| Critical Things |

# Wireless sensors Installation guide

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# Revision history

| Version | Notes |
|---|---|
| V1.0 | New, based on Ekkosoft Critical Installation Standards |
| V2.0 | Updated for updated (-03) sensors |

# Contents

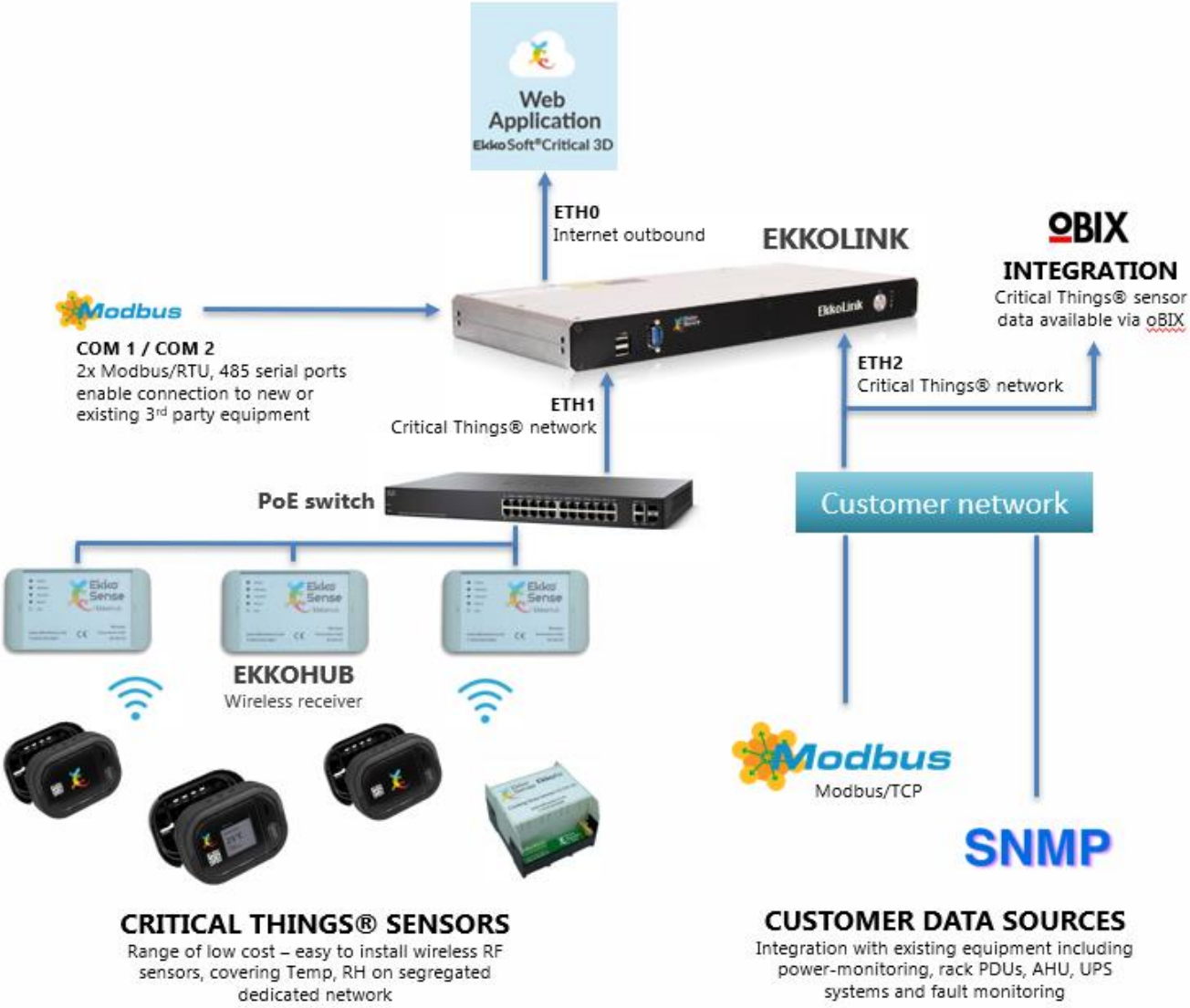
# 1. About this installation guide

This guide is aimed at sensor installers and explains how to install and use EkkoSense Critical Things ™ wireless sensors (EkkoSensors) and data receivers (EkkoHubs). The EkkoAir product is covered in a separate guide (EkkoAir Installation).

# 2. EkkoHub and wireless sensors

Critical Things ™ wireless sensors are designed to take accurate temperature and relative humidity measurements from the racks in a data centre.

The sensors use radio to communicate their measurements to an EkkoHub wireless transceiver unit. The EkkoHub receives the measurements and then sends them to the EkkoLink data aggregator for transmission to the EkkoSoft application via an internet connection.



# 3. Installation preparation

Before you install the EkkoSensors and EkkoHubs, you should make sure you have the appropriate Tools and safety equipment. You should also make sure you are familiar with the Installation workflow.

When you install the sensors, you need to make sure they are positioned correctly on the server racks and that they are within range of the EkkoHub. The EkkoHub has a recommended maximum range of 20m from EkkoSensors.

You should install the EkkoHub so that it can be connected to a Power over Ethernet switch for power and internet connection.

## Tools and safety equipment

To install the sensors and EkkoHub you will need:

- Tape measure
- Cable-ties
- Adhesive tape
- Screws and wall plugs (if fixing EkkoHub to a wall)
- Ethernet cable.

**CAUTION:** Always wear appropriate Personal Protective Equipment (PPE) for the site. For details, please contact the site manager.

## Installation workflow

To install Critical Things sensors and the EkkoHub, you should follow this workflow:

1. Identify your wireless sensor
2. Connect external thermistor sensors if required (see Using thermistor inputs on EkkoSensors)
3. Install a wireless sensor
4. Add a sensor to EkkoSoft
5. Install EkkoHub

# 4. Identify your wireless sensor

The first step is to identify the type of sensor you have. The model is shown on the label on the back of the sensor.


The first two characters correspond to the operating frequency. ES is 868.3MHz and FS is 923MHz. The operating frequency must match the receiving frequency of the EkkoHubs. EkkoHubs use the same two characters to identify the receiving frequency so ES sensors and ES EkkoHubs and FS sensors and FS EkkoHubs must be used together.

The next three characters correspond to the sensor type:

| Sensor Type Code | Wireless temperature sensor | Wireless humidity sensor | Number of optional external thermistor inputs | Built-in display |
|---|---|---|---|---|
| TSX | YES | NO | ONE | NO |
| THX | YES | YES | TWO | NO |
| TDX | YES | YES | TWO | YES |

The final character is the hardware version, 03 for this version of sensors.

All sensors can support external thermistors to provide additional temperature measurements. Some sensors support one external thermistor, others can support two. All sensors automatically detect which external thermistors are connected and start sending the data without requiring further configuration. More details are provided in Section 5 Using thermistor inputs on EkkoSensors. Thermistors are commonly referred to as “flylead sensors” or “flying lead sensors”.

# 5. Using thermistor inputs on EkkoSensors

The thermistor inputs on the EkkoSensors are configured for use with NTC thermistors with a nominal resistance of 10kΩ at 25°C and a ß value of 3435K at 25/85°C. This is commonly referred to as a Carel thermistor. Use of thermistors with other temperature characteristics will not give accurate results.

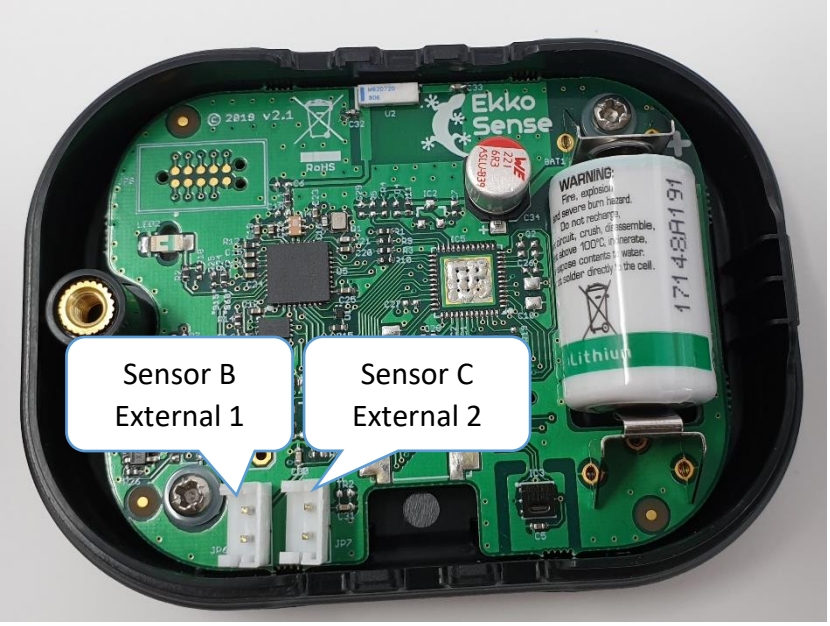
The connection to the EkkoSensor uses a standard JST two pole HER-2 crimp housing with SHE-001T-P0.6 or BEH-001T-P0.6 crimp connectors for wires with 0.05mm$^2$ to 0.33mm$^2$ cross sectional area (30-22AWG) and insulation overall diameter 1.0mm to 1.9mm.

Connections between the thermistor and sensor do not need to be screened but should be 3m or less.

EkkoSense supply a pre-assembled thermistor on 1.2m cable (EKCRSN00438) and a 3m cable with the HER-2 connector on one end and blank the other end (EKCRSN00476) for connection to other thermistors.

To connect a thermistor to a sensor, remove the back cover of the sensor by removing the screw.


The socket(s) are shown below. The identifiers B and C correspond to the way the measurement values are identified to the software. Care should be taken that when two thermistors are connected that they are clearly identified as B and C and correctly configured in the software. The temperature only sensor (TSX) has only the single connector for Sensor B.




The thermistor cable connectors push fit into the housings. When fitting the thermistors avoid touching the circuit board. The cables can be routed out of the air vents at the bottom or top of the sensor enclosure with examples or routing one or two out of the bottom being shown below:

Replace the sensor back by hooking it in at the right-hand side and then replacing the screw, taking care to ensure the thermistor cables route out through the holes and are not trapped.


ES-THX-03
EkkoSense Ltd
Made in UK
www.ekkosense.com
CE


ES-THX-03
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# 6. Install a wireless sensor

To install a wireless sensor, you need to:

1. Assess the location of the air inlets (see page 12)
2. Consider mounting requirements (see page 13)
3. Fit the wireless sensor (see page 15).

You can then Add a sensor to EkkoSoft (see page 17).

## Assess the location of the air inlets

You need to determine where the air inlets are positioned for the rack. This is because the sensor needs to be close to the air inlets and away from any equipment exhausts (outlets).

You need to determine where the air inlets are positioned for the rack. This is because the sensor needs to be close to the air inlets and away from any equipment exhausts.

Sensors can be fitted to standard racks or racks with glass front panels. Racks with glass fronts require a different approach, and so we have separated the two here.

### Regular racks – air inlets

Ideally, all of the equipment in the rack will be facing the same direction. This will give you a clear front and back, where the front is the side with the air inlets and the back is the opposite side, where the exhausts are. With this type of arrangement, you will install the sensor on the front of the rack with the optional external sensor positioned lower down.

However, on some sites, the equipment in a rack may be facing different directions. This can make it more difficult to position the sensor, as there is no clear front and back. With this type of arrangement, you need to determine which side of the rack is the warmest side. You can consider the warmest side to be the back (outlet) and the opposite side is where you will fit the sensor (the air inlet side).

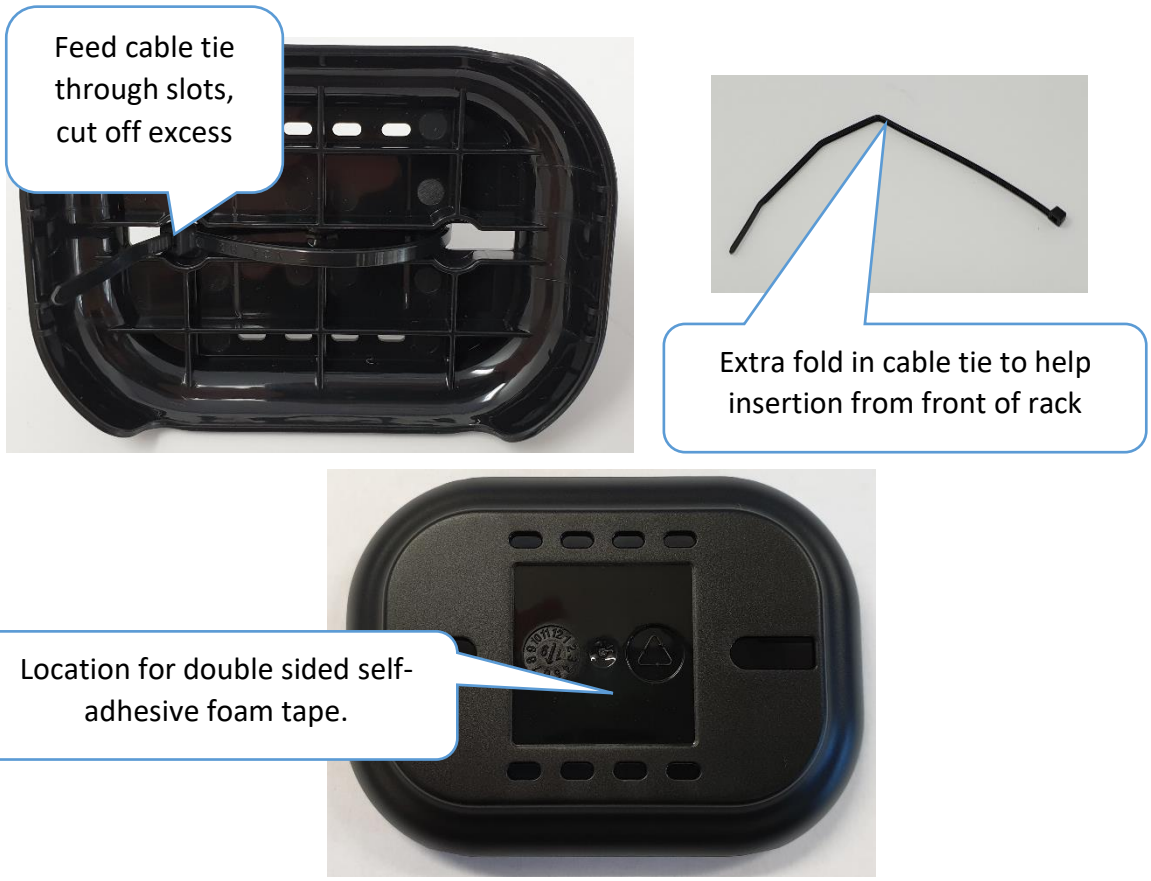
### Glass-front racks – air inlets

Racks with glass fronts often have the air inlets at the bottom of the front panel or at the sides. You will need to locate the air inlets before you can fit the sensor.

## Consider mounting requirements

The sensors are supplied with a standard mounting clip that can be cable tied to a mesh rack front or fixed to a glass front using double sided tape. Alternatively, the sensor can be directly mounted to a suitable surface using double sided tape. Bear in mind that this will prevent access to the sensor in the future for battery replacement and flylead sensor installation and so it should only be done if specifically requested. Cable ties are the preferred attachment method. The slots in the mounting clip are 4.2mm wide and suitable for use with 2.5mm to 3.5mm wide cable ties. Approximately 140mm length is usually convenient, for example Hellerman Tyton T18I. If it is not possible to get access to the inside of the rack door then the cable tie can be threaded through from the front by folding it in half to create a 'hook'.

If double sided tape is used, then check that it is compatible with the surface the sensor is being mounted to. Also pay attention to any surface preparation requirements to ensure reliable adhesion. Hi-Bond VST 4100C has been used successfully in the past and is available in 6mm wide reels (VST 4100C/1/6/10) for use on the sensors and 25mm wide reels (VST 4100C/1/25/10) for use with the mounting clip. Tesa 64958 and 3M VHB 4952 tapes are suitable for low surface energy (for example painted) surfaces.




On some sites, there are special requirements that you need to consider when you fit a sensor. Some common requests are:

- Sensors cannot be fitted to front panel and have to be hidden from view
- Flylead sensors must have their cable routed around the edge of the rack.

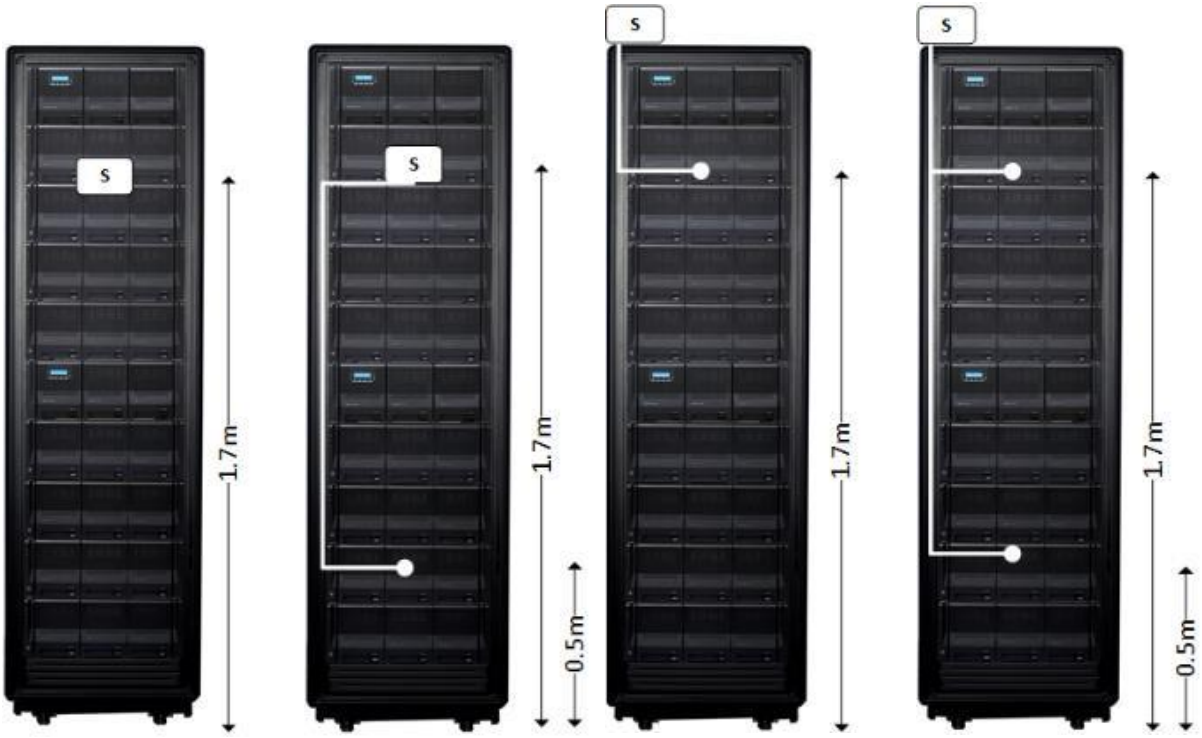
You also need to be aware of any practical limitations, such as the rack front lacking any fixtures to attach the sensor to.

⚠ **Sensors must not be located where they could block the air inlet to the rack**

## Fit the wireless sensor

Having located the air inlets and considered the mounting requirements the sensor can be installed. Some examples of suitable locations for the sensor in different situations are given in the following table:

| Rack type | Air inlets | Request | Suitable sensor position |
|---|---|---|---|
| Standard | Front | None | Sensor: Central, near inlet, 1.7m above the floor.<br>Flylead sensor (if used): Central, 0.5m from floor. |
| Standard | Front | No sensor on front | Sensor: On top of rack.<br>Flylead sensor: Central, near inlet, 1.7m above the floor. |
| Standard | Mixed | None | Sensor: On coolest side, near inlet, 1.7m above the floor.<br>Flylead sensor: Central on same side as sensor, 0.5m from floor. |
| Standard | Mixed | No sensor on front | Sensor: On top of rack.<br>Flylead sensor: Central on coolest side, 1.7m above the floor. |
| Standard | Mixed | No sensor on front, two temperature measurements required | Sensor: On top of rack.<br>Flylead sensors: Central on coolest side. One sensor 1.7m above the floor, the other sensor 0.5m above the floor. |
| Glass front | Front, bottom | None | Sensor: On top of rack.<br>Flylead sensor: Central, with flylead sensor secured in place so that sensor is next to the air inlet. Secure the flylead with tape. |
| Glass front | Side | None | Sensor: On top of rack.<br>Flylead sensor: Position down the side of the rack so that the sensor is next to the air inlet. Secure the flylead with tape. |




Now that you have installed the sensor, the next step is to add it to the EkkoSoft software, so that it can be monitored (see Add a sensor to EkkoSoft on page 17).

You may prefer to install all of the sensors and then add them to EkkoSoft afterwards.

# 7. Add a sensor to EkkoSoft

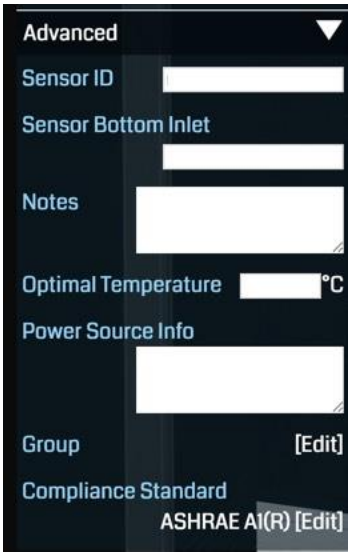
When you have installed a sensor, you need to add it to the Ekkosoft software so that it can be monitored.

There are two ways to add a sensor to EkkoSoft. You can either use a 2D barcode scanner to scan the sensor's QR code or you can enter the scanner's ID manually.

1. Login to EkkoSoft on a laptop (internet connection required).
2. Select the data centre.
3. Select **Visit Room**.


4. Select **Editor** mode.

5. Select the rack that the sensor is attached to.
6. Expand the **Advanced** settings.




7. Select the **Sensor ID** field.
8. Connect a 2D barcode scanner to your laptop (via USB) and scan the sensor's QR code. The QR code is on the label on the front of the sensor. It is also available on the LCD screen (ES-TDX-03 sensors only).

   If you do not have a 2D barcode scanner, you can enter the sensor's ID manually. We recommend that you use a barcode scanner where possible, as it reduces the chances of a scanner's ID being mistyped.

   When you scan the QR code, the sensor's ID code is automatically copied from the 2D barcode reader into the **Sensor ID** field (as long as the Sensor ID field is selected).
9. Repeat this process for each sensor that you add to the racks.

# 8. Battery installation or replacement

The EkkoSensors use a Lithium Thionyl Chloride ½ AA 3.6V battery. Use only SAFT LS14250 or Tadiran SL-750/S / TL-5902 batteries.

To get to the battery remove the sensor back cover by undoing the screw. Avoid touching the circuit board.

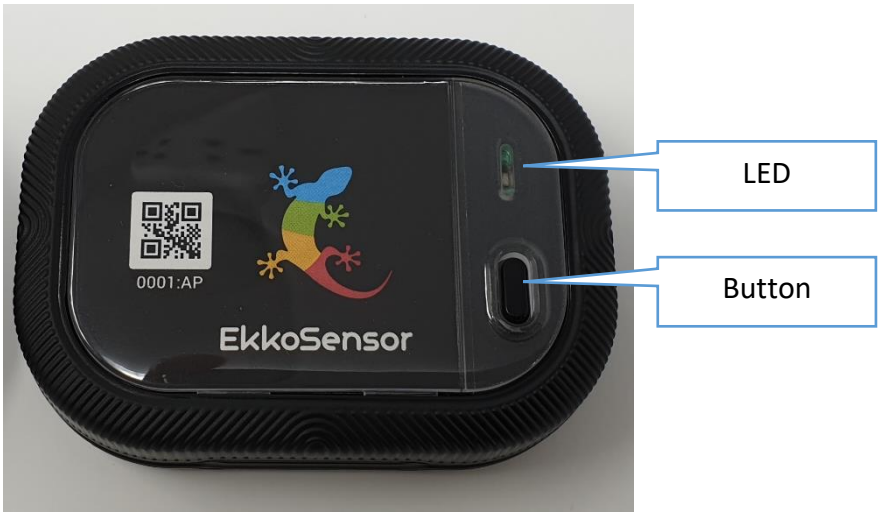

Remove the battery by rolling it to the side and lifting it out.


Ensure the new battery is fitted with the correct polarity, positive to the '+' symbol on the board (the flat metal clip on the board). Fit a new battery by pushing in the negative terminal against the spring contact first and then pushing it completely in to place.


Replace the sensor cover by hooking the right hand side into the front section and tightening the screw.

| ⚠ | **Battery handling and storage precautions** |
|---|---|
| **Store batteries in a cool (preferably below 21°C and in any case below 30°C), dry and ventilated area, away from possible sources of heat, open flames, food and drink. Avoid exposure to direct sunlight for long periods.** | |
| **Keep spare batteries in original packaging until they are ready to be installed** | |
| **Do not dispose of batteries in a fire, they may leak or rupture** | |
| **Do not disassemble, crush, puncture or otherwise damage batteries** | |
| **Insert batteries correctly** | |
| **Store used batteries as if they are new until they can be safely disposed of** | |
| **Recycle used batteries if possible. Dispose of in accordance with local laws and regulations** | |
| **Batteries do not contain hazardous materials according to EC Directives 91/157/EEC, 93/86/EEC, and 2002/95/EC (RoHS)** | |

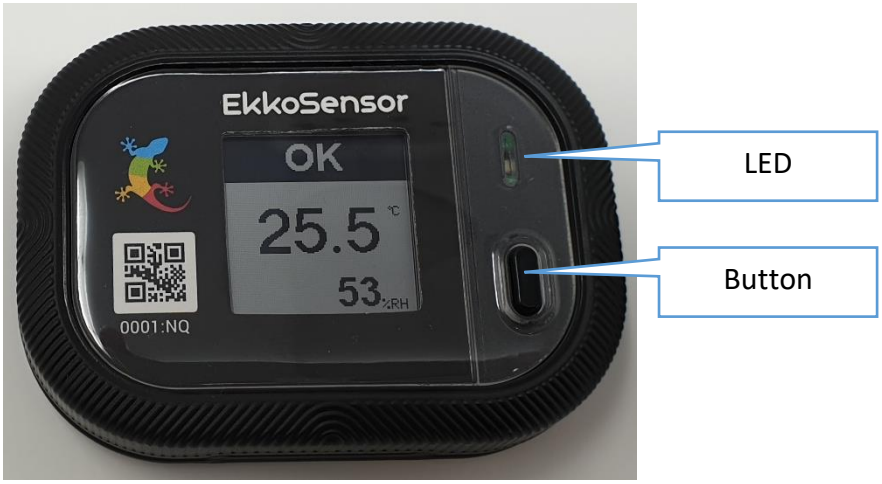
# 9. Using TSX and THX sensors




The button has two functions:

- A short press triggers the sensor to send a measurement message immediately instead of waiting for the next scheduled message. This may be useful during initial installation.
- A long press puts the sensor into configuration mode. The LED flashes briefly to indicate that the sensor is in configuration mode. On each flash the sensor sends a special message to indicate that it is in configuration mode and waits for a response. It does this four times at five second intervals before returning to normal operation. Configuration mode is used by the configuration application to change sensor reading interval or encryption key. See the separate user guide on the configuration application for more information.

# 10. Using the TDX sensors




The button has two functions:

- A short press moves through the different display screens. The first press moving away from the main screen also triggers the sensor to send a measurement message immediately instead of waiting for the next scheduled message. This may be useful during initial installation.
- A long press puts the sensor into configuration mode. The LED flashes briefly to indicate that the sensor is in configuration mode. On each flash the sensor sends a special message to indicate that it is in configuration mode and waits for a response. It does this four times at five second intervals before returning to normal operation. Configuration mode is used by the configuration application to change sensor reading interval or encryption key. See the separate user guide on the configuration application for more information.

The display provides with useful status information, including:

- The measurements currently being taken by the sensor
- Graphs showing the sensor's measurements over time
- Information about the sensor.

## Browse the sensor screens

To navigate between the sensor's screens, press the button. Each time you press the button, the next available screen is shown. If the button is not pressed for one minute the sensor returns to the main screen.

## Main screen

The main screen shows the current temperature and relative humidity measured by the internal sensor and the temperature measured by any thermistor sensors.

At the top of the display, it shows OK or ALERT. OK is displayed when all temperature measurement sources active for generating alerts are within the configured limits. ALERT is displayed if one or more of the temperature measurement sources active for generating alerts are outside the configured limits.The sensor status also shows the current temperature of the internal sensor and the relative humidity (RH only on sensors that measure humidity).

The display units can be selected between Celsius and Fahrenheit using the configuration application.


Normal display showing temperature and relative humidity from internal sensor.


Alert display showing temperature and relative humidity from internal sensor.


Normal display showing temperature and relative humidity from internal sensor and temperature from thermistor sensor inputs. Sensor B (External 1) is the upper of the two, Sensor C (External 2) is the lower. If only one thermistor sensor is fitted then the other display area remains blank.


Normal display in when configured for Fahrenheit.

## Thermistor temperature measurements

The next screens show the temperature measured by the thermistor sensors if fitted.

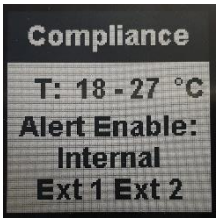

Temperature measured by first thermistor sensor (Sensor B / External 1)


Temperature measured by first thermistor sensor (Sensor C / External 2)

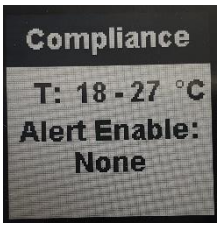
## Compliance

The compliance screen shows the temperature range that is used to determine if the temperature is at an acceptable level (compliant). This can be changed by the configuration application in the range -30°C to 69°C (22°F and 156°F). It also shows which temperature measurement inputs are included for alert generation. Again, this can be changed by the configuration application.


Default compliance settings; low threshold 18°C (64°F), high threshold 27°C (81°F), internal sensor only active for alert generation.




Example display with all temperature measurement sources active for alert generation.

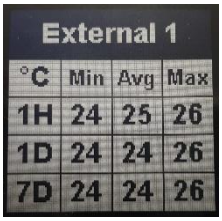



Example display with no temperature measurement sources active for alert generation.

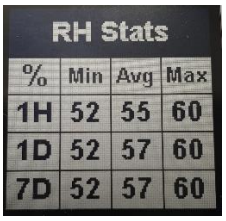
## Statistics screens

The next screens show a summary of the minimum, average, and maximum temperatures that have been measured by the internal sensor and any thermistor sensors that are installed followed by the minimum, average and maximum relative humidity measured by the internal sensor. There are minimum, average, and maximum values for the current hour, the current day, and the past seven day period. The number of screens available depends on the number of external thermistor sensors that are present. There will always be a screen for the internal temperature measurement and the internal relative humidity measurement. The statistics are reset if the configuration of the unit is changed.


Example screen for internal temperature sensor statistics.




Example screen for first thermistor sensor (Sensor B / External 1) temperature statistics.

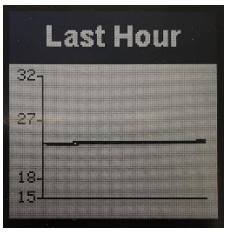



Example screen for internal humidity sensor statistics.

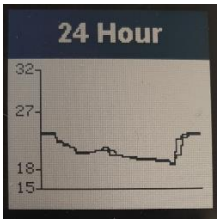
## Graphs

You can view the historical temperature data in a graph format on the sensor's display. There are three graph screens available: Last Hour, 24 Hour, and 7 Day, each providing a graph for a different time period (last hour, last 24 hours, and last 7 days).

All temperature measurement sources that are present are included in the graph so there can be up to three lines.



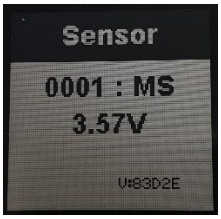

Example screen for last hour temperature measurements (internal temperature sensor and one thermistor reading very similar temperatures).




Example screen for last 24 hour temperature measurements (internal temperature sensor and one thermistor showing slight difference in response time between temperature measurements).

## Sensor information screens

The final two screens provide information about the sensor.




The top line shows the sensor's ID and the second line shows the battery voltage. In the bottom corner, you can see the firmware details, which should be quoted when reporting any issues about the sensor to EkkoSense.


The QR code screen provides the same sensor ID information as printed on the front of the sensor.

A final press completes the cycle and returns the display to the main screen.

# 11. EkkoSensor specifications

| Parameter | Specification |
|---|---|
| Operating temperature range | -10°C to 55°C (14°F to 131°F) |
| Operating humidity range | 0% to 100% non-condensing |
| Temperature accuracy (internal sensor) | ±0.3°C typical (±0.5°F) |
| External inputs measurement accuracy (excluding accuracy of thermistor) | ±0.6°C typical (±1°F) |
| Humidity accuracy | ±2% typical from 20% to 80% RH |
| Temperature alerts (TDX model only) | Low and high thresholds configurable between -30°C and 69°C (-22°F and 156°F). Alerts can be generated by some or all temperature inputs. |
| Weight | 51g (1.8oz), 62g (2.2oz) in clip |
| Dimensions | 75mm x 55mm x 22mm (3” x 2.2” x 0.9”)<br>80mm x 58mm x 28mm (3.1” x 2.3” x 1.1”) in clip |
| Operating range (from EkkoHub) | > 20m (21yds) |
| Battery life | > 5 years at 2 minute transmit interval (TSX, THX)<br>> 3 years at 2 minute transmit interval (TDX) |
| RF data link | GFSK 250kbit/s at 868.3MHz (ES versions) or 923MHz (FS versions) |
| Enclosure material | Black ABS with polycarbonate front window |
| Mounting method | Cable tie through clip or self adhesive pad |
| Power supply | Internal field replaceable ½ AA lithium thionyl chloride battery |

| Parameter | Specification |
|---|---|
| Regulatory approvals (ES version) | CE marked:<br>Radio Equipment Directive (RED) 2014/53/EU<br>Low Voltage Directive (LVD) 2014/35/EU<br>Radio EN 300 220<br>EMC EN 61326-1 with reference to EN 301 489<br>Safety - EN 60950 |
| Regulatory approvals (FS version) | FCC rules CFR 47 Part 15.107 and 15.109 Class A<br>FCC rules CFR 47 Part 15.247 |

# 12. Install EkkoHub

The EkkoHub wireless transceiver unit receives the data messages from Critical Things ™ wireless sensors (EkkoSensors, EkkoAirs) and sends them to the EkkoLink data aggregator.

To install an EkkoHub unit:

1. Find a suitable position for the EkkoHub (see page 29).
2. Fit the EkkoHub transceiver unit (see page 30).

## Find a suitable position for the EkkoHub

Before you install an Ekkohub transceiver unit, you need to locate a suitable position in the room. The things you need to consider are:

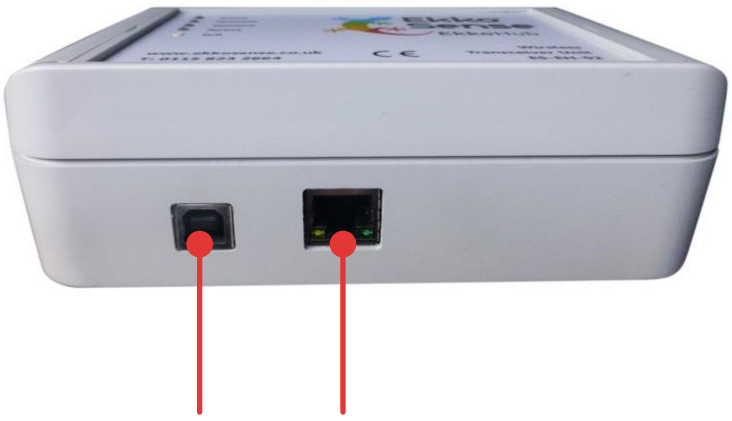
- The EkkoHub can be positioned in any orientation, but the front needs to be facing outwards so that the LEDs can be seen.
- The EkkoHub has to be positioned at less than 20m from the wireless sensors.
- The front panel of the EkkoHub should not be positioned on or next to metal.
- For best performance, you should fit the EkkoHub so that it has clear space around it, with only its rear in contact with a surface.
- The EkkoHub needs to be connected to a Power over Ethernet switch for power and data connection.

## Fit the EkkoHub transceiver unit

When you have identified a suitable location, you can fit the EkkoHub unit.

1. Open the side sections on the EkkoHub to reveal four mounting holes (two holes per side).


2. Feed cable ties through the holes and secure the EkkoHub to a cable basket. Alternatively, you can drill holes in the wall and fit screws through the holes in the Ekkohub casing to fix the EkkoHub in place. Insert wall plugs into the holes in the wall before screwing the EkkoHub into position.
3. Connect the EkkoHub to the Power over Ethernet switch via an Ethernet cable. When you make the connection, the EkkoHub's Power LED should light up, followed by the Network LED.




**Note:** The USB port can be used to connect to a laptop for changing the EkkoHub configuration. In this case the EkkoHub will draw power from the USB host device and does not need the Ethernet connection.

# 13. EkkoHub LEDs

The EkkoHub has four status LEDs.

| LED | Function and expected status |
|---|---|
| Power | Flashes to indicate that the EkkoHub is receiving power. This must be Illuminated for the hub to work. If the LED does not light then check the cabling between the hub and the PoE switch and check that the PoE switch is powered |
| Network | Illuminates continuously to indicate that the EkkoHub has a connection to the EkkoLink. This must be Illuminated for the EkkoHub to work.<br>If the LED does not light then check the cabling to the PoE switch. If the EkkoLink has custom configuration then check that the EkkoHub has been configured to match this. |
| Transmit | Not used. Reserved for future development. |
| Receive | Toggles state from dark to illuminated and vice versa every time a data packet is received from a sensor. If there is no activity then check that the hub is correctly configured for the sensors (Operating Frequency - ES or FS, Encryption Key). |

# 14. FCC Statement

The EkkoSense wireless sensors and EkkoHub comply with part 15 of the FCC Rules.

Operation of EkkoSense wireless sensors and EkkoHub is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

**CAUTION:** Changes or modifications to the products that are not expressly approved by EkkoSense Ltd could void the user's authority to operate the equipment.