LB 9510

Lumat Luminescence Tube Luminometer

Operating Manual

71450BA2

Rev. No.: 02, 10/2023

Not for use in in-vitro diagnostic (IVD) procedures.

The information in this guide is subject to change without notice.

DISCLAIMER
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This instrument is not designed or intended for use with installations or equipment in hazardous environments. Servicing of the instrument must only be performed by Berthold Technologies Field Service Engineers or service staff authorized by Berthold Technologies.

Please contact our ServLightCompass® Center at service@berthold.com if you have any operational issues.

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

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

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1 Prefatory Comments

1.1 Contact Information

Berthold Technologies GmbH & Co. KG
Calmbacher Str. 22
75323 Bad Wildbad
Germany

Sales and Customer Service
Internet: www.berthold.com
Phone: +49 7081 177-0
Fax: +49 7081 177-100
E-Mail: bio@berthold.com

Central Customer Service
Phone: +49 (0)7081 177-111
Fax: +49 (0)7081 177-339
E-Mail: service@berthold.com

1.2 Typographical Conventions

⚠ DANGER

Indicates an imminent, major hazard, which will certainly 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.

Symbols	Description
●	Enumerations
1.	Actions are symbolized by numbers
< >	Buttons are printed inside angular brackets in bold type
[ ]	Menu titles and items, dialog boxes and select lists are printed inside square brackets in bold type
/	Menu items and submenu items are separated by an angular line.
	On screenshots: Reference to submenu or information described in the text.

1.3 Safety Manual and Operating Manual

LB 9510 Lumat is supplied with two manuals belonging together.

- The Safety Manual, ID No. 71450BA27, contains safety relevant information to be observed by the user.
- The Operating Manual, ID No. 71450BA2, contains additional information on operating software, and other important information of the manufacturer.

Revision no. and release date can be found in the footer of the manuals. Keep both manuals for future reference.

NOTICE

Validity of Safety Manual and Operating Manual

This revision of the Operating Manual is only valid in conjunction with the Safety Manual ID No. 71450BA27rev. 00 or latest revision.

For safety reasons make a note of the IDs and revision numbers of both manuals in case you need to replace lost manuals.

Always read the Safety Manual prior to the Operating Manual and both before first use of the instrument.

1.3.1 The Operating Manual

The operating manual is valid from the delivery of the Berthold product to the user until its disposal. Keep the operating manual for future reference.

Read all instructions thoroughly and completely before working with the product.

The information in this guide is subject to change without notice.

However, should questions arise which are not answered in this manual please contact BERTHOLD, bio@berthold.com.

Revision history of the operating manual

Date	Changes
12/2020	Initial document; ID 71450BA2#00
05/2023	Updated with LightCompass® Software. ID 71450BA2#01

10/2023	Added LightCompass® Trademark

2 Software Installation

The instrument is operated with LightCompass® software. Follow the instructions for LightCompass® software installation.

IMPORTANT

Precondition for both software packages:
Windows compatible PC with Windows 10.

2.1 Installation of LightCompass® Software

IMPORTANT

Technical Data of LightCompass® Software:
The technical data can be found in chapter 8.

IMPORTANT

Software installation

- Do not connect the instrument to PC during software installation.
- For installation **local administrator level** is necessary.

The LightCompass® operating software and the instrument driver software are delivered on a USB stick.

Installation

1. Close all Windows applications before you start installing the software.
2. Insert the USB stick into a USB slot and browse to the USB root directory.
3. The USB stick contains the Setup file for the LightCompass® software. Double-click the .exe file to start the installation.

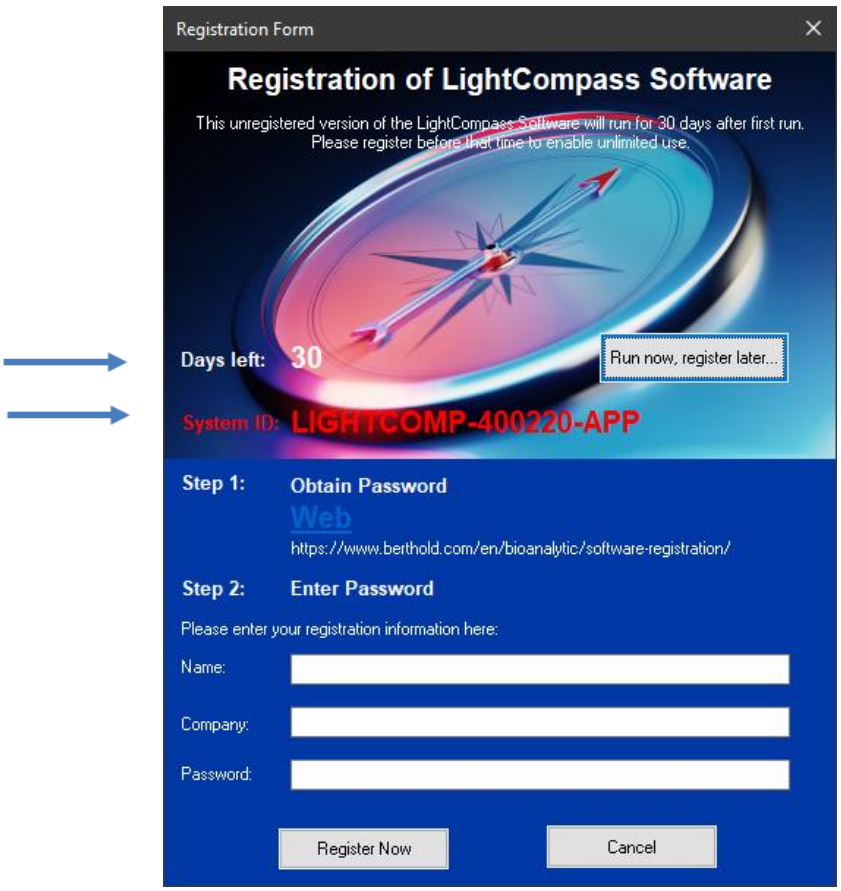
   Depending on Windows security settings Security Warnings dialogues may appear during the installation steps. Always confirm the messages to continue the installation.

4. Follow the installation wizard. Select / insert your entries. Confirm your entries with **<OK>** or **<Next>**. Close the dialog with **<finished>.**
5. The LightCompass® Software icon will appear on your desktop after installation.

2.2 Software Registration

1. Double-click the LightCompass® icon. The software will open and show a **[Registration form]** dialog box.
2. Use the LightCompass® software within a trial period of 30 days after first run without registration. A prompt to enter a registration password will appear each time the software is started until the registration password is entered.

   User may close the **[Registration Form]** dialog box by clicking **<Run now, Register Later>** and continue working with the software. The remaining days of the trial period are decremented.



3. **Obtain Password**: Press the Web button on the registration form, insert the required information in the web registration form and forward it to Berthold Technologies.

Please provide the System ID of the PC. The number is printed in red in the registration dialog of the software (see picture above).

The owner will receive the registration password from Berthold Technologies via E-Mail.

4. **Enter Password:** Enter the password within 30 days to enable unlimited use.

   When the **[Registration Form]** dialog box appears, enter the user's name, the company name and the provided password. Click **<Register Now>**. Upon entry of the correct password, continue using the software. The **[Registration Form]** dialog box will not appear again.

   Click **<Cancel>** to quit without registration.

3 LightCompass® Software

3.1 LightCompass® Directories and Files

The directories for data and parameter files are defaulted as described below. Any accessible directory on the computer and the local network can be selected though when saving data and parameter files using the "**Save … File As…**" command.

Default directories

- Data files C:\ProgramData\LightCompass\Measurement
- Protocol files C:\ProgramData\LightCompass\Protocol

File Names

There is no limitation in naming data and protocol files other than the Microsoft Windows conventions.

Protocol file names are to be defined at the end of creating a protocol. Renaming is possible using the **[Save As…]**" command producing a copy of the protocol file with a new name.

Data file names are named automatically with their date and time stamp. Renaming is possible using the **[Save As…]**" command producing a copy of the data file with a new name.

File Types

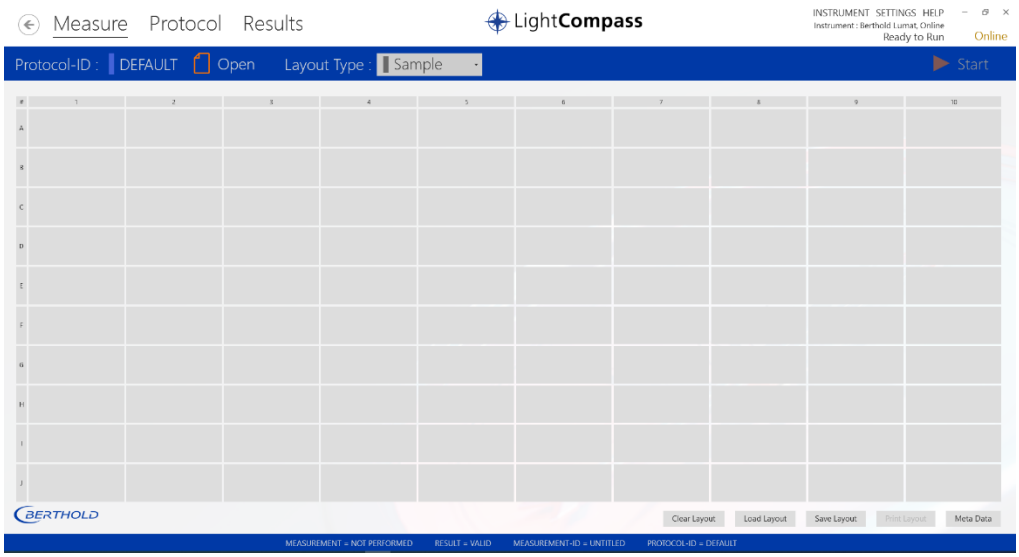
LightCompass® works with different file types indicated by the respective file name extensions.

- Measurement files have the extension .meas
- Protocol files have the extension .prot

3.2 LightCompass® User Interface

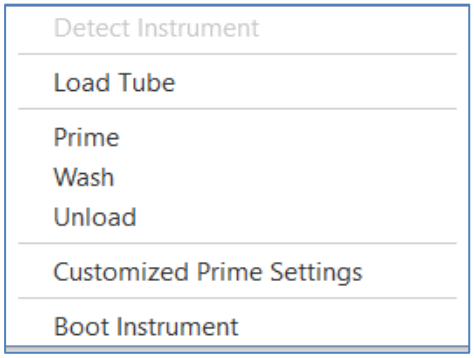
3.2.1 LightCompass® Default Setup

Default main screen of LightCompass®:



3.2.2 Instrument Menu

In the Instrument menu basic instrument settings and communication may be accessed.



[Detect Instrument]	detects the connected Berthold instrument.
[Load Tube]	turns sample rotor once: moves tube from loading position into measurement position.
[Prime]	Opens the injector priming sequence (filling the lines).
[Wash]	Opens the Injector wash sequence cleaning the lines).
[Unload]	starts the unloading sequence (recovering reagents back into the reservoir)

[Customized Prime Settings] Define a user and /or application specific prime sequence.

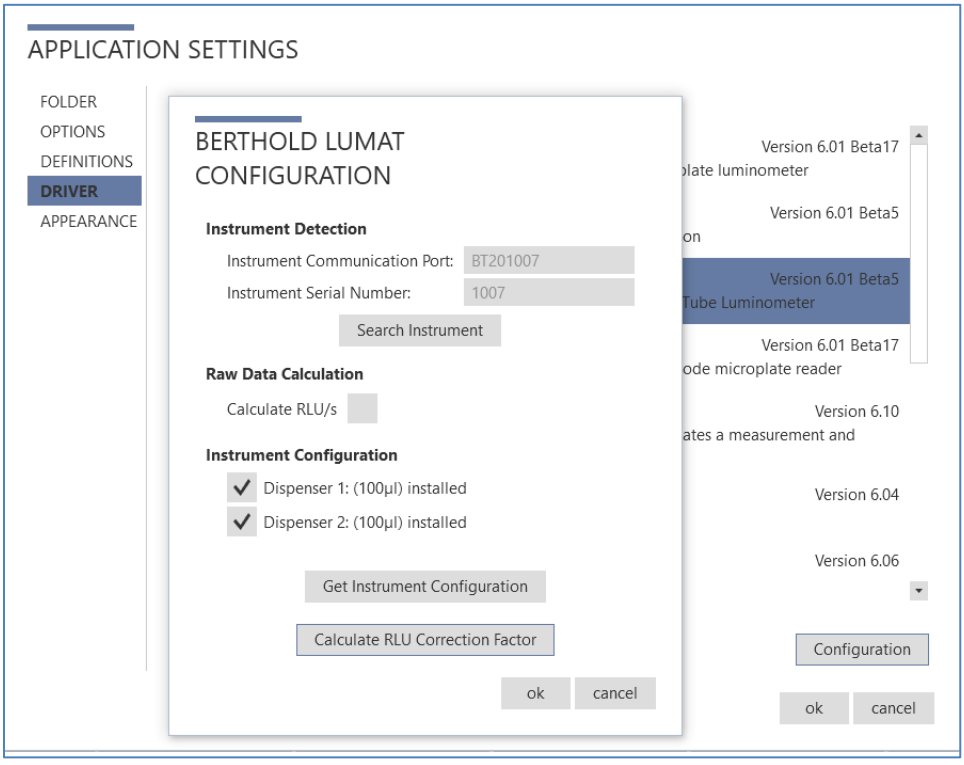
[Boot Instrument] establishes communication and boots instrument.

3.2.3 Settings Menu

In the **[Settings]** menu you can define the default root directory for the measurement and protocol files. Also, you can manage security settings, instrument drivers and appearance of the software itself.

[Configuration of Instrument]:

To check the configuration of your instrument, click **[Settings] / [Driver] / [Berthold Lumat] / <Get Instrument Configuration>**. In the configuration submenu you may search the instrument, activate the calculation of

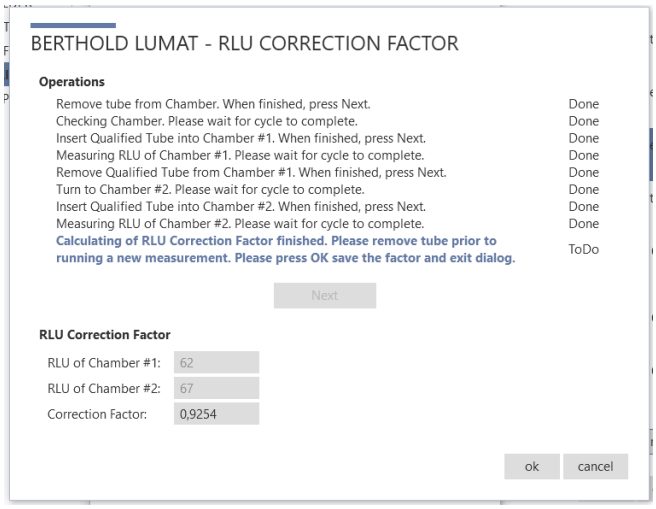


RLU/s for your measurement data instead of RLU, get the configuration of the connected instrument and calculate the correction factor for the sample adapters.

<Calculate RLU Correction Factor>:

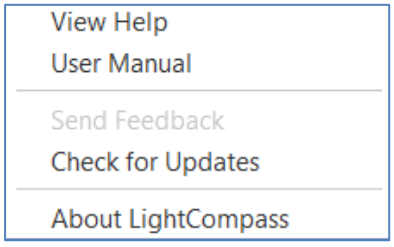
The instrument is equipped with two sample adapters. The properties of both adapters in their efficiency to transmit the light to the detector are

usually very similar. The adapters are matched and paired at the factory. For extremely precise measurements or in case one of the adapters got dirty you can adjust both responses by determining the RLU correction factor. Click **<Calculate RLU Correction Factor>** and follow the guideline.



3.2.4 Help Menu

The **[Help]** menu allows you to view the online Help function, to open the software manual, send feedback and check online for updates and to view the basic software information.



4 Operation with LightCompass®

Defining protocols using the Protocol Wizard of LightCompass® software and running measurements on the Lumat is straight forward. The procedure is the same for Raw Data, Curve Fit and Cut-off.

In order to provide the utmost light collecting efficiency the tube holders are equipped with reflectors which may exhibit phosphorescence after exposure to light. We recommend using a 2 sec delay before each measurement.

A measurement can be carried out immediately after a stored protocol is selected. At the end of each measurement the results are stored and may be printed or exported.

Result file names can be given without limitation. The extension for result files as well as measurement files is fixed, though.

Manual protocol setup:

The subchapters below describe the use of the Protocol Wizard for protocol setup. Manual setup is not described in detail in this manual. General steps for manual setup of protocols:

- Switch to the **[Protocol]** tab, click **[Reset]** to set everything to default.
- Click **[Add Step]** or **[Remove Step]** to edit your protocol.
- Set the Step Properties for each Step you add.
- After finishing the setup click on **[Save As…]** to save the Protocol and give it a descriptive name.
- Your protocol is loaded and ready to run.

IMPORTANT

Onboard user manual and Online Help

For further information on setup of protocols or additional software help, please refer to the menu **[Help] / [View Help]** or **[User Manual].**

4.1 Define a Protocol using the Protocol Wizard

IMPORTANT

Protocol wizard

The protocol setup can be guided through a wizard. Most of the steps passed through the protocol setup are similar in all kinds of protocols, Raw Data, Cut-Off and Curve Fit.

To set up a protocol, start at the Main Screen and proceed as follows:

- Switch to the **[Protocol]** tab, click **[Open]** and then **[Protocol Wizard]** on the right side of the software window.
- Click **[Add Step]** or **[Remove Step]** to edit your protocol
- Click **<Next>** to get to the next page
- After finishing all steps click on **<Finish>** so end the protocol wizard
- Your protocol is loaded and ready to run

Please refer also to the menu **[Help] / [View Help]** or **[User Manual]** for further information**.**

4.2 Protocol Wizard - Measurement Page

4.2.1 Settings

[Rack Settings]

Define the format your data shall be displayed on the Measure and Results page. Set the view according to your preferences.

Recommendation for tube format:

[User Defined] / Columns: (1) / Rows: number > no. of samples.

[Background Measurement]

Check the checkbox if you want to perform a background measurement and define the background measurement time and, if desired, a background threshold.

4.2.2 Endpoint

[Label Settings]

Here you can define a name for this specific step and give a description.

[Measurement Settings]

Define the measurement time (counting time) for each tube.

4.2.3 Kinetic

[Label Settings]

Here you can define a name for this specific step and give a description.

[Kinetic Settings]

Here you can set up the total time the measurement should last, the counting time for each measurement step and an optional delay time. From these data the number of repeats is calculated automatically.

4.2.4 Dispense

With this step you define an injection with one injector. To dispense with more than 1 injector just select this step multiple times and place it at the desired position in your protocol workflow.

[Injector Settings]

Here you can define the injector to be used, which volume shall be dispensed and the injection speed.

4.2.5 Delay

With this step you define a delay step. If you want to insert a delay time more often during the protocol just select this step multiple times and place it at the desired position in your workflow.

[Delay Settings]

Here you can set the delay time from 0.1 to 3600 seconds.

4.2.6 Unload

With this step you define an unload step of the tube. If you want to insert an unload step more often during the protocol just select this step multiple times and place it at the desired position in your workflow.

[Unload Settings]

Here you can set up the time how long the tube shall remain outside of the instrument (from 0.1 to 3600 seconds).

4.3 Protocol Wizard - Protocol Type and Properties Pages

Select the type of protocol evaluation on the Protocol Type Page.

Depending on your selection – Raw Data / Cut-Off / Curve Fit protocol – the following different Properties Pages will be available.

4.3.1 Raw Data Properties Page

Select the no. of replicates and the no. of decimals.

4.3.2 Cut-Off Properties Page

Check the controls to be used and select the no. of decimals. Select the replicates for samples and used controls and specify the Cut-Off threshold calculation.

[Use Positive Controls]

Tic the checkbox to use the positive control.

[Use of Negative Controls]

Tic the checkbox to use the negative control.

[No. of Decimals]

Up to 3 decimals are available.

[Replicates of]

Define the number of samples replicates, and, if the respective checkboxes have been ticked, the number of positive and negative controls.

[Cut-Off Threshold Calculation]

Select the number of divisions (2 or 3) first to set the number of thresholds, select the Flag for your thresholds and the Threshold Formula.

4.3.3 Curve Fit Properties page

Immunoassays are measured using a curve fit protocol. Follow the recommendation for settings in the kit insert.

IMPORTANT

Context specific information

The cursor may be drawn over the words to provide context specific information for the settings and their options.

Specific submenus and check boxes may be available or greyed out, depending on your selected protocol settings.

Select the

[No. of Standards] Minimum is 4 standards.

[No. of Controls] Select 0-10 controls.

[No. of Decimals] Up to 3 decimals are available.

[Standardization Type] check the respective check box:

Full standardization: A complete set of standards is measured together with the samples. This method is best suited to eliminate day-to-day variations in assay preparation as well as lot variations of the chemistry. This assay type is well suited for research applications requiring the use of known standards to calculate the concentration of unknow Immunoassay with n samples with the help of a standard curve.

Choose full standardization to measure the whole standard curve before measuring samples.

Reference curve: A complete set of standards is measured once by the user (reference curve). Two calibrators are measured respectively with the samples, adjusting this reference curve to day-to-day variations in assay preparation as well as lot variations of the chemistry.

Choose reference curve to use a measured curve and recalibrate it with the help of 2 calibrators.

Master curve: The master standard curve is provided by the kit supplier and is entered manually. Two calibrators are measured with the samples adjusting the original standard curve to day-to-day variations in assay preparation as well as lot variations of the chemistry.

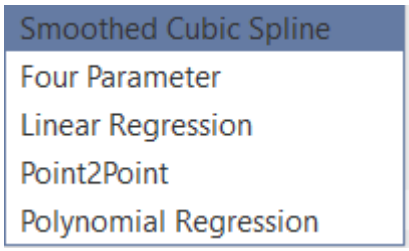
Choose master curve to use a verified curve for your assay and recalibrate it with the help of 2 calibrators.

[Replicates]

Select the number of replicates for Samples, Standards, Controls or Calibrators. Depending on your settings, Controls and Calibrators may be greyed out.

[Advanced Settings]

Select the Fit Method between



and the Axis Scaling between Lin/Log and Log/Log

For many research assays utilizing a standard curve, a log/log transformation and linear regression are often used.

[Concentration Settings]

Insert the concentration units and, in case of defined calibrators, insert the calibrator concentration.

[Expected Range]

Tic the checkbox to activate the submenu and insert the limit values. Below the low limit and above the high limit, concentrations will not be calculated.

[Cut Off Limits]

Tic the checkbox to activate the submenu and insert the limit values. There will be shown remarks in the report, if concentrations are below, between or above thresholds.

[Control ID] [Standard ID]

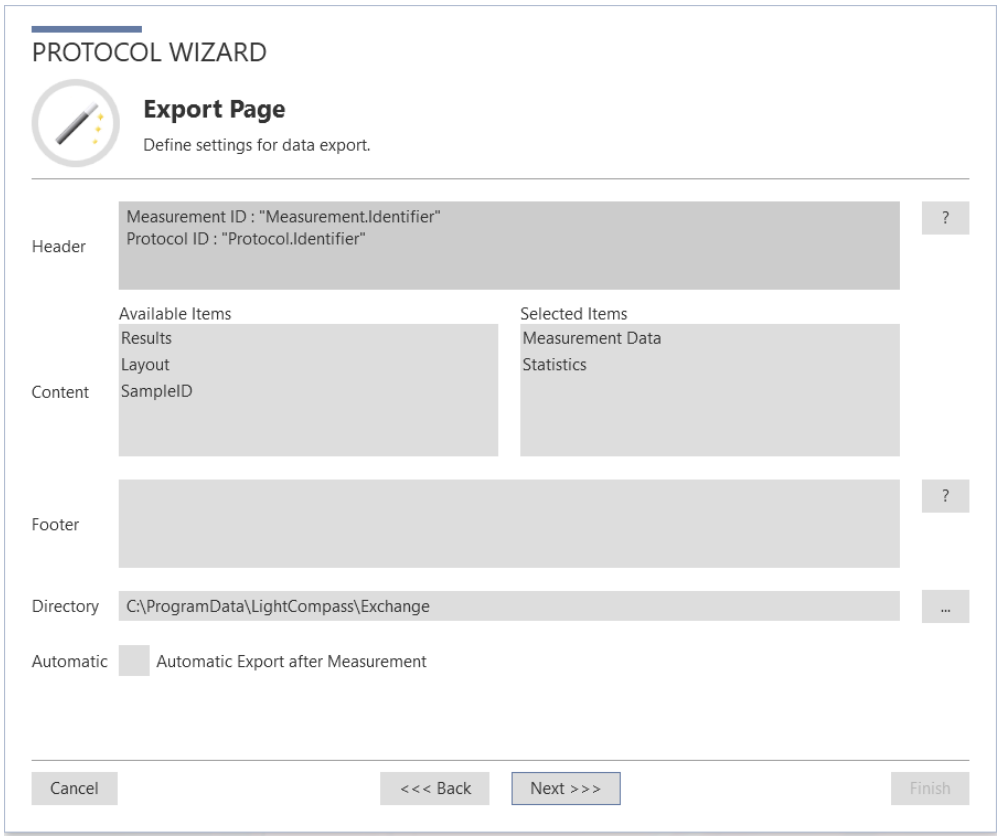
Insert the concentration of standards and the limits for your controls. Depending on your settings on the curve properties page, the availability of items may vary.

4.4 Protocol Wizard - Export Page and Print Page

Define the settings for data export in the [Export Page].

Type your **[Header]** specific for this protocol.

Select the **[Content]** by dragging items from left to right.



Define your settings for printout in the Print Page.

4.5 Protocol Wizard - Protocol Page

Enter an identifier (File Name) for the protocol under which it is to be saved.

4.6 Perform a Measurement

NOTICE

Use of injectors:

If injectors are to be used, they must be primed prior to protocol start. Click **[Instrument] / [Prime]** and prime the injectors to be used.

To start a measurement,

1. Click **[Open]** and double-click the selected protocol in the menu **[Manage Protocols]**. The screen will switch to **[Measure].**
2. Assign the defined **[Layout Type]**, e.g., for Endpoint measurement

usually **Sample** and the required **Injector**s, one after the other to your defined rack size by clicking **<#>** for assignment to all samples, or into the respective lines/wells in case of assignment to single samples. This assignment will activate the **<Start>** button.

3. Click the **<Start>** button in the software and press the button at the instrument front to measure a sample.
4. The Result view is strongly dependent on the settings of your protocol. Click **[Results]** to view your **[Results]** and, depending on your settings, e.g., **[Graphics], [Curve fit], [Printout], [Export]** and **[Meta Data]**.

5 Maintenance

NOTICE

Consult Safety Manual 71450BA27

The information in this chapter is only valid in conjunction with the Information in Chapter 5 of the Safety Manual. See chapter 1.3 of this Operating Manual for details. Always read the Safety Manual completely, prior to the Operating Manual and both before first use of the instrument.

5.1 Maintenance of the Injector System

Some assays require the injection of reagent prior or during measurement. For good operation, the injector lines have to be maintained regularly and must be primed previously and washed after use.

- Berthold Technology recommends strongly to perform the priming with deionized water first and leaving the lines filled with deionized water before priming with reagents, to avoid reagent aerosol splashes at the injector tips and thus contamination of the instrument.
- Check the tubing connections regularly for leaks. Faulty tubing connections must be replaced. Call an authorized service center!

Priming and washing are software controlled. All functions are located in the **[Instrument]** menu.

5.1.1 Priming the Tubing

See also chapter 5.1. of the Safety Manual.

Injection lines have to be primed (filled) prior to measurements which require the use of injectors for reagent addition.

To prime the injector, proceed as follows:

1. Connect the injector tubing to be primed to the reagent container.
2. Select **[Instrument] / [Prime]** to open the **[Prime Injectors]** dialog box.

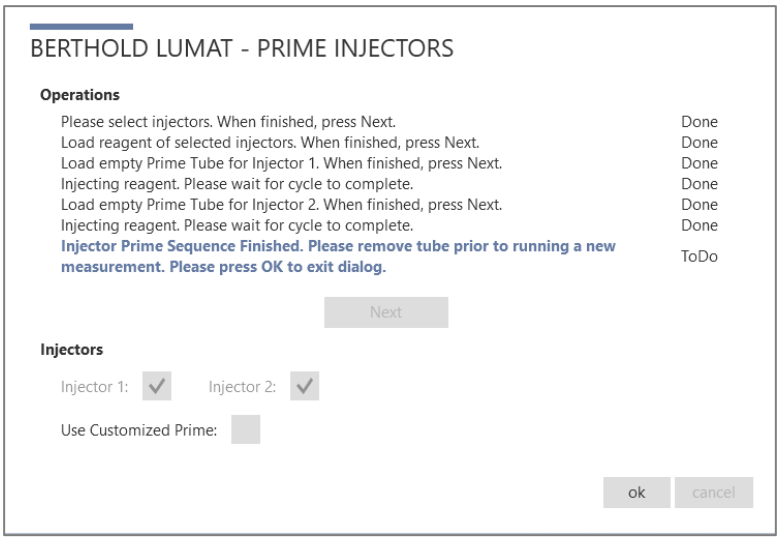
3. Select the **[Injectors]** to be primed by checking the check box. All injectors may be selected at the same time.

   Check **[Customized Prime Settings]** to select a user defined priming method. See chapter 5.1.2 for further information.

   The default prime instruction is used if **[Customized Prime Settings]** is unchecked. See the **[Customized Prime Settings]** menu **/ Default / [Load]** for settings of the default prime instruction.

4. Always use empty 12x75 mm vials for priming. Each injectors needs a separate vial.

5. Follow the commands on the screen and wait for the prime process to be finished.



6. Click **<OK>** to exit the dialog.

7. The injectors are now primed and ready to use.

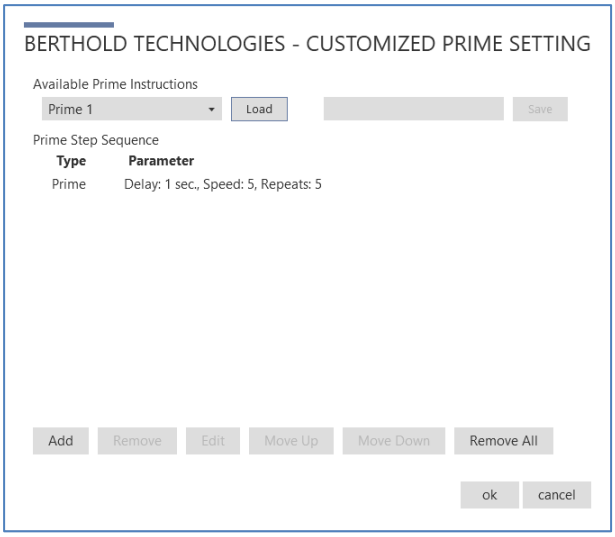
5.1.2 Customizing the Priming Sequence

Some reagents (e.g., high viscosity) or solutions (e.g., cells) require special priming procedures which can be defined individually.

To setup a customized prime sequence proceed as follows:

1. Starting at the [**Main]** screen, click **[Instrument] / [Customized Prime Settings].**

2. The **[Prime Customize]** dialog will be displayed.



3. Click **[Add]** and select your settings.

Available settings:

Injection: the injector is filled with the max. injection volume from the reagent reservoir and injects the set volume

Volume	percentage of the max. inj. vol.
Delay	delay before the operation in sec
Speed	1 … 10
Repeats	number of repeats

Delay: A delay time that elapses between operations, e.g. to mimic the injection timing of the assay (this can be important with a cell suspension).

Delay	elapsing time in sec

Oscillate: the injector is (partly) filled and oscillates between the set positions (back into the reagent reservoir).

Start. Point	percentage of the max. inj. vol.
End Point	percentage of the max. inj. vol.
Speed	1…10
Repeats	number of repeats

Ventilate: the injector is completely filled (beyond the max. injection volume) from the reagent reservoir and injects the total volume of the bellow.

Delay	delay before the operation in sec
Speed	1 … 10
Repeats	number of repeats

Prime: the injector is filled with the max. injection volume from the reagent reservoir and injects the full volume

Delay	delay before the operation in sec
Speed	1 … 10
Repeats	number of repeats

4. Select a setting and click **[Edit]** to change the settings. Confirm with **<OK>**.
5. Setup a Prime Step Sequence by adding all necessary settings. **[Remove], [Move Up], [Move Down]** or **[Edit]** every step, or **[Remove all]** steps. Name your **Prime Step Sequence** and **[Save]** it.
6. **Click <OK>.**
7. Re-open the Customized Prime Settings menu, then. The new Prime Instructions will be available in the List of Available Prime Instructions then. Select your file, click **[Load]** and **<OK]**.
8. Continue as described in chapter 5.1.1. Check **[Use Customized Prime]** and prime the injectors.

5.1.3 Empty the Tubing

This operation can be used to empty the injection lines after the measurement and re-collect valuable reagents in the reagent reservoirs.

Make sure the reagent reservoirs are connected to the injection tubing!

1. Click **[Instrument] / [Unload]**. The **[Unload Injector]** sequence will open.
2. Define the **[Number of unload cycles].** Each cycle is equivalent to the max. injection volume of the injector installed.
3. Check the check boxes of the respective **[Injectors]** to define whether Injector 1 or Injector 2 or both are to be emptied and follow the instructions on the screen.
4. Click **<OK>.**

5.1.4 Cleaning the Tubing

Observe the information in chapter 5.4 and 5.4.3 in the Safety Manual.

The injector system must always be clean to avoid carryover of reagents and contamination. Wash the injector tubing

- before start of operation
- whenever changing reagents
- after completion of your work.

Proceed as follows:

1. Select **[Instrument] / [Wash]** to open the **[Wash Injector]** Sequence dialog box.
2. Enter the **[Number of Wash Cycles].** One wash cycle consists of one shot. 10 cycles ensure that the injector system is completely filled. Depending on the substances used, Berthold Technologies recommends up to 30 cycles for washing a single 100µl injector and up to 10 cycles for 300µl injectors (repeat with a new tube, if necessary).

NOTICE

Avoid overflow!

The maximum capacity of a standard tube (12 x 75 mm) is 5 ml. Each Wash Cycle uses the maximum volume of an injector (100 µl or 300µl).

Make sure the total Wash volume does not exceed the volume of the tubes.

Every injector needs a separate tube!

3. Select the **[Injectors]**. All injectors may be selected at the same time.
4. Click **<Next>** and follow the commands on the screen.
5. Exit the dialog box with **<OK>.**
6. The injector system is now washed.

5.2 Further maintenance information

Further information on maintenance items can be found in the Safety Manual:

Safety Manual Chapter	Item
5.1	Replace tubing connections
5.2	Special spare parts
5.3	Replace reagent filters
5.4 and sub-chapters	Cleaning and Decontamination
5.5	Disposal

6 Quality Control Check

It is considered good laboratory practice to run laboratory samples according to instructions and specific recommendations included in the package insert of the reagent kit or the standard laboratory protocol for the test to be conducted. A failure in the performance of Quality Control checks could result in erroneous test data.

It is recommended to run known internal quality standards or samples attendant to the measurement runs or to use the **Luminescence Test Tube**, offered by Berthold Technologies.

7 Warranty and Technical Issues

7.1 Special Spare Parts

Special spare parts, to be purchased from the manufacturer or his representative, are listed in the safety manual, chapter 5.2.

7.2 Warranty Statement

The instrument is sold in accordance with the general conditions of sale of Berthold Technologies GmbH & Co KG and its affiliates and representatives.
Berthold Technologies warrants this product to be free of defects in material and workmanship for a period of 12 months from the date of delivery, ex works Bad Wildbad.
Berthold Technologies or its authorized representative will repair or replace, at its option and free of charge, any product that under proper and normal use proves to be defective during the warranty period.
Berthold Technologies shall in no event be liable or responsible for any incidental or consequential damage, either direct or indirect.

The above warranty shall not apply if:

- the product has not been operated in accordance with the operating manual
- the product has not been regularly and correctly maintained
- the product has not been repaired or modified by a Berthold Technologies authorized representative or user
- parts other than original Berthold Technologies parts are used
- the product and parts thereof have been altered without written authorization from Berthold Technologies GmbH & Co KG
- the product has not been returned properly packed in the original Berthold Technologies packaging

This warranty does not apply to any third party product involved in the application.

7.3 Customer Service

Customer service will be provided in the first instance by the network of Berthold Technologies representatives. In the event of any problem experienced with your instrument, the first recourse should be your local Berthold Technologies representative. For further problems requiring hardware or software expertise, the Technical Support group at Berthold Technologies GmbH & Co KG will be available by phone, fax or email to deal with your queries. Here is their address, phone, fax and e-mail:

Berthold Technologies GmbH & Co KG
Technical Support
Calmbacher Str. 22
75323 Bad Wildbad
Germany
Phone: +49 7081 177 114
Fax: +49 7081 177 301
Email: service@berthold.com

If a problem arises with the instrument which you are not able to resolve, please contact the technical support. Please also make sure that you have the relevant information available before contacting Berthold Technologies. Helpful information would include:

- serial numbers, part number, revision: see production label on instrument.
- software and firmware versions
- monitor and log files (refer to the respective service manuals)

Confirmation on Decontamination

If you return an instrument to BERTHOLD TECHNOLOGIES for servicing purposes which is not properly decontaminated, there will be a health risk for BERTHOLD TECHNOLOGIES employees.

We therefore need your confirmation that the instrument was decontaminated and cleaned properly before shipping. Follow the instructions in the safety manual, chapter 5.4 – 5.6.

In addition a RMA-number is required to ship an instrument for repair and identify your instrument when it arrives.

In case of an instrument repair please refer to our website and follow the instructions:

https://www.berthold.com/en/company/service/form-rma-return-material-authorization/

8 Technical Data of LightCompass® Software

Operating system	Win 10 (32/64bit)
PC requirements	Pentium like CPU (2 GHz or better/intel Core iX recommended), 1 free USB 2.0 port.
Interface(s)	USB
LightCompass® Software	Wizard support for parameter entries Selection of wells Endpoint Kinetic Cut-Off Curve Fit Injection, Wash and Prime menu Data export: EXCEL

The technical data of the device can be found in the safety manual.

9 Index

Modifications due to technical advancement reserved.