

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electronic time switches.
2. Electromechanical dial-time switches.
3. Outdoor photoelectric switches, solid state, flexible mounting.
4. Outdoor photoelectric switches, low voltage.
5. Indoor occupancy and vacancy sensors.
6. Switchbox-mounted occupancy sensors.
7. Digital timer light switch.
8. Outdoor motion sensors.
9. Lighting contactors.
10. Conductors and cables.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings:

1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

C. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranties.

1.4 WARRANTY

- A. Special Extended Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.
 - 2. Extended Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES, LOW VOLTAGE

- A. Description: Solid state; one set of NO dry contacts rated for [24 V(dc) at 1 A] [24 V(ac) at 1 A], to operate connected load, complying with UL 773, and compatible with [luminaire] OR [lighting control panelboard].
 - 1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
 - 3. Time Delay: Thirty-second minimum, to prevent false operation.
 - 4. Mounting: 1/2 inch (13 mm) threaded male conduit.
 - 5. Failure Mode: Luminaire stays ON.
 - 6. Power Pack:
 - a. Dry contacts rated for [20 A] [LED] load at 120 and 277 V(ac), for [13 A] at 120 V(ac), and for [1 hp] at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.
 - 1) LED status lights to indicate load status.
 - 2) Plenum rated.
 - b. Digital controller capable of accepting [three] [four] 8PSJ inputs with [one] outputs rated for [20 A] LED] load at 120 and 277 V(ac), for [13 A] [16 A] [LED] at 120 and 277 V(ac), and for [1 hp] at 120 V(ac). Sensor has 24 V(dc), Class 2 power source.
 - 1) With integral current monitoring.

- 2) Compatible with digital addressable lighting interface.
- 3) Plenum rated.

2.2 INDOOR OCCUPANCY AND VACANCY SENSORS

Coordinate choices below with subsequent paragraphs in this article.

A. General Requirements for Sensors:

1. [Wall] or [Ceiling]-mounted, solid-state indoor [occupancy] [and] [vacancy] sensors.
2. [Passive infrared] [Ultrasonic] or [Dual] technology.
3. [Integrated] power pack.
4. [Hardwired] connection to switch[and BAS and lighting control system].

Retain subparagraphs below to specify various types of units required for Project.

5. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
6. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - c. Combination Sensor: Unless otherwise indicated, sensor must be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
7. Sensor Output: [Contacts rated to operate the connected relay, complying with UL 773A] [Sensor is powered from the power pack].
8. Power: [Line voltage]
9. Power Pack: Dry contacts rated for 20 A [ballast] [or] [LED] load at 120 and 277 V(ac), for 13 A tungsten at 120 V(ac), and for 1 hp at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.
10. Mounting:
 - a. Sensor: Suitable for mounting in any position in a standard device box or outlet box.
 - b. Relay: Externally mounted through a 1/2 inch (13 mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); turn lights off when selected lighting level is present.

B. PIR Type: [Wall] or [Ceiling] mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm).

Retain one of three subparagraphs below.

2. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
3. Detection Coverage (Corridor, Ceiling Mounted): Detect occupancy within 90 ft. (27.4 m) when mounted on a 10 ft. (3 m) high ceiling.

C. Ultrasonic Type: [Wall] [Ceiling] mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inch (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inch/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 ft. (27.4 m) when mounted on a 10 ft. (3 m) high ceiling in a corridor not wider than 14 ft. (4.3 m).
6. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of [1000 sq. ft. (110 sq. m)] [2000 sq. ft. (220 sq. m)] [3000 sq. ft. (330 sq. m)] when mounted 84 inch (2100 mm) above finished floor.

D. Dual-Technology Type: [Wall] [Ceiling] mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch

(23 200 sq. mm), and detect a person of average size and weight moving not less than 12 inch (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inch/s (305 mm/s).

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of [1000 sq. ft. (110 sq. m)] [2000 sq. ft. (220 sq. m)] [3000 sq. ft. (330 sq. m)] when mounted 48 inch (1200 mm) above finished floor.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switch box [with provisions for connection to BAS] [using hardwired connection] [using wireless connection].

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application [,and must comply with California Title 24].
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
4. Switch Rating: Not less than 800 VA [ballast] [or] [LED] load at 120 V, 1200 VA [ballast] [or] [LED] load at 277 V, and 800 W incandescent.

- B. Wall-Switch Sensor Tag WS1:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of [900 sq. ft. (84 sq. m)] [2100 sq. ft. (196 sq. m)].
2. Sensing Technology: [PIR] [Dual technology - PIR and ultrasonic].
3. Switch Type: [SP.] or [SP, field-selectable automatic "on," or manual "on," automatic "off."]
4. Capable of controlling load in three-way application.
5. Voltage: [Match the circuit voltage] [120 V [Dual voltage - 120 and.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor..
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes."
8. Color: [White]
9. Faceplate: Color matched to switch.

- C. Wall-Switch Sensor Tag WS2:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: PIR.

3. Switch Type: [SP.] [SP, manual "on," automatic "off."] [
4. Capable of controlling load in three-way application.
5. Voltage: [Match the circuit voltage] [120 V]
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than [No. 18] AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than [No. 14] AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION OF SENSORS

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. 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 instructions.

3.2 INSTALLATION OF CONTACTORS

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 INSTALLATION OF WIRING

Coordinate this article with Drawings.

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's instructions.
- C. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by [authorities having jurisdiction] Coordinate "Tests and Inspections" Paragraph below with "Qualifications" and "Field Quality Control" articles in Section 260010 "Supplemental Requirements for Electrical."
- B. Tests and Inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

- C. Nonconforming Work:
 - 1. Lighting control devices will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Prepare test and inspection reports.
- E. Manufacturer Services:
 - 1. Engage factory-authorized service representative to [support] field tests and inspections.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within [12] <Insert number> months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to [two] <Insert number> visits to Project during other-than-normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 2. For daylighting controls, adjust set points and dead band controls to suit Owner's operations.
 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 MAINTENANCE

- A. Software and Firmware Service Agreement:
1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement includes software support for [two] years.
 2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software upgrades that become available within [two] years from date of Substantial Completion. Verify upgrading software includes operating system and new or revised licenses for using software.
 - a. Upgrade Notice: No fewer than [30] days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.
 3. Upgrade Reports: Prepare written report after each update, documenting upgrades installed.

END OF SECTION 260923