

SECTION 26 09 23 – OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
- B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.
- C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including, but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.
- D. Provide factory commissioning as listed in part 3.

1.2 EQUIPMENT QUALIFICATION

- A. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
- B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.
- C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- D. Wall switch and line voltage products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.3 SYSTEM DESCRIPTION

- A. The objective of this section is to ensure the proper installation of the occupancy sensor-based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- B. The occupancy sensor-based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

1.4 SUBMITTALS

- A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

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- B. Submit typical room plans clearly marked by manufacturer showing proper product, location and orientation of each sensor. Beam patters shall be marked on plans.
 - 1. Location of doors, windows and typical types of room furniture shall be accounted for in the layouts of the sensors. Provide additional sensors as required on the plans.
- C. Submit any interconnection diagrams per major subsystem showing proper wiring.
- D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.
- E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.5 SYSTEM OPERATION

- A. Factory Startup: It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service shall be provided at no additional cost.
- B. Adjustments must include setting the proper sensitivity and time delay in the sensors. Simply changing sensitivity to maximum, unless space requires, shall not be acceptable. The sensitivity shall be set appropriately for the space, to detect half step into room, and detecting people working at a desk at the four (4) corners of the room.
 - 1. Automatic sensitivity or time delay settings shall NOT be used. All sensitivity and time delay settings shall be actively set.
- C. Provide the appropriate sensor for each room. Simply selecting dual technology sensors for every space shall not be acceptable.
 - 1. Where dual technology sensors are used, initial occupancy shall require both technologies (PIR and ultrasonic), while either technology will maintain and re-trigger occupancy.
- D. Sensors shall be set as vacancy (lights turn on by button, maintain by sensing individuals, and turn off when an individual is no longer sensed). Lights shall not operate automatically, unless noted otherwise.
 - 1. Provide compatible low voltage dimmers and wire with sensor. Digitally addressable sensors, dimmers and room controller may be used, provided sensor meets requirements of this specification. When a digitally addressable lighting control system is installed, manufacturer of the sensors and associated devices shall match the system.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identification with labels describing contents.
 - 1. Ten (10) low voltage ceiling mounted dual technology occupancy sensors.
 - 2. Five (5) dual voltage wall switch sensors.
 - 3. Ten (10) dual voltage power packs.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Lutron.

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- A. Listed products by application shall be Watt Stopper product numbers. Should the contractor choose to use an alternate listed manufacturer, they shall provide the sensor that meets the requirements of the specified sensors. Should an alternate manufacturer require additional sensors due to coverage patterns, they shall be provided at no additional cost to the owner.
1. Instructional and lecture Spaces: Provide, low (24) voltage ceiling mounted dual technology occupancy sensor with isolated relay. Provide coverage pattern to accommodate entire room.
 2. Open Offices, Restrooms, Storage Rooms and Corridors: Provide, low (24) voltage ceiling mounted ultrasonic occupancy sensor with isolated relay. Provide coverage pattern to accommodate entire room.
 - a. If sensor is not available with isolated relay, Dual tech sensors may be used in Open Offices to achieve isolated relay functionality; however, the sensor shall be programed as ultrasonic only. Remaining sensors must be ultrasonic type.
 3. Private Offices, Cafeteria and Conference Rooms: Provide, low (24) voltage ceiling mounted passive infrared occupancy sensor with isolated relay. Provide coverage pattern to accommodate entire room.
 - a. If sensor is not available with isolated relay, Dual tech sensors may be used in private Offices, cafeteria and conference rooms to achieve isolated relay functionality; however, the sensor shall be programed as PIR only.
 4. High Ceiling/Structure Spaces (Gymnasiums, Atriums, etc.): Provide, low (24) voltage high ceiling mounted passive infrared occupancy sensor. provide coverage pattern to accommodate entire space.
 5. Wet/damp, Refrigerated, Exterior and Unconditioned Spaces: Provide, low (24) voltage low temperature / wet listed passive infrared occupancy sensor. Provide coverage patter to accommodate entire area.
 6. Provide, where indicated, dual (120/277) voltage passive infrared wall switch occupancy sensor. Set as vacancy so that manual operation is required to turn lights on.
 7. Provide, where indicated, dual (120/277) voltage passive infrared 0-10V dimming wall switch occupancy sensor. Set as vacancy so that manual operation is required to turn lights on.
 8. Provide a dual (120/277) voltage power packs/lighting controllers (programmed for manual on when connected with low voltage station) and relay packs compatible with sensors as required.
 9. Provide low voltage controls (switches and dimmers), where indicated, compatible with the sensor power pack/lighting controller, from the same manufacturer as the occupancy sensor.
 10. Refer to Division 26 "Lighting Sequence of Operations," for time delay settings. Where no time delay setting is indicated, provide 10-minute time delay.
 11. Manufacturer shall be responsible to provide a shop drawing which indicates correct sensor type and location of sensor within each space.
- B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

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- C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180° coverage capability.
- D. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
- F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
- G. Vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
- H. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
- I. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).
- J. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
- K. Dual technology sensors shall be either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas.
- L. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
- M. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- N. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
- O. All sensors shall be capable of operating normally with LED lighting, electronic ballasts, PL lamp systems and rated motor loads.
- P. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- Q. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- R. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- S. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

- T. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- U. All sensors shall have UL rated, 94V-0 plastic enclosures.

2.3 CIRCUIT CONTROL HARDWARE – CU

- A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
- B. Relay Contacts shall have minimum ratings of:
 - 1. 20A – 120 VAC Incandescent
 - 2. 20A – 120 VAC Ballast
 - 3. 20A – 277 VAC Ballast
- C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
- D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #12 AWG.
- E. Input voltage shall be dual (120/277) rated.

2.4 INTEGRATION

- A. The BAS shall be integrated into the occupancy sensors via auxiliary relay in educational spaces, offices and conference rooms to provide occupancy notification. Coordinate integration with BAS installer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All controls shall be set as vacancy (manual operation required to turn lights on), unless noted otherwise.
- B. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (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.
- C. It is the contractor's responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at owner's facility, to verify placement of sensors and installation criteria.
- D. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary

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to familiarize the owner's personnel with the operation, use, adjustment, and problem-solving diagnosis of the occupancy sensing devices and systems.

- E. Occupancy Sensors shall be provided with minimum 10' additional wiring to allow repositioning of the sensor after the fact for poorly positioned sensors. Extra wire shall be coiled and supported adjacent to the power pack.
- F. Provide label on ceiling grid for location of occupancy sensor power pack above ceiling.
- G. Care shall be used in placing occupancy sensors to ensure proper activation of sensors. Consideration shall be given to HVAC equipment and diffusers, as well as windows and doors. Refer to sensor instruction manual for appropriate placement, in addition to manufacturer submittals.

3.2 FACTORY COMMISSIONING

- A. Before wiring between occupancy sensors and lighting control system is started, a pre-installation meeting, lasting a minimum of four (4) hours, shall be scheduled to ensure proper installation and functionality. This meeting shall be performed at the project site between the Distributed Lighting Control Manufacturer, Occupancy Sensor Manufacturer and installing Contractor. During this meeting, wiring connections and placement of devices shall be discussed and fully coordinated to ease the installation process for the contractor. Meeting minutes shall be composed by the contractor indicating time, personal present and discussion topics.
- B. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system. The factory authorized technician shall enter every space containing an occupancy sensor to verify the locations, sensitivity and delay. Any issues that have been noted previous to this visit shall also be addressed. This meeting shall include, at a minimum, the installing contractor, lighting control manufacturer (when installed) and occupancy manufacturer.
- C. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors. This training shall be during an additional visit around substantial completion and last a minimum four (4) hours.
- D. Approximately four (4) weeks after substantial completion, a follow-up meeting lasting a minimum four (4) hours shall be scheduled with the Distributed Lighting Controls Manufacturer, Contractor, and Owner to provide any additional technical assistance required and fine tune all occupancy sensors on the project.
- E. All commissioning visits shall be scheduled a minimum two (2) weeks in advance, and the Architect, Engineer, Owner and Construction Manager/Clerk of the Work shall be informed of all meetings in addition to parties that are to be present. A factory authorized technician shall be present at all required commissioning meetings. Any additional meetings required for a fully functioning system shall be included at no additional cost to the owner.

END OF SECTION 26 09 23