~~~~~ ***PROJECT NOTE*** ~~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL “PROJECT NOTE” TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE” DATE. THE “CPS CONTROL” DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS. REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ ***END OF PROJECT NOTE*** ~~~~

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

~~~~~ ***PROJECT NOTE*** ~~~~~~

SELECT APPLICABLE LIGHTING CONTROL DEVICES AT INTERIOR SPACES. USE OF OUTDOOR MOTION SENSORS IS NOT TYPICAL FOR CPS PROJECTS. REVIEW WITH CPS IF OUTDOOR MOTION SENSORS ARE REQUIRED FOR PROJECT.

SELECT OUTDOOR CONTROL DEVICES AS REQUIRED.

REFER TO ROOM DATA SHEETS FOR ADDITIONAL INFORMATION FOR USE OF THE DEVICES PER ROOM TYPE

~~~ ***END OF PROJECT NOTE*** ~~~~

1.01 SECTION INCLUDES

A. Occupancy/Vacancy sensors.
B. Outdoor motion sensors.
C. Outdoor photoelectric controls.
D. Daylighting controls.
E. Low Voltage Wall Control Devices.
F. Lighting contactors.
G. Toggle Switches
H. Line Voltage Dimmer Switches

1.02 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.
B. Chicago Electrical Code - Municipal Code of the City of Chicago, Building/Electrical Code Requirements; 2018.
C. Chicago Energy Conservation Code - Chicago Energy Transformation Code, based on the International Energy Conservation Code, with amendments; Current Edition.
D. City of Chicago Building Code - Chicago Construction Codes, Title 14B; Current Edition.
E. IEEE C62.41.1 - IEEE Standard Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (Reaffirmed 2008).
F. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
G. IEEE C62.45 - Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits; 2002.
H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
I. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
J. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
K. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).
L. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.
M. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
N. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
O. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
   2. Coordinate the placement of wall switch occupancy/vacancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy/vacancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement.
   5. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 51 00 and lighting fixture schedule.
   6. Notify Architect/Engineer of Record of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
B. Pre-Wire Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
   1. Low voltage wiring requirements.
   2. Separation of power and low voltage/data wiring.
   3. Wire labeling.

4. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
5. Control locations.
6. Load circuit wiring.
7. Connections to other equipment.
8. Installer responsibilities.

C. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
C. Shop Drawings:
1. Occupancy/Vacancy Sensors: Provide lighting plan indicating location, device coverage, model number, and orientation of each occupancy/vacancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
3. Interconnection diagrams for occupancy sensors and daylighting controls showing field-installed wiring.
D. Field quality control reports.
E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
F. Operation and Maintenance Data: Include detailed information on device programming and setup.
G. Maintenance Materials: Furnish the following for Board's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Manufacturer's recommended operation and maintenance practices for each type of product including, but not limited to:
a. Tools required.
b. Acceptable cleaners and recommended cleaning practices.
c. Replacement parts list.
d. Manufacturer service department contact information.
e. Submittal data.
f. Intended operation narrative.
H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.05 QUALITY ASSURANCE

A. Listed and labeled as defined in the Chicago Electrical Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with City of Chicago Building Code, Chicago Energy Conservation Code and Chicago Electrical Code.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.
B. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide five year manufacturer warranty for all occupancy/vacancy sensors.
C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
D. Provide five year manufacturer warranty for digital load controllers.
E. Except as otherwise noted, products provided shall be warranted against defects in design, manufacture, and operation for a period of not less than five (5) years.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Occupancy/Vacancy sensors: 1% of total devices; minimum of 2 devices
   2. Outdoor motion sensors: Minimum one of each type.
   3. Outdoor photoelectric controls: Minimum one of each type.
   4. Daylighting controls: Minimum one of each type.
   5. Powerpacks: Minimum one of each type.
   6. Low Voltage Wall Control Devices: Minimum two of each type.
   7. Lighting contactors: Minimum one of each type.
   8. Toggle Switches: Minimum two of each type.
   9. Line Voltage Dimmer Switches: Minimum two of each type.
   10. Switch Button Covers: equal to five percent of amount installed for each size/type indicated, but no fewer than five for each size/type.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.
B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

~~~~~ PROJECT NOTE ~~~~~~

EDIT BELOW TO INCLUDE / EXCLUDE OCCUPANCY SENSING DEVICES IN COORDINATION WITH THE SCOPE OF THE PROJECT.

~~~ END OF PROJECT NOTE ~~~~

2.02 INDOOR OCCUPANCY/VACANCY SENSORS

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com
   2. Cooper Lighting Solutions, Inc: www.cooperlighting.com
   3. Current NX: www.currentlighting.com/controls-sensors
   4. Leviton Manufacturing Company, Inc: www.leviton.com.
   5. Lutron Electronics Company, Inc: www.lutron.com
   6. WattStopper: www.wattstopper.com

B. All Occupancy/Vacancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS
~~~ END OF PROJECT NOTE ~~~~

      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.
      d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and audible sound sensing technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
   5. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.
   6. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
      a. Coordinate both technologies within the same sensor to have the same coverage area.
   7. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   8. Turn-Off Delay: Field adjustable, with time delay setting over a minimum range of 1 to 15 minutes.
   9. Sensitivity: Field adjustable.
   10. Compatibility (Non-Dimming Sensors): Suitable for controlling low-voltage lighting with electronic transformers, and fractional motor loads, with no minimum load requirements.
   11. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings. Provide any power packs, relay and control components necessary for a fully functional complete system.
   12. Where multiple occupancy sensors occur within the same space, connect sensors together to control the lights as a unit.
   13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

14. Bypass Switch: Override the on function in case of sensor failure.

C. Wall Switch Occupancy/Vacancy Sensors:

1. General Requirements:
   a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
   b. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
   c. Where indicated, provide two button units for raise/lower dimming of a single lighting load.
   d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.
   e. Finish: Match finishes specified for wiring devices, unless otherwise indicated.
   f. Provide vandal resistant coated-steel wire cage for passive infrared (PIR) and dual technology wall switch occupancy sensors located in areas subject to damage or vandalism..

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS
~~~ END OF PROJECT NOTE ~~~~

2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
   a. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 square inches.

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS
~~~ END OF PROJECT NOTE ~~~~

3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within area of 400 square feet.
   a. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches.
   b. Provide sensors operating at a minimum of 32 kHz and a maximum of 98dB.

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS
~~~ END OF PROJECT NOTE ~~~~

4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:
   1. General Requirements:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Provide field selectable setting for disabling LED motion detector visual indicator.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Locate sensors away from areas with strong air currents such as adjacent to HVAC diffusers.
      f. Layout of sensors shall account for sensitivity adjustments below maximum and any absorptive materials such as carpeting or material covered partitions.
      g. Finish: White unless otherwise indicated.

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS
~~~ END OF PROJECT NOTE ~~~~

   2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      b. Extended Range Sensors: Capable of detecting motion within 90 feet of sensor at a mounting height of 10 feet, with a field of view of 360 degrees.
      c. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches.
      d. Provide sensors operating at a minimum of 32 kHz and a maximum of 98dB.

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS
~~~ END OF PROJECT NOTE ~~~~

   3. Ultrasonic Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 600 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.
         1) Corridor Coverage: Capable of detecting motion within 90 feet at a mounting height of 10 feet in a corridor not wider than 14 feet.

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS

~~~ END OF PROJECT NOTE ~~~~

4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 600 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

~~~~~ PROJECT NOTE ~~~~~~
EDIT SENSOR TECHNOLOGY OPTIONS BELOW TO SUIT PROJECT REQUIREMENTS
~~~ END OF PROJECT NOTE ~~~~

5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Do not use to initiate an ON sequence.
   b. Provide automatic gain control.
   c. Standard Range Sensors: Capable of detecting motion within an area of 600 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   d. Extended Range Sensors: Capable of detecting motion within an area of 2,000 at a mounting height of 9 feet.
      1) Corridor Coverage: Capable of detecting motion within 90 feet at a mounting height of 10 feet in a corridor not wider than 14 feet.

E. Power Packs for Low-Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low-voltage class 2 transformer and relay compatible with specified low-voltage occupancy sensors for switching of line-voltage loads.
   2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating: As required to control load indicated on drawings.

2.03 OUTDOOR MOTION SENSORS

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com
   2. Cooper Lighting Solutions, Inc: www.cooperlighting.com
   3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
   4. Leviton Manufacturing Company, Inc: www.leviton.com.
   5. Lutron Electronics Company, Inc: www.lutron.com
   6. WattStopper: www.wattstopper.com

B. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.

C. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.

D. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during adjustable turn-off delay time interval.

E. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.

F. Integral Photocell: For dusk to dawn operation.

G. Manual Override: Activated by switching power off to unit and then back on.
H. Load Rating: LED load at 120 V ac.
I. Coverage: Capable of detecting motion within distance of 50 feet at mounting height of 8 feet, with field of view of 270 degrees.
J. Operating Temperature: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 degrees Fahrenheit, rated as rain-tight according to UL 773A.
K. Bypass Switch: Override the on function in case of sensor failure.
L. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.
M. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 square inches.

2.04 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
1. Acuity Brands, Inc: www.acuitybrands.com
2. Cooper Lighting Solutions, Inc: www.cooperlighting.com
3. Hubbell Building Automation: www.hubbellautomation.com.
4. Intermatic, Inc: www.intermatic.com.
5. Leviton Manufacturing Company, Inc: www.leviton.com.
6. NSI Industries LLC: www.nsiindustries.com
7. Paragon Electrical Products; www.paragoncontrol.com.

B. Locking Receptacle-Mounted Outdoor Photo Controls
1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on compatible receptacle, listed and labeled as complying with UL 773.
2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
3. Mounting: Twist lock complying with ANSI C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
4. Photo Sensor: Cadmium sulfide.
5. Light Level Activation: 1.5 to 10 turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
6. Voltage: As required to control load indicated on drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control load indicated on drawings.
9. Surge Protection: 160 joule metal oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE C62.45 for Category A1 locations.
10. Time Delay: 15-second minimum, to present false operation

2.05 DAYLIGHTING CONTROLS

A. Manufacturers:
1. Acuity Brands, Inc: www.acuitybrands.com
2. Cooper Lighting Solutions, Inc: https:/www.cooperlighting.com/
3. Hubbell Building Automation, Inc: www.hubbellautomation.com
4. Leviton Manufacturing Company, Inc: www.leviton.com.
5. Lutron Electronics Company, Inc: www.lutron.com/sle.
6. WattStopper: www.wattstopper.com.

B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors, manual override controls, and lighting control system.

C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
   1. Sensor Type: Filtered silicon photo diode.
   2. Sensor Range:
      a. Indoor Photo Sensors: 10 to 200 footcandles.
      b. Atrium Photo Sensors: 100 to 1000 footcandles.
      c. Corridor Photo Sensors: 100 to 1000 footcandles.
      d. Skylight Photo Sensors: 1000 to 10,000 footcandles.
         1) Housed in threaded plastic fitting for mounting under skylight, facing up at skylight.
   3. Finish: White unless otherwise indicated.
   4. Relay Unit: Power supply to sensor shall be 24V dc, 150 mA and Class 2 power source as defined by the Chicago Electrical Code.
   5. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
   6. Indicator: Two LEDs to indicate the beginning of on-off cycles.
   7. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773AUL . Sensor shall be powered from the relay unit

2.06 LOW VOLTAGE WALL CONTROL DEVICES

A. Switch Control/Manual Override Stations: Control voltage, momentary contact, push button style switching devices providing the indicated switch function to interface with the modular/networked control system. Provided with the following:
   1. 1,2,3,4, or 8 pushbutton actuators on a single gang device.
   2. Removable buttons for field replacement
   3. LED on the face of each pushbutton providing visual feedback of switch/load status and switch/programming assignment.
   4. Thermoplastic construction designed for ganged wall box installation with other similar devices.
   5. Modular wiring terminations for the connection of field wiring between modular/networked control devices.

B. Scene Control Stations: Control voltage, solid state, devices providing dimming function(s) and ON/OFF function(s) from the same device and interfaces with the modular/networked control system. Provided with the following:
   1. Pushbutton pre-set control of multiple loads as well as the ability to manually raise/lower the lighting levels of each of the pre-set loads.
   2. Individual pre-set scene buttons and separate raise/lower control function shall be programmed and provided on a sign gang strap device.
   3. Thermoplastic construction designed for ganged wall box installation with other similar devices.
   4. Modular wiring terminations for the connection of field wiring between modular/networked control devices.

C. Dimming Control Stations: Control voltage, solid state, devices providing dimming function to interface with the modular/networked control system. Provided with the following:
   1. Single button style actuator to manually raise/lower and turn ON/OFF controlled luminaire(s) lighting level.
   2. Multi-location (3-way and 4-way) control function of connected loads.
   3. LED indicators provide visual feedback for programming and troubleshooting.
   4. Thermoplastic construction designed for ganged wall box installation with other similar devices.

5. Modular wiring terminations for the connection of field wiring between modular/networked control devices.

~~~~~ PROJECT NOTE ~~~~~~
TOUCHSCREENS SHOULD NOT BE USED IN LOCATIONS WHERE DURABILITY IS A CONCERN.
~~~ END OF PROJECT NOTE ~~~~

D. Touchscreen Stations: Flush to wall surface installed devices, providing a flat, planar, capacitive touch sensitive user interface to the networked control system. Provides the following functions:
   1. User programmable and configurable
   2. Brightness Level setting of the controlled luminaires and devices
   3. Preset assignments, re-programming, and preset recall.
   4. ON/OFF control of controlled luminaires and devices.
   5. Interface with third party A/V equipment, to allow for control of third party equipment, devices, and components, via the touch screen.
   6. Raise/lower dimming of controlled luminaires, shades, projectors, etc

2.07 LIGHTING CONTACTORS

A. Manufacturers:
   1. ABB: www.electrification.us.abb.com
   2. ASCO Power Technologies, LP; a division of Emerson Electric Co
   3. Eaton Corporation: www.eaton.com
   4. Rockwell Automation Inc: www.rockwellautomation.com
   5. Schneider Electric: www.se.com

~~~~~ PROJECT NOTE ~~~~~~
REVISE SUBPARAGRAPHS BELOW, IF REQUIRED, FOR SPECIFIC RATINGS OR INDICATE ON DRAWINGS. COORDINATE CONTROL VOLTAGE WITH LIGHTING CONTROL SYSTEM IF USED.
~~~ END OF PROJECT NOTE ~~~~

B. Description: Electrically operated and mechanically held lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

C. Short Circuit Current Rating:
   1. Provide contactors with listed short circuit current rating not less than available fault current at installed location as indicated on the drawings.

D. Enclosures:
   1. Comply with NEMA ICS 6.
   2. Environment Type per NEMA EN 10250: As indicated on the drawings.
   3. Finish: Manufacturer's standard unless otherwise indicated.

2.08 TOGGLE SWITCHES

A. Manufacturers subject to compliance with requirements, provide products by one of the following manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com
   2. Cooper Lighting Solutions, Inc: www.cooperlighting.com

3. Hubbell Incorporated: www.hubbell-wiring.com.
4. Leviton Manufacturing Company, Inc: www.leviton.com.
5. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Lighted Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Pilot Light Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

F. Locking Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

G. Momentary Contact Wall Switches: Heavy Duty specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

H. Locking momentary contact wall switches: Heavy duty specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.

2.09 LINE VOLTAGE DIMMERS

A. Manufacturers subject to compliance with requirements, provide products by one of the following manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com
   2. Cooper Lighting Solutions, Inc: www.cooperlighting.com
   3. Hubbell Incorporated: www.hubbell-wiring.com
   4. Leviton Manufacturing Company, Inc: www.leviton.com
   5. Lutron Electronics Company, Inc: www.lutron.com
   6. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.
   7. WattStopper: www.wattstopper.com.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Continuously adjustable slide control type with separate on/off switch..

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
   1. Fluorescent: 600 VA.
   2. LED: 300 VA

E. Provide locator light, illuminated with load off.

F. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.
G. 600W dimmers shall require no derating when ganged with other devices.
H. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with Chicago Electrical Code.
C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
D. Verify that final surface finishes are complete, including painting.
E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.
G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.
C. Protect installation from dust and debris of other construction activities.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 - Boxes for Electrical Systems as required for installation of lighting control devices provided under this section.
    1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
    2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect/Engineer of Record to obtain direction prior to proceeding with work.
C. Maintain separation of remote-control, signaling, and power-limited circuits.
    1. See manufacturer instructions and Section 26 05 19 for control wiring conductors, wiring methods, and identification requirements.
D. Install and aim sensors in locations to achieve not less than 95 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
E. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceiling or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.
F. Install lighting control devices in accordance with manufacturer's instructions.
G. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
H. Install lighting control devices plumb and level, and held securely in place.
I. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26 - Wiring Devices - Lutron.

J. Provide required supports in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.
K. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
L. Identify components and power and control wiring according to Section 26 05 53 - Identification for Electrical Systems.
    1. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
    2. Label time switches with a unique designation.
M. Occupancy/Vacancy Sensor Locations:
    1. Location Adjustments: Do not make adjustments to locations without obtaining approval from Architect/Engineer of Record.
N. Outdoor Photo Control Locations:
    1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
    2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by photo control itself.
O. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into photo control.
P. Daylighting Control Photo Sensor Locations:
    1. Location Adjustments: Do not make adjustments to locations without obtaining approval from Architect/Engineer of Record.
    2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure light level controlled at designated task location, while minimizing measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
    3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into space, while minimizing measured amount of lighting from artificial sources.
Q. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near sensor location.
R. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
S. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
T. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 05 33.16 - Boxes for Electrical Systems for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.
B. Inspect each lighting control device for damage and defects.
C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
D. Test time switches to verify proper operation.
E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
G. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.
B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect/Engineer of Record.
C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
D. Where indicated or as directed by Architect/Engineer of Record, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect/Engineer of Record. Record settings in written report to be included with submittals.
F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect/Engineer of Record.
G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect/Engineer of Record. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect/Engineer of Record.
H. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.
B. After system checkout and adjustment, the contractor shall operate the system for the review of the Board Representative and Architect/Engineer of Record. Necessary adjustments or modifications shall be made as required by the Board Representative or Architect/Engineer of Record.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
B. See Section 01 79 00 - Demonstration, Training and Commissioning, for additional requirements.
C. Demonstration: Demonstrate proper operation of lighting control devices to Architect/Engineer of Record, and correct deficiencies or make adjustments as directed.
D. Training: Train Board's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
    1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
    2. Provide minimum of two (2) sessions of four (4) hours of training. Provide a recording of one of the sessions for future use.

3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of installed lighting control devices.
4. Location: At project site.

END OF SECTION