

SECTION [26 09 43.19]**WIRELESS NETWORK LIGHTING CONTROLS**

This section includes editing notes to assist the user in editing the section to suit project requirements. These notes are included as hidden text, and can be revealed or hidden by one of the following methods:

Microsoft Word: From the pull-down menu, select “Tools”, then “Options”. Under the tab labeled “View”, select or deselect the “hidden Text” option. Microsoft’s ¶ button (located in the toolbar) can also be utilized to show all non-printing characters, which also reveals the hidden text.

PART 1 – GENERAL**1.01. SUMMARY****A. Related Documents:**

1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:

1. Wired and Wireless Vacancy/Occupancy Sensors
2. Wired and Wireless Daylight sensors
3. Wired and Wireless wall dimmers and switches
4. Wireless Controllers and Radios
5. Smart Luminaires and Smart LED Lamps
6. Networked Management Appliance
7. Networked Lighting Controllers
8. Networked Plug Load Controllers
9. Bluetooth Interface Gateway
10. Router/network switch.

1.02. RELATED SECTIONS

- A. [01 00 00] General Requirements
- B. [25 11 13] Integrated Automation Network Servers
- C. [25 15 16] Integrated Automation Software for Control and Monitoring Networks
- D. [26 05 00] Common Work Results for Electrical
- E. [26 06 50.13] Lighting Panelboard Schedule
- F. [26 06 50.16] Lighting Fixture Schedule
- G. [26 01 50] Operation and Maintenance of Lighting

- H. [26 08 00] Commissioning of Electrical Systems
- I. [26 09 00] Instrumentation and Control for Electrical Systems
- J. [26 09 13] Electrical Power Monitoring
- K. [26 09 23] Lighting Control Devices
- L. [26 24 00] Switchboards and Panelboards
- M. [26 25 00] Low-voltage Enclosed Bus Assemblies
- N. [26 27 00] Low-voltage Distribution Equipment
- O. [26 27 13] Electricity Metering
- P. [26 28 00] Low-voltage Circuit Protective Devices
- Q. [26 35 00] Power Filters and Conditioners
- R. [26 50 00] Lighting
- S. [26 51 19] LED Interior Lighting
- T. [27 00 00] Communications

1.03. REFERENCES

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000
- B. IEEE C37.90.1-2012 IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- C. NFPA 70 (2017) - National Electrical Code.
- D. NFPA 70b (2016) - Recommended Practice for Electrical Equipment Maintenance.
- E. NFPA 70e (2018) - Standard for Electrical Safety in the Workplace.
- F. Electronic Code of Federal Regulations Title 47 → Chapter I → Subchapter A → Part 15
- G. NEMA Section Lighting Systems | Lighting Controls – National Electrical Manufacturers Association
- H. NETA ATS (2017) - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- I. DLC Qualified Systems – DesignLights Consortium Networked Lighting Control System Technical Requirements V5.0
- J. UL 916 – Underwriters' Laboratories Standard for Energy Management Equipment
- K. UL1376 – Wireless Cybersecurity
- L. UL 8750 – Underwriters' Laboratories Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products
- M. UL 773 – Underwriters' Laboratories Standard for Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting

- N. UL 60950-1 – Underwriters' Laboratories Standard for Information Technology Equipment - Safety - Part 1: General Requirements
- O. CSA C22.2
- P. UL 514C – Underwriters' Laboratories Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
- Q. UL 1363 – Underwriters' Laboratories Standard for Relocatable Power Taps
- R. UL 1449 – Underwriters' Laboratories Standard for Surge Protective Devices
- S. UL 2043 – Underwriters' Laboratories Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
- T. NRTL Certified – Nationally Recognized Testing Laboratories
- U. Bluetooth BLE 5.0
- V. [2016 State of California Building Energy Efficiency Program Title 24 Requirements]

1.04. SUBMITTALS

- A. Submit under provision of Section [01 22 00].
- B. Certificates: Certify that submitted equipment either meets specification as stated or meets specification through an alternate means and indicate the specific methodology used.
 - 1. Meets specification as stated.
 - 2. Meets specification through an alternate means and indicate the specific methodology used.
- C. Shop Drawings: The Subcontractor shall submit for approval Shop Drawings prepared in accordance with Section [01 33 00] "Submittal Procedures", and as required by other sections of the Specifications. Provide [five (5)] printed copies of:
 - 1. Product data sheets, installation and operation manuals, setup instructions on equipment, component devices, and accessories on manufactured system network devices. Include dimensions, colors, power requirements, and configurations.
 - 2. Schematic (one-line diagram) of system indicating planned locations and relationships of electrical components, network devices, and accessories in manufactured system.
 - 3. Sequence of Operation to describe how system operates and performs in the building, including control schedules and clock schedules.
 - 4. Manufacturer's Instructions including application conditions and limitations of use. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Provide electronic copies of all shop-drawing submittals utilizing Adobe PDF.

1.05. QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum five (5) years' experience in the manufacturing of power management and control systems.
- B. Installer Qualifications: Company certified and approved by the power monitoring controls equipment manufacturer.
- C. Products shall be tested, approved and labeled/listed by a nationally recognized testing laboratory (NRTL) as listed in [26 05 00] "Common Work Results for Electrical."
- D. Electrical equipment and materials shall be new and within one year of manufacture, complying with the latest codes and standards. No used, re-built, refurbished and/or re-manufactured electrical equipment and materials shall be furnished on this project.

1.06. DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in unopened cartons or bundles as appropriate, clearly identified with manufacturer's name, Underwriter's or other approved label, grade or identifying number.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dust, dirt, water, construction debris, and traffic.

1.07. WARRANTY

- A. Provide manufacturer's full [five (5) years] warranty covering 100% parts from the date of system startup completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Controls Manufacturer: [LiteTrace- Keilton+Autani]
- B. Acceptable Device Manufacturers: [LiteTrace- Keilton+Autani] Meeting the BLE Bluetooth 5.0 Standard
- C. Basis of design, and with prior approval including the specified requirements of this section, one of the following:
 - 1. [LiteTrace- Keilton+Autani]
 - 2. [Insert manufacturer's name]
- D. Substitutions: [Not permitted.] [Under provisions of Division 1.]
 - 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 [\$150.00] 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 wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough in.

2.02 GENERAL

- A. Products included in this specification include all Modular Network Components.

2.03 ENERGY MANAGEMENT NETWORK HARDWARE

- A. Provide [Autani Manager] Networked Management Appliance and integrated interface devices CR05 and RTR's to establish a premises-based industrial control processor that manages all Lighting Control devices through an integrated Bluetooth wireless mesh communications network.
 1. Mounting: [Wall bracket] [table-top]
 2. Storage: 120GB with HDD, 2GB RAM
 3. Remote Access I/O Support
 - a. Provide LAN: (1) 10/100/1000 Ethernet, TCP/IP v4
 - b. Serial: 2-1 dedicated internal, (1) open
 - c. USB: (2) USB 2.0 host interfaces
- B. Provide [Autani CR05 and RTR router interface] premises-based industrial Bluetooth Interface and routing interface that connects and integrates with the [Autani Manager] Networked Management Appliance through an integrated CAT 5 wired network topology.
 1. CR05 and RTR Mounting: [IT Closet] [Ceiling Mount] [Wall Mount] per drawings.
 2. Storage: [1 GB] with HDD, [2GB RAM]
 3. Remote Access I/O Support: LAN: (1) 10/100/1000 Ethernet, TCP/IP v4
- C. Hardware power, operational, and system performance for [Autani Manager and its associated CR05 and RTR components].
 1. Endpoint Capacity: [1000] endpoints
 2. Power
 - a. Manager Power Supply: 120V Brick plug in
 - i. Manager Estimated Draw – 14W Max load
 - b. CR05 Power supply - 12V-DC CAT 5 powered
 - c. RTR Power supply – 12V-24V
 3. Radio Network
 - a. IEEE 802.15.1 - 2.4GHz ISM compliant

- b. Range: Approximately 200' line of sight transmit/receive for 2.4GHz and 200' line of sight transmits or receives.
 - i. Long Range – TX5 antenna, 5db provides 1,850ft LOS
- 4. Regulatory Approvals
 - a. [UL60950-1] [CSA C22.2]
 - b. [FCC (V8NZRB1000152) Certified Class B Digital Device, FCC Part 15C] [IC (7737A-ZRB1000152)]
 - c. Local Utility Requirement: [DLC]
- 5. Autani Manager Operating Environment Conditions
 - a. Operating Temperature: 10° to 40°C
 - b. Storage Temperature: -25° to 80°C
- 6. RTR Routing Interface Operating Environment Conditions
 - a. Operating Temperature: -30° to 55°C
 - b. Storage Temperature: -30° to 85°C
- 7. CR05 Bluetooth Interface Operating Environment Conditions
 - a. Operating Temperature: -30° to 55°C
 - b. Storage Temperature: -30° to 85°C
- 8. Protocols
 - a. Building Management Integration: [BACnet MS/TP] [BACnet/IP]
 - b. Wireless: 802.15.1 BLE with mesh networking
 - c. Ethernet: HTTP/HTTPS, FTP
 - d. Security: Internal firewall, IPSEC, isolated wireless and internal processors
 - e. UDP: 59370, 59371, 54261
 - f. TCP: 443 (remote access, outbound VPN connection)

2.04 ENERGY MANAGEMENT SOFTWARE

- A. Provide [Autani EnergyCenter™] energy management software installed on the [Autani Manager] Networked Appliance with wireless gateway for [local] [remote] access for programming and monitoring of the lighting system.
- B. Provide browser-based graphic user interface to program, monitor, coordinate, and control the management and control functions, both locally on the device and remotely via connected devices.
- C. Optimize lighting through the use of [custom] [standard] schedules, occupancy, light level, events, and demand response programs with prioritized load shedding via compatible [EnergyCenter™] software that is [customizable [PRO™]] [standardized] [BacNet enabled] for browser-based management and control of [lighting] systems that may be connected to the building management control system.

- D. The Networked Management Appliance to retain and store all system events for [two (2) years] so that data can be analyzed to further optimize energy use and savings.
 - E. Provide real-time and historical lighting energy usage with real-time consumption data through charts, graphs, and reports.
 - F. Provide reporting for user-defined filters as well as per individual meter for targeted analysis of consumption cost.
 - G. Provide comprehensive and actionable information to users in the form of [on-screen displays] [printed reports] [exportable data] [PDF] [CSV].
 - H. Provide real-time alerting for user-defined and system events via [email] [SMS].
 - I. Provide estimated and actual data on [daily cost] [energy consumption kWh] [pounds of CO2 generated].
 - J. Provide secure, password-protected access with assignable access rights to prevent unauthorized users from logging into the system or effecting changes upon the system.
 - K. Provide over the air mechanism to securely upgrade or change firmware on all connected devices.
 - L. Interface with [Autani's] wireless fixture and room controllers, wired and wireless motion sensors.
 - M. Provide [local] [remote] access to calculated Energy Consumption and when metering is deployed, real-time metering of energy consumption, including real energy, reactive energy, apparent energy, voltage, current and power factor for each phase.
- 2.05 WIRELESS NETWORKED SWITCHING AND DIMMING LIGHTING CONTROLLERS [AUTANI PPA-102, PPA-104, PPA-103 SERIES]
- A. Provide [Autani PPA Series Controller Series] plenum rated device designed specifically for the control and management of circuit-based loads.
 - B. Provide remote management and control of lighting levels via schedules, sensor inputs, overrides, and curtailments.
 - C. Provide switching of up to (2) [120] [277] VAC single pole 20-amp circuits and dimming of up to (2) 0-10V dimmable loads [with power pack].
 - D. Provide [momentary] [maintained] contact closure per circuit for local control via PPA-104S-D series.
 - 1. Momentary override switches (toggle mode).
 - 2. Standard lighting switches [toggle mode] [switch mode]
 - E. Provide capability to program a circuit such that the setting of a local control in the "off" position overrides all inputs, sensors, schedules, curtailments, and presets.
 - F. Provide local controls and status indicators.

- G. Communicate wirelessly with one another, the Network Management Appliance, and other network devices via a reliable 802.15.1 BLE based mesh network.
 - H. Managed by a user-defined combination of adjustable [schedules] [over-rides] [curtailments] [sensor inputs] [local controls] via a 24-hour x 7 days x 365-day schedule. Behavior of the lighting controller and associated devices responsive to light level, sensors, and timing of automatic shutoffs during vacancy.
 - I. Sensor devices connected to the wireless controller should be available for other network devices to utilize by mapping the input and data of any sensor connected to a Lighting Controller to any or all other Lighting Controllers and Networked devices in the system.
 - J. Provide ability to operate as a standalone, non-networked device responding to local switch and sensor inputs.
 - K. In the event of Network failure, the Lighting Controller to operate as a stand-alone device with local control and response to Sensor Inputs.
 - L. Configurable via local pushbuttons for [10 second] [18 minute] [30 minute] timeout for automatic shutoff of controlled circuits by the Lighting Controller in non-networked mode.
 - M. Device ratings and approvals
 - 1. Input Voltage Range: 85 to 305VAC
 - 2. Recommended Voltage: 100 to 277VAC
 - 3. Radio Network
 - a. IEEE 802.15.1-2003 2.4GHz ISM compliant; Range: Approx. 200' LOS transmit/ receive via each device.
 - b. Provide additional range via interchangeable antenna [TX1] [TX5] TX5 capable of 1,850 ft LOS
 - 4. Regulatory Approvals
 - a. UL 916 CSA C22.2 No. 205 (Listing E113003)
 - b. UL 2043 Plenum Rated
 - c. FCC (V8NWAT1000153) & IC (7737A- WAT1000153), Certified Class B Digital Device, FCC Part 15
 - d. FCC (SZV-TCM320U) & IC (5713A- TCM320U), Certified Class B Digital Device, FCC Part 15
- 2.06 WIRELESS NETWORKED DIMMING FIXTURE CONTROLLER [AUTANI PPA-102S SERIES]
- A. Provide wireless plenum rated [Autani PPA-102S] device designed specifically for the control and management of dimmable lighting circuits and individual lighting fixtures.

- B. Provide remote management and control of lighting levels via schedules, sensors inputs, overrides, and curtailments.
- C. Provide control of up to 6amp - 0-10V DC dimmable [LED] lighting fixtures with Dual Channel for CCT tuning.
- D. Fully compatible with Keilton+Autani Devices including [occupancy/vacancy sensors] [daylight sensors] [low voltage sensors].
- E. Communicate wirelessly with one another, the Network Management Appliance, and other network devices via a Bluetooth BLE 5.0 DLC-NLC based mesh network.
- F. Managed by a user-defined combination of adjustable [schedules] [over-rides] [curtailments] [sensor inputs] [local controls] via a 24-hour x 7 days x 365-day schedule. Behavior of the lighting controller and associated devices responsive to light level, sensors, and timing of automatic shutoffs during vacancy.
- G. Sensor devices connected to the wireless controller should be available for other network devices to utilize by mapping the input and data of any sensor connected to a Lighting Controller to any or all other Lighting Controllers and Networked devices in the system via Autani App.
- H. Provide ability to operate as a standalone, non-networked device responding to local dimming and sensor inputs.
- I. In the event of Network failure, the Lighting Controller to operate as a stand-alone device with local control and response to Sensor Inputs.
- J. Device ratings and approvals
 - 1. Input Voltage Range: 12 to 30 VDC
 - 2. Recommended Voltage: 12 to 24 VAC / VDC
 - 3. Radio Network: IEEE 802.15.1-BLE - 2.4GHz ISM compliant; Range: Approx. 200' LOS transmit/ receive
 - 4. Regulatory Approvals
 - a. UL 916 CSA C22.2 No. 205 (Listing E113003)
 - b. UL 2043 Plenum Rated
 - c. FCC (V8NZRB1000152) & IC (7737A- ZRB1000152), Certified Class B Digital Device, FCC Part 15

2.07 WIRED MOTION SENSORS

- A. Provide [Autani EcoSensors Model EFS series] [passive infrared (PIR)] [dual technology (ultrasonic and PIR)] wired motion sensor. Motion sensor mode of operation to be configured with Keilton+Autani App and monitored in the [EnergyCenter™] energy manager software.
 - 1. Operation
 - a. Smart On/Off Mode: Lights turn on when coverage area is occupied, and turn off when occupancy is no longer detected after a predetermined time delay.

- b. Vacancy Mode: Lights turn on only when an occupant turns on lights using a local switch, and turn off when occupancy is no longer detected after a predetermined time delay.
2. Detection: PIR sensor detects heat and movement.
 - a. Sensor Output: Contacts rated to operate the connected controller.
 - b. Sensor is powered from the [Autani PPA Series] wireless PPA series controller.
 - c. Mounting: [ceiling] mounted
 - i. [Ceiling mounted to acoustical ceiling T-grid].
 - ii. [Surface mounted].
 - d. Indicator: LED display, to show when motion is detected during testing and normal operation of sensor. Blue LED indicator indicates configuration mode and Green LED indicator reflects active motion being detected.
 - e. Detection (Dual Technology)
 - i. PIR sensor is initial detection and has a range of 42 feet major motion. Multiple occupancy sensors may be connected to the [Autani] wireless room controller.
 - ii. Ultrasonic detects KHZ deviations from the emitted KHZ to hold lights on after initial activation by PIR.
 3. Sensor devices connected to the wireless controller should be available for other network devices to utilize by mapping the input and data of any sensor connected to a Lighting Controller to any or all other Lighting Controllers and Networked devices in the system.
 4. Provide optional accessories [Modular 10ft, 25ft or 50ft. RJ-45 CAT 5 Extension] [Modular Splitter RTP] to facilitate Daisy chaining of multiple sensors. access for maintenance.
 5. Device Ratings and approvals
 - a. Power - DC12V- Cat 5 cable- powered from PPA powerpack
 - e. Radio – Radio Located on Powerpack – Sensor comms hardwired to PPA
 - f. Range: Approx. 200' LOS transmit/ receive via each device.
 - b. Regulatory Approvals: FCC (SZV-STM300U) & IC (5713A- STM300U)
 - c. Detection Range:
 - i. Ceiling Mounted: 42" Diameter
 - ii. Wall Mounted: 52" Wide Angle Lens

2.08 WIRELESS MOTION SENSOR

A. Provide [CS or BCS sensor series] wireless passive infrared (PIR) motion sensors with mode of operation to be configured with the [Keilton+Autani] app software and Managed by the EnergyCenter Software in the Autani Manger appliance.

1. Operation

- a. Smart On/Off Mode: Lights turn on when coverage area is occupied, and turn off when occupancy is no longer detected after a predetermined time delay.
- b. Vacancy Mode: Lights turn on only when an occupant turns on lights using a local switch, and turn off when occupancy is no longer detected after a predetermined time delay.

2. Detection: PIR detects heat and movement.

3. Sensor Output: Wireless signal is sent via mesh network to the Keilton+Autani network and back to the Networked Management Appliance [Autani Manager].

- a. Mounting: [Ceiling] [wall] mounted.
- b. Communicate wirelessly with one another, the Network Management Appliance through the [Keilton+Autani Device Network}

4. Sensor devices connected to the wireless controller should be available for other network devices to utilize by mapping the input and data of any sensor connected to a Lighting Controller to any or all other Lighting Controllers and Networked devices in the system.

B. Device ratings and approvals

1. Low voltage AC 120/277V or Battery CS123A – 3V.

2. Radio Network: IEEE 802.15.1-2003 2.4GHz ISM compliant.

3. Range: Approx. 200' LOS transmit/ receive via each device

4. Regulatory Approvals: FCC (SZV-STM300U) & IC (5713A- STM300U)

5. Detection Range

- a. Ceiling Mounted: 42' diameter
- b. Wall Mounted: 52' wide angle lens

2.09 WIRELESS DAYLIGHT/PHOTO SENSORS

A. Provide [Autani EFS, CS, or BCS Series sensor] automatic [dimming] [zoned switching] control to implement daylighting energy saving strategies using wired 0-10V dimming photocell. One photocell per daylighting zone. Autani sensors possess multisensory technology including continuous 0-10V Daylight harvesting. Configuration is completed in the app during commissioning.

C. Provide configurable [instantaneous] lighting response [30 seconds] to account for transient changes.

D. Mounting: [ceiling] mounted

- 1. [Ceiling mounted to acoustical ceiling T-grid].

2. [Surface mounted].

2.10 WIRELESS WALL SWITCHES [AUTANI WP SWITCH SERIES]

A. Provide AC 120/277V or Battery (CR2032) wireless WP wall switches to control the ["ON" and "OFF" state] [Dimming Level]. Configure multiple wireless wall switches in [2] [3] [4] way switch configurations via Keilton+Autani app.

1. [On/Off] Operation: [Lights turn on, off when the on/off] [Dim level when the device lower or raise button is pressed and held]
2. Sensor Output: Wireless signal is sent via mesh network and to the [Autani Manager] Networked Management Appliance.
3. Mounting: Wall [surface] [box] mounted

B. Device ratings and approvals

1. Electrical: AC-120/277V or Battery (Cr2032 or AAA)
2. Radio Network - IEEE 802.15.1-2003 2.4GHz ISM compliant; Range: Approx. 200' LOS transmit/ receive via each device
3. Regulatory approval: FCC (SZV-PTM210U) & IC (5713A- PTM210U)

2.11 SMART LUMINAIRES AND SMART LED LAMPS

A. See Section [26 06 50.16 Lighting Fixture Schedule] [26 50 00 Lighting] [26 51 19 LED Interior Lighting] for BLE compliant luminaires and lamp compatibility.

B. Communicate wirelessly with compatible OEM fixture companies using Keilton+Autani White label controls

2.12 SMARTLET OUTLET PLUG LOAD CONTROLLER [AUTANI WF20 SERIES]

A. Provide wirelessly managed device designed specifically for the control and management of Plug Loads, including remote management and control of Plug Loads via schedules, sensors inputs, overrides, and curtailments when used in conjunction with Keilton+Autani app and Autani's EnergyCenter™ energy management software.

B. Provide control of standard 120VAC, 20 AMP duplex receptacles. Top receptable is normal switched constant power and lower receptacle is controlled wirelessly and managed by one or more occupancy sensors.

C. Communicate wirelessly with one another, the Network Management Appliance, and other network devices via a BLE mesh network.

D. Configured, managed, and controlled via HTML (web) pages provided over the [LAN] [WAN] by [Autani EnergyCenter™] Software installed on the [Autani Manager] Networked Management Appliance.

E. It shall be possible to map the input and data of any sensor connected any or all other Networked devices in the system.

F. Device ratings and approvals

1. Load Capacity: 20A @ 120VAC

2. Input Voltage Range: 120VAC
3. Internal Relay
 - a. Max Switching Power: 1800VA
 - b. Max Switching Voltage: 120VAC
 - c. Max. Switching Current: 15A
4. Radio Network
 - a. IEEE 802.15.4-2003 2.4GHz ISM compliant
 - b. Range: Approx. 600' LOS transmit/ receive
5. Regulatory Approvals
 - a. UL UL 916 CSA C22.2 No. 205 (Listing E113003)
 - b. UL 2043 Plenum Rated
 - d. FCC (V8NZRB1000152) & IC (7737A- ZRB1000152), Certified Class B Digital Device, FCC Part 15
6. Environmental
 - a. Test condition of all ratings 25°C
 - b. Operating Temperature: 0° to 70°C
 - c. Storage Temperature: -25° to 80°C
- G. [Connect to network occupancy sensor.]

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Provide complete installation of the [Autani] Networked Lighting Control Devices in accordance with contract documents and as shown on the Construction Drawings.
- B. CR05 – Bluetooth interface shall be installed per manufacturer recommendations yielding the device be installed in the center of each zone to ensure best communications with the zone devices.
- C. RTR – Routing interface should be installed to provide Cat 5 connections to CR05's and Manager. CAT 5 runs should be no longer that 1000ft. However, the first RTR should be no longer that 50ft from the Manager. Following this initial length, topology runs are as shown on the device Specification sheet
- D. Potential, control power and current transformers, shorting terminal block, test blocks, fuse blocks and fuses shall be completely installed and wired to the energy meter within the equipment enclosure designated, unless shown otherwise on the Construction Drawings.
- E. Sensors

1. Coordinate layout and installation of [ceiling-mounted] [wall-mounted] devices with other construction that penetrates [ceilings] [walls] or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
 2. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
 3. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.
- F. Systems integration to be coordinated with owner's representative, [Autani] lighting control system manufacturer and other related equipment manufacturers.
- G. Provide equipment at locations and in quantities indicated on drawings.
- H. Provide any additional equipment required to provide control intent.
- 3.02 FIELD QUALITY CONTROL
- A. Perform field inspection, testing, and adjusting in accordance with Section [01 40 00]
 - B. Verify that all control devices, components, receptacles; lighting equipment, etc. are powered and energized prior to initiating factory start up and commissioning.
 - C. Verify LED driver type and functioning / powered luminaires.
- 3.03 FACTORY START UP
- A. Provide both the manufacturer and the electrical engineer with [ten (10)] working days written notice of the Factory Start up.
 - B. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in final testing.
 - C. Final programming to be completed by an authorized manufacturer's representative to establish control of the network as required by the specified sequence of operations.
 - D. Project Record Documents: Provide five (5) copies of the final results including actual locations of components and accessories to building owner and owner's representatives.
 - E. If deficiencies are discovered during the Factory Start Up, the Electrical Contractor to provide reimbursement of all expenses necessary for scheduling additional time and subsequent site visitation for required attendees.
 - F. An unsatisfactory condition revealed by these test results, or unsatisfactory methods of tests and/or testing apparatus and instruments, shall be brought to the attention of the [Engineer] [Project Manager] [Factory Representative]. Corrections by the electrical contractor shall be validated by re-tests to the satisfaction of the [Engineer] [Project Manager] [Factory Representative].

3.04 ACCEPTANCE AND COMMISSIONING

- A. Final acceptance [Per California building Efficiency Standards (Title 24, Parts 1 and 6)] [Per local code requirements] shall depend upon the satisfactory test results as performed in accordance with the verification of the sequence of operations and manufacturer's instructions.
- B. Test and Inspections:
 - 1. Operate the system and its various components to ensure that it is performing properly and in accordance with the sequence of operations.
 - 2. Run a preliminary test for the purpose of:
 - a. Determining whether the equipment is in a suitable condition to conduct the acceptance test.
 - b. Checking and adjusting equipment.
 - c. Training facility personnel.
 - d. Verify that sensors are mapped to appropriate devices.
 - e. Verify that lighting scheduling has been applied.
 - f. Verify drawings are uploaded and viewable within the energy management system software.
 - g. Verify that all system alerts and trigger notifications are configured.
 - 3. Final system acceptance test: Individually test each networked device and demonstrate that they are operating properly.
 - 4. Supply all equipment necessary for system adjustment and testing.
 - 5. Verify that the electrical data and information displayed is correct and properly tracking in real time.

3.05 COMMISSIONING, TRAINING AND DEMONSTRATION

- A. Commission the system such that all connected devices are operational, reporting accurately and correctly in accordance with the sequence of operations.
- B. Demonstrate the operational use of the system to the Owner.
- C. Upon completion of the system programming, provide [four (4) hours] training to the owner's personnel on the operation and maintenance of the system.
- D. Attendance: [Electrical Contractor] [System Integrator] [Owner] [Owner's Representative] Designated Design Representative(s) for [Architect] [Engineer] [Lighting Designer] [Autani] Manufactured System Representative.
- E. Provide five (5) copies of final acceptance testing and test results.

END OF SECTION