Digital Illumination Interface Alliance

September 2018

DALI-2: Standardized, interoperable components and smart luminaires

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Introduction

DALI-2 extends and enhances the strengths of DALI as a dedicated, standardized protocol for digital lighting control. For many years, the lighting community has installed DALI systems that are robust, scalable, cost-effective, reliable and flexible. But now, for the first time, DALI-2 has brought standardization to products such as sensors and other input devices, as well as application controllers, which are the "brains" of a DALI system. Furthermore, with its rigorous testing and verification procedures, the DALI-2 certification program from DiiA brings the promise of significantly-improved interoperability of products from different vendors.

DALI: Dedicated for lighting

DALI is dedicated and optimized for lighting control, and has many unique features that are not found in other protocols, such as a defined light-output (dimming) curve. The DALI standard includes specific features for emergency lighting, colour control, sensors and controls for lighting, and load shedding, and many more. Other features in development include new functions for control gear; new input devices and features; and the DALI-wireless standard.

DALI is based on robust, bidirectional communication, and enables devices to report failures, answer status queries, and provide other information. DALI commands enable digital control, configuration and querying of devices. Commands can be addressed to an individual device, to groups of devices, or to all devices (broadcast).

Examples of control commands include those that start a fade to a defined light output level, recall scenes or turn the lights off. Configuration commands include, for example, those that change the fade time or change the light level stored in a scene. Examples of query commands include those that ask what the current light output level is, or whether there is a lamp failure.

DALI also provides the flexibility to reconfigure lighting systems using software, without the need for rewiring. Different lighting functions and moods can be achieved in different rooms or areas of a building, and then easily adjusted and optimized.

Development of DALI-2

DALI-2 refers to the latest version of the international DALI standard, IEC 62386. To create DALI-2, the original DALI standard was restructured, upgraded and enhanced with a strong focus on product interoperability. One important feature of DALI-2 is the incorporation of much more detailed and rigorous testing requirements, which are intended to ensure that products from different suppliers are able to work together. As DALI-2 continues to evolve and mature, this will eliminate many of the incompatibility issues that could cause problems with older DALI (version-1) devices in the field.

Alongside the DALI-2 standard, which is published in a number of Parts by IEC, the Digital Illumination Interface Alliance (DiiA) has introduced the DALI-2 certification program. Launched in mid-2017, DALI-2 certification enables suppliers to show that their products meet all the requirements of all relevant Parts of the standard. DALI-2 certified products are able to carry the DALI-2 logo, and are listed in the fully-searchable Product Database on the DiiA website.

DALI-2 certification is enabled by test sequences that are developed by DiiA, and provided to DiiA member companies as a membership benefit. Product test results must be submitted to DiiA, and are then checked and verified before DALI-2 certification is granted. In contrast, DALI version-1 testing relies on self-declaration by suppliers, without any verification checks.

Since the launch of DALI-2 certification, several milestones have been reached. The first DALI-2 products to be certified were LED drivers (control gear) from a number of different companies. These were followed by the first single-master DALI-2 application controllers, and the first DALI-2 bus power supplies (**Figure 1**).

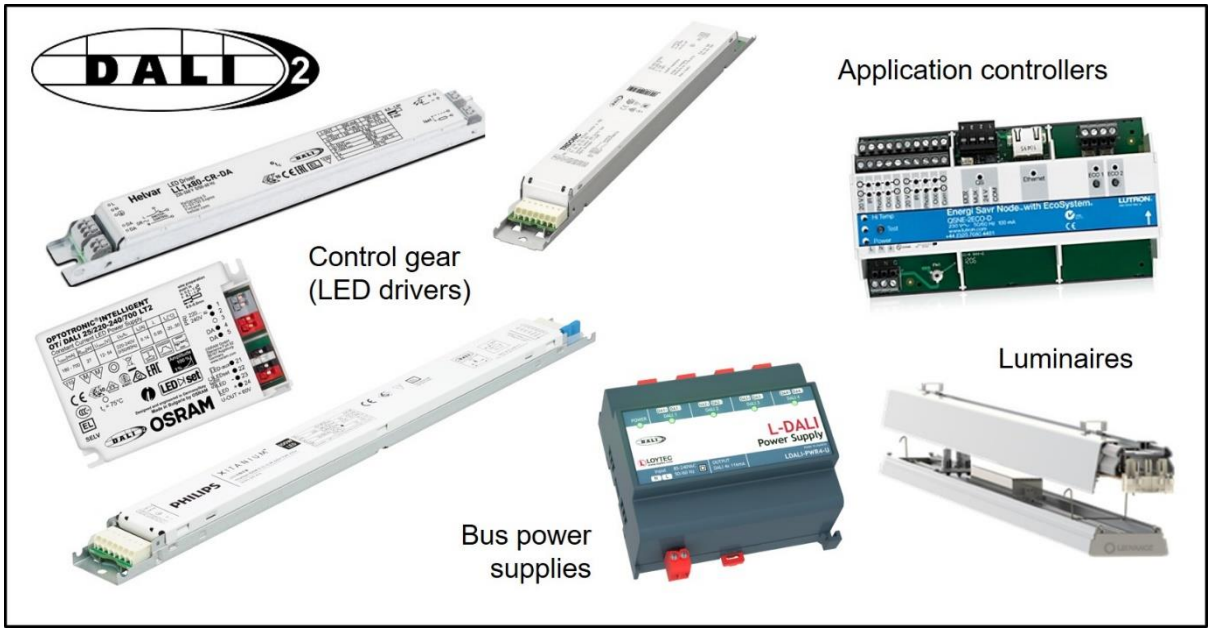

Figure 1. Examples of DALI-2 certified products, which are all listed in the online Product Database on the DiiA website.

Also, the first DALI-2 luminaires were listed on the DiiA website. Currently, DALI-2 luminaires do not have to be certified separately but are required to contain DALI-2 certified components.

At the time of writing, over 175 DALI-2 certified products are listed in the DiiA online Product Database, from a wide range of DiiA member companies. Including DALI version-1 control gear, the database contains more than 1000 products from DiiA member companies. Since June 2018, it is compulsory to list any DALI version-1 products that are available on the market, providing visibility, traceability and reassurance for customers.

New test sequences

Another fundamental improvement in DALI-2 is the standardization of sensors and other input devices, such as sliders, push-buttons and occupancy and light-level sensors, as well as application controllers. With these additions, the DALI-2 standard now extends to all devices in a lighting-control system. While the relevant Parts of the IEC 62386 standard are already in place for these devices (see Figure 2), DiiA is working hard to develop test sequences that will enable such products to be included in the DALI-2 certification program. The intention is to eliminate cross-vendor incompatibility issues, creating a level playing field and improving customer confidence and choice.

DiiA's current priority is to update the test sequences for Parts 101, 102 and 103. In due course, this will enable DALI-2 certification of multi-master application controllers. At the same time, DiiA is actively developing test sequences for DALI-2 occupancy sensors (Part 303) as well as other input devices. Also on the horizon are test sequences for control gear allowing colour control (Part 209), and for self-contained emergency control gear (Part 202).

The Timeline on the DiiA website (www.dali2.org/certification/timeline.html) shows progress in developing all the DALI-2 test sequences.

Further standardization

To create DALI-2 test sequences, DiiA relies on contributions from many of its member companies, who specify, write and review the required documents and software.

At the same time, IEC continues to update existing Parts of IEC 62386 for DALI-2 and to publish new Parts. In recent months, IEC has published a DALI-2 version of Part 207, covering LED drivers (i.e. control gear for LED modules). Among the new publications is Part 221, which covers the control-gear requirements for demand response by way of load shedding.

The DiiA website (www.dali2.org/dali/standards.html) maintains an up-to-date list of all the IEC 62386 Parts, as well as the latest version of **Figure 2**.

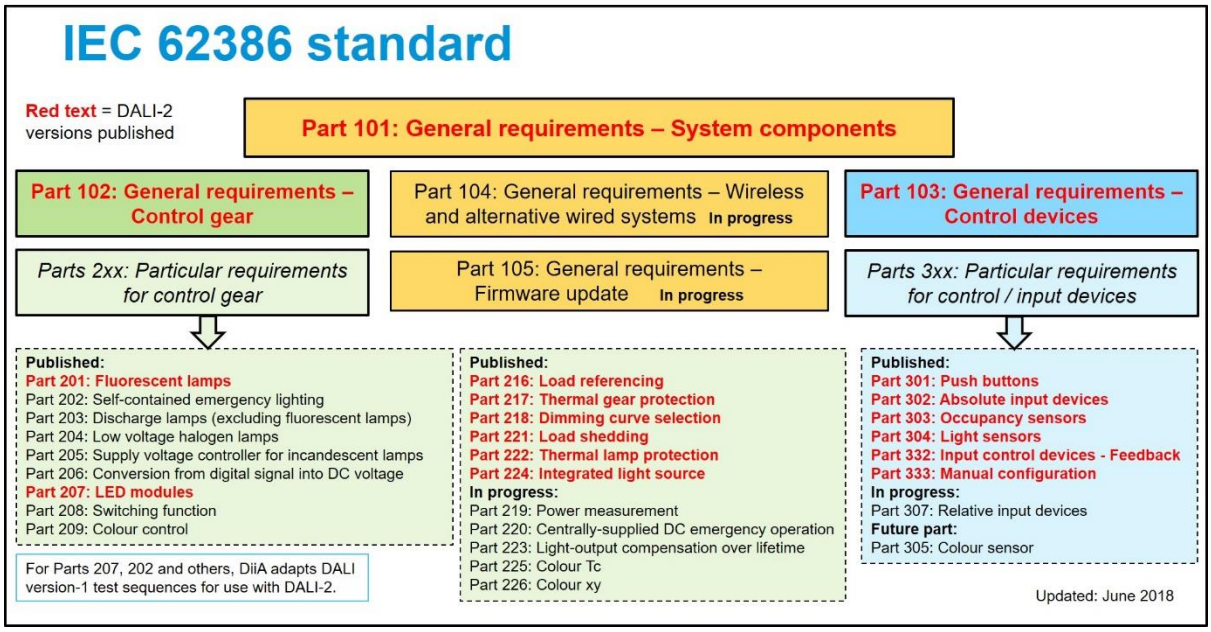

Figure 2. IEC 62386 is published in multiple Parts by IEC. The latest version of this diagram can be found on the DiiA website (www.digitalilluminationinterface.org/dali/standards.html).

Recently, DiiA and IEC signed a liaison agreement, enabling DiiA to contribute directly to the development of IEC 62386. The IEC category D liaison allows DiiA to participate in the relevant work group (WG 11 of TC 34) within IEC. Representatives from DiiA now work with lighting experts from different countries who already contribute to WG 11.

Intra-luminaire DALI

DiiA is also actively developing new specifications, and is working with Standards Development Organizations (SDOs) including IEC and ANSI to develop standards based on these DiiA specifications. One example has important applications for smart, connected LED luminaires that can become part of the Internet of Things (IoT). Such luminaires use an internal DALI bus to facilitate the incorporation of sensors and/or wireless communication modules. As described in a new DiiA specification, the internal LED driver used in this application can provide power to some devices on the DALI bus. Other DiiA specifications define how the LED driver can use a new data model to provide information – such as energy metering and operational diagnostics – in a standardized format that builds on the DALI protocol. This enables reporting of luminaire-specific data, typically via a wireless link, to a centralized server.

An extension of this work is to include a standardized socket that enables sensors or communication devices to be seamlessly connected to the LED luminaire. A modular approach with a standardized interface supports the development of a broad range of such devices, and allows product ecosystems to flourish. Luminaires are future-proofed and can be upgraded in line with the ongoing evolution of sensing and connectivity technologies.

DiiA is collaborating with the Zhaga Consortium, which has also developed relevant specifications in this area, to define truly comprehensive specifications as the basis for broad adoption and increased speed to market.

DiiA membership

DiiA is an open, global consortium that operates on behalf of its members to stimulate the worldwide adoption of DALI-2 and the proliferation of lighting networks using DALI technology. The organization recently reached the milestone of 150 member companies, including 22 Regular members who contribute directly to DiiA activities including development of test sequences and specifications. Many companies join as Associate members, while the Community category is open only to luminaire makers, who can use the DALI trademarks (according to DiiA rules) without paying a membership or licensing fee. More information on the benefits of joining DiiA can be found on the DiiA website (www.digitalilluminationinterface.org/membership/benefits.html).

Conclusions

With rigorous testing and verification procedures in place, the DALI-2 certification program represents a significant improvement in securing interoperability between DALI products, and is building further confidence in the DALI interface throughout the lighting industry. DiiA is developing new test sequences to bring more product types, including sensors and application controllers, into the DALI-2 certification program. At the same time, IEC is extending IEC 62386, and introducing new standardized functions and features. DiiA is also developing new specifications that will enable new applications such as intra-luminaire DALI, and help smart, connected luminaires to join the IoT.