CAL2

User Manual

February 18, 2021

CONTENT

1   INTRODUCTION

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

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

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 CAL2 corresponds to the essential requirements of the following EC directive in its current version:

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

1.2   Intended use

Based on iQ-LED technology, this compact light source is designed for flexible integration into a production line. It has an external micro spectrometer and is controlled with the iQ-LED control software or via dip switches when not connected to a PC.

- Only suitable for indoor use.
- Place your system in a dry, constant 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 any error regarding the internal temperature, you will get a warning message, and the system will automatically shut off to avoid any damage.

1.2.1   Departing from described setup

The following steps must be performed in the correct chronology to allow smooth commissioning. Departing from the chronology may lead to an incorrect working device.

1. Install the iQ-LED software
2. Connect CAL2 to power and via USB to the PC
3. Switch CAL2 on; the system drivers will now be installed
4. After drivers are installed completely, start the software

1.2.2   USB connection

Only an appropriate USB connection allows error-free operation of CAL2. Use delivered USB cables. If you need to extend the USB connection to longer distances, please check if powered hubs/repeaters are necessary.

1.3 General safety information

⚠️ **WARNING!**

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

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

- CAL2
- Calibration device (spectrometer)
- Power cord
- USB cable
- Control software
- Calibration protocol
- 2x plates for connecting the spectrometer

Optional equipment:

iQ-Analyzer software (shading module)

This module includes a special chart layout file that allows the analysis of images with and without a keyhole effect.

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

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:
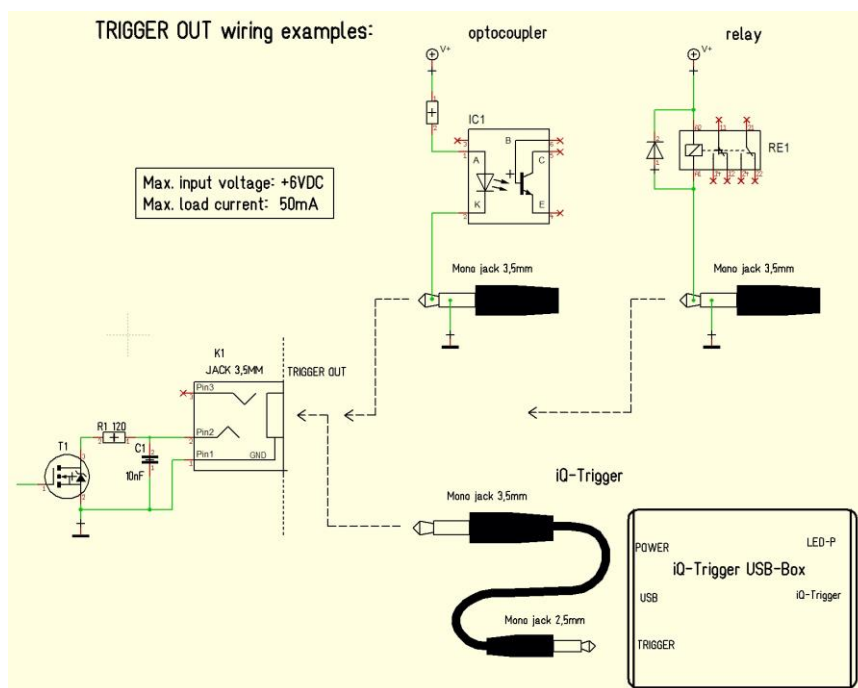
Trigger OUT wiring examples

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

1. Connect the power cord to the power supply on the back of CAL2.
2. Connect the USB cable to the CAL2 and your PC.
3. Turn on the CAL2; the power switch is next to the power supply.
4. Connect the spectrometer to the PC using the USB cable. The system will install the spectrometer and iQ-LED drivers on your PC; this will take a few seconds.
5. You can check the installation in your hardware manager.

Hardware Manager: active iQ–LED and spectrometer

3.3 Camera positioning

- Your DUT should be as close as possible to the CAL2 diffuser
- The lens should be precisely in the middle of the diffuser

If these requirements are not fulfilled, an inhomogeneous illuminated field of view will occur. The easiest way to align the camera correctly is to use the optional iQ-Align (see 2.1).

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 setup instructions from the iQ-LED control software 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 the CAL2.

NOTE

The iQ-LED devices can operate with high precision only when 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

When the spectrometer is connected to the CAL2, it can calibrate your system, generate a new illuminant, or change the intensity. Two different adapter plate sizes are provided with the CAL2 device to connect the spectrometer. The smaller plate lets you see the actual light setting next to the calibration device, and the larger plate ensures a perfect measurement in the center of the window. Attach the spectrometer to the plate using the fiber cable, and then attach the plate to the CAL2 using the two metal clamps, as seen below.

Connected calibration device

Please use caution when working with the spectrometer and fiber, and avoid putting extra pressure on the device. If you have finished your light setting or calibration, you can disconnect the calibration device and stop the measurement in the control software. The spectrometer can also be used for external measurements of other light sources.

The iQ-LED software (see iQ-LED software manual) automatically generates the best 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.

After calibrating and reinstalling the spectrometer to your system, perform a spectral calibration (iQ-LED calibration) and check if this intensity value is still correct. If it is not correct, you have to perform a lux calibration.

4.3.3 iQ-LED calibration

The individual LED lights of the iQ-LED inside the CAL2 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. Suppose you save a preset with LED channels that uses its maximum intensity. In that case, 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, and 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 light intensity will continue to get lower when the influence of the noise continues to get higher. When using standard illuminants with an intensity lower than 25 lux, it will no longer be possible to get a correct value.

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.

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. Do not remove the fiber from the spectrometer.

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

5.2 Care instructions

- Do not touch, scratch, or pollute the diffuser.
- If there is any dust on the diffuser, 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**!
- Only store and transport the CAL2 in the delivered hard case.

5.3 Disposal instructions

After the service life of CAL2, it must be disposed of properly. Electrical and electromechanical components are included in CAL2. Observe your national regulations and ensure that third parties cannot use CAL2 after disposing of it.

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.