

# RESONATE WIRELESS VACANCY/OCCUPANCY SENSOR

## Installation Guide



This guide covers Resonate Vacancy/Occupancy sensor models, RVS-A-*xW*, RVS-B-*xW*, RCS-A-*xW* and RCS-B-*xW*. The RCS is identical to the RVS with the addition of a battery to provide power for support of auto-on occupancy sensor applications.

The character *x* in the model number is replaced with U for 902MHz, Y for 868MHz radios, and J for 928MHz radios.

The package includes the sensor, installation guide, lens mask sticker and two wire adaptor straps for soft ceiling tile mounting. The cover is removable. Please note: the cover must be fully seated for proper operation.

### Resonate Vacancy/ Occupancy Sensor Description

The RVS/RCS (also referred to as the sensor in this guide) is a wireless, energy harvesting sensor that monitors room occupancy state using a passive infrared motion (PIR) detector. The RVS/RCS sensors are intended for indoor use only, mounted on a ceiling at 8-10 feet from the floor.

NOTE: The RVS is a solar powered device that absorbs solar energy from artificial or natural light sources. Before assigning the RVS sensor to a receiver or controller, the sensor should be exposed to a good light source for a minimum of 2 minutes.

## Sensor Operation

The RVS sensor is powered by solar energy from natural or artificial light sources. The solar energy is transformed into electrical energy which is then used as a power source for the sensor. Powered by two solar cells, the sensor will begin operation without a battery within 2 minutes of being in sufficient light. The sensor will operate with 6 foot candles (65 lux) light energy. The RCS has instantaneous operation (battery powered).

## Wireless Telegrams

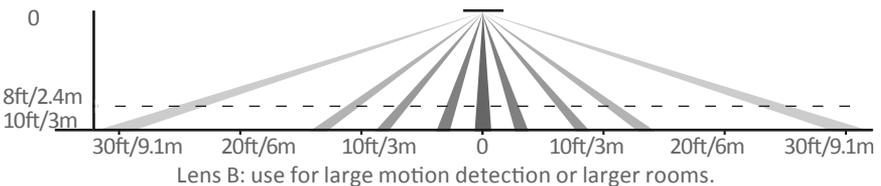
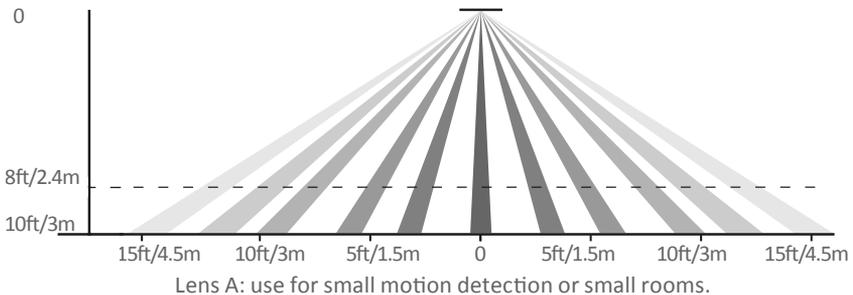
The motion sensor supports the Occupancy Sensor EnOcean profile A5-07-01.

The sensor will transmit occupancy or vacancy depending on the occupancy state of the room. The sensor will broadcast occupancy immediately upon a state change from vacant to occupied. The sensor broadcasts a telegram when movement is detected and repeats occupied telegrams with a minimum 100 second period between subsequent transmissions.

After detecting motion, the sensor is shut-down to conserve energy for 100 seconds. When the sensor awakens and further motion is detected, the sensor will transmit an occupied telegram. If no motion is detected within 100 seconds, the sensor transmits a vacancy telegram, 200 seconds total since the previous transmission. The sensor will remain active until the next occupancy state is triggered by motion detection. If the sensor does not detect motion, it resends the vacancy telegram every 1000 seconds.

## Motion Detection

The sensors use a PIR sensor element that detects motion by measuring the infrared energy emitted by objects. The sensors are calibrated to detect the temperature range of the human body. The sensor has a lens that breaks the viewing angle of the sensor into zones (movement zones), infrared energy moving in and out of a zone is how the occupied state is defined. The amount of movement that triggers the sensor is dependent upon the density of the zones where the motion takes place. A



higher density of zones means smaller motion will trigger the sensor.

For detection of small motion (typing, drinking from a coffee cup), use the A lens which has more movement zones. Place the sensor close to the location where the motion may occur.

The sensor comes with a sticker that can be applied to the lens to mask off areas where motion detection is not desired.

An LED under the lens will blink once every 100 seconds when the sensor is detecting motion. Additionally, the LED color indicates the status of the battery when applicable, see the following table.

LED Color	Battery Status
Red	No battery or weak
Amber	50% discharged
Green	Full charge

## 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.

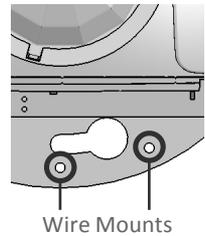
NOTE: The sensor cannot detect occupancy through solid objects including items placed by a tenant, such as file cabinets or shelves.

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 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 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. Use the included lens mask stickers to mask off these areas.
  - Larger offices where larger body motion is more common, placement of the sensor is less critical.
2. For the best sensor performance, mount the RVS 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 6 foot candles 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 6 FC requirement. If the light value does not meet this requirement, install a battery.

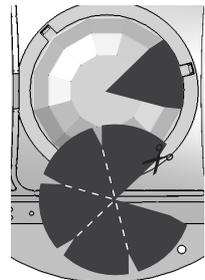
3. Remove the cover by inserting a small screwdriver under the white enclosures lip. Gently twist the screw driver and pull the cover away from the base.
4. Choose a mounting method. The RVS/RCS sensor can be mounted:
  - With the integrated magnets to a steel T-bar ceiling frame or other metallic surface by placing the sensor on to the metal rail.
  - With screws and anchors (not provided) to a wall-board ceiling.
    - i. Use a pencil to mark the mounting base keyhole locations and remove the sensor.
    - ii. Using a drill, bore the two holes and insert the anchors.
    - iii. Install the screws, leaving them loose while you place the sensor.
    - iv. Tighten the screws.
  - With the provided wire adapter straps to a soft ceiling tile.
    - i. Mark the sensor mounting location on the ceiling tile with a pencil. Remove the ceiling tile from the T-bar frame.
    - ii. Insert the soft ceiling tile adapters through the pair of small holes beside both keyholes on the sensors mounting plate.
    - iii. Poke the adapter tines through the ceiling tile, then bend each tine over in opposite directions for a secure fit.
    - iv. Replace the ceiling tile.
  - 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. Refer to the section titled **Linking the Sensor to a Receiver**.
6. Once linking is complete, replace the sensor cover. **Ensure the cover is fully seated.** If the cover is not firmly attached, it could obstruct the lens and adversely affect operation.



## 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

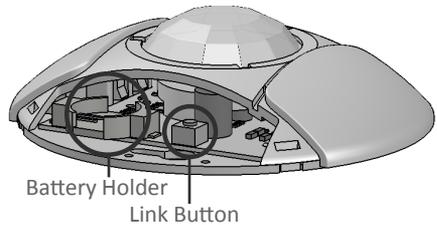
This process requires the controller or receiver to be mounted, powered and within range of the sensor to be linked.

The sensor is a solar powered device that absorbs energy through a solar panel; storing it for use during low light periods. Before assigning the sensor to a receiver/controller, the RVS must be exposed to a good light source for at least 2 minutes.

1. Remove the cover by inserting a small screwdriver under the white enclosures lip. Gently twist the screw driver and pull the cover away from the base.
2. Activate LEARN or LINK mode at the receiver, if necessary refer to the manufacturers documentation.
3. Press the sensors LINK button.
4. Deactivate LEARN mode at the receiver.

### Installing or Replacing the Battery

The battery is not required for normal operation when the RVS receives adequate natural or artificial light, minimum 6 foot candles or 65 lux. The RCS model comes with a battery (requires installation).



1. Remove the cover by inserting a small screwdriver under the white enclosures lip. Gently twist the screw driver and pull the cover away from the base.
2. To remove an old battery, use a small screwdriver as a lever and insert under the battery. Gently twist the screwdriver so the battery pops out.
3. Install or replace the battery with a new CR1632 coin cell battery insuring the positive side (+) will be facing up.
4. Place the battery in the holder and press in place with your thumb.

### Test Operating Modes

Test modes require a battery to be installed. For RVS units, insert a CR1632 battery to run tests.

NOTE: An alternative to installing a battery is to use a bright light (hand-held LED light, or Smart Phone) and shine this on the sensor while in test mode. Depending on the light used, this may provide sufficient energy to run the test selected. Do not use this method for Light Level Test, Walk Test Mode or Range Confirmation .

Remove the cover for access to the test button.

The following 4 tests can be selected when in test mode operation.

#### Light Level Test:

1. To enter Light Level Test mode, press and hold the test button for 6 seconds. The green LED will begin to blink (LEDs are located under the lens).
2. Press the test button again for 6 seconds to select Light Level Test. The green LED will blink in accordance to the light level it is detecting. This will

change (2 second lag time) if you move the sensor to areas with different light levels. See blink indicator table on the next page.

### LIGHT LEVEL TEST TABLE

The green LED will blink according to the energy produced by the solar cell

Blinks	Lux	Foot Candles	Charge Level
0	0	0	below operating level
1	50-100	4.5 to 9	min. operating level
2	100-200	9 to 18	operational
3	200-400	18 to 36	operational
4	400-800	36 to 72	operational
5	800+	72+	operational

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 Test button for 10 seconds.

**Range Confirmation Test:** provides visual feedback of the sensors signal strength by a linked receiver with range confirmation capability (only “F series” controllers have range confirmation ability). Have only one receiver linked to the sensor for proper operation of the test and disable repeaters in range for proper test operation).

The Range Confirmation test requires a battery to be installed.

1. To enter Range Confirmation Test mode, press and hold the test button for 6 seconds. The green LED will begin to blink.
2. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the test button scrolls through the LED indicators. When the amber LED is blinking, go to step 3.
3. Press and hold the test button again for 6 seconds to select Range Confirmation Test.
4. 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.

### RANGE CONFIRMATION TEST TABLE

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 4 seconds and run for a duration of 50 seconds. You may quit the test at any time by pressing the test button for 10 seconds.

**Walk Test Mode:** In walk test mode, the red LED will blink on every motion event. This allows an installer to verify the sensor can monitor and detect motion in an area as required.

1. To enter Walk Test mode, press and hold the Test button for 6 seconds. The green LED will begin to blink.

2. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the test button scrolls through the LED indicators. When the red LED is blinking, go to step 3.
3. Press and hold the test button again for 6 seconds to select Walk Test mode. The red LED will begin blinking when motion is detected. The test will run for a duration of 100 seconds. You may quit the test at any time by pressing the test button for 10 seconds.

**Sensitivity Adjust Mode:** The sensitivity feature allows the installer to adjust the sensitivity level. False occupancy states caused by other elements can be reduced by reducing the sensitivity level. The default setting is max. sensitivity.

To enter sensitivity adjust mode, press and hold the Test button for 6 seconds. The green LED will begin to blink.

1. A quick press and release of the button at this point will allow you to select between test modes. Pressing and releasing the test button scrolls through the LED indicators. When the red and amber LEDs are blinking simultaneously, go to step 2.
2. Press and hold the test button again for 6 seconds to select PIR sensitivity adjust mode. One of the LEDs will begin blinking based on the selected settings, see the **Sensitivity Adjust Table**.
3. A press and release of the button will allow you to scroll through the settings as shown in the sensitivity adjust table on page 7.

**SENSITIVITY ADJUST TABLE**

Setting	Indication
High	Green LED blinking
Medium	Amber LED blinking
Low	Red LED blinking

NOTE: The low sensitivity setting is used as the base line for the lens detection ray diagrams found on the data-sheet.

4. To select a setting press and hold the test button for 10 seconds when the desired LED is blinking. To exit without saving, allow the test to time-out in 60 seconds.

## Installing Wireless Devices

Careful planning is needed when locating the receivers and transmitters based on the construction materials in the space and possibility of tenant’s furniture disrupting the transmissions.

The occupancy sensor should be installed in the space where the receiver is mounted and connected to the occupancy control equipment. The signal will travel through some material barriers.

Refer to the tables on the next page for range considerations with building materials that reduce the radio signal power.

Material	Attenuation
Wood	0 - 10%
Plaster	0 - 10%
Glass	0 - 10%
Brick	5 - 35%
MDF	5 - 35%
Ferroconcrete	10 - 90%
Metal	90 - 100%
Aluminum	90 - 100%

Material	Radio Range-typical
Line of sight:	80' (24m) corridors
Line of sight:	150' (46m) open halls
Plasterboard:	80' (24m) through 3 walls
Brick:	33' (10m) through 1 wall
FerroConcrete:	33' (10m) through 1 wall
Ceiling:	not recommended

## Wireless System Layout Hints

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. Transmitters are not affected by these sources of interference.

## 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 (868 MHz models only)

CE Marking

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)



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