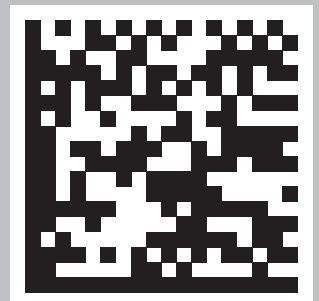# Intelligent Video Analytics Pro

MVC-IVA-LPR | MVC-IVA-LPRX | MVC-IVA-MMR | MVC-IVA-DGS

en Application note

Table of contents

1   Use latest software

Before using the software application for the first time, make sure that you are running the most current software release. For consistent functionality, compatibility, performance, and security, regularly update the software throughout the operational life of the software application. Follow the instructions in the product documentation regarding software installation and updates.

The following links provide more information:

– General information: https://www.boschsecurity.com/xc/en/support/product-security/
– Security advisories, that is a list of identified vulnerabilities and proposed solutions: https://www.boschsecurity.com/xc/en/support/product-security/security-advisories.html

Bosch assumes no liability whatsoever for any damage caused by operating its products with outdated software components.

2   Introduction

Intelligent Video Analytics (IVA) Pro licenses

IVA Pro License Plate, IVA Pro Vehicle Make Model and IVA Pro Dangerous Good Signs are a deep neural network based video analytics that detects and reads license plates on moving vehicles (car, bus, truck, motorbike). The license plate are transmitted in real time via different protocols ensuring easy integration.

To access and start the video analysis use a web browser once the camera connection is established or the Configuration Manager program. For more information on the access and start of the applications, refer to *Connection, page 14*.

More information

For more information, software downloads, and documentation, go to www.boschsecurity.com and the corresponding product page.

Compatibility

For information on supported cameras, refer to the Bosch Video Product Selector:
www.videoselector.boschsecurity.com

Refer to

3   Installation considerations

The quality of vehicle license plate detection and recognition, vehicle make and model identification, and dangerous goods sign detection depends on the location and position of the camera installation, and the camera configuration settings. This chapter describes the requirements to achieve the best results.

After modifying or adjusting the installation position or camera settings, you must reset the calibration of the LPR in the web browser of the camera view or in the Configuration Manager.

To reset the calibration via the web browser:

1.   Open the web browser view of the device.
2.   Click **Configuration** > **Alarm** > **LPR.**
3.   Click **Reset Calibration.**

To reset the calibration via the Configuration Manager:

1.   Start Configuration Manager.
2.   In the **View** area, click the **VCA** tab.
3.   Select **License Plate Recognition** tab.
4.   Click **Reset Calibration.**

For more information on connecting to the application, refer to *Connection, page 14.*

3.1   Positioning

Chose the position of the camera so that it is possible to observe the movement of the license plate during the vehicle passage.

Height [m]
The camera should be installed at a height slightly above the roof of the vehicle.
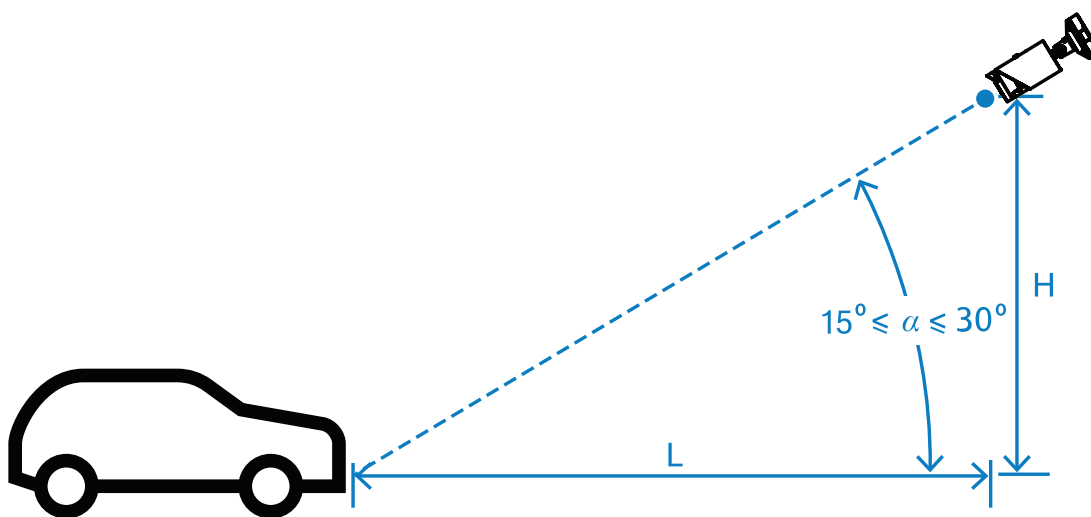
The installation height H depends on the availability of mounting constructions, and in practice this means:

2.0 m ≤ H ≤ 10.0 m

Notice!
Low elevation installation
Installing the camera at a low elevation, such as at the level of the vehicle's roof, may cause the camera to be blinded at night by the vehicle headlights. This positioning could prevent the camera from accurately analyzing the movement and detection of the vehicle.

Distance [m]

The distance from the camera to the detection line is directly derived from the height of the installation H. The optimal distance L is the distance for which the angle α between the optical axis of the camera and the plane of the road equals 22.5°. For example, for the installing height H = 6 m can be calculated:

$L = H \cdot \cot(α) = 6 \cdot \cot(22.5°) \approx 6 \cdot 2.4 = 14.4$ m

For more information on setting the detection line, refer to *Detection line , page 10*.

The table that follows indicates the ideal distance in relation to the camera height. For reliable recognition, the focal length of the camera lens should be sufficient to reach the required pixels on target.

For more information on the character size for the license plate, refer to *Character size, page 11*.

Height (H) m (ft)	Optimal Distance (L) m (ft)
2.0 m (6.6 ft)	4.8 m (15.8 ft)
2.5 m (8.2 ft)	6.0 m (19.8 ft)
3.0 m (9.8 ft)	7.2 m (23.8 ft)
3.5 m (11.5 ft)	8.5 m (27.7 ft)
4.0 m (13.1 ft)	9.7 m (31.7 ft)
4.5 m (14.8 ft)	10.9 m (35.6 ft)
5.0 m (16.4 ft)	12.1 m (39.6 ft)
5.5 m (18.0 ft)	13.3 m (43.6 ft)
6.0 m (19.7 ft)	14.5 m (47.5 ft)
6.5 m (21.3 ft)	15.7 m (51.5 ft)
7.0 m (23.0 ft)	16.9 m (55.4 ft)
7.5 m (24.6 ft)	18.1 m (59.4 ft)
8.0 m (26.2 ft)	19.3 m (63.4 ft)
8.5 m (27.9 ft)	20.5 m (67.3 ft)
9.0 m (29.5 ft)	21.7 m (71.3 ft)
9.5 m (31.1 ft)	22.9 m (75.3 ft)
10.0 m (32.8 ft)	24.1 m (79.2 ft)

The angle α can be adjusted to suit the conditions of a particular installation solution, but it should be within the range:

$15° ≤ α ≤ 30°$

ⓘ
Notice!

If the angle α is too small (< 15°) then there may be an overshadowing of vehicles following one another. If the angle α is too large (> 30°) the geometry of the number plate will be disturbed. At night, the light from the IR illuminator will not reflect properly, making vehicle detection weaker.

Angle

The camera can be installed within the lane or at the lane's edge.

It is important that the horizontal angle β between the optical axis of the camera and the axis of the road is not greater than 30°:

−30° ≤ β ≤ +30°
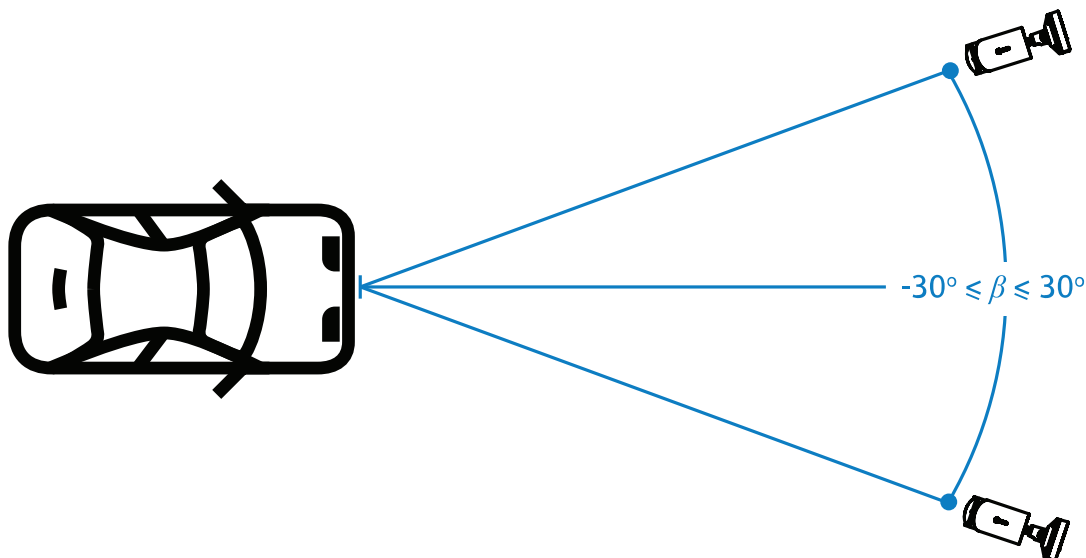
ⓘ
Notice!

Ensure that the value β remains within the specified range to avoid distortion. Exceeding the range may reduce image detection quality, causing narrow characters on the license plate or inadequate IR illumination due to lack of reflected light.

Tilt angle [°]

When installing the camera, ensure proper leveling by aligning the longer edge of the license plate parallel to the camera's horizontal field of view.
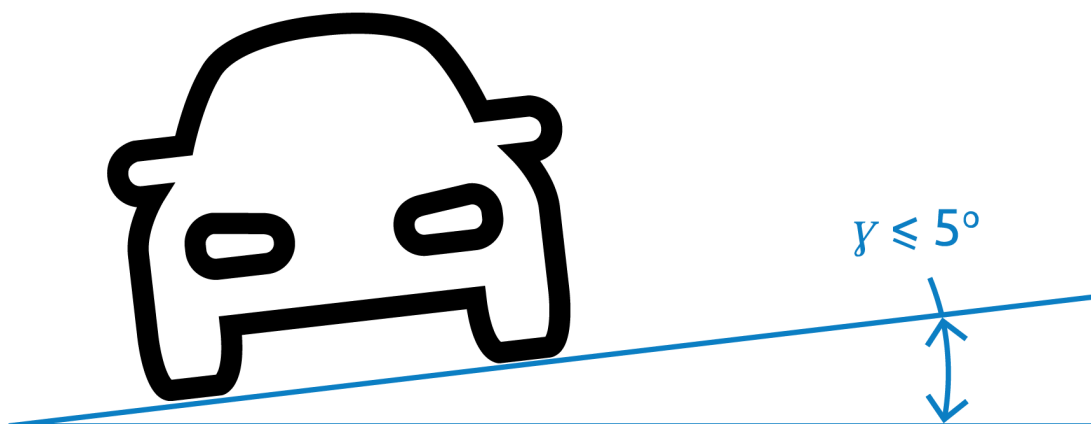
For best performance the tilt angle should be within the range of −5° ≤ γ ≤ +5°, but must be within the range −30° ≤ γ ≤ +30°.

3.2   Number of lanes

Choose the position of the camera relative to the lane considering the number of lanes the detection of the vehicle will cover.
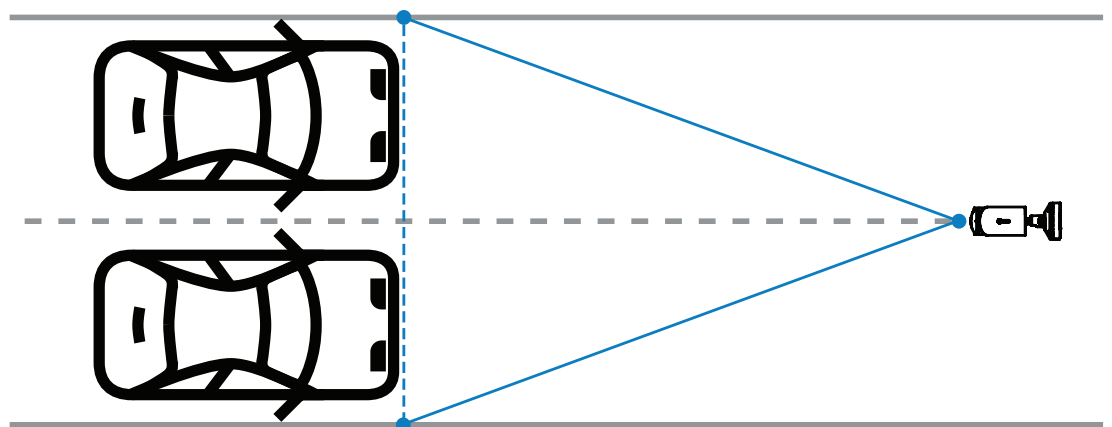
1-Lane

When a camera covers one lane, you can install within the lane or at the edge of the lane.
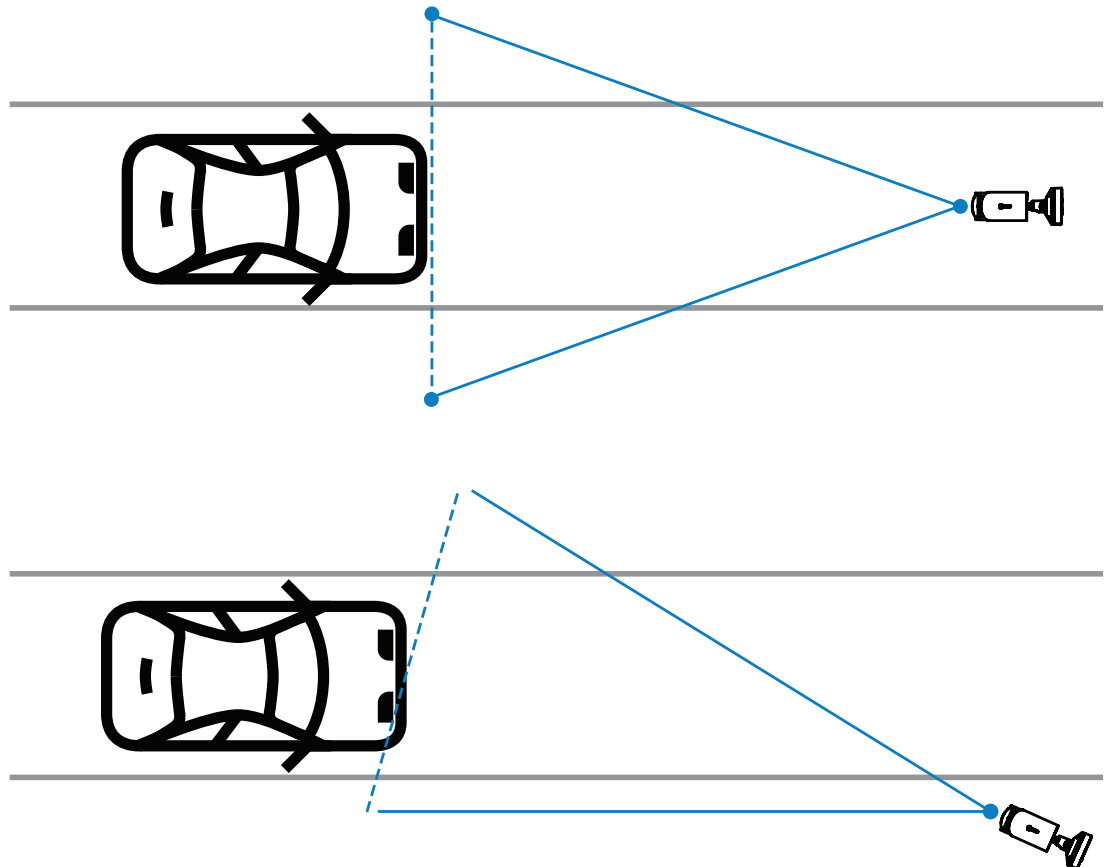
The field of view should be at least twice as wide as the lane to ensure that the front of the vehicle is visible.

2-Lanes

For two-lane detection, install the camera on the line separating the lanes.

> **(i)** **Notice!**
> Avoid install the camera at the edge of the road as it can cause to overshadow the vehicles and reduce or prevent the visibility of the license plate. If it is technically no other possibility, it is better to install the camera at the edge of the faster lane, where less trucks are driving.

3.3   Field of view

Detection line

The detection line is a virtual horizontal line in the field of view that indicates where the expected detection of the license plate should occur. Usually it is the line in the middle of the field-of-view height.
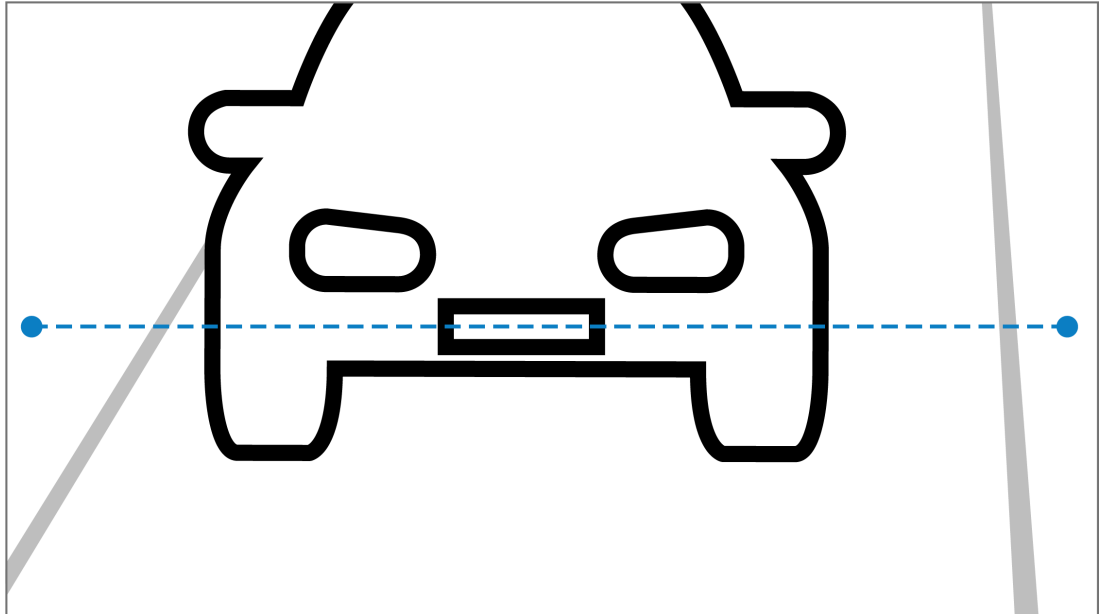
License plate on the detection line

Field width

The setting of the field of view width depends on the number of observed lanes. Usually, the optimal width is 6 m at the height of the detection line.

For more information on choosing the camera mounting based on number of lanes, refer to *Number of lanes, page 9*.
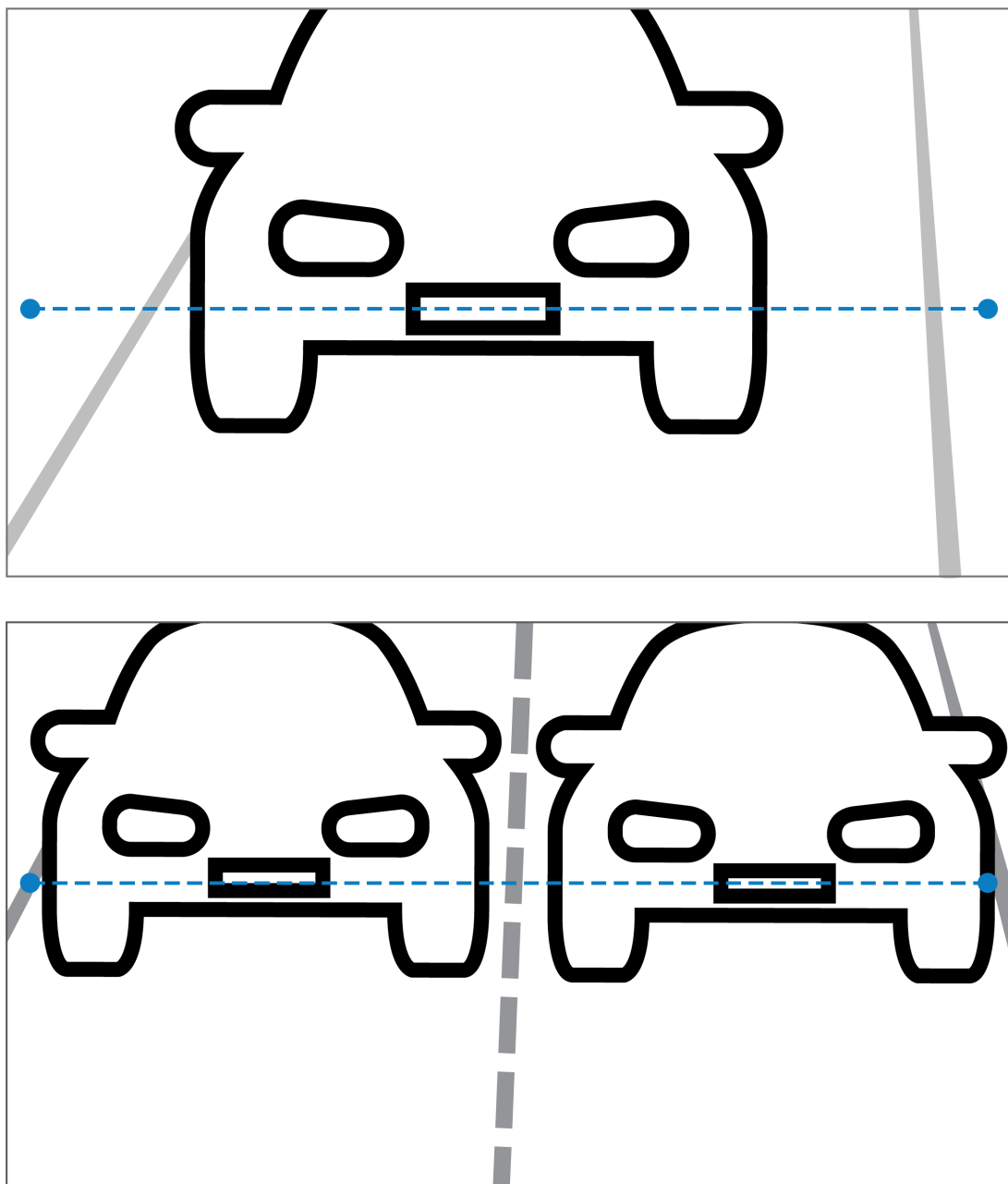
Field of View

The setting of the field of view depends on two factors:

– Minimum character height
– Maximum vehicle speed

The IVA Pro License Plate requires that for a given vehicle passage in the field of view, the license plate is visible at least twice. This means that the field of view for height must cover a large enough road section to make the number plate visible twice at maximum speed, considering a frame rate of 12.5 frames per second.

In this case, the user can modify the zoom and angle of the camera.

Character size

The recommended character height for the license plate on the detection line is for S = 16 pixels.

A character height of 16 pixels in the processed image is considered the optimal pixel density. The application can still recognize plates with smaller character heights, such as 10-12 pixels per character in non-noisy images.

Image resolution
The device optimization profile defines the image resolution used by the License Plate Recognition (LPR) analytics.
Selecting the correct profile allows the camera to balance performance, bandwidth, and analytical precision.
Two profiles are available:
–   **Balanced:**
    For general installations and standard network usage.
    –   2MP/4MP/5MP/6MP cameras: 1280 x 720 px
    –   8MP cameras: 1024 x 576 px
–   **IVA optimized:**
    For scenes that require higher analytical accuracy or where fine character details must be preserved.
    –   All cameras: 1920 x 1080 px

> **Notice!**
> When the camera operates in IVA Optimized mode, the internal LPR analytics use a higher processing resolution (1920 × 1080 px). As a result, the available stream profiles can change. The primary stream (Stream 1) may automatically adjust its resolution or frame rate. The other available Streams can be mirrored from Stream 1 or limited in selectable settings.
> Before activating IVA Optimized mode, verify that the configured stream profiles, recording settings, and network bandwidth remain compatible with the modified streaming behavior..

For more information on the configuration of the device optimization profile, refer to *Device optimization profile, page 15*.

3.4   Parameters

LPR Scene Mode
For best performance, it is recommended to select the LPR scene mode of the camera 24 hours a day.

Exposure
The following Exposure settings are recommended:
–   Maximum shutter < 1/750 s for parking applications
–   Maximum shutter < 1/1750 s for other applications

> **Notice!**
> Allow the camera to modify automatically the exposure time according to the lighting conditions.

In low-light or night conditions, note the following information:

- To identify the vehicle's class, make, or model from the image, the front or rear of the vehicle must be visible.
- At night, the camera prioritizes to capture the license plate, using IR illumination that reflects the license plates. In this situation it can happen that only the license plate is visible, not the rest of the vehicle.
- If visibility of these details is necessary, additional illumination is required.

4   Connection

Notice!
Make sure your camera have an activated license for IVA Pro License Plate, IVA Pro Vehicle Make Model, IVA Pro Dangerous Good Signs or IVA Pro License Plate plus Make Model.

4.1   Starting via the web browser

A computer with a web browser (Google Chrome, Microsoft Edge, or Mozilla Firefox) is used to receive live images, control the unit, and replay stored sequences. The unit is configured over the network using the browser.

To start the license using the web browser view:

1.   Open the web browser view of the device. To do this, in the address bar of the web browser enter http://<IP address of the device>.
2.   Click **Configuration** > **Alarm** > **VCA.**
3.   In **VCA configuration**, select **LPR Mode** from the drop down menu.
4.   Go to the **LPR** page.
      The camera image and the **Lanes and detections** summary details are visible here.

Notice!
The system requirements and operation of the web browser view are described in the documentation of the corresponding camera.

4.2   Starting via the Configuration Manager

Configuration Manager can be installed on any Windows PC that communicates with the respective device over a network. Configuration Manager needs no license and no additional programs are required to analyze live images.

Notice!
The system requirements and operation of Configuration Manager are described in the Configuration Manager manual.

To start VCA:

1.   Start Configuration Manager.
2.   In the toolbar, click the **My Devices** tab, then select the device for which you wish to configure VCA.
3.   In the **View** area, click the **VCA** tab.
      The VCA start page is displayed and the camera image appears to the right.
4.   Select **License Plate Recognition** tab.
      The camera image shows the detection area that is delimited with a green line.

Notice!
If the VCA configuration of this camera is in use, no other users can configure VCA of this camera at the same time. Only the first user is able to do this. Other users receive a message that configuration is not possible.

5   Configuration

5.1   Device optimization profile

The device optimization profile defines the image resolution used by the License Plate Recognition (LPR) analytics.

To change the device optimization profile:
1.   Open the web browser view of the device.
2.   Go to **Configuration** > **Camera** > **Installer menu**.
3.   Select from the Device o**ptimization profile dropdown menu the one of** the following options:
      –   **Balanced**: standard resolution and full streaming capability.
      –   **IVA Optimized**: higher analytical resolution for improved detection performance.

---

i

Notice!
Changing the profile affects the effective resolution used for the license-plate recognition and may impact network bandwidth and CPU load.

5.2   License plate format

The vehicles license plates are different from different regions. To retrieve the correct format and details from the vehicles detected, you must select the applicable country of the license plate:
1.   Click **Configuration** > **Alarm > LPR.**
2.   On the top right, in the **License plate format** select the region applicable for the intended from the drop down menu.
3.   Click **Reset calibration** button.
      Note: After selecting or changing to a new region you must reset the calibration.

5.3   Detection area

The default detection area covers the full captured video. Adjust the detection area to include only the area of interest. Additionally, the license plate should be visible at least twice within the detection area. It is important to configure a balanced detection area.
To configure the detection area:
1.   Click and drag the corner to adjust the detection area.
2.   Click **Save.**

5.4   Lanes and detections

Lanes
It is possible to configure maximum of two lanes in the detection area. The page shows one lane added by default.
To add a lane:
▸   Click the **Add lane** button.
      The button disappears once the two lanes are added.
To remove a lane:
1.   Select the lane you want to remove.
2.   Click on **Remove lane.**
To configure the lane or lanes:
1.   Click on **Lane 1** or **Lane 2** button.

2.   In the **Configure lane** window, if desired edit the name identification in **Lane name** field.
3.   Choose from the **Lane direction** drop down menu, the direction **Up** or **Down.**
      The direction up indicates the outgoing traffic flow and the direction down indicates the ongoing traffic flow.
4.   Click **Ok** to confirm the selection or **Cancel** to go back.
5.   Click and drag the endpoints to adjust the size of the lane.
6.   Click and drag the line to choose the position within the detection area.
7.   Click **Save.**

Detections

The section **Lanes and detections** shows a summary of the last twenty vehicles detected.

The following columns are available:

–   Time - Date and timestamp
–   Plate image - Picture of the full license plate
–   License plate - The license plate alphanumeric characters
–   Country - Country of origin of the license plate
–   Hazard Identification number - only if the IVA Pro Dangerous Good Signs license is activated

1.   Click **Show more** to see more details of the detected vehicle.
2.   Click **Close** to go back to the previous page.

5.5   List management

Quickly access and manage license plate data directly in the camera. Assign response actions by plate category for automated decisions.

To manually add a license plate to a list:
1.   On the LPR page, click **Lists**.
2.   Click **Add entry**.
3.   Enter the respective license plate, the country (ISO 3166-1 A-2 codes, for example "US") and the list name.
4.   Click **Save**.
      Note: When saving, blank spaces and separator characters will be removed.

To import a CSV file:
1.   On the LPR page, click **Lists**.
2.   Click **Import CSV**.
3.   Click **Select CSV file**.
4.   Select the respective import mode.
      Append to existing entries: New entries are added, duplicates are ignored. A license plate can only be on one list.
      Replace all existing entries: Old list entries are deleted and replaced by the new CSV content.

To export a CSV file:
1.   On the LPR page, click **Lists**.
2.   Click **Export CSV**.
      All existing entries are downloaded in a CSV file.

Relay control

When saving a list for the first time, a window displays informing you about updating the alarm task script for relay activation.

If you do not need relay triggering:

▸   Click **Save List Only - No Relay**.

If you need relay triggering:

▸   Click **Replace Script & Save List**.
     An automatically generated alarm task script triggers the relay once a plate matches with one of
     the lists.

5.6   Integrations

5.6.1   MQTT integration

The MQTT interface allows third-party systems to receive real-time License Plate Recognition (LPR)
event data directly from the camera.

To configure MQTT for IVA Pro License Plate , follow the steps below:

1.   Open **Configuration Manager**.
2.   In the left toolbar, click the **camera icon**.
       A list of connected cameras appears.
3.   Select the camera where IVA Pro License Plate is installed.
4.   Go to **Network** > **MQTT**.
5.   Click **Add broker** icon.
       The Add broker dialog appears.
6.   Select the **Protocol from the dropdown menu**.
7.   Enter the **Address** of the MQTT broker.
8.   Define a **Topic prefix** to group camera events.
9.   Enter the **User name** and **Password**.
10.   Select a **Client certificate** and **Trusted CA** for secure communication.
11.   Define a **Publish filter** to select which events are sent.
12.   In **QoS**, select the desired Quality of Service level:
       –   At most once
       –   At least once (recommended)
       –   Exactly once
13.   Click **OK** to add the broker.

MQTT Output

Each MQTT message includes:

–   License plate number
–   License plate type
–   Country code
–   Issuing entity (State)
–   Vehicle make and model (IVA Pro Vehicle Make Model license is required)
–   Vehicle type (IVA Pro Vehicle Make Model license is required)
–   Matched list name (if any)
–   Base64-encoded plate image

Notice!

Dangerous Goods Sign (DGS) detections are not transmitted via MQTT.

Notice!
Vehicle Make/Model/Type data are only included when the IVA Pro Vehicle Make Model license is active with the IVA Pro License Plate on the same camera.

5.6.2   Webhook integration

The Webhook interface enables direct communication between the camera and external systems by sending JSON-formatted license-plate data to a defined HTTP endpoint.

To configure the Webhook, follow the steps:

1. Open **Configuration Manager**.
2. In the left toolbar, click the **camera icon**.
   A list of connected cameras appears.
3. Select the camera where IVA Pro License Plate is installed.
4. Go to **VCA** > **License Plate Recognition**.
5. Click **Webhook** at the top of the page.
   The Configure Webhook window opens.
6. Enter the **HTTP Endpoint** of the target server.
7. Enter the **Organization ID**.
8. Enter the **Secret Key**.
9. Enter the **Auth Token**.
10. Click **Save** to activate the Webhook configuration.

Webhook Output

For every detection, a JSON object is transmitted to the configured endpoint containing the following information:

– License-plate number
– Country or state of the plate
– GPS coordinates of the camera
– Camera name
– Timestamp of the detection (UTC)
– Camera ID
– Plate confidence value
– Vehicle make, model, and type (if IVA Pro MMR license is active)
– Base64-encoded image of the license plate

Notice!
The structure of the JSON message may vary depending on the active licenses (for example, IVA Pro MMR) and the camera firmware version.

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