



lightSTUDIO

User Manual

November 9, 2022





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1 SAFETY INSTRUCTIONS

1.1 For the Image Engineering lightSTUDIO

The following general safety instructions must be observed when operating the lightSTUDIO:

- ⚠ Caution, the lightHEAD is heavy - several people are required for assembly!
- ⚠ Wear safety shoes when moving the lightSTUDIO!
- ⚠ The control cabinet must not be opened. Failure to do so can result in an electric shock!
- ⚠ Before connecting the device to the supply voltage, the operator must ensure that the supply connections (socket) are correctly grounded!
- ⚠ Before commissioning, all cables (main power cable, USB cable to the PC, and the remote emergency stop switch cable) must be laid so there is no risk of stumbling or cable damage!
- ⚠ Before each device start-up, the interior must be checked for the correct position! A minimum safety distance of 5 cm between the interior and movement planes of the moving chart and rotating disc must be observed!
- ⚠ The device safety bar must be pulled out entirely before using the device!
- ⚠ The operator must check that the chart is securely fastened each time before starting the device!
- ⚠ Only personnel trained by the manufacturer may attach the chart!
- ⚠ Only trained personnel may operate the device!
- ⚠ The device may only be operated with an equipped chart!
- ⚠ When the device is switched on, all people present must maintain a safety distance of 2 meters from the device! Otherwise, the device must be switched off using the main switch!
- ⚠ The extended device bar must not be bypassed or manipulated!
- ⚠ There is a risk of hitting your head when replacing the spectrometer. Ensure that appropriate head protection is used.






1.2 For the Image Engineering iQ-LED Devices



WARNING AGAINST OPTICAL RADIATION!

Some of the LEDs of the iQ-LED are emitting invisible light in the IR and near UV area:

-  DO NOT look directly into the emitted light or look through the optical LED system, this can cause irreversible eye damage.
-  DO NOT look directly into the open sphere or light source when using high intensities or sequences with low response time.
-  DO NOT open the device when connected to power supply and without any instructions from the the Image Engineering support team.



2 INTRODUCTION

lightSTUDIO is a lightbox for the illumination of a scene with different standardized light types.

Two types of light heads are available: the Standard lightHEAD and the LED lightHEAD. The basic version contains six light sources with a blue filter (~10000 K). All light sources can be dimmed from 1-100% to set an appropriate light level. The LED version uses 20 narrow bands and two white LED channels for the creation of almost every desired spectral distribution. A spectroradiometer provides feedback to the control software to ensure spectra and intensities are accurately reproduced. Spectral distributions can be changed rapidly within 25 ms.

lightSTUDIO-M is an extension with two moving targets, a horizontally moving frame, which can be equipped with any test chart, and a rotating plate on the back wall that can carry different round test charts. The velocity of both moving options can be varied over a wide range.

The HDR option adds the capability to generate high-contrast scenes in the center part of the back image. Two LG4 lightboxes can produce a contrast ratio of up to 10.000:1 when the surrounding illumination is dimmed, and they can also be equipped with different transparent test charts.

All variants of lightSTUDIO are equipped with interior objects which represent a wide range of real-world situations. Amongst these is, for example, a ColorChecker for measuring the color reproduction and the white balance.

lightSTUDIO can be controlled in all combinations by software using a USB connection to a Windows PC. The Standard lightHEAD is also controllable with a panel on its front side.

NOTES FOR READING THIS MANUAL:

Numbers in square brackets [] in the text refer to the red numbers in the images.

Text in *italics* refers to labels on control elements of the software.

DEFINITION:

The term illuminant in the context of the lightSTUDIO is used as follows: The combination of a relative spectral response curve (predefined or measured) and an illumination value in lux, which is achieved at a dedicated position in the lightbox. This information is saved in a proprietary file format with a file ending .iqilluminant. Illuminants must be generated before the LED lightHEAD can be used.



ATTENTION:

Since version 1.6.0, the creation of illuminants for the LED lightHEAD is no longer available in the lightSTUDIO software and now must be performed in the iQ-LED software. The lightSTUDIO software shares the same directory for all files, depending on the LED lightHEAD, with the iQ-LED software. See chapter [4.3.3](#) for details.

3 ADDITIONAL HARDWARE

Depending on the equipment of the lightSTUDIO, some additional hardware is delivered. The lightSTUDIO-M also includes a timecode display and a mechanical finger (iQ-trigger).

3.1 iQ-Trigger/iQ-Trigger-T

iQ-Trigger is a mechanical finger that can be used to press the release button of a camera in a reproducible way. iQ-Trigger is shipped with a hydraulic adjustment arm that holds the iQ-Trigger and



an L-shape holder on a mounting plate (Manfrotto Type 405).

The L-shape holder can be mounted to a geared head, or a tripod with the Manfrotto RC4 rapid connect system. The adaptor plate has a ¼" screw for compact cameras.

The iQ-Trigger comes with two different fingers, including a solid finger for general use and a finger with a touch pen tip. To exchange the fingers, tighten the knurled screw at the back of the iQ-Trigger until the magnet is locked, then screw off the finger and replace it with the other one. Untighten the knurled screw again.

Please remember that the front foam adds an

extra delay when using the touch pen finger.

Also, use the knurled screw on top of the iQ-Trigger to adjust the travel distance of the finger. The further the screw is turned in, the shorter the distance the finger has to move.

As a general rule, try to set the travel distance as short as possible. A smaller travel distance implies more power and less delay. iQ-Trigger is controlled with the software (chapter 0).



The iQ-Trigger-T is intended for use with touch screens on mobile devices. Please read the iQ-Trigger manual for further information on iQ-Trigger-T usage.

For use with the lightSTUDIO-M, plug the cable of iQ-Trigger or iQ-Trigger-T into the corresponding 6,3 mm port of the electrical control cabinet of the lightSTUDIO.

3.2 Timecode display



The timecode display is used for tracing movement and illumination scenes over time. For example, the movement of the horizontal test chart in the Moving lightSTUDIO may be scrutinized for artifacts in captured images or videos. Another possible application might be the examination of changes in the adaption of the camera to rapid light changes with the LED lightHEAD. The timer also has a counter mode to enumerate different capture scenes. For an example, see the sample video on the lightSTUDIO product page on the Image Engineering website.

The timecode display shows the time in the format MM:SS.MS [1]. The maximum time is 99 min, 59 s, and 999 ms. Bars with 50 LEDs are placed above and below the digits [2, 3]. The flashing LED ticker denotes the progress in units of 1/100 s; thus, all 100 LEDs are illuminated subsequently one time per second.

To start the operation, connect the timecode display with the power supply [9]. With the remote push buttons for resetting and starting/stopping [7, 8], the display can be operated remotely from outside the lightbox. For use with the software, connect the display with the USB cable to the electrical control cabinet (see [chapter 5.5.4](#)).



With the “Mode” button [5], the display can be switched between counter and timer functionality. In timer mode, the external push button connected to the jack plug “Start/Stop” [8] toggles between running and pausing. In counter mode, the button is used for incrementing. In both modes, the display can be reset with the built-in reset button [4] or the external reset button connected to the jack plug “Reset” [7].

For use with the lightSTUDIO-M, plug the USB cable of the timecode display into the corresponding USB port of the electrical control cabinet of the lightSTUDIO.

4 USAGE WITHOUT SOFTWARE

Depending on the chosen combination, some parts of the lightSTUDIO can be used without the software. The lightHEAD-S and lightHEAD-L are equipped with a control panel on the front side, which comprises switching light sources, adjusting intensities, and storing the intensity value for each light. The translation and rotation of the lightSTUDIO-M are only accessible utilizing the software. The timecode display may also be used as a stand-alone device ([chapter 3.2](#)).

4.1 Standard lightHEAD (lightSTUDIO-S)



For the initial operation, select a light source using one push-button [2, 3] after turning on the power supply. Press the “Light ON/OFF” [1] button to illuminate the corresponding light source.

The control panel has eight knobs for switching the lights: four for the fluorescent lamps F12, F11, D50, and D65 [3] and four for the halogen lamps [2]. The latter have different preset values for the intensities of 10 lx, 100 lx, 400 lx, and one for 400 lx with blue filtering. The knobs for the three halogen settings use the same lamp type but with a different current supply. With the rotary knob [4], the intensity for all

light sources can be varied from 0 to 100% in 1% steps.

To store an intensity setting for one type, keep the corresponding knob pressed and press the “Store” knob [1] until the display shows the result.

With the knob “LCD backlight” [5], you can adjust the background lighting of the display panel.

NOTE:



Only one light source can be illuminated at the same time.

It may take some minutes until the color temperature and illuminance of the lamps are reliably stable. All values measured in the acceptance protocol were measured three minutes after switching on the lights.

4.2 LED lightHEAD V2 (lightSTUDIO-L)



The lightHEAD with iQ-LED V2 technique adds more functionality and a more comprehensive illuminance range (25 - 2000 lux) to the previous lightHEAD version. See the datasheet for more technical information. The lightHEAD incorporates a control panel, which enables the user to use it without a connection to a PC.

Usage of control elements:

- [1] Hold the power switch for two seconds to turn the LED light on and off.
- [2] [3] Switch between 44 stored illuminants. Use iQ-LED software > V3.0.0 to generate and store illuminants on the lightHEAD.
- [4] It plays and interrupts a sequence of illuminants. Use iQ-LED software > V3.0.0 to generate and store a sequence on the lightHEAD. Three default illuminants are stored upon delivery of the device: A, D50, and D75, with intensities noted in the acceptance protocol.
- [5] Displays the memory slot number of an illuminant. Read the iQ-LED software manual instructions to see how the number is assigned to an illuminant.

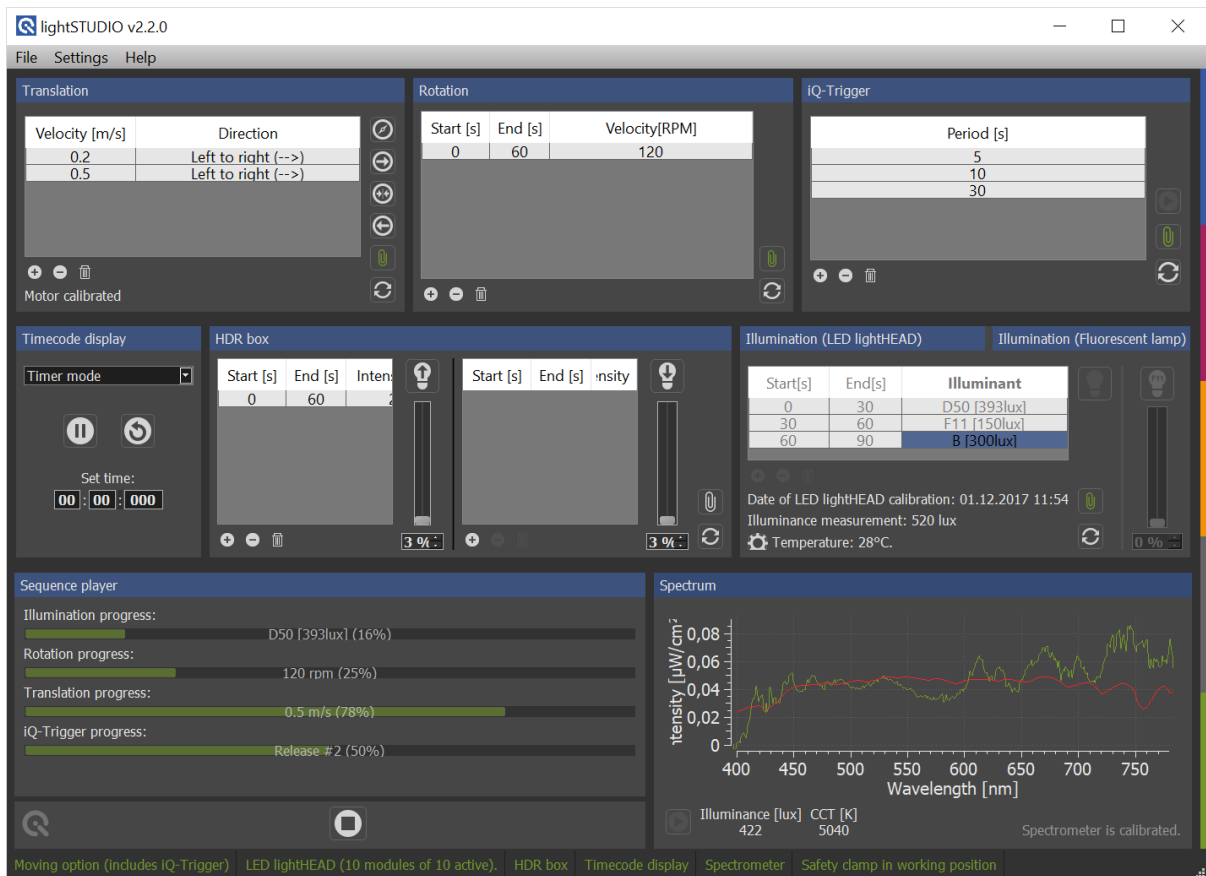


- 6] The Trigger Out socket can not be controlled with this software, and it is automatically triggered when illuminants are switched. The duration of the output signal (short circuit) is 500 ms. A 3.5 mm mono jack can be plugged into the socket, and an additional iQ-Trigger USB box can be connected here.
- [7] Only available on LED lightHEADs built before December 2020:
Power and intensity control knob for fluorescent lamp F11.
Press the button to turn the lamp off.

5 SOFTWARE DOCUMENTATION

5.1 Introduction

The lightSTUDIO is a Windows software designed to control the lightSTUDIO and its components (Moving target option, Standard or LED lightHEAD, HDR box, timecode display, and iQ-Trigger). Each part can be accessed and controlled separately. Moreover, sequence lists can be created for simultaneous processing, including test chart movements and illumination with the lightHEADs and HDR box. The graphical user interface (from now on, referred to as GUI) offers a complete overview of all components simultaneously and quick access to creating an intuitive workflow with the lightSTUDIO. Each component functions as a plug-in for the software, which switches the corresponding module in the GUI on or off when a device is connected or disconnected.



The GUI display of a lightSTUDIO-LMH with LED lightHEAD, HDR box, moving test charts, iQ-trigger and timecode display.

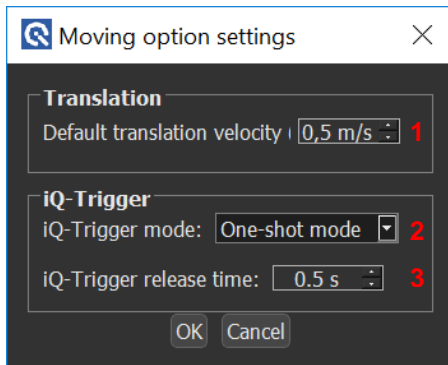
5.2 Installation

Please choose the proper installer (32 or 64-bit) for your Windows operating system and run it. During installation, some drivers and additional software are installed. For proper software function, allow all drivers and software to be installed. The software installations include:

- Microsoft .NET Framework
- Microsoft Visual C++ Redistributable (2008, 2013, 2015)
- Java 7 Runtime

5.3 Settings

5.3.1 Moving option settings (lightSTUDIO-M)



In the *Moving option settings* dialog, specifications can be modified for some components of the Moving lightSTUDIO.

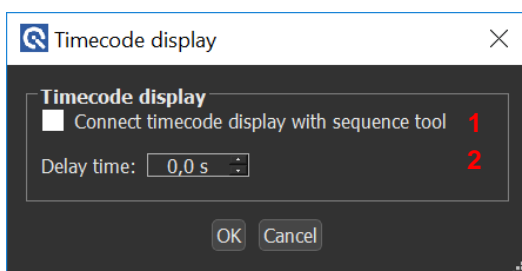
The *default translation velocity* [1] defines the transportation speed of the moving test chart in a range between 0.01 and 3.0 m/s. This value is used for the movement when clicking the *move left*, *move home*, or *move right* buttons and as speed for the return movements of a sequence.

The *iQ-Trigger mode* menu [2] offers three options for the behavior of the iQ-Trigger:

- One-shot mode:* iQ-Trigger is released once with the *start/stop* button and stays activated with a predefined duration time, as edited in the corresponding field below.
- Toggle mode:* iQ-Trigger is released by clicking the *start/stop* button and stays activated until the next click on the button.
- Continuous mode:* iQ-Trigger is released by pressing the *start/stop* button and stays activated until the button is released.

The *iQ-Trigger release time* [3] denotes the duration of the iQ-Trigger release when the *one-shot mode* is selected. The minimum time is 0.1 s.

5.3.2 Timecode display settings (lightSTUDIO-M)





The *Connect timecode display with sequence tool* [1] option allows the time code display to start simultaneously with the sequence. The *delay time* [2] defines a time lag after which the display starts.

5.3.3 Usage of LED lightHEAD

With the LED lightHEAD, more functionality and flexibility are available compared to the Standard lightHEAD. iQ-LED technology generates individual illuminants with predefined illumination values and can quickly switch between them.

All calibration and creation of illuminants for the lightSTUDIO software must be performed in the iQ-LED software. Always use the current version of the lightSTUDIO and the iQ-LED software. Read the iQ-LED software manual and familiarize yourself with the calibration procedure and the creation of illuminants.

Illuminant creation:

Illuminants are the essential basis for illuminating the LED lightHEAD. They consist of a relative power spectral distribution in the visual range from 380 nm to 780 nm and an illuminance value (measured in cd/m^2 or lux). These illuminants are generated with the iQ-LED software. All illuminant files and other calibration data are saved to this directory:

C:\Users\\AppData\Roaming\Image Engineering\iQ-LED\binV3\data

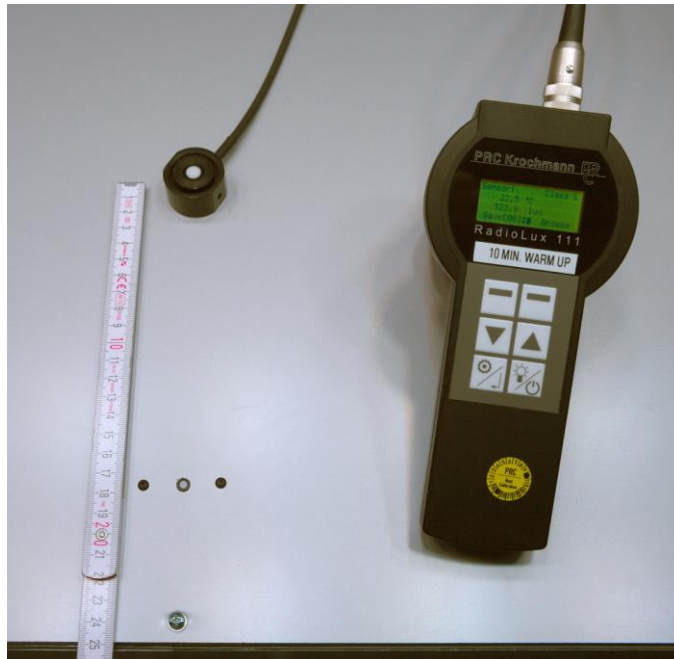
The Lightstudio software loads all data from this directory and makes them available for use.

1. Start with calibration and illuminant creation in the iQ-LED software
2. Close the iQ-LED software (never run the iQ-LED and the Lightstudio software at the same time, two software instances can not communicate with the hardware controllers at the same time)
3. Start Lightstudio software and use the illuminants directly (see chapter [LED lightHEAD](#))



Reference illuminance measurement:

When performing an illuminance measurement according to the iQ-LED manual, be aware that the reference illuminance measurement for the acceptance protocol was measured at this position:



The initial illuminance measurement was performed at 25 cm distance from front side.

Spectral calibration:

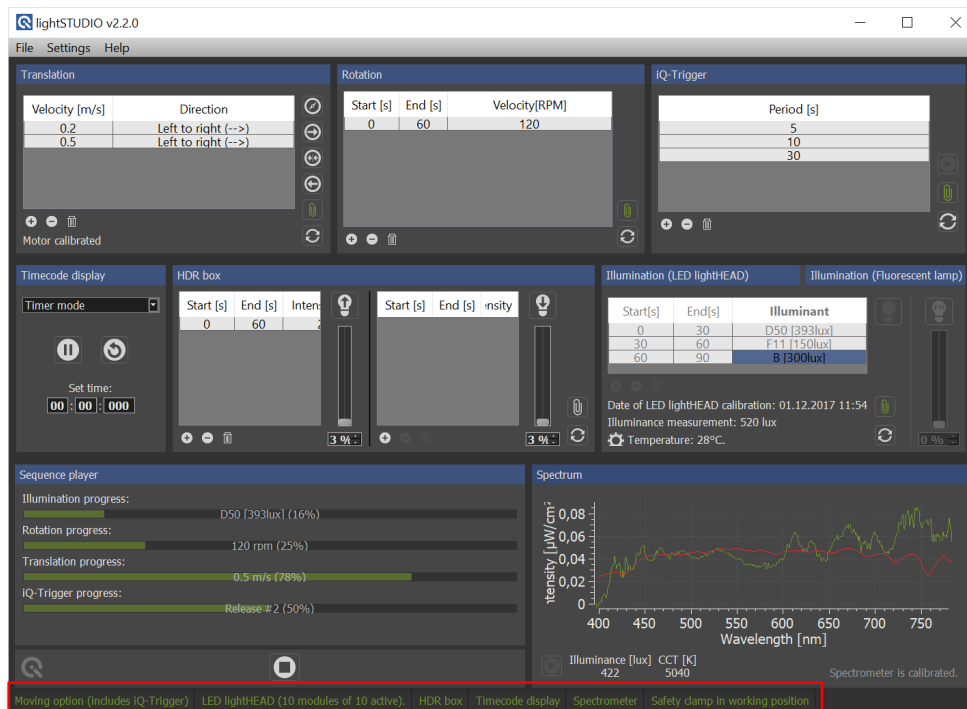
Recommendations for calibration repetition:

During the first **600** working hours of the lightSTUDIO, perform a spectral calibration every **50** operating hours.

After the first **600** operating hours, a calibration of every **150** working hours is sufficient.



5.4 Hardware status bar



The status bar gives information about the connected hardware components. If a component is available in your lightSTUDIO configuration, it is highlighted in green. The release state of the safety clamp is also displayed.

NOTE:

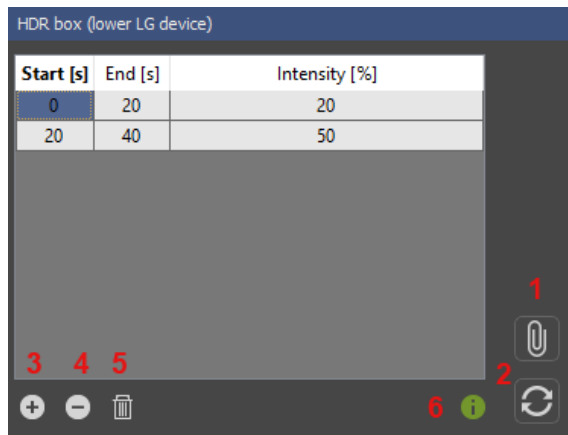
If the safety clamp is pushed in, the internal control unit stops the power supply to the motors immediately. All buttons for the translation or rotation functions are disabled in the software. Pull the clamp out until it reaches the stop position to enable usage of the translation and rotation functionality.

5.5 Module overview

Each component of the modular lightSTUDIO can be controlled separately. The software's plug-in mechanism only displays modules connecting to the corresponding hardware device. If a device is connected during runtime, the module appears in the GUI.



5.5.1 Sequence lists



Each hardware control module in the software, except the timecode display, has five buttons and a table for sequence editing. Lists for sequences of movements, rotations, iQ-Trigger releases, and illumination (lightHEAD and HDR option) can be edited with a table, modified, and saved for reuse. All sequence lists can be executed simultaneously.

When the button [1] is activated, the sequence is started by clicking the *play* button ([chapter Sequence player](#)). If the button [1] is activated, none of the control items in each module can be used to avoid disturbance of the sequence. If the loop button [2] is activated, the complete sequence list for this component of the lightSTUDIO is repeated infinitely until the user stops the sequence.

There are three buttons when editing the list: a new row is added to the table with the button “+” [3]. Button [4] deletes a selected row, and a button [5] clears the whole table. Move the mouse cursor over the info button [6] to display useful technical data about the corresponding device.

Start[s]	End[s]	Velocity[RPM]
0	5	20
5		60
10	15	100

While editing the fields of a table, the values are validated for the wrong input. Velocities in rotation and translation are verified for applicability (see data sheet for limits), and times are checked for overlapping ranges. The numbers entered may have a decimal notation using a ‘.’ or a ‘,’. Missing values are highlighted in red. The buttons [1] and [2] are only enabled if the table is complete.

All sequences can be added to the sequence tool in every desired combination.

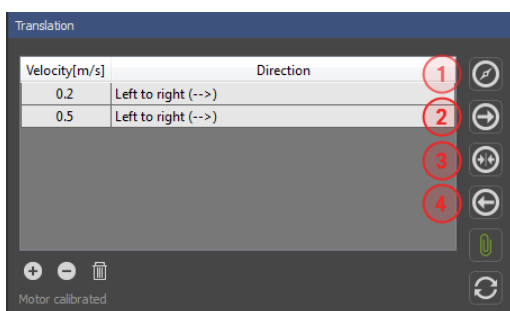
All lists can be saved and opened in the *File* menu or with the keyboard shortcuts *Ctrl + S* and *Ctrl + O*.



5.5.2 Modules for Moving option

The lightSTUDIO-M incorporates three functionalities: the translation chart, the rotation chart, and the iQ-Trigger. The three modules are displayed in the software for controlling these devices. The iQ-trigger is connected to the lightSTUDIO directly without the iQ-Trigger USB box, which is part of the lightSTUDIO-M. The iQ-Trigger may be used as a stand-alone device with a USB box. See the documentation of the iQ-Trigger for further details.

5.5.2.1 Translation



Each time the program is started, a calibration movement of the (translational) chart must be performed to define a so-called home position for the motor control. Click the home button [1] to start the procedure: the chart moves to the center and then to the final destination on the right side.

This procedure can be performed at any time; it is obligatory in the following cases:

- The main power of the lightSTUDIO is turned off during the runtime of the program
- The safety clamp is released
- One of the emergency stop switches of the lightSTUDIO is released.

Now all other functions are enabled. With the *right* [2], *center* [3], or *left* [4] buttons, the chart is moved to the very right, center, and very left positions with default velocities (see [chapter 5.3.1](#)).

In the sequence table, translational movements for the test chart can be edited. Values between 0.001 and 3.0 m/s can be entered in the velocity column. Movements from left to right or reverse are available in the direction column. If two subsequent directions in the list are equal, a return movement is inserted with a default velocity defined in the settings ([chapter 5.3.1](#)).

NOTE:

Compared to the illumination list or the rotation list, a translation of the test chart is not triggered by start and end times but only by the velocity setting. Due to varying acceleration and deceleration of the motor, the duration for one period can only be estimated. The progress bar for the translation hints at how long it lasts, but it may not be highly exact.



5.5.2.2 Rotation

Start[s]	End[s]	Velocity[RPM]
0	30	20
30	60	60

In the sequence table, movements for the rotating chart can be edited. There are three columns available. The first contains the start times, the second the end times for a period of rotation, and the last column the velocity in revolutions per minute (RPM). The velocity must be in the range between -360 and 360 RPM. Positive values let the plate rotate counterclockwise, and negative values clockwise.

The periods must not overlap in time, and negative times are not allowed. A message dialog is displayed if a time value entered is invalid. To insert a break of rotating, enter a later start time for a specific period than the end-time of the precedent period. Inserting a row with velocity 0 has the same effect.

5.5.2.3 iQ-Trigger

Period [s]
5
10
30

The iQ-Trigger device allows you to release your camera button with the software. You can release iQ-Trigger with the *play/stop* button [1] depending on the settings in the options menu ([chapter 5.3.1](#)) in the one-shot, toggle, or continuous mode. A status bar at the bottom displays the progress of the iQ-Trigger in the released state. In the sequence list, time stamps for the release of the iQ-Trigger can be edited. At each time stamp, the iQ-Trigger is released for the time defined in the settings ([chapter 5.3.1](#)).



NOTE:

Due to mechanical construction, the mechanical finger of iQ-Trigger is limited in continuous operation:

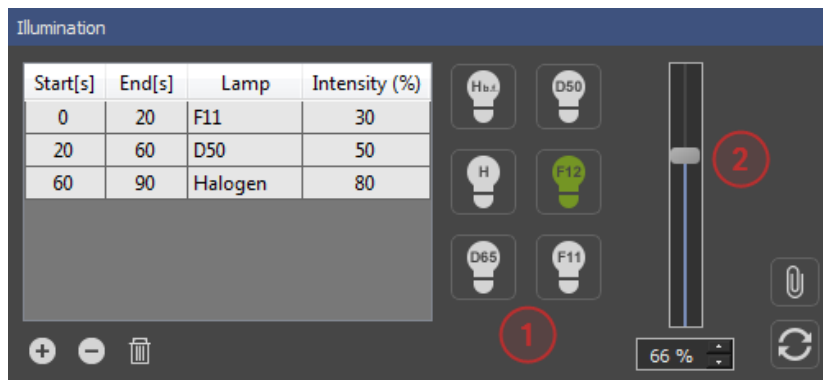
- Maximum time in the released state: 60 s
- Shortest release time: 100 ms
- For continuous operation, the duty cycle must not be longer than 50% (duty cycle = the ratio of release time to period).

The mechanical finger may heat up or be destroyed if operated for a long time in a released state without interruption.

5.5.3 Modules for Illumination

Three illumination devices are available: the Standard lightHEAD and the LED lightHEAD. The HDR kit with two LG2 light boxes is also available as a separate option. All three have panels in the software.

5.5.3.1 Standard lightHEAD



If a Standard lightHEAD head is delivered with your lightSTUDIO, the illumination module lets you switch the corresponding lamps on and off [1] and set the intensity [2]. Only one lamp type can be illuminated at one time; hence, switching one lamp type on turns all others off. There are six types of lamps: F11, F12, D50, D65, Halogen (H), and Halogen with a blue filter (H_{b.f.}). Clicking a lamp type button during the first run of the program turns the respective lamp on with an intensity of 100%. If the intensity is varied with the slider or input field [2], the value is stored during runtime, thus setting the lamp intensity when turned on again.

The sequence list shows four columns. The first and second columns define a period's start- and end times. In the third column, the lamp type is selected. In the fourth column, the intensity can be varied between 0 and 100%.



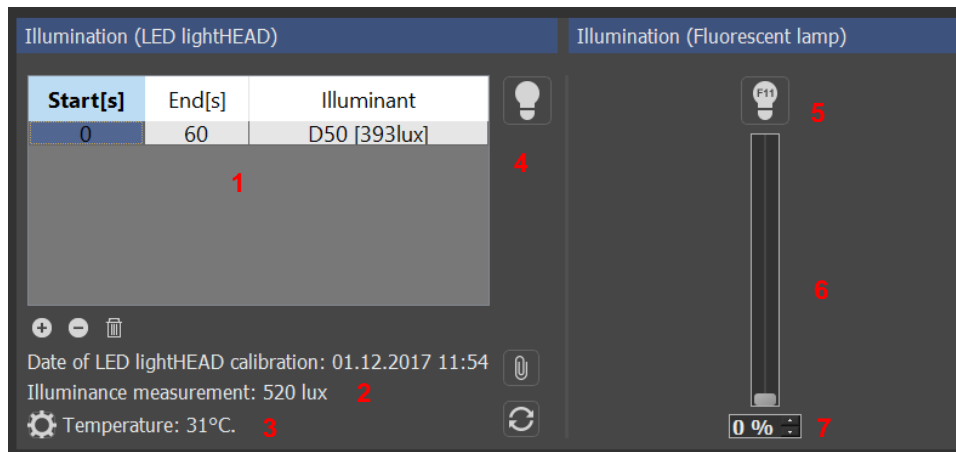
NOTE:

For sequences, operating times of less than 3 seconds are not advised since switching the lamps takes some time (1...3 s depending on lamp type). Thus, rapid changes may lead to omitted periods.

It is crucial to remember that it takes a couple of minutes until the color temperature and illuminance are stable for all lamp types.

All values measured in the acceptance protocol were measured 3 minutes after switching the lights on.

5.5.3.2 LED lightHEAD



For sequences, all illuminants created with the iQ-LED software are available in the third column of the sequence list. Add a start and end time to complete one illumination period. Since switching time between illuminants is very fast, periods down to 50 ms are possible.

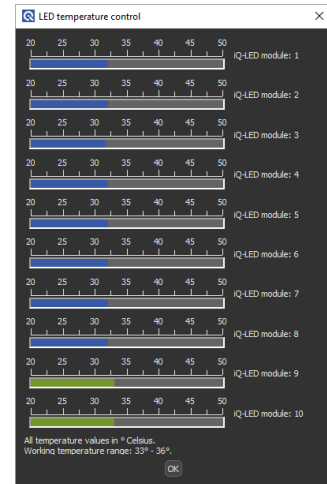
For LED lightHEADs built before December 2020, there is an additional fluorescent lamp of type F11 mounted into the LED lightHEAD by default. This lamp can be switched on and off using button *F11* [5], and its intensity varied with a slider [6] and value input field [7]. During a sequence playback, this lamp is turned off to attain the selected spectrum and illuminance.

Underneath the table there is information about existing spectral calibration and illuminance adjustment [2]. It is possible to switch the selected illuminants on and off by enabling this functionality with the lamp button [4]. Click on one of the selected illuminants in the list to turn it on.

The temperatures of the iQ-LED modules impact the temporal stability of the selected spectra. The optimal operating temperature is between 33 and 36 °C; thus, the lightHEAD needs generally be warmed



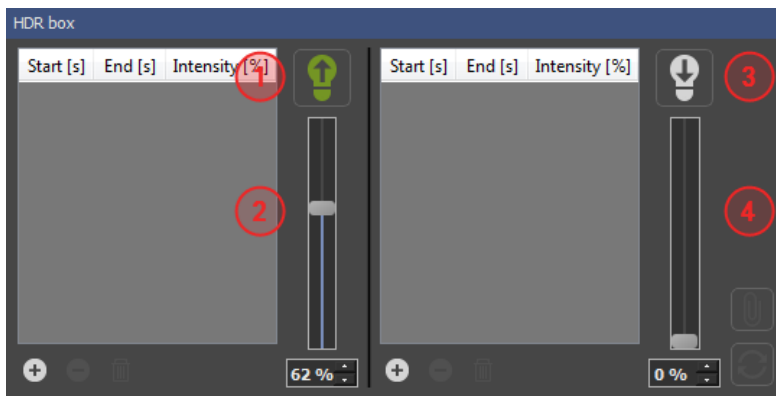
up before usage. In the panel, the temperature of the coldest module is displayed [3]. Click the button to the left of the temperature display to show a more advanced view. The thermometer is colored blue if the (coldest) module is below the working temperature, green in the operating range, and red if the temperature exceeds the operating range. To accelerate warm-up, click the lamp button to the right of the thermometer – all iQ-LED modules are switched on with all 22 channels set to 100 % illumination. When the lower temperature threshold is reached, the modules are switched off. Click the thermometer button to the right to view the temperatures of all ten iQ-LED modules.



5.5.3.3 HDR box

The HDR box can generate illumination ratios for measurements of High Dynamic Range scenes. The new generation of built-in LG4 devices allows an illumination ratio of up to 1:65000 inside the lightSTUDIO box.

LG2 devices (until January 2018)

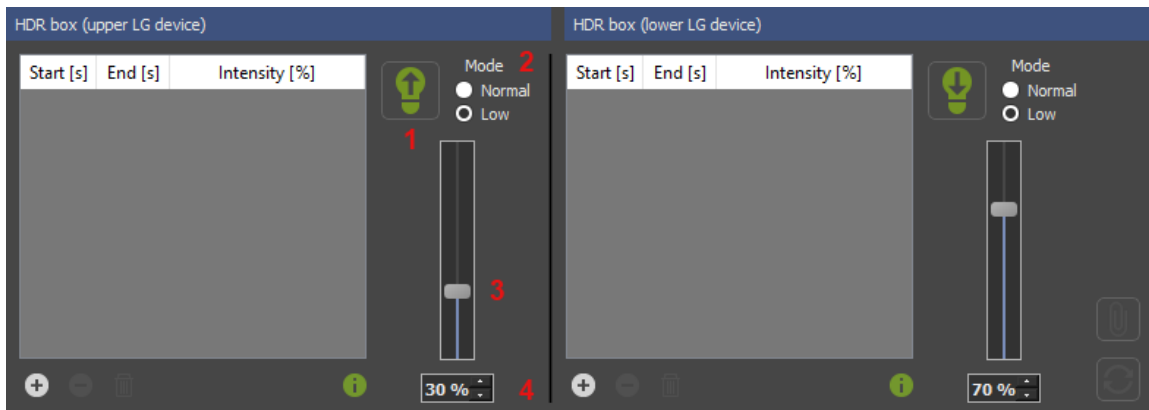


The HDR module in the software enables you to control both LG4 lamps of the HDR box. The upper lamp is switched on using button [1], and the intensity is controlled with a slider or input field [2]. The same applies to the lower lamp, buttons [3] and [4].

For both lamps, separate sequence lists are available. Activating the sequence or looping functionality applies to both lamps. Enter start and end times and the intensity from 0...100 %.

Since switching the LG4 on and off takes 1...2 s, shorter periods are not advisable and may be omitted in the sequence player.

LG4 devices (since December 2018)

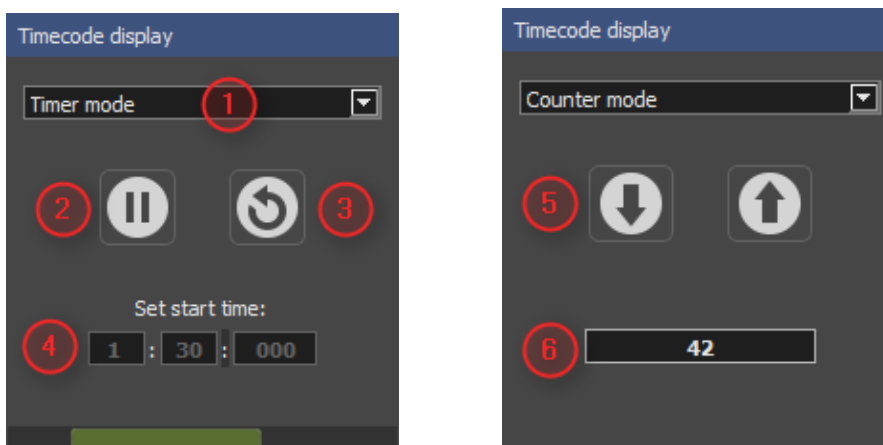


Each LG4 device in the HDR box is equipped with 432 white LEDs with a color temperature of approximately 5000K. It has two power modes, “normal” and “low,” which can be switched in the panel. See the data sheet of LG4 for further details.

The (upper) LG4 lamp is switched on with button [1] and the intensity can be controlled with a slider or an input field [3] and [4]. The same applies to the lower LG4 lamp on the right side. Switch between the low and normal modes of the lamp with the radio button [2]. In low mode, the maximum intensity of the lamp is approximately 10% of the maximum intensity in normal mode. In both cases, the intensity can be tuned from 1 to 100% in 1% increments.

For both lamps, separate sequence lists are available. Activating the sequence or looping functionality applies to both lamps. Enter start and end times and the intensity from 0...100 % depending on the selected mode.

5.5.4 Timecode Display



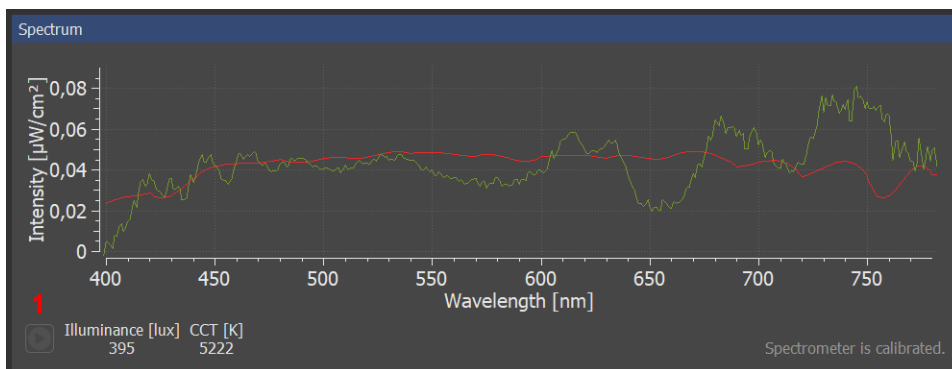
The module for the timecode display ([chapter 3.2](#)) offers two operating modes: timer and counter. Switch between the modes with the menu [1].



Timer mode: Start and stop the timecode with the *start/stop* button [2].
Clicking the reset button [3] resets the timecode display to 00:00.000.
A status bar at the bottom of the module denotes a currently running timecode display. In the three fields for setting a start time [4], the timer can be set to minutes from 0...99, seconds from 0...59, and milliseconds from 0...999. If the option “*Connect time code display with sequence player*” is activated in the settings (chapter 0), the timecode display starts with the entered start time.

Counter mode: The display works as a counter. You may count up and down one digit with the up-and-down buttons [5]. Or enter a number from 0 to 65535 in the text field [6].

5.5.5 Module spectral measurement



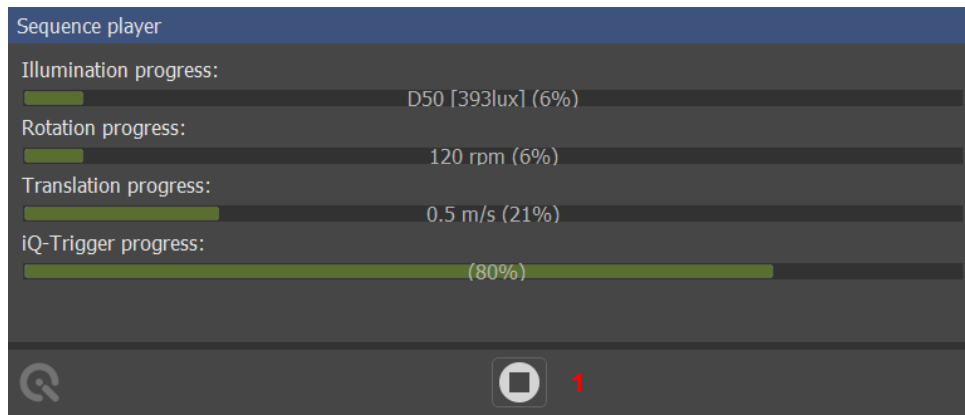
The spectral measurement functionality is only available with the LED lightHEAD. The spectrometer is built into the bottom plate of the lightbox in the bottom plate. Click button *play/stop* [2] for switching permanent spectral measurements on and off.

During sequence playback of LED illuminants, button [1] is disabled, and the current measured spectrum (green) and the target spectrum (red) are displayed.

The illuminance value and the Correlated Color Temperature (CCT) are also measured and displayed.



5.5.6 Sequence player



If at least one component of a lightSTUDIO is enabled for the sequence player, all activated sequences are started by clicking the *play/stop* button [1]. Clicking the *play/stop* button again stops the sequence player. Progress bars display the advance of all sequences.

6 SPECTROMETER RECALIBRATION (LIGHTSTUDIO-L)

6.1 Introduction

The spectrometer requires a recalibration yearly, regardless of the operating hours. If a spectrometer calibration is necessary, please contact Image Engineering.

The spectrometer must be sent to our office with a notation for calibration. Use appropriate packaging to prevent the spectrometer from being damaged during shipping.

A temporary replacement spectrometer can be provided to bridge the time gap while your spectrometer is recalibrated. Please contact us for conditions and procedures.

6.1.1 Important information:

The Fiber is sensitive, do not overbend, and handle with care.

Do not remove the Fiber from the spectrometer

Caerfully pack and cushion the spectrometer before shipping.

6.1.2 Tools

You will need:



-
- Hexagonal key 1,5 mm
 - Hexagonal key 2 mm
 - Slotted screwdriver
 - Side cutter

6.1.3 Preparation

Before you start, please disconnect the power and USB cables from the device.



6.2 Removing the Spectrometer

6.2.1 Accessing the spectrometer (lightSTUDIO-L)

To access the spectrometer, you must access the bottom side of the lightSTUDIO.

Take the lightHEAD of the lower section of the device and put it to the side. The lightHEAD is heavy, so use at least one other person to assist you.

Flip the lower part by 90 degrees to access the spectrometer.



Slide the cover open. You will probably have to remove one of the aluminum profile's plastic caps. Use the slotted screwdriver to pry it out.





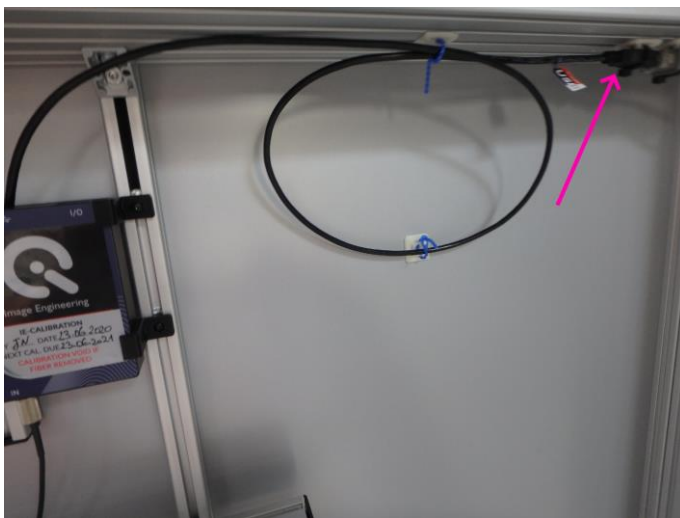
6.2.2 Accessing the spectrometer (lightSTUDIO-LM)

The moving variant of the spectrometer has slightly different access to the spectrometer.
(LS-LM + LS-LMH)

6.2.3 Remove the USB-Cable

lightSTUDIO-L: Unplug the USB cable from the extension cord.

lightSTUDIO-LM: Unplug the USB cable from the switch box.



Open the cable straps holding the cable in place.

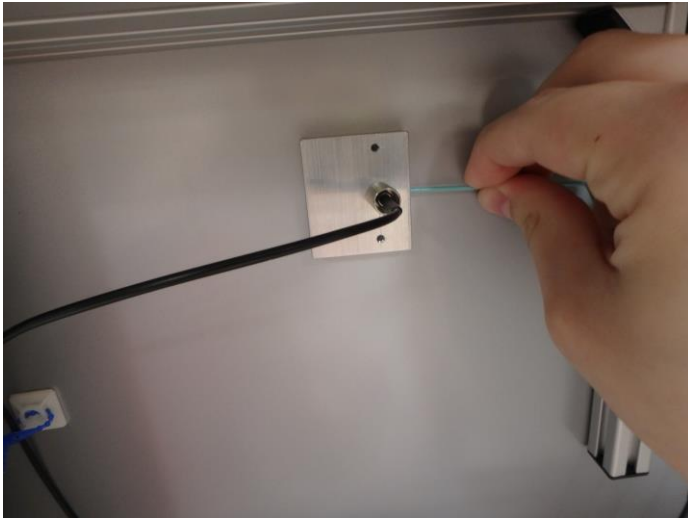
If the cable straps cannot be opened by hand, use the side cutter to cut them open.

6.2.4 Free the fiber

Start by opening the cable straps that hold the fiber. Ensure you do not damage the fiber.

The tip of the fiber is a cosine corrector held in place by a grub screw.

Use the small 1,5 mm hex key to open the grub screw and carefully slide the fiber out of the holding block.



6.2.5 Unscrew the spectrometer

The spectrometer is held in place by a few hex head screws. Use the 2 mm hex key to unscrew the spectrometer.



When it moves freely in the brackets, pull it out carefully and make sure not to damage the fiber.



6.3 Shipping

Package the spectrometer carefully and ensure the Fiber does not get damaged.

Use cushioning material. For shipping details please contact Image Engineering.

6.4 Installing the freshly calibrated spectrometer

To Install the spectrometer, follow the steps above in reverse order. When fixing the fiber in the holding block, the top of the cosine corrector should be even with the plate.



7 COPYRIGHT AND TRADEMARKS

7.1 Trademarks

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The lightSTUDIO software uses open-source software:

libusb (www.libusb.org) is an open source project, the code is licensed under the GNU Lesser General Public License version 2.1 or later (www.gnu.org/licenses/old-licenses/lgpl-2.1.html).

Qt (www.qt.io) is an open source framework, the code is licensed under the GNU Lesser General Public License version 3.0 or later (www.gnu.org/licenses/lgpl-3.0).

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