GAMMAcast Detectors
LB 6739, LB 6752, LB 6760

Operating Manual

Embedded Software as of Vers. 1.3.0 (LB 6739, LB 6752)
and Vers. 1.0.4 (LB 6760)

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BERTHOLD

BERTHOLD TECHNOLOGIES GmbH & Co. KG
P.O. Box 100 163
75312 Bad Wildbad, Germany
www.berthold.com

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

Operating Manual

1 About this Document

1.1 Some Prior Remarks

The GAMMAcast detectors were produced by the manufacturing company BERTHOLD TECHNOLOGIES GmbH & Co. KG (designated as Berthold in the following) and supplied to you in a complete and functionally reliable condition.

It is essential that you have read this operating manual prior to operation. We have tried to compile for you all information for safe and proper operation. However, if you should still have questions which are not answered in this operating manual, please refer to Berthold.

1.2 Storage Place

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

1.3 Target Group

The GAMMAcast detectors may only be installed, operated, maintained and repaired by trained personnel.

1.4 Validity of the Operating Manual

Before commissioning and using the GAMMAcast detectors in connection with a suitable evaluation unit provided by Berthold, it is required to carefully read the present operating manual as well as the operating manual of the corresponding evaluation unit.

The operating manual is valid from the delivery of the GAMMAcast detectors to the user until their disposal. Modification services are not carried out by the manufacturer Berthold.

1.5 Copyright

1.6 Structure of the Manual

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

1.7 Notation

In this manual, the following notations are used to state the software interface and the operation:

Identifier	Meaning	Example
Quotation mark	Field in the software user 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 (key) or an area on the touch display if a mouse is not used for controlling.

1.8 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.

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 Symbols Used on the Device

Read the operating manual

Please observe the instructions in this operating manual.

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 the document “Technical Information”.

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 GAMMAcast detectors are used in connection with a suitable evaluation unit (EVU) provided by Berthold and a corresponding source of radiation in order to measure the radiation intensity occurring during a radiometric measurement.

The following constitutes proper use:

- Adhering strictly to the instructions and operation sequences and not undertaking any different, unauthorised practices which could put your safety and the operational reliability of the GAMMAcast detectors at risk.
- Observing the provided safety instructions.
- Carrying out the prescribed maintenance measures or having them carried out for you.

2.3 Improper Use

- If the GAMMAcast detectors are used in a way which is not described in the present operating manual, the warranty will be void.
- Berthold only accepts liability for and/or guarantees the compliance of the GAMMAcast detectors with their published specifications.

Avoid the following circumstances:

- Using the GAMMAcast detectors in systems in which explosive gases may escape to the surroundings. The GAMMAcast detectors and the EVU are not explosion-proof.
- Non-compliance with the sections in the operating manual on the EVU used and on the GAMMAcast detectors.
- Applying conditions and requirements which do not conform to those stated in the technical documents, datasheets, operating and assembly instructions and other specific guidelines of the manufacturer.
- Using the GAMMAcast detectors in a damaged or corroded condition.
- Restructuring or changing the system components.

NOTICE

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

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

2.4 Qualification of the Personnel

NOTICE

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

In different parts of this operating manual, reference is made to personnel with certain qualifications who can be entrusted with different tasks during installation and maintenance.

The personnel is divided into three groups:

- Persons with general knowledge
- Experts
- Authorised persons

The meaning of these terms and the requirements applicable to the respective group of people are described in the following sections.

Persons 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.

Those with a 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.

Those with a general knowledge are e.g. technicians who can undertake different tasks during the transportation, assembly and installation of the shielding under the guidance of an authorised person. This can also refer to construction site personnel. The persons in question must have experience in the transportation and assembly of heavy component parts.

Experts

Experts are persons who have sufficient knowledge in the required area due to their specialist training and who are familiar with the relevant national health and safety regulations, accident prevention regulations, guidelines and recognised technical rules.

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

Authorised Persons

Authorised persons are those who are either designated for the corresponding task due to legal regulations or have been approved by Berthold for certain activities.

2.5 Operator's Obligations

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

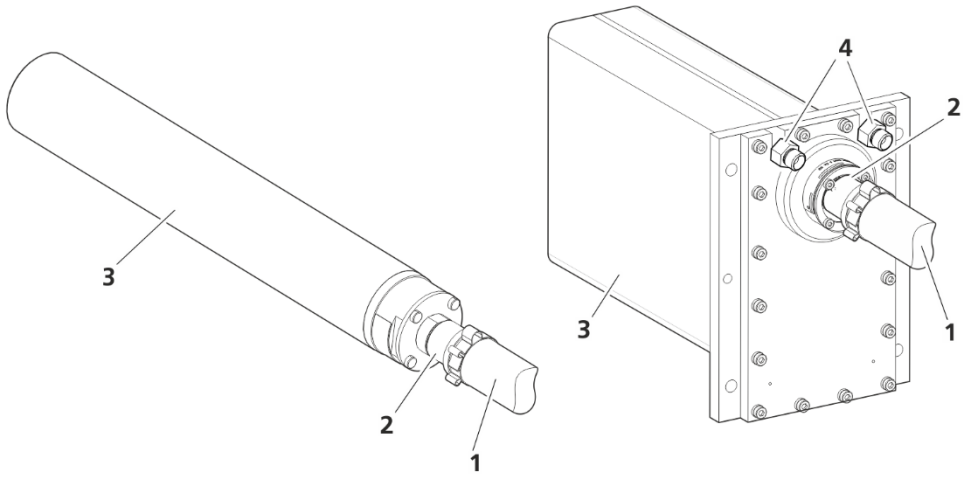
- Observation and use of the operating manual and the legal provisions.
- Intended operation of the product.
- Observation of the plant security instructions and the operating instructions of the operator.
- Regular monitoring/maintenance of the product

3 Product Description

The GAMMAcast detectors convert the Gamma-rays emitted by a source of radiation into electrical impulses. The pulse rate emitted at the output of the GAMMAcast detectors to the evaluation unit is proportional to the impinging radiation intensity.

The GAMMAcast detectors described herein are scintillation counters that, in connection with a suitable evaluation unit, determine the radiation intensity occurring during a radiometric measurement.

3.1 Overview



1 Heat protection hose
2 PlugProtect plug-in connection
3 Stainless steel housing
4 Connections for the water cooling

Fig.1 View of the GAMMAcast detectors,
Left: LB 6739 / LB 6760; Right: LB 6752

The GAMMAcast detectors consist of the following components:

- Stainless steel housing
- Electronics with integrated CPU
- Scintillator (crystal - LB 6739 / LB 6760 or PVT - LB 6752)
- Water cooling system (optional for LB 6739 / LB 6760)
- Connection cable with heat protection hose and PlugProtect plug-in connection.

3.1.1 Scintillator

The GAMMAcast detectors are distinguished by means of the external dimensions and the scintillators used.

- **GAMMAcast detector LB 6739:**
  Scintillation counter with crystal and photomultiplier (see technical information, chapter 1)
- **GAMMAcast detector LB 6752:**
  Polymer scintillation counter with photomultiplier (see technical information, chapter 1)
- **GAMMAcast detector LB 6760:**
  Scintillation counter with crystal and silicon photomultiplier (see technical information, chapter 2)

3.1.2 Connection Cable

The plug-in connection "PlugProtect" protects the transition between the GAMMAcast detector and the connection cable against moisture penetration. The heat protection hose covering the connection cable protects it against too high temperatures.

The connection cables are commonly connected to a terminal box. For this purpose, a variant with HeavyCon plug or open ends can be used. The terminal box is connected to the EVU.

3.1.3 Water Cooling System

A version of the GAMMAcast detectors with water cooling is available to protect the scintillators against too high temperatures. The GAMMAcast detector LB 6752 has already been provided with a water cooling system integrated into the housing.

3.2 Storage

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

4 Commissioning

4.1 Initial Operation

DANGER

Danger to life from electric shock!

- Installation may only be carried out by a qualified electrician.
- Installation may only be carried out if all components has been de-energised.
- Only open the housings when there is no voltage.

NOTICE

Danger due to inadmissible place of use!

The GAMMAcast detectors must not be used in systems in which explosive gases or vapours may form. They are not explosion-proof.

NOTICE

Risk of breaking!

The GAMMAcast detector contains a PMT with glass housing and/or a fragile scintillation crystal. The glass housing of the PMT can break. The crystal can break or splinter.

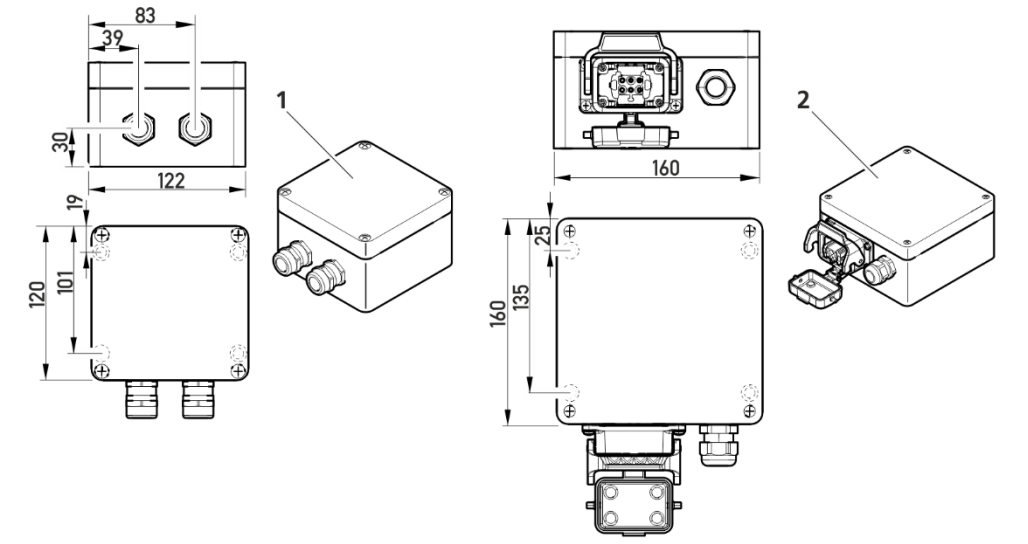
- Handle the GAMMAcast detector with care.

Mount the GAMMAcast detector to the outside or inside of the mould. If required, connect the water cooling system. Additional information is provided in chap. 4.3.

The GAMMAcast detector is connected either via a terminal box (Fig.3) or directly to the EVU. The connection diagram of the respective evaluation unit is to be taken into account. For the connection to the EVU, please also refer to the connection diagram provided in the operating manual of the EVU.

4.2 Terminal Box

The detectors and the EVU are to be connected via the terminal box. This connection is to be made with a standard 6–wire shielded cable (6 x 0.5 mm²) with a maximum length of up to 1000 m. As required, the terminal box can be ordered for open ends (Mat. No. 07005, Fig.2, item 1) or with an industrial connector (Mat. No. 34787, Fig.2, item 2).



1 Terminal box for open ends
2 Terminal box for industrial connector

Fig.2 Terminal box for detectors

4.2.1 Mounting the Terminal Box

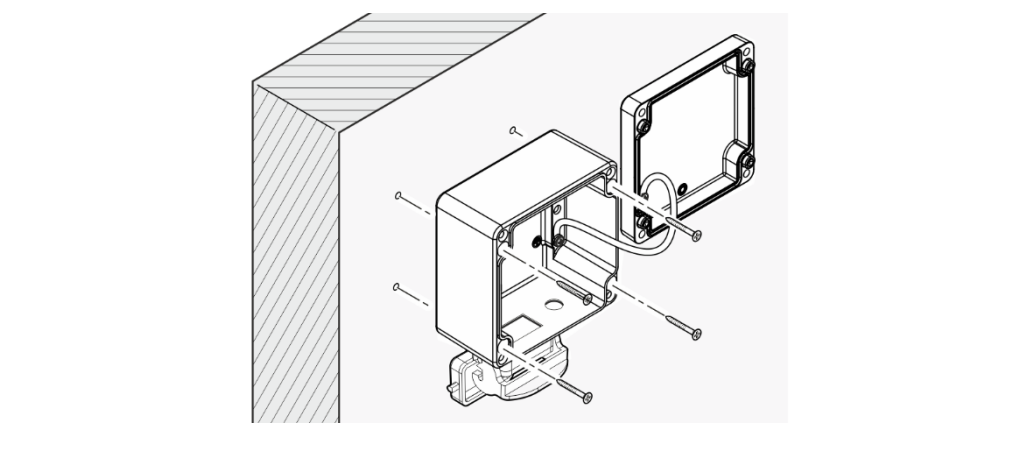


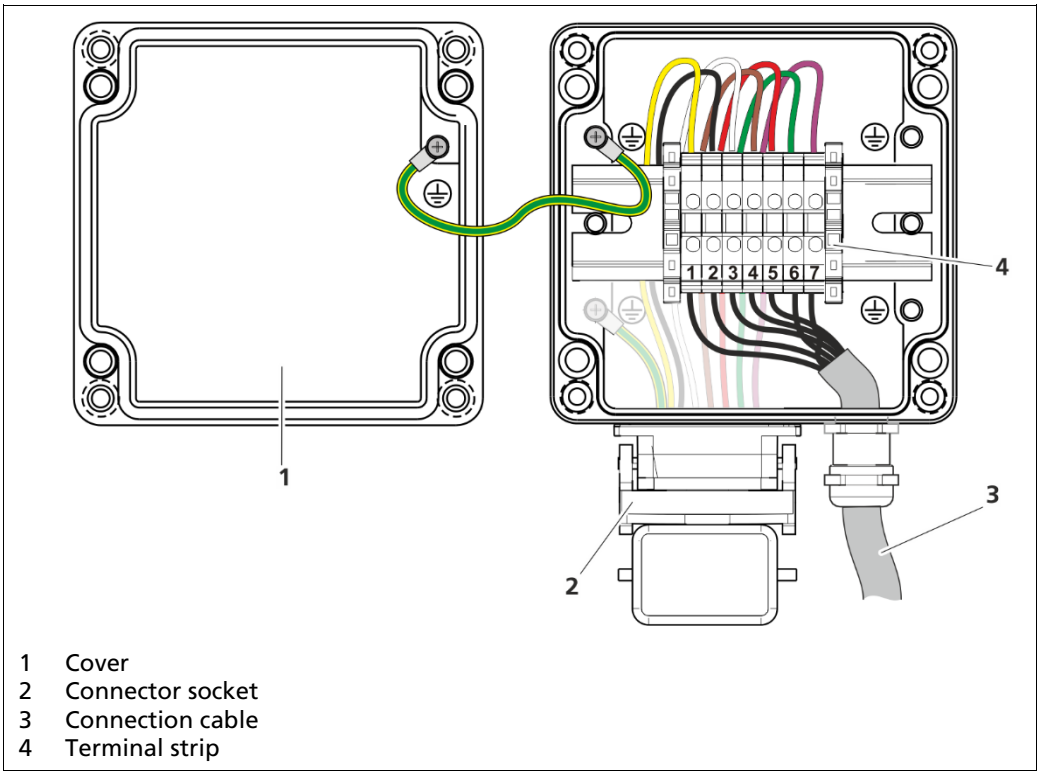
Fig.3 Mounting the terminal box (variant with industrial connector)

Install the terminal box near the mould in a protected but easily accessible place. The terminal box can be installed in different ways and manners depending on:

- the general physical conditions at the site.
- the temperature conditions around the casting floor.
- the distance from the mold.

The terminal box must be secured to a wall or to a pillar so that the sturdy cable (connection lines inside the hose) will not move the terminal box.

4.2.2 Connect Terminal Box



1 Cover
2 Connector socket
3 Connection cable
4 Terminal strip

Fig.4 Connect terminal box (variant with industrial connector)

Cables coming from the GAMMAcast detector	Terminal strip of the EVU or of the terminal box
Yellow	1
Black	2
White	3
Brown	4
Red	5
Gray[1]	6[1]
Violett	7

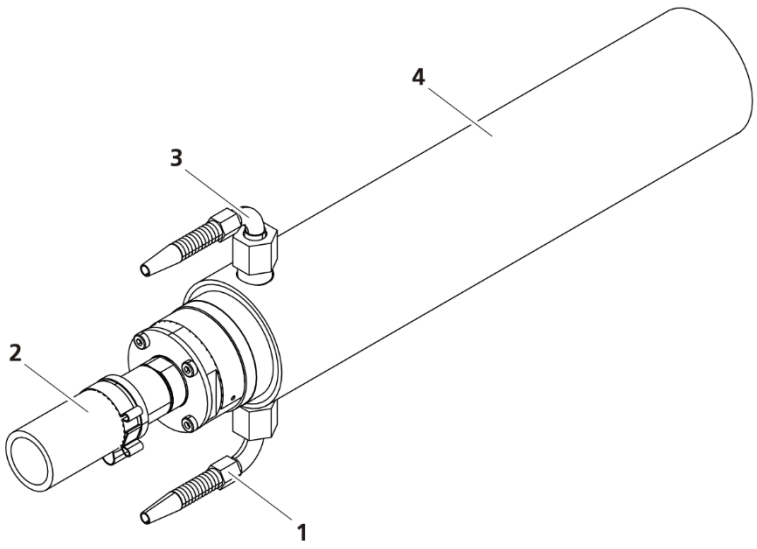
[1] If connecting to the EVU LB 452 castXpert grey may also be connected to pin 6, please also refer to the connection diagram in the technical information of the EVU LB 452.

4.3 Water Cooling System Connection

The GAMMAcast detector LB 6752 is already provided with a water cooling system upon delivery. The GAMMAcast detectors LB 6739 and LB 6760 can be purchased with an optional water cooling system.

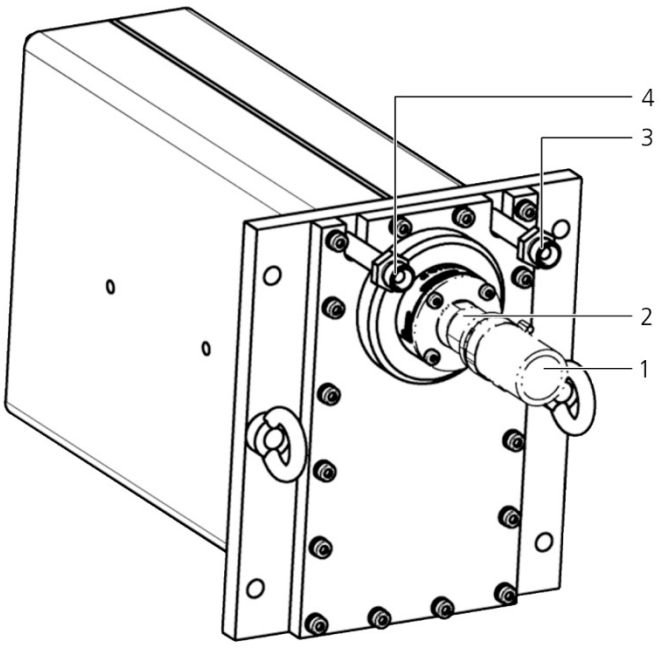
NOTICE

Please make sure that the water is drained at the highest point, as shown in (Fig.5, item 3 and Fig.6, item 4).



1 Water cooling inlet
2 Plug-in connection "PlugProtect"
3 Water cooling outlet
4 Water cooling system

Fig.5 GAMMAcast detector LB 6739 or LB 6760 with water cooling system



1 Connection cable with heat protection hose
2 Plug-in connection "PlugProtect"
3 Water cooling inlet
4 Water cooling outlet

Fig.6 GAMMAcast detector LB 6752 with integrated water cooling system

Insert the GAMMAcast detector with water cooling system into the bore in the mould that corresponds to the GAMMAcast detector. When using a water cooling system (with GAMMAcast detector LB 6739 or LB 6760), please note that the bore must be accordingly bigger.

When fixing the GAMMAcast detector to the water cooling system, please make sure that the discharge nozzle on the mould is at the highest point (Fig.5, item 3 and Fig.6, item 4.) This will ensure that there is always enough water in the water cooling system and that no air bubbles can form.

NOTICE

Damage to the device!

When using water that does not have the same quality as drinking water, the water cooling system and the GAMMAcast detector may be damaged due to deposits of dirt particles.

Reduced cooling power!

Only water that has the same purity as drinking water may be used as coolant. Please observe the minimum cooling water requirement of the GAMMAcast detectors (chap. 4.4).

Connect the inlet and outlet of the cooling water to the GAMMAcast detector (LB 6739 / LB 6760: Fig.5, item 1 and 3; LB 6752: Fig.6, item 3 and 4).

4.4 Minimum Cooling Water Requirement

NOTICE

Device damage due to high temperatures!

If the cooling water flow is shut off to early after end of casting, the admissible temperature of the GAMMAcast detector may be exceeded.

If the water is left in the water cooling system when there is a risk of frost, this may cause mechanical damage to the water cooling system.

- Keep the cooling water flowing as long as necessary.
- Drain the water cooling system when there is a risk of frost.

4.4.1 GAMMAcast Detector LB 6739 / LB 6760

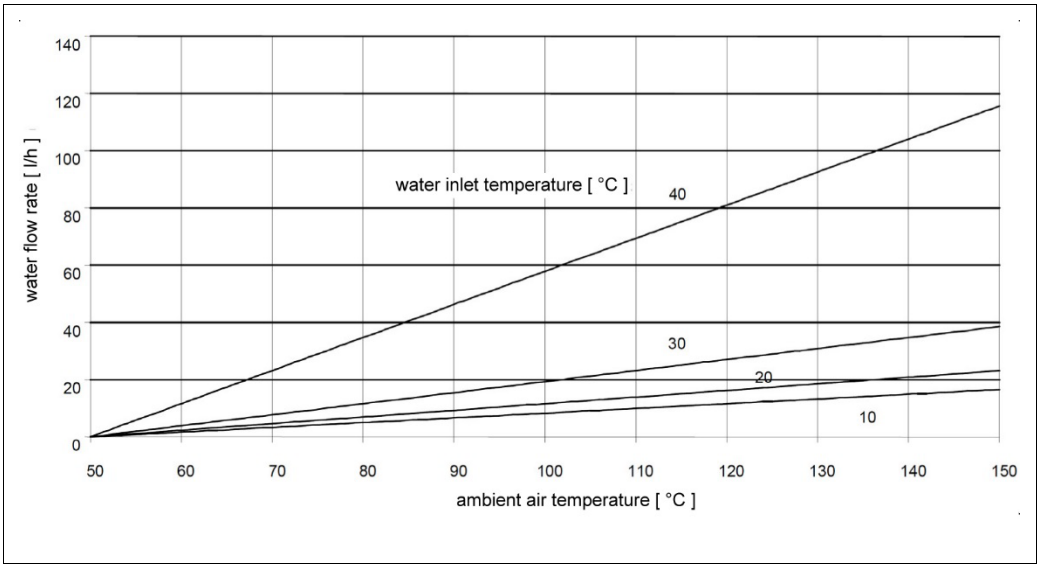


Fig.7 Minimum cooling water requirement LB 6739 / LB 6760

4.4.1 GAMMAcast Detector LB 6752

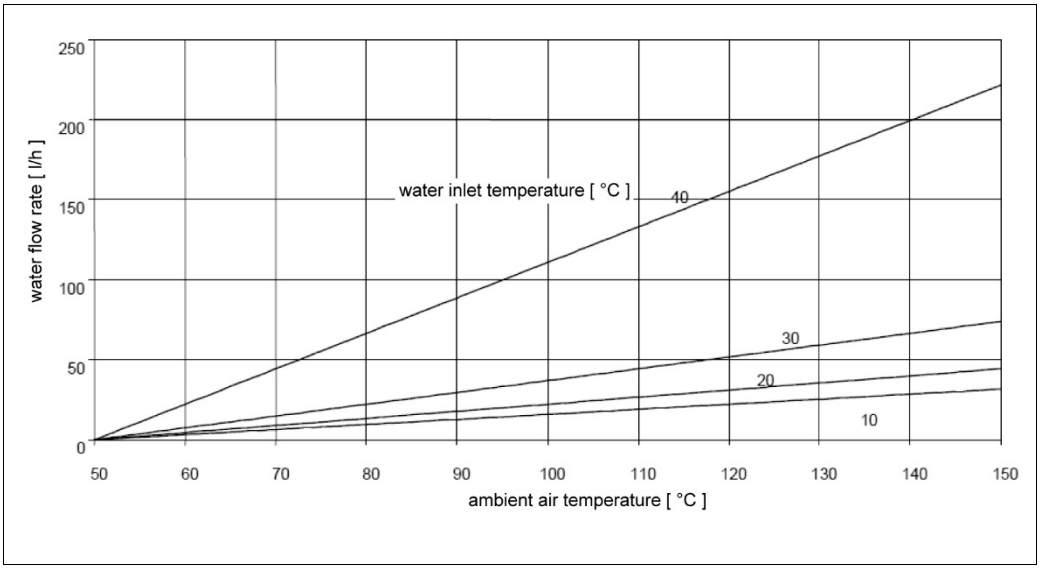


Fig.8 Minimum cooling water requirement LB 6752

5 Software

In order to be able to access all functions of the GAMMAcast detectors, it is required to operate the detector via the EVU LB 452, that enables the use of a software control.

When operating the detector with another EVU, such as the LB 352, a detector software modem can be used in connection with a PC in order to access the software of the detector.

More information on the use of the software of the EVU LB 452 are provided in chapter 5 of the operating manual "47344BA2".

5.1 Operation via Detector Service Modem

A GAMMAcast detector can be checked in the repair shop by connecting it to a PC via the "detector service modem". In order to use the GAMMAcast detector via the "detector service modem", the following requirements must be met:

System requirements

- Menu language: English
- Windows XP or higher
- 512 MB RAM
- 1 gigahertz processor
- USB port

Connections

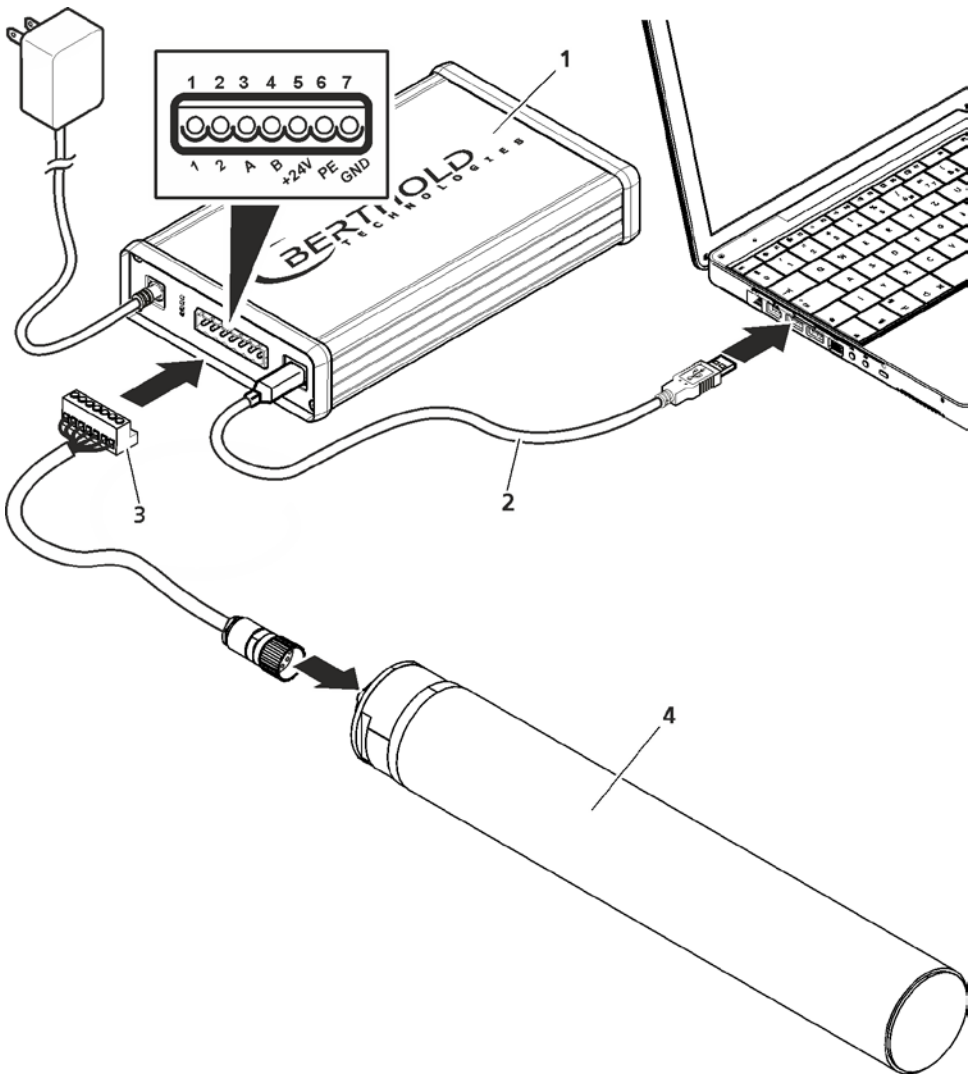
- USB 2.0 to PC
- RS485 to detector
- Supply voltage 24 VDC (100-240 VAC power supply unit included)

IMPORTANT

No communication with the GAMMAcast detector!

Missing drivers or system requirements are not met!

- Please note the system requirements in the document technical information under chap. 6.
- Install the drivers by executing the driver file "BertholdRS485.exe" before connecting the detector service modem. The software can be downloaded from the Berthold website (www.berthold.com).
- Execute the installation file "Setup.exe" in order to install the operating software "LB 67xx PC control". The software can be downloaded from the Berthold website (www.berthold.com).

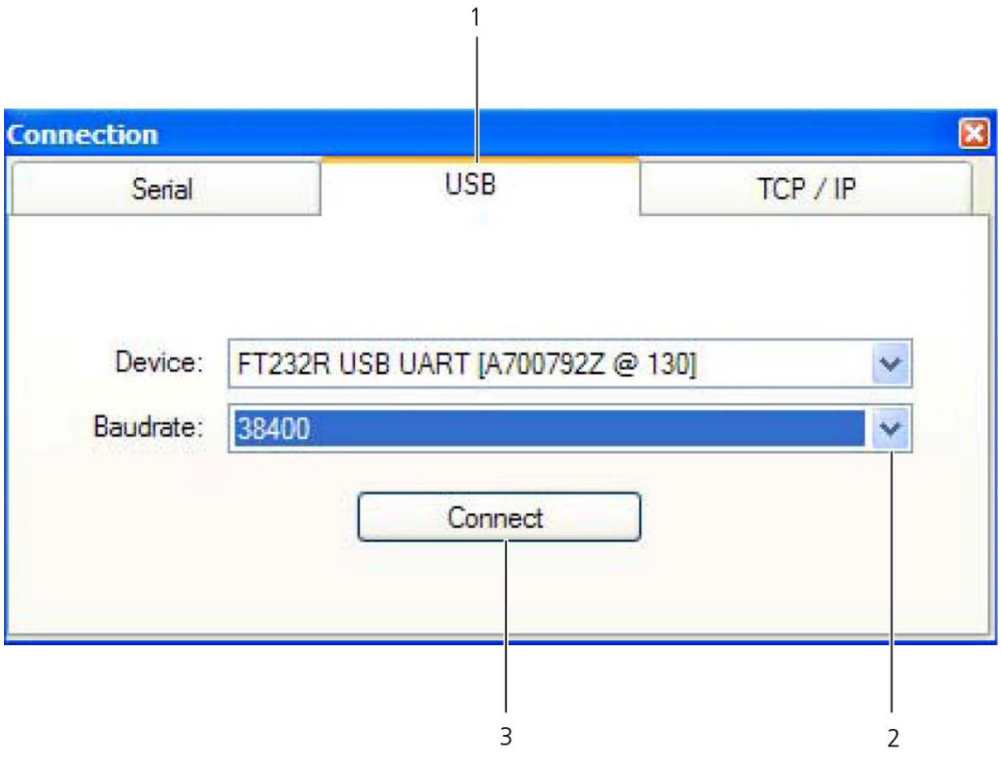


1 Service detector modem
2 USB cable
3 Terminal connector strip for GAMMAcast detector
4 GAMMAcast detector

Fig.9 Detector service modem

1. Connect the GAMMAcast detector to the terminal strip (Fig.9, item 3) of the detector service modem (Fig.9, item 1).
2. Connect the detector service modem via the supplied USB cable (Fig.9, item 2) to a free USB port on your PC.
3. Connect the mains cable to the detector service modem.
4. Start the programme **"LB 67xx PC control.exe"**.
   ▶ The program (connection window) opens.

5.1.1 Establish Connection



1 Tab “USB”
2 Selection “Baudrate”
3 Button “Connect”

Fig.10 Connection window, Software “LB 67xx PC control”

1. Click on the tab <USB> (Fig.10, item 1).
2. In the drop-down menu (Fig.10, item 2), select a baud rate of 38400.
3. Click on <Connect> (Fig.10, item 3).
   ▶ The main screen of the program LB 67xx PC control opens.

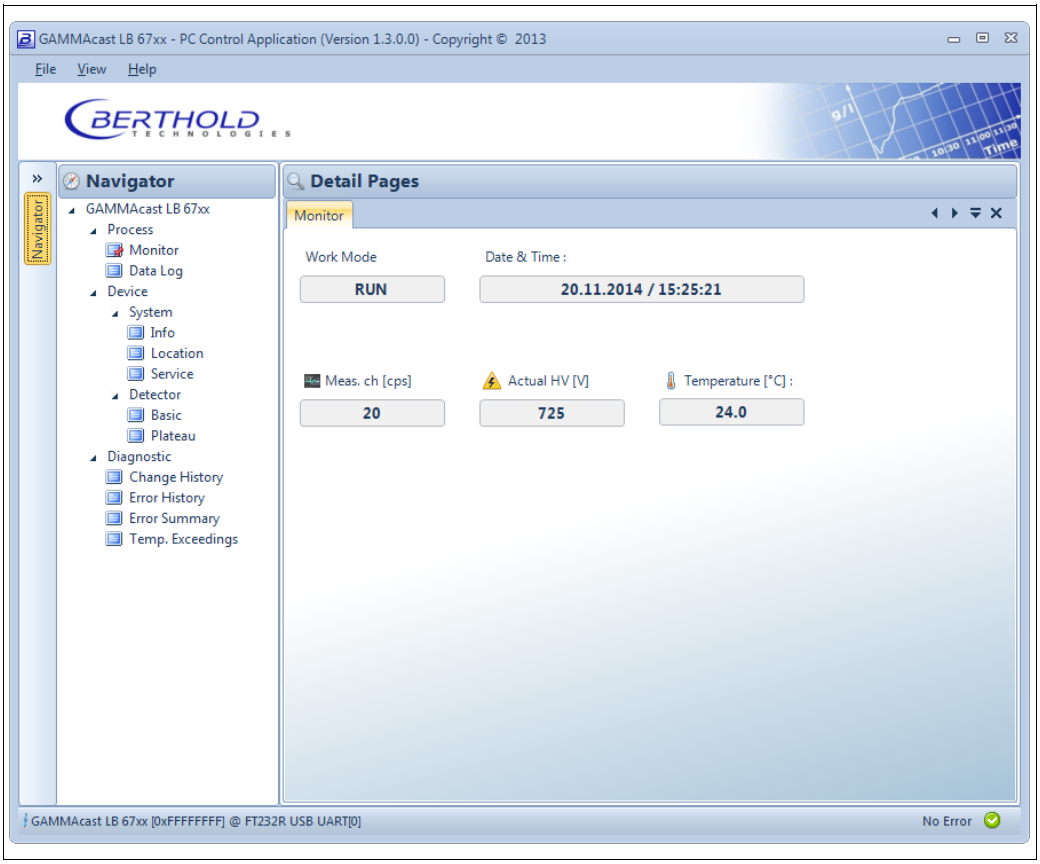


Fig.11 Start page, operating software "LB 67xx PC Control Application"

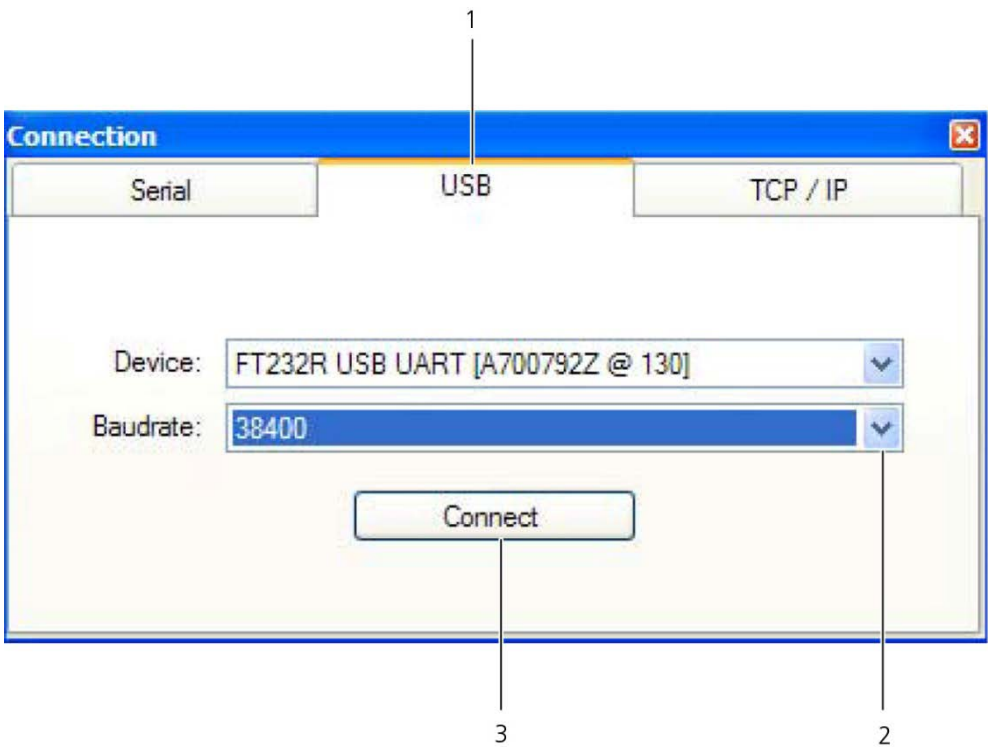
IMPORTANT

The scope of the operating software "LB 67xx PC control" is the same as that of the operating software of the EVU. For this reason, a separate description will not be provided at this point. For more information, please refer to chapter 6.

5.1.2 Software Update

The following chapter describes how a software update is performed with the detector service modem. A software update can be also be performed with the EVU. Please refer to the manual 47344BA2 for further instructions.

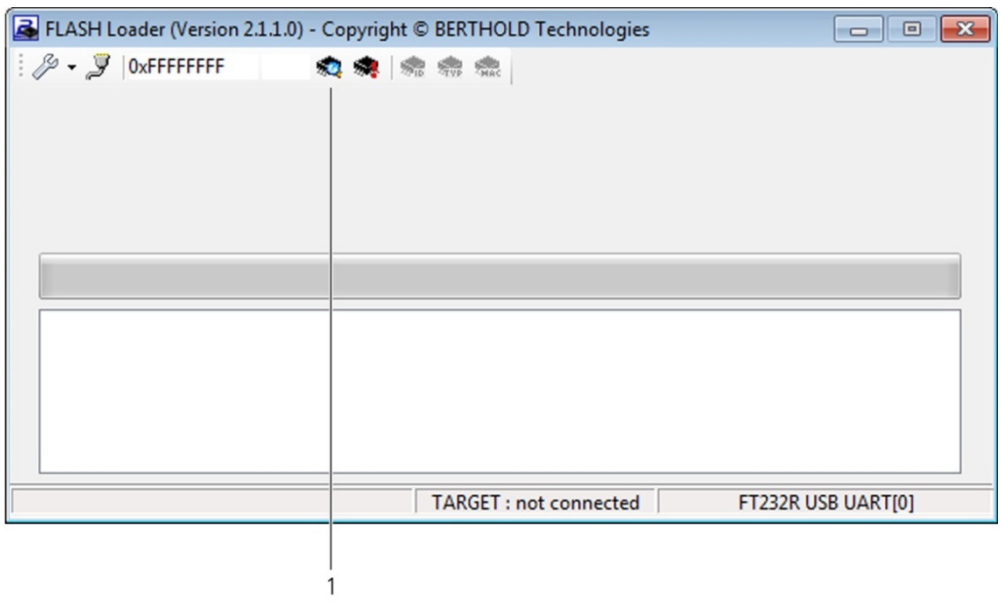
1. Install the drivers by executing the driver file. "BertholdRS485.exe" before connecting the detector service modem.
2. Run the installation file "Setup.exe" to install the service program "FLASH Loader". The software of the detector can be updated with the service program "FLASH Loader".
3. Connect the GAMMAcast detector to the terminal strip of the "detector service modem".
4. Connect the "detector service modem" via the supplied USB cable to a free USB port on your PC.
5. Connect the detector service modem via the supplied AC adapter to the power supply.
6. Start the program "FlashLoader.exe". The software can be downloaded from the Berthold website (www.berthold.com).
   ▶ The program (connection window) opens.



1 USB tab
2 Selection of baud rate
3 Connect button

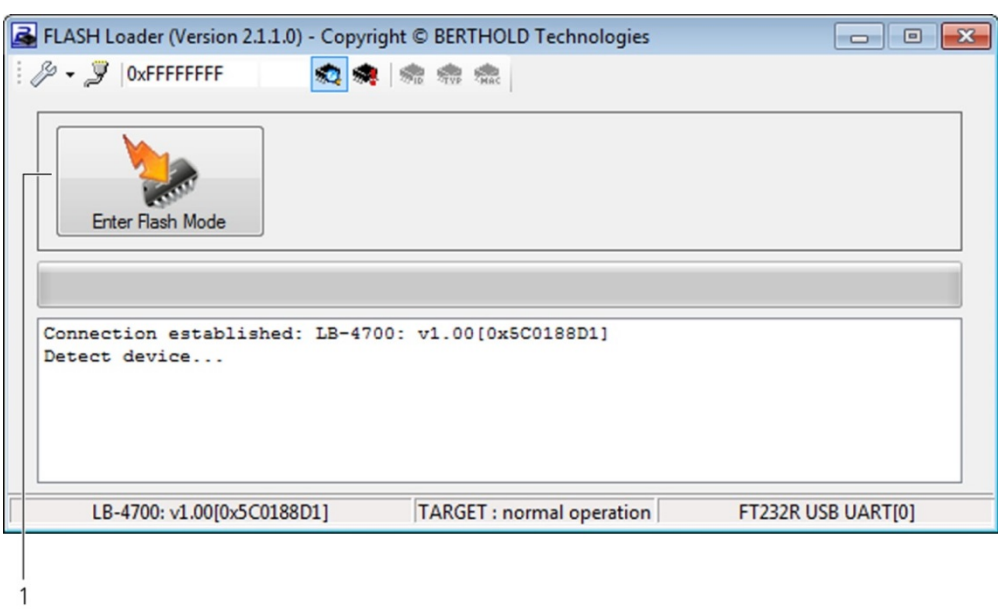
Fig.12 Connection Window "Flash Loader"

7. Click on the tab <USB> (Fig.12, item 1).
8. Select a baud rate of 38400 in the selection menu (Fig.12, item 2).
9. Click on <Connect> (Fig.12, item 3).
10. Click on the button <detect device> (Fig.13, item 1).
    ▶ The program establishes a connection to the detector.



1 Button <detect device>

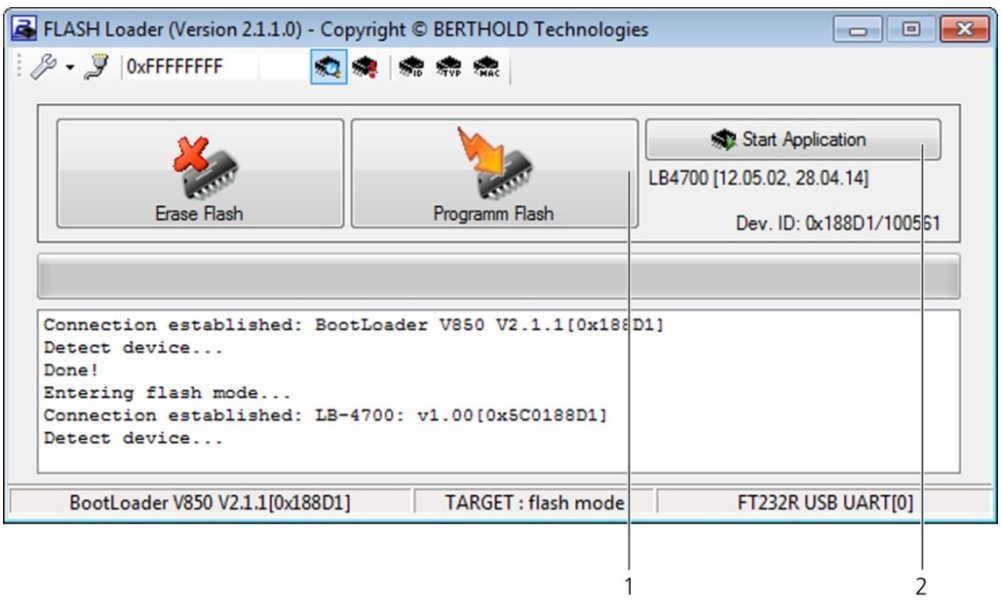
Fig.13 Flash Loader Main Screen



1 Button < Enter Flash Mode >

Fig.14 Flash Loader Connection

11. Click on the button <Enter Flash Mode> (Fig.14, item 1).



1 Button < Program Flash Mode >
2 Button <Start Application>

Fig.15 Flash Loader "Program Flash" Page

12. Click on the button <Program Flash> (Fig.15, item 1).
    ▶ A dialogue window is opened.
13. Select the corresponding file for the software update.
    ▶ The detector is programmed with the respective software.

IMPORTANT

Make sure that the detector is only programmed with compatible software. Please note that the detectors LB 6739 / LB 6752 and the detector LB 6760 have different software!

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

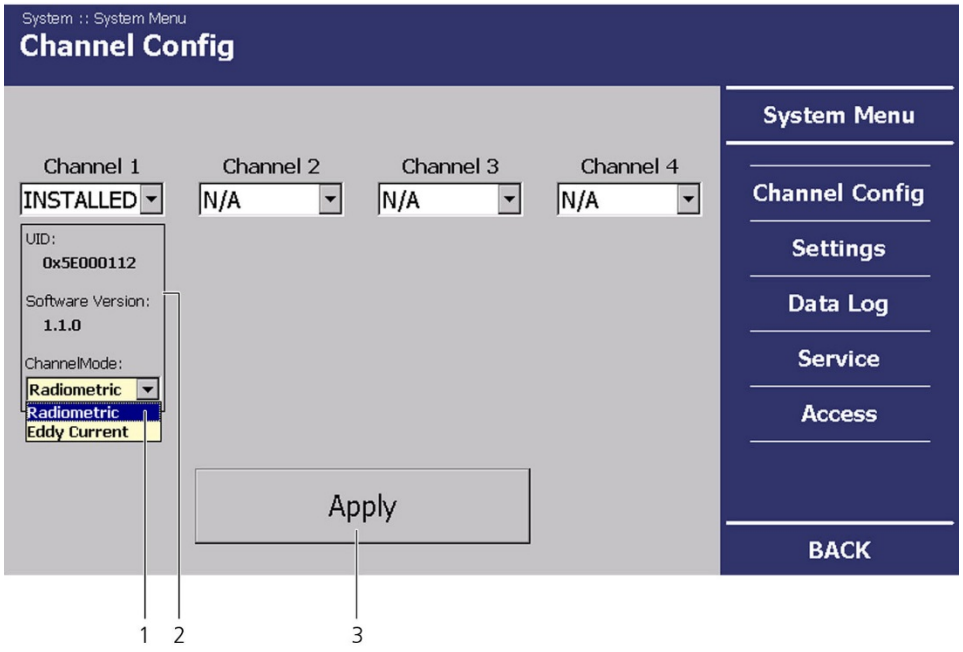
IMPORTANT

Reset the detector to the factory default settings if the first or second digit of the software version should have changed. Make a note of the settings before and after you enter the factory reset again.

5.2 Operation via EVU LB 452

5.2.1 Installation of the GAMMAcast Detector

When connecting the GAMMAcast detector to an installed measurement channel of the EVU, the detector will automatically be detected and started.



1 Channel mode drop-down menu
2 Drop-down menu channel 1
3 Apply button

Fig.16 System menu, channel settings

NOTICE

Measurement not possible!

- Make sure that the GAMMAcast detector is correctly connected (see chap. 4). At least one basic module must be installed in the corresponding channel.
- The channel mode "Eddy Current" is not admissible for the GAMMAcast detectors. In the <Channel Setting> menu in the drop-down menu, set the "Channel Mode" (the measurement technique) to "Radiometric" (Fig.16, item 1).

Proceed as follows in order to set up the measurement channel:

1. In the standard display, click on System | System Menu | Channel Configuration, in order to access the "Channel Setting" submenu.
2. In the drop-down menu below "Channel XY" (Fig.16, item 2), select <INSTALLED>.
3. In the drop-down menu below "Channel Mode" Fig.16, item 1), select "Radiometric" as measurement method.
4. Click on <Apply> (Fig.16, item 3).
   - The measurement channel has been set up correctly. For information on the other menus, see the operating manual for the EVU LB 452 (47344BA2).

6 Menu Detector

In Fig.17 the schematic structure of the "detector" menu is displayed. In the "detector" menu, you can carry out a check of the detector by acquiring a plateau, make detector settings and set the tripping limits of alarms for temperature exceedings.

You can also look into the error history and export service data, reboot the detector or reset it to the factory settings.

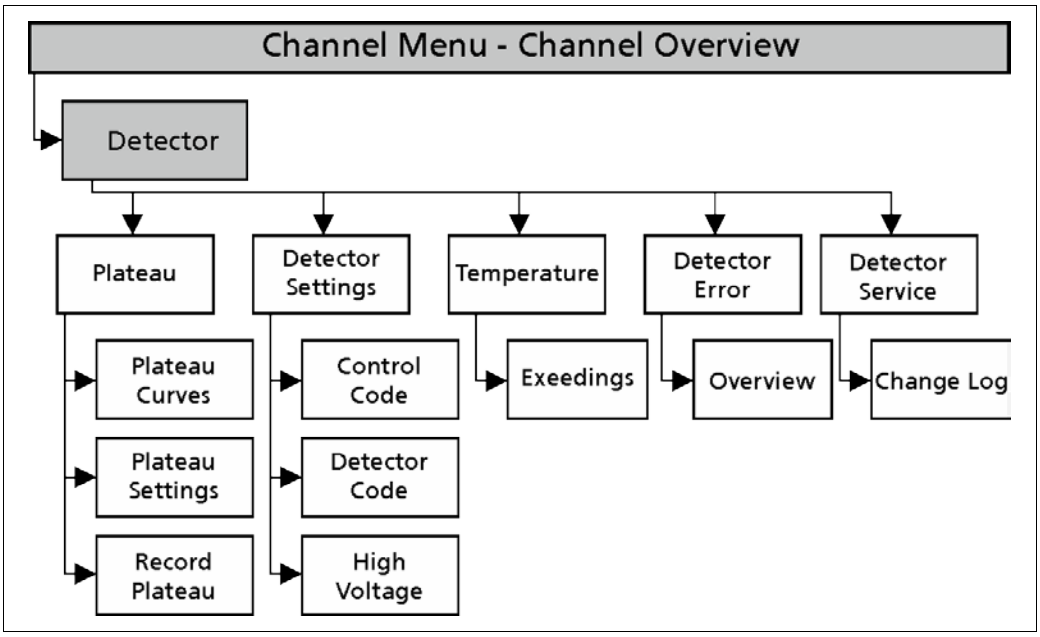


Fig.17 Menu structure, "Detector" submenu

6.1 Plateau

IMPORTANT

In the condition as supplied, the operating point has already been correctly adjusted by Berthold by means of plateau curve acquisition.

Acquiring a plateau and setting the correct supply voltage of the photomultiplier must only be carried out, if the crystal, photomultiplier or electrical components have been exchanged

During the plateau acquisition, the high voltage required for the operation of the photomultiplier (PMT) is gradually increased. The pulse rate is measured after each increase.

The determined plateau curve is displayed in a diagram. When the high voltage increases, the pulse rate will increase as well. This must result in the development of a clear plateau. If the plateau is too short or too steep, this means that the detector is working in an unstable manner. In the event of an error, the PMT and/or the crystal must be replaced.

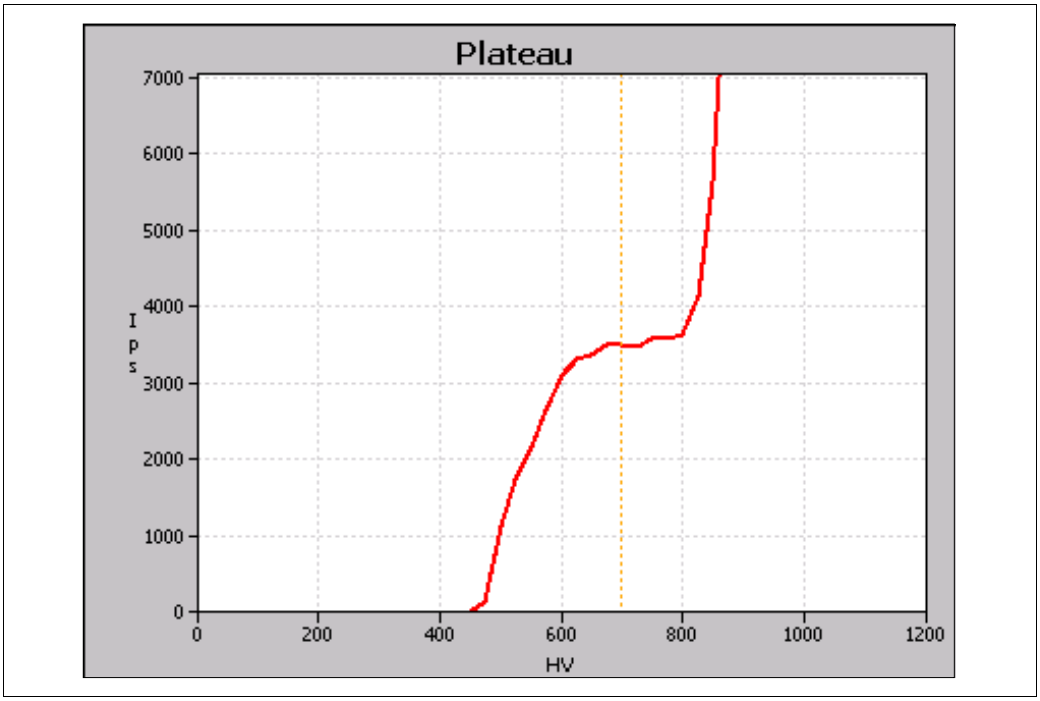
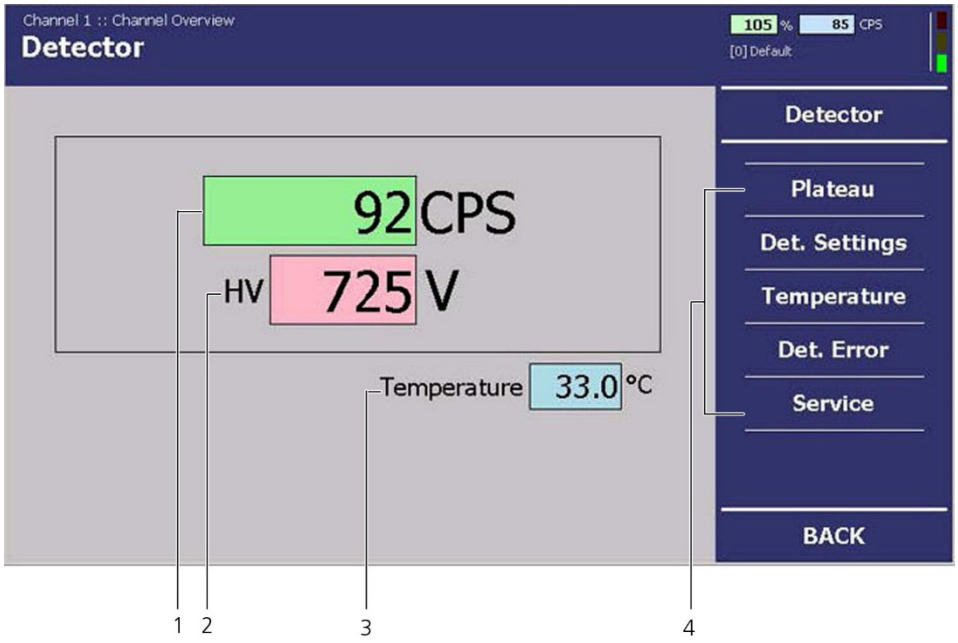


Fig.18 Plateau

Other damages to the scintillation counter can already be determined by means of a visual inspection. For more information on the visual inspection, please refer to chap. 7; the inspection can be carried out within the framework of maintenance work, see chap. 7.

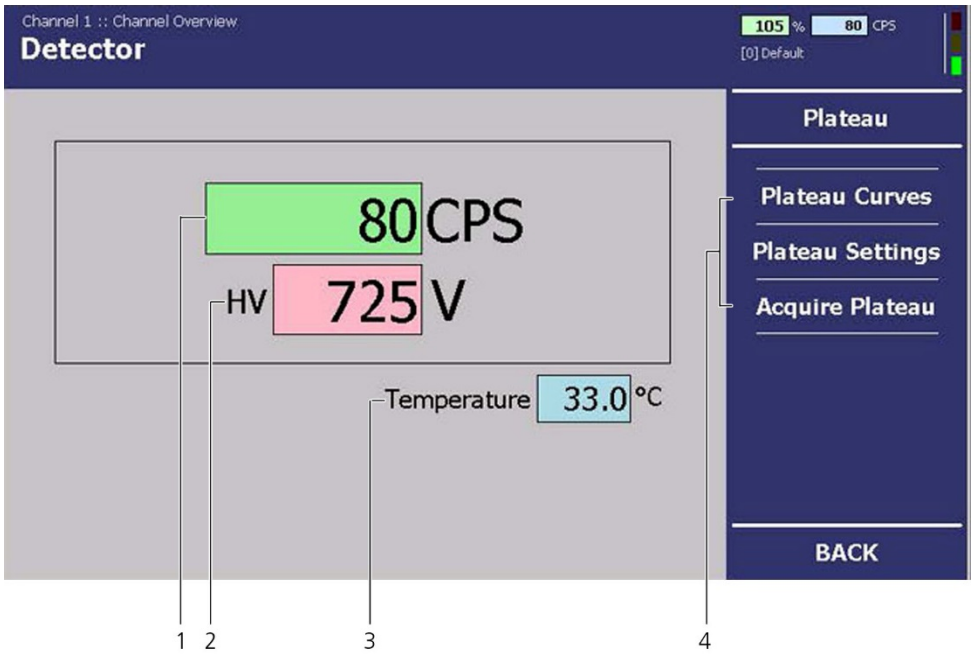
1. In the standard display, click on the channel <Channel XY> to which you had connected a GAMMAcast detector and for which you want to acquire a plateau.
   ▶ The Channel Overview menu opens.
2. In the Channel Overview menu, click on <Detector> to access the "Detector" submenu.
   ▶ The Detector submenu opens.
3. In the menu Channel XY | menu Channel Overview | Detector, click on <Plateau> to access the "Plateau" submenu.



1 Current count rate display field
2 Current voltage display field
3 Current temperature display field
4 Detector submenus

Fig.19 Menu “Detector | Plateau”

4. Click on Detector | Plateau | Plateau Settings, if you wish to change the pre-set values for the plateau acquisition.



1 Current count rate display field
2 Current voltage display field
3 Current temperature display field
4 Detector plateau

Fig.20 Menu “Plateau”

6.1.1 Plateau Settings

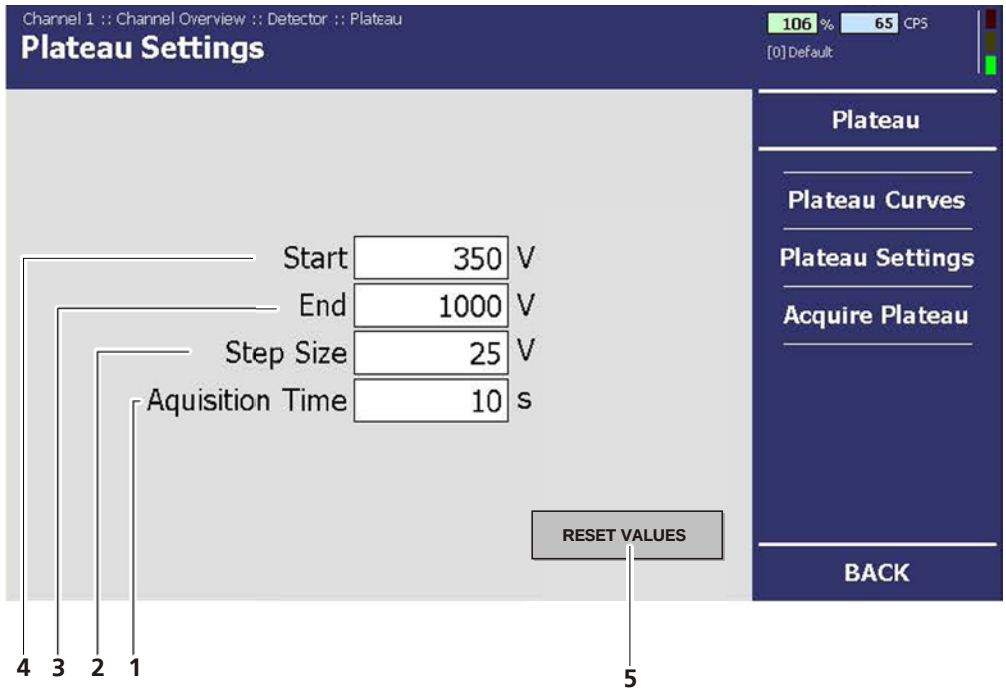
NOTICE

In the condition as supplied, the values in the submenu "Plateau Settings" are pre-set by Berthold.

- Only change these values after prior consultation with Berthold.

In the Plateau Settings submenu, you have the following settings options:

Plateau start/end	Definition of the range of the plateau acquisition.
Plateau step size	Refers to the step size (interval) between two measuring points.
Plateau acquisition time	Refers to the time that is used per measuring point for the counting of the count rate (cps).
Reset Values (only LB 6760)	Sets the parameters described above to the default settings. These depend on the individual built SiPM-crystal combination. Use this button after changing the SiPM-crystal combination, before you start a plateau recording.



1 Time input field - acquisition time per interval
2 Input field for the voltage - step size (interval)
3 Voltage input field - end of the plateau recording
4 Voltage input field - start of the plateau recording
5 Button RESET VALUES (only LB 6760)

Fig.21 Menu "Channel Overview" menu, Detector - Plateau (Plateau Settings)

6.1.2 Record a Plateau

When acquiring a plateau, proceed as follows:

1. Position a test source at the front side of the GAMMAcast detector or use the source of radiation built into the mould. When using the source of radiation, bring the lock of the shielding to the "OPEN" position.

NOTICE

Incorrect plateau acquisition!

Please make sure that there is a constant distance between the source and the GAMMAcast detector.

- Please make sure that there are no objects in the beam path.

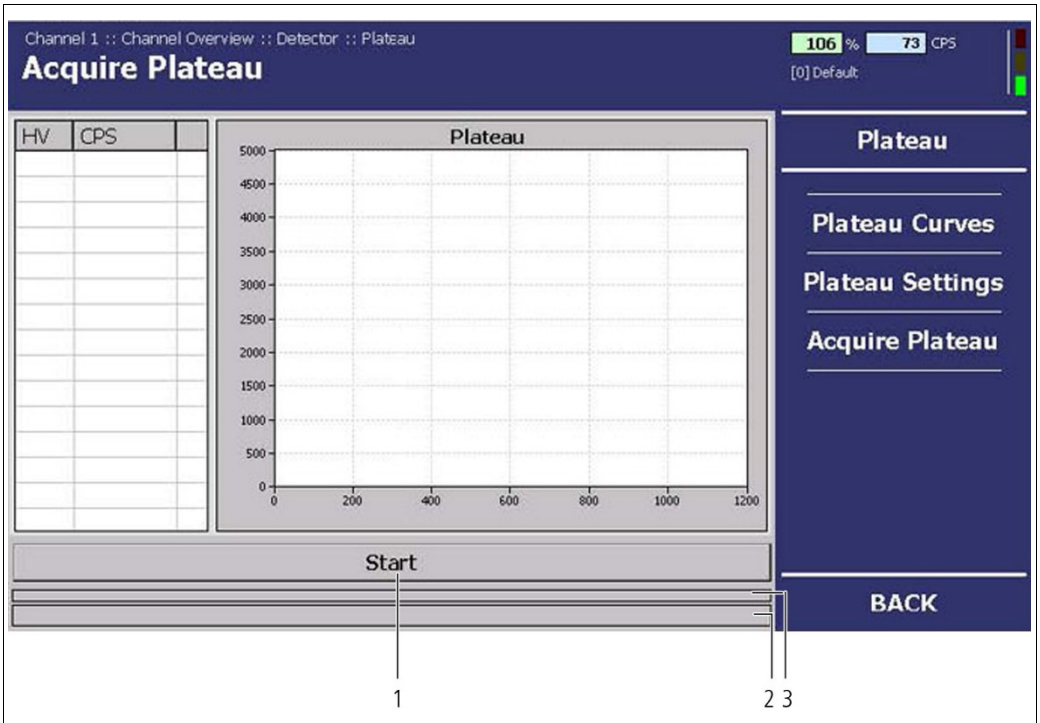
NOTICE

Measurement will be interrupted!

By acquiring a plateau, the current measurement of the mould level is interrupted.

- Make sure that there is no measurement in progress at the time of the plateau acquisition.

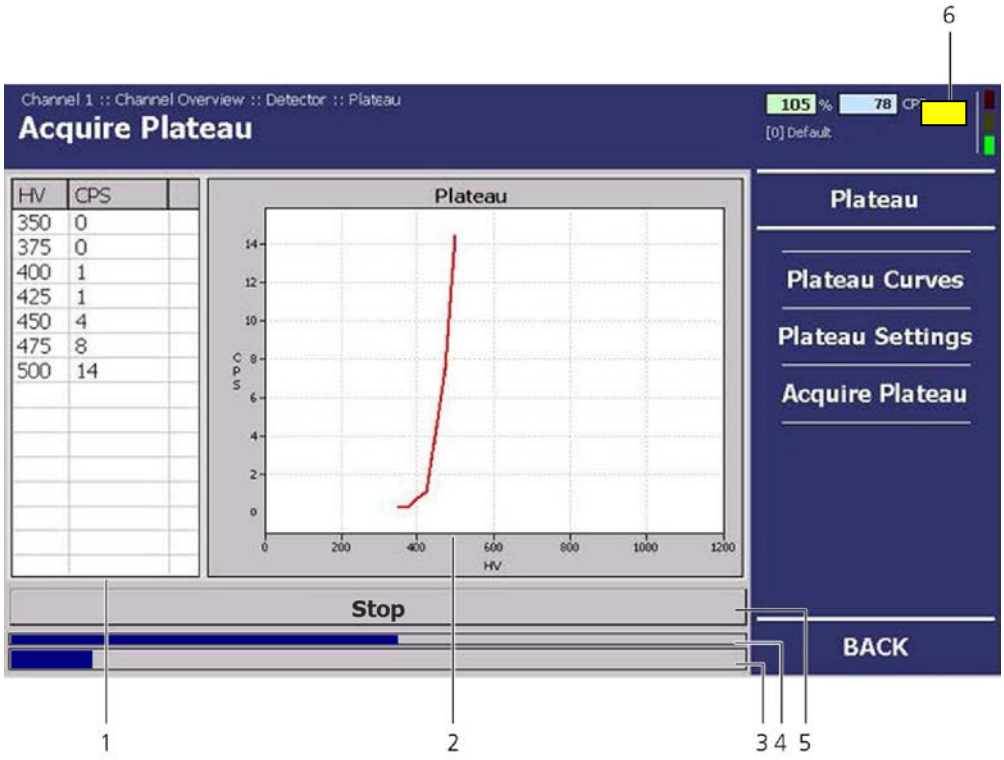
2. In the menu Channel XY | menu Channel Overview | Detector, click on <Plateau>, to access the "Plateau" submenu.
3. Click on **<Acquire Plateau>**.
   - The Acquire Plateau submenu opens.



1 Start button
2 Progress bar for the acquisition time of the respective voltage
3 Progress bar for the acquisition time of the plateau acquisition (overall)

Fig.22 Menu "Channel Overview", “Detector - Plateau (Plateau Settings)”

4. Click on the button <Start> in order to acquire a plateau.
   - A confirmation message opens.
5. Confirm the confirmation message by clicking on <OK>.
   - The EVU switches to **"DET"** mode. The current measurement is stopped.
   - The plateau recording is started automatically. This process can take several minutes.
6. The recorded values are read in and showed in the table and the plateau curve is drawn and automatically saved.



1 Table: Recorded count rate (CPS) for the respective voltage
2 Display of the plateau curve
3 Progress bar for the acquisition time of the respective voltage
4 Progress bar for the acquisition time of the plateau acquisition (overall)
5 Stop button
6 Detector mode (DET) display

Fig.23 "Channel Overview" menu, Detector - Plateau (Plateau Acquisition)

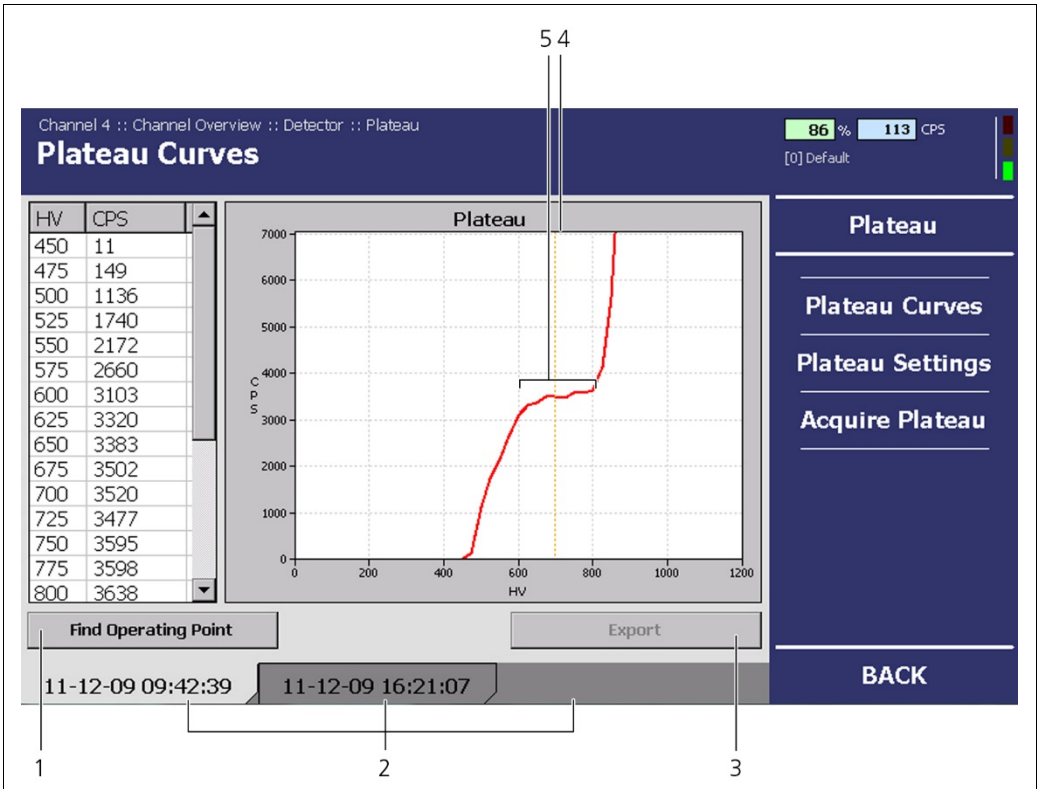
- When the acquisition is complete, a confirmation message opens. Confirming it will automatically search for and determine the operating point.
- The plateau recording is complete.
- If you detected any malfunctions of the GAMMAcast detector during the plateau acquisition, a visual inspection is to be carried out as the next step.

6.1.3 Plateau Curves

This menu offers you the following options:

- **Display of different plateau curves**. The tabs will only appear, if you have already acquired several plateaus.
- **Finding the operating point** using the different plateau curves (if you have acquired several curves).
- **Export of plateau acquisitions** in tabular form (.txt file) onto a USB flash drive.

7. In the menu Channel XY | menu "Channel Overview" | Detector, click on <Plateau> to access the "Plateau" submenu. Click on <Plateau Curves>. The Plateau Curves submenu opens.



1 "Find operating point" button
2 Tabs for the different plateau acquisitions
3 Export button
4 Display of operating point
5 Plateau (flat section of the curve)

Fig.24 Menu “Channel Overview”, Detector – Plateau – (Plateau Curves)

Finding the Operating Point

The operating point defines the value for the high voltage that is required for the operation of the photomultiplier.

NOTICE

In the condition as supplied, the operating point of the GAMMAcast detectors has already been pre-set by Berthold. It is only required to find and set a new operating point if the crystal, the photomultiplier or electrical components were exchanged at a later time.

1. Click on the button <Find operating point> in order to create a new operating point.
2. Confirm the confirmation message by clicking on <OK>.
   ▶ The operating point is automatically searched for and created.

Export of Plateau Record

Click on the button <Export> in order to export the data of the plateau acquisition.

The table, containing the voltages (HV) and corresponding count per second (CPS) values, is stored in the main directory of the USB flash drive in form of a **txt. file**.

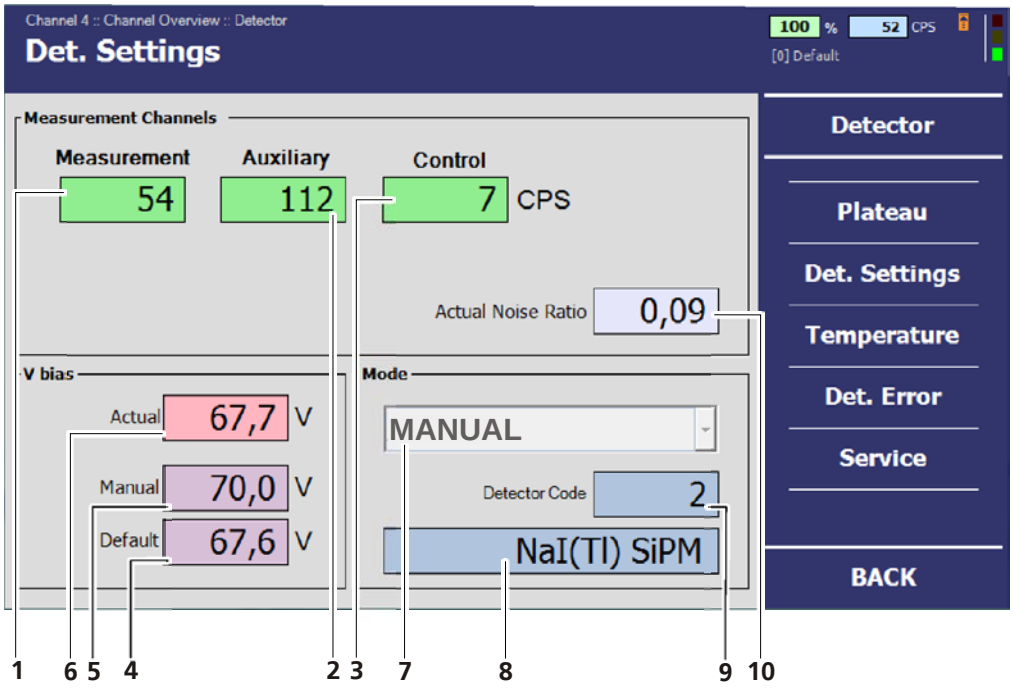
Malfunctions in the GAMMAcast detector may be caused by glass breakage, overheating or strong incidence of light. These damages are to be detected by carrying out a visual inspection.

6.2 Detector Settings

In the menu Channel XY | menu "Channel Overview" | Detector, click on <Det. Settings> to access the "Detector Settings" submenu.

This menu provides you with the following displays:

- High voltage control mode.
- Detector code.
- View values for the high voltage (HV) and change them if required).



1 Display field Count rate (CPS) of the measurement channel
2 Display field Auxiliary channel (CPS)
3 Display field Control channel (CPS)
4 Input field “HV Actual”
5 Input field “HV Manual”
6 Display field “HV Actual”
7 Menu “Control Mode”
8 Display field “Scintillator”
9 Input field “Detector code”
10 Display field “Actual Noise Ratio”

Fig.25 "Channel Overview" menu, Detector - Detector Settings

Actual Noise Ratio If the level rises above a specified limit, a warning is triggered because the thermal noise is too close to the measurement threshold (Value range between 0 and

NOTICE

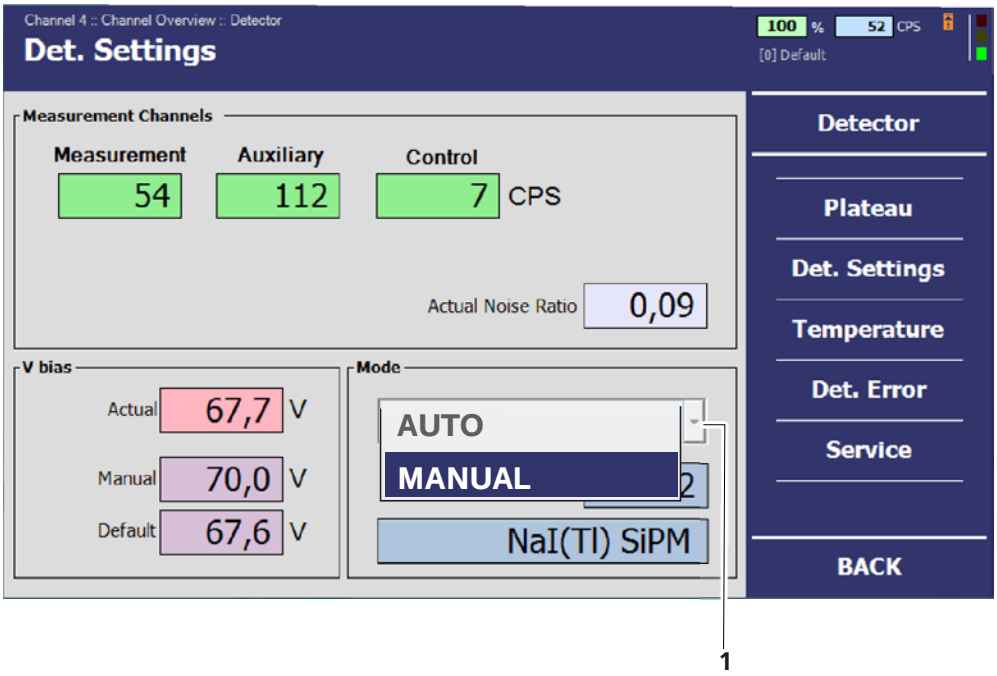
If the value is below the set thresholds, the measurement is not compromised. Therefore, the numerical value gives no indication of the quality of the measurement.

6.2.1 Setting the Control Mode

NOTICE

Using the "Automatic" control mode is not recommended for GAMMAcast Detectors LB 6752.

- The GAMMAcast detector LB 6739 should preferable be used in "automatic" mode and the LB 6760 must used in "automatic" mode.



1 Drop-down menu for control mode selection

Fig.26 "Channel Overview" menu, Detector - Detector Settings

1. Click on the drop-down menu.
   - The drop down menu for the control mode selection opens.
2. Select the desired mode (MANUAL only at LB 6752 detectors).

6.2.2 Detector Code

NOTICE

Depending on the GAMMAcast detector used, the detector code has been pre-set by Berthold in the condition as supplied.

- Change the value only after consultation with Berthold.

Possible detector codes:

Detector code	GAMMAcast detector
1	LB 6739; crystal: CsI with vacuum PMT
2	LB 6760; crystal: NaI with SiPM
3	LB 6760; crystal: NaI with SiPM (less sensitivity)
10	LB 6752; polymer scintillator with vacuum PMT 150 mm x 100 mm x 50 mm
11	LB 6752; polymer scintillator with vacuum PMT 150 mm x 100 mm x 25 mm

6.2.3 Setting High Voltage

NOTICE

In the conditions as supplied, the values for the high voltage have already been pre-set by Berthold.

If the operating point must be readjusted due to a replacement of the crystal, PMT or electrical components, we recommend using the function "Acquire Plateau". Manually setting the high voltage is not recommended!

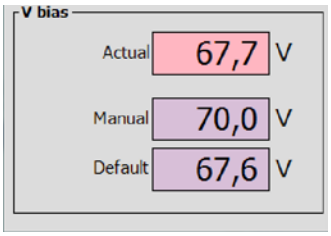


Fig.27 Field “V_bias”

Actual	Currently back measured voltage.
Manual	In control mode "Manual" used target voltage.
Default	In control mode "Automatic" used starting value for the voltage.

6.3 Temperature

NOTICE

Damage to the GAMMAcast detector!

In the condition as supplied, the values for the threshold and the hysteresis have already been pre-set by Berthold. The maximum temperature specified in the technical data may not be exceeded.

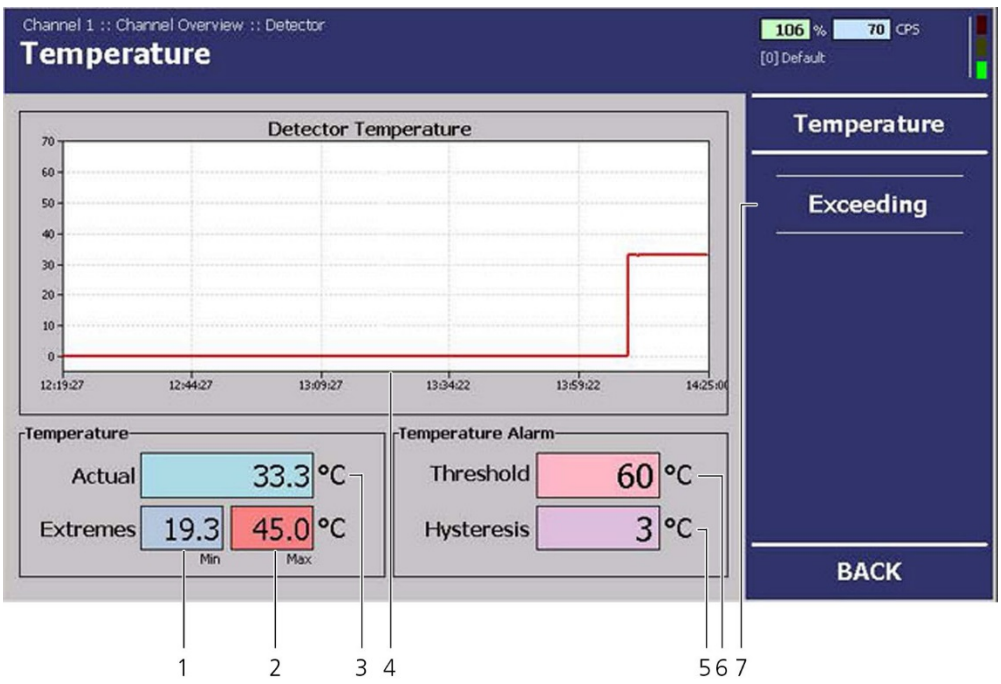
If the threshold is set too high, the temperature alarm might not be triggered even though the admissible temperature at the GAMMAcast detector has already been exceeded.

Setting the threshold too high may cause damage to the scintillator of the GAMMAcast detector.

The "Temperature" submenu offers you the following options:

Actual	Display of the current GAMMAcast detector temperature.
Extremes	Display of achieved maximum and minimum temperatures of the GAMMAcast detector
Threshold	Setting the temperature (threshold) at which an alarm is to be triggered (see “EVU LB 452 castXpert, alarm relay)
Hysteresis	Setting the hysteresis: When the temperature increases, the temperature alarm will be triggered once the set threshold temperature of (in this case) 50°C is exceeded. If the temperature falls again, the alarm does not switch off until the temperature falls below (in this case) 50°C - 3°C = 47°C.

In the menu Channel Overview | Detector, click on **<Temperature>** if you want to set the threshold and hysteresis for the temperature alarm of the GAMMAcast detector.



1	Extremes display field (minimum temperature)
2	Extremes display field (maximum temperature)
3	Current temperature display field
4	Graphical display of temperature over the course of time
5	Input field for temperature alarm - hysteresis
6	Input field for temperature alarm - threshold
7	"Exceeding" button

Fig.28 "Channel Overview" menu, Detector - Temperature

6.3.1 Exceedings

NOTICE

The temperature exceedings displayed in the "Exceeding" submenu do not depend on the set threshold temperature triggering the temperature alarm. The thresholds (53 °C, 65 °C and 70 °C) used for this list are fixed-programmed.

In the menu Channel Overview | Detector | Temperature, click on **<Exceeding>** to access the "Exceeding" submenu. In the "Exceeding" submenu, you can see a tabular overview (Fig.29) of the excessive temperatures.

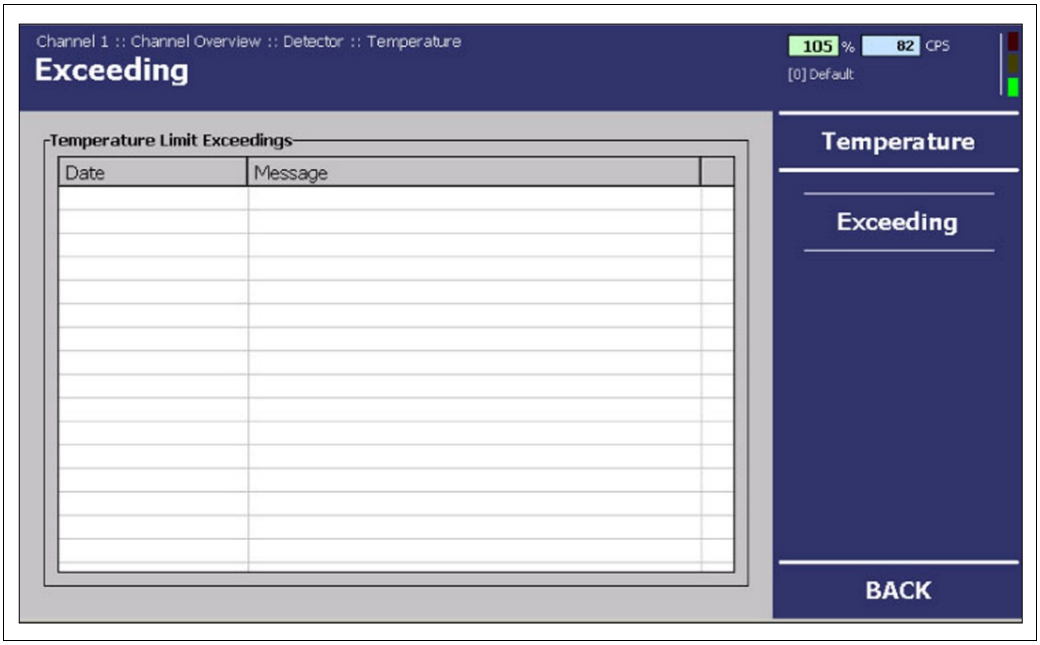
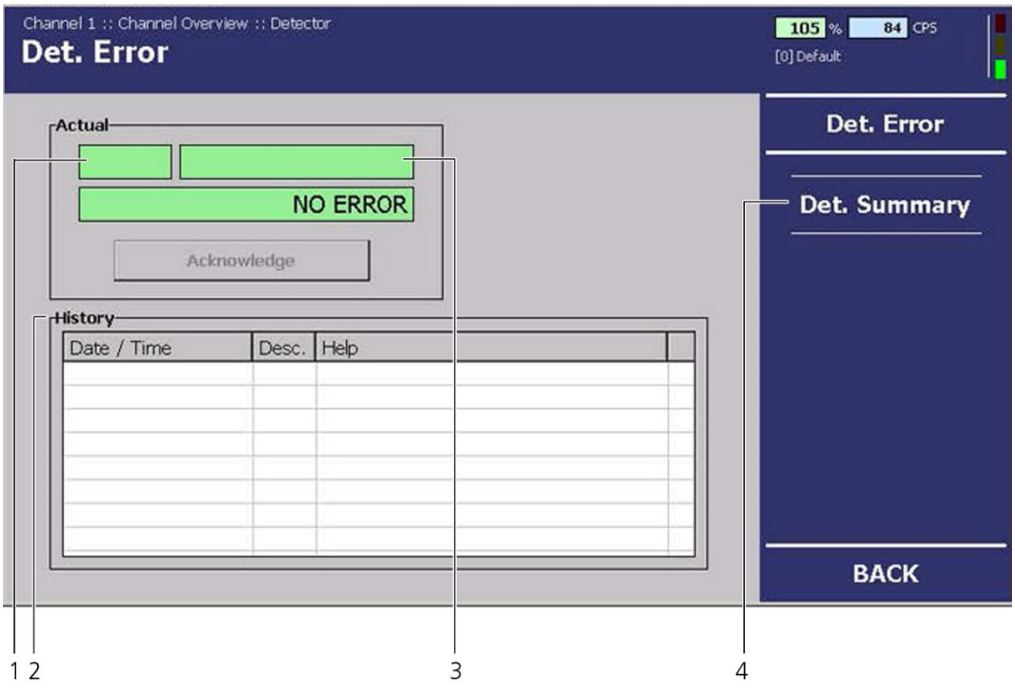


Fig.29 "Channel Overview" menu, Detector - Temperature (Exceeding)

6.4 Detector Error

In the menu Channel Overview | Detector, click on <Det. Error>.



1 Display of the current error code
2 Display of the error message
3 Display of the error history
4 Detector summary submenu

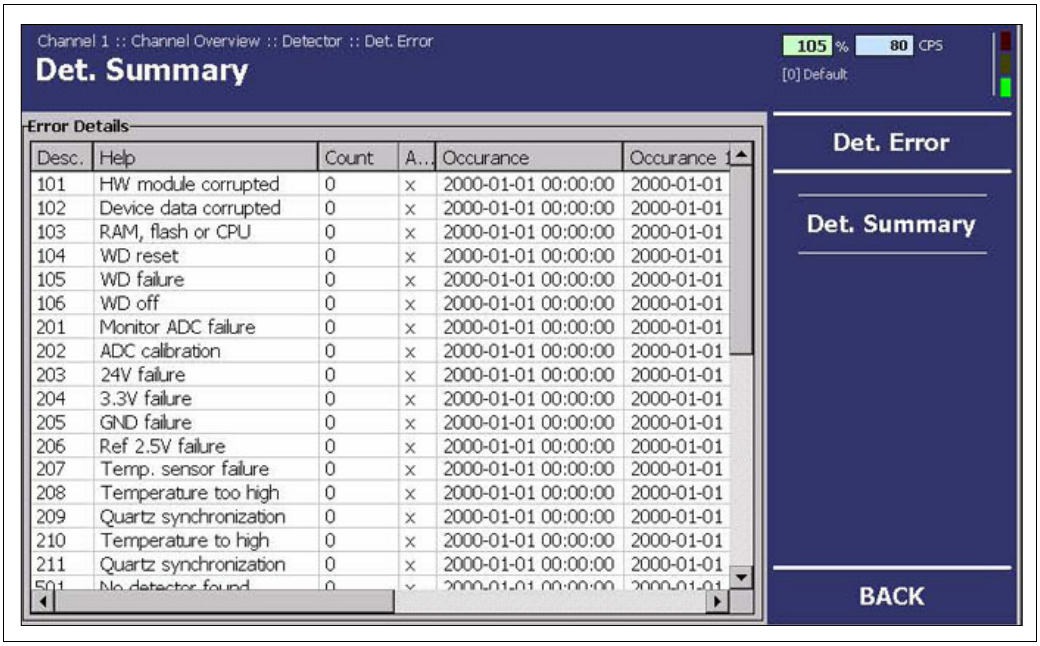
Fig.30 "Channel Overview" menu, Detector, Det. Error

In the "Det. Error" submenu you can view the following information:

- **Actual** Displays the current error message and the error code.
- **History** Displays the error history with the error message and the error codes.

6.4.1 Overview

In the menu Channel Overview | Detector | Det. Error, click on <Summary> to access the Summary submenu. In the "Summary" submenu, you can find a detailed error list.



Desc.	Help	Count	A...	Occurance	Occurance 1
101	HW module corrupted	0	x	2000-01-01 00:00:00	2000-01-01
102	Device data corrupted	0	x	2000-01-01 00:00:00	2000-01-01
103	RAM, flash or CPU	0	x	2000-01-01 00:00:00	2000-01-01
104	WD reset	0	x	2000-01-01 00:00:00	2000-01-01
105	WD failure	0	x	2000-01-01 00:00:00	2000-01-01
106	WD off	0	x	2000-01-01 00:00:00	2000-01-01
201	Monitor ADC failure	0	x	2000-01-01 00:00:00	2000-01-01
202	ADC calibration	0	x	2000-01-01 00:00:00	2000-01-01
203	24V failure	0	x	2000-01-01 00:00:00	2000-01-01
204	3.3V failure	0	x	2000-01-01 00:00:00	2000-01-01
205	GND failure	0	x	2000-01-01 00:00:00	2000-01-01
206	Ref 2.5V failure	0	x	2000-01-01 00:00:00	2000-01-01
207	Temp. sensor failure	0	x	2000-01-01 00:00:00	2000-01-01
208	Temperature too high	0	x	2000-01-01 00:00:00	2000-01-01
209	Quartz synchronization	0	x	2000-01-01 00:00:00	2000-01-01
210	Temperature to high	0	x	2000-01-01 00:00:00	2000-01-01
211	Quartz synchronization	0	x	2000-01-01 00:00:00	2000-01-01
501	No detector found	0	x	2000-01-01 00:00:00	2000-01-01

Fig.31 "Channel Overview" menu, Detector, Det. Error - Summary

6.5 Detector Service

The "Service" submenu offers you the following options:

Export service data

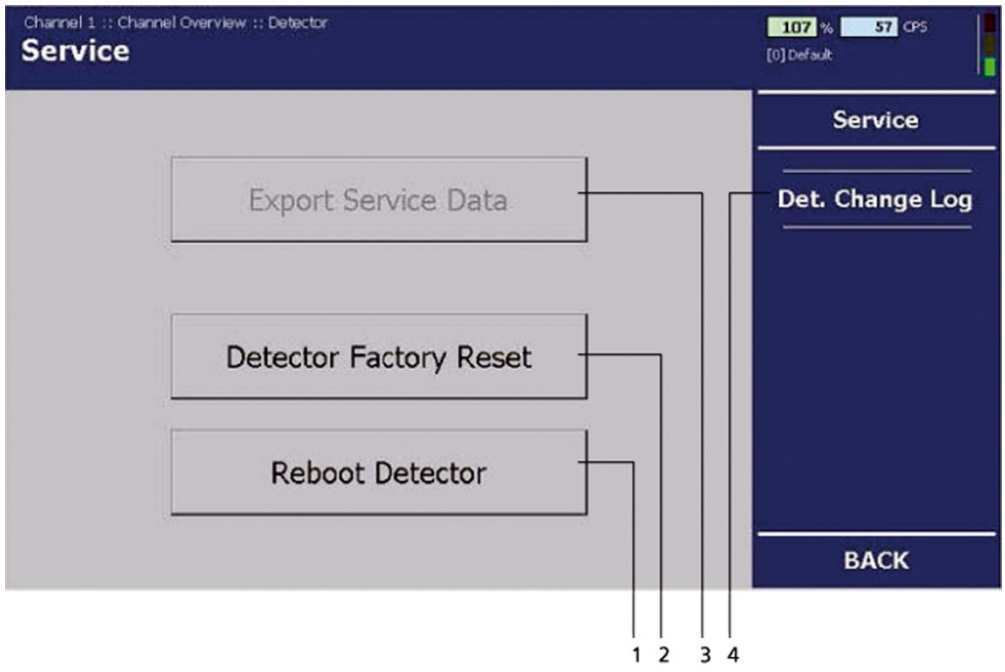
This button will only appear if you connect a USB flash drive to the EVU. The service data is stored in the main directory of the USB flash drive in form of a .csv file. Service data includes:

- Change log
- The error log
- Production data
- Temperature data

Resetting the detector settings
Clicking on the button <Detector Factory Reset> will reset all settings of the detector to the factory settings.

Reboot detector
Clicking on this button will reboot the GAMMAcast detector. No settings will be deleted in the process.

In the menu "Channel Overview" | Detector, click on <Service> to access the "Detector Service" submenu.



1 "Reboot detector" button
2 "Detector Factory Reset" button
3 "Export Service Data" button
4 Button for the detector change log submenu

Fig.32 "Channel Overview" menu, Detector, Service

6.5.1 Exporting Service Data

NOTICE

Already existing service data will not be overwritten since the file names contain the date and time of the export.

Please note that all data contained in the .csv files is kept in English.

3. Connect the USB flash drive to the USB port of the front panel (see operating manual "47344BA2").
4. Click on <Export Service Data>, to save the service data on the USB flash drive.
   - The data export starts automatically. During the export, the message "loading..." is displayed.

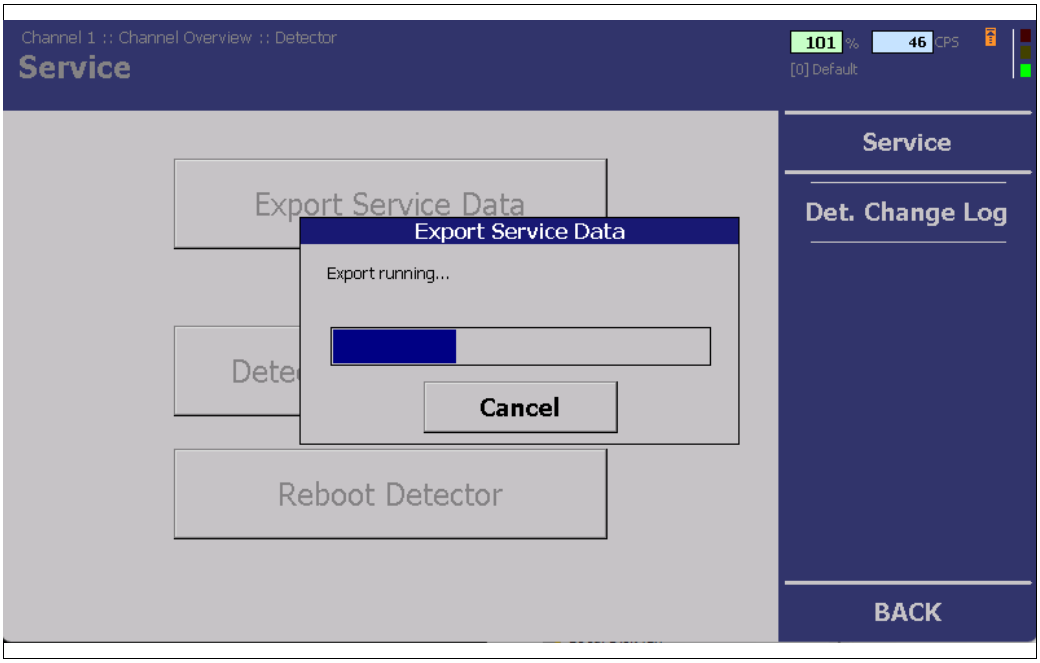


Fig.33 "Channel Overview" menu, Detector, Service (Data export in progress)

Four .csv files are saved to the main directory of the USB flash drive (Change Log, Error Log and System Data and Temperature Data). If the process is complete, the display will switch back to the "Service" submenu.

6.6 Detector Factory Reset

NOTICE

When resetting the detector to its factory settings, all entered settings, for example the plateau acquisitions, will be lost and the measurement will be stopped.

1. Click on <Detector Factory Reset> if you want to reset the GAMMAcast detector to its factory settings.
   - The warning window opens.
2. Confirm the warning message by clicking on <OK>.
   - The EVU will switch to "Error" mode for approx. 1 second. The EVU will switch back to "Run" mode afterwards. The measurement system is operating again.
   - The GAMMAcast detector has now been reset to its factory settings. A reboot of the EVU is not required.

6.6.1 Rebooting the Detector

NOTICE

For safety reasons, you can manually reboot the GAMMAcast detector after an update. However, a reboot is automatically carried out after each update of the GAMMAcast detector, the EVU or the channel.

1. Click on <Reboot detector> in order to reboot the GAMMAcast detector.
   - The warning window opens.
2. Confirm the warning message by clicking on <OK>.
   - The EVU will switch to "Error" mode for approx. 1 second. The EVU will switch back to "Run" mode afterwards. The measurement system is operating again.
   - The GAMMAcast detector is automatically rebooted; a reboot of the EVU is not required.

6.7 Error Codes

In the following tables you can find the error codes of the GAMMAcast detectors which provide you with information on how to fix the errors.

For more information on the error correction of the EVU, please refer to chap. 8 of the operating manual "47344BA2".

6.7.1 GAMMAcast Detectors

Code	Text	Description	Correction	Class
101	HW module corrupted	Missing circuit board or incompatible test header	▶ Carry out a software update ▶ Contact service	Error
102	Device data corrupted	Data inconsistency found	▶ Carry out factory reset ▶ **Attention:** All settings of the detector will be lost!	Error
103	RAM, Flash or CPU	Error in main memory Hardware error	▶ Contact service	Error
104	WD reset	The system has been reset by the watch dog (WD) Hardware error	▶ Contact service	Error
105	WD failure	The watch dog (WD) was activated but the system was not reset Hardware error	▶ Contact service	Error
106	WD off	The debug jumper is sticking, the watchdog is disabled.	▶ Remove debug jumper	Error

6.7.2 Mainboard

Code	Text	Description	Correction	Class
201	Monitor ADC failure	The monitoring ADC (Analogue Digital Converter) has failed Hardware error.	▶ Contact service	Error
202	ADC Calibration	Error while calibrating the ADC Hardware error	▶ Contact service	Error
203	11 V failure	Faulty 11 V operating voltage Hardware error	▶ Contact service	Error
204	+5 V failure	Faulty +5 V operating voltage Hardware error.	▶ Contact service	Error
205	-5 V failure	Faulty -5 V operating voltage Hardware error	▶ Contact service	Error
206	GND failure	Measured GND value too large Hardware error	▶ Contact service	Error
207	Ref 2.5 V failure	Faulty 2.5 V reference voltage Hardware error	▶ Contact service	Error
208	Temperature sensor CPU	Temperature sensor on CPU circuit board failed Hardware error	▶ Contact service	Warning
209	AMP temperature sensor	Temperature sensor on AMP circuit board failed Hardware error	▶ Contact service	Warning
210	Temperature too high	Temperature is/was too high (60 °C 65 °C 70 °C)	▶ Ensure sufficient cooling of the GAMMAcast detector ▶ Use GAMMAcast detector with water cooling	Warning
211	Quartz synchronisation	Deviations in oscillator detected	▶ Contact service if occurring repeatedly	Error

6.7.3 Detector Control

Code	Text	Description	Correction	Class
501	DAC Calibration	Error while calibrating the DACs Hardware error	▶ Contact service	Error
502	Pulse reception error	Timeout upon receipt of pulse rates	▶ Carry out software update	Error
503	Measuring threshold	Threshold of measurement channel 1 incorrect Hardware error	▶ Contact service	Error
504	Threshold channel 2	Threshold of measurement channel 2 incorrect Hardware error (Only in HV-Modus “automatically“)	▶ Contact service	Error
505	Threshold channel 3	Threshold of measurement channel 3 incorrect Hardware error (only in HV-Modus “automatically“)	▶ Contact service	Error will be displayed only from 1.2.4
506	Threshold Control channel	Threshold of control channel incorrect Hardware error	▶ Contact service	Error will be displayed only from 1.2.4
507	Pulse difference	Deviation too big when comparing count rates with redundant channels (only in safety mode)	▶ Ensure that the GAMMAcast detector housing is correctly locked (prevent incidence of light) ▶ Check high voltage supply of photomultiplier ▶ Contact service	Warning
508	No pulses	There are no pulses registered	▶ Check PMT and/or high voltage control	Warning Error only from 1.2.4
509	Lower current limit	Anode current of the PMT too high	▶ Check high voltage control and/or set high voltage	Warning
510	Upper current limit	Anode current of the PMT much too high	▶ Check high voltage control and/or set high voltage	Error
511	HV control voltage	HV control voltage not correct Hardware error	▶ Contact service	Error
512	HV failure	HV not correct. Hardware error	▶ Contact service	Error
513	HV limit value	HV too high (only in HV-Modus “automatically“)	▶ Check PMT and/or high voltage control	Warning
514	HV 20 % below average	HV value < 20 % below average (only in HV-Modus “automatically“)	▶ Check PMT and/or high voltage control	Warning

Detector Control (continued)

Code	Text	Description	Correction	Class	
515	HV 20 % above average	HV value >20 % above average (only in HV-Modus “automatically“)	▶ Check PMT and/or high voltage control	Warning	
516	Glitch	Glitch detected (only in HV-Modus “automatically“)	▶ Contact service if occurring repeatedly	Error	
517	Detector Control error	Error in detector control Hardware error	▶ Contact service	Error	
518	Noise Ch. Warning	Noise level is close to measurement threshold.	▶ Check thresholds and ambient temperature. If it occurs repeatedly, replace SiPM-crystal combination.	Warning	Only LB 6760
519	Noise Ch. Alarm	Noise level is too close to measurement threshold. No realiable count rate can be determined.	▶ Check thresholds and ambient temperature. If it occurs repeatedly, replace SiPM-crystal combination.	Error	
520	Noise Ch. Cps	No or too high noise count rate	▶ Check thresholds and ambient temperature. If it occurs repeatedly, replace SiPM-crystal combination.	Warning	
521	Temperature sensors	The temperature sensor on the sensor board is not working correctly.	▶ Check thresholds and ambient temperature. If it occurs repeatedly, replace SiPM-crystal combination.	Warning	
522	Temperature warning	High temperature on sensor board.	▶ Check ambient temperature	Warning	
524	Plateau recording	A plateau recording is running. The measured CPS cannot be used for a measurement.	▶ Wait until recording is finished or cancel recording.	Test	

6.7.4 Process Connection

Code	Text	Description	Correction	Class	
600	System error	Hardware error. Flow of data is disrupted or interrupted.	▶ Contact service	Error	Only LB 6760
700	System error	Hardware error. Flow of data is disrupted or interrupted.	▶ Contact service	Error	
701	Data reception	Timeout upon receipt of output data	▶ Carry out software update	Error	
702	Pulse output	Pulse output does not correspond to measured count rate Hardware error	▶ Contact service	Error	

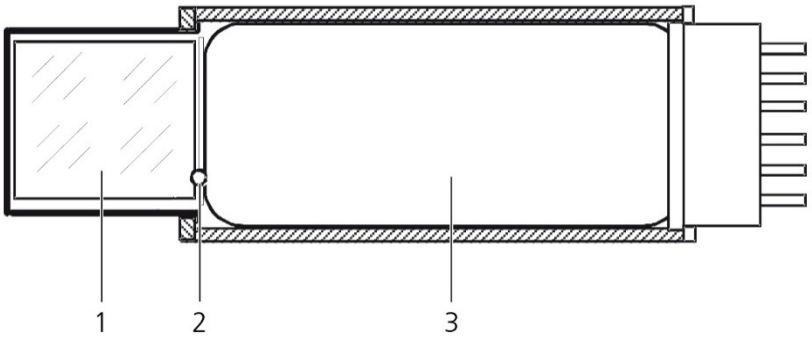
7 Maintenance

Malfunctions of the GAMMAcast detectors can be caused by mechanical or thermal overloading. These malfunctions do not always result in a complete failure of the GAMMAcast detectors.

In most cases, the specific sensitivity changes or noticeable instabilities occur. In these cases, acquiring a new plateau can be helpful (for instructions on how to acquire a plateau, see chap. 6.1.2) to compensate for possible instabilities.

7.1 Visual inspection of Crystal and Photomultiplier (not LB 6760)

Malfunctions in the GAMMAcast detector may be caused by glass breakage, overheating and strong incidence of light. These damages are to be detected by carrying out a visual inspection.



1 Crystal
2 Window with photocathode
3 Photomultiplier (PMT)

Fig.34 Representation of the crystal and photomultiplier (LB 6739)

- The crystal must be as clear as glass on the inside and show a slight greenish colouring. Any cracks, milky spots or yellow-brown colouring on or in the crystal are signs of overheating. In this case, the crystal must be replaced.
- There is a vapour-deposited layer (photocathode) on the inside of the photomultiplier (PMT). This layer causes the window to have a slightly brownish or smoked glass colour. If this layer is no longer present or if it is stained, this means that the photocathode including the PMT has been destroyed (e.g. by overheating, glass breakage or incidence of light). In this case, the PMT must be replaced.
- The replacement procedure for these two components is detailed in chap. 7.1.1.

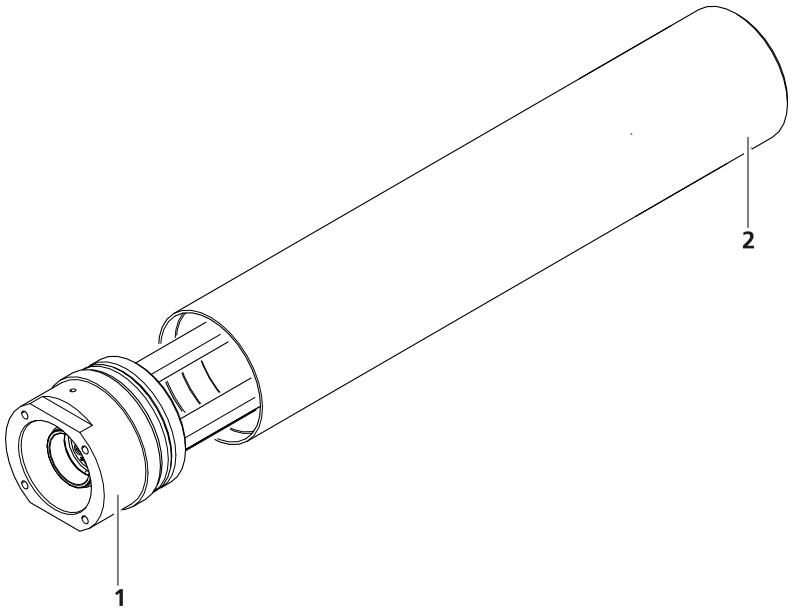
7.1.1 Replacing the PMT or the PMT Crystal Combination (only LB 6739)

A replacement of the PMT or PMT crystal combination is carried out in the following cases:

- Noticeable instabilities due to thermal or mechanical overloading or bright light incidence.
- Error during plateau recording (short or too steep plateau).

For replacing the crystal or photomultiplier, the following tools/materials are required:

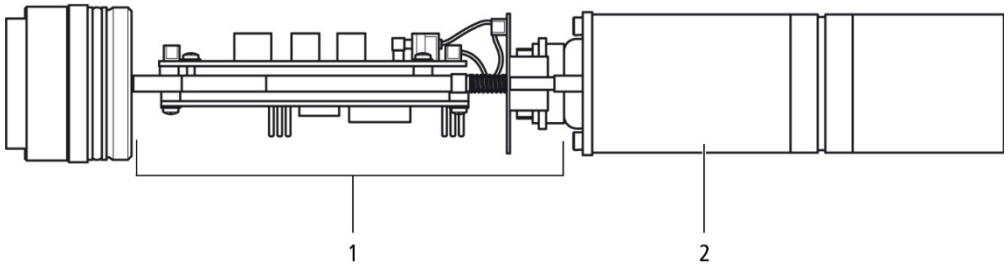
- Spanner
- Pliers
- Screwdriver/hexagon wrench
- If required, spacer rings
- Thread grease



1 Base
2 Housing pipe (front end)

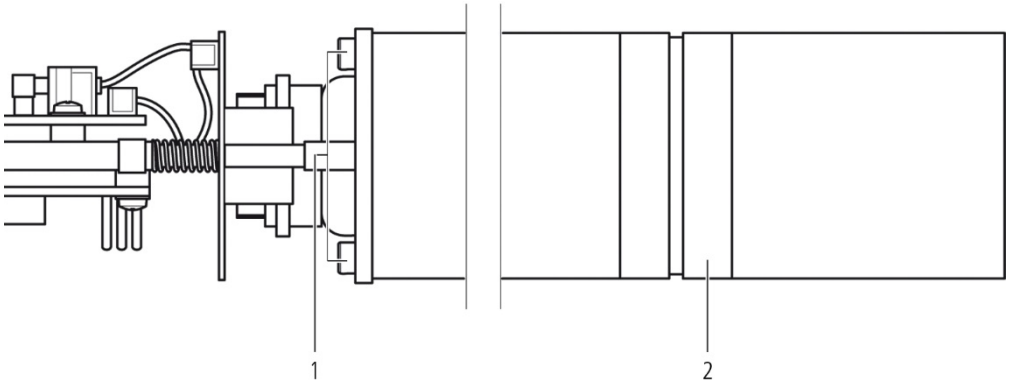
Fig.35 GAMMAcast detector LB 6739 with housing pipe

1. De-energise the GAMMAcast detector. In order to do this, remove the plug of the GAMMAcast detector from the EVU.
2. Fix the base using a spanner.
3. Carefully screw on the housing pipe using pliers. Only use the pliers at the front end of the housing pipe. Ensure that the housing pipe is not deformed in any way.



1 Electronics unit
2 Photomultiplier crystal combination with encapsulated crystal on the inside

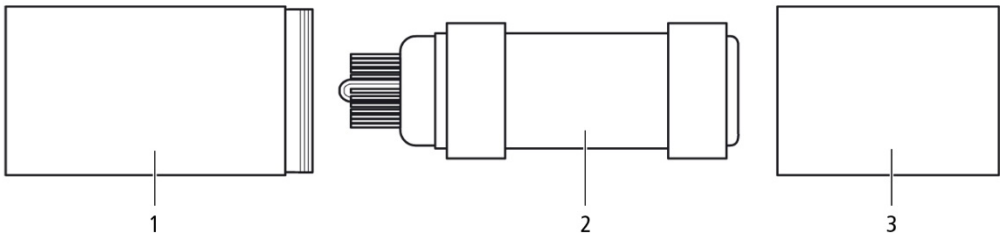
Fig.36 GAMMAcast detector LB 6739 CsI 40/50 without housing pipe



1 Screws of the photomultiplier crystal combination
2 Aluminium adhesive tape

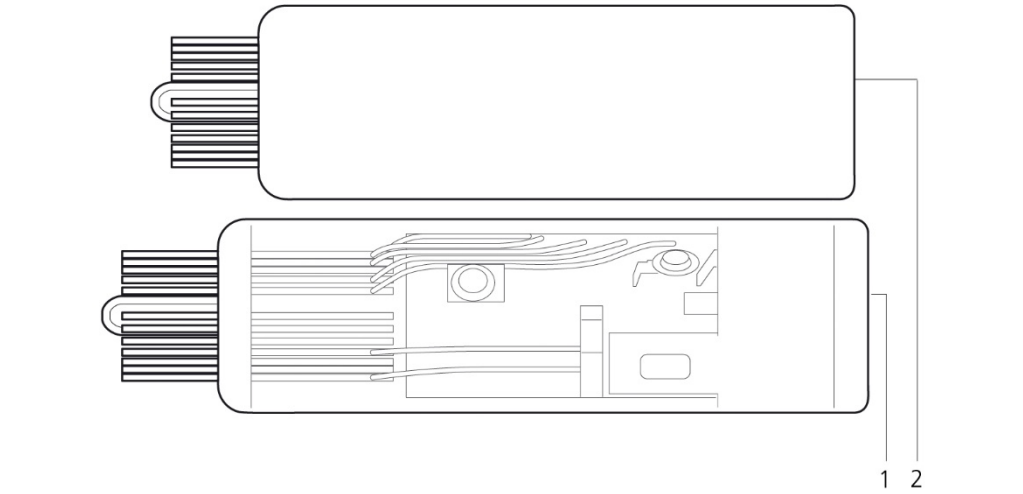
Fig.37 GAMMAcast detector LB 6739 CsI 40/50, magnetic shielding and aluminium adhesive tape

1. Loosen the screws on the magnetic shielding. If the entire photomultiplier crystal combination is to be replaced, proceed with step 12.
2. Remove the aluminium adhesive tape from the metal shielding.
3. Unscrew the metallic shielding.
4. Pull the PMT out of the metallic shielding.
5. Insert the new PMT into the metallic shielding.
6. Evenly and centrally place the silicon washer located between the crystal and the PMT on the crystal.
7. Screw the crystal back onto the magnetic shielding.
8. Glue the connection together using aluminium adhesive tape.



1 Metallic shielding
2 Photomultiplier
3 Metallic shielding with encapsulated crystal

Fig.38 GAMMAcast detector LB 6739 CsI 40/50, PMT removed

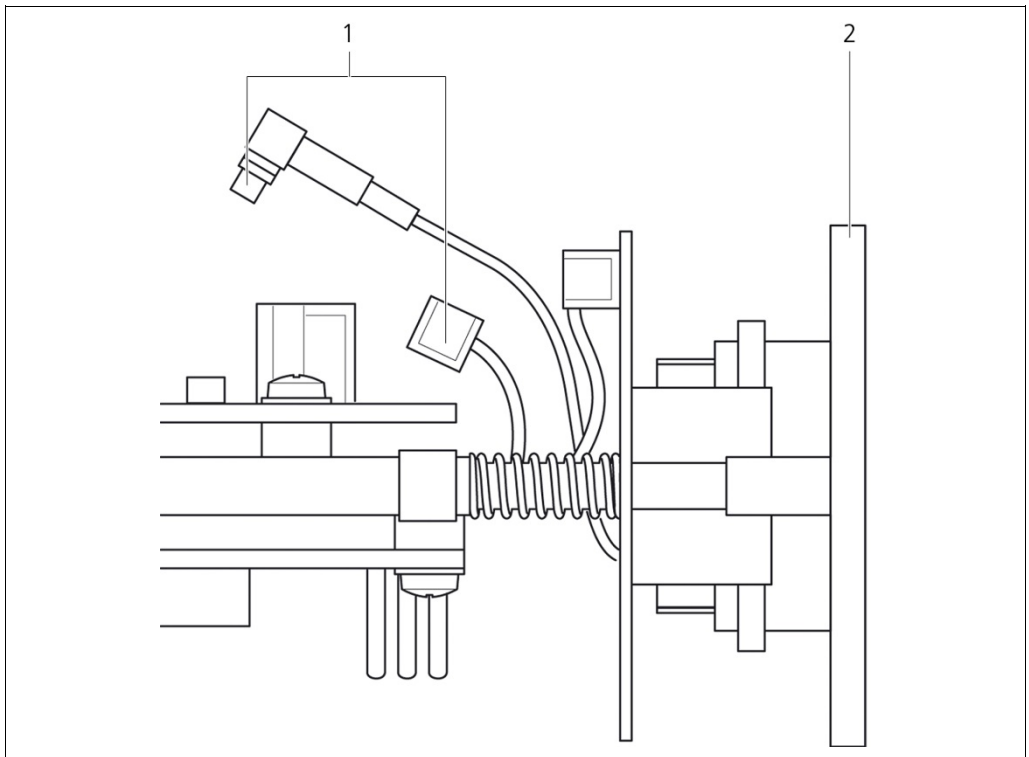


1 PMT, length: 89 mm
2 PMT, length: 95 mm

Fig.39 PMT, 89 mm and 95 mm long

NOTICE

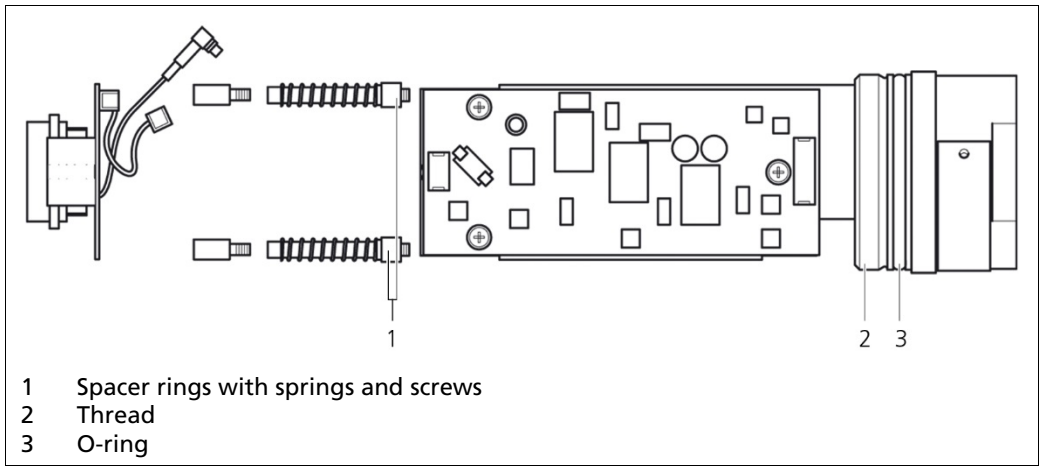
Two different photomultipliers of different length are used. For length compensation, two spacer rings are supplied that need to be installed and/or removed if required.



1 Connection cable
2 Support ring with screws

Fig.40 GAMMAcast detector LB 6739 CsI 40/50, PMT removed

If a modification of the spacer rings should be required, disconnect both connection cables from the electronics unit and remove the screws located at the support ring.



1 Spacer rings with springs and screws
2 Thread
3 O-ring

Fig.41 PMT without Mu-metal shielding, spacer rings installed

1. Remove the screws and springs at the spacer rings and push on the spacer rings - if the shorter PMT is used - or remove them. Put the springs back on afterwards.
2. Tighten the support ring again
3. Plug the connection cable back into the electronics unit.
4. Tighten the PMT crystal combination again.
5. Before screwing on the housing pipe, grease the thread and the O-ring using a suitable thread grease.

NOTICE

After having replaced the PMT and assembled the GAMMAcast detector, a plateau curve must be acquired and the operating point must be readjusted.

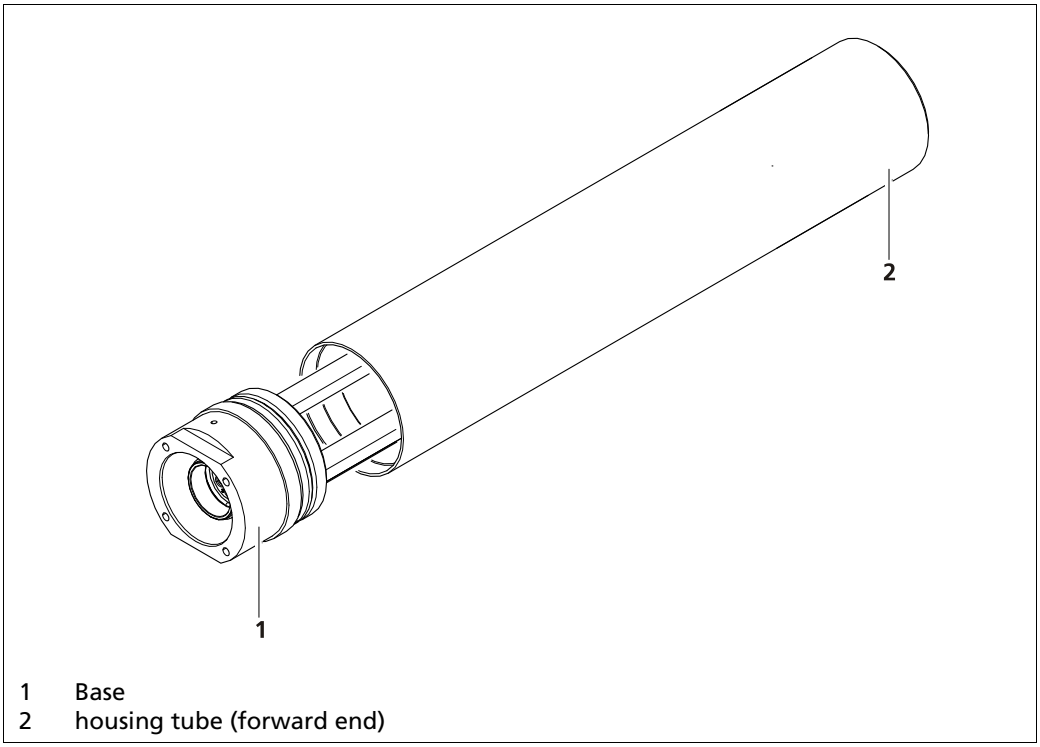
7.2 Replace SiPM-crystal Combination (only LB6760)

Replacing the SiPM crystal combination is carried out in the following cases:

- Conspicuous instability by thermal, mechanical overstressing or bright light.
- Error in the Plateau recording (short or too steep plateau).

To replace the SiPM-crystal combination you need the following tools / materials:

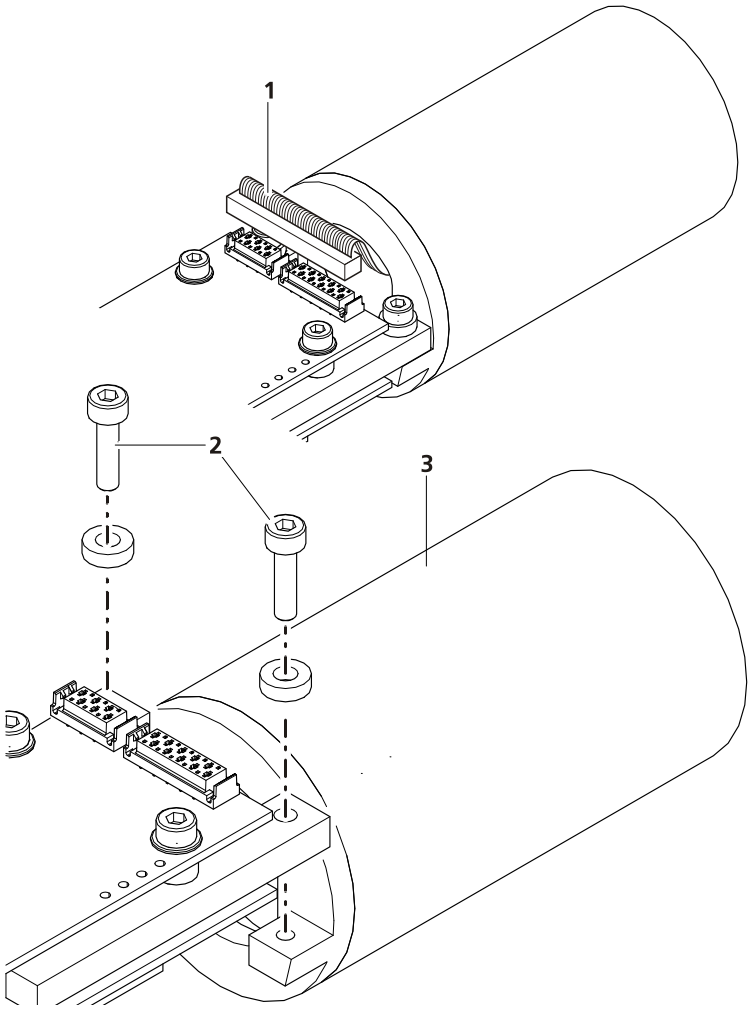
- Wrench
- Pliers
- screwdriver / hexagonal wrench
- If necessary, spacers
- Thread lubricant



1 Base
2 housing tube (forward end)

Fig.42 GAMMAcast detector LB 6760, with housing tube

1. De-energize the GAMMAcast detector by pulling off the plug of GAMMAcast detector of the EVU.
2. Fix the base with a wrench.
3. Carefully unscrew the housing tube with a plier. Attach the plier only at the forward end. Ensure that the housing will not deformed.



1 Connection cable
2 Screws with washers
3 SiPM-crystal combination

Fig.43 Replace SiPM-crystal combination

1. Remove the connection cable from the electronic part.
2. Loosen the screws and remove the SiPM-crystal combination.
3. Plug the connection cable at the electronic part.
4. Retightening the SiPM-crystal combination.
5. Lubricate threads and O-ring before screwing the housing tube with a suitable thread grease.

NOTICE

After changing the SiPM-crystal combination a new plateau-recording must be made mandatory. To do this, push the button "RESET VALUE" in the menu "Plateau Settings" and then restart the Plateau recording.

8 Decommissioning

DANGER

Danger to life from electric shock!

- Installation may only be carried out by a qualified electrician.
- Installation may only be carried out if all components has been de-energised.
- Only open the housings when there is no voltage.

Follow this sequence for decommissioning:

1. Remove the connection cable from the GAMMAcast detector.
2. Remove the GAMMAcast detector with/without water cooling from the mould.
3. If required,remove the GAMMAcast detector from the water cooling system.
4. If required, dispose of the GAMMAcast detector at a specialist waste management company.

8.1 Disposal of GAMMAcast Detectors

CAUTION

Toxic!

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

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

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

Modifications due to technical advancement reserved.

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BERTHOLD TECHNOLOGIES GmbH & Co. KG

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

Mat No. 48452BA2

GAMMAcast
LB 6739, LB 6752, LB 6760

GAMMAcast Detectors
GAMMAcast Detektoren
Technical Information
Technische Information

48452TI · Rev. No.: 00 · 04/2023

BERTHOLD

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Inhaltsverzeichnis

1. Technical Data GAMMAcast LB 6739 / LB 6760

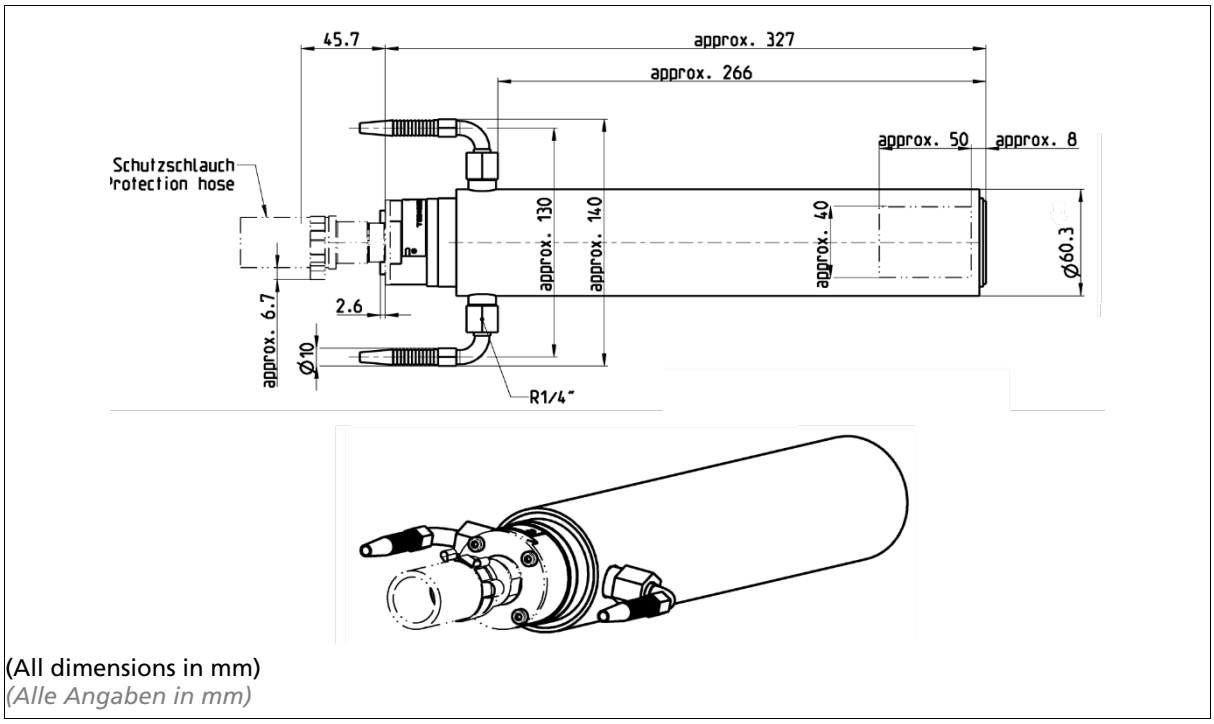
1. Technische Daten GAMMAcast LB 6739 / LB 6760

Mechanical Data *Mechanische Daten*	
Scintillator *Szintillator*	LB 6739: CsI crystal; Ø 40 mm or Ø 25 mm, H: 50 mm LB 6760: NaI crystal: Ø 40 mm, H: 50 mm *LB 6739: CsI-Kristall; Ø 40 mm oder Ø 25 mm, H: 50 mm* *LB 6760: NaI-Kristall; Ø 40 mm, H: 50 mm*
Admissible operating temperature *Zulässige Betriebstemperatur*	LB 6739: ...+ 50 C ambient temperature LB 6760: ... + 60 C ambient temperature At higher temperatures, a water cooling system is required (optional) *LB 6739: ...+ 50 C Umgebungstemperatur* *LB 6760: ... + 60 C Umgebungstemperatur* *Bei höheren Temperaturen ist eine Wasserkühlung erforderlich (Option)*
Storage temperature *Lagertemperatur*	-20°C … +70°C *-20°C … +70°C*
Auxiliary energy *Hilfsenergie*	15…32 VDC, approx. 1.2 W *15…32 VDC, ca. 1,2 W*
Output signal *Ausgangssignal*	Pulses, max. 10 V *Impulse, max. 10 V*
Communication *Kommunikation*	RS 485 *RS 485*
Water cooling system (optional) *Wasserkühlung (Option)*	Connection: R¼ max. pressure: 6 bar Cooling water quality requirement: Drinking water quality (or filtered operating water without suspended matter) *Anschluss: R¼* *Max. Druck: 6 bar* *Anforderung Kühlwasserqualität:* *Trinkwasserqualität (oder gefiltertes Betriebswasser ohne Schwebstoffe)*
Protection class *Schutzart*	IP 66 / IP 67 *IP 66 / IP 67*
Connection *Anschluss*	Detector – terminal box and/or detector – evaluation unit: Special connection cable with PlugProtect connector open ends or HeavyCon plug Terminal box – evaluation unit: 6-wire, shielded (6 x 1.5 mm²) max. length 1000 m *Detektor – Klemmkasten bzw. Detektor – Auswerteeinheit:* *Spezialanschlusskabel mit PlugProtect-Stecker* *Enden offen oder HeavyCon-Stecker* *Klemmkasten – Auswerteeinheit: 6-adrig, abgeschirmt* *(6 x 1,5 mm²) Länge max. 1000 m*

Weight *Gewicht*	Approx. 2 kg With water cooling system approx. 3 kg *ca. 2 kg* *Mit Wasserkühlung ca. 3 kg*
Software *Software*	Measurement of the temperature in the detector Storage of temperature extreme values Possibility of acquiring the plateau curve with automatic determination of the correct high voltage supply of the photomultiplier (either via castXpert LB 452 or via the detector service modem) Storage of the last three plateau curves (LB 6739) Error log (stored in detector) *Messung der Temperatur im Detektor* *Speicherung Extremwerte Temperatur* *Möglichkeit der Aufnahme der Plateaukurve mit automatischer Ermittelung der korrekten Hochspannungsversorgung des Photomultipliers (entweder über castXpert LB 452 oder über Detektor Service Modem)* *Speicherung der letzten drei Plateaukurven (LB 6739)* *Fehlerlog (Speicherung im Detektor)*

1.1. Dimensional Drawing with Water Cooling System

1.1. Maßbild mit Wasserkühlung

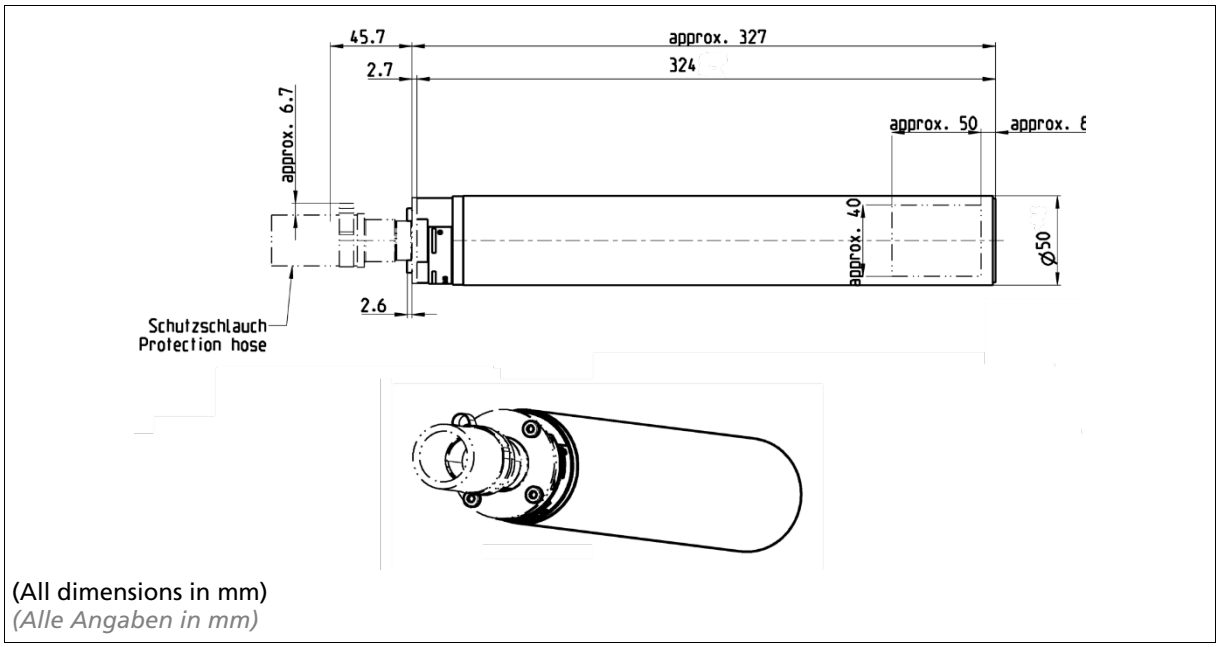


(All dimensions in mm)
(Alle Angaben in mm)

TI-Abb. 1 GAMMAcast-Detector LB 6739 and LB 6760, Drawing with water cooling system
GAMMAcast-Detektor LB 6739 und LB 6760, Maßbild mi Wasserkühlung

1.2. Dimensional Drawing Without Cater Cooling System

1.2. Maßbild ohne Wasserkühlung



(All dimensions in mm)
(Alle Angaben in mm)

TI-Abb. 2 GAMMAcast-Detector LB 6739 and LB 6760, Drawing without water cooling system
GAMMAcast-Detektor LB 6739 und LB 6760, Maßbild ohne Wasserkühlung

2. Technical Data GAMMAcast LB 6752

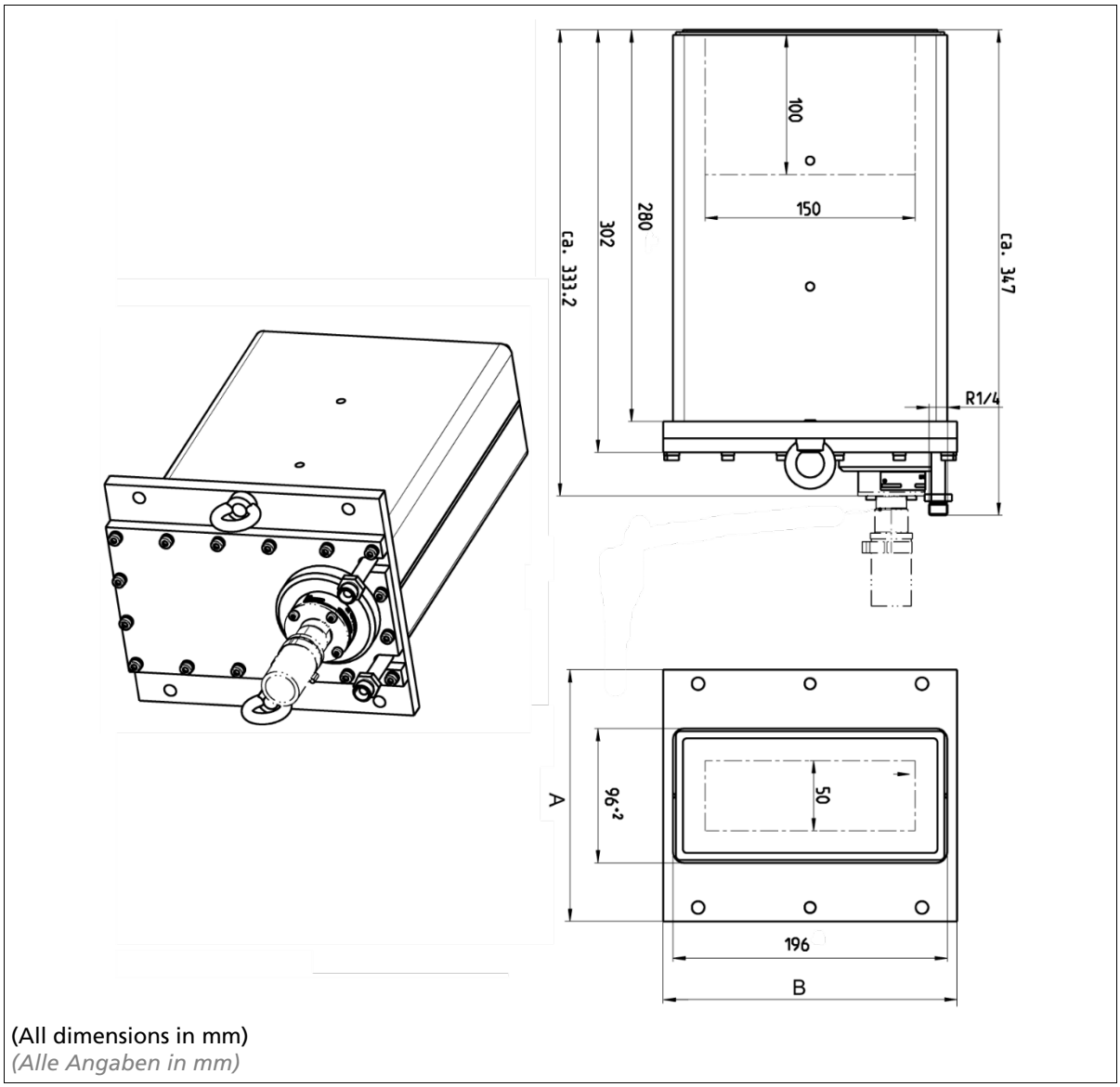
2. Technische Daten GAMMAcast LB 6752

Mechanical Data *Mechanische Daten*	
Scintillator *Szintillator*	Polymer scintillator 100x50x150 mm *Polymerszintillator 100x50x150 mm*
Admissible operating temperature *Zulässige Betriebstemperatur*	-20°C … +50°C ambient temperature At higher temperatures, the water cooling system must be used. *-20°C … +50°C Umgebungstemperatur* *Bei höheren Temperaturen muss die Wasserkühlung verwendet werden*
Storage temperature *Lagertemperatur*	-20°C … +65°C *-20°C … +65°C*
Auxiliary energy *Hilfsenergie*	15…32 VDC, approx. 1.2 W *15…32 VDC, ca. 1,2 W*
Output signal *Ausgangssignal*	Pulses, max. 10 V *Impulse, max. 10 V*
Communication *Kommunikation*	RS 485 *RS 485*
Water cooling system *Wasserkühlung*	Connection: R¼ Max. pressure: 6 bar Cooling water quality requirement: Drinking water quality (or filtered operating water without suspended matter) *Anschluss: R¼* *Max. Druck: 6 bar* *Anforderung Kühlwasserqualität:* *Trinkwasserqualität (oder gefiltertes Betriebswasser ohne Schwebstoffe)*
Protection class *Schutzart*	IP 66 / IP 67 *IP 66 / IP 67*
Connection *Anschluss*	Detector – terminal box and/or detector – evaluation unit: Special connection cable with PlugProtect connector with open ends or HeavyCon plug Terminal box – evaluation unit: 6-wire, shielded (6 x 1.5 mm²) max. length 1000 m *Detektor – Klemmkasten bzw. Detektor – Auswerteeinheit:* *Spezialanschlusskabel mit PlugProtect-Stecker* *Enden offen oder HeavyCon-Stecker* *Klemmkasten – Auswerteeinheit:* *6-adrig, abgeschirmt (6 x 1,5 mm²)* *Länge max. 1000 m*
Weight *Gewicht*	Approx. 24 kg *Ca. 24 kg*

Software	Measurement of the temperature in the detector Storage of temperature extreme values Possibility of acquiring the plateau curve with automatic determination of the correct high voltage supply of the photomultiplier (either via castXpert LB 452 or via the detector service modem) Storage of the last three plateau curves Error log (stored in detector)
Software	*Messung der Temperatur im Detektor* *Speicherung Extremwerte Temperatur* *Möglichkeit der Aufnahme der Plateaukurve mit automatischer Ermittlung der korrekten Hochspannungsversorgung des Photomultipliers (entweder über castXpert LB 452 oder über Detektor Service Modem)* *Speicherung der letzten drei Plateaukurven* *Fehlerlog (Speicherung im Detektor)*

2.1. Dimensional Drawing with Water Cooling System

2.1. Maßbild mit Wasserkühlung



(All dimensions in mm)
(Alle Angaben in mm)

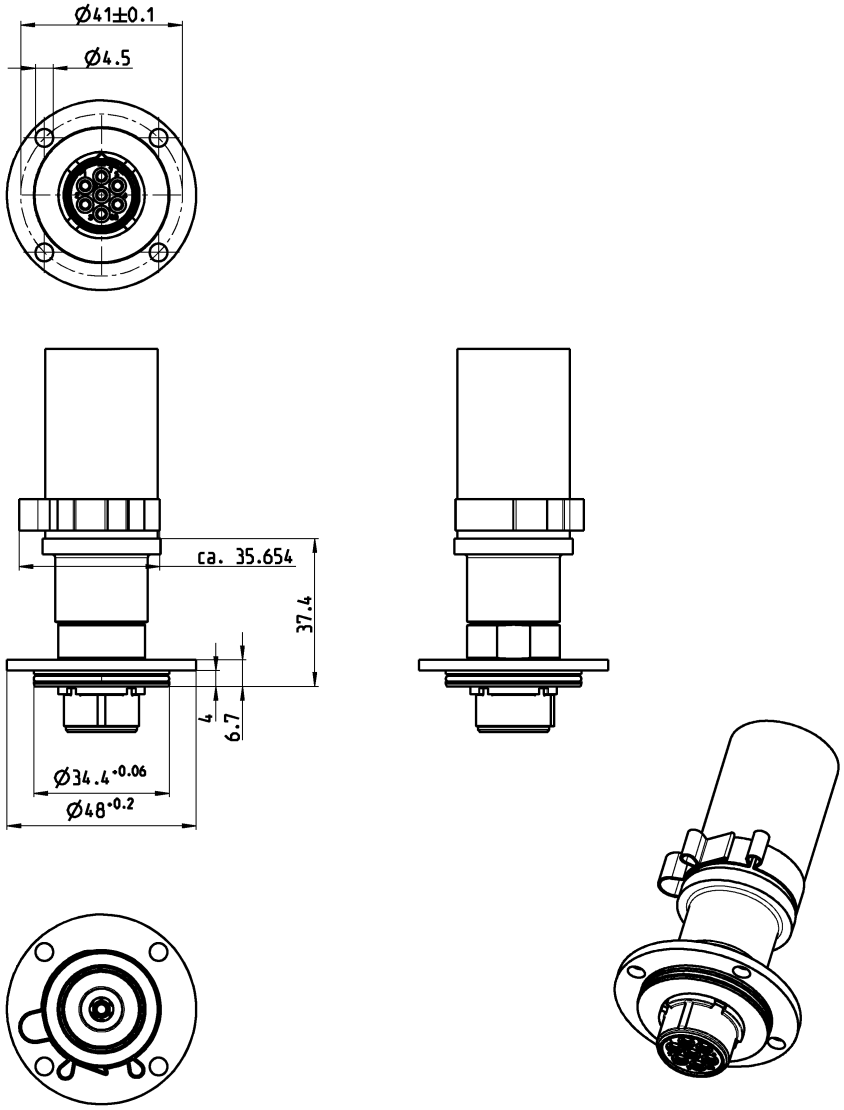
TI-Abb. 3 GAMMAcast-Detector LB 6752, Drawing with water cooling system
GAMMAcast-Detektor LB 6752, Maßbild mit Wasserkühlung

Flange sizes AxB (mm) and bores (9 mm) *Flanschgrößen AxB (mm) und Bohrungen (9 mm)*	
LB 6752-11	180x210, 4 bores on long side plus 2 eyebolts *180x210, 4 Bohrungen lange Seite plus 2 Transportösen*
LB 6752-21	155x210, 4 bores on long side plus 2 eyebolts *155x210, 4 Bohrungen lange Seite plus 2 Transportösen*
LB 6752-31	120x280, 6 bores on short side *120x280, 6 Bohrungen kurze Seite*
LB 6752-53	155x210, as LB 6752-21, 25 mm scintillator *155x210, wie LB 6752-21, 25 mm Szintillator*

LB 6752-54	180x210, as LB 6752-11, 25 mm scintillator *180x210, wie LB 6752-11, 25 mm Szintillator*
LB 6752-80	155x210, 4 bores on long side plus 2 eyebolts, without water cooling (Attention: changed housing dimensions: 78x178) *155x210, 4 Bohrungen lange Seite plus 2 Transportösen, ohne Wasserkühlung* *(Achtung: veränderte Gehäusemaße: 78x178)*

3. Connection Cable: Connection Possibilities

3. Anschlusskabel: Anschlussmöglichkeiten



(All dimensions in mm)
(Alle Angaben in mm)

TI-Abb. 4 PlugProtect plug-in connection, straight (All dimensions in mm)
PlugProtect Steckeranschluss gerade (Alle Angaben in mm)

3.1. Technical Data Connection Cable

3.1. Technische Daten Anschlusskabel

Technical GAMMAcast cable *Technische GAMMAcast Kabel*	
Complete cable assembly *Komplette Kabelkonfektion*	
Application *Applikation*	Mould level *Gießspiegel*
Temperature range *Temperaturbereich*	-20 … +125 °C operation -20 … + 70 °C storage *-20 … +125 °C Betrieb* *-20 … + 70 °C Lagerung*
IP protection *IP-Schutzart*	IP 67
Length *Länge*	Available in 5, 10, 15, and 20 meters *Erhältlich in 5, 10, 15 und 20 Metern*
Detector connection *Detektoranschluss*	Standard GAMMAcast female connector *Standard GAMMAcast-Buchse*
Junction box connection *Anschluss an die Anschlussdose*	Open ends or industrial connector *Offene Enden oder Industriestecker*
Protective hose *Schutzschlauch*	
Länge *Length*	5 m for all cable lengths *5 m für alle Kabellängen*
Material *Material*	Silicone coated fiberglass *Silikonbeschichtetes Glasfasergewebe*
Robustness *Robustheit*	Handles splashes of liquid steel and iron *Unempfindlich gegenüber Spritzern von flüssigem Stahl und Eisen*
Temperature range *Temperaturbereich*	-55 … +260 °C operation +1090 °C for 20 minutes +1640 °C for 15 – 30 seconds *-55 … +260 °C Betrieb* *+1090 °C für 20 Minuten* *+1640 °C für 15 – 30 Sekunden*
Electrical cable ***Elektrisches Kabel***	
Länge *Length*	Available in 5, 10, 15, and 20 meters *Erhältlich in 5, 10, 15 und 20 Metern*
Material *Material*	Silicone coated *Silikonbeschichtung*

Diameter *Durchmesser*	13 mm
Temperature range *Temperaturbereich*	-25 … +180 °C operation *-25 … +180 °C Betrieb*
Minimum bend radius *Minimaler Biegeradius*	~130 mm dynamic installation ~ 80 mm static installation *~130 mm dynamische Verlegung* *~ 80 mm statischer Einbau*
GAMMAcast connector ***GAMMAcast-Anschluss***	
Material *Material*	Stainless steel *Rostfreier Stahl*
Temperature range *Temperaturbereich*	-20 … +125 °C operation *-20 … +125 °C Betrieb*
Special Features *Besondere Merkmale*	

- Strain relief spring
  Zugentlastungsfeder
- Stainless-steel screw connection on detector side
  Detektorseitige Schraubverbindung in Edelstahl
- Backward compatible with existing detectors and junction boxes
  Rückwärtskompatibel mit vorhandenen Detektoren und Anschlussdosen
- Developed in cooperation with our customers
  Entwickelt in Zusammenarbeit mit unseren Kunden

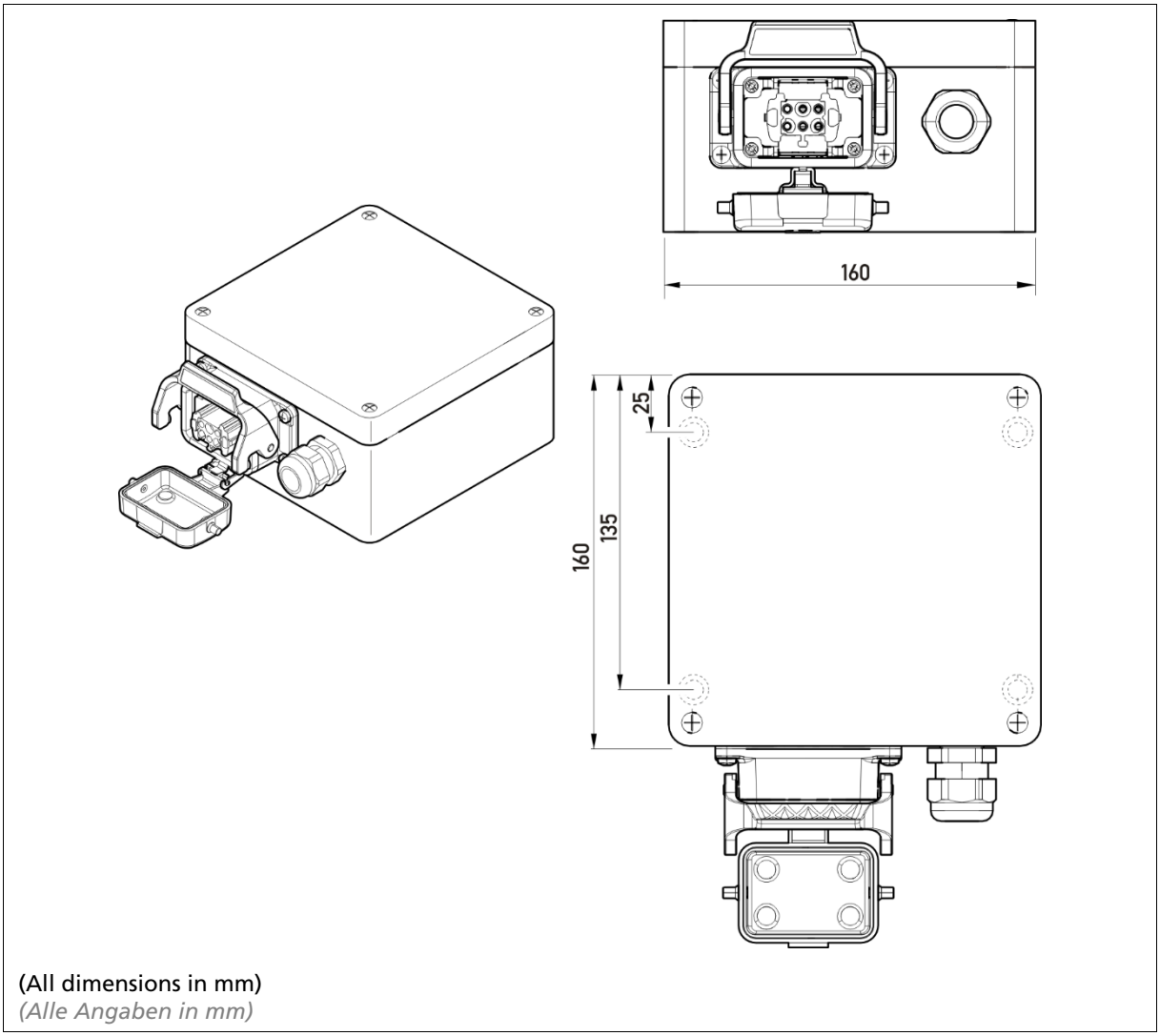
3.2. Lengths and Variants

3.2. Längen und Varianten

Mat.-No. *Mat.-Nr.:*	*Description* *Bezeichnung*	*Cable Length* *Kabellänge*	*Connection* *Anschlusse*
74212-050	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	5 m	Open ends *Offene Enden*
74212-100	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	10 m	Open ends *Offene Enden*
74212-150	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	15 m	Open ends *Offene Enden*
74212-200	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	20 m	Open ends *Offene Enden*
74213-050	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	5 m	Industrial connector *Industrie-Steckverbinder*
74213-100	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	10 m	Industrial connector *Industrie-Steckverbinder*
74213-150	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	15 m	Industrial connector *Industrie-Steckverbinder*
74213-200	GAMMAcast cable with 5 m protective hose *GAMMAcast Kabel mit 5 m Schutzschlauch*	20 m	Industrial connector *Industrie-Steckverbinder*

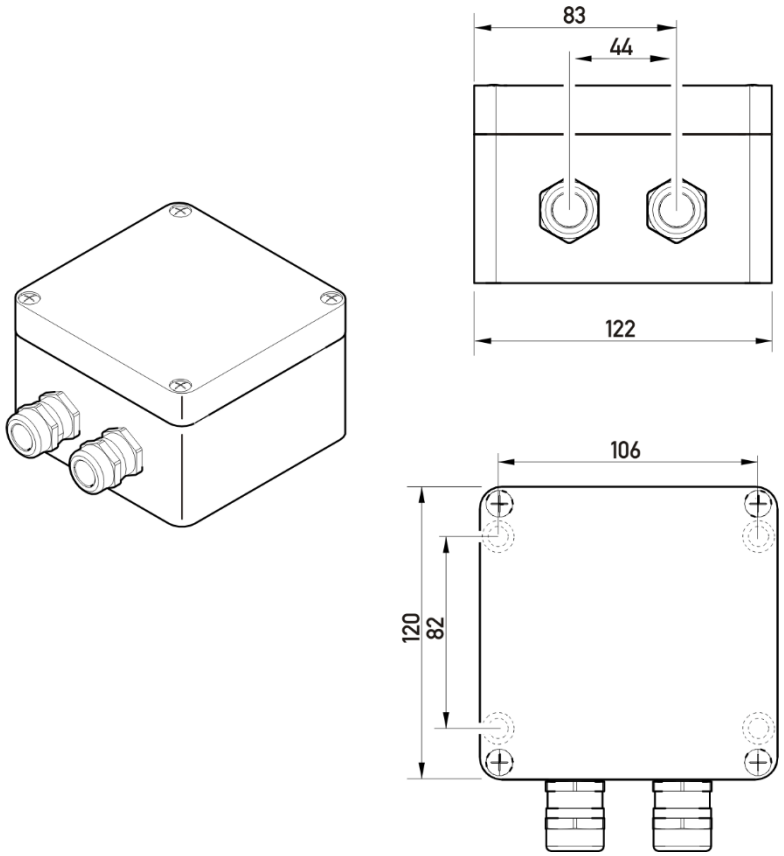
4. Connection Terminal Box for GAMMAcast Detectors

4. Anschlussklemmkasten für GAMMAcast-Detektoren



(All dimensions in mm)
(Alle Angaben in mm)

TI-Abb. 5 Connection terminal box with industrial connector (Mat. No. 34787)
Anschlussklemmkasten mit Industriesteckverbinder (Mat-Nr.: 34787)

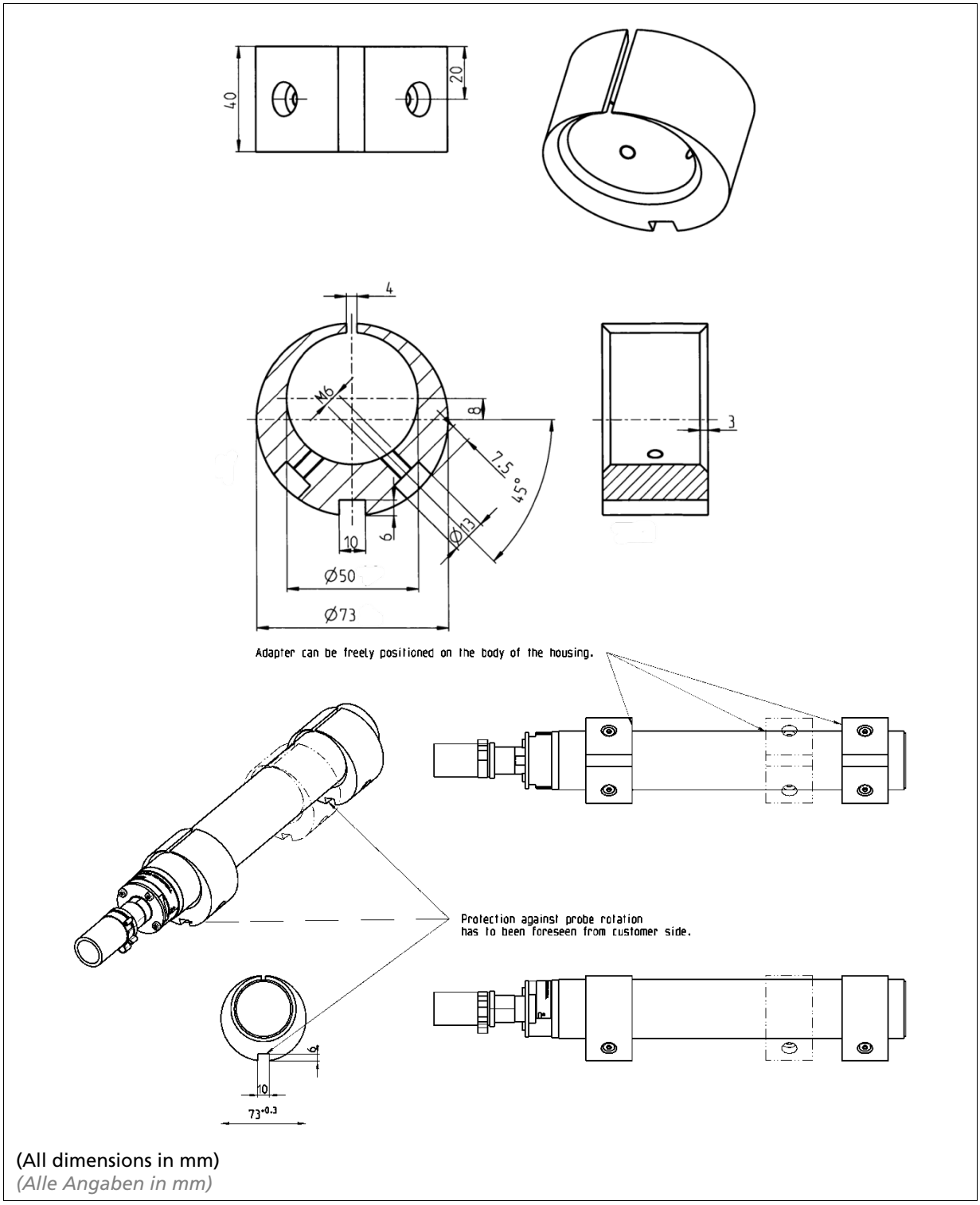


(All dimensions in mm)
(Alle Angaben in mm)

TI-Abb. 6 Connection terminal box for open ends (Mat. No. 07005)
Anschlussklemmkasten für offene Enden (Mat.-Nr.: 07005)

5. Replacing LB 6651 with GAMMAcast LB 6739 / LB 6760

5. Ersatz von LB 6651 durch GAMMAcast LB 6739 / LB 6760



(All dimensions in mm)
(Alle Angaben in mm)

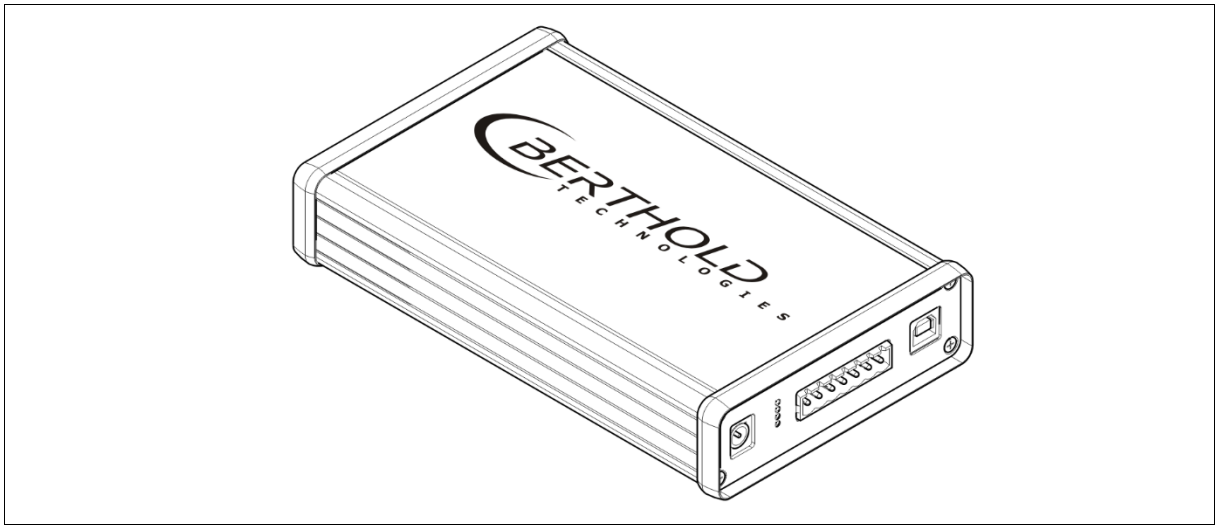
TI-Abb. 7 Changed detector dimensions are compensated by adapter ring (Mat. No. 58009)
Verändertes Detektormaß wird durch Adapterring (Mat.-Nr.: 58009) ausgeglichen

6. Detector Service Modem

6. Detektor Service Modem

Modem (Mat. No. 65365) for connecting the detectors of the GAMMAcast series to a PC for maintenance purposes.

Modem (Mat.-Nr.: 65365) zum Anschluss der Detektoren der GAMMAcast-Serie zur Wartung an einem PC.



TI-Abb. 8 Detector service modem
Detektor Service Modem

Technical Data Detector Service Modem *Technische Daten Detektor Service Modem*	
System requirements *Systemanforderungen*	Menu language: English Windows XP or higher 512 MB RAM 1 gigahertz processor USB port *Menüsprache: Englisch* *Windows XP or höher* *512 MB RAM* *1 Gigahertz Prozessor* *USB Anschluss*
Connections *Anschlüsse*	USB 2.0 to PC RS485 to detector Supply voltage 24 VDC (100-240 VAC power supply unit included) *USB 2.0 zum PC* *RS485 zum Detektor* *Versorgungsspannung 24 VDC (100-240 VAC Netzteil enthalten)*
Software LB 67xx PC Control	Display of count rate Display of the detector temperature Display of extreme values of detector temperature Automatically and manually setting of high voltage for the operation of the photomultiplier *

Software *LB 67xx PC Control*	Automated process for acquiring the amplifier plateau of the photomultiplier * Access to the change log of the connected detector Access to the error log of the connected detector Software update Resetting the detector to the factory settings *Anzeige der Zählrate* *Anzeige der Detektortemperatur* *Anzeige der Extremwerte der Detektortemperatur* *Automatisches und manuelles Setzen der Hochspannung zum Betrieb des Photomultipliers** *Automatisiertes Verfahren zur Aufnahme des Verstärkungsplateaus des Photomultipliers** *Einsicht in den Änderungslog des angeschlossenen Detektors* *Einsicht in den Fehlerlog des angeschlossenen Detektors* *Softwareupdate* *Detektor auf Werkseinstellungen zurücksetzen*

* depending on the connected detector

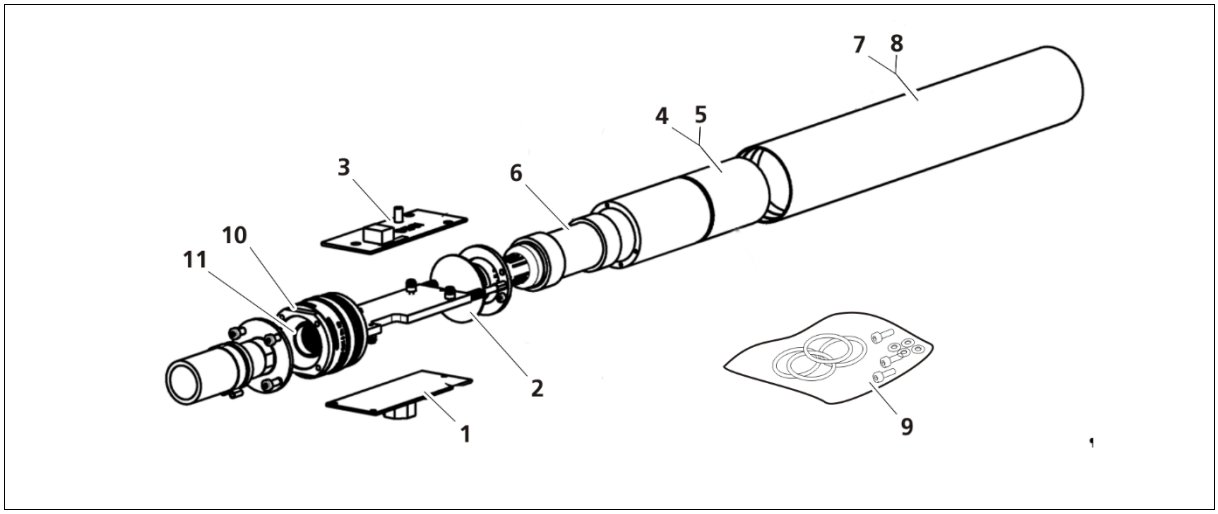
** je nach angeschlossenem Detektor*

7. GAMMAcast: Important Spare Parts (Selection)

7. GAMMAcast: wichtige Ersatzteile (Auswahl)

7.1. Spare Parts LB 6739

7.1. Ersatzteile LB 6739

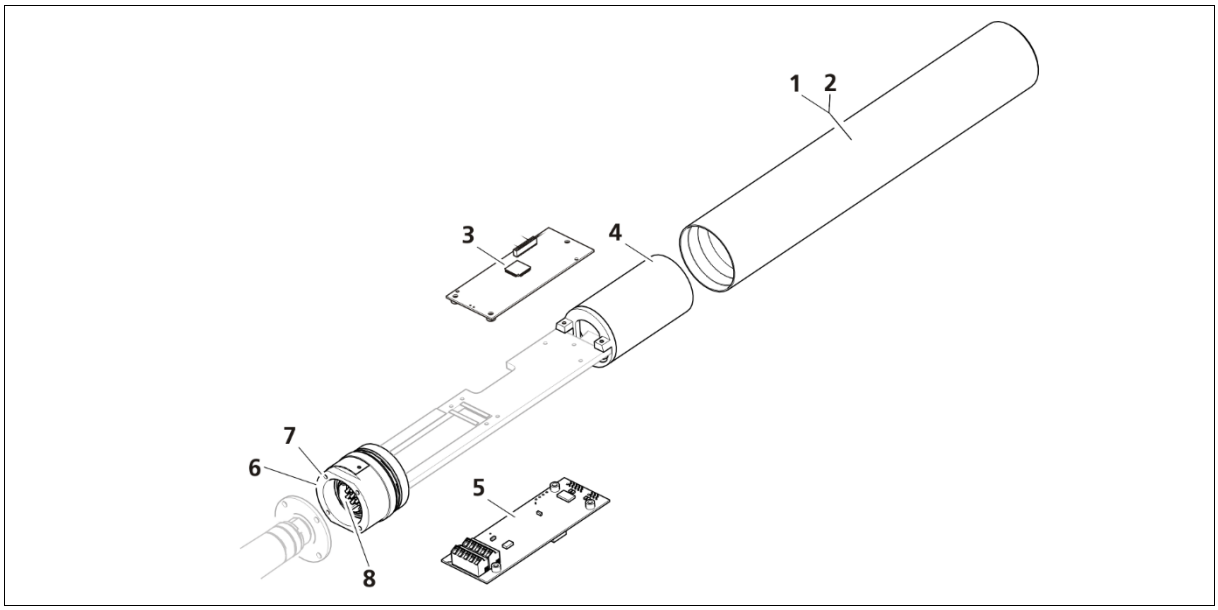


TI-Abb. 9 Spare parts LB 6739
Ersatzteile LB 6739

Spare parts LB 6739 *Ersatzteile LB 6739*		
1	64466-S	CPU board *CPU-Board*
2	53148-S	Photomultiplier base with high voltage cascade and voltage divider *Photomultiplier-Sockel mit Hochspannungskaskade und Spannungsteiler*
3	53437-S	HV (High Voltage) board *HV (High Voltage) Board*
4	59832-S	Crystal unit CsI(Na) 40x50 mm² crystal *Kristalleinheit CsI(Na) 40x50 mm² Kristall*
4	59833-S	Crystal unit CsI(Na) 25x50 mm² crystal *Kristalleinheit CsI(Na) 25x50 mm² Kristall*
5	55282-S	Photomultiplier crystal unit CsI(Na) 40x50mm² crystal *Photomultiplier-Kristall-Einheit CsI(Na) 40x50mm² Kristall*
5	55285-S	Photomultiplier crystal unit CsI(Na) 25x50mm² crystal *P10hotomultiplier-Kristall-Einheit CsI(Na) 25x50mm² Kristall*
6	55653-S	1'' Photomultiplier unit *Photomultiplier-Einheit 1''*
7	52496-S	Detector housing without water cooling *Detektorgehäuse ohne Wasserkühlung*
8	53442-S	Detector housing with water cooling *Detektorgehäuse mit Wasserkühlung*
9	55873-S	Spare parts kit (gaskets, screws, other small parts, laid out for 5 detectors) *Ersatzteilsatz (Dichtungen, Schrauben, andere Kleinteile für 5 Detektoren)*
10	64149-S	Mechanical base unit without plug inner part *Mechanische Sockeleinheit ohne Steckerinnenteil*
10	52479-S	Mechanical base unit with plug inner part *Mechanische Sockeleinheit inkl. Steckerinnenteil*

7.2. Spare Parts LB 6760

7.2. Ersatzteile LB 6760

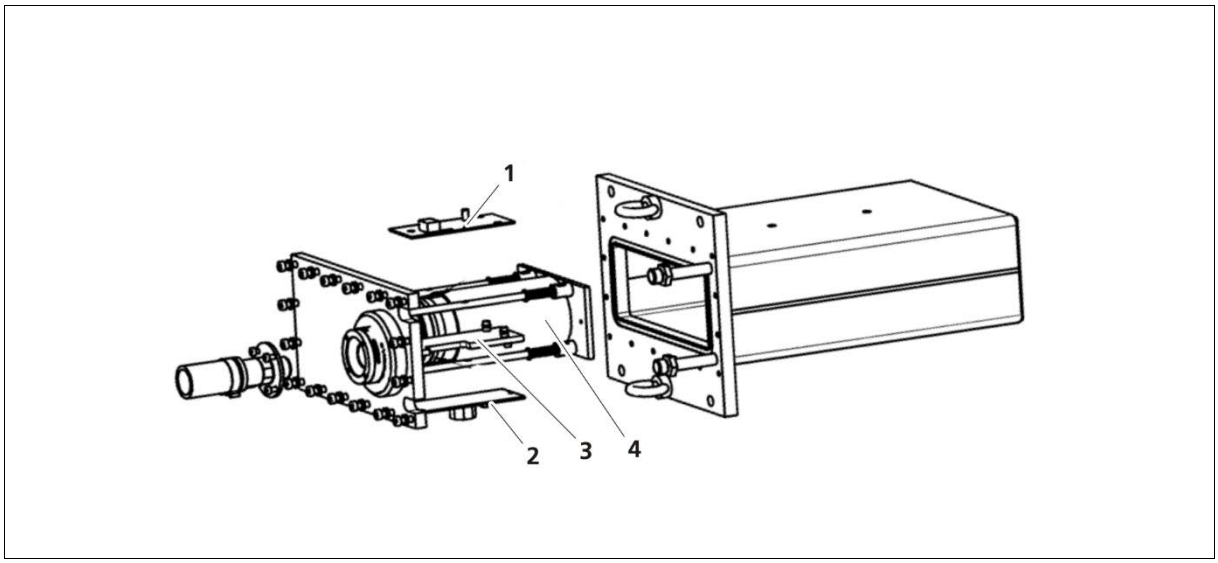


TI-Abb. 10 Important spare parts LB 6760
Wichtige Ersatzteile LB 6760

Spare parts LB 6760 *Ersatzteile LB* 6760		
1	52496-S	Detector housing without water cooling *Detektorgehäuse ohne Wasserkühlung*
2	53442-S	Detector housing with water cooling *Detektorgehäuse mit Wasserkühlung*
3	64465-S	CPU board *CPU-Board*
4	63607-S	SiPM-crystal combination (NaI(Tl) 40x50mm² crystal) *SiPM-Kristallkombination (NaI(Tl) 40x50mm² Kristall)*
5	64464-S	Signal processing unit *Signalverarbeitungsplatine*
6	63615-S	Mechanical base unit without plug inner part *Mechanische Sockeleinheit für ohne Steckerinnenteil*
7	63616-S	Mechanische Sockeleinheit with plug inner part *Mechanische Sockeleinheit inkl. Steckerinnenteil*
8	63626-S	Plug connector inner part *Innenteil Anschlussstecker*

7.3. Spare Parts LB 6752

7.3. Ersatzteile LB 6752



TI-Abb. 11 Important spare parts LB 6752
Wichtige Ersatzteile LB 6752

Spare parts GAMMAcast *Ersatzteile GAMMAcast*		
1	64466-S	CPU board *CPU-Board*
2	56085-S	Preamplifier board *Vorverstärker-Board*
3	53144-S	Photomultiplier base with high voltage generator *Photomultiplier-Sockel mit Hochspannungsgenerator*
4	34819-S	2'' photomultiplier unit *Photomultiplier-Einheit 2''*

Modifications due to technical advancement reserved.