

## **SECTION 260923 – LIGHTING CONTROL DEVICES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Control modules
  - 2. Occupancy sensors
  - 3. Photocells
  - 4. Power packs
  - 5. Relay panels
  - 6. Wall switches and dimmers
  - 7. Communications bridges
  - 8. Lighting contactors
- B. Related Requirements:
  - 1. Division 26 Section "Building Wire and Cable" for wire and cables for lighting controls except as referenced in this section.
- C. The lighting control system specified in this section shall provide time-based, sensor-based, and manual lighting control.
- D. The system shall be capable of turning lighting loads on/off, as well as dimming lights, where applicable.
- E. System devices shall be networked together, if noted on plans, enabling digital communication, and shall be individually addressable.
- F. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity, even if network connectivity to the greater system is lost.
- G. The system architecture shall facilitate remote operation via a computer connection.
- H. The system shall not require any centrally hard-wired switching equipment.

#### **1.3 SEQUENCE**

- A. See lighting controls sequence matrix, following this section for additional information on sequence.

## 1.4 ACTION SUBMITTALS

- A. Product data sheets: general device descriptions, dimensions, wiring details, nomenclature.
- B. Riser diagrams: typical per room type showing device interconnectivity, other diagrams as needed for interaction with other systems.
- C. Contractor start-up worksheet must be completed prior to factory start-up.
  - 1. Documentation of functional testing must be completed for each space, prior to engineer's site inspection.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.
- B. Hardware and Software Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On a CD/DVD, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application.

## 1.6 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
- B. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

## 1.7 WARRANTY

- A. All devices in lighting control system shall have a 5 year warranty.

## **PART 2 - PRODUCTS**

### 2.1 LIGHTING CONTROL SYSTEMS

- A. Manufacturers:
  - 1. Basis of design: nLight Network Control System by Sensor Switch or subject to compliance and prior approval with specified requirements of this section, one of the following:
    - a. WattStopper Digital Lighting Management (DLM)
    - b. Cooper Greengate
    - c. Leviton SectorFlex
  - 2. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the responsibility of the electrical contractor to ensure that any price quotation received and submittals made are for lighting control systems which meet or exceed these specifications.

This includes ensuring equipment can be located in electrical/mechanical spaces and still allow for required clearances.

**B. System requirements:**

1. System shall have an architecture that is based upon three main concepts:
  - a. Intelligent lighting control devices
  - b. Standalone lighting control zones
  - c. Network backbone for remote or time-based operations
2. Intelligent lighting control devices shall consist of one or more basic lighting control components: occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
3. Intelligent lighting control devices shall communicate digitally and possess RJ-45 style connectors.
4. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
5. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
6. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
7. Individual lighting control zones must be continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
8. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.
9. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located device such as a panel) to facilitate system robustness and minimize wiring requirements.
  - a. Exception: Specific applications, such as exterior lighting, that require centralized or remote switching shall be capable of being accommodated.
10. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.
11. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements
12. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.
13. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
14. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via the wired backbone.
15. System shall be capable of operating a lighting control zone according to several sequences of operation. See drawings for additional information regarding lighting control sequences. System shall be able to change a networked space’s sequence of operation according to a time schedule, so as to enable customized time-of-day, day-of-week utilization of a space.
16. Control software shall enable logging of system performance data and presenting useful in-

formation in a web-based graphical format and downloadable to .CSV files.

17. System shall provide the option of having pre-terminated plenum-rated CAT5e cabling supplied with hardware.

## 2.2 CONTROL MODULE (GATEWAY)

- A. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.
- B. Devices shall have a user interface that is capable of wall-mounting, powered by low-voltage, and have a touch-screen.
- C. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
- D. Device shall automatically detect all devices downstream of it.
- E. Device shall have a standard and astronomical internal time clock.
- F. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
- G. Device shall have a USB port.
- H. Each control gateway device shall be capable of linking 1500 devices to the management software.
- I. Device shall be capable of using a dedicated or DHCP assigned IP address.

## 2.3 COMMUNICATION BRIDGES

- A. Device shall surface mount to a standard 4" x4" square junction box.
- B. Device shall have eight RJ-45 ports.
- C. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to the control gateway(s).
- D. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.

## 2.4 LIGHTING CONTROL LOW VOLTAGE SWITCHES

- A. Physical: All switches shall fit into a standard GFI wall opening. Switches shall be available in button configurations according to the wall station schedule in the drawings or via an alternate approved configuration.
- B. Devices shall be available with zero or one integrated Class 1 switching relay.

- C. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- D. All switches shall have two RJ-45 ports.
- E. All devices shall provide toggle switch control. Dimming control must be provided as noted in schedule on drawings.
- F. All low voltage switch and trim ring colors to be white, except in locations as noted on plans.
- G. Devices with dimming control outputs can control 0-10VDC dimmable fixtures by sinking up to 20 mA of current.
- H. Devices shall have mechanical push-buttons that provide tactile and LED user feedback. Push-buttons must be provided with custom button labeling kits. Coordinate switch labeling with owner and A/E team. Labeling to correspond with final room name and numbering.
- I. In order to reduce the number of devices, in rooms with more than two switchlegs, graphic wall stations will be permitted. Graphic wall station locations must be approved during shop drawings.
  - 1. Device shall have a 3.5" full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
  - 2. Device shall enable configuration of lighting presets, switched and dimmed, via password-protected setup screens.
  - 3. Device shall enable user supplied .JPG screen saver image to be uploaded.
  - 4. Device shall surface mount to a single gang switch box.
  - 5. Device shall have a micro-USB style connector for local computer connectivity.
  - 6. Device shall have two RJ-45 ports for communication.

## 2.5 NETWORKED SYSTEM POWER (RELAY) PACKS

- A. Power pack shall incorporate one or more class 1 relays and contribute low voltage power to the rest of the system. Secondary packs shall incorporate the relay(s), shall have an optional 2<sup>nd</sup> relay and 0-10VDC dimming output, but shall not be required to contribute system power. Power supplies shall provide system power only, but are not required to switch line voltage circuits. Auxiliary relay packs shall switch low voltage circuits only.
- B. Power packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power to the system.
- C. All devices shall have two RJ-45 ports.
- D. Every power pack parameter shall be available and configurable.
  - 1. For rooms connected to the backbone, parameters shall be remotely from the software and locally via the device push-button.
  - 2. For stand-alone rooms, parameters shall be configurable locally via the device push-button.
- E. Power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

- F. Power (secondary) packs shall be available that provide up to 16 amps switching of all lighting load types.
- G. Power (secondary) packs shall be available that provide up to 5 amps switching of all load types as well as 0-10 VDC dimming of LED drivers.
- H. Specific secondary packs shall be available that require a manual switch signal (via a networked wall station) in order to close its relay.

## 2.6 OCCUPANCY SENSORS

### A. General:

- 1. Install all occupancy sensors in accord with manufacturer's recommendations.
- 2. The contractor and manufacturer shall select units with the required contact voltage and current ratings as required for the lighting load the sensor is to control, taking into account the nature of the load-i.e.-incandescent, inductive, etc.
- 3. In addition, select sensors to cover the physical area in which they are to be installed. This might mean using large area units or multiple units in a given space. When necessary, provide interconnecting wiring between units, relays and manufacturer's control units where required. These accessories are not shown or specified but shall be provided where the physical conditions of the room or the electrical requirements of the load so necessitate.
- 4. Make all adjustments for each occupancy sensor for light level, sensitivity and time delay in coordination with and to suit the needs and requirements of the owner. Tilt and adjust adjustable units for maximum coverage.
- 5. For all units but especially for non-standard room shapes, such as in the case of long narrow rooms or hallways, select units with the appropriate field of view, standard or long range lenses, wide angle lenses, linear coverage, etc., all as required to suit the application.
- 6. Coordinate the exact locations and mounting heights of adjustable wall units with the conditions on the wall, with other devices and equipment on the wall and with manufacturer's recommendations. For ceiling mounted units, coordinate with other ceiling mounted equipment and with reflected ceiling plans.
- 7. Provide all power packs, conduit, conductors, boxes, etc. as necessary for a complete occupancy sensor installation.
- 8. Provide interconnecting wiring between occupancy sensors, where multiple occupancy sensors are to be provided in the same room to only allow room lighting to be turned off when all occupancy sensors indicate the room to be unoccupied.

### B. Networked system occupancy sensors

- 1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
- 2. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10VDC dimming output. Sensors shall be capable of switching 120/277 VAC. Load ratings shall be 800W @ 120VAC, 1200W @ 277 VAC, and ¼ HP motor. Relays shall be dry contacts.
- 3. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
- 4. Sensors shall be available in multiple lens options which are customized for specific applications.
- 5. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- 6. All sensors shall have two RJ-45 ports or be capable of utilizing a splitter.

7. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue.
  8. Every sensor parameter shall be available and configurable.
    - a. For rooms connected to the backbone, parameters shall be configurable remotely from the software or locally via the device push-button.
    - b. For stand-alone rooms, parameters shall be configurable locally via the device push-button.
  9. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring the units together with CAT-5 cabling.
  10. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
  11. Wall switch sensors shall fit a standard single-gang GFI opening.
  12. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to a mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (off) condition.
  13. Sensors with dimming can control 0-10 VDC dimmable fixtures by sinking up to 20 mA of Class 2 current.
- C. Wall Switch Replacement Occupancy Sensor Dual-Technology Type
1. Wall unit, suitable for mounting to a standard outlet box, employing passive infrared and ultrasonic or microphonic technology, suitable for 120/277 volt operation, suitable for use with electronic ballasts, possessing immunity to EMI and RFI, detects movement over 2000 square foot with a 180 degree line-of-sight coverage, adjustments for time delay and sensitivity; and containing an “auto-off-on” switch. Standard color to be white.
- D. Ceiling mounted occupancy sensor type A:
1. Ceiling type, suitable for mounting to a standard outlet box, dual ultrasonic or microphonic and passive infrared technology, 360 degree coverage, possessing immunity to EMI and RFI, adjustments for light level, time delay and sensitivity. Provide white units. Manufacturer to select angle coverage, range, number of sensing sides and other necessary parameters to suit the conditions and size of the space.
- E. Ceiling mounted occupancy sensor type B:
1. Ceiling type, suitable for mounting to a standard outlet box, employing passive infrared technology, possessing immunity to EMI and RFI, 360 degree coverage, coverage square footage as required, adjustments for light level, time delay and sensitivity. Color to be white.

### PART 3 - EXECUTION

#### 3.1 GENERAL INSTALLATION

- A. Support lighting controls cabling according to Section 271100.
- B. Install all equipment in accordance with manufacturer’s printed instructions unless noted otherwise.
- C. All spaces shall be programmed according to schedules included in the drawings.
- D. Coordinate layout and installation of ceiling-mounted devices with other construction that pene-

trates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

## 3.2 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label contactors with a unique designation.

## 3.3 FIELD QUALITY CONTROL

- A. Testing and Calibration of Lighting Controls: Prior to Final Acceptance/ Punch, contractor shall provide Functional Testing and Calibration of all Lighting Controls and Lighting Control Systems as required in this specification.
- B. Prepare test and inspection reports for each lighting control area or room. Reports shall include all information for each type of control device or system as outlined in **Testing, Adjusting and Calibration of Lighting Control Devices and Systems** below. Provide three (3) copies of all records and reports to A/E prior to date of Final Acceptance Punch List site visit. Records shall be bound in three (3) ring binders and properly labeled, dated and identified for project. Provide tabulation separations to identify different systems (i.e. building interior vs. exterior or theatre) and devices. Provide Table of Content as first sheet.

## 3.4 TESTING, ADJUSTING AND CALIBRATION OF LIGHTING CONTROL SYSTEMS

- A. Perform Manufacturer's Power-Up and Installation checklist. At a minimum include:
  - 1. Inspection of all terminations for tightness.
  - 2. Check all wiring for completeness.
  - 3. Inspect all low and line voltage wires and cap unused wires.
  - 4. Apply power.
  - 5. Confirm system functions.
  - 6. Set Date and Time.
  - 7. Provide any software updates.
  - 8. Programming is complete, according to schedules in drawing.
  - 9. Graphical interface is functioning properly.
- B. Verify override switch operation and time-out of override, per schedules on drawings.
- C. Verify 24 hours OFF/ON settings are functioning.
- D. Verify photocell controlled luminaire(s) are ON at dusk and OFF at Dawn or Time Set as determined by Owner and A/E.
- E. Verify lighting contactors controlled via the Lighting Control System operate and controlled lighting groups correspond with plans and are operating correctly.



- F. Troubleshoot and correct all deficiencies.
- G. Record all data and sign/date of performance of Calibration and Testing. Record shall include Location (room #), time and date, performed by, settings and written verification that all items listed above and required by manufacturer have been performed. Include verification (time ticket) of all work performed by factory representative for programming and adjustments.

## 3.5 TESTING, ADJUSTING AND CALIBRATION OF LIGHTING CONTROL DEVICES

- A. Occupancy Sensors:
  - 1. Record location, quantity, and model number of sensor(s) and verify application.
  - 2. Verify location and quantity of sensor(s) is optimal for room.
  - 3. Perform “walk” mode test to adjust the following:
    - a. Ultrasonic/microphonic range
    - b. Infrared range
    - c. Sensitivity – unit should activate within 2-3 seconds of entry for automatic on spaces. Unit should not de-activate when space is occupied, especially in corners. Unit should not “nuisance” activate due to occupants outside space.
- B. Wall switches
  - 1. Record location, quantity, and model number of switch(es) and verify operation.
  - 2. Operate each switch and verify the controlled luminaire(s) correspond with the plan.
- C. Troubleshoot and correct all deficiencies.
- D. Record all data. Sign and date performance record. Record shall include:
  - 1. Location (room #)
  - 2. Time
  - 3. Date
  - 4. Performed by
  - 5. Settings
  - 6. Written verification that all procedures required above and required by manufacturer have been performed.

## 3.6 DEMONSTRATION/TRAINING

- A. Coordinate demonstration of products specified in this Section with A/E and Owner.
- B. Engage a factory-authorized service representative to start up system and train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Training sessions shall be videotaped and given to the Owner on CD/DVD. Schedule training at least two weeks in advance. Notify both A/E and Owner of training dates.
- C. Within the first year after final acceptance/substantial completion, provide 1 day (4 hours) to allow for a site visit from a factory-authorized service representative to adjust programming, graphics, schedules, and re-train Owner's personnel as required.

## 3.7 WARRANTY

- A. General. The contractor warrants that all work provided under the contract will be in conformance with the contract and free from defects in workmanship, materials and equipment for a period of one (1) year or such longer periods may be specified in the contract documents, except as provided below. Warranty time periods shall commence from the date of Owner acceptance of the whole, or any part of the project.
- B. Latent Defects. On demand by the Owner, at any time within the one (1) year period following substantial completion or final acceptance, if applicable, the Contractor shall promptly repair or replace all defective or non-conforming work resulting from, or constituting, latent defects, fraud, fraudulent concealment or gross negligence. The Owner and/or A/E will give timely notice of such defects.
- C. Prompt Repair. Upon notice from Owner of such defects or non-conforming work, the Contractor shall promptly visit the site within 48 hours in the company of a building representative, and shall provide all labor, material and equipment to promptly repair or replace the defective or non-conforming work. The repair shall include all adjacent work not necessarily provided by the Contractor but damaged as a result of such defects or non-conforming work, Owner may repair or replace such work and charge the cost thereof to the Contractor. Work which is repaired or replaced by the Contractor shall be inspected and shall be warranted by the Contractor in accordance with this Article. The warranties set forth herein are in addition to all warranties or guarantees expressed or implied by operation of law, statute or ordinance.
- D. Commercial Warranties. The Contractor shall deliver all commercial warranties received from manufacturers to the A/E prior to final completion but this shall not reduce Contractor's obligations under this article.

END OF SECTION 260923