DetectorPack. User Guide

Introduction

General information

The purpose of the document

The *Axxon PSIM* software system – *DetectorPack PSIM*. User Guide contains the information necessary to install and operate the additional software modules that are part of the *Axxon PSIM* software system *DetectorPack PSIM*.

The structure of this document allows the user to skim the information contained on the *DetectorPack PSIM* and to select, depending on the level of training, topics of interest for a more detailed study. Chapters in the manual – or the informational or reference content – each have their own underlying structure.

The Introduction section is intended as a general introduction to this document.

The Requirements for software and hardware platform section describes the requirements for computers and operating systems that use software modules included in the *DetectorPack PSIM*.

The Installing the DetectorPack PSIM section contains the recommendations for users and administrators to install, repair and remove the *DetectorPack PSIM.*

The Configuring detection modules section provides the information on functional characteristics, requirements for video cameras, and configuring the detection modules.

The Operating detection modules section provides the information on operating the detection modules.

Purpose of the subsystem DetectorPack PSIM

The following *DetectorPack PSIM* modules are intended for integration and use with *Axxon PSIM*:

1. *Heat map detection*.
2. *Detection of moving against crowd flow*.
3. *Queue length detection*.
4. *Smoke detection*.
5. *Detection of light indication control*.
6. *Fire detection*.
7. *Stopped vehicle detection*.
8. *People counter detection*.
9. *Train detection*.
10. *Traffic light detection*.
11. *Crowd detection (TVN)*.
12. *Fluid level detection*.
13. *Sweethearting at checkout detection*.
14. *Barcode detection*.
15. *Equipment detection (PPE)*.
16. *Neurocounter*.
17. *Neurotracker*.
18. *Person location tracker*.

The functional characteristics of these detection modules are provided in the corresponding sections (see Configuring detection modules).

Requirements for software and hardware platform

General requirements for base computers and operating system

The requirements for the base computers and operating system for the modules included in the *DetectorPack PSIM* correspond to the same requirements for *Axxon PSIM* (see Axxon PSIM Administrator's Guide).

Each software module automatically determines which computing resources it can use—a central processing unit (CPU) or a graphics processing unit (GPU).

For the modules that use neural analytics (see General information on Neural analytics), the operating device can be set manually.

Platforms for the operation of detection software modules

The *DetectorPack PSIM* is comprised of the independent software modules that operate on the following platforms:

Module	x32	x64
Heat map detection	✓	✓
Detection of moving against crowd flow	✓	✓
Queue length detection	✗	✓
Smoke detection	✗	✓
Detection of light indication control	✗	✓
Fire detection	✗	✓
Stopped vehicle detection	✓	✓
People counter detection	✓	✓
Train detection	✓	✓
Traffic lights detection	✓	✓
Crowd detection (TVN)	✗	✓
Fluid level detection	✗	✓
Sweethearting detection	✗	✓
Barcode detection	✓	✗
Equipment detection (PPE)	✗	✓
Neurocounter	✗	✓
Neurotracker	✗	✓
Person location tracker	✗	✓

Attention!

- Simultaneous operation of 32-bits and 64-bits modules on one computer is impossible.
- The list of available detection tools contains only those that work on a 32-bit or a 64-bit platform.

Note

- When the VMDA tracker is launched in a separate process, it operates correctly both on a 32-bit and a 64-bit platform (see Axxon PSIM software. Administrator's Guide). You can separate the VMDA tracker to the single process using the VMDAEXT registry key which is described in Registry Keys Reference Guide. The most recent versions of these documents are available in the AxxonSoft documentation repository.
- By default, the detection tools are launched in one common process. To launch a detection tool in a separate process, set the **IsProcessObject_<Detection type>**=1 registry key parameter value for the required detection tool, for example, for a train detection: IsProcessObject_TRAIN_DETECTOR=1 (see Registry Keys Reference Guide).

Requirements for hardware platform for decoding video on GPU

If detection tools use GPU for decoding video (see Configuring detection modules), the following device requirements must be met:

1. For NVIDIA GPU:
   a. CUDA 11.1 – 11.4.
   b. Compute Capability 3.5 – 8.6.

   > **Attention!**
   >
   > CUDA is compatible with generations of computers on architectures: Kepler (partially), Maxwell, Pascal, Volta, Turing, Ampere (partially), see CUDA.

   > **Note**
   >
   > You can check the version of GPU Compute Capability on the manufacturer's website.

   > **Attention!**
   >
   > When you use NVIDIA GPU, we recommend installing the latest driver from the NVIDIA official website.

   c. Support for the required codec in NVDEC (see https://developer.nvidia.com/video-encode-and-decode-gpu-support-matrix-new).

   > **Attention!**
   >
   > Video decoding can be performed on two NVIDIA GPUs simultaneously.

2. For integrated Intel GPUs:
   a. 6th generation CPU and above.
   b. Support for the required codec in Intel Quick Sync Video.

Requirements for hardware platform for neural analytics operation

When you use neural analytics (see General information on Neural analytics), the hardware platform must meet the following requirements:

1. Due to the features of NVIDIA SDK, the neural analytics can operate only on Windows Server 2019 OS and Windows 10 OS.
2. The neural network analytics supports the following devices: CPU, GPU NVIDIA, VPU (Intel NCS).

   Attention!

   - In order to connect the Intel NCS, plug in the device to the USB port and make sure that Windows displays it with one of the following names: Movidius, Myriad X, VSC Loopback Device. You can use Intel NCS on any computer that meets the hardware requirements of *Axxon PSIM* (see General requirements for PCs).
   - We don't recommend using more than one Intel NCS device on the same Server.

3. If you use CPU or Intel GPU for the neural analytics operation, then the following requirements must be met:
   a. support for the following CPUs:
      i. 6th–10th Generation Intel® Core™ processors;

         Attention!

         If you use CPU below 6th Generation Intel® Core™ processors, the operation of detection tools isn't guaranteed.

      ii. Intel® Xeon® v5 family;
      iii. Intel® Xeon® v6 family;
      iv. Intel® Movidius™ Neural Compute Stick;
      v. Intel® Neural Compute Stick 2;
      vi. Intel® Vision Accelerator Design with Intel® Movidius™ VPUs.
   b. the OpenVino toolkit must support the Intel CPU that you use (see https://software.intel.com/content/www/us/en/develop/tools/openvino-toolkit/system-requirements.html);
   c. processor must support the AVX2 or AVX512 instruction set (see https://ark.intel.com/content/www/us/en/ark/search/featurefilter.html?productType=873&1_Filter-InstructionSetExtensions=3533&1_Filter-Family=595).
4. NVIDIA GeForce 1050 Ti GPU or newer. GPU requirements:
   a. at least 2 GB of memory;
   b. CUDA 11.1 – 11.4;
   c. Compute Capability 3.5 – 8.6.

      Attention!

      - CUDA is compatible with generations of computers on architectures: Kepler (partially), Maxwell, Pascal, Volta, Turing, Ampere (partially), see CUDA.
      - When you use NVIDIA GPU, we recommend installing the latest driver from the NVIDIA official website.
      - You can check the version of GPU Compute Capability on the manufacturer's website.

When you use a GPU, a single neural network consumes 500 MB of video memory. For example: to run any number of fire and smoke detection channels based on neural networks, you must use a graphics card with 1GB of memory or more. You can use multiple video cards in your system.

Attention!

For the correct operation of each detection tool, video requirements must be met.

The requirements are specific for each detection tool and are given in the corresponding sections (see Configuring detection modules).

Installing the DetectorPack PSIM

General description of the Detector Pack distribution kit

DetectorPack PSIM is supplied as a software installation package (distribution kit). The current version of the distribution kit can be downloaded from the official AxxonSoft website.

The distribution kit contains all the necessary software components for installing *DetectorPack PSIM* on a base computer.

The distribution kit allows you to install, restore and remove *DetectorPack PSIM*.

Attention!

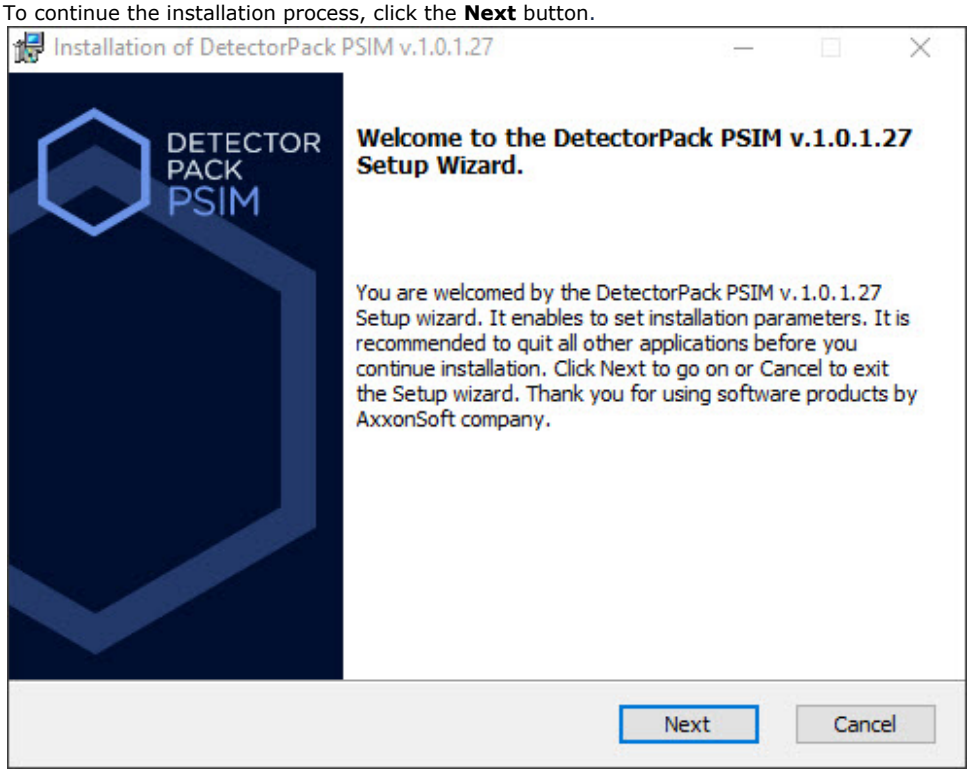
- Prior to installing, restoring or removing *DetectorPack PSIM*, *Axxon PSIM* should be shut down.
- Administrator rights are required for installing, restoring or removing *DetectorPack PSIM*.

Installation

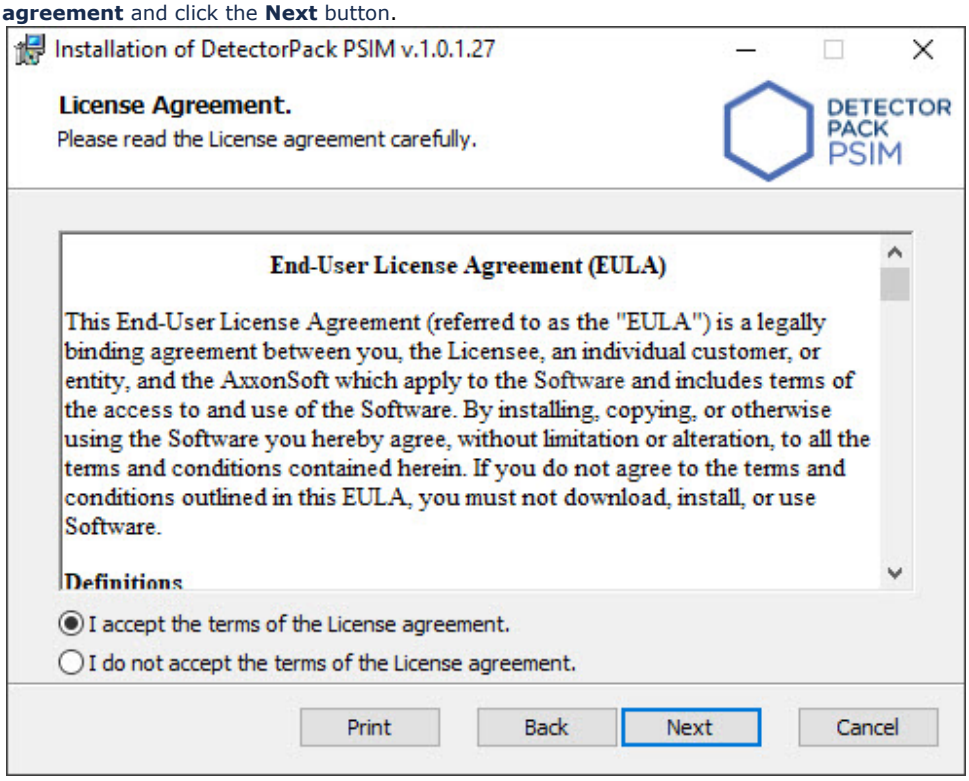
DetectorPack PSIM is installed as an extension to *Axxon PSIM*.

To install *DetectorPack PSIM*, do the following:

1. In the root directory of the distribution package, run the setup.exe executable file
2. To continue the installation process, click the **Next** button.

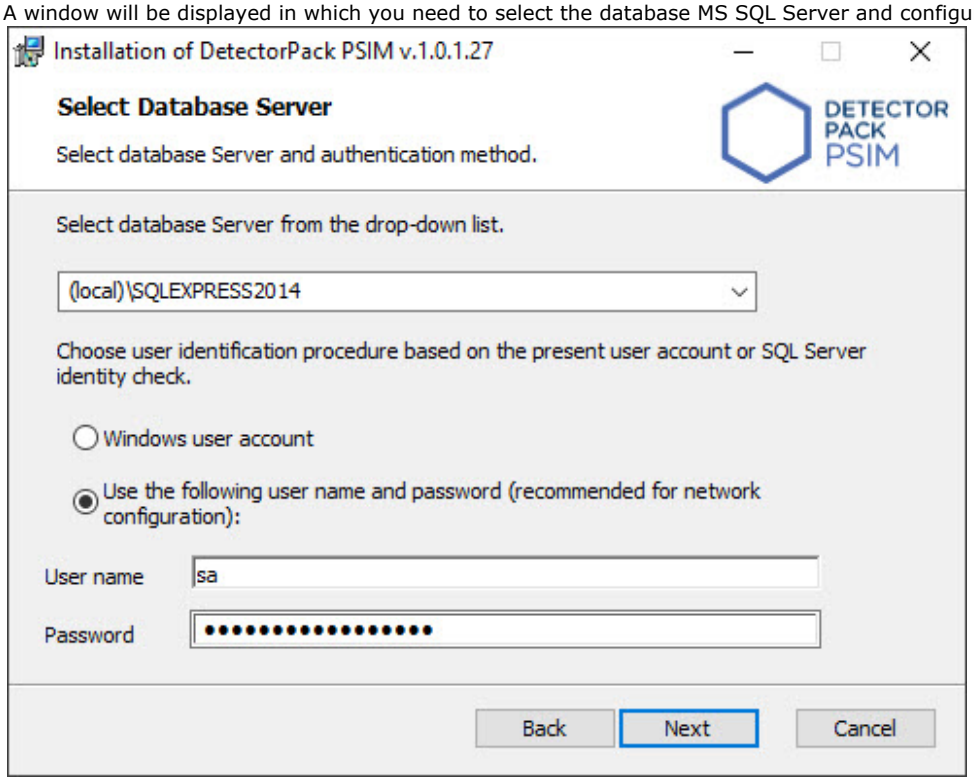


3. Read the terms of the license agreement carefully. Then set the radio button to **I accept the terms of the License agreement** and click the **Next** button.



> **Note**
>
> Click the **Print** button to print the license agreement.

4. A window will be displayed in which you need to select the database MS SQL Server and configure the connection settings.



5. Select the database MS SQL Server from the **database Server** drop-down list.

> **Note**
>
> To use the SQL server installed on this (local) computer, select (local)\SQLEXPRESS (set as default).

6. Set the authentication parameters that will be used by *DetectorPack PSIM* when connecting to the SQL server.

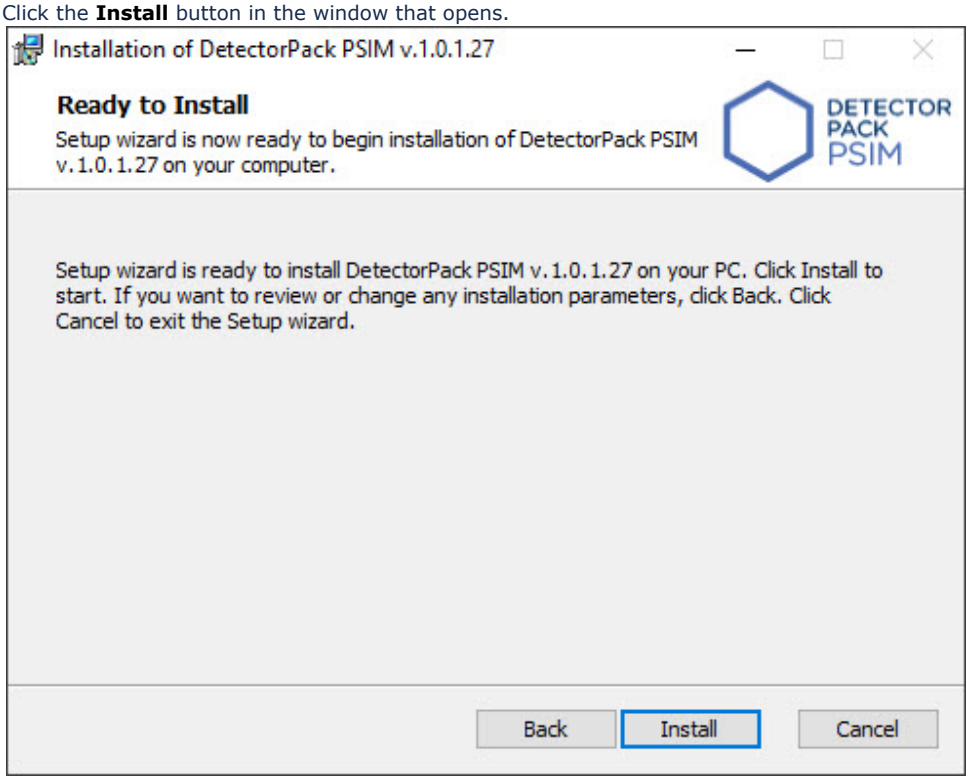
Authentication methods	**Windows credentials**	**SQL server authentication using the following username and password (Recommended)**
Use cases	The SQL server from *DetectorPack PSIM* distribution package (or from a third-party distribution package) and *DetectorPack PSIM* are installed on the same computer	The SQL server from *DetectorPack PSIM* distribution package and *DetectorPack PSIM* are installed on the same computer. Connection to the SQL server with the specified username (login) and password can be made from any remote computer that is in the same TCP/IP network domain as the computer on which the SQL server is being installed
	The SQL server and *DetectorPack PSIM* are installed on different computers that are connected via TCP/IP network and located in the same network domain. In Windows OS on the computer with installed MS SQL server, an account should be created for the user currently authorized in Windows OS on the computer on which *DetectorPack PSIM* is being installed	The SQL server from *DetectorPack PSIM* distribution package and *DetectorPack PSIM* are installed on different computers that are connected via TCP/IP network and located in the same network domain. The username (login) and password should match the username (login) and password used to access the SQL server

	Full-featured SQL server (installed optionally) and *DetectorPack PSIM* are installed on different computers that are connected via TCP/IP network and located in the same network domain. An account should be created on the remote SQL server for the user currently authorized in Windows OS on the computer on which *DetectorPack PSIM* is being installed	Full-featured SQL server (installed optionally) and *DetectorPack PSIM* are installed on the same or different computers that are connected via TCP/IP network and located in the same network domain. The username (login) and password should match the username (login) and password used to access the SQL server

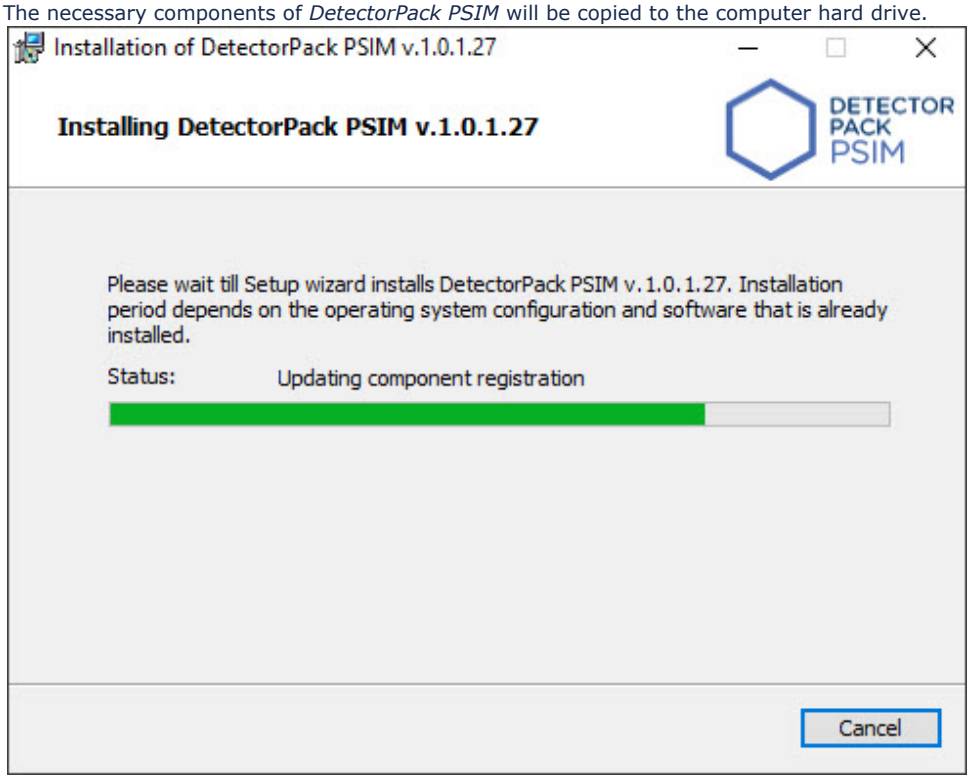
Attention!

If *DetectorPack PSIM* is installed by the computer Administrator, and Windows credentials are used for the SQL server authentication, access to the database by any other user will not be possible without additional configuration of the idb.exe utility and knowledge of the Administrator login and password. It is strongly not recommended to use this method of the SQL server authentication.

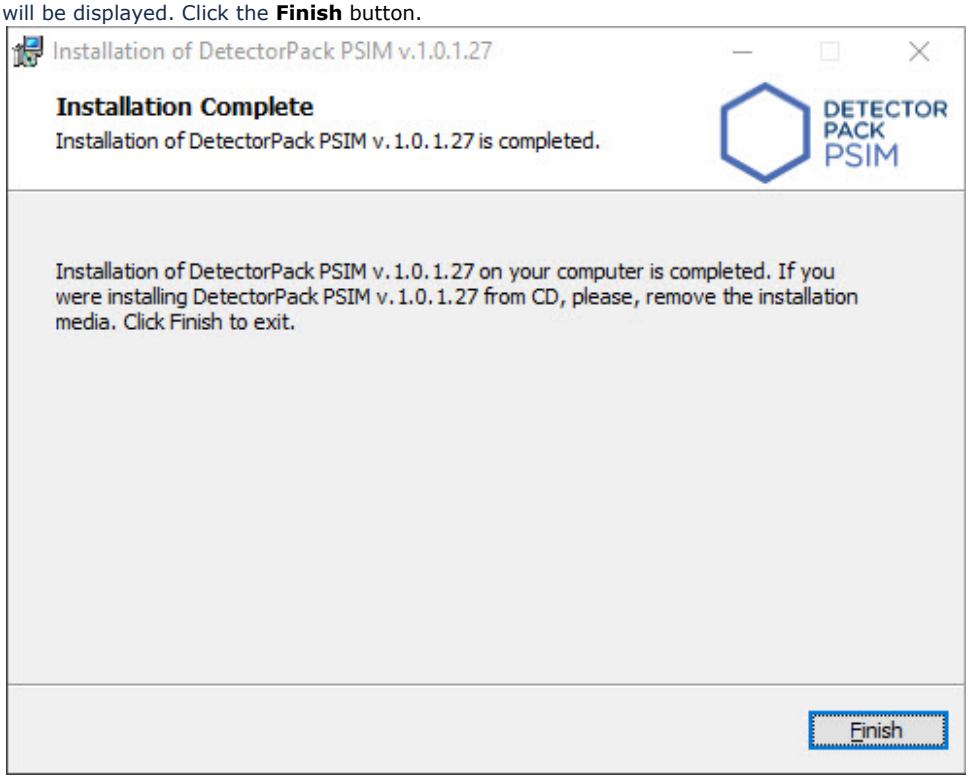
7. Click the **Next** button to continue the installation process.
8. Click the **Install** button in the window that opens.



9. The necessary components of *DetectorPack PSIM* will be copied to the computer hard drive.



10. After all *DetectorPack PSIM* components are successfully copied, the message about the completion of the installation process will be displayed. Click the **Finish** button.



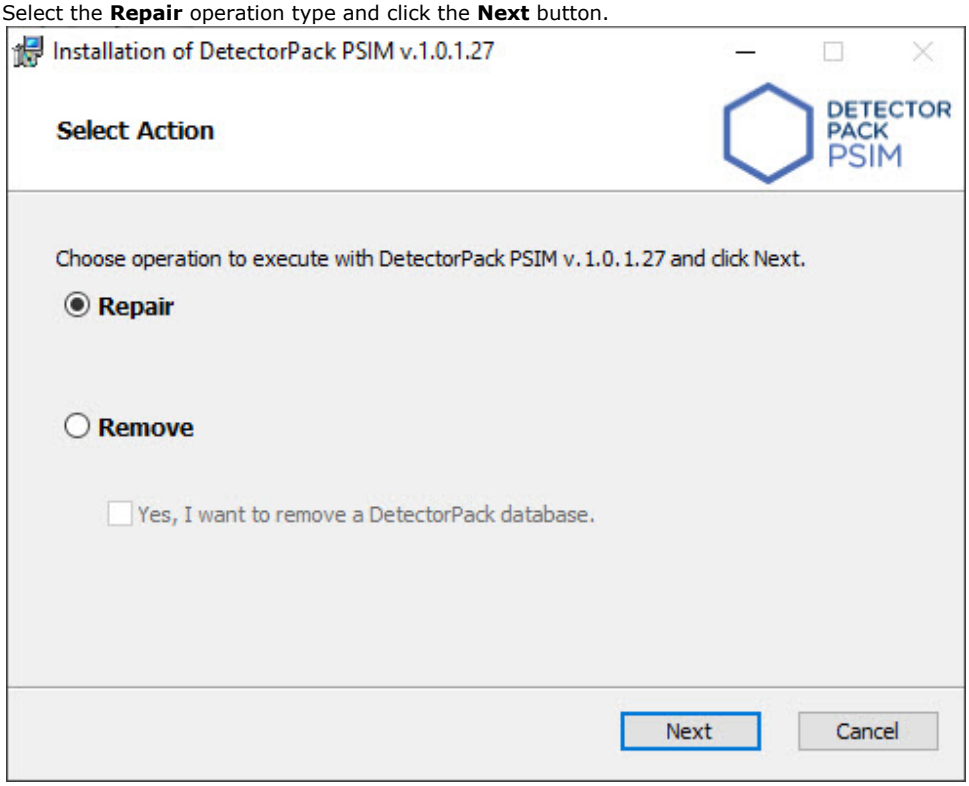
The *DetectorPack PSIM* installation in complete.

Repair

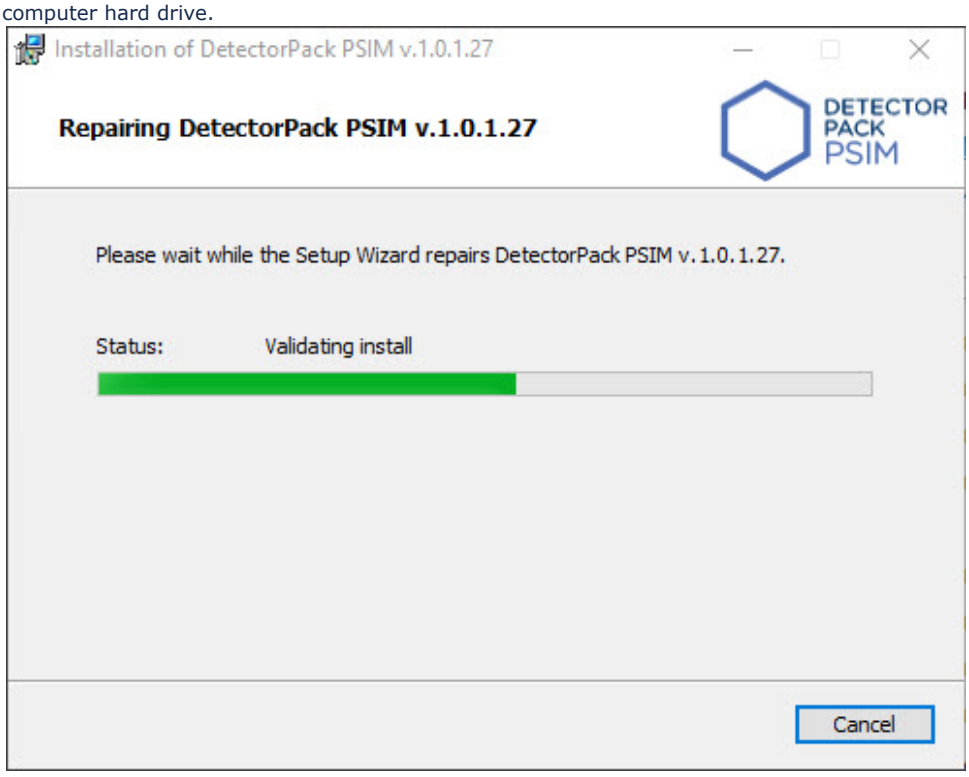
The repair mode is used if *DetectorPack PSIM* software components need to be reinstalled.

To repair *DetectorPack PSIM*, do the following:

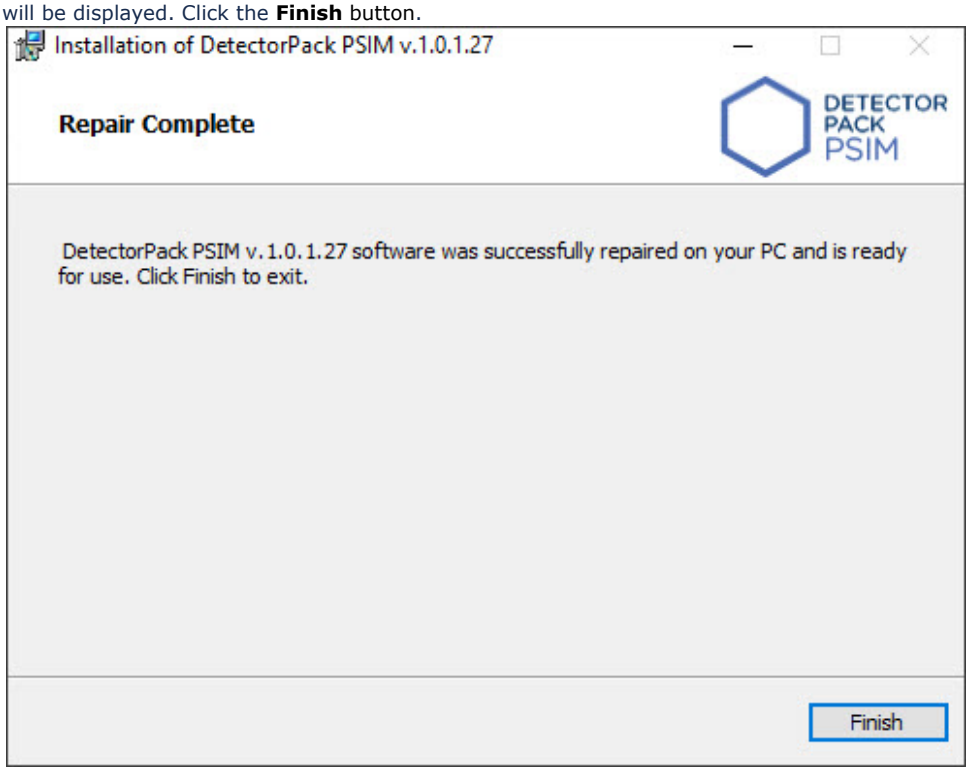
1. In the root directory of the distribution package, run the setup.exe executable file.
2. Select the **Repair** operation type and click the **Next** button.



As a result, the installed components will be checked and the necessary components of *DetectorPack PSIM* will be copied to the computer hard drive.



3. After all *DetectorPack PSIM* components are successfully copied, the message about the completion of the repairing process will be displayed. Click the **Finish** button.



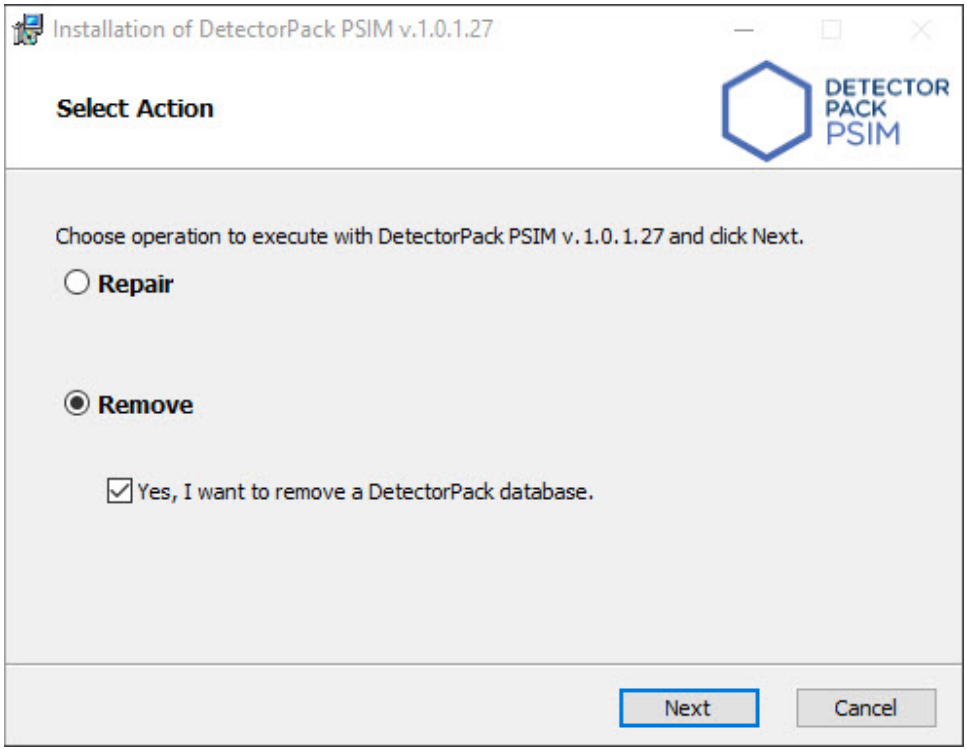
The *DetectorPack PSIM* repair is complete.

Removal

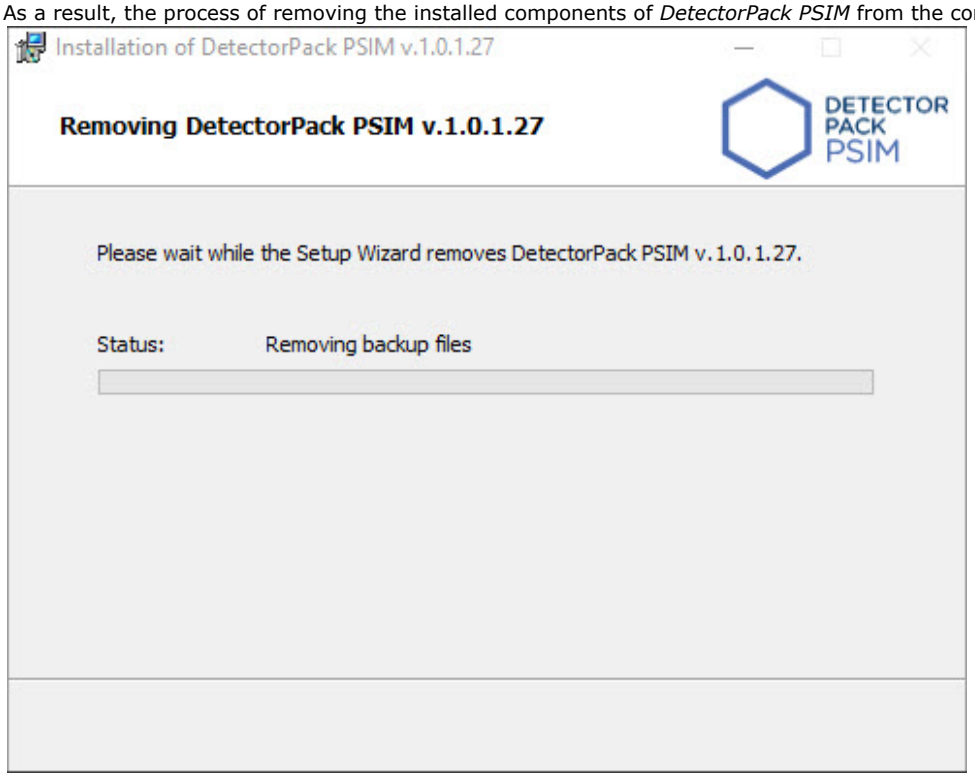
To remove *DetectorPack PSIM*, do the following:

1. In the root directory of the distribution package, run the setup.exe executable file.
2. Select the **Remove** operation type and click the **Next** button.

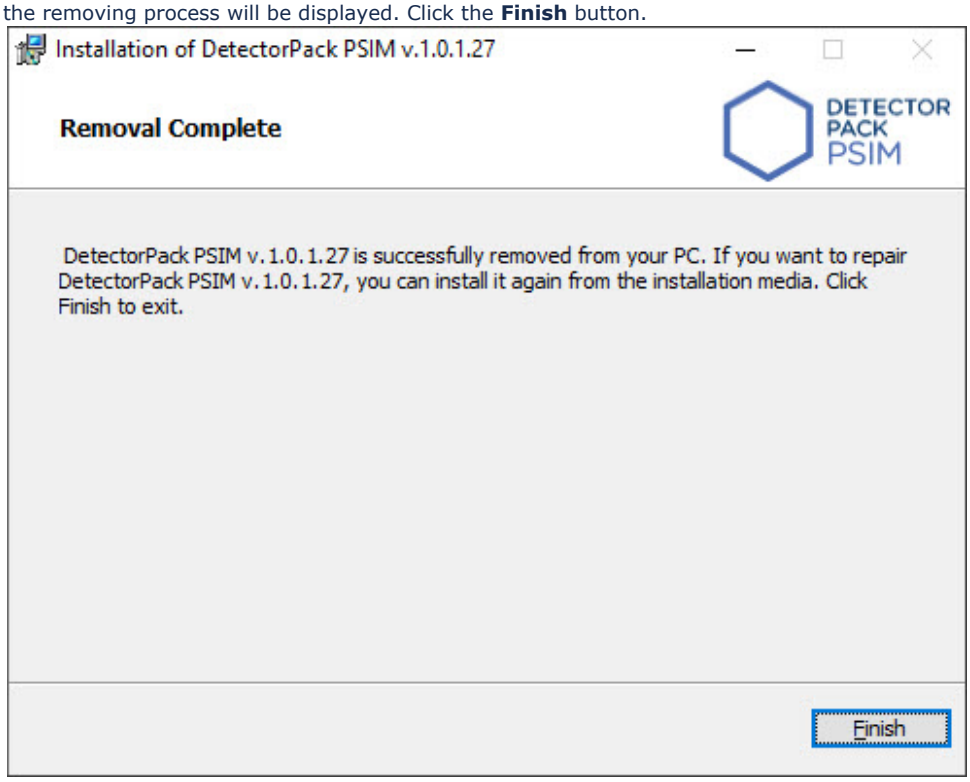
> **Note**
>
> If it is also necessary to delete the *DetectorPack PSIM* database, set the **Yes, I want to remove a DetectorPack database** checkbox.



3. As a result, the process of removing the installed components of *DetectorPack PSIM* from the computer hard drive will begin.



4. After all *DetectorPack PSIM* components are successfully removed from the hard drive, the message about the completion of the removing process will be displayed. Click the **Finish** button.



DetectorPack PSIM removal is complete.

Installing DetectorPack PSIM in silent mode

It is possible to install *DetectorPack PSIM* in a quiet (silent) mode. For this select one of the following options:

1. Specify in the **setup.ini** file in the installation directory (see Installation):

```
[Startup]
CmdLine=/quiet
```

```
[Info]
Name=DetectorPack
Version=1.00.000
DiskSpace=8000  ;DiskSpace requirement in KB

[Startup]
CmdLine=/quiet
Product=DetectorPack PSIM
PackageName=Product.msi
LogOptions =
QuietCmdLine=/quiet

[Install1]
DisplayName=MS Visual Studio 2015 Redistributable x64
CmdLine=/q
Product=Redist\VC2015_Redistributable_Package\x64\vcredist_x64.exe
Required=1
QuietCmdLine=/q
Platform=x64
GUID={A1C31BA5-5438-3A07-9EEE-A5FB2D0FDE36}

[Install2]
DisplayName=Sentinel Runtime
CmdLine=/i /cm
Product=Redist\Hasp\haspdinst.exe
Required=1
QuietCmdLine=/i /nomsg
```

   When **Setup.exe** is run, *DetectorPack PSIM* is installed in the quiet (silent) mode.
2. In the *DetectorPack PSIM* installation directory specify the following command in the Windows command line:

```
setup.exe /quiet
```

   When the command is executed, the *DetectorPack PSIM* installation in the silent mode starts.

Configuring detection modules

General information on metadata

Metadata is any accompanying data to any basic information. Metadata refers to additional information about the content or object. It reveals information about the attributes and properties that characterize an entity, allowing you to automatically search and manage it in large information flows. In this User Guide, metadata is the accompanying data that describes the behavior of objects in the camera field of view.

In *Axxon PSIM*, you can obtain metadata in two ways:

1. When analyzing video images on the Server by detection tools.
2. When receiving ready metadata from the embedded analytics of cameras (see Embedded detectors).

> **Attention!**
>
> To obtain metadata, video decompression and analysis takes place, which leads to a heavy load on the Server and limits the number of cameras used on it.

The following tools can be used to analyze video images on the Server and create metadata:

Detection tool	Information contained in metadata from a detection tool
Barcode detection	About the contents of all barcodes in the frame
Equipment detection (PPE)	About the position of all the people in the frame
Neurotracker	About all moving objects in the frame: type, their position in the frame, size, direction of movement, speed, color, and so on
Person location tracker	About the position and pose (skeleton) of all people in the frame
Pose detection	
Shooter detection	
Handrail grip detection	

Metadata is stored as tracks of objects in the local VMDA Server directory on the disk that was selected when creating the VMDA metadata repository (see Creating and configuring VMDA metadata storage), in the vmda.schema file.

General information on Neural analytics

Requirements for software and hardware platform

DetectorPack PSIM uses neural network analytics. The following features are available on the basis of neural networks:

1. **Neurotracker** (see Neurotracker).
   Neurotracker detects only objects of a specified class using a neural network. The Neurotracker is more accurate than the regular one, and detects even static objects, but it requires more computing resources.
2. **Fire and Smoke detection** (see Fire detection and Smoke detection).
   Neural network detects fire and smoke in a frame.
3. **Person location tracker** (see Person location tracker).
   Neural network determines each person's skeleton and detects poses that can represent a security threat.
4. **Neurocounter** (see Neurocounter).
   Neural network counts the number of objects in a specified area.
5. **Sweethearting detection** (see Sweethearting at checkout detection).
   Neural network detects the theft of goods by cashiers who don't scan barcodes of some items at the checkout.
6. **Equipment detection** (see Equipment detection (PPE)).
   Neural network divides the human body into segments, detects the equipment (PPE) on a specified body segment, and checks its condition. Segmenting and classification neural networks are used to operate the Equipment detection (PPE).

The quality of work and the resource consumption of the neural network-based detection tools directly depend on the optimization of the neural network model used.

Notes

The file names for each neural network model depend on the device on which the neural network will operate:

- If you intend to use a CPU or Intel GPU (integrated video core), then it is necessary to train the neural network file using the OpenVINO toolkit, and the name of the neural network file must contain the **_openvino** substring at the end. For example, **test1_openvino.ann**.
- If you intend to use an NVIDIA GPU graphics processor, then the name of the neural network file should contain only the name of the neural network. For example, **test1.ann**.
- If you intend to use the Intel NCS, then the name of the neural network file must contain the **_movidius** substring at the end. For example, **test1_movidius.ann**.

Before you start configuring the neural network-based detection tools, you must contact the AxxonSoft technical support and request the model files of the trained neural networks. Technical support specialists will request the required data (see Data collection requirements for neural network training) and then provide the files for each neural network model. These files must be distributed to all Servers where you plan to use the detection tools.

Attention!

The startup (initialization) time of each neural network on NVIDIA GPU can take 2-3 minutes, depending on the neural network model that you use. Until initialization is complete, no events will be received from detection tools.

Data collection requirements for neural network training

To train neural networks, it is necessary to collect and submit to AxxonSoft video recordings and images from your actual cameras taken in the same resolution and under the same conditions as in your future application.

For example, if your neural network is intended to analyze outdoor video feeds, your videos must contain all range of weather conditions (sun, rain, snow, fog, and so on) in different times of day (daytime, twilight, night).

General requirements for collected data:

- when collecting video recordings and images, specific requirements for object images, scene, angle, illumination and video stream must be met for those detection tools that you plan to use (see Configuring detection modules);
- if it is required to train the neural network in different conditions of time of day, lighting, angle, object types or weather, then the video material must be collected in equal shares for each condition, that is, it must be balanced.

> **Note**
>
> Example. It is necessary to detect a person in the surveillance area at night and during the day.
>
> Data collected correctly:
>
> - four video recordings of the surveillance area, each five minutes long;
> - the object of interest appears in the frame in each video fragment;
> - two fragments must be recorded in night conditions, two fragments—in daytime conditions.
>
> Data collected incorrectly:
>
> - three video recordings of the surveillance area, each five minutes long;
> - the object of interest appears in the frame in each video fragment;
> - two fragments were recorded in night conditions, one fragment—in daytime conditions.

Extra requirements for videos for each neural analytics tool are listed in the following table:

Tool	Requirements
Neurofilter	No less than 1000 frames containing objects of interest in given scene conditions, and the same amount of footage containing no objects (background footage)
Neurotracker	three to five minutes of video containing objects of interest in given scene conditions. The more the number and variability of the situations in the scene, the better
Pose detection tools	10 seconds of video of a scene with no people. No less than 100 different persons in given scene conditions. **Attention!** Different conditions mean, among others, different poses of an individual in scene (tilting, different limbs patterns, and so on)
Equipment detection tool (PPE)	A list of all reference equipment with examples must be collected from the facility and coordinated with the analytics manufacturer (see Example of providing a list of valid equipment at the facility). Several videos 3-5 minutes each with personnel in the given scene conditions. Personnel must move and change poses in the recorded videos, as well as remove and put on equipment at intervals of 30 seconds. Since the Equipment detection tool (PPE) is designed for artificial constant lighting, videos in other lighting conditions are not required
Fire detection and Smoke detection	At least 1000 frames with various objects of the class of interest in the given scene conditions and the same number of frames without the objects of interest in the frame (noise frames)
Food recognition*	Images of at least 80% of the actual menu items must be provided. Each menu item requires 20 to 40 images in different conditions

If the above requirements for the collection of data transmitted for training the neural network model are met, and if the neural network is operated in conditions that are as similar as possible to the conditions in which the material for its training was collected, then the overall accuracy** of neural network analytics is guaranteed from 90% to 97% and the percentage of false positives is 5-7%. For general networks***, an overall accuracy of 80-95% and a false positive rate of 5-20% are guaranteed.

Note

* This analytics will be available in future versions of *Axxon PSIM*.

** Accuracy is indicated for a neural network model, which was trained under operating conditions.

*** A general network is a network that was not trained under operating conditions.

The requirements may be changed or added to at any time.

Configuring the speedup of neural analytics launch on GPU

It can take several minutes to launch neural analytics algorithms on NVIDIA GPU after the Server restart. During this time, the neural models are optimized for the specific type of GPU that you use.

You can use the caching function to ensure that this operation is performed only once. Caching saves the optimization results on the hard drive and uses it for the subsequent analytics runs.

When you install *DetectorPack*, the GPU_CACHE_DIR system variable is created automatically, the value of which specifies the path to the folder with optimization results C:\Program Files (x86)\Axxon PSIM\Modules64\caffewrapper\Networks\cached.

The cache size depends on the number of neural networks used and their type, the minimum size is 70 MB.

> ⚠ **Attention!**
>
> This function works in beta mode for all detection tools that use neural analytics (see General information on Neural analytics).

Optimizing the operation of neural analytics on GPU

A utility was added to neural analytics, which allows you to create GPU neural network caches without using *Axxon PSIM*. The presence of cache speeds up the initialization and optimizes video memory consumption.

Attention!

- To optimize the operation of neural analytics on GPU, you must start and shut down *Axxon PSIM* (see Starting and shutting down the Axxon PSIM software).
- If the system has the software running on GPU, you must stop its operation.
- If you update neural analytics or change the model of NVIDIA GPU, you must recreate cache.

Creating GPU neural network caches:

1. Command example:

   ```
   C:\Program Files (x86)\Axxon PSIM\Modules64\caffewrapper\NeuroAnalyticsGpuCacheGenerator.exe -g 0 -p
   "<System disk>\<Directory of neural network location>\Neural_network_name.ann"
   ```

   where the -g parameter determines the sequence number of a graphics card according to nvidia-smi, and the -p parameter allows you to select the required neural network to create a cache.
   To create a cache for multiple neural networks, list the paths to the selected neural networks, separated by a space.
   Command example:

   ```
   C:\Program Files (x86)\Axxon PSIM\Modules64\caffewrapper\NeuroAnalyticsGpuCacheGenerator.exe -g 0 -p
   "<System disk>\<Directory of neural network location>\Neural_network_name.ann" "C:\Program Files (x86)
   \Axxon PSIM\Modules64\caffewrapper\Models\poseEstimator_original.ann"
   ```

2. **-v** is a parameter to output the procedure log to the console during cache generation.
   Command example to automatically create caches of four neural networks included in neural analytics with log output:

   ```
   C:\Program Files (x86)\Axxon PSIM\Modules64\caffewrapper\NeuroAnalyticsGpuCacheGenerator.exe -g 0 -v
   ```

   Command example:

   ```
   C:\Program Files (x86)\Axxon PSIM\Modules64\caffewrapper\NeuroAnalyticsGpuCacheGenerator.exe -g 0 -p
   "<System disk>\<Directory of neural network location>\Neural_network_name.ann" -v
   ```

3. **--int8=1** is a parameter to create a quantized version of the cache for those neural networks for which quantization is available. By default, the **--int8=0** parameter is disabled.
   Command example:

   ```
   C:\Program Files (x86)\Axxon PSIM\Modules64\caffewrapper\NeuroAnalyticsGpuCacheGenerator.exe -g 0 --
   int8=1
   ```

   Attention!

   The neural networks for which the quantization mode is available are included in neural analytics together with the *.info file.

   The neural networks for which the quantization mode is available:

   - GeneralNMCar_v1.0GPU_onnx.ann—vehicles.
   - GeneralNMHuman_v1.0GPU_onnx.ann—human.
   - GeneralNMHumanTopView_v0.8GPU_onnx.ann—human, top view.

Selecting a camera video stream for the detection modules

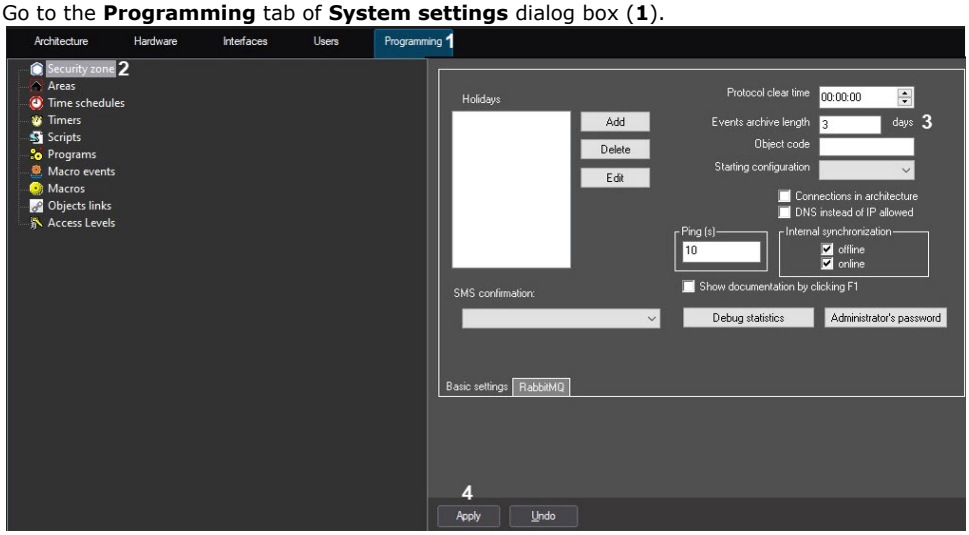
By default, the detection modules included in the *DetectorPack PSIM* subsystem use the Video Analytics camera stream. In order for the detection modules to use the Default camera stream, it is necessary to change the **VMDA.ignoreAnaliticStream** registry key value to **1** (see Registry keys reference guide, for details about working with the registry, see Working with Windows OS registry).

> **Note**
>
> If the camera is not used in the multi-thread mode, the first stream (the only one) will be used regardless of the key value.

Configuring the events archive length

Reports by results of detection working received with the help of *WEB Report System PSIM* web-reports subsystem are creating on information from the event log database. On default the event archive is storing in the database for three days, but it is insufficient for proper report creating. To increase the events archive length, do the following:

1. Go to the **Programming** tab of **System settings** dialog box (**1**).



2. Go to the **Security zone** object's settings panel (**2**).
3. Enter the period of events storage in the database in the **Events archive length ___ days** field (**3**). For example, specify the archive storage period equal to 30 days.
4. Click the **Apply** button (**4**).

Configuring the events archive length is completed.

Configuring the Scanning mode

On the page:

General information

The scanning mode in *DetectorPack PSIM* can improve detection of small objects or objects in areas far away from the camera. For example, when the camera is placed at a long distance and objects (such as people, smoke, fire) are small in the frame, scanning mode can improve detection.

In the scanning mode, the frame is divided into several scanning windows for detection accuracy.

Scanning windows are parts of the frame that are analyzed separately and all together at the same time. Scanning windows allow the detection tool to receive more events, which improves the accuracy of detecting distant or small objects that might otherwise be missed.

Scanning mode is available for Fire detection, Smoke detection, Neurocounter, Neurotracker.

Attention!

The scanning mode doesn't provide absolute detection accuracy, regardless of the number of windows.

Configuring the scanning mode

By default, scanning windows with the following sizes are created: windowH(Scanning window height)=540, windowW(Scanning window width)=480, windowStepH(Scanning window step height)=540, windowStepW (Scanning window step width)=480.

You can change the sizes of the scanning windows of the *Neurocounter* and *Neurotracker* detection tools using registry keys. To do this, do the following:

1. Create a new section in the registry:
   a. NEURO_TRACKER_id, where id is the id of the neurotracker, which window sizes you want to change for the scanning mode, at the path Computer\HKEY_LOCAL_MACHINE\SOFTWARE\WOW6432Node\AxxonSoft\Axxon PSIM\DetectorExt\NEURO_TRACKER for the neurotracker.
   b. NEURO_COUNTER_id, where id is the id of the neurocounter, which window sizes you want to change for the scanning mode, at the path Computer\HKEY_LOCAL_MACHINE\SOFTWARE\WOW6432Node\AxxonSoft\Axxon PSIM\DetectorExt\NEURO_COUNTER for the neurocounter.
2. In this section, create four registry keys **windowH**, **windowW**, **windowStepH**, **windowStepW** and assign nonnegative integer values to them. If you don't specify any of the four keys, the default sizes of the scanning windows are used. See Registry keys reference guide. For more information on working with the registry, see Working with Windows OS registry.

Parameter	Value	Description
Scanning mode	Set the checkbox	Scanning mode is enabled
	Clear the checkbox	Scanning mode is disabled
Scanning window height windowH	Numeric value (in pixels)	The height and width of the scanning window are determined according to the actual size of the frame and the required number of windows. If the height and/or width of the scanning window exceeds the height and/or width of the frame, the registry key automatically changes the window parameter to the appropriate frame size.

Scanning window width windowW	For example, the real frame size is 1920×1080 pixels. To divide the frame into four equal windows, set the width of the scanning window to 960 pixels and the height to 540 pixels
Scanning window step height windowStepH	The scanning step determines the relative offset of the windows. If the step is equal to the height and width of the scanning window respectively, the segments will line up one after another. Reducing the height or width of the scanning step will increase the number of windows due to their overlapping each other with an offset. This will increase the detection accuracy, but will also increase the CPU load **Attention!** The height and width of the scanning step must not be greater than the height and width of the scanning window—the detection tool will not operate with such settings.
Scanning window step width windowStepW	

Recommendations for custom configuration of the scanning mode

1. The number of windows depends on the specific tasks, the quality of the source frame, and the capabilities of the devices. If the source frame is of low quality or small size, a large number of windows won't improve the accuracy of the detection, but can lead to false alarms or no detection. You must select the number of scanning windows experimentally. The recommended optimal number of scanning windows is from four to eight.
2. To determine the size of scanning windows, divide the height and width of the frame so that to get the required number of windows.
3. We recommend setting the same values for the window height and scanning step, as well as the window width and scanning step.
4. If you didn't get the detection tool responses at the same values of window and step, you must experimentally reduce the scanning steps relative to the height or width.

Attention!

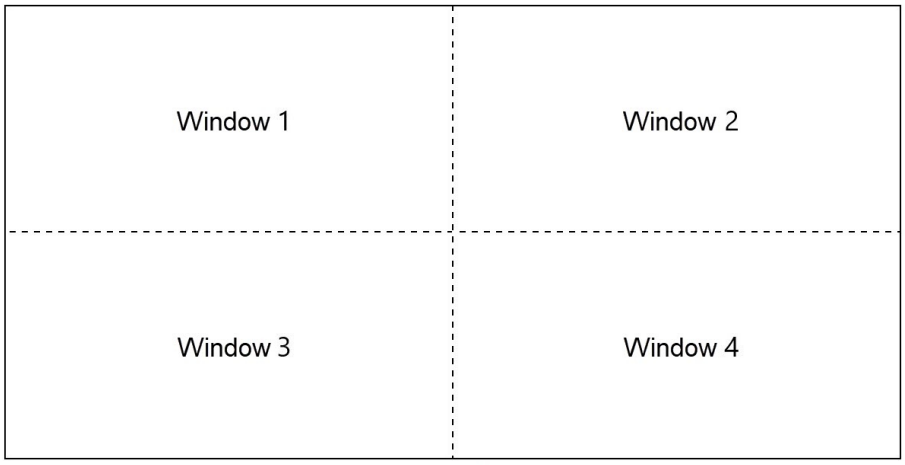
a. Increasing the number of windows increases the load on the device.
b. Custom configuration is possible for *Neurocounter* and *Neurotracker* only. If you enable the scanning mode for *Fire detection* and *Smoke detection*, the default parameters are used.

Example of configuring the scanning mode

It is necessary to configure the scanning mode for *Neurocounter* to detect vehicles in the distance. If the actual frame size is 1920×1080 pixels, set the following values in the detection tool settings to divide the frame into four equal windows:

1. **Scanning window**—set the checkbox (see Configuring the Neurocounter module) in the settings of the detection tool.
2. Specify the values for the registry keys in the NEURO_COUNTER_id section:
   a. windowH=540;
   b. windowStepH=540;
   c. windowW=960;
   d. windowStepW=960.

As a result, the frame will be conditionally divided into four equal windows that will be analyzed separately and all together at the same time. If vehicles are detected in any of these windows, the detection tool can trigger.



Surveillance frame

Activating the VI license

On the page:

Types of VI licenses

There are two types of VI licenses: a hardware Guardant USB dongle and a software key.

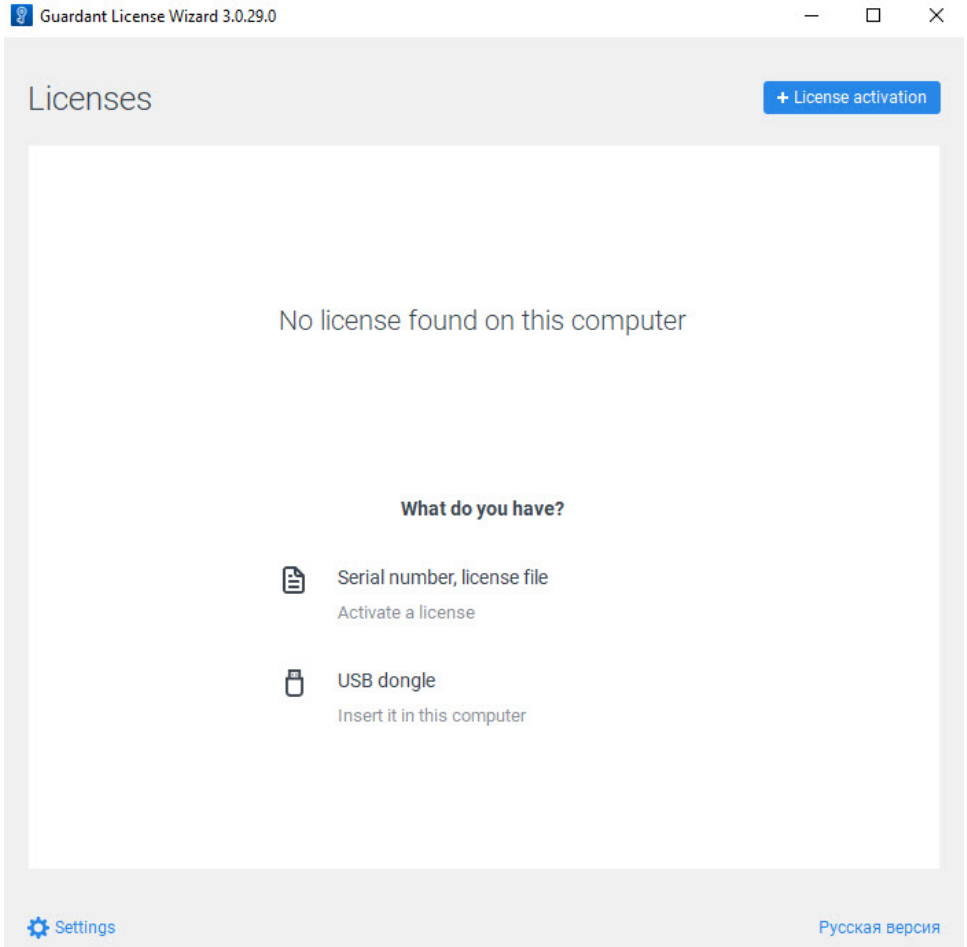
Using a Guardant USB key

Insert the USB dongle into the port of a computer with the Guardant drivers installed. Then launch *Axxon PSIM*.

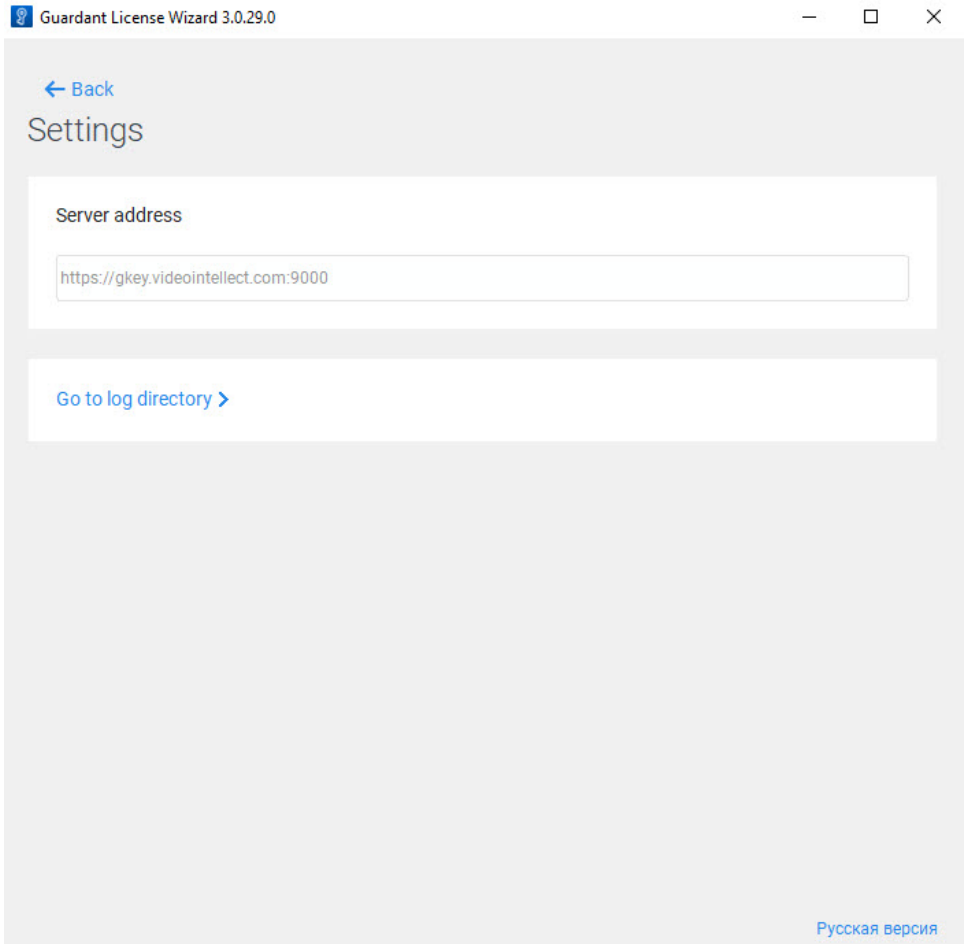
Using a VI software key

The **license_wizard** utility allows you to activate a license on your computer or another computer and to write/overwrite a license file onto a USB dongle for use on any computer.

1. Open the **license_wizard** utility located in the folder: <Axxon PSIM installation directory>\Modules64\DetectorExt\visdk\distrib.
2. Click the **Settings** button.



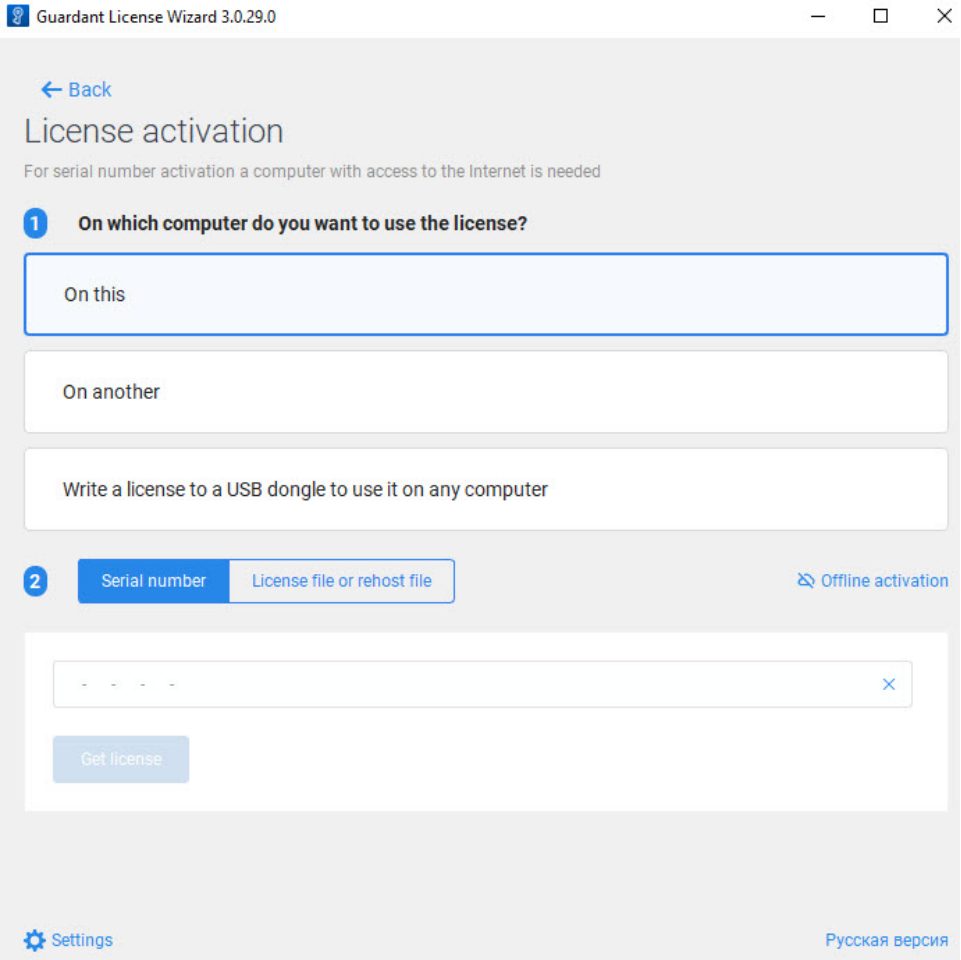
3. In the **Server address** field, enter: https://gkey.videointellect.com:9000.



4. Click the **Back** button.
5. Click the **Activate License** button.

    a. To activate a license on your computer:

i. In the **On which computer do you want to use the license?** section, select **On this**.

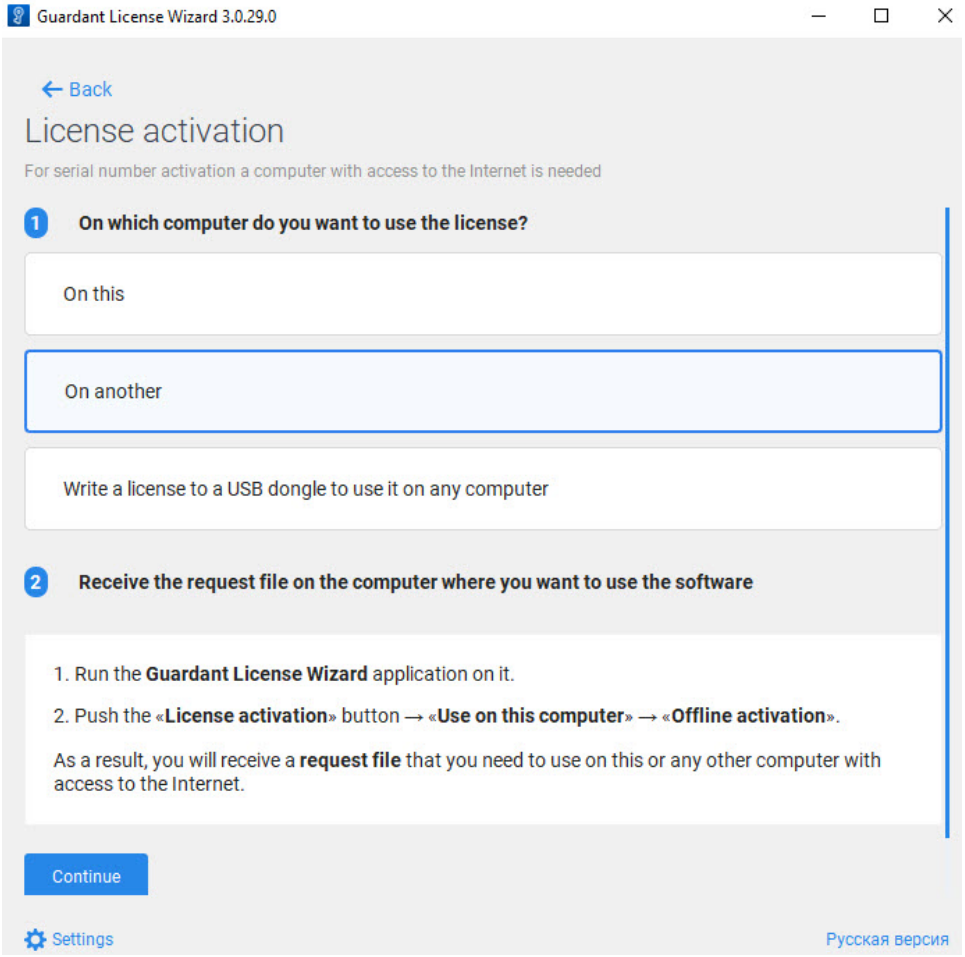


ii. In the **Serial number** tab, enter the serial number of the license, which can be obtained from a *VI* manager.

iii. Click **Get license**.

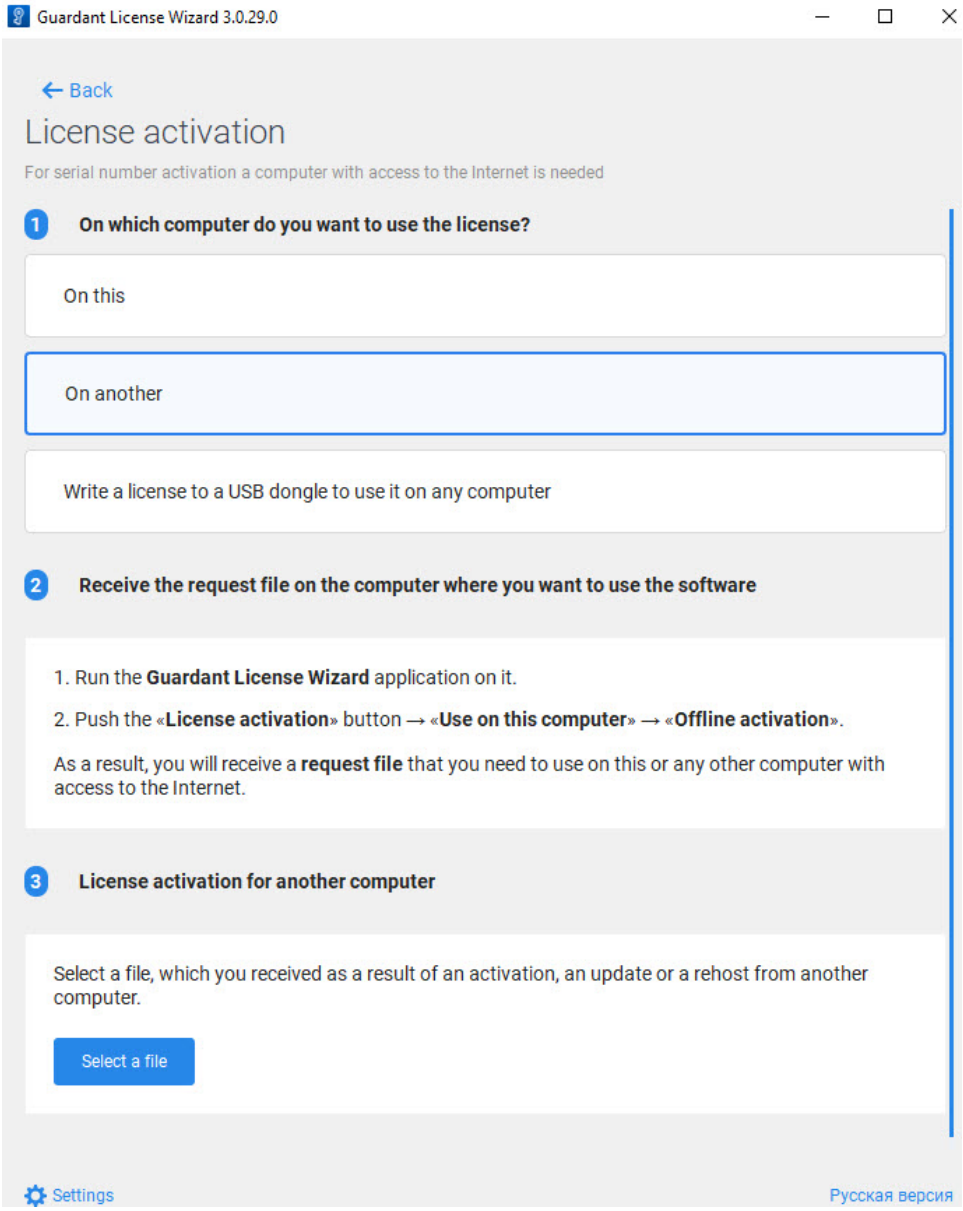
b. To activate a license on another computer:

i. In the **On which computer do you want to use the license?** section, select **On another**.



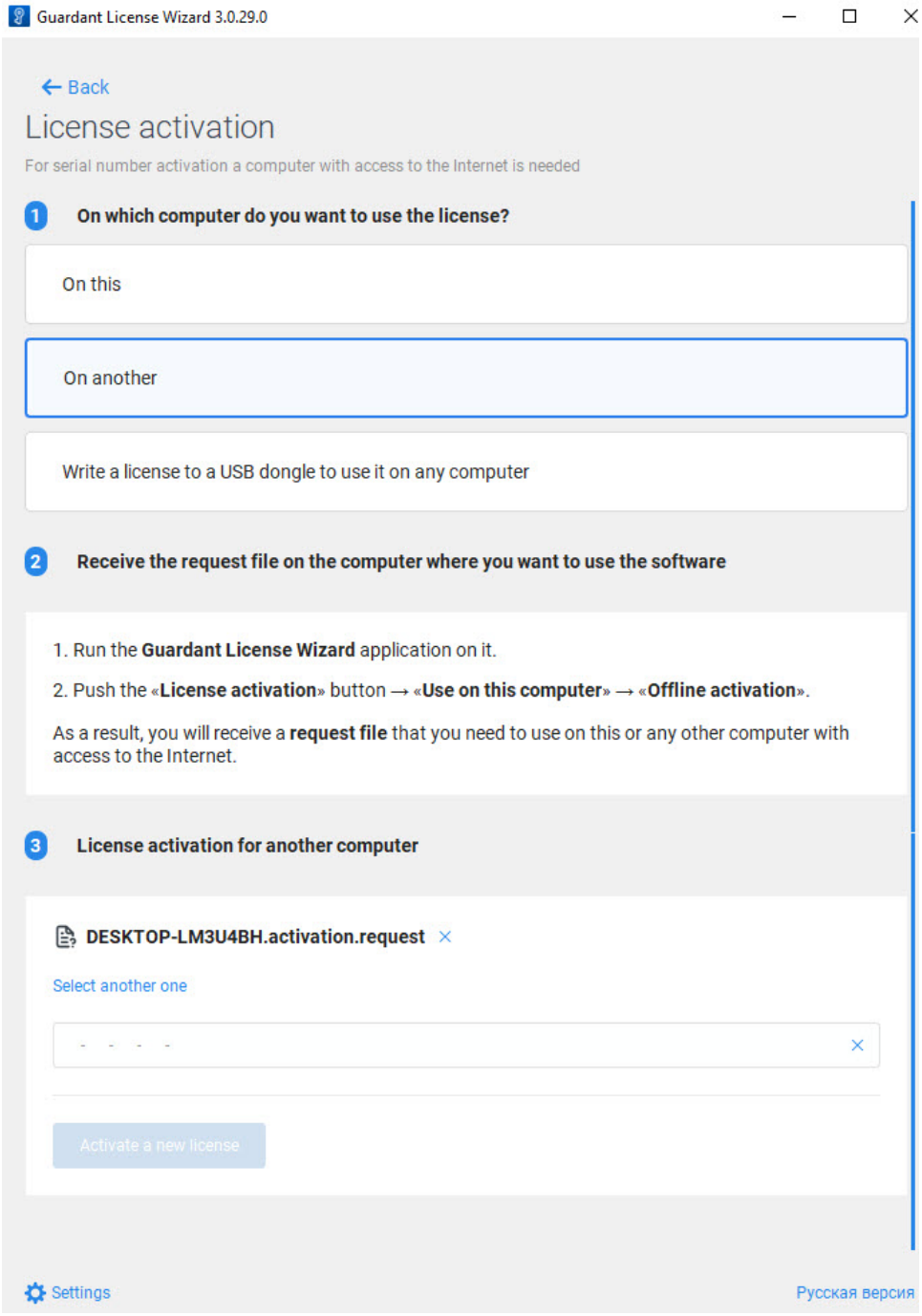
ii. On the second computer, launch the **license_wizard** utility.
iii. Follow all steps in this instruction from 1 to 5ai.
iv. Click **Offline activation**. The resulting request file can be used on any computer with Internet access.
v. Transfer the request file to the first computer.

vi. On the first computer, click **Select a file**.



vii. On the first computer, enter the license serial number, which can be obtained from a *VI* manager.

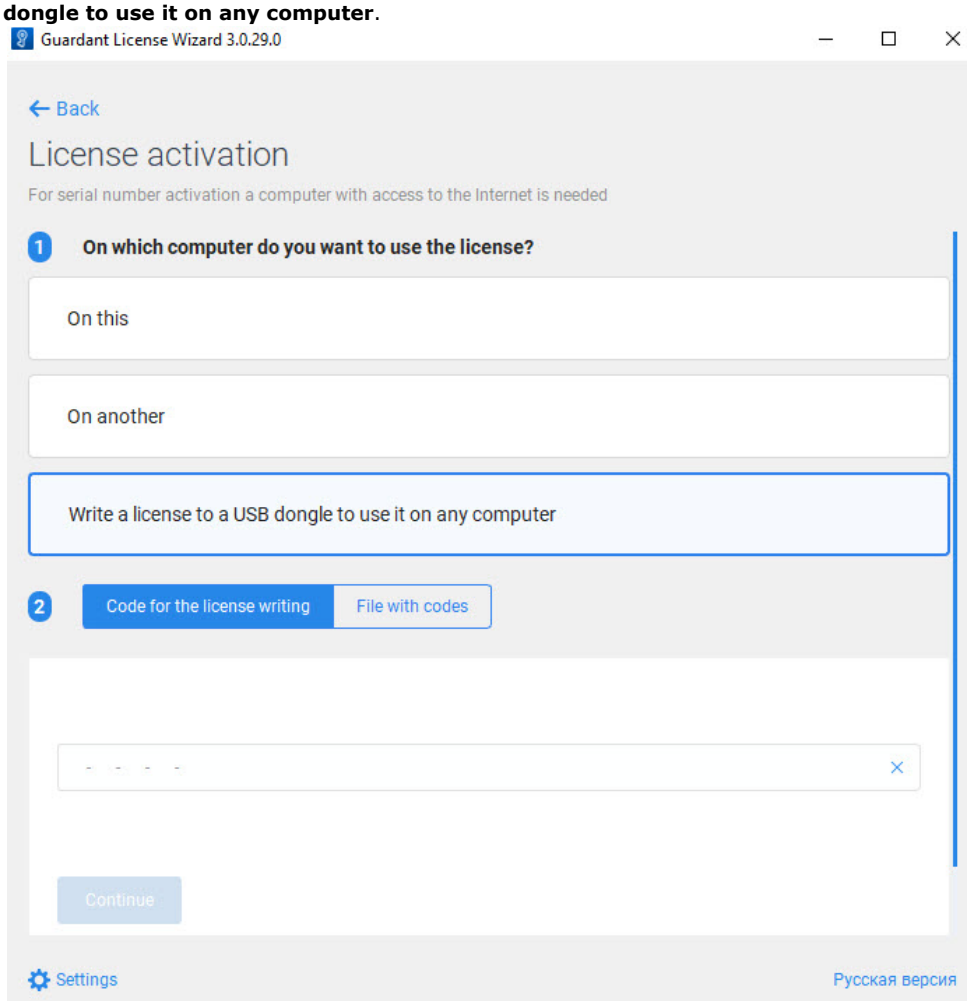
viii. Click **Activate a new license**.



c. To write or overwrite a license file onto a USB dongle:

i. Insert the USB dongle into the computer.

ii. In the **On which computer do you want to use the license?** section, select **Write a license to a USB dongle to use it on any computer**.



iii. Enter the license serial number, which can be obtained from a *VI* manager.
iv. Click **Continue**.
v. Write the license file to the USB dongle. The old license (if any) will be deleted.

The activation of the *VI* license is complete.

Heat map detection

Functionality of the Heat map detection

The *Heat map detection* is designed to define zones of stopping and to estimate delay time of visitors in areas of interest.

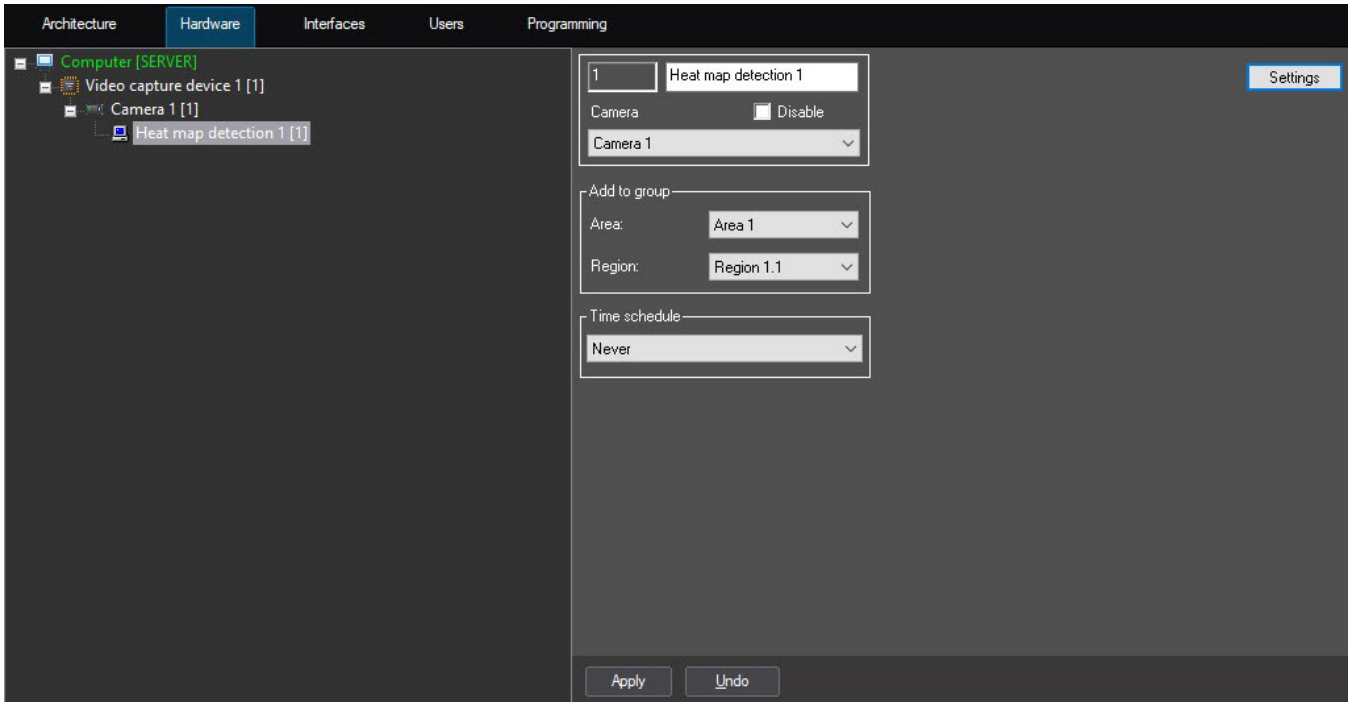
Camera requirements for the Heat map detection module

The requirements for the cameras that will work with the *Heat map detection* module are listed in the following table.

Camera	• Resolution: 720x576 (CIF4), using of 360x288 (CIF1) is acceptable; oversize images are reduces until CIF4. • Fps: not less than 6 • Color: analytics works with grey and color images. • Camera must be rigidly fixed.
Lighting	• The best working of detection is archived at medium lighting. In conditions of insufficient (night) or excessive (exposure) lighting, the quality of analytics can be reduced. • Sharp changes of lighting can lead to short-time invalid analytics working.
Scene and camera angle	• The best position – camera "looks" to the scene vertically down. The better this requirement, the carefully the received estimation. • Sizes of camera field of view: 3x3m is minimal (6x6 people), 4x4m is optimal (8x8 people), 8x8m is maximal (16x16 people). • Background is static and is not changed sharply. • Analytics can work inappropriately on specular surfaces and in case of sharp shadows from moved objects. • Analytics can work inappropriately in case of in the camera field of view there are periodic movements of background objects (trees, working TV, etc.)
Objects image	• Image quality: the image is to be clear, without visible defects from reducing procedure. • Permissible size of a person (the area of a rectangular track around a person) as a percentage of the frame area: from 0.25% to 10%

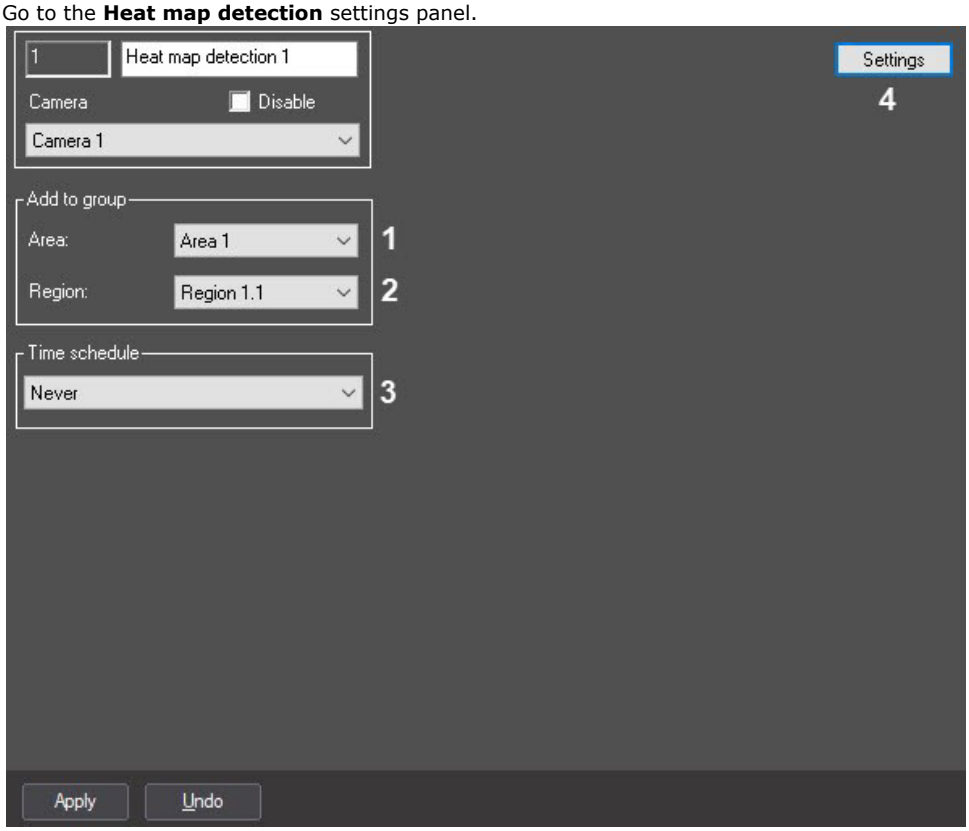
Configuring the Heat map detection module

The *Heat map detection* module can be configured using the **System settings** menu, on the **Hardware** tab, on the **Heat map detection** settings panel, using the **Camera** settings.



The *Heat map detection* module is configured as follows:

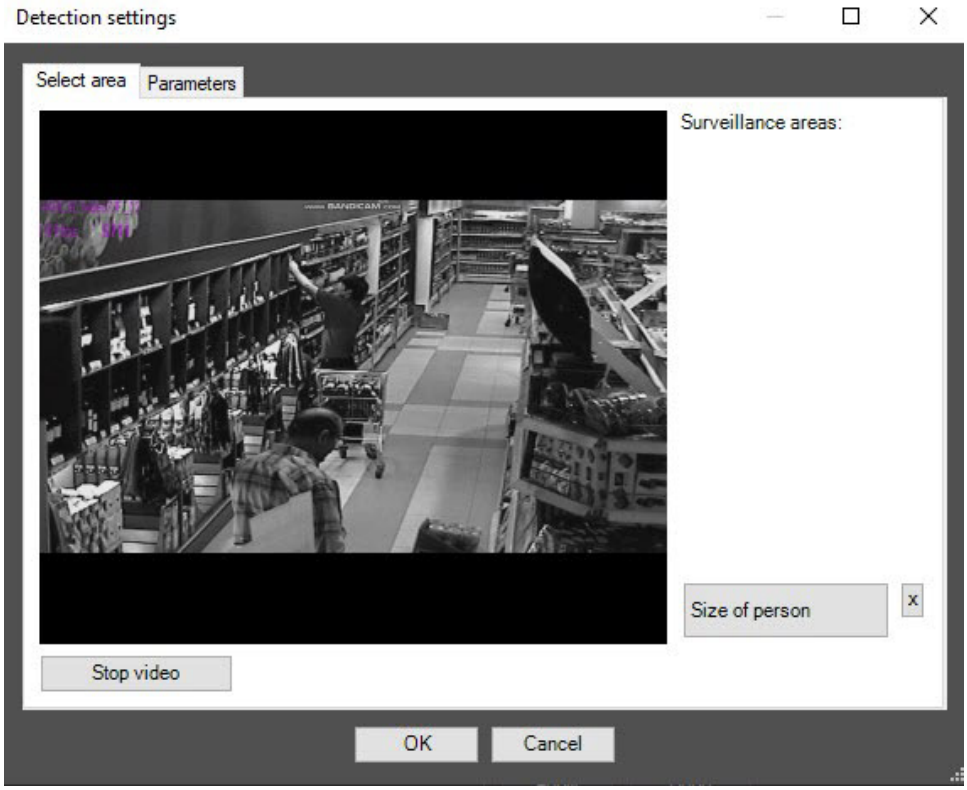
1. Go to the **Heat map detection** settings panel.



2. From the **Area** drop-down list, select the **Area** object to display the list of regions which belong to this area (**1**).
3. From the **Region** drop-down list, select the **Region** object to which this detection should be referred (**2**).
4. From the **Time schedule** drop-down list, select the corresponding time schedule during which the detection will work (**3**).

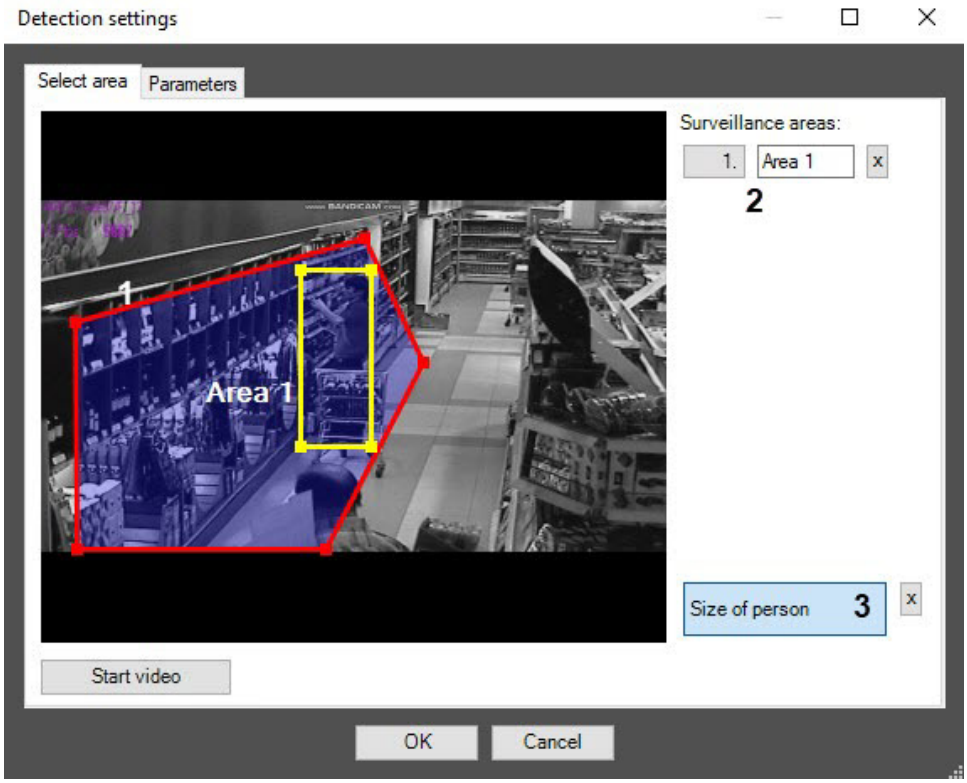
> **Attention!**
>
> If no custom **Time schedule** objects is created in the system, two time schedules are available—**Always** and **Never**. The **Never** time schedule is set by default, so the detection tool will not work if the default settings are left unchanged.

5. Click the **Settings** button (**4**). The **Detection settings** window will open.



6. Specify the surveillance area and the approximate size of people in the video image:
   a. Click the **Stop video** button to capture the video image.
   b. On the captured video image specify areas to be analyzed (**1**). To specify the area, set the nodal points of interested area using the left mouse button. After setting the last nodal point, click the right mouse button and closing the curve will perform automatically.

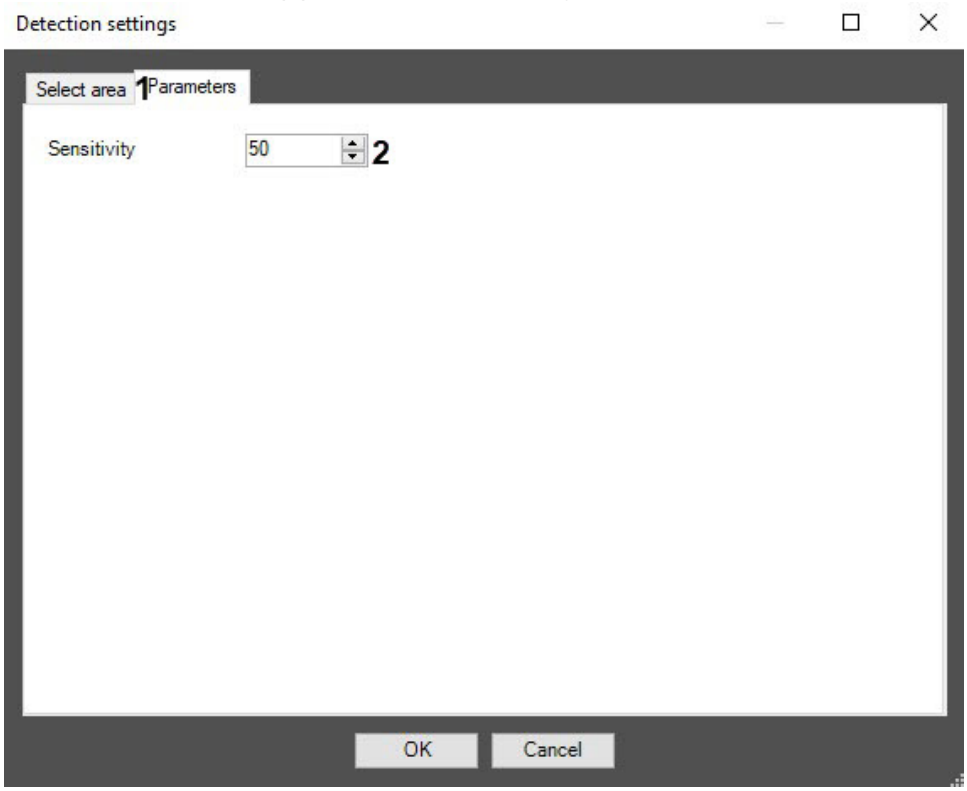
Surveillance areas are numbered in the order of creation starting from 1. Adding area at the right from the video image the corresponding button is displayed (**2**).



c. To remove a selected area, click the x button next to the surveillance area (**2**).

7. Set the approximate person size as follows:
   a. Click the **Size of person** button (**3**).
   b. On the captured video image, set the approximate person size. To do this, use the left mouse button to select a rectangular area (**1**).
   c. To remove the person size, click the x button next to the **Size of person** button.
8. Setting the module parameters:

a. Go to the **Parameters** tab (**1**) in the **Detection settings** window.



b. Using the **up-down** buttons, enter the value of sensitivity parameter in the **Sensitivity** field (**2**). The optimal value is selected experimentally by testing detection on triggering in the required conditions. The value range is from 0 to 100. The more sensitivity the more possibility of false triggering. The less sensitivity, the more possibility of losing event.

9. Click the **OK** button.

Configuring the *Heat map detection* module is completed.

VI detection of movement in prohibited area

Functionality of the VI detection of movement in prohibited area module

The *VI detection of movement in prohibited area* software module has the following features:

1. Recognition of movement in a given direction.
2. Recognition of people in given areas.
3. Generation of alarm when a person moves in a given area.

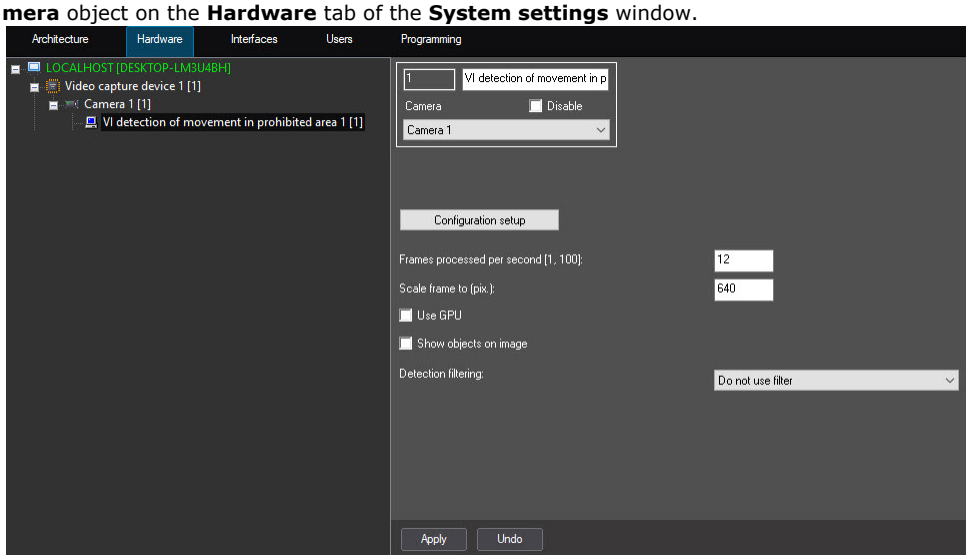
Configuring the VI detection of movement in prohibited area module

На странице:

Configuring the *VI detection of movement in prohibited area* software module includes general settings and configuration settings: detection zone, configuration parameters and detection tool characteristics.

General settings

1. Go to the settings panel of the **VI detection of movement in prohibited area** object, which is created on the basis of the **Ca mera** object on the **Hardware** tab of the **System settings** window.

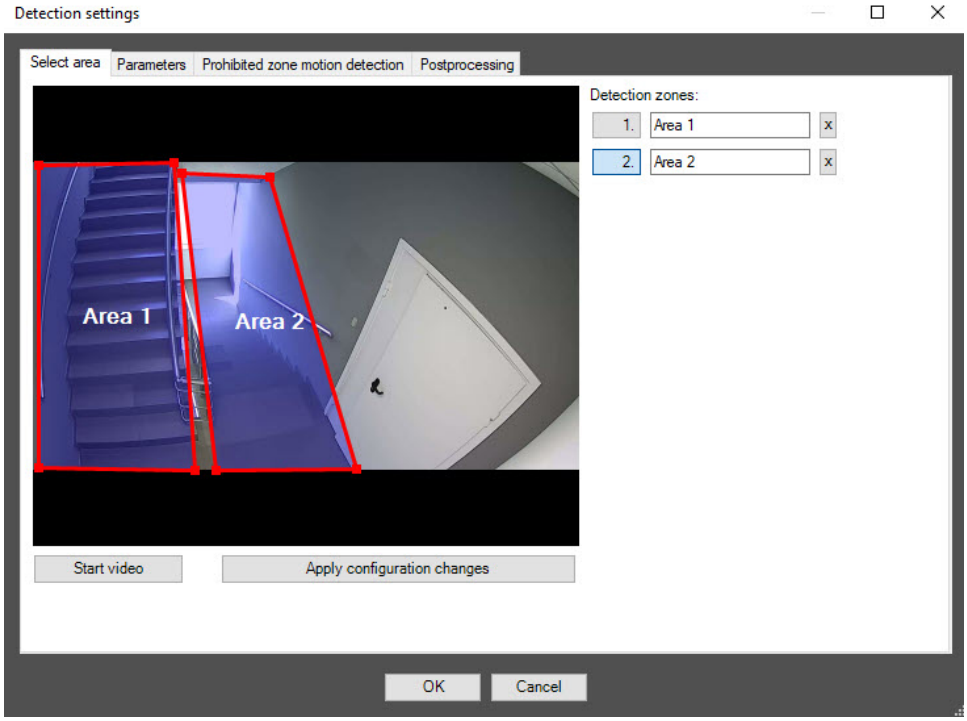


2. In the **Frames processed per second [1, 100]** field, specify the number of frames in the range 1-100 that the detection tool processes per second. The default value is **12**. You can specify only a positive integer. If you enter a number outside the range 1-100, it is automatically changed to the nearest border value. If you leave the field blank, it automatically returns to the default value when you save the settings.
3. In the **Scale frame to (pix.)** field, specify in the range 480-960 the size of the frame in pixels after scaling. The default value is **640**.
4. Set the **Use GPU** checkbox if it is necessary to use a graphics processor (NVIDIA GPU) when working with a neural network.
5. Set the **Show objects on image** checkbox if it is necessary to highlight the detection zone with a red border on the Video surveillance monitor when a motion event is generated in the prohibited area. The prohibited area is specified in the detection tool settings on the **Select area** tab.
6. From the **Detection filtering** drop-down list, select the filter that you want to use: **Object filter**, **Object counting filter**, **Do not use filter** (default). You can configure filters on the **Postprocessing** tab of the **Detection settings** window.
7. Click the **Configuration setup** button. As a result, the **Detection settings** window opens.

The Select area tab

1. In the **Detection settings** window, on the **Select area** tab, click the **Stop video** button to pause the video.

2. By default, one detection zone is highlighted with a red border. You can add more zones with the mouse, as well as change the borders of a zone by clicking its number in the list on the right. Number of a detection zone is highlighted in blue.



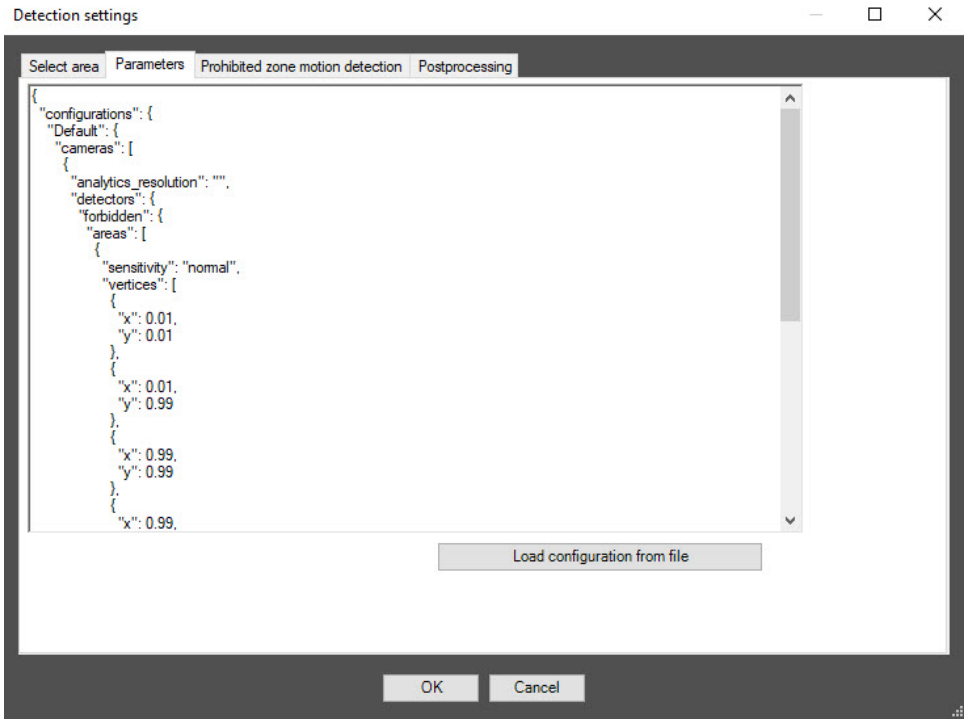
3. To rename a detection zone, enter a new name in the field to the right of its number. The new name appears in the zone caption on the video image.

> **Note**
>
> To delete a detection zone, click the x button to the right of the zone name.

4. Click the **Apply configuration changes** button to save all changes.
5. To start video playback, click the **Start video** button.

The Parameters tab

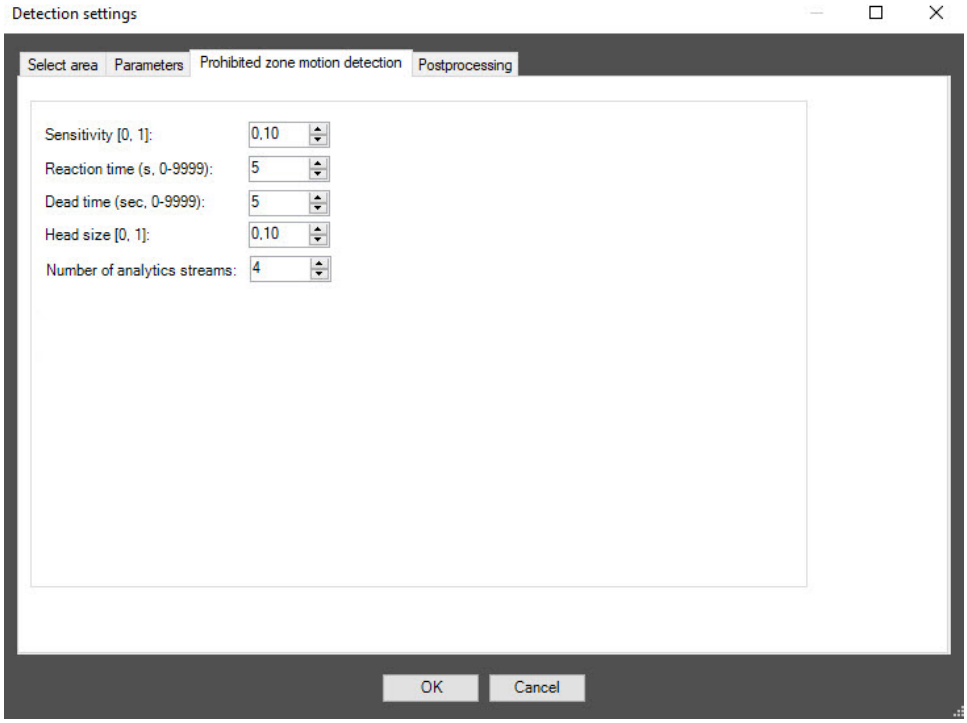
1. Go to the **Parameters** tab of the detection tool settings window. This tab displays the parameters of the used configuration. If you do not need to change the configuration, skip steps 2 and 3 and go to the next tab.



2. To use custom configuration, click the **Load configuration from file** button.
3. In the standard Windows search window that opens, specify the path to the configuration file in JSON format.

The Prohibited zone motion detection tab

1. Go to the **Prohibited zone motion detection** tab.



2. In the **Sensitivity [0, 1]** field, specify the detection tool sensitivity used to detect moving objects in the specified area in the range 0–1. The higher the sensitivity, the less noticeable an object can be detected. The default value is **0.10**.
3. In the **Reaction time (s, 0-9999)** field, specify the period of time in seconds in the range 0–9999, after which the the alarm event **Motion in the specified area** is generated on the detection tool. The countdown begins from the moment the object enters the detection zone. If there is no movement during the reaction time, the timing stops and the counter is reset to zero. T he default value is **0**.

4. In the **Dead time (sec, 0-9999)** field, specify in seconds the time interval in the range 0–9999, during which the repeated event is not generated. The default value is **0**.
5. In the **Head size [0, 1]** field, specify in the range 0–1 what part of the video image height is the human head. The default value is **0.10**.
6. In the **Number of analytics streams** field, specify the number of video streams that is used for neural network analytics. The default value is **4**.
7. Click the **OK** button to save the settings.
8. To save the changes, click the **Apply** button on the settings panel of the **VI detection of movement in prohibited area** object.

Configuration of the *VI detection of movement in prohibited area* software module is complete.

VI detection of prohibited direction

Functionality of the VI detection of prohibited direction module

The *VI detection of prohibited direction* software module has the following features:

1. Recognition of movement in a direction.
2. Recognition of people in given areas.
3. Generation of alarm when a person moves in a given direction.

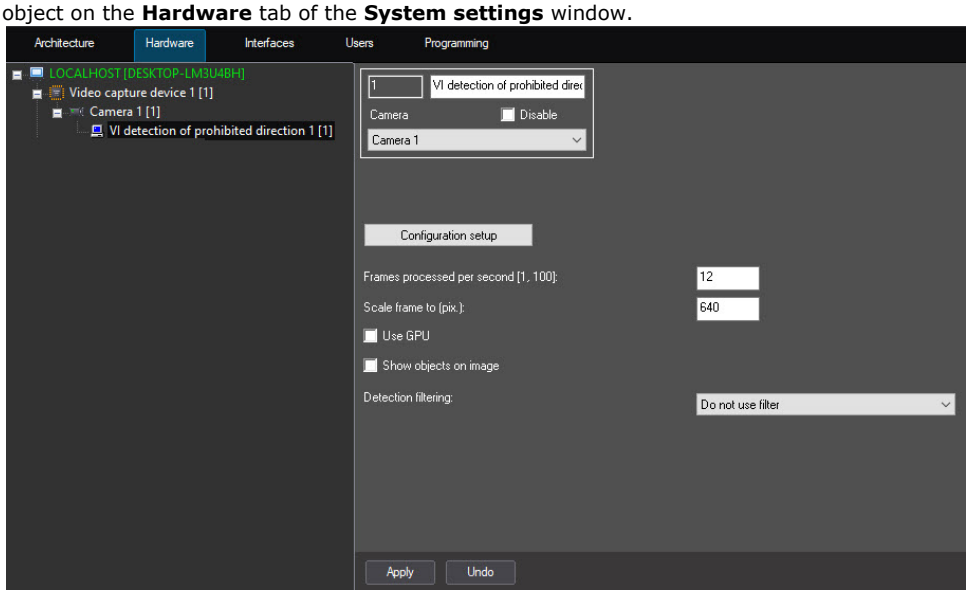
Configuring the VI detection of prohibited direction module

На странице:

Configuring the *VI detection of prohibited direction* software module includes general settings and configuration settings: detection zone, configuration parameters and detection tool characteristics.

General settings

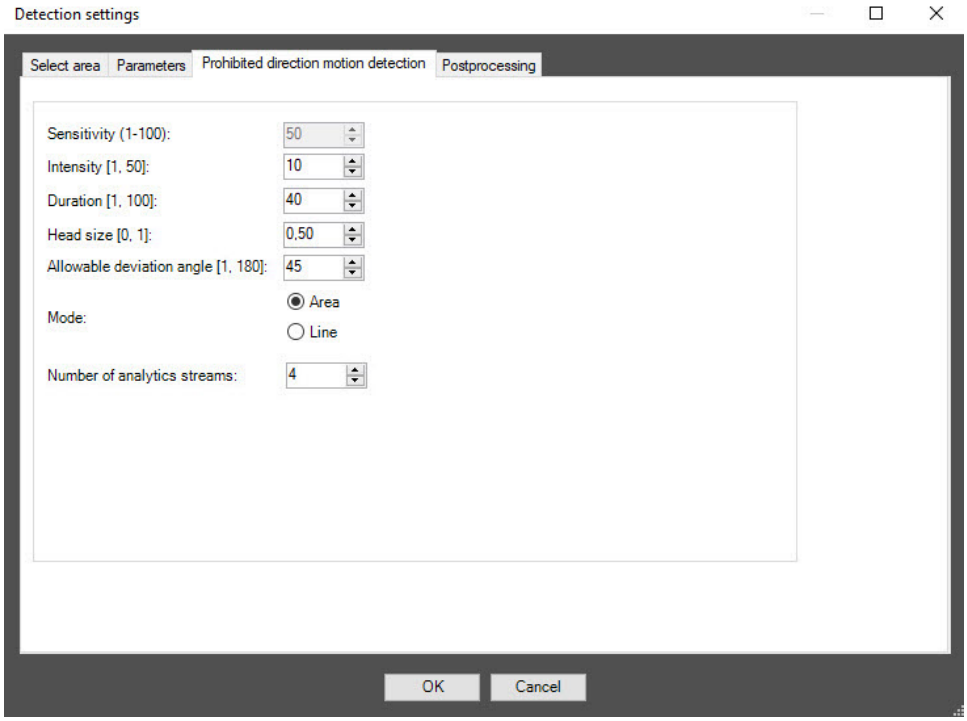
1. Go to the settings panel of the **VI detection of prohibited direction** object, which is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** window.



2. In the **Frames processed per second [1, 100]** field, specify the number of frames in the range 1-100 that the detection tool processes per second. The default value is **12** (recommended). You can specify only a positive integer. If you enter a number outside the range 1-100, it is automatically changed to the nearest border value. If you leave the field blank, it automatically returns to the default value when you save the settings.
3. In the **Scale frame to (pix.)** field, specify in the range 480-960 the size of the frame in pixels after scaling. The default value is **640**.
4. Set the **Use GPU** checkbox if it is necessary to use a graphics processor (NVIDIA GPU) when working with a neural network.
5. Set the **Show objects on image** checkbox if it is necessary to highlight the detection zones with a red border on the Video surveillance monitor when a motion event is generated in the prohibited direction. The detection zones are specified in the detection tool settings on the **Select area** tab.
6. From the **Detection filtering** drop-down list, select the filter that you want to use: **Object filter**, **Object counting filter**, **Do not use filter** (default). You can configure filters on the **Postprocessing** tab of the **Detection settings** window.
7. Click the **Configuration setup** button. As a result, the **Detection settings** window opens.

The Prohibited direction motion detection tab

1. Go to the **Prohibited direction motion detection** tab.



2. In the **Sensitivity (1-100)** field, specify as a percentage in the range 0-100 the sensitivity of the detection tool to detecting moving objects in the detection zone. The higher the sensitivity, the less noticeable object can be detected. The default value is **50**. If you select the **Area** mode in the **Mode** parameter, this setting is disabled.
3. In the **Intensity [1, 50]** field, specify in arbitrary units in the range 1–50 how noticeable the object's movement in the detection zone must be for the detection tool to trigger. The default value is **10**. If you enter a value out of range, it is automatically changed to the appropriate boder value. If you select the **Line** mode in the **Mode** parameter, this setting is disabled.
4. In the **Duration [1, 100]** field, specify in arbitrary units in the range 1–100 the duration of the object's movement in the prohibited direction. It can be used when analyzing dense passenger flows, when an object making its way in the opposite direction appears in the camera's FOV only for short time intervals, and the rest of the time is hidden from view by the crowd. The default value is **40**. If you enter a value out of range, it is automatically changed to the appropriate boder value. If you select the **Line** mode in the **Mode** parameter, this setting is disabled.
5. In the **Head size [0, 1]** field, specify in the range 0–1 what part of the video image height is the human head. The default value is **0.50**. If you select the **Line** mode in the **Mode** parameter, this setting is disabled.
6. In the **Allowable deviation angle [1, 180]** field, specify in degrees in the range 1–180 the permissible deviation from the direction of movement specified by the red arrow in the prohibited direction. The default value is **45**. If you enter a value out of range, it is automatically changed to the appropriate boder value. If you select the **Line** mode in the **Mode** parameter, this setting is disabled.
7. In the **Mode** parameter, select **Line** if detection zone is determined by lines. The **Area** mode is selected by default—detection zone is determined by a polygon. The display of the **Select area** tab depends on the selected mode.

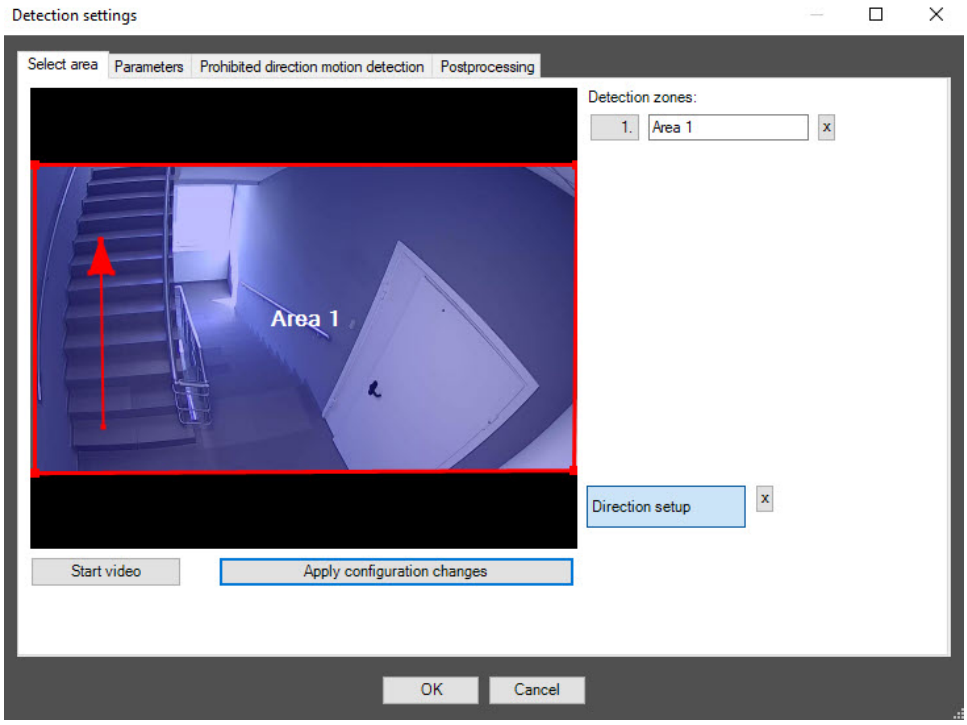
> **Note**
>
> When you change the mode, all settings return to default values on the **Select area** tab.

8. In the **Number of analytics streams** field, specify the number of video streams that are used for neural network analytics. The default value is **4**.
9. To save the detection tool settings, click **OK**.
10. Click the **OK** button to save the settings.

The Select area tab

1. Go to the **Select area** tab.
2. Click the **Stop video** button to pause the video.
3. Specify parameters of a detection zone:
    a. When you select the **Area** mode (default) on the **Prohibited direction motion detection** tab:

i. By default, the detection zone is highlighted with a red border. You can change the boders of the detection zone using the mouse by clicking its number in the list on the right, the number of the selected zone is highlighted in blue. Move the borders of the detection zone.



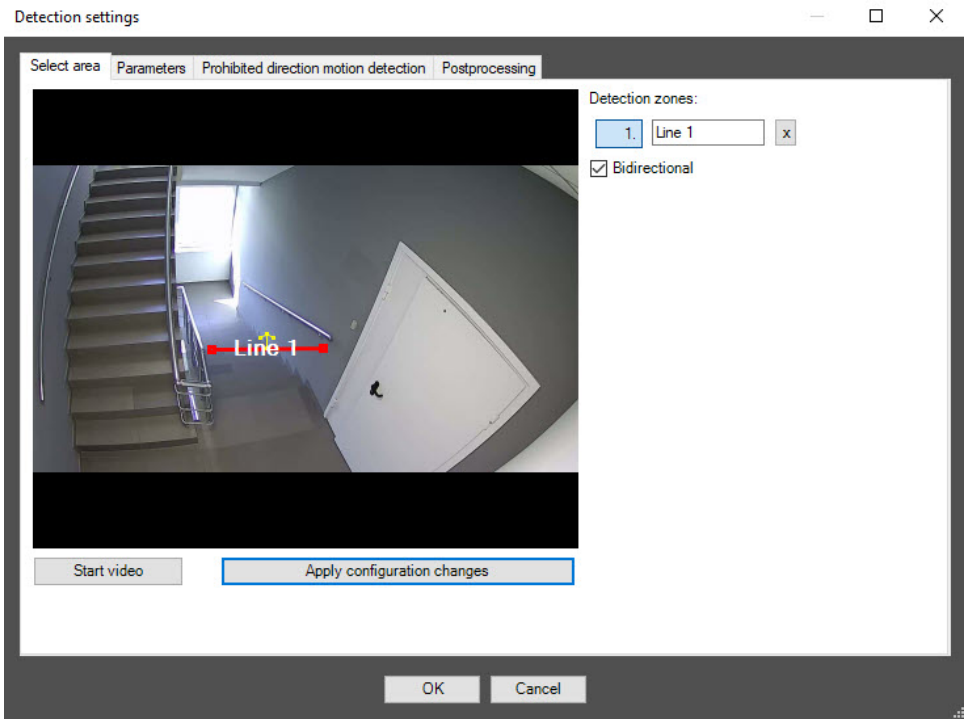
ii. To create a new detection zone, click the video image in the required point and use the mouse to specify its boders. To delete a detection zone, click the x button to the right of the zone name.

> **Note**
>
> The maximum number of detection zones is 20.
>
> To rename a detection zone, enter a new name in the field to the right of its number. The new name appears in the zone caption on the video image.

iii. To specify a prohibited direction, using a mouse, turn the red arrow in the required direction. To delete a direction arrow, click the x button to the right of the **Direction setup** item that must be selected, that is, highlighted in blue.

b. When you select the **Line** mode (default) on the **Prohibited direction motion detection** tab:

i. By default, a red detection line with a yellow arrow is displayed. Yellow arrow indicates prohibited direction. You can change the detection line by clicking its number in the list on the right. The number of the selected line is highlighted in blue. You can move both sides of the line.



ii. To create a new line, click the video image in the required point and use the mouse to specify its boders. To delete a detection line, click the x button to the right of its name.

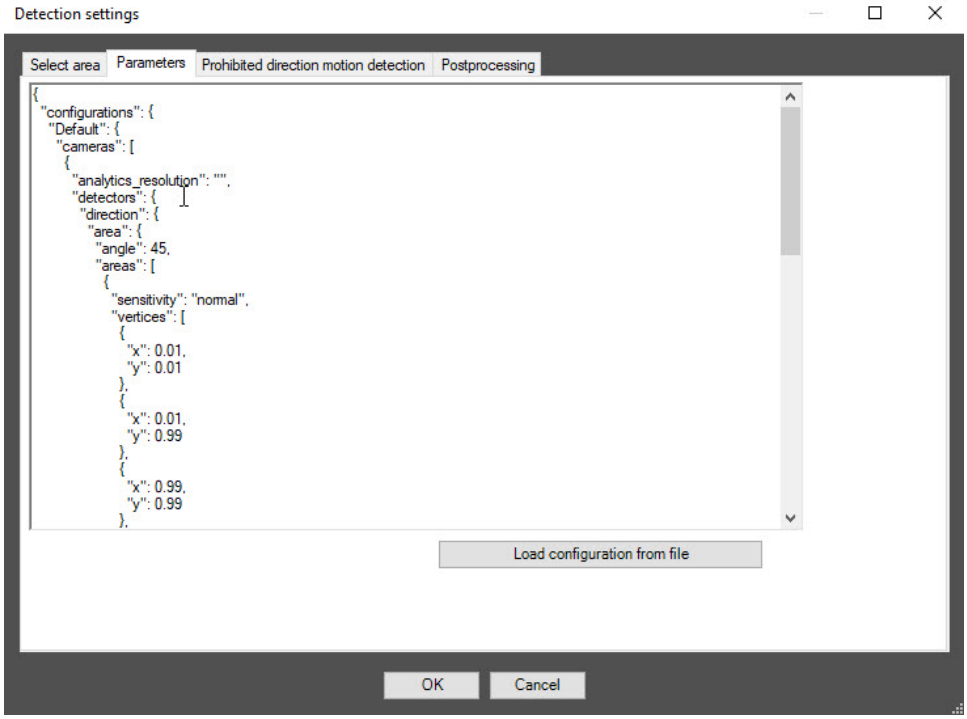
iii. Set the **Bidirectional** checkbox for the detection tool to generate an event when a line is crossed in both directions.

> **Note**
>
> The maximum number of detection lines is 20.
>
> To rename a detection line, enter a new name in the field to the right of its number. The new name appears in the line caption on the video image.

4. Click the **Apply configuration changes** button to save all changes.
5. To start video playback, click the **Start video** button.

The Parameters tab

1. Go to the **Parameters** tab of the detection tool settings window. This tab displays the parameters of the used configuration. If you do not need to change the configuration, skip steps 2 and 3 and go to the next tab.



2. To use custom configuration, click the **Load configuration from file** button.
3. In the standard Windows search window that opens, specify the path to the configuration file in JSON format.
4. Click the **OK** button to save the settings of the detection tool.
5. Click the **Apply** button on the settings panel of the **VI detection of prohibited direction** object to save the changes.

Configuration of the *VI detection of prohibited direction* software module is complete.

Detection of moving against crowd flow

Functionality of the Detection of moving against crowd flow

The *Detection of moving against crowd flow* module is designed to detect objects moving in the video image in direction different from direction of movement the majority of same objects. The *Detection of moving against crowd flow* module performs the following functions:

1. Recognizing movement against a crowd.
2. Recording events about recognizing a movement against a crowd to the database.

Camera requirements for the Detection of moving against crowd flow module

The requirements for the cameras that will work with the *Detection of moving against crowd flow* module are listed in the following table:

Camera	• Resolution should be at least 640x480 pixels • Fps not less than 6
Scene and camera angle	• The camera “looks” to the scene vertically down
Object images	• People move in a video image from top to bottom or from bottom to top
Lighting requirements	• Objects should be visually separated from the background and from each other

Configuring the Detection of moving against crowd flow module

Behavior of the Detection of moving against crowd flow module

Operation of the detection of moving against crowd flow is controlled by the following parameters:

1. **Movement against a crowd**—direction reversed to the direction in which a crowd is moving in the video image. Direction of crowd movement is called the right direction.
2. **Number of people in a crowd**—minimum number of people moving in the direction of a crowd at which the detection should trigger.

If the number of people in a crowd moving in the right direction is less than the **Number of people in a crowd** parameter, the detection won't trigger.
If the number of people in a crowd moving in the right direction is greater or equal to the **Number of people in a crowd**, then:

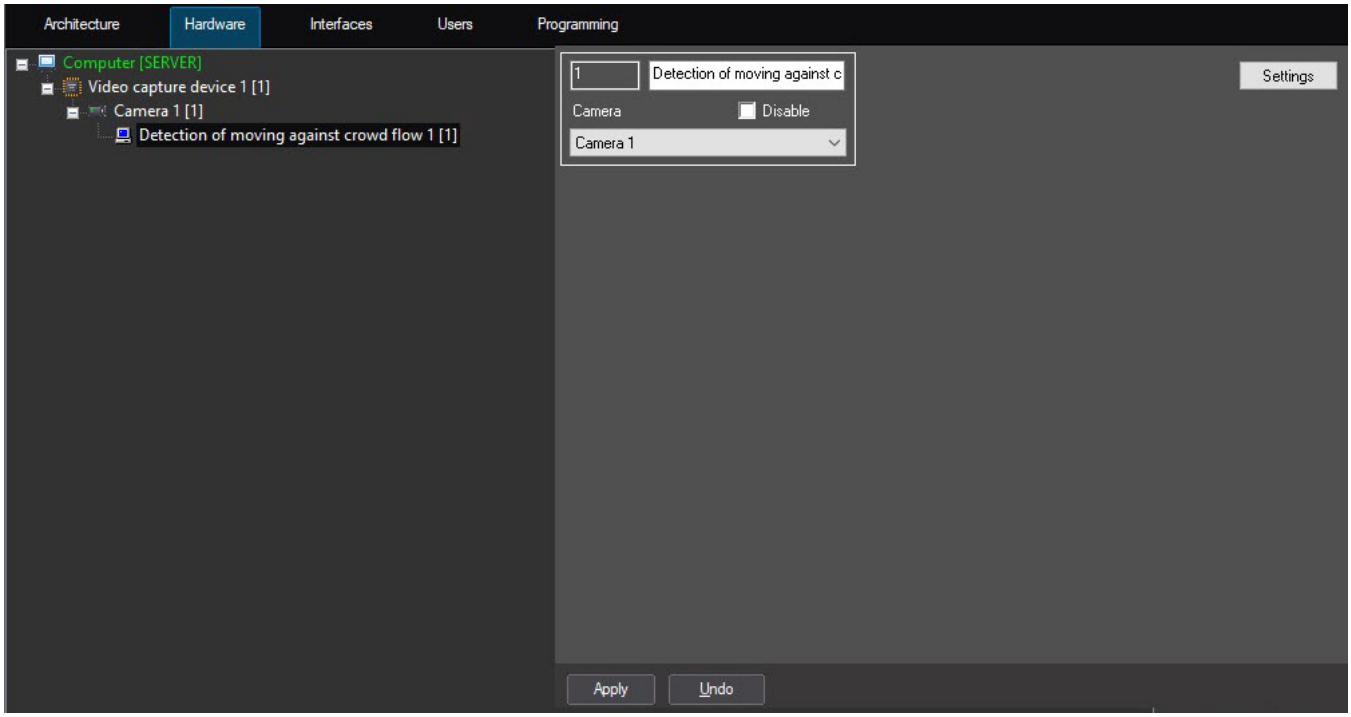
- if the number of people moving against a crowd is from 1 to 2 inclusive, the detection will trigger;
- if the number of people moving against a crowd is 3 or more, the detection won't trigger;
- if there are no people moving against a crowd, the detection won't trigger.

There won't be new triggers, until the person on whom the detection triggered, leaves the monitored area.

Example. A steady flow of people goes against a crowd. In the monitored area, only 1 or 2 persons move against a crowd. In this case, only one trigger will happen when the first person will go against a crowd. There won't be new triggers until a flow moving against a crowd doesn't stop.
If all people moving against a crowd left the monitored area, i.e., there is only a crowd moving in the right direction in the monitored area, and a new person moving against a crowd enters the area, then the detection will trigger.

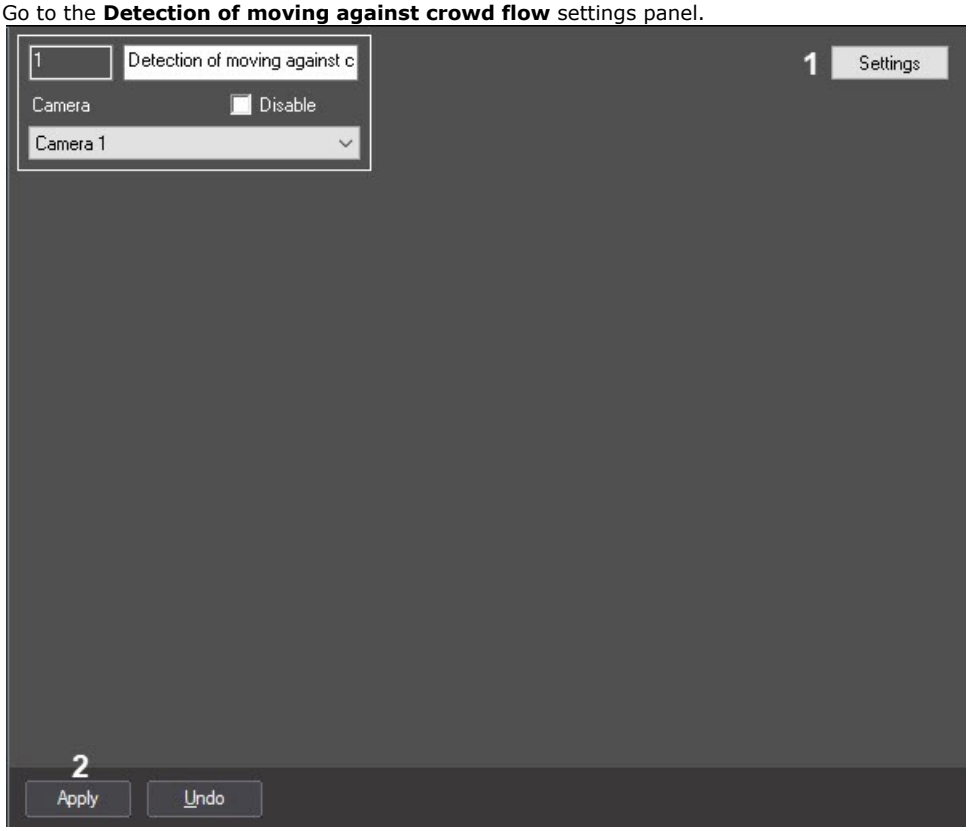
Setting up the Detection of moving against crowd flow module

The *Detection of moving against crowd flow* module can be configured using the **System settings** menu, on the **Hardware** tab, on the **Detection of moving against crowd flow** object settings panel created on the basis of the **Camera** object.

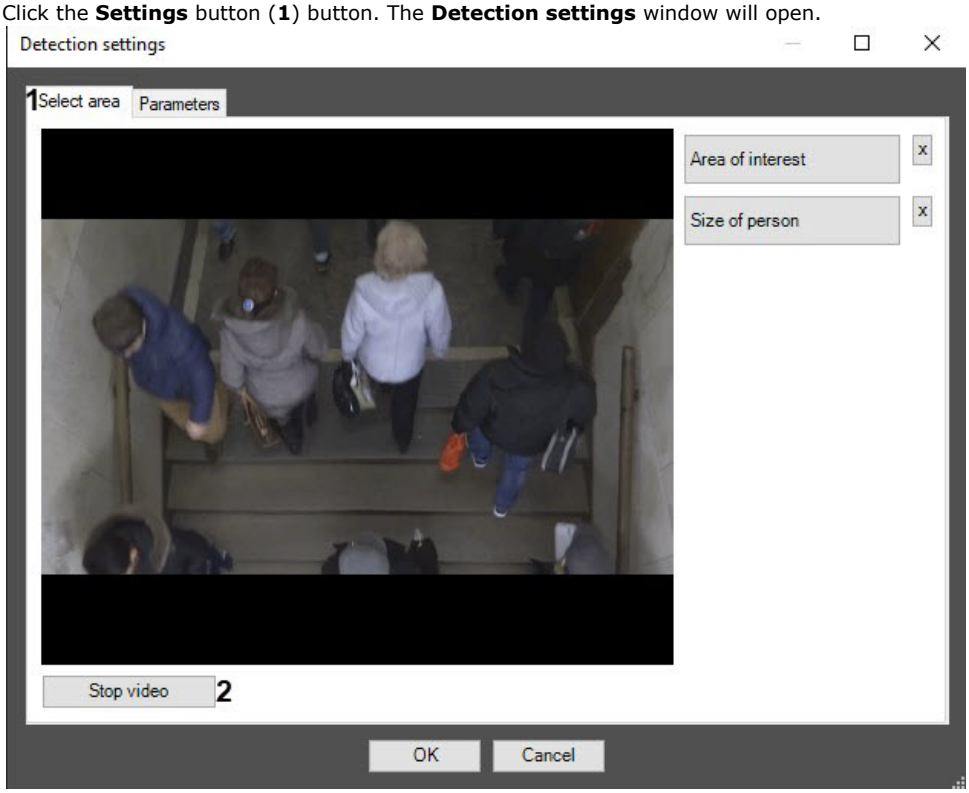


The *Detection of moving against crowd flow* module is configured as follows:

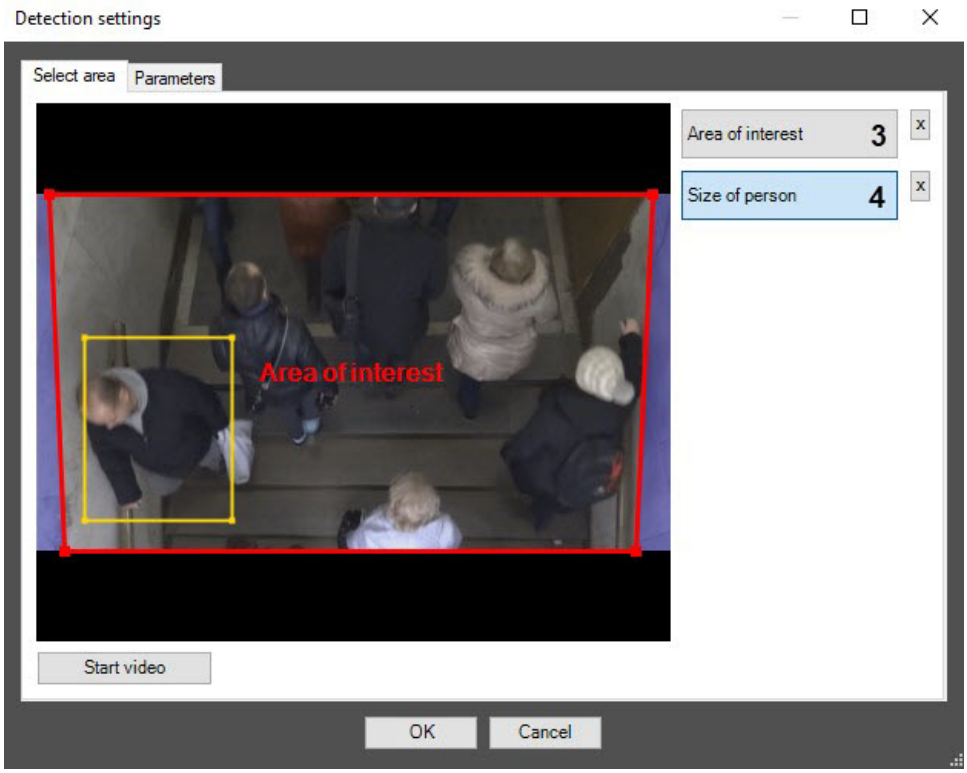
1. Go to the **Detection of moving against crowd flow** settings panel.



2. Click the **Settings** button (**1**) button. The **Detection settings** window will open.



3. Specify the surveillance area:
   a. Go to the **Select area** tab (**1**).
   b. Click the **Stop video** button to capture the video image (**2**).
   c. Click the **Area of interest** button (**3**).



   d. On the captured video image, specify areas to be analyzed. To specify the area, set the nodal points of the area of interest using the left mouse button. Area is considered to be specified when the last nodal point is consisted with the first one. It is possible to add only one area. When attempting to add the second area, the first one will be deleted. After area specifying, the remaining part of video image will be darkened.

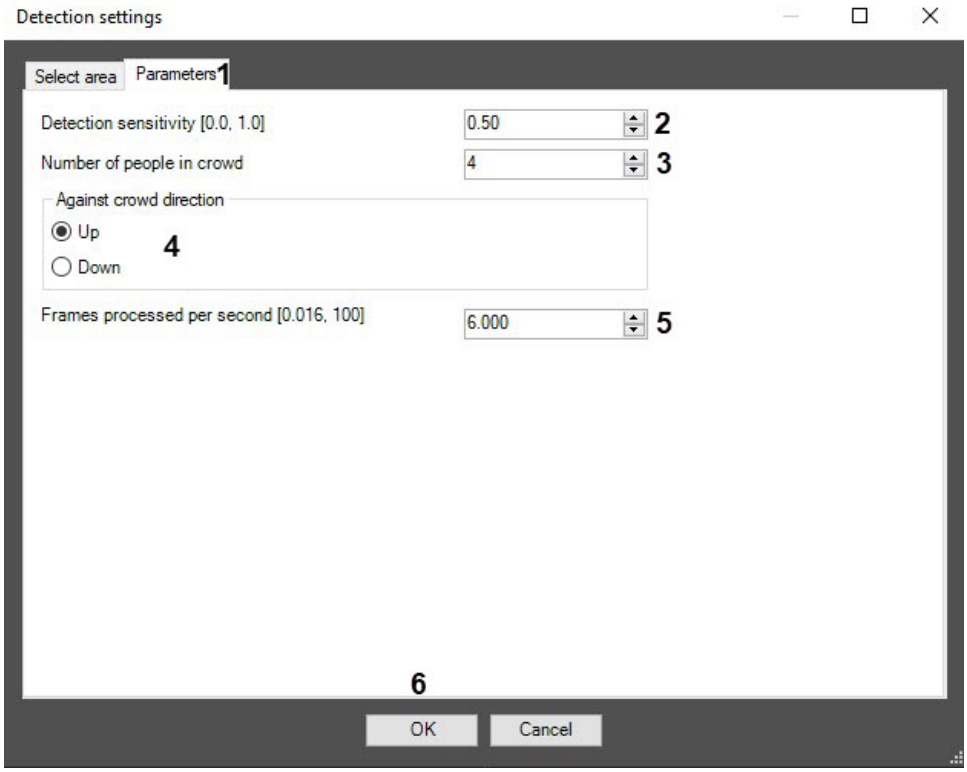
> **Note**

To remove the area, click the x button next to the **Area of interest** button.

e. Click the **Size of person** button (**4**). Set the required person size. To do this, click the left mouse button on the captured video image and extend a rectangular area to required size.

> **Note**
>
> To remove the area, click the x button next to the **Size of person** button.

4. Specify parameters of detection of moving against crowd flow:
   a. Go to the **Parameters** tab (**1**).



   b. In the **Detector sensitivity [0.0, 1.0]** field, enter the value of sensitivity parameter using the **up-down** button (**2**). Optimal value of the parameter is selected experimentally by testing the detection for triggers in the required conditions. The range of values is from 0 to 1. The less the detection sensitivity, the greater the probability of event missing.
   c. In the **Number of people in crowd** field, specify the minimum number of people moving in the direction of a crowd in which the detection should trigger (**3**).
   d. Set the **Against crowd direction** switch to the position, corresponding to the objects movement against a crowd on the video image (**4**).
   e. In the **Frames processed per second [0.016, 100]** field (**5**), set the number of frames per second that will be processed by the detection tool. The higher the value, the more accurate the detection tool works, but the higher the CPU load.
5. Click the **OK** (**6**) button to save the changes and return to the settings panel of the **Detection of moving against crowd flow** object.
6. Click the **Appply** (**2**) button on the settings panel of the **Detection of moving against crowd flow** object.

Configuring the *Detection of moving against crowd flow* module is complete.

Queue length detection

Functionality of the Queue length detection module

The *Queue length detection* module is designed to carry out the following functions:

1. Count the number of people waiting in line within a certain time interval.
2. Record the number of people waiting in line in a database.
3. Plot the crowding in an observed area.
4. Generate an event when threshold queue length is exceeded and record it to the Event protocol database.

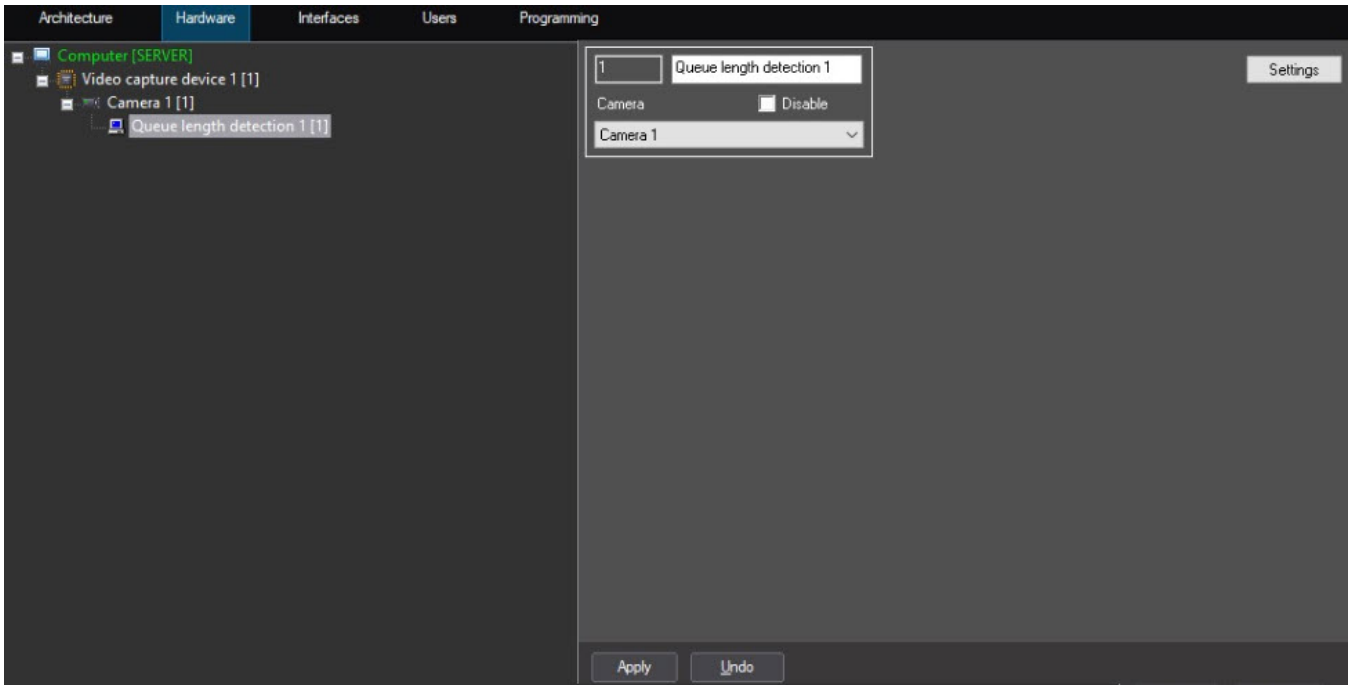
Camera requirements for the Queue length detection module

The requirements for the cameras that will work with the *Queue length detection* module are listed in the following table.

Camera	• Resolution: 720x576 (CIF4), using of 360x288 (CIF1) is acceptable; oversize images are reduces until CIF4. • Fps: not less than 6. • Color: analytics works with grey and color images. • Camera must be rigidly fixed.
Lighting	• The best working of detection is archived at medium lighting. In conditions of insufficient (night) or excessive (exposure) lighting, the quality of analytics can be reduced. • Sharp changes of lighting can lead to short-time invalid analytics working.
Scene and camera angle	• The best position – camera "looks" to the scene vertically down. The better this requirement, the carefully the received estimation. • Sizes of camera field of view: 3x3m is minimal (6x6 people), 4x4m is optimal (8x8 people), 8x8m is maximal (16x16 people). • Background is static and is not changed sharply. • Analytics can work inappropriately on specular surfaces and in case of sharp shadows from moved objects. • Analytics can work inappropriately in case of in the camera field of view there are periodic movements of background objects (trees, working TV, etc.).
Objects image	• Image quality: the image is to be clear, without visible defects from reducing procedure. • Permissible size of a person (the area of a rectangular track around a person) as a percentage of the frame area: from 0.25% to 10%.

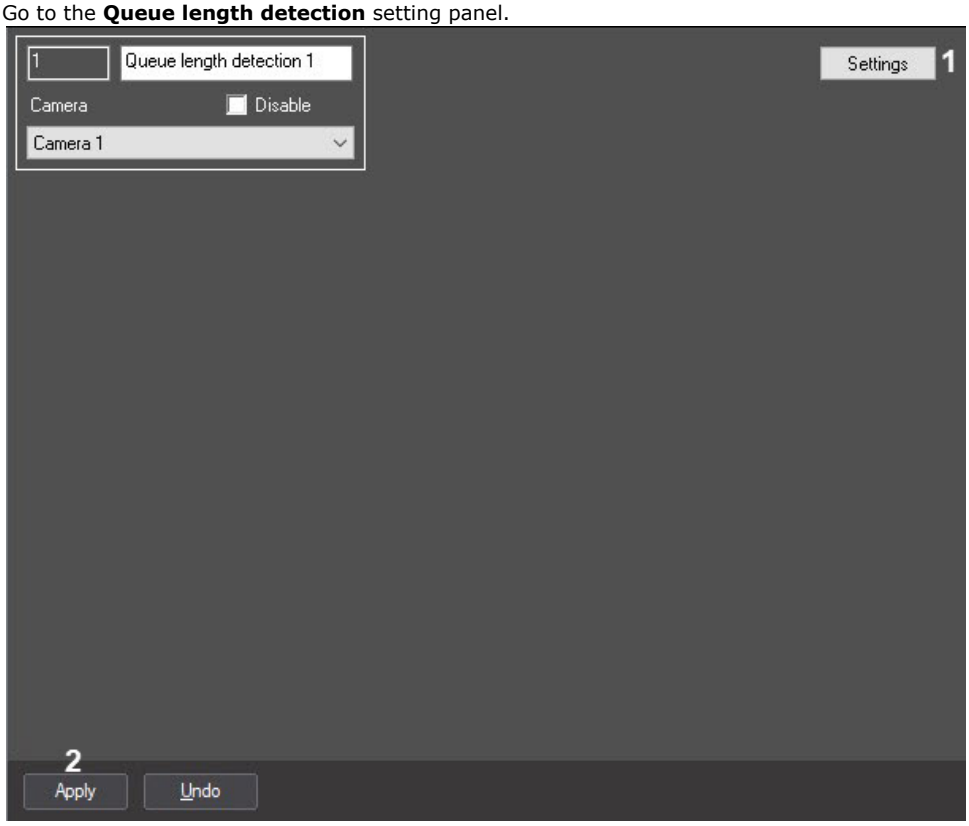
Configuring the Queue length detection module

The *Queue length detection* module can be configured on the settings panel of the **Queue length detection** object created under the **Camera** object in the **Hardware** tab of the **System settings** dialog box.

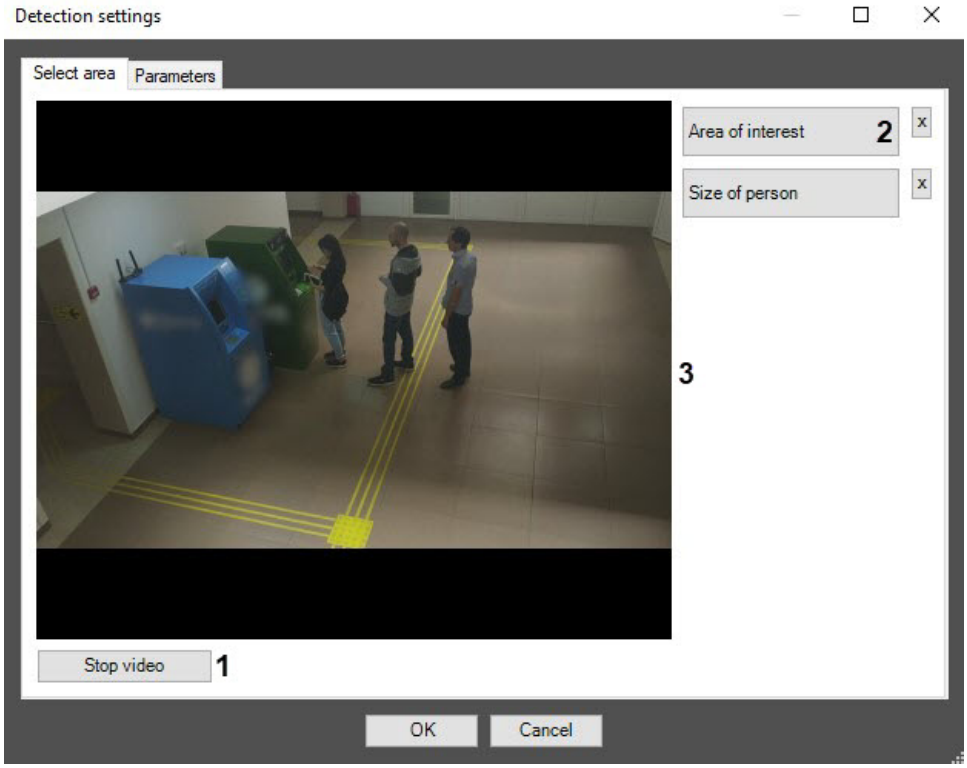


Configure the *Queue length detection* module as follows:

1. Go to the **Queue length detection** setting panel.

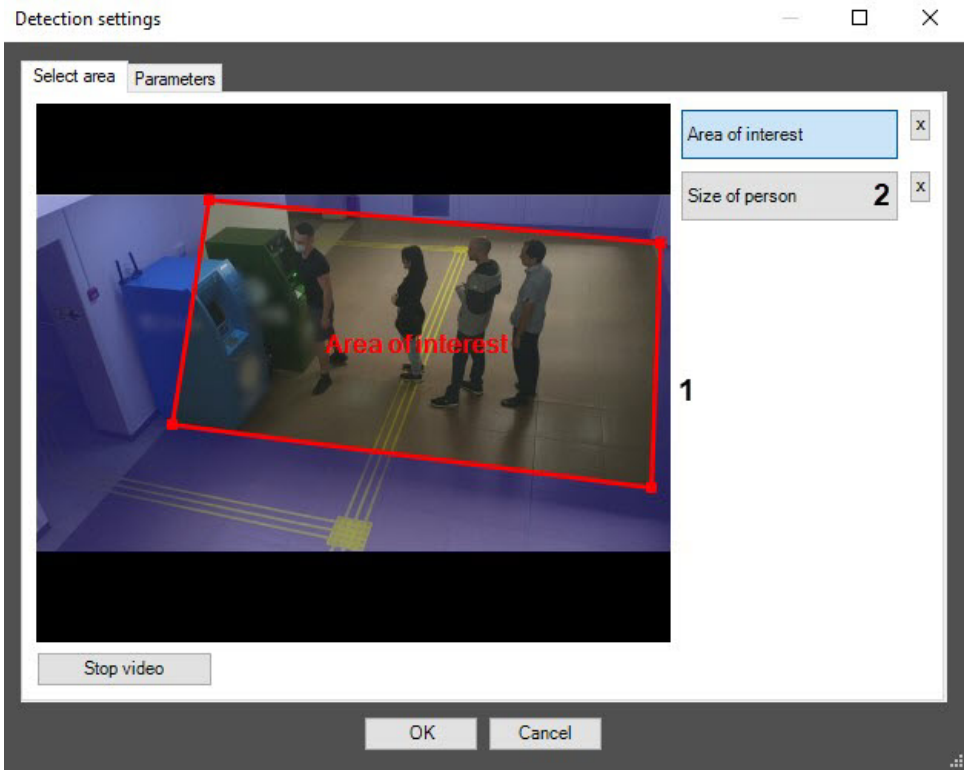


2. Click the **Settings** button (**1**).
   The **Detection settings** window appears.



3. Specify the area of interest and the approximate size of a person in the video image:
   a. Click the **Stop video** button to capture the video image (**1**).
   b. Click the **Area of interest** button (**2**).
   c. Using the left mouse button, select the four points of the area in the captured video image (**3**) to be analyzed (**1**). Only one area can be added. If a second area is specified, then the first area will be deleted. Upon selection of the area the remaining part of the video image will be dimmed.

> **Note**
>
> To remove a selected area, click the button x next to the **Area of interest** button.



Attention!

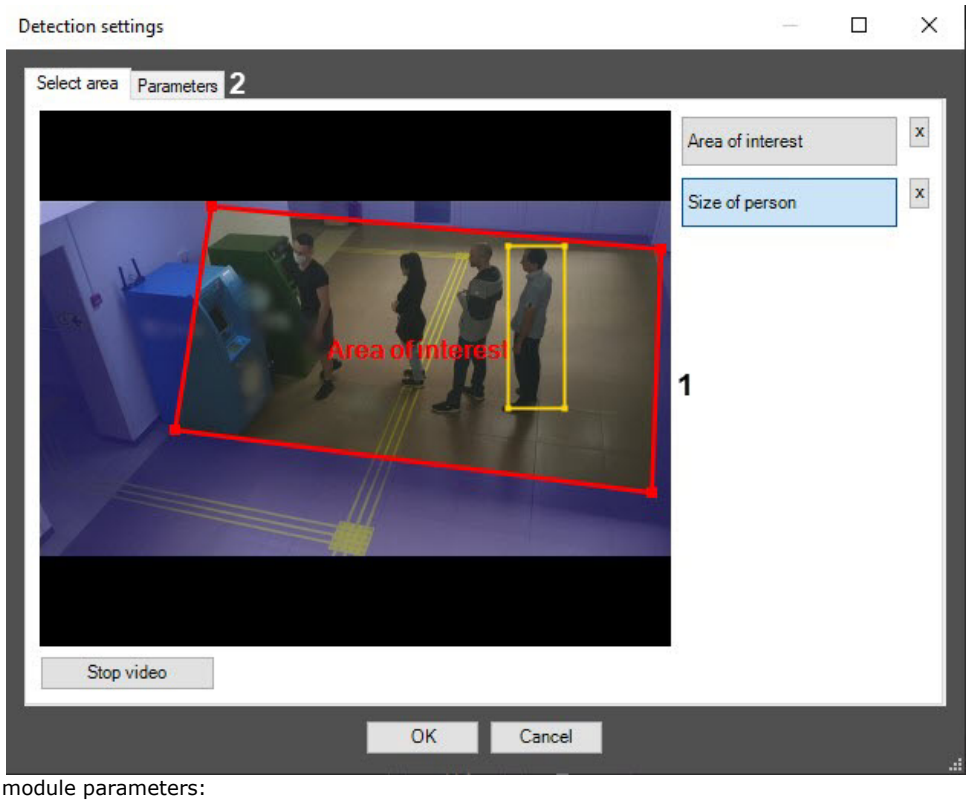
Setting the **Area of interest** is a mandatory requirement for the detection module operation.

d. Click the **Size of person** button (**2**).

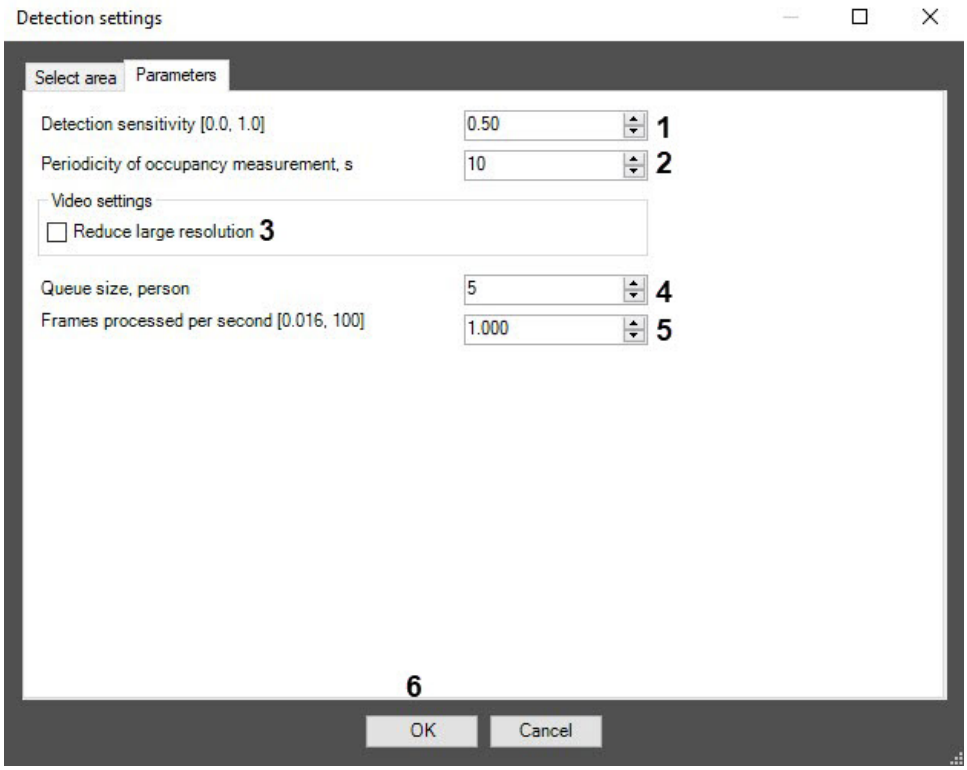
e. In the captured video image (**1**), specify the approximate size of a person. To do this, use the left mouse button to specify a rectangular area (**1**).

Note

To remove the person size, click the button x next to the **Size of person** button.



4. Set the module parameters:
   a. Go to the **Parameters** tab (**2**).
   b. Set the detection sensitivity field in a range from 0 to 1 with up to two decimal places (**1**). The higher sensitivity, the less significant objects will be considered as a queue, i.e., the algorithm will react to more inconsiderable motion. So, only considerable change of the scene will be analyzed by the queue length detection if the minimum value of the detection sensitivity is specified.



   c. In the **Periodicity of occupancy measurement, s** field, specify a time period in seconds for counting the number of people in the observed area (**2**). The minimum value of this parameter is an interval between frames of analyzed video stream, but not less than one second and not more than 3600 seconds. The value of the parameter depends on the

scene characteristics. For example, if a queue in the field of video camera view is not changing for a long time, than the parameter value can be reasonably large. It is not recommended to specify value of this parameter more than 3-5 minutes for the correct operation of algorithm on the average scene.

> **Note**
>
> The more often the occupancy is measured, the greater the load on the system.

d. Set the **Reduce large resolution** checkbox to create and process the new frame consisting of even lines of the initial frame (**3**).
e. In the **Queue size, person** field, enter the minimum number of people in a queue required for triggering the detection tool (**4**).
f. In the **Frames processed per second [0.016, 100]** field, enter the number of frames per second that the detection tool will process (**5**). The higher the value, the more accurate the detection tool operation, but the higher the load on the processor.

> **Note**
>
> All events from the **Queue length detection** object can be found in the **Event Viewer**. See Obtaining traffic information in the area of interest.

5. Click the **OK** button (**6**) to save changes and return to the settings panel of the **Queue length detection** object.

> **Note**
>
> To return to the settings panel of the **Queue length detection** object without saving changes, click the **Cancel** button.

6. Click the **Apply** button (**2**) on the settings panel of the **Queue length detection** object.

Configuring the *Queue length detection* module is completed.

Fire detection and Smoke detection

Functionality of the Fire detection and Smoke detection modules

> ⚠ **Attention!**
>
> Unlike standard fire/smoke detection systems, the *Fire detection* and *Smoke detection* modules face many issues related to the scene and background in the video image. Thus, we cannot guarantee 100% smoke/fire detection. The smoke and fire detection tools are meant to increase the likelihood of fire/smoke detection. However, there may be both false alarms and failures to detect actual cases of fire/smoke in the camera's FoV.

The *Fire detection* and *Smoke detection* modules is designed to carry out the following functions:

1. Recognizing fire/smoke in the specified area of video image.
2. Recording events of fire recognition to the database.

Camera requirements for the Fire detection and Smoke detection modules

The requirements for cameras that will work with the *Fire detection* and *Smoke detection* modules are shown in the following table.

Camera	• It is recommended to use color cameras. With black and white cameras, the recognition quality can be much worse • Resolution must be at least 640x360 pixels • Number of frames: the response rate of the detection module depends on the number of frames per second, by default, it is 1 per every 10 seconds (in most cases, it is enough to detect a fire/smoke that lasts more than 1 minute)
Lighting	• Fire/smoke must be visually separable from the background
Object images	• The minimum area of fire/smoke in the frame depends on the neural network used. For a standard neural network (see Configuring the Fire detection and Smoke detection modules), the area of fire/smoke must be at least 10% of the frame. In some cases, when the fire is well contained, it can be sufficient for a detection tool that the width/height of the fire zone is 1-3% of the width/height of the frame

Attention!

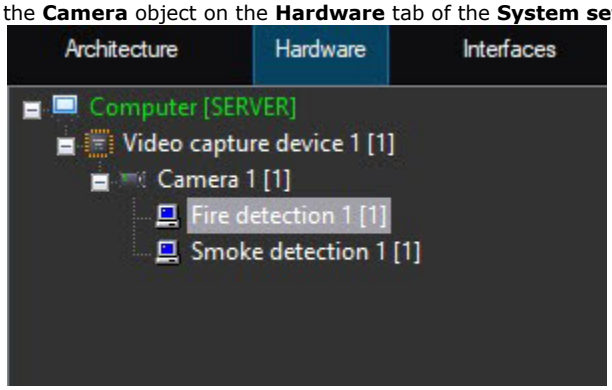
If the area of interest is specified on the video image, then the above requirements are relevant for it, and not for the entire frame (see Configuring the Fire detection and Smoke detection modules).

Correct operation of the Fire detection and Smoke detection isn't guaranteed if you use a video stream or frames that were masked before they got into *Axxon PSIM* by an IP camera or similar means and methods.

Configuring the Fire detection and Smoke detection modules

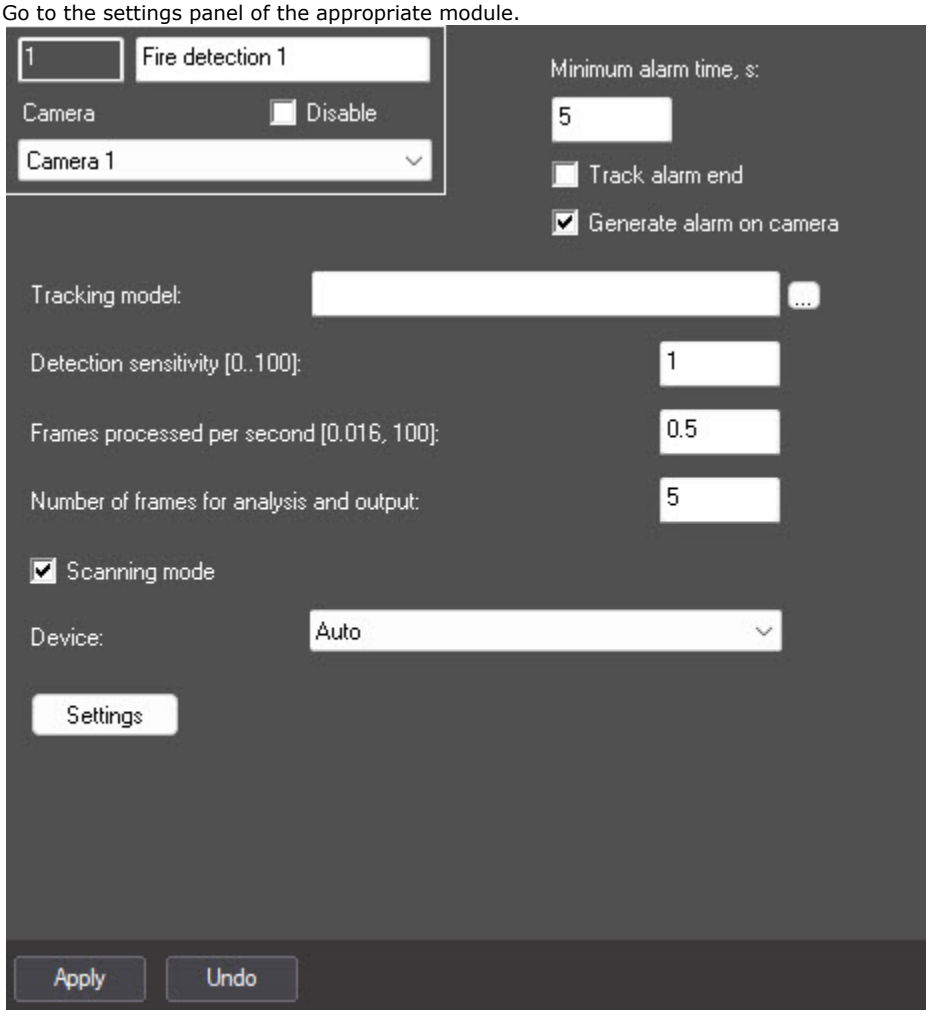
Camera requirements for the Fire detection and Smoke detection modules

- The *Fire detection* module can be configured on the settings panel of the **Fire detection** object created on the basis of the **Ca mera** object on the **Hardware** tab of the **System settings** dialog window.
- The *Smoke detection* module can be configured on the settings panel of the **Smoke detection** object created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.



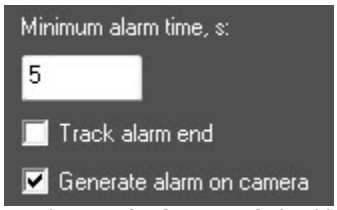
The *Fire detection* and *Smoke detection* modules are configured similarly and as follows:

1. Go to the settings panel of the appropriate module.

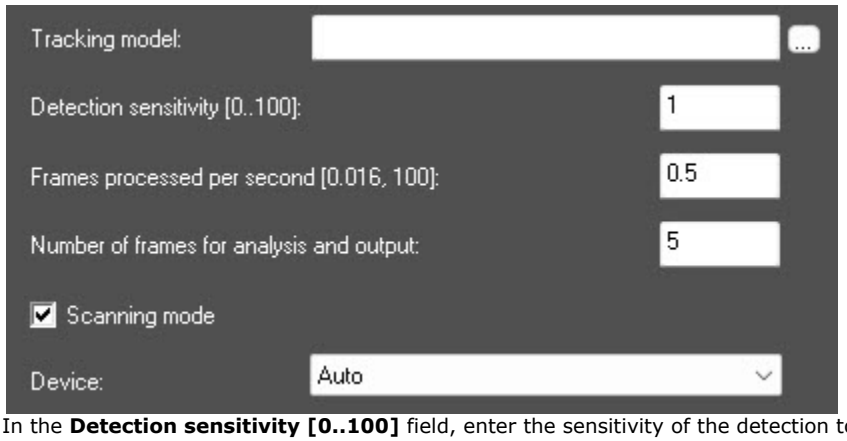


2. In the **Minimum alarm time, s** field, enter the time period in seconds during which the repeated fire/smoke alarms will be ignored.

> **Note**
>
> For example, if 5 seconds is set in the **Minimum alarm time, s** field, and there is a fire/smoke on the image during a longer period of time, then in order to avoid receiving messages about the fire/smoke from the detection tool every 5 seconds, set a higher value for the **Minimum alarm time, s** parameter (for example, 10 seconds). In this case, only one message about the fire/smoke will be displayed, and all the following alarms will not be displayed in the *Even t viewer* until the time interval between the recognitions of the fire/smoke becomes longer than 10 seconds.



3. Set the **Track alarm end** checkbox, if it is necessary to generate an end-of-alarm event only after the expiration of the time, which is counted as: time of the last received alarm + time specified in the **Minimum alarm time, s** parameter.
4. Set the **Generate alarm on camera** checkbox, if it is necessary to initiate an alarm on the camera when a detection tool is triggered.
5. By default, the standard (default) neural network is initialized according to the device selected in the **Device** drop-down list. The standard neural networks for different types of processors are selected automatically. If a custom neural network is prepared for use, in the **Tracking model** field, click the ... button, and select the file in the standard Windows Explorer window that opens.



6. In the **Detection sensitivity [0..100]** field, enter the sensitivity of the detection tool—integer value in the range from 0 to 100. This parameter determines at what certainty of fire/smoke detection the detection tool will trigger: the higher the sensitivity, the higher the recognition threshold. For example, at sensitivity **100**, the detection tool neural network must get 100% certainty for some period of time when processing the frames. The value of the **Detection sensitivity** field is determined experimentally.
7. In the **Frames processed per second [0.016, 100]** field, set the number of frames per second that will be processed by the neural network. This value affects the processor load: the higher the value, the greater the load. It also affects the operation speed of the algorithm: the higher the frame rate, the faster the required number of frames are collected for making a decision and triggering an alarm, if required.
8. In the **Number of frames for analysis and output** field, enter the minimum number of frames in the range 5–20 for the detection tool to analyze before triggering. The higher the value, the more reliable the result of the detection tool operation. At the same time, if the value is too high, the short-time fire/smoke can be missed. If you enter a value less than the minimum, the value is set to 5.

> **Note**
>
> Multiplication of **Minimum alarm time, s** and **Number of frames for analysis and output** values is the time period (in seconds) after which the alarm will trigger after the fire/smoke detection.

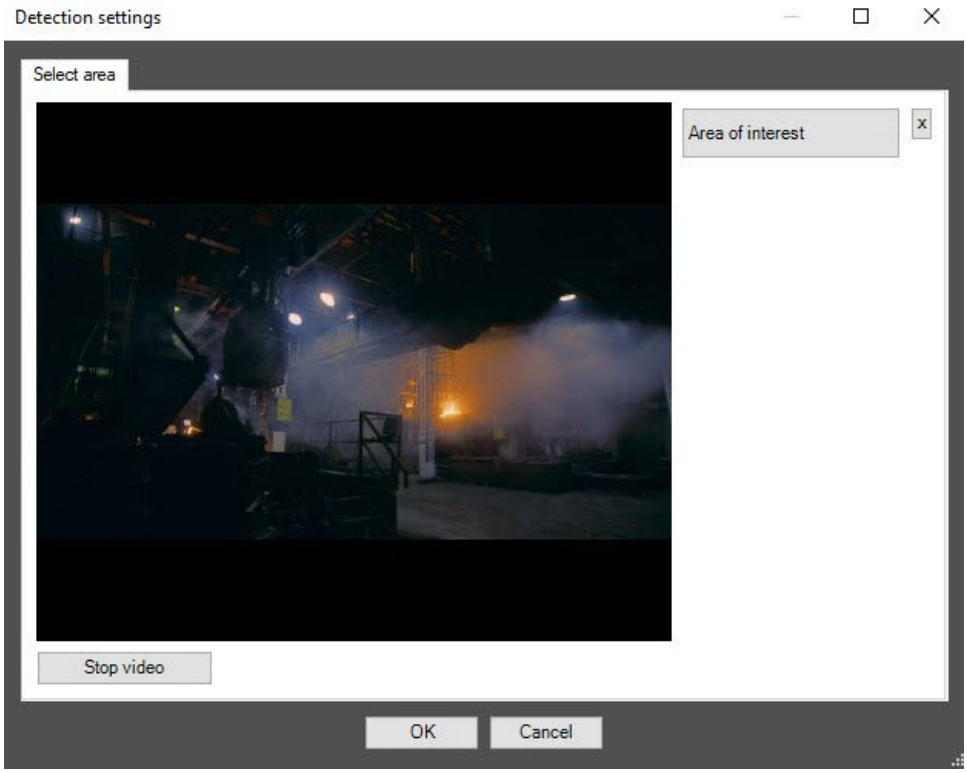
9. Set the **Scanning mode** checkbox to track small objects. If you enable this mode, the load on the system will increase. So we recommend specifying a small number of frames processed per second in the **Frames processed per second [0.016, 100]** field. By default, the checkbox is clear. For more information on the scanning mode, see Configuring the Scanning mode.

> **Note**
>
> You cannot configure the scanning windows for the *Fire detection* and *Smoke detection* modules. The default parameters are used.

10. From the **Device** drop-down list, select the device on which the neural network will operate: CPU, one of NVIDIA GPUs, or one of Intel GPUs. **Auto** (default value)—the device is selected automatically: NVIDIA GPU gets the highest priority, followed by Intel GPU, then CPU.

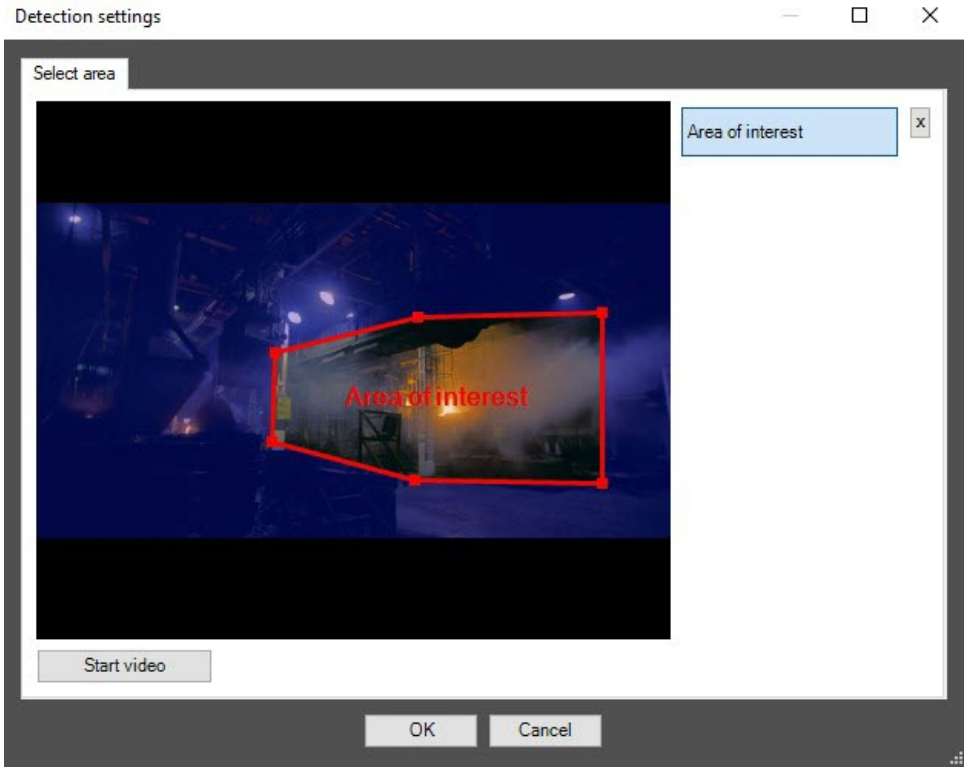
> **Attention!**
>
> a. We recommend using the GPU.
> b. It may take several minutes to launch the algorithm on NVIDIA GPU after you apply the settings. You can use caching to speed up future launches (see Optimizing the operation of neural analytics on GPU).

11. Specify the area of interest on the video image:
    a. Click the **Stop video** button to capture the video image.



    b. Click the **Area of interest** button.

c. On the captured video image, set the anchor points of the area, the situation in which you want to analyze, by sequentially clicking the left mouse button. After adding an area, the rest of the video image will be darkened. If you don't specify the area of interest, the entire frame is analyzed.



d. Click the **OK** button.

> **Note**
>
> - To remove the area, click the x button next to the **Area of interest** button.
> - You can add only one area. If you try to add a second area, the first area will be deleted.

12. Click the **Apply** Apply button.

Configuring the *Fire detection* and *Smoke detection* modules is complete.

Detection of light indication control

Functionality of the Detection of light indication control module

The *Detection of light indication control* module is designed to carry out the following functions:

1. Keeping track of light sources (lamps) in an observed area.
2. Record events about recognizing of light sources insertion or elimination to the database.

Camera requirements for the Detection of light indication control module

The requirements for the cameras that will work with the *Detection of light indication control* module are listed in the following table.

Camera	• Resolution should be at least 320x240 pixels • Fps: not less than 6 • Camera must be rigidly fixed.
Scene and camera angle	• The camera is pointed to the area where all light sources are located (ideally, the optical axis of the camera is pointed strictly perpendicularly to this area).
Objects image	• Light sources in the video image should be visually distinguishable.

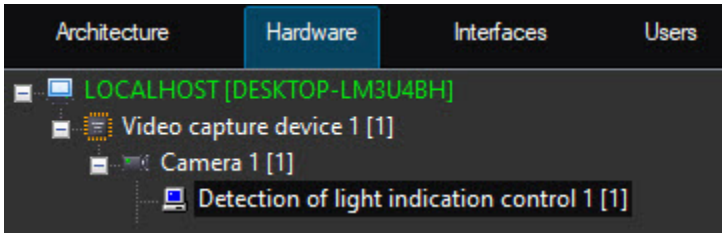
Configuring the Detection of light indication control module

On the page:

The *Detection of light indication control* module registers turning on and off of light indication in the camera FOV.

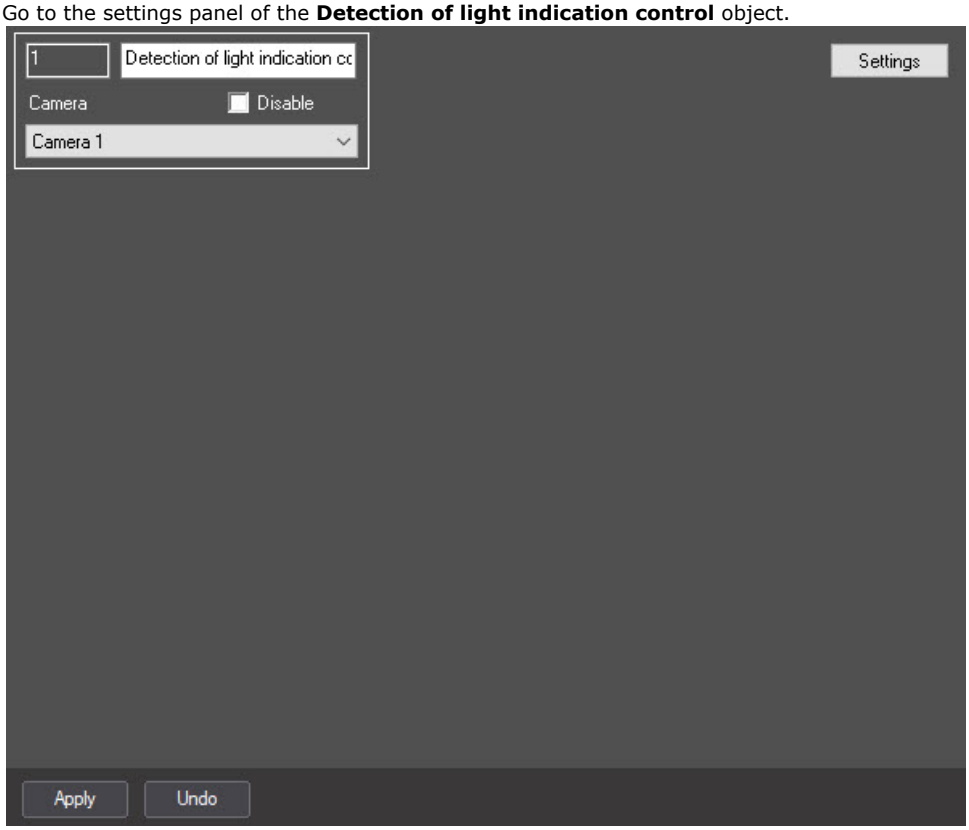
Configuration of the *Detection of light indication control* module includes: selection of detection areas, specifying the parameters of the detection tool.

You can configure the *Detection of light indication control* module on the settings panel of the **Detection of light indication control** o bject that is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.

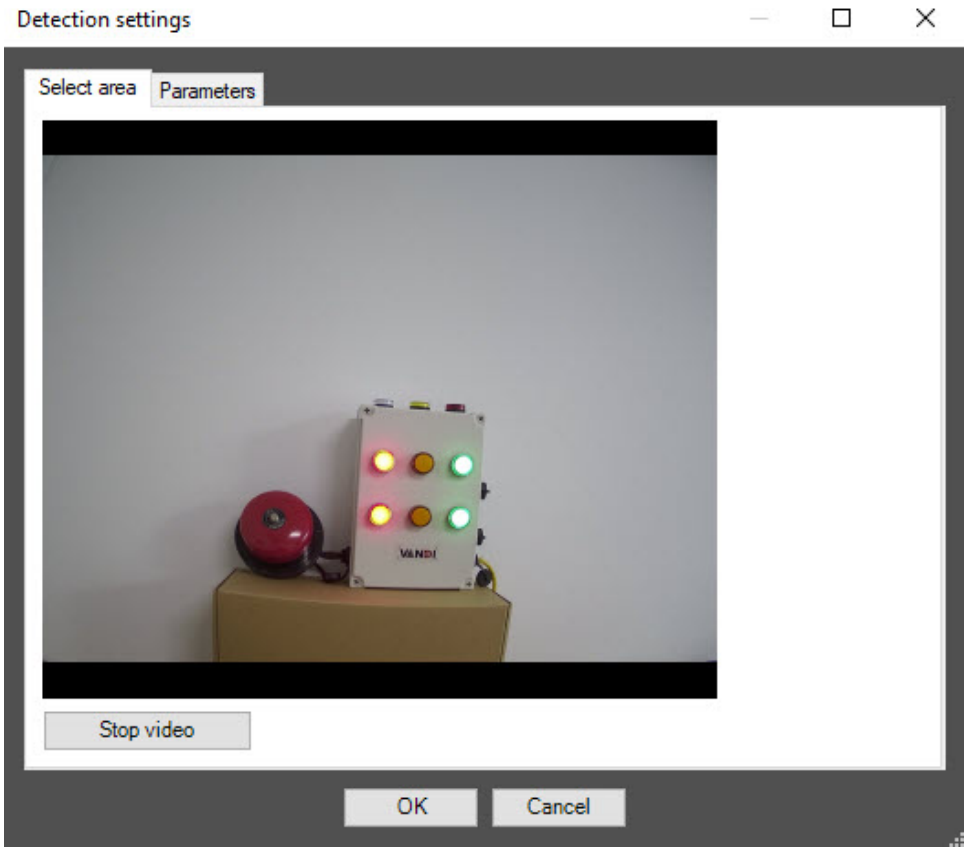


Selecting detection areas

1. Go to the settings panel of the **Detection of light indication control** object.

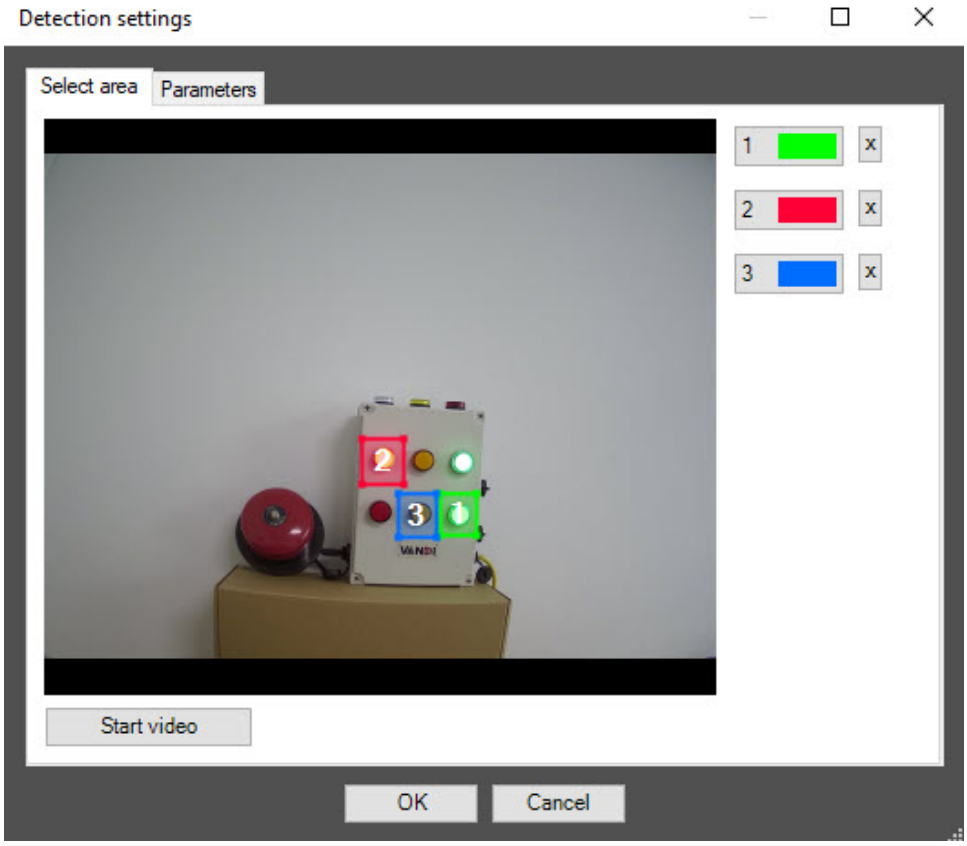


2. Click the **Settings** button. The **Detection settings** window opens.



3. In the **Detection settings** window, click the **Stop video** button to pause the playback and capture the video image.
4. On the video image, specify the location of the light sources that you want to monitor with the detection tool. For this, on the captured video image, specify the detection areas by clicking in the frame and stretching the bounding box to the required

size. The detection areas are numbered in the order of creation, starting from 1. When you add an area, the button corresponding to this area is displayed to the right of the video image.

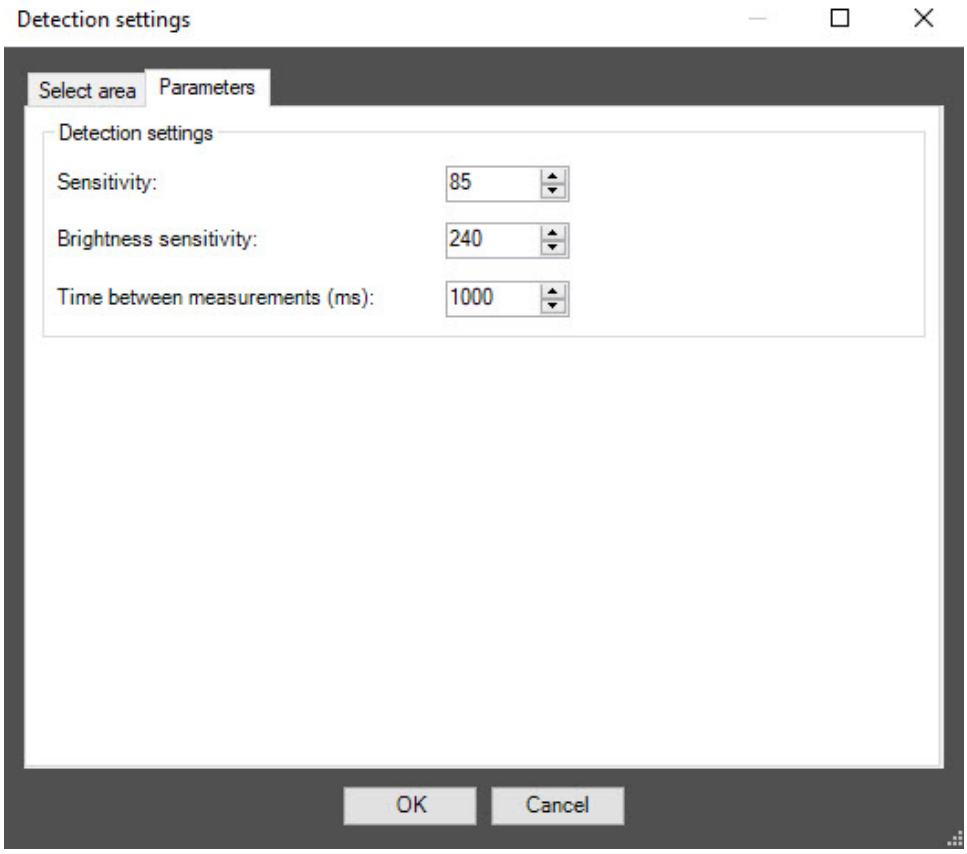


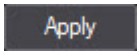
Note

1. The number of detection areas is unlimited.
2. You can change the size and position of detection areas by moving their borders with the mouse.
3. Note that changes in local illumination and reflective surfaces near lamps that are in the detection area can cause false triggering of the detection tool.
4. To correctly specify a detection area, you must include in it a small part of the area near the light source.
5. To change the borders of a detection area, activate it by clicking the button with its number in the list of areas (the button will change its color to blue) and resize the area on the video image.
6. To delete an area, click the x button to the right of the area number.

Parameters of the detection tool

1. Go to the **Parameters** tab.



2. In the **Sensitivity** field, specify the sensitivity of the detection tool to the change of the video image in the range from 0 to 100. You must select the optimal value experimentally by testing detection on triggering in the required conditions. The higher the sensitivity, the higher the probability of false triggering. The lower the sensitivity, the greater the probability of missing an event. The default value is **85**.
3. In the **Brightness sensitivity** field, specify the sensitivity of the detection tool to the change of the light source state. The default value is **240**. You must select the optimal value experimentally by testing detection on triggering in the required conditions. For a dim light source, we recommend increasing the value of the parameter.
4. In the **Time between measurements (ms)** field, specify in milliseconds the time interval between two measurements of light indication. The default value is **1000**.
5. Click the **OK** button to save the changes and close the **Detection settings** window.
6. On the settings panel of the **Detection of light indication control** object, click the **Apply** 

button to save the changes.

Configuring the *Detection of light indication control* module is complete.

VI detection of crowd

Functionality of the VI detection of crowd module

You can use the *VI detection of crowd* module as a part of video surveillance systems at sites characterized by mass crowds of people (subways, train stations, airports, other transport infrastructure facilities, museums, shopping and entertainment centers, sports facilities, and so on) in order to automatically detect situations in which the number of people exceeding a specified threshold gathers in the camera FOV.

The *VI detection of crowd* module has the following features:

1. Detection of crowding and congestion of large numbers of people moving through building entrances, through narrow passages, on approaches to escalators during mass events.
2. The detection tool is in a normal (non-alarming) state when a dense crowd is moving through a controlled area at a low speed. If the crowd stops, that is, at the moment of congestion formation, an alarm is generated (the **Crowd** event).

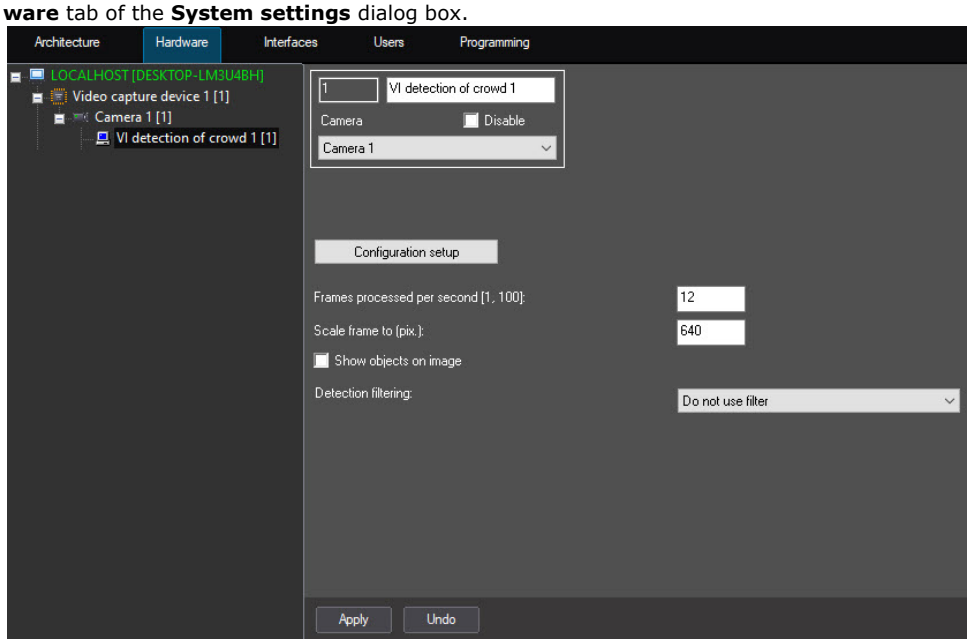
Configuring the VI detection of crowd module

На странице:

Configuring the *VI detection of crowd* software module includes general settings and configuration settings: detection zone, configuration parameters and detection tool characteristics.

General settings

1. Go to the settings panel of the **VI detection of crowd** object, which is created on the basis of the **Camera** object on the **Hard ware** tab of the **System settings** dialog box.

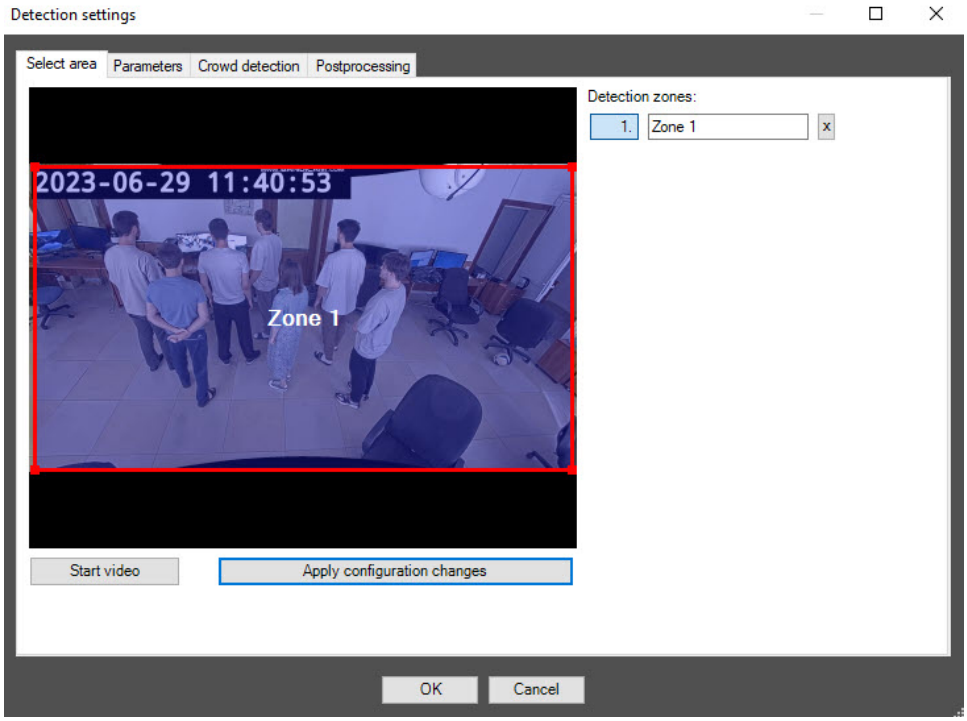


2. In the **Frames processed per second [1, 100]** field, specify the number of frames in the range 1-100 that the detection tool processes per second. The default value is **12** (recommended). You can specify only a positive integer. If you enter a number outside the range 1-100, it is automatically changed to the nearest border value. If you leave the field blank, it automatically returns to the default value when you save the settings.
3. In the **Scale frame to (pix.)** field, specify in the range 480-960 the size of the frame in pixels after scaling. The default value is **640**.
4. Set the **Show objects on image** checkbox if it is necessary to highlight the detection zone with a red border on the Video surveillance monitor when a crowd detection event is generated. The detection zone is specified in the detection tool settings on the **Select area** tab.
5. From the **Detection filtering** drop-down list, select the filter that you want to use: **Object filter**, **Object counting filter**, **Do not use filter** (default). You can configure filters on the **Postprocessing** tab of the **Detection settings** window.
6. Click the **Configuration setup** button. As a result, the **Detection settings** window opens.

The Select area tab

1. In the **Detection settings** window, on the **Select area** tab, click the **Stop video** button to pause the video.

2. By default, the entire frame is outlined with a red border as a detection zone. You can change the borders of a zone with the mouse by clicking its number in the list on the right. Number of a detection zone is highlighted in blue.



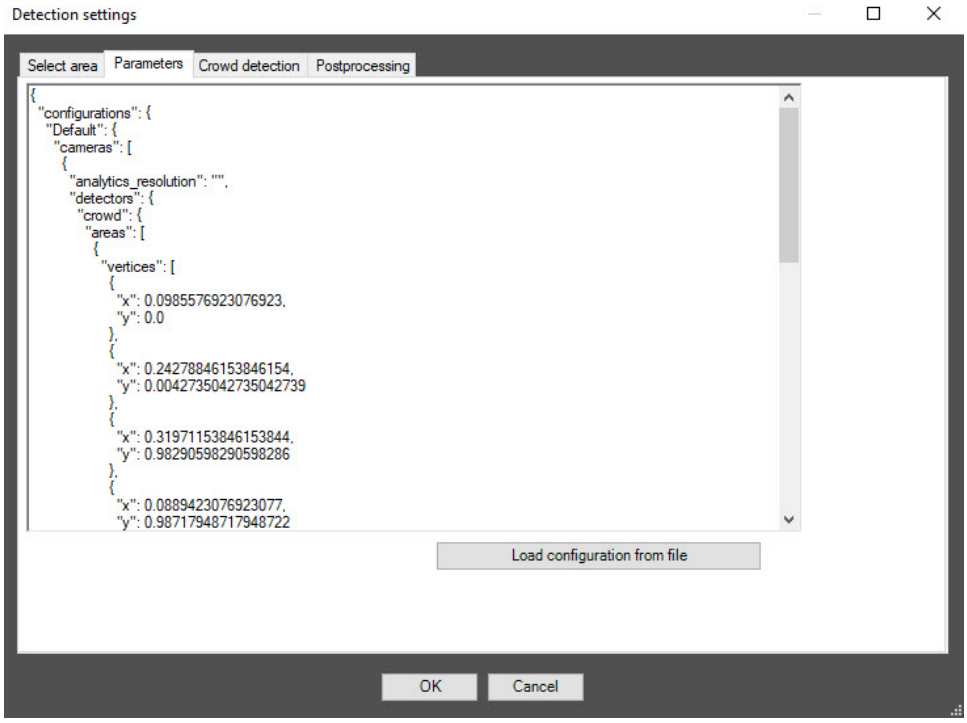
3. To rename a detection zone, enter a new name in the field to the right of its number. The new name appears in the zone caption on the video image.

> **Note**
>
> You can specify only one detection zone.
>
> To delete a detection zone, click the x button to the right of the zone name.

4. To save all changes, click the **Apply configuration changes** button.
5. To start video playback, click the **Start video** button.

The Parameters tab

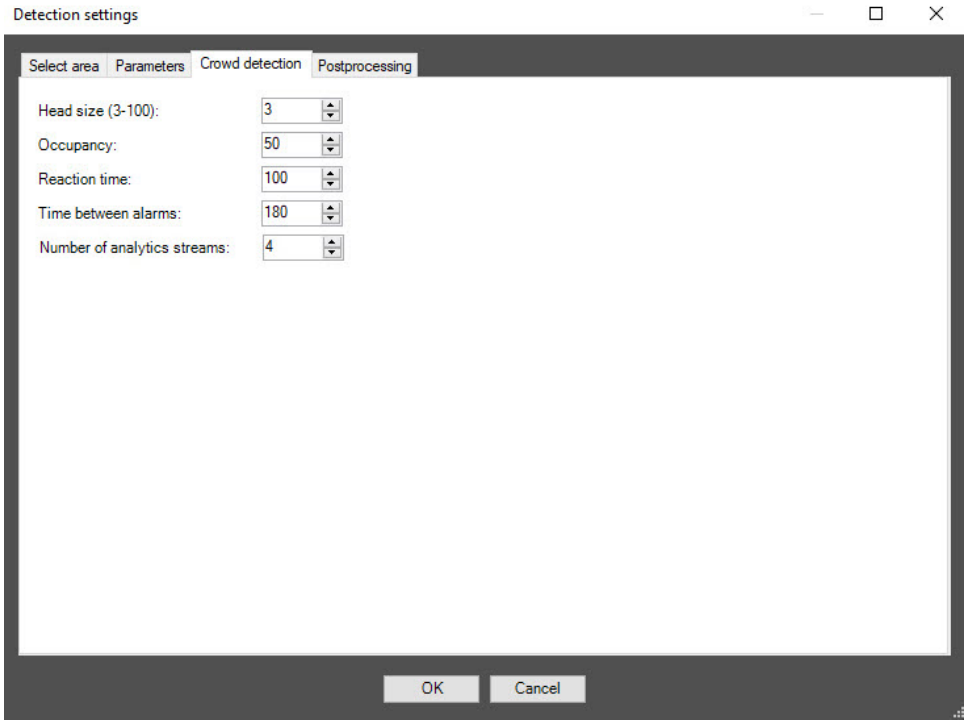
1. Go to the **Parameters** tab of the **Detection settings** window. This tab displays the parameters of the used configuration. If you do not need to change the configuration, skip steps 2 and 3 and go to the next tab.



2. To use custom configuration, click the **Load configuration from file** button.
3. In the standard Windows search window that opens, specify the path to the configuration file in JSON format.

The Crowd detection tab

1. Go to the **Crowd detection** tab.



2. In the **Head size (3-100)** field, specify in the range 3-100 what part of the video image height is the human head. The specified fractional value is rounded to an integer value when you switch to another field or save the settings. The default value is **3**.
3. In the **Occupancy** field, specify as a percentage the share of the detection zone area, which must be filled in order for the detection tool to record the beginning of the **Crowd** event. If the occupancy remains longer than the time threshold specified in the **Reaction time** field, a **Crowd** alarm event is generated on the detection tool. The default value is **50**.

4. In the **Reaction time** field, specify in seconds the time interval after which a **Crowd** alarm event is generated on the detection tool if the value of the **Occupancy** parameter remains equal to or above the set threshold. If during the specified period of time the value of this parameter drops below the threshold value, then the time counting stops and the counter is reset to zero. The default value is **100**.
5. In the **Time between alarms** field, specify in seconds the frequency of a **Crowd** alarm event generation. The default value is **180**.
6. In the **Number of analytics streams** field, specify the number of video streams that are used for neural network analytics. The default value is **4**.
7. To save the detection tool settings, click the **OK** button.
8. To save the changes, click the **Apply** button on the settings panel of the **VI detection of crowd** object.

Configuration of the *VI detection of crowd* software module is complete.

"VI" abandoned objects detection

Functionality of the VI abandoned objects detection module

The *VI abandoned objects detection* software module has the following features:

1. Automatic detection of abandoned or disappeared objects that remain stationary for a certain period of time in the specified detection zones.
2. Generation of an alarm when abandoned or disappeared objects are detected in the specified detection zones.

Camera requirements for the VI abandoned objects detection module

Camera requirements for the *VI abandoned objects detection* module are given in the table:

Camera	• Pitch angle of the camera optical axis relative to the horizontal plane:
	  ◦ at least 15 degrees for the inclined method of placement
	  ◦ from 80 to 100 degrees for placement on ceiling
	• Resolution is from 640x360 to 1920×1080 pixels
	• Resolution can be:
	  ◦ lower for close-up scenes (2–7 meters for cameras with standard focal length) without loss of recognition quality
	  ◦ higher for scenes far from camera (from 10 meters)
	• FPS is at least 25
	• Color image only

Lighting	• Lighting in the scene is from 100 to 1000 lux
Scene and camera angle	• Shooting distance is from 5 to 30 meters • Density of people flow is no more than one person per square meter • Volume of the abandoned object is from 3 cubic decimeters • Background texture: moving, random and inhomogeneous background with contrast variations from 0.2 to 0.8
Object images	• For abandoned objects, the optimum density is 100 pixels per meter • Maximum signal-to-noise ratio (without the function of automatic signal amplification) is at least 42 dB • Resolution of the video image is at least 1280x960 pixels • Image isn't noisy and isn't distorted by artifacts of the compression algorithm • Distortion is no more than 10% (at the edges of the frame—at a distance of one third from its center in width, height and diagonal)

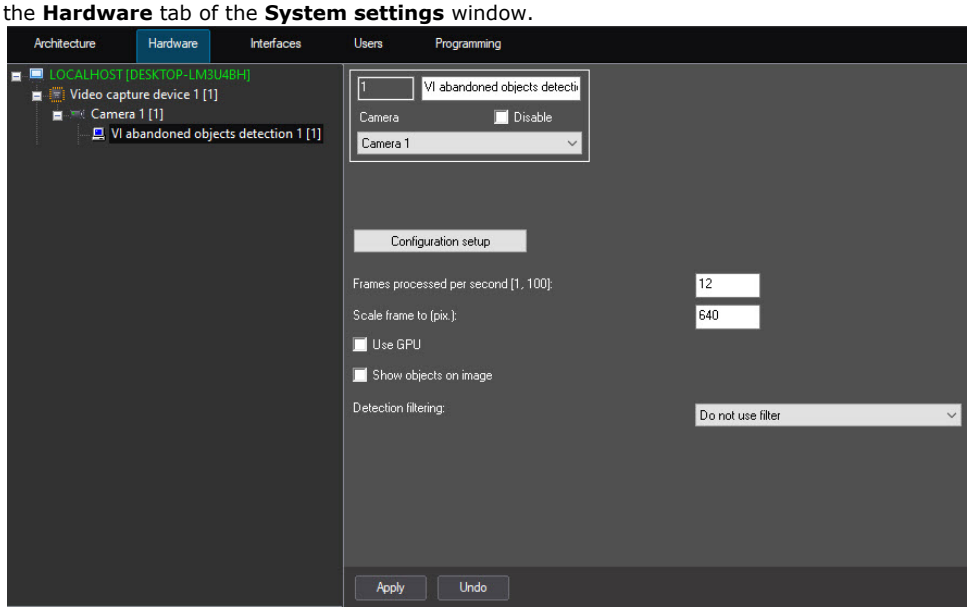
Configuring the VI abandoned objects detection module

На странице:

Configuration of the *VI abandoned objects detection* module includes general settings and configuration setup: determining the configuration parameters and detection tool characteristics.

General settings of the detection tool

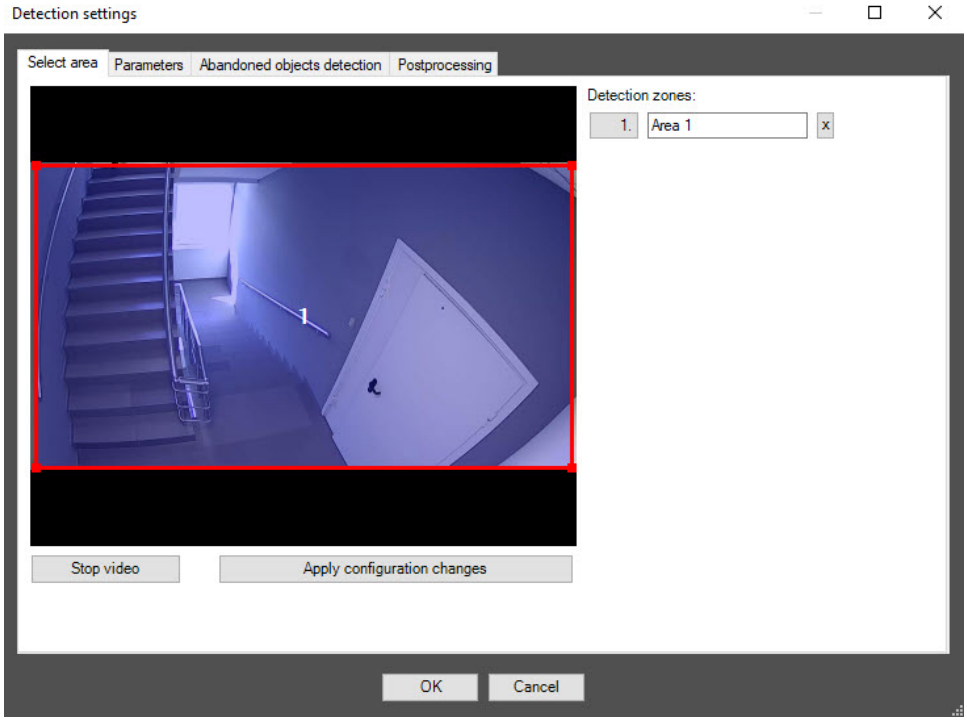
1. Go to the settings panel of the **VI abandoned objects detection** object that is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** window.



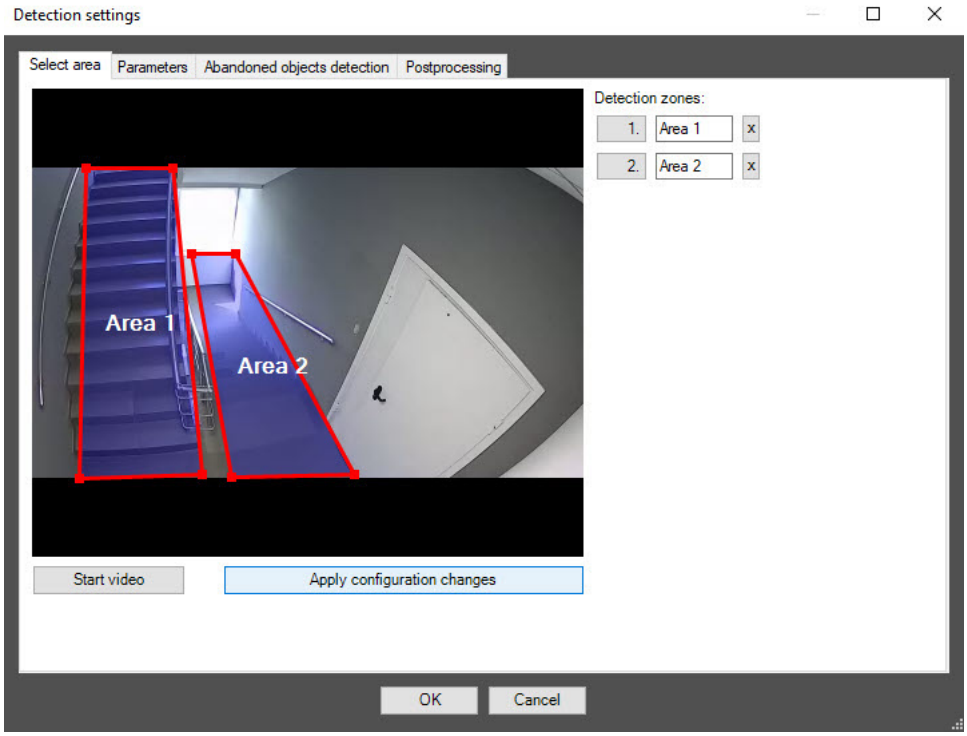
2. In the **Frames processed per second [1, 100]** field, specify the number of frames in the range 1-100 that the detection tool processes per second. The default value is **12** (recommended). You can specify only a positive integer. If you enter a number outside the range 1-100, it is automatically changed to the nearest border value. If you leave the field blank, it automatically returns to the default value when you save the settings.
3. In the **Scale frame to (pix.)** field, specify in the range 480-960 the size of the frame in pixels after scaling. The default value is **640**.
4. Set the **Use GPU** checkbox to use NVIDIA GPU when working with the neural network.
5. Set the **Show objects on image** checkbox to highlight the detection zone with a red border on the Video surveillance monitor when an object detection event is received.
6. From the **Detection filtering** drop-down list, select the filter that you want to use: **Object filter**, **Object counting filter**, **Do not use filter** (default). You can configure filters on the **Postprocessing** tab of the **Detection settings** window.
7. Click the **Configuration setup** button. The **Detection settings** window opens.

The Select area tab

1. In the **Detection settings** window, on the **Select area** tab, click the **Stop video** button to pause video playback.



2. By default, one detection zone is highlighted with a red border. You can add more zones with the mouse, as well as change the borders of a zone by clicking its number in the list on the right. Number of a detection zone is highlighted in blue.



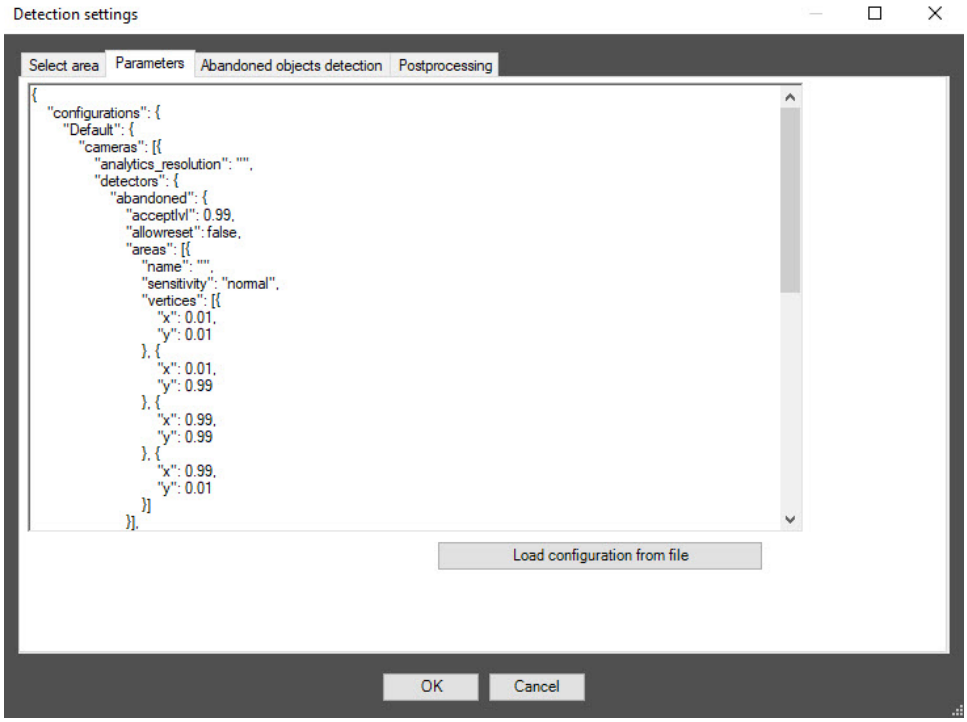
3. To rename a detection zone, enter a new name in field to the right of its number. The new name appears in the zone caption on the video image.

> **Note**
>
> To delete a detection zone, click the x button to the right of the zone name.

4. To save all changes, click the **Apply configuration changes** button.
5. To start video playback, click the **Start video** button.

The Parameters tab

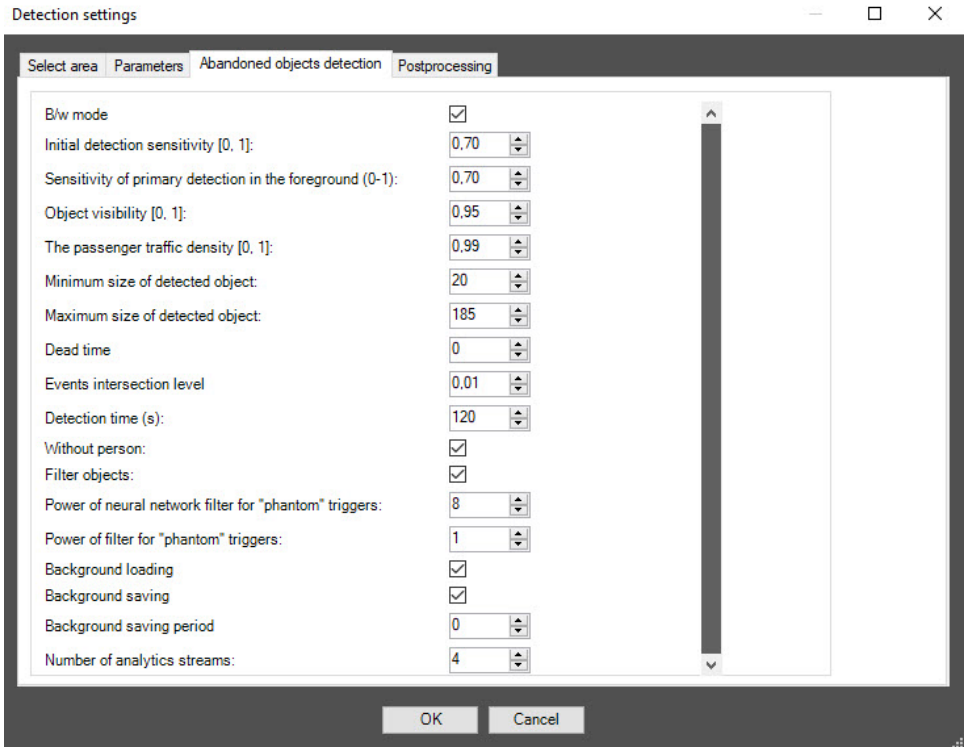
1. Go to the **Parameters** tab. The parameters of the configuration that you use are displayed here. If you don't want to change the configuration, skip steps 2 and 3 and go to the next tab.



2. To use your configuration, click the **Load configuration from file** button.
3. In the standard Windows search window that opens, specify the path to the prepared configuration file in JSON format.

The Abandoned objects detection tab

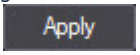
1. Go to the **Abandoned objects detection** tab.



2. Clear the **B/w mode** checkbox to disable the black and white mode. By default, the checkbox is set.

3. In the **Initial detection sensitivity [0, 1]** field, specify the general sensitivity of the detection tool to detect abandoned objects in the range 0-1. The **0** value—no object is detected. The **1** value—maximum sensitivity. The default value is **0.70**.
4. In the **Sensitivity of primary detection in the foreground (0-1)** field, specify the sensitivity of the detection tool to detect abandoned objects in the foreground in the range 0-1. The **0** value—no object is detected. The **1** value—maximum sensitivity. The default value is **0.70**.
5. In the **Object visibility [0, 1]** field, specify in fractions the sensitivity of the detection tool to detect barely visible, merging with the background objects in the range 0-1. The higher the value of the parameter, the less noticeable object can be detected. The recommended value (default) is **0.95**.
6. In the **The passenger traffic density [0, 1]** field, specify the sensitivity of the object detection in conditions of intensive overlapping of the object by passing people in the camera FOV in the range 0-1. The default value is **0.99**.
7. In the **Minimum size of detected object** field, specify in centimeters on one side the minimum allowable size of an object that you want to detect. You must specify the size of an object relative to the frame. Smaller objects don't trigger the detection tool. The default value is **20**.
8. In the **Maximum size of detected object** field, specify in centimeters on one side the maximum allowable size of an object that you want to detect. You must specify the size of an object relative to the frame. Larger objects don't trigger the detection tool. The default value is **185**.
9. In the **Dead time** field, specify the time interval in seconds during which the occurrence of a repeated event is blocked. An event is considered repeated if its event intersection level is equal to or greater than the value specified in step 10. The default value is **0**.
10. In the **Events intersection level** field, in the range 0-1, specify the level representing the way the repeated events are filtered An event is considered repeated if the ratio of the intersection area to the area of the conjunction of two events is greater than or equal to the value specified for this parameter. The default value is **0.01**. This parameter value is used in the **Dead time** parameter.
11. In the **Detection time (s)** field, specify the time interval in seconds, after which an object is considered abandoned. The default value is **120**.
12. Clear the **Without person** checkbox so that objects near people are also detected. By default, the checkbox is set, which means that objects near people are ignored.
13. Clear the **Filter objects** checkbox to disable the neural network filter of objects. By default, the checkbox is set, which means that the neural network filter is enabled.
14. In the **Power of neural network filter for "phantom" triggers** field, specify in the range 0-100 the level of filtering of monotone or monochromatic triggers, for example, spots on the floor. You must select the value of the parameter empirically. The default value is **8**.
15. In the **Power of filter for "phantom" triggers** field, specify in the range 0-50 the level of shadow and glare filtering depending on scene contrast, lighting variability, presence of shadows and glare. You must select the value of the parameter empirically. The default value is **1**.
16. Clear the **Background loading** checkbox to disable the loading of video background. By default, the checkbox is set. After restart, the detection tool loads the previously saved background not to retrain the network model.
17. Clear the **Background saving** checkbox so that the background isn't saved. By default, the checkbox is set, which means that the background of the video is saved regularly with the periodicity specified in the **Background saving period** field. When you shut down the detection tool, the previously accumulated background is saved to a file for subsequent loading at startup.

    > **Note**
    >
    > If you use the **Background loading** and **Background saving** parameters during initial configuration, you save time on automatic training at the first startup.
    > Even if the checkboxes are clear, the background is saved and updated over the specified period, so to completely disable background saving, specify **0** in the **Background saving period** field.

18. In the **Background saving period** field, specify the time period in seconds for which the background of the video is saved. The default value is **0**.
19. In the **Number of analytics streams** field, specify the number of video streams that are used for the operation of the neural network analytics. The default value is **4**.
20. Click the **OK** button to save the settings of the detection tool.
21. To save the changes, click the **Apply** 

button on the settings panel of the **VI abandoned objects detection** object.

Configuration of the *VI abandoned objects detection* software module is complete.

Stopped vehicle detection

Functionality of the Stopped vehicle detection module

The *Stopped vehicle detection* module is designed to carry out the following functions:

1. Recognizing cars stopped in the specified areas.
2. Recognizing jams in the specified areas.
3. Recording Jams and Stopped cars events to the database.
4. Recording events of jam elimination or start of movement of previously detected stopped car to the database.

Camera requirements for the Stopped vehicle detection module

The requirements for the cameras that will work with the *Stopped vehicle detection* module are listed in the following table:

Camera	• Resolution should be at least 720x480 pixels • Fps: not less than 15, recommended fps is 25 • Camera should be rigidly fixed to avoid shaking
Scene and camera angle	• Recommended height of camera mounting: 6-7 m • Recommended angle of camera mounting: no more than 30 degrees relative to the horizontal line • It is recommended to mount camera above the middle of analyzed traffic area • If the camera is installed on the side of the traffic area, the efficiency of the detection algorithm decreases
Object images	• The vehicles and their elements, for example, a radiator grill, should be visually distinguishable on the video image • It is recommended to use the Zoom-In/Zoom-Out camera functions to improve the response reflection from vehicles on the scene, i.e. settings in which the vehicle elements are clearly distinguishable
Lighting requirements	• Objects should be visually separated from the background and from each other.

Configuring the Stopped vehicle detection module

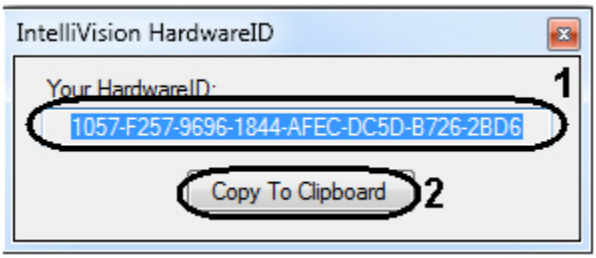
Licensing the Stopped vehicle detection module

> **Attention!**
>
> For the detection module to operate, the MS Visual C++ Runtime 2015 redistributable package must be installed on the computer.

To license the *Stopped vehicle detection* module, do the following:

1. Go to the <*Axxon PSIM* installation folder>\Modules\IntelliVision folder.
2. Run the HardwareID.exe utility.

   > **Attention!**
   >
   > Run the HardwareID.exe utility as a computer Administrator.
   >
   > The utility should be started after the full loading of the operating system, specifically after the start of all required services and applications.

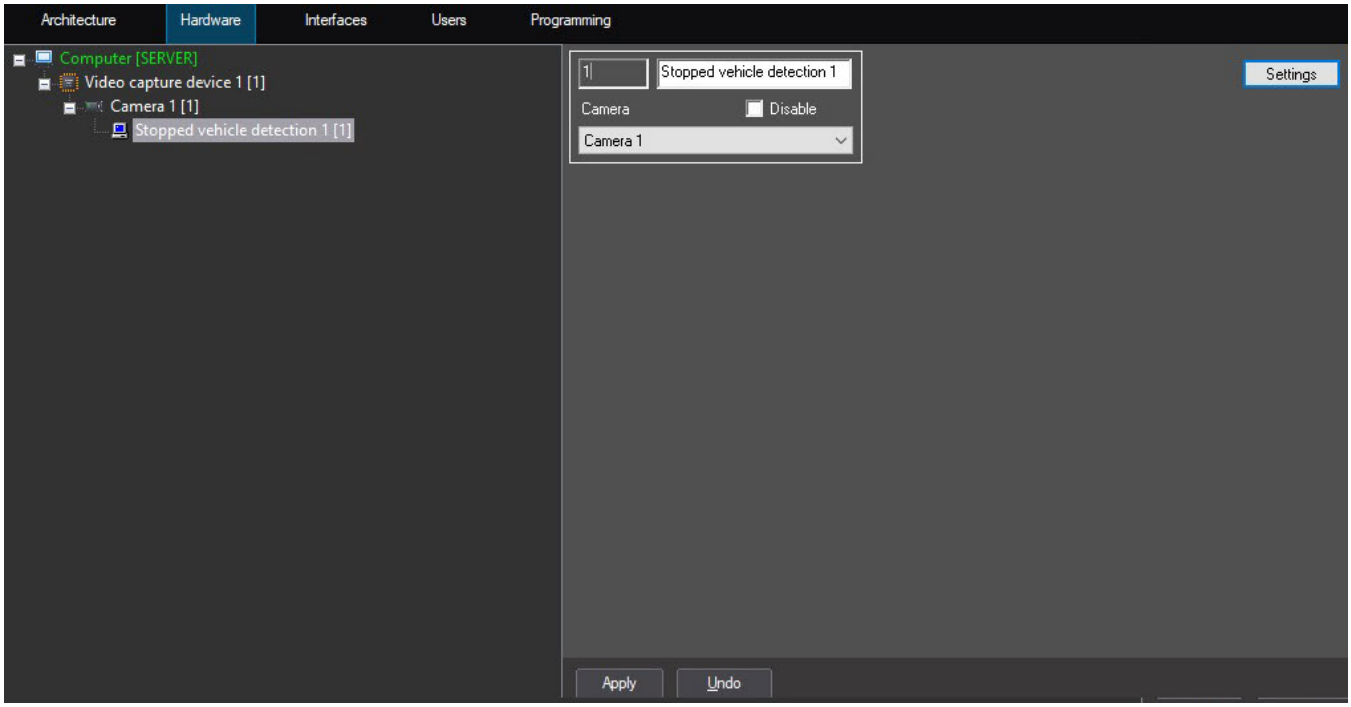
   

3. The code is displayed in the **Your HardwareID** field (**1**).
4. Click the **Copy To Clipboard** button to copy the code to the clipboard (**2**).
5. Send the code to the manager of the AxxonSoft company and specify the number of **Stopped vehicle detection** which you plan to use.
6. Receive the regkey.dat file from the manager of the AxxonSoft company.
7. Put the received file to the <*Axxon PSIM* installation folder>\Modules64\ folder.

Licensing the *Stopped vehicle detection* module is completed.

Configuring Stopped vehicle detection module

The *Stopped vehicle detection* module is configured on the settings panel of the **Stopped vehicle detection** object, created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.

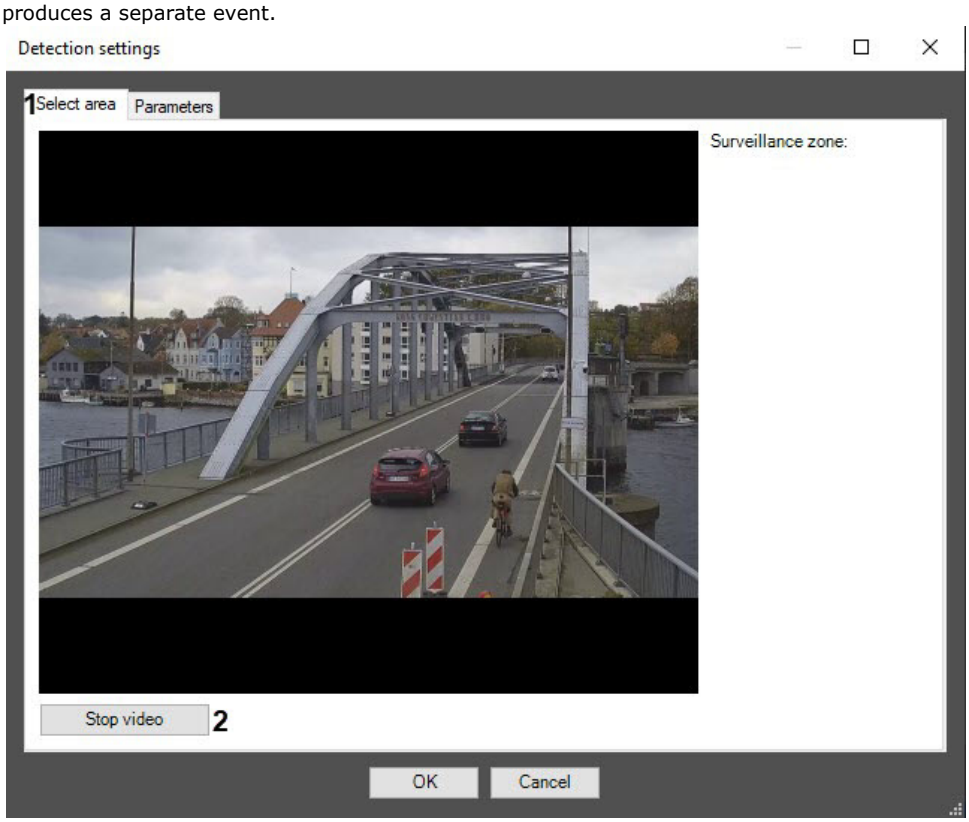


The *Stopped vehicle detection* module is configured as follows:

1. Go to the settings panel of the **Stopped vehicle detection** object.

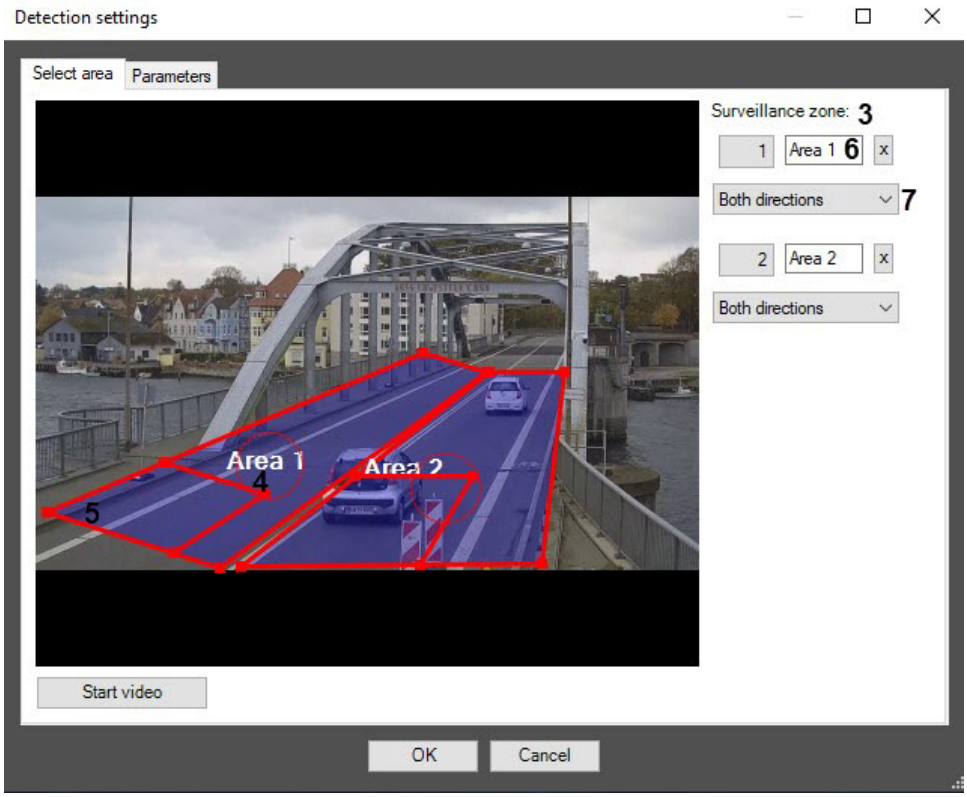
2. Click the **Settings** (**1**) button. The **Detection settings** window will open.

3. Set the surveillance zones on the **Select area** tab (**1**). Several zones can be added. Detection tool triggering in each zone produces a separate event.



To add a surveillance zone, do the following:

a. Click the **Stop video** button (**2**) to capture the video image.
b. To add a zone, click any mouse button on the video image. Several zones can be added (**3**). Detection tool triggering in each zone produces a separate event.



> **Note**
>
> For each surveillance zone, both vehicle stop and vehicle leaving the zone are detected.

c. Set the required size, shape and position of the surveillance zone:
   - to change the zone size, use the anchor points of the zone;
   - to rotate the zone, drag it, while holding the mouse pointer close to the inner perimeter of the zone;
   - to move the zone around the frame of the video image, use a dotted line circle (**4**).

d. Specify the approximate size of the vehicle in each surveillance zone by changing the size of the internal areas in the bottom left corner of the zone (**5**). This field is called the detection area.

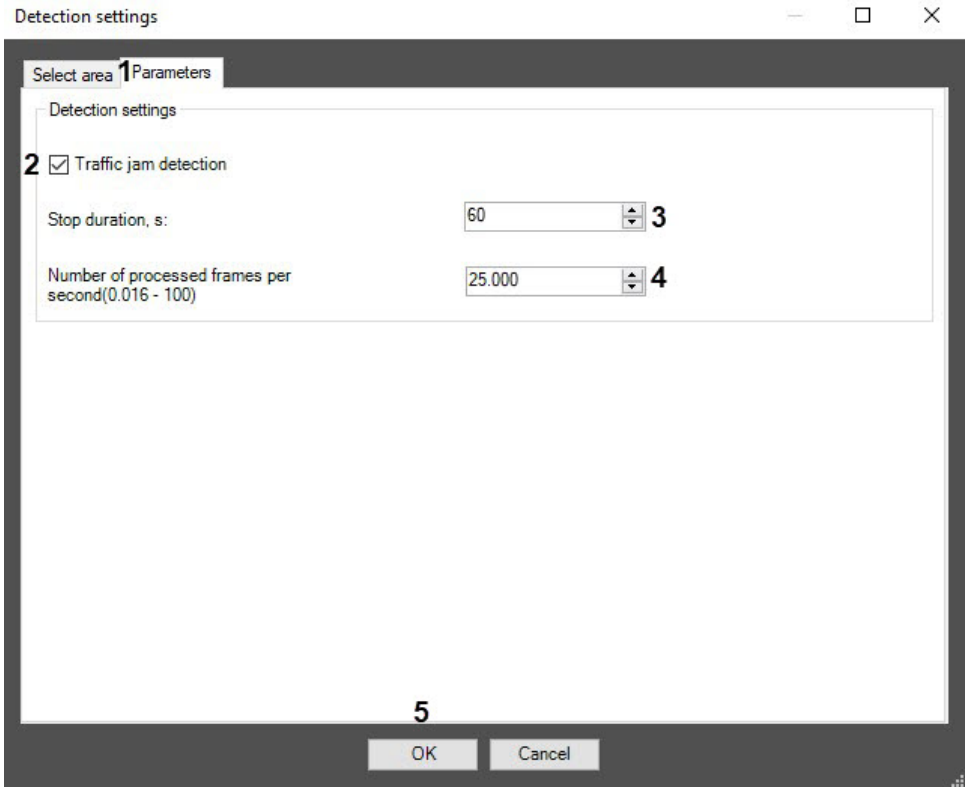
> **Note**
>
> Each surveillance zone over its entire area is proportionally covered by detection areas of the specified size. It is necessary to set the approximate dimensions of the vehicle so that each surveillance zone includes no more than 256 detection areas.
>
> - To control the coverage of the zone with detection areas, use the debug window (see Appendix 1. Debug window).
> - The stopped vehicles can be detected only in those parts of the surveillance zone, which are covered with detection areas.

e. Enter zone name (**6**).

f. Select the direction of the vehicles movement relative to the camera for each surveillance zone (**7**).

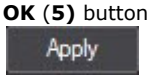
> **Note**
>
> To remove the area, click the x button next to the **Area of interest** button.

4. Go to the **Parameters** tab (**1**).



5. Set the **Traffic jam detection** checkbox (**2**), if you want to receive events about the traffic jams.
6. In the the **Stop duration, s** field (**3**), set the vehicle minimal stop duration in seconds.
7. In the **Number of processed frames per second (0.016-100)** field (**4**), specify the number of frames the detection tool will process per second. The higher the value, the more accurate the detection tool operates. but the load on the CPU is higher as well. The default value is 25 frames.

> **Note**
>
> All events received from the **Stopped vehicle detection** object can be observed in the **Event viewer** interface window (see Operating the Stopped vehicle detection module).

8. Click the **OK** (**5)** button to save the changes and return to the settings panel of the **Stopped vehicle detection** object.
9. Click the 

button on the settings panel of the **Stopped vehicle detection** object.

Configuring the *Stopped vehicle detection* module is completed.

People counter detection

Functionality of the People counter detection module

The *People counter detection* module is designed to carry out the following functions:

1. Count visitors in an observed area.
2. Record events about visitor entries into the observed area to a database.
3. Record ievents about visitor exits from the observed area to a database.
4. Generate reports by the number of visitors in the observed area.

> **Note**
>
> The *People counter detection* module does not operate properly in the real time mode, i.e. it cannot be used to immediately count visitors. As the operation algorithm of the detection tool is static, the maximum people count accuracy is reached at some periods of time (every 15 minutes of non-stop operation). Mainly people count accuracy depends on whether the requirements given in the Camera requirements for the People counter detection module are met.

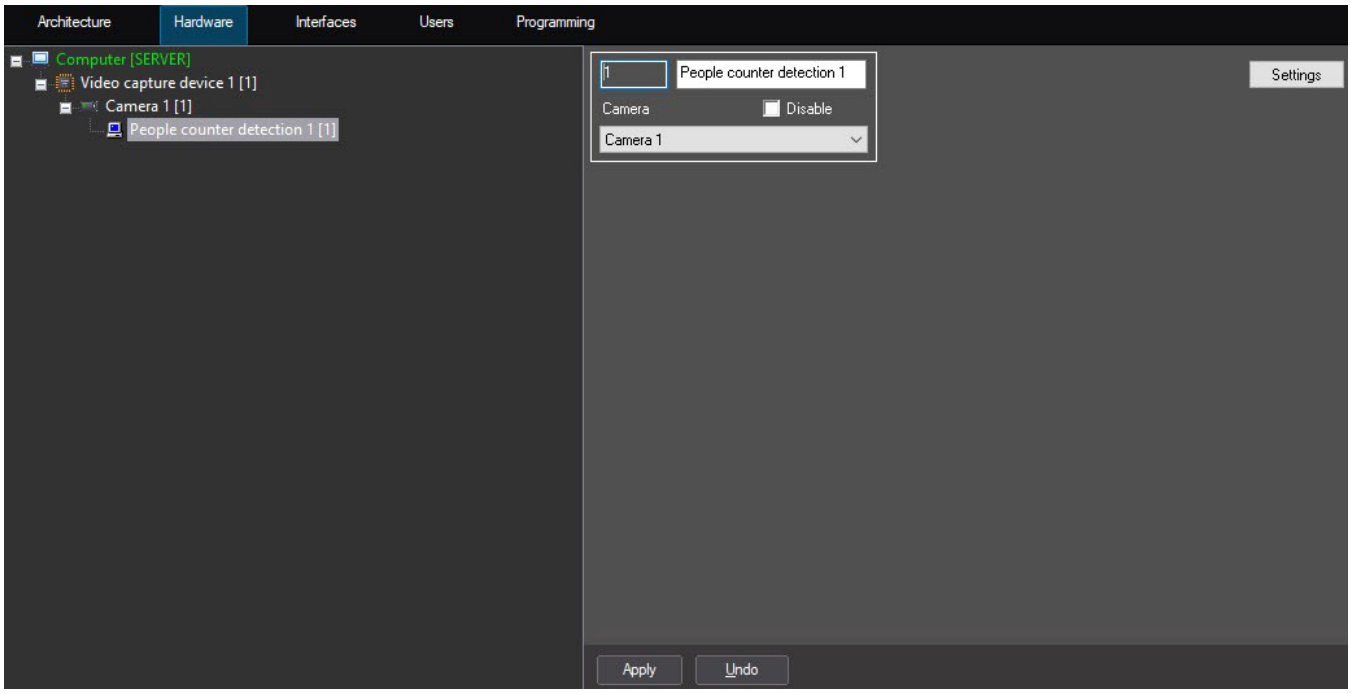
Camera requirements for the People counter detection module

The requirements for the cameras that will work with the *People counter detection* module are listed in the following table.

Camera	• Resolution: 720x576 (CIF4), using of 360x288 (CIF1) is acceptable. Resolution zoom-in over CIF4 is not improve the quality of recognizing procedure. • Fps: 25. • Color: only color camera can be in use. • Camera must be rigidly fixed.
Lighting	• The best working of detection is archived at medium lighting. In conditions of insufficient (night) or excessive (exposure) lighting, the quality of analytics can be reduced. • Sharp changes of lighting can lead to short-time invalid analytics working.
Scene and camera angle	• The best position – camera "looks" to the scene vertically down. The better this requirement, the carefully the received estimation. • Sizes of camera field of view: 2x2m is minimal, 4x4m is optimal (8x8 people). • Background is static and is not changed sharply. • In the recognized are there no moving objects except of people. • Analytics can work inappropriately on specular surfaces and in case of sharp shadows from moved objects. • Analytics can work inappropriately in case of in the camera field of view there are periodic movements of background objects (trees, working TV, etc.). • People occulting by static objects is to be minimal (by columns, trees etc.).
Objects image	• Image quality: the image is to be clear, without visible defects from reducing procedure. • Permissible size of a person (the area of a rectangular track around a person) as a percentage of the frame area: from 10% to 60%.
Other	• People shouldn't move by continuous flow, by groups by several people are counted properly.

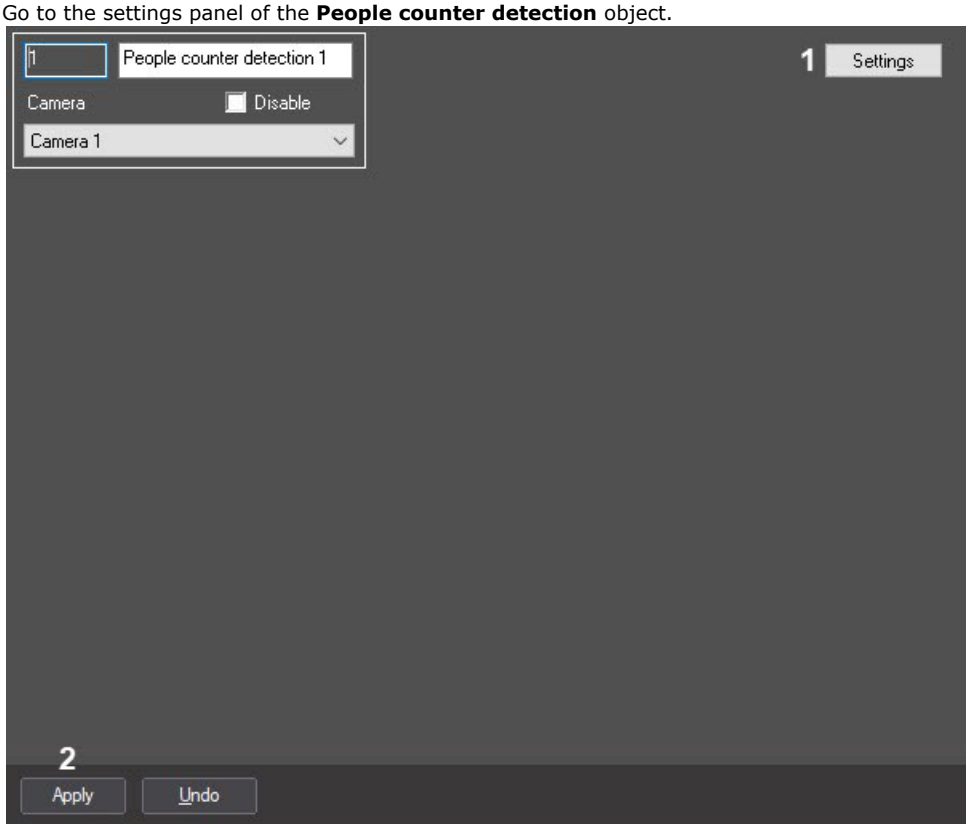
Configuring the People counter detection module

You can configure the *People counter detection* module on the settings panel of the **People counter detection** object that is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.

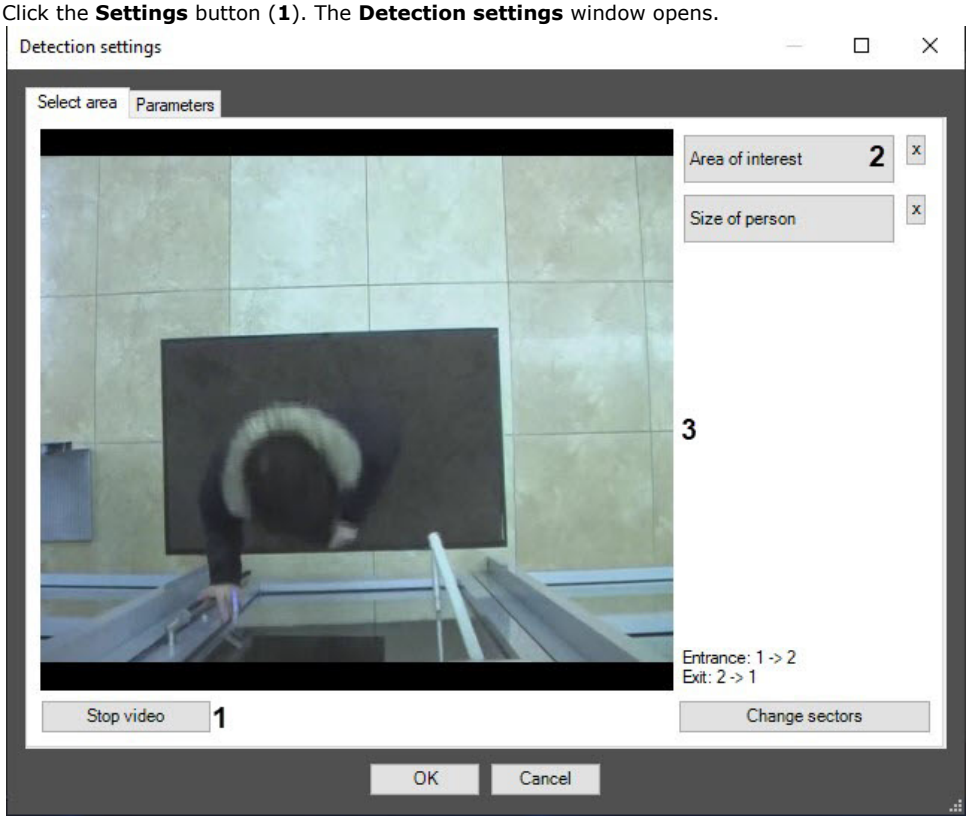


The *People counter detection* module is configured as follows:

1. Go to the settings panel of the **People counter detection** object.

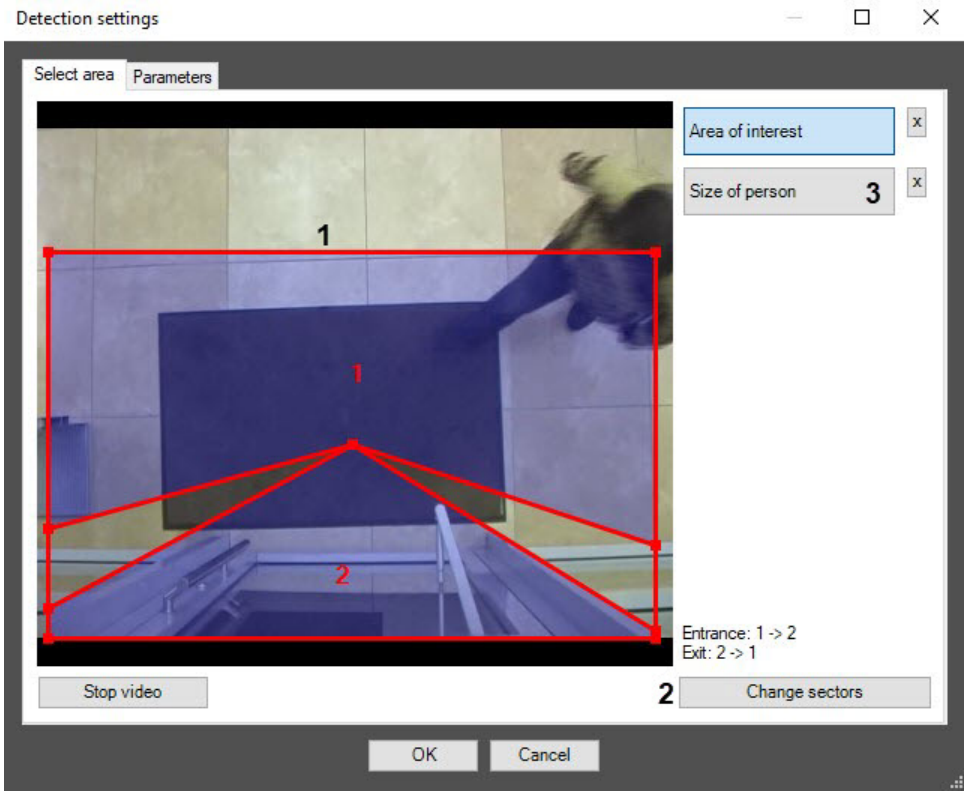


2. Click the **Settings** button (**1**). The **Detection settings** window opens.



3. Specify the area of interest on the video:
   a. Click the **Stop video** button to capture the video image (**1**).
   b. Click the **Area of interest** button (**2**).
   c. On the captured video image (**3**), specify the detection area. Click in the frame area and stretch the frame borders that limit the surveillance area to the required size. You can add only one area. If you try to add a second area, the first area will be deleted.

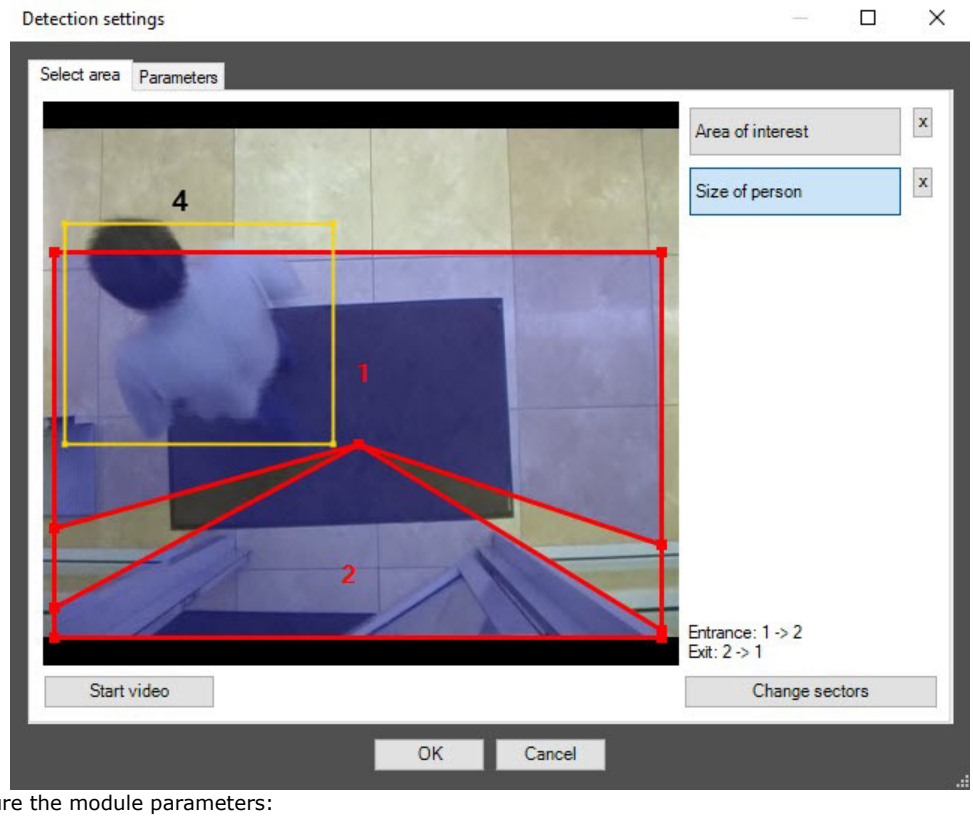
> **Note**
>
> To remove an area, click the x button next to the **Area of interest** button.
>
> The area of interest is divided into two sectors—1 and 2. If an object moves from sector 1 to sector 2, it is logged as the entry of a visitor. If the visitor moves from sector 2 to sector 1, it is logged as an exit.



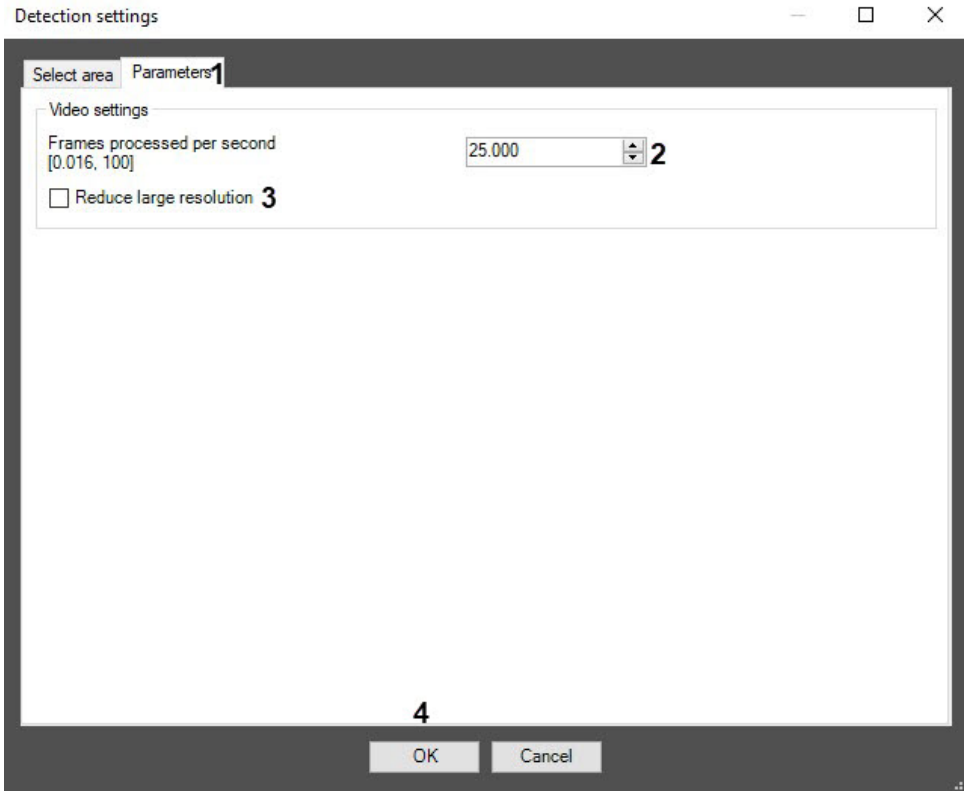
d. Specify the required size, shape and position of the sectors in the area of interest by moving their borders (**1**).
e. If you want to swap sectors 1 and 2, click the **Change sectors** button (**2**).

4. Specify the approximate person size as follows:
   a. Click the **Size of person** button (**3**).
   b. On the captured video image, specify the approximate person size as a rectangular area using the mouse (**4**).

> **Note**
>
> To remove the person size, click the x button next to the **Size of person** button.



5. Configure the module parameters:
   a. Go to the **Parameters** tab of the **Detection settings** window (**1**).



   b. In the **Frames processed per second [0.016, 100]** field (**2**), specify the number of frames per second that the detection tool processes.
   c. Set the **Reduce large resolution** checkbox to create and process a new frame consisting of even lines of the initial frame when the next frame is received (**3**).
6. Click the **OK** (**4**) button to save the changes and return to the settings panel of the **People counter detection** object.
7. On the settings panel of the **People counter detection** object, click the **Apply** button.

Configuring the *People counter detection* module is complete.

Train detection

Functionality of the Train detection module

The *Train detection* module is designed to carry out the following functions:

1. Recognizing of train presence/absence in the monitored area.
2. Recording events of train appearance in the monitored area to the database.
3. Recording events of train disappearance from the monitored area to the database.

Camera requirements for the Train detection module

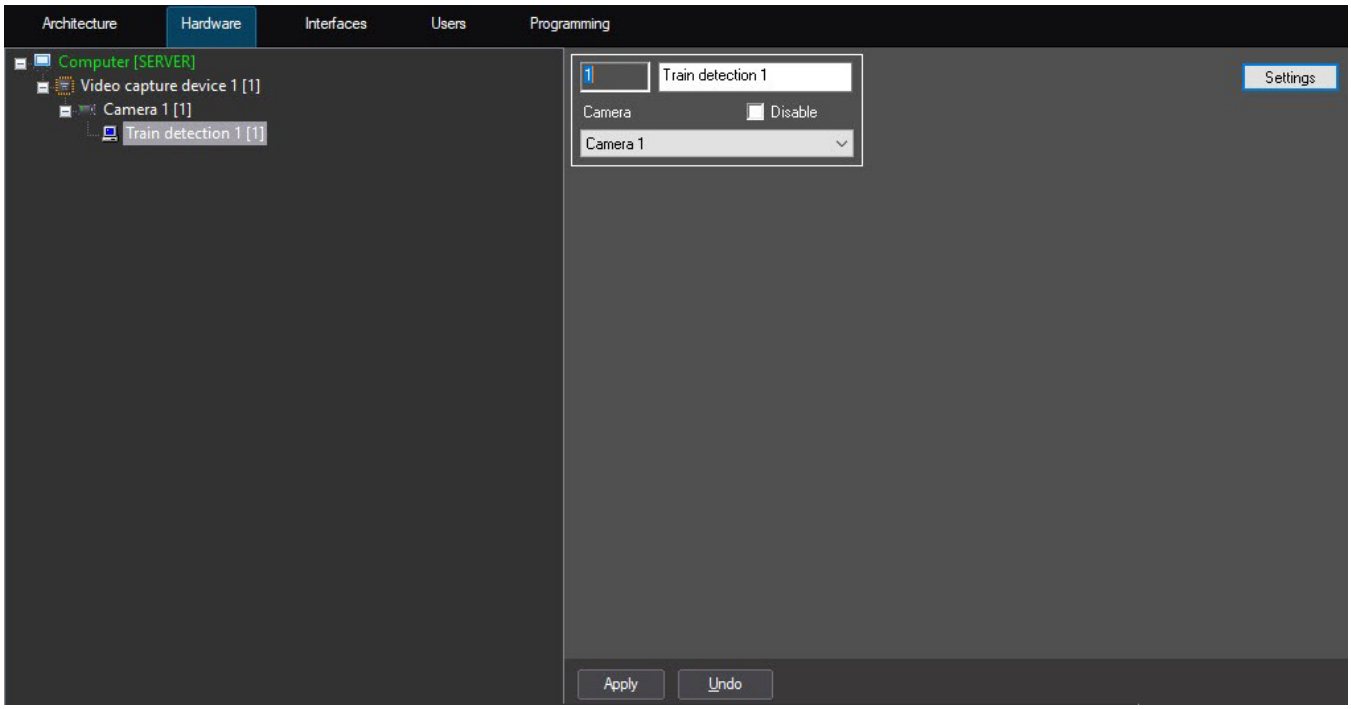
The requirements for the cameras that will work with the *Train detection* module are listed in the following table.

Camera	• Resolution should be at least 640x480 pixels. • Fps: not less than 6. • Color: analytics works with grey and color images. • Camera shaking should not result in image offsets greater than 1% of the frame size.
Lighting	• Medium lighting. In conditions of insufficient (night) or excessive (exposure) lighting, the quality of analytics can be reduced. • No sharp changes of lighting.
Scene and camera angle	• Camera is to be directed in the line of the railway or as close to it as possible. • Background is mostly static and is not changed sharply.
Objects image	• At the time the detector was started, there was no train in FoV. • Minimum overlapping of moving objects with the static objects in the scene (columns, trees, etc.). • Analytics may not work correctly on reflective surfaces and if there are sharp shadows from moving objects. • The width and height of objects in the image should not exceed 75% of the frame size. • The speed of objects in the image should not be less than 1 pixel per second.

Configuring the Train detection module

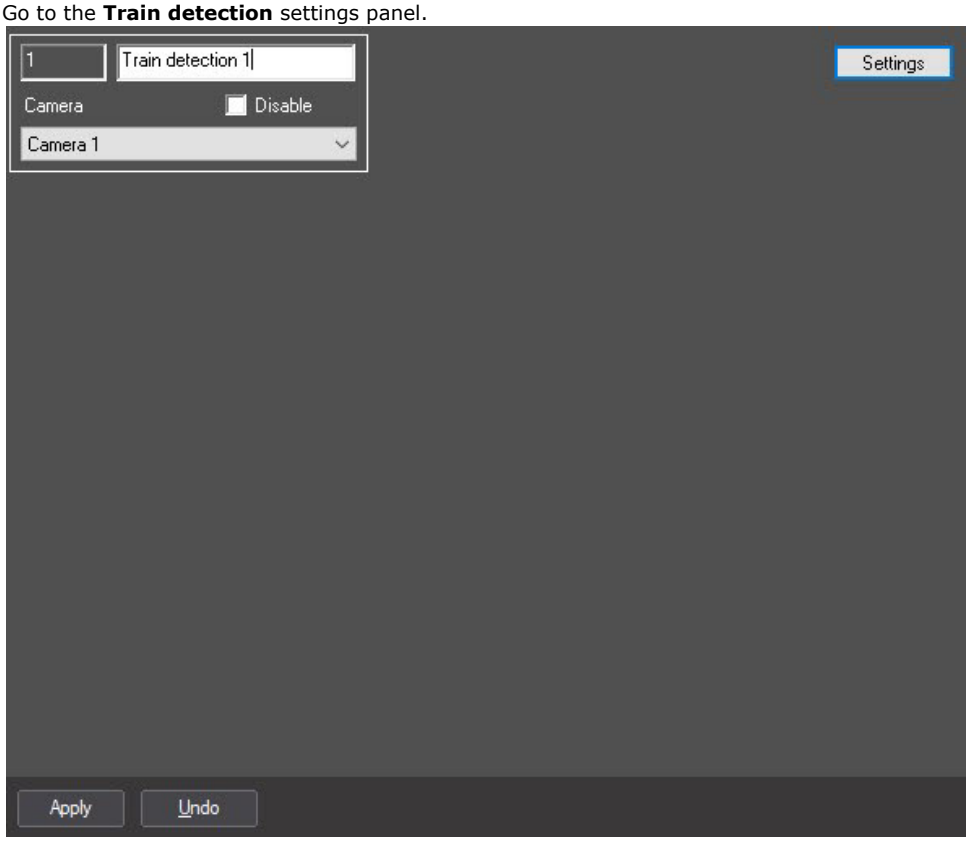
> **Note**
>
> It is not recommended to create more than four **Train detection** objects for the correct operation of the *Train detection* module.

The *Train detection* module can be configured on the settings panel of the **Train detection** object created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.

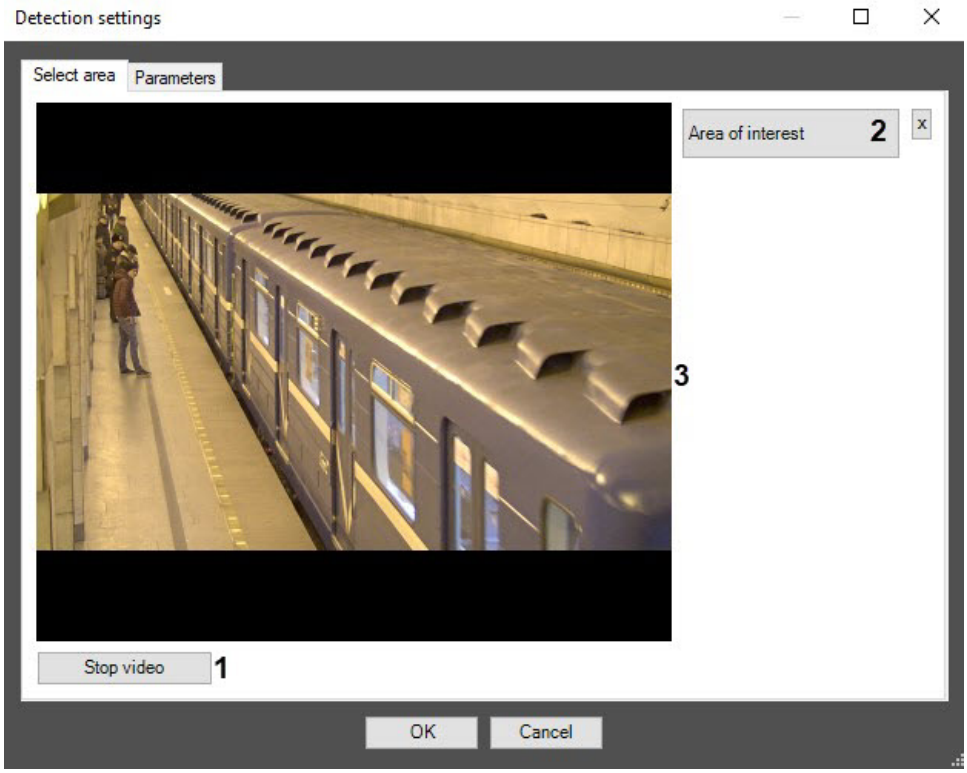


The *Train detection* module is configured as follows:

1. Go to the **Train detection** settings panel.

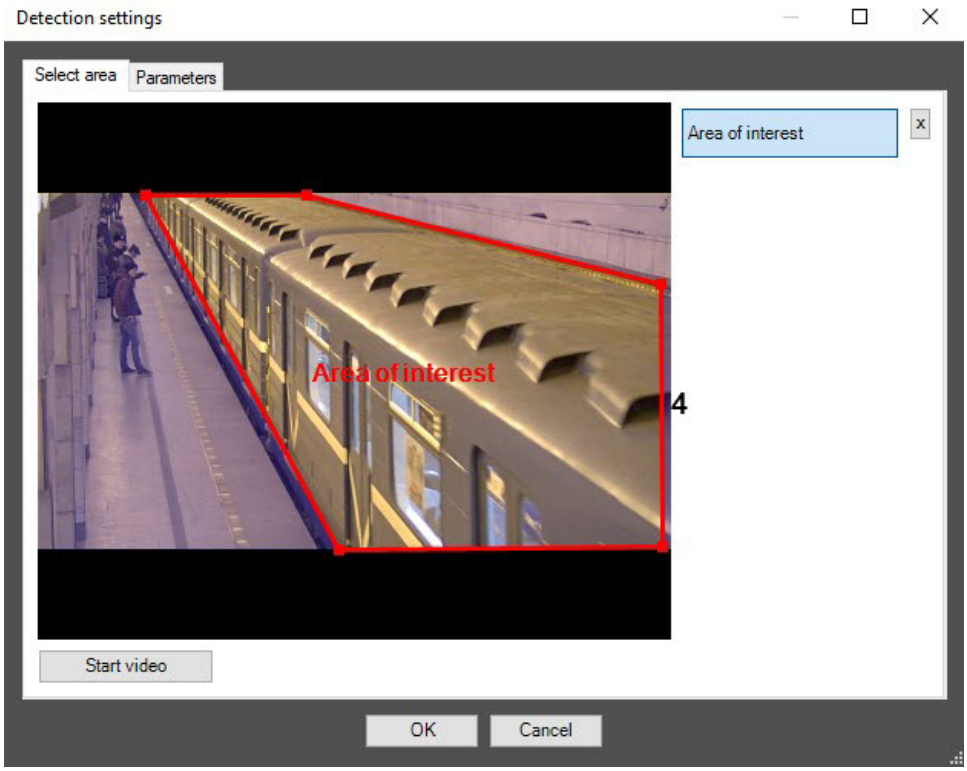


2. Click the **Settings** button. The **Detection settings** windows will open.
3. Specify the surveillance area on the video image:
    a. Click the **Stop video** button to capture the video image (**1**).



    b. Click the **Area of interest** button (**2**).

c. On the captured video image (**3**), sequentially specify nodal points of area to be analyzed by clicking the left mouse button (**4**). It is possible to add only one area. Wheen attempting to add the second area, the first one will be deleted. After area specifying, the remaining part of video image will be darkened.



Note

To remove the area, click the x button next to the **Area of interest** button.

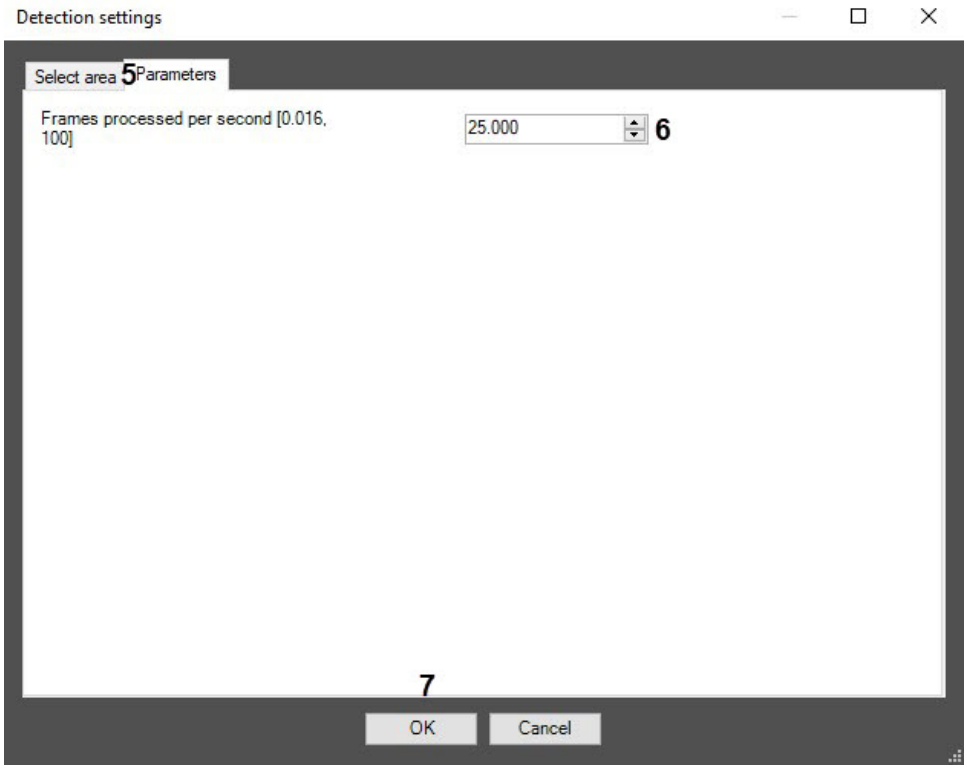
Note

The surveillance area should be specified in such a way that except for the train movement, there is no other movement.

Attention!

Setting the **Area of interest** is a mandatory requirement for the detection module operation.

4. Go to the **Parameters** tab (**5**) and do the following:



   a. In the **Frames processed per second [0.016,100]** field (**6**), set the number of frames per second that will be processed by the detection tool.
   b. Click the **OK** button to save the changes and return to the settings panel of the **Train detection** (**7**).

> **Note**
>
> To return to the settings panel of the **Train detection** without saving the changes, click the **Cancel** button.

5. Click the **Apply** button on the **Train detection** settings panel.

Configuring the *Train detection* module is complete.

Traffic light detection

Functionality of the Traffic light detection module

The *Traffic light detection* module is designed for the following functions:

1. Determining the traffic light state without connection to the traffic light controller.
2. Creating the messages about permitted and forbidden moving directions.
3. Transmitting the data about permitted and forbidden moving directions to the *Traffic violations detection* module.

Note.

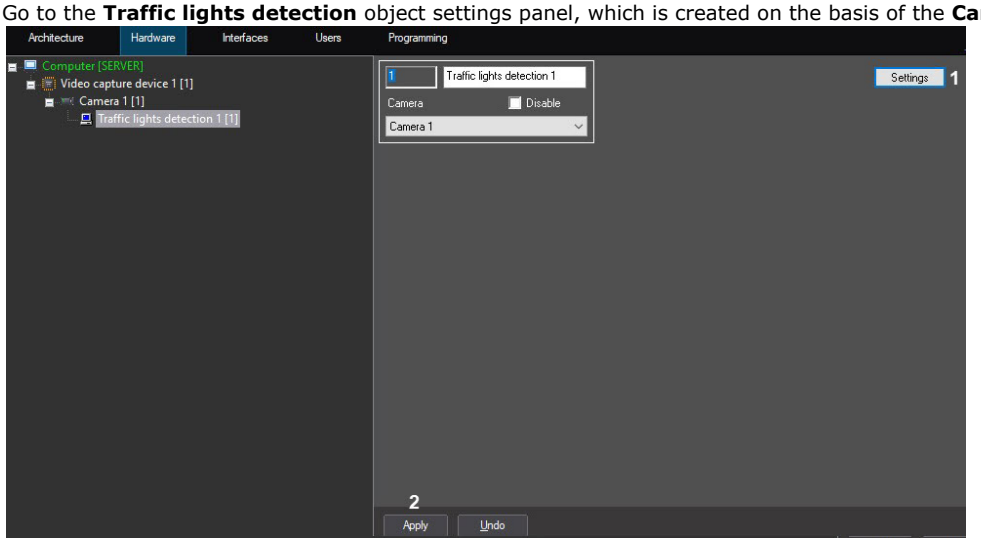
The *Traffic light detection* module is used in the *Traffic violations detection* software module, which is part of *Auto PSIM* (see Traffic violations detection).

Configuring the Traffic light detection module

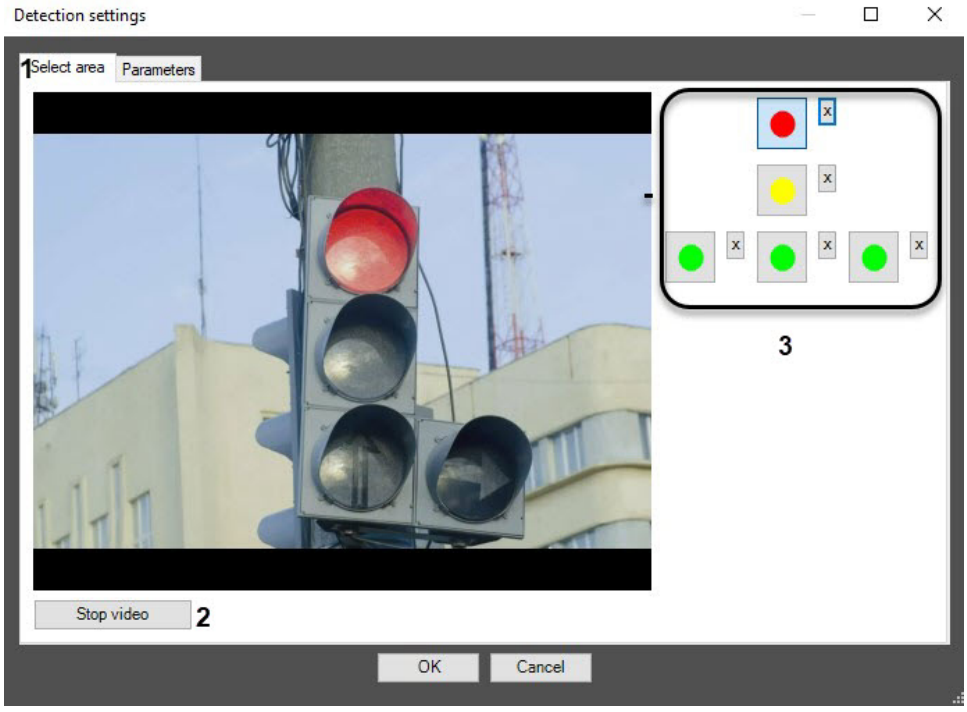
> **Attention!**
>
> For the correct operation of the *Traffic lights detection* module, a traffic light must be always visible to camera and must not be blocked by any objects or other vehicles.

To configure the *Traffic lights detection*, do the following:

1. Go to the **Traffic lights detection** object settings panel, which is created on the basis of the **Camera** object.

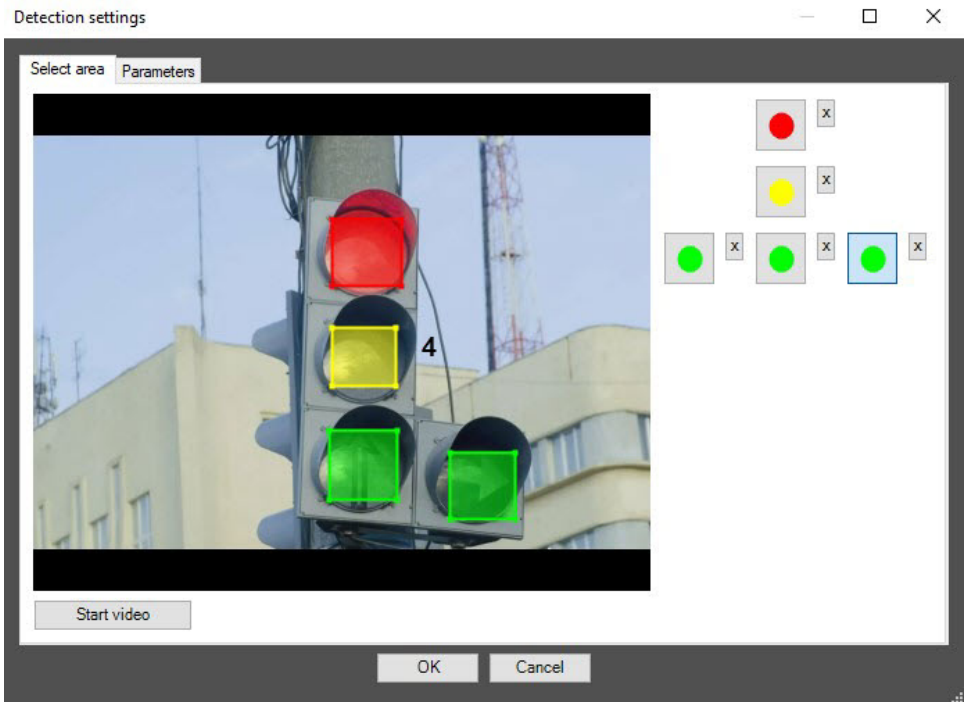


2. Click the **Settings** button (**1**). The **Detection settings** window will open.



3. In the **Select area** tab (**1**), specify the area of traffic light signals:
    a. Click the **Stop video** button to capture the video frame (**2**).
    b. Do the following actions for each traffic light signal:

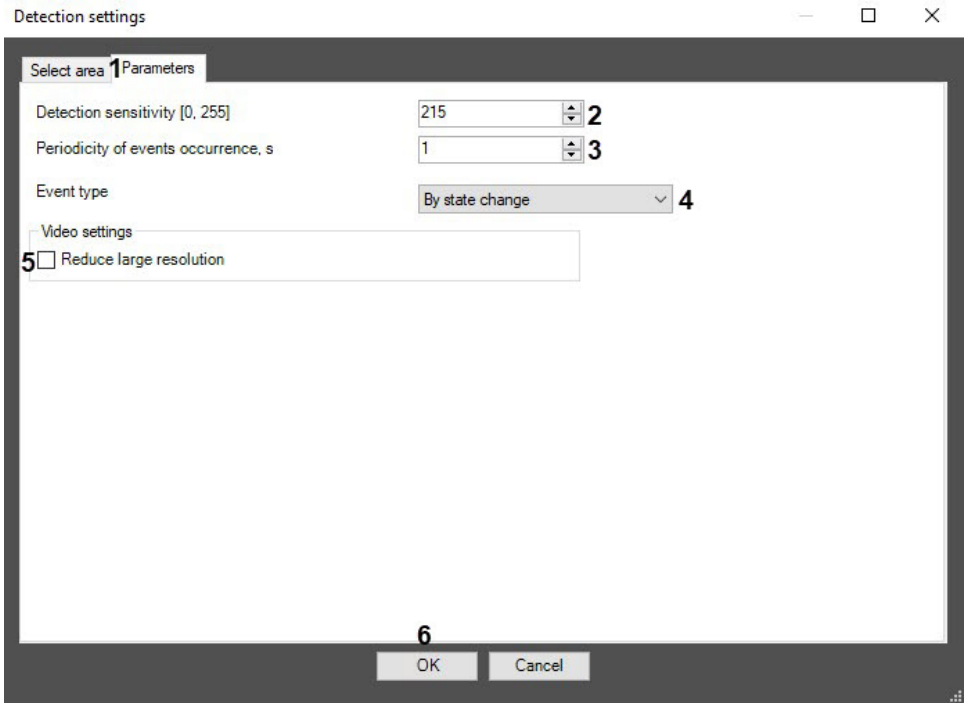
        - click the button with this signal (**3**);
        - specify the area of this signal on the captured video frame (**4**). Click the left mouse button on the video frame and move the cursor holding it.



Note

To remove the area, click x next the corresponding button.

4. Specify the software module parameters:
   a. Go to the **Parameters** (**1**) tab.
   b. In the **Detection sensitivity [0, 255]** field (**2**), specify the detection sensitivity in conventional units in the range from 0 to 255.



   c. In the **Periodicity of events occurrence, s** field (**3**), enter the time period (in seconds) between creating messages about the states of traffic light signal.
   d. In the **Event type** drop-down list (**4**), select the type of event to be detected: **By state change**, **By period**, **By period and state change**.
   e. Set the **Reduce large resolution** checkbox if the state of traffic light signal is to be recognized on the frame (**5**).

5. Click the **OK** button to save the changes and return to the settings panel of the **Traffic light detection** object (**6**).

   > **Note**
   >
   > Click the **Cancel** button to return to the settings panel of the **Traffic light detection** object without saving the changes.

6. Click the **Apply** button (**2**).

Configuring the *Traffic light detection* software module is completed.

Crowd detection (TVN)

Functionality of the Crowd detection (TVN) module

The *Crowd detection (TVN)* module has the following functions:

1. Counting the number of people in each selected area and in all areas in total, and recording the result into the database.
2. Generating an event according to the selected operation mode of the detection tool and recording into the database of the **Even t Viewer**.

Camera requirements for the Crowd detection (TVN) module

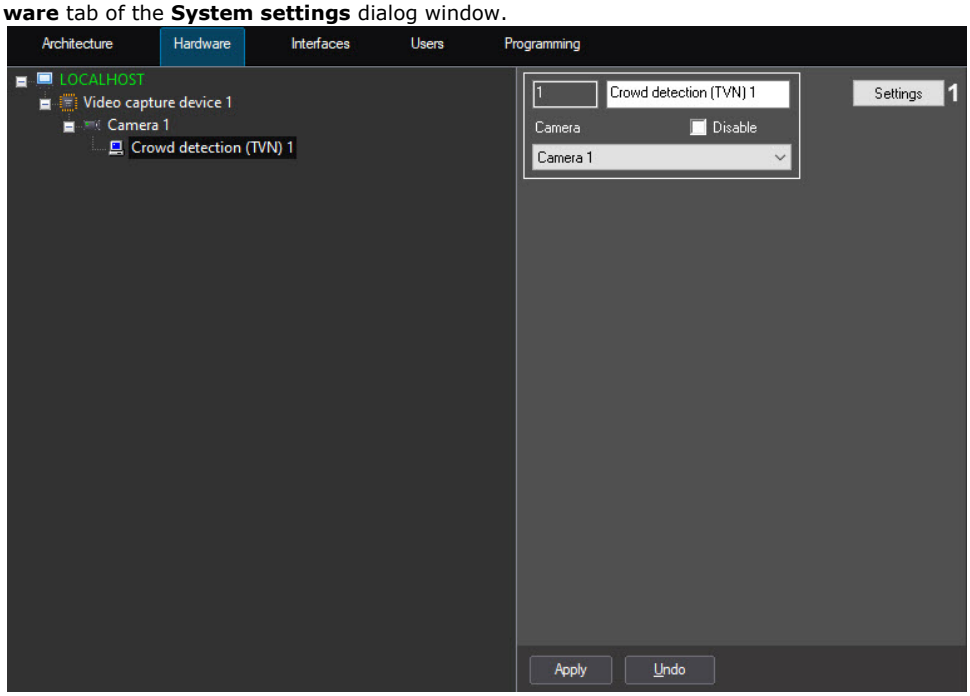
Camera requirements for the **Crowd detection (TVN)** module are given in the table.

Camera:	• Resolution: 265x256 pixels and higher
Lighting:	• The best detection tool performance is achieved under good lighting: no flash, with even lighting, in normal weather conditions (no rain). In conditions of insufficient lighting (for example, at night), the quality of algorithm performance may decrease. • Analytics may not work correctly with light and shade variations on objects: homogeneous lighting is recommended, without complex light-refracting forms
Scene and camera angle:	• Analytics may not work correctly if the scene is a repeating pattern (e.g., a crosswalk and a cart on it). • Analytics may not work correctly when recording a close-up view with only one face in it
Object images:	• Analytics may not work correctly if there are objects that look like people (monuments, animals) in the camera FOV

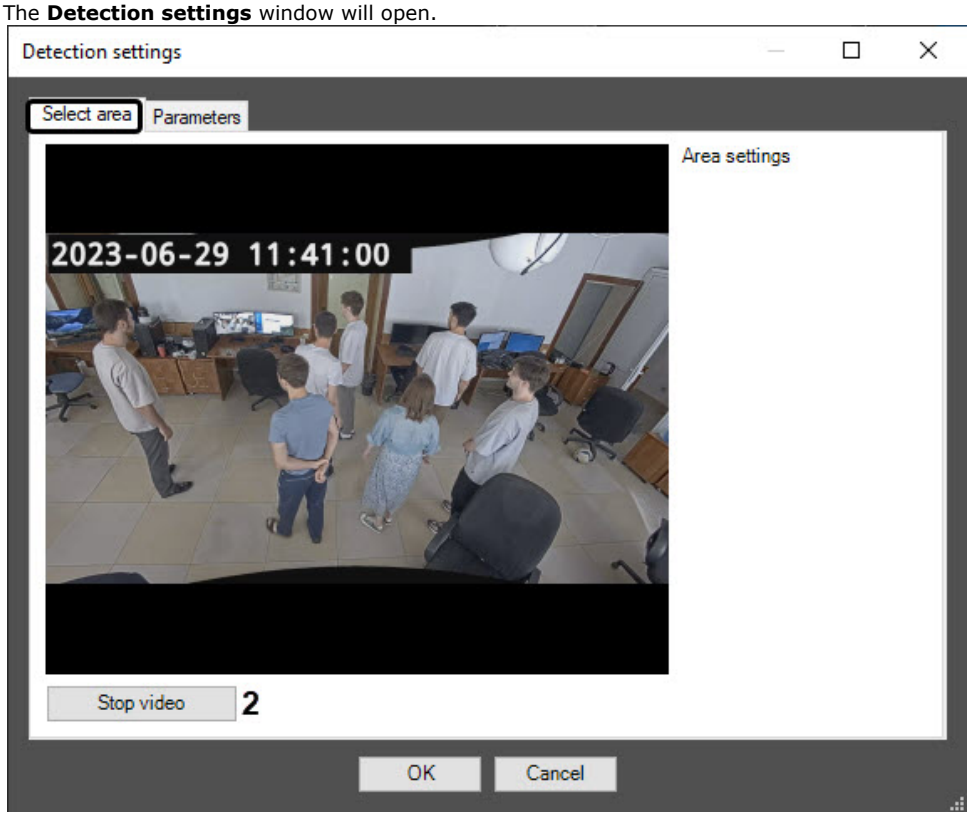
Configuring the Crowd detection (TVN) module

To configure the *Crowd detection (TVN)* module, do the following:

1. Go to the settings panel of the **Crowd detection (TVN)** object that is created on the basis of the **Camera** object on the **Hard ware** tab of the **System settings** dialog window.

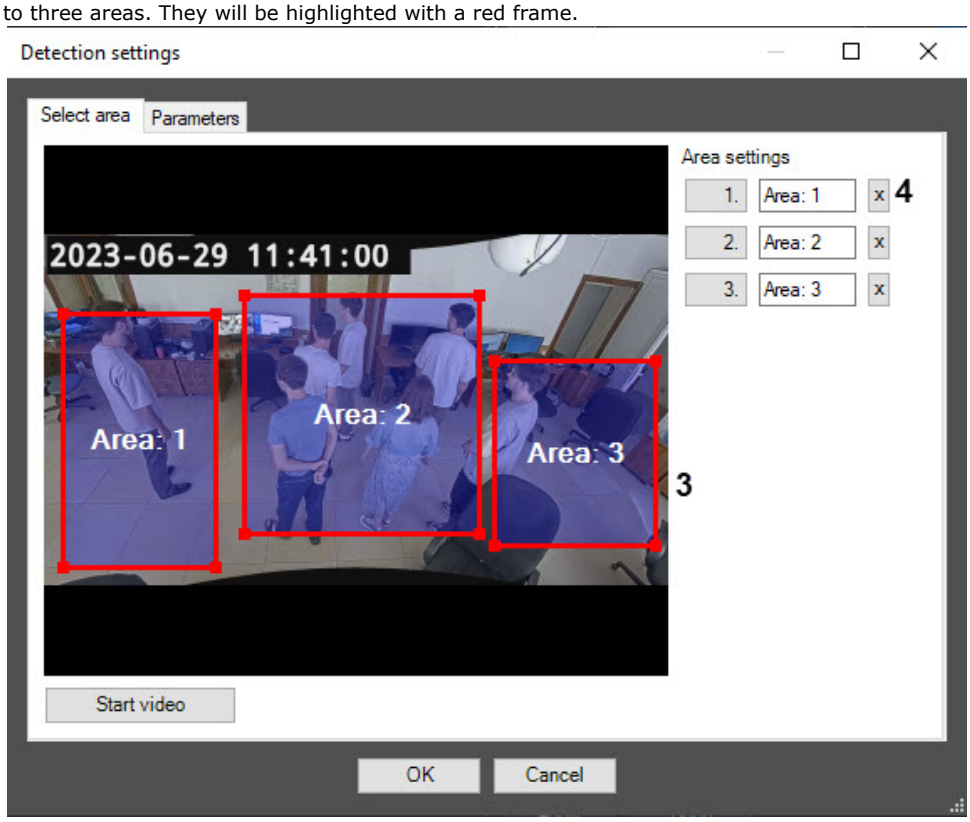


2. Click the **Settings** button (**1**).
   The **Detection settings** window will open.



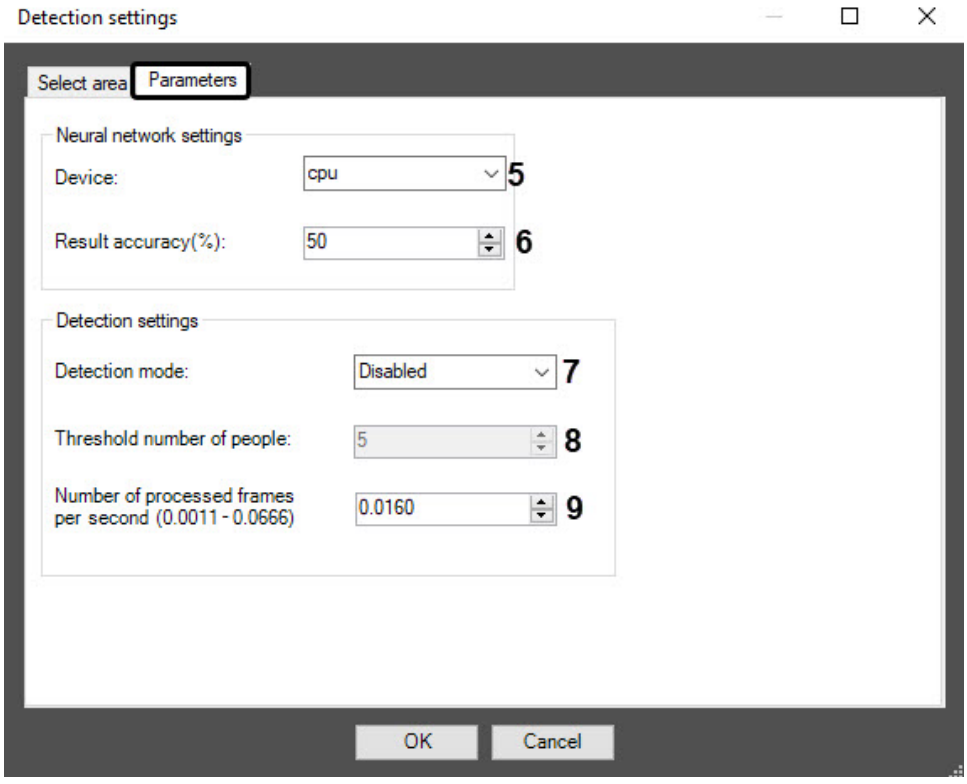
3. In the **Detection settings** window on the **Select area** tab, specify the surveillance area. For this, do the following:
   a. Click the **Stop video** button to capture a frame of the video image (**2**).

b. On the captured frame (**3**), left-click to specify the areas, the situation in which must be analyzed (**1**). You can add up to three areas. They will be highlighted with a red frame.



> **Note**
>
> To delete an area, click the x button next to the corresponding area (**4**).

4. On the **Parameters** tab, configure the neural network settings:



a. From the **Device** drop-down list (**5**), select the device on which the neural network will run: **cpu**—central processor or **gpu**—NVIDIA graphics processor.
b. In the **Result accuracy (%)** field (**6**), enter an integer value in the range from 10 to 100 as a percentage. The larger the value, the more accurate the result, but the time of frame processing increases. The default value is 50%.

5. Configure the detection tool settings:
   a. From the **Detection mode** drop-down list (**7**), select the condition under which the detection tool will trigger.
      i. **Disabled**—the detection tool triggers at an interval that depends on the number of frames processed per second specified at step 5c;
      ii. **If threshold exceeded**—the detection tool triggers if the number of people detected in the frame exceeds the threshold value (step 5b);
      iii. **If threshold not reached**—the detection tool triggers if the number of people detected in the frame doesn't exceed the threshold value (step 5b).
   b. In the **Threshold number of people** field (**8**), enter the number of people detected in the frame to trigger the detection tool at step 5a. The default value is 5.
   c. In the **Number of processed frames per second (0.0011-0.0666)** field (**9**), enter the number of frames per second that the detection tool will process. At the minimum value of 0.0011 the video image will be analyzed once every 15 minutes, at the maximum value of 0.0666—once every 15 seconds.

   > **Note**
   >
   > You can see all events received from the **Crowd detection** object in the **Event Viewer** interface window.

6. Click the **OK** button to save changes and return to the settings panel of the **Crowd detection (TVN)** object.
7. On the settings panel of the **Crowd detection (TVN)** object, click the **Apply** button.

VI detection of camera state

Functionality of the VI detection of camera state module

The *VI detection of camera state* software module has the following features:

1. Recognition of atypical changes in a video surveillance scene (lighting, darkening, de-focusing).
2. Recognition of the type of change in a video surveillance scene.
3. Generating an alarm when there is an atypical change in a video surveillance scene.

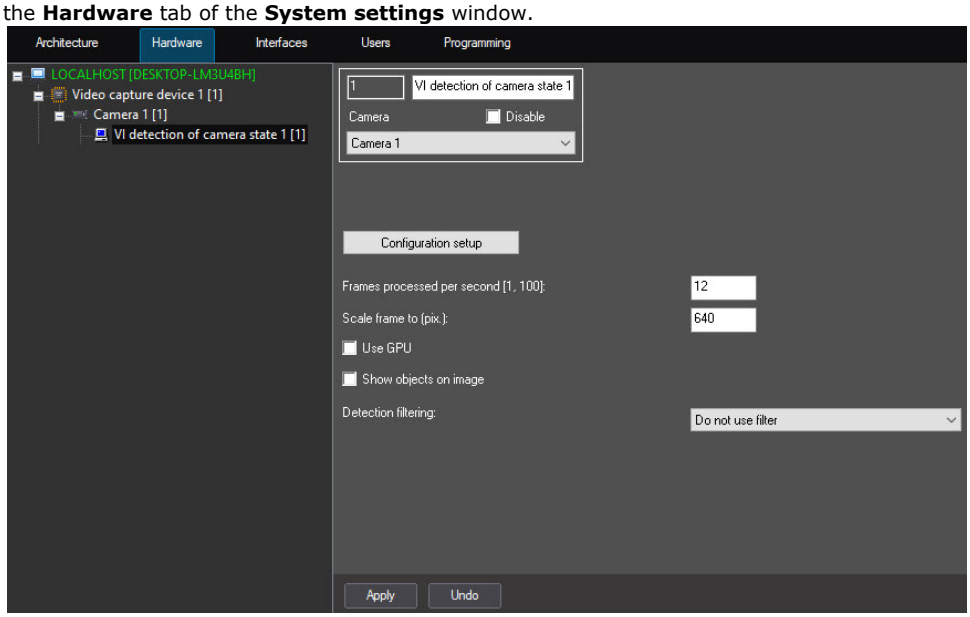
Configuring the VI detection of camera state module

На странице:

Configuring the *VI detection of camera state* software module includes general settings and configuration settings: configuration parameters and detection tool characteristics.

General settings

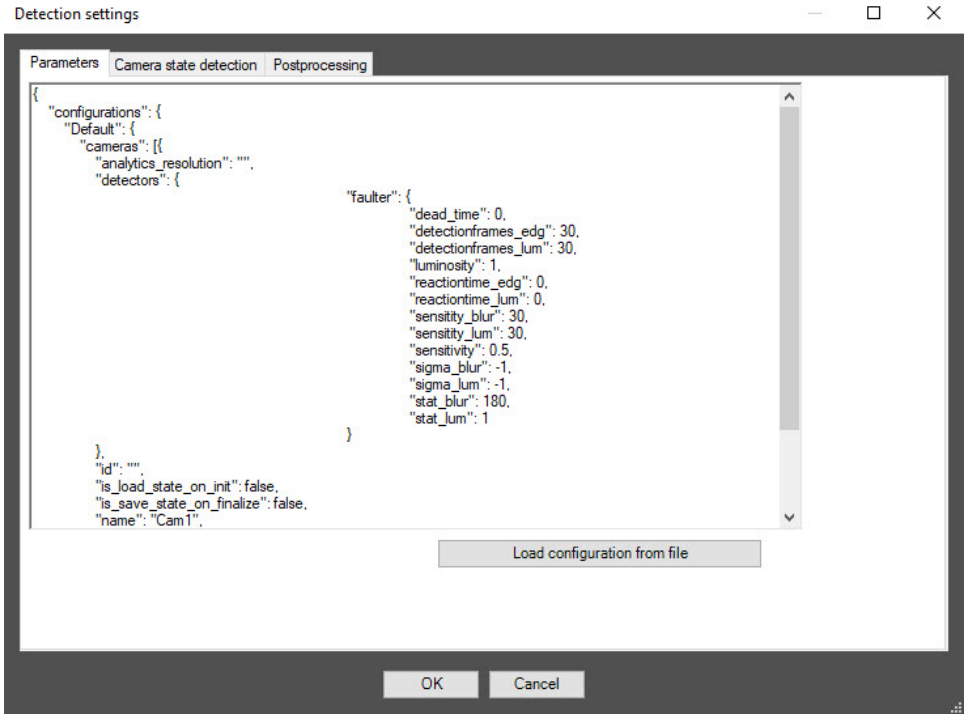
1. Go to the settings panel of the **VI detection of camera state** object, which is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** window.



2. In the **Frames processed per second [1, 100]** field, specify the number of frames in the range 1-100 that the detection tool processes per second. The default value is **12** (recommended). You can specify only a positive integer. If you enter a number outside the range 1-100, it is automatically changed to the nearest border value. If you leave the field blank, it automatically returns to the default value when you save the settings.
3. In the **Scale frame to (pix.)** field, specify in the range 480-960 the size of the frame in pixels after scaling. The default value is **640**.
4. Set the **Use GPU** checkbox to use NVIDIA GPU when working with the neural network.
5. Set the **Show objects on image** checkbox to highlight the detection zone with a red border on the Video surveillance monitor when a camera state change event is received.
6. From the **Detection filtering** drop-down list, select the filter that you want to use: **Object filter**, **Object counting filter**, **Do not use filter** (default). You can configure filters on the **Postprocessing** tab of the **Detection settings** window.
7. Click the **Configuration setup** button. The **Detection settings** window opens.

The Parameters tab

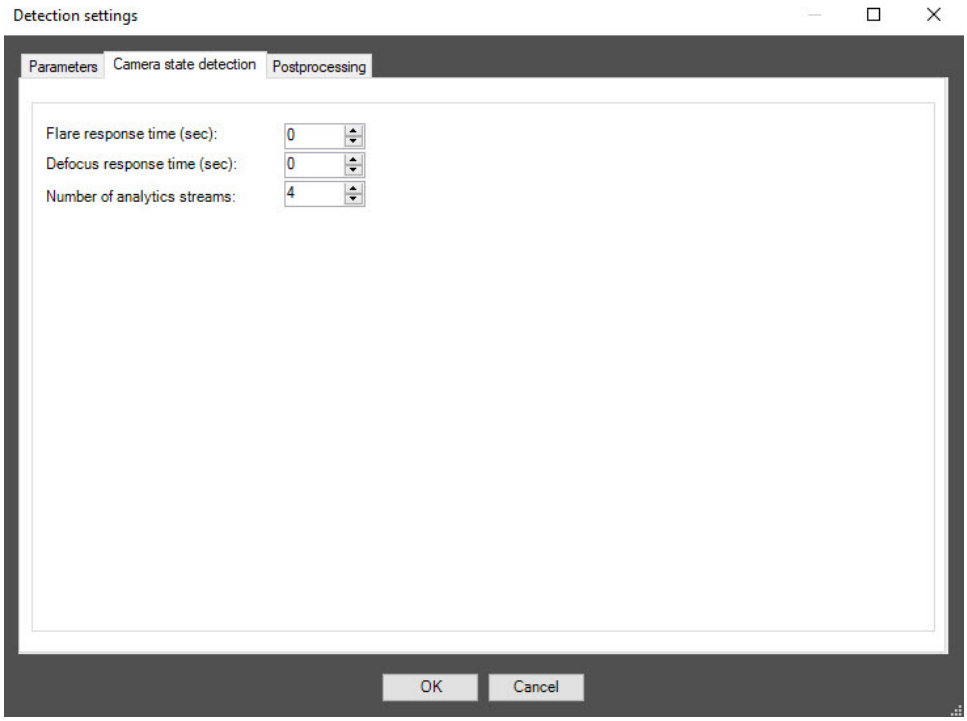
1. Go to the **Parameters** tab of the detection tool settings window. This tab displays the parameters of the used configuration. If you do not need to change the configuration, skip steps 2 and 3 and go to the next tab.



2. To use custom configuration, click the **Load configuration from file** button.
3. In the standard Windows search window that opens, specify the path to the configuration file in JSON format.

The Camera state detection tab

1. Go to the **Camera state detection** tab.



2. In the **Flare response time (sec)** field, specify the time interval in seconds after which the detection tool signals whether the video surveillance scene is backlighted or darkened.
3. In the **Defocus response time (sec)** field, specify the time interval in seconds after which the detection tool signals that the video surveillance scene is defocused.
4. In the **Number of analytics streams** field, specify the number of video streams that are used for neural network analytics. The default value is **4**.

5. To save the detection tool settings, click the **OK** button.
6. To save the changes, click the **Apply** button on the settings panel of the **VI detection of camera state** object.

Configuration of the *VI detection of camera state* software module is complete.

Fluid level detection

Functionality of the Fluid level detection module

The *Fluid level detection* module operates together with the *IntLab* license plates recognition module, which is a part of *Auto PSIM*. For more details on this module, refer to *Auto PSIM*. Administrator's Guide (the most relevant version of this document is available in the AxxonSoft documentation repository).

The *Fluid level detection* module provides the following functionality:

1. Determination of the fluid level in carriages passing in the field of view of the thermal camera.
2. Record data on the fluid level into the Event viewer database. When operating together with the *IntLab* recognition module, the data on the fluid level is also recoded into the *Auto PSIM* database.
3. Putting titles indicating the fluid level onto the video image in the Video Surveillance Monitor.
4. Putting the vertical line indicating the fluid level onto the video image in the Video Surveillance Monitor (using the script).
5. Transfer of data about the fluid level to *Auto PSIM* for display in the **Vehicle Tracer** interface window and then search for the LP recognition events in the database by the fluid level.

> **Note**
>
> This functionality is disabled if the *Fluid level detection* module is operating independently, i.e. without the *IntLab* recognition module.

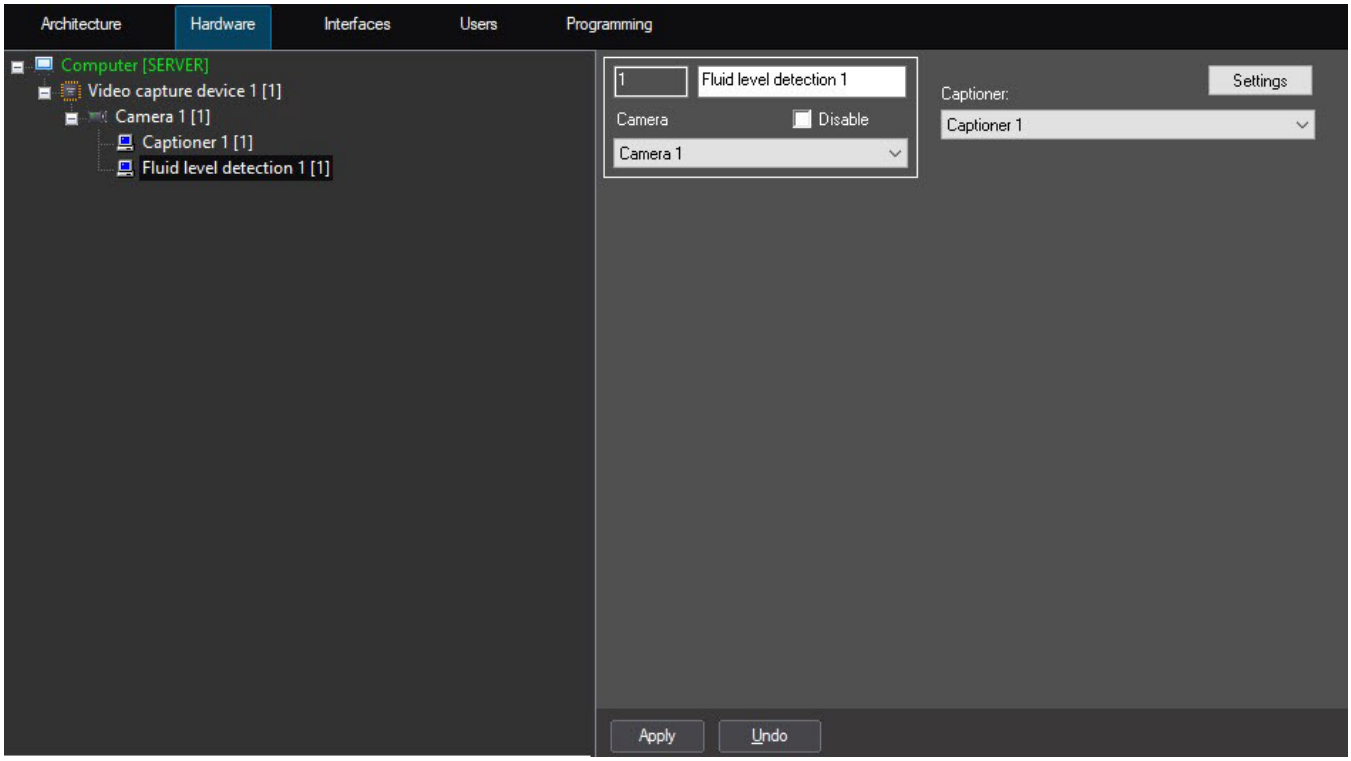
Camera requirements for the Fluid level detection module

The requirements for video cameras working with the *Fluid level detection* module are as follows:

Camera	• Thermal imaging camera
Scene and camera view	• The optical axis of the video camera should be directed perpendicular to the direction of carriages movement
Images of objects	• Video should have a clear temperature gradient

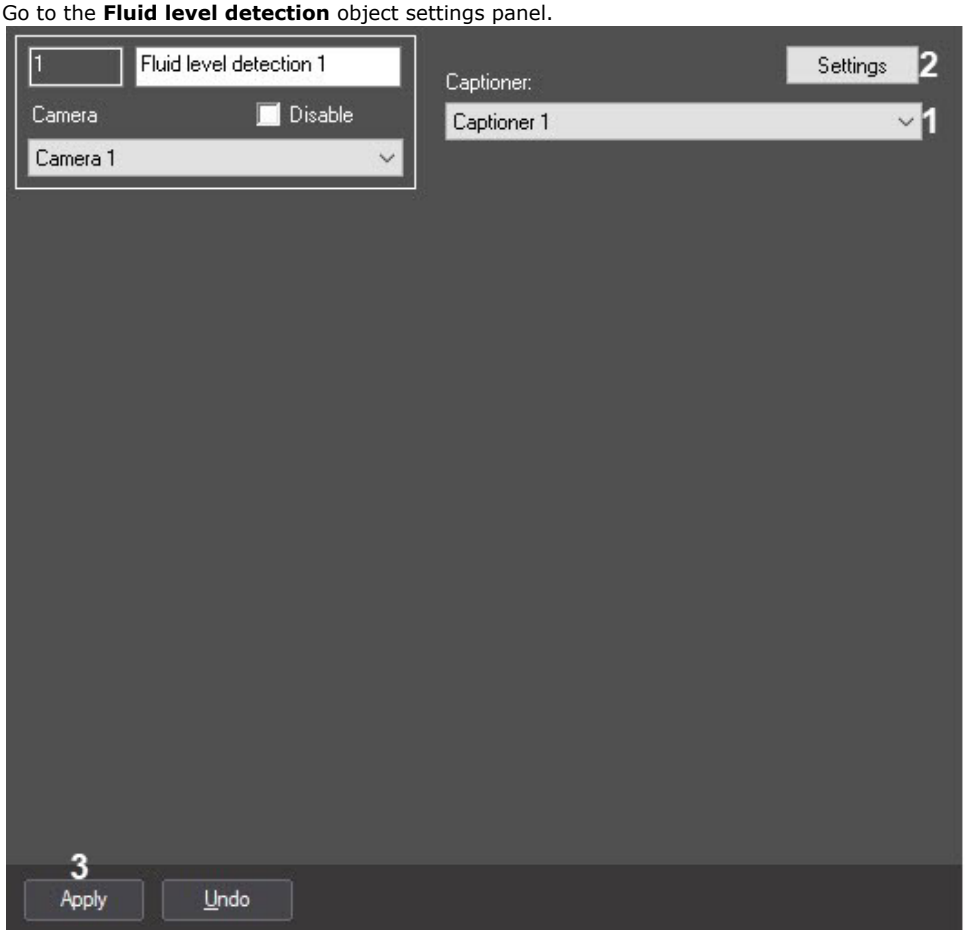
Configuring the Fluid level detection module

The *Fluid level detection* module is configured on the **Fluid level detection** object settings panel. This object is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** window.



The *Fluid level detection* module is configured as follows:

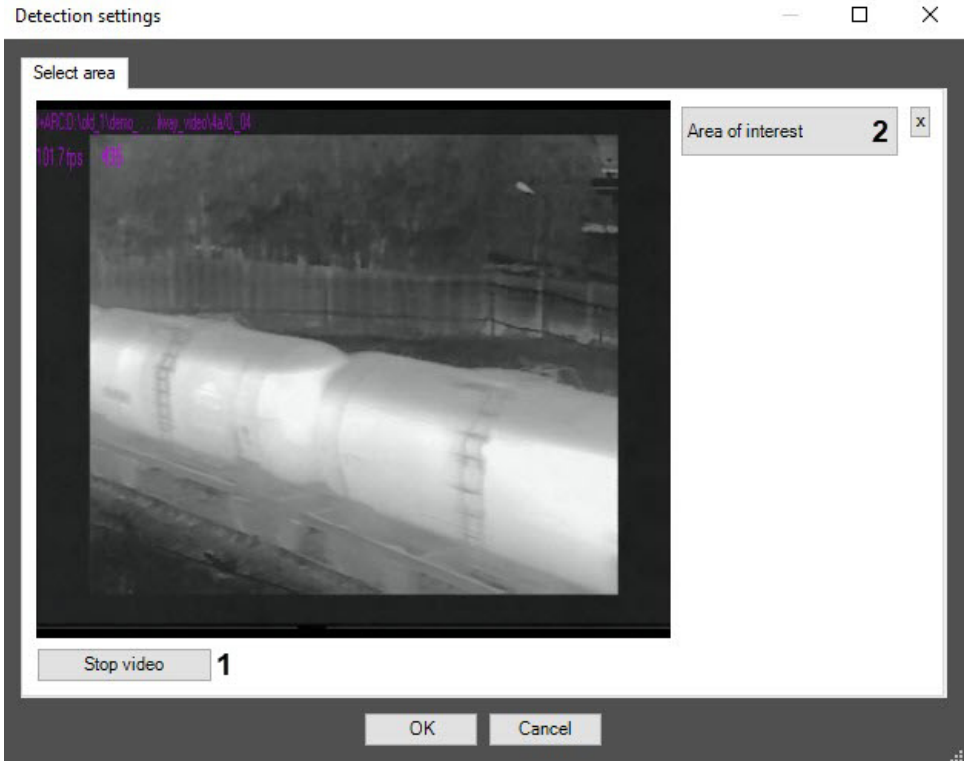
1. Go to the **Fluid level detection** object settings panel.



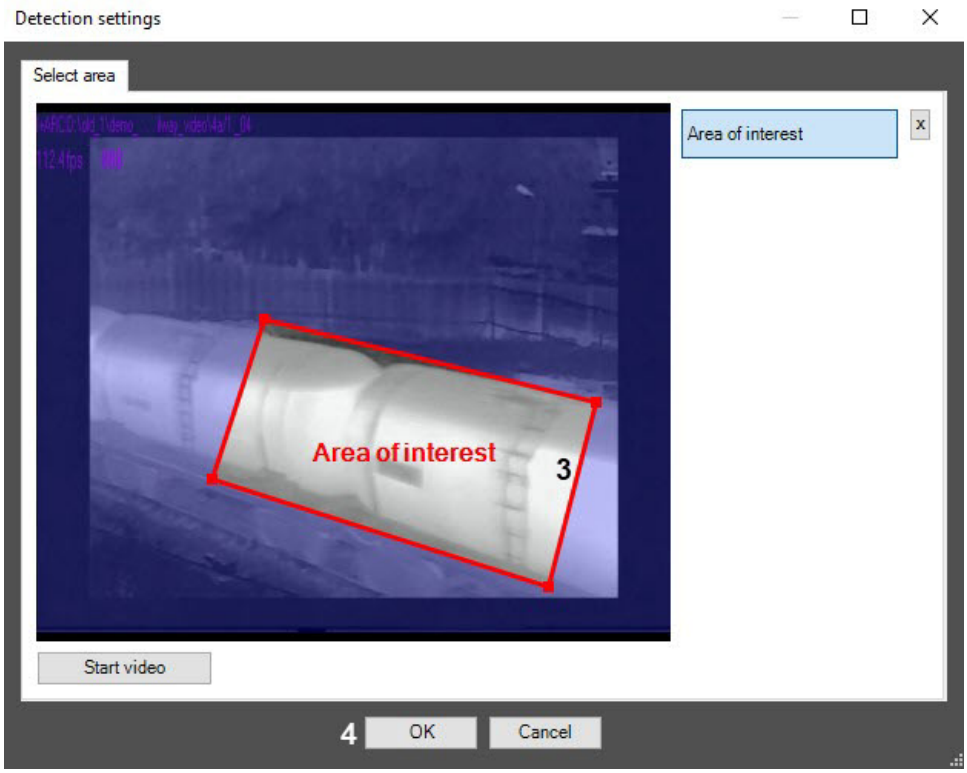
2. In the **Captioner** drop-down list, select the **Captioner** object created on the basis of the same **Camera** object as the **Fluid level detection** object (**1**). This captioner will be used to overlay captions of fluid level onto the camera video image in the Video surveillance monitor.

> **Note**
>
> For more info on how to create and configure the **Captioner** and **Monitor** objects, refer to the *Axxon PSIM* software. Administrator's Guide. For details on operation of these objects, refer to *Axxon PSIM* software. Operator's Guide. The most relevant versions of these documents are available in the AxxonSoft documentation repository).

3. Click the **Settings** button (**2**). The **Detection settings** dialog box opens.



4. Select the frame in this settings window to set the area of interest. For that, click the **Stop video** button (**1**).
5. Click the **Area of interest** button (**2**).
6. Using the left mouse button, select the four corners of the area on the captured video image (**3**). Only one area may be so designated. Upon selection of the area, the remaining part of the video image will be dimmed.



Note

To remove a selected area, click the x button.

7. Click the **OK** button (**4**).
8. Click the **Apply** button (**3**) on the **Fluid level detection** object settings panel to save the changes.

Sweethearting at checkout detection

Functionality of the Sweethearting at checkout detection module

The *Sweethearting at checkout detection* module is used to prevent cases of intentional employee theft by avoiding to scan goods at the cash register (sweethearting). The module works together with the *POS PSIM* software and *WEB Report System PSIM* subsystem.

The *Sweethearting at checkout detection* module has the following functions:

1. Recognizing the events of scanning at cash registers in real-time video.
2. Recording events of successful scanning to the **Event Viewer**.
3. Recording events of successful scanning to the database.

Note

Theft facts are displayed in the *WEB Report System PSIM* in the **Sweethearting** report. When creating the report, events from *POS PSIM* and the *Sweethearting at checkout detection* module are compared. If the detection tool recorded the scanning of goods, but events from *POS PSIM* were not recorded at that time, then the theft occurred. Other cases are considered normal. For more information about how to configure and work with *POS PSIM* and *WEB Report System PSIM*, see *POS PSIM.* Administrator's Guide and *WEB Report System PSIM.* User Guide (the latest versions of these documents are available in the AxxonSoft documentation repository).

Note

The real theft detection probability is 50% in order to avoid frequent false triggering of the detection tool. Though, multiple theft attempts will be detected with a 90% probability. Mainly, theft detection probability depends on whether the requirements given in Camera requirements for the Sweethearting at checkout detection module are met.

Camera requirements for the Sweethearting at checkout detection module

The requirements for the cameras that will work with the *Sweethearting at checkout detection* module are listed in the following table:

Camera	• Resolution must be at least 1920x1080 pixels • FPS is at least 12 • Only color cameras
Scene and camera angle	• The angle of the surveillance camera must be set so that the cashier's hands are clearly visible. The control area (where the cashier holds hands with the goods in front of the reader) must be from 150x150 to 250x250 pixels
Object images	• The area of interest of the detection tool (see Configuring the Sweethearting at checkout detection module) must be set in a way that the initial position of the goods is outside this area. The goods must be carried along the entire specified area (in case of vertical or horizontal location of the area—from one side to the other, and if the area is angled—from one diagonal to another)
Lighting	• Objects must be visually separable from the background and from each other

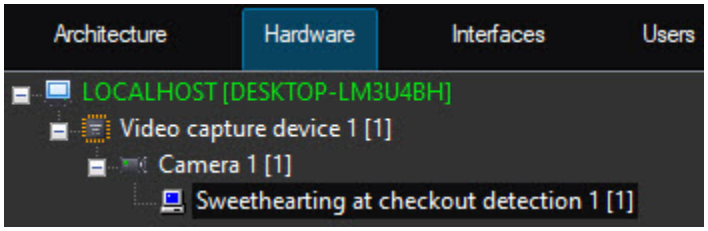
Attention!

Correct operation of the detection tool isn't guaranteed if you use a video stream or frames that were masked before they got into *Axxon PSIM* by an IP camera or similar means and methods.

Configuring the Sweethearting at checkout detection module

On the page:

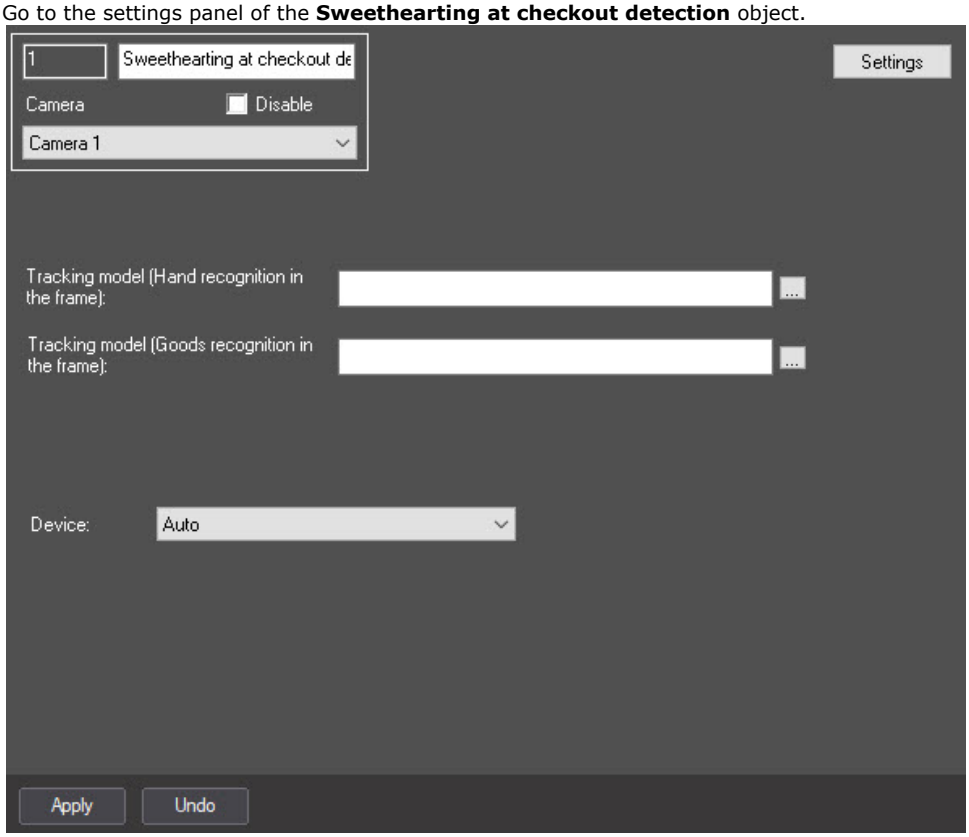
You can configure the *Sweethearting at checkout detection* module on the settings panel of the **Sweethearting at checkout detection** object created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.



Basic settings of the detection tool

To configure the *Sweethearting at checkout detection* module, do the following:

1. Go to the settings panel of the **Sweethearting at checkout detection** object.



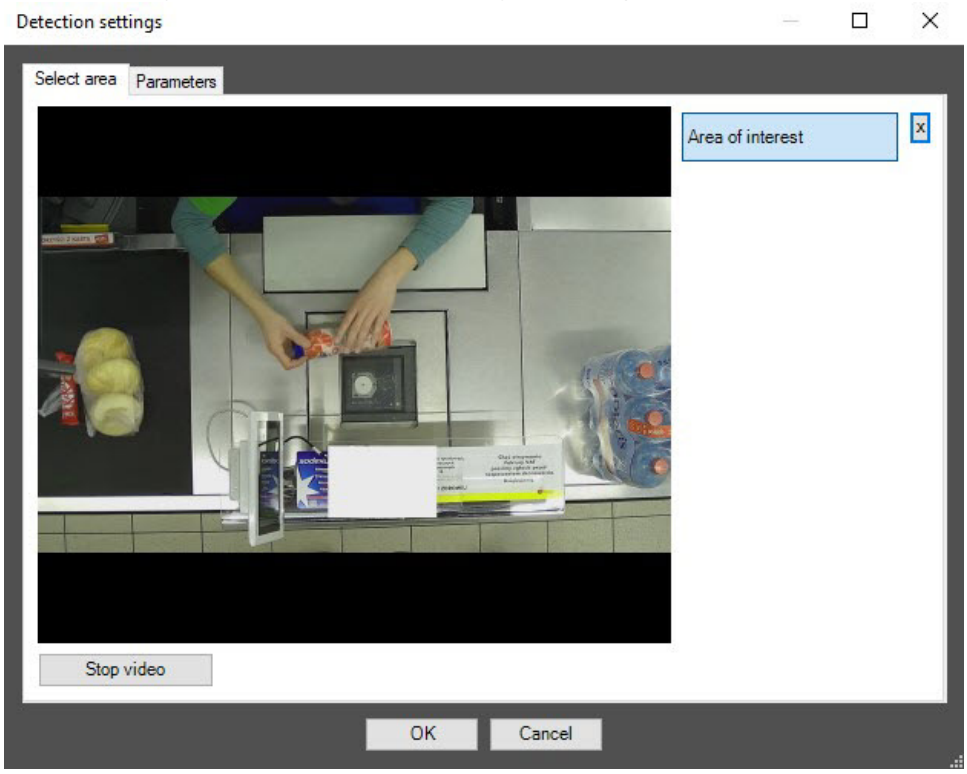
2. By default, standard (default) neural networks of hand and goods recognition in the frame are initialized according to the device selected at step 3. If you want to use custom neural networks, click the ... button to the left of the **Tracking model (Hand recognition in the frame)** and **Tracking model (Goods recognition in the frame)** fields and in the standard Windows Explorer window that opens, specify the file of the corresponding neural network.

3. From the **Device** drop-down list, select the device on which the neural network will operate: CPU, one of NVIDIA GPUs, or one of Intel GPUs. **Auto** (default)—the device is selected automatically: NVIDIA GPU gets the highest priority, followed by Intel GPU, then CPU.

> **Attention!**
>
> - We recommend using GPU.
> - It can take several minutes to launch the algorithm on NVIDIA GPU after you apply the settings. You can use caching to speed up future launches (see Configuring the speedup of neural analytics launch on GPU).

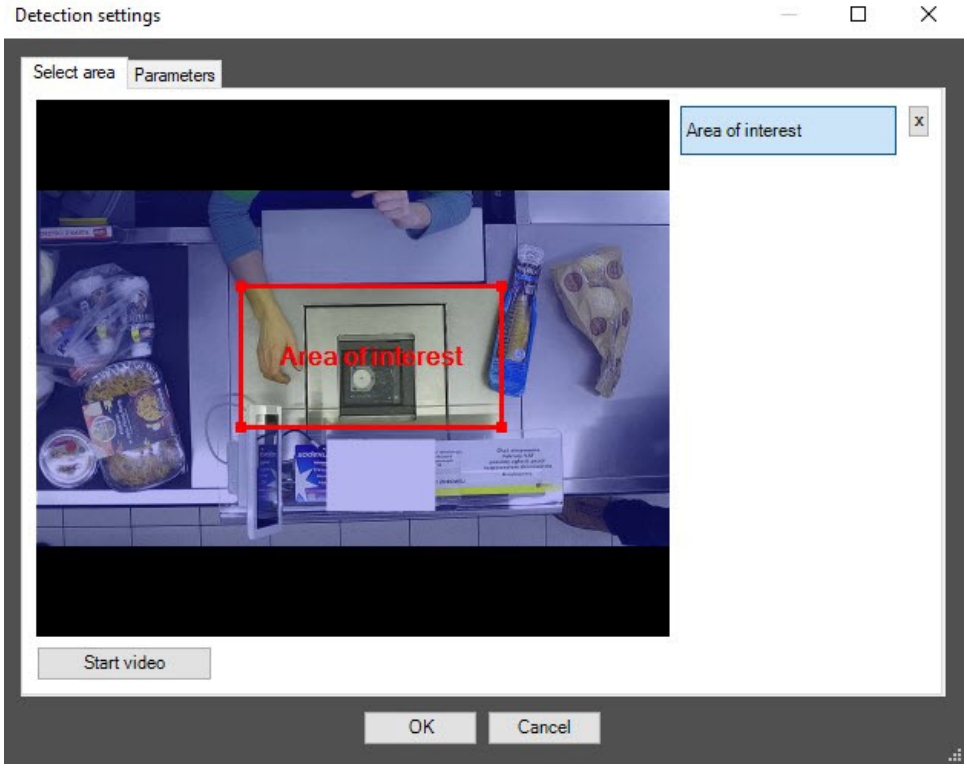
Selecting area of interest

1. Click the **Settings** button. The **Detection settings** window opens.



2. Go to the **Select area** tab and click the **Stop video** button to pause the playback and capture a video frame.

3. Click the **Area of interest** button to specify an area of interest. The button is highlighted in blue color.

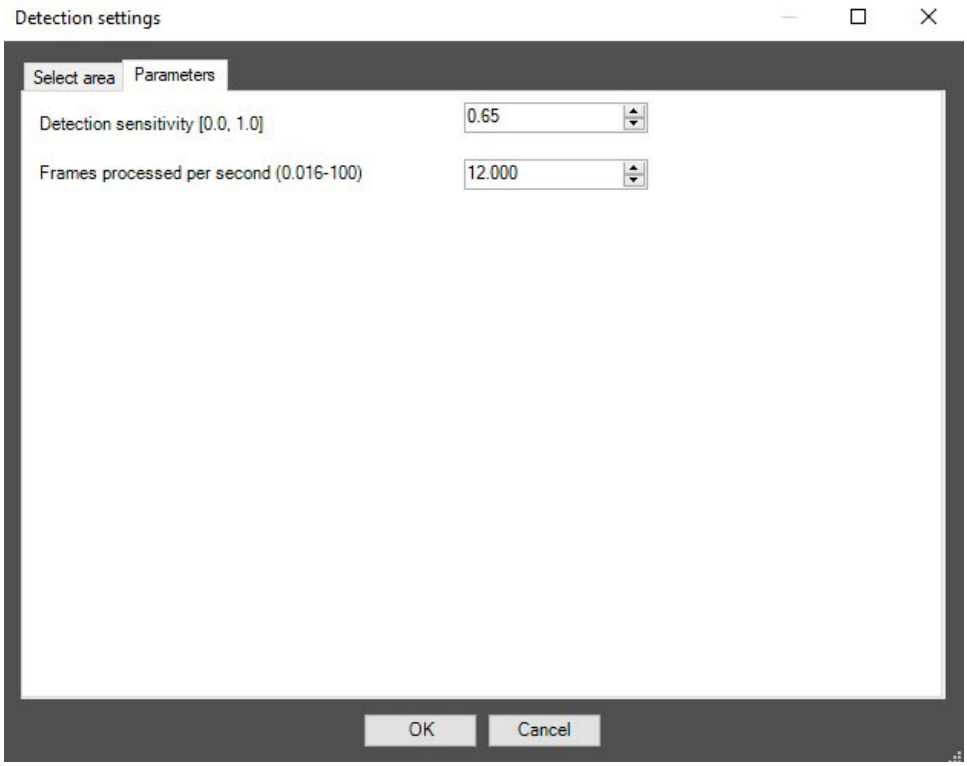


4. On the captured frame, use the mouse to set anchor points of the area where objects are detected. The rest of the frame is grayed out. The selected area must meet the requirements described in Camera requirements for the Sweethearting at checkout detection module. If you don't specify the area of interest, the entire frame is analyzed.

> **Note**
>
> - You can add only one area. If you try to add a second area, the first area will be deleted.
> - To delete an area, click the x button to the right of the **Area of interest** button.

Configuring the detection tool parameters

1. Go to the **Parameters** tab of the **Detection settings** window.



2. In the **Detection sensitivity [0.0, 1.0]** field, specify the detection sensitivity in the range from 0.0 to 1.0. The default value is **0.65**.

> **Note**
>
> The detection sensitivity value is selected experimentally. The lower the sensitivity, the greater the probability of false positives. The higher the sensitivity, the less chance of false alarms, however, some useful tracks can be skipped.

3. In the **Frames processed per second (0.016-100)** field, specify the number of frames per second that the detection tool processes in the range from 0.016 до 100. The default value is **12**.
4. Click the **OK** button to save the changes and return to the settings panel of the **Sweethearting at checkout detection** object.

> **Note**
>
> To return to the settings panel of the **Sweethearting at checkout detection** without saving the changes, click the **C ancel** button.

5. Click the **Apply** button to save the changes.

The *Sweethearting at checkout detection* module is now configured.

Barcode detection

Functionality of the Barcode detection

The *Barcode detection* is designed to define barcodes or QR-codes in areas of interest.

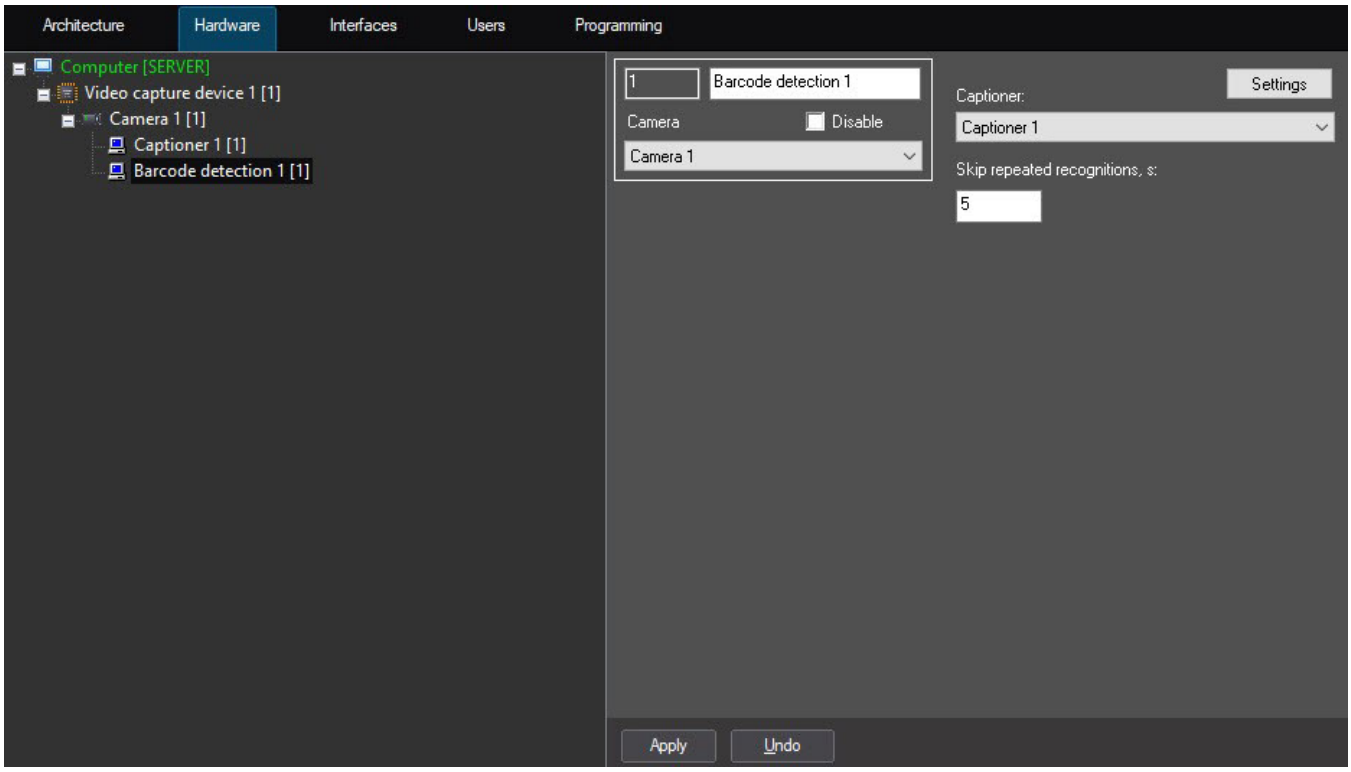
Camera requirements for the Barcode detection module

The requirements for cameras that will work with the *Barcode detection* module are given in the table below.

Camera	• The resolution depends on the barcode size in the frame. If the barcode size takes half the frame, then a resolution of 260 pixels wide is enough • FPS rate: 6
Lighting	• The image should be clear, lines should be visually separable from each other
Scene and camera view	• The angle between the optical axis of the camera and the plane of the barcode should be not more than 15°
Images of objects	• Maximum width and height of the detected barcode – 65536 pixels • The area of the detected barcode is not less than 1296 pixels • Each of barcode sides is not less than 10 pixels **Note.** For example, if the barcode height is 10 pixels, than its width should be not less than 130 pixels. Vice versa, if the barcode width is 10 pixels, than its height should be not less than 130 pixels

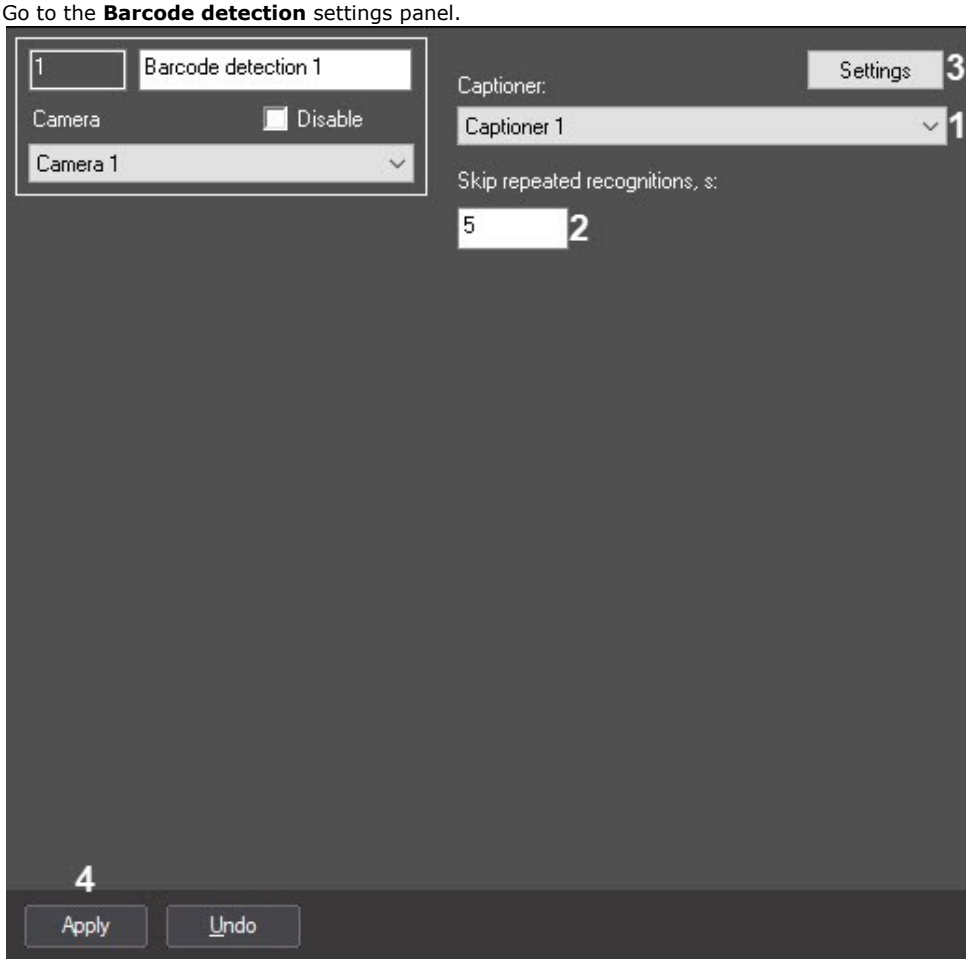
Configuring the Barcode detection module

The *Barcode detection* module can be configured using the **System settings** menu, on the **Hardware** tab, on the **Barcode detection** settings panel, using the **Camera** settings.



The *Barcode detection* module is configured as follows:

1. Go to the **Barcode detection** settings panel.

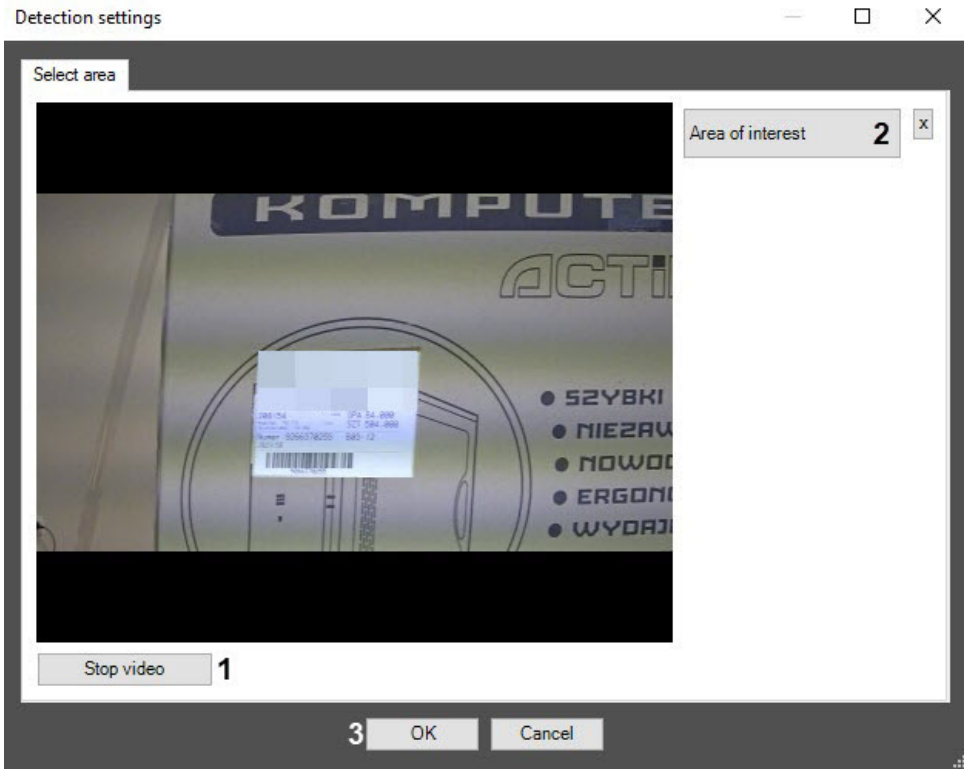


2. From the **Captioner** drop-down list, select the captioner with the help of which result will be displayed in the monitor (**1**)
3. In the **Skip repeated recognitions, s** field, enter the time in seconds in which the repeated code is recognized (**2**).

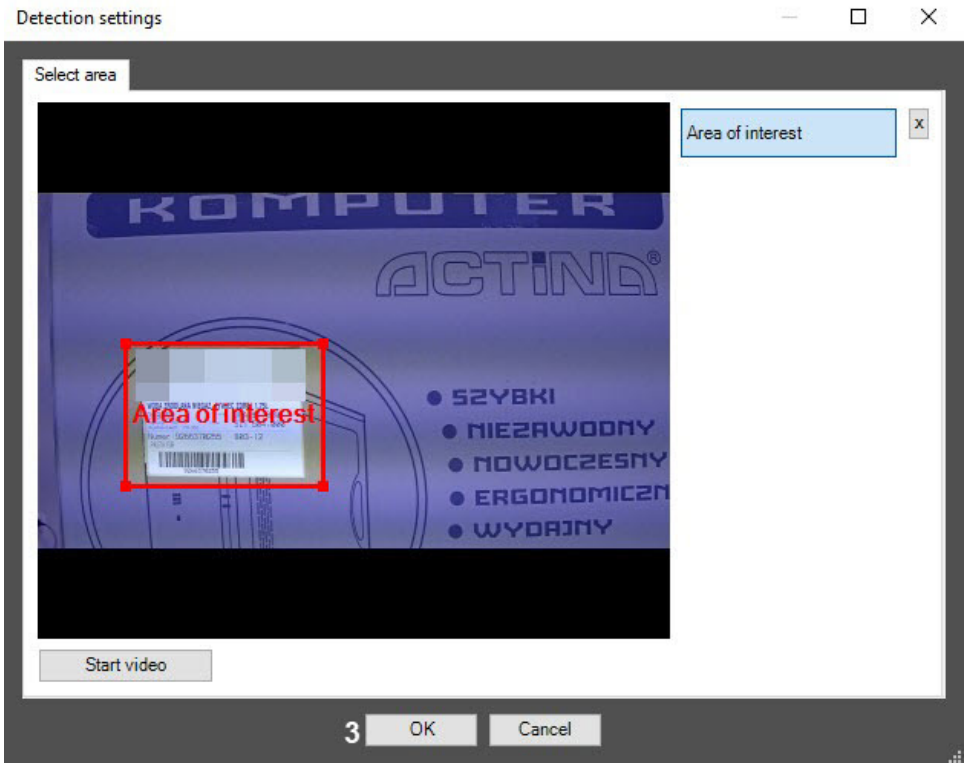
> **Note**
>
> If there are different barcodes or QR-codes one after another, the recognition is performed instantly. If there are repeated barcodes, the new result will be displayed after the time period specified in the settings.

4. Click the **Settings** button (**3**). The **Detection settings** window will open.
5. Specify the detection surveillance area:

a. Click the **Stop video** button to capture the video image (**1**).



b. Click the **Area of interest** button (**2**).



c. On the captured video image, specify areas to be analyzed. It is possible to add only one area. When attempting to add the second area, the first one will be deleted. After area specifying, the remaining part of video image will be darkened.

> **Note**
>
> To remove the area, click the x button next to the **Area of interest** button.

Attention!

Barcode can be detected not only when the entire barcode or QR code is within the specified area, but also only a fragment of it.

d. Click the **OK** button (**3**) to save the changes and return to the settings panel of the **Barcode detection**.

Note

To return to the settings panel of the **Barcode detection** without saving the changes, click the **Cancel** button.

6. On the **Barcode detection** settings panel, click the **Apply** button (**4**).

Configuring the *Barcode detection* module is complete.

Equipment detection (PPE)

Functionality of the Equipment detection (PPE) module

The *Equipment detection tool (PPE)* locates individuals wearing no personal protective equipment within the area where it's required, and also individuals wearing improperly applied PPE.

> **Attention!**
>
> It is recommended to use the detector in a "gateway" environment: at the entrance to an area in which equipment or PPE is required, the employee is delayed for 5-10 seconds, during which the detection tool determines the presence of the necessary equipment (see Examples of configuring Equipment detection tool (PPE) for solving typical tasks).

For detection tool operation, at least two separate neural networks are used:

- Segmenting network—it structures up an image of a human body (locates head, shoulders, arms, hands, thighs, legs and feet);
- Classifying network—it detects equipment (PPE) on a specified body part, and checks if it's properly applied.

> **Attention!**
>
> To train a classification neural network, it is necessary to provide a list of equipment (see Example of providing a list of valid equipment at the facility).

Video stream and scene requirements for the Equipment detection (PPE) module

The requirements for cameras that will work with the *Equipment detection (PPE)* module are shown in the following table.

Video stream from camera	• The resolution is at least 640x360 pixels. It is also not recommended to use a resolution higher than 1920×1080, since higher resolution does not increase the detection quality, but significantly increases the consumption of resources. The optimal resolution for solving typical tasks is 1280x720. • The frame rate per second in the video stream from the camera is at least 3 for solving typical tasks. • Color image only
Lighting	• Lighting in the scene is at least 200 lux per square meter. In conditions of insufficient or excessive lighting (night or light-striking), stable operation of the video analytics is not guaranteed. • There are no abrupt changes in lighting
Scene and camera angle	• Moving objects are visually separable from each other. • The background is mostly static and does not change abruptly. • There are no products made of rods in the detection area. • Moving objects are minimally obscured by static objects in the scene (columns, trees, etc.). • The analyzed scene does not have reflective surfaces and sharp shadows from moving objects. If present, they should be masked. • Camera shake does not result in image offsets greater than 1% of the frame size
Object images	Objects image requirements for Equipment detection tool (PPE)

Attention!

Correct operation of the detection tool isn't guaranteed if you use a fisheye lens.

For the detection tool to work correctly, you must position the camera in such a way that the person wearing the equipment can be seen in detail from this angle. We don’t recommend pointing the camera from the top downwards, because in this case the correct operation of the detection tool isn’t guaranteed.

Correct operation of the Equipment detection (PPE) isn't guaranteed if you use a video stream or frames that were masked before they got into *Axxon PSIM* by an IP camera or similar means and methods.

Requirements for software and hardware platform

Objects image requirements for Equipment detection tool (PPE)

To ensure the correct recognition of personal protective equipment, the following image requirements should be met:

1. The object to be detected (PPE) is clearly distinguishable by the human eye.
2. The image is not noisy and not distorted by compression algorithm artifacts.
3. The width or height of the equipment does not exceed 75% of the frame size.
4. The duration of the object's visibility is at least 3-8 frames. The minimum number of frames depends on the task.
5. There are no visible physical barriers between the camera lens and the analyzed object.
6. The minimum value of pixel density per meter is observed:

Image resolution	Object type	Minimum pixel density per meter (ratio of the object width in pixels to the object width in meters)	Minimum object size in pixels, Width x Height
1920x1080	Human	170	~102x309
1280x720	Human	128	~77x233
640x360	Human	80	~48x145

7. The minimum dimensions of the equipment on the body areas in pixels are observed. An example of equipment dimensions for a resolution of 1920x1080:

    a. Upper body (torso) 75*100.
    b. Legs 75*105.
    c. Head 60*65.
    d. Hands 65*60.
    e. Feet 45*40.
    f. Set of equipment 165*295.

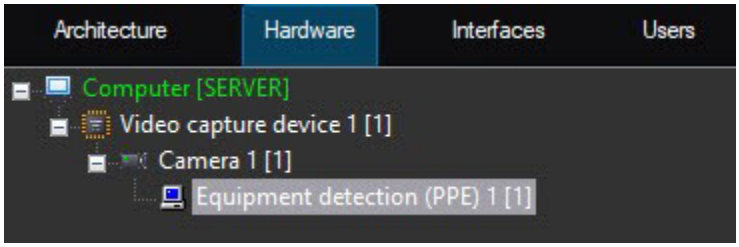
Video stream and scene requirements for the Equipment detection (PPE) module

Configuring the Equipment detection (PPE) module

On the page:

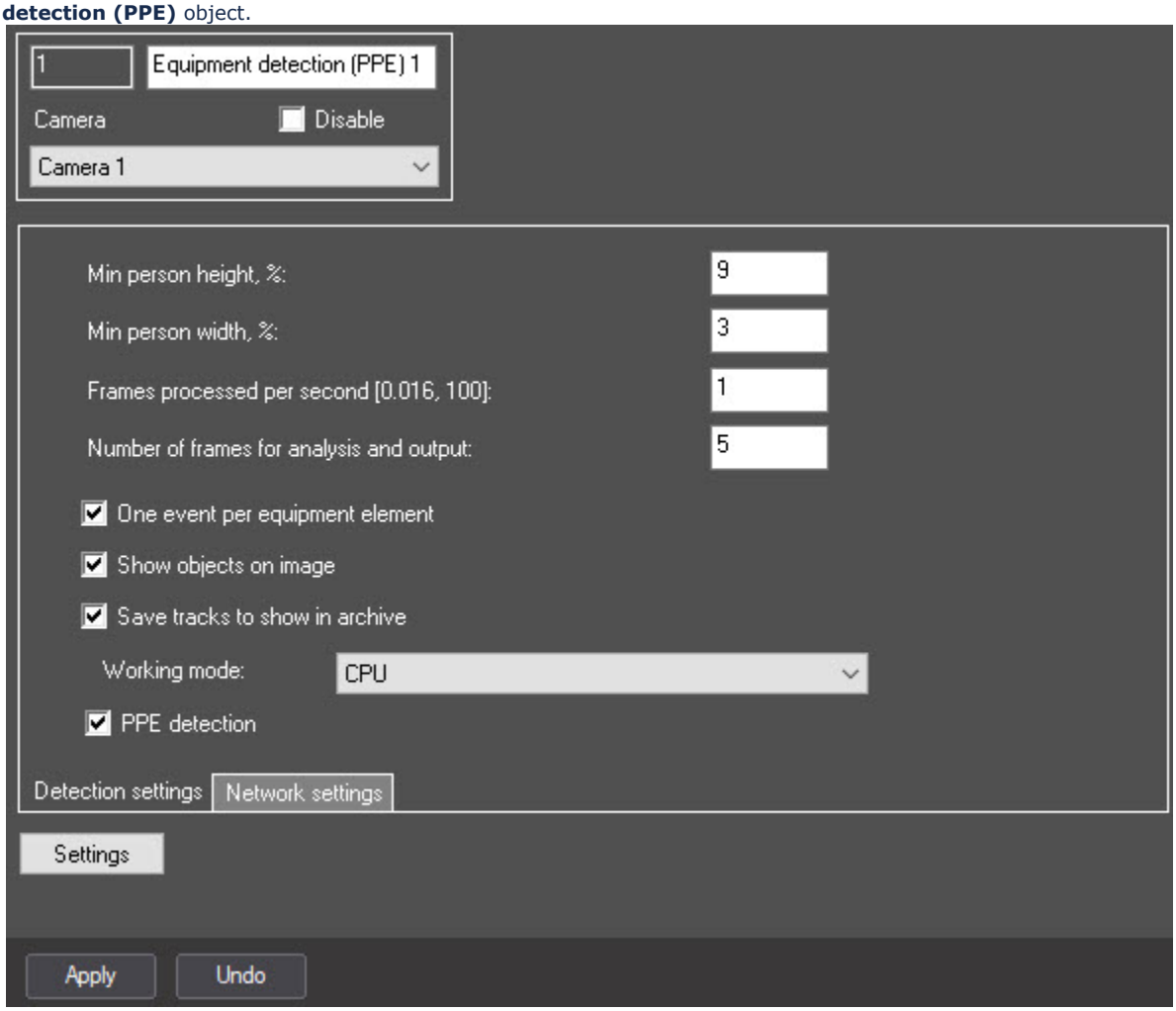
Configuration of the *Equipment detection (PPE)* module includes: general settings of the detection tool, selection of the area of interest, configuration of the neural networks.

The *Equipment detection (PPE)* module is configured on the settings panel of the **Equipment detection (PPE)** object created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.



General settings of the detection tool

General configuration of the detection tool is performed on the **Detection settings** tab on the settings panel of the **Equipment detection (PPE)** object.



1. In the **Min person height, %** and **Min person width, %** fields, enter the minimum height and width of a person in the frame as a percentage of the frame height/width. Objects smaller than the specified size will not be detected.
2. In the **Frames processed per second [0.016, 100]** field, set the number of frames per second that will be processed by the detection tool.
3. In the **Number of frames for analysis and output** field, enter the minimum number of frames on which a violation must be detected in order to generate a trigger. The value must be in the range [2; 20].
4. By default, the **One event per equipment element** checkbox is set, and the detection tool triggers once for each equipment element violation within an object (track). If you want the detection tool to trigger each time an equipment violation occurs, clear the checkbox.

> **Note**
>
> Example. A person appeared in the frame without a helmet, then put it on and then took it off again. If the **One event per equipment element** checkbox is set, then there will be one trigger, if not—two triggers.

5. Set the **Show objects on image** checkbox if it is necessary to highlight the detected object with a frame on the image in the **Monitor** interface object window.
6. Set the **Save tracks to show in archive** checkbox to save the object (track) to the archive.

> **Note**
>
> The frame on the image of the detected object is saved in the **Monitor** object archive.

7. From the **Working mode** drop-down list, select the device on which the neural network will operate: CPU, one of NVIDIA GPUs or one of Intel GPUs. The default value is **CPU**. Depending on the device that you select, the neural networks will be selected.

Attention!

- It may take several minutes to launch the algorithm on NVIDIA GPU after you apply the settings. You can use caching to speed up future launches (see Optimizing the operation of neural analytics on GPU in Windows OS).
- If you specify other processing resource than the CPU, this device will carry the most of computing load. However, the CPU will also be used to run the detection tool.

8. Set the **PPE detection** checkbox to detect the presence of personal protective equipment (PPE). By default, the checkbox is clear.

Selecting the area of interest

1. Click the **Settings** button. The **Detection settings** window will open.

2. Click the **Stop video** button to pause playback and capture a frame of the video image.

3. Click the **Area of interest** button to specify the area of detection. The button will be highlighted in blue.

4. On the captured video frame, sequentially set the anchor points of the area in which the objects will be detected by left-clicking the mouse button. The rest of the frame will be faded. If you don't specify the area of interest, the entire frame is analyzed.

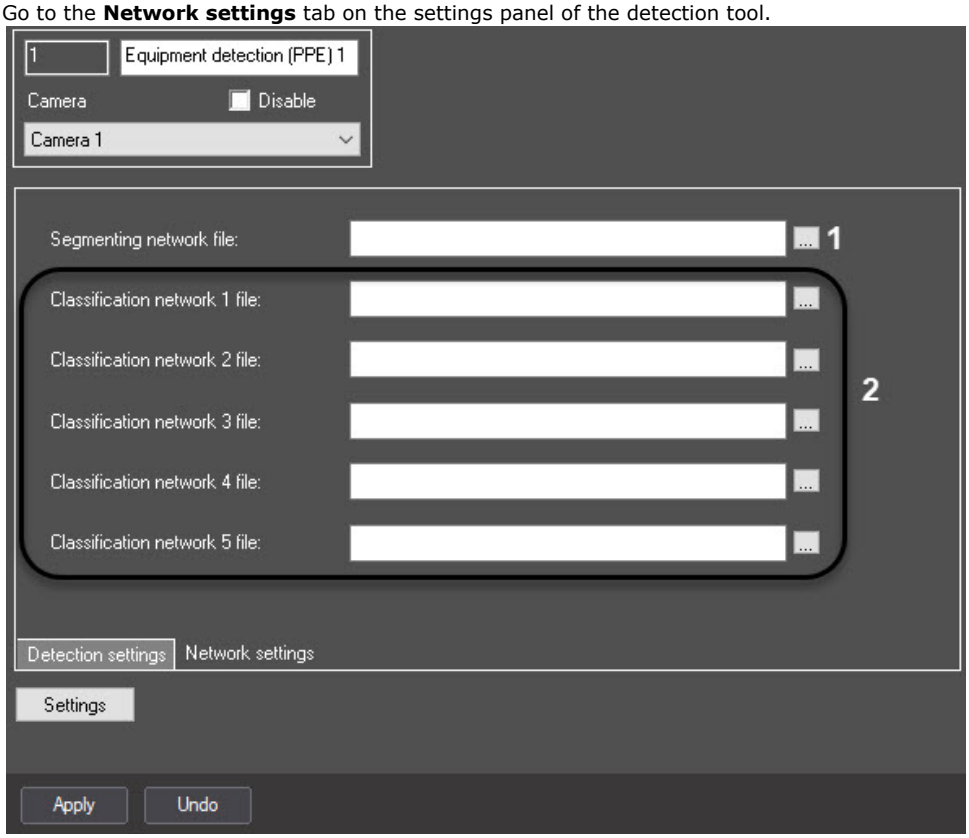
> **Note**
>
> - You can add only one area. If you try to add a second area, the first area will be deleted.
> - To delete the area, click the x button to the right of the **Area of interest** button.

There can be only one area of interest.

5. Click the **OK** button to close the **Detection settings** window and return to the settings panel of the detection tool.

Configuring neural networks

1. Go to the **Network settings** tab on the settings panel of the detection tool.



2. By default, the standard (default) segmenting neural network is initialized according to the device selected in the **Working mode** drop-down list. The standard neural networks for different processor types are selected automatically. If you use a custom segmenting neural network, click the ... button (**1**) to the right of the **Segmenting network file** field, and in the standard Windows Explorer window, specify the path to the file.
3. By default, two standard classification neural networks are initialized: classification neural network (PPE on the head) and classification neural network (PPE on the body) according to the selected processing device in the **Working mode** drop-down list. Each classification neural network detects equipment on a specific body segment. The standard classification neural networks for different processor types are selected automatically. If you want to detect only one item of equipment, click the ... button to the right of the **Classification network file** field (**2**), and in the standard Windows Explorer window, specify the path to the custom neural network file. If there are several custom neural network files, specify the path to each.
4. Click the **Apply** button to save the settings.

The *Equipment detection (PPE)* module is now configured.

Examples of configuring Equipment detection tool (PPE) for solving typical tasks

Example of providing a list of valid equipment at the facility

Example of providing a list of valid equipment at the facility

Data collection requirements for neural network training

For correct detection, it is important to understand exactly what items of equipment are used at the facility.

A complete list of equipment should be provided regardless of the current season of the year. This will help to reduce the number of false events from the *Equipment detection tool (PPE)* and get the most positive experience from using this analytics.

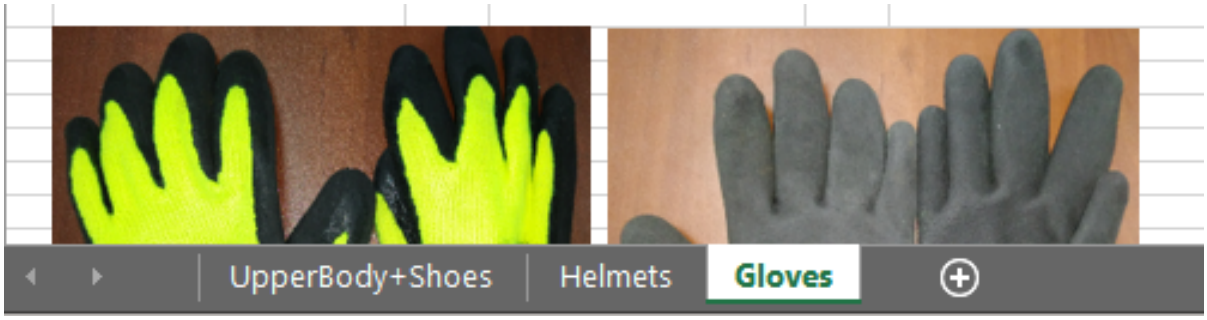
Below are examples of lists in the form of a table:

Gloves #1

Gloves #2

Gloves #3

Gloves #4


UpperBody+Shoes
Helmets
Gloves

Helmet #1:

Helmet #2:

Helmet #3:

Helmet #4:

Helmet #5 (#4 screen:)

Helmet #6 (#4 earmuffs):

UpperBody+Shoes | **Helmets** | Gloves


Weldor:
Cleaning:
Standard:
UpperBody+Shoes
Helmets
Gloves

Examples of configuring Equipment detection tool (PPE) for solving typical tasks

Typical tasks for detecting personal protective equipment are the following:

1. Detection in gateway conditions. A gateway is a border, which can be either a virtual line or a door, a barrier, a turnstile. The algorithm for working in gateway conditions is as follows:
    a. A person stops in front of an area where PPE is required.
    b. The person poses in a way that it is possible to check the presence of all items of equipment (the item is not overlapped by the person himself, other items of equipment, items of clothing).
    c. Human screening. There should be no obstacles between the person and the camera, blocking the person for screening.
2. Detection in a production conditions: persons move freely in the detection area.

> **Note**
>
> By default, the *Equipment detection tool (PPE)* is configured for detection in gateway conditions.

The recommended settings for solving typical tasks are as follows:

Settings	Equipment detection in gateway conditions	Equipment detection in production conditions
The number of frames processed per second	1	3
Minimum person height	0,01	0,09
Minimum person width	0,01	0,03
Number of frames for analysis and output	3	7
One event per item of equipment	Yes	Yes

Neurocounter

Functionality of the Neurocounter module

Neurocounter counts the number of objects in a given surveillance area using a neural network. When the event condition is met, an event with the number of detected objects is generated.

Video stream and scene requirements for the Neurocounter module

The requirements for cameras that will work with the *Neurocounter* module are shown in the following table.

Video stream from camera	• The resolution is at least 640x360 pixels. It is also not recommended to use a resolution higher than 1920×1080, since higher resolution does not increase the detection quality, but significantly increases the consumption of resources. The optimal resolution for solving typical tasks is 1280x720 (see Example of configuring Neurocounter for solving typical task). • The frame rate per second in the video stream from the camera is at least 8 for solving typical task. • Both colorless (gray) and color images
Lighting	• Lighting in the scene is at least 50 lux per square meter. In conditions of insufficient or excessive lighting (night or light-striking), stable operation of the video analytics is not guaranteed. • There are no abrupt changes in lighting
Scene and camera angle	• Moving objects are visually separable from each other. • The background is mostly static and does not change abruptly. • Moving objects are minimally obscured by static objects in the scene (columns, trees, and so on). • The analyzed scene does not have reflective surfaces and sharp shadows from moving objects. If present, they should be masked. • Camera shake does not result in image offsets greater than 1% of the frame size
Object images	Objects image requirements for Neurocounter

Attention!

Correct operation of the neurocounter is not guaranteed if you use a fisheye lens.

Correct operation of the neurocounter isn't guaranteed if you use a video stream or frames that were masked before they got into *Axxon PSIM* by an IP camera or similar means and methods.

Requirements for software and hardware platform

Objects image requirements for Neurocounter

To ensure the correct operation of *Neurocounter*, the following image requirements should be met:

1. The object to be detected is clearly distinguishable by the human eye.
2. The width or height of the objects does not exceed 75% of the frame size.
3. The image is not noisy and not distorted by compression algorithm artifacts.
4. The duration of the object's visibility is at least 6 frames.
5. The object moves in the certain direction between two adjacent frames at a distance which does not exceed the object's size. This condition is necessary for the correct calculation of the trajectory of the object (track).
6. The minimum value of pixel density per meter is observed:

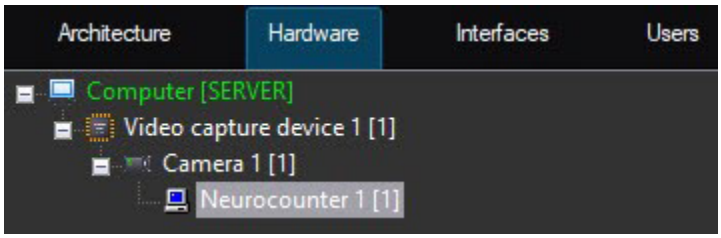
Image resolution	Object type	Minimum pixel density per meter (ratio of the object width in pixels to the object width in meters)	Minimum object size in pixels, Width x Height	Ratio of the object width to the frame width as a percentage
1920x1080	Human	55	~25x105	~3%
1280x720	Human	35	~17x70	~3%
640x360	Human	17	~10x42	~3%
1920x1080	Light vehicle (2 axles)	55	~354x300	~20%
1280x720	Light vehicle (2 axles)	35	~240x205	~20%
640x360	Light vehicle (2 axles)	17	~132x112	~20%

Video stream and scene requirements for the Neurocounter module

Configuring the Neurocounter module

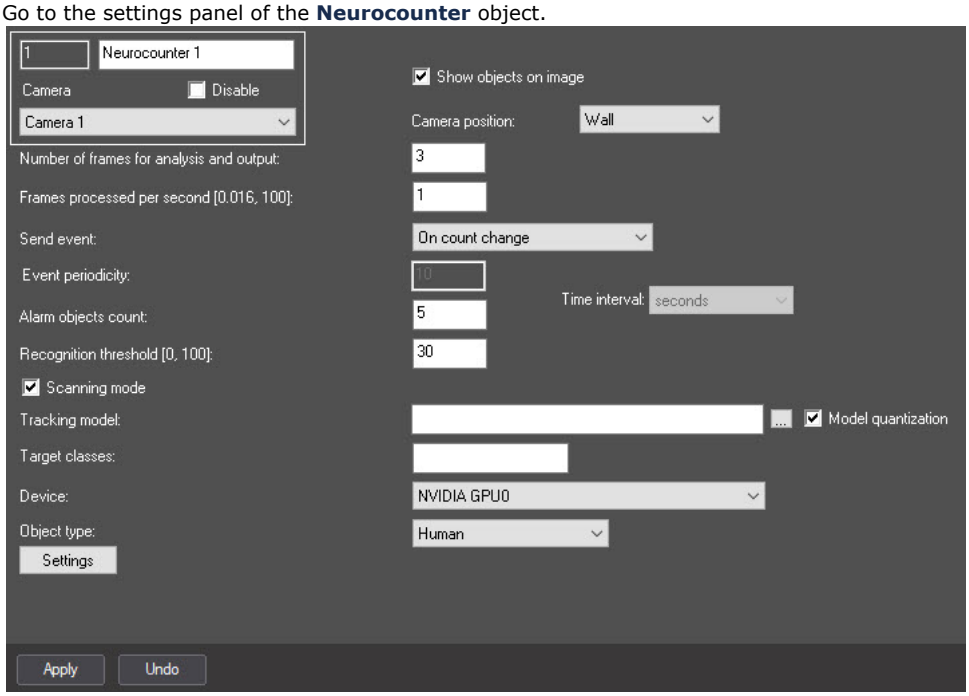
On the page:

Configuration of the *Neurocounter* module includes: configuring the detection tool, selecting the area of interest. You can configure the *Neurocounter* module on the settings panel of the **Neurocounter** object created on the basis of the **Camera** object on the **Hardware** t ab of the **System settings** dialog window.



Configuring the detection tool

1. Go to the settings panel of the **Neurocounter** object.



2. Set the **Show objects on image** checkbox to frame the detected objects on the image in the debug window (see Start the debug window).
3. From the **Camera position** drop-down list, select:
    a. **Wall**—objects are detected only if their lower part gets into the area of interest specified in the detection tool settings.
    b. **Ceiling**—objects are detected even if their lower part doesn't get into the area of interest specified in the detection tool settings.
4. In the **Number of frames for analysis and output** field, specify the number of frames to be processed to determine the number of objects on them.
5. In the **Frames processed per second [0.016, 100]** field, specify the number of frames processed per second by the neural network in the range from 0.016 to 100. For all other frames interpolation will be performed—finding intermediate values by the available discrete set of its known values. The greater the value of the parameter, the more accurate the detection tool operation, but the higher the load on the processor.
6. From the **Send event** drop-down list, select the condition by which an event with the number of detected objects will be generated:

- **If threshold exceeded** is triggered if the number of detected objects in the image is greater than the value specified in the **Alarm objects count** field.
- **If threshold not reached** is triggered if the number of detected objects in the image is less than the value specified in the **Alarm objects count** field.
- **On count change** is triggered every time the number of detected objects changes.
- **By period** is triggered by a time period:
    a. In the **Event periodicity** field, specify the time after which the event with the number of detected objects will be generated.
    b. From the **Time interval** drop-down list, select the time unit of the counter period: **seconds**, **minutes**, **hours**, **days**.

7. In the **Alarm objects count** field, specify the threshold number of detected objects in the area of interest. It is used in the **If threshold exceeded** and **If threshold not reached** conditions. The default value is **5**.
8. In the **Recognition threshold [0, 100]** field, enter the neurocounter sensitivity—integer value from 0 to 100. The default value is **30**.

> **Note**
>
> The neurocounter sensitivity is determined experimentally. The lower the sensitivity, the higher the probability of false alarms. The higher the sensitivity, the lower the probability of false alarms, however, some useful tracks can be skipped (see Example of configuring Neurocounter for solving typical task).

9. Set the **Scanning mode** checkbox to detect small objects. If you enable this mode, the load on the system increases. So we recommend specifying a small number of frames processed per second in the **Frames processed per second [0.016, 100]** field. By default, the checkbox is clear. For more information on the scanning mode, see Configuring the Scanning mode.
10. By default, the standard (default) neural network is initialized according to the object selected in the **Object type** drop-down list and the device selected in the **Device** drop-down list. The standard neural networks for different processor types are selected automatically. If you use a custom neural network, click the  button to the right of the **Tracking model** field and in the standard Windows Explorer window, specify the path to the file.

> **Attention!**
>
> To train a neural network, contact the AxxonSoft technical support (see Data collection requirements for neural network training). A neural network trained for a specific scene allows you to detect objects of a certain type only (for example, a person, cyclist, motorcyclist, and so on).

11. Set the **Model quantization** checkbox to enable model quantization. By default, the checkbox is clear. This parameter allows you to reduce the consumption of the GPU processing power.

> **Note**
>
> a. AxxonSoft conducted a study in which a neural network model was trained to identify the characteristics of the detected object. The following results of the study were obtained: model quantization can lead to both an increase in the percentage of recognition and a decrease. This is due to the generalization of the mathematical model. The difference in detection ranges within ±1.5%, and the difference in object identification ranges within ±2%.
> b. Model quantization is only applicable for NVIDIA GPUs.
> c. The first launch of a detection tool with quantization enabled may take longer than a standard launch.
> d. If GPU caching is used, next time a detection tool with quantization will run without delay.

12. If necessary, specify the class of the detected object in the **Target classes** field. If you want to display tracks of several classes, specify them separated by a comma with a space. For example, **1**, **10**.
The numerical values of classes for the embedded neural networks: **1**—Human/Human (top view), **10**—Vehicle.

> **Note**
>
> a. If you specify a class/classes from the neural network and a class/classes missing from the neural network, the tracks of a class/classes from the neural network will be displayed (**Object type**, **Neural network file**).
> b. If you specify a class/classes missing from the neural network, tracks won't be displayed.

13. From the **Device** drop-down list, select the device on which the neural network will operate: CPU, one of NVIDIA GPUs, or one of Intel GPUs. **Auto** (default value)—the device is selected automatically: NVIDIA GPU gets the highest priority, followed by Intel GPU, then CPU.

Attention!

a. We recommend using the GPU.
b. It may take several minutes to launch the algorithm on NVIDIA GPU after you apply the settings. You can use caching to speed up future launches (see Optimizing the operation of neural analytics on GPU).

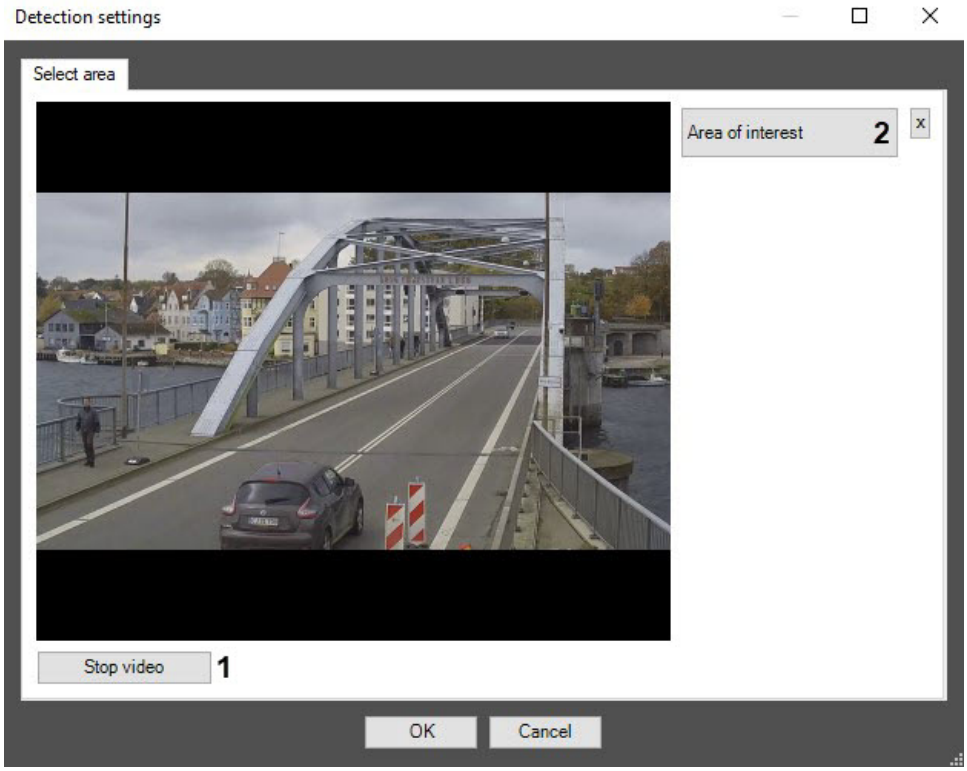
14. From the **Object type** drop-down list, select the object type:
    - **Human**—the camera is directed at a person at the angle of 100-160°.
    - **Human (top-down view)**—the camera is directed at a person from above at a slight angle.
    - **Vehicle**—the camera is directed at a vehicle at the angle of 100-160°;
    - **Person and vehicle (Nano)**—person and vehicle recognition, small neural network size;
    - **Person and vehicle (Medium)**—person and vehicle recognition, medium neural network size;
    - **Person and vehicle (Large)**—person and vehicle recognition, large neural network size.

Note

Neural networks are named taking into account the objects they detect. The names can include the size of the neural network (**Nano**, **Medium**, **Large**), which indicates the amount of consumed resources. The larger the neural network, the higher the accuracy of object recognition.

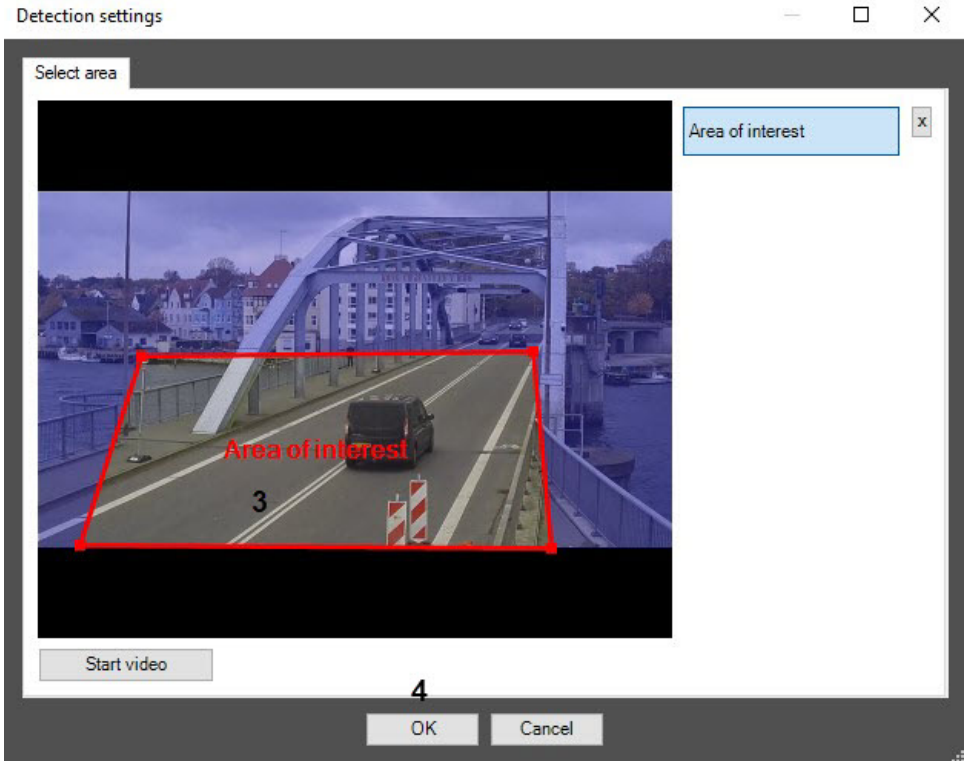
Selecting the area of interest

1. Click the **Settings** button. The **Detection settings** window opens.



2. Click the **Stop video** button (**1**) to pause the playback and capture the frame.

3. Click the **Area of interest** button (**2**) to specify the area of interest. The button will be highlighted in blue.



4. On the captured frame, sequentially set the anchor points of the area in which the objects will be detected. The rest of the frame will be faded. If you don't specify the area of interest, the entire frame is analyzed.

> **Note**
>
> *a.* You can add only one area of interest. If you try to add a second area, the first one will be deleted.
>
> *b.* To delete an area, click the x button to the right of the **Area of interest** button.

5. Click the **OK** button to close the **Detection settings** window and return to the settings panel of the **Neurocounter** object.
6. Click the **Apply** Apply button to save the changes.

Configuring the *Neurocounter* module is complete.

Example of configuring Neurocounter for solving typical task

To detect objects with a speed less than 0.3 m/s, the following settings are recommended:

1. **The number of frames for analysis and output**: 3.
2. **The number of frames processed per second**: 1.
3. **Neural filter**: No.
4. **Recognition threshold**: 30.
5. **Neural network file**: Path to the *.ann neural network file. You can also select **Object type**.

> **Note**
>
> By default, the neural counetr is configured for detection of objects with a speed less than 0.3 m/s.

To solve tasks in which the speed of the object is greater than 0.3 m/s, it is necessary to increase the number of processed frames and /or reduce the number of frames for analysis and output. The values are selected by trial-and-error method depending on the conditions of the task.

Neurotracker

Functionality of the Neurotracker module

Video stream and scene requirements for the Neurotracker module

Objects image requirements for neural tracker

Configuring the Neurotracker module

- Configuring the neurotracker track counter
- Examples of configuring neural tracker for solving typical tasks

Functionality of the Neurotracker module

A neurotracker is designed for detecting any objects in a video image and calculating the metadata. The neurotracker operation involves the use of a neural network, which allows to reduce the computation load and improve the quality of the object detection. Any detection tool can be implemented on the basis of the neurotracker. The neurotracker independently receives the necessary tracks, both with moving and with completely motionless (during the whole analysis period) objects.

The following objects can be created on the basis of the neurotracker:

- neurotracker counter (for periodical events notifying about the number objects received from the neurotracker);
- VMDA detection tools: Line crossing, Motion in the area (you can configure some actions in the system on triggering of VMDA detection tools).

Video stream and scene requirements for the Neurotracker module

The requirements for the video stream and the scene when working with the *Neurotracker* module are given in the table:

Video stream from camera	• The resolution is at least 640x360 pixels. It is also not recommended to use a resolution higher than 1920×1080, since higher resolution does not increase the detection quality, but significantly increases the consumption of resources. The optimal resolution for solving typical tasks is 1280x720 (see Examples of configuring neural tracker for solving typical tasks). • The frame rate per second in the video stream from the camera is at least 8 for solving typical tasks. • Both colorless (gray) and color images
Lighting	• Lighting in the scene is at least 50 lux per square meter. In conditions of insufficient or excessive lighting (night or light-striking), stable operation of the video analytics is not guaranteed. • There are no abrupt changes in lighting
Scene and camera angle	• Moving objects are visually separable from each other. • The background is mostly static and does not change abruptly. • Moving objects are minimally obscured by static objects in the scene (columns, trees, and so on). • The analyzed scene does not have reflective surfaces and sharp shadows from moving objects. If present, they must be masked. • Camera shake does not result in image offsets greater than 1% of the frame size
Objects image	Objects image requirements for neural tracker

Attention!

Correct operation of the neurotracker isn't guaranteed if you use a fisheye lens.

Correct operation of the neurotracker isn't guaranteed if you use a video stream or frames that were masked before they got into *Axxon PSIM* by an IP camera or similar means and methods.

Requirements for software and hardware platform

Objects image requirements for neural tracker

To ensure the correct operation of detection tools based on the neural tracker, the following image requirements should be met:

1. The object to be detected is clearly distinguishable by the human eye.
2. The width or height of the objects does not exceed 75% of the frame size.
3. The image is not noisy and not distorted by compression algorithm artifacts.
4. The duration of the object's visibility is at least 6 frames.
5. The object moves in the certain direction between two adjacent frames at a distance which does not exceed the object's size. This condition is necessary for the correct calculation of the trajectory of the object (track).
6. The minimum value of pixel density per meter is observed:

Image resolution	Object type	Minimum pixel density per meter (ratio of the object width in pixels to the object width in meters)	Minimum object size in pixels, Width x Height	Ratio of the object width to the frame width as a percentage
1920x1080	Human	55	~25x105	~3%
1280x720	Human	35	~17x70	~3%
640x360	Human	17	~10x42	~3%
1920x1080	Light vehicle (2 axles)	55	~354x300	~20%
1280x720	Light vehicle (2 axles)	35	~240x205	~20%
640x360	Light vehicle (2 axles)	17	~132x112	~20%

Video stream and scene requirements for the Neurotracker module

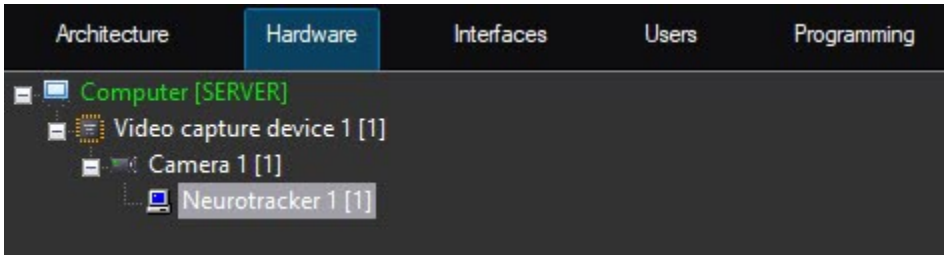
Configuring the Neurotracker module

On the page:

The *Neurotracker* module registers object tracks in the camera FOV during recording using a neural network and saves them to the VMDA metadata storage (see Creating and configuring VMDA metadata storage).

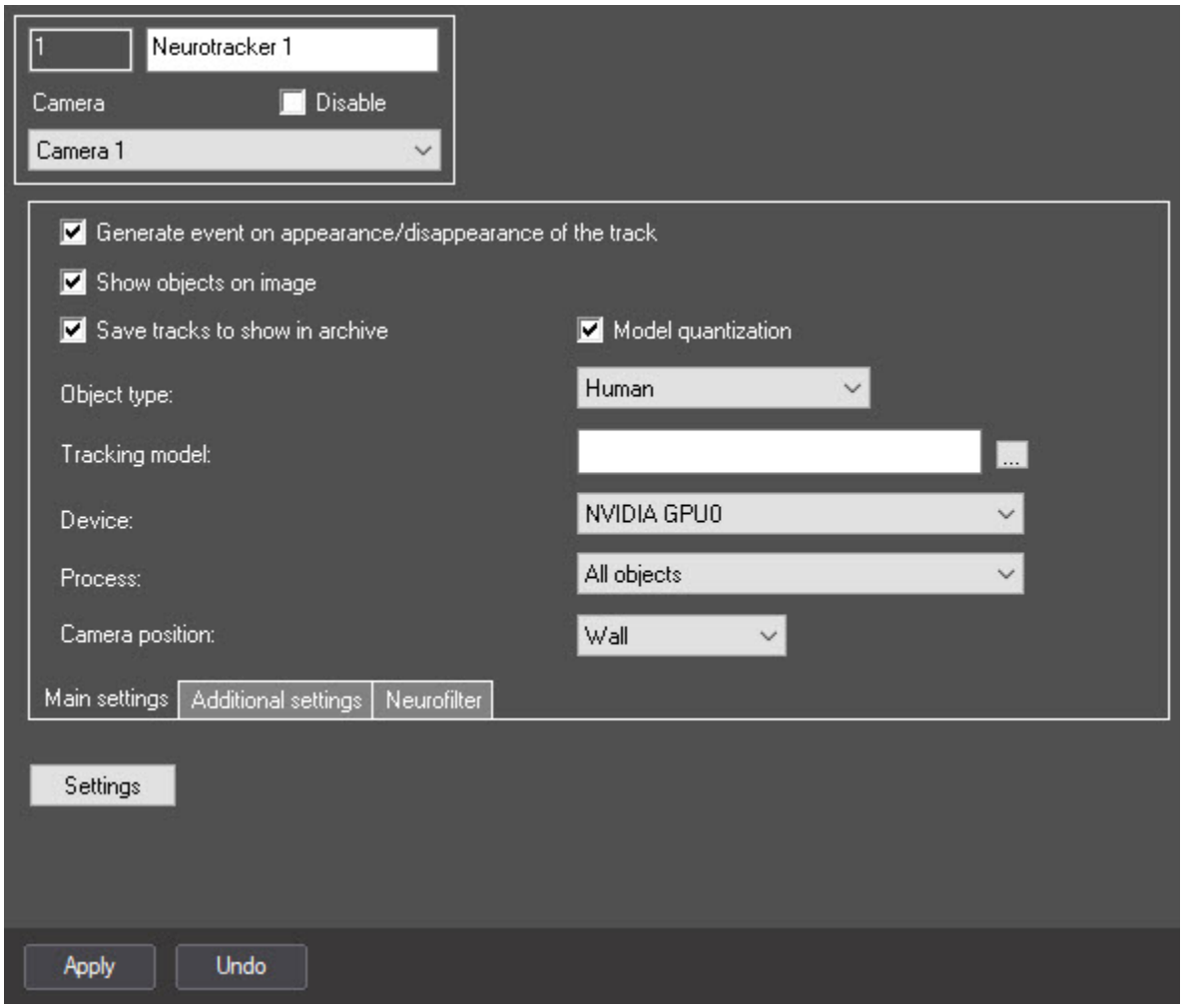
Configuration of the *Neurotracker* module includes: main and additional settings of the detection tool, selection of the area of interest, configuration of the neurofilter.

You can configure the *Neurotracker* module on the settings panel of the **Neurotracker** object that is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.



Main settings of the detection tool

You can configure the main settings of the detection tool on the **Main settings** tab on the settings panel of the **Neurotracker** object.



1. Set the **Generate event on appearance/disappearance of the track** checkbox to generate an event when an object (track) appears in the frame and disappears from the frame.

> **Note**
>
> The track appearance/disappearance events are generated only in the debug window (see Start the debug window). They are not displayed in the **Event viewer**.

2. Set the **Show objects on image** checkbox to highlight the detected object with a frame when viewing live video.
3. Set the **Save tracks to show in archive** checkbox to highlight the detected object with a frame when viewing the archive.

> **Note**
>
> This parameter does not affect the VMDA search and is used just for the visualization. For this parameter, the *titles* database is used.

4. Set the **Model quantization** checkbox to enable model quantization. By default, the checkbox is clear. This parameter allows you to reduce the consumption of the GPU processing power.

Note

a. AxxonSoft conducted a study in which a neural network model was trained to identify the characteristics of the detected object. The following results of the study were obtained: model quantization can lead to both an increase in the percentage of recognition and a decrease. This is due to the generalization of the mathematical model. The difference in detection ranges within ±1.5%, and the difference in object identification ranges within ±2%.
b. Model quantization is only applicable for NVIDIA GPUs.
c. The first launch of a detection tool with quantization enabled may take longer than a standard launch.
d. If GPU caching is used, next time a detection tool with quantization will run without delay.

5. From the **Object type** drop-down list, select the object type for analysis:
   - **Human**—the camera is directed at a person at the angle of 100-160°;
   - **Human (top-down view)**—the camera is directed at a person from above at a slight angle;
   - **Vehicle**—the camera is directed at a vehicle at the angle of 100-160°;
   - **Person and vehicle (Nano)**—person and vehicle recognition, small neural network size;
   - **Person and vehicle (Medium)**—person and vehicle recognition, medium neural network size;
   - **Person and vehicle (Large)**—person and vehicle recognition, large neural network size.

   Note

   Neural networks are named taking into account the objects they detect. The names can include the size of the neural network (**Nano**, **Medium**, **Large**), which indicates the amount of consumed resources. The larger the neural network, the higher the accuracy of object recognition.

6. By default, the standard (default) neural network is initialized according to the object selected in the **Object type** drop-down list and the device selected in the **Device** drop-down list. The standard neural networks for different processor types are selected automatically. If you use a custom neural network, click the ... button to the right of the **Tracking model** field and in the standard Windows Explorer window, specify the path to the file.

   Attention!

   To train a neural network, contact the AxxonSoft technical support (see Data collection requirements for neural network training). A neural network trained for a specific scene allows you to detect objects of a certain type only (for example, a person, cyclist, motorcyclist, and so on).

7. From the **Device** drop-down list, select the device on which the neural network will operate: CPU, one of NVIDIA GPUs, or one of Intel GPUs. **Auto** (default value)—the device is selected automatically: NVIDIA GPU gets the highest priority, followed by Intel GPU, then CPU.

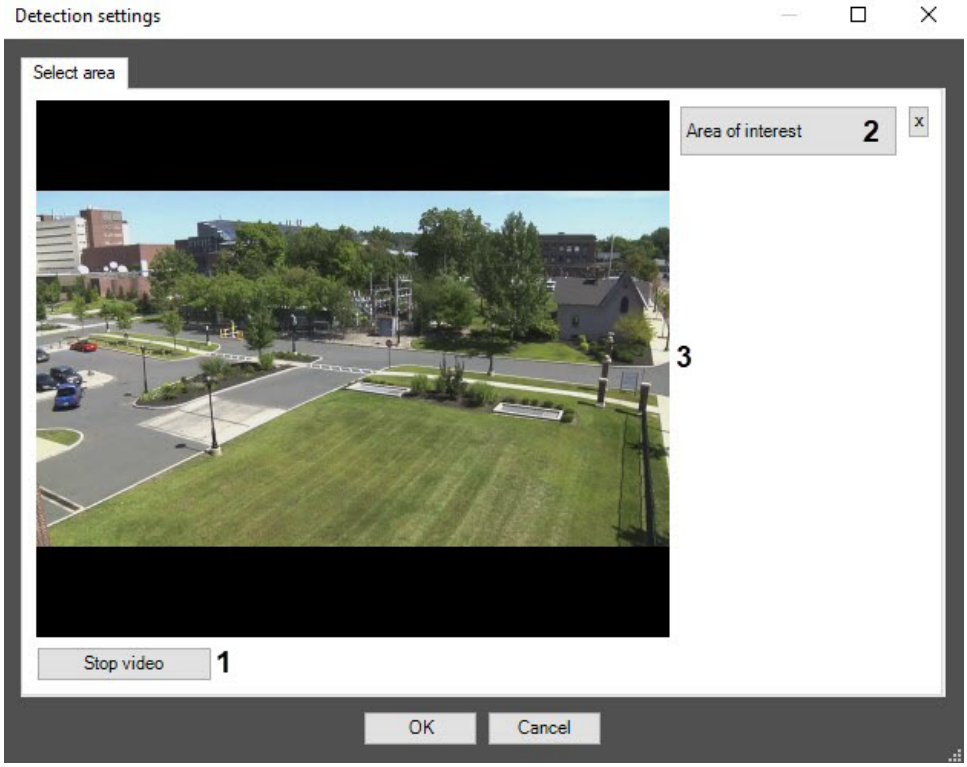
   Attention!

   a. We recommend using the GPU.
   b. It may take several minutes to launch the algorithm on NVIDIA GPU after you apply the settings. You can use caching to speed up future launches (see Optimizing the operation of neural analytics on GPU).

8. From the **Process** drop-down list, select which objects must be processed by the neural network:
   - **All objects**—moving and stationary objects;
   - **Only moving objects**—an object is considered to be moving if during the entire lifetime of its track, it has shifted by more than 10% of its width or height. Using this parameter can reduce the number of false positives;
   - **Only stationary objects**—an object is considered stationary if during the entire lifetime of its track, it has shifted by no more than 10% of its width or height. If a stationary object starts moving, the detection tool triggers and the object is no longer considered stationary.
9. From the **Camera position** drop-down list, select:
   a. **Wall**—objects are detected only if their lower part gets into the area of interest specified in the detection tool settings.
   b. **Ceiling**—objects are detected even if their lower part doesn't get into the area of interest specified in the detection tool settings.

Selecting the area of interest

1. Click the **Settings** button. The **Detection settings** window opens.

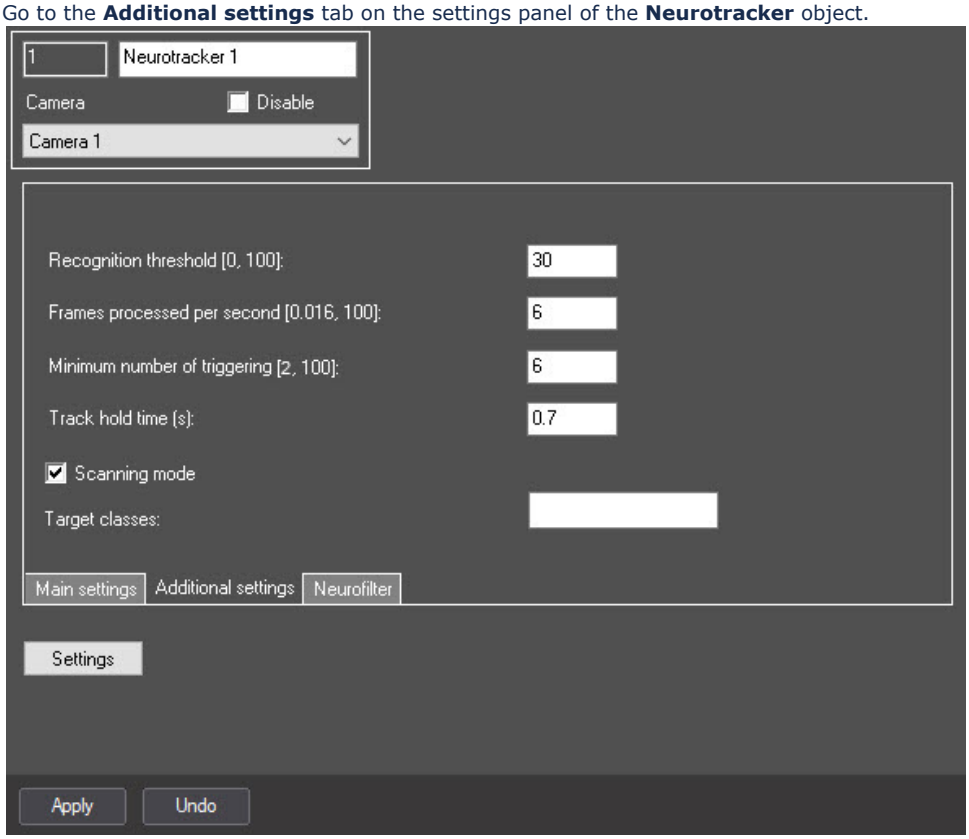


2. Click the **Stop video** button (**1**) to pause the playback and capture the frame.
3. Click the **Area of interest** button (**2**) to specify the area of interest. The button will be highlighted in blue.

4. On the captured frame, sequentially set the anchor points of the area (**1**), in which the objects will be detected. The rest of the frame will be faded. You can add only one area of interest. To delete an area, click the x button. If you don't specify the area of interest, the entire frame is analyzed.
5. Click the **OK** button (**2**) to close the **Detection settings** window and return to the settings panel of the **Neurotracker** object.

Additional settings

1. Go to the **Additional settings** tab on the settings panel of the **Neurotracker** object.



2. In the **Recognition threshold [0, 100]** field, specify the neurocounter sensitivity—an integer value in the range from **0** to **100** .

> **Note**
>
> The neurotracker sensitivity is determined experimentally. The lower the sensitivity, the higher the probability of false alarms. The higher the sensitivity, the lower the probability of false alarms, however, some useful tracks can be skipped (see Examples of configuring neural tracker for solving typical tasks).

3. In the **Frames processed per second [0.016, 100]** field, specify the number of frames processed per second by the neural network in the range from 0.016 to 100. For all other frames interpolation will be performed—finding intermediate values by the available discrete set of its known values. The greater the value of the parameter, the more accurate the detection tool operation, but the higher the load on the processor.

> **Note**
>
> The recommended value is at least 6 FPS. For fast moving objects (running person, vehicle)—at least 12 FPS (see Examples of configuring neural tracker for solving typical tasks).

4. In the **Minimum number of triggering [2, 100]** field, specify the minimum number of neurotracker triggers required to display the object track. The higher the value of this parameter, the longer it takes from the object detection moment to the display of its track. A low value of this parameter can lead to false positives. The default value is **6**. The value range is 2-100. The entered value that is greater than the maximum value or less than the minimum value from the specified range, is automatically adjusted to the maximum or minimum value, respectively.
5. In the **Track hold time (s)** field, specify the time in seconds after which the object track is considered lost in the range from 0.3 to 1000. This parameter is useful in situations where one object in the frame temporarily overlaps another. For example, when a large vehicle completely overlaps a small one.

> **Note**
>
> If an object (track) is close to the frame boundary, then approximately half the time specified in the **Track hold time (s)** field must elapse from the moment the object disappears from the frame until its track is deleted.

6. Set the **Scanning mode** checkbox to detect small objects. If you enable this mode, the load on the system increases. So we recommend specifying a small number of frames processed per second in the **Frames processed per second [0.016, 100]** field. By default, the checkbox is clear. For more information on the scanning mode, see Configuring the Scanning mode.

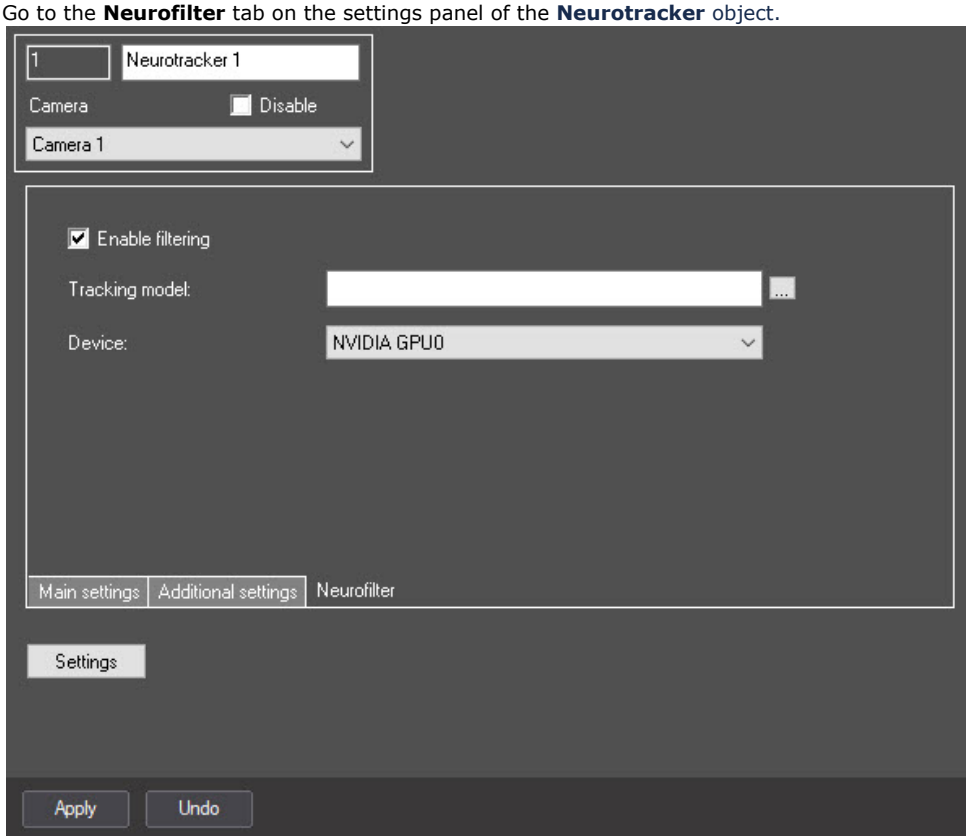
7. If necessary, specify the class of the detected object in the **Target classes** field. If you want to display tracks of several classes, specify them separated by a comma with a space. For example, **1**, **10**.
The numerical values of classes for the embedded neural networks: **1**—Human/Human (top view), **10**—Vehicle.

> **Note**
>
> a. If you leave the field blank, the tracks of all available classes from the neural network will be displayed (**Object type**, **Neural network file**).
> b. If you specify a class/classes from the neural network, the tracks of the specified class/classes will be displayed (**Object type**, **Neural network file**).
> c. If you specify a class/classes from the neural network and a class/classes missing from the neural network, the tracks of a class/classes from the neural network will be displayed (**Object type**, **Neural network file**).
> d. If you specify a class/classes missing from the neural network, the tracks of all available classes from the neural network will be displayed (**Object type**, **Neural network file**).

Neurofilter

You can use the neurofilter to sort out some of the tracks. For example, the neurotracker detects all freight trucks, and the neurofilter leaves only those tracks that correspond to trucks with cargo door open. To configure a neurofilter, do the following:

1. Go to the **Neurofilter** tab on the settings panel of the **Neurotracker** object.



2. Set the **Enable filtering** checkbox to enable neurofilter. By default, the checkbox is clear.
3. By default, the standard (default) neural network is initialized according to the device selected in the **Device** drop-down list. The standard neural networks for different processor types are selected automatically. If you use a custom neural network, click the ... button to the right of the **Tracking model** field and in the standard Windows Explorer window, specify the path to the file.

> **Attention!**
>
> To train a neural network, contact the AxxonSoft technical support (see Data collection requirements for neural network training). A neural network trained for a specific scene allows you to detect objects of a certain type only (for example, a person, cyclist, motorcyclist, and so on).

4. From the **Device** drop-down list, select the device on which the neural network will operate: CPU, one of NVIDIA GPUs, or one of Intel GPUs. **Auto** (default value)—the device is selected automatically: NVIDIA GPU gets the highest priority, followed by Intel GPU, then CPU.

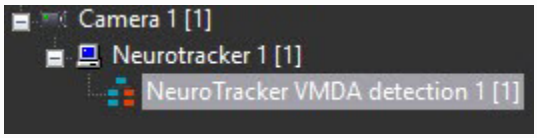
Attention!

a. The device for the neurofilter must match the device specified for the neurotracker in the **Device** drop-down of the main settings. If you select **Auto**, the neurofilter will run on the same processor as the neurotracker, according to the priority.
b. It may take several minutes to launch the algorithm on NVIDIA GPU after you apply the settings.

5. Click the **Apply** button to save the changes.

Note

If necessary, create and configure the NeuroTracker VMDA detection tools on the basis of the **Neurotracker** object. The procedure of creating and configuring the NeuroTracker VMDA detection tools is similar to creating and configuring the VMDA detection tools for a regular tracker. The only difference is that it is necessary to create the NeuroTracker VMDA detection tools on the basis of the **Neurotracker** object, and not the **Tracker** object (see Creating and configuring the VMDA detection). Also, if you select the **Staying in the area for more than 10 sec** detector type, the time the object stays in the zone, after which the NeuroTracker VMDA detection tools are triggered, is configured using the LongInZoneTimeout2 registry key, not LongInZoneTimeout. The procedure of configuring the alarm generation mode for any type of VMDA detection tools is similar to the VMDA detection tools for a regular tracker using the **VMDA.oneAlarmPerTrack** registry key (see Registry keys reference guide).



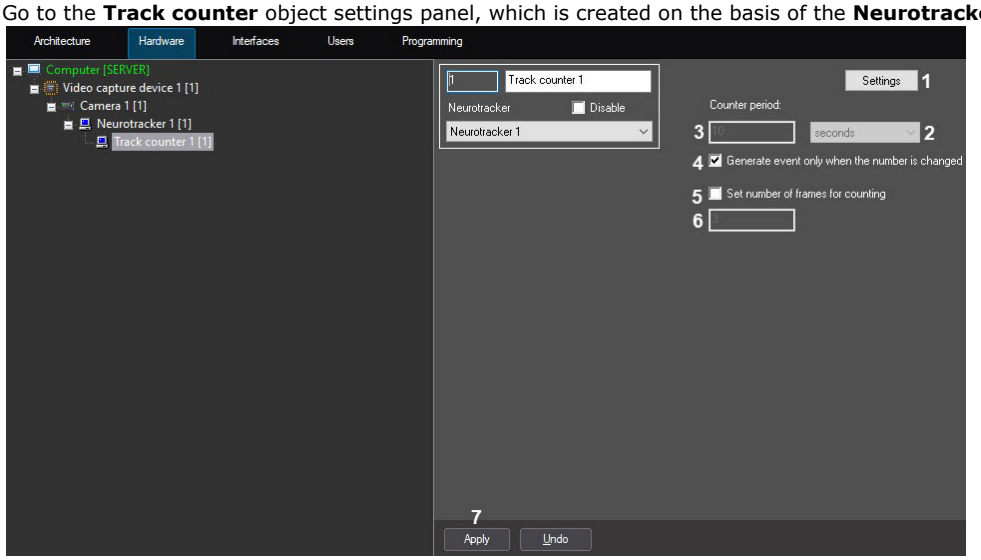
Configuration of the *Neurotracker* module is complete.

If events are periodically received from several objects, then for convenience, you can create and configure neurotracker track counters (see Configuring the neurotracker track counter).

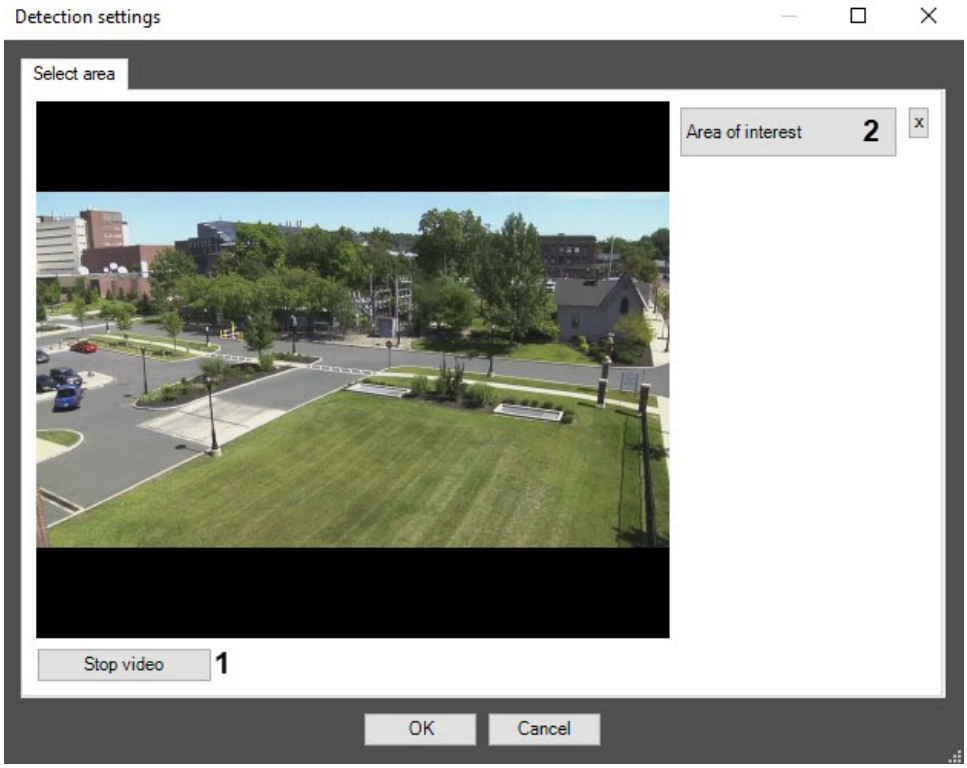
Configuring the neurotracker track counter

The neurotracker track counter is configured as follows:

1. Go to the **Track counter** object settings panel, which is created on the basis of the **Neurotracker** object.

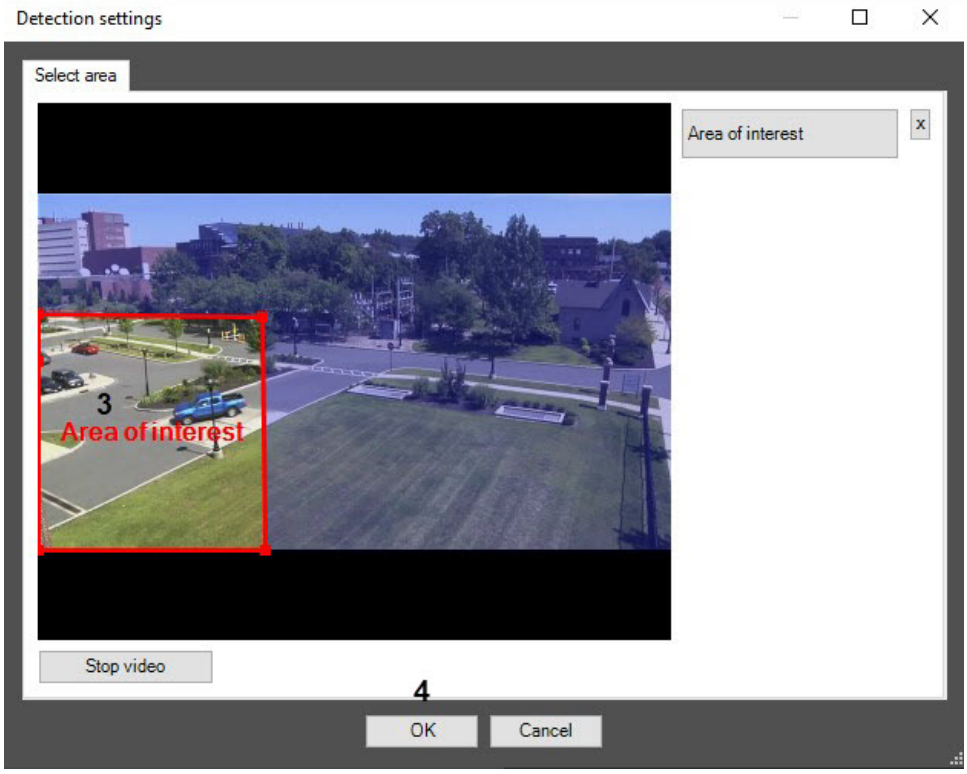


2. On the video image, specify the surveillance area, within which the track counter will count the objects:
   a. Click the **Settings** button (**1**). As a result, the **Detection settings** window will open.



   b. Click the **Stop video** button (**1**) to capture a frame of the video image.

c. Click the **Area of interest** button (**2**) and select the area, within which the track counter will count the objects (**3**).



> **Note**
>
> To delete the selected area, click the x button.

d. Click the **OK** button (**4**).

3. If the **Generate event only when the number is changed** checkbox (**4**) is not set, then from the **Counter period** drop-down list (**2**), select the counter period time unit: **seconds**, **minutes**, **hours**, **days**. Then in the field (**3**), specify the time in which the event containing the total number of objects recorded for a given time period will be generated.
4. Set the **Generate event only when the number is changed** checkbox (**4**) if it is necessary to generate events only when the number of recorded objects changes.

> **Note**
>
> If this checkbox is set, the **Counter period** field becomes inactive, and the specified value of the counter period is ignored.

5. If objects are lost during the track counter operation, then for more accurate counting, set the **Set number of frames for counting** checkbox (**5**) and in the field (**6**), enter the number of frames that will be analyzed to calculate the average objects number.

> **Note**
>
> - This feature works only if the **Generate event only when the number is changed** checkbox is set.
> - The value of the number of frames for counting is selected experimentally depending on the neural network used. Recommended values are: 3, 5, 7, 9.

6. Click the **Apply** button (**7**).

The neurotracker track counter is configured.

> **Note**
>
> To display the events that were generated by the neurotracker track counter in the **Event Viewer**, it is necessary to configure a filter for the track counter. For details, see Configuring event filters for displaying in the Event viewer.

Examples of configuring neural tracker for solving typical tasks

Recommended neurotracker settings for detecting moving people or vehicles are shown in the table:

Settings	Task: detection of moving people	Task: detection of moving vehicles
Main		
The number of frames processed per second	6	12
Minimum number of triggerings	6	6
Neural filter	no	no
Recognition threshold	30	30
Tracking model	Path to the *.ann neural network file. Or you can select a specific **Object type**.	Path to the *.ann neural network file. Or you can select a specific **Object type**.
Objects to process	Only moving objects	Only moving objects

Note

By default, the neural tracker is configured for detection of moving people.

Person location tracker

Functionality of the Person location tracker module

The *Person location tracker* is the detection module for tracking the human location on the video image using the neural network, which allows reducing the processing load and improving the detection quality. The *Person location tracker* allows detecting the human pose and generating the corresponding event.

On the basis of the *Person location tracker*, the **Pose detection** objects can be created, including the following detections:

- Sitting person detection—the detection triggers when a sitting human is found in the frame.
- Recumbent person detection—the detection triggers when a recumbent human is found in the frame.
- Hands up detection—the detection triggers when a human with one or two hands raised is found in the frame. The hand is considered being raised if the forearm is parallel to the backbone.
- Person detection—the detection triggers when any pose of a human is found in the frame.
- Close-standing people detection—the detection triggers if the distance between two people is less than specified.

On the basis of the *Person location tracker*, the **Shooter detection** object can be created, including the following detection:

- Shooter detection—the detection triggers when a human reaching their hand forward parallel to the ground is found in the frame.

Video stream and scene requirements for the Person location tracker module

The requirements for the cameras that will work with the *Person location tracker* module are listed in the following table.

Video stream from camera	• The resolution is at least 640x360 pixels. It is also not recommended to use a resolution higher than 1920×1080, since higher resolution does not increase the detection quality, but significantly increases the consumption of resources. The optimal resolution for solving typical tasks is 1280x720. • The frame rate per second in the video stream from the camera is at least 8. • Color image only
Lighting	• Lighting in the scene is at least 50 lux per square meter. In conditions of insufficient or excessive lighting (night or light-striking), stable operation of the video analytics is not guaranteed. • There are no abrupt changes in lighting
Scene and camera angle	• Moving objects are visually separable from each other. • The background is mostly static and does not change abruptly. • Moving objects are minimally obscured by static objects in the scene (columns, trees, and so on). • The analyzed scene does not have reflective surfaces and sharp shadows from moving objects. If present, they should be masked. • Camera shake does not result in image offsets greater than 1% of the frame size
Objects image	Objects image requirements for Person location tracker

Attention!

Correct operation of the Person location tracker and pose detection tools isn't guaranteed if you use fisheye cameras and other cameras with strong image distortion.

Correct operation of the Person location tracker and pose detection tools isn't guaranteed if you use a video stream or frames that were masked before they got into *Axxon PSIM* by an IP camera or similar means and methods.

Requirements for software and hardware platform

Objects image requirements for Person location tracker

To ensure the correct recognition of a person's posture, the following image requirements should be met:

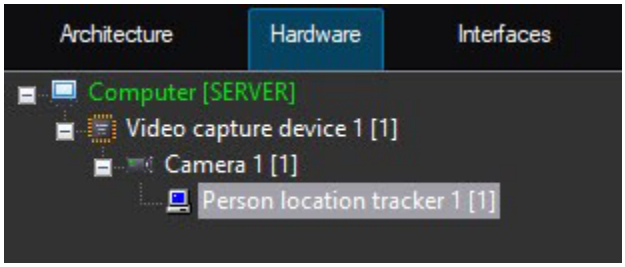
1. The object to be detected is clearly distinguishable by the human eye.
2. The detected object is completely within the frame.
3. The image is not noisy and not distorted by compression algorithm artifacts.
4. The duration of the object's visibility is at least 2 frames.
5. The minimum value of pixel density per meter is observed:

Image resolution	Object type	Minimum pixel density per meter (ratio of the object width in pixels to the object width in meters)	Minimum object size in pixels, Width x Height
For pose detection tools			
1920x1080	Human	170	~102x309
1280x720	Human	128	~77x233
640x360	Human	80	~48x145

Video stream and scene requirements for the Person location tracker module

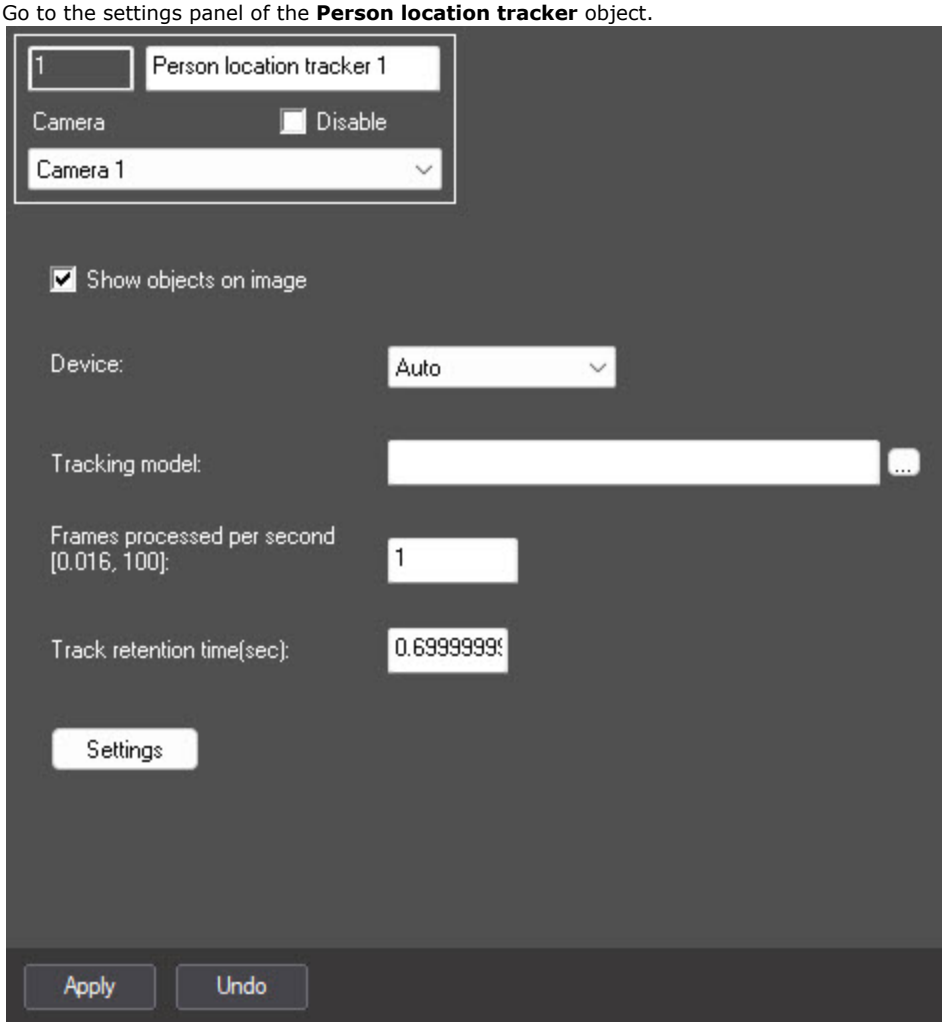
Configuring the Person location tracker module

The *Person location tracker* software module is configured on the settings panel of the **Person location tracker** object. This object is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.



The *Person location tracker* software module is configured as follows:

1. Go to the settings panel of the **Person location tracker** object.



2. Set the **Show objects on image** checkbox, if it is necessary to highlight the detected object with a frame when viewing live video.
3. From the **Device** drop-down list, select the device on which the neural network will operate. **Auto**—device is selected automatically: NVIDIA GPU gets the highest priority, followed by Intel GPU, then CPU.

> **Attention!**
>
> - We recommend using the GPU.
> - It may take several minutes to launch the algorithm on NVIDIA GPU after you apply the settings. You can use caching to speed up future launches (see Optimizing the operation of neural analytics on GPU).

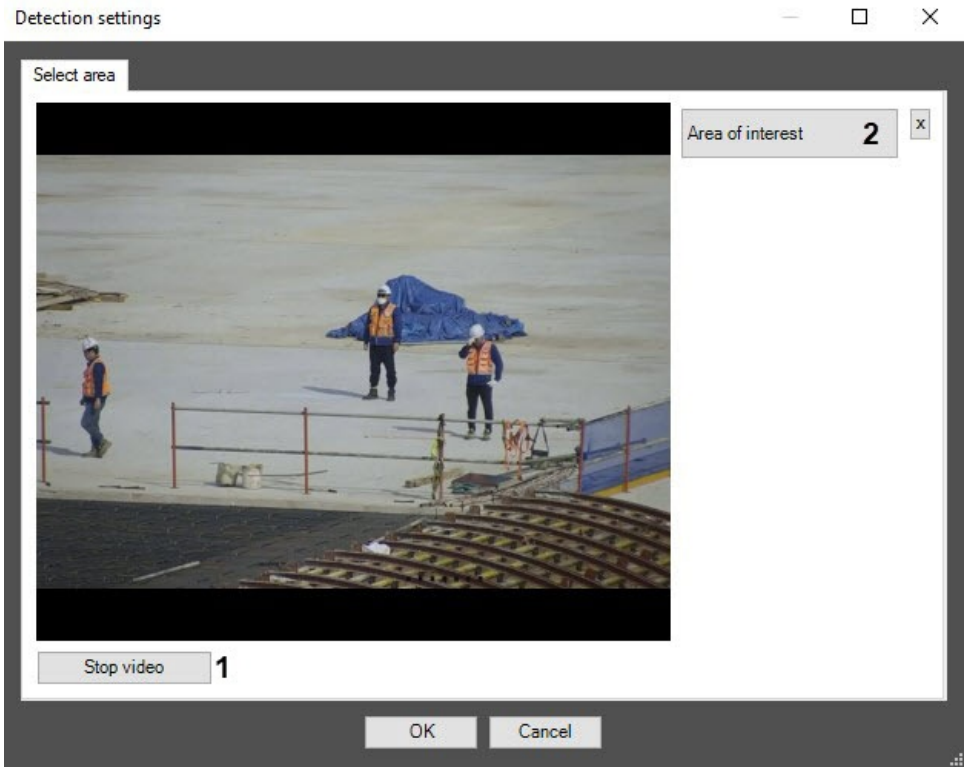
4. If you want to use a unique neural network, in the **Tracking model** field, click the ... button. In the opened standard Windows Explorer window, specify the neural network file. If you leave the field blank, the default networks will be used. They are selected automatically depending on the selected device.
5. In the **Frames processed per second [0.016, 100]** field, set the number of frames per second that will be processed by the detection tool.

> **Attention!**
>
> For the scenes with static people, the FPS value must be at least 2. For the scenes with moving people—at least 4.
>
> The larger this value, the higher the accuracy of pose detection, but the greater the CPU load. With FPS=1, the accuracy will be no less than 70%.
>
> This parameter varies depending on the object speed of movement. To solve typical tasks, FPS value from 3 to 20 is sufficient. Examples:
>
> - pose detection for moderately moving objects (without sudden movements)—FPS=3;
> - pose detection for moving objects—FPS=12.

6. In the **Track retention time (sec)** field, specify the time in seconds in the range from 0.3 to 1000 after which the object track is considered lost. This parameter is useful in situations when one object in the frame temporarily overlaps another.

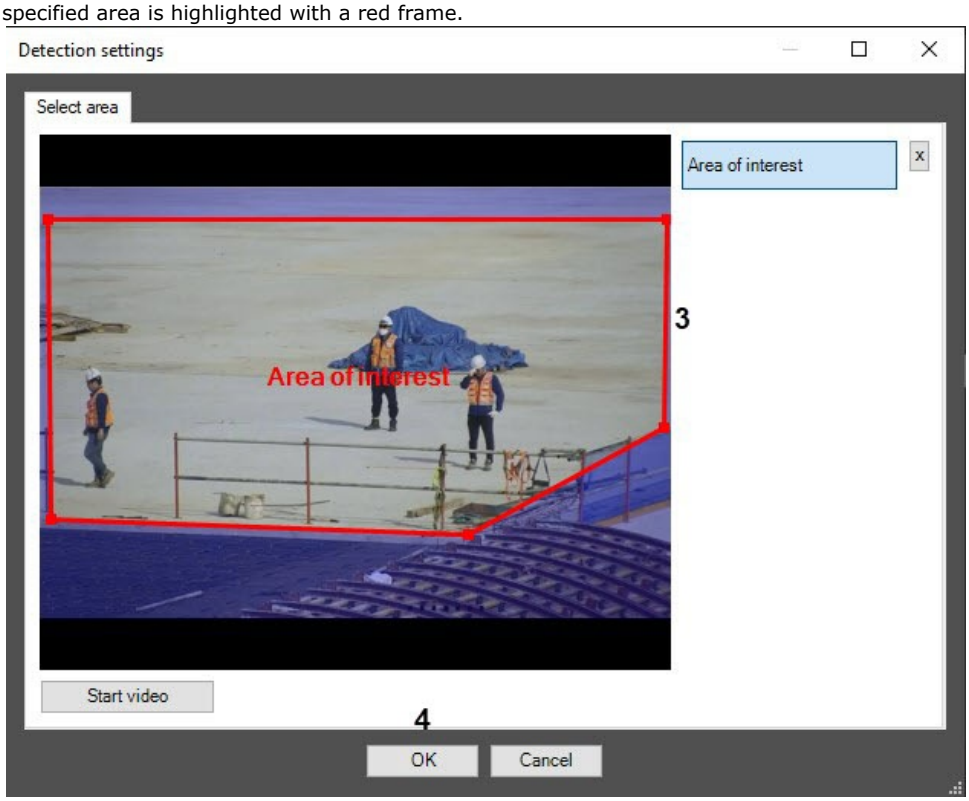
> **Note**
>
> If an object (track) is close to the frame border, then approximately half the time specified in the **Track retention time (sec)** field must elapse from the moment the object disappears from the frame until its track is deleted.

7. Click the **Settings** button. As a result, the **Detection settings** window opens.



   a. Click the **Stop video** button (**1**) to capture a frame.

b. Click the **Area of interest** button (**2**) and specify the area in which the Person location tracker will operate (**3**). The specified area is highlighted with a red frame.



> **Note**
>
> To delete the selected area, click the x button.

c. Click the **OK** button (**4**) to save the settings of the detection tool.

8. Click the **Apply** button on the settings panel of the **Person location tracker** object
9. Configure the Pose detection (see Configuring the Pose detection), the Shooter detection (see Configuring the Shooter detection), or the Handrail grip detection (see Configuring the Handrail grip detection).

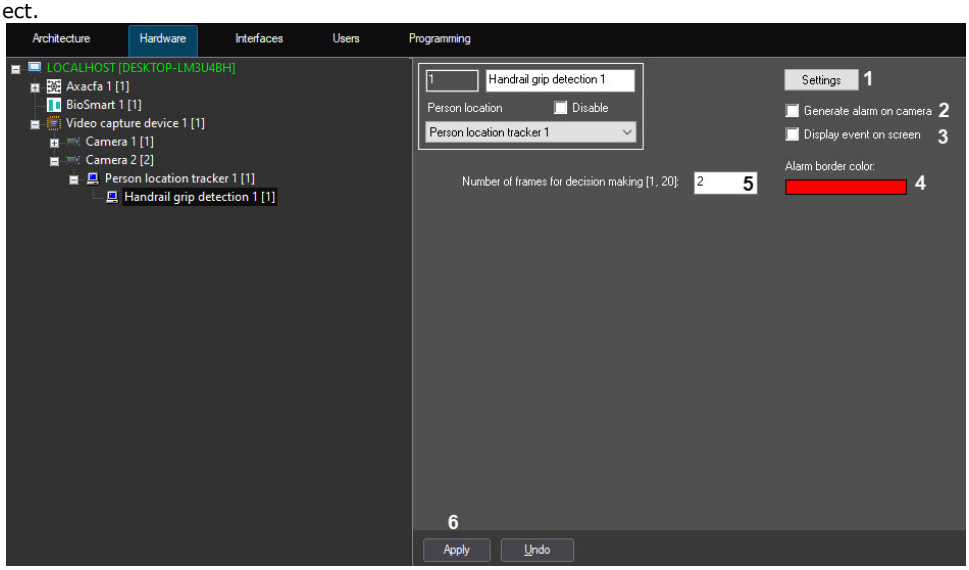
Configuration of the *Person location tracker* software module is complete.

Configuring the Handrail grip detection

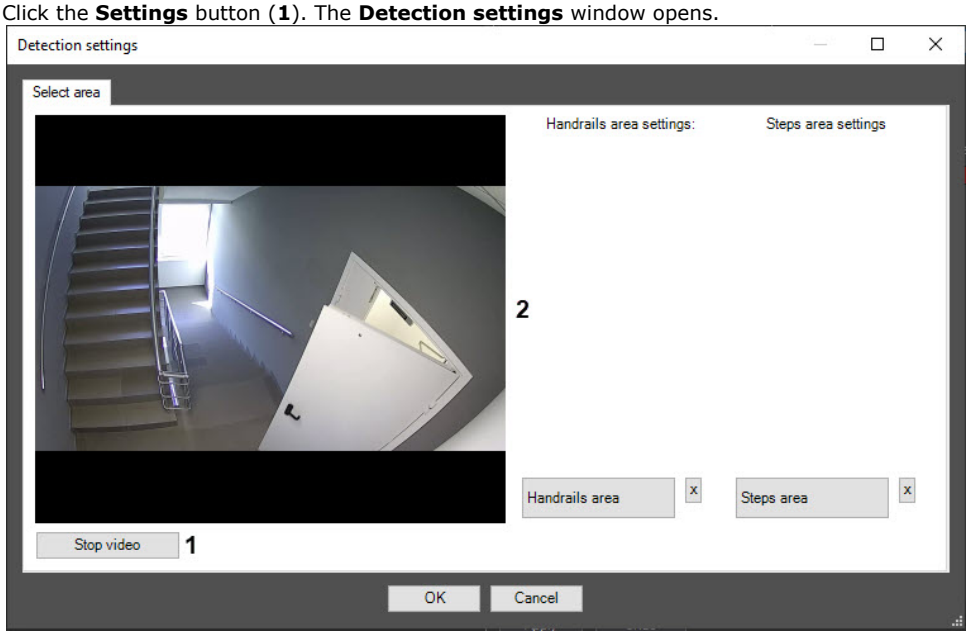
The Handrail grip detection is used to detect safety violations when a person is walking on stairs and doesn't hold the handrail with their hands.

To configure the Handrail grip detection, do the following:

1. Go to the settings panel of the **Handrail grip detection** object that is created on the basis of the **Person location tracker** obj ect.

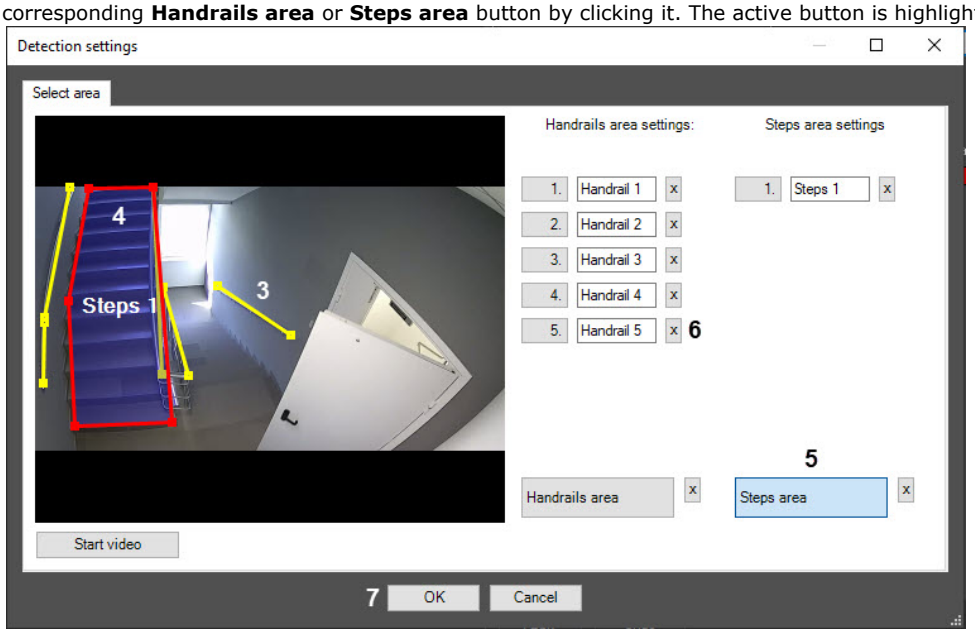


2. Configure the handrails and steps areas. For this, do the following:
   a. Click the **Settings** button (**1**). The **Detection settings** window opens.



   b. Click the **Stop video** button (**1**) to capture a frame of the video image (**2**).

c. On the captured frame, set at least one handrails area (**3**) and at least one steps area (**4**). To add an area, enable the corresponding **Handrails area** or **Steps area** button by clicking it. The active button is highlighted in blue (**5**).

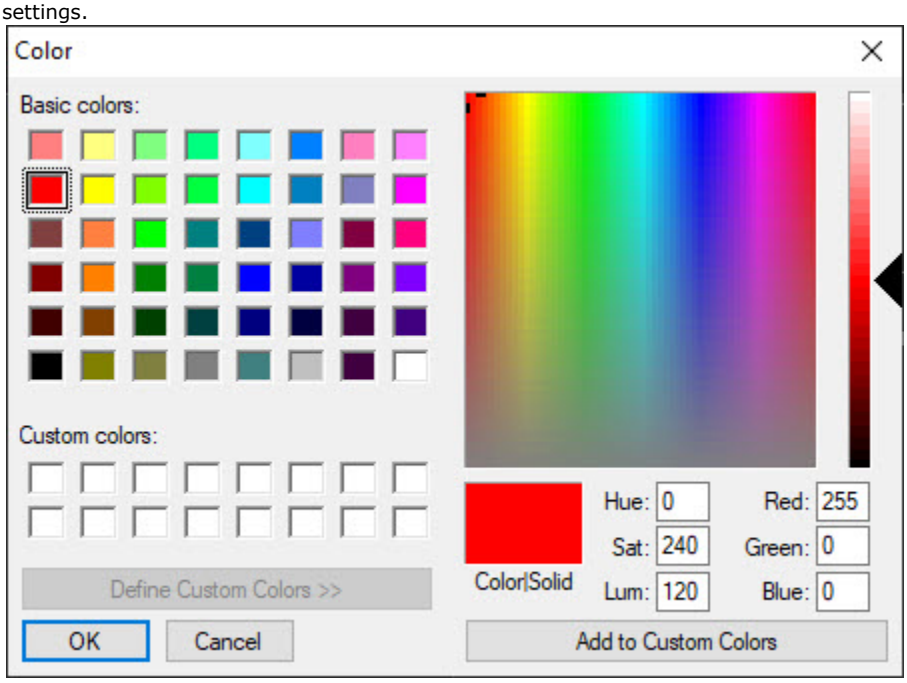


> **Note**
>
> - For the Handrail grip detection to work, you must create at least one handrails area and at least one steps area. Otherwise the detection tool won't work.
> - To delete an area, click the x button to the right of the corresponding steps or handrail area (**6**).
> - If the handrail in the frame is curved, you must specify it with several lines.
> - The accuracy of specifying the handrails and steps areas increases the accuracy of the detection.
> - If the handrail is wide, it is recommended to specify the handrail line in the middle of the handrail.
> - The location of the object in the steps area is determined by the middle of the lower extremities (the middle between the ankles. If they aren't visible, then the middle between the knees).

d. Click the **OK** button (**7**) to save the changes and return to the settings panel of the detection tool.

3. On the settings panel of the detection tool, set the **Generate alarm on camera** checkbox (**2**) to generate an alarm on camera when the detection tool is triggered. By default, the checkbox is clear.
4. Set the **Display event on screen** checkbox (**3**) to display an alarm border on the screen when the detection tool is triggered. You can specify the color of the alarm border in the next step. By default, the checkbox is clear.

5. In the **Alarm border color** field (**4**), specify the color of the alarm border using the color palette. The default color is red. You can open the **Color** palette by double-clicking the color field. After selecting the frame color, click the **OK** button to save the settings.

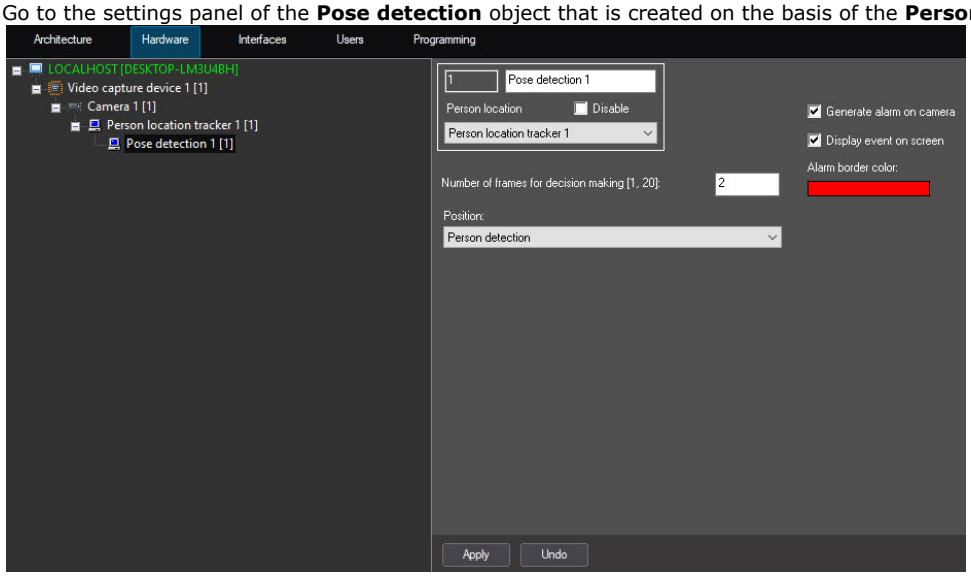


6. In the **Number of frames for decision making (1, 20)** field (**5**), enter the required number of frames from 1 to 20, on which a person is walking on the stairs and doesn't hold the handrail, to generate the corresponding event. The default value is
.
7. Click the **Apply** button (**6**) to create a detection tool with the specified settings.

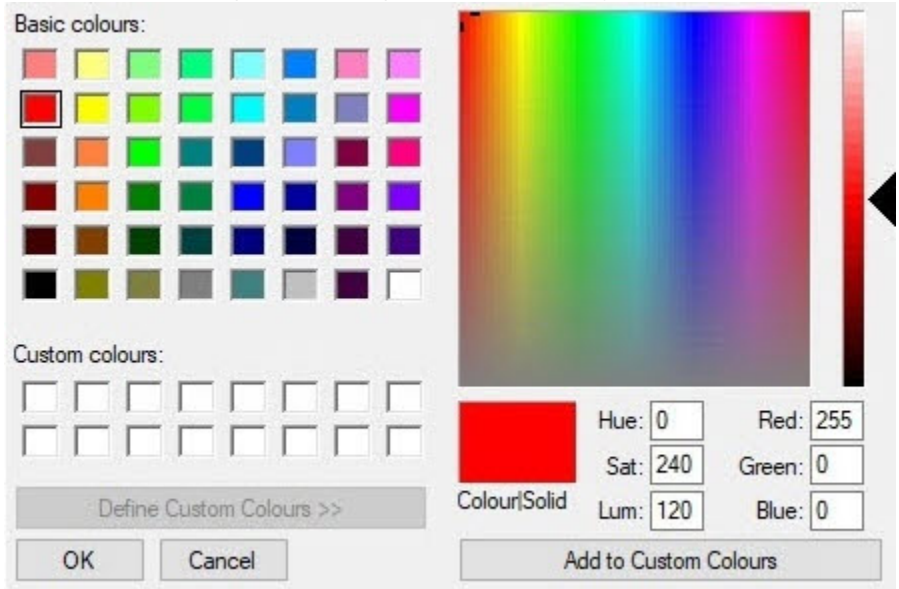
Configuring the Pose detection

To configure the Pose detection, do the following:

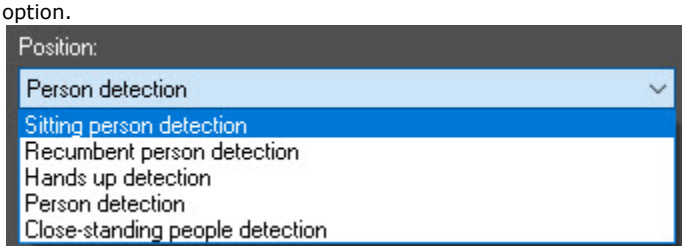
1. Go to the settings panel of the **Pose detection** object that is created on the basis of the **Person location tracker** object.



2. In the **Number of frames for decision making [1, 20]** field, enter the required amount of frames from 1 to 20 on which a person must be found in the specified pose to trigger the corresponding event. The default value is **2**.
3. Set the **Generate alarm on camera** checkbox to gererate an alarm on camera when the detection tool detects the specified pose. The checkbox is clear by default.
4. Set the **Display event on screen** checkbox to display an alarm border on the screen when the detection tool triggers. You can specify the color of the alarm border in the next step. The checkbox is clear by default.
5. In the **Alarm border color** field, specify the color of the alarm border using the color palette. The default color is red. Double click the color field to open the **Color** palette. After selecting the border color, click the **OK** button to save the settings.

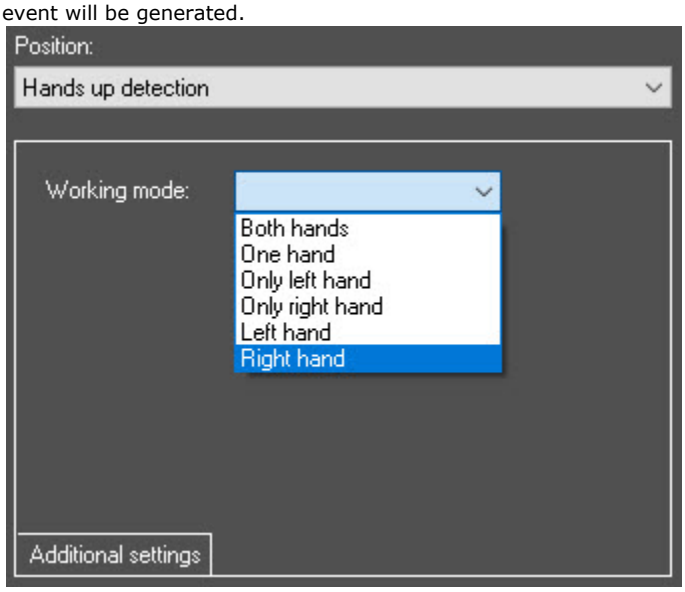


6. From the **Position** drop-down list, select the person position that you want to detect. Further settings depend on the selected option.

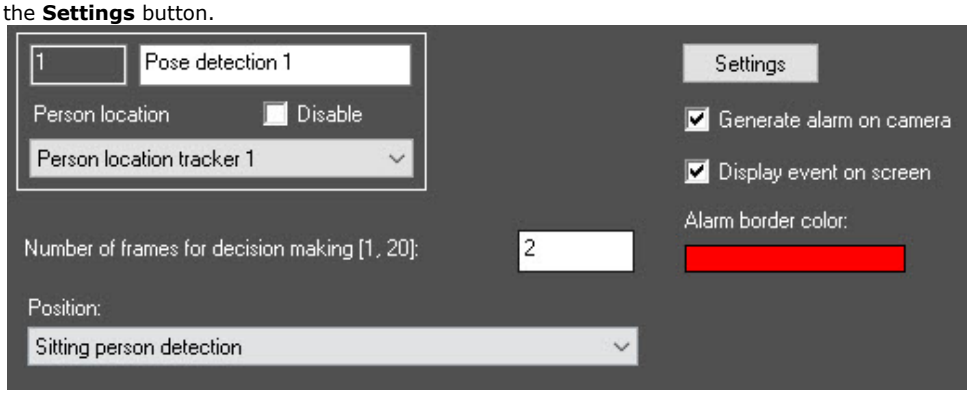


   a. **Person detection**—the detection tool triggers when there is a person in any pose in the frame.

b. **Hands up detection**—the detection tool triggers when there is a person with hands raised in the frame. A hand is considered raised if the forearm is parallel to the backbone and the wrists are above the shoulders. If this detection is selected, the additional settings will become available. **Working mode**—sets the hands position at which the alarm event will be generated.

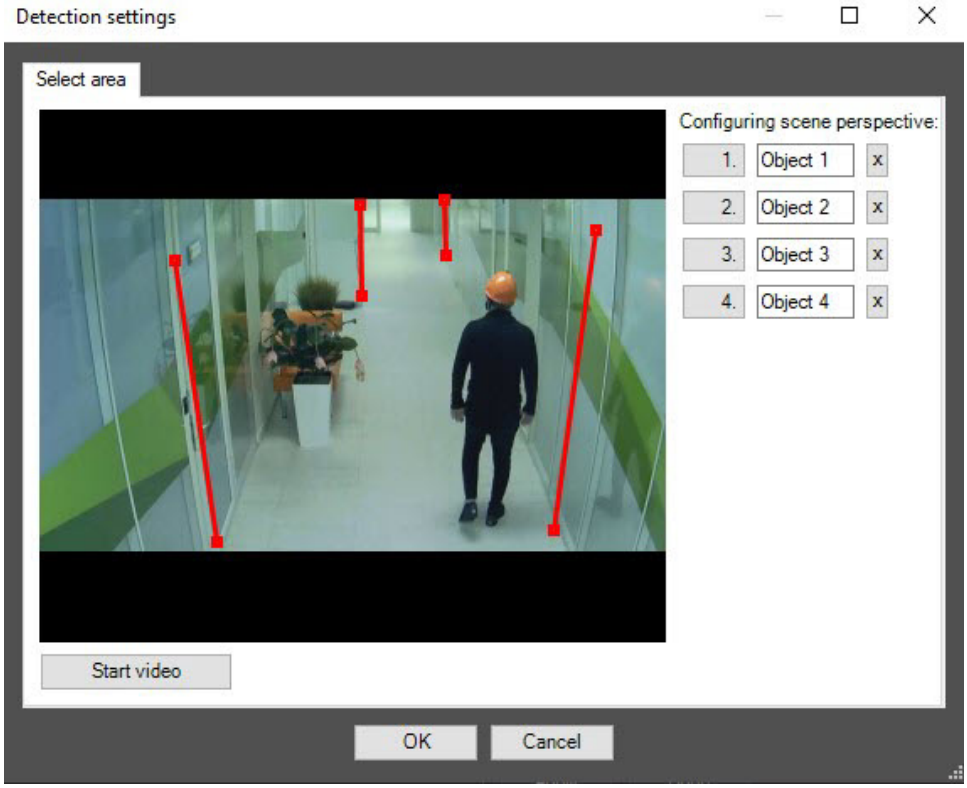


c. **Sitting person detection**—the detection tool triggers when there is a sitting person in the frame. For this and further options of the person position, perspective adjustment is available. To adjust the perspective of the video image, click the **Settings** button.



i. In the **Detection settings** window, click the **Stop video** button to capture a frame.

ii. Specify at least three calibration segments in different parts of the frame. To create a calibration segment, click and hold the left mouse button on the video image so that you can specify the necessary length size. You can change the size of the already created segments using the anchor points. The calibration segments must be located at different angles to each other depending on the scene and the distortion of the video image.



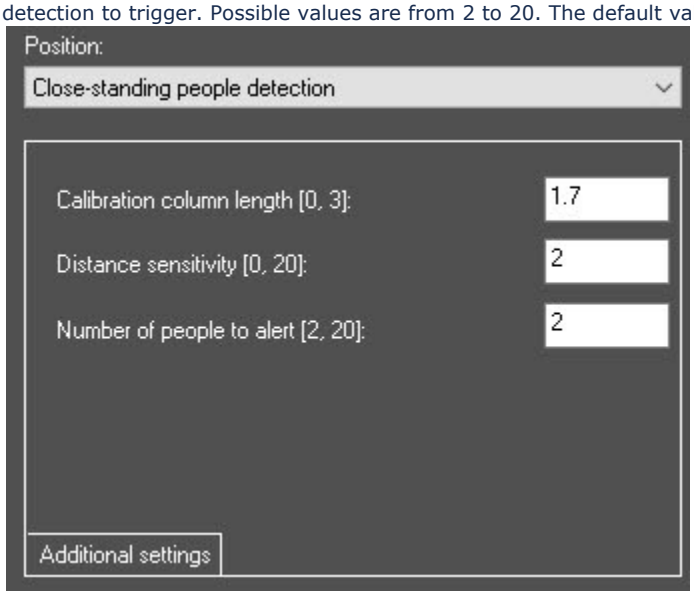
To delete the created segment, click the x button.

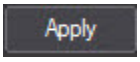
iii. Click the **OK** button to save the settings of the perspective of the video image.

d. **Recumbent person detection**—the detection tool triggers when there is a recumbent person in the frame. You can exclude repeated triggering of the Pose detection tool when there is a recumbent person in the frame by using the **Rec**

umbent.SkipSitPeople registry key with the value **1**, and the **Recumbent.SkipSitPeopleTimeOffset**, and **Recumbent.SkipSitPeopleAreaOffset** registry keys. For more information on registry keys, see Registry keys reference guide. For the information on working with the registry, see Working with Windows OS registry.

e. **Close-standing people detection**—the detection tool triggers when there are close-standing people in the frame. If you select this detection, the following additional settings will become available:
   i. **Calibration column length [0, 3]**—sets the length of the calibration segments from 0 to 3 meters that were set when adjusting the perspective of the video image. The default value is **1.7**;
   ii. **Distance sensitivity [0, 20]**—sets the minimum distance between people from 0 to 20 meters. If the distance between people in the frame is equal to or less than the specified value, then the detection will trigger. The default value is **2**;
   iii. **Number of people to alert [2, 20]**—sets the number of people who must break the distance for the detection to trigger. Possible values are from 2 to 20. The default value is **2**.



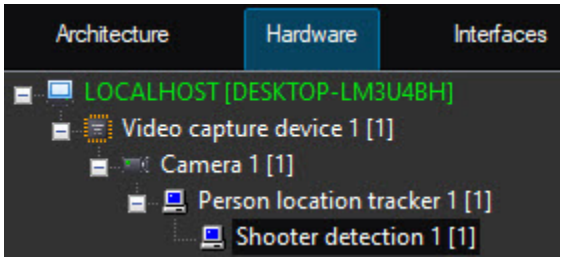
7. Click the **Apply** 

button to save the settings.

The Pose detection is now configured.

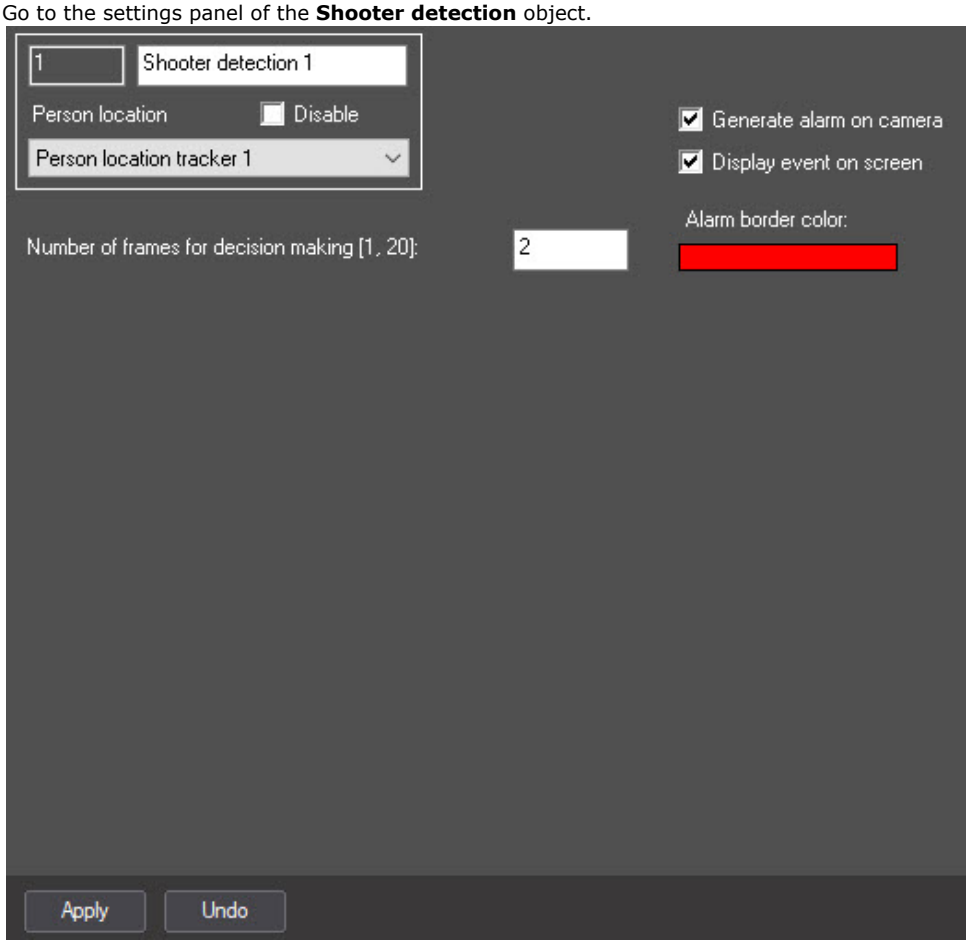
Configuring the Shooter detection

The **Shooter detection** object is created on the basis of the **Person location tracker** object on the **Hardware** tab of the **System settings** dialog window.



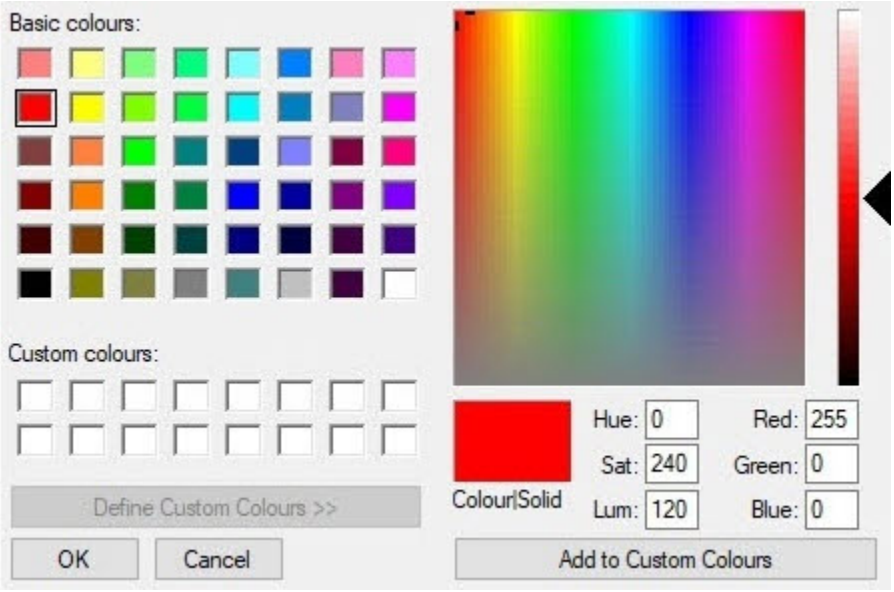
To configure the **Shooter detection**, do the following:

1. Go to the settings panel of the **Shooter detection** object.



2. In the **Number of frames for decision making [1, 20]** field, enter the required amount of frames from 1 to 20 on which a person must be found in the shooter pose to trigger the corresponding event. The default value is **2**.
3. Set the **Generate alarm on camera** checkbox to gererate an alarm on camera when the detection tool detects the specified pose. The checkbox is clear by default.
4. Set the **Display event on screen** checkbox to display an alarm border on the screen when the detection tool triggers. You can specify the color of the alarm border in the next step. The checkbox is clear by default.

5. In the **Alarm border color** field, specify the color of the alarm border using the color palette. The default color is red. Double click the color field to open the **Color** palette. After selecting the border color, click the **OK** button to save the settings.



6. Click the **Apply** button.

The Shooter detection is now configured.

VI abandoned objects street detection

Functionality of the VI abandoned objects street detection module

The *VI abandoned objects street detection* software module has the following features:

1. Automatic detection of abandoned or disappeared objects that remain stationary for a certain period of time in the specified detection zones with scene changes due to weather conditions or unstable lighting.
2. Generation of an alarm when abandoned or disappeared objects are detected in the specified detection zones.

Camera requirements for the VI abandoned objects street detection module

Camera requirements for the *VI abandoned objects street detection* module are given in the table:

Camera	• Pitch angle of the camera optical axis relative to the horizontal plane:
	  ◦ at least 15 degrees for the inclined method of placement
	  ◦ from 80 to 100 degrees for placement on ceiling
	• Resolution is from 640x360 to 1920×1080 pixels
	• Resolution can be:
	  ◦ lower for close-up scenes (2–7 meters for cameras with standard focal length) without loss of recognition quality
	  ◦ higher for scenes far from camera (from 10 meters)
	• FPS is at least 25
	• Color image only

Lighting	• Lighting in the scene is from 100 to 1000 lux
Scene and camera angle	• Shooting distance is from 5 to 30 meters • Density of people flow is no more than one person per square meter • Volume of the abandoned object is from 3 cubic decimeters • Background texture: moving, random and inhomogeneous background with contrast variations from 0.2 to 0.8
Object images	• For abandoned objects, the optimum density is 100 pixels per meter • Maximum signal-to-noise ratio (without the function of automatic signal amplification) is at least 42 dB • Resolution of the video image is at least 1280x960 pixels • Image isn't noisy and isn't distorted by artifacts of the compression algorithm • Distortion is no more than 10% (at the edges of the frame—at a distance of one third from its center in width, height and diagonal)

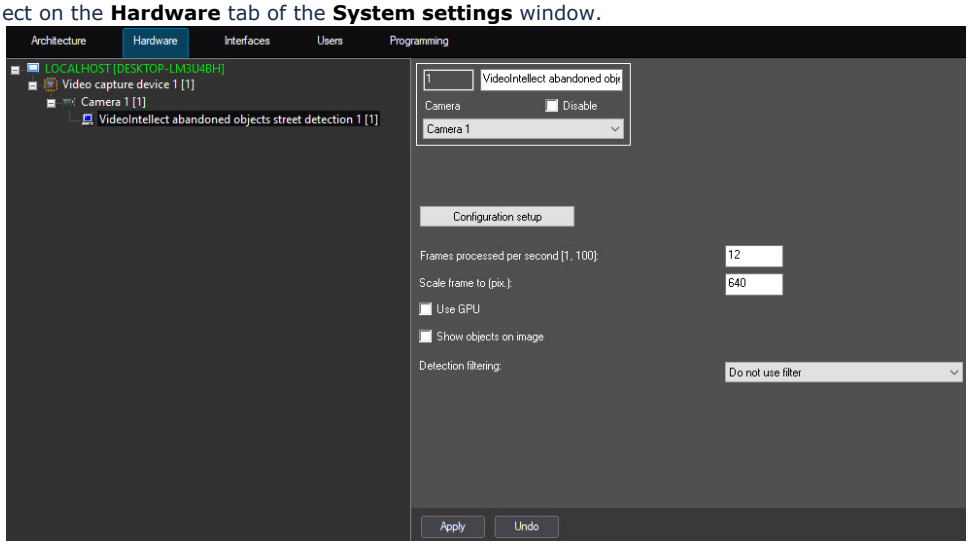
Configuring the VI abandoned objects street detection module

На странице:

Configuration of the *VI abandoned objects street detection* module includes general settings and configuration setup: determining the configuration parameters and detection tool characteristics.

General settings of the detection tool

1. Go to the settings panel of the **VI abandoned objects street detection** object that is created on the basis of the **Camera** obj ect on the **Hardware** tab of the **System settings** window.



2. In the **Frames processed per second [1, 100]** field, specify the number of frames in the range 1-100 that the detection tool processes per second. The default value is **12** (recommended). You can specify only a positive integer. If you enter a number outside the range 1-100, it is automatically changed to the nearest border value. If you leave the field blank, it automatically returns to the default value when you save the settings.
3. In the **Scale frame to (pix.)** field, specify in the range 480-960 the size of the frame in pixels after scaling. The default value is **640**.
4. Set the **Use GPU** checkbox to use NVIDIA GPU when working with the neural network.
5. Set the **Show objects on image** checkbox to highlight the detection zone with a red border on the Video surveillance monitor when an object detection event is received.
6. From the **Detection filtering** drop-down list, select the filter that you want to use: **Object filter**, **Object counting filter**, **Do not use filter** (default). You can configure filters on the **Postprocessing** tab of the **Detection settings** window.
7. Click the **Configuration setup** button. The **Detection settings** window opens.

The Select area tab

1. In the **Detection settings** window, on the **Select area** tab, click the **Stop video** button to pause video playback.

2. By default, one detection zone is highlighted with a red border. You can add more zones with the mouse, as well as change the borders of a zone by clicking its number in the list on the right. Number of a detection zone is highlighted in blue.

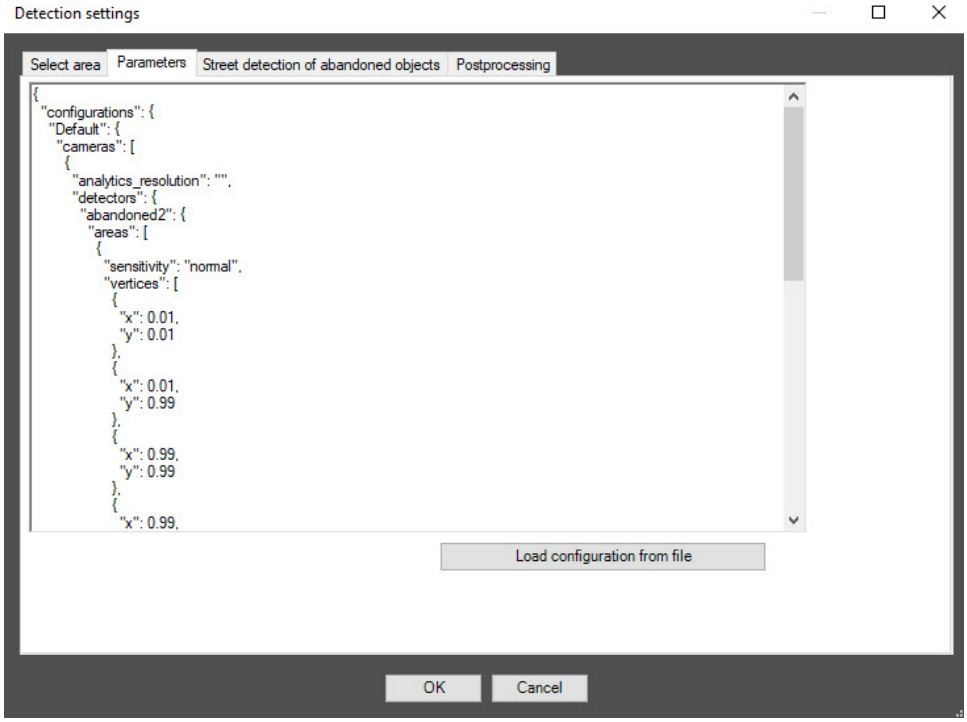
3. To rename a detection zone, enter a new name in field to the right of its number. The new name appears in the zone caption on the video image.

> **Note**
>
> To delete a detection zone, click the x button to the right of the zone name.

4. To save all changes, click the **Apply configuration changes** button.
5. To start video playback, click the **Start video** button.

The Parameters tab

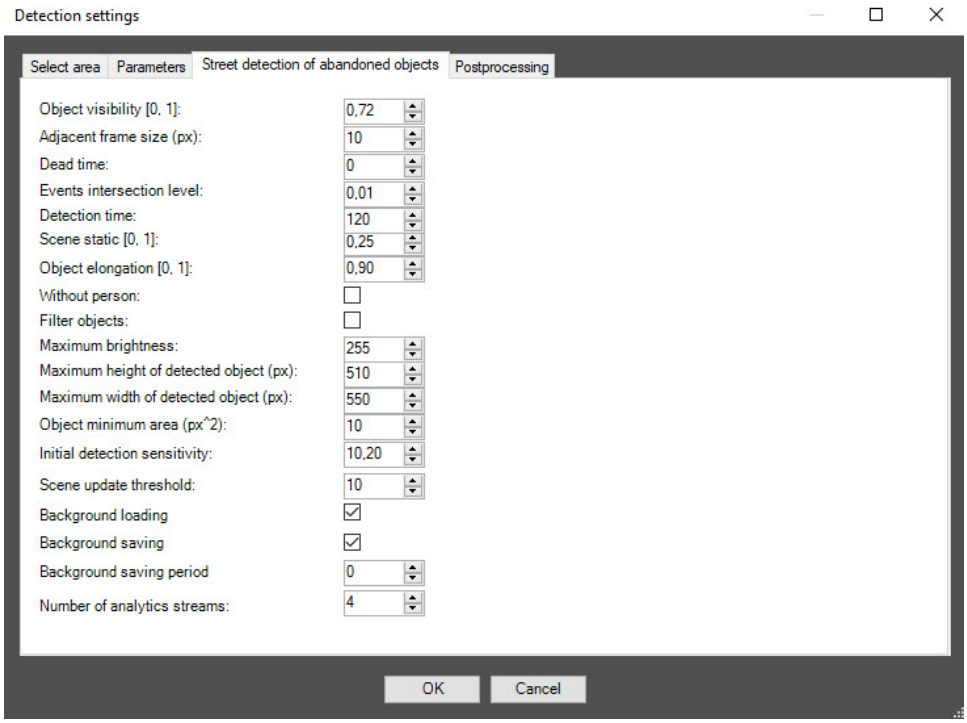
1. Go to the **Parameters** tab. The parameters of the configuration that you use are displayed here. If you don't want to change the configuration, skip steps 2 and 3 and go to the next tab.



2. To use your configuration, click the **Load configuration from file** button.
3. In the standard Windows search window that opens, specify the path to the prepared configuration file in JSON format.

The Street detection of abandoned objects tab

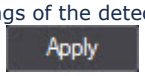
1. Go to the **Street detection of abandoned objects** tab.



2. In the **Object visibility [0, 1]** field, specify in fractions the sensitivity of the detection tool to detect barely visible, merging with the background objects in the range 0-1. The higher the value of the parameter, the less noticeable object can be detected. The recommended value (default) is **0.72**.
3. In the **Adjacent frame size (px)** field, specify in pixels the maximum distance between the objects, the frames of which are merged. The default value is **10**.

4. In the **Dead time** field, specify the time interval in seconds, during which the occurrence of a repeated event is blocked. An event is considered repeated if its event intersection level is equal to or greater than the value specified in step 5. The default value is **0**.
5. In the **Events intersection level** field, in the range 0-1, specify the level representing the way the repeated events are filtered An event is considered repeated if the ratio of the intersection area to the area of the conjunction of two events is greater than or equal to the value specified in this parameter. The default value is **0.01**. This parameter value is used in the **Dead time** parameter.
6. In the **Detection time** field, specify the time interval in seconds, after which an object is considered abandoned. The default value is **120**.
7. In the **Scene static [0, 1]** field, specify in fractions the level of scene statics in the range 0-1. The higher the value of the parameter, the less the scene dynamics is taken into account. The default value is **0.25**.
8. In the **Object elongation [0, 1]** field, specify in fractions the level of object elongation in the range 0-1. Objects with a greater level of elongation don't trigger the detection tool. The default value is **0.90**.
9. Set the **Without person** checkbox so that objects near people are ignored. By default, the checkbox is clear, which means that objects near people are also detected.
10. Set the **Filter objects** checkbox to enable the neural network filter of objects. By default, the checkbox is clear, which means that the neural network filter is disabled.
11. In the **Maximum brightness** field, specify in the range 0-255 the maximum allowable brightness of an object that you want to detect. The default value is **255**.
12. In the **Maximum height of detected object (px)** field, specify in pixels in the range 0-2160 the maximum allowable height of an object that you want to detect. Larger objects don't trigger the detection tool. The default value is **510**.
13. In the **Maximum width of detected object (px)** field, specify in pixels in the range 0-4096 the maximum width of an object that you want to detect. Larger objects don't trigger the detection tool. The default value is **550**.
14. In the **Object minimum area (px^2)** field, specify in pixels raised to the second power the minimum area of an object that you want to detect. Smaller objects don't trigger the detection tool. The default value is **10**.
15. In the **Initial detection sensitivity** field, specify as a percentage the minimum value to distinguish an object from the background. If this parameter is lower than the threshold value for an object, the detection tool doesn't trigger. The default value is **10.20**.
16. In the **Scene update threshold** field, specify as a percentage the minimum value to update the background if the number of changes in the frame exceeds it. The default value is **10**.
17. Clear the **Background loading** checkbox to disable the loading of video background. By default, the checkbox is set. After restart, the detection tool loads the previously saved background not to retrain the network model.
18. Clear the **Background saving** checkbox so that the background isn't saved. By default, the checkbox is set, which means that the background of the video is saved regularly with the periodicity specified in the **Background saving period** field. When you shut down the detection tool, the previously accumulated background is saved to a file for subsequent loading at startup.

> **Note**
>
> If you use the **Background loading** and **Background saving** parameters during initial configuration, you save time on automatic training at the first startup.
> Even if the checkboxes are clear, the background is saved and updated over the specified period, so to completely disable background saving, specify **0** in the **Background saving period** field.

19. In the **Background saving period** field, specify the time period in seconds for which the backgound of the video is saved. The default value is **0**.
20. In the **Number of analytics streams** field, specify the number of video streams that are used for the operation of the neural network analytics. The default value is **4**.
21. Click the **OK** button to save the settings of the detection tool.
22. To save the changes, click the **Apply** 

button on the settings panel of the **VI abandoned objects street detection** object.

Configuration of the *VI abandoned objects street detection* software module is complete.

Operating detection modules

Note

In order to view alarm archive or frame for events of detection modules supporting events in *Event Viewer* or *Operator protocol*, create and configure the detection tool object link with camera—see *Axxon PSIM software. Administrator's Guide*, the most relevant version of this document is available in the AxxonSoft documentation repository.

Operating the Heat map detection

Generating a report on the basis of Heat map detection

Reports are generated via the web-based *WEB Report System PSIM*.

All necessary information is provided in the *WEB Report System PSIM. User Guide*.

Operating the VI detection of movement in prohibited area module

In case of an alarm in the surveillance area, the corresponding message **Movement in prohibited area** from the **VI detection of movement in prohibited area** object is received in the **Event viewer** interface window. When an alarm in the surveillance area stops, the **Triggering end** event is received. See also VI detection of movement in prohibited area.

Event viewer 1 [~6]

Show filters | Clear

Source	Event	Region	Add. info	Card	Date and ti...
VI detection of movement in prohibited area 1	Movement in prohibited area				09.12.2024...
VI detection of movement in prohibited area 1	Movement in prohibited area				09.12.2024...
VI detection of movement in prohibited area 1	Movement in prohibited area				09.12.2024...
VI detection of movement in prohibited area 1	Movement in prohibited area				09.12.2024...
VI detection of movement in prohibited area 1	Movement in prohibited area				09.12.2024...
VI detection of movement in prohibited area 1	Movement in prohibited area				09.12.2024...

For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

If you set the **Show objects on image** checkbox (see Configuring the VI detection of movement in prohibited area module), when the detection tool triggers, an alarm border appears in the monitor window.

Example of displaying the **Movement in prohibited area** event on the monitor:

Operating the VI detection of prohibited direction module

In case of an alarm in the surveillance area, the corresponding message **Prohibited direction movement** from the **VI detection of prohibited direction** object is received in the **Event viewer** interface window. See also VI detection of prohibited direction.

Event viewer 1 [~3]

Source	Event
VI detection of movement in prohibited direction 1	Prohibited direction movement
VI detection of movement in prohibited direction 1	Prohibited direction movement
VI detection of movement in prohibited direction 1	Prohibited direction movement

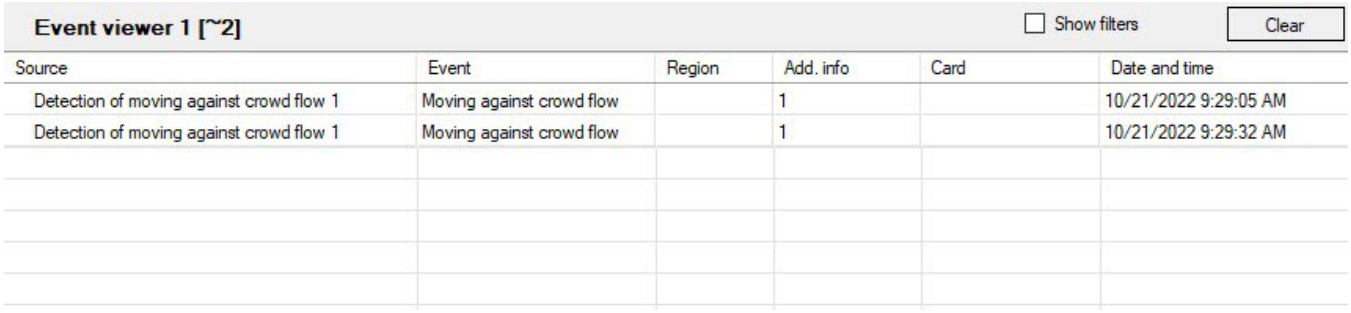
For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

If you set the **Show objects on image** checkbox (see Configuring the VI detection of prohibited direction module), when the detection tool triggers, an alarm border appears in the monitor window.

Example of displaying the **Prohibited direction movement** event:

Operating the Detection of moving against crowd flow

The *Detection of moving against crowd flow* module sends the **Moving against crowd flow** message to the **Event viewer** when the objects moved against a crowd are recognized in the monitored area. Also the **Add. info** column will display the value, corresponding to the direction in which movement against the crowd was detected: **0**—up or **1**—down.



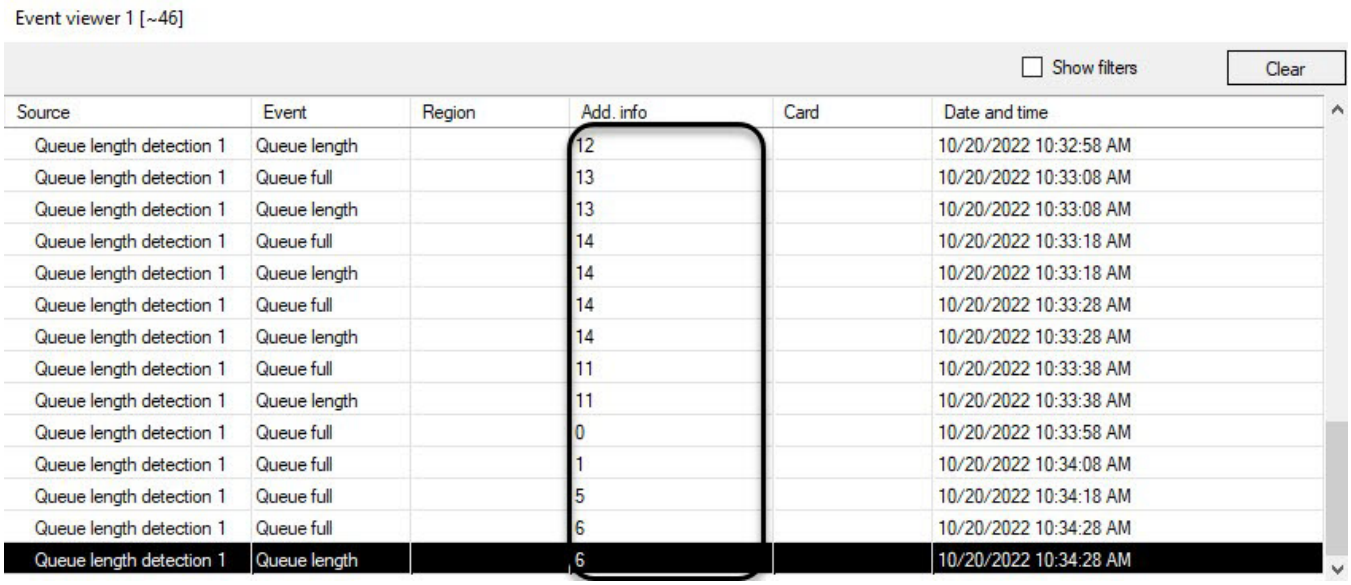
Note.

For more information on working with the **Event viewer** interface, see the Operator's Guide.

Operating the Queue length detection module

Obtaining traffic information in the area of interest

Events from the *Queue length detection* module get at specified intervals to the **Event viewer**.



Note

For more information on working with the **Event viewer** interface, see the Operator's Guide.

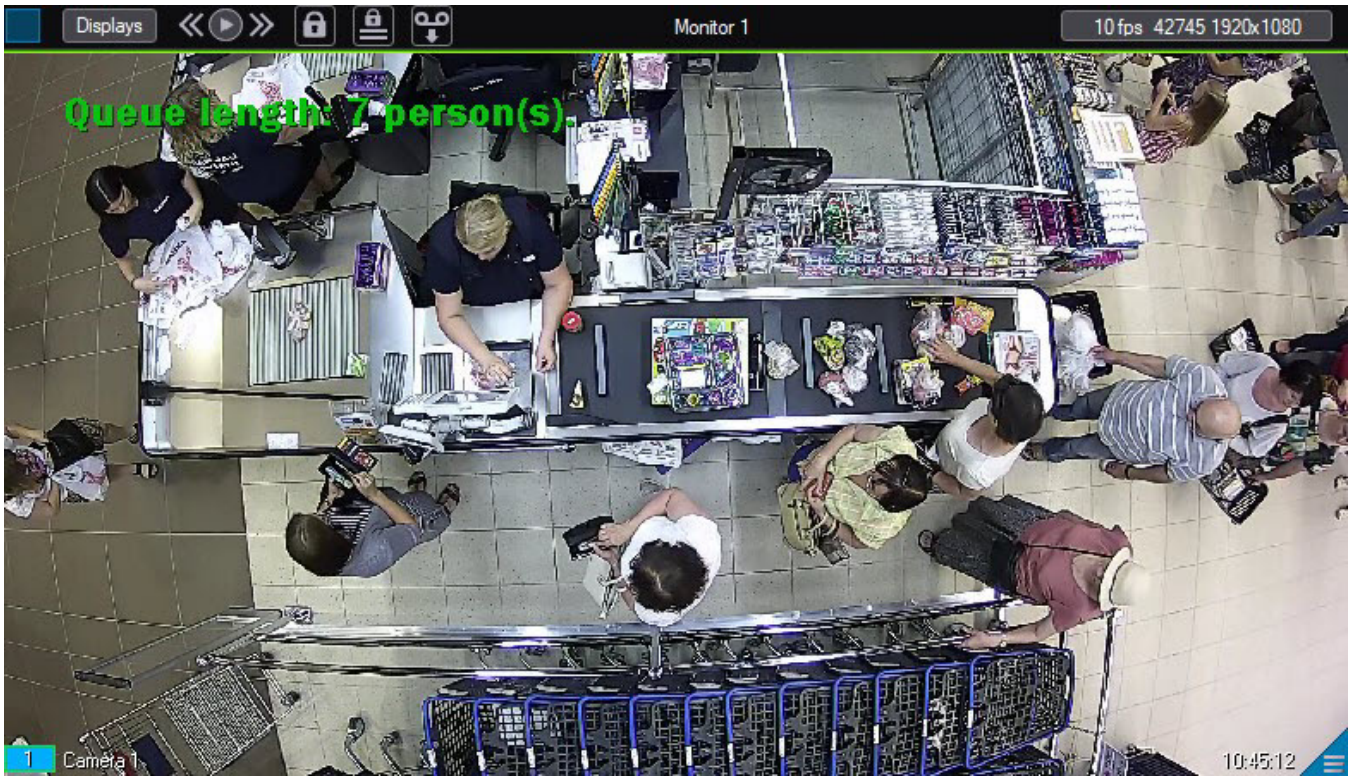
Generating a report on the traffic in the area of interest

Reports on the traffic in the area of interest are generated via the web-based *WEB Report System PSIM*.

All necessary information is provided in the web-based WEB Report System PSIM. User Guide.

Visualization of operating the Queue length detection

Visualization of operating the *Queue length detection* in the Monitor window can be realized with the help of user scripts on the base of the **Titles** object. Detailed description of one of these scripts is presented in the Example 1. Visualization of operating the *Queue length detection* in the Video surveillance monitor on the page Examples of scripts on the Jscript language in the section of The Script object. Programming using the JScript language document.



Operating the Fire detection and Smoke detection modules

The *Fire detection/Smoke detection* module sends the **Fire detected**/**Smoke detected** messages to the **Event viewer** interface window in case of fire/smoke recognizing in the monitored area. When fire/smoke disappears in the monitored area, the **Fire stopped**/**Smoke stopped** event is displayed. If fire/smoke is permanently present in the monitored area, only the event of fire/smoke detection is displayed. If the detection tool is configured correctly, no other events from it come until fire/smoke disappearance. See also Configuring the Fire detection and Smoke detection modules.

Event viewer 1 [~23]

Source	Event	Region	Add. info	Card	Date and time
Fire detection 1	Fire detected				10/21/2022 10:42:09 AM
Fire detection 1	Fire stopped				10/21/2022 10:42:13 AM

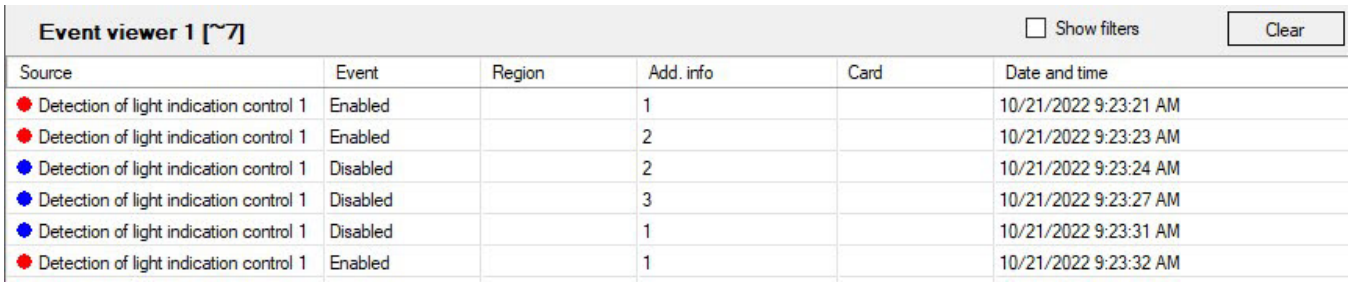
Event viewer 1 [~23]

Source	Event	Region	Add. info	Card	Date and time
Smoke detection 1	Smoke detected				10/21/2022 10:45:36 AM
Smoke detection 1	Smoke stopped				10/21/2022 10:45:49 AM

Detailed information about working with the **Event viewer** interface window is presented in the Operator's Guide. Current version of this document is available in the AxxonSoft documentation repository.

Operating the Detection of light indication control module

The *Detection of light indication control* module sends messaged to the **Event viewer** when the light source is detected or lost in the surveillance area.



Source	Event	Region	Add. info	Card	Date and time
Detection of light indication control 1	Enabled		1		10/21/2022 9:23:21 AM
Detection of light indication control 1	Enabled		2		10/21/2022 9:23:23 AM
Detection of light indication control 1	Disabled		2		10/21/2022 9:23:24 AM
Detection of light indication control 1	Disabled		3		10/21/2022 9:23:27 AM
Detection of light indication control 1	Disabled		1		10/21/2022 9:23:31 AM
Detection of light indication control 1	Enabled		1		10/21/2022 9:23:32 AM

When a light source is detected (enabled), it is logged as an **Enabled** event. If a light source is lost (disabled), it is logged as a **Disable** event. The number of surveillance area from which the event received is displayed in the **Add. info** column.

Operating the VI detection of crowd module

In case of an alarm in the surveillance area, the corresponding message **Crowd detection** from the **VI detection of crowd** object is received in the **Event viewer** interface window. When an alarm in the surveillance area stops, the **Triggering end** event is received. See also VI detection of crowd.

Event viewer 1 [~1]

Source	Event
VI detection of crowd 1	Crowd detection

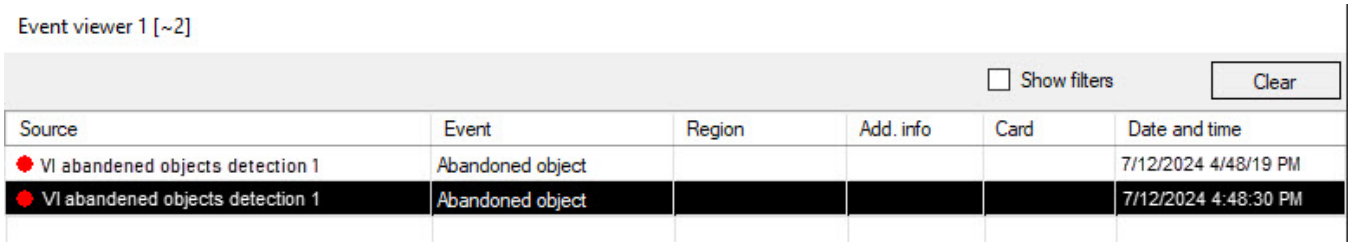
For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

If you set the **Show objects on image** checkbox (see Configuring the VI detection of crowd module), when the detection tool triggers, an alarm border appears in the monitor window.

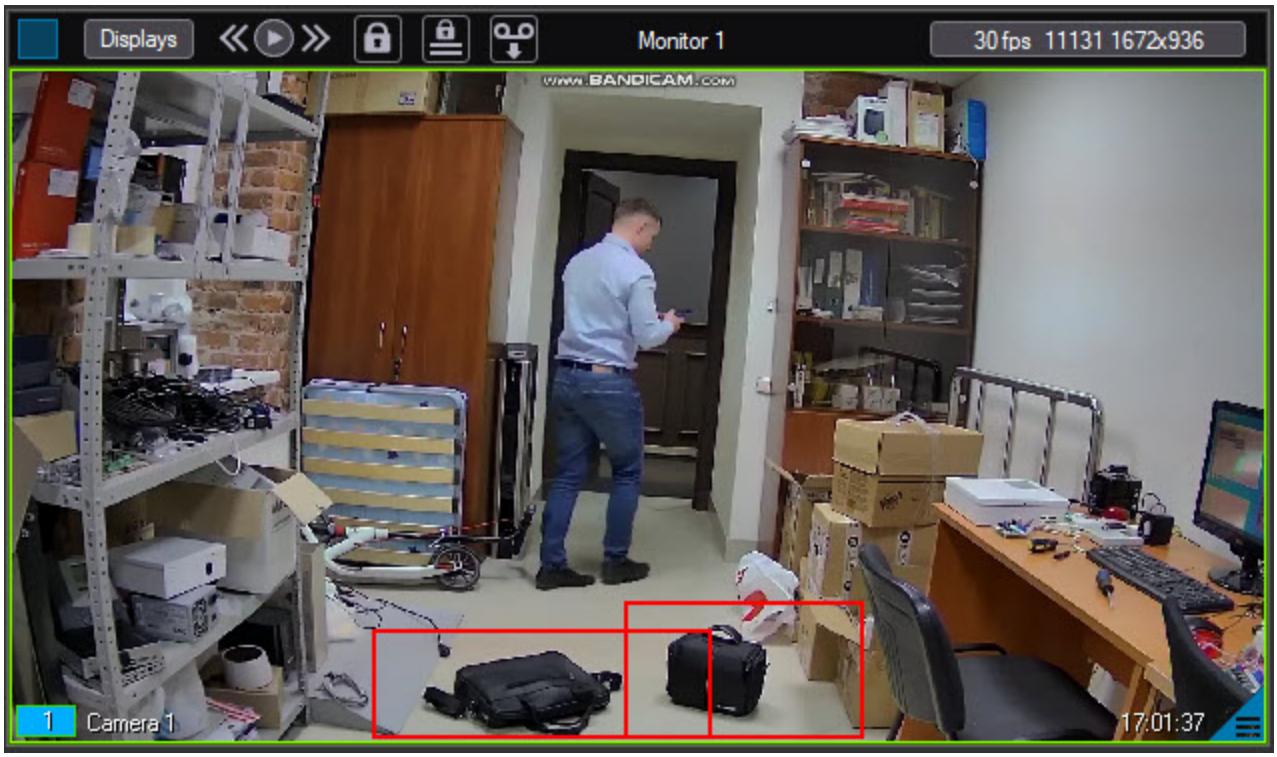
Operating the VI abandoned objects detection module

In case of an alarm in the surveillance area, the corresponding message **Abandoned object** from the **VI abandoned objects detection** object is received in the **Event viewer** interface window. See also "VI" abandoned objects detection.

For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

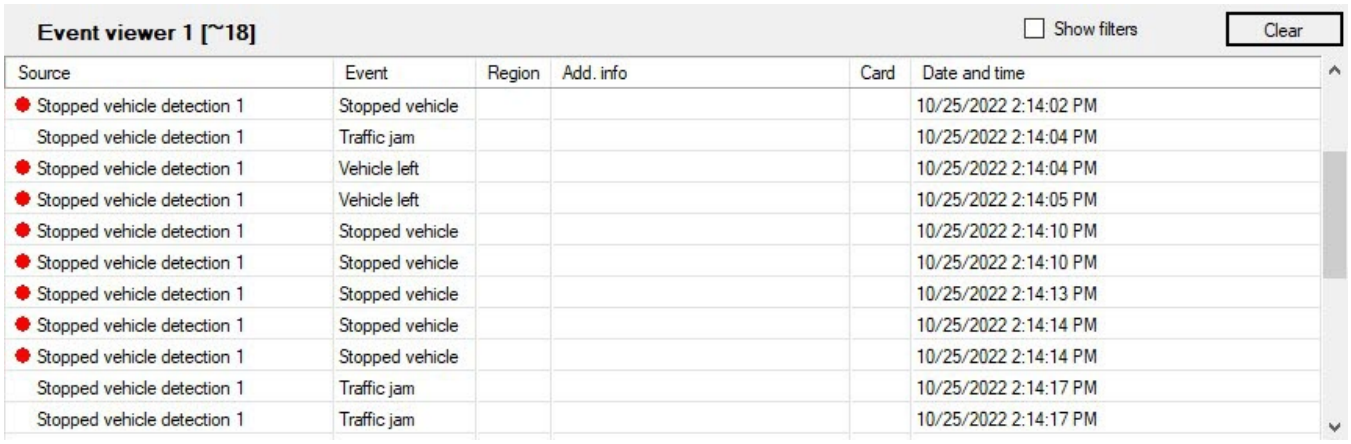


If you set the **Show objects on image** checkbox (see Configuring the VI abandoned objects detection module), when the detection tool triggers, an alarm border appears in the monitor window.



Operating the Stopped vehicle detection module

The *Stopped vehicle detection* module sends messages to the **Event viewer** when the stopped vehicle is detected in the surveillance area.



Note

For more information on working with the **Event viewer** interface, see the Operator's Guide.

When a traffic jam is detected, it is logged as a **Traffic jam** event.

If a stopped car is detected in the surveillance area, it is logged as a **Stopped car** event.

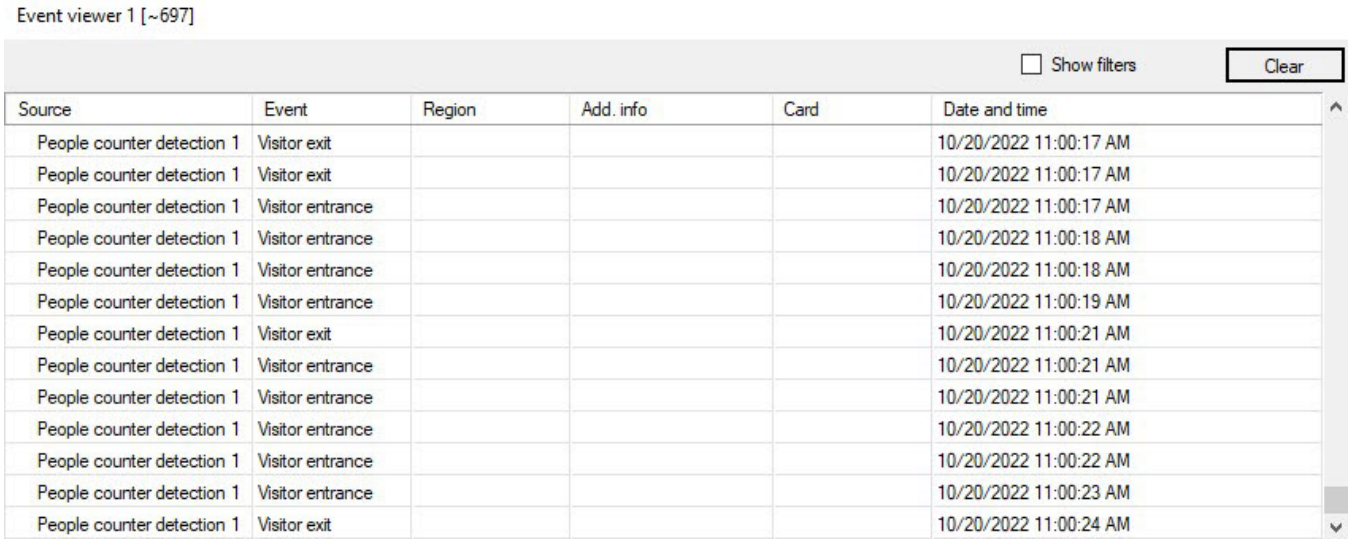
Note

The independent_zone<> parameter of the STOPPEDCAR (**Stopped car**) event contains the id number of a zone where the stopped car was detected. This parameter can be used in macros, programs and scripts. More details on these tools are available in the *Axxon PSIM Software. Administrator's Guide, Programming Guide and Programming Guide (JScript)*. The most recent versions of these documents are available at AxxonSoft documentation repository.

Operating the People counter detection module

Obtaining information on number of visitors

The *People counter detection* module provides entries onto the **Event viewer** when visitors pass through the area of interest.



Source	Event	Region	Add. info	Card	Date and time
People counter detection 1	Visitor exit				10/20/2022 11:00:17 AM
People counter detection 1	Visitor exit				10/20/2022 11:00:17 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:17 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:18 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:18 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:19 AM
People counter detection 1	Visitor exit				10/20/2022 11:00:21 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:21 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:21 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:22 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:22 AM
People counter detection 1	Visitor entrance				10/20/2022 11:00:23 AM
People counter detection 1	Visitor exit				10/20/2022 11:00:24 AM

When a visitor moves from sector 1 to sector 2, it is logged as **Visitor entrance**; if the visitor moves from sector 2 to sector 1, it is logged as **Visitor exit**.

Note.

For more information on working with the **Event viewer** interface, see Operator's Guide.

Generating a visitor report

Visitor reports are generated via the web-based *WEB Report System PSIM*.

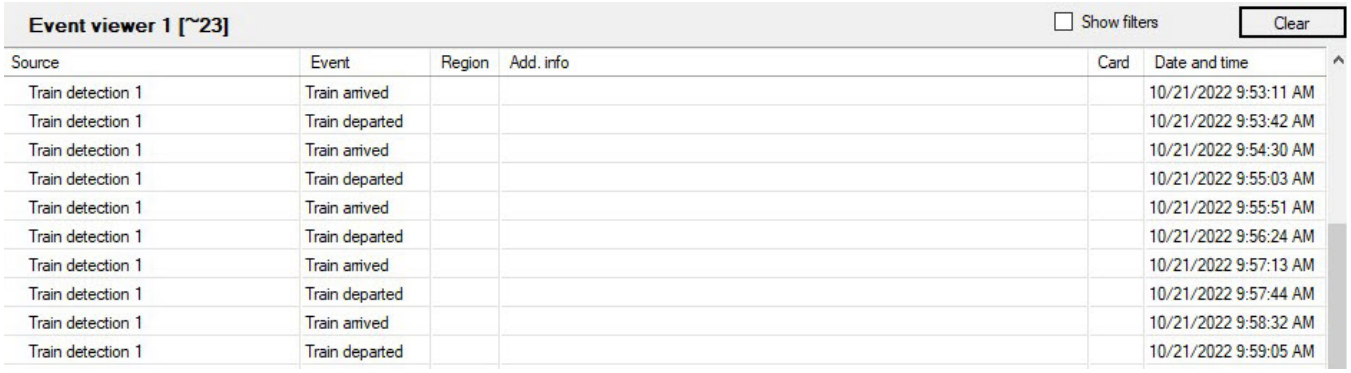
All necessary information is provided in the *WEB Report System PSIM. User Guide*.

Visualization of operating the People counter detection

Visualization of operating the *People counter detection* in the **Monitor** window can be realized with the help of user scripts on the base of the **Titles** object. Detailed description of one of these scripts is presented in the Example 2. Visualization of operating the *People counter detection* in the Video surveillance monitor on the page Examples of scripts on the Jscript language in the section of The Script object. Programming using the JScript language document.

Operating the Train detection module

The *Train detection* module sends messages to the **Event viewer** interface window in case of train recognizing in the monitored area or in case of train disappearance from the monitored area.



When the train is recognized, it is logged as an **Train arrived** event. When the train is disappeared, it is logged as an **Train departed** event.

Operating the Traffic lights detection module

When the state of traffic lights changes in the surveillance area, messages from the *Traffic lights detection* module are received in the **Event viewer** interface window.

For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

Operating the Crowd detection (TVN) module

When the *Crowd detection (TVN)* module is running, the video image is analyzed and, depending on the selected mode (see Configuring the Crowd detection (TVN) module), different messages are sent to the **Event Viewer** interface window.

The **Event Viewer** window when the **Disabled** mode is selected:

Crowd detection (TVN) 1	Crowd		all:0/area1:0		7/4/2023 9:53:34 AM
Crowd detection (TVN) 1	Crowd		all:3/area1:3		7/4/2023 9:53:48 AM

The **Event Viewer** window when the **If threshold exceeded** mode is selected:

Crowd detection (TVN) 1	Number of people threshold value exceeded		all:2/area1:2		7/4/2023 9:52:36 AM
Crowd detection (TVN) 1	Number of people threshold value exceeded		all:7/area1:7		7/4/2023 9:52:51 AM
Crowd detection (TVN) 1	Number of people threshold value exceeded		all:6/area1:6		7/4/2023 9:53:06 AM

The **Event Viewer** window when the **If threshold not reached** mode is selected:

Crowd detection (TVN) 1	Number of people threshold value not reached		all:5/area1:5		7/4/2023 9:51:19 AM
Crowd detection (TVN) 1	Number of people threshold value not reached		all:8/area1:8		7/4/2023 9:51:34 AM
Crowd detection (TVN) 1	Number of people threshold value not reached		all:1/area1:1		7/4/2023 9:51:49 AM

Note

For the detailed information on working with the **Event Viewer** interface window, see Operator's Guide.

Operating the VI detection of camera state module

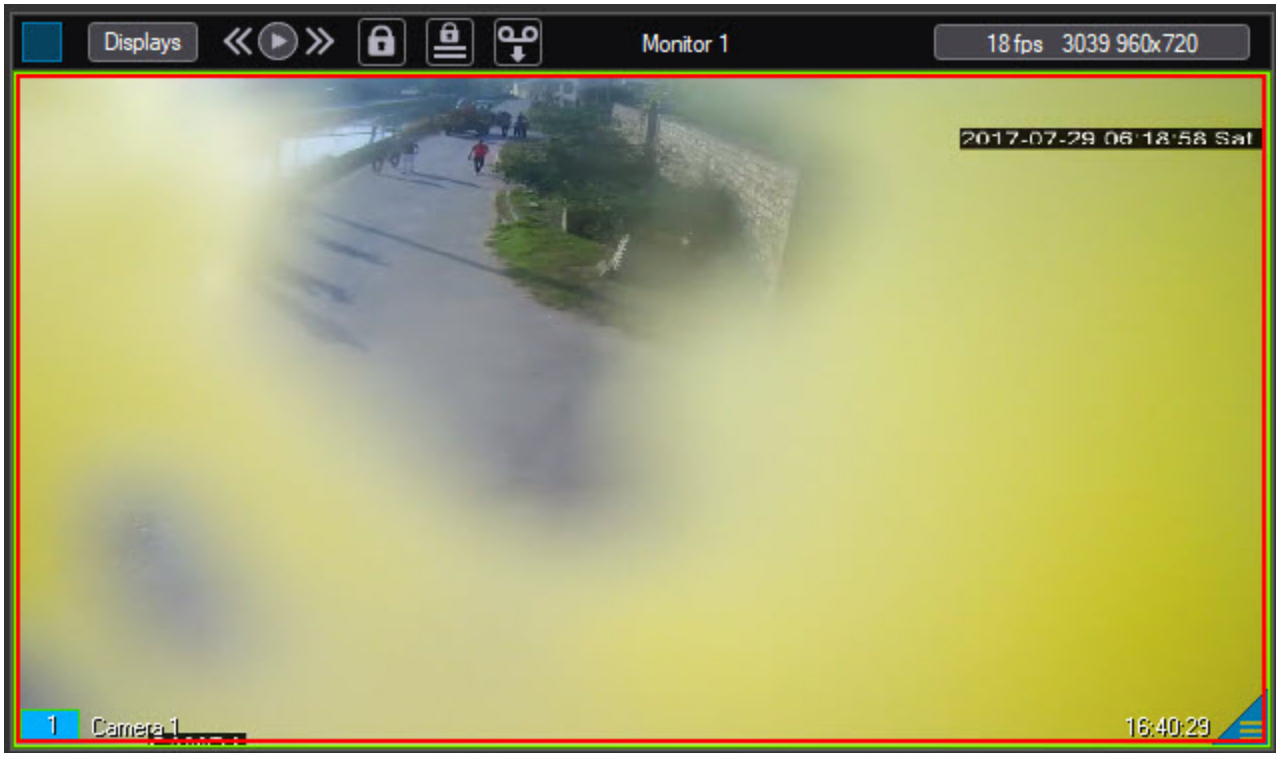
In case of an alarm in the surveillance area, the corresponding message **Camera state change** from the **VI detection of camera state** object is received in the **Event viewer** interface window. When an alarm in the surveillance area stops, the **Triggering end** eve nt is received. See also VI detection of camera state.

Event viewer 1 [~3]

Source	Event
VI detection of camera state 1	Camera state change
VI detection of camera state 1	Camera state change
VI detection of camera state 1	Camera state change

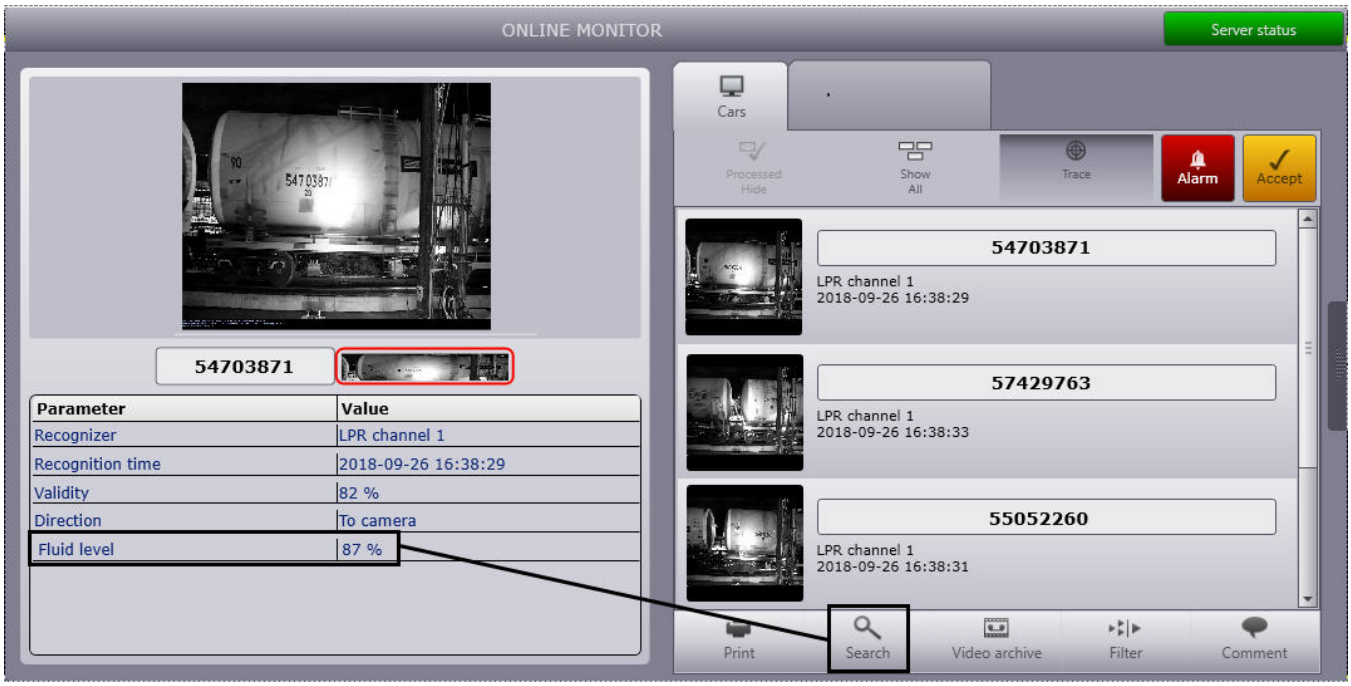
For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

If you set the **Show objects on image** checkbox (see Configuring the VI detection of camera state module), when the detection tool triggers, an alarm border appears in the monitor window.



Operating the Fluid level detection module

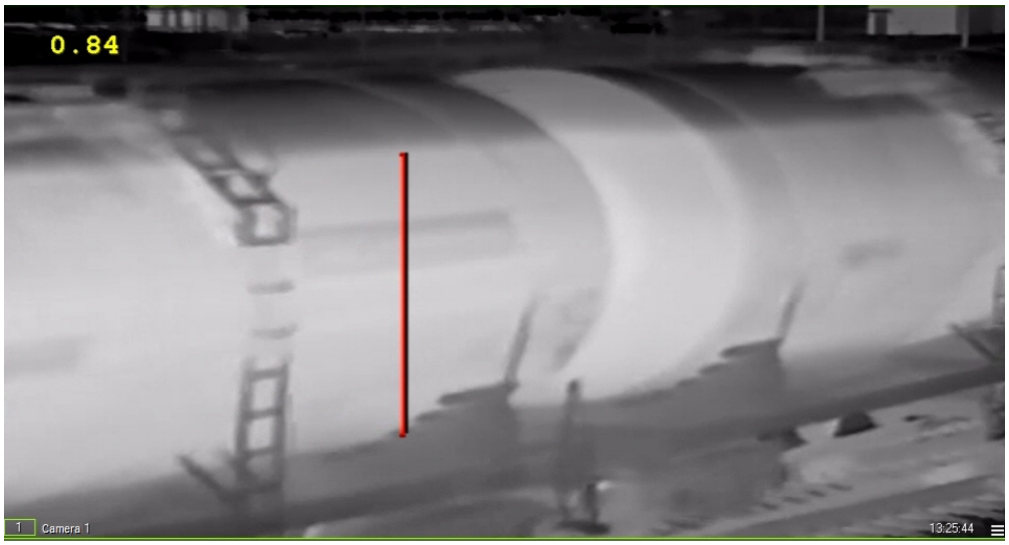
In case the **Fluid level detection** object is selected on the *IntLab* module settings panel, then the *Fluid level detection* module is operated in the **Vehicle tracer** interface window which is the part of *Auto PSIM*. For details on operation of this object, refer to the *Auto PSIM. Operator's Guide* (the most relevant versions of this document is available in the AxxonSoft documentation repository). The fluid level is displayed in the parameters list in the **Online monitor** window when the LP is being recognized. You can also perform a search by the fluid level in the recognizers databases.



The *Fluid level detection* module also displays the fluid level as captions over the video image in the Surveillance Window of the the corresponding camera.

> **Note**
>
> To use this functionality, specify the captioner when configuring the *Fluid level detection* module (see Configuring the Fluid level detection module).

In addition, a script can be created that allows drawing a vertical line on the video image in the Surveillance Window, showing the level of the fill:



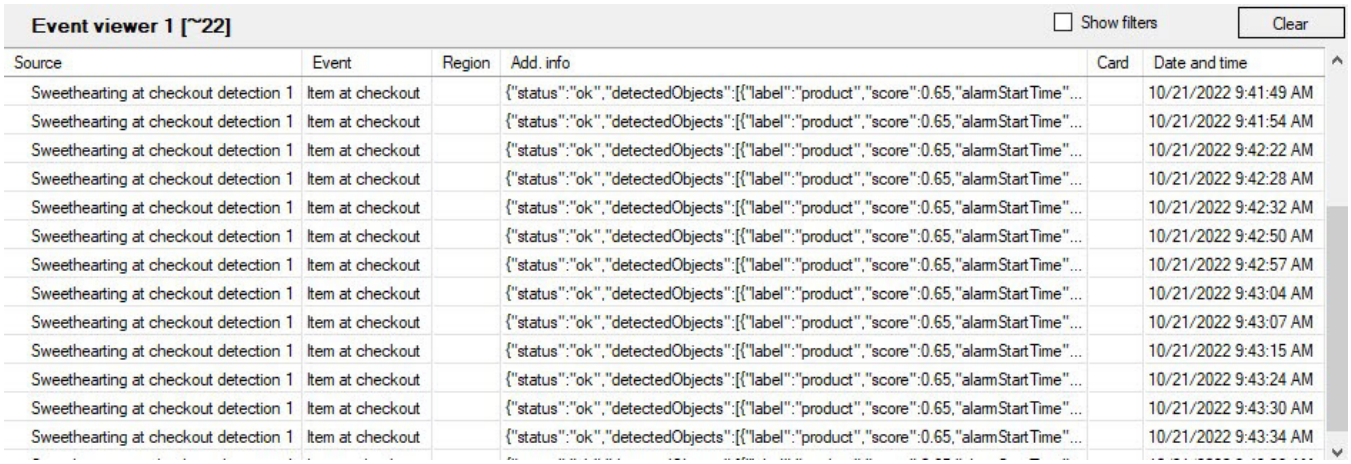
For details on the scripts refer to the Axxon PSIM software. Programming Guide (JScript).

The script text is given below. After copying, replace the cam (camera identifier) and x1, x2, y1, y2 parameters with the actual values.

```
if(Event.SourceType == "FLUID_DETECTOR" && Event.SourceId == "1" && Event.Action == "FLUID_ACTION")
{
 var L = Event.GetParam("param0");
 L=100-L*100; //the L parameter sets the line height
 DoReactStr("MONITOR","","SET_MARKRECT","cam<"+cam+">,color<255>,id<"+cam+">,x1<"+x1+">,x2<"+x2+">,y1<"+L+">,
y2<"+y2+">");
 //  coordinates x1, x2, y1, y2 set line position in the Surveillance window
}
```

Operating the Sweethearting detection module

In case the scanned item appears in the area of interest, the **Item at checkout** message is sent from the *Sweethearting at checkout detection* module to the **Event viewer** interface window.



Source	Event	Region	Add. info	Card	Date and time
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:41:49 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:41:54 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:42:22 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:42:28 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:42:32 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:42:50 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:42:57 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:43:04 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:43:07 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:43:15 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:43:24 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:43:30 AM
Sweethearting at checkout detection 1	Item at checkout		{"status":"ok","detectedObjects":[{"label":"product","score":0.65,"alarmStartTime"...		10/21/2022 9:43:34 AM

The detailed information about working with **Event viewer** interface window is presented in the *Axxon PSIM software package. Operator's Guide*. Current version of this document is available in the AxxonSoft documentation repository.

The *Sweethearting detection* module provides a timeout during which the repeated triggering of the detection tool is ignored. By default, the timeout duration is 3000 milliseconds. To change the timeout duration, specify the necessary value in milliseconds for the **report_frequency** parameter (for more details, see Registry keys reference guide, for more information about working with the registry, see Working with Windows OS registry).

> **Note**
>
> If the timeout duration was changed, to apply the specified parameter value, it is necessary to restart the *Axxon PSIM* or click the **Apply** button on the *Sweethearting detection* module settings panel (see Configuring the Sweethearting detection module).

Generating sweethearting reports

Sweethearting reports are generated via the *WEB Report System PSIM* (the Sweathearting report). For more details on creating reports, refer to *WEB Report System PSIM. User Guide*.

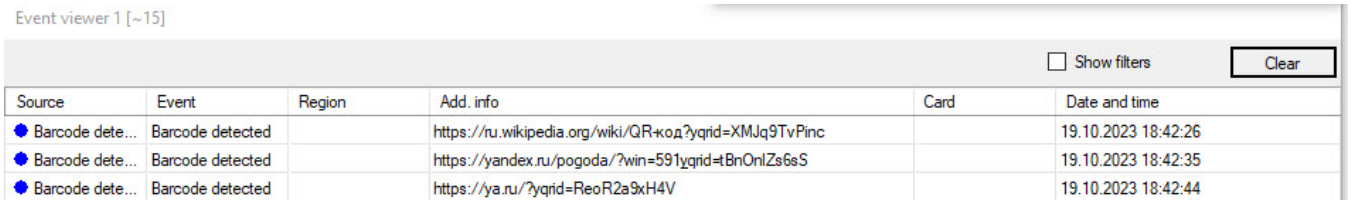
In order to be able to create a Sweathearting report, the **POS terminal** objects corresponding to the cash terminals on which the cashiers operate should be configured. This object is part of the *POS PSIM* software package (see *POS PSIM*. Administrator's Guide for details, the most current version of this document is available in the AxxonSoft documentation repository).

Operating the Barcode detection module

When detecting a barcode or a QR code in the area of interest, the result of the *Barcode detection* operation are displayed in the **Monit or** interface window using the **Captioner** object.

You can search by detected barcodes using the **Search by captions** interface object.

When detecting a barcode or a QR code in the area of interest, the **Event viewer** receives the corresponding message **Barcode detected** from the **Barcode detection** object. The barcode and QR code data is displayed in the **Add. info** column.



For more information on working with the **Event viewer** interface window, see *Axxon PSIM. Operator's Guide*. You can find the current version of this document in AxxonSoft documentation repository.

Example of displaying a **Barcode detected** event on the screen:

Operating the Equipment detection (PPE)

In case a violation is detected in the monitored area, the *Equipment detection (PPE)* module sends the **No <name of body segment> PPE detected** event to the **Event viewer** interface window.

Event viewer 1 [~6]

Show filters | Clear

Source	Event	Region	Add. info	Card	Date and time
Equipment detection (PPE) 1	No head PPE detected				6/8/2023 5:37:28 PM
Equipment detection (PPE) 1	No head PPE detected				6/8/2023 5:37:28 PM
Equipment detection (PPE) 1	No torso PPE detected				6/8/2023 5:37:29 PM

If you set the **PPE detection** checkbox (see Configuring the Equipment detection (PPE) module), the *Equipment detection (PPE)* module sends the **<Name of body segment> PPE detected** event to the **Event viewer** interface window when personal protective equipment (PPE) is detected.

Event viewer 1 [~12]

Show filters | Clear

Source	Event	Region	Add. info	Card	Date and time
Equipment detection (PPE) 1	Torso PPE detected				6/8/2023 5:34:51 PM
Equipment detection (PPE) 1	Torso PPE detected				6/8/2023 5:34:52 PM
Equipment detection (PPE) 1	Head PPE detected				6/8/2023 5:34:56 PM

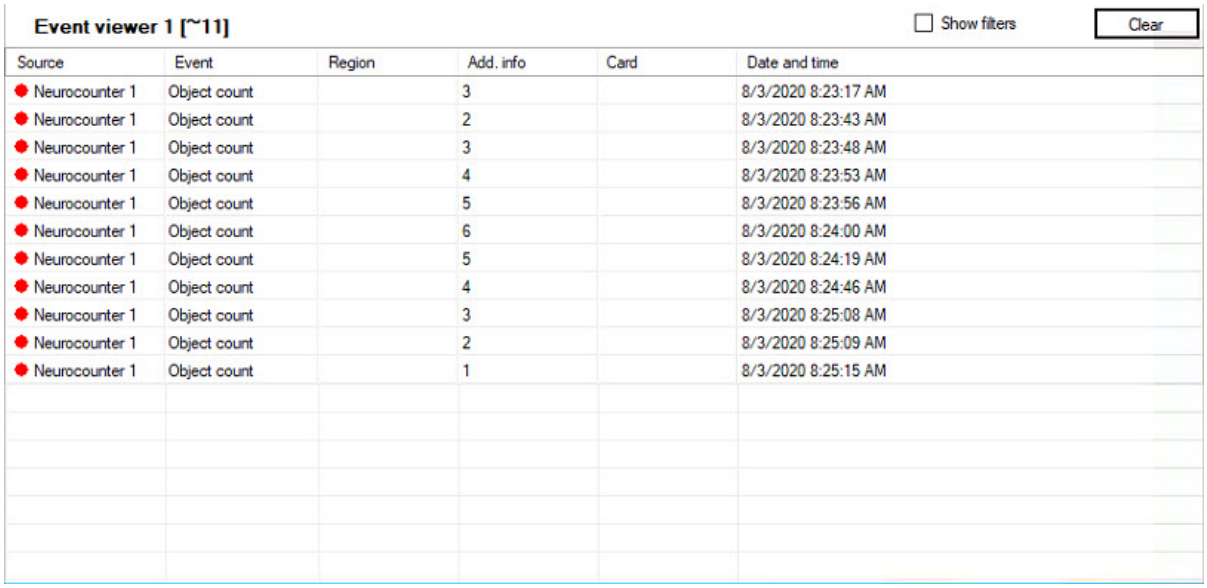
For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM software. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

If you set the **Show objects on image** checkbox (see Configuring the Equipment detection (PPE) module), a white frame appears on the monitor when the detection tool triggers.

Example of displaying the **No head PPE detected** event on the monitor.

Operating the Neurocounter module

In case the objects are detected in the monitored area, the *Neurocounter* sends the events with the corresponding number of objects to the **Event viewer** interface window.



Source	Event	Region	Add. info	Card	Date and time
Neurocounter 1	Object count		3		8/3/2020 8:23:17 AM
Neurocounter 1	Object count		2		8/3/2020 8:23:43 AM
Neurocounter 1	Object count		3		8/3/2020 8:23:48 AM
Neurocounter 1	Object count		4		8/3/2020 8:23:53 AM
Neurocounter 1	Object count		5		8/3/2020 8:23:56 AM
Neurocounter 1	Object count		6		8/3/2020 8:24:00 AM
Neurocounter 1	Object count		5		8/3/2020 8:24:19 AM
Neurocounter 1	Object count		4		8/3/2020 8:24:46 AM
Neurocounter 1	Object count		3		8/3/2020 8:25:08 AM
Neurocounter 1	Object count		2		8/3/2020 8:25:09 AM
Neurocounter 1	Object count		1		8/3/2020 8:25:15 AM

For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM software. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

Operating the Neurotracker module

In case the alarm is detected in the monitored area, the *Neurotracker* module sends the **Alarm** message to the **Event viewer** interface window. When the alarm disappears in the monitored area, the **No alarm** event is displayed. See also Configuring the Neurotracker module.

When you use the the neurotracker track counter, the **Track counter** object will receive the **Number of tracks** events that contain the number of recorded objects. The counting of the number of objects starts from 0, not from 1, i.e.: 0, 1, 2, 3, etc.

For details on operation of working with the **Event viewer** interface window, refer to the *Axxon PSIM software. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

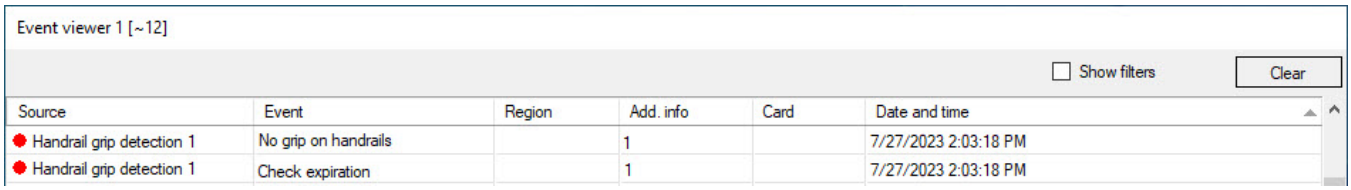
Operating the Person location tracker module

In case the alarm is detected in the monitored area, the *Person location tracker* module sends the **Alarm** message to the **Event viewer** interface window. When the alarm disappears in the monitored area, the **No alarm** event is displayed. See also Configuring the Person location tracker module.

For details on operation of working with the **Event viewer** interface window, refer to the *Axxon PSIM software. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

Operating the Handrail grip detection module

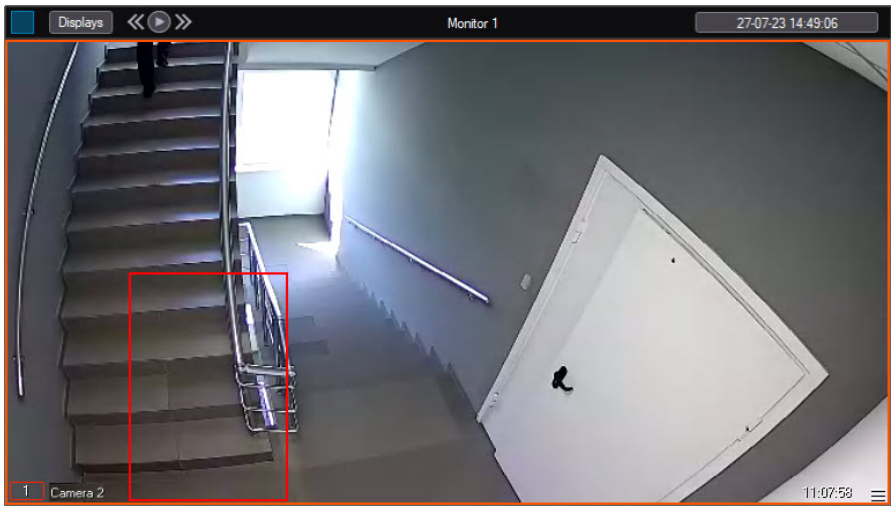
If an alarm is detected in the surveillance area, the corresponding **No grip on handrails** message from the **Handrail grip detection** object is displayed in the **Event viewer** interface window. When the alarm in the surveillance area stops, the **Check expiration** event is displayed. See also Configuring the Handrail grip detection.



For the detailed information on working with the **Event viewer** interface window, see Operator's Guide.

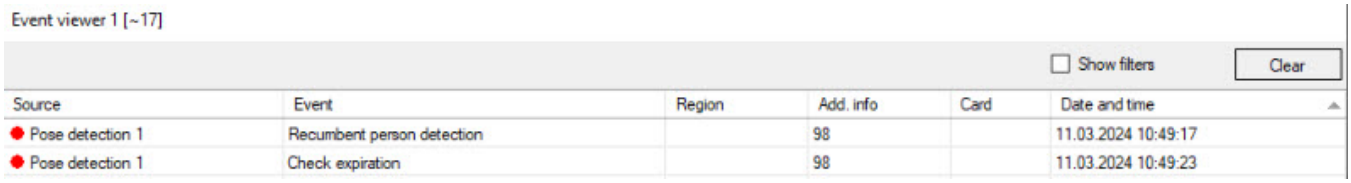
If you set the **Display event on screen** checkbox (see Configuring the Handrail grip detection), when the detection tool triggers, an alarm border of the color specified in the settings appears in the monitor window.

Example of displaying the **No grip on handrails** event on the screen:



Operating the Pose detection module

In case of an alarm in the surveillance area, the **Event viewer** interface window receives a message corresponding to the position of the person that you want to detect, for example, **Recumbent person detection**, from the **Pose detection** object. When an alarm in the surveillance area stops, the **Triggering end** event is received. See also Configuring the Pose detection.



For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

If you set the **Display event on screen** checkbox (see Configuring the Pose detection), when the detection tool triggers, an alarm border of the color specified in the detection tool settings appears in the monitor window.

Example of displaying the **Recumbent person detection** event on the monitor:

Operating the Shooter detection module

In case of an alarm in the surveillance area, the corresponding message **Active shooter detection** from the **Shooter detection** object is received in the **Event viewer** interface window. When an alarm in the surveillance area stops, the **End of action** event is received. See also Configuring the Shooter detection.

Event viewer 1 [−2]

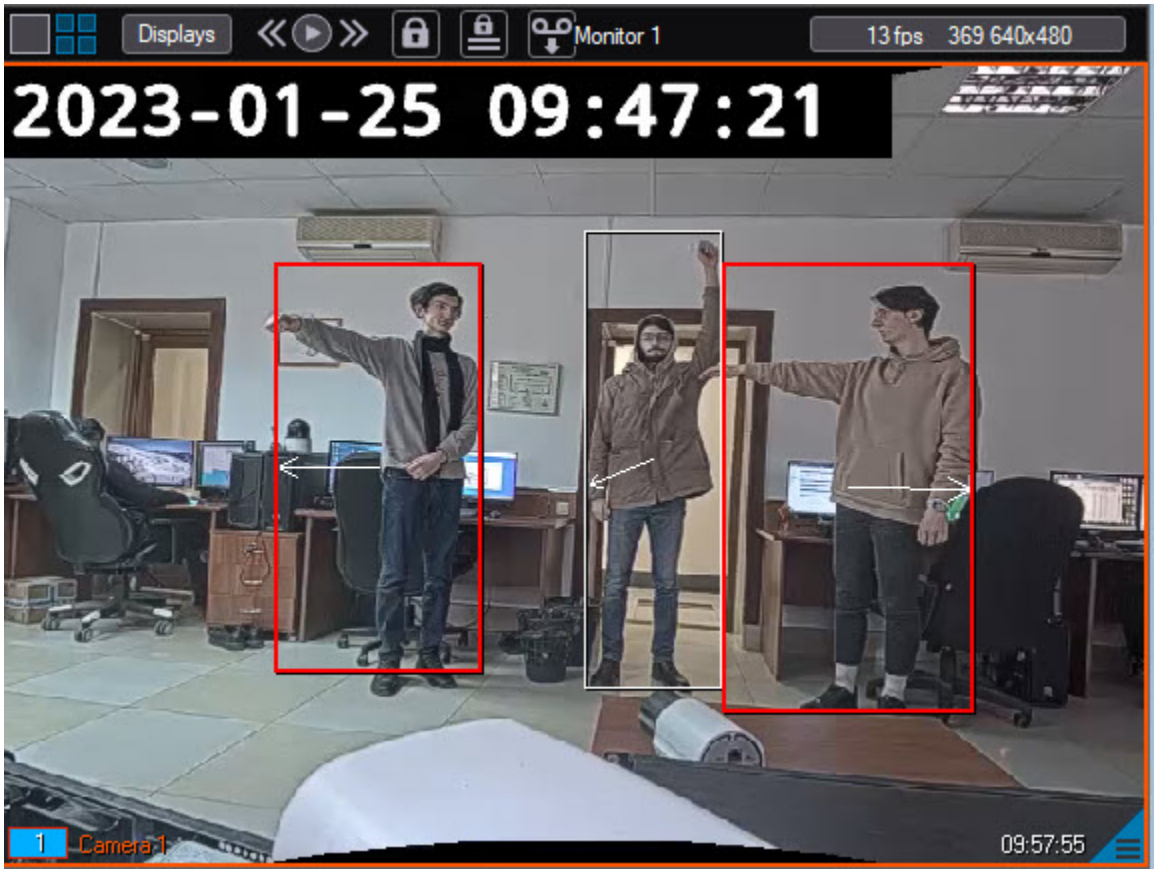
Show filters | Clear

Source	Event	Region	Add. info	Card	Date and time
Shooter detection 1	Active shooter detection		2		3/14/2023 3:05:18 PM
Shooter detection 1	End of action		2		3/14/2023 3:05:21 PM

For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

If you set the **Display event on screen** checkbox (see Configuring the Shooter detection), when the detection tool triggers, an alarm border of the color specified in the detection tool settings appears in the monitor window.

Example of displaying the **Active shooter detection** event on the monitor:



Operating the VI abandoned objects street detection module

In case of an alarm in the surveillance area, the corresponding message **Abandoned object** from the **VI abandoned objects street detection** object is received in the **Event viewer** interface window. When an alarm in the surveillance area stops, the **Triggering end** event is received. See also VI abandoned objects street detection.

For details on working with the **Event viewer** interface window, refer to the *Axxon PSIM. Operator's Guide.* Current version of this document is available in the AxxonSoft documentation repository.

Event viewer 1 [~2]

Show filters | Clear

Source	Event	Region	Add. info	Card	Date and time
VI abandoned objects street detection 1	Abandoned object				7/12/2024 4/48/19 PM
VI abandoned objects street detection 1	Abandoned object				7/12/2024 4/48/30 PM

If you set the **Show objects on image** checkbox (see Configuring the VI abandoned objects street detection module), when the detection tool triggers, an alarm border appears in the monitor window.

Example of displaying the **Abandoned object** event:

Appendix 1. Debug window

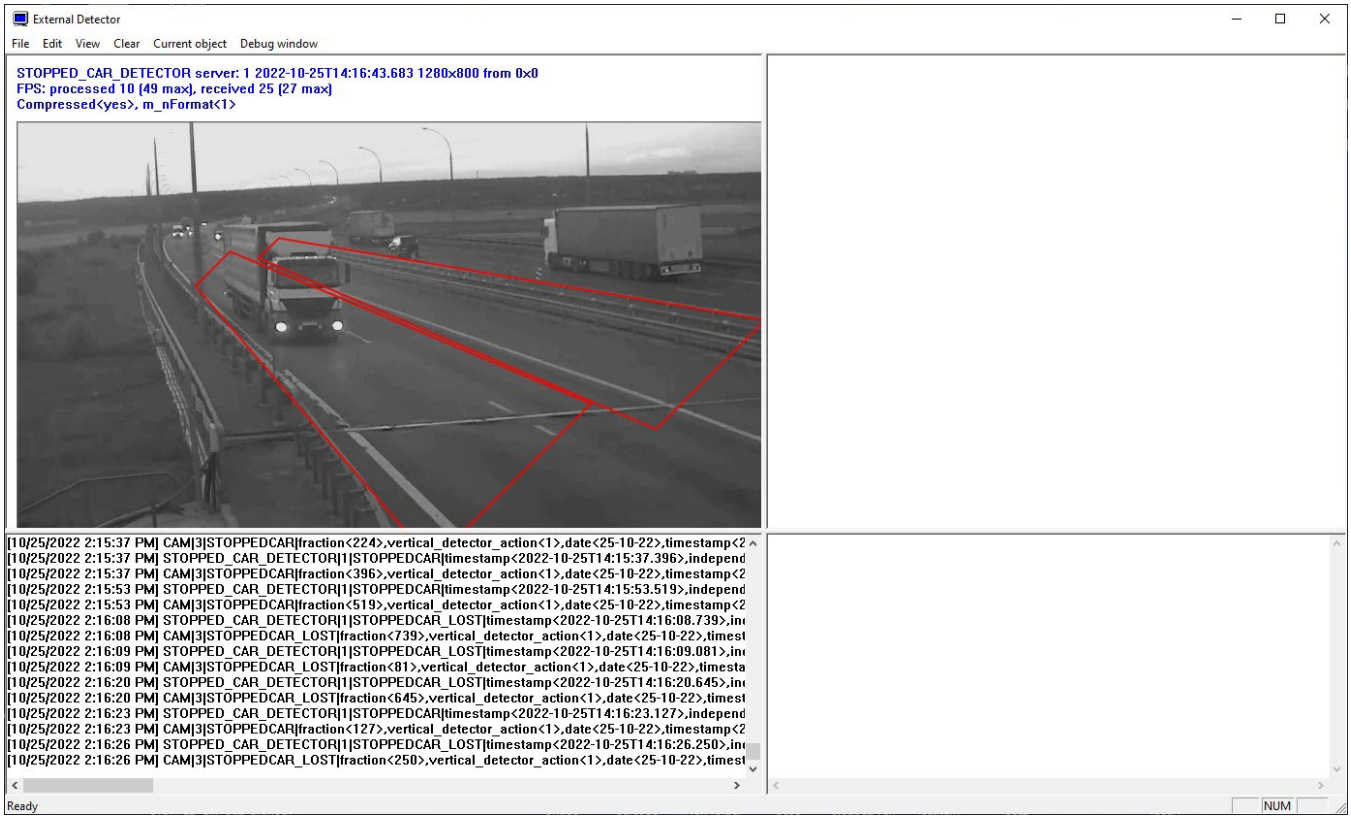
General information about Debug window

The debug window is designed to control events received from detections registered in the system. Besides, the function of displaying the detection area above the video image received from camera is available in the debug window.

Start the debug window

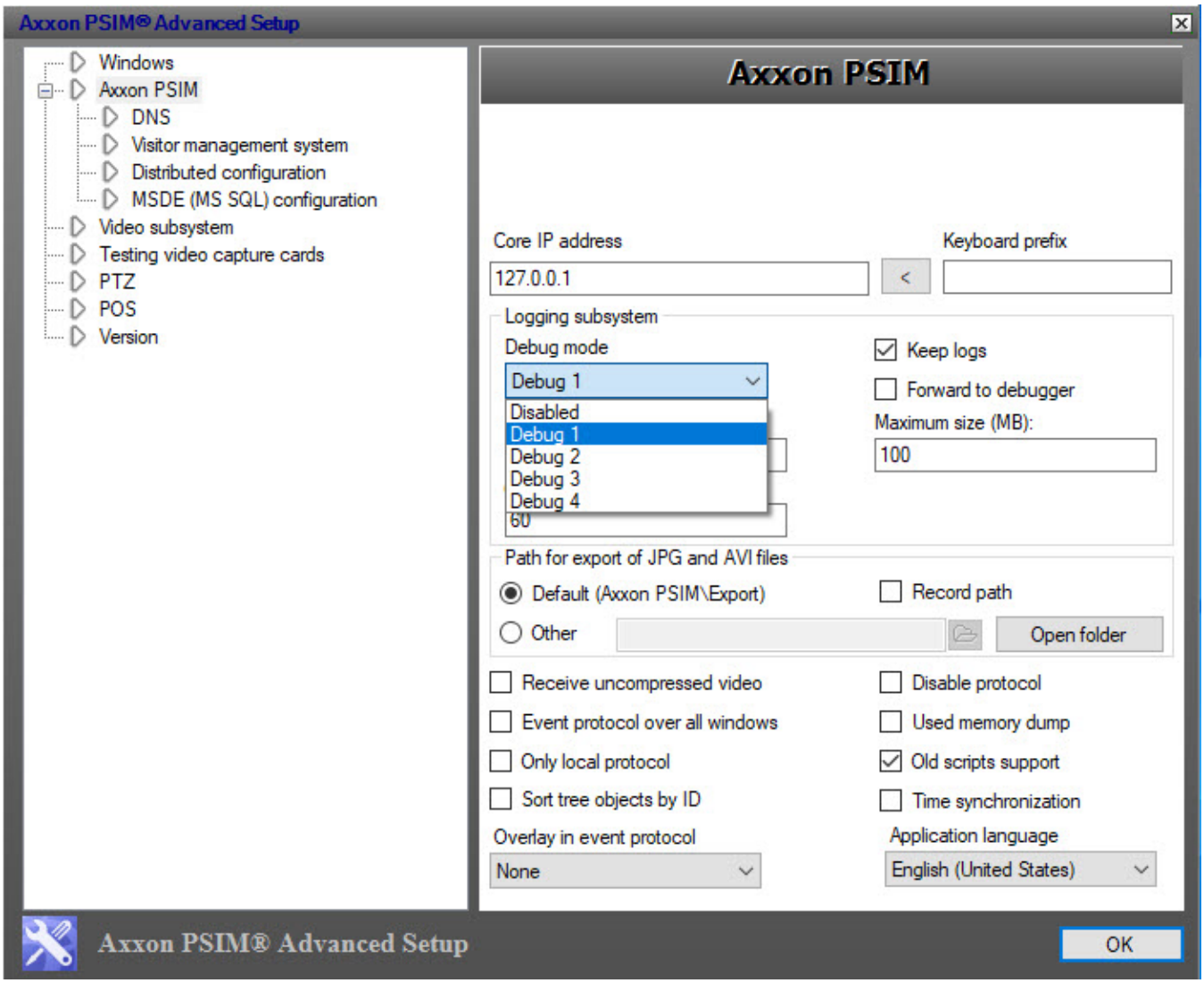
Start of the debug window is performed from the Windows task bar. Double click the left mouse button on the  icon to start the debug window.

As a result the **External Detector** window is displayed.



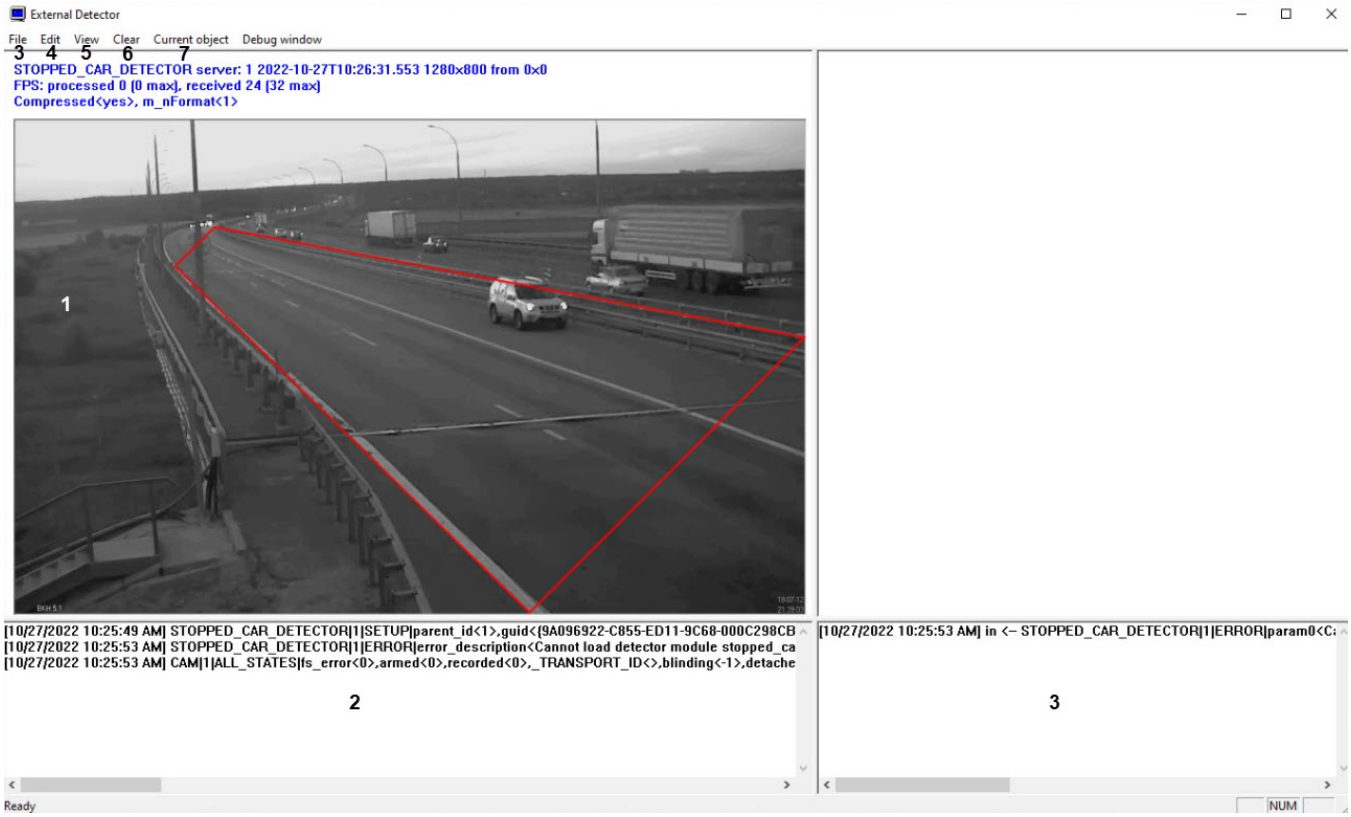
Attention!

Start the debug window is possible only if the **Debug** mode is enabled with the help of *Axxon PSIM* Advanced Setup utility.


Axxon PSIM® Advanced Setup
Windows
Axxon PSIM
DNS
Visitor management system
Distributed configuration
MSDE (MS SQL) configuration
Video subsystem
Testing video capture cards
PTZ
POS
Version
Axxon PSIM
Core IP address
127.0.0.1
<
Keyboard prefix
Logging subsystem
Debug mode
Debug 1
Disabled
Debug 1
Debug 2
Debug 3
Debug 4
60
Keep logs
Forward to debugger
Maximum size (MB):
100
Path for export of JPG and AVI files
Default (Axxon PSIM\Export)
Other
Record path
Open folder
Receive uncompressed video
Event protocol over all windows
Only local protocol
Sort tree objects by ID
Disable protocol
Used memory dump
Old scripts support
Time synchronization
Overlay in event protocol
None
Application language
English (United States)
Axxon PSIM® Advanced Setup
OK

Interface of debug window

The debug window contains the interface components described in the following table.



No	Name	Description
1	Preview area	Element is designed for displaying the detection area above the video image. Besides detection area the specific detection settings are displayed: • the person size for queue length detection and people counter detection; • detection zones for stopped vehicle detection.
2	Area of Events viewing from detectors	Events from detectors registered in the system are displayed in this area.
3	Area of system events viewing	All system events except events from detectors are displayed in this area.
4	**File** menu	Access to the Exit function**.**
5	**Edit** menu	Access to the operations with text.
6	**View** menu	Access to the function of displaying and hiding the status bar.
7	**Clear** button	Clear areas of events viewing.
8	**Current object** menu	Selection of a detector settings of which are displayed in the preview area. The detector selection have an impact on the camera from which the video stream is used for displaying in the preview window.

Appendix 2. Commands, requests and events of the DetectorPack PSIM software modules

Events of the software modules

All events from the *DetectorPack PSIM* software modules come from the **CAM** object that corresponds to the **Camera** system object.

You can use events of software modules in *Axxon PSIM* scripts to launch the procedures when a corresponding event occurs (see Guide for creating scripts (programming)).

Event format:

```
CAM|"_id_"|"_command_"|"_parameters_"
```

Events description:

Event	Description	Software module used
NEW_OBJECT	Appearance of a new track (object)	*Neurotracker*
OBJECT_LOST	Disappearance of a track (object)	*Neurotracker*
CURRENT_OBJECTS	Event for the GET_STATUS command	*Neurotracker*

List of event parameters:

Parameters	Parameters description
cam<>	id of the software module that generates an event
fraction<>	Millisecond timestamp of event
new_id<>	id of a new track (object)
detector_id<>	id of the detection tool
owner<>	Server name
date<>	Date of event
label<>	id of object class
guid_pk<>	id of event (randomly generated for each event)
core_global<>	When an event is generated, all CORE objects in the distributed system are notified
time<>	Time of event
lost_id<>	id of a disappeared track (object)
y1.0<>...	1—upper left corner of the track frame (object), 0—sequence number of a track (object) in the event, **<>**—**y** coordinate
y2.0<>...	2—lower right corner of the track frame (object), 0—sequence number of a track (object) in the event, **<>**—**y** coordinate
x1.0<>...	1—upper left corner of the track frame (object), 0—sequence number of a track (object) in the event, **<>**—**x** coordinate
x2.0<>...	2—lower right corner of the track frame (object), 0—sequence number of a track (object) in the event, **<>**—**x** coordinate
id.0<>...	0—sequence number of a track (object) in the event, **<>**—object id
id.count<>	Current number of tracks (objects)
mdparam0<>	Parameters of the track border, where 0—sequence number of a track, <>—track coordinates, display angle and track id. For example, for mdparam0<35-44-16-35-360-6>, 35-44-16-35—track coordinates, 360—display angle, 6—track id
show<>	Drawing a border on live video: 0—do not draw, 1—draw

color0<>	Border color, where 0—sequence number of a track, <>—border color, vmda_color—parameter that specifies border color of the VMDA detection. If you don't specify the parameter, border color is red by default
lifetime<>	Border lifetime in milliseconds
type<>	Type of detection source: 0—VMDA, 10—Detector Pack
parent_id<>	Id of parent detection tool: for the VMDA detection, this is the id of the tracker or Neurotracker. For the Pose detection tool, this is the id of the basic person tracker
type_rect<>	Type of track border
persistent_exist<>	Presence of tracks that must be saved to the archive in the MD_INFO command. 0—no tracks to save to the archive
persistent0<>	Track that must be saved to the archive, where 0—sequence number of a track, <>—track id
iit_object_id0<>	Track id, where 0—sequence number of a parameter, <>—track id
tss<>	Current time from which the lifetime<> of a border is calculated, for example, tss<30-06-2023 12:02:40.000>

Commands of the software modules

You can use commands of the software modules in *Axxon PSIM* scripts (see Guide for creating scripts (programming)), or send directly to the kernel using *IIDK* (see Axxon PSIM Integration Developer Kit (IIDK)).

Commands description:

Command	Description	Software module used
GET_STATUS	Generates events for each detected object. These events contain a unique object ID, relative x and y coordinates (if the upper left corner is 0.0, and the lower right corner is 100,100), date/time, and so on	Neurotracker
MD_INFO	Draws borders of different types	VMDA detection, NeuroTracker VMDA detection, Pose detection, Shooter detection, Handrail grip detection

Example of the GET_STATUS command:

```
DoReact(NEURO_TRACKER|1|GET_STATUS);
```

Example of the MD_INFO command (generation of an alarm border and saving it to the archive):

```
DoReactStr("CAM","1","MD_INFO","mdparam0<10-10-56-52-360-5>,iit_object_id0<1>,show<1>,color0<255>,
lifetime<3000>,type<8>,parent_id<1>,persistent0<1>,persistent_exist<1>,tss<30-06-2023 12:02:40.000>,
type_rect<1>");
```