

DALI-2 Specification – Australia/New Zealand

## General

The lighting control system shall be based on open standards confirming to best practice design, commissioning, maintenance, and security.

* 1. The lighting control system (LCS) shall be built upon the open AS/NZS 62386 standards as published by Standards Australia.
	2. The LCS shall have native support for DALI and DALI-2 input (switches / sensors) and output (LED drivers/relays/dimmers) devices based on IEC 62383 without requiring a protocol converter or gateways.
	3. Controllers should support multi-master and input device requirements defined in AS / NZS 62386-103. To ensure compatibility with products from a range of vendors, controllers that that support only proprietary input devices are not suitable.
	4. The LCS shall support the device types required to achieve the defined control schedule whilst considering future upgrades. At a minimum a control system should support.

Part 201 Fluorescent Lamps (Device Type 0)
Part 207 LED modules (Device Type 6)

Part 209 Colour change (Device Type 8)

Part 301 Particular requirements – Input devices – Push buttons
Part 302 Particular requirements – Input devices – Absolute input devices

Part 303 Particular requirements – Input devices – Occupancy sensor

Part 304 Particular requirements – Input devices – Light sensor

* 1. Where required the control system should additionally support.

Part 202 Self-contained emergency lighting (Device Type 1)

Part 206 Conversion to DC voltage (Device Type 5)

Part 208 Switching function (Device Type 7)

Part 218 Dimming curve selection

Part 252 Energy Reporting

Part 305 Colour sensor (upgradeable)

* 1. The control system shall be designed to ensure best possible system robustness. Single failure points shall be avoided. Distributed control is ideal.
	2. The LCS shall be securely firmware upgradable from a central location and allow future compatibility with newer standards and functionality.
	3. The control system shall support the use of a single line for input, output and emergency devices in accordance with the DALI-2 protocol to minimise wiring and commissioning expenses.
	4. Linking of control system components should be via an open standard such as TCP / IP ethernet. Where ethernet is used the controllers shall be suitable for use on both existing IT infrastructure a dedicated Building Systems Network (BSN) as stipulated in the electrical specification.
	5. Where TCP / IP connections are used network devices shall support a minimum of 100mbps connection speed for use in modern networks.
	6. System time shall be set with an open protocol such as Network Time Protocol (NTP) that does not require manual configuration to establish or maintain. Time clocks that must be manually set are discouraged.
	7. On networks of more than line, all commissioning and maintenance shall be possible from a central location. The control system as installed should provide all utilities required to address configure, maintain, monitor, and diagnose faults. Systems should not require connection of separate tools for system maintenance.
	8. Remote configuration shall be possible via cloud interface that does not require remoting in or port forwarding to the building services network.
	9. To support building configuration, the system should be expandable through the use of additional controllers on the existing network.
	10. The control system shall employ authentication and an encryption suite equal to or better than TLS 1.2 for both controller-to-controller communication and controller to cloud / external server.
	11. RSA key length shall be suitable for enterprise grade security (E.G. 4096). The controller shall incorporate PSK and PKI mechanisms as appropriate for the application
	12. The LCS shall require only outgoing ports for cloud connection.
	13. Controller shall not expose services such as Telnet and SSH to maintain security on local network.
	14. DALI and DALI -2 control gear and devices shall be connected to a series of DALI lines with an initial target of 55 output devices and 20 input devices per line to allow for future expansion / changes. Each DALI line should support addressing of 64 control devices and 63 control gear as defined in AS / NZS 62386-103.

## Switch Inputs

* 1. The proposed control system shall have a range of compatible DALI-2 control products shall be available for integration including
		+ - * Push Buttons
				* Illuminated Push button
				* Bus Couplers
				* Lighting control plate
				* Rotary dials
	2. Push button mechanisms shall be suitable for installation into Clipsal S2000 or similar faceplates.
	3. A LCP shall be complaint to AS / NZS 62386-301 (Push Buttons)
	4. The LMS shall support certified DALI-2 Push buttons across manufacturers

## Sensors

* 1. Sensors shall be located as appropriate to maximise detection an minimise false positives.
	2. Sensors shall incorporate both Motion detection and light metering. The Lux based control shall be independent of motion, I.E. a controller may use either the motion or light metering or a combination of both for control of lighting.
	3. The system shall support Sensor powered directly from the control line so that they may be installed without additional mains circuitry.
	4. The LMS shall support multiple light or occupancy sensors per controlled room or area.
	5. A sensor shall be compliant to AS/NZS 62386-303(Occupancy) and AS/NZS 62386-304(light sensor)
	6. The LMS shall support certified DALI-2 occupancy and light level sensors across manufacturers

## Touch Screens

* 1. The LCS shall support user configurable touch interfaces
	2. The LCS should support lighting control via applications running on Android or IOS devices.
	3. The LCS as installed shall support the addition of touch screen / apps without additional hardware that it may be added at any time as the usage requirements set by the site owner dictate
	4. The touch screen and app interfaces shall have options for local communication, I.E. TCP/IP to ensure continuity of control during internet outages.

## Relay Control

* 1. Relay devices shall be compliant to AS/NZS 62386-208
	2. Relays for switching of lighting loads shall be at a minimum TV-5 rated, with 120A inrush current
	3. Relays for switching multiple LED drivers shall have a minimum inrush of 450A for 0.2ms.

## Configuration

* 1. The behaviour of the control system upon receiving a push button, occupancy or light level event message shall be configurable and support those actions or tasks required meet the control schedule. Typically, a button press shall be able to initiate.
		+ - * A lighting command
				* A profile change
				* A sequence of events
				* An emergency light test
				* Sensor override

Typically, a sensor event shall be able to initiate

* + - * + A lighting command
				+ The initialisation or continuation of a lighting control sequence

These actions may be directed at

* + - * + Any Address, group, or broadcast on local controller
				+ Any Address, group, or broadcast on any controller connected to the same IP Subnet
				+ A lighting zone encompassing any number of controllers on the same IP Subnet
	1. Where appropriate Lighting control Sequences shall be common across all controllers in the control system. It is desirable that the common sequences can be edited at a single location.

## DALI Communications

* 1. Each controller shall individually address each input and output device even in control schemes utilising broadcast or group control to allow for per fitting diagnostics and maintenance. Duplicate addresses shall be automatically resolved.
	2. The control system shall record the GTIN and serial number of each connected device to meet building device traceability standards.
	3. The LCS shall be able to and communicate with query each input and output device independently.
	4. Broadcast and group control methods are allowed where appropriate provided they do not compromise device reporting.

## DALI status

* + 1. Each DALI-2 controller shall provide line status information to commissioning and maintenance personal, for example;
			- * DALI short
				* DALI device limit exceeded
				* Bad communications
				* Suspected excess DALI cable.
				* Firmware update in progress
				* Controller in startup

## DALI line design

* 1. DALI power supplies shall meet the requirements of AS / NZS 62386-101
	2. For systems of more than 15 devices each DALI line power supply shall have a guaranteed supply current of at least 235mA
	3. DALI control cabling shall follow the requirements of IEC 62386-101. Including;
		+ - * minimum cross-sectional area of 1.5mm2
				* Maximum end to end voltage drop of 2V
				* Maximum cable distance of 300M
	4. Where practical all DALI devices in a single room shall be connected to the same DALI line.
	5. Where practical all sensors and switches shall be directly connected to the same DALI line as the devices they control. However the control system shall still provide the ability for a switch or sensor to seamlessly control lights on any line.

## Local controller networks

* 1. Lighting controllers shall contain all required interfaces to connect directly to both the DALI line and TCP / IP network with the requirement of additional devices such as gateways or bridges.
	2. Systems should minimise protocol conversion for simplicity of installation and maintenance. Systems shall not require configuration and commissioning of multiple protocols to connect DALI devices to greater building control systems.
	3. Where the lighting control schedule calls for a connection to Building Management Systems the controllers shall support BACnet IP or equivalent via the local controller network.

## Cloud services

* 1. To minimise onsite time, call outs and commission time, secure connection to an Australian cloud service is desirable. The Cloud software shall be of a bidirectional type that synchronises changes back to local controllers.
	2. Configuration updates, access to test reports, maintenance and monitoring shall be provided via the cloud interface.

## Site management

* 1. The site management software should avoid the installation of any proprietary software on local machines. A modern browser-based interface is ideal. Interfaces for site users shall be accessible any modern web browser.
	2. The Lighting control system shall employ modern user access control to manage access, rolls and permissions. At a minimum the user access control shall.
		+ - * Provision individual user accounts which may provide them with access to one or more sites.
				* Provide multiple levels of account access, I.E. Site owners, Site users, tenancy owners, tenancy users
				* Support the addition and removal of user accounts by privileged accounts.
				* Limit access of building controllers to only those required by the user. I.E. by tenancy
				* Log actions and changes by users against their account.

## Scheduling

* 1. Where the control scheme requires time-based control or configuration each controller in the LMS shall maintain its own time via internal time clock or similar method. The time clock shall be backed up by battery backup so that after a duration of power loss the lighting system can resume operation as appropriate for that time of day.
	2. Where the control scheme requires timed events to be tied to sunrise and sunset the control system shall implement an on-board astrological clock to calculate sunrise and sunset times based on site location.

## Emergency Test software

* 1. Emergency lighting devices shall be compliant to AS/NZS 62386-202 AS 2293.3 and AS/NZS 60598.2.22.
	2. The Lighting control system shall the test facilities described in AS/NZS 62386-202. The system shall not require a proprietary emergency test protocol or proprietary emergency devices.
	3. The lighting control system shall be compliant with the requitements of automated test systems described in AS 2293 Parts 1-3
	4. The LCS shall incorporate a test manager cable of starting and scheduling both function and emergency tests, recording results and tracking devices through life whether removed, replaced or moved within the system.
	5. As new devices are connected to the DALI line the test manager shall automatically add those devices to a default function and duration test schedule.
	6. The LMS shall track the globally unique GTIN and serial numbers of connected devices to ensure that test history and integrity cannot be corrupted by changing short address.
	7. The LMS shall support the initiation of manual tests via push button, Key switch or user interface.

## Commissioning and handover

* 1. The LCS system shall be configured to meet the requirements specified here and in the lighting control schedule.
	2. The supplier shall support the system including provision of
		+ - * As configured report.
				* Emergency test results
				* Graphical representation of lighting and control arrangements.
				* Client demonstration
				* Client training
				* Usage instructions