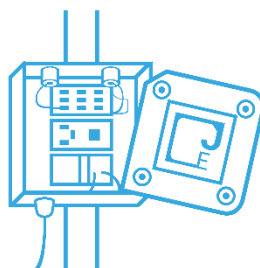


SED ACAP

Manual

v 3.11



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Introduction

SED (Sound Event Detector) is a solution that uses a proprietary machine learning-based algorithm to detect, classify, and alert to unwanted acoustic events. These events may include gunshots, screams, or the sound of breaking glass. The SED application can be operated either through a dedicated SED device or an Axis camera using the ACAP platform. This manual provides information about the version of SED used within ACAP..



Compatibility

The compatibility of the SED Application with the target Axis camera can be check on <https://www.axis.com/support/tools/product-selector> websites. SED Application requires:

- Chip architecture: armv7hf or aarch64

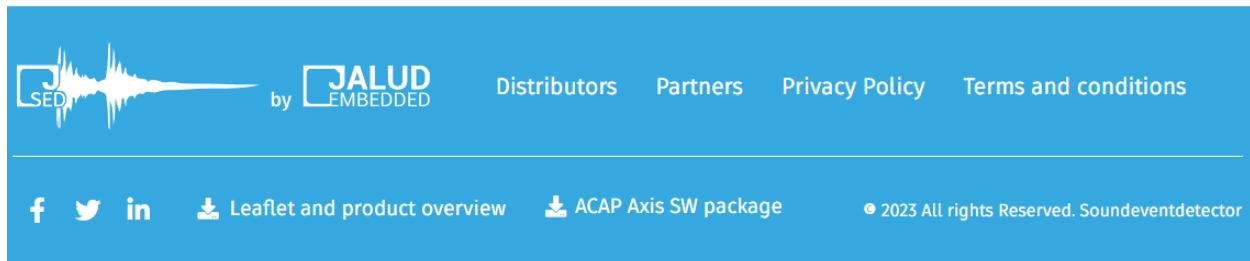
Chip	Architecture
ARTPEC-8	aarch64
ARTPEC-7	armv7hf
ARTPEC-6	armv7hf
S2E	armv7hf
S2L	armv7hf
S3L	armv7hf
S5	aarch64
S5L	aarch64

- Minimal firmware version: 10.10
- Audio Support



Installation

The SED ACAP application can be downloaded on our websites: www.soundeventdetector.eu or on the following link: [SED ACAP Download](#).



The link navigates into a folder with on our storage. The user can choose from multiple versions of SED application. The name of the package contains this information:

- SED - name of the application.
- Application version – current application version is 3.11.
- Architecture - Axis chip architecture (armv7hf or aarch64).
- Detection Model – internal name of the detection model

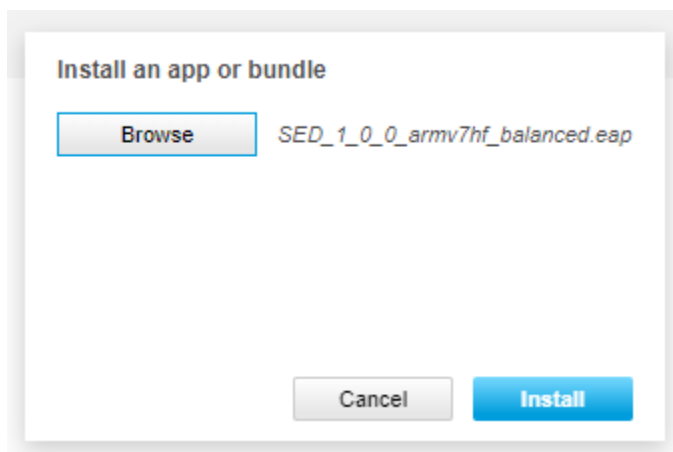


packages 		
Moje soubory		
Název ^	Čas úpravy	
 archive	06/26/2025 13:15:05	
 MANUAL.txt	08/17/2023 12:55:12	
☐ SED_3_11_0_aarch64_basic_M250620_1.eap	06/26/2025 13:11:24	
☐ SED_3_11_0_armv7hf_basic_M250620_1.eap	06/26/2025 13:15:11	

Figure 1: SED Package Folder

Package Installation

To install the application, follow the standard Axis approach. Navigate to camera Settings → Apps → Add and install the downloaded package.



Note: It is necessary to check “Allow root-privileged apps” **before** installing the application unless the application settings won’t be accessible.



Figure 2: Allow root-privileged apps

License

To generate a license navigate to Axis License key registration website: [License key registration](#). Log in with credentials to Axis Communications account. Free Trial license key or a Full license key can be generated.

- Trial license can be generated without any interaction from our side. It contains full set of features, but it expires in 30 days.
- To generate a Full license key, you will need a license code. To obtain the license code contact us on acap@jalud-embedded.com.

To generate a license key, fill serial number of the target device. Select the options as shown on picture below and press GENERATE button. The license key is generated and can be used for application activation on the target device.

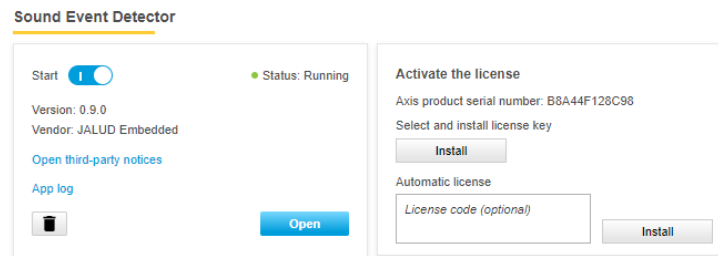
The screenshot shows a web form titled "Generate License Key". It includes instructions to complete the form for activation and a link to the batch registration page. The form has four steps: 1. Enter the device ID (Serial Number B8A44F128C98, device name AXIS P1375 BB). 2. Select type: "I'd like to create a trial or a free license" is selected. 3. Choose an application (Sound Event Detector) and press generate. The license type is set to "Trial (30 days)". 4. Download the license key. The expiration date is March 22, 2023.

Figure 3: Generate Trial License

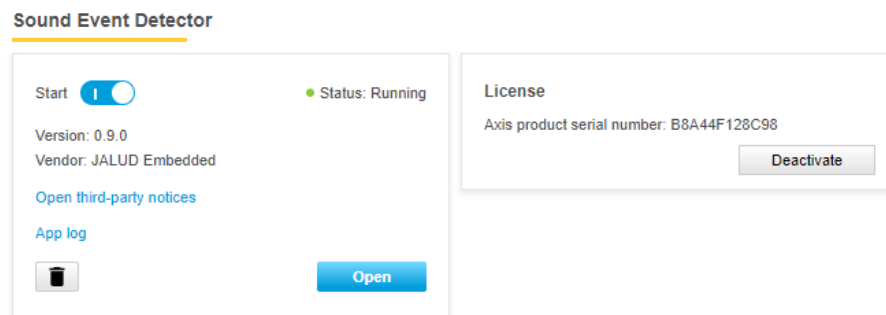
The screenshot shows a web form titled "Generate License Key". It includes instructions to complete the form for activation and a link to the batch registration page. The form has four steps: 1. Enter the device ID (Serial Number B8A44F128C98, device name AXIS P1375 BB). 2. Select type: "I have a license code" is selected. 3. Enter the license code (6M26H-JNM4G-F3FVS-CGTA5) and press generate. 4. Download the license key. A link to show the content of the license key is provided.

Figure 4: Generate Full License

To apply the license key, navigate into Sound Event Detector application on the target device.



The application is ready to use afterwards.



Audio

To ensure that the application works as expected the target device needs to be equipped with a recommended microphone and audio needs to be properly set.

Audio Settings

The audio needn't to be allowed for streaming and the SED application is still able to get an audio input necessary for its function. The only important setting is a microphone gain that needs to be set manually. The microphone gain is recommended to set in between 25 - 35dB. The higher value increases the range of the detection, but if it is too high the audio input signal becomes too noisy.

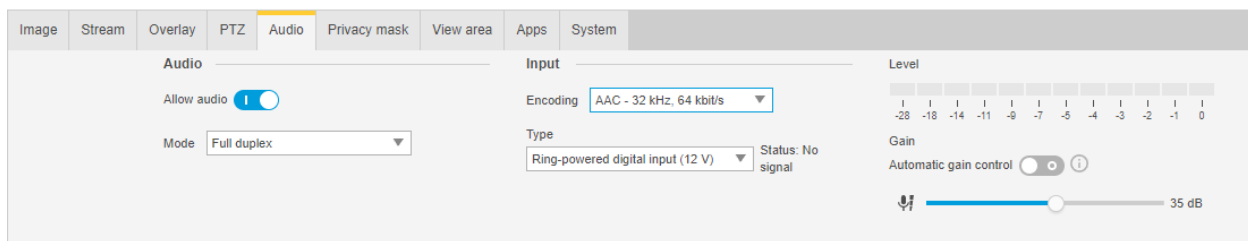


Figure 5: Audio Settings

The microphone gain setting is accessible after the audio is allowed. Once the microphone gain is set, the audio can be disabled again.

Application

The SED Application detects the sound of an unwanted acoustic events. The audio classification process is done in 2 steps.

The first step in classification process is detection that is responsible for detecting that something unusual has happened in the target device surrounding. The detected unusual event is further analyzed to distinguish between the common events (ambulance, traffic, train, siren, children, construction works, etc.) and the dangerous ones (gunshot, glass break, scream, etc.). The detector is energy-based and with standard settings in standard behavior it detects around 2500 unusual events each day. Therefore, the detector alone is not sufficient to reliably detect dangerous events.

The second step is classification. The SED application contains a classifier based on deep neural networks. The classifier has very high accuracy (99.7%) and therefore it detects dangerous situations with high sensitivity without wasting resources on false alarms.

Based on the result of the classification process, two groups of acoustic events are distinguished:

- **SED Alert:** The acoustic event was recognised as one of the dangerous situations. The SED Application recognises dangerous situations such as Gunshot, Glass Break, Scream, Male Scream, etc. SED Alerts trigger an alert on the user side by default.
- **SED Event:** The acoustic event was NOT recognised as dangerous. The user is not informed about those events by default. The information about the detection still might be useful in some specific cases:
 - Warehouse during a night when silence is expected.
 - Senior house during a night when an intense impulse sound might indicate a human fall.
 - etc.

Complete list of alerts and events [here](#).

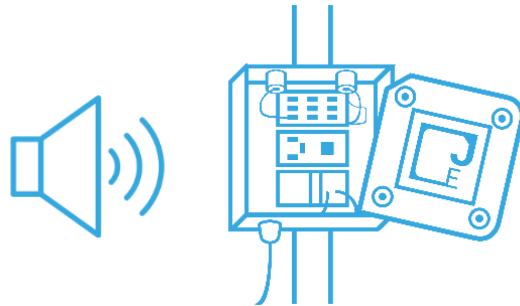
The input audio data are processed and analysed directly on the target device, and it is not necessary to send it outside the device. To minimise the amount of time that is needed to serve a triggered alert, SED enables the possibility to send a small audio fragment that has triggered the alert together with the alert data. This small audio fragment is sufficient to distinguish between real and false alarms, but it is not sufficient to identify a person. All the details can be found in **[GDPR Study]**

Noise Measurement

Noise measurement is an additional feature of the SED application that computes an ambient noise level in the device's surroundings. The computed value is periodically sent to the user in a defined interval. Based on the measured values, graphs or heat maps can be created.

A further analysis can be made based on the measurement values:

- A sudden increase in noise level might indicate a potentially dangerous situation (e.g. sport fans grouping or a demonstration).
- It can inform the user about the disturbance of the night piece.
- It can indicate a shouting before a street fight.
- etc.



Communication

The SED Alerts can communicate with the target VMS directly over Dynamic Event Management from Axis and/or indirectly over **SED Server** via TCP protocol. Each of the ways has its own advantages and use cases. There is no restriction on using both at once and taking advantage of both ways of communication.

TCP Communication

The SED Application uses a proprietary encrypted TCP protocol to communicate with the SED Server. SED Server, available in the cloud and can be used for communication, is provided by default together with technical support.

The main advantages of communication over the SED Server are:

- **Adaptation of classification model:** When a device is located in a new place, it can happen that it starts to trigger multiple false alarms on a specific sound. If the device communicates over the SED Server, it is possible to catch the sound fragments that cause false alarms and tune the default classification model for the specific environment. This is the reason why we highly recommend to enable communication over the SED Server at least for the first month after the installation of the SED application.
- **Localisation:** When at least 3 devices detect the same event, it is possible to triangulate the exact location of the sound source (shooter in case of a gunshot, hooligan in case of a glass break or victim in case of screaming). The SED Server serves as the central point where the data from devices is processed, and localisation is calculated.
- **Combine ACAP and SED Devices:** The SED Server is able to handle communication from both the ACAP SED Application and the SED Device. The common case is to use in a place where localisation is needed, one ACAP Application on a camera that observes the surroundings, together with two SED Devices.
- **Compatibility:** The SED Server implements multiple standard communication protocols to communicate with VMS - ONVIF, REST OpenAPI, Contact ID, etc. Besides, it is possible to create drivers for proprietary solutions.
- **One entry point:** Multiple VMS charge fees based on the number of entry points. SED Server is only one entry point from the VMS point of view, but it can redirect messages from all the devices.

The SED Server is available in the cloud by default, but there are other possibilities:

- The server can be placed on the user's local machine to handle the communication within a private local network.

For manuals and further information about SED Server and its communication protocols specifications, contact us at support@jalud-embedded.com.

VAPIX Communication

Axis Dynamic Event Management (DEM) is a standard communication used by multiple ACAP applications. Communication is established directly between the target device and the user's application. The Axis DEM uses ONVIF standards to trigger events.

The SED Application defines an event for Noise Measurement and an event for each type of SED Alert by default. Some of the VMSs do not support binding a reaction based on a group of events or on the identical part of the event topic path. In those cases, SED Application allows to group all SED Alerts into one event, and the information about the event is moved into the data. Grouping is possible in the case of sending SED Events as well.

Noise Measurement

Topic: tnsaxis:CameraApplicationPlatform/SED_Measure/NoiseMeasurement

Type: Property

Source:

Data:

- NoiseLevel: Energy level of noise in dB in the device's surroundings
- Datestamp: Date ("yyyy-MM-dd") when the device state has changed
- Timestamp: UTC Time ("hh:mm:ss.zzz") when the device state has changed

9:04:14 AM

tnsaxis:CameraApplicationPlatform/SED_Measurement/NoiseMeasurement Changed

Timestamp: 230223-100414276
NoiseLevel: 55.855407

SED Alert

\$alert\$ - [Gunshot, Glassbreak, Scream, Male Scream]

Topic: tnsaxis:CameraApplicationPlatform/SED_Alert[/ \$alert\$]

Type: Stateless

Source:

Data:

- [EventType: \$alert\$]
- EnergyLevel: Energy level of the event in dB
- BackgroundLevel: Energy level of the noise in dB in the device's surroundings
- Datestamp: Date ("yyyy-MM-dd") when the device state has changed
- Timestamp: UTC Time ("hh:mm:ss.zzz") when the device state has changed

9:06:58 AM

tnsaxis:CameraApplicationPlatform/SED_Alert/Gunshot

Initialized

BackgroundEnergy: 36.883757
EventEnergy: 66.420796
Timestamp: 230223-100656648

SED Event

\$event\$ - [Others, Siren, Fireworks]

Topic: tnsaxis:CameraApplicationPlatform/SED_Event[/ \$event\$]

Type: Stateless

Source:

Data:

- [EventType: \$event\$]
- EnergyLevel: Energy level of the event in dB
- BackgroundLevel: Energy level of the noise in dB in the device's surroundings
- Datestamp: Date ("yyyy-MM-dd") when the device state has changed
- Timestamp: UTC Time ("hh:mm:ss.zzz") when the device state has changed

9:08:08 AM

tnsaxis:CameraApplicationPlatform/SED_Event/Others

Initialized

BackgroundEnergy: 46.394732
EventEnergy: 65.641740
Timestamp: 230223-100806713

Rules

Trigger of the ACAP Event can be connected with an Axis rules mechanism. The most common way of the rule's usage is to write a text into a video stream with the information about the detected Alert type if the alerts are grouped to fulfil VMS limitations and VMS is not able to work with the data of the alert.



Device events MQTT events**Rules** Schedules Recipients Manual triggers

☐ New rule

☒ Use this rule

Name

Wait between actions (max 23:59:59)

Condition ^

SED Alert: MaleScream

Application

SED Alert: Glassbreak

SED Alert: Gunshot

SED Alert: MaleScream

SED Alert: Scream

SED Event: Others

SED Event: Siren

SED: NoiseMeasurement

Video motion detection 3

VMD 4: Any Profile

VMD 4: Profile 1

Audio

Audio clip playing

Audio detection

Device status

Above operating temperature

Above or below operating temperature

Below operating temperature

IP address removed

Network lost

Figure 6: Axis Rules

Activation of SED alarms in Genetec Security Centre

1. Start the Config Tool and log in as an administrator.
2. Open the Video task and select the video unit with the Sound Event Detector ACAP enabled in the camera logical tree.

3. Open the Properties tab and scroll to the bottom of the page to the Enable metadata stream switch. If it is not enabled, enable this feature.
4. In the Applications window, check Sound Event Detector.
5. In the Application events window, check all or selected SED Alerts that you plan to use on the system. Note: This step does not activate the corresponding detection in the camera application. This activation must be done on the camera web interface in the Court Event Detector application settings.
6. Continue by configuring the GSC system response to each event in Automations or Actions (formerly Event-To-Action) - operator notification, automatic system response, alarm activation, etc. SED events would be offered to you in the Events and Alarms configuration (as SED_Alert... or SED_Event...). If you still don't see them on the system after the above configuration, restart the GenetecServer service on the main Directory server.

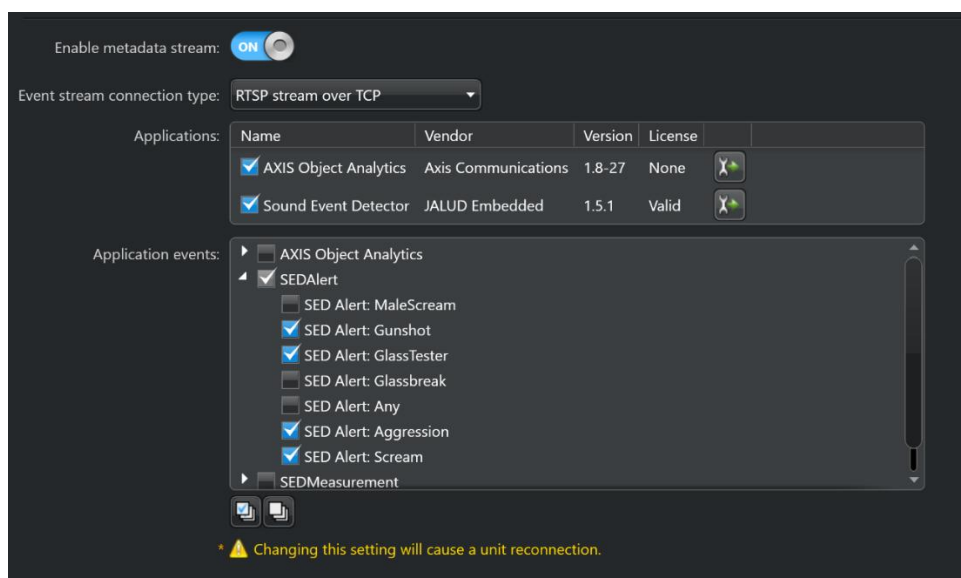


Figure 7: Activation of SED alarms in Genetec Security Centre

Due to the different ranges of audio settings in the camera itself and in the Genetec Security Centre application (Axis from -12dB to 75dB; SC from 0 to 100%, which corresponds to 18dB to 55dB), there may be situations where it is necessary to prevent the audio parameters in the camera from being overwritten. In most cases, the standard range in the application is sufficient, and there is no need to change the settings. If problems arise, it is necessary to adjust the Security Centre settings to prevent unwanted changes to the audio parameters in the camera.

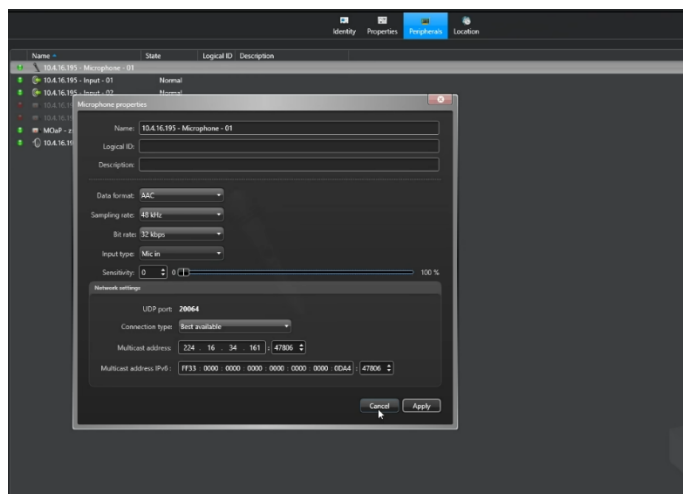


Figure 8: Audio Settings

In Archiver, under the Advanced Settings tab, you need to add two conditions in Additional Settings.

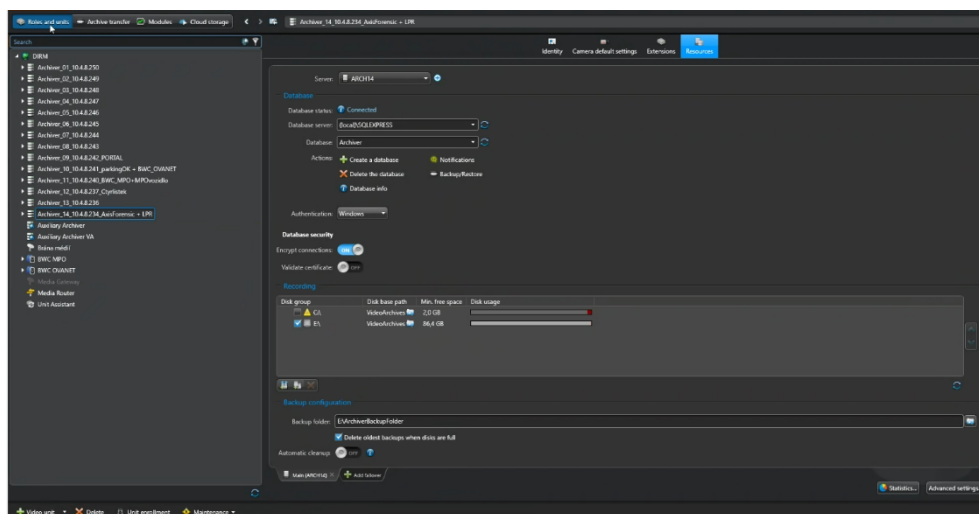


Figure 9: Genetec Security Centre Archiver

Conditions:

3.1 AudiInputTypeConfigurationDisabled with value 1

This Advanced setting prevents any changes on the device, regardless of changes made in the Config Tool.

3.2 StratocastAudioGainOverrideDisabled with value true

This Advanced setting prevents the toggling off of the Automatic input gain toggle on the device.

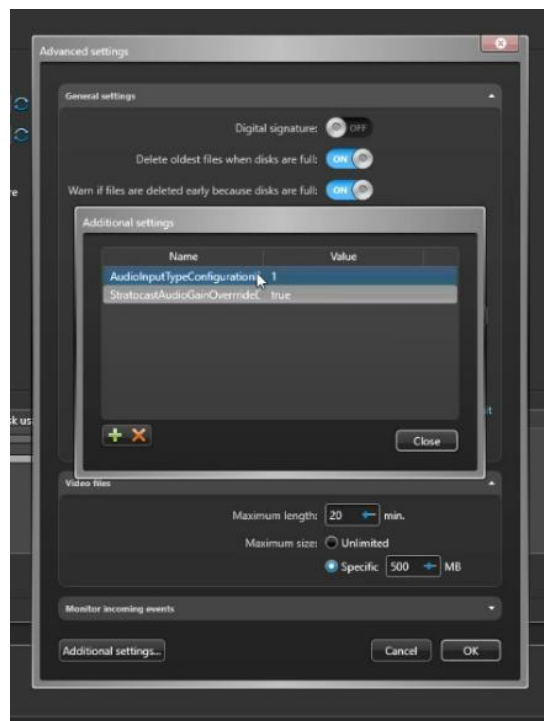


Figure 10: Advanced Settings – Add condition

Application Settings

Open button on the application panel navigates into settings page.



Figure 11: Settings Page

Manual

This option navigates to the [SED ACAP Manuals](#) folder. The user can download the actual version of this manual in multiple language variants.

manuals 

Moje soubory

Název ^	Čas úpravy	
 br	02/21/2023 11:20:40	
 cs	02/21/2023 11:20:26	
 de	02/21/2023 11:20:22	
 en	02/21/2023 11:20:13	
 es	02/21/2023 11:20:33	

Settings

The SED application behaviour might be affected via settings. The settings are split into categories, and the user can use the navigation panel to switch between the categories.

Setting

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
------------------	-----------------	------------	-------------	----------	------------------	-----	-------

Figure 12: Navigation Panel

Any change of settings takes effect after the application restarts. The user is informed about it on the settings page. Values that were recently updated and haven't taken effect yet are, in this case, displayed on the settings page.

Setting

Changes will take effect after a reboot.

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
------------------	-----------------	------------	-------------	----------	------------------	-----	-------

Enabled Updated!
☐

Figure 13: Settings Changed

Settings within categories are sorted in alphabetical order as the page is generated.

Alerts

Alert settings allow user to enable and disable sending alerts based on their type. The recordings of examples for each alert type can be downloaded [here](#). The set of alerts differs based on the SW version – **full** vs **basic**.

Complete list and description of alerts and events [here](#).

Alerts	AudioFilter	AudioInput	Detector	Events	EventsArchive	NoiseMeasurement	Simulation	TCP
--------	-------------	------------	----------	--------	---------------	------------------	------------	-----

Aggression

☐

GlassTester

☐

Glassbreak

☐

Gunshot

☐

MaleScream

☐

Scream

☐

Save

Figure 14: Alert Settings

Audio Input

!DO NOT CHANGE WITHOUT PREVIOUS DISCUSSION!

Audio input contains parameters of the audio input signal to match the classification settings. There is no need to change those settings under standard circumstances, and if the recommended microphone is used.

BitsPerSamples: Number of bits per each sample of the input audio device.

NumberOfChannels: Number of channels the input audio signal contains

SampleRate: Sample rate of the input audio signal.

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
BitsPerSample 16 NumberOfChannels 1 SampleRate 32000 Save							

Figure 15: Audio Input

Audio Filter

!DO NOT CHANGE WITHOUT PREVIOUS DISCUSSION!

Audio Filters filter out noise from the input audio signal. The basic high-pass filter is sufficient for the target device to work in most environments. The audio filters are meant to be adapted if the target device is located in a specific environment with high noise on specific frequencies. If it is the case, contact us at support@jalud-embedded.com.

Type [index]: Type of the filter. The current version supports the HighPass filter and the Adaptive LMS filter.

HPFrequency: The high-pass cutoff frequency

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
------------------	-----------------	------------	-------------	----------	------------------	-----	-------

HPFrequency

TypeIndex

Save

Figure 16: Audio Filter

Detector

!DO NOT CHANGE WITHOUT PREVIOUS DISCUSSION!

Detector settings affect the behaviour of the detector in the classification process, and therefore, it has a significant impact on the number of detected events. The default settings are suitable for most environments.

AdaptingPeriod[s]: When the application is started, the detector adapts the energy threshold on the ambient noise level. The SED application triggers no alerts during the time defined by the Adaptation period after it is started.

Alpha: Defines how quickly the detector adapts to the ambient noise level change. If the value is too low, the detector is not able to adapt quickly enough to a changing background. If the value is too high, the detector can adapt to the uncommon event too quickly and prevents its detection. The default value is tested in many environments to work in an optimal way.

FrameSize [ms]: The length of the audio signal frame from which the noise level is computed. Increasing the value reduces the accuracy of the timestamp of the beginning of a detected event. Lowering the value increases the vulnerability to a random noise.

Margin[dB]: The margin value defines a threshold for how much the noise level of the event must exceed the average ambient noise level to be detected and classified. Change the settings only if needed and carefully. The default detector settings are optimal for most environments.

Event:

- **Fixed Length:** If the option is enabled, each detected event has a fixed duration defined by the *Max Duration* value. If disabled, the duration of the value can be shorter in case the energy level drops below the threshold.

- **Min Duration [ms]:** The minimum amount of time the energy of the event must remain above the threshold to be detected and classified.
- **Max Duration [ms]:** The maximum (or the fixed) event duration. If the event has a longer duration, only the beginning of the *Max Duration* is classified.
- **Send Multiple Events:** This option defines what happens if event duration exceeds the *Max Duration*. If disabled (default, then the rest of the event is dropped - for most cases, this behaviour is sufficient. If enabled, the end of one event is the beginning of another until the noise level drops below the threshold or until the detector adapts to the new ambient noise. This option is useful in an environment where a dangerous situation is likely to happen after a sudden increase in ambient noise:
 - production hall after switching on a loud machine
 - etc.

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
AdaptingPeriodS 60 Alpha 0.0004 Event\FixedLength ☐ Event\MaxDurationMs 1024 Event\MinDurationMs 256 Event\SendMultipleEvents ☐ FrameSizeMs 16 MarginDb 10 Save							

Figure 17: Detector Settings

Events

Event settings allow user to enable or disable sending events based on their type. The difference between alerts and events is that alerts indicate sounds of dangerous or

unwanted events. The event, on the other hand, indicates a sound of events that are common in most environments and in most cases do not indicate anything special. Nevertheless, they might be interesting in some scenarios – for example detection of people in areas where nobody should be.

This feature is available only in the **full** SW variant. The recordings of examples for each alert type can be downloaded [here](#).

Complete list and description of alerts and events [here](#).

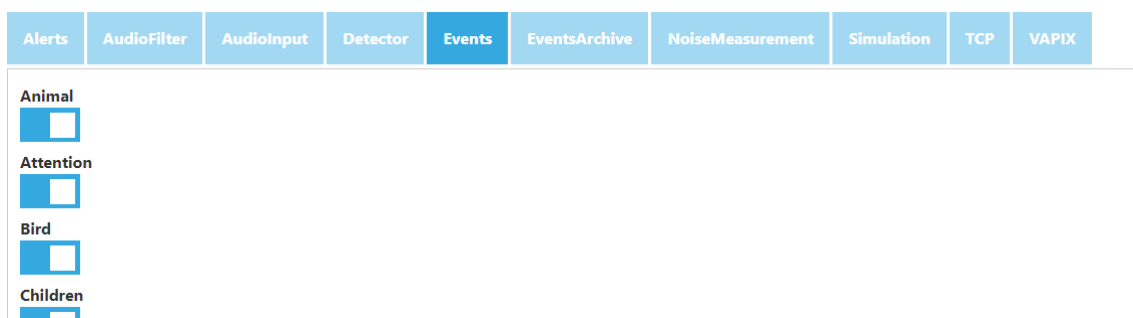


Figure 18: Events Settings

Events Archive

If archiving is enabled, the device stores all events that were classified, regardless of their class. This functionality gives the possibility to investigate **false negatives** if such a case is identified.

Enabled: Enable/Disable archiving

MaxSpaceUsed[MB]: Defines a maximum size in MB of archived events on the hard drive. In case of storing a new event that exceeds the value of the oldest event in the archive is removed first and the new event is stored afterwards.

MinSpaceLeft[MB]: Defines a minimum space in MB that must be left on the hard drive. The behaviour of storing a new event that should breach the minimum amount of space on the hard drive is identical to that described above.

Alerts	AudioFilter	AudioInput	Detector	Events	EventsArchive	NoiseMeasurement	Simulation	TCP	VAPIX
--------	-------------	------------	----------	--------	---------------	------------------	------------	-----	-------

Enabled
☐

MaxSpaceUsedMB
512

MinSpaceLeftMB
10

Save

Figure 19: Events Archive Settings

Noise Measurement

Enabled: Enable/Disable noise measurement.

Interval[s]: Time between two noise measurements

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
------------------	-----------------	------------	-------------	----------	------------------	-----	-------

Enabled
☐

IntervalS
60

Save

Figure 20: Noise Measurement Settings

Simulation

Simulation settings enable sending simulated alerts instead of processing the audio signal. This option is useful, especially for system tests

AlertsSimulationEnabled: If Alerts simulation is enabled, the application does not process microphone input and triggers alerts periodically instead. Triggered alert contains a valid timestamp, but it contains no sound data nor any information about the sound data energy level. The simulation switches one by one all the alerts enabled in the **Alerts** settings.

AlertsSimulationInterval[s]: The interval in seconds between two following alerts

AudioSimulationEnabled: If Audio simulation is enabled, the application does not process microphone input and processes data from an audio record stored on the hard drive instead.

AlertsSimulationEnabled
☐

AlertsSimulationIntervals
15

AudioSimulationEnabled
☐

Save

Figure 21: Audio Simulation Settings

TCP

Enabled: Enable/Disable TCP communication

Server Address: IP address of the server - the IP address of the cloud server is set by default.

Server Port: Port on which the server is listening for incoming connections

Server Secured: Defines whether the communication with the server is encrypted or not. The server in the cloud requires a secure connection.

Send Alerts: Enable / Disable sending of detected alerts (Gunshot, Glassbreak, Scream)

Send Alerts Data: Enable / Disable sending audio fragments together with alerts. The audio fragment is 1s long by default.

Send Events [index]: Enable / Disable sending of SED Events. Be aware that if all events are sent to a standard place, a user might be flooded by up to several thousand events per day. To avoid these, multiple settings are available:

- None (default): No events are sent.
- All: All detected events are sent.
- Above 60 dB: Only events that are louder than 60dB are sent.

- Above 75 dB: Only events that are louder than 75dB are sent.

Send Events Data: Enable / Disable sending audio fragments together with events. See more details in *Send Alerts Data*. If all events are sent and cloud SED Server is used discuss enable of sending events audio data with us on acap@jalud-embedded.com first.

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
Enabled ☐ SendAlerts ☐ SendAlertsData ☐ SendEventsData ☐ SendEventsIndex None ▼ ServerAddress 80.211.41.205 ServerPort 44444 ServerSecured ☐ Save							

Figure 22: TCP Communication Settings

VAPIX

Enabled: Enable/Disable VAPIX communication

Send Alerts: Same as TCP communication

Send Alerts Data: Not supported by VAPIX

Send Events [index]: Same as TCP communication

GroupEvents [index]: This setting is used to define if grouping of SED Alerts and SED Events is used or not. User can choose from those options:

- Not Used: Only separated events are sent
- Use Instead: Only group events are sent

- Use Together: Separate and Group events are sent together. It means that if alert is triggered two events at once are sent.

AlertsSimulation	AudioSimulation	AudioInput	AudioFilter	Detector	NoiseMeasurement	TCP	VAPIX
Enabled ☐ SendAlerts ☐ SendAlertsData ☐ SendEventsIndex All ▾ SendEventsData ☐ GroupEventsIndex NotUsed ▾ Save							

Figure 23: VAPIX Communication Settings

Annexes and Other Documents

[GDPR Study]: [GDPR Study](#)

