



# ANPR INSTALLATION MANUAL

Version 1.1  
04/22/2016

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## 1. Camera and scene requirements.

1.1. License plate must be readable and well lit.

1.2. License plate dimensions must be at least:

- 150 pix for rectangular plates and 100 pix for two row plates (for Russia, Kazakhstan, Armenia, Uzbekistan, Serbia).
- 130 px for rectangular plates and 70 pix for two row plates (for all other supported countries).

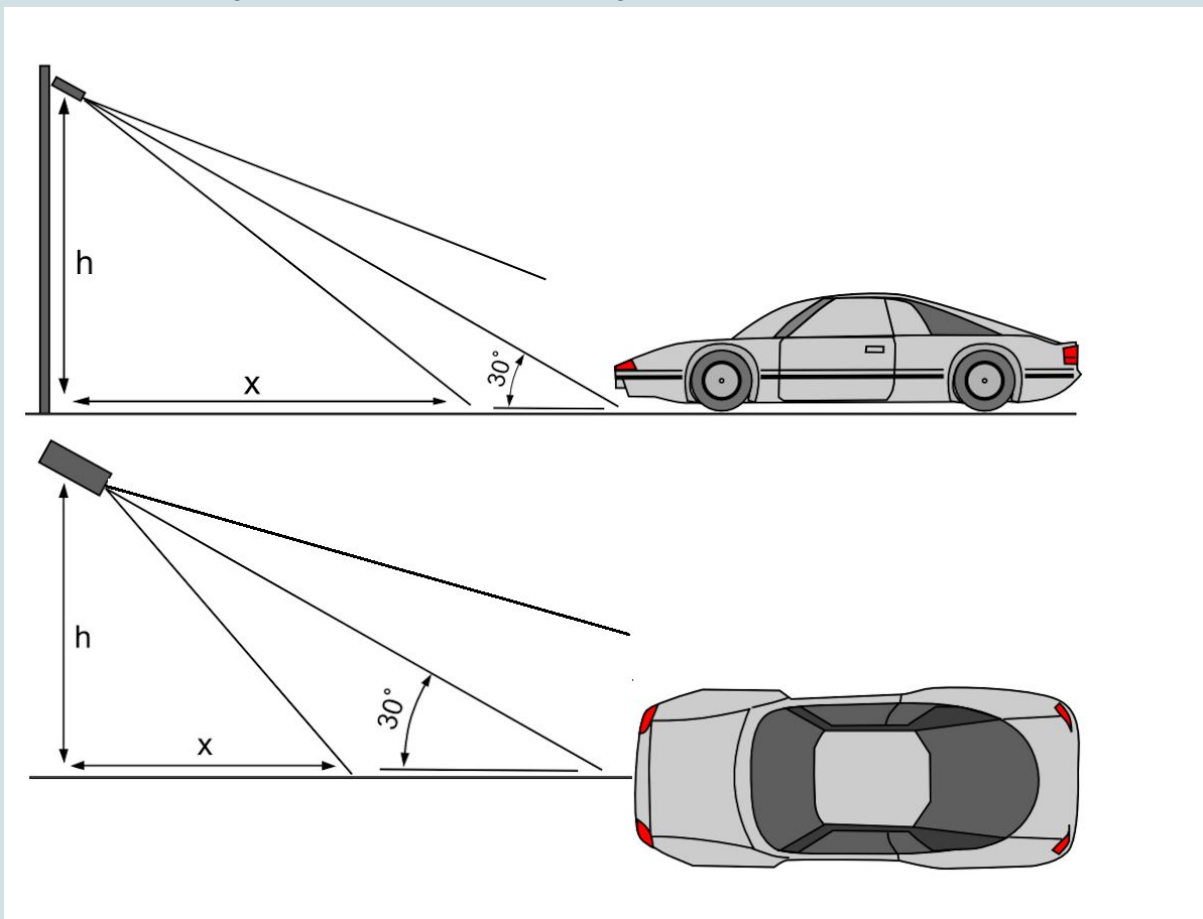
NOTE : You should always set for rectangular plates.

1.3. Allowed tilt - 5 degrees (clock- and counterclockwise).



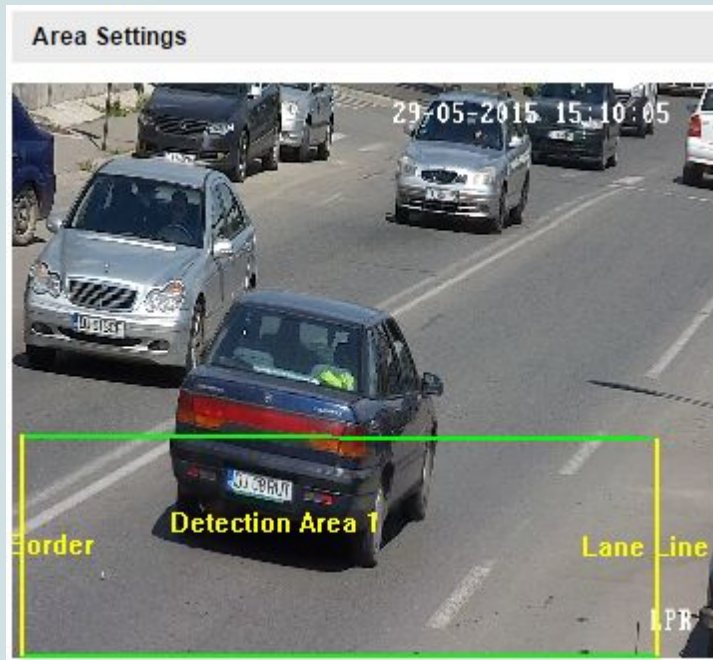
1.4. Vertical angle - should not exceed 30 degrees.

1.5. Horizontal angle - should not exceed 30 degrees.



## 2. How to.

Set the number of lanes and draw them to the frame



Set the region recognition

Total Number of Lanes	1
Region	Europe Region

For the correct recognition is necessary to set the parameter of the maximum and minimum size of the license plate.

- Define the area of interest on the frame and set up it
- Measure the size of the license plate area of interest.
  - The minimum width of the license plate in ROI (LPminW)
  - The maximum width of the license plate in ROI (LPmaxW)
- Set the parameters

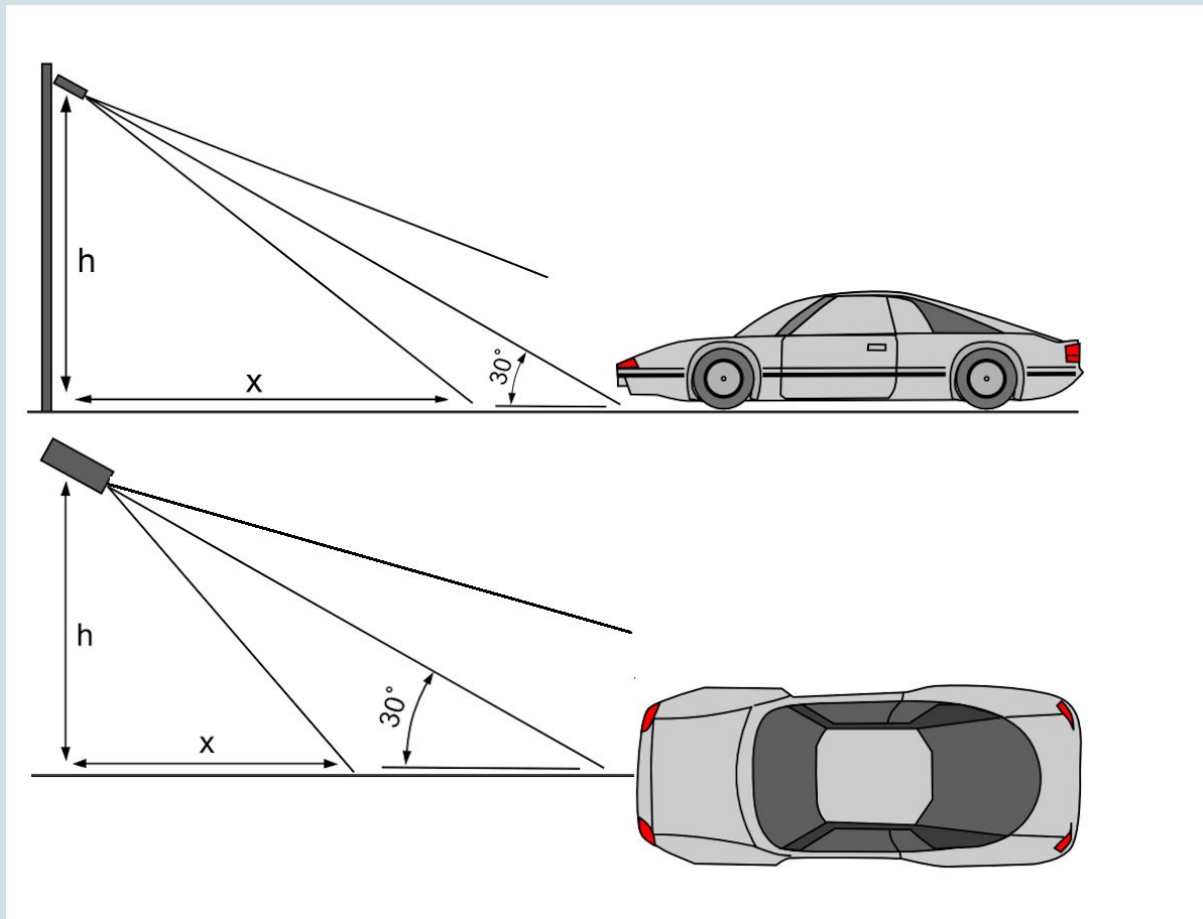
License Plate Region Settings		
<input checked="" type="checkbox"/> Enable License Plate Recognition		
Plate Width	Min	130
	Max	260

Plate Width Min = LPminW rounded to tens

Plate Width Max = LPmaxW rounded to tens, but not less than 2 x LPminW

Adjust the threshold level by the current situation.

## Angles of mounting



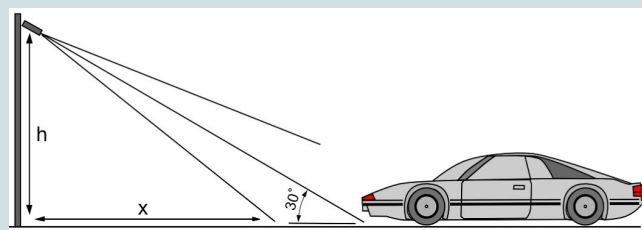
You can measure all of the needed geometrical lengths using a Pythagorean equation. But it is sometimes hard to measure the angles properly.

Using this equation, we've measured some typical cases for you. Feel free to use them as a cheat sheet.

### Vertical angle

The initial formula is  $x = h * \sqrt{3}$

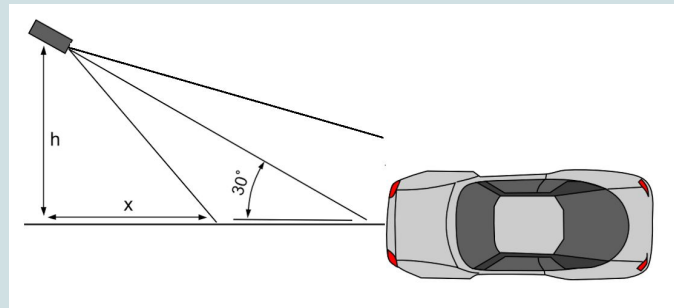
h (meters)	minimal x (meters)
1	1,7
1.5	2,6
2	3,4
2.5	4,3
3	5,1
3.5	6
4	6,8



**Horizontal angle**

The initial formula is  $x = y * \sqrt{3}$

y (meters)	minimal x (meters)
1	1,7
1.5	2,6
2	3,4
2.5	4,3
3	5,1
3.5	6
4	6,8



So, first of all you measure (or use the cheat sheet) the vertical angle. Then measure the horizontal angle. You need to take the bigger of them.

For example, if you mounting the camera on a 2 meter pole (h), 3 meters from the road (y) - correct vertical angle will be reached from  $2 * 1.7 = 3.4$  m and farther.

However correct horizontal angle will be reached from  $3 * 1.7 = 5.1$  m and farther.

So to fulfill both requirements, we take the bigger  $x = 5.1$  m.

Example of good license plate at day.



Example of good license plate at night.

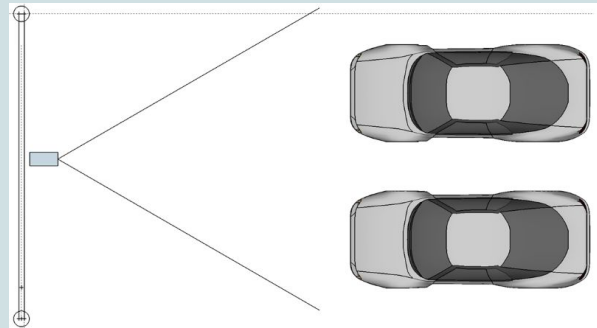


### 3. Recommendations on mounting and adjusting.

3.1. If you want to recognize two or more lanes - it is generally recommended to mount a camera on a crossbar.

3.2. We assume that you have IR-Led, if you want to recognize LP at nighttime.

3.3. Shutter speed must be big enough to cut the light from car's headlights at night (usually it's about 1/1000). But bear in mind, that too big of a shutter may obscure the edges of the lines (especially shadows).



3.4. Depth of focus - is a very important parameter. If you are using a camera with a CS-mount lens, use fixed lens. Fixed lens are better for LP recognition due to greater depth of focus. Megapixel lens is strongly recommended - usually they have M or MP marking.

3.5. When you'll be choosing the place of mounting, remember about sunrises and sunsets. Direct sunlight beams can distort a picture. If the cars facing a direct sunlight - use a lens with auto iris mode.

3.6. If you are mounting a camera on a roadside pole - check how the pole reacts to heavy cars or a convoy of cars. Some poles have tangible tremor. It will make LP recognition almost impossible.

3.7. If you tuned the camera perfect for the daylight - wait for the night, and see what happens then (and vice versa).

3.8. If you don't know, how many pixels are in the LP - take a full-frame screenshot and use a graphic editor (like photoshop). Almost all of them have some kind of "ruler" tool.

3.9 It is generally advised to turn down WDR and BLC. In most cases, they will make the picture more pretty, but at the cost of smudging small details (like an edges of letters in LP). The same case goes with Digital Noise Reduction (it is recommended to have it low, at 10-20).

3.10 On a certain rare conditions there may be a cases of false detections - recognizing of fences, ads and other image parts that are structurally or semantically looks like a license plate. To minimize this:

- a. Adjust the roi accordingly. It may be a good idea to make it smaller, or change it's shape, omitting the parts, which potentially may be false detected.
- b. Adjust the min and max lp settings according to upper instructions - do not leave a default 130-300.
- c. There may be cases, when the best performance will occur by changing angle of lens or moving the camera. In some cases, shooting a front lp is better.

3.11 To effectively capture the vehicle camera should be set so as to provide the minimum depth-of-field (DOF). Depth-of-field (or length of the zone of sharpness) is the amount of distance between the nearest and farthest objects that appear in acceptably sharp focus in a video. .

You are free to calculate the minimum depth of field using the formula



$$L_{dof} = \frac{4 * T_{rec} * V_{max}}{3600}, m$$

were  $L_{dof}$  - depth-of-field, length in meters, m;

$T_{rec}$  - recognition time per one plate in milliseconds, ms;

$V_{max}$  - maximum vehicle speed, kmph.

Using this equation, we've calculated some typical cases for you.

Maximum vehicle velocity, kmph	Recognition time per one plate, ms				
	100	200	300	400	500
	Depth-of-field, meters				
40	4	9	13	18	22
80	9	18	27	36	44
100	11	22	33	44	56
120	13	27	40	53	67
140	16	31	47	62	78
180	20	40	60	80	100
200	22	44	67	89	111
220	24	49	73	98	122
240	27	53	80	107	133

**NOTE:**

**1) The minimum sizes of the number plate on the edges of the zone of sharpness shall be not less than specified in paragraph 1.2 of this manual.**

**2) DOF depends on f-number of lens diaphragm, which may be auto-adjusted by a camera in case of illumination changes. So iris control must be set to "manual", not "auto". Or insure that DOF length is enough for the worst possible illumination case.**

3.12 It is also important to control the exposure time for the effective recognition of license plates. We calculated the maximum value of the vehicle speed for a standard exposure time values for the camera mounted at a horizontal angle of 30 degrees.

Exposure time, s	Maximum vehicle speed, kmph
1/100	5
1/250	40
1/1000	100
1/2000	200
1/4000	400

**NOTE:**

**Also the exposure time must be adjusted according to the light conditions. So it should be selected for each case.**

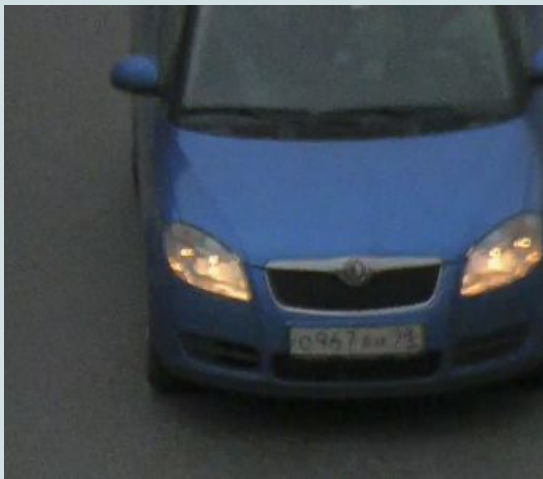
## 4. How not to. Common mistakes.

### 4.1. Focus.



Notice how there is not enough focus for all frame. Car with a green frame will be detected, and other cars will not.

Adjust the focus on the lens.



On these examples you can adjust the focus or shutter speed.

#### 4.2. Too much light.

You can either adjust the shutter speed, or dim the IR-Led (for the night).



#### 4.3. License plate width.



It seems that LP is well lit and readable by eye. However, if we'll measure full frame in photoshop, we'll see that LP width is under 80px - which is not enough.

#### 4.4. Insufficient light.

Adjust the shutter speed or provide some extra light.

