

Installation Manual – Smart Office



This installation manual describes how to install Yanzi IoT infrastructure and sensors in smart offices.

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1. Introduction

Yanzi Networks delivers an end-to-end, horizontal, and all-IP software Internet of Things platform. We offer sensors, gateways, and Cirrus, a cloud platform solution packaged into a Software as a Service solution (SaaS) for Smart Building applications. The horizontal and all-IP approach provides a solution that is fast, robust, and transformative.

1.1 Best Technology

All IP technology, all the way to the sensor, ensures powerful scaling to thousands of sensors and excellent cost efficiency. Yanzi Networks focus on open standards and leverage the widely deployed protocols such as 4G/LTE, Ethernet, Wi-Fi, and the low power "brother" to Wi-Fi, IEEE 802.15.4, which enables battery operated sensors to last for 10+ years.

1.2 Easiest to install

Automatic security provisioning provides best-in-class installation provided by the patent pending zero-touch configuration. Sensor installation do not need trained installers but can leverage the employees on site. The optimized power management deliver very long battery life which secure a minimum of maintenance required once installed.

1.3 Enterprise security

Yanzi Networks combines ease of installation and maintenance with enterprise security. It is a highly secure solution with all links in Cloud and to Gateway being authenticated with client and server certificates and all communication is made using SSL encryption. All local communication, between the sensors and the Gateway, is encrypted for both wired and wireless solutions. Each sensor has an individual key and can be revoked remotely.

1.4 Cirrus Software as a Service

The Yanzi Cirrus Software as a Service provides Device and Gateway management at a new level. The Cirrus data model allow access to any data originating from any location with a uniform interface without the need to understand the sensor details. A secure Gateway-to-Cloud connector to multiple redundant link servers provides reliable remote access to Gateway.

The Cirrus open API is a JSON over web socket API where all operations are authenticated. The API supports both hot and cold data paths.

2. Installation Planning

2.1 Infrastructure

The infrastructure has two parts: The Gateway and the IoT network. The Gateway is the brains of the system and manage all sensors, collects all data, and keeps a communication channel open to the Cloud. The IoT network is required to enable sensors to communicate with the Gateway. The IoT network is completely built on IP communication, same as on the Internet. The IoT network is built using one or more Access Points, just like a WiFi network is built. The Access Points communicate with the Gateway using standard Ethernet connectivity. For more information on networks and wireless technologies, please see support sections below.

Before ordering any infrastructure products, the first step is to decide type of Internet connection and way to build the IoT network according to the following sections.

2.1.1 Connecting the Gateway to Internet

Gateways can be connected to the Internet in two ways:

- 1) Sharing the Internet connection already available in the building or
- 2) Using a mobile broadband uplink

Sharing the Internet connection does not mean the IoT network must run on the corporate network. It means using a separate port on the customer' firewall to create a separate network that only provides Internet access.

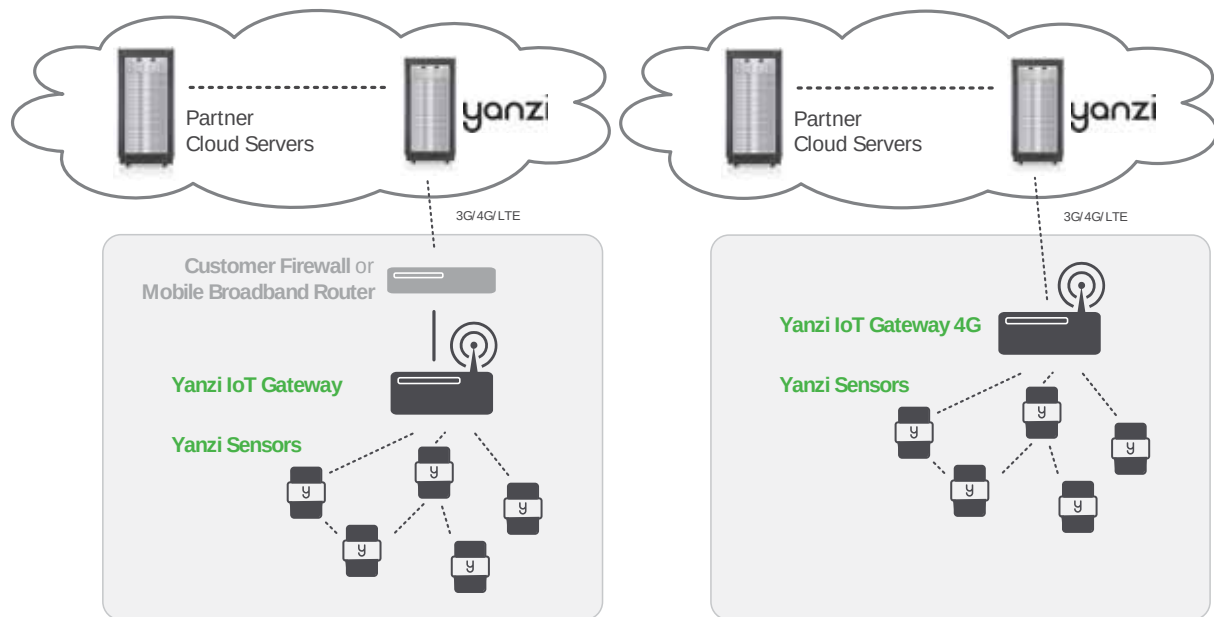
2.1.2 Building the IoT Network

The IoT Network can be built in two ways.

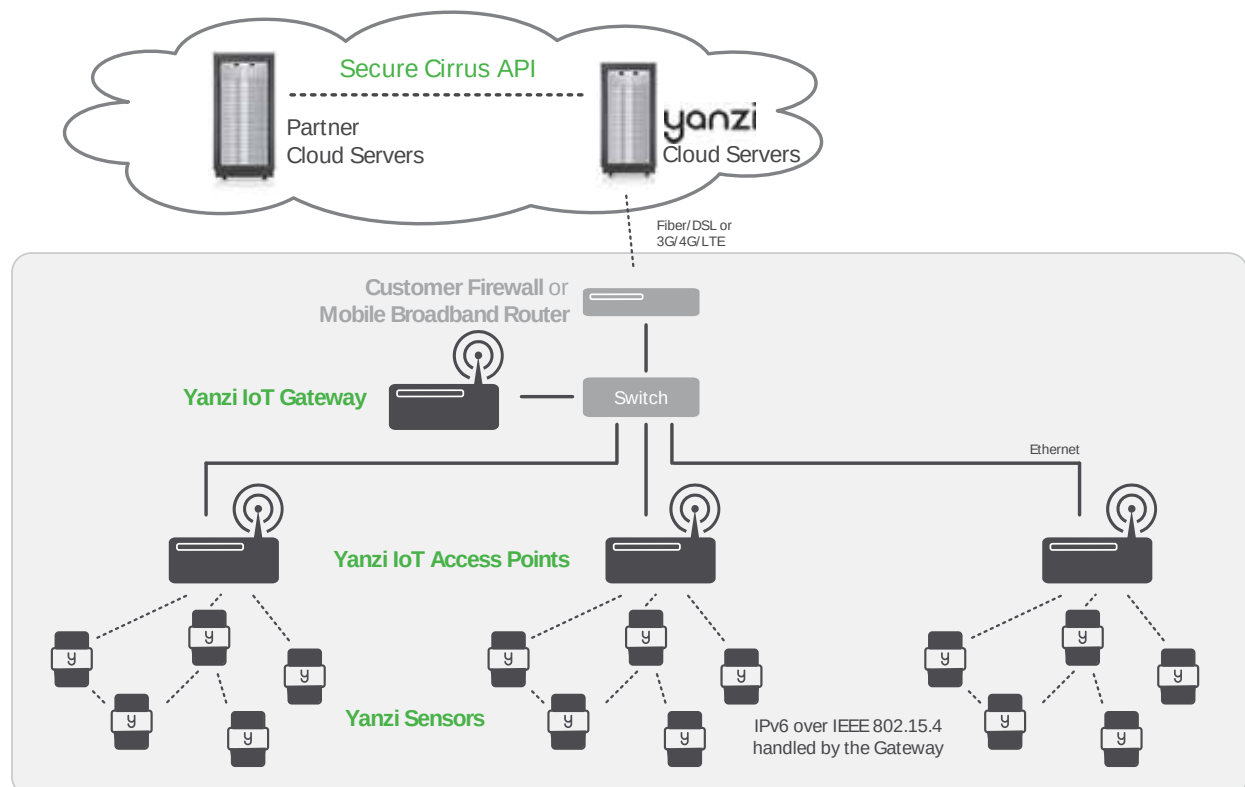
- 1) If there are Ethernet cabling available in the building, it may be possible to use a single Gateway and connect that to one or more Access Points using those Ethernet cables.
- 2) If there are no Ethernet cabling available and it is not possible to pull new cables, the IoT network is built using one or more Gateways. Most of the Gateways have access points capabilities already built-in so a small IoT network can be created around each Gateway. These Gateways all communicate separately with the Cloud and can be made into a single virtual location in the Cloud.

2.1.3 Infrastructure Examples

Small system where only one Gateway is enough to create the wireless IoT network. Internet connectivity can be provided using Ethernet (on the left) or using built-in mobile broadband in the Gateway (on the right).



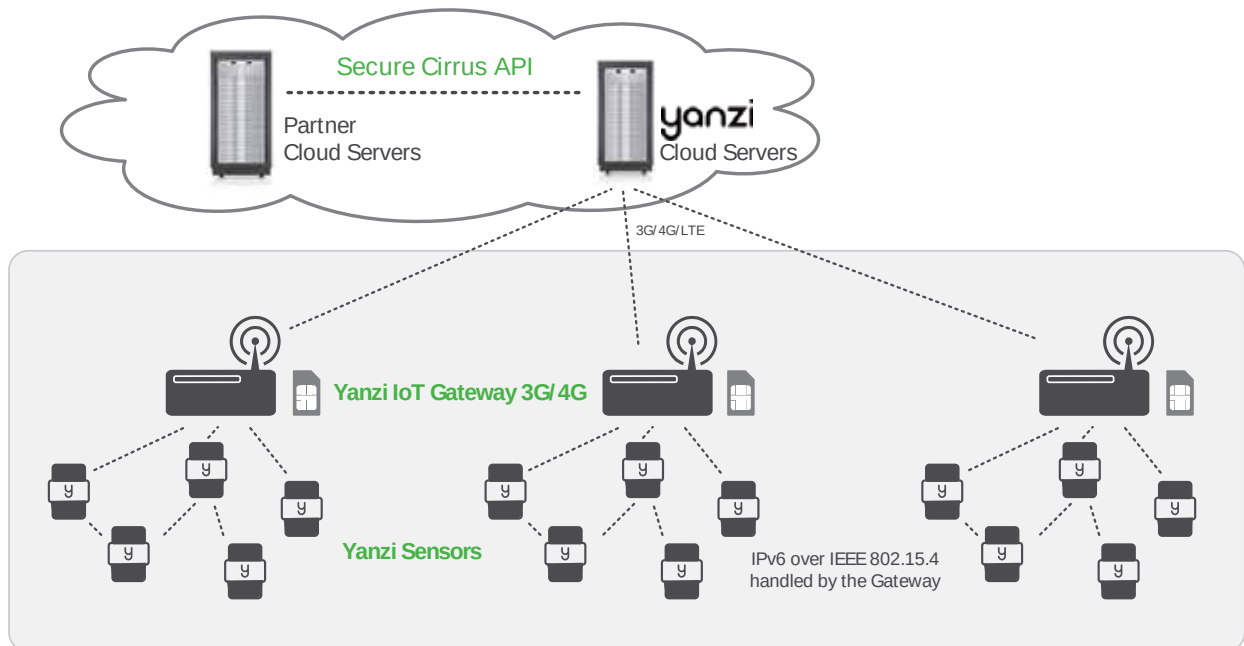
Large system reusing Ethernet infrastructure in building and where Internet connectivity can be provided by sharing a port on the existing firewall or using an external mobile broadband router.



- DHCP addresses are required for the Gateway and the Access Points
- The Gateway communicates with the Access Points using UPnP and SSL over Ethernet
- Internet connection only requires outgoing port 443 and 4445. No inwards connection required. Gateway connects automatically to the Yanzi server.
- All communication links are encrypted
- PoE switch connects and powers all IoT Access Points (when AP has PoE support)

- Optional UPS on PoE switch and Gateway to enable operation when power is lost

Large system completely stand-alone without using any existing infrastructure.



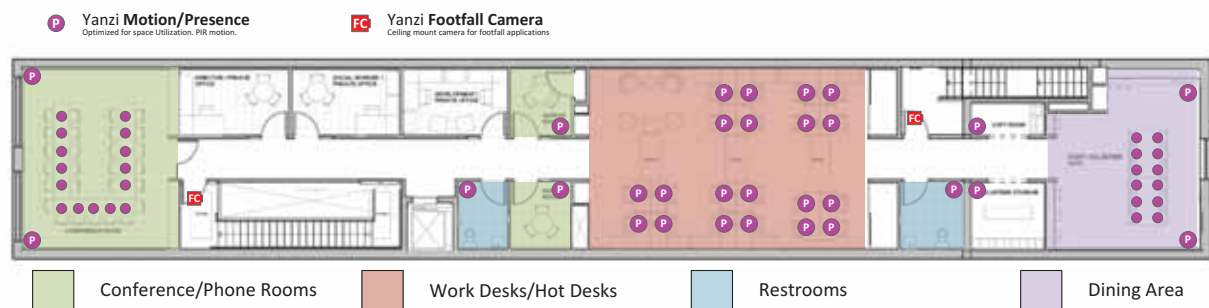
2.2 Use Cases

Depending on which use case to cover, the type and position of sensors may vary. Two typical use cases are shown below for space utilization and comfortability.

2.2.1 Space Utilization

For space utilization, Yanzi Motion/Presence sensors are added under the table at each work desk chair and at each chair of larger conference rooms (typically rooms with 6 chairs or more) to detect usage. For room usage, Yanzi Motion/Presence or Yanzi Motion+ is placed on the wall (rooms larger than 20m² are recommended to use two sensors to make sure the whole room is covered). Selection between Motion/Presence sensor and Motion+ sensor depends on if comfortability use case also should be covered as the Motion+ sensor monitors more things than the Motion/Presence sensor.

Motion/Presence sensors may also be used for restroom utilization to monitor each stall as well as the washroom.

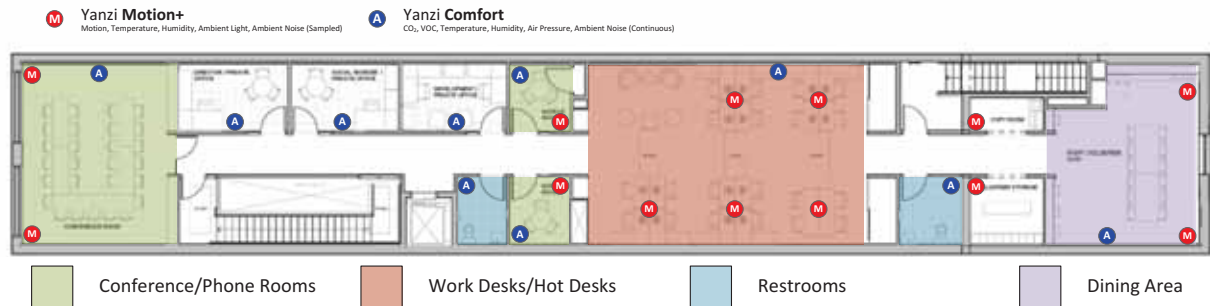


Footfall cameras may be placed in the ceiling of each entrance to the building and can as well be placed at the entrance to any area where specific information is wanted. The footfall cameras are connected to the Gateway using Ethernet/PoE. This proposal do not focus on footfall cameras.

2.2.2 Comfortability

For comfortability, the work environment is monitored using for example CO₂, temperature, humidity, barometric pressure, volatile organic compounds (VOC), ambient light and ambient noise sensors. Yanzi Comfort sensors are placed in each room (conference room, phone booths, locker room, etc.) where people are present for longer periods of time as well spread out in open work spaces. In open work spaces, recommendation is to use one Yanzi Comfort for each 15-25 work desks.

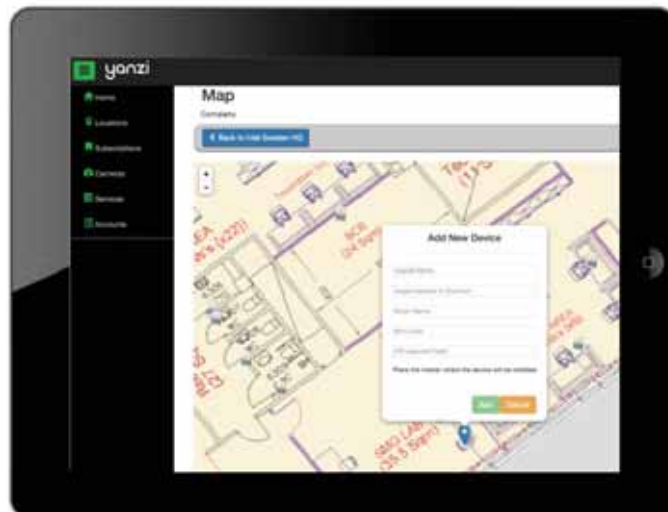
Yanzi Motion+ are used to monitor occupancy and light at work desks (preferably placed in the ceiling where it covers about 6-8 work desks depending on height of ceiling). It is also used to monitor utilization of smaller rooms such as conference rooms, phone booths, locker rooms, storage rooms, kitchens, restrooms, etc.



2.3 Installation Tool

One of the important parts after the installation is to know where sensors have been placed. The mapping between the sensor unique ID and the physical location is done at time of installation using the Yanzi installation tool in Yanzi Live. This is a browser based installation tool that allows for quick installation of many sensors.

Prior to installation, make sure the floor map(s) has been provided to Yanzi and added to your account.



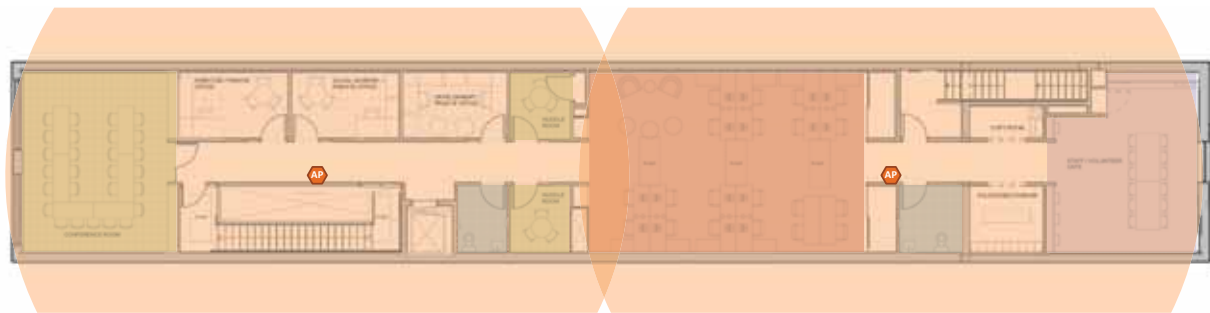
3. Installation of Infrastructure

Gateways are recommended to be peered prior to installation. Peering means connecting the Gateway to a specific account. Users can then be added or removed from this account to control access. Peering is done using the installation tool or provided as remote support by Yanzi. Yanzi needs the Gateway ID (printed on the Gateway label), the location name it should have, as well as a user with administrative rights for this account.

Make sure the infrastructure is always built prior to installing any sensors. Install the Gateway and connect it to Internet. Install the Access Points and connect them to the same network as the Gateway according to the pictures above.

The wireless IoT network created around Access Points have a range of about 500-1,500 m² (~ 5,000-15,000ft²). The actual range depends heavily on walls, obstacles, materials, and number of potential mesh nodes (This is very similar to WiFi access points). Wireless coverage is affected for example by elevator shafts (lots of metal), bathrooms (water and thick walls), and other radio disturbances such as WiFi access points and microwave ovens.

IoT Access Points (or Gateways with mobile broadband) is shown below with an approximated wireless coverage shown as orange circles. In this specific building, two Access Points per floor is enough.



4. Teams and Equipment

Most efficient is usually to have installer teams of 2-3 persons. Multiple teams can work in parallel for quicker sensor installations. 1 person places the sensor on the floor map and scans the QR code. 1-2 persons place the sensor on the correct spot in the building.

Each installation team needs

- Laptop with Chrome browser
 - Internet access is required for the laptop as installation tool is web based
- QR code scanner
 - Such as the Motorola, Symbol, or Zebra DS6708
- Plastic bins for carrying sensors
- Access to all rooms in building where sensors are to be placed

5. Sensor Handling Tips

5.1 Battery lid

To open and close the battery lid, gently push the back side label close to the battery lid with your thumb and slide the battery lid downwards with your other hand.

5.2 Sensor element

The sensor elements must be handled with care as these are sensitive parts.

5.3 Battery insertion

The battery powered sensors operate with 4 batteries, note the polarity when inserting the batteries. Polarity is always shown in the sensors battery compartment as well as on the battery itself.

It is very important to follow the battery requirements when inserting batteries, see page 16.

Verify that the front panel LED is turned on within 5 seconds after inserting batteries. Note that it may only be turned on for a very short while to save battery. If you do not see the LED come on even for a short while, please remove the batteries and re-insert them again. If it still doesn't work, please see the Troubleshooting section.

5.4 External power input

For sensor requiring an external power supply, insert the USB-C connector on the bottom side of the sensor carefully until a "click" is detected. See each product manual for more details.

Verify that the front panel LED is turned on within 5 seconds after inserting power.

6. Placement of Sensors

General tips on placement

- Try to place the sensors in discrete locations
- Place sensors along walls at about 150-170 cm (60-70 inches) from floor
- Sensors are attached using screws or adhesive tape
- Target wood, plastic, or metal surfaces that are flat
- Avoid wall papers as they may break if sensor must be removed
- Avoid painted walls when using adhesive tape as modern paint is efficient in repelling adhesive tape
- Remove tape cover and press firmly ON THE SLEEVE for 10 seconds. After 10 seconds, the adhesive tape is strong enough to hold the sensor. Full adhesiveness is reached after 72 hours.

Yanzi **Motion+**

- Place on wall of smaller rooms such as conference rooms and phone booths
- Place in ceiling above groups of 4-8 work desks

Yanzi **Comfort**

- Place on wall not close to work desk
- Requires a power outlet within 0.5 meters (longer cables available as accessory)

Yanzi **Presence** for work desks

- Place under work desk about an arm's length from edge

Yanzi **Presence** for conference room chairs

- Place under conference room table at each chair about an arms length from edge

Yanzi **Presence** for conference room corner

- Place in corner of smaller rooms and along walls in larger rooms
- Face away from windows to avoid direct sunlight
- Face away from door to avoid detecting people walking outside the room
- Use multiple sensors for large rooms (>20m²)

7. Installation of Sensors

Sensors are installed using the Yanzi installation tool. Make sure you get login credentials from Yanzi prior to installation and that the floorplan of the building has been added to the account.

7.1 Start Yanzi Installation tool

- 1) Using a Chrome browser, go to the link specified by Yanzi, typically something like <https://cirrus5.yanzi.se>
- 2) Sign in using the credentials provided by Yanzi, email and password
- 3) When logged in, click “Locations” in the left column
- 4) In the list of locations, click on the location where installation should take place.
- 5) Click Map to the right of the top bar
- 6) The floor plan will now open and you are ready to install sensors

The Yanzi installation tool is a cloud based tool so make sure Internet connection is available throughout the building.

7.2 Installation Procedure

- 1) Click “Start Installation” in the top right corner
- 2) Select floor in the bottom right corner
- 3) Zoom into area on the floorplan where the sensor should be installed
- 4) Click on the exact sensor location where the sensor will be installed
- 5) Add the following properties in the pop-up that is displayed
 - Device ID.** Scan the sensor QR code using the hand scanner.
Example: EUI64-0090DAFFFE00526A
 - Optional: **Height from the floor** in [mm]
Example: 1500
 - Optional: **Room name**
Example: G51
- 6) Turn on the sensor
 - For battery powered sensors: Pull power switch to ON.
 - For USB powered sensor: Insert the USB cable and plug in the power adapter to a wall socket.
- 7) Place sensor by removing the non-stick film on the back of the sensors sleeve and place it into position by pressing FIRMLY on the gray sleeve for 10 seconds (if adhesive tape is used)
- 8) Restart at point 4 for next sensor

When done, click “Stop Installation” in the top right corner.

Sensors are assigned a radio channel, encryption key, and configuration settings automatically and data should be available in the Cloud within a few minutes after installation.

8. Wireless

For high speed devices, Ethernet and WiFi is the typical communication mediums used. For very low power devices such as battery driven devices, a sister protocol to WiFi is used that is called the IEEE 802.15.4.

IEEE 802.15.4 has about the same range as WiFi and normally operates on the same ISM band, 2.4GHz. There are Sub-GHz solutions for IEEE 802.15.4 as well but for normal high density installations, it is not required for reach.

9. Working with Sensors

9.1 LED Behavior

All sensors have a dual color LED that can indicate green or orange. The typical LED behaviors are shown in the table below.

Sensor LED State	Description	Note
Off	Power is off or sensor is in sleep	All sensor turn the LED off a short while after power has been applied to avoid light pollution. A short press on the button turns the LED on to display status if sensor has power.
Short orange or green blink	Power has just been applied and sensor is booting up	Wait a few seconds for actual status
Blinking green (slow)	Sensor is ready to be peered with a location	Use the installation tool to peer the sensor with a Gateway (Location)
Steady green	Sensor is peered with a location and working	
Blinking green (fast)	Sensor is about to be reset	See details on resetting a device in section below
Blinking orange/green (fast)	Sensor has been reset to factory default	See details on resetting a device in section below

9.2 Resetting a device

If a device should be removed from an installation, please hold the button on the sensor pressed for about 20 seconds. After 15 seconds the LED will start flashing green quickly to warn that if you keep the button pressed, it will reset. After another 5 seconds it will start flashing orange/green which means it is now reset. Release the button and the sensor will reboot as factory default.

10. Battery Requirements

It is very important to follow these guidelines to avoid serious injuries. Bad handling of batteries may cause them to leak, potentially rapidly, creating a risk of injury as the internals of batteries are very corrosive. It is recommended to use Alkaline batteries in most use cases and Lithium (LiFeS₂) for cold use cases.

- Note the polarity of the batteries when inserting them. Polarity is always shown in the battery compartment as well as on the battery itself.
- Note the voltage of the batteries. There are several voltages available for the same size of batteries. See the product manual for details on which battery to use.
- Never mix type of batteries. Only use the same type of chemical compound in all batteries.
- Never mix old and new batteries. Make sure all batteries used are from the same package.
- Do not use old batteries. Batteries older than 2 years should be avoided as they may have aged differently and therefore have different voltages.
- If batteries get warm within 5 seconds after insertion, remove the batteries immediately.
- It is recommended to use protective glasses when working with batteries.



11. Post Installation

Following the successful completion of the Yanzi smart building installation, we recommend you to send an internal email to all company team members informing them of the reasons for the installation. It is important to explain the purpose of the installation and to clarify that no images, video, or sound is ever recorded and that their privacy is respected and maintained at all time. We then advise you to focus on all the benefits the installation will bring, e.g. a constant monitoring of CO₂ and temperature that will allow continuous improvements of the climate environment at the office.

12. Troubleshooting

Behavior	Solution	Note
Gateway won't connect	<u>Ethernet-based gateways</u> Yanzi IoT Gateway: 1. Ensure Ethernet cable is plugged in 2. Verify gateway is receiving power and is turned on Yanzi IoT Gateway Plus: 1. Ensure Ethernet cable is plugged in to the right-hand port 2. Verify gateway is receiving power and is turned on. If using PoE, double-check your switch is providing power over Ethernet. Yanzi IoT Gateway Rack: 1. Ensure Ethernet cable is plugged into the right-hand port (the one next to the VGA port) 2. Verify the gateway is receiving power and is turned on <u>4G-based gateways</u> Yanzi IoT Gateway 4G: 1. Verify gateway is receiving power and is turned on 2. Ensure sim card is inserted Yanzi IoT Gateway Plus 4G: 1. Verify gateway is receiving power and is turned on 2. Ensure sim card is inserted	
Sensor won't connect	<u>Battery powered sensors</u> 1. Ensure batteries are inserted 2. Some battery powered sensors have a power switch, verify this is set to ON <u>USB powered sensors</u> 1. Ensure cable is plugged in 2. Verify the power adapter is plugged in to a working outlet	It is always possible to check any sensors status by pushing the button. The LED will then indicate the current state of the sensor, see page 15 for LED behavior.

13. General Product Information

The information below relates to the following products

- Yanzi Climate, SWTH1-1230
- Yanzi Motion, MDW1-0201
- Yanzi Presence, MDW3-0180
- Yanzi Motion+, MDW3-0231
- Yanzi Comfort, SWAQ3-0372

These devices complies with part 15 of the FCC Rules. Operation 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.

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

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 or more 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.