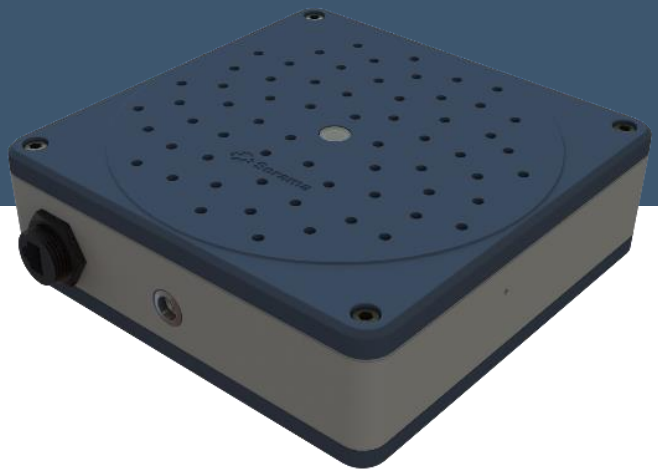
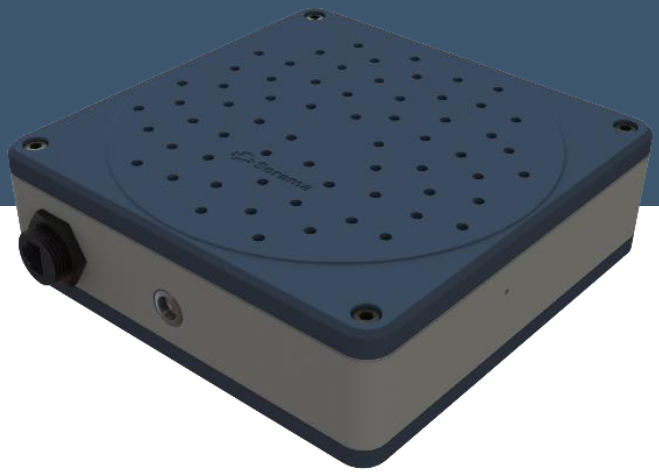
Sorama

L642
Acoustic Monitor

User Manual





Date of issue: 02/02/2024

Firmware version: 2.9.0

Contents

Conformity

Sorama B.V.

Achtseweg Zuid 153H

5651 GW Eindhoven

The Netherlands

Declare under our sole responsibility that the products:

Product name	**L642 Acoustic Monitor**
Model number(s)	**L642, L642+, L642v, L642v+**

Are in conformity with the requirements of the following EU Directive or other normative documents. This declaration is based on the full compliance of the products with the following European standards:

- **2014/30/EU For Electromagnetic compatibility directive (EMC)**
  - EN 61000-6-3:2007+A1:2011
  - EN 61000-6-2:2005 + AC:2005
- RoHS3 Restriction of Hazardous Substances
  - EU2011/65/EU RoHS2
  - EU2015/863

Technical Compliance Data held by:

Sorama B.V.

Achtseweg Zuid 153H

5651 GW Eindhoven, NL

Signed for and on behalf of Sorama B.V.

Name: Rick Scholte, CEO

Address: Achtseweg Zuid 153H, 5651 GW, Eindhoven

Safety Information

This document contains important information which should be kept at all times with the instrument during its operational life. Any user of this instrument should be in possession of these instructions with the instrument. Eventual updates to this information will be added to the original document. The instrument can only be operated by trained personnel in accordance with these instructions and local safety regulations.

This instrument is intended only for the measurement of sound and vibration. The instrument is appropriate for continuous use. The instrument operates reliably in demanding conditions, as long as the documented technical specifications of all components are adhered to. Compliance with the operating instructions is necessary to ensure the ideal performance.

Replacement Parts and Accessories

Only use original parts and accessories approved by the manufacturer. Using non original replacement parts and accessories can compromise the operation safety and functionality of the product. Misuse will void warranty.

To prevent possible electrical shock, fire, or personal injury follow these guidelines:

• Read all safety information before you use the product.

• Use the product only as specified in this manual.

• Do not use the product around explosive gases and vapor.

• Do not use the product if it is damaged.

• Do not use the product if it operates incorrectly.

• Do not apply more than the rated voltage.

• Incorrect wiring can damage the sensor and void the warranty. Before applying power, make sure all connections are correct and secure.

• To prevent possible electrical shock, fire, or personal injury make sure that the sensor is grounded before use.

• Only allow an approved technician repair the product.

• The metallic enclosure of the sensor is not necessarily earthed by installation. At least one of the following safety measures must be met to minimize the danger of electrostatic charges:

  o Earth grounding of the cable shield

  o Installing the unit's metallic enclosure on an earth grounded mounting bracket or on any other grounded bases

  o Protect the operator from electrostatic discharge

Contacts

The supplier will, during the warranty period in office hours (GMT +1), provide the required first line support when technical faults occur. Customers can request support by sending an email to support@sorama.eu or by calling +31 (0) 40 247 4484. After receiving a detailed description of the occurring error(s), Sorama will evaluate the problem. When the issue does not have any relations to the services of Sorama or support is requested outside the warranty period, costs will be charged to the customer.

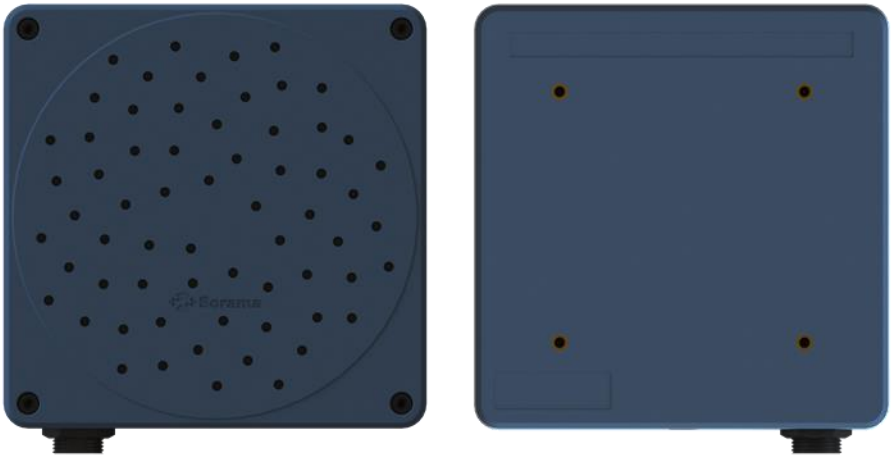
1 Description

The Sorama L642 is the evolution in acoustic monitoring solutions. It combines the powerful use of acoustic imaging, detection of sound levels, and accurate localization. The Sorama L642 supports edge computing, all powered and connected with one single network cable.

The Sorama L642 can be used in a variety of application fields: safety and security, mobility, environmental and loud vehicle detection. The acoustic monitors can be easily connected to cover larger areas with secure and GDPR proof data handling.

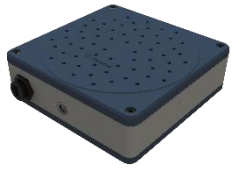
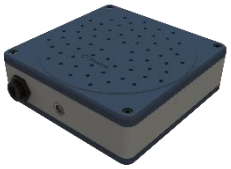
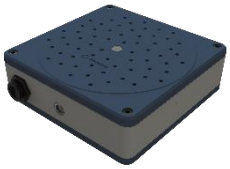
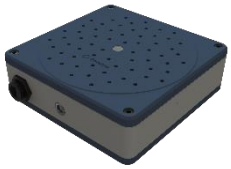
1.1 Features

- All in one acoustic monitoring
- Environmental noise monitoring
- Visual light camera integrated (L642V)
- Sound intensity mapping

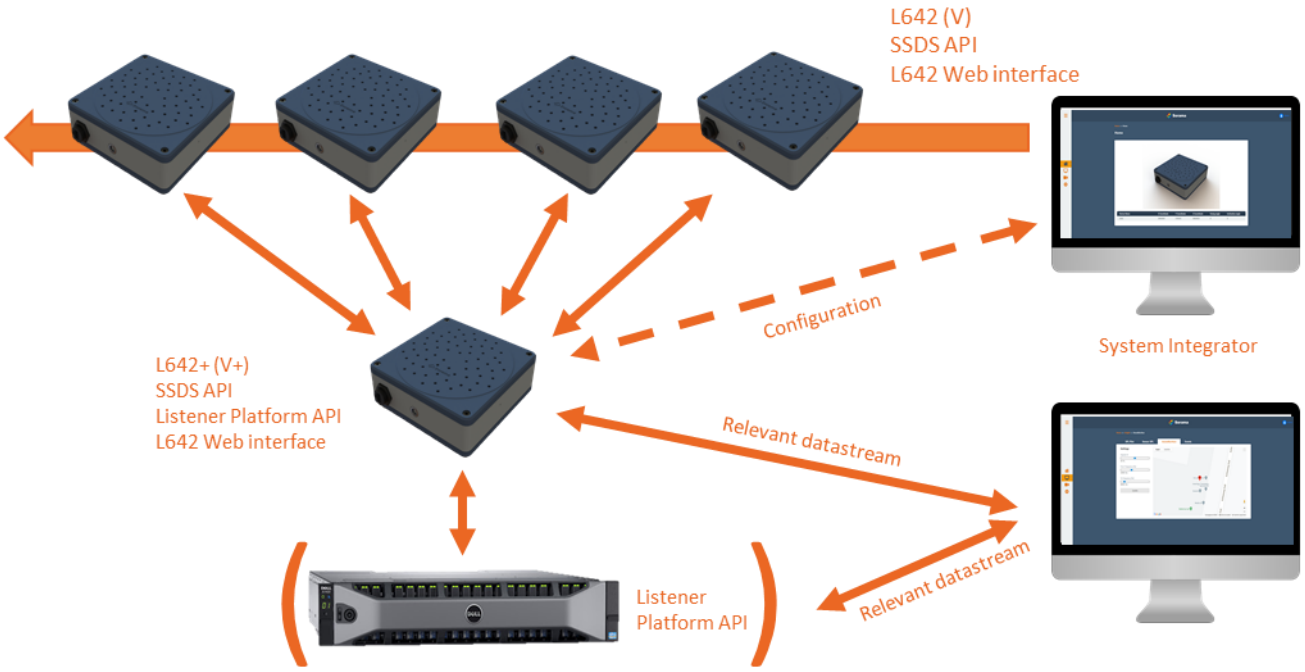


1.2 Available models

The following model variants from L642 series.

			
Sorama L642	**Sorama L642+**	**Sorama L642V**	**Sorama L642V+**
• 64 MEMS microphones • Sunflower Array • Jetson Nano • Base API Framework • Sound Source Detection API • dB Values • Localization	• 64 MEMS microphones • Sunflower Array • Jetson Xavier NX • Base API Framework • Sound Source Detection API • dB Values • Localization	• 64 MEMS microphones • Sunflower Array • Jetson Nano • Base API Framework • Sound Source Detection API • dB Values • Localization • Integrated camera	• 64 MEMS microphones • Sunflower Array • Jetson Xavier NX • Base API Framework • Sound Source Detection API • dB Values • Localization • Integrated camera

1.3 System Overview



2 Technical Data

2.1 Physical Properties

Size (LxWxD)	170 x 170 x 65 mm	6.7 x 6.7 x 2.5 inch
Weight	0.85 kg	1.7Lb
Power	PoE+ port 100-240V AC, max 37W; IEEE 802.3	Status LED red, green

2.2 System Integration

API	Open HTTP REST
Event Triggers	dB SPL or SoundSurfaces™ Threshold
Event Actions	Acoustic SoundSurfaces™ overlay
Output Protocols	Websocket and ModbusTCP

2.3 Camera (for L642v and L642v+)

Integrated visible light	
Resolution video	720x1280
Aspect ratio	16:9
Camera Resolution	720p at 30fps

2.4 Microphones

Type	MEMS	Digital Bottom Port
SNR (A-weighted, at 1 kHz)	64 dB for 94 dB SPL	@ 1kHz
Sensitivity	-26 dBFS +/- 1.5dB	At 1 kHz, 94 dB SPL
Acoustic Overload Point	120 dB SPL	At 1 kHz, <10% THD

2.5 General

Ingress Protection	IP54
Operating Temperatures	-20 °C to 50 °C (4 °F to 122 °F)
Warranty	2-year

3 Environment

3.1 Ambient Temperature

The L642 is designed for ambient operating temperatures between -20°C to 50°C (4°F to 122°F). It is necessary to verify the environmental temperature. Make sure to install the housing at a safe distance of any nearby heating sources. Note that cold water can cause condensation, which can lead to damage in the device. The ambient operating relative humidity is between 10-100% RH (non-condensing).

3.2 Protection

The L642 complies with the international protection standard IP54. For V and V+ versions, a protective lens is attached. Please be aware that the L642 is not watertight but splash-proof. The effectiveness against splashing under IP54 is possible only if the device is inspected periodically to inspect all seals of the waterproof connectors.

4 Installation

The L642 series is an IP based device. A good reliable network and power infrastructure is the backbone of every IP based solution, and the same applies to the L642 acoustic monitor. In the installation you will first find the minimum requirements we prescribe to have the best operating experience with the L642 acoustic monitor.

4.1 System Requirements

1. **Power:** The L642 is powered via Power over Ethernet (PoE) (IEEE 802.3af-2003). Only one Cat5e or Cat6 network cable is needed for connecting a Listener. The L642 uses around 10-15 Watt of power. The power can be provided either via a PoE Switch or a separate PoE injector to the L642. The L642(V)+ needs PoE+ (IEEE 802.3at-200) and uses up to 20 Watts of power.

2. **Connection (Wired):** The L642 can be connected to the network via one Cat5e or Cat6 network cable. In case of a fiber optic network a fiber to copper converter needs to be used to connect the L642 to the network.

3. **Connection (Wireless):** In case of a wireless network requirement, the L642 can be connected to the network using a Wifi, 4G or 5G router.

4. **Throughput:** The L642 uses about 3 Mbit/sec of data and the L642(V) uses up to 7 Mbit/sec of data. (Note: the value is subject to change in the future)

5. **Internet:** The L642 does not need an active internet connection to function. However, if the SoundSurface™ tab is used, an internet connection is needed to load the Google Maps image.

6. **Network requirements**
    1. **Throughput:** The L642 uses about 3 Mbit/sec of data for live SoundSurfaces™ and up to 15Mbit/sec if also video is used (streaming page).
    2. **Broadcast/Multicast messages:** The network, on which the L642 devices are connected, has to support (or not block) broadcast messages. Broadcast messages from the L642 are used to find them (mDNS protocol, ZeroConf). The ZeroConf uses the following IP address: 224.0.0.251. Alternatively, the user can configure a static IP to reach the unit, mDNS is not required then.
    3. **Used Ports:** Communication to an L642 device is handled via ports 80, 443, 9011, 9012, 9013, 9014, 9015 and 9016.

Stability: The L642 device is able to recover from network failures. However, if a network is down for a longer time, data might get dropped. The L642 buffers all data for at least 30 seconds. This data can retroactively be retrieved.

4.2 Connecting the L642

There are several modes in which you can connect the L642:

1. Mode 1: Connect to a Network using DHCP
2. Mode 2: Connect directly to a PC/Laptop using Auto IP
3. Mode 3: Connect to a Network using Static IP
4. Mode 4: Connect directly to a PC/Laptop using Static IP

ⓘINFORMATION

When you get a new L642 device, it is configured so it can be connected in both mode 1 and 2 without any additional configuration.

If you want to configure the L642 to connect it in mode 3 or 4, you will first need to connect it in mode 1 or 2 and change the configuration of the L642 via the dashboard as explained in section 4.3.

ⓘINFORMATION

To power the L642, you need a PoE injector or PoE capable switch. The PoE switch detects if a device needs PoE or not. The requirement is PoE+ for the L642+ and L642V+

⚠IMPORTANT

Firmware version 1.0.0 only supports **Mode 1 connections**.
Starting from firmware version 1.0.1, all 4 modes are supported.

4.2.1 Mode 1: Connect to a Network using DHCP

To connect using mode 1, connect the L642 to a network which has a DHCP server available. Typically, the router of your network runs a DHCP server, but this can also run in a server computer. Contact your network administrator for more information about your particular network setup.

Connection can be made in two ways (note '+' devices require PoE+):

1. Connect the L642 directly to a suitable PoE capable switch that is connected to the network
2. Connect the L642 via a suitable PoE injector to a non-PoE capable switch that is connected to the network

The DHCP server will then automatically provide an available IP address to the L642 in the address range that the network administer has configured. The devices that can communicate with the L642 (e.g. your PC/Laptop) need to be connected to the same network, either via a wired connection or a wireless access point.

4.2.2 Mode 2: Connect directly to a PC/Laptop using Auto IP

To connect using mode 2, connect the L642 directly to a PC or Laptop.

Since ethernet ports on a PC/Laptop are (almost) never PoE capable, you will require a suitable PoE injector. Connection can be made in two ways (note '+' devices require PoE+):

1. Connect the L642 via a suitable PoE injector to a free ethernet port on your PC/Laptop
2. Connect the L642 via a suitable PoE injector to an ethernet-usb dongle plugged into your PC/Laptop

The L642 will assign itself an IP address in the 169.254.0.0/16 range, also known as the Auto IP range.

4.2.3 Mode 3: Connect to a Network using Static IP

To connect using mode 3, connect the L642 to any network (with or without DHCP server).

Connection can be made in two ways (note '+' devices require PoE+):

1. Connect the L642 directly to a suitable PoE capable switch that is connected to the network
2. Connect the L642 via a suitable PoE injector to a non-PoE capable switch that is connected to the network

A manually determined, fixed IP address can be assigned to the L642 via the Dashboard.

> ⚠ IMPORTANT
>
> Manually setting a static IP Address incorrectly can lead to the device becoming unreachable. Make sure you configure the device correctly or ask your network administrator for help.

4.2.4 Mode 4: Connect to a to a PC/Laptop using Static IP

To connect using mode 4, connect the L642 directly to a PC or Laptop.

Since ethernet ports on a PC/Laptop are (almost) never PoE capable, you will require a suitable PoE injector. Connection can be made in two ways (note '+' devices require PoE+):

1. Connect the L642 via a suitable PoE injector to a free ethernet port on your PC/Laptop
2. Connect the L642 via a suitable PoE injector to an ethernet-usb dongle plugged into your PC/Laptop

A manually determined, fixed IP address can be assigned to the L642 via the Dashboard.

> ⚠ IMPORTANT
>
> Manually setting a static IP Address incorrectly can lead to the device becoming unreachable. Make sure you configure the device correctly or ask your network administrator for help.

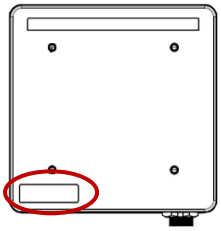
4.3 Setting up the L642

Before you start:

- Make sure the L642 is connected to your PC/Laptop in either mode 1 or mode 2 as described in section 4.2
- Wait until the indicator light (on the side of the L642) becomes solid green.

Step 1

Keep the serial number of the L642 ready. The serial number can be found on the back of the device at the bottom-left.

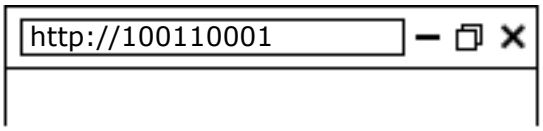


Step 2

Open your web browser (Chrome, Firefox, Edge, Safari)

Step 3

Type *http://<serial number>* in your address bar. E.g. *http://100110001*



If your network does not have DNS server or if you connected the device directly to your PC add *.local* at the end of the serial number address. e.g. *http:// 100110001.local*

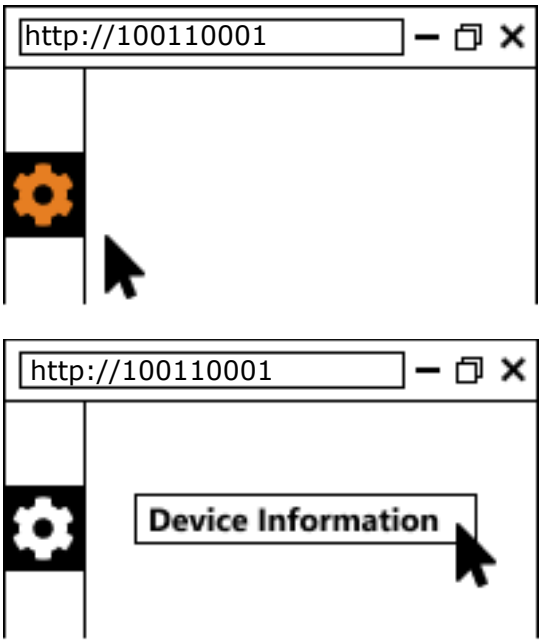
Step 4

Your browser will now show the device dashboard and prompt you to login. The default credentials are:

Username: admin
Password: admin

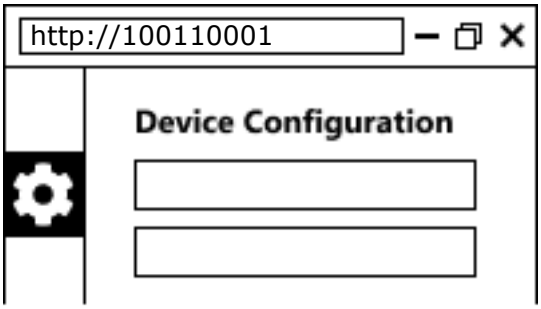
Step 5

In the device dashboard go to the “Device Configuration” page and click on Device Information



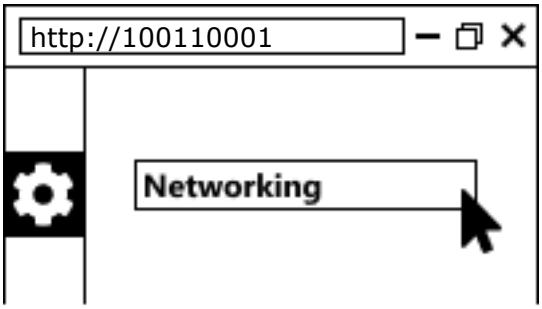
Step 6

Set the device coordinates and relevant installation information such as angles and target distances (if known)



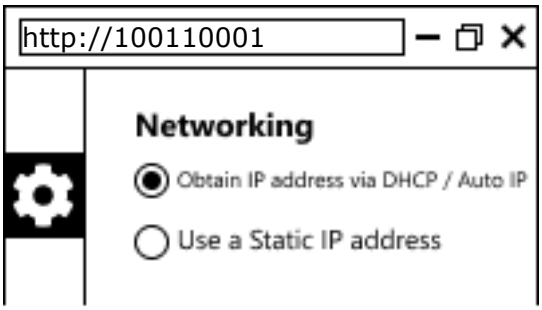
Step 7

Go back to the “Device Configuration” page and click on Networking.



Step 8

In the Network page set the preferred network settings according to your project.



⚠ IMPORTANT

Firmware version 1.0.0 only supports DHCP.
Starting from firmware version 1.0.1, DHCP, Auto IP and Static IP are all supported

Select “Obtain IP address via DHCP / Auto IP” (the default) if you want to run the L642 in either mode 1 or 2 as described in section 4.2. No additional configuration is required.

Select “Use a Static IP address” if you want to run the L642 in either mode 3 or 4 as described in section 4.2. You will need to specify the following:

- IP address: The static IP address that the L642 should use
- Subnet mask: The subnet mask of the network the L642 is (going to be) connected to
- Gateway: The gateway address of the network the L642 is (going to be) connected to
- Primary and Secondary DNS Address: The IP addresses of the primary and secondary DNS server on the network.

After the device has been configured, you will need to reload your browser window since the IP address of the L642 has changed. Depending on your network setup and the values you have entered, you might also need to change the configuration of your network adapter before you can reach the L642 again. Ask your network administrator for assistance.

ⓘ INFORMATION

Currently all values need to be specified. If you do not need one of the values, just leave it at the default setting. If you don’t know what these settings mean, contact your network administrator.

⚠ IMPORTANT

Manually setting a static IP Address incorrectly can lead to the device becoming unreachable. Make sure you configure the device correctly or ask your network administrator for help.

4.3.1 Using the L642 with HTTPS

It is also possible to use the L642 with a secured HTTPS connection. This causes the device's information to be encrypted, and is a more secure way to communicate with the L642 than HTTP.

Before this can be done, the client device on which the L642 is monitored (desktop, laptop, etc.) should "trust" the Sorama certificates. How to do this is described below:

1. Go to the Sorama developer page https://sorama.eu/dev, and download the *Sorama Root CA.cer*, *Sorama Intermediate CA.cer* and *Sorama Leaf Intermediate CA.cer* onto your laptop or desktop.
2. Double click on the downloaded "Sorama Root CA.cer"
    - click 'Open'
    - click 'Install Certificate…"
3. Decide for who to install this
    - "Current User" only for the current logged in Windows user
    - "Local Machine" for everybody using this Windows PC
    - Select the one you want and click "Next"
4. Select the store where to install this certificate
    - Select "Place all certificates in the following store"
    - Then select "Trusted Root Certification Authorities"
    - Click "Finish"
    - (if prompted) Click "Yes" to be sure you trust this Root certificate
5. Follow the same steps for "Sorama Intermediate CA.cer" and "Sorama Leaf Intermediate CA.cer" except instead of selecting the "Trusted Root Certification Authorities" at step 4b, select "Intermediate Certification Authorities"
6. Your browser will likely need a restart, after that your certificates are ready

Once these certificates are trusted, HTTPS can be enabled. To enable HTTPS, go to

Networking on page 40.

ⓘINFORMATION

When enabled, the device will use its on-board TLS/SSL certificate to host the dashboard and all APIs in secure HTTPS mode (and WSS for websocket connections). If the device does not have a certificate installed, or the certificate has expired, HTTPS will automatically be disabled even if you enable this option. In that case, please contact your vendor.

4.4 Performing a firmware update

Before you start:

The following steps assume you have already completed the device setup as described in section 4.3, and can access the device dashboard.

Step 1

In the device dashboard go to the “Device Configuration” page and click on Firmware Update.

Step 2

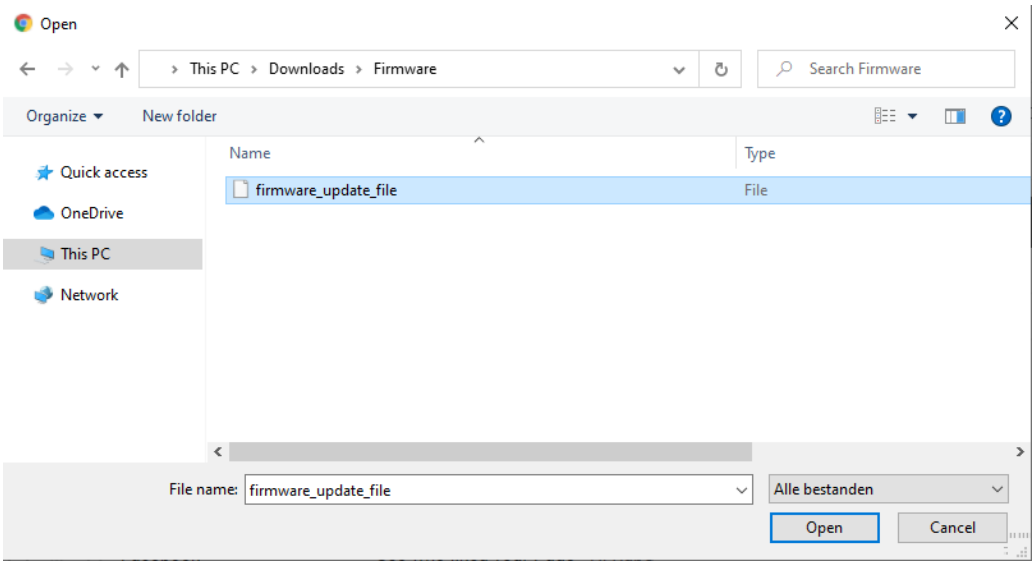
On the Firmware Update page, click “Click here to select a file”. A file selection menu will appear.

⚠ IMPORTANT

When the unit is updated in auto-IP, the IP may change after the update. The new IP can be found with an IP scanner, or the device can be reached locally with the serial number.

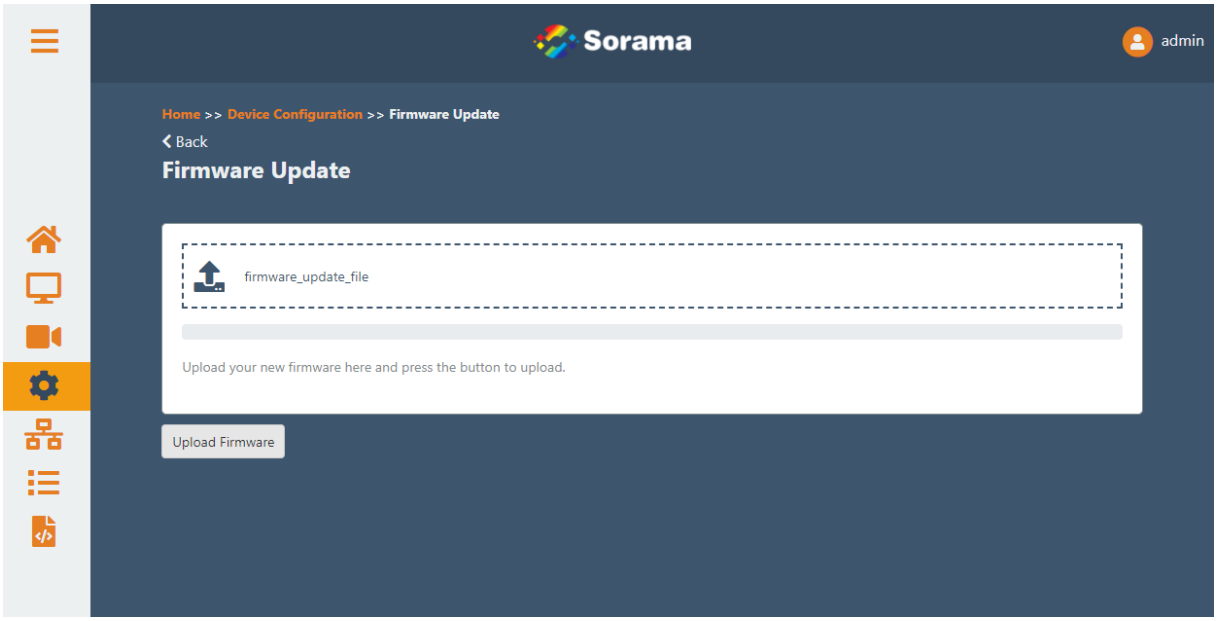
Step 3

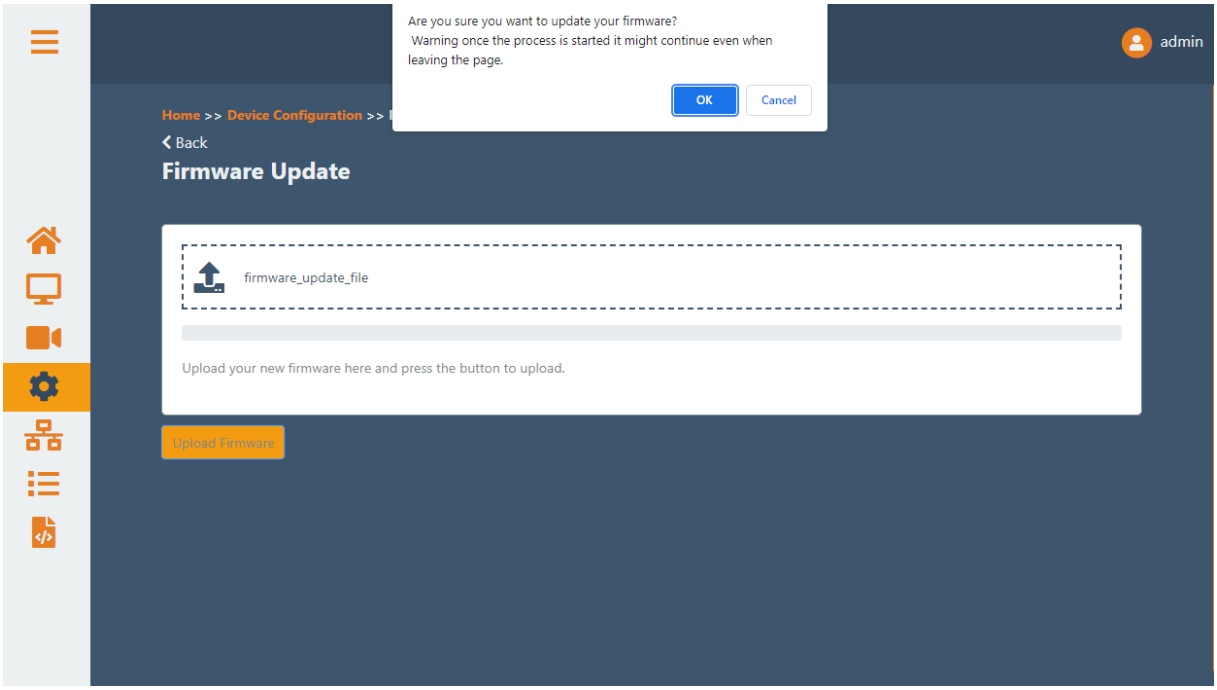
Select the firmware file from the file selection menu and click “Open”.



Step 4

Click “Upload Firmware”. A popup window will appear asking you to confirm, click “OK”.





Step 5

First, the file will be uploaded to the device. The progress bar indicates the progress of the upload.

Second, the device will install the new firmware, this can take between 1 and 5 minutes. The progress bar will keep animating during this process.

When the firmware update is complete, the progress bar turns green. The device will now be reset. Wait until the led on the device turns green again, then refresh the dashboard and you can start using the device with the new firmware.

4.5 LED Indicator

The LED indicator is a small semi-transparent dot (powered off) on the side of the L642.

Color:	state:	Function
Red	Solid	Starting or error state
Green	Solid	Ready

The LED indicator can be turned off through the dashboard. This can be done on the Device Information page as described in chapter 5.5.4 on page 42

4.6 General Mounting solution

L642 has three main ways to be placed in the environment. No matter the mounting choice, we advise to make use of the Vesa 10 mounting on the back of the unit.

4.6.1 Pole mounted

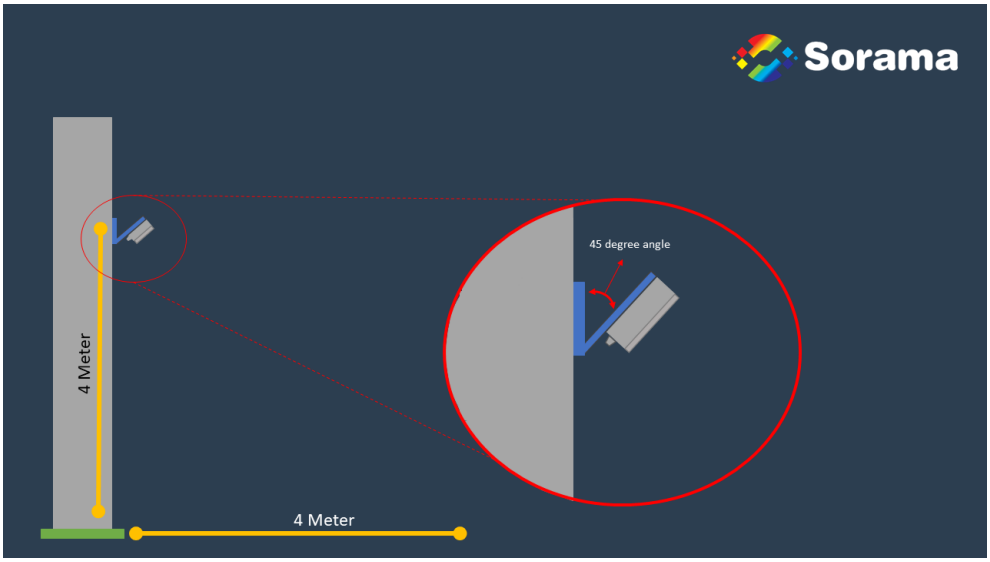
Sorama has a pole mounting bracket available that can be ordered as a separate accessory which can be connected to a pole mount adapter.

The orientation should be such that the RJ45 connector of the L642 is facing the pole.

4.6.2 Wall mounted

Sorama has a 45 degree wall mounting bracket available that can be ordered as a separate accessory.

The orientation should be so that the RJ45 connector points to the wall.



4.6.3 Mounting height

The mounting height is depending on your situation and differs from area to area. In general, the distance to the area being measured should be:

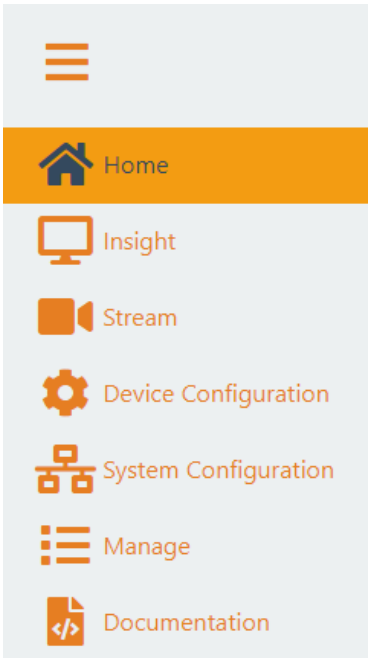
- Minimum of 4 meters.
- Maximum of 15 meters.
- Outside of these bounds the system will not be able to properly monitor the whole area.
- Inside of these bounds, the area that can be monitored approximately equals twice the mounting height. Example:
    - The L642 mounted at 4 meters high can cover an approximate area of 8x8 meters.
    - The L642 mounted at 8 meters high can cover an approximate area of 16x16 meters.
    - The L642 mounted at 15 meters high can cover an approximate area of 30x30 meters.

⚠ IMPORTANT

No other holes should be drilled in the housing as this will affect the water-resistance capabilities of the device or worse damage the electrical components inside.

5 L642 Dashboard

L642 devices have (almost) all functionality visible on the dashboard. All functions provided via the dashboard are also available by directly using the API. Use the navigation menu to the left to go the following pages:



Only on "V" devices

Only on "+" devices

Extra pages may appear when using licenses to unlock licensed features.

5.1 Home Page

Providing the basic information of the selected L642; name/tag, IP address, Serial number, MAC address and Firmware version.

5.2 Insight pages

The insight page provides several tabs with basic insight to the acoustic data of the device.

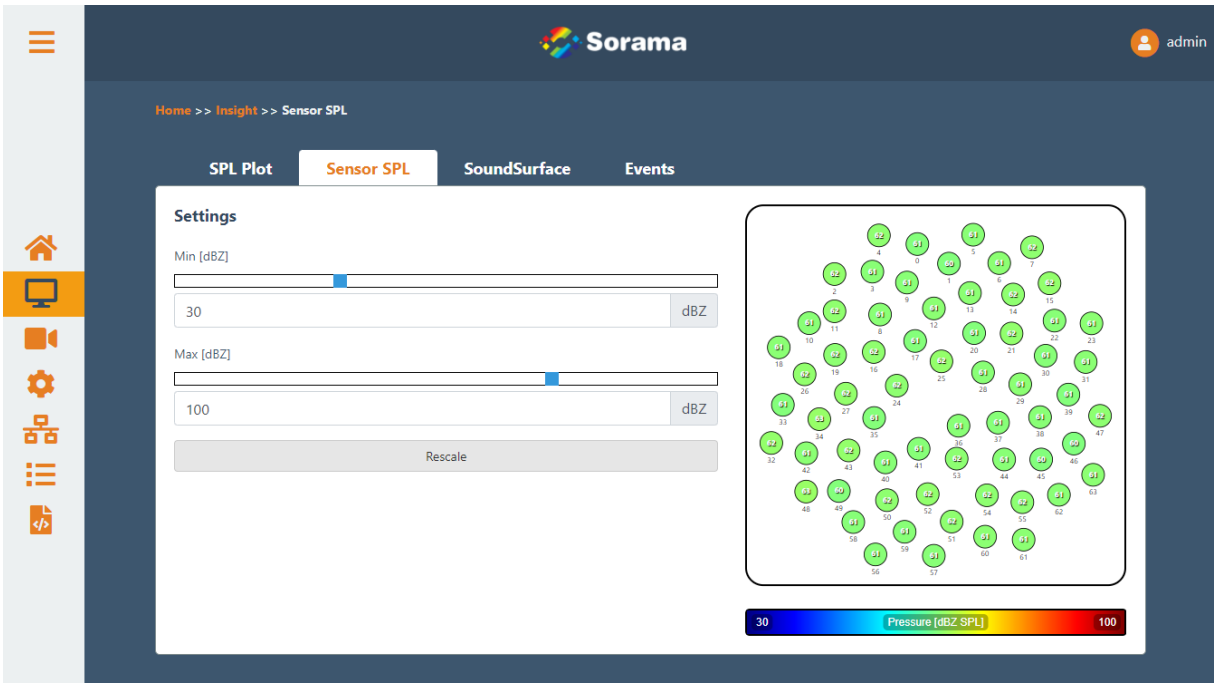
5.2.1 SPL Plot

Out of the box, on this page the Sound Pressure Level (SPL) is measured in dB(A) and dB(C) over time. A higher SPL value corresponds with higher sound intensity.

- Mode: Live mode will update the SPL graph live. In History mode, historic data can be viewed from the selected start time till selected end time.
- Start Date/ End Date: here the start and end times for the historic plot can be selected. When the start/end dates are changed, press Update Graph to revisualize the plot.
- Export Leq Data: Get a file with the currently visualized SPL data. This can be both a .csv or a text file
- Export Lden Data: Get a file with all the stored Lden data. This can be both a .csv or a text file
- Export Ldn Data: Get a file with all the stored Ldn data. This can be both a .csv or a text file
- Export LAmax: Get a file with all the stored LAmax data. This can be both a .csv or a text file

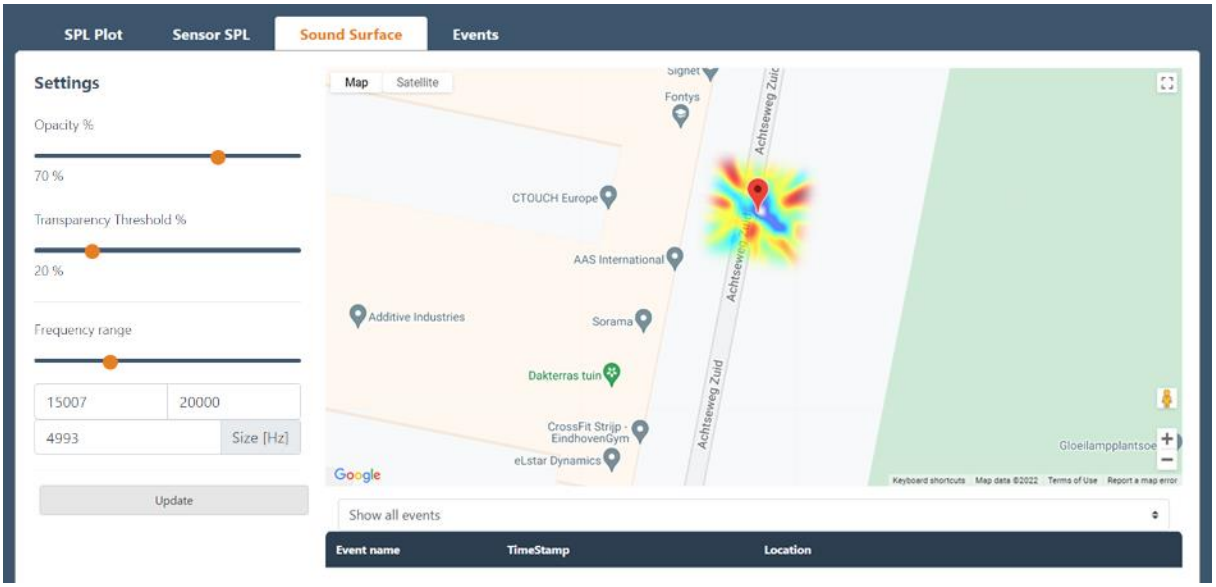
5.2.2 Sensor SPL

At first use, on this page the sound pressure level of every single channel is measured in dB(Z) and displayed respectively. You can easily check if there is any abnormality coming from any of the microphone channels using this page.



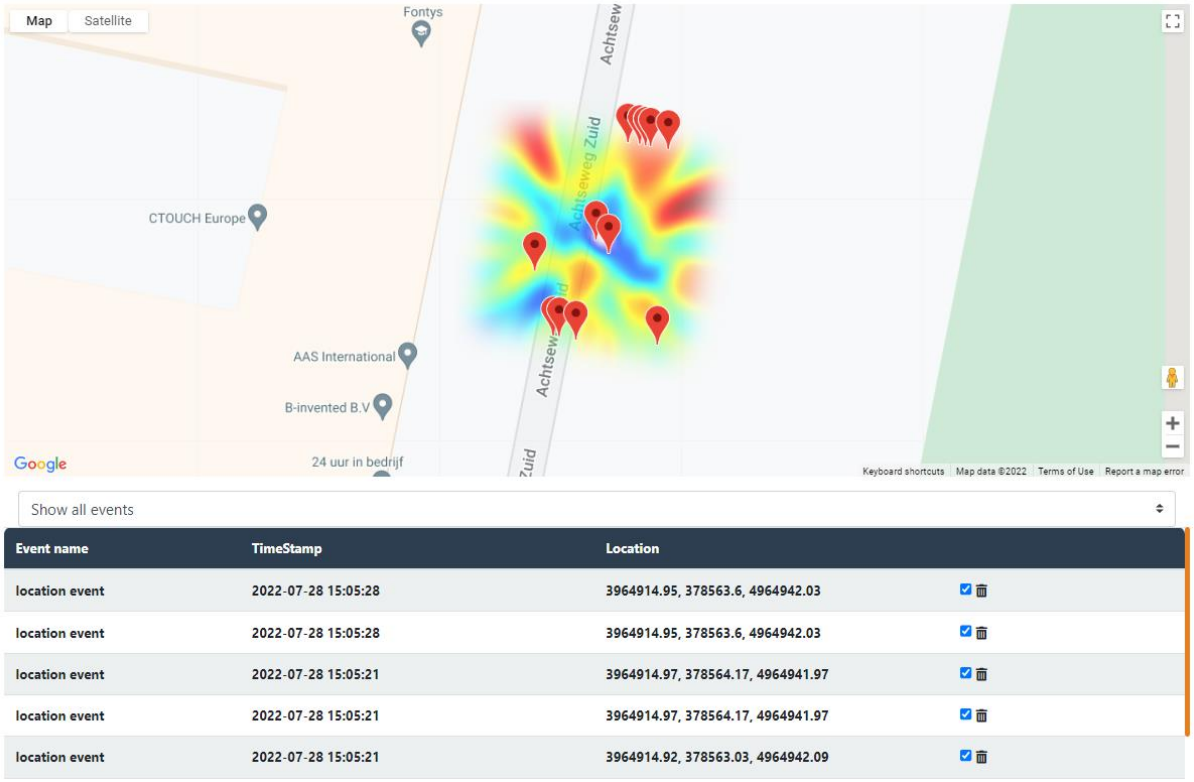
- Use the Min slider or input box to set a minimum value. Any value below this value will be colored dark purple.
- Use the Max slider or input box to set a maximum value. Any value above this value will be colored dark red.
- Rescale will reset the min/max values to scale with the data coming from the device at the moment the button is pressed.

5.2.3 SoundSurface™



Each acoustic monitor has a specified GPS-position, height and orientation. The L642 uses spatial filtering to detect where sound is coming from. The sound intensity of its monitored area is plotted on a background image (map). An example for the User Interface is given in the figure below.

- Use the opacity slider to make the SoundSurface™ drawn over the image more opaque.
- Use the transparency slider to make the lower sound levels transparent.
- Use the Frequency range slider to configure which frequencies should be used in the analysis of the SoundSurface™ in this page. Press Update to update the frequency selection.

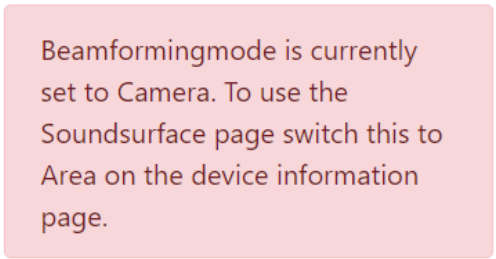


The Soundsurface page can also show the triggered events and the location of the events.

- Logged events are displayed below the SoundSurface™ image. When an event is triggered on a certain position, the location where this event was triggered is shown on the map. With the dropdown menu, you can choose to:
    - Show all events
    - Show last the event
    - Show no events
- Events can be discarded by clicking the 🗑 icon, or simply turned invisible by unticking the box.

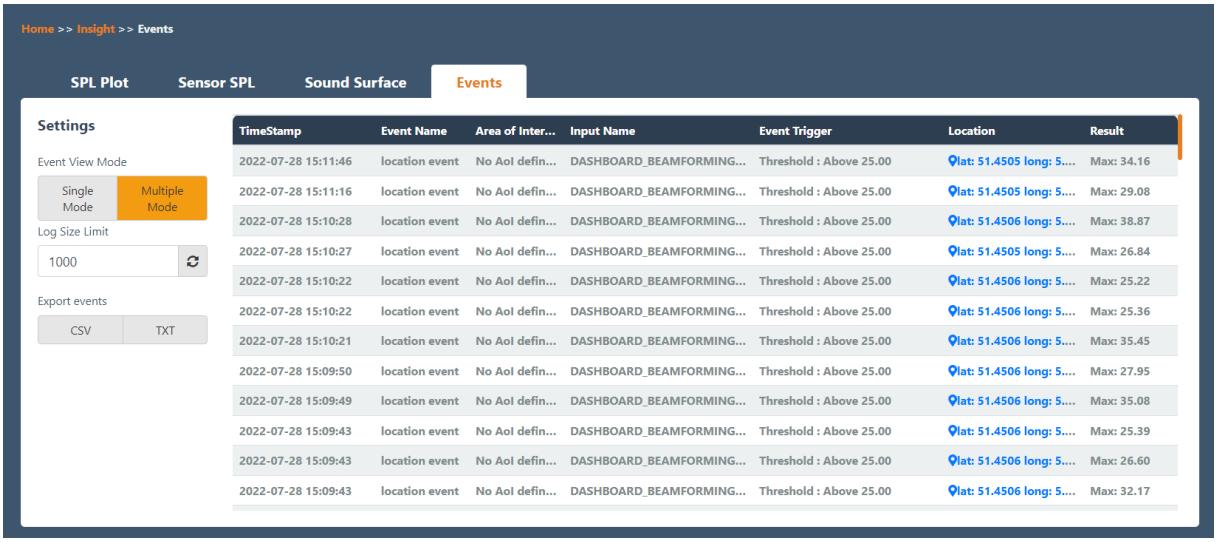
ⓘINFORMATION

The following warning is shown when the beamforming mode is set to camera. Set the beamforming mode to area on the Device Information page.



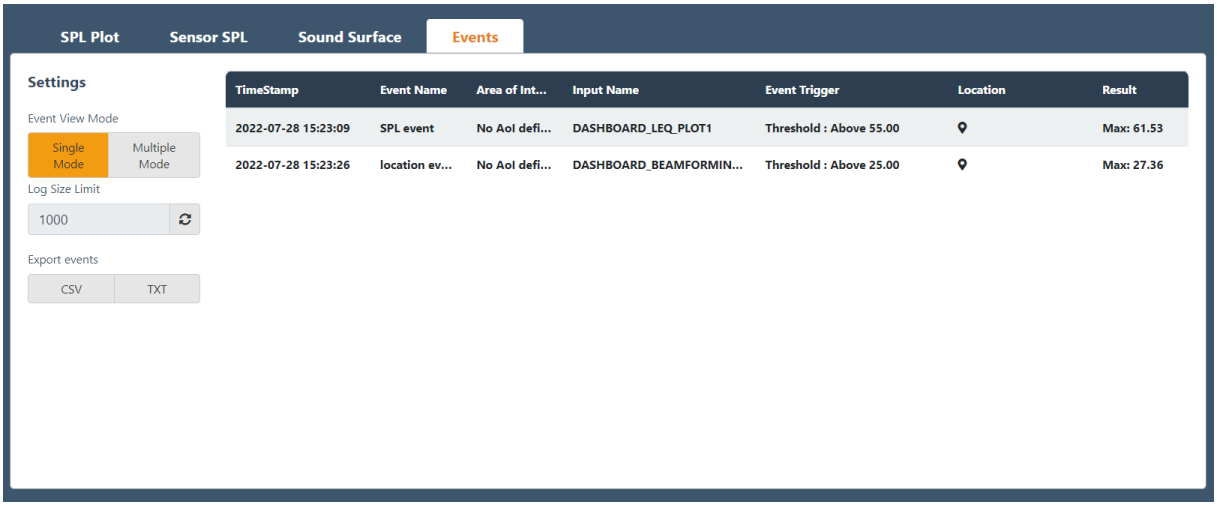
5.2.4 Events

Created events that are triggered can be monitored on the events page.



In “Multiple Mode”, all triggered events are displayed with timestamp and additional information.

- Log Size Limit is the amount of events that will be displayed on the events page. Use the reload button (↻) to refresh the log size
- Use the CSV button export to export the events in “.csv” format or the TXT button for “.txt” format.

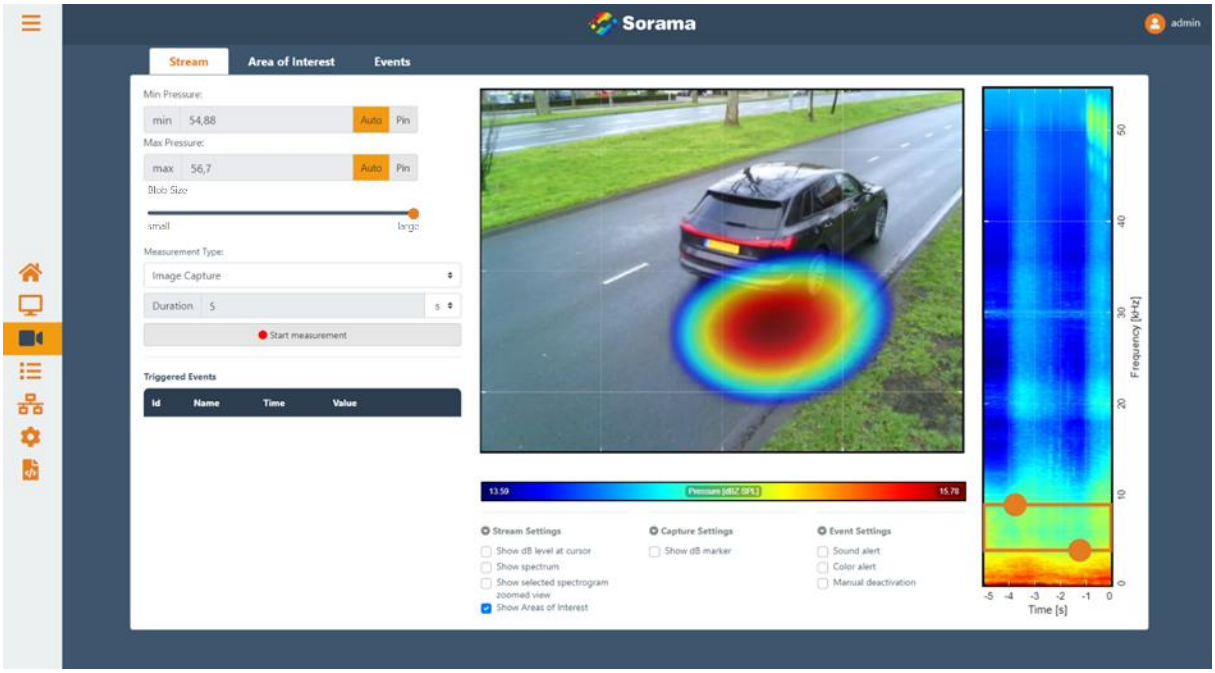


In “Single Mode”, only the latest instance of the triggered event is displayed, and refreshed whenever the event is triggered again. More information about events will be discussed on the Management page.

5.3 Streaming page

5.3.1 Stream

The streaming page shows the camera feed with the SoundSurface™ overlay. This page is only available on “V” devices. The live feed is indicating the spot where the loudest sound, from within the selected frequency range, is located. The selected frequency range is indicated by the orange outline in the spectrogram plot. Using the spectrogram, a user can see information about the frequencies that are detected. Red colors represent high intensity, blue colors represent low intensity. The sound pressure (dB(Z)) within the selected frequency range can be seen in the color bar and in the min/max pressure underneath the stream.



- The user can drag the frequency range to view a different band or make it smaller/larger by dragging the orange circles. The minimum frequency range is 2000 Hz wide and the maximum frequency selection is 8000 Hz wide.
- The min/max values can be pinned by clicking “Pin”. They can then be set by the user
- The min/max values can be automatically rescaled by clicking “Auto”. They will then rescale automatically to best visualize the sound sources
- Blob Size: With this slider, the user can decrease the size of the SoundSurface™ source indicators. This slider effectively decreases the gap between the min/max SPL value in the SoundSurface™. This feature is useful to better visualize low frequency sources.
- MultiSource Settings: the multi source filter can be enabled by checking the Apply Multi source under the Stream Settings options.
    - Number of Sources: Enter an integer value that specifies the number of sources to be displayed by the SoundSurface™ source indicators.
    - SNR Threshold: The SoundSurface™ source indicators are drawn when the SNR exceeds the threshold value. When there are no sound sources detected above the threshold value, no source indicators/blobs are drawn.

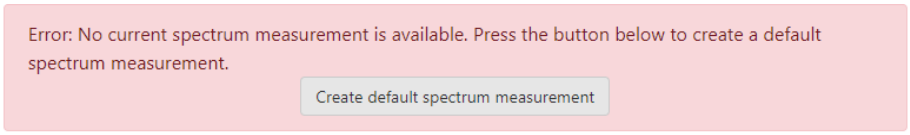
    - SNR Values: The SNR values for each source indicated in the MultiSource settings (Number of Sources). Useful as indicator to set the SNR Threshold value.
- Measurement Type: The type of measurement that will be done when clicking “Start Measurement”. All measurements initiated this way will be downloaded automatically to the user’s computer. The will also be saved in the File Management page.
    - Image Capture: will capture an image of the current SoundSurface™ including min/max values and spectrogram.
    - Video Capture: will start recording a video from the video stream. The video will stop when the specified duration is over, or the “Stop Measurement” button is pressed.
    - Audio Capture: will start a full range audio recording from the audio stream. The recording will stop when the specified duration is over, or the “Stop Measurement” button is pressed.

- **Stream Settings:**
    - Show dB level at cursor: will show the decibel level of the beamforming point when the cursor hoovers over it.
    - Show Spectrum: will change the time based spectrogram to a Realtime spectrum plot.
    - Show selected spectrogram zoomed view: will show a more zoomed in visualization of the selected frequency range.
    - Show Areas of Interest: will make the existing Areas of Interest visible in the camera image.
    - Apply Multi source: enable/disable the multi source filter, when enabled the Multi Source settings will appear on the left side of the dashboard.
- **Capture settings:**
    - Show dB marker: will show the dB marker on the most dominant source in the image captures.
    - Power grid frequency: choose between 50 or 60 Hz, based on the region where the device is used.
- **Event settings:**
    - Sound alert: will play a sound when an event is triggered. The sound will be played by the Computer/laptop which is monitoring the dashboard.
    - Color alert: will show a visual warning in the dashboard image when an event is triggered
    - Manual deactivation: will show any triggered event in the list with a red color until the operator manually deactivates it. This makes sure that the issue is actively reviewed before it is discarded.

Example: The colors of the sound image and the steaming video represent sound intensity. Blue is low intensity; red is high intensity. The red spots on the image are the locations where the L642 detects the most sound coming from.

ⓘINFORMATION

The following warning is shown when there is no spectrum measurement yet. Click “Create default spectrum measurement” to create a new spectrum measurement to visualize the spectrum.



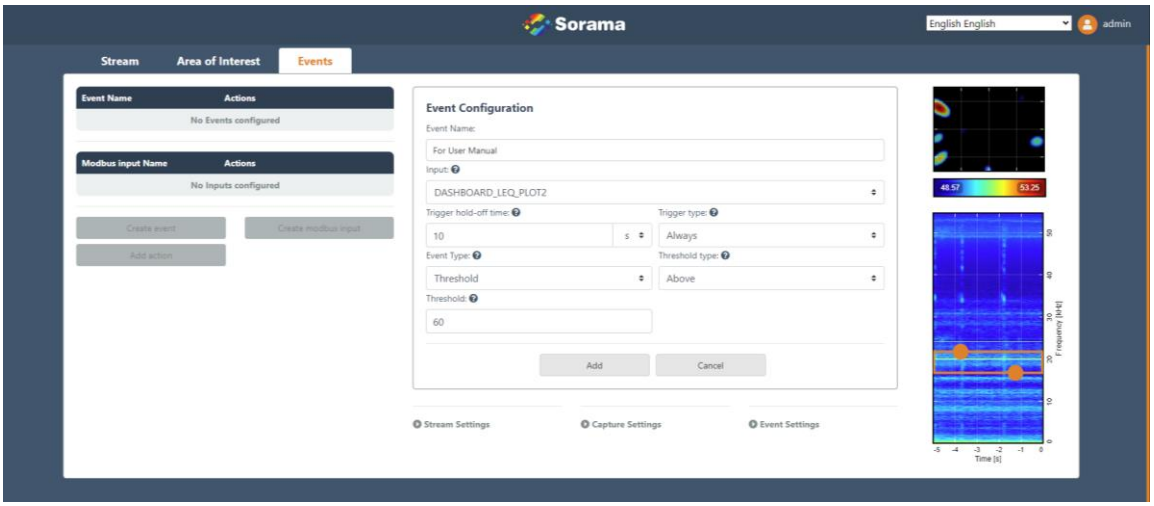
5.3.2 Area of Interest

The Areas Of Interest (AOI) can be configured in the Area of Interest tab. The Area of Interest tab can be seen below. Areas of interest can be used to get a special trigger when an event occurs in a certain area in the field of view, or to exclude events from other parts of the SoundSurface™.

- **Add new Area of Interest:** Create a new area of interest. This can be a rectangle, circle or line.
  - When the desired shape is selected, the area of interest can be drawn in the video stream.
  - The area of interest can be saved and named by clicking on the “save” icon
  - The area of interest can be deleted by clicking on the “delete” icon.
- **Saved Areas of Interest:** In order to edit an already saved area of interest, the desired area of interest should be selected. This can be done by clicking the desired area of interest from the list, or clicking it in the video stream.
  - Events can be triggered based on the Area of Interest. Triggers for the area of interest can be defined on the Events tab in the Management page. An AOI will only trigger if the SPL threshold inside is exceeded AND the peak of the SoundSurface™ is inside the AOI.

5.3.3 Events

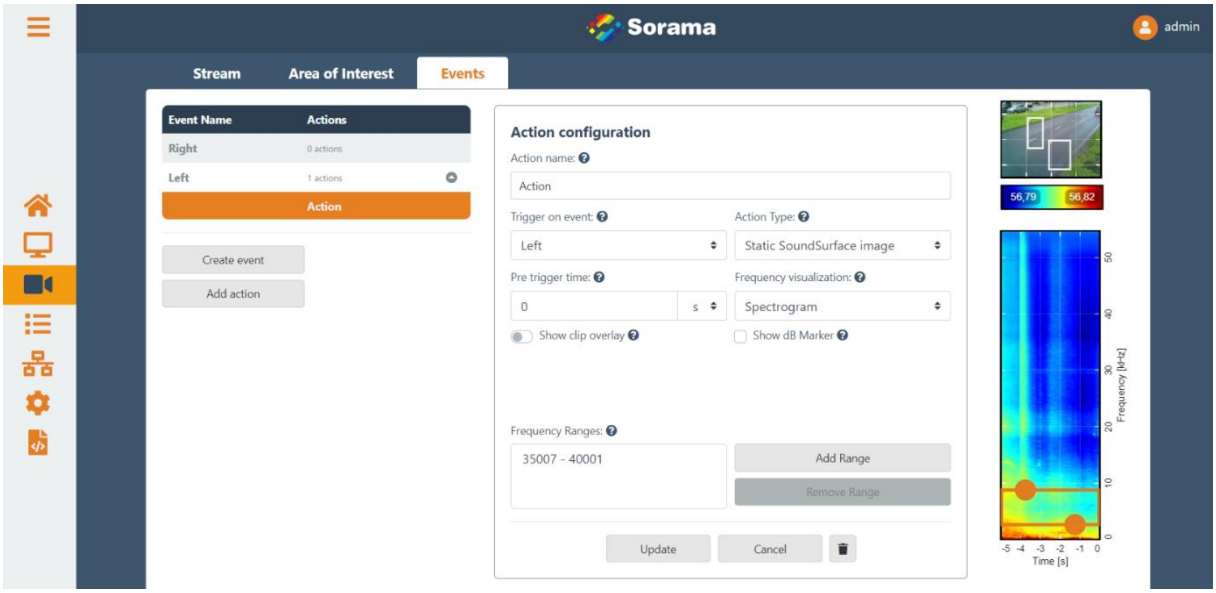
Events and actions can also be set from the Streaming page.



- On the left side is a list of all active events on the device.
    - **Event Name:** The name of an event.
    - **Actions:** The number of actions that are triggered by the event.
    - **Create event:** To add a new event, click on the button. The settings for the new event can then be filled in on the right side of the dashboard.
- The settings for a selected or new event are displayed on the right side of the dashboard.
    - **Event Name:** The name of the event, it can be changed after the event configuration is made.
    - **Input:** The entity this event is added to. This can be a measurement or a SoundSurface™.
        - If a classification measurement is to be chosen as input, the event type should be set to classification.
        - If the input is a SoundSurface™, an area of interest can be chosen. This means that the event will only trigger when the SPL threshold inside the AOI is exceeded AND the peak of the SoundSurface™ is inside the AOI.
    - **Event Type:** The type of event. The options are “Threshold” and "Classification”. Depending on the “Event Type” there are other settings available which tell the system when to trigger this event. For the Threshold Event Type it are the following settings:
        - **Threshold type:** When to trigger the event, if the measurement output is above or below the specified threshold. Threshold value and the Threshold type can be updated/changed after event is configured for the first time.
        - **Trigger hold-off time:** This defines the minimum time between event triggers and therefore functions as an event rate limiter. When a second trigger occurs before the hold-off time of the first trigger elapsed, the second trigger is ignored and will not result in an event being generated. If this setting is set to zero, the event rate is not limited.
        - **Trigger type:** On which edge of the signal to trigger the event. The options are; Always, Rising Edge, Falling Edge & Dual Edge.

The classification events will trigger when an anomaly is detected and it can be configured with the following settings:

- **Area:** The event will only trigger when it occurred in the selected area of interest.
- **Trigger hold-off time:** This defines the minimum time between event triggers and therefore functions as an event rate limiter. When a second trigger occurs before the hold-off time of the first trigger elapsed, the second trigger is ignored and will not result in an event being generated. If this setting is set to zero, the event rate is not limited.
- **Trigger type:** On which edge of the signal to trigger the event. The options are; Always, Rising Edge, Falling Edge & Dual Edge.



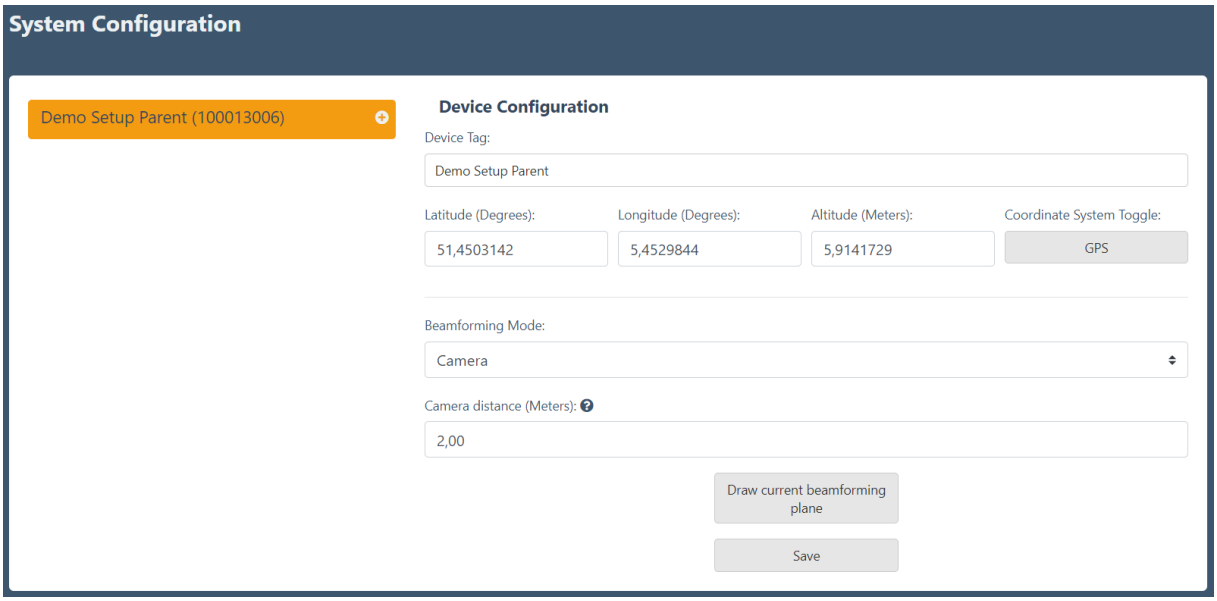
Actions can be linked to an event. These actions will be executed when the event is triggered. Actions can be defined by clicking “Add action”. A list of possible actions is given below.

- Data measurement (wav)
  - **File Format:** The format used to store the data. The options are Binary and Wav
  - **Duration:** The total duration of the measurement
  - **Pre trigger time:** The number of seconds before the action to include in the recording
- Live/Static SoundSurface™ image
  - **Pre trigger time:** The number of seconds before the action to include in the recording
  - **Frequency range:** The selected frequency range which is visible in the image. When choosing Live SoundSurface™ image, the frequency selection will be same as the SoundSurface™ frequency selection.
  - **Frequency visualization:** How the spectral data is visualized in the image. The “Spectrum” will show the instantaneous spectrum, where the spectrogram will show the spectrum data of the past 5 seconds.
  - **Min/Max pressure:** The min/max dB value which will be shown in the audio overlay. If left blank, the scaling will be automatic.
  - **Show dB Marker:** If the dB marker should be shown on the capture
- Video:
  - **File name:** The name of the file that the video will make. Filename should only contain A-z, a-z, 0-9, _ and - with a maximum length of 32 characters.
  - **Pre-recording time:** The number of seconds before the event was triggered to include in the recording
  - **Duration:** The total duration of the measurement
  - **Color opacity:** Opacity of the sound surface color overlay in percentage, with 100% being completely opaque and 0% being completely transparent.
  - **Color threshold:** Sound pressure overlay transparency threshold in percentage of maximum value

5.4 System Configuration

Multiple models from the L642 series can be linked to work as a single unit. An L642+ or L642V+ can function as a server to a maximum of 10 other models as clients. Any model can be a client. With this server-client setup, you can manage all devices within this setup using only the server device as entry point. With this setup, access to all individual units is no longer needed. The server device will make sure the changes are forwarded to its clients.

5.4.1 How to setup

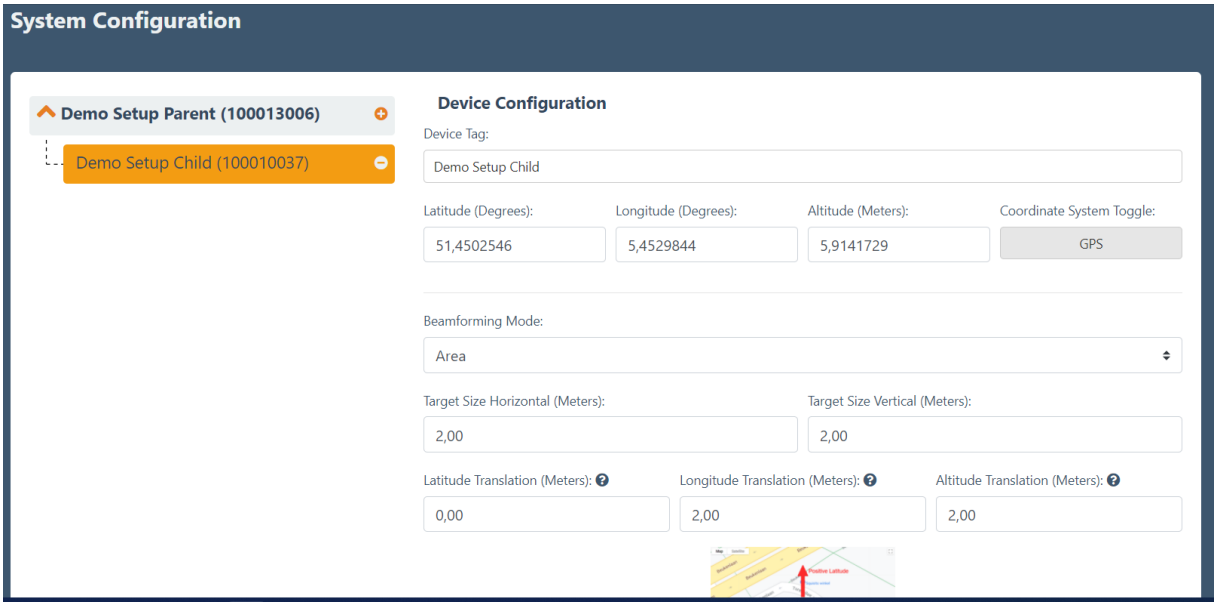


Go to System Configuration page on the server device; Click on the + icon to add a client device; Enter the serial number of the client device you wish to add and click OK; The server device will restart, since its settings have just been changed. Wait for the page to be reloaded to see the client added; Clicking on the client's serial number will show its settings.

5.4.2 Functionalities within this setup

Device settings

Everything associated with device settings of all devices within this setup can be managed using the server device only. Settings of both server and clients can be viewed and updated using the "Device Info" page. The functionality works the same as without clients. This entails that both the server and its clients will restart once their settings have changed, resulting in losing the connection for a short while.



SoundSurfaces™

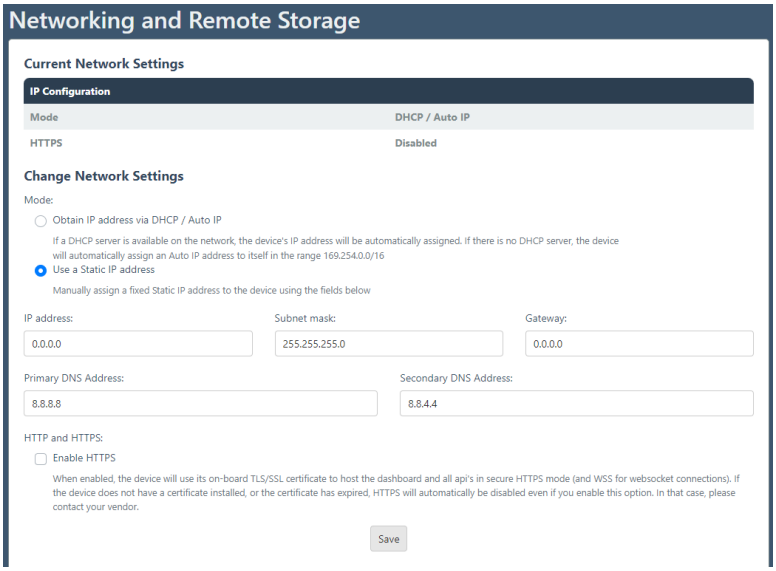
A SoundSurface™ created on a server device will also be created on its clients. The clients will have a SoundSurface™ which has the same settings as the server device, only gathering data from their field of view. The clients will forward their data to the server device, resulting in one overview with the SoundSurfaces™ of all devices within this server-client setup. These SoundSurfaces™ can be viewed on the SoundSurface™ page in the dashboard of the server device.

5.5 Device Configuration Pages

5.5.1 Users

- Delete: deletes the selected user account
- Use “new password” and “confirm new password” to set the password of the selected user

5.5.2 Networking



- Swap network settings by choosing between automatic or static IP
  - In a DHCP network, the L642 will get an available IP address from a router from within the network.
  - With static IP, the user gets to choose an IP. This could conflict with existing IP addresses within the network, so be careful when using this feature.
- Enable HTTPS: tick this box to make the L642 able to connect through HTTPS.
  - More on the HTTPS connection and trusting of the certificates can be found in paragraph 4.3.1, *Using the L642 with HTTPS* on page 17.

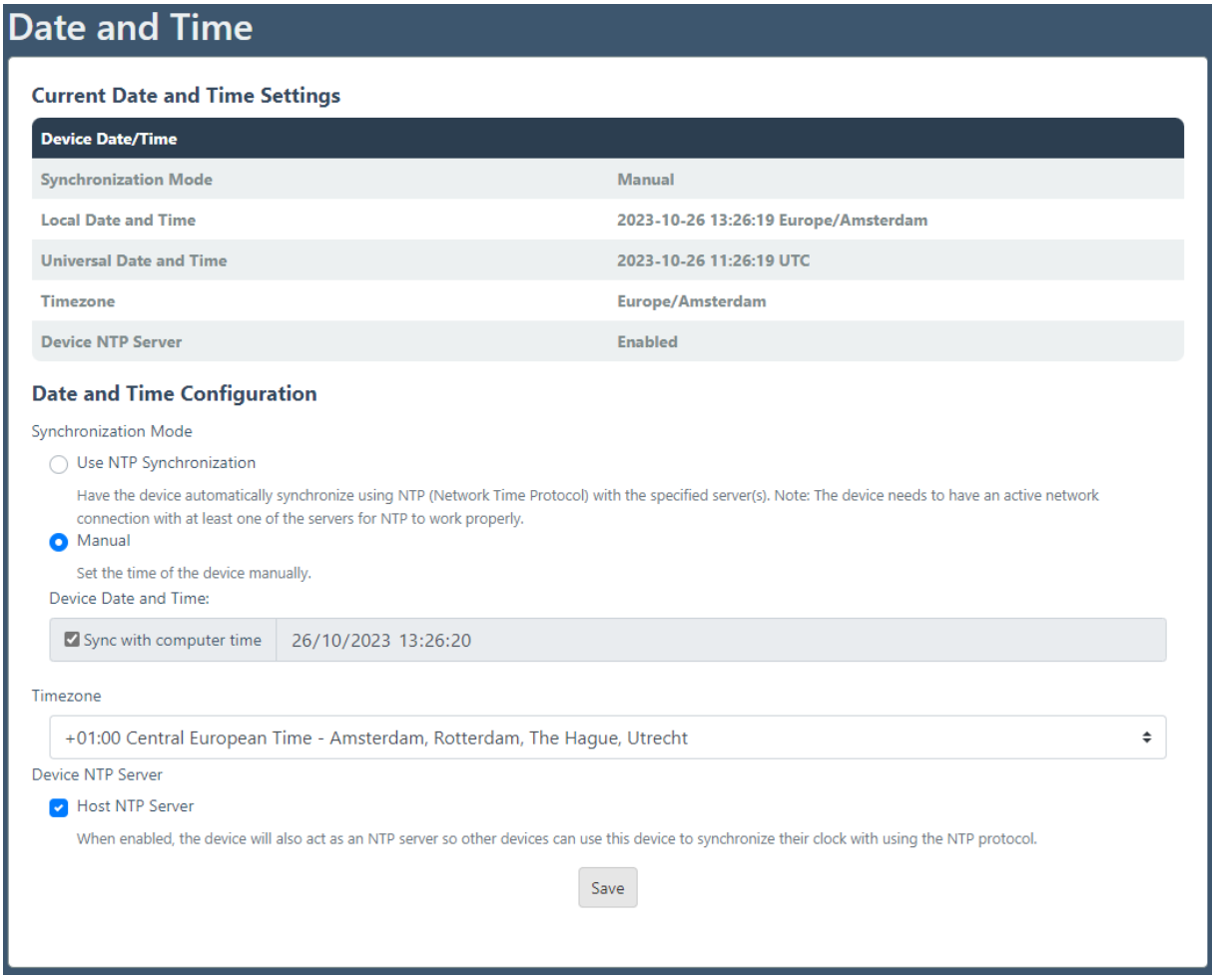
ⓘINFORMATION

When enabled, the device will use its on-board TLS/SSL certificate to host the dashboard and all APIs in secure HTTPS mode (and WSS for websocket connections). If the device does not have a certificate installed, or the certificate has expired, HTTPS will automatically be disabled even if you enable this option. In that case, please contact your vendor.

⚠IMPORTANT

When the unit is updated in auto-IP, the IP may change after the update. The new IP can be found with an IP scanner, or the device can be reached locally with the serial number.

5.5.3 Date and Time



- NTP synchronization can be used to synchronize the device's time to a NTP server.
- It is also possible to set the time manually. Use the "sync with computer time" flag to automatically fill in your device's time or fill in a time manually.
- Time zone is the time zone in which the device currently is.
- It is also possible to host an NTP server. This is useful to let other devices synchronize with the L642's time.

5.5.4 Device Information

Device Configuration

Device Tag:

Enter name...

Latitude (Degrees): 51,4505870

Longitude (Degrees): 5,4539270

Altitude (Meters): 5,9141729

Coordinate System Toggle: GPS

Beamforming Mode:

Area

Target Size Horizontal (Meters): 5,00

Target Size Vertical (Meters): 5,00

Latitude Translation (Meters): 0,00

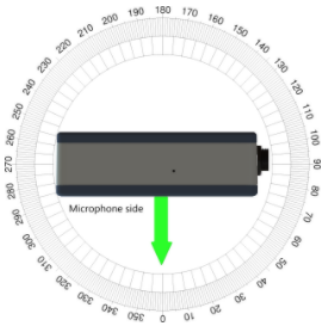
Longitude Translation (Meters): 0,00

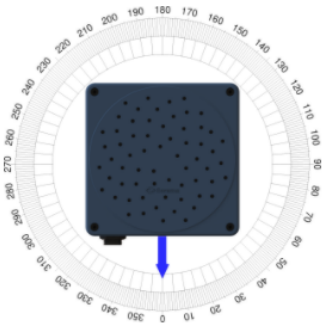
Altitude Translation (Meters): 4,00

Device Pitch (Degrees): 0,00

Device Yaw (Degrees): 0,00

Device Roll (Degrees): 0,00



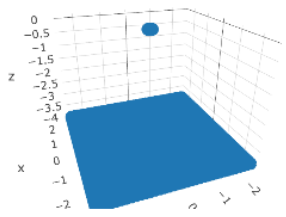


Target Area Pitch (Degrees): 0,00

Target Area Yaw (Degrees): 0,00

Target Area Roll (Degrees): 0,00

Draw current beamforming plane

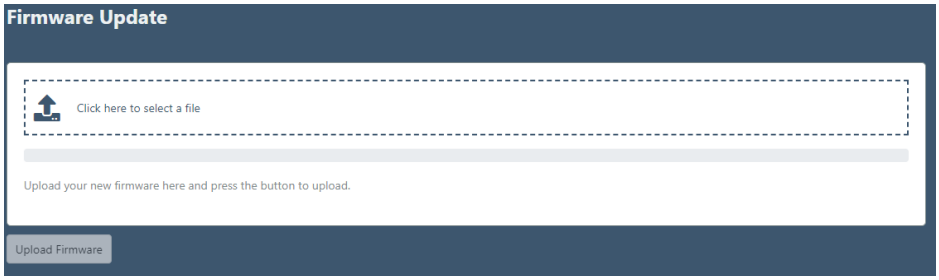


Save

The device information is necessary to create a SoundSurface™ in camera mode, but most importantly for area mode. The area mode beamforming can be seen in in the SoundSurface™ tab in the "Insight" page.

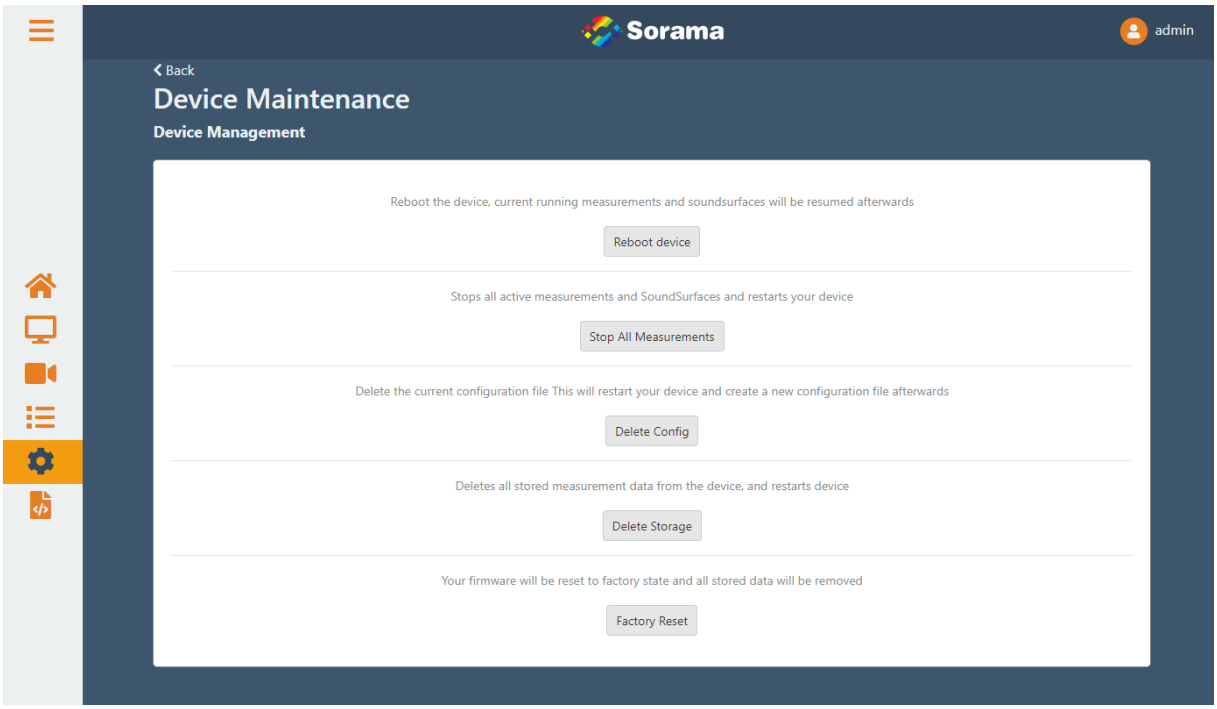
- Device Name: A user settable name for this device.
- Latitude/Longitude/Altitude or X/Y/Z: Set the (GPS) location for this device.
    - These coordinates are used to show the device location on a map. The altitude does not correspond to the height above the target distance. This can be done with the altitude translation below.
- Beamforming mode:
    - Camera mode creates a SoundSurface™ that is compatible with the integrated camera of V units. In this mode camera distance should be filled in, which corresponds with the mean distance between the L642 and the target.
    - Area mode is used to create a SoundSurface™ which can be projected on a selected area. Settings for the device are explained below.
- Target Size Horizontal/Vertical: The dimensions in meters of the rectangular area that is to be observed. Horizontal and vertical dimensions correspond with the horizontal and vertical dimensions as seen from the device when the roll is 0°.
- Latitude/Longitude/altitude translation: Area translations relative to the device's position.
    - Positive latitude corresponds with a translation towards the north.
    - Positive altitude latitude corresponds with a translation towards the east.
    - Positive altitude corresponds with the height of the device relative to the area. An altitude translation of 0 means that the area is at the same height as the microphones. As a result the SoundSurface™ cannot be created.
- Device Pitch/Yaw/Roll: Set the orientation of the device.
    - Pitch is the angle in which the unit is facing up or down. When the unit is facing down, the pitch is 0°.
    - Yaw is the orientation compared to the north. When the device has a pitch of 0° and the ethernet cable insert is facing south, the yaw is 0°.
    - Roll is the how much the unit is turned facing an object. In most cases, the roll is 0°.
- Target Area Pitch/Yaw/Roll: Set the orientation of the target area:
    - Pitch is the angle in which the target area at a slope. When the target is not at an angle, the pitch is 0°.
    - Yaw is the orientation compared to the north. If the area has the same orientation to the north as the device, the same Yaw should be set.
    - Roll is how far the target is turned facing the unit. In almost all cases, the roll is 0°.
- Draw current beamforming plane: Gives a 3D visualization of the area compared to the microphone locations of the device.
    - When new settings are not saved yet, the old settings will be visualized.
- Save: Save settings. The device will reboot, and after rebooting, the device will use the new settings to make a SoundSurface™.
- Show status LED: Show the status LED on device. If this is unticked, the Led will turn off.

5.5.5 Firmware Update



For a detailed description on performing firmware updates, see page 18.

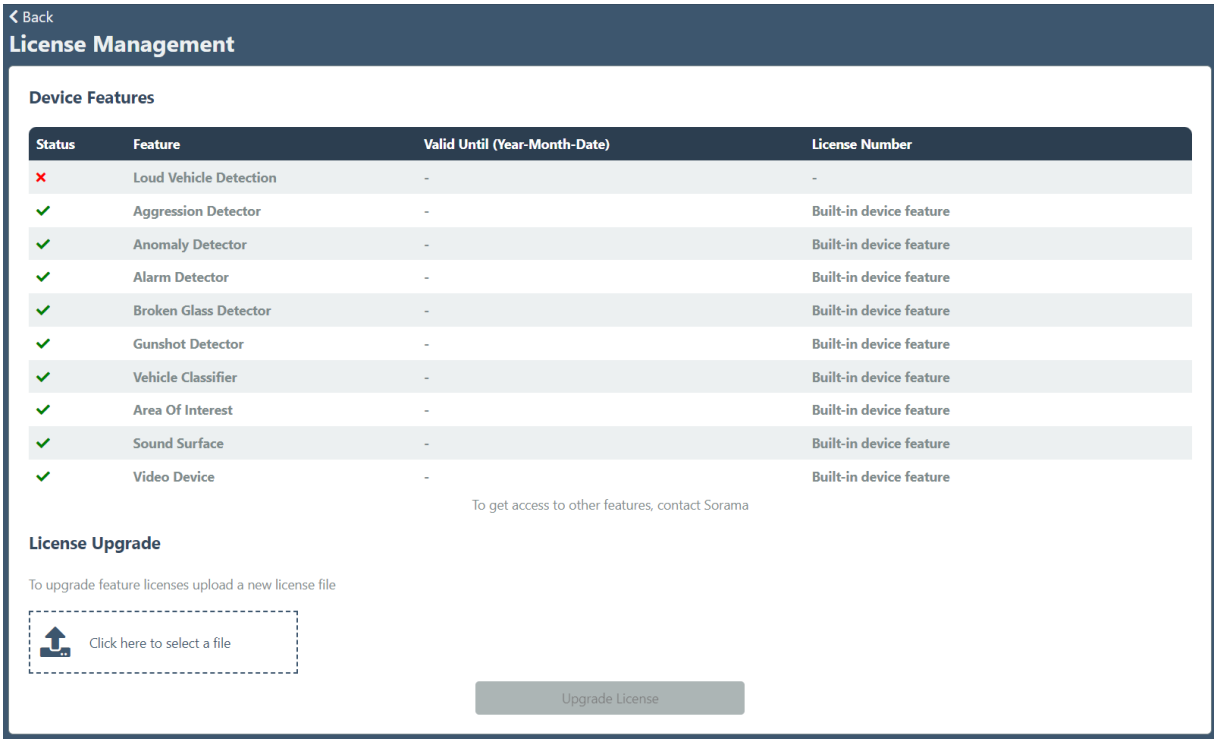
5.5.6 Device Maintenance



- “Reboot device”: Reboots the device.
- “Stop All Measurements”: Stops and removes all configured Entities (e.g. Measurements and SoundSurfaces) from the device and reboot.
- “Delete Config”: Deletes the configuration file of the L642’s software. Resets the device to default settings and reboots afterwards.
- “Delete Storage”: Deletes all stored measurement data and reboot.
- “Factory Reset”: Resets the device, including firmware, to the original firmware on the device when it was shipped.

5.5.7 License management

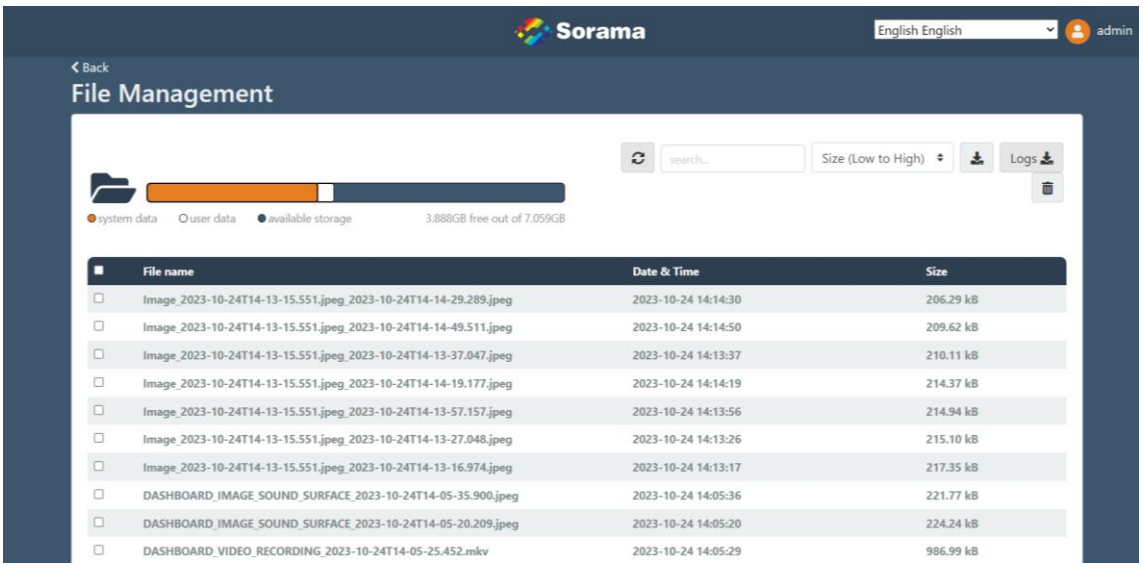
The license management page shows which licenses are activated on the device. This is also the page where new licenses can be uploaded and activated.



- Status: Status of the license. ✗ means an unactive license. ✓ means that the license is active.
- Feature: Name of the featured License
- Valid until: Date when the license expires
- License number: The number of the specific license. If a license is built-in, it will be displayed here.
- License Upgrade: Here a new license can be uploaded

5.5.8 File Management

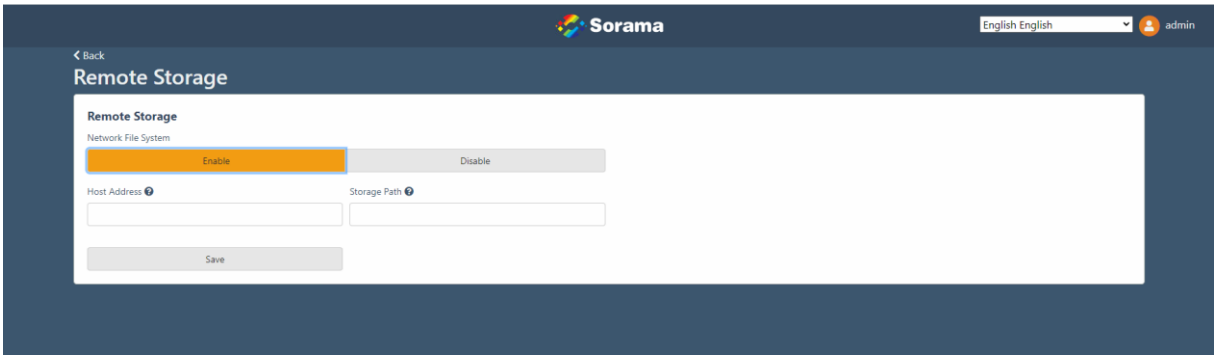
As of 2.6.0, it is possible to view the stored files through the File management page. All stored files will be shown here. The storage is managed FIFO (First in First out). This means that when the full storage capacity of 4 GB is approached and a new measurement is done, the newest file will replace the oldest file in the storage.



- File name: The name of a file or item.
- Date & Time: Date and time of when the item was created.
- Size: The size of the item.
- Files can be searched by name by using the search bar.
- Sort by: Click the “Filters” button to sort the files by name, by date, or by size in ascending or descending order.
- : Click the “Refresh” button to refresh the page and see if here are any newly save files.
- : Click the “Download” button to download the currently selected files.
- Logs : Click the “Logs” button to download all the logs from the device.
- : Use the “Delete” button to delete the selected files.

5.5.9 Remote Storage

Setup a remote storage with Remote Storage Settings. Currently, only Network File System (NFS) servers are supported.

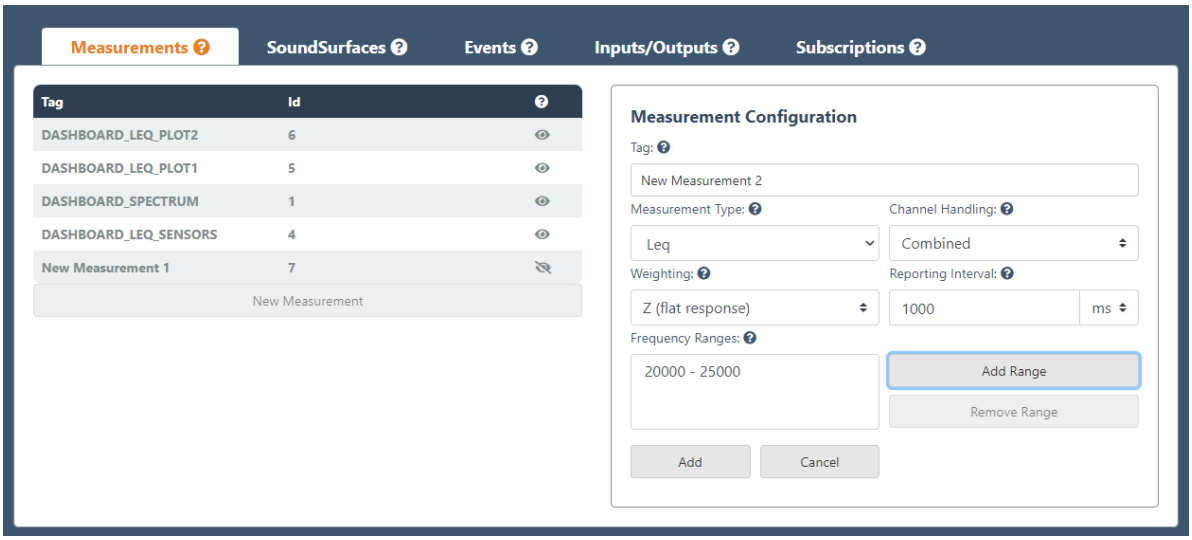


- When this feature is enabled, all files in the file manager will periodically (every minute) be copied to the remote storage server. Still the files will be saved on the device.
- **Host Address:** this is the IP address of the NFS2, NFS3 or NFS4 server.
- **Storage Path:** the file path on the NFS server where the files will be saved.

5.6 Management pages

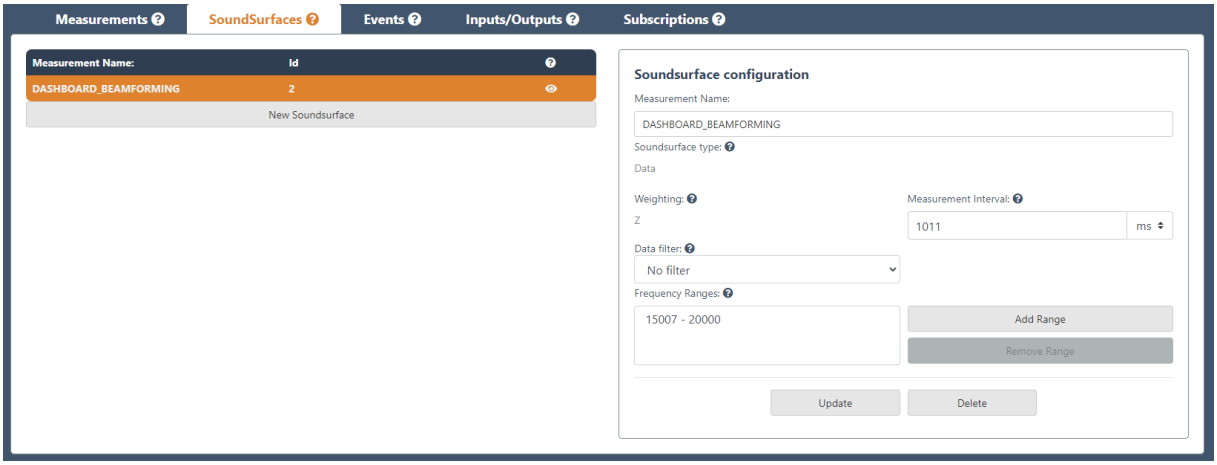
In the management pages, a user can see which entities are running and active on the device. There are tabs for different groups of entities. Certain entities are made by the dashboard. They have a visible tag and a flag indicating this.

5.6.1 Measurements



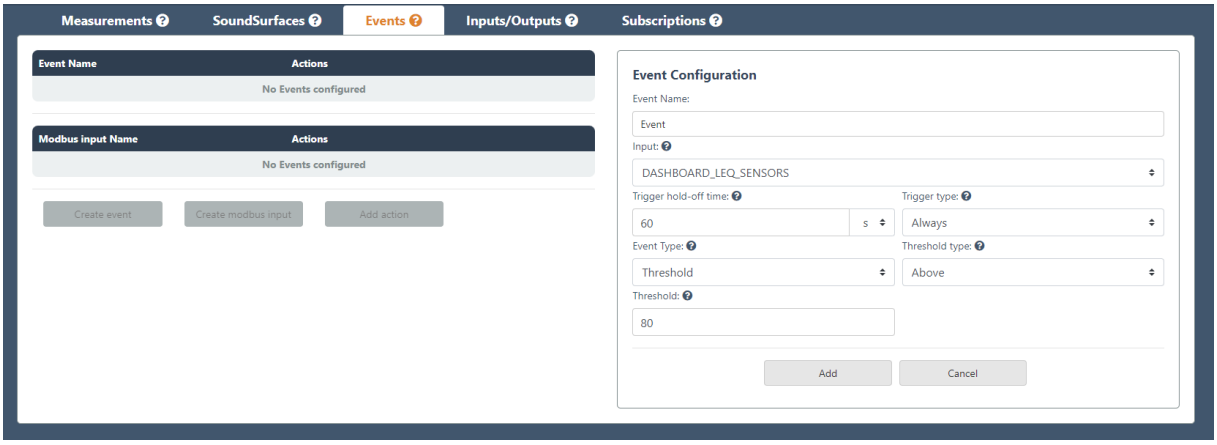
- On the left side is a list of all active measurements on the device.
    - **Measurement Name:** A human readable name of a measurement, does not have to be unique.
    - **Id:** The unique number automatically assigned to each measurement. Ids are always unique.
    - A checkmark in the last column shows that a measurement is created by the front-end. A cross means a measurement is created by a user.
    - **New Measurement:** Can be clicked to start adding a new measurement. The settings to the right should then be filled in.
- On the right side are the settings of a selected or new measurement can be seen.
    - **Measurement Name:** The name of the measurement.
    - **Measurement Type:** The type of measurement. Examples are Leq, spectrum or classification.
        - When classification is chosen, a classification type must be selected. This could be anomaly detector or vehicle classifier.
        - When anomaly detector is selected, the device will train on the occurring sound for 60 seconds. After that, anomalies can be detected.
    - **Output Format:** Determines if the measurement will **combine** the 64 channels or gives back **separate** results.
    - **Weighting:** Can be used to apply a certain pre-defined acoustic weighting to results.
    - **Measurement Interval:** How often the measurement will produce a result. Audio is averaged over this duration.
    - **Frequency ranges:** Can be selected and edited, added or removed.

5.6.2 SoundSurface™



- On the left side is a list of all active SoundSurfaces™ on the device.
  - **Measurement Name:** A human readable name of the SoundSurface™, does not have to be unique.
  - **Id:** The number automatically assigned to the SoundSurface™. Ids are always unique.
  - An open eye at the end of the column means the SoundSurface™ is used for dashboard visualizations, and it is recommended not to change the SoundSurface™.
  - **New SoundSurface™:** Can be clicked to start adding the new SoundSurface™. The settings to the right should then be filled in.
- On the right side the settings of a selected or new SoundSurface™ can be seen
  - **Measurement Name:** The name of the SoundSurface™.
  - **SoundSurface™ Type:** The type of SoundSurface™. Options are Data, Image or Video.
  - **Weighting:** Can be used to apply a certain pre-defined acoustic weighting to results
  - **Measurement Interval:** How often the SoundSurface™ will produce a result. Audio is averaged over this duration.
  - **Data filter:** Option to enable to Multi Source filter in the SoundSurface.
  - **Frequency Ranges:** Can be selected and edited, added or removed. Note that there is a maximum total range the device can analyze. In this release this is 8000Hz.
  - For when “SoundSurface™ Type” Video is chosen:
    - **File Format:** mkv, sor, webm and mp4.
    - **Weighting:** The weighting to apply to the measured frequency content before calculating the result
    - **File Name:** The name of the SoundSurface file
    - **Opacity:** Opacity of the color overlay in percentage. With 100% being completely opaque. And 0% being completely transparent.
    - **Color Threshold:** Sound pressure overlay transparency threshold in percentage of the maximum value.
    - **Duration:** The total duration of the video

5.6.3 Events



- On the left side is a list of all active events on the device.
    - **Event Name:** The name of an event
    - **Id:** The unique number assigned to each event. Ids are always unique; tags don't have to be.
    - **Create event:** Can be clicked to start adding a new event. The settings to the right should then be filled in.
- On the right side are the settings of a selected or new event can be seen
    - **Event Name:** The name of the event.
    - **Input:** The entity this event is added to. This can be a measurement or a SoundSurface™.
        - If a classification measurement is to be chosen as input, the event type should be set to classification.
        - If the input is a SoundSurface™, an area of interest can be chosen. This means that the event will only trigger when the SPL threshold inside the AOI is exceeded AND the peak of the SoundSurface™ is inside the AOI.
    - **Event Type:** The type of event. The options are "Threshold" and "Classification". Depending on the "Event Type" there are other settings available which tell the system when to trigger this event. For the Threshold Event Type it are the following settings:
        - **Threshold type:** When to trigger the event, if the measurement output is above or below the specified threshold. Threshold value and the Threshold type can be updated/changed after event is configured for the first time.
        - **Trigger hold-off time:** This defines the minimum time between event triggers and therefore functions as an event rate limiter. When a second trigger occurs before the hold-off time of the first trigger elapsed, the second trigger is ignored and will not result in an event being generated. If this setting is set to zero, the event rate is not limited.
        - **Trigger type:** On which edge of the signal to trigger the event. The options are; Always, Rising Edge, Falling Edge & Dual Edge.

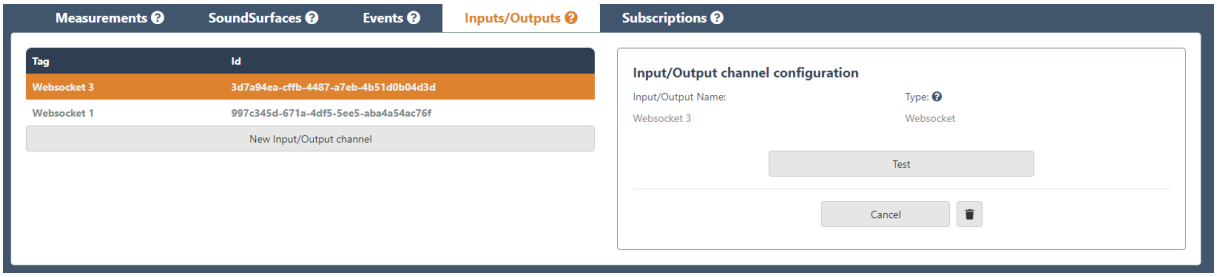
    The classification events will trigger when an anomaly is detected and it can be configured with the following settings:

- **Area:** The event will only trigger when it occurred in the selected area of interest.
- **Trigger hold-off time:** This defines the minimum time between event triggers and therefore functions as an event rate limiter. When a second trigger occurs before the hold-off time of the first trigger elapsed, the second trigger is ignored and will not result in an event being generated. If this setting is set to zero, the event rate is not limited.
- **Trigger type:** On which edge of the signal to trigger the event. The options are; Always, Rising Edge, Falling Edge & Dual Edge.

Actions can be linked to an event. These actions will be executed when the event is triggered. Actions can be defined by clicking “Add action”. A list of possible actions is given below.

- Data measurement (wav)
  - **File Format:** The format used to store the data. Choices are Binary or Wav
  - **Duration:** The total duration of the measurement
  - **Pre trigger time:** The number of seconds before the action to include in the recording
- Live/Static SoundSurface™ image
  - **Pre trigger time:** The number of seconds before the action to include in the recording
  - **Frequency range:** The selected frequency range which is visible in the image. When choosing Live SoundSurface™ image, the frequency selection will be same as the SoundSurface™ frequency selection.
  - **Frequency visualization:** How the spectral data is visualized in the image. The “Spectrum” will show the instantaneous spectrum, where the spectrogram will show the spectrum data of the past 5 seconds.
  - **Min/Max pressure:** The min/max dB value which will be shown in the audio overlay. If left blank, the scaling will be automatic.
  - **Show dB Marker:** If the dB marker should be shown on the capture
- Video:
  - **File name:** The name of the file that the video will make. Filename should only contain A-z, a-z, 0-9, _ and - with a maximum length of 32 characters.
  - **Pre-recording time:** The number of seconds before the event was triggered to include in the recording
  - **Duration:** The total duration of the measurement
  - **Color opacity:** Opacity of the sound surface color overlay in percentage, with 100% being completely opaque and 0% being completely transparent.
  - **Color threshold:** Sound pressure overlay transparency threshold in percentage of maximum value

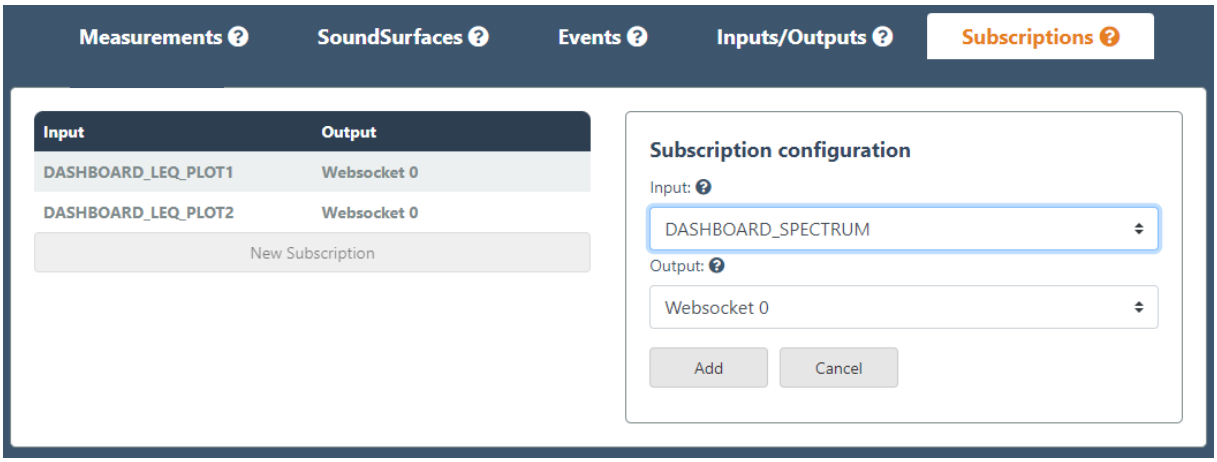
5.6.4 Input/Outputs



On the Input/Outputs tab, the list of active websocket channels will appear. The tag and the ID are properties of the websocket which are given by the external creator of the websocket. A test message can also be sent through the websocket by pressing the “Test” button. Using the bin icon, it is possible to delete a websocket channel.

> ⓘINFORMATION
>
> Websocket channels are also used by the dashboard internally. These websocket channels will also show up on the Input/Outputs tab. So don’t be alarmed when the list is filled with unknown websocket channels.

5.6.5 Subscriptions



- On the left side is a list of all active subscriptions on the device.
  - **New Subscription:** Can be clicked to start adding a new subscription. The settings to the right should then be filled in.
- On the right side are the settings of a selected or new subscription can be seen.
  - **Input:** The entity which provides data for this subscription.
  - **Output:** The output channel to which this subscription sends the data, provided by the input.

5.7 (API) Documentation

This page contains documentation on the L642 device. This is for advanced development and integrations with third party systems or software. The Sorama API is based on a HTTP REST API. All calls are communicated via HTTP(S) or WebSocket. The device hosts the following documents:

1. Sound Source Detection API
2. Authentication API
3. Device manager
4. Quick Start Guide PDF
5. User manual PDF (this document)

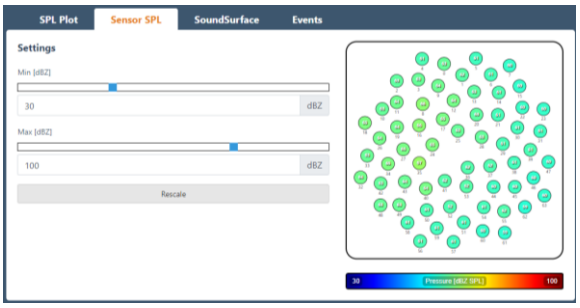
Please visit our website for more information:

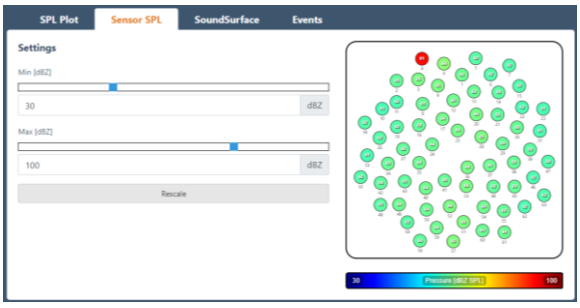
www.sorama.eu/dev

6 Troubleshooting

How to check device health / when to request a new device

Microphone health can be monitored on the sensor SPL page of the device. The left picture below shows a proper microphone array. A microphone is faulty, when it is stuck on a single value or when its value is very dissimilar to the values of the other microphones. An example of a faulty microphone in the array is shown in the right picture below.





A good rule of thumb is: replace the device when more than 30 microphones display these kinds of symptoms.

Stream page does not show SoundSurface™ overlay or spectrum

It is possible that there is a large difference between the time the L642 thinks it is and between what your PC thinks it is. To resolve this, you can set the device time to match your PC's time. Check the Date and Time on page 41 on how to do this.

I set a certain reporting interval, but data is returned at a slower rate

It is possible that a selection of measurements and SoundSurfaces™ is selected which the device is not able to run live. Usually this happens if 2 "Data" SoundSurfaces™ are active. Remove one of them and give the device a restart. If it still persist, also remove some measurements and reboot the device.

How do I restart my device without removing power

For Dashboard users, the easiest way is to go to the Device Maintenance page and press "Reboot device". This will reboot the device. Via the API, you can do a reboot call, check the device manager API documentation for that.