LUXRIOT LPR 2.1 Administration Guide

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1   Introduction

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

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

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 Luxriot EVO 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
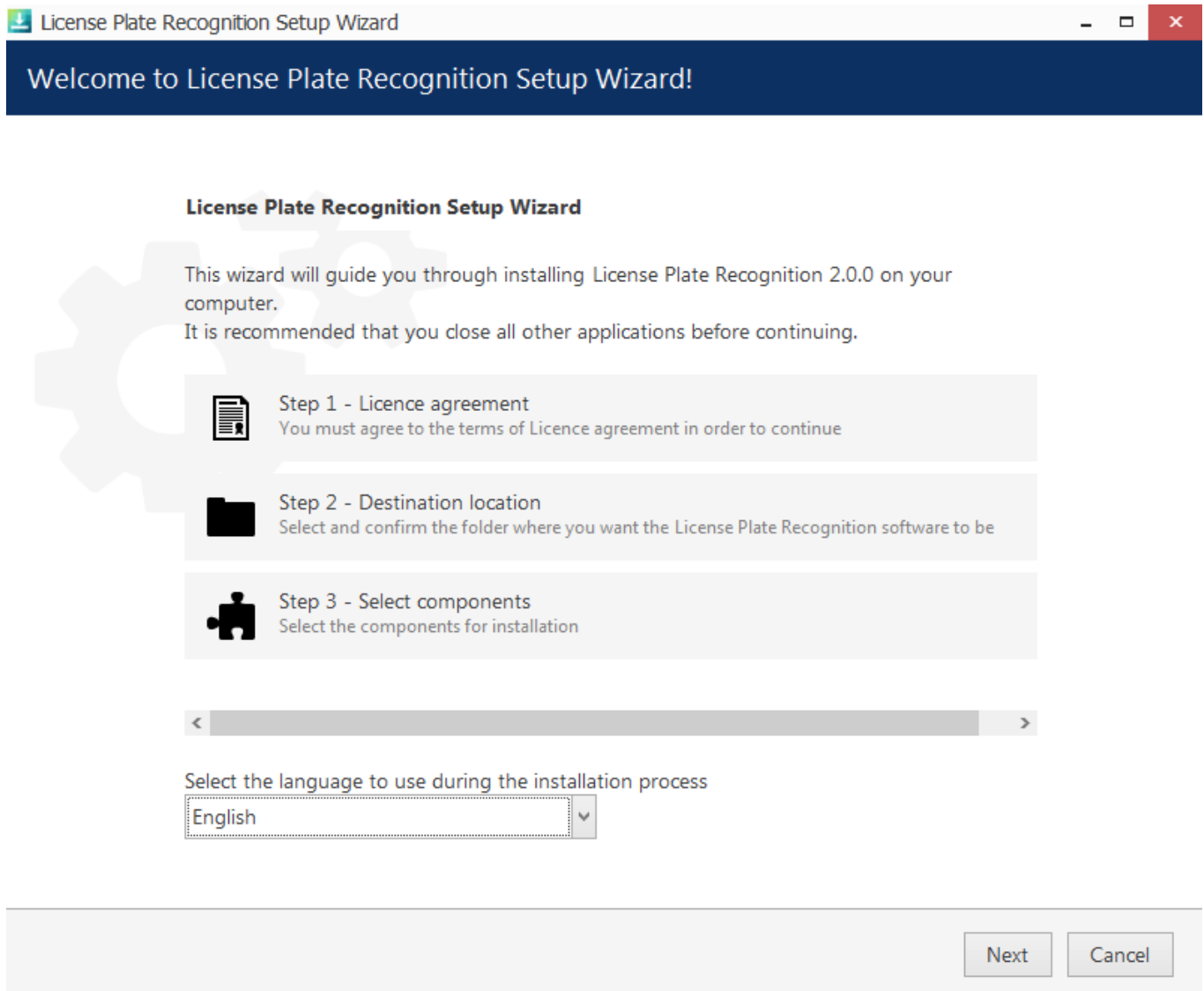- Preferred Web browsers are Google Chrome and Mozilla Firefox

2   Installation

Start the installation by launching your Luxriot LPR installation package. The installation wizard will guide you through the steps: after competing them, LPR will be installed as a Windows service on your computer.
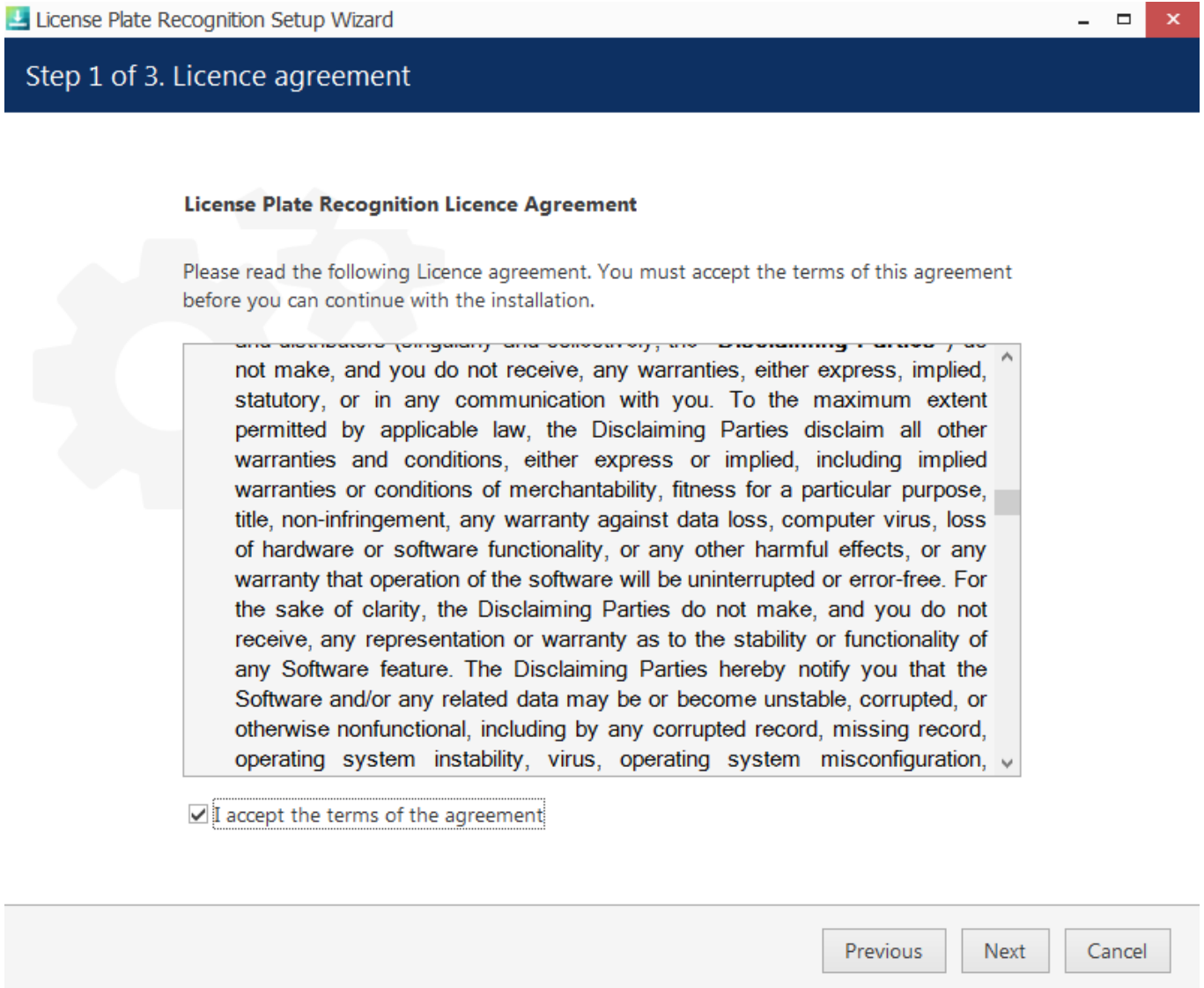
> 💡 Before starting the installation, make sure that:
> - no other de-/installation routines are running
> - the chosen server computer fulfils all the recommendations and requirements listed in the Introduction section of this document
> - Windows updates are not pending and are not being installed
> - no other service occupies default LPR port of 8082
> - target Luxriot EVO server(s) have HTTP connection enabled (HTTP port is not set to 0)

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

Read the Luxriot LPR license agreement and mark the checkbox below if you agree to it to be able to proceed, otherwise press *Cancel* to roll back the installation.

License Plate Recognition Setup Wizard

Step 2 of 3. Destination location

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

Where do you want License Plate Recognition to be installed?

Setup will install License Plate Recognition in the following folder. Click browse to select a different folder.
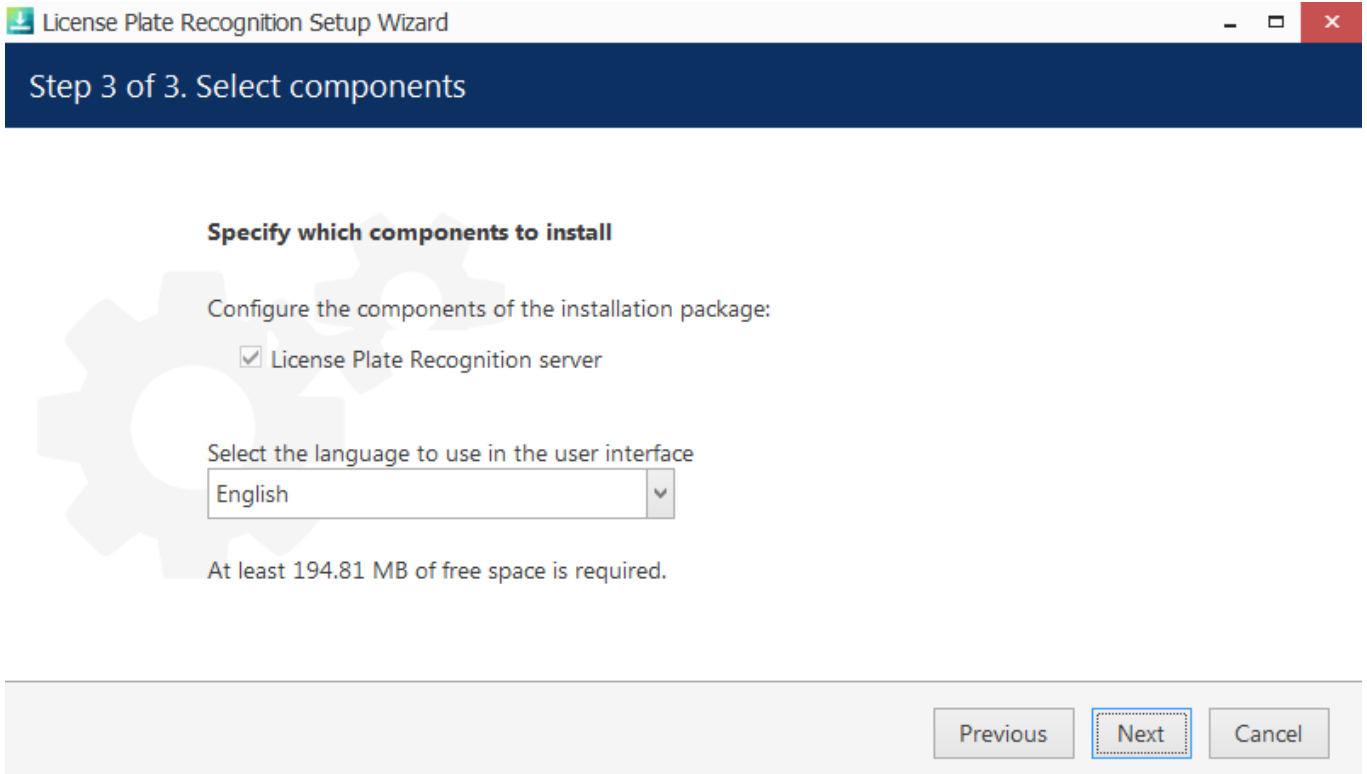
C:\Program Files\License Plate Recognition

Browse...

Installation requires at least 194.81 MB of disk space.

Previous   Next   Cancel

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

License Plate Recognition Setup Wizard

Step 3 of 3. Select components

Specify which components to install

Configure the components of the installation package:

☑ License Plate Recognition server

Select the language to use in the user interface

English

At least 194.81 MB of free space is required.

Previous   Next   Cancel

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

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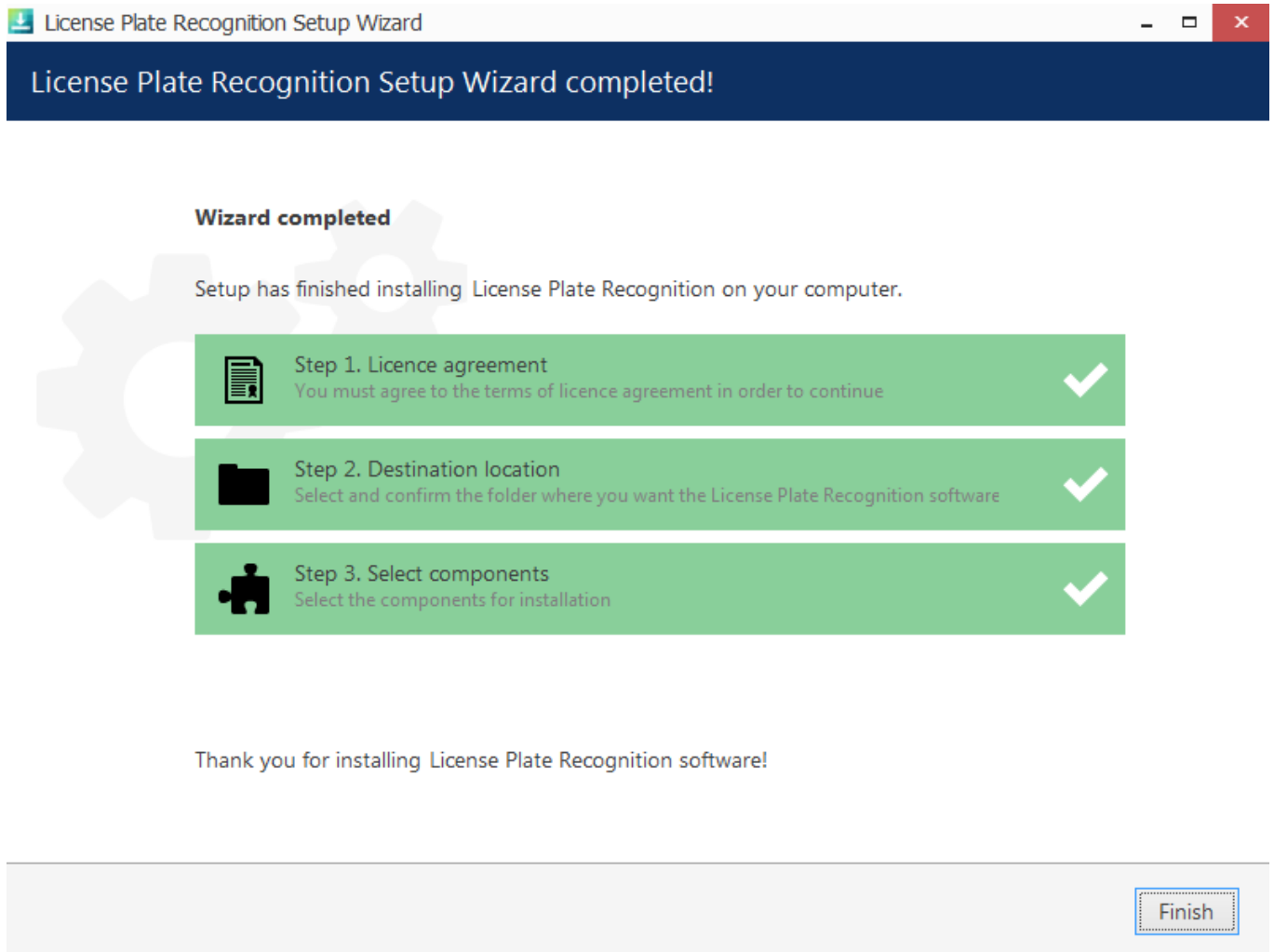
After LPR has been installed, you will see the installation summary. Press *Finish* to exit the wizard.

In case your CPU is detected to be not suitable (not powerful enough) for LPR, you will get a corresponding message and the installation will not continue. Please check with the system requirements for the LPR computer to help you choose CPU for Luxriot EVO LPR.
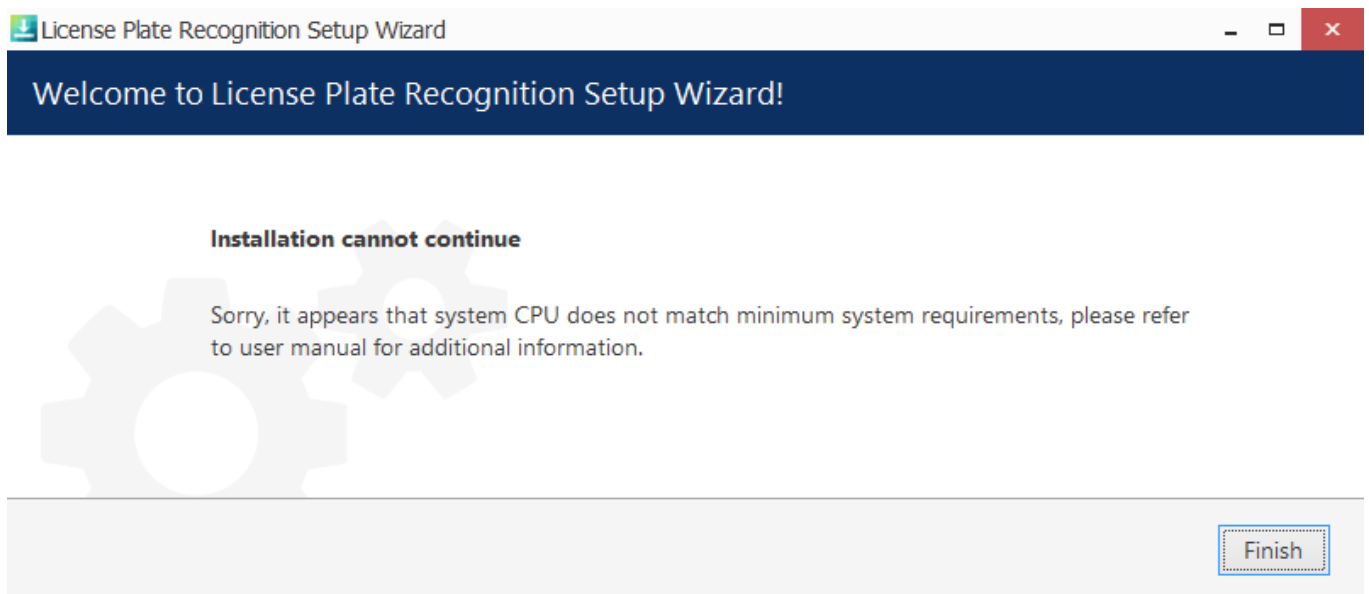
Luxriot LPR is installed as a Windows service and a webpage-like user interface is provided for its configuration and management. After installation has been successfully completed, you will find the *License Plate Recognition Service*

Configuration shortcut on your Desktop: double-click it to open the LPR Web user interface.

3   Activation and License Management

Luxriot 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 computer's IP address (you can also use *localhost* or *127.0.0.1* for local machines)
- *Port*: 8082 is the default HTTP port for LPR service access (you can change this after you log into the configuration interface)
- *User name*: admin
- *Password*: admin

After you log in, you will be offered to activate your LPR copy. You have the following options here:

- enter a production license key and activate it automatically **online** (requires active Internet connection)
- activate a production license key **offline** by contacting Luxriot representative and providing them with your **license key and the system ID** from the offline activation form (use this method if there is no permanent Internet connection to the server)
- request a 30-day trial license key (requires Internet connection, offline trial activation is NOT possible)

> ⚠ Make sure to activate the license on the finite server computer assembly. Changing, removing, replacing hardware components after the activation may cause **activation issues**.
>
> If your server has no Internet connection, we recommend that you do not use USB 4G/WiFi sticks but use **offline** activation instead.

Offline activation

Step 1. Send system ID to support to receive activation code

System ID

72755A68626B7A7D7379246F156A080200180FFE

Step 2. Activate using license key and activation code received from support

Activation code

Submit

After applying your key in either manner, you will get a summary displaying your license, its type and expiration day (for trial licenses only). You can access this page anytime later by clicking the *Manage license* link in the bottom left corner of the LPR Web interface. Here, you can also see the LPR version information and last page refresh time.

Manage license
2.0.0.271

6/27/2017 12:21:08 PM

To enter a **different license** (e.g., to replace the trial license with a production key), click the *Change* button in the top right corner of the license management page and enter the details in the same way as you did before.

4   Service Management

Service homepage offers quick access links to system settings and license plate list management. License plate list is also accessible from within *Service Settings*; once you are done with server/camera setup, you do not have to browse the settings again but rather use the quick access link to open the plate list. Click anytime on the *License Plate Recognition* header over the *Service Settings* menu to go to the service homepage.

Click the *Service Settings* link to enter the LPR **configuration section**, which will allow you to:

- add Luxriot EVO server(s)
- add channels for analysis from existing Luxriot EVO servers
- manage license plate lists with tags
- change LPR Web User Interface (UI) and LPR service settings

Service Settings

Switch to the *Settings* section to access 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 recognised plates
    - **Frame archive path**: *C:\License Plate Recognition*
- Maximum amount of storage that can be taken by frame archive
    - **Quota**: *90%*
- Use Luxriot EVO watchdog to monitor LPR as well if Luxriot EVO server is installed on the same computer

(feature is unavailable without Luxriot EVO server installed)
- **Enable Watchdog**: *false* (disabled)
- Internal log detalization level, from *Trace* (most detailed) to *Error* (major errors only)
  - **Log level**: W*arn* (mid-low verbosity)

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

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 disk is allowed to be full. If your disk is already 91% full even without LPR archive, and you set quota to 90%, no frames will be saved.

Storage quota mechanism does not know about any other quotas applied to the same disk: e.g., if Luxriot EVO 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 as well. 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.

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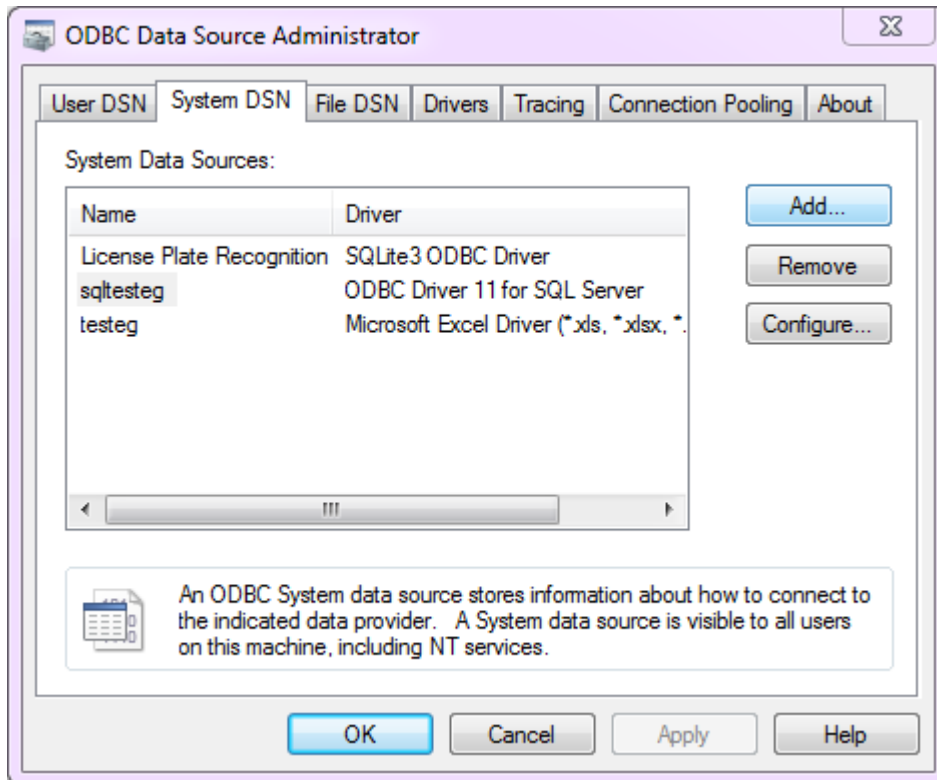
Switch to the *System DSN* tab and click the *Add* button on the right; find the *ODBC Driver for SQL Server* entry, select it and click *Finish*. An additional dialog box will appear, offering you to enter the data source properties:

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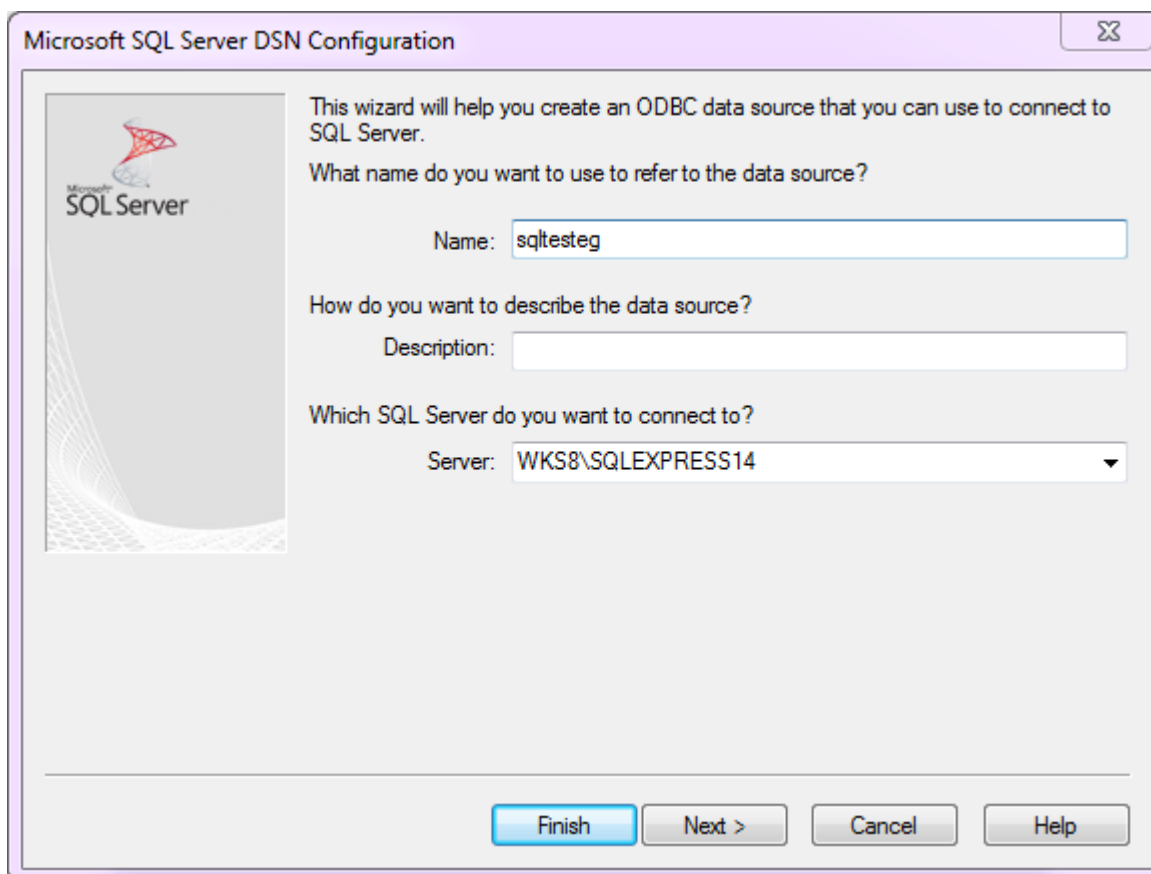
On the next steps, you can leave all the **default** settings. Finish the wizard: the newly created DSN will appear in the *System Data Sources* list.

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

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 is able to 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.

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**.

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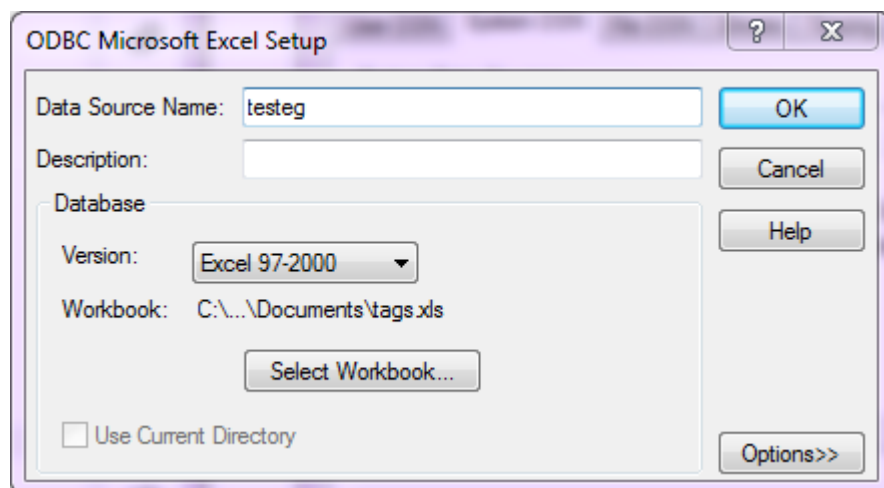
In the **driver settings**, you just need to specify the DSN name itself (to be used in LPR), file version (for Excel) and the file (Excel) or directory containing the file (CSV).

TAGS IMPORT SETTINGS

Tags import query

```
SELECT * FROM [Sheet1$]
```

Connection string for Tags import database

```
DSN=testeg;Header=False
```
Database connection string

Tags import database user

Tags import database password

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 other 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 is modified, the changes will be reflected in LPR Web UI in about one minute.

Server Configuration

To start actually using the recognition engine, it is necessary to connect to a Luxriot EVO server that contains LPR channels pre-configured, and then add desired channels to LPR. If you have not set up your Luxriot EVO 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.

> ⚠️ Luxriot LPR 2.0 is designed to work only with Luxriot EVO servers of Luxriot EVO S and Luxriot EVO Global editions. For LPR versions compatible with other Luxriot products, please contact support@luxriot.com.

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

Add new server

Host

192.168.1.83

Server address or hostname

Port

8085

Server port

User

lindemann

Server user

Password

••••••••••••

Server password

Submit

The following fields are to be filled here:

- **Server**: Luxriot EVO server computer IP address or hostname. If you are connecting to Luxriot EVO Global system, make sure to use the address of the central server.
- **Port**: HTTP port of the target Luxriot EVO server (8080 by default). When connecting to a remote Luxriot EVO server, make sure this port is allowed on all intermediate routers and firewalls.
- **User** and **password**: Luxriot EVO 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 full description on the Luxriot EVO 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 settings, click *Submit*. Connection with the target server will be established automatically: if the Luxriot EVO 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.

Channel Setup

Server setup only establishes connection between LPR and Luxriot EVO server(s) on the service level. In order to start recognising 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 similar to editing the server settings.

Add new channel

Server

| localhost   ⌄ |
Server

Channel

| Sehnsucht   ⌄ |
Channel to use as video source for recognition

Preset

| Fast   ⌄ |
Recognition configuration presets

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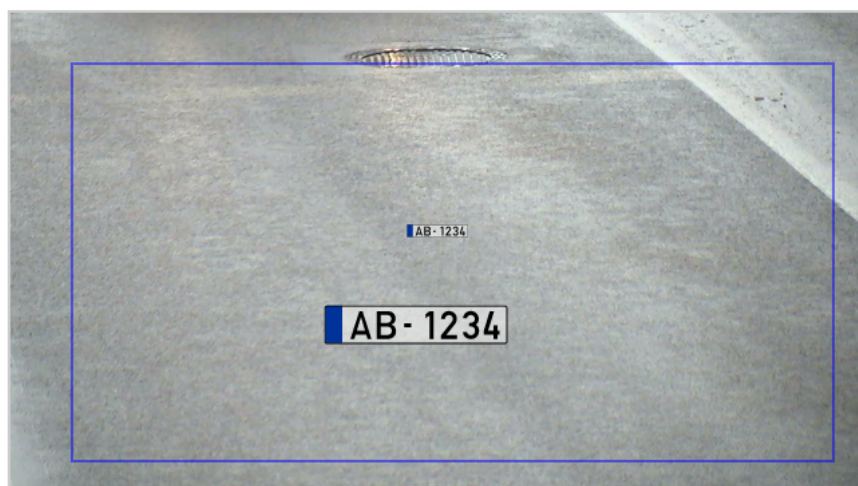
Select a server from the list of your connected servers and then select one of the channels. Note that channel must be enabled in Luxriot EVO server configuration and the server itself must be connected in LPR. If the Luxriot EVO server is offline, you will be unable to select it in the *Add new channel*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

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

GENERAL	VIDEO ENGINE	FRAME ENGINE
Minimum character size	☐ Enable video engine	☑ Enable frame engine
< 16 >	Video engine threads 2	Frame engine threads 4
Maximum character size	Plate presence time (ms) 200	Plate processing timeout (ms) 170
< 56 >		Required amount of additional frames with same plate detected 0
Rotate		
< 0 >		
Motion filter		
On		

Submit

Choose your desired recognition parameters and click *Submit* to add the channel into LPR configuration. If the target Luxriot EVO server is online and reachable, the channel analysis will be started immediately. You can add one or more channels from every connected Luxriot EVO 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 Luxriot EVO server settings: then, recognition results passed to Luxriot EVO 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 utilisation
> - smaller license plate character size range decreases utilisation
> - 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.
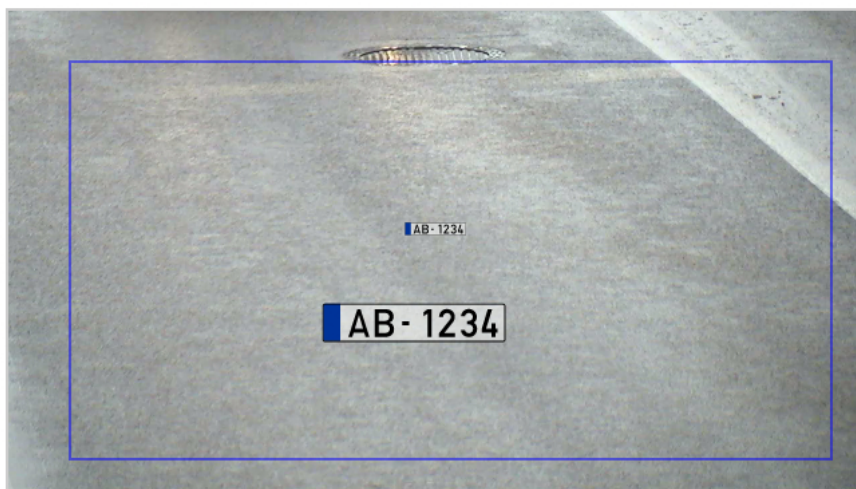
Parameter Presets

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.

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 in order to trigger motion)
- **Frame delay**: minimum frame feed interval, time before processing the next frame
- **Aggregation time**: the amount of time to collect similar 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

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)

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** is efficient when a full and/or clear license plate is likely to be present only in a small number of video frames, as in the following cases:
  - vehicle speed is medium to high
  - intensive traffic
  - low or intermittent light conditions
- **video engine** works best when there are many similar frames with the same license plate, for instance, when:
  - 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 amount 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 in order to achieve best recognition rate with Luxriot LPR.

It should be possible for the human eye to recognise 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.

Number plate should be seen in a frame with a minimum resolution of 2x2 pixels per one square centimetre. European number plate regular size is 52 per 11cm; so, a number plate should be of a size of a frame not less than 104 per 22 pixels. This means that 200 per 200 pixels resolution is recommended per square metre of the viewing area. For instance, for a video stream with 1920x1080 resolution, camera view for LPR should be up to 10 metres wide and 5 metres 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

Automatic settings for the camera lens must be disabled (i.e., auto iris, auto focus, back-light compensation, auto shaking compensation and others). The shutter timing should be set to acceptable minimum to prevent blurring. Shutter speed value is determined by object speed and the angle at which the object is viewed (say, a car going at the speed of 60 km/h covers about 15 cm over 0.01 second). An optimal setting for most situations is 1/600 but individual cases may require a speed of 1/1000 and faster. 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. Camera lens type and zoom setting: a varifocal zoom lens with a maximum focal length of 80 mm or more is recommended.

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 more or less 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 expected vehicle movement direction to minimize the relative side speed of the license plate towards the camera. This allows to shrink 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.

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 in situ. 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.

How to pick the right lens settings manually: set camera for constant recording and 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 Luxriot EVO archive. If the license plates are blurred, open the iris a bit more and check new recordings. Repeat the procedure until the picture is sharp and its quality is good enough for the human eye to recognize the symbols on the license plate. Fix the iris in the last best position.

Camera resolution: usage of analog/IP cameras with at least D1 resolution (768x494 (NTSC) or 752x582 (PAL)) is possible. Recommended resolution is from 720p to 1080p (1280x720 to 1920x1080).

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 cars appear, notify certain person by email when a VIP customer arrives etc. All the rules are set up on the Luxriot EVO 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
- **synchronise** 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.

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

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, 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 Luxriot EVO but is rather foreseen for internal usage by LPR administrators.

Tags are used by Luxriot EVO 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 Luxriot EVO.

8   Recognition Results

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

On the Luxriot EVO side, these results can be used in three ways:

- live results,
- archive investigation,
- event and action scenarios.

In order to make the results available on the Luxriot EVO server and in the Luxriot EVO Monitor, LPR must be configured as an external service via Luxriot EVO 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.

Add External Service

Once you have added the target Luxriot EVO server into LPR configuration, it will appear in Luxriot EVO Console automatically. All you need to do is to add it into a group to make Luxriot EVO Monitor software aware of it.

In Luxriot EVO 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 Luxriot EVO Monitor application(s) connected to this Luxriot EVO server.

Live

Open your Luxriot EVO Monitor and connect to the Luxriot EVO 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*.
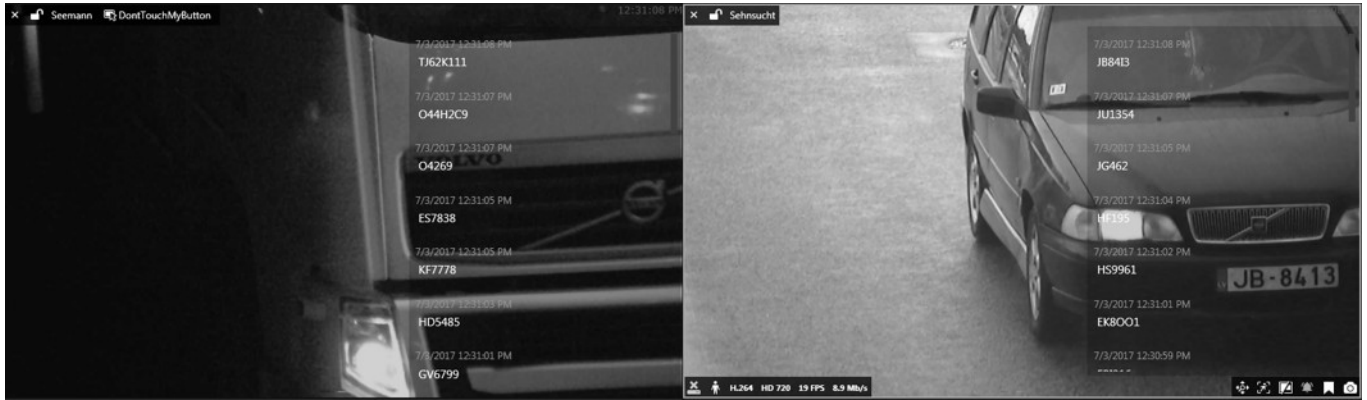
The list of the live results is cleared when you close the Luxriot EVO Monitor application meaning that each time Luxriot EVO Monitor starts with an empty notification pane and it gets filled as the recognition results arrive.

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 showed by the overlay icon in the bottom-left corner of the viewport (yellow = recording ON, white = OFF).

Investigation

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


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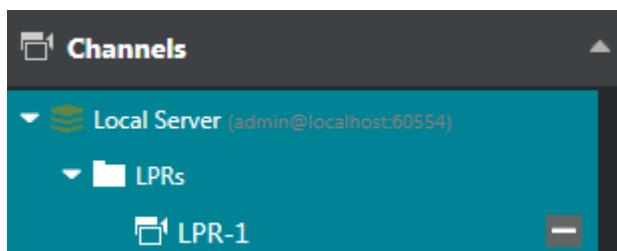
Next, enter your **keywords** in the search field. You can enter either the whole plate number or a part of it - with or without an asterisk (*) as a wildcard.

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.
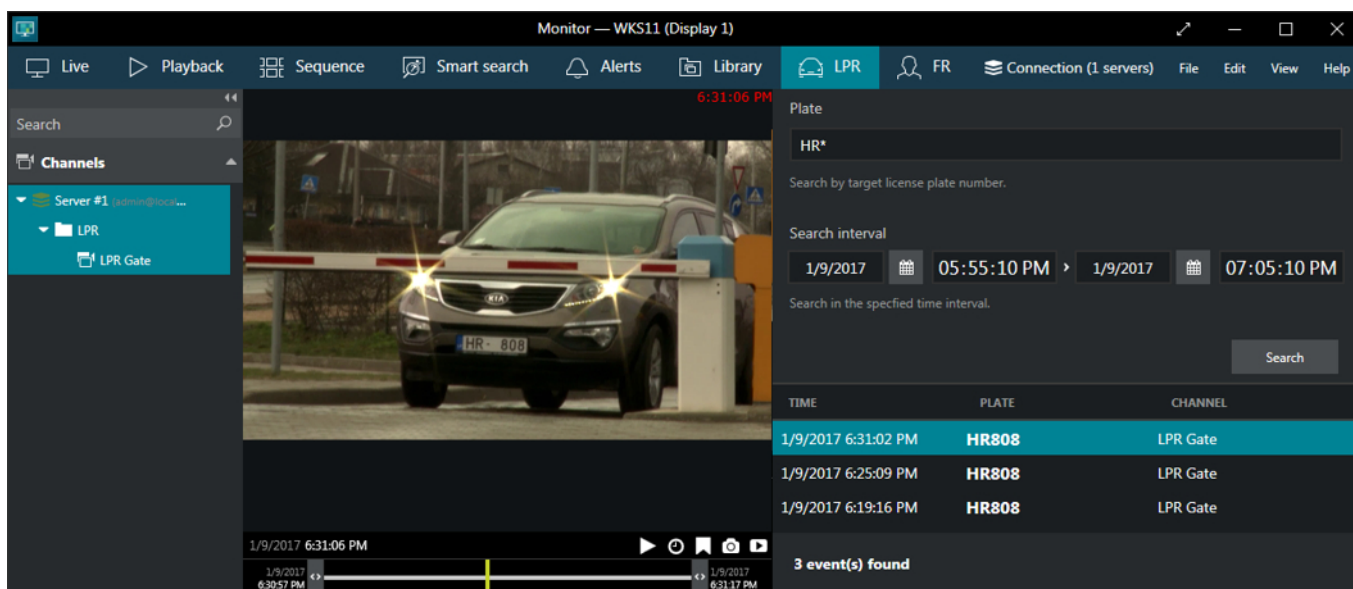
After that, click the *Search* button to view the results. Please note that, depending on the selected time range and number of channels, the search may take some time; the results when be listed in the bottom-right-hand area after they have been found. Do not press the *Search* button repeatedly: this 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 Luxriot EVO Monitor controls and also 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/centre 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, provided that you do not close the Luxriot EVO Monitor application. If you do, all your search results will be discarded.

Events & Actions

Using Luxriot EVO 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 Luxriot EVO 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.

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 Luxriot EVO Monitor 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 Luxriot EVO Monitor 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 also 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 Luxriot EVO administration manual for a **full guide** on Luxriot EVO actions.