SENSORWORX®

WIRELESS CEILING MOUNT OCCUPANCY SENSOR

INSTALLATION & OPERATION INSTRUCTIONS

(Units w/ Date Code 210303 and later)

MODEL NUMBERS	DESCRIPTION
SWX-201-B	WIRELESS CEILING MOUNT SENSOR, PIR, 360° SMALL MOTION, BATTERY POWERED
SWX-211-B	WIRELESS CEILING MOUNT SENSOR, PIR, 360° SMALL MOTION, w/ DAYLIGHT HARVESTING PHOTOCELL, BATTERY POWERED
SWX-221-B	WIRELESS DUAL TECHNOLOGY CEILING MOUNT SENSOR, PIR/ACOUSTIC, 360° SMALL MOTION, BATTERY POWERED
SWX-299-JP	CEILING SENSOR TRIM RING FOR MOUNTING TO SINGLE GANG MUDRING, HANDY BOX, OR 4" OCTAGON BOX

OVERVIEW

The **SENSOR**WORX® wireless ceiling mount occupancy sensor is a simple, yet reliable battery powered control solution. Preferred by contractors for their flexible mounting methods, **SENSOR**WORX wireless sensors greatly reduce total installation time and wireless pairing fuss. Requiring just a few seconds per device, **SENSOR**WORX wireless sensors can be linked to one or more wireless load controllers (such as the **SWX-851** wireless wall switch, or a **SWX-950** series wireless power pack). Additionally, these sensors can be configured to work in applications with other wireless or wired ceiling, corner, or hallway sensors to provide extended coverage in large or irregularly shaped spaces.

As with all **SENSOR**WORX products, the latest PIR (passive infrared) technology and techniques are used to provide unmatched occupant detection performance and energy savings. Additionally, units are available with an integrated microphone to provide overlapping passive acoustic detection for rooms with obstructions or where occupant motion is limited. An integrated daylight harvesting photocell is also an available option for PIR only units.

BASIC OPERATION

Sensors detect movement in the infrared energy that radiates from occupants as they move within the device's field-of-view. Once occupancy is detected, the sensor immediately signals a wirelessly linked load controller (e.g. power pack) to switch on or dim up the connected lighting. If equipped with passive dual technology (PIR/Acoustic), the units microphone is then also enabled to further enhance detection while the lights are on. At regular intervals, the sensor will retransmit its latest occupancy status such that the load controller can keep lights on for occupants during brief periods of inactivity, while returning the space to an energy saving lights off (or dim) state once no longer occupied.

SPECIFICATIONS

ELECTRICAL & WIRELESS

BATTERY TYPE
Requires one CR123(A) Lithium Battery

BATTERY LIFE
PIR Model - Designed for 10 yr.
PIR & Daylight Harvesting Model - Designed for 7 yr.
Dual Tech. Models - Designed for 5 yr.
Non-Volatile Memory (saves all settings regardless of battery state)
Blink Warning @10% Life

RANGE
80' line of site w/o obstruction (walls)
40' with obstruction (walls/floors)

FREQUENCY
915 MHz ISM Band

WIRELESS LINKING
Simple 3 sec. Push Button Process

SECURITY
All Wireless Data is Encrypted

ENVIRONMENTAL

OPERATING TEMP
32°F to 122°F (0°C to 50°C)

RELATIVE HUMIDITY
0-95% Non-Condensing, Indoor Use Only

CODE COMPLIANCE

These sensors can be used to meet ASHRAE 90.1, IECC, & Title 24 energy code requirements.

PHYSICAL

SIZE
4.00" Diameter x 1.25" H
(10.16 x 3.17 cm)

WEIGHT
4.75 oz

COLOR
White

LED INDICATION
Motion Detection (when in Test Mode)
Wireless Linking (Pairing)

OPERATION

OPERATING MODES
Occupancy & Vacancy Modes
Configured on Linked Controller

COMPATIBLE LOAD CONTROLLERS
SWX-851 Wall Switch
SWX-950 / 951 / 970 Power Packs

WIRELESS TEST MODE
Button Toggles On/Off Wirelessly Linked Loads

COVERAGE TEST MODE
White LED Illuminates Upon Detected Occupancy

TIME DELAY OPTIONS
Configured at Load Controller(s)
1, 5, 10, 15, 20, 30 min.

FEATURES

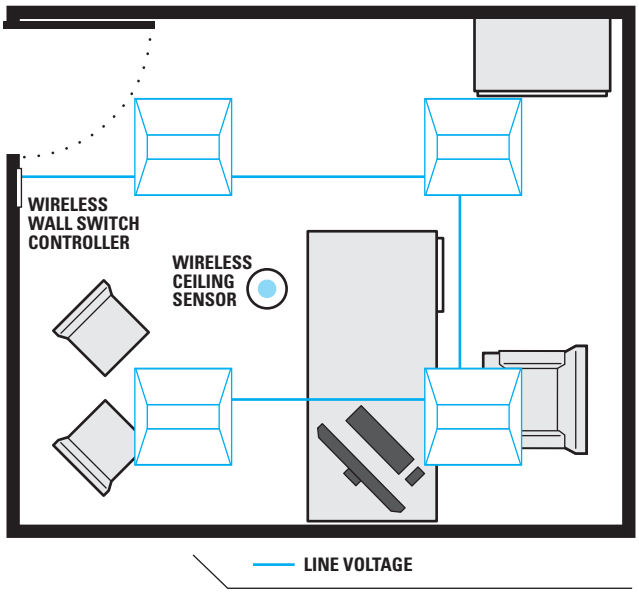
- **Pairs in Seconds with Wireless Controllers**
- **Passive Infrared (PIR) Detection**
- **Passive Dual Technology (PIR/Acoustic) Detection (Optional)**
- **360° Small Motion Coverage Pattern**
- **Optional Daylight Harvesting & On/Off Photocell**
- **Designed for 10 Year Battery Life**
- **Compact Size and Matte Finish**
- **Four Contractor Friendly Mounting Methods**
- **Mounting Nipple Attachment with Integrated Hole Saw**
- **Convenient Test Modes**

APPLICATIONS

SMALL SPACES

For control of small spaces like a private office, a single sensor linked to a wireless wall switch controller (**SWX-851**) is recommended (see diagram on right). Linking additional sensors is also an option if necessary. Switching from a second location (e.g. 3-way) is achieved by linking a remote wireless wall switch to the wireless switch controller. Both occupancy (auto-on) and vacancy (manual-on) operation are achievable in order to meet energy code requirements. Dual Technology sensors are recommended in spaces where people are seated or where obstructions like bathroom stalls block line of site to the sensors.

- Small Offices
- Copy Rooms
- Private Restrooms



LARGE SPACES

Multiple wireless sensors can be easily linked to a wireless power pack load controller (**SWX-950**) to provide coverage for larger spaces (or larger loads) like an open office. Additional functionality such as switching/dimming from multiple locations (e.g. 3-way) or interfacing with wired control devices is achieved by linking to a wireless power pack with appropriate functionality. Dual Technology sensors are recommended in spaces where people are seated and/or where obstructions like cubicle walls block line of site to the sensors.

- Classrooms
- Conference Rooms
- Break Rooms
- Open Areas
- Hallways

OCCUPANCY w/ INTEGRATED PHOTOCELL OPTION (MODEL SWX-211-B)

There are several types of photocell applications supported by this option. The operational mode is selected at the linked wireless power pack or wall switch controller that is wired to the lighting load(s).

DAYLIGHT HARVESTING

- Recommend for spaces where it is important to not distract occupants (e.g., offices, classrooms).
- Lights will gradually dim in order to maximize energy savings while maintaining desired overall lighting level.
- Requires dimming power pack controller.
- Option to dim to low trim or turn lighting off.

ON/OFF PHOTOCELL CONTROL

- Recommended for public spaces (hallways, entryways, etc) where fully switching of lighting off and on will not cause distraction of occupants.
- Lights are switched off if ambient light level surpasses threshold and back on if level drops.

INHIBIT ONLY PHOTOCELL CONTROL

- Lighting is held off if sufficient ambient light level is present upon initial occupancy.
- Lighting will turn on if light level drops below setpoint.
- Once on, lighting will only turn off from vacancy or manual switching, never from daylight.

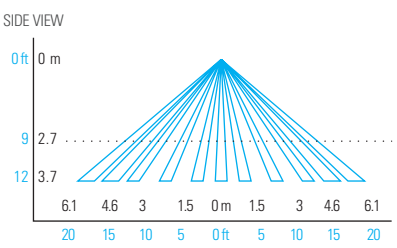
COVERAGE

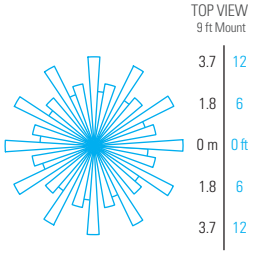
PASSIVE INFRARED (PIR)

- Detection range improves when walking across beams as compared to into beams.
- Line of site between occupant and sensor is required for detection.
- Sensor can not see through glass windows or doors.
- Spaces with small temperature differential between occupants and ambient may encounter reduced sensitivity/range.

SMALL MOTION 360°

- Excellent detection of small motions from sitting or stationary occupants (e.g. hand motions).
- 8 to 12 ft (2.44 to 3.66 m) mounting height recommended.
- ~500 ft^2 of coverage





DUAL TECHNOLOGY (PIR/ACOUSTIC)

- Units with dual technology (model **SWX-221-B**) have overlapping acoustic detection of the complete PIR coverage area.
- A PIR event is required to initially enable acoustic detection.
- Sounds indicating occupancy reset the sensor's time delay while non-occupant noises are filtered out. Occupant sounds alone will not keep lights on indefinitely, PIR motion must be periodically detected for lights to remain on for an extended time.
- After sensor time out expires, acoustic detection remains enabled for 15 seconds to enable voice reactivation of lights for additional convenience and safety.

COVERAGE (CONT.)

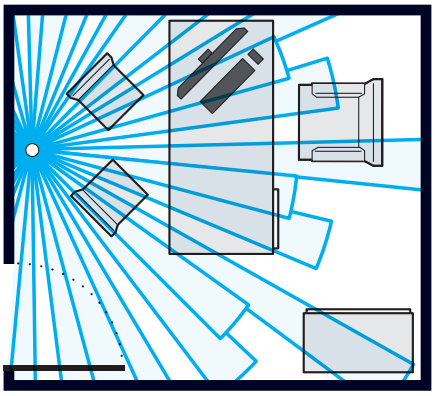


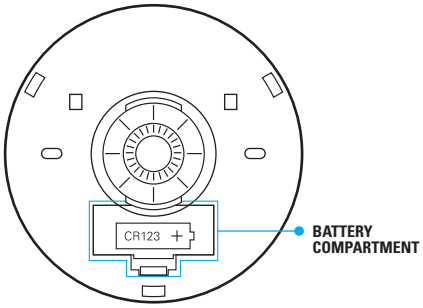
Diagram 1 - Recommended Sensor Placement in a Private Office

SENSOR PLACEMENT

Typically, a sensor should be located such that all entrances to the room/space are adequately covered. Ideally, a sensor should be located so that its coverage beams are perpendicular to the door. This ensures that an occupant is detected immediately upon entering. See Diagram 1. Note, however, it is important to locate a sensor such that its coverage pattern can not extend through an open door, which could result in detection of persons walking by, but not into, a room.

BATTERY INFORMATION

- The sensor runs on one CR123(A) Lithium Battery (included).
- 10 year battery life design for PIR only models. For PIR units with enabled integrated photocells, expected battery life is 7 years. For dual technology units with acoustic detection enabled, expected battery life is 5 years.
- Install battery prior to mounting sensor. Polarity is indicated on the battery compartment door.
- If the sensor's battery life reaches 10%, all wirelessly linked load controllers will blink lights on/off/on upon initial occupancy as a replacement warning.
- Replacement batteries are available at most retailers or home centers where batteries are sold or from **SENSOR**WORX.



INSTALLATION INSTRUCTIONS

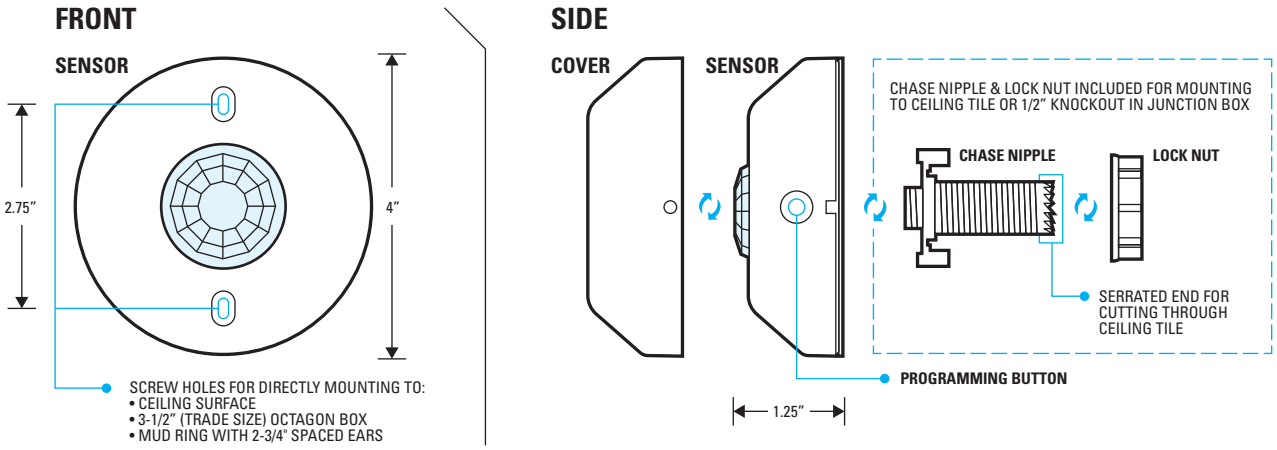
MOUNTING OPTIONS

A. Chase nipple & lock nut (included) for mounting unit to ceiling tile or 1/2" knockout in junction box. See Side Diagram below.

B. Screw holes for directly mounting to ceiling surface, 3-1/2" (trade size) octagon box, or mud ring with 2-3/4" spaced ears. See Front Diagram below.

INSTALLATION NOTES

- If mounting to ceiling tile, use the serrated end of the chase nipple to cut a 7/8" hole. Screw chase nipple into rear of sensor. Install assembly into hole and screw plastic nut onto chase nipple from back side of tile.
- To install cover, line up dimples with indents on sensor and turn clockwise.



Note: If mounting to a Single Gang Mudring, Handy Box, or 4" Octagon Box, a trim ring is required. Part Number: **SWX-299-JP.**

COMPATIBLE WIRELESS DEVICES

The below chart lists the devices that can be used in a **SENSOR**WORX wireless application. Note that occupancy sensors, photocells, and remote switch & dimmers are transmit only devices and therefore must be linked to a load controller for switching or dimming of lighting.

MODEL #	DESCRIPTION	WIRELESS TYPE	POWER TYPE
SWX-201-B	Small Motion 360° Sensor, PIR	Transmit	Battery
SWX-211-B	Small Motion 360° Sensor, PIR w/ Integrated Daylight Harvesting Photocell	Transmit	Battery
SWX-221-B	Dual Technology Sensor (PIR/Acoustic), Small Motion 360°	Transmit	Battery
SWX-401-B	Wide View Sensor, PIR	Transmit	Battery
SWX-421-B	Dual Technology (PIR/Acoustic) Wide View Sensor	Transmit	Battery
SWX-402-B	Long Range Hallway Sensor, PIR	Transmit	Battery
SWX-250-B	Daylight Harvesting & On/Off Photocell	Transmit	Battery
SWX-851-xx	Wall Switch Load Controller, No Neutral Required, <xx = color>	Transmit & Receive	120-277 VAC
SWX-852-B-xx	Remote Switch (On/Off), <xx = color>	Transmit	Battery
SWX-852-2-xx	Remote Line Powered Switch (On/Off), <xx = color>	Transmit	120-277 VAC
SWX-852-2P-B-xx	Remote 2-Zone On/Off Wall Station, <xx = color>	Transmit	Battery
SWX-854-B-xx	Remote Dimming Switch (On/Off, Raise/Lower), <xx = color>	Transmit	Battery
SWX-854-2-xx	Remote Line Powered Dimming Switch (On/Off, Raise/Lower), <xx = color>	Transmit	120-277 VAC
SWX-854-2P-B-xx	Remote 2-Zone Dimmer Wall Station, <xx = color>	Transmit	Battery
SWX-854-4S-B-xx	Remote 4-Scene Selector & Dimmer Wall Station, <xx = color>	Transmit	Battery
SWX-874-ELV-xx	Phase Dimming Load Controller - Reverse (default) or Forward Phase, <xx = color>	Transmit & Receive	120 VAC
SWX-950	Power Pack Load Controller, 20A	Transmit & Receive	120/277 VAC
SWX-950-AX	Hybrid Wireless/Wired Power Pack Load Controller, 20A	Transmit & Receive	120/277 VAC
SWX-950-AX-D2	Hybrid Wireless/Wired Power Pack Load Controller, 20A, 0-10V Dimming (Class 2)	Transmit & Receive	120/277 VAC
SWX-951-D1	Fixture Controller, 1A@, 0-10V Dimming	Transmit & Receive	120-277 VAC
SWX-950-D1 (D2)	Power Pack Load Controller, 20A, 0-10V Class 1 Dimming (Class 2 model)	Transmit & Receive	120/277 VAC
SWX-970-D1 (D2)	Advanced Load Controller w/ App, 16A, 0-10V Class 2 Dimming (Class 1 model)	Transmit & Receive	120-277 VAC

WIRELESS LINKING (PAIRING)

Linking an occupancy sensor with a wireless wall switch controller or power pack load controller is quickly done via the following procedure:

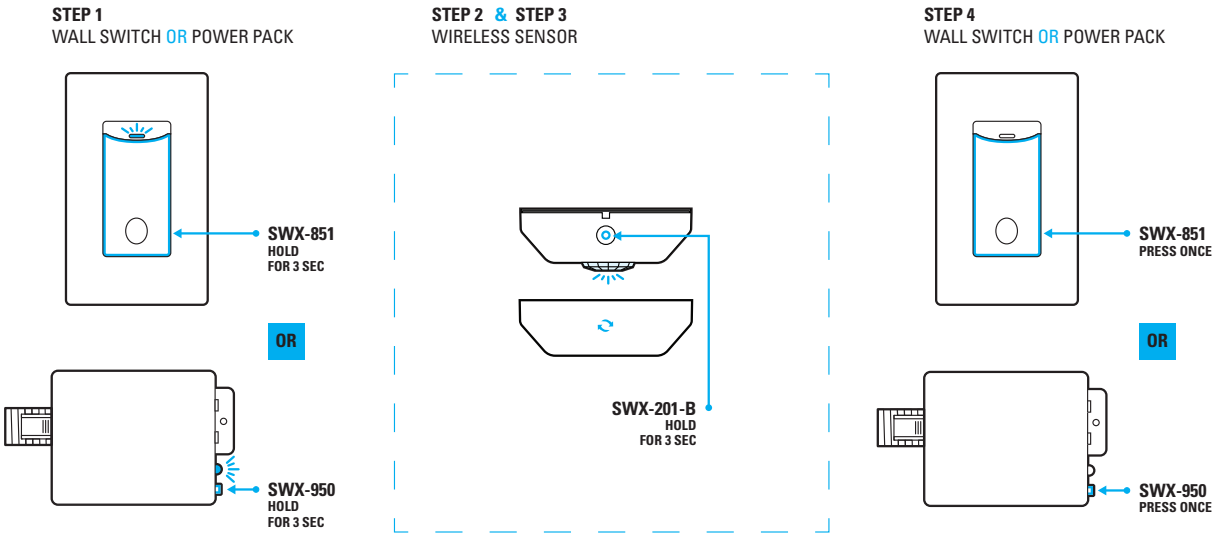
Step 1. Enter learn mode by holding down the wireless load controller's button for 3 seconds until the LED starts alternating white then blue, then release.

Step 2. At the sensor, hold down the programming button for 3 seconds until the LED starts alternating white then blue. Releasing will link the sensor with any device in learn mode (see note 1 below). The lights will toggle once as confirmation.

Step 3. Repeat step 2 to link another sensor or device.

Step 4. When all devices have been linked, exit learn mode on the wireless load controller by pressing the button 1 time. Learn mode will also be automatically closed after 15 minutes of no new devices being linked.

Note 1: When in learn mode, the alternating LED colors on the wireless load controller will periodically pause and blink out the total number of linked devices. There will be no blinks during the pause until the first device is linked.



OPERATION NOTES

OCCUPANCY ONLY MODELS (MODELS SWX-201-B / SWX-221-B)

- Wireless sensors periodically transmit their PIR and/or acoustic (if equipped) occupancy status. Referred to as the sensor's "heartbeat", this period is optimized to conserve battery life.
- If a sensor transmitted "unoccupied" at its last heartbeat, any new PIR detection event will be transmitted immediately.
- Using the information received from linked sensors, wirelessly linked load controllers switch lighting accordingly.
- All load controllers have a master time delay that is initially set only when a PIR occupancy transmission is received from a linked sensor. The time delay will then be reset every time a sensor reports any occupancy (either PIR or acoustic). Lights will be switched off once all linked sensors have continuously reported unoccupied for the duration of the time delay.
- To prevent lights from staying on indefinately from just acoustic events, after ~30 minutes the load controller will stop considering acoustic events from all linked sensors until after a PIR event is received again.
- As an added safety measure after lights are switched off, acoustic detection remains enabled for 15 seconds to enable voice reactivation of lights.
- If a load controller does not receive any heartbeat transmissions from a linked sensor for 10 minutes it will blink out an error code (4 blue blinks, followed by a pause) and consider itself occupied (so as to override the lights on). If more than one sensor is linked, the sensor heartbeats from all sensors must have stopped for the error warning to begin blinking.

OCCUPANCY W/ INTEGRATED PHOTOCELL OPTION (MODEL SWX-211-B)

- Sensors with the integrated photocell require auto-setpoint calibration to be initiated from the sensor in order to enable photocell operation.
- Every ~15 seconds the photocell transmits the light level it is measuring in the space.
- Dimming from high trim to low trim (or in reverse) due to daylight harvesting requires ~1.5 minutes.
- The wirelessly linked load controller compares the received light level to the setpoint and controls the connected lighting accordingly.
- Wireless load controllers will only listen to a single wireless photocell sensor. If more than one is wirelessly linked, the unit that last ran the auto-setpoint calibration procedure will be used.
- The photocell control algorithm compensates for the contribution of the controlled lighting to the overall light level of the space. This prevents lights from cycling back on shortly after they are switched off by the photocell operation.
- Refer to the instruction sheets of the wirelessly linked load controllers for information on their respective LED blink out behavior when controlled lights are transitioning on or off from photocell operation.
- To accomodate multi-zone photocell applications, wireless power packs can be configured to track according to the received daylight level, but control lights a fixed percentage brighter.

CONFIGURATION

FUNCTION #3: PHOTOCELL AUTO-SETPOINT (MODELS# SWX-211-B / SWX-231-B ONLY)

The minimum overall light level that is to be maintained in a space controlled by a sensor with an integrated photocell is referred to as the "setpoint". The setpoint value is stored in the linked wireless controller (i.e. **SWX-950** series power pack, and/or **SWX-851** wall switch) and is compared to the light level value being transmitted from the photocell every 15 seconds. The controller will then adjust the level of the connected lighting in order to maximize energy savings while maintaining desired minimum light level. The setpoint value initially is established by the running the Auto-Setpoint calibration procedure that is built into the wireless photocell sensor.

The Auto-Setpoint calibration procedure should be run after the SWX-211-B photocell sensor is first wirelessly linked to a controller. Once initially determined, the setpoint can be manually changed at the linked controller by selecting from a list of values.

RUNNING THE AUTO-SETPOINT CALIBRATION PROCEDURE

SETTING #	DESCRIPTION	
1	Run Auto-Setpoint	
2	Photocell Enabled	
3	Photocell Disabled	(default)

AUTO-SETPOINT CALIBRATION IS REQUIRED FOR DAYLIGHT HARVESTING/PHOTOCELL FUNCTIONALITY - SEE BELOW STEPS

Step 1. Press and release the unit's pushbutton **3 times**. By default the White LED will blink back three times indicating the photocell is **Disabled**. This blink back will repeat 3x before exiting the function.

Step 2. Before the unit exits, interrupt the blink back by pressing the button **1 time** (corresponding to **SETTING #1 = Run Auto-Setpoint)**. The photocell sensor will confirm this selection by flashing white once, pausing, then repeating. After the third confirmation sequence, the unit will begin flashing its LED White then Blue for 30 seconds. During this time the user should move away from the photocell sensor.

Lights will then be cycled in order for the photocell sensor to take measurements with the controlled lighting both on and off. These readings allow the photocell sensor to calculate the controlled (artificial) light level and select its optimum setpoint. When the photocell sensor has completed its calibration procedure the LED will rapid flash White twice. Lighting will then be controlled according to the photocell operational mode and setpoint.

Note: If the photocell device does not see a change in light level during this cycle (i.e. the application is open loop), an auto-setpoint of 25.0 fc will be chosen. This situation will also occur if a flashlight is shined into the photocell continuosly during the calibration process (for example in an effort to acheive a high auto-setpoint). To prevent this from occuring, switch the flashlight off and back on along with the power pack controller's relay switching off and back on. This will simulate a large ambient light change and will result in a high setpoint (e.g. 99 fc) to be stored.

FUNCTION #6 - ACOUSTIC DETECTION (MICROPHONE)

To disable a dual technology sensor's microphone and have it function as just a PIR sensor, follow the below procedure:

SETTING #	DESCRIPTION	
2	Acoustic Detection (Microphone) - Disabled	
4	Acoustic Detection (Microphone) - Enabled	(default)

DISABLING ACOUSTIC DETECTION

1. Press and release the unit's pushbutton **6 times**, then wait 2 seconds. By default the white LED will blink back four times indicating that Acoustic Detection is **Enabled**. This blink back will repeat 3x before exiting the function.
2. Interrupt the blink back and press the pushbutton the number times equal to the desired command (e.g. **2 times** for Acoustic Detection - **Disabled**).
3. The LED will blink back the new setting number as confirmation and will be saved after three confirmations. After the third confirmation sequence, a successful save will be indicated by two sets of rapid white flashes. If the blue LED rapid flashes twice, save was unsuccessful and process should be started over.

FUNCTION #8 - RESTORING FACTORY DEFAULTS / UNPAIRING

To return a wireless sensor to its original factory default settings or to unpair from all linked wireless load controllers the following commands can be executed.

SETTING #	DESCRIPTION
3	Restore Factory Defaults
4	Send a "Forget Me" Message to all Paired Controllers

ENTERING A RESTORE FACTORY DEFAULTS OR FORGET ME COMMAND

1. Read through the above list and note the number of the desired command
2. Press and release the unit's pushbutton **8 times**, then wait 2 seconds. The white LED will blink back 2 times, pause and repeat.
3. Interrupt the blink back and press the pushbutton the number times equal to the desired command (e.g. **3 times** to Restore Factory Defaults).
4. The LED will flash back the command number as confirmation and will be executed after three confirmations. Two sets of rapid white flashes indicates success. If the bue LED rapid flashes twice, the command was unsuccessful and process should be started over.

TESTING & TROUBLESHOOTING

FUNCTION #2 - COVERAGE TEST MODE

To put a sensor in **COVERAGE** test mode for 10 minutes:

1. Press and release the button **two times**.

2. Once the LED blinks white, press and release the button **one** additional time.

3. The LED will blink back white three times and then rapid flash twice indicating the change to test mode was sucessful.

To test coverage, wait until lights turn off then walk into range of sensor. Lights will immediately switch back on. While in test mode the LED will blink white when it transmits an occupied signal (maximum of once every 4 seconds). For dual technology units in test mode, the blue LED will blink instead of the white LED if only acoustic detection has occured during the last 4 second period. After 10 minutes, the unit will automatically exit test mode.

Note 1: Once test mode has been inititated from a linked sensor, the linked controller will ignore all other wireless sensors until a new sensor initiates test mode or the 10 minutes expires. To exit test mode manually, follow above procedure but in step 2 press the button **two** times instead.

Note 2: Putting a sensor into test mode will also shorten any photocell transition times to 30 seconds to facilitate quicker testing.

TESTING WIRELESS LINKING (PAIRING)

1. Press and release the button one time.
Lighting controlled by any/all linked load controller(s) will toggle one time as confirmation.

FCC INFORMATION (FCC ID: 2AVRY-SWX0002)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:
1. This device many not cause harmful interference, and
2. This device must accept any interference received, Including interference that may cause undesired operation
Changes and Modifications not expressly approved by BLP Technologies can void your authority to operate this equipment under Federal Communications Commission's rules.
In order to comply with FCC/ISED RF Exposure requirements, this device must be installed to provide at least 20 cm separation from the human body at all times.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

ISED CANADA INFORMATION (IC: 26012-SWX0002)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.
In order to comply with FCC/ISED RF Exposure requirements, this device must be installed to provide at least 20 cm separation from the human body at all times.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
3. Afin de se conformer aux exigences d'exposition RF FCC / ISED, cet appareil doit être installé pour fournir au moins 20 cm de séparation du corps humain en tout temps