SECTION 260943.13
DIGITAL - NETWORK LIGHTING CONTROLS
WAVELINX WIRELESS LIGHTING CONTROL SYSTEM

This specification was updated January 1, 2017 and supersedes all previous WaveLinx specifications.

This section includes editing notes. These notes are hidden and can be viewed by:
Microsoft Word: From the FILE menu select OPTIONS, then DISPLAY. Under the DISPLAY VIEW, select or deselect the HIDDEN TEXT option and click OK.

PART 1- GENERAL

1.1 SUMMARY

A. The following specification details the minimum compliance and related criteria for a complete and fully operational wireless digital addressable lighting control system for all interior lights.

1.2 REFERENCES

A. American National Standards Institute/ (ANSI) (www.ansi.org)

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)

D. International Organization for Standardization (ISO) (www.iso.ch)

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 wireless 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. Load management.
6. Multi-level scene control
7. Scheduling
8. Demand Response
9. Task Tuning.
10. Power measurement data reporting.
11. Mobile device configuration and control
12. Automatic Code Commissioning

13. The wireless 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.

14. The wireless lighting control system shall provide network communication of all sensor and device data for all light fixtures including power measurement, occupied/unoccupied status, scene status and daylight information.

15. The wireless lighting control system shall provide out-of-the-box functionality of all light fixtures with integrated sensors providing occupancy automatic ON to 75% light level and automatic OFF after 20 minutes. Systems that do not include out-of-the-box functionality shall not be acceptable.

16. The wireless lighting control system shall provide a method for the installer to verify wireless communications and address all wireless devices with a single push button. Systems that require device addressing using a manual data entry method through software shall not be acceptable.

17. The wireless lighting control system shall provide visible indication on all wireless devices when as each wireless device joins the wireless network. Systems that do not provide a visual indicator per device to the installer shall not be acceptable.

18. The wireless lighting control system shall provide the capabilities for the installer to create a construction group of all wireless occupancy sensors and wireless wallstations to control all installed wireless light fixtures.

19. The wireless lighting control system shall be able to be completely programmed and configured using a mobile application. Systems that require web or PC software for configuration shall not be acceptable.

20. The wireless lighting control system shall allow addressed wireless light fixtures with integrated sensors to be identified by shining a laser or bright flashlight into the sensor. Identified light fixtures shall provide visible indication on the mobile application. Systems that do not permit reverse identification method shall not be acceptable.

21. The wireless lighting control system shall allow wireless wallstations, receptacles, relays and remote sensors to be identified by simple pushbutton method on each device. Identified devices shall provide visible indication on the mobile application. Systems that do not permit
The reverse identification method shall not be acceptable.

The wireless lighting control system includes the following components:

22. Integrated sensors shall include passive infrared sensor, digital photocell, microprocessor, a wireless radio (IEEE 802.15.4), and a load controller for ON/OFF/DIM.

23. Relay Switchpack with 0-10V control shall contain a utility grade power meter chip and a latching relay to control 20Amp load and 120mA 0-10V sink. Device shall include LED indication and pushbutton for device override and identification.

24. Tilemount daylight sensor shall include a digital photocell, microprocessor, a wireless radio (IEEE 802.15.4), and a load controller for ON/OFF/DIM.

25. Wallstation shall be mains powered (120/277VAC), including the following features:
   a. Numerous button configurations, supporting small and large engraved buttons
   b. Individual button LED indication
   c. Universal light icon with raise/lower buttons
   d. Each button fully programmable for Area Scene or Zone control
   e. Wireless radio (IEEE 802.15.4)

26. Battery powered, wireless ceiling sensor shall include passive infrared sensor, microprocessor, a wireless radio (IEEE 802.15.4), LED indication and pushbutton for device identification.

27. Receptacle control shall include a constant hot and controlled plug output.
   a. The receptacle control shall provide a single input for incoming power, devices that require constant hot and switched inputs shall not be acceptable.
   b. The receptacle control shall be clearly marked “Controlled” and with the NEMA defined controlled symbol 🗓️
   c. The receptacle control shall include a wireless radio (IEEE 802.15.4) to provide control and power measurement data.

28. Wireless Area Controllers shall wirelessly communicate (IEEE 802.15.4) with all sensors, wallstations, relays, and receptacles to coordinate control areas, and zones. The Wireless Area Controller shall support the following features:
   a. Multiple wireless radios
   b. Power over Ethernet connection to building LAN
   c. Up to 16 areas
   d. Up to 16 zones per area
   e. Area scene configurations
   f. Multiple occupancy sets per area
   g. Multiple daylight sets per area
   h. Demand Response reduction values
   i. Scheduling configuration
   j. Configuration backup and restore capabilities
   k. Automatic Code Commissioning

29. Mobile application shall communicate using Wi-Fi to a single Wireless Area Controller or a building IT network with multiple Wireless Area Controllers. The Mobile application shall include the following features:
a. Ability to connect to multiple Wireless Area Controllers
b. Administrative and user login credentials
c. Demonstration and Live mode
d. Automatic Code Commissioning
e. Drag and drop or multi select programming of wireless lighting system

30. LIGHTING CONTROL APPLICATIONS
   a. Minimum lighting control performance required, unless local Energy Code is more stringent.
   b. Occupancy/vacancy requirements – Provide an occupancy/vacancy sensors with Manual On/ Automatic Off or Automatic On/ Automatic Off functionality in all spaces. Manual On vacancy sensors should be used for any enclosed space with a Manual On switch that does not require hands free operation. Spaces with multiple occupants or where line of sight might be obscured ceiling or corner mount sensors and Manual wallstations would be required. Automatic On of lighting via occupancy sensor cannot exceed 50% of lighting. Systems that do that allow the user to select Occupancy or Vacancy Mode shall not be acceptable.
   c. Bi-Level switching – Provide multi-level switching and/or variable dimming for maximum energy savings. (Qualifies for EPACT tax deductions of $0.60 per foot)
   d. Task Lighting / Receptacle Control – Provide automatic shut off of non-essential plug loads and task lighting in all spaces. Provide Manual On or Automatic On of receptacles whenever spaces are occupied. Receptacle Control will only be shut off when no occupancy is detected within the space. Systems that do not provide receptacle control for a full 20 Amp circuit shall not be acceptable.
   e. Daylight Zones – Primary sidelit or toplit areas within an enclosed space shall be controlled separately and automatically by individual integrated daylight sensors. Adjustments to the daylight zones must be provided by a simple to use, intuitive mobile application.
   f. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to dim electric light to the lowest light level and OFF.
   g. Provide the ability to adjust the high end and low end trim of the dimmers to ensure the lighting automatically provides energy saving even when daylighting calls for full illumination.
   h. Provide the ability for the dimmers and the relays to function separately. Systems where the 0-10V dimmers and relays are tied together reduce design capabilities and shall not be acceptable.
   i. Shall be capable of automatically responding to a Demand Response Signal and adjusting the lighting level, without the need of programming or software. Systems that require software or commissioning to provide Demand Response integration shall not be acceptable. (Required for California Title 24 2013)
   j. Additional controls:
   k. Provide occupancy or vacancy sensors (Auto On or Manual On) for any enclosed office, conference, meeting or training rooms. Spaces with multiple occupants or where line of sight may be obscured require ceiling or wall/corner mounted sensors with Manual On switches.
   l. Conference, meeting, training, auditoriums and multi-purpose rooms shall have controls that allow for scene based and independent control of each output. Rooms larger than 300 square feet shall support at least four (4) pre-set lighting scenes. Occupancy or vacancy sensors shall ensure all lighting, receptacles.
m. Egress lighting control shall be integral to the system. The system shall provide an automatic control of adjacent corridor and/or egress lighting based upon room occupancy. Systems that do not ensure that adjacent corridor and/or egress lighting is controlled with room occupancy shall not be acceptable.

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 typical application installation configurations.
   c. Wiring diagrams for typical device 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 2016, IECC 2015, or any newer versions of these codes).

6. Provide a description of the system.

7. System setup and programming to be provided by installer, certified technician or factory field service personnel.
   a. This will involve an additional charge.

8. Follow-up by Field Services for “fine tuning” and additional configuration to occur approximately 90 days after system turnover.
   a. This will involve an additional charge.

9. Re-occurring service contractor for site audit and continuing configuration on a 1, 2, or 3 year schedule after system turnover.
   a. This will involve an additional charge.

1.5 CLOSEOUT SUBMITTALS

A. Sustainable Design Closeout Documentation.

B. Wireless 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 shall have at least 10 years of experience in the manufacture of lighting control systems. Manufacturers that do not have at least 10 years experience shall not be acceptable.
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 DELIVERY, STORAGE AND HANDLING
A. The contractor is responsible for complete installation of the entire system according to strict factory standards and requirements.
B. Packaging: All components of the lighting control system shall be packaged in a single box as a QuicKit or as individual components. The QuicKit catalog number will be marked on package label along with bill of materials. Individual component packages will be marked with product catalog number.
C. Handling: Packaging will include clear installation instructions for all components with typical illustrations of installation locations and connections. The installing contractor can easily match each package to the layout on the design floor plans.

1.9 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. Wireless 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).
   6. Coordinate layout and installation of luminaries and controls with other construction.
   7. Coordinate site commissioning with manufacturer no less than 21 days prior to required date.
1.10 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 shipment.

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

3. Eaton wireless fixtures with standard 0-10V dimmable ballast or driver module warranty is [5] years. When purchased with the WaveLinx Wireless Lighting Control system this warranty shall also be [5] years by the lighting fixture manufacturer.

4. Extended warranty options may be provided for an additional charge to extend the system warranty to a total of ten [10] years.

5. Recommended extra materials:
   a. WaveLinx Ceiling Sensors: Provide 1 of each product type for every 200 installed, to be used for maintenance.
   b. Tilemount Daylight Sensors: Provide 1 of each product type for every 100 installed, to be used for maintenance.
   c. WaveLinx Wallstations: Provide 1 of each product type for every 200 installed, to be used for maintenance.
   d. WaveLinx Receptacle: Provide 1 of each product type for every 100 installed, to be used for maintenance.
   e. WaveLinx Relay Switchpack: Provide 1 of each product type for every 200 installed, to be used for maintenance.
   f. Wireless Area Controller: Provide 1 of each product type for every 100 installed, to be used for maintenance.

1.11 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: Eaton WaveLinx Wireless Connected Lighting (WCL) system

B. Substitutions: [Not Permitted]

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

2. Any substitutions provided by the contractor shall be reviewed at the contractor’s expense by the electrical engineer at a rate of [$200.00] per hour.

3. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design, highlighted in an alternate color, to the engineer for review and approval prior to rough-in.

2.2 CONNECTED DEVICES

A. Load control devices.

1. Product: WaveLinx Relay Switchpack with 0-10 [WSP-MV-10]
   a. Plenum rated
   b. Integrated, self-contained unit consisting internally of an isolated load switching control relay [and a power supply to provide low voltage power].
      1. 20amp 120/277VAC General Purpose
      2. 16amp 120/277VAC electronic ballast (LED load)
      3. Single class 2 0-10V dimming output (IEC 60929 Annex E) sinks up to 120mA per (40 μA max per circuit leakage to line)
      4. 0-10V output supports up to 60 ballasts/drivers that draw a standard 2mA each
   c. Power measurement accuracy of 5%, reporting data to the Wireless Area Controller for display on the WaveLinx Mobile Application
   d. Shall be compatible with electronic ballast, LED, incandescent, magnetic or electronic low voltage, and magnetic or electronic fluorescent, as well as motor loads.
   e. Shall be capable of controlling up to 20Amp receptacle or plug loads.
   f. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.
   g. Relay Switchpack shall be FCC certified.
   h. Relay Switchpack shall be a Class 1 device

   a. Integrated, self-contained unit providing a constant hot plug connection and a controlled plug connection.
      1. 15amp 120VAC constant hot
2. 15amp 120VAC controlled load
   b. Controlled load plug shall be labelled with “Controlled” and NEMA standard symbol for controlled plug loads.
   c. Power measurement accuracy of 5%, reporting data to the Wireless Area Controller for display on the WaveLinx Mobile Application
   d. Shall provide LED indication of status and wireless communication as well as override button.
   e. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.
   f. WaveLinx Receptacle shall be FCC certified.
   g. WaveLinx Receptacle shall be a Class 1 device

B. Control devices.

   a. Mains powered wireless wallstation providing multi-level control of an area or zone
      1. 120VAC input
   b. Shall provide individual button LED indication of status and wireless communication as well as selected button.
   c. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.
   d. WaveLinx Wallstation shall be FCC certified.
   e. WaveLinx Wallstation shall be a Class 1 device
   f. Wireless momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:
      1. Multi-level scene selection
      2. Scene raise/lower
      3. Toggle ON/OFF
      4. Removable buttons for field replacement with engraved buttons and/or alternate color buttons [ENGRV-*BTNLS-*]. Button replacement may be completed without removing the switch from the wall.
      5. Intuitive button labeling to match application and load controls.
      6. Pre-defined digital button configurations. Each wallstation is shipped with pre-defined digital button configurations which are automatically mapped to specific area/zone controls when added to an area in the WaveLinx Mobile Application.
   g. Multiple WaveLinx wallstations may be installed in an area by simply connecting them to the WaveLinx network. No additional configuration will be required to achieve multi-way switching.
   h. WaveLinx wallstations are delivered with pre-defined functions including, raise, lower, Half Lights, Full Lights, Read, Relax, Dimmed, Night, manual and scene control.
   i. Optional custom labeling is available for application or location specific wallstation button labels.
2.3 CONNECTED SENSORS

A. Ceiling mounted or fixture integrated sensors.

1. Product: WaveLinx Ceiling Sensor [CWPD-1500]
   a. Sensing mechanism
      1. [Infrared]: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
   b. Power failure memory
      1. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.
   c. Products tested in identical manner, complaint to NEMA WD 7-2011 Occupancy Motion Sensors Standards
   d. Sensor shall have time delays from 10 to 20 min
   e. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation
   f. Sensor is battery powered by standard AA batteries
   g. Sensor provides indication of battery life through the WaveLinx Mobile Application
   h. Sensor battery life shall be 10 years based on approximately 30 activations and wireless signals per day.
   i. Sensors shall monitor changes in occupancy, changes in ambient light levels and communicate digital control commands to light fixtures according to a control strategy.
   j. Sensor shall wirelessly transmit occupancy; light level, power to the WaveLinx Wireless Area Controller which allows the data to be stored in a central location on premises and displayed via the WaveLinx Mobile Application.
   k. 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.
   l. Sensors have remotely adjustable settings for dimming levels, occupied/unoccupied light levels, occupancy/vacancy sensing, and sensitivity to changes in motion and changes in ambient light levels.
   m. Sensors have the ability to remotely adjust light output to reduced levels and remain at that reduced level for an adjustable time period before turning off when a space is vacant.
   n. Programming is stored in each sensor in addition to the Wireless Area Controller. Sensors operate independently of from Wireless Area Controller, so there cannot be single point failure. Systems must operate so there is no single point of failure.
   o. Responds to digital (load shed command) Demand Response signal.
   p. Sets high end trim via priority assigned in profile.

2. Product: WaveLinx Integrated Sensor [SWPD1]
   a. Sensing mechanism
      1. [Infrared]: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
      2. [Daylight]: Utilize integrated daylight sensor to provide closed loop daylight dimming control. Each WaveLinx Integrated Sensor provides an individual daylight dimming zone to provide highly accurate daylight levels at the work surface throughout the entire space.
   b. Power failure memory
      1. Controls incorporate non-volatile memory. Should power be interrupted and
subsequently restored, settings and parameters saved in protected memory shall not be lost.

c. Products tested in identical manner, complaint to NEMA WD 7-2011 Occupancy Motion Sensors Standards

d. Sensor shall have time delays from 10 to 20 min

e. Sensor shall provide unique daylight calibration taking into account for light level at the sensors, work surface and integrated luminaire light output.

f. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation

1. Green LED indication when sensor is in out-of-the-box operation mode

2. White LED indication when sensor has been connected to the WaveLinx wireless lighting control system

g. Test mode- fifteen second time delay

h. Walk-through mode

i. Sensors are RoHS compliant

j. Sensor shall provide out-of-the-box functionality of occupancy detection, directly controlling integrated fixture.

1. Occupied default light level is 75%

2. Unoccupied default light level is OFF

3. Occupancy default time out is 20 minutes

k. Sensors shall monitor changes in occupancy, changes in ambient light levels and communicate digital control commands to light fixtures according to a control strategy.

l. Sensor shall wirelessly transmit occupancy; light level, power to the WaveLinx Wireless Area Controller which allows the data to be stored in a central location on premises and displayed via the WaveLinx Mobile Application.

m. 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.

n. Sensors have remotely adjustable settings for dimming levels, occupied/unoccupied light levels, occupancy/vacancy sensing, and sensitivity to changes in motion and changes in ambient light levels.

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

p. Programming is stored in each sensor in addition to the Wireless Area Controller. Sensors operate independently of from Wireless Area Controller, so there cannot be single point failure. Systems must operate so there is no single point of failure.

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

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

3. Product: WaveLinx Tilemount Daylight Sensor [TMSWP1]

a. Sensing mechanism

1. [Daylight]: Utilize Tilemount daylight sensor to provide closed loop daylight dimming control to a circuit of connected fixtures.

b. Power failure memory

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

c. Tilemount sensor connects to a control module which supports up to 3Amps of connected fixtures.
d. Tilemount is designed to be installed in a ½” or ¾” ceiling tile within 54” of the control module and connected fixtures.

e. Sensor shall provide unique daylight calibration taking into account for light level at the sensors, work surface and integrated luminaire light output.

f. All sensors shall provide an LED as a visual means of indication and diagnostics.

g. Sensors are RoHS compliant

B. Control Module:

1. Sensor shall connect to a 0-10V dimmable ballast or driver via a control module or connect to a WaveLinx enabled drivers without the use of WaveLinx control module.

2. Sensor shall connect to a controller via a low voltage cable for interior 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. Control Module shall be installed by luminaire manufacturer and is shipped as an integral component to the luminaire.

5. Sensor shall be FCC certified.

6. Sensor shall be a Class 2 device.

7. System shall support user initiated manual demand response and utility or BMS initiated automatic demand response.

8. Control Module Components:

a. Power Measurement capable of 5% 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. Control Module and Sensor shall communicate energy usage Wireless Area Controller.

h. Electrical/Connections:

i. Circuit protection:

1. Listed to UL 916.

2. FCC Part 15 Class A certified.

j. Manufacturer to pre-wire control module in fixture.

k. Control module shall be plenum rated.

l. Connection between sensors and control module 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.
2.4 CONNECTED SPACES

A. WaveLinx Wireless Area Controller [WAC-POE]

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:

   a. 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

   b. an occupant sensor that shall turn lighting off within 20 minutes of an occupant leaving a space, or

   c. a signal from another control or alarm system that indicates the area is occupied.

2. Provide Wireless Area Controllers [WAC-POE] in the locations and capacities as indicated on the plans and schedules. Each Wireless Area Controller [WAC-POE] shall have the following capabilities:

   a. The Wireless Area Controller [WAC-POE] is a server class appliance that discovers, programs and manages WaveLinx connected devices, connected sensors and connected Apps.

   b. Uses industry standard HTTPS security with AES-128 encryption safeguards the integrity of the entire system. Backups prevent data loss and restore fixtures to operational modes. It constantly monitors areas to ensure that spaces are managed according to the assigned user preferences and tasks being performed.

   c. Powered-over-Ethernet (PoE) at 48V device, utilizes the building PoE network switches (by others) or a PoE injector [WPOE-120] (accessory by Eaton) for power and network connection.

      a. Maximum CAT 5e cable distance between the Wireless Area Controller and a network PoE 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.

      d. Wi-Fi access point and wireless client capabilities. Wi-Fi capabilities are automatically disabled if the Wireless Area Controller is physically connected to a building LAN and receives an IP address. Systems that allow multiple simulations methods of network connection (Wi-Fi & LAN) shall not be acceptable.

      e. 2.4 GHz Transceiver for IEEE 802.15.4 wireless radio for communication to connected devices and sensors.

      f. Shall support AES 128-bit encryption

      g. LED indicators for status of various wireless radios and communications.

      h. Shall be FCC Part 15 Class A, RoHS certified.

      i. Wireless Area Controller connection cables shall be plenum rated.

   b. Shall be Class 2 devices.

3. Construction Grouping

   a. PAIR button to allow automatic creation of Construction Group allowing simplified automatic control of all connected devices and sensors.

   b. The patent-pending Construction Grouping mode permits contractors to complete a quick system start-up to confirm that the devices have been installed correctly, instead of waiting for factory-trained technicians to get the lights on a project in working order.
Contractors follow a simple process to pair the wireless devices with the appropriate WAC and initiate occupancy-based lighting control functionality. This saves lighting energy during the construction phase of the project by ensuring that the lights are turned off when the area is unoccupied.

c. Construction grouping provides visual indication to the installer that devices have received wireless communication from the Wireless Area Controller and received a unique individual address. Systems that do not provide visual indication of device connection to the wireless network shall not be acceptable.
d. Construction grouping provides automatic grouping of connected devices to provide simple occupancy-based and wallstation control of all devices, without the need of a factory trained technician. Systems that require special software or training to group wireless devices shall not be acceptable.

4. Scalability and Data Integrity
   a. The Wireless Area Controller can be deployed as a dedicated installation managing up to 200 wireless device (connected devices, connected sensors). When deployed as a dedicated installation the Wireless Area Controller acts as a local wireless access point for Wi-Fi connection method to the WaveLinx Mobile Application.
   b. The Wireless Area Controller can be deployed as a network installation managing up to 200 wireless devices (connected devices, connected sensors) per Wireless Area Controller. When deployed as a network installation the Wireless Area Controller connects to the building LAN or wireless network as a client using DHCP. The maximum number of Wireless Area Controllers on the building network is dependent upon the building network configuration.

2.5 CONNECTED APPLICATIONS
   B. WaveLinx Mobile Application [WAPP]
   5. Administrative programming and editing may be conducted via an intuitive iOS or Android mobile application.
   6. WaveLinx Mobile shall support the following features:
      a. Network discovery of multiple Wireless Area Controllers
      b. Naming and identification of Wireless Area Controllers
      c. Unique administrative login credentials for each Wireless Area Controller
      d. Discovery of wireless devices per Wireless Area Controller (Find Devices)
      e. Creation of up to 16 Areas per Wireless Area Controller
      f. Creation of up to 16 Zones per area
      g. Creation of multiple Occupancy Sets per area
      h. Creation of Daylight Sets for each integrated luminaire
      i. Creation of Demand Response values for each area
      j. Definition of scene values for each area
      k. Definition of schedules for each Wireless Area Controller
      l. Blink identification and reverse identification of each connected devices and sensor
Identified connected devices and sensors will indicate on the WaveLinx Mobile Application their selection by the device icon pulsing on the screen.

Ability to utilize drag and drop, multi select and filter capabilities for easy association of connected devices and sensors to a defined area.

Automatic Code Commissioning features include:
1) Automatic association of all devices added to an area to provide a California Title 24 2016 code compliant sequence of operations
2) All occupancy sensors are joined together to provide an Automatic ON to 50% light level
3) All occupancy sensors are joined together to provide an Automatic OFF of all luminaires and plug loads after 20 minutes of unoccupancy.
4) Automatic closed loop daylighting to approximately 500lux
5) Automatic wallstation button mapping providing the dominant button providing a 50% light level all other buttons provide multi-level dimming control from 30%-100%
6) Automatic display of area power measurement data
7) Automatic Demand Response of 20%

Additional screens if needed to adjust Automatic Code Commissioning settings.

PART 3- EXECUTION

3.1 INSTALLATION
A. The control system shall be installed and fully wired as shown on the plans by the installing contractor. The contractor shall complete all electrical connections to all control circuits.
B. Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated.
C. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF, etc.).
   3. Load parameters (e.g. blink warning, ETC.).

3.2 PRODUCT SUPPORT AND SERVICE
A. Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

3.3 FACTORY COMMISSIONING (OPTIONAL)
A. Upon completion of the installation, the system shall be commissioned by the manufacturer’s factory authorized representative who will verify a complete fully functional system.
B. The electrical contractor shall provide both the manufacturer and the electrical engineer with twenty one working days written notice of the system startup and adjustment date.
C. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner’s personnel on the adjustment and maintenance of the system.
D. Qualifications for factory certified field service engineer:

Eaton’s Lighting Systems
Digital Lighting Control
1. Certified by the equipment manufacturer on the system installed.

E. Make first visit upon completion of installation of WaveLinx Wireless Connected Lighting system:
   1. Verify locations of Wireless Area Controllers
   2. Verify implementation of Construction Group process
   3. Identify connected devices and program using WaveLinx Mobile and Automatic Code Commissioning.
   4. Verify that system operation control based on defined sequence of operations (SOO).
   5. Obtain sign-off on system functions.

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

3.4 CLOSEOUT ACTIVITIES (OPTIONAL)

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.

3.5 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 WaveLinx Wireless Connected Lighting bill of materials.

END OF SECTION