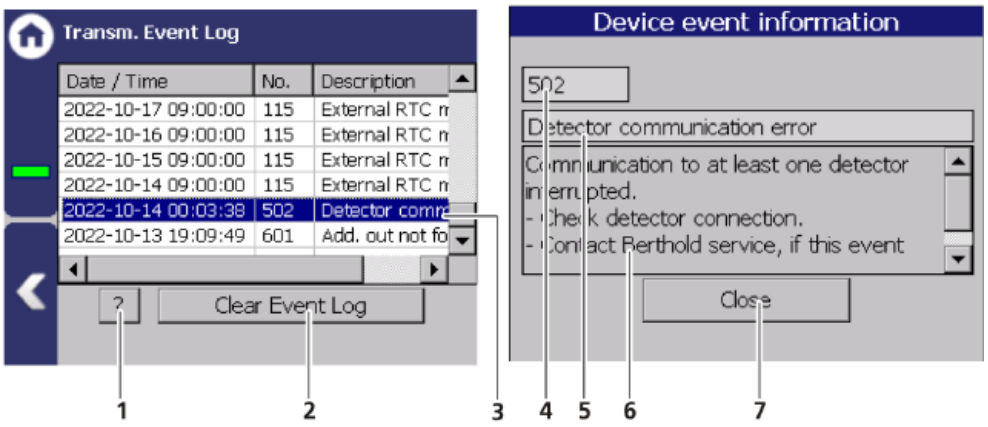
The last 25 events of the transmitter (EVU) are displayed in the window "Transm. Event Log".



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. 124 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. 125 Display an event log information

1. Click on a line in the list (Fig. 125, item 3).
2. Click on <?> (Fig. 125, item 1).

▶ The event description appears.

3. With the button <Close>, close the event description (Fig. 125, item 7).

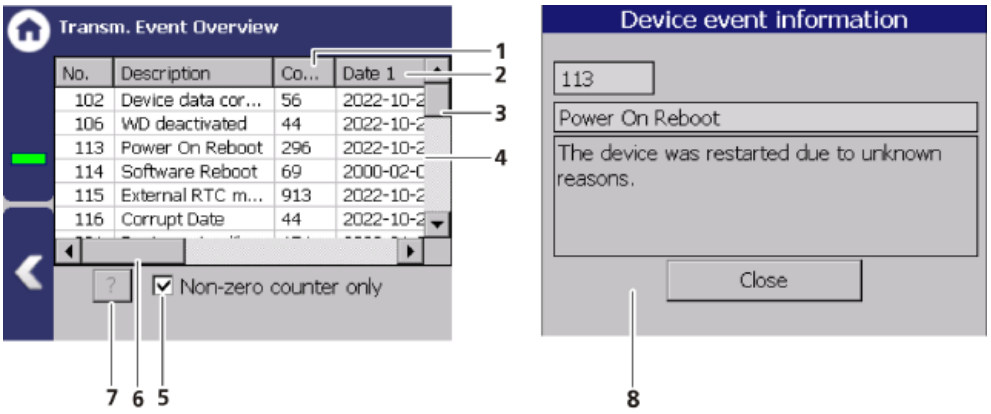
NOTICE

With the button <Clear event log> (Fig. 125, 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” (Fig. 126, item 5) in order to display events that have occurred.



1	Column “Number”	5	Check box “Non Zero counter only”
2	Column “Date”	6	Horizontal scroll bar
3	Vertical scroll bar	7	Button < ? >
4	Event line	8	Window “Device event information”

Fig. 126 Transmitter Event Overview

1. Click on a line in the list (Fig. 126, item 4).
2. Click on <? > (Fig. 126, item 7).

▶ The window event information (Fig. 126, item 8) appears.

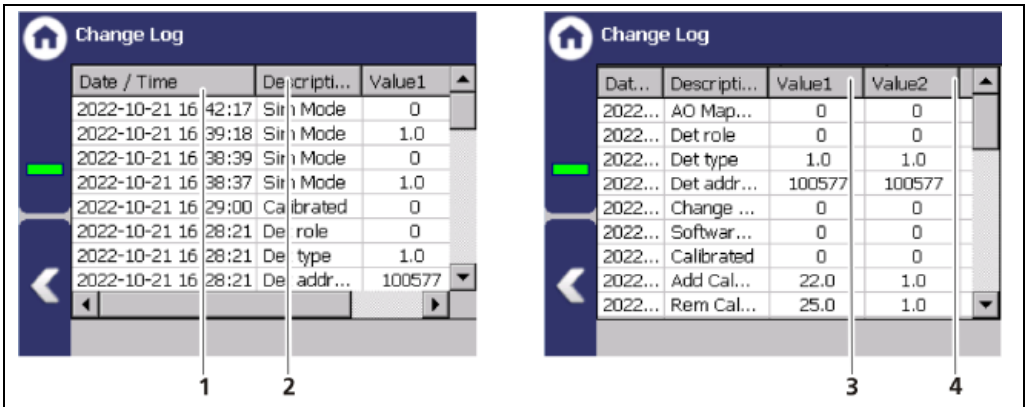
3. Close the event information with the button <Close>.
4. Slide the bar of the horizontal scroll bar (Fig. 126, item 6) to the right to see at what times (date, time) the event occurred.

▶ The last 5 time stamps 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 Date/Time of the change
2 Short info of the change
3 Old value
4 New value

Fig. 127 Change Log (Transmitter)

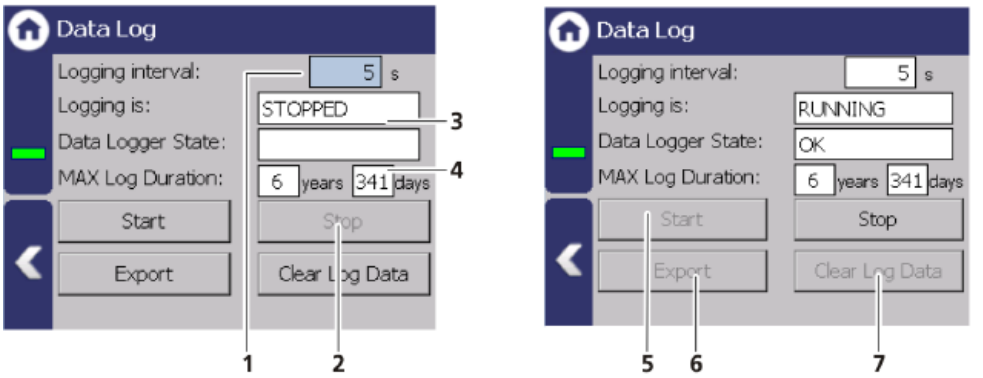
8.4 Data Log

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 and 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 MAX Log Duration (years | days)
5 Button <Start>
6 Button <Export>
7 Button <Clear log data>

Fig. 128 Data Log

Change log interval

1. Click on the button <Stop> (Fig. 128, item 2) if the data log is running.
2. Click on the input field “Log interval” (Fig. 128, item 7) and enter the time in seconds.
3. Confirm with the Enter key.

▶ The interval was accepted

4. Click on the button <Start> (Fig. 128, item 4) to start the data log process.

Clear log data

1. Click on the button <Stop> (Fig. 128, item 2) if the data log is running.
2. Click on the button <Clear Log Data> (Fig. 128, item 7).

▶ The message window “Clear Log Data” appears. All logged data will be erased after clicking <Yes>.

3. Click on the button <Yes> to erase all logged data or cancel with the button <No>.

Export Log Data

1. Click on the button <Stop> (Fig. 128, item 2) to stop the data log process.
2. Connect a USB storage device to the EVU (Fig. 3, item 5).
3. Click on the button <Export> (Fig. 128, item 5).

- The export process is started and can take several minutes to complete. This time depends on the amount of data records stored.
- 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. 129 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.

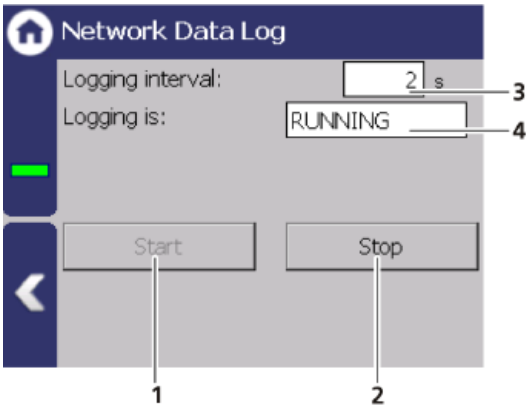
IMPORTANT

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 Display field / Input field „Logging Interval“
4 Display field „Logging State“

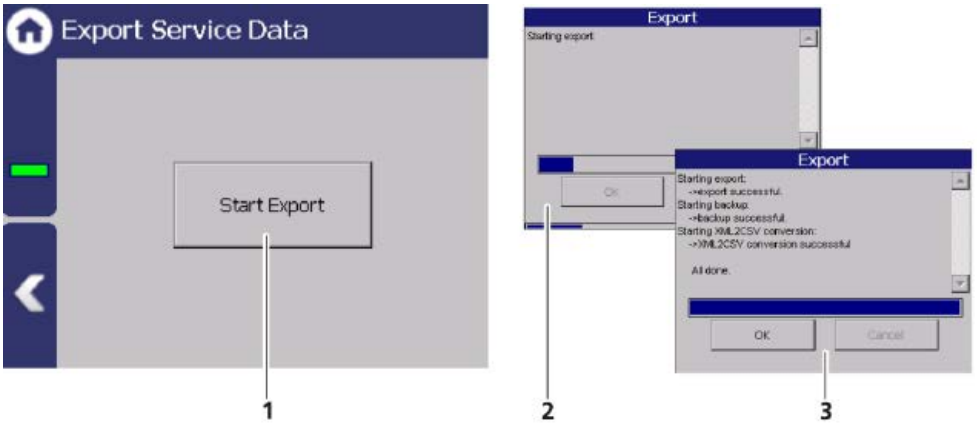
Fig. 130 Network Data Log (started)

1. Click on the button <Stop> if necessary. Click on the entry field “Logging interval” (Fig. 130, item 3) and enter an interval.
2. Start the network data log with the button <Start> (Fig. 130, 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 of the PC:
   > telnet "IP Address" -f "LogFileName" (for example 192.168.2.101 -f C:\\Users\Test\log.txt).

- The log data is displayed and saved in the created log file.
- Use the key combination "CTRL" and "+" to stop the recording of the log data.

8.6 Export Service Data

Diagnostics | Export Service Data



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

Fig. 131 Export Service Data

1. Connect a USB storage device to the EVU (Fig. 3, item 5).
2. The USB storage device is recognized by the system after a few seconds and the button <Start Export> (Fig. 131, item 1) can be clicked.

▶ The process window is displayed and the export of service data will be carried out (Fig. 131, item 2).

▶ After successful export a confirmation message Fig. 131, item 3) is displayed.

Information

A new folder "LB47x_Export" is created on the USB storage device and the backup file 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, 7-Wire/RS485-Repeater module, Current Output/HART module: LEDs are not illuminated	module not clamped properly	▶ Check cabling, contact sockets
No signal	Detector does not work	▶ Check the function 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 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)
Touchscreen 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 of the EVU emits an error current. The error relay gives alarm (contact opens). If a Current Output/HART module is used, all utilized current outputs will emit error currents as well.

Out of specification (S)

The detector, one of its components or the process itself, are out of normal specification. The message appears on the display and is stored in the error log (error relay and current output remain unaffected).

Function Check (C)

Indicates that entries are made at the detector or a function check/simulation is being performed. The message appears on the display and is stored in the error log (error relay and current output remain unaffected).

Maintenance required (M)

Appears e.g. at M308 "Source Replacement". See table in section 9.2.2. The message appears on the display and is stored in the error log (error relay and current output remain unaffected).

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.
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 (-20°C) of the permissible operating temperature.
M110	Temp LL OOS (out of specification)	S	The internal temperature of the device is below the lower limit (-30°C). The correct function of the device cannot be guaranteed.
M111	Temp UL maintenance	M	The internal temperature of the device is close to the upper limit (70°C).
M112	Temp UL OOS	S	The internal temperature of the device is above the upper limit (85°C). The correct function of the device cannot be guaranteed.
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. Limit value can be configured. Factory setting: -20°C.
M304	Det. Temp UL failure	F	Detector temperature at / above upper limit. Limit value can be configured. Factory setting: 60°C
M305	Det. Temp LL OOS	S	Detector temperature at / below lower limit. Limit value can be configured. Factory setting: -20°C.
M306	Det. Temp UL OOS	S	Detector temperature at / above upper limit. Limit value can be configured. Factory setting: 60°C.
M307	XIP. Radiation Interference XIP Detected measurement stopped	S	Radiation interference (XIP) 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 value under 0%
M325	Level over 100%	S	Level value over 100%
M326	GPC out of spec	S	Compensation factor of Gas Property Compensation has reached its limit. Check process.
M327	No GPC detector	S	No detector for Gas Property Compensation found. Connect / configure detector.
M330	Adjust failure	S	Error in the adjust process

M335	Overflow failure	F	The count rate at the GPC detector has fallen below the switching point.
M336	Overflow OOS	S	The count rate at the GPC detector has fallen below the switching point.
M337	GPC auto-deactivated	S	The GPC is disabled because the count rate determined by the GPC detector is below the set threshold.
M338	PBC active	C	The PBC function is active.
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. Contact Berthold service, if this event occurs repeatedly.
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 least one detector registers “Failure". Check detector events.
M504	Detector out of spec.	S	At least one detector registers "out of specification". Check detector events.
M505	Detector function check	C	At least one detector registers "function check". Check detector events.
M506	Detector maintenance	M	At least one detector registers "maintenance". Check detector events.
M599	Internal program error	F	Internal system failure. If the event remains it could be caused by a defective hardware. Contact Berthold service.

9.2.4 Current Output/HART Module

Code	Message	NAMUR107	Help Text
M601	Add. out not found	S	Lost connection to Current Output/HART module. Check “Additional Outputs” settings and RS485 connections. Contact Berthold service, if this event occurs repeatedly.
M602	Add. out comm. error	M	Temporarily lost connection to Current Output/HART module. Check “Additional Outputs” settings and RS485 connections. Contact Berthold service, if this event occurs repeatedly.
M603	Add. out HW module	M	Internal software failure of Current Output/HART module. Restart the device. Contact Berthold service, if this event occurs repeatedly.
M604	Add. out current loop open	M	At least one current output loop of Current Output/HART module is open. Check cable connection.
M605	Add. out overtemperature	S	Internal temperature of Current Output/HART module is too high. The correct function of the device cannot be guaranteed.
M606	Add. out error	F	Internal software failure of Current Output/HART module. Restart the device. Contact Berthold service, if this event occurs repeatedly.
M699	Internal program error	F	Internal software failure of Current Output/HART module. 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 feedback value is too high. Calibrate analog output. Several passes may be necessary. 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 and the modules 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 and the modules may only be carried out by experts (see chapter 2.3 Qualification of the Personnel). In case of doubt, the complete EVU or modules should 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-energize 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-energized.
- 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.

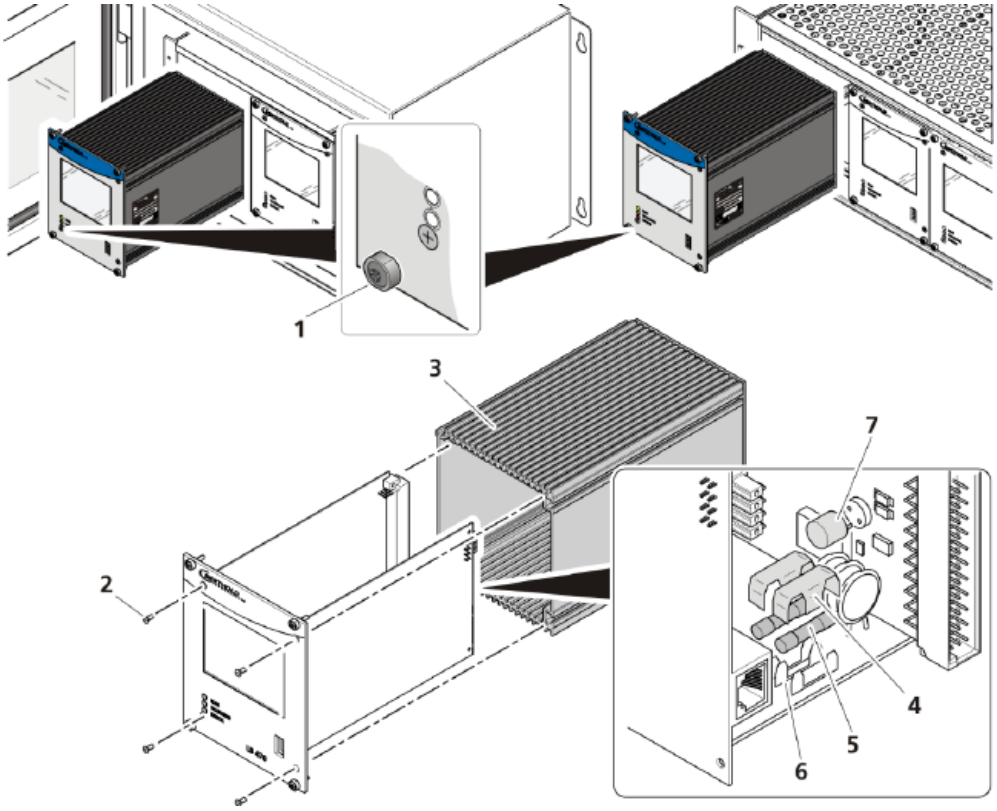
NOTICE

Damage to the device! Short circuit!

Components can be damaged if incorrect fuses are used.

- Only use fuses which correspond to the fuses on the circuit board of the module. Note the information in the document “Technical Information” in chapters:
  - 5 Master EVU
  - 6 Slave Module,
  - 7 7-Wire/RS485-Repeater Module
  - 8 Current Output/HART module

Replacing Fuse in the Master Module



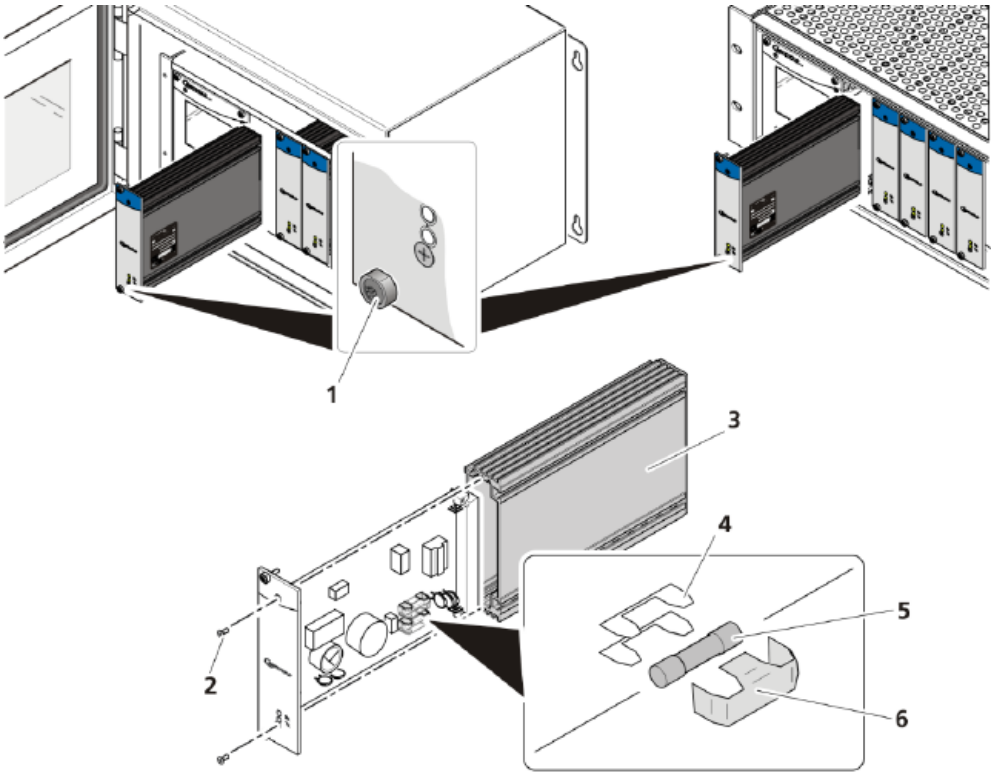
1	Fixing screws	5	Fuse 250V 1A T (5x20 mm)
2	Screws	6	Base
3	Housing	7	Fuse 250V TR5 T80mA (Ø 8,5 mm)
4	Covering fuse		

Fig. 132 Replacing fuses master EVU

1. De-energize the device.
2. Loosen the four fixing screws (Fig. 132, 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. 132, item 2).
4. Pull out the housing (Fig. 132, item 3) carefully.
5. Remove the protective covering of the fuse (Fig. 132, item 4).
6. Remove the fuse (Fig. 132, 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. 132, 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. 132, item 1).

▶ The fuse change was carried out correctly.

Replacing Fuse in the slave module, 7-Wire/RS485-Repeater module, Current Output/HART module



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

Fig. 133 Exchange fuses slave module for example

1. De-energize the device.
2. Loosen the four fixing screws (Fig. 133, item 1) and remove the module from the wall housing or subrack.
3. Loosen the two sunken screws on the front side of the module (Fig. 133, item 2).
4. Pull out the housing (Fig. 133, item 3) carefully.
5. Remove the protective covering of the fuse (Fig. 133, item 6).
6. Remove the fuse (Fig. 133, item 5).
7. Insert the new fuse 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. 133, 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 touchscreen and keyboard membrane 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.

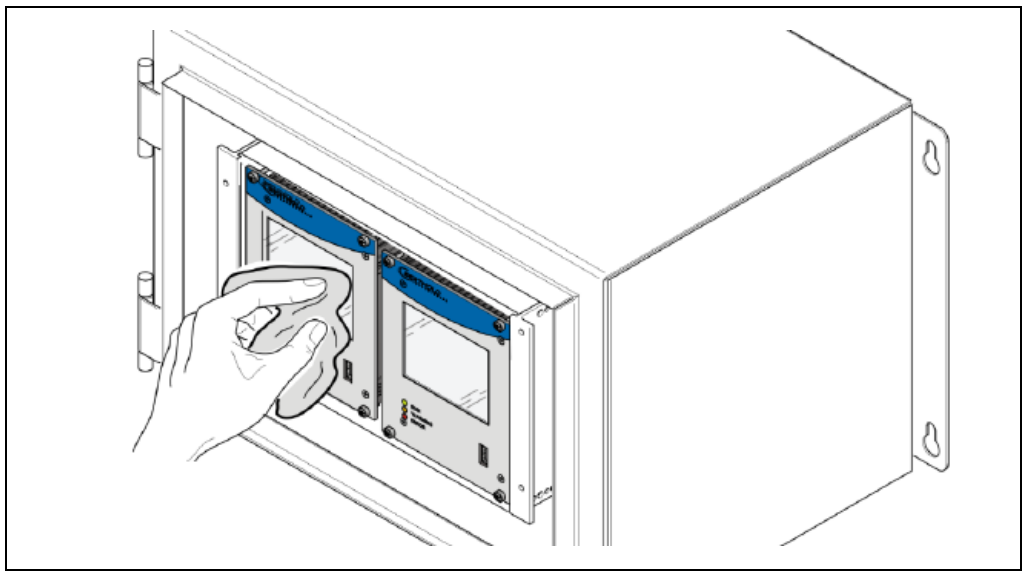


Fig. 134 Cleaning the display

1. 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.
6. Make sure that the display is completely dry and free of cleaning agents before switching on the device again.

- ▶ 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.

11 Decommissioning

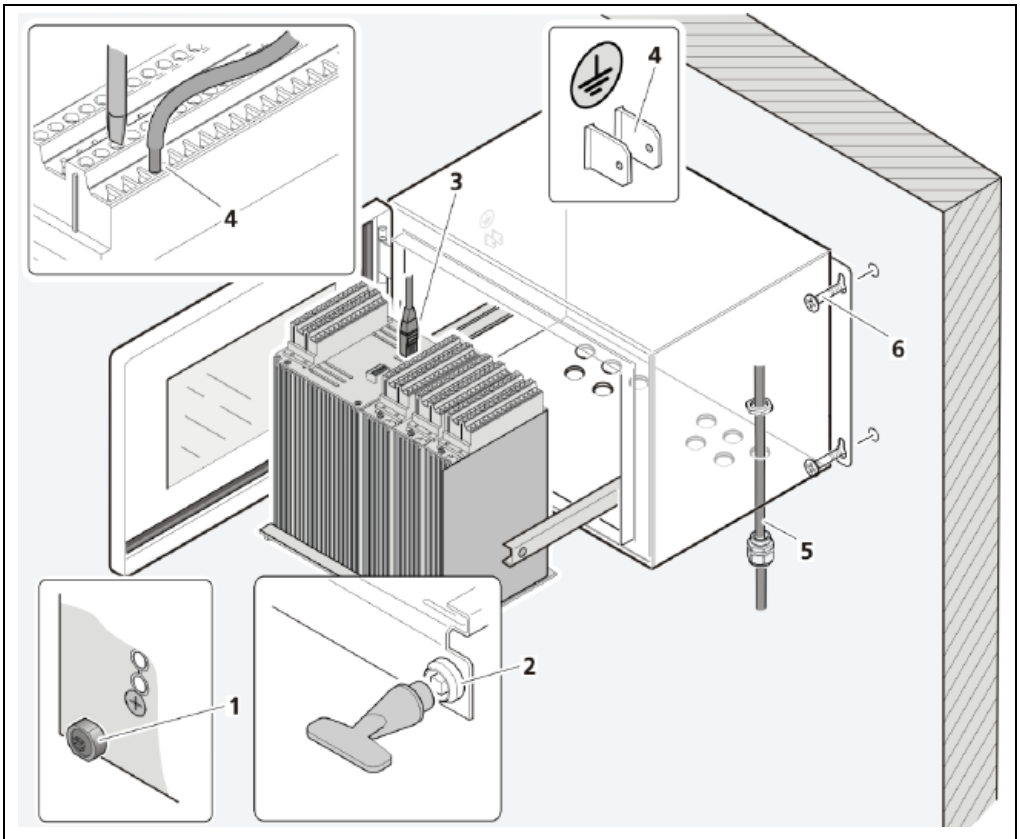
⚠ DANGER

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-energized.
- 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

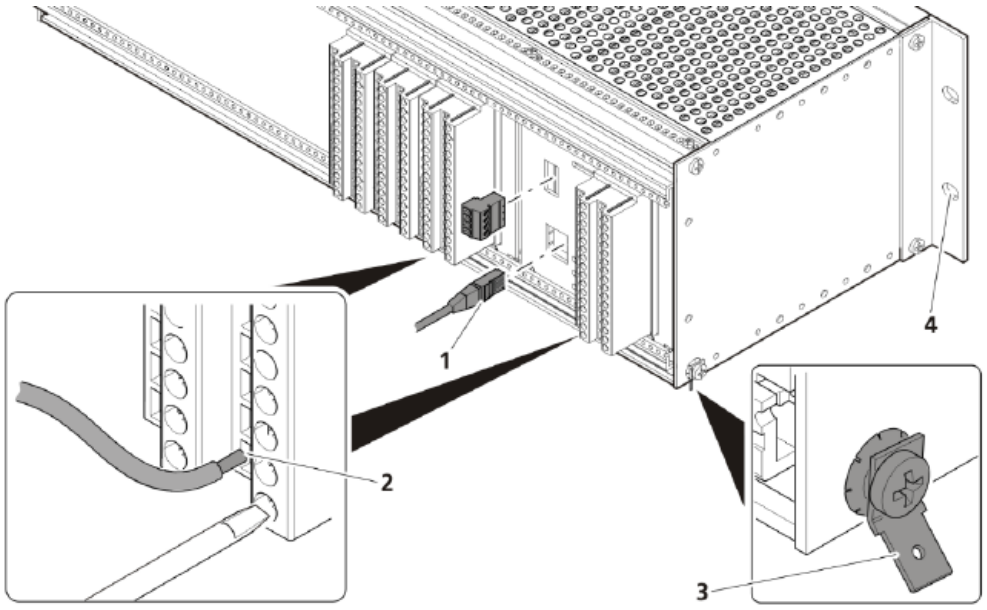
Fig. 135 Decommissioning wall housing

1. Make sure that the locking bolts (Fig. 135, item 1) of all modules are tightened in order to prevent slipping.
2. Loosen the lock (Fig. 135, 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. 135, item 3).
6. Remove all lines (Fig. 135, item 4).
7. Loosen the cable gland (Fig. 135, 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. 135, item 6) and remove the wall housing.

▶ Decommissioning is complete.

11.2 Decommissioning 19" Subrack



1 RJ45 connector (network)
2 Clamp blocks
3 PE cable
4 Screw Connections

Fig. 136 Decommissioning 19“ subrack

1. De-energize the device.
2. Remove the network plug (Fig. 136, item 1).
3. Remove all lines from the clamp blocks (Fig. 136, item 2).
4. Remove the PE cable (Fig. 136, item 4).
5. Remove the connections (Fig. 136, item 4) and pull the subrack from the 19" rack.

▶ Decommissioning is complete.

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, it must be disposed of according to legal regulations (e.g. RL 2012/19/EU) by a specialized waste management company.

12 Appendix

12.1 Setup Protocol

General data		
Date		
Number of detectors	LB 4700 _____ LB 480 _____	
Cascaded measurement	☐ YES ☐ NO	
Number of sources		Source No.
Activity		
Isotope	☐ Cs-137 ☐ Co-60	
Vessel		
Product(s)		

Device configuration		
Installation variant	☐ Wall housing ☐ Subrack	
Connection	☐ Terminal block	
Power supply	☐ 100-240 V AC ☐ 18-32 V DC	
Number of Master EVU		
Number of Slave modules		
Number of Current Output/HART modules		
Number of 7-Wire/RS485-Repeater modules		
Device ID Level Detectors		Software Versions:
Device ID PBC Detector		Software Version:
Device ID GPC Detector		Software Version:

Parameters	
Password	_____
Language	☐ DE ☐ EN ☐ _____
CE Remote control	☐ enabled
Network	☐ DHCP active IP Address _____ • _____ • _____ • _____ Subnet _____ • _____ • _____ • _____ Gateway _____ • _____ • _____ • _____ DNS-Server _____ • _____ • _____ • _____ MAC Address _____
Time constant level detector	
Time constant PBC trigger detector	
GPC	☐ enabled ☐ Cs-137 ☐ Co-60
Damping	_____ s time constant
XIP	☐ Detection enabled Measurement Delay _____ s Hold Time _____ s I_O Factor _____ RI Sigma _____
Source replacement	☐ Notification enabled
Digital inputs	DI-1 Assignment: ☐ Measurement stopped DI-2 Assignment: ☐ Measurement stopped
Analog output	AO Mapping Assignment _____ Values _____ _____ AO-Monitoring enabled ☐ AO Failure Mode _____
Analog output (additional modules)	AO Mapping Assignment _____ Values _____ _____ AO Failure Mode _____

Parameters		
Digital Outputs	DO-2 Assignment: _____	DO-3 Assignment: _____
Total Comp. Level Alarm Behaviour	NE 107 Status when Alarm ☐ No Status ☐ Out of Specification ☐ Failure	
Overflow 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.

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Unité d'évaluation
DuoSeries
LB 47x

Détecteurs
DuoSeries
LB 4700

Informations sur la sécurité

56925BA59 Rev.05 08/2023

BERTHOLD

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

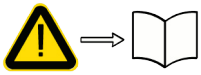
Les sections identifiées avec ce symbole signalent des informations importantes du produit ou de son fonctionnement.

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.

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LB 476 Level+

Technical Information

56925TI2LP Rev.01 08/2023

BERTHOLD

Table of Contents

1. Evaluation Unit and Extension Modules

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

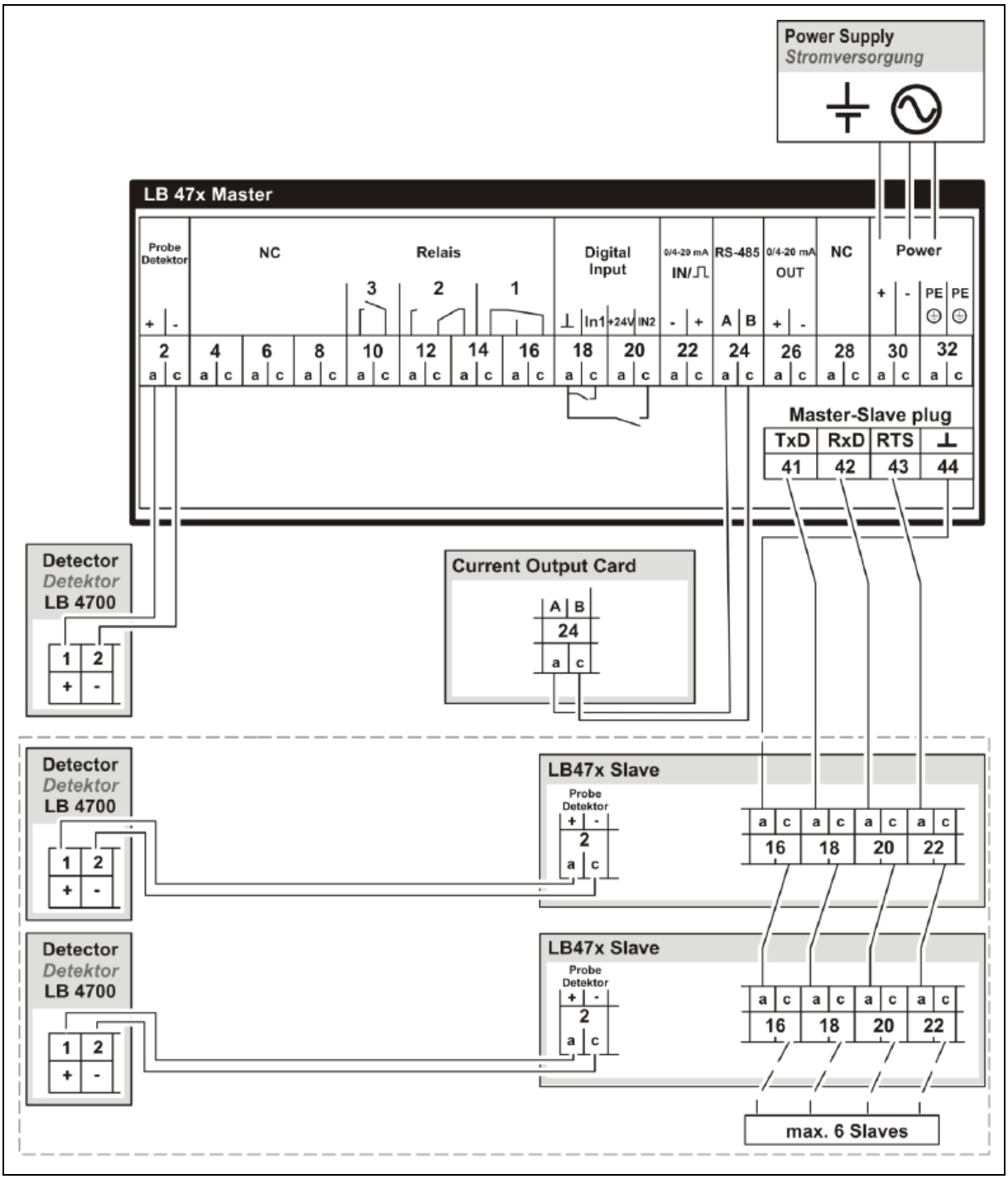
⚠ WARNING

Danger to life due to explosion!

- This version of the evaluation unit is not explosion protected and is not designed for hazardous environments.

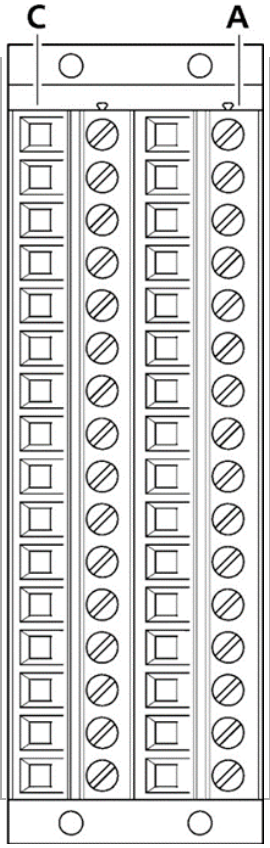
2. Connection Diagrams

2.1. Assignment Master EVU with LB 4700 Detectors



TI-Fig. 1 Assignment master EVU with LB 4700 detectors

Terminal Block Master EVU with LB 4700 Detectors



Signal	Pin	Pin	Signal
DETECTOR LB 4700 GND	C - 2	A - 2	DETECTOR LB 4700+
n.a. *	C - 4	A - 4	n.a. *
n.a. *	C - 6	A - 6	n.a. *
n.a. *	C - 8	A - 8	n.a. *
RELAIS 3 COM	C - 10	A -10	RELAIS 3 NO
RELAIS 2 COM	C - 12	A - 12	RELAIS 2 NO
RELAIS 1 NC	C - 14	A - 14	RELAIS 2 NC
RELAIS 1 COM	C - 16	A - 16	RELAIS 1 NO
DIGITAL IN 1	C - 18	A - 18	DIGITAL IN GND
DIGITAL IN 2	C - 20	A - 20	+ 24 V (GND --> A-18)
CURRENT IN +	C - 22	A - 22	CURRENT IN –
RS485 B (Curr.Output/HART)	C - 24	A - 24	RS485 A (Curr.Output/HART)
CURRENT OUT –	C - 26	A - 26	CURRENT OUT +
n.a. *	C - 28	A - 28	n.a. *
Main N AC, DC 24 V (–)	C - 30	A - 30	Main L1 AC, DC 24 V (+)
PE**	C - 32	A - 32	PE**

* not assigned
** Protective conductor

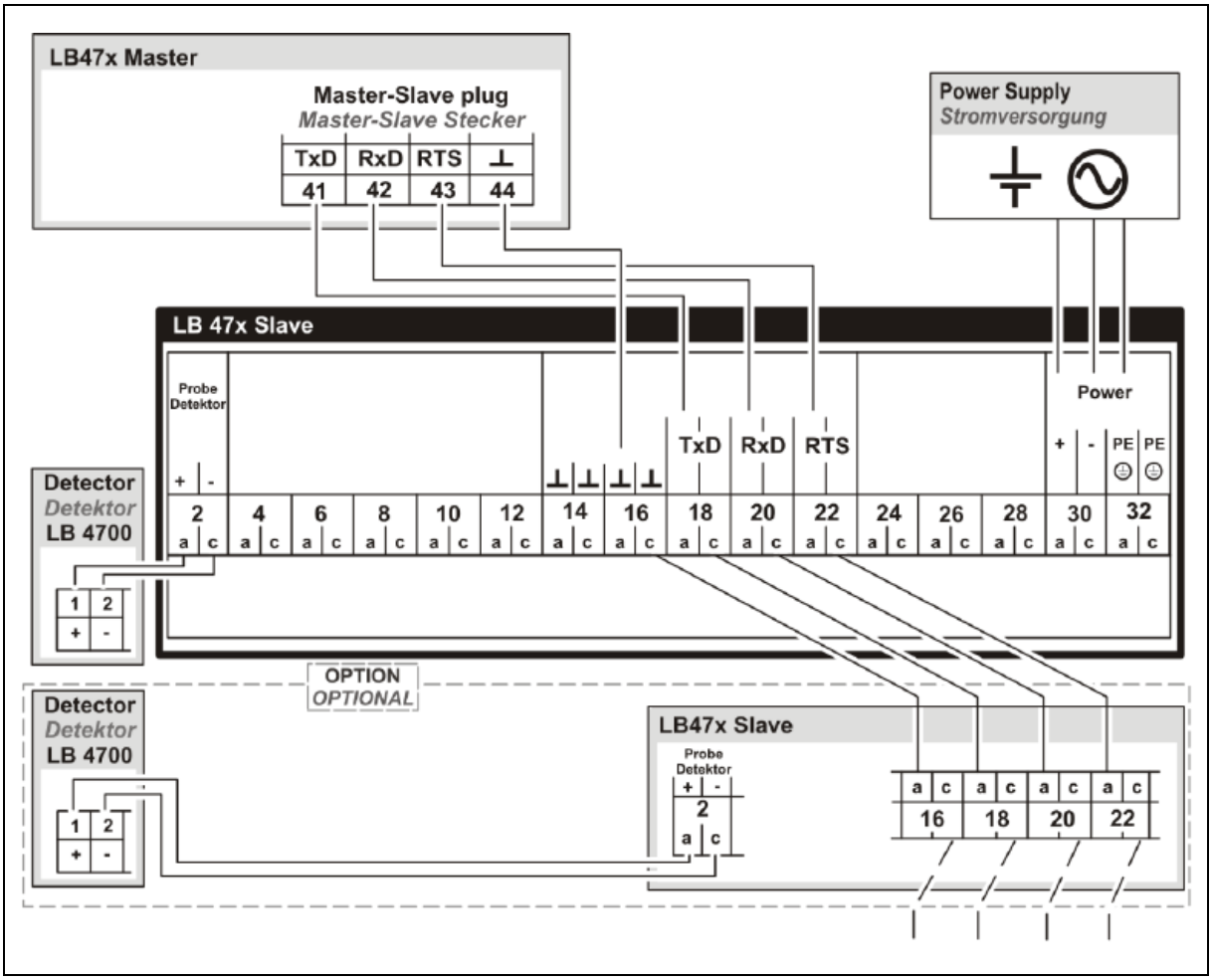
NOTICE

Since the master EVU and the extension modules (7-Wire/RS485-Repeater module, Current Output/HART module) create a RS485 network, ensure that the last bus participants (first and last) are terminated and thus require a 120 Ω terminating wire resistor between terminal A-24 and C-24.

2.2. Assignment Slave Module

NOTICE

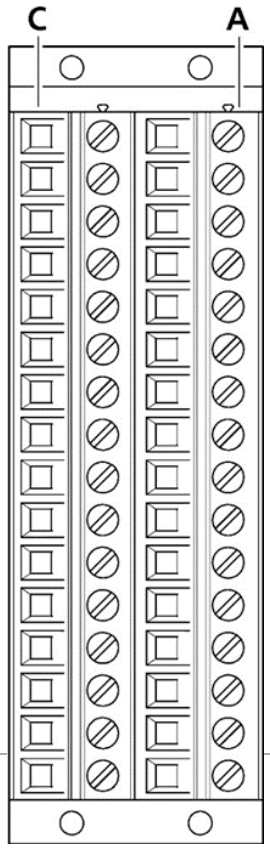
Slave modules are only used with LB 4700 detectors.



TI-Fig. 2 Assignment slave module

Terminal Block Slave Module

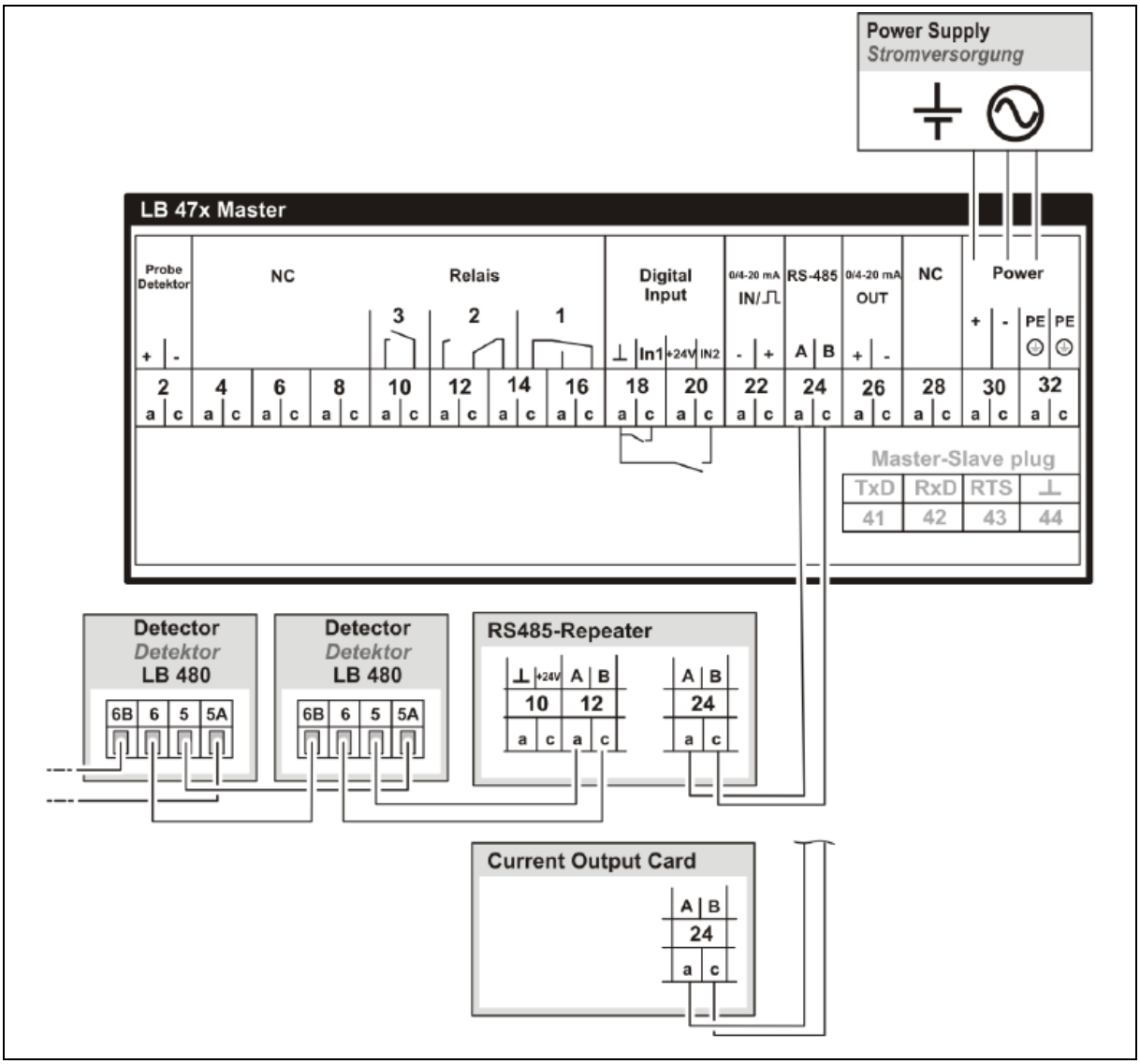
Signal	Pin
DETECTOR SLAVE GND	C - 2
n.a**	C - 4
n.a**	C - 6
n.a**	C - 8
n.a**	C - 10
n.a**	C - 12
GND	C - 14
GND	C - 16
TxD to SLAVE *	C - 18
RxD to SLAVE *	C - 20
RTS to SLAVE *	C - 22
n.a**	C - 24
n.a**	C - 26
n.a**	C - 28
Main N AC, DC 24 V (–)	C - 30
PE ***	C - 32



Pin	Signal
A - 2	DETECTOR SLAVE +15 V
A - 4	n.a**
A - 6	n.a**
A - 8	n.a**
A - 10	n.a**
A - 12	n.a**
A - 14	GND
A - 16	GND
A - 18	TxD from MASTER/SLAVE
A - 20	RxD from MASTER/SLAVE
A - 22	RTS from MASTER/SLAVE
A - 24	n.a**
A - 26	n.a**
A - 28	n.a**
A - 30	Main L1 AC, DC 24 V (+)
A - 32	PE ***

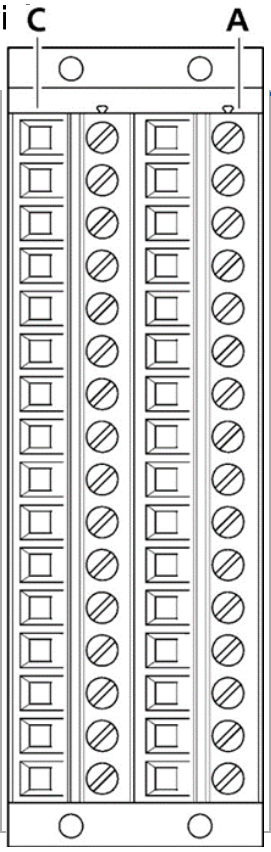
* option
** not assigned
*** Protective conductor

2.3. Assignment Master EVU with LB 480 Detectors



TI-Fig. 3 Assignment EVU with LB 480 Detectors

Terminal Block Master EVU wi



Signal	Pin	Pin	Signal
n.u. ***	C - 2	A - 2	n.u. ***
n.a. *	C - 4	A - 4	n.a. *
n.a. *	C - 6	A - 6	n.a. *
n.a. *	C - 8	A - 8	n.a. *
RELAIS 3 COM	C - 10	A -10	RELAIS 3 NO
RELAIS 2 COM	C - 12	A - 12	RELAIS 2 NO
RELAIS 1 NC	C - 14	A - 14	RELAIS 2 NC
RELAIS 1 COM	C - 16	A - 16	RELAIS 1 NO
DIGITAL IN 1	C - 18	A - 18	DIGITAL IN GND
DIGITAL IN 2	C - 20	A - 20	+ 24 V (GND --> A-18)
CURRENT IN +	C - 22	A - 22	CURRENT IN –
RS485 B ****	C - 24	A - 24	RS485 A ****
CURRENT OUT –	C - 26	A - 26	CURRENT OUT +
n.a. *	C - 28	A - 28	n.a. *
Main N AC, DC 24 V (–)	C - 30	A - 30	Main L1 AC, DC 24 V (+)
PE**	C - 32	A - 32	PE**

* not assigned
** Protective conductor
*** not used for this case
**** RS485-Repeater module/Current Output/HART module

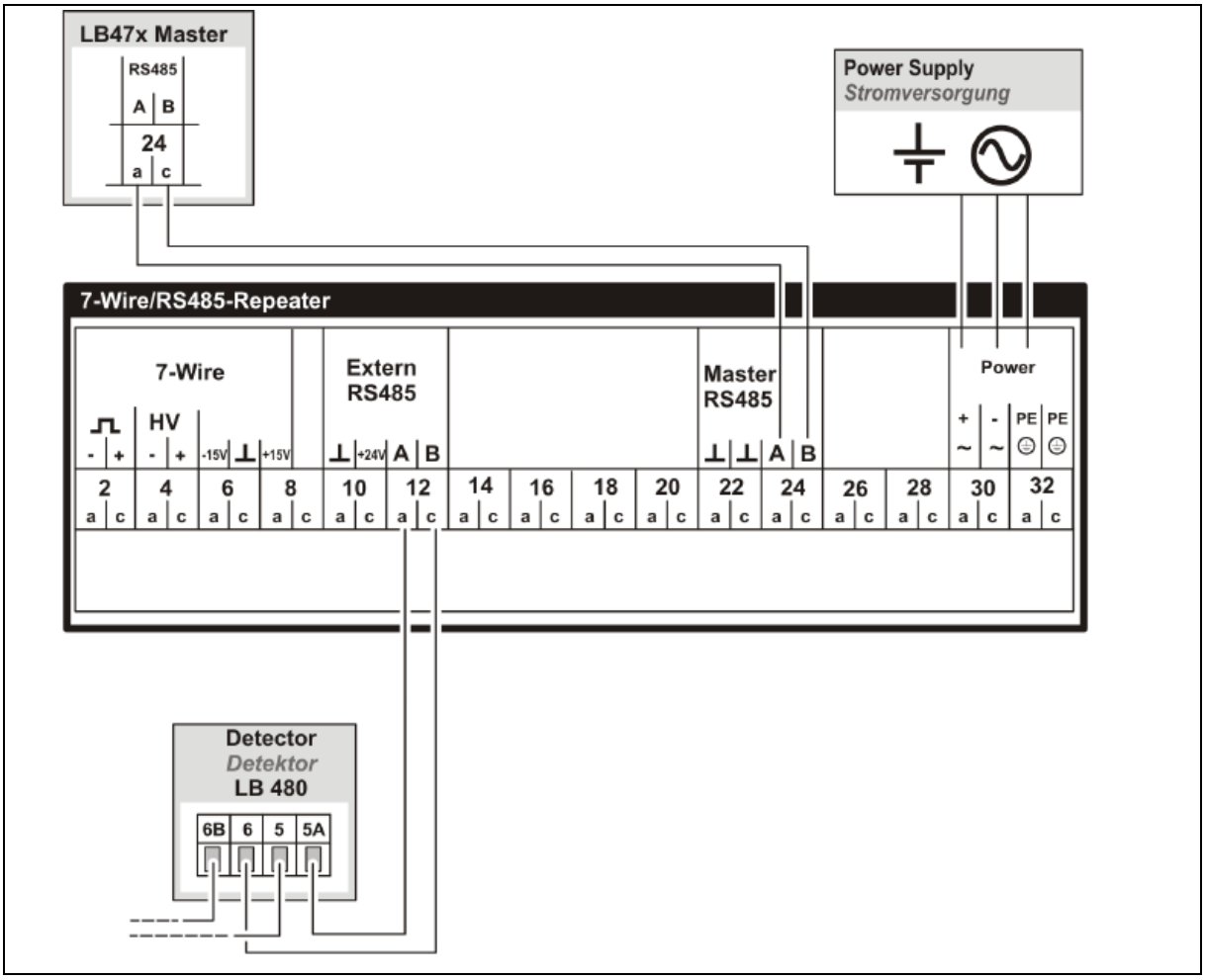
NOTICE

Since the master EVU and the extension modules (7-Wire/RS485-Repeater module, Current Output/HART module) create a RS485 network, ensure that the last bus participants (first and last) are terminated and thus require a 120 Ω terminating wire resistor between terminal A-24 and C-24.

2.4. Assignment 7-Wire/RS485-Repeater Module

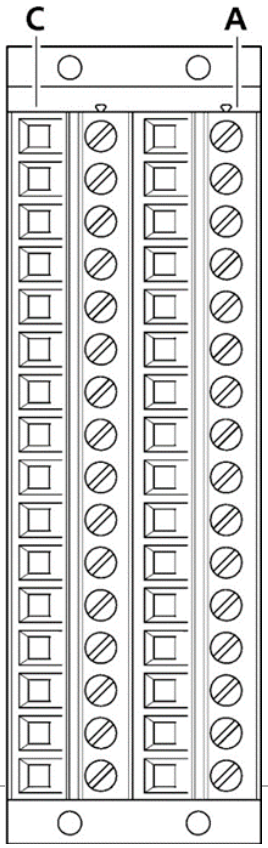
NOTICE

7-Wire/RS485-Repeater modules are only used with LB 480 detectors.



TI-Fig. 4 Assignment 7-Wire/RS485-Repeater module

Terminal Block 7-Wire/RS485-Repeater



Signal	Pin	Pin	Signal
n.a. *	C - 2	A - 2	n.a. *
n.a. *	C - 4	A - 4	n.a. *
n.a. *	C - 6	A - 6	n.a. *
n.a. *	C - 8	A - 8	n.a. *
+24 V	C - 10	A - 10	GND
RS485 B to Detector LB 480	C - 12	A - 12	RS485 A to Detector LB 480
n.a. *	C - 14	A - 14	n.a. *
n.a. *	C - 16	A - 16	n.a. *
n.a. *	C - 18	A - 18	n.a. *
n.a. *	C - 20	A - 20	n.a. *
GND	C - 22	A - 22	GND
RS485 B to Master	C - 24	A - 24	RS485 A to Master
n.a. *	C - 26	A - 26	n.a. *
n.a. *	C - 28	A - 28	n.a. *
Main *Netz* N AC, DC 24 V (-)	C - 30	A - 30	Main *Netz* L1 AC, DC 24 V (+)
PE **	C - 32	A - 32	PE **

* not assigned
** Protective conductor

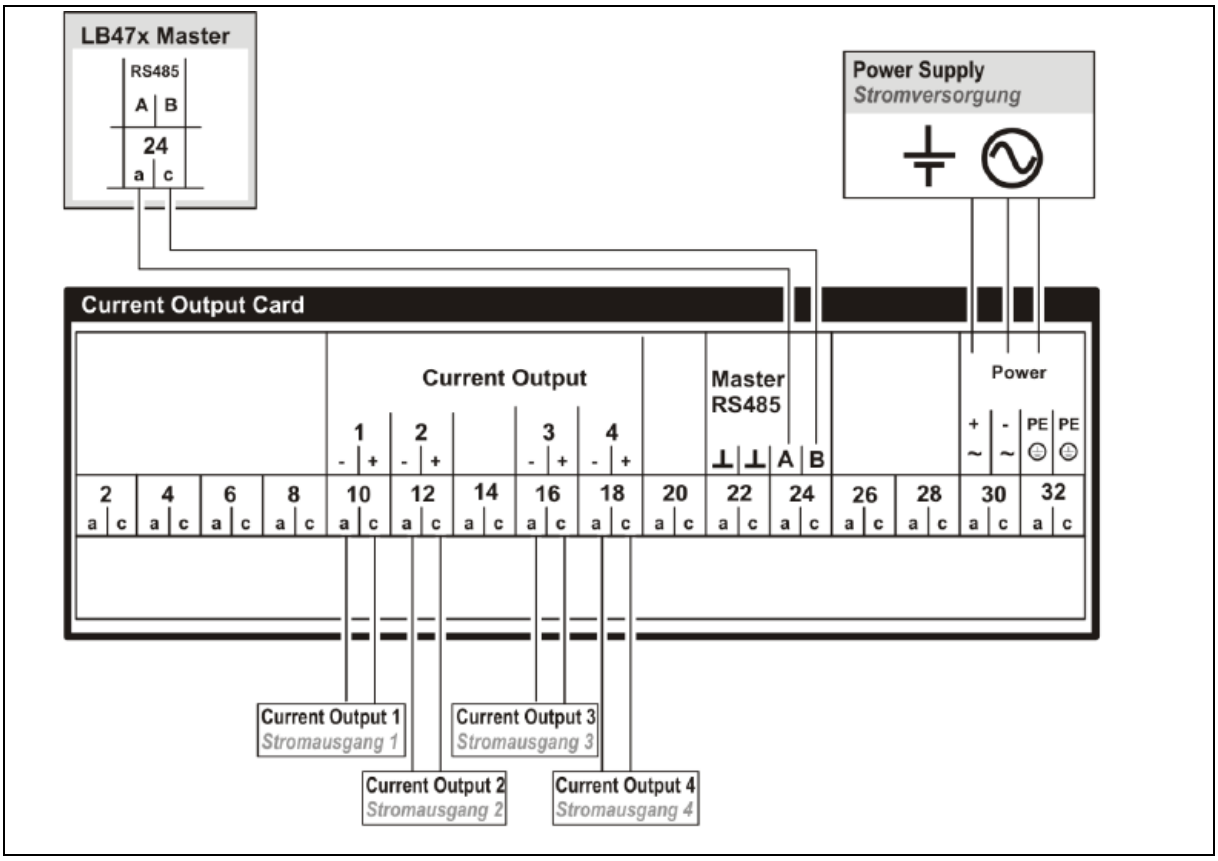
NOTICE

Since the master EVU and the extension modules (7-Wire/RS485-Repeater module, Current Output/HART module) create a RS485 network, ensure that the last bus participants (first and last) are terminated and thus require a 120 Ω terminating wire resistor between terminal A-24 and C-24.

NOTICE

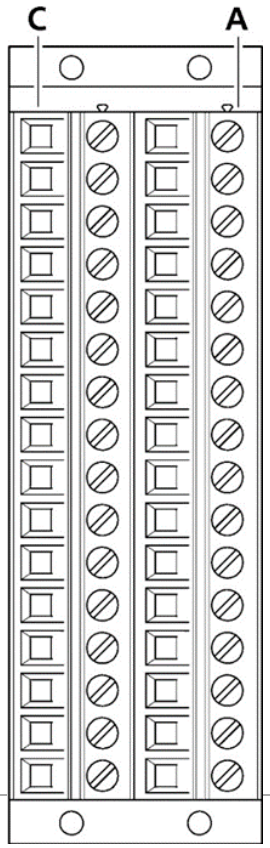
For the RS485 network between 7-Wire/RS485-Repeater module and LB 480 detector, no termination is necessary as this is already activated internally. It must also be noted that in this case the 7-Wire/RS485-Repeater module is physically placed at the end/beginning of the bus and the LB 480 detector placed at the other end of the bus must have a termination.

2.5. Assignment Current Output/HART module



TI-Abb. 5 Assignment Current Output/HART module

Terminal Block Current Output/HART



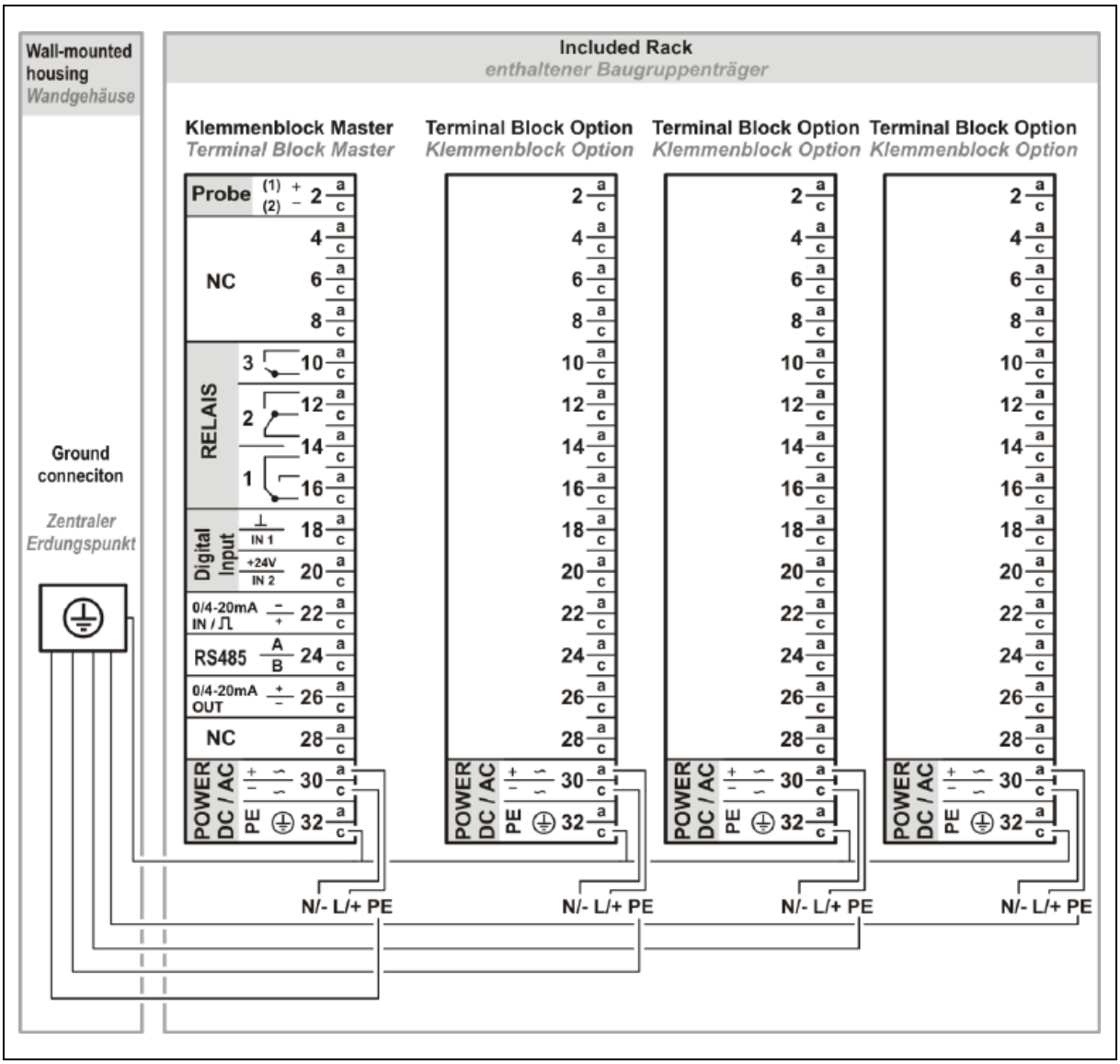
Signal	Pin	Pin	Signal
n.a. *	C - 2	A - 2	n.a. *
n.a. *	C - 4	A - 4	n.a. *
n.a. *	C - 6	A - 6	n.a. *
n.a. *	C - 8	A - 8	n.a. *
Current Out 1 +	C - 10	A - 10	Current Out 1 -
Current Out 2 +	C - 12	A - 12	Current Out 2 -
n.a. *	C - 14	A - 14	n.a. *
Current Out 3 +	C - 16	A - 16	Current Out 3 -
Current Out 4 +	C - 18	A - 18	Current Out 4 -
n.a. *	C - 20	A - 20	n.a. *
GND	C - 22	A - 22	GND
RS485 B to Master	C - 24	A - 24	RS485 A to Master
n.a. *	C - 26	A - 26	n.a. *
n.a. *	C - 28	A - 28	n.a. *
Main *Netz* N AC, DC 24 V (-)	C - 30	A - 30	Main *Netz* L1 AC, DC 24 V (+)
PE **	C - 32	A - 32	PE **

* not assigned
** Protective conductor

NOTICE

Since the master EVU and the extension mdules (7-Wire/RS485-Repeater module, Current Output/HART module) create a RS485 network, ensure that the last bus participants (first and last) are terminated and thus require a 120 Ω terminating wire resistor between terminal A-24 and C-24.

2.6. Assignment of the Wall-mounted Housing for arbitrary Extension Modules



TI-Fig. 6 Assignment drawing of the wall-mounted housing

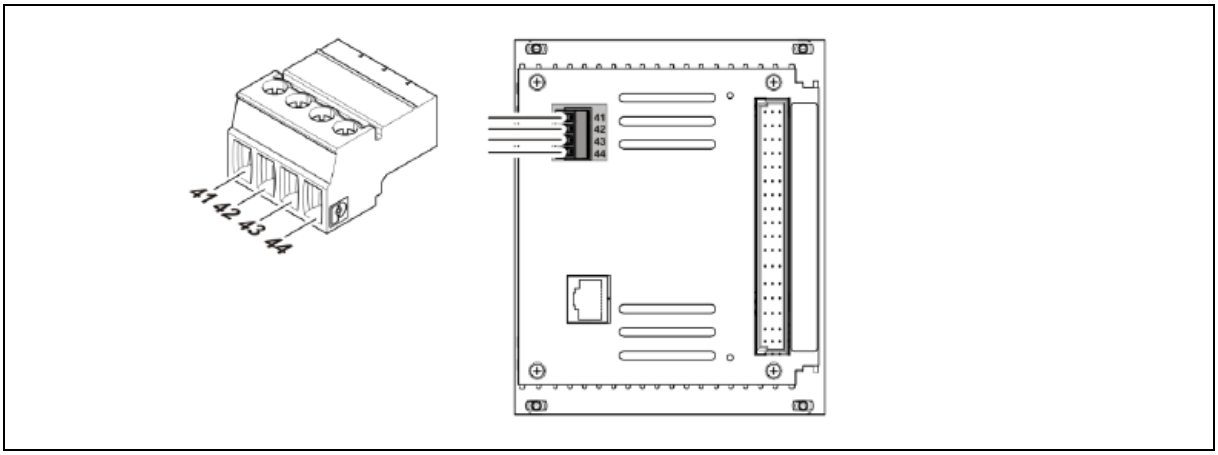
NOTICE

The wall housing includes a sticker as shown in TI-Fig. 6. The terminal assignments of the three possible extension modules are also shown on the sticker.

2.7. Assignment Terminals Master/Slave Plug

NOTICE

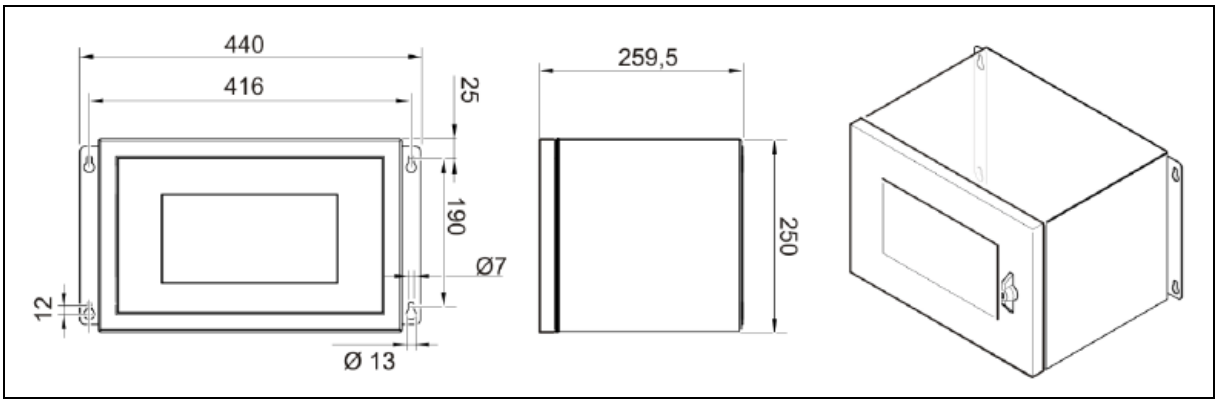
The Master/Slave plug is only used in Master/Slave configurations with LB 4700 detectors.



TI-Fig. 7 Assignment Terminal Master/Slave Plug

Signal	Pin
TxD	41
RxD	42
RTS	43
GND	44

3. Wall Housing

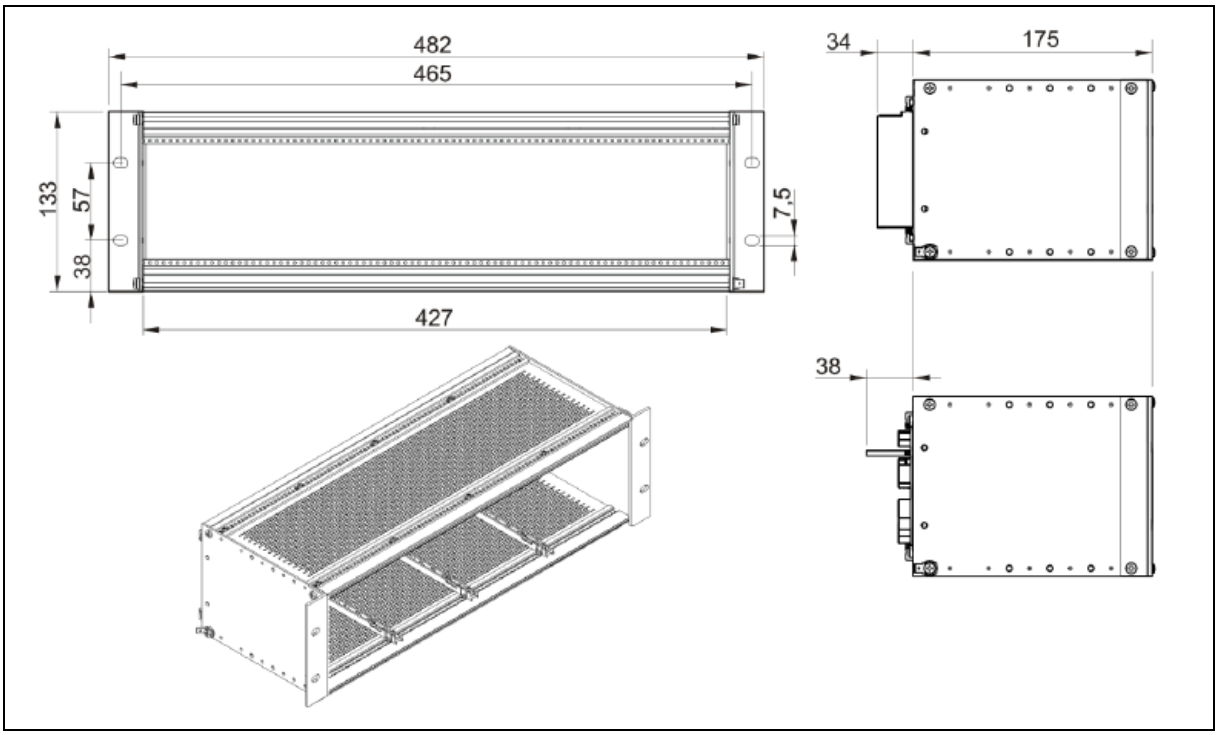


TI-Fig. 8 Drawing wall housing

Technical Data	
Max. assembly	- 1 Master, 3 arbitrary extension modules with terminal blocks[1]
Weight (with circuit board, without modules)	8.8 kg
Degree of protection	IP65
Operational temperature	-20 °C … +40 °C
Strorage temperature	-25 °C … +80 °C
General ambient conditions	Overvoltage category: II Pollution Degree: 2 Altitude: up to 2000 m Rel. humidity: 93% or less
User interface, colours	Powder coated, grey
Cable entry	8 x M16, 2 x M32

[1] No NRTL certification

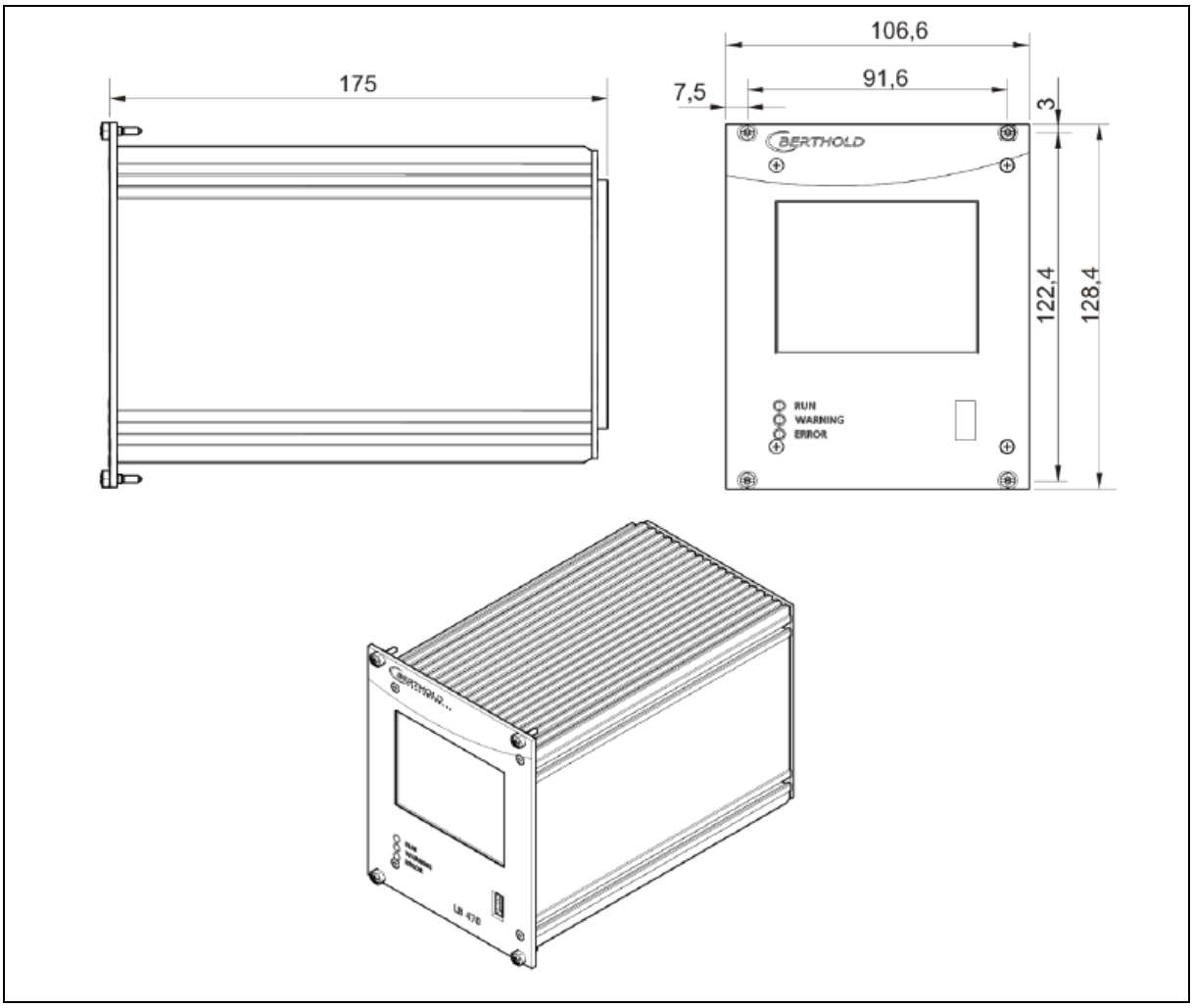
4. 19" Subrack



TI-Fig. 9 Drawing 19" subrack

Technical Data	
Standard units	3HE/84TE
Max. Assembly	3 Master + 3 Slave / 2 Master + 6 Slave / 4 Master / 1 Master+ 9 Slave / 12 Slave
Weight (with circuit board, without modules)	1.4 kg
Weight terminal block	220 g
Operational temperature	-20 °C … +50 °C, not condensing
Storage temperature	-25°C ... +80°C
Degree of protection	IP20

5. Master EVU



TI-Fig. 10 Drawing master EVU

Technical Data	
Weight	1200 g
Operational temperature	-20 °C … +50 °C not condensing. Avoid direct sunlight. Unobstructed air circulation must be provided to the subrack.
Storage temperature	-30 °C ... +80 °C
General ambient conditions	Overvoltage category: II Pollution Degree: 2 Altitude: up to 2000 m Rel. humidity: 93% or less
Degree of protection	IP20[1]
Connections	- 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

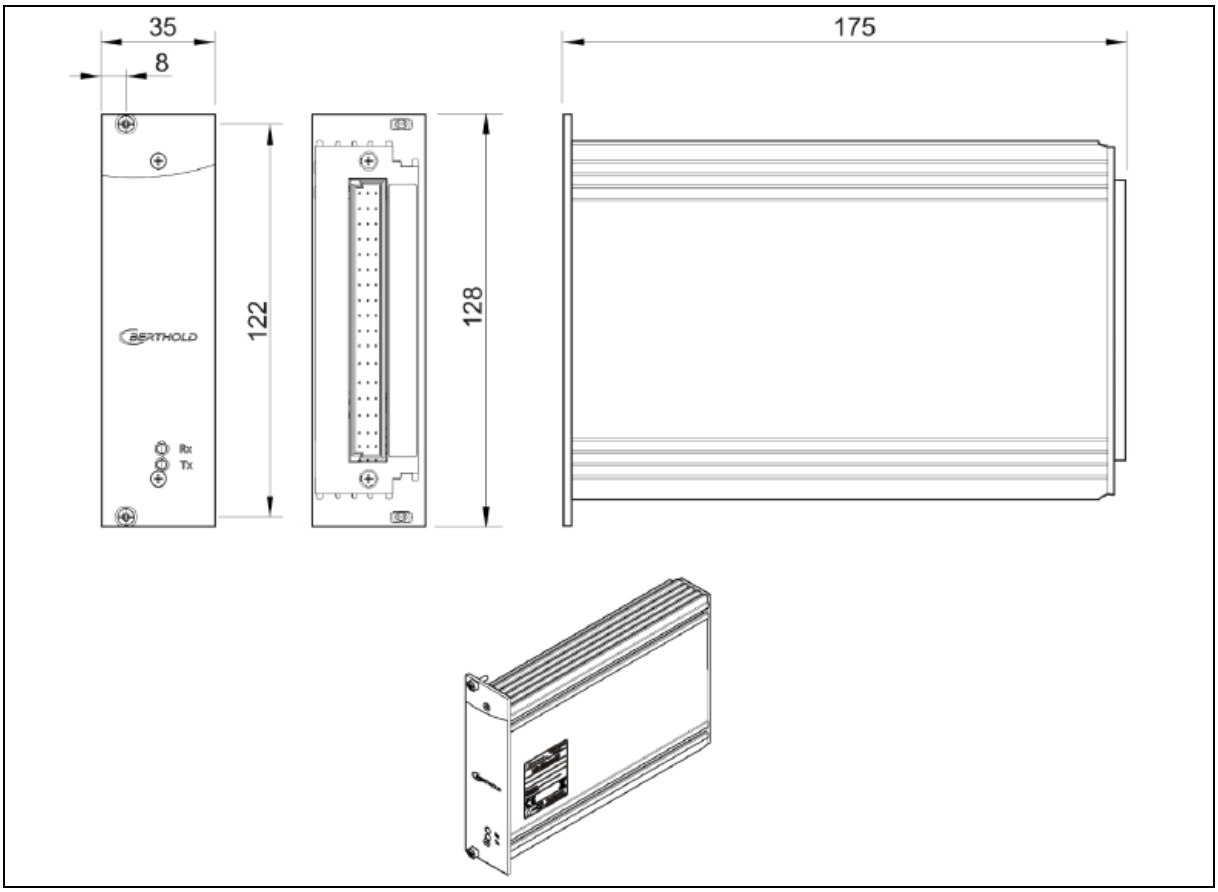
Display	- graphical LCD display - 320 x 240 points, 262,000 colours - Dimmable LED background lighting - Touchscreen
Computer core	- Processor: Dual Core DSP/ARM Controller - clock frequency: 300 MHz internal (20 MHz external quartz) - ROM: 512 KByte - RAM: 64 MByte ext. SDRAM, 128 KByte int. shared RAM - FLASH: 8 MByte external serial

Power Supply	
Voltage	100…240 VAC 50/60 Hz (wide range input) +/- 10% 21…32 VDC (24 VDC power input)
Power consumption	22 VA, 15 W
Fuses	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)

[1] Designed for indoor use. Outdoor use only possible if installed in wall housing.

Interfaces	
Current output	4…20 mA 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 ohm 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.
Digital outputs	3 relays, U_{max} = 33 V AC_{eff}, 46 V DC; I_{max} = 1 A functions: Relay 1: SPDT for error signalling Relay 2: SPDT assignable by software Relay 3: SPST assignable by software
Digital inputs	2 x together electrically isolated (500 V) Switch between DigIn and GND, U_{outmax} approx. 24 V Function configurable via software
External supply	Output voltage: 24 V DC Output current: max. 150 mA
RS485	For communication between Master EVU, 7-Wire/RS485-Repeater module, Current Output/HART module and testing and evaluation purposes. Not isolated from main electronics and USB port, electrically isolated from remaining 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 U_{out} = 5 V, I_{outmax} = 0.5 A
Ethernet	RJ45 connection via back wall, 10 Mbit, DHCP supported, max. 3 m Designed for maintenance purposes. Not designed for-long-term operation.

6. Slave Module



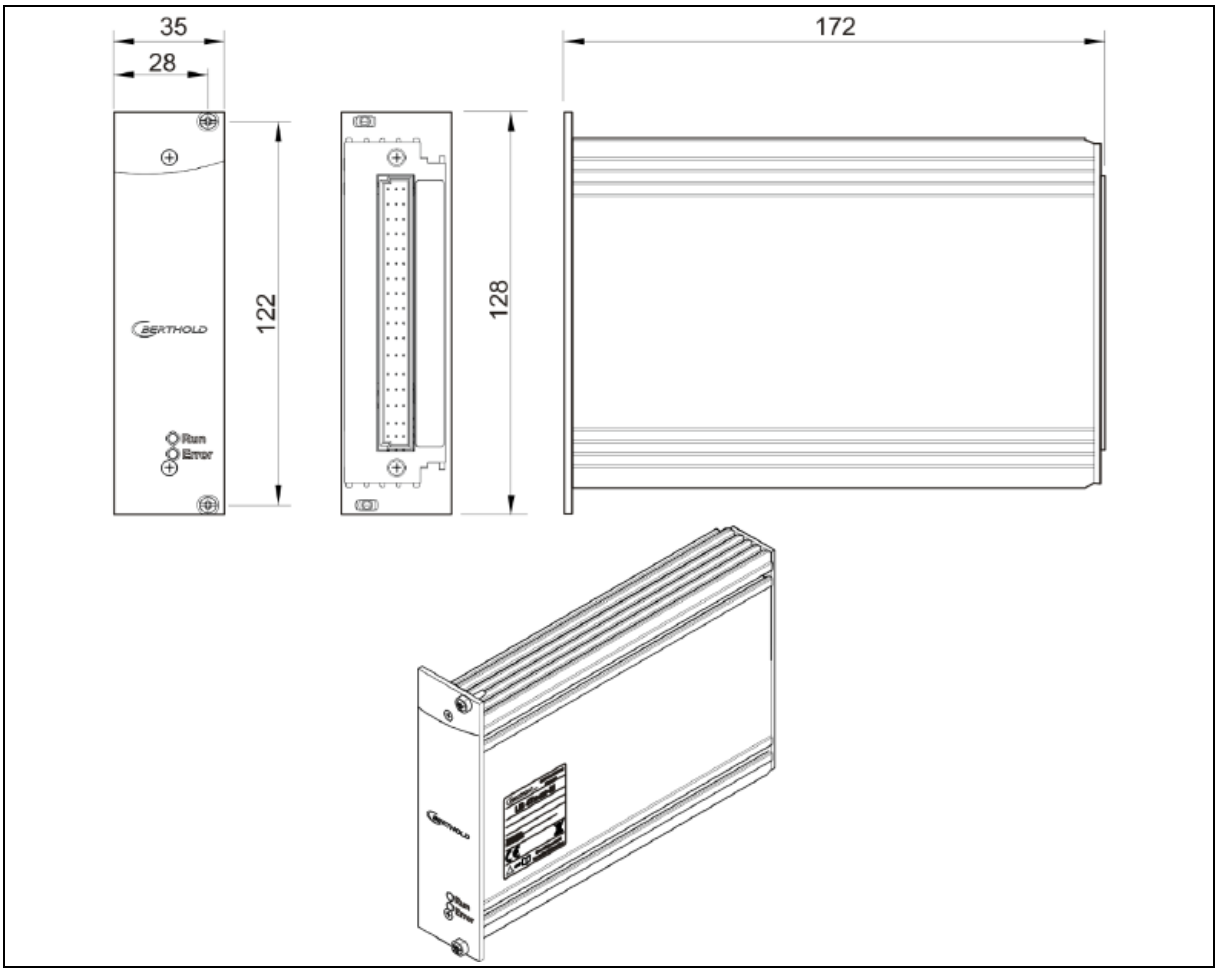
TI-Fig. 11 Drawing slave module

Technical Data	
Weight	600 g
Operational temperature	-20 °C … +50 °C, not condensing. Avoid direct sunlight. Unobstructed air circulation must be provided to the sub-rack.
Storage temperature	-30 °C ... +80 °C
General ambient conditions	Overvoltage category: II Pollution Degree: 2 Altitude: up to 2000 m Rel. humidity: 93% or less
Degree of protection	IP20[1]

Power Supply	
Voltage	100…240 V AC 50/60 Hz (wide range input) +/- 10% 21…32 VDC (24 VDC power input)
Power consumption	6 VA, 5 W
Fuses	Internal, 2 x 250 V, 1 A delayed, 5x20 mm, 1500 A breaking capacity IEC 60127-2
Connections	32-pin plug connector

[1] Designed for indoor use. Outdoor use only possible if installed in wall housing.

7. 7-Wire/RS485-Repeater Module[1]



TI-Abb. 12 7-Wire/RS485-Repeater module

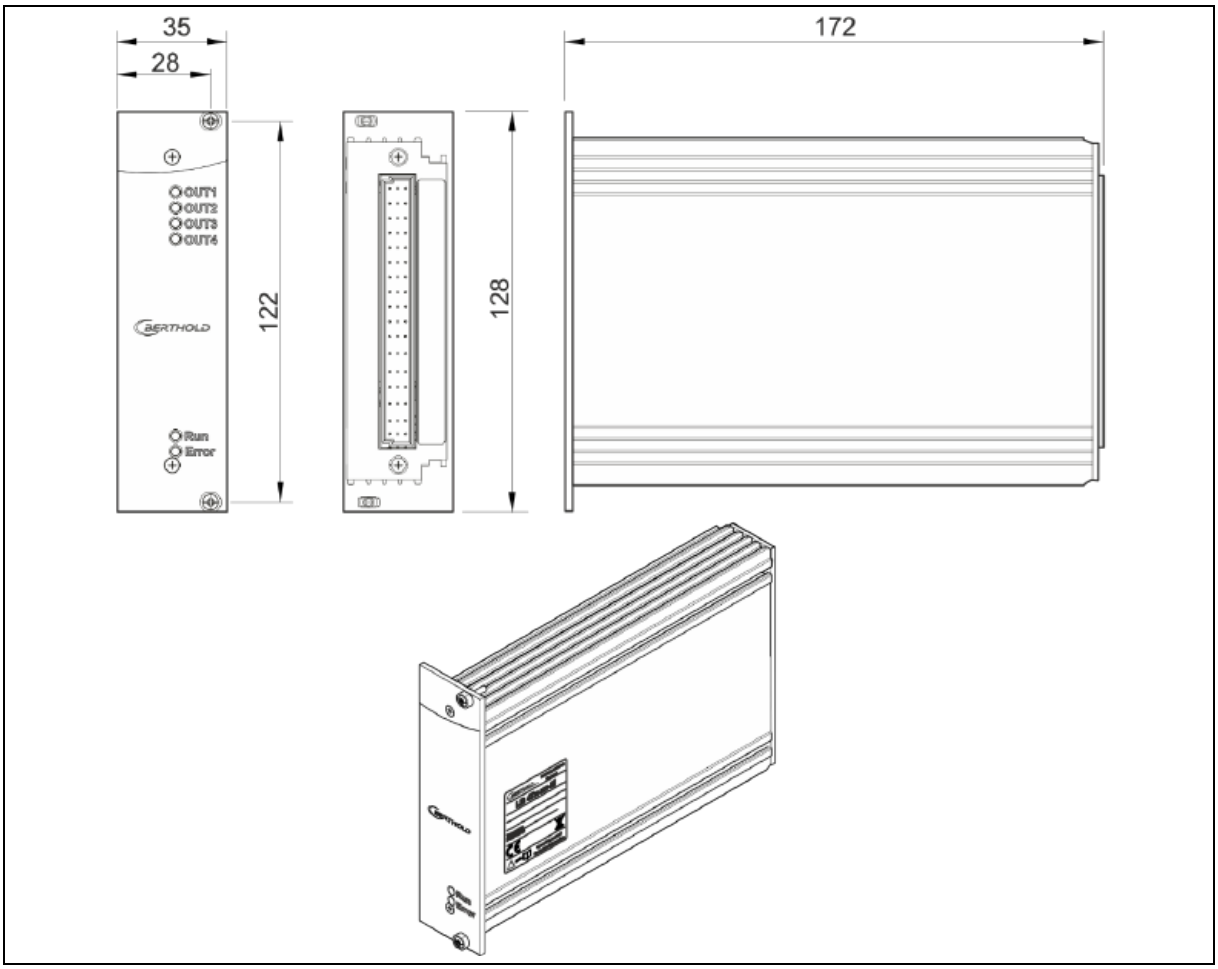
Technical Data	
Weight	500 g
Operational temperature	-20 °C … +50 °C not condensing. Avoid direct sunlight. Unobstructed air circulation must be provided to the subrack.
Storage temperature	-30 °C ... +80 °C

[1] No NRTL certification US/CAN

General ambient conditions	Overvoltage category: II Pollution Degree: 2 Altitude: up to 2000 m Rel. humidity: 93% or less
Degree of protection	IP20[2]
Power Supply Voltage	100…240 VAC 50/60 Hz (wide range input) +/- 10% 21…32 VDC (24 VDC power input)
Power Consumption	8 VA, 4 W
Fuses	Internal, 2 x 250 V, 1 A delayed, 5x20 mm, 1500 A breaking capacity IEC 60127-2

[2] Designed for indoor use. Outdoor use only possible if installed in wall housing.

8. Current Output/HART Module[1]



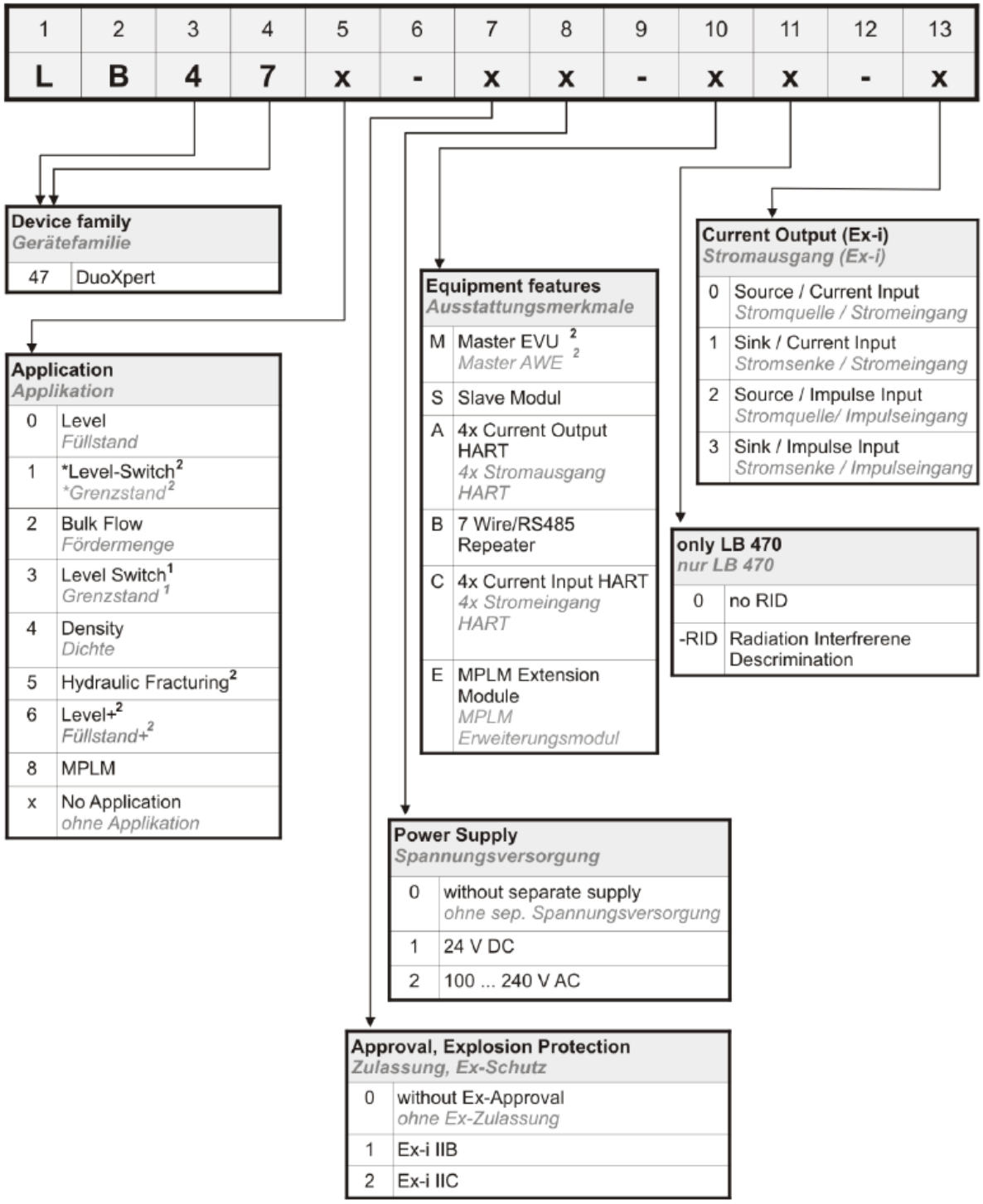
TI-Fig. 13 Current Output/HART module

Technical Data	
Weight	500 g
Operational temperature	-20 °C … +50 °C not condensing. Avoid direct sunlight. Unobstructed air circulation must be provided to the subrack.
Storage temperature	-30 °C ... +80 °C
General ambient conditions	Overvoltage category: II Pollution Degree: 2 Altitude: up to 2000 m Rel. humidity: 93% or less
Degree of protection	IP20[2]
Power Supply Voltage	100…240 VAC 50/60 Hz (wide range input) +/- 10% 21…32 V DC (24 VDC power input)
Power Consumption	16 VA, 5 W
Fuses	Internal, 2 x 250 V, 1 A delayed, 5x20 mm, 1500 A breaking capacity IEC 60127-2

Current Outputs	4x 4…20 mA as power source. Operation as power sink not possible. Continuous short circuit proof and galvanically isolated (500 V). Burden when operating as a power source: 600 ohm.

[1] No NRTL certification US/CAN
[2] Designed for indoor use. Outdoor use only possible if installed in wall housing.

9. Number Key LB 47x



TI-Fig. 14 Number Key

[1] Only available as Ex-i version
[2] Only available as a standard version
*Other Hardware

10. EG-Declaration of Conformity LB 47x

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 330981
Persönlich haftende Gesellschafterin / Fully liable Associates: BERTHOLD TECHNOLOGIES Verwaltungs-GmbH
Registergericht / Court of Registration: Stuttgart HRB 331520
Geschäftsführung / Management: Horst Knauß, Dr. Dirk Mönnich
USt.-Id-Nr. / VAT Reg. No.: DE813050511
Deutsche Steuernummer / German Tax No.: 45038/08038
WEEE-Reg. No.: DE95468650

Sparkasse Pf-CW 75323 Bad Wildbad Konto/Account No. 8 043 003 (BLZ 666 500 85) SWIFT-BIC PZHSDE66 IBAN: DE37 6665 0085 0008 0450 03
Volksbank 75179 Pforzheim Konto/Account No. 557 004 (BLZ 666 900 00) SWIFT-BIC VBPFDE6G IBAN: DE85 6669 0000 0000 9570 04
Commerzbank 75105 Pforzheim Konto/Account No. 6 511 120 (BLZ 666 800 12) SWIFT-BIC DRES DEFF 666 IBAN: DE05 6668 0013 0651 1120 00

11. EU-Declaration of Conformity 7-wire/RS-485 repeater

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EU-Konformitätserklärung

EU-Declaration of Conformity

Nr./*No.: CE20041-01*

Hiermit erklären wir in alleiniger Verantwortung, dass die Bauart des nachfolgend bezeichneten Geräts, in der von uns in den Verkehr gebrachten Ausführung den unten genannten einschlägigen Harmonisierungsvorschriften der EU entspricht.

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

We hereby declare, under our sole responsibility, that the design of the following device placed on the market by us complies with the relevant harmonized rules of the EU.

Unauthorized modifications or unintended use of the product makes this declaration invalid

Hersteller *Manufacturer*	**BERTHOLD TECHNOLOGIES GmbH & Co. KG** Calmbacher Str. 22, D-75323 Bad Wildbad, Germany
Produktbezeichnung *Product name*	**7-Leiter/RS-485 Repeater** ***7-wire/RS-485 repeater***
Typenbezeichnung / Modell *Type / model*	**LB47x-01-B0** **LB47x-02-B0**

Richtlinie/Verordnung *directive/regulation*		**angewendete Normen** *applied standards*
*Niederspannungsrichtlinie *low voltage directive*	2014/35/EU	EN 61010-1:2010 + A1:2019
EMV / *EMC*	2014/30/EU	EN IEC 61326-1:2021 Namur NE 021:2017
RoHS	2011/65/EU	

* nur die Variante LB47x-02-B0 (100-240 V AC) fällt in den Geltungsbereich den LVD – die Variante LB47x-01-B0 (24 V) nicht.
Only the variant LB47x-02-B0 (100-240 V AC) in within the scope of the LVD – but not the variant LB47x-01-B0 (24 V).

Diese Erklärung wird in Verantwortung für den Hersteller ausgestellt durch
This declaration is issued by the manufacturer released by

Dr. Jürgen Briggmann

Head of R&D
Bad Wildbad, 13.01.2023

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: Thomas Bogner
USt.-Id-Nr. / VAT Reg. No.: DE813050511
Deutsche Steuernummer / German Tax No.: 49038/08038
WEEE-Reg. No.: DE99468690

Bankverbindungen / Bank Details	IBAN BLZ	Konto / Account	Swift BIC
Sparkasse Pforzheim-Calw	DE37 6665 0085 0008 0450 03		PZHSDE66
Volksbank Pforzheim	DE85 6669 0000 0000 9570 04		VBPFDE66
Commerzbank Pforzheim	DE05 6668 0013 0651 1120 00		DRESDEFF666

12. EU-Declaration of Conformity 4x Current Output/HART

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Fax +49 7081 177-100
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EU-Konformitätserklärung

EU-Declaration of Conformity

Nr./*No.: CE20040-01*

Hiermit erklären wir in alleiniger Verantwortung, dass die Bauart des nachfolgend bezeichneten Geräts, in der von uns in den Verkehr gebrachten Ausführung den unten genannten einschlägigen Harmonisierungsvorschriften der EU entspricht.

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

We hereby declare, under our sole responsibility, that the design of the following device placed on the market by us complies with the relevant harmonized rules of the EU.

Unauthorized modifications or unintended use of the product makes this declaration invalid

Hersteller *Manufacturer*	**BERTHOLD TECHNOLOGIES GmbH & Co. KG** Calmbacher Str. 22, D-75323 Bad Wildbad, Germany
Produktbezeichnung *Product name*	**4x Spannungsausgang/HART** ***4x current output/HART***
Typenbezeichnung / Modell *Type / model*	**LB47x-01-A0** **LB47x-02-A0**

Richtlinie/Verordnung *directive/regulation*		**angewendete Normen** *applied standards*
*Niederspannungsrichtlinie *low voltage directive*	2014/35/EU	EN 61010-1:2010 + A1:2019
EMV / *EMC*	2014/30/EU	EN IEC 61326-1:2021 Namur NE 021:2017
RoHS	2011/65/EU	

* nur die Variante LB47x-02-A0 (100-240 V AC) fällt in den Geltungsbereich den LVD – die Variante LB47x-01-A0 (24 V) nicht.
Only the variant LB47x-02-A0 (100-240 V AC) in within the scope of the LVD – but not the variant LB47x-01-A0 (24 V).

Diese Erklärung wird in Verantwortung für den Hersteller ausgestellt durch
This declaration is issued by the manufacturer released by

Dr. Jürgen Briggmann

Head of R&D
Bad Wildbad, 13.01.2023

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: Thomas Bogner
USt.-Id-Nr. / VAT Reg. No.: DE813050511
Deutsche Steuernummer / German Tax No.: 49038/08038
WEEE-Reg. No.: DE99468690

Bankverbindungen / Bank Details	IBAN BLZ	Konto / Account	Swift BIC
Sparkasse Pforzheim-Calw	DE37 6665 0085 0008 0450 03		PZHSDE66
Volksbank Pforzheim	DE85 6669 0000 0000 9570 04		VBPFDE66
Commerzbank Pforzheim	DE05 6668 0013 0651 1120 00		DRESDEFF666

14. UK Declaration of Conformity 7-wire/RS-485 repeater

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Phone +49 7081 177-0
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info@Berthold.com
www.Berthold.com

UK Declaration of Conformity File No.: UK20041-01

We hereby declare, under our sole responsibility, that the design of the following device placed on the market by us complies with the relevant U.K. legislation for UKCA-marking.

Unauthorized modifications or unintended use of the product make the declaration invalid.

Product name: ***7-wire/RS-485 repeater***

Type / model: ***LB47x-01-B0***
LB47x-02-B0

Regulation		applied standards
*Electrical Equipment (Safety) Regulations 2016	SI 2016/1101	EN 61010-1:2010+A1:2019
Electromagnetic Compatibility Regulations 2016	SI 2016/1091	EN IEC 61326-1:2021 Namur NE 021:2017
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012	SI 2012/3032	

** Only the variant LB47x-02-B0 (100-240 V AC) in within the scope of the Electrical Equipment (Safety) Regulations – but not the variant LB47x-01-B0 (24 V).*

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, 13th of January 2023

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 Thomas Bogner
USt.-Id-Nr. / VAT Reg. No. DE813050511
Deutsche Steuernummer / German Tax No. 49038/08038
WEEE-Reg. No. DE99468690

Bankverbindungen / Bank Details	IBAN BLZ Konto / Account	Swift BIC
Sparkasse Pforzheim-Calw	DE37 6665 0085 0008 0450 03	PZHSDE66
Volksbank Pforzheim	DE85 6669 0000 0000 9570 04	VBPFDE66
Commerzbank Pforzheim	DE05 6668 0013 0651 1120 00	DRESDEFF666

16. UK Declaration of Conformity 4x Current Output/HART

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UK Declaration of Conformity File No.: UK20040-01

We hereby declare, under our sole responsibility, that the design of the following device placed on the market by us complies with the relevant U.K. legislation for UKCA-marking.

Unauthorized modifications or unintended use of the product make the declaration invalid.

Product name: ***4x current output/HART***

Type / model: ***LB47x-01-A0***
LB47x-02-A0

Regulation		applied standards
*Electrical Equipment (Safety) Regulations 2016	SI 2016/1101	EN 61010-1:2010+A1:2019
Electromagnetic Compatibility Regulations 2016	SI 2016/1091	EN IEC 61326-1:2021 Namur NE 021:2017
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012	SI 2012/3032	

** Only the variant LB47x-02-A0 (100-240 V AC) in within the scope of the Electrical Equipment (Safety) Regulations – but not the variant LB47x-01-A0 (24 V).*

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, 13th of January 2023

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 — Thomas Bogner
USt.-Id-Nr. / VAT Reg. No. — DE813050511
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Volksbank Pforzheim	DE85 6669 0000 0000 9570 04	VBPFDE66
Commerzbank Pforzheim	DE05 6668 0013 0651 1120 00	DRESDEFF666

17. NTRL Certification US/CAN wall-mounted housing

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

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

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

18. NTRL Certifikate 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, 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

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 Straβe 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

19. Parts Overview

Mat. No.	Description
64656	LB 476-02-M0 Level+ Transmitter (100…240 VAC)
64657	LB 476-01-M0 Level+ Transmitter (24 VDC)
73033	LB 47x-02-A0 4x Current Output/HART (100…240 VAC)
73072	LB 47x-01-A0 4x Current Output/HART (24 VDC)
73148	LB47x-02-B0 7-Wire/RS485-Repeater (100…240 VAC) Only required when using LB 480 (1x in total)
73147	LB47x-01-B0 7-Wire/RS485-Repeater (24 VDC) Only required when using LB 480 (1x in total)
63285	LB 47x-02-S0 Slave (100…240 VAC) Only required when using LB 4700 (per detector)
63286	LB 47x-01-S0 Slave (24 VDC) Only required when using LB 4700 (per detector)
64607	19" subrack for use with terminal blocks
74818	Wall-mounted housing with preinstalled terminal blocks for 1x Master and 3x arbitrary extension module
59477	Terminal block for LB 47x Master and Master/Slave plug
59478	Terminal block für LB 47x Slave
73149	Terminal block for Current Output/HART
73150	Terminal block for 7-Wire/RS485-Repeater
37526	Front Cover Plate 21 HP / 3 RU (Master)
59501	Front Cover Plate 7 HP / 3 RU (Slave)
56925-6BA1	Operating Manual LB 476 Level+, German
56925-6BA2	Operating Manual LB 476 Level+, English