

SECTION 260943

NETWORK LIGHTING CONTROLS

PART 1 – GENERAL

1.1 Summary

- A. Section includes a networked lighting control system comprised of the following components:
 - 1. System Software Interfaces
 - a. Management Interface
 - b. Historical Database and Analytics Interface
 - c. Visualization Interface
 - d. Personal Control Applications
 - 2. System Backbone and Integration Equipment
 - a. System Controller
 - b. OpenADR Interface
 - 3. Wireless Networked Devices
 - a. Sensor Interface
 - b. Light Controllers
 - c. Digital Sensors
 - d. Sensor-Controllers
 - e. Networked Luminaires
 - f. Communication Bridge
 - 4. Wired Networked Devices
 - a. Wallstations
 - b. Graphical Wallstations
 - c. Auxiliary Input / Output Devices
 - d. Communication Bridge
- B. The networked lighting control system shall meet all of the characteristics and performance requirements specified herein.
- C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.1. Related Documents

- A. Section 262726 Wiring Devices
- B. Section 260923 Lighting Control Devices
- C. Section 260943.13 Digital-Network Lighting Controls
- D. Section 260943.16 Addressable Fixture Lighting Control
- E. Section 260943.19 Wireless Network Lighting Controls

F. Section 265113 Interior Lighting Fixtures

1.3 Submittals

- A. Submittal shall be provided including the following items.
 - 1. Bill of Materials necessary to install the networked lighting control system.
 - 2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
 - 3. Riser Diagrams showing device wiring connections of system backbone and also typical per room/area type.
 - 4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
 - 5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
 - 6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
 - 7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
 - 8. Hardware and Software Operation Manuals.

1.4 Approvals

- A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.
- B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.
- C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.
- D. For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.5 Quality Assurance

- A. Product Qualifications
 - 1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
 - 2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V1.01.
 - 3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.

4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
 5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.
- B. Installation and Startup Qualifications
1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.
- C. Service and Support Requirements
1. Phone Support: Toll free technical support shall be available.
 2. Remote Support: The bidder shall offer a remote support capability.
 3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
 4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.6 Project Conditions

- A. Only install equipment after the following site conditions are maintained:
1. Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)
 2. Relative Humidity: less than 90% non-condensing
- B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above, at any point prior to installation.
- C. Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

1.7 Warranty

- A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
- B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.8 Maintenance & Sustainability

- A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 – EQUIPMENT

2.1 Manufacturers

- A. Acceptable Manufacturers
 - 1. Acuity Brands Lighting, Inc.
- B. Basis of Design System: **Acuity Controls XPoint Wireless**

2.2 System Compliance

- A. System components shall comply with UL 916 and UL 924 standards where applicable.
- B. System components shall comply with CFR Title 47, Part 15 standards where applicable.
- C. System components shall comply with ISED Canada RSS-247 standards where applicable.
- D. All equipment shall be installed and connected in compliance with NFPA 70.

2.3 System Performance Requirements

- A. System Architecture
 - 1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
 - 2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, and manual wall station capable of indicating switching and/or dimming. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
 - 3. System must be capable of interfacing directly with networked luminaires utilizing wireless RF communication to interconnect networked luminaires with control components such as sensors, wall stations and system backbone (see *Control Zone Characteristics*).
 - 4. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
 - 5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wallstations without requiring connection to a higher level system backbone; this capability is referred to as “distributed intelligence.”
 - a. Wireless lighting control zones of at least 128 devices per zone shall be supported.
 - 6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.

7. Lighting control zones shall be capable of being networked with a higher level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
 8. The system may include one or more system controllers that provide time-based control and global system control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP protocol.
 9. The system may include “communication bridge” devices that route communication from lighting control zones (wired or wireless) to and from the system controller, for purposes of decreasing system wiring requirements.
 10. All devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.
- B. Wireless Networked Control Zone Characteristics
1. No wired control connections between wireless networked devices shall be required.
 2. Wireless networked devices shall communicate via radio frequency of 2.4 GHz using a standards-based wireless networking protocol.
 3. Wireless network shall be self-healing, such that optimum routing paths between devices are automatically established or restored if any nodes are respectively added to or removed from the wireless network.
 4. Wireless network communication shall support uniform and instant response such that all luminaires in a lighting control zone respond immediately and synchronously in response to a sensor or wallstation signal.
 5. To support the system architecture requirement for distributed intelligence, wireless network communication shall support communication of control signals from sensors and wallstations to networked luminaires and wireless load control devices, without requiring any communication, interpretation, or translation of information through a backbone device such as a wireless access point, communication bridge or gateway.
 6. All wireless communication shall be encrypted using the 128-bit Advanced Encryption Standard (AES).
 7. Accounting for typical environmental conditions and typical building construction materials encountered within parking garage environments or within high-bay applications in industrial, warehouse, convention center and gymnasium environments, wireless networked devices shall be capable of communicating to at least 30’ spacing between luminaires with embedded wireless transceivers, and shall be capable of communicating to at least 60’ spacing between wireless networked devices installed external to luminaire housings or other enclosures.
 - a. Wireless networked devices shall have a line-of-sight communication range of at least 1000’ under ideal environmental conditions.
 8. The following types of networked control devices shall be provided for egress and/or emergency light fixtures:

- a. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss or interruption of power sensed via line voltage connections.

C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet/MSTP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet/MSTP protocols:
 - a. The system shall support control of individual devices, including, but not limited to, control of relay and dimming output. All system devices shall be available for control.
 - b. The system shall support reading of individual device status information, including but not limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.
 - c. The system shall support activation of pre-defined system Global Profiles (see *Supported Sequence of Operations for further definition of Global Profile capabilities*).
2. The system shall support activation of Profiles (local or global) and Preset Scenes from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See *Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities*.)
3. The system shall support activation of system profiles from Demand Response Automation Servers via the OpenADR 2.0a protocol.

D. Supported Sequence of Operations

1. The following characteristics and performance requirements shall apply to wireless control zones provided by the system.
2. Control Zones
 - a. Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.
3. Wallstation Capabilities
 - a. Wallstations shall be provided to support the following capabilities:
 - 1) On/Off of a local control zone.
 - 2) Continuous dimming control of light level of a local control zone.
 - 3) Preset Scenes that can activate a specific combination of light levels across local and/or global zones, as required.

- 4) Profile Scenes that can modify the sequence of operation for selected devices in response to a button press. Refer to “Schedule and Global Profile Capabilities” within the Supported Sequence of Operations section for additional definition of Profile capabilities required to be configurable in response to a wallstation button press.
 - b. 3-way / multi-way control: multiple wallstations shall be capable of controlling the same local and global control zones, so as to support “multi-way” switching, dimming, preset scene, and profile scene control.
4. Occupancy Sensing Capabilities
- a. Occupancy sensors shall be configurable to control a local zone.
 - b. Multi-sensor control: multiple occupancy sensors shall be capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zone addresses.
 - c. System shall support the following types of occupancy sensing sequence of operations:
 - 1) On/Off Occupancy Sensing
 - 2) Partial-On Occupancy Sensing
 - 3) Partial-Off Occupancy Sensing
 - 4) Vacancy Sensing (Manual-On / Automatic-Off)
 - d. On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:
 - 1) Occupancy sensors automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.
 - 2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.
 - 3) To provide additional energy savings the system shall also be capable of combining Partial-Off and Full-Off operation by dimming the lights to a designated level when vacant and then turning the lights off completely after an additional amount of time.
 - 4) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under *Photocell Sensing Capabilities*.
 - 5) The use of a wallstation shall change the dimming level or turn lights off as selected by the occupant. The lights shall remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

- e. Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:
 - 1) The use of a wallstation is required turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the previous light level. Initially occupying the space without using a wallstation shall not result in any change in light level.
 - 2) Occupancy sensors shall automatically turn lights off when vacancy occurs is detected. To provide an enhanced occupant experience the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
 - 3) To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of vacancy, the system shall support an “automatic grace period” immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wallstation is required to turn lights on.
 - 4) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under *Photocell Sensing Capabilities*.
 - 5) At any time, the use of a wallstation shall change the dimming level or turn lights off as selected by the occupant. The lights shall remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
 - f. To accommodate different types of environments, vacancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.
5. Photocell Sensing Capabilities (Automatic Daylight Sensing)
- a. Photocell sensing devices shall be configurable to control a local zone.
 - b. The system shall support continuous dimming in response to a photocell, where the control zone automatically adjusts its dimming output in response to photocell readings.
 - c. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.
 - d. The photocell response shall be configurable to optionally allow the control zone to automatically turn off if sufficient daylight is present. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.
6. Schedule and Global Profile Capabilities
- a. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, wallstation input, contact closure input state, RS-232/RS-485 command, BACnet

input command, and demand response signal. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.

- b. Scheduling. Global profiles may be scheduled with the following capabilities:
 - 1) Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
 - 2) Timeclock: Global Profile time of day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every “n” number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after “n” recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
 - 3) Astronomical Clock: Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
 - 4) Blink warning and timed extension capabilities. At the end of a scheduled period, the system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule. Wallstations may be programmed to provide timed overrides that turn the lights on for an additional period of time. Timed override duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.
 - 5) Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.
 - c. System Global Profiles shall have the following additional capabilities:
 - 1) Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed input devices, and software management interface.
 - 2) Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.
 - 3) Parameters that shall be configurable and assigned to a Global Profile include light level, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wallstations.
 - d. A backup of Global Profiles shall be stored on the software’s host server such that the Profile backup can be applied to a replacement system controller.
7. Automated demand response capabilities. Profiles created for automated demand response events shall support automatic reduction of light level to programmable values. At least four levels of demand response profiles shall be supported by the system.

2.4 System Software Interfaces

A. Management Interface

1. Product Series: SensorView
2. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
3. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
4. Management interface shall require all users to login with a User Name and Password, and shall support creation of at least 100 unique user accounts.
5. Management interface shall support at least three permission levels for users: read-only, read & change settings, and full administrative system access.
6. Management interface shall be capable of restricting read-only and read & change access for user accounts to specific devices within the system.
7. All system devices shall be capable of being given user-defined names.
8. The following device identification information shall be displayed in the Management interface: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
9. Management interface shall be able to read the live status of a networked luminaire or intelligent control device and shall be capable of displaying luminaire on/off status, dim level, power measurement, device temperature, PIR occupancy sensor status, microphonic occupancy sensor status, remaining occupancy time delay, photocell reading, and active Scenes or Profiles.
10. Management interface shall be able to read the current active settings of a networked luminaire or intelligent control device and shall be capable of displaying dimming trim levels, occupancy sensor and photocell enable/disable, occupancy sensor time delay and light level settings, occupancy sensor response (normal or vacancy), and photocell setpoints and transition time delays.
11. Management interface shall be able to change the current active settings and also default settings for an individual networked luminaire or intelligent control device.
12. Management interface shall be capable of applying settings changes for a zone of devices or a group of selected devices using a single “save” action that does not require the user to save settings changes for each individual device.
13. A printable network inventory report shall be available via the management interface.
14. A printable report detailing all system profiles shall be available via the management interface.
15. All sensitive information stored by the software shall be encrypted.

16. All system software updates must be available for automatic download and installation via the internet.

B. Historical Database and Analytics Interface

1. Product Series: SensorView GreenScreen
2. System shall provide a historical database that stores device operational history and calculates energy usage for all networked luminaires and intelligent control devices.
3. System shall be capable of reporting lighting system events and performance data back to the historical database for display and analysis.
4. Historical database shall be capable of recording historical data for up to 20,000 networked devices for a period of at least 1 calendar year.
5. An "Energy Scorecard" shall be displayed that shows calculated energy savings in dollars, kWh, or CO₂.
6. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc.).
7. Energy savings data shall be calculated for the system as a whole or for individual zones.
8. A time scaled graph showing all relay transitions shall be presented.
9. A time scaled graph showing a zones occupancy time delay shall be presented
10. A time scaled graph showing the total light level shall be presented.
11. User shall be able to customize the baseline run-time hours for a space.
12. User shall be able to customize up to four time-of-day billing rates and schedules.
13. Historical data shall be exportable from the Historical Database via a "CSV" type of file format.

C. Visualization Interfaces

1. Product Series: SensorView nFloorplan
2. System shall provide a web-based visualization interface that displays graphical floorplan.
3. Graphical floorplan shall offer the following types of system visualization:
 - a. Full Device Option - A master graphic of the entire building, by floor, showing each control device installed in the project with zones outlined to include but not be limited to the following:
 - 1) Controls embedded light fixtures
 - 2) Controls devices not embedded in light fixtures
 - 3) Daylight Sensors
 - 4) Occupancy Sensors
 - 5) Wall Switches and Dimmers
 - 6) Scene Controllers

- 7) Networked Relays
 - 8) Bridges
 - 9) System Controllers
 - 10) Panels
 - 11) Zone outlines
- b. Zone Only Option - A master graphic of the entire building, by floor, showing only control zones:
 - 1) Zones outlined
 - c. Allow for pan and zoom commands so smaller areas can be displayed on a larger scale simply by panning and zooming each floor's master graphic.
 - d. A mouse click on any control device shall display the following information (as applicable):
 - 1) The device catalog number.
 - 2) The device name and custom label.
 - 3) Device diagnostic information.
 - 4) Information about the device status or current configuration is available with an additional mouse click.

D. Personal Control Applications

- 1. Product Series: Virtual Wallpods
- 2. Software interface shall support personal control software applications that provide user-specific control of individual luminaires, control zones, and scene presets.
- 3. Personal control applications shall support control of dimming output or definition of dimming presets for luminaires and devices that are dimmable.
- 4. The system administrator shall be capable of defining personal control permissions for each user account.
- 5. Software interface shall provide a Microsoft Windows® operating system taskbar application for personal lighting control.
- 6. Software interface shall provide an Apple iOS® operating system application (supported by mobile phones and mobile tablet devices) for personal lighting control.

2.4 System Backbone and System Integration Equipment

A. System Controller

- 1. Product Series: nECY
- 2. System Controller shall be multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.

3. System Controller shall have 32-bit microprocessor operating at a minimum of 1 GHz.
4. System Controller shall have minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support its own operating system and databases.
5. System Controller shall perform the following functions:
 - a. Facilitation of global network communication between different areas and control zones.
 - b. Time-based control of downstream wired and wireless network devices.
 - c. Linking into an Ethernet network.
 - d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
6. System Controller shall have an integral web server to support configuration, diagnostics and hosting of software interfaces.
7. Device shall have option for a graphical touch screen to support configuration and diagnostics.
8. Device shall have three RJ-45 networked lighting control ports for connection to any of the following:
 - a. The graphical touch screen
 - b. Wired communication bridges
 - c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port)
9. Device shall support a wireless network communication bridge for communication to wireless network lighting control zones.
10. Device shall be capable of communicating with software interfaces via LAN connection.
11. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
12. Device shall have a standard and astronomical internal time clock.
13. Device shall have 2 switched RJ-45 10/100 BaseT Ethernet ports for local area network (LAN) connection.
 - a. Ethernet connection shall support daisy chain wiring to other lighting control system LAN devices, such as other system controllers.
 - b. Ethernet connection shall support IPv4 and shall be capable of using a dedicated static or DHCP assigned IP address.
14. Device shall have 2 x USB 2.0 Expansion ports for 802.11 Wi-Fi Adapter enabling wireless connectivity including:
 - a. Hot Spot
 - b. Access Point
 - c. Client

15. Each System Controller shall be capable of managing and operating at least 750 networked devices (wired or wireless).
 - a. Multiple System Controllers may be networked together via LAN connection to scale the system up to 20,000 networked devices.
 16. System Controller shall support BACnet/IP and BACnet/MSTP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
 - a. BACnet/MSTP shall support up to minimum of 50 additional BACnet MS/TP controllers in addition to the Expansion I/O modules.
 - b. BACnet/MSTP shall support 9600 to 115200 baud.
 - c. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
 17. Shall contain a "FIPS 140-2 Level 1 Inside" cryptographic module.
 18. System controller shall be available with an optional NEMA 1 enclosure with separate compartments for Class 1 and Class 2 wiring connections.
 - a. Enclosure shall support power input power of 120-277VAC or 347VAC.
- B. OpenADR Interface
1. Product Series: nADR
 2. System shall provide an interface to OpenADR protocol Demand Response Automation Servers (DRAS) typically provided by local electrical utility.
 3. OpenADR interface shall meet all of the requirements of Open ADR 2.0a Virtual End Nodes (VEN), including:
 - a. Programmable with the account information of the end-user's electrical utility DRAS account credentials.
 4. OpenADR interface shall support the activation of system profiles configured for each of the automated demand response levels defined in the utility demand response program.

2.5 Wireless Networked Devices

- A. Wireless Networked Sensor Interface
1. Product Series: XPA SIAC2 L2
 2. The wireless sensor interface shall integrate industry standard low voltage switching devices and contact closure outputs into the control network.
 3. The device interface shall have a universal power supply that operates at 120, 208, 240 or 277 VAC.
 4. The device shall be listed to the UL 916 standard to allow field installation.
 5. The device shall be listed to the UL 2043 listing for mounting in a plenum.
 6. The device interface shall provide low voltage input channels suitable for connecting to momentary contact wall switches and dry contact outputs from other systems.
 7. The device shall be capable of broadcasting the following manual wall control commands: on, off, and adjust dim level.

B. Wireless Networked Light Controllers

1. Product Series: XPA RLx DSI
2. The wireless light controller shall have a line voltage relay and 0-10V dimming output suitable for control of commercial and industrial lighting including fluorescent, HID, induction and LEDs.
3. Device shall have an integrated non-removable antenna for wireless communication.
4. The wireless light controller shall have a universal power supply that operates at 120, 208, 240 or 277VAC.
5. The device shall be listed under the UL 916 standard to allow field installation.
6. The device shall have optional measurement capability of the amperage, voltage, wattage, and watt-hours of its controlled lighting.
 - a. Amperage and current measurements shall be accurate to +/- 2%.
 - b. Wattage measurement shall account for power factor of the load, so that real active power is reported by the system instead of apparent power.
7. Wireless light controller options shall be available that support the following minimum relay specifications:
 - a. Normal power, 5A relay
 - b. Emergency power, 5A relay (UL924 listed)
 - c. Emergency power, no relay (UL924 listed); still provides 0-10V dimming control and power measurement of the load while providing unswitched and "fail-on" operation of the lighting load.

C. Wireless Networked Digital Sensors

1. Product Series: XPA DS ES7, XPA DS SBG
2. Digital sensors provide integrated digital occupancy sensing and digital photocell sensor suitable for embedding into the enclosure of a luminaire.
3. Digital sensor shall have the following form factors and lens types:
 - a. High-mounting height (15-45'), 360° PIR with minimum 15' detection radius, and photocell.
 - b. Low-mounting height (up to 15'), extended range 360° PIR with up to 30' detection radius and photocell.
 - c. Micro-sensor form factor, 360° PIR and photocell.

D. Wireless Networked Sensor-Controllers

1. Product Series: XPA CMxB, XPA SBOx
2. Sensor-Controllers shall integrate the following functions in to a single enclosure:
 - a. Line voltage relay and 0-10V dimming control of a lighting load.
 - b. Power measurement of lighting load (voltage, amperage, watts, and watt-hours).
 - c. Digital PIR occupancy sensor.

- d. Digital photocell sensor.
 - e. User button used to provide diagnostic and factory-default reset capabilities.
3. Sensor-Controllers shall mount to luminaires or junction boxes with a secured chase nipple suitable for ½" KO mounting holes.
 4. Sensor-Controller options shall be available that support the following minimum enclosure, relay, and lens specifications:
 - a. Enclosure Types
 - 1) Damp location, including optional offset bracket to locate the sensor lens to avoid detection cutoff from the luminaire.
 - 2) Wet location, IP65 rated enclosure or better, including optional back heights and nipple extension lengths to locate the sensor lens to avoid detection cutoff from the luminaire.
 - b. Relay Types
 - 1) Normal power, 5A relay.
 - 2) Emergency power, 5A relay (UL924 listed).
 - 3) Emergency power, no relay (UL924 listed); still provides 0-10V dimming control and power measurement of the load while providing unswitched and "fail-on" operation of the lighting load.
 - c. Lens Types
 - 1) "No lens," which has no occupancy sensing or photocell sensing capability but allows the Sensor-Controller to be used purely as an externally mounted lighting control device.
 - 2) High-mounting height (15-45'), 360° PIR with minimum 15' detection radius, and photocell.
 - 3) Low-mounting height (up to 15'), extended range 360° PIR with up to 30' detection radius and photocell.

E. Wireless Networked Luminaires

1. Product Series: Networked Luminaires shall be of the following Acuity Brands LED series, which come factory enabled with embedded wireless networking capability:
 - a. Holophane Indoor model families:
 - EMW**
 - EVT4**
 - PHG**
 - PHS**
 - PHZ**
 - PHZL**
 - PLED**
 - VL**

- b. Lithonia Enclosed & Gasketed model families:

- DMW2 LED**

- FHE LED**

- VAP LED**

- c. Lithonia High Bay model families:

- IBG**

- IBH**

- IBL**

- JCBL**

- JHBL**

- d. Lithonia Parking Garage model families:

- DSXPG**

- PGX**

- 2. Networked luminaire shall have a mechanically integrated control device.
- 3. Networked LED luminaire shall be capable of communicating wirelessly to other networked luminaires or intelligent control devices (sensors, photocells, wallstations).

F. Wireless Network Communication Bridge

- 1. Product Series: XPA BRG
- 2. A communication bridge device shall be provided that interfaces the System Controller with wireless networked devices.
- 3. Device shall consume no more than 6 W of power.
- 4. Device shall be capable of communicating with a group of at least 250 wireless networked devices and luminaires, so as to reduce the amount of communication bridges required in the system.
- 5. Device shall be supplied with mounting hardware suitable for wall mounting in a utility or data closet.
- 6. To provide security, the wireless bridge shall be unresponsive to wired and wireless communication that do not conform to the specific protocols used by the networked lighting control system.

2.6 Wired Networked Devices

A. Wired Networked Wallstations

- 1. Product Series: nPODM, nPODM xS
- 2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
- 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
- 4. All wallstations shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
- 5. Devices with mechanical push-buttons shall provide tactile and LED user feedback.

6. Devices with mechanical push-buttons shall be made available with custom button labeling.
 7. Wallstations shall support the following device options:
 - a. Number of control zones or scenes: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off
 - 2) Preset Scene
 - 3) Global Profile
 - c. Colors: Ivory, White, Light Almond, Gray, Black, Red
- B. Wired Networked Graphical Wallstations
1. Product Series: nPOD GFX
 2. Device shall surface mount to single-gang switch box.
 3. Device shall have a 3.5" full color touch screen.
 4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.
 5. Device shall have a micro-USB style connector for local computer connectivity.
 6. Communication shall be over standard low voltage network cabling with RJ-45 connectors.
 7. Device shall enable user supplied screen saver image to be uploaded within one of the following formats: jpg, png, gif, bmp, tif.
 8. Control Types Supported:
 - a. On/Off
 - b. Preset Scene
 - c. Global Profile
 9. Graphic wall stations shall support the following device options:
 - a. Number of control zones: Up to 16
 - b. Number of scenes: Up to 16
 - c. Colors: Ivory, White, Light Almond, Gray, Black
- C. Wired Networked Auxiliary Input / Output (I/O) Devices
1. Product Series: nIO 1s, nIO X
 2. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

4. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
 - a. Contact closure input
 - b. RS-232/RS-485 digital input
5. Input supports activation of global scenes and profiles.

D. Wired Networked Communication Bridge

1. Product Series: nBRG
2. Device shall surface mount to a standard 4" x 4" square junction box.
3. Device shall have 8 RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.
4. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.
5. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply, or powered via low voltage network connections from powered lighting control devices (e.g. power packs).
6. Wired Bridge shall be capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

PART 3 – EXECUTION

3.1 Installation Requirements

A. Installation Procedures and Verification

1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
 - a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
 - b. Length
 - c. Insertion Loss

B. Coordination with Owner's IT Network Infrastructure

1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
 - a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
 - b. The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

C. Documentation and Deliverables

1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
 - a. As-Built floor plan drawings showing daisy-chain wired network control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
 - b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
 - 1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
Titleblock

Text- Inclusive of room names and numbers, fixture tags and drawings notes
Fixture wiring and homeruns
Control devices
Hatching or poché of light fixtures or architectural elements

- 2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 System Startup

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
 1. Low voltage network cable testing shall be performed prior to system startup.
- B. System start-up and programming shall include:
 1. Verifying operational communication to all system devices.
 2. Programming the network devices into functional control zones to meet the required sequence of operation.
 3. Programming and verifying all sequence of operations.
 4. Customization of owner's software interfaces and applications.
- C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

3.3 Project Turnover

- A. System Documentation
 1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
- B. Owner Training
 1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

End of Section