Specifying with DALI

A Lighting Designer's Guide

DALI® Alliance

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1. Scope

This document is a comprehensive guide to specifying with DALI. It primarily covers DALI wired technology, System design considerations, DALI product database usage, and advanced features like colour control, data monitoring, and integration with emergency lighting. It serves as a detailed guide for professionals in designing and specifying DALI-based lighting control systems, ensuring they leverage the latest in lighting technology for enhanced efficiency, interoperability, and functionality.

Key Milestones in DALI Development and Certification

Development of the DALI Protocol

Late 1990s

The Digital Addressable Lighting Interface (DALI) protocol was developed through a collaboration of various members of the lighting industry.

Introduction of IEC 62386

2009

The IEC 62386 standard was introduced as the international framework for DALI systems.

Launch of DALI-2 Certification

2017

The DALI-2 certification programme was launched.

Formation of the Digital Illumination Interface Alliance

The Digital Illumination Interface Alliance (DiiA) was established in response to industry demands for independently verified certification programmes and to drive further innovation.

Introduction of D4i Certification

2019

The D4i certification program was introduced for lighting control in (or on) luminaires (luminaire-level lighting control - LLLC).

2020

Rebranding as the DALI Alliance

The organisation was rebranded as the DALI Alliance, becoming the global industry organisation for DALI lighting control.

Introduction of DALI+

2024

DALI+ with Thread certification programme was introduced extending choice, flexibility and creative freedom for lighting designers and specifiers by supporting the development of wired, wireless and IP based systems, using DALI throughout.

2. Terms and Definitions

Table 2-1 Terms & Definitions

Term	Definitions
Ballast	A type of control gear, typically referring to those for fluorescent lamps.
Broadcast	A method of sending a command to all DALI devices on the bus simultaneously.
Commissioning	The process of configuring and setting up DALI devices and networks, including assigning addresses, creating groups, and defining scenes.
Commissioning Tool	Software or hardware used to configure and commission DALI systems.
Control device	Device that is connected to the bus and sends commands to other devices connected to the same bus. Control devices are application controllers and/or input devices.
Control gear	Device that is connected to the bus and receives commands to control at least one output, typically a lamp, in a direct or indirect way.
Application Controller	Control device that is connected to the bus and sends commands to control input devices and/or control gear connected to the same bus. For example, could adjust lighting levels, modify scenes, or implement automation functions.
Dimming Curve	A predefined curve that determines how a DALI ballast or driver dims the light output in response to control commands (level instructions).
Driver	A type of control gear, typically referring to those for LED light sources.
Emergency Lighting	DALI devices and luminaires that support emergency lighting functionality, ensuring illumination during power outages.
Gateway	A control device that allows DALI devices to be controlled or used by other communication protocols.
Group	A grouping of DALI control gear or control devices or input device instances that can be simultaneously addressed by a command sent to the group.
Input device	A type of control device that provides information or measurements to application controllers. Examples are push-buttons, occupancy sensors and light sensors.
Multi-master	A control device that is designed to share the bus with other multi-master control devices.
Single-master	A control device that is not capable to share the bus with multi-masters, except possibly when polling input devices.
Bus Power Supply	A component that provides power to the bus to enable communications, and as the supply for bus-powered devices.
Scene	A predefined lighting state, including light level and colour, that can be recalled to create different lighting moods or scenarios.
Sensor	An input device that detects occupancy, light levels, or other environmental factors.
Short Address	A unique identifier assigned to each DALI device on the bus for individual control, configuration, or querying.
Subnet	A system of DALI devices connected to a single DALI bus.

3. DALI® Lighting Technology

What is DALI?

DALI, or Digital Addressable Lighting Interface, is a protocol or language for wired and wireless lighting systems, allowing them to 'talk' to and 'understand' each other, all standardised under IEC 62386 and DALI Alliance specifications. It allows precise and intelligent communication between various lighting components, enabling designers to create more versatile, responsive, and innovative lighting solutions*.

3.1 Components in a DALI System

DALI systems consist of several crucial components, each playing a pivotal role in the overall functionality of the system:

Input Devices: These are user interfaces like switches, dimmers, or sensors that send user inputs or environmental measurements to the application controller.

Application Controller: This is the system's brain. It processes inputs and makes decisions, sending instructions to other components in the system.

Control Devices: These are application controllers or input devices, or both.

Wired DALI Bus: This is the system's communication line, a two-wire conduit carrying power for bus-powered devices such as sensors, as well as data to interconnect all components.

Bus Power Supply: This component supplies power to the DALI bus, providing typically 16 V and up to 250 mA of current. Can be a standalone product or integrated within control gear or a control device.

Control Gear: Typically LED drivers, they provide power to the lights as directed by the application controller.

Luminaires: These lighting fixtures contain or have attached DALI Control Gear to deliver light output as per received instructions.

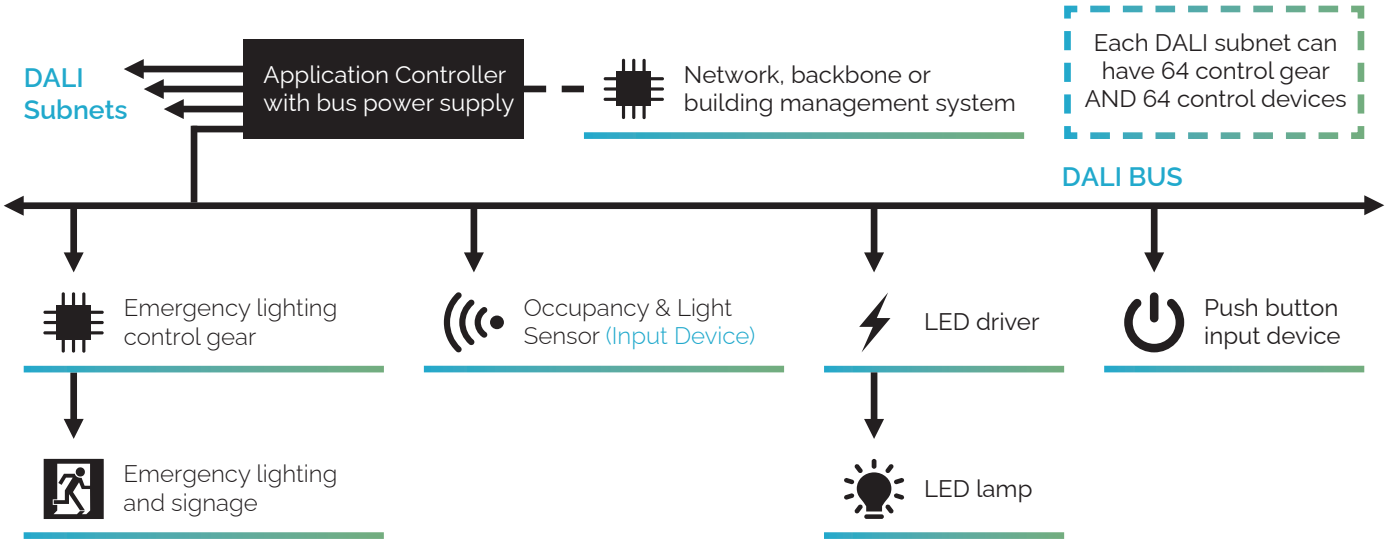


Figure 1. An Example of a DALI Lighting Control System

* **Note:** Wireless systems will be addressed in a future document.

3.2 Wiring in a DALI System

Wiring in a DALI system is relatively straightforward. It follows a master-responder architecture where the application controller sends information and instructions, and the luminaires respond to these instructions or information requests.

Structure and Signal Flow
DALI uses a two-wire bus to transmit data and supply power on the same pair of wires, eliminating the need for a separate bus cable and simplifying the overall structure.

Ease of Installation
Except for devices containing a bus power supply, where the connection will be marked 'DA+' and 'DA-', the wires in a DALI system are not polarity sensitive, meaning the cores can be connected to any terminal. This feature significantly reduces the likelihood of wiring errors commonly encountered in traditional lighting systems and ensures a smoother installation process.

Topology Flexibility
DALI supports flexible wiring topologies like daisy-chain, star connections, or a combination of these (Figure 2), using a standard 1.5mm^2 two-core cable. This flexibility allows for ease of installation and adaptability to different layout needs. The total cabling distance is limited to 300m (except in cases where the cable layout and characteristics are specially designed and selected) and allows a maximum bus current of 250mA.

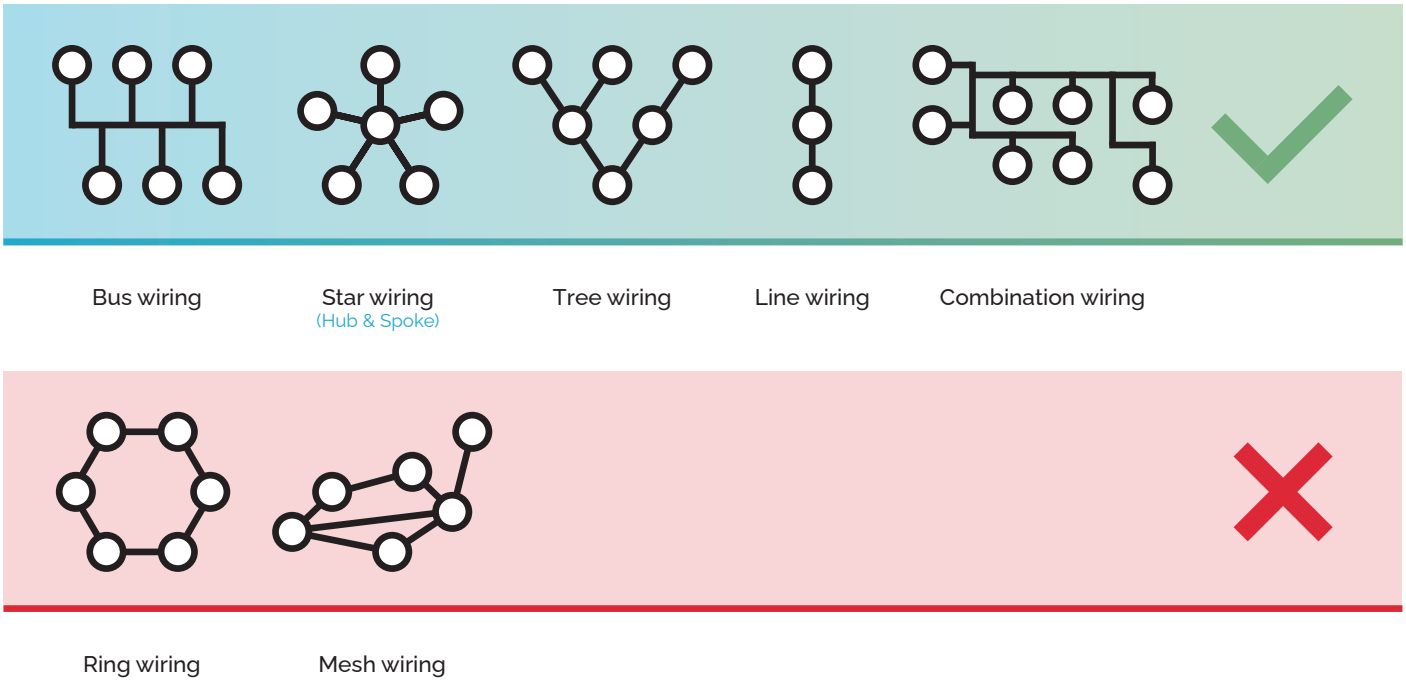


Figure 2. DALI Wiring Topologies

3.3 Addresses and Groups in a DALI System

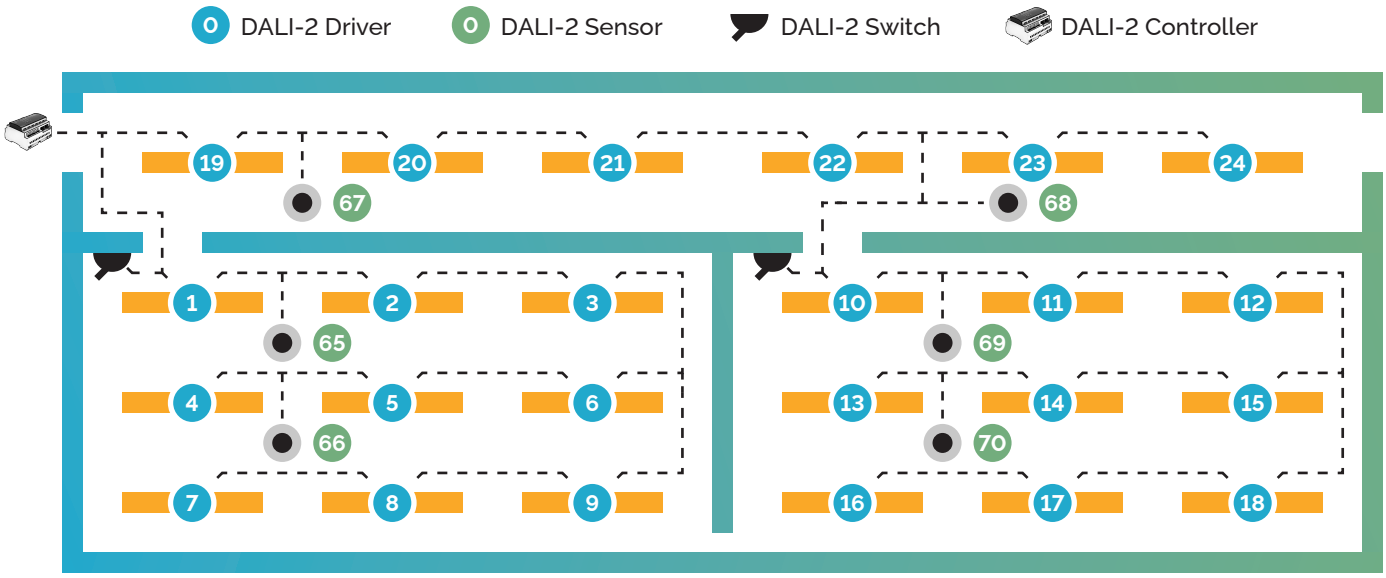


Figure 3. An Example of Addresses and Groups in a DALI System

Figure 3 showcases a DALI system managing corridor lighting flanked by classrooms, illustrating the seamless interaction between classroom and corridor lighting control.

Unique Addressing
Each luminaire and control device (e.g., sensor/switch) within the DALI system has a unique identifier. This allows for individual control of each element. A single DALI system can address up to 64 control gear units (LED drivers) and 64 control devices (sensor/switch), totalling 128 unique addresses.

Network and Commissioning
All control gear and control devices are connected to the same data bus network. Commissioning software and certain application controllers can automatically assign unique addresses to each device within the system.

Grouping for Functional Control
Once addressed, DALI systems allow the creation of groups that reflect space usage. Imagine a "club" area within a school that serves as a central activity point. A DALI group can be formed to logically combine the control gear and control devices in this space. Each group responds only to instructions specifically addressed to it, ignoring commands meant for other groups.

3.4 How DALI Works

In a DALI system, devices are controlled, configured, and provide information through a two-wire bus. This system makes it easy to access pre-programmed scenes and reconfigure settings using software.

Commands are sent to DALI devices for specific operations:

- **Control Commands (level instructions)**
  Adjust light intensity or colour.
- **Configuration Commands**
  Modify device settings.
- **Query Commands**
  Request device status.

Scenes are preset lighting configurations for individual lights or groups. Each control gear stores up to 16 scenes, and when activated, scenes adjust the lighting to predefined levels and colours.

3.5 The Benefits of DALI Compared to Traditional Systems

The below graphic summarises the wide-ranging benefits of DALI compared to traditional systems such as analogue systems (0/1-10V) and switched systems.

The Benefits of DALI Compared to Traditional Systems

	Benefit of DALI	Limitations of traditional systems
Precise Control	Lighting environments can be tailored to suit specific needs.	Traditional systems have limited control, which can make it difficult to make precise adjustments.
Energy Efficiency	DALI can be used to optimise energy usage, resulting in significant cost savings.	Energy efficiency depends on the type of lighting fixtures and lighting control features.
Flexibility	Individual and group control enables DALI systems to adapt to changing lighting needs without the need for extensive rewiring.	Traditional systems may require significant time and expense to modify, as the process often involves rewiring.
Scalability	DALI devices can be easily added and removed to suit building sizes and layouts.	Extending systems requires complex rewiring.
Scene Control	DALI supports pre-programmed scenes for quick transitions between lighting setups.	Limited scene setting capability.
Interoperability	DALI certified devices from different DALI manufacturers are compatible with each other.	Lack of standardisation limits interoperability.
Diagnostic Capabilities	With DALI Diagnostics add-on feature, maintenance becomes easier with detailed updates on the device's status, as any issues can be quickly identified.	Analogue systems provide minimal diagnostic information, leading to longer downtime during maintenance.

The Benefits of DALI Compared to Traditional Systems continued

Simple Wiring

Benefit of DALI	Limitations of traditional systems
DALI's simplified wiring reduces the risk of installation errors.	Analogue systems have individual wiring setups, increasing the risk of installation errors.

Integration

Benefit of DALI	Limitations of traditional systems
A DALI system can be seamlessly integrated with other building automation systems by selecting an application controller equipped with the necessary features.	Limited integration possibilities.

Dimming Capabilities

Benefit of DALI	Limitations of traditional systems
DALI provides standardised dimming curve enabling precise, repeatable dimming.	Lack of standardised dimming curve results in inconsistent light output.

Environmental Benefits

Benefit of DALI	Limitations of traditional systems
DALI lighting systems can be configured for energy-efficient operation, contributing to sustainability goals.	Traditional systems usually consume more energy due to limited control capabilities.

Global Standardisation

Benefit of DALI	Limitations of traditional systems
DALI is globally recognised, ensuring compatibility with DALI component manufacturers worldwide.	Analogue systems lack standardised protocols, leading to potential compatibility issues in installations.

Compliance with Regulations

Benefit of DALI	Limitations of traditional systems
DALI can optimise lighting usage and reduce energy consumption to meet energy efficiency and lighting control standards.	Analogue systems can comply with specific regulations, but they may have limitations in meeting more advanced lighting control standards.

3.6 How Different Persona Groups can Benefit from DALI

Table 3-1 illustrates how various persona groups benefit from DALI. Take a closer look and discover the advantages it provides.

Table 3-1 How Different Persona Groups Benefit from DALI

Feature	Lighting Specifiers & Designers	Occupants/Users	Building Owners	Maintenance Personnel
Precise Control	Use DALI to create the perfect ambience or aesthetic.	Experience optimal lighting for all your activities.	Boost the property value with precise and efficient lighting.	Resolve issues quickly with clear, detailed diagnostics.
*Energy Efficiency	Create designs that are as economical as they are beautiful.	Enjoy the luxury of lower bills by using efficient lighting.	Improve property appeal with modern, energy- saving lighting.	Work with energy-efficient systems that require minimal interventions and benefit from lower operating costs.
Flexibility	DALI lets you change lighting designs with ease to suit every need.	Enjoy lighting that changes to fit every mood and moment.	Adapt building lighting to keep spaces fresh and efficient.	Easily adjust and maintain different lighting setups.
Scalability	With DALI, adjusting the size of your lighting designs is made easy.	Experience lighting that evolves and adapts to your varying needs.	Optimise operations with scalable lighting solutions.	Easily integrate new DALI devices without extensive rewiring.
Scene Control	Create different atmospheres with DALI's scene-setting capabilities.	Switch between lighting scenes with a simple click.	Improve energy savings and ROI by setting up energy-efficient scenes.	Efficiently manage multiple scenes to reduce downtime.
Interoperability	Design with confidence, integrating different DALI devices, knowing they'll work together seamlessly.	Experience effortless control across various DALI manufacturers and devices.	Improve tenant satisfaction with smooth, integrated building automation using different DALI devices.	Maintain a harmonious system where all DALI devices can interact seamlessly regardless of the manufacturer.
*Remote Monitoring & Control	Adjust lights remotely with ease using DALI.	Easily control lighting from any location.	Cut costs with centralised, remote control of building lighting.	Streamline maintenance with centralised, remote monitoring and control.
Diagnostic Capabilities	Spot and fix issues quickly with DALI's detailed diagnostics.	Experience reliable lighting with quick issue resolution.	Ensure that equipment lasts longer and operates at its best.	Use detailed diagnostics to make maintenance efficient and reduce downtime.
Simple Wiring	Designing is made easy with the convenience of DALI's simple wiring.	Enjoy hassle-free and dependable installations.	Save on installation costs thanks to DALI's simplified wiring.	Speed up installations and reduce wiring-related issues.

Table 3-1 How Different Persona Groups Benefit from DALI Continued

Feature	Lighting Specifiers & Designers	Occupants/Users	Building Owners	Maintenance Personnel
*Integration	Integrate lighting smoothly with other systems using DALI.	Enjoy seamless interaction with integrated building automation.	Enhance building efficiency and satisfaction with integrated systems.	Achieve reliable control and smooth integration across systems.
Dimming Capabilities	Create dynamic effects with DALI's support for dimmable fixtures.	Adjust lights to your preference, creating the perfect ambience.	Improve energy efficiency with adjustable lighting.	Provide users with the ability to adjust lighting levels to meet their needs easily.
*User-Friendly Interface	Offer intuitive DALI interfaces for effortless lighting control.	Enjoy easy interaction with user-friendly lighting systems.	Increase tenant satisfaction with intuitive, user-friendly interfaces.	Train users effectively on intuitive DALI control interfaces.
*Environmental Benefits	Go green with DALI's energy-efficient operation.	Live sustainably with eco-friendly lighting.	Gain recognition with green certifications and sustainable operations.	Support sustainability goals with the security of supply from DALI.
Global Standardisation	Rely on DALI's global standards for consistent, compatible designs.	Experience consistent, reliable lighting.	Simplify operations and procurement with standardised solutions.	Ensure that all systems are consistent, standardised, and reliable.
*Compliance with Regulations	Use DALI to assist in aligning designs with applicable standards and regulations.	Enjoy spaces that are compliant and meet the highest standards.	Increase property value and maintain a good reputation by using DALI to help meet regulations.	Use DALI to help ensure systems meet industry standards, minimising risks of non-compliance.

* **Note:** These benefits depend on the capabilities of the application controller, the lighting control system, and how the system has been commissioned and maintained.

3.7 Real-World Applications of DALI

Table 3-2 showcases different scenarios where DALI lighting control can be applied effectively. While it is not a complete list, it provides insights into the diverse applications of DALI.

Table 3-2 Real-World Applications of DALI

Application Scenarios	Description	DALI Award Winner / Case Study
Offices	Precise lighting control for productivity and energy efficiency.	Shanghai LONTRI – Estée Lauder R&D Centre (2023)
Retail Stores	Flexible lighting designs to enhance customer experience.	Delmatic – Battersea Power Station (2022)
Industrial Warehouses	Optimal lighting for safety and efficient operations.	Synapse Wireless – Uline Store C6 (2022)
Residential	Tailored lighting for comfort and aesthetics in homes.	Sunricher – Taiziwan High-end Building (2022)
Hospitality and Hotels	Inviting atmospheres for guests with scene control.	Bluebottle – Ritz Carlton Hotel (2023)
Educational Settings	Adjustable lighting for learning environments.	Zencontrol – University of Warwick Faculty of Arts (2021)
Hospitals and Healthcare	Reliable lighting for patient care and well-being.	Zencontrol – Louisa Martindale Building (2023)
Outdoor and Landscape	Dynamic and energy-efficient lighting to enhance outdoor spaces.	Zencontrol – Louisa Martindale Building (2023)
Entertainment Venues	Dramatic lighting effects for concerts, shows, and events.	Smartscape Queensland Ballet in Brisbane (2022)
Transportation (e.g., Airports, Train Stations)	Controlled lighting in transit hubs for safety and comfort.	Delmatic – Zayed International Airport (2023)
Public and Government Buildings	Efficient lighting solutions for public facilities and offices.	KSLD – Scottish Parliament Debating Chamber (2020)
Sports Venues	Dynamic lighting setups for sporting events and arenas.	Synapse Wireless – Uline Store C6 (2022)
Industrial Manufacturing	Precision lighting control for manufacturing processes.	Volvo Group Real Estate – Battery Pack Factory (2023)
Residential Buildings	Efficient and adjustable lighting solutions for residential complexes.	Morlights – Ko'ula at Ward Village (2023)
Libraries	Balanced lighting for reading and study areas in libraries.	Helvar on behalf of Elekon Energy Systems – People's Library Ankara (2020)
Cinemas and Theatres	Enhance the audience experience with cinematic lighting.	Tridonic – Roxy Cinemas (2023)

4. The DALI Protocol

The DALI protocol is outlined and defined in the international standard IEC 62386 and in specifications written by the DALI Alliance.

For lighting designers, understanding the differences between DALI version-1 and DALI-2 products is essential to specifying efficient, interoperable, and reliable lighting systems.

4.1 DALI version-1 Pre-certification Registration Programme

DALI version-1 was a pre-certification registration programme based on an older version of the DALI protocol. Registration for new DALI version-1 products ended in April 2022. This programme applied primarily to control gear and did not include devices such as application controllers, sensors, or bus power supplies.

While manufacturers were responsible for carrying out their own tests to ensure their products comply with DALI version-1, the DALI Alliance did not verify these results. However, if a control gear passed the DALI version-1 testing requirements, it had to be registered with the DALI Alliance before displaying the DALI logo (Figure 4).

DALI version-1 products, also known as 'registered products', are listed online in the DALI Product Database.

DALI version-1 products or pre-certification products are not recommended for new designs.

Figure 4. DALI logo used on DALI version-1 registered products.

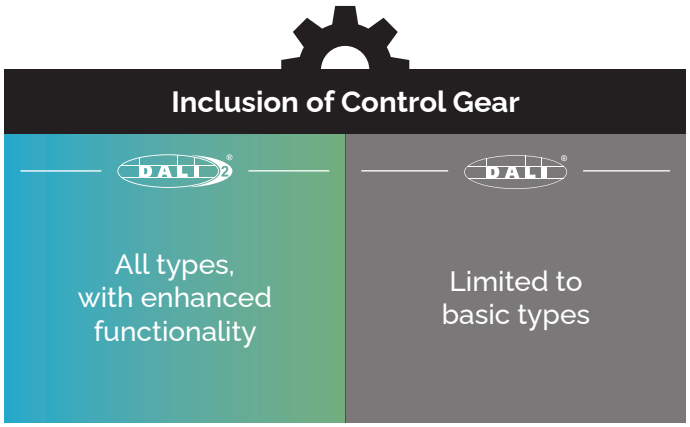
4.2 DALI-2 Certification Programme

DALI-2 is a certification programme based on the latest version of the DALI protocol. This covers a wide range of devices, such as control gear, application controllers, input devices (sensors), and bus power supplies.

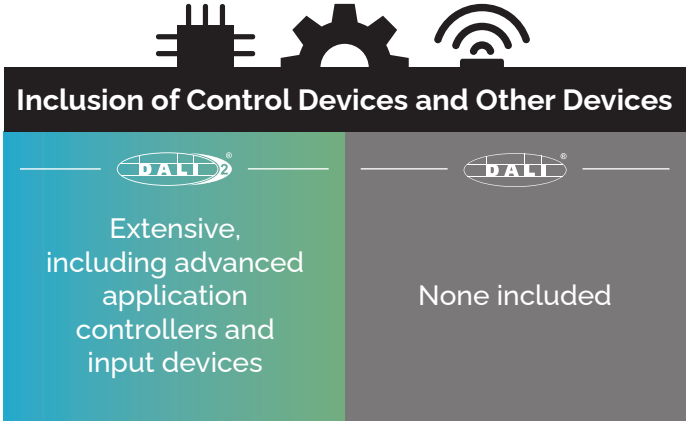
DALI-2 products must pass extensive testing by the member company that owns, designs, or manufactures the product. Alternatively, testing can be conducted by an independent accredited test house. The results are then verified by the DALI Alliance. Only after verification are products listed in the DALI Product Database and allowed to display the DALI-2 logo.

Figure 5. DALI-2 logo for use on DALI-2 certified products.

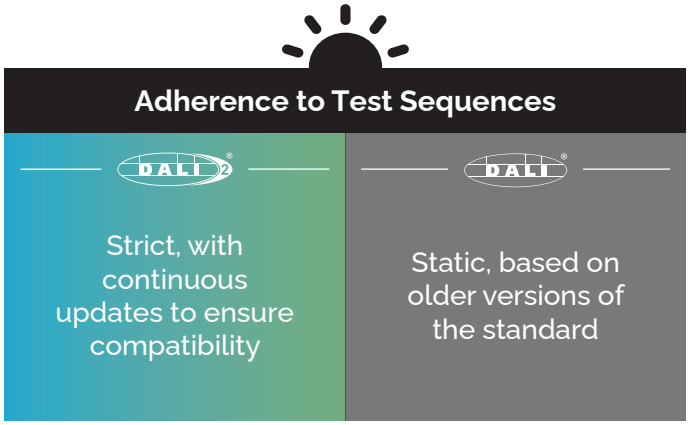
Table 4-1 Comparing DALI-2 Certification and Pre-certification DALI version-1



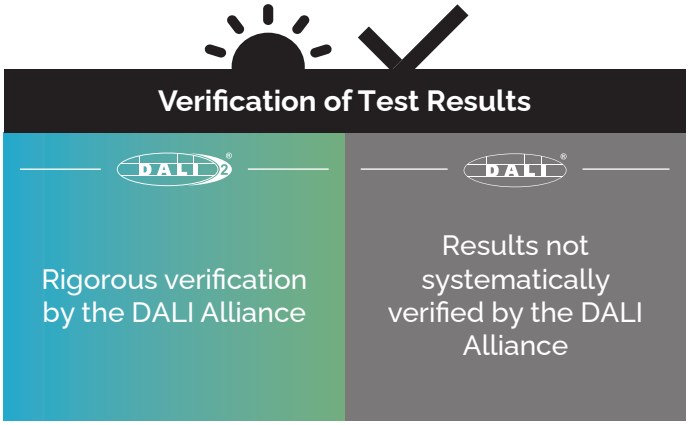
DALI-2 certified control gear provide broader and more advanced control gear options



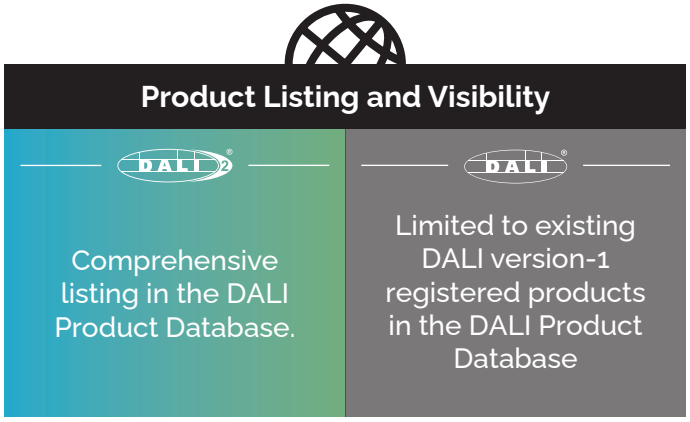
DALI-2 certification supports a broader array of devices, offering more comprehensive control possibilities



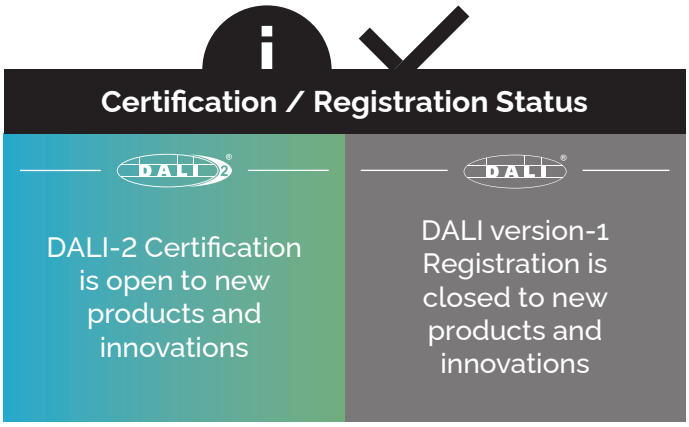
DALI-2 certification ensures interoperability between DALI-2 certified products and compliance with newer technologies



DALI-2 certification provides greater assurance of product reliability and performance



DALI-2 offers a wider range of products and likely a longer support timeline



DALI-2 certification ensures future-proof product solutions

DALI Dimming

DALI-2 certification brought with it advanced dimming capabilities which allows a wider selection of fade times to enhance flexibility in lighting setups.

Key features of DALI with DALI-2 certified products
Here, we'll explore the essentials of DALI dimming. With a broader control over light levels and smart integration capabilities, it's all about giving designers precise and versatile control.

Detailed Light Control:

- Adjust light levels with exceptional range, from a subtle 0.1% to a full 100% brightness.

Smart Dimming Curves:

- Utilises dimming curves in sync with human eye perception, ensuring smooth and comfortable light adjustments.

Flexible Light Commands:

- Provides both direct and indirect commands to adjust light levels, ensuring smooth control of individual or grouped lights.
- Offers enhanced group and scene management to effortlessly control various lighting setups.

Efficient Two-Way Communication:

- Luminaires provide feedback about their current level and status, alerting to any issues or inconsistencies and allowing for confirmation of the desired light output.

Customisable Light Transitions:

- Designers can set how fast or slow lights change between different brightness levels, creating a visually comfortable space.

Interoperability:

- Provides consistent and reliable performance across products from different manufacturers.

Integration with Sensors:

- Can adjust light levels automatically in response to environmental changes, such as daylight availability or room occupancy, through communication with sensors and other input devices.

Critical Differences in Dimming Capabilities Between DALI version-1 Products and DALI-2 Certified Products

Table 4-2 highlights the key differences and enhancements in dimming capabilities between DALI version-1 products and DALI-2 certified products.

Table 4-2 Key Differences in Dimming Capabilities Between DALI version-1 Products and DALI-2 Certified Products

Feature	DALI version-1 Products	DALI-2 Certified Products
Compatibility	Unverified	Enhanced, with improved interoperability between different manufacturers' devices
Sensor Integration	Proprietary	Standardised
Fade Times	Limited configurability	Wider range of fade times, both faster and slower, for smooth transitions between light levels
Standardised Device Types	Control gear (e.g., ballasts, LED drivers)	Extended, including control devices (e.g., application controllers, sensors, and other input devices)
Error Handling	Basic	Advanced, with detailed feedback and error reporting

Example Scenario: Lighting Setup for a Luxury Department store

A luxury department store wants to install a lighting system that adapts to factors such as natural daylight availability and customer presence in each department. There are also specific lighting requirements for promotional products and displays.

With DALI-2 Certified Products

- **Precise lighting control:** The store can control how products are perceived.
- **Advanced Sensor Integration:** The store can use DALI-2 sensors that adjust lighting dynamically based on ambient light and occupancy to ensure optimal lighting conditions and energy efficiency.
- **Enhanced Device Control:** Application controllers can manage multiple lighting scenes to highlight featured products based on time of day or in-store events, enhancing the shopping experience.
- **Bi-Directional Communication:** Fixtures and sensors can communicate bi-directionally with the control system for real-time adjustments and feedback. If a light source fails or performs poorly, the system can detect it immediately, minimising downtime and maintaining the desired ambience.
- **Colour Control:** DALI-2 supports detailed colour control, which means the store can create nuanced lighting scenes, changing the colour temperature or hue based on the time of day or particular marketing focuses.

With DALI version-1 Products

- **No Sensor Integration:** DALI version-1 does not support sensors.
- **Basic Device Control:** Controlling lighting scenes is more basic, potentially requiring manual intervention or having limitations on scene complexity.

Verdict:

In this department store setting, DALI-2 shines due to its precision, adaptability, and real-time responsiveness. It ensures that the lighting aligns perfectly with changing conditions throughout the day, offering both a welcoming atmosphere and energy efficiency.

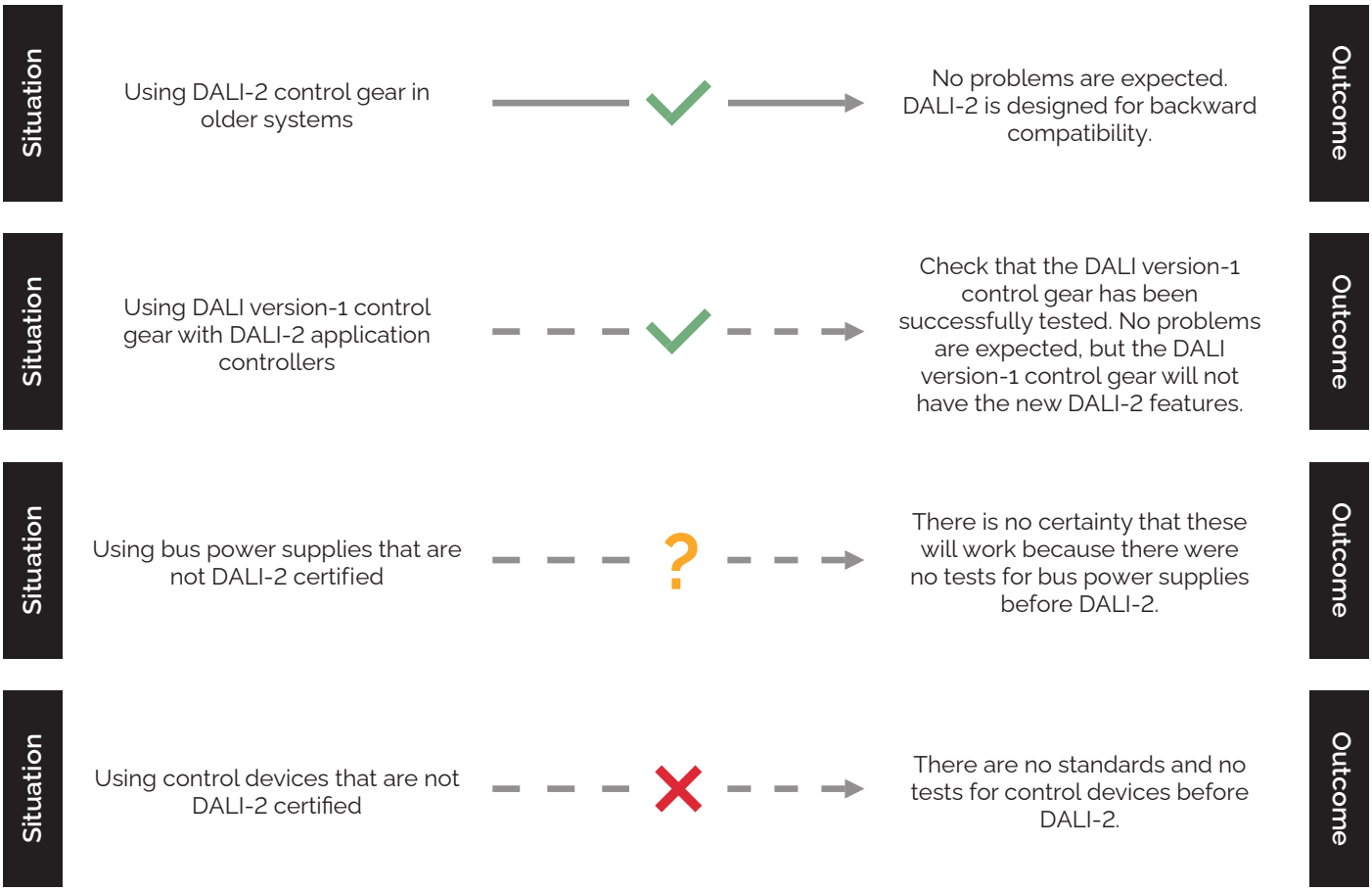
Application controllers orchestrate different lighting scenes seamlessly, enhancing product presentation regardless of the time or store events.

In conclusion, DALI-2 stands out as the optimal choice for modern retail lighting, offering precision, adaptability, and real-time responsiveness that enhance the shopping experience.

4.3 Mixed Systems of DALI version-1 Products and DALI-2 Certified Products

A lighting control system may use a combination of DALI version-1 and DALI-2 certified products when it is necessary to upgrade or expand existing infrastructure without replacing the older parts at once. This is typical when there are budget constraints.

Here, we explore potential outcomes when combining components from both DALI version-1 and DALI-2 certified products in a lighting system.



4.4 DALI Colour Control

DALI-2 simplifies choosing from the three standardised methods of colour control, known as colour types: Tunable White (Tc), RGBWAF, and xy coordinate. Certification makes specification easier.

Tunable White (Colour Temperature)

Choosing the right colour temperature is essential for a lighting designer when creating the perfect ambience and mood for a given space. In a fitness centre, for example, users want to feel energised and motivated during their workouts, which means subdued, dim lighting is not the best choice. However, in a romantic setting, soft and gentle illumination is desired.

With tunable white, you can adjust the colour temperature of white light to mimic natural light. Tunable White allows you to choose from shades, such as the warm, golden glow of an incandescent lamp or the cooler, more blue tone of sunlight at midday (Figure 5). This option provides more flexibility and control in lighting design compared to conventional analogue-based lighting systems.

RGBWAF

When creating different moods and visual effects in various environments, RGBWAF allows control over up to six colour channels, enabling a broad spectrum of colours. For example, combining red and blue can produce a dynamic and vibrant lighting effect with energetic and contrasting tones, while mixing blue and amber creates a peaceful and calming twilight ambience.

However, RGBWAF is a cost-effective solution but does not provide precise or consistent colour output across different luminaires. This makes it suitable for applications where absolute colour accuracy is less critical, such as decorative or ambient lighting in homes, restaurants, or entertainment venues.

xy coordinate (xy chromaticity)

This DALI Colour Control add-on dives deep into the nuances of colour, allowing precise and repeatable selection of every colour that the human eye can perceive, as shown in Figure 6, within the limits of the selected luminaire.

Picture yourself walking into a museum where artefacts are showcased under light that can replicate a natural environment. From a cloudy morning in the Himalayan mountains to the afterglow of sunset on a distant beach, you can accurately recreate every shade and tone with xy coordinate.

Unlike RGBWAF, which offers a broad colour range but lacks consistency across luminaires, xy coordinate ensures precise calibration of LEDs and control gear, delivering a uniform and repeatable colour output. This makes it ideal for applications where colour accuracy is critical, such as museums, galleries, and architectural lighting.

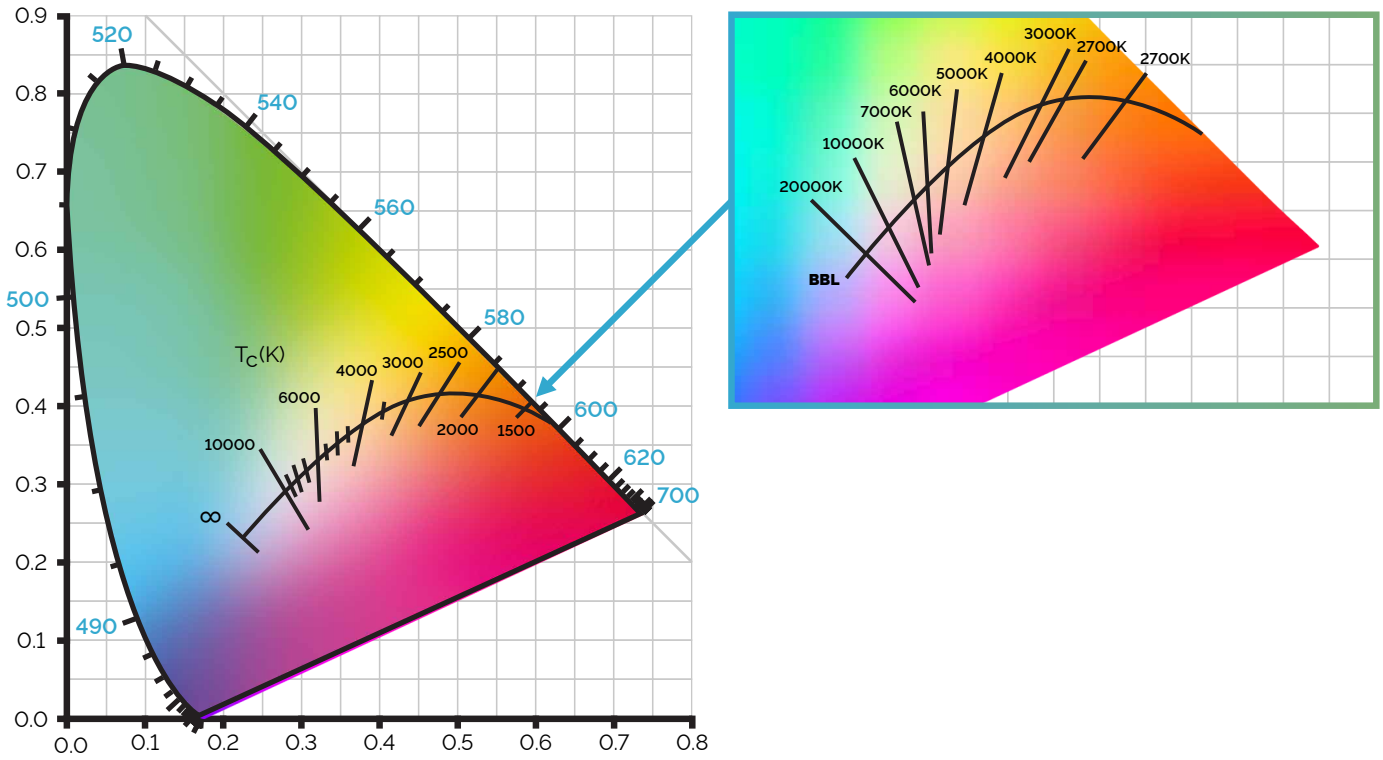


Figure 6. Tunable White CIE Chromaticity Curve and xy Coordinate CIE Chromaticity Curve (showing black body line)

Table 4-3 Features and Benefits of DALI-2 Colour Control

Feature	Benefit	DALI Colour Control Type
Colour Mixing	Create the desired lighting atmosphere or visual impact by combining colours to produce a broad spectrum of hues, shades, tones, and effects.	- RGBWAF - xy coordinate
Dynamic Colour Options	A variety of lighting colours can be created to complement themes, branding, or visual aesthetics perfectly.	- RGBWAF - xy coordinate
Fidelity and Accuracy	DALI-2 systems ensure that the desired colour and brightness remain consistent over time and across fixtures.	- Tunable White - xy coordinate
Individual Lighting Fixture Control	Lighting can be customised to meet the requirements of a space by accurately controlling the colour and intensity of each lighting fixture.	- Tunable White - RGBWAF - xy coordinate
Tunable White Lighting	Tunable White lighting enables customisation of the colour temperature to complement the décor of a room or create a specific ambience suitable for various activities.	- Tunable White - xy coordinate
Colour Changing Effects	A straightforward way to create dynamic and captivating visual effects that make spaces more engaging and memorable for occupants.	- RGBWAF - xy coordinate
Light Source and Control Gear Calibration	Precise calibration of the light source and control gear combination ensures optimal colour accuracy in your designs, enhancing the overall lighting experience.	- Tunable White - xy coordinate
Scene Programming	Users can recall specific settings and seamlessly transition between colour and brightness levels. This adaptability allows lighting to be customised to suit different activities and events.	- Tunable White - RGBWAF - xy coordinate
Group Control	Group control is a simple way to control and coordinate lighting effects across several lighting fixtures, which creates smooth and synchronised transitions of colours.	- Tunable White - RGBWAF - xy coordinate

Table 4-3 Features and Benefits of Colour Control Continued

Feature	Benefit	DALI Colour Control Type
Interoperability	Interoperability with other DALI-2 products ensures that users can trust that these devices will work together seamlessly and reliably.	- Tunable White - RGBWAF - xy coordinate
Energy Efficiency	Using only necessary colours or intensity reduces power waste, resulting in energy savings and a more sustainable lighting solution.	- Tunable White - RGBWAF - xy coordinate

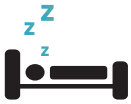
Examples of Suitable Environments for Implementing DALI Colour Control

Retail Outlets

Design attractive product displays that will catch the attention of potential customers.

Restaurant and Bars

Enhance the mood and ambience of your space while complementing the décor.



Hotels

Improve ambience and comfort with personalised lighting in rooms and shared spaces.

Office

Can improve productivity and overall well-being with tunable white lighting.

Museums & Galleries

Create stunning displays with high-quality performance lighting that won't damage artefacts or artwork.

Event Spaces

Produce an impressive and unforgettable lighting display that complements the event's theme.

Theatres and Performance Venues

Elevate a performance space with a beautiful and functional lighting design.

Residential spaces

Equip residential spaces with user-friendly controls. Occupants can adjust the lighting to their preferences, whether enjoying a cosy winter evening or hosting a lively social event.

Outdoor spaces

Enhance architectural features, landscapes, and public spaces to create a unique outdoor experience.

4.5 DALI Data

DALI Data allows configured LED drivers to provide real-time performance monitoring, improved asset management, diagnostics, and energy metering. Stored in a standardised format within memory banks in the LED driver, this data enables efficient system management and predictive maintenance.

DALI-2 Data is optional for DALI control gear but is a standard feature in D4i control gear.

DALI Data Categories

DALI Data is categorised into three key areas, as defined by the IEC 62386 standard. IEC 62386-251, 252, and 253 cover luminaire, energy, and diagnostic data, but other parts of IEC 62386 define additional data types that extend system functionality.

Luminaire Data
IEC 62386-251 (DALI Part 251) – Luminaire Data

- Stores luminaire-specific details such as GTIN, light output, CCT & CRI, and light distribution.
- Supports asset management and simplifies inventory tracking.

Energy Data
IEC 62386-252 (DALI Part 252) – Energy Reporting

- Provides real-time power and energy usage for control gear.
- Enables energy monitoring and efficiency optimisation.

Diagnostic Data
IEC 62386-253 (DALI Part 253) – Diagnostics & Maintenance

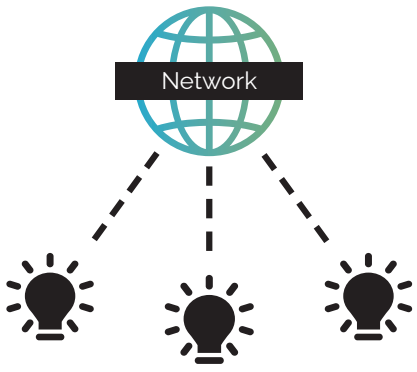
- Captures operating data for control gear and lamps, including failure conditions and run-time data.
- Supports predictive maintenance and fault detection.

These specifications are available from DiiA, and are also included in ANSI C137.4

Using DALI Data

In the Factory

- Luminaire data is programmed into drivers



During Operation

- Performance monitoring
- Energy usage data can be used e.g. for billing

In the field

- Performance monitoring
- When installed, luminaires can automatically transfer data to a remote network
- Reduces human error, saves installation time and cost
- Operator has a full map of asset information

Diagnostics

- Predictive maintenance
- Diagnostics data allows network operator to anticipate need for maintenance
- Repair team has knowledge of location and type of fixture

4.5.1 DALI Luminaire Data

DALI Luminaire Data provides fixed information about luminaires. Luminaire information is typically written into the LED driver by the luminaire manufacturer.

Luminaire Data includes:

- Luminaire supply power and voltage
- Light output
- CCT (Correlated Colour Temperature)
- CRI (Colour Rendering Index)
- Light distribution
- Luminaire body colour
- Luminaire identification, enabling asset tracking.

Benefits of DALI Luminaire Data:

Comprehensive Data Collection

DALI Luminaire Data provides advanced luminaire information such as nominal light output, CCT, CRI, light distribution, and luminaire body colour.

Maintenance

DALI Luminaire Data describes the main features of the luminaire, making updates or replacement easier.

Regulatory Compliance

The luminaire data provided is detailed and can help in meeting energy and building codes.

Scenario

"A pole tilt sensor on a streetlight indicates a luminaire may have been damaged in a collision."

With DALI Luminaire Data, the Facilities Manager:

- ✓ Used the luminaire GTIN information to determine the manufacturer.
- ✓ Used the luminaire identification number to determine the precise asset, looking up a data-base to determine its location.
- ✓ Used the luminaire nominal light output, CCT, CRI, and light distribution information to select a suitable replacement luminaire.
- ✓ Used the luminaire body colour to ensure the replacement luminaire was correctly coloured.

4.5.2 DALI Energy Data

DALI Energy Data offers advanced real-time tracking of power and energy consumption metrics in each luminaire. LED drivers equipped with DALI-2 Energy Data capabilities can provide operational data, including:

- Active energy/power: The real energy/power consumed.
- Apparent energy/power: The product of rms voltage and current. Apparent energy/power usage is often considered by utilities when billing larger consumers.
- Load-side energy/power: The real energy/power delivered to the lamp.

Table 4-4 Benefits of DALI-2 Energy Data Compared to Traditional Methods of Energy Monitoring

Benefit	DALI Energy Data	Traditional Methods of Energy Monitoring
Precision	DALI Energy Data provides detailed data for monitoring energy at individual luminaire or fixture levels.	Traditional methods typically provide less detailed information, such as whole-circuit measurements.
Granularity	DALI Energy Data can distinguish between different zones or individual luminaires to help identify energy usage patterns.	Traditional methods may not offer detailed distinctions between different zones or areas.
Real-time Monitoring	Data is available in real-time, allowing users to monitor and respond to energy consumption metrics.	Data collection often involves manual measurements and assessments, causing delayed responses.
*Control & Optimisation	Control settings can be adjusted in response to real-time energy consumption data.*	Traditional methods lack automation and adaptability.*
Energy Efficiency	DALI Energy Data helps to identify energy-saving opportunities such as dimming, scheduling, and detecting faulty luminaires.	Traditional methods often require manual assessments to uncover potential energy savings.
*Regulatory Compliance	DALI Energy Data provides detailed records to support compliance with energy efficiency standards.*	Traditional methods only provide basic records to support compliance with energy efficiency standards.*
*Predictive Maintenance	DALI Energy Data assists in predictive maintenance by alerting to unusual energy consumption.	Traditional methods only provide limited information.

* **Note:** These benefits depend on the capabilities of the application controller, the lighting control system, and how the system has been commissioned and maintained.

Scenario

"An office building owner wants to achieve green certification status."

To improve energy efficiency, the office building owner:

- Analysed the energy consumption patterns on different floors using active energy/power data.
- Identified specific office spaces with LED fixtures that consume more energy using load-side energy/power data.
- Estimated the total energy load of the building's lighting system by summing the reported energy/power data.

The building owner improved the office building's overall efficiency by retrofitting poorly performing areas with energy-efficient LEDs and implementing motion sensors in low-traffic areas, driving down energy consumption.

4.5.3 DALI Diagnostics Data

DALI Diagnostics Data allows advanced monitoring and diagnostics of lighting fixtures, including control gear and lamps. LED drivers with DALI Diagnostics capabilities can report operational data, including:

- Failure conditions for control gear and lamps, including counters.
- Control gear information such as operating time, start counter, supply voltage and frequency, power factor, temperature, and output current.
- Light source information includes operating voltage, current, temperature, light source start counter, and light source on time.

DALI Diagnostics Data is beneficial for immediate and predictive maintenance. Maintenance teams can use the data collected to identify potential issues or failures in advance. This allows them to take proactive measures to prevent downtime and reduce maintenance costs.

Table 4-5 Benefits of DALI Diagnostics Data Compared to Traditional Diagnostics Methods

Benefit	DALI Diagnostics Data	Traditional Diagnostic Methods
Detailed Analysis	DALI Diagnostics Data provides detailed information on the performance of the control gear and the light source. The data gives users a clearer understanding of the status of their system, helping them make more informed decisions.	Traditional diagnostic methods provide generalised information on system performance.
*Comprehensive Monitoring	Users can monitor the entire system simultaneously, ensuring no component goes unchecked. This leads to better system longevity and fewer unexpected issues.	Monitoring is often limited to specific components or requires manual checks.
Real-time Alerts	Real-time notifications allow quicker responses to problems, reducing potential damage and downtime.	Alerts may be delayed or absent altogether.
Detailed Operational Data	DALI Diagnostic Data provides data such as operating time, start counter, and supply voltage so users can understand how their fixtures are performing and respond to any detected issues.	Typically, traditional diagnostic methods only provide basic operational metrics.
*Predictive Maintenance	DALI Diagnostic Data provides wear and usage metrics, helping users plan maintenance or repairs before a component wears out or fails.	Maintenance is reactive based on visible issues or breakdowns.

Table 4-5 Benefits of DALI Diagnostics Data Compared to Traditional Diagnostics Methods Continued

Benefit	DALI Diagnostics Data	Traditional Diagnostic Methods
*Cost Savings	There are potential cost savings in repairs and replacements due to preventative measures and early fault detection.	Failure to detect issues or take preventive measures early on could result in unforeseen repair costs.
Reliability	Operational data can be used to optimise the system for energy efficiency.	Insufficient documentation or data makes compliance verification challenging.
Energy Efficiency	DALI Diagnostic Data provides data such as operating time, start counter, and supply voltage so users can understand how their fixtures are performing and respond to any detected issues.	Typically, traditional diagnostic methods only provide basic operational metrics.
*Regulatory Compliance	DALI Diagnostic Data provides support in meeting regulatory standards or verifying performance claims.	Insufficient documentation or data makes compliance verification challenging.
Extended Fixture Lifespan	Adjustments based on the diagnostics data provided ensure that fixtures operate optimally, extending fixture lifespan.	Without the capacity to make data-driven system adjustments, fixtures might not operate optimally, potentially shortening their lifespan.

* **Note:** These benefits depend on the capabilities of the application controller, the lighting control system, and how the system has been commissioned and maintained.

4.6 DALI Self-Contained Emergency

Unfortunate events are a reminder of why emergency lighting is so important. It's not just best practice; in many regions it is a legal obligation that requires careful consideration. Choosing the right emergency lighting solution can make building management easier, improve efficiency, and ensure the safety of occupants.

DALI Self-contained Emergency is an advanced feature, engineered to integrate and manage emergency lighting equipment, including emergency luminaires with built-in or adjacent batteries, and exit signs, within a DALI lighting control system. The design ensures compliance with international standards such as IEC 62034:2012.

This advanced feature offers several key benefits, including continuous monitoring to keep an eye on the status of emergency lighting components, automatic activation during power outages or emergency situations, and efficient energy management to optimise emergency lighting while still providing flexibility for future system modifications.

How DALI Self-Contained Emergency Works

- **Seamless Integration:** DALI Emergency enables the smooth integration of emergency lighting devices into the DALI lighting control system. This integration ensures that emergency lighting is part of the overall lighting infrastructure and can be controlled and monitored alongside regular lighting fixtures.
- **Monitoring and Control:** One of the standout features of DALI Emergency is continuous monitoring and control of emergency lighting devices. When implemented, the system is capable of regularly checking the status and performance of these devices. This includes mandatory function and duration tests to ensure that emergency luminaires are functional and that their batteries can fully power emergency lighting without premature discharge. Any faults or failures are reported to the system, allowing for prompt maintenance, and ensuring that the emergency lighting is always ready when needed.
- **Periodic Automatic Testing:** DALI Emergency offers an optional feature called 'Periodic automatic testing', which allows the automatic scheduling of the two types of tests, after a delay and repeating periodically.
- **Automatic Activation:** In the event of a power failure, the emergency lamps are automatically activated regardless of the state of the control system.
- **Dimming for Standby:** During normal operation, DALI Emergency type A (maintained, dimmable) allows for the emergency luminaires to be dimmed, and type B (maintained, non-dimmable) allows the emergency luminaires to be switched on or off. This dimming and switching capability allows luminaires to be used for general lighting as well as emergency lighting and helps reduce energy consumption while ensuring the emergency luminaires remain operational and ready to respond when an emergency occurs. This energy-saving feature is beneficial for sustainability and cost-efficiency.

DALI Emergency Control Gear

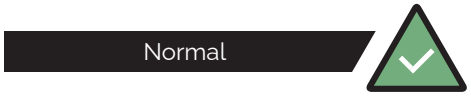
DALI Emergency control gear is designed to manage lighting during emergencies. Four types are available - A, B, C, and D - each with specific features and applications. The graphic below provides a brief overview of how each type works and when it is commonly used.

DALI Emergency Control Gear by Type

Type	A	B	C	D
Operational Status	Maintained	Maintained	Maintained	Non-maintained
DALI Control	Controllable	Controllable	Non-controllable	Non-controllable
Dimming Ability	Dimmable	On/off	Non-dimmable	Non-dimmable
Behaviour	The lamp is on during power outages and testing. When the normal supply is on, the lamp responds to DALI commands (dimming). In some cases, an additional hardwired input allows on/off switching when mains power is present.	The lamp is on during power outages and testing. When the normal supply is on, the lamp responds to DALI commands (switching). In some cases, an additional hardwired input allows on/off switching when mains power is present.	The lamp is on during power outages and testing. When the normal supply is on, the lamp remains on continuously. In some cases, an additional hardwired input allows on/off switching when mains power is present.	The lamp is on during power outages and testing. When the normal supply is on, the lamp remains off.
Usage	General lighting and Emergency lighting	General lighting and Emergency lighting	Emergency exit lighting and continuously lit areas	Emergency exit lighting and Standby Emergency lighting

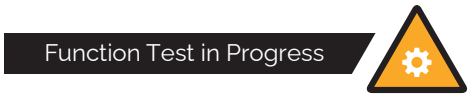
DALI Self-contained Emergency

DALI Self-contained Emergency has seven operating modes, each vital to ensure the system's reliability and efficiency in emergencies. Refer to the graphic below for a description of the emergency lighting modes available within the DALI-2 framework.

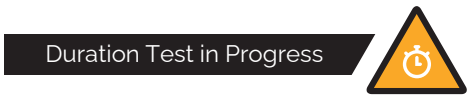


Mains power is on.

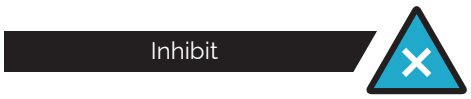
Mains power is off, and the emergency lighting is running from the battery.



A short test (typically < 1 minute) to ensure the emergency lighting, battery, circuit, and changeover relay are operating correctly.



An extended test (typically 1-3 hours) to check if the battery can fully power emergency lamp without premature discharge.



Mains power is on, and an 'INHIBIT' input or command has been received. While in this mode, a failure of the mains supply causes rest mode instead of emergency mode.

Mains power is off, and emergency lights are off (because of a discharged battery, 'REST' command, or mains failure in inhibit mode).

When mains power is restored during emergency mode, the emergency lighting continues to operate at the emergency level for a configurable period of time before returning to normal mode.

4.7 DALI Input Devices

Input devices provide information from user triggers or measurements to the application controller(s) in a DALI system. Application controllers can use this information in their decision-making and control the lighting accordingly. Sensors provide information such as occupancy and lighting level data to enable automated control, while other input devices such as push-buttons, sliders and rotary controls allow users to make adjustments.

Types of DALI Input Devices

This section will explore the types and capabilities of DALI-2 Input Devices.

1. **Push-button devices:** These devices respond to a range of user actions, such as pressing, releasing, short-pressing, long-pressing, and double-pressing, and can also detect a stuck button.

2. **Absolute input devices:** This category of devices includes simple on/off and multi-position switches, as well as digital or analogue inputs. They may also feature sliders or rotary controls to generate a 'position' event.

3. **Occupancy Sensors:** This type of sensor detects motion or presence and generates events periodically or when there are changes in state to 'occupied', 'vacant', 'movement', or 'no movement'.

4. **Light Sensors:** Light sensors measure illuminance levels and can report levels periodically or when there are changes in the measurement. In addition, they offer programmable hysteresis to minimise bus traffic to optimise efficiency and data management.

Features and Benefits of DALI Input Devices

Table 4-6 outlines the features and benefits of DALI Input Devices compared to input devices found in traditional systems.

DALI Input Devices have several advantages over those found in analogue systems, such as multi-master capabilities for enhanced integration, multiple operating settings for adaptability, and support for multiple instances to optimise space and resources.

Table 4-6 Feature & Benefits of DALI Input Devices Compared to those in Analogue Systems

Features	Description	Benefits of DALI Input Devices	Limitations of Input Devices in Analogue Systems
Multi-Master	Allows multiple devices to operate on the same DALI bus.	Allows for more flexible and distributed control within a DALI system. This feature enables each input device to send events and receive responses independently, making it easier to integrate sensors and control devices while maintaining efficient communication. The biggest advantage is that multiple input devices can operate together on the same two-wire DALI bus. For example, in a classroom with multiple sensors and two doors, a push-button panel can be installed at each door to control the same groups of lights.	A unidirectional control unit controls the bus.
Multiple Operating Settings	Input devices are generally used in event-driven mode but can operate by polling or periodic transmission.	Provides versatile operating modes that cater to different system needs and lighting scenarios.	They are typically confined to a single, event-driven mode, unable to adapt to varying system needs and lighting scenarios.
Multiple Instances	An input device can support 32 or more separate instances (e.g., different types of sensors or controls).	Incorporating multiple instances into a single product optimises space and resources.	Support limited functionality per device. This limits functionality and requires more space and resources.
Feedback Feature	The optional 'feedback' feature can control LED indicators on each instance (e.g., the indicators on push-buttons).	Improves user interaction by delivering immediate and clear system status and response feedback.	They have limited or no feedback features available. There is a lack of clear and immediate system status indication.

4.8 DALI Application Controllers

Application controllers are like the brains of a DALI system. They manage and regulate information and commands to optimise lighting performance.

Before proceeding further, it is crucial to understand the differences between how single-master and multi-master DALI application controllers operate:

1. **Single-Master:** Only one application controller is allowed on the DALI bus, serving as the sole point for decision-making and command execution. Single-master suits simpler, more straightforward lighting control needs where centralised control is sufficient. Some single-masters are much more capable and can be used in the largest of lighting systems. In this case their limitation is that they cannot use event messages or with other application controllers on the same bus.

2. **Multi-Master Configuration:** Multi-master application controllers support event-driven operation and can be designed to work with other application controllers on the same DALI bus, enabling collaborative system management.

Function of Application Controllers

- **Processing Information:** Application controllers process information from various sources, including control gear, input devices, other application controllers, and external devices, buses, or systems. They interpret the signals and data these sources provide to determine the appropriate action.

- **Decision-Making:** They use processed information and system inputs to decide how to control lighting equipment and other connected devices.

  Sending Commands: After processing information and making decisions, application controllers send commands to the control gear to adjust the lighting conditions (e.g., brightness, colour temperature), and also to other control devices to modify their behaviour.

Interaction with Other Components

- **Control Gear:** Application controllers communicate with the control gear to control the lighting conditions and receive feedback about the current state of the lighting equipment.

- **Input Devices:** They use information from input devices, such as switches and sensors, to make decisions and adjust the lighting accordingly.

- **Other Application Controllers:** Some multi-master application controllers can exist on the same bus with other multi-master application controllers, allowing them to share information and make collective or decentralised decisions.

- **External Devices/Buses/Systems:** Application controllers can interact with external entities, allowing integration with other systems and additional functionality. It is common for larger systems to be built using a backbone such as Ethernet or Wi-Fi, with one application controller in each DALI system connected to this backbone.

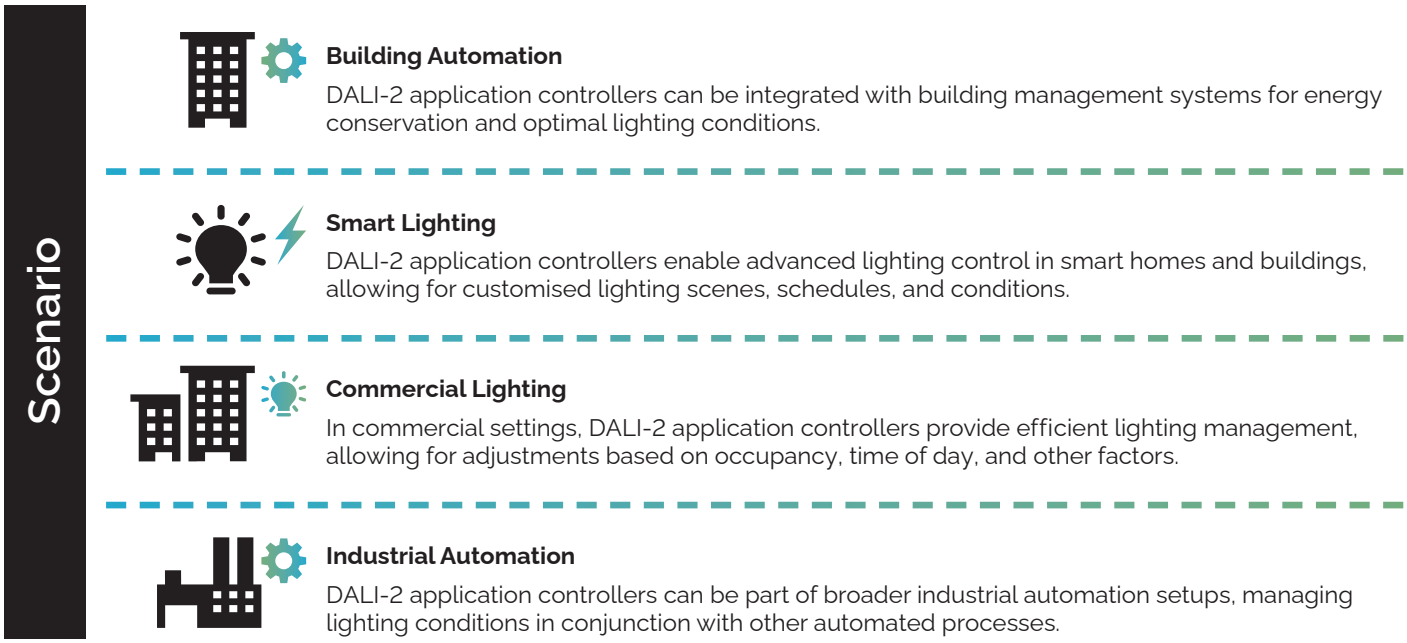
Event-Driven Operation and Polling

DALI-2 Application Controllers can poll (query) input devices or control gear, for example, to check status or obtain measurements for real-time adjustments.

Multi-master application controllers can support the event-driven operation of input devices, allowing the system to respond immediately to changes in input devices' states or other events.

Examples of scenarios using DALI-2 Application Controllers

An application controller is essential in a DALI system to control the lights. Without one, luminaires remain at 100% brightness with no way to adjust them. Application controllers provide versatility in managing lighting across various environments, including homes, commercial spaces, and industrial settings (refer to the graphic below).



4.9 D4i

Developed by the DALI Alliance, D4i is a certification program designed to facilitate intra-luminaire communication. It incorporates a mandatory set of DALI parts specifically tailored for this application. DALI and D4i enables luminaire-level lighting control, paving the way for smarter, connected, and more energy efficient lighting solutions*.

To understand the capabilities of D4i in intelligent lighting, let's explore its key aspects and how they work together to create a robust solution.

Key Aspects of D4i at a Glance

Power Supplies: D4i certified luminaires include bus power, and for outdoor luminaires an AUX power supply, to ensure that intra-luminaire devices are adequately powered.

Data: D4i certified luminaires provide luminaire, energy, power, and diagnostics data.

Standardisation: Promotes interoperability among devices from different manufacturers.

D4i Luminaires: These luminaires boost the functionality and adaptability of lighting systems by ensuring seamless integration with various control devices and sensors.

To explore the core features and benefits of D4i, refer to Table 4-7.

Table 4-7 Core Features and Benefits of D4i®

D4i Device	D4i Feature	Benefits
Control Gear (e.g., LED drivers)	Luminaire Data	Enhances asset management.
	Energy Data	Provides real-time power and energy usage for control gear and promotes cost savings.
	Diagnostics Data	Enables predictive maintenance and reduces downtime.
	Integrated Bus Power Supply	Simplifies the integration of sensors and other control devices.
Auxiliary Power Supplies	Auxiliary 24V power	Supports high-power control devices, especially for outdoor city-wide communications.
Control Devices	Luminaire-Mounted Control Devices	Controls the lights and can optionally include sensors.
D4i® Luminaires	Luminaires contain D4i components	Promote interoperability between different devices and manufacturers.

* **Note:** D4i will be addressed in more detail in a future document.

Detailed insights

Control Gear:

- **Easily Integrate:** All D4i LED drivers have an integrated DALI bus power supply and can provide power to connected devices. In luminaires with D4i drivers, this significantly simplifies the integration of sensors and other control devices that are exclusively powered by the bus.
- **International Standards:** D4i-certified control gear meets the requirements of IEC 62386 Parts 101, 102, 207, 250, 251, 252, and 253. These requirements are also published in ANSI C137.4. D4i certification helps ensure that the requirements of these standards are met.

Auxiliary Power Supplies:

- **Provide Extra Power:** For control devices with higher power requirements — such as wireless communication devices for city-wide networks — a D4i auxiliary 24V power supply is also provided. This can be integrated into the D4i driver or be a separate device in the luminaire.

Control Devices:

- **International Standards:** D4i-certified control devices meet the requirements of IEC 62386 Parts 101, 103, and 351, with optional support for Parts 30x. These requirements are also published in ANSI C137.4, and optionally, for outdoor luminaires, in ANSI C136.41 and C136.58. D4i certification helps ensure that the requirements of these standards are met..
- **Easily Integrate:** Integrating control devices within or onto luminaires simplifies installation, provides localised control, and promotes energy-savings and adaptability in lighting.

D4i luminaires:

- **Adapt to IoT Environments:** Besides ensuring interoperability, D4i luminaires provide intelligent control and optimal energy utilisation in modern IoT and smart environments.

All certified D4i products and D4i luminaires bear the D4i logo. Certified D4i products are listed in the DALI Product Database. Further information on D4i can be found on the DALI Alliance website.

Figure 7. D4i® Logo

4.10 Zhaga-D4i

The Zhaga-D4i is a collaborative initiative between the DALI Alliance and the Zhaga Consortium. Zhaga-D4i certified products are entitled to bear the dual logos of both Zhaga and D4i, which is a testament to their plug-and-play interoperability, seamlessly integrating sensors, communication nodes, and luminaires. Of note, Zhaga-D4i certified products inherit all the capabilities of D4i while also adding the mechanical/connector plug-and-play interoperability enabled by the Zhaga consortium's specifications.

Figure 8. Dual Logos of Zhaga and D4i®

Key Aspects at a Glance

- **Standardised Interface**
  Ensures mechanical, electrical, and communication compatibility between devices and modules.
- **Plug-and-Play Functionality**
  Simplifies the process of installation, detection, and configuration of integrated systems.
- **Interoperability**
  Focuses on seamless operation between devices from different manufacturers, regardless of origin.
- **Smart City and IoT Ready**
  Actively contributes to the advancement of IoT in smart cities by offering a comprehensive solution to connectivity. To explore the core features and benefits of Zhaga-D4i, refer to the below graphic.

Core Features and Benefits of Zhaga-D4i

Zhaga-D4i / Luminaire

A D4i™ luminaire with a powered Zhaga socket that can accommodate a Zhaga-D4i control device.

Benefit

Enhanced interoperability with easy device accommodation

Zhaga-D4i / Control Device

A D4i™ control device with a Zhaga connector (e.g., light-level or occupancy sensors, communication nodes)

Benefit

Streamlined integration and communication across luminaires

Detailed insights

Zhaga-D4i Luminaires:

- **Enable Interchangeability:** Compliant with both Zhaga and D4i standards, these luminaires allow for consistent integration between different manufacturers.
- **Lead Smart Upgrades:** Their modular design allows easy upgrades, ensuring luminaires stay current and IoT-ready.

Zhaga-D4i Control Device:

- **Ensure Flexibility:** Zhaga-D4i certified devices can easily be integrated, replaced, or upgraded, making luminaires IoT-ready.
- **Support Connectivity:** Using standardised interfaces in control devices ensures smooth communication among systems, enhancing the integration and effectiveness of smart lighting in IoT networks.

Details of D4i-certified products are available in the DALI Alliance product database, while those also achieving Zhaga certification can be found in the Zhaga Certified Products Database.

4.11 DALI+

DALI+ expands lighting control technology by integrating the established DALI protocol with wireless and IP-based networks. Developed by the DALI Alliance, DALI+ allows all the features of DALI-2 and uses the existing DALI commands but transmits them through wireless and IP-based mediums instead of the traditional DALI two-wire set-up. This ensures data transmission from control gear, luminaires, and sensors, maintaining the ability to monitor energy consumption, power usage, and diagnostic data in real-time for applications such as predictive maintenance.

DALI+ is a flexible lighting solution that can be easily upgraded to cover entire building networks thanks to its innovative addressing features. For example, in commercial buildings, when IT systems and building services - including lighting control - work together in IP-based networks, building operators can expect:

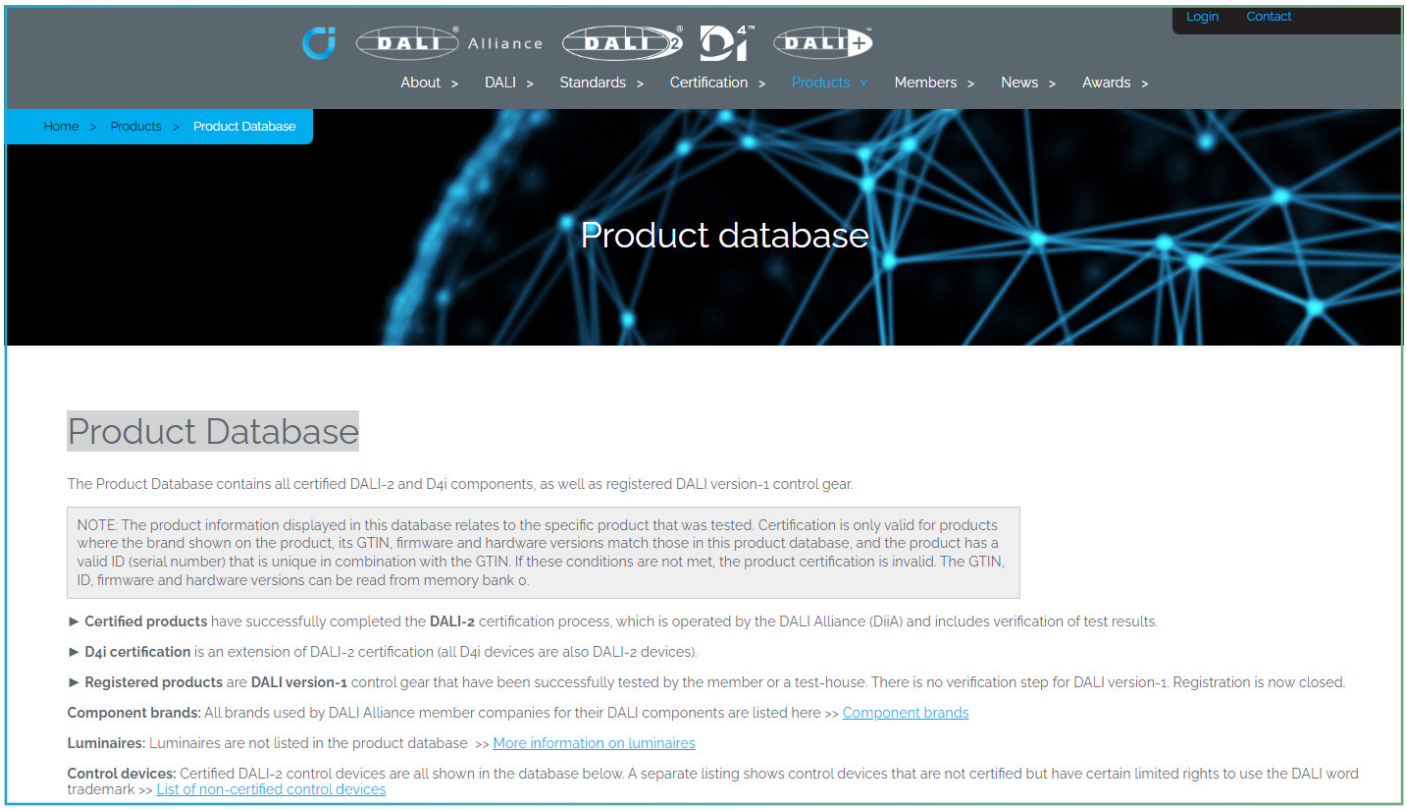
- End-to-end addressing and security
- Effortless connectivity amongst previously-isolated applications
- Boundless scalability
- Enhanced, speedy, and cost-efficient integration
- Abundant flexibility and choices in both physical transport and applications

In essence, DALI+ offers a technical framework where lighting control can operate and be managed wirelessly without compromising the in-depth control and data access inherent in traditional wired DALI systems. By doing so, DALI+ successfully aligns with the practical needs of modern lighting design and management.

For more information on DALI+, visit the DALI Alliance website.

5. DALI Product Database

The DALI Product Database is an online directory at www.dali-alliance.org/products, offering comprehensive listings of DALI certified products. This chapter provides an overview of the database, detailing the types of products included and how to use the platform. We advise users to refer to the Product Database User Guide for more comprehensive details.



5.1 Products in the DALI Product Database

The database showcases:

- **Certified Products:** These products have been through DALI-2, D4i, and DALI+ certification processes, each of which includes verification of independent test results.
- **D4i Products:** An extension of DALI-2, D4i devices are also DALI-2 devices.
- **Registered Products:** These are DALI version-1 control gear tested by the manufacturer or a testing facility.

The database does not list:

- **Luminaires:** Brands used for DALI-2 or D4i luminaires are listed on the DALI Luminaire Brands page.
- **Zhaga-D4i certified luminaires:** These can be found online in the Zhaga Certified Products Database.
- **Zhaga-D4i certified nodes:** Zhaga-D4i jointly certified products can be found online in the Zhaga Certified Products Database.

The product categories listed in the DALI Product Database include:

- Control gear (LED drivers, ballasts, ECGs, etc.)
- Application controllers
- Input devices (sensors, switches, push-buttons, etc.)
- Bus power supplies
- AUX power supplies

All brands that manufacturers use for their DALI components are listed online on the DALI Components Brands page.

5.2 Function of the Product Database

The database serves three primary purposes:

1. **Verification of Certification and Registration:** Users can validate the claims of product certification and registration made by manufacturers.
2. **Feature-specific Product Search:** The Product Database allows users to filter results based on desired features. The advanced search allows for the exclusion of specific features.
3. **Insight into DALI-related Features:** Each product listing outlines DALI-associated features, including the parts implemented from the IEC 62386 standard (DALI Part Number).

5.3 Product Search and Filters

The product search area helps users to refine their search based on specific criteria:

- **By Brand**
  The brand mentioned on the product must correspond with the database's listing.
- **By Product Part Number**
  This information can be obtained from the manufacturer or from the product label.
- **By Product Name**
  Search using the entire or part of the product name.
- **By Family Products**
  The results can be condensed to represent product families or expanded to show each member.
- **By DALI Product ID**
  This is a unique product identifier given by the DALI Alliance.
- **By GTIN**
  Global Trade Item Number – a number or 'electronic barcode' that uniquely identifies a product and is stored in each product's memory bank.

Additional search features include the option to view discontinued products and the inclusion of registered DALI version-1 control gear.

5.4 Finding Specific Products

For precise searches, users can follow any of these recommendations:

1. Use the DALI Product ID
2. Use the GTIN
3. Select the specific brand
4. Please enter the product name or product part number

5.5 Searching for Products with Desired Features

The DALI Product Database allows users to search and filter products based on distinct types and features that include DALI Part Numbers corresponding to the IEC 62386 Standard:

- Control gear (e.g., LED drivers, ballasts, and ECGs)
- Application controllers
- Input devices (e.g., Sensors, switches, and push-buttons)
- Bus power supplies
- AUX power supplies
- Other specific properties (e.g., connectors and regional suitability)

5.6 Additional Information

Control devices that are not DALI-2 certified aren't listed in the DALI Product Database. However, non-certified control devices featured online on the Listed Control Devices page use the 'DALI' word trademark, but not the logo.

6. Designing a DALI Lighting Control System

Aims of this chapter:

How to select the features and capabilities of DALI to maximise lighting control system capabilities in a project.

6.1 DALI-2® Specific Lighting Design Considerations

1. Define the basic parameters of the project understanding what elements of DALI will be used or not.

2. **Understanding DALI's Capabilities**
   Gain thorough knowledge of DALI's unique features and capabilities, crucial for maximising its potential in your designs.

3. **System Requirements and Goals**
   Clearly define the project's requirements and objectives for the DALI lighting system. Determine the desired functionality and performance of the entire system, focusing on leveraging DALI's capabilities.

   [Remember: do not assume that the project's size determines the system's sophistication].

4. **Cost-Effective Strategies**

   - Analyse and refine the design so the resulting DALI lighting system configuration offers the best value for the project.
   - During the design phase, weigh the cost implications carefully.
   - Employ value engineering to balance functionality, aesthetics, and cost-effectiveness.
   - Plan for future scalability, with an immediate set-up that meets requirements.
   - Use natural light and daylight harvesting strategies to reduce energy consumption.
   - Implement cost-effective design strategies, such as efficient zoning and grouping of lighting fixtures.
   - Consider including DALI Luminaire, Data and Energy add-on features to proactively enhance system redundancy and cost-efficiency.

5. **Network Design and Topology**

   - Design the network layout and topography in line with DALI specifications and capabilities.
   - Select the most suitable network topology (e.g., daisy-chaining, star, or bus) for the DALI-2 system.
   - Plan for scalability and redundancy to meet project goals.
   - Implement robust security measures to safeguard the DALI network from unauthorised access.

6. Ease of Installation and Maintenance: Ensure the design promotes easy installation and maintenance, leveraging DALI-2's unique configuration for efficiency.

7 **Device Addressing Capacity**
Adhere to DALI's limit of 64 devices per control line.

8 **DALI Cabling (for Lighting Designers)**

- To ensure reliable communication over DALI networks, it is recommended to use 1.5mm^2 cable (15AWG), allowing a maximum distance of 300m between the two farthest-apart devices on the bus when using the maximum rated bus power supply of 250mA. The two bus wires should be adjacent to each other. Refer to Section 3.2 for further details.

9 **Power Supply Requirements**
Ensure the power supply meets DALI power specifications, typically a 16-22.5 V DC voltage range and a maximum current of 250mA.

10 **Integration of DALI Systems with Other Systems**
Consider whether DALI systems should be integrated with other control and building management systems.

11 **Future Scalability with DALI**
Consider limiting the number of control gear per DALI bus to fewer than the maximum permitted 64 and also select application controllers that can be networked allowing additional application controllers to be added in the future. Refer to Sections 3.1-3.3 for further details.

12 **Verification of Specific Functionalities in DALI**
Confirm that DALI components support the required specialised functionalities (beyond the inherent capabilities), such as advanced scene control, colour tuning, or integration with emergency lighting systems. Refer to Section 5 for further details.

13 **Manufacturer Specifications Review for DALI Products**
Thoroughly review and confirm the compatibility and functionality of each DALI product against manufacturer specifications. For certified products, refer to Section 5.

14 **Functionality Check - DALI System**
Select an application controller that supports the desired functionality and future functionality of the system. Refer to Section 4.8 for further details.

15 **Configuration of DALI Systems**
Check the system supports the detailed configuration required.

16 **Reference Projects**
Identify case studies or projects demonstrating successful DALI implementations. Refer to the 'DALI Awards' and 'Projects & Case Studies' sections on the DALI Alliance Website for examples of successful DALI implementations.

17 **Verification of DALI Certification**
Confirm the authenticity of DALI-2 components by checking for the DALI-2 logo and verifying in the DALI Product Database. Refer to Section 5.1 for further details.

18 **Verification of luminaires**
Confirm with the luminaire manufacturer that all DALI components are listed in the DALI Product Database.

6.2 General Lighting Design Considerations

1. **Lighting Requirements**
   Understand the specific lighting requirements of the project, such as desired lighting levels, colour temperature, and lighting effects. Refer to Chapter 3 for further details.

2. **Space Layout**
   Knowledge of the layout of the space, including architectural features, furniture placement, and any spatial constraints, helps determine the positioning of lighting fixtures.

3. **Regulations and Codes**
   Familiarity with local building codes and regulations related to lighting design, energy efficiency, and safety is essential for compliance. Lighting controls may be helpful or essential for meeting regulatory requirements.

4. **Environmental Considerations**
   Environmental factors like daylight availability and natural lighting can impact lighting design decisions. Consider this when selecting sensors and application controllers.

5. **Aesthetics and Design Intent**
   Understanding the project's design intent and aesthetic goals, including the desired ambience and style, influences fixture selection and control strategies.

6. **User Needs**
   Consideration of the needs and preferences of end-users, occupants, or clients regarding lighting control and flexibility. Consider this when selecting input devices and application controllers.

7. **Energy Efficiency**
   Ensure the lighting design aligns with energy efficiency goals, including LED lighting and efficient control systems. Refer to Section 4.5 for further details.

8. **Maintenance and Accessibility**
   Knowledge of maintenance requirements and accessibility to lighting fixtures for servicing and replacement.

9. **Budget Constraints**
   Awareness of budget constraints and the need to optimise the design for cost-effectiveness. Consider that lighting control system savings such as energy efficiency and productivity may outweigh the initial investment cost.

10. **Compatibility with Existing Systems**
    If existing lighting or building management systems exist, understanding how DALI will integrate with them is crucial.

11. **Emergency Lighting**
    Incorporate automated emergency lighting requirements and ensure compliance with relevant safety standards.

12. **Lighting Zones/Areas**
    Define lighting zones/areas within the space and determine how they will be controlled. Consider how spaces will be utilised in the future.

13 **Dimming and Colour Control**
If colour-tuning or dimming capabilities are required, specify the desired range and control parameters.

14 **Sustainability Goals**
Align the lighting design with sustainability and green building objectives.

15 **Luminaire Selection**
Choose appropriate fixtures, considering factors like fixture type, output, and compatibility with DALI control. Refer to Section 6.1 paragraph 18.

16 **Lighting Scenes**
Determine the desired lighting scenes and presets for different activities or moods.

17 **User Interface**
Specify the user interface or control devices used for DALI control.

18 **Testing and Commissioning**
Plan for system testing, commissioning, and user training before project completion.

19 **Documentation**
Create comprehensive documentation of the lighting design, including layouts, schedules, and control logic.

7. How to Specify DALI Lighting Control Systems

When integrating DALI lighting control systems into a space, it's essential to recognise that every lighting project has its unique demands and requirements. The initial step is to pinpoint the client's objectives, the space's purpose, and the ambience they aspire to achieve. Additionally, it's important to determine the client's preferences for accessing lighting control and the level of control they want to have over the system.

The key is to specify the system with a holistic view, not the individual components.

7.1 Getting Started with the Specification Process

Before embarking on the specification journey, these key elements should be at the forefront:

1. **DALI Compatibility**
   Ensure all specified devices carry either the DALI-2, D4i or DALI+ logo for interoperability and compliance with the IEC 62386 Standard. The DALI Product Database contains a list of all certified DALI-2 and D4i products and registered DALI version-1 control gear (See Chapter 5). Products not listed do not meet DALI-2 and D4i requirements.

2. **Device Types and Functionality**
   Define the specific DALI-2 products needed, such as dimmable LED luminaires, light sensors, occupancy sensors and switches.

3. **Control Requirements**
   Assess control needs, such as scene setting, colour control, and integration with building management systems.

4. **Data Reporting and Monitoring**
   Determine if the project requires DALI products that provide data reporting and monitoring capabilities for remote performance analysis and diagnostics.

5. **Dimming Performance**
   Specify dimming requirements considering factors like resolution and compatibility.

6. **Energy Efficiency**
   Consider lighting solutions are energy-efficient and sustainable, especially those using LED technology and sensors that adhere to energy standards.

7. **System Scalability and Futureproofing**
   Reflect on the system's ability to adapt to future needs and efficiently integrate new devices.

7.2 How to Specify DALI Control Gear

When choosing and specifying DALI control gear, use the following signposts to guide your planning:

- **Lighting Fixture Type**
  Begin by pinpointing the exact kind of lighting you need for your project. Such as fluorescent, self-contained emergency, discharge lamps, low voltage halogen, incandescent or LED. Check Table 7-1 for the corresponding DALI part number (e.g., Part 204 for low-voltage halogen).

- **Emergency Lighting Needs**
  Should you need emergency lighting (Part 202), specify whether it should be maintained, non-maintained, controllable, or non-controllable, and if dimming is necessary. Refer to Table 7-1 for DALI Part 202 type options.

- **Dimming Requirements**
  For dimming needs, choose an option in Table 7-1 that supports dimming.
  For example, specify Part 209 for colour tuning.

- **Colour Control Requirements**
  If you require sophisticated colours for your project, choose Part 209 (DT8) as it supports various colour control options such as xy colour types, Tunable White (Tc), and RGBWAF. Refer to Table 6-1 for details. Table 7-1.

- **Data and Monitoring**
  If your project requires data and monitoring features like luminaire data, energy data, diagnostics data, or extended emergency data, specify the corresponding DALI Part number (e.g., Part 251 for luminaire data) to meet monitoring and management needs.

- **Power Supply**
  Assess whether the DALI control gear needs an integrated bus power supply (Part 250) or can draw power from the DALI bus. Check the DALI Product Database for bus-powered control gear options.

- **D4i Certification**
  If your project leans towards D4i certification, ensure that the control gear is D4i compliant. The DALI Product Database lists D4i certified control gear encompassing Part 251 for luminaire data, Part 252 for energy data, Part 253 for diagnostics data, and Part 250 for integrated bus power supply.

Table 7-1 Part Numbers - DALI Control Gear

Feature	DALI Part Number
Fluorescent	201
Self-contained emergency ● **Type A:** Maintained controllable, dimmable. ● **Type B:** Maintained, controllable, non-dimmable. ● **Type C:** Maintained, non-controllable. ● **Type D:** Non-maintained, non-controllable	 202 202 202 202
Discharge lamps	203
Low voltage halogen	204
Incandescent dimmer	205
Conversion to DC (1-10V) interface	206
LED drivers	207
Switching	208
Colour control (DT8) ● Colour type xy coordinate ● Colour type Tc ● Colour type RGBWAF	 209 209 209
Bus-powered	Refer to the DALI Product Database
Integrated bus power supply	250
Luminaire data	251
Energy data	252
Diagnostics data	253
D4i certified	Refer to the DALI Product Database

7.3 How to Specify Luminaires for a DALI system

When choosing lighting fixtures for a DALI system, it's crucial to ensure their compatibility with the DALI control gear. The luminaires selected should be able to support DALI addressing and dimming while also meeting the design and functional requirements of the space.

DALI-2 and D4i compatibility
The DALI Alliance does not operate a certification program for luminaires; however, luminaires containing certified DALI-2 products or D4i products can carry the respective logos. Luminaire brands that manufacture luminaires containing certified DALI-2 components or D4i components are listed online on the DALI Luminaire Brands page. To confirm product suitability, check the data sheets or contact the manufacturer.

Zhaga Book 18
If your project requires smart interfaces between outdoor luminaires and sensors or communication modules, specify Zhaga Book 18 compliant luminaires.

Zhaga-D4i certification
If your project especially requires Zhaga-D4i, only select compliant luminaires. You can find a list of Zhaga-D4i luminaires online in the Zhaga Certified Products Database.

7.4 Specifying DALI Input Devices

Input devices are pivotal in lighting control systems, allowing user interaction and data collection. When specifying these devices, take into account the following factors:

- **DALI Part Numbers**
  Choose the appropriate DALI part numbers that align with your project's input device requirements (Table 7-2). For example, if you require push-button controls, specify DALI input devices with Part 301.

- **Compatibility**
  To ensure seamless integration and optimal system performance, verify that the selected DALI input devices are compatible with the designated DALI luminaires and application controllers.

- **Zhaga Book 18**
  If your project involves outdoor luminaires, specify sensors that comply with Zhaga Book 18 standards.

- **NEMA connectors (ANSI C136.41)**
  For outdoor lighting applications, especially when specifying occupancy sensors (Part 303) or light sensors (Part 304), include a requirement for NEMA connectors (ANSI C136.41). These connectors ensure secure and weatherproof electrical connections to the power supply. NEMA (ANSI C136.41) compliant sensors can be found in the DALI Product Database.

- **D4i Certification**
  An extension of DALI-2 certification, D4i includes additional requirements outlined in the document, "D4i Certification and Trademark Use." Control gear must implement parts 207 and 250-253, while control devices must implement part 351. All D4i-certified products are listed in the DALI Product Database.

- **Zhaga-D4i certification**
  If your project mandates Zhaga-D4i certification, specify input devices that meet these certification requirements. The Zhaga Certified Products Database contains a list of Zhaga-D4i compliant products.

- **Bus-Powering**
  Decide whether the DALI input devices should be bus-powered. If this is a requirement, specify bus-powered input devices from the options listed in the DALI Product Database.

Table 7-2 Types and Features of DALI Input Devices

Feature	DALI Part Number
Includes Push-button, digital input	301
Includes Slider, switch, digital/analogue input	302
Includes Occupancy sensor	303
Includes light sensor	304
Includes generic input device	Refer to the DALI Product Database
Luminaire-mounted control devices • Type A • Type B • Type C	 351 351 351
D4i certified	Refer to the DALI Product Database

7.5 How to Specify DALI Application Controllers

Application controllers are the 'brains' of your lighting control system. To ensure seamless integration into your DALI lighting system, consider these key factors:

- **DALI Control Gear Compatibility**
  For smooth integration, specify controllers compatible with your chosen DALI control gear. Check the DALI Product Database for compliant options.

- **Multi-Bus Support and Power Supply**
  If your project involves multiple DALI buses or bus-powered components, select application controllers that can efficiently manage and power these buses as needed. Check the DALI Product Database for compliant options.

- **Input Devices Support**
  If your design includes input devices like push-buttons (Part 301) or switches/sliders (Part 302), specify application controllers that can interface with and respond to these input devices.

- **Sensor-Based Control**
  For projects incorporating occupancy sensors (Part 303) or light sensors (Part 304), choose application controllers that seamlessly integrate with and respond to sensor inputs.

- **Manual Control**
  If manual control features such as switching (Part 208), incandescent dimming (Part 205), or conversion to DC (1-10V) interface (Part 206) are necessary, specify application controllers that provide these functionalities (refer to Table 7-3).

- **Specialised Lighting Control (Advanced Control)**
  When advanced lighting control features like self-contained emergency (Part 202), discharge lamps (Part 203), low voltage halogen (Part 204), LED (Part 207), and colour control (Part 209, DT8) are part of your project, choose application controllers capable of effectively managing these specialised lighting elements.

- **Feedback and Configuration**
  For designs requiring feedback mechanisms and advanced configuration options, select application controllers that support feedback from control gear, addressing, grouping, and manual configuration (Parts 332 and 333) as needed.

- **Luminaire-Mounted Control Devices**
  If your design incorporates luminaire-mounted control devices (Type A, B, C, D), specify application controllers compatible with these specific luminaire types (Part 351) that can provide the necessary control functions.

- **Data and Monitoring**
  If data and monitoring features are essential, opt for application controllers that support luminaire data (Part 251), energy data (Part 252), or diagnostics data (Part 253).

- **Integrated Bus Power Supply**
  Specify integrated bus power supply (Part 250) support if necessary for your project.

- **D4i Certification**
  If your project requires D4i certification, choose application controllers that meet these requirements. D4i compliant application controllers are listed in the DALI Product Database and can include support for reading the data from Part 251 for luminaire data, Part 252 for energy data, Part 253 for diagnostics data, and Part 250 for integrated bus power supply.

- **Zhaga-D4i Certification**
  For Zhaga-D4i certification, select compliant application controllers listed in the Zhaga Certified Products Database.

Table 7-3 Properties of DALI Application Controllers

Feature	DALI Part Number
Supports DALI version-1 control gear	Refer to the DALI Product Database
Supports DALI-2 control gear	Refer to the DALI Product Database
More than one DALI bus supported.	Refer to the DALI Product Database
Bus-powered	Refer to the DALI Product Database
Support for event messages from input devices	Refer to the DALI Product Database
Support for other application controllers on the same bus	Refer to the DALI Product Database
Support for Push-buttons	301
Support for Switches/sliders	302
Support for Occupancy sensors	303
Support for Light sensors	304
Support for generic input device	Refer to the DALI Product Database
Support for Self-contained emergency	202
Support for Discharge lamps	203
Support for Low-voltage halogen	204
Support for Incandescent dimmer	205
Support for Conversion to DC (1-10V) interface	206
Support for LED	207
Support for Switching	208
Support for Colour Control (DT8)	209
Support for feedback from control gear (including lamp failure feedback)	Refer to the DALI Product Database

Table 7-3 Properties of DALI Application Controllers Continued

Feature	DALI Part Number
Support for addressing or grouping of control gear	Refer to the DALI Product Database
Support for features of connected control devices • Feedback • Manual configuration	 332 333
Luminaire-mounted control devices • Type A • Type B • Type C • Type D	 351 351 351 351
D4i certified	Refer to the DALI Product Database
Support for Luminaire-mounted control device • Type A • Type B • Type C	 351 351 351
Support for Integrated bus power supply	250
Support for Luminaire data	251
Support for Energy data	252
Support for Diagnostics data	253

7.6 How to Specify DALI Bus Power Supplies

Guaranteed/Maximum Supply Current:

- First determine the total bus current consumption of all devices connected to the DALI bus.
  - For bus-powered devices, this is stated on the product or in the datasheet.
  - For externally-powered products, assume 2mA for each.
- Total those currents, then allow an additional 10mA or 20% (whichever is greater).
- This "total bus current consumption" needs to be met by the bus power supplies.

One or more bus power supplies can be used to provide this current:

- Choose one or more bus power supplies, with a **total "guaranteed supply current" that is greater than or equal to the calculated "total bus current consumption"**.
- If using more than one bus power supply, add the "maximum supply current" given on the label or in the datasheet. This **"total maximum supply current"** must not exceed 250mA. If it does, then the selected combination of bus power supplies is unsuitable – choose alternative bus power supplies.
- Don't forget that some products in the system may have integrated bus power supplies. These may be sufficient or may need to be disabled if there are too many – use the above calculations to check.

Table 7-4 Properties of DALI Bus Power Supplies

Feature	DALI Part Number
Guaranteed supply current > 100mA	Refer to the DALI Product Database
Maximum supply current < 250mA	Refer to the DALI Product Database

7.7 How to Specify Standalone AUX Power Supplies

When selecting the most suitable AUX power supply for your DALI system, consult the DALI Product Database for a comprehensive list of power supplies. Ensure that the specified AUX power supply aligns with your DALI system's voltage and power requirements to guarantee smooth and dependable operation.

Specifying With DALI – A Lighting Designer's Guide

The DALI Alliance is also known as the
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