Abridged Engineers Specification

DALI LIGHTING CONTROL SYSTEM

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1. GENERAL: SYSTEM DESCRIPTION

The Contractor will allow to supply, install, test and commission a fully functioning, native DALI Compliant Lighting Control System [with a high level BMS interface] complying with the following requirements.

This DALI Networked Lighting Control System ("the system") shall only use DALI and Ethernet infrastructure for distribution of the system's messaging protocol. As such, use of non-networked devices – such as stand-alone sensors – are not permitted unless specifically called for or included on the drawings.

This lighting control system shall provide full control of all connected areas as indicated on the drawings and provide full compliance to the International Standard for Lighting Control – IEC62386, DALI, through use of appropriate, DALI Compliant systems and products.

1.1. The Lighting control system must be DALI Compliant, must carry the DALI certification label (as proof of DALI testing); with the DALI Compliant products listed on the DALI AG website from a DALI Group Member.
1.2. DALI Compliance means the DALI standard – IEC 62386; Including General Requirements: 101 (System), 102 (Control Gear), 103 (Control Devices)
1.3. The contractor shall provide, upon request, relevant DALI testing and DALI Compliance Certification documentation for all DALI Compliant devices installed.
1.4. This DALI Compliance requirement includes DALI drivers and/or DALI ballasts being provided by the luminaire manufacturer or supplier.
1.5. All input devices such as LCPs', light sensors and motion sensor shall be connected to the DALI line either directly or via a DALI compliant application controller as defined in the DALI Standard, such as a RAPIX DALI eHUB device.
1.6. All output devices such as DALI relays must be fully DALI compliant and adhere to section 1.1.
1.7. The DALI Lighting control systems shall be capable of DALI Type 8 control (also known as DALI 209 and DALI Tunable White). Solutions which do not provide this control or require separate components to meet this requirement shall not be accepted.
1.8. DALI devices described as DALI compatible rather than DALI Compliant shall not be accepted. DALI compliance is essential to meet specification compliance

2. Building Wide Lighting Control System

2.1. The system shall be able to link all DALI lines into one integrated system through the use of Ethernet enabled DALI Zone Controllers. Each DALI Zone controller shall include built in Ethernet and a dual port Ethernet switch on-board to allow Ethernet devices to be inter-connected to each other without the need to home run Ethernet cables from every zone controller to the buildings LAN connections to achieve this connectivity.
2.2. The programming and scheduling information for the building wide DALI system shall be stored in every DALI zone controller for fail-safe redundancy so that if any DALI zone controller goes offline the remainder of the system continues to fully function.
2.3. The DALI zones controllers shall perform all astronomical time schedules. The DALI zone controllers will automatically negotiate a time clock master on the Ethernet network to ensure that all schedules always run. If the Ethernet network between the DALI zone controllers is disrupted such that 1 or more Ethernet networks are created, the DALI zone controllers shall automatically nominate a new time clock master to ensure no schedules are missed.
2.4. The DALI Zone controllers shall feature comprehensive systems redundancy whereby a failure of any controller allows the site project or definition information for all controllers to be retrievable, including the failed controller.

2.5. Lighting System Controllers that store information exclusively to themselves with no redundancy shall not be accepted.

2.6. The DALI Zone controllers shall not need manual re-programming in the event of a failure. Instead, assigning the replacement device with the failed device's IP Address shall enable the system to automatically re-program the replacement device.

2.7. DALI Compliant power supplies shall not be integrated in the DALI Zone controllers. A separate DALI power supply per DALI line shall be provided to allow for simple replacement in the case of a power supply failure without needing to replace the DALI zone controller to return the DALI line back to operational status.

2.8. DALI controllers with embedded power supplies shall not be accepted.

2.9. It shall be designed to ensure the maximum current delivered to a DALI line of 250mA will not be exceeded.

2.10. The DALI Compliant power supply shall provide sufficient power to the DALI line such there shall be at least 64 mA DALI power supply margin when all luminaires and control devices are connected to a line for satisfying peak current demands that occur during the communication to ensure communication effectiveness.

2.11. The DALI Zone controllers must display the IP address of the controller on an externally visible LCD screen for easy identification of the device without having to connect to the device or the network with a PC.

2.12. This LCD screen must also enable further diagnosis of both the controller and the DALI lines which are attached to it, including the ability to control the DALI lines directly by using built in navigation buttons and menu system, without a PC or network connection.

3. Lighting Control System Security

The intent of providing the secure lighting control system is to prevent and limit risk, damage and consequences from potential unauthorised system access for the purpose of:

(i) unauthorised control of the system;
(ii) preventing legitimate use of the system;
(iii) unauthorised monitoring of the system;
(iv) unauthorised modifications to the system

Further, the security requirements specified below shall be included in the lighting control system to prevent and limit the risks associated with the following attack vectors:

- Impersonation attacks,
- Replay attacks,
- Man in the Middle (MITM) attacks,
- DoS / DDoS attacks,
- Site-wide field bus attacks

3.1. The lighting control system shall ensure that all IP lighting control message communications between its own devices are encrypted and authenticated. Systems which are incapable of providing this level of security as detailed below shall not be accepted.

3.1.1. This authentication and encryption shall be operational immediately upon energizing the lighting control system components and shall be active without the need for human intervention.

3.1.2. The lighting control system shall provide this security capability via Ethernet connected DALI line controllers.

3.1.2.1. Systems which require additional system or 3rd party hardware to achieve this level of security shall not be accepted.

3.1.3. Each DALI line controller shall share the same security capabilities to eliminate a single point of failure or unauthorised access via a "weak link".

3.1.4. The system shall not act on IP lighting control messages until the source has been authenticated.

3.1.5. The system shall employ a means of ignoring repeated messages to protect against replay attacks.

3.1.6. It shall not be possible to disable the message encryption, even to aid system debugging.

3.2. The lighting control system shall use a project key for authentication to prevent unauthorized access and systems changes.

3.2.1. These keys shall be randomly generated to prevent the use of common passwords.

3.2.2. The lighting control system shall provide a secure mechanism to recover stored system data only by having physical access to the DALI Line Controllers. This acts to prohibit unauthorized systems changes. It also acts to guarantee that the operator/owner is not ransomed by a single party for system maintenance in the future.

3.2.3. Systems which require system-files to maintain the system and/or systems which allow unsecured access to retrieve files from system hardware without the use of a key shall not be accepted.

3.3. The lighting control system hardware shall not have TELNET or FTP services running.

3.3.1. Systems which use these services shall not be accepted.

3.3.2. Any other open ports must apply the security requirements described herein.

3.4. The lighting control system shall have passed vulnerability testing, such as Nessus and the contractor shall, upon request, provide a copy of the vulnerability test.

3.4.1. System which are unable to provide proof of this vulnerability testing shall not be accepted.

3.5. The lighting control system's security methods shall use industry standards and not 'home-brew' or non-standardized encryption methods to ensure industry best practice protection and provide clear security upgrade paths.

3.5.1. Symmetric encryption (e.g. AES) must use a key of at least 128 bits.

3.5.2. Asymmetric encryption (e.g. RSA) must use a key of at least 512 bits.

3.5.3. Hashing functions (e.g. MD5, SHA) must be at least 128 bits.

3.5.4. Messages much use a mechanism to detect and reject messages that have been tampered with (e.g. message HMAC).

3.5.5. The system must use a mechanism to detect and reject replayed messages.

3.5.6. Block cyphers (e.g. AES) must use a random Initialisation Vector for each message.

3.6. The lighting control system shall limit unauthorized control and communication from field input devices.

3.6.1. If an attacker is able to connect to the field bus, any such connection shall have control limited to the same as the configured devices which are attached to the field bus segment to prevent the potential for site-wide control, nuisance and damage.

3.6.2. Any third-party system connected to the field bus shall have control limited to the same as the configured devices which are attached to the field bus segment to prevent the potential for site-wide control, nuisance and damage.

3.7. The lighting control system shall protect passwords using industry best-practice

3.7.1. Usernames and passwords must be stored encrypted or as a salted hash

3.7.2. Log-in credentials must be transmitted within the system encrypted or as a salted hash

3.8. The lighting control system shall ensure that all IP lighting control message communications between 3rd party systems and the lighting control system are provided using the same security methods.

4. Lighting Control Panels

4.1. The system shall provide a modular switch approach whereby combinations of master and slave modules can create precisely defined lighting control panels without leaving blank or unused buttons.

4.2. Each master push button or rocker type shall be capable of being connected to up to 5 slave devices for creation of 6 gang lighting control panels to a single master.

4.3. These modular switches shall be able to be inserted into standard '30 mech' apertures.

4.4. Each modular switch shall have two LED backlight colours – white and amber – which can be configured to operate based on system state.

4.5. The switch plates shall, for easy circuit identification without the need or cost of button engraving, provide the ability to replace the button switch surrounds and /or the rotary dial rings with different coloured surrounds or rings respectively.

4.6. Switch plates shall include the ability to provide digital rotary dimming functionality. These digital rotary dials shall be provided with a small and a large dial to suit the aesthetics of the wall switch selected.

4.7. The rotary dials shall provide a Quick Flick functionality - whereby a quick flick of the rotary dial either clockwise or counter-clockwise instantly dims the connected lighting to the **maximum** or **minimum** levels respectively.

4.8. The rotary dials shall be able to adjust the fade rate associated with the rotary dial to increase or decrease the rate at which the lights dim up or down depending on the rotation of the dial.

4.9. The system shall provide automatic LED Indicator state tracking so that control of any short address or group address from one LCP is automatically visually indicated on associated buttons.

5. System Commissioning

5.1. Initial DALI Short Addressing, DALI Scenes and DALI Group Commissioning shall be performed using the RAPIX Addressing software to ensure no time is wasted during the DALI commissioning phase and to provide a level playing field for commissioning agents and contractors

6. Specific Requirements and Integrations

6.1. DALI Emergency Lighting Monitoring

6.2. Where specified and detailed in other sections of this specification, the Monitored Emergency Lighting System shall comprise of DALI Emergency drivers and comply to AS/NZ2293.

6.3. This DALI Emergency requirement shall be integral to the DALI Zone controllers allocated to control the lighting, without the addition of separate specialised hardware to provide communication and AS/NZ2293 compliance.

6.4. The Emergency Monitoring software shall reside on a Windows 7 (or greater) PC and be connected to the system via Ethernet.

6.5. DALI Emergency and DALI LED, DALI Relay, DALI ballasts and other DALI product types shall co-exist on a single DALI line to reduce cabling and equipment requirements.

6.6. 3rd Party Device Integration

6.7. The system shall be capable of having DALI Compliant Control Devices connected, from any manufacturer, on all DALI lines and respond accordingly to these complying DALI commands.

6.8. The system shall be capable of accepting the complete range of complying DALI commands issued from these 3rd party DALI compliant control devices for control of the DALI line on which it is installed.

6.9. Systems which cannot accept 3rd party DALI compliant control devices on the DALI line or require only DALI control devices from a single manufacturer, shall not be accepted.

6.10. Additionally the system shall be able to utilise complying DALI messages from 3rd party DALI compliant control devices to trigger scenes on other DALI lines anywhere in the system, when the system is utilizing DALI Zone Controller hardware.

7. BMS Integration

7.1. The lighting control system will have a high level interface to the BMS to enable integration. This functionality will depend on the BMS interface required and the precise integration points determined.

7.2. This BMS integration will be achieved through software without the need to add a separate specialized BMS interface hardware device for protocols such as BACNET, MODBUS, OPC, LON, KNX.

APPROVED MANUFACTURERS

The Lighting Control equipment shall be manufactured by:

Diginet Control Systems
Member of Gerard Lighting
96-112 Gow Street,
Padstow NSW 2211

RAPIX Lighting Control System