SECTION 260943 - LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Wireless Lighting Control Systems consisting of a network of hardware components designed to provide custom controllability of lighting levels throughout. The system shall consist of an enterprise ZigBee-based products as well as a Bluetooth mesh product offering.

1.3 DEFINITIONS

A. Area: A grouping of devices which can be programmed to respond together to a single command

B. Bluetooth: A standard for the short-range wireless interconnection of mobile phones, computers, and other electronic devices.

C. Cloud: An application making use of a remote server to access and process encrypted data, rather than a local server.

D. Color Tunable: A control functionality to modify the color of light emitted from a light fixture by isolating red, green, blue and potentially white LED channels within the fixture, allowing the user to select specific hues of color. Also known as RGB or RGBW, which indicate the common color channels used to mix colored light.

E. Device: A collective term for all networked lighting control system products, including gateways, occupancy/vacancy sensors, daylight harvesters, wall dimmers, touchscreens, controlled receptacles, and controllers.

F. Integrated Controls: Fixtures with integrated controls feature a system specific driver Integrated controls can also be referred to as “Luminaire Level Lighting Control”.

G. Luminaire Level Lighting Control: In a lighting control system, it can be considered to have Luminaire Level Lighting Control, or “LLLC” if each fixture has its own type of control and sensor on-board and can be an individual zone.

H. Mesh: Stand-alone wireless mesh network consisting of devices that communicate with one another.

I. Monitoring: The real-time measurement of status and power consumption reported from a device or devices to the Lighting Control System User Interface.

J. On-Board Controls: Fixtures with on-board controls such as a system occupancy sensor, daylight sensor, or controller added on-board at the factory have On-Board controls. On-Board controls can typically be referred to as “Luminaire Level Lighting Control”.

K. RGB and RGBW: Acronyms for Red-Green-Blue-White which indicate control functionality to modify the color of light emitted from a light fixture by isolating red, green, blue and potentially white LED channels within the fixture, allowing the user to select specific hues of color. Also known as Color Tunable.

L. Sensor: A device which collects input from the environment and communicates it to the Lighting Control System. Sensors may include occupancy/vacancy, daylight harvesting, or 3rd party devices.

M. Scene: Preset saved illumination levels.

N. Site: A master group where multiple Areas can be grouped and managed.

O. Smartshift: System functionality allowing luminaires to modify their correlated color temperature to automatically adjust over the course of the day based on astronomical timeclock data. This function is also known as circadian lighting, tunable white lighting or white tunable.

P. Trigger mode: While in trigger mode, a device will monitor a non-system device or 3rd party sensor which is not part of the mesh network, and relay data from the sensor to the Lighting Control System.

Q. User Interface: The platform by which individuals access the system to monitor and control the lighting.

R. ZigBee: A standards-based wireless technology developed to enable low-cost, low-power wireless machine-to-machine (M2M) and internet of things (IoT) networks. Zigbee is for low-data rate, low-power applications.

S. Zone: One Group of fixtures that will all behave in the same manner. Zones are homerun through a single controller or sensor relay.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for devices.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Operational documentation for firmware.

B. Shop Drawings:

1. Floor Plans: Location, orientation, and coverage area of each sensor; zone designations; and other specific design symbols and designations as required to define the installation, location, and configuration of all control devices.
2. Devices: Provide actual quantities and types of individual devices which will be necessary for a properly functioning system. Quantities shown on drawings are approximate. Manufacturer shall dictate actual quantities based on their product offering.
3. Cut Sheets: Provide all specification sheets, wiring diagrams, and specific installation instructions for all products and components required for a properly functioning system.
4. Controls Narrative: Provide details as needed to communicate how the devices should control the lighting. May include schedules of operation for zones and the desired response behaviors of devices based on input from the sensors. May include user interface direction such as specific scenes for each space, programmed digital buttons for touchscreens, or user account information.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

B. Operational Documentation:

1. Completed device table or As-Built construction set showing device identification numbers, physical location, and zone numbers.
2. Username and password for manufacturer's support website.
3. Printout of graphic screens.
4. Operation of adjustable zone controls.
5. Testing and adjusting of emergency power features.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within the specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of input and output to execute switching or dimming commands.
b. Failure of controllers to operate under software commands.

2. Warranty Periods:

   a. For all Lightcloud devices: 10-Year full hardware warranty with 100% repair / replacement coverage for all properly installed devices. Warranty shall include labor.

   b. For all Lightcloud Blue devices: Warranty varies by device and shall be a minimum of 3-Year full hardware warranty with 100% repair / replacement coverage for all properly installed devices

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, RAB Lighting, or approved equal.

2.2 LIGHTING CONTROL SYSTEM DEVICES – Enterprise System

A. The Enterprise Networked Lighting Control System shall consist of devices that have the capability to communicate with each other via a distributed mesh network. Devices contain integrated radios operating to IEEE 802.15.4 standards. The system communicates as a closed system using a proprietary protocol, compliant with United States National Security Agency's "Recommended Practices Guide for Securing Zigbee Wireless Networks in Process Control System Environments". Specified distance ranges herein are expressed in terms of distance from device to device, rather than from a centralized device.

1. All system devices shall be provided by the manufacturer with technical / user support for the period of the warranty.
2. The system shall consist of a combination of the devices outlined below:
3. Central Processing Device (henceforth referred to as "Gateway"):
   a. The Gateway shall not require any software installation.
   b. The Gateway shall not require or use any WiFi LAN internet connection.
   c. The Gateway shall communicate with a remote server over a private, encrypted 4G cellular connection independent of any building networks. The cellular encryption shall conform to the United States National Security Agency's "Recommended Practices for Securing Mobile Devices".
   d. The Gateway shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay to other devices in the mesh network.
   e. The Gateway shall contain an Uninterruptable Power Supply which provides power for up to two hours after any loss of power.
   f. The Gateway is provided with a power supply which shall be plugged into a 120V unswitched outlet.
   g. The Gateway shall be capable of operating a mesh network of up to 200 devices.

h. The Gateway shall communicate with Lightcloud devices via 2.4 GHz wireless mesh network.

4. Central Processing Hub (henceforth referred to as “HUB”):
   a. The HUB shall connect to a 2.4GHz or 5GHz Wi-Fi network.
   b. The HUB shall have the capability to control up to 30 local Lightcloud devices on the same network, and an unlimited amount of HUBs can be used at a location.
   c. The HUB shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay to other devices in the mesh network.
   d. The HUB shall be mounted in a standard junction box and requires a hard connection of 120-277VAC, 50/60Hz, 2W.
   e. The HUB is suitable for indoor use.
   f. The HUB shall act as the brain of the system and shall be equipped with an integrated dimmer for remotely controlling scenes and zones.
   g. The HUB shall be configured through the Lightcloud App

5. Daylight Harvesting Device (henceforth referred to as “Daylight Harvester”):
   a. The Daylight Harvester shall not require hard-wired power of any kind. It shall exclusively be powered by its integral photocell.
   b. The Daylight Harvester measures the quantity of light entering a space through a window or skylight.
   c. The Daylight Harvester reports real-time data to the system every 5 minutes.
   d. The Daylight Harvester shall be capable of taking instantaneous light level readings on demand by the press of a button.
   e. The Daylight Harvester shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards.
   f. The Daylight Harvester provides single-direction information to the system and does not function as a repeater in the mesh network.
   g. The Daylight Harvester shall be commissioned using a USB connection but requires no permanently connected wires to function once commissioned.
   h. The system has the ability to be programmed to dim or switch luminaires in response to the light levels measured by the Daylight Harvester.

6. Occupancy / Vacancy Sensor (henceforth referred to as “OC”):
   a. All OCs shall contain a passive infrared (PIR) sensor.
   b. Coverage patterns for the OC shall be based on the lens of the PIR sensor.
   c. The OC shall be equipped with onboard control capable of toggling its respective zone on/off as well as dimming up/down.
   d. The OC shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
   e. The OC shall be outfitted with an onboard indication of strength of the mesh network signal as well as an indicator of the connectivity status to the mesh network.
   f. The current draw shall be 20mA@120VAC, and 12mA @277VAC.
   g. All OCs contain an integrated relay and shall be capable of switching the load directly wired to them.
   h. All OCs shall be capable of switching loads as follows:

1) Electronic Ballast: 277VAC, 3300W
2) Magnetic Ballast: 277VAC, 1200W / 120VAC, 800W
3) Tungsten: 220VAC, 3000W
4) Dimming: 0-10V (Class2)

i. All OCs shall be capable of dimming lighting loads directly wired to them via 0-10V dimming.

j. All OCs shall be outfitted with the option to function in either Occupancy Mode (Auto-on, Auto-off), or Vacancy Mode (Manual-on, Auto-off). Modes are selectable, and do not require an electrician.

k. When OC is operating in Occupancy Mode, sensor shall provide:
1) User-Configurable timeout specified in minutes
2) User-Configurable dim level to use when space is not occupied, from 0 % (Off) to 100%.
3) User-Configurable time out setting

l. When OC is operating in Vacancy Mode, sensor shall provide:
1) User-Configurable timeout specified in minutes
2) User-Configurable re-entry timeout specified in minutes
3) The re-entry timeout defines the “Grace Period” in which the sensor, while in Vacancy Mode, will function in Occupancy Mode after the lighting load is automatically switched off after the specified timeout period.

m. The OC shall have the capability to measure and monitor power consumption on the attached load.
1) Historical power consumption data must be readily available via a Web-Based User Interface
2) Energy consumption data shall be found on a per-Sensor basis via a Web-Based User Interface
3) A Monthly Energy Consumption Report shall be able to be downloaded via a Web-Based User Interface

7. Occupancy Sensor – Luminaire (henceforth referred to as “OCSH”)
a. All OCSHs shall contain a passive infrared (PIR) sensor.
b. Coverage patterns for the OCSH shall be based on the lens of the PIR sensor and shall generally be a 30’ diameter at a 9’ mounting height.
c. The OCSH shall have an input voltage of 5VDC and shall be connected to a compatible Lightcloud Controller using the provided 6’ cable and RJ09 Connector.
d. The OCSH requires a Gateway and will communicate through the Lightcloud Controller over the Zigbee communication protocol.
e. The range shall be up to 100’ between standard building materials; up to 1,000’ clear line of sight.
f. Sensor shall sense occupancy or vacancy and shall have an occupancy timeout of between 1 minute to 240 minutes.
g. The OCSH sensor shall have the capability of providing closed loop daylight harvesting to allow for the dimming of electric lighting within associated daylight zones.
h. The OCSH sensor shall be UL Listed and shall have an IP rating of 66 for dust and water. It shall be suitable for dry, damp, or wet environments for indoor and outdoor applications.

8. Load Controlling and Dimming Device (henceforth referred to as “LC”)
    a. The LC shall be outfitted with an LED indicator Light that is illuminated when the device is powered.
    b. The LC shall have onboard controls capable of toggling its respective zone either on or off, as well as being capable of setting the illumination level for that zone.
    c. The LC shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay on the mesh network.
    d. The LC shall be outfitted with onboard indication of the strength of the mesh network signal.
    e. The LC shall be plenum and IP66 rated.
    f. The LC contains an integrated relay and shall be capable of supporting loads of at least 15A@120/277V.
    g. The LC shall be equipped with a threaded nipple capable of being installed at a Junction box or at a Panelboard/Loadcenter.
    h. The LC shall be capable of dimming its zones fixtures via 0-10V dimming.
    i. The LC shall be capable of monitoring measured power consumption of the attached load and reporting to the system:
        1) Historical power consumption data must be readily available via a Web-Based User Interface.
        2) Energy consumption data shall be found on an LC basis via a Web-Based User Interface.
        3) A Monthly Energy Consumption Report shall be available to be downloaded via a Web-Based User Interface.
    j. The LC Controller shall be available in a 480V product offering. The 480V device shall operate in the same way as the Lightcloud Controller and shall have a 2A switching capacity.

9. Load Controlling Mini and Dimming Device (henceforth referred to as “LCM”)

    a. The LC shall be outfitted with an LED indicator Light that is illuminated when the device is powered.
    b. The LC shall have onboard controls capable of toggling its respective zone either on or off, as well as being capable of setting the illumination level for that zone.
    c. The LC shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
    d. The LC shall be outfitted with onboard indication of the strength of the mesh network signal.
    e. The LC shall be plenum and IP66 rated.
    f. The LC contains an integrated relay and shall be capable of supporting loads of at least 4.2 @120V.
    g. The LC shall be equipped with a threaded nipple capable of being installed at a Junction box or at a Panelboard/Loadcenter.
    h. The LC shall be capable of dimming its zones fixtures via 0-10V dimming.
    i. The LC shall be capable of monitoring measured power consumption of the attached load and reporting to the system:
        1) Historical power consumption data must be readily available via a Web-Based User Interface.

2) Energy consumption data shall be found on an LC basis via a Web-Based User Interface.
3) A Monthly Energy Consumption Report shall be available to be downloaded via a Web-Based User Interface.

10. Load Controlling 3A and Dimming Device (henceforth referred to as “LC3”)
    a. The LC3 shall consist of two pieces – an actuator module and a radio module.
    b. The LC3 shall be outfitted with an LED indicator Light that is illuminated when the device is powered.
    c. The LC3 shall have onboard controls capable of toggling its respective zone either on or off, as well as being capable of setting the illumination level for that zone.
    d. The LC3 shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
    e. The LC3 shall be outfitted with an onboard indication of the strength of the mesh network signal.
    f. The LC3 shall be plenum and IP66 rated.
    g. The LC3 actuator module contains an integrated relay and shall be capable of supporting loads of at least 3A@120V.
    h. The LC3 actuator module may be installed within a fixture housing if there is space, and the radio shall be installed to the outside of the housing via a knockout. If there is not enough space in the fixture, the luminaire controller may be mounted into a junction box, with the radio module always outside any metal enclosure.
    i. The LC3 shall be capable of dimming its zones fixtures via 0-10V dimming.
    j. The LC3 shall be capable of monitoring measured power consumption of the attached load and reporting to the system:
        1) Historical power consumption data must be readily available via a Web-Based User Interface.
        2) Energy consumption data shall be found on an LC basis via a Web-Based User Interface.
        3) A Monthly Energy Consumption Report shall be available to be downloaded via a Web-Based User Interface.

11. Wall Dimmer (henceforth referred to as “WD”)
    a. The WD shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
    b. The WD shall be outfitted with one or more LEDs to indicate the strength of the mesh network signal.
    c. The WD shall be outfitted with one or more LEDs to indicate the connectivity status of the device to the mesh network.
    d. The WD shall have the capability to switch and/or dim lighting zones or activate and dim predefined scenes.
    e. The WD shall be capable of being configured via the Web-Based User Interface, without the need for an Electrician.
    f. The WD does not act as a relay and will not be wired to luminaires but will communicate with load control devices over the mesh network to allow switching and/or dimming, or scene control.

g. The standard WD shall be capable of being installed in single gang or multi gang electrical boxes, without occupying more than one gang.
h. The WD shall feature a decora-style screw-less faceplate.
i. The WD shall feature LEDs to indicate the current dim level for the zone being controlled.
j. The WD shall operate on 120-277V and has a power consumption of not more than 2W.

12. Wall Dimmer w/ integral Occupancy Sensing (henceforth referred to as “WDOC”)
a. The WDOC shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
b. The WDOC shall be outfitted with one or more LEDs to indicate the strength of the mesh network signal.
c. The WDOC shall be outfitted with one or more LEDs to indicate the connectivity status of the device to the mesh network.
d. The WDOC shall have the capability to switch and/or dim lighting zones or activate and dim predefined scenes.
e. The WDOC shall be capable of being configured via the Web-Based User Interface, without the need for an Electrician.
f. The WDOC does not act as a relay and will not be wired to luminaires but will communicate with load control devices over the mesh network to allow switching and/or dimming, or scene control.
g. The standard WDOC shall be capable of being installed in single gang or multi gang electrical boxes, without occupying more than one gang.
h. The WDOC shall feature a decora-style screw-less faceplate.
i. The WDOC shall feature LEDs to indicate the current dim level for the zone being controlled.
j. The WDOC shall operate on 120-277V and has a power consumption of not more than 2W.
k. The WDOC shall be equipped with an on-board PIR motion sensor which will provide occupancy and vacancy sensing as well as closed loop daylight harvesting.
l. The occupancy sensor shall have a 30’ – 35’ diameter at a 4’ Mounting Height.

13. Phase Dimmer (henceforth referred to as “PD”)
a. The PD shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
b. The PD shall be outfitted with one or more LEDs to indicate the strength of the mesh network signal.
c. The PD shall be outfitted with one or more LEDs to indicate the connectivity status of the device to the mesh network.
d. The PD shall have the capability to switch and/or dim lighting zones or activate and dim predefined scenes.
e. The PD shall be capable of being configured via the Web-Based User Interface, without the need for an Electrician.
f. The PD is both a Dimmer and Phase Controller (ELV/MLV) in one device. The Dimmer can control its attached load, other controllers, or a combination of the two.

g. The Phase Dimmer shall have load switching capacities as follows: 450W LED (reverse phase), 450W Incandescent (reverse phase), 450W Magnetic Low Voltage (symmetric forward phase), 450W Electronic Low Voltage (reverse phase), 450 W Dimmable CFL (reverse phase).
h. The standard PD shall be capable of being installed in single gang or multi gang electrical boxes, without occupying more than one gang.
i. The PD shall feature a decora-style screw-less faceplate.
j. The PD shall feature LEDs to indicate the current dim level for the zone being controlled.
k. The PD shall operate on 120V and has a power consumption of not more than 60mA.
l. The PD is suitable for indoor use only and is not plenum rated.

14. Phase Dimmer Blank (henceforth referred to as “PDB”)
    a. The PDB shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
    b. The PDB shall be outfitted with one or more LEDs to indicate the strength of the mesh network signal.
    c. The PDB shall be outfitted with one or more LEDs to indicate the connectivity status of the device to the mesh network.
    d. The PDB shall have the capability to switch and/or dim lighting zones or activate and dim predefined scenes.
    e. The PDB shall be capable of being configured via the Web-Based User Interface, without the need for an Electrician.
    f. The PDB is both a Dimmer and Phase Controller (ELV/MLV) in one device. The Dimmer can control its attached load, other controllers, or a combination of the two.
    g. The Phase Dimmer Blank shall have load switching capacities as follows: 450W LED (reverse phase), 450W Incandescent (reverse phase), 450W Magnetic Low Voltage (symmetric forward phase), 450W Electronic Low Voltage (reverse phase), 450 W Dimmable CFL (reverse phase).
    h. The standard PDB shall be capable of being installed in single gang or multi gang electrical boxes, without occupying more than one gang.
    i. The PDB shall feature a blank faceplate.
    j. The PDB shall feature LEDs to indicate the current dim level for the zone being controlled.
    k. The PDB shall operate on 120V and has a power consumption of not more than 60mA.
    l. The PDB is suitable for indoor use only, and is plenum rated.

15. Twistlock Controller (henceforth referred to as “LCTWIST”)
    a. The LCTWIST shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
    b. The LCTWIST shall mount to a fixture using a NEMA standard ANSI C136.10/C136.41 on-board receptacle.

c. The LCTWIST shall be rated for 120—277V, 50/60Hz and shall have load switching capacity of 5A @120VAC and 5A @277VAC.
d. The LCTWIST shall be capable of advanced daylight sensing, GPS location reporting, 0-10V dimming, pole-damage detection, surge protection, utility grade energy metering, remote control and setup from a web app, and shall not require an internet connection.
e. The LCTWIST shall have a signal strength indicator and a network indicator.
f. The LCTWIST shall have an IP rating of 65 for ingress protection for dust and water, and shall have an operating temperature of -40◦C - +70◦C.

16. Controlled Receptacle (henceforth referred to as “CR”)
    a. The CR shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
    b. The CR shall be a duplex receptacle which provides plug-load control and measured power monitoring for loads up to 20A.
    c. The CR shall be rated for indoor use and may be mounted in a single or multi-gang junction box.
    d. The CR shall be capable of being managed by schedules, timers and sensors. CR shall have the capability to be controlled and configured wirelessly using cloud-based management.
    e. The CR shall be permanently marked for designation.
    f. The CR shall be tamper resistant,
    g. The CR shall be compliant with ASHRAE 90.1- 2010.

17. Touchscreen Controls (henceforth referred to as “TS”)
    a. The TS shall switch on/off or dim any zone within the wireless mesh network that it is programmed to control.
    b. The TS shall activate any one of an unlimited number of predefined lighting scenes.
    c. The TS shall be User Configurable via a Web-Based User Interface, without the need for an Electrician.
    d. The TS shall be capable of permanent wall installation.
    e. The TS shall be outfitted with an integrated radio operating to IEEE 802.15.4 standards, and acts both as a receiver and a relay in the mesh network.
    f. The TS shall interface wirelessly with load controlling devices via the mesh network.
    g. The TS shall not be required to be hard-wired to lighting fixtures.
    h. The TS shall operate with a voltage of 120-277V and has a power consumption of no greater than .3A.

18. Integrator (henceforth referred to as “LCBMS”)
    a. The LCBMS shall be a custom device which is programmed by the manufacturer for each individual customer.
    b. The LCBMS shall integrate with all BACnet applications and will be unique.
    c. The LCBMS shall be powered by a plug-in adaptor.

d. The LCBMS shall communicate with the Gateway to allow Lightcloud to interact with the BMS system. Each individual Gateway will require an individual LCBMS to be used with BACnet.
e. The LCBS shall have BACnet Testing Labs approval B-ASC Ver.12, LonMark 3.4C Certification – ProtoNode Series, and TUV Approved – UL 916 EN 60950-1, EN 50491-3 and CSA C22-2 Standards.

B. The Enterprise Networked Lighting Control System Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a UL testing agency (not ETL), and marked for intended location and application.

C. All Components of the Enterprise Networked Lighting Control System shall be qualified by the DLC.

D. All Components of the Enterprise Networked Lighting Control System shall be Title 24 Compliant.

2.3 WEB-BASED USER INTERFACE – Enterprise Networked Lighting Control System

A. Workstations: Desktop, Laptop, Tablet, Smartphone, etc., any device which has web access shall have the ability to login online to access the system.

B. Web Interface: Internet portal, with an unlimited number of unique usernames and password(s), and a custom graphical user interface, allowing programming commands to be applied to the Gateway(s) via the secure 3G connection. Each of the unlimited unique usernames can be provided specific accesses to the system such that a user cannot access portions of a system they should not have access to.

C. Through the Web User Interface, the owner shall be capable of viewing sensor parameters, time delays, sensitivities, and daylighting set-points for all zones. Energy Monitoring, tracking, reporting and user management shall be accessible through the web-based user interface. For applications where luminaires with Smartshift tunable white are integrated into the control system, the interface shall allow user to select preset schedules to allow for changing the correlated color temperature of the luminaires based on timeclock-driven events. For applications where luminaires have color tunability, are RGB or RGBW, the system shall allow the selection of specific hues of light for the luminaires based on user input using the application.

2.4 LIGHTING CONTROL SYSTEM DEVICES – Bluetooth Networked Lighting Control System

1. The Bluetooth Networked Lighting Control System shall consist of devices that are controlled via an independent, self-automated Bluetooth mesh system. Each device in the system can communicate directly with any other device in it, eliminating the need for a Gateway or Hub. The range shall be up to 60’ between standard building materials; up to 200’ clear line of sight for devices.

2. Controller (henceforth referred to as “LCB”)

a. The LCB shall have an input voltage of 120V-277V AC.
b. The LCB shall be remotely controlled to enable switching and dimming in any compatible 0-10V LED fixture.
c. The LCB shall direct connect to a manufacturer specific mobile application via Bluetooth; no head-end devices are required.
d. The LCB shall be capable of manually controlling a fixture's on/off and dim level using the single controller button.
e. The LCB shall be able to quickly identify the fixture during commissioning by pressing the controller button 1 time to highlight the device in the mobile app.
f. The LCB shall be able to switch an LED load of up to 400W.
g. The LCB shall have both a white finish and a black finish. The white finish is indoor only (IP20), and the black finish shall be capable of being installed both indoors and outdoors (IP66).
h. The LCB shall carry a 5-Year warranty.

3. Occupancy Sensor (henceforth referred to as "LCBS")
   a. The LCBS shall be a hardwired sensor and shall easily mount to a junction box.
   b. The LCBS shall have an input voltage of 120V-277V AC.
   c. The LCBS shall be capable of both occupancy and vacancy sensing, and shall feature adjustable sensitivity and timeouts
   d. The LCBS shall be offered in either Passive Infrared or Microwave.
   e. The LCBS shall communicate over a secure wireless Bluetooth Mesh network, and no head-end devices are required.
   f. The LCBS shall operate as a motion detector with the ability to control zones, or to provide motion information only.
   g. The LCBS shall also feature closed loop daylight harvesting.
   h. The LCBS shall be suitable for use indoor as well as outdoor and carry an IP66 Rating.
   i. The LCBS shall carry a 5-Year Warranty.

4. Occupancy Sensor – Luminaire Integrated (henceforth referred to as "OCSH")
   a. OCSH shall be factory-integrated into a luminaire to provide Luminaire Level Lighting Control (LLLC).
   b. All OCSHs shall be offered in either Passive Infrared or Microwave.
   c. Coverage patterns for the OCSH shall be based on the lens of the sensor, and shall generally be a 30' diameter at a 9' mounting height.
   d. The OCSH shall have an input voltage of 5VDC and shall be connected to a compatible Lightcloud Blue Controller using the provided 6' cable and RJ09 Connector.
   e. Sensor shall sense occupancy or vacancy and shall have an occupancy timeout of between 1 minute to 240 minutes.
   f. The OCSH sensor shall have the capability of providing closed loop daylight harvesting to allow for the dimming of electric lighting within associated daylight zones.
   g. The OCSH sensor shall be UL Listed and shall have an IP rating of 66 for dust and water. It shall be suitable for dry, damp, or wet environments for indoor and outdoor applications.
   h. The OCSH shall carry a warranty which aligns with the luminaire warranty.

5. Wireless Battery-powered Occupancy Sensor (henceforth referred to as “OCB”)
    a. The OCB shall wirelessly sense occupancy using PIR technology.
    b. The OCB shall easily mount to wall, ceiling, or placed on a flat surface.
    c. The OCB shall feature an adjustable base to expand the detection area.
    d. The OCB shall feature a 3-year battery lifespan. Placing the OCB in high traffic areas could reduce the battery life.

6. 5-Pin Plug-In Controllers
    a. The 5-Pin Plug-In Controller shall consist of a plug-in auxiliary component to allow for the connection to the Bluetooth Mesh wireless Network and which can be added to compatible light fixtures via the connection port. They shall have an IP rating of 20 and shall carry a 3-Year Warranty.
    b. The 5-Pin Plug-In Controllers shall be offered in three options:
        1) Bluetooth Controller (LCB) only for on/off control, dim level, color temperature, schedules, scenes and SmartShift when used with compatible fixtures.
        2) Bluetooth MVS Controller (LCBS) for microwave sensing, daylight harvesting, on/off control, dim level, color temperature, schedules, scenes and SmartShift.
        3) Bluetooth PIR Controller (LCBS) for passive infrared sensing, daylight harvesting, on/off control, dim level, color temperature, schedules, scenes and SmartShift when used with compatible fixtures.

7. Low-Voltage Controllers / Sensors
    a. The Low-Voltage Controllers / Sensors shall consist of a device with a 12VDC power output, and which shall easily screw into compatible fixtures which have a sensor port or which will be outfitted with an accessory port attached to a knockout on the fixture. They shall have an IP rating of 66 and shall be suitable for Indoor or Outdoor applications and shall carry a 5-Year Warranty.
    b. The Low-Voltage Controller / Sensors shall be offered in both back and white finishes, and with either MVS or PIR sensing technology, and with various mounting height options.
    c. The Low-Voltage Controller / Sensors shall be remotely controlled to enable switching and dimming in any compatible 0-10V LED fixture with a 12V output driver, shall be able to connect to the LCB mobile app via Bluetooth, and shall have integrated motion and daylight sensing.

8. Wireless Battery-operated Remote (henceforth referred to as “Remote”)
    a. The Remote is a wireless handheld battery device used to control other Bluetooth devices.
    b. The Remote shall directly connect to the Lightcloud Blue mobile app via Bluetooth.
    c. The Lightcloud Blue App shall assign the Areas or Lights which the Remote shall control.
    d. The Remote will include a single gang faceplate and backplate which can be mounted to any surface or used to replace an existing wall switch. The backplate can easily be removed from the included wall plate kit to allow for mounting in a multi-gang application.

e. The Remote will magnetically connect to the backplate to easy removal and other mounting accessories shall be available. For additional mounting accessories contact the manufacturer.
f. The Remote can be configured to control up to 3 Areas for On/Off, Dim Level, CCT or for an entire Site up to 600 devices for On/Off and Dim Level.
g. The Remote will have customizable programmable function buttons for up to 6 Scenes, not available when the Remote is configured to control an entire Site.

9. Hard-Wired Wall Dimmers (shall henceforth be referred to as X/ZDIM)
   a. X/ZDIM requires a constant line voltage power source.
   b. X/ZDIM shall be compatible with Lightcloud Blue wireless lighting control system.
   c. X/ZDIM shall carry a 3-Year Limited Warranty.
   d. X/ZDIM shall be suitable for indoor use in dry and damp environments.
   e. ZDIM communicates through the Lightcloud Blue App and shall not need to be connected to a load.
   f. ZDIM can be connected to 120-277V.
   g. XDIM communicates through the Lightcloud Blue App, and depending upon the XDIM that is selected, can be connected to a phase dimming load (120V) or to a 0-10V dimming load (120-277V). Load capacity restrictions shall apply.
   h. XDIM when connected to a phase dimming load does not require a neutral wire.
   i. X/ZDIM shall be offered with an integral PIR motion sensor / Daylight Harvester. The sensor shall be capable of detection to a 26’ distance. Sensor settings can be configured using the Lightcloud Blue App.
   j. X/ZDIM can be configured using the Lightcloud Blue App to adjust low- and high-end trim, set to Switch Mode to limited to On/Off control, or set to control the entire Site.

10. Nano
    a. The NANO shall require constant power via a USB connection.
    b. The NANO shall be connected to a 2.4 GHz Wi-Fi network.
    c. The NANO shall expand the Lightcloud Blue app to add connectivity to either Amazon Alexa or Google Home for voice control and remote access.
    d. The NANO shall allow for accurate timekeeping, scheduling, and shall provide information wirelessly to all LCB devices in the event of a power outage.
    e. The NANO shall carry a 3-Year No-Compromise Warranty
    f. The NANO shall be suitable for indoor use in dry environments.

11. LCB Enabled Smart Lamps (Henceforth referred to as “Lamps”)
    a. Lamps shall offer an integrated Bluetooth controller and do not require a Gateway or Hub.
    b. Lamps shall be capable of being controlled wirelessly with a mobile app for ON/OFF, dimming, Color Temperature, Scenes, Schedules, and SmartShift (when available)
    c. Lamps shall require constant power to function within the system.
    d. Lamps shall carry a 3-Year No-Compromise Warranty.
    e. Lamps shall be suitable for use in open and enclosed fixtures.
    f. Lamps shall be suitable for use in dry and damp environments. Select Lamps suitable for wet environments.

B. CONDUCTORS AND CABLES

1. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. For Class 2 conductors in "Class 2 Control Cables" Paragraph below, retain wire size based on voltage drop, or use No. 18 AWG.
3. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

2.5 ANDROID/APPLE USER INTERFACE – Bluetooth Networked Lighting Control System

A. Smartphone or tablet running Android or Apple shall be used during the provisioning and programming of the Bluetooth Lighting Control System. Only one device shall be used during the provisioning and programming.

B. Once a system has been commissioned, the mobile application is only required to make programming modifications, the devices in the network retain their programming.

C. Through the App User Interface, the owner shall be capable of viewing sensor parameters, time delays, sensitivities, and daylighting set points for all Areas. For applications where luminaires with Smartshift tunable white are integrated into the control system, the interface shall allow user to select preset schedules to allow for changing the correlated color temperature of the luminaires based on timeclock-driven events. For applications where luminaires have color tunability, are RGB or RGBW, the system shall allow the selection of specific hues of light for the luminaires based on user input using the application.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 260553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 260553 "Identification for Electrical Systems."

C. Identify all ceiling-mounted controls with zone numbers.

D. Label each device cable within 6 inches (152 mm) of connection.

E. Complete the Device Table using Gateway Device ID numbers. Each device is furnished with a Device Identification sticker, to be manually labeled in the field during installation.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test continuity of each circuit.

B. Perform the following tests and inspections:

1. Test each load controller using local and remote controls.
2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, and manufacturers’ recommendations. Certify compliance with test parameters.
3. Inspect each device for secure mounting and hardware defects.
4. Verify that all equipment is clean.
5. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Field Test Reports:

1. Event log verifying the performance of all devices generating event messages to include occupancy sensors, control buttons, alarm messages, and any other change of value messages.

D. Lighting controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a Device Table, and Programming Schedule. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.4 STARTUP SERVICE – LIGHTCLOUD ENTERPRISE SYSTEM

A. Startup service shall be initiated by the Contractor and performed by the System Manufacturer, and shall include the following:

1. Contractor shall send digital copies of device tables or as-built drawings with device ID tags to the Manufacturer upon completion of device installations.
2. Contractor shall call the Manufacturer to initiate the commissioning of the system.
3. Complete installation and startup checks according to manufacturer's written instructions, and in accordance with the Owner / Facility Manager’s desired system functionality, completed remotely.
4. Activate luminaires and verify that all lamps are operating at 100 percent.
5. Confirm correct communications wiring, initiate communications between devices and load controllers, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.
6. Manufacturer shall remotely confirm system connectivity.
7. Manufacturer shall remotely confirm proper switching / dimming of each zone being controlled.
8. Contractor shall be capable of walking through the facility while communicating with the manufacturer to visually confirm functionality of zone on/off/dim.
9. Contractor shall be capable of walking through the facility while communicating with the manufacturer to visually confirm functionality of sensors for sensitivity and / or timeout as required.

B. Startup Service shall be performed by the Manufacturer after receiving the following information:

1. Contractor to provide manufacturer with the names and locations of zones to be controlled by the system.
2. Contractor to contact manufacturer to verify system connectivity.
3. Owner / Facility Manager shall contact the manufacturer to communicate desired system functionality / behavior / reporting needs.

3.5 BASIC SYSTEM FUNCTIONALITY – LIGHTCLOUD ENTERPRISE SYSTEM

A. Basic system functionality based on industry best practices are outlined below. All functionality is subject to change based upon Owner’s requirements and / or stricter code requirements.

1. Manufacturer remotely configures sensors so that controlled zones remain lighted to a programmed level for task performance for the following time periods unless otherwise noted:

    a. Bathrooms, storage rooms, and other areas not always occupied: 10 minutes after occupant leaves area.
    b. In offices, classrooms, reception areas, kitchens, and libraries: 30 minutes after occupant leaves area.
    c. In hallways, corridors, and stairwells: 15 minutes after occupant leaves area.

2. Manufacturer remotely configures sensors so that lights are off or at a programmed level for energy conservation after the timeout period.

a. Programming of daylight harvesting devices varies based on the location of the device, height of the windows and architecture of the room. Contractor or end user to visually confirm task light levels during commissioning.

3. Manufacturer remotely configures wall dimmers as follows, unless otherwise noted:

a. Device shall act like a dimmer, on/off control, or scene control.
1) If the device is being used as a dimmer, the max/min trim levels shall be set to desired levels to meet illumination levels for the space / task local to that control.

4. Manufacturer remotely configures Daylight Harvesters to measure illumination levels and provide input to allow controllers to dim artificial lighting in the space.
5. Manufacturer remotely configures Scene Controllers per the clients' requests.

3.6 ADJUSTING – LIGHTCLOUD ENTERPRISE SYSTEM

A. When requested within 10 Years from date of Substantial Completion, manufacturer shall provide assistance in adjusting system to suit actual occupied conditions with the option to renew and extend.

3.7 WEB-BASED USER INTERFACE SERVICE – LIGHTCLOUD ENTERPRISE SYSTEM

A. Technical Support: Beginning at the date of Substantial Completion, the service agreement shall include firmware support for ten years, with the option to renew and extend.

B. Upgrades of Service: At Substantial Completion, all firmware will be upgraded to the latest version. All future firmware upgrades shall be provided as they become available with no downtime for a period of ten years, with the option to renew and extend.

3.8 DEMONSTRATION – LIGHTCLOUD ENTERPRISE SYSTEM

A. At the owner's request, manufacturer shall train owner's maintenance personnel to adjust, operate, and maintain the lighting control system and devices.

B. At the owner's request, manufacturer shall support any and all system adjustments to be completed remotely throughout the 10 year warranty period.

3.9 SYSTEM FUNCTIONALITY AND STARTUP – LIGHTCLOUD BLUE

A. For a Lightcloud Blue system with greater than 100 Devices the installer shall complete a virtual training with the manufacturer to review best practices for installation and startup.

B. Installer shall download the Lightcloud Blue mobile App on their phone or tablet, and shall commission LCB devices as they are installed.

1. Create an account.
2. Wire devices and document their ID's.

3. Provision devices to pair LCB devices – only one phone/tablet should be used.
    a. Battery-operated devices need to “Wake up” before pairing, see product instruction manual.
4. Commission devices to configure system settings – only one phone/tablet should be used.
5. Verify site functionality.
    a. Organize devices
    b. Name areas
    c. Activate power usage
    d. Confirm dimming or non-dimming
    e. Confirm manual controls function accordingly
    f. Configure sensors
    g. Activate any scheduling
    h. Configure any scenes
    i. Check that integrations are functioning properly
    j. Perform any updates that may be available
    k. Configure any necessary alerts

END OF SECTION 260943