



# DRAFT Networked Lighting Control System Technical Requirements

Version 4.0 Draft 1  
February 5, 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"> <li>Initial Technical Requirements published.</li> </ul>
1.01	May 7, 2016	<ul style="list-style-type: none"> <li>Clarified that the Technical Requirements are for Interior Control Systems. Systems designed and marketed exclusively for exterior applications are not eligible to be qualified.</li> </ul>
1.02	Feb 24, 2017	<ul style="list-style-type: none"> <li>Clarified that the Technical Requirements do not cover DC or PoE systems.</li> </ul>
2.0	Jun 1, 2017	<ul style="list-style-type: none"> <li>Version 2.0 published, with addition of Exterior Control Systems.</li> </ul>
3.0	Jun 1, 2018	<ul style="list-style-type: none"> <li>Version 3.0 published, with addition of DC/PoE Systems, Scenes, and multiyear plans for Energy Monitoring and Cybersecurity.</li> </ul>

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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## 26 Scope of Technical Requirements

27 These are requirements for Interior and Exterior networked lighting control (NLC) systems associated with  
28 commercial and industrial buildings, roadways, and exterior environments. NLC systems are defined for the  
29 purposes of these requirements as the combination of sensors, network interfaces, and controllers that effects  
30 lighting changes to luminaires, but does not include the luminaires themselves. Any luminaire-specific control  
31 requirements are addressed separately by the DLC’s [Solid-State Lighting Technical Requirements](#) and [Qualified](#)  
32 [Products List](#).

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

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

38 **Horticulture control systems are not eligible to be qualified at this time.**

## 39 Definition of “Required” vs. “Reported” Capabilities

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

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

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

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

54

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

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

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

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

- 66 • Continuous Dimming
- 67 • Individual Addressability
- 68 • Luminaire Level Lighting Control (LLLC, integrated)
- 69 • Networking
- 70 • Startup and Configuration Party
- 71 • Type of User Interface

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

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

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

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

## 87 **Multi Year Plans**

### 88 **Energy Monitoring Plan**

89 **New with V4.0, Energy Monitoring is now a required capability. The details of this capability are described in**  
90 **Table 3 below. Various methods of energy monitoring are acceptable for meeting this requirement, including**

91 automated measurement methods and methods that require manual input of fixture wattage to measure  
92 energy use.

### 93 **Future Plan**

94 In V5.0, to be released June 1, 2020, methodologies with numerical manual input will not be accepted as  
95 meeting the energy monitoring requirement unless supported by a new ANSI standard that specifies the  
96 accuracy of the methodology. If an ANSI standard to support the methodology is not developed, then only  
97 automated measurement methods will be accepted and manufacturers will self-report the accuracy of the  
98 automated measurement method. The DLC will require timestamped output data to be available via API.  
99 Optional .CSV file output will also be reported.

### 100 **Cybersecurity Plan**

101 In alignment with the cybersecurity multi-year plan in the prior V3.0 requirements, the DLC is taking the next  
102 step with cybersecurity to help ensure qualified systems utilize best-practice standards for cybersecurity. New  
103 with V4.0, the DLC is establishing criteria for acceptable cybersecurity standards. Systems must comply with  
104 one or more of these standards in order to claim the optional Reported "Cybersecurity" capability. With  
105 Version 5.0 in 2020, the DLC will update the requirements so that systems must have the Cybersecurity  
106 capability to be qualified.

### 107 **Criteria for acceptable cybersecurity standards**

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

- 109 1. Certifiable
- 110 2. A standardized methodology established through either:
  - 111 a. A voluntary consensus process such as ANSI, ISO, IEC...
  - 112 b. A federal agency of the USA or Canada
- 113 3. Multiple third-party accredited labs are available to perform testing and certification
- 114 4. Applies to one or more of the following:
  - 115 a. Product development process lifecycle
  - 116 b. Components
  - 117 c. System
  - 118 d. Cloud Services
- 119 5. Includes at least 3 of the following technical content, for (b,c,d) above
  - 120 a. Penetration testing
  - 121 b. Communication robustness testing
  - 122 c. Vulnerability identification testing
  - 123 d. Multiple levels of security

### 124 **Terminology**

125 **Cybersecurity:** The practice of defending networked systems and data from malicious attacks.

126 **Process:** Standards that address the development process in order to reduce the number of cybersecurity  
127 vulnerabilities that are designed into components, systems and services, and that manifest over the product  
128 lifecycle.

- 129 **Components:** Standards that address the cybersecurity of each individual component in a networked system.
- 130 **System:** Standards that address the networked system including aspects such as authentication, data
- 131 confidentiality, system integrity, and service availability.
- 132 **Cloud Services:** Standards for cloud services that address secure integration with services from a remote cloud
- 133 computing provider.

134 **Standards that meet the criteria**

135 In V4.0 (2019), compliance is reported with the following cybersecurity standards that meet the DLC’s  
 136 proposed criteria for acceptable cybersecurity standards:

- 137 • ANSI UL 2900-1
  - 138 ○ Product certifications are available from certification bodies including UL and Intertek. Lab
  - 139 accreditations for manufacturers to self-certify may also be available from UL.
- 140 • CTIA Cybersecurity Certification
  - 141 ○ Certifications available through CATLs (CTIA Authorized Test Labs):
  - 142 <https://www.ctia.org/about-ctia/certification-resources>.
- 143 • FedRAMP (Federal Risk and Authorization Management Program)
  - 144 ○ Certifications available through 3PAOs (Third Party Assessment Organizations):
  - 145 <https://marketplace.fedramp.gov/#/assessors?sort=assessorName>
- 146 • IEC 62443
  - 147 ○ Certifications available through ISASecure, <http://www.isasecure.org/en-US/> and IECCE,
  - 148 <https://www.iecee.org/>
- 149 • ISO 27001
  - 150 ○ Certifications available through several organizations

Standard	Process	Components	System	Cloud Services
ANSI/UL 2900-1	y	y	y	
CTIA Cybersecurity	y	y		
FedRAMP				y
IEC 62443	-4-1	-4-2	-3-3	
ISO 27001	y			

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152 **Future Plan**

153 In V5.0 (2020), cybersecurity compliance, as outlined in V4.0 from 2019, will be required on June 1, 2020, for  
 154 the product development process and for networked components. (Please note that the DLC offers a one year  
 155 grace period for previously listed systems, see the ‘Annual Revisions and Grace Period’ section in this  
 156 document for more information.) Additional standards may be added to the acceptable standards list that  
 157 meet the selection criteria above. Potential new standards that may be added to this list as they become  
 158 standardized include ANSI/UL 2900-2-4 for BMS, ANSI/UL 2900-2-5 for lighting, and CSA CVP (Cybersecurity  
 159 Verification Process).

160 In V6.0 (2021), cybersecurity compliance will also be required at the System level, and at the Cloud level for  
 161 products with cloud-based capabilities.



Timeline	Process	Components	System	Cloud Services
V5.0 2020	Required	Required		
V6.0 2021	Required	Required	Required	Required

162

## 163 Interoperability Plan

164 New with V4.0, the DLC proposes to develop a new multi-year plan for interoperability. The initial step this  
 165 year is to create a new reported “Interoperability” capability by reorganizing data that is already displayed in  
 166 the QPL under various headings. The intent of this reorganization is to establish an initial framework to  
 167 characterize the interoperability of listed systems, which can be expanded in the future. A more specific  
 168 interoperability plan for future years will be proposed with V5.0 in 2020.

### 169 Criteria

170 In V4.0 (2019), interoperability is recognized as a “Reported Capability” for products that offer a level of  
 171 interoperability based on the following criteria:

- 172 • Products from multiple vendors are available
- 173 • Applies to either of the following types of digital communication:
  - 174 ○ Within a system (sensors, drivers, wall switches...)
  - 175 ○ Between systems (lighting, cloud, HVAC, BMS, API...)
- 176 • Applies to one or more of the following layers:
  - 177 ○ Physical configuration
  - 178 ○ Electrical signals
  - 179 ○ Data

### 180 Terminology

181 **Interoperability:** The ability of systems or systems components to transmit, receive, interpret, and/or react to  
 182 data and/or power and function in a defined and appropriate manner. *(Modified from NEMA/ANSI C137.0-*  
 183 *2017.)*

### 184 Future Plan

185 In 2019, the DLC will research and develop a multi-year plan for the V5.0 update in 2020. This will include  
 186 refinements of the above criteria, and may be centered around specific use cases.

187 **Annual Revisions and Grace Period**

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

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

196 Table 1 provides a Summary of “Required” and “Reported” System Capabilities for Interior Lighting Systems.

197 **Table 1: Interior Lighting Systems**

'Required' Interior System Capabilities	'Reported' Interior System Capabilities
<ul style="list-style-type: none"><li>• Networking of Luminaires and Devices</li><li>• Occupancy Sensing</li><li>• Daylight Harvesting / Photocell Control</li><li>• High-End Trim</li><li>• Zoning</li><li>• Luminaire and Device Addressability</li><li>• Continuous Dimming</li><li>• Energy Monitoring</li></ul>	<ul style="list-style-type: none"><li>• Control Persistence</li><li>• Scheduling</li><li>• Device Monitoring / Remote Diagnostics</li><li>• Type of User Interface</li><li>• Luminaire Level Lighting Control (LLLC, integrated)</li><li>• Personal Control</li><li>• Load Shedding (DR)</li><li>• Plug Load Control</li><li>• Emergency Lighting</li><li>• Cybersecurity</li><li>• Color Changing / Tuning</li><li>• Ease of Implementation</li><li>• Scene Control</li><li>• Interoperable</li></ul>

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199 Table 2 provides a Summary of “Required” and “Reported” System Capabilities for Exterior Lighting Systems.

200 **Table 2: Exterior Lighting Systems**

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

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

207 **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 <i>External Systems Integration</i> 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 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 <a href="#">NEMA LSD 64-2014</a> 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.
11	Energy Monitoring	The capability of a system to report the energy consumption of a luminaire and/or a group of luminaires. Individual luminaire 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 in a project). Timestamped output data must be available from the system as either a regularly-spaced series in time, or a series of state-change events. If data is recorded in a regularly-spaced time series, then the time interval between recorded data points must be less than or equal to 15 minutes. Timestamped output data must be available via one or more of the following: .CSV file, API. The 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	<p>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.</p> <p>A wireless dimmer switch may only be considered a personal control interface if product documentation:</p> <ol style="list-style-type: none"> <li>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</li> <li>describes configuration for personal control within a larger area.</li> </ol> <p>A software-based interface may only be considered personal control if product documentation:</p> <ol style="list-style-type: none"> <li>shows it provides a specific interface intended for personal control by an individual user within a subsection of a larger space and that</li> <li>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).</li> </ol>																														
16	Load Shedding (Demand Response)	<p>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).</p>																														
17	Plug Load Control	<p>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).</p>																														
18	Interoperable	<p>The capability of systems or system components to transmit, receive, interpret, and/or react to data, and function in a defined and appropriate manner.</p> <p>This applies to either of the following types of digital communication:</p> <ul style="list-style-type: none"> <li>Within a system (among sensors, drivers, wall switches...)</li> <li>Between systems (lighting, cloud, HVAC, BMS, API...)</li> </ul>																														
19	Emergency Lighting	<p>Publicly available documentation illustrating how a system's luminaires connect with an emergency power source.</p> <p>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.</p>																														
20	Cybersecurity	<p>The compliance with a cybersecurity standard that meets the DLC criteria.</p> <p>Current list of standards:</p> <table border="1" data-bbox="574 1675 1498 1915"> <thead> <tr> <th>Standard</th> <th>Process</th> <th>Components</th> <th>System</th> <th>Cloud Services</th> </tr> </thead> <tbody> <tr> <td>ANSI/UL 2900-1</td> <td>y</td> <td>y</td> <td>y</td> <td></td> </tr> <tr> <td>CTIA Cybersecurity</td> <td>y</td> <td>y</td> <td></td> <td></td> </tr> <tr> <td>FedRAMP</td> <td></td> <td></td> <td></td> <td>y</td> </tr> <tr> <td>IEC 62443</td> <td>-4-1</td> <td>-4-2</td> <td>-3-3</td> <td></td> </tr> <tr> <td>ISO 27001</td> <td>y</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Standard	Process	Components	System	Cloud Services	ANSI/UL 2900-1	y	y	y		CTIA Cybersecurity	y	y			FedRAMP				y	IEC 62443	-4-1	-4-2	-3-3		ISO 27001	y			
Standard	Process	Components	System	Cloud Services																												
ANSI/UL 2900-1	y	y	y																													
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FedRAMP				y																												
IEC 62443	-4-1	-4-2	-3-3																													
ISO 27001	y																															

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.

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