New DiiA specifications: Data and Power-Supply specifications enable smart luminaires with IoT connectivity

September 2018
Summary

• Addressing the market need for intelligent lighting fixtures with sensing and communication capabilities and IoT connectivity, DiiA has finalized a set of five new specifications based on the DALI lighting-control protocol.

• The specifications enable smart LED drivers and luminaires that can report operational, diagnostic and inventory data. Also, the specifications simplify the addition of sensors and wireless-communication nodes (also known as network lighting controllers) to luminaires by taking care of power-supply requirements. In turn, this makes it more straightforward for luminaires to participate in the IoT.

• The five new DiiA specifications build on DALI-2, with its strong focus on multi-vendor interoperability. DiiA has worked with other organizations, notably the American National Standards Institute (ANSI), to ensure global alignment of the specifications.

• In due course, DiiA will provide the new specifications to IEC for incorporation into IEC 62386, the international DALI standard. Also, DiiA will create test sequences for the new specifications, enabling their incorporation into the DALI-2 certification program.
# New DiiA specifications

## Power Supply specifications

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## Data specifications

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Supporting DALI in the IoT era

- Smart, connected luminaires that report operational, diagnostic and inventory data
Enabling DALI in standalone luminaires

- **AUX specification**
- **DALI Part 250** (integrated bus power supply)
- **DALI Parts 251-3** (operational & diagnostic data)

Optional AUX supply

DALI-2 LED driver with integrated bus power supply and Data

Intra-luminaire DALI bus

Remote lighting-control network

- LEDs
Overview of new DiiA specifications

• DiiA has created a series of new specifications for additional features for DALI-2 control gear, describing:
  – How data is stored, accessed and reported
  – How power is supplied to other DALI devices inside a luminaire

• Different solutions are already available in the market:
  – Several LED driver makers (including DiiA members) offer drivers that simplify the connection of sensors to luminaires
  – A US-based utility is using a DALI network inside lighting poles for asset management

• DiiA specifications bring harmonization to the market
  – Reduces complexity, creates an open market and more choice for OEMs
  – DiiA is working with ANSI, the US-based standards organization
Overview of new DiiA specifications #2

• Specifications build on existing DALI-2 standards
  – Additional features extend scope of DALI-2 for control gear (mainly focused on LED drivers)
  – Specifications describe how data is stored in, and made available from, memory banks of DALI-2 control gear*

• Specifications enable:
  – Smart LED drivers that can report a broad range of operational and diagnostic data
  – Simplified integration of sensors and/or communication modules with luminaires

* Except for the AUX Power Supply specification
Current status of specifications

• Specifications were written by DiiA’s Technical & Certification Work Group (T&C WG).

• Specifications are available to DiiA members, and are in the approval phase.

• In due course, DiiA will provide specifications to IEC for incorporation into IEC 62386, the international DALI standard.

• DiiA’s T&C WG will create test sequences for the new specifications.

→ New specifications will be incorporated into the DALI-2 certification program.
Collaboration with ANSI

• In developing the specifications, DiiA worked with the ANSI Accredited Standards Committee (ASC) C137 on Lighting Systems. The ANSI committee provided feedback on the draft DiiA specifications.

• Forthcoming ANSI standards in this area will be aligned with the DiiA specifications, including the proposed ANSI standard C137.4, entitled “Digital Interface with Auxiliary Power”.

• “The close cooperation between ANSI ASC C137 and DiiA is enabling development of specifications that will address stakeholder needs and have global relevancy by aligning with the DiiA specifications,” said Mike O’Boyle, Technical Coordinator of the proposed ANSI C137.4 Working Group.
DiiA specifications on Data

- Three new DiiA specifications define storage and accessibility of data relating to DALI control gear and luminaires.
- Specifications define the location, type and format of data stored in the memory banks of DALI control gear. They also describe the exchange of data with DALI control devices.

DALI Part 251 – Memory Bank 1 Extension
- Enables drivers inside luminaires to report luminaire-specific data, such as part number or nominal light output. Useful for asset management etc.
- More details on Part 251

DALI Part 252 – Energy Reporting
DALI Part 253 – Diagnostics & Maintenance
- Enable smart DALI-2 drivers that can store and report operational and diagnostic data in a standardized format. For example, the driver could monitor and report its energy usage, total operating time, and incidences of thermal shutdown, as well as many other parameters.
- More details on Parts 252 & 253
Typical inter-luminaire DALI system

- Shows one possible example of a DALI system
- Systems can contain more than one application controller
- A bus power supply is required, either separate or integrated with an existing device

DALI bus

- Bus power supply
- Application controller
- Sensor
- Additional luminaires and/or input devices (e.g. sensors)

Luminaire

- DALI-2 driver
- LEDs

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Inter-luminaire DALI with data reporting

- Bus power supply
- Application controller
- Sensor

Driver implements Data specifications (DALI Parts 251, 252, 253)
  - Reports operational and diagnostic data, and luminaire-specific data, via DALI bus
DiiA specifications on Power Supply

Specifications define how DALI control gear can supply power to connected DALI devices.

DALI Part 250 – Integrated Bus Power Supply
• Describes how a control gear with an integrated DALI bus power supply can provide power to a connected DALI control device
• The capabilities and configuration of the integrated bus power supply are given and set via parameters in memory banks in the control gear

AUX Power Supply
• A separate DiiA specification that defines an optional AUX power supply, provides additional 24V power supply if required.
  – Does not use memory banks

→ Data specifications can be used by control gear in any application

→ Power Supply specifications focus mainly on intra-luminaire DALI
Intra-luminaire DALI bus with sensor

- New specifications simplify the addition of DALI control devices (e.g. sensors) to luminaires

- Integrated bus power supply defined by DALI Part 250

- Sensor functions as DALI application controller (sends commands to driver)

- DALI-2 LED driver with integrated bus power supply

- Driver communicates with sensor via internal DALI bus

- Driver provides power to sensor via DALI bus
Luminaire with low-power communication node

- Luminaire is able to communicate wirelessly with a remote lighting-control network

DALI Part 250 (Power Supply) and DALI Parts 251-3 (Data)

DALI-2 LED driver with integrated bus power supply and Data

Communication node

Typically a DALI “gateway” to wireless protocol of choice

Functions as DALI application controller
Outdoor luminaires

- Auxiliary power supply (AUX) required if bus power supply is not sufficient for node.

**AUX Power Supply specification**

- DALI Part 250 (Power Supply) and DALI Parts 251-3 (Data)

**Optional AUX supply**

- DALI-2 LED driver with integrated bus power supply and Data

**Communication node /sensor**

In intra-luminaire DALI bus applications, a sensor is often integrated with communication node.
**Luminaire with secondary node**

- **LEDs**
- **Communication node / sensor**
- **Optional AUX supply**
  - DALI-2 LED driver with integrated bus power supply and Data
- **Intra-luminaire DALI bus**
- **Secondary control device e.g. motion sensor**

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Benefits of implementing specifications

Enabling smart DALI-2 LED drivers:
• Drivers can report operational data relating to energy usage, diagnostics and maintenance
  – Provides luminaire owner with valuable information relating to energy consumption, failures etc
• Drivers inside luminaires can also report luminaire-specific data
  – Useful for asset management etc
→ Intelligent, connected luminaires that participate the Internet of Things (IoT)

Providing power to DALI devices:
• Drivers with integrated bus power supply can provide power to a sensor or communication module (DALI control device) that is incorporated into a luminaire
• Simplifies integration of sensors and/or communication modules in luminaires
• Another DiiA specification defines an auxiliary power supply (AUX) if more power is needed

Enabling smart, connected LED luminaires:
• Wireless module can exchange driver/luminaire data with remote network infrastructure
  – Typically, the node is a DALI “gateway” to the wireless protocol of choice
New DiiA specifications
Details
Data specifications – General

• DALI-Data Specifications define the location, type and format of data stored in the memory banks of DALI control gear.

• Accessibility of data:
  – Defined by adding Read-Only and Read-Write attributes to cells in a memory bank.
  – Specifications also allow a manufacturer to provide a vendor-specific means to protect individual memory cells (read protection or write protection is possible).

• A latching mechanism provides the possibility to read synchronised data across multiple drivers. This is useful, for example, for energy metering.
Data specifications – Parts 251

DALI Part 251 – MB#1 Extensions (luminaire data)

• Describes how memory bank 1 can be used by a luminaire manufacturer to store additional information, which has no impact on the functionality of the control gear.
  – Inventory-related information for asset management
  – Other luminaire-specific information, such as: Nominal light output, power at minimum dim level, CCT, light distribution type.

• Allows manufacturer to encode data about the luminaire – such as part number, or nominal light output – in the factory. When the luminaire is installed, the data is readily available to the lighting-control network.
  – A utility company or lighting-installation owner could use this capability to monitor and manage their lighting assets accurately and efficiently.
Data specifications – Parts 252 & 253

DALI Part 252 – Energy Reporting
• Enables a driver to provide information on its power and energy usage.
• Active energy and power (mandatory), apparent energy and power (optional) and load-side energy and power (optional).

DALI Part 253 – Diagnostics & Maintenance
• Describes data related to driver, LED light source and luminaire.
• Examples of driver-related data: total operating time, total number of starts, power factor, driver derating due to light source thermal overload, output power limitation, thermal shutdown
• Examples of light-source-related data: On time, number of starts, voltage, current, short circuit, open circuit
• Examples of luminaire-related data: rated median useful life of luminaire, internal driver reference temperature
Power Supply specifications – Part 250 & AUX

Specifications define how DALI control gear can supply power to connected DALI devices, either via an integrated bus power supply (Part 250) or via an optional AUX power supply (AUX specification).

DALI Part 250 – Integrated Bus Power Supply
• Describes how a control gear with an integrated DALI bus power supply can provide power to a connected DALI control device
• The capabilities and configuration of the integrated bus power supply are given and set via parameters in memory banks in the control gear
• Control gear reports key data for bus power supply, such as guaranteed supply current and maximum supply current
• DALI application controller can enable or disable the integrated bus power supply. This can also be achieved during production, for example by the luminaire manufacturer.

AUX Power Supply
• A separate DiiA specification that defines an optional AUX power supply, provides additional 24V power supply if required.
  – Does not use memory banks