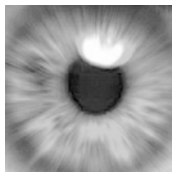

Luminance variations of 7-segment display

Objective

The quality of the visual appearance of a 7-segment display depends on the luminance level and on the uniformity of luminance in each segment and the uniformity from segment to segment.

In figure 1 is shown the first attempt on a segment construction. It is obvious that this does not have a sufficient quality. The problem is most of all the very visible hot-spots and secondly individual LED variations in luminous intensity. The latter problem is solved by sorting the LED's, as it would be too costly to make individually power supply to each of them.

Work done

In order to address the first problem the luminance variation over each segment was measured. As the typical dimensions of the individual segments are 10 mm × 3 mm, an ordinary luminance meter is not capable of resolving the luminance variations, while ICAM is the perfect tool for this kind of task. The spatial resolution of the luminance measurements is app. 30 µm.

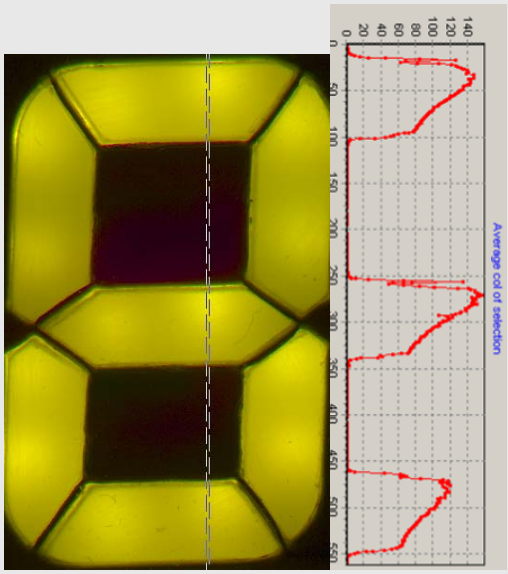

Fig.1. Hot spots in 7-segment. Vertical luminance variation through 7-segment is shown in diagram.

One measurement (2 sec.) was needed to retrieve the wanted data. The ICAM measurements gave solid and detailed information for the process of DELTA's design of the segments for high efficacy and high uniformity.

Results

The optical simulation answered the questions of LED positions, properties of reflective surfaces and properties of the diffusing transparent materials.

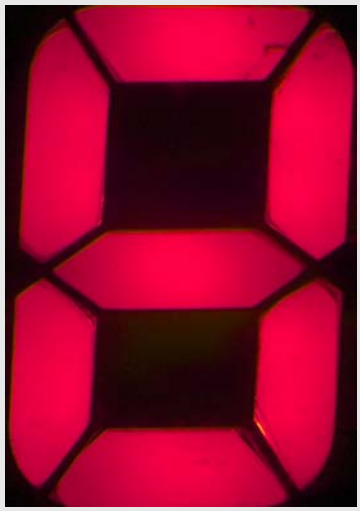

Fig. 2. Hot spot were removed from the 7-segment after optimization of materials and shape.

As the average brightness is a trade off with the uniformity, ICAM measurements during the prototyping gave valuable inputs to the design process.

Afterwards measurements are serving as control of achieved quality of the components used in the final segments.

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