DLC TECHNICAL REQUIREMENTS FOR LIGHTING CONTROLS SYSTEMS

NLC V5.2

DRAFT 1

RELEASED MARCH 30, 2026

About this Document

This version of the Technical Requirements document contains updates and clarifications made to the previously released NLC5.1 document. These updates are denoted by yellow highlighted line numbers or table rows.

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

Contents

1 Introduction

The DesignLights Consortium (DLC) is committed to providing decision makers with data and resources on quality lighting, controls, and integrated building systems to reduce energy use, carbon emissions and light pollution. Through the Networked Lighting Controls (NLC) Qualified Products List (QPL) and its technical requirements, the DLC helps efficiency programs, manufacturers, specifiers, and building owners identify NLC systems that provide reliable performance, security, and measurable energy impacts.

With each new version of the technical requirements, the DLC has worked closely with manufacturers, utilities, researchers, and other stakeholders to ensure that the NLC program continues to reflect both technological progress and real-world deployment experience. Previously, the DLC updated the technical requirements to support interoperability, energy reporting, and integration with other building systems, helping align the NLC program with broader trends toward connected and data-enabled building infrastructure.

Version 5.2 of the NLC Technical Requirements focuses on these goals:

1) Highlight emerging capabilities in networked lighting controls
    - Present new system capabilities, particularly integrations with thermostats to save energy and improve building performance
2) Strengthen the role of NLC in energy efficiency programs by:
    - Improving confidence in savings through standardization confiugration reporting (ANSI/NEMA C137.9)
    - Creating a clear pathway for first generation LED projects to achieve deeper savings through NLC upgrades
3) Simplify and improve the QPL experience
    - Streamline capability descriptions and enhance usability so stakeholders can more easily understand, compare, and select qualified systems
4) Improve visibility across connected product categories
    - Create stronger linkages between NLC systems and SSL products to support clearer specification pathways and coordinate system design

Together, these changes reinforce the role of networked lighting controls as a foundation for integrated building controls and deeper energy savings across building systems. The DLC has also created the NLC-HVAC Integration Toolkit, which provides a framework and case studies to pursue successful, energy-saving integration projects.

Additionally, to support opportunities in horticulture energy efficiency programs, language has been added to allow horticultural control systems that meet these requirements to be listed on the NLC QPL.

2 Scope of Technical Requirements

These are requirements for NLC systems associated with commercial and industrial buildings, roadways, and outdoor environments. An NLC system is defined for the purposes of these requirements as a collection of interconnected devices that enable the implementation of lighting control strategies such as individual addressability, continuous dimming, high end trim, occupancy sensing, daylight harvest and scene control, etc.

Luminaires, retrofit kits, and lamps are qualified separately by the DLC's Solid-State Lighting/LED (SSL) Technical Requirements and Qualified Products List. While the NLC technical requirements apply at the system level, the SSL technical requirements apply to integral luminaire controls. These requirements are non-overlapping and complementary, meaning NLC manufacturers do not need to qualify their systems under SSL.

DC and PoE networked lighting control systems are eligible to be qualified, in conjunction with the SSL Testing and Reporting Requirements for DC and PoE Lamps, Luminaires, and Retrofit Kits.

Building management systems and horticultural control systems that control networked lighting plus other building systems, such as HVAC, are eligible to be qualified as NLC systems and listed on the QPL, provided they meet all the DLC's requirements for NLC. Note that the DLC does not claim to qualify any HVAC-specific or horticultural-specific capabilities of these systems at this time. Please see our Hort QPL for qualified luminaires and lamps for horticulture.

2.1. Indoor and Outdoor System Scopes

Different NLC systems are appropriate for different uses based on their capabilities. Each QPL-listed NLC system will qualify for one or more System Scopes, based on its capabilities, as listed below.

Indoor Systems

The DLC NLC QPL reports on the following System Scopes for indoor systems:

- Room or Zone
- Whole Building
- Portfolio/Enterprise
- Structured Parking

Room or Zone: This phrase indicates a "room-based system", defined by the DLC as a system that is designed to control lighting in a single room or zone, and where the control, configuration and management of the system is contained within the room or space illuminated by the system. In order to interact with the system (for instance, to change any settings or to download any data), a user must be physically present in or in close proximity to the room or space illuminated by the system.

A *Whole Building system* provides a centralized dashboard for energy monitoring and scene control across multiple rooms or zones within a single building. This dashboard could be implemented by various means such as one or more gateways, a local server, a cloud server, or a mobile app.

A *Portfolio/Enterprise system* provides a centralized dashboard for energy monitoring and scene control across multiple sites (such as multiple buildings across a college campus or multiple stores of a retail franchise).

Indoor or Outdoor Systems with Weatherproof Equipment

The *Structured Parking* scope can apply to either indoor or outdoor systems that meet the indoor or outdoor requirements with weatherproof equipment.

Outdoor Systems

The DLC NLC QPL reports on the following System Scopes for outdoor systems:

- Structured Parking
- Area/Building Outdoor/Parking
- Streetlight (Residential Streets)
- Roadway (Highways)

The *Area/Building Outdoor/Parking* scope is intended for systems designed to control lighting installed in the environments surrounding a building.

The *Streetlight (Residential Streets)* scope is intended for systems designed to control outdoor lighting installed at the municipal scale.

The *Roadway (Highways)* scope is intended for systems designed to control outdoor lighting installed for high-speed limited access highways.

2.2. Definition of Required Versus Reported Capabilities

The Technical Requirements are built on **required** and **reported** system capabilities.

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

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

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

3 NLC Requirements

Some capabilities are required for Indoor systems but reported for Outdoor systems, and vice versa, as shown in **Tables 2 and 3**. While this section is loosely organized with required capabilities first, followed by reported capabilities, that organization is not precise due to variations between indoor and outdoor requirements.

3.1. Requirements Other Than Control Capabilities

Table 1 describes requirements for all DLC-qualified NLC systems, beyond the control capabilities summarized in **Tables 2 and 3**. The complete qualification process is described here.

Table 1. Requirements Other Than Control Capabilities

Row	Requirement	Definition
1	Customer Available Information	For an applicant to claim a capability listed in **Tables 2 and 3**, 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 for a finished product available publicly on a website, and/or included with the product packaging, and/or provided to the customer upon request. It cannot be a document produced for the sole purpose of obtaining DLC qualification without further use or availability 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 the DLC Technical Requirements and will not be made available or distributed publicly. The following capabilities from **Tables 2 and 3** are exempt from this requirement because their functionality does not depend on operator understanding: • Continuous Dimming • Individual Addressability • Luminaire Level Lighting Control (LLLC, embedded) • Networking • Ease of Implementation • Type of User Interface • Cybersecurity • Control Persistence

Row	Requirement	Definition
2	Warranty	The DLC requires a minimum warranty of five years for all components of the system addressed by the requirements, except for software, on-premises computer server(s), and cloud service. An optional warranty extension to five years is acceptable for meeting this requirement; however, the NLC QPL will indicate that an extended warranty must be purchased to meet the requirements.
3	Commercial Availability and Verification	Before they can be listed, all systems must be fully commercially available in the U.S. and/or Canada, must be able to be purchased, and must have complete, final documentation and literature readily available on the manufacturer's website or available to the customer upon request, as described in Row 1, "Customer Available Information". The DLC requires that a qualified system has been installed and operated successfully in at least one actual field installation at a third-party site (not occupied by the applicant or an agent of the applicant). The DLC will verify this through a case study and/or a customer reference. The facility may be of any size where all the DLC-required capabilities are functional. Multiple sites may be used. For instance, occupancy sensing may be implemented at one site and high-end trim at another. If daylight harvesting is not available at a third-party site, then it may be demonstrated in a live webinar in an installation at a building owned by the manufacturer. Daylight harvesting is the only DLC-required capability eligible for this exception. Manufacturers of private label systems may submit an application two weeks before the system is launched. This approach requires the private label applicant to submit a letter of intent (template available here) during the application submission process confirming that the system will be launched within two weeks. When the system is commercially available, the applicant must notify the DLC at info@designlights.org. If the system is not yet commercially available after the two-week launch window, it will be temporarily delisted from the NLC QPL until it has been launched.
4	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.) This requirement may be waived or shortened for annual re-listings of a previously qualified system for which a recording of a prior presentation is available, and the system has not changed extensively.

Row	Requirement	Definition
5	Case Study, Customer Interview	The DLC requires a case study or a customer reference for a field site where the NLC system has been installed. The DLC may contact the referenced customer to verify all DLC-required capabilities of the system. The site may not be an office of the manufacturer or a business partner directly connected to the applicant, such as a lighting sales representative. The DLC wishes to confirm with an unbiased third party that the system has been installed and operated successfully in at least one actual field installation. This contact information will not be shared with any other parties. *Note:* The Customer Interview is required only for new OEM applications.

130

131 ## 3.2. Requirements for Indoor Lighting Systems

132 **Table 2** summarizes required and reported system capabilities for indoor lighting systems.

133 ***Table 2*: *Required and Reported Capabilities for Indoor Lighting Systems***

***Required* Indoor System Capabilities**
Networking of Luminaires and Devices
Individual Addressability
Zoning
Continuous Dimming
Cybersecurity
Occupancy Sensing
Daylight Harvesting/Photocell Control
High-End Trim
Energy Monitoring (except room-based systems)

***Reported* Indoor System Capabilities**
Type of User Interface
Luminaire Level Lighting Control (LLLC, integrated)
Control Persistence
Scheduling
Energy Monitoring (room-based systems)
Personal Control
Scene Control
Plug Load Control
Load Shedding/Demand Response
External Systems Integration
Configuration Reporting
Emergency Lighting
Device Monitoring/Remote Diagnostics

Color Changing/Tuning

3.3. Requirements for Outdoor Lighting Systems

Table 3 summarizes required and reported system capabilities for outdoor lighting systems.

***Table 3*: Required and Reported Capabilities for Outdoor Lighting Systems**

***Required* Outdoor System Capabilities**	***Reported* Outdoor System Capabilities**
Networking of Luminaires and Devices	Type of User Interface
Individual Addressability	Luminaire Level Lighting Control (LLLC, integrated)
Zoning	Control Persistence
Continuous Dimming	Scene Control
Cybersecurity	Load Shedding/Demand Response
Occupancy Sensing AND/OR Traffic Sensing	External Systems Integration
Daylight Harvesting/Photocell Control	Emergency Lighting
High-End Trim	Device Monitoring/Remote Diagnostics
Scheduling	Color Changing/Tuning
Energy Monitoring	

3.4. Capability Requirement Definitions

This section provides a definition of each capability. These capabilities apply to both Indoor and Outdoor systems, except where noted. If an applicant answers 'yes' to a capability definition, that capability can be claimed. If an applicant answers 'no', then the capability cannot be claimed. The DLC NLC application form specifies in more detail the information the DLC asks about each capability and the information that will be published on the QPL. Beyond the basic definitions shown here, the DLC NLC application contains additional questions about most capabilities. After answering 'yes' to the first key question about a capability, an applicant can answer additional questions about that capability with any well-documented response.

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

3.4.0. 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).

3.4.1. 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.

3.4.2. Individual Addressability

The ability to communicate digitally and uniquely with each individual luminaire/lamp, sensor, controller and user interface device in the lighting system, allowing for software-controlled configuration and re-configuration of devices and control zones independent of electrical circuiting.

3.4.3. Zoning

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).

Indoor: 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.

Outdoor: Zoning is required for high-end trim.

3.4.4. 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). At least one user interface needs to support continuous dimming, but not every user interface needs to have that capability.

3.4.5. Cybersecurity

Cybersecurity is required for all qualified NLC systems. While the standards in **Table CS-1** and services in **Table CS-2** can be applied to NLCs, not all their requirements may be relevant for various applications of lighting control systems. Manufacturers and their certification bodies should review each option to identify the appropriate requirements for each system being qualified, and customers should select product requirements based on the risk profile of each project.

To claim the cybersecurity capability, a system must, at the time of qualification, have a valid certification for one or more of the specified standards in **Table CS-1** or services in **Table CS-2**.

The list of applicable standards in **Table CS-1** and services in **Table CS-2** will be reviewed for each incremental revision to the Technical Requirements, or annually, whichever comes sooner. Applications referring to a potential new standard or service will only be accepted for review after the new standard or service has been vetted and an updated set of Technical Requirements has been published. The addition of a new standard or service may only warrant a minor Technical Requirements dated update.

Certification in any one of the four categories of **Table CS-1** (Process, Components, System, Cloud Services) is sufficient.

Table CS-3 describes how DLC reviewers will confirm compliance.

The DLC will confirm that cybersecurity certification will be valid for at least 12 months after the time of application submission. If the certification will expire within a year, the NLC manufacturer must submit a letter of intention of renewal with the application and must provide an updated certificate upon its expiration, in compliance **with Table CS-2 or CS-3**, to avoid being delisted.

The DLC will confirm cybersecurity certification once a year in July. If a certificate has lapsed, a system must be recertified to avoid being delisted.

Some cybersecurity certifications offer different levels of compliance based on risk management. For instance, some standards offer lower performance requirements for room level systems that cannot be upgraded to add a permanent internet connection. Therefore, the DLC cybersecurity requirement applies to all systems—with the understanding that comprehensive systems with many capabilities are subject to more rigor, compared to simple systems with few capabilities.

Cybersecurity Standards Definitions:

- **Cloud Services:** Standards for cloud services that address secure integration with services from a remote cloud computing provider.
- **Components**: Standards that address the cybersecurity of each individual physical end device in a networked system.
- **Cybersecurity:** The practice of defending networked systems and data from malicious attacks.
- **Process**: Standards that address the development process in order to reduce the number of cybersecurity vulnerabilities designed into components, systems and services, and that manifest over the product lifecycle.
- **System**: Standards that address the networked system, including aspects such as authentication, data confidentiality, system integrity, service availability, protocol converters, firewalls, gateways, web servers and web services interfaces.

Criteria for Acceptable Cybersecurity Standards:

The DLC recognizes the cybersecurity standards listed in **Table CS-1** that meet criteria 1-3 below, and the cybersecurity services listed in **Table CS-2** that meet criteria 2-3 below:

1. Certifiable with a methodology established through one of the following:
   a. A voluntary consensus process such as ANSI, ISO, IEC, etc.
   b. A federal agency of the USA or Canada
   c. A collaborative multi-stakeholder engagement process such as the Cloud Security Alliance
2. Applies to one or more of the following:
   a. Product development process lifecycle
   b. Components/embedded devices
   c. System
   d. Cloud services
3. Includes at least three of the following technical content, for 2.b, 2.c, and/or 2.d above:
   a. Penetration testing
   b. Communication robustness testing
   c. Vulnerability identification testing
   d. Multiple levels of security
   e. Root of Trust with trusted boot and secure storage of encrypted data
   f. Assessment by accredited entity

List of Certifications:

Cybersecurity standards and cybersecurity services that meet the criteria listed above are shown in **Tables CS-1 and CS-2**, respectively. Once a certification (i.e., a standard or a

service) is listed here, the DLC does not expect to remove it with less than two years' notice.

As new cybersecurity standards and/or certification pathways become available, the DLC will evaluate them and update these tables accordingly.

Table CS-1: Cybersecurity Standards Recognized by the DLC

Standard	Process	Components/ Embedded Devices	System	Cloud Services
ANSI/UL 2900-1	y	y		
ANSI/ISA/IEC 62443	62443-4-1	62443-4-2	62443-3-3	
SOC 2	y		y	y
ISO 27001	y			
ISO 27017 (with 27001)				y
FedRAMP				y
CSA STAR				y
ioXt		y	y	y
PSA Certified		y	y	
CSA/ANSI T200	y	y	y	

Table CS-2: Cybersecurity Services Recognized by the DLC

Service	Proof of Compliance
UL IoT Security Rating (UL 1376)	Copy of certificate or letter from UL
Intertek Cyber Assured	Copy of certificate or letter from Intertek

258 ***Table CS-3: Proof of Cybersecurity Standard Compliance***

Standard	Proof of Compliance
ANSI/UL 2900-1	Certification claim listed on applicant's website, plus a compliance letter or copy of certificate issued by an accredited certification body.
IEC 62443	ISASecure registry of a component, system or Certified Development Organization at https://isasecure.org/end-users, or Copy of IECEE certificate or listed at https://certificates.iecee.org/ods/cb_hm.xsp, or Copy of certificate from another accredited agency, such as UL, VDE, DEKRA, etc.
SOC 2	Certification claim listed on applicant's website, plus a compliance letter from third-party auditor.
ISO 27001	Copy of an accredited certification from a member of the ANSI-ASQ National Accreditation Board, as listed at http://anabdirectory.remoteauditor.com, or Copy of an accredited certification from an organization accredited as "Management Systems Certification Bodies" for ISO 27001 by the International Accreditation Service (IAS) at https://www.iasonline.org/search-accredited-organizations-2
ISO 27017 (with 27001)	Copy of an accredited certification from a member of the ANSI-ASQ National Accreditation Board, as listed at http://anabdirectory.remoteauditor.com
FedRAMP	"Authorized" at https://marketplace.fedramp.gov/products
CSA STAR	"Certification" or "Attestation" at https://cloudsecurityalliance.org/star/registry
ioXt	Copy of ioXt certificate or letter from accredited testing organization or certified at https://compliance.ioxtalliance.org/products
PSA Certified	Listed at https://www.psacertified.org/certified-products
CSA/ANSI T200	Certification claim listed on applicant's website, plus a compliance letter or copy of certificate from CSA or from an accredited lab, along with a copy of a letter of accreditation from CSA.

259 *Renewal is required at least every three years for a certificate to remain valid.*

3.4.6. Occupancy Sensing

The capability to affect the operation of lighting equipment based upon detecting the presence or absence of people in a space or outdoor environment.

Outdoor systems must include either occupancy sensing or traffic sensing. They may include both, but that is not required.

3.4.7. Traffic Sensing

The capability to affect the operation of lighting equipment based upon detecting the presence or absence of people in a space or outdoor environment.

Outdoor systems must include either occupancy sensing or traffic sensing. They may include both, but that is not required.

3.4.8. High-End Trim*

The capability to set the maximum light output to a less-than-maximum state of an individual luminaire/lamp 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.

3.4.9. 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 outdoor environment. This capability is typically called daylight harvesting for indoor systems, and photocell control for outdoor systems.

3.4.10. Scheduling

A control strategy that controls lighting, equipment or systems based on time of day or astronomical event - for example, scheduling building lighting to be automatically turned off at 6 p.m. or at sunset. Scheduling capability is reported for indoor systems and required for outdoor systems. Outdoor 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.

3.4.11. Energy Monitoring

The capability of a system to report the energy consumption of a luminaire/lamp and/or a group of luminaires/lamps. The basic capability of energy monitoring is required, with an exception for room-based systems.

Detailed description:

- 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 verified by DLC consists of one or both of:
    - Sample .CSV file with documentation
    - API documentation
- The basic, required capability of energy monitoring is aligned with ASHRAE 90.1-2016 Section 8.4.3. as follows:
    - Energy use by indoor lighting (if applicable), outdoor lighting (if applicable) and receptacle circuits (if monitored by the NLC) can be monitored independently.
    - For buildings with tenants, the data for each tenant space can be reported to each tenant.
    - Energy use data can be transmitted to a building control system (if present) and graphically displayed.
    - The lighting system energy use can be recorded and stored in either of the two ways described below.
        - Data is recorded at least once every 15 minutes and reported at least hourly, daily, monthly and annually, or recorded and reported upon state change, with data stored for at least 24 months;
          or
        - At any time during the first year after original configuration, the preceding four weeks of 15-minute interval data can be reported, and daily interval data can be reported since the date of original configuration.
- Lighting system energy data is reported by the NLC and can be shared electronically (automatically or manually generated email) with authorized entities. For example, utility energy efficiency programs for NLCs can receive the energy data to verify

energy savings. The lighting energy data may also be accessed for central display of facility energy end-use status or for a building portfolio management provider to benchmark energy performance. Note that the recommended best practice for energy data accuracy is described in ANSI C137.5. “Energy Reporting Requirements for Lighting Devices”.

The energy monitoring capability is not required for room-based systems. A “room-based system” is defined in the **System Scopes section above.** In order for a system to qualify for this exemption, the DLC review process must confirm that the product claims only “Room or Zone” for indoor scope as listed on the DLC QPL; and that, if a room-based system is capable of being upgraded with an internet connection, the upgraded system must meet all of the required capabilities of the Technical Requirements and be listed on the QPL.

In order for room-based systems to claim the optional energy monitoring capability:

- Energy data can be retrieved by a user in the room when required - hourly, daily, monthly or yearly, or on demand; and
- Energy data can be retrieved in the form of a CSV file and/or API.

3.4.12. Luminaire Level Lighting Control (LLLC, integrated)

NLC V5.2 Technical Requirements are now aligned with the recent release of DLC SSL V6.0 Technical Requirements, which clarified control capabilities relevant to LLLC functionality. The DLC SSL QPL will be updated with new control capability information by Dec. 15, 2026.

NLC V5.2 Technical Requirements address the NLC system capability for LLLC. SSL V6.0 addresses the luminaire and integrated control components that enable the LLLC capability to function in a lighting system.

LLLC is defined as the capability to have a networked occupancy sensor, ambient light sensor and high-end trim installed for each luminaire/kit/lamp and directly integrated or embedded into the form factor during the 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 to list this information publicly on the QPL.

3.4.13. Control Persistence

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.

3.4.14. 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 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:

- 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
- Describes configuration for personal control within a larger area.

A software-based interface may only be considered personal control if product documentation:

- Shows it provides a specific interface intended for personal control by an individual user within a subsection of a larger space; and

- 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).

3.4.15. Scene Control

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.

3.4.16. 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).

3.4.17. 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 without manual intervention. The method by which the system implements this capability (managed by NLC and/or BMS) must be clearly described in the publicly available reference(s). The method for pre-defining the system behavior for temporary load reduction must be accessible through a user interface. The data the NLC can receive and interpret from other networked systems must include at least a signal that can be used for purposes such as LS/DR.

Basic/one-way: A demand response signal is received by an NLC system, and the energy consumption of the system is reduced in a pre-defined way on a temporary basis, without manual intervention.

Advanced/two-way: A control feedback loop and communication is established between a building's demand response server and a demand control originator (such as a grid operator, energy provider, microgrid or onsite Distributed Energy Resource), so that the building modifies its real-time energy consumption in response to the originator's needs and reports the results to the originator. The NLC participates in this ecosystem as one of the load-responding building systems.

Reporting:

Examples of data about communication for LS/DR in the DLC database include power data availability, granularity and accuracy, as well as supported versions of OpenADR.

3.4.18. 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, Modbus, LonWorks or other open protocols, application program interface (API) or other methods. To claim this **reported** capability, the data available from the NLC for exchange with other networked systems must include occupancy status at the zone, space or area level, and energy data at the zone-, circuit- or system-level. The data the NLC can receive and interpret from other networked systems must be digital, and able to be used for purposes such as scene control, zones, groups, areas, regions and/or presets. The method, including formats and languages, by which the system implements this capability must be clearly described in the publicly available reference(s).

NLC-integrated Thermostats

Thermostats are now available that can easily integrate with an NLC system to receive digital occupancy data from the NLC system. Within the External Systems Integration capability, the DLC recognizes NLC systems that support these thermostats, as shown in **Table TH-1**. The thermostat information shall be submitted by the NLC manufacturer as part of the application process.

Note: Detailed questions about most capabilities are not included in this document. However, since integrated thermostats are a new topic for the DLC, **Table TH-1** is included here, to benefit from the public comment process.

Table TH-1: Thermostats recognized by the DLC

Row	Question	Acceptable Answer(s)
1	Name of the thermostat manufacturer, model name and model number?	Provide info
2	Does the thermostat receive and respond to digital occupied/unoccupied data by changing temperature setpoints and fan control?	Yes
3	Can thermostat-NLC integration be configured by GUI, without writing code?	Yes
4	Can the thermostat be configured by GUI to subscribe to occupancy data from multiple occupancy sensors?	Yes
5	Can the GUI display zones for lighting and for HVAC together, overlaid on a single floorplan?	Yes
6	Can the thermostat receive data for partial occupancy and respond appropriately? For example, a thermostat controls a space with 10 occupancy sensors, one of which currently indicates 'occupied'. This indicates 10% partial occupancy. Can the thermostat respond differently, versus data indicating complete vacancy or full occupancy?	Yes or No
7	Does lighting-thermostat integration require a gateway?	Yes or No
8	Can lighting and thermostat be scheduled together on one GUI display, with offset(s) for thermal inertia?	Yes or No
9	Are the primary thermostat terminal designations RGYW?	Yes or No
10	In addition to digital occupancy data, can the thermostat also accept 24VAC wired occupancy input?	Yes or No
11	What digital protocol(s) is used to transfer occupancy data between the thermostat and NLC system (or gateway if used)? Bluetooth NLC, EnOcean, Zigbee 3.0, Zigbee 4.0, other	Choose all that apply
12	Besides occupancy, what additional data can the NLC transfer to the thermostat, configured by GUI without writing code?	Choose all that apply

	none, humidity, CO2, particulates, pressure, other	
13	What GUI type(s) are supported? mobile app, web browser, wallstation	Choose all that apply

Key Questions on NLC-Integrated Thermostats

Key Question 1: Row 3 of **Table TH-1** asks, "Can thermostat-NLC integration be configured by GUI, without writing code?" The intent of the language "without writing code" is to separate systems that can be integrated with automated handshakes vs systems that require advanced customization by a third-party integrator or factory representative. Is the current language "without writing code" sufficiently clear, or is there other language that could indicate this distinction in a more precise way without sacrificing brevity?

Key Question 2: Row 5 of **Table TH-1** asks, "Can the GUI display zones for lighting and for HVAC together, overlaid on a single floorplan?" The intent of the question is to speak to the ease of use of the GUI and whether a user can interact with the GUI in an intuitive manner without receiving technical training. Is the current language sufficiently clear, or is there a less prescriptive way to specify the desired result - that lighting and HVAC zones can be easily matched with a GUI, in a manner that can be unambiguously confirmed or denied?

Key Question 3: (Similar to Key Question 1) Row 12 of **Table TH-1** asks, "Besides occupancy, what additional data can the NLC transfer to the thermostat, configured by GUI without writing code?" The intent of the language "without writing code" is to separate systems that can be integrated with automated handshakes vs systems that may require advanced customization by a third-party integrator or factory representative. Is the current language "without writing code" sufficiently clear, or is there other language that could indicate this distinction in a more precise way without sacrificing brevity?

3.4.19. Configuration Reporting

The capability of an NLC system to produce NEMA/ANSI C137.9 compliant NLC configuration reports.

3.4.20. 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.

3.4.21. Device Monitoring / Remote Diagnostics

The capability to monitor, diagnose and report operational performance including system and/or component failures.

3.4.22. 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.

4 Policy Clarifications and Updates

4.1. Schedule of Revisions

Revision	Date	Description
1.0	Apr. 21, 2016	Initial Technical Requirements published.
1.01	May 7, 2016	Clarified that the Technical Requirements are for indoor control systems. Systems designed and marketed exclusively for outdoor 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 outdoor control systems.
3.0	Jun. 1, 2018	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	Version 4.0 published, with addition of energy monitoring requirement, and criteria for cybersecurity certifications and building management systems capable of networked lighting control.
5.0	Jun. 23, 2020	NLC5 published, with addition of cybersecurity requirement. Energy monitoring definition aligned with ASHRAE 90.1-2016. Three capabilities labeled as supporting Interoperability.
5.1	June 28, 2024	NLC5.1 published with updated criteria for acceptable cybersecurity standards and services, and new section on NLC Primary Use Designations. The words “Interior” and “Exterior” were changed to “Indoor” and “Outdoor” to align with other DLC documents.
5.2		NLC V5.2 published to recognize NLC systems that support thermostat integration, and systems that support the ANSI/NEMA C137.9 configuration reporting standard. LLLC systems can now be associated with an LLLC luminaire/kit listed under SSL V6.0 on the DLC SSL QPL. The document format was updated to consolidate capability descriptions; the term “Primary Use Designation” was changed to “System Scope” to align with the NLC QPL; and a reference to ANSI NEMA C137.5 was added to the Energy Monitoring recommendations. Added language to support the qualification of horticultural control systems.

4.2. Policy Clarifications and Updates

As the DLC processes applications for NLC V5.2 and interacts with stakeholders, we anticipate opportunities for minor corrections, terminology clarifications and policy interpretations. To be as transparent as possible, the NLC Technical Requirements will be updated as needed, and the changes will be tracked in the table below and on the DLC website. **Table 4** will show the corrections or clarifications and where they can be found in the document.

Table 4: Updates and Clarifications, Published as Needed

Date Updated	Subject	Change Type	Description	Affected Page(s)