This document was created to benchmark the settings and tools needed to successfully deploy LPR with the ipConfigure’s Enterprise Surveillance Manager.

Specific hardware and software was used to obtain optimal settings, namely: Axis Q1604 IP Camera, Fujinon 3MP 8/80mm lens (Part # DV10X8SA-1). Testing was conducted with the following environmental conditions: daylight hours, no extra light included (white or infrared), and dawn to dusk timeframe for normal operation.
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**AXIS RECOMMENDED SETTINGS FOR Q1604 CAMERA**

**INITIAL CAMERA SETUP**

1. Log onto the camera directly. Axis cameras default IP Address is: 192.168.0.90.

2. Check that the camera is running the latest firmware for that model (can be obtained from Axis’s main webpage) and the Fujinon 5/50 mm or 8/80mm lens is attached.

3. Select Setup | Basic Setup | Video Stream | Image. The first time you login to the camera you will be asked to apply a **CAPTURE MODE** - we require this to be set to **1 MP 1280x720 (16:9)**. *(Note: If you have to factory default the camera at some point in the future you will need to re-apply this setting).*

   At initial login to camera or under **Basic Setup | Video Stream** set to the following:

   ![AXIS Q1604 Network Camera](image)

   a. Under **Image Appearance** | **Capture mode set Resolution to:** 1280x960 (4:3)
   b. Set **Compression** level to 0
   c. Save these settings
UNDER VIDEO & AUDIO | CAMERA SETTINGS set the following:

Image Appearance:
1. Set Color level to 50
2. Set Brightness to 50
3. Set Sharpness to 50
4. Set Contrast to 50
(The above settings should be used as a starting point for operation on a sunny day.)

Exposure Settings:
5. Set the Exposure value to: 70 (ideal range is 60-70)
6. Set the Exposure Control to Automatic
7. Set Shutter to Fixed
8. Set Shutter to 1/2000s
9. Set Gain to Auto
10. Set Max Gain to 27dB

**Exposure Settings:**
11. Ensure that Enable Backlight compensation is not checked

**Wide Dynamic Range:**
12. Ensure that WDR - Dynamic Capture is off

**Exposure Settings:**
13. Set IR cut filter to: Auto

**View Image Settings:**
15. Click on Save to save these settings.
ADJUSTING CAMERA LPR FOV

Before continuing, it is important to understand FOV and how this relates to the camera and the optimal settings related to distance, height, FOV, depth of field, and width of view. The following diagram will help understand Camera Placement, width and height of FOV and the LPR capture range.

Scenarios

Gate or Parking Garage

![Diagram showing camera placement and angle]

**Lens:** Fujinon 5-50mm lens  
**Distance:** ≈ 8 feet  
**Angle:** 10 degrees  
**Frames Per Second:** 1 fps  
**Assumptions:**  
- Vehicles come to a complete stop before entering and leaving a controlled area  
- Entrance and Exits are well lit  
- At least 150 pixels of plate data
Street

Lens: 5 – 50 mm Fujinon lens
Distance: 10 – 50 feet
Angle: 30 degrees
Frames Per Second: 10 fps
Assumptions:
- Vehicles are travelling between 25 – 35 mph
- Vehicles don’t ever come to a complete stop
- This is not considered a high congestion street
- Night time reads are not a requirement
- At least 150 pixels of plate data
Country Road

Lens: 8 – 80 mm Fujinon lens
Distance: 50 – 80 feet
Angle: 20 degrees
Frames Per Second: 10 fps
IR Illuminator: Axis T90A42
Assumptions:
● Fujinon lens is a day night lens
● Lights in the enclosure would be disabled
● Cars are travelling less than 40 mph
● The IR illuminator is long range and can reach 80 feet
● At least 150 pixels of plate data
UNDER SETUP | VIDEO & AUDIO | FOCUS we set the focus on the camera:

1. Put a check in the “Show pixel counter” box and drag it across the plate of a parked vehicle that you want to act as the focus area for plate detection within the window.

2. The plate of must be at least **150 pixels wide**.

3. With a stopped vehicle in the image perform this focus process. Proceed through the auto focus adjustment steps. (This should be done with as little motion in the scene as possible). You may need to focus this a few times if the scene changes (experiences motion) throughout this process. You need to focus at the point where the ideal plate size of at least 150 pixels exists on the counter.
   a. Click on the **Open Iris** button.
   b. Click on the **Reset** button.
   c. Click on the **Fine-tune focus automatically** button.
d. **NOTE:** You can click on the Advanced tab at this point to fine tune the autofocus manually after it resets. This should be done if the image does not automatically refocus to an ideal picture.

e. Click on the Enable Iris button to close this session of Focusing the FOV on the camera.
IPCONFIGURE LPR CAMERA SETUP

Before calibrating an LPR camera it needs to be added into ESM. Adding the camera for the most part is just like any normal surveillance camera with a few exceptions explained here.

CAMERA SETTINGS IN ESM ADMIN UI:

1. **Camera Application**: By default this will be set to *Surveillance*, change this to *LPR* and select **Apply**
2. **Overview Camera**: This allows a secondary camera already configured in the ESM system to be linked to this LPR camera. This will link that cameras recording with the LPR reads captured.
3. **Image Resolution**: For LPR application this needs to be set to (1280x960).
4. **Frame Rate**: Best results are at 10 fps.
5. **Compression**: Best results are at 0%.

*Quick Tip* Once all settings have been made make sure there is a check box in the “Enabled” field and then click “Apply” to start up the process.
IPCONFIGURE LPR USER INTERFACE GUIDE

LPR REAL-TIME TAB:

The Real Time tab provides users with up to the minute results including the date/time of detection, tag number, tag images, location, LPR camera name and a series of actions that can be taken. Simply choose a LPR designated camera from the Global Camera Directory and the last 50 LPR events will be displayed on the page. Operators can choose several refresh rates from the drop down list.

If the tag number is indicated in blue text then it has not been verified by an operator. If the tag is indicated in green text then the tag has been verified. Tag images may be viewed in a larger pop up window if selected.

Note: Verifying plate data is optional. Although the algorithm can be trained it is not required in order to achieve accurate reads. The accuracy of the algorithm is largely a result of camera placement.

![LPR Real-Time Tab Screenshot](image-url)
LPR SEARCH TAB:

Plate Search:

The LPR search screen allows users to define searches against specific tag numbers based on accuracy, repetitive visits, or predefined watch lists. Additionally, users can playback video from the assigned overview camera if one is installed.

1. In order to perform a LPR search a LPR camera has to be setup and available in the Global Camera Directory. LPR cameras are designated by the LPR icon . Check the box next to the LPR camera to enable a search.

2. Users can enter any number of characters in the Search Plate Number field or none at all. If no characters are entered and accuracy is lowered to 25% all results will be displayed in a given time/date range. Wildcard characters are also available if the entire plate number is not known:

<table>
<thead>
<tr>
<th>Wildcard character</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| %                  | Any string of zero or more characters. | F% - Any plate that begins with F, i.e. FXY 241  
|                    |             | F3% - Any plate that begins with F3, i.e. F3T 021  
|                    |             | %12 - Any plate that ends with 12, i.e. AGT 712  
|                    |             | %GR% - Any plate that contains GR, i.e. GRR 1234  |
| _ (underscore)     | Any single character. | RG_0 - Any plate that starts with RG, ends with 0 and has one other character, i.e. RG40  |
| [ ]                | Any single character within the specified range ([A-F]) or set ([ABCDEF]). | [K-L]% - Any plate that starts with K or L, i.e. L45 001  |
| [*]                | Any single character not within the specified range ([^A-F]) or set ([^ABCDEF]). | %[^A-C] - Any plate that does not end with A, B, or C, i.e. KXX 121  |

3. The Defined Searches field allows users to run a Sequential Search or a search based on Repetitive Plate Visits.

4. The Search Watch List field allows a user to search based on the contents of a specific watch list. Leave this field set to “None selected” to search all plates.

5. Select the date and time parameters for your search.

6. Select the Search button .
Search Actions:

1. Select View icon to see an overview shot of the vehicle on the LPR page above the Search pane. If an overview camera has been installed and configured the corresponding video that is associated with the plate capture will also be displayed. The LPR result in red text is overlaid on the image on the bottom left corner of the window. Note: The text overlay can be disabled by the ESM Administrator if it obscures the plate.

2. Click on the snapshot image of the vehicle and a separate pop up window will be displayed allowing you to zoom in and zoom out with a magnifying glass.

3. The Verify icon allows users to verify the tag read and thus improve the accuracy of the LPR algorithm on future reads. A Verify Plate dialogue box will appear enabling operators to correct the result and add other information such as the State, Country, Manufacturer, Model and Color of the vehicle. When verified, tag number will change to green text on the page.

4. Select the Add icon for that specific tag to be added to a Watch List and subsequently display a red flag icon if captured on future reads. To create a Watch List, refer to the section below on Watch Lists.

5. The Stats icon provides a pop up window which displays a chart of the location(s), date(s), and frequency of the selected plate. The x-axis lists the dates of the capture while the y-axis lists the number of captures. Multiple locations will be displayed by different color squares in the chart. Operators can view the frequency that plate has been captured in the past 1, 7, 14, or 30 days. These results can be exported in Excel, Word, and PowerPoint format. The stats window can be pinned to the forefront of your display using the push pin icon. Results on the chart can be updated in real-time by clicking the refresh icon. Tip: Mouse over the colored squares in the chart to display the time of capture.

6. The Export icon allows operators to save still images of the captured vehicle as well as the associated video from a secondary overview camera (if installed). Users will be prompted with the option to save both the overview video and the still image of the vehicle. If user selects “No” then just the still image of the vehicle will be saved. Note: Overview video clips are one minute in length.
LPR WATCH LIST TAB:

Operators can create custom watch lists of plates that once detected can trigger flags on the LPR Real Time page and are indicated on the LPR Search page.

1. To create a watch list select the Watch List tab and right click on the Global Watch List and select Add. You will be prompted to enter a name for your watch list.

2. To manually add a plate to a Watch List select the Watch List then click Add at the top of the page. Enter plate information in the fields provided and click the Add button to save. Operators can also input a confidence level which will affect how close the algorithm has to come to a match in order to flag a watch list hit. Your watch list is now available for use by all operators. Users can automatically add plates on the LPR Search page and on the Real Time page using the Add icon. Note: Email alerts can also be triggered from Watch List hits if configured by your ESM administrator.

3. Other actions include the Edit icon which enables operators to edit the plate number, state, or trigger confidence. After making edits, select Update to save the changes or Cancel to discard the changes. The Delete icon removes a plate from the Watch List. The Stats icon graphs the frequency that particular plate has been detected at a location(s) over a specified period of time.
4. Email alerts can be sent when a plate number matches a Watch List entry if your ESM Administrator has enabled this feature. User simply types in email addresses (separated by commas) in the Email field at the top of the page to receive notifications of flagged plates. Hit the update button to save changes.

NCIC Watch List:

ESM supports the Federal Bureau of Investigation (FBI) import of the National Crime Information Center (NCIC) license plate file. The NCIC has been called the lifeline of law enforcement- an electronic clearinghouse of crime data that can be tapped into by virtually every criminal justice agency nationwide, 24 hours a day, and 365 days a year. Once you obtain access to the NCIC license plate file you can manually add it to ESM or if you require the file more frequently you can automate the file being placed on the ESM server and it will be processed daily. There are two way to add a NCIC watch list to LPR.

By User Interface:
1. Login to ESM and navigate to the LPR tab.
2. Select the Watch List tab.
3. Right click Global Watch List and click Add
4. Type in a name for this watch list
5. Right click your new watch list and select Update with NCIC file
6. Find the file you want to upload
7. Reload browser

By Folder:
1. Locate NCIC file
2. Go to C:\ipconfigure\watchlist
3. Drop the NCIC file into the watch list folder
4. User interface will update with the name given on the file
ENVIRONMENTAL CONSIDERATIONS

Dusk certainly presents issues and it seems to come in about 5 minute clips. Once you get the settings working with the current available light and the LPR engine is reading good data, wait 5 minutes, the accuracy will go down. This sort of manual tweaking is not really worth the 5 extra minutes per day of valid plate data that would be obtained. Not to mention you can interrupt normal daytime operations if you start to mess with Max Shutter Speeds and Exposure values to increase the light of the image.

What sort of lighting is notice for the environment?
There may be some image quality issues around the thermal off the ground, especially in Texas on hot days where blacktop is present. This can be noticed in the images if they seem wavy and rigid when zoomed in on them. Due to the height at which we hang the cameras off the side of the building, this should dissipate from our view. We saw it when the camera was about 3 feet off the ground, it disappeared when moving the camera to 10 feet and higher.