OfficeSense

Sensor Installation manual

Version 1.1, March 6, 2020

Contents

Introduction

General description

OfficeSense is a workspace utilization sensor solution for LoRaWAN wireless networks to measure occupancy of conference rooms, desks and other office spaces, and for monitoring the indoor office environment. The OfficeSense series consist of a Presence sensor, a Desk sensor, an two different Comfort sensors.

The Presence sensor measures room occupancy, temperature and humidity. The Desk sensor is used to detect desk availability and the Comfort sensor measures a mix of different environmental variables including CO_2, temperature, humidity, luminance and noise levels. The OfficeSense sensor device is battery powered and designed to be long lasting and it is easily deployable.

Intended readership

This installation manual is intended for the building manager, installation coordinator and the installation engineer who physically installs the OfficeSense sensor.

What makes the OfficeSense sensor series unique?

- Intelligent presence sensor:
  - Sending presence information, not motion data
  - Extremely low data rates, extremely low presence updates conserving battery power
  - Built-in intelligence prevents false-positive errors
  - Highly sensitive and low power PIR (passive infra-red) sensor
- OfficeSense Comfort (temperature, humidity and CO_2)
  - Send updates in a set time interval or;
  - Send updates on significant difference in measurement
- Power consumption
  - 4 regular AA batteries, available anywhere
  - Improved deep-sleep capabilities: only airtime when needed
- Over the Air (OTA) configuration
  - Default sensor configuration adjustable to needs
  - OTA firmware updates (future release)
- Application switch to adjust settings
  - E.g. modifiable sample times and deep sleep interval timers
- Remote monitoring for sensor maintenance
  - Last seen indication
  - Battery level indication
  - Metadata functions also includes sensor ID, sensor type, software version, heartbeat interval, etc.

Sensor handling

The OfficeSense sensors may be damaged by improper storage or handling. The sensor elements are particularly sensitive to external force, so please handle them with care, therefore:

- Do not drop them during transport and installation
- Do not spill any liquids such as drinks, washbasins etc.

Technical information

Generic

Operating power:	1.2-3V
EU directives compliance:	RoHS 2011/65/EU, RED 2014/53/EU
Network type:	LoRaWAN
Frequency plan:	EU868, US915, IN865 (AU915, AS925 under development)

Presence

Battery type:	2 or 4 x 1.5V AA batteries (preferably non-rechargeable)
Range:	In building: up to 120m (range depending on building structure and configuration)
Recommended installation location:	Indoor on the ceiling
Operating temperature range:	-20~+60°C
Temperature measurement range:	-40~+80°C
Temperature resolution:	0.01°C
Temperature accuracy:	±0.4°C (typical)
Relative humidity measurement range:	0-100%
Relative humidity resolution:	0.1%
Relative humidity accuracy:	±2% (typical)
Dimensions:	115x115x40 mm
Weight	0.25 kg (including batteries)
Device battery lifecycle	10 years, depending on configuration and battery type

Desk

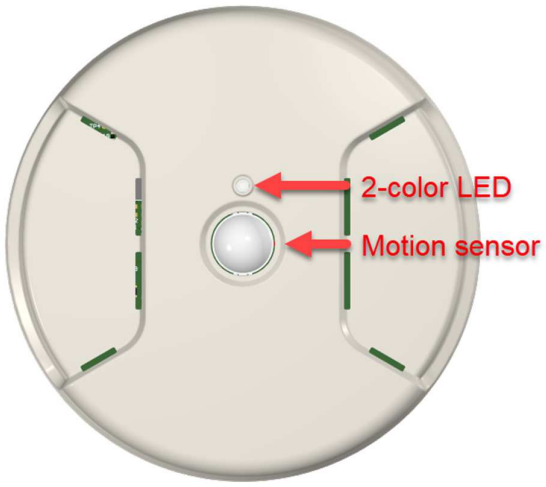
Battery type:	2 x 1.5V AA batteries (preferably non-rechargeable)
Range:	In building: up to 100m (range depending on building structure and configuration)
Recommended installation location:	Under a desk, 30 cm from front edge
Operating temperature range:	-20~+60°C
Dimensions:	138x75x29 mm
Weight	0.2 kg (including batteries)
Device battery lifecycle	>5 years, depending on configuration and battery type

Comfort

Battery type:	4 x 1.5V AA batteries (preferably non-rechargeable)
Range:	In building: up to 120m (range depending on building structure and configuration)
Recommended installation location:	At a wall, at appr. 1,8 m height
Operating temperature range:	-20~+60°C
Temperature measurement range:	-40~+80°C
Temperature resolution:	0.01°C
Temperature accuracy:	±0.4°C (typical)
Relative humidity measurement range:	0-100%
Relative humidity resolution:	0.1%
Relative humidity accuracy:	±2% (typical)
CO_2 measurement range:	0-5000 ppm
CO_2 measurement resolution:	1 ppm
CO_2 measurement accuracy:	+/-(45ppm+3% of reading)
Dimensions:	115x115x40 mm
Weight	0.3 kg (including batteries)
Device battery lifecycle	2 years, depending on configuration and battery type

Sensor operation

The table below describes the different modes of operation and the means of identifying them. The Presence and Comfort sensor have a 2-color LED (green and red) that is used for status indication. Note: Not all operational modes can be identified by the user using the LED.



Status red-LED	Status green-LED	Description	Sensor status
Off	On	The state after activating the sensor by placing batteries or removing the battery-pull-tab.	**Start-up**
Off	Blinks every 500ms	The sensor has not joined a network.	**Joining network**
Off	Blinks	Normal operation mode. Sensor is activated by motion and determines the room occupancy using a custom algorithm.	**Occupancy detection**
Off	Off	When no motion is detected and the sensor is not running the occupancy detection algorithm or collecting sensor data. The sensor is in sleep mode to preserve power.	**Sleep**
Blinks	Off	An error has occurred. Power cycle device and/or replace batteries, else replace device.	**Error**
On	Off	The battery level is low and the battery should be replaced.	**Empty Battery**

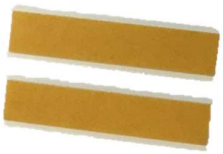
Installation guide

Presence Sensor and Comfort Sensor

Before starting the deployment of the sensors make sure the LoRa network is in place and connected and that the QR codes of the rooms are printed and attached to the rooms.

Check Package contents

You have received a set of OfficeSense sensors in a box. The box contains the following:

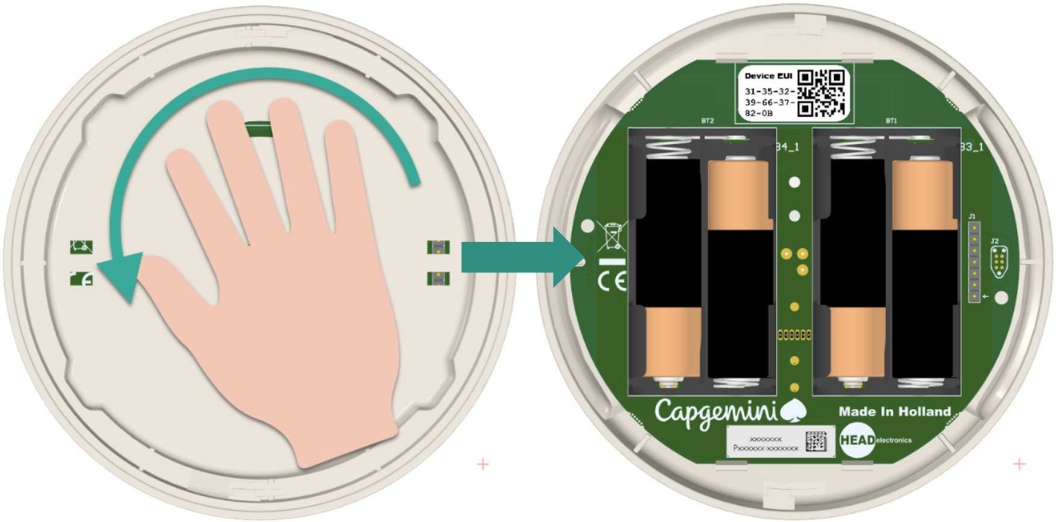
Contents of the box			
Sensors (with batteries inside)	Strips of double-sided tape	-Or-	Ceiling clips *(Presence Sensor only)*
			

The sensors that are shipped are based on your country. Please check if the label on the box matches your country.

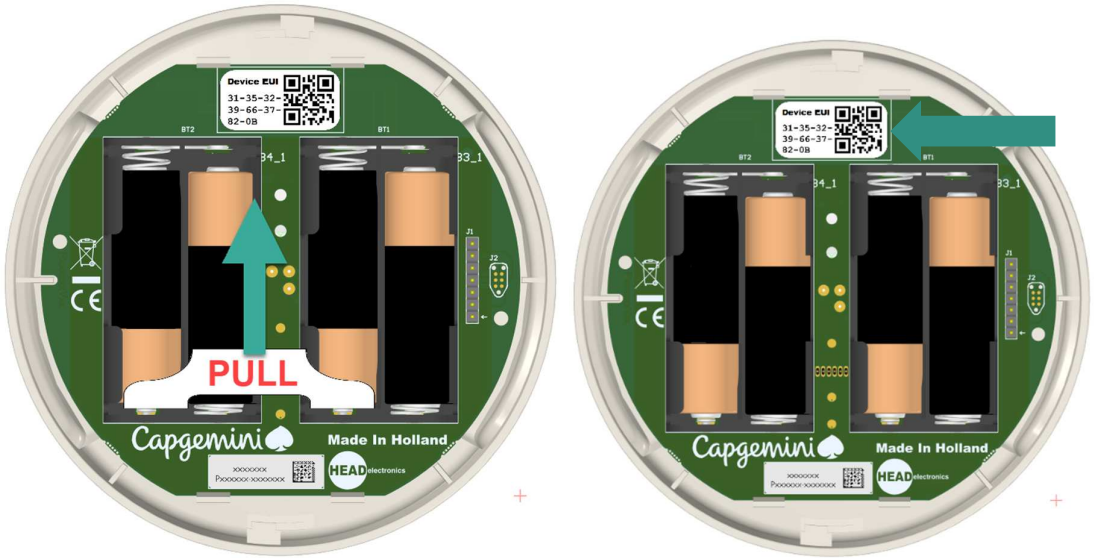
Getting the sensors ready

The sensors come pre-equipped with batteries. To activate the sensor, you need to remove the plastic pull tab to enable power to the device.

To get access to the batteries and the sensor QR code, you need to open the sensor casing. You can open the sensor casing by rotating the base-plate anti-clockwise.



This will give you acces to the battery pull-tab and the QR code for registering the sensor to the room. After you pull the tab make sure the batteries are properly inserted into the device.



Mounting the Comfort Sensor

The Comfort sensor is advised to be mounted to the wall of the room at a height of approximately 1.80 meters. Provided in the shipping box are strips of double-sided tape which can be used to mount the sensor.

Deploying sensors using the double-sided tape

1) Open the Comfort sensor by removing the baseplate (turn anti-clockwise).
2) Stick the tape to the baseplate of the sensor, as shown below.
3) Clean the surface of the wall at a height of 1.80m from dust, dirt and grease.
4) Make sure the target surface is flat and dry (no relief surface).
5) Stick the baseplate to the surface of the wall with the tape, press firmly.
6) Scan QR code of the sensor and remove the battery-pull-tab to activate it.
7) Attach the sensor to the baseplate by turning it clockwise on the baseplate.

Deploying sensors using two screws (not included)

The baseplate of the sensor has openings to screw the device onto the wall.

1) Open the Comfort sensor by removing the baseplate (turn anti-clockwise).
2) Position the baseplate and mark the two drill holes by using a pencil.
3) Remove the baseplate and drill holes.
4) Use a screwdriver to install the baseplate at the desired location.
5) Scan QR code of the sensor and remove the battery-pull-tab to activate it.
6) Attach the sensor to the baseplate by turning it clockwise on the baseplate.

Mounting the **Presence Sensor**

There are multiple options to mount the sensor to the ceiling of the room. Provided in the shipping box are either strips of double-sided tape or special ceiling clips which can be used to mount the sensor.

Deploying sensors using the ceiling clip (optional)

Note: the ceiling clip can be used with suspended ceiling constructions with metal strips with a width of up to 2.5 cm.

1) Open the sensor by removing the baseplate (turn anti-clockwise).
2) Attach the ceiling clip to the ceiling.
3) Attach the sensor baseplate on the clip (you will hear a click!).
4) Scan QR code of the sensor and remove the battery-pull-tab to activate it.
5) Attach the sensor to the baseplate by turning it clockwise on the baseplate.

Deploying sensors using the double-sided tape

1) Open the sensor by removing the baseplate (turn anti-clockwise).
2) Stick the tape to the baseplate of the sensor, as shown below.
3) Clean the ceiling surface from dust, dirt and grease.
4) Make sure the target surface is flat and dry (no relief surface).
5) Stick the baseplate to the ceiling surface with the tape, press firmly.
6) Scan QR code of the sensor and remove the battery-pull-tab to activate it.
7) Attach the sensor to the baseplate by turning it clockwise on the baseplate.

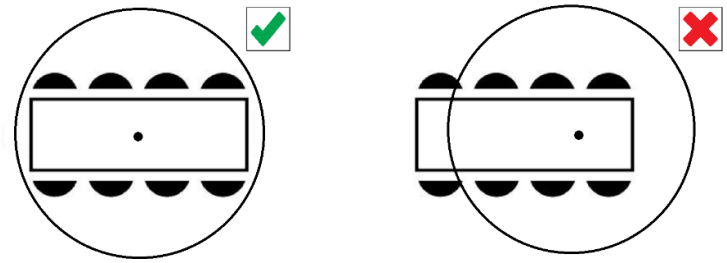
Deploying sensors using two screws (not included)

The baseplate of the sensor has openings to screw the device onto the wall.

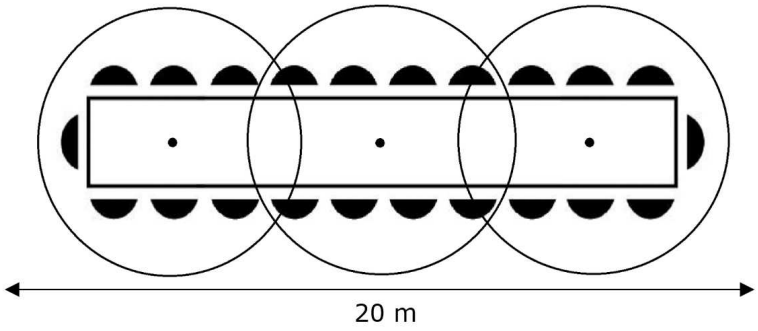
1) Open the sensor by removing the baseplate (turn anti-clockwise).
2) Position the baseplate and mark the two drill holes by using a pencil.
3) Remove the baseplate and drill holes.
4) Use a screwdriver to install the baseplate at the desired location.
5) Scan QR code of the sensor and remove the battery-pull-tab to activate it.
6) Attach the sensor to the baseplate by turning it clockwise on the baseplate.

Presence sensor placement recommendations

The sensor needs to be placed right above the working area for the detection of the people working there. Especially in smaller rooms, it suffices to place the sensor in the middle of the ceiling, right above the desk or table to detect everyone sitting around it.

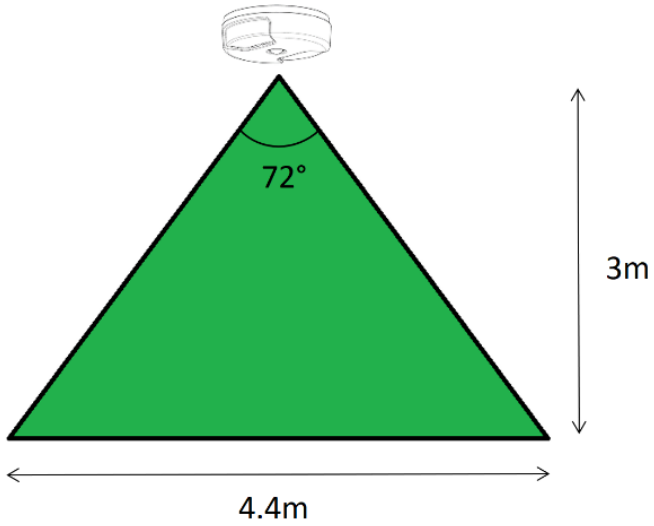


For larger rooms, it is recommended to use multiple sensors and spread them evenly across the seating area, like in the figure below. It is recommended to slightly overlap the detection planes of the sensors for better detection results.



Additional information

The figure below shows the detection fields of the sensor. The recommended maximum height of the ceiling is 3m.



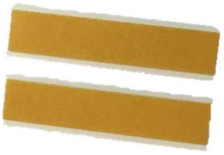
Desk Sensor

The following steps provide an extensive overview of the full installation process and are intended for the building manager and/or installation coordinator.

Check Package contents

You have received a set of Desk sensors in a box. The box contains the following:

Contents of the box

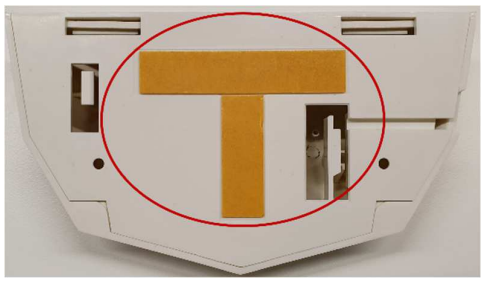
Casing 	Strips of double-sided tape 
Baseplate 	PCB (inside casing) 

The sensors that are shipped are based on your country. Please check if the label on the box matches your region. Do note that the Desk sensor normally is not shipped with batteries included. One should make sure sufficient batteries are available (2 AA batteries per desk sensor).

Preparing the desk sensor

After unpacking the box and checking whether it's complete, the sensors can be installed. To do so, please follow the steps below. Please note: these steps should be completed **per desk individually**.

1) Insert 2 AA batteries into battery-casing
   a) Note the proper orientation of the batteries (+ and -)
   b) The desk sensor starts working as indicated by the integrated LED
2) Close casing
   a) Make sure the casing and baseplate are correctly aligned
3) Apply double-sided tape (see picture below).



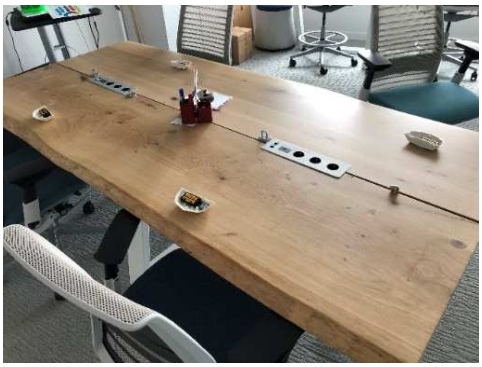
➔ Repeat above steps at every desk.

Mounting the sensor

To mount the devices under desks, you ideally work with two people.

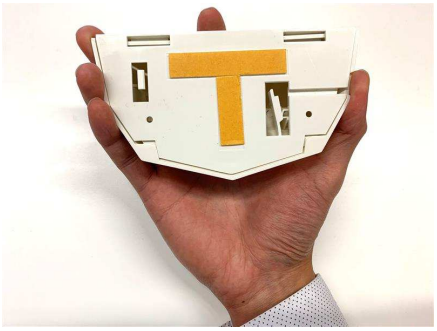
Person A: Scans QR codes for correct sensor-to-desk mappings.

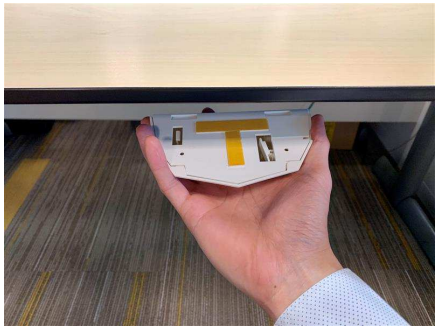
Person B: Attaches the desk sensor devices under the desks.



In order to establish an accurate reading, we advise you to install a sensor for each seating on the desk (see picture above).

- ➔ Now you can mount the device under the desk: make sure the orientation of the sensor is right. The straight back of the sensor should points backwards, the smoothed front should face towards the front of the desk.
- ➔ Hint: hold the sensor like the picture on the right for easy mounting.

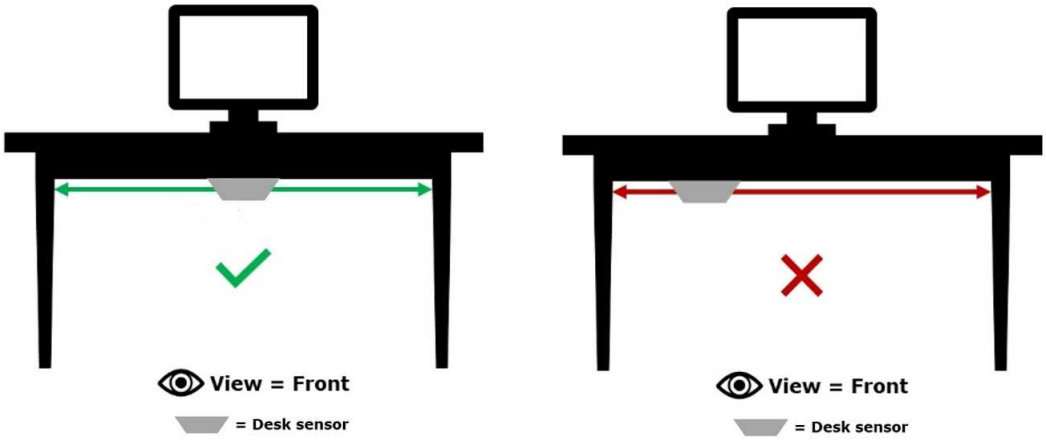




Sensor placement recommendations

Recommendation 1

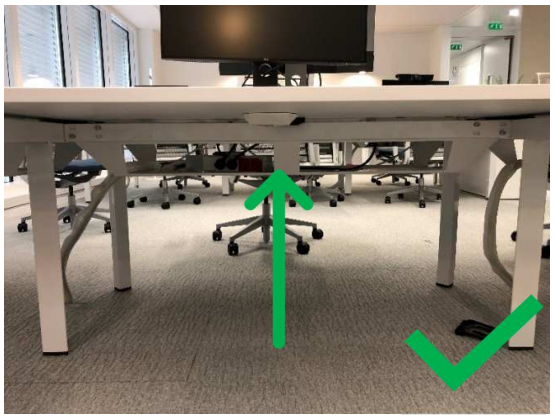
Make sure the sensor is placed in the middle of the desk as much as possible.



Please refer to the examples below.

Sensor placed too much to the right

Sensor is not placed straight either



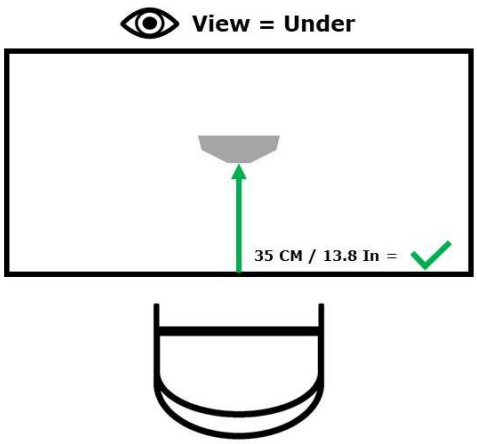
Sensor placed in the middle and straight

Recommendation 2

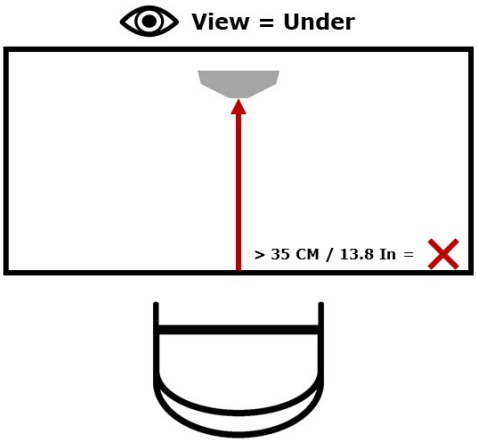
Place the sensor under the desk at a distance of appr. 35 centimeters / 13,8 inches from the front-edge of the desk. If it is a standing desk, the distance should be as far back as possible which is 55 centimeters / 21.7 Inches.

Exceptions:

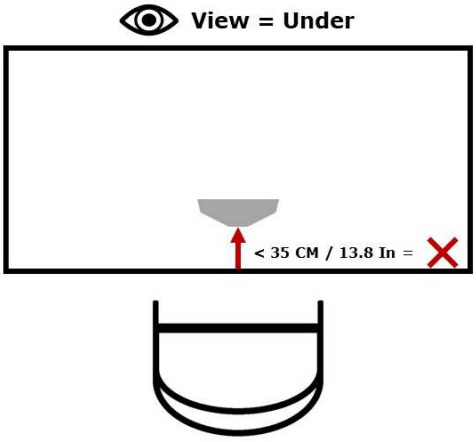
- If there is anything else located under the desk that hinders correct mounting.
  ➔ Then make sure mounting is done as good as possible.



Mounting at 35 cm / 13.8 inch is correct



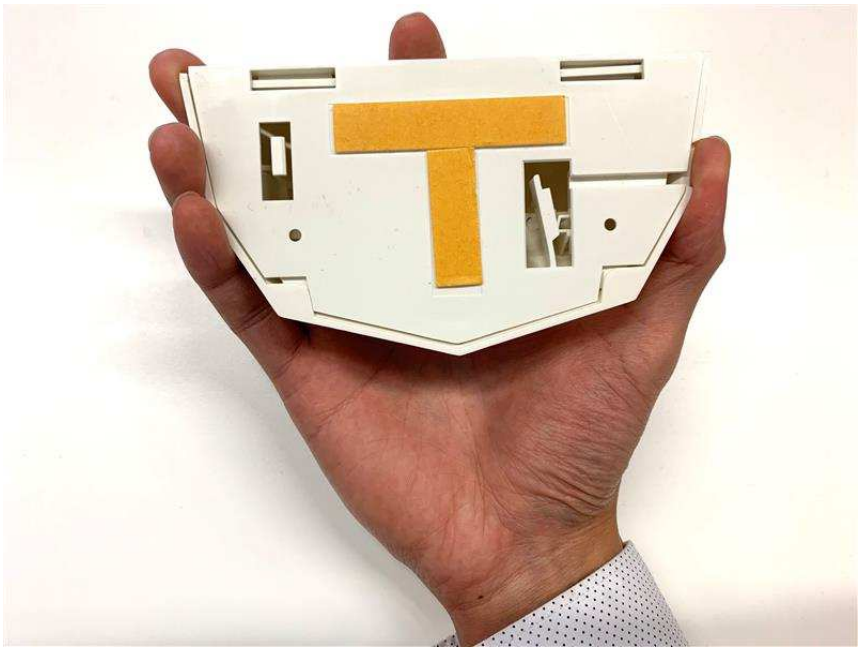
*Mounting at **more than** 35 cm / 13.8 inch is less than optimal*



*Mounting at **less than** 35 cm / 13.8 inch is less than optimal*

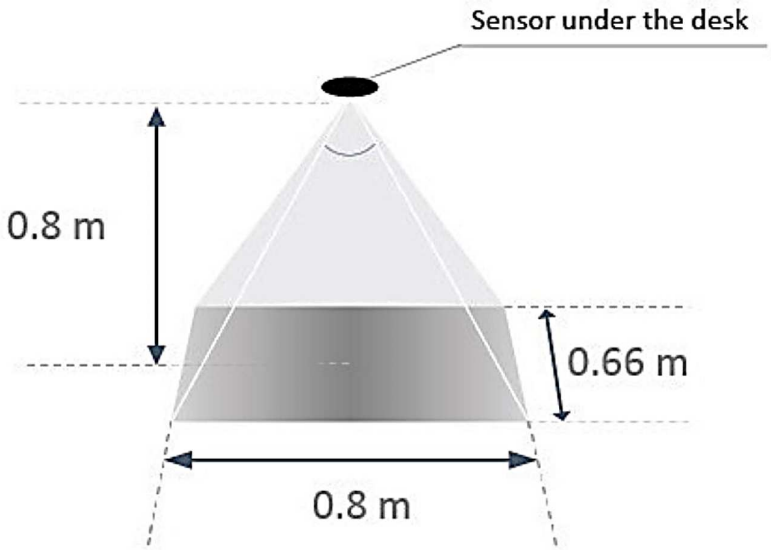
Recommendation 3

Make sure the sensor is installed according to the picture below. The smoothed front of the sensor should be faced towards the person sitting behind the desk.



Additional information

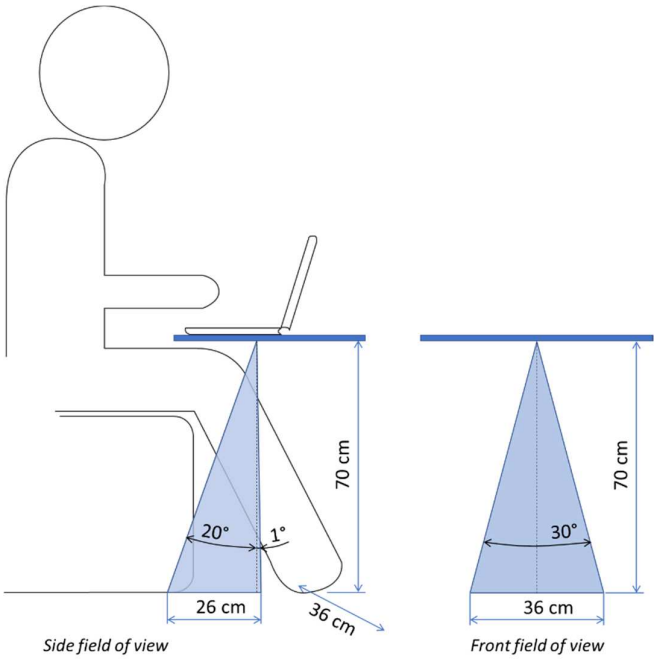
The picture below provides some information about the range of the sensor. The example is based on a desk with a height of 80 centimetres, which is not the maximum range of the sensor.



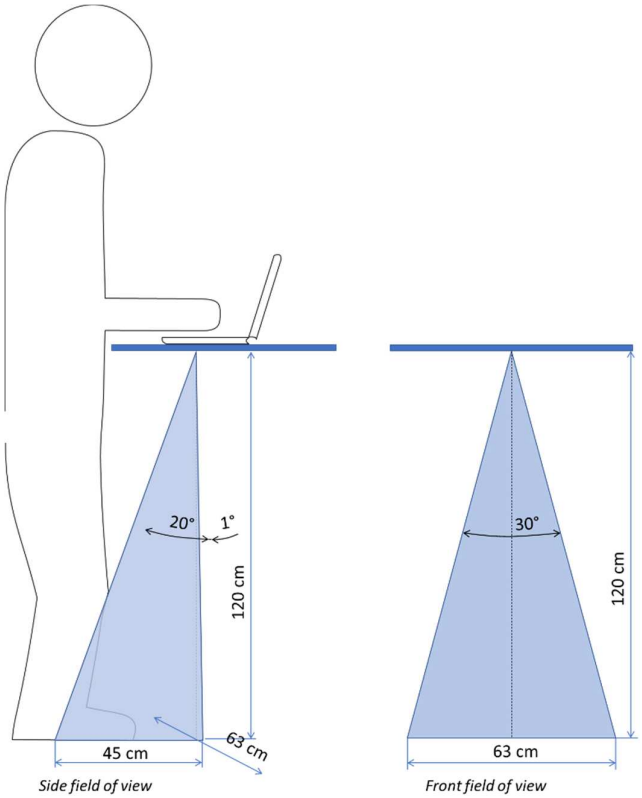
Another aspect to take into account is the 'field of view' of the motion sensor. Its field of view is specifically designed to be able to operate optimally under desks. This means that

if a desk is not used, the sensor will not likely detect people just passing by. Also when an opposite is used, it is not likely the desk sensor would be triggered by the legs of the person sitting in opposite.

The picture below shows the situation with a normal desk at a height of 70 cm.



The following picture shows the situation of an elevated or standing desk at a height of 120 cm.



Installing 'Barcode to Sheet' application

To map or link the sensors to a specific location, e.g. meeting room or desk, they need to be scanned and registered for asset management functionalities in your platform. One way to do this is to use the Barcode to Sheet smartphone app. The use of this app will create a .csv file which can be used to link the sensors to your location in the user application or IoT platform.

Prerequisites:

A smartphone (iOS or Android) with camera and email capability.

Steps:

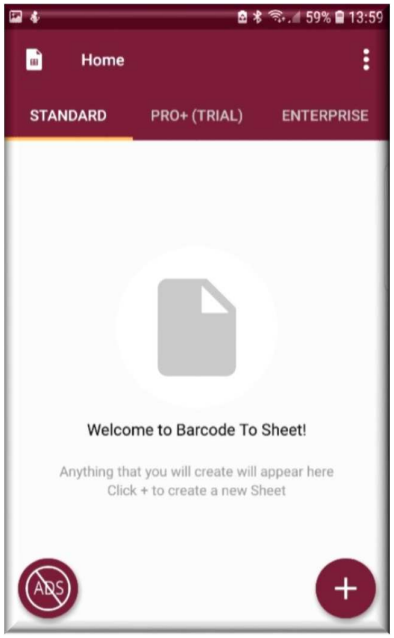
1) Install the 'Barcode to Sheet' application on your smartphone from the Playstore/Appstore:

   a) Playstore:
   https://play.google.com/store/apps/details?id=com.vel.barcodetosheet

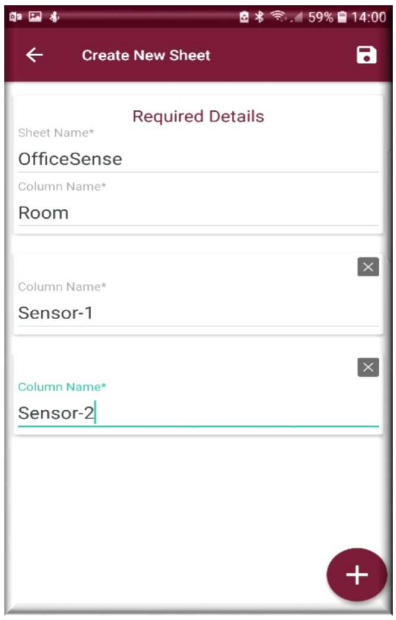
   b) AppStore:

   https://itunes.apple.com/us/app/barcode-to-sheet/id1327326217?mt=8

2) After installation, open the app:

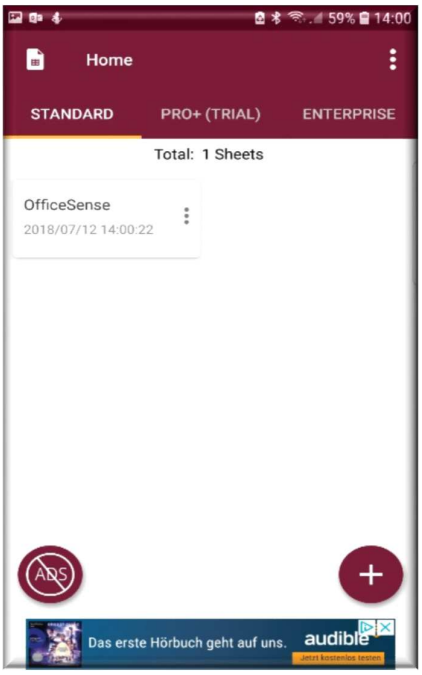


3) Click on "+" to create the file to scan and connect the rooms with the sensors. The following screen will appear:



4) Fill in the sheet name with "OfficeSense.<Office Location>. In general, the office location is the streetname of the location. Please check your floorplan. *Example: OfficeSense.Tilsit (Tilsit is the name of the street address in Paris, France).*
5) Fill in 1st column name with "Room".
6) Check in the provided floor plan which room is the biggest room in your office and how many sensors will be mounted there.
7) Fill in additional column names with "Sensor-1", "Sensor-2", "Sensor-3", etc, depending on the maximum number of sensors to be fixed in the largest room. Additional columns can be added by clicking the "+" on down right corner of the app.
8) Click on the "Save"-button on the top left of the app to save the .csv file.

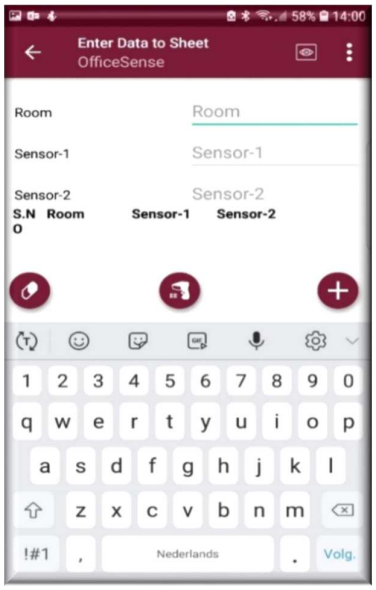
You will automatically return to the previous screen where you will find the created file, which is empty for now:



Registering a sensor with the ‘Barcode to Sheet’ app

This process describes how to create a .csv file where the sensors are mapped to the room they are deployed in.

1) Open the ‘Barcode to Sheet’ app on your smartphone.
2) Open the .csv file you have created earlier.
   The following screen will appear:

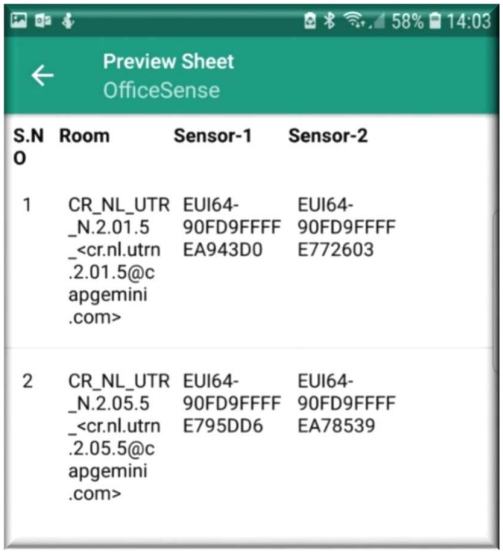


The next steps describe how to register sensors to a room.

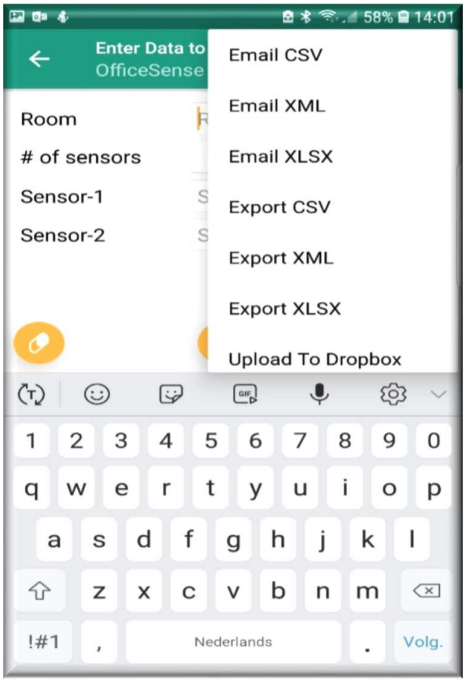
1) Locate a room which you are going to provision with sensors.
2) Locate the QR code of that room (usually near the door).
3) Make sure the column ‘Room’ is selected and scan the QR code of the room by clicking the scan button ( ).
4) When deploying sensors, select the column ‘Sensor-1’ and scan the QR code of the sensor with the scan button ( ).
5) If multiple sensors are deployed in the same room, select the other sensor columns to link additional sensors to that room.
6) When all the sensors are scanned for that room, click on the “+” button to add and save the data to the .csv file.
7) Repeat this process for all the rooms in your office.

After finishing all the rooms in your office, you can proceed with the next steps.

1) You can click on the  - button to see the contents of the .csv file.



2) Click on the  - button and select "email CSV" to send the .csv file to an email address of choice. Add the office location and "sensor to room mapping" as email subject.



The data can now be processed in your smart building backend. The presence information will be available in the user app as soon as possible.

Installation procedure reference

Preparation checklist

Before sensor deployment can begin, check if these items are taken care of first.

- ☐ Make sure the local LoRa network is in place (LoRa gateways are deployed and are connected).
- ☐ Check if QR codes for the rooms have been printed and placed at the rooms, or if other identifiers are available as location reference.
- ☐ Walkthrough this installation manual and procedure with the engineer(s) who are responsible for installation of the sensors.
- ☐ Verify the contents of the sensor shipment (also if they are for the right country!). (Reference this manual for explanation).
- ☐ If not included in the sensor shipment, make sure sufficient batteries are at hand (normally AA batteries).
- ☐ Install the 'Barcode to Sheet' app on your smartphone. Reference this manual for explanation.
- ☐ Gather other tools you need for sensor deployment (cleaning material, stepladder, drill, screws and screwdriver, etc).

Deployment steps

All the steps required for mounting and registering the sensors are described below. Referring to chapters in this manual when extra explanation is needed.

1) Open the 'Barcode to sheet' app and open the .csv template (Chapter *Installing 'Barcode to Sheet' Application*).

2) Locate the next room

3) Scan the QR code of the room (Chapter *Registering a sensor with the 'Barcode to Sheet' app*).

4) Mount the sensor on the ceiling (Chapter *Mounting the sensor on the ceiling*).

5) Scan the QR code of the sensor (Chapter *Registering a sensor with the 'Barcode to Sheet' app*).

6) Repeat from step 2 until every room has been deployed with sensors

7) Validate and send your .csv file through email (Chapter *Registering a sensor with the 'Barcode to Sheet' app*).

Regulations

Legal notices

All information, including, but not limited to, information regarding the features, functionality, and/or other product specification are subject to change without notice. The manufacturer reserves all rights to revise or update its products, software, or documentation without any obligation to notify any individual or entity. All brands and product names referred to herein are trademarks of their respective holders.

Federal Communication Commission Interference Statement

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.

Non-modifications statement

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Caution

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.
(3) This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

Declaration of conformity

Hereby, the manufacturer declares that OfficeSense sensor is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.