ALPR with MMC Plugin User Guide

v2.8.2 or higher

Rev: 05/25

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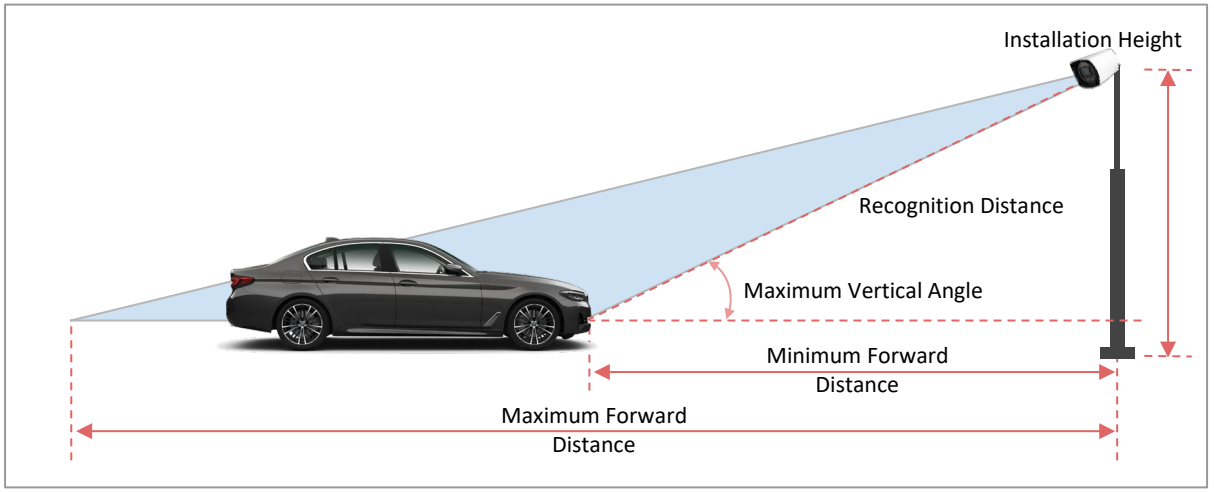
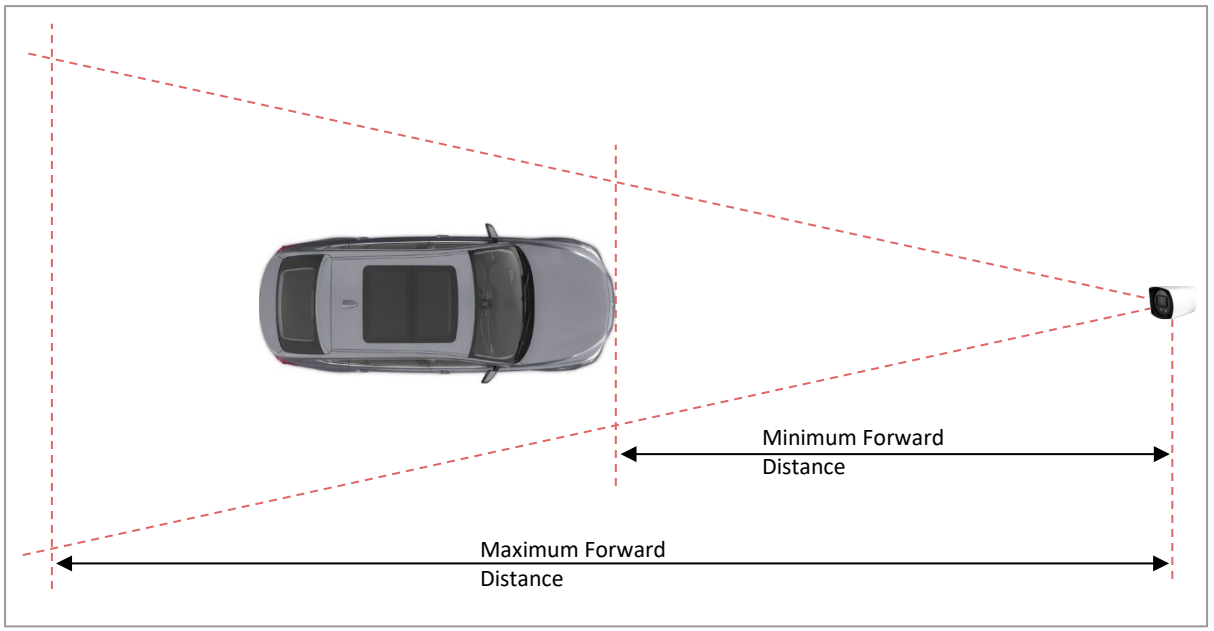
Installing and Positioning Camera

The ALPR (Automatic Number Plate Recognition) engine with MMCR (Maker, Model, and Color Recognition) running on the camera will have the best results following the recommended installation constraints below.

Vertical Angle

- Maximum Vertical Angle @ up to 40KMH (25MPH): **30 degrees**
- Maximum Vertical Angle @ up to 70KMH (45MPH): **25 degrees**
- Maximum Vertical Angle @ up to 120KMH (75MPH): **15 degrees**





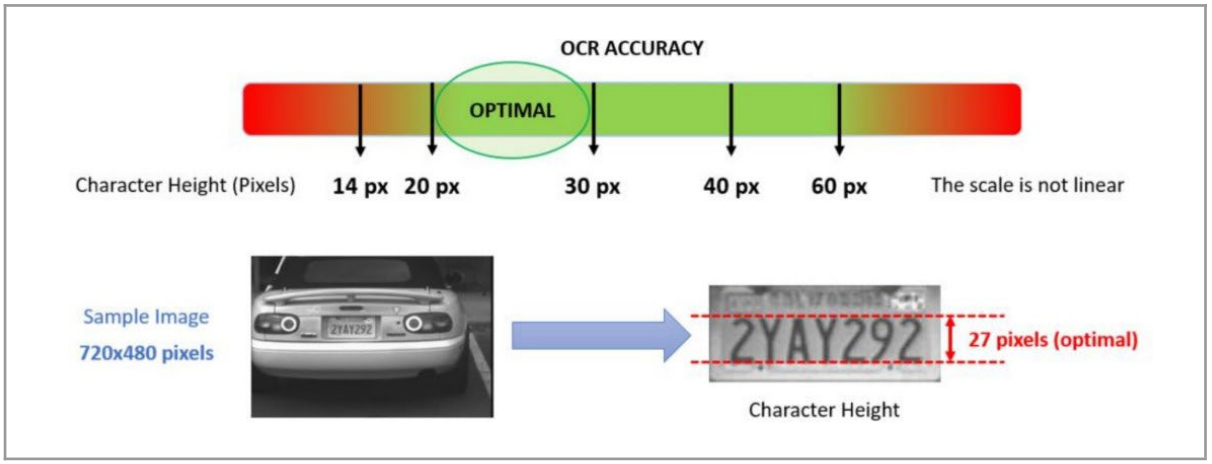
Detectable Range

The objective of an ALPR system is to capture an image with a clear and readable license plate. To achieve this, the characters on the plate should have a height between 20-30 pixels for larger plate formats (e.g., EU 50cm plates) and about 25-35 pixels for USA–style plates, which are physically smaller and have narrow character stroke width in many states.

Certain Middle Eastern and Arabic plates are smaller and need an even greater character pixel height of 30-40 pixels. For example, in Abu Dhabi, the small characters next to or above the main characters are only 3cm high and may require a much higher camera resolution.

The camera should be set up so that the combination of the distance, focal length, and camera resolution provides an image that the OCR can accurately analyze.

Details on combining these settings are provided later in this guide.



Optimal character height in pixels

The focal length tells us the angle of view (how much of the scene will be captured) and the magnification (how large individual elements will appear).

The longer the focal length, the narrower the angle of view and the higher the magnification.

The shorter the focal length, the wider the angle of view and the lower the magnification.

For zoom lenses, the minimum and maximum focal lengths are stated, for example, 10–40 mm. When purchasing a lens for ALPR, we need to know the distance between the camera and the reading point. We recommend the following varifocal lens:

- Gate or Parking
    - Distance between camera & reading point: 3 to 10 meters
    - Recommended lens: 2.7-13.5 mm or similar
- Highway, road or street
    - Distance between camera & reading point of 15 to 30 meters

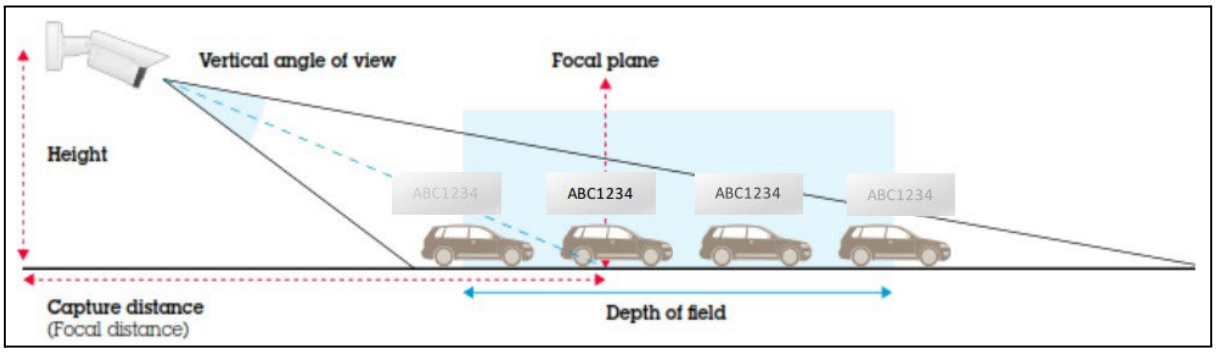
Recommended lens: 5-50 mm or similar. Here is the recommended detection range for the camera.

Focal Length (Angle of View)	Recommended distance (m)
6 - 50 mm (40.8° to 6.9°)	7 - 30

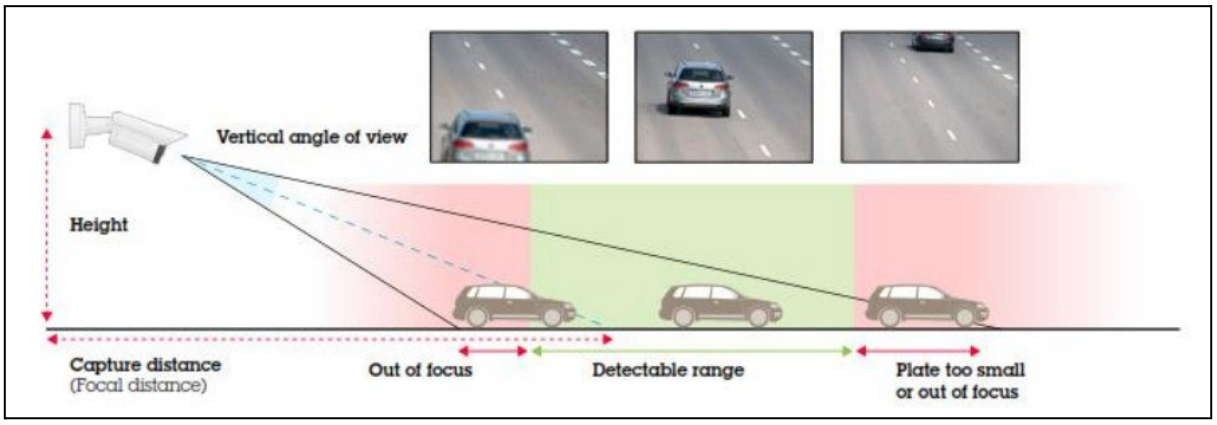
Maximum Forward Distance depends on lens zoom; however, it should not exceed the effective IR range.

Depth of Field

The depth of field (DOF) determines the range around the focal plane where the image is still acceptably sharp. The camera must be well-focused to make the license plates sharp and readable. The image is, however, sharp not only at one specific distance but in a range of distances around the focal plane, as illustrated in the figure below. The size of this range is called the "depth of field." The DOF is normally larger for a longer capture distance.

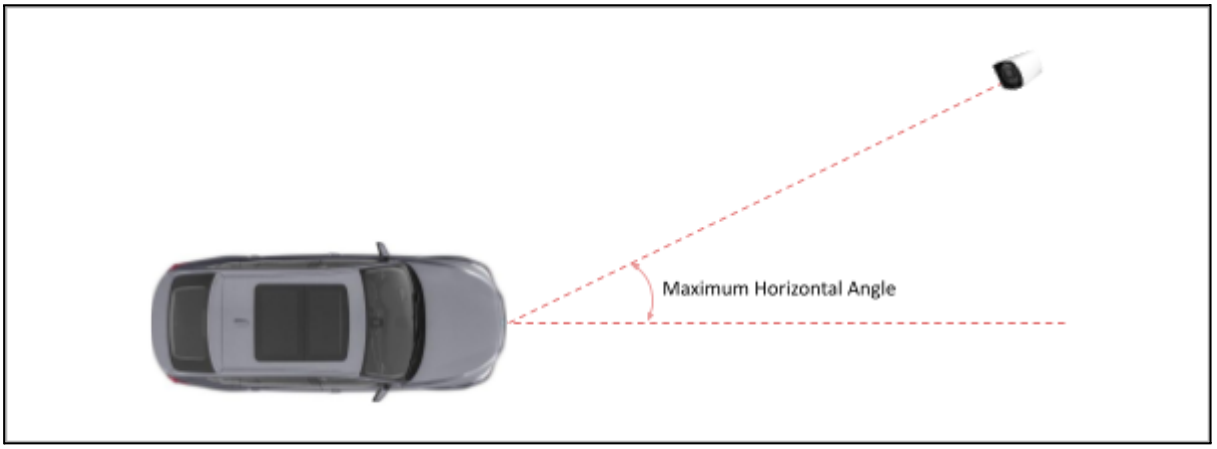


The "detectable range" is the range of distances along the road where the license plate is visible and readable in the above image. Ideally, the detectable range is the full field of view of the camera, but this is not always the case. The detectable range can be limited by the depth of the camera's field, and vehicles far away are sometimes too small for the image sensor to resolve well.



Horizontal Angle

- Maximum Horizontal Angle for recognition: **25 degrees** or **below**

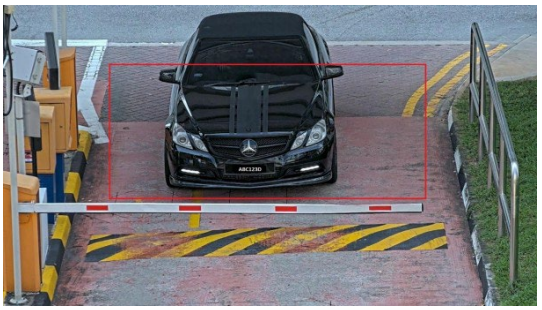


Roll (Slope) Angle

For the best results, check the angle of your plate compared to the horizontal angle and rotate the camera to less than 25°, as shown below.

Recognition Zone

Typically, a large inner ROI is set up to offset some margins and guarantee that the whole vehicle is in view once the license plate is read for rear or frontal view.

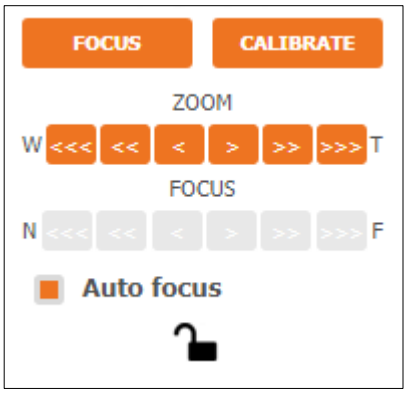


Recommended Camera Settings

Camera Settings

Please check and configure the Camera Settings (SETUP > CAMERA) for the best result.

- **Auto Focus** – (enabled by default). Use the *Auto Focus* feature while viewing the camera. If the number plate is still not focused, fine-tune it using manual focus.

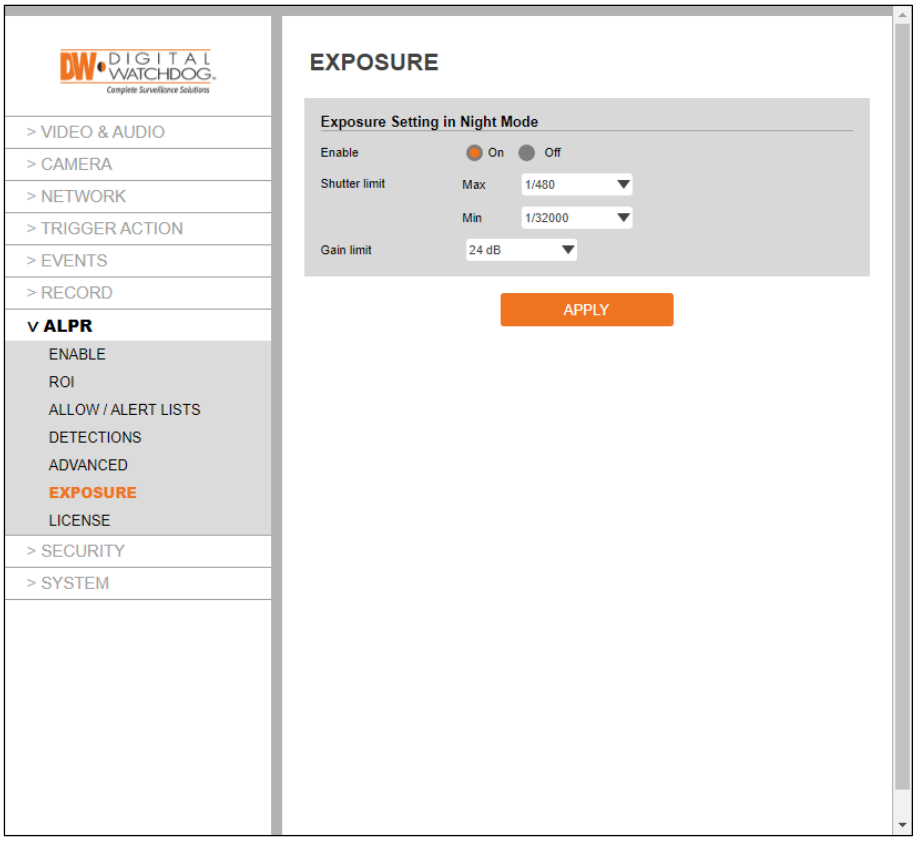


- **Wide Dynamic Range** – disable this setting (*OFF*)
- **Day & Night** – Select *Auto*
- Set the **Max** value of the **Shutter Limit** depending on the application:
  - Gate or Parking Maximum exposure time **1/480** (2 milliseconds)
  - Road or Street Maximum exposure time **1/960** (1 milliseconds)
- **Gain Limit –** set to *24 dB* to optimize the blur and noise trade-off in most scenes.
  - Adjust the max gain to 9 dB if license plates are overexposed.
- **Auto Exposure –** set to *ON*.
- Set the input video resolution of the ALPR plugin depending on the application.
  - Gate or Parking: **1280 x 720 pixels** or **higher**
  - Road or Street: **1920 x 1080 pixels**

  Please refer to the video settings for the input video resolution of the ALPR plugin.

ALPR Exposure Settings

- **Exposure Settings in Night Mode** – in the *ALPR > Exposure* menu, select *ON* and enable the feature. This camera automatically adjusts the exposure settings above to support ALPR in Night mode, overriding the *Exposure Settings* (SETUP > CAMERA > EXPOSURE SETTINGS).
  - Once the ALPR plugin has been activated, the *Exposure Settings in Night* feature is enabled.

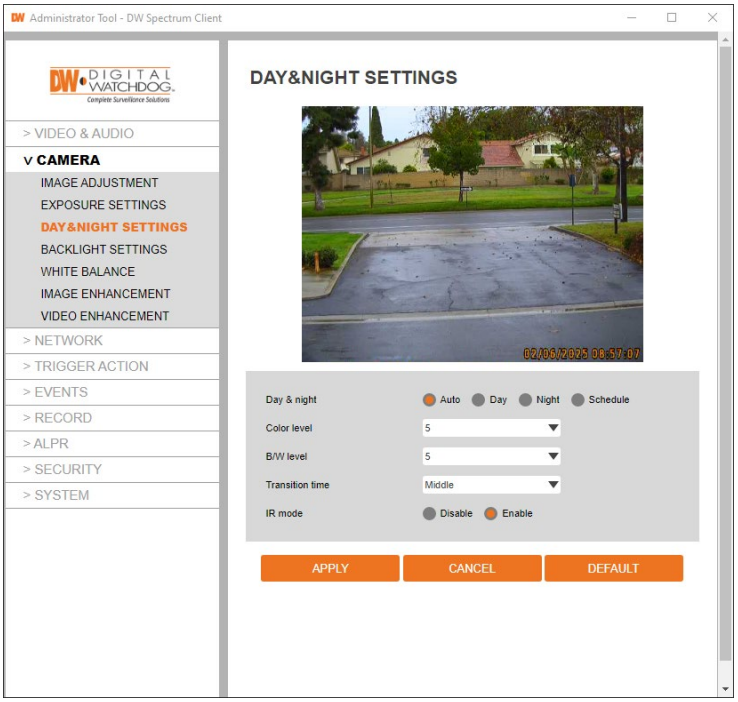


Test the above settings by running through the scenario with a vehicle. For best results, test the settings in the darkest lighting conditions. to ensure good results during nighttime and daytime.

Installing the ALPR Plugin on the Camera

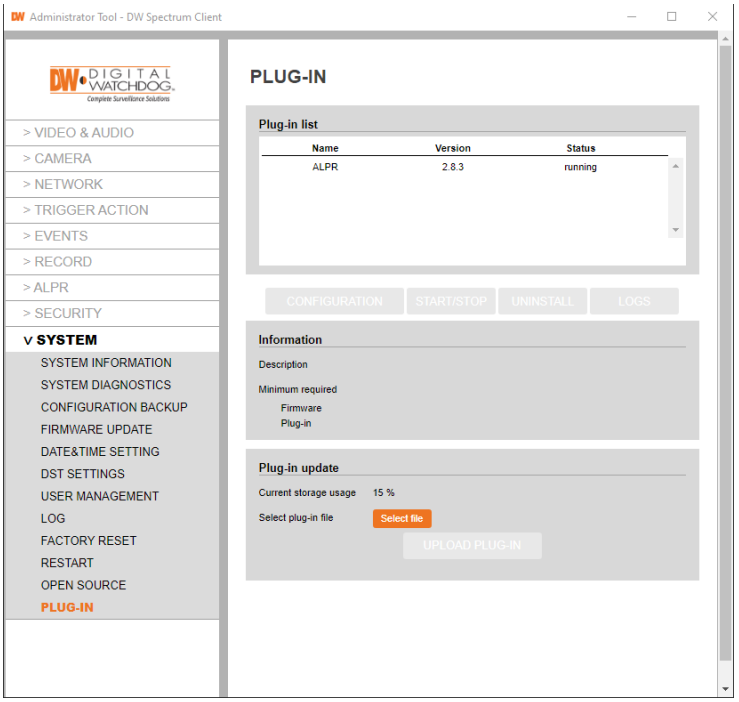
The ALPR functionality is installed as a plugin on the camera.

IMPORTANT: Ensure that the camera's *Date&Time* settings, including the time zone, are correctly set before proceeding with the ALPR plugin installation and configuration. You can set the date/time and time zone settings in the *SYSTEM > DATE&TIME SETTING* page.



To install the ALPR plugin:

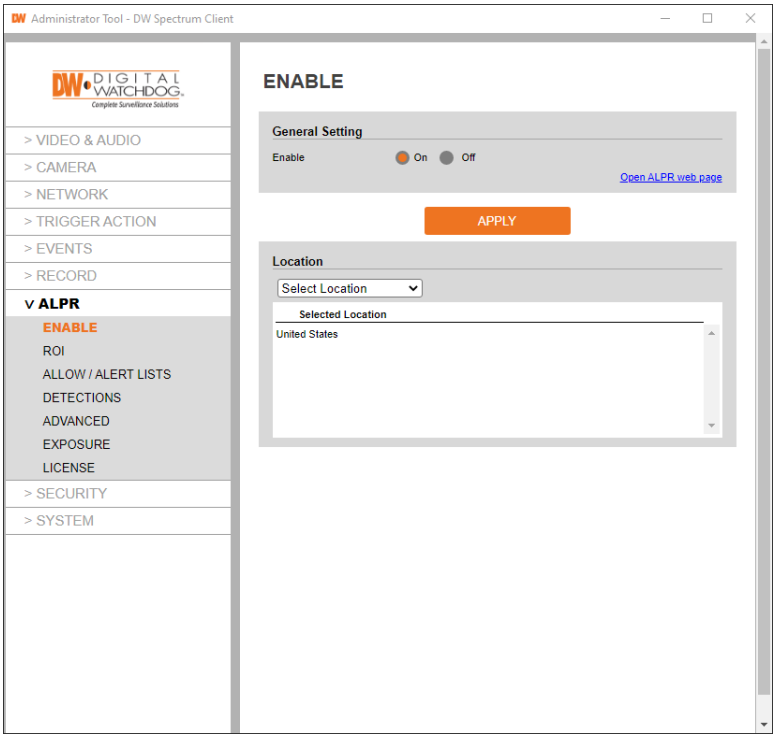
1. Navigate to SETUP > SYSTEM > PLUGIN page in the camera's web interface.



2. In the "Plugin update" section:
    - Click "Select file" to choose the ALPR plugin file.
    - Click the "Upload Plugin" button to begin the installation.
3. Wait for the installation to complete. Once finished, the ALPR plugin will appear in the Plugin list with a "running" status.

After successful installation, an ALPR menu will be added to the SETUP menu. You can enable or disable the ALPR plugin from either:

1. The SETUP > SYSTEM > PLUG-IN page, or
2. The SETUP > ALPR > ENABLE page

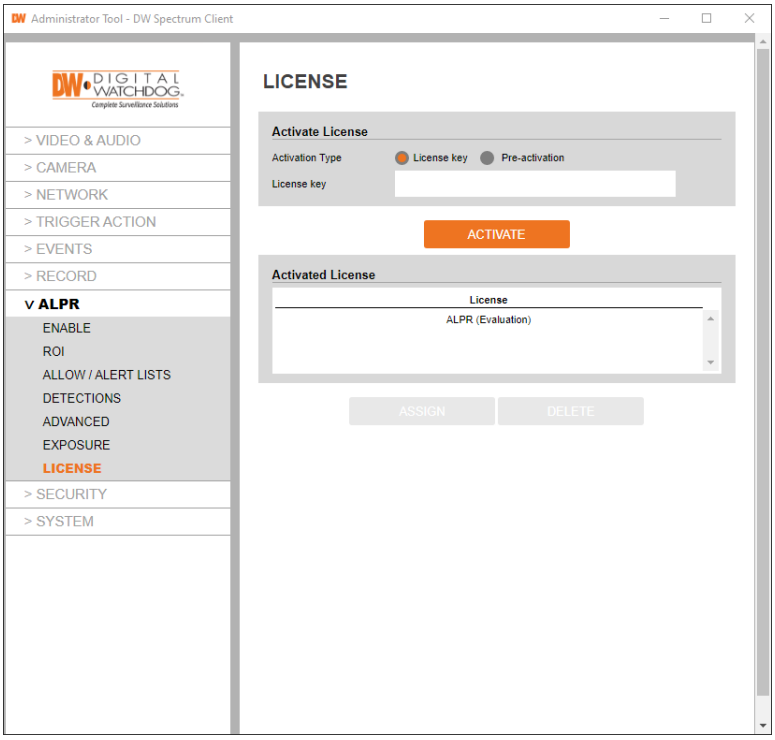


To access the ALPR settings and monitoring page:

1. Click the "Open ALPR web page" link on the SETUP > ALPR > ENABLE page or
2. Enter "**`http://<camera IP address>/cgi-bin/admin/alpr.cgi`**" directly into a web browser.

Licensing the ALPR Plugin

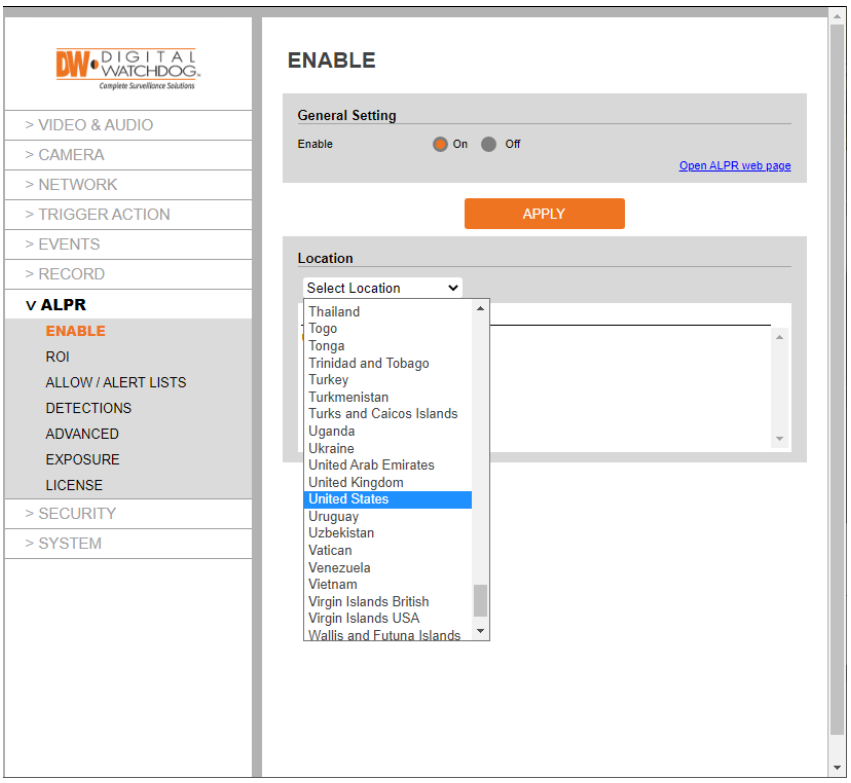
The ALPR plugin is pre-installed on the camera, offering Make, Model, and Color recognition. However, license activation is necessary for plate recognition. To activate, input the provided product key (xxxxx-xxxxx-xxxxx-xxxxx-xxxxx) into the License Key field and click the Activate button.



ALPR Location Settings

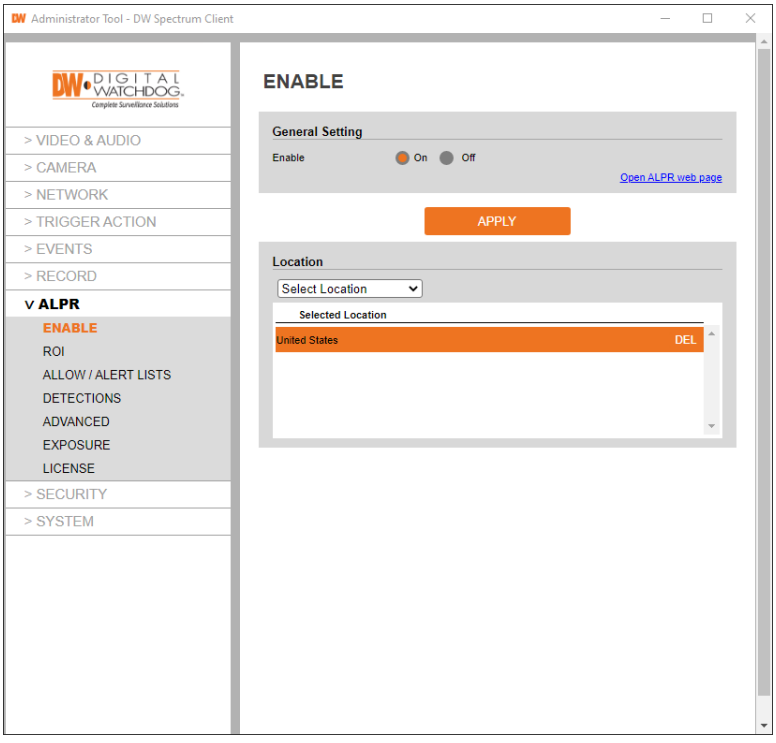
Inserting a Location

In the *ALPR* > ENABLE menu, use the "Select location" drop-down to add up to ten countries to recognize license plates. The “United States” is selected by default.



Removing a Location

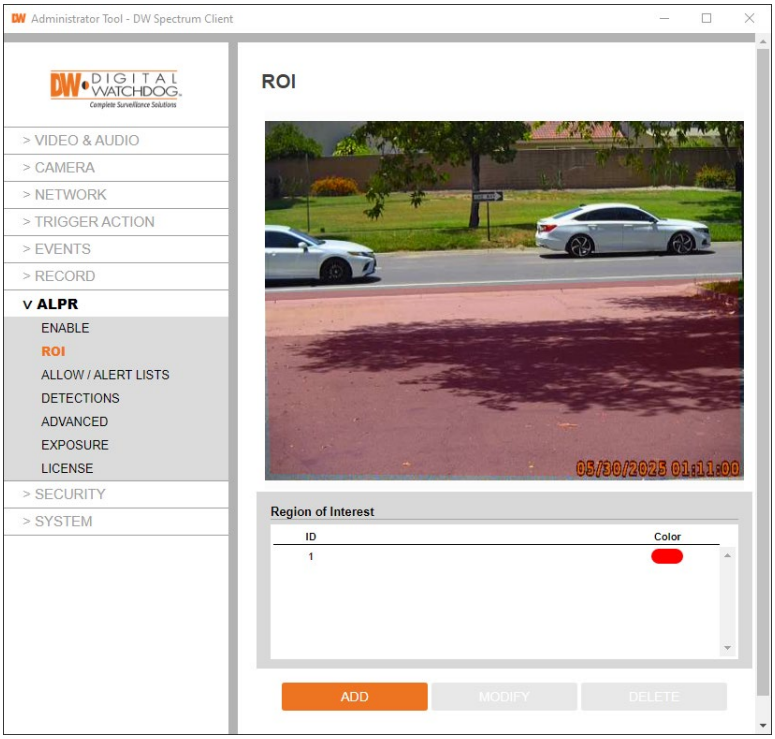
1. Select the location from the list.
2. Click the delete (DEL) button.



ROI (Region of Interest) Settings

ROIs define specific zones in the video frame where plate detection occurs. This improves performance by:

- Reducing false positives from non-plate areas
- Accelerating processing by limiting OCR scope
- Improving detection accuracy



The ROI system in the ALPR plugin is flexible and easy to use. Users can define polygon-shaped regions, allowing precise control over areas of interest.

Up to 9 ROIs can be set up for more complex scenarios, although such needs are relatively rare.

For an ROI to be effective, the entire license plate must be inside or outside the defined region to pass the recognition test. This ensures that partial plate readings, which could lead to inaccuracies, are avoided.

By mastering the use of ROIs, users can significantly enhance the performance and accuracy of their ALPR plugin, tailoring it to their specific surveillance needs and environmental conditions.

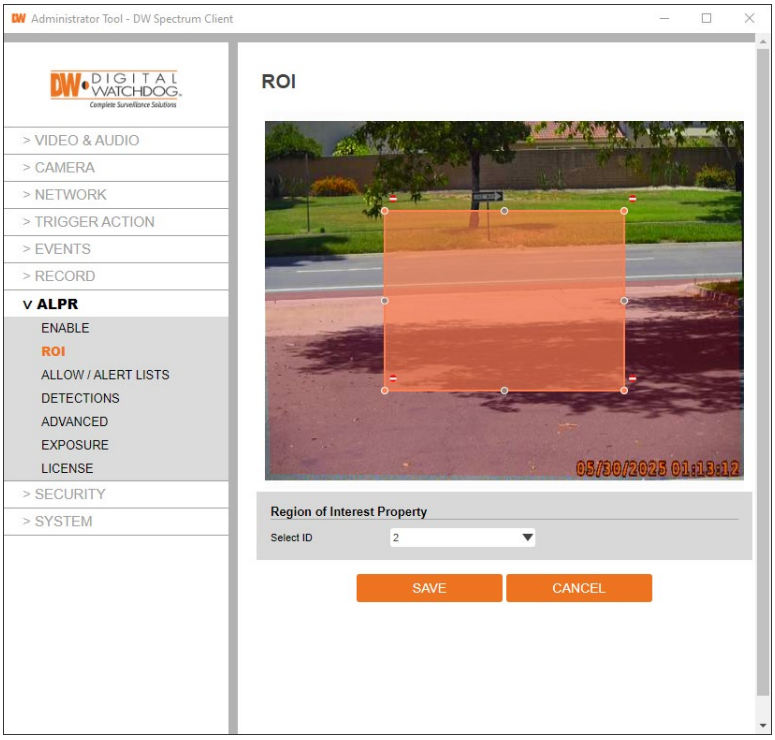
Managing ROIs

In the ALPR > ROI menu, users can configure and manage regions of interest as needed.

Adding an ROI:

1. Click the Add button to create a new ROI.
2. Select an unused ID to assign.

3. Click-and-drag to shape and adjust the ROI area as needed. Clicking on a grey node will add an additional vertex/side to the polygon.
4. Click the Save button to apply the ROI to the camera.



Removing ROIs

1. Select the ROI ID from the list.
2. Click the Delete button.

Modifying ROIs

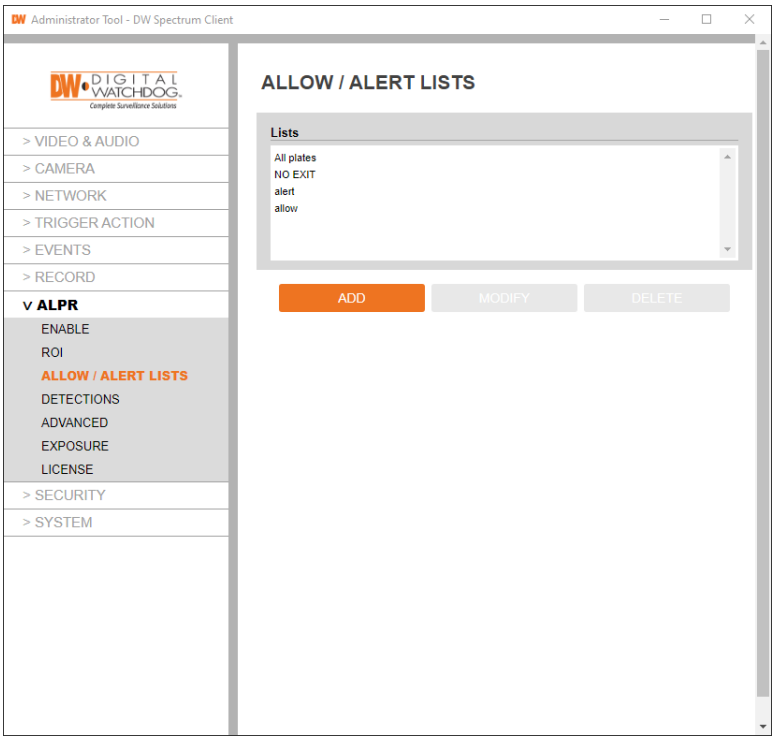
1. Select the ROI ID and click the Modify button.
2. Modify the ROI area.
3. Click the Save button.

Modifying ROI Area

1. Moving a vertex position: Click and drag a red node (🔴).
2. Deleting a vertex: Click the delete icon(⛔) associated with a node.
3. Adding a vertex: Click on a grey node (⚫).

Allow/Alert Lists

The ALPR plugin matches captured license plates with a user-defined allow or alert list of license plates. When a match is found, the plugin generates events that can be used for subsequent processing, improving vehicle monitoring and access control functionalities.



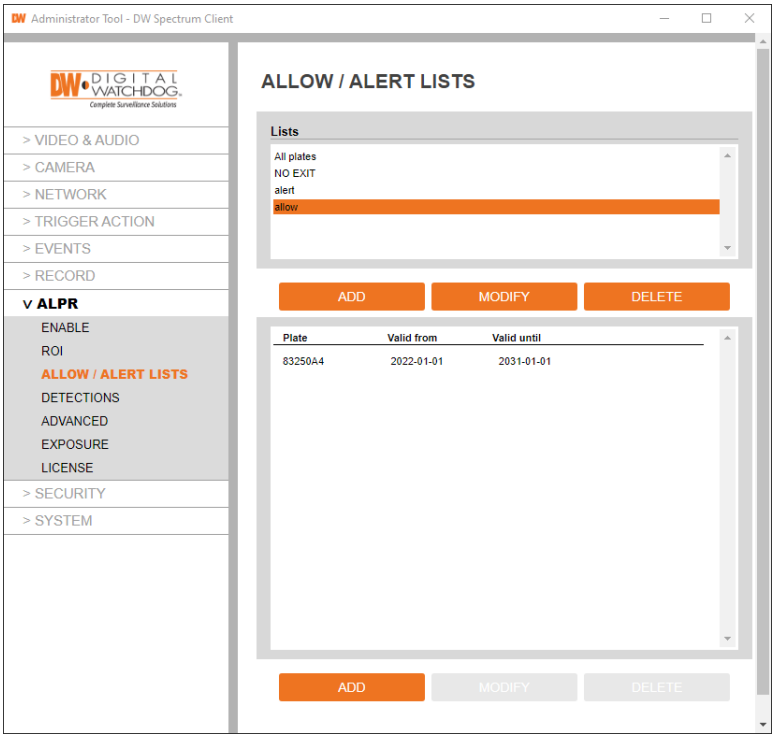
List Storage and Capacity

The ALPR plugin stores lists of user-defined licenses either in the camera memory or microSD card:

1. If a microSD card is installed in the camera, lists are stored there, with a capacity of up to 1,000,000 plates (depending on available space).
2. Without a microSD card, lists are stored in the camera's internal memory, which has a limited capacity of 200 plates maximum.

Managing lists:

By default, *Allow* and *Alert* lists are added. You can add custom lists. The *Allow* and *Alert* lists cannot be modified or deleted.



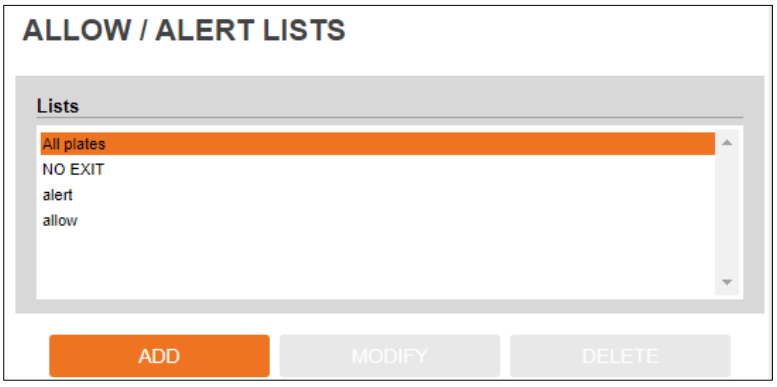
Adding a custom list

1. Click the Add button
2. Fill in the plate number and valid periods.
3. Click the Save button.

****NOTE:** Due to a technical limitation, the maximum "To" date is currently set to 31/12/2030.

Modifying a custom list

1. Select the plate from the plates list.
2. Click the Modify button and update the plate information.
3. Click the Save button.



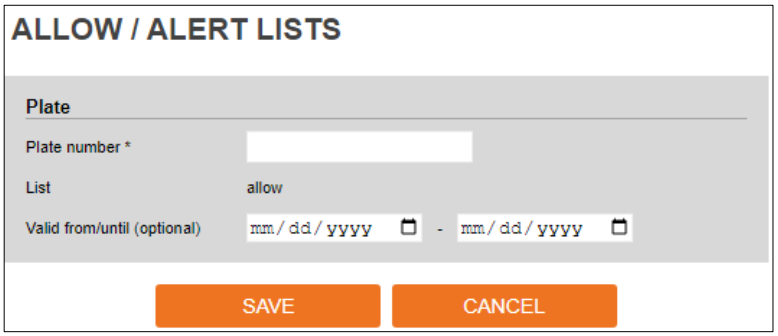
Deleting a custom list

1. Select the plate from the plates list.

2. Click the Delete button.

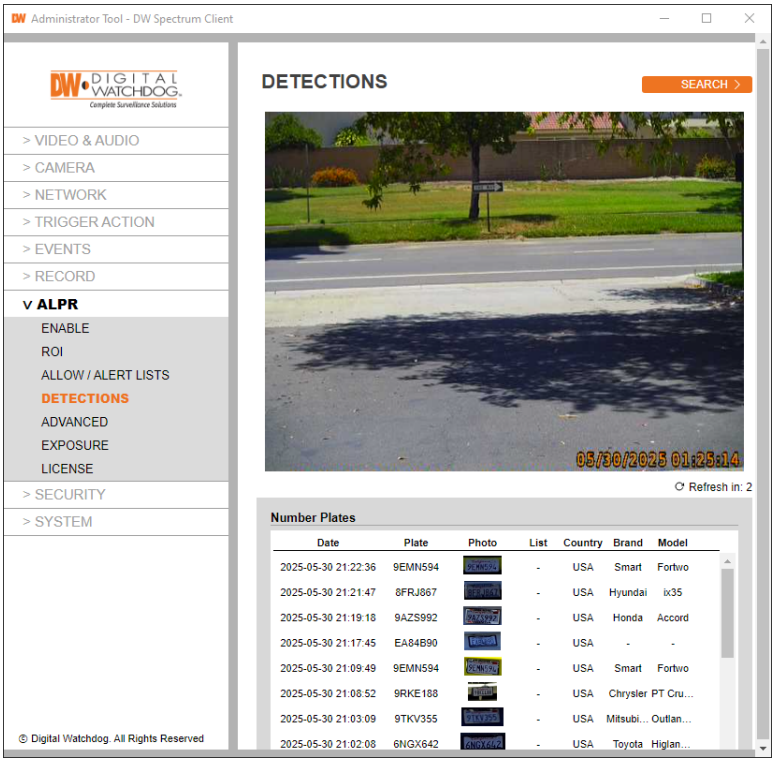
Managing a plate in the list:

Select a list to add, modify, or delete a plate.



Detections (Live Monitoring)

The camera stores the latest license plate readings in its internal memory for display. Additional readings are cached in the browser. For long-term storage of up to 100,000 records, the LPR activity can be saved in a local database. Refer to the **Search** section for more details.



- **Date**: The date that the number plate is recognized
- **Plate**: The plate number
- **Photo**: The number plate picture cropped from the vehicle
- **List**: Marked as Allow or Deny if the number plate is listed in Allow List or Deny List
- **Country**: The country of the recognized number plate
- **Brand**: The manufacturer of the detected vehicle
- **Model**: The model of the detected vehicle

You can see more information, such as color and vehicle type, and view it if you click one of the detected number plates.

**NOTE: Recognized items may differ depending on the installed license type.

**NOTE: At night or with insufficient light, color or model information may be inaccurate.

Search

If you activate the database service, you can store up to 500 license plate numbers in a local database. If an SD memory card is installed in the camera and the "Store database in the SD card" option is enabled, you can store up to 100,000 license plate numbers.

Once this limit is reached, new plate reads will replace the oldest ones. However, if the microSD card becomes full before the limit you set is reached, then data will no longer be able to be saved.

Searching for License Plates

You can view the list of detected license plates in the **ALPR > Detections > Search** menu.

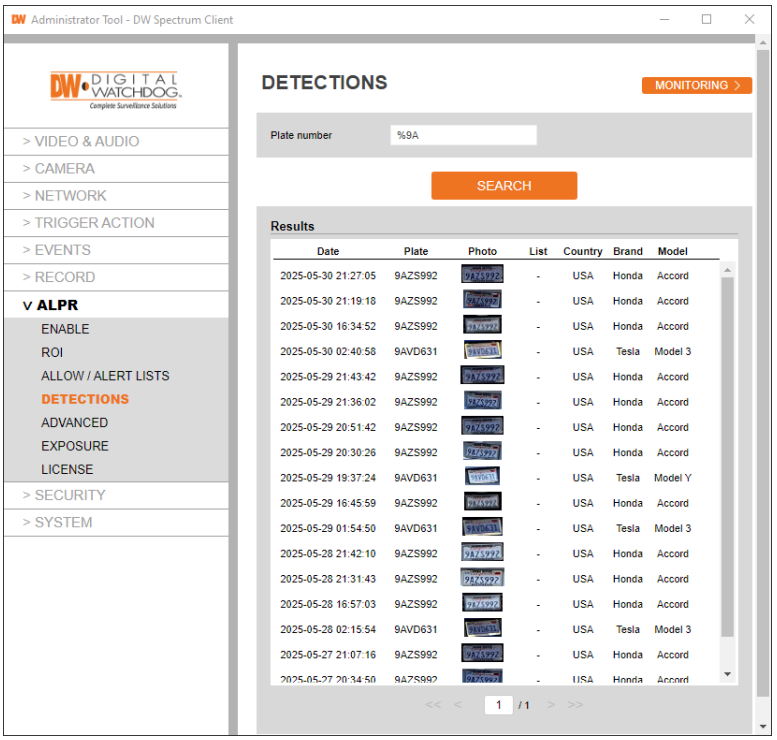
If you want to search all plates, leave the **Plate number** field empty and click the Search button.

To search for a specific or partial plate stored in the camera, enter the plate number in the Search box and click the button. Only license plates that match the entered characters will be searched in this case.

To search using only a part of the license plate number, you can use % as a wildcard character. For example:

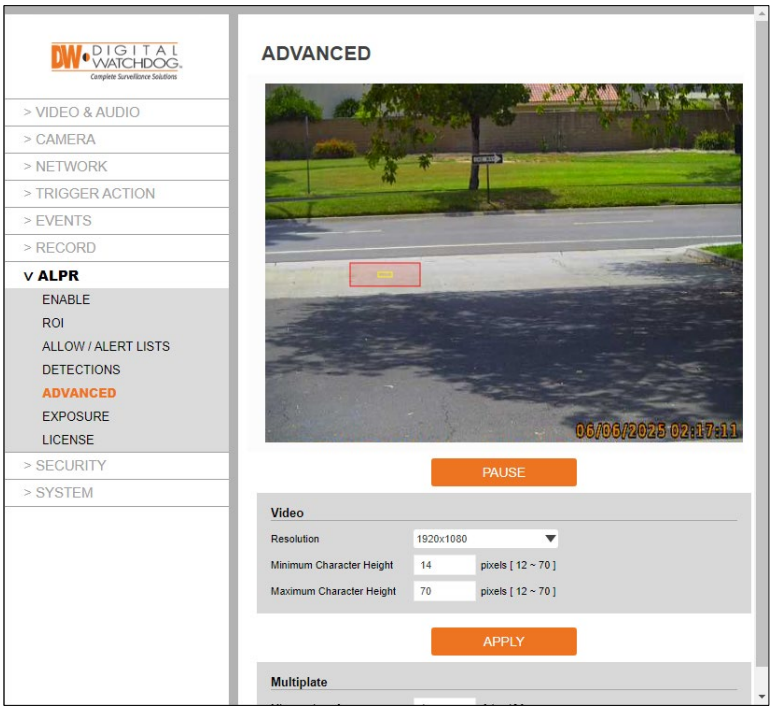
- To search for license plates starting with A20: A20%
- To search for license plates containing A20: %A20%
- To search for license plates ending with A20: %A20

It allows for more flexible searching, enabling users to find plates that start with, contain, or end with specific characters.

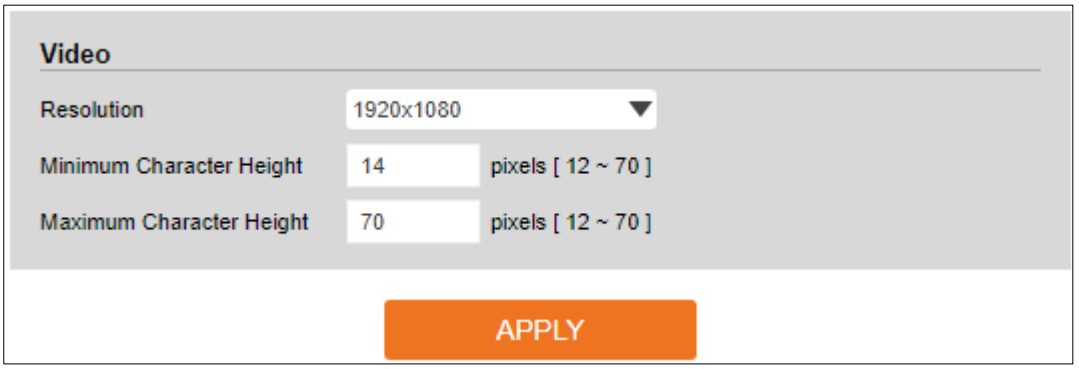


Advanced Settings

The Advanced Settings allows for detailed configuration so users can fine-tune parameters to optimize performance based on specific deployment scenarios and requirements.



Video Settings



- **Resolution:**
  Select the desired Resolution from the drop-down list. Any changes will immediately be shown on the live display.
  - When the camera is installed to read plates in a single lane, a resolution of 1280x720 is recommended.
  - When the camera is installed to read plates in wide or multiple lanes, a resolution of 1920x1080 is recommended.
- **Minimum Character Height (12-70 pixels):**
  This is the minimum height for license plate characters to be readable. With proper camera zoom adjustment, plate characters should be 20-30 pixels high in the intended reading area of the field of view. Setting this value too low may cause misreads due to excessively small plate images.

**NOTE: For small plates such as most Arabic plates - or plates with additional small characters (e.g., Costa Rica), a minimum character pixel height of 30 pixels is recommended.

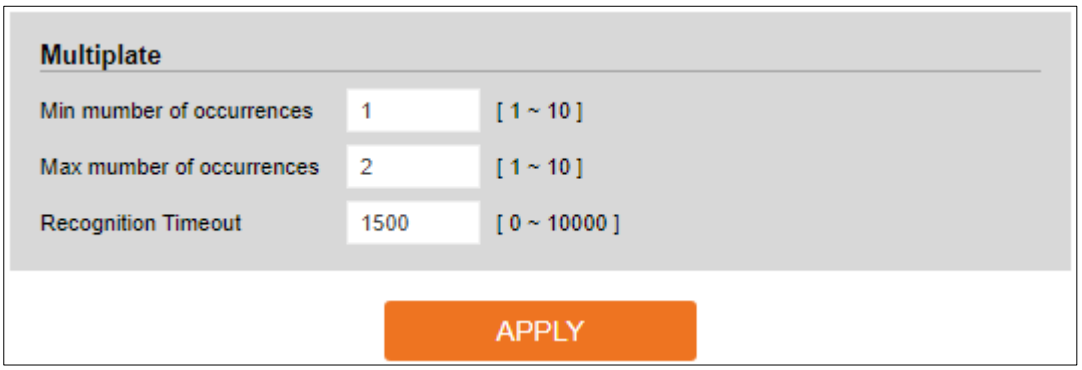
- **Maximum Character Height (12-70 pixels):**
  This is the maximum height for license plate characters before they become too large to process effectively. If the camera's zoom ratio is set correctly, plate characters should not exceed 50-60 pixels in height within the intended reading area of the field of view. Setting this value too high may lead to processing errors or missed detections, as oversized characters can obscure important details or extend beyond the recognition algorithms' optimal range.

  **NOTE: The recommended difference between the minimum and maximum heights is 10-20 pixels.

- **Verifying the Character Height configuration:**
  To verify that the height settings are correct, click over the live video to show two rectangles that represent the minimum and maximum thresholds. The height of characters on the plate should fall within these two rectangles. You can drag these rectangles around the screen to where your target plates are.

Multiplate Settings

The multiplate rate refers to the number of times the same license plate is read within the maximum recognition period. Multiple reads of a single plate improve accuracy.



Set a delay (e.g., 1000ms or 1 second) to prioritize accuracy over immediate reads. This allows the system to continue identifying the same plate for longer. If a new plate is detected during this delay, the previously identified plate will be reported, and tracking of the new plate will begin.

- **Multiplate minimum number of occurrences (1-10)**

  Set the minimum number of times a plate should be read within the Timeout period to be considered valid.

- **Multiplate maximum number of occurrences (1-10)**

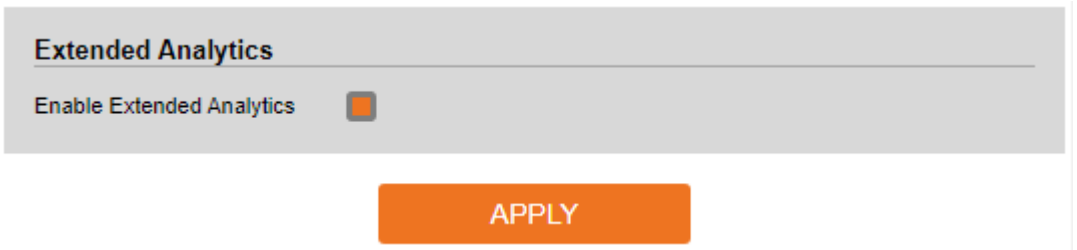
  Set the maximum number of times a plate should be read before being reported (this may happen before the timeout).

- **Multiplate Recognition Timeout**

  Set the number of milliseconds that the engine should spend analyzing a plate. (1000 milliseconds = 1 second)

Extended Analytics Setting

When the Extended Analytics setting is enabled, the engine will find a plate, and the MMC analytic will attempt to identify the make, model, and color of the vehicle using Deep Learning technology.



The ALPR plugin recognizes approximately 680 car manufacturers and 7,250 models and can recognize make, model, and color from the front and rear views with very high accuracy. The engine does not require calibration and automatically determines the vehicle's orientation. The software will report up to 11 colors but note that colors are often distorted by lighting and reflection on a vehicle.

The camera will read the plate and show as much of the front or back of the vehicle as possible at a reasonably shallow angle. The ALPR plugin will report vehicle types, including motorcycle (if it has a plate), car, pickup, van, truck and bus.

Troubleshooting

In most cases, license plate reading issues are caused by the following:

- Incorrect positioning of the camera
- Incorrect camera lens (or zoom setting)
- Insufficient illumination
- Incorrect camera settings - e.g., shutter speed
- Incorrect settings of the ALPR App.

This section will study the most common issues and how to fix them.

The ALPR plugin software in the camera starts and then stops suddenly.

Solution:

Check that you have uploaded the license key and that the date and time settings (*System > Date&Time*) are set correctly for the camera.

The ALPR plugin license is valid but a “Check license” message appears.

Solution:

Check that the camera date and time settings are correct.

The ALPR plugin software is running but not reading plates.

Solution:

Check if you can see the license plate in the image and if the image's quality is good (not under- or over-exposed). As a general rule, if you can't easily read the plates, the software won't be able to read them either!

Image is everything, so try to adjust the camera lens by zooming in or out. Check if the camera needs to be repositioned closer or further from the reading point.
The captured image should show the complete vehicle. This, however, depends on the resolution that the camera has been set to.

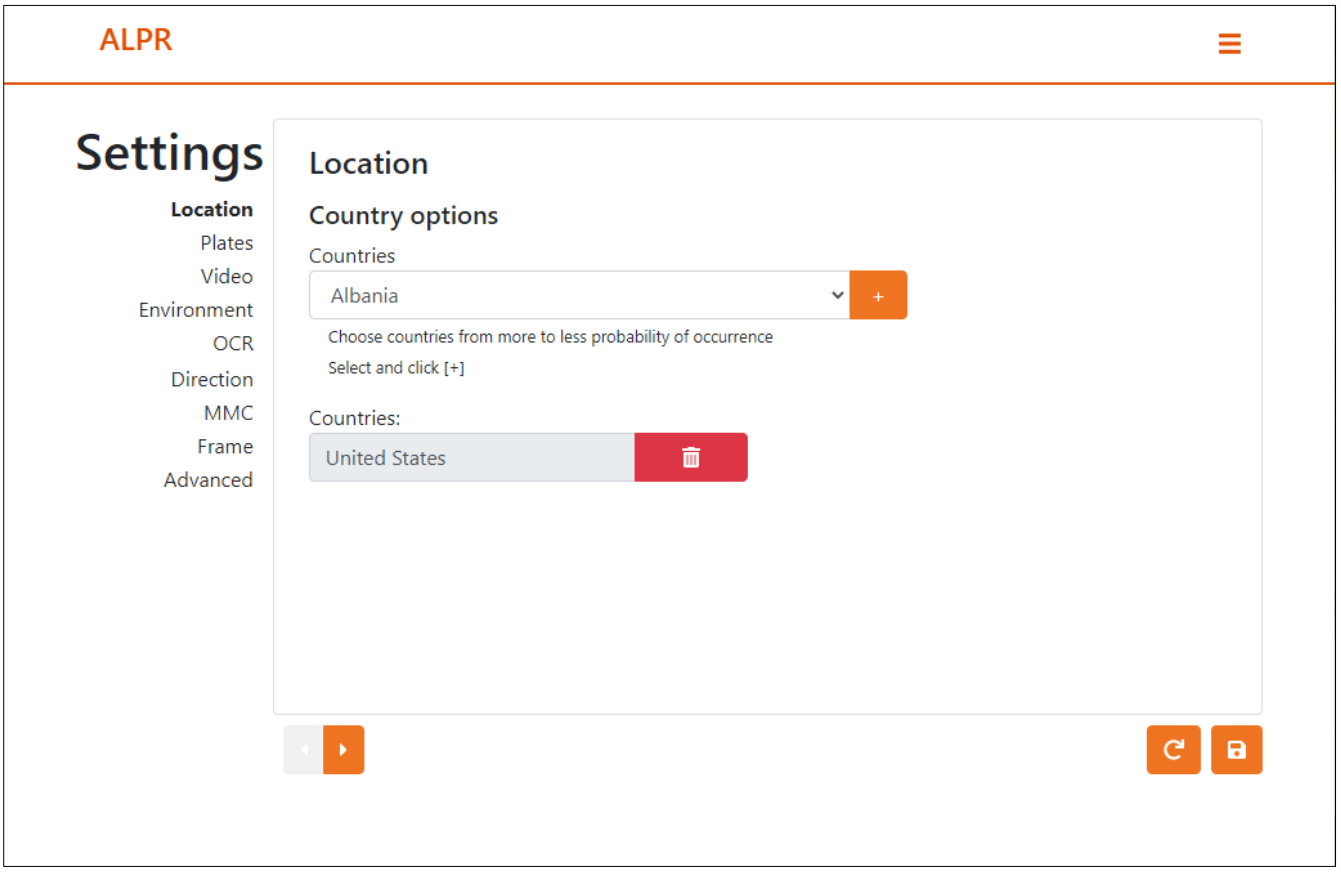
If the video quality looks good, go to the camera's settings and ensure the shutter speed is high enough to prevent blurring but slow enough to allow enough light in through the lens.

If you CAN see the license plate clearly in the image and the software is not reading anything, navigate to the *ALPR > ENABLE* menu and click “Open ALPR web page.”
Try changing the following parameters in the settings section of the App to be more tolerant:

- In the Country options, do not select the Grammar Strict checkbox.
- In the Video options, change the Minimum Character Height to 14 pixels.

- In the Video options, change the Maximum Character Height to 60 pixels.
- In the OCR options, change the Minimum Global Confidence to 50.
- In the OCR options, change the Minimum Character Confidence to 25.
- Delete any existing Region of Interest (ROIs) in the Region of Interest section.

Change these settings one by one, checking to see if the issue has been resolved as you go. Save the changes once you can see the license plate image and the software is reading.



ALPR plugin is running, but it does not read all of the plates.

Solution:

In the ALPR plugin configuration, in the Video options, check that the resolution value in the drop-down list is adequate.

- View the log file, scroll to the end, and look for the message:
- *[INFO] Vaxreader[xxxx]: -Plate 0 (<pixel height> - <milliseconds>): <plate>*
- Check the value of the plate's character pixel height registered in the log.
- If the resolution is 1280 x 960 and the pixel height of the plate is 40, it is recommended that you set the resolution to a lower value.

Plate patches are inverted on the plates list.

After installing a new camera, sometimes the plate patches appear upside-down after

being read. Note that the camera has an auto-sensor to determine the orientation.

Solution:

Set the correct orientation required in the Camera Settings/ Stream section:

After changing this (or any other settings in the camera), you should stop and restart the ALPR plugin application. All should be well.

JSON or XML has been set up but no plates are being received.

Solution:

If you use a remote URL to receive the data, check that a DNS server has been selected in the camera setup.

IMPORTANT: If you are using a URL rather than an IP address, make sure that you have set up a DNS server in the camera settings menu.

1. Go the SETUP
2. Select NETWORK > NETWORK Settings.
3. Enter a DNS server such as 8.8.8.8 with a secondary server such as 8.8.4.4. These are free Google DNS servers that will map your URL names.

Dynamic Text Replacement Reserved Words

Reserved words

$date$	Timestamp in ISO8601 format
$plate$	Plate number
tag	Unique hash for this plate number. The same plate number will always give the same tag. Format based on UTMC algorithm.
$plateutf8$	Plate number in utf8 format.
$country$	Full country of origin name.
$countrycode$	3-letter country code.
$state$	Plate State for USA.
$category$	Plate category for countries that support it.
$blacklist$	Description on the blacklist linked to the plate number.
$whitelist$	The description on the whitelist is linked to the plate number.
$ifblacklist$...$ifblacklist$	If the plate is on the blacklist, the text in the 'if clause' will be displayed.
$ifwhitelist$...$ifwhitelist$	If the plate is on the whitelist, the 'if clause' text will be displayed.
$ifnolist$...$ifnolist$	The 'if clause' test will be displayed if the plate is not on a list.
$confidence$	Global confidence (0-100).
$charheight$	Average char height (pixels).
$processingtime$	Processing time in milliseconds.
$left$	Left coordinate for the plate on the image (pixels).
top	Top coordinate for the plate on the image (pixels).
$right$	Right coordinate for the plate on the image (pixels).
$bottom$	The bottom coordinates for the plate on the image (pixels).
$absoluteleft$	Plate left position based on the total image width (0-1).

$absolutetop$	Plate top position based on the total image height (0-1).
$absoluteright$	Plate right position based on the total image width (0-1).
$absolutebottom$	Plate bottom position based on the total image height (0-1).
$width$	OCR image width.
$height$	OCR image height.

ip	Camera IP address.
$roiid$	Roi ID where the plate number is found.
$speed$	Vehicle speed (Km/h).
$multiplate$	Amount of times that the plate has been read before reporting.
$image$	Full JPEG image encoded in base64.
$jpegsize$	JPEG size in bytes.
$make$	The vehicle make
$model$	The vehicle model
$color$	The vehicle color
$class$	The vehicle classification (type â€, "e.g., car, van etc.)
$vehicleaccess$	Entry / Exit events (0: Unknown, 1: enter, 2: exit, 3: overstay)
$dwelltime$	Time spent in monitored area in seconds
$year$	Year
$signaled$	True if a trigger caused the read.
id	Database ID for this read.
$direction$	Enumerate with the vehicle direction (0: Unknown, 1: Towards, 2: Away, 3: Stopped)
$directionstr$	String with the vehicle direction.
$safedate$	Date in format %Y%m%d_%H%M%S in the camera time zone (Useful for filenames).
$localdate$	Date in format %d/%m/%Y in the camera time zone
$localtime$	Date in format %H: %M: %S in the camera time zone.

$imageid$	Signal ID in case of a trigger read.
$plateimage$	Plate crop JPEG image encoded in base64.
$platejpegsize$	JPEG size in bytes.
$overviewimage$	Overview JPEG image encoded in base64.
$overviewjpegsize$	JPEG size in bytes.
$epoch$	Unix epoch (seconds).
$utcdate$	Will report the date in ISO8601 format but always in UTC. (2020-12-31T16:11: 30.000Z)
etx	End transmission character (03)
stx	Start transmission character (02)

Additional Values

$image$	Full JPEG image encoded in base64.
$jpegsize$	JPEG size in bytes.
$make$	The vehicle make
$model$	The vehicle model
$color$	The vehicle color
$class$	The vehicle classification (type â€, "e.g., car, van etc.)
$vehicleaccess$	Entry / Exit events (0: Unknown, 1: enter, 2: exit, 3: overstay)
$dwelltime$	Time spent in monitored area in seconds
$year$	Year
$month$	Month number
day	Day number
$hour$	Hour
$minute$	Minute
$second$	**Seconds**