

# Automatic license plate recognition



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## 1 Introduction

The release of camera firmware 6.50 means that certain Bosch surveillance cameras have a scene mode which is optimized for capturing license plate images. This scene mode limits the maximum gain and optimizes the noise filtering settings to provide ANPR software packages with the best possible images for decoding the license plate codes. This application note describes the preparation steps necessary to optimize your ANPR results with Bosch cameras.

Please be aware that Bosch cameras can capture images of license plates, but do not process the images to retrieve the license plate code itself. You need additional software running on a server, appliance or in the cloud to do so, which then compares the code with, for example, 'white' or 'black' lists. Such software is available through Bosch IPP partners. A summary of ANPR software suppliers who have used Bosch cameras for ANPR applications can be found in appendix A. Please see the Bosch IPP website [www.boschsecurity.com/xc/en/partners](http://www.boschsecurity.com/xc/en/partners) for the latest information.

The optimal camera configuration is different for each ANPR software solution. This document describes the factors that impact the quality of the results.

**Note:** Automatic license plate capture and decoding is referred to by different names in various parts of the world.

- ▶ In Europe it's generally called Automatic Number Plate Recognition (ANPR).
- ▶ In USA it's often called Automatic License Plate Recognition (ALPR or LPR). License plates are also referred to as vehicle registration plates.

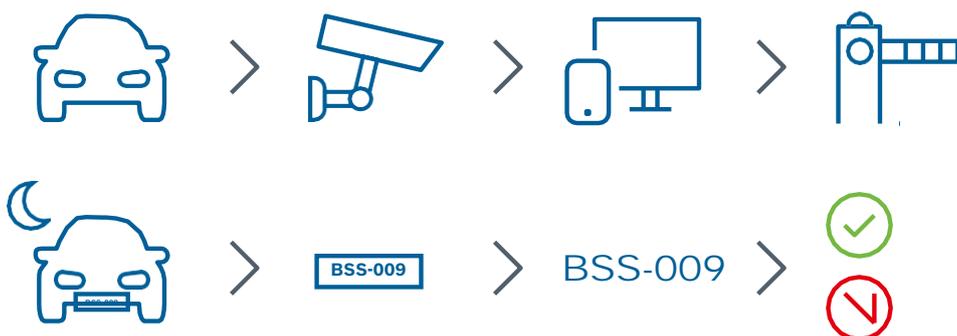
Throughout this document we use the abbreviation ANPR.

## 2 Considerations for ANPR camera projection, system component selection and configuration

A complete ANPR system performs the following steps:

- 1 Capturing video images on the camera image sensor
- 2 Preprocessing of the image for optimal license plate detection
- 3 License plate detection and cropping
- 4 Processing the cropped license plate image for optimal character finding and recognition
- 5 Capturing the characters and recognizing the complete license plate code, optionally with country or state code and any additional information fields
- 6 Storing and processing the license plate code according to application-specific needs
- 7 Controlling access barriers

Only step 1 is performed by the camera. The other steps are performed by the ANPR software system.



For reliable results, the requirements of the ANPR software need to be considered when selecting and configuring the ANPR camera.

These requirements are related to the following parameters:

- ▶ Countries/states supported
- ▶ License plate background colors supported
- ▶ Maximum vehicle speed
- ▶ Maximum number of lanes covered by a single camera
- ▶ Maximum horizontal and vertical angle with the lane axis
- ▶ Minimum plate size in number of pixels
- ▶ Number of frames needed for reliable plate recognition

These parameters are described in the paragraphs below.

Appendix B gives the actual values from various ANPR software suppliers for these parameters.

### **Countries/states supported**

It's possible that ANPR software suppliers do not support all types of license plates, or plates from all countries. Regularly check the supplier's websites for the latest list of countries and states that are supported, as new countries and states are frequently added.

### **License plate type and background colors supported**

Some ANPR software packages can't handle all background colors allowed on license plates. Many ANPR suppliers can handle only retroreflective license plates.

For a worldwide list of plate layouts and designs, see:

[https://en.wikipedia.org/wiki/Vehicle\\_registration\\_plate](https://en.wikipedia.org/wiki/Vehicle_registration_plate)

For a more detailed list of permitted license plates in US please see:

[https://en.wikipedia.org/wiki/Vehicle\\_registration\\_plates\\_of\\_the\\_United\\_States](https://en.wikipedia.org/wiki/Vehicle_registration_plates_of_the_United_States)

Consult your ANPR software supplier to find out about limitations and possible solutions/options when dealing with challenging plates. Sometimes white or colored light illuminators can be used to help recognition.

Check the processing power and network bandwidth needed by the ANPR software and server.

In appendix A, you can find ANPR supplier-specific details, as well as references to web resources detailing the limitations.

### **Maximum vehicle speed at which plates can be decoded**

Maximum vehicle speed at the detection point determines the maximum camera shutter speed. For start-stop applications try an exposure time of 1/500 s. For speeds of 120 km/h, exposure times of 1/1750s or 1/2500 s are more appropriate. The frame rate of the camera can also be reduced at lower speeds or in start-stop applications, which in turn reduces the processing power required for ANPR.

### **Maximum number of lanes with a single camera**

The lens quality is important for ANPR, especially in multi-lane applications. Off-center MTF should be sufficient to produce enough contrast. The lens distortion should be low enough to ensure that enough pixels per target are captured for off-center lanes. Make sure that the IR lighting, which is required at night, has an even light distribution pattern (i.e. no dark corners) across all lanes. Various ANPR software packages have different ways of dealing with multiple lanes. They may require additional licenses. Check with your supplier.

### Maximum camera mounting angle; horizontal and vertical

When determining the mounting point of the camera, respect the maximum camera mounting angle, both horizontally and vertically, specified by the ANPR software supplier. ANPR software will not work reliably beyond these limits. For best results, the horizontal angle should be as small as possible. While it is recommended to ensure the vertical angle is within ANPR supplier limits, it's also advisable to mount the camera higher than the license plate, in order to minimize headlight glare issues.

### Minimum plate size in number of pixels

The ANPR software supplier will specify the minimum number of pixels required, horizontally and vertically, for reliable decoding of the license plate code. This, combined with the resolution of the camera and the focal length of the lens, determines the maximum distance at which the ANPR system can retrieve license plate codes. The minimum pixel values can differ per country. For example, Middle Eastern license plates require more pixels than those from Western Europe. Also make sure that the IR light has enough power to adequately illuminate all license plates.

### Minimum number of frames needed for reliable plate recognition

Some ANPR software packages require more than a single image of the same license plate to reliably recover the license plate code. This can impact the camera depth of field and lens. Using a high frame rate (e.g. 60 fps) can help deal with this.

## 3 Bosch products capable of license plate capture

The following camera models have tuned firmware, allowing them to produce good-contrast, low-noise images that are suitable for license plate processing:

### Fixed box camera

This camera is suited for single- or multi-lane use in start-stop and highway applications with vehicle speeds of up to 130 km/h.

DINION IP starlight 6000 (with built-in Essential Video Analytics)

- ▶ NBN-63013-B (720p)
- ▶ NBN-63023-B (1080p)
- ▶ DINION IP starlight 7000 (with built-in Intelligent Video Analytics)
- ▶ NBN-73013-BA (720p)
- ▶ NBN-73023-BA (1080p)

The firmware version on this camera should be FW 6.50 or later.

This can be obtained from <http://downloadstore.boschsecurity.com>.

For these fixed cameras a separate housing, lens and optional infrared illuminator can be used:

### UHO outdoor camera housing for DINION cameras:

- ▶ UHO-POE-10

### Varifocal megapixel lenses:

- ▶ LVF-5005C-S1803 (1.8-3mm)
- ▶ LVF-5005C-S4109 (4.1-9mm)
- ▶ LVF-5005C-S0940 (9-40mm)



**IR illuminator 5000:**

- ▶ IIR-50850-SR Illuminator, 850nm, short range (13W)
- ▶ IIR-50850-MR Illuminator, 850nm, medium range (26W)
- ▶ IIR-50850-LR Illuminator, 850nm, long range (39W)
- ▶ IIR-50850-XR Illuminator, 850nm, extra-long range (52W)



**NOTE:** The illumination distance ranges mentioned in the data sheets for these illuminators are for surveillance applications, not ANPR applications. In ANPR applications, using the ANPR scene mode, the distance range will be much less than for surveillance applications. The 39 W illuminator has been tested up to 30 meters.

**IR illuminator power supplies:**

- ▶ PSU-IIR-35 Power supply, 100-240VAC/24VDC, 1.25A, 35W
- ▶ PSU-IIR-60 Power supply, 100-240VAC/24VDC, 2.5A, 65W
- ▶ PSU-IIR-100 Power supply, 100-240VAC/24VDC, 4.2A, 100W

**IR illuminator brackets:**

- ▶ IIR-MNT-SLB Bracket for illuminator, single L, black
- ▶ IIR-MNT-DLB Bracket for illuminator, double L, black
- ▶ IIR-MNT-TLB Bracket for illuminator, triple L, black



### Bullet camera with integrated IR

This camera is suitable for single-lane, start-stop applications with a maximum distance between camera and license plate of 15 meters.

DINION IP starlight 6000i IR. Order number: NBE-6502-AL (1080p)

The firmware version on this camera should be FW 6.50 or later.  
This can be obtained from <http://downloadstore.boschsecurity.com>.

### PTZ camera with integrated IR

This camera is suitable for single- or multi-lane use in start-stop and highway applications with vehicle speeds of up to 130 Km/h. License plates can be captured at multiple preset positions, e.g. at gas stations or toll booth barriers.

AUTODOME IP starlight 5000i IR. Order number: NDP-5512-Z30L

The firmware version on this camera should be FW 6.50 or later.  
This can be obtained from <http://downloadstore.boschsecurity.com>.

The following accessories can be used with this camera:

- ▶ NDA-U-PA0 Surveillance cabinet  
24VAC Surveillance cabinet, 24 VAC input, 24 VAC output, IP66. Order number NDA-U-PA0
- ▶ NDA-U-PA1 Surveillance cabinet  
120VAC Surveillance cabinet, 100 - 120 VAC 50/60 Hz input, 24 VAC output, IP66. Order number NDA-U-PA1
- ▶ NDA-U-PA2 Surveillance cabinet  
230VAC Surveillance cabinet, 230 VAC input, 24 VAC output, IP66. Order number NDA-U-PA2
- ▶ NDA-U-CMT Corner mount adapter  
Universal corner mount, white. Order number NDA-U-CMT
- ▶ NDA-U-PMAL Pole mount adapter, large  
Universal pole mount adapter, white; large. Order number NDA-U-PMAL
- ▶ NDA-U-PMAS Pole mount adapter, small  
Universal pole mount adapter, white; small. Order number NDA-U-PMAS
- ▶ NDA-U-PMT Pendant pipe mount, 12" (31cm)  
Universal pipe mount for dome cameras, 31 cm, white. Order number NDA-U-PMT
- ▶ NDA-U-PMTE Pendant pipe extension, 20" (50cm)  
Extension for universal pipe mount, 50 cm, white. Order number NDA-U-PMTE
- ▶ NDA-U-PSMB Pendant wall/ceiling mount SMB  
Surface mount box (SMB) for wall mount or pipe mount. Order number NDA-U-PSMB
- ▶ NDA-U-WMP Wall mount plate  
Back plate for universal wall mount, corner mount and pole mount, white, IP66. Order number NDA-U-WMP
- ▶ NDA-U-WMT Pendant wall mount  
Universal wall mount for dome cameras, white. Order number NDA-U-WMT
- ▶ NDA-U-RMT Pendant parapet mount  
Universal roof mount for dome cameras, white. Order number NDA-U-RMT
- ▶ LTC 9230/01 Roof mount adapter  
Flat Roof Mount Adapter for mounting a unit in an upright position on a flat surface. Order number LTC 9230/01
- ▶ VG4-SFPSCKT ethernet to SFP interface kit  
Ethernet media converter video transmitter/data receiver fiber optic kit for AUTODOME cameras and for MIC-IP-PSU for MIC analog cameras. Order number VG4-SFPSCKT
- ▶ SFP-2 Fiber module, multimode, 1310nm, 2LC SFP Fiber Optic Module, 2 km (1.2 miles), 2 LC connectors. Multi-mode 1310 nm. Order number SFP-2
- ▶ SFP-3 Fiber module, single-mode, 1310nm, 2LC SFP Fiber Optic Module, 20 km (12.4 miles), 2 LC connectors. Single-mode 1310 nm. Order number SFP-3
- ▶ SFP-25 Fiber module, 1310/1550nm, 1SC SFP Fiber Optic Module, 2 km (1.2 miles), 1 SC connector. Multi-mode 1310/1550 nm. Order number SFP-25
- ▶ SFP-26 Fiber module, 1550/1310nm, 1SC SFP Fiber Optic Module, 2 km (1.2 miles), 1 SC connector. Multi-mode xxxxxxxx



**FLEXIDOME camera with integrated IR**

This camera is suitable for single-lane, start-stop applications with a maximum distance between camera and license plate of 10 meters.

FLEXIDOME IP starlight 5000i IR. Order number: NDE-5502-AL (1080p)

Please note that although the other members of the FLEXIDOME IP starlight 5000i family :Order numbers NDI-5502-A, NDE-5502-A and NDI-5502-AL also have the LPR scene mode, we recommend to only use the NDE-5502-AL as this camera has IR built in and is an IK10 rated outdoor model.

The firmware version on this camera should be FW 7.80 or later.

This can be obtained from

<http://downloadstore.boschsecurity.com>.



## 4 Checklist and system design steps

- ✓

Check whether the ANPR software supplier supports license plates from the required countries and states. Appendix A lists the URLs of a number of ANPR software supplier sites that provide this information.

Countries required: .....

All countries required are supported by the following ANPR software suppliers: .....

- ✓

Check what background colors license plates in the application have, and if these are supported by the software. Sometimes special color lighting or lens filtering is required by the ANPR software supplier. The supplier should help you address these challenges.

License plate colors: .....

ANPR software supplier recommendations with respect to illumination:.....

- ✓

Check the number of lanes per camera and the lane width for the application at hand.

Number of lanes: .....

Lane width: .....

Note: Use a DINION box camera in 2-3 lane applications. If more lanes need to be covered, use multiple cameras.

- ✓

For multi-lane applications, check if the ANPR software supplier supports multi-lane capture, or recommends using a camera for every lane. Additional licenses may be needed for multi-lane capture.

Multi-lane license plate capture supported by the supplier: .....

Extra license requirements for multi-lane applications: .....

- ✓

Check that the software can be used at the vehicle speeds specified by the end-user. Be aware that some suppliers have different licenses/software for start-stop or free-flow applications.

Maximum speed requirements: .....

ANPR software supplier maximum speed supported: .....

License requirements of ANPR software supplier at requested speeds: .....

- ✓

Select a mounting position so that the mounting angles remain within the limits set by the ANPR software supplier. In general, try to keep the horizontal off-axis angles as small as possible. The camera should preferably be mounted higher than the license plate height a to reduce headlight glare.

Supplier max H-angle: ..... Max V-angle: .....

Site H-angle < Supplier H-angle: ..... Site V-angle < Supplier V-angle: .....

- ✓

Using the minimum pixel values required by the ANPR software supplier for the license plate and the camera resolution, calculate the lens focal length for the appropriate distance between license plate and camera using the Bosch lens calculator.

Focal length required: .....

The cameras have a horizontal resolution of 1920 pixels. If the ANPR software requires a minimum of 200 pixels per meter at the license plate, you can therefore cover a scene with a horizontal range of maximum 9.5 meters. This is equivalent to approximately three lanes. The lens quality is critical (resolution off-center at open aperture). For challenging multi-lane applications consider using a higher-quality lens, with better resolution in the corners. Be sure to select an IR-compensated lens. For night-time or poorly-illuminated applications, the camera will need permanent IR illumination and B/W operation.

IR illumination needed: .....

### Practical advice:

When mounting the camera on a pole or gantry near a highway, make sure it is firmly mounted, as the camera system will be exposed to constant shocks, vibration and wind gusts. Bosch brackets have been tested with external Bosch illuminators to ensure they remain stable under such conditions.

In start-stop applications with a single lane per camera and distances < 15 meters, consider using the DINION IP starlight 6000i IR bullet camera. For distances beyond 15 meters, the built-in IR illuminator is not powerful enough and the maximum focal length (12 mm) does not provide sufficient resolution for license plates. In case a FLEXIDOME form factor is preferred, and the distance between plate and camera is less than 10 meters, then the FLEXIDOME IP starlight 5000i IR dome camera can also be used in start-stop applications. The distance between lens and license plate is even more limited, as the max focal length is 10mm.

The AUTODOME IP starlight 5000i IR can be configured remotely, can cover multiple lanes simultaneously and performs ANPR on multiple presets. It's an all-in-one capture solution.

For other applications use a DINION box camera with the appropriate housing, IR illuminator and bracket. In many cases, the 9-40mm lens LVF-5005C-S0940 will be sufficient, although other lenses can be specified if required.

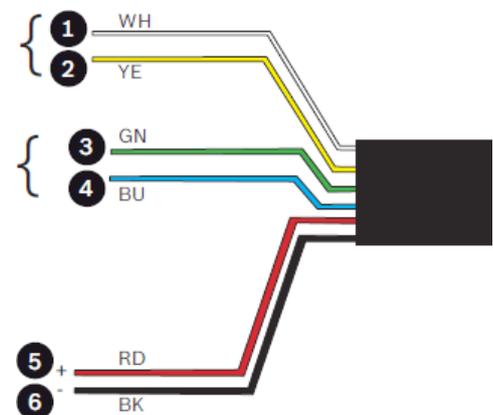
## 5 Installing and configuring Bosch IR illuminators

When Bosch IR illuminators are used, the wires 1 (white), 2 (yellow), 3 (green) and 4 (blue) remain unconnected. The power supply is connected to wires 5 (red) and 6 (black). If DC is used, red is + and black is -.

The IR illuminator should match the field of view of the lens at the required focal length. The light level should be the same in the center as in the corners. Check the illuminator beam pattern for this. If required, use a high-quality diffuser on the illuminator to match the lens's field of view. Diffusers are provided with the illuminator. When using Bosch illuminators, select the 60° diffuser supplied with the device to ensure even lighting in multi-lane applications. Narrow diffusers will allow a greater capture distance, but may produce an uneven beam pattern with dark corners in multi-lane applications.

Bosch illuminators have an outdoor sensor. This is not required, so the sensor dial should be turned fully counterclockwise.

Bosch illuminators also have a power dial so that the amount of light can be tuned in-situ. Setting the power dial and the sensor dial is explained in the camera configuration section below.



## 6 Configuring a DINION box camera for ANPR

This section assumes you are familiar with configuring Bosch cameras using the web server in the camera and a PC or laptop with a web browser.

### Step 1 | Setting camera defaults

If the camera is not new out of the box, restore the default settings (see figure 1).

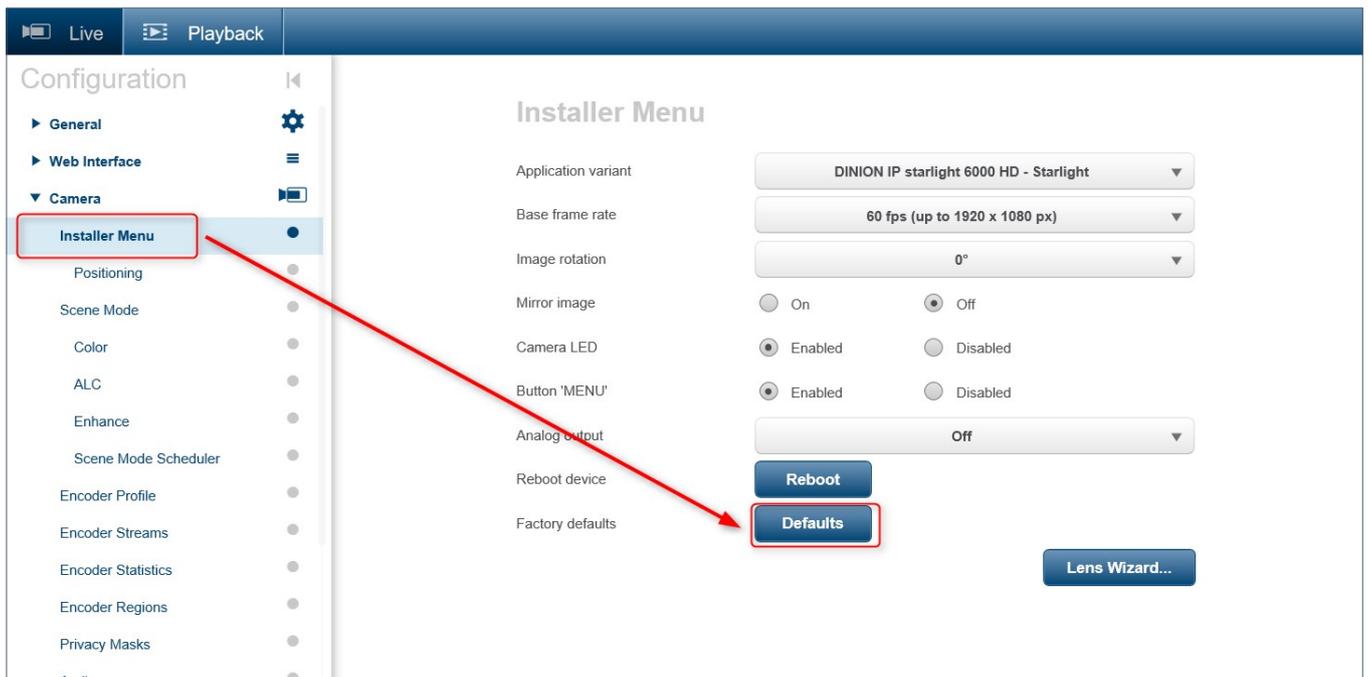


Figure 1

For steps 2 and 3, please refer to figure 2.

### Step 2 | Setting starlight mode

In the Installer menu, select the camera application variant 'starlight'.

### Step 3 | Setting the base frame rate

If your ANPR software requires more than a single image per vehicle for reliable license plate recognition, select the camera application variant 'starlight' and verify that the base frame rate is 60 fps in the installer menu. Some ANPR software packages require up to 7 consecutive frames to produce reliable license plate codes. At a vehicle speed of, say, 144 km/h (which is 40 m/s) and at 25 fps, the camera takes around 280 ms to capture these images, with 40 ms uncertainty in the sampling. In those

320 ms the vehicle covers a distance of 13 meters, and the license plate needs to be sharp over this entire distance, with the lens aperture probably fully open. If you use a camera base frame rate of 60 fps, the distance moved by the vehicle is cut in half to 6.5 meters. It's easier to get sharp images over this reduced range.

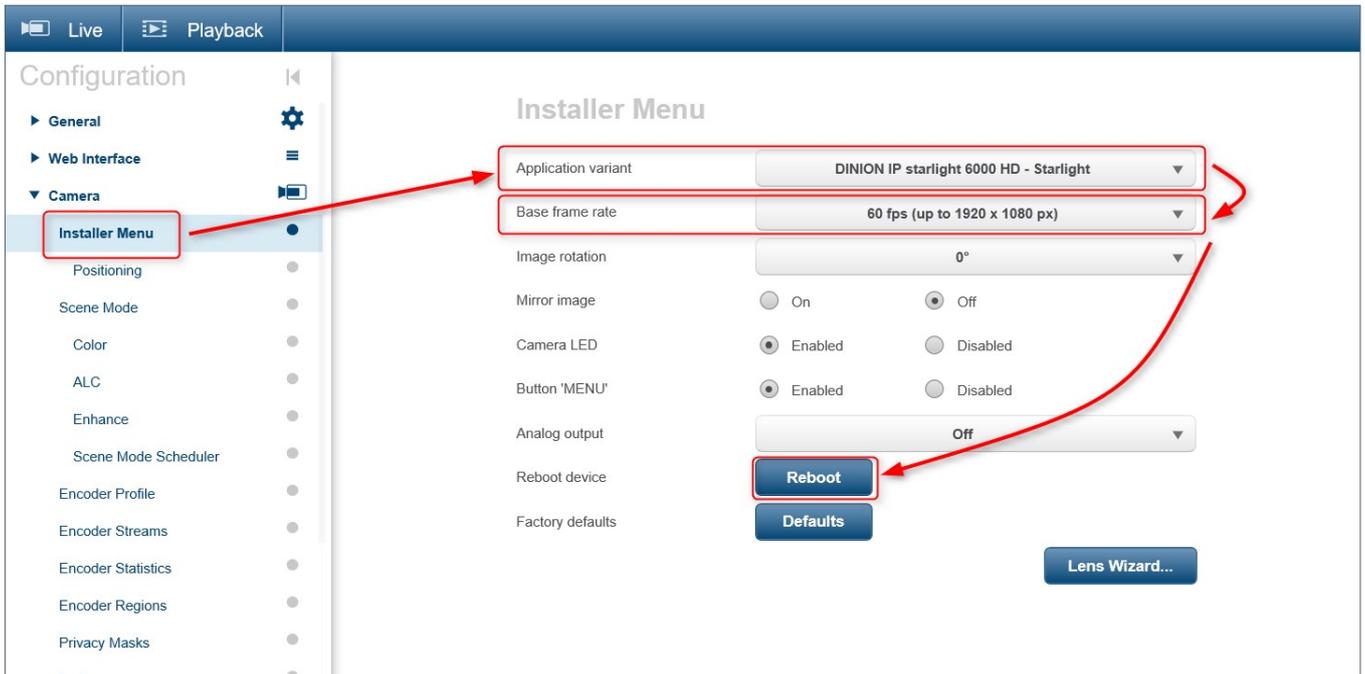


Figure 2

### Step 4 | Setting the focal length

Set the focal length on the lens to cover the required scene width. Take into account the requirements described in the Checklist and system design steps chapter.

### Step 5 | Setting the focus

Focusing the camera (figure 3).

Select the Outdoor scene mode and set a short, fixed exposure time to make sure the camera aperture is fully open. Now use the focusing tools in the Installer menu to set the camera so the license plate is sharp at the right distance. Use a stopped vehicle at the capture spot to verify license plate sharpness. In multi-lane deployments, be sure to check all lanes for proper sharpness.

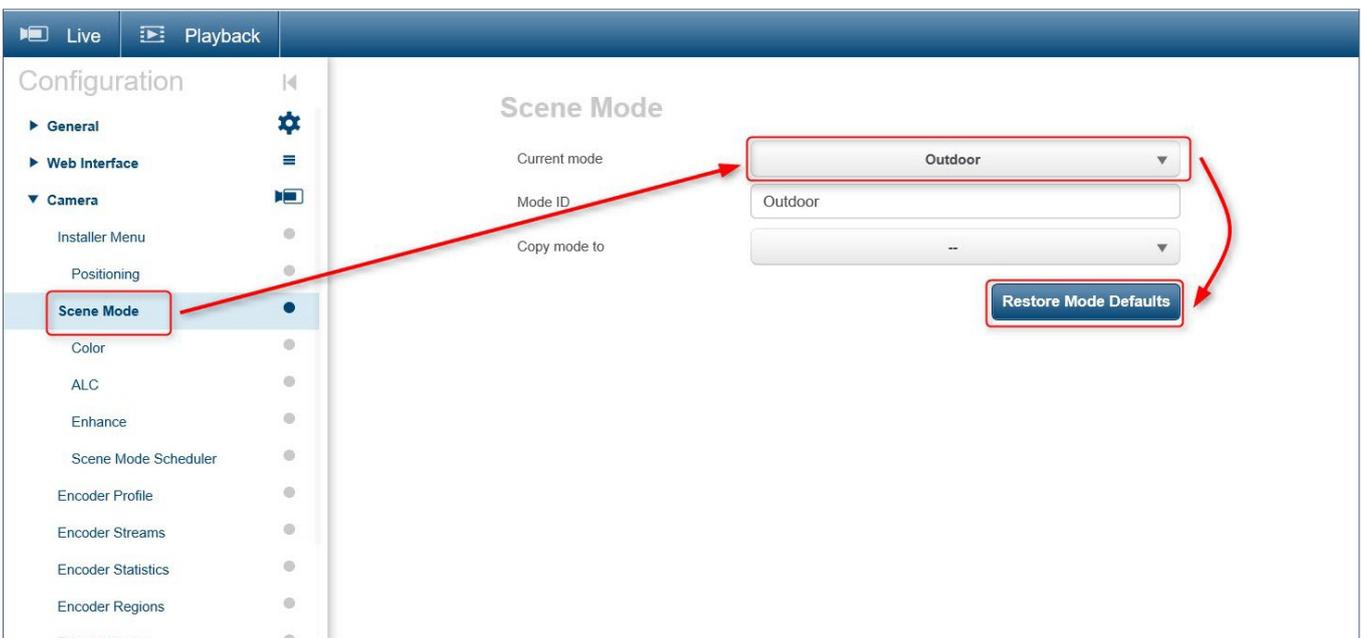


Figure 3

### Step 6 | Verifying the pixel width and height of the license plate

Use the pixel counter tool in the camera menu (figure 4) to verify that the license plate size in pixels is not too large or too small for the ANPR software. Repeatedly click on the 'Update' button until a license plate shows up in the image. Draw a frame around the license plate and verify that the pixel count matches the given supplier values.

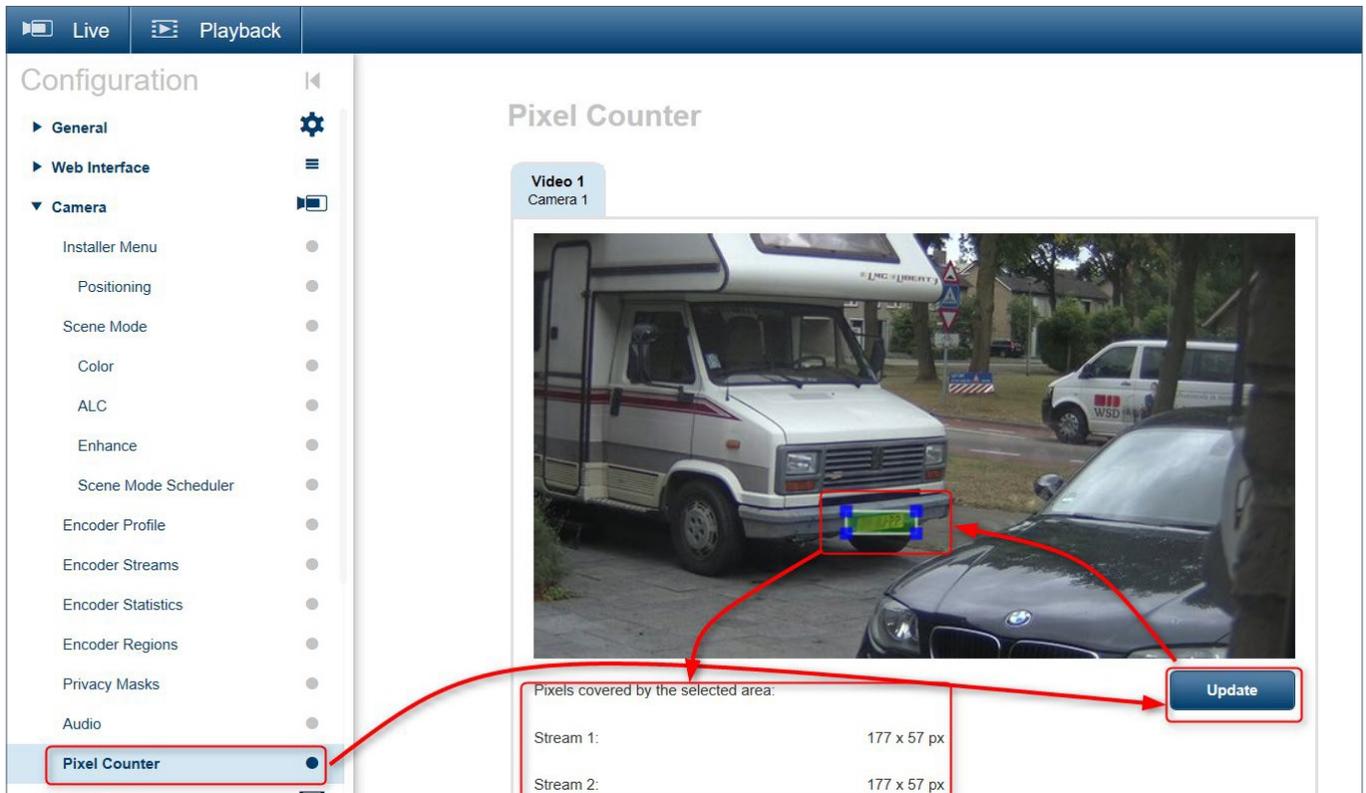


Figure 4. Licence plate is blurred halfway due to privacy reasons

### Step 7 | Setting the LPR scene mode

See figure 5.

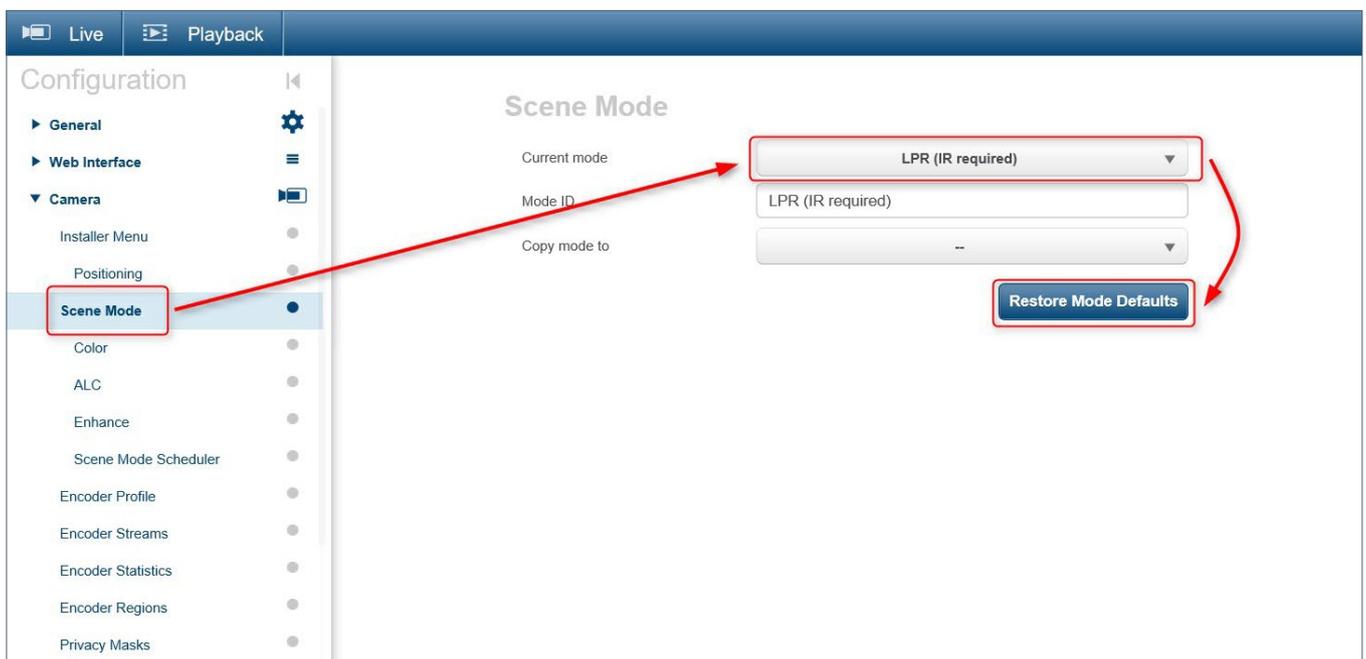


Figure 5

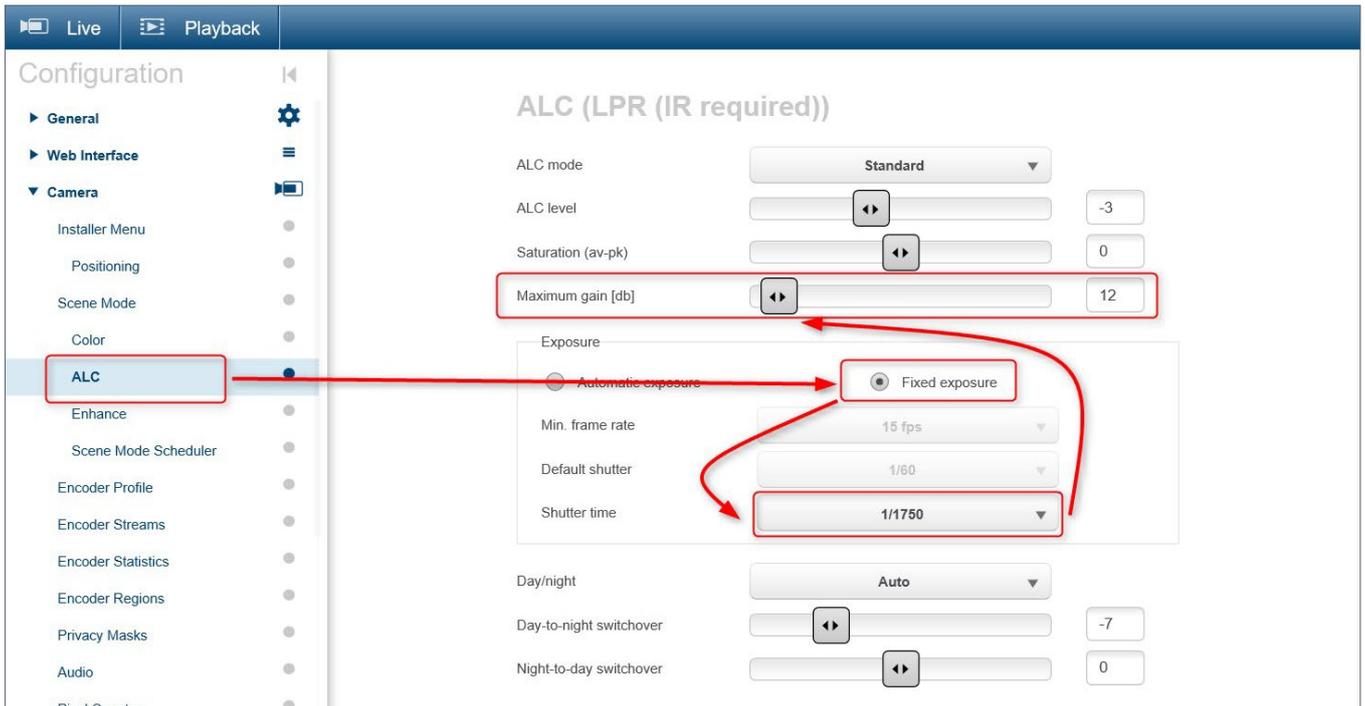


Figure 6

**Step 8 | Setting the fixed exposure mode**

See figure 6. Set a shutter speed of 1/500s or faster. For high vehicle speeds, preferably use 1/1750s or 1/2500s to prevent motion blur. In ALC scene mode at these shutter speeds, the camera image will show a license plate with sufficient contrast. The rest of the image will be dark, with the exception of the headlights (see figure 7). This is to be expected in this mode.



Figure 7

Licence plate is blurred halfway due to privacy reasons

### Step 9 | Setting the maximum gain level

The range of the maximum gain slider in ALC scene mode is capped in the camera firmware to prevent glare and noise problems. Adjust the maximum gain setting (figure 6) and the IR illuminator power dial (marked in green in figure 8) until you generate license plate images without glare but with sufficient contrast/sharpness. Be sure the IR illuminator sensor dial (marked in red in figure 8) is turned fully anti-clockwise.

1. **Sensor dial:** Turn fully counterclockwise
2. **Power dial:** Clockwise for more power, counterclockwise for less power.

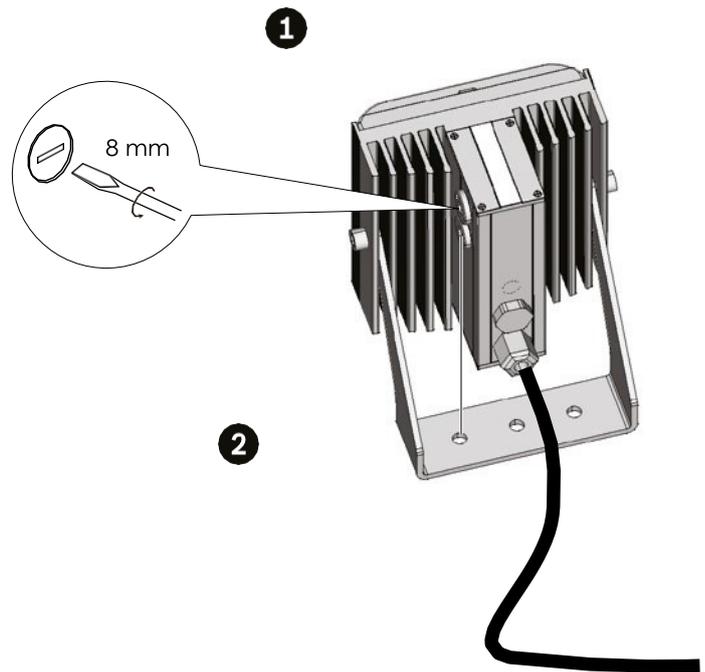


Figure 8.

### Step 10 | Setting the encoding quality

For best ANPR results, the camera should deliver a video stream to the ANPR server with as few compression artifacts as possible. In surveillance applications, the user will normally balance image quality with network bandwidth requirements and storage requirements. In ANPR applications the encoding profile should prioritize the image quality of the video stream over storage savings. After restoring the camera to its default settings, the first profile has the best image quality (see figure 9).

Select the 'HD Image Optimized' profile name.

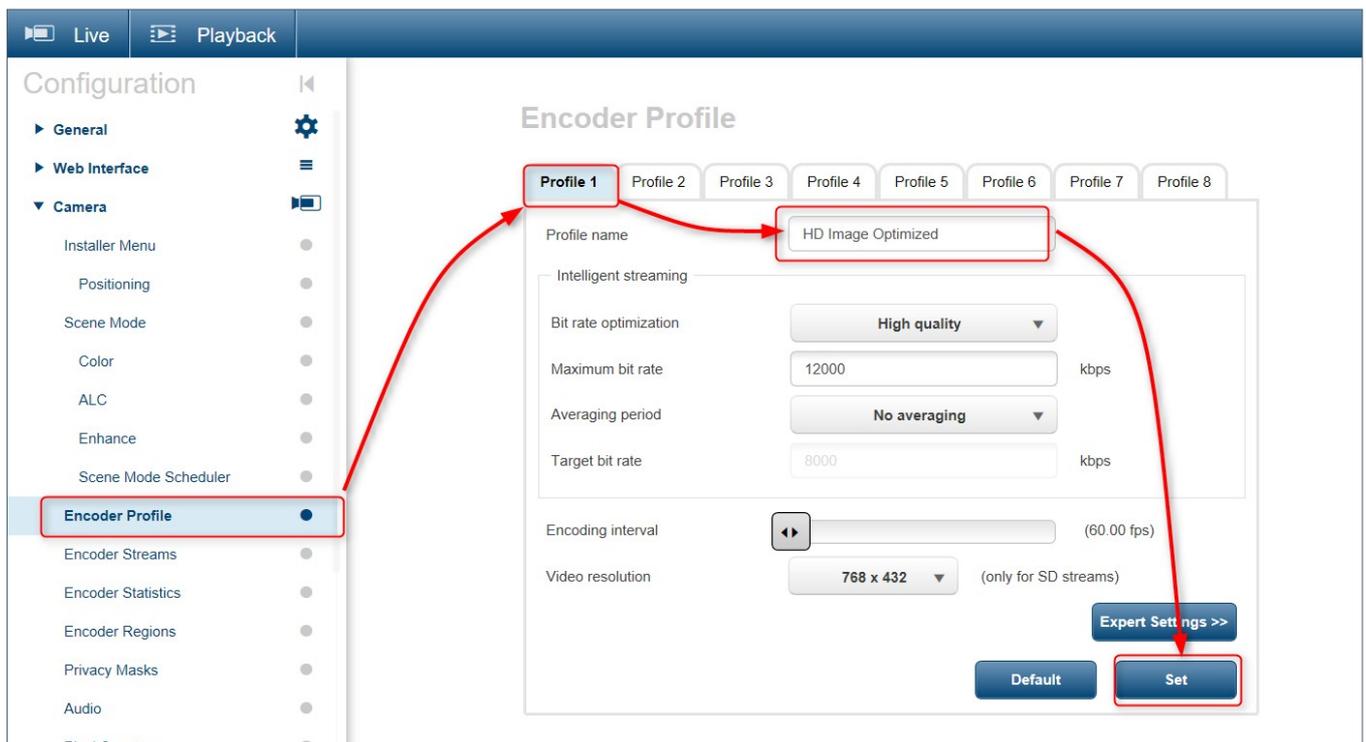


Figure 9

Now check if the video stream to the ANPR software has the correct encoder profile. See figure 10.

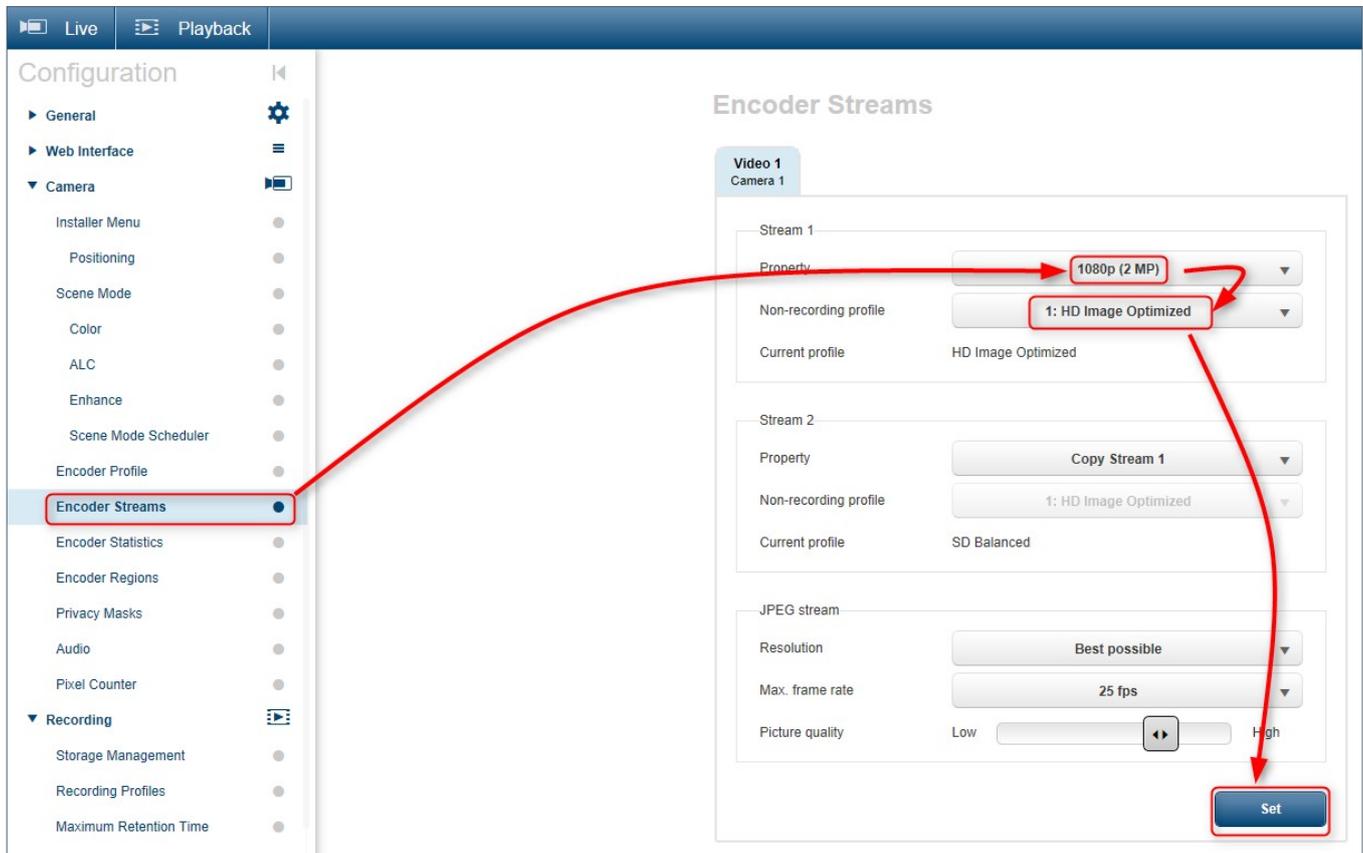


Figure 10

If the ANPR server has trouble keeping up with high-bandwidth video streams, you can consider lowering the frame rate of the cameras if the application allows. For start-stop applications this is often a viable solution. Consult the ANPR software supplier for specific advice regarding the video stream quality. Some packages are better at recognizing and decoding license plates at low frame rates or low resolution than others.

### Tips and tricks

If you still have problems with headlight glare you could try a higher camera mounting position.

If you have problems with reflections from wet roads, try using a circular polarizing filter. Light reflecting from wet roads tends to be polarized linearly. Lowering the gain and/or increasing the IR light power might also help. Keep in mind that a polarizing filter will reduce the amount of light reaching the sensor by 50 to 75% (1 to 2 f-stops).

Check results both in daytime and at night if LPR capture is required 24/7. In multi-lane deployments, check capture performance in all lanes.

## 7 Configuring a DINION IP starlight 6000i IR camera for ANPR

This section assumes you are familiar with configuring Bosch cameras using the web server in the camera and a PC or laptop with a web browser.

The DINION IP starlight 6000i IR camera with FW 6.50 captures license plates of vehicles travelling at up to 50 km/h in a single lane at distances of up to 15 meters.

Perform the following steps to configure this camera:

### Step 1 | Setting camera defaults

In the Installer menu, restore the camera defaults. The default base frame rate is 60 fps (see figure 1). If your ANPR software requires more than a single image per vehicle for reliable license plate recognition, make sure the base frame rate is set to 60 fps.

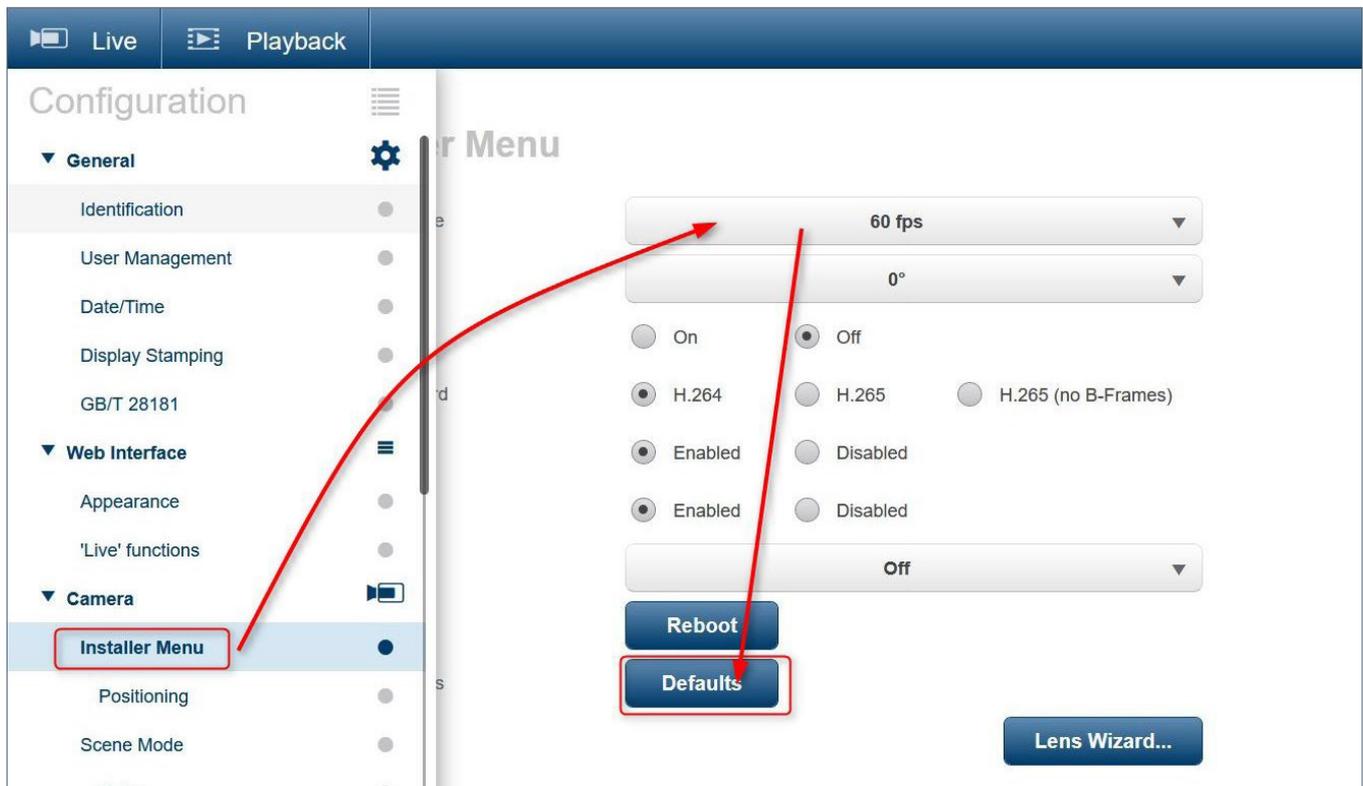


Figure 1

### Step 2 | Setting focal length

In the Installer menu select the Lens Wizard (see figure 2).

Set the focal length (see figure 3) so the license plate images have a sufficient number of pixels for the ANPR software. (Refer to Appendix B for the minimum sizes of license plate images per ANPR supplier).

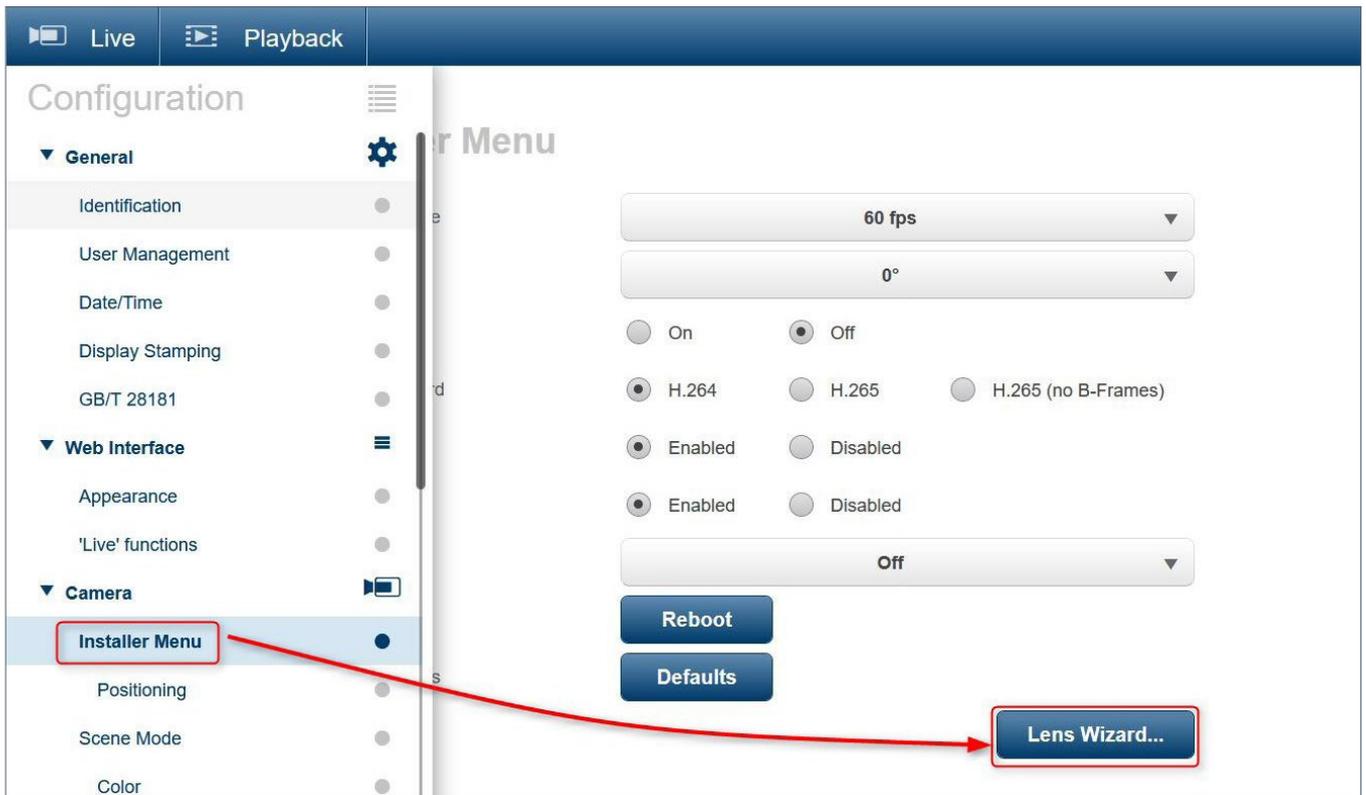


Figure 2

### Step 3 | Setting focus

Select the image area to focus on (push/pull the boundaries of the pink area).

Next, activate Autofocus (see figure 3) and close the Focus and Zoom Adjustment window.

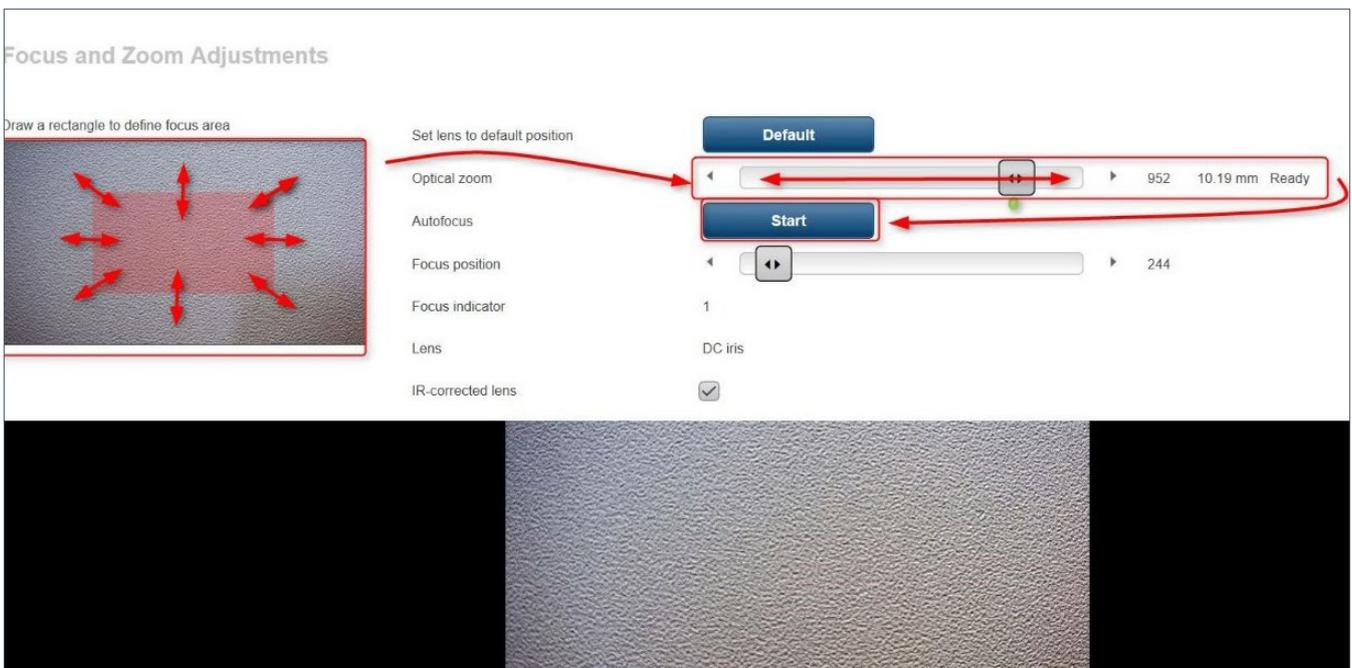


Figure 3

### Step 4 | Setting the LPR scene mode

Set the camera scene mode to LPR and restore the defaults (see figure 4)

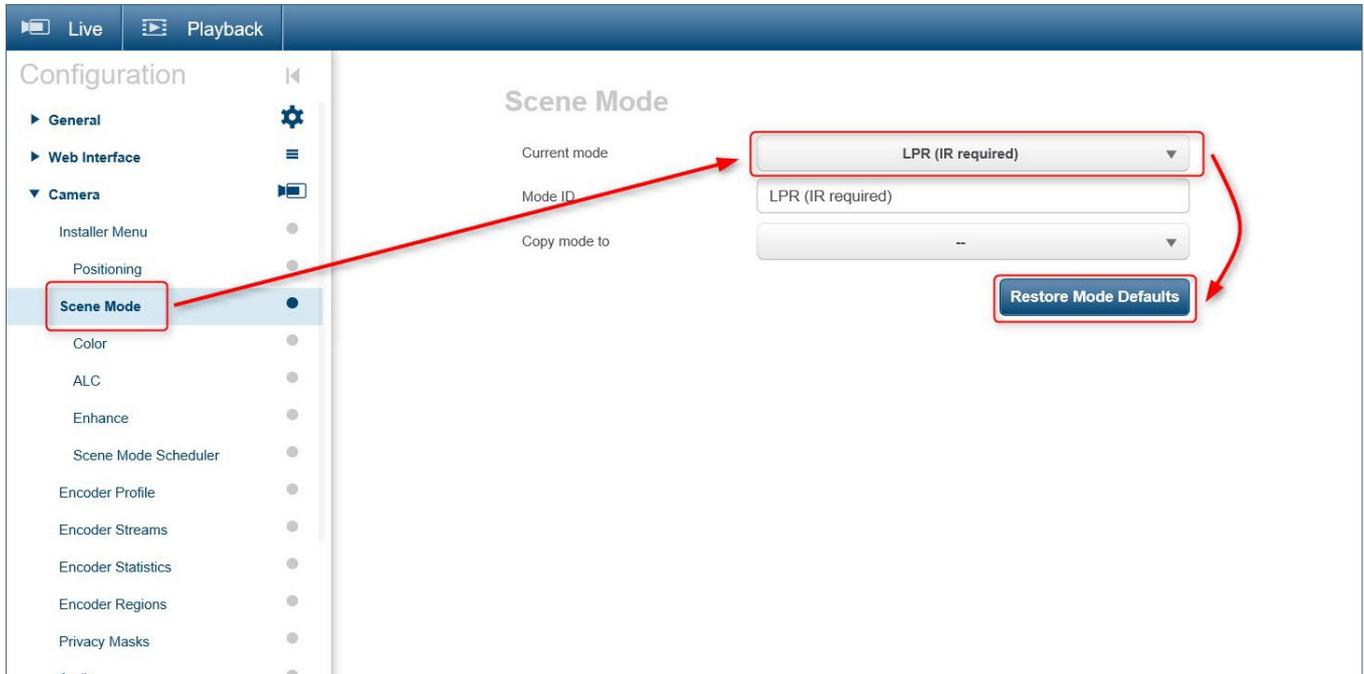


Figure 4

### Step 5 | Setting the maximum gain level and exposure time

In the ALC menu (see figure 5) specify Fixed exposure, select a short enough exposure time to prevent motion blur, set Day/ night to Monochrome, turn the IR function on if 24/7 B/W is needed, or select Auto to have the camera switch between color and B/W. Set both the Intensity and Maximum gain to values that give adequately-lit license plates with no overexposure.

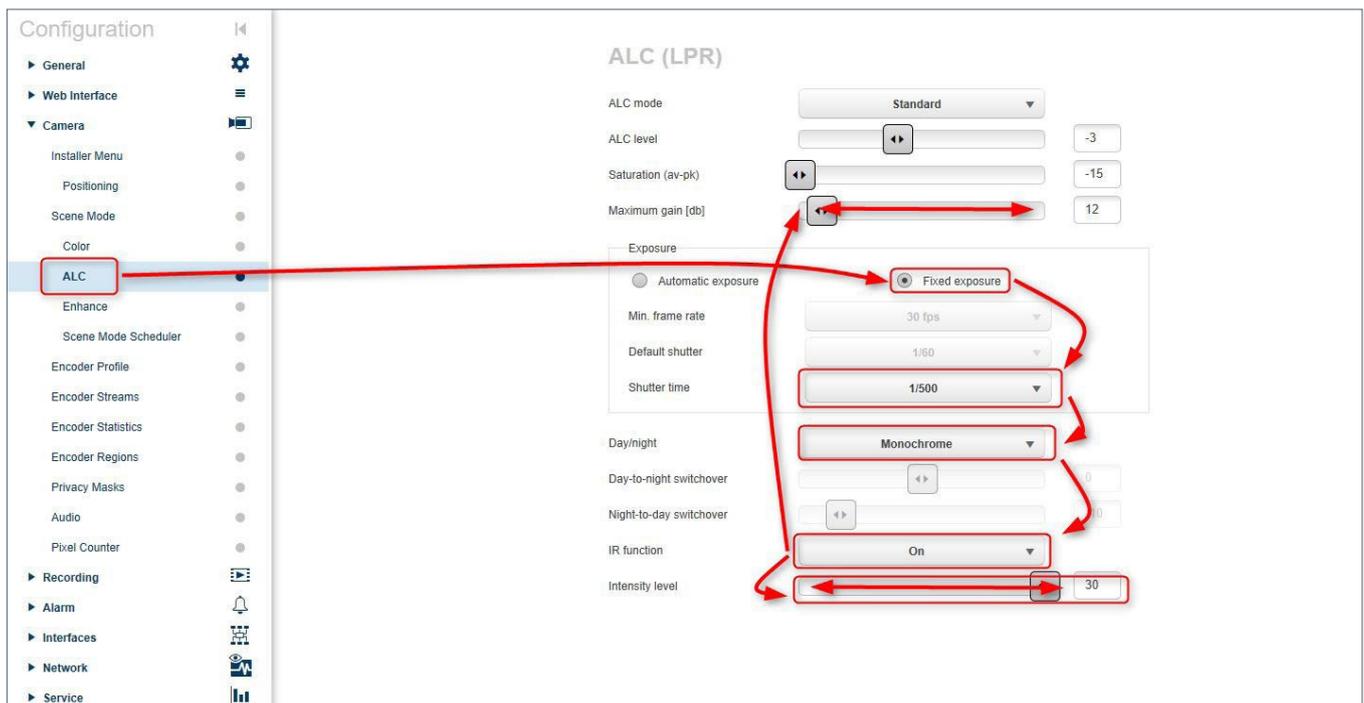


Figure 5

In LPR capture scene mode at these shutter speeds, the camera will capture license plate images with sufficient contrast for ANPR (see figure 6).



Figure 6

Licence plate is blurred halfway due to privacy reasons

In B/W mode the image will be dark, with the exception of the license plate and headlights (see figure 7). This is to be expected in ALC (LPR) scene mode.



Figure 7

Licence plate is blurred halfway due to privacy reasons

### Tips and tricks

If you still have problems with headlight glare you could try a higher camera mounting position. Check results both in daytime and at night if LPR capture is required 24/7.

## 8 Configuring a FLEXIDOME IP starlight 5000i IR camera for ANPR

This section assumes you are familiar with configuring Bosch cameras using the web server in the camera and a PC or laptop with a web browser.

The FLEXIDOME IP starlight 5000i IR camera with FW 7.80 captures license plates of vehicles travelling at up to 30 km/h in a single lane at distances of up to 10 meters.

Perform the following steps to configure this camera:

### Step 1 | Setting camera defaults

In the Installer menu, restore the camera defaults. The default base frame rate is 60 fps (see figure 1). If your ANPR software requires more than a single image per vehicle for reliable license plate recognition, make sure the base frame rate is set to 60 fps.

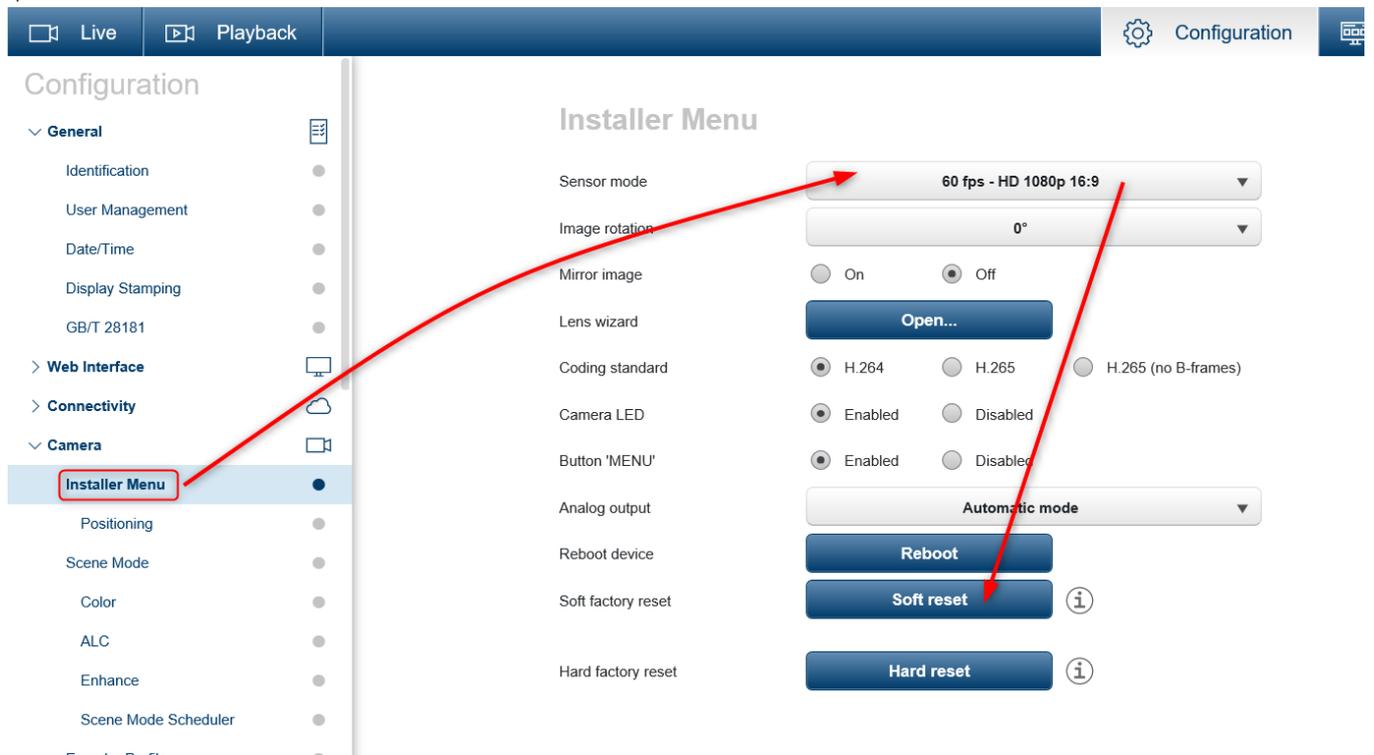


Figure 1

### Step 2 | Setting focal length

In the Installer menu select the Lens Wizard (see figure 2).

Set the focal length (see figure 3) so the license plate images have a sufficient number of pixels for the ANPR software. (Refer to Appendix B for the minimum sizes of license plate images per ANPR supplier).

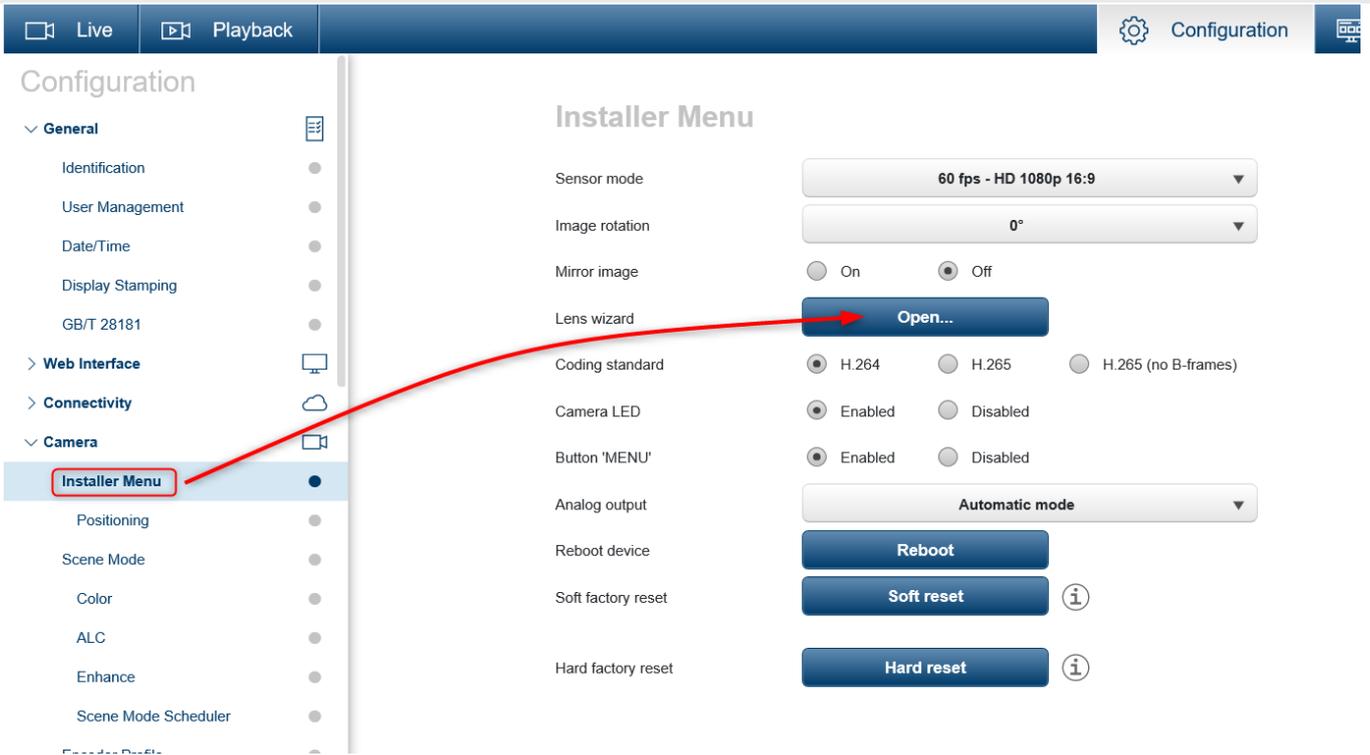


Figure 2

### Step 3 | Setting focus

Select the image area to focus on (push/pull the boundaries of the pink area). Next, activate Autofocus (see figure 3) and close the Focus and Zoom Adjustment window.

#### Focus and Zoom Adjustments

Draw a rectangle to define focus area

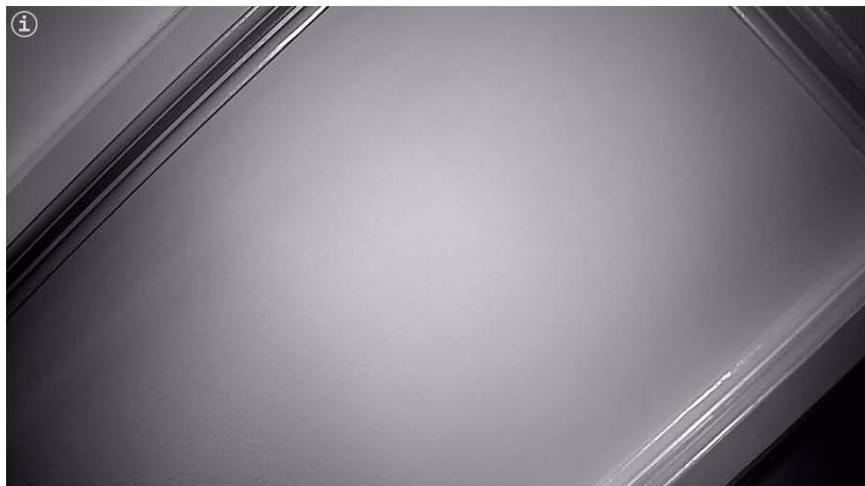
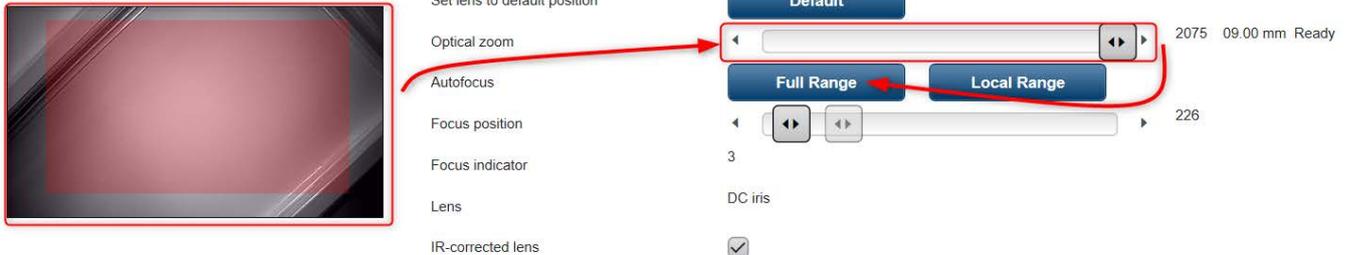


Figure 3

### Step 4 | Setting the LPR scene mode

Set the camera scene mode to LPR and restore the defaults (see figure 4)

The screenshot displays the camera configuration interface. At the top, there are tabs for 'Live' and 'Playback', and a 'Configuration' button with a gear icon. The left sidebar shows a tree view of configuration categories: General, Web Interface, Connectivity, and Camera. Under the 'Camera' category, 'Scene Mode' is selected and highlighted with a red box. The main content area is titled 'Scene Mode' and contains three fields: 'Current mode' (set to 'LPR'), 'Mode ID' (set to 'LPR'), and 'Copy mode to' (set to '--'). A 'Restore Mode Defaults' button is located below the 'Copy mode to' field. Red arrows point from the 'Scene Mode' menu item in the sidebar to the 'Current mode' dropdown, and from the 'Restore Mode Defaults' button back to the 'Current mode' dropdown.

Figure 4

### Step 5 | Setting the maximum gain level and exposure time

In the ALC menu (see figure 5) specify Fixed exposure, select a short enough exposure time to prevent motion blur, set Day/night to Monochrome, turn the IR function on if 24/7 B/W is needed, or select Auto to have the camera switch between color and B/W. Set both the Intensity and Maximum gain to values that give adequately-lit license plates with no overexposure.

Configuration

- General
  - Identification
  - User Management
  - Date/Time
  - Display Stamping
  - GB/T 28181
- Web Interface
- Connectivity
- Camera
  - Installer Menu
  - Positioning
  - Scene Mode
  - Color
  - ALC**
  - Enhance
  - Scene Mode Scheduler
  - Encoder Profile
  - Encoder Streams
  - Encoder Statistics

### ALC (LPR)

ALC mode: Standard

ALC level: -3

ALC - average vs. peak: -15

ALC speed: Slow

Maximum gain [dB]: 12

Exposure:  
 Automatic exposure  
 Fixed exposure

Maximum shutter [s]: 1/750

Default shutter [s]:

Fixed shutter [s]: 1/500

Day/night: Monochrome

switch\_level\_nd: -10

IR function: On

Intensity level: 30

Figure 5

In LPR capture scene mode at these shutter speeds, the camera will capture license plate images with sufficient contrast for ANPR (see figure 6).

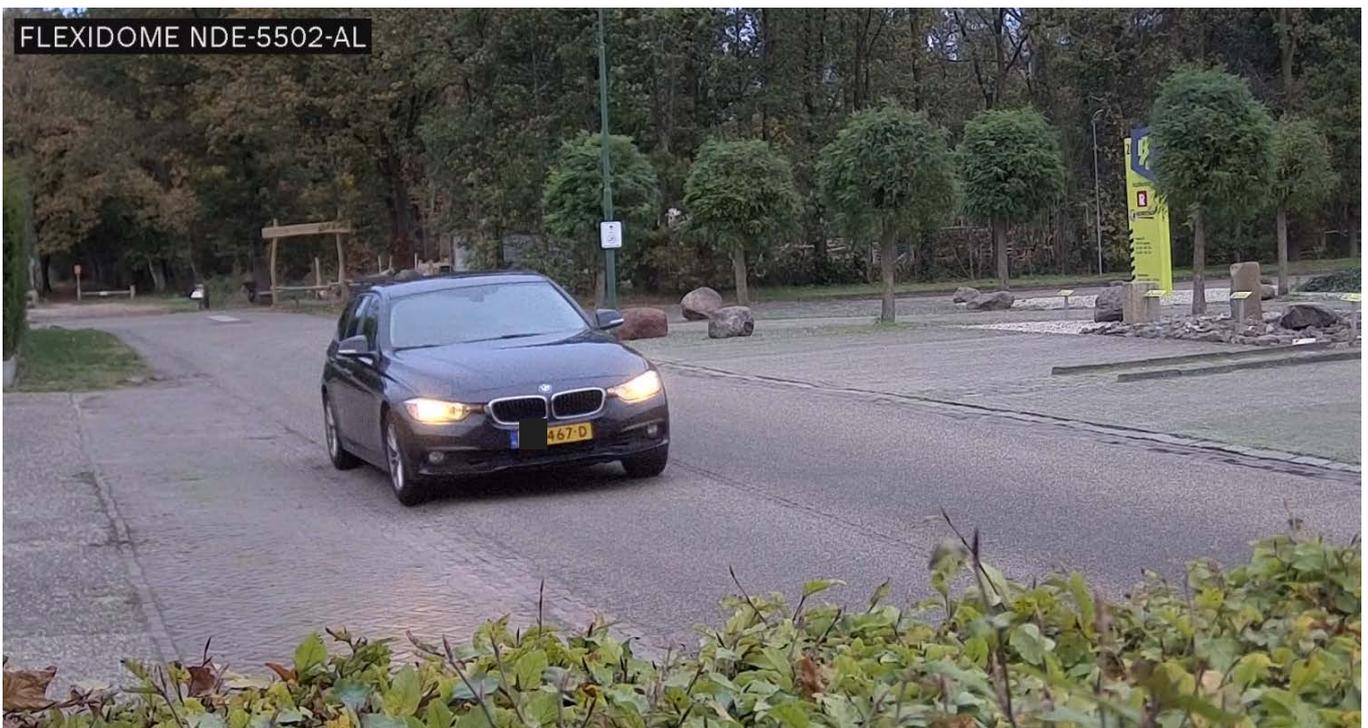


Figure 6 License plate is blurred halfway due to privacy reasons

In B/W mode at night the image will be dark, with the exception of the license plate and headlights (see figure 7). This is to be expected in ALC (LPR) scene mode.



Figure 7 License plate is blurred halfway due to privacy reasons

### Tips and tricks

If you still have problems with headlight glare you could try a higher camera mounting position. Check results both in daytime and at night if LPR capture is required 24/7.

## 9 Configuring an AUTODOME IP starlight 5000i IR camera for ANPR

This section assumes you are familiar with configuring Bosch cameras using the web server in the camera and a PC or laptop with a web browser.

The AUTODOME IP starlight 5000i IR camera with FW 6.50 captures license plates of vehicles travelling at up to 130 km/h, in multiple lanes, at distances of up to 30 meters.

By making use of presets, the camera can collect multiple license plate images, e.g. from different pumps at a gas station or toll booths at a toll plaza with barriers.

Perform the following steps to configure this camera:

### Step 1 | Setting camera defaults

In the Installer menu, restore the camera defaults. The default base frame rate is 60 fps (see figure 1). If your ANPR software requires more than a single image per vehicle for reliable license plate recognition, make sure the base frame rate is set to 60 fps.

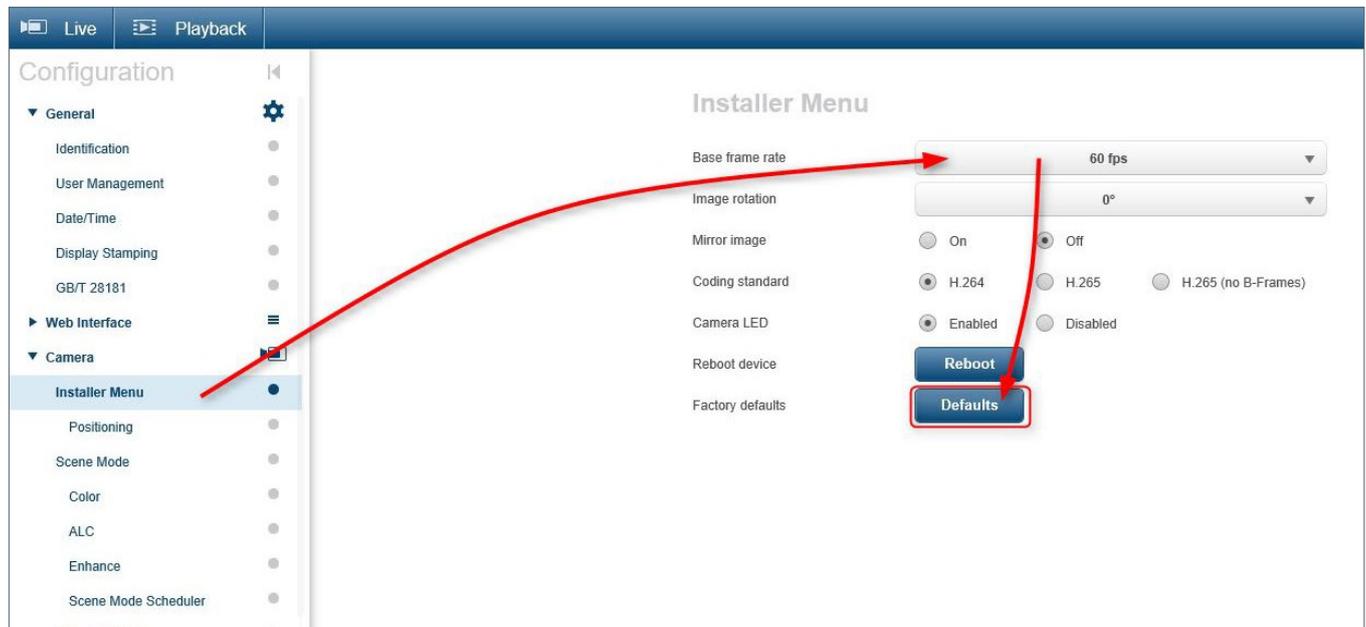


Figure 1

## Step 2 | Setting the encoder quality

In the Camera menu select Encoder Streams (see figure 2).

For stream 1, select 1080p (2MP) for Property.

In the Non-recording profile, select 1: HD Image Optimized. This is important as it minimizes encoding artifacts in the video stream delivered to the ANPR software.

Click the 'Set' button to save the stream settings.

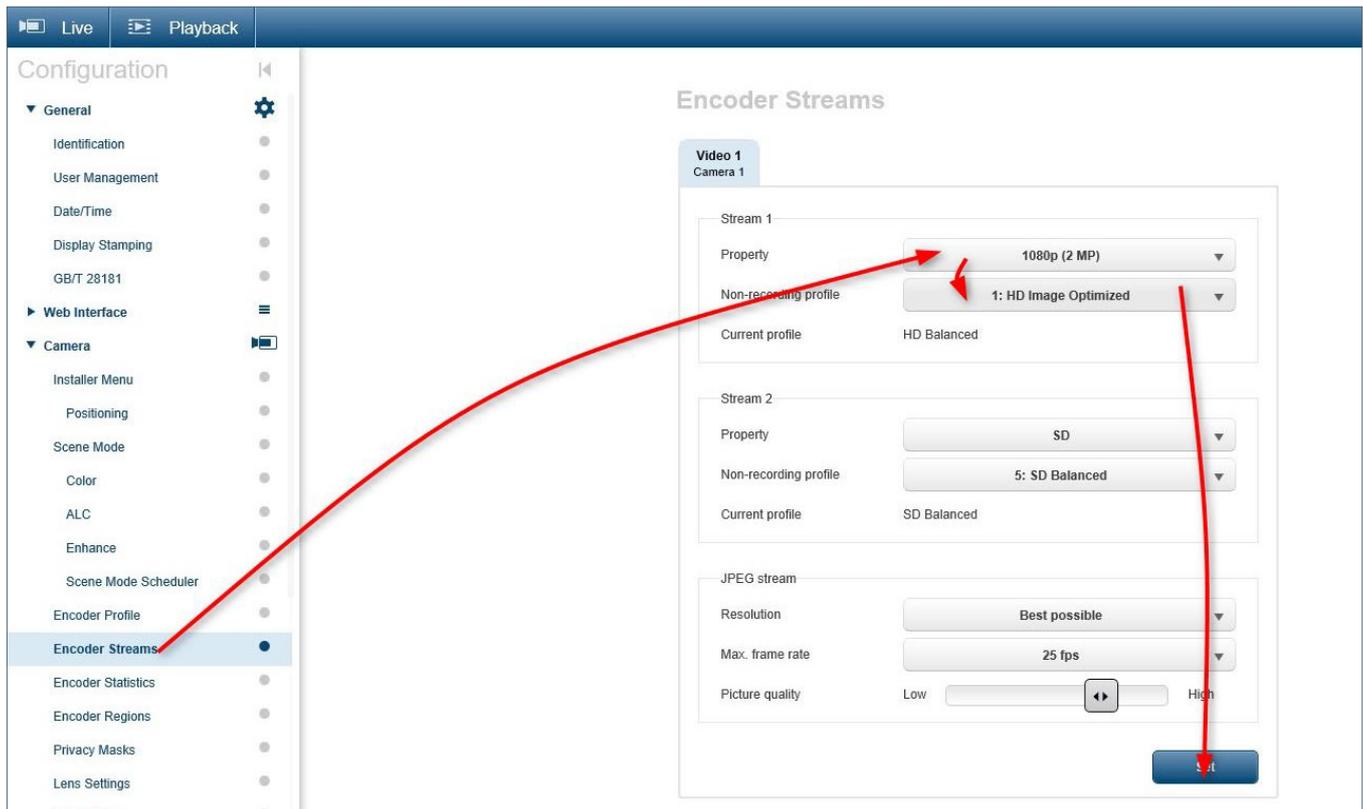


Figure 2

## Step 3 | Configuring the illuminator

In the Camera menu select Illuminator (see figure 3).

Set the IR mode to Auto.

Set the IR near intensity limit level to 100.

Set the IR far intensity limit level to 100.

**NOTE:** If you get overexposed images when capturing close to the camera, decrease the IR near intensity limit value until you get the correct exposure.

Set the IR operation range to 1X to 30X

Switch the Spotlight mode off.

Click the 'Set' button to store the configured settings.

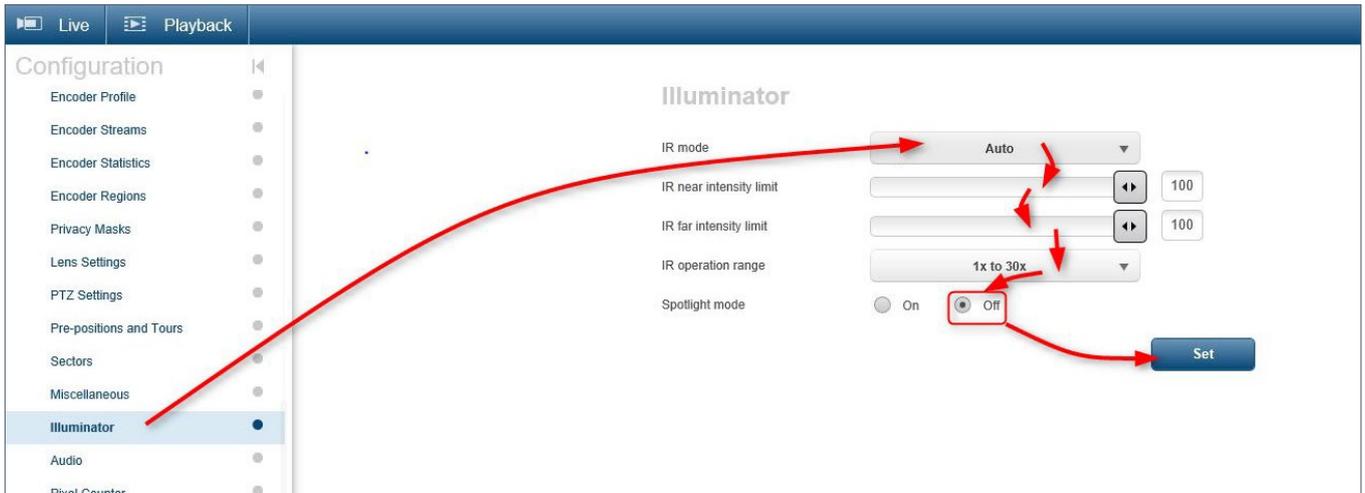


Figure 3

### Step 4 | Setting the manual focus mode

- ▶ In the Camera menu select Lens Settings (see figure 4).
- ▶ Select Manual mode for Autofocus, as you want to determine the exact point of focus yourself. This should be fixed regardless of whether a vehicle is at the designated spot or not.
- ▶ Set the Focus priority range to 10 m, and make sure the IR focus correction is on. Be sure to turn the digital zoom off.

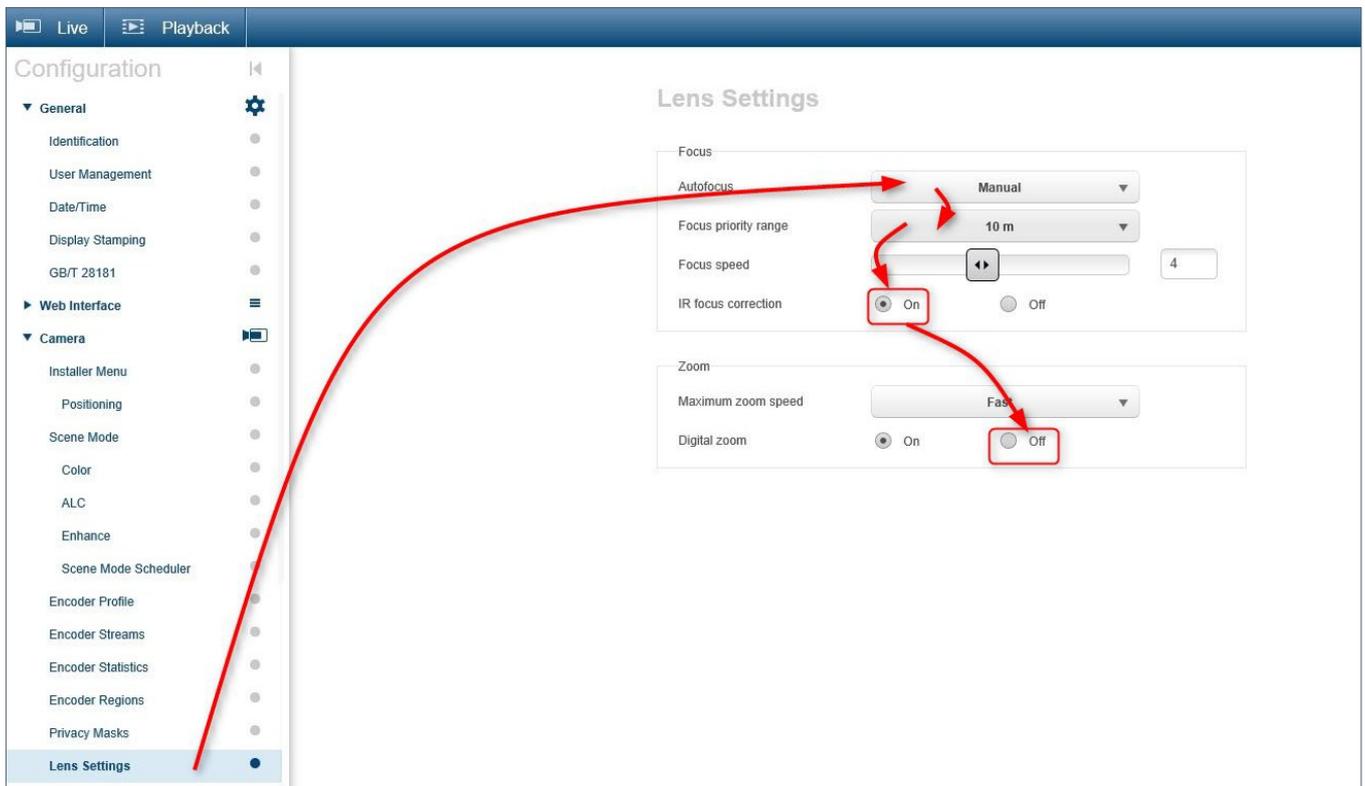


Figure 4

### Step 5 | Setting the LPR scene mode

In Scene Mode, set the Current mode to LPR and restore the defaults (see figure 5).

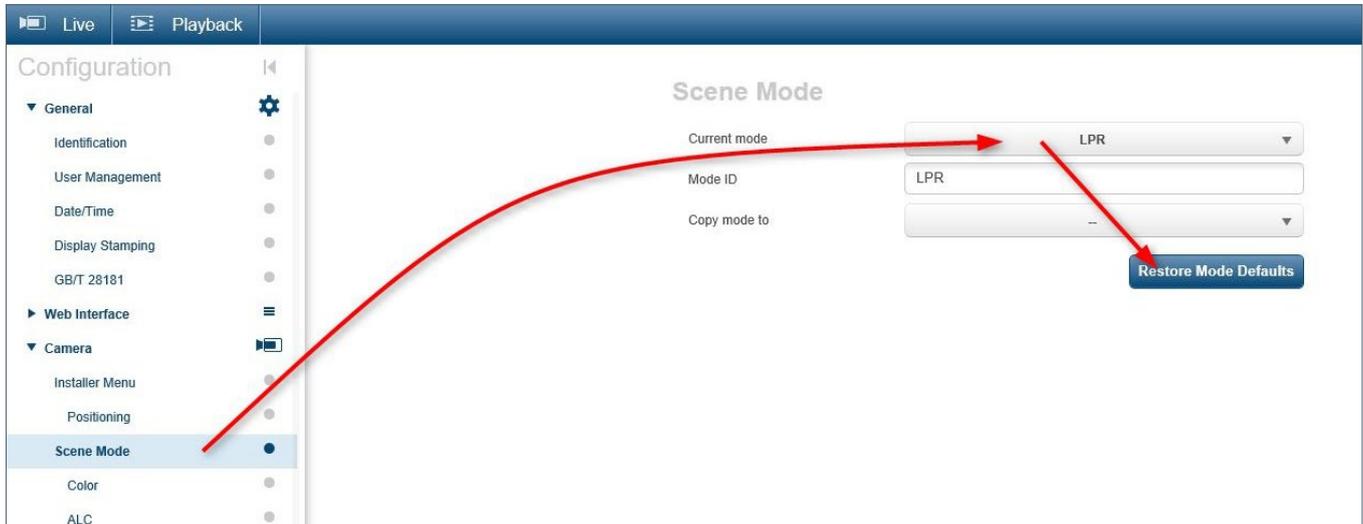


Figure 5

### Step 6 | Setting the maximum gain level and exposure time

Select ALC in the Camera menu (see figure 6).

Set ALC mode to Standard and ALC level to -

3. Set the Saturation (av-pk) to -15.

Set Day/Night to Monochrome if you always want B/W images, or select Automatic to get color images during daytime and B/W images at night.

Set Iris-Priority open-vs-close to -15.

Set Exposure to Fixed Exposure. Now select a shutter time that will produce sharp images. For slow-moving vehicles 1/500 will do; for fast-moving vehicles select 1/1750 or 1/2500.

Set the Maximum Gain to a value that gives adequately-lit license plates with no overexposure.

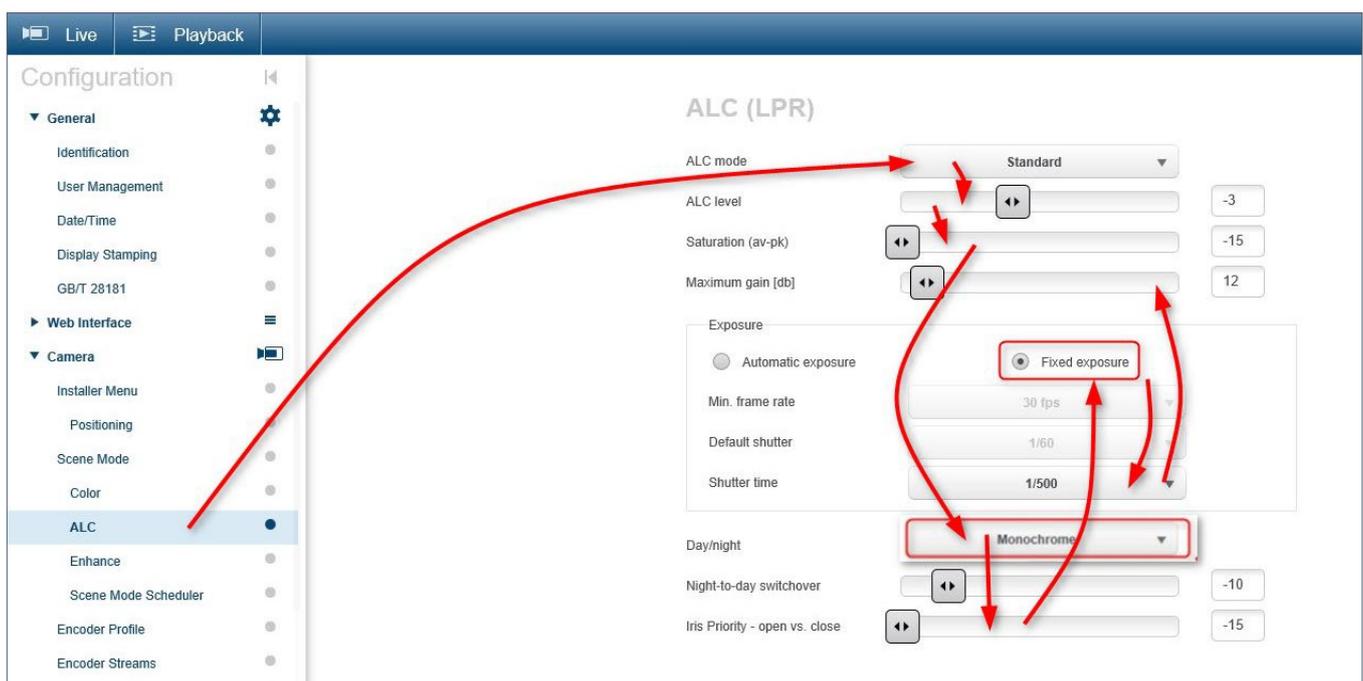


Figure 6

In ALC (LPR) capture scene mode at these shutter speeds, the camera will capture license plate images with sufficient contrast for ANPR (see figure 7).



Figure 7

Licence plate is blurred halfway due to privacy reasons

In B/W mode the image will be dark, with the exception of the license plate and headlights (see figure 8). This is to be expected in ALC (LPR) scene mode.



Figure 8

Licence plate is blurred halfway due to privacy reasons

**Tips and tricks**

If you still have problems with headlight glare you could try a higher camera mounting position. Also try lowering the IR near intensity level and IR far intensity level in the Illuminator menu.

Check results both in daytime and at night if LPR capture is required 24/7.

## Appendix A: Bosch internal contacts for ANPR partners

ANPR software suppliers that can work with Bosch surveillance cameras:

### ISS

Bosch MKR contact	EMEA: Dmitry Rybakov	NAM: Joel White
Bosch IPP contact	EMEA: Richard Schurink	NAM: Heidi Urban

### Neurosoft

Bosch MKR contact	EMEA: Constant Rutten	NAM: Joel White
Bosch IPP contact	EMEA: Richard Schurink	NAM: Heidi Urban

### Streaming Networks

Bosch MKR contact	EMEA: Constant Rutten	NAM: Joel White
Bosch IPP contact	EMEA: Richard Schurink	NAM: Heidi Urban

### Genetec

Bosch MKR contact	EMEA: MKR regional split	NAM: Jeffrey Swan
Bosch IPP contact	EMEA: Andre Eichhorn	NAM: Andre Eichhorn

## Appendix B: ANPR partner solution details

Supplier specific ANPR parameters:

Supplier	Countries supported
<b>ISS</b>	<p><b>Europe</b> Austria, Belarus, Belgium, British Virgin Islands, Bulgaria, Estonia, Finland, France, Germany, Italy, Latvia, Lithuania, Moldova, Poland, Portugal, Russia, Slovenia, Spain, Ukraine, Turkey, United Kingdom.</p> <p><b>Middle East</b> Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE (Dubai, Abu-Dhabi, RAK, Fujairah, Sharjah, UAQ).</p> <p><b>Africa</b> Nigeria, South Africa, Tanzania.</p> <p><b>North America</b> Canada, USA (Northeast, Midwest, West, South).</p> <p><b>South and Central America</b> Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Jamaica, Mexico, Panama, Paraguay, Peru, Salvador, Tahiti, Trinidad and Tobago, Uruguay, Venezuela.</p> <p><b>Asia</b> Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Malaysia, Singapore, Taiwan.</p>
<b>Neurosoft</b>	Info request is with supplier
<b>Streaming Networks</b>	US, Canada, Columbia, Germany, Turkey, UK
<b>Genetec Autovue Flexreader™ LPR</b>	<p><b>Asia-Pacific</b> Australia (optimized for New South Wales), Mongolia (note 13), Queensland, Western Australia, Northern territory (Australia), Hong Kong, Singapore Japan (note 13), New Zealand, Vietnam.</p> <p><b>Caribbean/Latin America</b> Argentina (note 1), Brazil, Columbia, Mexico Jalisco, Argentina Multi (note 2) Cayman Islands, Costa Rica, Peru, Bahamas, Chile, Mexico, St-Maarten, Bermuda.</p> <p><b>Europe/Middle East/Africa</b> Abu Dhabi, France, Kuwait, Sharjah, Arabic Peninsula (note 3), Great Britain, Netherlands, South Africa, Azerbaijan, General European context, Lebanon, Spain, Bahrain, Morocco, Switzerland, Belgium (note 4), Germany, Norway, Turkey, Belgium Multi (note 5) , Italy, Oman, Turkey Only (note 8), Denmark, Ivory Coast, Poland, Turkmenistan, Dubai, Iceland, Portugal, United Arab Emirates, Europe (note 6), Ireland, Qatar, Emirates (note 9), Europe One and Two Lines (note 7), Jordan, Romania, Kazakhstan, Saudi Arabia (note 13).</p> <p><b>North America</b> Alabama, Alberta, Arizona, British Columbia, California, Colorado, Connecticut, Delaware, Florida, General US context, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Kentucky, Indiana, Louisiana, Maine, Manitoba, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Brunswick, Newfoundland, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Northeast states (note 10), Ohio, Oklahoma, Ontario, Oregon, Pennsylvania, Pennsylvania Delaware (note 11), Prince Edward Island, Quebec, Rhode Island, Saskatchewan, South Carolina, Tennessee, Texas, Utah and Neighbors (note 12), Vermont, Virginia, Washington State, Winnipeg, Wisconsin, Wyoming, Yukon.</p>

**Notes:**

- 1: One-line plates only.
- 2: One- and two-line plates.
- 3: Includes Saudi Arabia, Bahrain, Kuwait, and UAE.
- 4: One-line plates only.
- 5: One- and two-line plates.
- 6: One-line plates only.

7: One- and two-line plates.

8: Excludes Q, W, and X characters.

9: Includes Abu Dhabi, Dubai and Sharjah.

10: Includes Pennsylvania, Delaware, Florida, Vermont and New York.

11: Includes Pennsylvania, Delaware, Florida, Vermont and New York. 12: Includes Utah, Oregon, Montana, and North Dakota plates.

13: Non-Latin characters are not supported in the Security Center.

**NOTE:** The number of countries/states supported by ANPR software suppliers tends to expand over time. Contact your MKR for the latest status, or if a country of interest is not listed.

**License plate type and background colors supported**

<b>ISS Secur Auto</b>	Retroflective plates
<b>Neurosoft Neuro Car 3</b>	Info request is with supplier, retroflective plates
<b>Streaming Networks</b>	Retroflective plates, Roman script only
<b>Genetec</b>	Retroflective plates

**Maximum vehicle speed at which plates can be decoded**

<b>ISS</b>	250 km/h (with Bosch cameras only tested to 130 km/h)
<b>Neurosoft</b>	210 km/h using Bosch cameras
<b>Streaming Networks</b>	Depends on camera shutter speed
<b>Genetec</b>	50 km/h

**Maximum number of lanes covered by a single camera (1080p)**

<b>ISS</b>	1-2
<b>Neurosoft</b>	1-2
<b>Streaming Networks</b>	2 (with a 720p camera)
<b>Genetec</b>	1

**Maximum camera mounting angle; horizontal and vertical with the lane axis**

<b>ISS</b>	H-angle 30°, for US plates/Middle Eastern plates 20°, V-angle 40°
<b>Neurosoft</b>	Info request is with supplier
<b>Streaming Networks</b>	H-angle 35°, V-angle 35°
<b>Genetec</b>	H-angle 50°, V-angle 30°

**Minimum plate size in number of pixels**

<b>ISS</b>	200 ppm for EU plates, 400 ppm for Middle Eastern plates
<b>Neurosoft</b>	Info request is with supplier
<b>Streaming Networks</b>	Plate should be 100-140 pixels wide
<b>Genetec</b>	Characters on plate must be between 30 and 60 pixels high

**Minimum number of frames needed for reliable plate recognition**

<b>ISS</b>	3 for EU plates, 7 for Middle Eastern plates
<b>Neurosoft</b>	1
<b>Streaming Networks</b>	1
<b>Genetec</b>	1

## Contact

For product datasheets and manuals please visit <https://www.boschsecurity.com/xc/en/product-catalog/>.

For questions related to integration of cameras in ANPR solutions, please contact the persons mentioned in appendix B

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### **Bosch Security and Safety Systems**

Protecting lives, buildings and assets is our aim. Our product portfolio includes video security, intrusion detection, fire detection and voice evacuation systems as well as access control and management systems. Professional audio and conference systems for communications of voice, sound and music complete the range.

Visit [boschsecurity.com](https://www.boschsecurity.com) for more information.  
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