PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide and install the necessary equipment for a complete lighting control system as specified on the lighting drawings, lighting control details, and relay panel schedules. The system shall consist of lighting control relay panels (there shall be at least one relay provided for each space), occupancy sensors, wall stations, and photosensors, that are interconnected via a topology free network to form a complete system. Only relays shall switch the lighting loads and the networked devices and/or the astronomical time clock shall control the relays.

B. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions, and Division l Specification Sections apply to work specified in this section.

C. Related Work Specified Elsewhere:

1. Section 26 05 10 Basic Electrical Requirements
2. Section 26 05 53 Electrical Identification
3. Section 26 27 26 Wiring Devices

1.02 QUALITY ASSURANCE

A. Manufacturers: Provide products by the lighting control equipment manufacturer indicated on the drawings and specifications, or approved equal. To ensure a uniform installation and single responsibility, all of the equipment including relay panels, occupancy sensors, wall stations, photosensors, etc. shall be supplied by a single manufacturer.

B. Warranties:

1) The Manufacturer of the lighting control equipment shall warranty the Relay panels (including relays), Occupancy Sensors, Wall Stations, etc. to be free from defects of material or workmanship for a period of two (2) years from the date of final commissioning. During the period of this warranty, equipment which proves to be defective shall be repaired or replaced at no charge. Unauthorized local repairs of the equipment during the warranty period shall relieve the manufacturer of his responsibilities under this warranty.

2) The bidder shall include the name, address, and phone number of at least two factory authorized Field Warranty centers within a 150 mile radius of the jobsite as a part of the bid.

3) The Manufacturer shall establish the terms and price for an extended warranty of the equipment for each year after the expiration of the warranty stated above. The Owner shall have the option of accepting or rejecting said extended warranty at the beginning of each year.

1.03 CODES AND STANDARDS

A. Install all work in accordance with the applicable requirements of the following:

1. Underwriter's Laboratories, Inc.
2. National Electrical Code (NFPA-70)
3. National Electrical Manufacturers' Association (NEMA)
4. ANSI construction and rating standards

B. Certificate of Installation: The Contractor shall submit certificates from the manufacturer's field engineer stating installed system is operating properly and complies with manufacturer's recommendations.

1.04 SUBMITTALS

A. Submit shop drawings to the Engineer for review that shall include the following:

1) Outline Drawings: Indicate dimensions, arrangement of components, and clearance and access requirements.

2) Block Diagram: Show interconnections between components specified in this Section and devices furnished by the controls system contractor. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

3) Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram. There shall be a job specific overall wiring diagram showing all relay panels and the method of interconnection of all occupancy sensors, remote relay panels, wall stations, exterior photosensors, etc.

4) Drawings showing the occupancy sensor layout and coverage for the entire building(s) in all areas that are specified to have occupancy control. Drawings shall indicate the type of sensor including model number for all sensors shown.

5) Manufacturer catalog data, specification sheets, and technical data for all products provided.

B. The lighting control manufacturer shall be one who has been continuously engaged in the manufacture of occupancy sensors, relay panels, and lighting control equipment for five years or more.

C. Substitutes will be considered only when they are submitted ten days prior to bid date, and are accompanied by sufficient catalog data, specifications, and technical information (including schematic wiring diagrams of the specific system designed) for evaluation. Summarize proposal with a list of equipment catalog or series numbers. The submittal shall indicate whether the submitted equipment meets the specification exactly or, if an alternate methodology is used to meet the intent of the specification, specifically indicate the alternate methodology in the submittal. Prior approval submittal, review, and approval shall not be considered to be shop drawing review and approval.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. Handle equipment and controls carefully to prevent breakage, denting and scoring finish. Do not install damaged equipment and controls; replace and return damaged units to equipment manufacturer.

B. Store lighting control equipment in clean, dry spaces that meet the manufacturer’s recommendations for environmental conditions. Store in original cartons and protect from dirt, physical damage, weather, and construction traffic.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Listing of a manufacturer as acceptable does not in any way relieve the contractor from the responsibility for providing a lighting control system that meets all the requirements of these specifications.

1. Nexlight; Northport Engineering Group
2. Hubbell Building Automation
3. Lutron Electronics Company, Inc.
4. Leviton Mfg. Company Inc.
5. Lighting Control and Design
6. Watt Stopper

2.02 RELAY PANELS

A. Scope and functionality: To provide lighting control relay cabinets, as specified in the drawings and these specifications, that will control the lighting in the individual spaces based on occupancy, manual input or time of day scheduling. Occupancy sensors, manual switches, an internal timing and control unit, and/or external sensors or other control signal sources send a digital signal to a microprocessor based programmable-system control module that processes the digital signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits for groups of lighting fixtures or other loads. All sensors, switches, and any external devices providing an input into the lighting control module shall be addressable either inherently or by means of a digital interface that will provide addresses for the analog devices. When programmed, the system shall control each relay by the means indicated on the relay panel schedules. The individual space control (as specified in the relay panel schedules) shall be the first priority for the programming (i.e., occupancy sensor, time of day, etc.) but the BAS system shall be capable of overriding the programming through manual user input into the BAS or through programmed schedules in the BAS. The BAS interface provided by this contractor for the lighting control system shall provide the controls programmer with the ability to see each relay as a point on the controls system and the functionality to program individual overrides for each of those points.

1. The relay cabinet shall contain mechanically latching lighting control relays with a minimum life cycle of 150,000 ON/OFF cycles at full load. Lighting control relays shall be individually UL listed and shall bear labels indicating compliance. Lighting control relays shall be specifically designed for control of 120, or 277VAC lighting loads including but not limited to incandescent, low-voltage, neon, cold cathode, LED, fluorescent and HID lighting sources at a full 20 AMPS and motor loads of 1/2 Hp @ 120 VAC or 1.5 Hp @ 277 VAC. Lighting control relays shall be designed with a mechanical latching mechanism that shall hold the relay in its last activated state indefinitely, with no change of state during an interruption of power. Each lighting control relay shall include a mechanical means of turning the relay ON or OFF without the need for electrical power of any kind. The relays shall have a KAIC rating equal (at a minimum) to that shown on the relay panel schedules.

C. The relay cabinet shall not exceed twenty inches in width and six inches in depth.

D. The relay panel shall include in the control module an astronomical timeclock with programmable geographic location.

E. The relay panel must be U.L. approved and shall bare labels to indicate compliance.

F. Communication over the control network shall allow any switch input from any device to be linked to any relay output or group of relay outputs in the lighting control system for complete, unrestricted control.

G. The lighting control system specified herein shall utilize a 2-wire topology free polarity insensitive powered network. Devices connected to the network shall be capable of doing so without regard for network topology or wiring polarity.

H. Power Failure and Power-Up Options: Each lighting control panel shall be provided with circuitry that shall automatically shut down the controller whenever the incoming power fails. Upon restoration of incoming control power, the lighting control panel electronics shall be restarted and resume normal operations, and all circuits will be maintained in the condition they were last in.

1. The lighting control system shall be provided with spare relays as indicated on the relay panel schedules and any required programming expandability for the spare relays.

J. Provide one (1) BACnet (the basis of design) communication interface at each building for integration with the BAS. Lighting control panels within the same building shall be interconnected via control wiring and the lighting control network. Remote buildings shall each have a BACnet interface and an independent lighting control network. All inter-building communication shall be accomplished through the BAS on the fiber optic backbone, there shall be no cabling between buildings for the lighting control network. The interface with the BAS shall enable the BAS operator to remotely control and monitor individual relays from a BAS operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the BAS. Coordinate the BAS interface type and/or protocol with the controls contractor prior to purchase. The basis of design is BACnet SMTP; however, if the controls system being installed would more easily interface with the lighting control system using another type of protocol (i.e., Lon Talk, Modbus, etc.) present this option (with supporting documentation and cost or credit pricing) to the engineer for review and approval.

2.03 OCCUPANCY SENSORS, WALL SWITCH STATIONS, AND PHOTOSENSORS

A. Scope and functionality: To provide dual technology occupancy sensors, wall stations, etc. in all areas and coordinated with the relay panel schedules for type of control. The manufacturer shall provide a complete layout of all occupancy sensors required prior to bid. The occupancy sensors and wall stations shall open and close the relays in the lighting control panel via the lighting control network. If required for low voltage power, switch packs may be used to provide power to occupancy sensors, but shall not switch the lighting loads in the space. All occupancy sensors and wall stations shall be inherently addressable or provided with a digital interface to provide addresses for analog devices. Occupancy sensors and wall stations shall communicate with the lighting control panel via a topology and polarity free communications network. Submit shop drawings indicating the layout and type of all sensors and wall stations (including a single line diagram of all control wiring) applicable to the area of coverage and size/type room to be controlled.

B. Dual Technology Sensor (Ceiling and Wall Type)

1) The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.

2) Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

3) Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

4) Ceiling mounted sensors shall have a flat, unobtrusive appearance and provide 360° coverage.

5) To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

6) Provide complete with power pack (if required for low voltage power not supplied though network).

7) Sensors shall have a time delay that is adjusted automatically or shall have a fixed time delay of 5 to 30 minutes, set by DIP switch.

8) Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

9) The sensors shall feature terminal style wiring, which makes installation easier.

10) Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.

11) Sensors shall have standard 5 year warranty and shall be UL listed.

12) Spare Sensors and Parts - Provide ten (10) percent spare of each sensor type, power pack and device installed in the facility or five of each type, whichever is greater.

C. Wall Switch Stations

1) Push-Button Switches: Modular, momentary-contact, low-voltage type.

2) Match color specified in Section 26 27 26 "Wiring Devices."

3) Integral LED pilot light to indicate when circuit is on.

4) Provide a stainless steel wall plate, number of gangs, as required.

5) Engraved or permanently silk-screened on wall plate. Use ON/OFF designations or as indicated on Drawings.

D. Photosensor

1) Provide an exterior photosensor for the purpose of providing an input to the lighting control network for available daylight.

2) The sensor shall be addressable or provided with a digital interface to provide an address to an analog device.

3) The sensor shall support a range of at least zero to one hundred footcandles and have a resolution of 1 footcandle.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install lighting controls where shown, in accordance with manufacturer's written instructions and with recognized industry practice to ensure that lighting control equipment complies with applicable requirements of NEC and UL standards and with the applicable portions of NECA's "Standard of Installation."

B. Relay panel locations shall be coordinated by the electrical contractor prior to rough-in.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

D. Size all conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Identify components and power and control wiring according to Section 26 05 53 "Electrical Identification."

F. T-tapping of control wiring shall not be accepted.

G. Label all control wiring with a unique designation marking it as part of the lighting control network.

H. Coordinate layout and installation of ceiling-mounted occupancy sensors with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies. All sensor locations shall comply with the manufacturer’s recommendations for installation.

I. It shall be the Contractor's responsibility to locate and aim occupancy sensors in the correct location required for a complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The Contractor shall provide additional sensors, if required, to properly and completely cover the respective room.

3.02 COMMISSIONING

 Provide factory commissioning of the complete system as part of the closeout. A factory authorized field engineer (or certified factory representative) shall inspect the complete installation and programming of the system and provide a report documenting that the installation and programming of the system is in compliance with this specification. The report shall be provided as part of the closeout documents. The commissioning agent shall, at a minimum, perform the following verifications:

1) Verify connection and location of controls.

2) Energize processor panel and download system data program.

3) Verify proper connection of panel links (low voltage/data) and address panel.

4) Download system panel data to panels (if applicable).

5) Check load currents and remove by-pass jumpers.

6) Verify system operation control by control, circuit by circuit.

7) Verify proper operation of manufacturers interfacing equipment.

8) Obtain sign-off on system functions.

9) User to be trained on system operation.

3.03 TRAINING

 Provide a minimum of four (4) hours of training for at least two maintenance personnel to be conducted by a factory authorized field engineer (or certified factory representative). The training shall include (but not be limited to); programming, troubleshooting, and repair.

Appendix Reference: PCS Lighting Control and Emergency

 Lighting Detail

 PCS Lighting Control Detail

 PCS Lighting Control Notes

**END OF SECTION**