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# LE7 x2, x4, x6, E, IR

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

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# 1 INTRODUCTION

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

Inappropriate utilization may cause damage 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 to illuminate 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 light interference.
- 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 smooth 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 an 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, check if powered hubs/repeaters are necessary.

## 1.3 General safety information



### WARNING!

Some LEDs emit 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 sphere or light source when using high intensities or sequences with a low response time.



- **Do not** open the device without 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
- 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 device's viewing angle under test.

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

1. Center your camera's axis of vision to the chart center point
2. Make sure the camera is not contorted on the chart plane
3. Remove the test chart and turn on a standard illuminant to a low intensity (< 200 lx)
4. Adjust the camera distance 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 directly 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 use 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-LEDs:



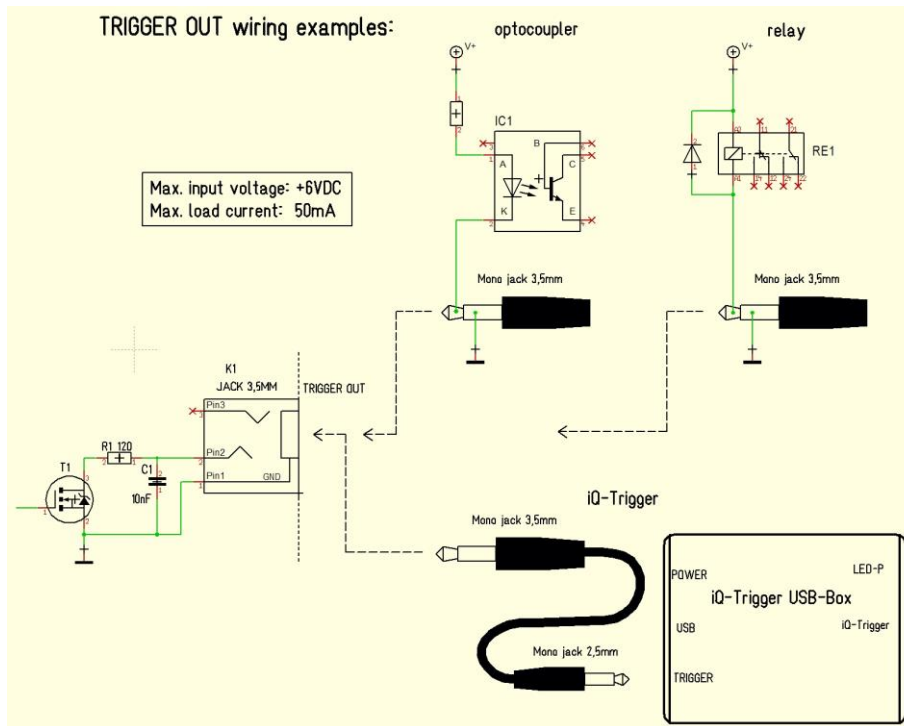
- Use the "+" and "-" buttons to switch between 44 saved illuminants
- The numerical display shows the storage of the illuminants
- With the play and stop button, you can start and stop a saved light sequence with different illuminants (it is possible to save one sequence on the device)
- Use the power button to 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 generated illuminants or sequences on your device, please follow the iQ-LED SW user manual instructions.

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 your LE7. Connect the LE7 USB cable to your PC and turn on the LE7 (the power switch is next to 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 operate at high precision only 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 yearly, 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-LEDs 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 ensure that all measurements including the auto-generated and standard illuminants, are correct, you must 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. The light source will run at a higher intensity while still having low intensity behind the chart plane. Please use the 'Density Filter Compensation' in your iQ-LED software to get the corresponding intensity behind the filter. 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 0,25 lx. For example, when considering both the ND filter value of 1,8 and a correction factor regarding the optical structure, a generated illuminant D with 120 lx (using all modules, calibrated with the TE291 calibration chart) should correspond to an intensity of approximately 0,25 lx when using only the iQ-LED module with the ND filter.

To get a rough idea of 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 impossible to measure such low intensities with the internal spectrometer. Instead, we recommend using an external radio lux meter to verify the correct intensity.

# 5 ADDITIONAL INFORMATION

## 5.1 Maintenance

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

## 5.2 Care instructions

- If dust is 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 must be **recalibrated!**

## 5.3 Disposal instructions

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

Contact Image Engineering if assistance for disposal is required.



## 6 TECHNICAL DATASHEET

See annex for the technical data sheet. It can also be downloaded from the website of Image Engineering:

<https://image-engineering.de/support/downloads>.