



**360/3D Surround View Monitoring System
Camera Calibration for Light-Duty Vehicles
User's Manual**

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1 Introduction

1.1 About this Guide

This guide document first give you a basic idea on how to calibrate the outside cameras installed in the car and then describe the instructions during each calibration step. Please carefully read this file during initial calibration phase especially if you are new comer in that industry.

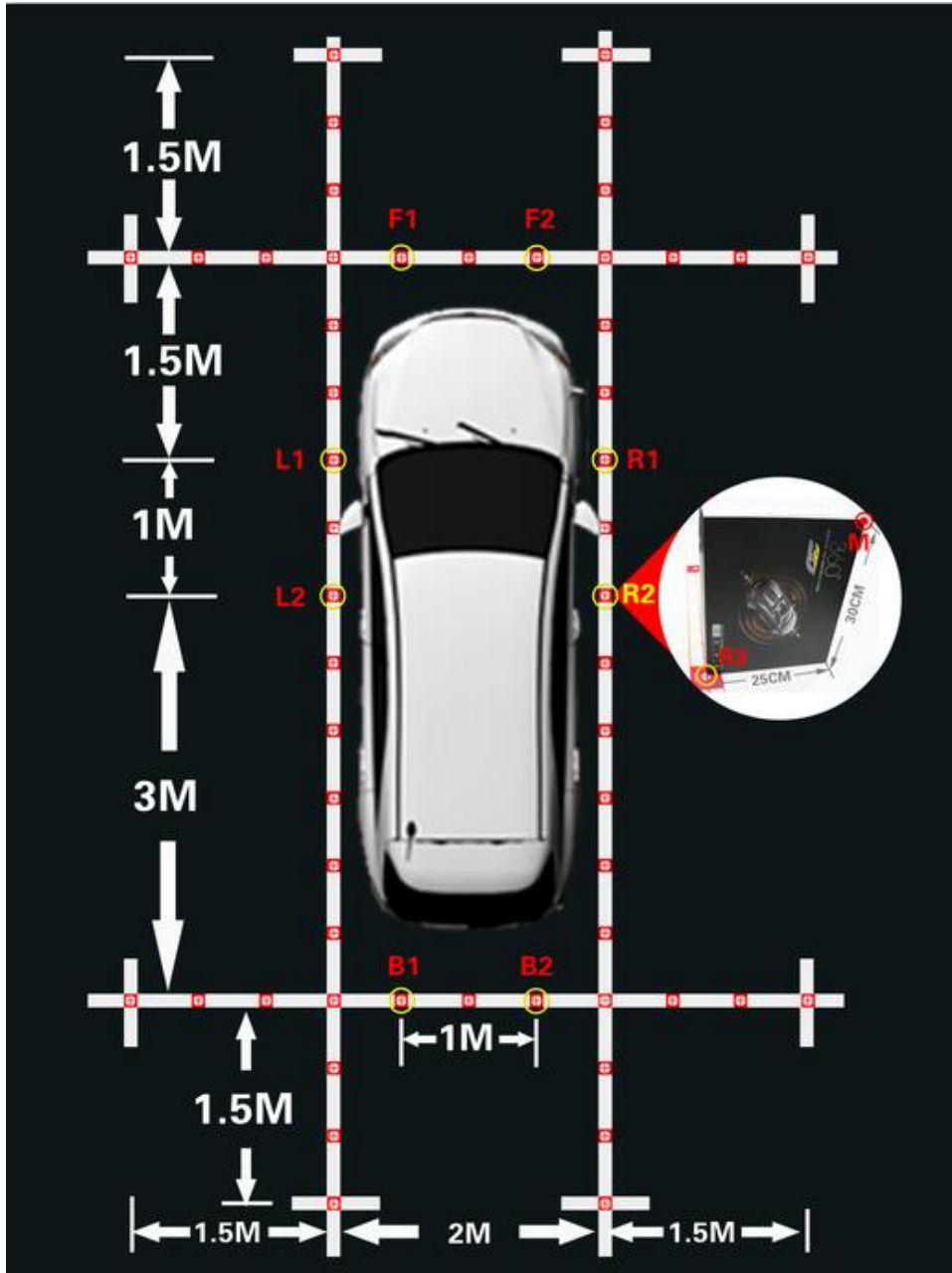
1.2 Brief introduction to Camera Calibration

The NEXADAS 360° 3-D Surround View Monitoring Technology synthesizes images from four cameras to create a true 3D sophisticated view of a vehicle's surroundings. The technology enables flexible omni-directional monitoring around a vehicle from a dynamically definable perspective or "free eye point."

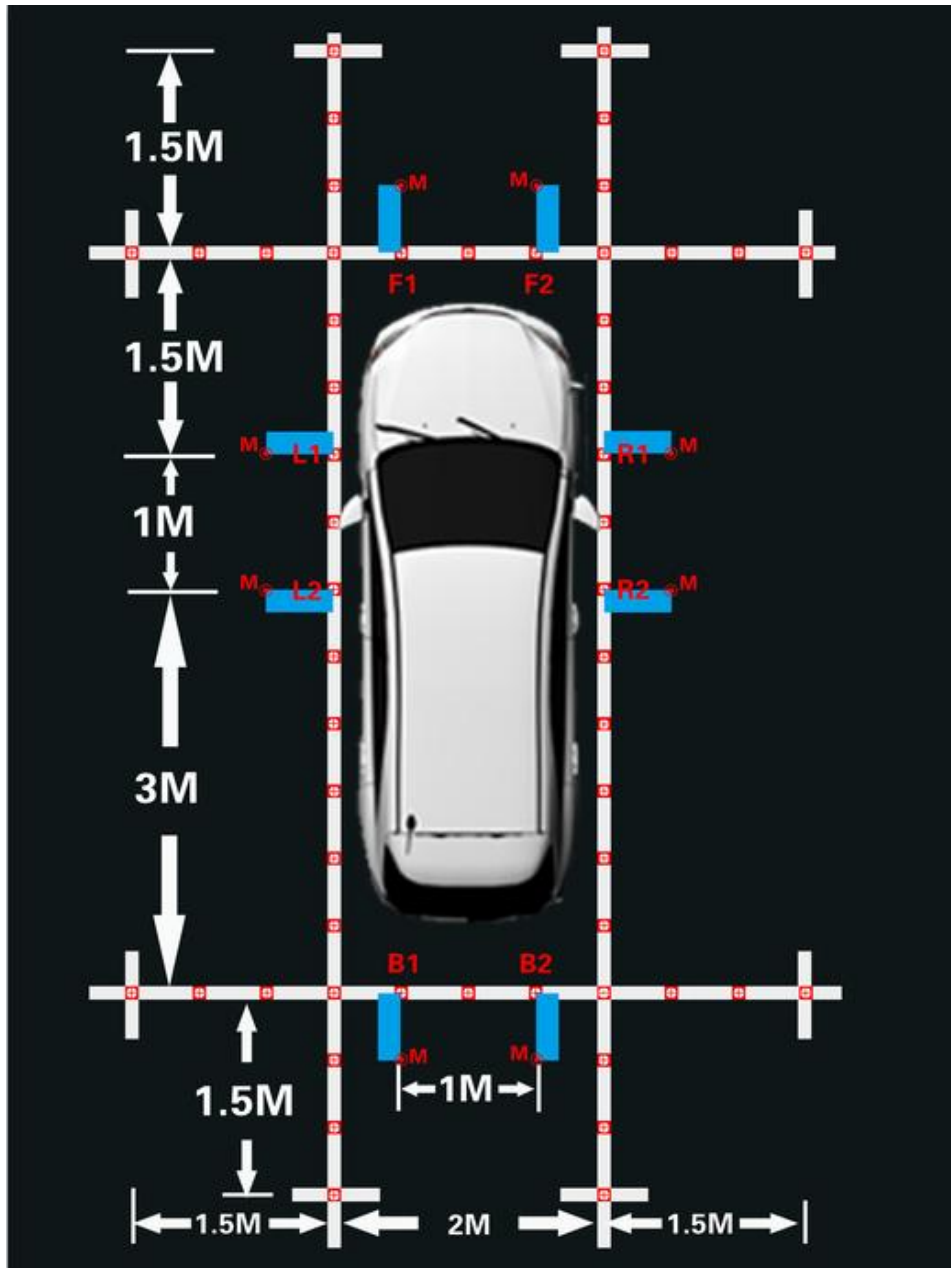
The procedure which designed to make system software know camera parameters is called camera calibration. Before the NEXADAS system working, we need to know exactly both the intrinsic and extrinsic parameters for the outside fish-eye cameras, like camera installation position, angles, focal length and barrel distortion parameters, etc.

Unlike to other system, the cameras calibration steps in our product do not take a high cost printed check-board for calibration, it is more simple and easy. You need only one marked tape and 8 packing boxes(2 packing boxes for each), then you can help yourself to finish all the calibration steps. please pay attention to the following diagram list below.





It's strong recommended that the operator should paste the marked tape on the ground exactly the same way as the up mentioned diagram. Please kindly note that the distance between each red marked points is 0.5m so that to make easy for you to set some dimension parameters, and please also note that the points with a yellow circle mark are the points to be checked in the capturing mode during calibration step.



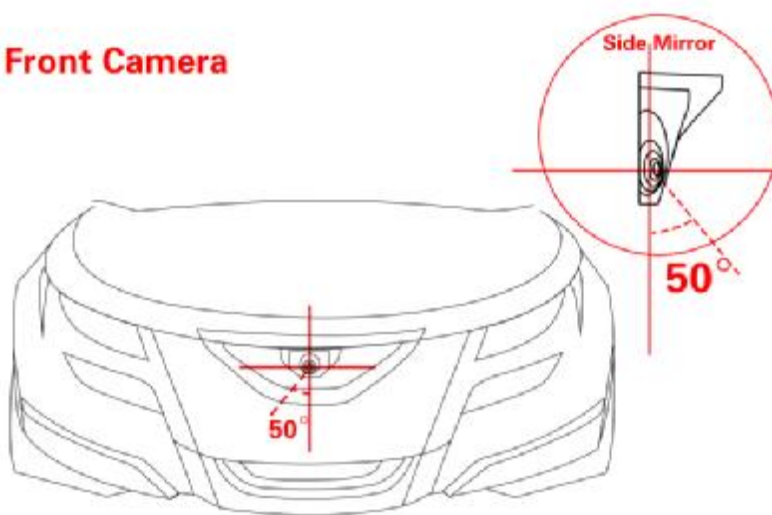
The blue blocks in the upper picture are the packing boxes used for checking space points to be calibrated while the yellow circled points are served for ground points. If 8 packing boxes is not available, for example, you only buy 1 set of our SVM system, you are also capable to finish the calibration, you can open the box and then you get the upper case the bottom case, both of them are ideal for calibration. The basic idea is to choose some known world coordinates and tell the system where these points is in the image captured by the cameras, then both the intrinsic and extrinsic camera matrix can be calculated base on the relationship between the known world coordinates and the corresponding pixel positions.

2 Camera Installation

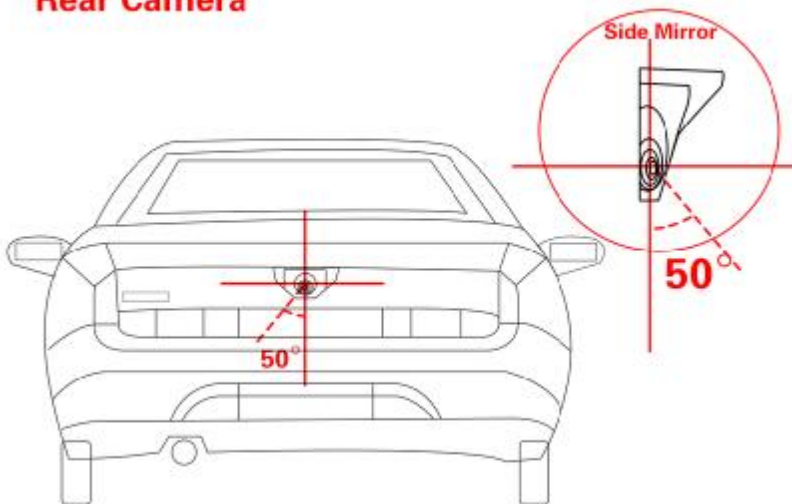
2.1 Principles for side cameras Installation

Keep in mind that choose a proper camera installation position to get as many pixel contents as possible while keep the door of the car is visible. So for the side cameras, since all these cameras is wide angle fish-eye cameras, so keep it is visible for the door of the car will always not be problem, please choose a far side to drill the hole for the side mirror, and please be well noted that there is also some physical limitation when drill the hole which should keep as many pixels contents while keep a nice appearance.

Front Camera



Rear Camera

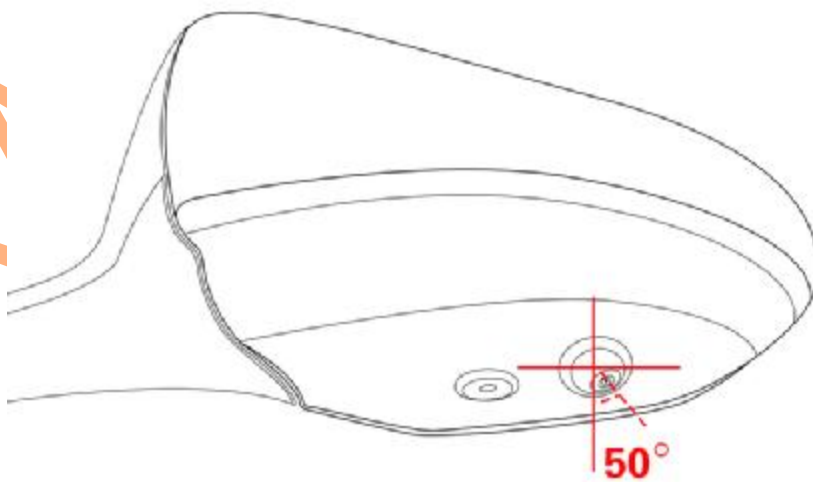
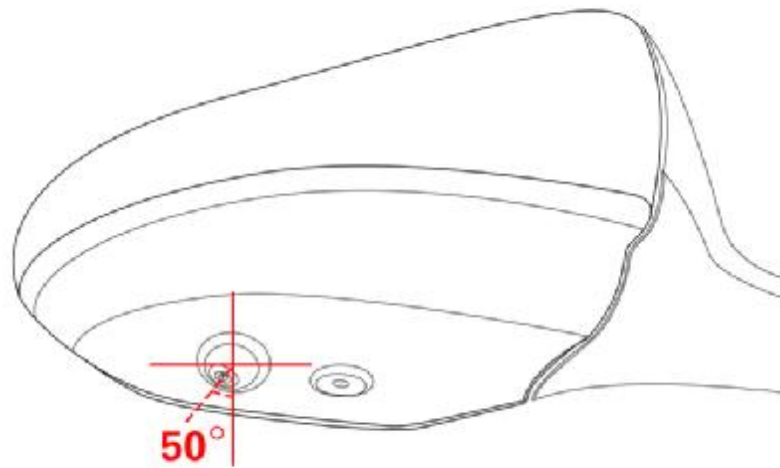


For most cases when in the dark environments, the side lightening condition is not as good as the front or rear camera, so it is always necessary for the end customer to choose the LED light

accessory. These kind of LED is very useful not only for the lightening purpose but it also act a caution light in parking mode. Our system has a G-sensor to detect the event of a collision or a scratch, it is very sensitive to detect small vibrations, and the LED is power on to indicate a recording function is starting.

2.2 Principles for front/Rear camera Installation

For the Front/Rear Camera, the basic principle lie on the height when install those cameras. As you know the higher the installation position should be, the better video quality you are expected to get. And if you are the authorized distributor or OEM cooperater for NEXADAS, it is strong recommended to choose a SUV or MPV working as a demonstration.



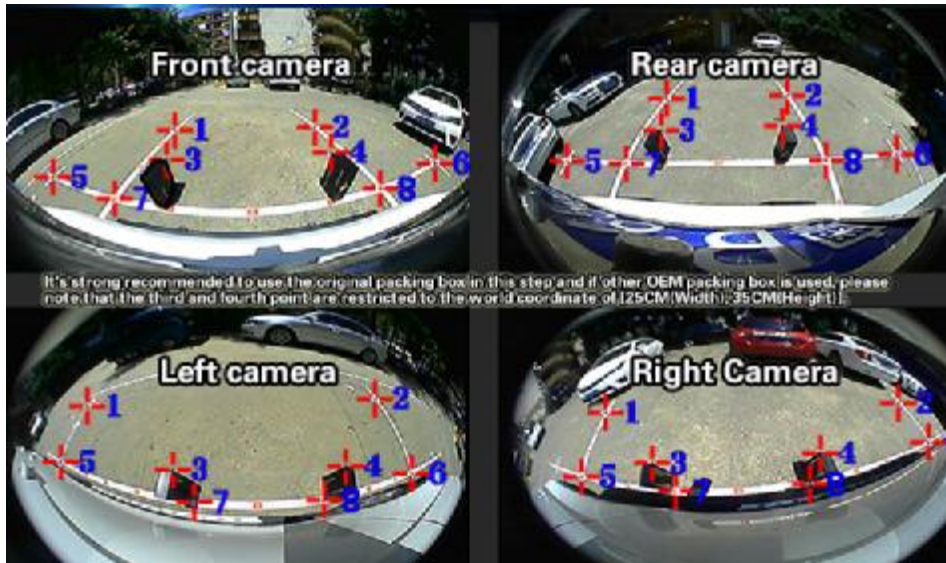
1.

3 Camera Calibration

3.1 How to paste the tape on the ground

3.1.1 Introduction

Since we need to choose 8 pixels for each camera during initial camera calibration phase. The following picture give you a basic understanding on how to pick out these special pixels through the remote controller.



3.1.2 Software operation steps

1. First please "mode" button in the remote controller to toggle into system managements interface. Once the mode button is pressed, the system will pop up the main dialog as follows:

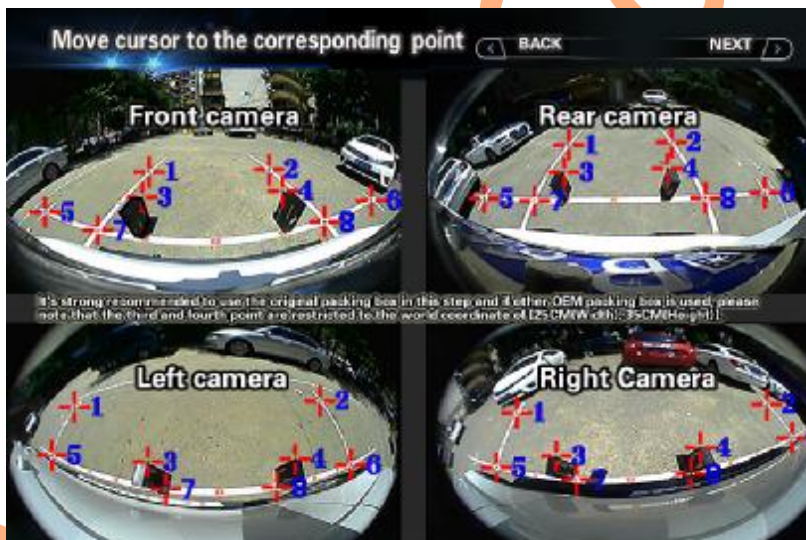


2. Enter the confirm button to Camera Calibration.

3. You need first to choose the vehicle type camera sensor type. For most common case, choose light duty vehicle, and change the sensor class to PC3089, other menu is used for advance user, if you are the first time to use this menu, keep the following shadow options as default.



4. The following menu is used to give a reference when paste the marked tape, if you are familiar with this picture, please go to next step directly.



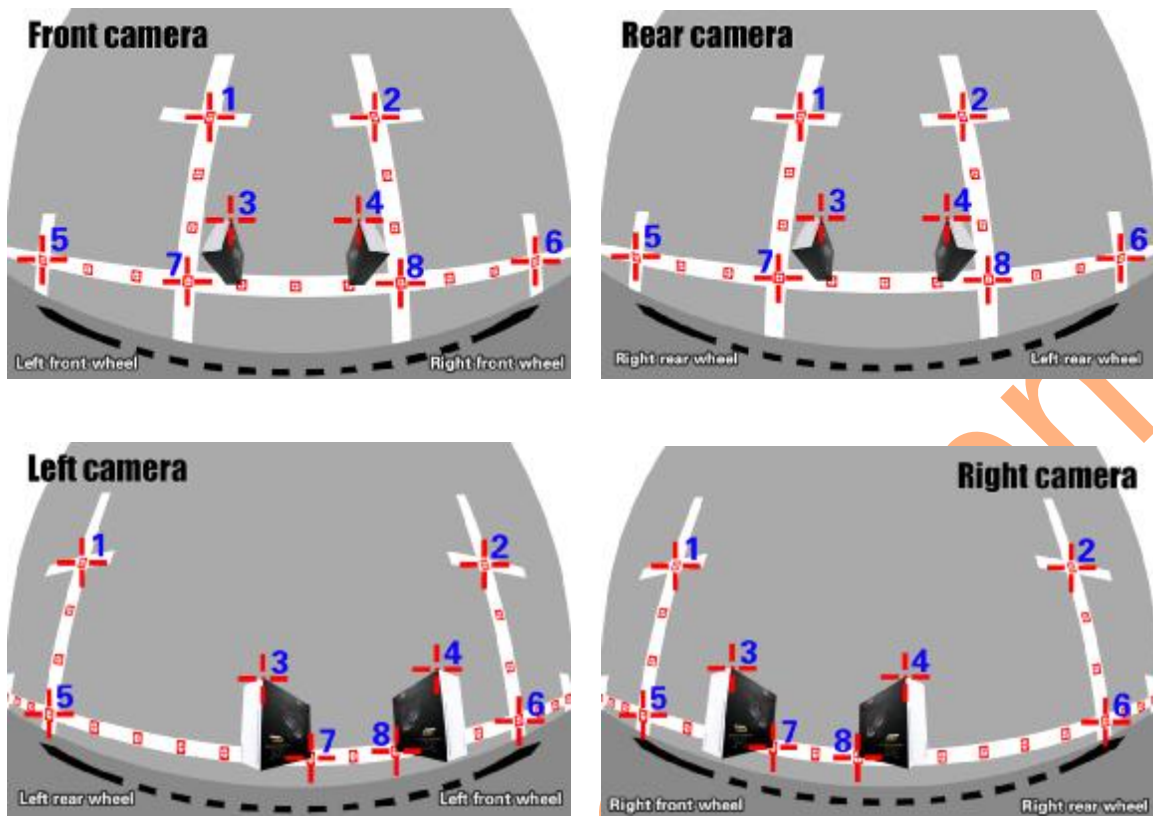
5. Then you need to confirm the whether the output image from each sensor is mirrored or not. If the image is not mirrored please choose the Original Image and vice, versa.



6. After the sensor direction is confirmed, then pay all attention to move to the most important phase, camera calibration. Please carefully use the remote controller to shift the cross cursor to the accurate position of the corresponding points in right order. Please check the following picture for a better understanding. There is something in common like,

- (1) The distance between the packing box is 1m;
- (2) The space points is always marked as point-3 and point-4;
- (3) The point-3 and point-4(space points) should be 30cm high and 25cm away from the ground mark point.
- (4) Keep in mind that the way how to paste the marked tape and how to place the packing box is different between front/rear camera and side cameras. But there is symmetry between side cameras and between front camera and rear camera. Please review the top view of the entire calibration system picture at the beginning of this documents.

1 Because fast merging mode only take several seconds but meanwhile the Merging All mode take about fifteen minutes. And you can take full use of Fast Merging mode to double check if something wrong is existing in the previous steps. If you can get a perfect



7. If you has passed through all the above mentioned steps, congratulation, you are more close to get the final image. Please choose "Fast Merging" first before "Merging All".



4 Because fast merging mode only take several seconds but meanwhile the Merging All mode take about fifteen minutes. And you can take full use of Fast Merging mode to double check if something wrong is existing in the previous steps. If you can get a perfect merged video as a result, then congratulations, and the system will guarantee the success to get a perfect result in Merging All mode.

4 Diagnostics & Trouble Shooting

[Trouble 1]. Some part of the image after Fast Merging complete is blank.

If you are steadily confirmed that all these above-mentioned steps are correct, please use your smart phone to take a photo after you finish each step when move done all cross cursor to these corresponding calibration points to us, our system can dump all these calibration data to TF card and our technical team will help you to find the root of the problem once we get your calibration data. Please contact our sales if you need more instruction on how to dump the calibration data.

[Trouble 2]. Picture after merging is not accurate or seamless

These problem is mainly caused by the installation position, and these case is most common in the vehicle with a lower chassis, the picture quality captured by the camera will be poor and so that the calibration error will be magnified.

These problem will also come out when you are lacking of care when move the cross cursor to the calibration points, the error is magnified manually.

[Trouble 3]. Some part of the picture after merging is mirrored

If you are choosing some OEM camera in your own supplier chain, please confirm whether the image from the sensor is mirrored or not, and if mirrored, please choose the mirror function in the menu.

[Trouble 4]. The corner part of the picture is blank

These problem may be caused by the camera itself, please make sure if the camera get sufficient pixel content after camera installation(whether the installation position is too close to the ground)

[Trouble 5]. The merging result is completely fail

1. Be careful to choose a proper vehicle size when starting the camera calibration. Different vehicle should choose the corresponding size in the first step.
2. Make sure there is no low level mistake, just like take the front camera when calibrate the rear camera or make a mistake for the left/right direction.
3. If you are steadily confirmed that all these above-mentioned steps are correct, please use your smart phone to take a photo after you finish each step when move done all cross cursor to these corresponding calibration points to us, our system can dump all these calibration data to TF card and our technical team will help you to find the root of the problem once we get your calibration data. Please contact our sales if you need more instruction on how to dump the calibration data.

5 Service Promise



As a leading R&D enterprise in the Automobile industry, we are committed to engineering and manufacturing our products to the highest standards of quality, performance, and value. From our advanced product design, manufacturing and quality control procedures to our friendly and knowledgeable support teams, our commitment to satisfy you is paramount. In every interaction with NEXADAS, you can be confident you will receive our commitment to Service, Support, and Solutions. For 7 years, our objective has been to ensure that every customer is completely satisfied with every purchase. To underscore this commitment, we offer our Satisfaction Guarantee. This means we will work diligently to resolve any issue you have with your purchase until you are completely satisfied. NEXADAS employees are prepared to do whatever it takes to make certain that the entire process of doing business with us is a positive and professionally rewarding experience for you. We greatly appreciate your business. It is our intent to keep you as a customer for life.

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