iQ-LED Technology Statement

Important information for all users of iQ-LED devices

29. September 2023

Image Engineering GmbH & Co. KG · Im Gleisdreieck 5 · 50169 Kerpen · Germany
T +49 2273 99991-0 · F +49 2273 99991-10 · www.image-engineering.de

CONTENT

1 SCOPE

This document shall provide additional information when using iQ-LED Technology. It specifically refers to the section "3.3.2 Spectral Calibration" in the manual[1].

The document states:

Light-emitting diodes degrade over time. This process decelerates after the first 500 operating hours. As a result, a calibration of the light source needs to be performed regularly. In the first 600 hours, we recommend every 50 operating hours. After the first 600 hours, we recommend every 150 operating hours.

We want to provide more detailed information regarding this statement.

2 iQ-LED AND CALIBRATION

LEDs, in general, change during their lifetime. They will degrade in intensity from a long-term perspective (thousands of hours of usage). In the short term (within the first hundreds of hours), it is possible to see an increase in intensity.

iQ-LED technology uses an internal spectrometer to perform a self-calibration. Each LED channel's spectral distribution and absolute energy are measured during this step. The calibration data is then used to adjust the intensity value per channel to reach the best fit of the light source's desired spectrum.

If an LED degrades over time, the calibration step will ensure that the LED is controlled with a higher intensity to reach the same light intensity as before.

Example: Channel 5 has an intensity value of 40.8%, resulting in the desired light intensity. After the self-calibration measured that the light intensity is not the same anymore, it will correct the intensity value to a slightly higher value of, e.g., 41.1%, so the light intensity again matches the original.

No channel should be at its maximum intensity, as that does not leave room for correcting a slight degradation over time.

[1] https://www.image-engineering.de/content/products/software/led_control_software/downloads/iQ-LED_software_manual.pdf

3 MAXIMUM INTENSITY OF ILLUMINANTS

The iQ-LED Software has a feature to define the maximum intensity per illuminant to ensure that the generated illuminant has enough headroom to be reproduced over the iQ-LED device's expected lifetime.

See section 4.1 of the manual. The "i" button will provide the maximum possible intensity while considering long-term usage and headroom for long-term degradation.

Setting single or even all channels to maximum intensity is not an intended operation mode and should not be used at any time besides during the intended warm-up.

4 TEMPERATURE CONTROL

iQ-LED devices have a thermal management system to keep the LEDs within a controlled temperature range to maximize the intensity stability. This thermal management is designed for normal usage and recommended maximum intensity. Significantly higher intensities (such as all channels to maximum) can potentially overheat the device and trigger a safety switch that will turn off the element.

If an overheating occurs and you observe the device turn itself off, please ensure that the same operating conditions are not used again as you are outside of the operation range that can be used for an extended period.

Reduce the intensity and check if the thermal management is compromised for any other reason, e.g., a blocked air stream into the device or an environment with temperatures outside the operation temperatures defined in the datasheet.

5 USAGE OF IQ-LED IN THE FIRST HUNDREDS OF HOURS

As stated in the manual and cited in section 1, Image Engineering recommends a higher calibration frequency within the first 600h of lifetime. That will ensure constant illumination and prevent those possible effects of LED "burn-in," which could change the spectrum.

Some customers that use the iQ-LED Technology in a 24/7 environment (like production lines) would like to keep the recalibration at the lowest possible frequency. We see two strategies if a frequency of ~50h is not feasible for your application.

5.1 IQ-LED MONITORING

Every iQ-LED device is equipped with an absolute calibrated spectrometer, which can also be read out via API. So, a change in the emitted spectrum can be detected by comparing the current spectrum with a reference spectrum. A recalibration can then be triggered when a significant deviation is detected.

Instead of using a fixed frequency of recalibration, the recalibration can be triggered based on the actual need. As the recommended 50h frequency has some margin, the accurate recalibration based on measurement is expected to be longer and will increase within the first 600h of operation.

If changes in the emitted spectrum after recalibration are of concern, the software (and API) allows you to create illuminants based on older calibrations. Thus, it is possible to "undo" a recalibration if this did not have the intended effect.

5.2 BURN-IN

If the recommended operation with an increased frequency of self-calibration is not possible, a burn-in phase can be an option. In this case, the device will be operated outside of the intended environment for a certain period, so the frequency of recalibration can be lower afterward.

If this is the process you would like to follow, please be aware:

- The period of 600h is calculated based on normal usage. Normal usage means that illuminants with an intensity of or below the maximum intensity (see section 3 of this document) are used.
- To reach burn-in within 600h of operation, an intensity significantly below the maximum intensity (~30% of maximum) is sufficient.
- Creating a sequence of different illuminants and regularly changing the illuminants is advised (e.g., changing between illuminants every 60s).
- The device has to be operated via the USB connection when not supervised.