Spurring innovation for networked lighting control systems

EDN edn.com/spurring-innovation-for-networked-lighting-control-systems/

Yoelit Hiebert June 23, 2021

As LED technology becomes more commonplace and products more commoditized, there's been increased interest in functionality above and beyond simply providing illumination. Terms like IoT and interoperability have been part of numerous presentations at lighting conferences and trade shows for several years, and large lighting companies are increasingly investing in IT expertise. But there's still a general perception within the lighting industry that the number of actual implementations of networked lighting control systems is not as robust as expected.

To spur innovation, the DOE has reactivated its L-Prize competition. The first competition was held in the early years of LED technology for general illumination to provide an incentive for the development of commercial LED-based products. The $10M prize was awarded in 2011 to Philips Lighting for the development of an 10W A-bulb that provided a lumen output comparable to a standard 60W A19 incandescent. The winning entry (**Figure 1**) provided an efficacy of 94 lm/watt, a significant accomplishment at the time.

Figure 1 Philips Lighting won the 2011 L-Prize for its 10W A-bulb. Source: Wikipedia

The current L-Prize competition is intended to accelerate advancements in LED lighting systems in the areas of performance, energy efficiency, and cost savings. Functionality beyond simply providing illumination will be evaluated, including building system integration capability, maintenance requirements, and grid signal responsivity.

To help manufacturers of lighting control systems achieve the goals of the L-Prize competition, the Zhaga Consortium has recently made its Book 20, published in 2020, available to the public. The Zhaga Consortium is an international body that focuses on defining interface standards in support of intelligent building networks. Zhaga "Book 20: Smart interface between indoor luminaires and sensing/communication modules" defines the mechanical and electrical interfaces between an indoor LED luminaire and sensing and communication nodes that provide inputs to the lighting control system. An outdoor counterpart, "Book 18: Smart interface between outdoor luminaires and sensing/communication modules" was published in 2019.

Zhaga Book 20 defines a luminaire extension module LEX-M as a device that interfaces with the luminaire, specifically the driver, to provide information to the control system, as shown in **Figure 2**. Associated with the LEX-M are the LEX-MR luminaire extension module receptacle, the LEX-S luminaire extension slot, the LEX-LP luminaire extension luminaire plug, and the LEX-B luminaire extension bus, shown in **Figure 3**.

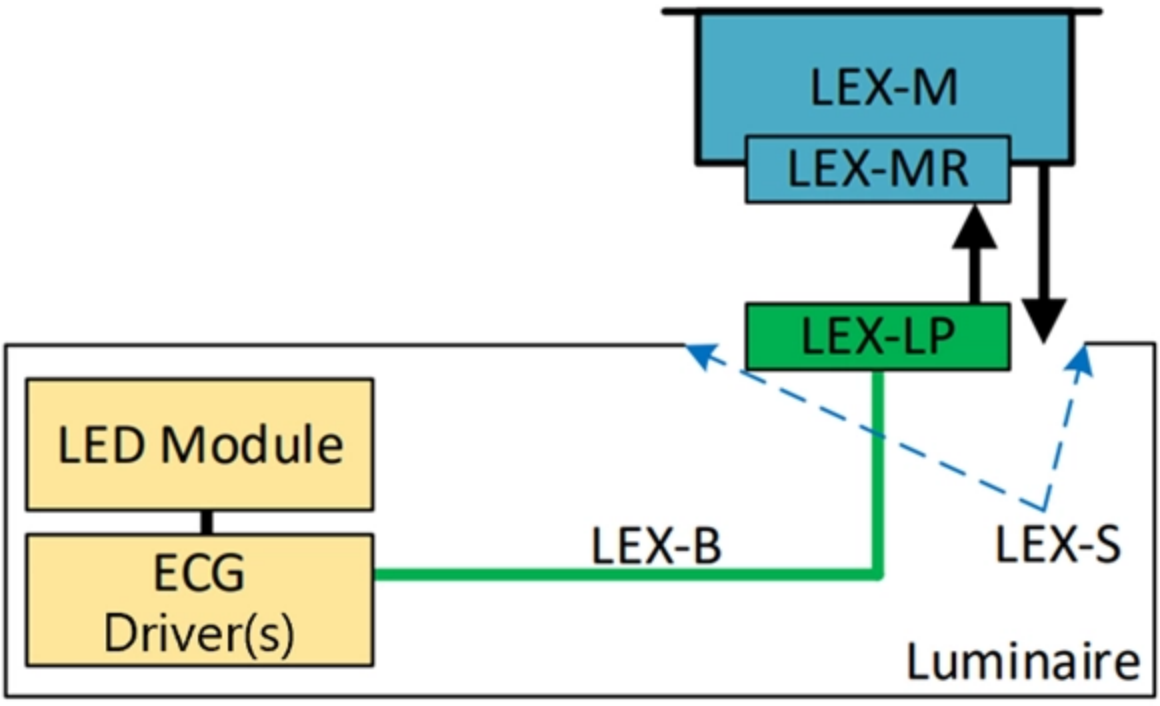

Figure 2 This diagram shows a typical luminaire and a LEX-M, as defined in Zhaga Book 20. Source: Zhaga Consortium, reproduced with permission.

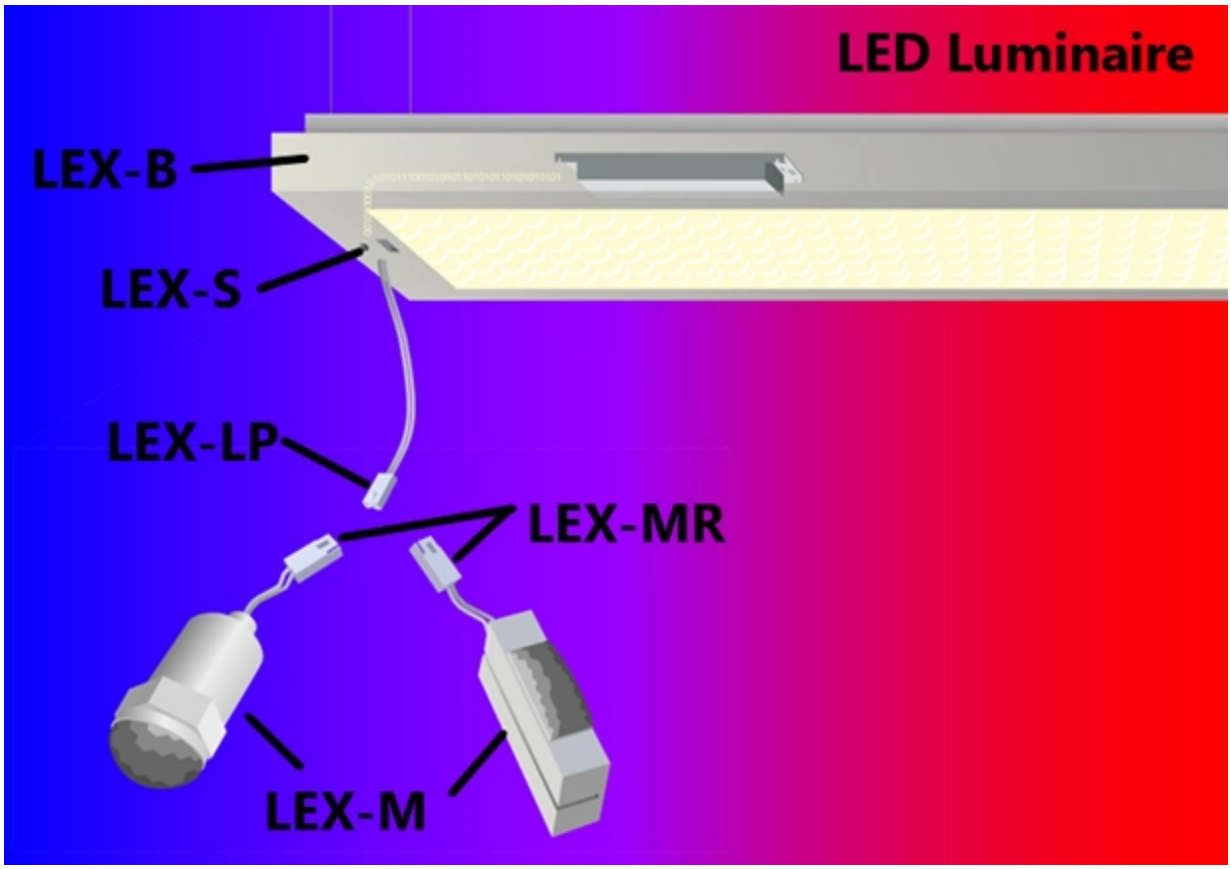

Figure 3 Here is an example of a physical implementation of the Zhaga Book 20 interfaces and devices. Source: Zhaga Consortium, reproduced with permission.

Book 20 provides detailed requirements for the mechanical interface of an LEX-M device including the allowable physical geometry, the method by which the device is attached to the luminaire, and the size of the LEX-S mounting slot. Electrical interface requirements include pin assignments for LEX-MR and LEX-LP connectors, insulation requirements, and an additional section devoted to DALI implementations. The standard also provides a compliance test protocol for both mechanical and electrical parameters.

The Zhaga Consortium was founded in 2010 with the goal of encouraging the physical interchangeability of LED luminaire subsystems, e.g., light engines, modules, arrays, drivers, sensors, and communication devices, as a means of advancing adoption of LED-based lighting products. While Zhaga at first focused on components internal to the luminaire, it has in the last few years shifted its attention to interfaces for external devices like sensors. This change was prompted by a realization that device interoperability was a critical factor in the successful implementation of networked lighting controls and building systems.

That brings us back to the current L-Prize competition. The DOE has geared this competition toward several aspects of LED lighting which, according to DOE research, present significant potential for advancement. According to the DOE, luminaire efficacy could be nearly doubled through improvements to both LED and luminaire materials, optical design, and optimized configuration of the electronics components and subsystems. Advances in dynamic

implementations of spectral content and intensity could have positive impacts on both occupant health and productivity while also decreasing energy usage. Integration and optimization of building systems could result in lower energy usage through occupant-based activation of lighting and HVAC. And improvements in manufacturability, replaceability, maintenance requirements, and end-of-life strategies, such as recycling, could reduce the lifetime costs of networked systems.

The competition will happen in three phases: a concept phase expected to last about 9 months, a prototype phase expected to last about a year, and a manufacturing and installation phase expected to last about 20 months. The competition is applicable to lighting systems providing general illumination for indoor commercial environments, and the $10M prize for the third phase is expected to be awarded in late 2024.

—Yoelit Hiebert has worked in the field of LED lighting for over 10 years and has experience in both the manufacturing and end-user sides of the industry.

Related articles: