DALI-2: The global standard for smart, digital lighting control in the IoT era

物聯網時代智慧，數位，照明控制的全球標準

Scott Wade, DiiA Technical & Certification Manager – DiiA
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DALI-2: The global standard for smart, digital lighting control

Digital Addressable Lighting Interface

- **World-wide standard** for lighting control communications
- Technically managed in the open standard **IEC 62386**
- Driven by Digital Illumination Interface Alliance (DiiA)
- Ensures **interoperability** through testing, certification and registration with trademark use
- **Control, configuration & querying** of devices over a 2-wire bus
- **Individual, group & broadcast addressing** to any DALI device
- DALI, DALI-2 and D4i trademarks owned by Digital Illumination Interface Alliance
Membership (October 2019)

- **190+ members** world-wide

- Membership allows DALI trademark use:
  - **600+** DALI-2 certified products
  - **1000+** DALI version-1 registered products

- Membership types:
  - Regular
  - Associate
  - **Community registration** – for luminaire makers
# Membership benefits

<table>
<thead>
<tr>
<th>Membership Type</th>
<th>Associate Member</th>
<th>Regular Member</th>
<th>Community (Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to DiIA test sequences</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Certification of DALI-2 products, use of DALI-2 logo on certified products</td>
<td>X</td>
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<tr>
<td>Use of logos (DALI-2, DALI version-1) on luminaires containing DALI devices from DiIA members</td>
<td>X</td>
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<tr>
<td>Use of DALI version-1 logo on products other than luminaires</td>
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<tr>
<td>Use of DiIA logo and DALI version-1 logo for marketing materials</td>
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<tr>
<td>Access to members-only website</td>
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<tr>
<td>Participation in General Assembly meetings</td>
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<tr>
<td>Receive membership communication</td>
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<tr>
<td>Access to draft deliverables (test sequences, specifications)</td>
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<td>Approval of final deliverables</td>
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<td>Participation and voting in working groups. Contribute to DiIA roadmap and development of test specifications.</td>
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<tr>
<td>Participation in interoperability events (Plugfests)</td>
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<tr>
<td>Eligible for Board of Directors membership</td>
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</tbody>
</table>

Membership benefits: [www.dali2.org/membership/benefits.html](http://www.dali2.org/membership/benefits.html)
Member companies

For the latest list of members:
www.dali2.org
First DiiA Members’ Plugfest Vienna 4-5 September

- 18 companies attended, bringing an estimated 70-100 products
- Control gear, control devices and bus power supplies
- 1 to 1 testing, as well as larger system testing
- Excellent cooperation between members to develop DALI.
- All gained confidence in their products, with many finding minor issues or areas for improvement.
DiiA events in 2020 – under consideration

DiiA is considering events in the Asia-Pacific region in 2020

- Please let us know if your company is interested in participating in DiiA events in 2020
- Several possibilities are:
  - Plugfest (product testing event)
  - Technical training (DALI-2 and D4i specifications)
  - DALI Summit + Seminars
- Which location(s) are preferred? For example:
  - Hong Kong
  - Shenzhen
  - Shanghai
  - Beijing
  - Taipei
  - Tokyo
Key facts – devices

Currently, the standard describes **three basic types** of devices:

- **Control gear**
  - Normally directly connected to the lamp (example: LED drivers)

- **Control devices**
  - Application controllers: Make decisions and control the lights
  - Input devices: Provide information to the system (example: occupancy sensor)

- **Bus power supplies**
  - Provide typically 16 V, up to 250 mA to power the bus.
Key facts – technical limits

• Maximum 64+64 addresses per DALI subnet
  • 64 drivers (control gear)
  • 64 control devices

• Maximum 300 m cabling (between furthest-apart devices)

• 250 mA max. bus power supply
Key facts – digital benefits

• **Digital benefits**
  - Robust communication
  - Addressing: individual (64+64), groups (16/32) and broadcast (all)
  - Flexible: Changes can be made via software
  - Flexible: Simple operation “out-of-box”
  - Two-way communication (feedback)

• **Cabling benefits**
  - Standard 2-core cable (1.5mm²)
  - Polarity-free & free wiring topology
  - DALI power and data on same pair of wires
DALI benefits – light output

• “If you ask for 50%, you get 50%”
  • The dimming curve is standardised and tested
  • This means that devices follow the same dimming curve, maintaining light output consistency
DALI benefits – colour control

• Allows simple control of colour:
  • RGBWAF for individual control of each colour channel
  • Tc/tuneable white for colour temperature control

• Allows precise and repeatable selection of colour:
  • xy

• Allows smooth fading between colours

• For best results, xy and Tc colour types allow calibration
DALI benefits – emergency lighting

• Automated self-testing:
  • In many countries, there is a legal requirement for periodic testing of emergency lighting
  • DALI allows this to be automated:
    ▪ Function test: quick test of the battery, charging circuit, driver/relay and lamp
    ▪ Duration test: checks operation for the rated duration (for example: 1 h, 3h...)

• Feedback:
  • Test results and information on failures
  • Other information, including battery charge level, lamp operating hours and more.
**DALI benefits – Data/diagnostics for IoT**

Recent new specifications from DiiA:

- 5 new specifications for control gear and a 24V power supply (parts 150, 250-253)
  - Provide: [luminaire data](#), [power/energy measurement](#), [diagnostics](#) information
- New Trademark to indicate suitability for [intra-luminaire](#) and small systems up to 4 luminaires

Coming soon:

- New specification for [luminaire-mounted control devices](#) (part 351)
- [Certification](#)
D4i specifications for intra-luminaire DALI (outdoor luminaires)

- AUX supply*
- DALI-2 LED driver with integrated bus power supply and data
- LEDs
- Power
- Data
- Intra-luminaire DALI bus
- Luminaire
- Communication node / sensor (part 351)

Part 150/AUX
DALI Part 250 (integrated bus PSU)
DALI Part 251-3 (operational & diagnostic data)

*Auxiliary (AUX) power supply can be in a driver, or implemented in a separate product.
Zhaga – D4i

Zhaga-D4i node
(sensor and/or wireless communication node)

Zhaga-D4i luminaire (outdoor)

Intra-luminaire DALI bus

Second node

D4i driver

Zhaga receptacle
Specifications and tests – Recent or in progress

- **Input devices (301-304)**
  - Tests released and certification started (**May 2019**)

- **D4i and parts: 150, 250-253, 351:**
  - D4i certification: starting soon
  - Updates to parts 150, 250-253
  - New specification, part 351: Luminaire mounted control devices

- **DALI-2 tests for the following are in progress:**
  - 209 – Colour control
  - 208 – Switching control gear
  - 205 – Dimmer
  - 202 – Self-contained emergency lighting
Specifications and tests – Work in progress (2)

- Other specifications in progress:
  - 306 – Generic sensor
  - 305 – Colour sensor (IEC)
  - DALI-wireless

- Future work:
  - Tests for 105 – Firmware update
  - Tests for 220 – Central emergency
DALI wireless

• DiiA recently announced that two routes are being investigated:
  1. DALI wireless gateway
  2. DALI wireless using IEC 62386-104

• The DiiA Technical & Certification Work Group is now working on both options
DALI wireless – Gateway

- DALI wireless \textit{gateway}:
  - Interface between a DALI-wired system and a wireless system such as Zigbee or Bluetooth™
  - The wireless system used initially will be announced later.
  - A specification will describe which commands and data will be supported across the interface.
  - Tests will be developed to allow certification.

- The next page shows an \textbf{example} of the \textit{system architecture}:
  - Including 2 gateways
  - D4i luminaires are single luminaires containing DALI-wired control gear and possibly a sensor
DALI wireless – Gateway: example architecture

Gateway: example architecture

- Gateway between DALI-wired and Zigbee/Bluetooth
- D4i Luminaire
- Zigbee or Bluetooth

Wireless eco-system
DALI wireless – 104 solution

- DALI wireless using IEC 62386-104
  - Part 104 was published in May 2019
  - Support for 2 underlying wireless protocols is specified: Bluetooth™ mesh and UDP
  - The T&C Work Group will determine any additional requirements that are necessary.
  - Tests will be developed to allow certification.

- The next page shows an example of the system architecture
  - Products in the wireless mesh are DALI-wireless using part 104
  - A device with both DALI-wired and DALI-wireless connections can be used to connect a D4i luminaire
  - D4i luminaires are single luminaires containing DALI-wired control gear and possibly a sensor
DALI wireless – 104 solution: example architecture

Application Controller

Wireless-mesh
Part 104 over Thread or Bluetooth Mesh

no protocol
gateway needed

D4i Luminaire

Input device

Control gear

Input device

Control gear
Further information – DiiA website:

• **DALI Quick Start Guide:**
  http://www.dali2.org/downloads/

• **Product database:**
  http://www.dali2.org/products

• **Membership benefits:**
  http://www.dali2.org/membership/benefits.html

• **D4i:** https://www.dali2.org/d4i/

• **Contact us:**
  info@digitalilluminationinterface.org