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Modular line light uses UHB-LEDS for web inspection applications

In web-based machine vision systems, high brightness line lights must maintain uniform illumination across their width. To achieve sufficient brightness and uniformity, many lighting manufacturers use fiber-coupled halogen lamp sources. With the recent advances in ultra high-brightness LEDs (UHB-LEDs), many vendors including Innovations In Optics, Inc. (Woburn, MA; www.innovationsinoptics.com) are looking to replace these products with modular line lights that use LEDs as the light source.

"Until now," says Thomas Brukilacchio, President, "the performance of LED line lights has fallen short of industry expectations." Recently Brukilacchio and his colleagues have combined both imaging and non-imaging optics with LED chip-on-board (COB) high density arrays. The resulting intensity surpasses Halogen illumination and also has a significantly improved lifetime designed to exceed 30,000 hours. Each four inch module contains five evenly spaced 0.7mm wide by 7mm long LED die arrays supplied by either CREE (Durham, NC; www.Cree.com) or SemiLEDs (Boise, ID; www.semileds.com) (**Figure 1**).

"To collimate the light from the devices mounted on the T-Clad™ PCB manufactured by The Bergquist Company (Chanhassen, MN; www.bergquistcompany.com) ," says Brukilacchio, "a specially designed non-imagining plastic collimator was designed with SolidWorks (Concord, MA; www.solidworks.com) and optimized using Zemax CAD based ray tracing software from Zemax Development Corporation (Bellevue, WA; www.zemax.com). Any number of these modules can then be placed linearly within a custom metal housing for specific web based inspection length requirements (**Figure 2**). To ensure that light from each of the individual modules within the line light is uniform, an aspheric lens is then coupled along the length of the line light.

"Line lights that use fiber optics to deliver light along individual regions along the line may suffer from intensity fluctuations or degradation as the halogen lamps used in such systems can vary and degrade over their lifespan," says Brukilacchio.

To maintain uniform illumination across its LED-based line light, Innovations In Optics' module can be configured with both a photosensor and a thermistor. By feeding analog measurement from these devices to the device's power supply controller, these measurements can allow the intensity of light and temperature of the light to be constantly maintained.

"Using LED light sources coupled with novel optics dramatically decreases illumination inefficiencies, while at the same time increasing the lifespan of the light," says Brukilacchio. Of course, the use of LEDs can provide other advantages, especially for designers of machine vision lighting systems. While Innovations in Optics initial line light will be offered as a 24 inch long white line light initially target priced at $2,500, future products will incorporate different types of LED modules.

"Instead of mounting five LEDs of the same color in each of the arrays," says Brukilacchio, "each individual array could consist of a number of red, green and blue LEDs." In this way, the systems integrator could configure the light as a red, green, blue or white light source.

By using a calibrated integrating cavity with an aperture of 2.5mm, Innovations in Optics has measured the light output of its white LED illumination system at greater than 1MLux when powering the LED die at below their rated 350mA current specification and cooled by free convection. According to Brukilacchio, light intensities of 5MLux are achievable by operating the device at higher current, with auxiliary cooling. The company is marketing the product directly and through US distributor and systems integrator Visics Corporation (Wellesley, MA; www.visics.com) and is looking for both a UK and European distributor.

FIGURE CAPTIONS

Figure 1: Replacing fiber/Halogen based illumination sources is the aim of an LED line light from Innovations in Optics. Each line light consists of a number of discrete LEDs mounted on a PCB and coupled to an optical collimator.

Figure 2: Once the LED and optic modules are mounted into a line light, an aspheric lens is mounted across the width to uniformly focus the light.