Ruukki® Roof Sensor Installation and Software parameter settings instructions

- Sensors and electronics installation can be started after the locations of sensors on roof are determined.
- Sensor settings and interface configuration can be done later without a need to access roof installations.

Installation phases in brief

A Sensor device (strain gage) installation instructions
- Locate the planned sensor point, clean and degrease area, measure and mark
- Expose and smooth metal on small area with sandpaper (#200-300), after sanding clean and degrease area properly
- Orient and align a sensor with roof structure, glue by pressing 90 seconds
- Install cables towards Server installation location

B Powering up Ruukki® Roof Server
- Connect all sensor cables and Ethernet cable to Ruukki® Roof Sensor Server
- Connect Ethernet cable to powered PoE unit. This will reboot the main system and Server will find all connected sensors automatically and soon it’s ready to use.

C How to connect Ruukki® Roof Server WiFi/LAN network
- Connect PC/Laptop to WiFi service (recommended – some mobile devices may lack capabilities)
  - RuukkiRoofSensor (SSID: name of wireless network)
  - RuukkiRoofSensor (WPA: password to network for the first time)
- Open WEB page https://ruukkiroofsensor (https://192.168.4.1)
- Use service as administrator to configure system:
  - Press LOCK-icon in Menu/Configuration page (user: admin pswrd: admin)
  - it is mandatory change of administrator password for the first time.
  - Mark down and memorize new password – Log in with the new password

D Finalizing software parameters and user interface
- Insert a representative background picture of roof/building
- Test sensor warning lights (“test”) and locate sensor corresponding sensor position over a background picture (“move”)
- Insert pre-calculated sensor values on sensor locations (factory setting is Ε = 400), calibrate sensors and give notes (reason of change) and save parameters
- Log out after all sensor have parameters
- Test network address also with http://ruukkiroofsensor (http://192.168.4.1)

Preparation list: needed information and easy to find materials (not included in the box)
- Calculus report from POIMU software: sensor placement plan and strain parameters
- Cleaning and degreasing liquid, clean lint free wipes
- tools like curved blade knife exposing and smoothing metal surface (only a small #240 sanding paper is included)
- cable fixings and cable conduits (self adhesive low voltage minimum 7x12mm)
- A longer Ethernet cable: to have data and power (PoE injector) in more accessible place closer to power sockets/ reach to on-house free Ethernet sockets/ to ease later installation of several box contents together with Ethernet cables.
What is in the box?

One Ruukki® Roof Sensor box includes software User Guide and necessary components fully prepared to have two snow load measurement points ready for calibration. There is also additional sensor for temperature and humidity measures.

For larger and more complex monitoring system use several boxes content – or contact ruukki.com

**In the box you find:**

- 1pcs Ruukki® Roof Sensor Server box
- 2pcs Sensors with light diffusors, sensors and cables in pouches fully assembly ready.
- 1pcs Bluetooth sensor Ruuvi Tag – a white round case as software compatible to additional measurement for end user convenience and needs.

Under second lid under Server box there is:

- 1psc Power over Ethernet injector with power cord and
- 1pcs short Ethernet cable for PoE feed
- 1pcs extra sensors extension cable sensors
- 1psc plastic bag containing:
  - one sensor glue 2g in applicator
  - one needle to open glue applicator
  - pieces of anti-stick film for glueing phase
  - pieces of double sided tape
  - piece of grinding paper (#200–300 grit)

**What is Not in the box that is needed?**

- Measuring and marking tools like ruler and pens, some removable masking tape.
- Knife/scraper with curved blade
- You can use also a light flat sanding tool for removing paint and smoothing the exposed metal surface with #200–300 sanding paper. In case of roof profile has a tight groove as sensor installation point the knife and provided sanding paper are useful.
- Cleaning and degreasing:
  - Acetone or Isopropanol Acetone mixture for technical decreasing and cleaning
  - Wipes (non-lint) for cleaning and degreasing
- Cable management:
  - Self-adhesive cable conduits starting from size 7x12mm, some larger one could be useful like 25x35mm for several cables
  - It is highly recommended alternative for long power extension cords to use longer Ethernet cable for PoE depending house size and height and available electricity.

In order to have accurate snow load measures you need calculated sensor location values from POIMU software report for system calibration.
Preparation list: easy to find assembly materials, not included in the unit box

- **Design information for sensor installation**
  - Ruukki® POIMU-software report or collected sensor drawing for sensor locations and strain values (E)
  - Prepared picture of presenting building roof for inserting interface view. This can be floor plan, structural picture or aerial/satellite picture, drawing, a screen shot.

- **On site electricity availability, LAN availability is optional – good to know**
  It is highly recommended to use longer Ethernet cable instead of separate power extension cord for electricity.
  - From many local shops there is usually available 10m-15m or 20m Ethernet cables that are suitable for both PoE power and data connection. Also electricians may have parts and cable available to build up Ethernet cable to needed length – up to 100m. And that distance can be extended further with inexpensive Ethernet switches.

Place PoE unit in accessible place at the floor level or close to nearest free house Ethernet connection if available.
- There could be also free PoE ports available already in the building. In that case the PoE injector and cable is not needed at all – consult house IT/communication people.
- With use of house Ethernet cables is a great advantage – there is usually a dedicated and locked space for house Ethernet cables, LAN routers and switches and also Ruukki® Roof Sensor PoE supply can be situated there. Other network connections are easy to arrange there without visiting the roof.

- **Some tools**
  - Measuring device and marker to locate and mark sensor positions
  - Clean disposable wipes and degreasing solution like isopropyl-acetone mixture for example
  - Cable management materials, like cable conduits and cable ties

- **Protect yourself and others first before starting installation**
  - You need to have safe and stable access to the roof surfaces
  - Use protective eye glasses and provided non-stick Teflon films when glueing. A piece of tape helps to keep Teflon film in place. You are about to work on roof level and handling low viscosity glue also above your eyes level. Avoid extra troubles beforehand like having glue in eye or attaching yourself or your finger to sensor or to roof.

Illustration of single Roof Sensor server system setup
A Sensor device (strain gauge) installation instructions

- **Overview**
  Roof material strain has to be transferred to sensor strain gauges in order to work accurately. Very close connection of steel surface and strain gauge sensor is needed. This can be achieved with thin and tight glue layer and proper adhesion.

  Surface preparation (cleaning, smoothing) and with carefully made degreasing are basic essentials to have correct long lasting performance.

- **Notes about Sensor locations:**
  Sensors are installed at predefined positions defined and calculated with POIMU software (defined by structural engineer). However do not install sensors on overlapping joints or double steel sheet layers or near some post-assembled hanging objects on the roof.

  - Sensor direction is ideally the same as direction of the load bearing profile
  - Sensor position in the profile form is at the **lowest flat surface** towards ground/floor.
Example of two profiles from https://www.ruukki.com/b2b/products/load-bearing-profiles T153-40L-840 (with flat bottom) and on the right T130M-75L-930 (with highly formed bottom – there is flat space only in the center groove for sensor.

However do not install sensor on overlapping joints of profile sides or close proximity of some post assembled hanging fixings, ventilation pipes or lighting fixture fixings etc. that might not be seen in design pictures. Such locations may disturb values affected by snow load only.

In case no suitable pre-calculated positions are available choose suitable similar position from close proximity. Re-measure the new location carefully from both support beam surfaces (+/-10mm). With this new information it is possible to re-calculate new strain values with POIMU software and install corresponding parameters to Roof Sensor Software.

- **Measure and mark sensor placement on the roof from the preplanned sensor location.** Usually it is defined at the middle point between roof supports where the strain from snow load is at its highest level so sensitivity is also highest. Other distances than center point work also but need to be re-calculated.

Example of POIMU report with finnish language: for sensor #1 support “D” and distance 3125 (in mm’s). Supports are defined from support center point so practically measurable distance from support side to sensor placement point is 3050mm when support width is 150mm.
**Sensor installation preparation**
Clean the overall working area around sensor location

Remove possible colour coatings on actual sensor placement until roof metal is exposed (large enough area like, minimum of 5cm x 2cm for a strain gage).

Smooth the exposed metal surface with provided sanding paper (or with flat sanding tool (#200-300 grit)).

Clean and degrease sensor area with new clean cloth. Just one sweep and discard the cloth. Repeat this decreasing three times with a clean cloth every time.

**Proper cleaning cannot be overestimated.**

Cleaning and removing dirt, grease, oil and other particles from the small target area will make sure that bonding will be long lasting i.e. sensor adhesion is best possible for a long life.

Before adding glue just check and practice that you have a good stable position for pressing and holding the sensor controlling correct position and direction. – 90 second hold may sound a short time at first.

**Note about sensor direction and how much direction error affects accuracy**
Ideally sensor is exactly the same direction and alignment as the load bearing sheet profile is. Lowest measurement errors and highest accuracy is ensured. On the other hand a deviation of 3 degrees out of alignment direction the accuracy and measurement deviation will still be under 1%. – deviation of measurement is likely close to 5 points per million or less.

**This level of direction accuracy can be usually achieved with just eyesight and free hand.**

If high accuracy is needed you may use transparent tape for sensor preplacement directing the sensor (without glue) – loose one end of the tape or cut the tape with knife to get access under strain gauge sensor to place glue material on right place between sensor and target. Press for 90 seconds. Tape attached on the roof and the sensor will help to memorize the alignment and sensor position during the positioning, pressing and cure.
• **Glueing preparation:**
  **Protect yourself first**
  Use protective eye glasses (you are about to press low viscosity glue above your eyes and head). Ensure by testing first that you have a stable position and reach for glueing.

  **Prepare glue applicator**
  Open the cap of sensor glue applicator. Tip can be opened with provided needle.

  **Close the cap when not in use – cure is started with presence of moisture in air. On very dry conditions there may be need of extra time or use extra moisture (or so called super glue accelerators).**

There is two staring gauge sensors found and prepared. One is glued to small piece of steel already. This is thermal sensor measuring steel thermal expansion for compensation. It will be placed close to sensor glued to roof (to be at the same temperature as measured roof material is). Using two strain gauges there is other advantages on system robustness and early warnings if measurement is somehow compromised by poor adhesion for example. In the picture both strain gauge sensors are shown from backside.

Correct side of strain gauge sensor against the roof and glue can be seen visually (where sensor surface is exposed from protecting cover/cable strain relief). This is more visible when looking it both sides having light reflecting from the sensor surface. Another tip of orientation is that thin wires at sensor surface are connected on sensor back side.

Please handle unprotected sensor with care not to contaminate it. A small piece of tape holding Teflon protector film with the cable helps handling it in place.
**Strain gauge glueing**

Apply a small drop of glue to sensor and without further hesitations place and press strain gauge sensor for minimum of 90 seconds.

**Cure starts in seconds with humidity on air.** On dry air humidity conditions the time may be longer. In extreme dry air conditions you use so called fast glue accelerators spray after position and pressing – they contain needed moisture.

Attach sensor cable connector to Ruukki® Roof Sensor circuit board if it is not there already.

**Ver 1.1 is having a single connector for both sensors.** Ver 1.0 sensors may have a separate marked connectors. “Relay Output (Normally open)” – connector: Snow load alarm information can be guided from here to most building automation systems with I/O with cable pair. Those can be installed now or added later on to any of Roof Sensor boards. Connector with screw terminals for the cable pair is provided there ready for use.

Place the connected sensor board to roof metal with bottom magnets.

One good Roof Sensor attachment point is just over the strain gauge assembly protecting sensors from air drafts.

You can hide extra length cables under sensor envelope. In case of smooth surface profile just roll green strain gauge sensors cables around and under the cover edges.
Finalizing sensor board assembly with Light Diffusor Globe.

Fit and press lightly Light Diffusor Globe and twist it to sensor board assembly notches. Check that diffusor globe is attached and cannot slip out by itself just by pulling lightly.

Use cable conduits to finalize the sensor assembly guiding sensor cable towards Ruukki® Roof Sensor Server position.

Follow the same procedure for other specified sensors. Strain Gauge Sensor assembly side is done.

You may connect the Sensor cables to Server units already on the free USB ports by loosening the Server Plastic Cover.

Server units plastic cover is acting as a strain relief for USB-connectors not to slip out accidentally. To get connectors in place lightly twist the cover sides and lift connectors to be more accessible. Insert cables. Press and snap cover back while guiding the cable connectors to slots. In this picture also Power over Ethernet cable is inserted – it has its own locking mechanism connectors.

Attach Ruukki® Roof Sensor Server Box to visible place to wait power and calibration phase.
B Powering up Ruukki® Roof Server

- **Connect Ethernet cable to PoE source after Sensor cables and PoE cable are connected to ports in the Server unit**
- **Power up PoE supply with a power cord**
  Led light should appear to PoE supply as a mark of powering +48VDC Power over Ethernet standard.

Server and sensors in the roof level will automatically boot up. For a moment also Sensor shows lights and flashes of light when server is registered the sensors. (In some rare occasions some sensor light may stay lit showing a load code even calibration is not made yet – this is a pure change having uncalibrated sensor readings happens to be close to the used values).
C How to connect Ruukki® Roof Server WiFi/LAN network

In order to change parameters setting and background pictures you need to have WiFi-capable personal computer, laptop or modern mobile device.

- **Login to RuukkiRoofSensor network**
  - select wireless network (SSID): RuukkiRoofSensor
  - if asked (for the first time) use: RuukkiRoofSensor as a network password (case sensitive)

With WEB-browser go to address: https://ruukkiroofsensor or https://192.168.4.1

In order to make parameter changes you need to use secure https-protocol to connect Ruukki® Roof Sensor service. Different browsers may give different warnings about insecure connection. It is safe to proceed.

You may need to disconnect mobile 3G/4G/5G connections from background because some browser might have a high preference to connect Internet and look for the addresses from Wide Area Network instead of Local Area Network (where address is found).

**For the first time:**
Select menu “Configuration” (https://192.168.4.1/#/configuration)
Click “LOCK”-icon

Use **admin** as the user and **admin** as a password.

Troubleshoot: sometimes this does not work for possible pre-testing reasons. There can be a mandatory first time changed password done – please try admin1 as a password in that case.

- **Change the password**
It is mandatory to change the password for the first time. Change password and please memorize / make note here of the new password.

  Username: admin  
  Password: ____________________

Please remember to inform to building owner/manager Ruukki® Roof Sensor Server new administrator password. For example with this paper.

Regular users do not need this password in order to monitor snow load.

- **Sign in with the new password**
After connecting with new password:
  - Server time is updated from your device  
  - Connected Sensors are registered to system and are seen in a lists  
  - You have privileges to alter the sensor and system preferences settings

Relevant icons appear gray and not active if you are not logged in as administrator or changes are not available on software. You can still see the strain values.

12  EN Roof Sensor Installation instruction
D Finalizing software parameters and user interface

• Update building image

Please select and load suitable picture of building for user interface background picture to help users to see sensor placement on building.

This is for your and user convenience to better track and understand sensors where they are installed. This picture can be changed later for another one if needed.

Take a screenshot to remember the sensor positions over the picture if you change the picture otherwise you need to test and track them again.

• Locate and find corresponding numbering for assembled sensors

Select “Locate sensor” from Configuration page

Click first sensor and select “test alert”. Corresponding sensor will flash at roof and you can check where that sensor number is located.

Move sensors by clicking (round sensor icon) and select “move” and then clicking new position over the background picture.
• Setting up parameters for sensors (one after another from the list row)
  On Configuration page select first sensor row from a list and adjust parameters according roof sensor design and report. Click on the corresponding row. Please note that number does not corresponds numbers in POIMU report but actual locations!

\[ \varepsilon = \text{fill the calculated strain value in numbers for sensor position} \]

**Gauge factor** = no need to change this factory setting (2,1)

In case assembly is done in winter time and there is snow load in the roof at time of calibration please fill physically measured snow load value in here as estimated load (%). More on this on next page.

NOTE: In order to save the new values you need to enter a reason of value change first. Time and reason of change will be recorded on database and can be viewed afterwards. It can be used as an installation note also or verification of changed value.

Please press SAVE-icon

New values are saved. Time and reason of change is recorded.

**Estimated load** (%) is done in practice by estimating and measuring the real weight of snow on the roof in several locations and calculate its load over m2. That is compared to characteristic snow load value on roof found in POIMU software report last pages, in example that is 2.20 kN/m2.

Calibration can be done again when there is no snow load in the roof to make measurements more accurate not depending weighting inaccuracies or estimations.

Please enter, locate and calibrate all other sensors in the list row with corresponding values and save with reason.

Basic sensors settings for snow load monitoring operation is done.
Other settings

In case there is no possibility or readiness to use the other settings the individual setting icon are shown gray (inactive).

• Updating the server software
If there is a note of software improvement or Ruukki® Sensor Network applications available it is possible to update software with a local machine as logged in administrator.

Please first download and make update file available in your browser machine (like in “downloads” folder).

Press Update-icon:
for example update file name can be in a form of “1538153393618.gpg”
Number string is a unix-time-stamp – a larger value means later update if you have a several. At this view you can see time stamps beside icon.

After update system will reboot showing some flashing of alarm lights and boot up with updated software with improvements. Updating software do not have effect on already collected history values, database notes (reasons) or registered sensors or they calibration or measured values.

• Remote information or backup data
In case you need remote information or backup data from Ruukki® Roof Sensor it needs to have access outside from Local Area Network where cloud service is operating.

This can be done by connecting:
– Ethernet cable to available and already Internet capable connected Local Area Network (LAN)
(some network adjustments may be needed depending of the present network configurations and firewalls, you may need to consult your IT)

Arranging some other connection method like 3–4G connections to Local Area Network where Ruukki® Roof Sensor operates. (some monthly payments will apply).

Ruukki® Roof Sensor will then just send data for predefined system for remote backup purposes one-directionally only. Server does not accept incoming access as a factory default.

Having a remote information possibility this backup information of roof measurements are likely useful when contacting with Ruukki Construction Oy specialist for some roofing advice.

• Design files and documents
You can upload relevant design files to local Roof Sensor itself in order to find relevant information later for further use. These can be like POIMU calculus or reports, design files, pictures like building background picture or installation pictures, locations of electricity or connection points. Or even picture of some changes in installation phase.
• Information on additional measurements
  There is nothing to be configured here. Box contains also one Bluetooth sensor – RuuviTag – a small clever device is software compatible with Ruukki® Roof Sensor as additional measurement for end user convenience and monitoring needs.

  They are seen as Blue Rectangles in Roof Sensor user view – you can move them to representing location when signed in as administrator.
  Regular users can click on the icons and have the latest Ruuvi Tag sensor readings (similar way as snow load and its integrated T/%RH/P information).

  After powering Ruuvi Tag by its internal battery there is temperature, humidity and air pressure data available in the Ruukki® Roof Sensor Server page if Tag is in range. There is also accelerometer information if Tag is configured to another mode. Mode can be changed by opening the Ruuvi Tag case and press “B” button once. Picture of open Ruuvi Tag and more information and possibilities can be found at https://ruuvi.com/ruuvitag-specs/. Ruukki® Roof Sensor accepts 5 pcs of Ruuvi Tags at the moment.
Information on using multiple Ruukki® Roof Sensor box contents on larger monitoring system with multiple sensor points in different and distant parts of building

By using Ethernet cabling it’s possible to create a large area monitoring system covering hundreds of meters distances using general Local Area Network methods – even there is no house Ethernet cabling available. With affordable Ethernet switches and cables a larger Roof Sensor system with own isolated and secure local area network can be easily created.

PoE Injectors is useful to install close to LAN Switch location (at technical space) so all needed power is delivered from floor level with Ethernet cables – no extra power sockets are needed in the space itself and no batteries are need to be changed regularly on the roof.

First install one box contents according to these installation instructions as a Server unit. Following boxes are installed as Nodes (Server unit turned into a Node mode beforehand prepared on the floor level)

To put larger system to work in practice there is a need to have only one Roof Sensor Server. Even system is working technically correctly and the visual lights are operating correctly with multiple servers, the software user will be quite confused with multiple systems.

Change a Server to Node (a slave unit mode):
“Server-to-Node” setup file is copied on empty USB-stick. USB-stick is put in to the Ruukki® Roof Sensor unit USB-port and reboot device (switch power off and then on). After rebooting the device acts as a Node even without the USB-stick. Server provides Wi-Fi hotspot – Node does not. Configured Node can be changed back to Server mode with a different setup file “Node-to-Server” on connected USB-stick and reboot – if ever needed to do so.

Setup files can be downloaded from: https://www.ruukki.com/b2b/products/load-bearing-profiles/load-bearing-sheets/ruukki-roof-sensor
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