



Networked Lighting Control System Technical Requirements

Version 4.0
June 10, 2019

Note: Changes from Version 3.0 are highlighted in yellow.

Schedule of Revisions

Revision Number	Date	Description
1.0	Apr 21, 2016	<ul style="list-style-type: none">Initial Technical Requirements published.
1.01	May 7, 2016	<ul style="list-style-type: none">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	<ul style="list-style-type: none">Clarified that the Technical Requirements do not cover DC or PoE systems.
2.0	Jun 1, 2017	<ul style="list-style-type: none">Version 2.0 published, with addition of exterior control systems.
3.0	Jun 1, 2018	<ul style="list-style-type: none">Version 3.0 published, with addition of DC/PoE systems, scenes, and multi-year plans for energy monitoring and cybersecurity.
4.0	Jun 10, 2019	<ul style="list-style-type: none">Version 4.0 published, with addition of energy monitoring requirement, criteria for cybersecurity certifications, and building management systems capable of networked lighting control.

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).

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25 Scope of Technical Requirements

26 These are requirements for Interior and Exterior networked lighting control (NLC) systems associated with
27 commercial and industrial buildings, roadways, and exterior environments. NLC systems are defined for the
28 purposes of these requirements as the combination of sensors, network interfaces, and controllers that effects
29 lighting changes in luminaires, retrofit kits or lamps. Luminaires, retrofit kits and lamps are qualified separately
30 by the DLC's [Solid-State Lighting Technical Requirements](#) and [Qualified Products List](#).

31 DC and PoE networked lighting control systems are eligible to be qualified, in conjunction with the [SSL Testing
32 and Reporting Requirements for DC and PoE Lamps, Luminaires, and Retrofit Kits](#).

33 Building Management Systems that control networked lighting plus other building systems such as HVAC, are
34 eligible to be qualified as NLC systems and listed on the QPL, provided that they meet all of the DLC's
35 requirements for NLC. Note that the DLC does not claim to qualify any HVAC-specific capabilities of these
36 systems at this time.

37 Horticultural control systems are not eligible to be qualified at this time.

38 Definition of “Required” vs. “Reported” Capabilities

39 The Technical Requirements are built on “Required” and “Reported” system capabilities.

40 **“Required” Capabilities:** Required capabilities shall be available in all systems to be listed on the QPL. Systems
41 that do not offer these capabilities are not eligible to be listed. A successful application will provide
42 information on the availability of these capabilities and characteristics. Key information provided by the
43 manufacturer will be published on the QPL.

44 *Note:* While the DLC requires systems to offer a particular capability, the DLC does not specify whether a
45 capability must be installed on a project. For instance, while the DLC requires systems to have daylight
46 harvesting/photocell capability, the DLC does not specify which rooms or luminaires on a project must be
47 installed with daylight harvesting/photocell capability. Project-specific requirements for rebates and
48 incentives are determined by individual efficiency programs.

49 **“Reported” Capabilities:** The DLC will report on the presence or absence of, type, and/or characteristics of
50 each Reported capability for qualified systems. While systems are not required to include these capabilities, a
51 successful application will provide information on the presence or absence of these capabilities and their
52 characteristics. Key information provided by the manufacturer will be published on the QPL.

53

54 **Additional Requirements (in addition to Tables 1,2,3)**

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

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

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

- 65 • Continuous Dimming
- 66 • Individual Addressability
- 67 • Luminaire Level Lighting Control (LLLC, integrated)
- 68 • Networking
- 69 • **Ease of Implementation**
- 70 • Type of User Interface

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

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

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

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

86

87 **Multi-Year Plans**

88 In order to serve the needs of stakeholders for long term planning, the DLC includes multi-year plans for some
89 topics and/or requirements. These plans outline a general direction for each topic over the next few years,
90 subject to refinement through the stakeholder engagement process.

91 **Energy Monitoring Plan**

92 The DLC's utility and energy efficiency program members have requested that energy data reports be made
93 available to support networked lighting control incentive/rebate programs. In alignment with the multi-year
94 plan proposed in the prior V3.0 requirements, energy monitoring is now a required capability in V4.0 with an
95 exception for room-based systems. Data is reported via .CSV file and/or API. Methods of energy monitoring
96 may include automated measurement methods and methods that require manual input of wattage to
97 measure energy use. As part of the application or re-application process, each product that qualifies for
98 energy monitoring will provide to the DLC a sample .CSV file or API documentation.

99 **Energy monitoring capability is not required for room-based systems**

100 A "room-based system" is defined as follows: A system that is designed to control lighting in a single room or
101 space and where the control, configuration, and management of the system is contained within the room or
102 space illuminated by the system. In order to interact with the system, (for instance, to change any settings or
103 to download any data), a user must be physically present in, or in close proximity to, the room or space
104 illuminated by the system.

105 In order for a system to qualify for this exemption, the DLC review process will confirm that the product claims
106 only "Room or Zone" for interior scope as listed on the DLC QPL.

107 **Plan for V5.0 Technical Requirements to be released in June 2020**

108 Version 5.0 will focus on specifying requirements for the energy data produced by the system, including
109 required energy data fields and associated characteristics. V5.0 is expected to include a requirement for 15-
110 minute timestamped interval energy data in Wh, and record retention of at least one year. The DLC intends to
111 work within the ANSI/NEMA C137 Committee to develop the specific data requirements to include in V5.0.
112 V5.0 will also consider a reporting requirement for systems to output a Configuration Report that identifies
113 system configuration and settings such as high-end trim, delay dwell times, zoning, and lighting levels at the
114 time of installation/commissioning. The purpose of this report will be to aid efficiency programs and
115 customers in confirming appropriate system configuration.

116

117 **Cybersecurity Plan**

118 In alignment with the multi-year plan proposed in the prior V3.0 requirements, the DLC is taking the next step
119 to help ensure qualified systems utilize best-practice standards for cybersecurity.

120 With these current V4.0 requirements (2019), the DLC has established criteria for cybersecurity standards that
121 will be accepted in order to claim the optional reported “Cybersecurity” capability.

- 122 • In order to claim the cybersecurity capability, a system must have a valid certification for one or more
123 of the specified standards at the time of qualification.
- 124 • The list of applicable standards in Table CS-1 will be reviewed for each incremental revision to the
125 Technical Requirements, or annually, whichever comes sooner.
- 126 • Self-certification is acceptable, provided that it is accredited by a certifying body with a formal
127 procedure to authorize self-certification. For example, UL has a Data Acceptance Program for
128 cybersecurity to authorize self-certification to ANSI/UL 2900-1.

129 **Criteria for acceptable cybersecurity standards**

130 The DLC recognizes cybersecurity standards that meet the following criteria:

- 131 1. Certifiable with a standardized methodology established through either:
 - 132 a. A voluntary consensus process such as ANSI, ISO, IEC, etc.
 - 133 b. A federal agency of the USA or Canada
 - 134 c. A collaborative multi-stakeholder engagement process such as the Cloud Security Alliance
- 135 2. Applies to one or more of the following:
 - 136 a. Product development process lifecycle
 - 137 b. Components/Embedded Devices
 - 138 c. System
 - 139 d. Cloud Services
- 140 3. Includes at least 3 of the following technical content, for (2. b,c,d) above
 - 141 a. Penetration testing
 - 142 b. Communication robustness testing
 - 143 c. Vulnerability identification testing
 - 144 d. Multiple levels of security
- 145 4. Renewal is required at least every 3 years, in order for a certificate to remain valid.

146 **Definitions**

- 147 • **Cybersecurity:** The practice of defending networked systems and data from malicious attacks.
- 148 • **Process:** Standards that address the development process in order to reduce the number of
149 cybersecurity vulnerabilities that are designed into components, systems, and services, and that
150 manifest over the product lifecycle.
- 151 • **Components:** Standards that address the cybersecurity of each individual component in a networked
152 system.
- 153 • **System:** Standards that address the networked system, including aspects such as authentication, data
154 confidentiality, system integrity, and service availability.

- **Cloud Services:** Standards for cloud services that address secure integration with services from a remote cloud computing provider.

List of standards

Standards that meet the criteria are listed in Table CS-1. Once a standard is on this list, the DLC does not expect to remove it with less than two years of notice.

Table CS-1

Standard	Process	Components/ Embedded Devices	System	Cloud Services
ANSI/UL 2900-1	Y	Y		
IEC 62443	-4-1	-4-2	-3-3	
SOC 2	Y		Y	Y
ISO 27001	Y			
ISO 27017 (with 27001)				Y
FedRAMP				Y
CSA STAR				Y

161

In V5.0 (scheduled for release in June 2020)

- The DLC will convene a technical working committee on cybersecurity in 2019, in order to refine the cybersecurity plan for V5.0 and beyond.
- All listed systems will be required to be certified with at least one standard that meets the DLC criteria for acceptable cybersecurity standards, as shown in Table CS-1.
- Certification in any one of the four categories (Process, Components, System, Cloud Services) will be sufficient.
- A process will be described for re-certification, in case a system’s certification expires after qualification.
- For room level systems that cannot be upgraded to add a permanent internet connection, an exception or delay in the requirement will be considered in the stakeholder engagement process.

Cybersecurity Notes

While the standards in Table CS-1 can be applied to NLCs, not all of their requirements may be relevant for lighting control systems. Manufacturers and their certification bodies should review each standard to identify the appropriate requirements for each system being qualified.

177 **Other Future Plans**

178 Later in 2019, the NLC QPL will migrate from its current Excel format to an online format similar to the online
179 DLC SSL QPL. In that process, the organization of the data will be modified in order to support a better user
180 experience.

181 **Interoperability**

182 The DLC is currently researching and developing a multi-year plan for interoperability to be included in the
183 V5.0 update in 2020.

184 **Annual Revisions and Grace Period**

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

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

193

194 Table 1 provides a Summary of “Required” and “Reported” System Capabilities for interior lighting systems.

195 **Table 1: Interior Lighting Systems**

'Required' Interior System Capabilities	'Reported' Interior System Capabilities
<ul style="list-style-type: none">• Networking of Luminaires and Devices• Occupancy Sensing• Daylight Harvesting / Photocell Control• High-End Trim• Zoning• Individual Addressability• Continuous Dimming• Energy Monitoring	<ul style="list-style-type: none">• Control Persistence• Scheduling• 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• Emergency Lighting• Cybersecurity• Color Changing / Tuning• Ease of Implementation• Scene Control

196

197 Table 2 provides a Summary of “Required” and “Reported” System Capabilities for exterior lighting systems.

198 **Table 2: Exterior Lighting Systems**

'Required' Exterior System Capabilities	'Reported' Exterior System Capabilities
<ul style="list-style-type: none">• Networking of Luminaires and Devices• Occupancy Sensing AND/OR Traffic Sensing• Daylight Harvesting / Photocell Control• High-End Trim• Zoning• Individual Addressability• Continuous Dimming• Scheduling• Energy Monitoring	<ul style="list-style-type: none">• Control Persistence• Device Monitoring / Remote Diagnostics• Type of User Interface• Load Shedding (DR)• External Systems Integration• Emergency Lighting• Cybersecurity• Color Changing / Tuning• Ease of Implementation• Scene Control

199

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

204 Table 3: Capability and Requirement Definitions

205 **Note:** Some NLC systems control luminaires and retrofit kits, and some NLC systems control lamps within
 206 luminaires. The latter systems use a wireless controller integrated inside each lamp. The “luminaires/lamps”
 207 phrase indicates that a requirement applies to luminaires and retrofit kits if an NLC system controls luminaires
 208 and retrofit kits; and the requirement applies to lamps if an NLC system controls lamps.

Row	Capability	Definition
1	Networking of Luminaires and Devices	The capability of individual luminaires/lamps and control devices to exchange digital data with other luminaires/lamps 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.
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/lamps 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	<p>The capability to group luminaires/lamps 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).</p> <p>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.</p> <p>Exterior: Zoning is required for high-end trim.</p>
7	Individual Addressability	<p>The ability to uniquely identify and/or address each individual luminaire/lamp, 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.</p>
8	Continuous Dimming	<p>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).</p>
9	Control Persistence	<p>The capability of a networked lighting control system's lowest-level ("edge device") luminaire/lamp 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.</p>
10	Scheduling	<p>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 time-based scheduling, and "astronomical" scheduling functionality for sunrise and sunset programming, based on geographical location and time of year.</p>
11	Energy Monitoring	<p>The capability of a system to report the energy consumption of a luminaire/lamp and/or a group of luminaires/lamps.</p> <ul style="list-style-type: none"> • Individual luminaire/lamp monitoring as well as energy monitoring on dedicated lighting circuits is acceptable. • The method by which the system implements this capability must be clearly described, including whether the system provides automated energy measurement or relies on numerical manual input during system setup for accurate measurement (such as inputting the wattage of each luminaire/lamp in a project). • Reference consists of one or both of: <ul style="list-style-type: none"> ○ Sample .CSV file with documentation ○ API documentation • Energy monitoring is not required for room based systems. • In order for a system to qualify for this exemption, the DLC review process will confirm that the product claims only "Room or Zone" for interior scope as listed on the DLC QPL.
12	Device Monitoring / Remote Diagnostics	<p>The capability to monitor, diagnose, and report operational performance including system and/or component failures.</p>

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 or kit, and directly integrated or embedded into the form factor during the luminaire or kit 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 the 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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 (i.e. each occupant can control their own area, but not their neighbors' areas).
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, Cloud)	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 publicly available reference(s).

19	Emergency Lighting	Publicly available documentation illustrating how a system’s luminaires connect with an emergency power source. 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	Cybersecurity	The compliance with a cybersecurity standard that meets the DLC criteria. The current standards are shown in Table CS-1 and listed here: <ul style="list-style-type: none"> • ANSI/UL 2900-1 • IEC 62443 • SOC 2 • ISO 27001 • ISO 27017 (with 27001) • FedRAMP • CSA STAR
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	Ease of Implementation	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.