

1 LIGHTING CONTROL SYSTEM

1.1 Introduction

The lighting controls scope of work is based upon maximum flexibility and maximum control. It provides a system that can be reconfigured without the need to rewire, while providing control down to an individual ballast.

The lighting control system is to be a DALI (Digital Addressable Lighting Interface) control system with DALI controlled fixtures and DALI controllers throughout the interior space. The lighting controllers, ballasts, emergency fittings and other operating devices are to fully comply with the DALI standard (IEC 62386) enabling devices from multiple manufacturers to be used in the system.

DALI loops are to be linked on an Ethernet network using DALI Control BM2500-DALI controller/gateways from Monitor Software to provide computer control, configuration and analysis as well as occupant control from computers in their workstations and offices.

The system must provide manual control, scheduled occupancy control, automatic occupancy control and daylight harvesting to dim down the electric lighting in response to daylight admittance.

The lighting controls are to utilize timed schedules, occupancy sensors, light sensors and switches to control the lighting in the interior spaces on each floor. The overall intent is to provide electric light only when the space is occupied and to provide as little electric light as is necessary to achieve the required light level for the work plane.

The system is to provide the status of all ballasts and emergency fittings on the system and is to provide the tools to identify and replace ballast and lamp failures.

The successful tenderer is to engage a specialist software integrator to program and commission the system such as Monitor Software (contact Andrew Parker on 0408 367006).

1.2 System Description

The lighting control system shall consist of multiple DALI loops linked to form a building-wide solution using intelligent BM2500-DALI controller/gateways on an Ethernet network.

As DALI is a distributed control system all DALI controller/gateways and DALI controllers must co-exist enabling devices from different manufacturers to be mixed and matched to provide maximum flexibility now and in the future. Controllers must not interfere with each other in compliance with the DALI standard (IEC 62386).

The DALI control system shall be capable of incorporating DALI Operating Devices from multiple vendors including:

- DALI Ballasts for control of fluorescent and compact fluorescent lamps
- Transformers for low voltage fittings
- LED Drivers
- Ballasts for HID lamps
- DALI Relay Modules
- Exit Signs and Emergency Fittings
- Inverters for Evacuation fittings
- Future DALI operating devices from various manufacturers

The system is to be capable of incorporating a wide range of controls from multiple vendors including those shown in the list below. These should include but not be limited to wall mount controls, occupancy sensors and light level sensors.

- Controller/Gateways
- Group Controllers
- Schedulers
- Sequencers
- Occupancy Sensor Interfaces
- Light Sensor Interfaces
- Blind Controllers
- Partition Controllers
- Remote Controllers
- Touch panels and screens
- Access Controllers – door controllers
- Security panels
- SMS/Email Communications modules
- Future DALI controllers from various manufacturers

1.3 DALI Controller/Gateways

The BM2500-DALI Controller/Gateways are required to link the distributed DALI loops onto an Ethernet network in order to provide computer configuration, control, analysis and maintenance.

The controller/gateways are to operate independently and must continue to process local inputs and schedules when disconnected from the network. The controllers must not be reliant on a server.

The controller/gateways are to provide scheduling of DALI groups for scheduled occupancy, sequencing for override timers and effect lighting.

The controller/gateway shall provide local intelligence and features including:

- a) Integrated real time clock with automatic daylight savings adjustment and leap-year correction.
- b) Integrated sunrise/sunset support based on site location (latitude and longitude).
- c) Automatic Time Schedules to control groups for scheduled occupancy with support for holiday exceptions.
- d) 16 multi-function digital inputs for operator pushbuttons and sensors including occupancy sensors and daylight sensors.
- e) 2 digital outputs for additional control and interlocking to external equipment such as fans, valves and security panels.
- f) 32 configurable sequences for override sequences, mood and effect lighting.
- g) Each controller/gateway is to support two DALI control loops (up to DALI 128 ballasts).
- h) An in-built web server for error reporting of DALI loop, ballast and lamp failures.
- i) Local processing. In the event of network failure or disconnection from the Ethernet network the intelligent controller/gateway is to continue to run automatic time schedules and process inputs independently.
- j) Computer monitoring and configuration. The controller/gateway shall allow configuration, monitoring and analysis from computers on the Ethernet network.
- k) Computer control. The controller/gateway shall allow occupants to control their local lighting using their computers on the network.

1.3.1 Controller/Gateway Inputs

The controller/gateway inputs are required to provide manual control through the use of switches and pushbuttons, occupancy control using motion detectors and daylight harvesting using light sensors. The inputs are also used for integration with remote controls, security panels and access control systems.

The controller/gateway shall provide:

- a) 16 integral digital inputs for use with switches, pushbuttons, occupancy sensors, light sensors etc.
- b) Multi-group functionality so that one input can control multiple DALI Groups. An input is not to be limited to a single group.
- c) Input Profiles that enable an input to operate differently for Normal-hours and After-hours operation.

Examples of uses for this functionality include but are not limited to:

Wall-plate Pushbutton

Office Hours:	Single button dimmer
After Hours:	Toggle MAXIMUM/OFF with dimming override sequence (30 min 75%, 5 min 50%, 5 min 25%, 5 min OFF)

Wall-plate Pushbutton – After Hour cleaners

Office Hours:	Single button dimmer
After Hours:	Toggle 60%/OFF with override sequence (25 min MINIMUM, 5 min OFF)

After hours Occupancy sensor

Office Hours:	disabled (lights are scheduled ON)
After Hours:	40 minute Override Sequence (MAXIMUM, 30 min 50%, 5 min 25%, 5 min OFF)

Occupancy sensor with variable override

Office Hours:	60 minute Override Sequence
After Hours:	30 minute Override Sequence

Toilet occupancy – reed switch

(Toilet lights are scheduled on to MINIMUM)

Office Hours:	MAXIMUM, 15 min MINIMUM
After Hours:	30 minute Override Sequence

- d) The inputs are to provide different functionality based on a condition.

For example, in a partitioned room a wall-plate switch is to control the partitioned area when the partition is closed and the whole area when the partition is opened.

1.3.2 Automatic Time Schedules

In order to cater for scheduled occupancy the controller/gateways shall include an integrated real-time clock.

The controller/gateway shall provide:

- a) An integrated real-time clock to allow automatic time schedules to be run on the gateway independent of the Ethernet network.
- b) To ensure ongoing accuracy the real-time clock is to support automatic synchronization with a network time server.
- c) The real-time clock is to provide automatic daylight savings adjustment and leap year correction.
- d) Sunrise/sunset support based on site location. Schedules are to be provided with a configurable offset to allow lighting to be controlled relative to dusk and dawn.
eg. Sunrise + 20 minutes
Sunset – 30 minutes
- e) Custom time schedules are to be configured for an absolute time
eg. Office Open, Monday to Friday at 8:30am
Cleaners lights, Thursdays at 8:00pm
- f) Linked time schedules relative to another time schedule
eg. Office Open + 15 minutes
- g) Repeat time schedules
eg. Run façade lighting sequence every 30 minutes from 7pm until 11pm
- h) Time schedules must be able to be configured to include or exclude holiday periods. Holiday periods are to be configurable for one or more days and are to be able to be selected as perpetual (eg. January 1, every year)
- i) Scheduled actions are to include all DALI commands (eg. MAXIMUM, SCENE2), DALI Arc Levels (eg. 80%) and Sequences (eg. 50%, 5 mins 25%, .5 mins OFF).
- j) Configuration of the time schedules is to be completed from a computer over the Ethernet network.

1.3.3 Sequences

Control sequences are required to provide multi-step override timers and mood and effect lighting.

Examples of uses for sequences include:

Override sequence	30 mins 75%, 5 mins 50%, 5 mins 25%, 5 mins OFF
Delayed exit button	Goto 50%, 5 mins MINIMUM, 5 mins OFF
Façade color mixing	variations in red, green, blue over time
Mood lighting	SCENE1, 20 sec SCENE2, 30 sec SCENE3, 40 sec SCENE4

- a) The controller/gateways are to be able to store 32 sequences of up to 8 steps where each step consists of a configurable time delay and action. Longer sequences are to be achieved by linking sequences.
- b) Sequences are to be activated by a Time Schedule, from an Input or by Computer/PDA via the Ethernet network.
- c) Configuration of the sequences is to be completed from a computer over the Ethernet network.

1.3.4 Computer Control

In order to get the most out of the lighting control system it is advantageous to provide individual occupants with the ability to adjust the light level of their own workspace. This is particularly true of people working in front of a computer screen where comfort levels differ from person to person.

It is therefore a requirement of the controller/gateway to accept commands from computers connected to the Ethernet network. This provision is to be provided by a desktop applet that provides the user with full control of his/her lighting.

The applet is to include a slider with full dimming capabilities plus buttons with the following functions: Maximum, Minimum, Off, Scene 1 to 16, Previous, Favorite 1 to 4.

The group of ballasts to be controlled is to be configurable.

1.3.5 Status and Error Information

The controller/gateways are to monitor the connected DALI loops are to provide status and error information for DALI loops, ballasts and lamps.

The status and error information is to be available on web pages served by the integrated webserver in the controller/gateway. This means that only a web-browser is required by maintenance or operations staff to monitor the system.

1.3.6 Maintenance and Ballast Replacement

The controller/gateway is to monitor the connected DALI loops are to provide status and error information for DALI loops, ballasts and lamps. The maintenance software is to identify a faulty ballast and address and reconfigure the replacement ballast with a simple point and click operation.

1.4 Wallplates

Wallplates consisting of push to make switches are required to provide the occupant with manual control of the workspace lighting. The switches are to be configurable so that they can issue different DALI commands depending on the usage requirements of the space.

Uses of the switches include but are not limited to the following:

- Toggle button, eg. On|Off
- Single button dimmer, eg. On|Off and Up|Down
- On and Up button
- Off and Down button
- Scene button, eg, Scene 1
- Multi-scene button, eg Scene1, Scene2, Scene3, Off

A typical wallplate configuration for an office space consists of a single button providing toggle on/off and dimming capabilities. A typical configuration for a meeting room consists of a 6-button wallplate providing three scene buttons, up and down buttons and an off button.

It should be noted that many buttons require an override sequence for after hours operation as detailed in the specification control schedule.

A full list of the required wallplates is provided in the accompanying drawings.

1.5 Occupancy Sensor Interface

The DALI occupancy sensor interface is used to control a group of ballasts depending on the occupancy of an area as determined by occupancy sensors. The interface is to operate with one or more occupancy sensors that provide a contact closure output.

The group of ballasts to be controlled is to be configurable allowing the space to be reconfigured or modified without changing the fixture wiring.

The lighting level activated when the sensor detects a change in occupancy is to be configurable to match the use of the space.

1.6 Light Sensor Interface

The DALI light sensor interface is used to control the level of a group of ballasts depending on the light level of an area as determined by a light sensor. The light sensor interface is typically used to control a group of ballasts adjacent to a row of windows.

The group of ballasts to be controlled is to be configurable allowing the space to be reconfigured or modified without changing the fixture wiring.

When the group is on the light level is raised or lowered depending on whether the light level determined by the light sensor is above or below the setpoint.

1.7 DALI Relay Module

The DALI Relay Modules are required to provide ON/OFF control for non-dimmable loads such as standard electronic ballasts, incandescent lamps, fans and motors. The modules are to accept DALI commands over the DALI loop allowing modules to be placed adjacent to the load to be controlled.

The DALI Relay Modules are to be provided as indicated on the accompanying drawings.

1.8 DALI Blinds Controller

DALI Blinds Controllers are required to allow blinds and curtains to be incorporated into the lighting control system where indicated on the accompanying drawings. The controller is to be fully DALI compatible allowing the blinds to be integrated into DALI scenes.

The blinds controller should have two independent control channels each with two single pole volt free contacts capable of switching the required load.

The blinds controller is to include a status LED and relay state indicators. The status LED is to provide status and fault indication. The relay state indicator LED's are illuminated when the respective relay is closed.

The relays in the blinds controller are to be internally isolated permitting separate mains phases to be controlled in one unit.

1.9 Emergency and Exit Signs

The lighting control system is to incorporate the emergency fittings and exit signs as detailed in the accompanying drawings. The emergency lighting is to be monitored on the DALI system in line with the DALI emergency standard.