Hanwha LPR Solution

Low Speed License Plate Reading cameras with Open Platform LPR application

USER MANUAL v1.0

Hanwha LPR Solution

Hanwha Techwin Camera Requirements

LPR Solution (License Plate Recognition) is an edge based application bundled with WISENET X Camera Series, (XNO-6120R, XNV-6120R) allowing them to become license plate readable cameras. Through the combination of these leading technologies, organizations can gain new levels of insight through the automation of video monitoring processes to strengthen security, enhance loss and fraud reduction, optimize operations and boost awareness. The camera with the LPR application is intended mainly for low speed (below 35 MPH) traffic conditions such as parking lots, stop and go and free flow traffic.

The LPR application comes licensed and configured with the camera, ready to use out of the box with a few settings to suit your installation environment. Its user-friendly installation speeds up setup and installation so as to capture the license plate. It is completely integrated into the Wisenet WAVE VMS. Other integration options are available as generic JSON push, FTP or SMTP.

The default conditions considered are for US number plates with 6” (H) x 12” (W) in size, either front or rear plates. If the plate sizes are different, zoom must be adjusted accordingly. As a normal rule, the plate must be zoomed in to ¼ of the entire view of the image. If characters are narrow, the aiming angle of the camera must be strictly smaller than the maximum skew angle defined below in the Technical Specifications section. Hanwha Techwin cameras, allow for saving typical presets of parameters for different environmental conditions.

1. Camera Pre installation

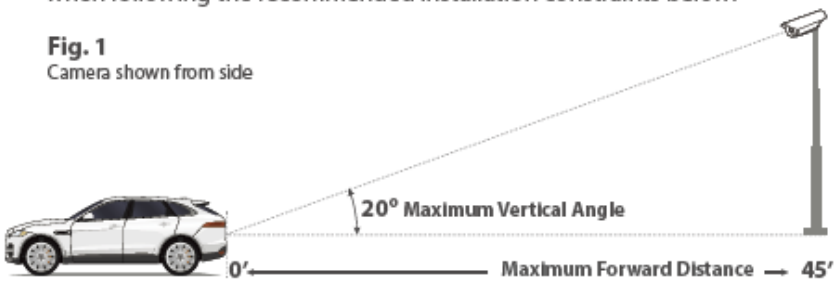
1.1 Choosing a Location

It is very important to choose a location where you can mount the camera in an angle and distance where you capture the plate with good visibility during day and night conditions. Make sure that the camera angle is as perpendicular as possible to the plate for a good read.

Considering the target camera, XNO-6120R & XNV-6120R models, the following guidelines must be kept while selecting the install location.

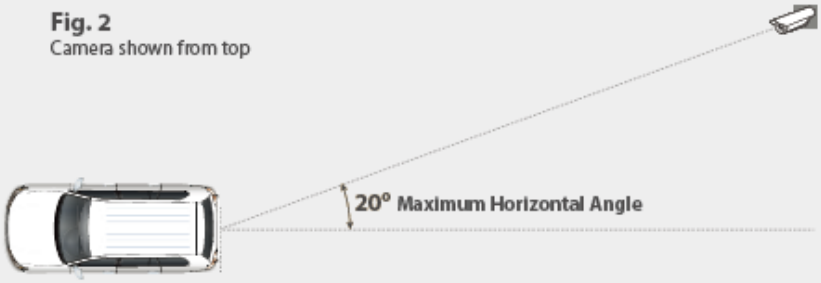
The license plate recognition (LPR) technology running on this camera will provide you with the best results when following the recommended installation constraints below.

Fig. 1
Camera shown from side



Recommended
20 degrees Maximum Vertical Angle
45 feet Maximum Forward Distance

Fig. 2
Camera shown from top



Recommended
20 degrees Maximum Horizontal Angle

1.2 Measure

For this step you will need three meausrements in feet. (A) Lane Offset (from center of plate to the line parallel to the curb intersecting the bottom of the camera) (B) Forward Distance (min and max expected) (C) Camera Height (min and max expected)

Chart Your Measurements Here

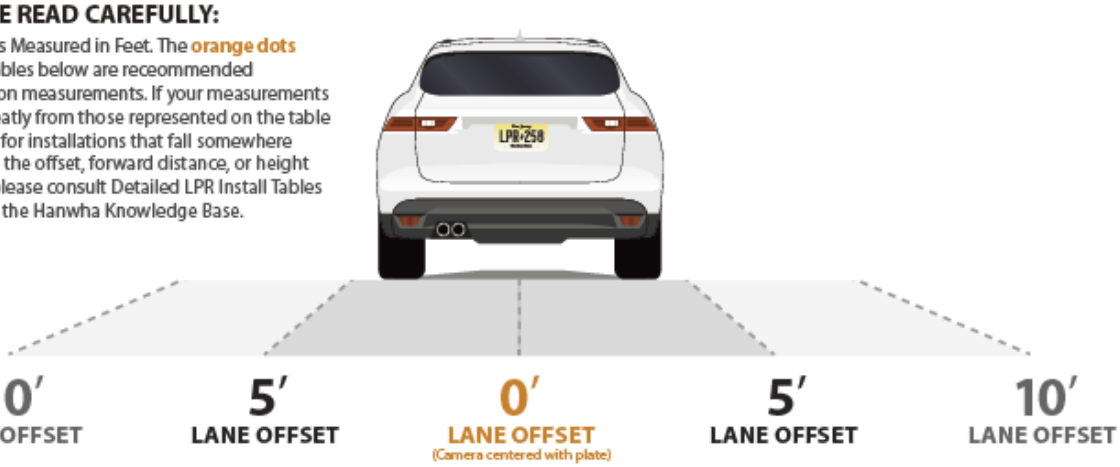
A Lane Offset	
B Forward Distance	
C Camera Height	

1.3 Checking Camera Position

The diagram and tables below illustrate recommended locations based on known offsets. Verify that the camera height and forward distance indicated by orange dots fall within the measurements you took in previous step, *1.2 Measure*.

PLEASE READ CAREFULLY:

Distances Measured in Feet. The **orange dots** on the tables below are recommended installation measurements. If your measurements differ greatly from those represented on the table - such as for installations that fall somewhere between the offset, forward distance, or height shown, please consult Detailed LPR Install Tables article in the Hanwha Knowledge Base.



0′ LANE OFFSET

Camera Height	Forward Distance 5'	10'	15'	20'	25'	30'	35'	40'
4'		•	•	•	•	•	•	•
6'			•	•	•	•	•	•
8'				•	•	•	•	•
10'					•	•	•	•
12'						•	•	•
14'							•	•

5′ LANE OFFSET

Camera Height	Forward Distance 5'	10'	15'	20'	25'	30'	35'	40'
4'			•	•	•	•	•	•
6'			•	•	•	•	•	•
8'				•	•	•	•	•
10'					•	•	•	•
12'						•	•	•
14'							•	•

10′ LANE OFFSET

Camera Height	Forward Distance 5'	10'	15'	20'	25'	30'	35'	40'
4'						•	•	•
6'						•	•	•
8'						•	•	•
10'						•	•	•
12'						•	•	•
14'							•	•

2. Installing and positioning the camera

2.1 Camera Installation

NOTE: ***Refer to XNO-6120R or XNV-6120R installation guide and follow the installation instructions.***

2.2 Adjust for Plate “Rotation” Angle

For best results, check the angle of your plate compared to the horizontal angle and rotate the camera to less than 3° as shown below (Recommended Angle(s).

3. Configuring your camera

Note:

(i) The camera has a unique default username and password to access the camera settings:

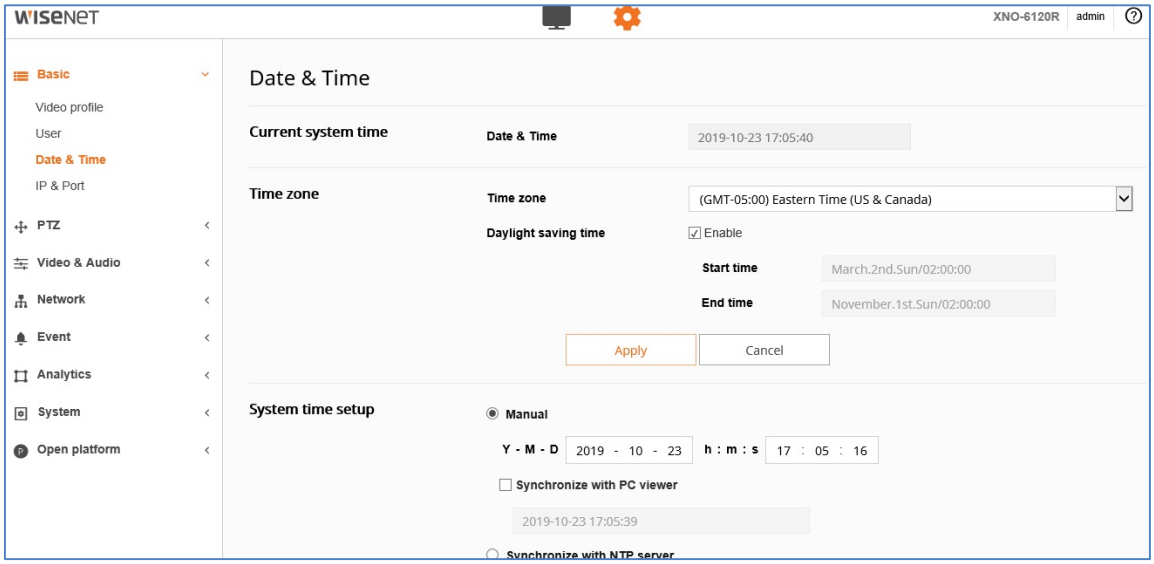
User Name: **admin**

Password: Enter the MAC Address of the unit, using capital hexadecimal characters, no space, hyphens or colons. Example: **00166CC22735**

Please change the default password upon first login when you access the camera settings, before proceeding.

(ii) Make sure to set correct **date and time** for the camera before going in to any additional settings. Syncing with an NTP server is recommended.

(iii) Make sure that the camera has the right firmware (Ver. 1.40 or above). This is pre-installed on the camera.



3.1 Field of View

The below steps you will need to perform in the Wisenet camera configuration webpage

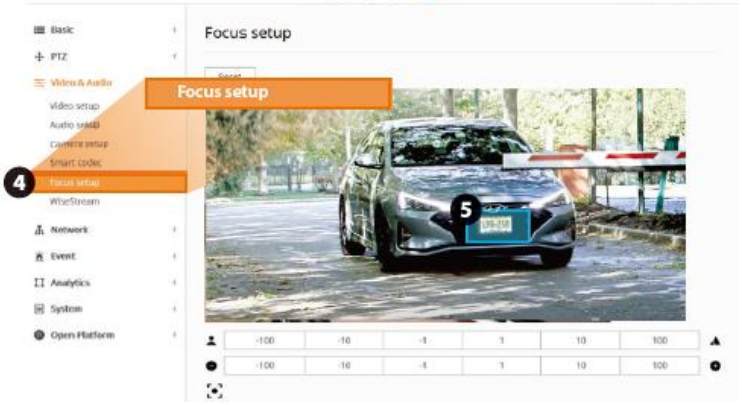
1. Configure camera so the images are correct. You may want to adjust the “Flip” or “Mirror” Settings from the Video Setup Menu.
2. Set camera zoom to capture license plate at about 20% of the entire width of the image
3. Adjust camera view angle so the plate passes through the middle of the image.

3.2 Simple Focus on Plate Read Area

A unique feature of this camera allows you to select the plate area and hit a button to perform a "Simple Focus" on this plate area.

4. From the Video & Audio menu, select **Focus Setup**.
5. Click and drag to draw an area of focus where the license plate is displayed.
6. Click the **Simple Focus** button to initiate a focus operation on the user-specified area.

NOTE: *The area indicated is not stored. If you need to perform a new Simple Focus, please draw a new area on-screen.*



3.3 Configure initial camera settings

Choose the settings that best describes your LPR needs. The default settings are for a stop and go. You can change these settings as needed.

	FREE FLOW (Plate read while moving up to 35MPH)	STOP N' GO (Plate read while stopped)
SSDR : Levels can increase the brightness		
SSDR	Enables * - Tune this setting in step 4	Enable
Level	6	1
D Range	Wide	Narrow
WHITE BALANCE		
Mode	ATW	ATW
BACKLIGHT		
Mode	OFF	OFF
EXPOSURE		
Brightness	50	50
Min. Shutter	1/500	1/120
Max. Shutter	1/12000	1/12000
Prefer Shutter	1/500	1/120
Anti Flicker	OFF	OFF
SSNR	OFF	OFF
Iris	DC (Auto)	DC (Auto)
AGC	Low * - In step 4	Middle
DAY/NIGHT : Set the day/night mode always in b/w		
Mode	B/W	B/W
SPECIAL		
DIS	OFF : Digital Image Stabilization is not applicable for LPR settings	OFF : Digital Image Stabilization is not applicable for LPR settings
Sharpness	OFF	OFF
Gamma	0.45	0.45
Contrast	50	50
Color Level	50	50
Defog	OFF	OFF
OSD : You can display camera title, time etc using this feature		
FOCUS		
Mode	Manual	Manual
Digital Zoom	OFF	OFF
Zoom Mode	Manual	Manual
Zoom Speed	Fast	Fast
Lens Reset	Manual	Manual
IR : Built in ir light helps to illuminate reflective plates specially when the environment has low light condition		
Mode	Manual	Manual
Level	100 * - In step 4	100

NOTE: *The settings indicated with a * may be adjusted for real-world performance during step 4.*

3.4 Observing proper Installation

Image captured by the camera must be sharp and the license plate should pass near the center of the image. See examples below for a few image guidelines.

Fig. 1

Zoom and Focus
The total width of the License Plate should be between 1/5 and 1/4 if possible of the entire image. For best reading image should be centered.

Fig. 2

Plate Visibility
Path of plate motion should cross the image as close to the center as possible.

3.5 Examples of improper installations

Too Far | Too Dark | Not Focused

Washed Out and Over Exposed | Car Too Fast, Not Zoomed in, Cut off | Not Zoomed In

3.6 Verify Plate Rotation is Correct

After plate area focus is complete, verify that you successfully rotated the camera less than 3° angle as shown below.

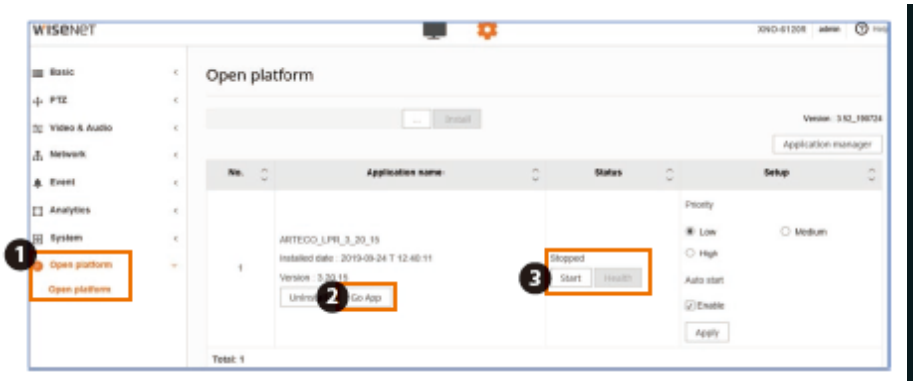
Recommended Angle(s)

4. Configuring LPR Application

4.1 Optimizing the LPR application settings

The LPR application is an Open Platform app pre-installed and licensed, bundled with the camera. Once you connect to the camera's web browser interface, navigate to **Open Platform -> Go to App -> Start.**

Make sure the app has **started**, and ensure that Auto Start is **enabled**.

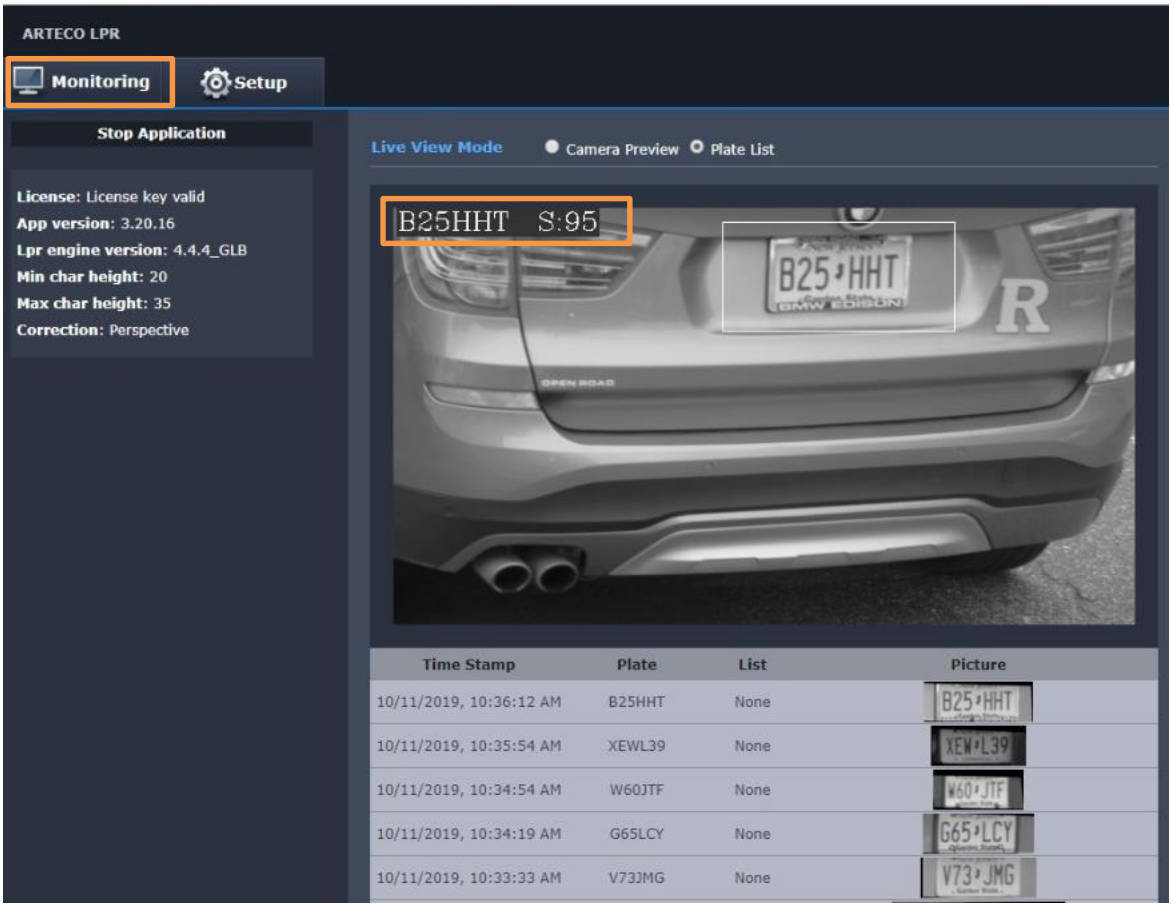


Once you are in the app, another browser tab will open up. This page is made up of two main menus: "**Monitoring**" and "**Setup**".

Monitoring section is only to observe the OCR reads. When a plate is read, the app draws a rectangle surrounding the plate and displays the plate in the image corner as shown below. The number after the plate string is the accuracy score of that reading stated by the software.

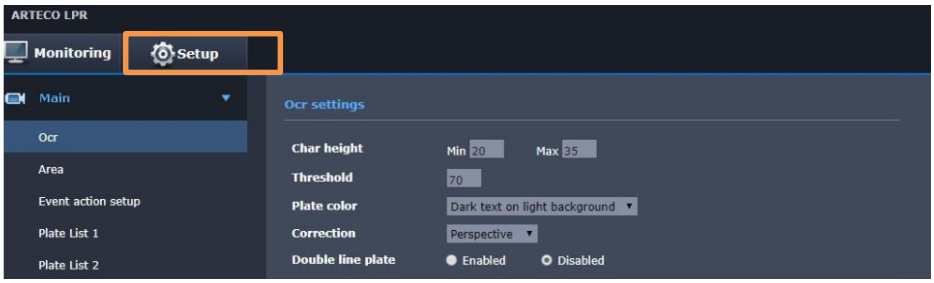
You can switch on/off the plate reader by clicking on the "Stop Application" main switch.

Hanwha LPR Solution



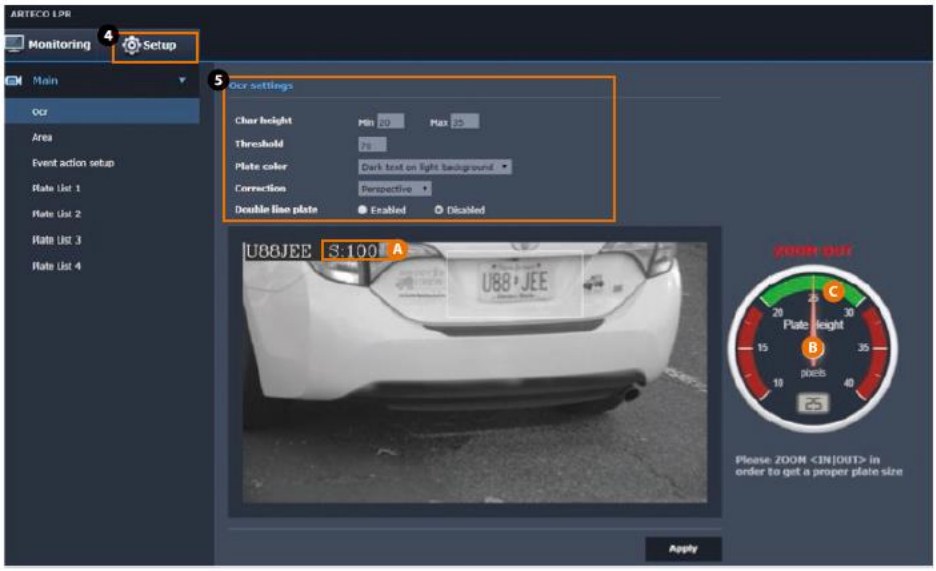
On this page, it is possible to see also the latest plates read by the Application, by enabling the "**Plate List**" mode.

Navigate to the **Setup** screen as shown below



Configure OCR Settings as follows

Character height Min.	20
Character height Max.	30
Threshold	70
Plate color	Dark Text on light background
Double line Plate	Disabled



Make note of the dial position as the pointer moves through the dial. Ideally you should target the vehicle to be at the center of the image, well zoomed in as in the above picture.

- **A Notice the threshold on the image is 100%**
- **B Dial pointer is at the center of the dial**
- **C Pixels captured is 25**

This is a 100% accurate read. You should target anything from 90 – 100 threshold for a reliable read. If you are not able to achieve this read, go back to Camera settings on Section 2 & 3. The most important settings is to adjust the Camera Zoom and Focus settings by observing the dial pointer

4.2 Adjusting the zoom level

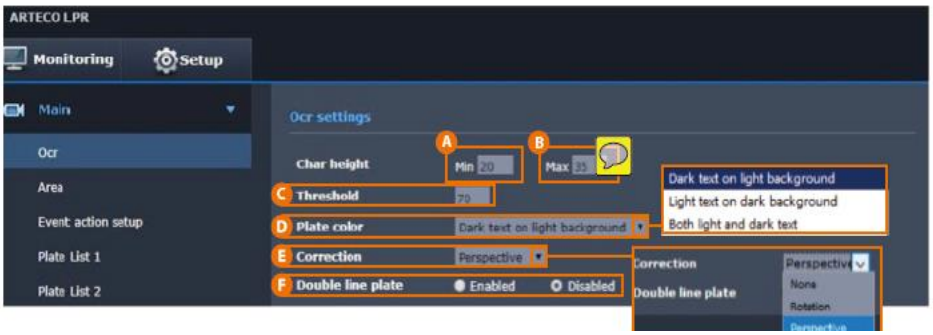
Using the Dial pointer on the Plate Height gauge, Zoom in / out and observe the needle to get it in the green range. The dial is only for observing the reads as the cars pass through. Zoom settings are under Camera setup. Refer to section #3 for accessing the setup menu.

Example of Good Read

Example of Bad Read

4.3 Fine tuning settings

Try changing the following settings for a clear view of the plate reads



4.4 Check for Character Height & Threshold

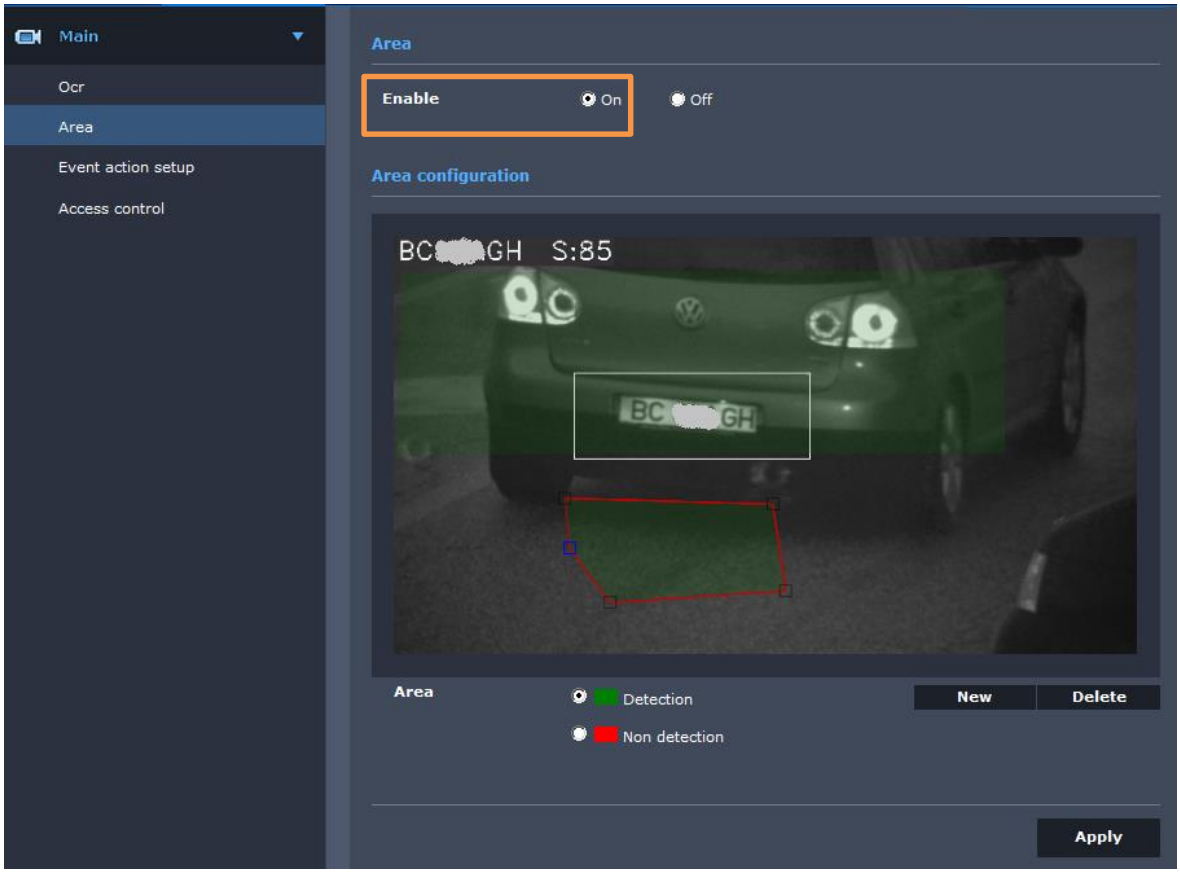
- Check the A **"Char height Min"** (Minimum Character Height) to the number of pixels [pixels] expected by software, while B **"Char height Max"** (Maximum character height) is the maximum character height [pixel] expected by software. Minimum acceptable character is 20 pixels.
- C **Threshold** will allow to cutout readings with weak confidence in order to avoid fake readings. Note this may make some plates that are read partially to be missed.
- A bright, clear and well sized plate image generate a score = 100. A misreading will fall below 50. A good inital setting for the threshold is = 70.
- You may adjust these values to optimize the readings in your installation

4.5 Adjust for Plate Text Contrast & Plate Correction Settings

- D **Plate Color**: Here you will be allowed to set the plate color and background with the options above. Our recommendation is to set it as "Dark text on white background" to easily identify the number plates.
- E **Correction**: Opening the "Correction" drop down menu, you will be allowed to select on of two distortion corrections: Perspective or Rotation. Choose for the dominant image distortion, if any. Otherwise select "none" to preserve camera CPU resources.
- F **Double line plate**: If enabled will allow OCR to read plates split over 2 lines, which may not be applicable to US number plates. After changing the parameters click on "apply" to confirm the changes.
- After changing the parameters click on "Apply" to confirm the changes

4.6 Area menu

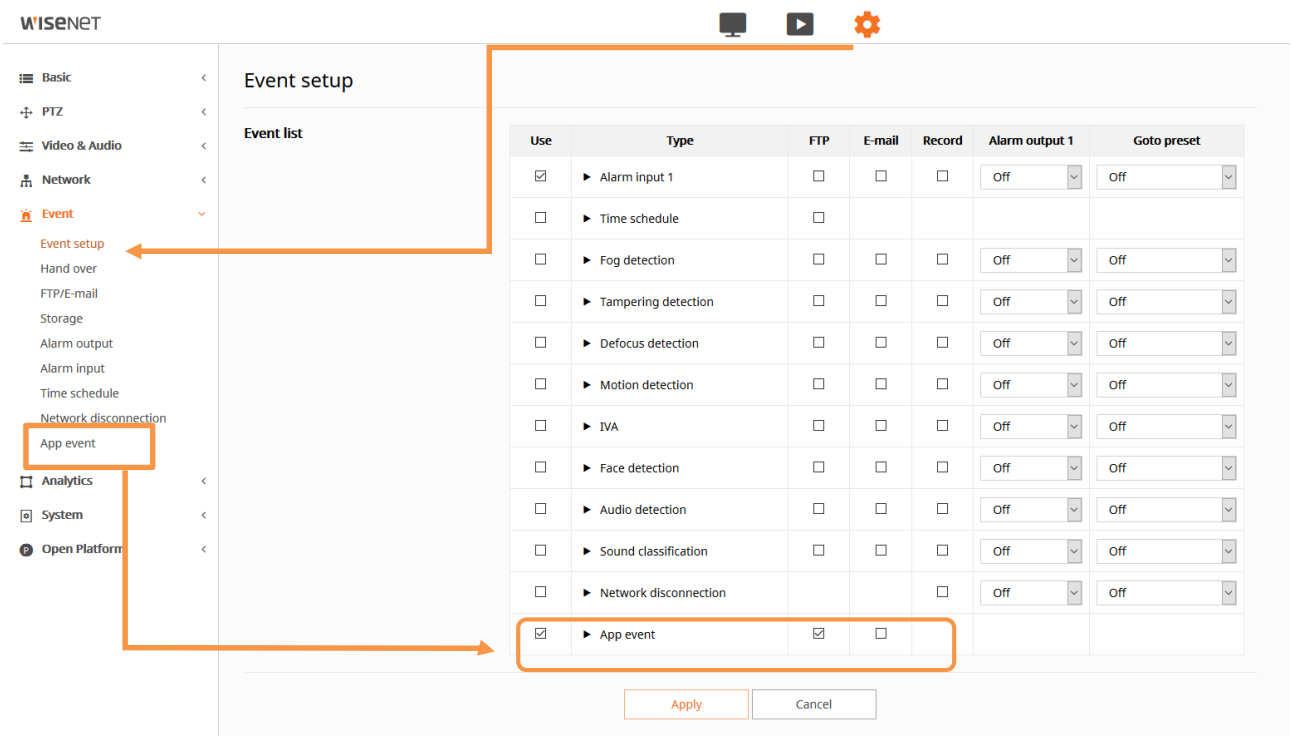
The App provides this menu in order to define active zones for plate readings. You will be able to set more than one (green) area where the software reads plates or define (red) masking areas where LPR will not read plates.
This function is often useful when the camera aims to a two-way lane and you would not get readings from one of two directions (incoming or outgoing vehicles).
In order to enable this feature select main switch to “On”. Define if you want to draw a “detection” or “non-detection” zone and click on “New”.
Click and drag your mouse on the camera image in order to define the area contour and right click with mouse when done.
If you want to remove an area, click on area in order to select it and then hit the button “Delete”.



After changing parameters click on “Apply” and confirm the changes.

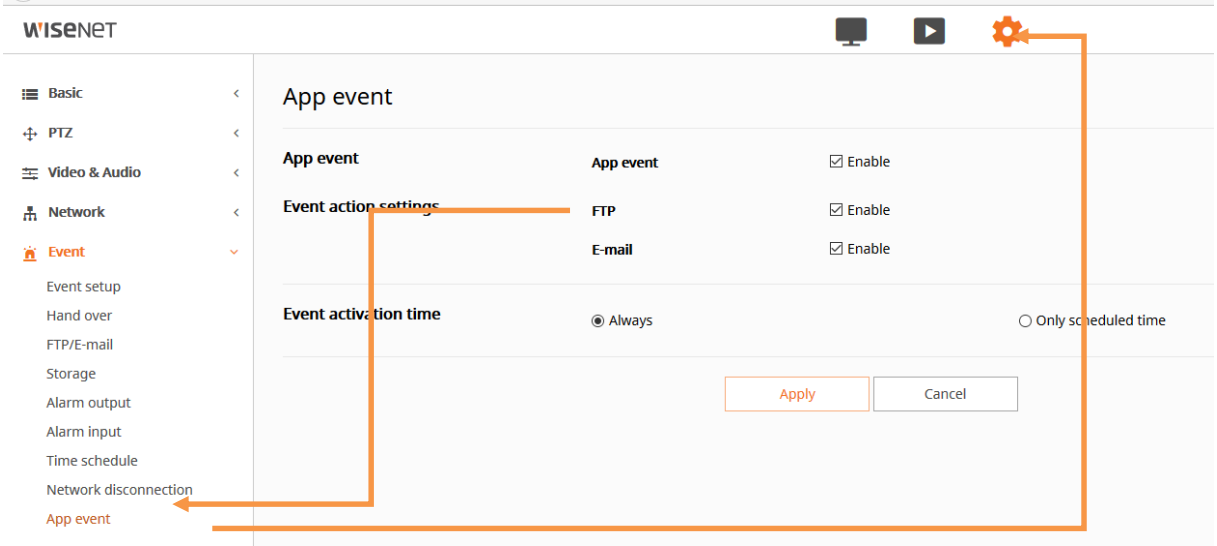
4.7 Event management settings

To enable the main switches for all the LPR events, please go to “**Event Setup**” menu and enable the checks as described below, then click “Apply” and confirm:



Email and FTP Events

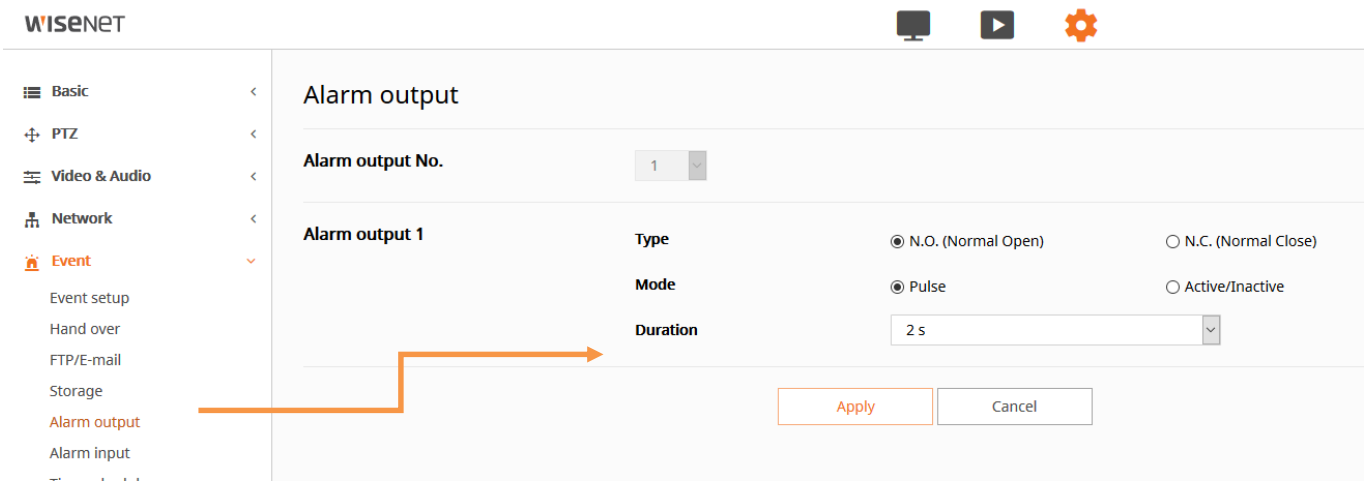
To allow the Camera to manage specifically the email and FTP App event you have to set the following checks (FTP/email) from menu **Setup** → **Event** → FTP/Email as shown below:



Do not enable any FTP sending, unless there is an FTP server enabled to receive images.
After all settings are done, click on “Apply” and confirm.

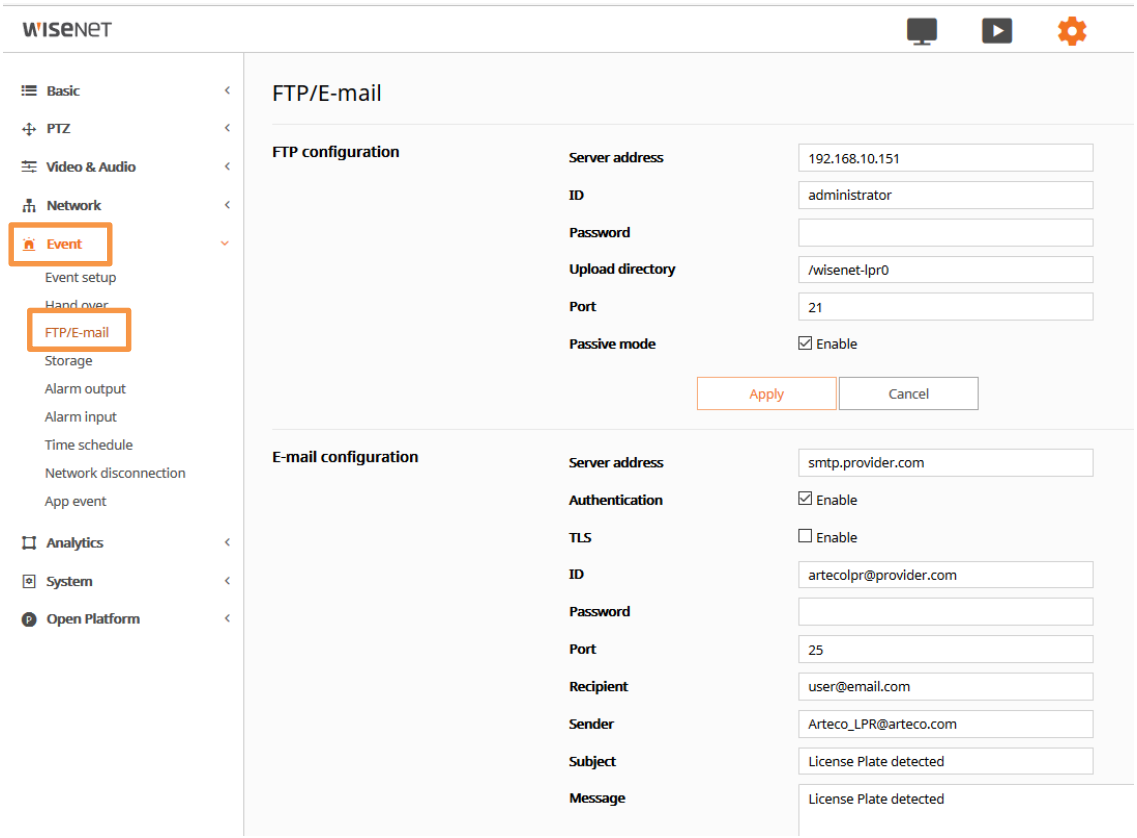
Digital output app events

In order to allow the Camera to manage the digital output you have to set the following checks from menu **Setup → Event → Alarm Output.** Typical settings for access control application are shown below:



When all settings are done, click on “Apply” and confirm.

In order to allow the Camera to send email notifications you have to set the following parameters from menu **Setup → Event →** FTP / Email as shown below:



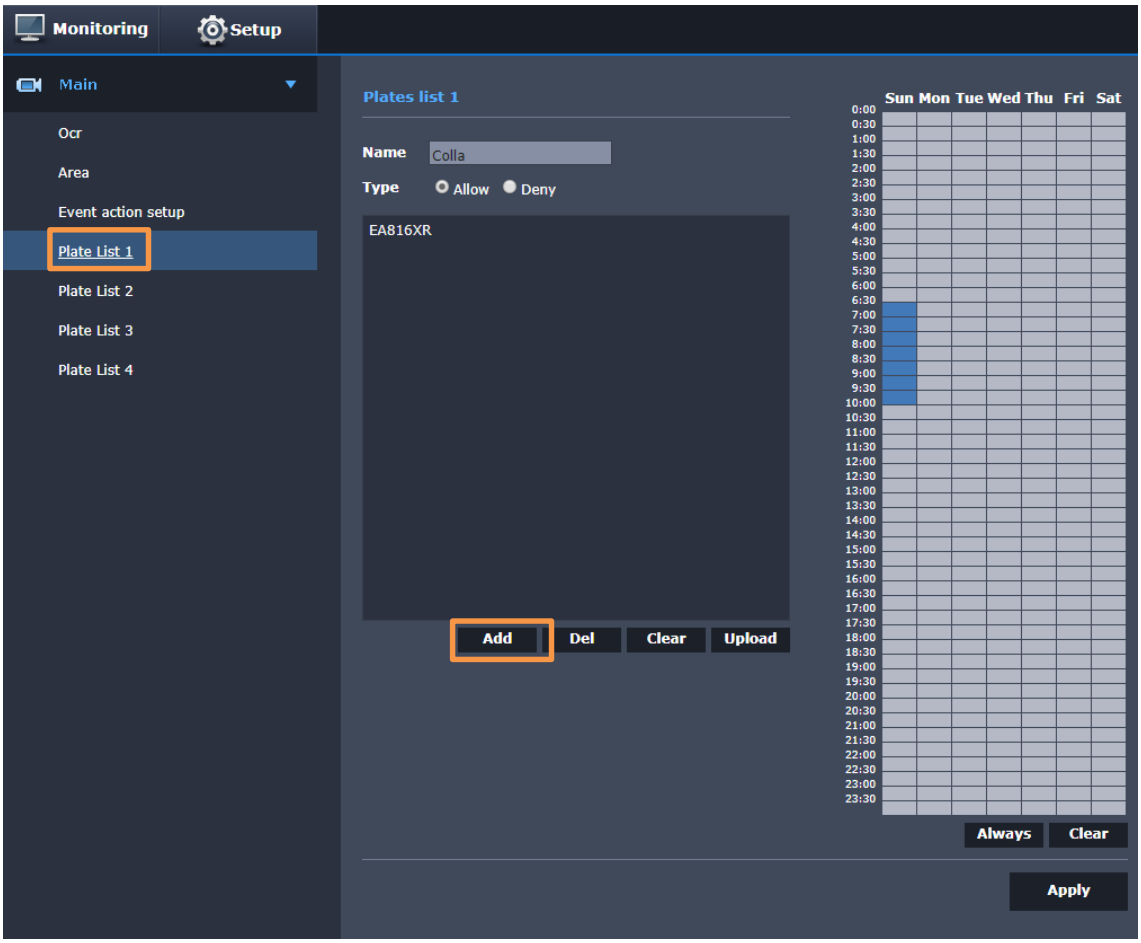
When all settings are finalized, click on “Apply” and confirm.

Video profiles

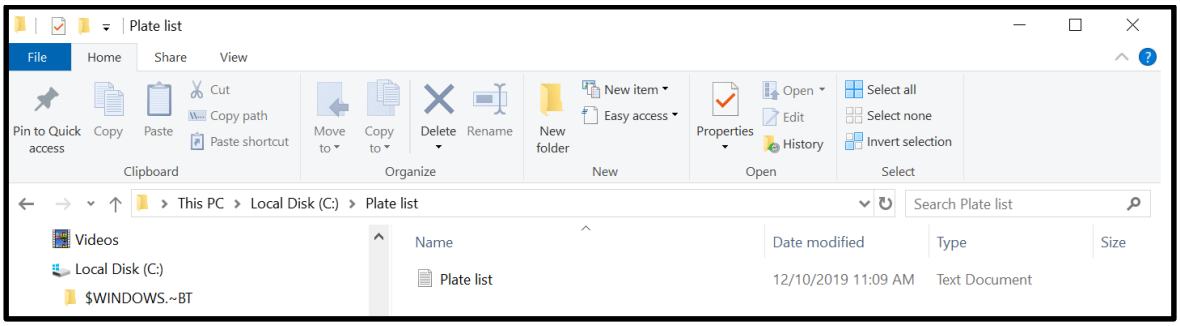
In the video profiles menu you will find a custom profile labelled as “OPENSDKMJPEG” and created automatically by the LPR App. This profile is used by LPR App for plate reading and for displaying the plates in the preview web page.

Embedded Access Control (White list/Black list)

A total of 4 lists of plates can be managed within the App. Each list can contain about 16,000 plates (depending on the standard).
Each list can be activated on a weekly schedule to automatically allow or deny access to up to 4 different groups on a time basis.
It is possible to directly enter the license plates in the relative menu, or to import a text file (eg .txt, .csv, etc.) containing the data separated by commas: "AB123CD, FF54223," .. and so on.



Match plates file: the App allows to upload a plate list for access control matching; the maximum file size is 16KB (more than 1000 plates).
To upload a List, go to menu camera menu **Setup → Access Control** and click on “**Upload List**”.
This will open the typical file browser window to upload the file to the camera.



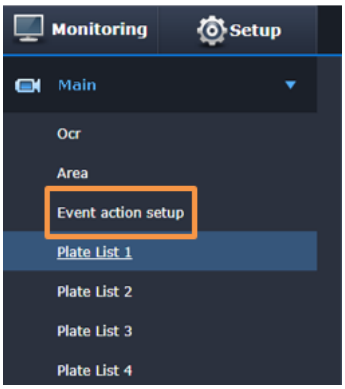
Click on "**Open**" to load the file to camera and then enable the Access Control by selecting "On" as pointed out in the previous image.
In addition, a list editing mode is also provided via HTTP/CGI commands, as explained at the end of the manual.

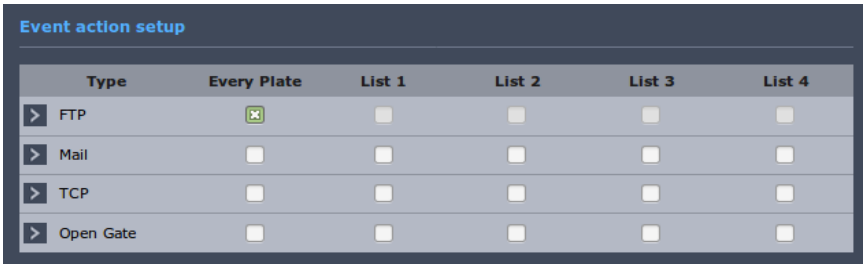
Access control configuration

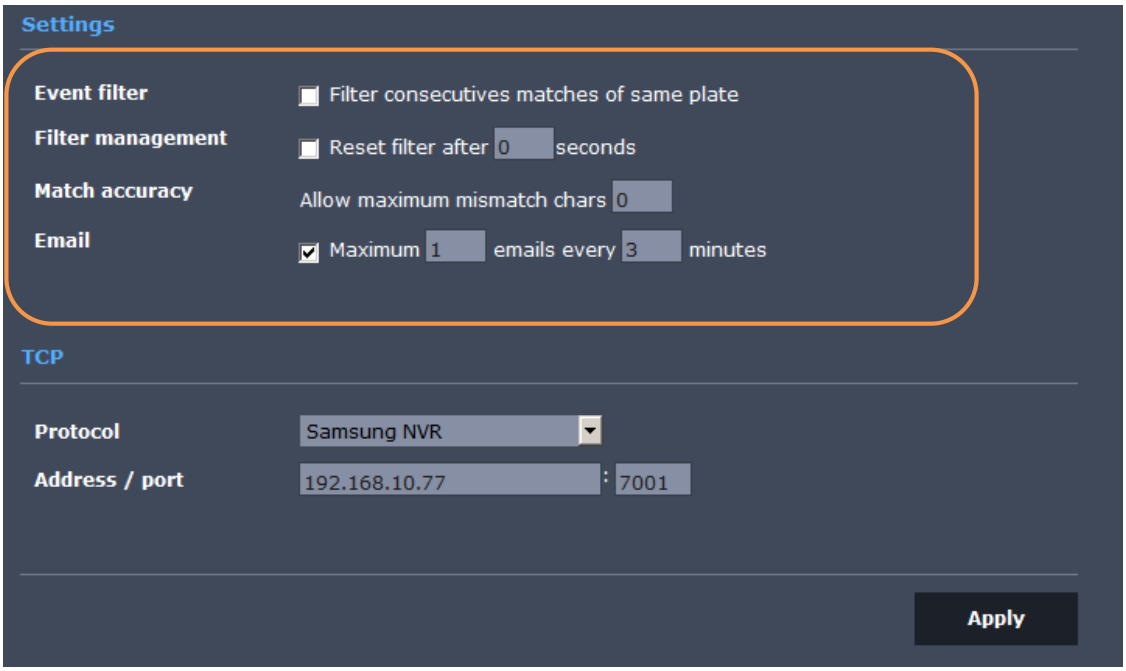
In this section, we are going to define what the camera should do, depending on the lists.

The user can define FTP image sending (to other VMS for instance), email sending, TCP data sending (WAVE VMS protocol) and digital output trigger "Open Gate".

The combination Actions – Triggers can be defined by setting the table shown in the image below that belongs to **APP menu Setup → Event action setup**:







In the sub-menu "**Settings"** the user can define some features for access control:

Event Filter: If checked it triggers the defined actions once, after the first match and until the plate read will match the same plate in the list. This function is aimed to avoid multiple triggers to the gate, while a vehicle is stopped and its plate is read continuously by the camera.

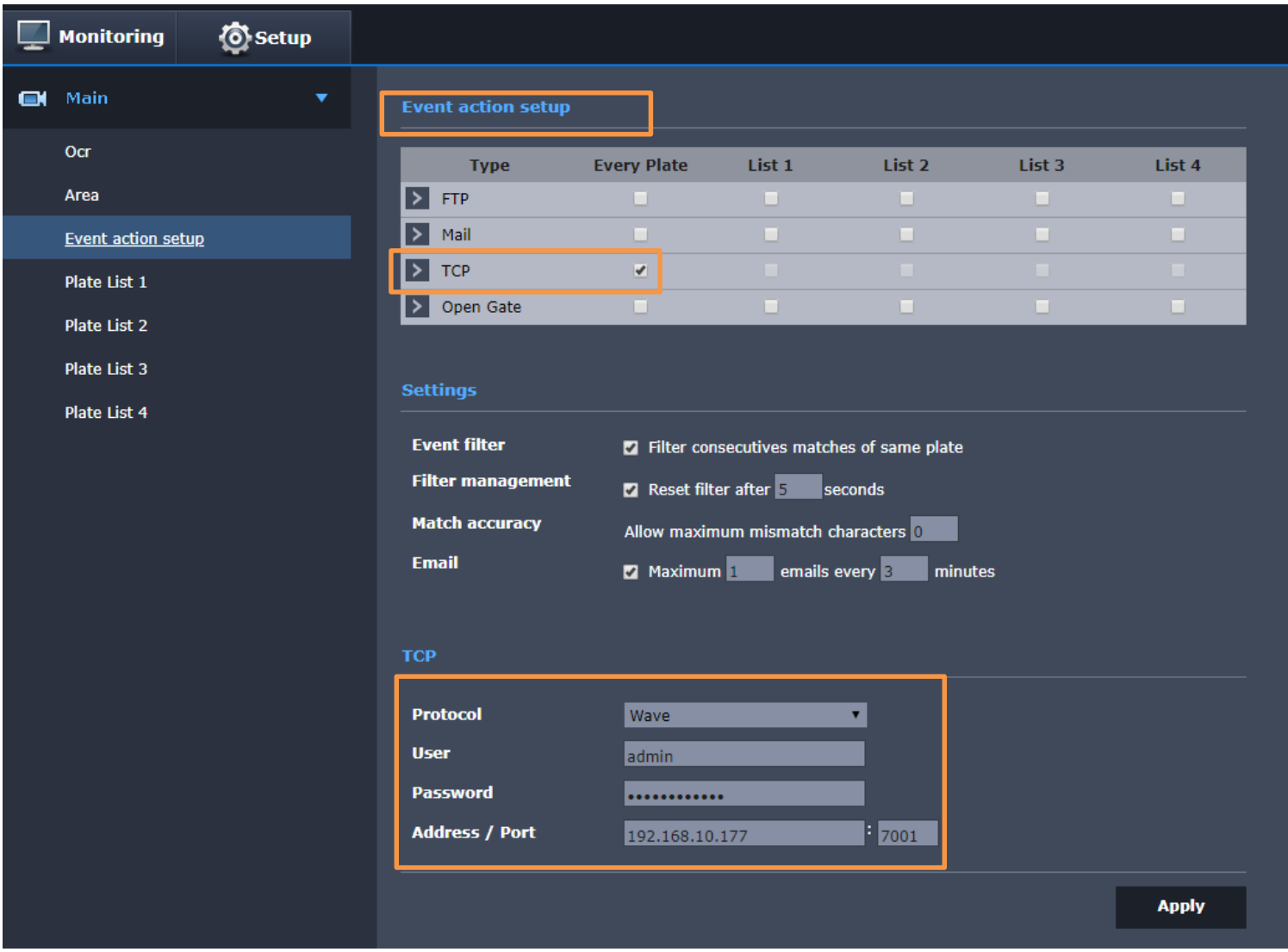
Filter Management: Enabling this feature you will reset the previous filter after the defined "seconds" so as to re-trigger the defined actions. This function is aimed to re-open the gate again, after the gate recloses and the vehicle did not pass through in time within gate open time window.

Match Accuracy: This parameter sets the number of possible mismatched characters tolerance in order to trigger the defined actions, despite there not being a complete plate-reading match. It can be useful in order to allow entrance even in case of small read errors.

Email: This filter allow you to limit the frequency of email sent in a defined time interval. This is useful in order to save triggering SMTP mail server anti-spam filters.

4.8 Configure LPR for Wisenet WAVE VMS

In order to allow the application to send events, go to the **Setup menu** -> **Event action setup** and enable "**TCP**" for the "Every Plate" event (or one or more lists) in the related box, in order to receive the license plates read in to the Wisenet WAVE VMS.



- Set the "**Wave**" protocol in the TCP – Protocol menu to send the plate reads to the WAVE VMS.
- Insert here the username and password of a WAVE Server
- Insert the IP address & communication port (default port is 7001), as per WAVE server configuration. These settings should match what is set on the WAVE server side.
- After changing, the parameters click on "Apply" and confirm the changes.

On the WAVE server side, you do not need to make any other configurations; the system will **automatically** receive the events associated with the camera.

LPR application integration

FTP image

The camera can transmit read plates snapshots through the system FTP client configurable from http://<IP_addr>/home/setup/event_ftpemail.cgi

The file name format is “20140826113939-DV680JB.jpg” where “20140826” is the date and “113939” is the camera timestamp; “DV680JB” is the decoded plate string.

If no readings occurs the App sends a keep alive image named as “KA.jpg” containing the current image taken at the time of generating the file. The keepalive period if no reading occurs is a file every 10 seconds.

TCP JSON Push

In order to accomplish to different integration needs towards external peripherals we have added two different JSON protocols that allows for network socket notifications through a standard format.

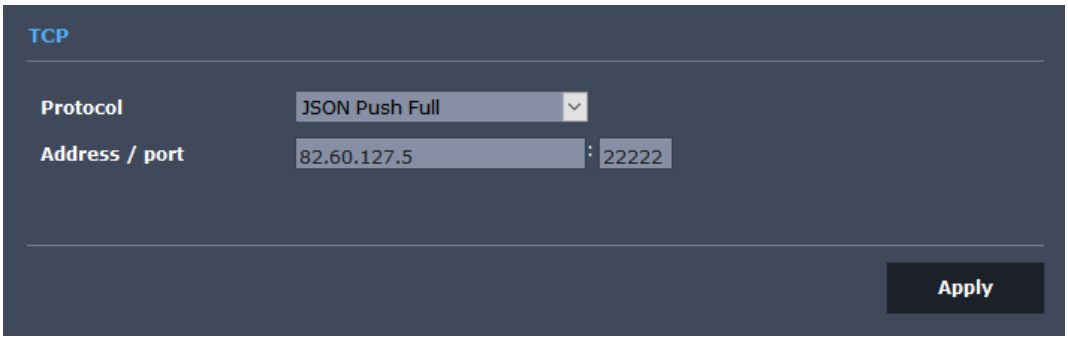
JSON Push Protocol consist of JSON messages sent over a TCP connection to a user defined TCP socket server.
Keeplalive and plate-read messages are sent over the “simple” version, while the “full” version notifies also the whole and crop plate images.

From Setup -> Event Action menu you can select Full or Simple JSON packets:

JSON Push Full

JSON Push Simple

The socket server coordinates (address/port) should be inserted in the relative fields of “Event Action Setup Page” as shown below:



The Full version message contains more information like the Image of vehicle and the image of plate.
The protocol consists of two messages: KeepAliveEvent and PlateDetectedEvent.
The messages are unidirectional from the Camera (TCP Client) to the TCP Socket Server.
The messages uses the JSON syntax.

KeepAliveEvent

KeepAliveEvent is sent every 10 minutes and is formatted in the following way:

{"KeepAliveEvent":"SerialNumber":"ABCDEF","LicenseValid":"0"}}\n

where

SerialNumber is the Serial Number of the camera

LicenseValid is “1” if Application License is Valid “0” if is not Valid.

At the end of message is append a newline character to help socket server size parsing.

PlateDetectedEvent

This event is sent every time a new Plate is detected and it is formatted as follows:

Full Protocol Version:

{"PlateDetectedEvent":"SerialNumber":"ABCDEF","PlateNumber":"AAAAAA","Date":"20161113","Time":"212724","VehicleImage":"XXXXXXXXXXXXXXXXXXX","PlateImage":"YYYYYYYYYYYYY","MatchListResult":"0"}}\n

where

SerialNumber is the Serial Number of the camera

PlateNumber contains the string plate detected in UTF8 encoding

Date is formatted like “yyyymmdd”

Time is formatted like “hhmmss”

VehicleImage is the BASE64 representation of the full image processed by the LPR

PlateImage is the BASE64 representation of the image of the plate

MatchListResult can be:

- “0” (Match list not configured)
- “1” (Plate match one entry in the match list)
- “2” (Plate does not match any entry in the match list)

At the end of message is append a newline character to help socket server size parsing.

Simple Protocol Version:

{"PlateDetectedEvent":"SerialNumber":"ABCDEF",

"PlateNumber":"AAAAAA","Date":"20161113","Time":"212724","MatchListResult":"0"}}\n

where:

SerialNumber is the Serial Number of the camera

PlateNumber contains the string plate detected in UTF8 encoding

Date is formatted like “yyyymmdd”

Time is formatted like “hhmmss”

MatchListResult can be:

- “0” (Match list not configured)
- “1” (Plate match one entry in the match list)
- “2” (Plate does not match any entry in the match list)
- At the end of message is append a newline character to help socket server size parsing.

Remote Plate List Management via browser (CGI commands)

Add Plate To List

http://x.x.x.x:8080/addPlate?l=Y&n=XXXXXXX
where:
->Y is the list number [1-4]
->XXXXXXX is the plateNumber

return:
On Success: {"result":"OK"}
On Error: {"result":"ERROR"}

Remove Plate From List

http://x.x.x.x:8080/delPlate?l=Y&n=XXXXXXX
where:
->Y is the list number [1-4]
->XXXXXXX is the plateNumber
return:
On Success: {"result":"OK"}
On Error: {"result":"ERROR"}

Clear List

http://x.x.x.x:8080/clrList?l=Y
where:
->Y is the list number [1-4]
return:
On Success: {"result":"OK"}
On Error: {"result":"ERROR"}

Get List
http://x.x.x.x:8080/getList?l=Y
where:
->Y is the list number [1-4]

return:
On Success: JSON List Object

{"name":"List 1",
"type":"allow",
"timeslots":"00000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000",
"plates":["AAAA","BBBB","CCCC"]}

Fields description:
- name (string representing the list name)
- type (“allow” or “deny”)
- timeslots: string of “1” or “0” of size (7 x 24 x 2). Each character represents the activation of a slot time. Each time slot is 30 minutes long. The slots start from the 00:00-00:29 of Sunday and ends with the 23:30-23:59 of Saturday

On Error: {"result":"ERROR"}

5 LPR Technical Specifications

Features	Specs	Details
Speed of Vehicle	Up to 35MPH	Stop and go, Low speed, Single Lane LPR applications
Speed of OCR engine	1PPS	One plate per second
LPR Read Accuracy	95%	Depends on plates, and install conditions. See recommended height, lane offset and distance
Required Frame Rate	Min. 10fps, Max 20fps	Required frame rate for LPR application
Camera Height	Min. 4 ft Max. 14 ft	Camera height measured from the bottom of the pole to the camera
Capture Distance	Min. 10 ft Max. 65 ft	Forward distance measured from number plate to the camera lens *1
Horizontal Plate Angle	20 Deg. Max	20° angle from aiming direction perpendicular to plate
Vertical Plate Angle	20 Deg. Max	20° angle from aiming direction perpendicular to plate
Max. Plate Rotation Angle	3 degrees	Allowable rotation of license plate in the image
Min. Character Height	20 pixels	Identified in the LPR application window
Data Transfer Method	FTP, SMTP and JSON Push commands	Manual configurations in LPR app to transmit data to other systems Eg: VMS
Open Platform	LPR application	Dedicated for LPR application

*1 LPR plate capture distance vary depending on conditions

Hanwha LPR Solution

Appendix A

LPR software Re-Installation

If you need to re-install the LPR application, please see the process below to install the application and activate the license

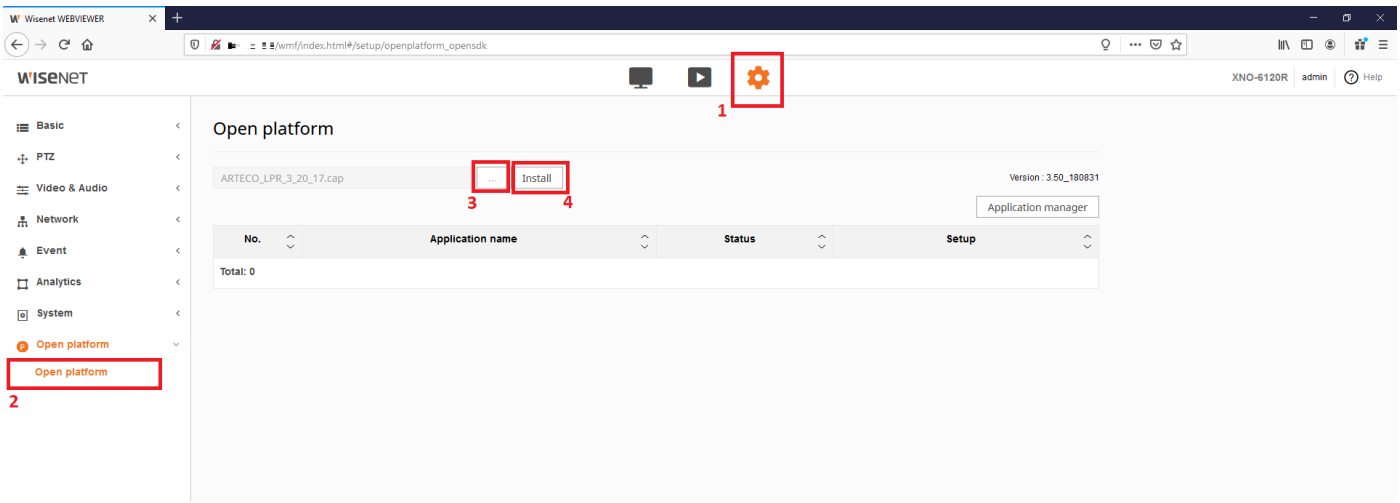
Note:

- Make sure to set the correct date and time before proceeding.
- Update your Hanwha Techwin Wisenet camera to latest available firmware if required.
- Open your web browser and login to in the camera's web interface.
- Download the LPR application from the support site
- Locate the LPR license key. You should find the license key printed on the quick reference guide. If you are unable to locate contact Hanwha technical support along with the model and serial no. information of the camera

Now you can install the software application LPR into your camera.

From the camera's web interface, please follow these steps:

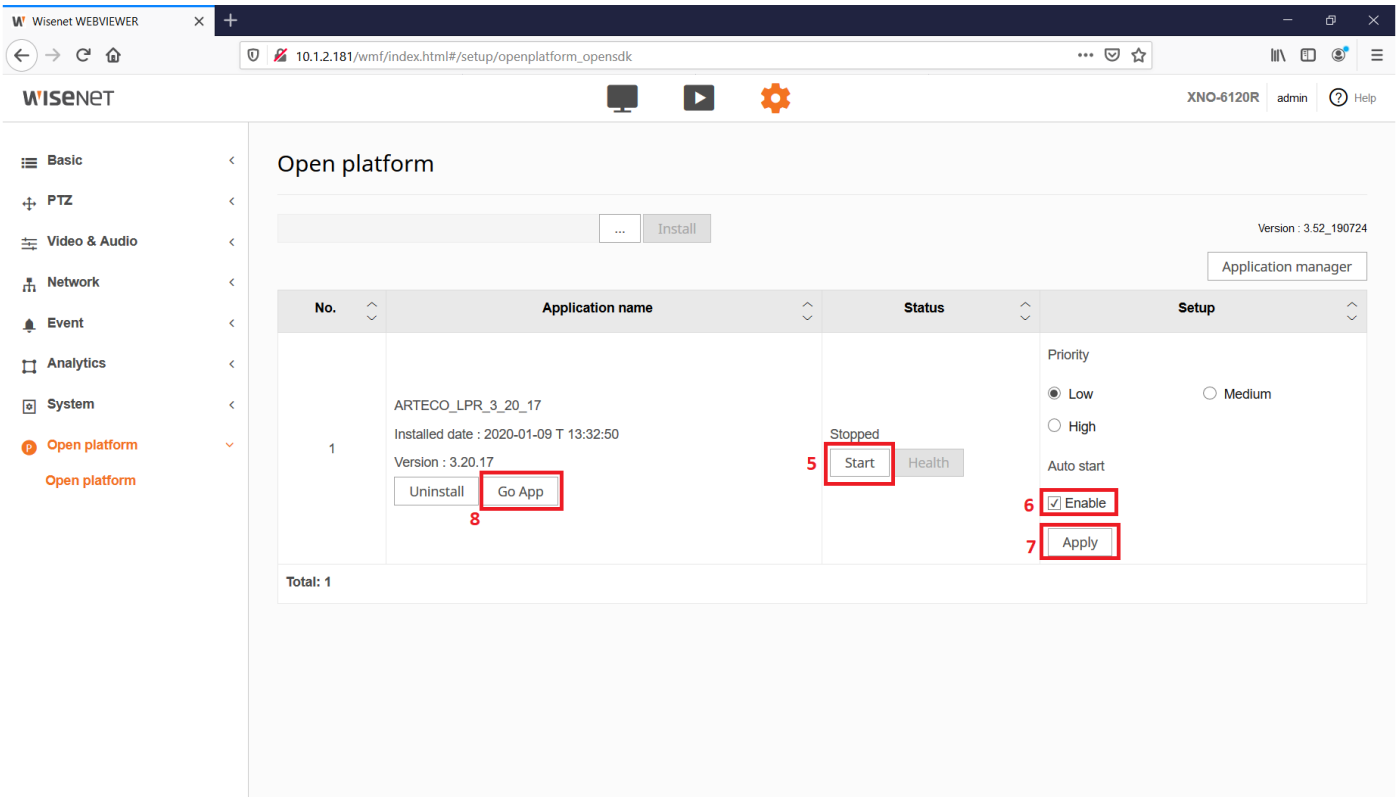
1. Click on the gear icon for "Setup"
2. Click on "Open platform"
3. Click on "…" to browse for the "xxx LPR.cap" file
4. Click on "Install"



After the LPR application is installed, please follow these steps:

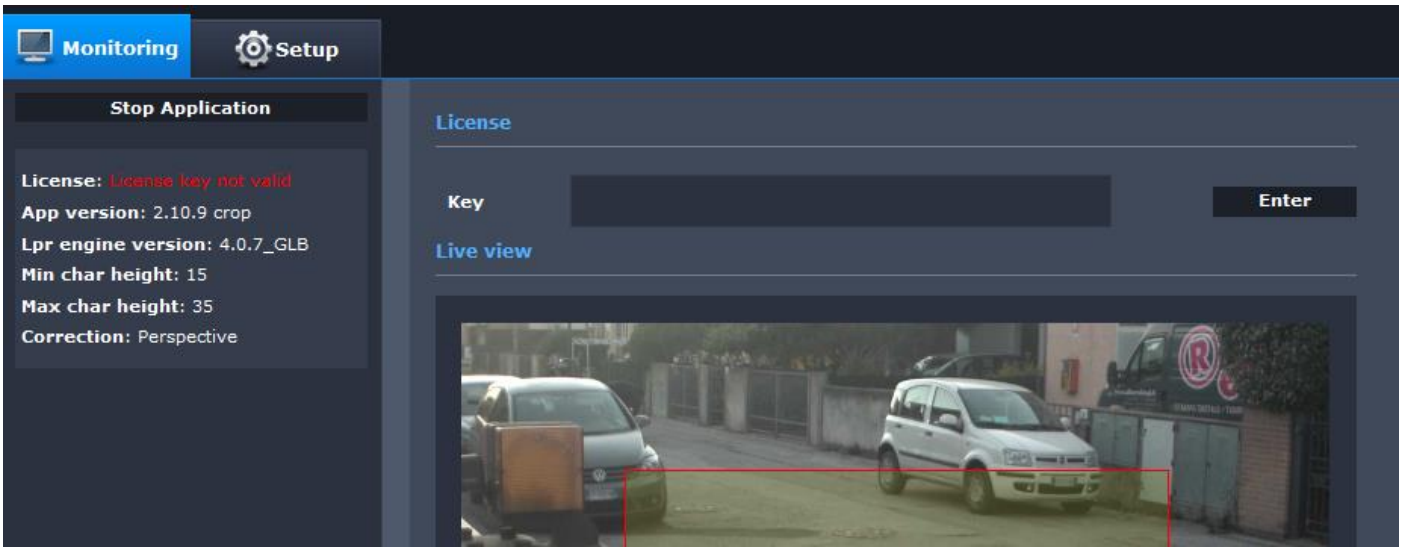
5. Click the "Start" button to start the application.
6. Check the checkbox to "Enable" the Auto Start option that allows the application to start when the camera is rebooted.
7. Click on "Apply"
8. Click "Go App" to Open the LPR application

Hanwha LPR Solution

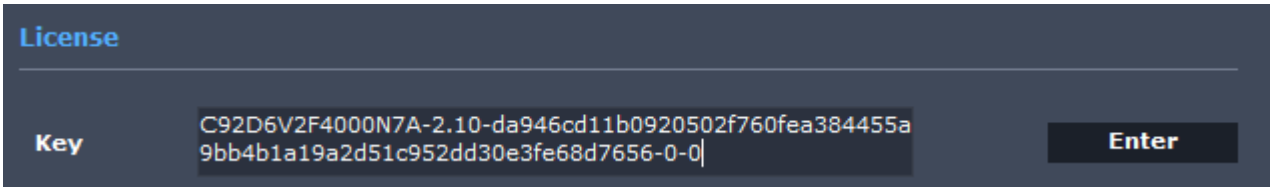


LPR Application License Key Activation

After installing the LPR Application as described in the previous section, the license key needs to be activated



Please insert the license key which may be found in the Quick Reference Guide received in the box, based on your camera's serial number, and then click on the "Enter" button.

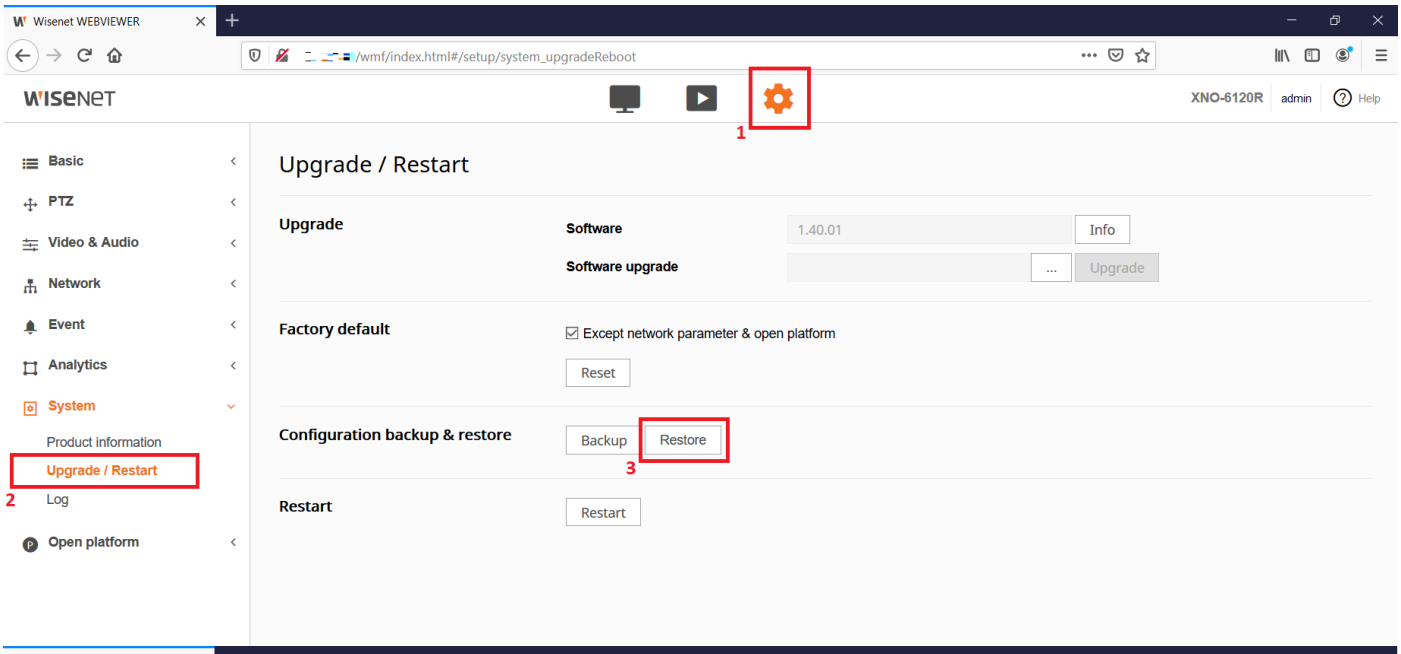


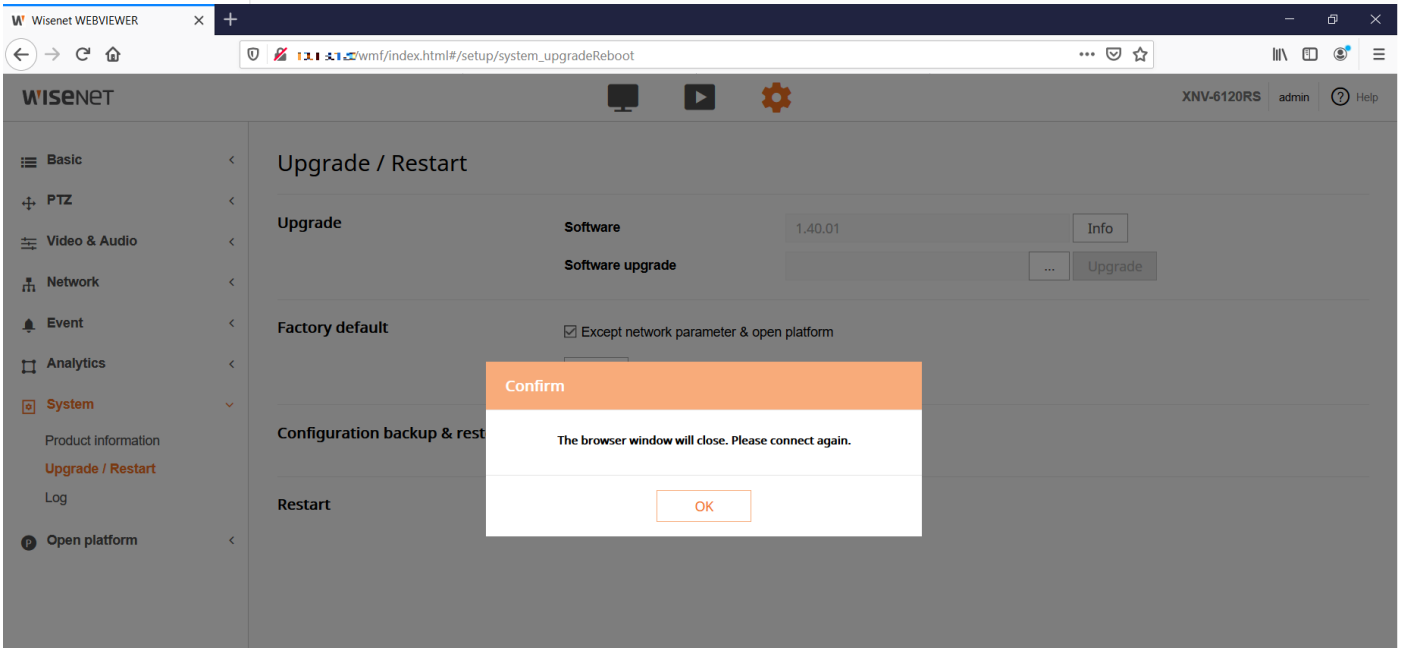
Camera Configuration Restore

After your LPR application is licensed, you may go through the following steps to restore a pre-defined camera configuration which may be suitable for the LPR application.

Note: this will override the current camera configuration, including the username and password.

1. Click on the gear icon for “Setup”
2. Click on “System” -> “Upgrade / Restart”
3. Click on “Restore” and browse for the “xxx.bin” file for your camera model





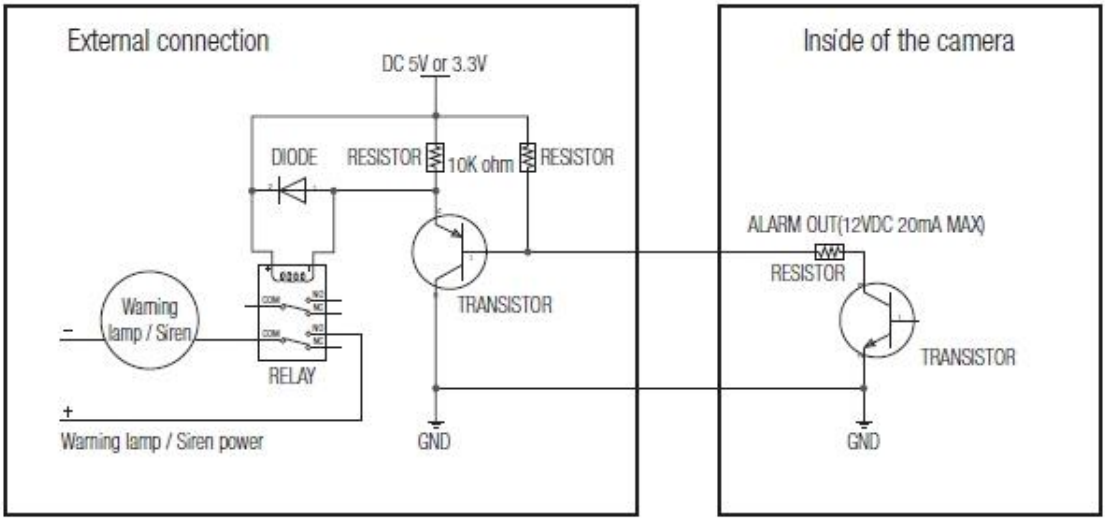
When you reconnect to the camera, the pre-defined camera configurations will be loaded.
You will need to use the following credentials in order to log in to the camera.

Username: admin
Password: Techwin1#

Appendix B

Output configuration for external triggers

Hanwha Techwin IP cameras provide at least one digital output “open collector” type. This means you cannot just load this output with an uncontrolled current. Most of the connections between the camera and a generic “load” (like a gate open control) can be implemented by putting a DC relay between the camera and the electric load. The relay coil must adsorb 20mA maximum and it is recommended to be powered at 3.3 to 5Vdc. You may read the connection scheme in the camera user manual similar as given below



For more information about wire connections to camera output, please refer to the camera user manual or the access control device configuration.

Notes

Hanwha LPR Solution

Hanwha Techwin America
500 Frank W. Burr Blvd. Suite 43 Teaneck, NJ 07666
Toll Free : 877.213.1222
www.HanwhaSecurity.com