AXIS Perimeter Defender

AXIS Perimeter Defender
AXIS Perimeter Defender PTZ Autotracking

User manual

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AXIS Perimeter Defender

AXIS Perimeter Defender is an application for perimeter surveillance and protection. It is ideal for high-security perimeter protection where there is a need to strengthen the physical access control system with reliable intrusion detection.

AXIS Perimeter Defender is primarily designed for so-called sterile zone protection, for example along a fence marking a boundary. The term sterile zone refers to an area where people are not supposed to be.

Use AXIS Perimeter Defender in an outdoor environment to:

- Detect moving persons.
- Detect moving vehicles, without discriminating between vehicle types.
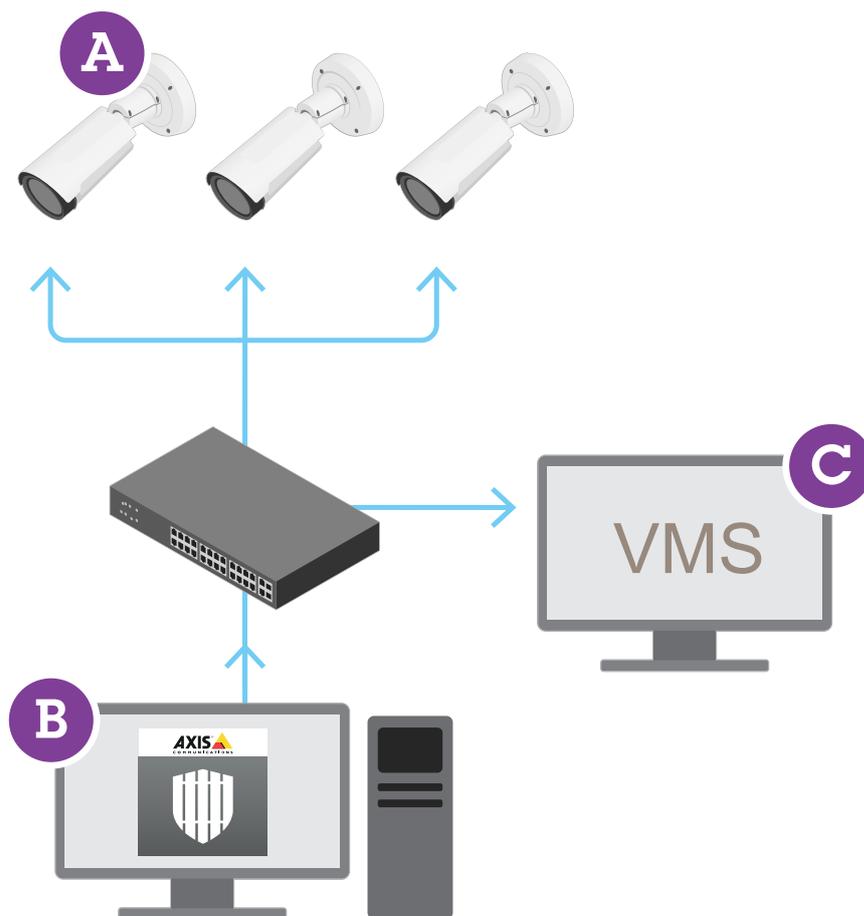
This camera can run the application in calibration mode, AI mode, or both modes in combination. If you choose to run it in AI mode only, camera mounting is more flexible and you don't need to calibrate the cameras.

AXIS Perimeter Defender consists of a desktop interface (B), from where you install and set up the application on the cameras (A). You can then configure the system to send alarms to the Video Management Software (C).

AXIS Perimeter Defender PTZ Autotracking is a plugin to the AXIS Perimeter Defender application, using the same desktop interface. With the plugin, you pair a fixed visual or thermal camera with an Axis Q-line PTZ camera. You can then maintain continuous detection coverage of a scene with the fixed camera while the PTZ camera automatically tracks and gives you closer views of detected objects.

Important

> AXIS Perimeter Defender PTZ Autotracking requires calibration of both fixed and PTZ cameras.

AXIS Perimeter Defender offers the following types of detection scenarios:

- **Intrusion**: triggers an alarm when a person or a vehicle enters a zone defined on the ground (from any direction and with any trajectory).

- **Loitering**: triggers an alarm when a person or a vehicle remains in a zone defined on the ground for more than a predefined number of seconds.

- **Zone-crossing**: triggers an alarm when a person or a vehicle passes through two or more zones defined on the ground in a given sequence.

- **Conditional**: triggers an alarm when a person or a vehicle enters a zone defined on the ground without first passing through another zone or zones defined on the ground.

How does it work?

Detection of objects

AXIS Perimeter Defender can detect moving persons or vehicles. To be detected:

- A person or vehicle must be completely visible in the detection zone for at least three seconds.

- A vehicle can be up to 12 meters (39.4 feet) long. (With AI mode, there is no max length.)

- Persons or vehicles must be visibly moving in the camera's field of view. This means that the detection rate of a person moving towards or away from the camera in a straight line is lower than for a person walking perpendicular to the camera's field of view.
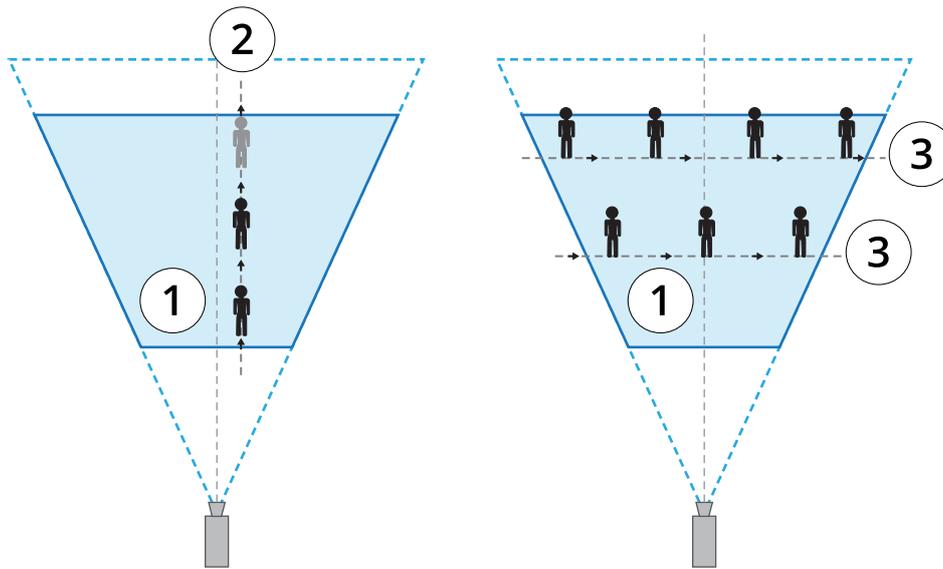
1   Detection zone
2   Person walking away from the camera
3   Persons walking perpendicular to the camera's field of view

- The point of detection must be inside the detection zone. The point of detection is at the feet of a person or at the center of a vehicle.

1   *Point of detection inside the detection zone*
2   *Point of detection outside the detection zone*
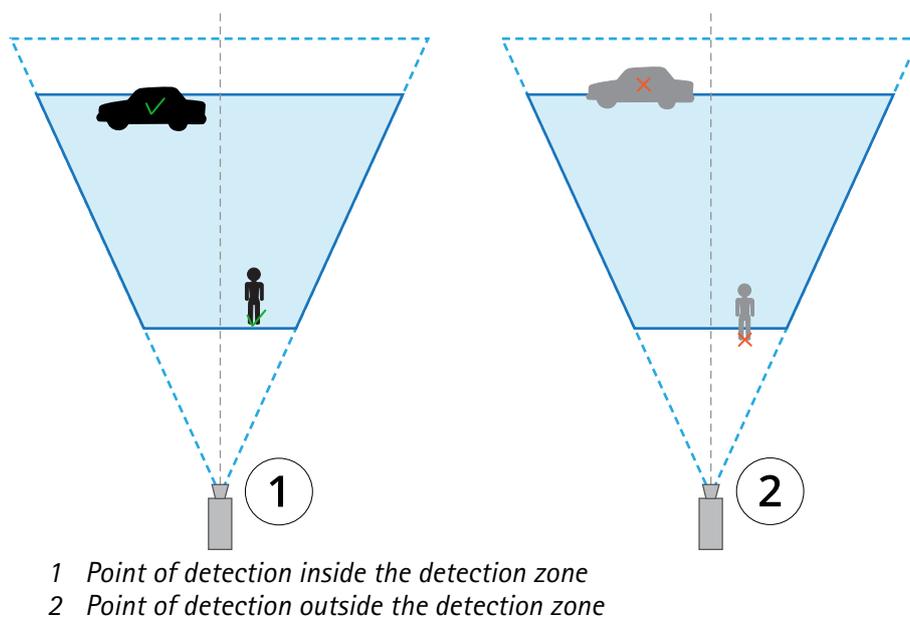
Once detected, AXIS Perimeter Defender continues to track the person or vehicle even if partially hidden, for example if the body of a person is hidden behind a car but the head is still visible.

If a detected person or vehicle stops moving for a few seconds, AXIS Perimeter Defender stops tracking it. If they start moving again after less than 15 seconds, the application continues to track them. If the person was in a zone-crossing zone, there is no guarantee that the scenario will trigger correctly.

How does PTZ Autotracking work?

In AXIS Perimeter Defender PTZ Autotracking, a fixed camera and a PTZ camera work together. When the fixed camera detects moving people or vehicles, it sends the object location data to the paired PTZ camera. As long as the objects remain within the fixed camera's field of view, the PTZ camera can automatically follow the objects and adjust the zoom level to keep them in view.

Conditions where detections can be delayed or missed

- Fog
- Light shining directly into the camera
- Inadequate light
- Overly noisy image

Situations that can trigger false alarms

- Partially hidden people or vehicles. For example, a small van that appears from behind a wall can look like a person since the visible part is high and narrow.
- Insects on the camera lens. Note that day-and-night cameras with infrared lights attract insects and spiders.
- A combination of car headlights and heavy rain.
- Human-size animals, especially if the additional approach types crouch/crawl or log roll have been selected in the **Scenarios** tab.
- Strong light causing shadows.

The user interface

The AXIS Perimeter Defender interface lets you, for example, calibrate devices, set up scenarios and perform actions for multiple devices. Remote setup allows configuration from wherever there is a network connection.
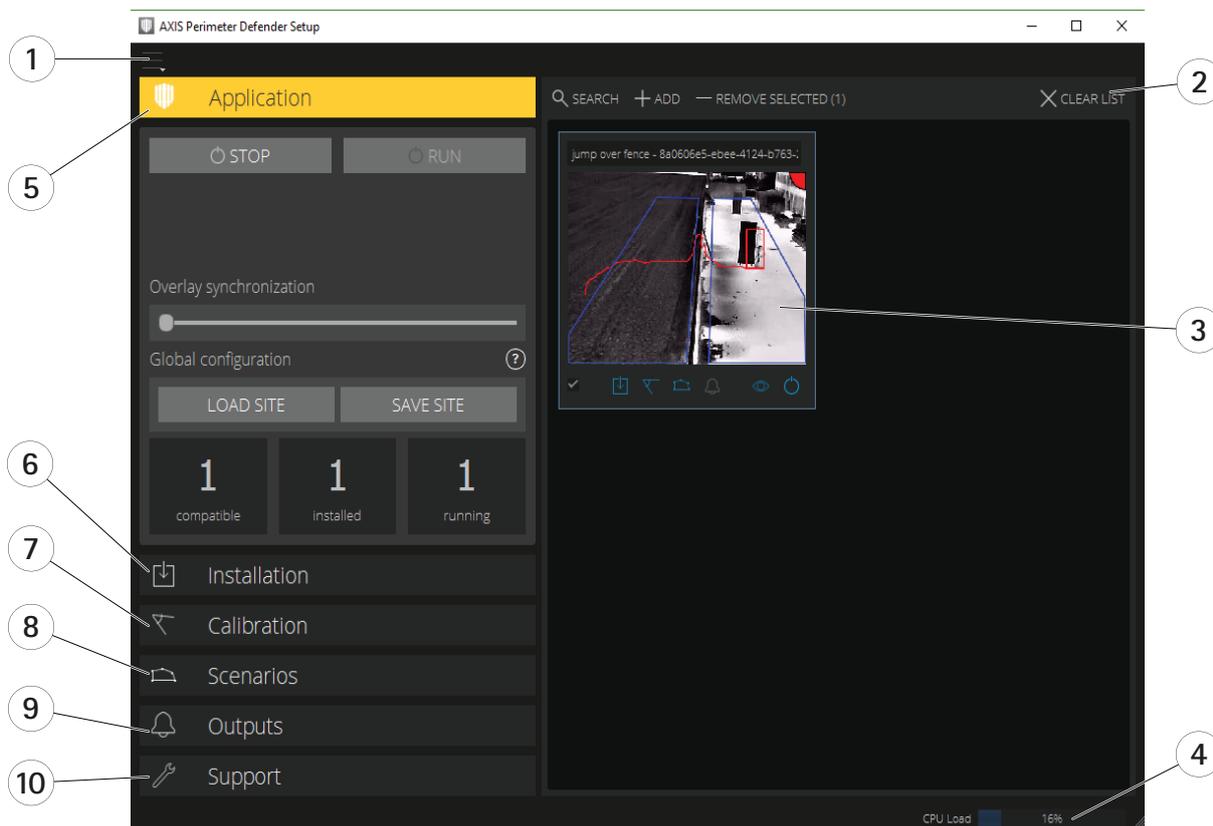
1 Interface settings, on page 7
2 Handle devices. See Add devices, on page 16.
3 Live view, on page 8
4 CPU load indicator. See CPU load, on page 11.
5 Application tab, on page 9
6 Installation tab, on page 9
7 Calibration tab, on page 10
8 Scenarios tab, on page 10
9 Output tab, on page 10
10 Support tab, on page 11

Interface settings

The interface settings menu contains:

Folder settings –

Device configuration path: Select where to store temporary files and calibration video.

Site configuration path: Select where to store configuration files from load paths.

Camera passwords – View the passwords in use and add new passwords. Passwords are not stored once the user exits the application.

Manage demo clips packages – Import or remove demo clips.

Enable full frame rate mode – Change the frame rate in the live view. See *CPU load, on page 11.*

Display feet and inches – Change between metric and imperial units.

Change language – Change the language in the application.

About – View the version of AXIS Perimeter Defender Setup.

Live view

Each connected device gets a live view in the main interface. The live view provides the device status and quick access to the main functions.

1. Device name – Click to edit the device name. It always includes the IP address and MAC number of the device. Hover the name to show the aspect ratio used for analysis, which provides maximum field of view coverage, and to see if the device is on a remote connection.

2. Live image – In the overview mode, the frame rate is 1 fps. Double-click to maximize the image and increase the frame rate to 8 fps.
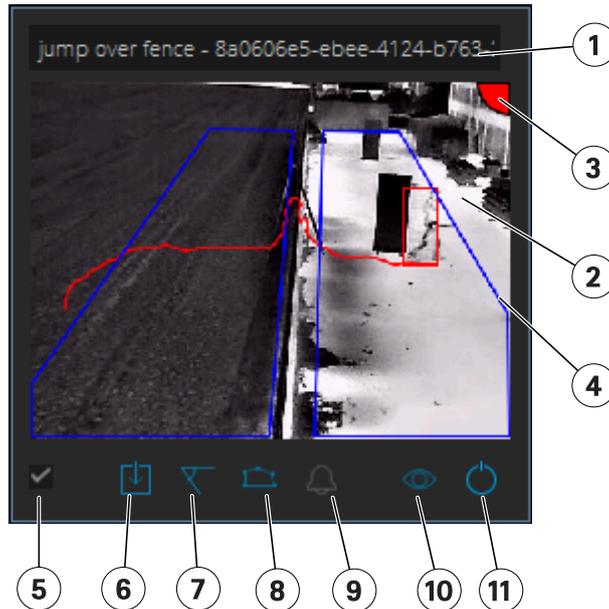
3. Alarm status – The alarm status is only visible if the overlay is active and AXIS Perimeter Defender is installed, configured, and running. Grey means that the alarm functionality is not active or that the configuration settings are loading. Green means that the alarm functionality is active. Red means that an alarm has been triggered.

4. Detection zones – The detection zones are only visible if the overlay is active and AXIS Perimeter Defender is installed, configured, and running.

5. Selection checkbox – To be able to select multiple devices, use this checkbox.

6. Installation status and quick access button – Hover to show the version of AXIS Perimeter Defender installed on the device. If the icon is replaced by ⟳, this means a more recent version is available. Click to open the Installation tab for the device. Grey means that the device is not installed. Orange means that the device is installed, but does not have a valid license. Blue means the device is installed with a valid license.

7. Calibration status and quick access button – Click to open the Calibration tab for the device. Grey means that the device is not calibrated. Blue means that the device is calibrated.

8. Scenarios status and quick access button – Click to open the Scenarios tab for the device. Grey means that no scenario is defined. Blue means that at least one scenario is defined.

9. Outputs status and quick access button – Click to open the Output tab for the device. Grey means that no outputs are configured. Blue means that at least one output is configured.

10. Overlay status and toggle button – Click to toggle overlay on and off. Grey means that the overlay is inactive. Blue means that the overlay is active. The overlay is shown as a bounding-box around detected objects as well as a "snail-trail" displaying trajectory of objects.

11. Running status and toggle button – Click to run/stop the application on the device. Grey means that the application is stopped. Blue means that it is running.

Note

Overlay is only available if a direct connection from the device to the user's computer is available, that is if no firewalls or similar prevent connection to the overlay port on the device.

Live view – PTZ Autotracking

The live view for devices that have AXIS Perimeter Defender PTZ Autotracking installed differs slightly from the regular live view.
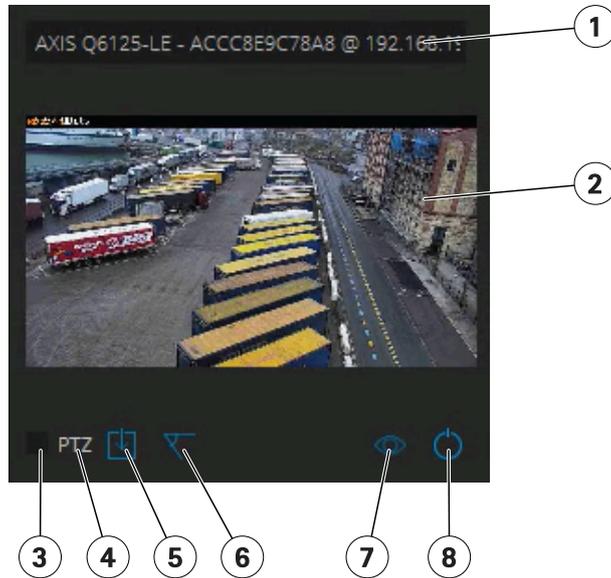
1 Device name
2 Live image
3 Selection checkbox
4 Indicates that the device uses AXIS Perimeter Defender PTZ Autotracking
5 Installation status and quick access button
6 Calibration status and quick access button
7 Overlay status and toggle button
8 Running status and toggle button

Application tab

- **Run** – Start the analytics on the selected device(s).

- **Stop** – Stop the analytics on the selected device(s).

- **Load Site** – Load a previously saved site, i.e. devices and their respective configuration files

- **Save Site** – Save the current site, i.e. save all the device information and their respective configurations files

- **Overlay synchronization** - Control over AXIS Perimeter Defender metadata overlay synchronization. This slider controls delay between metadata overlay and received images to compensate for slower image streaming compared to metadata. Slider value indicates the delay set for the current selected camera. If more than one camera are connected, the value indicated is that of the first selected camera. Changing the slider value changes delay for all the selected cameras.

You can also see the number of compatible devices added, the total number of devices with AXIS Perimeter Defender installed and the number of devices on which analytics is running.

Installation tab

- **Application: Install** — Install the application on the selected device(s).

- **Application: Uninstall** — Uninstall the application on the selected device(s).

- **Licence: Install** — Install licence on the selected device(s).

Calibration tab

- **Automatic** — Perform an automatic calibration of the selected device(s).
- **Manual** — Perform a manual calibration of the selected device(s).

Scenarios tab

- **Global parameters** — apply to all scenarios.
- **Advanced scenarios** — create intrusion, loitering, zone-crossing and conditional scenarios.

PTZ settings tab

Note

This tab is only shown if you have the plugin AXIS Perimeter Defender PTZ Autotracking.
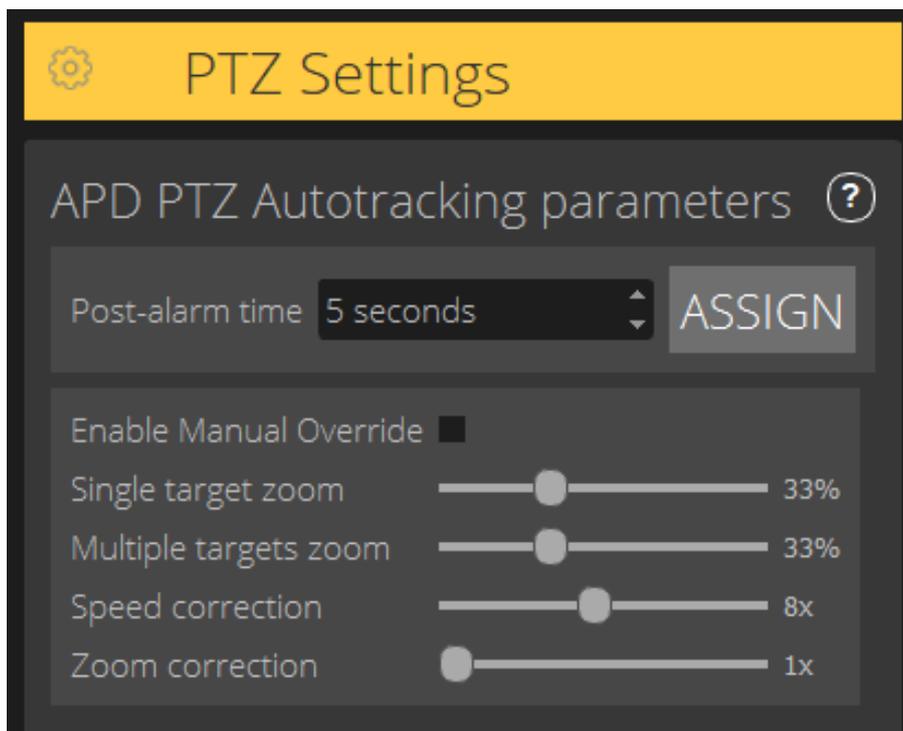
- **Post–alarm time** – Define the time before the PTZ camera returns to its home position, once the tracked object has disappeared from view.
- **Enable manual override** – When checked, the operator can take control of the PTZ camera with a joystick, in the VMS, or in the camera's webpage.
- **Single target zoom** – Adjust the zoom level for tracking a single target. A higher value gives better possibilities for identification, but also increases the risk of losing rapidly moving objects.
- **Multiple targets zoom** – Adjust the zoom level for tracking multiple targets.
- **Speed correction** – Adjust the tracking speed to keep rapidly moving objects centered in the PTZ camera image. Note that a high value can lead to tracking instability.
- **Zoom correction** – A higher value increases the zoom out for objects that are close to the edge of the PTZ camera's field of view.

Output tab

- **Configure** — Open the device's webpage to create and configure alarms.
- **Test alarm** — Test the alarm configured for the device.
- **Post–alarm time: Assign** — Set the post-alarm time.

Support tab

- **Load** — Load backed-up configuration for selected device(s). This is especially useful to quickly restore after a device failure or accidental uninstallation. The configuration includes:

- License

- Parameters

- Calibration and scenarios

- Calibration video

- **Save** — Create a backup of the selected device(s)' configuration.

- **Clear** — Erase calibration and scenarios from the selected device(s). This is useful if the cameras have moved, as calibration and detection zones are then no longer valid.

- **View application log** — View the AXIS Perimeter Defender internal log.

- **Export support log** — Generate a support file that contains detailed information. Always include this file with a support request.

CPU load

The CPU load indicator indicates the current computer CPU load in real-time. An excessive CPU load could result in an unresponsive computer or application. Make sure to close other applications when you use AXIS Perimeter Defender Setup, to maximize your CPU allocation. If the CPU load is too high and you try to add a device, the system issues a warning.

Each added device takes up CPU resources from the host computer when decoding and displaying the video stream. To limit the impact on the host computer, video streams from added devices display at a reduced frame rate (approximately 1 fps) by default. Normal frame rate (approximately 8 fps) is restored when streams are maximized or during the calibration process.

Important

> **Enable full frame rate mode** can lead to an unresponsive interface if you connect to a large number of cameras or when you use a low-power computer.

Show a demo of AXIS Perimeter Defender

For demo purposes, AXIS Perimeter Defender and AXIS Perimeter Defender PTZ Autotracking comes pre-installed with a few demo clips that can be used to demonstrate the analytics without the need for an active, installed camera. The demo clips show the kind of detection and autotracking results that can be expected in different environments.

1. Go to **Application > Add > Demo Clips** and do one or more of the following:
   - Filter demo clips according to their type.
   - Select at least one demo clip.
2. To add the demo clips, click **Add Selected Demo Clips**.

Once added, the demo clips appear as standard video streams in the interface. Calibration is available and analytics already activated so that the user immediately sees analytics and autotracking results on the video stream. Analytics and autotracking can be stopped or started by clicking the running status in the live view or the **Run** or **Stop** buttons on the left pane.

Calibration and pairing can be modified and redone. Similarly, detection scenarios can be added, removed and modified.

The **Support** tab on the left pane has a **Clear** button that lets you revert calibration and scenarios to the original values. It is not possible to completely remove the calibration.

Get started

The installation process for AXIS Perimeter Defender and AXIS Perimeter Defender PTZ Autotracking differs slightly.

Get started with AXIS Perimeter Defender

You need to go through the following steps to get your site up and running with AXIS Perimeter Defender:

1. Mount the camera. See *Mount the camera, on page 12*.
2. Download and install the software on your computer. See *Install software on computer, on page 15*.
3. Connect to your devices. See *Add devices, on page 16*.
4. Install AXIS Perimeter Defender on each device. See *Install software on devices, on page 17*.

Note
> You don't need to calibrate devices that run in AI mode only. To run devices in calibration mode and AI mode simultaneously, you need to calibrate them.

5. Calibrate the devices. See *Calibrate - AXIS Perimeter Defender, on page 18*.
6. Define the rules for what should trigger alarms by adding scenarios. See *Define scenarios, on page 24*.
7. Set up alarms to be sent. See *Define outputs, on page 28*.

Get started with AXIS Perimeter Defender PTZ Autotracking

You need to go through the following steps to get your site up and running with AXIS Perimeter Defender PTZ Autotracking:

1. Mount the cameras. See *Mount the camera, on page 12* and *Mount the PTZ camera, on page 14*.
2. Download and install the software on your computer. See *Install software on computer, on page 15*.
3. Connect to your devices. See *Add devices, on page 16*.
4. Install AXIS Perimeter Defender version 2.5.0 or later on the fixed camera, and AXIS Perimeter Defender PTZ Autotracking on the PTZ camera. See *Install software on devices, on page 17*.
5. Calibrate the devices and set up scenarios. See *Calibrate - PTZ Autotracking, on page 24*.
6. Pair the devices. See *Pair the cameras - PTZ Autotracking, on page 27*.
7. Set up alarms to be sent. See *Define outputs, on page 28*.

Mount the camera

About the design tool

To specify the camera placement on site, we recommend you use Design tool for AXIS Perimeter Defender. It takes into account both Axis cameras' and AXIS Perimeter Defender requirements. Furthermore, you can use it when performing dual installations, that is, when using two cameras in combination. The tool helps you decide:

- Camera mounting height
- Tilt angle
- Minimum detection distance
- Maximum detection distance

To download the tool, go to *axis.com/products/axis-perimeter-defender*

Recommendations for mounting the camera

Note

For cameras that run in AI mode only, you can find mounting recommendations in the application.
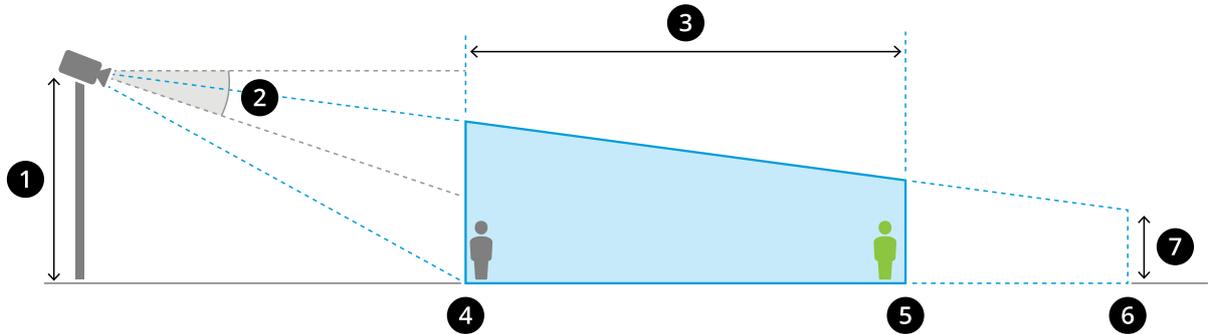
An appropriately mounted camera.

1   Mounting height
2   Tilt
3   Detection zone
4   Minimum detection distance
5   Maximum detection distance
6   Field of view distance
7   Field of view elevation

Object height at the maximum detection distance – For a standing person to be detected at the maximum detection distance, the pixel height must be at least 5% of the total image height (3.5% for thermal cameras). For example, if the height of the visualized image is 576 pixels, the height of a person standing at the end of the detection zone must be at least 28 pixels (20 pixels for thermal).

Object height at the minimum detection distance – For a standing person to be detected at the minimum detection distance, the pixel height cannot be more than 60% of the total image height.

Object height in AI mode – When you run the application in AI mode, objects need to be the same size or larger than the avatar to be detected.

Tilt angle – The camera must be oriented towards the ground so that the center of the image is under the horizon. Mount the camera so that the minimum detection distance is longer than half of the camera's mounting height (minimum detection distance > camera mounting height / 2).

Roll angle – The roll angle of the camera must be nearly equal to zero.
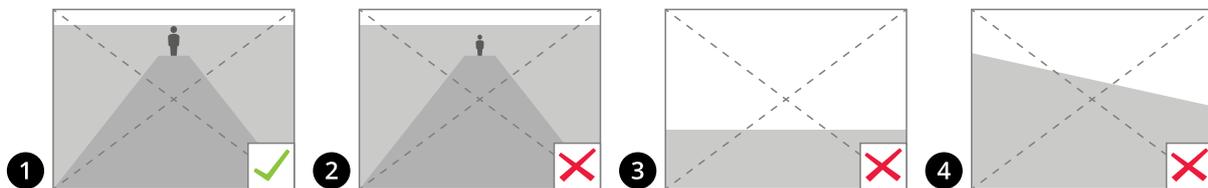
1   Object height, tilt angle, and roll angle are suitable.
2   Object height at maximum detection distance is less than 5% of the image height (3.5% for thermal cameras).
3   The center of the image is above the horizon line.
4   The roll angle of the camera is not nearly equal to zero.

The maximum detection distance depends on:
- Camera type and model

- Camera lens. A higher focal range allows for a longer detection distance.

- The minimum pixel size a human must cover in the image to be detected. The pixel height of a standing person must be at least 5% of the image height for visual cameras and 3.5% for thermal cameras.

- Weather

- Lighting

- Camera load

When you mount the camera, remember:
- The application tolerates small camera vibrations, but you get the best performance when the camera is not subject to vibrations.

- The field of view of the camera must be fixed.

Mounting height

To reach a particular detection distance, apart from the required minimum pixel size, the camera must be placed at a minimum height. There is no maximum mounting height as long as the other requirements, especially the tilt angle, are met.

Required detection distance	Minimum camera mounting height
20 m (66 ft)	2.5m (8 ft) (lowest permissible height)
100 m (330 ft)	3m (10 ft)
200 m (650 ft)	4 m (13 ft)
300 m (1000 ft)	5 m (16 ft)
500 m (1600 ft)	6 m (20 ft)

Scene requirements

Note

For cameras that run in AI mode only, you can find scene requirements in the application.

The detection zone needs to provide the following conditions:
- Clear sight

- The ground must be flat or with only a slight slope

- Light does not trigger by movement

- Clear sight

- For visual cameras, the level of illumination and image settings must be sufficient to provide enough contrast between humans and vehicles and the background.
    - When you use an Axis day-and-night camera with artificial lighting, we recommend at least 50 lux in the entire detection zone.

    - When you use external IR spots, we recommend a maximum detection distance of 80 m and that the range of the IR spots is more than twice the maximum detection distance.

    - When you use built-in IR lighting, the maximum detection distance is limited to max 20 m, depending on the camera and the environment.

- For thermal cameras, there needs to be a high contrast between background and foreground

To optimize the detection performance, AXIS Perimeter Defender automatically learns the difference between day and night and uses this information to fine-tune the detection algorithms. The fine-tuning takes about 24 hours, which means optimal detection during both day and night is achieved after running the application for that time.

Mount the PTZ camera

This chapter describes how to mount the PTZ camera in relation to the fixed camera. For instructions on how to mount the fixed camera, see *Mount the camera, on page 12*.
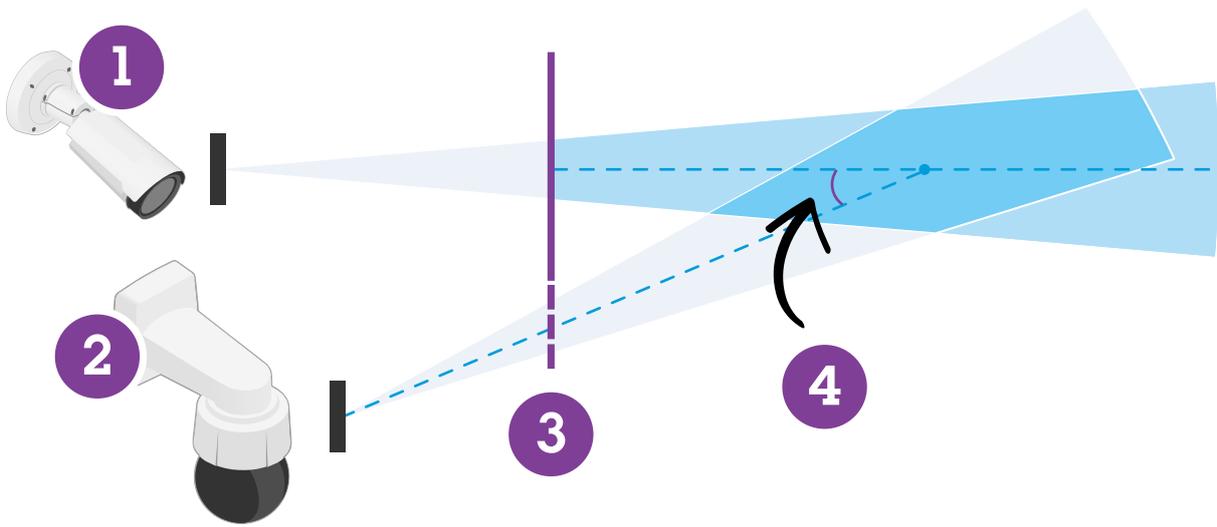
1   Fixed network camera
2   PTZ network camera
3   Minimum detection distance
4   Angle between the cameras

- The home preset position of the PTZ camera must cover more than 60% of the detection zone of the fixed camera.

- To be tracked by the PTZ camera, a standing person must cover more than 4% of the image height of the PTZ camera.

- The PTZ camera must be placed before the minimum detection distance of the fixed camera (C).

- The angle between the fixed camera and the PTZ camera must be less than 30° (D).
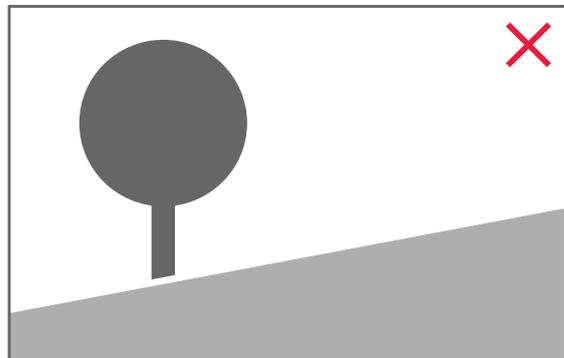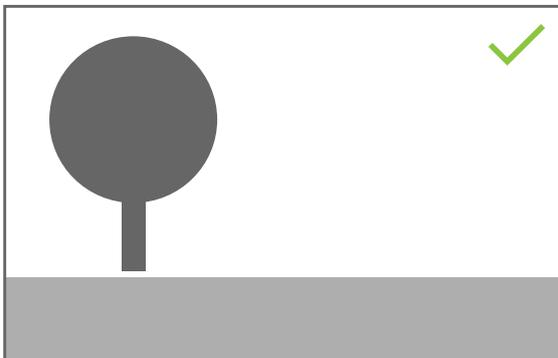
- The ground must be flat.

Install software on computer

Cameras running AXIS Perimeter Defender must be reachable through HTTP from the computer running the AXIS Perimeter Defender Setup Interface.

AXIS Perimeter Defender Setup Interface (only required during the setup phase) requires:

- Intel® Core™ 2 Duo processor or better

- Support for Open GL

- At least 16 GB RAM

- Windows® 10, Windows® 11, or Win Server 2022

- At least 1024 x 768 screen resolution

Note that there are limits to the number of cameras that can be handled by a single computer. For example, for a machine with an 11th Gen Intel® Core™ i5-1135G7 processor @ 2.40GHz it is recommended to add a maximum of 10 cameras and to run a simultaneous automatic calibration on a maximum of 5 cameras.

Note

Running AXIS Perimeter Defender Setup Interface on a virtual machine is not supported.

1. Download the AXIS Perimeter Defender software from *axis.com/products/axis-perimeter-defender*

2. Install the software on your computer.

Add devices

You can add devices to the AXIS Perimeter Defender application in three different ways:

- Automatically through a network scan. See *Add devices automatically, on page 16*.
- Manually by specifying connection settings. See *Add devices manually, on page 17*.
- Automatically by loading a previously saved site. See *Load an existing site, on page 17*.

When you have added a device, you see a list of all other applications installed on the device. We recommend you to stop any non-essential applications, as they use the camera's CPU resources, which impacts the performance of AXIS Perimeter Defender and may prevent correct installation.

If a device doesn't have enough CPU resources, for example because other applications are running, AXIS Perimeter Defender lowers the frame rate. If the frame rate is below 5 frames per second, a yellow warning triangle is displayed next to the device name in the live view. When you hover the triangle, the current frame rate is displayed.
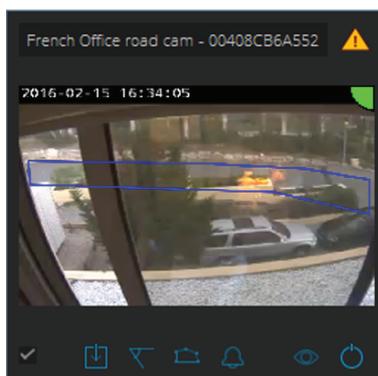
Note

A frame rate below 5 fps can significantly decrease the video analytic performance. This can result in both missed and false detections.

For more information, see *CPU load, on page 11*.

Add devices automatically

Important

The search functionality does not work across networks, that is, AXIS Perimeter Defender Setup can only find devices that are connected to the same sub-network as that of the client running the software. To add devices connected to a different sub-network, add them manually. The search functionality may also fail if the network routers or switches are configured to filter multicast.

1. To scan the surrounding network for devices, go to **Application** and click **Search**.
   When you do a search for the first time and no passwords are available, a password dialog opens. Otherwise the available password are used to connect to the devices.

2. Select devices and click **Add selected devices**.
   If the password is correct, a static image shows up to guide the user when selecting devices.

Add devices manually

1. Go to **Application** and click **Add**.

2. Enter the following:

– The device's IP address or hostname.

– The device's root password, since AXIS Perimeter Defender requires root access.

– The HTTP port used to connect. The default port is 80.

– An optional name for the device for easier recognition.

– If the device is on a remote network for which connection may be slow, check **Device on remote network**. Slow connections that are not configured as remote can lead to non-working or bad calibrations.

Note

For remote connections the user must be able to connect to the device through HTTP. Make sure to setup the HTTP port correctly. Remote configuration can fail when the connection doesn't have sufficient or stable bandwidth.

3. Click **OK**.

Note

If it doesn't work to add a camera by hostname, verify the network and DNS settings or add the device using its IP address.

Load an existing site

To load a previously saved site configuration:

1. Go to **Application** and click **Load site**.

2. Browse to select the site configuration file and click **Open**. The live view shows up automatically.

Install software on devices

You need to install AXIS Perimeter Defender on each device.

If you want to check which version of AXIS Perimeter Defender that is installed on a device, you can hover the **Installation status** in the live view.

If a device doesn't have AXIS Perimeter Defender installed, all icons in the live view are grey.

Install the software on a device

1. Go to **Installation**.

2. Select the device(s) where you want to install the application.

3. Select the latest available version of AXIS Perimeter Defender and click **Install**.
AXIS Perimeter Defender is now installed on the selected device(s) and starts automatically.

4. Browse for a licence and do one of the following:

– If you install on a single device: select the license file for the device.

– If you install on multiple devices: select the folder where license files are stored.

5. Click **Install**.

Calibrate - AXIS Perimeter Defender

Calibration

Note

You don't need to calibrate devices that run in AI mode only. To run devices in calibration mode and AI mode simultaneously, you need to calibrate them.

For AXIS Perimeter Defender to correctly interpret the scene, you must calibrate all devices. During calibration, you introduce points of reference that provide depth and height information for the processor. You also define the zone of interest.

Calibration consists of two tasks:
1. Perform a calibration:

    –   automatic — recommended in most cases. See *Perform an automatic calibration, on page 18*.

    –   manual — recommended if the automatic calibration fails on a camera, for fine tuning, or when it would be impractical to conduct a walkthrough of the scene and there are objects of known height in the scene. An example of this is a remote perimeter with a fence line consisting of a number of evenly spaced fence posts of a consistent height. See *Perform a manual calibration, on page 22*.

2. Verify the calibration results. See *Verify the quality of the calibration , on page 20*.

To speed up the configuration of a large site, you can calibrate multiple devices simultaneously. You can perform the calibration automatically or manually, just like for a single camera. Consider the following before you calibrate multiple devices simultaneously:

*   The maximum number of devices you can install and configure simultaneously depends on the CPU power and the memory available on your computer. Too many devices in AXIS Perimeter Defender Setup can cause crashes. When the CPU overload warning appears, install and configure a subset of the devices using the save site-feature.

*   Automatic calibration of multiple devices requires more CPU resources and RAM than for a single device. On low-spec systems this might make the computer unresponsive for some time or lead to an application crash. In case of a crash, videos captured are still available to be used afterwards for single camera calibration.

Note

*   AXIS Perimeter Defender supports different image aspect ratios according to the maximum resolution provided by the camera. As a result, you need to redo all previous calibrations if you change the resolution. However, if you change the stream resolution in the camera's webpage, you don't need to re-calibrate.

*   We recommend you to use the same image aspect ratio in AXIS Perimeter Defender and in the VMS, to make sure that the displayed information fits the image content. To find out the aspect ratio, hover the camera name in the live view.

*   If a camera moves after calibration, you need to re-calibrate it for the analytic results to be correct.

Perform an automatic calibration

With automatic calibration, you can calibrate one or more cameras by letting a person walk through the surveillance scene. The camera automatically gathers the information required to calibrate itself.

For a successful automatic calibration:
*   Don't calibrate when there are a lot of people in the field of view.

*   Don't calibrate when there are a lot of vehicles passing in the field of view.

*   Don't calibrate when there are other objects moving in the field of view. For example trees or flags moving in the wind.

*   Don't calibrate a camera which has not been installed parallel to the ground.

- The person who walks through the scene must be able to cover the whole field of view from front to back. If that is not possible, it is better to switch to manual calibration.

- If the camera is on a remote network but not connected as remote, the person who walks through the scene must walk for about 5 minutes to make sure enough images are captured. This is because the frame rate is usually lower for devices on remote networks.

1. Go to **Calibration**.

2. Select the device(s) you want to calibrate.

3. Click **Automatic**.

4. Set the recording start time. The capture should start at least 10 seconds before the person who walks through the scene enters the field of view.

5. Set the recording duration. Consider that:
   - there needs to be enough time for the person to walk back and forth through the whole scene.
   - the length of the video affects the calibration computation.

6. Enter the height (cm) of the person who walks though the scene and click **Capture**.
   To reuse a previously captured video, click **Use previous capture**.

7. Let the person walk though the scene according to the following instructions:
   - Walk in a zigzag path that covers as much as possible of the detection zone from front to back of the scene. We recommend a V-shaped path across the field of view.
   - Remain almost always fully visible from head to feet in the field of view.
   - Walk slowly in straight lines.
   - Keep an upright posture the whole time.
   - Pause for 1–2 seconds before changing direction.

An example of a walk sequence.

8. Verify that automatic calibration has been successful by confirming that the person is detected accurately. See *Verify the quality of the calibration , on page 20*.

9. To save the calibration, click **Accept**.
   To perform a new calibration, click **New**.
   To perform a manual calibration, click **Manual**.

When you have accepted the calibration, blue borders indicate the maximum detection zone. The maximum detection zone is the largest area that can be monitored. Outside of this area, intruders might be detected but it is not guaranteed.

Verify the quality of the calibration

After a calibration, you should see the person who walked through the scene in several different places. If the person is not visible at all, the automatic calibration has failed and needs to be redone.

There are several ways to verify the quality of the calibration:
- Check the calibration precision indicator. It reflects an automatically computed precision level that measures how well the person covered the scene and how well he or she was detected. If the precision indicator is in the red zone the calibration has failed and you are not able to click **Accept**. See *Perform a manual calibration, on page 22.*

- You can use the grid tool. See *Use the grid to verify calibration, on page 20.*

- You can use the avatar tool. See *Use the avatar to verify calibration, on page 21.*

- You can check the detection results. See *Use detection results to verify calibration, on page 22.*

1   *Calibration precision indicator*
2   *Grid and avatar tools*
3   *Dynamic or static view*
4   *View modifiers*
5   *Toggle between calibration image and live view*
6   *Horizon line*

The horizon line represents the visible end of the ground in the scene. When you define scenarios, it is not possible to place scenario zones in the blue area above the horizon line, as this is above the ground and scenario zones are by definition on the ground.

Use the grid to verify calibration

The grid should correspond to a square grid on the ground. You can toggle the display of the grid by clicking the grid view modifier icon.

Important

    The grid does not affect the calibration, it is a tool to make sure the calibration is correct.

You can turn the grid by dragging it in the preview pane. Try to align it with some structure in the scene to see if the result seems reasonable.

If the grid is parallel to the ground, does not have a weird slope, and, after having applied the necessary rotation to the grid, is parallel to man-made artefacts that are parallel in the real world, then the calibration is good.
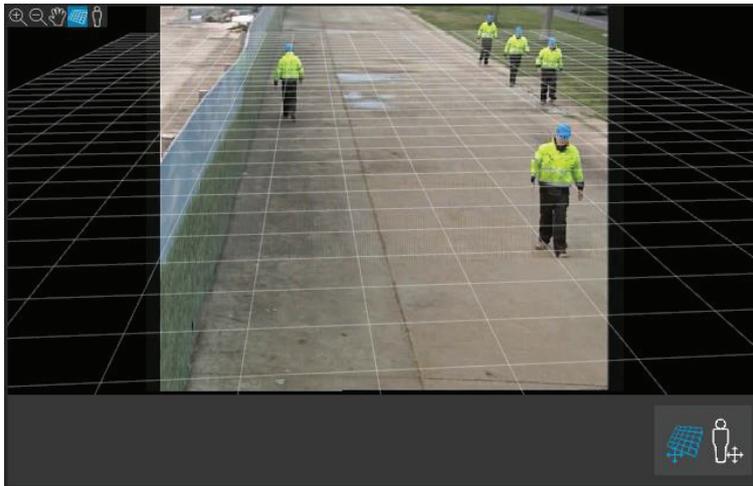
An example where the grid is correctly aligned with the road shoulders.
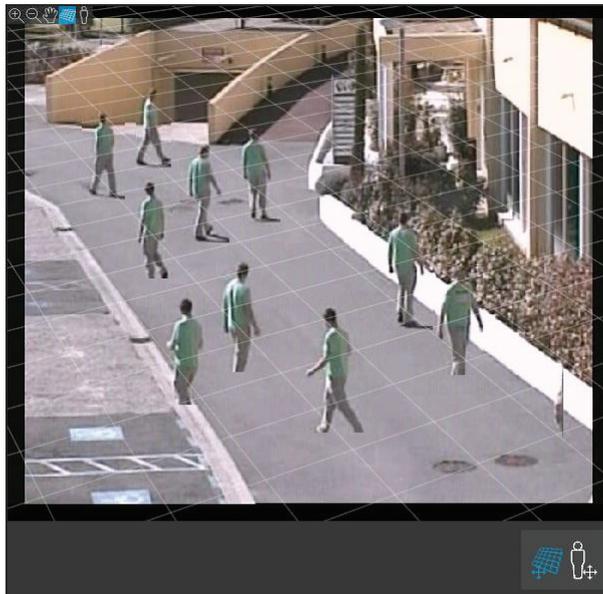
An example where the grid is not correctly aligned with the road shoulders.

Use the avatar to verify calibration

The avatar allows you to place a 3D person avatar of average height in the scene. You can toggle the display of the avatar by clicking the avatar view modifier icon.
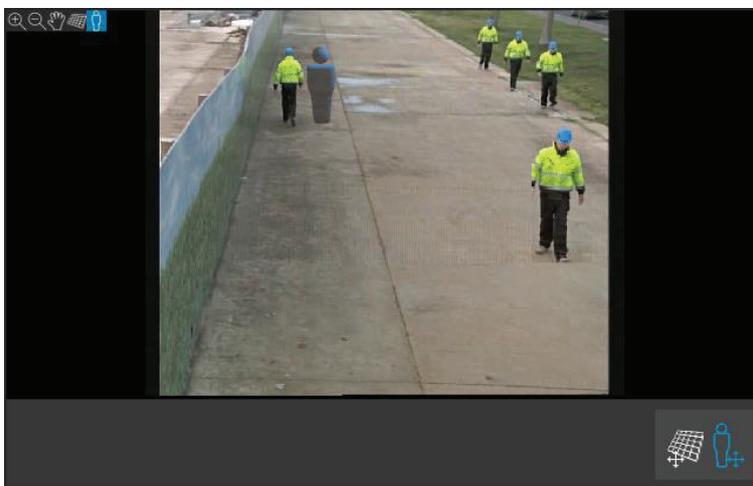
Its size in the view pane corresponds to the size of an average person at that position according to the current calibration. By moving the avatar around, you can make sure its size is reasonable in relation to other objects or

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people in the scene. You should check the avatar at different positions, since the avatar could be correctly sized at one position but incorrectly sized elsewhere in the image.

Use detection results to verify calibration

You can use the detection results to check how AXIS Perimeter Defender would perform with the current calibration if it received the video footage of the person's walk as a live stream.

1. Switch from **Calibration results** to **Detection results**.
2. Check the detections of the people or vehicles entering the surveillance scene:
   – If the calibration is fine, people are marked with red rectangles and vehicles with blue rectangles.
   – If people or vehicles are frequently not marked, the automatic calibration has most likely failed.
   – A red zone shows the detection limit zone according to the computed calibration, that is, the zone where the prerequisites on the human height in the image are not respected. In this zone the detection might fail because of the target size.

Note
- If the computed calibration is wrong, the red zone is also wrong.
- If the person is too far away, he or she might not be marked. A minimum size is necessary for the detection to work. For more information, see *Mount the camera, on page 12*.
- Reviewing detection results may not work on remotely connected cameras, because the capture can have a too low frame rate. It does not mean that the configuration has failed. Use the avatar and the grid to verify calibration instead.

Perform a manual calibration

If you have not attempted an automatic calibration, you need to capture a short video and create a composite image before you can perform a manual calibration. Follow the same steps as for an automatic calibration (*Perform an automatic calibration, on page 18*), but select **Manual** instead of **Automatic** in the **Calibration** tab. To create the composite image after you have captured a video:

- move the slider to navigate in the video clip
- at key positions, click the camera icon to add images to the composite

Make sure the composite image reflects the full cross-section of the scene: front, back, left and right.

When you have a composite image, created manually or automatically, you can continue the manual calibration.

The calibration engine calibrates by estimating:
- the horizon
- the way vertical lines spread, or fan out, in the image
- the scale of the scene

When you perform a manual calibration, you need to provide this information to the calibration engine through calibration elements. There are three types of calibration elements:

- **Person sticks** are used to mark the known height of an average person at various positions in the scene. If you have already attempted an automatic calibration, it is very likely that the image displayed in the editor pane shows several instances of the same person. Place person sticks from the ground up to mark the height and direction of the person at one or more positions. A person stick must start on the ground and should be vertical in the real world. The length of a person stick in the real world must correspond to the height indicated next to the **Person** button in the editor pane. Person sticks are marked with a semi-transparent light blue symbol.
  How to best place a person stick

– We recommend that you place the stick on a person having their feet close together.

– If you place a stick on a person standing on the ground with the feet apart, place the lower point on the ground halfway between the heels of the person.

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- Align the stick should with the person's torso. However, if he or she is leaning in some direction, typically forwards while walking, try to compensate the leaning by placing the stick more upright. Use any clues in the scene to guide you, for example trees, fences, or lamp posts.

- For the scale of the scene, at least one person stick with the corresponding person height is needed. If there is no person visible in the scene, you can add a person stick on some other vertical object of known height, for example a 3 m fence post, and set the person height to the height of the object.

- **Parallel horizontal lines (H–lines)** are used to mark known horizontal and parallel lines in the scene. These lines can be on the ground or on a wall or both, but they must all be parallel. If you add H-lines, you need to add at least two. You can place them on the sides or the markings on a straight road, on a set of straight railroad tracks, on some visible structure on a wall, or on the tops and bottoms of a row of fence posts. H-lines are marked in light blue.

- **Vertical lines (V–lines)** are used to mark known vertical lines in the scene. A V-line should mark some vertical structure in the real world. This can be for example a fence post, the corner of a building, or a sign. A V-line does not need to start on the ground. V-lines are marked in dark blue. Note that V-lines are very sensitive as a small change of orientation may dramatically change the calibration. As a rule of thumb, V-lines should lean right on the right side of image and left on the left side.

1   Person sticks
2   Vertical lines (V-lines)
3   Parallel horizontal lines (H-lines)
4   Grid and avatar tools

Number of calibration elements

Generally, when you add person sticks, H-lines and V-lines in the scene, the more the better. The calibration engine can calibrate with very few lines, but typically the calibration quality gets better the more lines and sticks you draw. When you add person sticks, we recommend that you place them both near and far, left and right.

Vertical structures in the image

According to *Recommendations for mounting the camera, on page 13*, all cameras must point slightly downwards. As a result, all vertical structures in the real world seem to fan out like a peacock-tail in the image. This means that all person sticks and V-lines should tilt towards the edge of the image. A stick on the right half of the image should lean to the right and a stick on the left should lean to the left. At least one of the placed person sticks or V-lines must be "correctly leaning" for the calibration to work.

The precision indicator provides visual feedback on the level and quality of detail that has been added to the scene. For successful manual calibrations, mark-ups should cover the scene from front to back and from left to right. This is indicated by a green precision indicator.

Calibration quality

The quality of the calibration can be checked with the grid or avatar manipulators. See *Verify the quality of the calibration , on page 20.* Alternatively, click **Review**. This shows you the result of running AXIS Perimeter Defender on the captured video using the current manual calibration.

Calibrate - PTZ Autotracking

Important

To achieve good results, the calibration must be of high quality. Follow the guidelines and instructions carefully.

Note

You can calibrate both cameras at the same time, or one at a time.

1. Select both the fixed camera and the PTZ camera.

2. Go to **Calibration** and click **Setup PTZ position**. A pop-up with the view from the fixed camera is shown. The PTZ camera will pan, tilt, and zoom for a short while when the application starts up.

3. Check that the view from the two cameras are aligned with each other.
    If they are not, click the live view image to adjust the view of the PTZ camera until it matches the view of the fixed camera. Make sure there is no roll.

4. Click **Setup PTZ position**.
    If the button is not visible, move the pop-up with the view from the fixed camera.

5. Click **Automatic**.

6. Perform an automatic calibration according to the instructions in *Perform an automatic calibration, on page 18.*

7. Use the avatar to verify the quality of the calibration for the fixed camera. See *Use the avatar to verify calibration, on page 21.*
    If the quality is good enough, click **Accept**.
    If the quality is not good enough, use the video from the automatic calibration to make a manual calibration. Click **Manual** and follow the instructions in *Perform a manual calibration, on page 22.*

8. In **Scenarios**, define the rules for what should trigger alarms. See *Define scenarios, on page 24.*

9. In **Calibration**, click **Review** in the live view of the PTZ camera.

10. Use the avatar to verify the quality of the calibration for the PTZ camera. See *Use the avatar to verify calibration, on page 21.*
    If the quality is good enough, click **Accept**.
    If the quality is not good enough, use the video from the automatic calibration to make a manual calibration. Click **Manual** and follow the instructions in *Perform a manual calibration, on page 22.*

11. Pair the cameras. See *Pair the cameras - PTZ Autotracking, on page 27.*

Define scenarios

Scenarios

AXIS Perimeter Defender includes common sterile zone scenarios that you can configure to secure and monitor sensitive areas. In the calibration step, the maximum detection zone was created to provide a default scenario of the type intrusion/loitering. In this step, you can define more sophisticated detection scenarios of three different types:

Note

If you're a user of AXIS Perimeter Defender 4.0, you can now configure scenarios without the desktop application. Changes will transfer to the desktop application. To read more go to *Web Interface, on page 36.*

*   intrusion/loitering. See *Set up the intrusion/loitering scenario, on page 25*

*   zone-crossing. See *Set up the zone-crossing scenario, on page 26*

*   conditional. See *Set up the conditional scenario, on page 26*

If the **!** symbol appears by a scenario name, it means the scenario setup is not complete. The most common issue is that its detection zone has not yet been defined.

Global parameters

The global parameters that you set in the user interface apply to all scenarios.

Camera type – For visual cameras, select **Color – Day–Night**. For thermal cameras, the camera type is automatically set to thermal.

> Note
> - Additional approach types can increase the risk of false alarms, for example caused by animals.
> - Additional approach types are not supported for devices that only run in AI mode.

Additional approach types – Select the ones you want to cover with your detection scenario.

Advanced mitigation – For devices with AI mode, check **AI** to turn it on. You can use **Headlights/vehicles in scene** if the scene contains vehicles, headlights, or headlight effects such as reflections. If you use this setting, performance can sometimes be reduced in normal conditions. By default, all scenarios are supposed to contain vehicles and thus headlights. You can use **Insects/droplets on lens** to ignore triggers from rain drops or insects, and reduce false alarms.

Sensitivity – To increase the sensitivity of the system, move the slider to the right. A higher sensitivity reduces the risk of missed detections, but increases the risk of false alarms.

Target size filtering – For devices with AI mode, you can filter out objects smaller than the target size.

Duration parameters

For each scenario you create, you can set duration parameters.

Min presence in zone – Set the time that an object has to stay in a zone for the zone to be activated.

Narrow zone – If the zone is narrow and can be crossed in 1–2 seconds, there is a risk of missed alarms. You can mitigate this with the **Narrow zone** functionality. Note that it can't be combined with **Min presence in zone**.

Set up the intrusion/loitering scenario

The intrusion/loitering scenario is designed to trigger an alarm when an object enters a certain zone and remains in the zone for longer than the predefined time.

The default scenario created in the calibration step is of the type intrusion/loitering, and it uses the maximum detection zone. To use this scenario as it is, click **Accept** in the **Scenarios** tab.

To change the default scenario:

1. Go to **Scenarios > Advanced scenarios**.

2. Change the default detection zone:
   - To move existing points in the detection zone, click and drag them with the mouse.
   - To create additional points, click any of the existing segments and drag with the mouse.

3. Under **Detect**, select what type of objects to detect.

4. Under **Duration parameters**, if you don't want an object to trigger an alarm as soon as it enters the zone, set the loitering time in **Min presence in zone**.

5. If the zone is narrow and can be crossed in 1–2 seconds, and you still want alarms to trigger, select **Narrow zone**. This setting can't be combined with **Min presence in zone**. For more information, see *Duration parameters, on page 25*.

6. To upload the changes to the camera and switch back to the main view, click **Accept**.

Set up the zone–crossing scenario

The zone-crossing scenario is designed to trigger an alarm when an object passes through two detection zones in a given sequence.

Important
>   The zone-crossing scenario has the following limitation: if the object that triggers the scenario stops moving for a few seconds in the origin zone before moving on to the end zone, the scenario doesn't trigger.

Under **Duration parameters**, you can define a minimum presence time for each of the zones in the scenario. If T_A is the minimum time in the origin zone and T_B in the end zone, an alarm only triggers if the object stays longer than T_A in the origin zone and then longer than T_B in the end zone.

1. Go to **Scenarios > Advanced scenarios**.

2. Click **New** and select **Zone–crossing**.

3. Create two detection zones separated by at least one meter (3 feet 3 3/8 inches):
    –   To create a detection zone, click multiple times in the image.

    –   To finish the zone, right-click in the image.

4. To specify the forbidden crossing direction, click **Select origin** and then click one of the zones.

5. Under **Detect**, select what type of objects to detect.

6. Under **Duration parameters**, if you don't want a zone to be activated as soon as an object enters, set the **Min presence in** for one or both zones.

7. If the zone is narrow and can be crossed in 1–2 seconds, and you still want alarms to trigger, select **Narrow zone**. This setting can't be combined with **Min presence in zone**. For more information, see *Duration parameters, on page 25*.

8. To upload the changes to the camera and switch back to the main view, click **Accept**.

Set up the conditional scenario

The conditional scenario is designed to trigger an alarm when an object enters a certain zone without first passing through others.

Under **Duration parameters**, you can define a minimum presence time for each of the zones in the scenario. If T_A is the minimum time in the authorized zone and T_B in the intrusion zone, an alarm only triggers if the object:
*   stays longer than T_B in the intrusion zone without having entered the authorized zone first.

*   stays shorter than T_A in the authorized zone, then enters and stays longer than T_B in the intrusion zone.

No alarm triggers if the object:
*   doesn't enter or stays shorter than T_B in the intrusion zone.

*   stays longer than T_A in the authorized zone, then enters the intrusion zone (regardless of how long the object stays).

1. Go to **Scenarios > Advanced scenarios**.

2. Click **New** and select **Conditional**.

3. Create two or more detection zones separated by at least one meter (3 feet 3 3/8 inches):
    –   To create a detection zone, click multiple times in the image.

    –   To finish the zone, right-click in the image.

4. To specify the allowed crossing direction, click **Select intrusion zone** and then click one of the zones.

5. Under **Detect**, select what type of objects to detect.

6. Under **Duration parameters**, if you don't want a zone to be activated as soon as an object enters, set the **Min presence in** for one or both zones.

7. If the zone is narrow and can be crossed in 1–2 seconds, and you still want alarms to trigger, select **Narrow zone**. This setting can't be combined with **Min presence in zone**. For more information, see *Duration parameters, on page 25.*

8. To upload the changes to the camera and switch back to the main view, click **Accept**.

Pair the cameras - PTZ Autotracking

In the setup for AXIS Perimeter Defender PTZ Autotracking, you must pair the fixed camera and the PTZ camera with each other to make sure a moving object is tracked in an efficient way by the PTZ camera.

If you performed an automatic calibration, you can *Perform an automatic pairing, on page 27* of the two cameras. Otherwise you need to *Perform a manual pairing, on page 27.*

Perform an automatic pairing

In the pairing video, the red lines represent the person, and the orange bounding box represents the zoomed-in image of the PTZ camera.

1. In **Calibration > PTZ Pairing review**, verify the pairing videos from the two cameras:
   - check that the red lines in the two images are aligned throughout the video
   - check that the red lines always go from feet to head of the person
   - check that the person is always centered within the orange bounding box in the PTZ camera video

2. If the conditions in step 1 are fulfilled, select **Interactive pairing review**.
   If the conditions are not fulfilled, click **Manual** and follow the steps in *Perform a manual pairing, on page 27.*

3. Move the slider to navigate in the video clip. Check that:
   - the blue lines in the two images are aligned throughout the video
   - the person is always centered within the orange bounding box in the PTZ camera video

4. If there are scenes where the orange bounding box is missing:

   4.1. Activate the avatar in the fixed camera image.

   4.2. Use the slider to move back and forth in the video. Place the avatar at the person in the fixed camera view, and check that the red dot is at the feet of the person in the image from the PTZ camera.

5. If there are scenes where the automatic pairing did not add blue lines, click **Manual** and add red lines manually at the person. See *Perform a manual pairing, on page 27* for detailed instructions.

6. Click **Accept** and **Exit**.

Perform a manual pairing

When you perform a manual pairing, you add vertical red lines from feet to head of the person who walked through the surveillance scene in the calibration step. You need to add lines throughout the video, to cover the whole scene.

If you already performed an automatic pairing, the video already contains blue lines.

Remove blue and red lines that:
- don't start at the person's feet
- don't go all the way to the person's head
- don't have a corresponding line in the PTZ camera image

To remove a line, click it and press Delete.

1. Move the slider to navigate to an image in the video clip where the person is visible.

2. Add a red line at the person in the fixed camera image. Start the line at the person's feet. The line gets an ID number.

3. Add a corresponding red line at the same object in the PTZ camera image. Check that the ID number matches the one in the fixed camera image.

4. Repeat steps 1–3 until you have covered the whole scene.
   When the video clip contains a sufficient number of lines for a valid pairing:

   – the **Accept** button becomes active

   – an orange bounding box is shown in the PTZ camera image

5. Check that the person is always centered within the orange bounding box. If there are scenes where it's not, add more red lines.

6. Activate the avatar in the fixed camera image.

7. Move the slider to navigate in the video clip. Use the avatar to check that:

   – in the fixed camera image, the size of the avatar corresponds to the person's size, in different positions

   – in the PTZ camera image, the red dot is at the feet of the person

   – in the PTZ camera image, the person is always centered within the orange bounding box

8. Click **Accept**. If the button is inactive, you need to add more red lines first.

9. Click **Exit**.

Define outputs

To make AXIS Perimeter Defender output alarms when it detects an intrusion, you need to define rules for it. The system can send alarms to, for example, a VMS.

AXIS Perimeter Defender can send alarms through different interfaces.

From the application itself:

- XML or plain text alarm notifications over TCP/IP
- XML metadata streams over multipart HTTP

From the device:

- Basic free text notifications for alarms over TCP/IP
- Electrical outputs (dry or wet contacts)
- E-mail notifications
- FTP upload of alarm images

You can activate several interfaces at the same time.

For more in-depth information, see *Outputs, on page 29.*

To define rules for sending alarms from the device:

1. Go to **Outputs** and click **Configure**. The device's webpage opens in a web browser.

2. Create a new action rule.

3. From the list of triggers, select **Applications**, then **AXISPerimeterDefender** and the scenario to trigger the action.

Note
> To trigger the same action for all defined scenarios, select **ALL_SCENARIOS**.

4. From the list of actions, select the action to perform when the condition is met.

5. Click **OK**.

For more detailed information about how to create action rules, see the device's user manual.

Advanced configuration

Outputs

XML/text alarm notifications

This interface allows a TCP/IP recipient to receive a more complete and descriptive XML or text message for each alarm. With respect to the free-text interface, the XML/text interface offers the following advantages:

- A notification is sent at the beginning of the alarm, at the end of the alarm and every 10 seconds during the alarm.

- Timestamp: the start-of-alarm and end-of-alarm notifications contain a timestamp which is synchronized with the camera clock and gives the exact date and time of the events.

- Alarm type: AXIS Perimeter Defender supports several alarm types, see *Define scenarios, on page 24*. The XML/text notifications contain the information of which type of alarm has been triggered. Pay attention: the "zone crossing" scenario has type "passage" and the loitering scenario has type "presence"

- Zone(s) involved in the alarm generation; where each AXIS Perimeter Defender scenario is associated to one or more zones, the XML/text notifications include which zone is associated to the alarm (i.e., for an intrusion alarm, the intrusion zone in which a person has been detected)

With respect to the free-text interface, the XML/text interface has the following limitations:

- The message text is fixed, and there are no free-text fields.

- Only one recipient is supported per camera at a time.

The recipient of the XML/text notifications receives four types of messages:

- AXIS Perimeter Defender sends a CONNECTION_TEST message when the XML notification is configured in order to verify that the communication with the recipient works as expected.

- When AXIS Perimeter Defender triggers an alarm, it sends an ALARM_START message.

- During the alarm duration, AXIS Perimeter Defender sends several "alarm in progress" messages, one every 10 seconds. All these messages have the same GUID tag, identical to that of the ALARM_START message and ALARM_STOP messages related to the same alarm

- At the end of the alarm, AXIS Perimeter Defender sends an ALARM_STOP alarm.

For explanation of the format of these messages, both in XML and text format, see *XML and text format examples, on page 29*.

XML and text format examples

The XML format is the default format for the TCP/IP notifications. Nevertheless, if the notification size is important, a text format, generating shorter messages, can be used. In order to select the text format, the **Do not use XML for alarms parameter** must be selected in the AXIS Perimeter Defender configuration page.

Example:
A CONNECTION_TEST message in XML format looks like this example:

```
<?xml version="1.0"?><KEENEO_MESSAGE xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"        xmlns:xsd="http://www.w3.org/2001/XMLSchema"        VERSION=
"5.0.0"        ID="1"        TYPE="CONNECTION_TEST"        SENDER_IP=
"192.168.1.40"        SENDER_PORT="0">   <REFERENTIAL>45</REFERENTIAL></KEENEO_MESSAGE>
```

- VERSION is the internal version of the XML syntax and protocol.

- ID is a numeric identity for the message. ID's are not guaranteed to be unique nor progressive.

- TYPE is the type of the message, here "CONNECTION_TEST". The message type determines the sub-tags of the message (none for messages of type "CONNECTION_TEST").

- SENDER_IP is the ip address of the Axis camera sending the XML notification.

- SENDER_PORT is always zero; the camera cannot receive incoming messages.

- REFERENTIAL is the numeric ID associated to the camera

If the text format is chosen, the notification messages contain 7 fields each, separated by the "pipe" character "|". If a field can't be specified (for example, it does not make sense for that message type), it is replaced by "-".

The seven fields are, from the first to the last (in parenthesis, the corresponding XML field when the format is XML):

1. The message numeric ID ("ID" attribute of the XML "KEENEO_MESSAGE" header).
2. The IPv4 address of the camera ("SENDER_IP" attribute of the XML "KEENEO_MESSAGE" header).
3. The referential number associated to the AXIS Perimeter Defender instance ("REFERENTIAL" tag).
4. The message type ("TYPE" attribute of the XML "KEENEO_MESSAGE" header).
5. The alarm type ("TYPE" tag).
6. The name of the scenario that has triggered the alarm ("SCENARIO_NAME" tag).
7. The timestamp ("TIMESTAMP" tag). The timestamp format is the same as for the XML format.

The previous CONNECTION_TEST message in TEXT format is:

```
1|192.168.1.40|45|CONNECTION_TEST|-|-|-
```

Example:
An ALARM_START message in XML format looks like this example:

```
<?xml version="1.0"?><KEENEO_MESSAGE xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"        xmlns:xsd="http://www.w3.org/2001/XMLSchema"        VERSION=
"5.0.0"    ID="9999"        TYPE="ALARM_START"        SENDER_IP=
"192.168.1.40"       SENDER_PORT="0">   <REFERENTIAL>0</REFERENTIAL>   <TYPE>INTRUSION</
TYPE>   <SCENARIO_NAME>Intrusion-0</SCENARIO_NAME>   <EXTRA_DATA>zone=testzone</EXTRA_
DATA>   <TIMESTAMP>2014-03-01T21:24:12.114</TIMESTAMP>   <GUID>77acddf9-e0d4-402e-a497-
231aeee22788</GUID></KEENEO_MESSAGE>
```

- The message header is the same as the "CONNECTION_TEST" message.
- The message type is "ALARM_START", and has a set of sub-tags.

– REFERENTIAL is the numeric ID associated to the camera.

– TYPE is the type of the alarm triggered by AXIS Perimeter Defender, "INTRUSION" in this example. Other possible types are "PRESENCE", "PASSAGE" and "CONDITIONAL".

– SCENARIO_NAME is the name of the scenario that triggered the alarm, as defined in the configuration interface. See *Set up the intrusion/loitering scenario, on page 25*

– EXTRA_DATA carries the zone name (or list of zone names) involved with the alarm, like the intrusion zone.

– TIMESTAMP is the date and time of the alarm start, in the format YYYY-MM-DDTHH:mm:ss.zzz, where:
  – YYYY is the year on 4 digits, like 2014.
  – MM is the month number on 2 digits, like 01 for January.
  – DD is the day number on 2 digits, like 03 for the 3rd.
  – 'T' is a fixed letter
  – HH is the hour in 24-hour format, from 00 to 23
  – mm are the minutes on 2 digits, from 00 to 59
  – ss are the seconds on 2 digits, from 00 to 59
  – zzz are the milliseconds on 3 digits, from 000 to 999.
  AXIS Perimeter Defender uses the camera internal date and time for generating the alarm timestamp, thus it is important to synchronize the camera with some kind of external clock.

– GUID is a unique identifier that is constant for all messages related to the same alarm (so ALARM_START, ALARM_IN_PROGRESS and ALARM_STOP)

This is the equivalent, in text format, of the ALARM_START message:

```
9999|192.168.1.40|0|ALARM_START|INTRUSION|Intrusion-0|2014-03-01T21:24:12.114
```

Example:

An ALARM_IN_PROGRESS message in XML format looks like this example:

```
<?xml version="1.0"?><KEENEO_MESSAGE xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"        xmlns:xsd="http://www.w3.org/2001/XMLSchema"        VERSION=
"5.0.0"        ID="9999"        TYPE="ALARM_IN_PROGRESS"        SENDER_IP=
"192.168.1.40"        SENDER_PORT="0">  <REFERENTIAL>0</REFERENTIAL>  <TYPE>INTRUSION</
TYPE>  <SCENARIO_NAME>Intrusion-0</SCENARIO_NAME>  <GUID>77acddf9-e0d4-402e-a497-
231aeee22788</GUID></KEENEO_MESSAGE>
```

- The message header is the same as the "CONNECTION_TEST" and "ALARM_START" message.

- The message type is "ALARM_IN_PROGRESS", and has a set of sub-tags.

– REFERENTIAL is the numeric ID associated to the camera.

– TYPE is the type of the alarm triggered by AXIS Perimeter Defender the same of the corresponding ALARM_START.

– SCENARIO_NAME is the name of the scenario that triggered the alarm, the same of the corresponding ALARM_START.

– The GUID is the same of the corresponding ALARM_START.

The corresponding ALARM_IN_PROGRESS message in TEXT format:

```
9999|192.168.1.40|0|ALARM_IN_PROGRESS|INTRUSION|Intrusion-0|-
```

Example:

An ALARM_STOP message in XML format looks like this example:

```
<?xml version="1.0"?><KEENEO_MESSAGE xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"        xmlns:xsd="http://www.w3.org/2001/XMLSchema"        VERSION=
"5.0.0"        ID="9999"        TYPE="ALARM_STOP"        SENDER_IP=
"192.168.1.40"        SENDER_PORT="0">  <REFERENTIAL>0</REFERENTIAL>  <TYPE>INTRUSION</
TYPE>  <SCENARIO_NAME>Intrusion-0</SCENARIO_NAME>  <EXTRA_DATA>zone=testzone</EXTRA_
DATA>  <TIMESTAMP>2014-03-01T21:24:26.304</TIMESTAMP>  <GUID>77acddf9-e0d4-402e-a497-
231aeee22788</GUID></KEENEO_MESSAGE>
```

- The message header is the same as the previous messages.

- The message type is "ALARM_STOP", and has the same set of subtypes of the ALARM_START message.

The corresponding ALARM_IN_PROGRESS message in TEXT format:

```
9999|192.168.1.40|0|ALARM_STOP|INTRUSION|Intrusion-0|2014-03-01T21:24:26.304
```

The TCP/IP connection is always closed after each message. Therefore, the recipient has to keep the listening socket always open for being able to receive further notifications.

Communication errors

If the remote recipient of XML notifications is not reachable, for example because of a network disconnection, AXIS Perimeter Defender starts buffering the non-delivered alarms internally and periodically (at least every 10 seconds) tries to deliver them again. After a consecutive number of failures in delivering new messages (failures while trying to deliver again a message from the buffer does not account for that), AXIS Perimeter Defender declares the recipient as "permanently offline" and stops sending XML notifications to the recipient. The number of consecutive failures is fixed to 20, roughly corresponding to 4 or 5 intrusion alarms of an average duration of 40 seconds each. AXIS Perimeter Defender starts sending notifications to the same recipient again if one of the following events occurs:

- AXIS Perimeter Defender is restarted.

- The same value of the parameter "Alarm streaming url" is saved again.

Post-alarm time

AXIS Perimeter Defender implements the notion of "post-alarm time". This is defined as the time interval after an alarm stops, during which, if another alarm is triggered, both alarms are merged into a unique one.
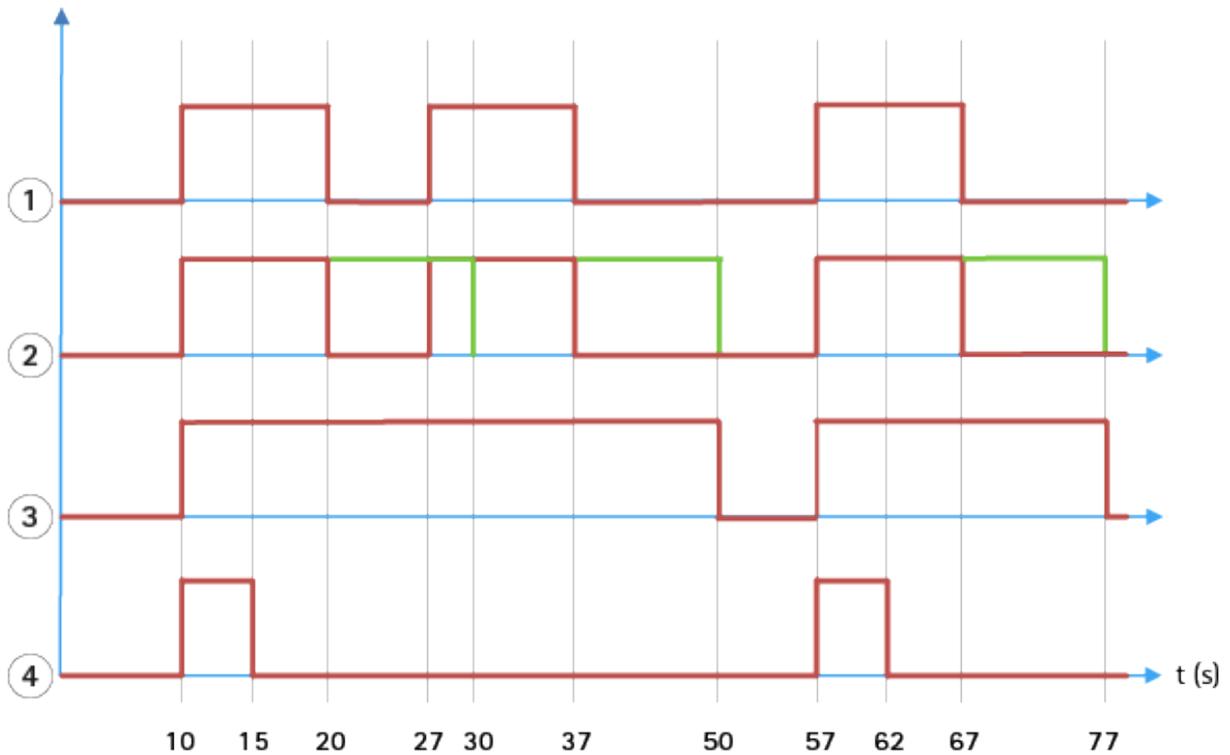
1 Three alarms triggered by AXIS Perimeter Defender at time 10, 27 and 57. Each alarm
   has a duration of 10 seconds, i.e. an intruder has taken 10 seconds to cross the intrusion
   zone.
2 A post-alarm time of 10 seconds is added.
3 Alarms using XML notifications and XML metadata.
4 Alarms using email notifications, ftp image upload, electrical contacts and basic TCP/IP
   notifications.

(2) Notice how a post-alarm time of 10 seconds (in green) increases the duration of each alarm, thus leading to the fusion (merge) of two alarms that are separated by 10 seconds or less.

(3) You can see the resulting alarm number and duration as raised by AXIS Perimeter Defender through XML notifications and XML metadata. The post-alarm time can be used for obtaining fewer longer alarms instead of several, shorter and consecutive ones.

(4) For email notifications, ftp image upload, electrical contacts, and basic TCP/IP notifications, the result of using a 10 second post-alarm time is different. These notifications only consider the alarm start, and neglect the alarm stop. Thus, there is no notion of "alarm duration" when you use these notifications, and, as a consequence, the post-alarm time does not change the duration of the notification itself. It is always fixed to the value chosen by the user when configuring the notification. So, when consecutive alarms are merged into one because of the post-alarm time, only one notification is sent. You can see that AXIS Perimeter Defender merges the first two alarms, thus sending only one notification. Therefore, email notifications, ftp image upload, electrical contacts and basic TCP/IP notifications notifies only for two of them. The graph shows a fixed duration of 5 seconds for these notifications.

How to configure the post-alarm time

1. Open AXIS Perimeter Defender Setup.

2. Go to **Outputs**.

3. Change the **Post-alarm time** setting. The default value is 7 seconds.

4. Click **Assign**.

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Metadata

Burnt-in metadata overlay

Burnt-in metadata overlay is a feature that can draw analytics detections to selected live streams directly in the camera. The detections are graphical overlays in the form of bounding boxes and trajectory lines. The streams are selected based on their resolution and, if the device has support for view areas, on a view area. The burnt-in metadata shows up both in live view and during playback of recorded material.

Burnt-in metadata overlays on selected streams

For example, you can set up the application to add overlays on all streams with resolution 640x480. In that case, only the streams with this resolution have the overlay, and the others stay unmodified.

Burnt-in metadata overlays on selected view areas

When supported, you can also indicate a view area along with the resolution. For example, you can choose to have overlays on streams fetched from view area number 3 at resolution 1280x720. In this case, only the streams matching this configuration will have the overlays, and other streams will stay unmodified including those fetched from view area 3 but at a different resolution, and those fetched at 1280x720 but not from view area 3.

Add burnt-in metadata to the video stream

Note
> This function is only available on devices with software 7.30 or later.

This example explains how to turn on burnt-in metadata overlays on all video streams with resolution 640x480. Video streams at any other resolution remain unaffected.

1. Select camera in the panel with live views.

2. Go to **Outputs > Burnt-in Metadata Overlay**.

3. Select **Enabled**.

4. In the drop-down list, select resolution 640x480.

5. Click **Apply**.

6. Make sure the metadata shows up in the live view for that resolution.

VMS integration

AXIS Perimeter Defender integrates seamlessly with the following video management systems (VMS):
- Security Center from Genetec™
- XProtect® from Milestone

For information about the VMS versions supported, see *axis.com/products/axis-perimeter-defender/support-and-documentation*

Alarms triggered by AXIS Perimeter Defender are automatically converted to events in the VMS, which in turn can trigger a wide set of actions and leverage the full power of the VMS. Simultaneously, the live metadata generated by AXIS Perimeter Defender is sent to the VMS for live display and recording. Therefore, the metadata is also available when playing the recorded video sequences in playback mode.

An automated intrusion detection system is designed to trigger alarms and provide information that helps inform the security intervention. This may include providing a prompt to a mobile device or displaying the alarm event within a VMS perhaps with the subject that created the alarm event highlighted on screen.

Standard event integration

AXIS Perimeter Defender leverages and extends the native ACAP interfaces and capabilities for sending alarms and supplementary information to external devices or VMS. Events output by AXIS Perimeter Defender can be translated into messages to the VMS, by connecting action rules to them.

The following alarm channels from the camera to the VMS are available:

- Basic free text notifications for alarms (TCP/IP)

- Electrical outputs (dry or wet contacts)

- Email notifications

- Ftp upload of alarm images

These integrations can be configured on the camera. See *Post-alarm time, on page 31*.

VMS Bridges

For the following video management systems, we provide pre-developed integration modules, referred to as "bridges":

- Milestone XProtect® 2014 and 2016 Corporate/Expert/Enterprise/Professional/Express. Enterprise/ Professional/Express editions do not support metadata (no live or playback display of metadata)

- Genetec™ Service Center 5.3 and 5.4 Pro/Enterprise/SV32/SV16

The bridges provide two integrations:

- Creating custom alarm events in the VMS, matching the events output by AXIS Perimeter Defender.

- Displaying alarm overlays, or bounding boxes, on top of live and recorded video material from (except for Milestone XProtect® Enterprise/Professional/Express editions).

You need to download and install the VMS bridges as separate applications. For more information on how to install and configure these bridges, see the user manual for the specific bridge.

Create a rule in AXIS Camera Station

This section explains how to integrate AXIS Perimeter Defender with an AXIS Camera Station event system. You'll learn how to:

- Configure an AXIS Camera Station rule to trigger when an intrusion takes place.

- Verify that the configuration is done correctly.

1. Configure and calibrate AXIS Perimeter Defender in the AXIS Perimeter Defender setup software. For help with the installation and calibration of AXIS Perimeter Defender, refer to AXIS Perimeter Defender user manual or *or product page*.

2. Add the camera to AXIS Camera Station by following the **Add Camera** wizard.

3. Configure a Device Event trigger:

    3.1. Go to **Configuration** > **Recording & Events** and open the **Advanced rules** tab.

    3.2. Create a new rule and select the **Device Event** trigger.

    3.3. Select the camera where AXIS Perimeter Defender is installed.

    3.4. In the **Event** list, select **AXISPerimeterDefender**.

    3.5. In the **Feature** list, select the name of the configured Intrusion (in this case "Intrusion-1"). If you want to trigger the rule for all the configured scenarios, select **ALL_SCENARIOS**.

    3.6. Select **Yes** if the trigger should be activated when there is an intrusion. When an intrusion is detected, the Activity window will show a status change that helps to verify if the setup is correct.

    3.7. Click **OK** and **Next** to configure the action(s).

3.8.   In the **Add Action** dialog, you can add one or several actions for the rule.
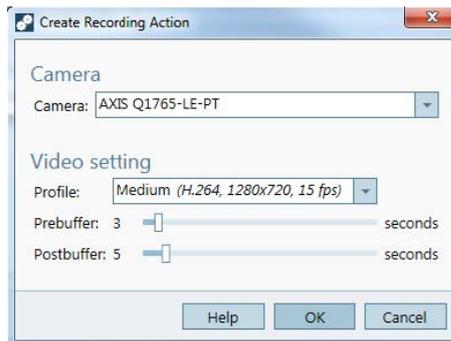
In this example we add a recording action and an alarm action.

3.9.   Click **Finish**.
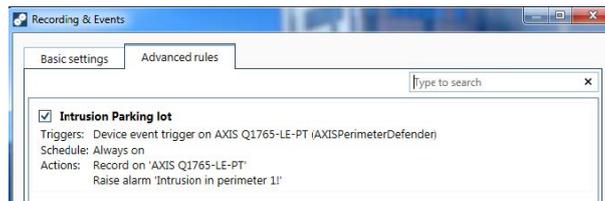
The example shows a rule that triggers two actions when an intrusion takes place.

4.   Test that your configuration works as expected by simulating an intrusion, for example by physically entering the monitored area.

Web Interface

Starting with AXIS Perimeter Defender 4.0, you can now access a web interface that allows you to configure scenarios without the desktop application installed.

To get to the web interface:

- Open a web browser.

- Enter the IP address of the device

- Go to Apps

- Go to **AXIS Perimeter Defender** in the list, and click **Open**.

Note

Calibration is not yet available in the web interface. To calibrate the camera, use the desktop application. To read more, go to *Calibrate - AXIS Perimeter Defender, on page 18*

Scenarios

Create an intrusion scenario

The intrusion scenario is designed to trigger an alarm when an object enters a defined zone and remains in the zone for longer than the set time.

To create an intrusion scenario:

1. Go to **Scenarios** in the web interface.

2. Click on **+ Create**.

3. Select **Intrusion**.

4. Click **Select this template**.

5. Set a custom descriptive name for the scenario

6. Select what type of objects that should trigger an alarm.

7. To reshape the default detection zone, drag the anchor points in any direction. Once an anchor point is moved, new anchor points will be created to further customize the shape.

8. Under **Intrusion zone**, if you don't want an object to trigger an alarm as soon as it enters the zone, set the **Minimum presence in zone**.

9. If the zone is narrow and can be crossed in 1–2 seconds, and you still want alarms to trigger, select **Narrow zone**. For more information, see *Duration parameters, on page 25*.

10. Click **Save**.

Create a zone crossing scenario

The zone crossing scenario is designed to trigger an alarm when an object moves from a predefined zone into a restricted zone.

To create a zone crossing scenario:

1. Go to **Scenarios** in the web interface.

2. Click on **+ Create**.

3. Select **Zone crossing**.

4. Click **Select this template**.

5. Set a custom descriptive name for the scenario

6. Select what type of objects that should trigger an alarm.

7. To reshape the default zones, drag the anchor points in any direction. Once an anchor point is moved, new anchor points will be created to further customize the shape.

8. Under **Zone 1**, if you don't want an object to trigger an alarm as soon as it enters the zone, set the **Minimum presence in zone**.

9. If the zone is narrow and can be crossed in 1–2 seconds, and you still want alarms to trigger, select **Narrow zone**. For more information, see *Duration parameters, on page 25*.

10. To decide which zone should be restricted, click the directional arrow next to **Restricted zone entry**. By default, **Zone 2** is the restricted zone.

11. Set the parameters for **Zone 2**.

12. Click **Save**.

Create a conditional scenario

The conditional scenario gives you the freedom to define the conditions for triggering alarms in a scene.

To create a conditional scenario:

1. Go to **Scenarios** in the web interface.

2. Click on **+ Create**.

3. Select **Conditional**.

4. Click **Select this template**.

5. Set a custom descriptive name for the scenario

6. Select what type of objects that should trigger an alarm.

7. If you need more zones than the default, click **+ Add zone**

8. Choose the zone that is the intrusion zone in the drop-down menu under **Intrusion Zone**. Arrows indicate the different zones relation to the chosen intrusion zone.

9. To reshape the default zones, drag the anchor points in any direction. Once an anchor point is moved, new anchor points will be created to further customize the shape.

10. If you don't want an object to trigger an alarm as soon as it enters the zone, set the **Minimum presence in zone**.

11. If the zone is narrow and can be crossed in 1–2 seconds, and you still want alarms to trigger, select **Narrow zone**. For more information, see *Duration parameters, on page 25*.

12. Click **Save**.

Edit scenarios

To edit a scenario you've created in the web interface or in the desktop app:

1. Go to **Scenarios** in the web interface.

2. Click on **Edit** on the scenario you'd like to edit..

3. Click on **Save** once you're done.

Rename scenarios

To change the name of multiple scenarios at once:

1. Select the scenarios, you'd like to rename

2. Click on **Rename** that is now available in the menu.

3. Change the names to your liking.

4. Click **Save**.

Delete scenarios

To delete multiple scenarios at once:

1. Select the scenarios, you'd like to delete

2. Click on **Delete** that is now available in the menu.

3. To confirm, click **Delete**.

Settings

The web interface has a built in help panel with information about the various settings on each page. Click the help icon (?) to access the panel.

Troubleshooting

For all functionalities to work as expected, it is mandatory to configure the following Axis parameters:

- Network / TCP-IP / Basic / Default router
- Network / TCP-IP / Advanced / Domain name
- Network / TCP-IP / Primary DNS Server
- Network / TCP-IP / Secondary DNS Server
- Network / TCP-IP / NTP server address
- Network / TCP-IP / SMTP (email)
- System Options / Date & Time / Time Zone
- System Options / Date & Time / Synchronize with NTP server

Update to the latest version

To take advantage of latest improvements without having to re-calibrate and redefine scenarios, we recommend that you upgrade to the latest version of AXIS Perimeter Defender.

1. Download and install the latest version of AXIS Perimeter Defender.
2. Click **Install**. AXIS Perimeter Defender Setup automatically performs the necessary steps for completing the installation:
- Back-up the existing calibration, scenarios, parameters and license.
- Install new version.
- Restore license.
- Restore calibration and scenarios.
- Restore parameters.
- If an application was running it is restarted.

Upgrade the camera software

Note

Before upgrading the camera software, save all AXIS Perimeter Defender settings. Upgrading the software removes the application and its settings from the camera. If settings are saved, they can be restored using AXIS Perimeter Defender Setup.

1. Use AXIS Perimeter Defender Setup to save the site configuration.
2. Upgrade the camera software. For instructions, see the camera's User Manual.
3. Start AXIS Perimeter Defender Setup.
4. Use the load site option to automatically load the saved site configuration for each upgraded camera.

Installation troubleshooting

Problem	Possible reason	Solution
There is a Windows® message saying it is impossible to install the software.	The operating system on the laptop or PC is not compatible.	Verify the Windows® operating system matches that specified in the requirements.
There is a Windows® message saying the installation was incorrect.	Windows® Compatibility Assistant has detected a possible problem with the installation.	Confirm that the installation is correct anyway and proceed.

Problem	Possible reason	Solution
Installation fails during installation of XVID.	Installation of XVID fails because of old partial installation of XVID present on computer.	Delete the XVID folder in C:\Program Files (x86) and try installing again.
The installer package suddenly crashes after the EULA display. There is a Windows® error message telling that the application exited in an unusual way. It is impossible to close the installer.	A known problem in the installers leads to an application crash under some circumstances.	Open task manager and kill all "msiexec.exe" processes. Then kill the installer process and restart the installer.

Configuration troubleshooting

Problem	Possible reason	Solution
Problems with opening AXIS Perimeter Defender.	You do not have sufficient Windows® user rights.	Make sure you have administrator rights.
The search functionality does not find my cameras.	Firewall	Firewalls and antivirus software can sometimes block camera discovery. If required, configure the firewall to allow network traffic to and from AXIS Perimeter Defender. If this does not solve the problem, configure the firewall to allow the following ports: UDP port 5353 and TCP port 80.
	IP address problems	Any device in a network must have a unique IP address to be able to communicate with other devices. When using AXIS Perimeter Defender, it is recommended to use fixed IP addresses for the cameras. Make sure that every IP device on the network has its own IP address and does not reuse an already taken IP address.
	The camera is not available from the user computer.	In a browser, go to the IP address of the camera to confirm whether it is available or not. If you cannot reach it, then the camera has not been correctly installed on the network or the computer does not have access to the camera.
It is not possible to add a camera.	Camera connection parameters, for example IP address, password or HTTP port, are incorrect.	Verify the parameters entered are correct and repeat.
	The camera cannot be seen from the user's computer.	In a browser, go to the IP address of the camera to confirm whether it is available or not. If you cannot reach it, then the camera has not been correctly installed on the network or the computer does not have access to the network which the camera is on.

Problem	Possible reason	Solution
Loss of video streams in the AXIS Perimeter Defender Setup.	Video Source is no longer available.	The video source has been interrupted and has not refreshed on the display.
	Use a browser to check if the camera is available.	Click the tile where the stream should be and resize the interface and the stream should come back.
The automatic calibration does not work or yields bad results.	Prerequisites are not met.	Make sure the mounting requirements are met. See *Mount the camera, on page 12*.
	The camera has a roll.	It is not possible to calibrate camera having a roll.
	Slow connection to camera not configured as remote.	Connect camera as remote device to lower bandwidth requirements.
	There are other moving objects in the scene used for the automatic calibration such as cars, trees or other persons.	Repeat the auto-calibration, or calibrate the device manually.
	The field of view is cluttered making the person walking in front of the camera partially hidden a lot of the time.	Calibrate the device manually.
	The field of view is small like entrances.	Calibrate the device manually.
	The capture video was not properly recorded because of insufficient disk space.	Check that there is adequate disk space and that the application has permission to save the video recording on the computer where the AXIS Perimeter Defender interface is running.

Operation troubleshooting

Problem	Possible reason	Solution
The application does not run even though the configuration is OK.	The camera software is not up-to-date.	Make sure you have the latest software for the camera.
The overlay is not displayed in AXIS Perimeter Defender Setup even though the analysis is running.	The application is blocked after a start or stop operation or an upgrade of the AXIS Perimeter Defender package.	Restart the camera.
	A firewall is blocking the connection to the camera metadata listening port.	Configure the firewall in order to allow the configuration interface to connect to the metadata listening port on the camera.
	An antivirus program is blocking the reception of the overlay.	Configure the anti-virus in order to allow the overlay to be received.

No alarms are triggered in the AXIS Perimeter Defender setup on the configuration computer even though the analysis is running and the overlay is visible.	Although the target is in the scene it's not matching a conditional scenario, for example not moving from one zone to another in the zone crossing scenario.	Make sure the scenario is correctly specified, including conditions.
	Poor detection.	Make sure the mounting requirements are met. See *Mount the camera, on page 12*. Also make sure that the calibration is precise enough and that the sensitivity is high enough.

Performance troubleshooting

Problem	Possible reason	Solution
OSD and analysis keep switching on and off.	The CPU charge on the camera is too high.	Possible solutions: • Make sure camera streams are not visualized unnecessarily, as each instance increases the load on the CPU. • If recording on in-built motion detection is activated, try decreasing the recording quality to free up CPU capacity. • Deactivate recording on motion detection and make sure motion detection is deactivated.
The displayed video frame rate is very low.	Too many video stream visualizations may cause the frame rate to drop below the default 8 fps.	Make sure camera streams are not visualized unnecessarily, as each instance increases the load on the CPU.
A target enters the sterile zone and triggers multiple alerts.	The post-alarm duration is too short.	Adjust the post-alarm duration. Go to AXIS Perimeter Defender Setup > **Outputs**.
A potential target enters the sterile zone but does not raise an alert, resulting in a missed detection.	The contrast of the object against the background is too low.	Make sure the mounting requirements are met. See *Mount the camera, on page 12*.
	Inadequate scene lighting or the camera's low-light performance is insufficient.	Make sure the mounting requirements are met. See *Mount the camera, on page 12*.
	AXIS Perimeter Defender has the sensitivity set too low.	Increase the sensitivity in the global scenario parameters.
	The camera has moved, rendering the calibration incorrect.	Redo the calibration.
	The calibration is not precise enough.	Verify the calibration of the camera. Go to AXIS Perimeter Defender Setup.

Problem	Possible reason	Solution
	Although the target is in the scene, it does not match a conditional scenario. For example, in the zone crossing scenario the object does not move from one zone to another.	Make sure the scenario is correctly specified, including its conditions.
The target is detected but is incorrectly classified (person as vehicle or vehicle as person).	The camera height, positioning or orientation is incorrect.	Make sure the mounting requirements are met. See *Mount the camera, on page 12*.
	The camera is too far from the zone.	Make sure the mounting requirements are met. See *Mount the camera, on page 12*.
	Calibration is not precise enough.	Verify the calibration of the camera. Go to AXIS Perimeter Defender Setup.
AXIS Perimeter Defender generates an alarm when there is not an intrusion into the sterile zone.	The sensitivity of the analysis is too high.	Decrease the sensitivity. Go to AXIS Perimeter Defender Setup.
	The calibration is not precise enough.	Verify the calibration of the camera. Go to AXIS Perimeter Defender Setup.
	The camera has moved rendering the calibration incorrect.	Redo the calibration.
	Wrong camera height, positioning or orientation.	Make sure the mounting requirements are met. See *Mount the camera, on page 12*.
	The camera is moving, swaying or vibrating.	Make the camera installation more stable.
	Vegetation, flags, or other moving objects close to the camera.	Remove the offending items from the camera's field of view. Objects that are constantly in the scene but not close to the camera are ignored by AXIS Perimeter Defender.
	Insects on or near the camera lens.	Deter insects from encroaching on or near the camera lens.

About this manual

This manual is intended for administrators and users of AXIS Perimeter Defender. It includes instructions for using and managing the product on your network. Previous experience of networking of use when using this product.

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