VILPE® Sense

VILPE SENSE GUIDEBOOK

Contents

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Innovative and Easy

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VILPE SENSE LEAK DETECTOR

1. VILPE SENSE LEAK DETECTOR

1.1. Design guide

System components

- **VILPE Sense Leak Detector sensors (RHT-2)**. The intelligent VILPE Sense leak sensor detects, locates, and alerts about leaks and other moisture issues. The sensors are installed, for example, in the insulation layer on a flat roof with a distance of approximately 4-5 m (10 sensors / 200 m^2). To ensure the same installation depth, the sensor can be attached to a suitable long VILPE Croco mount (sold separately). The system also requires a VILPE Sense Mobile Base Station (sold separately) to function. Suitable for roofs or walls. The package includes 10 sensors (RHT-2).
- **VILPE Sense Mobile Base Station (CCU-1).** Required for cloud connection. Receives VILPE Sense Leak Detector sensor data from the smart roof system's sensors and control unit. Uploads and stores this data directly to VILPE's cloud service for analysis and later use. 50 control units and 200 leak detectors (RHT-2) can be linked to one mobile base station. Two models available: with and without pre-installed SIM card (card is required for use).

With SIM: Preinstalled SIM card with a data service subscription is included. The guarantee for the subscription is 10 years. The SIM card operator is Elisa M2M (Vodafone Global) and it works in EU and ETA countries.

No SIM: The local operator and subscription must support one or several of the following: LTE-M (LTE Cat. M1), or NB-IoT (LTE Cat. NB1) or 2G (EDGE/EGPRS). Data only subscription is enough. The subscription must allow data usage of 100 MB/month or more. The SIM must be configured not to require a PIN code. The SIM card size is micro-SIM.

VILPE Sense Leak Detector (RHT-2).

VILPE Sense Mobile Base Station (CCU-1)

Installation of the RHT-2 sensor

The RHT-2 sensor is designed to be installed in the roof insulation of a flat roof, but it can also be installed in many other constructions where temperature and/or humidity conditions needs to be monitored. The sensor measures the condition through the holes located at the pointed end of the sensor. Typically, the sensor's pointed end should be positioned below the midpoint of the insulation.

Example of installing an RHT-2 sensor on a flat roof:

- It is recommended to install the sensors in the site at the same depth. It is recommended to use a Croco fastener to control a sensor's installation depth.
- The sensor can be installed either directly in the roof insulation before the roof membrane is installed or through the roof membrane. You can install the sensor vertically or in other positions. For example, if the insulation thickness is less than 150 mm, the sensor can be installed diagonally or horizontally. In this case, the sensor is installed without the Croco fastener.
- If needed, drill a hole with a 17-19 mm drill through the roof membrane and/or insulation to the desired installation depth for the sensor. If the insulation material is rigid (such as EPS, XPS, or PIR), it is recommended to drill a hole through the insulation board. This way, the water that has flowed onto the vapor barrier and the resulting moisture rise can be detected by the sensor more quickly in the event of a potential leak.
- If the sensor is installed with a Croco fastener, insert the sensor into the hole until it reaches the base of the Croco fastener.
- Seal the installation site waterproof with a new piece of roof membrane.
- The recommendation is to install the sensors 4-5 meters apart.

Installation according to your project schedule

VILPE Sense Leak Detectors can be conveniently installed at different stages of a construction project. Here are three options.

Sensor installation before installing the underlay membrane or PVC roofing

The biggest advantage of this installation timing is that no holes need to be drilled into the waterproofing membrane. This eliminates the need for patching and keeps installation work costs low. However, this option requires special care to ensure that the sensors are placed accurately according to the plan. It is also important to ensure that the fasteners used for securing the underlay membrane do not damage the already installed sensors. The installation work must also be carefully planned to prevent the roof structures from being exposed to weather conditions for an extended period.

Sensor installation after the underlay membrane installation, before installing the waterproof roofing

Installing sensors at this stage offers several advantages. The work can be carried out separately from the roof construction work, allowing for easier and more accurate positioning of the sensors, for example by measuring and marking the installation locations on the membrane in advance.

With no time pressure, the measurements can be done more carefully, and the sensor installation and registration in the cloud service can be done systematically, reducing the likelihood of errors.

Additionally, only one or two people are needed for the installation and registration of the sensors. This installation phase also ensures that the roof structures remain protected from the elements, and the work can be scheduled according to the weather.

Sensor installation as a retrofit on a finished roof

Retrofit installation on a finished roof offers the same flexibility as the previous option. Additionally, the sensor locations can be easily marked on the roof with paint, for example. Retrofit installation requires drilling holes in the roofing material for the sensors. These holes must be patched, and the patches will remain visible on the roof.

When should VILPE Sense Leak Detectors be registered?

VILPE Sense Leak Detectors can be registered at different stages of a construction project. Choose the timing that best suits your project. Registering the leak detectors is essential for the system to create an accurate humidity map that reflects the locations of the detectors and the conditions of the structures. In all cases, the first step is to create a site plan in the cloud service.

Installation and registration of leak detectors during roof construction

- **Description:** The leak detectors are installed and registered in the cloud service during roof construction. The installer registers the detectors using their smartphone as they are placed in the structures. The smartphone is used for both registration and reading the site plan.
- **Benefits:** This option minimises errors in the placement of the detectors. The plan can be adjusted flexibly if, for example, a detector needs to be installed in a different location than originally planned. Using QR codes makes registration easier, eliminating the need for manual entry of serial numbers.
- **Challenges:** Using a smartphone on the roof can be difficult, especially in bad weather.

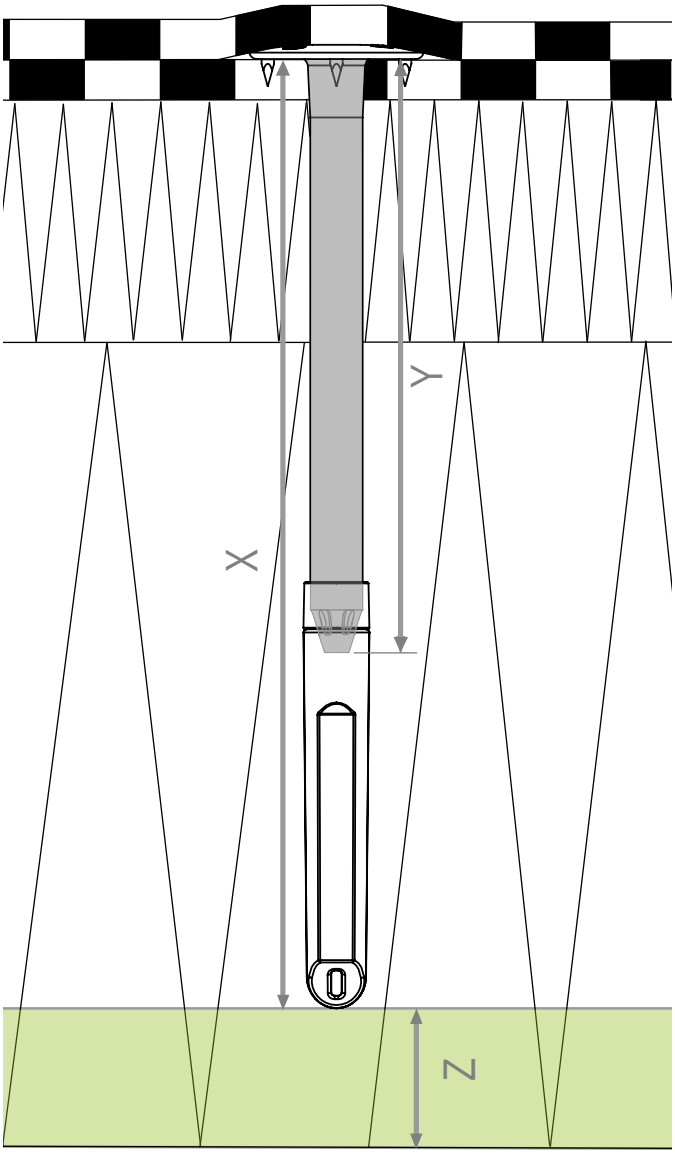
Registration of leak detectors after installation using stickers

- **Description:** The leak detectors are registered after installation. During installation, additional stickers from the product packaging are affixed to the printed site plan and used later for registration, possibly in office spaces.
- **Benefits:** This option provides flexibility during installation. The detectors can be registered conveniently in the office, and there is no need for a smartphone on-site. QR codes make registration easier.
- **Challenges:** Handling the printed site plan on the roof can be challenging, and the additional stickers may get damaged in humid weather.

Registration of leak detectors before installation using stickers

- **Description:** The leak detectors are registered in advance before installation. The locations of the detectors are marked on the printed site plan, and the product packages are labelled so that the correct detector can be linked to the right location on the site map.
- **Benefits:** Using QR codes and pre-registering the products in the office simplifies the process, eliminating the need for a smartphone during installation.
- **Challenges:** Making changes to the plan after registration can be difficult, and there is an increased risk of incorrect installation.

1.2. Recommended Croco length for leak detector

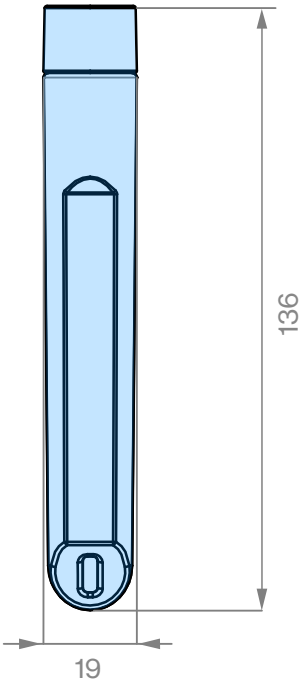


Keep in mind that leak detector is above vapor seal and does not pierce it.

X Sensor depth (mm)

Y Croco A/B

Z Leeway / Distance to vapor seal



Insulation depth (mm)	Croco A/B Y	Sensor depth (mm) X	Leeway (mm) Z
< 150			
160	20	135	25
170	20	135	35
180	20	135	45
190	20	135	55
200	50	165	35
210	50	165	45
220	50	165	55
230	80	195	35
240	80	195	45
250	80	195	55
260	100	215	45
270	100	215	55
280	120	235	45
290	120	235	55
300	140	255	45
310	140	255	55
320	150	265	55
330	150	265	65
340	170	285	55
350	170	285	65
360	200	315	45
370	200	315	55
380	200	315	65
390	230	345	45
400	230	345	55
410	250	365	45
420	250	365	55
430	250	365	65
440	250	365	75
450	250	365	85
460	300	415	45
470	300	415	55
480	300	415	65
490	300	415	75
500	300	415	85
510	350	465	45
520	350	465	55
530	350	465	65
540	350	465	75
550	350	465	85
560	400	515	45
570	400	515	55
580	400	515	65
590	400	515	75
600	400	515	85

2

VILPE SENSE HUMIDITY CONTROL SYSTEM

2. VILPE SENSE HUMIDITY CONTROL SYSTEM

2.1. Design guide

System components

- **VILPE ECo Sense** or **VILPE ECo FLOW Roof Fan**. The system may contain several fans, in which case each is connected to a single control unit with sensors (**VILPE Sense Basic Kit**).
- **VILPE Sense Basic Kit Mob.** At least two sensors (RHT-1) must be connected to one control unit: an indoor control sensor and an outdoor control sensor. A maximum of five sensors can be connected to the control unit.

  There are two options for the basic kit:

  The VILPE Sense Basic Kit (735040, includes the MCU-1 control unit) connects directly via the LoRaWAN network maintained by Digita. This version is recommended for sites located in Finland where only one VILPE Sense Humidity Control system is installed.

  The VILPE Sense Basic Kit Mob. (735042, includes the MCU-2 control unit) requires the VILPE Sense Mobile Base Station to connect to the cloud service. This version is recommended for sites consisting of multiple humidity control systems or a combination of humidity control systems and leak detectors.
- **Possible additional sensors.**
- **VILPE Sense Mobile Base Station (CCU-1). Required for cloud connection.** Receives VILPE Sense data from the smart roof system's leak detector sensors and control unit (MCU-2). Uploads and stores this data directly to VILPE Sense cloud service for analysis and later use. 50 control units (MCU-2) and 200 leak detectors (RHT-2) can be linked to one mobile base station. Two models available: with and without preinstalled SIM card (card is required for use).

  With SIM: Preinstalled SIM card with a data service subscription is included. The guarantee for the subscription is 10 years. The SIM card operator is Elisa M2M (Vodafone Global) and it works in EU and ETA countries.

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VILPE ECo Sense Roof Fan

VILPE ECo FLOW Roof Fan

VILPE Sense Basic Kit Mob.

VILPE Sense Sensor (RHT-1)

VILPE Sense Mobile Base Station (CCU-1)

Functions

The VILPE Sense system measures the temperature and relative humidity of roof structures or crawl spaces. It also measures the outdoor air temperature and relative humidity. Based on these measurements, an algorithm developed for VILPE Sense calculates, among other things, the corresponding absolute humidity values in order to set roof fan to the appropriate speed.

The algorithm specifically uses absolute humidity values for control, as warm air can contain much more water than the same volume of cold air, and relative humidity alone is not an indication of the amount of moisture in the structure or the outside air.

The algorithm monitors and adjusts the speed of the roof fan (and hence the ventilation of the structure) to keep the humidity levels and temperature as appropriate as possible. In other words, the system aims to keep conditions in the structure as unfavourable as possible for mould and microbial growth. Thanks to an intelligent algorithm, the system can also be used to cool roof structures in summer.

The measurement data is collected and stored in the VILPE Sense cloud service, where it can be further analysed if necessary. It is also possible to set alarm limits for the temperature or humidity level measured by each sensor.

Suitable structures

The VILPE Sense system is suitable for ventilating and monitoring a wide range of structures as required. It is designed primarily for the ventilation and monitoring of roof structures and ventilated subfloors or crawl spaces. VILPE Sense can also be used to cool roof structures in summer.

All that is required for the system to work is some air circulation in the space being ventilated and the structures will have replacement air. On low-pitch roofs, the replacement air is usually provided by negative pressure vents or from under the eaves. The better the circulation of air in the space to be ventilated, the better the system will work.

In every building project, ensure that air can move at least slightly within the insulated space. Typically, air can move if mineral wool is used as insulation. If rigid insulation materials such as EPS, XPS, or PIR are used and the waterproofing material is glued or welded to the insulation, air will not be able to move within the insulated space unless there are ventilation grooves in the insulation. The type of roofing material used can also affect ventilation; for example, air typically can move between a mechanically fastened PVC membrane and the insulation.

The insulation on a low-pitch roof is best ventilated when the insulation has ventilation grooves and a collector channel at the roof fan and negative pressure vent pass-throughs. Even if the insulation has no ventilation at all, the airflow provided by VILPE Sense helps to keep the structure dry.

In ventilating a base level or crawl space, the location of the replacement air vents or Ross ventilation poles plays an important role, as the air must circulate as fully as possible throughout the ventilated space.

The area to be ventilated must be a single, open space, or exhaust ducting must be built into the base levels to circulate air through all parts of the area.

2.2. Sizing and layout

Ventilation of roof insulation on a low pitch roof

On a low-pitch roof, one roof fan and the VILPE Sense Basic Kit can be used to ventilate and monitor an area of around 200 m^2.

The system works best with insulation with ventilation grooves. In a new building, it is necessary to include collector channels in the insulation for the roof fan and the negative pressure vents, to allow air to circulate through all the ventilation grooves in the insulation.

If the insulation does not have ventilation grooves or cavities, the roof fan mounted on a negative pressure vent, and any other negative pressure vents, should be raised slightly to achieve better airflow. The aim is to have an air gap of 5-10 mm between the underlay and the insulation at the point where the vent is installed. A piece of the insulation material can be used to raise the vent.

The VILPE ECo Sense Roof Fan can be installed directly onto a roof-mounted negative pressure vent. With the supplied adapter, it fits either 110 mm or 160 mm outer diameter pipes or negative pressure vents. In general, it is best to place the roof fan at the roof's highest point.

If there are fire breaks in the structure, a roof fan and Sense Basic Kit must be installed in each section to be monitored.

The indoor control sensor is placed inside the exhaust air duct equipped with a roof fan, on top of the insula-

tion. The outdoor control sensor is installed, for example, under the eaves in a location that is not exposed to direct sunlight and will not be covered in snow in winter. The maximum operating range of the sensors from the control unit is typically 40–100 meters.

Often, there are various structures between the control unit and the sensor that can cause signal distortion, reflection, or attenuation. In particular, metal sheeting or thick or multiple heavy structural layers between the control unit and the sensor can significantly shorten the signal range. Typically, a reliable 100 meter operation range can only be achieved if there is a direct line of sight between the devices.

1-3 additional sensors can be installed per Sense Basic Kit.

An existing roof will usually need to be opened to allow additional sensors to monitor potential leak risk locations. The best places for additional sensors are, for example, insulation around inlets and roof drains, or other areas with a higher risk of leakage.

Ventilation of the attic or roof void on a steep pitch roof

Roof fan selection

The VILPE Sense system is suitable for ventilating attic spaces (but not an attic room) or open roof structures. The roof fan is chosen based on the required air volumes so that the air in the ventilated space changes once every two hours when the roof fan operates at half-power.

If the selected roof fan is too powerful and the air exchange rate at half-power is too high, the reference control voltage (default value 4 V) or the maximum control voltage (default value 9.5 V) of the control unit's algorithm can be adjusted in the cloud service. This allows for the ventilation rate to be set appropriately to the desired reference point.

If the roof has negative pressure ventilation, the VILPE ECo Sense Roof Fan (suitable with the supplied adapter for either 110 mm or 160 mm pipes, or negative pressure vents) can be installed directly in place of the existing ventilation pipe.

Otherwise, a VILPE ECo FLOW Roof Fan with a suitable pass-through should be selected. Replacement air must be provided in the ventilation space if it is not available, for example from under the eaves.

If there are fire breaks in the structure, a dedicated roof fan and Sense Basic Kit should be installed in each section to be monitored.

Sensor placement

The indoor control sensor is placed in the ventilated space near the exhaust ventilation point, such as on a roof truss. The indoor sensor is installed, for instance, under the eaves in a location that is not exposed to direct sunlight and will not be covered in snow in winter. The typical maximum operating range of the sensors from the control unit is 40–100 meters. Generally, on steep roofs, the distances are short, and sensor placement is easy.

When planning the ventilation for roof structures of larger warm halls, special attention should be paid to sensor placement. For example, if the roof fans and control units are located at the ridge, placing the external sensor under the eaves might weaken the signal too much, depending on the distance and construction materials. Often, various structures between the control unit and the sensor can cause signal distortion, reflection, or attenuation. In particular, metal sheets or thick or multiple heavy structural layers between the devices can significantly reduce the signal range. In practice, a reliable 100-meter range is typically achieved only if there is a direct line of sight between the devices.

If alternative placement for the external sensors cannot be arranged, one solution is to place them in a separate ventilated plastic installation box. The installation box can be mounted on the roof of the hall or on a pole next to the building that extends above the roofline.

In order to monitor the ventilated space in more detail, 1-3 additional sensors per Sense Basic Kit can be installed, for example within mineral wool insulation at the ends of the roof space.

Ventilation of a crawl space or other ventilated base levels

The roof fan is chosen based on the required air volumes so that the air in the ventilated space changes once every two hours when the roof fan operates at half power.

If the selected roof fan is too powerful and the air exchange rate at half-power is too high, the reference control voltage (default value 4 V) or the maximum control voltage (default value 9.5 V) of the control unit's algorithm can be adjusted in the cloud service. This allows for the ventilation rate to be set appropriately to the desired reference point.

It is recommended to use a VILPE ECo FLOW roof fan suitable for the air volume together with a pass-through that is compatible with the roof type.

The ventilated space must have Ross ventilation poles or other vents for replacement air. The vents should be located so that air can circulate throughout all parts of the base level (including near corners). Replacement air openings should be sized appropriately so that the negative pressure is not too great, nor that the opening is too large for the amount of air to be ventilated.

New buildings

If the space to be ventilated is complex in shape or consists of separate sections, it is usually sensible to design an exhaust air ducting system. This allows the capacity of the roof fan to be distributed as desired to all sections of the ventilated space.

The exhaust air ductwork must be piped into the structure up to the roof, where the roof fan and VILPE Sense Control Unit will be installed. If the area to be ventilated is a single open space, then an exhaust duct from the base level to the roof is sufficient.

Existing buildings

The same guidelines for ventilating base levels apply as for new buildings. Note that it may be difficult to build ductwork or run an exhaust duct through the structure to the roof afterwards.

Install the indoor control sensor so that it measures the temperature and humidity of the exhaust air from either the top or the bottom of the exhaust air duct. The outdoor control sensor is installed outdoors in a location that is not exposed to direct sunlight and will not be buried in snow in winter.

The maximum operating range of the sensors from the control unit is typically 40–100 meters. Often, there are various structures between the control unit and the sensor that can cause signal distortion, reflection, or attenuation. In particular, metal sheeting or thick or multiple heavy structural layers between the control unit and the sensor can significantly shorten the signal range. Typically, a reliable 100 meters operation range can only be achieved if there is a direct line of sight between the devices.

In order to monitor the humidity levels more closely, 1-3 additional sensors can be installed, for example in corners where there is no ventilation opening.

2.3. Installation and set-up

Note the serial numbers of the control units and sensors of all basic kits before installation. You should also mark the sensors to indicate which are indoor and which are outdoor sensors. The serial numbers can be written down in the installation manual, or the model labels can be photographed.

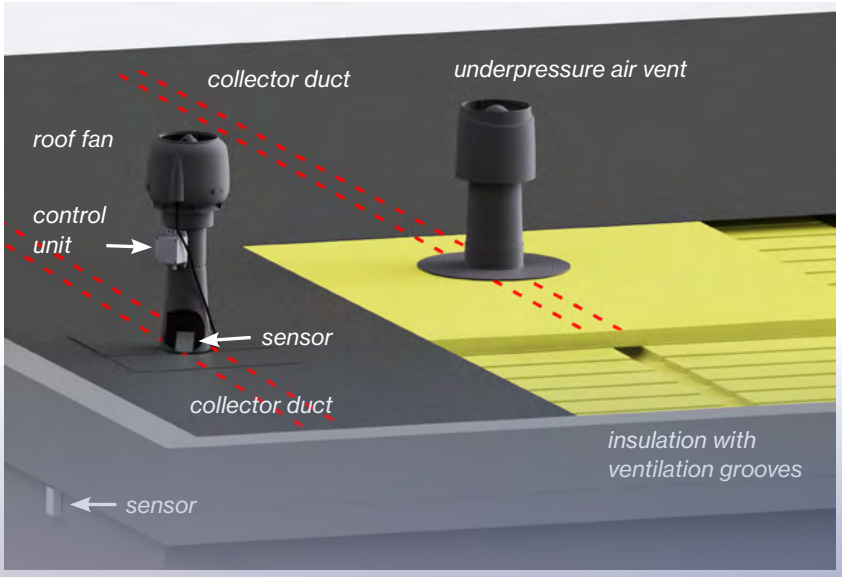
The fan is installed on the roof, either in place of a negative pressure vent or in a suitable pass-through. Power supply to the roof fan should be provided in accordance with the installation instructions. The control unit of the Sense Basic Kit should be installed alongside the roof fan, and the fan's control cable should be connected to the control unit according to the basic kit's instructions.

An indoor control sensor should be installed to measure the temperature and humidity of the exhaust air from the ventilated space. The outdoor sensor should be installed, for example, under the eaves, where it will not be exposed to direct sunlight, nor covered in snow in winter. If necessary, additional sensors can be installed for more detailed monitoring.

Register the products from the basic kit with their serial numbers in the VILPE cloud service at sense.vilpe.com

Registration instructions are also available at vilpe.com/sense-installation

Once the devices are registered and the electricity is connected, the first readings will be available in the cloud within 12-24 hours.



2.4. Installation and registration

2.4.1. VILPE Sense Mobile Base Station and Basic Kit installation and registration

Productno. 735043/735044 & 735042

01 Before installing the basic kit, make sure that the roof fan is switched off.

02 Make a note of the serial numbers before the installation of the basic kit. You will find the serial number on the nameplate label of the device (e.g. A123456ABCD).

a. You can take a photo of the labels or write down the serial numbers in the installation manual, for example.

03 Install the control unit (MCU-2) included in the basic kit on the side of the roof fan on the roof and the sensors according to the installation instructions in the package.

a. Do not place the outdoor sensor in a spot where it will be exposed to direct sunlight.
b. Remember to remove red jumpers from the sensors (RHT-1) before installation.

04 Switch on the roof fan. The roof fan should start.

a. The control unit controls the roof fan with control voltage of 10 V in the beginning. After few hours of charging, the control voltage changes to 3 V, until connection to cloud service has been successful.

05 Make a note of the serial number of the access point (CCU-1) before installation. You will find the serial number on the nameplate label of the device (e.g. A123456 ABCD).

a. You can take a photo of the label or write down the serial number in the installation manual, for example.

06 Install the VILPE Sense Mobile Base Station according to the installation instructions indoors on the floor closest to the roof.

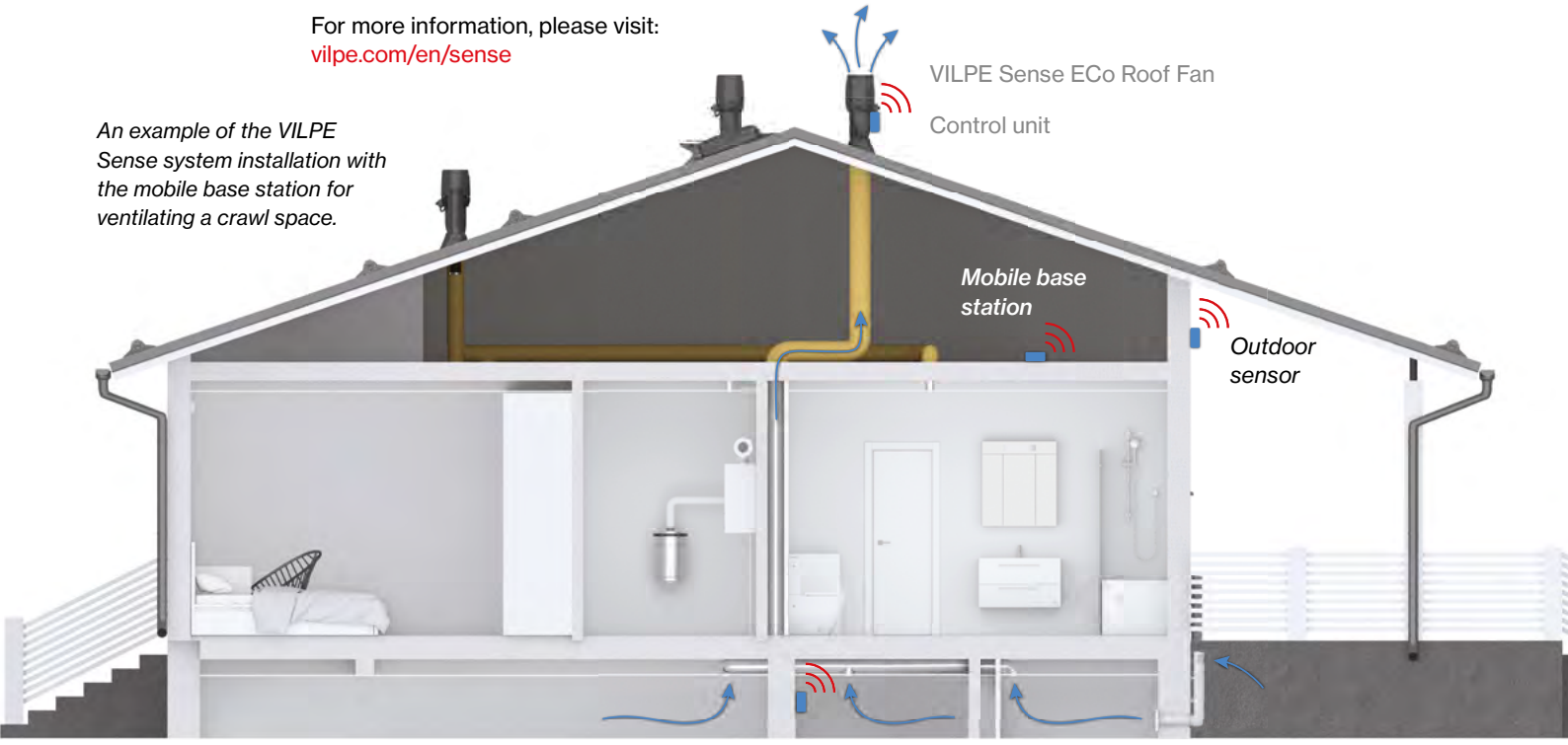
07 Go to sense.vilpe.com to register the devices.

08 If you have not created a user account in the VILPE Sense cloud service yet, click “Go to registering”.

09 Enter the serial number of the VILPE Sense Mobile Base Station (CCU-1) first and follow the instructions on the website.

a. Don’t forget to register the control unit and the sensors on the next page.

For more information, please visit:
vilpe.com/en/sense



An example of the VILPE Sense system installation with the mobile base station for ventilating a crawl space.

2.4.2. VILPE Sense Basic Kit installation and registration

Productno 735040

01 Before installing the basic kit, make sure that the roof fan is switched off.

02 Make a note of the serial numbers before the installation of the basic kit. You will find the serial number on the nameplate label of the device (e.g. A123456ABCD).

a. You can take a photo of the labels or write down the serial numbers in the installation manual, for example.

03 Install the control unit (MCU-1) included in the basic kit on the side of the roof fan on the roof and the sensors according to the installation instructions in the package.

a. Do not place the outdoor sensor in a spot where it will be exposed to direct sunlight.
b. Remember to remove red jumpers from the sensors (RHT-1) before installation.

04 Switch on the roof fan. The roof fan should start.

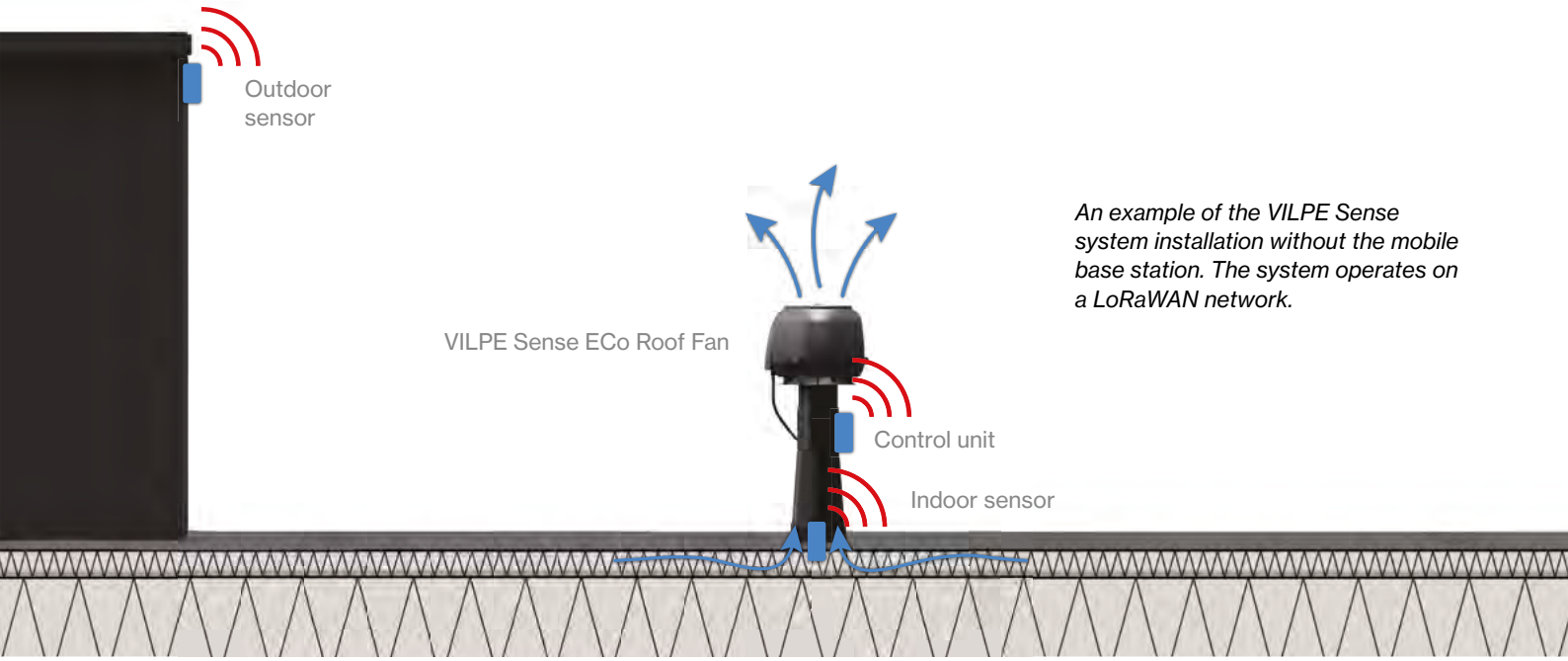
a. The control unit will control the roof fan with a control voltage of 3 V until the system device have been registered in the VILPE Sense cloud service.

05 Go to sense.vilpe.com

06 If you have not created a user account in the VILPE Sense cloud service yet, click “Go to registering”.

07 Enter the serial number of the control unit (MCU-1) first and follow the instructions on the website

For more information, please visit: vilpe.com/en/sense



An example of the VILPE Sense system installation without the mobile base station. The system operates on a LoRaWAN network.

3

VILPE SENSE CLOUD SERVICE AND PLANNING

3. VILPE SENSE CLOUD SERVICE AND PLANNING

3.1. Planning instructions

Descriptions of VILPE Sense device types used in the cloud service

Device Type	Description
VILPE CCU-1	The mobile base station CCU-1 is a gateway device through which the RHT-2 and MCU-2 connect to the cloud service.
VILPE RHT-2	The sensor RHT-2 is a leak detection sensor that transmits data to the cloud service via CCU-1.
VILPE MCU-1	The control unit MCU-1 is a moisture management control unit that does not require a mobile base station (CCU-1) to connect to the cloud service. However, it always requires at least two sensors (RHT-1) to function.
VILPE MCU-2	The control unit MCU-2 is a moisture management control unit that must be linked to a mobile base station (CCU-1) to connect to the cloud service. It also always requires at least two sensors (RHT-1) to function.
VILPE RHT-1	The sensor RHT-1 is a moisture management sensor that must always be linked to a control unit (MCU-1 or MCU-2) to function.

How to use the cloud service in the planning and installation phases

Before installing the VILPE Sense system, the installation needs to be pre-planned using VILPE's Sense cloud service at sense.vilpe.com through the browser on your computer.

During the planning phase, you enter information about the site and specify the VILPE Sense device locations in the system prior to installation. This allows you to only read the unique serial numbers of the devices being installed and register them to the corresponding devices in the plan during the installation phase. A mobile phone with a camera can be used to read the serial number from the device if the serial number label includes a QR code. Otherwise, the serial number is entered manually.

Before you can start planning the project in the cloud service, you must have valid user credentials for the system. You can create the user credentials in the system when registering the devices, but you will need the serial numbers of the devices for this. If you do not yet have access to physical devices or serial numbers, you can request user credentials via email from sales@vilpe.com or by submitting an inquiry through the web form at: https://www.vilpe.com/request-access/

Example of the site layout image

You will need a site layout image for the cloud service

The purpose of the layout image is to describe the installation site as a two-dimensional area, including the shape of the roof as seen from above. It can be taken from the blueprint or a direct image of the roof from the air. You can also use an image from Google Maps. Ensure that all parts of the roof are in the correct proportions.

At least one actual measurement in site layout image should be known (in meters), such as the length of one side of the roof. If desired, you can also mark the measurements on the site layout image.

During the installation phase, it is easier to locate planned sensor positions in the construction site when there are some reference points visible on the site layout image, such as other technical equipment on the roof.

The site layout image should be in png, jpg/jpeg, or gif format (maximum size is 10 MB).

You can add your own annotations to the site layout image, such as names of different areas.

Instructions for mobile base station

The maximum operating range between the base station and the sensors depends on both the physical distance and the materials obstructing the signal between the devices. Heavy structures, such as concrete and metal, interfere with the signal the most. The actual operating distance between devices is typically 40–100 meters.

Number and placement of mobile base stations:

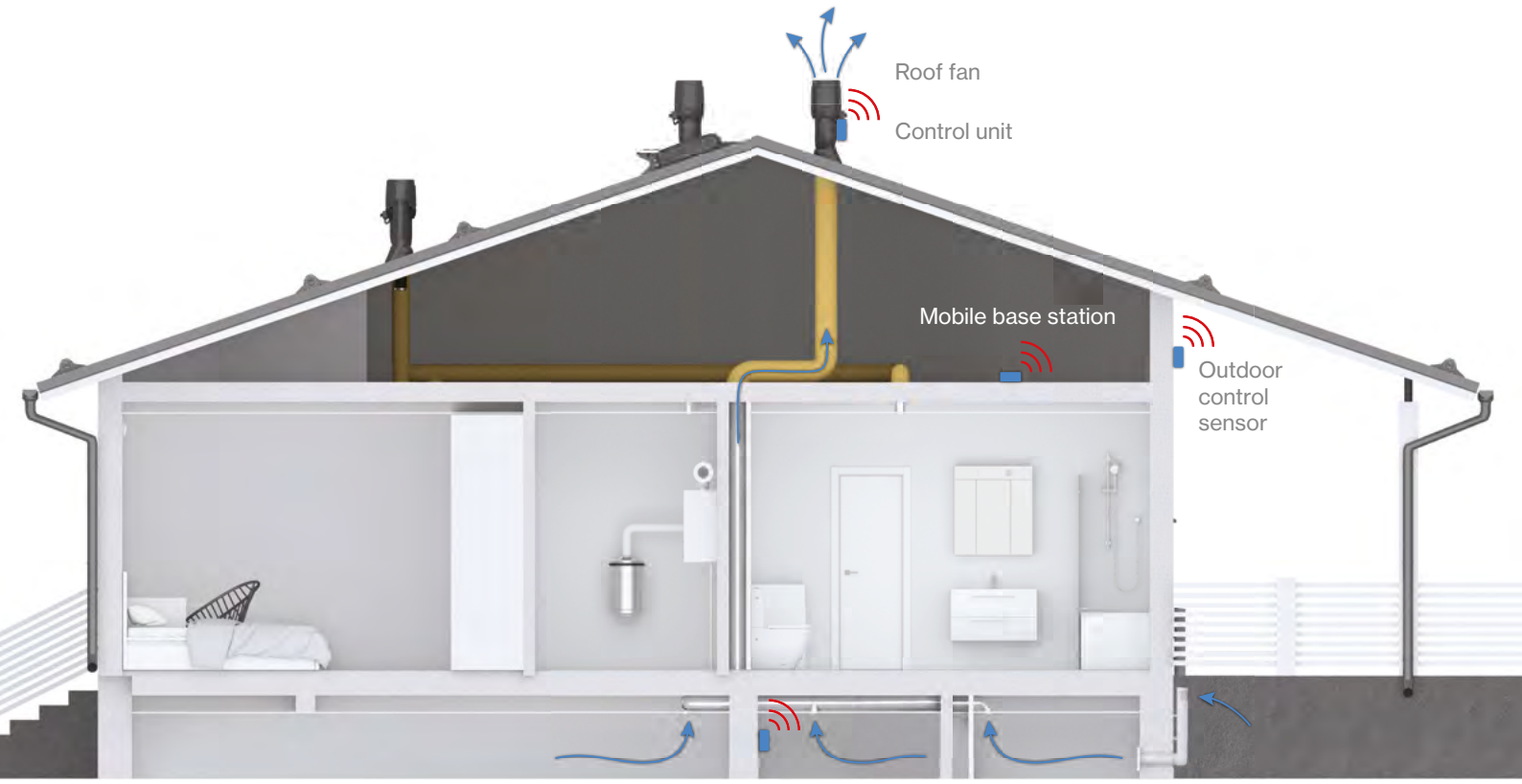
Distance to metal surfaces: Do not install the base station or control unit directly against metal surfaces or inside a metal enclosure. Aim to place the device at least 30–50 cm away from large metal surfaces. Avoid installing the devices in areas where the signal may reflect off multiple surrounding metal surfaces.

Installation in open space: Install the base station at least 1–2 meters above the ground or floor surface. If possible, choose a location where there is as much open space around the base station as possible.

Minimize obstacles: Avoid installing in locations where there is a large, direct metal obstacle, thick or multiple layers of heavy structures between the base station and the device. However, corrugated metal roofing or reinforced concrete slabs usually do not cause significant signal interference.

Distance to the base station: Keep in mind that points 1–3 can significantly impact signal behaviour and may reduce the recommended maximum distance between the devices. Use the maximum distance as a guideline only if the requirements of points 1–3 are met.

Number of mobile base stations: The required number of mobile base stations depends on the number of devices, distances, and possible obstacles. One base station can serve up to a maximum of 200 leak detector sensors and 50 control units. Base stations can be easily added to the system later if needed. If retrofitting additional base stations is not desirable, the system should be designed so that the estimated coverage areas of the base stations overlap sufficiently. This way, if the signal is weak, a device can be linked to use an alternative base station.



Options for planning and registering VILPE Sense devices

VILPE Sense devices can be pre-planned in cloud service.

In this method, a new project is created in the cloud with a site map where the desired device locations, basic information, and necessary device links are added in the design mode. This allows the installation phase to use an installation view where all planned devices are registered in the system one by one in their predetermined locations. After installation, all devices in the system can be monitored from the moisture map view of the project.

VILPE Sense moisture control devices can also be registered into the system without pre-planning.

In this case, each VILPE Sense Mobile Base Station (CCU-1) and control unit (MCU-1/MCU-2) with its sensors are registered in the system as a new device. The control unit will only appear in the control unit list, and the devices will not be positioned on the project's site map. However, a new project can be created later, and the already registered devices can be placed on the site map.

Planning phase in the cloud service

01 Log in to VILPE Sense cloud service at sense.vilpe.com using your login credentials.

02 Select *New site* by clicking on the plus sign in the upper right corner to create a new site.

03 Provide a name for the site and upload a site layout image. Then click *Next*.

04 Optionally, specify the time of day you want the leak detector sensors to measure humidity levels. This can be changed later.

05 You can set alarm thresholds for temperature and/or relative humidity, or based on percentage points above the average relative humidity. These settings can also be modified later. The alarm settings apply only to leak detection, and the alarm settings related to humidity control can be configured separately in the controller settings.

06 Once the settings are complete, click *Create*.

07 You will be taken to the *Sites* view, where the newly created site is displayed. Click on the site's name to open the *Humidity map* view. The actual humidity map will be displayed once the system has been fully planned and the devices have been registered.

08 Go to planning mode by selecting *Planning mode* from the menu next to the site name on the right side.

09 Set the scale for the site layout image by selecting *Set scale* from the menu icon (*three dots*) in the upper right corner of the view with the site image.

10 Move the endpoints of the visible line on the site layout image to mark the measurements. Enter the corresponding length in meters in the field, e.g., *153.5*, and then click *Save*.

11 If the mobile base stations or other devices have already been registered in the system for the respective site, you can add them to the plan (layout image) by selecting *Devices* from the menu icon (*three dots*). Choose the relevant device from the list and then click to place the device in your chosen location on the layout image. If this is not the case, you can proceed to the next step.

12 Add new devices to the layout image by by left-clicking at the desired location on the layout image. From the form that opens, first select the device type and name the device if needed. Depending on the device type, necessary linkages, such as selecting a possible mobile base station or control unit, must also be made. The most recently selected base station or control unit is automatically pre-filled. The number of devices already linked to the control unit or mobile base station is displayed below the selection box. Click *Add* when the desired settings are entered.

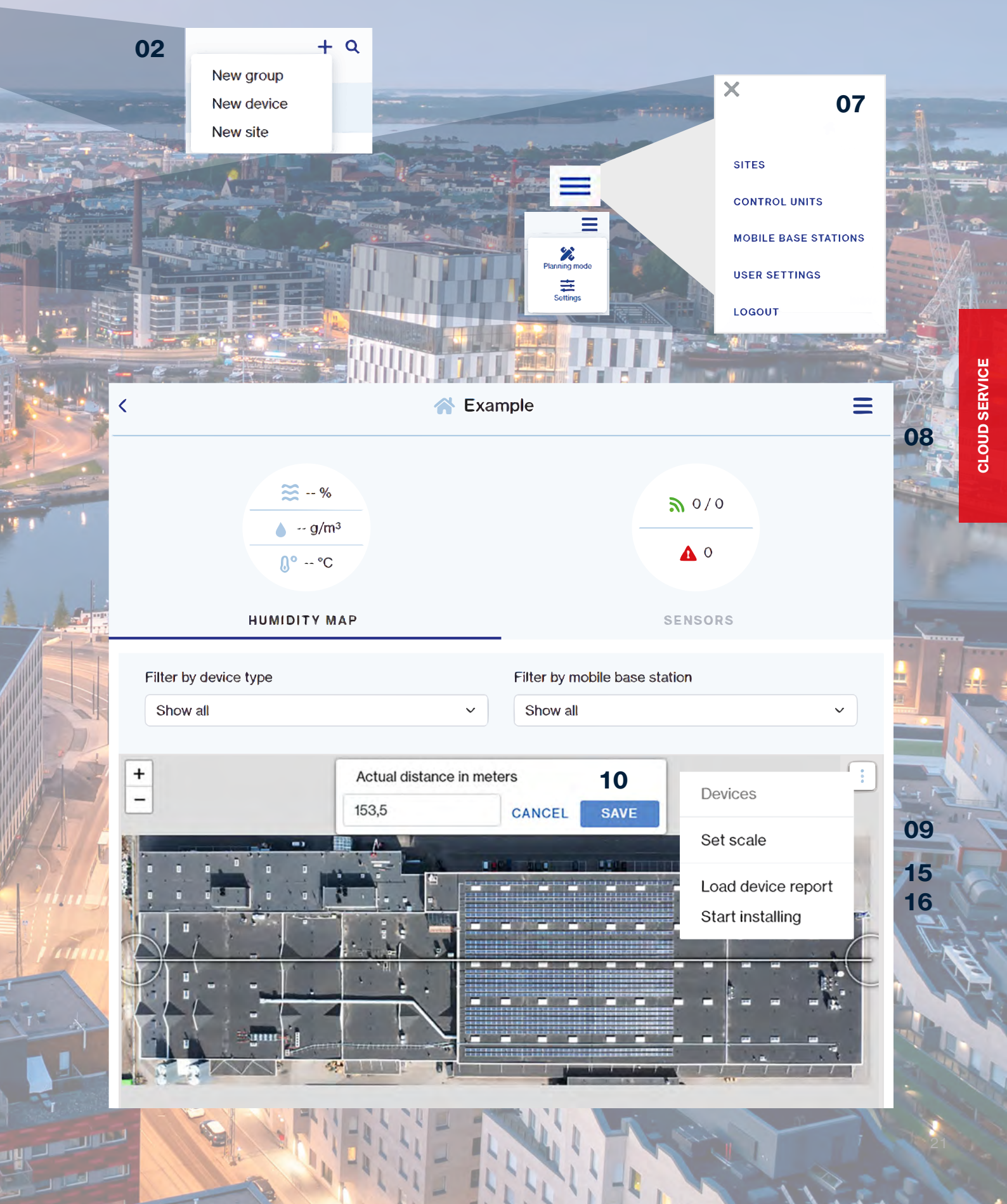
13 Optionally, you can move the planned device's position on the site layout image. First, select the device by clicking on its icon. Hold down the left mouse button over the highlighted icon and drag it to the desired location. If the device is already registered, you can move it as follows: select the device, open the device information menu, choose *Move device*, and click on the desired location on the layout image.

14 Add all devices to the site layout image in the same manner.

15 Once the plan is complete, you can generate a device report from the plan. The report can be downloaded by clicking the menu icon (*three dots*) and selecting *Load device report*. The report will include information such as the number of different types of devices added to the plan.

16 Optionally, you can activate the installation mode for the site, which prevents movement and addition of devices. If necessary, you can easily switch from installation mode back to planning mode to make changes to the plan.

After the planning phase comes the installation phase. The site owner can invite the installer as a user through the site settings, creating the necessary user credentials for the installer. During the installation phase, the devices to be installed must be accessible to the installer. The installer logs into the cloud service using their own user credentials. It is recommended to first register the mobile base stations according to the plan before registering other devices.



Installation phase in the cloud service using a mobile device

01 Log in to the VILPE Sense cloud service on your mobile device through the browser.

02 Go to the *Sites* view in the top left corner of the menu.

03 Select the site where the devices will be installed.

04 Choose *Planning mode* from the menu in the upper right corner.

05 When you are ready to start the installation, select *Installation mode.*

06 Tap on the icon of the device in the plan that you want to install. By tapping the icon, the device registration process will automatically start.

07 Enter the device's serial number or tap *Read QR code* if the device has a QR code. If the device has a QR code, you can use your mobile device's camera to read it.

Select *Read QR code*, and your mobile device's camera will be activated. *Note:* Allow the use of the mobile device's camera separately, if necessary. Take a picture of the QR code and confirm the image (*OK*) if it is clear. If you want to take the picture again, select *Retry*.

08 Tap *Next* once the serial number has been entered.

09 Install the device in the location marked on the image and click *Register*.

10 Tap on the icon of the next device to be installed according to the plan.

11 Install all devices in the same manner.

After the installation, the site owner can deactivate the planning mode in the site settings, which means that only the owner can make changes to the site. If ownership needs to be transferred to another person (e.g., from the contractor's representative to the end user), it can also be done in the site settings. Ownership can be transferred to any user who has been added to the site. Ownership can be transferred to another user by selecting *Move ownership* from the menu next to the user (*three dots*). It is advisable to agree with the relevant user in advance before the ownership transfer. Once the ownership has been transferred, the new owner can log into the system with their login credentials.

3.2. Control unit adjustments for VILPE Sense Humidity Control

Modifying the control unit's adjustment algorithm parameters

In some cases, it may be necessary to modify the parameter values of the control unit's adjustment algorithm. It is important to note that the default values generally work best in most situations and consulting an HVAC professional or VILPE's technical support is recommended before making any changes.

The need to adjust parameters may arise in the following situations, for example:

Oversized exhaust fan: If the selected exhaust fan is oversized for the ventilation requirements, modifying the adjustment parameters may be necessary to ensure optimal performance.

Special conditions: If you want the exhaust fan to stop completely as soon as the absolute humidity of the outside air is higher than that of the space being ventilated.

Temperature limits: If the fan needs to be stopped when the outdoor temperature falls below a certain level, parameter adjustments may be required.

Descriptions of control unit adjustment algorithm parameters

Below are descriptions of the control unit's adjustment algorithm parameters, including their adjustment ranges, default values, and important considerations.

Parameter (unit)	Adjustment range (step)	Default value	Description	Important considerations
Reference control voltage (V)	0...10 (0,1)	4	Reference control point of the roof fan, where the target/design ventilation air exchange rate is achieved.	The reference point set by the HVAC designer is based on the characteristics of the ventilated space and the selected roof fan. This value is essential for achieving the correct air exchange rate.
Maximum control voltage (V)	0...10 (0,1)	9,5	Maximum control voltage of the roof fan.	The algorithm controls the roof fan between the minimum and maximum control voltages. If the maximum control voltage is reduced, the maximum ventilation power is scaled down, which may be necessary in cases where the exhaust fan is oversized.
Minimum control voltage (V)	0...10 (0,1)	1,8	Minimum control voltage of the roof fan.	With the default value, ventilation is continuously active when the outdoor temperature is above the stopping temperature. If the minimum control voltage is set to, for example, 0 V, the algorithm scales down to zero, allowing ventilation to stop based on humidity conditions as well. Typically, the exhaust fan stops when the control voltage is below 1 V. This setting impacts energy efficiency and the system's response to changes in humidity conditions.
Stopping temperature (°C)	-7...+15 (1)	-7	Ventilation stopping temperature. The exhaust fan is stopped when the outdoor temperature falls below this value.	By increasing the stopping temperature, ventilation stops more readily as the outdoor temperature drops.

- **Default values:** In most cases, the default values are optimized for common applications, ensuring efficient and safe system operation.
- **Documentation:** It is advisable to carefully document any changes made for future reference and potential adjustment restoration.

Additional instructions:

- **Monitoring:** The effects of changes on system performance should be monitored regularly.
- **Safety:** Incorrectly set parameters can lead to inefficient operation or even damage to the system.
- **Interdependence with other settings:** Parameter adjustments may also affect other parts of the system, so a comprehensive review is important.

If you are uncertain about the suitability of the settings, we recommend contacting VILPE's technical support or a qualified HVAC professional to determine the correct values.

3.3. Alarm settings

For the VILPE Sense Leak Detector and Humidity Control, it is possible to enable various alarms. It is recommended to activate these alarms immediately upon system installation. The recommended initial alarm settings can be found in the following tables. It is essential to regularly check the alarm settings and adjust them as necessary. The goal is to set the alarms to be sensitive enough without causing false alarms.

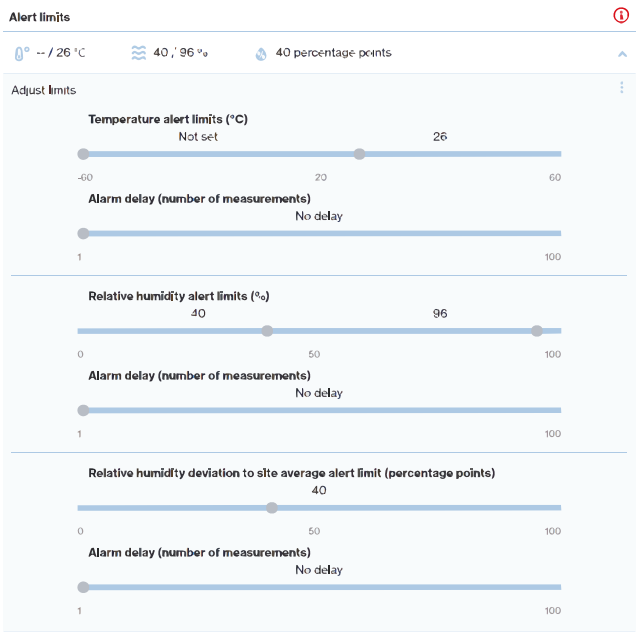
Alarm types and recommended initial settings:

VILPE Sense Humidity Control

Alarm type	Description	Recommended initial settings
Mold index	Mold index-based alarm. The alarm threshold is not user-adjustable. The alarm threshold for the mold index is 2.5.	Mold index alarm on.
Relative humidity	Alarm when the relative humidity measured by the sensor is above or below the alarm threshold continuously for at least the alarm delay time.	Indoor sensor: • Upper limit: 90 % • Alarm delay: 12 measurements (24 hours)
Temperature	Alarm when the temperature measured by the sensor is above or below the alarm threshold continuously for at least the alarm delay time.	

VILPE Sense Leak Detector

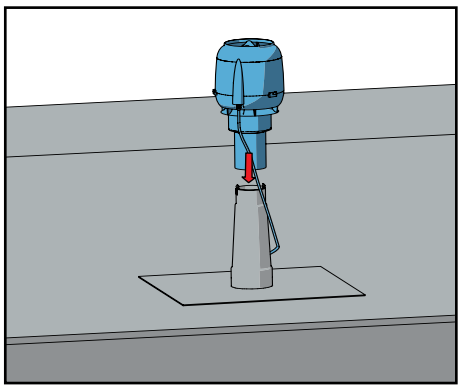
Alarm type	Description	Recommended initial settings
Relative humidity deviation from average	The alarm is activated when the relative humidity measured by a single sensor deviates from the average of all sensors continuously for at least the alarm delay time. If the deviation setting is 20 percentage points and the sensor average is 55 %, the alarm threshold is 75 % (55 % + 20 %).	• Deviation: 20 percentage points (*Note:* The average of the sensors must be below 79 %) • Alarm delay: 4 measurements (48 hours)
Relative humidity	The alarm is activated when the relative humidity measured by the sensor is above or below the set alarm threshold continuously for at least the alarm delay time.	• Upper limit: 90 % • Alarm delay: 4 measurements (48 hours)
Temperature	The alarm is activated when the temperature measured by the sensor is above or below the set alarm threshold continuously for at least the alarm delay time.	

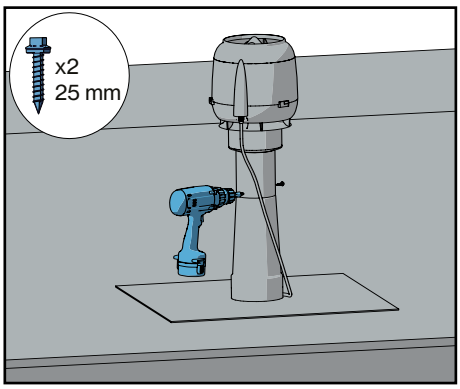


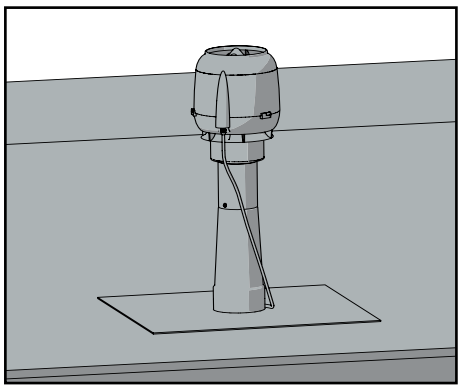
ATTACHMENTS

Attachment 1. ECo Sense roof fan installation

ECo Sense roof fan

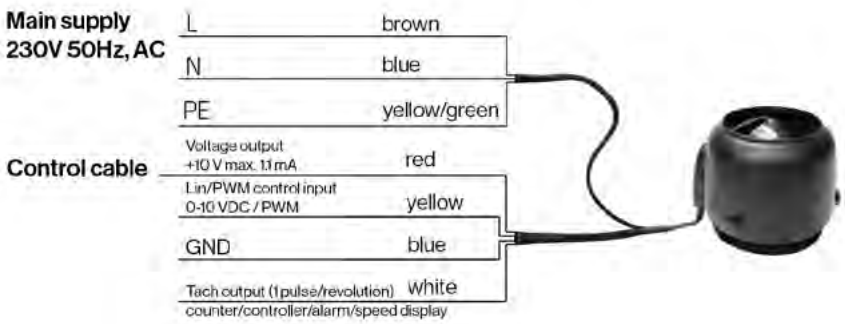






General

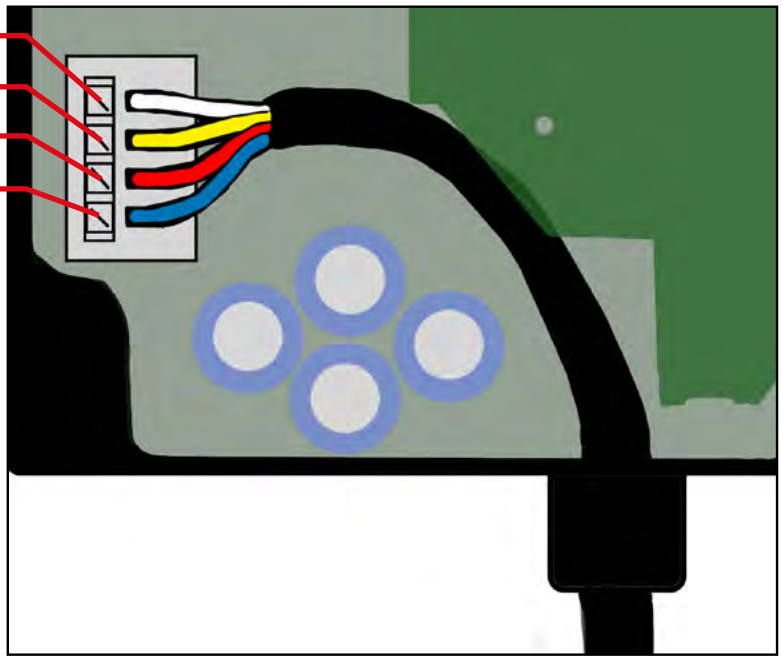
Power input	83 W
Current	0.75 A
Voltage	230 V, 50 HZ
Capacitor	-
Rotation speed	3200 rpm



VILPE Sense

1. WHITE: ALARM/COUNT
2. YELLOW: INPUT 0-10V
3. RED: +10V OUT
4. BLUE: GND

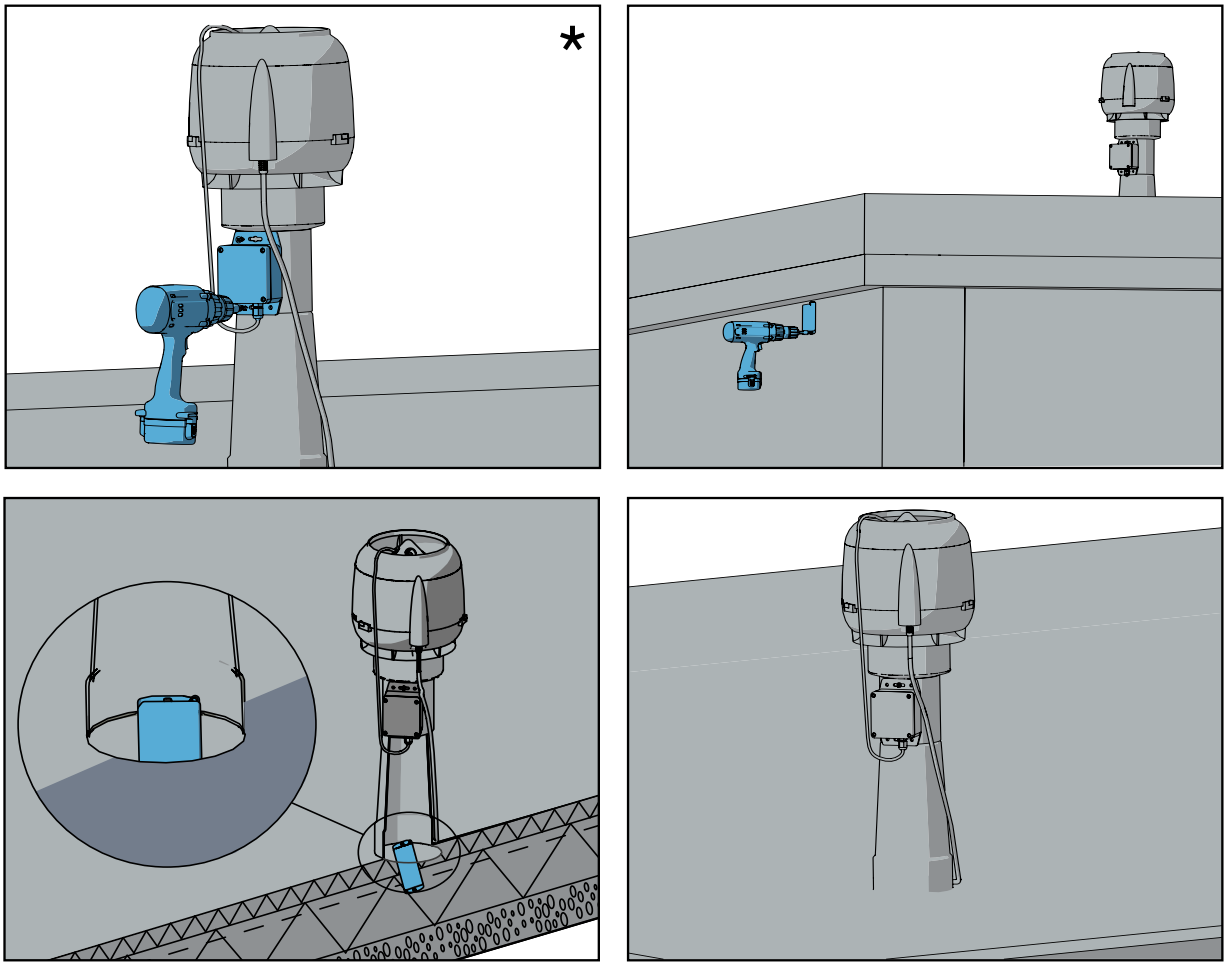
1. Valkoinen: Hälytys/Laskuri
   Vit: Larmsignal/Varvtalsmätning
   Белый: Предупреждение/импульс
   Biały: Alarm/Licznik
2. Keltainen: Ohjaustulo 0-10V
   Gul: Styringgång 0-10V
   Желтый: Вход 0-10 В
   Żółty: Wejście sterujące 0-10V
3. Punainen: +10V Ulostulo
   Röd: +10V Utsignal
   Красный: +10 В Выход
   Czerwony: +10V Sygnał wyjściowy
4. Sininen: Maa
   Blå: Jord
   Синий: Земля
   Niebieski: Ziemia



Attachment 2. Basic kit installation

Register your products online using **the serial numbers on the devices:**
Rekisteröi tuotteet **laitteissa olevilla sarjanumeroilla** netissä:
Registrera produkterna **med serienummer** på nätet:
Зарегистрируйте продукты в интернете **под имеющимися на устройствах серийными номерами:**
Reģistrējiet produktus **ierīcē ar esošajiem sērijas numuriem** internetā:
Užregistruokite gaminius internetu **pagal prietaisų serijos numerius:**
Zarejestruj swoje produkty online, podając **numery seryjne umieszczone na urządzeniach:**
SENSE.VILPE.COM
VILPE.COM/SENSE-INSTALLATION

A.



ATTACHMENTS

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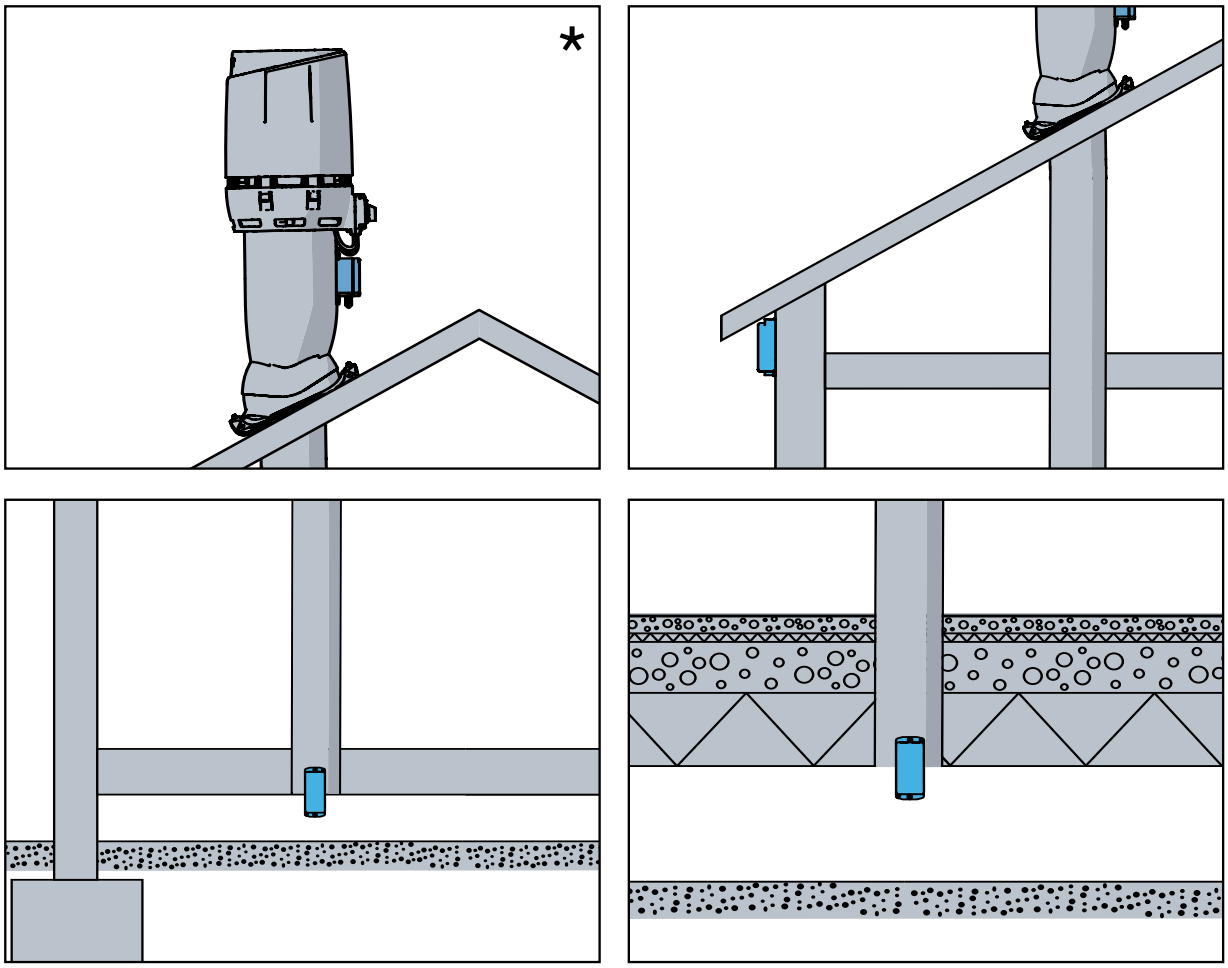
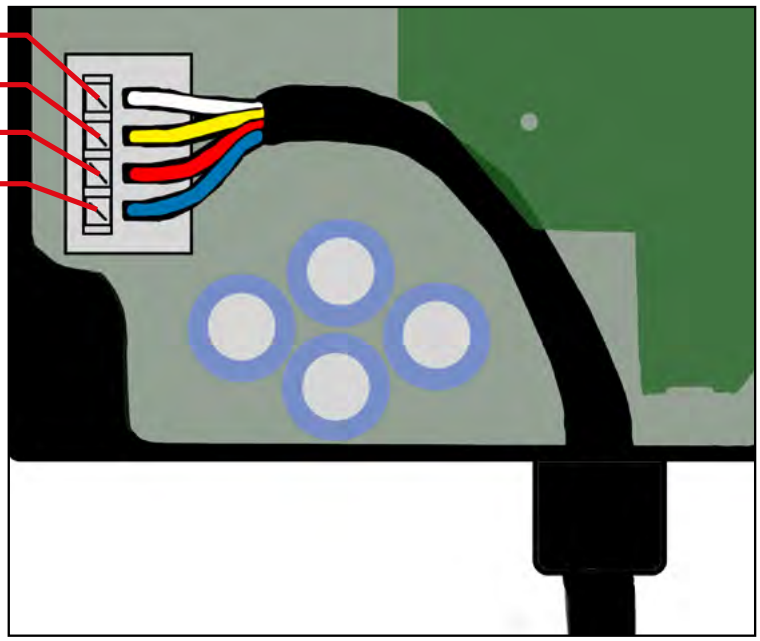
B.



*

1. WHITE: ALARM/COUNT
2. YELLOW: INPUT 0-10V
3. RED: +10V OUT
4. BLUE: GND



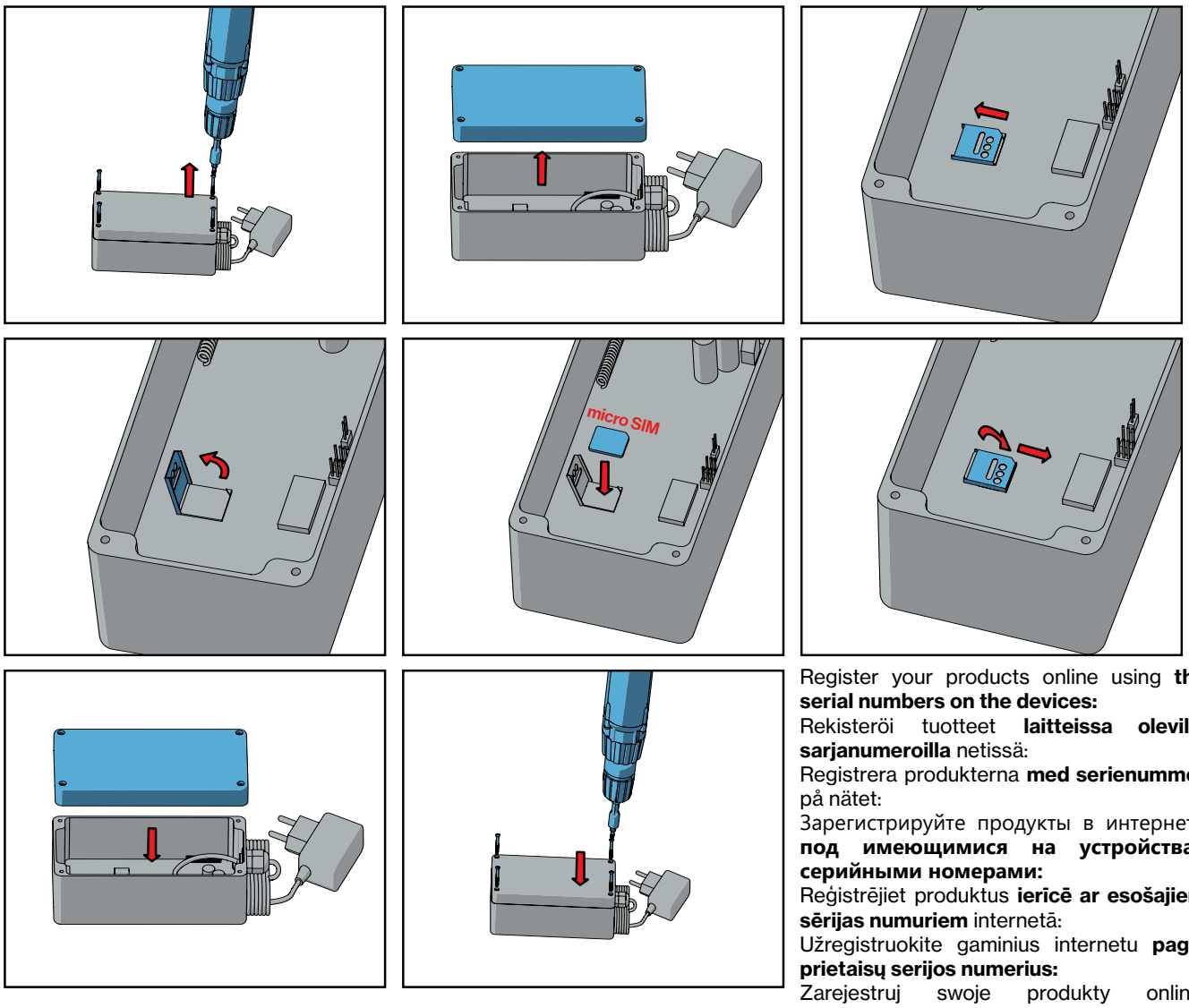
1. Valkoinen: Hälytys/Laskuri
   Vit: Larmsignal/Varvtalsmätning
   Белый: Предупреждение/импульс
   Biały: Alarm/Licznik
2. Keltainen: Ohjaustulo 0-10V
   Gul: Styringgång 0-10V
   Желтый: Вход 0-10 В
   Żółty: Wejście sterujące 0-10V
3. Punainen: +10V Ulostulo
   Röd: +10V Utsignal
   Красный: +10 В Выход
   Czerwony: +10V Sygnał wyjściowy
4. Sininen: Maa
   Blå: Jord
   Синий: Земля
   Niebieski: Ziemia

Attachment 3. Mobile base station installation

VILPE Sense mobile base station

Asenna SIM-kortti (koskee vain tuotetta 735044) | Installera SIM-kortet (gäller endast 735044) | Вставь СИМ-карту (только для 735044) | Instalējiet SIM karti (tikai 735044) | Zainstaluj kartę SIM (tylko dla 735044)

1. Insert SIM-card (only for 735044)

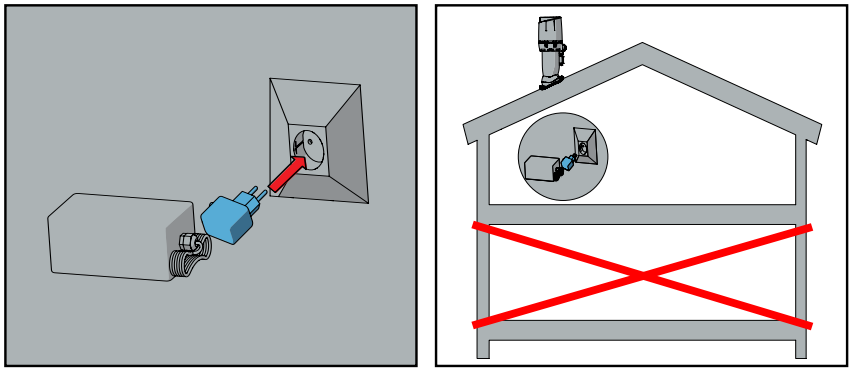


Register your products online using **the serial numbers on the devices:**
Rekisteröi tuotteet **laitteissa olevilla sarjanumeroilla** netissä:
Registrera produkterna **med serienummer** på nätet:
Зарегистрируйте продукты в интернете **под имеющимися на устройствах серийными номерами:**
Reģistrējiet produktus **ierīcē ar esošajiem sērijas numuriem** internetā:
Užregistruokite gaminius internetu **pagal prietaisų serijos numerius:**
Zarejestruj swoje produkty online, podając **numery seryjne umieszczone na urządzeniach:**

SENSE.VILPE.COM
VILPE.COM/SENSE-INSTALLATION

Asennus | Installation | Монтаж | Instalējiet | Montaż

2. Installation



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Attachment 4. Leak detector installation

VILPE Sense Roof Leak Detector

Register your products online using **the serial numbers on the devices:**
Rekisteröi tuotteet **laitteissa olevilla sarjanumeroilla** netissä:
Registrera produkterna **med serienummer** på nätet:
Зарегистрируйте продукты в интернете **под имеющимися на устройствах серийными номерами:**
Reģistrējiet produktus **ierīcē ar esošajiem sērijas numuriem** internetā:
Užregistruokite gaminius internetu **pagal prietaisų serijos numerius:**
Zarejestruj swoje produkty online, podając **numery seryjne umieszczone na urządzeniach:**

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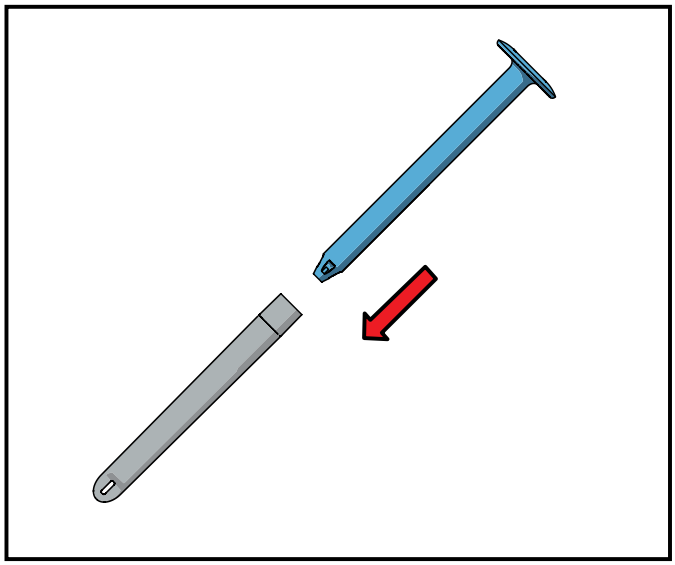

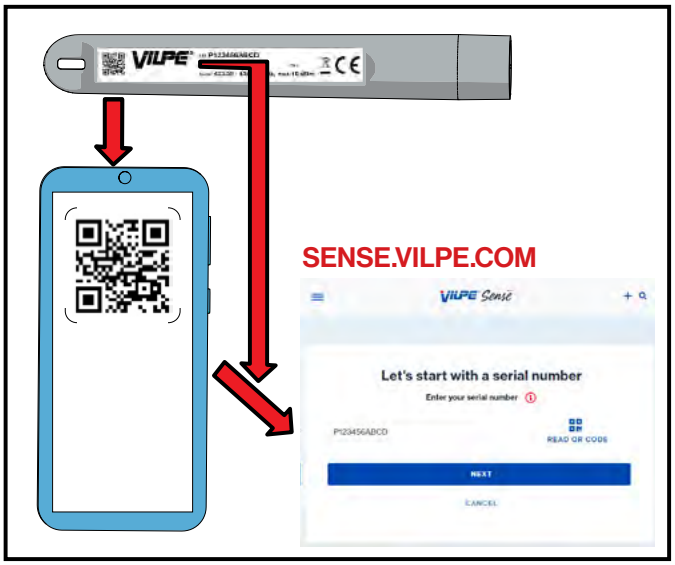

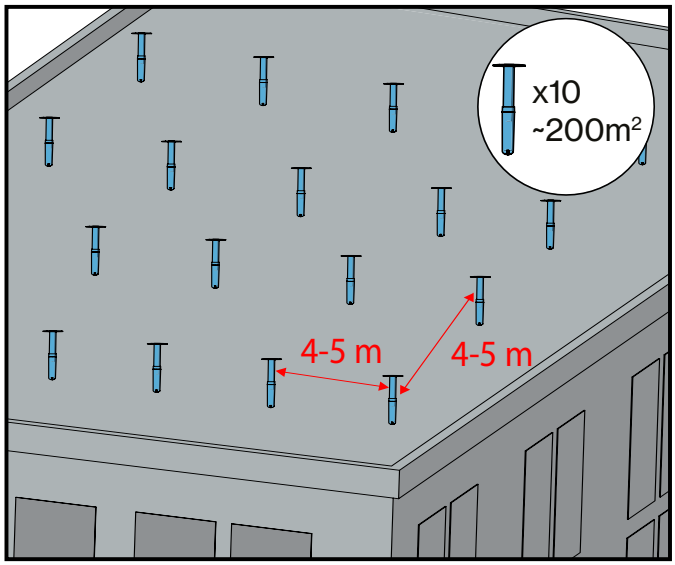

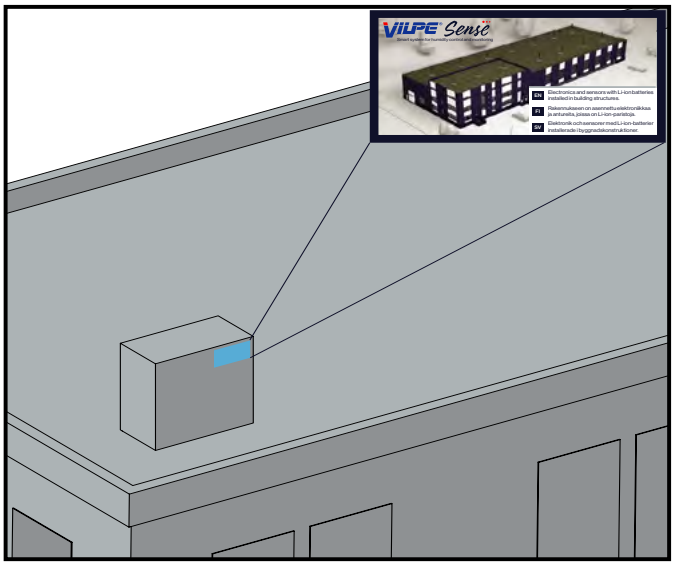

VILPE.COM/SENSE-INSTALLATION

ATTACHMENTS

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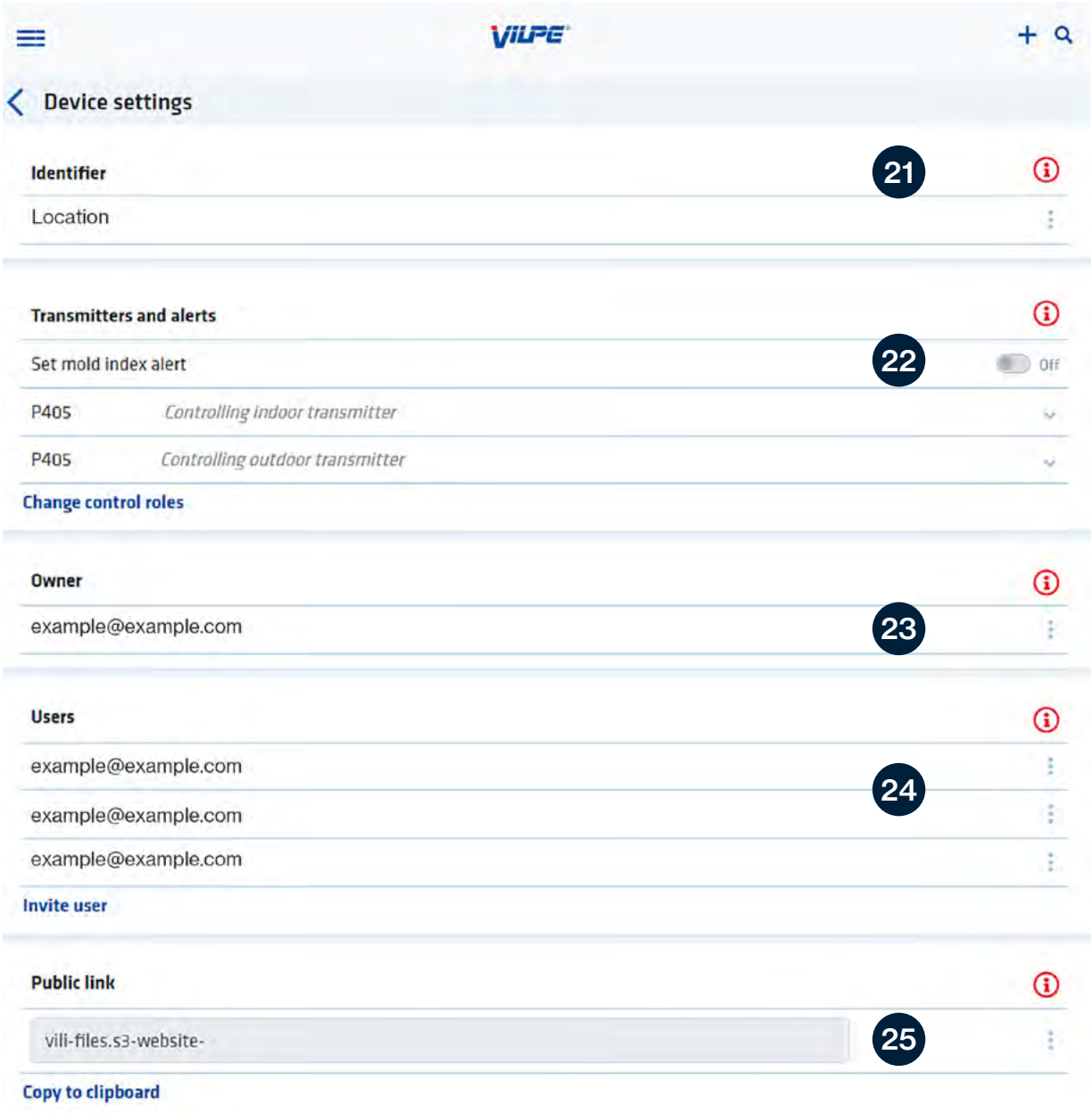
Attachment 5. Humidity control user interface

1. Settings, log out, front page
2. Choose a location
3. Outdoor air RH level
4. Structures RH level
5. Roof fan rotation speed
6. Create new group / add new device
7. Search
8. Settings (only for admin users)
9. Mold index
10. Conditions
11. History (only for admin users)
12. Refresh
13. Choose time period
14. Roof fan rotation speed
15. Choose sensors/conditions
16. Last update
17. Sensors
18. Temperature
19. RH levels
20. Calendar

Settings for admin users



21. Choose location name
22. Choose sensor names and set alarm values
23. Change device's admin user
24. Add and remove users
25. Sharable link to data collected by the device (no registration)

VILPE® Sense

VILPE Oy

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sales@vilpe.com