Installation Guide

Updated 3 days ago

Introduction

This guide provides information about how to install a set of Disruptive Technologies sensors and cloud connectors.

The goal of the installation is to achieve a robust and safe sensor installation that can reliably deliver measurements in more than a decade without further maintenance.

No expert knowledge of sensors or radio equipment is required to achieve a high-quality installation of sensors from Disruptive Technologies.

The focus of the guide is to provide practical advice, rule of thumb guidelines and suggestions based on installation experience. Depending on the actual installation environment these suggestions may not be optimal but should be a decent trade-off between required installation effort and achieved results.

For advice on maximizing installation reliability and reduce chances of data loss see Avoiding data loss

For more information on safety please refer to the Safety and Use leaflet included in the Cloud Connector box.

Expected coverage

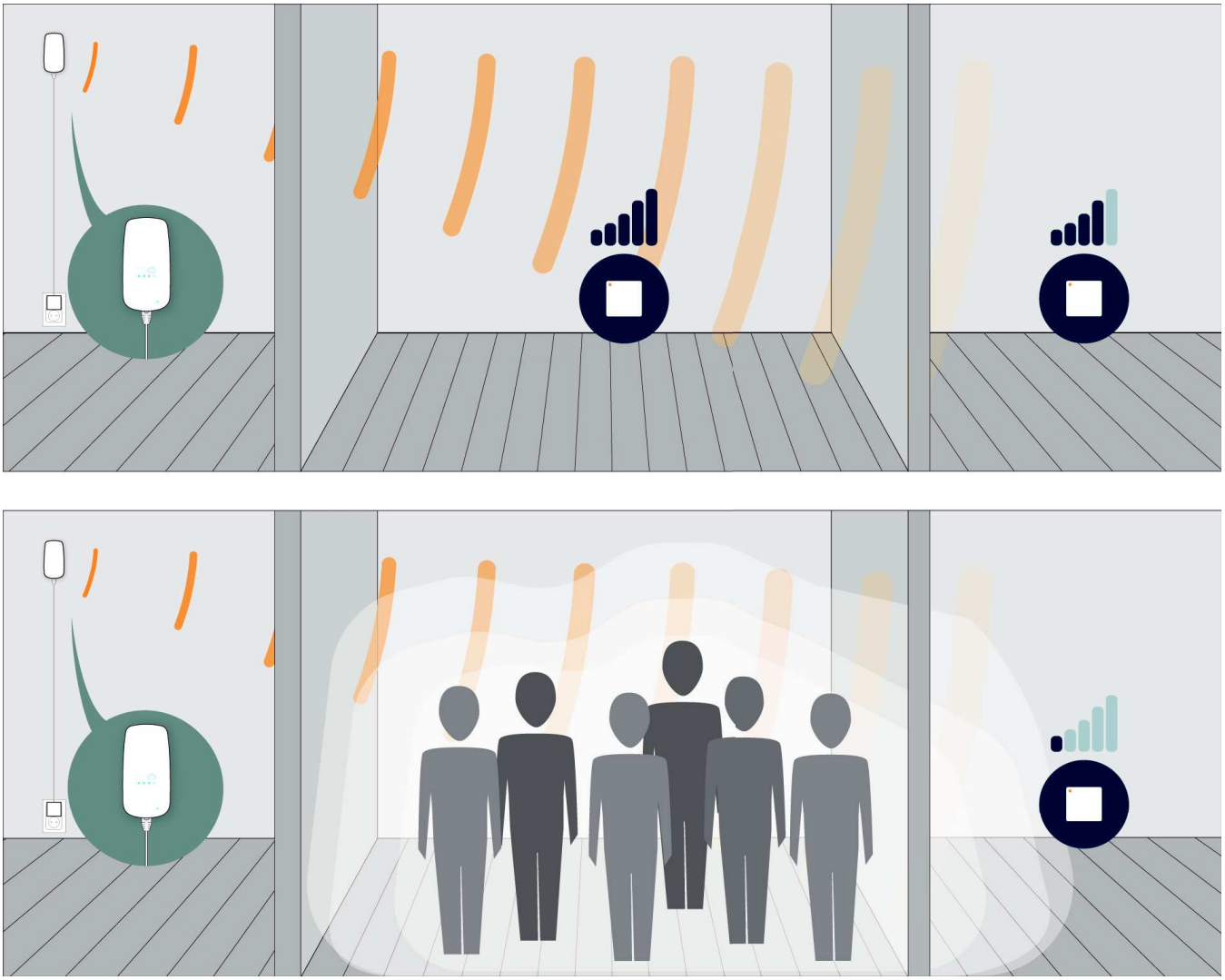
The key element of a healthy installation is the connectivity between sensors and cloud connectors, and between the Cloud Connector and the network. Every sensor needs to have a decent signal to at least one Cloud Connector. It is recommended to keep the radio signal reading in Studio or the API above 30%. As a rule of thumb, a Cloud Connector can be thought of as a high-quality WiFi router with a similar coverage area. Note that sensor data will not be transferred to the cloud and will therefore not be stored if the Cloud Connector loses its electricity supply or its network connection.

As with all radio equipment installations, end results are a product of many factors of the environment that will influence the setup, such as :

- Radio interference and other radio signals
- Wall compositions, internal dry walls vs. thick outer walls or metal cabinet walls
- The density of people in the area
- Height and layout of rooms and surfaces

To achieve the best results, the installation should be tested when the activity in the installation area is representative of normal use. E.g. if the installation is verified in an empty building, results may differ when the building is filled with people on a

busy day.



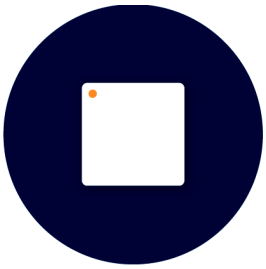
In general, **it is better to add margins on connectivity than spend time optimizing the max distance** between sensors and Cloud Connectors.

Quick Installation - Step by Step

Setting up Cloud Connectors and Sensors

What you will need to carry out an installation

One or more Cloud Connectors

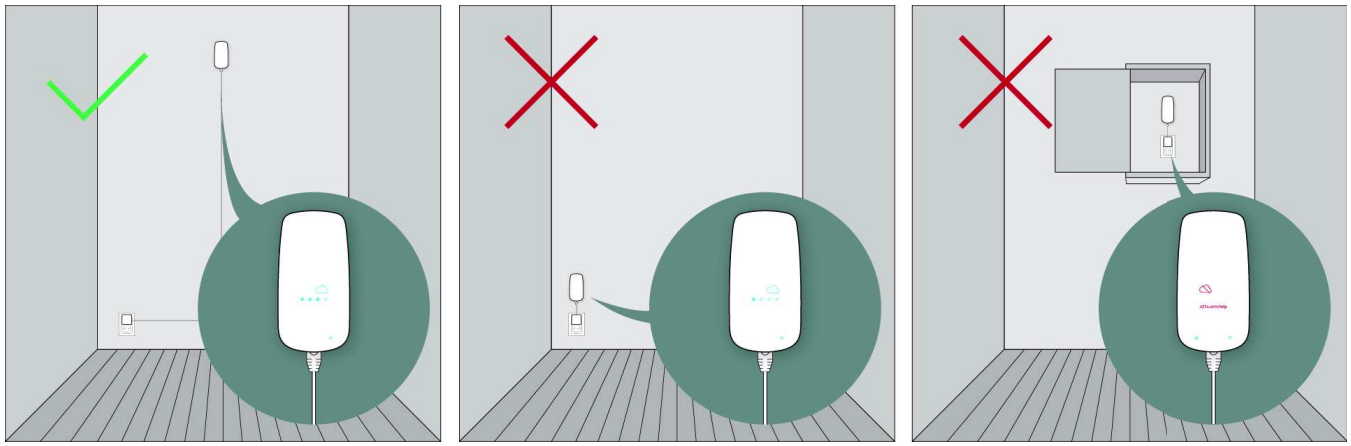


One or more Sensors

Smartphone with Internet access (A computer can also be used, but a portable device is recommended)

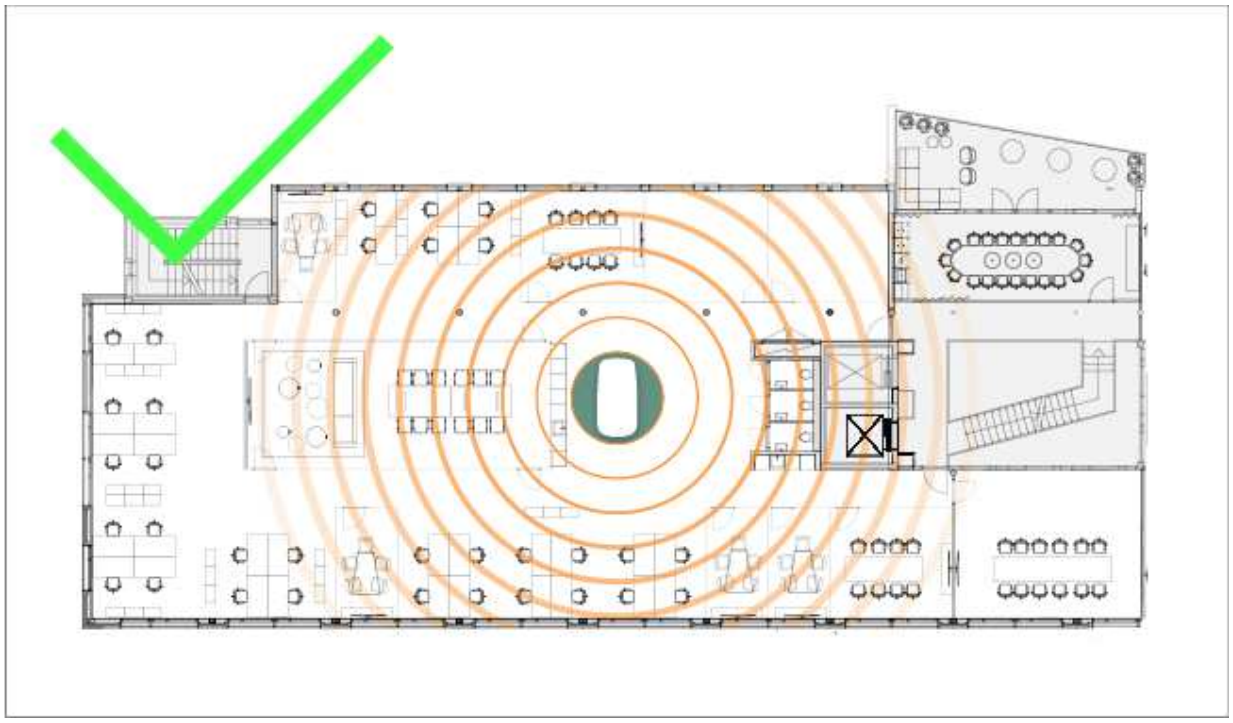
Access to DT Studio

Step 1: Place Cloud Connector

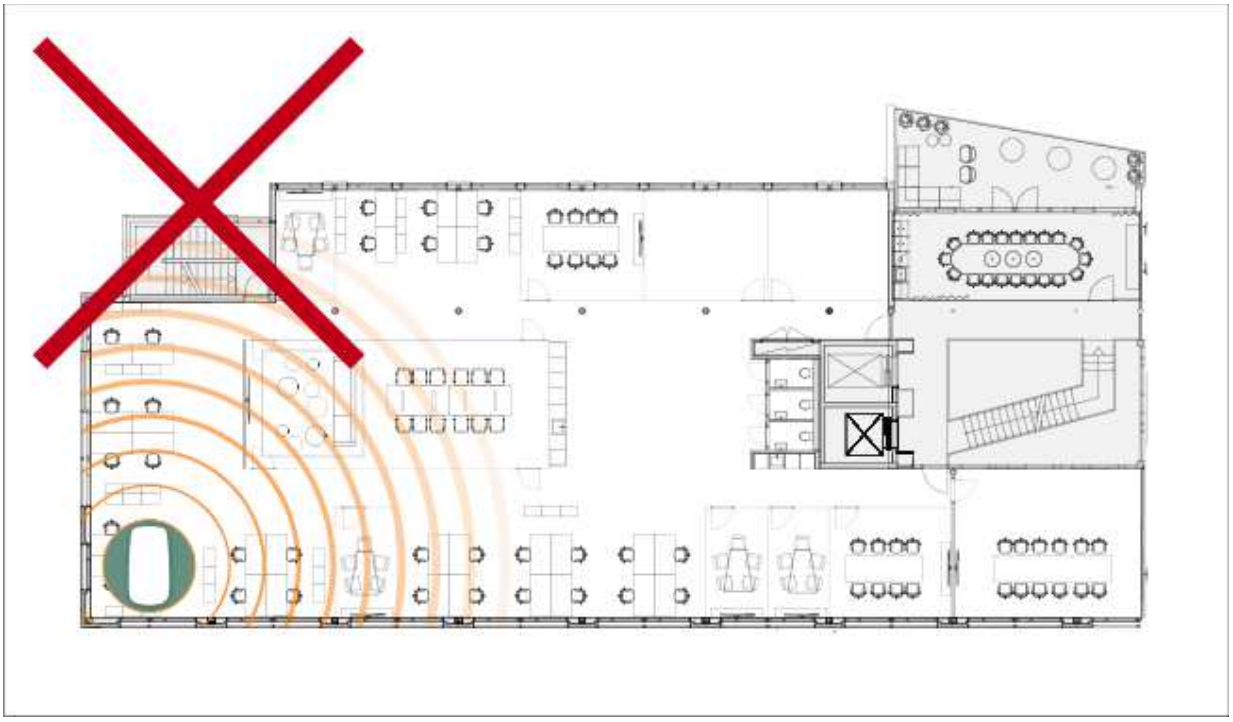


Place the Cloud Connector high on the wall or in the ceiling (similar to WiFi access points). Avoid placing it in metal cabinets or behind metal doors.

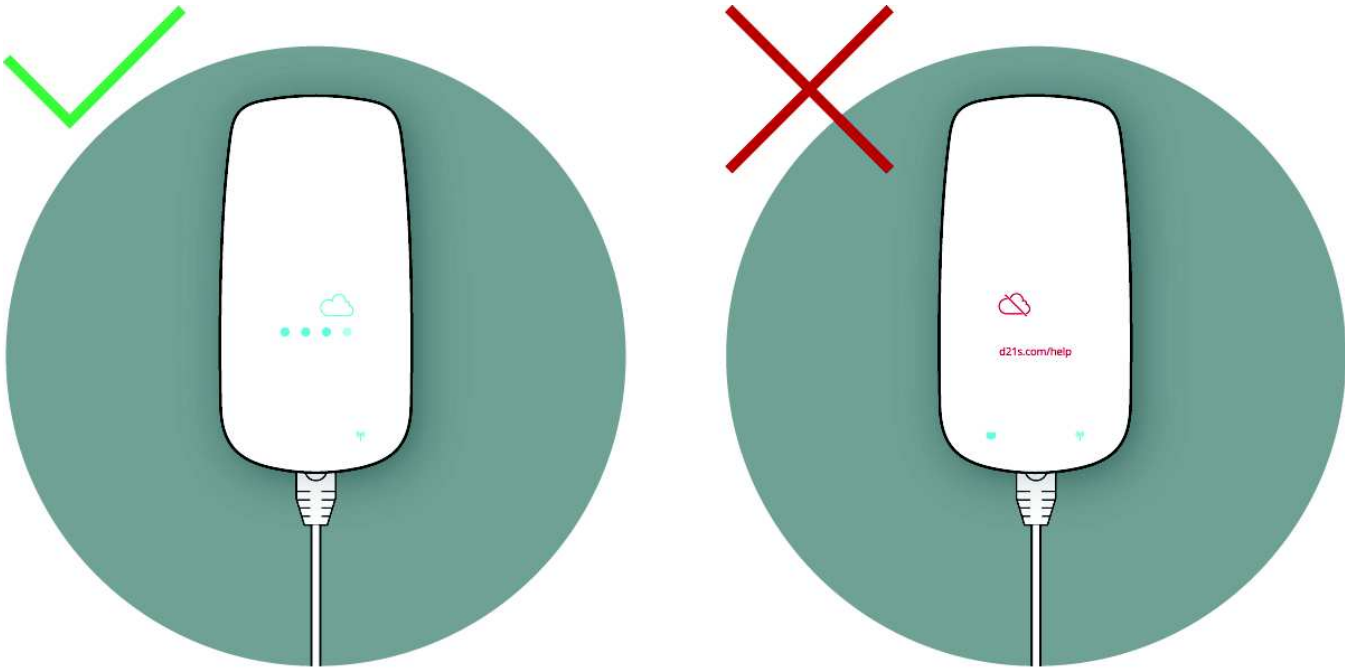
Place the Cloud Connector in the middle of the installation area.



Placing the Cloud in the corner of the installation will limit the achieved range.



Step 2: Look for the white cloud on Cloud Connector

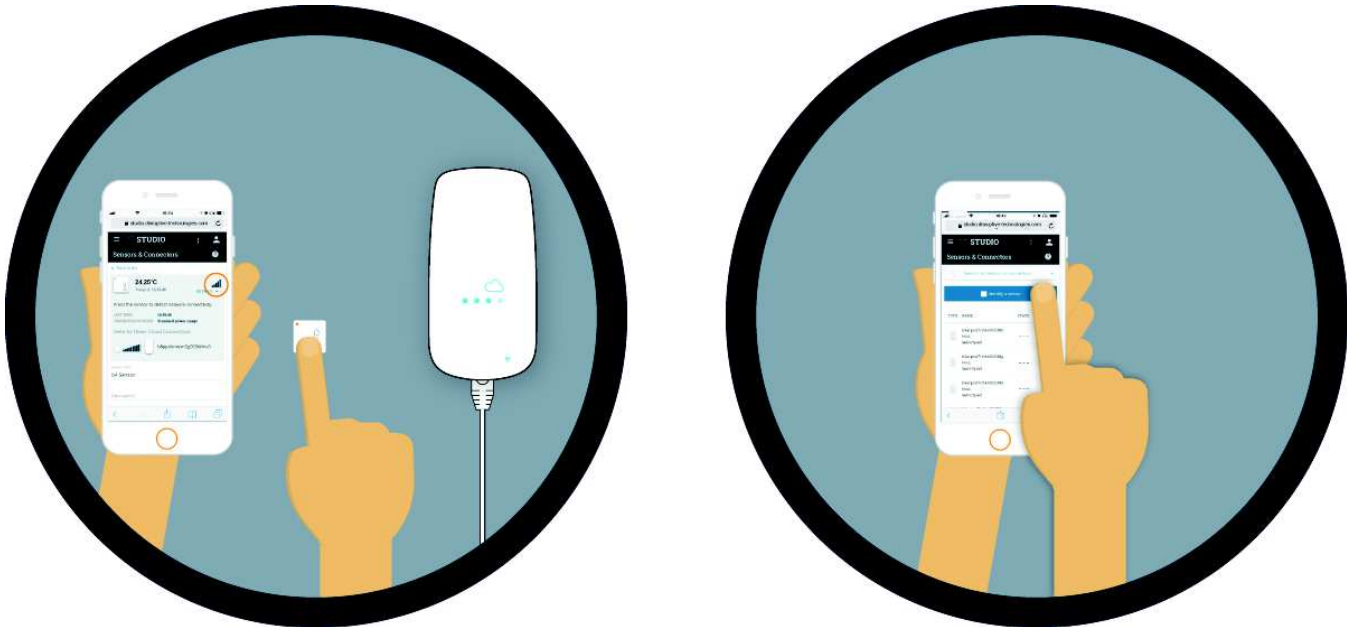


If a white cloud symbol appears on the Cloud Connector, it has successfully connected to the Cloud. The dots beneath the cloud symbol indicate the signal strength.

If a red cloud appears on the Cloud Connector, go to troubleshooting.

Step 3: See sensors in Studio, close to Cloud Connector

- Go to www.studio.disruptive-technologies.com
- Navigate to the **project** you are currently installing
- Go to **Sensors & Connectors** in the project
- Press ***Identify Sensor*** within DT Studio
- **Press** the physical sensor

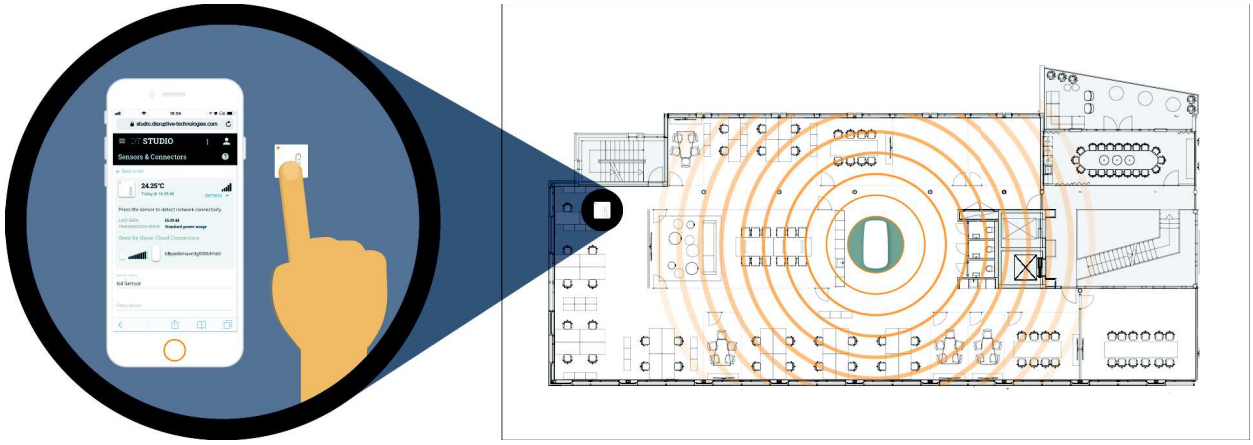


This will bring up the detail view for the sensor that has just been pressed. Confirm that the signal strength is high.

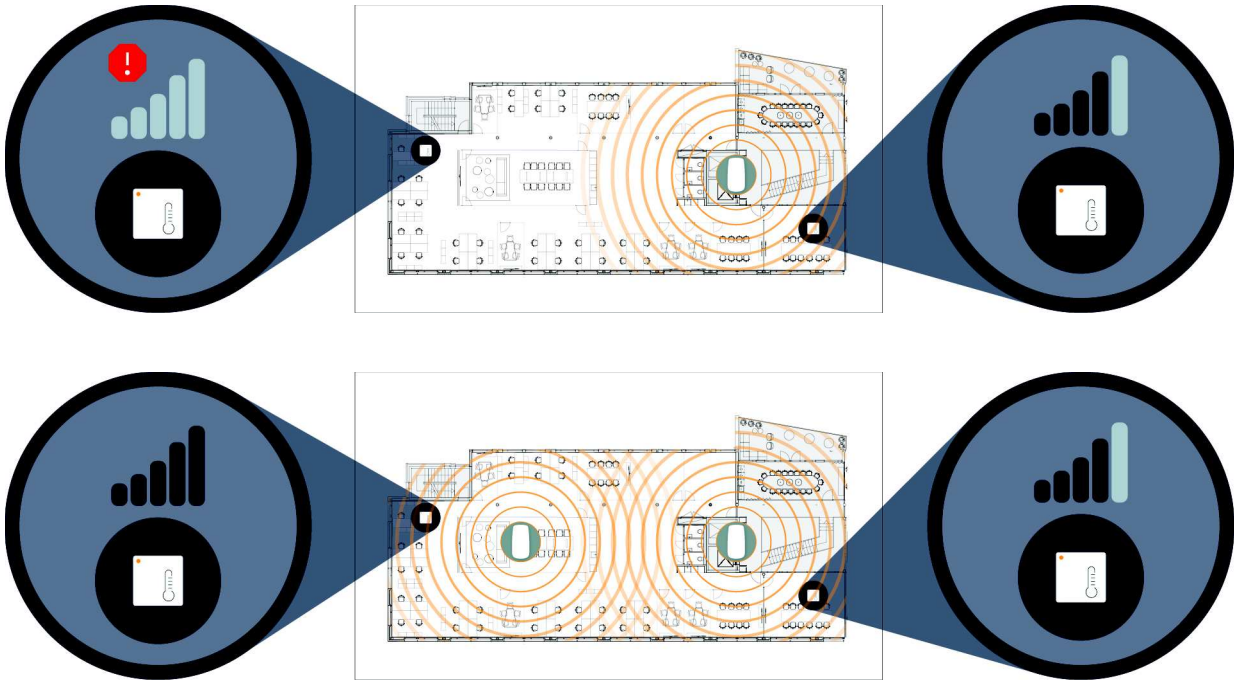
If you are not able to identify your sensor or the reported signal strength is weak, go to troubleshooting.

Step 4: Check range at the installation point

- Bring your sensor to the installation point
- Mount the sensor with the non-permanent adhesive included in your kit
- Verify the range by pressing the sensor and seeing a response in DT Studio



If the sensor does not report at the installation point ( ) or the sensor reports in boost mode (b), we recommend installing an additional Cloud Connector to ensure coverage.



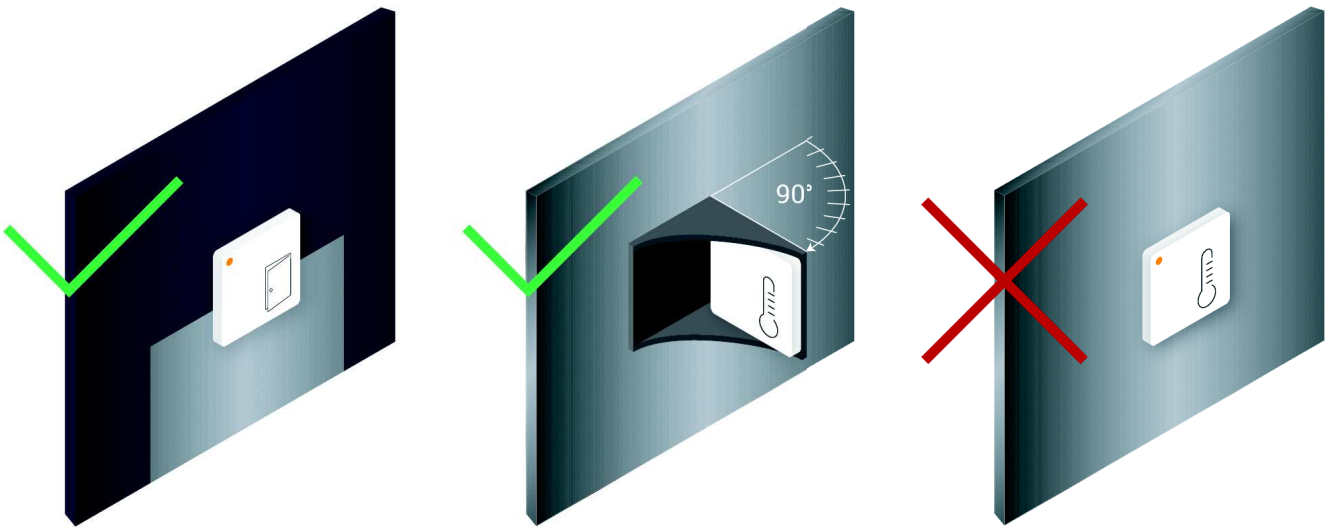
Step 5: Place sensors

Peel and stick to the surface

The sensors are equipped with a strong adhesive for permanent installation. When the final location is verified, make sure the surface is clean and dust-free. Peel the protective film from the backside of the sensor and place it. Firm application pressure helps develop better adhesive contact and improve bond strength.

Placement on metal

If a sensor is placed directly on a metal surface the wireless range will be severely affected, therefore some caution is needed for such placements. In cases where there is a considerable distance between the Sensor and Cloud Connector, we recommend to not place sensors directly on metal. If the installation point requires placement on metal and wireless range is crucial, the sensor should either be placed halfway on metal or an installation bracket orienting the sensor perpendicular to the metal surface should be used (see illustration below). For more information on sensor placements on metal goto Range in various environments.

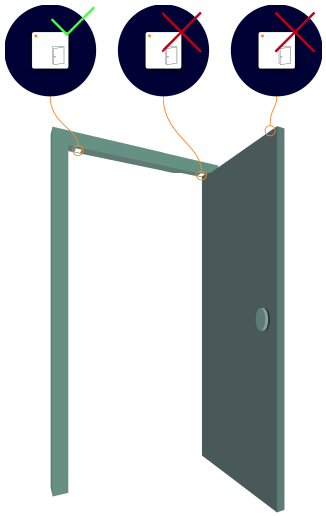


Name the sensor

We highly recommend naming the sensors when placed. The naming of sensors is done in DT Studio by editing the field Sensor name.

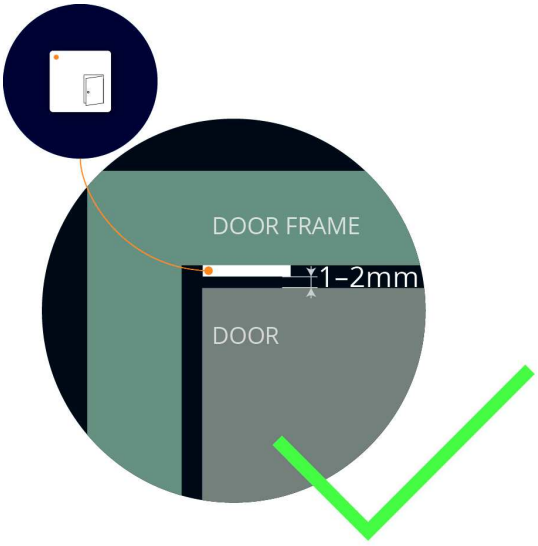
Door sensor

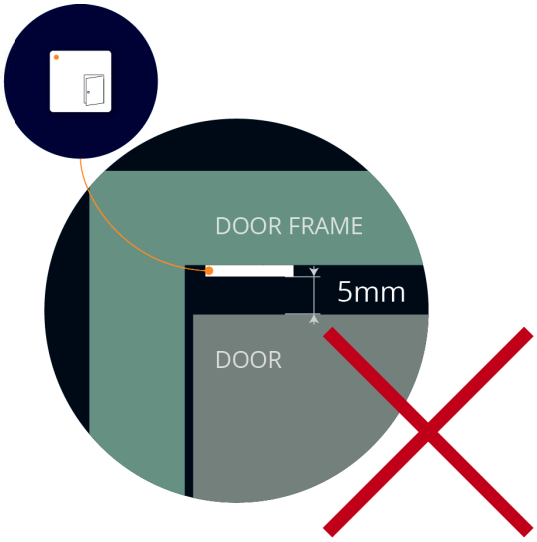
When placing a door sensor, place the sensor in the top part of the door frame on the opposite side of the hinge. This placement ensures minimal dust build-up on the sensor and allows the sensor to detect slight door openings.



Detection Distance

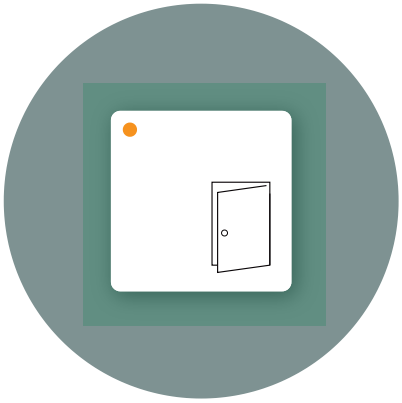
The Door Sensor can robustly detect objects 2 mm from the surface of the sensor.





Recommended temperature range for robust operation

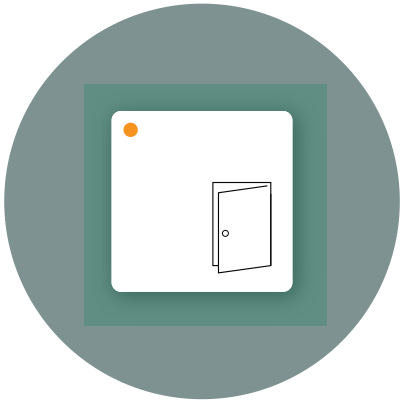
The Door Sensor has a recommended operating temperature range of 3 to 50 degrees Celsius (37.4–122 °F).

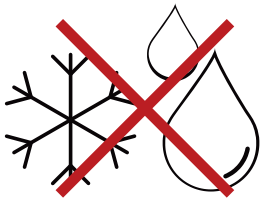


3–50 °C

Unreliable conditions

Avoid the buildup of condensation and ice on the sensor as this may trigger false detections. Also, avoid placement where dust and dirt will set on the surface.

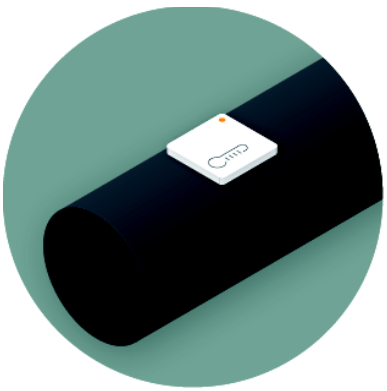


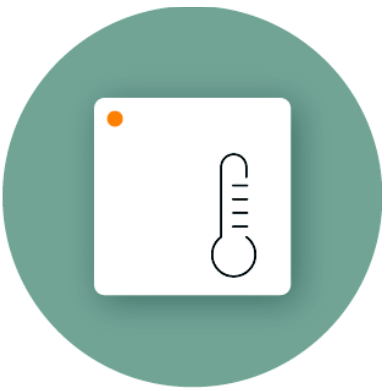


Temperature sensor

Placement

Due to the small size and a robust build, the temperature sensor can be placed practically anywhere you wish to measure temperature.

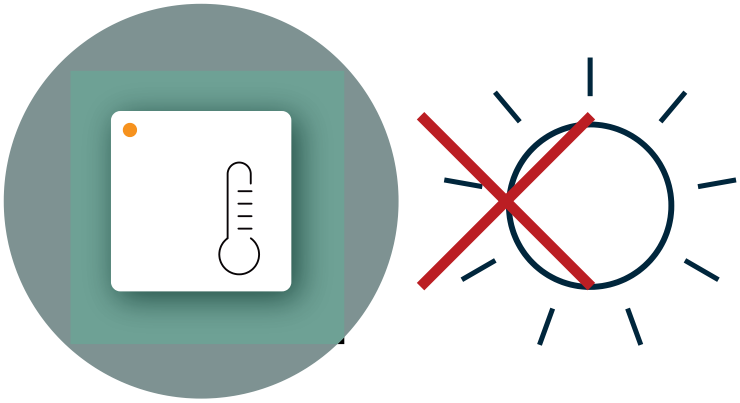




Avoid heat sources when measuring room temperature

Avoid surfaces with direct sunlight or heated surfaces if you want an accurate representation of room temperature.

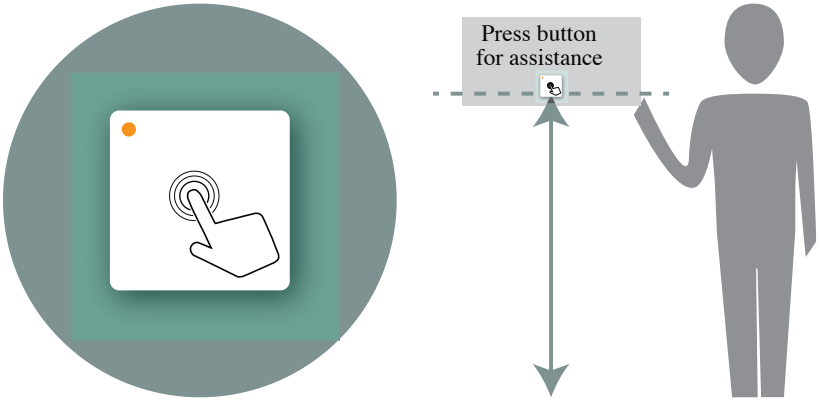
Also, note that the thin double-sided tape on the back of the sensor will attach the sensor close to the mounting surface with a relatively low thermal resistance. This means that for installations on surfaces with high thermal capacity (e.g. a concrete wall), temperature measurements will not be representative of the air temperature. For mounting options with increased thermal resistance, please visit Mounting DT Wireless Sensors.



Touch button

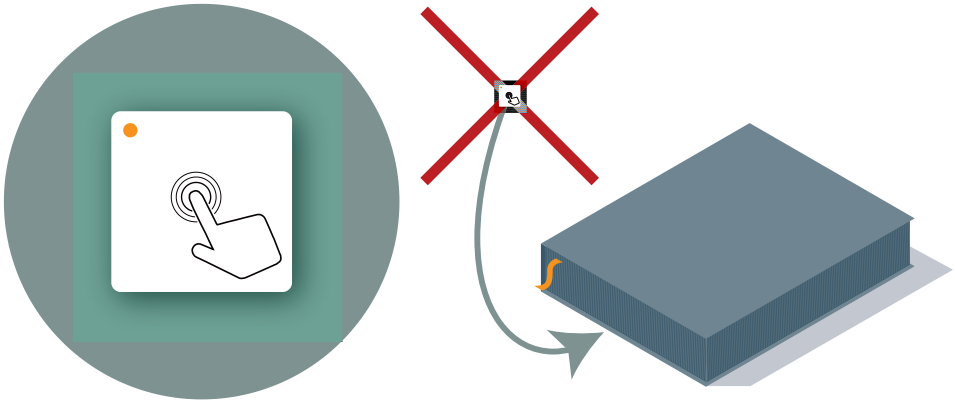
Button placement

Place the sensor so it is easily accessible at a sensible height, depending on use.



Avoid Clutter

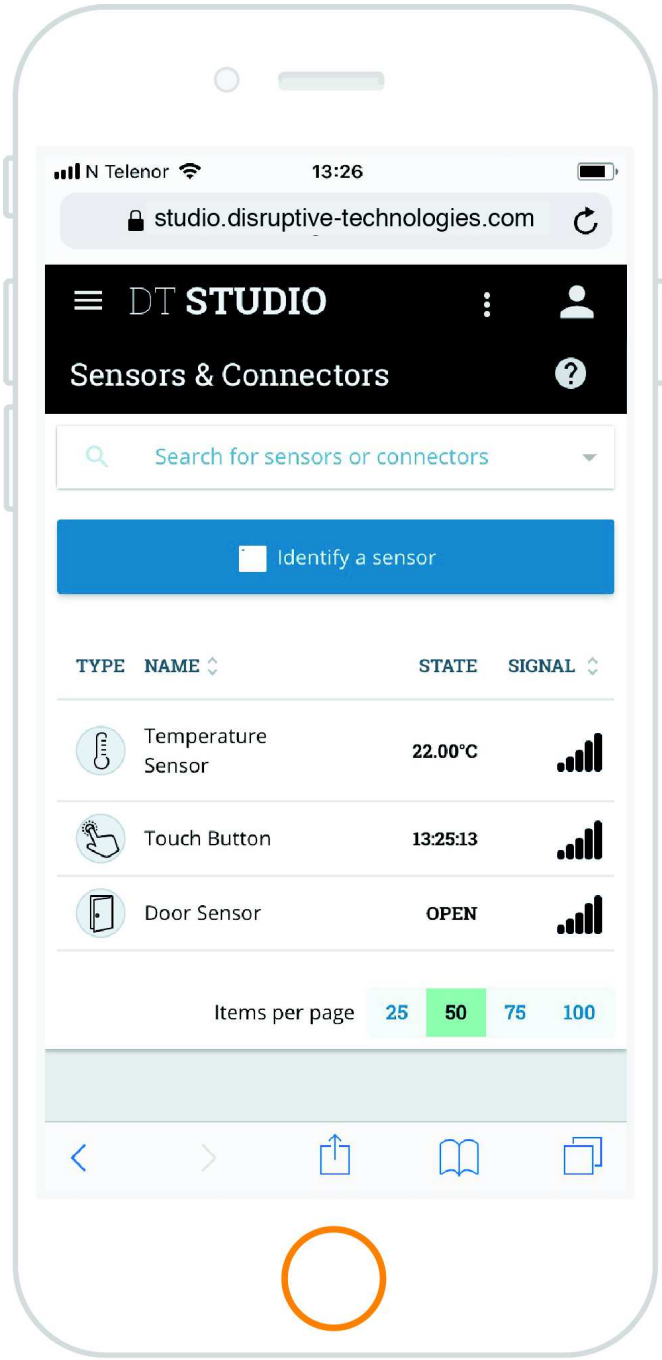
Avoid placing the sensors where it can be covered by books, paper or other objects.



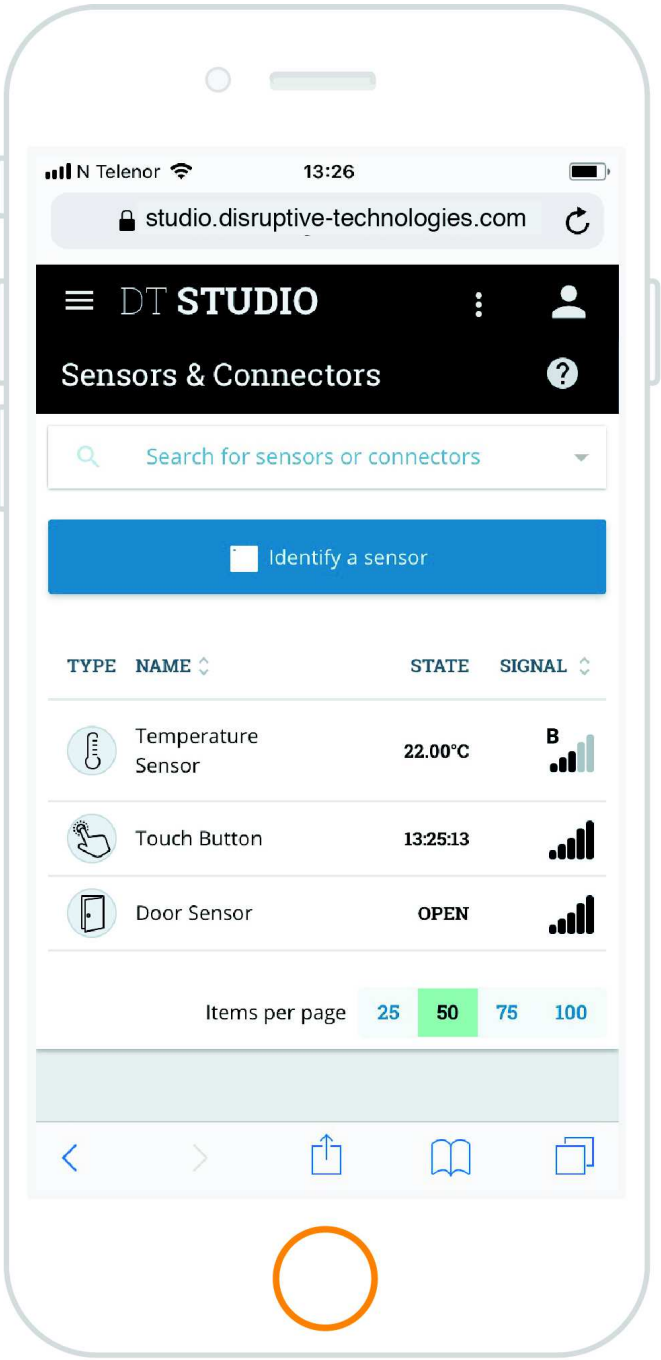
Step 6: Verify device list in DT Studio

The last step is to open up the project you are currently installing in DT Studio and verify that all sensors are reporting and that the signal strength for the whole installation is good.

If all sensors are reporting with no warnings or indications on the signal strength, the installation is complete. If one or more sensors are in boost mode( ) or are not reporting ( ), go to troubleshooting.



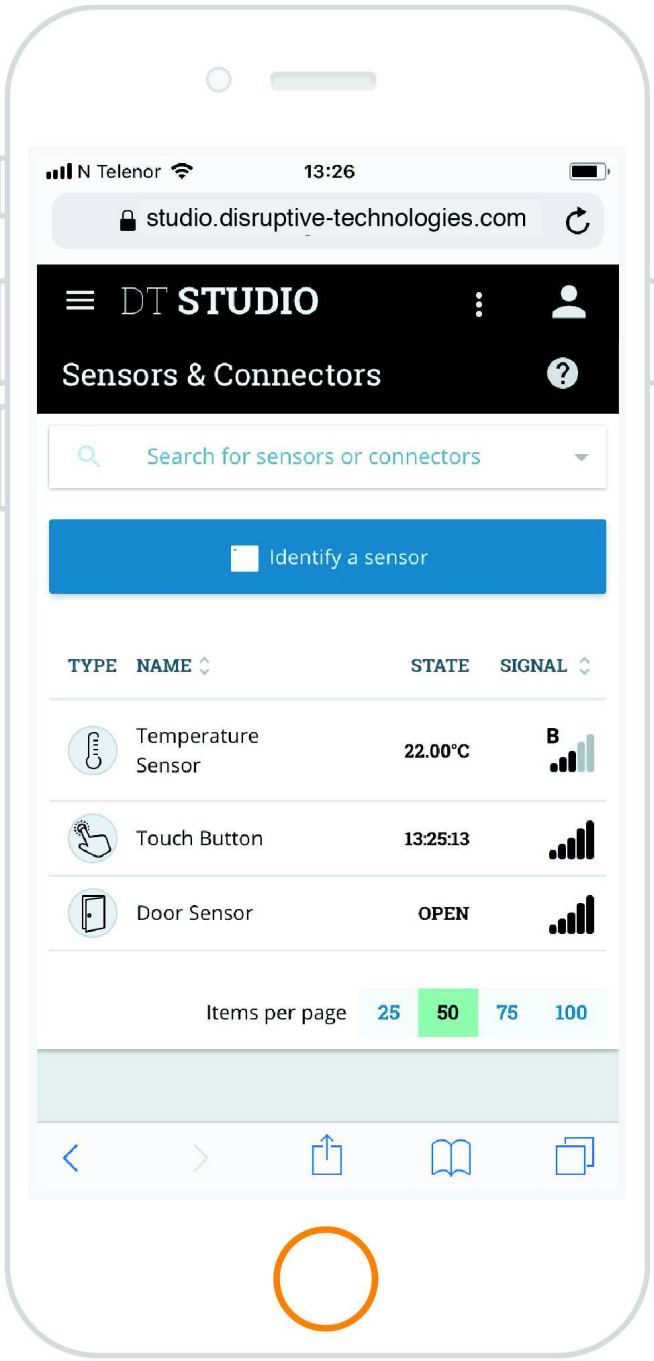
All sensors reporting and signal strength is good

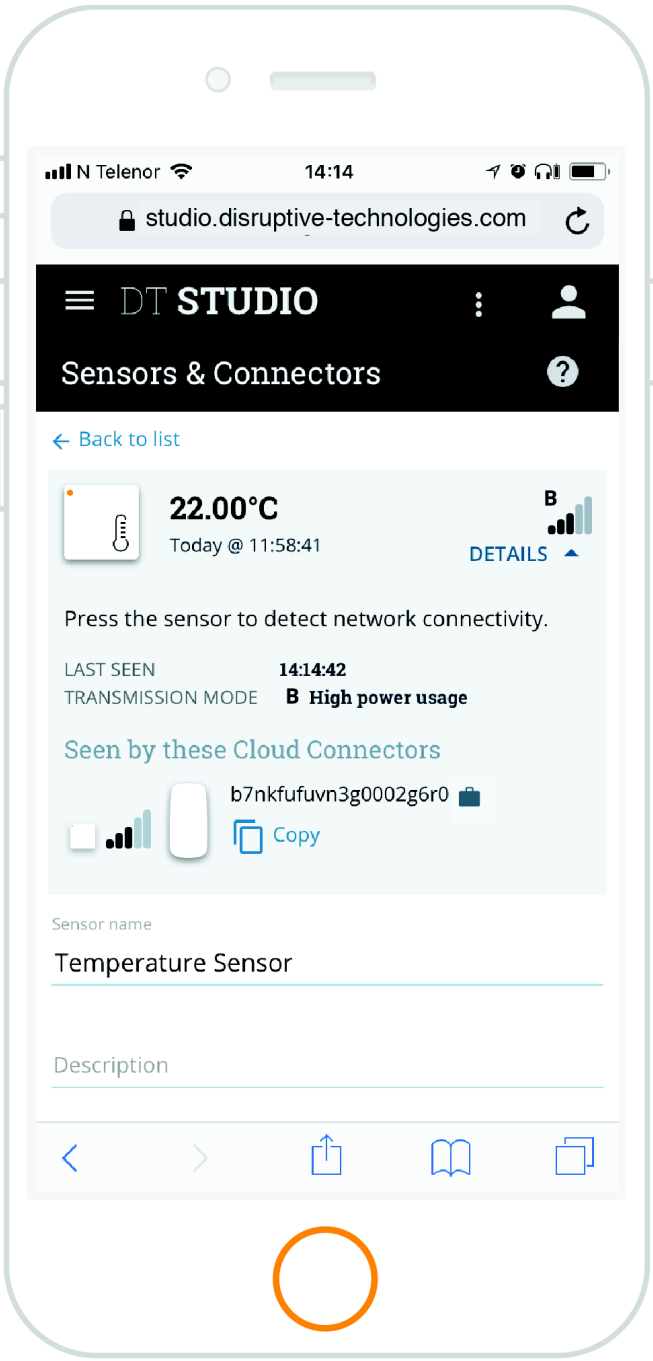


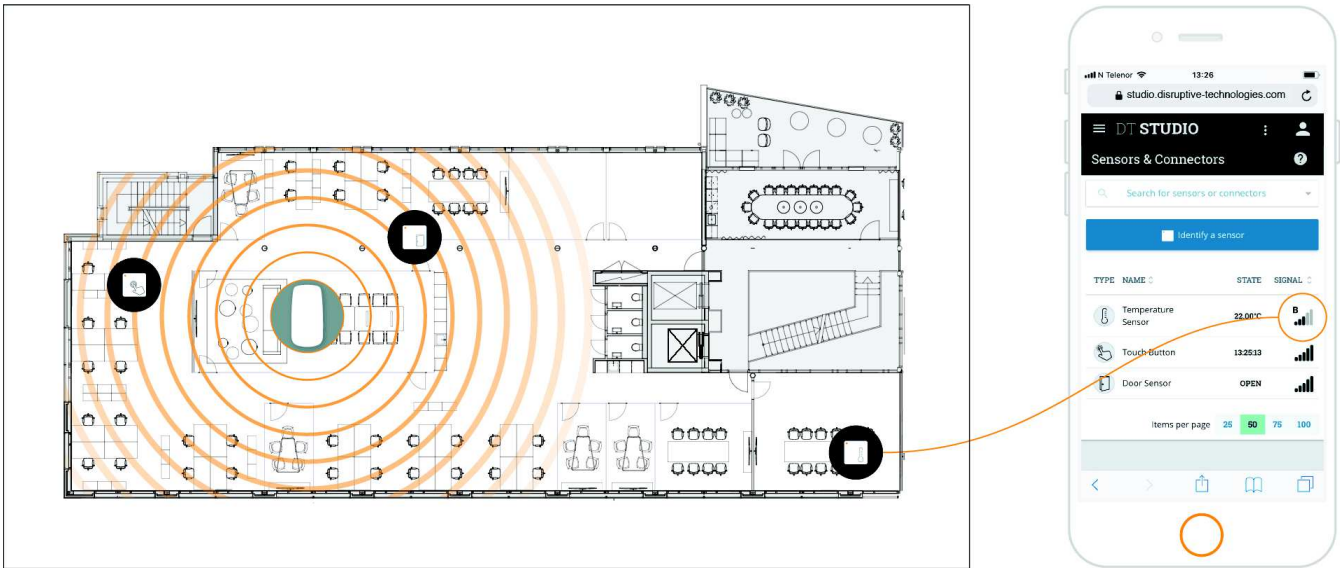
One sensor in boost mode

Visual Troubleshooting

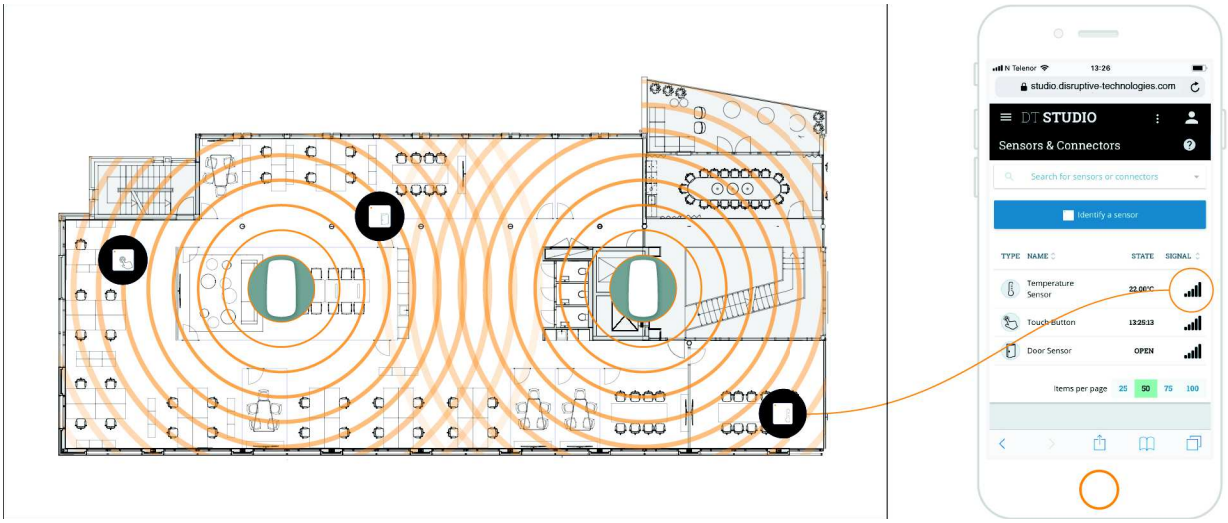
If a sensor is transmitting in boost mode ( ), using high energy transmissions, the sensor will be listed as shown below. The warning indicator highlights that this should be looked into.







Placing an additional Cloud Connector closer to the sensor in boost mode ( ) will allow the sensor to report in normal mode. The sensor transitions between transmission modes automatically.



Appendix

Range in various environments

To achieve a healthy installation, the critical factor is radio connectivity between the sensors and the Cloud Connector. The key factors to consider when placing Cloud Connectors in addition to distance are :

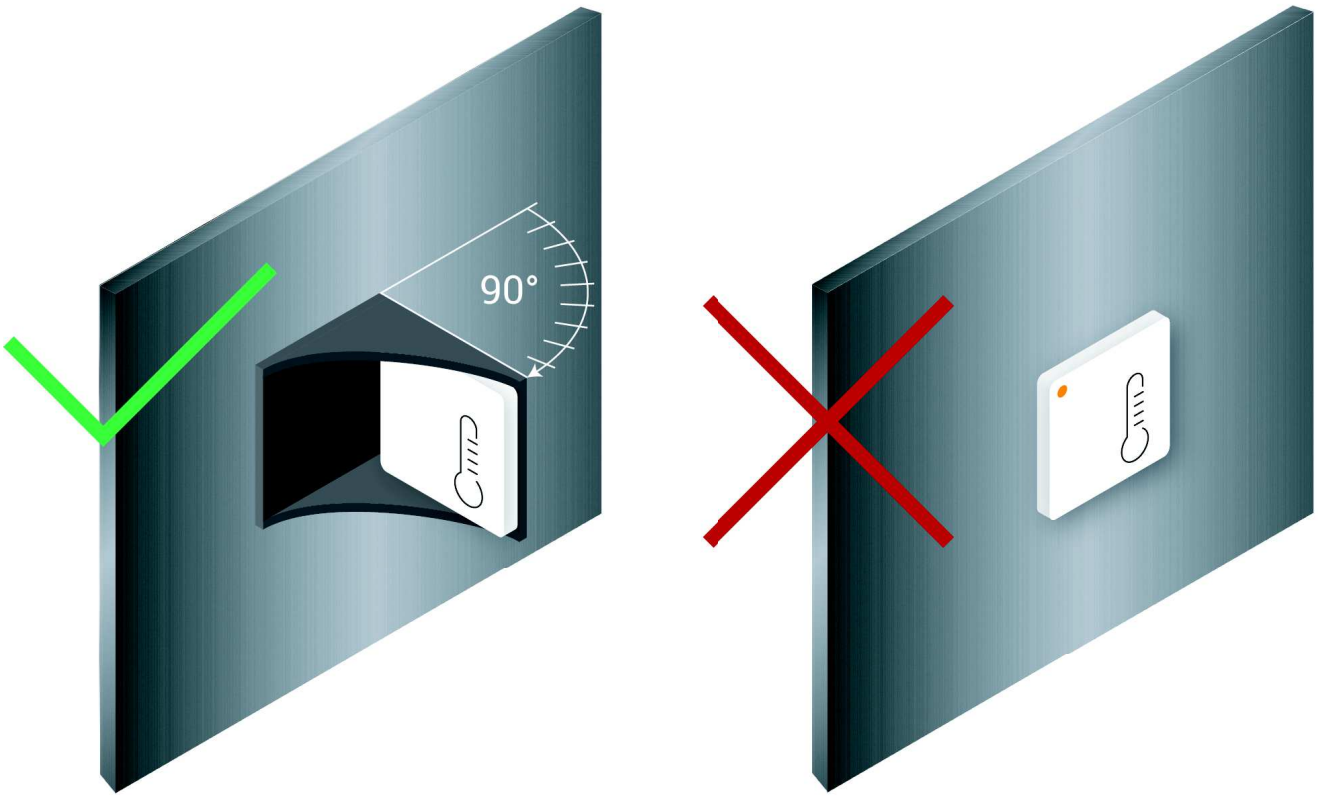
Materials in walls and ceilings.

- Metal acts as a mirror to radio waves and can both block signals in some directions and reflect them further in another direction.
- Drywalls dampens signals slightly, whereas brick walls dampen signals significantly.

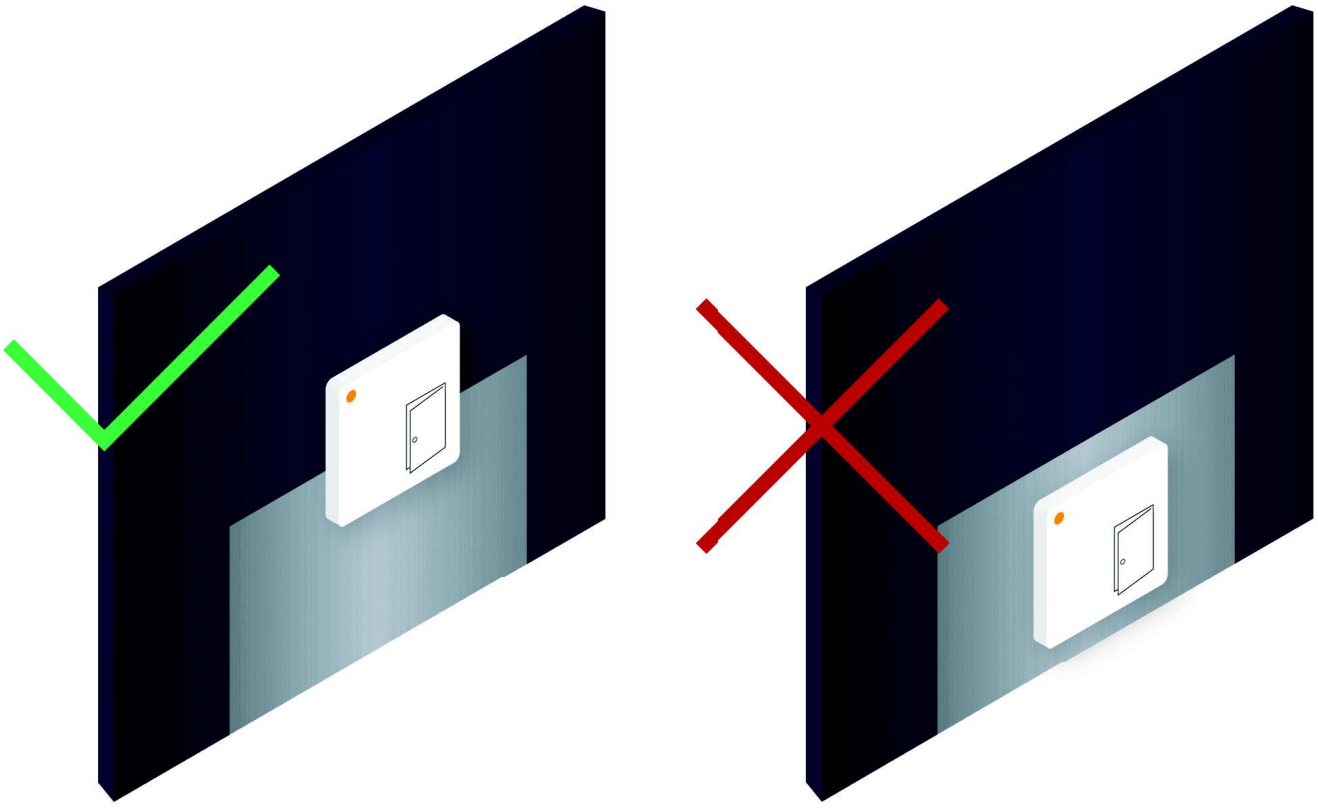
- Simple windows may let signals through with little loss, whereas tinted glass or modern windows with UV-blocking coatings may cause significant signal loss or act as signal-mirrors.

The material of the surface where the sensor is fixed

- If sensors are placed directly onto metal surfaces signal strength will suffer and result in reduced range. For such installations, a plastic bracket orienting the sensor perpendicular to the metal surface should be considered.



- Alternatively, if the installation surface is partially metal, i.e. a metal sheet incorporated in a wooden structure, placing the sensor halfway on the metal surface and halfway on the wooden surface will positively affect the sensors internal antenna, resulting in a better range.



- If mounting the sensor directly on metal can not be avoided, beware of reduced range. E.g. for detecting the opening and closing of a metal door, the Cloud Connector might need to be placed closer to this sensor than sensors placed on other materials.

Line of sight vs. indirect signal paths

- The more complex the geometry of the installation site, the more difficult it is to predict the signal paths. In some cases such as concrete shafts, the signal may bounce its way along the channel.

Unblocked signal paths

- It is always better for the sensor to have as little obstruction between it and the Cloud Connector as possible. In environments where people and trolleys/crates etc. move around, signal strength may vary significantly depending on the time of day and activity. Placing Cloud Connectors high in the environment reduces many of these effects.

Avoiding closed metal boxes

- Metal reflects radio signals. A completely closed metal box will drastically reduce range. Placing sensors in rooms with the metal floor, walls and ceilings will need a Cloud Connector inside the room, and in many cases will require the Cloud Connector to be connected through Ethernet.
- Closed fridges and freezers generally have non-metallic openings, such as flexible material around doors and hinges. The signal can thus escape the metal case, but not without loss.
- The Cloud Connector should not be placed in a metal cabinet, such as a power installation cabinet.

Noise in the environment

- In a room full of people speaking at the same time, it is hard to hear anyone but the person next to you. If the range is far below expectations in direct-line-of-sight setups, background radio noise should be investigated. Damaged or low-quality radio equipment may be sources of noise.

For a more detailed introduction to Range and Cloud Connector placement, see the separate white paper on Range.

Radio transmission modes

The sensors and Cloud Connectors can communicate in different radio modes. The normal mode is optimized for low energy usage. If the sensor is unable to reach the Cloud Connector in the normal mode, it will try a different high energy mode, referred to as “Boost” as it will boost the communication range. In DT Studio, sensors transmitting in boost mode have yellow warning signs on their signal indicators ( ).

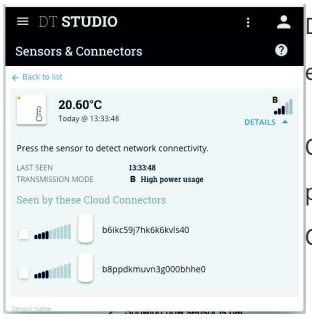
In Boost mode, the sensors use a different channel, spend longer on transmission and thus drains more energy from the battery. The slower transmission mode and higher latency translate into a better range.

In an attempt at getting measurements through when the installation provides insufficient connectivity between the sensor and the Cloud Connector, the sensor will thus trade-off energy use for an increased range. If sensors often fall back to boost mode, this is an indication that the installation should be modified. Better placement of and possibly additional Cloud Connectors should be considered. A sensor constantly staying in boost mode will have its life expectancy reduced to around a fifth.

Number of Cloud Connectors required

While planning an installation a conservative estimate is that a Cloud Connector will cover 200 square meters, similar to a high-end WiFi base station. In some environments, such as tall spacious rooms, much larger areas can be covered by a single Cloud Connector.

The ideal way to decide on the number of required Cloud Connectors is thus to perform a trial installation in a representative installation environment and use the initial trial to extrapolate numbers for a complete installation.



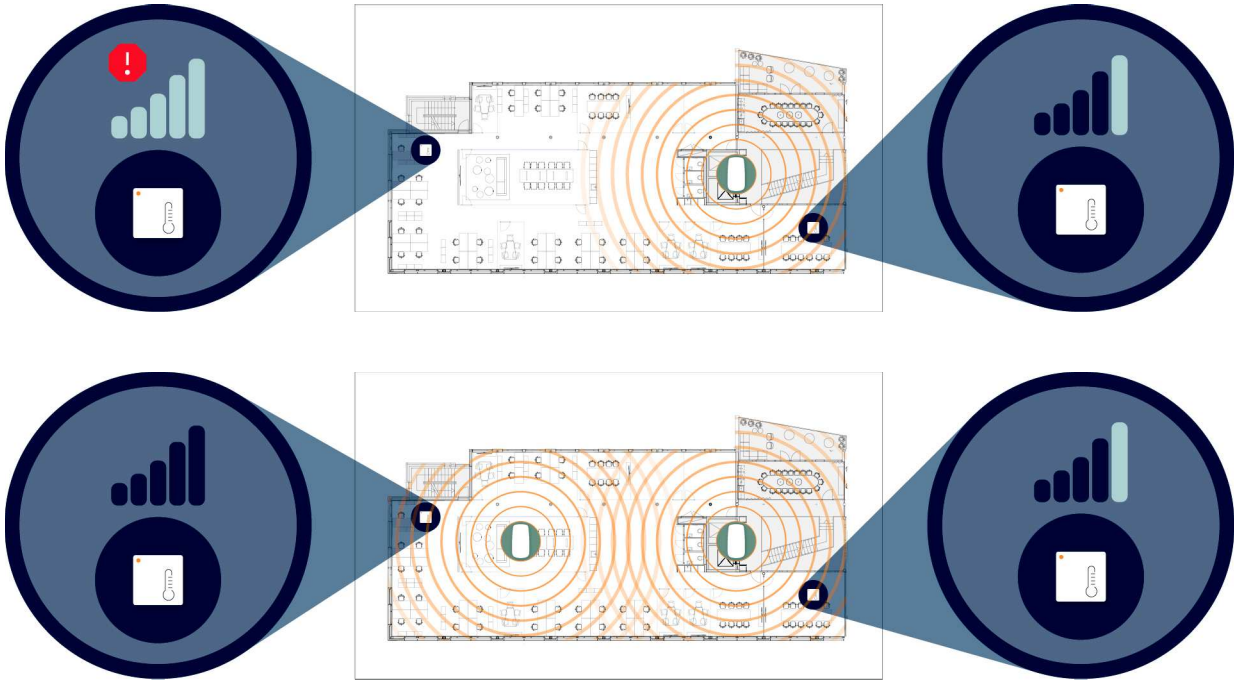
DT Studio has an interactive feature which displays the connectivity between a selected sensor and each of the Cloud Connector that picks up its signal:

Open this view by clicking the “DETAILS” link underneath the connectivity bar on the sensor detail page. Whenever the sensor is touched, an updated reading of signal strength from each Cloud Connector will be displayed.

As holding sensors in your hand influences radio signals it is recommended that the sensor be placed onto a surface matching the target installation and then touched.

When moving away from the Cloud Connector, signal strength will drop depending on the sensors distance from the Cloud Connector as well as the signal reflection in the environment. At some point, sensors will resort to Boost mode and eventually

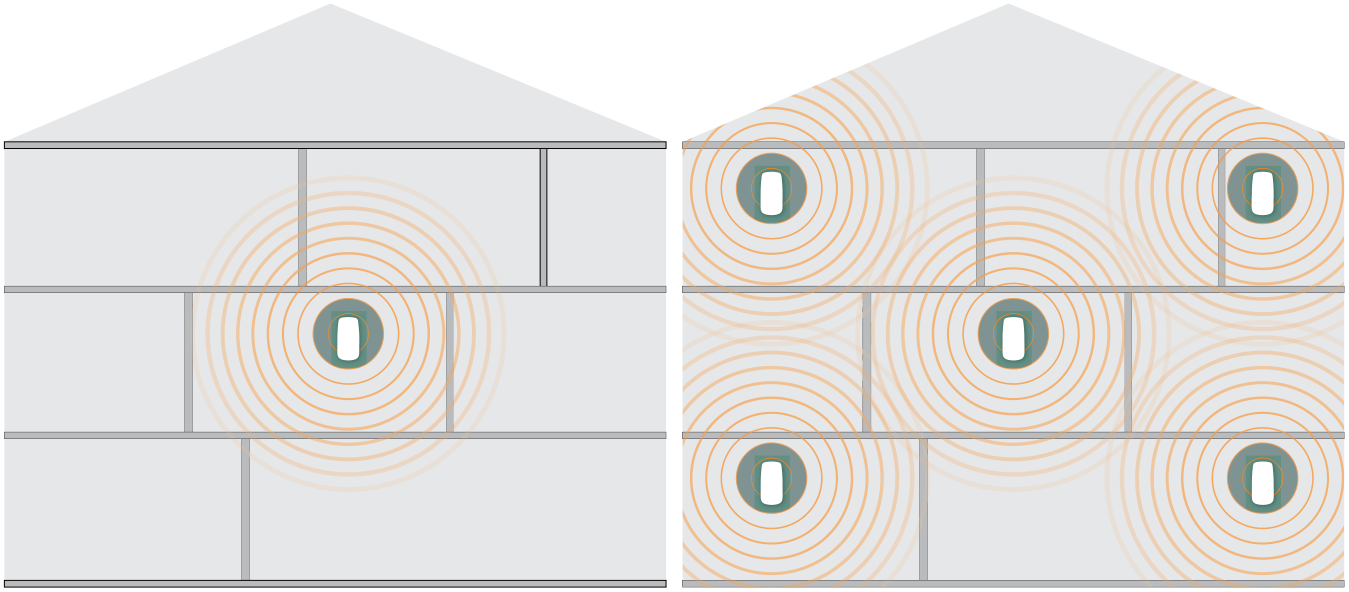
not get through at all. Place more Cloud Connectors until the installation area is sufficiently covered.



For increased reliability, let each sensor reach two or more Cloud Connectors.

Multiple floors, covering large areas.

When covering building over multiple floors, consider that placement of a Cloud Connector on one floor may give some coverage at the floor above and below. The coverage will depend on the construction of the building, especially the material of the floors. Try placing Cloud Connectors on each floor shifted horizontally to maximize the signal coverage.



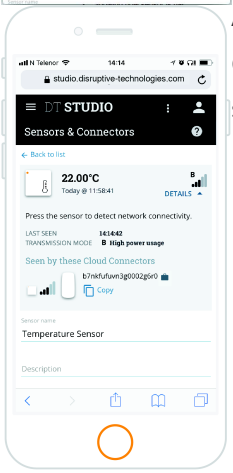
Tools supporting installation and verification

DT Studio on mobile

DT Studio will show signal strength as a number of bars for each sensor and whether the sensor is operating in normal or high power (Boost) mode.

The user interface is optimized to work on a mobile phone and can be used as an interactive tool to inspect the signal range in the target environment.

When touched, each sensor will trigger a Connectivity Status update to DT Studio.



After having placed the Cloud Connector, a rough outline of the coverage area around the Cloud Connector can be found by carrying a sensor around - regularly pressing it to check connectivity at that spot.

Cloud Connector Mode for activity monitor

If a sensor is not responding, the Cloud Connector has an activity monitor mode, which can be used to verify that a Sensor is transmitting.

Use this to confirm that the sensor is operational.

Cloud Connector installation

How a Cloud Connector is installed depends on the type of connection options the Cloud Connector supports. The Cloud Connector has one of two configurations:

- Cloud Connector with Ethernet and built-in cellular modem
- Cloud Connector with Ethernet only

Independent on the type of connection, the white cloud indicator lights up when the connector is ready to act as a gateway for sensors around it.

Once the Cloud Connector is powered it will start and connect to the DT Cloud via Ethernet, or if available through its built-in cellular modem.

Cloud Connector mounting

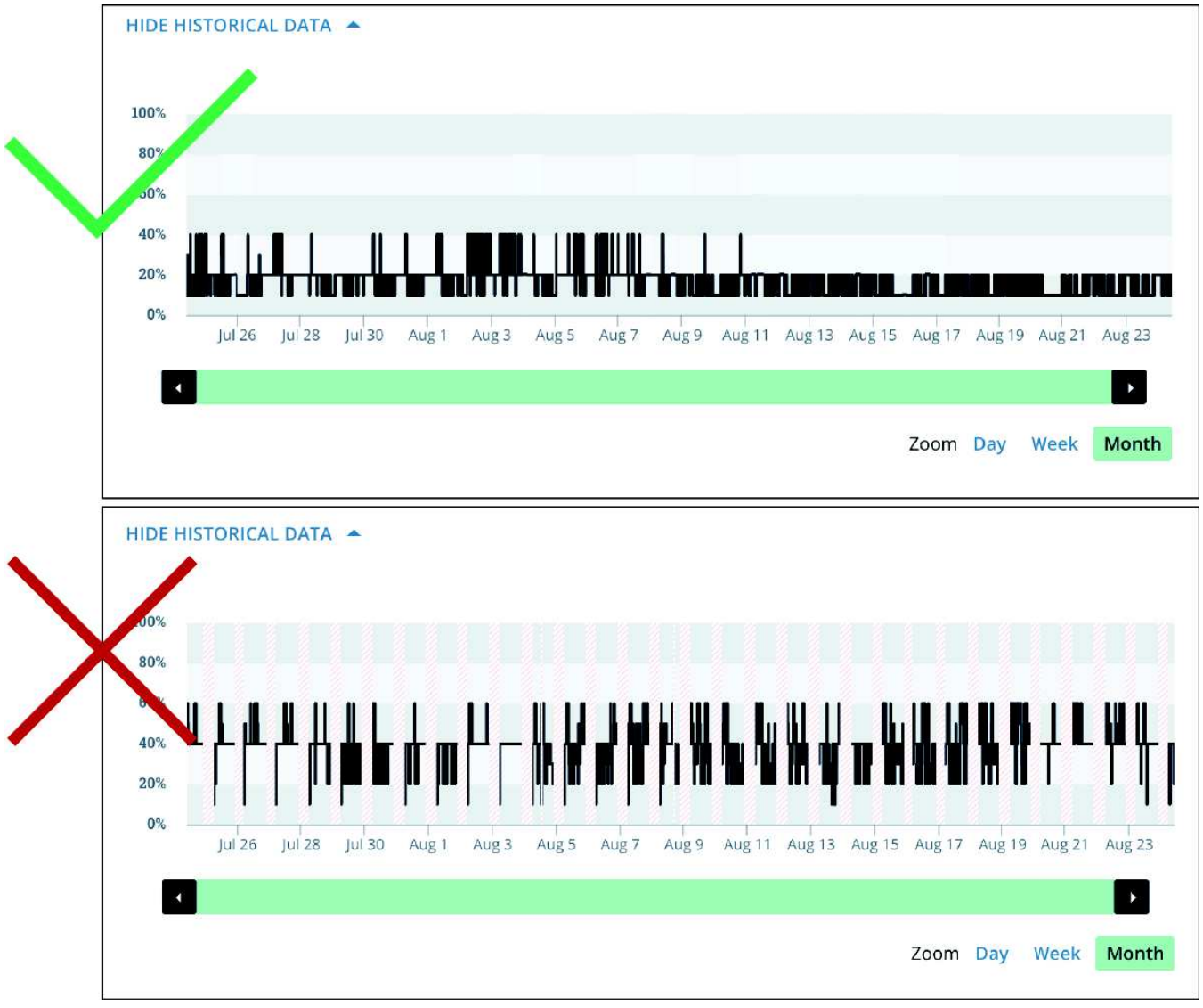
To maximize the value of the cloud connector, provide it with a direct signal path to the sensors

- Place it high up on a wall or right above ceiling panels
- Place it in the center of the room/area to cover
- Do not place it in a metal cage
- Do not place it in a bundle of power cords and next to other equipment emitting radio noise
- Rather use an extension cable, than accepting a sub-optimal location.

Cloud Connector cellular connection (requires built-in cellular modem)

When a Cloud Connector that supports cellular is connected through the built-in cellular modem, we recommend reviewing the connection after some time. DT Studio provides historical data on the Cloud Connector cellular connectivity.

The illustration below shows one acceptable installation with a slightly low average signal strength, but with few connection drop-outs, and one unacceptable installation where the signal strength is sufficient, but connection drop-outs occur periodically. Periodic drop-outs like this may indicate that the power socket in use is powered down each night, and is not suitable to power the Cloud Connector.



Cloud Connector Ethernet network requirements

If high-quality Ethernet access to the internet is available, the Cloud Connector would benefit from being connected via this vs. the built-in cellular modem (if available).

- Cellular modem latency is generally higher than land-based cable access.
- Cellular signal strength is an additional factor that can influence the robustness
- The Cloud Connector will fall back to cellular if the Ethernet provided drops

Please make sure that DHCP is activated on the Ethernet network; the Cloud Connector will ask for an IP address automatically when connected.

Avoiding data loss

To operate reliably and avoid data loss, sensors require at least one Cloud Connector that is connected to the DT Cloud and within range of the sensors.

To reduce chances of lost data packets to a minimum, please ensure:

- Connect Cloud Connectors to an uninterrupted power supply, allowing them to operate in case of a power outage.
- Make sure that Cloud Connectors with a built-in cellular modem is placed at a location with sufficient cellular coverage even if the Cloud Connector normally operates on Ethernet. This will allow the Cloud Connector to fall back to using cellular connectivity in case of network issues.
- Have each sensor within reach of at least two Cloud Connectors. This allows a secondary Cloud Connector to receive data from the sensor in case of packet loss or loss of an entire Cloud Connector.

The sensor will perform multiple attempts at delivering a reading, including switching to high energy boost mode for an increased range. If none of these retry attempts get through, the data point will be lost.

Troubleshooting

Sensor not reporting

- Bring a sensor close to Cloud Connector and see if it will start reporting. It may take several hours before the sensor will automatically detect and reconnect to the network if it has been completely offline for an extended period of time
- Use the Cloud Connector activity mode to verify if the sensor is transmitting. Go to www.d21s.com/help to learn how to initiate the activity monitor.

Too much boost mode traffic

- If caused by low signal
  - Add Cloud Connectors
  - If possible move sensor into line-of-sight or similar better placement
  - Move existing Cloud Connector - e.g. middle-of-the room, above the ceiling.
- If caused by other issues

- If the Cloud Connector supports cellular make sure that it has good connectivity. If the connectivity between the Cloud Connector and the cloud is intermittent, this will generate boost mode traffic even if the reception between the Cloud Connector and the Sensor is good
- Measure signal background noise to establish if the environment is noise challenged.
- Get in touch with DT personnel to help debug the situation.

Cloud Connector Offline

Go to www.d21s.com/help for a comprehensive troubleshooting guide for the Cloud Connector.

Network security configuration

When connecting the Cloud Connector to the local network via Ethernet, the network security configuration must allow the Cloud Connector to access required network ports and resources :

- Port 123 UDP - For NTP time synchronization.
- Port 53 UDP - For DNS name resolution
- *.resin.io port 80, 443
- *.pubnub.com port 80, 443
- sds-receiver-grpc.prod.disruptive-technologies.com port 443
- ccon-manager.prod.disruptive-technologies.com port 443

Notices

This device complies with ISED's license-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device

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