

SECTION 260923**LIGHTING CONTROL DEVICES WITH DIGITAL****PART 1 GENERAL****1.01 DESCRIPTION**

- A. Provide lighting control equipment complete and operable as specified herein and as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. All lighting control equipment shall be UL and CUL listed and labeled and shall comply with the NEC.
- B. Comply with FCC Regulations of Part 15, Subpart J, for Class A.
- C. All equipment in this section to have a minimum 5 year warranty.

1.03 SUBMITTAL AND RECORD DOCUMENTATION

- A. Submit product data for lighting control equipment and systems components, including dimensions and data on features and components. Include elevation views of front panels of control and indicating devices. Include data on ratings.
- B. Submit wiring diagrams detailing specific systems tailored to this Project and differentiating between factory-installed and field-installed wiring.
- C. Submit maintenance data for lighting control equipment and systems components to include in the operation and maintenance manual specified in Division 1.

PART 2 PRODUCTS**2.01 LINE-VOLTAGE OCCUPANCY SENSORS (AUTOMATIC WALL SWITCH)**

- A. Sensor shall be capable of detecting presence in the control area by detecting infrared energy. Small movements shall be detected, such as when a person is writing while seated at a desk.
- B. The sensor shall be a completely self-contained control system that replaces a standard toggle switch. Switching mechanism shall be a latching air gap relay, compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices shall not be allowed. Sensor shall have ground wire and grounded strap for safety.
- C. Sensor shall utilize advanced control logic based on RISC (Reduced Instruction-Set Circuit) microcontroller.
- D. To avoid false ON activations and to provide immunity to RFI and EMI, a technology shall be used to respond only to those signals caused by human motion.
- E. The sensor shall utilize continuously adjusting Zero Cross Relay control.
- F. Sensors shall utilize 'Smart Set' technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of Smart Set shall be selectable with a DIP switch.

- G. Sensor shall have a time delay that is adjusted automatically (with the Smart Set setting) or shall have a fixed time delay of 5, 10, 15, 20 or 30 minutes, walk-through mode, or test mode, set by DIP switch. In walk-through mode, lights shall turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
- H. Sensor shall have the choice of light flash alert and/or audible alert of impending light shutoff.
- I. Sensor shall have sensitivity adjustment that is set to either automatic or reduced sensitivity.
- J. Sensor shall have a built-in light level feature selectable with DIP switch.
- K. Sensor shall have automatic-ON or manual-ON operation.
- L. Sensor shall operate at universal voltages.
- M. Sensor shall be capable of switching 0-800 watts fluorescent/incandescent or 1/6HP @ 120VAC; 0 to 1200 watts fluorescent or 1/6 HP @ 230/277VAC.
- N. The sensor shall utilize a temperature-compensated dual element sensor and a multi-element Fresnel lens.
- O. Fresnel lens shall be made of hard, 1.0mm Poly IR 2 material for greater sensitivity and detection performance. Lens shall have grooves facing in to avoid dust and residue build up.
- P. To assure detection at desktop level uniformly across the space, sensor shall have a two-level, 28-segment multi-element Fresnel lens system.
- Q. Sensor shall cover up to 300 square feet for walking motion, with a field of view of 180 degrees.
- R. The sensor shall not protrude more than 3/8" from the wall and should blend in aesthetically.
- S. Adjustments and mounting hardware shall be concealed under a removable, tamper resistant cover.
- T. Provide as dual relay model where indicated on drawings.
- U. Manufacturers: Watt Stopper PW-100/200 Series, Lutron, Sensor Switch, or approved equal.

2.02 OCCUPANCY SENSORS (CEILING MOUNT, 360 DEG, DUAL TECHNOLOGY)

- A. 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.
- B. 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.
- C. 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.
- D. Sensors shall be mounted to the ceiling with a flat, unobtrusive appearance and provide 360deg of coverage.
- E. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

- F. To avoid false ON activations and to provide immunity to RFI and EMI, a technology shall be used to respond only to those signals caused by human motion.
- G. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up.
- H. Sensors shall operate at 24 VDC/VAC and halfwave rectified and utilize a power pack.
- I. Sensors shall utilize 'Smart Set' technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of Smart Set shall be selectable with a DIP switch.
- J. 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.
- K. 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.
- L. Sensors shall have a built-in light level sensor that works from 10 to 300 footcandles.
- M. The sensors shall have a manual on function that is facilitated by installing a momentary switch.
- N. Sensors shall have eight occupancy logic options that give the ability to customize control to meet application needs.
- O. The sensor shall have an additional single-pole, double-throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
- P. 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.
- Q. Manufacturers: Watt Stopper DT-300 Series, Lutron, Sensor Switch, or approved equal.

2.03 OCCUPANCY SENSORS (CEILING/WALL BRACKET MOUNT, DUAL TECHNOLOGY)

- A. 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.
- B. 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.
- C. 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.
- D. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize a technology that automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- E. Sensor shall be capable of corner mounting to a wall or ceiling in order to eliminate detection through open doorways and outside of controlled area. Coverage of both technologies must be complete and overlapping throughout the controlled area.

- F. To avoid false ON activations and to provide immunity to RFI and EMI, a technology shall be used to respond only to those signals caused by human motion.
- G. Sensor shall operate at 24 VDC/VAC and halfwave rectified and utilize a power pack.
- H. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.
- I. The lens shall cover up to 2000 square feet for walking motion when mounted at 10 ft and 1000 sq ft of desktop motion.
- J. DT-200 sensors shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
- K. Sensors shall utilize 'Smart Set' technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of Smart Set shall be selectable with a DIP switch.
- L. Sensors shall have a time delay that is adjusted automatically (with the Smart Set setting) or shall have a fixed time delay of 5 to 30 minutes.
- M. 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.
- N. Sensor shall have an override-ON function for use in the event of a failure.
- O. Sensor shall have a built-in light level sensor that works from 10 to 300 footcandles.
- P. 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.
- Q. Manufacturers: Watt Stopper DT-200 Series, Lutron, Sensor Switch, or approved equal.

2.04 OCCUPANCY SENSORS (CEILING MOUNT, ULTRASONIC)

- A. The ultrasonic occupancy sensors shall be capable of detecting presence in the floor area to be controlled by detecting Doppler shifts in a transmitted ultrasound.
- B. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40KHz. It shall utilize a technology that automatically adjusts the detection threshold to compensate for changing levels of activity and airflow throughout the controlled space.
- C. To avoid false ON activations and to provide immunity to RFI and EMI, a technology shall be used to respond only to those signals caused by human motion.
- D. Sensors of varying frequencies shall not be allowed so as to prevent sensors from interfering with each other and to assure compatibility in the event more sensors are added.
- E. The UT-300 sensor shall operate at 24 VDC/VAC and half-wave rectified and utilize a power pack.

- F. UT-355 shall incorporate a switching power supply for reduced power consumption; shall operate at 120/230/277 VAC, and shall not require a power pack. The UT-355 shall be utilized in areas with inaccessible ceiling spaces.
- G. Detection shall be maintained when a person moves only within or a maximum distance of 12 inches either in a horizontal or vertical manner at the approximate speed of 12 inches per second.
- H. The UT-300 sensor shall have a manual 'on' function that is facilitated by installing a momentary switch.
- I. Sensors shall be mounted to the ceiling with a flat, unobtrusive appearance and provide 360 deg of coverage.
- J. Sensors shall utilize 'Smart Set' technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of Smart Set shall be selectable with a DIP switch.
- K. Sensor shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after 30 seconds.
- L. UT-300 sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
- M. Sensors shall have a time delay that is adjusted automatically (with the Smart Set setting) or shall have a fixed time delay of 5 to 30 minutes.
- N. The sensor 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.
- O. Approved Manufacturer: Watt Stopper UT-300 / UT-355, Lutron, Sensor Switch, or approved equal.

2.05 POWER AND AUXILIARY RELAY PACKS

- A. Power pack shall be a self-contained transformer and relay module in a single small package.
- B. Power and auxiliary relay packs shall have dry contacts capable of switching 20 amp ballast load, 13 amp incandescent, 1 hp @120 VAC; 20 amp ballast @ 277VAC; 15 amp ballast, 1 hp @ 220-240 VAC.
- C. Power packs shall provide a 24 VDC, 150mA output/
- D. Power packs shall be capable of parallel wiring without regard to AC phases on primary.
- E. Auxiliary relay packs shall contain no transformer power supply and shall switch 120 VAC, 277 VAC or low voltage.
- F. Power and auxiliary relay packs shall have low voltage Teflon coated leads, rated for 300 volts, suitable for use in plenum applications.
- G. Power pack shall be UL 2043 rated, use UL94 V-O plenum rated plastic, and have low voltage Teflon leads for use in plenum applications.
- H. Power packs shall utilize Zero Crossing Circuitry.

- I. Manufacturers: Watt Stopper, Lutron, Sensor Switch, or approved equal.

2.06 EMERGENCY BYPASS RELAY

- A. Manufacturer: L C & D GR2001 E/S.

2.07 DIGITAL OCCUPANCY SENSOR (AUTOMATIC WALL SWITCH, DUAL TECHNOLOGY, DIMMING)

- A. Manufacturer: nLight nWSX PDT LV DX, or approved equal.

2.08 DIGITAL OCCUPANCY SENSOR (CEILING MOUNT, 360 DEG, DUAL TECHNOLOGY)

- A. Manufacturer: nLight nCM PDT 9, or approved equal.

2.09 DIGITAL SWITCH (ON/OFF)

- A. Manufacturer: nLight nPODM, or approved equal.

2.10 DIGITAL SWITCH (ON/OFF SINGLE ZONE DIMMING)

- A. Manufacturer: nLight nPODM DX, or approved equal.

2.11 DIGITAL SWITCH (ON/OFF 4-ZONE DIMMING)

- A. Manufacturer: nLight nPOD GFX, or approved equal.

2.12 DIGITAL DIMMING MODULE (0-10V)

- A. Manufacturer: nLight nPP16D, or approved equal.

2.13 DIGITAL RAISE/LOWER INTERFACE MODULE

- A. Manufacturer: nLight nIO RLX, or approved equal.

2.14 DIGITAL TYPE NL EMERGENCY BYPASS RELAY (NON DIMMING APPLICATION)

- A. Manufacturer: nLight nPP16ER, or approved equal.

2.15 DIGITAL TYPE NLD EMERGENCY BYPASS RELAY (DIMMING APPLICATION)

- A. Manufacturer: nLight nPP16DER, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. It shall be the Contractor's responsibility to locate and aim sensors in the correct location required for a complete and proper volumetric coverage within the range of coverage of controlled areas per the manufacturer's recommendations. The Contractor shall provide the quantity of sensors necessary to properly and completely cover each room indicated to have occupancy sensing.
- B. The Contractor shall provide power packs as required to accomplish the occupancy sensing indicated.

- C. Mount power packs to junction boxes in accessible locations above wall switches and per the manufacturer's instructions.
- D. Mount the sensors with adapters and/or swivels per the manufacturer's instructions.
- E. Connect low voltage/digital cables per manufacturer's installation instructions.
- E. It is the Contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the Owner's facility, to verify placement of sensor and installation criteria.
- F. The Contractor shall provide, at the Owner's facility, the training to familiarize the Owner's personnel with the operation, use, adjustment, and problem-solving diagnosis of the lighting control equipment and systems.

3.02 TESTING

- A. The lighting control equipment and systems shall be thoroughly tested to confirm proper operation.

END OF SECTION