Product Document

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Application Note

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Basic Pre-Production Light & Color Sensor Solution Validation Process

Suggested Tools and Processes for Pre-Production Validation of Light- and/or Color-Sensing Solutions

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Content Guide

1 Introduction

This Application Note will guide the user through a simple example of representative steps for accomplishing pre-production validation of a light sensing solution using **ams** Ambient Light Sensors, Color Sensors, and Spectral Sensors. The process applies equally to Lux, CCT, and xyY Chromaticity validations, as the steps and resource requirements are highly parallel.

2 Theory

By utilizing Production-Representative product units in a controlled environment, the behavior of the overall system can be evaluated to confirm/validate that the behavior and performance meet desired functional criteria during development and/or immediately prior to production-release of the Model or Platform design.

3 Recommended Equipment

3.1 Light Box

A Light Box is an enclosure which allows delivery of an intended light-source illumination, but prevents ambient light from influencing the measurements being taken using the intended light source.

This enclosure can be a professional Light Box like these examples: a) GTI brand, Model PDV-2e/M Multi-Source Portable Desktop Viewer, b) XRite brand, Model SpectraLight QC.

The enclosure can also be built to application-specific requirements with regard to preferred size, shape, and light source(s). Light Source placement is important to ensure consistent illumination of the Device Under Test [DUT] during data-gathering (generally each of multiple same-type sources are placed equidistant from the center of the unit).

Figure 1:
Light Box Examples

X-Rite Spectralight QC Light Box

GTI Model Model PDV-2e/M

3.2 Colorimeter/Lux Meter

A Colorimeter/Lux Meter is an instrument for measuring Light Color information and Light Intensity

One recommended Colorimeter is the Konica-Minolta CL200A. This instrument can, and should be, calibrated. This instrument delivers multiple standards-referenced pieces of information used in Color and Lux measurements like a) Lux, b) CCT White-Point, and c) X, Y, and Z Color.

Figure 2:
Konica-Minolta CL200A

3.3 Production-Representative Units

A “Production-Representative” Unit is a unit of the design under-evaluation. This would normally be a Unit Model or Platform built to the same specifications, and with the same materials, which will be used for final production.

Critical factors in Production Representative units include, but may not be limited-to:

- Any optical treatments like ink, Anti-Glare or Anti-Reflective coating on the sensor Aperture,
- The Mechanical relationships between the Aperture, Sensor, any Bezel or other mechanical item impacting the Field of View [FoV] of the sensor.

4 Validation Process

The following steps outline the basic sequence of setup and data gathering to support validation of platform behavior.

1. Set up a controlled-lighting space appropriate for taking data with the Device Under Test (DUT) (no ambient light, only the light specific to the intended source should be present) – e.g. The Light Box described in Section 3.1 of this document.
2. Be sure that there is room for the DUT and the Colorimeter/Lux Meter (described in Section 3.2 of this document) to be positioned facing the light sources, side-by-side, at the same distance from the light sources.
3. Place the DUT and CL-200A at the center of box/light-sources positioned so that the Light Sensor aperture in the DUT and the CL-200A meter head (looks kind of like a ping-pong ball) are equal distance from the center point of the box/light source(s) and parallel to the face of the source/diffuser on the source.
4. It is important to make the distance from both devices to the light Sources (Bulbs) equal.
5. Best results for testing and validation will be obtained by making sure that the DUT and Meter are also closely aligned with one another, with the center of the diffusion area for the Light Source(s), and with light falling as directly and evenly dispersed onto their light sensors/Light Sensor Apertures as possible.

Figure 3:
Preferred Positioning of Meter and DUT for Data Gathering – Side View

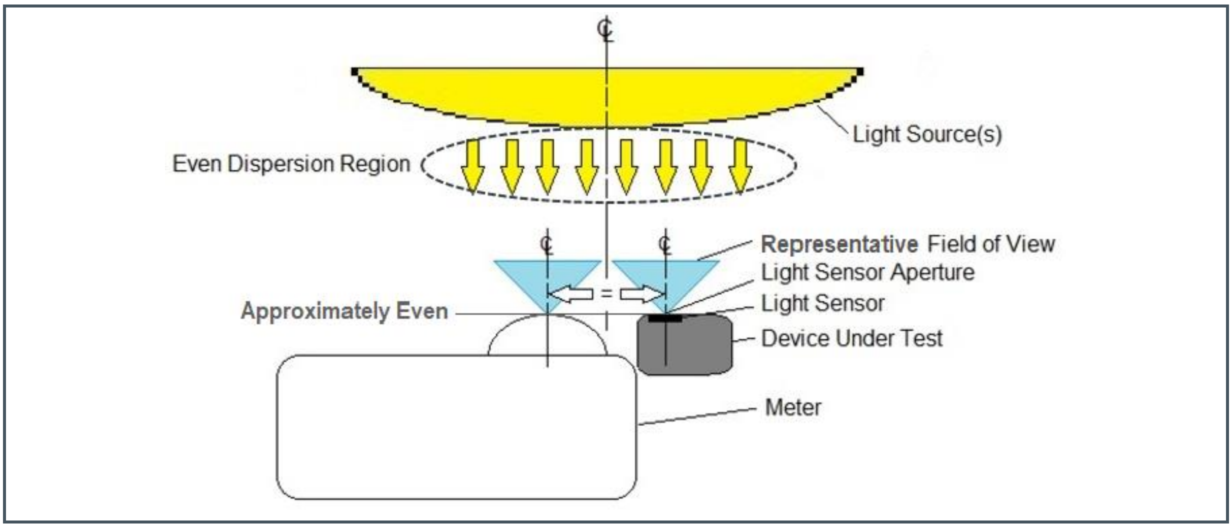
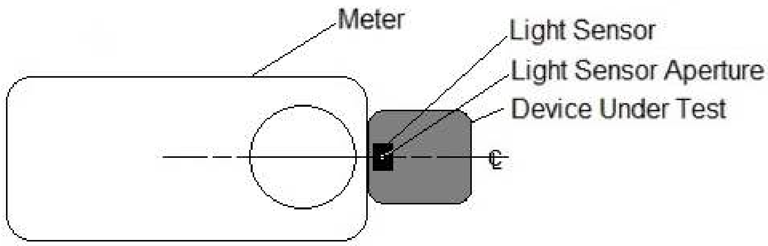


Figure 4:
Preferred Positioning of Meter and DUT for Data Gathering – Top View (1)



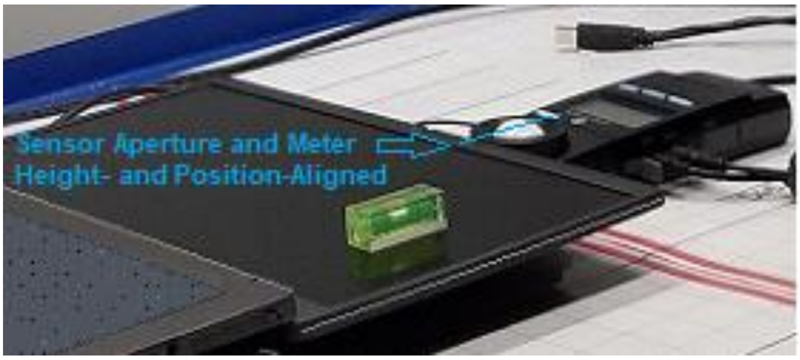
(1) Light Source and Field of View graphics removed for clarity

6. Space/Lift the DUT height so THAT the Sensor or Sensor Aperture surface and top of the CL-200A “ping-pong ball” are at similar heights (vertical distances to the light source(s)).

Information

Using a simple stack of paper to lift and vertically-position the DUT is a very effective solution since it is very adjustable, and supports the DUT firmly.

Figure 5:
Example: DUT Positioned with CL200A Colorimeter Properly Aligned



7. Use a simple bubble-level on the lap top bezel or display surface to set the top position so that it is horizontal, and the aperture is facing directly upward at the light source(s).

Figure 6:
Example: DUT Positioned with Sensor Aperture Properly Oriented

8. Choose 2 or 3 light types with bulbs matching the correction-matrix-creation bulbs for best test-correlation with Reference data – including low-IR content source or two, and one High-IR content source (most environments at this point in time have a reduced-count of High-IR sources, so more focus is often applied to low-IR sources for operational validation).
9. Good Light-Type choices: TL83 (3000k CCFL), D50 LED bulb, 25w incandescent soft-white behind a diffuser.
10. Guidance is available for selecting bulbs for this purpose.
11. Bulbs with bases/connection-methods standard for the local test-location resources are always preferred.
12. Connect the Colorimeter to the DUT or preferred Colorimeter Data-Collection PC (Konica-Minolta CL-200A recommended, since **ams**' data-gathering tools are set up for this, and this is the tool used for generation of the Color- and Lux-Correction matrices/PDT file(s)).
13. Take a sequence of several measurements with each bulb type individually (for best test-correlation with Reference data do not turn multiple light-sources on at once) and record those measurements using available tools.
14. It is normally best to gather reference data (meter data) and DUT data at the same time – since various factors can vary slightly, and cause unwanted variation in results, if data is gathered for the reference data and DUT data at different times. (For example: In computing applications, DUT data can be logged using System Sensor Data Logging resources and Konica-Minolta Colorimeter data using Python-based data-gathering tools, for Industrial/Medical/Consumer and other types of solutions, native code or an **ams** Light/Color Sensor Controller and GUI can gather DUT Data while the CL200A gathers data in parallel).
15. Using an Excel Spreadsheet or similar tool, the gathered instrument (reference) and DUT data points can be compared, and the behavior of the DUT validated against design specifications.

5 Summary

There is no single correct way to accomplish a pre-production validation process for Lux, CCT, and xyY chromaticity measurements. Since there are a range of methods which can/will produce excellent results, and a range of methods which will produce less-than-ideal results, it is important to understand the process, and to implement a validation procedure which will produce repeatable results meeting the standards and guidelines of a given design.

Adjustments or modifications to the process can, and often should be made to optimize efficiency in completing this important step in the design and product-release process.

This document offers equipment and process recommendations which have proven to support successful pre-production validation for a range of products entering the market over many years.

Guidance is available regarding implementation of a solution which can best fit the engineering, quality systems, and standard methods for any company so that costs and efficiencies are optimized, while being certain that the end product performs within design specifications.

6 Revision Information

Changes from previous version to current revision v1-00	Page
Initial version	

- Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
- Correction of typographical errors is not explicitly mentioned.

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