Networked Lighting Control System Technical Requirements

Version 3.0
June 1, 2018

Note: Changes from Version 2.0 are highlighted in ==yellow==.

Schedule of Revisions

Revision Number	Date	Description
1.0	Apr 21, 2016	• Initial Technical Requirements published.
1.01	May 7, 2016	• Clarified that the Technical Requirements are for Interior Control Systems. Systems designed and marketed exclusively for exterior applications are not eligible to be qualified.
1.02	Feb 24, 2017	• Clarified that the Technical Requirements do not cover DC or PoE systems.
2.0	Jun 1, 2017	• Version 2.0 published, with addition of Exterior Control Systems.
==3.0==	==Jun 1, 2018==	• ==Version 3.0 published, with addition of DC/PoE Systems, Scenes, and multiyear plans for Energy Monitoring and Cybersecurity.==

This document defines requirements to be met or reported for lighting control systems listed on the DesignLights Consortium® (DLC) Networked Lighting Controls Qualified Products List (QPL).

Scope of Technical Requirements

These are requirements for Interior and Exterior Networked Lighting Control (NLC) systems associated with commercial and industrial buildings, roadways, and exterior

14 environments. NLC systems are defined for the purposes of these requirements as the
15 combination of sensors, network interfaces, and controllers that effects lighting changes
16 to luminaires, but does not include the luminaires themselves. Any luminaire-specific
17 control requirements are addressed separately by the DLC's Solid-State Lighting
18 Technical Requirements and Qualified Products List, https://www.designlights.org/solid-
19 state-lighting/qualification-requirements.

20 This revision of this Technical Requirements document is the first one to accept DC and
21 PoE networked lighting control systems in conjunction with the SSL Luminaire DC and
22 PoE Policy to be released in September 2018. Please note that while the DLC will accept
23 and begin processing DC and PoE based NLC applications beginning in June 2018, to
24 avoid confusion with rebate/incentive programs, the DLC will not publicly qualify and list
25 DC/PoE Control Systems until the corresponding SSL application process is available in
26 September 2018. See the DLC Technical Workplan for the current schedule.

Definition of "Required" vs. "Reported" Capabilities

28 The Technical Requirements are built on "Required" and "Reported" system capabilities.

29 **"Required" Capabilities:** Required Capabilities shall be available in all systems to be
30 listed on the QPL. Systems that do not offer these capabilities are not eligible to be
31 listed. A successful application will provide information on the availability of these
32 capabilities and characteristics. Key information provided by the manufacturer will be
33 published on the QPL.

34 *Note:* While the DLC requires systems to offer a particular capability, the DLC does not
35 specify whether a capability must be installed on a project. For instance, while the DLC
36 requires systems to have daylight harvesting / photocell capability, the DLC does not
37 specify which rooms or luminaires on a project must be installed with daylight
38 harvesting / photocell capability. Project-specific requirements for rebates and
39 incentives are determined by individual efficiency programs. The DLC intends to develop
40 best-practice guidelines that individual utilities may adopt, in whole or in part, to guide
41 installation of capabilities on a project. These guidelines will be developed in 2018
42 separately from this Technical Requirements document with input from DLC
43 stakeholders.

44 **"Reported" Capabilities:** The DLC will report on the presence or absence of, type,
45 and/or characteristics of each Reported capability for qualified systems. While systems
46 are not required to include these capabilities, a successful application will provide
47 information on the presence or absence of these capabilities and their characteristics.
48 Key information provided by the manufacturer will be published on the QPL.

Additional Requirements

"Customer Available Information": In order for an applicant to claim a capability listed in Tables 1 and 2, the manufacturer's customer literature must specify that the system has the capability, with instructions for how to configure and/or use this feature.

"Customer available" means the documentation is a finished product available publicly on a website, and/or included with the product packaging, and/or provided to the customer upon request. It should not be a document produced for the sole purpose of obtaining DLC qualification without further use for customers. The DLC reserves the right to accept, reject, or require changes to documentation to satisfy this requirement. Any documentation provided to the DLC will be used for the purpose of verifying compliance with DLC Technical Requirements and will not be made available publicly or distributed.

The following capabilities from Table 1 and 2 are exempt from this requirement:

- *Continuous Dimming*
- *Individual Addressability*
- *Luminaire Level Lighting Control (LLLC, integrated)*
- *Networking*
- *Startup and Configuration Party*
- *Type of User Interface*

Warranty: The DLC requires a minimum warranty of at least 5 years for all components of the system addressed by the requirements, with the exception of software, on-premises computer server, and cloud service. An optional warranty extension to 5 years is acceptable in meeting this requirement, however the QPL will identify that an extended warranty must be purchased to meet the requirements.

Commercial Availability and Verification: All systems must be fully commercially available, able to be purchased, with complete, final documentation and literature readily available on the manufacturer's website before they can be listed. The DLC requires that a qualified system has been installed and operated successfully in at least one actual field installation. The DLC will verify this through a case study and/or a customer reference. See the Application Form for more information.

System Overview Presentation: As part of the Application Review Process, the DLC requires a system overview to be presented via webinar or in-person to the DLC. See the Application Form for more information. For annual re-listings of a previously qualified system,where a recording of a prior presentation is available and the system has not changed extensively, this requirement may be waived or shortened.

All requirements documents, including the Application Form, Instructions, and supporting documentation can be found on the DLC website at https://www.designlights.org/lighting-controls/qualify-a-system.

Energy Monitoring Plan

In V4.0, to be released June 1, 2019, Energy Monitoring will become a required capability. Manufacturers will report the method of monitoring (direct or calculated), and the accuracy of measurement that is direct.

In V5.0, to be released June 1, 2020, calculated methodologies will not be accepted as meeting the energy monitoring requirement unless supported by a new ANSI standard that specifies the accuracy of the methodology. If an ANSI standard to support the methodology is not developed, then only direct measurement methods will be accepted and manufacturers will self-report the accuracy of the direct measurement method.

Cybersecurity Plan

In V3.0, compliance is reported with cybersecurity standards including the following:

- ANSI UL 2900-1 for components, available for purchase:
  - https://standardscatalog.ul.com/standards/en/standard_2900-1_1
  - Product certifications are available from certification bodies including UL and Intertek
  - Lab accreditations to self-certify may also be available from UL
- IEC 62443
  - Certifications available from ISASecure, http://www.isasecure.org/en-US/
  - IEC 62443-3-3 for systems, available for purchase: https://webstore.iec.ch/publication/7033
  - IEC 62443-4-2 for components (an extension of -3-3)
    - Mature draft, not published yet
  - IEC 62443-4-1, -2-1, and -2-2 for manufacturers
- ISO 27000 family for manufacturers, available for purchase:
  - https://www.iso.org/isoiec-27001-information-security.html
- NIST IoT Cybersecurity Framework
  - https://www.nist.gov/programs-projects/nist-cybersecurity-iot-program

In V4.0, to be released June 1, 2019, compliance with a list of applicable cybersecurity standards will be reported. The stakeholder input process for V4.0 will propose how components, systems, and/or manufacturers must be certified, and to which standard(s), in order to claim this optional capability.

In V5.0, cybersecurity compliance, as outlined in V4.0 from 2019, will be required on June 1, 2020.

120 Annual Revisions and Grace Period

121 The DLC revises the Networked Lighting Controls Technical Requirements annually, with
122 final revisions completed on June 1 of each year. Each manufacturer must requalify and
123 relist a system each year with the annual Technical Requirements revision schedule.

124 Grace Period Policy: A twelve month listing grace period will be provided for systems
125 that have been qualified under a previous version of the Technical Requirements, but do
126 not meet revised requirements. These systems can be requalified and listed under the
127 previous version of the Technical Requirements. This will allow a period of one year to
128 develop an updated or new system that can be submitted for evaluation according to the
129 most current Technical Requirements.

130 Table 1 provides a Summary of "Required" and "Reported" System Capabilities for
131 Interior Lighting Systems.

132 Table 1 – Interior Lighting Systems

'Required' Interior System Capabilities	'Reported' Interior System Capabilities
• *Networking of Luminaires and Devices* • *Occupancy Sensing* • *Daylight Harvesting / Photocell Control* • *High-End Trim* • *Zoning* • *Luminaire and Device Addressability* • *Continuous Dimming*	• *Control Persistence* • *Scheduling* • *Energy Monitoring* • *Device Monitoring / Remote Diagnostics* • *Type of User Interface* • *Luminaire Level Lighting Control (LLLC, integrated)* • *Personal Control* • *Load Shedding (DR)* • *Plug Load Control* • *External Systems Integration (e.g. BMS, EMS, HVAC, Lighting, API)* • *Emergency Lighting* • *Cybersecurity* • *Color Changing / Tuning* • *Start-Up and Configuration Party* • *Scene Control*

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134 Table 2 provides a Summary of "Required" and "Reported" System Capabilities for
135 Exterior Lighting Systems.

Table 2 – Exterior Lighting Systems

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'Required' Exterior System Capabilities	'Reported' Exterior System Capabilities
• *Networking of Luminaires and Devices* • *Occupancy Sensing AND/OR Traffic Sensing* • *Daylight Harvesting / Photocell Control* • *High-End Trim* • *Zoning* • *Luminaire and Device Addressability* • *Continuous Dimming* • *Scheduling*	• *Control Persistence* • *Energy Monitoring* • *Device Monitoring / Remote Diagnostics* • *Type of User Interface* • *Load Shedding (DR)* • *External Systems Integration (EMS/BMS/HVAC/Lighting/API)* • *Emergency Lighting* • *Cybersecurity* • *Color Changing / Tuning* • *Start-Up and Configuration Party* • *Scene Control*

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139 Table 3 provides the detailed definitions for each capability or technical requirement.
140 This Table applies to both Interior and Exterior, except where noted. Please note that
141 the Application Form specifies in more detail what information the DLC requires from
142 manufacturers for each capability and what information will be published on the QPL.

143 Table 3: Capability and Requirement Definitions

Row	Capability	Definition
1	Networking of Luminaires and Devices	The capability of individual luminaires and control devices to exchange digital data with other luminaires and control devices on the system. This capability is required at the room, space, or area level, but not at the whole building level or beyond (e.g. non-lighting systems, or the internet).
2	Occupancy Sensing	The capability to affect the operation of lighting equipment based upon detecting the presence or absence of people in a space or exterior environment.
		Exterior systems must include either Occupancy Sensing or Traffic Sensing. They may include both, but that is not required.
3	Traffic Sensing	The capability to affect the operation of lighting or other equipment based upon detecting the presence or absence of moving vehicles in an area.
		Systems may satisfy this requirement through *External Systems Integration* as described below in lieu of in-system sensors if another source of data is used for presence or absence detection.
		Exterior systems must include either Occupancy Sensing or Traffic Sensing. They may include both, but that is not required.
4	Daylight Harvesting / Photocell Control	The capability to automatically affect the operation of lighting or other equipment based on the amount of daylight and/or ambient light that is present in a space, area, or exterior environment. This capability is typically called Daylight Harvesting for Interior systems, and Photocell Control for Exterior systems.

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5	High-End Trim*	The capability to set the maximum light output to a less-than-maximum state of an individual or group of luminaires at the time of installation or commissioning. High-End Trim must be field reconfigurable. This capability is distinct from automatic compensation for lumen depreciation, which automatically increases output as a system operates over time. *While the DLC specifically requires "High-End Trim", some manufacturers refer to this capability as "Task Tuning" or "Tuning" within their system interfaces. Refer to NEMA LSD 64-2014 for definitions of Lighting Controls Terminology.
6	Zoning	The capability to group luminaires and form unique lighting control zones for a control strategy via software-defined means, and not via physical configuration of mechanical or electrical installation details (e.g. wiring). Interior: Zoning is required for Occupancy Sensing, High End Trim, and Daylight Harvesting control strategies except for systems that feature Luminaire Level Lighting Control (LLLC) capabilities as defined in these requirements under "Reported Capabilities", in which case zoning is only required for Occupancy Sensing and High-End Trim control strategies. Exterior: Zoning is required for High End Trim
7	Luminaire and Device Addressability	The ability to uniquely identify and/or address each individual luminaire, sensor, controller, and user interface device in the lighting system, allowing for configuration and re-configuration of devices and control zones independent of electrical circuiting.
8	Continuous Dimming	The capability of a control system to provide control with sufficient resolution in output (100+ steps) to support light level changes perceived as smooth (as opposed to step dimming with a small number of discrete light levels).
9	Control Persistence	The capability of a networked lighting control system's lowest-level ("edge device") luminaire controllers to execute three energy saving strategies (occupancy sensing, daylight harvesting, and high-end trim) at a room-level, or finer, resolution in the absence of communications with the next higher networked element in the system's topology.
10	Scheduling	The capability to automatically affect the operation of lighting equipment based on time of day. Scheduling capability is Reported for Interior systems and Required for Exterior systems. Exterior systems are required to have event scheduling, and "astronomical" scheduling functionality for sunrise and sunset programming, based on geographical location and time of year.

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11	Energy Monitoring	The capability of a system to report the energy consumption of a luminaire and/or a group of luminaires. The use of energy monitoring on dedicated lighting circuits is also acceptable. The method by which the system implements this capability must be clearly described, including whether the data is based on direct measurements of current as a function of time ("direct"); or on records of dimming control signals as functions of time, combined with nominal wattage or other calculated methodologies that do not directly measure the current ("calculated"). In addition, the sampling frequency, reporting interval, record duration, and accuracy of reported data must be specified.
12	Device Monitoring / Remote Diagnostics	The capability to monitor, diagnose, and report operational performance including system and/or component failures.
13	Type of User Interface	The type of interface provided by the control system for users to read and adjust control system settings during system start-up, commissioning, and/or ongoing operation.
14	Luminaire Level Lighting Control (LLLC, integrated)	The capability to have a networked occupancy sensor and ambient light sensor installed for each luminaire, and directly integrated or embedded into the luminaire form factor during the luminaire manufacturing process. In addition to these required integrated components, LLLC systems must have Control Persistence capability as described in this document. To demonstrate commercial availability of the integrated component options, at least one family, luminaire or kit with integrated control must be verified by DLC. Manufacturers may choose whether or not to list this information publicly on the QPL.
15	Personal Control	The capability for individual users to adjust to their personal preferences, via networked means, the illuminated environment of a light fixture or group on of light fixtures in a specific task area. The publicly available information must clearly describe a control interface for use by a single individual who does not have access to system-wide settings. A wireless dimmer switch may only be considered a personal control interface if product documentation: a) shows that the physical configuration is suitable for workstation use (i.e. a small, self-contained unit without any external wiring, suitable for use as a handheld remote control), and b) describes configuration for personal control within a larger area.

		A software-based interface may only be considered personal control if product documentation: a) shows it provides a specific interface intended for personal control by an individual user within a subsection of a larger space and that b) the interface only allows access to personal control functions for the light fixtures in the specific areas being controlled <mark>(i.e. each occupant can control their own area, but not their neighbors' areas)</mark>.
16	Load Shedding (Demand Response)	The capability to reduce the energy consumption of a lighting system, in a pre-defined way, on a temporary basis, in response to a demand response signal. The method by which the system implements this capability must be clearly described in the publicly available reference(s).
17	Plug Load Control	The capability to control the power delivered to receptacles through scheduling or occupancy sensing. The method by which the system implements this capability must be clearly described in the publicly available reference(s).
18	External Systems Integration (e.g. BMS, EMS, HVAC, Lighting, API)	The capability to exchange data with other networked systems such as Building or Energy Management Systems (BMS/EMS), Heating Ventilation and Air Conditioning (HVAC) Systems, or other Lighting and Building Systems via BACnet, Application Program Interface (API) or other methods. The method, including formats and languages, by which the system implements this capability must be clearly described in the publicy available reference(s).
19	Emergency Lighting	<mark>Publicly available documentation illustrating how a system's luminaires connect with an emergency power source.</mark> The QPL will provide the URL(s) for online documentation provided by manufacturers for system designers to refer to. This documentation will identify wiring diagrams, required components, and/or application guides needed to understand design considerations for integrating the system into an emergency lighting system.
20	<mark>Cyber</mark>security	The QPL provides an optional field for system manufacturers to list a link to <mark>cyber</mark>security information of their choice about their system. <mark>In addition, the QPL will identify any components of a system that comply with UL 2900 or IEC 62443; and any manufacturers that comply with ISO 27001, IEC 62443, or the NIST IoT Cybersecurity Framework.</mark>

21	Color Changing / Tuning	The capability to alter the output and color of tunable white and/or variable color output luminaires via a dedicated control interface(s). To demonstrate compliance with this capability, the interface(s) must be clearly described in the product literature and allow for at least two CCT settings. These settings may be described in terms of CCT, such as 3000K or 5000K, or simple descriptive terms for the desired setting such as 'Night' or 'Day'. The product literature must also specify installation and configuration requirements to implement this functionality.
22	Start-up and Configuration Party	The QPL will identify the most typical responsible party and their required level of training to start-up and configure the system to the extent that all Required Capabilities are functioning. Documentation is not required.
23	Scenes	The capability of a system to provide two or more pre-programmed light level settings for a group or multiple groups of luminaires to suit multiple activities in a space, and allow for recall of these settings via a switch, control device, or signal from a BMS or API.

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