AXIS Q1686-DLE Radar-Video Fusion Camera

User manual

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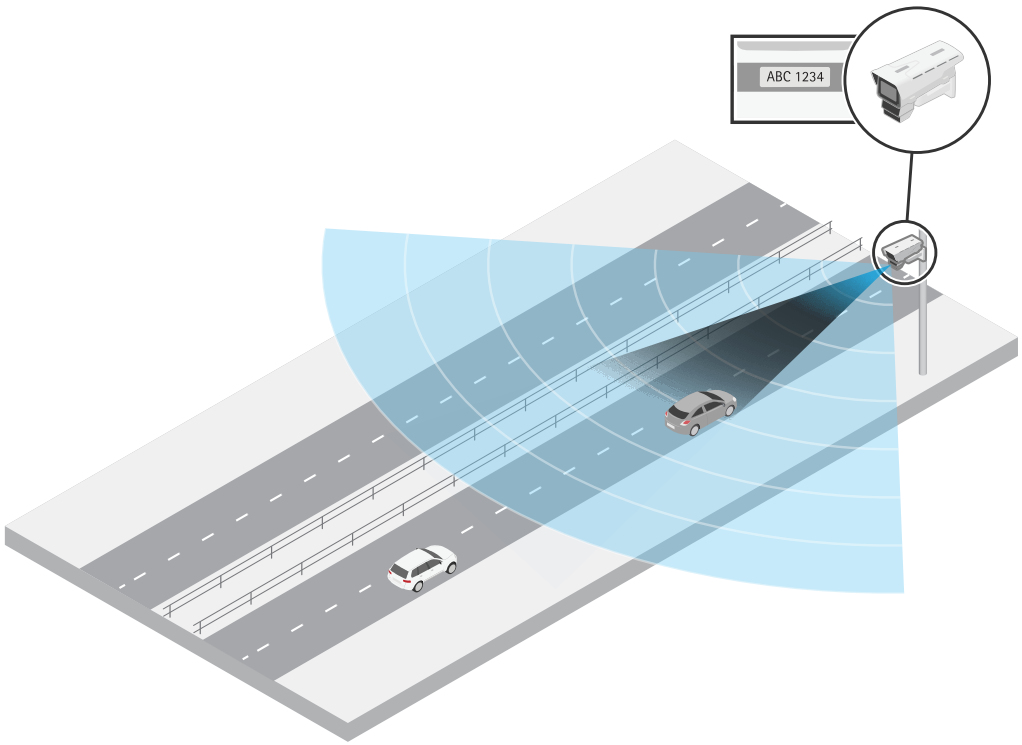
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Solution overview

A radar-video fusion camera is a visual camera with a fully integrated radar module. As such, this camera can use the radar to measure the speed of approaching or departing vehicles, and the video to capture license plates.

Use AXIS Q1686-DLE with an optional license plate capture application, like *AXIS License Plate Verifier*, or with a third-party solution, to process the images and speed provided by the camera.



AXIS Q1686-DLE is mounted on a pole on the side of a highway, and measures the speed and captures the license plates of approaching vehicles.

Radar-video fusion

Each technology in AXIS Q1686-DLE – radar, video, and optional license plate capture software – generates metadata on its own. The metadata includes information like speed, object class, direction, and license plate information. What's special about this device is that it fuses the metadata, which means it connects the speed and license plate of the same vehicle.

Note

AXIS Q1686-DLE produces the fused metadata, which needs to be processed by a video management software (VMS) or other platform. The VMS requests the metadata through the RTSP metadata stream and can use the data to trigger actions or log statistics.

The fused metadata is not available in the web interface of the device.

Installation

This video shows an example of how to install a radar-video fusion camera.

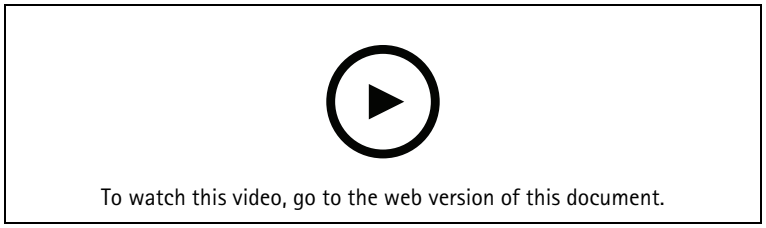
For complete instructions on all installation scenarios as well as important safety information, see the installation guide on *axis.com/products/axis-q1686-dle/support*



Note: The optical unit of the camera in the video is not identical with the one in AXIS Q1686-DLE.

Preview mode

Preview mode is ideal for installers when fine tuning the camera view during the installation. No login is required to access the camera view in preview mode. It is available only in factory defaulted state for a limited time from powering up the device.



This video demonstrates how to use preview mode.

Considerations

Where to install the product

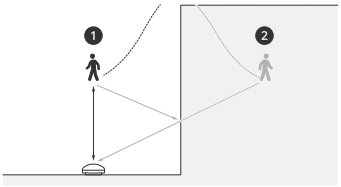
Mount the product appropriately to get the best video and radar coverage. Consider the following when you mount a radar-video fusion camera that is going to be used for license plate capture:

Center or side mounted

You can mount the camera on a gantry above the road, or on a sturdy pole on the side of a road. The ability to capture license plates and measure the speed of vehicles is affected by factors like the mounting height of the device, its position, the zoom of the camera, and the speed of approaching or departing vehicles. For more information about possible mounting scenarios, see *Installation examples, on page 10*.

Environment

Environmental aspects can affect the performance of the video and the radar. Direct sunlight can distort the image and affect the camera's ability to capture license plates. Solid and metal objects, such as road signs, trees or large bushes, can affect the radar by creating blind spots (radar shadow) behind the object. Metal objects in the field of detection, such as containers or trams, can cause reflections that affect the radar's ability to perform classifications, which can lead to ghost tracks and false alarms in the radar stream.



1 Actual detection

2 Reflected detection (ghost track)

Radar coexistence

If you mount more than eight radars or radar-video fusion cameras operating on the 60 GHz frequency band close together, they may interfere with each other, which can affect the radar's performance.

License plate capture software

AXIS Q1686-DLE doesn't include any license plate capture software. However, the device is built on an open platform, which makes it possible to use the device with third-party solutions on the edge or server side.

You can use AXIS Q1686-DLE with the edge application *AXIS License Plate Verifier*. The combination has been thoroughly tested and produces metadata that connects the speed and direction of a vehicle with its license plate. For recommendations on how to mount the device when you're going to use it with AXIS License Plate Verifier, see *Mounting recommendations with AXIS License Plate Verifier, on page 13*.

For information about third-party options for license plate capture, see *axis.com/support/tools/technology-partner-finder*. Contact your preferred supplier for recommendations on how to use the software.

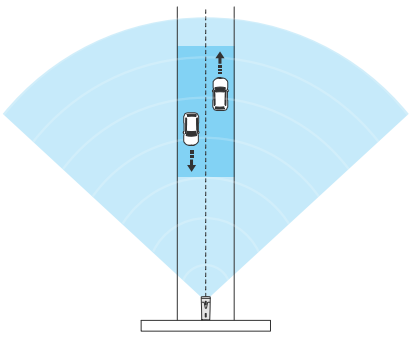
Detection ranges

The radar in AXIS Q1686-DLE has a horizontal field of detection of 95°. The detection range is the distance within which an object can be detected, tracked and trigger an alarm. It's measured from a near detection limit (how close to the device a detection can be made) to a far detection limit (how far from the device a detection can be made). The detection range is affected by different factors, for example:

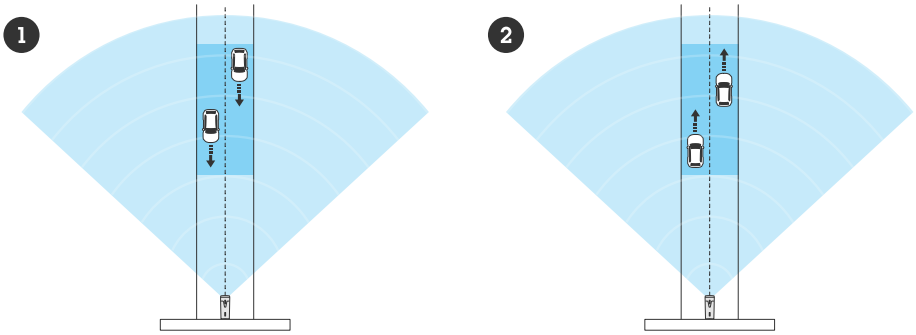
- the device's mounting height and tilt angle
- the moving object's type, size, and speed
- the scene
- the radar profile

There are three radar profiles available in this device:

Two-directional road monitoring – Default profile. Use this profile to track vehicles moving in both directions at up to **200 km/h (125 mph)**. Speed accuracy: ±2 km/h (1.25 mph).



One-directional road monitoring – Use this profile to track oncoming traffic (1) at up to **360 km/h (224 mph)**, or departing traffic (2) at up to **280 km/h (174 mph)**. Speed accuracy: ±3 km/h (1.86 mph).



Area monitoring – Use this profile to track humans, vehicles, and unknown objects moving at up to **55 km/h (34 mph)**. Speed accuracy: ±2 km/h (1.25 mph).

Note

- Enter the mounting height in the device's web interface.
- To change the radar profile, go to **Radar > Settings > Detection**.

For information about the radar's detection range when used for road monitoring, see *Road detection range, on page 8*.

For information about the radar's detection range when used for area monitoring, see *Area detection range, on page 8*.

Road detection range

The radar's road monitoring profiles are optimized for detecting and tracking vehicles. We recommend them when you use the device for speed measurement. When you use the device for license plate capture, we recommend the two-directional road monitoring profile.

When mounted at an optimal installation height, the detection ranges are:

- **25–100 m (82–328 ft)** for vehicles moving at 50 km/h (31 mph).
- **40–80 m (131–262 ft)** for vehicles moving at 100 km/h (62 mph).
- **50–70 m (164–230 ft)** for vehicles moving at 200 km/h (125 mph).
- **60–70 m (197–230 ft)** for vehicles moving at 280 km/h (174 mph).
- **30–40 m (98–131 ft)** for oncoming vehicles moving at 360 km/h (224 mph).

Note

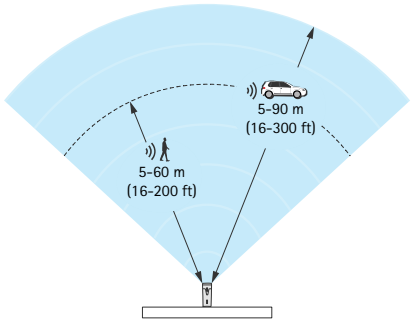
To minimize the risk of missed detections of vehicles travelling at high speeds, set up a radar scenario that triggers on the object types **Vehicle** and **Unknown**. For more information about how to set up a radar scenario, see *Add scenarios, on page 26*.

Area detection range

The area monitoring profile is optimized for detecting and tracking humans, but it also allows you to track vehicles and other slow-moving objects.

When mounted at an optimal installation height, the detection ranges are:

- **5–60 m (16–200 ft)** for humans.
- **5–90 m (16–300 ft)** for vehicles.



Detection ranges for humans and vehicles with the area monitoring profile.

The radar detection range was measured under these conditions:

- The range was measured along the ground.
- The object was a person with a height of 170 cm (5 ft 7 in).
- The person was walking straight in front of the radar.
- The values were measured when the person entered the detection zone.
- The radar sensitivity was set to **Medium**.

Mounting height	15° tilt	20° tilt	25° tilt	30° tilt	35° tilt	40° tilt	45° tilt
3.5 m (11 ft)	6.0–60+ m (19–196+ ft)	5.0–60+ m (16–196+ ft)	4.0–60+ m (13–196+ ft)	4.0–60 m (13–196 ft)	4.0–55 m (13– 180 ft)	4.0–40 m (13–131 ft)	4.0–30 m (13–98 ft)
4.5 m (14 ft)	6.0–60+ m (19–196+ ft)	6.0–60+ m (19–196+ ft)	5.0–60+ m (16–196+ ft)	4.0–60+ m (13–96+ ft)	4.0–60 m (13–196 ft)	4.0–45 m (13–147 ft)	4.0–40 m (13–131 ft)
6 m (19 ft)	10–60+ m (32–196+ ft)	9.0–60+ m (29–196+ ft)	7.0–60+ m (22–196+ ft)	6.0–60+ m (19–196+ ft)	6.0–60 m (19–196 ft)	5.0–55 m (16–180 ft)	5.0–55 m (16–180 ft)
8 m (26 ft)	16–60 m (52–196 ft)	14–60 m (45–196 ft)	10–60 m (32–196 ft)	8.0–60+ m (26–196+ ft)	8.0–60+ m (26–196+ ft)	7.0–60 m (22–196 ft)	7.0–60 m (22–196 ft)
10 m (32 ft)	21–60 m (68–196 ft)	19–60 m (62–196 ft)	14–60 m (45–196 ft)	12–60+ m (39–196+ ft)	10–60+ m (32–196+ ft)	9.0–60 m (29–196 ft)	9.0–60 m (29–196 ft)
12 m (39 ft)	25–60 m (82–196 ft)	23–60 m (75–196 ft)	19–60 m (62–196 ft)	16–60+ m (52–196+ ft)	13–60+ m (42–196+ ft)	11–60 m (36–196 ft)	11–55 m (36–180 ft)

Note

- Enter the mounting height in the web interface when you calibrate the radar.
- The detection range is affected by the scene, the device's tilt angle, and the moving object's type and size.
- Setting the radar sensitivity to **Low** will decrease the detection range by 20% while setting it to **High** will increase the detection range by 20%.
- In installations where you expect small animals to appear outside the fusion zone, but still in the detection zone of the radar, you can minimize the false alarms by setting the radar sensitivity to **Low**. This will however reduce the detection range.

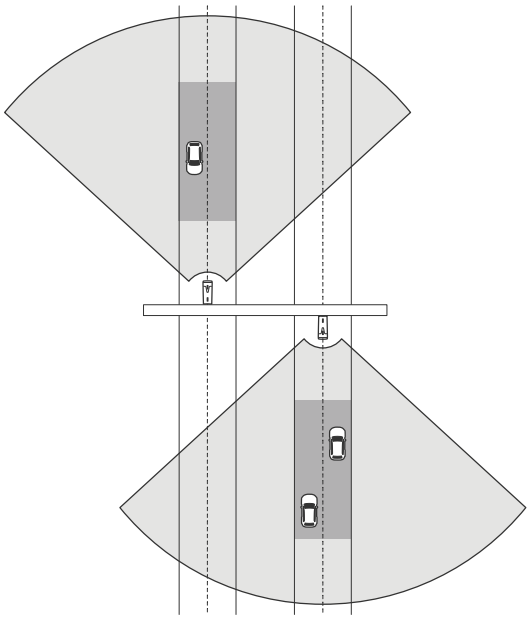
Installation examples and use cases

Installation examples

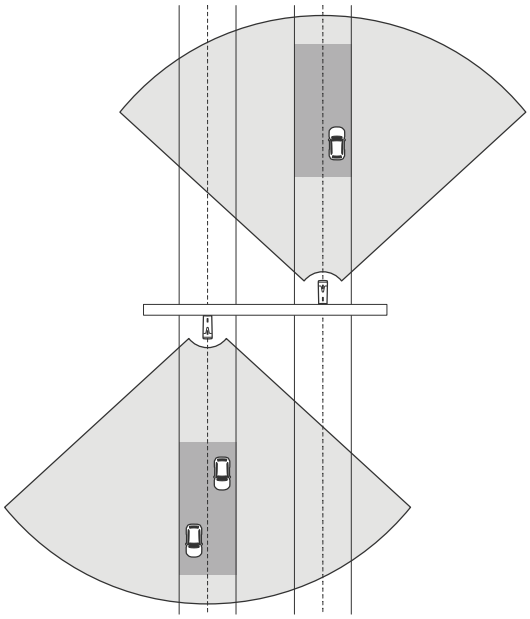
Center mounted

You can mount the radar-video fusion camera on a gantry above the road. This is the recommended placement if you want to measure the speed and capture license plates in two adjacent lanes.

Place the camera above the vehicles to view the license plates head on, and make sure to zoom in so that the lane, or lanes, where you intend to capture license plates cover the image.



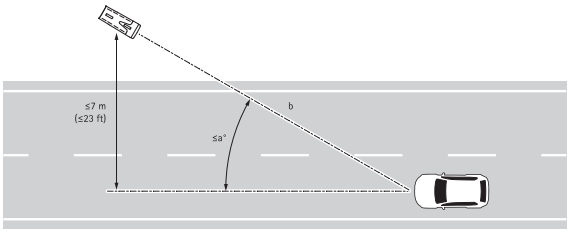
The same type of installation is possible if you want to capture license plates and the speed of vehicles that drive away from the radar-video fusion camera, instead of driving towards it.



Side mounted

You can mount the radar-video fusion camera on a sturdy pole on the side of the road. Make sure to zoom in so that the lane, or lanes, where you intend to capture license plates cover the image.

If you intend to capture license plates in two lanes in this type of installation, the **lateral distance** between the camera and the centre of the farthest lane should be max 7 m (23 ft).



For information about the **pan angle (a)** and **capture distance (b)**, as well as recommendations about how to mount the device when using AXIS License Plate Verifier, see *Mounting recommendations with AXIS License Plate Verifier, on page 13*.

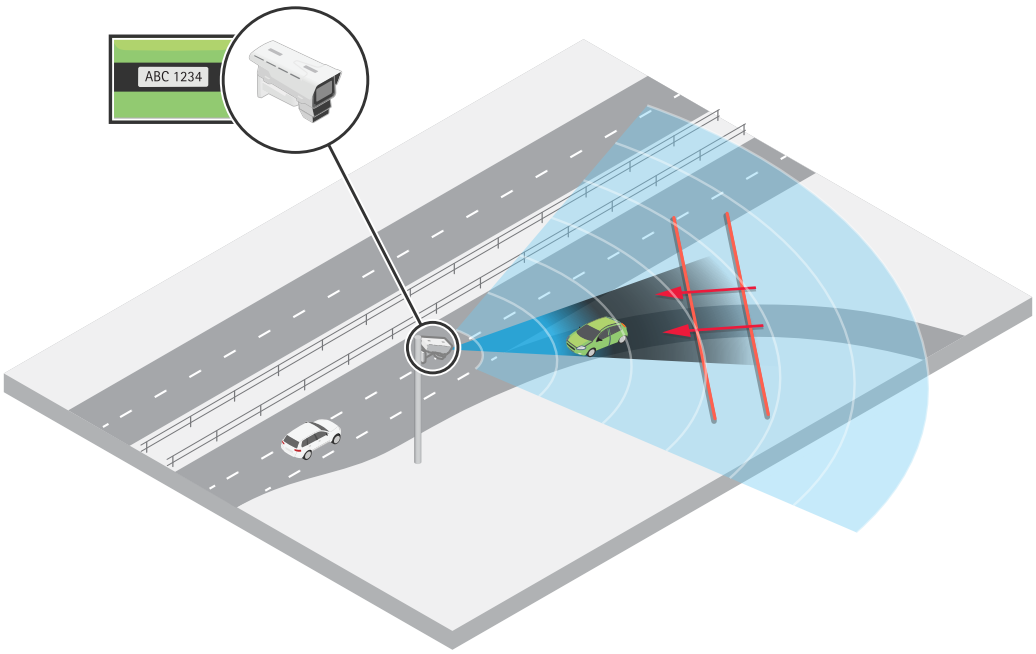
For information about license plate capture in general, see the white paper *License plate capture*.

Road monitoring use cases

Wrong-way detection

To capture the speed and license plates of vehicles driving in the wrong direction on a highway ramp, traffic control uses AXIS Q1686-DLE with AXIS License Plate Verifier installed.

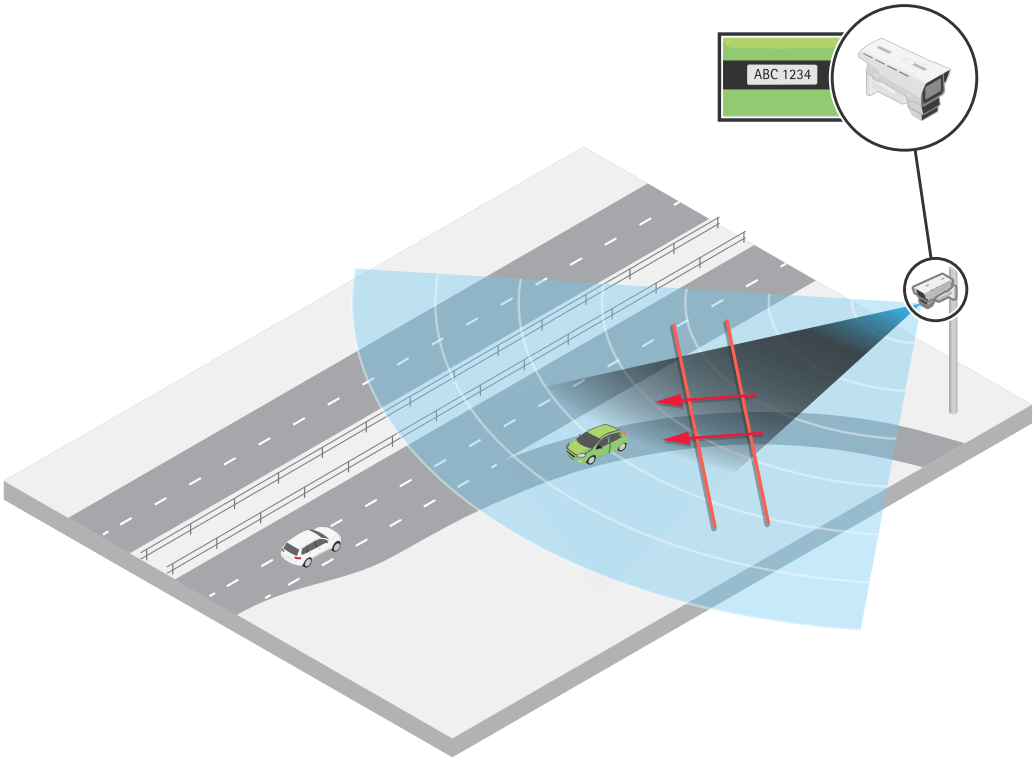
They mount the camera on a pole facing the ramp according to *Mounting recommendations with AXIS License Plate Verifier, on page 13*. For reliable detections, they set up a line crossing scenario in the radar pages of the device's web interface and configure it so that a vehicle must cross two virtual lines to trigger an alarm. In the radar scenario, they position the two lines across the ramp and specify the driving direction and speed the radar should trigger on.



Wrong-way detection of approaching vehicles

With this configuration, the radar detects vehicles and their speed when driving in the wrong direction. At the same time, the camera can provide visual identification and capture the license plates of the vehicles. With this setup it's possible to create rules for events, for example to trigger a recording when the vehicle crosses the lines, or trigger external lights that can warn the driver. Additionally, the license plate information can be processed on the server side.

The same setup is possible for capturing rear license plates. The radar measures the speed of departing vehicles while the camera captures the rear license plates.



Wrong-way detection of departing vehicles

For an example of how to create a rule that triggers a recording, see *Trigger a recording if a vehicle drives in the wrong direction, on page 32*.

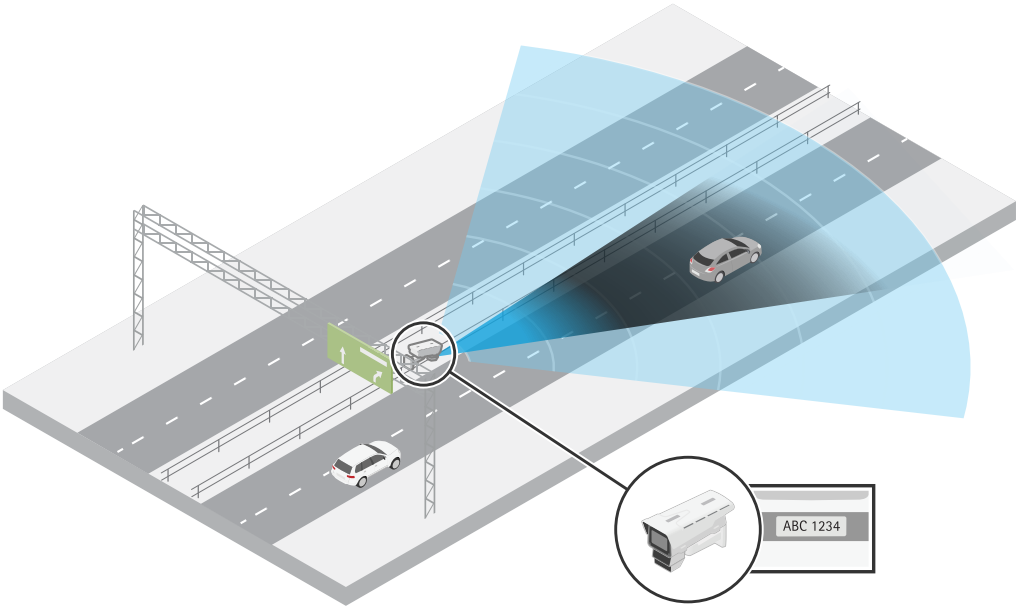
Speed violation detection

To detect speed violators on a highway, traffic control uses AXIS Q1686-DLE with AXIS License Plate Verifier. With this setup, they can capture the license plates and measure the speed of vehicles travelling in up to 200 km/h (125 mph) in both directions. For vehicles moving at higher speeds, they need to select the correct road monitoring profile to be able to alert on vehicles that either approach the device, or drive away from it.

Note

To capture license plates of vehicles moving at 200–360 km/h (125–224 mph), use server-based license plate capture analytics.

They mount the camera on a gantry to capture the license plates and measure the speed of departing vehicles. They follow the recommendations in *Mounting recommendations with AXIS License Plate Verifier, on page 13* and configure the camera according to the instructions in *Optimize the device for speed measurement and license plate capture, on page 18*. To process the speed and license plate metadata, they use a video management system (VMS).



Speed violation detection of departing vehicles

Mounting recommendations with AXIS License Plate Verifier

AXIS Q1686-DLE has been thoroughly tested with the application *AXIS License Plate Verifier*. The mounting recommendations in the following tables are based on the combined performance of the camera, radar and the application.

Center mounted

This table shows the recommendations for a device that is mounted on a gantry above the road where there is no lateral distance between the camera and the road.

Speed	Lanes	Mounting height	Capture distance	Tilt angle	Direction
Up to 80 km/h (50 mph)	2	6 m (19.7 ft)	25 m (82 ft)	13°	Oncoming or departing
	2	8 m (26.2 ft)	25 m (82 ft)	18°	Oncoming or departing
Up to 104 km/h (65 mph)	2	8 m (26.2 ft)	50 m (164 ft)	9°	Oncoming or departing
Up to 125 km/h (78 mph)	2	6 m (19.7 ft)	50 m (164 ft)	7°	Oncoming or departing
Up to 160 km/h (99 mph)	2	8 m (26.2 ft)	40 m (131 ft)	11°	Oncoming or departing
Up to 200 km/h (124 mph)	2	6 m (19.7 ft)	40 m (131 ft)	9°	Oncoming or departing

Up to 280 km/h (174 mph) 1) 2)	2	6–8 m (19.7–26.2 ft)	60 m (197 ft)	6°	Departing
Up to 360 km/h (224 mph) 1)	2	6–8 m (19.7–26.2 ft)	30 m (98 ft)	12°	Oncoming

1) Server-based analytics required to capture license plates.

2) External IR required.

Side mounted

Important

When using AXIS License Plate Verifier, side mounted is only suitable with the two-directional road monitoring profile and for vehicles traveling at up to 140 km/h (87 mph).

This table shows the recommendations for a device that is mounted on a pole on the side of the road where the lateral distance from the camera to the centre of the farthest lane on the road is max 7 m (23 ft).

Speed	Lanes	Mounting height	Capture distance	Tilt angle	Pan angle
Up to 50 km/h (31 mph)	1	2.5 m (8.2 ft)	25 m (82 ft)	6°	16°
	1	4 m (13.1 ft)	25 m (82 ft)	9°	16°
	2	6 m (19.7 ft)	25 m (82 ft)	13°	16°
	2	8 m (26.2 ft)	25 m (82 ft)	18°	16°
Up to 80 km/h (50 mph)	1	2.5 m (8.2 ft)	40 m (131 ft)	4°	10°
	1	4 m (13.1 ft)	40 m (131 ft)	6°	10°
Up to 104 km/h (65 mph)	2	8 m (26.2 ft)	50 m (164 ft)	9°	8°
Up to 125 km/h (78 mph)	2	6 m (19.7 ft)	50 m (164 ft)	7°	8°
Up to 140 km/h (87 mph)	2	6 m (19.7 ft)	40 m (131 ft)	9°	10°
	2	8 m (26.2 ft)	40 m (131 ft)	9°	10°

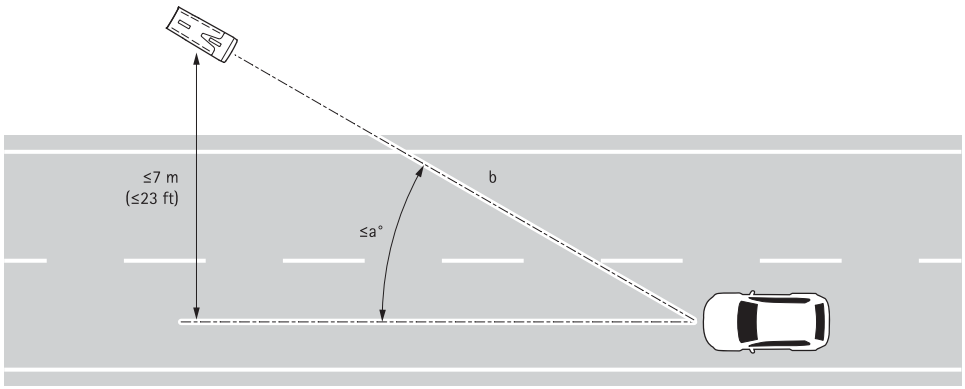
To learn more about the table parameters, see *Definitions, on page 14*.

For information about how to configure the device so it can measure the speed of passing vehicles and capture license plates, see *Optimize the device for speed measurement and license plate capture, on page 18*.

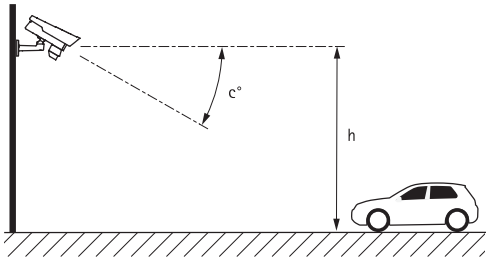
Definitions

- **Lateral distance**: The distance between the camera and the centre of the lane you monitor. If you monitor more than one lane, it's the distance to the centre of the farthest lane.
- **Mounting height**: The distance from the ground up to the optics in the device. Measure and validate the mounting height during installation. For more information, see *Validate the mounting height and tilt, on page 19*.
- **Tilt angle**: The downward tilt angle of the device. Use the web interface to find out the tilt angle. For more information, see *Show a text overlay with the tilt angle of the radar, on page 28*.

- **Pan angle**: The horizontal angle for side mounted devices when directed at the point of the road where you expect to capture license plates.
- **Capture distance**: The distance from the device to the point on the road where you expect to capture license plates
- **Speed**: The maximum speed at which the device can capture license plates and at the same time measure the speed of passing vehicles.



For side mounted cameras, the recommended maximum lateral distance to the farthest lane on the road is 7 m (23 ft), as shown in the illustration. The illustration also shows the pan angle **(a)** and the capture distance **(b)**.



The illustration shows the downward tilt angle **(c)** of the device, and the mounting height **(h)** measured from the ground up to the device.

Get started

Find the device on the network

To find Axis devices on the network and assign them IP addresses in Windows®, use AXIS IP Utility or AXIS Device Manager. Both applications are free and can be downloaded from *axis.com/support*.

For more information about how to find and assign IP addresses, go to *How to assign an IP address and access your device*.

Browser support

You can use the device with the following browsers:

	Chrome™	Edge™	Firefox®	Safari®
Windows®	✓	✓	*	*
macOS®	✓	✓	*	*
Linux®	✓	✓	*	*
Other operating systems	*	*	*	*

✓: Recommended

*: Supported with limitations

Open the device's web interface

1. Open a browser and type the IP address or host name of the Axis device.
   If you don't know the IP address, use AXIS IP Utility or AXIS Device Manager to find the device on the network.
2. Type the username and password. If you access the device for the first time, you must create an administrator account. See *Create an administrator account, on page 16*.

For descriptions of all features and settings in the web interface of devices with AXIS OS, see *AXIS OS web interface help*.

Create an administrator account

The first time you log in to your device, you must create an administrator account.

1. Enter an account.
2. Enter a password. See *Secure passwords, on page 17*.
3. Re-enter the password.
4. Accept the license agreement.
5. Click **Add account**.

Important

The device has no default account. If you lose the password for your administrator account, you must reset the device. See *Reset to factory default settings, on page 48*.

Secure passwords

Important

Use HTTPS (which is enabled by default) to set your password or other sensitive configurations over the network. HTTPS enables secure and encrypted network connections, thereby protecting sensitive data, such as passwords.

The device password is the primary protection for your data and services. Axis devices do not impose a password policy as they may be used in various types of installations.

To protect your data we strongly recommend that you:

- Use a password with at least 8 characters, preferably created by a password generator.
- Don't expose the password.
- Change the password at a recurring interval, at least once a year.

Make sure that no one has tampered with the device software

To make sure that the device has its original AXIS OS, or to take full control of the device after a security attack:

1. Reset to factory default settings. See *Reset to factory default settings, on page 48*.
   After the reset, secure boot guarantees the state of the device.
2. Configure and install the device.

Web interface overview

This video gives you an overview of the device's web interface.



Axis device web interface

Configure your device

Optimize the device for speed measurement and license plate capture

This radar-video fusion camera is factory-calibrated so that the camera and radar module are perfectly aligned.

Note

Do not move or remove the lens, optical unit or radar module since this will undo the calibration and alignment.

To optimize the device for vehicle detection, speed measurement, and license plate capture, follow these steps:

1. *Set the mounting height in the radar, on page 18*
2. *Run the traffic assistant, on page 19*
3. *Aim and tilt the device, on page 18*
4. *Validate the mounting height and tilt, on page 19*
5. *Optimize the image for license plate capture, on page 19*
6. *Set up a license plate capture solution, on page 20*



Set the mounting height in the radar

Set the device's mounting height in the radar's web interface. This helps the radar detect and measure the speed of passing objects correctly.

Measure the height from the ground up to the device as accurately as possible. If the ground is uneven, measure from the average ground elevation instead of from a single point.

1. Go to **Radar > Settings > General**.
2. Set the height under **Mounting height**.

Aim and tilt the device

Aim and tilt the device towards the area where you intend to capture license plates.

Note

This procedure requires physical access to the device.

1. If you're using the device with AXIS License Plate Verifier, check the tables in *Mounting recommendations with AXIS License Plate Verifier, on page 13* for tilt angle recommendations based on mounting height of the device, intended capture distance, and vehicle speed.
   If you're using a third-party license plate capture solution, contact your supplier for recommendations.
2. Loosen the screw in the wall mount.
3. Aim the camera at the road where you intend to capture license plates.
4. Tilt the device according to the recommendations.
5. Validate the position of the device, see *Validate the mounting height and tilt, on page 19* for instructions.

Run the traffic assistant

The traffic assistant guides you step-by-step to calibrate the radar for monitoring the speed of vehicles or to detect what direction vehicles are travelling.

- Go to **Radar > Settings > Traffic assistant > Configure** and follow the instructions.

Validate the mounting height and tilt

Note

This procedure requires physical access to the device.

To validate the position of the device, add two types of augmented overlays in the camera's live view. The overlays will help you check that the radar detects vehicles correctly at the intended capture distance.

The first overlay shows a projection of the radar through a grid, including the distance from the device to the road. The second overlay is a bounding box that shows a white box projected around a passing vehicle.

1. Go to **Video > Image**.
2. Click  in the live view to access the device's onscreen controls.
3. Expand **Predefined controls**.
4. Turn on **Augmented overlay (radar)**.
5. Click **Toggle augmented bounding boxes**.
6. Click **Toggle augmented overlay**.
7. In the camera's live view, check that the distance to the road is correct in the projected grid. Then check that the bounding boxes are projected around the passing vehicles, and not above, below, or next to the vehicles.
8. If necessary, re-measure the mounting height and adjust the settings, or adjust the tilt angle, and check again.
9. When you have validated the position of the device, tighten the screws in the wall mount.

Note

Turn off the augmented overlay when you're done with the validation.

Optimize the image for license plate capture

1. In the device's web interface, go to **Video > Installation > Traffic camera installation assistant**.
2. Select the surveillance mode **License plate capture**.
3. Click **Next**.
4. Under **Capture settings**, add the following information:
   - **Camera height**: the distance between the camera and the ground.
   - **Road distance**: the lateral distance between the camera and the middle of the lane that you are going to monitor.
   - **Max car speed**: the highest speed you expect the vehicles to reach on the road you are going to monitor.

   Note

   Turn on **Automatic distance** to calculate the car distance automatically.
   - **Car distance**: the distance between the camera and the approaching or departing vehicles.
5. Click **Next** in the traffic camera installation assistant.
6. The assistant provides a scene profile and a max shutter value for your installation. To save these settings, click **Apply settings**.

7. In the live view, zoom in so that the view covers the lane or lanes that you want to monitor. See for more information.
8. To verify the settings, record a few vehicles passing by and look at the license plates in the recording. See *Record and watch video, on page 25* for more information.

Set up a license plate capture solution

Set up a license plate capture solution that can process the images provided by the camera. For more information, see *License plate capture software, on page 7*.

AXIS License Plate Verifier

If you're going to use AXIS Q1686-DLE with AXIS License Plate Verifier, see *AXIS License Plate Verifier user manual* for information about how to set up the application.

If you intend to capture license plates in two lanes, we recommend that you create one area of interest for each lane in the application. For instructions, see *Adjust the area of interest* in AXIS License Plate Verifier user manual.

To validate that AXIS License Plate Verifier captures the license plates correctly, turn on license plate overlays in the web interface of AXIS Q1686-DLE. For more information, see *Show license plate overlays, on page 24*.

Basic settings

Set the capture mode

1. Go to **Video > Installation > Capture mode**.
2. Click **Change**.
3. Select a capture mode and click **Save and restart**.
   See also .

Set the power line frequency

1. Go to **Video > Installation > Power line frequency**.
2. Select a power line frequency and click **Save and restart**.

Adjust the image

This section includes instructions about configuring your device. If you want to learn more about how certain features work, go to *Learn more, on page 37*.

Level the camera

To adjust the view in relation to a reference area or an object, use the level grid in combination with a mechanical adjustment of the camera.

1. Go to **Video > Image >** and click .
2. Click  to show the level grid.
3. Adjust the camera mechanically until the position of the reference area or the object is aligned with the level grid.

Adjust the zoom and focus

To adjust the zoom:

1. Go to **Video > Installation** and adjust the zoom slider.

To adjust the focus:

1. Click  to show the autofocus area.

2. Adjust the autofocus area to cover the part of the image that you want to be in focus.
   If you don't select an autofocus area, the camera focuses on the entire scene. For traffic scenes where you intend to capture license plates, we recommend that you focus on the lines in the centre of the road.
3. Click **Autofocus**.
4. To fine tune the focus, adjust the focus slider.

Select scene profile

A scene profile is a set of predefined image appearance settings including color level, brightness, sharpness, contrast and local contrast. Scene profiles are preconfigured in the product for quick setup to a specific scenario, for example **Forensic** which is optimized for surveillance conditions. For a description of each available setting, see *The web interface, on page 36*.

You can select a scene profile during the initial setup of the camera. You can also select or change scene profile later.

1. Go to **Video > Image > Appearance**.
2. Go to **Scene profile** and select a profile.

Reduce image processing time with low latency mode

You can optimize the image processing time of your live stream by turning on low latency mode. The latency in your live stream is reduced to a minimum. When you use low latency mode, the image quality is lower than usual.

1. Go to **System > Plain config**.
2. Select **ImageSource** from the drop-down list.
3. Go to **ImageSource/I0/Sensor > Low latency mode** and select **On**.
4. Click **Save**.

Select exposure mode

To improve image quality for specific surveillance scenes, use exposure modes. Exposure modes lets you control aperture, shutter speed, and gain. Go to **Video > Image > Exposure** and select between the following exposure modes:

- For most use cases, select **Automatic** exposure.
- For environments with certain artificial lighting, for example fluorescent lighting, select **Flicker-free**. Select the same frequency as the power line frequency.
- For environments with certain artificial light and bright light, for example outdoors with fluorescent lighting at night and sun during daytime, select **Flicker-reduced**.
  Select the same frequency as the power line frequency.
- To lock the current exposure settings, select **Hold current**.

Benefit from IR light in low-light conditions by using night mode

Your camera uses visible light to deliver color images during the day. But as the visible light diminishes, color images become less bright and clear. If you switch to night mode when this happens, the camera uses both visible and near-infrared light to deliver bright and detailed black-and-white images instead. You can set the camera to switch to night mode automatically.

1. Go to **Video > Night mode**, and make sure that the mode is set to **Auto**.
2. To use the built-in IR light when the camera is in night mode, go to **Internal IR controls** and turn on **Allow IR**.

Optimize IR illumination

Depending on the installation environment and the conditions around the camera, for example external light sources in the scene, you can sometimes improve the image quality if you manually adjust the intensity of the LEDs. If you have problems with reflections from the LEDs, you can try to reduce the intensity.

1. Go to **Video > Night mode > Internal IR controls**.
2. Turn on **Allow IR**.
3. Click  in the live view and select **Manual**.
4. Adjust the intensity.

Reduce noise in low-light conditions

To reduce noise in low-light conditions, you can adjust one or more of the following settings:

- Adjust the trade-off between noise and motion blur. Go to **Video > Image > Exposure** and move the **Blur-noise trade-off** slider toward **Low noise**.
- Set the exposure mode to automatic.

Note

A high max shutter value can result in motion blur.

- To slow down the shutter speed, set max shutter to the highest possible value.

Note

When you reduce the max gain, the image can become darker.

- Set the max gain to a lower value.
- If there is an **Aperture** slider, move it towards **Open**.
- Reduce sharpness in the image, under **Video > Image > Appearance**.

Reduce motion blur in low-light conditions

To reduce motion blur in low-light conditions, adjust one or more of the following settings in **Video > Image > Exposure**:

Note

When you increase the gain, image noise also increases.

- Set **Max shutter** to a shorter time, and **Max gain** to a higher value.

If you still have problems with motion blur:

- Increase the light level in the scene.
- Mount the camera so that objects move toward it or away from it rather than sideways.

Maximize the details in an image

Important

If you maximize the details in an image, the bitrate will probably increase and you might get a reduced frame rate.

- Make sure to select the capture mode that has the highest resolution.
- Go to **Video > Stream > General** and set the compression as low as possible.
- Below the live view image, click  and in **Video format**, select **MJPEG**.
- Go to **Video > Stream > Zipstream** and select **Off**.

Handle scenes with strong backlight

Dynamic range is the difference in light levels in an image. In some cases the difference between the darkest and the brightest areas can be significant. The result is often an image where either the dark or the bright areas are visible. Wide dynamic range (WDR) makes both dark and bright areas of the image visible.

1. Go to **Video > Image > Wide dynamic range**.
2. Use the **Local contrast** slider to adjust the amount of WDR.
3. Use the **Tone mapping** slider to adjust the amount of WDR.
4. If you still have problems, go to **Exposure** and adjust the **Exposure zone** to cover the area of interest.

Find out more about WDR and how to use it at *axis.com/solutions/wide-dynamic-range-wdr*.

Stabilize a shaky image with image stabilization

Image stabilization is suitable in environments where the product is mounted in an exposed location where vibrations can occur, for example, due to wind or passing traffic.

The feature makes the image smoother, steadier, and less blurry. It also reduces the file size of the compressed image and lowers the bitrate of the video stream.

Note

When you turn on image stabilization, the image is slightly cropped, which lowers the maximum resolution.

1. Go to **Video > Installation > Image correction**.
2. Turn on **Image stabilization**.

Hide parts of the image with privacy masks

You can create one or several privacy masks to hide parts of the image.

1. Go to **Video > Privacy masks**.
2. Click + .
3. Click the new mask and type a name.
4. Adjust the size and placement of the privacy mask according to your needs.
5. To change the color for all privacy masks, click **Privacy masks** and select a color.

See also *Privacy masks, on page 37*

Show an image overlay

You can add an image as an overlay in the video stream.

1. Go to **Video > Overlays**.
2. Click **Manage images**.
3. Upload or drag and drop an image.
4. Click **Upload**.
5. Select **Image** from the drop-down list and click + .
6. Select the image and a position. You can also drag the overlay image in the live view to change the position.

Show a text overlay

You can add a text field as an overlay in the video stream. This is useful for example when you want to display the date, time or a company name in the video stream.

1. Go to **Video > Overlays**.
2. Select **Text** and click + .
3. Type the text you want to display, or select modifiers to show for example the current date.
4. Select a position. You can also click-and-drag the overlay in the live view to change the position.

Add street names and compass direction to the image

Note

The street name and compass direction will be visible on all video streams and recordings.

1. Go to **Apps**.
2. Select **axis-orientationaid**.
3. Click **Open**.
4. To add a street name, click **Add text** and modify the text to fit the street.
5. To add a compass, click **Add compass** and modify the compass to fit the image.

Show license plate overlays

License plate overlays are available with the application *AXIS License Plate Verifier*.

1. Go to **Video > Image**.
2. Click in the live view to access the device's onscreen controls.
3. Expand **Predefined controls**.
4. Turn on **License plate overlay**.
5. Click **Show overlay**.
6. To move the overlay, click **Move overlay**.

View and record video

This section includes instructions about configuring your device. To learn more about how streaming and storage works, go to *Streaming and storage, on page 37*.

Reduce bandwidth and storage

Important

Reducing the bandwidth can lead to loss of detail in the image.

1. Go to **Video > Stream**.
2. Click in the live view.
3. Select **Video format AV1** if your device supports it. Otherwise select **H.264**.
4. Go to **Video > Stream > General** and increase **Compression**.
5. Go to **Video > Stream > Zipstream** and do one or more of the following:

   Note

   The **Zipstream** settings are used for all video encodings except MJPEG.

- Select the Zipstream **Strength** that you want to use.
- Turn on **Optimize for storage**. This can only be used if the video management software supports B-frames.
- Turn on **Dynamic FPS**.
- Turn on **Dynamic GOP** and set a high **Upper limit** GOP length value.

Note

Most web browsers don't support H.265 decoding and because of this the device doesn't support it in its web interface. Instead you can use a video management system or application that supports H.265 decoding.

Set up network storage

To store recordings on the network, you need to set up your network storage.

1. Go to **System > Storage**.
2. Click + **Add network storage** under **Network storage**.
3. Type the IP address of the host server.
4. Type the name of the shared location on the host server under **Network share**.
5. Type the username and password.
6. Select the SMB version or leave it on **Auto**.
7. Select **Add share without testing** if you experience temporary connection issues, or if the share is not yet configured.
8. Click **Add**.

Record and watch video

Record video directly from the camera

1. Go to **Video > Stream**.
2. To start a recording, click ●.

   If you haven't set up any storage, click and . For instructions on how to set up network storage, see *Set up network storage, on page 25*
3. To stop recording, click ● again.

Watch video

1. Go to **Recordings**.
2. Click ▷ for your recording in the list.

Verify that no one has tampered with the video

With signed video, you can make sure that no one has tampered with the video recorded by the camera.

1. Go to **Video > Stream > General** and turn on **Signed video**.
2. Record video directly on the device, or use AXIS Camera Station Pro or another compatible video management software. For AXIS Camera Station Pro instructions, see the *AXIS Camera Station Pro user manual*.
3. Export the recorded video.
4. Use Axis *signed media verifier* tool to verify the recording.

Additional radar settings

Calibrate a reference map

To make it easier to see where detected objects are moving, you can upload a map for reference. You can use a ground plan or an aerial photo that shows the area covered by the radar. Calibrate the map so the radar view fits the position, direction, and scale of the map, and zoom in on the map if you're interested in a specific part of the scene.

You can either use a setup assistant that takes you through the map calibration step by step, or edit each setting individually.

Use the setup assistant:

1. Go to **Radar > Map calibration**.
2. Click **Setup assistant** and follow the instructions.

To remove the uploaded map and the settings you have added, click **Reset calibration**.

Edit each setting individually:
The map will calibrate gradually after you adjust each setting.

1. Go to **Radar > Map calibration > Map**.
2. Select the image you want to upload, or drag and drop it in the designated area.
   To reuse a map image with its current pan and zoom settings, click **Download map**.
3. Under **Rotate map**, use the slider to rotate the map into position.
4. Go to **Scale and distance on a map** and click on two pre-determined points on the map.
5. Under **Distance**, add the actual distance between the two points you have added to the map.
6. Go to **Pan and zoom map** and use the buttons to pan the map image, or zoom in and out on the map image.

Note

The zoom function doesn't alter the radar's area of coverage. Even if parts of the coverage is out of view after zooming, the radar will still detect moving objects in the entire area of coverage. The only way to exclude detected movement is to add exclude zones. For more information, see .

7. Go to **Radar position** and use the buttons to move or rotate the position of the radar on the map.

To remove the uploaded map and the settings you have added, click **Reset calibration**.



The video shows an example of how to calibrate a reference map in an Axis radar or radar-video fusion camera.

Add scenarios

A scenario is a combination of triggering conditions and detection settings, which you can use to create rules in the event system. Add scenarios if you want to create different rules for different parts of the scene.

Add a scenario:

1. Go to **Radar > Scenarios**.
2. Click **Add scenario**.
3. Type the name of the scenario.
4. Select if you want to trigger on objects moving in an area or on objects crossing one, or two, lines.

Trigger on objects moving in an area:

1. Select **Movement in area**.
2. Click **Next**.
3. Select the type of zone that should be included in the scenario.
   Use the mouse to move and shape the zone so that it covers the desired part of the radar image or reference map.
4. Click **Next**.
5. Add detection settings.

1. Add seconds until trigger after under **Ignore short-lived objects**.
2. Select which object type to trigger on under **Trigger on object type**.
3. Add a range for the speed limit under **Speed limit**.

6. Click **Next**.
7. Set the minimum duration of the alarm under **Minimum trigger duration**.
8. Click **Save**.

Trigger on objects crossing a line:

1. Select **Line crossing**.
2. Click **Next**.
3. Position the line in the scene.
   Use the mouse to move and shape the line.
4. To change the detection direction, turn on **Change direction**.
5. Click **Next**.
6. Add detection settings.
   6.1. Add seconds until trigger after under **Ignore short-lived objects**.
   6.2. Select which object type to trigger on under **Trigger on object type**.
   6.3. Add a range for the speed limit under **Speed limit**.
7. Click **Next**.
8. Set the minimum duration of the alarm under **Minimum trigger duration**.
   The default value is set to 2 seconds. If you want the scenario to trigger every time an object crosses the line, lower the duration to 0 seconds.
9. Click **Save**.

Trigger on objects crossing two lines:

1. Select **Line crossing**.
2. Click **Next**.
3. To make the object cross two lines for the alarm to trigger, turn on **Require crossing of two lines**.
4. Position the lines in the scene.
   Use the mouse to move and shape the line.
5. To change the detection direction, turn on **Change direction**.
6. Click **Next**.
7. Add detection settings.
   7.1. Set the time limit between crossing the first and the second line under **Max time between crossings**.
   7.2. Select which object type to trigger on under **Trigger on object type**.
   7.3. Add a range for the speed limit under **Speed limit**.
8. Click **Next**.

9. Set the minimum duration of the alarm under **Minimum trigger duration**.
   The default value is set to 2 seconds. If you want the scenario to trigger every time an object has crossed the two lines, lower the duration to 0 seconds.
10. Click **Save**.

Show a text overlay with the tilt angle of the radar

You can add an overlay in the radar's live view that shows the tilt angle of the radar. This is helpful during installation, or whenever you need to know the tilt angle of the device.

Note

The tilt angle overlay shows "90" when the device is horizontal. If the overlay shows "75", the tilt angle of the radar is 15° below the horizon.

1. Go to **Radar > Overlays**.
2. Select **Text** and click + .
3. Type **#op**.
   You can also click **Modifier** and select **#op** from the list.
4. Select a position. You can also drag the overlay field in the live view to change the position.

Set up rules for events

To learn more, see *Get started with rules for events*.

Trigger an action

1. Go to **System** > **Events** and click **+ Add a rule**. The rule defines when the device will perform certain actions. You can set up rules as scheduled, recurring, or manually triggered.
2. Enter a **Name**.
3. Select the **Condition** that must be met to trigger the action. If you specify more than one condition for the rule, all of the conditions must be met to trigger the action.
4. Select which **Action** to perform when the conditions are met.

Note

If you change the definition of a stream profile that is used in a rule, you need to restart all the rules that use that stream profile.

Save power when no motion is detected

This example explains how to turn on power saving mode when no motion is detected in the scene.

Note

When you turn on power saving mode, the IR illumination range is reduced.

Make sure that AXIS Object Analytics is running:

1. Go to **Apps > AXIS Object Analytics**.
2. Start the application if it is not already running.
3. Make sure you have set up the application according to your needs.

Create a rule:

1. Go to **System > Events** and add a rule.
2. Type a name for the rule.
3. In the list of conditions, under **Application**, select **Object Analytics**.
4. Select **Invert this condition**.

5. In the list of actions, under **Power saving mode**, select **Use power saving mode while the rule is active**.
6. Click **Save**.

Record video when the camera detects an object

This example explains how to set up the camera to start recording to the SD card when the camera detects an object. The recording will include five seconds before detection and one minute after detection ends.

Before you start:

- Make sure you have an SD card installed.

Make sure that AXIS Object Analytics is running:

1. Go to **Apps > AXIS Object Analytics**.
2. Start the application if it is not already running.
3. Make sure you have set up the application according to your needs.

Create a rule:

1. Go to **System > Events** and add a rule.
2. Type a name for the rule.
3. In the list of conditions, under **Application**, select **Object Analytics**.
4. In the list of actions, under **Recordings**, select **Record video while the rule is active**.
5. In the list of storage options, select **SD_DISK**.
6. Select a camera and a stream profile.
7. Set the prebuffer time to 5 seconds.
8. Set the postbuffer time to 1 minute.
9. Click **Save**.

Show a text overlay in the video stream when the device detects an object

This example explains how to display the text "Motion detected" when the device detects an object.

Make sure that AXIS Object Analytics is running:

1. Go to **Apps > AXIS Object Analytics**.
2. Start the application if it is not already running.
3. Make sure you have set up the application according to your needs.

Add the overlay text:

1. Go to **Video > Overlays**.
2. Under **Overlays**, select **Text** and click + .
3. Enter `#D` in the text field.
4. Choose text size and appearance.
5. To position the text overlay, click and select an option.

Create a rule:

1. Go to **System > Events** and add a rule.
2. Type a name for the rule.
3. In the list of conditions, under **Application**, select **Object Analytics**.
4. In the list of actions, under **Overlay text**, select **Use overlay text**.
5. Select a video channel.

6. In **Text**, type "Motion detected".
7. Set the duration.
8. Click **Save**.

Note

If you update the overlay text it will be automatically updated on all video streams dynamically.

Provide visual indication of an ongoing event

You have the option to connect the AXIS I/O Indication LED to your network camera. This LED can be configured to turn on whenever certain events occur in the camera. For example, to let people know that video recording is in progress.

Required hardware

- AXIS I/O Indication LED
- An Axis network video camera

Note

For instructions on how to connect the AXIS I/O Indication LED, see the installation guide provided with the product.

The following example shows how to configure a rule that turns on the AXIS I/O Indication LED to indicate that camera is recording.

1. Go to **System > Accessories > I/O ports**.
2. For the port that you connected the AXIS I/O Indication LED to, click to set the direction to **Output**, and click to set the normal state to **Circuit open**.
3. Go to **System > Events**.
4. Create a new rule.
5. Select the **Condition** that must be met to trigger the camera to start recording. It can, for example, be a time schedule or motion detection.
6. In the list of actions, select **Record video**. Select a storage space. Select a stream profile or create a new. Also set the **Prebuffer** and **Postbuffer** as required.
7. Save the rule.
8. Create a second rule and select the same **Condition** as in the first rule.
9. In the list of actions, select **Toggle I/O while the rule is active**, and then select the port the AXIS I/O Indication LED is connected to. Set the state to **Active**.
10. Save the rule.

Other scenarios where AXIS I/O Indication LED can be used are for example:

- Configure the LED to turn on when the camera starts, to indicate the presence of the camera. Select **System ready** as a condition.
- Configure the LED to turn on when live stream is active to indicate that a person or a program is accessing a stream from the camera. Select **Live stream accessed** as a condition.

Record video when the camera detects impact

Shock detection allows the camera to detect tampering caused by vibrations or shock. Vibrations due to the environment or to an object can trigger an action depending on the shock sensitivity range, which can be set from 0 to 100. In this scenario, someone is throwing rocks at the camera after hours and you would like to get a video clip of the event.

Turn on shock detection:

1. Go to **System > Detectors > Shock detection**.
2. Turn on shock detection, and adjust the shock sensitivity.

Create a rule:

3. Go to **System > Events > Rules** and add a rule.
4. Type a name for the rule.
5. In the list of conditions, under **Device status**, select **Shock detected**.
6. Click **+** to add a second condition.
7. In the list of conditions, under **Scheduled and recurring**, select **Schedule**.
8. In the list of schedules, select **After hours** .
9. In the list of actions, under **Recordings**, select **Record video while the rule is active**.
10. Select where to save the recordings.
11. Select a **Camera**.
12. Set the prebuffer time to 5 seconds.
13. Set the postbuffer time to 50 seconds.
14. Click **Save**.

Trigger a notification when the enclosure is opened

This example explains how to set up an email notification when the housing or casing of the device is opened.

Add an email recipient:

1. Go to **System > Events > Recipients** and click **Add recipient**.
2. Type a name for the recipient.
3. Select **Email** as the notification type.
4. Type the recipient's email address.
5. Type the email address that you want the camera to send notifications from.
6. Provide the login details for the sending email account, along with the SMTP hostname and port number.
7. To test your email setup, click **Test**.
8. Click **Save**.

Create a rule:

9. Go to **System > Events > Rules** and click **Add a rule**.
10. Type a name for the rule.
11. In the list of conditions, select **Casing open**.
12. In the list of actions, select **Send notification to email**.
13. Select a recipient from the list.
14. Type a subject line and message for the email.
15. Click **Save**.

Trigger a notification when the camera lens is tampered

This example explains how to set up an email notification when the camera lens gets either spray painted, covered, or blurred.

Activate the tampering detection:

1. Go to **System > Detectors > Camera tampering**.
2. Set a value for **Trigger delay**. The value indicates the time that must pass before an email is sent.

3. Turn on **Trigger on dark images** to detect if the lens is sprayed, covered, or rendered severely out of focus.

Add an email recipient:

4. Go to **System > Events > Recipients** and add a recipient.
5. Type a name for the recipient.
6. Select **Email** as the notification type.
7. Type the recipient's email address.
8. Type the email address that you want the camera to send notifications from.
9. Provide the login details for the sending email account, along with the SMTP hostname and port number.
10. To test your email setup, click **Test**.
11. Click **Save**.

Create a rule:

12. Go to **System > Events > Rules** and add a rule.
13. Type a name for the rule.
14. In the list of conditions, under **Video**, select **Tampering**.
15. In the list of actions, under **Notifications**, select **Send notification to email** and then select the recipient from the list.
16. Type a subject line and message for the email.
17. Click **Save**.

Use MQTT to send license plate and radar data

Use AXIS Q1686-DLE Radar-Video Fusion Camera with the application AXIS License Plate Verifier and the radar data to send the fused radar and license plate information to an MQTT broker.

Before you start:

- Install AXIS License Plate Verifier in your Q1686-DLE.
- Set up an MQTT broker and get the broker's IP address, username and password.
  Learn more about MQTT and MQTT brokers in *AXIS OS Knowledge Base*.

Set up the MQTT client in the web interface of the device where you have installed AXIS License Plate Verifier

1. Go to **System > MQTT > MQTT client > Broker** and enter the following information:
   - **Host**: The broker IP address
   - **Client ID**: The ID of the device
   - **Protocol**: The protocol the broker is set to
   - **Port**: The port number used by the broker
   - The broker **Username** and **Password**
2. Click **Save** and **Connect**.

Create a condition that publishes the ALPV and radar data as a payload to the MQTT broker:

3. Go to **System > MQTT > MQTT publication** and click **+ Add condition**.
4. In the list of conditions, under **Radar motion**, select **License plate and radar**.
5. Click **Add**.

Trigger a recording if a vehicle drives in the wrong direction

This example explains how to trigger a recording and record video to an SD card if the radar detects that a vehicle drives in the wrong direction.

Before you start:
- Make sure you have installed an SD card.

Add a scenario in the radar:
1. Go to **Radar > Scenarios**.
2. Click **+ Add scenario**.
3. Type the name of the scenario.
4. Select **Line crossing**.
5. Click **Next**.
6. To make the object cross two lines for the alarm to trigger, turn on **Require crossing of two lines**.
7. Position the lines in the scene.
   Use the mouse to move and shape them.
8. To change the detection direction, turn on **Change direction**.
9. Click **Next**.
10. Add detection settings.
    10.1. Set the time limit between crossing the first and the second line under **Max time between crossings**.
    10.2. Select that you want to trigger on vehicles under **Trigger on object type**.
    10.3. Add a range for the speed limit under **Speed limit**.
11. Click **Next**.
12. Set the minimum duration of the alarm under **Minimum trigger duration**.
    The default value is set to 2 seconds. If you want the scenario to trigger every time an object has crossed the two lines, lower the duration to 0 seconds.
13. Click **Save**.

Create a rule that triggers a recording:
1. Go to **System > Events** and add a rule
2. Type a name for the rule.
3. In the list of conditions, under **Radar motion**, select the scenario you just created.
4. In the list of actions, under **Recordings**, select **Record video while the rule is active**.
5. In the list of storage options, select **SD_DISK**.
6. Select **Camera 1**.
7. Set the prebuffer time to 5 seconds.
8. Set the postbuffer to 30 seconds.
9. Click **Save**.

Trigger a text overlay if a vehicle drives the wrong way

Before you start:
- The camera must be positioned in a proper way according to the mounting recommendations.
  See *Mounting recommendations with AXIS License Plate Verifier, on page 13*

Add a rule:
1. Go to **System > Events** and add a rule
2. Type a name for the rule.
3. Under **Condition**, select **License plate and radar**.
4. Select direction.
5. Under **Action**, select **Use overlay text**.

6. Select video channels.
7. Under **Text**, enter the message to show in the overlay.
8. Under **Duration**, enter how long time the text overlay will be shown.
9. Click **Save**.

Audio

Add audio to your recording

Turn on audio:

1. Go to **Video > Stream > Audio** and include audio.
2. If the device has more than one input source, select the correct one in **Source**.
3. Go to **Audio > Device settings** and turn on the correct input source.

Edit the stream profile that is used for the recording:

4. Go to **System > Stream profiles** and select the stream profile.
5. Select **Include audio** and turn it on.
6. Click **Save**.

Connect to a network speaker

Network speaker pairing allows you to use a compatible Axis network speaker as if it is connected directly to the camera. Once paired, the speaker acts as an audio out device where you can play audio clips and transmit sound through the camera.

Important

For this feature to work with a video management software (VMS), you must first pair the camera with the network speaker, then add the camera to your VMS.

Pair camera with network speaker

1. Go to **System > Edge-to-edge > Pairing**.
2. Click **Add** and select the pairing type **Audio** from the drop-down list.
3. Select **Speaker pairing**.
4. Type the network speaker's IP address, username and password.
5. Click **Connect**. A confirmation message appears.

Connect to a strobe siren

Network pairing allows you to pair a camera with a compatible Axis device with light and siren functionality. Once paired, the camera can configure and maintain both devices.

Pair the camera with a strobe siren:

1. Go to **System > Edge-to-edge > Pairing**.
2. Click **Add** and select the pairing type **Network pairing** from the drop-down list.
3. Type the IP address, username and password of the strobe siren.
4. Click **Connect**. A confirmation message appears.

To find devices directly on the network, click **Discover devices**.

Note

- The list shows all Axis devices that are found, not only devices that can be paired.
- An info icon is shown for devices that have already been paired. Hover over the icon to get information about pairings that are already active.
- Make sure the paired devices run the same AXIS OS version.

Important

- It's only possible to discover devices where Bonjour is enabled. To enable Bonjour for a device, open its web interface and go to **System > Network > Network discovery protocols**.

The web interface

To read about all the features and settings available in the web interface of devices with AXIS OS, go to *AXIS OS web interface help*.

Learn more

Long-distance connections

This product supports fiber-optic cable installations through a media converter. Fiber-optic cable installations offer a number of benefits such as:

- Long-distance connection
- High speed
- Long lifetime
- Large capacity of data transmission
- Electromagnetic interference immunity

Find out more about fiber-optic cable installations in the white paper "Long distance surveillance - Fiber-optic communication in network video" at *axis.com/learning/white-papers*.

For information about how to install the media converter see the Installation Guide for this product.

Remote focus and zoom

The remote focus and zoom functionality allows you to make focus and zoom adjustments to your camera from a computer. It is a convenient way to ensure that the scene's focus, viewing angle and resolution are optimized without having to visit the camera's installation location.

Privacy masks

A privacy mask is a user-defined area that covers a part of the monitored area. In the video stream, privacy masks appear either as blocks of solid color or with a mosaic pattern.

You'll see the privacy mask on all snapshots, recorded video, and live streams.

You can use the VAPIX® application programming interface (API) to hide the privacy masks.

Important

If you use multiple privacy masks it may affect the product's performance.

You can create several privacy masks. Each mask can have 3 to 10 anchor points.

Overlays

Overlays are superimposed over the video stream. They are used to provide extra information during recordings, such as a timestamp, or during product installation and configuration. You can add either text or an image.

The video streaming indicator is another type of overlay. It shows you that the live view video stream is live.

Note

Overlays are included in all video streams except SIP calls when the connection is over PoE class 3.

Streaming and storage

Video compression formats

Decide which compression method to use based on your viewing requirements, and on the properties of your network. The available options are:

Motion JPEG

Note

To ensure support for the Opus audio codec, the Motion JPEG stream is always sent over RTP.

Motion JPEG, or MJPEG, is a digital video sequence that is made up of a series of individual JPEG images. These images are then displayed and updated at a rate sufficient to create a stream that shows constantly updated motion. For the viewer to perceive motion video the rate must be at least 16 image frames per second. Full motion video is perceived at 30 (NTSC) or 25 (PAL) frames per second.

The Motion JPEG stream uses considerable amounts of bandwidth, but provides excellent image quality and access to every image contained in the stream.

H.264 or MPEG-4 Part 10/AVC

Note

H.264 is a licensed technology. The Axis product includes one H.264 viewing client license. To install additional unlicensed copies of the client is prohibited. To purchase additional licenses, contact your Axis reseller.

H.264 can, without compromising image quality, reduce the size of a digital video file by more than 80% compared to the Motion JPEG format and by as much as 50% compared to older MPEG formats. This means that less network bandwidth and storage space are required for a video file. Or seen another way, higher video quality can be achieved for a given bitrate.

H.265 or MPEG-H Part 2/HEVC

H.265 can, without compromising image quality, reduce the size of a digital video file by more than 25% compared to H.264.

Note

- H.265 is licensed technology. The Axis product includes one H.265 viewing client license. Installing additional unlicensed copies of the client is prohibited. To purchase additional licenses, contact your Axis reseller.
- Most web browsers don't support H.265 decoding and because of this the camera doesn't support it in its web interface. Instead you can use a video management system or application supporting H.265 decoding.

How do Image, Stream, and Stream profile settings relate to each other?

The **Image** tab contains camera settings that affect all video streams from the product. If you change something in this tab, it immediately affects all video streams and recordings.

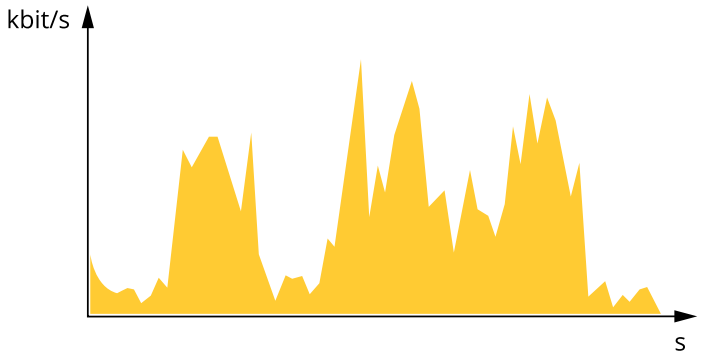
The **Stream** tab contains settings for video streams. You get these settings if you request a video stream from the product and don't specify for example resolution, or frame rate. When you change the settings in the **Stream** tab, it doesn't affect ongoing streams, but it will take effect when you start a new stream.

The **Stream profiles** settings override the settings from the **Stream** tab. If you request a stream with a specific stream profile, the stream contains the settings of that profile. If you request a stream without specifying a stream profile, or request a stream profile that doesn't exist in the product, the stream contains the settings from the **Stream** tab.

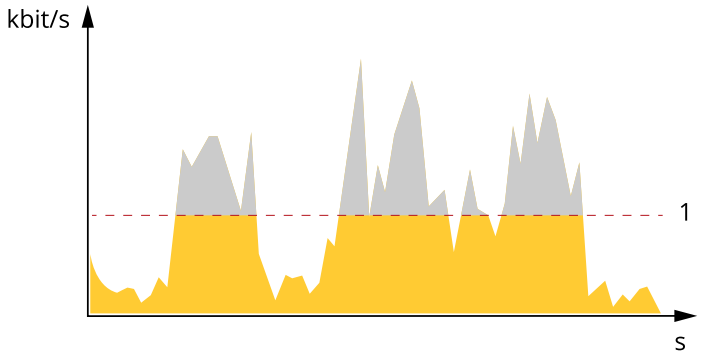
Bitrate control

Bitrate control helps you to manage the bandwidth consumption of your video stream.

Variable bitrate (VBR)
Variable bitrate allows the bandwidth consumption to vary depending on the level of activity in the scene. The more activity, the more bandwidth you need. With variable bitrate you are guaranteed constant image quality, but you need to make sure you have storage margins.



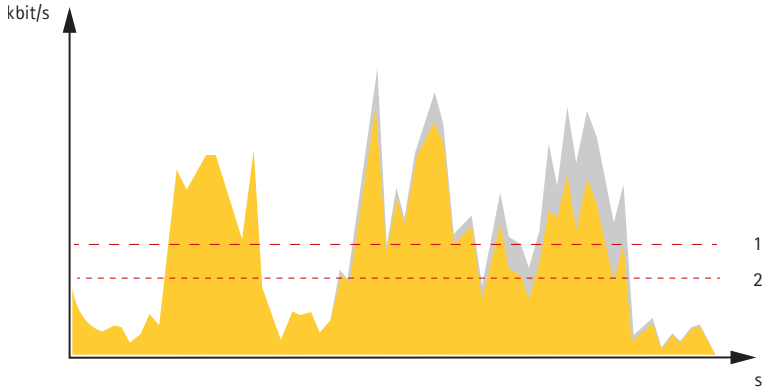
Maximum bitrate (MBR)
Maximum bitrate lets you set a target bitrate to handle bitrate limitations in your system. You might see a decline in image quality or frame rate as the instantaneous bitrate is kept below the specified target bitrate. You can choose to prioritize either image quality or frame rate. We recommend that you configure the target bitrate to a higher value than the expected bitrate. This gives you a margin in case there is a high level of activity in the scene.



1 Target bitrate

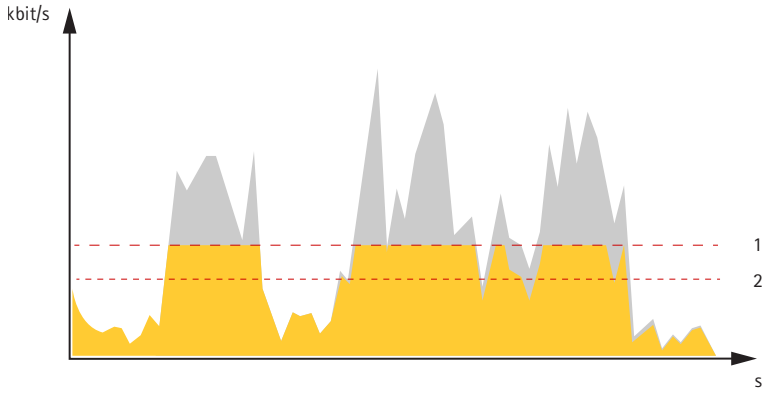
Average bitrate (ABR)
With average bitrate, the bitrate is automatically adjusted over a longer period of time. This is so you can meet the specified target and provide the best video quality based on your available storage. Bitrate is higher in scenes with a lot of activity, compared to static scenes. You are more likely to get better image quality when in scenes with a lot of activity if you use the average bitrate option. You can define the total storage required to store the video stream for a specified amount of time (retention time) when image quality is adjusted to meet the specified target bitrate. Specify the average bitrate settings in one of the following ways:

- To calculate the estimated storage need, set the target bitrate and the retention time.
- To calculate the average bitrate, based on available storage and required retention time, use the target bitrate calculator.



1 Target bitrate
2 Actual average bitrate

You can also turn on maximum bitrate and specify a target bitrate within the average bitrate option.



1 *Target bitrate*
2 *Actual average bitrate*

Edge-to-edge technology

Edge-to-edge is a technology that makes IP devices communicate directly with each other. It offers smart pairing functionality between, for example, Axis cameras and Axis audio or radar products.

Note

Make sure the paired devices run the same AXIS OS version.

For more information, see the white paper "Edge-to-edge technology" at *whitepapers.axis.com/edge-to-edge-technology*.

Speaker pairing

Edge-to-edge speaker pairing allows you to use a compatible Axis network speaker as if it's part of your camera. Once paired, the speaker's features are integrated in the camera's web interface and the network speaker acts as an audio out device where you can play audio clips and transmit sound through the camera.

The camera will identify itself to the VMS as a camera with integrated audio output and redirect any played audio to the speaker.

Network pairing

With edge-to-edge network pairing, you can connect your camera to a compatible Axis device with light and siren or illuminator light functionality and benefit from its integrated features.

Analytics and apps

With analytics and apps you can get more out of your Axis device. AXIS Camera Application Platform (ACAP) is an open platform that makes it possible for third parties to develop analytics and other apps for Axis devices. Apps can be preinstalled on the device, available for download for free, or for a license fee.

To find the user manuals for Axis analytics and apps, go to *help.axis.com*.

Note

- Several apps can run at the same time but some apps might not be compatible with each other. Certain combinations of apps might require too much processing power or memory resources when run in parallel. Verify that the apps work together before deployment.

AXIS Object Analytics

AXIS Object Analytics is an analytic application that comes preinstalled on the camera. It detects objects that move in the scene and classifies them as, for example, humans or vehicles. You can set up the application to send alarms for different types of objects. To find out more about how the application works, see *AXIS Object Analytics user manual*.

AXIS Image Health Analytics

AXIS Image Health Analytics is an AI-based application that can be used to detect image degradations or tampering attempts. The application analyzes and learns the behavior of the scene to detect blurriness or underexposure in the image, or to detect an obstructed or redirected view. You can set up the application to send events for any of these detections, and trigger actions through the camera's event system or third-party software.

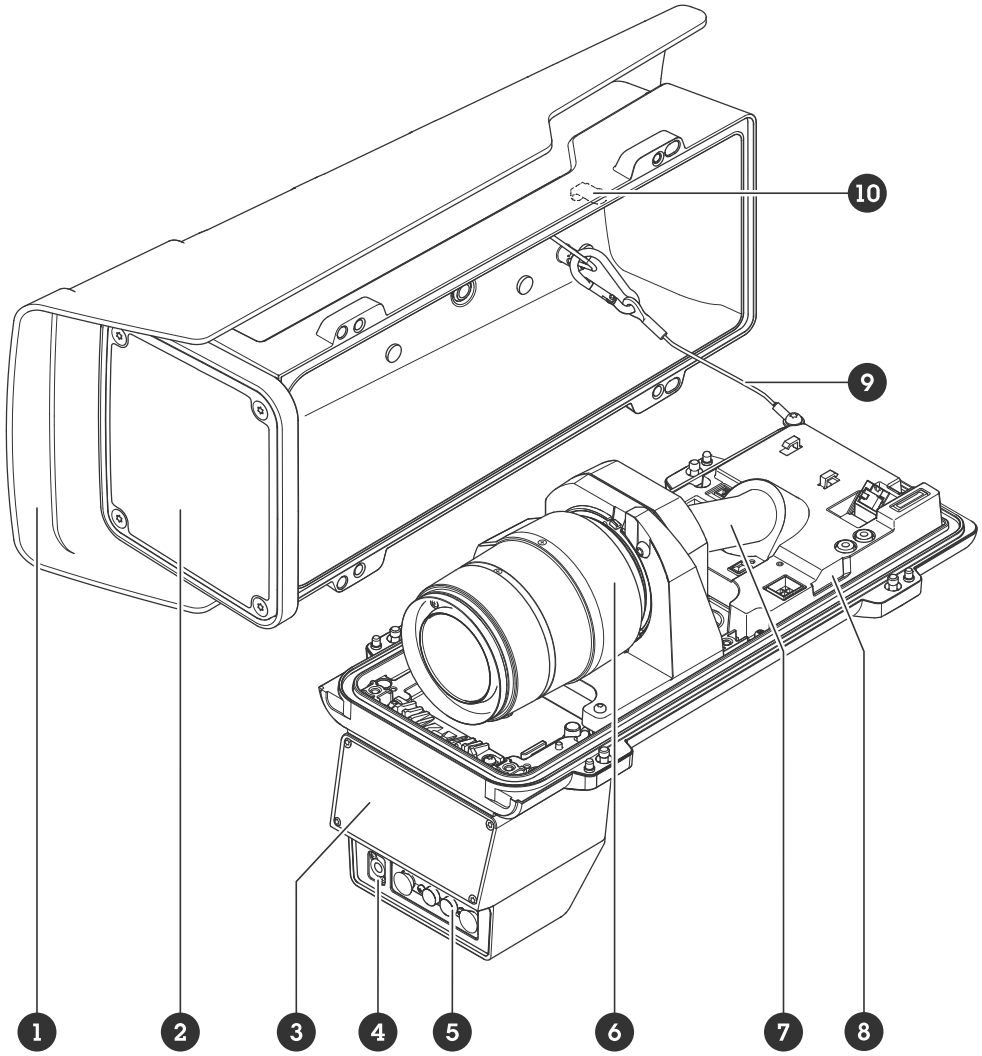
To find out more about how the application works, see *AXIS Image Health Analytics user manual*.

Metadata visualization

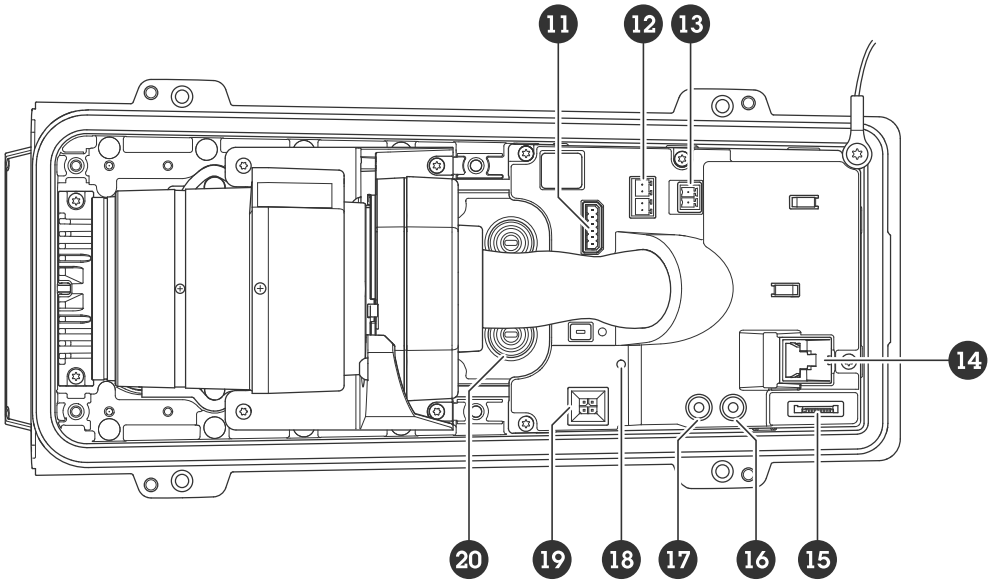
Analytics metadata is available for moving objects in the scene. Supported object classes are visualized in the video stream through a bounding box surrounding the object, along with information about the object type and confidence level of the classification. To learn more about how to configure and consume analytics metadata, see *AXIS Scene Metadata integration guide*.

Specifications

Product overview



1 *Weathershield*
2 *Window*
3 *Radar*
4 *Light sensor*
5 *IR illumination LED*
6 *Optical unit*
7 *Cable cover*
8 *Intrusion alarm sensor*
9 *Safety wire*
10 *Intrusion alarm magnet*



11 *I/O connector*
12 *RS485/RS422 connector*
13 *Power connector*
14 *Network connector (PoE)*
15 *microSD card slot*
16 *Audio out*
17 *Audio in*
18 *Status LED*
19 *Control button*
20 *Cable gasket M20 2x*

LED indicators

Note

- The Status LED can be configured to flash while an event is active.
- The LEDs turn off when you close the casing.

Status LED	Indication
Unlit	Connection and normal operation.
Green	Shows steady green for 10 seconds for normal operation after startup completed.
Amber	Steady during startup. Flashes during device software upgrade or reset to factory default.
Amber/Red	Flashes amber/red if network connection is unavailable or lost.
Red	Device software upgrade failure.

SD card slot

This device supports microSD/microSDHC/microSDXC cards.

For SD card recommendations, see *axis.com*.

microSD, microSDHC, and microSDXC Logos are trademarks of SD-3C LLC. microSD, microSDHC, microSDXC are trademarks or registered trademarks of SD-3C, LLC in the United States, other countries or both.

Buttons

Control button

The control button is used for:

- Resetting the product to factory default settings. See *Reset to factory default settings, on page 48*.
- Connecting to a one-click cloud connection (O3C) service over the internet. To connect, press and release the button, then wait for the status LED to flash green three times.

Intrusion alarm switch

Use the intrusion alarm switch to get a notification when someone opens the device's housing. Create a rule to make the device perform an action when the switch is activated. See *Trigger a notification when the enclosure is opened, on page 31*.

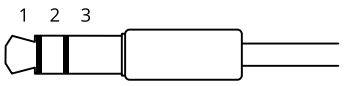
Connectors

Network connector

RJ45 Ethernet connector with Power over Ethernet Plus (PoE+).

Audio connector

- **Audio in** – 3.5 mm input for a mono microphone, or a line-in mono signal (left channel is used from a stereo signal).
- **Audio in** – 3.5 mm input for a digital microphone, an analog mono microphone, or a line-in mono signal (left channel is used from a stereo signal).
- **Audio out** – 3.5 mm output for audio (line level) that can be connected to a public address (PA) system or an active speaker with a built-in amplifier. A stereo connector must be used for audio out.



Audio input

1 Tip	2 Ring	3 Sleeve
Unbalanced microphone (with or without electret power) or line-in	Electret power if selected	Ground
Balanced microphone (with or without phantom power) or line-in, "hot" signal	Balanced microphone (with or without phantom power) or line-in, "cold" signal	Ground
Digital signal	Ring power if selected	Ground

Audio output

1 Tip	2 Ring	3 Sleeve
Channel 1, unbalanced line, mono	Channel 1, unbalanced line, mono	Ground

I/O connector

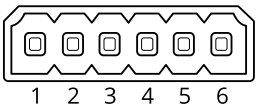
Use the I/O connector with external devices in combination with, for example, motion detection, event triggering, and alarm notifications. In addition to the 0 VDC reference point and power (12 V DC output), the I/O connector provides the interface to:

Digital input – For connecting devices that can toggle between an open and closed circuit, for example PIR sensors, door/window contacts, and glass break detectors.

Supervised input – Enables possibility to detect tampering on a digital input.

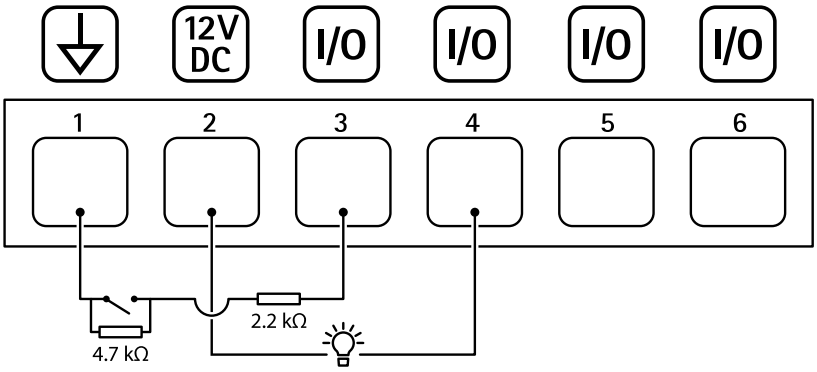
Digital output – For connecting external devices such as relays and LEDs. Connected devices can be activated by the VAPIX® Application Programming Interface, through an event or from the device's web interface.

6-pin terminal block



Function	Pin	Notes	Specifications
DC ground	1		0 VDC
DC output	2	⚠ Can be used to power auxiliary equipment. Note: This pin can only be used as power out.	12 VDC Max load = 50 mA
Configurable (Input or Output)	3–6	Digital input or Supervised input – Connect to pin 1 to activate, or leave floating (unconnected) to deactivate. To use supervised input, install end-of-line resistors. See connection diagram for information about how to connect the resistors.	0 to max 30 VDC
		Digital output – Internally connected to pin 1 (DC ground) when active, and floating (unconnected) when inactive. If used with an inductive load, e.g., a relay, connect a diode in parallel with the load, to protect against voltage transients.	0 to max 30 VDC, open drain, 100 mA

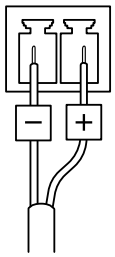
Example:



1 *DC ground*
2 *DC output 12 V, max 50 mA*
3 *I/O configured as supervised input*
4 *I/O configured as output*
5 *Configurable I/O*
6 *Configurable I/O*

Power connector

2-pin terminal block for DC power input. Use a Safety Extra Low Voltage (SELV) compliant limited power source (LPS) with either a rated output power limited to ≤100 W or a rated output current limited to ≤5 A.

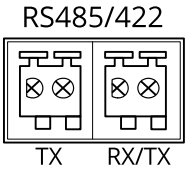


RS485/RS422 connector

Two 2-pin terminal blocks for RS485/RS422 serial interface.

The serial port can be configured to support:

- Two-wire RS485 half duplex
- Four-wire RS485 full duplex
- Two-wire RS422 simplex
- Four-wire RS422 full duplex point to point communication



Function	Notes
RS485/RS422 TX(A)	TX pair for RS422 and 4-wire RS485
RS485/RS422 TX(B)	
RS485A alt RS485/422 RX (A)	RX pair for all modes (combined RX/TX for 2-wire RS485)
RS485B alt RS485/422 RX (B)	

Clean your device

You can clean your device with lukewarm water.

NOTICE

- Harsh chemicals can damage the device. Don't use chemicals such as window cleaner or acetone to clean your device.
- Avoid cleaning in direct sunlight or elevated temperatures, since this can cause stains.

1. Use a can of compressed air to remove dust and loose dirt from the device.
2. If necessary, clean the device with a soft microfiber cloth dampened with lukewarm water.
3. To avoid stains, dry the device with a clean, nonabrasive cloth.

For more information about cleaning of Axis devices, see the white paper *Chemical resistance to common cleaning agents*.

Troubleshooting

Reset to factory default settings

⚠ WARNING

⚠ Possibly hazardous optical radiation is emitted from this product. It can be harmful to the eyes. Don't stare at the operating lamp.

Important

Reset to factory default should be used with caution. A reset to factory default resets all settings, including the IP address, to the factory default values.

To reset the product to the factory default settings:

1. Disconnect power from the product.
2. Press and hold the control button while reconnecting power. See *Product overview, on page 42*.
3. Keep the control button pressed for 15–30 seconds until the status LED indicator flashes amber.
4. Release the control button. The process is complete when the status LED indicator turns green. If no DHCP server is available on the network, the device IP address will default to one of the following:
   - **Devices with AXIS OS 12.0 and later:** Obtained from the link-local address subnet (169.254.0.0/16)
   - **Devices with AXIS OS 11.11 and earlier:** 192.168.0.90/24
5. Use the installation and management software tools to assign an IP address, set the password, and access the device.
   The installation and management software tools are available from the support pages on *axis.com/support*.

You can also reset parameters to factory default through the device's web interface. Go to **Maintenance** > **Factory default** and click **Default**.

AXIS OS options

Axis offers device software management according to either the active track or the long-term support (LTS) tracks. Being on the active track means continuously getting access to all the latest product features, while the LTS tracks provide a fixed platform with periodic releases focused mainly on bug fixes and security updates.

Using AXIS OS from the active track is recommended if you want to access the newest features, or if you use Axis end-to-end system offerings. The LTS tracks are recommended if you use third-party integrations, which are not continuously validated against the latest active track. With LTS, the products can maintain cybersecurity without introducing any significant functional changes or affecting any existing integrations. For more detailed information about Axis device software strategy, go to *axis.com/support/device-software*.

Check the current AXIS OS version

AXIS OS determines the functionality of our devices. When you troubleshoot a problem, we recommend that you to start by checking the current AXIS OS version. The latest version might contain a correction that fixes your particular problem.

To check the current AXIS OS version:

1. Go to the device's web interface > **Status**.
2. Under **Device info**, see the AXIS OS version.

Upgrade AXIS OS

Important

- When you upgrade the device software, your preconfigured and customized settings are saved. Axis Communications AB can't guarantee that the settings are saved, even if the features are available in the new AXIS OS version.
- Starting from AXIS OS 12.6, you must install every LTS version between your device's current version and the target version. For example, if the currently installed device software version is AXIS OS 11.2, you have to install the LTS version AXIS OS 11.11 before you can upgrade the device to AXIS OS 12.6. For more information, see *AXIS OS Lifecycle guide: Upgrade path*.
- Make sure the device remains connected to the power source throughout the upgrade process.

Note

- When you upgrade the device with the latest AXIS OS version in the active track, the product receives the latest functionality available. Always read the upgrade instructions and release notes available with each new release before you upgrade. To find the latest AXIS OS version and the release notes, go to *axis.com/support/device-software*.

1. Download the AXIS OS file to your computer, available free of charge at *axis.com/support/device-software*.
2. Log in to the device as an administrator.
3. Go to **Maintenance > AXIS OS upgrade** and click **Upgrade**.

When the upgrade has finished, the product restarts automatically.

Technical problems and possible solutions

Problems upgrading AXIS OS

AXIS OS upgrade failed

If the upgrade fails, the device reloads the previous version. The most common reason is that the wrong AXIS OS file has been uploaded. Check that the name of the AXIS OS file corresponds to your device and try again.

Problems after AXIS OS upgrade

If you experience problems after the upgrade, roll back to the previously installed version from the **Maintenance** page.

Problems setting the IP address

Can't set the IP address

- If the IP address intended for the device and the IP address of the computer used to access the device are located on different subnets, you can't set the IP address. Contact your network administrator to obtain an IP address.
- The IP address could be in use by another device. To check:
  1. Disconnect the Axis device from the network.
  2. In a Command/DOS window, type `ping` and the IP address of the device.
  3. If you receive: `Reply from <IP address>: bytes=32; time=10...` this means that the IP address might already be in use by another device on the network. Obtain a new IP address from the network administrator and reinstall the device.
  4. If you receive: `Request timed out`, this means that the IP address is available for use with the Axis device. Check all cabling and reinstall the device.
- There could be a possible IP address conflict with another device on the same subnet. The static IP address in the Axis device is used before the DHCP server sets a dynamic address. This means that if the same default static IP address is also used by another device, there could be problems accessing the device.

Problems accessing the device

Can't log in when accessing the device from a browser

When HTTPS is enabled, make sure that you use the correct protocol (HTTP or HTTPS) when you try to log in. You might need to manually type `http` or `https` in the browser's address field.

If you've lost the password for the root account, you must reset the device to the factory default settings. For instructions, see *Reset to factory default settings, on page 48*.

The IP address has been changed by DHCP

IP addresses obtained from a DHCP server are dynamic and could change. If the IP address has been changed, use AXIS IP Utility or AXIS Device Manager to locate the device on the network. Identify the device using its model or serial number, or by the DNS name (if the name has been configured).

If required, you can assign a static IP address manually. For instructions, go to *axis.com/support*.

Certificate error when using IEEE 802.1X

For authentication to work properly, the date and time settings in the Axis device must be synchronized with an NTP server. Go to **System > Date and time**.

The browser isn't supported

For a list of recommended browsers, see *Browser support, on page 16*.

Can't access the device externally

To access the device externally, we recommend you to use one of the following applications for Windows®:

- AXIS Camera Station Pro: 90-day trial version free of charge, ideal for small to mid-size systems.

For instructions and download, go to *axis.com/vms*.

Problems with MQTT

Can't connect over port 8883 with MQTT over SSL

The firewall blocks traffic that uses port 8883 since it's regarded insecure.

In some cases the server/broker might not provide a specific port for MQTT communication. It might still be possible to use MQTT over a port normally used for HTTP/HTTPS traffic.

- If the server/broker supports WebSocket/WebSocket Secure (WS/WSS), typically on port 443, use this protocol instead. Check with the server/broker provider to see if WS/WSS is supported and which port and basepath to use.
- If the server/broker supports ALPN, the use of MQTT can be negotiated over an open port, such as 443. Check with your server/broker provider to see if ALPN is supported and which ALPN protocol and port to use.

If you can't find what you're looking for here, try the troubleshooting section at *axis.com/support*.

Problems with overlays when using AXIS License Plate Verifier	
The license plate overlay is not available in the device's onscreen controls	If the license plate overlay isn't available in the device's onscreen controls after you have installed AXIS License Plate Verifier, try to restart the device. Go to the **Maintenance** page and click **Restart**.
Speed is missing in the license plate overlay in the device's onscreen controls	If the speed is missing in the license plate overlay after you have installed AXIS License Plate Verifier, make sure the mounting height of the device is set correctly in the device's web interface. To set the installation height in the device, go to **Radar > Settings > General > Mounting height**.

Performance considerations

The most important factors to consider:

- Heavy network utilization due to poor infrastructure affects the bandwidth.

Contact support

If you need more help, go to *axis.com/support*.

Cybersecurity

Cybersecurity supports a successful product lifecycle with minimized risks. You can find in-depth information and documentation about our cybersecurity approach at *axis.com/about-axis/cybersecurity*. Follow the cybersecurity guidelines below to receive product security notifications from Axis and to configure your product for a secure lifecycle and decommissioning.

At *Axis Trust Center*, you can find information about how Axis implements security compliance, transparency, data protection, and privacy.

Vulnerability management

Axis is a *Common Vulnerability and Exposures (CVE) Numbering Authority (CNA)*. To minimize your risk of exposure, we follow industry standards when identifying and resolving vulnerabilities in our devices, software, and services. Refer to *axis.com/vulnerability-management* for information about our vulnerability management policy or to report a vulnerability.

Security notifications

Subscribe to Axis security notification emails at *axis.com/security-notification-service*. We will send you information about vulnerabilities, corresponding security advisories, and other security-related matters for your Axis product.

Secure product lifecycle

Axis minimizes risks throughout the lifetime of our products through secure lifecycle management. Use our hardening guides at *help.axis.com* to more securely configure and operate your Axis products and to find information about:

Secure first-use – Axis products are pre-configured with high default protection to allow for secure initialization and encrypted communication from the very start.

Intended use and common configuration mistakes – Our guides provide information about the intended usage of Axis products, including common security-relevant misuse and configuration mistakes that should be avoided.

Managing vulnerabilities and supply chain transparency – A Software Bill of Material (SBOM) is published with every software release on *axis.com* to disclose vulnerabilities and improve supply chain transparency.

Decommissioning and the secure erasure of data – To securely decommission a product when it reaches the end of its lifecycle, reset it to factory default settings. This erases your configurations, stored data, and sensitive information.

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