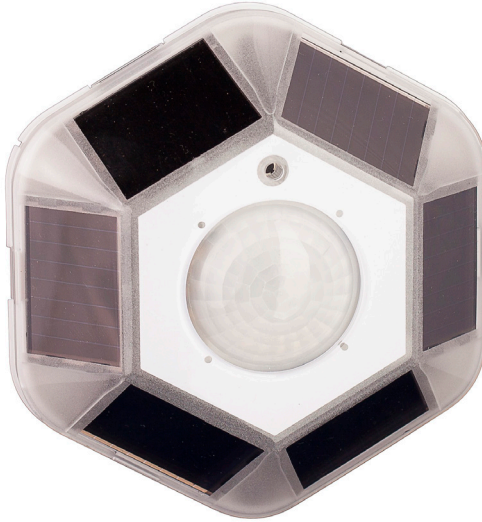**echoflex**
Powered by ETC

## WIRELESS CEILING MOUNT SENSOR
## FOR OCCUPANCY / VACANCY DETECTION
# INSTALLATION GUIDE



This guide covers all models of MOS-IR and MOS-DT ceiling occupancy sensor.

The MOS-IR product family includes:

MOS-IR-*x*A   Motion sensor with small motion short range lens (1000 sq. ft.)
MOS-IR-*x*B   Motion sensor with large motion large range lens (1900 sq. ft.)
MOS-IR-*x*C   Motion sensor with high bay lens (6300 sq. ft.)

The MOS-DT product family includes:

MOS-DT-*x*A   Motion and audio sensor with small motion short range lens (1000 sq. ft.)
MOS-DT-*x*B   Motion and audio sensor with large motion large range lens (1900 sq. ft.)

Where x is the frequency of the unit:  U=902 MHz, Y=868 MHz and J=928 MHz.
The package includes the occupancy sensor, lens mask sticker and installation guide.

**These Occupancy Sensors are intended for indoor use only in a dry location.**

**NOTE:** The MOS is a solar powered device that absorbs solar energy storing it for use during low light periods. Before assigning the MOS device to a receiver/controller, the device should be exposed to a good light source for a minimum of 5 minutes or install the start assist battery.

## MOS Sensor Description

The MOS sensor (also referred to as the sensor in this guide) is a wireless, energy harvesting, ceiling mount occupancy sensor. The MOS models include a single method PIR (passive infrared) sensor or a Dual Technology method of occupancy detection using a PIR sensor and audio interface (any reference to audio in this guide implies DT model only). The combination of PIR sensor and audio sensing adds additional assurance of positive occupant detection. Passive microphone technology provides full coverage of audible human activity across the entire PIR detection range. Innovative noise filtering is used to prevent false triggers that could keep lights on in empty rooms. Used for indoor applications, the detector is optimized for ceiling heights of 8 - 10 feet (2.4 - 3 meters) for the models with "A" and "B" lenses. Models with a "C" lens (PIR only) are optimized for high bay applications (40 feet or 12 meters).

## Sensor Operation

The MOS sensor monitors occupancy in interior spaces. The sensor is powered by solar energy from natural or artificial light sources. The solar energy is transformed into electrical energy which is then stored providing a continuous power source for the sensor. Powered by six solar cells, the sensor can operate without battery up to 7 days for the DT models and 9 days for the IR. The sensor will operate even with a brief exposure to light, however for best results the sensor should be mounted in a location with exposure for 2 hours of natural or artificial light (minimum of 160 lux of 15 foot-candles) on a daily basis.

A battery (CR2032) must be installed in the MOS-IR-*X*C sensor for use in high bay applications.

The motion sensor supports the Occupancy Sensor EnOcean profile A5-07-01.

The sensor must be within range of any linked receivers or controllers, installed within 80' (24m) of each other. For applications exceeding 80' (24m) range, telegram repeaters may be needed to extend reception range.

### Operating Sequence (dual technology models)

If the monitored space is vacant for a period of time, only the PIR interface will actively monitor for occupancy. The audio interface will be disabled.

Once the PIR has detected motion, an occupancy telegram is sent immediately and the audio interface is enabled.

Once the audio is enabled, two timers become active that control this interface.

1.      The **Audio Enabled Timer** is reset with each PIR event and defines the maximum duration which the audio remains active.

If the timer expires, the audio will be disabled, no other action will be performed at that time.  Once this timer has expired, only PIR triggers can reset the timer to keep the light on. The default setting for the Audio Enabled Timer is 60 minutes and is not configurable.

2.      The **Sensor Occupancy Timer** is reset upon each audio or PIR trigger at the next occurrence of a telegram. It defines the time in which an occupancy trigger (PIR or audio) must be detected to keep the audio active. The default value for this timer is 20 minutes and it is configurable to values of 5, 10, 15, 20 , 25 minutes or disabled. If the sensor occupancy timer expires, the MOS will send out a vacancy signal and 40 seconds later the audio will be disabled.  The 40 seconds is grace time

that allows an occupant to use sound to reset the sensor occupancy timer and keep the light on.

The audio interface has a sound threshold that when exceeded, will maintain the sensors occupied state while the timers are active. The threshold is slightly higher than the background noise level. The background noise level is averaged over a 30 second window and filtered out.  Any other sound louder than this background level will trigger the audio.

*For example: If a fan is running in the background while the space is occupied, only a sound slightly louder than the fan noise will trigger the audio.*

Either the PIR or audio can maintain the sensors occupied state with telegrams being sent at minimum every 100 seconds. A red LED under the PIR lens will blink when an occupied state telegram is sent. A linked Echoflex controller has an occupancy timer that is reset only when receiving occupied state telegrams so the lights will remain on so long as the sensor continues to sense occupancy.

See the controller install guide for details on setting up this timer and occupancy or vacancy modes of control.

## Operating Sequence (PIR model only)

The MOS-IR behaves similarly as the dual tech model; when vacant the PIR monitors for occupancy. Once motion is detected and the occupancy state is transmitted to the receivers, the minimum period to the next telegram is > 100 seconds. If no motion is detected in 200 seconds, a vacant telegram is sent. The sensor will transmit telegrams indicating vacancy every 1000 seconds. So long as linked controllers receive an occupied state telegram before their occupancy timer expires, the lights will remain on.
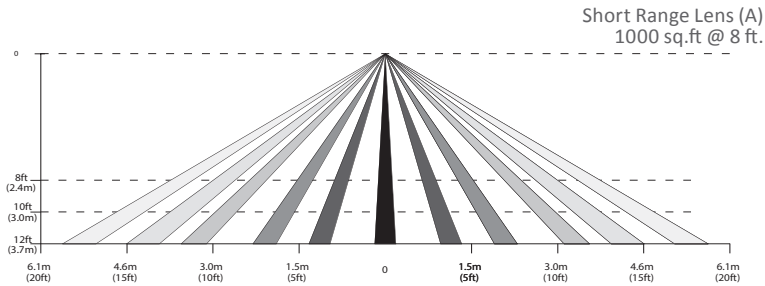

## Wireless System Layout Hints

- Reception range of 24 m (80 ft) - commercial office spaces (typical), up to 100m (330 ft) line of sight
- Avoid locating transmitters and receivers on the same wall.
- Avoid locating transmitters and receivers where the telegrams must penetrate walls at acute angles. This increases the material the telegram must pass through reducing the signal power.
- Avoid large metal obstructions as they create radio shadows. Place receivers in alternate locations to avoid the shadow or use repeaters to go around the obstacle.
- Do not locate receivers close to other high frequency transmitters.
- Leave at least 3' between the receiver and any other source of interference including, ballasts, LED drivers, computers, video equipment, Wi-Fi/LAN routers, GSM modems and monitors.
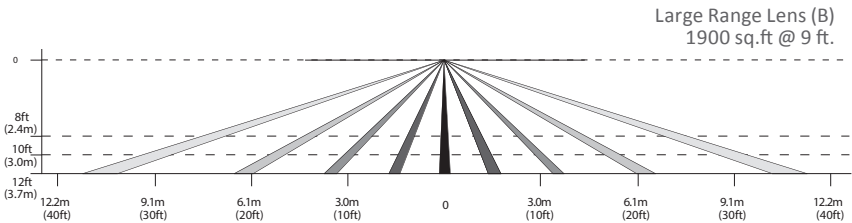

## Sensor Range

The sensor is offered with different lens options.

There is a lens with a high sensor ray density pattern (lens A) suitable for small motion detection, however this lens has shorter detection
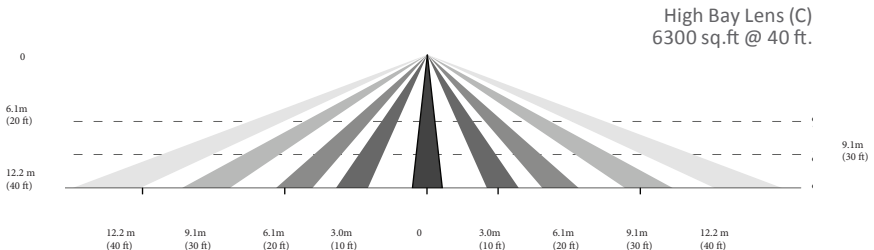
Short Range Lens (A)
1000 sq.ft @ 8 ft.

0

8ft
(2.4m)
10ft
(3.0m)
12ft
(3.7m)

| 6.1m (20ft) | 4.6m (15ft) | 3.0m (10ft) | 1.5m (5ft) | 0 | 1.5m (5ft) | 3.0m (10ft) | 4.6m (15ft) | 6.1m (20ft) |

*Dual Tech models only (A & B lenses)  - Reliable audio detection > 18 ft  provides overlapping coverage of monitored spaces.*

The second lens (B) has a broader range but is less sensitive for small motion detection.

Large Range Lens (B)
1900 sq.ft @ 9 ft.

0

8ft
(2.4m)
10ft
(3.0m)
12ft
(3.7m)

| 12.2m (40ft) | 9.1m (30ft) | 6.1m (20ft) | 3.0m (10ft) | 0 | 3.0m (10ft) | 6.1m (20ft) | 9.1m (30ft) | 12.2m (40ft) |

The third lens (C) is for high ceiling applications, for example: high bay warehouses (PIR models only).

High Bay Lens (C)
6300 sq.ft @ 40 ft.

0

6.1m
(20 ft)

9.1m
(30 ft)

12.2 m
(40 ft)

| 12.2 m (40 ft) | 9.1m (30 ft) | 6.1m (20 ft) | 3.0m (10 ft) | 0 | 3.0m (10 ft) | 6.1m (20 ft) | 9.1m (30 ft) | 12.2 m (40 ft) |

## Mounting the Sensor

The mounting location of the sensor is important as this will directly affect the receivers reception of the telegrams. Before installing, refer to the sections in the guide detailing the installation of wireless devices, layout tips and test operation modes.

**NOTE:** The sensor cannot detect motion through solid objects including items placed by a tenant, such as file cabinets or shelves.

**NOTE:** Do not locate the sensor near forced air vents as hot moving air may cause the sensor to false trigger. Leave at least 4' (1.2 m) minimum between air vents and the sensor.

**NOTE:** Incandescent lights may cause false trips when turning on.

1. Select a location to the mount the sensor on the ceiling by identifying the movement patterns that will be the most common in the space.
   • For smaller office spaces where hand motion on a desktop is common, locate

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the sensor off to one end of the desk, in line with the desk edge or slightly behind so the PIR lens has direct line-of-sight to the keyboard desktop area. Insure that the PIR lens does not have direct line-of-sight out a doorway where walk-by traffic could trigger the sensor (or apply lens mask sticker - See Lens Masking).
- Larger offices where larger body motion is more common, placement of the sensor is less critical.
2. For the best sensor performance, mount the sensor so at least one of the solar cells is facing a light fixture. The sensor will operate in low light levels however for best performance, a minimum of 5 foot candles (54 lux) must be maintained. If the controlled lights in the space are dimmable either manually or via daylight harvesting, insure the light level at the lowest dimmed level meets this 5 FC requirement. If the light value does not meet this requirement, install a battery.
3. Remove the cover. Using a small screwdriver for leverage, insert under the clear plastic cover at one of the relief tabs in the base plate and pull up. You will need to repeat with at least two tabs until the cover pops free.
4. Choose a mounting method. The sensor can be mounted:
- With the screws and anchors (not provided) to a wall-board ceiling. Use a pencil to mark the mounting base key hole locations and remove the sensor. Using a drill, bore the two holes and insert the anchors. Install the screws, leaving them loose while you place the sensor. Tighten the screws.
- With double sided tape or Velcro™, not provided. Cut two lengths of tape and remove the backing. Place on the mounting surface of the sensors back plate, pressing down. Remove the backing from the tapes other side and place the sensor on the ceiling surface, pressing firmly.
5. Replace the sensor cover aligning the button hole with the teach button and press in place.
6. Refer to the section titled **Linking the Sensor to a Receiver**.

## Lens Masking

Lens mask stickers are provided in the packaging for your convenience.

1. As needed, peel off the lens masks to fit the desired area to be blocked.
2. Apply the mask gently to the section of the lens exterior to block the required area from occupancy sensing.
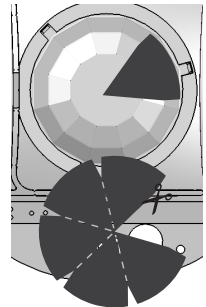


## Linking the Sensor to a Receiver

This process requires the controller or receiver to be mounted and powered and within range of the sensor to be linked.

1. Activate **LEARN** or **LINK** mode at the receiver, if necessary refer to the manufacturers documentation.
2. Tap the sensors TEACH button once.
3. Deactivate LEARN mode at the receiver.
**NOTE:** If the sensor is already linked to a controller, linking again will un-link the sensor.

## Installing or Replacing the Start Assist Battery

The battery is not required for normal operation of the A and B lens models. The battery (model CR2032) may be useful for installation purposes (test mode operation and linking) or for applications where there are long periods of no light.

1. Using a small screwdriver for leverage, insert under the clear plastic cover at one of the relief tabs in the base plate and pull up. You will need to repeat with at least two tabs until the cover pops free.

2. Using a finger, remove the old battery by pulling the battery free from the holder. Do not use a screwdriver.
3. Insert the new battery with the + positive side facing up and press in place with your finger.
4. Replace the cover over the sensor aligning the button hole with the teach button and press in place.

## Test / Setting Modes

The following tests and setting can be changed when in test mode:

- Light Level Test
- Range Confirmation Test
- Walk Test Mode,
- Sensor setting Mode including PIR or Audio Sensitivity and Sensor Occupancy Timer Adjust Mode
- LED indication disable

## Light Level Test

This test provides visual feedback of the immediate energy produced by the solar panels.

1. To enter Light Level Test mode, press and hold the teach button until the green LED begins to blink (about 6 seconds).
2. Press and hold the teach button again until the green LED stops blinking, about 6 seconds. The green LED will start blinking faster in accordance to the light level it is detecting, see table below.

### Light Level Test Indication

| Blinks | Lux / Foot candles | Time to Fully Charge | Discharge Time |
|--------|--------------------|----------------------|----------------|
| 0 | 0 / 0 | below operating level | n/a |
| 1 | 20-40 / 2-4 | operational | n/a |
| 2 | 40-80 / 4-8 | 48 hours | 100 hours |
| 3 | 80-160 / 8-16 | 24 hours | 150 hours |
| 4 | 160-320 / 16-32 | 12 hours | 200 hours |
| 5 | 320 + / 32+ | 6 hours | 225 hours |

The time to fully charge is based on the storage capacitor charging from a non-operational condition. Discharge time indicates how long a fully charged sensor will operate in the dark. The test will repeat every 2 seconds and run for a duration of 100 seconds. You may quit the test at any time by pressing the teach button for 6 seconds.

## Range Confirmation Test

This test provides visual feedback of the sensors signal strength by a linked receiver with range confirmation capability.

1. To enter Range Confirmation Test mode, press and hold the teach button until the green LED begins to blink (about 6 seconds).
2. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the teach button scrolls through the LED indicators. When the amber LED is blinking, go to step 3.
3. Press and hold the teach button again for 6 seconds to select Range Confirmation Test.

**NOTE:** Range Confirmation is only available with "F series" or later Echoflex Controllers

**NOTE:** The MOS must be at full charge and/or have the battery installed for Range Confirmation Tests energy requirements.

**NOTE:** Only one receiver can be linked to the sensor for proper operation of the test.

**NOTE:** Disable repeaters in range for proper test operation.

All three LED's will blink (for 1 second) in this test mode when the sensor transmits

or receives a Range Confirmation Telegram followed by the sensor displaying the linked signal strength status for 2.5 seconds, see table below.

| LED | Signal Strength |
| --- | --- |
| Green - Blinking 2.5 sec | -41 to -70 dBm |
| Amber - Blinking 2.5 sec | -70 to -80 dBm |
| Red - Blinking 2.5 sec | -80 to -95 dBm |
| No LED | No linked receivers detected |

The test will repeat every 10 seconds and run for a duration of 3 minutes. You may quit the test at any time by pressing the teach button for 6 seconds.

## Walk Test Mode

Walk test mode allows the installer to verify areas that are within range of the motion sensor.

1. To enter walk test mode, press and hold the teach button until the green LED begins to blink (about 6 seconds).
2. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the teach button scrolls through the LED indicators. When the red LED is blinking, go to step 3.
3. Press and hold the teach button again for 6 seconds to select walk test.

The red LED will blink every time a motion sensor trigger is detected. The test times out in 100 seconds. If a faster exit from walk test mode is required, press and hold the teach button for 10 seconds.

## Sensor Setting Mode

This mode allows adjustment of the PIR Sensitivity, Audio Sensitivity and Sensor Occupancy Timer duration. False occupancy states caused by external elements can be reduced by adjusting the sensitivity levels.

NOTE: New settings do not take affect until you save and exit.

1. To enter sensor setting mode, press and hold the teach button until the green LED begins to blink (about 6 seconds).
2. A quick press of the button at this level will allow you to scroll between the test/setting modes. When the red and amber LEDs are blinking, go to step 3.
3. Press and hold the button again until the LEDs stop blinking to select this mode, about 6 seconds.
4. A quick press of the button at this level scrolls between:
   Double Green - PIR Sensitivity
   Double Amber - Audio Gain (DT model only)
   Double Red - Occupancy Sensor Timer (DT model only)
5. Press and hold the teach button again for 5 seconds to select the desired sensor setting. The corresponding LED will blink according to the current setting. Press the button to scroll through the available settings.

   **PIR Sensitivity** - green LED blinks indicate setting

   1 blink = high (default);

   2 blinks = medium;

   3 blinks = low
   **Audio Sensitivity** - amber LED blinks indicate setting (DT model only)
   1 blink = automatic (default)
   2 blinks = low sensitivity
   3 blinks = disabled

   NOTE: If the Disabled setting is selected for Audio Gain, this disables the audio input however the Sensor Occupancy Timer will remain active.

**Sensor Occupancy Timer** - red LED  blinks indicate setting (DT model only)
1 blink = disabled
2 blinks = 5 minutes
3 blinks = 10 minutes
4 blinks = 15 minutes
5 blinks = 20 minutes (default)
6 blinks = 25 minutes

NOTE: If the Disabled setting is selected for the Sensor Occupancy  Timer, the audio will remain active the entire 60 minute duration of the Audio Enabled Timer. Disabling both the Sensor Occupancy Timer and Audio Sensitivity setting will have the sensor behave exactly like the IR model.

6. To save the Sensor setting, press and hold the teach button until all the LEDs double blink. The unit will now be in normal operating mode with the new setting in effect.

## LED Indication  Enable/Disable

Note: the settings do not take effect until you save and exit.

1. Enter Test mode as usual, press and hold the teach button until the green LED begins to blink (about 6 seconds).
2. A quick press and release of the button at this point will allow you to select between test modes. When the green and red LEDs are both blinking simultaneously, go to step 3.
3. Press and hold the teach button again for about 6 seconds until they stop blinking.
4. The red LED blinking indicates the motion detection LED is active. The green LED blinking indicates the LEDs are inactive. Tapping the teach button will toggle between these two states.
5. Save and exit by press and holding the teach button for 5 seconds.

## Agency Listings and Compliance

CEC Title 24 Compliant

Built in an ISO9001 certified facility

FCC Part 15.231 (902 MHz models only)

Contains FCC ID: TCM300U
The enclosed device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(I.)  this device may not cause harmful interference and
(ii.) this device must accept any interference received, including
interference that may cause undesired operation.

IC RSS-210 (902 MHz models only)

Contains IC: 5713A-STM300U

CE Marking(868 MHz models only)

ARIB STDT108 (928MHz models only)

Complies with the Japanese radio law and is certified according to ARIB STDT108. This device should not be modified (otherwise the granted designation number will become invalid)

**R 206-000372**

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