DetectorPack. User Guide

DetectorPack PSIM 1.0.1 (english)

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Table of Contents

1 Introduction

1.1 General information

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1.2 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 Software and hardware requirements 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.

1.3 Purpose of the DetectorPack PSIM

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

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

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

2 Software and hardware requirements

On this page:

2.1 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 analysis (see General information on Neural analytics), the operation device can be set manually.

2.2 Hardware and software requirements for neural analytics

The following requirements are imposed on the software and hardware platform when the neural network analytics is used:

1. Due to the NVIDIA SDK specific features, 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, Intel HDDL).

   Note

   In order to connect the Intel NCS, plug in the device to the USB port and make sure that Windows shows it with one of the following names: Movidius, Myriad X, VSC Loopback Device.
   Intel NCS can be utilized with any computer compliant to the *Axxon PSIM* hardware requirements (see Requirements for base PCs).

   Attention!

   It is not recommended to use more than one Intel NCS device on the same Server.
   Several Intel HDDL devices can be used on one Server if their revisions match.
   For Intel HDDL to work on a computer with AMD CPU, it is required that the OpenVino toolkit be installed according to the instructions on the site.

3. If CPU or Intel GPU is used for the neural network analytics operation, then the following requirements should be taken into account:
   a. support for the following CPUs:
      i. 6th-10th Generation Intel® Core™ processors;

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 should support the Intel CPU being used (for more information see https://software.intel.com/content/www/us/en/develop/tools/openvino-toolkit/system-requirements.html).

4. NVIDIA GeForce 1050 Ti GPU or newer. GPU requirements:
   a. at least 2 GB of memory;
   b. Compute Capability 3.5 - 8.6.

> **Note**
>
> Please check the GPU's Compute Capability version on the manufacturer's web site.

> **Attention!**
>
> When using NVIDIA graphics cards, it is recommended to install the latest driver from the NVIDIA official web site.

A single neural network consumes 500 MB of video memory. Each neural network is distributed between several object trackers within the GPU. For example: to apply the neural fire detector and the neural smoke detector to any number of channels, you should use a 1 GB graphics card or higher. You can use multiple video cards in your system.

> **Attention!**
>
> Make sure that video image requirements are met in order for each detection module to operate correctly. The requirements are specific for each detection module and are given in the corresponding sections (see Configuring detection modules).

2.3 Platforms for the detection software modules operation

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	☐	☐
Fire detection	☐	☐

Stopped vehicle detection	☐	☐
People counter detection	☐	☐
Train detection	☐	☐
Detection of light indication control	☐	☐
Sweethearting detection	☐	☐
Barcode detection	☐	☐
Fluid level detection	☐	☐
Neurotracker	☐	☐
Person location tracker	☐	☐
VideoIntellect embedded detector	☐	☐
Neurocounter	☐	☐
Equipment detection (PPE)	☐	☐
Traffic light detection	☐	☐

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).

3 Installing the DetectorPack PSIM

3.1 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!

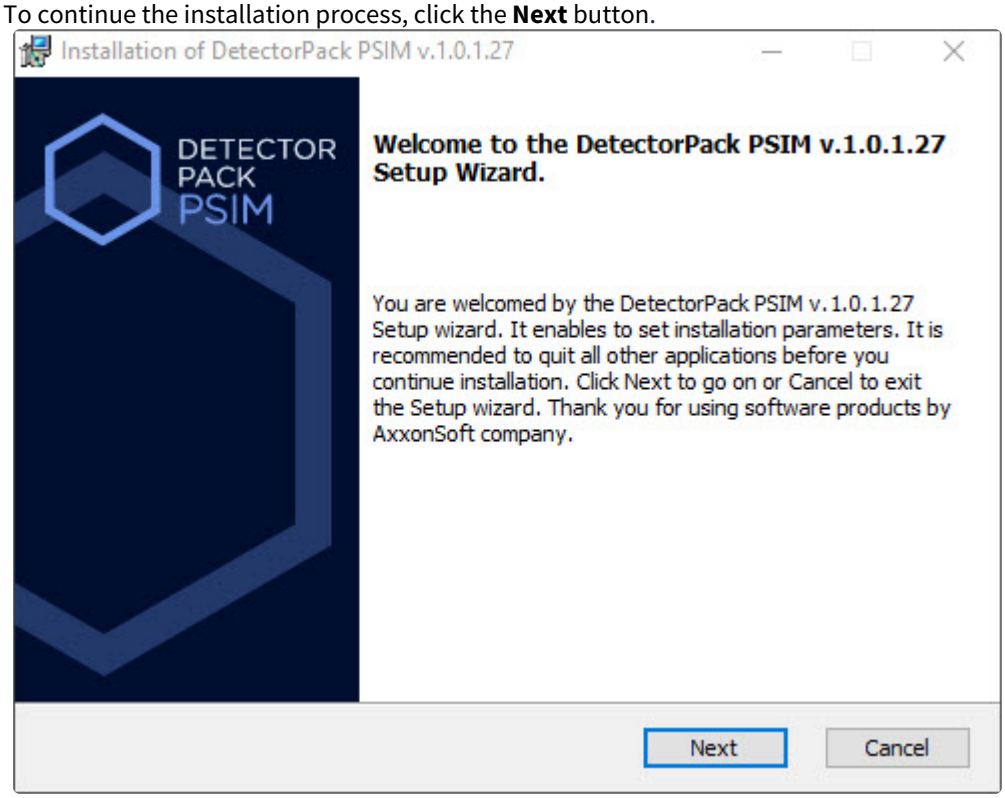
- Prior to installing, restoring or removing *DetectorPack PSIM*, *Axxon PSIM* should be shut down.
- Administrator rights are required for installing, restoring or removing *DetectorPack PSIM*.

3.2 Installation

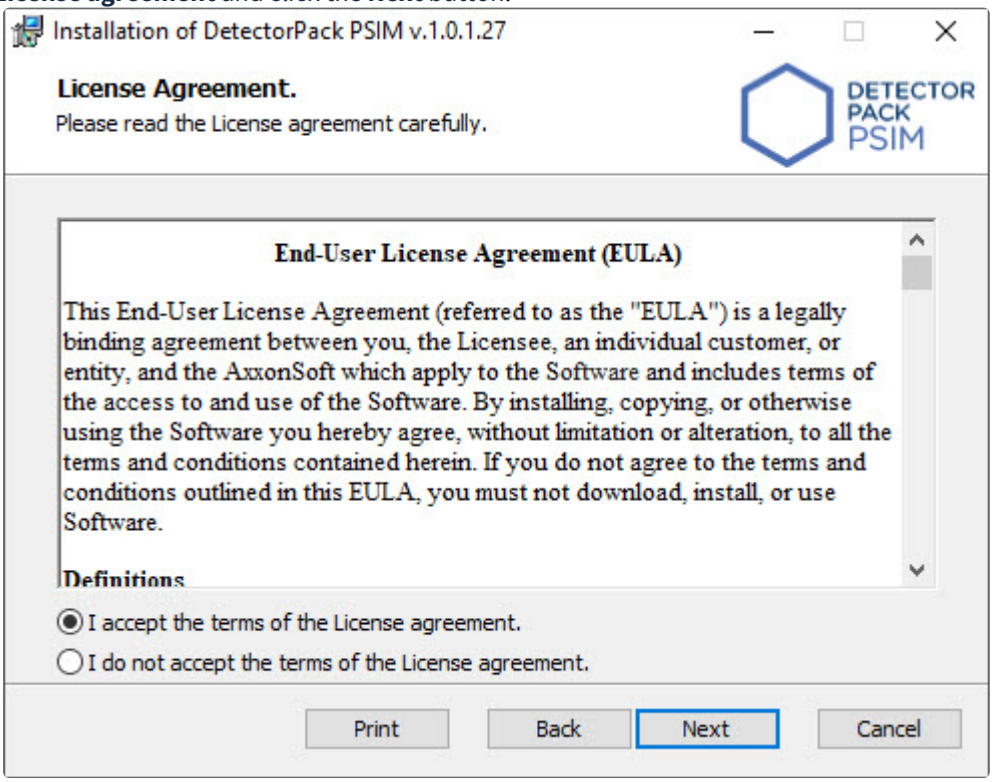
DetectorPack PSIM is installed as an extension to *Axxon PSIM*.

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.

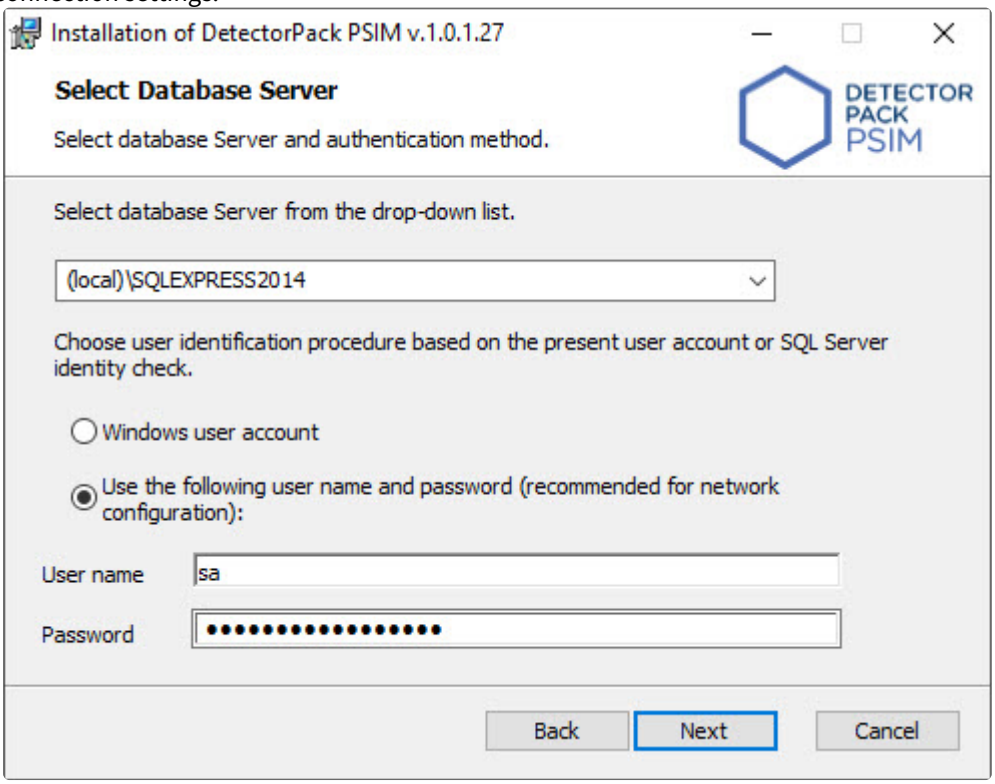


3. Read the terms of the license agreement carefully. Then set the radio button to **I accept the terms of the License agreement** and click the **Next** button.



> **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

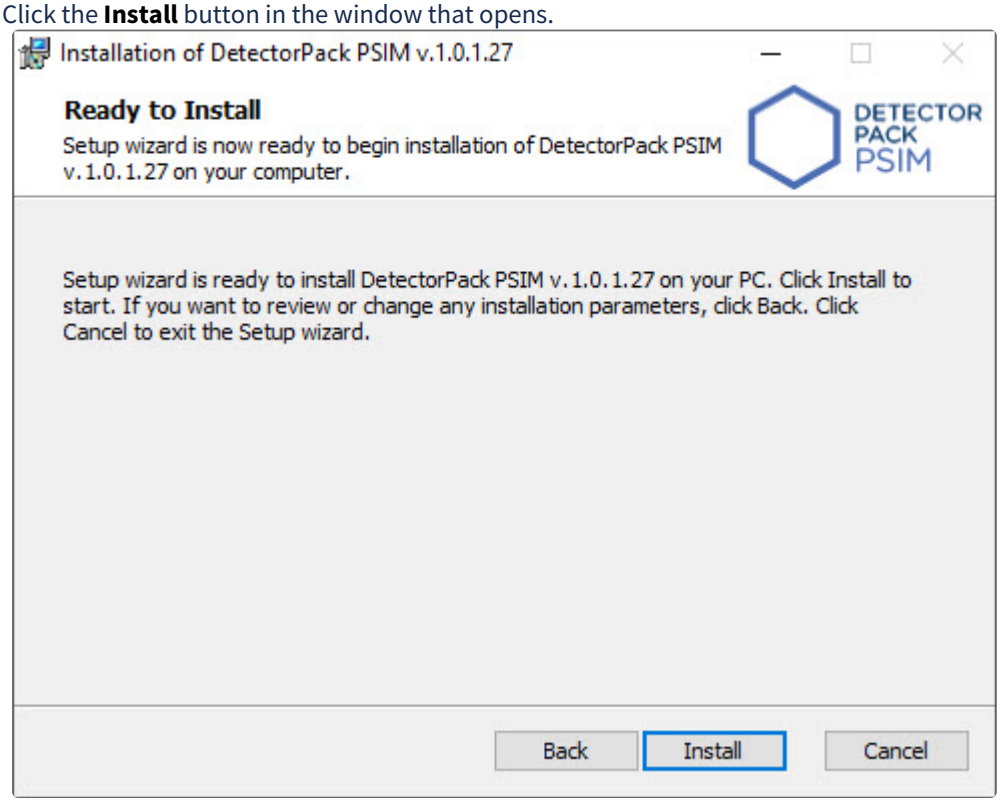
Authentication methods	Windows credentials	SQL server authentication using the following username and password (Recommended)
	The SQL server and *DetectorPack PSIM* are installed on different computers that are connected via TCP/IP network and located in the same network domain. In Windows OS on the 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!

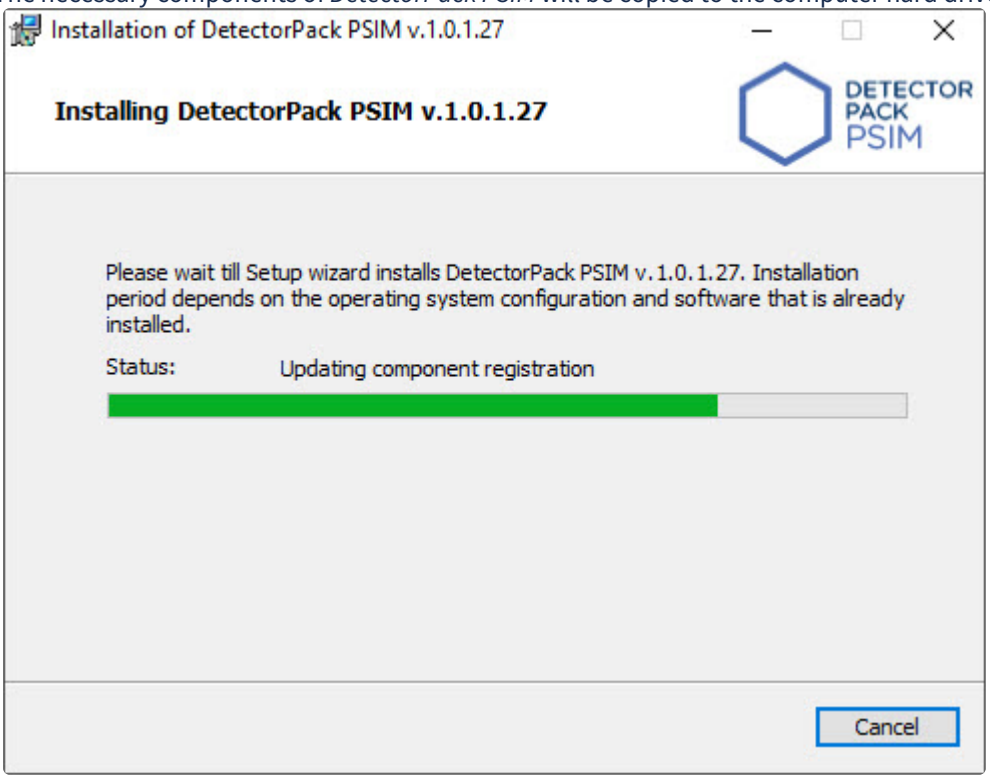
If *DetectorPack PSIM* is installed by the computer Administrator, and Windows credentials are used for the SQL server authentication, access to the database by any other user will not be possible without additional configuration of the idb.exe utility and knowledge of the Administrator login and password.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

7. Click the **Next** button to continue the installation process.

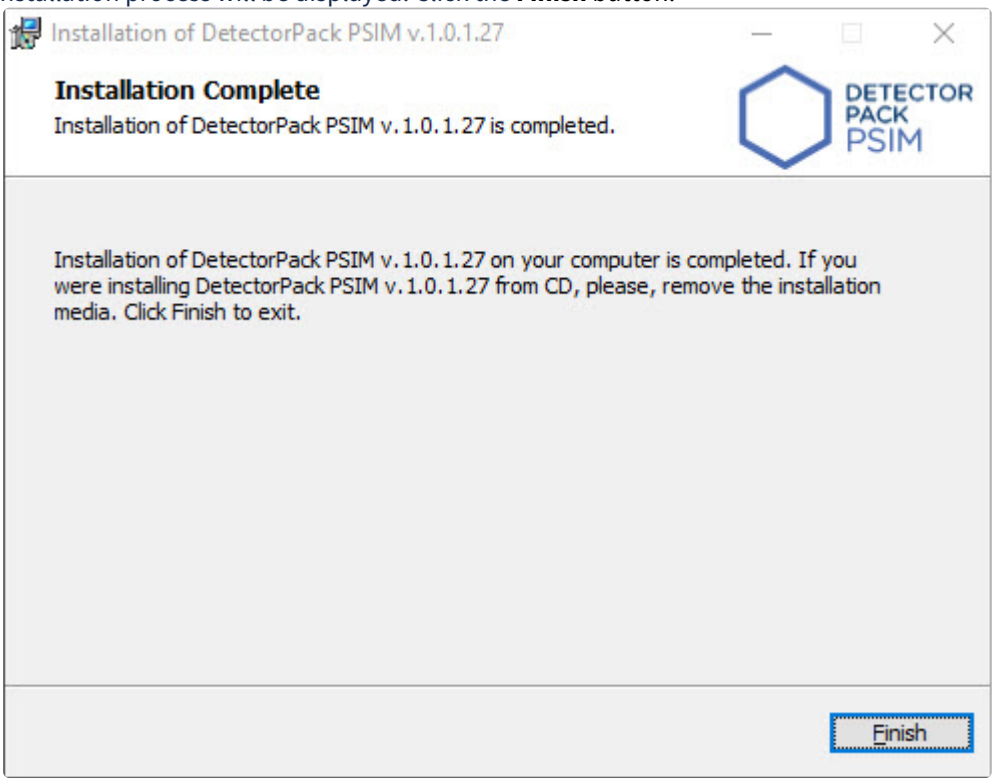
8. Click the **Install** button in the window that opens.



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.

> **Note**
>
> When installing *DetectorPack PSIM*, the files necessary for HDDL operation are located in the C:\Program Files (x86)\Common Files\AxxonSoft\DetectorPack\NeuroSDK\hddl\ folder.
> The **HDDL_INSTALL_DIR** system variable is created, in which you should specify the path to the folder with the files for HDDL operation. By default, the value of this variable is equal to the standard path, where these files are installed. This also applies to the case when *Axxon PSIM* and *Axxon One* are installed together.

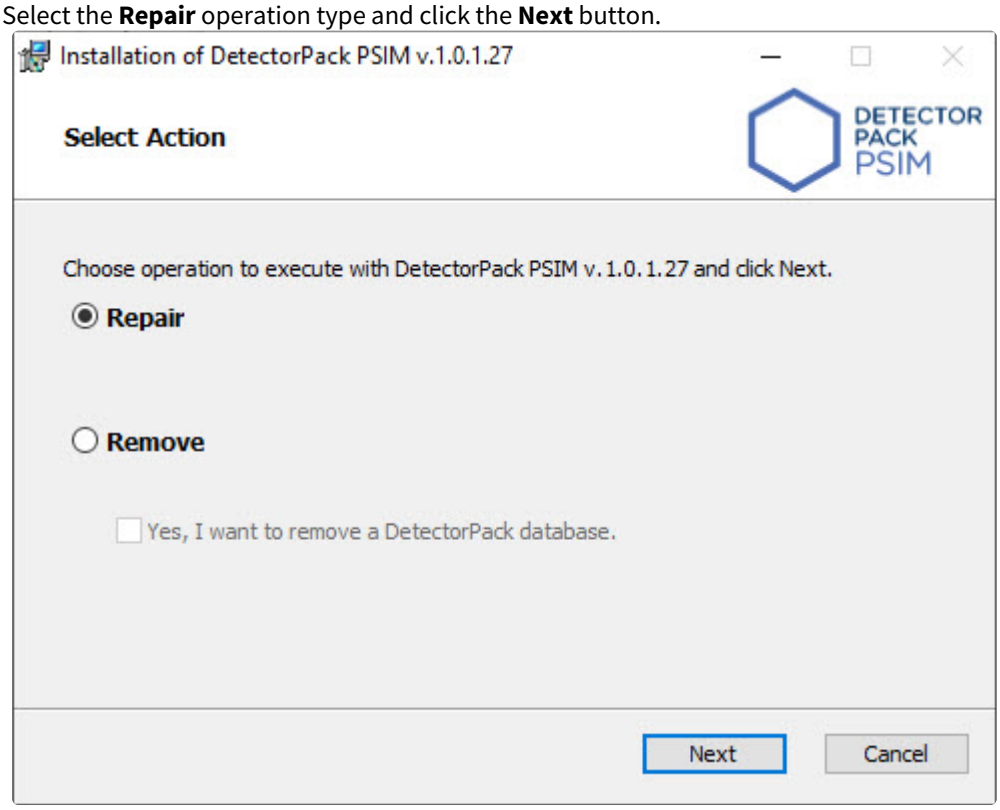
3.3 Repair

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

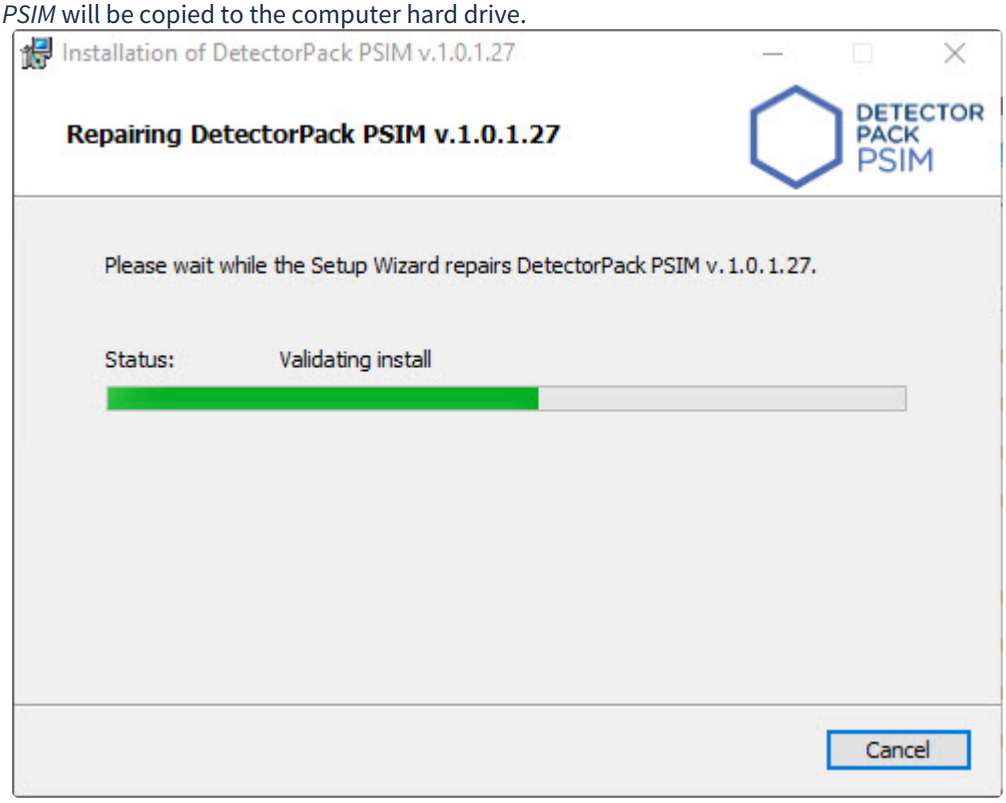
To repair *DetectorPack PSIM*, do the following:

1. In the root directory of the distribution package, run the setup.exe executable file.

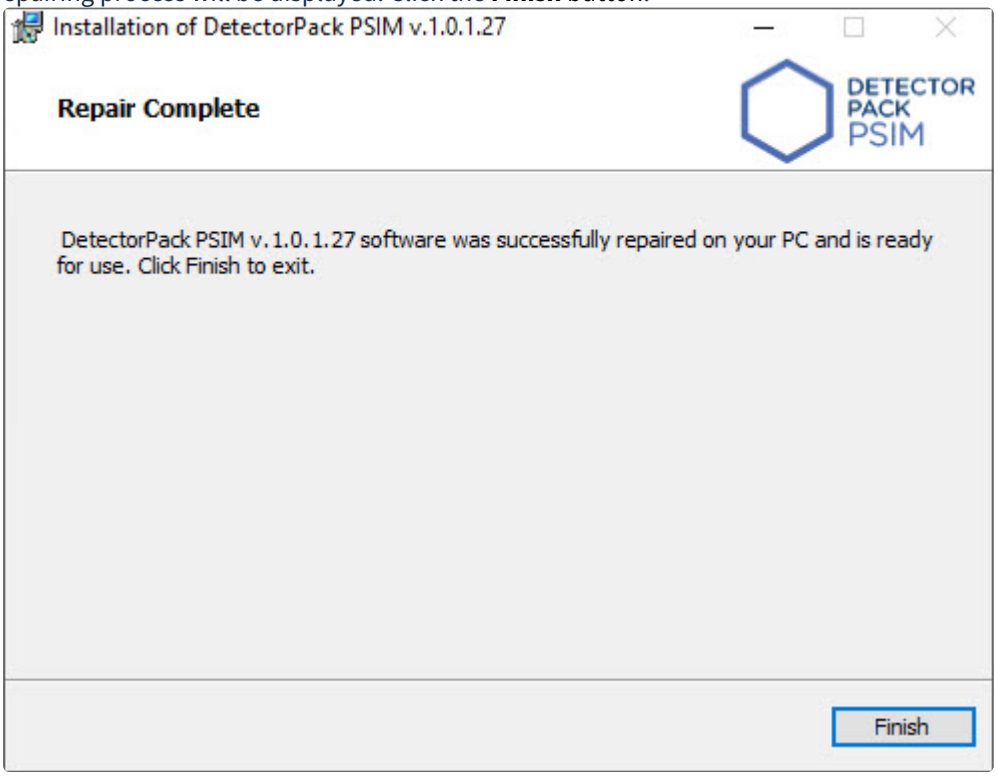
2. Select the **Repair** operation type and click the **Next** button.



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.



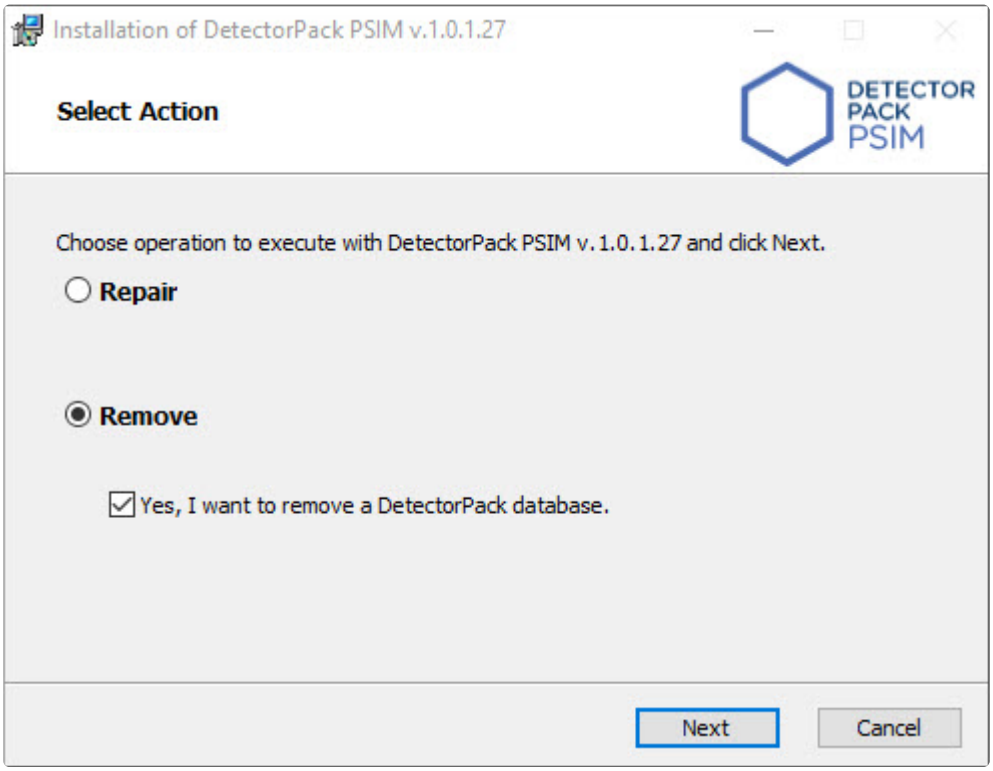
The *DetectorPack PSIM* repair is complete.

3.4 Removal

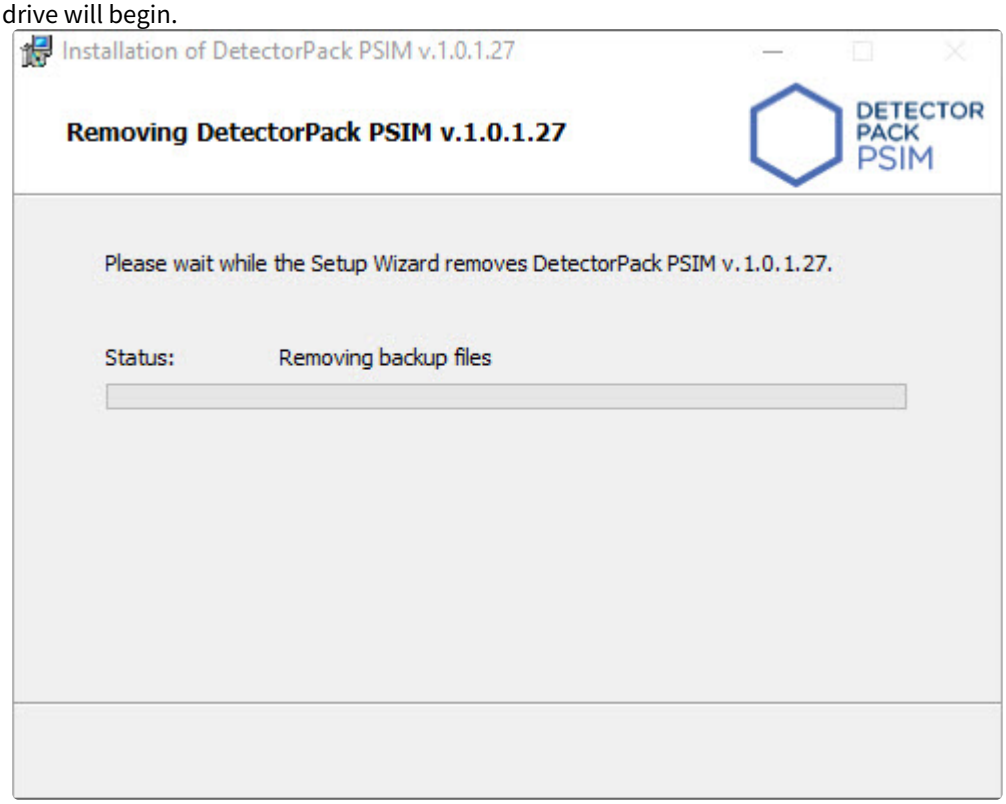
To remove *DetectorPack PSIM*, do the following:

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.

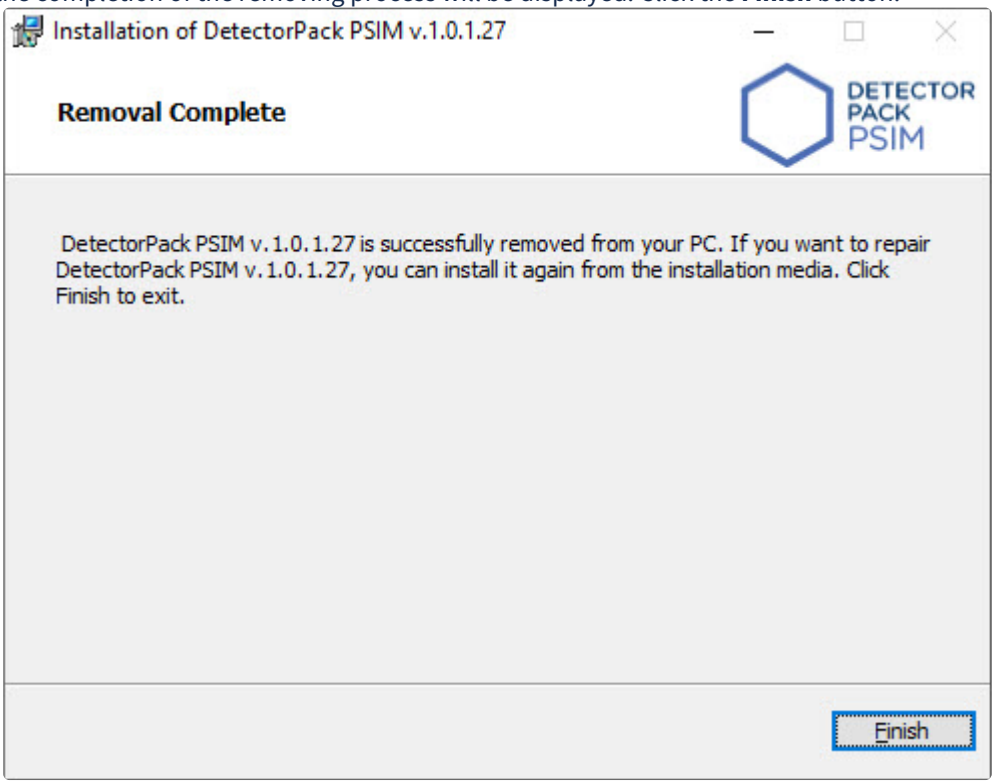
> **Note**
>
> If it is also necessary to delete the *DetectorPack PSIM* database, set the **Yes, I want to remove a DetectorPack database** checkbox.



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.

3.5 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.

4 Configuring detection modules

4.1 General information on Neural analytics

Software and hardware requirements

DetectorPack PSIM uses the AI analytics based on neural networks. The following AI features are available:

1. **Neurotracker** (see Neurotracker).
   Neural Tracker detects only objects of a specified class. The Neural Tracker is more accurate than the regular one, and detects even static objects, but it requires more computing resources.
2. **AI Smoke and Fire detection** (see Fire detection and Smoke detection).
   Neural network detects fire and smoke in FOV.
3. **AI Person location tracker** (see Person location tracker).
   AI-powered Posture Detection captures specific human poses that may represent a security threat.
4. **Neurocounter** (see Neurocounter).
   Neural network counts the number of objects in a given area.
5. **Sweethearting detection** (see Sweethearting at checkout detection).
   Neural network detects the theft of goods by cashiers who do not 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 given body segment, and checks its condition.

The quality of work and the resource consumption of the AI-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 should contain the **_openvino** substring at the end. For example, **test1_openvino.ann**.
- If you intend to use a GPU (NVIDIA 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 or Intel HDDL, then the name of the neural network file should contain the **_movidius** substring at the end. For example, **test1_movidius.ann**.
- Also, there should be a file with the ***.txt** extension in the same directory as the neural network file with the ***.ann** extension. The ***.txt** file should have the same name as the ***.ann** file.

Before you start setting up the AI-based detection tools, you should 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 should 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.

4.1.1 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 footage must contain all range of weather conditions (sun, rain, snow, fog, etc.) 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 should 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 should be collected in equal shares for each condition, that is, it should be balanced.

> **Note**
>
> Example. It is necessary to detect a person in the surveillance area at night and during the day.
> Data collected correctly:
> - 4 video recordings of the surveillance area, each 5 minutes long;
> - the object of interest appears in the frame in each video fragment;
> - 2 fragments were recorded in night conditions, 2—in daytime conditions.
>
> Data collected incorrectly:
> - 3 video recordings of the surveillance area, each 5 minutes long;
> - the object of interest appears in the frame in each video fragment;
> - 2 fragments were recorded in night conditions, 1—in daytime conditions.

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

Tool	**Requirements**
Neural Filter	No less than 1000 frames containing objects of interest in given scene conditions, and the same amount of footage containing no objects (background footage)
Neural Tracker	3 to 5 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
Posture detection tools	10 seconds of video of a scene with no persons. No less than 100 different persons in given scene conditions. **Attention!** Different conditions mean, among others, different postures of an individual in scene (tilting, different limbs patterns, etc.)

Tool	Requirements
Equipment detection tool (PPE)	A list of all reference equipment with examples should be collected from the object and agreed with the analytics manufacturer (see Example of providing a list of valid equipment at the facility). Several video recordings 3-5 minutes each with personnel in the given scene conditions. Personnel should move and change posture in the collected video recordings, 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, video recordings in other lighting conditions are not required
Food recognition*	Images of at least 80% of the actual menu items should be provided. Each menu item requires 20 to 40 images shot 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

* 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.

4.2 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).

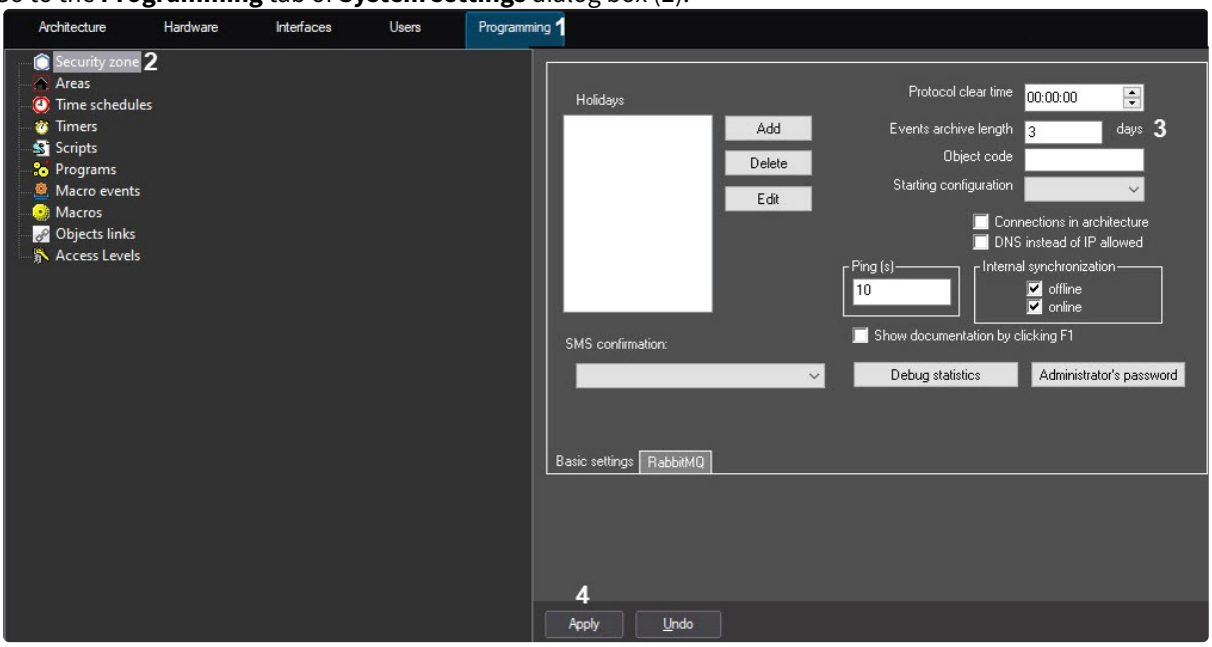
Note

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.

4.3 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.

4.4 Queue length detection

4.4.1 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.

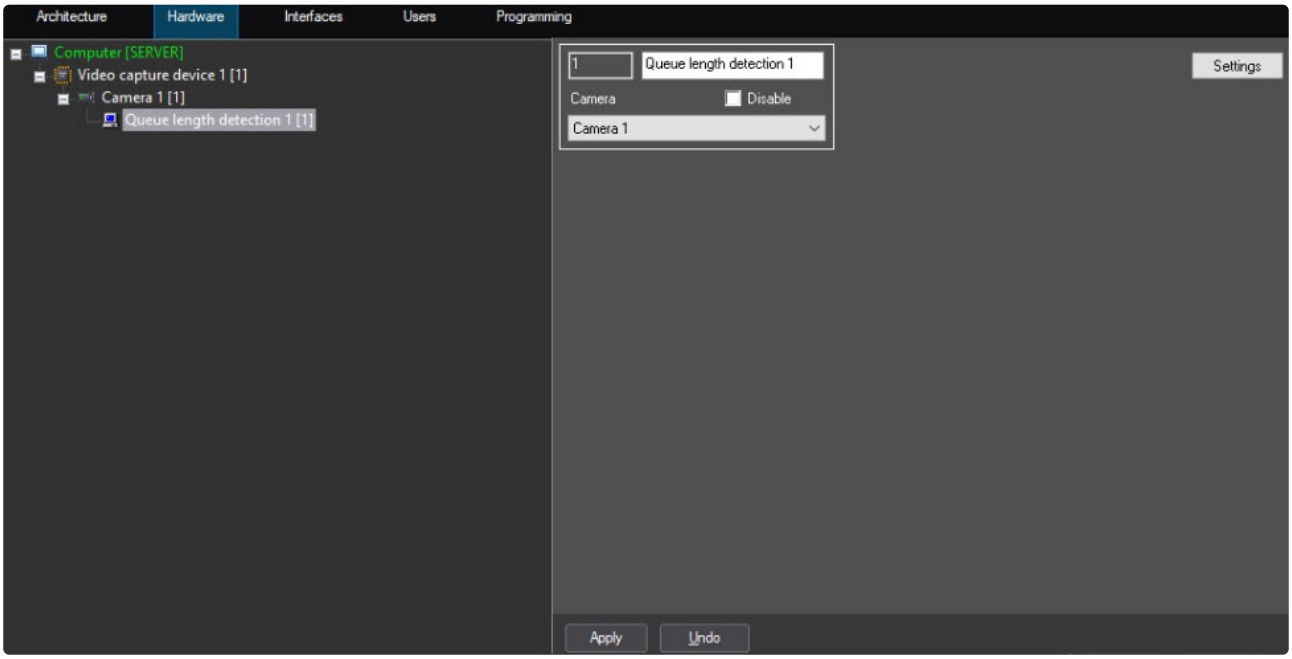
4.4.2 Camera requirements for the Queue length detection module

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%.

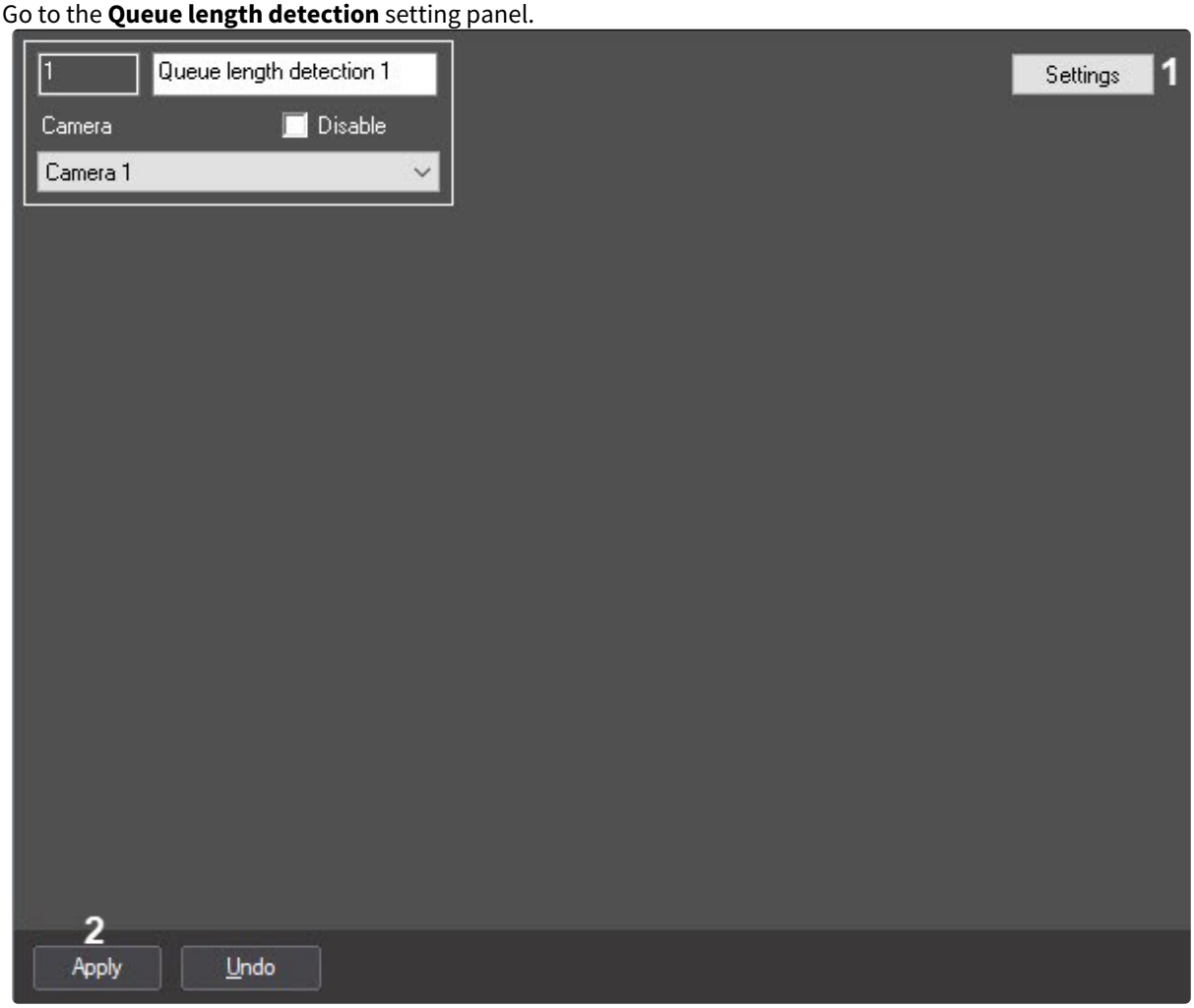
4.4.3 Configuring the Queue length detection module

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.

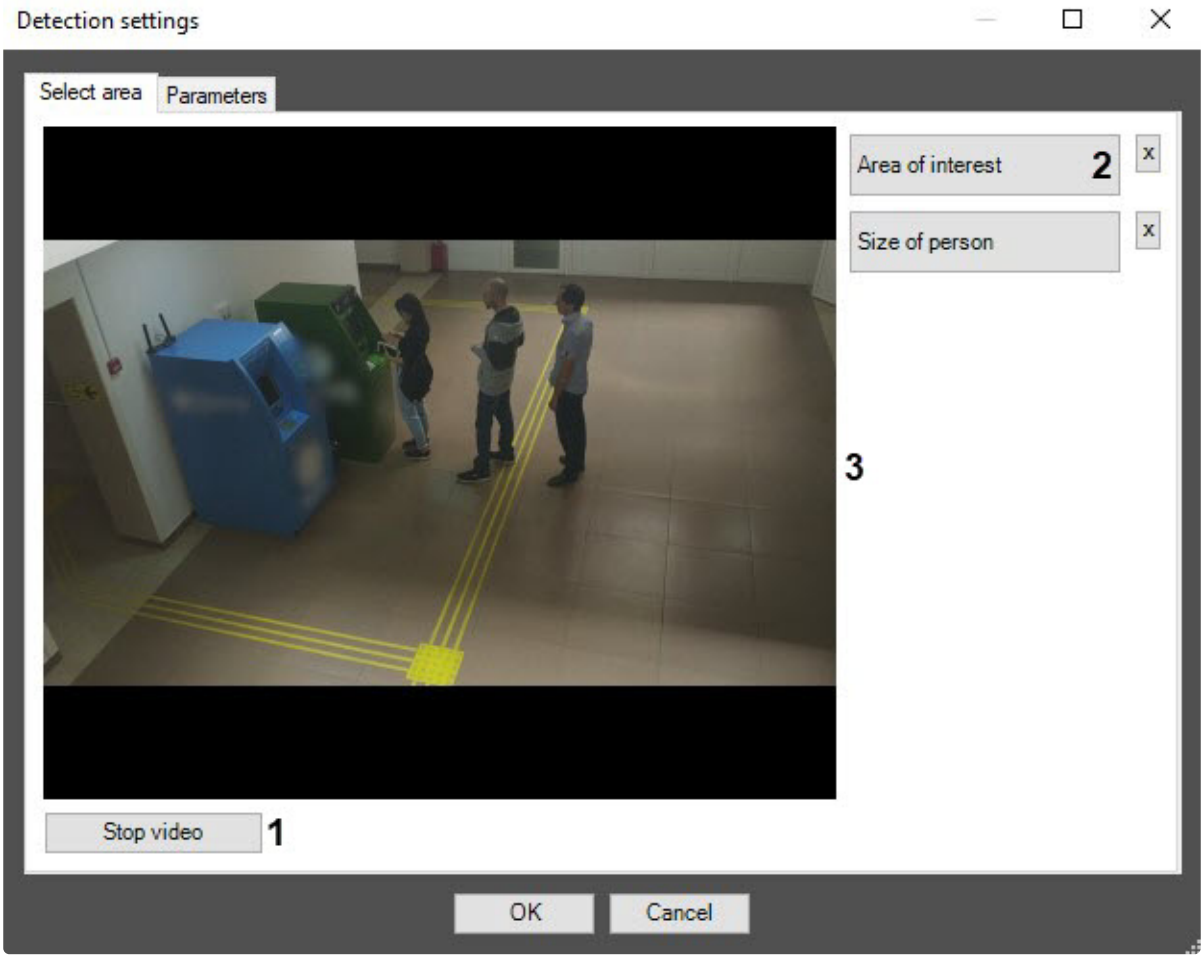


Configure the *Queue length detection* module as follows:

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

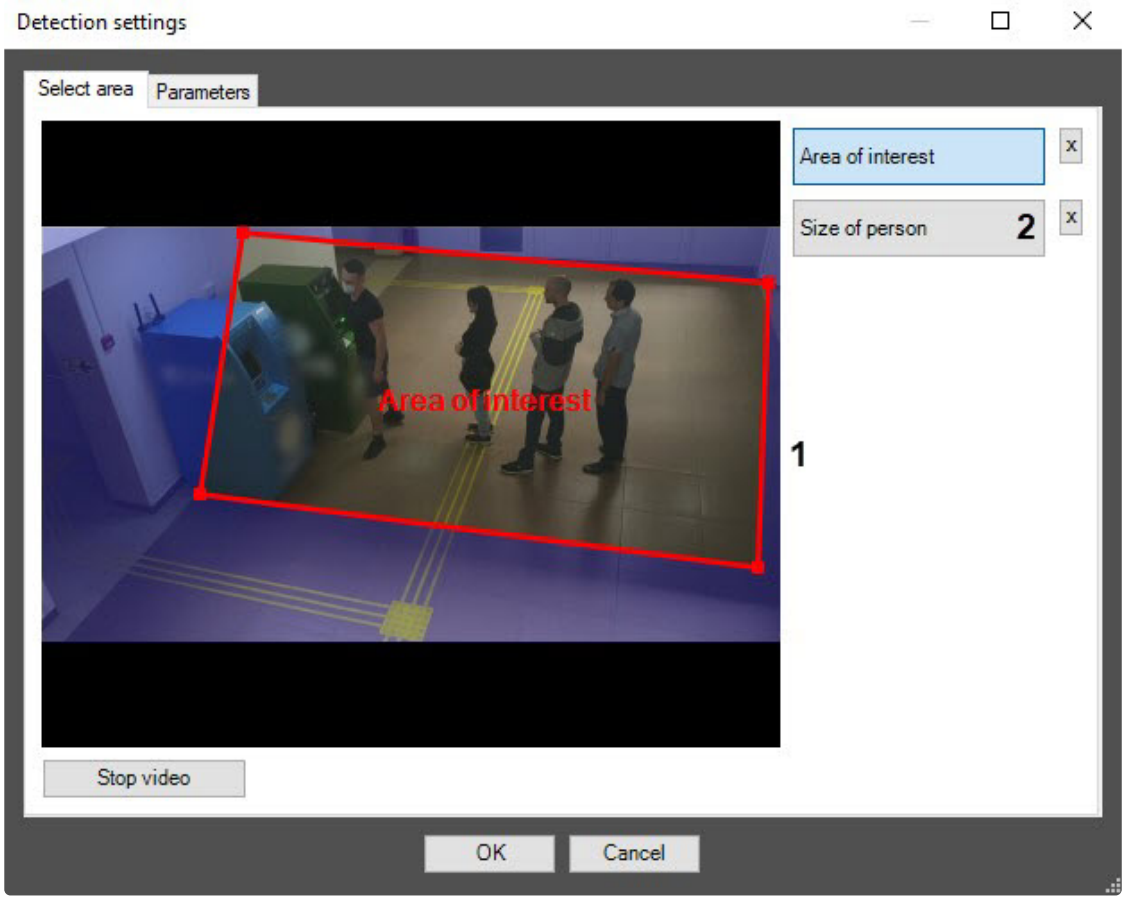


2. Click the **Settings** button (**1**).
   The **Detection settings** window appears.



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.



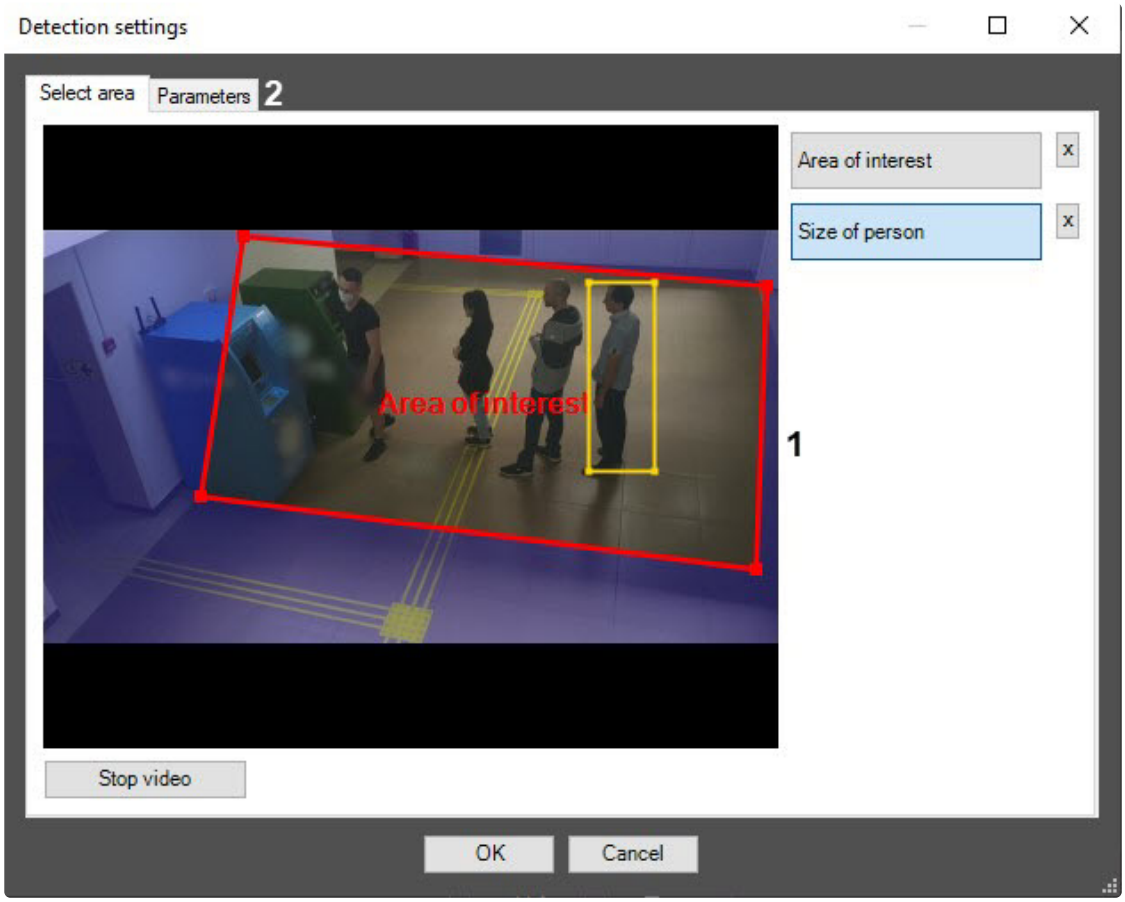
Attention!

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**).

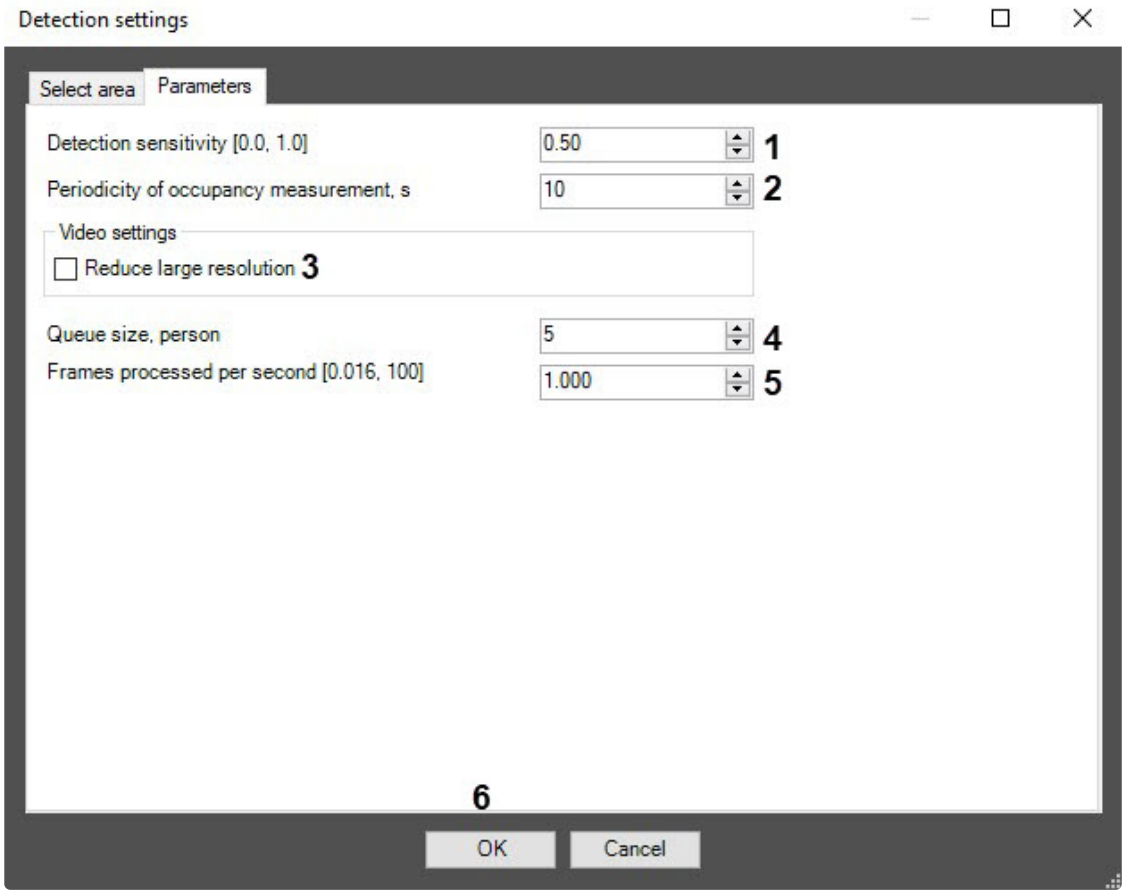
Note

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.

4.5 People counter detection

4.5.1 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.

4.5.2 Camera requirements for the People counter detection module

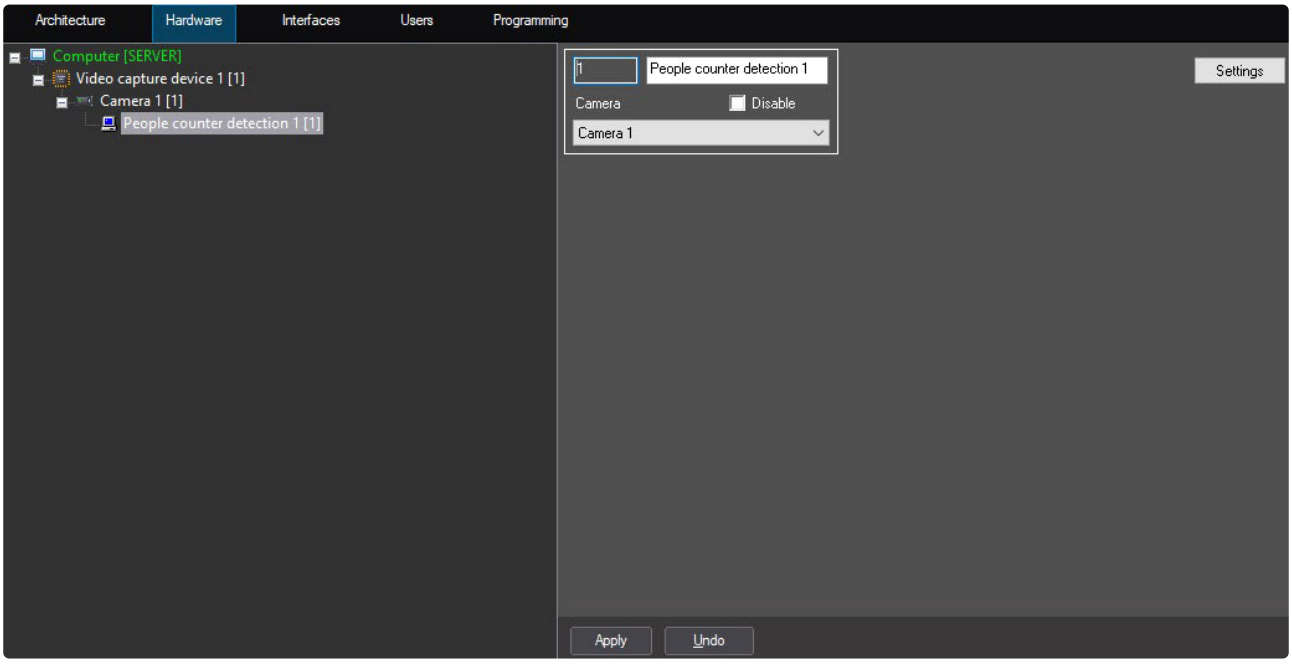
The requirements for the cameras that will work with the *People counter detection* module are listed in the following table.

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.

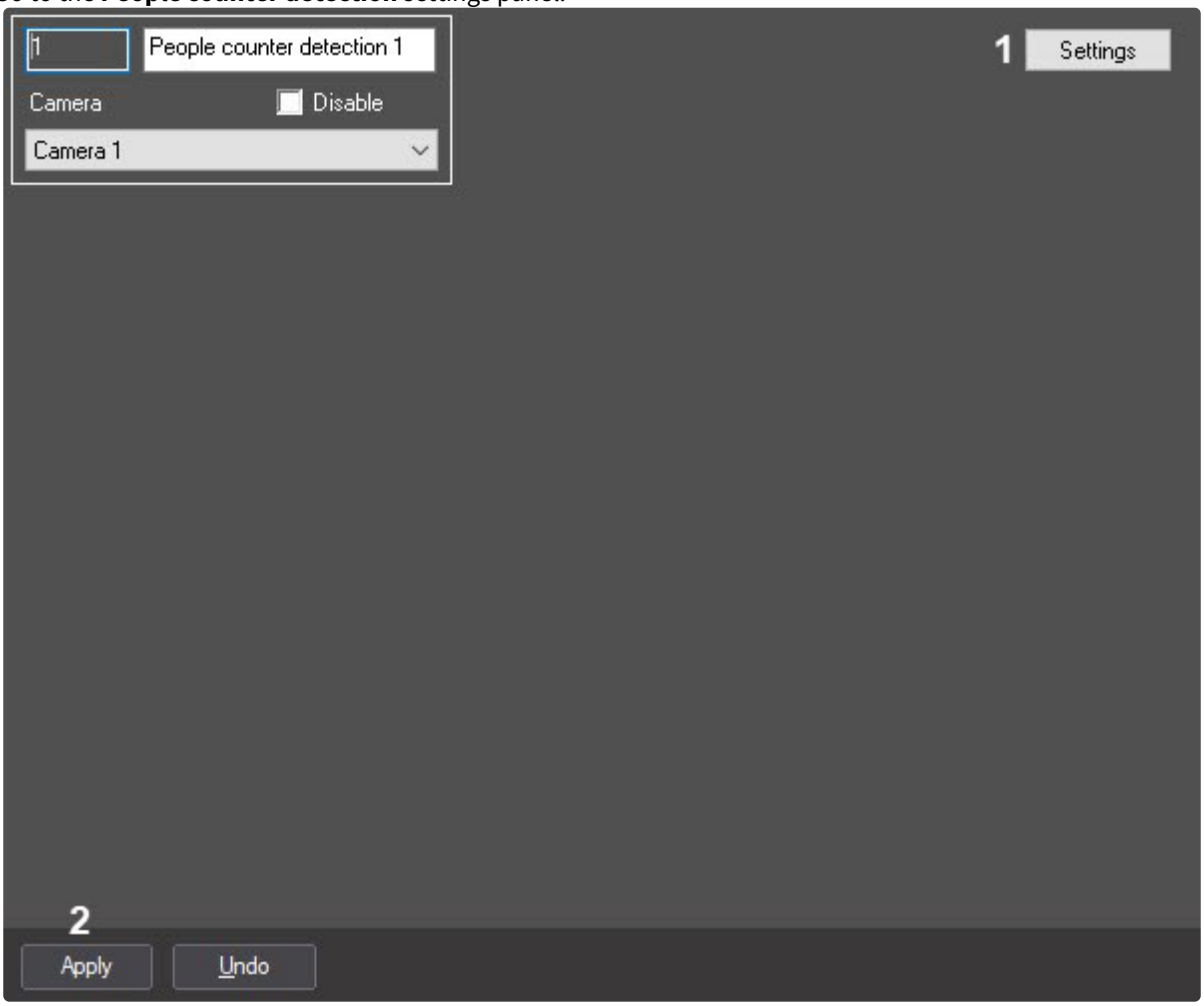
4.5.3 Configuring the People counter detection module

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



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

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

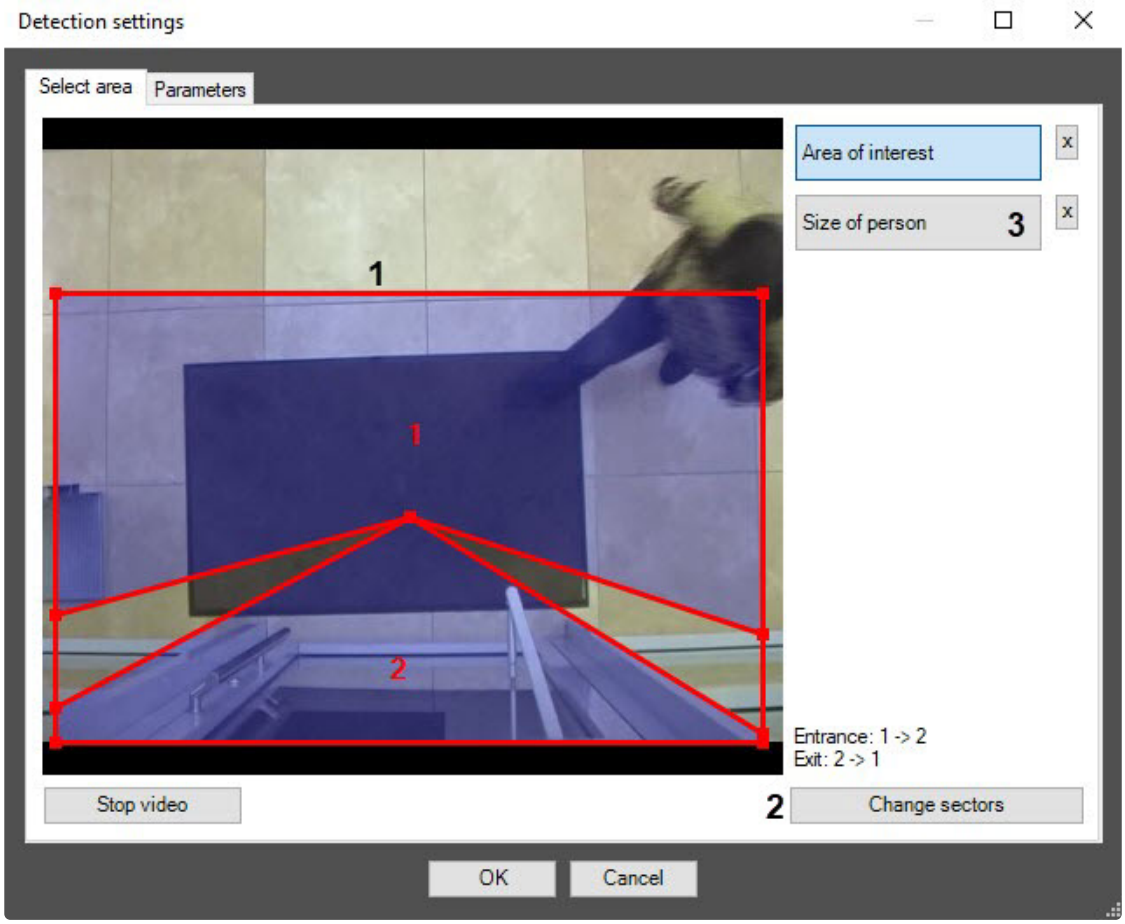


2. Click the **Settings** button (**1**). The **Detection settings** window will open.

3. Specify the area of interest and the approximate size of people 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 corners of the area on the captured video image (**3**) to be analyzed. Only one area may be so designated. If a second area is specified, then the first area will be deleted.

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

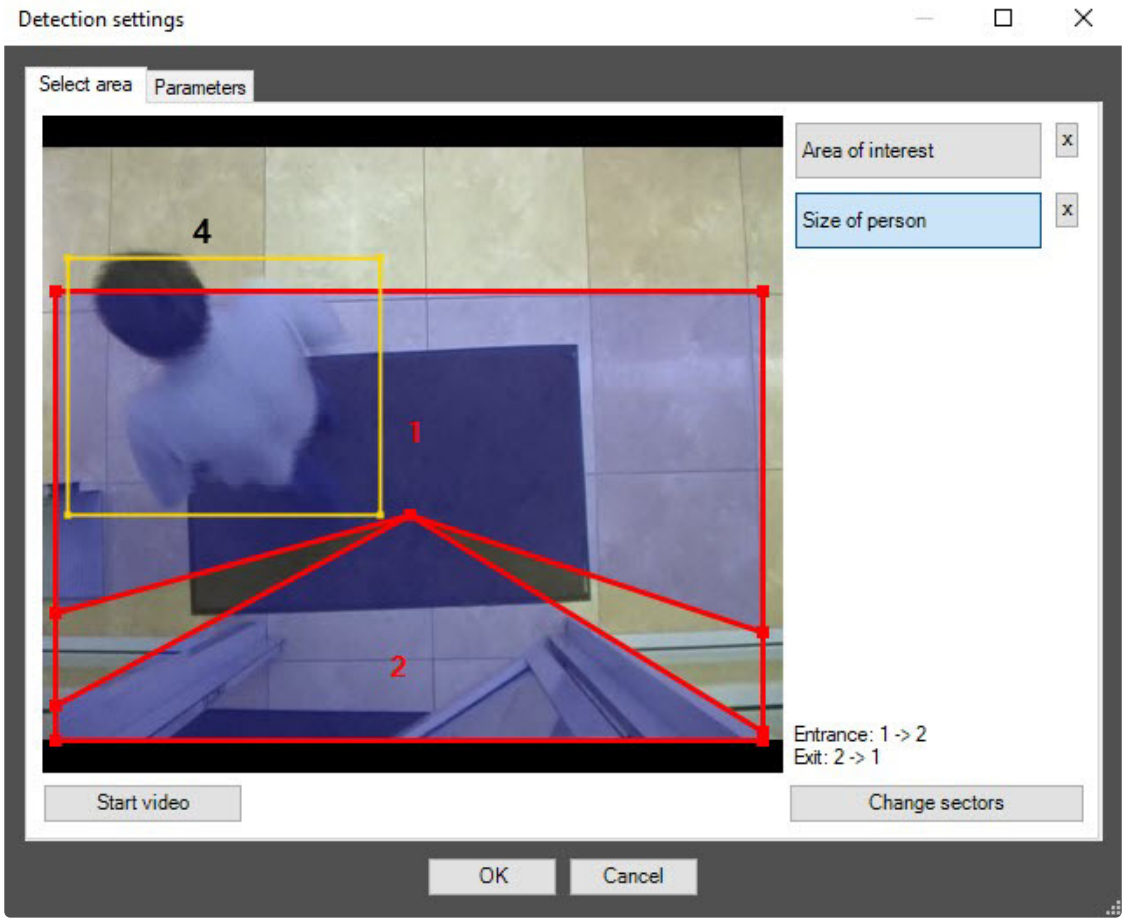
> **Note**
>
> The area of interest is divided into two sectors—1 and 2. If an object moves from sector 1 to sector 2, it is logged as the entry of a visitor. If the visitor moves from sector 2 to sector 1, it is logged as an exit.



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

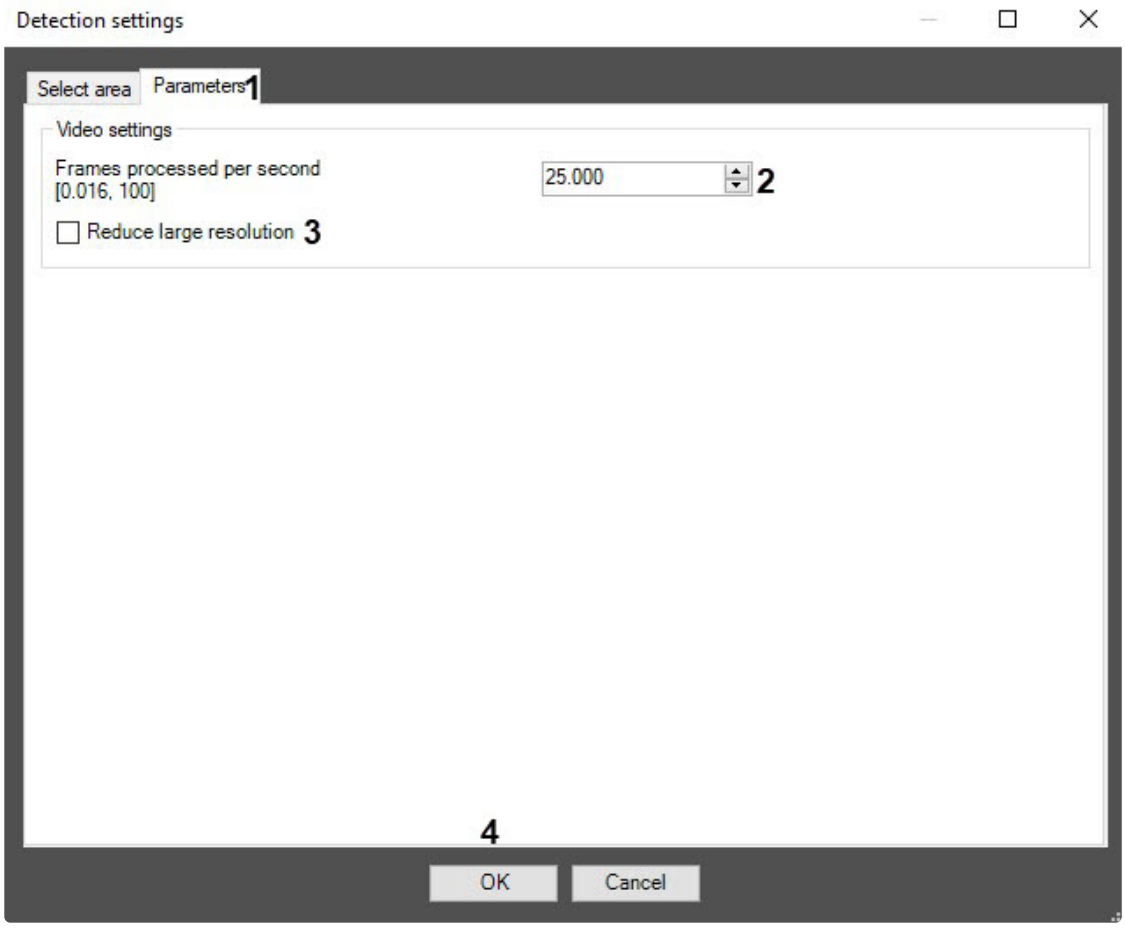
4. Set the approximate person size as follows:
   a. Click the **Size of person** button (**3**).
   b. On the captured video image, set the approximate person size. To do this, use the left mouse button to select a rectangular area (**4**).

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



5. Setting the module parameters:

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



b. In the **Frames processed per second [0.016, 100]** field (**2**), set the number of frames per second that will be processed by the detection tool.
c. Set the **Reduce large resolution** checkbox to create and process the new frame consisting of even lines of the initial frame (**3**).

6. Click the **OK** (**4**) button to save the changes and return to the settings panel of the **People counter detection**.
7. On the **People counter detection settings** panel, click the **Apply** (**2**) button.

Configuring the *People counter detection* module is complete.

4.6 Stopped vehicle detection

4.6.1 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.

4.6.2 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.

4.6.3 Configuring the Stopped vehicle detection module

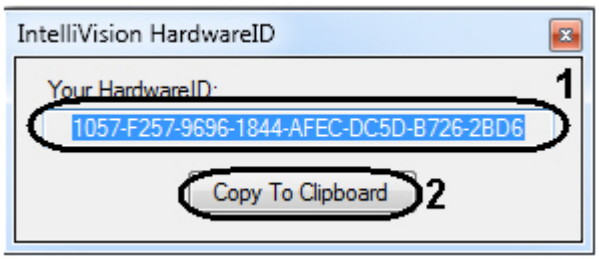
Licensing the Stopped vehicle detection module

> **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.

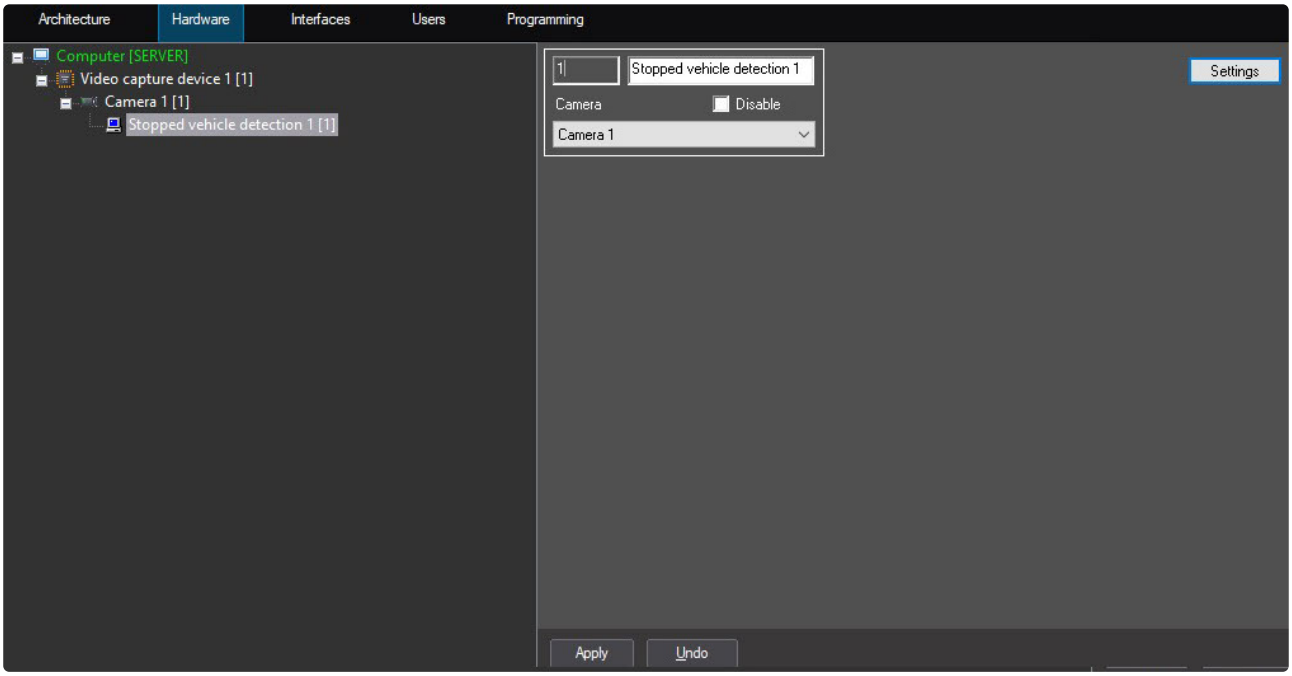


3. The code is displayed in the **Your HardwareID** field (**1**).
4. Click the **Copy To Clipboard** button to copy the code to the clipboard (**2**).
5. Send the code to the manager of the AxxonSoft company and specify the number of **Stopped vehicle detection** which you plan to use.
6. Receive the 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.

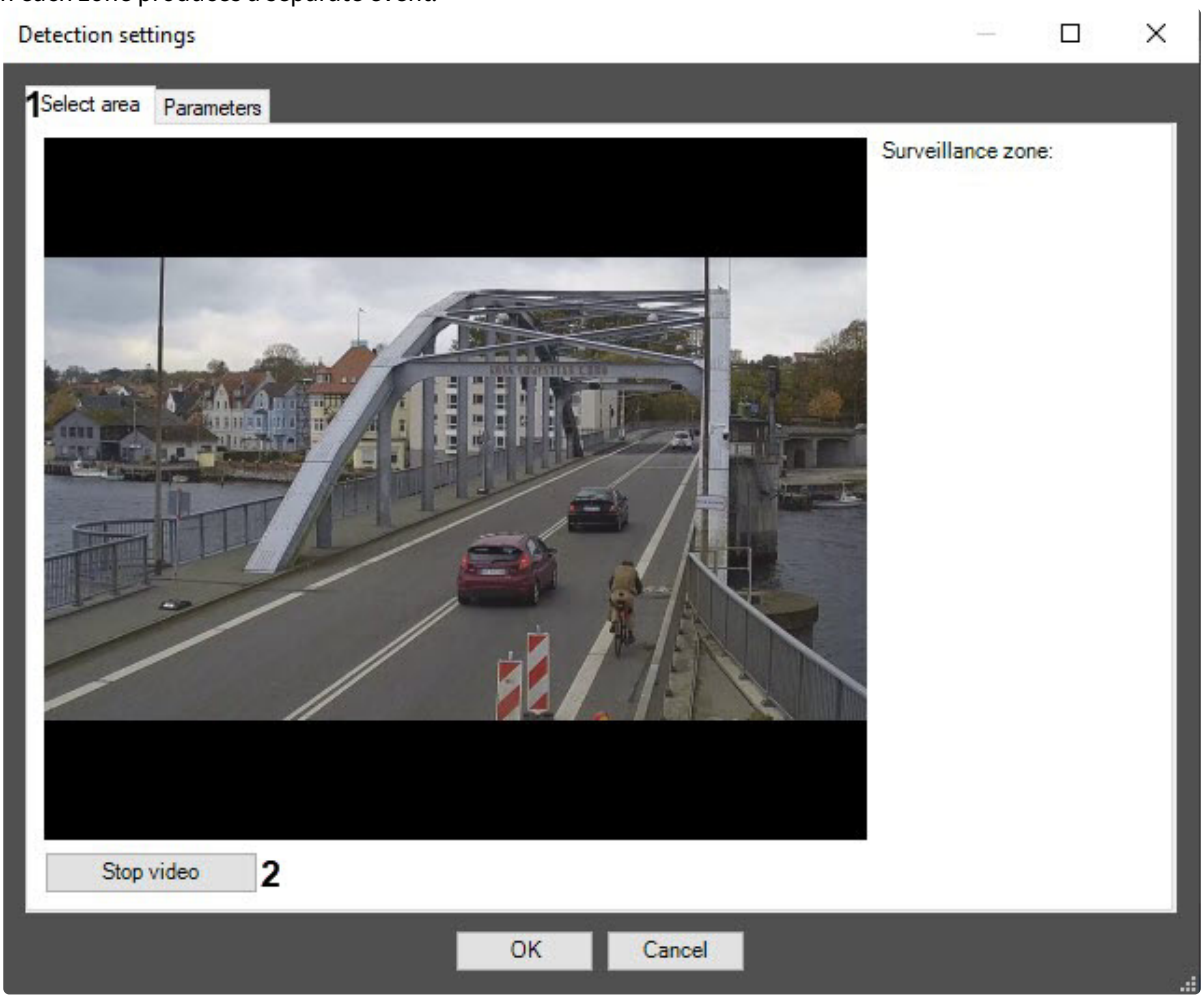


The *Stopped vehicle detection* module is configured as follows:

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

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

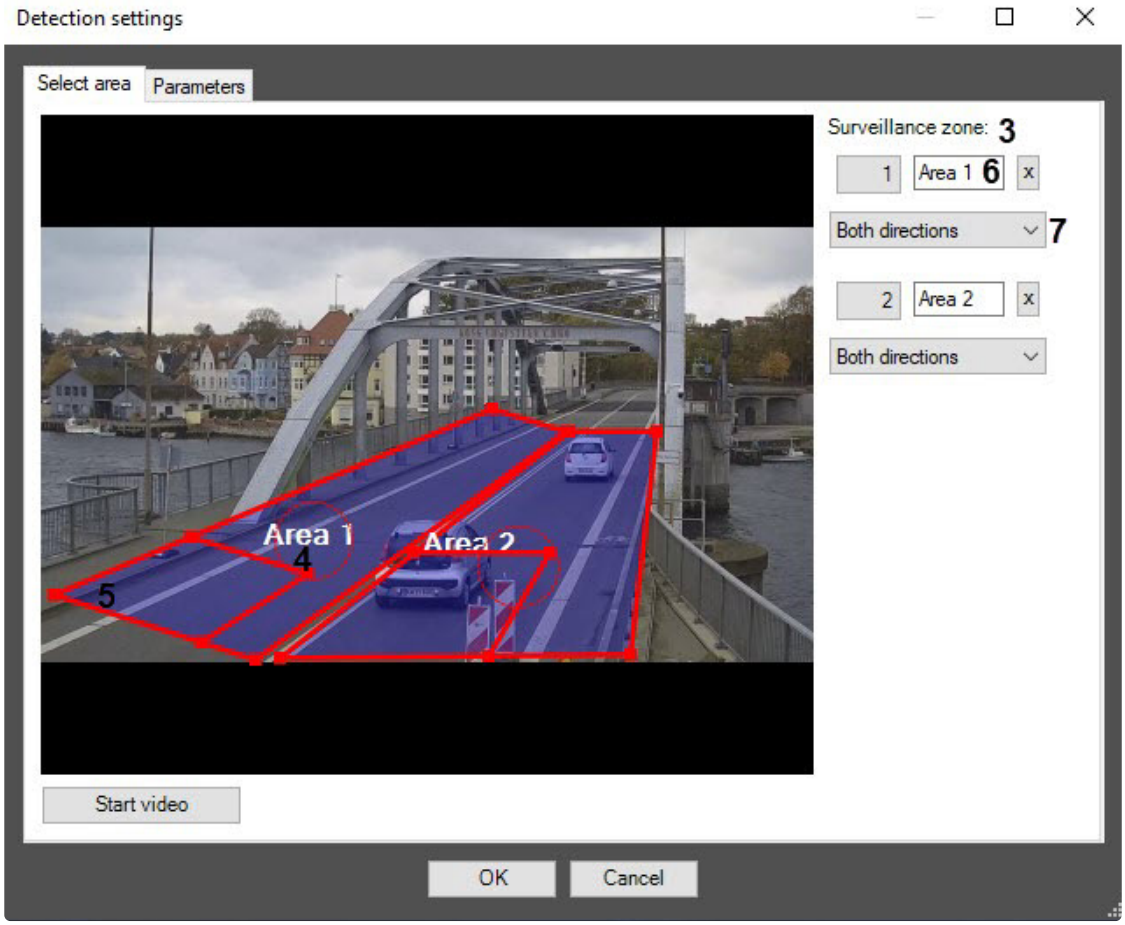
3. Set the surveillance zones on the **Select area** tab (**1**). Several zones can be added. Detection tool triggering in each zone produces a separate event.



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**).

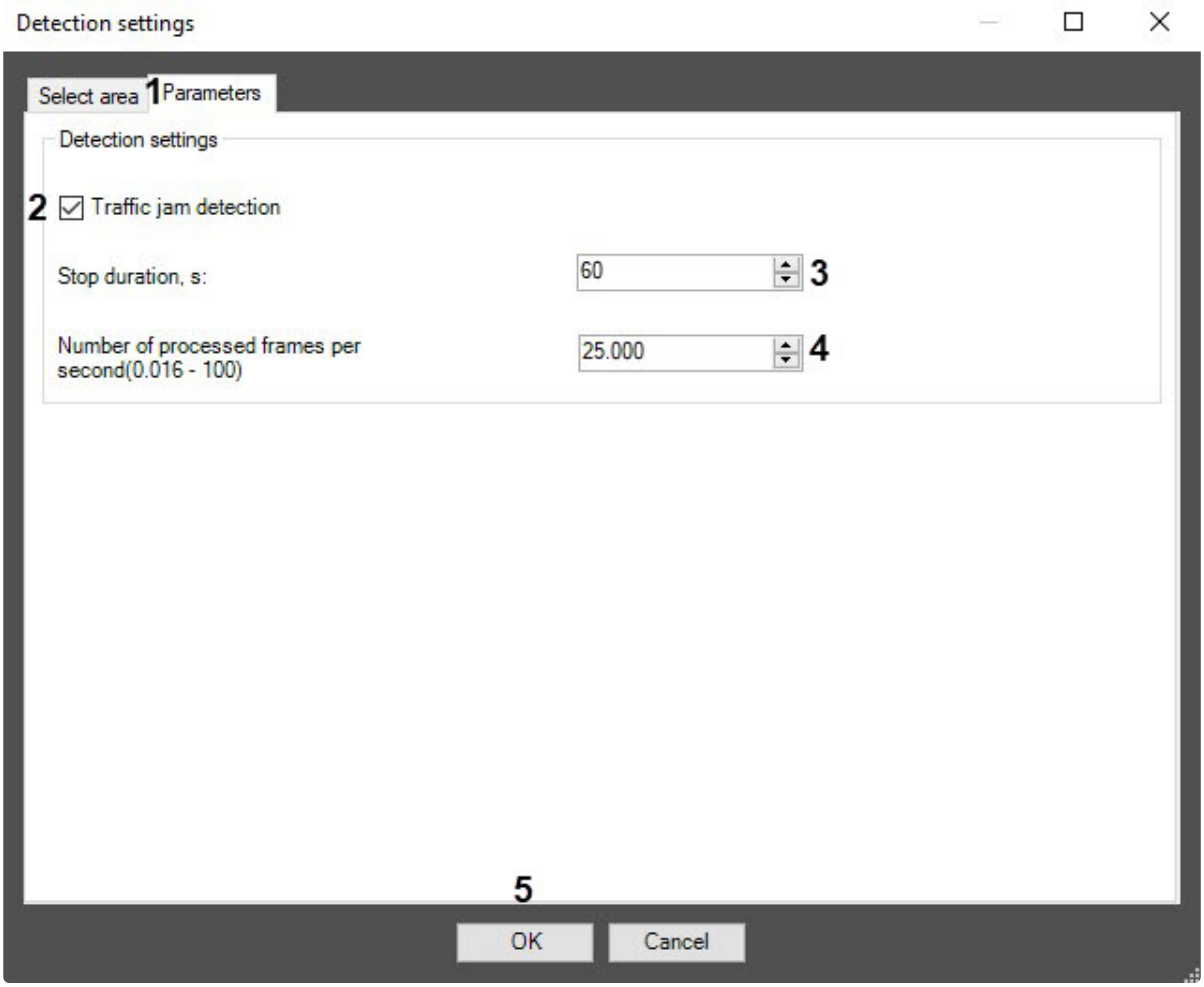
d. Specify the approximate size of the vehicle in each surveillance zone by changing the size of the internal areas in the bottom left corner of the zone (**5**). This field is called the detection area.

> **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.

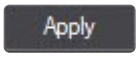
4. Go to the **Parameters** tab (**1**).



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.

4.7 Detection of light indication control

4.7.1 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.

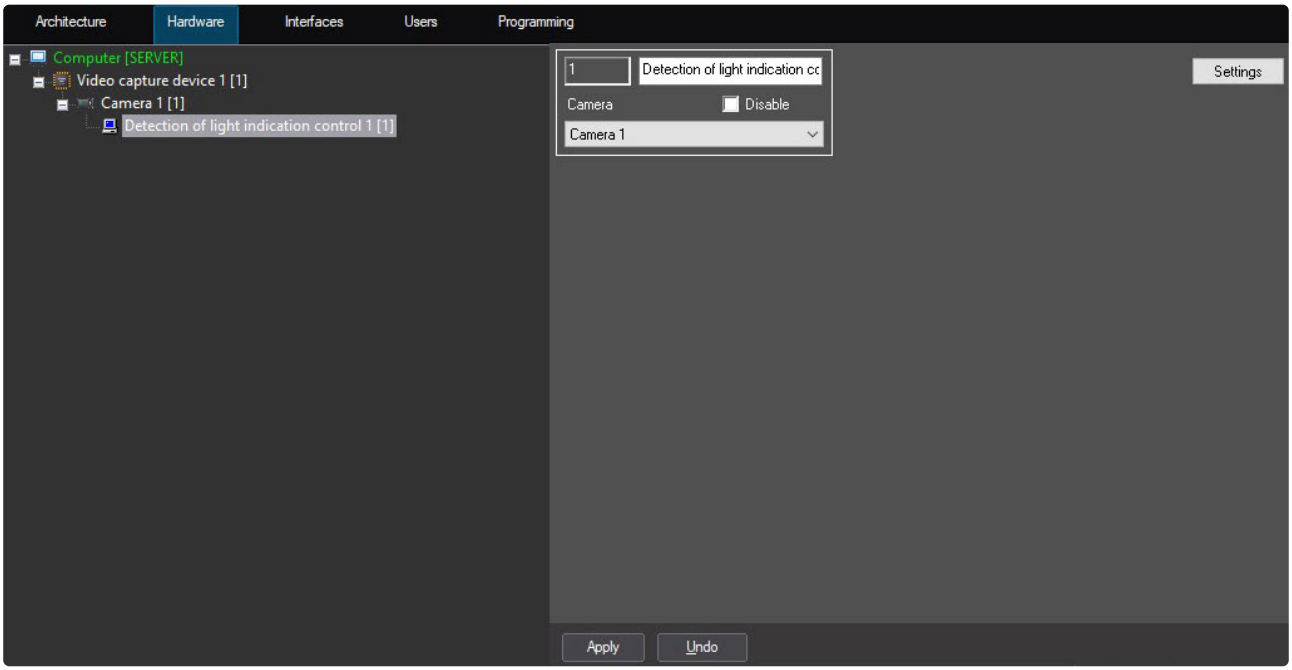
4.7.2 Camera requirements for the Detection of light indication control module

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.

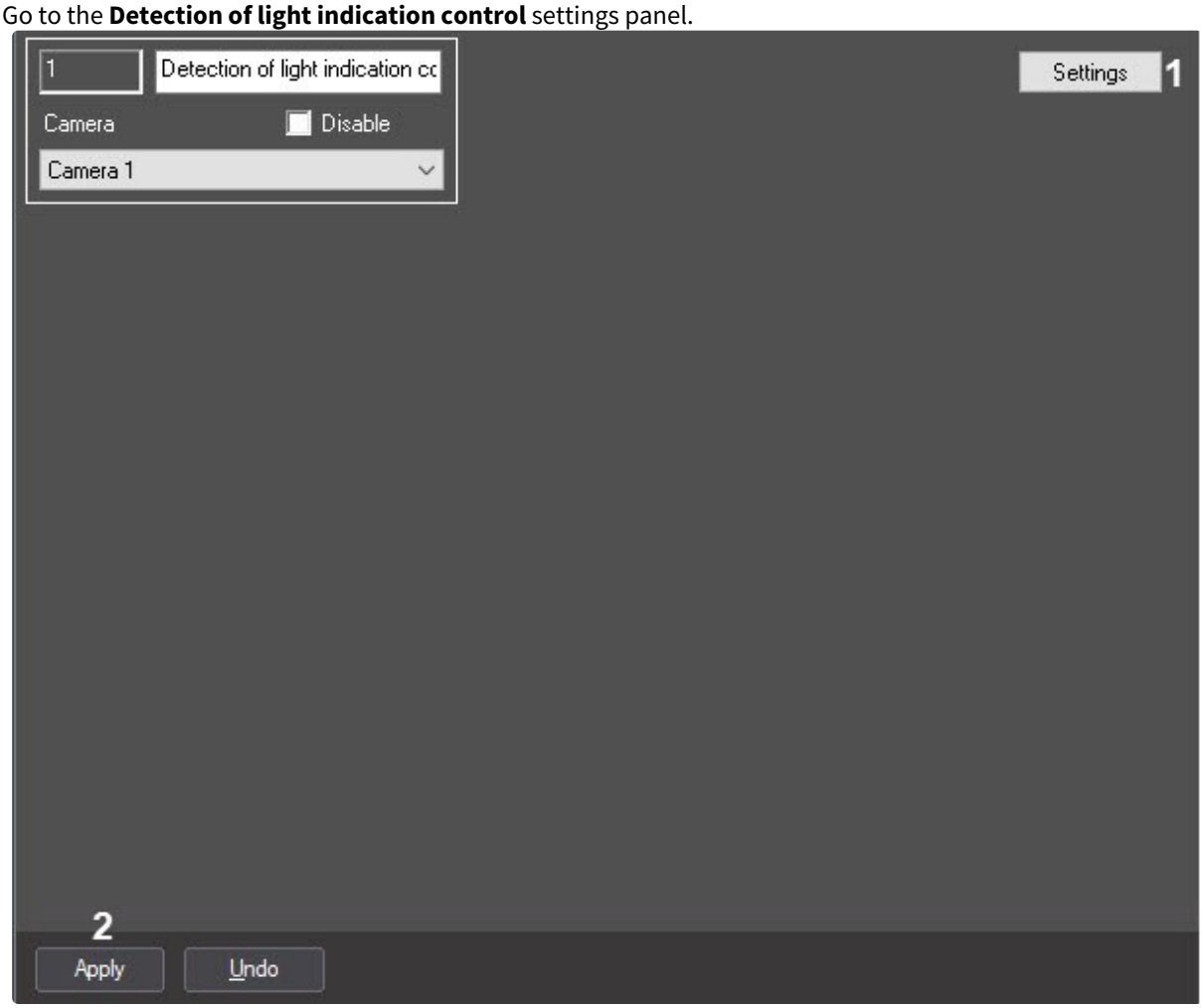
4.7.3 Configuring the Detection of light indication control module

The *Detection of light indication control* module is configured using the **System settings** menu, on the **Hardware** tab, on the **Detection of light indication control** settings panel, using the **Camera** settings.

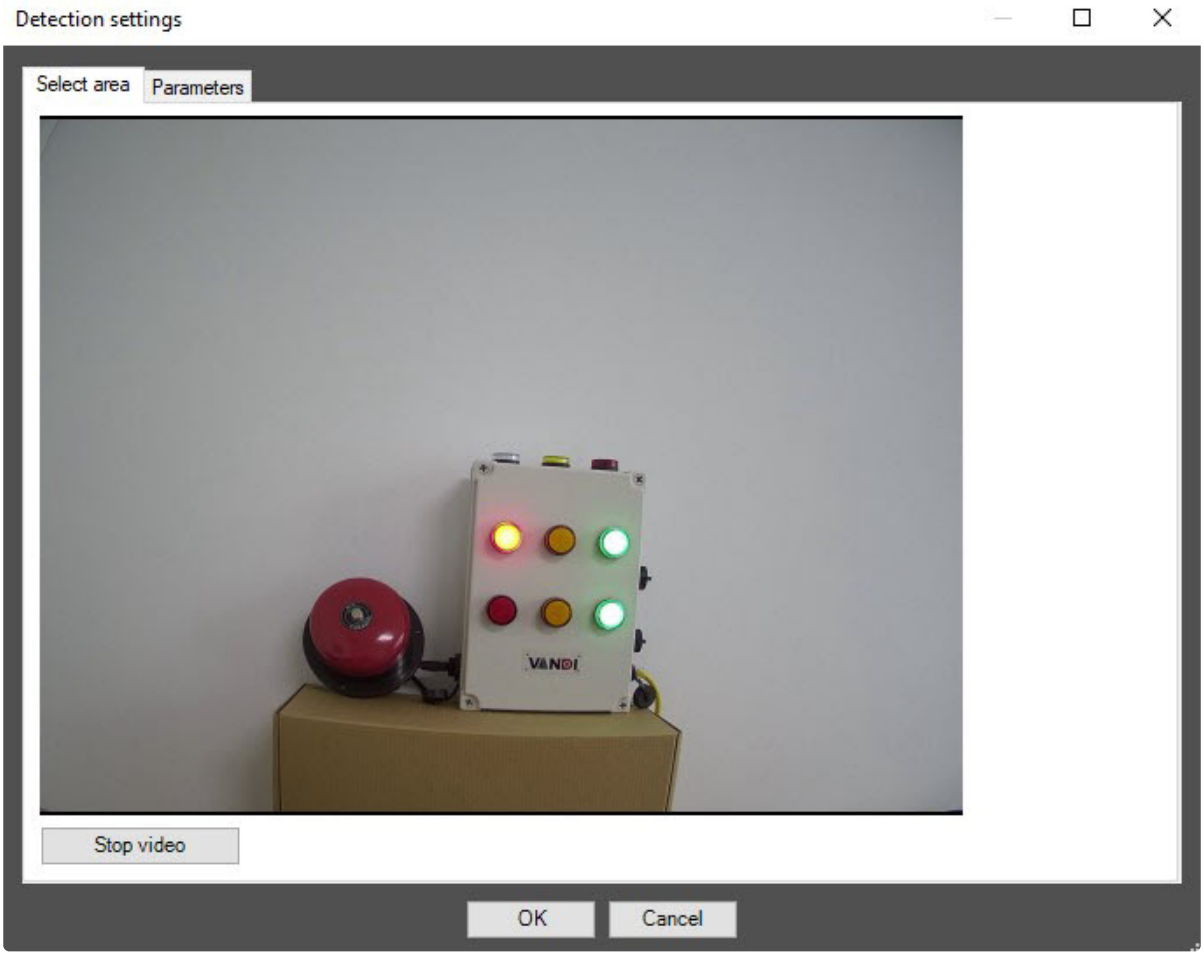


The *Detection of light indication control* module is configured as follows:

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

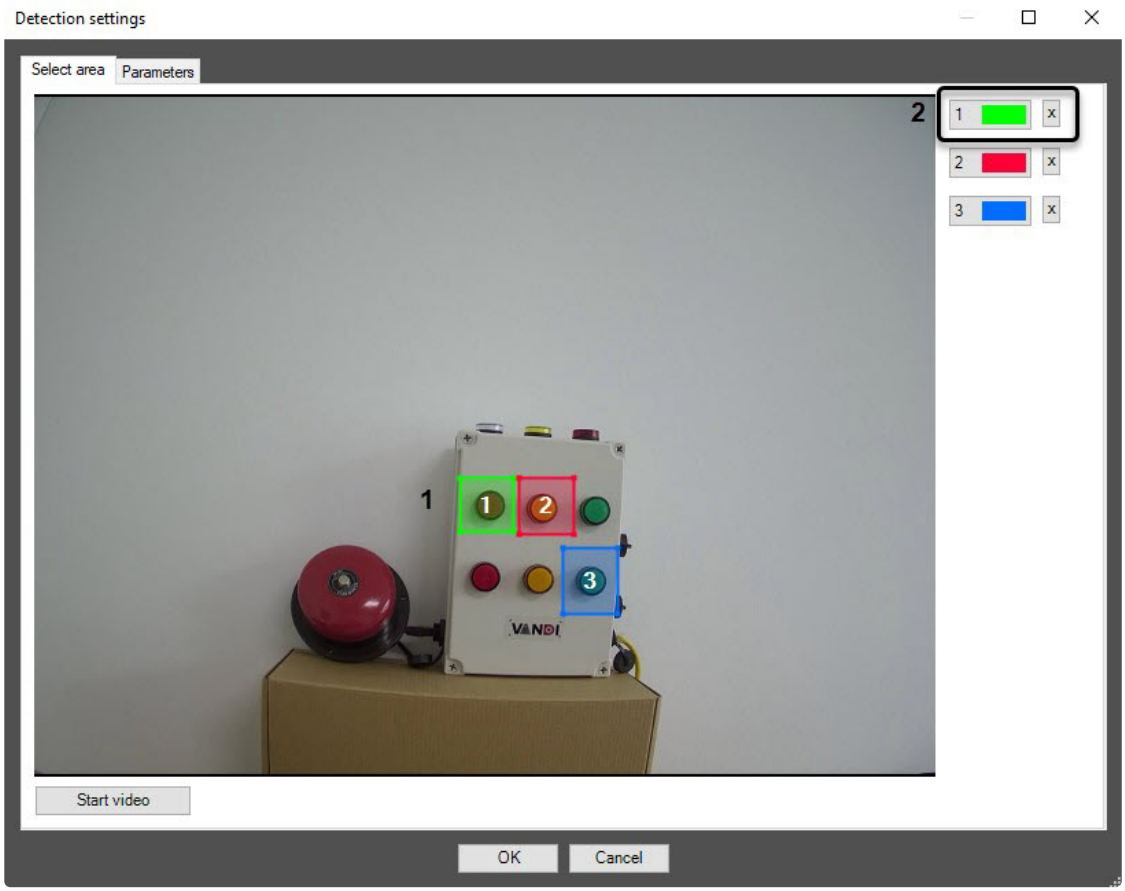


2. Click the **Settings** button (**1**). The **Detection settings** window will open.



3. Specify the location of lights sources in the image which should be tracked by detection:
   a. Click the **Stop video** button to capture the video image.
   b. On the captured video image, specify areas to be analyzes (**1**). Click the left mouse button in the frame area and stretch it to the required size. The minimal allowed size of the analyzed area is 15x15 pixels. The maximum allowed size of the analyzed area is 200x200 pixels.
   Areas of interest are numbered in the order of creation starting from 1. The number of analyzed area is not limited. Adding the area at the right from the video image the corresponding button is

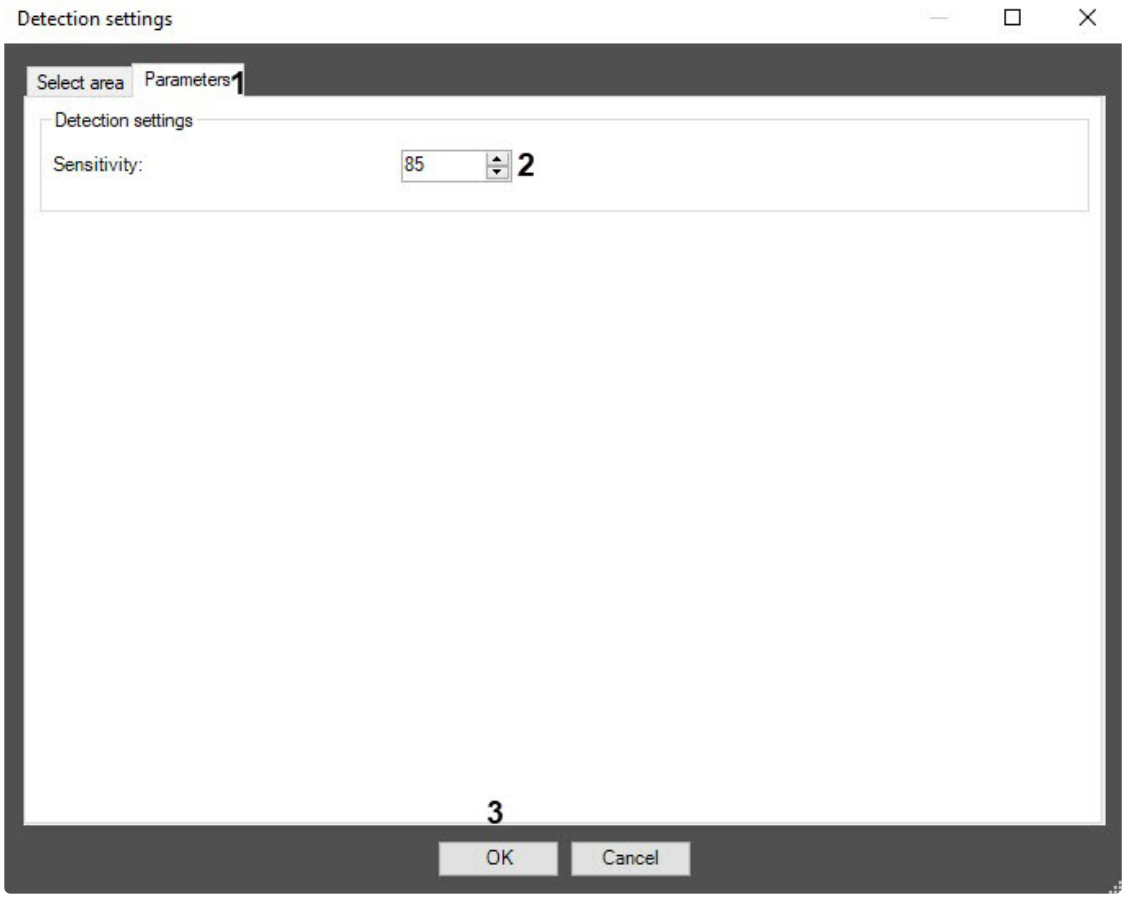
displayed (**2**).



c. Specify the required size, shape and location of sectors in the area of interest moving their borders. Selecting the area take into account that the local change of illuminance and specular surface near lamps in the area of interest can cause the false detection triggering.
d. To specify the area again, click the button with its number in the list of areas and mark the area in the video image frame (**2**).
e. Click the x button next to the **Area of interest** button.

4. Specify the detection sensitivity:

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



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.

5. Click the **OK** button (**3**) to save the changes and return to the settings panel of the **Detection of light indication control**.
6. On the **Detection of light indication control** settings panel, click the **Apply** button (**2**).

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

4.8 Heat map detection

4.8.1 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.

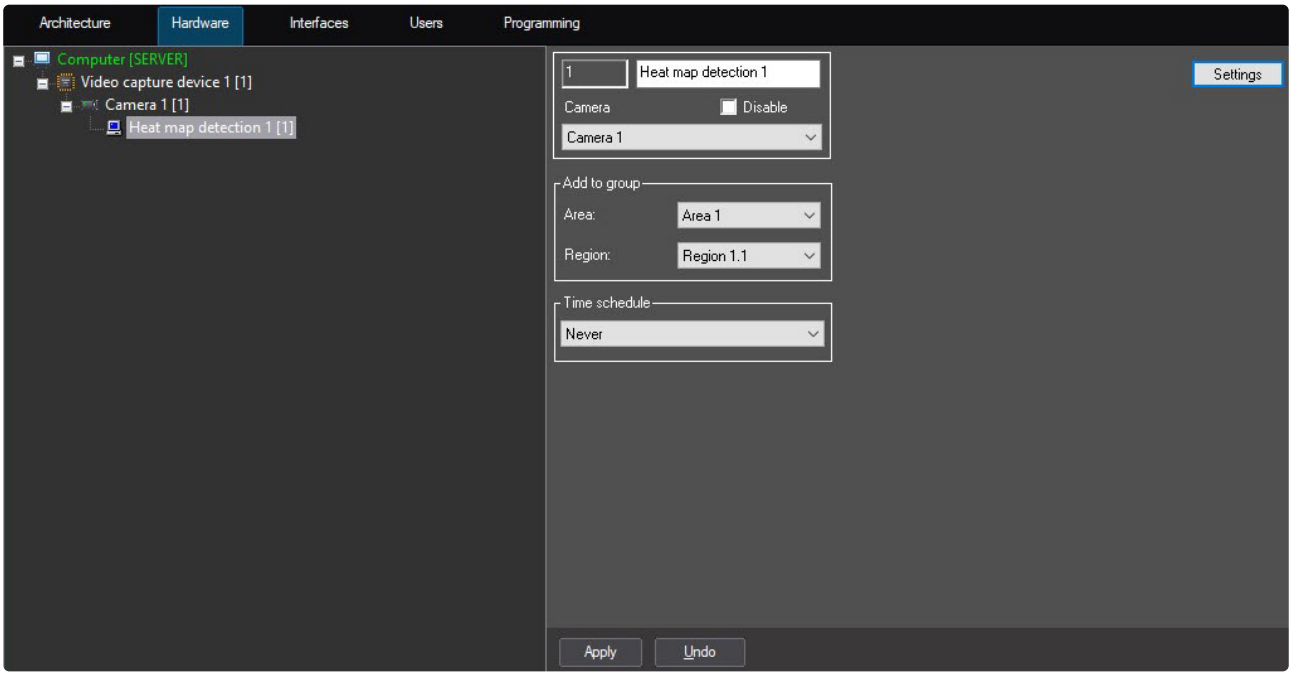
4.8.2 Camera requirements for the Heat map detection module

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%

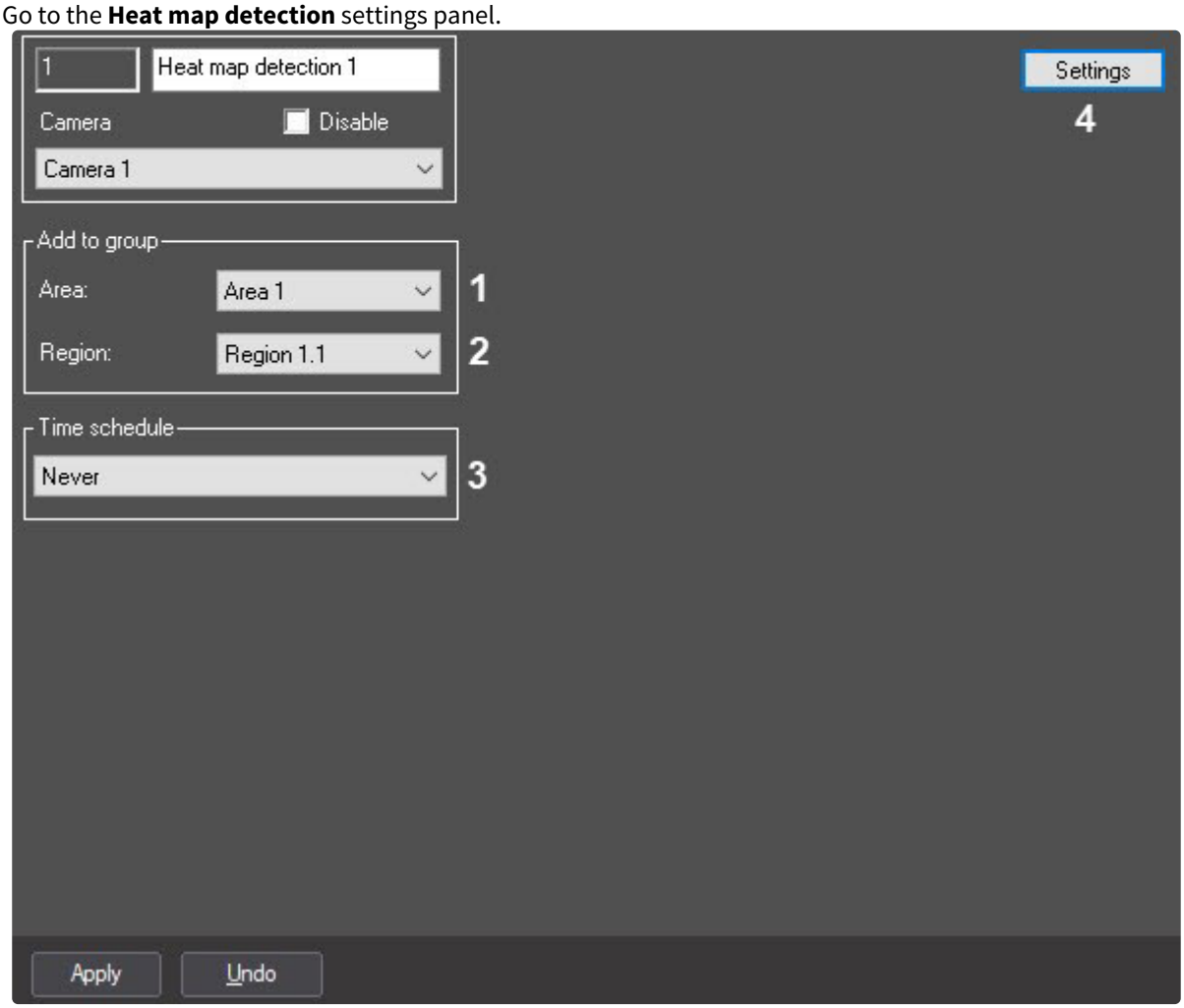
4.8.3 Configuring the Heat map detection module

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:

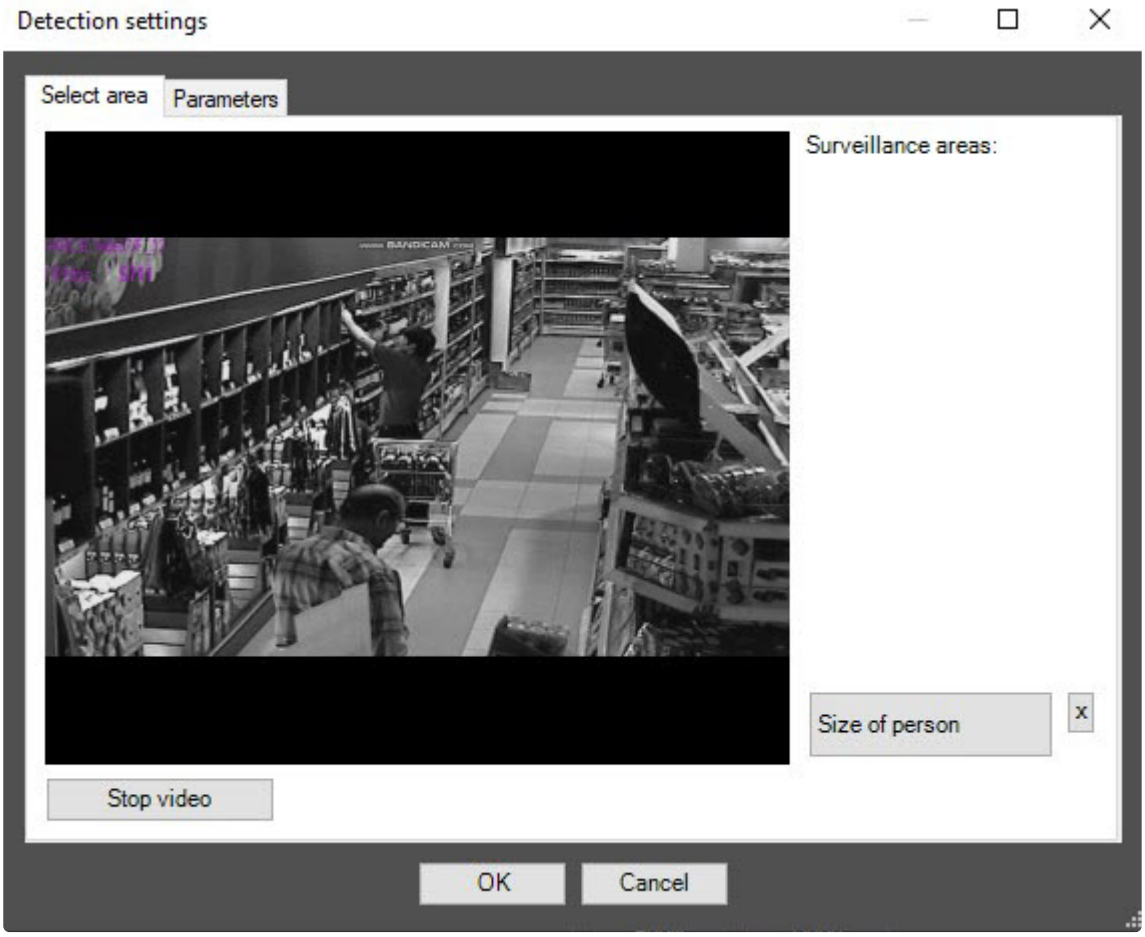
1. Go to the **Heat map detection** settings panel.



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**).

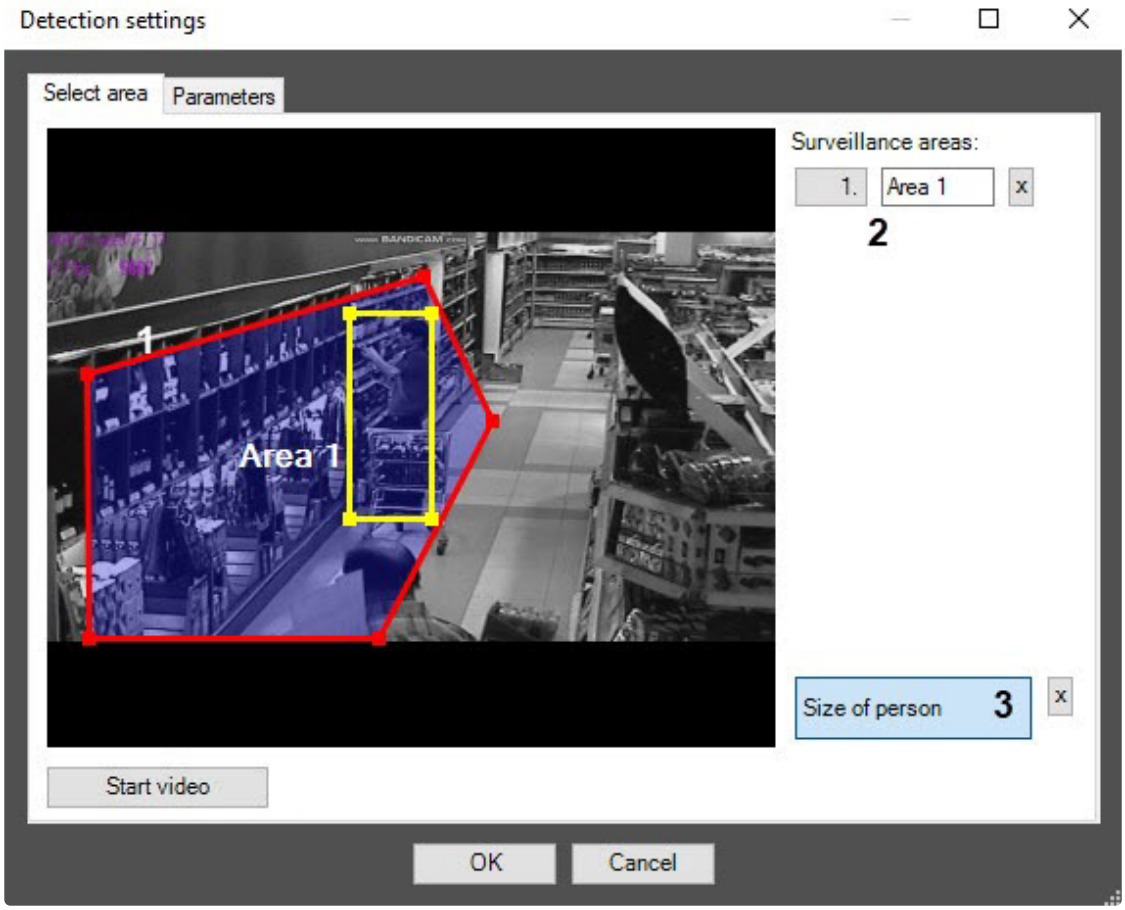
> **Attention!**
>
> If no custom **Time schedule** objects is created in the system, two time schedules are available— **Always** and **Never**. The **Never** time schedule is set by default, so the detection tool will not work if the default settings are left unchanged.

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

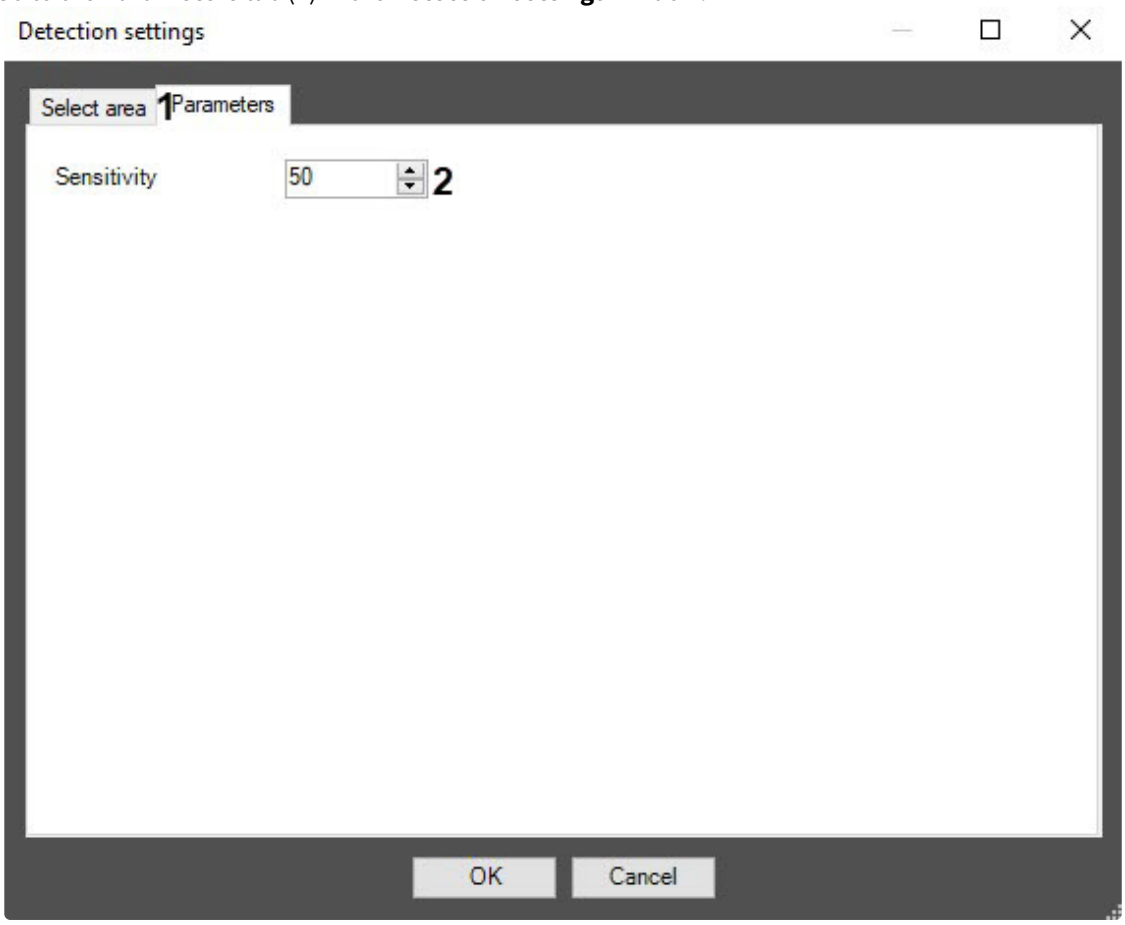
from the video image the corresponding button is displayed (**2**).



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.

4.9 Detection of moving against crowd flow

4.9.1 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.

4.9.2 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

4.9.3 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:

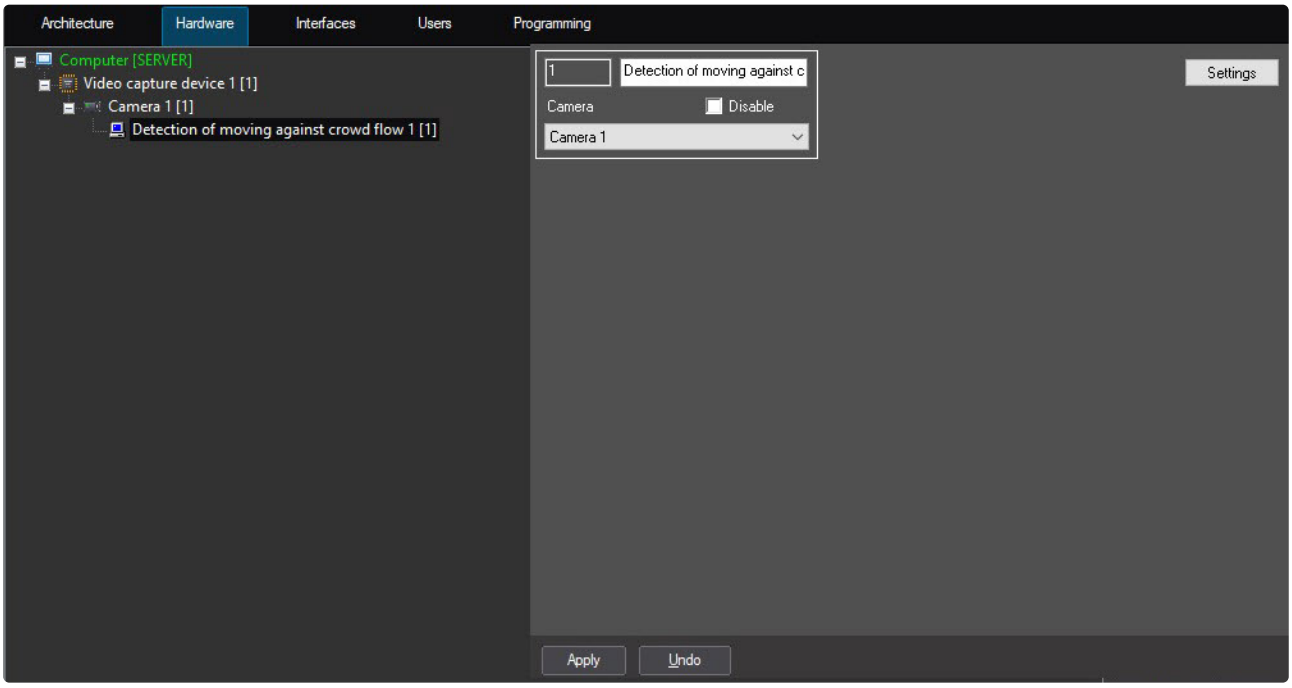
- if the number of people moving against a crowd is from 1 to 2 inclusive, the detection will trigger;
- if the number of people moving against a crowd is 3 or more, the detection won't trigger;
- if there are no people moving against a crowd, the detection won't trigger.

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.

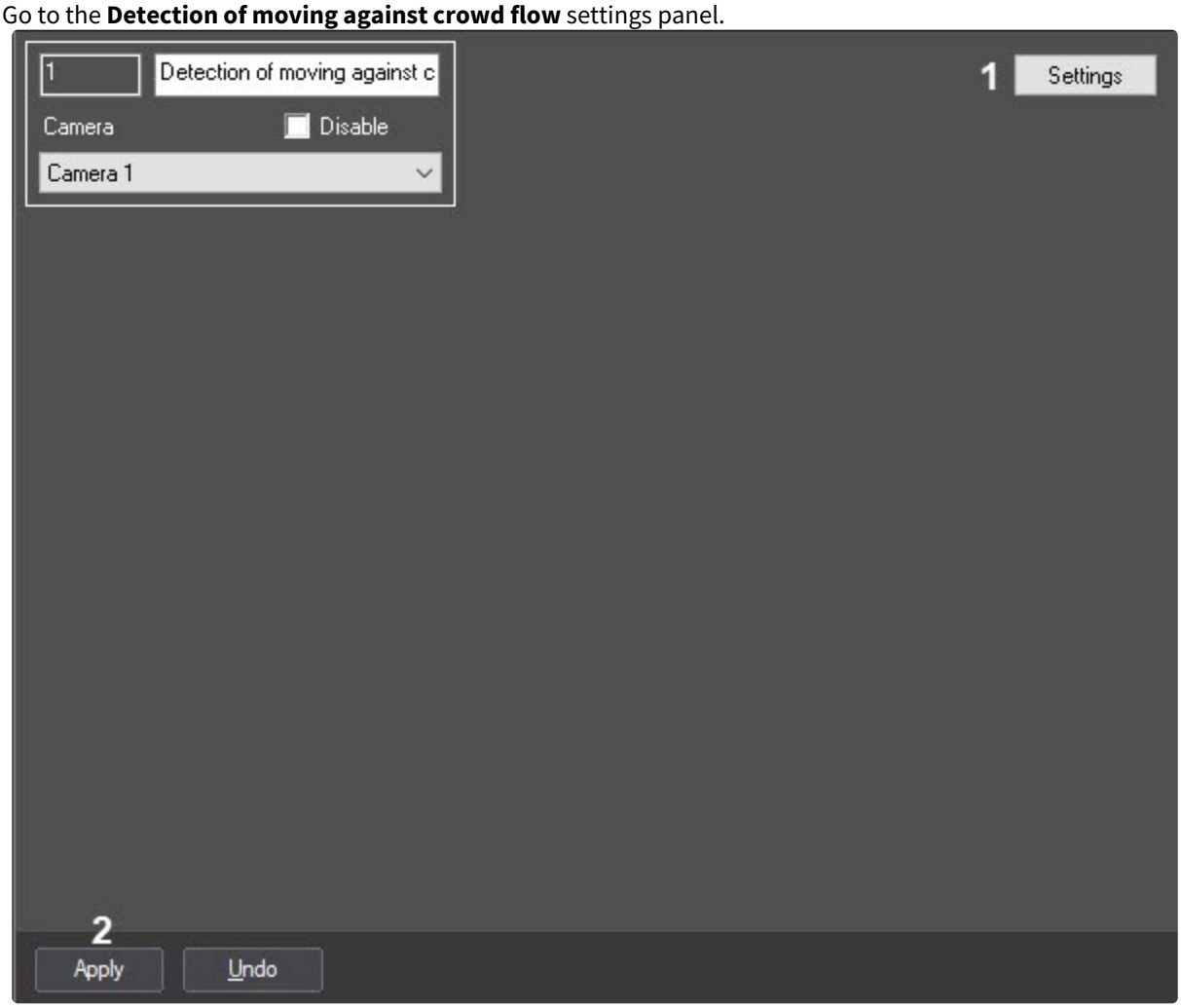
Setting up the Detection of moving against crowd flow module

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.

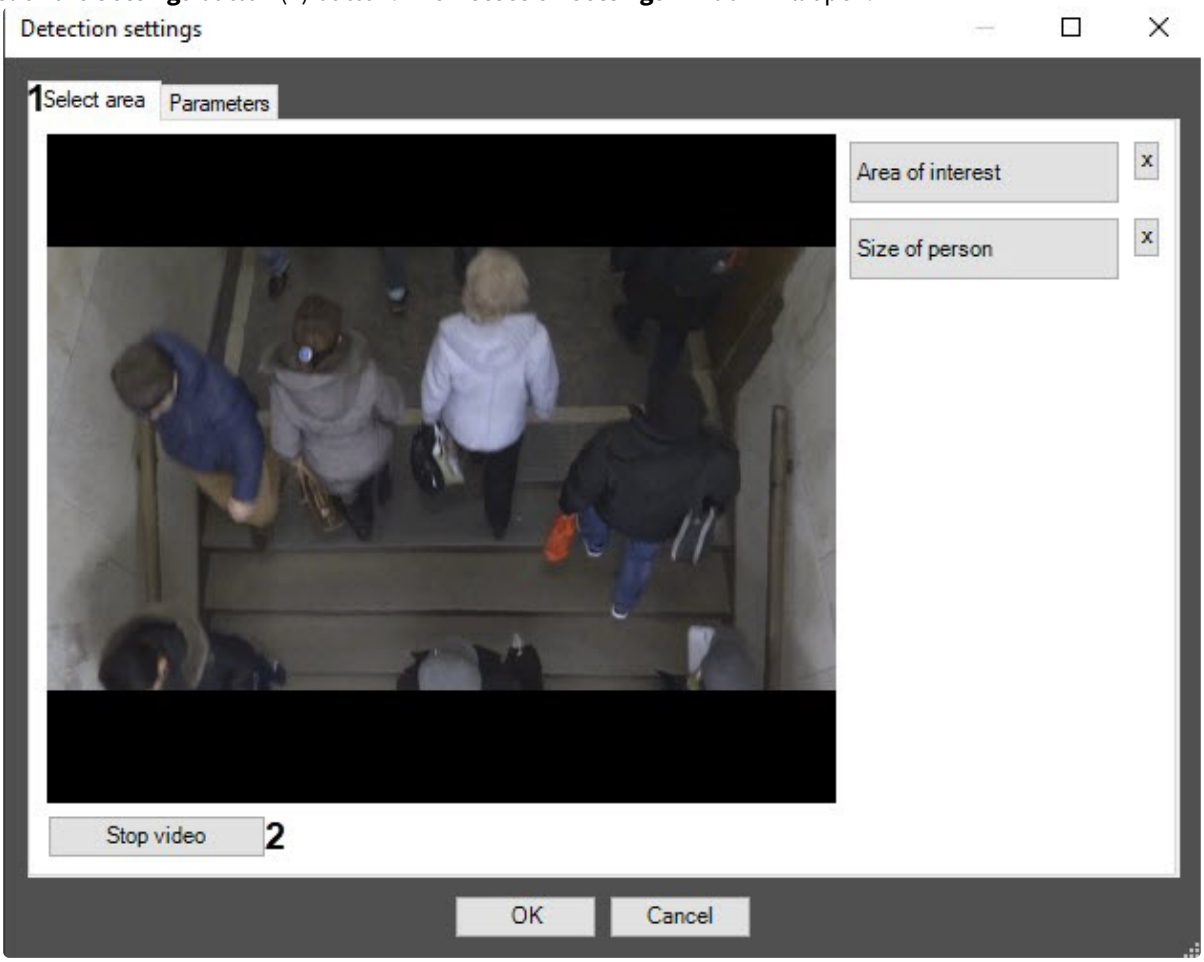


The *Detection of moving against crowd flow* module is configured as follows:

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

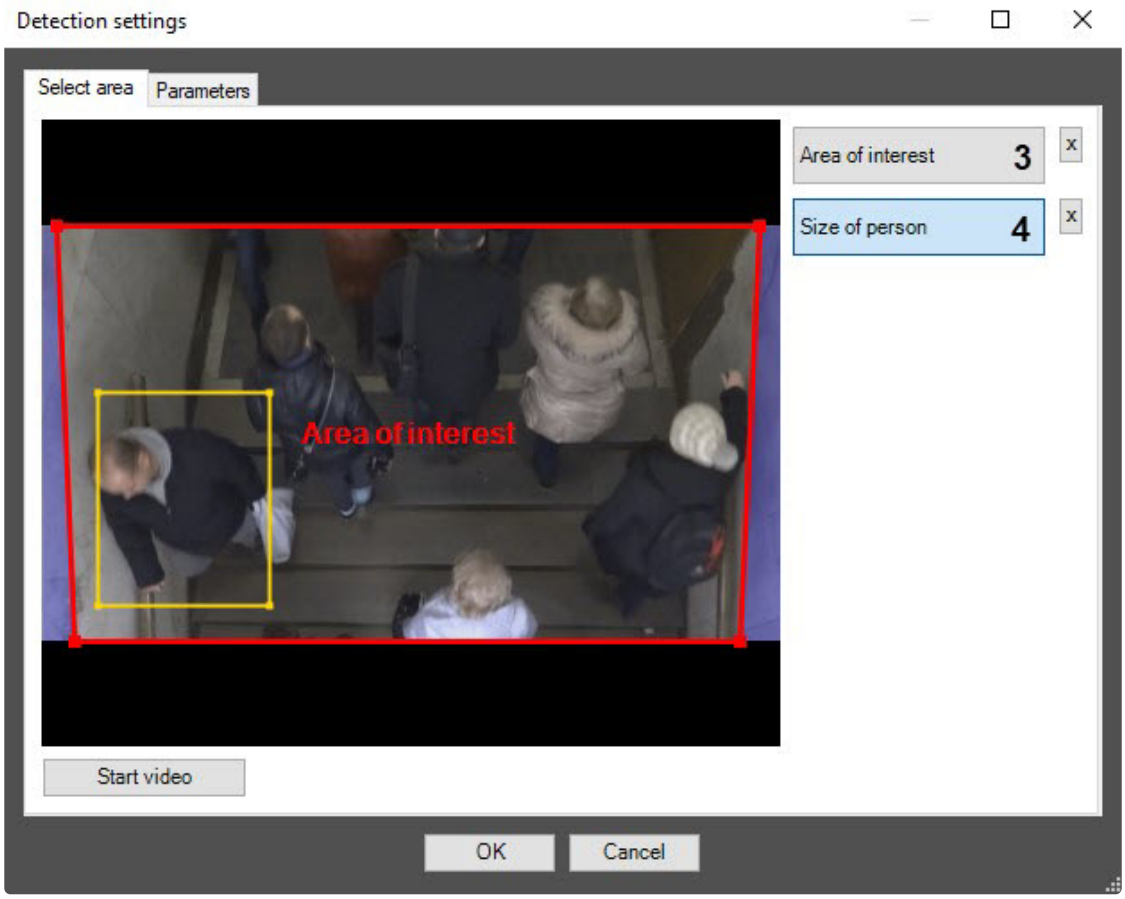


2. Click the **Settings** button (**1**) button. The **Detection settings** window will open.



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.

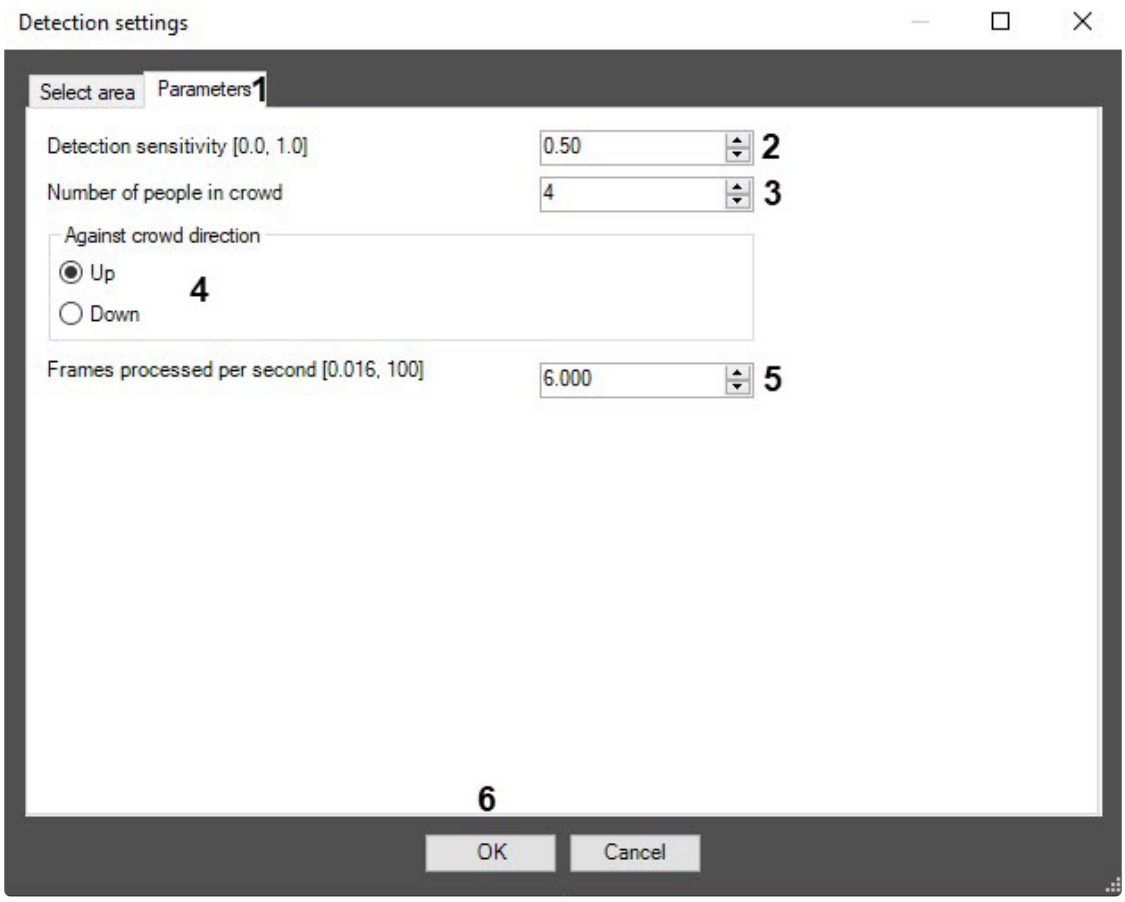
> **Note**
>
> To remove the area, click the x button next to the **Area of interest** button.

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.

4.10 Sweethearting at checkout detection

4.10.1 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.

4.10.2 Camera requirements for the Sweethearting at checkout detection module

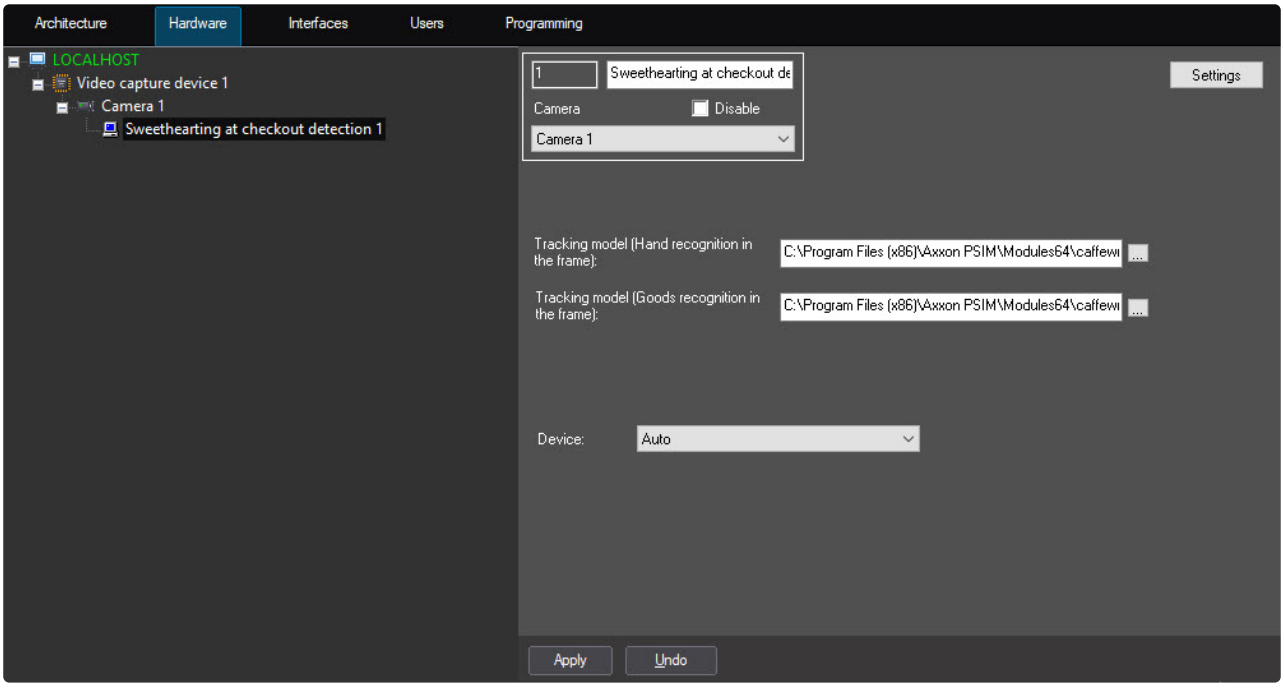
The requirements for the cameras that will work with the *Sweethearting at checkout detection* module are listed in the following table:

Camera	• Resolution should be at least 1920x1080 pixels • Fps not less than 12 • Only color cameras
Scene and camera angle	• The angle of the CCTV camera shall 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) should be from 150x150 to 250x250 pixels
Object images	• The area of interest of the detection tool (see Configuring the Sweethearting at checkout detection module) should be set in a way that the initial position of the goods is outside this area. The goods should be carried along the whole given area (in case of vertical or horizontal location of the area – from one side to the other, and in the case of the area at an angle – from one diagonal to another)

Lighting requirements	• Objects should be visually separated from the background and from each other

4.10.3 Configuring the Sweethearting at checkout detection module

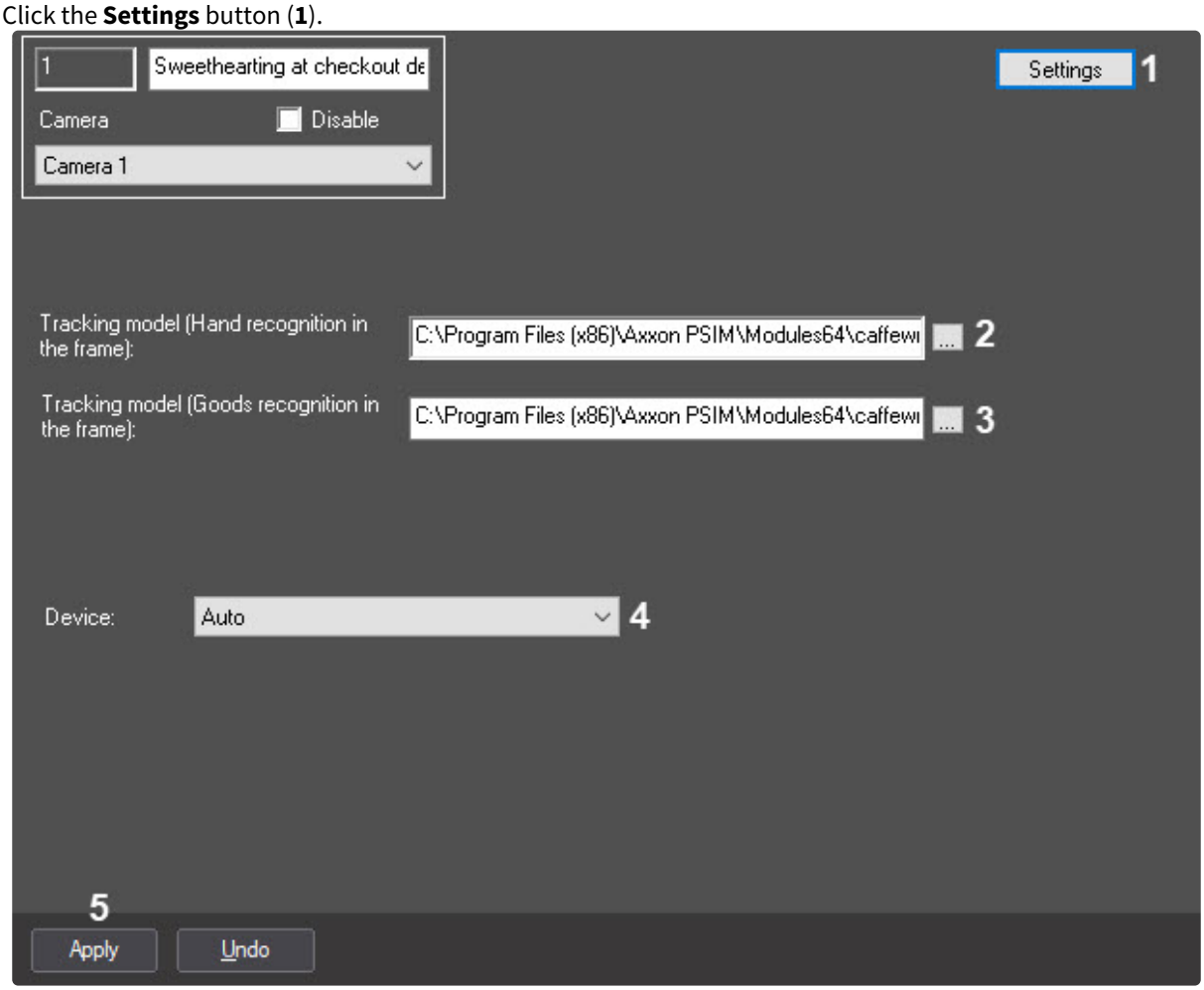
The *Sweethearting at checkout detection* module is configured on the settings panel of the **Sweethearting at checkout detection** object created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog box.



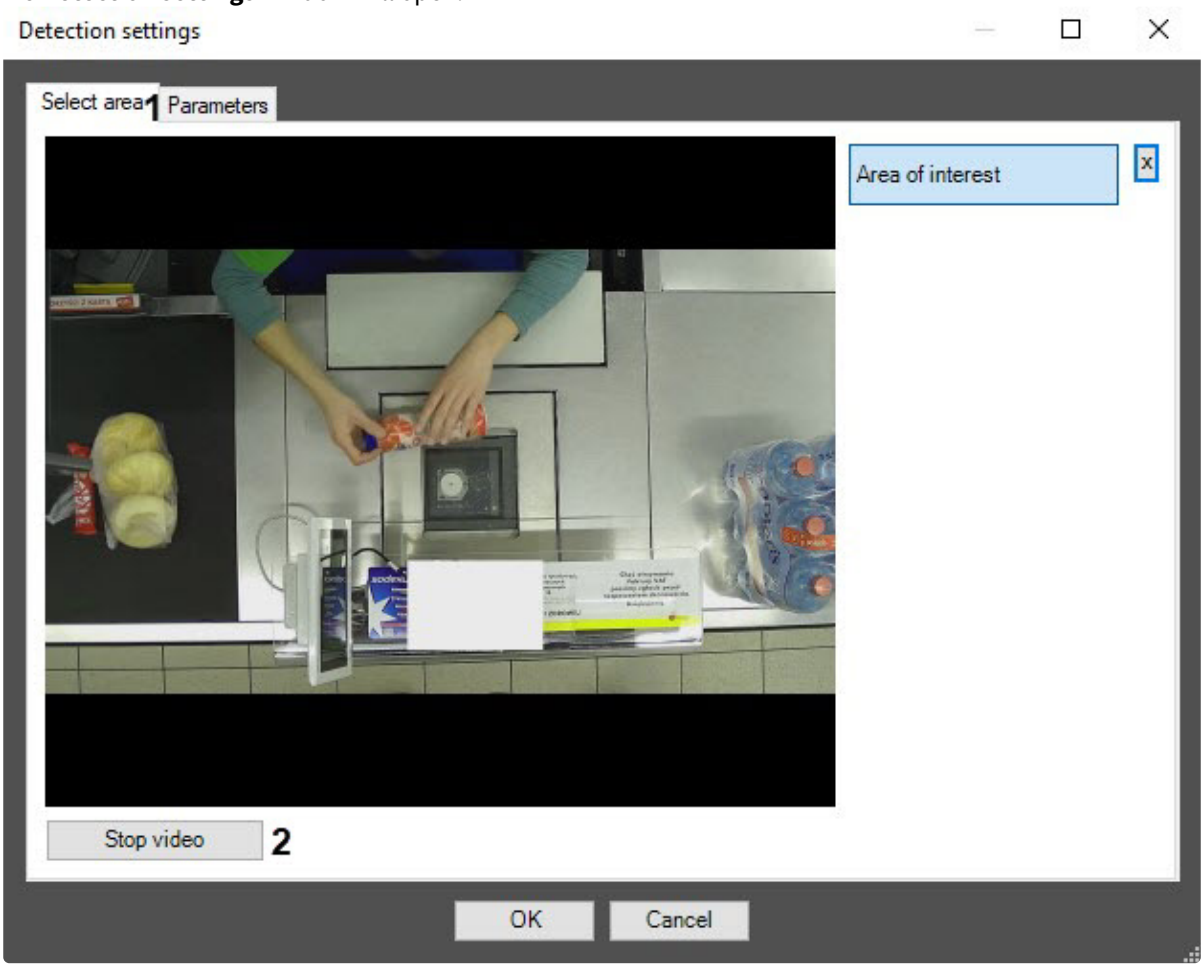
The *Sweethearting at checkout detection* module is configured as follows:

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

2. Click the **Settings** button (**1**).

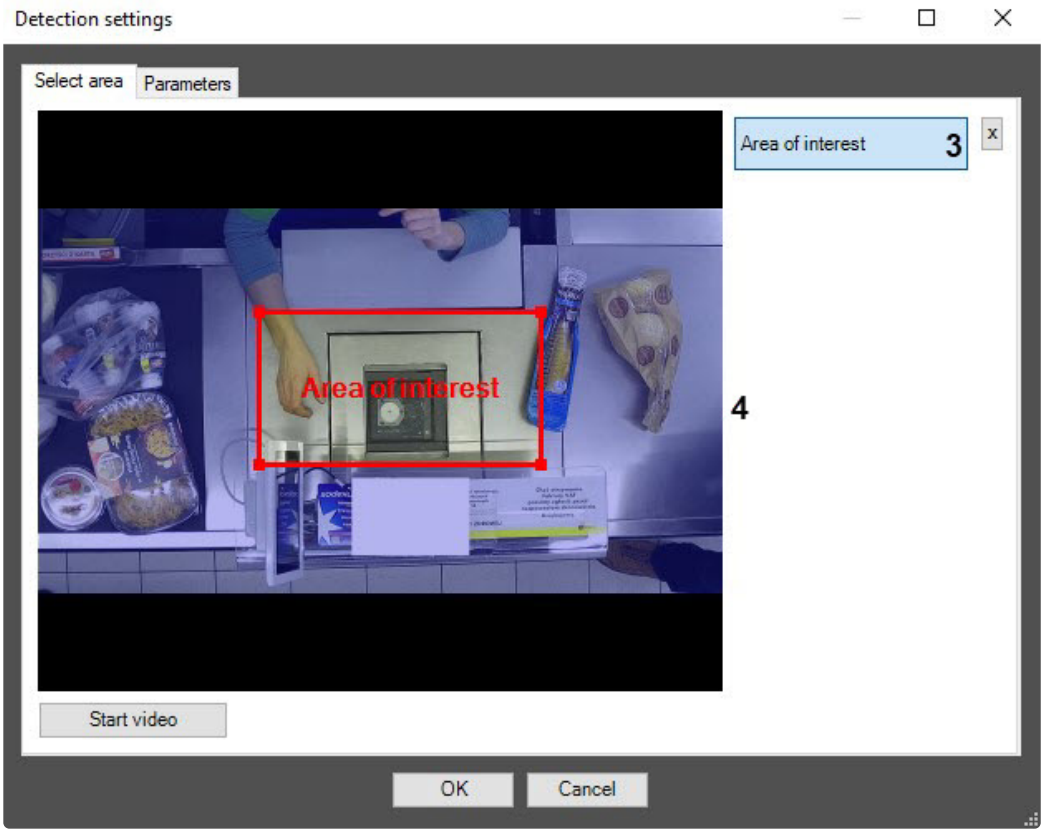


The **Detection settings** window will open.



a. Specify the area of interest of the detection:
    i. Go to the **Select area** tab (**1**).

ii. Click the **Stop video** button (**2**) to capture the video image.

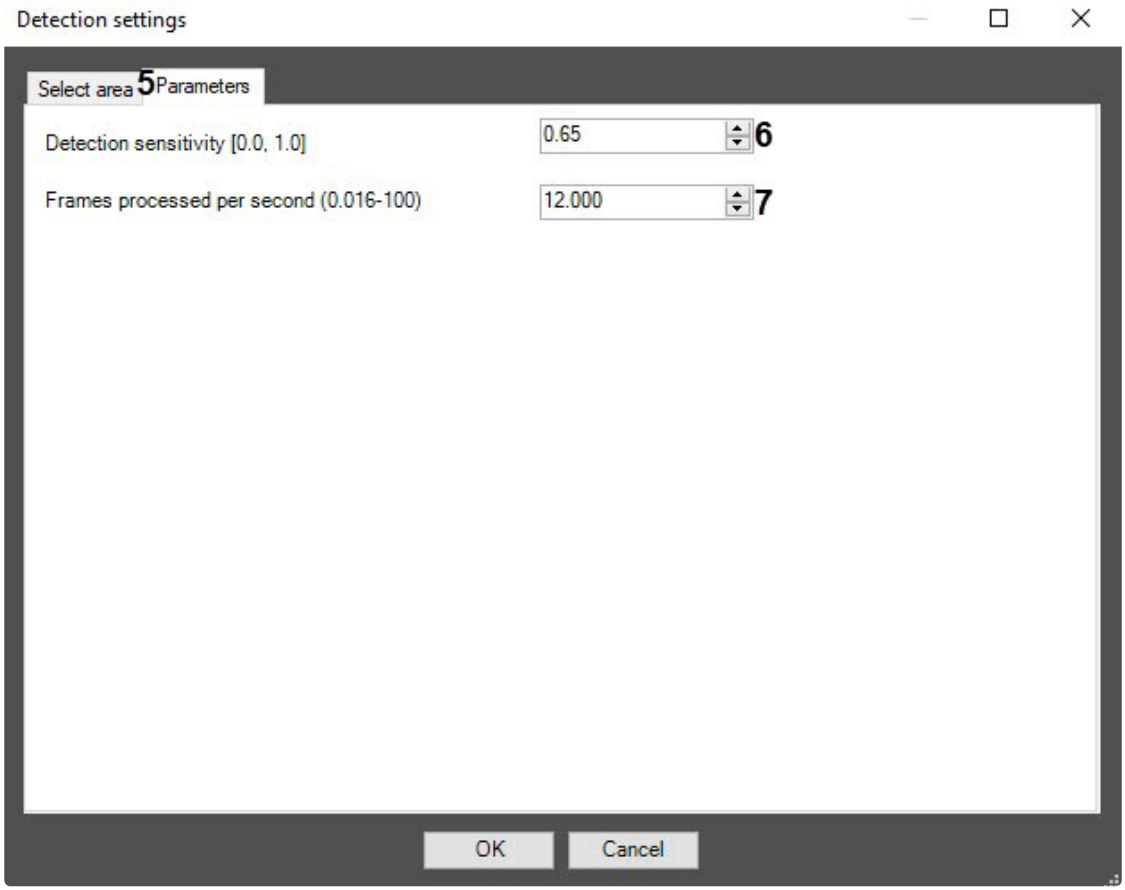


iii. Click the **Area of interest** button (**3**).

iv. Specify the area of interest in the captured video image to be analyzed (**4**). The selected area must comply with Camera requirements for the Sweethearting at checkout detection module.

> **Note**
>
> Only one area can be specified. If the second area is specified, then the first area will be deleted.
>
> To remove a selected area, click the x button next to the **Area of interest** button.

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



c. In the **Detection sensitivity [0.0 - 1.0]** field (**6**), specify the detection sensitivity in the range from 0.0 to 1.0.

> **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 may be skipped.

d. In the **Frames processed per second (0.016-100)** field (**7**), set the number of frames per second that will be processed by the detection tool. Default value is 12.

e. 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 **Cancel** button.

3. If you use a unique neural network, select a neural network file with the hand recognition in the frame (**2**) and goods recognition in the frame (**3**) tracking model. It is not necessary to select standard neural networks in this field, the system will automatically select the required one. Standard neural networks are located in the C:\Program Files (x86)\Axxon PSIM\Modules64\caffewrapper\Networks directory:

dpe_224_2cl_hands_v6_50k.ann	Neural network file with the hand recognition in the frame tracking model
dpe_224_2cl_product_v6_122_5k.ann	Neural network file with the goods recognition in the frame tracking model

4. In the **Device** drop-down list (**4**), select the device on which the neural network will operate.
5. Click the **Apply** button (**5**).

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

4.11 Barcode detection

4.11.1 Functionality of the Barcode detection

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

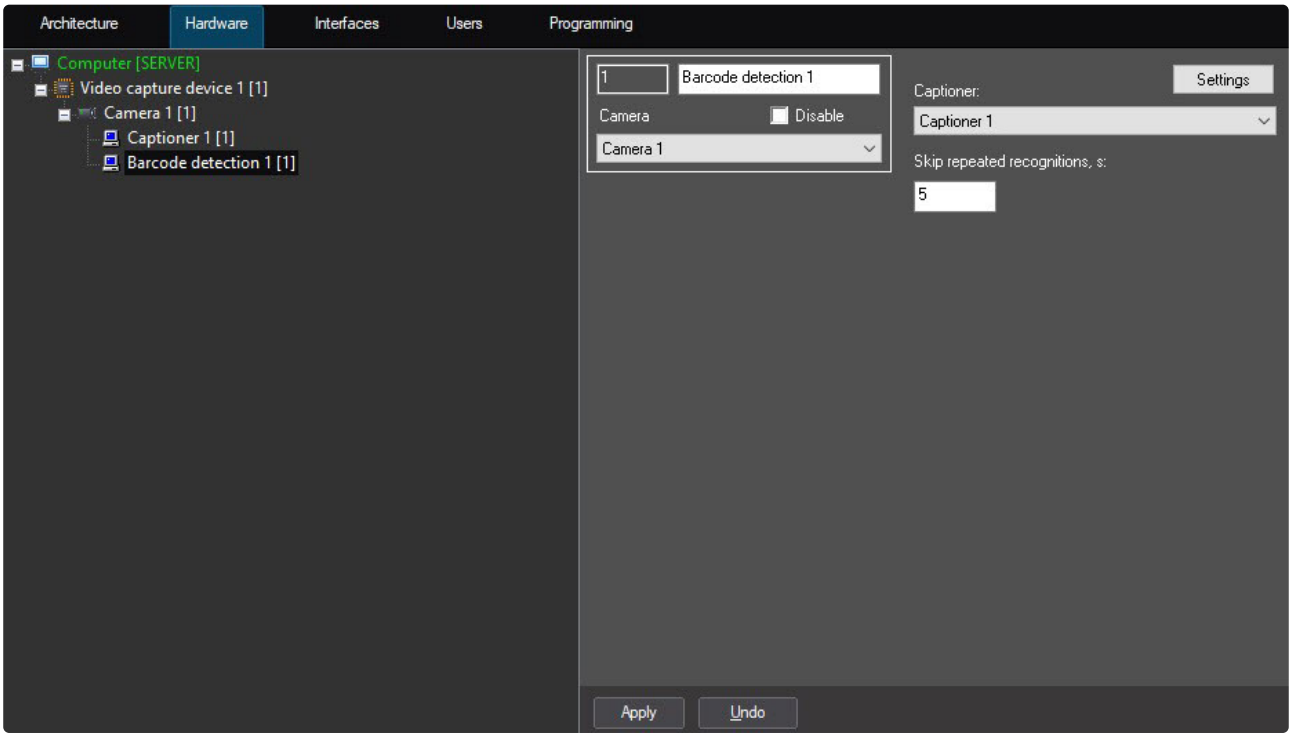
4.11.2 Camera requirements for the Barcode detection module

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

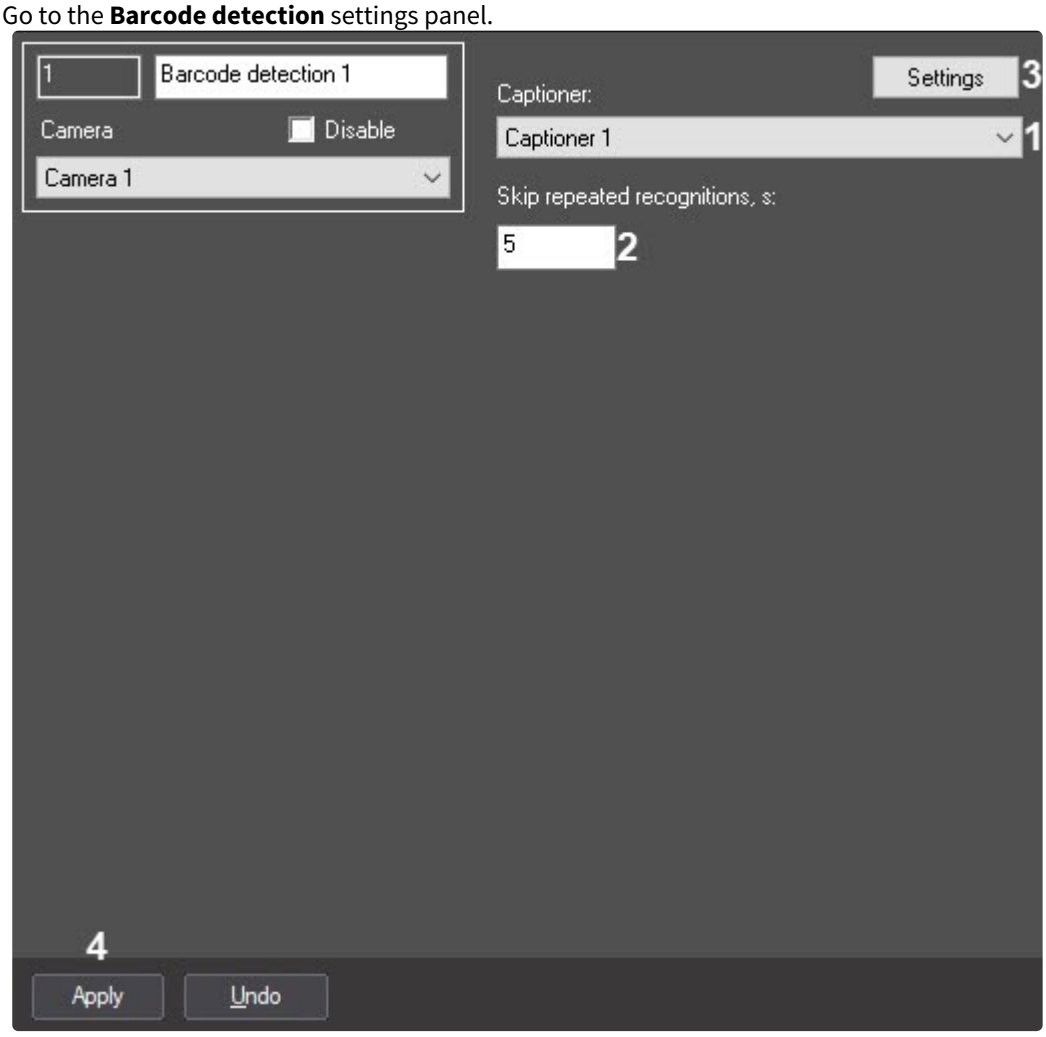
4.11.3 Configuring the Barcode detection module

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.

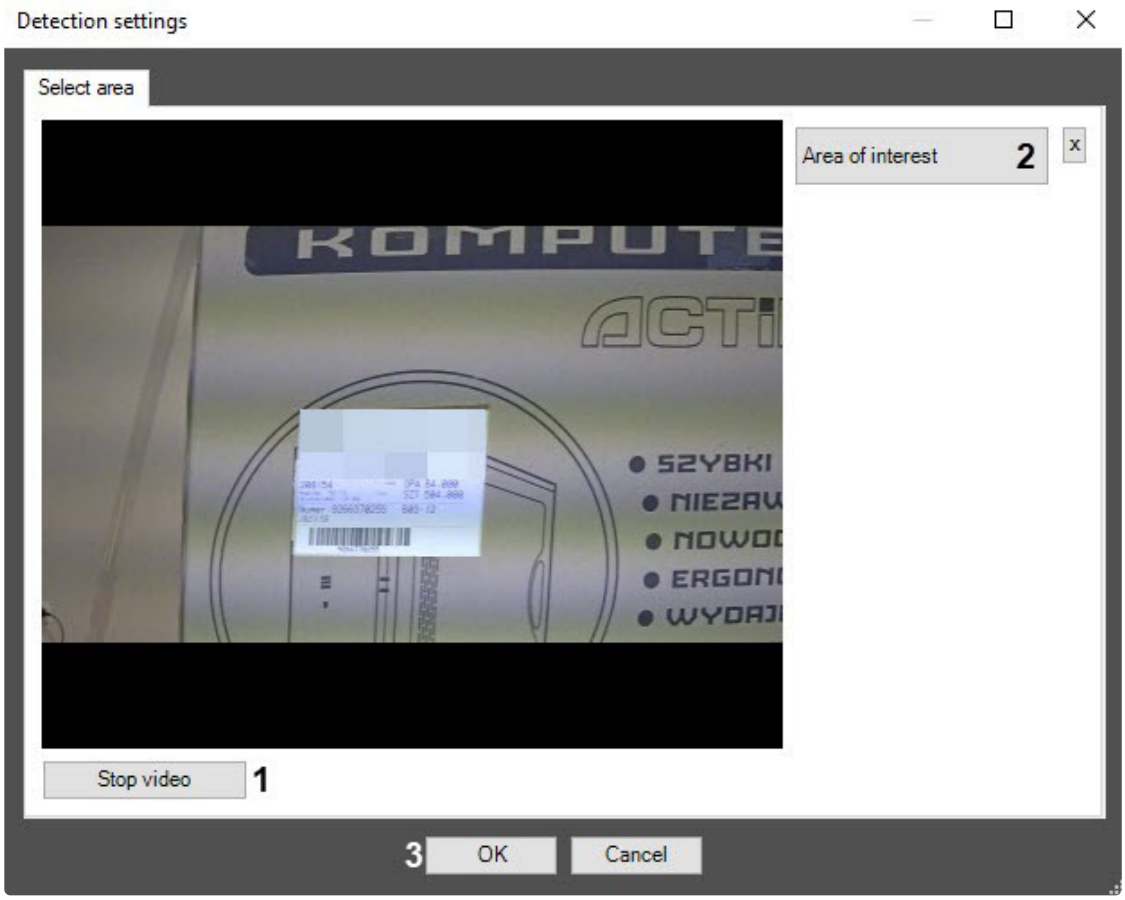


2. From the **Captioner** drop-down list, select the captioner with the help of which result will be displayed in the monitor (**1**)
3. In the **Skip repeated recognitions, s** field, enter the time in seconds in which the repeated code is recognized (**2**).

> **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.

4.12 Train detection

4.12.1 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.

4.12.2 Camera requirements for the Train detection module

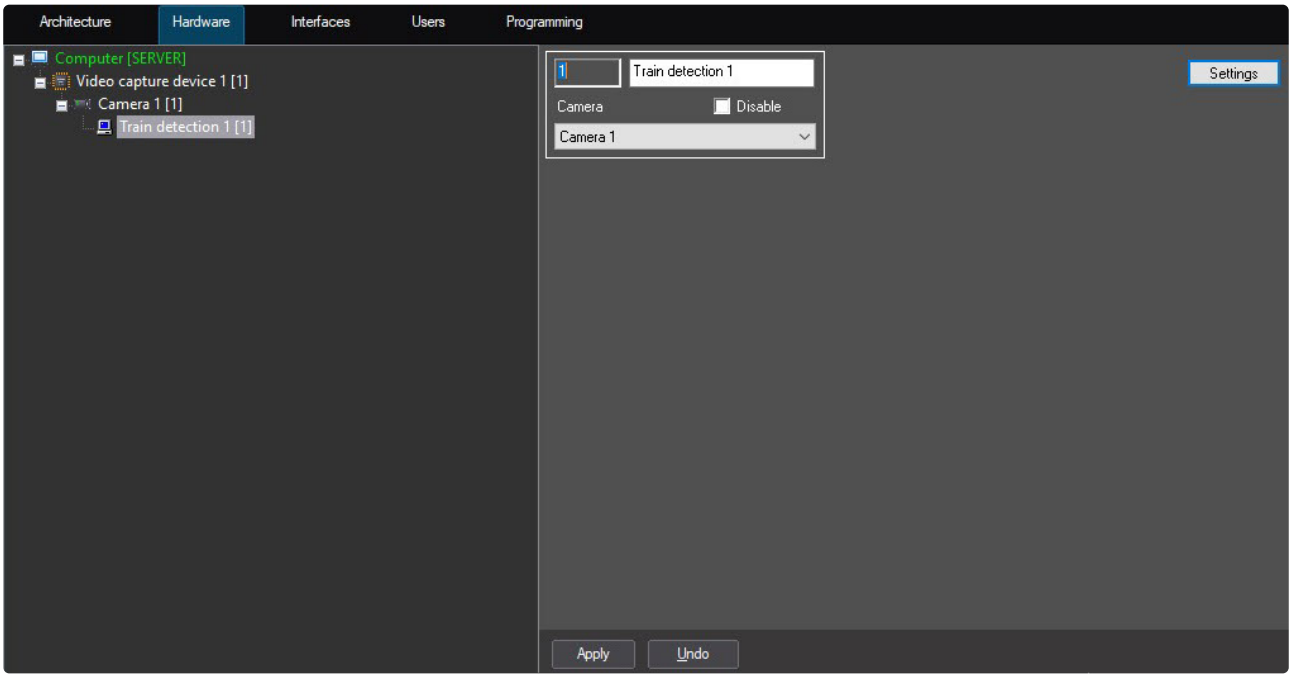
The requirements for the cameras that will work with the *Train detection* module are listed in the following table.

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.

4.12.3 Configuring the Train detection module

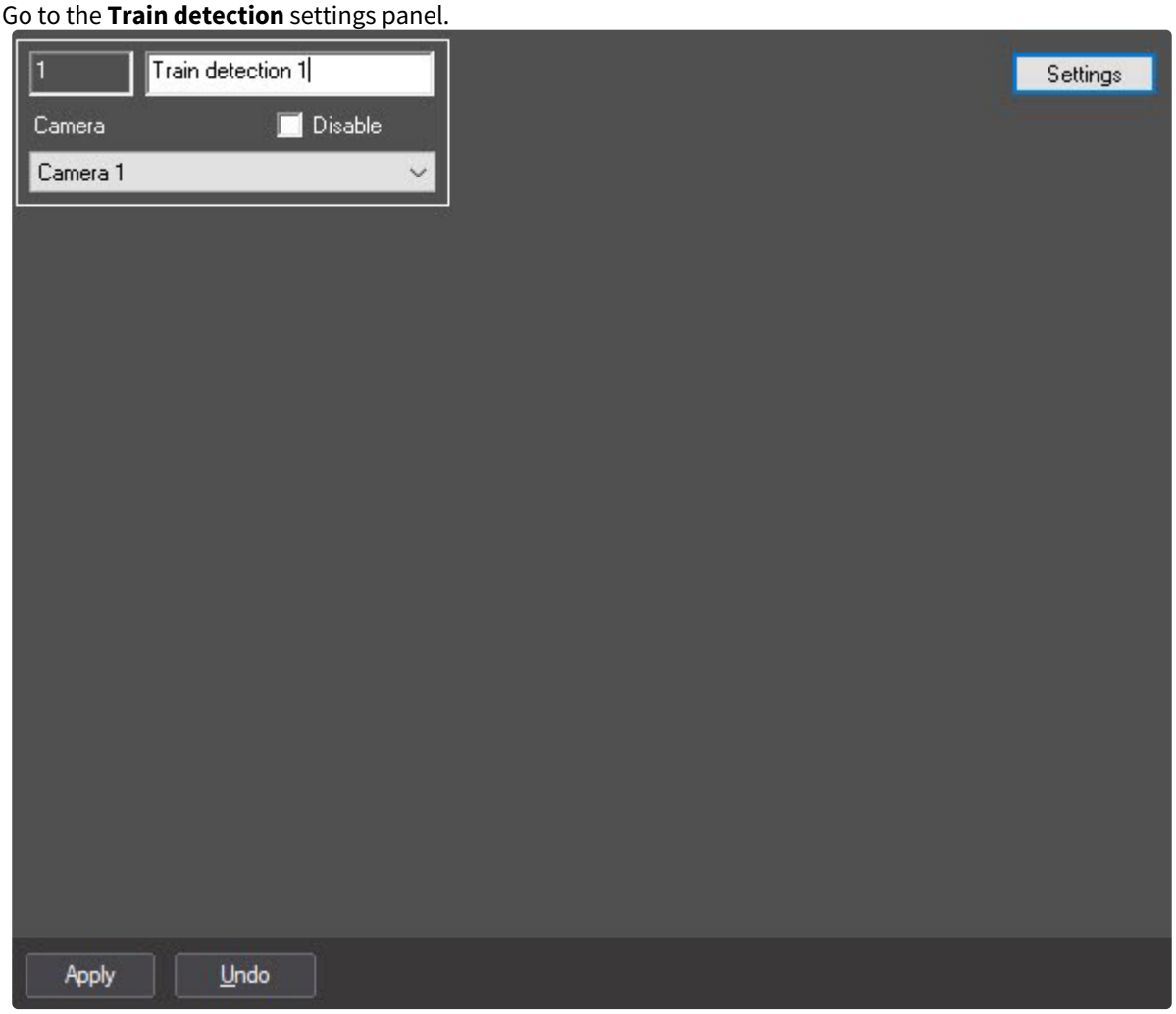
> **Note**
>
> It is not recommended to create more than four **Train detection** objects for the correct operation of the *Train detection* module.

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.



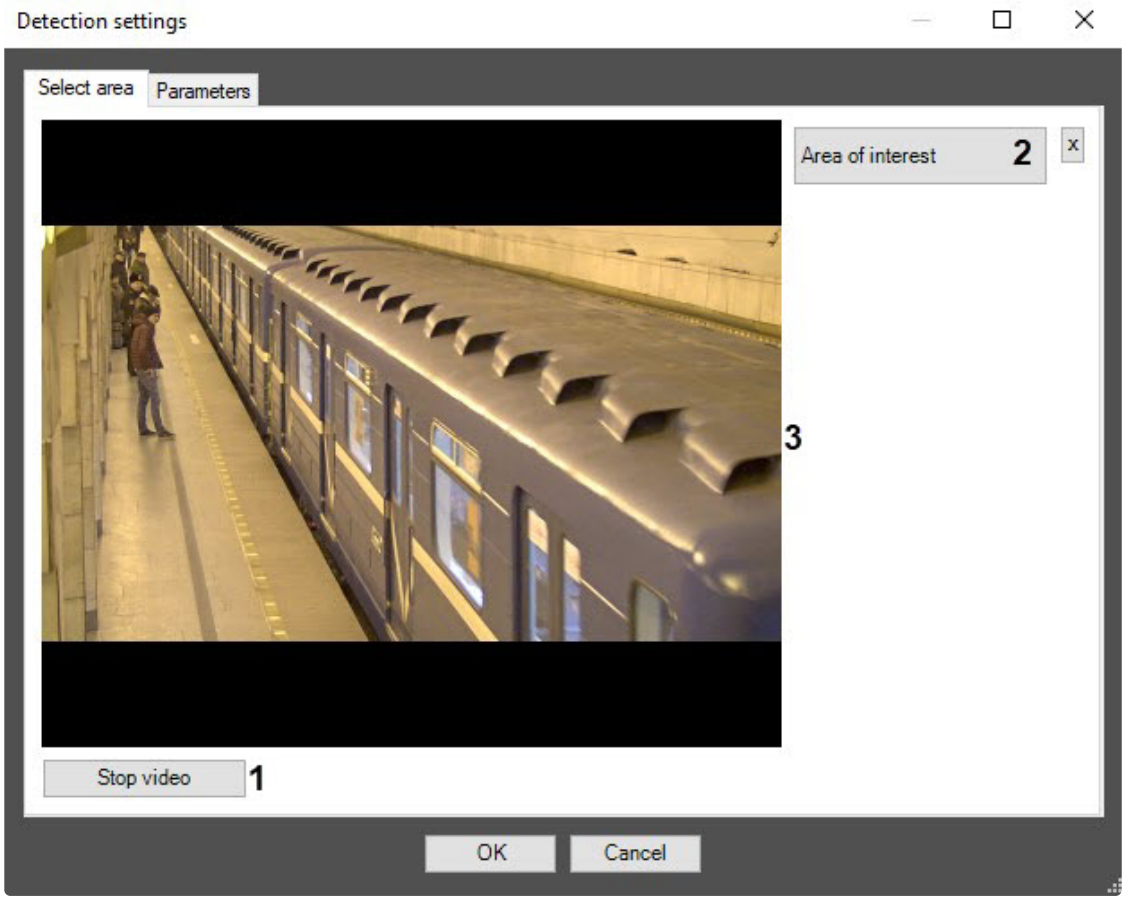
The *Train detection* module is configured as follows:

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



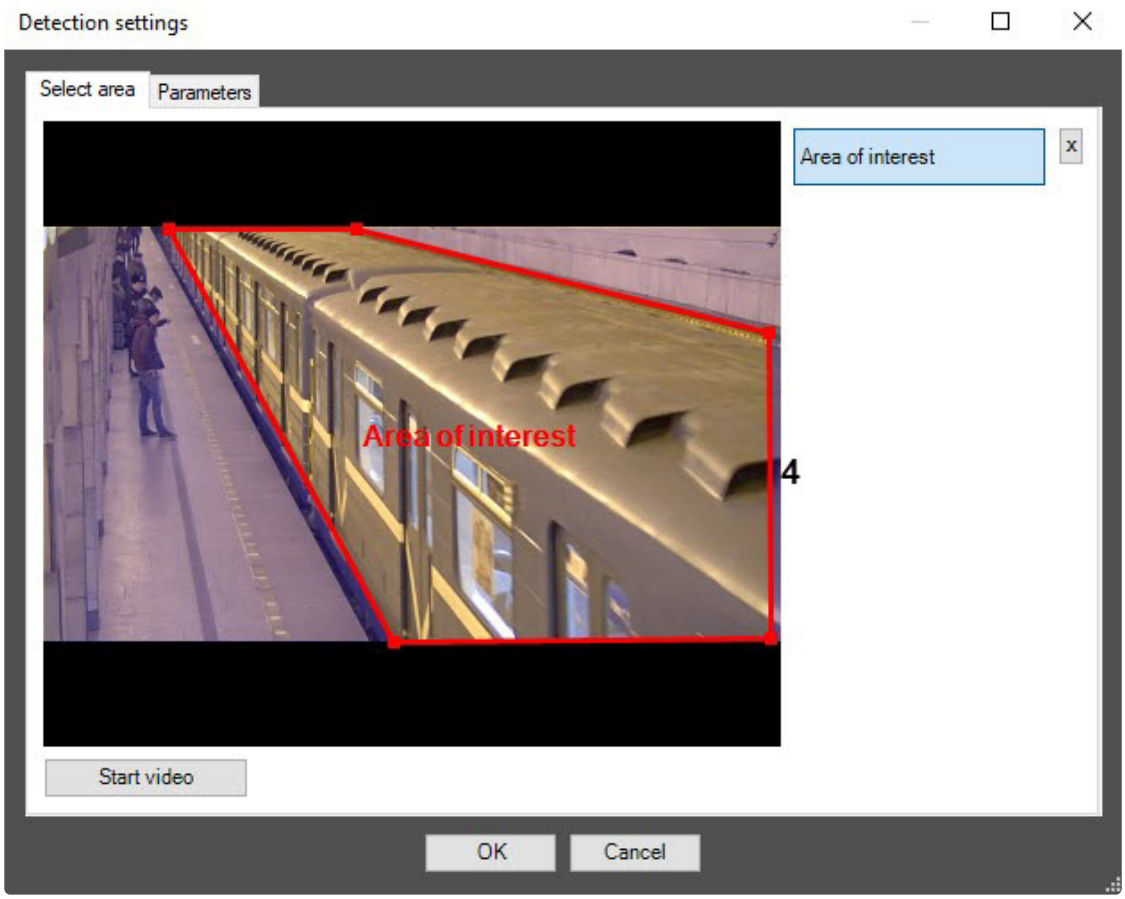
2. Click the **Settings** button. The **Detection settings** windows will open.
3. Specify the surveillance area on the video image:

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.

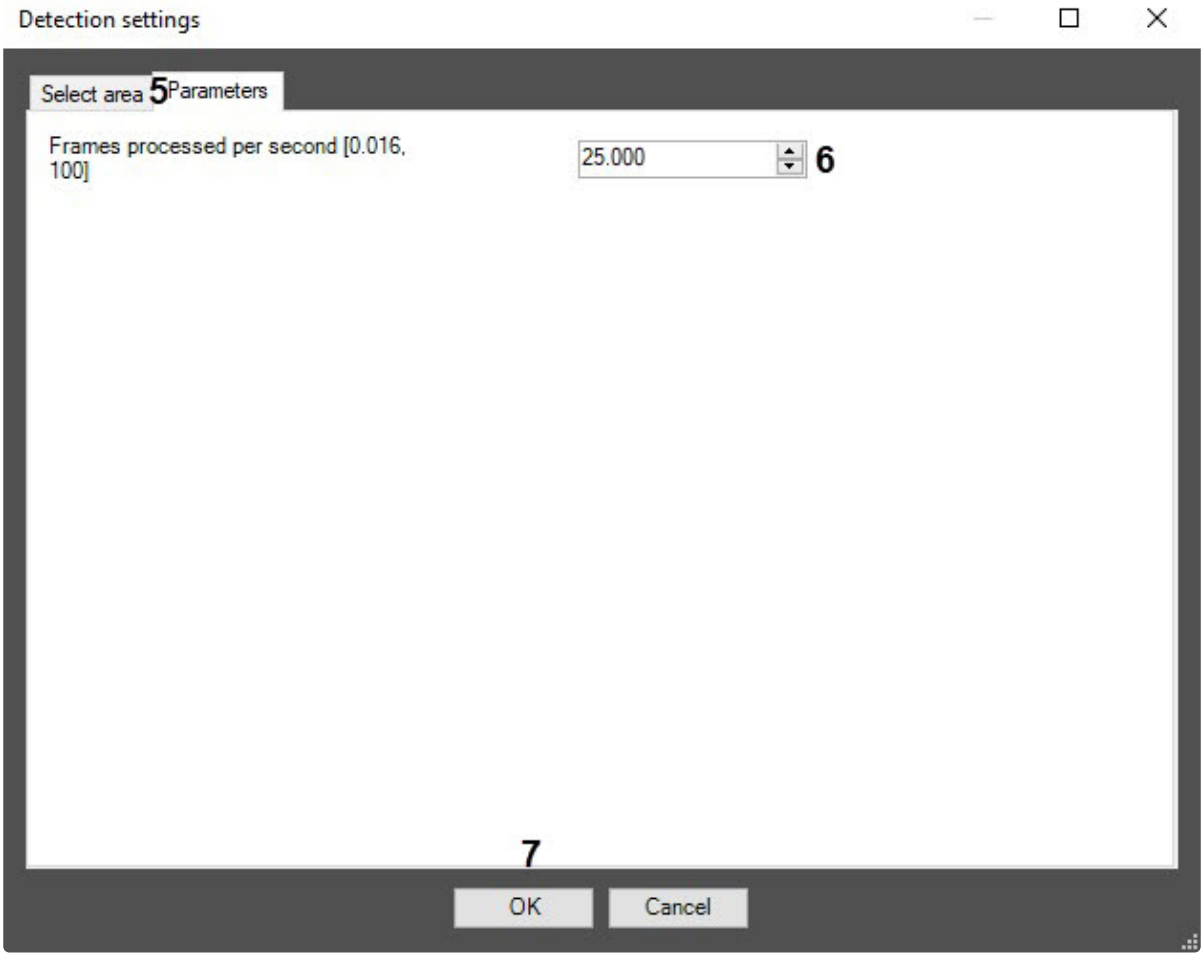
Note

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.

4.13 Fire detection and Smoke detection

4.13.1 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.

4.13.2 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 may be much worse • Resolution should 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 should be visually separated 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 should be at least 10% of the frame. In some cases, when the fire is well contained, it may 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!

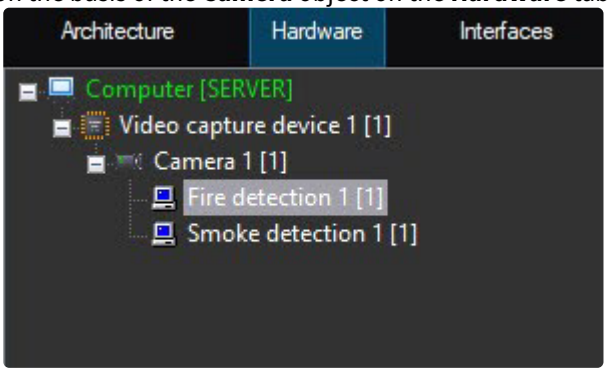
If the area of interest is specified on the video image, then the above requirements are relevant for it, and not for the entire frame (see Configuring the Fire detection and Smoke detection modules)

4.13.3 Configuring the Fire detection and Smoke detection modules

Camera requirements for the Fire detection and Smoke detection modules

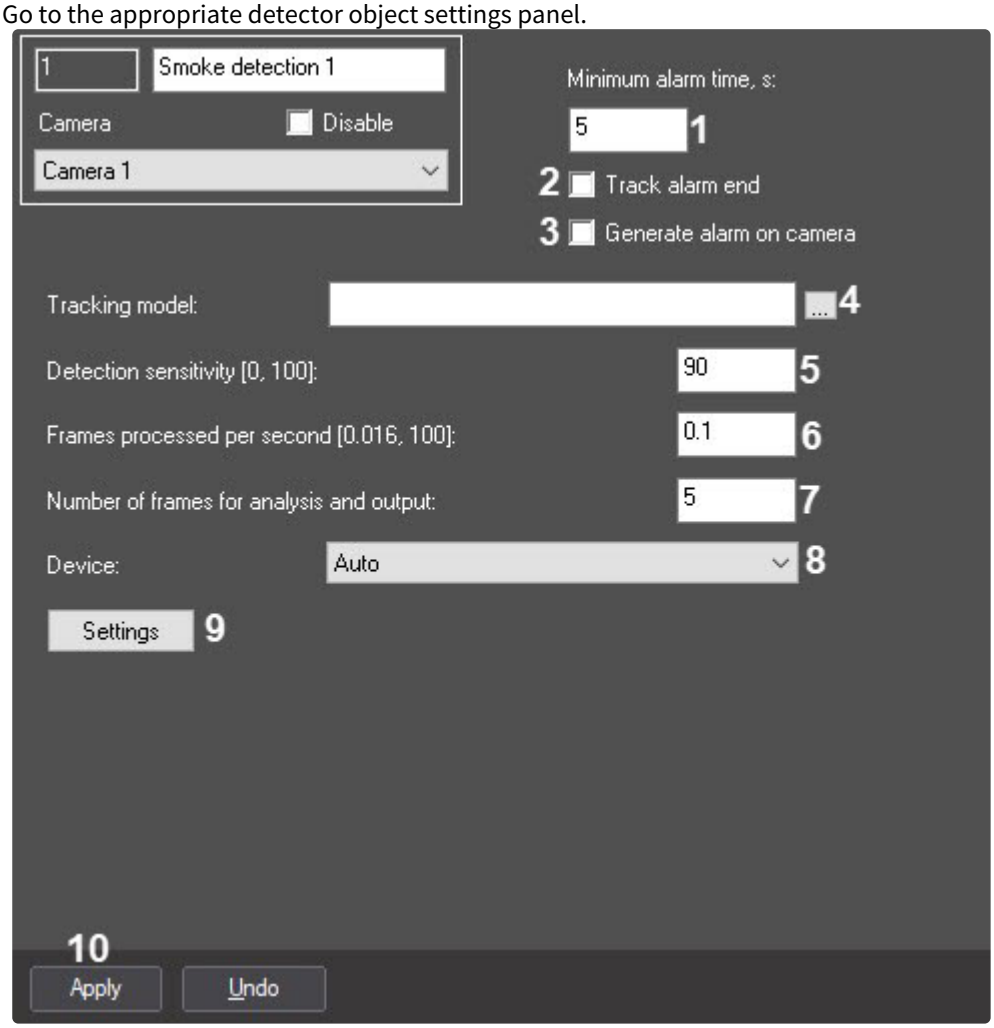
- The *Fire detection* module can be configured on the settings panel of the **Fire detection** object created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.

- 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 appropriate detector object settings panel.



2. In the **Minimum alarm time, s** field (**1**), 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 *Event viewer* until the time interval between the recognitions of the fire/smoke becomes longer than 10 seconds.

3. Set the **Track alarm end** checkbox (**2**), 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 (**3**), if it is necessary to initiate an alarm on the camera when a detection tool is triggered.
5. If a unique neural network is prepared for use, in the **Tracking model** field, click the ... button (**4**), and select the file in the standard Windows Explorer window that opens. If the field is left blank, the default neural networks will be used for detection (see the table below). They are selected automatically depending on the CPU and are located in the *C:\Program Files (x86)\Axxon PSIM\Modules64* directory:

Neural network name	Detection/CPU
smoke_openvino.ann	Smoke detection/CPU
smoke_original.ann	Smoke detection/GPU
fire_openvino.ann	Fire detection/CPU
fire_original.ann	Fire detection/GPU

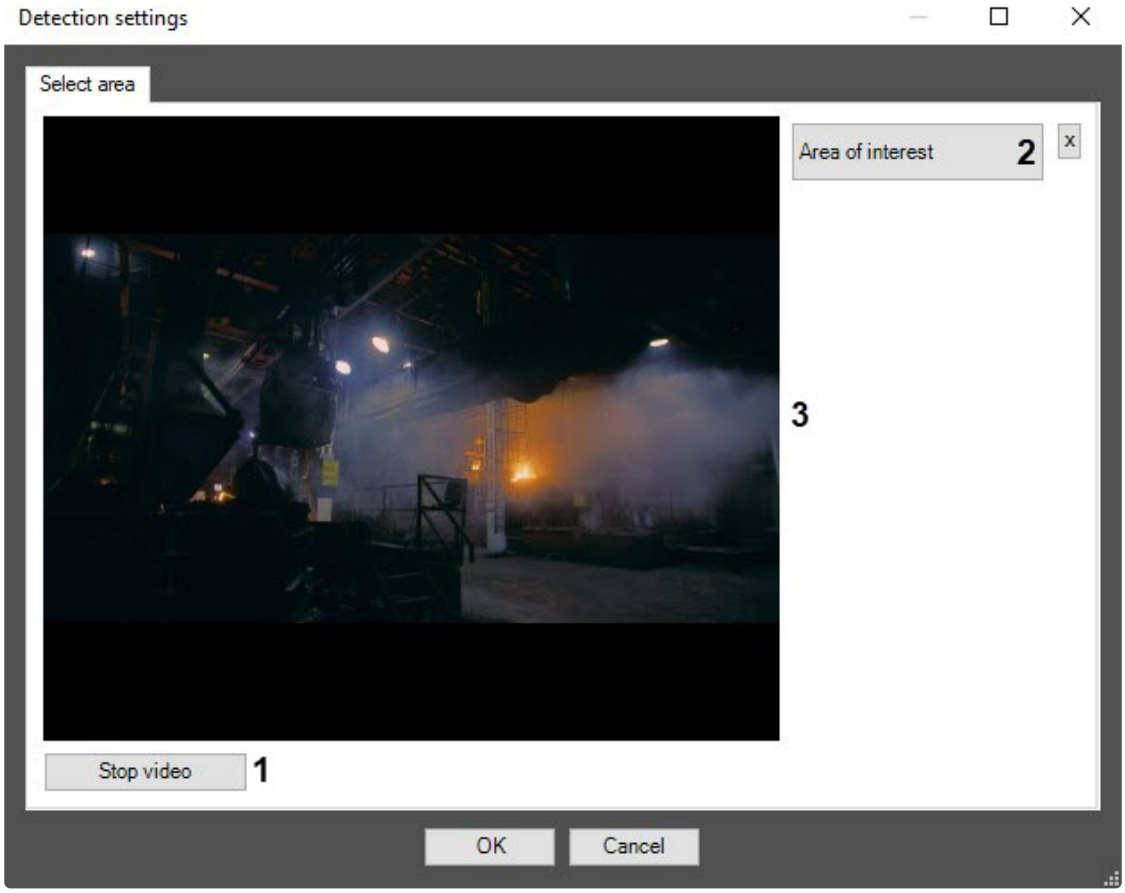
6. In the **Detection sensitivity [0, 100]** field (**5**), enter the sensitivity of the detection tool—integer value in the range from 0 to 100. This parameter determines at what certainty of fire/smoke detection the detection tool will trigger: the higher the sensitivity, the higher the recognition 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 (**6**), set the number of frames per second that will be processed by the neural network. This value has an impact on processor load: the higher the value, the greater the load. It also has an impact on the algorithm operation speed: the higher the frame rate, the faster the required number of frames will be collected for making a decision and triggering an alarm, if required.
8. In the **Number of frames for analysis and output** field (**7**), 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.

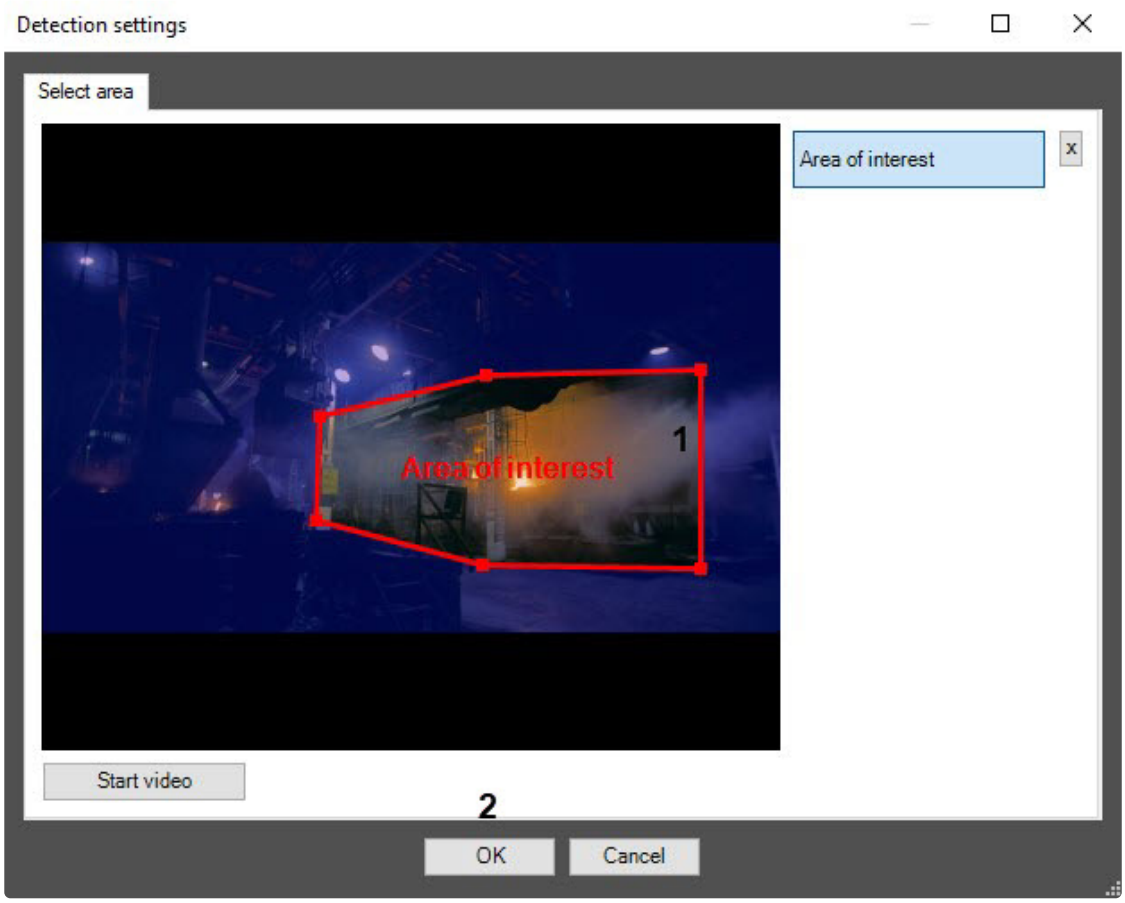
9. In the **Device** drop-down list (**8**), select the device on which the neural network will operate. **Auto**—the device is selected automatically: GPU gets the highest priority, followed by Intel GPU, then CPU.
10. Click the **Settings** button (**9**). The **Detection settings** windows will open.
11. Specify the area of interest 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**), set the anchor points of the area, the situation in which you want to analyze (**1**), by sequentially clicking the left mouse button. Only one area can be added. If you try to add a second area, the first area will be deleted. After adding an area, the rest of the video image will

be darkened.



d. Click the **OK** button (**2**).

> **Note**
>
> Specifying the **Area of interest** is a mandatory requirement for the detection module operation.
>
> To remove the area, click the x button next to the **Area of interest** button.

12. Click the **Apply** button (**10**).

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

4.14 Fluid level detection

4.14.1 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.

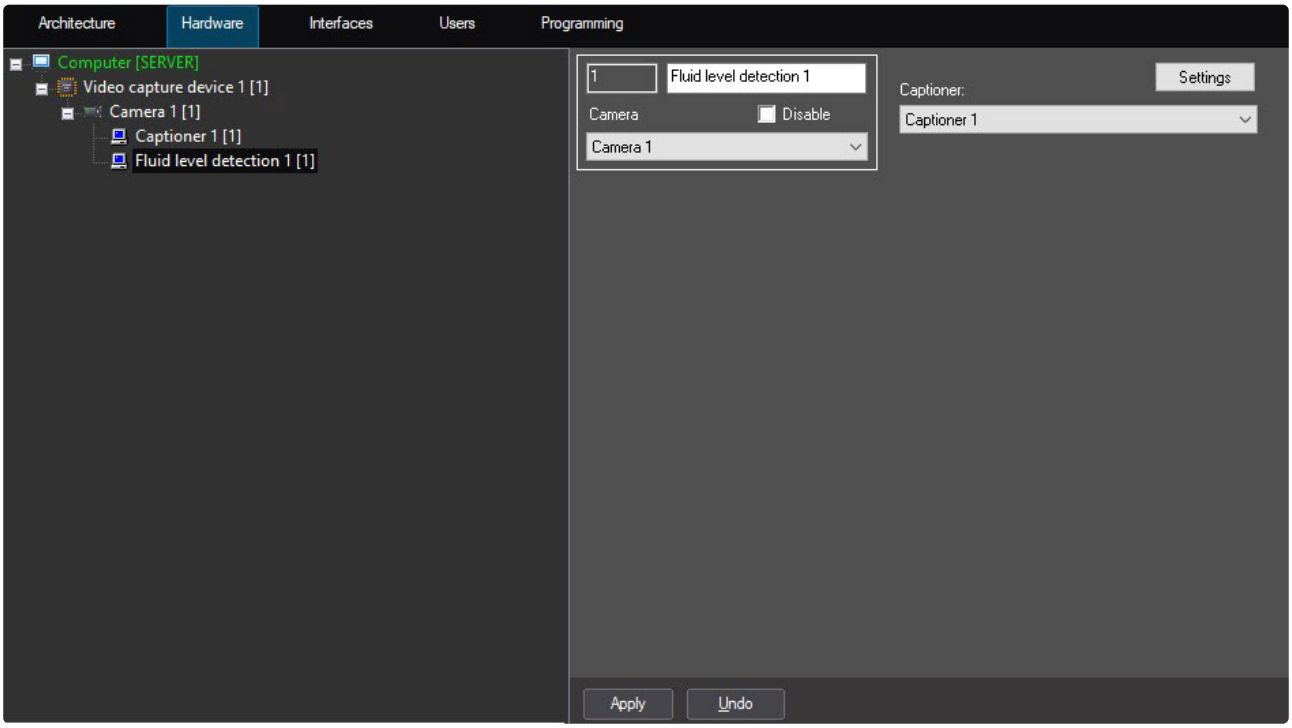
4.14.2 Camera requirements for the Fluid level detection module

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

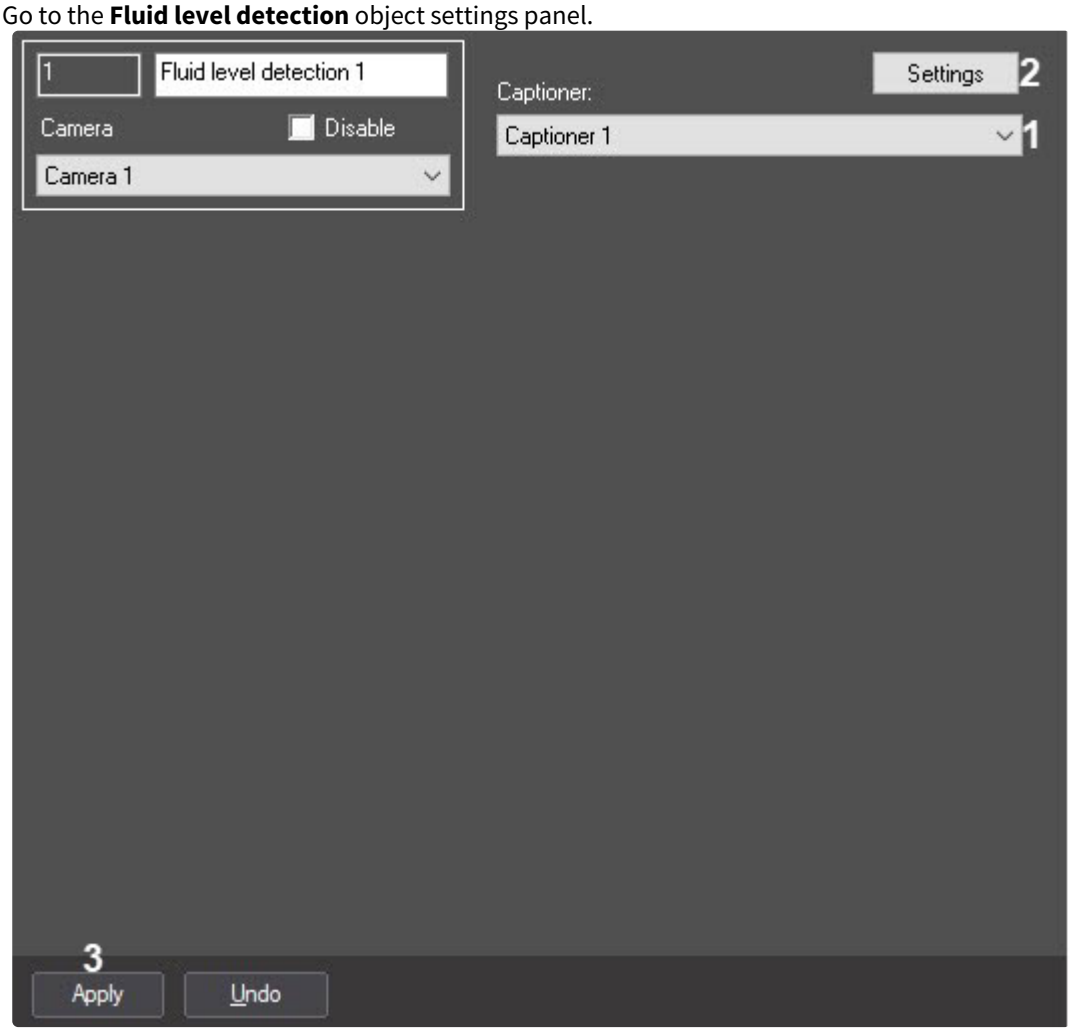
4.14.3 Configuring the Fluid level detection module

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:

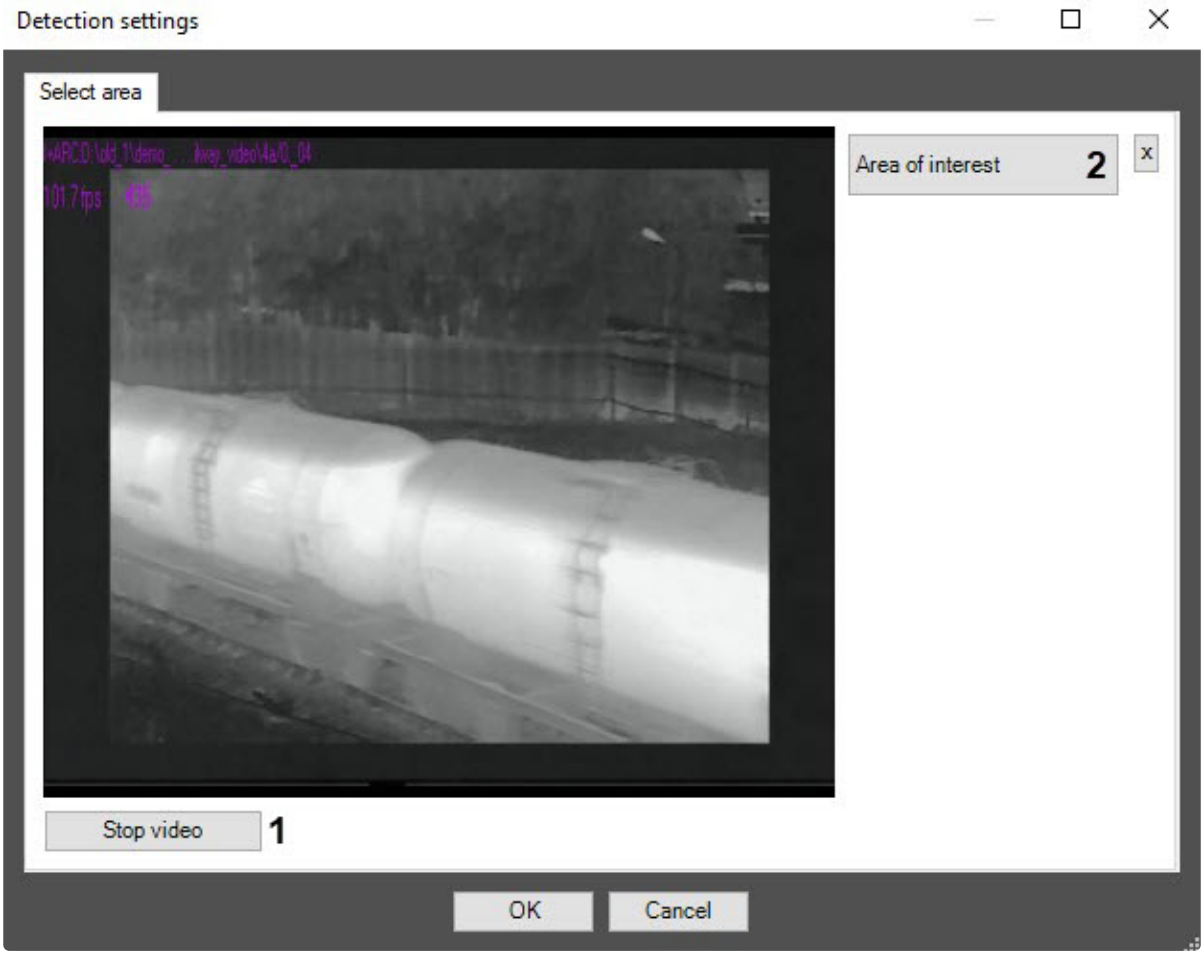
1. Go to the **Fluid level detection** object settings panel.



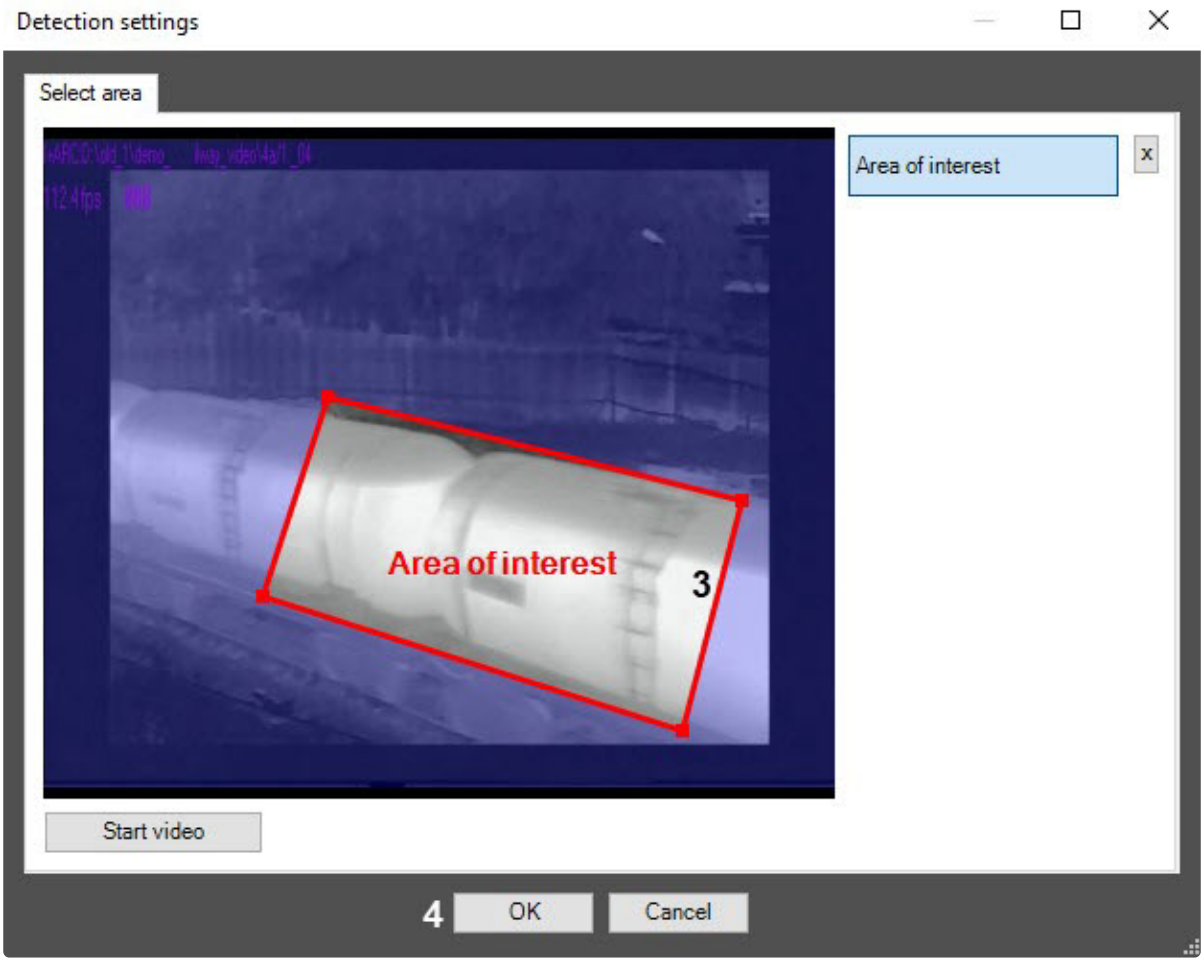
2. In the **Captioner** drop-down list, select the **Captioner** object created on the basis of the same **Camera** object as the **Fluid level detection** object (**1**). This captioner will be used to overlay captions of fluid level onto the camera video image in the Video surveillance monitor.

> **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.

4.15 Neurotracker

4.15.1 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).

4.15.2 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, 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.
Objects image	Objects image requirements for neural tracker

Attention!

Correct operation of the neural tracker is not guaranteed when using a fish-eye lens.

Software and hardware requirements

4.15.3 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 %

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
1280x720	Human	35	~17x70	~ 3 %

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
640x360	Human	17	~10x42	~ 3 %

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	Light vehicle (2 axles)	55	~354x300	~20%

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
1280x720	Light vehicle (2 axles)	35	~240x205	~20%

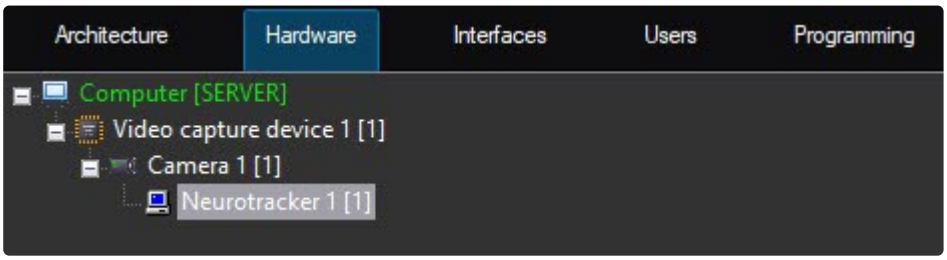
Image resolution	Object type	Minimum pixel density per meter (ratio of the object width in pixels to the object width in meters)	Minimum object size in pixels, Width x Height	Ratio of the object width to the frame width as a percentage
640x360	Light vehicle (2 axles)	17	~132x112	~20%

Video stream and scene requirements for the Neurotracker module

4.15.4 Configuring the Neurotracker module

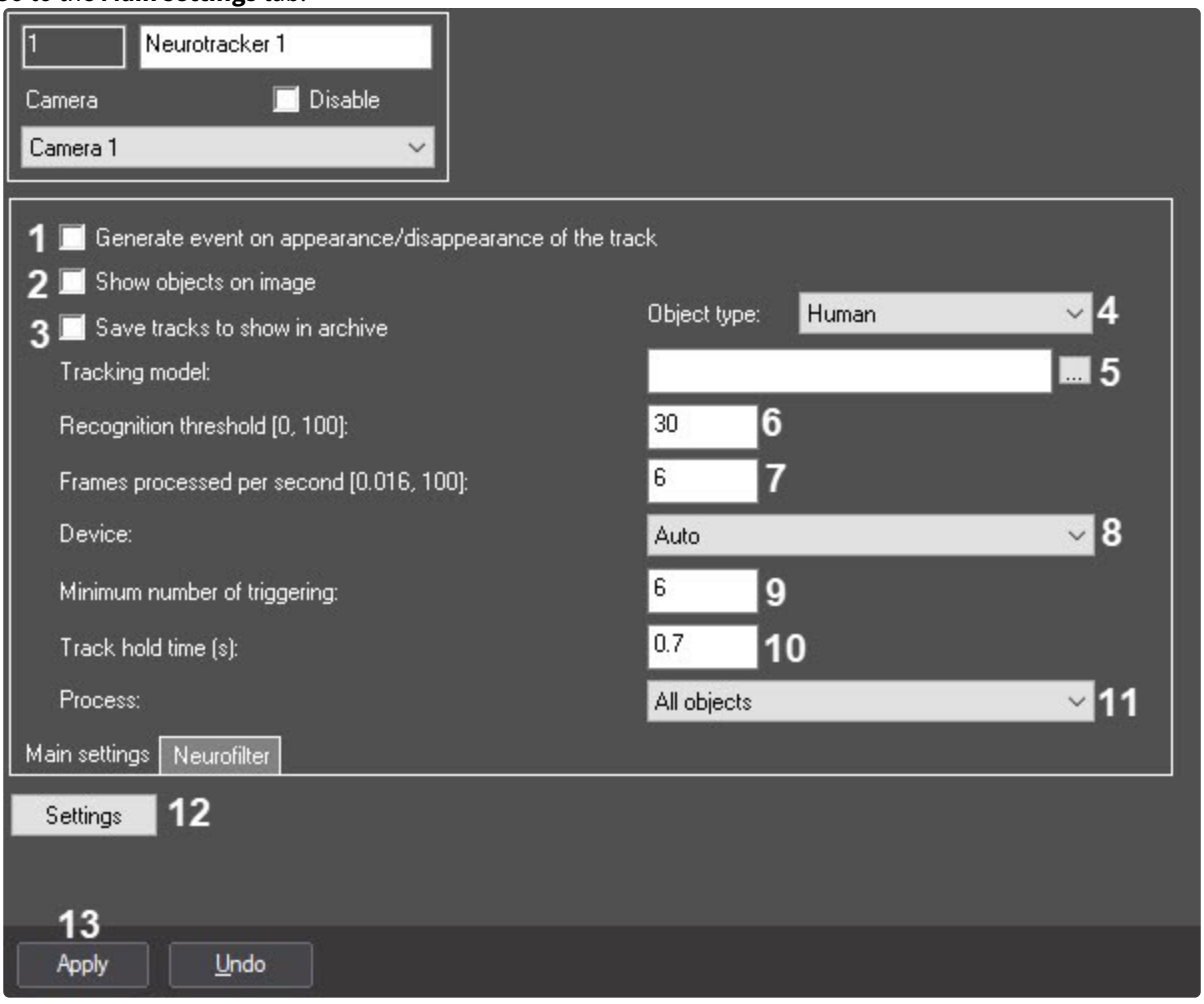
The *Neurotracker* module registers object tracks in the camera FOV during recording using a neural network and saves them to the VMDA metadata storage (see Creating and configuring VMDA metadata storage).

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



The *Neurotracker* module is configured as follows:

1. Go to the **Main settings** tab.



2. Set the **Generate event on appearance/disappearance of the track** checkbox (**1**), if it is necessary to generate the event when the track appears/disappears.

> **Note**
>
> The track appearance/disappearance events are generated only in the debug window (see Enabling the Debug window). They are not displayed in the Events protocol.

3. Set the **Show objects on image** checkbox (**2**), if it is necessary to highlight the detected object with a frame when viewing live video.
4. Set the **Save tracks to show in archive** checkbox (**3**), if it is necessary to highlight the detected object with a frame when viewing the archive.

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

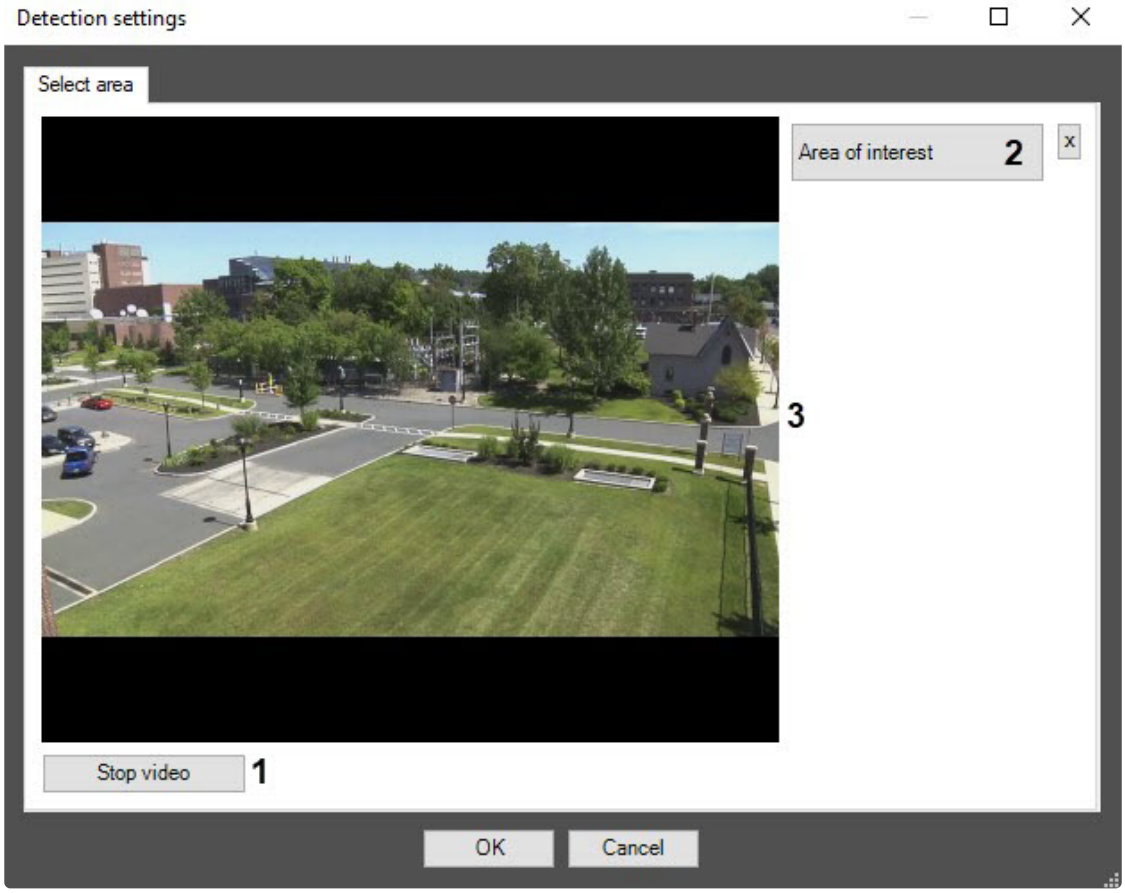
5. From the **Object type** drop-down list (**4**), select the object type, if the path to the neural network file is not set (step 6):
   - **Human**—the camera is directed at a person at the angle of 100-160°;
   - **Human (top-down view)**—the camera is directed at a person from above at a slight angle;
   - **Vehicle**—the camera is directed at a vehicle at the angle of 100-160°.
6. If a unique neural network is prepared for use, then in the **Tracking model** field, click the ... button (**5**) and select the file in the standard Windows Explorer window that opens. If the field is left blank, the default neural networks will be used for detection. They are selected automatically depending on the selected object type (**4**) and device (**8**).
7. In the **Recognition threshold [0, 100]** field (**6**), specify the neurocounter sensitivity—an integer value in the range from **0** to **100**.

> **Note**
>
> The objects detection threshold is determined experimentally. The lower the detection threshold, the more false triggerings there might be. The higher the detection threshold, the less false triggerings there might be, however, some useful tracks might be skipped. See Examples of configuring neural tracker for solving typical tasks.

8. In the **Frames processed per second [0.016, 100]** field (**7**), set the number of frames per second in the range from 0.016 to 100 that will be processed by the neural network. All other frames will be interpolated. The higher the specified value, the more accurate the tracking, but the higher the CPU load.
9. In the **Device** drop-down list (**8**), select the device on which the neural network will operate. **Auto**—the device is selected automatically: GPU gets the highest priority, followed by Intel GPU, then CPU.
10. In the **Minimum number of triggering** field (**9**), specify the minimum number of neurotracker triggers required to display the object track. The higher the value of this parameter, the longer it will take from the object detection moment to the display of its track. At the same time, a low value of this parameter can lead to false positives. The default value is 6. The value range is 1-10. 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/minimum value.
11. In the **Track hold time (s)** field (**10**), specify the time in seconds after which the object track is considered lost. This parameter is useful in situations where one object in the frame temporarily overlaps another. For example, when a large car completely overlaps a small one.

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

12. From the **Process** drop-down list (**11**), select which objects should 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 may 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.
13. Set the area of interest on the video image:
    a. Click the **Settings** button (**12**). The **Detection settings** window will open.



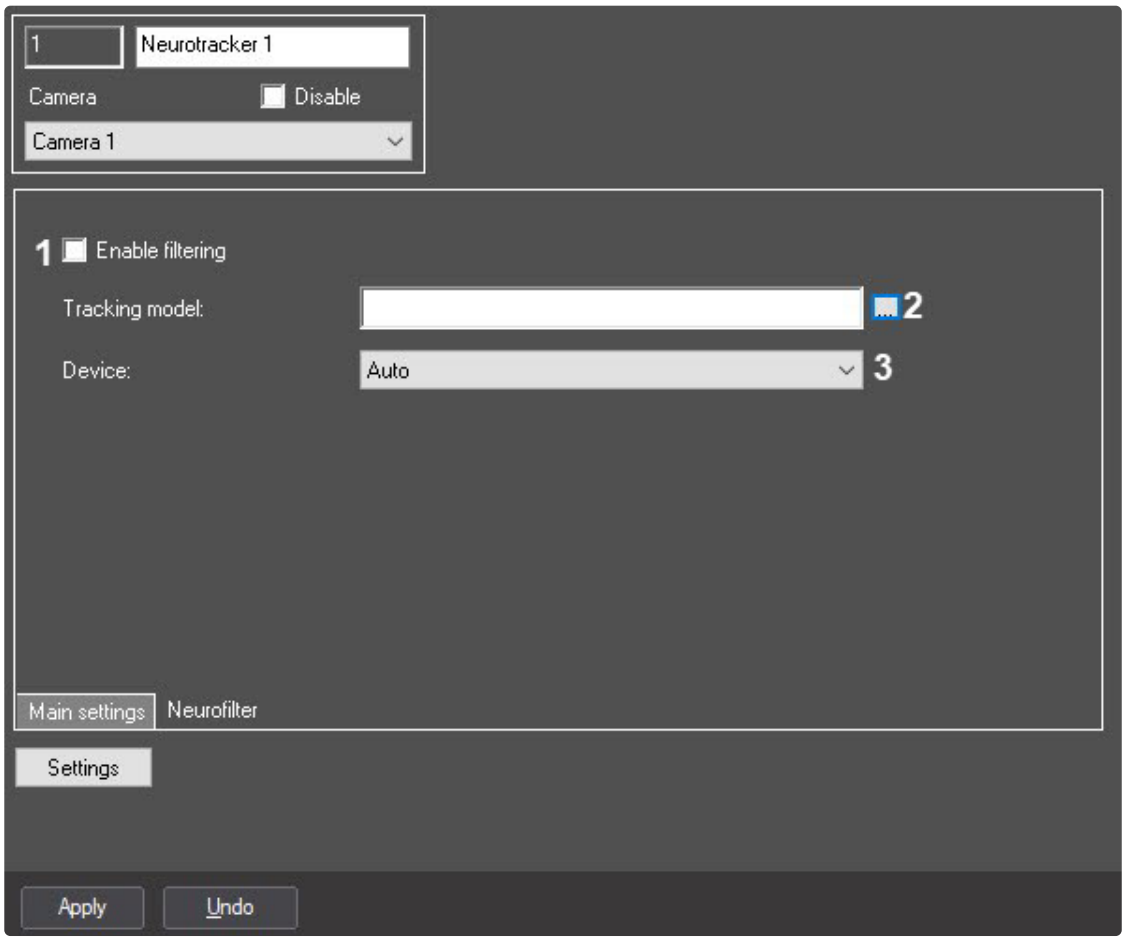
    b. Click the **Stop video** button (**1**) to capture a video frame.
    c. Click the **Area of interest** button (**2**).
    d. On the captured video frame (**3**), set the anchor points of the area, the situation in which you want to analyze (**1**), by sequentially clicking the left mouse button. Only one area can be added. If you try to add a second area, the first one will be deleted. After adding an area, the rest of the video image will

be darkened.

e. Click the **OK** button (**2**).

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

a. Go to the **Neurofilter** tab.

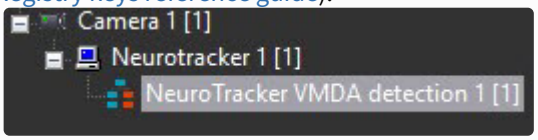


b. Set the **Enable filtering** checkbox (**1**).
c. Select the required neural network file for the neural filter (**2**). If the network path is not set, then the default network is used depending on the selected device (**3**). If the network path is specified, the neurofilter is created with the specified network.
d. From the **Device** drop-down list (**3**), select the device on which the neural network for the neural filter will operate. **Auto**—the device is selected automatically: GPU gets the highest priority, followed by Intel GPU, then CPU.

15. Click the **Apply** button (**13**).

> **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).



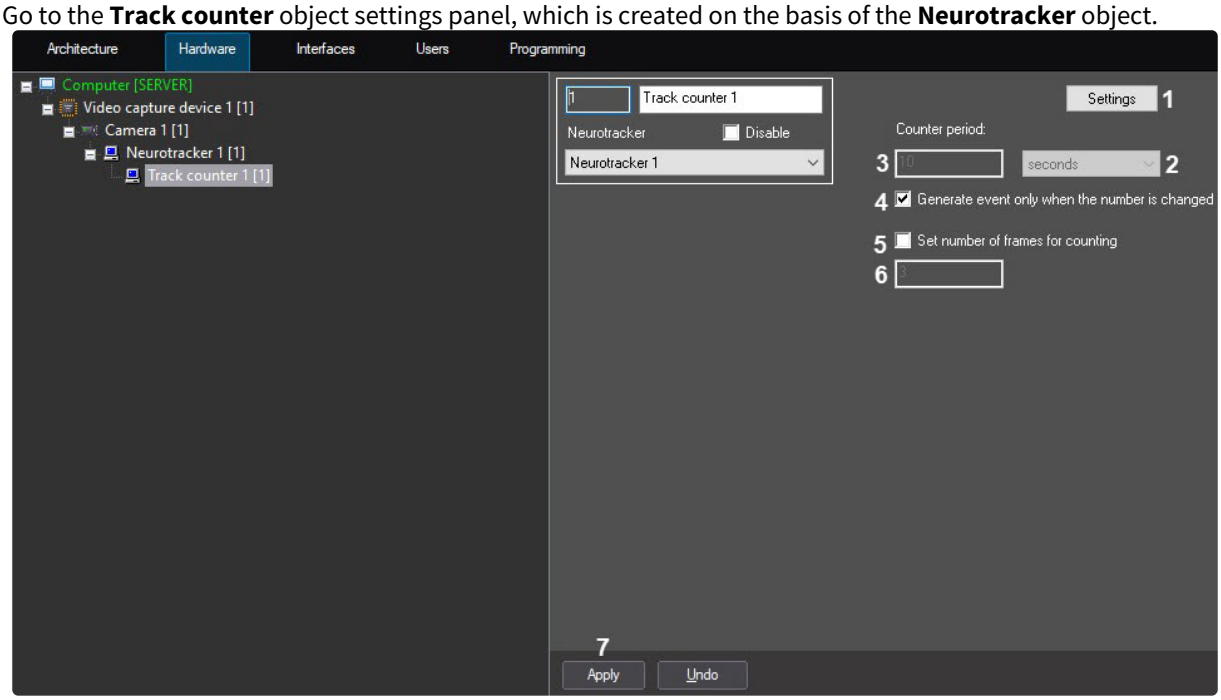
The *Neurotracker* software module configuration is complete.

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

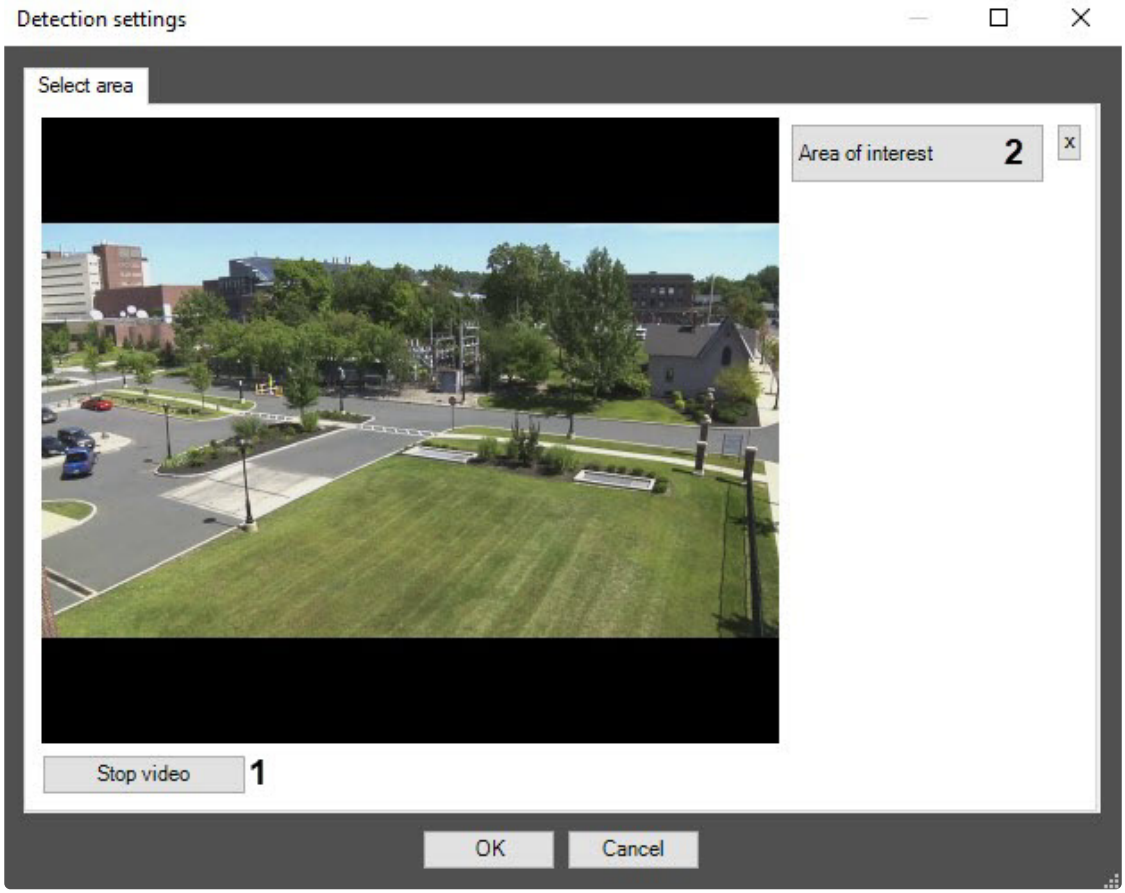
The neurotracker track counter is configured as follows:

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



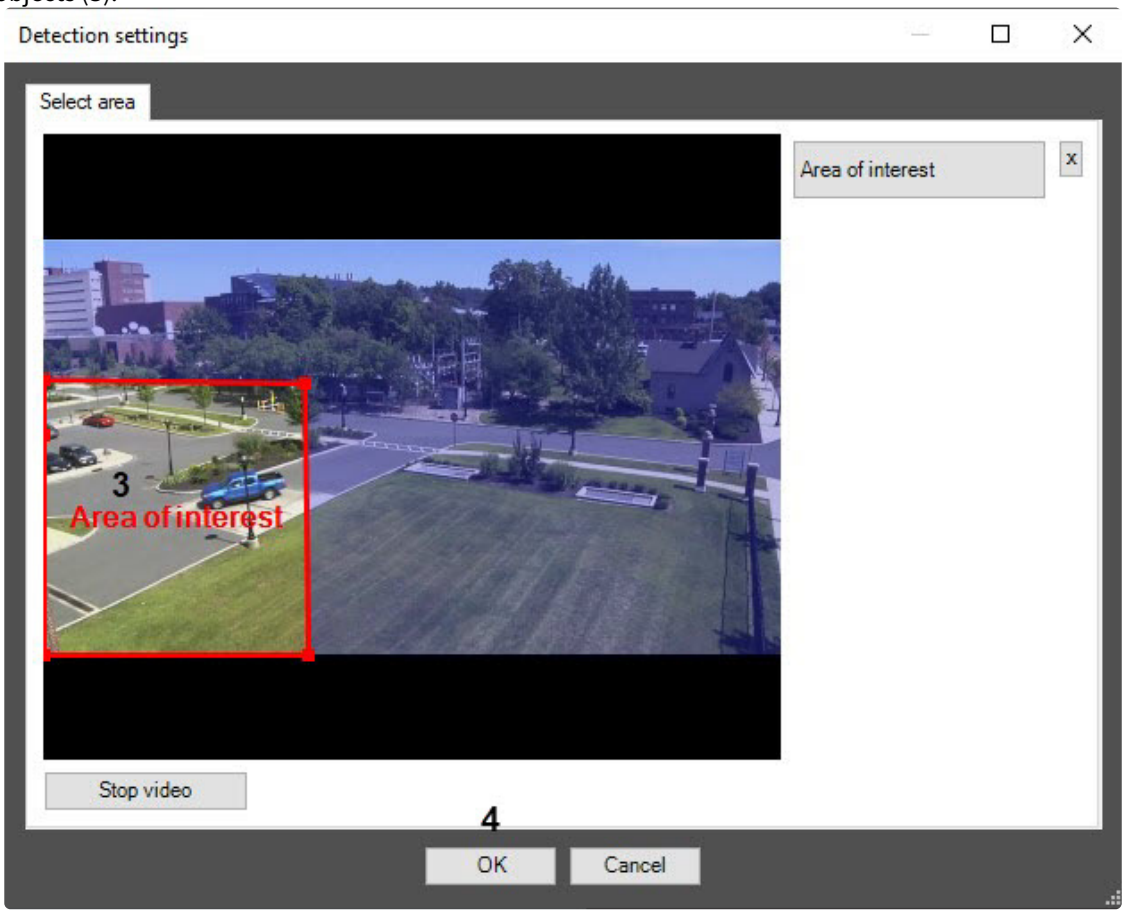
2. On the video image, specify the surveillance area, within which the track counter will count the objects:

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.

4.16 Person location tracker

4.16.1 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.

4.16.2 Video stream and scene requirements for Person location tracker

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, 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

Objects image	Objects image requirements for Person location tracker

Attention!

Correct operation of the Pose detection tools is not guaranteed when using fisheye cameras and other cameras with strong image distortion.

Software and hardware requirements

4.16.3 Objects image requirements for Person location tracker

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

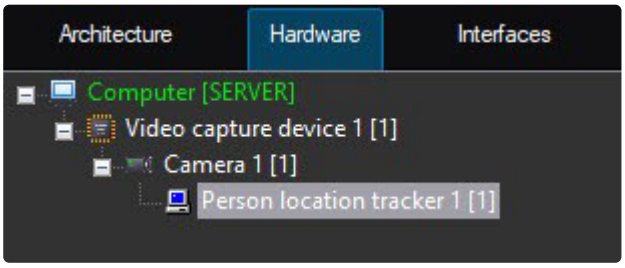
1. The object to be detected is clearly distinguishable by the human eye.
2. The detected object is completely within the frame.
3. The image is not noisy and not distorted by compression algorithm artifacts.
4. The duration of the object's visibility is at least 2 frames.
5. The minimum value of pixel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

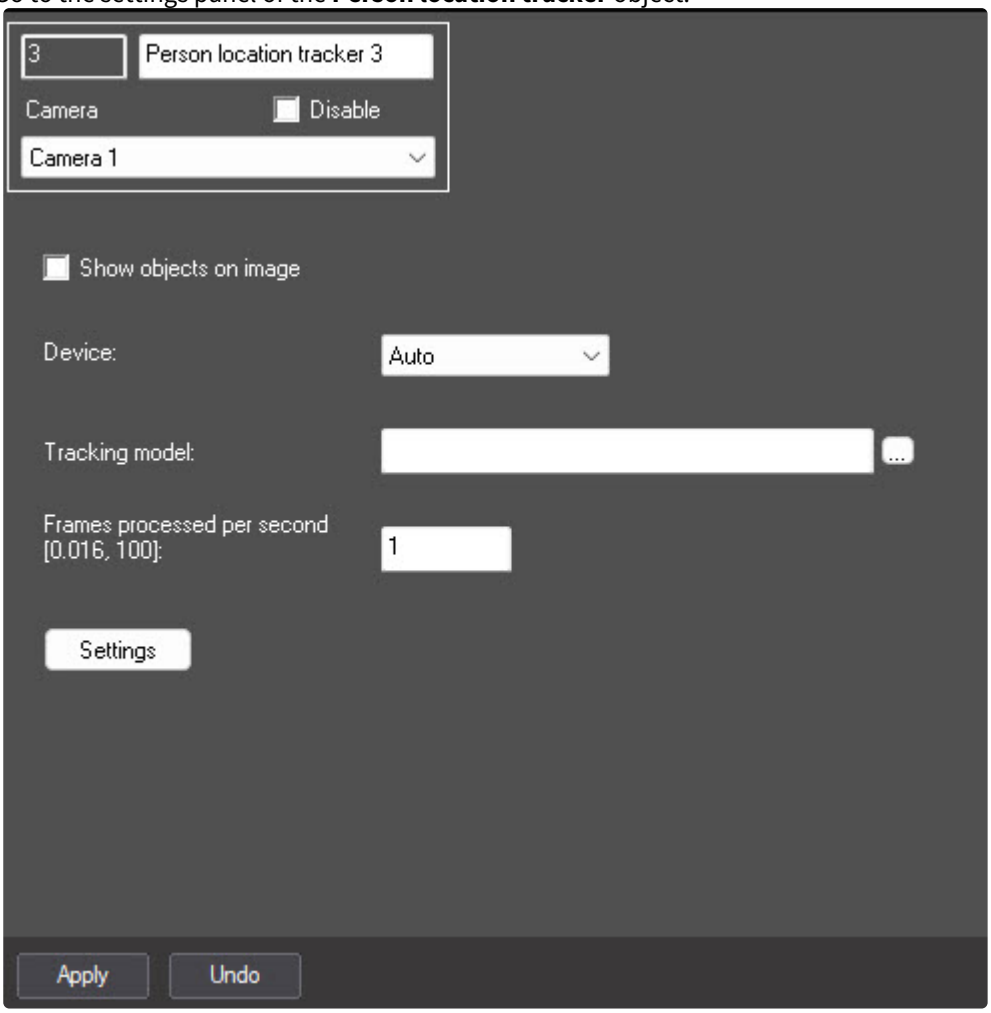
4.16.4 Configuring the Person location tracker module

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.



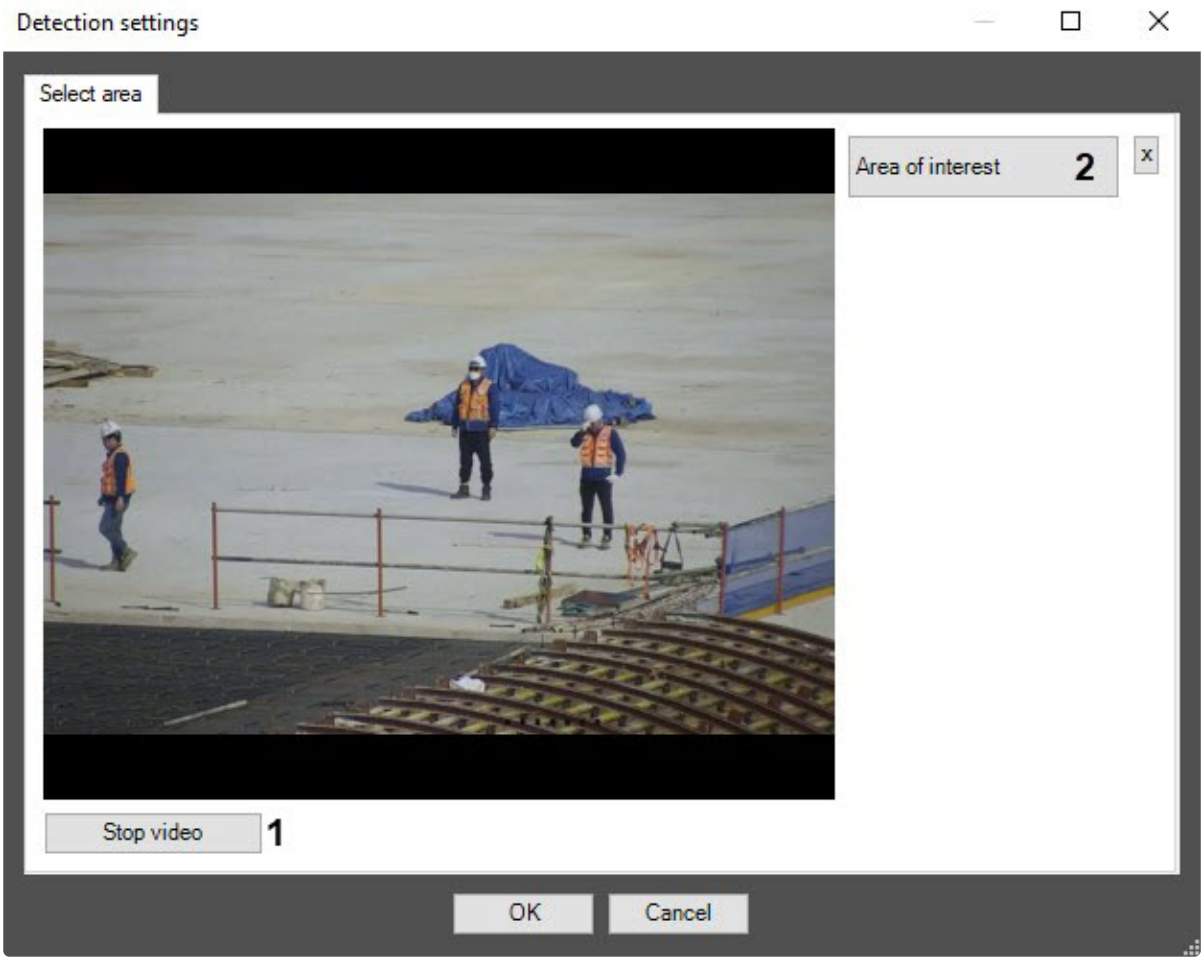
2. Set the **Show objects on image** checkbox, if it is necessary to highlight the detected object with a frame when viewing live video.
3. From the **Device** drop-down list, select the device on which the neural network will operate.
4. Select the required neural network file with the tracking model.
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:

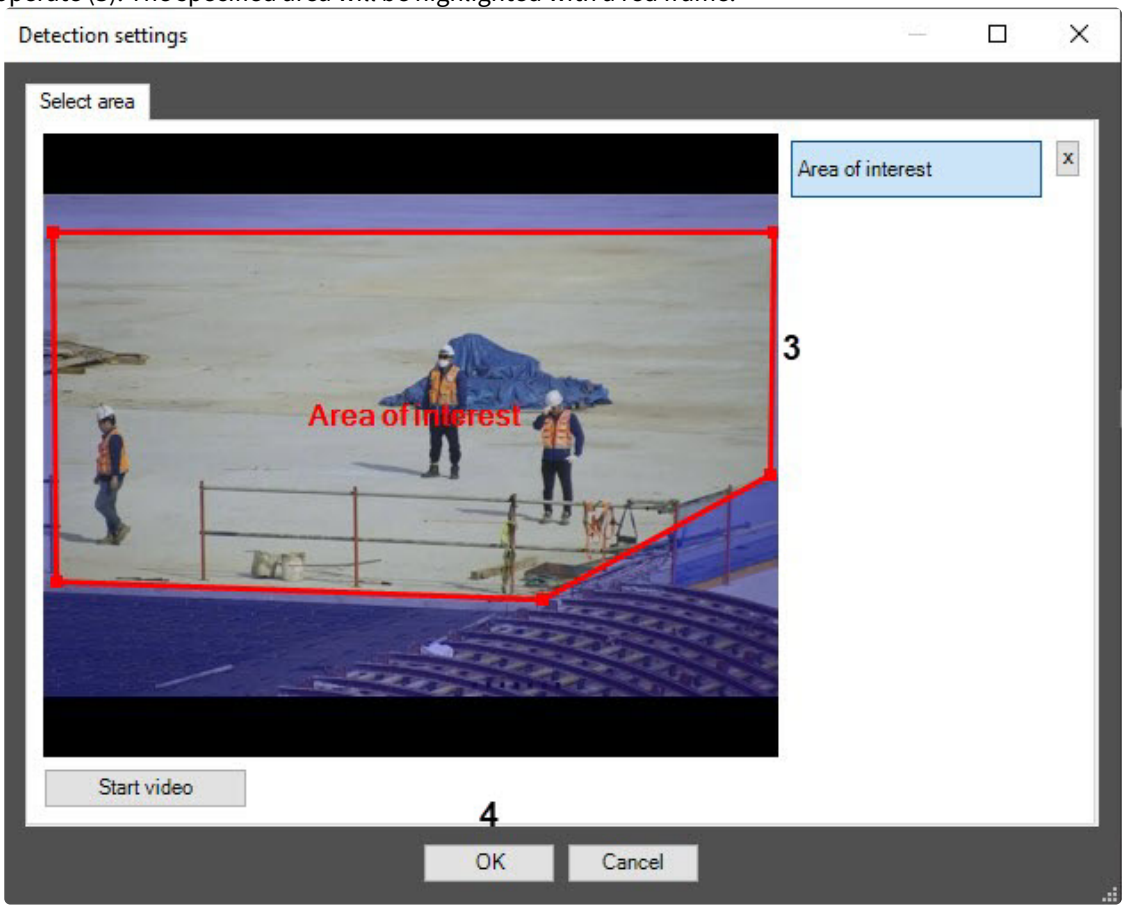
- pose detection for moderately moving objects (without sudden movements)—FPS=3;
- pose detection for moving objects—FPS=12.

6. Click the **Settings** button. As a result, the **Detection settings** window will open.



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

b. Click the **Area of interest** button (**2**) and specify the area in which the Person location tracker will operate (**3**). The specified area will be 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.

7. Click the **Apply** button on the settings panel of the **Person location tracker** object
8. 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).

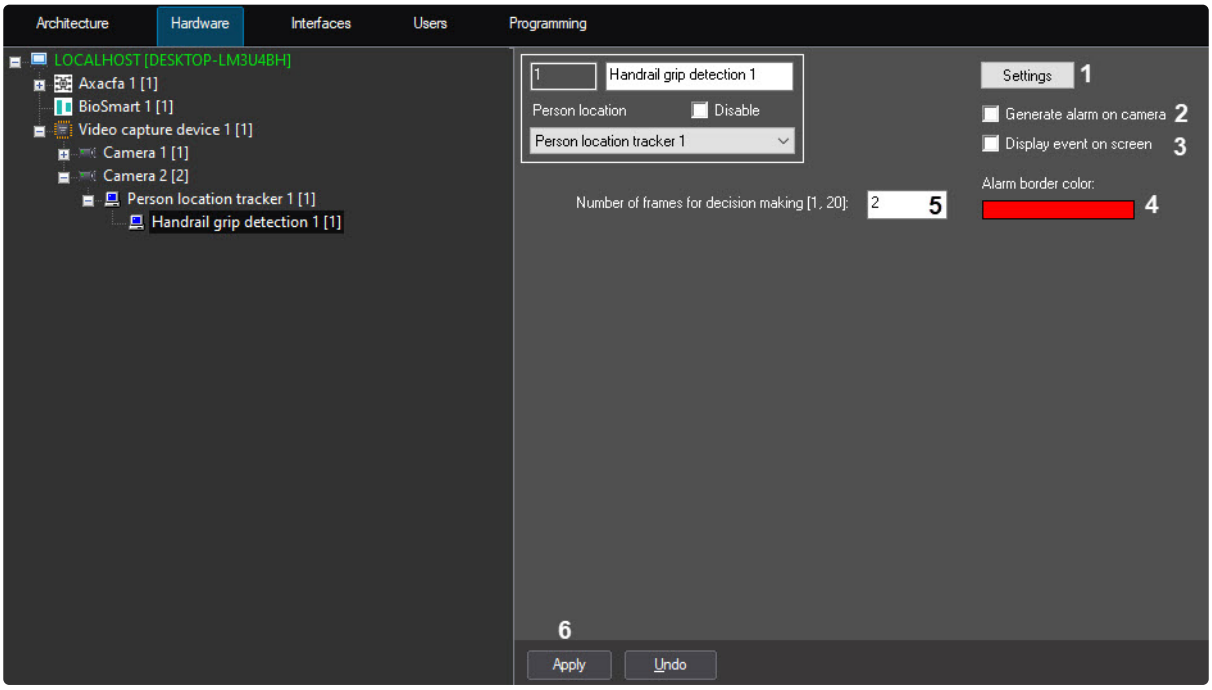
Configuration of the *Person location tracker* software module is complete.

Configuring the Handrail grip detection

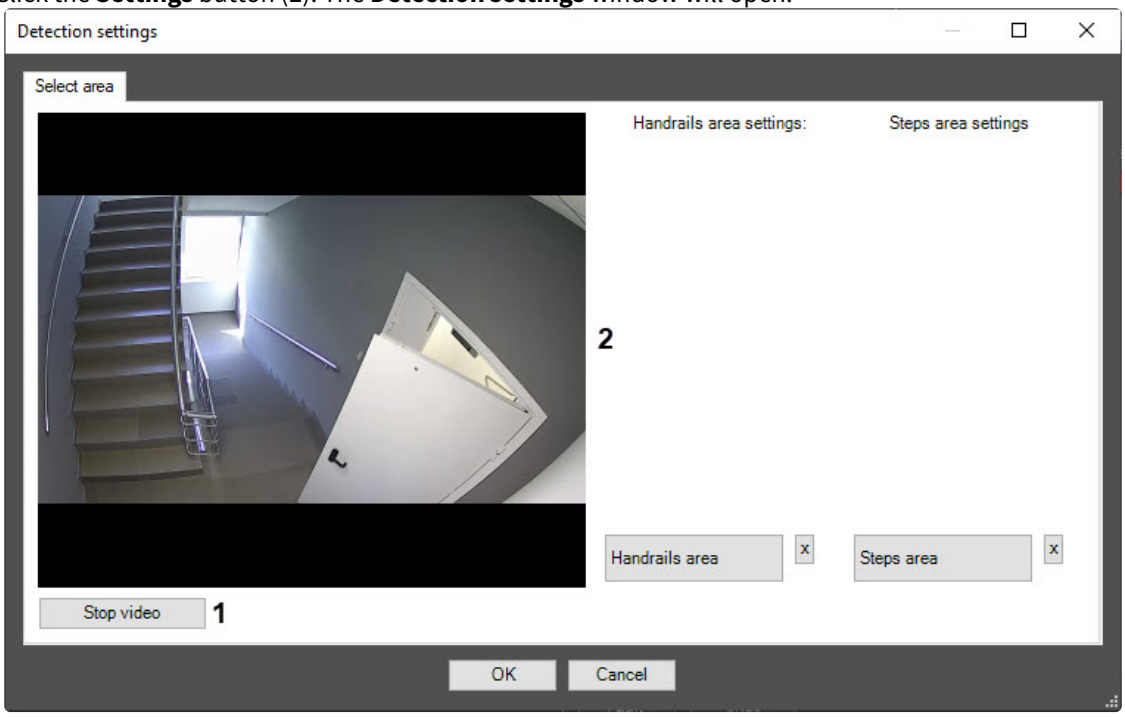
The Handrail grip detection is used to detect safety violations when a person is walking on stairs and doesn't hold the handrail with their hands.

To configure the Handrail grip detection, do the following:

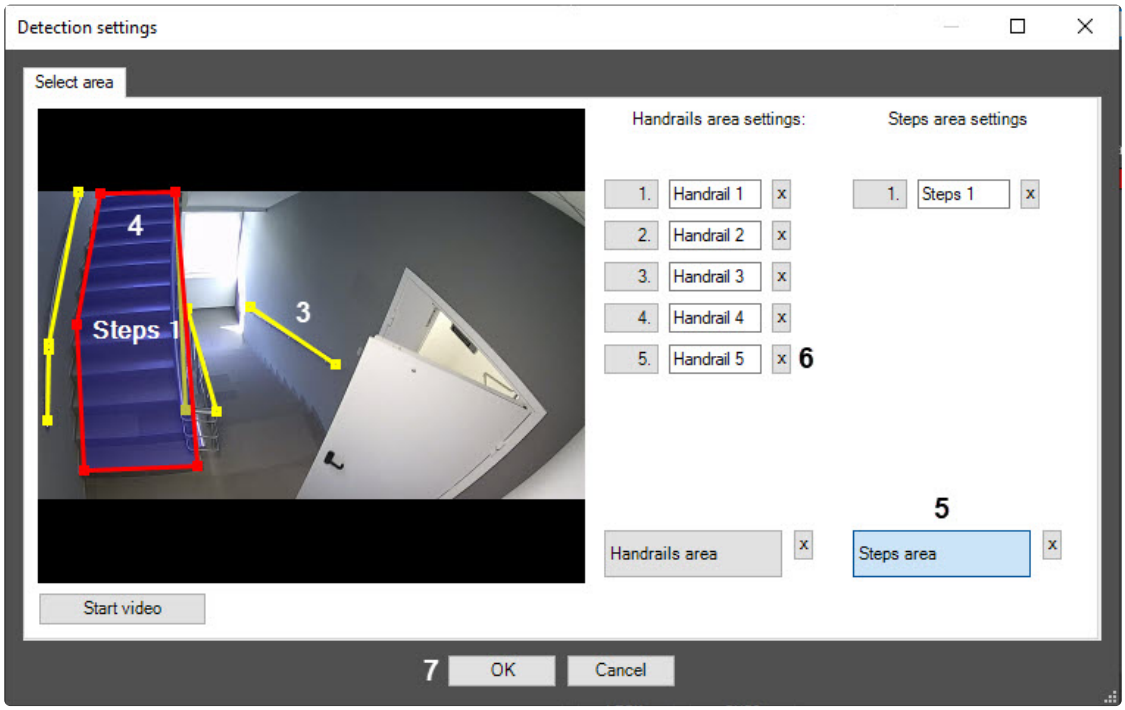
1. Go to the settings panel of the **Handrail grip detection** object that is created on the basis of the **Person location tracker** object.



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



   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**).

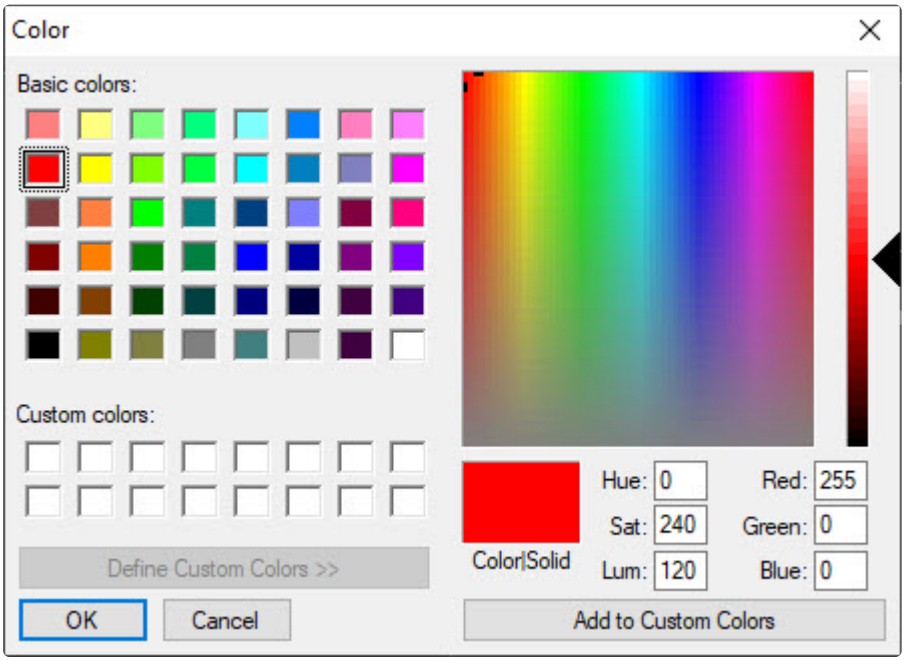


Note

- 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.
4. Set the **Display event on screen** checkbox (**3**) to display an alarm frame on the screen when the detection tool is triggered.
5. In the **Alarm border color** field (**4**), specify the color of the alarm frame 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.

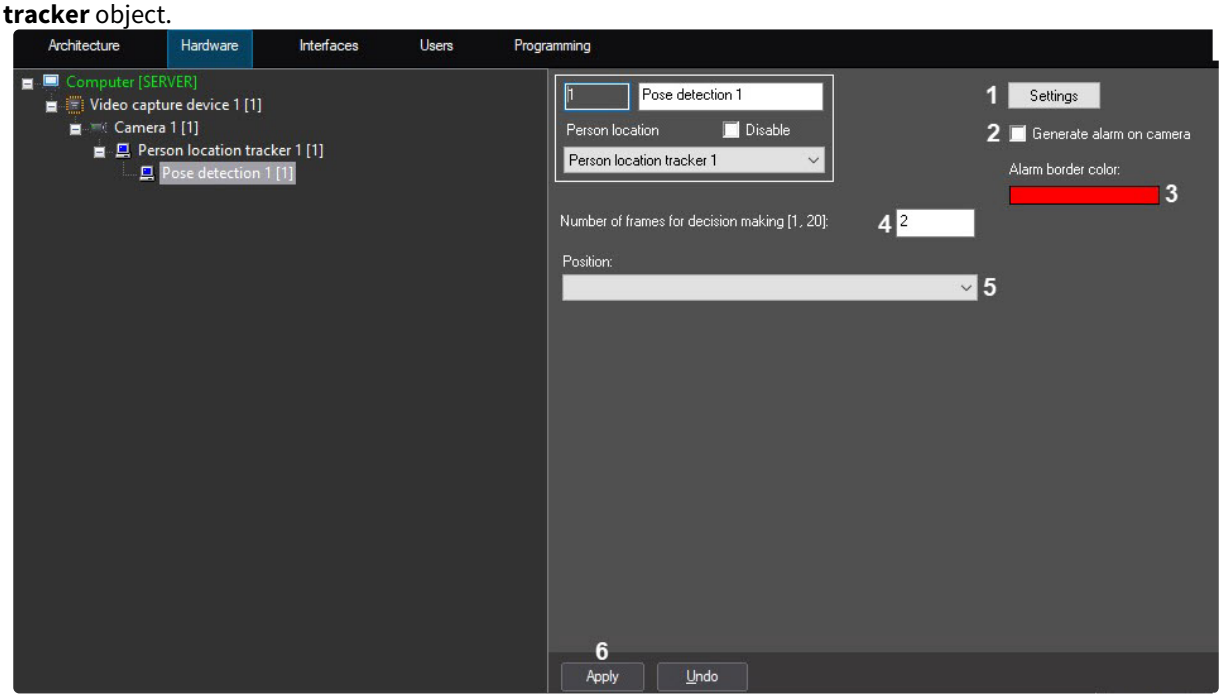


6. In the **Number of frames for decision making (1, 20)** field (**5**), enter the required number of frames from 1 to 20, on which a person is walking on the stairs and doesn't hold the handrail, to generate the corresponding event. The default value is 2.
7. Click the **Apply** button (**6**) to create a detection tool with the specified settings.

Configuring the Pose detection

The Pose detection is configured as follows:

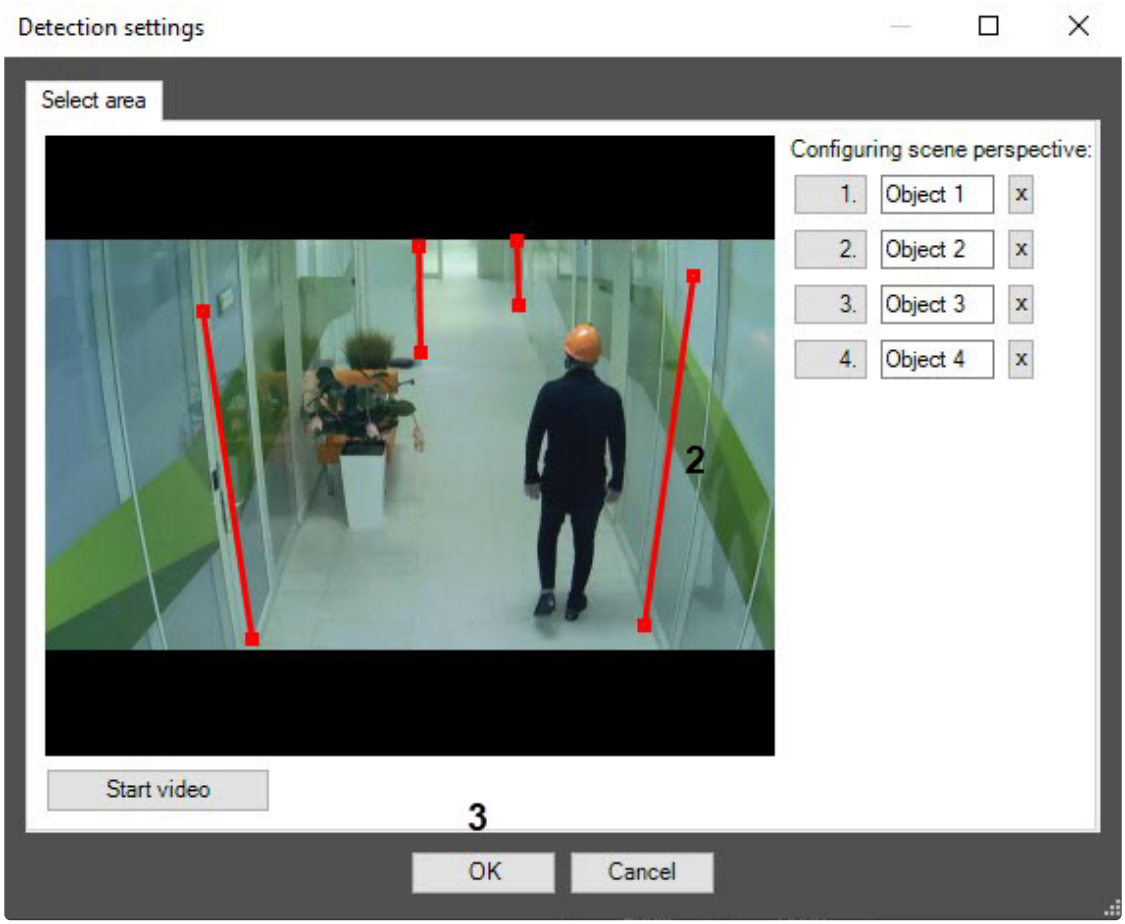
1. Go to the **Pose detection** object settings panel, which is created on the basis of the **Person location tracker** object.



2. Configure the perspective of the video image:

a. Click the **Settings** button (**1**). As a result, the **Detection settings** window will open.

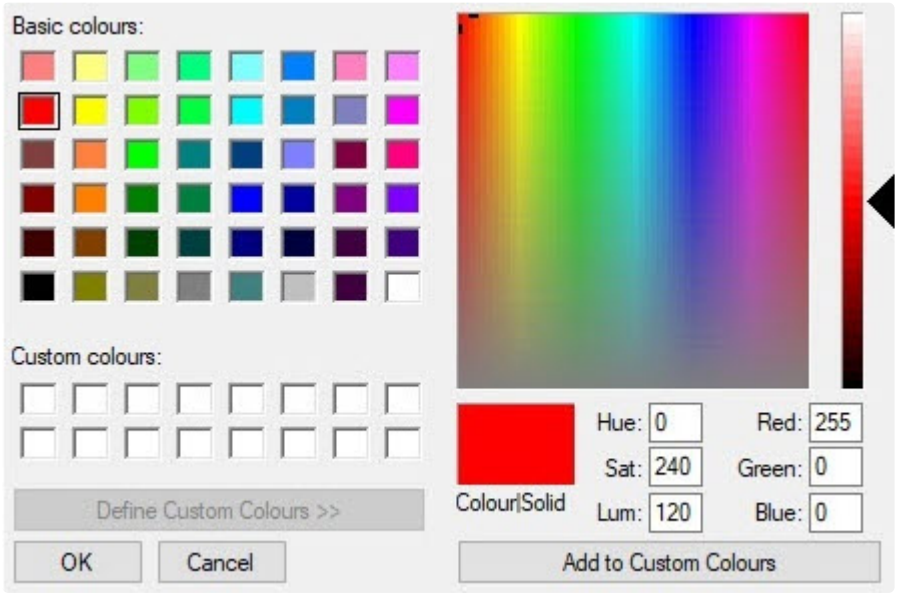
b. Click the **Stop video** button (**1**) to capture the video image.
c. Specify at least three calibration segments in different parts of the frame (**2**). To create a calibration segment, click and hold the left mouse button on the video image so that you can specify the necessary length size. You can change the size of the already created segments using the anchor points. The calibration segments should be located at different angles to each other depending on the scene and the distortion of the video image.



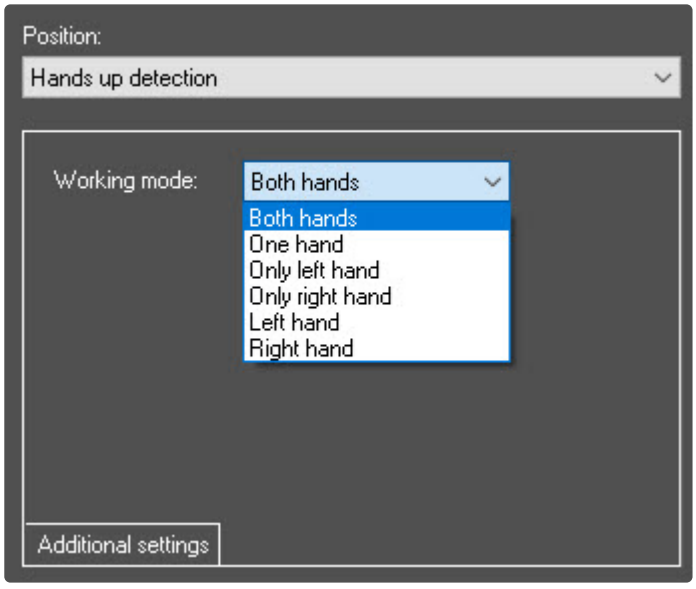
> **Note**
>
> To delete the created segment, click the x button.

d. Click the **OK** button (**3**).

3. Set the **Generate alarm on camera** checkbox (**2**) if it is also necessary to trigger an alarm on the camera by the specified pose detection.
4. In the **Alarm border color** field (**3**), 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.



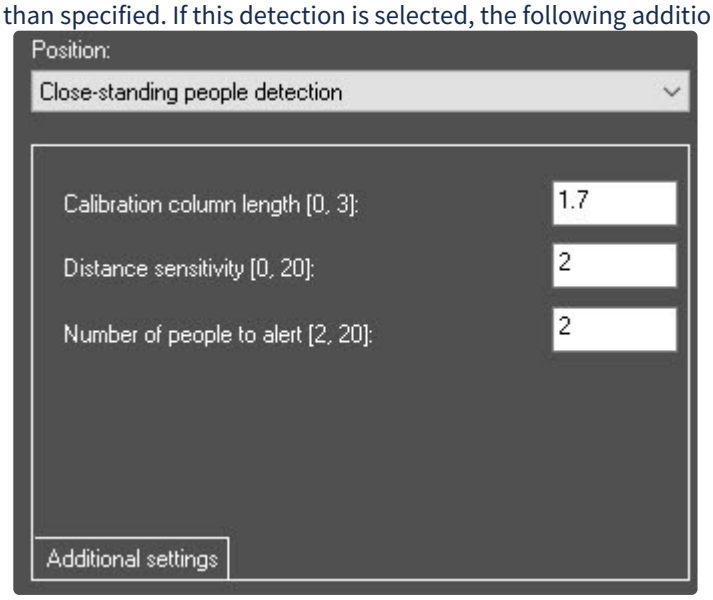
5. In the **Number of frames for decision making [1-20]** field (**4**), enter the required amount of frames from 1 to 20 on which the human should be found in the specified pose to trigger the corresponding event. The default value is 2.
6. From the **Position** drop-down list (**5**), select the human position which is necessary to detect:
   a. **Sitting person detection**—the detection triggers when a sitting human is found in the frame.
   b. **Recumbent person detection**—the detection triggers when a recumbent human is found in the frame.
   c. **Hands up detection**—the detection triggers when a human with hands raised is found in the frame. The hand is considered being raised if the forearm is parallel to the backbone and the wrists are above the shoulders. If this detection is selected, the following additional settings will become available:



   - **Working mode**—sets the hands position at which the alarm event will be generated.

   d. **Person detection**—the detection triggers when a human in any pose is found in the frame.

e. **Close-standing people detection**—the detection triggers if the distance between two people is less than specified. If this detection is selected, the following additional settings will become available:



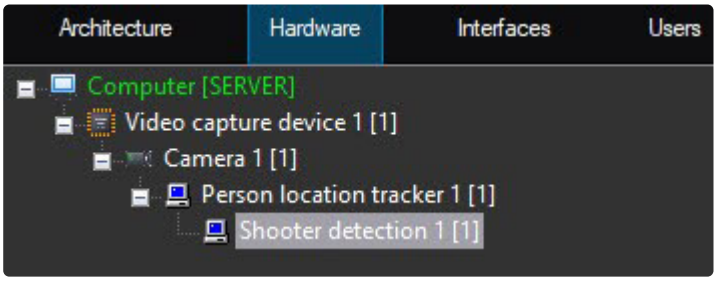
- **Calibration column length [0, 3]**—sets the length of the calibration segments from 0 to 3 meters, which were set when adjusting the perspective of the video image. The default value is 1.7;
- **Distance sensitivity [0, 20]**—sets the minimum distance between people from 0 to 20 meters. If the distance between people in the frame is equal to or less than the specified value, then the detection will be triggered. The default value is 2;
- **Number of people to alert [0, 20]**—sets the number of people who should break the distance for the detection to be triggered. Possible values are from 2 to 20. The default value is 2.

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

The Pose detection is now configured.

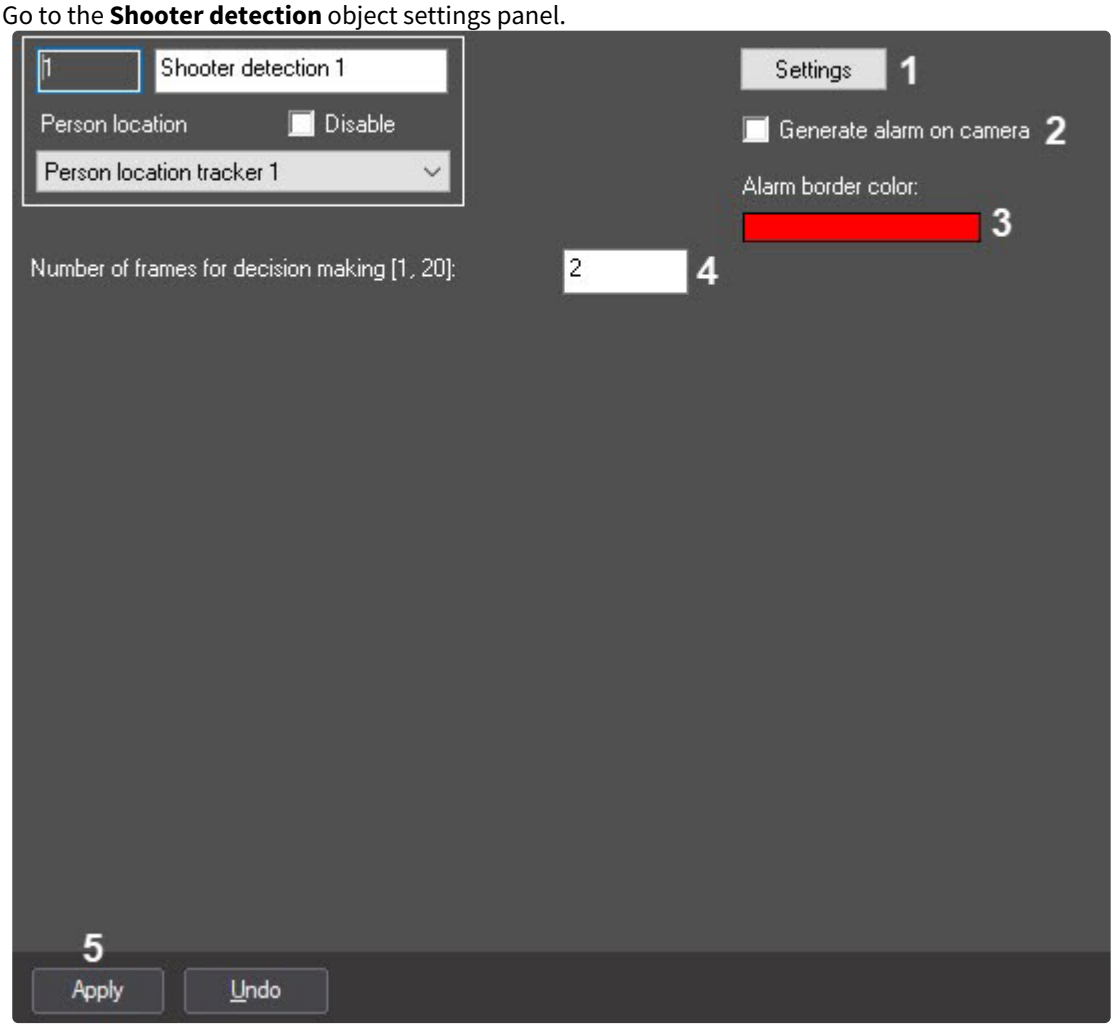
Configuring the Shooter detection

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.



The **Shooter detection** is configured as follows:

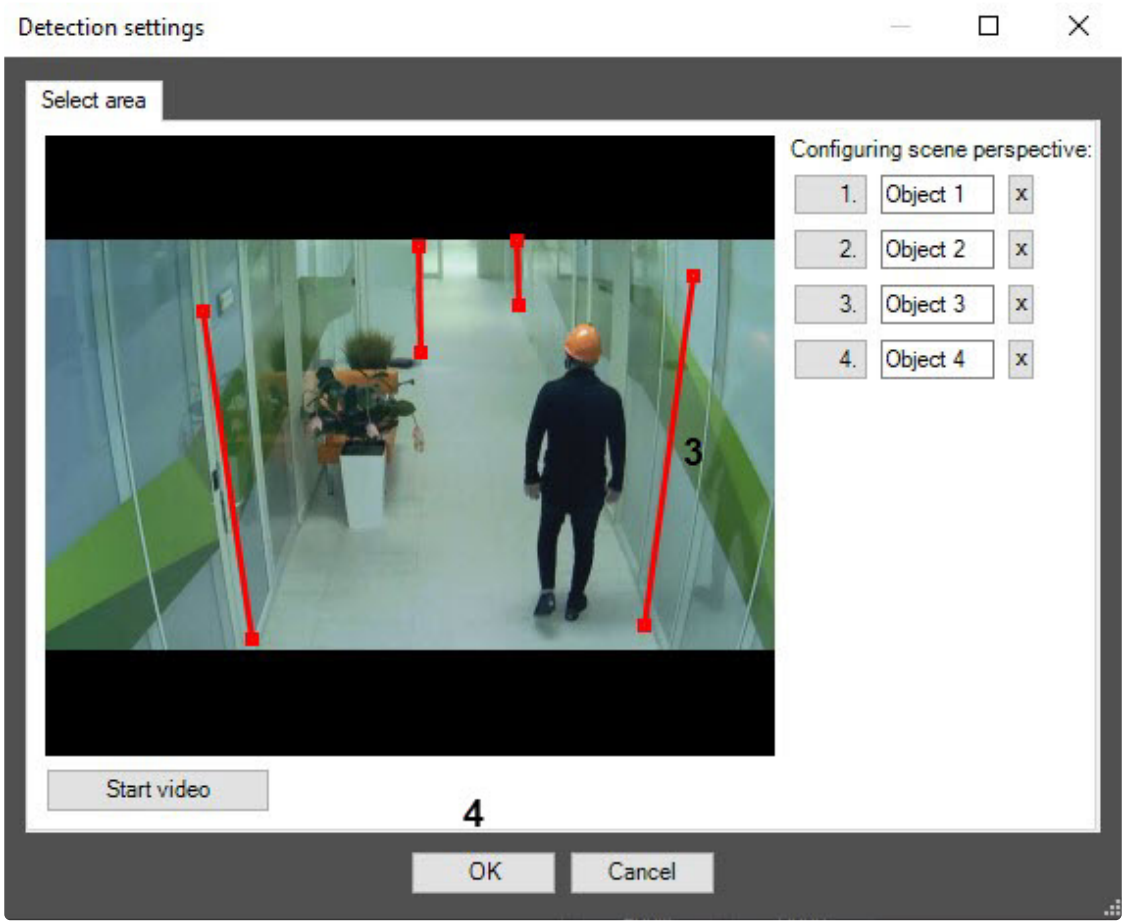
1. Go to the **Shooter detection** object settings panel.



2. Configure the perspective of the video image:

a. Click the **Settings** button (**1**). As a result, the **Detection settings** window will open.

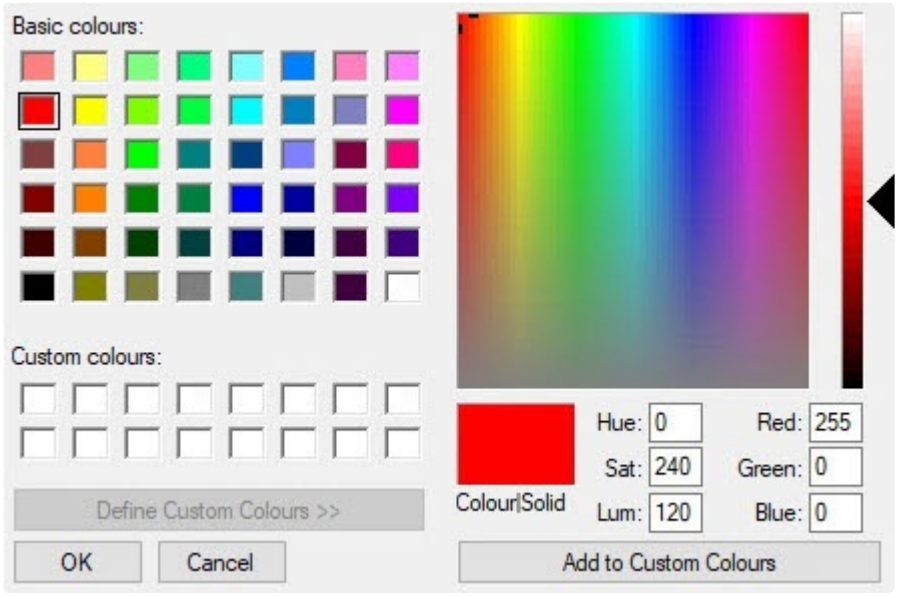
b. Click the **Stop video** button (**1**) to capture the video image (**2**).
c. Specify at least three calibration segments in different parts of the frame (**3**). To create a calibration segment, click and hold the left mouse button on the video image so that you can specify the necessary length size. You can change the size of the already created segments using the anchor points. The calibration segments should be located at different angles to each other depending on the scene and the distortion of the video image.



> **Note**
>
> To delete the created segment, click the x button.

d. Click the **OK** button (**4**) to save the settings of the perspective of the video image. The **Detection settings** window will close, and you will return to the **Shooter detection** object settings panel.

3. Set the **Generate alarm on camera** checkbox (**2**) if it is also necessary to trigger an alarm on the camera by the specified pose detection.
4. In the **Alarm border color** field (**3**), 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.



5. In the **Number of frames for decision making [1, 20]** field (**4**), enter the required amount of frames from 1 to 20 on which the human should be found in the shooter pose to trigger the corresponding event. The default value is 2.
6. Click the **Apply** button (**5**).

The Shooter detection is now configured.

4.17 VideoIntellect embedded detector

4.17.1 Functionality of the VideoIntellect embedded detector module

The *VideoIntellect embedded detector* module includes the following detection tools:

- **Abandoned objects detection**—used as part of video surveillance systems at crowded objects (metro, train stations, airports, museums, shopping malls, etc.) in order to automatically detect abandoned or disappeared objects, items, things, and other stationary scene changes that occurred in the surveillance area in the camera field of view and remain motionless for a given period of time.
- **Prohibited zone motion detection**—used as part of video surveillance systems at crowded objects (metro, train stations, airports, museums, shopping malls, etc.) in order to automatically detect people movement in the camera field of view.
- **Camera state detection**—used for automatic detection of atypical changes in the scene (flare, darkening, defocusing).
- **Prohibited direction motion detection**—used as part of video surveillance systems at crowded objects (metro, train stations, airports, museums, shopping malls, etc.) in order to automatically detect people movement in a prohibited direction in the camera field of view.
- **Other**—other VideoIntellect detection tools that are not integrated at the moment (see the official VideoIntellect website).

4.17.2 Licensing of the VideoIntellect embedded detector module

The *VideoIntellect embedded detector* module is licensed using an executable *.exe file that includes a license for each individual detection tool. To obtain this license file, please contact *VideoIntellect* technical support (official website).

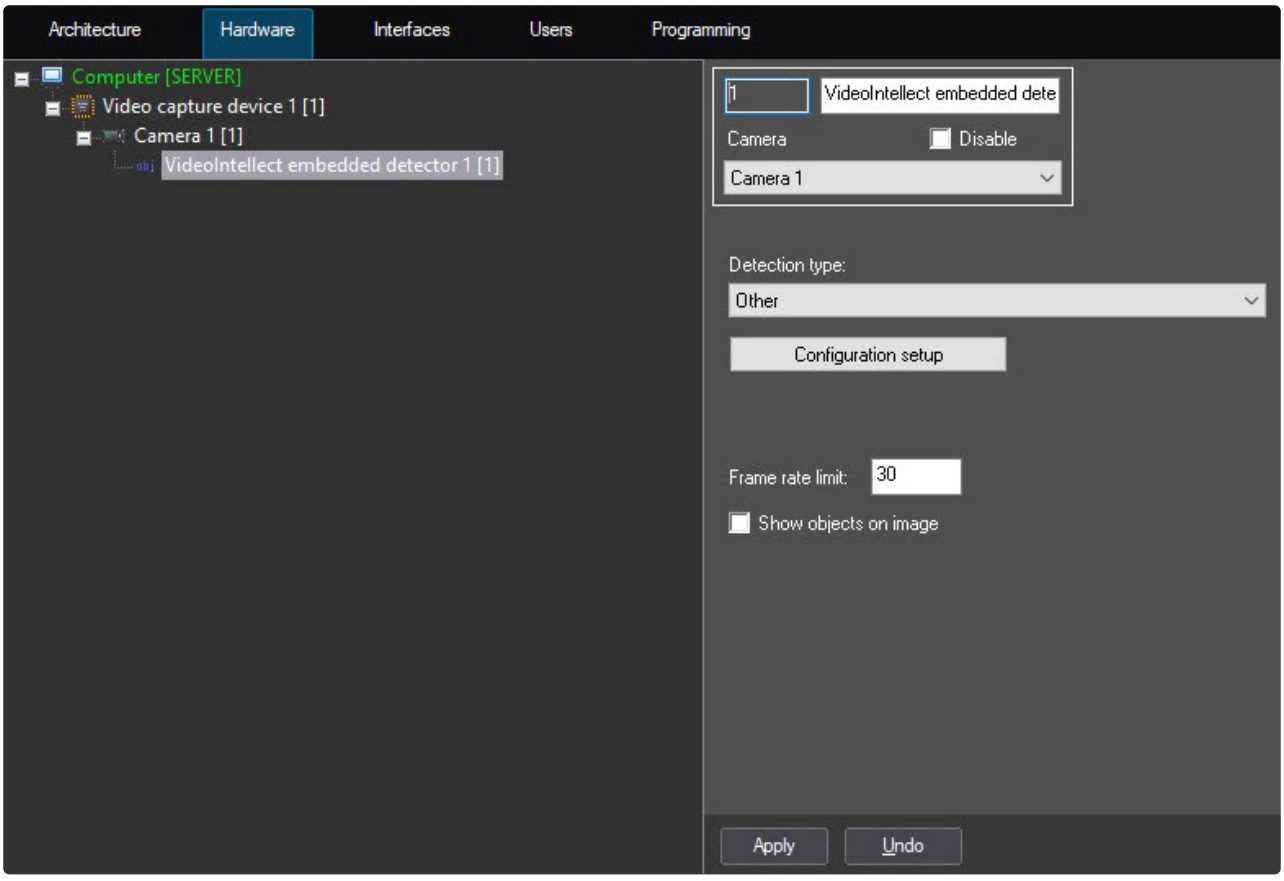
4.17.3 Camera requirements for the VideoIntellect embedded detector module

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

Camera	• Resolution: at least 640x480 pixels • Correct operation is not guaranteed if a fish-eye lens is used • Fps: not less than 12
Lighting	• The objects should be visually separated from the background and from each other
Scene and camera angle	• The camera should be static

4.17.4 Configuring the VideoIntellect embedded detector module

The *VideoIntellect embedded detector* module is configured on the settings panel of the **VideoIntellect embedded detector** object created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.



The *VideoIntellect embedded detector* module is configured as follows:

1. Go to the **VideoIntellect embedded detector** object settings panel.

2. From the **Detection type** drop-down list (**1**), select the required detection tool:
   - Abandoned objects detection,
   - Prohibited zone motion detection,
   - Camera state detection,
   - Prohibited direction motion detection,
   - Other.
3. Click the **Configuration setup** button (**2**) to configure the selected detection tool. As a result, the **Detection settings** window will open (for details, see Configuring VideoAxxon PSIM detection tools).
4. In the **Frame rate limit** field (**3**), enter the maximum number of frames per second that will be processed by the selected detection tool.
5. Set the **Show objects on image** checkbox (**4**) if it is necessary to highlight the detected object with a frame on the image in the **Monitor** interface object window.
6. Click the **Apply** button (**5**).

The *VideoIntellect embedded detector* module is now configured.

Configuring VideoIntellect detection tools

VideoIntellect abandoned objects detection

The *VideoIntellect abandoned objects detection* is configured as follows:

1. On the **Select area** tab (**1**), do the following:

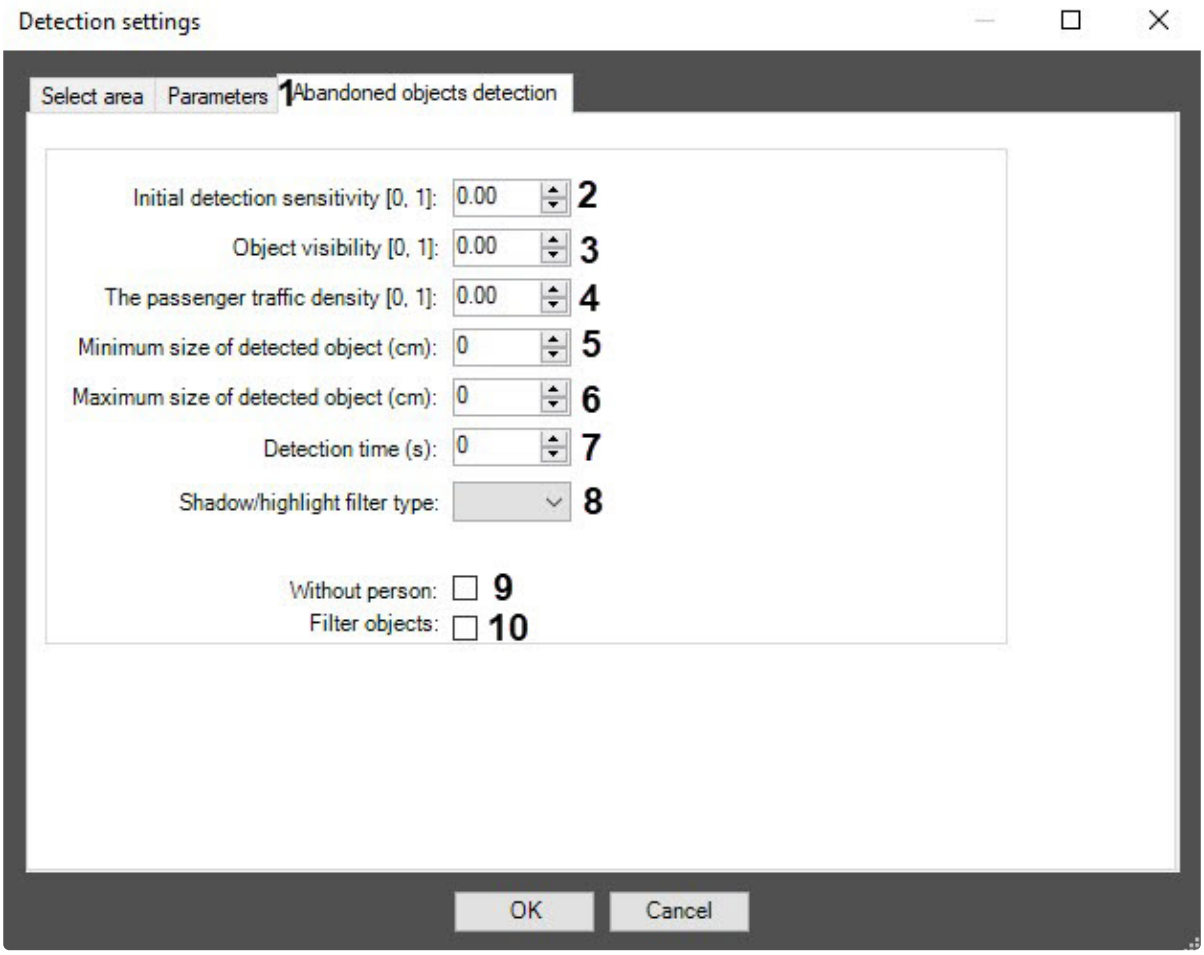
   a. To capture a frame of a video image, click the **Stop video** button (**2**).

b. Set one or more zones in which the abandoned objects will be detected (**3**).

c. All set zones are displayed in the **Detection zones** area (**4**). If necessary, you can change the name of the zone or delete the zone.

d. Click the **Apply configuration changes** button (**5**).

2. On the **Abandoned objects detection** tab (**1**), configure the detection tool parameters:

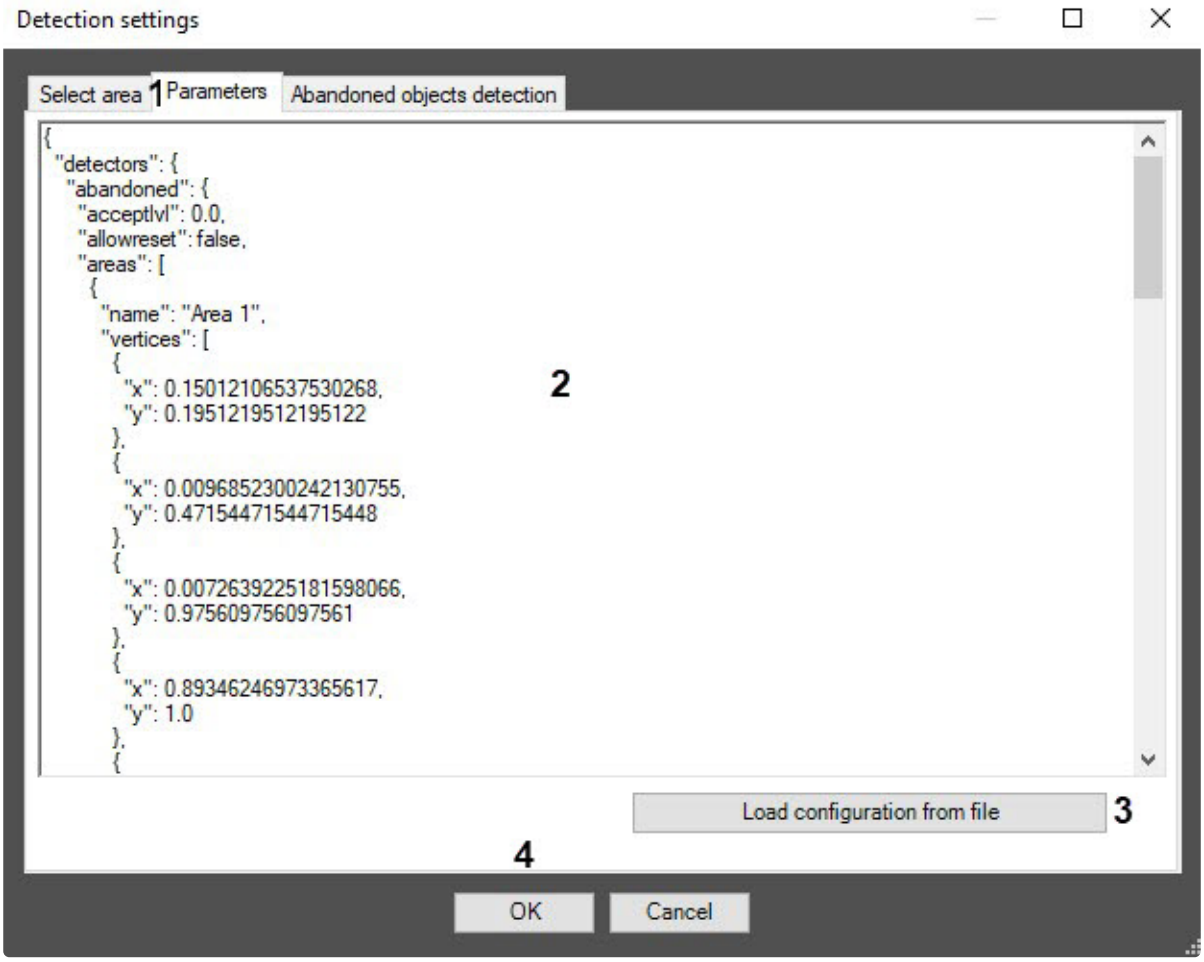


   a. In the **Initial detection sensitivity [0, 1]** field (**2**), enter the general sensitivity of the detector. Value range is from 0 to 1. Value 0 means that no object will be detected, value 1 means maximum sensitivity. The recommended value is 0.7.
   b. In the **Object visibility [0, 1]** field (**3**), enter the detection sensitivity of subtle (merging with the background) objects. This parameter indicates the ability of the detector to distinguish subtle (merging with the background) objects.
   Value range is from 0 to 1 in conventional units. Value 0 means the object will not be detected, value 1 means maximum sensitivity. The recommended value is 0.95. The recommended value range is from 0.82 to 0.97.
   c. In the **The passenger traffic density [0, 1]** field (**4**), enter the object detection sensitivity in conditions of intensive object overlap by passing people.
   d. In the **Minimum size of detected object (cm)** field (**5**), enter the minimum object size on one side in centimeters to be detected. Smaller objects will not trigger the detection. The size of the object is specified relative to the frame.
   e. In the **Maximum size of detected object (cm)** field (**6**), enter the maximum object size on one side in centimeters to be detected. Larger objects will not trigger the detection. The size of the object is specified relative to the frame.
   f. In the **Detection time (s)** field (**7**), enter the time in seconds after which the object is considered abandoned.
   g. In the **Shadow/highlight filter type** drop-down list (**8**), enable additional filtering of shadows and highlights (disabled by default). Select one of the filter types: "z003", "z002", "z001", "zac", "zu", "zz" depending on the scene contrast, lighting variability, presence of shadows and highlights. For

outdoor areas with shadows and visual noise (caused by grass and other plants, for example), and for objects with glares, the filter types "z003" and "zz" are recommended. For underbridge spaces with shadows and contrasting objects, the filter types are “z003” and “zac” are recommended. The filter is selected empirically.

h. Set the **Without person** checkbox (**9**) to ignore the objects left next to the person.
i. Set the **Filter objects** checkbox (**10**) to enable the object neural network filter.

3. On the **Parameters** tab (**1**), the area (**2**) displays the current detection configuration. This configuration can be copied to any text file. To upload a configuration from a file, click the **Load configuration from file** button (**3**).



Description of configuration parameters:

a. sensitivity—initial detection sensitivity.
b. rejectlvl—object visibility.
c. acceptlvl—the passenger traffic density.
d. objsizemin—minimum size of detected object.
e. objsizemax—maximum size of detected object.
f. detectiontime—detection time.
g. isFilterHumans—without a person.
h. isFilterObjects—filter objects.

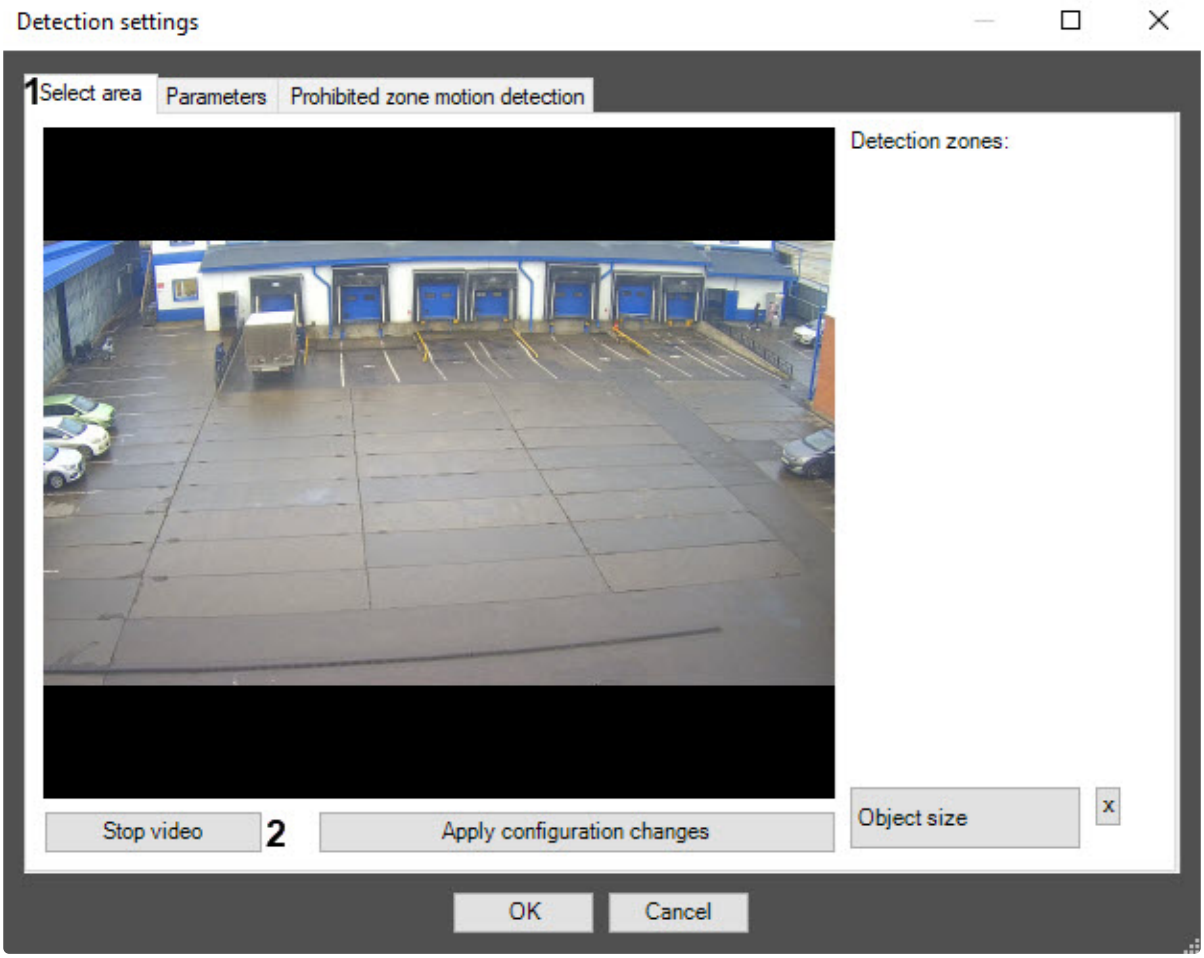
4. Click the **OK** (**4**) button to complete the detection configuration.

The *VideoIntellect abandoned objects detection* is now configured.

VideoIntellect prohibited zone motion detection

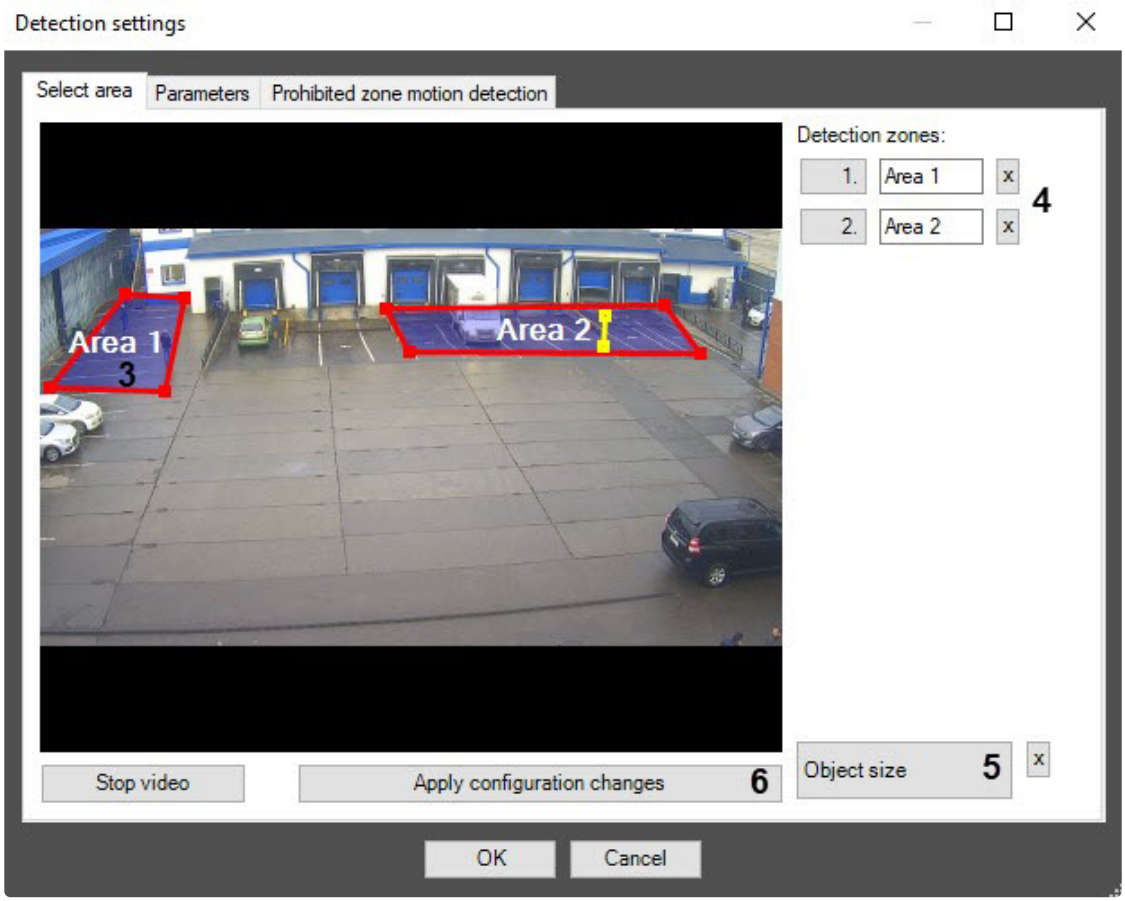
The *VideoIntellect* prohibited zone motion detection is configured as follows:

1. On the **Select area** tab (**1**), do the following:



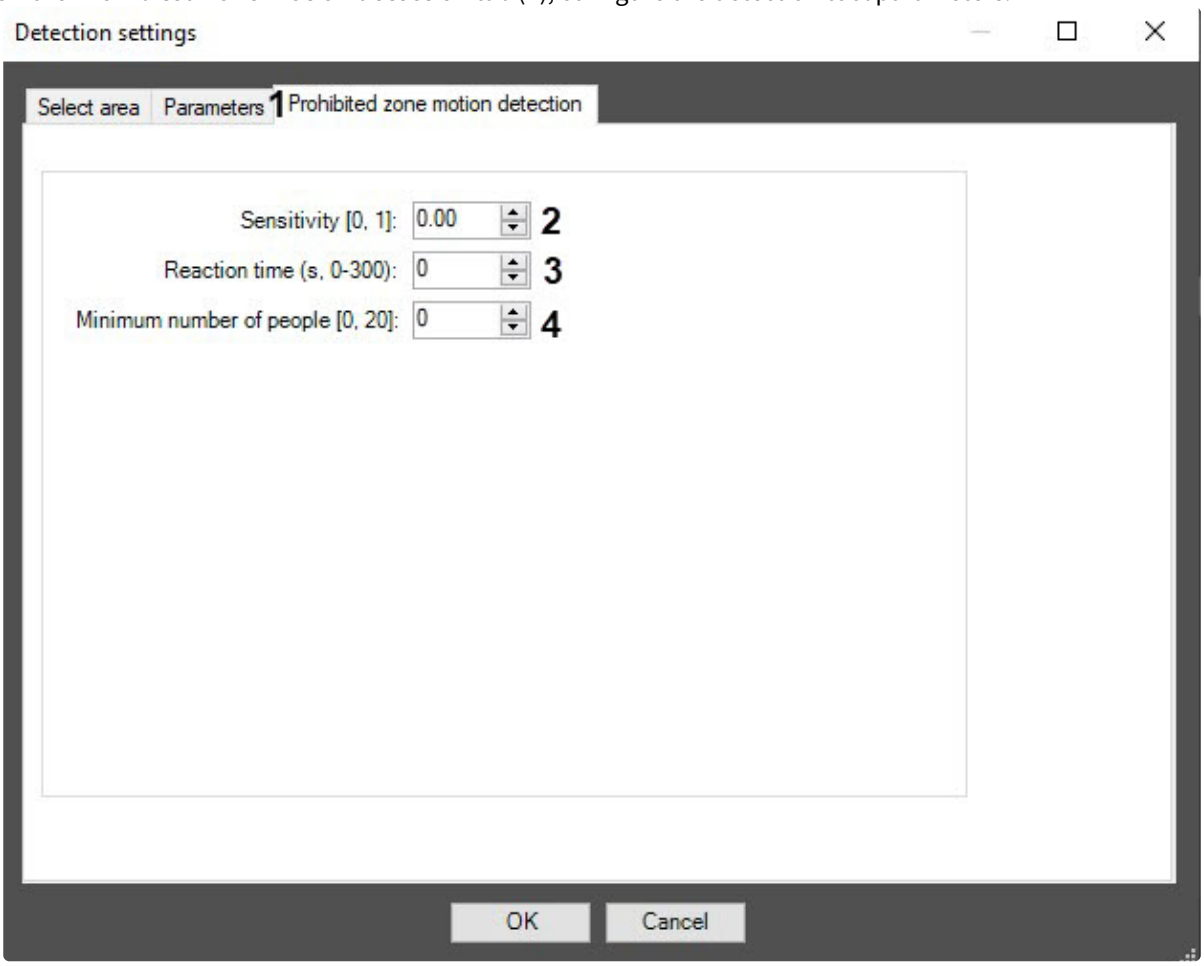
   a. To capture a frame of a video image, click the **Stop video** button (**2**).

b. Set one or more zones in which the motion will be detected (**3**).



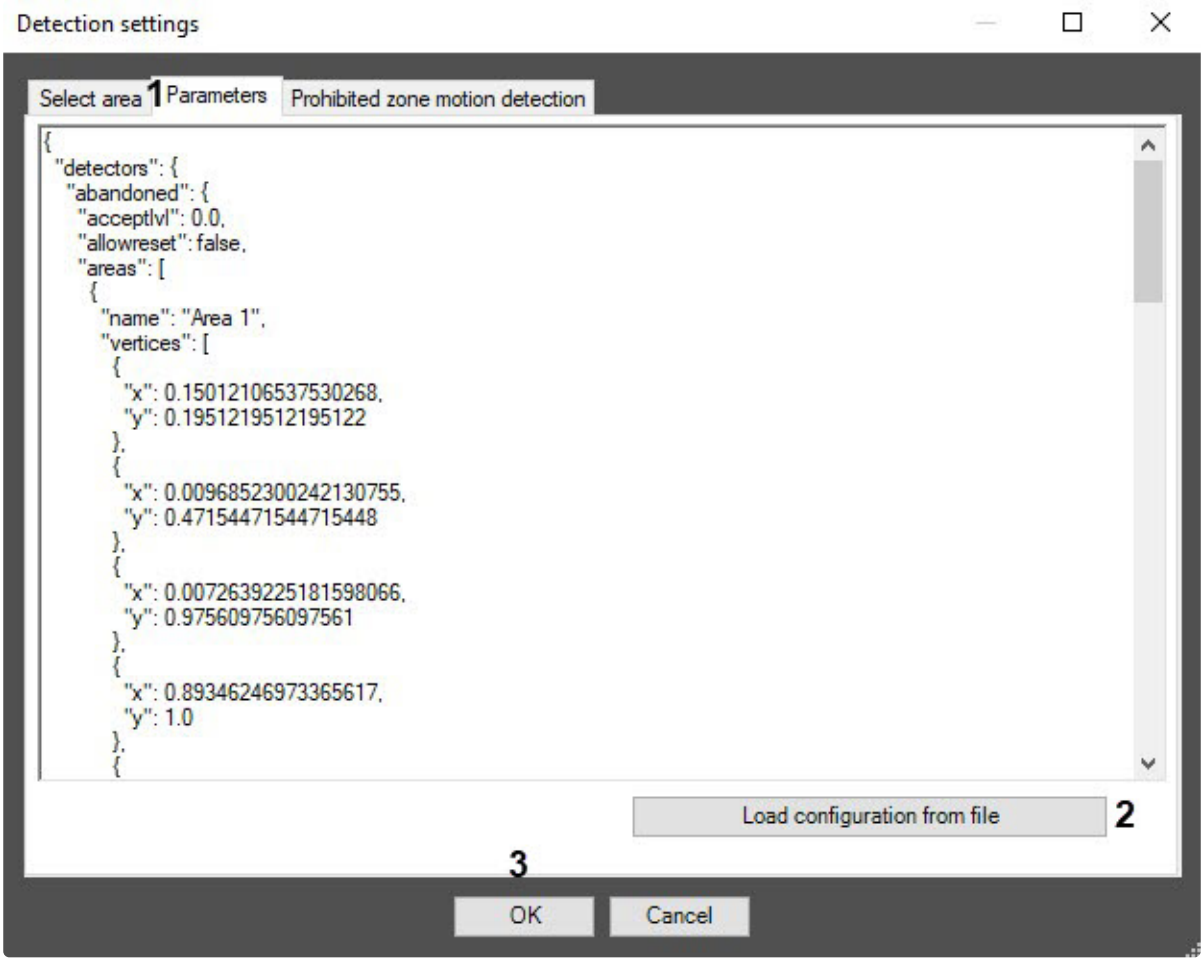
c. All set zones are displayed in the **Detection zones** area (**4**). If necessary, you can change the name of the zone or delete the zone.
d. Click the **Object size** button (**5**) and use the yellow line to set the approximate size of the human head.
e. Click the **Apply configuration changes** button (**6**).

2. On the **Prohibited zone motion detection** tab (**1**), configure the detection tool parameters:



   a. In the **Sensitivity [0, 1]** field (**2**), enter the detection tool sensitivity to detect moving objects in the analyzed area. The higher the sensitivity, the less visible a moving object can be detected.
   b. In the **Reaction time (s, 0-300)** field (**3**), enter the time in seconds after which the detection tool will indicate the occurrence of the "Prohibited zone motion detection" alarm situation. The countdown starts from the moment the object enters the detection zone. If there is no movement in the prohibited zone after the reaction time has expired, the time counting stops, and the time counter is set to zero.
   c. In the **Minimum number of people [0, 20]** field (**4**), enter the minimum number of people at which the detection tool starts recording an event. If the zone occupancy with people continues to be higher than the specified threshold time (the **Reaction time** parameter), then the detection tool indicates an alarm situation.

3. On the **Parameters** tab (**1**), the area (**2**) displays the current detection configuration. This configuration can be copied to any text file. To upload a configuration from a file, click the **Load configuration from file** button (**2**).



Description of some configuration parameters:

a. sensitivity—sensitivity.
b. sizeobject—the size of the human head.
c. reactiontime—reaction time.
d. minNumberOfObjects—minimum number of people.

4. Click the **OK** (**3**) button to complete the detection configuration.

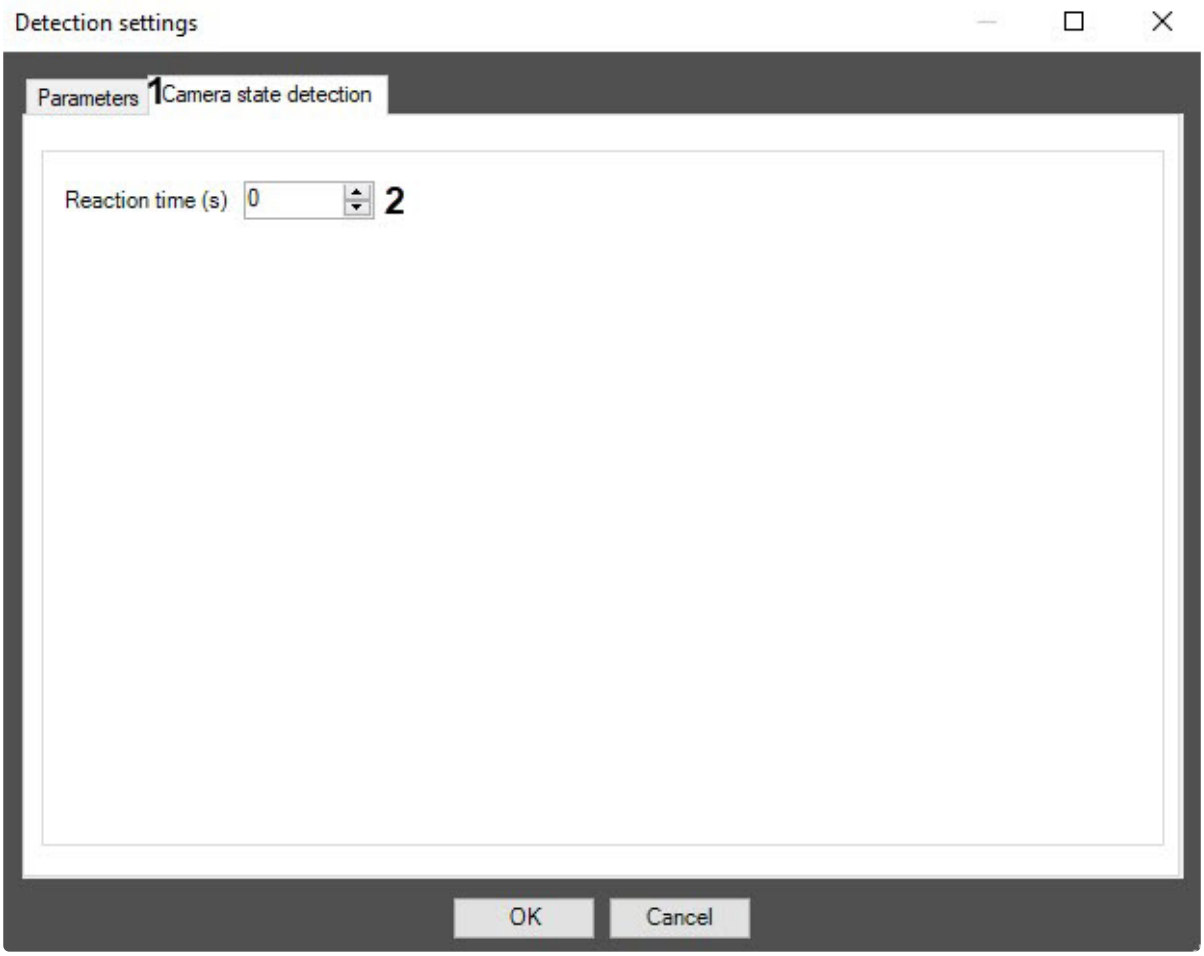
The *VideoIntellect* prohibited zone motion detection is now configured.

VideoIntellect camera state detection

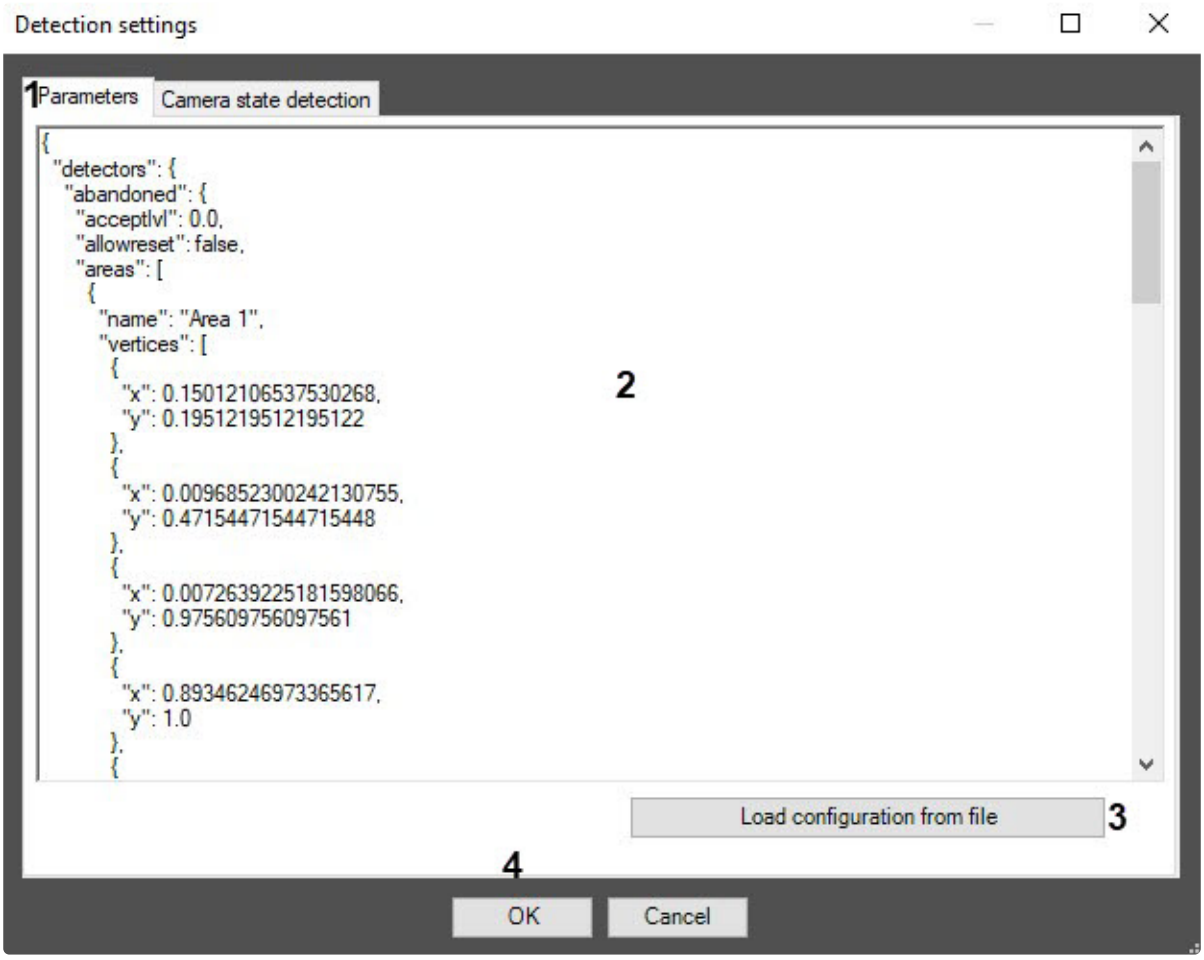
The *VideoIntellect* camera state detection is configured as follows:

1. On the **Camera state detection** tab (**1**), in the **Reaction time (s)** field, enter the time in seconds after which the detection tool indicates the fact of an atypical change in the scene (**2**). The countdown starts from the moment an alarm situation is detected. If there are no changes in the state of the camera, the time counting

stops, and the time counter is set to zero.



2. On the **Parameters** tab (**1**), the area displays the current detection configuration (**2**). This configuration can be copied to any text file. To upload a configuration from a file, click the **Load configuration from file** button (**3**).



Description of configuration parameters:

a. reactiontime—reaction time.

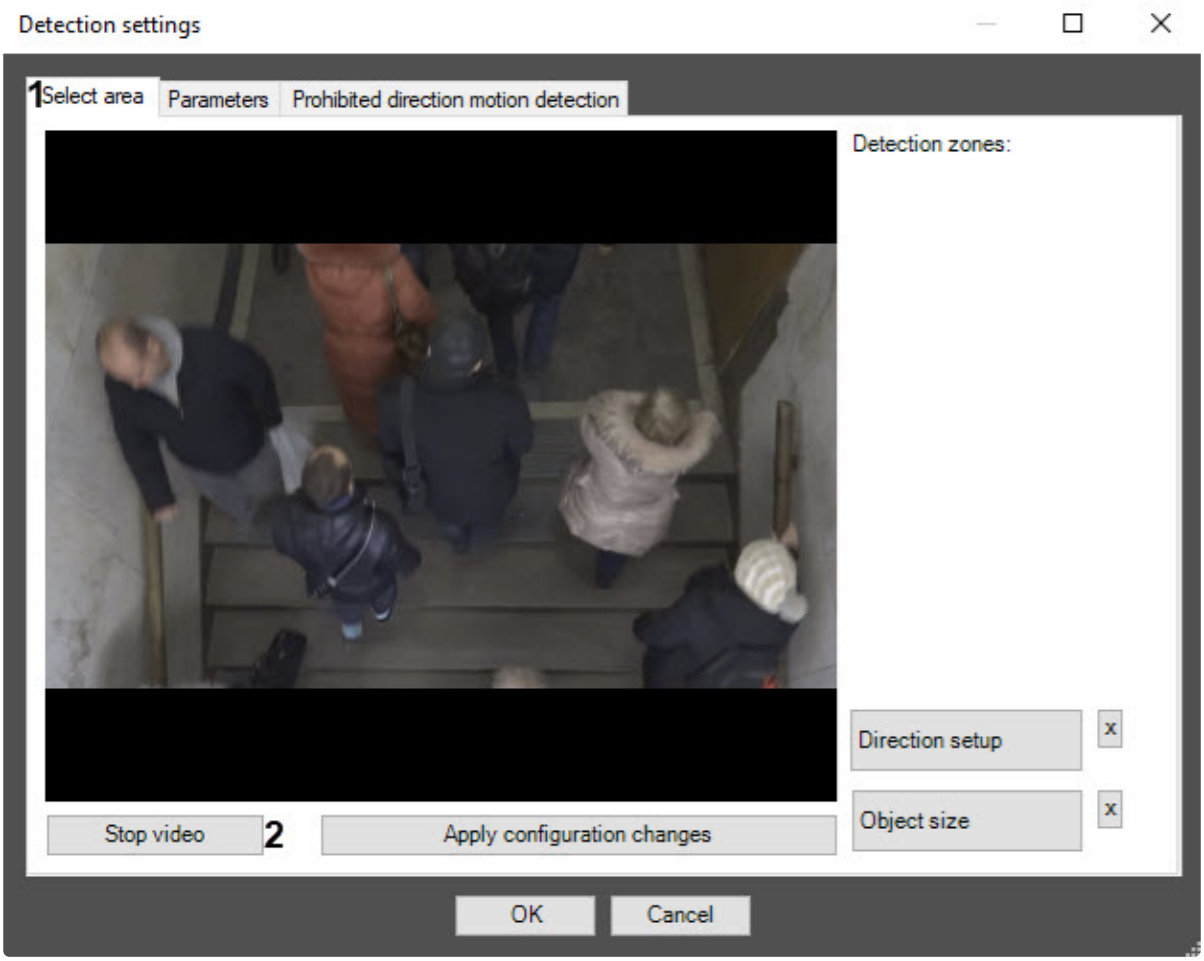
3. Click the **OK** (**4**) button to complete the detection configuration.

The *VideoIntellect* camera state detection is now configured.

VideoIntellect prohibited direction motion detection

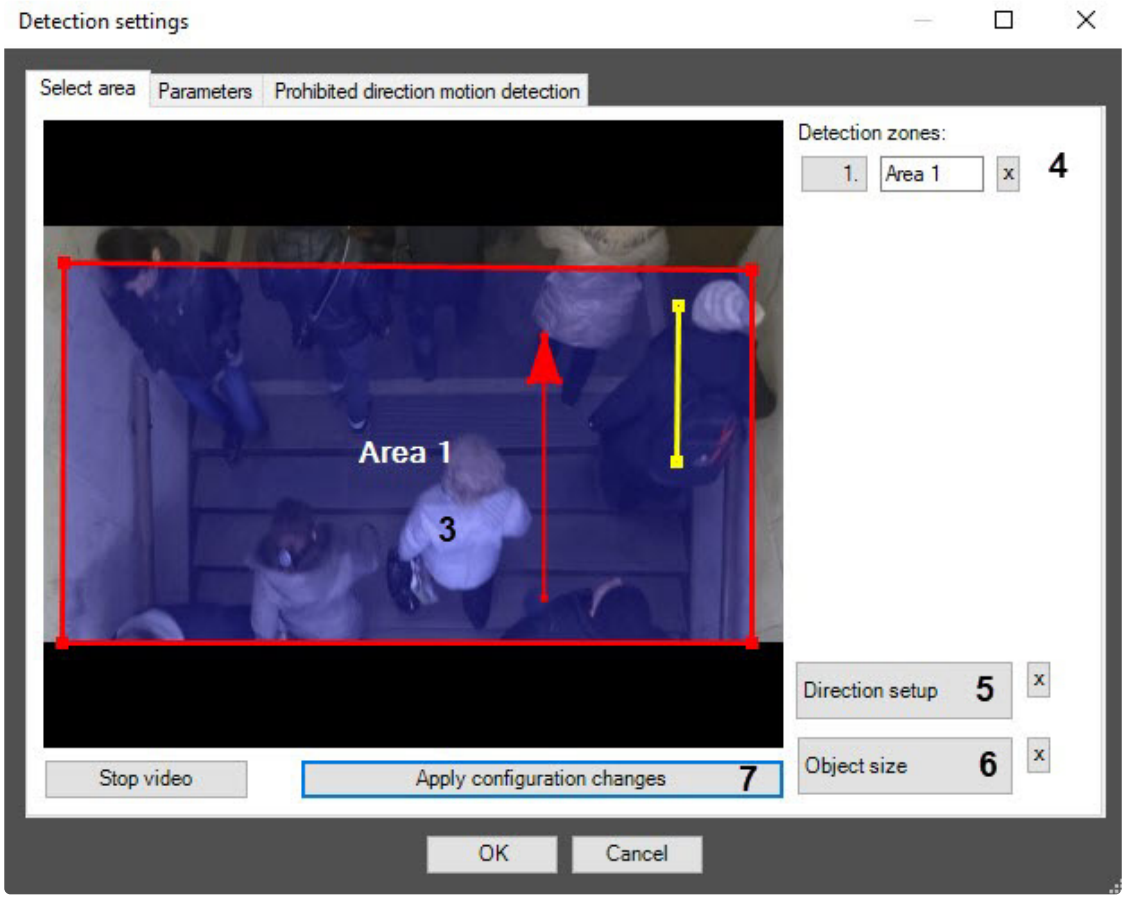
The *VideoIntellect* prohibited direction motion detection is configured as follows:

1. On the **Select area** tab (**1**), do the following:



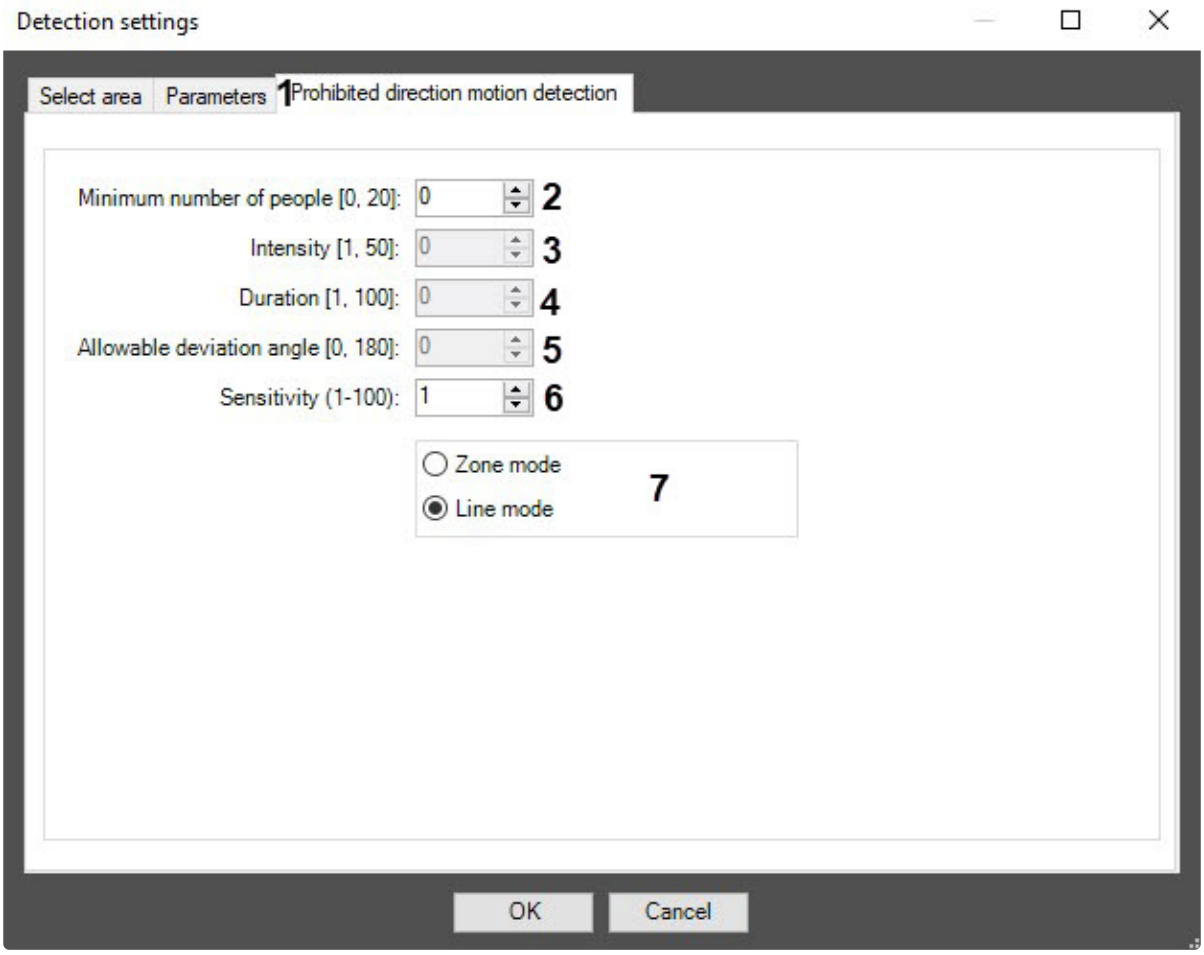
   a. To capture a frame of a video image, click the **Stop video** button (**2**).

b. Set one or more zones in which the motion will be detected (**3**).



c. All set zones are displayed in the **Detection zones** area (**4**). If necessary, you can change the name of the zone or delete the zone.
d. Click the **Direction setup** button (**5**) and use the arrow to set the correct motion direction. Moving against the direction of the arrow will be considered prohibited.
e. Click the **Object size** button (**6**) and use the yellow line to set the approximate size of the human head.
f. Click the **Apply configuration changes** button (**7**).

2. On the **Prohibited direction motion detection** tab (**1**), configure the detection tool parameters:

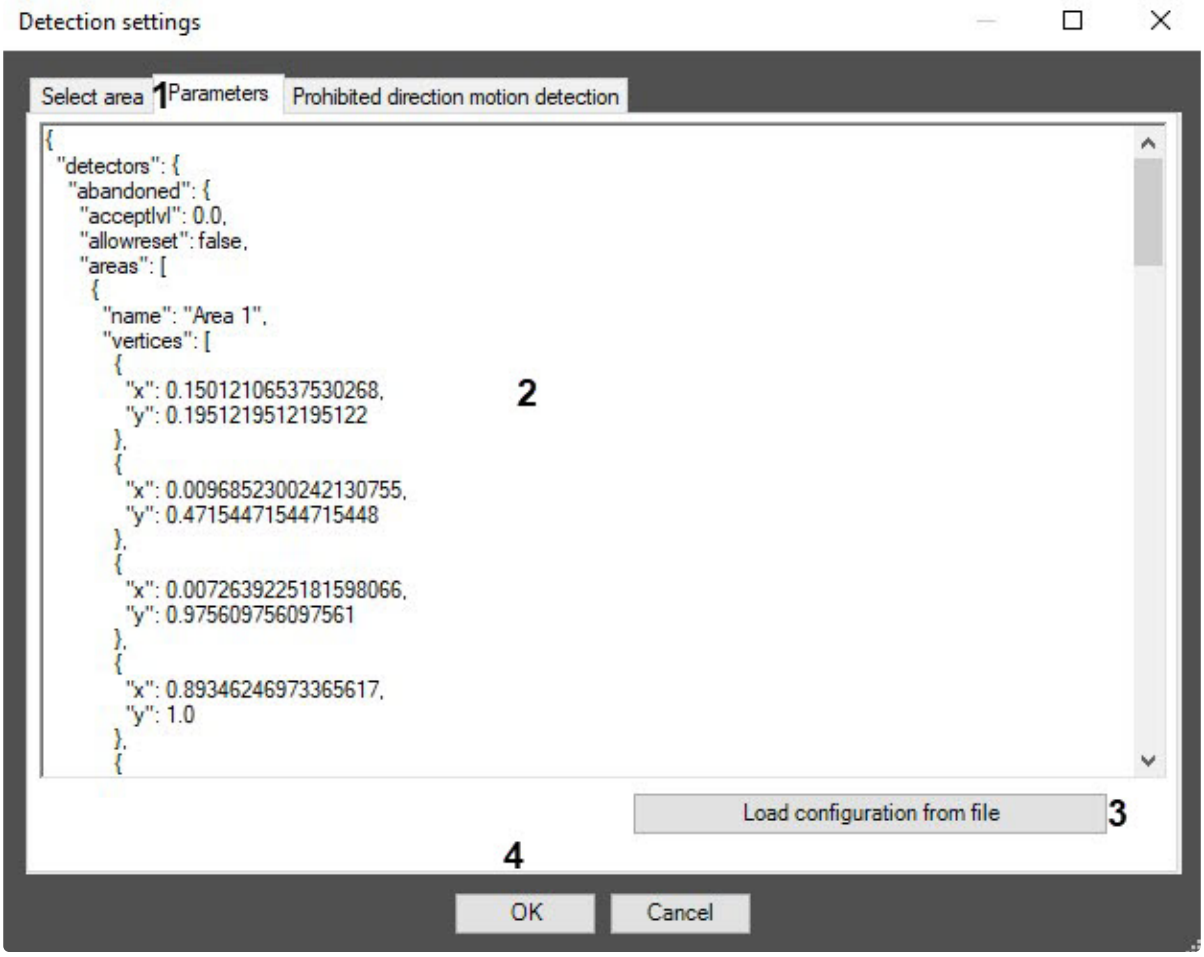


a. In the **Minimum number of people [0-20]** field (**2**), enter the minimum number of people at which the detection tool starts recording an event when they cross a zone or a line in a prohibited direction.
b. In the **Intensity [1-50]** field (**3**), enter the sensitivity of the object's movement in the zone. When this value is exceeded, the detection tool will trigger.
c. In the **Duration [1-100]** field (**4**), enter the duration in the object's movement conventional units in the prohibited direction.

> **Note**
>
> It can be used in the analysis of dense passenger traffic, in which an object making its way in the opposite direction appears in the camera field of view only for short periods of time, and the rest of the time it is hidden from the camera view by the crowd.

d. In the **Allowable deviation angle [0-180]** field (**5**), enter the allowable angle in degrees, indicating the allowable spread of the movement direction of the object in the prohibited direction from the direction specified by the arrow (the so-called "detection cone").
e. In the **Sensitivity (1-100)** field (**6**), enter the sensitivity of the detection tool to the moving objects in the analyzed direction as a percentage. The higher the sensitivity, the less noticeable moving object can be detected.
f. Select the mode of motion in the prohibited direction (**7**):
   - **Zone mode**—movement in the zone against the direction of the arrow will be considered prohibited;
   - **Line mode**—crossing the line against the direction of the arrow will be considered prohibited.

3. On the **Parameters** tab (**1**), the area displays the current detection tool configuration (**2**). This configuration can be copied to any text file. To upload a configuration from a file, click the **Load configuration from file** button (**3**).



Description of some configuration parameters:

a. minNumberOfObjects—Minimum number of people.
b. intensity—Intensity.
c. duration—Duration.
d. sizeobject—The size of the human head.
e. angle—Allowable deviation angle.

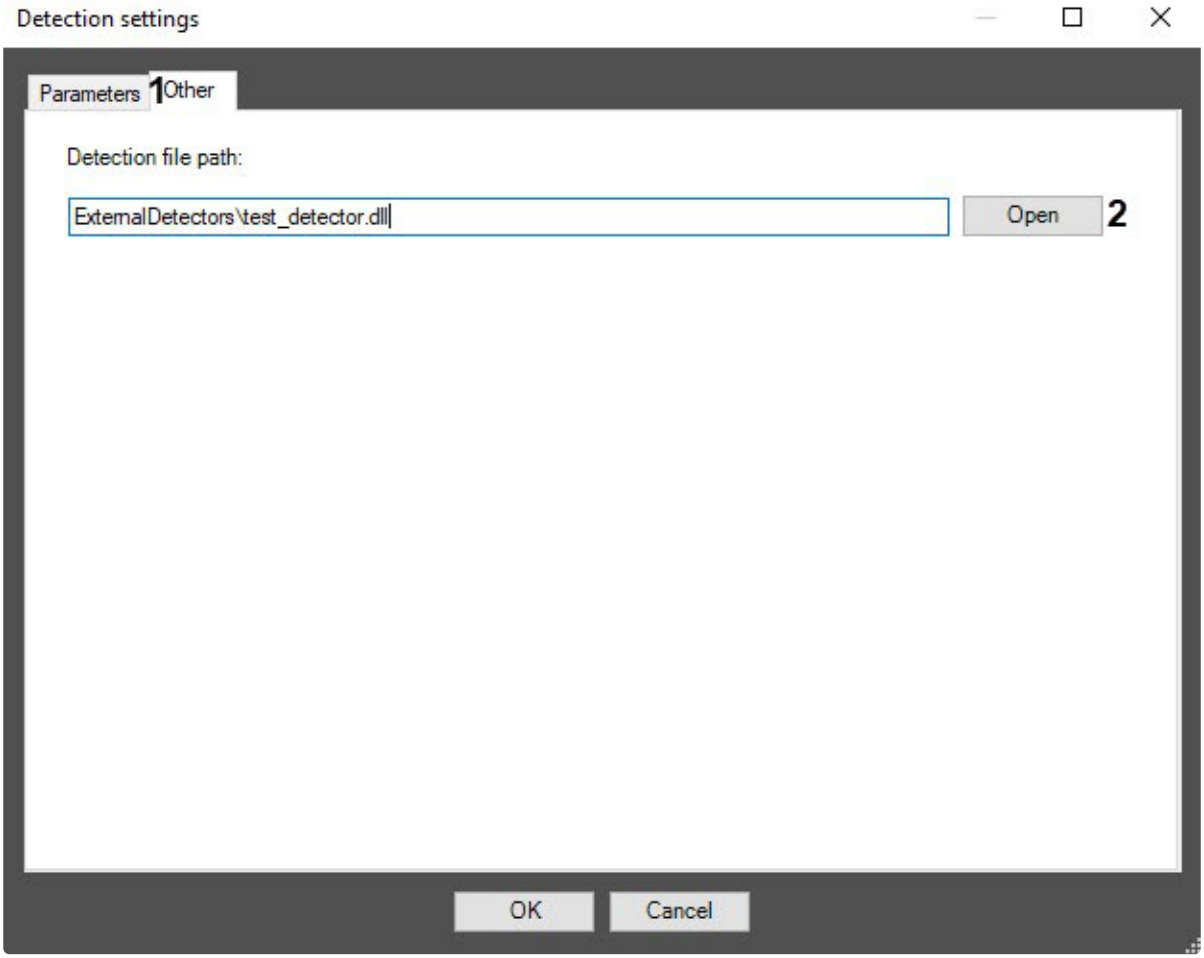
4. Click the **OK** (**4**) button to complete the detection tool configuration.

The *VideoIntellect* prohibited direction motion detection is now configured.

VideoIntellect other detection

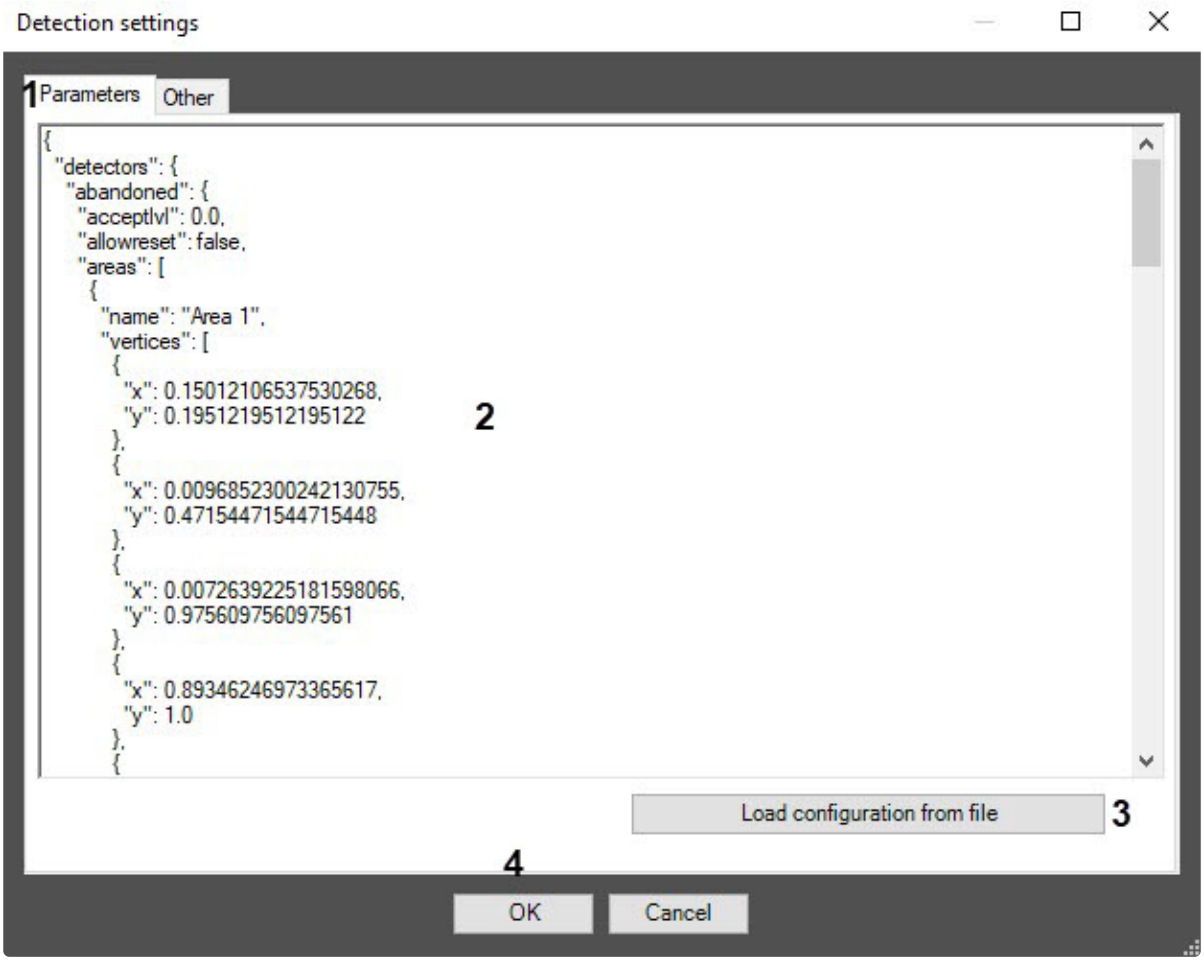
The *VideoIntellect* other detection is configured as follows:

1. On the **Other** tab (**1**), click the **Open** button (**2**) to open the .dll file of the *VideoIntellect* non-integrated detection tool.



2. On the **Parameters** tab (**1**), the area displays the current detection configuration (**2**). This configuration can be copied to any text file. To upload a configuration from a file, click the **Load configuration from**

file button (**3**).

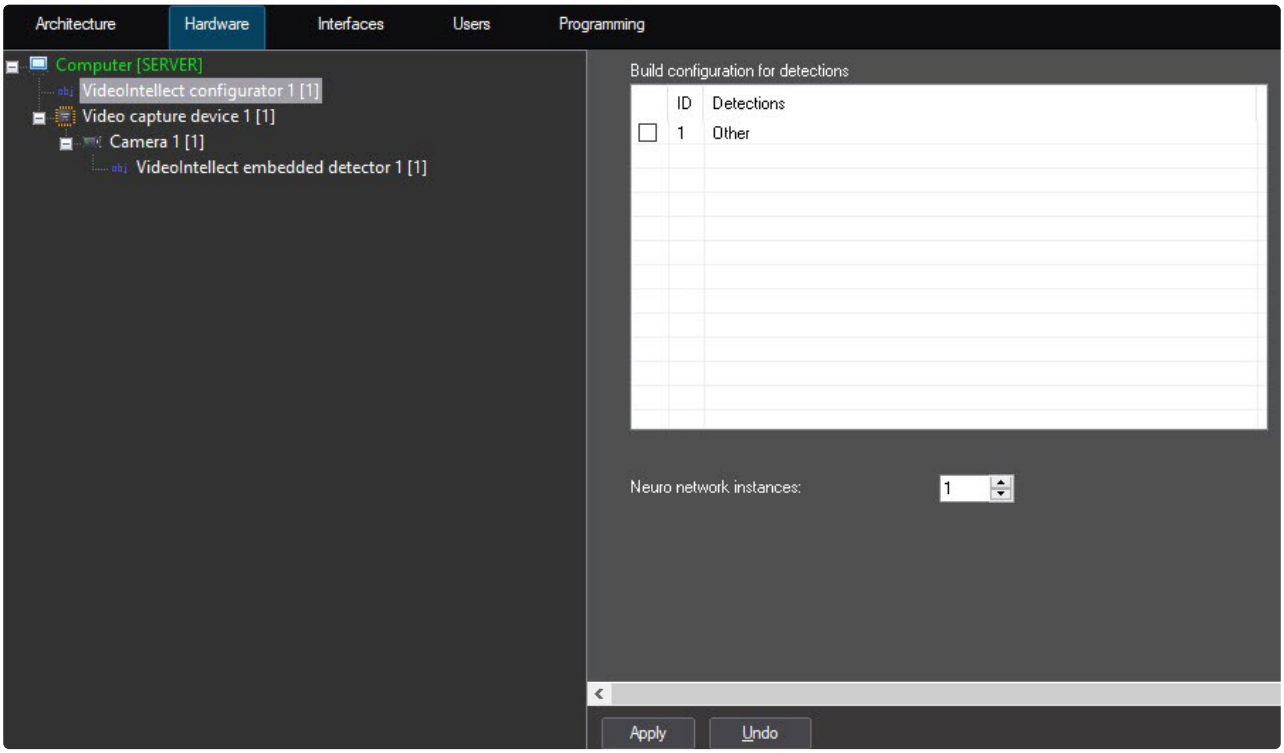


3. Click the **OK** (**4**) button to complete the detection configuration.

The *VideoIntellect* other detection is now configured.

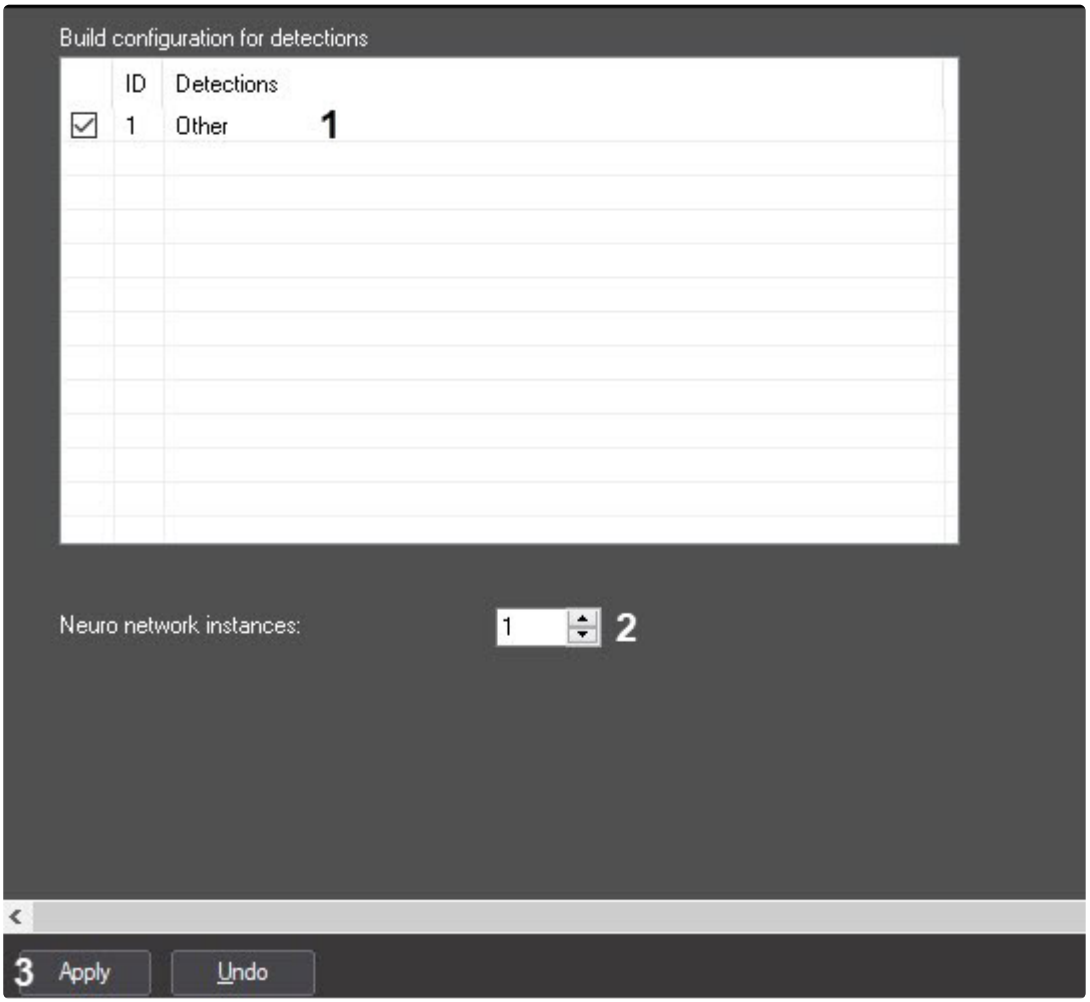
4.17.5 VideoIntellect configurator

The **VideoIntellect configurator** object is created on the basis of the **Computer** object on the **Hardware** tab of the **System settings** dialog window and is used to connect to the detections of the VideoIntellect filter. The VideoIntellect filter is a shell around filters that is a part of the VideoIntellect predictive video analytics platform. The filter works for all detections selected in the configurator.



To configure the configurator, do the following:

1. In the **Build configuration for detections** window in the area **1**, set the checkboxes next to the detections in which you want to create and set the filter. Only the pre-created detections are displayed in the list (see Configuring detection modules).



2. In the **Neuro network instances** field (**2**), specify how many instances of neural network filter should be created, in which the results of the statistical detection are processed. The recommended value is the number of physical computer cores.
3. Click the **Apply** button (**3**) to save the changes.

> **Note**
>
> If the **VideoIntellect configurator** object is not created, the detections operate without the VideoIntellect filter.

Configuring the VideoIntellect configurator is complete.

4.18 Neurocounter

4.18.1 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.

4.18.2 Video stream and scene requirements for 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, 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 Neurocounter

Attention!

Correct operation of the neural counter is not guaranteed when using a fisheye lens.

Software and hardware requirements

4.18.3 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 %

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
1280x720	Human	35	~17x70	~ 3 %

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
640x360	Human	17	~10x42	~ 3 %

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	Light vehicle (2 axles)	55	~354x300	~20%

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
1280x720	Light vehicle (2 axles)	35	~240x205	~20%

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
640x360	Light vehicle (2 axles)	17	~132x112	~20%

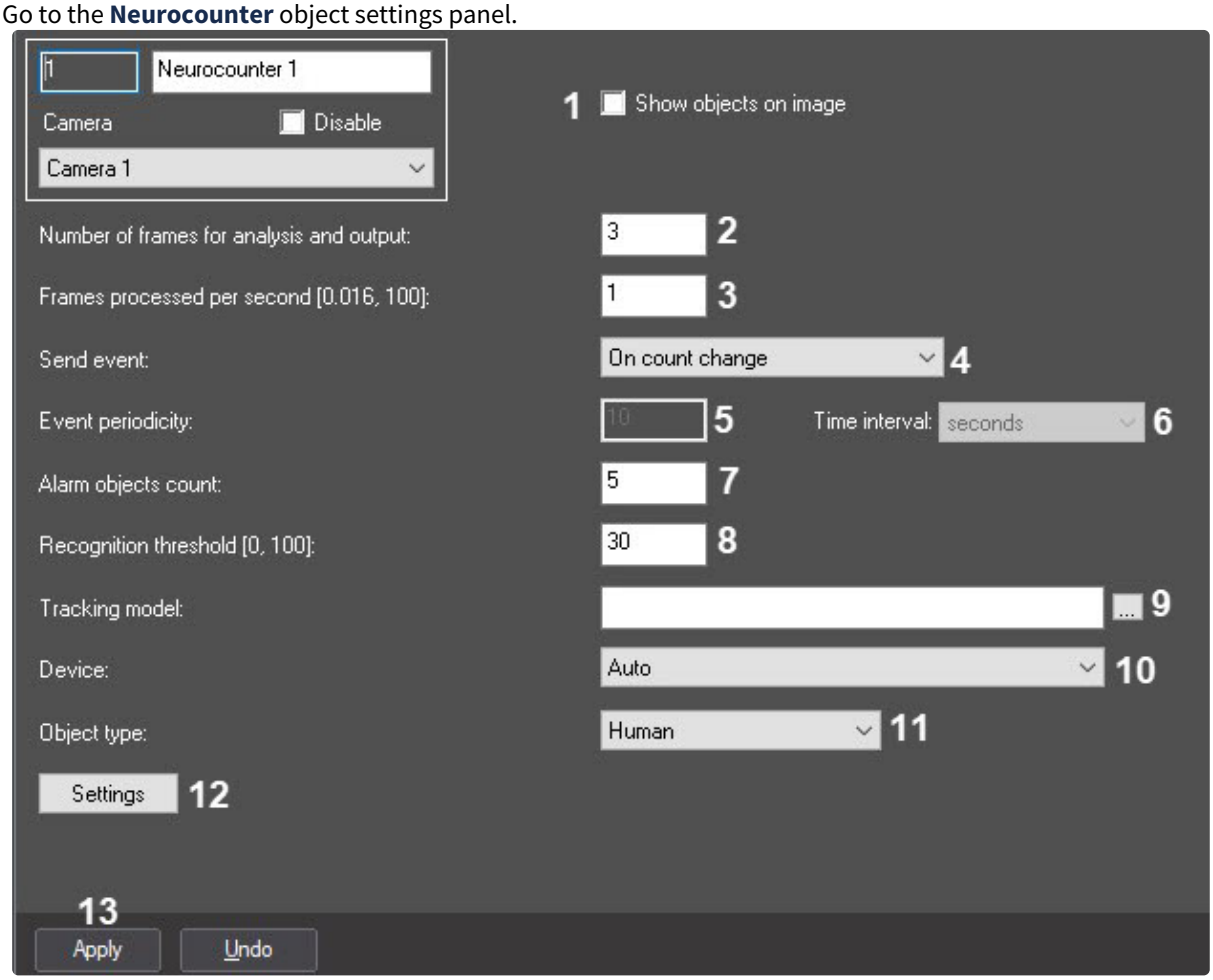
Video stream and scene requirements for Neurocounter module

4.18.4 Configuring the Neurocounter module

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

The *Neurocounter* module is configured as follows:

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



2. Set the **Show objects on image** checkbox (**1**), if it is necessary to frame the detected objects on the image in the debug window (see Start the debug window).
3. In the **Number of frames for analysis and output** field (**2**), specify the number of frames to be processed to determine the number of objects on them.
4. In the **Frames processed per second [0,016, 100]** field (**3**), set the number of frames processed per second by the detection tool.
5. From the **Send event** drop-down list (**4**), select the condition by which an event with the number of detected objects will be generated:

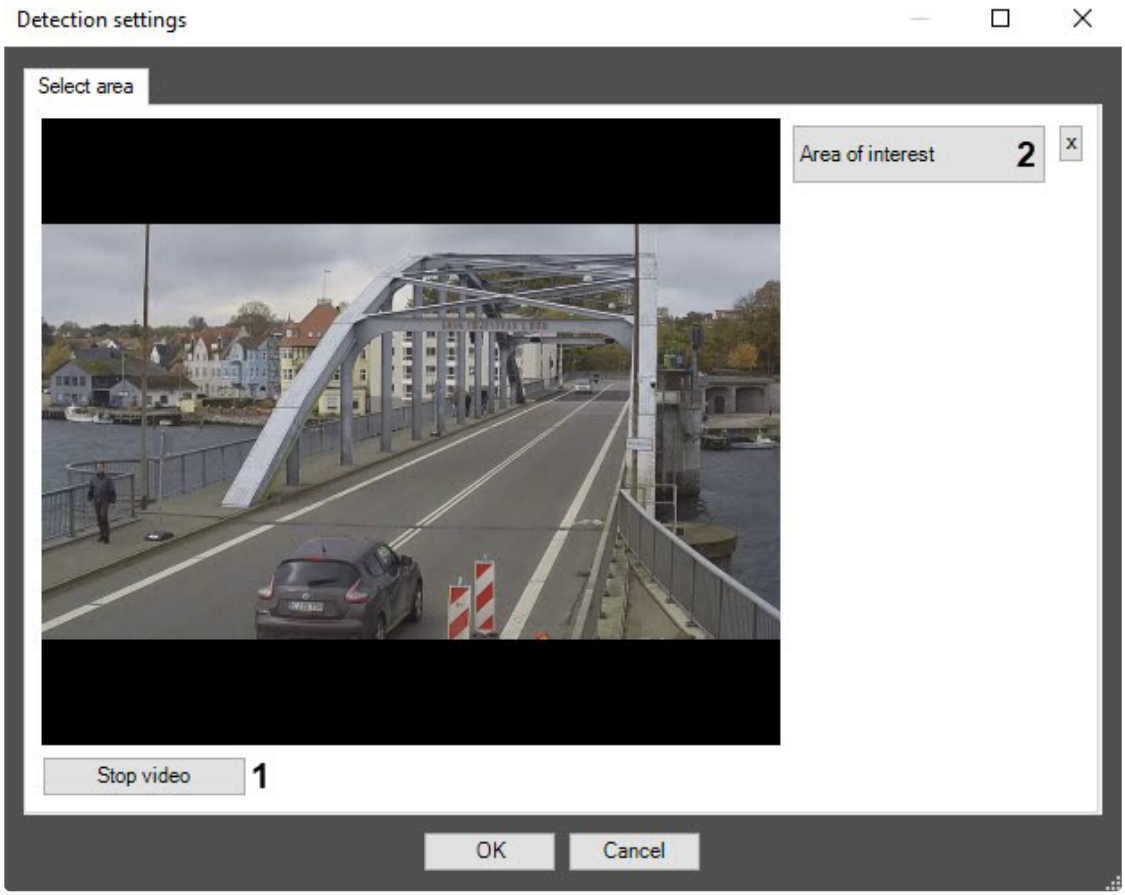
- **If threshold exceeded** is triggered if the number of detected objects in the image is greater than or equal to the value specified in the **Alarm objects count** field.
- **If threshold not reached** is triggered if the number of detected objects in the image is less than or equal to the value specified 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:
    i. In the **Event periodicity** field (**5**), set the time after which the event with the number of detected objects will be generated.
    ii. From the **Time interval** drop-down list (**6**), select the time unit of the counter period: **seconds**, **minutes**, **hours**, **days**.

6. In the **Alarm objects count** field (**7**), set 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.
7. In the **Recognition threshold [0, 100]** field (**8**), enter the neural counter sensitivity—integer value from **0** to **100**.

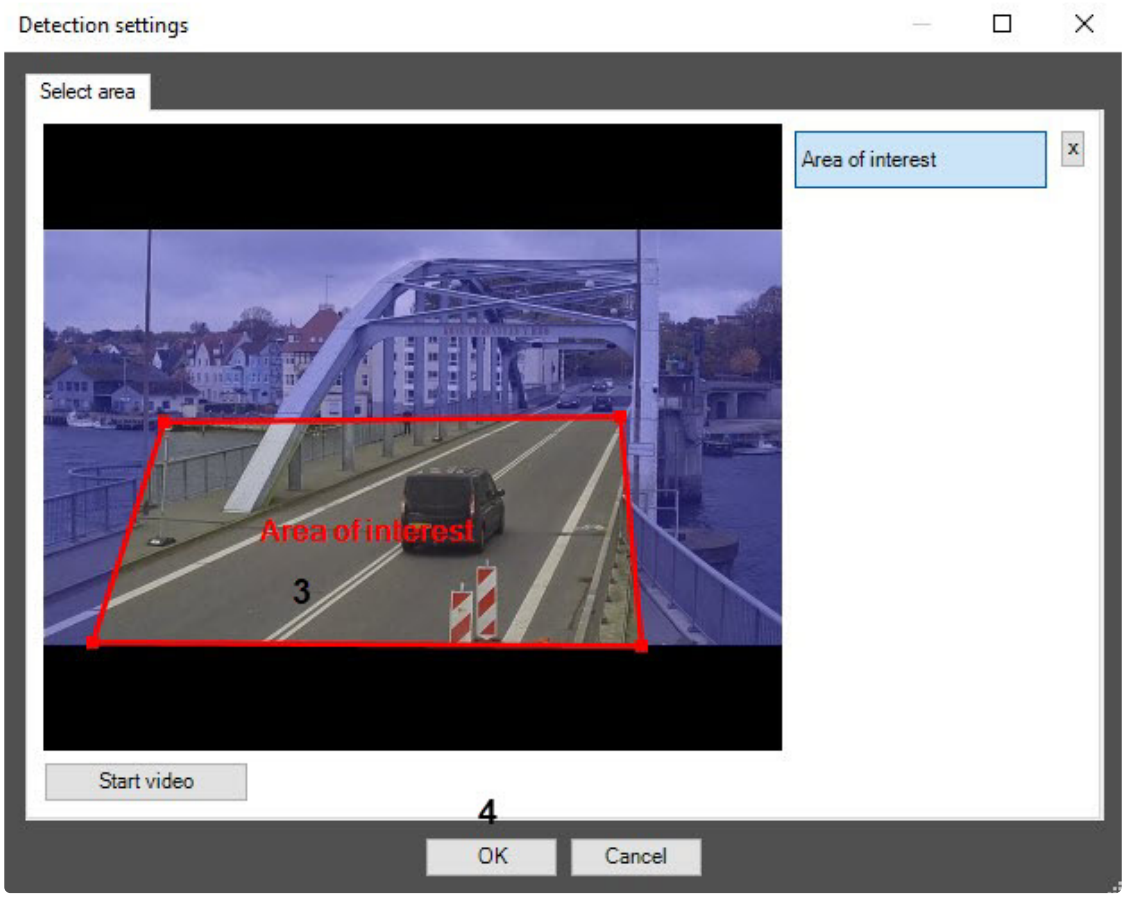
> **Note**
>
> The neural counter sensitivity is determined experimentally. The lower the sensitivity, the more false triggerings there might be. The higher the sensitivity, the fewer false triggerings there might be, however, some useful tracks might be skipped.

8. If a unique neural network is prepared for use, in the **Tracking model** field, click the  button (**9**), and select the file in the standard Windows Explorer window that opens. If the field is left blank, the default neural networks will be used for detection. They are selected automatically depending on the selected object type (**11**) and device (**10**).
9. If the path to the neural network was not specified at step 7, from the **Device** drop-down list (**10**), select the device on which the neural network will operate. **Auto**—the device is selected automatically: GPU gets the highest priority, followed by Intel GPU, then CPU.
10. From the **Object type** drop-down list (**11**), select the object type if the path to the neural network was not specified at step 7:
    - **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 sight angle.
    - **Vehicle**—the camera is directed at a vehicle at the angle of 100-160°.
11. Specify the detection surveillance area on the video image:

a. Click the **Settings** button (**12**). The **Detection settings** window will open.



b. Click the **Stop video** button (**1**) to capture the video image.
c. Click the **Area of interest** button (**2**).
d. 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 (**3**). Only one area can be added. If you try to add a second area, the first area will be deleted. After adding an area, the rest of the video image will be darkened.



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

12. Click the **Apply** button (**13**).

Configuring the *Neurocounter* module is complete.

4.18.5 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.

4.19 Equipment detection (PPE)

4.19.1 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).

4.19.2 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 is not guaranteed when using 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.

Software and hardware requirements

4.19.3 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

4.19.4 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

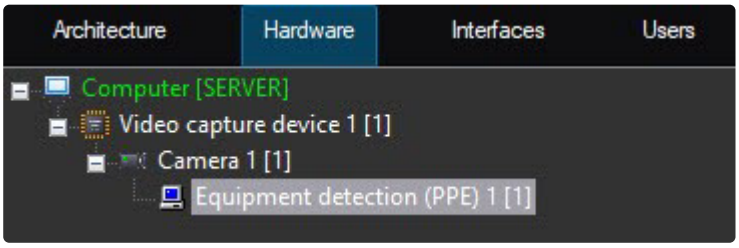
Gloves #3

Gloves #4


Helmet #1:
Helmet #2:
Helmet #3:
Helmet #4:
Helmet #5 (#4 screen:)
Helmet #6 (#4 earmuffs):
UpperBody+Shoes
Helmets
Gloves

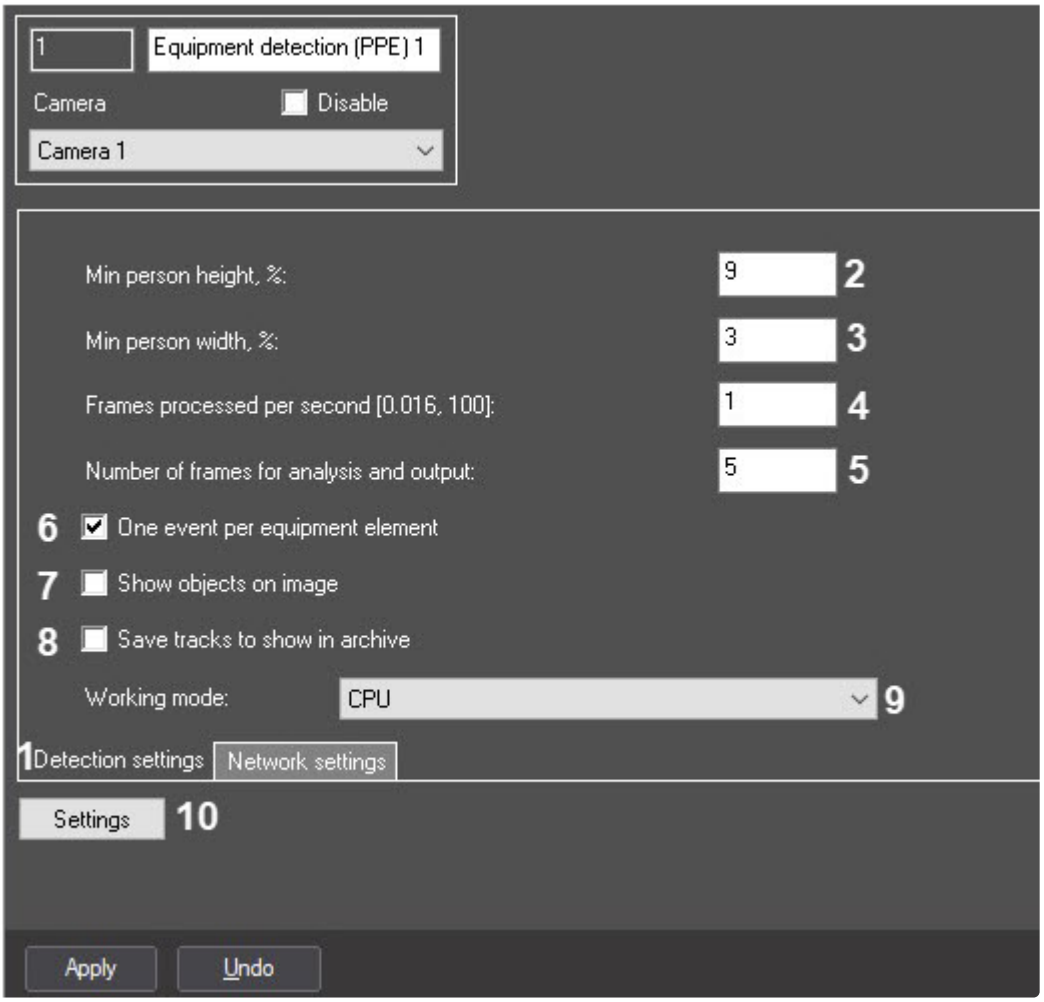
4.19.5 Configuring the Equipment detection (PPE) module

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.



The *Equipment detection (PPE)* module is configured as follows:

1. Go to the **Detection settings** tab (**1**) of the **Equipment detection (PPE)** object settings panel.



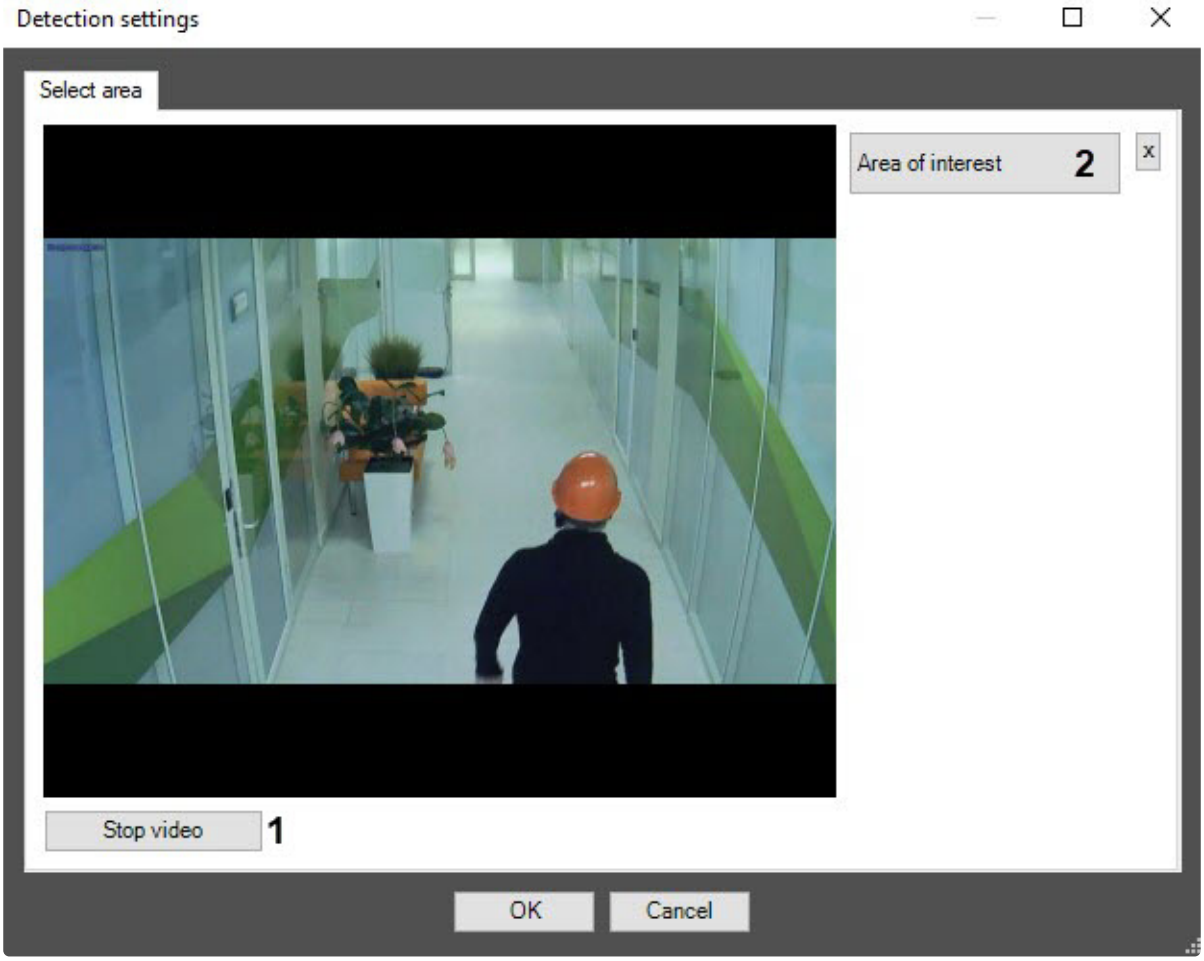
2. In the **Min person height, %** (**2**) and **Min person width, %** (**3**) fields, enter the minimum height and width of a person in the frame as a percentage of the frame height/width. Objects smaller than the specified size will not be detected.
3. In the **Frames processed per second [0,016, 100]** field (**4**), set the number of frames per second that will be processed by the detection tool.
4. In the **Number of frames for analysis and output** field (**5**), enter the minimum number of frames on which a violation should be detected in order to generate a trigger. The value should be in the [2; 20] range.
5. By default, the detection triggering is generated for each equipment violation. If it is necessary to generate a trigger once for each equipment item violation within a whole person's track, then clear the **One event per equipment element** checkbox (**6**).

> **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.

6. Set the **Show objects on image** checkbox (**7**) if it is necessary to highlight the detected object with a frame on the image in the **Monitor** interface object window.
7. Set the **Save tracks to show in archive** checkbox (**8**) to save the track in the archive.

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

8. From the **Working mode** drop-down list (**9**), select the device on which the neural network will operate.
9. Click the **Settings** button (**10**). The **Detector settings** window will open.

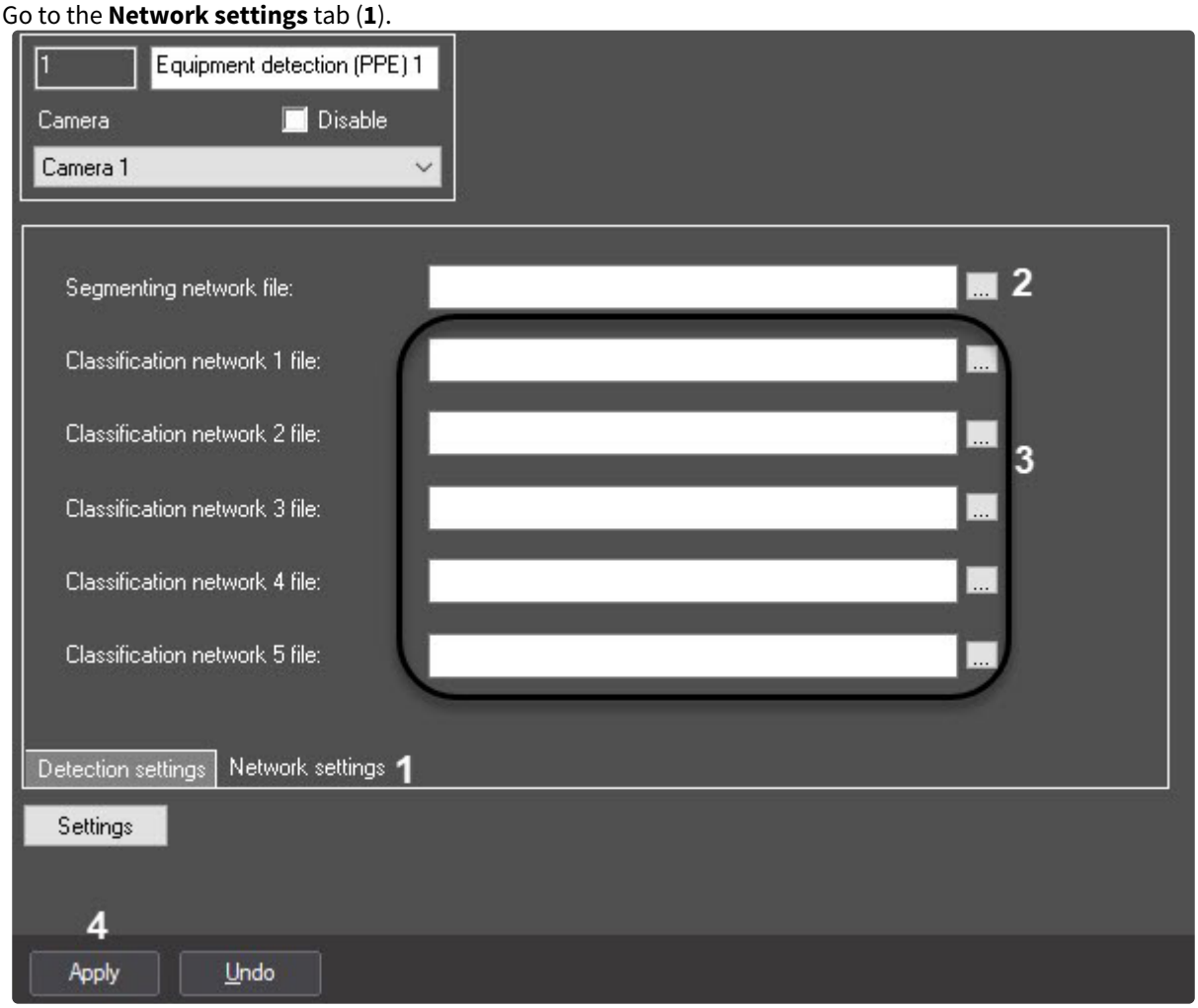


   a. Click the **Stop video** button (**1**) to capture a frame of the video image.
   b. Click the **Area of interest** button (**2**).

c. 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 (**3**).

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

10. Go to the **Network settings** tab (**1**).



11. Select the segmenting neural network file (**2**).
12. Select one or several files of the classification neural network (**3**). Each classification neural network detects equipment on a specific body segment.
13. Click the **Apply** button (**4**) to save the changes.

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

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

4.19.6 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

4.20 Traffic light detection

4.20.1 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.

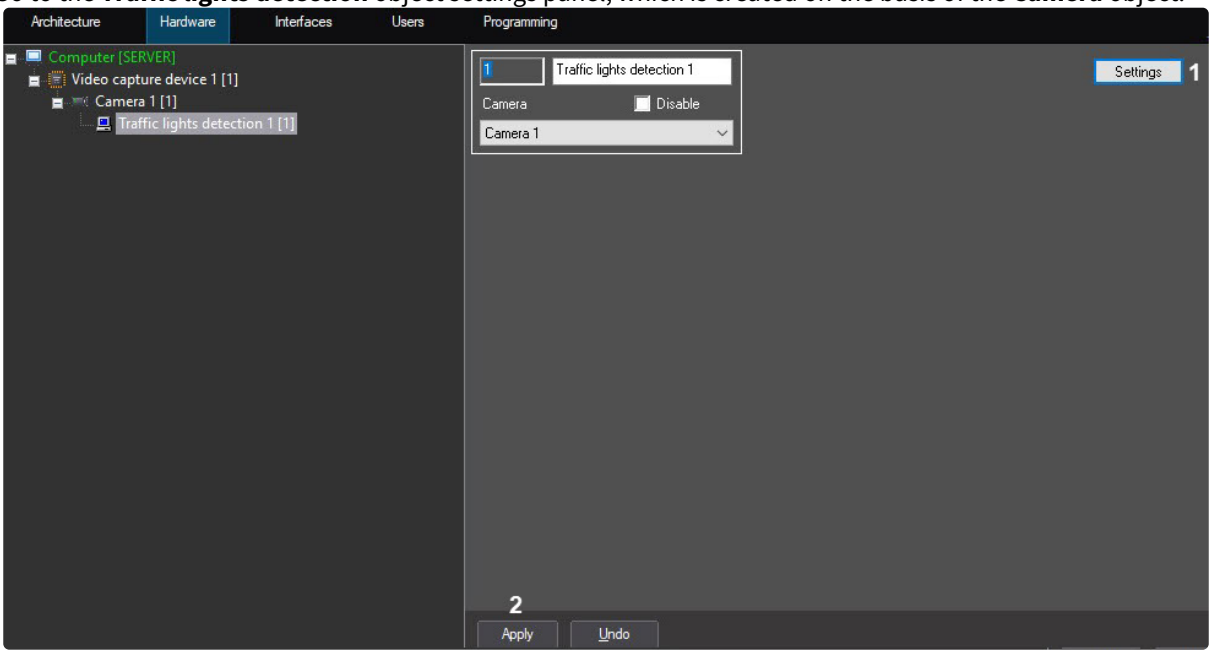
> **Note.**
>
> The *Traffic light detection* module is used in the *Traffic violations detection* software module, which is part of *Auto PSIM* (see Traffic violations detection).

4.20.2 Configuring the Traffic light detection module

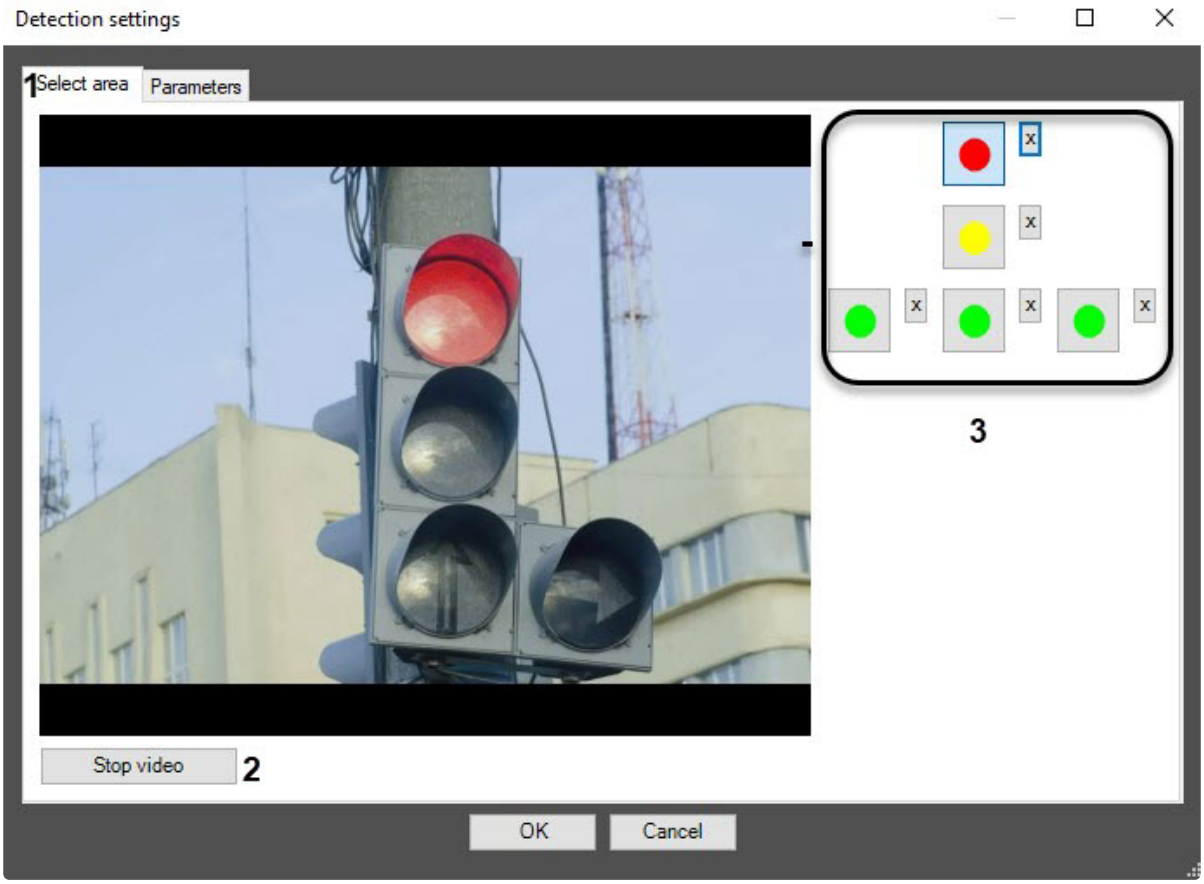
> **Attention!**
>
> For the correct operation of the *Traffic lights detection* module, a traffic light must be always visible to camera and must not be blocked by any objects or other vehicles.

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.

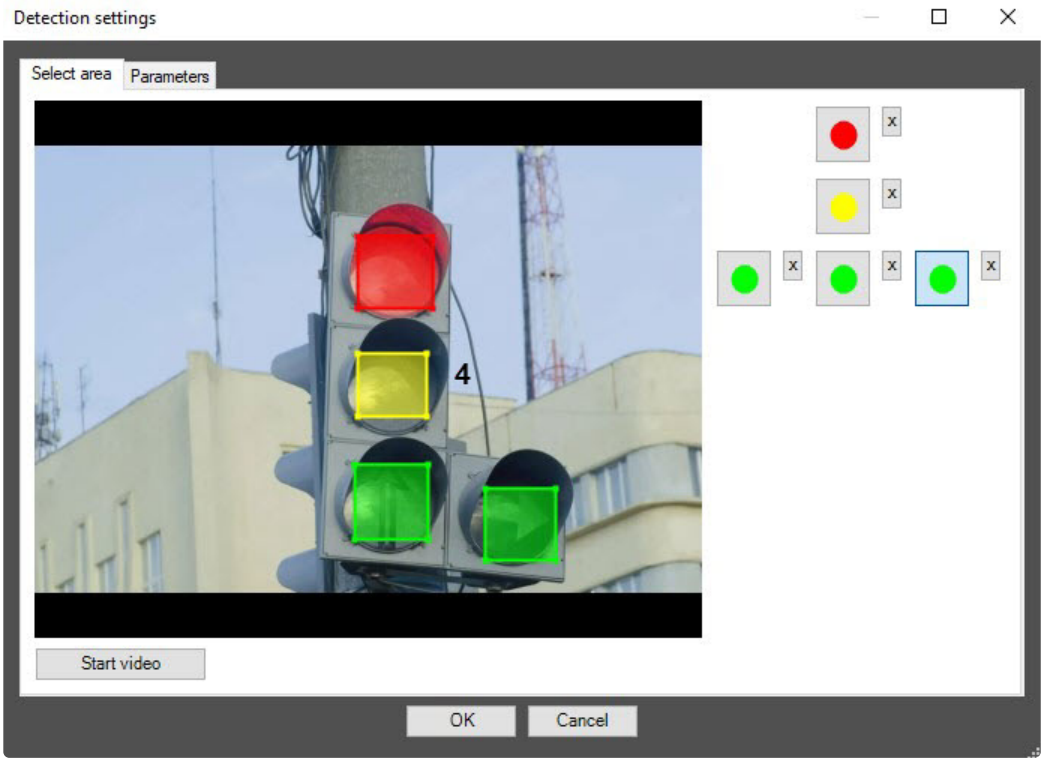


2. Click the **Settings** button (**1**). The **Detection settings** window will open.



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**).

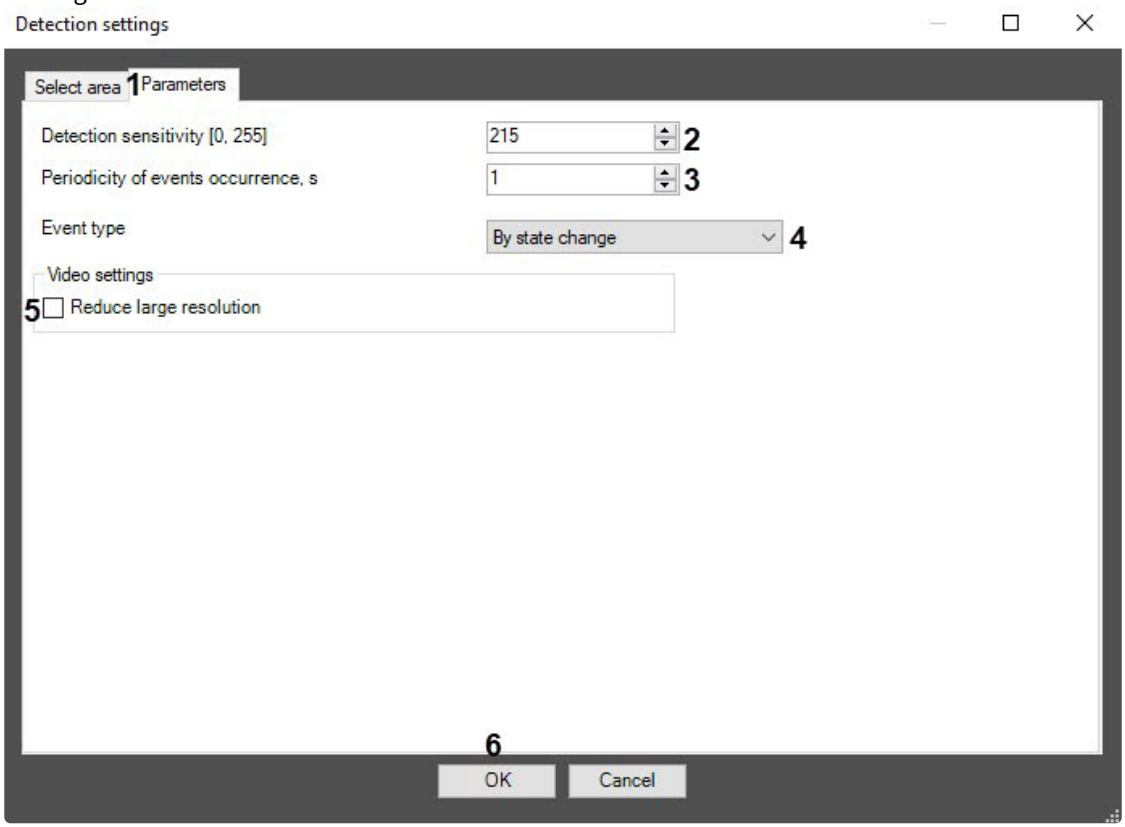
b. Do the following actions for each traffic light signal:
   - click the button with this signal (**3**);
   - specify the area of this signal on the captured video frame (**4**). Click the left mouse button on the video frame and move the cursor holding it.



> **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.

4.21 Crowd detection (TVN)

4.21.1 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 **Event Viewer**.

4.21.2 Camera requirements for the Crowd detection (TVN) module

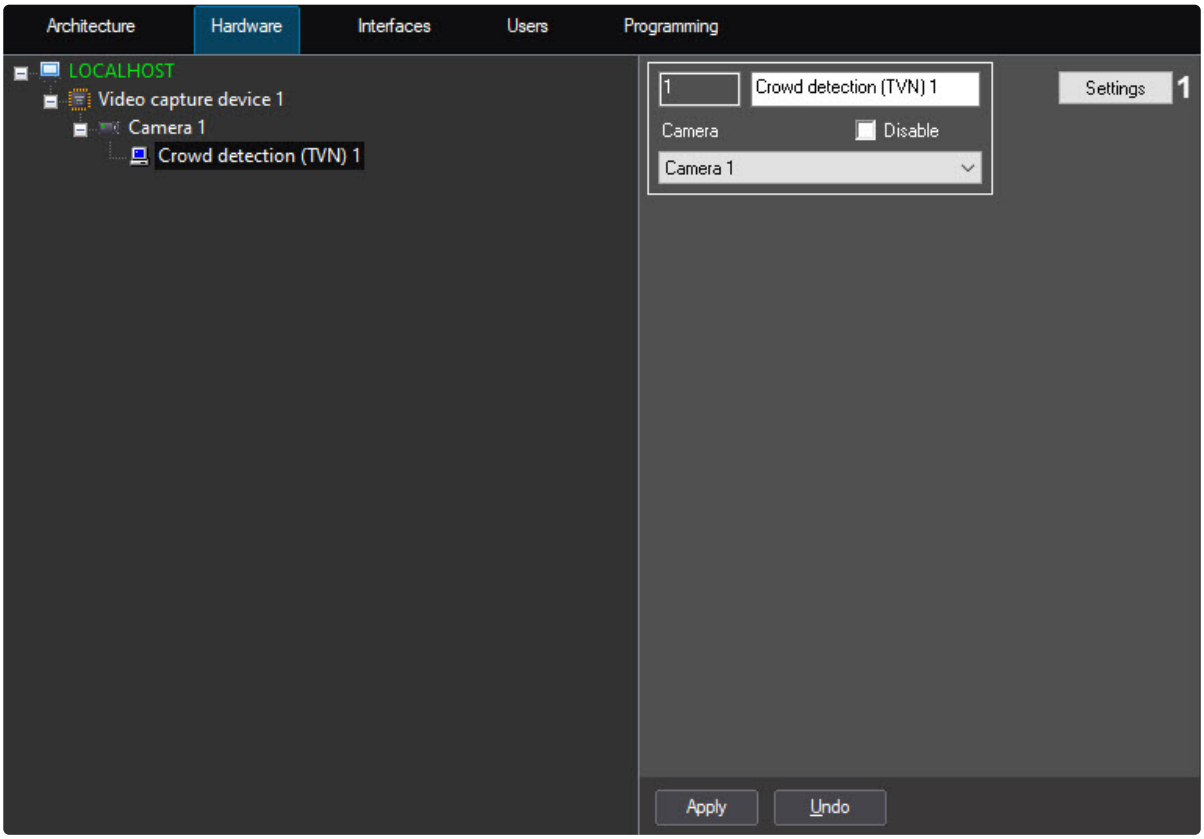
Camera requirements for the **Crowd detection (TVN)** module are given in the table.

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

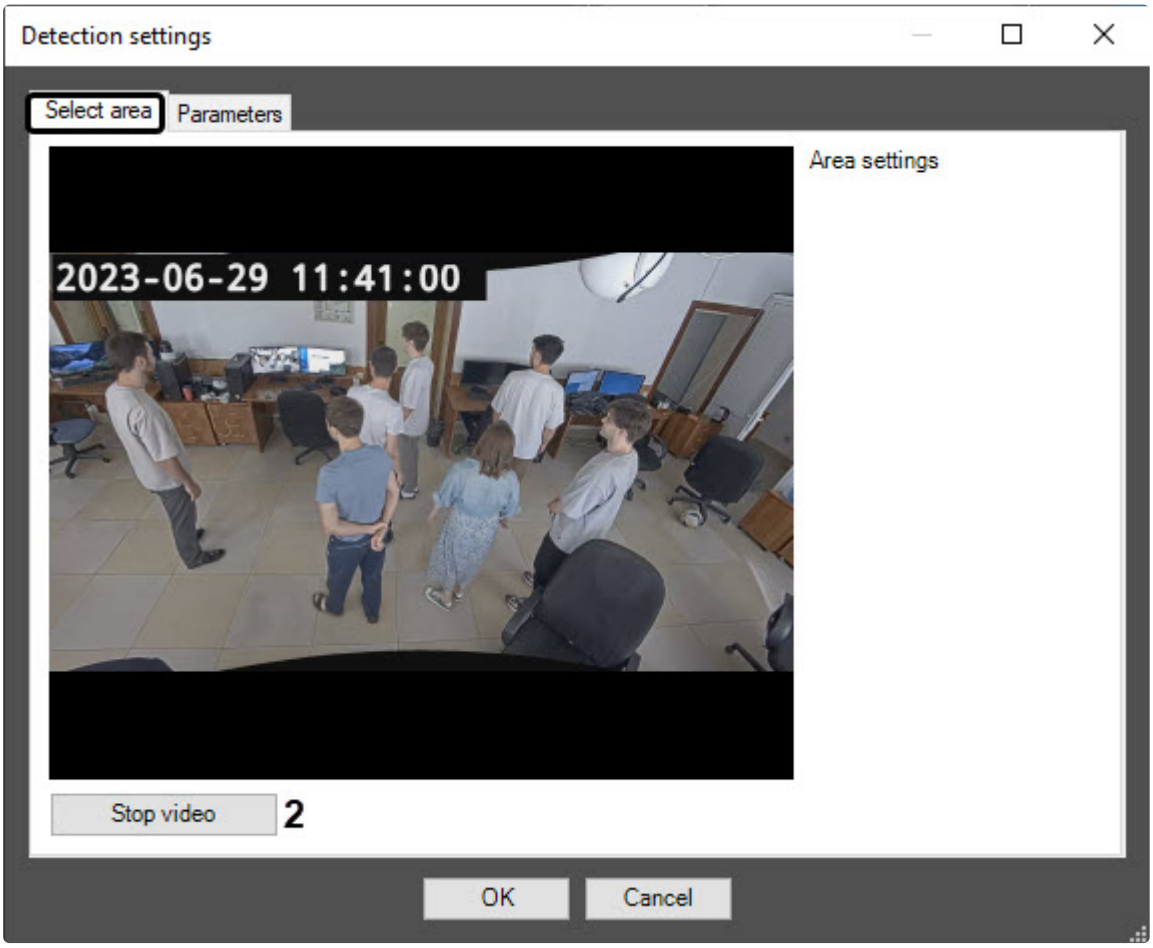
4.21.3 Configuring the Crowd detection (TVN) module

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

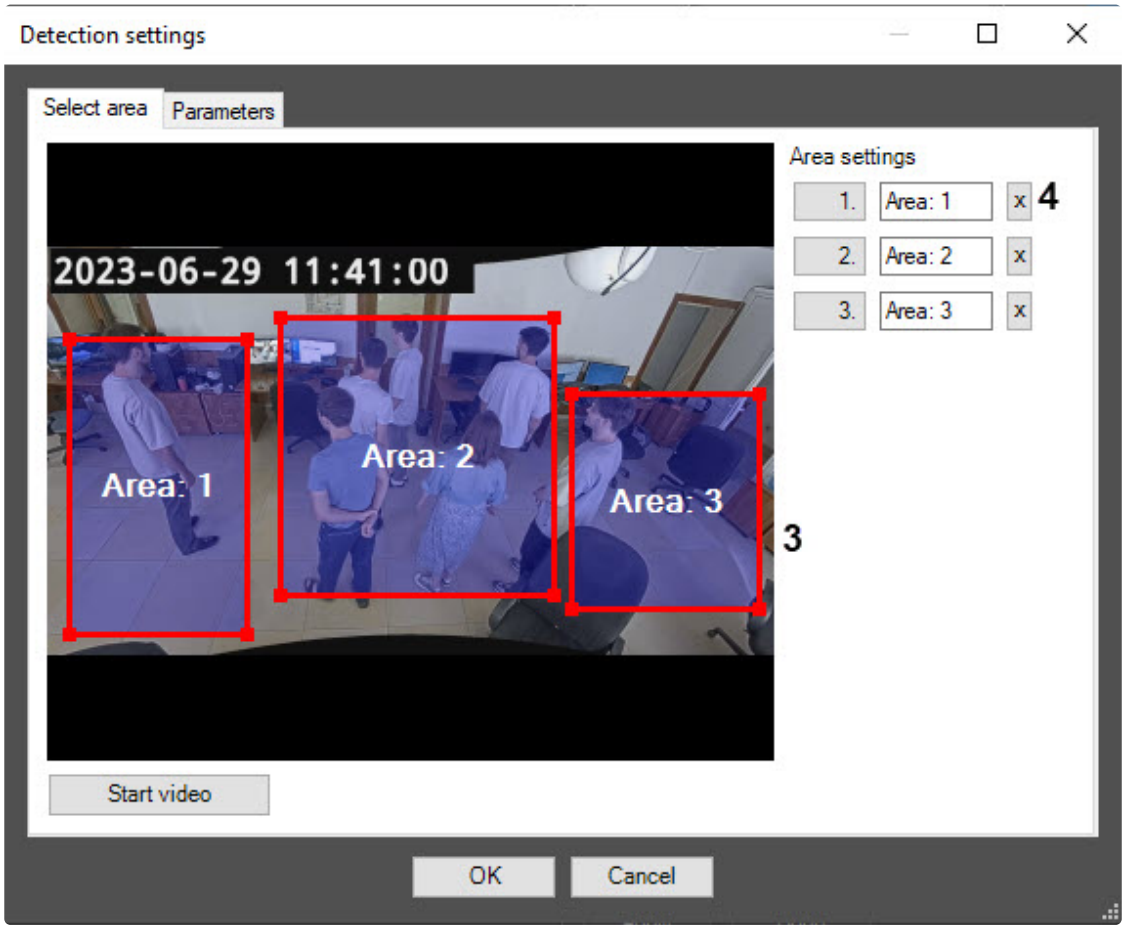
1. Go to the settings panel of the **Crowd detection (TVN)** object that is created on the basis of the **Camera** object on the **Hardware** tab of the **System settings** dialog window.



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



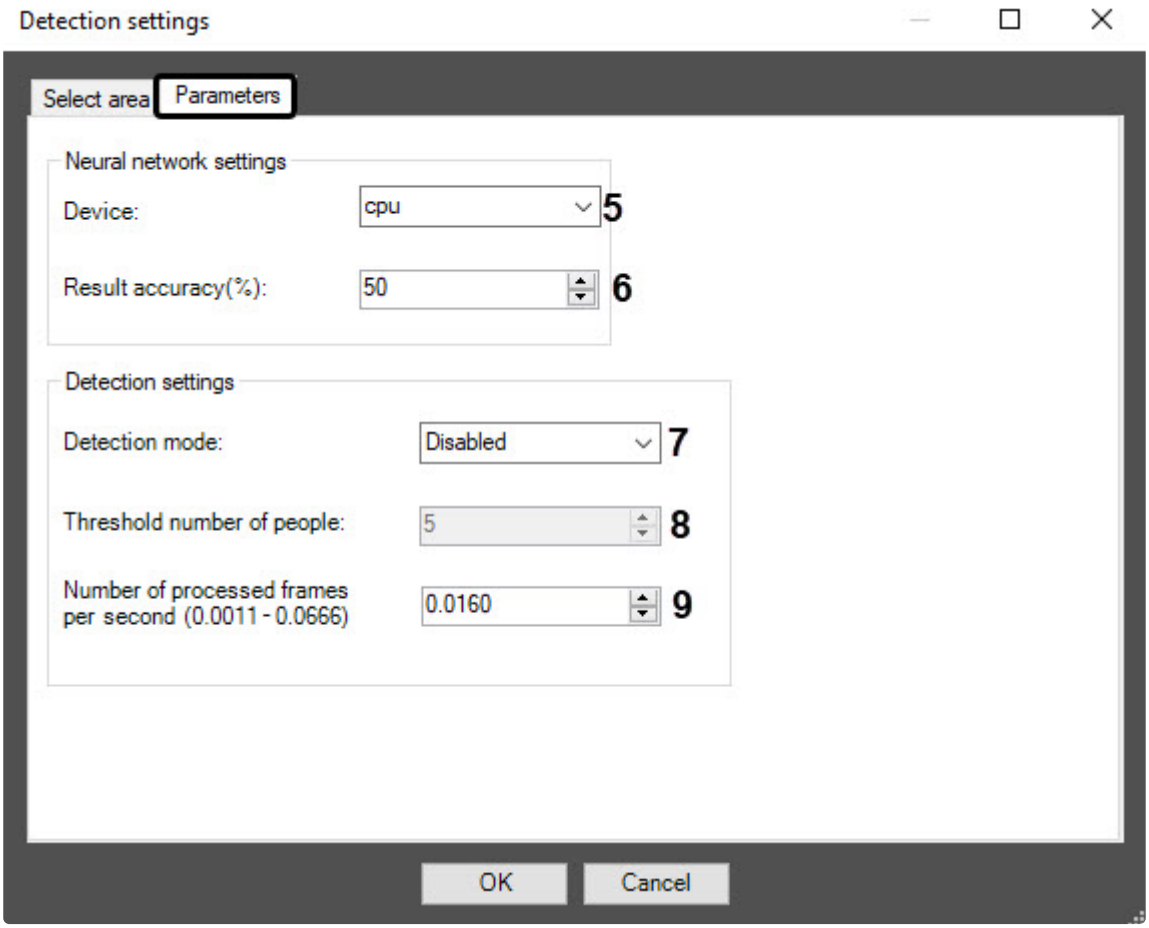
3. In the **Detection settings** window on the **Select area** tab, specify the surveillance area. For this, do the following:
    a. Click the **Stop video** button to capture a frame of the video image (**2**).
    b. On the captured frame (**3**), left-click to specify the areas, the situation in 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.

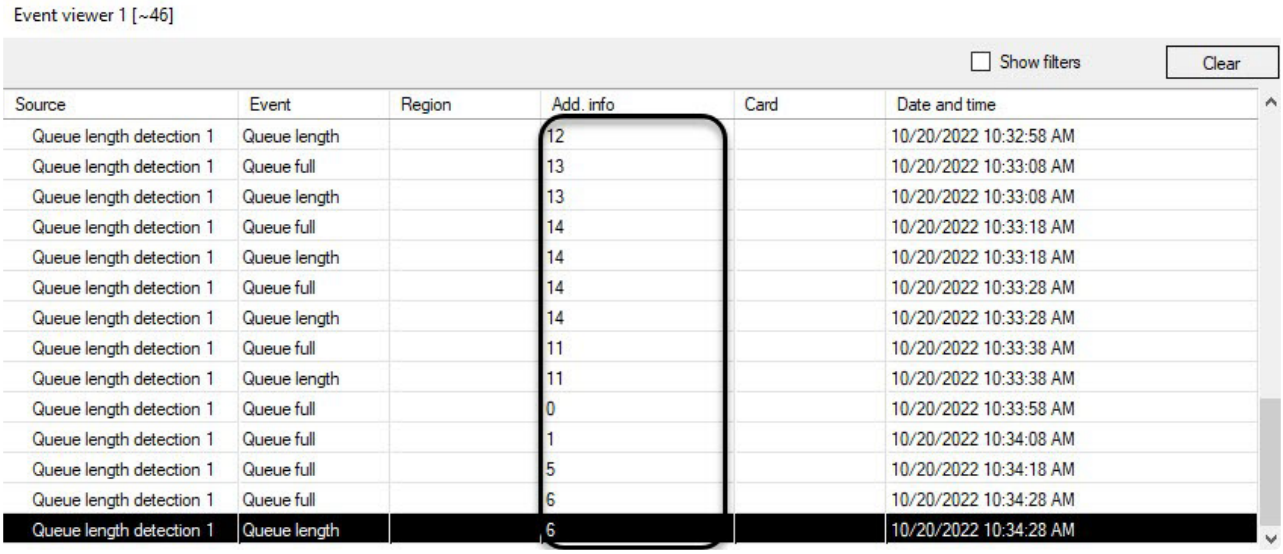
5 Operating detection modules

> **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.

5.1 Operating the Queue length detection module

5.1.1 Obtaining traffic information in the area of interest

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



Source	Event	Region	Add. info	Card	Date and time
Queue length detection 1	Queue length		12		10/20/2022 10:32:58 AM
Queue length detection 1	Queue full		13		10/20/2022 10:33:08 AM
Queue length detection 1	Queue length		13		10/20/2022 10:33:08 AM
Queue length detection 1	Queue full		14		10/20/2022 10:33:18 AM
Queue length detection 1	Queue length		14		10/20/2022 10:33:18 AM
Queue length detection 1	Queue full		14		10/20/2022 10:33:28 AM
Queue length detection 1	Queue length		14		10/20/2022 10:33:28 AM
Queue length detection 1	Queue full		11		10/20/2022 10:33:38 AM
Queue length detection 1	Queue length		11		10/20/2022 10:33:38 AM
Queue length detection 1	Queue full		0		10/20/2022 10:33:58 AM
Queue length detection 1	Queue full		1		10/20/2022 10:34:08 AM
Queue length detection 1	Queue full		5		10/20/2022 10:34:18 AM
Queue length detection 1	Queue full		6		10/20/2022 10:34:28 AM
Queue length detection 1	Queue length		6		10/20/2022 10:34:28 AM

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

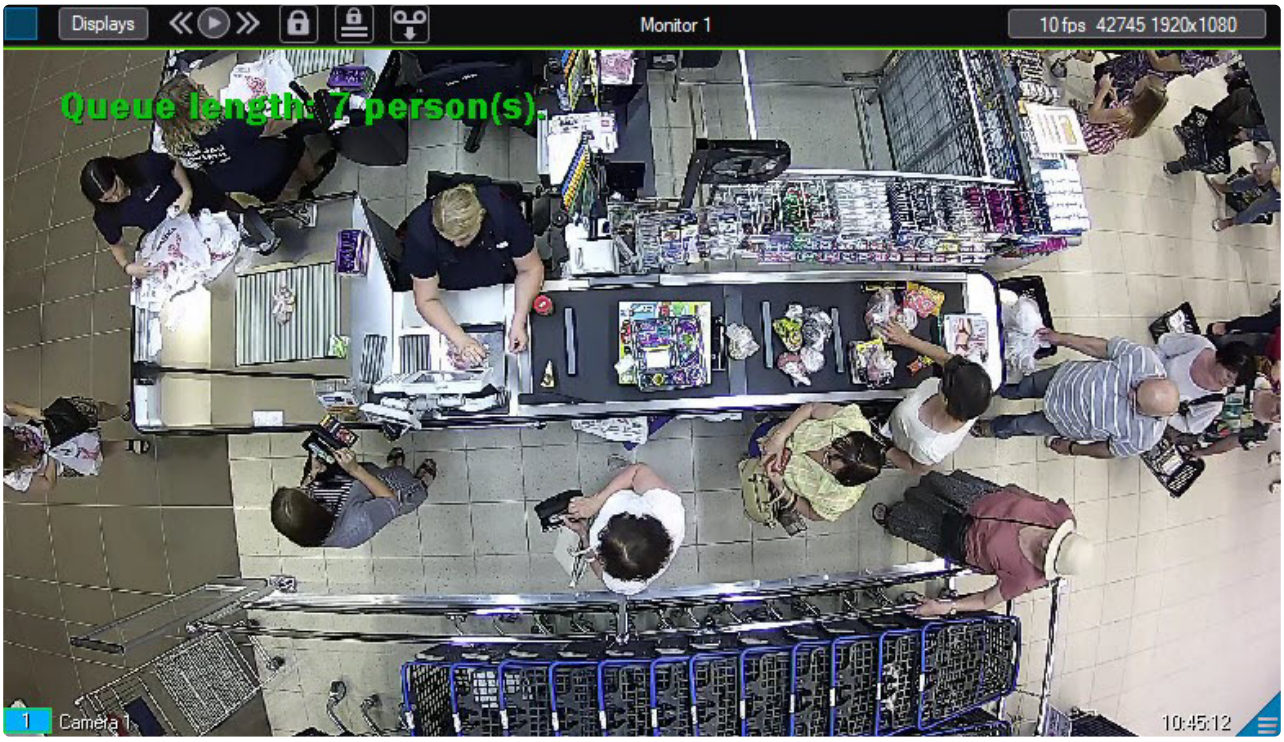
5.1.2 Generating a report on the traffic in the area of interest

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.

5.1.3 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 Script document.



5.2 Operating the People counter detection module

5.2.1 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.

Event viewer 1 [~697]

Show filters | Clear

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.

5.2.2 Generating a visitor report

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

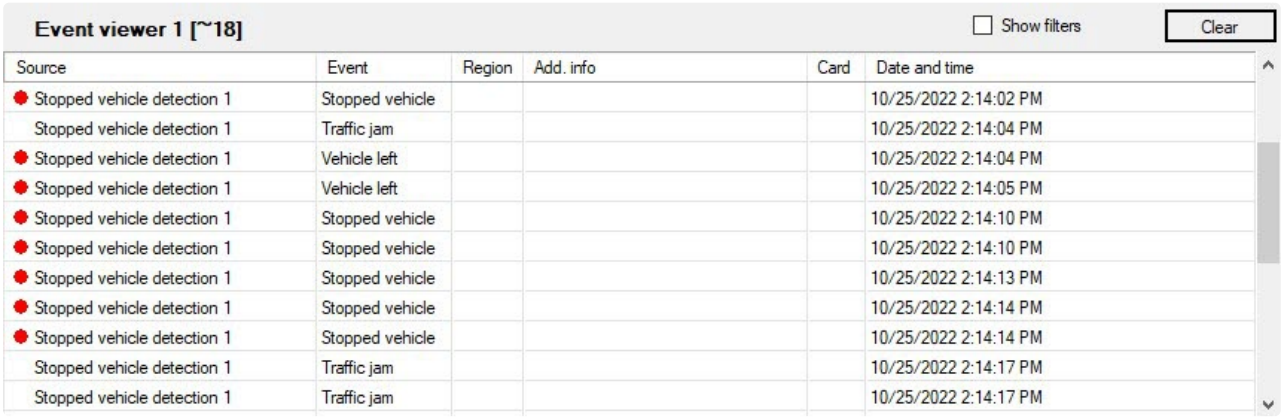
All necessary information is provided in the WEB Report System PSIM. User Guide.

5.2.3 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 Script document.

5.3 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.

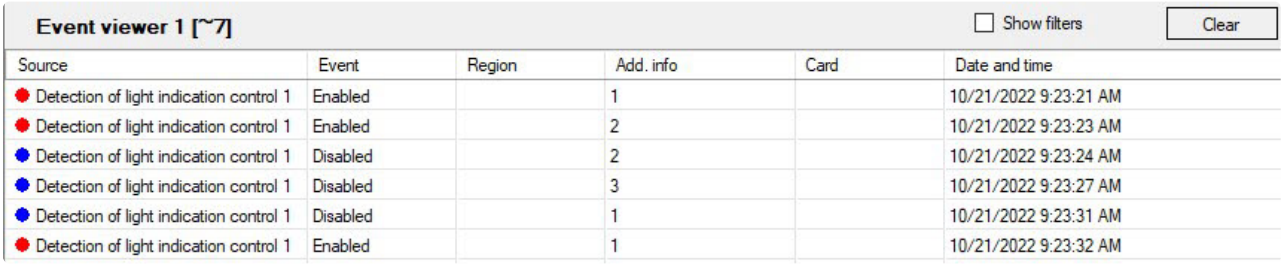
If a stopped car is detected in the surveillance area, it is logged as a **Stopped car** event.

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.

5.4 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.



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 **Disabled** event. The number of surveillance area from which the event received is displayed in the **Add. info** column.

5.5 Operating the Heat map detection

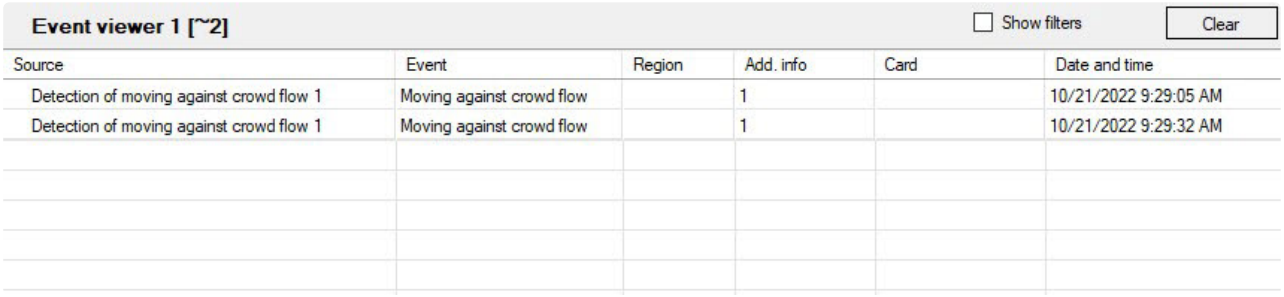
5.5.1 Generating a report on the basis of Heat map detection

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

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

5.6 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.

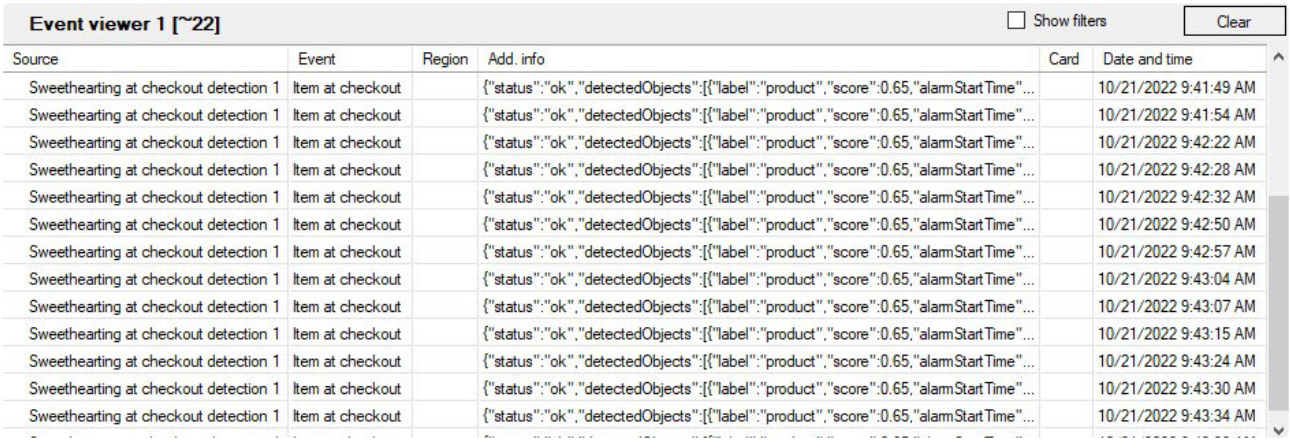


Note.

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

5.7 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.



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).

5.7.1 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).

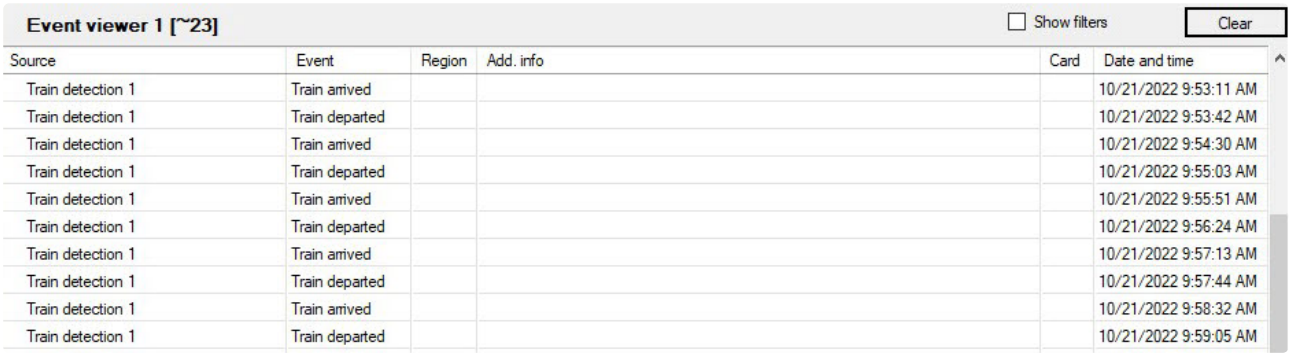
5.8 Operating the Barcode detection module

In case of recognizing barcode or QR-code in the area of interest the result of the *Barcode detection* operation will be displayed in the **Monitor** interface objects using the **Captioner** object.

Search by detected barcodes is performed using the **Search by captions** interface object.

5.9 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.



Source	Event	Region	Add. info	Card	Date and time
Train detection 1	Train arrived				10/21/2022 9:53:11 AM
Train detection 1	Train departed				10/21/2022 9:53:42 AM
Train detection 1	Train arrived				10/21/2022 9:54:30 AM
Train detection 1	Train departed				10/21/2022 9:55:03 AM
Train detection 1	Train arrived				10/21/2022 9:55:51 AM
Train detection 1	Train departed				10/21/2022 9:56:24 AM
Train detection 1	Train arrived				10/21/2022 9:57:13 AM
Train detection 1	Train departed				10/21/2022 9:57:44 AM
Train detection 1	Train arrived				10/21/2022 9:58:32 AM
Train detection 1	Train departed				10/21/2022 9:59:05 AM

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.

5.10 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

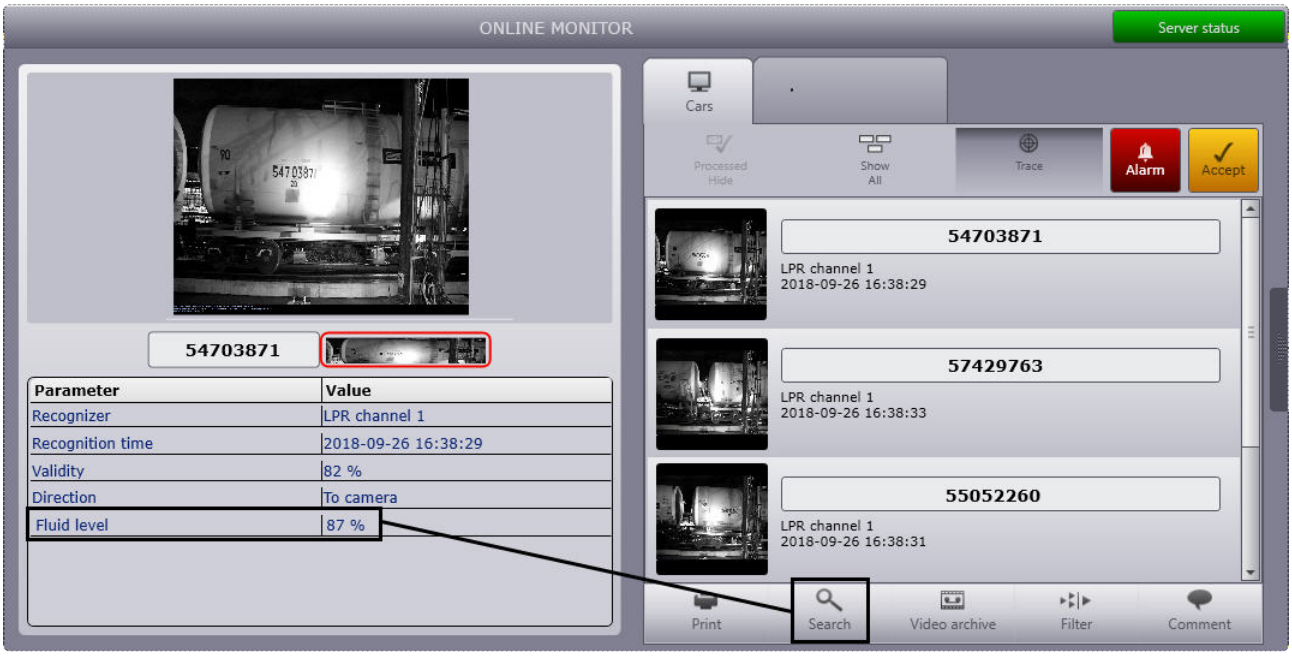
Event viewer 1 [~23]

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.

5.11 Operating the Fluid level detection module

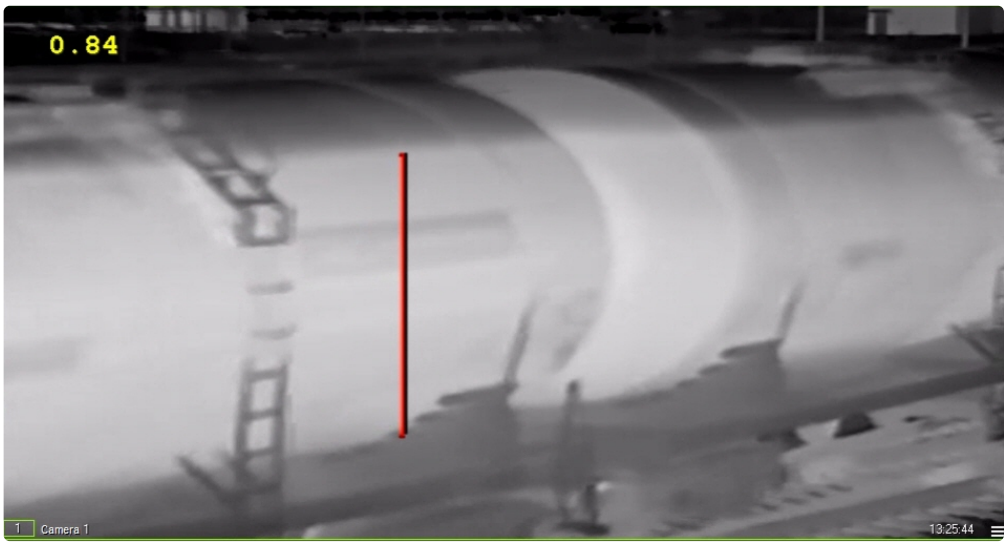
In case the **Fluid level detection** object is selected on the *IntLab* module settings panel, then the *Fluid level detection* module is operated in the **Vehicle tracer** interface window which is the part of *Auto PSIM*. For details on operation of this object, refer to the *Auto PSIM. Operator's 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
}
```

5.12 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.

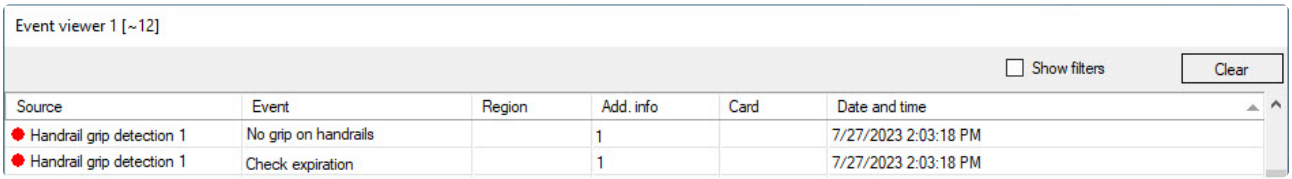
5.13 Operating the Person location tracker module

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.

5.13.1 Operating the Handrail grip detection module

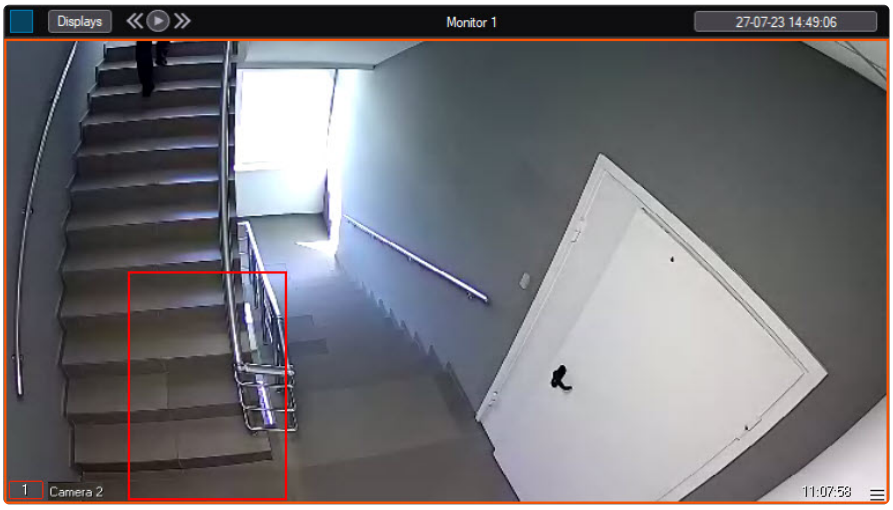
If an alarm is detected in the surveillance area, the corresponding **No grip on handrails** message from the **Handrail grip detection** object is displayed in the **Event viewer** interface window. When the alarm in the surveillance area stops, the **Check expiration** event is displayed. See also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



For the detailed information on working with the **Event viewer** interface window, see Operator's Guide. The current version of this document is available in the AxxonSoft documentation repository.

If you set the **Display event on screen** checkbox (see Configuring the Handrail grip detection), an alarm frame will be displayed on the screen when the detection tool is triggered.

Example of displaying the **No grip on handrails** event on the screen:



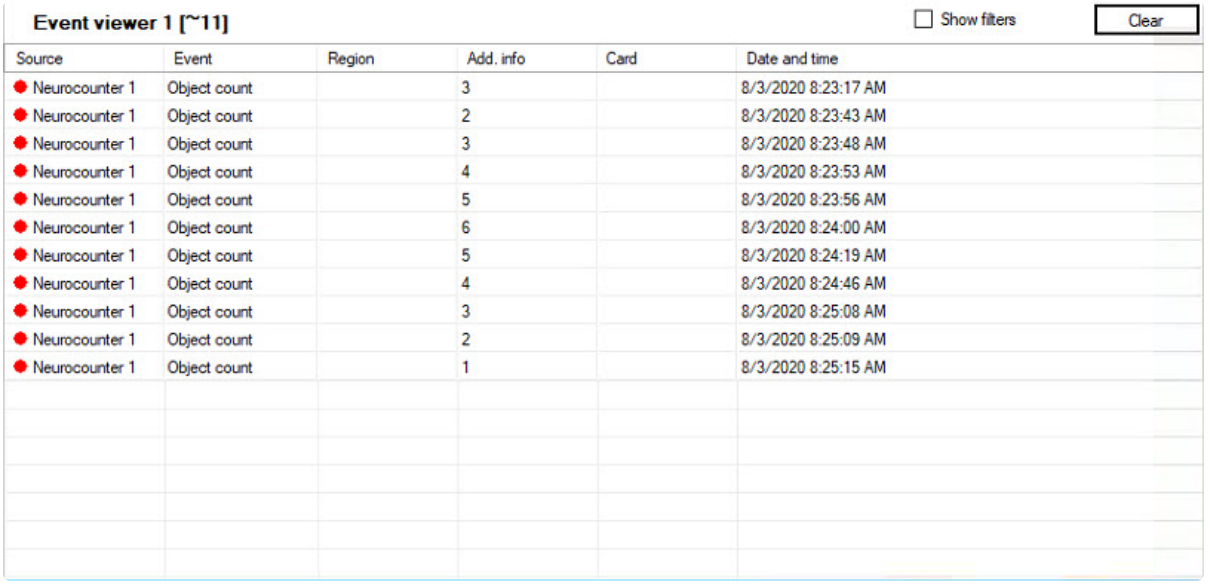
5.14 Operating the VideoIntellect embedded detector

In case the alarm event is detected in the surveillance area, the corresponding *VideoIntellect* detection tool sends the message from the object to the **Event viewer** interface window. For details, see Configuring the VideoIntellect embedded detector module.

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.

5.15 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.

5.16 Operating the Equipment detection (PPE)

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

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.

5.17 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.

6 Appendix 1. Debug window

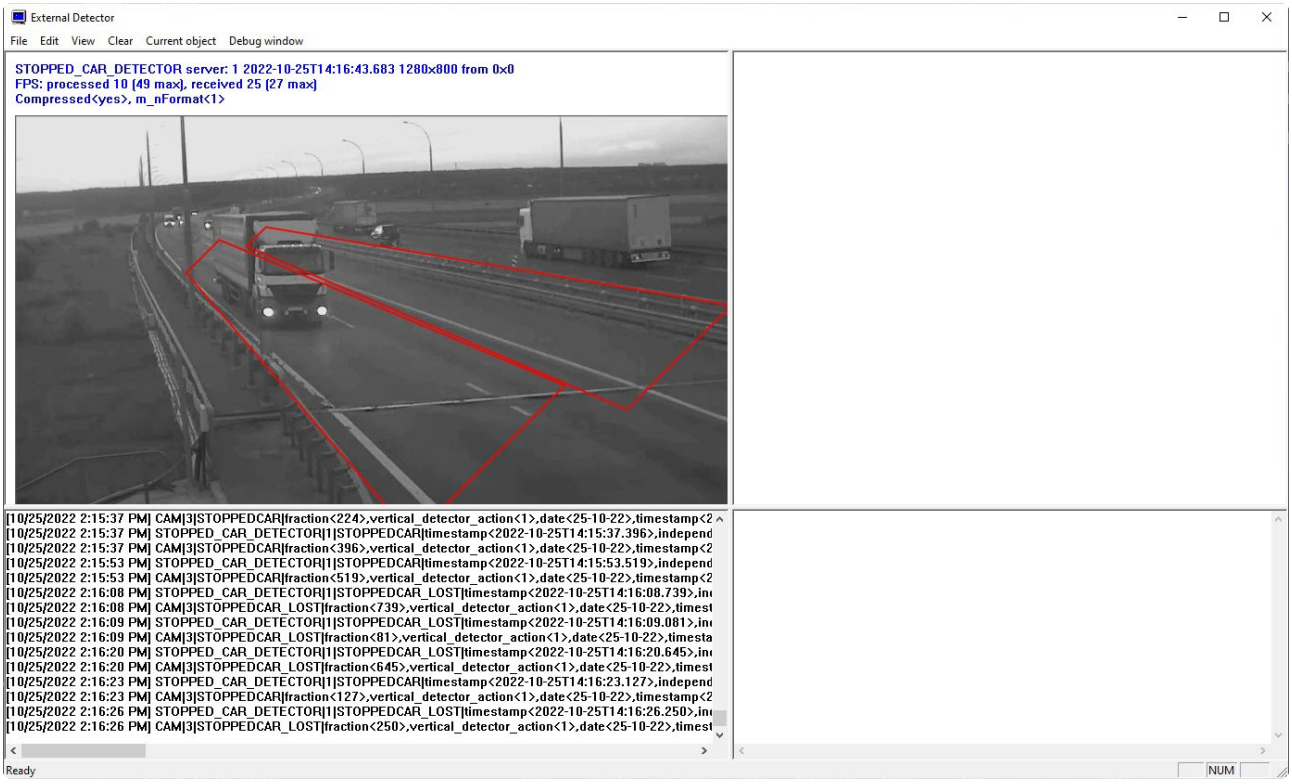
6.1 General information about Debug window

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.

6.2 Start the debug window

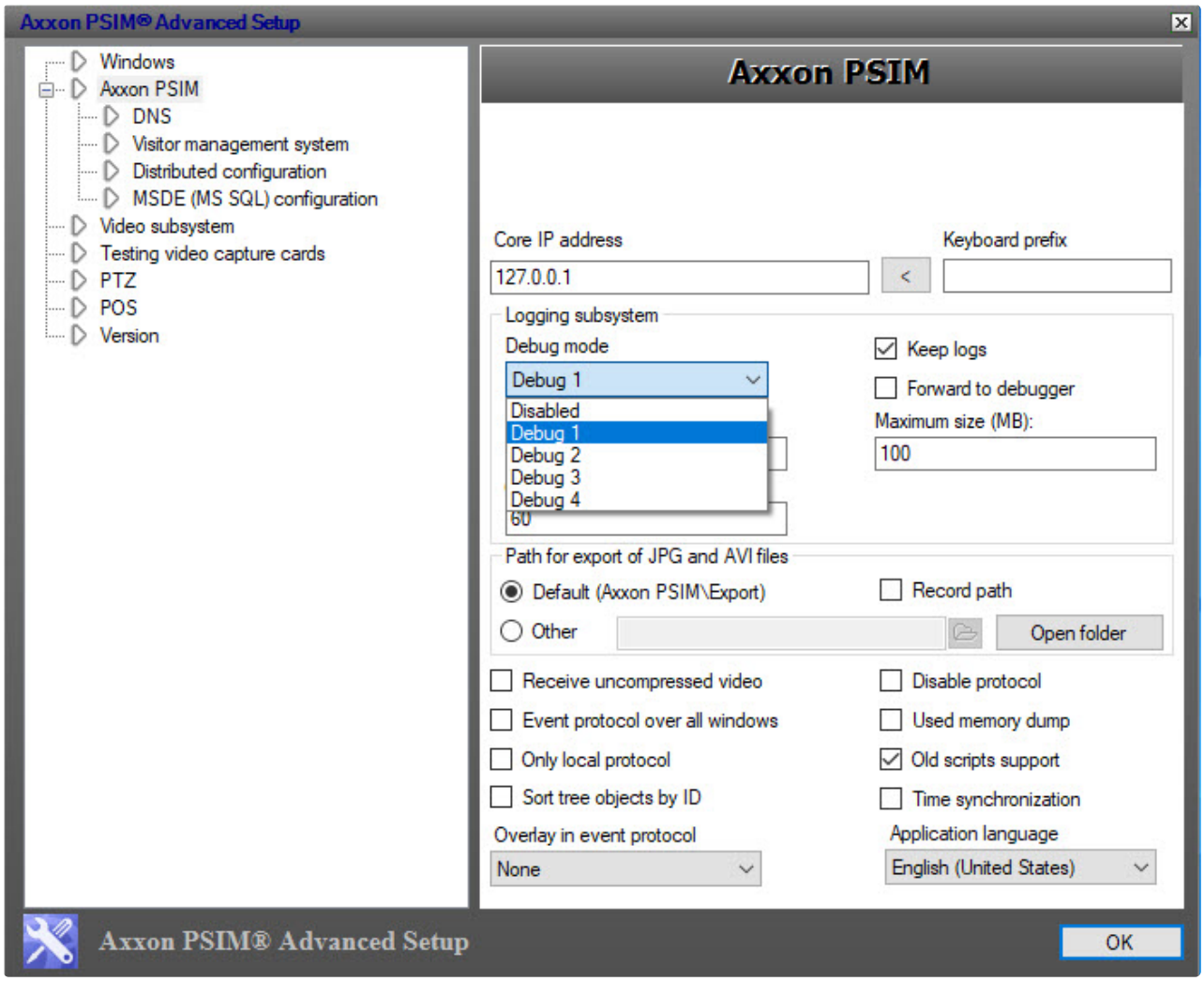
Start of the debug window is performed from the Windows task bar. Double click the left mouse button on the  icon to start the debug window.

As a result the **External Detector** window is displayed.



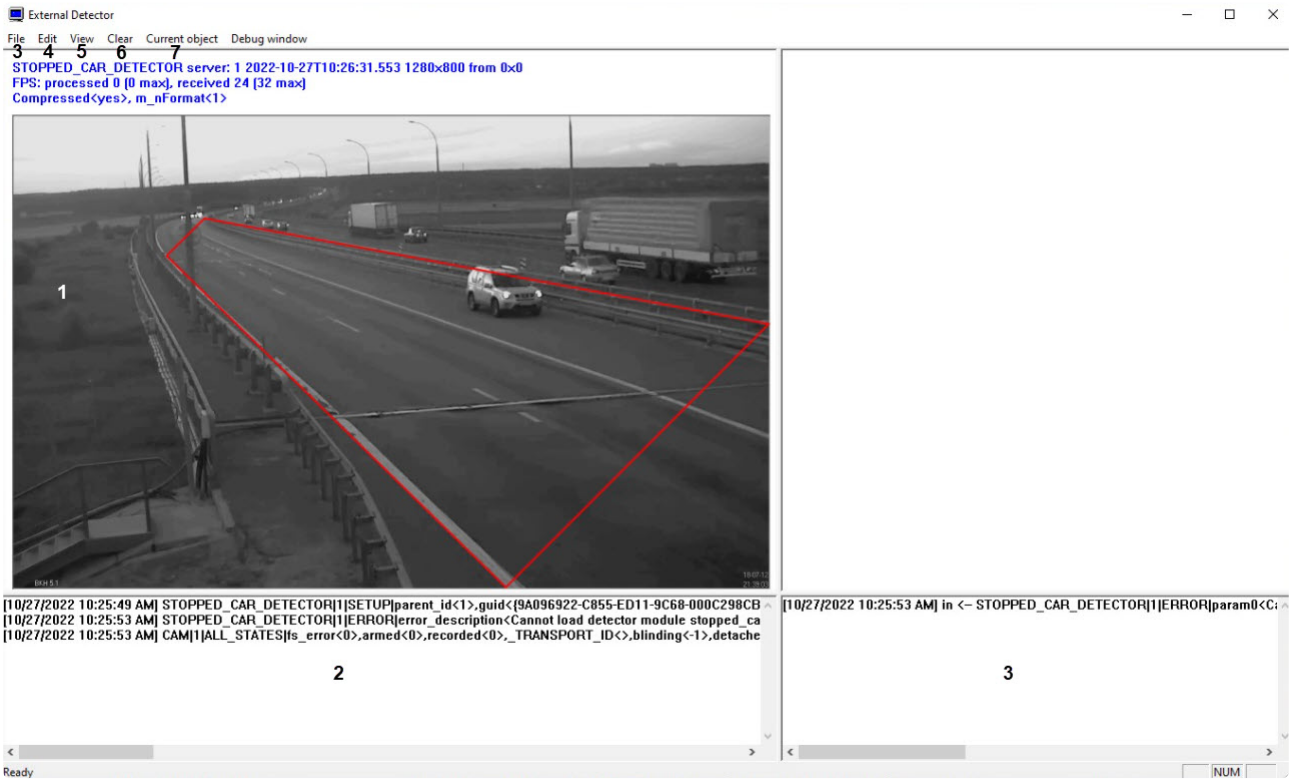
Attention!

Start the debug window is possible only if the **Debug** mode is enabled with the help of *Axxon PSIM* Advanced Setup utility.



6.3 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.

7 Appendix 2. Commands, requests and events of the DetectorPack PSIM software modules

7.1 Events of the software modules

All events from the *DetectorPack PSIM* software modules come from the **CAM** object, which corresponds to the **Camera** system object.

Events of software modules can be used in *Axxon PSIM* scripts to launch the procedures when a corresponding event occurs (see Programming Guide).

Event format:

```
CAM|"_id_"|"_command_"|"_parameters_"
```

Events description:

Event	Description	Software module used
NEW_OBJECT	The appearance of a new track (object)	*Neurotracker*
OBJECT_LOST	The 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 the event
fraction<>	Millisecond timestamp of the event
new_id<>	id of a new track (object)
owner<>	Server name
date<>	Date of event
guid_pk<>	id of event (randomly generated for each event)
core_global<>	When the event is generated, all CORE objects in the distributed system are notified

Parameters	Parameters description
time<>	Time of event
lost_id<>	id of a disappeared track (object)
y.0<>...	0 - serial number of a track (object) in the event, **<>** - **y** coordinates
x.0<>...	0 - serial number of a track (object) in the event, **<>** - **x** coordinates
id.0<>...	0 - serial number of a track (object) in the event, **<>** - object id
id.count<>	Current number of tracks (objects)

7.2 Commands of the software modules

Commands of the software modules can be used in *Axxon PSIM* scripts (see Programming Guide) or sent directly to the kernel using *IIDK* (see Axxon PSIM Integration Developer Kit (IIDK)).

Commands description:

Command	Description	Software module used
GET_STATUS	Generates the 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, etc.	Neurotracker

Example of the GET_STATUS command:

```
DoReact(NEURO_TRACKER|1|GET_STATUS);
```