IVS – License plate recognition

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1. Introduction, important information

This guide summarizes the configuration details related to license plate recognition in the IVS system.

For server-side license plate recognition:

- Connect the ANPR USB device,
- Install the Carmen framework along with the appropriate regional ANPR and MMR engine, and verify their operation,
- Create a server-side License Plate Recognition Detector,
- Adjust the camera's angle, field of view, and image settings to ensure proper viewing direction, character size, and visibility,
- Verify the proper operation of the motion detector running on the camera,
- Enable and draw a mask, define expected character size limits and other parameters in the server-side license plate recognition configuration window,
- Fine-tune the settings using statistics and OSD feedback,
- If you want to control a barrier, create license plate lists and groups, and set up the detection-partition-action process to control the opening (see the ***System Detectors and the IVS Alarm System*** documentation).

If you prefer camera-side license plate recognition, review the ***EINAR camera*** documentation.

Just like IVS, make sure to update the license plate recognition components with the quarterly released engines, and monitor the expiration dates of the licenses (see the ***System management*** documentation).

For a full overview of the system setup and configuration, refer to the ***IVS Installation manual*** documentation.

2. ANPR – Automatic number plate recognition

2.1. The Carmen FreeFlow engine

If you are using a server computer distributed by Intellio and have also ordered an ANPR license, Intellio experts have already installed the ANPR USB key and the ANPR engine on the requested server. You only need to configure the camera correctly and fine-tune the ANPR engine according to the environment.

If you want to install the components on your own server, download the latest Carmen ANPR framework and required engine from the Adaptive Recognition Carmen FreeFlow documentation page, and run the installers. If you also use MMR recognition, the latest engine can be found on the Carmen MMR page.

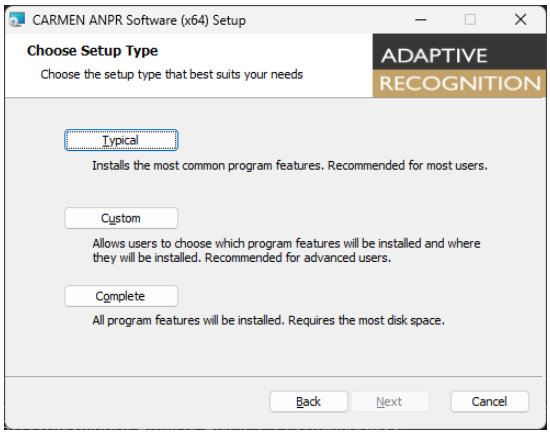
You can read more about updating the components in the ***System management*** documentation.

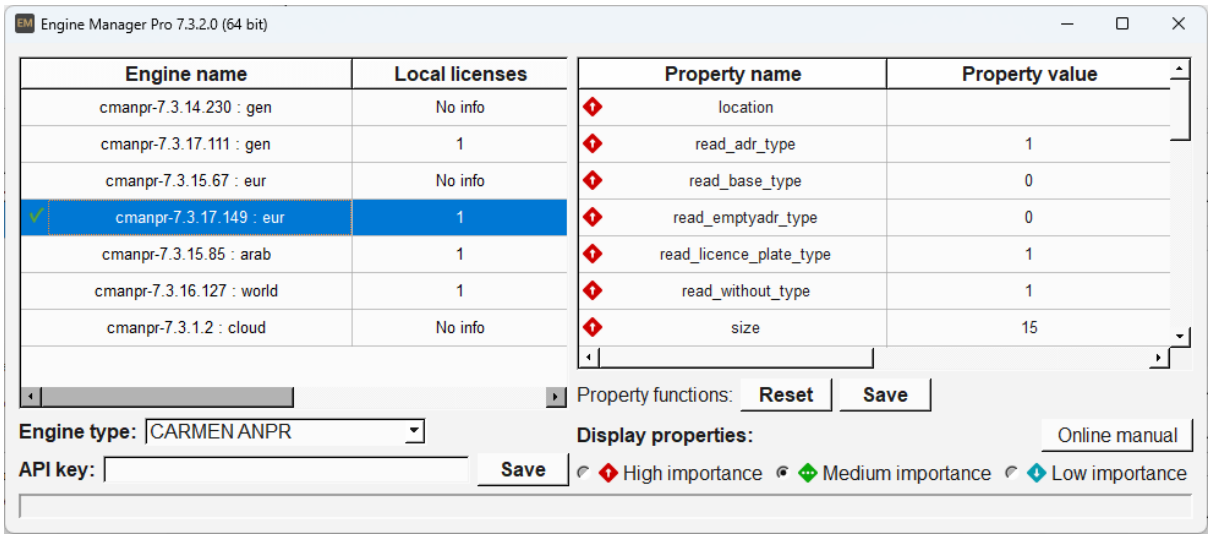
2.1.1. Carmen FreeFlow installation

If a version of Carmen FreeFlow earlier than 7.2.7.22 is already installed, it is recommended to uninstall the previous version before installation.

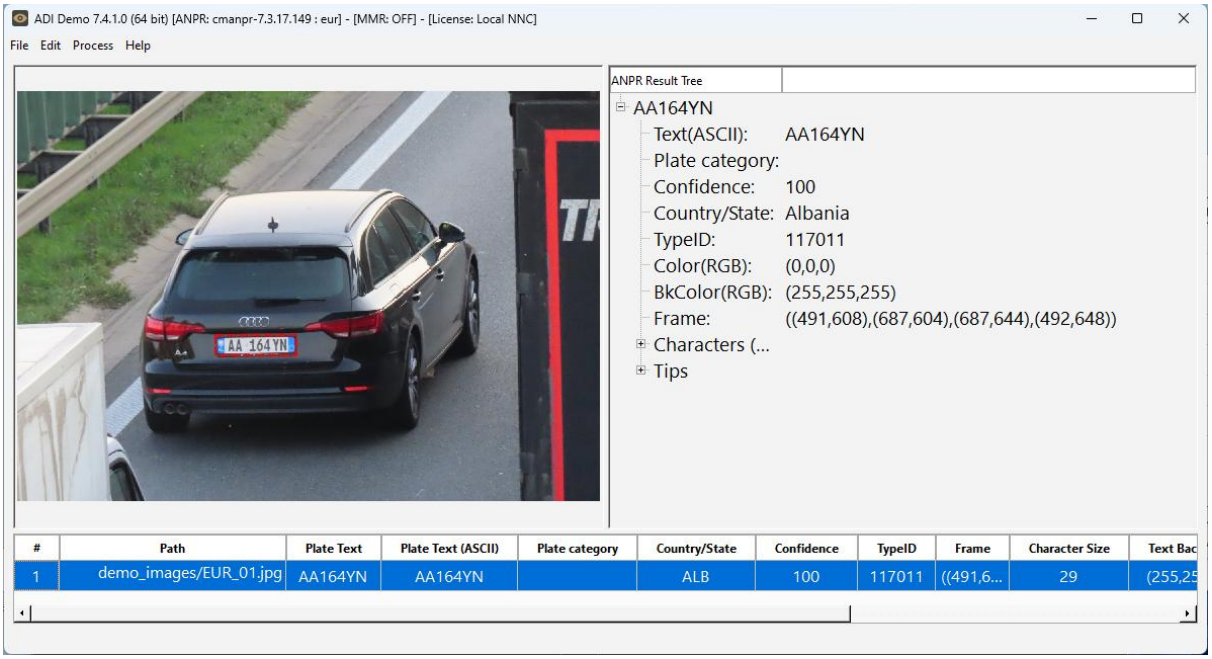
To install Carmen FreeFlow:

- **Stop** the Intellio Video **Watchdog** service on the server.
- **Stop** the Intellio Video **Server** service on the server.
- **Insert** the hardware key into one of the server's available **USB** slots.
- Run the downloaded installer package (**CARMEN_ANPR-7.3.1.29-x64.msi** or newer).
- After accepting the End User License Agreement, select the **Typical** installation type, then click the **Install** button to start the installation.
- From this point, the installation is automatic and requires no further input.
- If you have the localization engine available (in Europe, use eur: **cmanpr_eur_7.3.17.149_24Q3_x64.msi** or newer), install that as well. You can verify the installation using **Start / Adaptive Recognition / Engine manager (x64)**.





- After installation, to verify it is working properly, run the **Start / Adaptive Recognition / ANPR Demo for Images (x64)** application from the Start menu. If the program correctly recognizes the displayed license plate, the installation was successful.

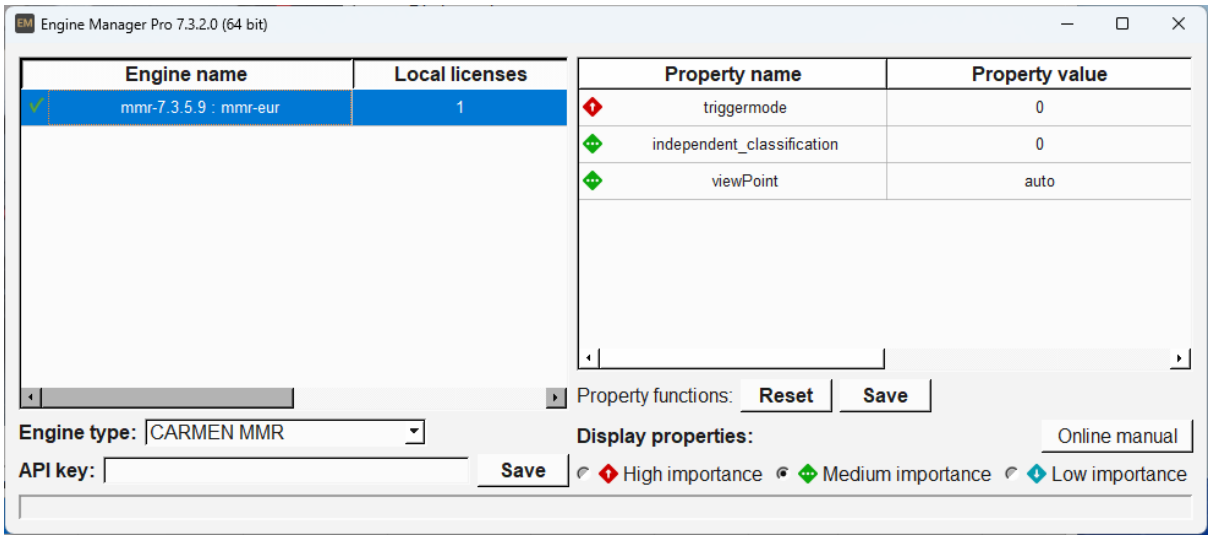


- Start the Intellio Video Watchdog service (this will automatically start the Intellio Video Server service as well).

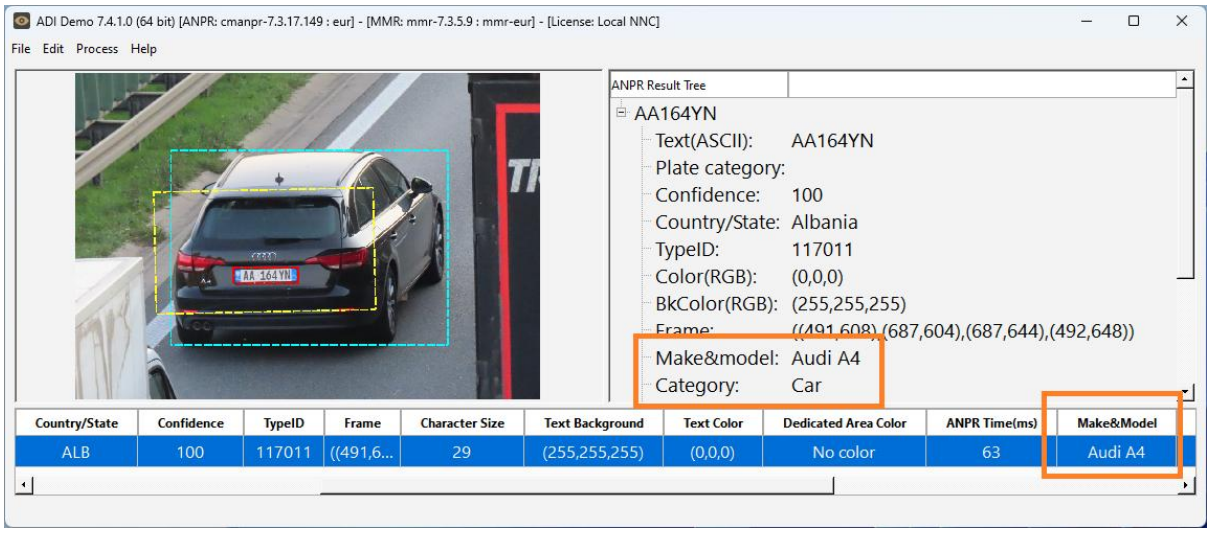
Make sure to install the FreeFlow program on all SITE servers that have a hardware key, and ensure that the same program version is running on every server to avoid potential issues.

2.1.2. MMR – identifying vehicle properties

In addition to recognizing the license plate, the system can also identify the vehicle's type, model, and color. This requires installing an additional engine (in Europe: **mmr_eur_7.3.5.9_24Q2_x64.msi** or later).

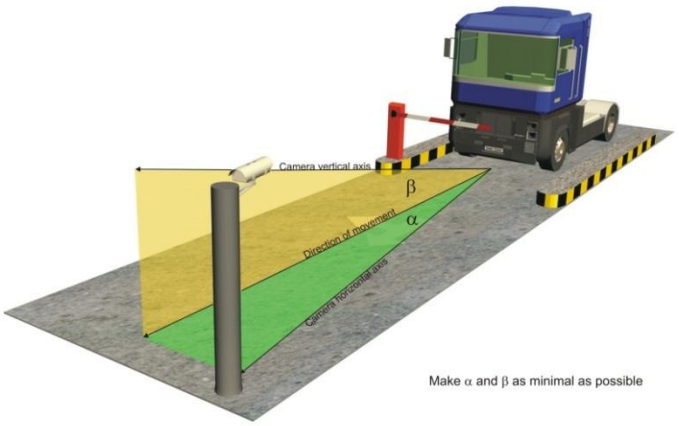


After installation, to verify functionality, launch the **Start / Adaptive Recognition / ANPR Demo for Images (x64)** application from the Start menu. Once the program starts, enable MMR processing in the Edit / Demo Preferences menu. If the program successfully detects the license plate and vehicle attributes, the installation was successful.



2.2. Camera placement and setup

The accuracy and speed of license plate recognition greatly depend on the camera's position. The optimal position is where the angle between the camera's longitudinal axis and the vehicle's travel direction is minimal, but under no circumstances should it exceed 30 degrees, either horizontally or vertically.



The distance between the camera and the license plate is also important. If the camera is too far away, the plate characters will be too small, resulting in low resolution. If the camera is too close, the characters will be too large.

For license plate recognition, the most important factor is the size of the characters in the image.

- For Latin characters, it is recommended to set the camera so that the plates are at least 16 pixels high, with an average of 25 pixels.
- For Arabic characters, it is recommended to set the camera so that the plates are at least 20 pixels high, with an average of 30 pixels.

To measure pixel height, you can use various image editing programs such as Paint or IrfanView (http://www.irfanview.com/), or check the camera OSD displayed in the IVS..

To achieve the most accurate results in the images, the license plate must be:

- high resolution,
- sharp,
- have high contrast,
- visible under good lighting conditions.

2.3. Video image settings for ANPR

For license plate recognition, it is extremely important to have the correct image settings. In a typical application, ANPR must work both day and night under various lighting conditions. As a guideline, we recommend the following settings, which may vary depending on specific conditions:

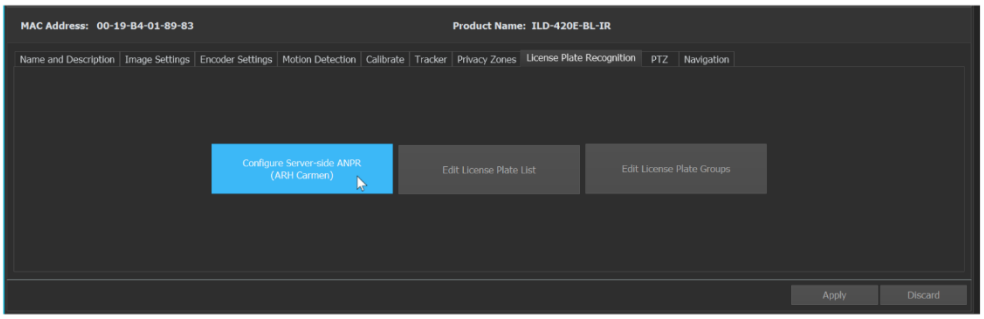
- The **Iris** should always be open.
- In the **Exposure** tab, **Flickerless** mode should be enabled.
- In the **Exposure** tab, **Maximum Exposure** should not be longer than 1/500.
- You may need to **disable WDR/HLC** on the camera.
- **Adjust** the brightness of the **IR illuminator** so that you get an image similar to the example above even in low light conditions.

2.4. License plate recognition

Enable license plate recognition and configure its parameters in the **License Plate Recognition** tab of the detecting camera (**Devices / Cameras / select the desired camera / License Plate Recognition** tab).

For more information about retrieving recognized license plates, refer to the **License Plate** section under **Event Query** in the ***User Manual***.

Within the License Plate Recognition tab, there are three buttons. Their settings and functions are as follows:



2.4.1. Configure License plate recognition

The window that opens when pressing the button contains five tabs and the image displayed by the camera. A mask can be created on the image - if set, license plate recognition will only occur within the selected area. We recommend limiting the detection area as much as possible to speed up recognition.

2.4.1.1. Basic

In the default Basic tab, you can enable license plate recognition for the selected camera.

Fontos: *License plate detection on a given camera will only run on images where that camera's motion detector signals (storage) motion! Therefore, to set up license plate recognition, you must check that the motion detector of the selected camera is working properly!*

- **Accept only after consecutive hit number**: Specifies how many frames must detect the same license plate for a confirmed recognition. If set to a value greater than one, only consecutive matches are counted, and the character sequence must be exactly the same. The higher this value, the slower but more reliable the recognition will be.
- **Limit recognition frequency**: Determines how many frames per second the ANPR engine should scan for license plates. The **Limit recognition frequency** is time-based. For example, if set to 5 fps, the time between processed frames will be at least 200 ms. If the camera operates at 5 fps but sometimes delivers frames less than 200 ms apart, those frames will be discarded. So, if you want ANPR to run on every frame of a low-fps camera, disable the **Limit recognition frequency** option, or set the fps limit higher than the camera's fps. Keep in mind that even with low-fps cameras, setting a **Limit recognition frequency** value is useful to ensure proper ANPR operation if the fps is increased later (e.g., to avoid delays).
- **Select Engine**: Here you can choose the ANPR engine to use. By selecting the localization engine (which recognizes country codes), the system can detect and display these in the event log. However, color recognition will not work with this engine, and recognition may be slower compared to a general engine.
- **Enable Color Recognition**: When enabled, the background and text color of the license plate can be detected. This is required in some Arabic countries, where the plate color distinguishes between otherwise identical license numbers. The **Color identification based on database** option allows the engine to use its internal color database, which generally gives better results, but may return incorrect data if the color is not predefined.
- **Include separator into the license plate**: Makes the displayed plate easier to read, but does not affect recognition. The separator character can be set freely.

2.4.1.2. Advanced

- **Image scale down size to use:** Sets the image size used for recognition. The smaller the image, the faster the license plate recognition engine runs - but this may reduce accuracy.
- **Timeout:** If the recognition process exceeds this time limit, the event will not appear.

Note: *The engine always tries to stay within the set value, but due to its operation, slight overruns may occur. As a result, the maximum recognition time shown in the Statistics tab may be higher than the set limit.*
Note: *If using a recognition engine that includes country code detection, the default value should be increased to at least 500 ms. It is recommended to align this setting with the number of cameras using the engine and with the Limit recognition frequency setting.*

- **Minimum confidence to accept:** The recognition engine only considers results where the characters are reliably identifiable - meaning they closely match the patterns trained in the recognition engine. This mainly helps filter out false positives but also improves

the accuracy of detected license plates. If the reliability of recognized plates is very low, this value can be reduced to as little as 1%.

- **Plate size (character height in pixels):** Set the average, minimum, and maximum size. Plates smaller than the minimum or larger than the maximum will not be recognized. These sizes must match the original (unscaled) image resolution. On OSD interfaces (detector and LPR layer), dimensions are always shown based on the original image size—even if recognition is performed on a scaled-down image.
- **Number of characters:** You can set the minimum and maximum number of characters for recognized license plates. If a plate has more characters than the maximum value, the recognition engine will not recognize it as a valid plate.
- **Filter identical license plates for the given period of time:** Prevents the same license plate from being detected multiple times within the given period.
- **Use GPU accelerated pre-filter:** If the server has a dedicated GPU that meets the minimum hardware requirements, this pre-filtering feature can be enabled. The pre-filter runs on all frames that contain motion, checking for the presence of a license plate. The ANPR and MMR processes will then run only on the specific image areas where the pre-filter detects a plate. If this option is disabled, ANPR and MMR will run on every full frame or on the masked area, resulting in slower recognition times.
  To use this feature, download and install the ANPR Acceleration component on the server.

2.4.1.3. MMR - Make and model recognition

- **Enable:** This option turns on the MMR (Make and Model Recognition) feature.
- **Select engine:** If the localization engine is installed, you must select the region-specific engine from the dropdown menu.
- **Maximum accuracy:** Allows MMR to run multiple times on the same vehicle, increasing recognition accuracy - especially if the "Accept only after consecutive hit number" setting in the Basic tab is greater than 1.
- **Reduce recognition area:** If enabled, IVS will run the MMR function only in the area around the license plate instead of the entire image. This improves recognition speed but may reduce accuracy in some cases.

2.4.1.4. Direction detection and filtering

It can detect the vehicle's direction of movement (approaching or departing) based on the license plate.

- **Disabled:** Turns off direction detection.
- **Basic:** Works by tracking changes in the character size of the license plate. It is faster but less accurate. For this function to work, the "Accept only after consecutive hit number" setting must be greater than 1 (for more reliable detection, a value of 3–4 is recommended). The system compares the character size of the current detection to the first one and estimates the direction based on the change.
- **Advanced:** More accurate but may delay the result. The delay time can be reduced using the Maximum Delay setting. Select one of the three arrows to indicate the approximate

movement direction (on the video image) of vehicles approaching the camera. Direction detection is based on the movement of the license plate and will only register the plate if the direction is confirmed by its movement - or if the maximum delay time has passed since the first detection.

Direction filtering: If direction detection is enabled, this setting allows you to filter license plate events based on the vehicle's direction (approaching or departing).

2.4.1.5. Statistics

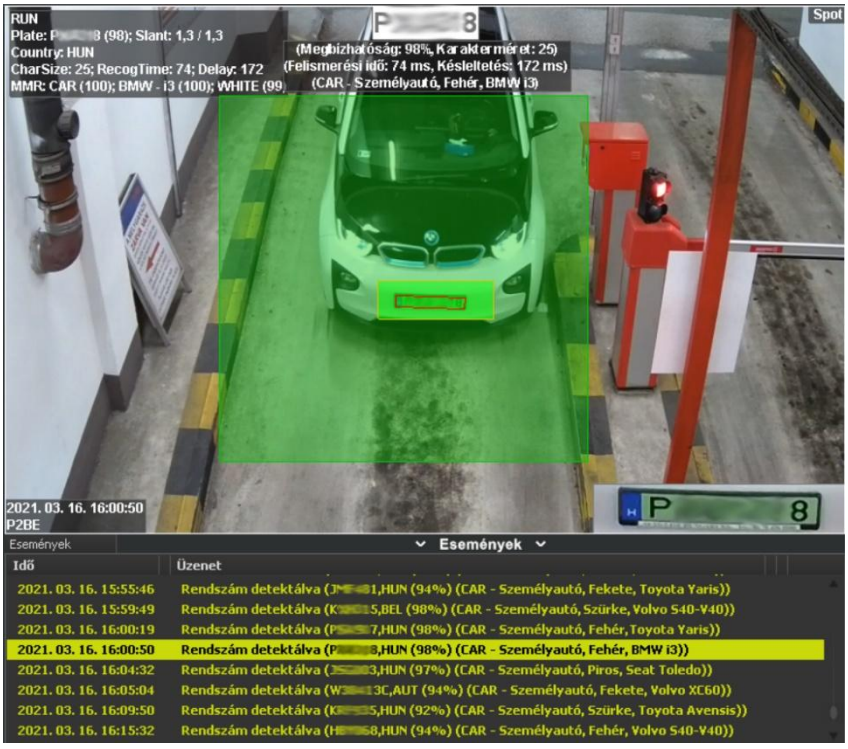
The **Statistics** tab contains statistical information about the processing performed by the recognition engine, such as maximum and average wait time, number of recognitions, number of timeouts, number of restarts, and the number of unreliable recognitions.

The statistics reset to zero after every change (**Apply / OK**).

2.4.2. Check the operation of license plate recognition

To verify proper license plate recognition on a camera and collect information for fine-tuning the settings, use the following sources:

- The data shown in the Statistics tab of the **Configure Server-Side ANPR** settings window,
- Information displayed in the **LPR OSD** layer on the live or recorded video,
- **License Plate detector OSD** information, which is also available on both live and recorded video.



2.4.2.1. Statistics information

Recognized plates (unfiltered):	Count of all recognized number plates.
Recognition	
Count:	Count of the images on which the ANPR process has run.
Time (min/max/avg): (ms)	The Minimum, maximum, and average recognition time.
Timed out:	Recognitions aborted due to timeout.
Character size	

Size (min/max/avg): (px)	The minimum, maximum, and average size of recognized characters.
Delay	
Time (max/avg): (ms)	The maximum and average delay time.
Drop Counts	
By low confidence:	Number of license plates discarded due to low confidence.

Delay time

Delay time refers to the total processing time of a given frame (decompression, waiting for CARMEN, recognition, etc.). If the delay reaches 3000 ms, new frames will be dropped until the delay goes back below 3000 ms. Recognition will not run on those dropped frames (and no LPR OSD layer will be displayed for them). With proper settings, the delay time remains consistently low (100–300 ms) and only increases occasionally and briefly - yet still stays below 3000 ms.

Note: *continuous server-side license plate recognition causes nearly all frames to be decompressed. For high-resolution cameras with high FPS, continuous motion can cause such high delay times that it may prevent effective ANPR operation - even if* ***Limit recognition frequency*** *is enabled.*
In such cases, it is recommended to reduce the camera's FPS settings, either instead of or in addition to using ***Limit recognition frequency****. Also, enabling the GPU accelerated pre-filter helps ensure that only frames containing a license plate are processed.*

2.4.2.2. Information of LPR OSD layer

RUN	License plate recognition ran on the frame; the results are shown in the following lines.
Skipped by FPS limit, last result:	The frame processing was skipped due to the configured FPS limit.
DROP! Reason: Plate position	License plate recognition ran on the frame, but the result was discarded due to the plate's position. There must be at least one character's width of space between the edge of the image and the recognized plate (based on the recognized character size).
LPR DROP! Reason: Timeout (ms)	The recognition engine did not find a plate within the set time (Timeout) on the frame, so it was discarded.
LPR DROP! Reason: Engine is busy (since X ms)	The frame was discarded because the recognition engine is still processing the previous frame. This can

	happen if the engine does not complete processing within the configured timeout, causing the next frame to be dropped. The time in parentheses shows how long the recognition engine has been processing.
Plate: ABCxyz (X)	The detected plate is shown, with its confidence value in parentheses.
Country:	For region-code recognition engines, the detected country/region is displayed.
CharSize:; RecogTime:; Delay: (ms)	Character size, recognition time, and delay time.

2.4.3. Edit License Plate List

Specified license plates can be organized into groups, each of which can have different alarm settings assigned. The license plate list can be imported and exported, so it is not necessary to manually enter each plate one by one every time. Filters help facilitate searching for individual plates and groups.

A single license plate can belong to multiple groups simultaneously: when the plate is recognized, the appropriate detector event will be triggered for every license plate group (however, additional filters can be set up on the detectors).

With the **Expiration date** setting, the license plate will be automatically removed from the group after the specified time has elapsed.

The entered license plates are case-sensitive, so all plates must be entered in uppercase letters.

The **Edit Groups** button opens the **Edit License Plate Groups** configuration window.

2.4.4. Edit License Plate Groups

Using license plate groups, different rules can be set for plates belonging to specific groups—for example, cars on one list can be automatically allowed through a controlled barrier, while cars on another list can trigger an alert to the security desk.

License plate groups can be freely created and deleted, along with their assigned colors. When a group is deleted, the plates assigned to it are not removed from the license plate list.

The list of license plate groups and the plates themselves are global for the SITE. The list can be edited on the **License Plate Recognition** tab of any camera using the **Edit License Plate Groups** button.

2.4.5. Manual entry

Automatic license plate recognition may fail or produce incorrect results for certain plates. In such cases, the operator has the option to manually enter the correct license plate. Plates entered this way will trigger a "Manual Entry" event from the license plate detector, which the alarm system can handle like any other event.

The **Manual Entry** function is accessible from the camera menu in **Live View** mode and requires special permissions to use.

3. Further steps

For an overview of additional system settings, please refer to the ***IVS Installation Manual*** documentation.