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1 Introduction

GANZ CORTROL LPR is an automatic License Plate Recognition application that is designed to work with GANZ CORTROL Premier and Global editions. This application accommodates customers with the specific need to detect, recognize and register motor vehicle license plates. GANZ CORTROL LPR is ideally suited for vehicle access control applications as well as for traffic control and enforcement applications.

1.1 System Requirements

- Microsoft Windows 64-bit operating system (7 SP1, 8, 8.1, 10, Server 2008 R2, Server 2012 R2)
- Both .NET Framework 3.5 and 4.5 (4.6) installed
- Intel Core™ i3 processor or better, or an equivalent AMD processor manufactured after 2011
- Minimum 4GB RAM, DDR4 strongly recommended

No. of recognition streams	CPU mode	RAM
1	Intel i5 or Xeon >3,0Ghz 4 physical cores	4GB
2	Intel i7 or Xeon >3,0Ghz 4 physical cores With Hyper-Threading	8 GB
4	Intel i7/i9 or Xeon >3,0Ghz 8 physical cores With Hyper-Threading	16 GB
6	Xeon >3,0Ghz 12 physical cores with Hyper-Threading Single or Dual CPU systems	24 GB
8	Xeon >3,0Ghz 16 physical cores with Hyper-Threading Single or Dual CPU systems	32 GB

1.2 System Recommendations

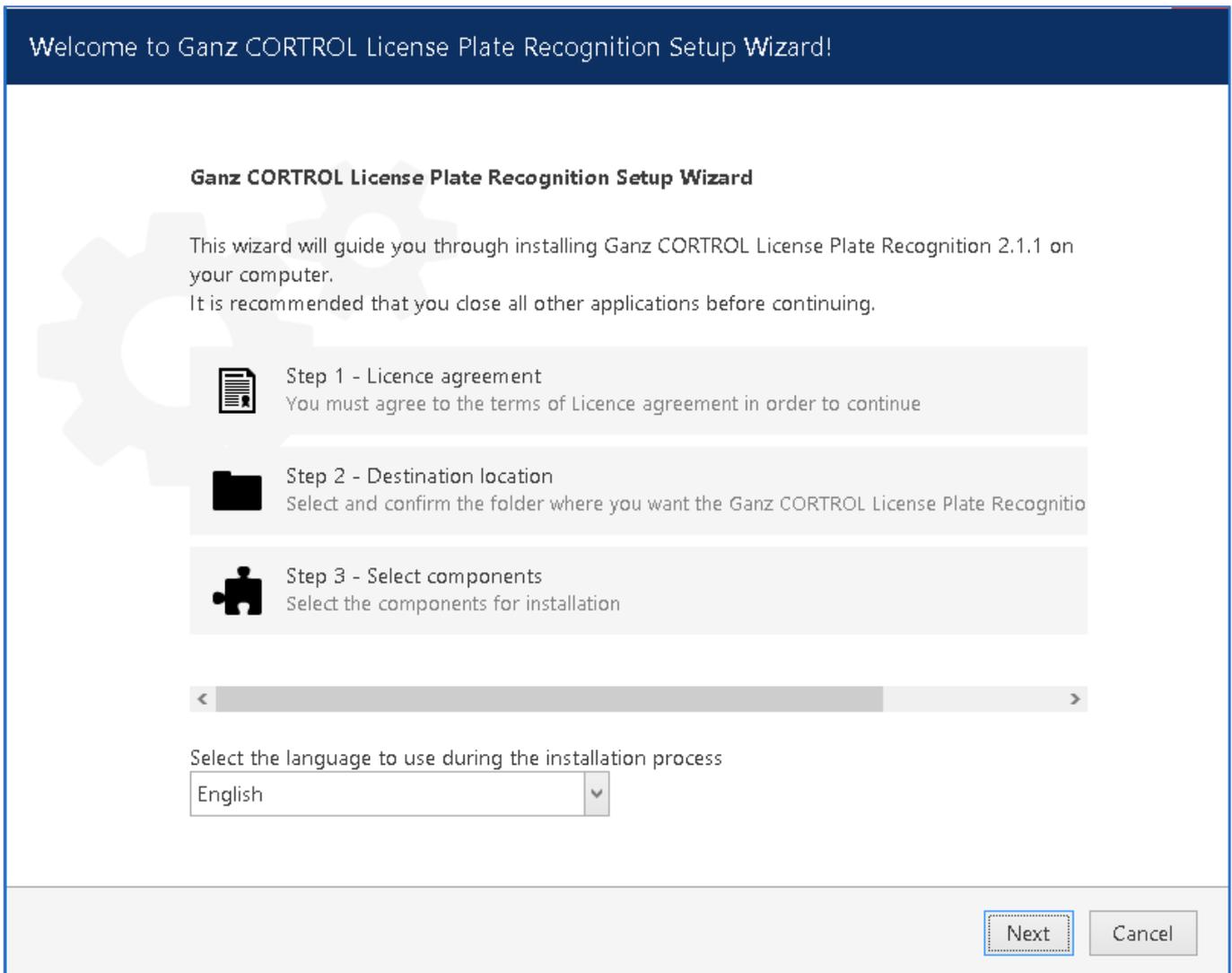
- All Windows updates should be installed (especially, this is critical for Windows 8 and newer editions and for pending updates)
- Ports for remote connections should be enabled through the firewalls (default port for the GANZ CORTROL Server is 8080)
- Installation and frame archive directories should be added to the antivirus exception list so that they are not scanned or interfered with in any other manner
- Preferred Web browsers are Google Chrome and Mozilla Firefox

2 Installation

Start the installation by launching your GANZ CORTROL LPR installation package. The installation wizard will guide you through the steps: after completing them, GANZ CORTROL LPR will be installed as a Windows service on your computer.

Before starting the installation, make sure that:

- No other de-/installation routines are running
- The chosen server fulfils all the recommendations and requirements listed in the Introduction section
- Windows updates are not pending and are not being installed
- No other service occupies the default LPR port of 8082
- The Target GANZ CORTROL Server(s) have HTTP connection enabled (The HTTP port is not set to 0)



First, choose the language to be used during the installation process and press *Next*.

Step 1 of 3. Licence agreement

Ganz CORTROL License Plate Recognition Licence Agreement

Please read the following Licence agreement. You must accept the terms of this agreement before you can continue with the installation.

IMPORTANT — READ CAREFULLY: This is a legal agreement between YOU (an individual or single entity ("**you[r]**") and CBC AMERICAS Corp. ("**CBC AMERICAS**") pertaining to the CorTrol® CMS Software you are about to install, copy, access or otherwise use, including any documentation which may be provided therewith (singularly and collectively, the "**Software**"). CBC AMERICAS licenses the Software to you only upon the express condition that you accept all of terms and conditions contained in this software license agreement (the "**Agreement**"). You should carefully read the following terms and conditions before using the Software. By opening the sealed package, installing, copying, accessing, or otherwise using the Software, you accept these terms and conditions and understand that they will be legally binding on you. If you do not agree to these terms, then CBC AMERICAS is unwilling to license the Software to you. If you do not agree with them, or do not want them binding on you, you must not install, copy, access, or otherwise use the Software, and you may return the Software for a full refund (less any shipping fees) within thirty (30) days of your license purchase date (the "**Product Return Period**"). After the Product Return Period, you and all license fees paid to CBC AMERICAS will be non-

accept the terms of the agreement

Previous

Next

Cancel

Read the GANZ CORTROL LPR license agreement and mark the checkbox below if you agree to it or order to proceed, otherwise press *Cancel* to roll back the installation.

Step 2 of 3. Destination location

Select and confirm the folder where you want the Ganz CORTROL License Plate Recognition software to be installed

Where do you want Ganz CORTROL License Plate Recognition to be installed?

Setup will install Ganz CORTROL License Plate Recognition in the following folder. Click browse to select a different folder.

C:\Program Files\Ganz CORTROL\Ganz CORTROL License Plate Recognition

Browse...

Installation requires at least 186.82 MB of disk space.

Previous

Next

Cancel

Specify the path for the folder GANZ CORTROL LPR is to be installed in. The default directory is *C:\Program Files\Ganz CORTROL\Ganz CORTROL License Plate Recognition*.

Step 3 of 3. Select components

Specify which components to install

Configure the components of the installation package:

- Ganz CORTROL License Plate Recognition server

Select the language to use in the user interface

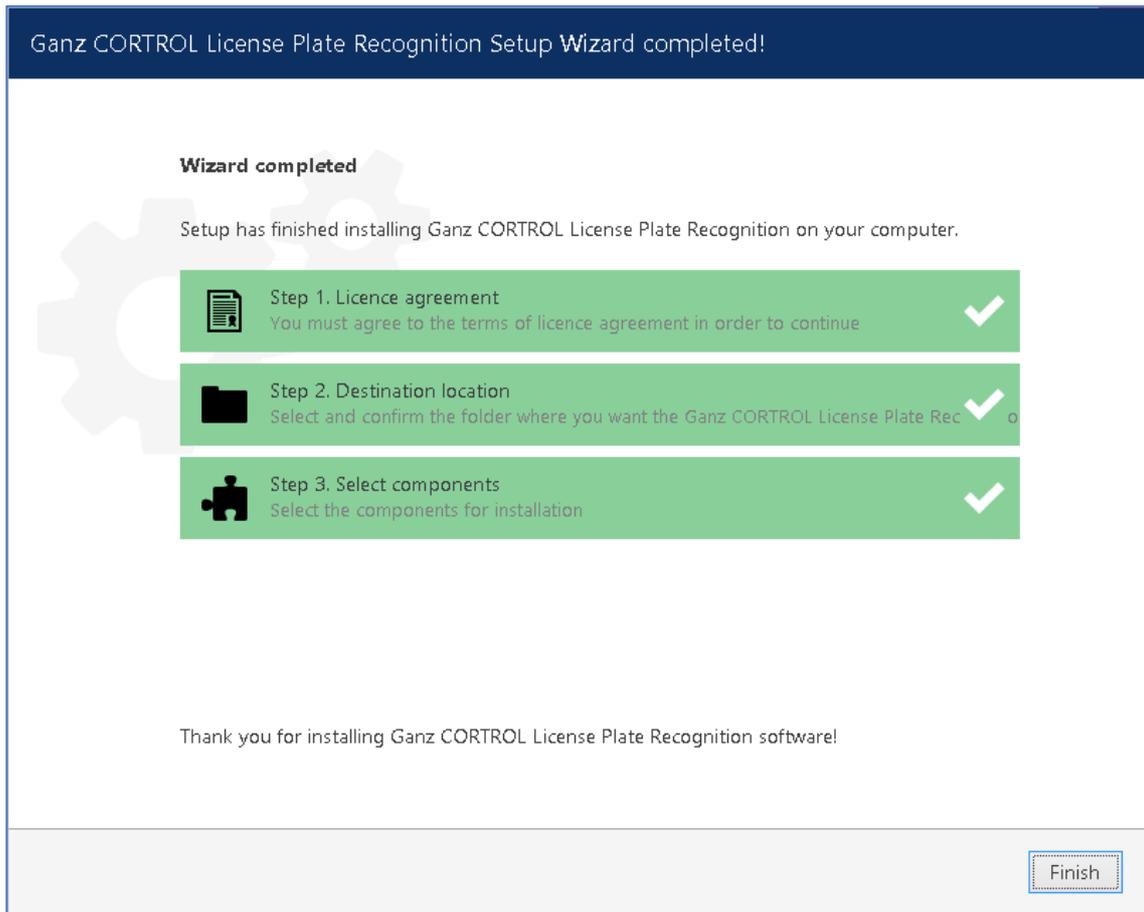
English 

At least 186.82 MB of free space is required.

Previous Next Cancel

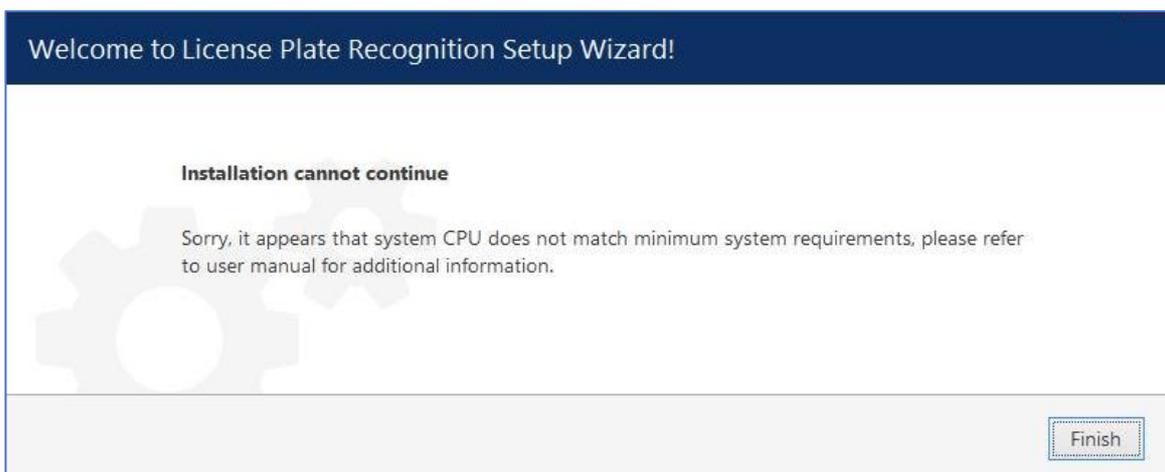
Review the installed components and choose the language for the GANZ CORTROL LPR interface. You will be able to change the language later via the GANZ CORTROL LPR service interface settings.

Press *Next* to begin the installation.



After GANZ CORTROL LPR has been installed, you will see the installation summary. Press *Finish* to exit the wizard.

In case your CPU is detected to be not suitable (not powerful enough) for GANZ CORTROL LPR, you will get a corresponding message and the installation will not continue. Please check with the system requirements for the GANZ CORTROL LPR server to help you choose the right CPU for the GANZ CORTROL LPR server.

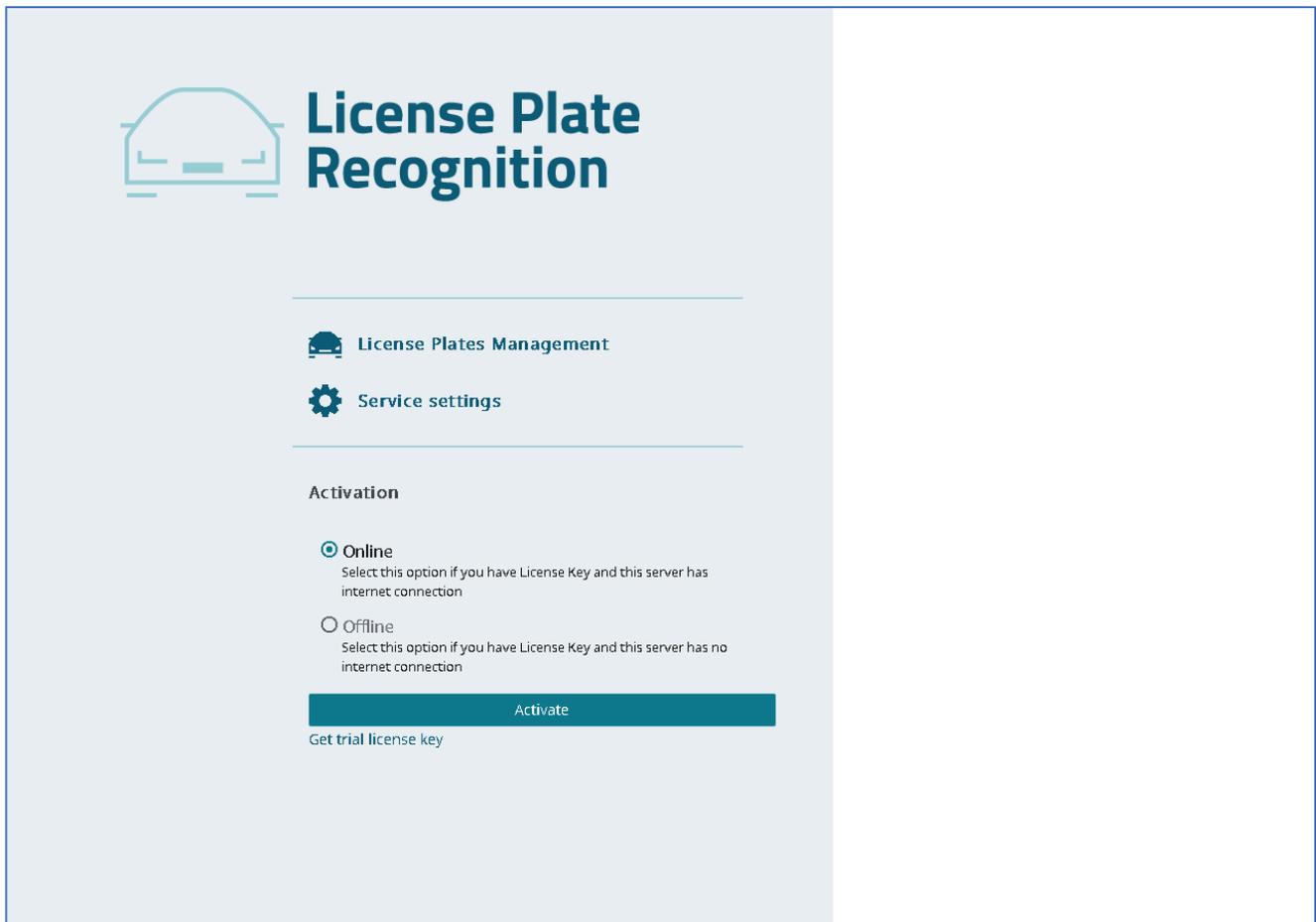


GANZ CORTROL LPR is installed as a Windows service and a webpage-like user interface is provided for its configuration and management. After installation has been successfully completed, you will find the *License Plate Recognition Service Configuration* shortcut on your Desktop: double-click it to open the LPR Web user interface.

3 Activation and License Management

GANZ CORTROL LPR activation is offered upon accessing the Web configuration interface for the first time. This can be done either by double-clicking the *License Plate Recognition Service Configuration* shortcut on the Desktop locally or by opening the service Web interface in your Web browser directly by using the following link over HTTP (both remote and local) using the following default parameters:

- *IP*: your server's IP address (you can also use *localhost* or *127.0.0.1* for local machines)
- *Port*: 8082 the default port for the LPR service (can be changed within the configuration interface)
- *User name*: admin
- *Password*: admin



4 Service Management

The License Plate Recognition homepage offers quick access links to “License Plate Management”, “Service Settings”, and license management.

License Plate Management link to enter the “Tags” page for license plate management.

Service Settings link to enter the configuration section.

Production License link to edit the current GANZ CORTROL LPR License.

It is recommended to perform a first time GANZ CORTROL LPR configuration in the following steps;

- Add GANZ CORTROL Server(s)
- Add channels for analysis from existing GANZ CORTROL Servers
- Manage license plate lists with tags
- Change LPR Web User Interface (UI) and LPR service settings



Ganz Control License Plate Recognition					
Tags					
PLATE	TAG	COMMENT1	COMMENT2	ADD	
GU8755	Blue	Employee	Park Staff	✕	
GS5932	Blue	Employee	Park Staff	✕	
FP9980	Blue	Employee	Park Staff	✕	
HR808	Blue	Employee	Park Staff	✕	
EV1003	Red	Trouble	Kicked out	✕	

Ganz Control License Plate Recognition	
Servers	HTTP INTERFACE
Channels	HTTP user <input type="text" value="admin"/> <small>Username for accessing web interface</small>
Tags	HTTP password <input type="password"/> <small>Password for accessing web interface</small>
Settings	Service port <input type="text" value="8082"/> <small>Web interface port. Please note that service must be restarted after port change</small>
	Language <input type="text" value="English"/> <small>Web interface language</small>

4.1 Service Settings

Switch to the *Settings* section to access the GANZ CORTROL LPR service setup: you can change the connection settings and administrator user account details here.

Initial parameter values are as follows:

- User name to access LPR server management
 - **HTTP user:** *admin*
- Password for LPR server management access
 - **HTTP password:** *admin*
- HTTP port (restart LPR service after changing the port for the changes to take effect)
 - **Service port:** *8082*
- Interface language
 - **Language:** *English*
- Location to store recognized plates
 - **Frame archive path:** *C:\License Plate Recognition*
- Maximum amount of storage that can be taken by frame archive
 - **Quota:** *90%*
- Enable Watchdog to monitor the GANZ CORTROL Server, and LPR service, if installed on the same computer (Watchdog is unavailable without the GANZ CORTROL server installed)
 - **Enable Watchdog:** *false* (disabled)
- Internal log detalization level, from *Trace* (most detailed) to *Error* (major errors only)
 - **Log level:** *Warn* (mid-low verbosity)

Note that these values will also be used if server configuration has been removed.

The Pre-defined directory for the frame archive is *C:\License Plate Recognition*, and default storage limitation is 90% of the total disk size. This means, a maximum total of 90% of the disk can be filled. If your disk is already 91% full even without the LPR archive, and you set quota to 90%, no frames will be saved.

The storage quota mechanism does not know about any other quotas applied to the same disk: e.g., if GANZ CORTROL is set to use the same storage location and it fills up the storage so that LPR quota is exceeded, no frames will be recorded. For instance, if your disk is currently 20% full and you set quota to 50%, LPR will use a maximum of 30% of disk space.

4.2 Recognition Database

LPR uses a **local** database for storing the recognition results by default: no extra settings are required if you want to use this option. If you wish to use your own database with a possibility to share it between multiple LPR servers, use the *Recognition Database Settings* section under *Service Settings* for setup. Such databases are referred to as **external** in this document.

Available settings:

- **Database driver:**
 - **Embedded** database: local SQLite database will be used
 - **ODBC/MSSQL:** external (regarding LPR) ODBC database
- **Connection string:**
 - Empty for the embedded database mode
 - Connection string in case of an external database
- **User:**
 - Empty for the embedded database mode
 - Username to be used to connect to an external database
- **Password:**
 - Empty for the embedded database mode
 - User password to be used to connect to an external database

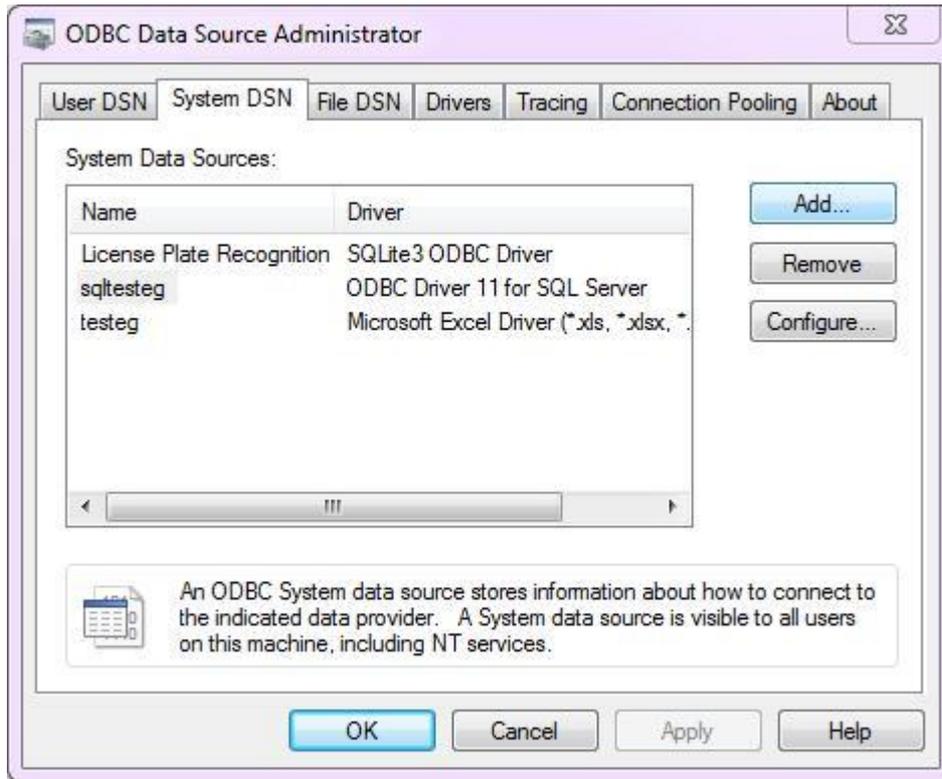
Local database mode is used by default and its only setting is the *Embedded database* option in the Recognition database settings section.

To set up an **external** database - used by one or more LPR servers - for storing the recognition results, the following **preliminary steps** should be taken:

- Install the desired server platform and create a database
- Download and install the [Microsoft ODBC Driver for SQL Server](#) on the machine where LPR service is running (make sure to use the 64-bit version)
- Create a new system DSN for your database via ODBC Data Source Administration panel on the machine where LPR service is running

After you have installed the abovementioned ODBC driver from Microsoft, it should appear in the Windows **ODBC Data Source Administration** panel. This panel can be opened in the following ways:

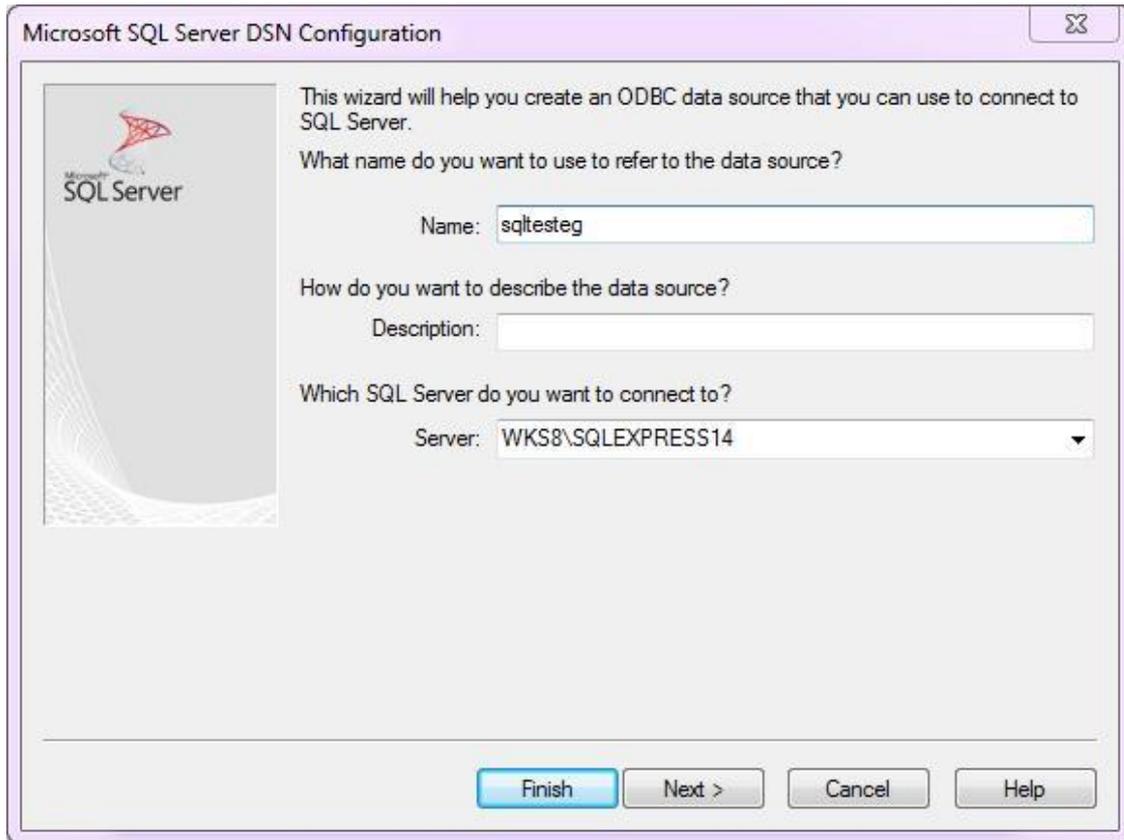
- Press *Win+R* and type *odbcad32* in the appeared windows, then hit *OK*; or
- In the *Search* field of the Windows Start Menu/Cortana, type *odbc* and click *Data Sources (ODBC)* under *Programs*; or
- Go to *Control Panel > Administrative Tools > Data Sources (ODBC)*



Switch to the *System DSN* tab and click the *Add* button on the right; find the *ODBC Driver for SQL Server* entry, select it and click *Finish*. An additional dialog box will appear, offering you to enter the data source properties:

- **Name:** user defined data source name, **mandatory**, to be used in LPR
- **Description:** user defined description, optional (you can leave it empty if you like)
- **Server:** your SQL server domain name or IP address, **mandatory**

When ready, click *Next* and enter username and password to connect to your SQL server under the *SQL Server authentication* section (second option).



On the next steps, you can leave all the **default** settings. Finish the wizard: the newly created DSN will appear in the *System Data Sources* list.

Now, go back to the **LPR Web configuration page** and enter the recognition database settings as follows:

- Driver: *ODBC/MSSQL*
- Connection string: *DSN=yourDSNforDB;Database=yourDBname*
- Username and password: the same ones you entered when configuring DSN for the database connection

RECOGNITION DATABASE SETTINGS	Driver to use for Recognition database connection	ODBC / MSSQL
	Connection string for Recognition database	DSN=sqltesteg;Database=myLPRresults
	Recognition database user	lpr
	Recognition database password	*****

Click *Submit* in the bottom of the page to save your settings. LPR now will use your configured external database for storing the recognition results; you can use the same database for other LPR servers as well.

Channels							
ID	NAME	MODE	SERVER	ACTIVE	ADD		
205	Gate LPR	Video	Global Server (localhost)	True			

To check if LPR can use the external database, go to the *Channels* section of LPR Web UI and click the *Details* icon (the rightmost icon) next to any active channel: recognition results will be listed in case of success; otherwise, an error will be displayed instead of the results. This section will also display the recognition results when a local database is used.

4.3 Tag Database

Similarly, to the recognition database, tagged black/white lists can be stored either locally or in an external database. By default, a local tag list is maintained, and there is an option to synchronise the list with a shared ODBC database: in this way, several LPR servers can use a single tag database, and this list can be edited from the Web UI of any of the LPR servers.

TAGS DATABASE SETTINGS

Driver to use for Tags database

ODBC / MSSQL
▼

Connection string for Tags database

DSN=MyTagTest;Database=myTagDB

Database connection string

Tags database user

lpr

Tags database password

.....

The procedure of the database setup is analogous to the recognition database setup described above. Once the external tag database connection has been configured, the tag list will appear in the *Tags* section; you will be able to edit the tag list from the LPR Web UI with the changes saved into the configured database. Tag list is **synchronised** with the external database approximately **once per minute**.

4.4 Tag Import

Alternatively, the tag list can be **imported** from an external database, or an Excel/CSV file. The tag list in this case is not available for editing via LPR Web UI; instead, the contents of the configured file will be passively loaded and then refreshed every minute.

It is recommended that you only use one **tag import mode** at a time: if you try using both tag database and tag import, the tag list will be altered every time it is synchronised with the source, which is hardly desirable.

You can use an external database in different modes for different LPR servers: for example, two of three LPR servers use it as a fully functional LPR database with a possibility to edit the tag list, and the third LPR server just imports the tag list created from the first two servers without modifying it.

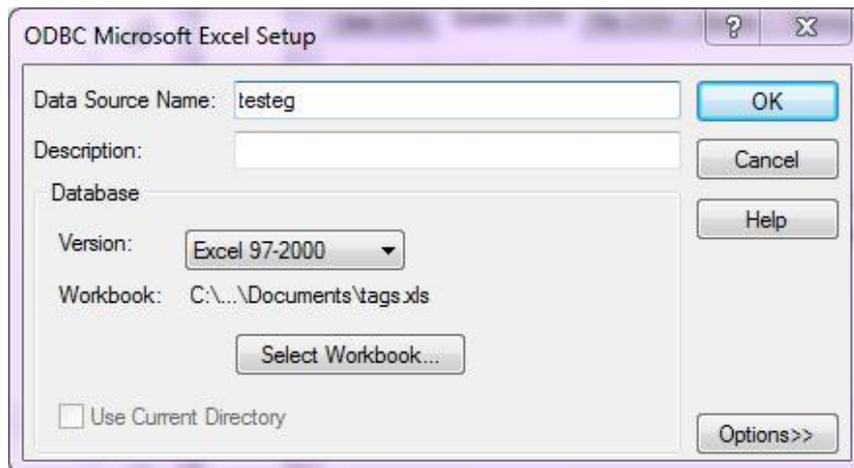
Before setting up the tag import from Excel/CSV in LPR, ensure the following:

Download and install the 64-bit [Microsoft Access Database Engine Redistributable](#)

Create a new system DSN via ODBC Data Source Administration panel on the machine where LPR service is running

You will find a detailed description of how a new system DSN is added in the *Recognition Database* section of this document. The only difference is that for each import mode you will need to use an appropriate driver - either Microsoft Excel Driver (for *.xls, *.xlsx files) or Microsoft Access Text Driver (for *.csv files).

If you choose to use tag import from a **database**, follow the steps in the *Recognition Database* section above. For instructions on **comma separated value files and spreadsheets**, see the description below.



In the **driver settings**, you just need to specify the DSN name itself (to be used in LPR), file version (for Excel) and the file (Excel) or directory containing the file (CSV).

TAGS IMPORT SETTINGS	Tags import query	<input type="text" value="SELECT * FROM [Sheet1\$]"/>
	Connection string for Tags import database	<input type="text" value="DSN=testeg;Header=False"/>
	Database connection string	
	Tags import database user	<input type="text"/>
	Tags import database password	<input type="text"/>

Tag import settings in LPR Web UI are as follows:

- Tags import **query**: SQL statement to retrieve the tag list from the target file or database (see examples below)
- **Connection string**: used to connect to the target file or database
- **Username and password**: if required (for databases only)



Tag import queries can look as follows:

- **Excel**: `SELECT * FROM [Sheet1$]` (or another sheet number)
- **CSV**: `SELECT * FROM file.csv` (where `file.csv` is your comma separated value file containing the tag list)



Connection strings examples:

- **Excel**: `DSN=yourDSNforXLS;Header=False`
- **CSV**: `DSN=yourDSNforCSV`

Click *Submit* to save the settings and go to the *Tags* section of LPR Web UI: if the connection is successful, the list will be imported from the selected source and there will be no options to edit it (controls for adding and removing the entries will be absent). If the file/database contents are modified, the changes will be reflected in LPR Web UI in about one minute.

4.5 Server Configuration

To start using the recognition engine, it is necessary to connect to a GANZ CORTROL Server that contains LPR channels pre-configured, and then add desired channels to LPR. If you have not set up your GANZ CORTROL server yet, proceed with its setup and get back to LPR when you are ready. Video management server configuration instructions can be found in the corresponding supporting documentation.



GANZ CORTROL LPR 2.1 is designed to work only with GANZ CORTROL Premier and Global editions.

Go to the *Servers* section and click *Add* to create a new server configuration.

Add new server

Host

Server address or hostname

Port

Server port

User

Server user

Password

Server password

The following fields are to be filled here:

- **Server:** GANZ CORTROL server IP address or hostname. If you are connecting to a GANZ CORTROL Global system, make sure to use the address of the central server.
- **Port:** HTTP port of the target GANZ CORTROL server (8080 by default). When connecting to a remote GANZ CORTROL server, make sure this port is allowed on all intermediate routers and firewalls.
- **User and password:** GANZ CORTROL user account to connect with. Depending on the connection type, user must have corresponding privileges and must be allowed to receive video from LPR channel(s). For a full description on the GANZ CORTROL security setup, please refer to the corresponding user manual.

Servers					
HOST	PORT	USER	STATUS	ADD	
localhost	8080	admin	Connected		
192.168.1.83	8085	lindenmann	Disconnected - Connection refused		

Once you have entered all the settings, click *Submit*. Connection with the target server will be established automatically: if the GANZ CORTROL server is online and reachable, you will see server status saying *Connected*. If the server is offline, LPR will endeavour to connect every few seconds until it reaches the server. You can add one or more servers for a single LPR server to work with. To edit or delete existing server, simply click the corresponding controls on the right of the server name in the list.

4.5 Channel Setup

Server setup only establishes connection between LPR and GANZ CORTROL server(s) on the service level. To start recognizing plates from video streams, you now need to choose video channels and define recognition parameters for each one. It is strongly advisable that you read and follow recommendations regarding camera positioning, which are available within this document.

To add a new channel, switch to the *Channels* section and click the *Add* button in the top right corner of the channel list. To edit any of the existing channels' settings, as well as disable/enable license plate recognition for a specific channel, simply click *Edit* for the desired item - this is like editing the server settings.

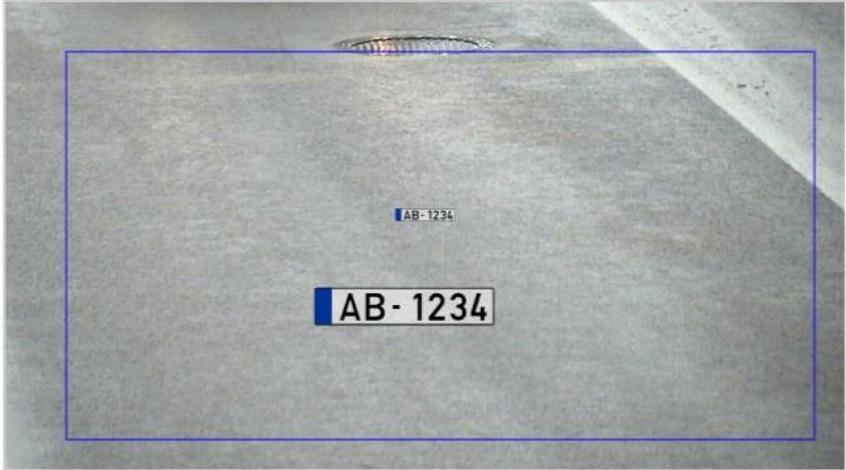
Add new channel

Server
localhost

Channel
Sehnsucht

Preset
Fast

Enabled
Uncheck to disable processing of this configuration



Select a server from the list of your connected servers and then select one of the channels. Note that channel must be enabled in GANZ CORTROL server configuration and the server itself must be connected in LPR. If the GANZ CORTROL server is offline, you will be unable to select it in the *Add new channel* form: in such case, ensure GANZ CORTROL server availability and try adding the channel again.

By default, the newly added channel has license plate recognition enabled.

Choose your desired recognition parameters and click *Submit* to add the channel into LPR configuration. If the target GANZ CORTROL server is online and reachable, the channel analysis will be started immediately. You can add one or more channels from every connected GANZ CORTROL server for a single LPR server to work with. To edit or delete existing channel, simply click the corresponding controls on the right of the channel name in the list.

Channels						
ID	NAME	MODE	SERVER	ACTIVE	ADD	
113	Sehnsucht	Frame	Global Server (localhost)	True		
125	Seemann	Frame	Global Server (localhost)	False		

If there are multiple channels in the list, you can quickly track their current operation by looking at the **activity status**: the channels available and enabled for recognition will have the status saying *True*, and those unavailable or with processing disabled will be marked as *False*.

The next sections of this document contain details on the recognition parameters, as well as recommendations for getting better results.

5 Recognition Parameters

For each channel, you are requested to choose the recognition parameters and set the recognition zone.

 LPR previews and processes the live video stream received from the channel so it is not necessary to have the recording enabled for the analysed channel. However, if you wish to be able to browse the recognition results later, you need to enable recording for the target channel in GANZ CORTROL server settings: then, recognition results passed to GANZ CORTROL server will be stored together with the video footage, allowing you to run investigation on past results.

 Note that some settings affect CPU usage, for example:

- Larger recognition area size increases CPU utilization
- Smaller license plate character size range decreases utilization
- Frame engine requires more CPU resource for the same video stream compared to the video engine

The **blue frame** defines the active recognition area - anything outside this area will not be accounted for when analysing video. Video overlay elements also include a static example of a license plate for you to see the minimum and maximum expected number height, which can be adjusted using the controls in the *General* section.

The **Enabled checkmark** below the preset choice turns recognition ON and OFF: it is marked by default meaning that recognition is enabled for every newly added channel.

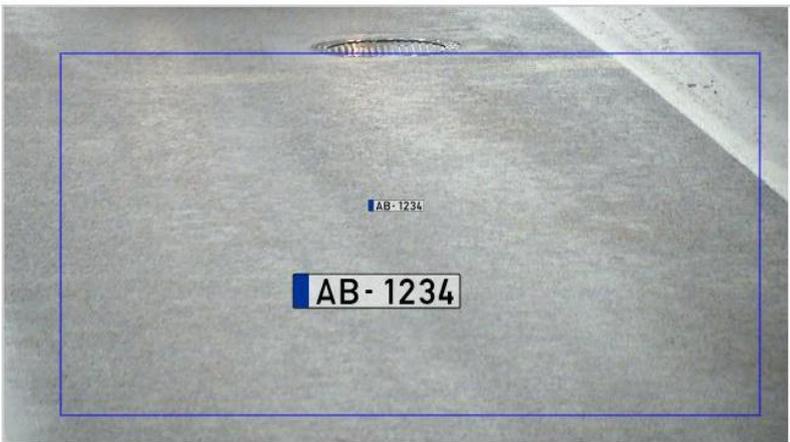
Add new channel

Server
localhost

Channel
Sehnsucht

Preset
Fast

Enabled
Uncheck to disable processing of this configuration



5.1 Parameter Presets

For your convenience, LPR has **recognition setting profiles**, each of the profiles has recognitions parameters that are optimised for that specific case.

The presets are based on the relative **vehicle speed**:

- **Fast**: the license plate is present in **1 to 3 frames**
- **Moderate**: the license plate is present in **4 to 10 frames**
- **Slow**: the license plate is present for **1 to 3 seconds**
- **Very slow**: the license plate can be seen for **longer than 3 seconds**

You can choose one of them and/or try your own settings: the profiles are generic and a few parameter adjustments may be required for individual cases. Also, such settings as license plate size and inclination are not affected by presets and therefore must be corrected to fit the actual situation.

5.2 General Parameters

Should you need to adjust the recognition parameters manually, here are explanations on each setting.

- **Minimum and maximum character size:** smallest and largest possible height of characters in the license plate (smaller range reduces CPU utilisation)
- **Rotate:** average angle of the license plate inclination from the horizontal
- **Motion filter:** filters equal frames so that frames without changes are not fed to the recognition engine
- **Motion threshold:** motion filter sensitivity (relative percentage of pixels to be changed to trigger motion)
- **Frame delay:** minimum frame feed interval, time before processing the next frame
- **Aggregation time:** the amount of time to collect comparable results from the engine(s) before triggering the plate
- **Plate absence timeout:** the minimum amount of time (in seconds) to wait before the same license plate can be triggered again
- **License plate schema:** colour composition of the license plates (options: ignore this characteristic, black letters on white (light) background, white letters on black (dark) background, both possible)
- **Countries:** country code list, sorted by priority (the first one will be the most expected), ISO 3166 two-letter codes are to be used

5.3 Supported countries:

Albania (AL)	Denmark (DK)	Jordan (JO)	Portugal (PT)
Algeria (DZ)	Ecuador (EC)	Kazakhstan (KZ)	Qatar (QA)
Argentina (AR)	Egypt (EG)	Korea, North (KP)	Romania (RO)
Australia (AU)	Estonia (EE)	Korea, South (KR)	Russian Federation (RU)
Austria (AT)	Finland (FI)	Kuwait (KW)	Saudi Arabia (SA)
Azerbaijan (AZ)	France (FR)	Latvia (LV)	Serbia (RS)
Bahrain (BH)	Georgia (GE)	Lebanon (LB)	Singapore (SG)
Belarus (BY)	Germany (DE)	Lithuania (LT)	Slovakia (SK)
Belgium (BE)	Ghana (GH)	Luxembourg (LU)	Slovenia (SI)
Bolivia (BO)	Greece (GR)	Macedonia (MK)	South Africa (ZA)
Bosnia Herzegovina (BA)	Guatemala (GT)	Malaysia (MY)	Spain (ES)
Brazil (BR)	Guernsey (GG)	Mexico (MX)	Sweden (SE)
Brunei (BN)	Hong Kong (HK)	Moldova (MD)	Switzerland (CH)
Bulgaria (BG)	Hungary (HU)	Monaco (MC)	Taiwan (TW)
Canada (CA)	India (IN)	Netherlands (NL)	Tanzania (TZ)
Chile (CL)	Indonesia (ID)	New Zealand (NZ)	Tunisia (TN)
Colombia (CO)	Iran (IR)	Nigeria (NG)	Turkey (TR)
Congo (CG)	Ireland (IE)	Norway (NO)	Ukraine (UA)
Congo D.R. (CD)	Isle Of Man (IM)	Pakistan (PK)	United Kingdom (GB)
Costa Rica (CR)	Israel (IL)	Paraguay (PY)	United States (US)
Croatia (HR)	Italy (IT)	Peru (PE)	Uruguay (UY)
Cuba (CU)	Jersey (JE)	Philippines (PH)	Venezuela (VE)
Czech Republic (CZ)		Poland (PL)	Vietnam (VN)

5.5 Engine-Specific Parameters

LPR has two available modes: video engine and frame engine. They have the same number recognition algorithms but use different result aggregation techniques, therefore

- **Frame engine:** Efficient for full and/or clear license plates within a small number of video frames:
 - Vehicle speed is medium to high
 - Intensive traffic
 - Low or intermittent light conditions
- **Video engine:** Best when there are many similar frames with the same license plate:
 - Vehicle speed is low - the cars are stopping before a barrier, a turn, a traffic light, or a speed bump

Both modes can be combined so that both frame and video engines are used for video stream analysis for better results (e.g., when vehicle speed is subject to change) but keep in mind this will require much more CPU resource. In most cases, picking just one mode with correct parameters is enough.

The most suitable engine and its configuration is picked automatically based on the selected recognition preset. Should you need to adjust the engine parameters manually, here is the explanation on these.

- Video engine:
 - **Video engine threads:** the number of logical threads of the recognition engine used for parallel processing of buffered frames, default setting is recommended
 - **Plate presence time:** maximum amount of time for the engine to aggregate the recognition results to produce a single output
- Frame engine:
 - **Frame engine threads:** the number of logical threads of the recognition engine used for parallel processing of buffered frames, default setting is recommended
 - **Analysis timeout:** plate processing timeout, maximum amount of time for single frame analysis
 - **Aggregation references:** minimum required number of additional frames with the same plate detected to trigger the result

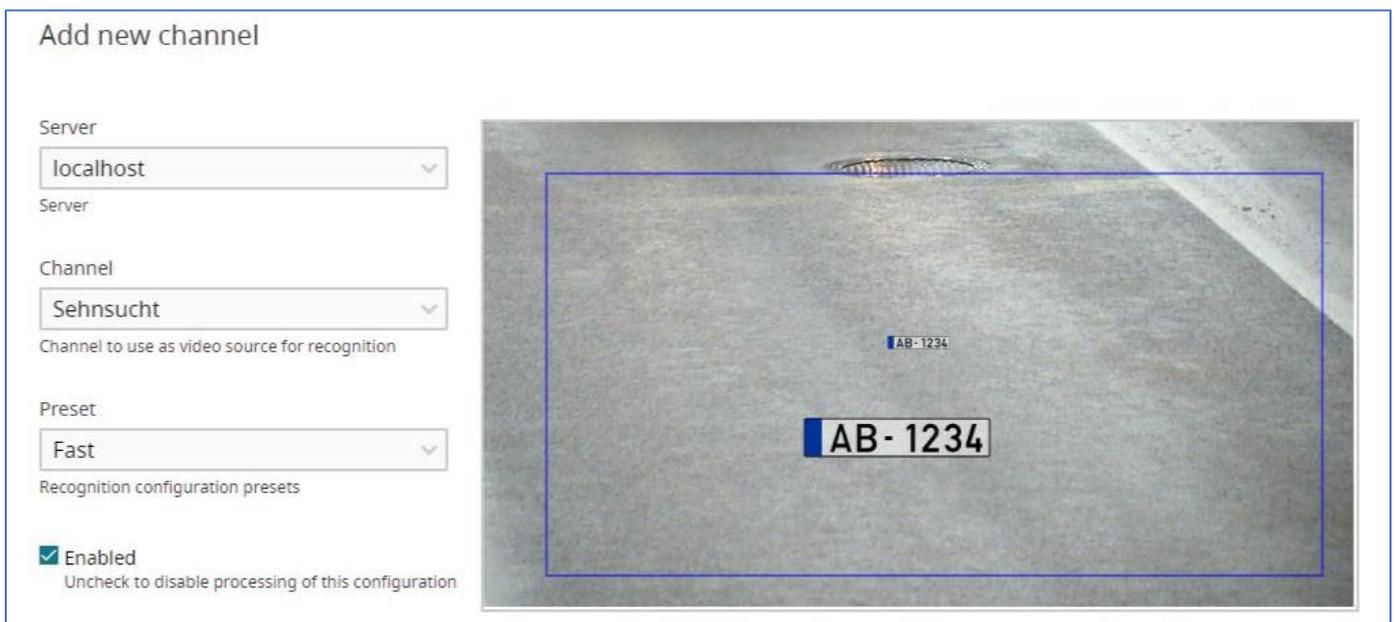
6 Setup Recommendations

There are a few recommended practices and general advice on the system setup to achieve best recognition rate with GANZ CORTROL LPR.

It should be possible for the human eye to recognize the license plate symbols in any frame. If license plate number as it appears on video frame is not clearly readable by you, recognition engine will not see it as well.

6.1 LPR Camera view

License plate should be seen in a frame with a minimum resolution of 2x2 pixels per 0.155 square inch (1 cm²). United States license plate regular size is 12.0 by 6.0 inches (305 by 152 mm); so, a license plate should be of a size of a frame not less than 104 by 22 pixels. This means that 200 by 200 pixels resolution is recommended per square 3.28 foot (1 meter) of the viewing area. For instance, for a video stream with 1920x1080 resolution, camera view for LPR should be up to 32 feet wide and 16 feet high (10 meters wide and 5 meters high).



Minimal recommended recognition frame rate:

- For still cars - 6FPS
- For slowly moving plates - 12FPS
- For moderate speed - 18FPS, license plate should be visible in 10 frames
- For fast moving cars - 20FPS, license plate should be visible in 3 frames

6.2 LPR Camera Setting

For optimal LPR Camera setup, several features, functions should be adjusted

- Lens – Automatic settings: Disable (auto iris, auto focus, back-light compensation, auto shaking, others)
- Lens – Manual setting: Turn auto shutter ON, then set the iris to an almost closed position
 - Record some moving cars, then check the quality of the recorded plates in the LPR archive
 - If the license plates are blurred, open the iris a bit more and check new recordings
 - Repeat till quality and picture is sharp enough for the human eye to recognize the license plate
 - Fix the iris in the last best position
- Lens type and zoom setting: Varifocal zoom lens with max focal length of 80 mm or more is recommended
- Camera resolution: Analog/IP cameras with at least D1 resolution (768x494 (NTSC) or 752x582 (PAL))
 - Recommended resolution is from 720p to 1080p (1280x720 to 1920x1080).
- Shutter timing: Set to acceptable minimum to prevent blurring
 - Optimal setting for most situations is 1/600
 - Individual cases may require a speed of 1/1000 and faster.

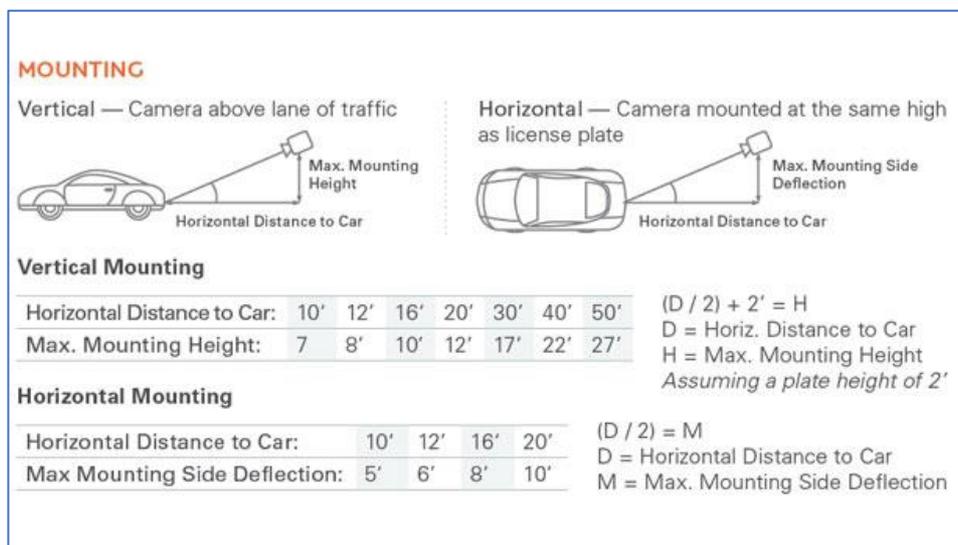
Shutter speed value is determined by the object speed and the angle at which the object is viewed (say, a car going at the speed of 37mph (60 km/h) and covers about 5.9 inch's (15 cm) over 0.01 second).

If you require license plate detection of vehicles going very fast, a specialised ANPR camera is strongly recommended, and maximum guaranteed speed can be usually found in the specification sheet of such a camera.

6.3 LPR Camera Mount

Perhaps the most crucial consideration for ensuring a high recognition and read rate are the distance and angles at which a camera is mounted at the license plate image capture site. The camera should be mounted in such a way that the horizontal lines of the image and the horizontal edges of the license plate are parallel. The corresponding horizontal angle should be within ± 20 degrees, and vertical angle within ± 40 degrees.

Choosing a good place for a camera will give more confident results and will require less processing power. Generally, it is best to place a camera in front of the expected vehicle movement direction to minimize the relative side speed of the license plate towards the camera. This allows to shrink the active recognition area and allows the license plate to appear in view for a longer time, which means more frames with a visible license plate will be received by the recognition engine for analysis.



6.4 LPR Camera illumination

Natural lighting conditions of a sunny day are enough for good recognition. However, it is strongly recommended to use additional light sources, for example, regular street road lamps and/or IR illumination (300lux) during night time.

There are no universal recommendations for cameras, lenses, IR illumination settings: everything should be tuned for the optimal recognition rates per site installation. It is recommended to use the IR illumination and electric light sources separately as electric lamps blind IR illumination and the recognition rate decreases. Intense electric lights (regular street road lamps with tree-like lights) are much better than IR illumination.

The software detects and recognizes the license plates of cars moving both towards and away from the camera but for night recognition it is recommended to process the rear plate of the vehicle, as it is illuminated by the tail lights and the camera is not glared by the flash of the car's headlights.



7 Tag Management

This section allows you to create tagged lists of known license plates (e.g., white or black lists), which enables you to set up various rules automated scenarios: for example, open the barrier automatically when a known car appear, notify certain person by email when a VIP customer arrives etc. All the rules are set up on the GANZ CORTROL server side and tags from LPR are used as a basis.

It is possible to perform tag management in the following ways:

- Use the **local database** for storing them and manage all tags via LPR Web interface
- Use a **shared database** for several LPR servers and manage all tags via any LPR server Web interface
- **Synchronize** LPR server with an external database or file (tag management via Web will be disabled)

Please see the Service Settings section of this document to learn how to connect to external databases.

To manage tagged lists in LPR, go to the *License Plates Management* directly or go to the *Tags* section of the *Service Settings*.

Ganz Control License Plate Recognition					
Tags					
PLATE	TAG	COMMENT1	COMMENT2	ADD	
GU8755	Blue	Employee	Park Staff	✕	
GS5932	Blue	Employee	Park Staff	✕	
FP9980	Blue	Employee	Park Staff	✕	
HR808	Blue	Employee	Park Staff	✕	
EV1003	Red	Trouble	Kicked out	✕	

Click the *Add* button on the top panel and a new row will appear on top of existing rows, allowing you to enter:

- **Plate:** license plate number (mandatory field)
- **Tag:** custom license plate tag to facilitate plate grouping (optional)
- **Comments:** user-defined comments, custom additional information

To remove an entry from the list, use the *X* button on the right side of the row.

Note that the *Add* and *X* buttons will be absent (tag management disabled) in case you have set up tag import from external database or file in the service settings.

A license plate cannot be simply put on the list without any extra information; rather, it **should be assigned a tag** in such a way, that license plate groups are created, allowing you to create black/white lists, distinguish personal and company cars, mark important customers and potentially unwanted persons etc.

Entries without any tag (with an empty tag), regardless of comment presence, **will be removed** automatically when saving the list.

Additionally, each entry can be supplemented with a user-defined comment, which is not used anywhere in LPR or GANZ CORTROL but is rather foreseen for internal usage by LPR administrators.

Tags are used by GANZ CORTROL as additional information coming with the recognition events: please see the next sections of this document on how to make LPR send recognition results and tags back to GANZ CORTROL.

8 Recognition Results

Recognition results from channels configured in LPR can be passed back to their source GANZ CORTROL server(s). Together with the results, license plate tags are passed as well.

On the GANZ CORTROL side, these results can be used in three ways:

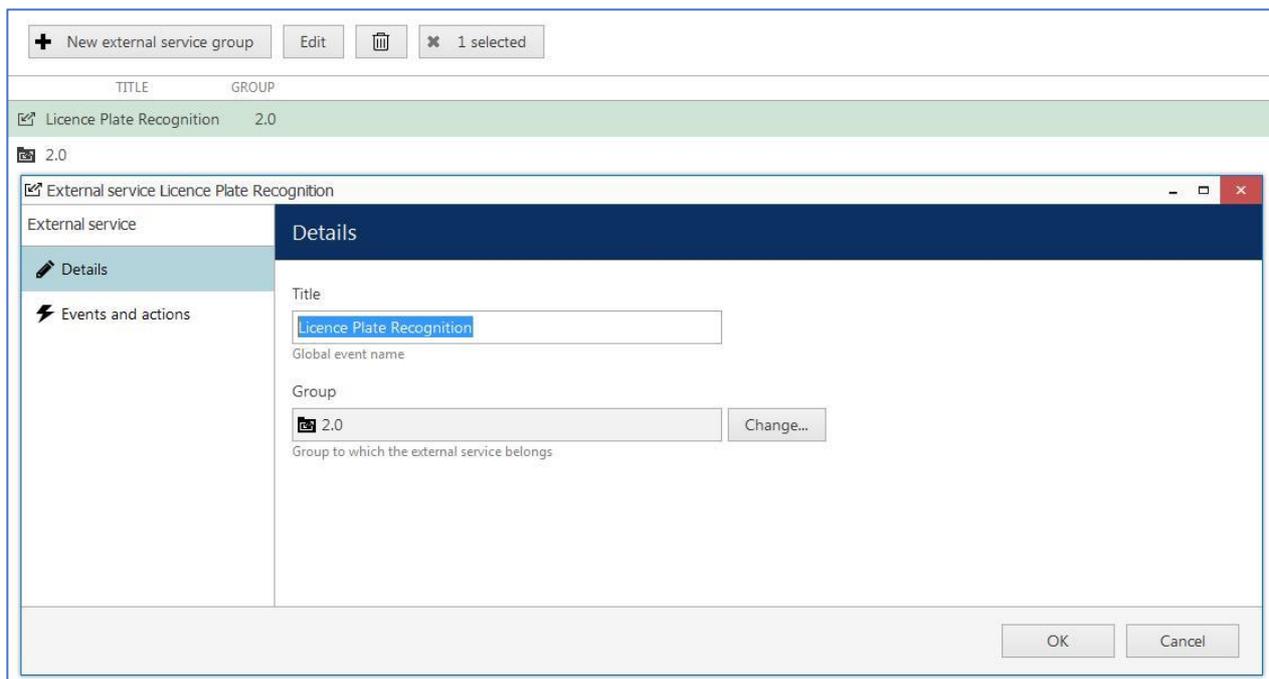
- Live results
- Archive investigation
- Event and action scenarios

To make the results available on GANZ CORTROL Server and in the GANZ CORTROL Client, LPR must be configured as an external service via GANZ CORTROL Console for the target server.

⚠ LPR service must be running and the target channels must be enabled for recognition in its configuration for you to be able to use all the functionality described in this topic.

8.1 Add External Service

Once you have added the target GANZ CORTROL Server into the LPR configuration, it will appear in the GANZ CORTROL Console automatically. All you need to do is to add it into a group to make GANZ CORTROL Client software aware of it.



In GANZ CORTROL Console, go to the *Configuration* section and choose *External Services* from the left-hand-side menu. On the upper panel, press the **+ New external service group** button; in the dialog box, enter a group name and click *OK* to save. The newly created group will appear in the item list.

Then, double-click your LPR service in the same list to open it for editing. On the *Details* tab, click the *Change* button and choose your newly created group, then save. Group membership will appear in the corresponding row next to the external service name. LPR will now appear as a separate tab in the GANZ CORTROL Client application(s) connected to this GANZ CORTROL server.

8.2 Live

Open your GANZ CORTROL Client and connect to the GANZ CORTROL server, for which LPR is doing recognition. Stay on the *Live* tab and drag and drop your target LPR channel onto one of the viewports.

If recognition is running for this specific channel, you can see the recognition results by opening the *Notification Pane* for this channel. The pane can be toggled using the viewport overlay controls, and its availability can be set up via main menu *Edit -> Application Settings*.



The list of the live results is cleared when you close the GANZ CORTROL Client application meaning that each time GANZ CORTROL Client starts with an empty notification pane and it gets filled as the recognition results arrive.

If your target channel is recorded, you can **double-click** any entry to see the moment of the recognition played back automatically in the same viewport using the instant playback. The recording status is shown by the overlay icon in the bottom-left corner of the viewport (yellow = recording ON, white = OFF).

8.3 Investigation

After you have connected LPR to GANZ CORTROL via *External Services*, a corresponding tab appears on the topmost panel of GANZ CORTROL Client. Click the tab to proceed with the investigation.

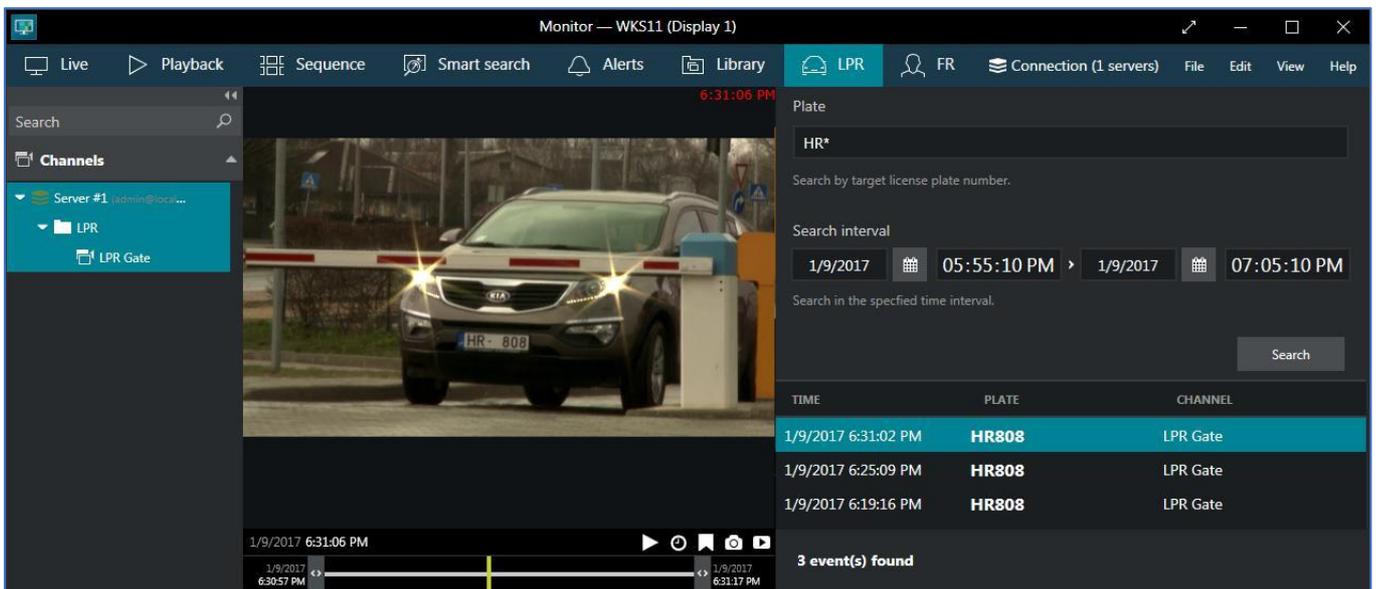


To start searching for the recognition results, you need to specify the target channel(s) first. To do this, click the + next to the channel, service group or server name in the *Resources* pane; you can add multiple channels from different external service groups. Use the - next to the channel, group or server name to deselect and exclude it from the search. Note that you will only be able to see the channels, for which recognition is enabled in LPR.



Next, enter your **keywords** in the search field. You can enter either the whole plate number or a part of it - with or without an asterisk (*) as a wildcard.

Specify the target **date and time range**: the date can be either entered manually from the keyboard or selected using the calendar control; the time can be also either entered manually or adjusted using your mouse wheel after clicking the digits and holding your mouse cursor over the time element.



After that, click the *Search* button to view the results. Please note that, depending on the selected time range and number of channels, the search may take some time; the results when be listed in the bottom-right-hand area after they have been found. Do not press the *Search* button repeatedly: this will re-initiate the search process.

Double-click any specific search result and it will be opened in the central viewing area in the **instant playback** mode, the recognition moment (plus some seconds before and after) being looped.

The instant playback here has some standard GANZ CORTROL Client controls and an option to switch to the regular playback mode.

- Use the semi-transparent *Play* viewport overlay control in the centre of the picture to play faster, slower or pause the playback: simply drag the arrow to the left/right/center position
- Timestamp in the upper-right-hand corner of the picture shows server time
- The small *Play* icon in the bottom-right-hand corner will take you to the *Playback* mode
- The *Clock* overlay control allows you to go to any particular moment in time in the same playback window
The *Flag* icon will open the *Add new bookmark* dialog box, allowing you to add a bookmark to this specific moment
- Pressing the *Camera* icon will export a snapshot
- Pressing the *Video clip* icon will automatically export the piece of video, which is currently being played
- The timeline contains the recognition related time interval but you can also adjust the boundaries by clicking and dragging the arrows on the left and right sides of the timeline (minimal interval is ten seconds)

You can switch to other tabs while investigating and you can return to the exact place where you left off by switching back to the LPR tab, if you do not close the GANZ CORTROL Client application. If you do, all your search results will be discarded.

8.4 Events & Actions

Using GANZ CORTROL event & action (E&A) management, you can specify your desired outcome for your whole video surveillance and LPR system's operation and determine how software reacts to any event caught on any LPR server and how it turns them into an automated process. Send emails, open and close gates and barriers, interact with any other software or just bring the attention of the operator to a specific recognition event that requires their immediate action.

To start with E&A, you need to create **events** based on LPR recognition results: pre-created LPR tags will be used for result grouping/differentiation. To do this, go to the *Events & Actions* section of GANZ CORTROL Console and choose *Events* in the left-hand-side menu. Click the + *New event* button on the upper panel to bring up the event creation dialog box.

The screenshot shows a dialog box titled "Event LPR Gate IN known cars*" with a "Details" tab. The form contains the following fields and options:

- Event type:** A dropdown menu set to "External service". Below it is the text "Select event type from list of possible event types".
- Title:** A text input field containing "LPR Gate IN known cars". Below it is the label "Event name".
- Source:** A button with a folder icon and the text "Sehnsucht". To its right is a "Change..." button. Below it is the label "Event source".
- Service group:** A button with a folder icon and the text "3.0". To its right is a "Change..." button. Below it is the label "Service group".
- Target event:** A dropdown menu with "Known" selected. The dropdown list shows "Known", "Office", "Unknown", and "VIP".

At the bottom right of the dialog are "OK" and "Cancel" buttons.

Choose the *External Service* event type and fill in the required extra information:

- **Title:** user-defined event title that will appear in the E&A configurator
- **Source:** a channel that has LPR running on it
- **Service group:** external service group that has your target LPR service in it
- **Target event:** recognition tag, the following ones are available:
- **all tags** defined in the License Plate Management section of the corresponding LPR server
- **Known:** any tag from the tagged license plates' list
- **Unknown:** recognition results not matching any of the tags from the list

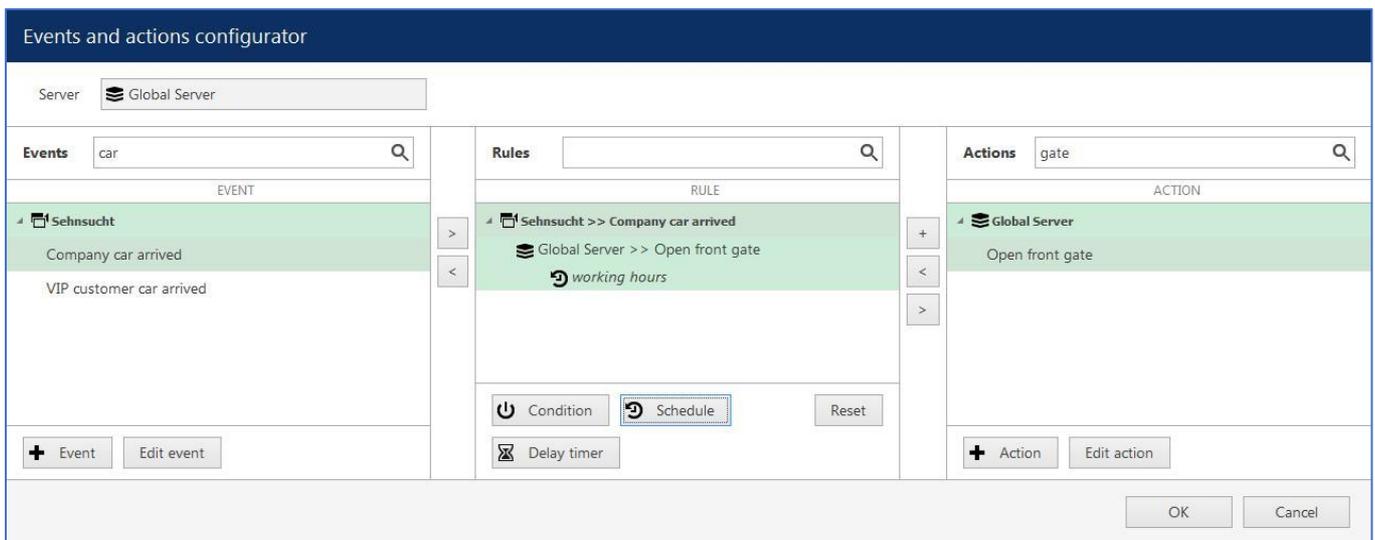
Click *OK* to save: the newly created event will appear in the event list. Double-click it at any time to open the event for editing; use the recycle bin button on the upper panel to remove an unnecessary event.

Next, create **actions** you want to be executed based on your new event. To do so, switch to the *Actions* section in the left-hand-side menu: it contains both some built-in actions as well the opportunity to define your own actions of multiple types.

Possible **examples** of actions used for LPR could be as follows:

- pop up the channel video in the GANZ CORTROL Client application to make sure the operator can see the recognition moment
- complement live video popup with a sound notification and/or with a text notification
- create a bookmark in the archived video and request a comment from the GANZ CORTROL Client user
- send an email to notify someone of a specific vehicle arrival
- trigger the digital output of some device for automatic barrier/gate/door opening
- send an SNMP trap to a third-party SNMP manager, etc.

When you have both events and actions ready to be used, switch to the *Rules* section to combine them into an event & action map. In the **server** selection box on the upper panel, pick the server that contains your target channel (the one with LPR running on it) and then open the *E&A Configurator*.



To combine events, actions and additional controls into rules, simply follow this scheme:

- Find your desired **event** in the *Events* list - use search filter on the top panel, if required use the < and > arrows or double-click events to add/remove them to/from the *Rules* list
- Click free space of the target rule in the *Rules* list (use CTRL or Shift to select multiple ones) - the selected rows will then become highlighted green
- Find your desired **action** in the *Actions* list - use search filter on top, if required
- Use the < and > arrows or double-click actions to add/remove them to/from the *Rules* list, and the + button to add more than one action for a single event
- Select desired actions and add auxiliary controls by clicking buttons on the bottom panel (see description below for details)

Once the rule map has been created, click the **OK** button in the bottom right corner to **save and exit**. Note that simply closing the *Event & Action Configurator* is analogous to clicking *Cancel*: no changes will be saved.

From the *Rules* section, you can temporarily disable any rules and test the enabled rules to make sure they work exactly how expected.

The events can be combined to build more complicated rules using **timers, schedules and conditions**. Please see your GANZ CORTROL administration manual for a **full guide** on GANZ CORTROL actions.