



LE7 x2, x4, x6, E, IR

User manual for the LE7 product line (x2, x4, x6, E, IR)

January 14, 2020



CONTENT

1	INTRODUCTION	3
1.1	Conformity.....	3
1.2	Intended Use.....	3
1.2.1	Departing from Described Setup	3
1.2.2	USB Connection.....	4
1.3	General Safety Information.....	4
2	GETTING STARTED	5
2.1	Scope of Delivery	5
2.2	Minimum Camera Distance and Positioning	5
2.3	Using different test charts.....	6
3	OPERATING INSTRUCTIONS HARDWARE	7
3.1	Overview display and ports	7
3.2	Connecting the Hardware.....	8
4	OPERATING INSTRUCTIONS SOFTWARE.....	9
4.1	Requirements.....	9
4.2	Software Installation	9
4.3	Starting the System	9
4.3.1	Spectrometer Settings	9
4.3.2	Spectrometer Calibration.....	9
4.3.3	iQ-LED Calibration	10
4.4	Low Intensity Use.....	10
4.4.1	Low light in combination with a neutral density chart	10
4.4.2	Using single iQ-LED modules for low light	11
4.4.3	Low light using the LE7-E	11
5	ADDITIONAL INFORMATION.....	11
5.1	Maintenance.....	11
5.2	Care Instructions	11
5.3	Disposal Instructions	12
6	TECHNICAL DATA SHEET	12



1 INTRODUCTION

Important information: Read the manual carefully before using this device.

Inappropriate utilization may cause damages to the device, to the DUT (device under test) and/or other components of your setup.

Please keep these instructions in a safe place and pass them on to any future user.

1.1 Conformity

We, Image Engineering GmbH & Co. KG, hereby declare, that the “LE7” corresponds to the essential requirements of the following EC directive:

- Electromagnetic Compatibility - 2014/30/EU
- RoHS 2 - 2011/65/EU
- Low Voltage - 2014/35/EU

1.2 Intended Use

The LE7 is based on a 0,5 m integrating sphere and iQ-LED technology for the purpose of illuminating transparent test charts. The LE7 is controlled with the iQ-LED control software or via dip switches directly on the device (without a connected PC). A micro-spectrometer is also included with the device.

- Only suitable for indoor use.
- Place your system in a dry, constantly tempered environment without any interfering light.
- The optimal ambient temperature range is 22 to 26 degrees Celsius. The maximum ambient temperature range is 18 to 28 degrees Celsius.
- The optimal system temperature range, displayed in the software user interface, is between 35 and 50 degrees Celsius. The system has internal temperature management, if there is an error regarding the internal temperature, you will get a warning message and the system will automatically turn off to avoid any damage.

1.2.1 Departing from Described Setup

The following steps must be performed in the correct chronological order to allow frictionless commissioning.

Departing from the chronology may lead to an incorrect working device.

1. Install the iQ-LED software
2. Connect LE7 to power and via USB to the PC
3. Switch LE7 on; the system drivers will be installed
4. Once the drivers are installed completely, you can start the software



1.2.2 USB Connection

Only the appropriate USB connection allows an error-free operation of the LE7. Use delivered USB cables. If you need to extend the USB connection to longer distances, then check if powered hubs/repeaters are necessary.

1.3 General Safety Information



WARNING!

Some LEDs are emitting invisible light in the IR and the UV near area.



- **Do not** look directly into the emitted light or through the optical LED system.
- **Do not** look directly into the open sphere or light source when using high intensities or sequences with a low response time.



- **Do not** open the device without any instructions from the Image Engineering support team or when connected to the power supply.



2 GETTING STARTED

2.1 Scope of Delivery

- Integrating sphere (with a dual-slot for D280 size charts)
- spectrometer (built-in)
- power cord
- USB cable
- control software
- control software
- calibration protocol

Accessories:

- Rolling Cart

Optional equipment:

- **iQ-Trigger:** The iQ-Trigger is a mechanical finger that can press the camera release button within 25 ms. When working with touchscreens, exchange the solid fingertip for a touch-pen tip.

2.2 Minimum Camera Distance and Positioning

For charts with complete transparent parts, please note the required minimum distance between the camera under test and the LE7. If the distance is too short, the camera may capture parts of the light source within the integrating sphere, which could cause irregular uniformity illumination in your image. The minimum camera distance depends on the viewing angle of the device under test.

Follow the steps below to ensure that the distance and position of your camera from the LE7 is correct:

1. Center your cameras axis of vision to the chart center point
2. Make sure the camera is not contorted in reference to the chart plane
3. Remove the test chart and turn on a standard illuminant to a low intensity (< 200 lx)
4. Adjust the distance of the camera to the LE7 until you see the first row of both iQ-LED devices in the top and bottom borders of the image
5. From this position, increase the distance of your camera to the LE7 so that both LED rows will move out of the image, the minimum increase of distance should be 45 mm
6. Insert your test chart again and proceed with your test



When using a diffuse test chart for shading or uniformity measurements, you can move your camera right in front of the diffuser chart.

2.3 Using different test charts

When using different test charts, the measured values of your system could vary depending on the chart or filter. Removing a chart will decrease the shown intensity, but does not mean that your spectral arrangement or the intensity of the LED device has changed.

We recommend recalibrating your LE7 and chart if you are using test charts that are significantly different in transparency or inside the reflection.



3 OPERATING INSTRUCTIONS HARDWARE

3.1 Overview display and ports

- 1 x USB port for software control
- 1 x port for power adapter
- 1 x trigger output

Use the control panel to set different light settings for the iQ-LED's:

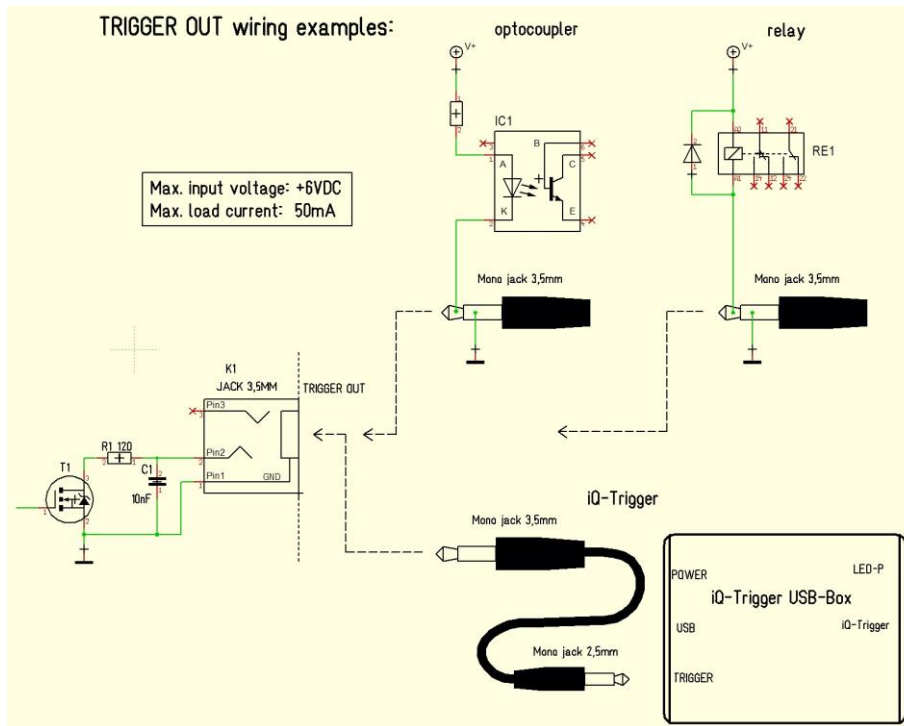


- with the “+” and “-” buttons you can switch between 44 saved illuminants
- numerical display to show the storage of the illuminants
- with the play and stop button you can start and stop a saved light sequence with different illuminants (it is possible to save one sequence on the device)
- with the power button, you can turn on and off the light
- there are three pre-stored illuminants on your device (the intensity of each illuminant is shown in the acceptance protocol of your device):
 - 1: illuminant A (default illuminant)
 - 2: illuminant D50
 - 3: illuminant D75

Note: To store your own generated illuminants or sequences on your device, please follow the instructions in the iQ-LED SW user manual.



Wiring examples for the trigger output:

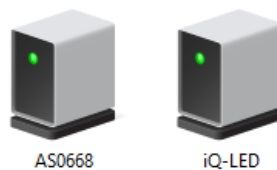


Trigger OUT wiring examples

The default duration value for the trigger output is 500 ms. This value can be modified with the iQ-LED API. A signal is sent out to the trigger output while changing the illuminates or the intensity of LED channels. It can be used to synchronize your test setup. For example, with an iQ-Trigger. (See 2.1 optional equipment)

3.2 Connecting the Hardware

Connect the power cord to the power outlet on the side of your LE7. Connect the USB cable from the LE7 to your PC and turn on the LE7 (the power switch is located beside the power outlet). Then connect the USB cable from the spectrometer calibration device to your LE7. The system will install the spectrometer and iQ-LED driver on your PC (this will take a few seconds). You can check the installation in your hardware manager:



Hardware Manager: active iQ-LED devices and spectrometer



4 OPERATING INSTRUCTIONS SOFTWARE

4.1 Requirements

- PC with Windows 7 (or higher) operating system
- One free USB port

4.2 Software Installation

Install the iQ-LED control software before connecting the hardware. Follow the set-up instructions from the iQ-LED control software quick start guide or manual.

4.3 Starting the System

Start the iQ-LED software by clicking the 'iQ-LED.exe' or the iQ-LED icon on your desktop.

Follow the iQ-LED software manual to control your LE7.

NOTE

The iQ-LED devices can only operate at high precision when the setup and calibration are performed correctly. Consult the iQ-LED software manual for a comprehensive description and read it carefully.

4.3.1 Spectrometer Settings

The iQ-LED software (see iQ-LED software manual) automatically generates the optimal spectrometer settings for your lighting conditions after pressing the "auto-detect" button. For special applications, it is also possible to set the spectrometer settings manually. If you have further questions, please contact the Image Engineering support team.

4.3.2 Spectrometer Calibration

Your spectrometer comes fully NIST traceable calibrated. We recommend recalibrating the spectrometer once a year, regardless of the operating hours. If a spectrometer calibration is required, please contact Image Engineering.

Note: Before removing the spectrometer, measure and note the lux value of a predefined standard illuminant.



4.3.3 iQ-LED Calibration

The individual LED lights of the iQ-LED's inside the LE7 depend on many different types and wavelengths. Some LEDs will change their intensity level and peak wavelength slightly in the first 500-600 working hours because of a burn-in effect.

The LEDs will also degrade in intensity during their lifetime. To make sure that all measurements including the auto-generated illuminants and the standard illuminants are correct, you have to perform a spectral calibration regularly.

You must also consider the degradation of the LED when saving self-defined presets. If you save a preset with LED channels that use its maximum intensity, the possibility exists that this intensity cannot be reached after the burn-in time or the long-time degradation of the LED. In this case, you will get a warning message from the iQ-LED control software.

During the first 500-600 working hours, we recommend performing a spectral calibration every 50 operating hours.

After the first 500-600 operating hours, a calibration of every 150 working hours suffices.

Other factors that indicate the need for a spectral calibration include unsatisfactory illuminant generation, the aberration of the intensity values, or a spectral curve that does not fit with the predefined standard illuminants of the corresponding preset.

- the spectrometer works correctly
- the spectrometer settings are correct
- all LED channels work correctly
- the dark measurement is correct
- your measurement environment is correct
- your ambient temperature is correct

How to perform the spectral calibration is described in the iQ-LED control software manual.

4.4 Low-Intensity Use

When using your system with very low intensity, the spectral measurement values will start to fluctuate. The lower the intensity, the higher the fluctuation. The generated light is still stable up to a certain point. The fluctuation of the values is caused by the noise of the spectral measurement of the internal spectrometer. The higher the noise influence, the lower the light intensity. An approximate value will no longer be possible when using standard illuminants with an intensity lower than 25 lux.

4.4.1 Low light in combination with a neutral density chart

You can use a neutral density filter chart and activate the neutral density correction in the iQ-LED control software. Now the light source will run at a higher intensity while still having low intensity behind the chart plane. To get the



corresponding intensity behind the filter please use the 'Density Filter Compensation' in your iQ-LED software. Please see chapter 3.1.3 in the software manual for details.

4.4.2 Using single iQ-LED modules for low light

With the iQ-LED Control SW version 3.2.0, you now have the option to turn off single iQ-LED modules in your device. This option gives you another possibility to decrease the intensity inside your device. Please note that when using single modules in edge positions of your LE7 (especially LE7-4x), the uniformity will decrease significantly. If using single modules, it is recommended to only use the center-positioned iQ-LED modules. How to deactivate/activate single modules is described in chapter 4.5 of the SW manual.

4.4.3 Low light using the LE7-E

In the LE7-E device, the top center iQ-LED is combined with a 1,8 ND filter. When using only this module with the described workaround from chapter 4.4.2, you will have the possibility to reach intensities to as low as 0,25lx. For example, when taking into account both the ND filter value of 1,8 and a correction factor regarding the optical structure, a generated illuminant D with 120lx (using all modules, calibrated with the TE291 calibration chart) should correspond to an intensity of approximately 0,25lx when using only the iQ-LED module with the ND filter. To get a rough idea which intensities will appear when using only the ND module, you can use a Density Filter Compensation value of **2,68** in the iQ-LED SW. Please see chapter 3.1.3 in the software manual for details. Please note that it is not possible to measure such low intensities with the internal spectrometer, instead, we recommend using an external radiolux meter to verify the correct intensity.

5 ADDITIONAL INFORMATION

5.1 Maintenance

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

5.2 Care Instructions

- If there is any dust inside the integrating sphere clean it with an air blower.
- Do not remove the fiber from the spectrometer, otherwise, the calibration is invalid and the spectrometer has to be **recalibrated!**



5.3 Disposal Instructions

After the service life of the LE7, it must be properly disposed of. Electrical and electromechanical components are included in LE7. Observe your national regulations and make sure that the LE7 cannot be used by third parties after disposal.

Contact Image Engineering if assistance for disposal is required.

6 TECHNICAL DATA SHEET

See annex for the technical data sheet. It can also be downloaded from the website of Image Engineering:
www.image-engineering.com.