SECTION 260943.13

DIGITAL - NETWORK LIGHTING CONTROLS

LUMAWATT PRO WITH ENLIGHTED LIGHTMANAGEMENT SYSTEM

This specification was updated October 4, 2016 and supersedes all previous LumaWatt Pro with Enlighted specifications.

PART 1- GENERAL

1.1 SUMMARY

A. The following specification details the minimum compliance and related criteria for a complete and fully operational distributed intelligence sensor and lighting control system for all interior lights.

1.2 REFERENCES

A. American National Standards Institute/ (ANSI) (www.ansi.org)
C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. Institute of Electrical and Electronic Engineers (IEEE) (www.ieee.org)
802.3af-2003 – Power over Ethernet standard

C. International Electrotechnical Commission (www.iec.ch)
IEC/EN 61000-4-2:2009 Electrostatic Discharge Testing Standard.

D. International Organization for Standardization (ISO) (www.iso.ch)
9001:2000 – Quality Management Systems.

E. National Electrical Manufacturers Association (NEMA) (www.nema.org)
WD1 (R2005) - General Color Requirements for Wiring Devices.

F. Underwriters Laboratories, Inc. (UL) (www.ul.com)
916 – Energy Management Equipment

G. Federal Communications Commission (FCC) (www.fcc.gov)
Title 47 CFR Part 15 Class A

1.3 SYSTEM DESCRIPTION

A. The lighting control system shall be capable of providing all of the following functions for all lighting:

1. Continuous dimming and automatic on/off controls.
2. Occupancy control.
3. Vacancy control.
4. Daylight harvesting.
5. Temperature sensing.
6. Load management.
7. Task Tuning.

8. Outage reports.

9. Utility grade metered energy savings reports.

10. The lighting control system shall be capable of continuous dimming and switching allowing each fixture to monitor its local environment and provide distributed control in response to environmental changes.

11. The lighting control system shall provide network backhaul of all environmental readings for all light fixtures including power consumption, occupancy information, and temperature information.

12. The lighting control system shall be provisioned and commissioned by means of strobing a laser at the sensor or wirelessly with a PC and mapping the sensor to a floor plan of the building.

    The lighting control system includes the following components:

13. Sensors each contain a passive infrared sensor, digital photocell, digital temperature sensor, microprocessor and a wireless radio.

14. For systems using controllers, each one shall contain a utility grade power meter chip and a latching relay which powers the sensors and sends the control signal to the light's ballasts or drivers.

15. For systems without separate controllers, the functionality of the controller shall be integrated into an LED driver such as the Philips XSR or have independent functionality when using 2-wire sensors.

16. Battery powered, wireless room controllers with dimming, on/off and scene selection features for manual override.

17. Gateways which wirelessly communicate with the sensors, aggregate the data collected by the sensors and transmit it to a central node that can reside on the premises or in the cloud.

18. This central node can store data collected by the sensors and host the software for a web-based graphical user interface for light management and energy savings display software.

19. Reports shall include graphical visualization tools for playback of occupancy and heat over time, usage by space types (conference rooms, open office areas, etc.), space utilization, and power usage.

20. Electronic Dimmable Ballast and/or LED Dimming Drivers. The project shall use standard Electronic dimmable 0-10 volt drivers or Philips XSR type drivers U.O.N.

1.4 SUBMITTALS

A. Specification Conformance Document - Indicate whether the submitted equipment:

1. Meets specification exactly as stated.

2. Meets specification via an alternate means and indicate the specific methodology used.

3. Shop Drawings; include:

a. Schematic (one-line diagram) will be specific to the project. Generic one-line diagrams will not be accepted. Provide drawing details for field installation that are specific to the project.
b. Wiring diagrams for alternative installation configurations.

4. Product Data: Catalog data sheets with performance specifications demonstrating compliance with specified requirements and are specific to the project.

5. Sequence of Operation to describe how each component operates and how any building wide functionality is achieved to exceed local energy code (Title 24 2016, ASHRAE 90.1 2013, IECC 2015, or any newer versions of these codes.

6. Provide a description of the system.

7. Follow-up by Field Services for "fine tuning" and programming to occur approximately 90 days after system turnover.

8. This will involve an additional charge.

1.5 CLOSEOUT SUBMITTALS

A. Sustainable Design Closeout Documentation.

B. Lighting control system manufacturer to provide an Operation and Maintenance Manual that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

1.6 QUALITY ASSURANCE

A. Manufacturer: manufacturer must have 5 years of experience in the manufacture of electronic field devices.

B. System components:

1. Listed by UL specifically for the electronic ballast/driver loads. Provide evidence of compliance upon request.

2. Listed by FCC specifically for the required wireless communication protocols. Provide evidence of compliance upon request.

1.7 APPROVALS

A. 10-working days prior approval before bid date is required for alternate proposals.

B. Complete catalog data, specifications and technical information on alternate equipment must be furnished to the Architect and Owner at least 30 business days in advance of the submission of approved Construction Documents.

C. For wired alternatives, manufacturer shall provide wiring diagrams and architectural details of interconnecting wiring for power signal and control. Contractor shall provide a labor cost (adder or deduction) to install the wired alternative to the lighting control system.

1.8 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature for indoor devices: 0 degrees to 50 degrees C (32 degrees to 122 degrees F).

2. Ambient temperature for outdoor devices: -35 degrees to 85 degrees C (-31 degrees to 185 degrees F).

3. Relative humidity: Maximum 90 percent, non-condensing.

4. Lighting control system must be protected from dust during installation.

5. Ambient temperature for Lighting Management Appliance: 10 degrees C to 35 degrees C (50 degrees F – 90 degrees F).

1.9 WARRANTY

A. Provide manufacturer's Enhanced 5 Year Limited Warranty:

1. 5-year limited warranty for the replacement of defective system components from the date of system startup completion.

2. Contractor shall provide limited workmanship warranty for one year from customer acceptance.

3. A standard 0-10V dimmable ballast or driver module warranty is [5] years. When purchased with a lighting control system this warranty shall also be [5] years by the lighting fixture manufacturer.

4. [For ballasts and drivers, see appropriate section that includes Interior Lighting Fixtures, Lamps, Ballasts and Drivers: Fluorescent Electronic Dimming Ballasts and Electronic LED Drivers.]

1.10 MAINTENANCE MATERIAL SUBMITTALS

A. The manufacturer shall make available to the End-User a method of ordering new equipment for expansions, replacements and spare parts through established distributor channels.

B. The manufacturer shall make new replacement parts available for minimum of 5 years from date of manufacture.

C. The manufacturer shall make directly available to the owner additional software apps that may be desired for a minimum of 10 years from the system's date of purchase.

D. [The manufacturer shall provide extended support that is billable at an hourly rate] OR [support that can be purchased on an annual maintenance contract basis.]

PART 2– PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: LumaWatt Pro with Enlighted Inc. – System: LumaWatt Pro with Enlighted's Distributed Intelligence Sensor Network and Lighting Controls System.

OR

B. [Basis of design product: LumaWatt Pro with Enlighted lighting control system or subject to compliance and prior approval with specified requirements of this section, one of the following:]

1. Acceptable Manufacturer: LumaWatt Pro with Enlighted Inc. – System: LumaWatt Pro with Enlighted's Distributed Intelligence Sensor Network and Lighting Controls System.

OR

2. [Basis of design product: LumaWatt Pro with Enlighted lighting control system or subject to compliance and prior approval with specified requirements of this section, one of the following:]
   a. LumaWatt Pro with Enlighted Inc. or approved equal.

2.2 GENERAL

A. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 50 degrees C (122 degrees F) and 90 percent non-condensing relative humidity. Equipment designed for outdoors must have an operating temperature range of -35 degrees C (-31 degrees F) to 85 degrees C (185 degrees F).

B. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC/EN 61000-4-2:2009.

1. Electrostatic charge builds up on people as a result of friction (walking across a carpet). When a person touches an electronic device, a discharge can occur and cause damage. Electrostatic Discharge (ESD) testing is done according to the IEC/EN 61000-4-2:2009 standard (human body model). Testing should be completed on all user accessible points such as terminal blocks, buttons, and control inputs.

2. Testing conducted shall prove devices and equipment can operate “without impairment of performance” as the pass/fail criteria.

2.3 SENSORS AND CONTROL UNITS

A. Ceiling Mounted or Fixture Mounted Built Environment Sensors.

B. Product: Built Environment Sensor.

C. Components

1. Passive Infrared Occupancy Sensor.

2. Digital Ambient Light Sensor.

3. Digital Temperature Sensor.

4. Processing Mechanisms:
   a. Microcontroller in each sensor.
   b. Communication Mechanism.
   c. Low power 2.4 GHz Transceiver based on IEEE 802.15.4 with an option for Bluetooth enabling.

5. Other:
   a. Unique internal reference number visibly displayed on module cover.

D. Operations:

1. Sensors shall monitor changes in occupancy, changes in ambient light levels and changes in temperature and communicate digital control commands to light fixtures according to a control strategy stored locally in the sensor.

2. Sensor shall wirelessly transmit occupancy; light level, power and temperature information to a

gateway device which allows the data to be stored in a central location on premises or in the cloud.

3. Sensors shall be fully adaptive with the ability to have the sensitively and timing to be remotely adjusted to ensure optimal lighting control for any use of the space.

4. Sensors have remotely adjustable settings for dimming levels, active motion windows for occupancy/vacancy sensing, and sensitivity to changes in motion and changes in ambient light levels.

5. Sensors have the ability to remotely adjust light output to reduced levels and linger at that reduced level for an adjustable time period before turning off when a space is vacant.

6. Sensors have the ability to remotely adjust their sensitivity to the magnitude, stability of changes in ambient light levels and sensors have the ability to remotely adjust the timeframe between daylight harvesting events.

7. Sensors can respond to Lighting Power Density levels that can be specified either to a defined LPD OR a percent reduction over an existing ASHRAE or Title 24 standard.

8. If power is interrupted and subsequently returned, lights automatically return to their setting prior to power interruption.

9. Sensors incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.

10. Programming is stored in each sensor in addition to the Energy Manager. Sensors operate indecently from Energy Manager, so there cannot be single point failure. Systems must operate so there is no single point of failure.

11. Responds to digital (load shed command) Demand Response signal.

12. Sets high end trim via priority assigned in profile.

13. Automatically scales light output proportional to load shed command.
    a. Example: If light output is at 30 percent and a load shed command of 15 percent is received, the ballast/driver automatically sets the maximum light output at 85 percent and lowers current light output by 4.5 percent to 25.5 percent.

E. Electrical/Connections:

1. Sensor shall connect to a 0-10V dimmable ballast or driver via a controller or connect to LumaWatt Pro with Enlighted enabled drivers without the use of LumaWatt Pro with Enlighted control unit.

2. Sensor shall connect to a controller via a low voltage cable for interior applications or Ruggedized Sensors for exterior applications.

3. If power dropouts in the event of a brown-out or black-out, when power is restored, the lighting system should recover quickly and automatically return to the last lighting levels. A momentary interruption (1 or 2 seconds) of power should not cause extended periods (20 seconds or more) without lighting while the system reboots and all other electrical equipment is back on.

4. Manufacturer to provide all necessary mounting hardware and instructions for the specific conditions under which the components shall be installed.

5. Sensor shall be FCC certified.

6. Sensor shall be a Class 2 device.

7. Sensor shall communicate no more than 300 bytes per minute.

8. System shall have user initiated manual demand response.

9. System shall be ADR 2.0a compliant. Systems that simulate ADR shall not be acceptable.

F. Controller:

1. Product: Control Unit.

2. Components:
   a. Utility Grade Power Meter capable of 1% power measurement accuracy.
   b. Controller to include latching relay, to decrease power requirements of the power pack.
   c. Operate Bounce Time: 3 ms. Max.
   d. Max Switching Voltage 277VAC and 125VDC.
   e. Insulation Rating: Class B and Class F.
   f. Operations:
   g. Controller shall measure the actual wattage of the fixture(s) that it controls.
   h. Controller shall meter real-time energy use at each fixture.
   i. Controller shall communicate real-time energy use to sensor unit.
   j. Electrical/Connections:
   k. Circuit protection:
      1. Listed to UL 916.
      2. FCC Part 15 Class A certified.
   l. Wiring instructions shall be included on unit.
   m. Controller shall be plenum rated.
   n. Control wiring between sensors and control units shall be Class 2, 18-24 AWG, stranded or solid depending on the application U.L Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

2.4 LIGHTING CONTROL DEVICE DETAILS

A. LumaWatt Pro with Enlighted Energy Manager

1. Spaces shall be equipped with an automatic control device to shut off lighting in those areas. This automatic control device shall function on either: 1) a scheduled basis, using time of day, with an independent program schedule that controls the interior lighting in areas that do not exceed 5,000 square feet and are not more than one floor, or 2) an occupant sensor that shall turn lighting off within 20 minutes of an occupant leaving a space, or 3) a signal from another control or alarm system that indicates the area is occupied.

2. Provide LumaWatt Pro with Enlighted Energy Managers in the locations and capacities as indicated on the plans and schedules. Each LumaWatt Pro with Enlighted Energy Manager shall have the following capabilities:

   a. The LumaWatt Pro with Enlighted Energy Manager serves as the user interface to the LumaWatt Pro with Enlighted Intelligent Lighting Control System. It is a server class appliance that discovers, commissions and manages LumaWatt Pro with Enlighted's Sensor Units. It is available as a family of appliances that support various advanced

features through licensing. The intuitive graphical user interface can be accessed using a standard web based browser.

b. Offers an interface that allows the system to communicate with the Building Management System (BMS) or Building Automation System (BAS). A BMS/BAS enables occupant data to be further utilized to allow for more efficient usage of a building and space. A BMS/BAS can utilize data from the LumaWatt Pro with Enlighted System for providing increased savings by optimizing the operations of a building's HVAC system.

c. Uses industry standard HTTPS security with AES-128 encryption safeguards the integrity of the entire system. Automatic backups prevent data loss and restore fixtures to operational modes. The system will provide reports that include fixture outages, lamp failure notifications, temperature and occupancy data. It constantly monitors areas to ensure that spaces are managed according to the assigned user preferences and tasks being performed.

B. Scalability and Data Integrity

1. When deployed on premise, LumaWatt Pro with Enlighted Energy Managers support up to 18,000 sensors. When hosted in the cloud, the Energy Manager can support multiple buildings in one instance, providing a comprehensive view of Energy Manager data for several campuses across the world.

2. Due to redundancy in the architecture, a Cloud hosted Energy Manager provides reliable data storage that can be accessed from any location at any time from a secure device eliminating a single point of failure.

C. Advanced Communications, Integration and PC Connectivity

1. The LumaWatt Pro with Enlighted Sensor Unit connects to the LumaWatt Pro with Enlighted Control Unit (CU) via a supplied cable or a Philips XSR type driver. The entire system is managed by the Energy Manager (EM) via Gateways (GW) and PoE switches using wireless communication. Wireless devices are based on the 802.15.4 technology. The CU is mounted in a lighting fixture or an approved enclosure. In the case of fluorescent lighting, the CU is installed inside the ballast cavity next to the dimming ballast. The CU may be used to control fluorescent, HID or LED systems controllable with a 0-10V input. The sensor is connected to the light fixture which helps in establishing control. The Sensor Unit communicates wirelessly with the gateway. The gateways on each floor are connected to the Energy Manager through a POE Switch (Network Switch). The EM is connected to the Local Network through a POE switch (Network Switch) and is assigned a designated static IP address.

D. Operator's Software

1. User programming and editing may be conducted online in web-based software. Data shall be entered through a simple menu-driven user interface. The operators' software provides all the information to the user regarding the consumption and saving of the energy utilized in the building environment. The basic operating software shall provide the following:

a. Site wiring documentation for all connected fixtures and system components shall be in O&M manual and project submittals. Reflected ceiling plan shall also be present in the software to show the location of components.

b. English descriptions of each circuit switch and calculated load.

c. Monitor/Control all fixtures.

d. Software shall show actual fixture states, with an optional menu showing how and when the fixture change occurred.

2. System Parameters:

a. System software to be sized based appropriately for the system which can be an unlimited number of fixtures. Any number of sites may be programmed from a single user interface.

b. Password features shall be allowed per site.

c. Configure software to automatically contact remote sites using a modem or I/P address.

d. Maximum CAT 5e cable distance between the LumaWatt Pro with Enlighted Energy Manager and a network switch, an LumaWatt Pro with Enlighted Gateway and a network switch or a network switch to a network switch is 330 feet. Care shall be taken when routing the cable to not exceed the 330-foot limitation including travel distance up and down structures.

E. Central Programming, Monitoring and Control Work Station

1. The control work station (LumaWatt Pro with Enlighted Energy Manager) shall provide monitoring, programming and control of the system. The system shall be shipped complete with all memory, cables, and peripheral devices. The complete system shall be factory tested prior to shipment. The system shall include at a minimum:

a. Energy Manager (Lanner Celeron)

1) 0-1,200 devices.

2) Memory: 4 GB

3) CPU: Intel Celeron J1900, 2 GHz

4) Hard Disk: 128 GB SSD

b. Mid-Range Energy Manager (Lanner i7)

1) 0-7,500 devices.

2) Memory: 8 GB

3) CPU: Intel i7-3517UE, 2.8 GHz

4) Hard Disk: 128 GB SSD

c. Enterprise Energy Manager (Dell)

1) 0-18,000 devices.

2) Memory: 16 GB

3) CPU: Intel Xeon E5-2600v3 with 8 cores

4) Hard Disk: 1 TB (2-500 GB Sata)

F. Ethernet Multi-User Connectivity-Weblink

1. The EM has 2 network cards. 1 of the network cards connects it to the intranet and the other network card connects the EM to the building network via PoE switch (Network Switch). The EM GUI runs in a web browser, such as Internet Explorer, Firefox, Safari or Chrome.

G. Scheduling Profile and Groups

1. Profile

a. “A lighting profile”, which is typically shortened to just profile, is a named set of configuration values that determine the setting of the light level of the luminaire (lighting fixture). The configuration values are used by the intelligence in the fixture along with the current operational mode, past and present sensor values, time of day, day of the week,

and passage of time to control the light level. How the light is turned on and off and the light level set, is called the behavior of the light.

2. Groups

a. "Groups of fixtures" is a new foundation technology added to the LumaWatt Pro with Enlighted software. Groups are used to allow all fixtures in the same group to share their occupancy state. Such groups are called a motion group.

b. Motion Group

1) The use for motion groups is for all fixtures in a room (e.g. conference room) to change to the occupied state (typically resulting in a fixture turning on their lights) when any fixture senses occupancy, and for all fixtures in a room to stay in the occupied state as long as any fixture senses occupancy.

2) Without the motion group capability (and configuration), lights at the *far end* of a *large room* will not sense an occupant entering the room and then adjust their light level.

3) With the motion group capability being configured for all of the fixtures in the room, when an occupant enters the room, the detection is communicated to all members of the group, and all fixtures will then react to the occupant and adjust their light levels according to their configuration. And when the room is occupied, this state is communicated to all members of the group. This typically results in all fixtures in the conference room staying lit while the room is occupied.

H. Daylighting Controls

1. LumaWatt Pro with Enlighted Sensor (Daylight)

a. The LumaWatt Pro with Enlighted Sensor (sensor) shall have the ability to sense daylight in the surrounding areas. This feature shall allow the automatic reduction of ambient lighting levels when sufficient daylight is present to maintain the programmed foot-candle levels. The daylight sensing feature shall be included in one sensor that also has the ability to sense motion, temperature control and individual energy monitoring.

I. Motion Controls

1. LumaWatt Pro with Enlighted Sensor (Passive Infrared-PIR)

a. The LumaWatt Pro with Enlighted Sensor (sensor) shall have the ability to sense motion through passive infrared detection in the surrounding areas. This feature shall allow the automatic activation of lighting to preset levels when motion is detected and provide the automatic reduction of lighting to preset levels when no motion is sensed after the programmed time-out period. The motion sensing feature shall be included in one sensor that also has the ability to sense daylight, temperature control and individual energy monitoring.

b. Areas larger than 100 square feet shall require 4 levels of lighting control or be fully dimmable.

1) Fixtures must be dimmable with 0-10 volt drivers or ballasts.

J. Energy Dashboard

1. LumaWatt Pro with Enlighted Energy Manager

a. The LumaWatt Pro with Enlighted Energy Manager shall have the ability to provide real-time graphic information concerning the energy usage of the individual lighting fixtures. This information shall include but not be limited to:

1) Displaying the building floor plan with the “ON” or “OFF” status of each light and the ability to zoom into to any fixture and get expanded operating information.

2) Providing real-time information for any lights that are not functioning and the date when they stopped working.

3) Employee flow patterns to see areas that are being used or not used.

4) Temperature graphs to show areas that might be too hot during certain times of the year to allow targeting of these areas requiring additional shading or areas that are too cold allowing adjustment of the HVAC system to compensate.

5) Sunlight penetration patterns throughout the year.

6) After-hours detection of anyone entering or leaving the building.

7) Enhanced security by documenting date, time and path or any entry into the building.

8) Remote troubleshooting of the system.

9) Reports that show variance reporting from historical averages.

10) Real-time views of building energy usage through a local monitor.

K. Shading Control

1. LumaWatt Pro with Enlighted Energy Manager

a. When used with a supplemental interface, the LumaWatt Pro with Enlighted Energy Manager shall have the ability to integrate with a third party shading controller that provides dry contact closures to facilitate the opening of a shade if there is too little ambient light or closing of the shade if it is too bright or a meeting requires reduced lighting levels for a presentation.

1) The level of automatic control shall be shades open or shades closed.

L. Security/Fire-Life Safety Control

1. LumaWatt Pro with Enlighted Energy Manager

a. When used with a supplemental contact closure interface, the LumaWatt Pro with Enlighted Energy Manager shall have the ability to communicate with security, fire-life safety systems and override designated groups that are connected to a Building Management System to have full output:

1) Local LumaWatt Pro with Enlighted Sensors shall provide input to detect after-hours movement for security and the location of occupied spaces for fire-life safety situations to assist support personal in locating and evacuating individuals.

2) When a password is provided, the LumaWatt Pro with Enlighted Energy Manager shall have the provision to be accessed via the internet by outside law enforcement or fire fighters for system access to determine areas of occupancy.

M. Exhaust Fan Control

1. LumaWatt Pro with Enlighted Plug Load Controller

a. Working in conjunction with the LumaWatt Pro with Enlighted Sensor for lighting, the LumaWatt Pro with Enlighted Plug Load Controller can provide “ON” control of

exhaust fans when an individual enters the space and “OFF” control to minimize energy usage when spaces are unoccupied.

1) Provides automated exhaust fan control so no separate switch is required to turn “ON” or “OFF” exhaust fans.

2) Suitable for restrooms and kitchen areas.

3) The LumaWatt Pro with Enlighted Plug Load Controller communicates wirelessly with the LumaWatt Pro with Enlighted Sensor that is used for lighting within that dedicated space.

N. Private and Open Office Plug Load Control

1. LumaWatt Pro with Enlighted Plug Load Controller

a. Working in conjunction with the LumaWatt Pro with Enlighted Sensor for lighting, the LumaWatt Pro with Enlighted Plug Load Controller can provide “ON” and “OFF” control of dedicated receptacles to minimize energy usage for monitors and other non-essential employee personal devices when spaces are unoccupied.

1) The LumaWatt Pro with Enlighted Plug Load Controller communicates wirelessly with the LumaWatt Pro with Enlighted Sensor that is used for lighting within that dedicated space. Plug load control is one 20-amp circuit in and two 20-amp switch legs out. One switch leg is controlled and the other switch leg is not controlled. Both switch legs shall have a utility grade power chip to monitor usage. The receptacle designated as “controlled” shall be supplied by others and marked in a manner which shows that the receptacle is controlled.

O. Lighting Fixture Metering

1. LumaWatt Pro with Enlighted Sensor

a. The LumaWatt Pro with Enlighted Sensor (sensor) shall have the ability to provide metering of each lighting fixture that contains a sensor. The sensor data shall be archived on the Energy Manager. The energy monitoring feature shall be included in one sensor that also has the ability to sense motion, daylight and temperature control.

P. User Control

1. LumaWatt Pro with Enlighted Energy Manager

a. If employee level control of local lighting fixtures is allowed, the LumaWatt Pro with Enlighted Energy Manager shall allow individual users the ability to dim those lights immediately adjacent to their work area.

1) Minimum and maximum lighting levels can be programmed that won’t allow individual users to go above or below certain levels during prescribed hours.

Q. Demand Response Control

1. LumaWatt Pro with Enlighted Energy Manager

a. For buildings 10,000 square feet or greater and upon notification by the local utility, the LumaWatt Pro with Enlighted Energy Manager shall automatically reduce lighting loads by 15% for the building when directed by the Building Management System (BMS).

1) Depending upon the type of BMS, a supplemental interface may be required for the LumaWatt Pro with Enlighted Energy Manager.

2) The 15% lighting level reduction shall occur uniformly across all areas programmed to reduce lighting power for Demand Response and Automated Demand Response events.

a) LumaWatt Pro with Enlighted is Open Automated Demand Response (OADR 2.0a) compliant.

b) Allows option for owner manually initiated Automated Demand Response to be able to lower power consumption during peak demands.

R. Intelligent Lighting Control

1. LumaWatt Pro with Enlighted Energy Manager

a. The LumaWatt Pro with Enlighted Energy Manager shall provide lighting controls that react to the time of day, working environment lighting requirements, daylighting, ambient lighting levels and level of activity within the building.

S. Advanced System Integration

1. Contact Closure Interfaces for Conference Rooms

a. When used with a supplemental interface, the LumaWatt Pro with Enlighted Energy Manager shall integrate with conference room scheduling systems and local AV controls through third party dry contact closure interfaces or the LumaWatt Pro with Enlighted Energy Manager REST API.

1) AV control systems like Crestron have the capacity to integrate with the LumaWatt Pro with Enlighted Energy Manager.

2. Contact Closure Interfaces for Shading Control

a. When used with a supplemental interface, the LumaWatt Pro with Enlighted Energy Manager shall have the ability to integrate with a third party shading controllers that provides dry contact closures or by using the Energy Manager REST API to facilitate the opening of a shade if there is too little ambient light or closing of a shade if it is too bright or a meeting requires reduced lighting levels for a presentation.

1) The level of automatic control shall be shades open or shades closed.

3. Other integration can be accomplished through TCP/IP.

T. Building Management System (BMS) Integration/BACnet/IP Protocol Implementation Statement (PICS)

1. BACnet/IP module, which is a licensable feature on the Energy Manager that allows integration of the LumaWatt Pro with Enlighted Lighting System with Building Management Systems (BMS) over BACnet/IP. The following functionality can be achieved using this interface:

a. Read Energy Consumption for Lighting and Plug Loads at aggregate and sensor level.

b. Dim individual or groups of sensors.

c. Issue emergency signal and turn lights on at area and Energy Manager level.

d. Issue a Demand Response Signal.

e. Control individual Plug Loads.

f. Find out occupancy at Area level.

g. Other integration can be accomplished through TCP/IP for digital interfacing.

2. The LumaWatt Pro with Enlighted Lighting BACnet/IP interface enables BACnet/IP based integration between the LumaWatt Pro with Enlighted lighting control network and any BACnet

compatible Building Management System (BMS). The lighting BACnet/IP software installed in the LumaWatt Pro with Enlighted Energy Manager provides seamless integration between the LumaWatt Pro with Enlighted network and BMS system via BACnet.

3. LumaWatt Pro with Enlighted BACnet lighting exposes LumaWatt Pro with Enlighted lighting objects over BACnet/IP. After the module is installed in the Energy Manager, the lighting objects can be monitored and controlled via BACnet/IP interface.

4. The Lighting BACnet/IP interface can be configured to run in the following two modes:

    a. Default Mode: This mode provides data for all BACnet/IP objects for each group. For example - Area, Energy Manager.

    b. Detailed Mode: This mode provides data for all BACnet/IP objects for all group and individual points. For example - Energy Manager, Area, Fixture and Plug Load.

U. Contact Closures

1. LumaWatt Pro with Enlighted Contact Closure I/O Device

    a. The Contact Closure I/O device bridges the LumaWatt Pro with Enlighted sensors and devices with the LumaWatt Pro with Enlighted Lighting Control network. When the Contact Closure input ports are triggered, it broadcasts to the LumaWatt Pro with Enlighted Lighting Control network to perform the required function, which is determined by programming from the Energy Manager Graphical User Interface (GUI). We support 10 devices per Energy Manager, each of which can support 40 inputs.

    b. Features

        1. Optimize Safety: When power is switched off in a building or area for any reason, the Contact Closure forces all lights to turn on when desired.

        2. Better Control: The Contact Closure can be programmed to turn all or selective lights to any light level including full-on. One or more switch groups in an area control the lights providing the most flexibility in managing fixture light levels.

        3. Increase Energy Savings: By returning all lights to normal lighting profiles specified in the LumaWatt Pro with Enlighted lighting network, the Contact Closure eliminates energy waste due to lights turned on to the maximum capacity.

    c. Programmed Digital Inputs

        1. Set all fixtures in Energy Manager to any preferred light level

        2. Set all fixtures in Switch Group to Scene in order to manage a sub-group of fixtures

        3. Set all fixtures to Auto mode to default to profile settings

        4. No Action

2.5 BALLASTS/DRIVERS

A. Product: 0-10V dimmable programmable ballast OR 0-10V dimmable LED power electronics.

2.6 MANUAL OVERRIDE CONTROLLERS

A. Wireless LumaWatt Pro with Enlighted Room Controllers (ERC).

B. Product: LumaWatt Pro with Enlighted Room Controller

C. Components:

1. 4 button control key pad

2. Digital Temperature Sensor

3. Communication Mechanism

    a. Low power 2.4 GHz Transceiver for IEEE 802.15.4

4. Security
    a. AES 128 encryptions
5. Other:
    a. CR2025 battery (7-year life)
6. Digital addressable systems require reprogramming when ballasts or drivers fail. Without a visible unique serial ID, extensive documentation and additional support is required to replace multiple ballasts or modules.

D. Operations:

1. Room controller shall be battery powered and wirelessly communicate with the sensors. Battery shall be available through commercial retailers.
2. Room controller shall have the ability to be programmed to allow for a space to be controlled with an Auto-on / Auto-off control strategy or a Manual-on / Auto-off control strategy.
3. Room controller shall have the ability to brighten, dim, turn on and off fixtures.
4. Room controller shall have the ability to recall 6 user programmable scenes and each scene can be remotely adjusted.
5. Room controller shall make a temperature reading any time one of its buttons is depressed and shall wirelessly transmit the temperature data to the sensors it controls.

2.7 GATEWAYS

A. Product: Gateway

B. Components:

1. Low power 2.4 GHz Transceiver for IEEE 802.15.4
2. Electrical/Connections:
3. Gateways shall wirelessly collect data from sensor units and relay it to the Lighting Energy Manager.
4. Gateways shall communicate over IP to Lighting Energy Manager.
5. Gateway connection cables shall be plenum rated.
6. Gateways shall be Powered-over-Ethernet at 48V.
7. Gateway Units shall be FCC Part 15 Class A, RoHS certified.
8. Gateways shall be Class 2 devices.

C. Operations:

1. Gateways are used for information gathering and commissioning communications only; lighting control remains with the individual sensors and power packs.
2. Gateways are used for information gathering and commissioning communications only; lighting control remains with the individual sensors and power packs.
3. Data Collection Mechanism:
    a. Gateways shall communicate with sensors wirelessly via 802.15.4 protocol.
    b. Gateways communications frequency shall be RF 2405-2480MHz.
    c. Gateways shall support AES 128-bit encryption.

2.8 ENERGY MANAGEMENT HARDWARE

A. Product: Lighting Energy Management Server

B. Operations:

1. Used 24 hours per day, 7 days per week to program, monitor, control, and provide data logging of digital network lighting controls.

2. Server can either be local (at the client site) or cloud-based.

3. Server software preinstalled and tested prior to shipping.

OR

4. Cloud-based server configured and tested by the manufacturer before being operated at client.

5. Server data can be accessed through a secure web portal assigned by I.T. personnel.

2.9 ENERGY MANAGEMENT SOFTWARE

A. The LumaWatt Pro with Enlighted Energy Manager shall be comprised of one of the configurations listed below. The system shall include at a minimum:

1. Energy Manager (Lanner Celeron)

a. 0-1,200 devices.

b. Memory: 4 GB

c. CPU: Intel Celeron J1900, 2 GHz

d. Hard Disk: 128 GB SSD

2. Mid-Range Energy Manager (Lanner i7)

a. 0-7,500 devices.

b. Memory: 8 GB

c. CPU: Intel i7-3517UE, 2.8 GHz

d. Hard Disk: 128 GB SSD

3. Enterprise Energy Manager (Dell)

a. 0-18,000 devices.

b. Memory: 16 GB

c. CPU: Intel Xeon E5-2600v3 with 8 cores

d. Hard Disk: 1 TB (2-500 Sata)

B. Provide system software license that is designed, tested, manufactured, and warranted by a single manufacturer.

C. Graphical User Interface:

1. Software shall be capable of loading floor plans of the installation and showing sensors appropriately located on each floor plan.

2. The GUI shall show real time occupancy, energy use and on/off control for each sensor on the floor plan.

3. The GUI shall clearly show distinct savings from task tuning, daylight harvesting, and occupancy sensing.

D. Lighting Profiles

1. GUI system shall facilitate mass-updating of sensor profiles by drag-and-dropping sensor units into desired profile setting. Profiles shall be available and preconfigured based on room type and to be compliant with Title 24 2016, ASHRAE 90.1 2013 and IECC 2015.

2. User shall have the ability to update profile descriptions, including but not limited to:
    a. Time-of-day cutoffs
    b. Light levels when occupied
    c. Ramp up and ramp down speed
    d. Time delays
    e. Sensor sensitivity

E. Data Access

1. Energy Management System shall have the ability to integrate with building management systems and building automation systems via BACnet, ModBus.

2.10 PLUG LOAD CONTROLLER

A. Product: Digitally addressable, single relay, plug load controller. Includes utility grade metering for controlled and uncontrolled outlets. Controllers shall be capable of controlling one or more outlets up to 20A.

1. Plug load controller is paired with a sensor or group of sensors in the control, configured at the sensor during system setup. Plug load controllers shall be simple to install, fitting onto a standard junction box.

B. Operation:

1. Each controller shall be configurable to operate in the following sequences based on occupancy:
    a. 1) Auto-on/Auto-off; 2) Manual-on/Auto-off.
    b. The controller(s) shall also be configurable to operate in the following sequences based on scheduled control based on Normal hours/After-hours basis: 1) Scheduled ON / OFF; 2) Manual ON / Scheduled OFF.

2. Each controller shall be configurable for ADR or holiday events.

3. Data Collection: Plug load controllers shall communicate with sensors wirelessly via 802.15.4 protocol.

4. Communications frequency shall be RF 2405-2480MHz.

2.11 DATA TRANSMISSIONS SHALL COMPLY WITH AES 128-BIT ENCRYPTION SOURCE QUALITY CONTROL

A. Perform full-function testing on all completed assemblies at end of line. Statistical sampling is not acceptable.

PART 3- EXECUTION

3.1 INSTALLATION

A. Product: Digitally addressable, single relay, plug load controller. Includes utility grade metering.

B. Install equipment in accordance with manufacturer's installation instructions.

C. Provide complete installation of system in accordance with Contract Documents.

D. Provide dedicated network between Gateways and Sensors.

E. Provide equipment at locations that are adjusted for field conditions and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

F. Contractor shall be responsible for installing in the field LumaWatt Pro with Enlighted Control Units in all fixtures that contain any type of LumaWatt Pro with Enlighted sensor. They may also be installed in junction boxes if there isn't sufficient space within the fixture. For exterior sensors, contractor shall also provide a wet location enclosure that can house the LumaWatt Pro with Enlighted Ruggedized Sensor and LumaWatt Pro with Enlighted Control Unit.

G. Contractor shall either purchase the LumaWatt Pro with Enlighted sensor and LumaWatt Pro with Enlighted Control Unit preinstalled in all fixtures or the contractor has the option of field installing the components, if a manufacturer won't preinstall the system or cannot due to space considerations. The contractor shall determine prior to bid whether or not he must include labor in his proposal to field install LumaWatt Pro with Enlighted components. No change orders will be allowed for field installation of any LumaWatt Pro with Enlighted components. Check LumaWatt Pro with Enlighted website for the most current list of LumaWatt Pro with Enlighted Luminaire OEM partners or call LumaWatt Pro with Enlighted for inquiries on specific fixtures and manufacturers that integrate LumaWatt Pro with Enlighted sensors and control units.

H. All suspended fixtures shall have integral LumaWatt Pro with Enlighted sensors and LumaWatt Pro with Enlighted Control Units unless the manufacturer cannot preinstall the LumaWatt Pro with Enlighted components due to space limitations. The LumaWatt Pro with Enlighted sensors shall be integrated into the bottom of the fixture for a seamless appearance. The contractor shall be responsible for field modifying the suspended fixtures, if the manufacturer doesn't preinstall the components. The contractor shall contact Ed De Sousa at LumaWatt Pro with Enlighted at 408-687-7202 for any questions concerning options for field mounting sensors integral to the fixture body. LumaWatt Pro with Enlighted sensors should not be field installed behind the fixture lens as it will interfere in the operation of the PIR function, but rather in the fixture body. The contractor shall be responsible for providing a warranty that supersedes the factory warranty on any lighting fixtures that are field modified for a period of 1 year after date of installation.

I. LumaWatt Pro with Enlighted shall provide a Sequence of Operations for typical control scenarios based on the room or exterior area usage. This document shall be used to program the LumaWatt Pro with Enlighted 4 Button Control Keypad and the Energy Manager.

3.2 SERVICE AND SUPPORT

A. Startup and Programming

1. Provide certified factory field service engineer to make minimum of two site visits to ensure proper system installation and operation under following parameters
    a. LumaWatt Pro with Enlighted shall be notified a minimum of (2) weeks prior to requiring the site visit.

2. Qualifications for factory certified field service engineer:
    1. Certified by the equipment manufacturer on the system installed.

3. Make first visit upon completion of installation of LIGHTING CONTROL SYSTEM:
    1. Verify connection of sensor units to controllers and ballasts/drivers.
    2. Place sensors onto the user-provided floor plan in the lighting energy management

server.

3. Verify that system operation control shall be programmed based on sequence of operations (SOO).
4. Obtain sign-off on system functions.

4. Make second visit to demonstrate and educate Owner's representative on system capabilities, programming, fine tuning and maintenance.
   a. Due to building operations, start-up of Lighting Control System may be required outside of normal business hours (Monday through Friday, 7 a.m. to 5 p.m.).

3.3 CLOSEOUT ACTIVITIES

A. Training Visit

1. Lighting control system manufacturer to provide [1] day additional on-site system training to site personnel. This shall be a part of the second visit by field service to the site. A separate third visit will require an additional charge.

2. For LEED projects, manufacturer shall conduct an on-site walkthrough to demonstrate system functionality to a Commissioning Agent.

3. During this visit, the manufacturer's Field Service Engineer will perform tasks, at the request of the facility representative or Commissioning Agent, such as to demonstrate wall control functions, explain or describe occupancy and/or daylight sensor functionality.

B. On-site Walkthrough

1. Lighting control system manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.

3.4 MAINTENANCE

A. Capable of providing on-site service support within 48 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup. Additional service contracts and warranties need to be verified as being available.

C. Prior to bid, confirm if an on-site meeting between the Lighting Control System Manufacturer and a Facility Representative will be required to evaluate system usage after the building has been in operation for a predetermined period of time. If a field service visit is required for Acceptance Testing or building commissioning, it shall be as an additional charge unless specifically stated in the specification and confirmed on the LumaWatt Pro with Enlighted bill of materials.

END OF SECTION