

Acknowledgements

IPWEA gratefully acknowledges the financial support of the Australian Government’s Department of the Environment and Energy in producing the original edition of this model specification in 2017 and of our corporate partners in producing this updated version. The intellectual contributions made to and assistance in reviewing drafts of this document by many Street Lighting and Smart Controls (SLSC) Programme partners is also gratefully acknowledged.

SLSC Partners

|  |  |  |
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| Institute of Public Works Engineering Australasia | Sylvania-Schréder |  |

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1 | Introduction

The need for a Model Public Lighting Controls Specification was first recognised in 2016 stakeholder consultations during the establishment of IPWEA’s public private partnership for the Street Lighting and Smart Controls Programme (SLSC) and is described on IPWEA’s website [www.slsc.org.au](http://www.slsc.org.au) and [www.slsc.org.nz](http://www.slsc.org.nz). Stakeholders noted a wide variety of approaches to early controls exploration and procurement that strongly suggested that impediments and inefficiencies were occurring across the economy, particularly in contrast to some overseas markets where adoption has been much greater.

Many buyers remain new to and largely unfamiliar with control systems for public lighting and thus have adapted guidance and procurement documents from a variety of local and international sources, often in an incoherent, inconsistent and internally contradictory manner.

This has resulted in procurement processes that were costly for suppliers to respond to, and raised the risks of inappropriate or poorly performing outcomes for buyers. Overall, this inefficient process has impeded the timely uptake of controls for public lighting despite the many demonstrated advantages they provide. A robust procurement model specification can address these issues and raise overall confidence levels about the use of control systems in public lighting.

The SLSC model specifications have been downloaded over 2000 times and an analysis early in 2019 by IPWEA showed that a large percentage of the top 50 Australian councils, road authorities, utilities and consultants have downloaded the model specifications. However, Version 1.0 was published in July 2017 and, in the three years since then, there has been much experience gained and many technology improvements and standards updates have occurred.

Version 2.0 accommodates a range of updates in significant areas, including:

* Terms and definitions;
* Domestic and international standards reflecting new technical features now available (eg asset management capabilities under DALI-2);
* The addition of and updates to Excel-based returnable technical schedules;
* The addition of and updates to an Excel-based pricing schedule; and
* Removal of sections related to procurement of other smart city devices as these were distracting from the main purpose of the specification and would require separate detailed consideration to be addressed adequately.

1.1 Purpose and Target Audience

This document is targeted at procurement and technical staff. It is intended to facilitate the acceleration of the adoption of smart networked lighting controls in public lighting. It expects to do this by assisting public lighting buyers, vendors, contractors, funders and advisors to efficiently and economically engage in procurement of control systems for public lighting.

The objective of this model specification is to provide an informative, structured template that is focused on the technical aspects for local governments, main road authorities and electricity distribution utilities to help them prepare their own customised specifications within a structured procurement either as a Request for Proposal (RFP), a Request for Quote (RFQ), or as a Request for Tender (RFT).

This Model Specification provides outcome-based guidance which has been harmonised with both international and local standards and specification requirements for public lighting. It seeks to accommodate and encourage innovation within the bounds of compliance with prevailing design, safety and performance standards and specifications. It is configured to cover both Australian and New Zealand application under the AS and AS/NZS standards framework. Once customised to their own circumstances, a procuring entity can use the resulting specification to select a suitable control system with confidence in the outcome.

In 2017, the smart networked controls sector for public lighting was very new to Australia and New Zealand, so this model specification was a substantial addition to the available public domain information. The development of the original version was funded by the Australian Federal Government to improve energy, environmental, economic and social outcomes.

1.2 The aim of Model Public Lighting Controls Specification

The aim of the Model Public Lighting Controls specification is to be:

1. Technically robust and current;
2. Accommodating of a modular procurement approach where each technology level – possibly provided by separate vendors - is interoperable with the other, or conversely a turnkey approach where the whole system is provided by a single Vendor. This is further explained in Section 3.
3. Compatible with AS/NZS standards and specifications and addressing gaps where AS/NZS guidance does not exist or is not suitably current;
4. Written concisely in easy to understand language;
5. Applicable to large and small projects in urban and rural applications;
6. Structured to include a range of selectable options to be chosen by the user to deliver a customised specification meeting their needs;
7. A living document, subject to ongoing review as the technology and market evolves; and
8. Widely and freely available to reduce barriers to uptake of controls and dramatically increase the likelihood of procurement and application.

Suggestions for improvements are welcomed. Please forward suggestions to the IPWEA head office using the contact details provided [www.ipwea.org](http://www.ipwea.org)

1.3 Why good public lighting design and smart controls are important

LEDs and smart controls have advanced greatly in recent years and provide many features and advantages that improve amenity, environmental, safety and financial outcomes in towns and cities. There are however some potentially adverse human and ecological impacts from all artificial lighting at night which good lighting design and the use of smart controls can help manage and minimise.

Artificial lighting can have an impact on human sleep patterns and the feeding, breeding and migratory patterns of some endangered species, in particular sea turtles, penguins and certain species of sea birds (see for example, Department of Agriculture, Water and the Environment - National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds). Different LED spectral distributions and smart controls systems have the ability to greatly mitigate such adverse impacts by eliminating some parts of the lighting spectrum that have an impact on these species and, by selectively and flexibly dimming or turning off lighting at sensitive times such as during seasonal breeding or migration periods. Specialist lighting design advice (eg from a full Member of the Illuminating Engineering Society ANZ, Registered Lighting Professional or equivalent) and specialist ecological advice is required on such matters.

Smart controls provide cities, suburbs and rural communities with many important benefits including those summarised below:

1. Efficiently maintain important safety infrastructure (public lighting) through computerised asset management techniques;
2. Tailor lighting levels, via the ability to facilitate adaptive lighting, to the precise requirements so that excess lighting is reduced and any harmful or unwelcome effects are minimised;
3. Reduce electrical energy usage at times when less lighting is required;
4. Precisely measure the electrical energy consumed (in contrast to the current practice which is often not metered) to capture the benefits of tailored lighting levels and off-peak dimming (now recognised in AS/NZS 1158.3.1) and switching; and
5. Provide a network infrastructure for sensors and smart devices to improve community liveability and resilience.

However, the features that provide these benefits also add complexity to the specification and procurement process, with which the market is unfamiliar, so there is a strong need for a guiding model specification document to help achieve best practice.

1.4 Document Guidance

This model specification is a multi-choice general guidance document targeted to assist procurement organisations to develop their own customised specification tailored to the exact needs and circumstances of the applicable region and organisation. The selectable content is divided into three categories, plus guidance notes (to be deleted after customisation):

1. Suggested text for inclusion in the tender document by **all** users is presented as mandatory requirements identified in normal black text;
2. Alternative options considered suitable for **some** users, is presented as an optional requirement to be chosen by the purchasing organisation are shown in Bold Green Italic; and
3. Where text is used to instruct user action, this is identified by bold blue coloured and/or by square brackets [ ].

**Note:** Explanatory text to guide user customisation is in burgundy coloured text boxes (as per this example) **which is intended to be deleted** after Users have finished compiling their own Customised Specification.

This Model Public Lighting Controls Specification document has been compiled and formatted in Microsoft Word 2016. Formatting is very important to facilitate comprehension of a necessarily complex and comprehensive subject so we recommend that Microsoft Word 2016 or later is used.

1.5 User Customised Specification - Source Acknowledgement

This IPWEA model specification is free-issued publicly in editable Word document format to allow for ease of customisation and general user convenience. Updated versions will be issued in future by IPWEA, as and when required on the [SLSC Website](http://www.slsc.org.au/home). When undertaking the compilation of a Customised Specification, Users should ensure that they are using the most current model specification version.

When compiling a customised specification IPWEA requests that:

1. Users maintain the completeness and structural integrity of the Model Specification document and customise only the user selectable options. Users should acknowledge the source of their Customised Specification e.g. “Based on IPWEA Model Public Lighting Controls Specification Version X.X”. This approach should improve procurement familiarity and assist Tenderers, Vendors and Users to reduce procurement time and costs;
2. If the Model Specification is materially altered, Users must not state or imply that the document is based on the IPWEA Model Public Lighting Controls Specification. ***Users must clearly indicate which part of the Model Specification has been altered.*** Ideally, IPWEA should be notified so that if the material change is one which would benefit the industry, it could be included in the next version of the Model Specification; and
3. Any excerpts of sections of the Model Specification should acknowledge IPWEA as the source.

1.6 Disclaimer

Although the information in this publication is believed to be correct at the time of printing, the Institute of Public Works Engineering Australasia (IPWEA), and its agents, contractors, directors, employees, subcontractors and officers, do not accept any contractual, tortious or other form of liability (including in negligence) arising from the information contained herein, to the extent permitted by law. The information included in this publication is intended as a general guide only, and is not tailored to your needs and circumstances. People using the information contained herein should apply, and rely upon, their own skills and judgement to the particular lighting installation they are considering, and seek appropriate professional lighting design and engineering advice as needed.

This document is not a substitute for specialist professional advice.

1.7 Document Information

Version 2.0 August 2020

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2 | Information for Tenderers

Note: This section makes recommendations about information to be provided to Vendors about the procurement timetable, the project being tendered, the required responses and how bids will be evaluated. The contents below are normally included in the ‘Information for Tenderers’ section of procurement documentation.

Note: When compiling public lighting controls specifications and tender documents significant consideration should be given to the various parties responsible and liable for delivering the lighting, safety and financial outcomes expected. With council-owned public lighting assets the lines of responsibility and liability are clear and obvious. But with Distribution Network Service Provider (DNSP) owned public lighting delivered as a service to councils (as is the majority case in Australia), the lines of demarcation are less clear.

If a DNSP is undertaking a public lighting controls procurement process on behalf of a council user there should be structured discussion and agreement between those parties regarding lighting requirements prior to the compilation of a Customised Specification. The versatility and flexibility of LED Luminaires and lighting controls can provide many functions that were previously not possible. This creates opportunities such as improved safety and amenity, cost savings and revenue prospects. However, there is a corresponding increase in exposure to risks, responsibilities and liabilities, that are ultimately borne by the service user (councils and road authorities) not the service provider.

This Model Specification does not cover the above issues as that is part of a commercial agreement, but both parties need to be very clear about how the detailed specification topics covered in this document will impact on the commercial issues.

Note: When Users are compiling a Customised Specification based on this Model Specification care is needed with selection options to only request quantities and levels of functionality for data collection and reporting to cater for tangible and identified User needs. Requesting additional or higher levels of functionality without identified User need (now or in future) may unnecessarily increase system complexity and cost. This has to be carefully weighed against the risk of insufficient future-proofing, as it would be a false economy if capacity to accommodate realistic future needs was not factored into procurement documents.

2.1 Procurement Process Timetable

The indicative timetable for this procurement process is as follows:

**Table 1 Procurement Process Timetable**

|  |  |
| --- | --- |
| **STAGE** | DATE |
| Tender release | DATE |
| Tender close | DATE & TIME |
| Short-listing notification | DATE |
| Short-listed candidates’ deadline for response with additional information requested | DATE – *Suggested as 1-2 weeks from short-listing notification* |
| Tender award date | DATE |
| Initial Control System delivery date | DATE - *Required delivery date of initial order. Procuring bodies should note that almost all Public Lighting Control Systems are manufactured overseas. Typical delivery lead times are 12-16 weeks for most suppliers.* |
| Targeted end date for the project | DATE |

Note: It is strongly suggested that a clear procurement process timetable as per the approach above is included as an introductory part of any Control System tender. This serves to both increase tenderer confidence that they are participating in a robust process and compels suppliers, in later sections of this tender, to identify whether they can meet delivery timetables

2.2 Project Description

This tender specification is for a Public Lighting Control System for**:** [Project Name] Covering: [Light Point Controller quantity] Light Point Controllers with a supporting Central Management System and Backhaul Communications Network.

[Insert concise 50-100-word project description summarising the geographic area and lighting types encompassed in the project.]

This tender specification does not represent a guarantee that procurement in the volume indicated above will eventuate or will actually be required. This procurement process is undertaken in good faith, but with no explicit or implicit obligation.

2.3 Tender Response

In responding to this tender, tenderers need to provide the following completed schedules:

1. **Schedule A - Vendor Information & Referees**
2. **Schedule B - Control System Technical Specification Compliance Response for:**
   1. **Central Management System**
   2. **Communication Networks**
   3. **Light Point Controllers**
   4. **Installation & Maintenance**
3. **Schedule C - Pricing**
4. Schedule D - Warranty Information
5. Schedule E - Vendor or Project Performance Guarantees, Insurances, Bonds (Optional)
6. Schedule F - Tenderer Statutory Declaration (Optional)

For the purpose of evaluating tenders, details of both the Tenderer and the Manufacturer (if not the same company) need to be tabled separately as shown below.

2.4 Tenderer Assessment Criteria

The criteria below are provided for information only and shows the list of typical assessment criteria that could be used by the User for the evaluation of the suitability of the tender offer and the Vendor.

The weighting of these criteria and the results of the tender assessment would typically remain confidential.

**Mandatory Assessment Criteria**

1. Financial and commercial trading integrity
2. Ability of the tenderer to attend site(s) as and when requested
3. Demonstrated capacity to fulfil the work health & safety requirements
4. Adherence to environmental management, sustainability and procurement guidelines
5. A minimum of [X] Vendor referees from appropriate reference projects provided of the same or larger size than this project

Selective Assessment Criteria

1. Performance attributes and functionality as assessed against the project specification
2. Manufacturer capacity (including qualifications and experience of local technical staff), resources and track record
3. Distributor capacity (including qualifications and experience of local technical staff) and resources (if applicable)
4. Total value represented, considering:
5. Net Present Value (NPV) of the tender proposal over the asset lifetime, including initial tender price, energy consumption, operating fees and maintenance requirements; and
6. Strength of warranty and any other performance guarantees offered

3 | Overall System Description

3.1 Information for Tenderers

Public Lighting Control systems can be described in overview as a set of three interacting Component levels which are illustrated in Figure 1 below:

1. **Central Management System,** with Software running on a central computer (cloud or on-premise server) that delivers web user interfaces on desktop and mobile devices;
2. **Network Communications Infrastructure,** is sub-divided into *Backhaul Communication Networks and Field Device Communication Networks* (differentiated in Figure 1 by a horizontal dotted line and slightly differing background colour) with having Gateways widely distributed across a geographic region; and
3. **Light Point Controllers,** comprising luminaire-mounted, column-mounted or cabinet-based Light Point Controllers.

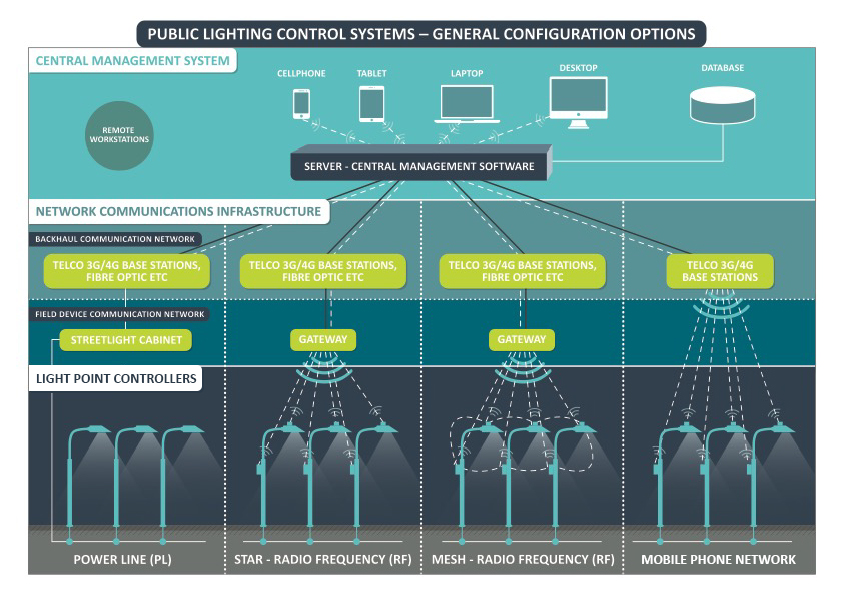


Figure 1 Public Lighting Control Systems – General Configuration Options (SLP)

All three levels consume and produce data to provide the region, city, town, electricity distributor, electricity retailer or street light maintenance company with operational functionality and information to save energy, reduce maintenance costs and to improve lighting for safety and quality of life.

3.2 Modular Procurement

Within each of these three levels there are various local and international Vendors and Manufacturers who supply the Components that comprise the whole system. While most systems are sold as integrated sets of Components, in some cases, Vendors and Manufacturers can provide individual system Components. In this “Modular” approach to procurement, Component Compatibility and Interoperability are critical and need to be managed by the procurement process to ensure a smoothly operating system.

Note: There are technical, financial, commercial and operational advantages and disadvantages that should be considered by the User. The Modular Procurement approach allows for commercial competition among suppliers in each of the levels of the system. This has the potential to apply strong and ongoing commercial pressure on Vendors but the need for Interoperability at different levels could create additional procurement and management tasks and may restrict application freedom and/or innovation.

3.3 Turnkey Procurement

In some cases, Vendors and Manufacturers can provide a complete an end-to-end “Turnkey” package, and in this case, the responsibility for Compatibility and Interoperability of the three levels is fully covered by the single Vendor or Manufacturer.

Note: There are technical, financial, commercial and operational advantages and disadvantages that should be considered by the User. The Turnkey Procurement approach insulates the User from responsibility for Component and Module Compatibility and Interoperability risks, but there could be risks of single supplier lock-in that may not be in long term interests of the User.

3.4 System Capabilities

To achieve the goals identified above, the main features of a lighting controls system are expected to cover the general capabilities listed below. A fit-for-purpose public lighting control system should be able to:

* 1. Install, commission and configure Gateways and Light Point Controllers easily, at low cost and without error;
  2. Switch, dim and brighten lighting levels according to ambient light, programming, schedules, calendars or real-time signals;
  3. Collect and aggregate energy consumption data with high accuracy for the User and/or to a third-party billing system;
  4. Identify luminaire and electrical failures, anomalies and other failures;
  5. Monitor operational hours and condition of luminaires and control electronics for predictive maintenance purposes and for warranty enforcement;
  6. Collect data from Light Point Controllers and supply to the User or to third party software such as Asset Management Systems (AMS), energy billing systems or Geographical Information Systems (GIS);
  7. Provide interfaces and/or mechanisms to interact with a variety of smart city sensors and platforms to adjust light levels and to potentially provide the city with information to help improve service, comfort and safety in the city; and
  8. Be scalable to handle a growing volume of data and number of devices to accommodate growth.

The illustration in below in Figure 2 depicts a simplified view of a controls-enabled luminaire capable of being used in a “smart city”. The lighting column-mounted Sensor and its communication Field Device may operate as part of the Lighting Control System or it may be part of another separate urban ICT network. To obtain the optimum benefits of a public lighting control system it is essential to conduct procurement, evaluation and deployment activities in a well-structured and harmonised manner to properly accommodate and manage the complex ICT issues.

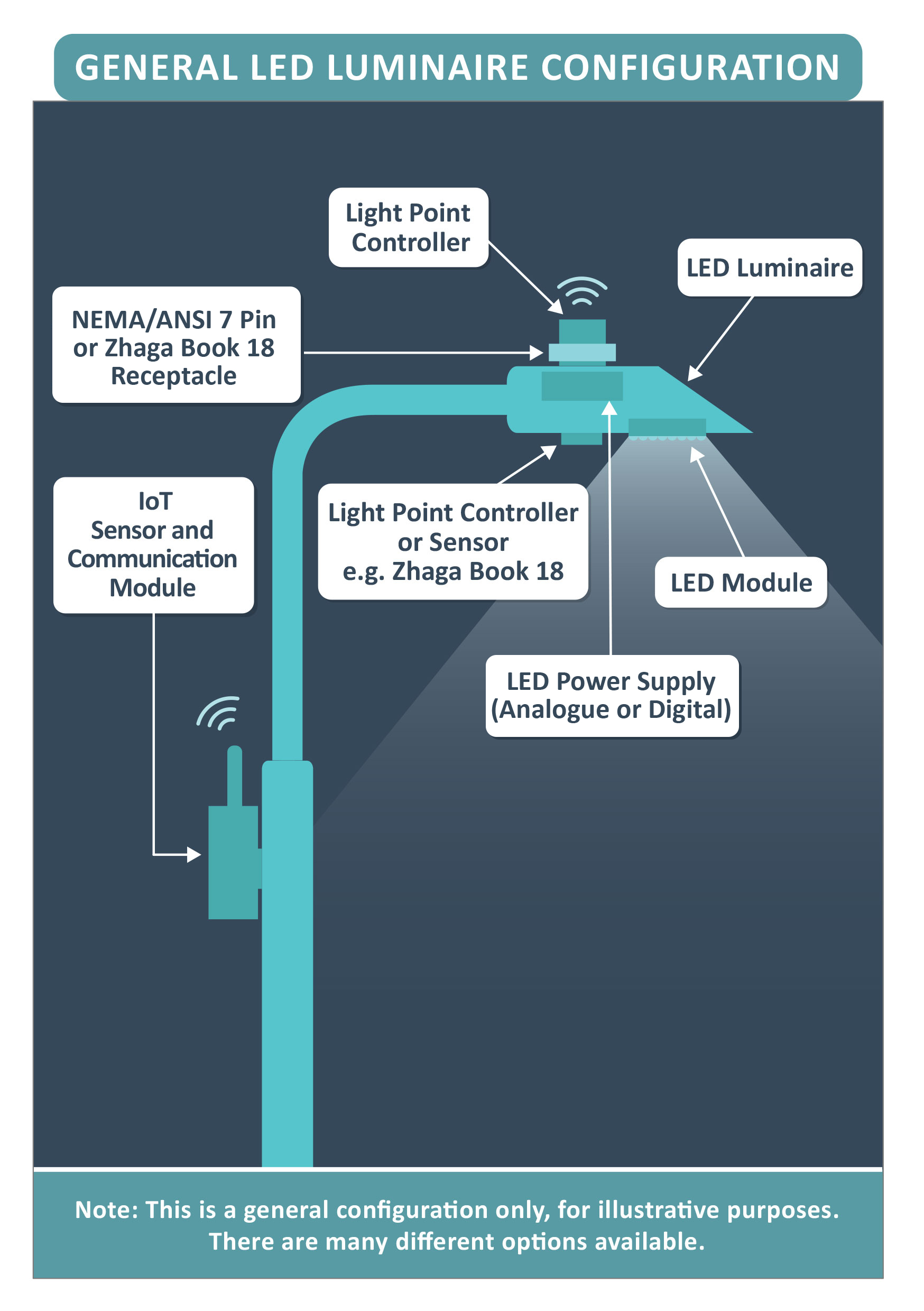


Figure 2 General LED Luminaire Configuration (SLP)

4 | Central Management System (CMS) Specification

4.1 Introduction

The Central Management System (CMS) is a computer environment (illustrated in Figure 1) that provides all shared System services, and consolidates and stores all System data. A User may specify a Central Management System as part of a complete integrated Turnkey System, or as a Modular Component to be integrated with the other Components available. It is very important that if purchased as a Component, it demonstrates high levels of Compatibility and Interoperability to function with other Components such as a Backhaul Communication Network, Field Device Communication Network and/or Light Point Controllers and/or third-party applications such as transport systems, Geographical Information Systems and/or Asset Management Systems.

The suggested technical specifications below for a Central Management System to be installed as part of the Public Lighting Control System are also contained within the Returnable Schedule B (i) spreadsheet – Central Management System.

4.2 Physical Features and Requirements

* 1. The System shall use a Central Management System that is hosted by:

Select ONE or more of the following options:

1. The User or a User specified Third Party
2. The Vendor. Hosting fees to be incorporated in first cost
3. The Vendor. Hosting fees to be separately identified as a recurring cost
4. The Vendor or 3rd party host [Insert “in Australia” or “in New Zealand”, if data sovereignty is a factor]
5. Other - Vendor proposed option
   1. The Vendor shall provide a description of the overall architecture, availability, reliability, scalability and security approach of the System irrespective of the hosting location and arrangements.
   2. The Vendor shall provide sample screen images depicting the following features and functions:
6. **Commissioning:** Installation and Configuration process of a new Light Point Controller
7. **Inventory:** Luminaire/Light Point Controller location with selectability on maps (e.g. using a lasso tool), description with multiple attributes (including identifier, type, model, supplier, address, etc.), ability to colour code assets and obtain a street level view of asset location – e.g. Google Street View
8. **Schedules/Calendars:** Defining schedules, assigning schedules to days and applying these calendars to groups of Light Point Controllers
9. **Failure analysis**: Display Luminaire and electrical failures on maps for the whole community (very high zoom level) and for a particular geographical section (low zoom level, e.g. a block) on road maps as well as satellite map, from several map providers
10. **Real time view:** Light Point Controller and Gateway status (i.e. online, online reporting error, offline, failures), luminaire status (On, Off, dimming level)
11. **Data analytics:** System power quality on any particular luminaire (including current requirements, peak requirement in last prescribed time period) and generally displaying the history of any collected data on any Light Point Controller
12. **Energy consumption:** System energy consumption (daily, weekly, monthly, quarterly and annually over a user-defined time period)
    1. The CMS shall be accessible to authorised individual users only by unique user identifier and password loss to prevent unauthorised access or control of the system.
    2. The CMS shall be accessible to authorised third party applications through a secure API.
    3. The CMS shall be capable of restricting user access to specific functions. These functions shall include the following:
13. Creating and managing users and groups
14. Installing/Commissioning/Removing/Replacing one or more Light Point Controllers
15. Configuring one or more Light Point Controllers
16. Applying a lighting strategy (switching and dimming times and levels based on photocell and/or astronomical clock and/or fixed times and/or events)
17. Collecting, displaying and analysing luminaire and electrical failures on maps and reports
18. Controlling and monitoring one or more Light Point Controllers in real time
19. Report generation for failure, energy and other purposes
20. Custom report generation
    1. The CMS shall be accessible through a handheld mobile device (smart phone and/or tablet) in a format designed to accommodate the size and user interface of the mobile device.
    2. All asset data shall be stored on the CMS. It shall be capable of storing the following asset and warranty information for all lighting control points:
21. Column number (Note: some lighting columns may be fitted with than one luminaire)
22. Column type
23. Light Point Controller unique identifier on the network
24. Light Point Controller make, model and firmware version
25. Column GPS location
26. Column grouping
27. Luminaire make and model
28. Luminaire optic and/or light distribution description
29. Luminaire nominal input voltage
30. Luminaire system power (Luminaire and Light Point Controller) (Watts)
31. Luminaire installation date
32. LED power supply (driver) make and model and firmware version
33. Electricity Retailer(s) and/or DNSP billing account number (there may be multiple retailers).
34. Other information [Required information description]
    1. The Central Management System shall be capable of retrieving and storing all remote monitoring data.
    2. Optional: The Central Management System shall integrate with the requirements of existing User systems (e.g. Council, Road Authority or DNSP):
35. Asset Management Systems (AMS) - [Specify particular systems]
36. Works order and contract control systems - [Specify particular systems]
37. User dashboards and citizen outage reporting systems - [Specify particular systems]

4.3 Logical Features and Requirements

The Central Management System shall:

* 1. Ensure secure communication between itself and all Light Point Controllers by enabling security features inherent to the underlying communications protocols;
  2. Be capable of detecting communication failures between Gateways and Light Point Controllers and the Central Management System and generate user alarms accordingly;
  3. Be capable of updating Light Point Controller firmware, auditing Light Point Controller firmware version and identifying Light Point Controller firmware corruption/hacking remotely and centrally, by group of Light Point Controllers;
  4. Be capable of remotely monitoring Communication Network and Light Point Controller performance, in order to identify and report any exception to normal operation;
  5. Have open interfaces (API’s) for integration with other software from other vendors, e. g. Asset Management Systems;
  6. Radio Frequency Communications Compliance: The system shall comply with all relevant regulations for Radio Frequency Communications as they apply to the particular system used in a country and/or region (eg AS/NZS CISPR 15 and AS/NZS 4268); and
  7. System Security: The system shall be manufactured, installed and commissioned so that appropriate levels of best practice system security are achieved.

4.4 Functional Features and Requirements

The Central Management System shall be capable of:

* 1. Commissioning new Light Point Controllers and sending configuration parameters to them (e.g. high/low voltage alarm threshold, luminaire nominal wattage)
  2. Collecting and storing the following online Lighting Control Point parameters:

1. Light Point Controller status (Online, Offline, Warnings, Errors) each time it changes
2. Luminaire status (ON, OFF, Dimmed State, Warnings, Errors) each time it changes
3. Input voltage (RMS) in ON state, with a new value every hour (24/7) or each time it changes by more than [X%]
4. Input current (mA) in ON state, with a new value every hour (24/7) or each time it changes by more than [X%]
5. Input active power (W) in ON state, with a new value every 30 mins (24/7) or each time it changes by more than [X%]
6. Input power factor in ON state, with a new value every hour (24/7) or each time it changes by more than [X%]
7. Cumulative ON state time (hours)
8. Cumulative energy consumption (kWh) to align with AEMO (Australia) or EA (NZ) requirements
9. GPS location (via an integral sensor in each Light Point Controller)

Select any number of the following Options [See Section 7.3 A]:

1. LED Power Supply (Driver) status (e.g. Warning or Error codes) if such data is made available by the power supply.
2. Ambient light level (via integral or external sensor)
3. Ambient temperature (via integral or external sensor)
4. Luminaire component(s) temperature (via integral sensor)
5. Status of Pin 6 and Pin 7 of the Light Point Controller (if NEMA-type Light Point Controller)
   1. Collecting events or failures detected by the Light Point Controller:
6. Luminaire;
7. LED Power Supply (Driver) if such data is made available by the power supply;
8. Mains voltage (either high or low voltage conditions, or total loss);
9. Input current (either over or under current conditions, or total loss);
10. Active input power (either over or under);
11. Low power factor;
12. High operating temperature; and
13. Flickering LED module.
    1. Programming the Reporting Frequency of online Lighting Control Point parameters for all Lighting Control Points.
    2. Manual Control, whereby the On/Off and Dimmed state of a single Luminaire or group of Luminaires is modified via commands created by the Central Management System.
    3. Defining Luminaire groups to apply programs or calendars (e.g. via lasso tool on map)
    4. Creating Control Programs that are composed of a set of switch ON, switch OFF and stepless dimming commands (from 1% to 99%).
    5. Creating Calendars that are composed of a set of Control Programs assigned to days of the year as per request by operator.
    6. Assigning Calendars, i.e. sets of control programs that use day and time, to groups of Luminaires and provide a mechanism to make sure these calendars are properly deployed in and executed by each Light Point Controller.
    7. Enabling Constant Light Output Control, whereby the Luminaire dimmed state is:
14. Option 1: Actuated to achieve a desired light output in lumens.

Note: This feature requires either a) knowledge of the relationship between Luminaire input control signal and light output in lumens or b) knowledge of both the relationship between Luminaire input control signal and true input power in Watts and the relationship between Luminaire true input power in Watts and light output in lumens; these relationship(s) must be present in the Central Management System (software) according to some pre-defined means. or user-defined types of luminaires or equivalent.

Option 2: Automatically actuated to achieve a maintained Constant Light Output (lumens) over time by compensating for Luminaire Lumen Depreciation.

Note: This feature requires either a) knowledge of the relationship between Luminaire input control signal and light output over time (lumen depreciation) or b) knowledge of both the relationship between Luminaire input control signal and true input power in Watts and the relationship between Luminaire true input power in Watts and light output over time (lumen depreciation); these relationship(s) must be present in the Central Management System (software) according to some pre-defined or user-defined types of luminaires (with their Constant Light Output characteristics) or measured using some internal capability. This feature will also result in increasing Luminaire true input power over time.

* 1. The Central Management System shall be capable of creating reports (including trend graphing), pre-defined or customised, on-demand (displayed on screen) or scheduled (sent by email), for any group of Luminaires defined by a filter or by a geographical area, to analyse:

1. **Assets,** e.g. list the identifiers, address, number of operating hour and any other attributes selected by the User
2. **Alarms or failures**, e.g. list the identifier, the GPS position, the Manufacturer and Model of Luminaire for any Light Point Controller that has an active Luminaire Failure and/or Communication Loss
3. **Energy Consumption,** e.g. daily, weekly, monthly, quarterly or yearly energy consumption for any group of Luminaire
4. **Electrical network quality,** e.g. list the identifier, the address and the Luminaire group and any other attributes selected by the User, for all the Luminaires where mains voltage was higher than [Voltage] at midnight last night
   1. The Central Management System shall be capable of generating configurable alarms and sending them to identified Users by email or text message (SMS) or by Application Programming Interface (API) in case of:
5. An event (e.g. Luminaire Failure event) is received by the CMS from a Light Point Controller
6. A number of events (e.g. Communication Loss) are received from more than [Number] Light Point Controllers all located within a certain geographical area
7. More than [Percentage] % of Light Point Controllers have failed within a group

4.5 Interoperability - Central Management Systems

* 1. Optional: The CMS shall be compliant with TALQ v 2.0 Specification

Note: The TALQ Consortium is a global alliance organisation of controls vendors that aims to set an accepted specification for management software interfaces to control and monitor Modular (i.e. multi-vendor component sourced) outdoor lighting networks. It promotes inter-operability between CMS and Light Point Controllers and their Communication Networks.

TALQ Consortium’s website is at: <http://www.talq-consortium.org./>

The CMS shall be Interoperable with [Insert one or more of the following Options]:

1. Analogue 0/1-10V compliant LED power supply;
2. Digital DALI-2 compliant and D4i certified LED power supply
3. D4i / Zhaga Book 18 compliant and D4i certified LED power supply, certified Zhaga Book 18 Sensors and Light Point Controllers connected via either Zhaga Book 18 interfaces or NEMA/ANSI C136.41 receptacles.

Note: The now superseded dimming option of 0/1-10V analogue LED power supply control signal operation is not a recommended option. The more advanced DALI digital LED power supply control signal options deliver a wide range of benefits that should be considered.

There are many performance and asset management advantages attainable through using DALI. A summary of the advantages of DALI-2 over analogue 0/1-10V is listed below:

1. DALI provides two-way digital communication between each individually addressed luminaire and the CMS;  
2. DALI with GPS accommodates automatic commissioning of luminaires, fully populating an asset database without error-prone human intervention;  
3. Unlike analogue 0/1-10V, DALI has a precise standardised dimming curve independent of Component brand; and  
4. Unlike analogue 0/1-10V, the DALI command set provides much more than simply dimming, e.g. direct entry and storage of the power supply and luminaire asset information and programmed technical and warranty information that otherwise needs error-prone human data entry.

The above features can facilitate significant improvements to asset database accuracy and labour productivity in installation, commissioning and system maintenance, by eliminating most manual data management tasks.

Note: The Digital Illumination Interface Alliance (DiiA) is an open, global consortium of lighting vendors whose aim is to grow the market for lighting control application based on IEC 62386 Digital addressable lighting interface, the international standard for DALI technology. DiiA has established an independently-verified product certification program that covers the functionality specified in the DALI-2 version of the IEC 62386 series of standards.

DiiA’s website is at: <https://www.digitalilluminationinterface.org/>

Note: The Zhaga consortium is a global lighting industry organisation that is developing specifications for components of LED luminaires, including LED power supplies, LED modules, and connectivity fit systems, across all lighting sectors. Developed Zhaga specifications are passed on to ANSI and the IEC for consideration as input to international IEC standards.

The Zhaga Consortium’s website is at: <http://www.zhagastandard.org/>

Note: The “Outdoor Connectivity Interface for Smart Luminaires” approach complies with Zhaga Consortium “Book 18” electrical, mechanical, data interface in combination with DALI 2.0 (Now US standards are aligning with international standards in this area. Refer to ANSI C137.4 and ANSI C136.58). It is early days for this approach but key manufacturers are in production with OEM interconnect components and with Zhaga-compatible DALI-2 LED power supply.

5 | Backhaul Communication Network Specification

The suggested technical specifications for a Backhaul Communication Network to be installed as part of the System (illustrated in Figure 1.) are described in this section and also contained within the Returnable Schedule B (ii) spreadsheet – Communication Networks.

5.1 Backhaul Specification

Note: A Backhaul Communication Network links the Central Management System to one or more networks of Light Point Controllers (i.e. Server to/from Light Point Controller, via Gateway, if applicable). A User does not usually specify a Backhaul Communication Network as this is usually selected by the Manufacturer or Vendor unless the User has negotiated a special arrangement with a Backhaul provider as part of other services, such as telecommunications (as described in Option A below).

Select one or more, as desired:

* 1. Optional***:*** The Backhaul Communication Network shall be provided by the User. It shall provide a minimum of secured encrypted IPv4/IPv6 communication channels (if multiple port – list all ports required between the Communication Network (e.g. Gateways) and the Central Management System). It shall be:

Select ONE or MORE, as desired:

1. One or more fibre optic networks that are operated by [Operator(s)] and to which the Central Management System shall connect; and/or
2. One or more mobile phone networks from [Operator(s)] with whom the User has negotiated a global communication contract.
   1. Optional: The System shall use a Backhaul Communication Network specified by the Vendor.
   2. Optional: The Vendor shall provide all available Backhaul Communication Network options:

Select one Option:

1. EXCLUDING those which have pre-defined fees (e.g. Vendor negotiated mobile network contracts).
2. INCLUDING those which have pre-defined fees (e.g. Vendor negotiated mobile network contracts).

6 | Field Device Communication Network Specification

The suggested technical specifications for a Field Device Communication Network to be installed or used as part of the System (illustrated in Figure 1.) are described in this section and also contained within the Returnable Schedule B (ii) spreadsheet – Communication Networks.

6.1 Physical Features and Requirements

* 1. Field Device Communication Network components shall be capable of normal operation over an ambient temperature range of:

Select ONE of the following options:

1. -15 degrees C to +60 degrees C (hot environment); or
2. -25 degrees C to +55 degrees C (medium environment); or
3. -40 degrees C to +40 degrees C (cold environment).
   1. Field Device Communication Network component enclosures installed external or remote to luminaires shall be rated to a minimum of IP65.

Note: Some Field Device Communication Network IT Components may require ventilation. The Ingress Protection (IP) requirement should be waived in such circumstances and a Vendor statement of suitability for the outdoor environment should be requested.

* 1. Field Device Communication Network components shall operate at 230V nominal (+10/-6%).

6.2 Logical Features and Requirements

The Field Device Communication Network shall:

1. Use a physical layer communication protocol or standard such as IEEE 802.15.4g for wireless mesh networks or Global System for Mobile communications (GSM) standards for mobile networks or LTE for Narrow Band IoT networks.
2. Be capable of connecting to Central Management Systems using open, standards-based networking technologies such as http, SMTP, SNMP, COAP, TCP, UDP or FTP.
3. Ensure that all data communications over the Field Device Communication Network be secured using a standards-based security protocol (e.g. TLS, DTLS, IPsec).
4. Allow only authenticated and authorised access to network services by a Central Management System, Gateway or Light Point Controller.
5. Be capable of maintaining accurate time either on its own or by synchronising with a remote service.
6. Provide a detailed view of the network and its topology, including all connected Gateways, Light Point Controllers, links, and ports.
7. Provide a real-time and historical detailed view of network performance, including available bandwidth, Gateways and Light Point Controller location, accessibility, signal strength, round-trip times, path costs, and packet delivery success/failure.
8. Provide a configuration management tool to view and remotely apply changes, updates, and patches to operating systems and applications on any single or a group of Field Device Communication Network components, including Gateways and Light Point Controllers.
9. Enable the operating system and applications to update all connected and active Gateways and Light Point Controllers within less than:

Select an Option

1. 1 hour,
2. half day
3. 1 day
4. Be capable of logging time-stamped activity. The logging level shall be configurable. Any write and execute operations completed by a Light Point Controller or Gateway shall be recorded together with the source IP address.
5. Provide basic firewall capabilities, including filtering by port, protocol, source IP address, and destination IP address.
6. Provide basic routing capabilities. The Gateway shall act as a multi-band Gateway, between the Backhaul Network and the Field Network.
7. Be capable of communicating using Internet Protocol version 4 or 6 (IPv4/IPv6). Every device must be addressable via an assigned IPv4/IPv6 address.
8. Electrical Safety Compliance: Gateways, Light Point Controllers and the Network system shall comply with all relevant regulations for electrical safety as they apply to the particular system used in the region (eg AS/NZS 3820).
9. Radio Frequency Communications Compliance: Gateways, Light Point Controllers and the Network system shall comply with all relevant regulations for Radio Frequency Communications as they apply to the particular system used in a country and/or region (eg AS/NZS CISPR 15 and AS/CA S2042).
10. System Security: The system shall be manufactured, installed and commissioned so that appropriate levels of best practice system security are achieved.
11. The Field Device Communication Network and any connected device or system shall:

Select from the following options:

1. Optional: Be able to authenticate each other by a standard-based mechanism (e.g. X.509 certificates or pre-shared keys).
2. Optional: Be able to authorise each other by a standard-based mechanism (e.g. X.509 certificates).
3. Optional: Be kept confidential using a standard-based encryption algorithm (e.g. AES-128 or AES-256).
4. Optional: Be checked for integrity using a standard-based algorithm (e.g. keyed HMAC with SHA-256).

6.3 Functional Features and Requirements

The Field Device Communication Network shall be capable of:

* 1. Two-way communication.
  2. Automatically supporting failover to alternate routes.
  3. Automatic retries while attempting to deliver messages/packets.
  4. Generating asynchronous alerts and routing both Field Device Communication Network and other device alerts to the Central Management System.
  5. Addressing of groups of Gateways and Light Point Controllers for bulk messages including remote firmware upgrades and configuration changes.
  6. Allowing near real-time communication and:

1. Receive and execute any manual override commands (ON/OFF/DIM) sent by the User from the Central Management System within less than:

Select ONE Option:

1. 5 seconds
2. 30 seconds
3. 1 minute
4. Read and send any electrical parameter (or information) on any Light Point Controller within less than the following, when requested by the User through the Central Management System:

Select ONE Option:

1. 5 seconds
2. 30 seconds
3. 1 minute
   1. Optional: Maintaining Network Availability for

Select ONE Option:

1. 95%

2. 99.9%

of active and functional Gateways and Light Point Controllers at least

Select ONE Option:

1. 95%

2. 98%

3. 99%

of the time (other than for third party causes eg power cuts). The Vendor shall provide the tools to monitor the performance of such a Service Level Agreement.

6.4 Interoperability

1. Optional: The Field Device Communication Network shall be Interoperable with the following Light Point Controllers, Gateways and Sensors [Insert Descriptions].

6.5 Rated Life and Reliability

1. The Rated Life of all Field Device Communication Network components at an ambient temperature of 25 degrees Celsius shall be greater than:

Select ONE of the following options:

1. 10 years
2. 15 years
3. 20 years

Note: There is a procurement balance to be struck between the Rated Life of a Device and the Economic Life of the Device. It may be an expensive choice for a User to specify a long rated life requirement for Gateways or Light Point Controllers if the Devices could be replaced at an earlier point for other reasons, including to capture economic or functional advantages of future new technology updates. Note that the Rated Life is not the same as the Warranty term.

1. The Vendor shall provide the predicted reliability of Field Device Communication Network components (Gateways and Routers) as calculated by Mean Time between Failures (MTBF) according to Telcordia SR-332.

6.6 Networked Standby Mode Power Disclosure

A.      The Vendor shall disclose the Networked Standby Mode Power consumption (W) for Gateways and Routers. Networked Standby Mode Power is power consumption when connected to a supply voltage with all functions off, except for support functions using a trigger from a network. This is in accord with the forthcoming AS/NZS 63103 based on IEC 63103.

7 | Light Point Controller Specification

Light Point Controllers are networked Components (hardware and embedded software) installed in the field that, following installation and commissioning, function together to adaptively control and remotely monitor Luminaires. These are illustrated in Figure 1. A User may specify Light Point Controllers as part of a complete integrated System, or as a Component to be integrated with other interoperable Components such as a Central Management System, Backhaul Communication Network or Field Device Communication Network.

The suggested technical specifications for Light Point Controllers to be installed as part of the System are described in this section and also contained within the Returnable Schedule B (iii) spreadsheet – Light Point Controllers.

7.1 Light Point Controller Information

* 1. The Vendor shall supply the following Light Point Controller information:

1. Brand
2. Type
3. Model Number

7.2 Physical Features and Requirements

* 1. Light Point Controllers shall be capable of operation over an ambient temperature range of:

Select ONE of the following options:

1. -15 degrees C to +60 degrees C (hot environment)

2. -25 degrees C to +55 degrees C (medium environment)

3. -40 degrees C to +40 degrees C (cold environment)

* 1. Light Point Controllers installed external or remote to luminaires shall be housed in enclosures rated to a minimum of IP65
  2. Light Point Controllers shall operate at 230V nominal (+10/-6% if NEMA/ANSI C136.41 compliant) or at 12/24V DC (if Zhaga 18 Book compliant)
  3. Light Point Controllers shall be integrated (mechanically and electrically connected) at Lighting Control Points:

Select ONE or MORE Options:

1. External to Luminaires, using a NEMA/ANSI C136.41 5 pin / 7-pin receptacle for electrical and dimming control signal connectivity.
2. External to Luminaires, using a Zhaga Book 18 40mm diameter Luminaire Extension Module for dimming control and sensor signal connectivity.
3. External to Luminaires, using a Zhaga Book 18 80mm diameter Luminaire Extension Module for dimming control and sensor signal connectivity.
4. Internal to Luminaires with only an antenna protruding and using hard-wired components for dimming control and sensor signal connectivity.
   1. Optional: Light Point Controller integration compatibility shall be verified for all Luminaires specified in section 11 Appendix B: Existing Luminaires.

Note: In order to achieve a high level of flexibility in User procurement, operational performance, and maintenance over the system lifetime, this Model Specification only supports Light Point Controllers that are capable of plug-in installation and operation (i.e. NEMA/ANSI C136.41 7-pin or Zhaga Book 18 enabled). Solutions that use Luminaire integrated LPC’s do not provide this flexibility.

* 1. Light Point Controllers shall be capable of actuating the status (ON state, OFF state) of Luminaires.
  2. Light Point Controllers shall be capable of actuating a Luminaire Dimmed state by creating a control signal that:

Select ONE or MORE options, as desired

1. Complies with analogue 0/1-10V standard (IEC 63128)
2. Complies with, and is DiiA certified to, DALI-2 digital standard (IEC 62386:2017)
3. Complies with DALI-2 and is D4i certified as being compliant with Zhaga Book 18 Specification

Note: See Section 4.5 Interoperability – Central Management Systems for User guidance notes on 0/1-10V, DiiA, DALI and Zhaga.

* 1. Actuated changes to Luminaire Dimmed states by Light Point Controllers shall occur at the following rate:

Select ONE or MORE options, as desired

1. Instantaneously, or as dictated by the Luminaire
2. Over a user programmable range (% change per minute) defined by the CMS
3. Greater than [% change] per minute
4. Less than [% change] per minute
   1. Light Point Controllers shall be capable of measuring and monitoring the following power parameters:
5. RMS input voltage (Volts)
6. RMS input current (Amps)
7. Active power (Watts) individually for Luminaire and LPC
8. Power factor
9. Optional: Frequency (Hz)
10. Optional: Apparent power (VA)
    1. Light Point Controllers shall measure energy consumption (in kWh) of both Luminaire and the Light Point Controller itself to:

Select ONE or MORE options, as desired

1. meet the requirements of the specific regional electricity regulator (if applicable).
2. meet metering accuracy and precision of better than +/-1.0% over a load range corresponding to the specific user-defined light level dimming or brightening range.

Note: To minimise conflict with the many parties involved, it is recommended that highly accurate metering capability be specified for all Public Lighting Controls. Most Manufacturers can readily deliver this performance.

* 1. Light Point Controllers shall incorporate internal surge protection (conforming to ANSI C136.2-2018) to:

Select ONE or MORE, as desired:

1. Not required

2. 5kV

3. 10kV

4. 20kV

5. Other *[*Insert other*]*

Note: Surge Protection Devices (SPD) are devices intended to protect downstream controls, power supplies and other components in the luminaire and network components against electrical surges and voltage spikes induced by nearby lightning strikes or other incidents. If the luminaire or supply circuit is suitably protected (i.e. SPD rated at 10kV or above), no separate SPD protection may be required within the Light Point Controllers. The User Specification requirements should be determined when the luminaire selection is known.

* 1. Optional: Light Point Controller energy consumption accuracy shall be verified with all Luminaires specified in Appendix B: Existing luminaires.

Note: Current electricity metering rules were never designed for the street lighting technology that is now available. The Australian National Electricity Market defines seven specific Metering Types with Type 7 being for unmetered loads used for street lighting. A Type 7 classification is therefore actually not a meter at all as no metering takes place. There is on-going consideration in Australian and New Zealand of how the metering capabilities of smart street lighting controls might be recognised under this regime.

Note: For reference - The new Zhaga Book 18 approach locates the electricity measurement / metering chip as part of the LED Power Supply (driver). It is not located within the Light Point Controller.

* 1. Light Point Controllers shall be capable of integrally sensing and monitoring over time the following environmental parameters:

Select ONE or MORE, as desired

1. Expected sunrise and sunset times (e.g. via an Astronomical Clock or via the CMS)
2. Ambient light level
3. GPS Location
4. Ambient temperature
5. Other (specify)

Note: GPS location functionality has substantial commissioning, asset management and productivity advantages when used in conjunction with DALI-2 asset information storage feature and/or Asset Management System (AMS) software. See Section 4.5 f) for a summary of the database accuracy and implementation productivity benefits of GPS combined with DALI, particularly for larger scale roll-outs.

* 1. Light Point Controllers shall be capable of logging energy consumption in minimum of 30 minute increments or be otherwise capable of accurately deriving energy consumption based on recording of a change in electricity consumption (unless another interval or requirement is otherwise required by the relevant electricity regulator) and also Cumulative energy consumption of each Light Control Point.
  2. Light Point Controllers shall log cumulative energy consumption according to the following specifications:

Select ONE or MORE, as desired

1. IEC 61968-9 Meter Reading and Control
2. The requirements specified by [Name of the relevant electricity regulator, electricity DNSP and/or electricity retailer*]*, as documented in [Electricity DNSP and/or electricity retailer] references to appropriate standards or specifications as applicable – Include relevant excerpts in Appendix if appropriate]

Note: Align requirements with AEMO (AU) and EA (NZ) guidelines and regulations

* 1. Optional: During Offline Operation (i.e. when the network is down), Light Point Controllers shall be capable of Storing the following offline Time-Stamped Control Point parameters:
  2. Controller status (Online, Offline, Warning or Error codes)
  3. Luminaire status (ON, OFF, Dimmed State, Warning or Error codes)
  4. Cumulative ON state time (minutes)
  5. Cumulative energy consumption (kWh)
  6. Optional: During Offline Operation Light Point Controllers shall be capable of storing measurements of identified Offline Parameters at a storing frequency of less than once every:

Select ONE Option

1. 1 Hour
2. 2 Hours
3. 6 Hours
4. 12 Hours

as well as when these values change by more than:

Select an option:

1. 5%
2. 10%
3. 15%

so that all important values are recorded and later sent to the Central Management System.

Note: Requiring shorter Storing Frequencies may increase unit cost.

* 1. Optional: During Offline Operation Light Point Controllers shall be capable of storing measurements of all Offline Parameters at the specified frequency for a storing period of greater than:

Select ONE Option:

1. 2 Days
2. 3 Days
3. 7 days
4. As required by the electricity market regulator

Note: Requiring longer storing periods may increase unit cost.

* 1. Optional: If a Light Point Controller loses electrical service due to an unforeseen event, the Light Point Controller shall:

1. Be capable of communicating the loss of electrical service to the Central Management System and/or to Light Point Controllers in the neighbourhood, which will send it to the Central Management System.
2. Be capable of communicating any Light Point Controller stored data to the Central Management System

Note: This feature requires the integration of a battery or capacitor, which may increase unit cost.

* 1. Optional: Be capable of self-commissioning without user input

7.3 Logical Features and Requirements

1. During Online Operation, Light Point Controllers shall be capable of Reporting the following online Control Point parameters:
2. Light Point Controller status (Online time, Offline time, Warning or Error codes)
3. Luminaire status (ON, OFF, Dimmed State, Warning or Error codes) if the Power Supply can provide such information
4. Average RMS input voltage (Volts) in the ON state
5. Average RMS input current (Amps) in the ON state
6. Average true input power (Watts) in the ON state
7. Average active power factor in the ON state
8. Cumulative ON state time (minutes)
9. Cumulative energy consumption (kWh)
10. GPS location (via integral sensor)
11. Optional: LED Power Supply status (e.g. Warning or Error codes) if the Power Supply can provide such information.
12. Optional: Ambient Temperature (via integral sensor)
13. Optional: LED Power Supply operating temperature

Note: Care is needed in specification and procurement to only request data collection and reporting functionality to cater for identified needs. Requesting additional functionality without an identified need or use may unnecessarily increase cost and complexity.

1. During Online Operation, Light Point Controllers shall be capable of reporting all online Control Point parameters for all Light Control Points when these values change by more than **[Insert % change]** from the expected level:

Select ONE Option:

1. 5%

2. 10%

3. 15%

1. and at a minimum Reporting Frequency of once per day **[or other interval as specified]**

Note: The Reporting Frequency performance will depend on the network size. Larger networks will generate longer time delays. Care is needed in specification and procurement to only request data collecting and reporting functionality to cater for identified needs. Requesting additional functionality without an identified need or use may unnecessarily increase cost and complexity.

1. During Online Operation, Light Point Controllers shall be capable of answering any request for real-time reading of all Light Point Controller parameters for a single Light Point Controller at a maximum of:

Select ONE option

1. 5 seconds

2. 10 seconds

3. 30 seconds

4. 1 minute

5. 5 minutes

Note: This specification establishes the maximum continuous update time during demonstration or troubleshooting, where a single Light Point Controller is being operated or evaluated. For large networks or some network architectures, specifying a shorter time may (in some cases) result in higher cost.

1. Light Point Controllers shall execute any single command received from the Field Device Communication Network in less than:

Select ONE option:

1. 1 second

2. 5 seconds

3. 15 seconds

4. 30 seconds

5. 60 seconds

Note: This specification establishes the maximum time for a single command to spread through the Field Device Communication Network and be received and executed by a Light Point Controller. If the command requires the reporting of data, this specification constrains only the time required to prepare the data for transmission, and not the subsequent propagation time back to the Backhaul Communication Network connection point.

1. Light Point Controllers shall automatically Report all data stored during Offline Operation, when Online Operation is restored.
2. Light Point Controllers shall include a method to verify the integrity of firmware to be executed, to prevent unauthorised or maliciously modified software from running on the Light Point Controller. This could, for example, use a secure Boot Loader scheme.
3. Radio Frequency Communications Compliance: The system shall comply with all relevant regulations for Radio Frequency Communications as they apply to the particular system used in a country and/or region.
4. System Security: The system shall be manufactured, installed and commissioned so that appropriate levels of best practice system security are achieved.

7.4 Functional Features and Requirements

Light Point Controllers shall be capable of:

1. Controlling a single Luminaire or groups of Luminaires.
2. Optional: Changes in the On/Off or Dimmed states to groups of Luminaires shall be staggered to limit the inrush current through other electrical components on the electrical circuit.
3. Manual Control, whereby the On/Off and Dimmed state of a single Luminaire or group of Luminaires is modified in response to commands from the Central Management System.
4. Manual Control, whereby the On/Off and Dimmed state of a single Luminaire or group of Luminaires is modified in response to commands from another LPC that has a directly attached Sensor.
5. Group Control, whereby Luminaire groups are controlled by programs or calendars (e.g. via lasso tool on map).
6. Control Programs, that are composed of a set of switch ON, switch OFF and stepless dimming commands (from 1% to 99%) defined at:
7. Any fixed time (hours, minutes) with at least [Appropriate number] of such events per day;
8. Or any sun-related time (e.g. sunrise plus 7 minutes, sunset minus 5 minutes);
9. Or any photocell-related event (applicable if the Light Point Controller has photocell);
10. Or any other events received from sensors (e.g. presence or activity sensor) to dynamically adjust light levels based on activity;
11. Or any input from Traffic Counting Devices to dynamically adjust light levels based on traffic density.
12. Calendar Control, from a set of Control Programs assigned to days of the year:
13. On a daily recurring basis;
14. Or on a weekday recurring basis;
15. Or on a weekend recurring basis;
16. Or on a special date/time period for special events.
17. Assigned Calendar Control, i.e. sets of Control Programs, to groups of Luminaires providing a mechanism to ensure Calendars are properly deployed and executed by each Light Point Controller.
18. Control Programs that provide Luminaire signalling to provide alerts to the community (e.g. luminaire flashing).
19. During Offline Operation Light Point Controllers shall be capable of maintaining Luminaire control by:
20. Storing the Control Program in the Light Point Controller to run even if the network is not present;
21. Continuing to operate according to the most recently programmed Scheduled Control; and
22. Continuing to operate according to the most recently programmed Adaptive Control using input from an integral sensor.
23. Optional: True input power control, whereby the Luminaire Dimmed state is actuated to achieve to a desired true input power (Watts).

Note: This feature requires knowledge of the relationship between Luminaire input control signal and true input power (Watts), which must be imported (manually or automatically) according to some pre-defined means, or measured using some internal (metering) capability.

1. Optional: Light output control, whereby the Luminaire Dimmed state is actuated to achieve a desired light output (lumens).

Note: This feature requires either a) knowledge of the relationship between Luminaire input control signal and light output (lumens) or b) knowledge of both the relationship between Luminaire input control signal and true input power (watts) and the relationship between Luminaire true input power (Watts) and light output (lumens); these relationship(s) must be imported manually or automatically according to some pre-defined means.

1. Optional: Automatically maintaining constant Luminaire light output (lumens) over time by compensating for Luminaire lumen depreciation.

Note: This feature requires either a) knowledge of the relationship between Luminaire input control signal and light output over time (lumen depreciation) or b) knowledge of both the relationship between Luminaire input control signal and true input power (Watts) and the relationship between Luminaire true input power (Watts) and light output over time (lumen depreciation); these relationship(s) must be imported (manually or automatically) according to some pre-defined means or measured using some internal capability. This feature will also result in increasing Luminaire true input power over time.

7.5 Interoperability

The system shall provide interoperability at various levels:

* 1. Optional: Between Central Management System and Field Device Communication Network:
  2. The Central Management System shall be certified as compliant with the TALQ Central Management System (CMS) specification v\_\_\_\_
  3. The Field Device Communication Network shall be certified with TALQ Outdoor Lighting Network (OLN) specification v\_\_\_\_
  4. Optional: Between Field Device Communication Network and Light Point Controller. The Field Device Communication Network shall accept, communicate with and interact with the following number of Light Point Controllers from independent Vendors.

Note: If operability on network level is required to be achieved on a proprietary network, Vendors should be contractually obligated to licence their network technology to other vendors to avoid single supplier lock-in.

Select ONE option:

1. 3

2. 4

3. 5

4. 6

List of Vendors HERE:

* 1. Between Light Point Controller and Luminaire:
  2. Optional: Interoperable with analogue 0/1-10 V compliant LED Power Supplies.
  3. Optional: Interoperable with digital DALI-2 compliant and certified LED Power Supplies.
  4. Optional: Interoperable with Zhaga Book 18 compliant and D4i certified LED Power Supplies.
  5. Optional: Interoperable with the Luminaires specified in Appendix B: Existing Luminaires.
  6. Optional: The Vendor shall agree to demonstrate Light Point Controller Interoperability with the existing Luminaires described in Appendix B: Existing Luminaires, prior to Installation.

7.6 Rated Life & Reliability

1. The Rated Life of all Light Point Controllers at an ambient temperature of 25 degrees Celsius shall be:

Select ONE option:

1. 10 years or more

2. 15 years or more

3. 20 years or more

Note: Increased Light Point Controller Rated Life requirements may lead to higher initial costs.

1. The Vendor shall report the predicted reliability of the Light Point Controllers, as calculated by Mean Time between Failures (MTBF) according to Telcordia SR-332.

7.7 Networked Standby Mode Power Disclosure

A.      The Vendor shall disclose the Networked Standby Mode Power consumption (W) for Light Point Controllers. Networked Standby Mode Power is power consumption when connected to a supply voltage with all functions off, except for support functions using a trigger from a network. This is in accord with the forthcoming AS/NZS 63103.

8 | System Installation and Commissioning Specification

8.1 Introduction

The section covers the combined tasks of System Installation, System Start-up and System Commissioning and is also contained within the Returnable Schedule B (iv) spreadsheet – Installation & Maintenance.

8.2 System Installation Responsibility

Typical System installation activities include hardware mechanical mounting, electrical connections and provisioning for network communication or configuration of basic parameters and default settings. Installation on its own does not result in a state where all Components are operating as intended or where all System functions and capabilities are available to the User.

Note: To make financial savings, Luminaire mounted Light Point Controllers preferably should be installed at the same time as new/replacement LED luminaires. This approach eliminates any additional time, disruption and cost of “up the column” return site visits at a later point.

1. Installation shall be performed by the responsible party:

Select ONE option:

1. The Vendor or its nominated sub-contractor
2. The following third party: [Third party name]

Control System Installation tasks excludes the physical “up the column” plug-in of the Light Point Controllers. This task should be carried out by a User nominated Luminaire installation contractor under a separate Luminaire installation contract.

1. All hardware necessary for installation and provisioning for network communication shall be provided by the Vendor.

8.3 System Installation Training Requirements

1. If the Vendor is not the responsible party, the Vendor shall provide training on the installation of Gateways and other components (if applicable) to the responsible party and provide a reasonable estimate in Schedule C of the typical component installation time.
2. The responsible party shall provide installation training manuals and all supporting documentation in electronic format.

8.4 System Installation Requirements

The responsible party shall:

* 1. Specify whatever coordination is needed with the User's IT staff.
  2. Mount and electrically connect all Gateways and other Components (as applicable) in a location sufficiently removed from sources of electromagnetic radiation that are likely to interfere with System Performance. The Vendor shall specify minimum acceptable distances.
  3. Inspect the installed System following the installation of all Components and verify that the System is capable of operating as intended.
  4. Ensure that a licensed electrician from the responsible party shall inspect the installed System after it has been fully energized and submit the regionally appropriate electrical installation Certificate of Compliance (CoC) and/or SDoC as per the requirements of AS/NZS 3000 and applicable local requirements, and/or EMC Compliance Declaration.
  5. Submit a brief written report of any defective materials and workmanship issues found during inspections, as well as any unsatisfactory test results.
  6. Submit a brief written report containing a list of all installed components, tests performed, test results, as-built drawings and with a final signoff by the responsible party.

If applicable, the User shall provide:

1. Physical locations for the Gateways (including GPS location);
2. Electric power for the Gateways;
3. Physical location of CMS server hosting (if on-premise server hosting is required);
4. CMS server IT services as applicable (if on-premise server hosting is required); and
5. Access to existing Backhaul Communication network, such as fibre (if available and controlled by the User).

8.5 System Start-Up

The process of System Start-up results in all Components operating as intended and all System functions are available to the User. System Start-up activities include the configuration of System hardware, firmware, and software. System Start-up does not result in a state where all System functions and capabilities are configured according to User desires.

8.6 System Start-Up Responsibility

* 1. System Start-up (pre-commissioning) shall be performed by:

Select ONE option:

1. The Vendor or its nominated sub-contractor
2. The following third party: [Third Party name]
   1. All hardware, software and tools necessary for System Start-up shall be provided by the Vendor.

8.7 System Start-Up Training Requirements

* 1. The responsible party shall provide System Start-up training manuals and all supporting documentation.

8.8 System Start-Up Requirements

The responsible party shall:

* 1. Identify a manufacturer-authorised representative available to support System Start-up.
  2. Specify coordination needed with the User's IT staff in order to complete System Start-up.
  3. Configure any hardware, firmware, or software to enable all System Components to operate as intended.
  4. Ensure that the latest versions of all firmware and software are installed, and perform any necessary updates or upgrades.
  5. Successfully demonstrate all System functions and capabilities System Start-up training.
  6. Ensure that following User acceptance of a successful demonstration of all System functions a System Start-up trial period shall commence.
  7. Ensure that the System Start-up proving period shall consist of:

Select ONE option:

1. 3 consecutive calendar days of System operation
2. 7 consecutive calendar days of System operation
   1. Ensure that all System functions shall operate normally for at least ninety-nine percent (99%) of the time.
   2. Remedy any issues discovered during the System Start-up trial period.
   3. Provide written documentation of all hardware, firmware, or software configurations and all modifications made in System Start-up, and shall accurately represent the System following a successful System Start-up proving period.

8.9 System Commissioning

* 1. The process of System Commissioning results in a state where all System functions and capabilities are configured according to contracted User requirements. Typical System Commissioning activities include the modification of System software settings.

8.10 System Commissioning Responsibility

* 1. System Commissioning training shall be performed by:

Select ONE option:

1. The Vendor
2. The Vendor-specified agent or representative
   1. System Commissioning shall be performed by:

Select ONE option:

1. The Vendor
2. The Vendor-specified agent or representative
3. The following Third Party: [Third Party name]

8.11 System Commissioning Training Requirements

1. The responsible party shall provide Commissioning training manuals and all supporting documentation in electronic Format

8.12 System Commissioning Requirements

The responsible party shall:

* 1. Identify a manufacturer-authorised representative that will be available to support System Commissioning.
  2. Modify any System software settings as necessary to configure all System functions.
  3. Optional: [When DALI-2 has been selected, include the following] Ensure and successfully demonstrate that the CMS accommodates standardised data field allocations for asset management parameters and successfully uploads these as per DiiA Specification for DALI-2 Part 251 Memory Bank 1 Extension.
  4. Successfully demonstrate all that System functions are performing according to User desires.
  5. Ensure that following User acceptance of a successful demonstration of all System functions performing according to User desires, a System Commissioning trial period shall commence.
  6. Ensure that the System Commissioning period shall consist of:

Select ONE option:

1. 7 consecutive calendar days of System operation
2. 14 consecutive calendar days of System operation
   1. Ensure that all System functions shall operate according to User Specification for at least ninety-nine percent (99%) of the time (after commissioning).
   2. Remedy issues discovered during the System Commissioning trial period.
   3. Submit written documentation of all System software settings required to configure all System functions according to User desires. Written documentation of all System software settings shall include all modifications made over the course of System Commissioning, and shall accurately represent the System following the completion of a successful System Commissioning trial period.
   4. Allow the User to undertake (at User cost) a post-commissioning lighting and control system site measurement and verification process of the complete lighting system (control system and installed luminaires) to confirm that the Vendor has delivered the lighting outcomes intended (as applicable to controls). This may be undertaken using the provisions of European Standard EN 13201-4:2015 Road Lighting Part 4: Methods of measuring lighting performance and Annexe D - Guidelines for measurement systems for adaptive road lighting. Other methods, including vehicular based dynamic lighting measurement techniques may be used for measurement and verification or check testing of lighting control system outcomes.
   5. Ensure that the system is Manufactured, Installed and Commissioned so that appropriate levels of best practice system security are achieved.

9 | System Maintenance Specification

The section covers the System maintenance requirements and is also contained within the Returnable Schedule B (iv) spreadsheet – Installation & Maintenance.

9.1 Maintenance Responsibility

1. The System shall be maintained by:

Select ONE option:

1. The Vendor
2. The following Third Party: [Third Party name]
3. The User
4. In the case that the Vendor is maintaining the System, the Vendor shall provide an overall description of its maintenance plan and its reactive and proactive service capabilities to meet that plan.

9.2 Maintenance Requirements

1. **If the System is maintained by a Third Party or the User:**
2. The Vendor shall provide comprehensive maintenance manuals and training at User premises, covering all aspects of the System;
3. The Vendor shall provide hardware and software maintenance and support according to the warranty terms for the duration of the warranty period. Any Maintenance term shall start following the end of the applicable warranty period;
4. The Vendor shall specify any mandatory maintenance required to maintain the terms of the warranty as well as provide an estimate of the annual number of hours required to maintain the System in Schedule C; and
5. Optional: Software and firmware upgrades, maintenance and support shall be provided for one year at no additional cost. The Vendor shall notify the User of any planned firmware updates, obtain User approval prior to making all changes and provide a process for reversing any changes if any faults or unwanted issues are identified.
6. Optional: The Vendor shall provide onsite assistance if remote support cannot resolve maintenance issues.
7. **If the System is maintained by the Vendor:**
8. The responsible party shall be responsible for the complete maintenance of the System, ensuring compliance with all terms of the Specification at all times;
9. If the Vendor is hosting the system, Vendor shall provide a comprehensive backup plan for software/system/server services, and stored data;
10. Optional: Monthly maintenance records and reports shall be submitted to the User. These shall include inspection reports, documentation of maintenance performed, and expected future maintenance requirements; and
11. Optional: The Vendor shall provide a mechanism to allow the User to submit requests for addressing any System malfunctions or maintenance issues.
12. Measurement and verification for routine maintenance and warranty enforcement: Any time after installation and commissioning the User may undertake (at User cost) lighting and control system site measurement and verification process of the complete lighting system (control system and installed luminaires) to confirm adequate maintenance of the lighting outcomes intended (as applicable to controls). This process may be undertaken using the provisions of European Standard EN 13201-4:2015 Road Lighting Part 4: Methods of measuring lighting performance. Annexe D - Guidelines for measurement systems for adaptive road lighting. Other methods, including vehicular based dynamic lighting measurement techniques may also be used for measurement and verification or check testing of lighting and control system outcomes.
13. The Vendor shall:
14. Hold a designated quantity of spares that it is able to be despatched within 24 hours of notification. The Vendor shall provide a suggested spares list and quantities to be held, for client acceptance or modification; and
15. Provide a 24 hour facility to receive and address requests for technical support.

10 | Appendix A: Terms and Definitions

Public Lighting Control System Terms and Definitions used in this Model Specification:

1. **Adaptive Control** – a method of controlling lighting system parameters according to variable needs and requirements.
2. **AES-128 or AES-256** –Advanced Encryption Standard – A specification for the encryption of electronic data established by the U.S. National Institute of Standards and Technology (NIST) adopted by the U.S. government and now used worldwide.
3. **ANSI** – American National Standards Institute – The primary US Standards Development Organisation (SDO).
4. **AMS** – Asset Management System – a type of integrated software package to manage the technical and financial operation and maintenance of infrastructure assets.
5. **API** – Application Programming Interface
6. **Asset Database** – a computerised database to store structured technical, financial and operational details of infrastructure assets.
7. **Astronomical Clock** – a device that determines the expected time of sunrise and sunset for a given calendar date and geographical location.
8. **Australian Energy Market Operator (AEMO)** – AEMO’s role is to balance the demand and supply of electricity and to operate markets across eastern and south-eastern Australia and the south west of Western Australia. AEMO is also responsible for managing unmetered load tables.
9. **Boot Loader** – a program that loads an operating system when a computer is turned on.
10. **Backhaul Communication Network** – a communication system linking the Central Management System to one or more Field Device Communication Networks (i.e. to the Gateways) .
11. **Central Management System (CMS)** – a computer environment that functions as the core of the System by providing all shared System services, and consolidating and storing System data.
12. **Constrained Application Protocol** **(CoAP)** – A specialised web protocol for use with constrained nodes and networks in the Internet of things for machine-to-machine applications.
13. **Compatibility** – the ability of a device to operate on a network with another device without interfering with the operation of the other device.
14. **Component** – any installed, replaceable and/or upgradable item with a unique product number that is necessary to meet the requirements of this specification.
15. **Control Point** – the location where a Luminaire is installed on a lighting column or outreach arm.
16. **D4i** – D4i is an intra-luminaire communications subset of DALI-2 that enables intelligent, connected, future-proofed LED luminaires with interoperability between components and devices.
17. **DALI** – acronym for Digital Addressable Lighting Interface. A digital intra-luminaire control protocol complying with IEC 62386 series, for two-way communication and control between the LED Power Supply (driver) and a lighting control system CMS. DALI-2 is an updated and enhanced version of DALI that is backwards compatible with DALI-1.
18. **DiiA** – the Digital Illumination Interoperability Alliance (DiiA) is the industry consortium that maintains DALI and develops and certifies DALI-2 power supplies and D4i certification of power supplies and devices.
19. **Field Devices** – the entire set of networked Components installed in the field and generally encompassing Light Point Controllers (LPC) and other Devices (e.g. sensors) that function together to adaptively control and remotely monitor Luminaires.
20. **Field Device Communication Network** – a communication system linking the Gateways to Light Point Controllers.
21. **FTP** –File Transfer Protocol - A standard network protocol used for the transfer of computer files between a client and server on a computer network
22. **Gateway (or Base Station, or Router**) – a communications device designed for interfacing between two communication networks that use different protocols.
23. **Graphical User Interface (GUI)** – a screen-based diagrammatic representation of a system.
24. **HMAC** – a specific type of Message Authentication Code involving a cryptographic hash function and a secret cryptographic key.
25. **Host Site** – the physical location of the Central Management System. Refers specifically to a site owned and operated by the User.
26. **http** – Hypertext Transfer Protocol -  An application protocol for distributed, collaborative, and hypermedia information systems.
27. **ICT** – Information and Communications Technology
28. **International Electrotechnical Commission (IEC)** – The international Standards Development Organisation (SDO) for electrical and electronic products and infrastructure.
29. **Ingress Protection (IP) -** AS/NZS 60529 Ingress Protection classifies and rates the degree of protection provided against intrusion by dust and moisture for mechanical casings and electrical enclosures.
30. **Internet Protocol (IP)** - Internet Protocol is the principal communications protocol in the Internet protocol suite for relaying data across network boundaries.
31. **Interchangeability** – the ability of a device to operate on a network in the same manner as a like device, where each device can be exchanged in the system.
32. **Interoperability** – the ability of a device to operate on a network in a consistent manner with a similar device.
33. **Latency** – the measure of time delay in a system.
34. **Light Point Controller (LPC)** – the device that originates a command to execute a lighting action at the luminaire. Most commonly connected via a NEMA ANSI C136.41 5 or 7-pin photocell receptacle, or a Zhaga Book 18 receptacle. LPC receptacles are usually mounted on the luminaire body, either on upper or lower surfaces.
35. **Lumen** – The SI unit of luminous flux (i.e. light output).
36. **Lumen Depreciation** – The depreciation in luminous flux (i.e. light output) for a specific light source over a defined period of time.
37. **Luminaire (or Light Fitting or Light Fixture)** – a complete lighting unit consisting of a lightsource and power supply together with an optical controller.
38. **Luminaire Extension Module** – the Zhaga Book 18 term for the base of the plug-in Light Point Controller and/or sensor device that mates with the Luminaire mounted Zhaga Book 18 receptacle.
39. **National Electrical Manufacturers Association (NEMA) -** the industry association of electrical equipment manufacturers in the United States.
40. **Management Station** – a user device that provides an interface to users to access the Central Management System e.g. mobile phone, laptop, tablet, desktop.
41. **Network** – a group of systems that function cooperatively or interdependently to provide a chain of command for lighting control.
42. **Networked Standby Mode** - mode when connected to a supply voltage with all functions off, except for support functions using a trigger from a network
43. **Node** – another name for a Light Point Controller (LPC)
44. **On-shore Insurance Bond** – an indemnification tool providing project-related financial underwriting.
45. **Online Operation** – the normal operating condition whereby Gateways or Light Point Controllers are communicating with the Central Management System.
46. **Offline Operation** – any condition whereby Gateways or Light Point Controllers are not communicating with the Central Management System.
47. **Parent Company Guarantee** – a financial guarantee from a principal company (usually international) to a subsidiary company (usually local) providing project-related financial underwriting.
48. **Photoelectric Cell or PE Cell** – a device that measures the ambient light level and compares it with a pre-set threshold.
49. **Project Performance Insurance** – an indemnification tool providing project related financial underwriting of satisfactory technical performance.
50. **Protocol** – a set of standard rules for communicating over a computer network or a lighting control system.
51. **Sensors** – Devices that may be installed on the same luminaire (eg via a Zhaga Book 18 receptacle), the same column or on the same Field Device Communication Network that enable measurement of physical parameters such as light, traffic, air quality, climate, or sound.
52. **SHA-256** – Secure Hash Algorithm - one of a number of cryptographic hash functions. Like a signature for a text or a data file.
53. **SMTP** – Simple Mail Transfer Protocol - An Internet standard for electronic mail transmission.
54. **SNMP** – Simple Network Management Protocol - a protocol for network management used for collecting information and configuring network devices on an Internet Protocol network.
55. **SPD** – Surge Protection Device – An electrical device that protects electrical networks from voltage surges caused by lightning strike or by other network incidents.
56. **Standby Mode** - mode when connected to a supply voltage with all functions off, except for support functions using a sensor, timer or external trigger not being a trigger from a network
57. **System** – the entire set of networked Components. Hardware and software, typically consisting of Light Point Controllers, Gateways, Backhaul, a Central Management System, and Management Stations, that function together to adaptively control and remotely monitor Luminaires.
58. **TALQ** - the TALQ Consortium is a global alliance organisation of controls vendors that aims to set a globally accepted specification for management software interfaces to control and monitor multi-vendor component outdoor lighting networks.
59. **TCP** – Transmission Control Protocol - one of the main protocols of the Internet protocol suite. The entire suite is commonly referred to as TCP/IP.
60. **UDP** – User Datagram Protocol - a simple OSI transport layer protocol for client/server network applications based on Internet Protocol
61. **X.509 Certificate** – a digital certificate that uses the international X.509 public key infrastructure standard that defines the format of public key certificates. X.509 certificates are used in many Internet protocols.
62. **Zhaga** – an International lighting industry consortium for development of specifications for optical, electrical, mechanical and data interfaces for Luminaires and Power Supplies.

11 | Appendix B: Existing Luminaire Specifications

Note: In Australia and New Zealand at present there is some likelihood of a Public Lighting Controls procurement process requiring interoperability with existing luminaires. Some Australian and New Zealand road authorities have already proceeded with the deployment of controls enabled LED luminaires using NEMA/ANSI C136.41 receptacles and dimming Power Supplies (either 0/1-10V analogue or DALI-1 digital or DALI-2 digital) in anticipation of future controls application. This appendix is included to indicate how a controls procurement process integrates with existing controls enabled luminaires.

11.1 Luminaire Descriptions

State the Luminaires that Light Point Controllers are to be Interoperable with. Provide details for each luminaire type:

* 1. Luminaire Type:
  2. Luminaire Quantity:
  3. Make:
  4. Model:
  5. Input Power (W):

11.2 Light Point Controller Integration Method

State the Light Point Controller integration method:

* 1. NEMA C136.10 receptacle
  2. NEMA C136.41 receptacle
  3. Zhaga Book 18 receptacle

11.3 LED Driver Control Signal

State the LED Driver Control Signal type:

* 1. 0/1-10V analogue
  2. DALI-1
  3. DALI-2
  4. Combined 0/1-10V analogue+DALI-1 digital
  5. Combined 0/1-10V analogue+DALI-2 digital
  6. Zhaga Book 18 Certified DALI 2

12 | Appendix C: Standards References

12.1 Normative References

1. **American National Standards Institute (ANSI)**
   1. ANSI C136.10 American National Standard for Roadway and Area Lighting Equipment—Locking-Type Photocontrol Devices and Mating Receptacles—Physical and Electrical Interchangeability and Testing
   2. ANSI C136.41 Roadway and Area Lighting Equipment – Dimming Control Between an External Locking Type Photocontrol and Ballast or Driver
   3. ANSI C136.2 American National Standard for Roadway and Area Lighting Equipment— Dielectric Withstand and Electrical Transient Immunity Requirements
   4. ANSI C136.58 Luminaire Four-Pin Extension Module and Receptacle - Physical and Electrical Interchangeability and Testing
   5. ANSI C137.4 – Lighting Systems - Digital Interface with Auxiliary Power
2. **International Electrotechnical Commission (IEC)**
3. IEC 60529 Degrees of protection provided by enclosures (IP Code)
4. IEC 62386-(Series) Digital addressable lighting interface (DALI)
5. IEC 63103 Non-active mode power measurements
6. IEC 63128 Lighting control interface for dimming - Analogue voltage dimming interface for electronic current sourcing control gear
7. **European Committee for Standardisation (CEN)**
8. EN 13201-4 Road Lighting Part 4: Methods of Measuring lighting performance
9. **Telcordia**
10. SR-332 Reliability Prediction Procedure for Electronic Equipment
11. **Australia/New Zealand Standards**
12. AS/CA S042 Requirements for connection to an air interface of a telecommunications network – Part 1: General
13. AS/NZS 60598.2.3 Luminaires Part 2.3: Particular requirements - Luminaires for road and street lighting
14. AS/NZS 1158 Series (Parts 0-5) - Lighting for Roads and Public SpacesSA/SNZ TS 1158.6 – Lighting for Roads and Public Spaces. Part 6 Luminaires - Performance
15. AS/NZS CISPR 15 Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
16. AS/NZS 3000 Electrical Installations (Australian/New Zealand Wiring Rules)
17. AS/NZS 3820 Essential safety requirements for electrical equipment
18. AS/NZS 4268 Radio equipment and systems - Short range devices - Limits and methods of measurement

12.2 Informative References

1. **Illuminating Engineering Society – North America (IESNA)**
2. RP-16-10 Nomenclature and Definitions for Illuminating Engineering
3. TM-23-11 Lighting Control Protocols
4. DG-28-15 The Guide for Selection, Installation, Operations and Maintenance of Roadway Lighting Control Systems
5. **U.S. Department of Energy Municipal Solid-State Street Lighting Consortium**
6. Model Specification for LED Roadway Luminaires, v1 2011
7. Model Specification for Networked Outdoor Lighting Control Systems, v2 2014
8. **TALQ Consortium**
9. TALQ Specification Version 2.0 (available only to members of the TALQ Consortium)
10. **Zhaga Consortium – Book 18 Outdoor Connectivity Interface for Smart Luminaires**
11. Zhaga Book 18 Edition 2.0 - Smart interface between outdoor luminaires and sensing / communication modules

13 | Appendix D: Returnable Schedules

In responding to this tender, tenderers need to provide the following completed schedules:

**SCHEDULE A** - Vendor Information & Referees

**SCHEDULE B** - Control System Technical Specification Compliance Response for:

* 1. Central Management System
  2. Communication Networks
  3. Light Point Controllers
  4. Installation & Maintenance

**SCHEDULE C** - Pricing

**SCHEDULE D** - Warranty Information

**SCHEDULE E** - Vendor or Project Performance Guarantees, Bonds, Insurances (Optional)

**SCHEDULE F** - Statutory Declaration (Optional)

13.1 SCHEDULE A: Vendor Information & Referees

Please provide the following details separately for both the Tenderer (typically a local distributor as Vendor) and the Manufacturer (if not the same company) for the purpose of evaluating tenders:

**Tenderer's Information**

|  |  |
| --- | --- |
| **ITEM** | **RESPONSE** |
| 1. Tenderer Name |  |
| 1. Location (Physical address) |  |
| 1. ABN or NZ Company No. |  |
| 1. Website |  |
| 1. Number of Employees |  |
| 1. Approximate Annual Financial Turnover | [Like all other information submitted, this will remain confidential to the Evaluation Panel and its advisers] |
| 1. Relationship to Manufacturer (if not the same company) | [Clarify whether distribution rights are exclusive, whether the manufacturer has shareholding in the distributor etc] |
| 1. Competencies in Outdoor Public Lighting Controls | [Brief company CV – Max half page] |
| 1. List of reference sites / customers | [List recent relevant reference sites/customers and approximate number of Light Point Controllers for each. Local reference sites preferred but international reference sites may also be relevant] |
| 1. Competencies of key ANZ-based staff | [Brief one-paragraph CVs of key technical  or customer-facing personnel] |
| 1. Ability to support site visits | [Name of customer service representative and location] |

[Tenderer to delete table below if tenderer and manufacturer are the same company]

**Manufacturer’s Information**

|  |  |
| --- | --- |
| **ITEM** | **RESPONSE** |
| 1. Manufacturer Name |  |
| 1. Location (Physical address) |  |
| 1. ABN / NZ Company No. |  |
| 1. Website |  |
| 1. ISO 9001 Certification No. |  |
| 1. Number of Employees |  |
| 1. Approximate Annual Financial Turnover | [Like all other information submitted, this will remain confidential to the Evaluation panel and its advisers] |
| 1. Competencies in Outdoor Public Lighting Controls and wireless communications | [Brief company CV – Max half page] |
| 1. Competencies of key ANZ-based staff (if applicable) | [Brief one-paragraph CVs of key technical  or customer-facing personnel] |
| 1. Ability to support site visits | [Name of customer service representative and location if applicable] |

**Referee’s Information**

The Tenderer shall provide [Insert No. of referees required] from recent projects. Tenderers shall provide a contact for each who is able to act as a referee for this tender and has given their permission to be contacted.

For most Vendors of Public Lighting Control Systems there may be few suitable local referees with application experience of sufficient scale, at this time. In this case, Vendors may provide (English speaking) referees from international projects.

The Tenderer shall provide a minimum of:

For local or international reference projects, other than trials. Select ONE of the following options:

1. Two referees
2. Three referees

Four referees

Note: Actual projects are required to obtain meaningful reference information. Trial or demonstration projects do not convey the nature of the typical support and backup patterns required of a Vendor. Vendors and Manufacturers operate in a world market and local procurement organisations need to access third party viewpoints on the nature of the system performance and support provided by the Vendor or Manufacturer. Setting a high quantity may unreasonably limit the field.

Information about referees and their projects shall be provided in the tables below:

**Referee 1**

|  |  |
| --- | --- |
| **ITEM** | **RESPONSE** |
| 1. Referee Name |  |
| 1. Organisation |  |
| 1. Location of Referee (Physical address) |  |
| 1. Telephone |  |
| 1. Email |  |
| 1. Project Description | [Brief description of project] |
| 1. Project Size and Nature | [Type of CMS Software, Type of Light Point Controllers, Type of Communication Network, Number of Light Point Controllers, Date of first installation, Date of last installation.] |
| 1. Project Objective and Achievements | [Goals of the project, Measurable benefits of the project, Non-measurable benefits of the project] |

**Referee 2**

|  |  |
| --- | --- |
| **ITEM** | **RESPONSE** |
| 1. Referee Name |  |
| 1. Organisation |  |
| 1. Location of Referee (Physical address) |  |
| 1. Telephone |  |
| 1. Email |  |
| 1. Project Description | [Brief description of project] |
| 1. Project Size and Nature | [Type of CMS Software, Type of Light Point Controllers, Type of Communication Network, Number of Light Point Controllers, Date of first installation, Date of last installation.] |
| 1. Project Objective and Achievements | [Goals of the project, Measurable benefits of the project, Non-measurable benefits of the project] |

Note: Tendering organisation to insert additional tables below if additional referees are required.

13.2 SCHEDULE B: Control System Technical Documentation

Tender submission documentation shall be provided in the attached Excel spreadsheet (Schedules B (i)(ii)(iii)(iv)t and supported by the following attachments:

1. Technical Specifications for all Components:
2. Brochures, specifications, technical data sheets, drawings and other technical information describing the Components to be used in the proposed System including explicit identification of model/catalogue numbers
3. Light Point Controller and Gateway regulatory safety and EMC compliance certifications and/or test reports and Supplier Declarations of Conformity (SDoCs)
4. Documentation of System topology and layout:
5. Proposed Light Point Controller and Gateway topology (e.g. Star, Mesh or Mobile communication), layout and proposed Gateway locations (if applicable)
6. Representative system communication paths between Light Point Controllers, Gateways and Backhaul communication network(s)
7. A description of the modelling or analysis methods used to support the proposed Light Point Controller, Gateway and Backhaul topology and layout, System communication paths, and confidence in System performance

13.3 SCHEDULE C: Price Information

A tender submission may be based on a traditional capital asset acquisition model or, for the supply of controls based on a Network-as-a-Service (NaaS) model, submissions can be based on on-going operating charges. The tender submission shall include pricing (initial) and fees (recurring) for a System that fully meets this specification, and does not require any additional options or upgrades.

The pricing is to be stated separately for each of the categories, as in the attached Excel-based Returnable Schedule C.

Note: This model specification is designed to align with Best Value (BV) public sector procurement processes that use evaluation methods that include price comparison on the basis of whole of life costing over the full asset lifespan and including the use of Discounted Cash Flow (DCF) techniques such as Net Present Value (NPV) calculations. Procurement and tender evaluation methods that use simple comparison of lowest initial pricing are not suitable.

13.3.1 Hardware Pricing Notes:

Hardware tender pricing as quoted in the attached Schedule C shall be for goods Free-Into-Store (FIS) at the following location:

Location of User or local installation contractor’s nominated store

13.3.2 Payment Terms

The tender submission should include any Vendor desired Payment Terms and identify any Vendor desired payment timing for the specified project steps.

13.3.3 Financing Options

The tender submission shall:

Select one or more, as desired

1. Include Vendor financing options
2. Include Vendor specified Third Party financing options
3. Not include financing options

13.4 SCHEDULE D: Warranty Information

13.4.1 Hardware Warranty

All Hardware Components shall be covered by a single-source written replacement warranty covering materials and workmanship for a period of:

Select ONE option:

1. 5 years
2. 10 years

This shall provide a full replacement Component product warranty from the date of the purchase invoice on a Component “return-to-base” labour and transport basis.

A full replacement return-to-base warranty shall include Component repair or replacement of (at a minimum):

1. Failure of any electrical, electronic, optical or mechanical components.
2. Failure of any ingress protection resulting in moisture or dirt degradation.
3. Vendor transport costs to and from a User nominated local store.

A full replacement return-to-base warranty does not include:

1. Site removal or reinstallation by Vendor, including transport and labour.
2. Component failure caused by improper handling, misuse, abuse, vandalism or negligence.
3. Any failed Component pro-rata usage cost recovery by the Vendor.

The User may perform field measurements and/or send Components to independent laboratories for testing (at User cost) to enforce warranty provisions at any time during the warranty period.

13.4.2 Software Warranty

All software shall be covered by a written replacement warranty and maintained via a firmware update mechanism for a period of:

Select ONE option:

1. 1 year
2. 2 years
3. 3 years
4. 5 years
5. 10 years

13.4.3 Warranty Certificates

Signed warranty certificates shall be provided to the client immediately upon completion of installation and commissioning. Unless specifically agreed with the User, these warranty conditions take precedence over any standard supplier warranty provisions or terms and conditions of sale.

13.5 SCHEDULE E: Vendor or Project Performance Guarantees, Bonds, Insurances

Note: Vendor Company financial security instruments such Parent Company Guarantees, Bank Guarantees, On-shore Insurance Bonds or Project Performance Insurance are various methods of indemnifying the User against deficiencies in performance of the System and/or of the Vendor during the Warranty period. These instruments may be a useful method of risk mitigation. Note that these measures may have cost implications and should not be applied unless there are specific reasons for doing so. In the case of Project Performance Insurance it should be stated in the Tender Specification whether the insurance premium costs will be borne by the User or by the Vendor.

1. Optional: The following Vendor and/or project performance risk mitigating instruments shall be provided by the Vendor:

Select ONE or MORE, as desired

* 1. Parent Company Guarantee [Insert all required details]
  2. Bank Guarantee [Insert all required details]
  3. On-shore Insurance Bond [Insert all required details]
  4. Project Performance Insurance [Insert all required details]

1. Optional: The Vendor and/or project performance risk mitigating instruments required as above shall have a duration of:

Select ONE or MORE, as desired

* 1. 3 Year
  2. 5 Year
  3. 10 Year
  4. Same duration as Hardware Warranty

13.6 SCHEDULE F: Statutory Declaration **(Optional)**

Note: Tendering organisations have the option of inserting a standard form of statutory declaration relevant to the jurisdiction of the tendering organisation allowing the vendor to attest to the truthfulness of their tender submission. Perhaps most importantly, vendors would be attesting to that the list of substantiating documentation is available in precisely the format requested and with appropriate certifications from accredited independent laboratories.

