

FD505 Wheel Alignment System User Manual

Service and support

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5D Four-wheel alignment system use precautions

- The operator must undergo the training of the company and be qualified before operation. The operator must have a certain basic knowledge of computer application and understand the basic knowledge of four-wheel alignment.
- FCAR 5D four-wheel aligner is a precision instrument and requires a dedicated person to manage the use to avoid collision and fall.
- The computer of the 5D four-wheel aligner is professionally used for the device. It is not allowed to load other software or hardware; it is not allowed to delete or change various applications in the computer at will; non-equipment maintainers should not tamper with the computer.
- Regularly check the level of the car's positioning ground to ensure correct testing and personnel safety. Remove obstacles around the car's location area to prevent impact on operations.
- The equipment structure and supporting tools in this manual should be read carefully before installation and commissioning.
- Avoid switching the computer host frequently.
- It is forbidden to disassemble the host and supporting tools.
- The fixture must be securely mounted on the rim.
- Power supply requirement:
 - a. Check if the power cable connection is reliable and damaged. Please use the socket with ground wire to charge the main head of the aligner. If the power supply voltage is unstable, please equip the AC voltage regulator by yourself.
 - b. Be sure to use a three-core protective power plug and socket with grounding to ensure personal safety and equipment stability.

- c. After the test is completed, exiting and closing the 5D four-wheel alignment system, please turn off the power on the socket to avoid damage to the equipment caused by the power grid spike.
- d. Special care must be taken that the relevant power supply equipment connected to the machine must comply with your country electrical standards. For example, not overloaded, the line must be safe, etc. otherwise it will cause damage to the machine, such as burning, etc. The company will not be responsible for the warranty of such problems.
- e. Do not pull or insert the cables of the machine without turning off the power.

FCAR 5D four-wheel alignment system

1 Product description

FCAR 5D four-wheel alignment system is the product and platform of FCAR self-developed vehicle four-wheel alignment., combined with the application feedback of 3D aligner users and the lack of 3D products. (Field, precision, transportation, installation, shunting, etc.) Through more than 5 years of research and development and test verification, it has launched an era-based, landmark four-wheel aligner product. Since then, the four-wheel aligner has achieved a leap from the 3D era to the 5D era.

1.1 When do you need to do wheel alignment?

When the following condition occurs, the vehicle needs to do wheel alignment:

- A. In general, it is recommended to do alignment for every 15,000 km or six months of driving;
- B. In general, for the new car, it is recommended to alignment after driving 3000 km;
- C. The direction is not straight when going straight, the steering wheel is vibrating, shaking or the steering wheel is too heavy, and it cannot be automatically returned

when turning.

- D. The vehicle is snaked or deviated to left and right in the driving direction, and the body is unstable and so on.
- E. There is a phenomenon of tire abrasion on the front or rear wheels.
- F. The tire is single-sided, irregular, blocky or feather-like abrasion.
- G. After installing new tires or after crash accident repair, and after updating new suspension or steering related accessories.

1.2 Definition of wheel alignment

In order to ensure the stability of the straight-line driving and the lightness of handling, and to reduce the wear of automobile tires and other parts, many factors must be considered to determine the angle between the wheel and the ground, the installation between the steering wheel, the steering knuckle and the front axle with the frame should maintain a certain relative position. This positional installation is called steering wheel alignment, also known as front wheel alignment.

Previously used wheel alignment referred to front wheel positioning, and now vehicles require rear wheel positioning in addition to front wheel positioning. The front and rear wheel positioning of the vehicle is to detect the angular position relationship between the car frame, the suspension member, the wheel, and the front and rear wheels in the direction of the X, Y and Z axis. After the vehicle is accurately measured by a dedicated instrument, the measurement result is compared with the original design standard parameters and adjusted to the standard range to meet the original design requirements to achieve the desired vehicle driving performance.

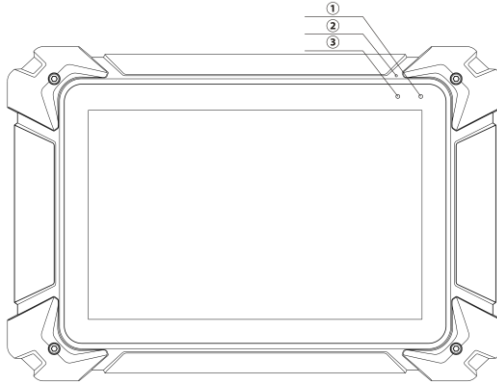
1.3 Product configuration

The general configuration of the FCAR 5D four-wheel alignment system is shown in the following figure.

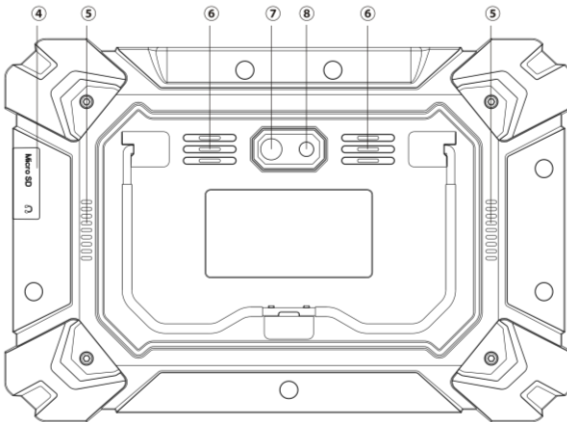

Technical parameter:

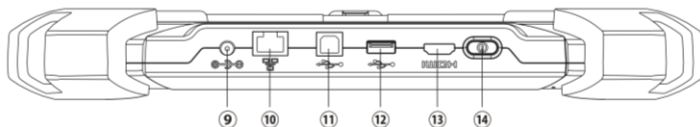
Measure item	Measure accuracy	Measure range
Camber angle	$\pm 0.01^\circ$	$\pm 8^\circ$
Caster angle	$\pm 0.03^\circ$	$\pm 19^\circ$
Front wheel inclination angle	$\pm 0.02^\circ$	$\pm 19^\circ$
Toe	$\pm 0.01^\circ$	$\pm 2^\circ$
Rear wheel thrust angle	$\pm 0.02^\circ$	$\pm 2^\circ$
Rear wheel axle deflection	$\pm 0.02^\circ$	$\pm 2^\circ$
Wheelbase difference	$\pm 0.02^\circ$	$\pm 2^\circ$
Front set back	$\pm 0.02^\circ$	$\pm 2^\circ$
Rear set back	$\pm 0.02^\circ$	$\pm 2^\circ$

Tablet structure diagram



Serial number	Name	Description
①	Power Indicator	Charging indicator
②	Microphone port	Voice input
③	Light sensor	External light intensity sensing





Serial number	Name	Description
④	TF card slot / 3.5mm headphone hole	Storage TF card location / headphone hole
⑤	Heat dissipation hole	For tablet cooling, avoid overheating
⑥	External horn hole	For external sound playback
⑦	Camera	For photography or video recording
⑧	Flash lamp	Used to provide light when light is weak
⑨	DC power port	For tablet charging or power supply
⑩	RJ45 interface	For network connection
⑪	USB interface (B shape)	Device interface: used to connect computers and use tablets as USB drives
⑫	USB interface	Host interface: for tablets to connect to other devices or to connect to USB drives
⑬	HDMI interface	Standard HDMI interface: used to connect HDTV output
⑭	Power switch	For on / off tablets, or for locking screens

1.4 Product functions and features

- **High precision**

5 high-resolution 2 million pixels ultra-clear industrial cameras, which can realize the change of the wheel angle of the whole car. With higher accuracy, the compensation

calculation error is based on the change of the intermediate camera monitoring level. Supported with double adjustment mode, wheel grounding adjustment, and wheel suspension adjustment, both the front and the rear of the car can be measured.

- **Wide sight**

The sight of camera can be adjusted freely, solving the problem that traditional 3D ultra-long, ultra-wide, ultra-narrow vehicles cannot measure.

- **Specialization**

The industrial-grade computer chip is faster and more accurate than the traditional computer in image recognition and angle calculation, and the measurement data is synchronized faster than 0.1 second. The position detection is rotated by rotating the target to perfectly solve the measurement site limitation.

- **Intelligentization**

It can adapt to multi-port synchronous display such as Android tablet, Android TV and subsequent Android mobile phone; dynamic loading display, stereo display is more intuitive.

- **Practicality**

Applicable to all kinds of lifting platforms (double columns, four columns, small scissors, large scissors), it solved the traditional 3D aligner lifting platform and site restrictions; overseas version using air transport box with casters, single handling; through WIF mode can directly communicate with the tablet, it can be demonstrated immediately once powering up, and it is convenient and quick to install and operate.

2 Selection and use of supporting tools

FCAR 5D four-wheel alignment system tools include high-precision fixtures, targets, corner discs, etc. It will be introduced separately in the following.

2.1 The use of corner plate

The 5D four-wheel alignment system is equipped with two corner plates which installed at the front wheel position of the car. Before driving, lock the corner plate with the locking pin to prevent it from rotating. Do not remove the locking pin when measuring the toe and inclination, so as to avoid measurement errors caused by wheel slip when pushing the car. In order to make the wheels to rotate freely during the caster measurement, the locking pins on both sides of the corner plate must be removed.



Note: When getting in the car, make sure the wheel is at the center of the turntable.

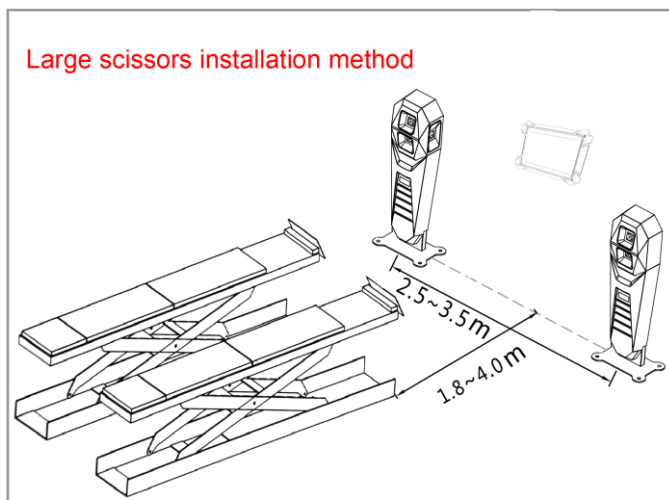
2.2 Special fixtures and targets

This fixture is a four-claw special fixture designed for the testing of 5D four-wheel alignment system. It has beautiful appearance and flexible use. The aligner is equipped with 4 targets (2 short and 2 long), which mainly provide target graphic reflection for the camera. The camera needs to be tested before testing to ensure that all four targets are within the camera's viewable range.

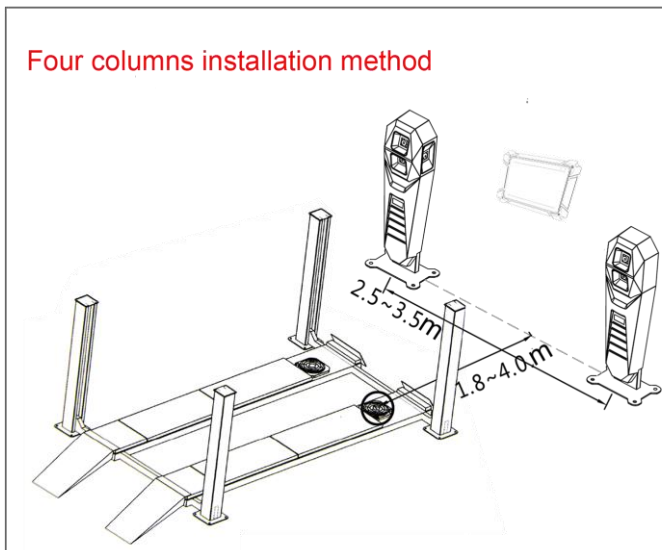
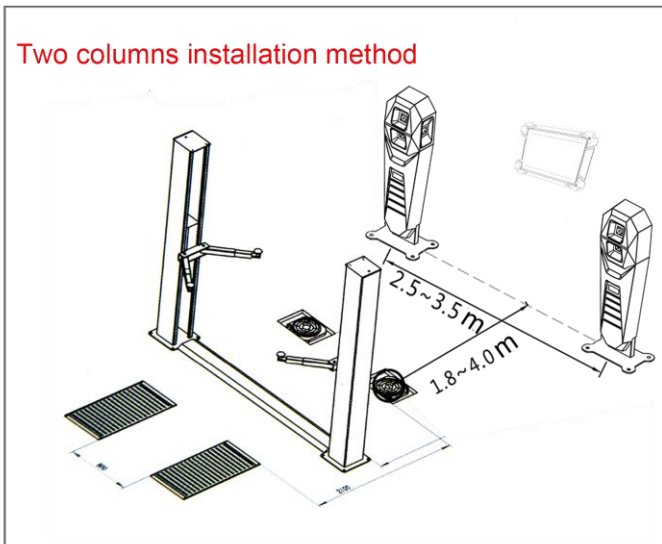


2.3 5D Four-wheel alignment system installation method

FCAR 5D four-wheel alignment system breaks through the limits of the field and is suitable for a variety of lifting platforms (two columns, four columns, small scissor and large scissors). The following are installation options:





Note: The small scissor installation scheme is similar to the large scissor



2.3.1 Target selection

Please refer to the table below to select the target type according to different lifting platforms:

Type	Physical view	Adaptation plan
Long target		large scissor/small scissor installation plan
Trapezoidal target		Two columns installation plan, four columns installation plan

Tip: the target type selection is complete and must be set in **[System Settings]**, as shown in **Chapter 6**.

3 Preparations before wheel alignment operation

3.1 Preparation before operation:

- 1) Install the corner plate and lock the corner plate with the locking pin to prevent it from rotating.
- 2) When driving the car, ensure that the tire is at the center of the corner plate. After stopping the car, tighten the handbrake to ensure that the car does not move, and the personnel are safe;
- 3) Check the rim size and tire pressure, the wear of the tires, the components status of the steering system and the suspension system, such as the tie rod ball head, shock absorber, etc. If there is excessive wear or unqualified component, please repair it first. Then perform wheel alignment.
- 4) Knowing the origin of car, manufacturer, models and factory year.
- 5) When car pushing compensated and adjusted, please ensure the horizontal position

of the steering wheel and use the steering wheel holder to lock it, as shown in the figure. When measuring and adjusting the caster measurement, pull the handbrake and hold the foot brake.



Figure 3.1-1 Steering wheel holder installation

3.2 Fixture/target installation

FCAR 5D four-wheel alignment system is equipped with 4 fixtures, 4 targets and 2 hosts. The host must be installed in the front position of the head of vehicle in the left and right direction (refer to the 5D four-wheel alignment installation method). The front wheel should install two short rod targets separately and the rear wheel should install two long rod targets separately.

➤ How to install fixture/target

The fixture has been locked to the center position before leaving the factory. There is no need to adjust the center and the fixture installation steps are as follows:

- 1) Rotate the hand wheel to make the claws fit to the diameter of the rim. The installation direction of the clamp is shown in figure 3.2-1;
- 2) The clamp handle is up and perpendicular to the ground, and the four jaws should stay to the edge of the rim closely;

- 3) Rotate the hand wheel again to adjust and lock the clamp to the rim position.

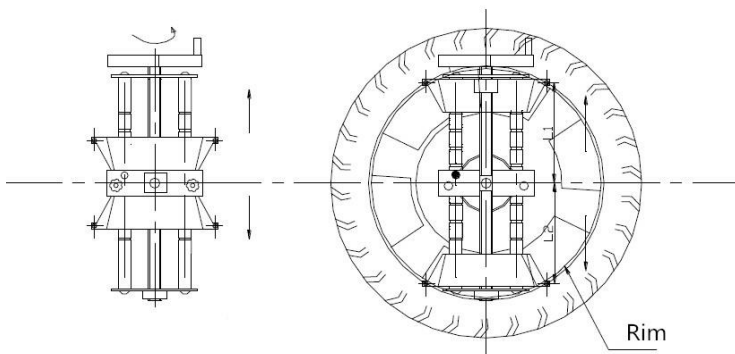


Figure 3.2-1 Fixture installation

The physical photo is shown below:



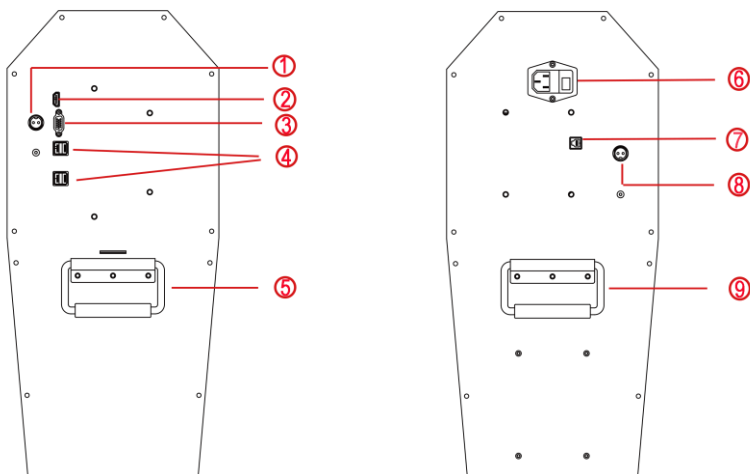
Note: When assembling the fixture, the claws should keep away from the lead block on the rim, please make sure that the four claws are in full contact with the rim.

Installed long and short target object as shown below:



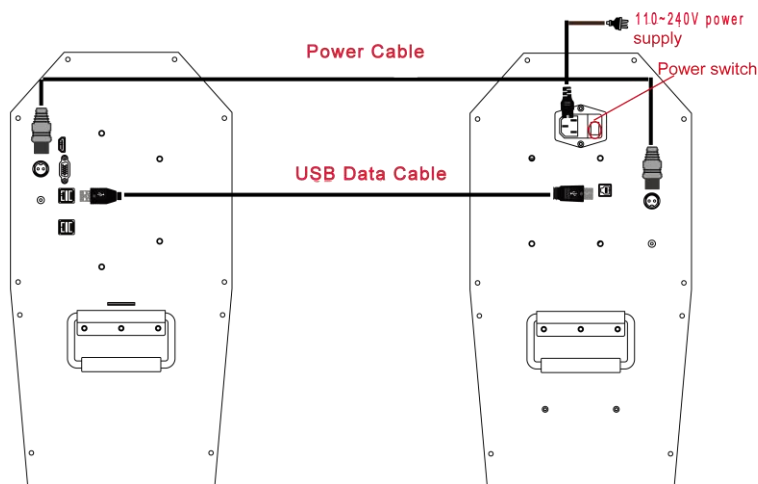
3.3 Device connection

The interfaces on the back of the main unit are as shown below :



Serial No.	Name	Serial No.	Name
①	Power interface	②	HDMI HD output
③	VGA interface	④	USB interface
⑤	Handgrip	⑥	Power interface
⑦	USB interface (B shape)	⑧	Power interface
⑨	Handgrip		

Connect the two mainframes with the power cord and data cable of our factory configuration as shown below. Connect the power plug to the standard three-terminal power socket. The power supply requires 110~240V. Turn on the power switch to start the two hosts.



3.4 Host on/off and function menu main interface

After the host is started, turn on the tablet. Since the tablet has been connected to Wi-Fi of the router built in the host computer at the factory, the program can connect to the host automatically. If not, you can manually select the connection according to the

Wi-Fi name identified on the host back. Run the program. the main function menu is shown as figure 3.4-1:





Note: How to connect, please confirm whether the host is started, whether the network is connected smoothly, or whether the Wi-Fi name is correct.



Figure 3.4-1 system main interface

The functions represented by each icon are shown in the table below :

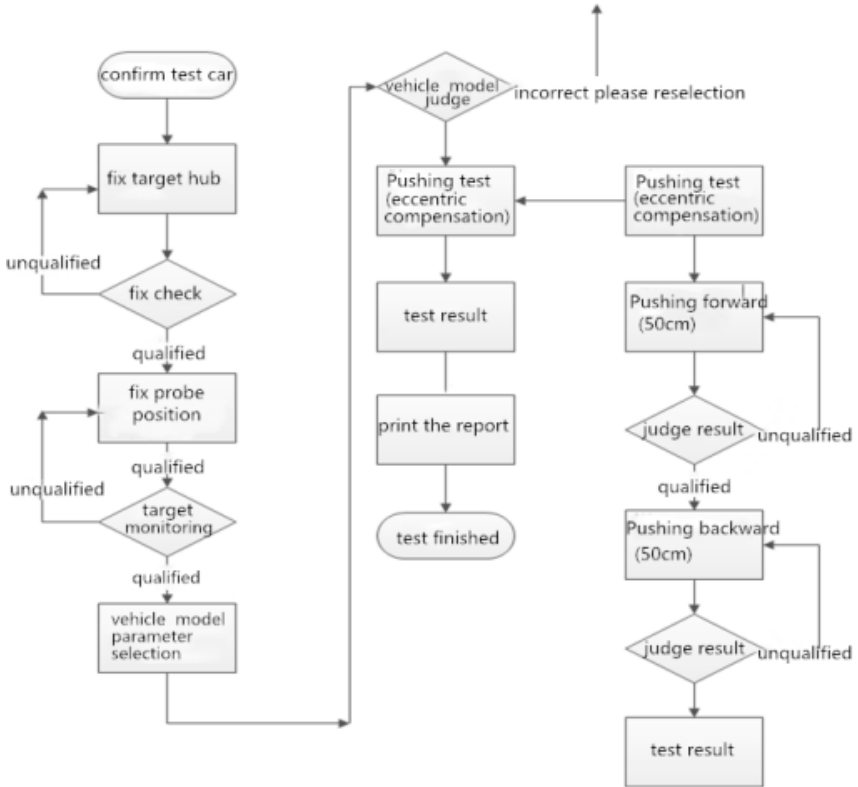
Icon	Icon name	Function description
	Target monitoring	Before wheel alignment, camera monitoring must be carried out to ensure that all targets are clearly within the visual range of the camera
	Select model	Select the model of the vehicle to be tested, and then directly enter the cart compensation and the caster measurement.

	Fast positioning	With this function, the maintenance technician can quickly judge whether the relative position of the camera and the target is correct or measure in the mode without vehicle data
	Maintenance information	View, modify, print service records
	System settings	Device private settings, global system settings, shop information settings, etc
	Exit	Exit 3D four-wheel alignment system normally and return to Android desktop

4 5D Four-wheel alignment system operation process


Before testing the wheel, the target should be monitored to ensure that the target is complete clear within the camera viewable range. After the target monitoring is completed, the vehicle pushing compensation and the caster measurement can be performed. If the measured result does not meet the requirements of the standard database, the corresponding adjustment should be made. After the adjustment is completed, a test run should be carried out to check whether the abnormal condition of the vehicle is eliminated. If the standard is not met, the measurement should be re-adjusted. The functions and operation methods of FCAR 5D four-wheel alignment system will be specifically introduced below.

The flow chart is as follows:



The two measurement modes of the FCAR 5D four-wheel aligner: ground mode and lift mode to meet different measurement platforms or site limits for users. The following two measurement modes are introduced separately.

4.1 Target monitoring

Before performing four-wheel positioning, no matter which measurement mode is used, target monitoring is required first. Select Target Monitoring  on the main interface of the system, as shown in figure 4.1-1 and 4.1-2, to ensure that all four targets are clearly within the visible range of the camera.

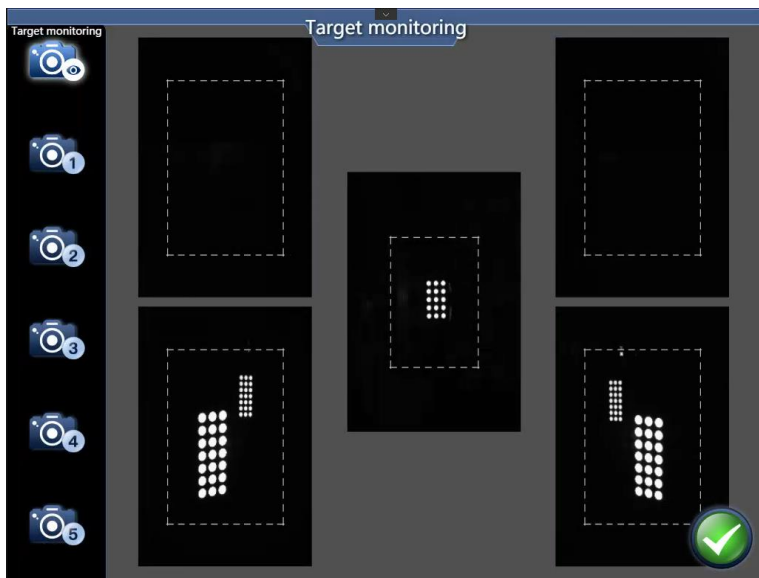


Figure 4.1-1 camera monitoring

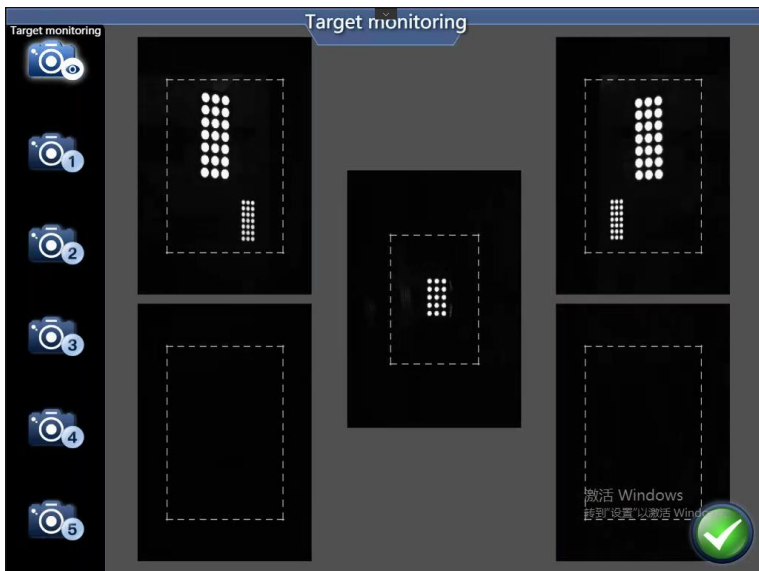


Figure 4.1-2 Target monitoring and lifting mode

Note:

1. During the test, the object or person between the camera and the target should be removed to prevent the target from being blocked, and ensure that the ground will not reflect light which will affect the measurement results.
2. If the target is blocked, the left and right targets should be properly adjusted. The target must be clearly visible.
3. Before entering the target monitoring, please make sure that the target type and front position are set correctly. For details, see **Chapter 6 System Setting**.

4.2 Ground mode

General measurement flow of ground mode: Model selection→ Push compensation →adjust→ Back tilt measurement→ adjust→ Test drive→ Save measurement data →View/print results, the operation flow and method of general measurement will be described below.

4.2.1 Vehicle selection


Select  on the main interface of the system, the system will automatically enter the vehicle selection interface. The vehicle selection interface is shown in figure 4.2.1-1:



Figure 4.2.1-1 Vehicle selection



Figure 4.2.1-2 Standard data

About the model data, you can get the custom model data through the two ways.

1) Custom Models

You can add a model to your custom models through the following operation:

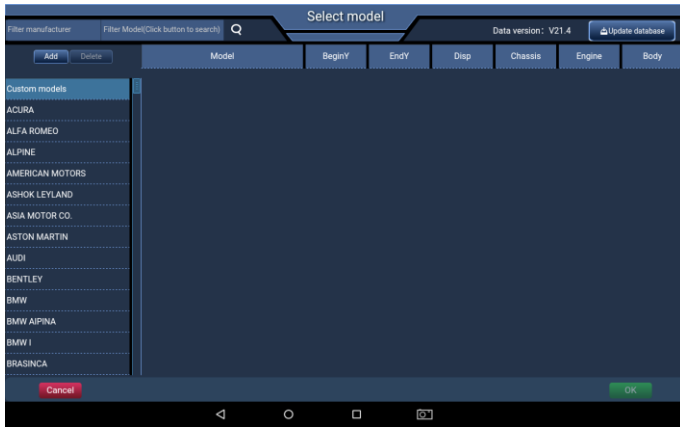
Select a model, then press the **[Copy To Custom]** button in the **Select model** interface, and the model will be added to your custom models.

When you select **[Custom models]** menu, you can see your custom models list. Through the **[Add]** or **[Delete]** button in the upper left corner of this page, you can add or delete a

model.

Note:

- Please add the model data according to the factory standard, do not add it at will!
- You cannot delete any of the system models.

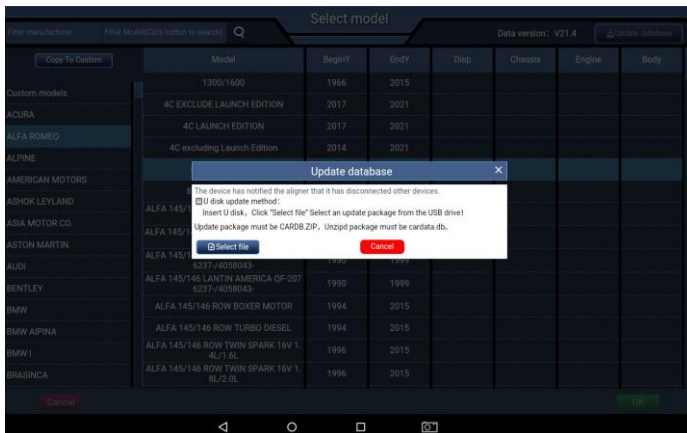


2) Update Database

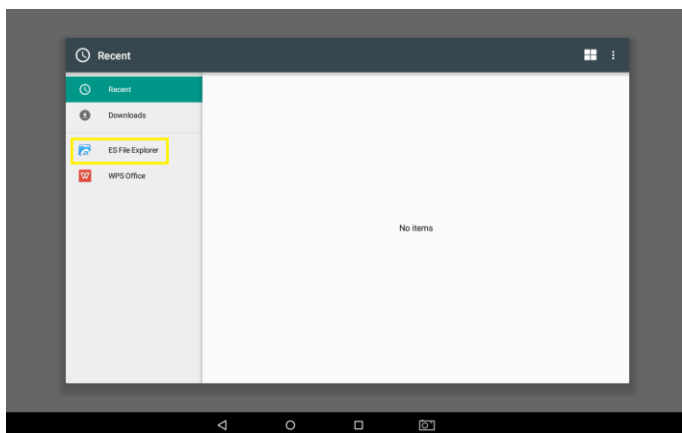
You can add the model data in batch through this function. FCAR provides the new model data regularly.

The detailed steps are as follows:

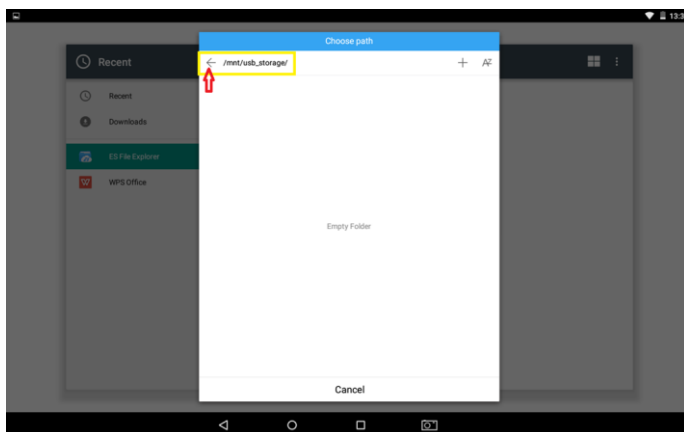
- Press the button [**Update database**] in the **Select model** interface, the system will pop up the dialog as shown below.



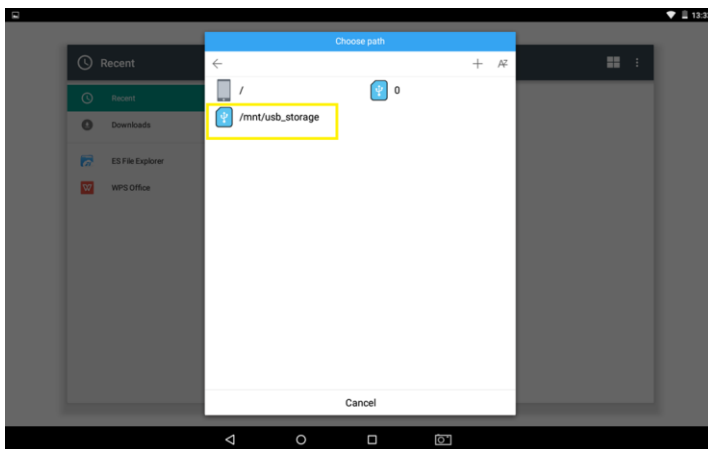
- b) Insert an USB disk with data package **cardb.zip** to F7 series tablet
- c) Click [Select file], you will see [ES File Explorer]



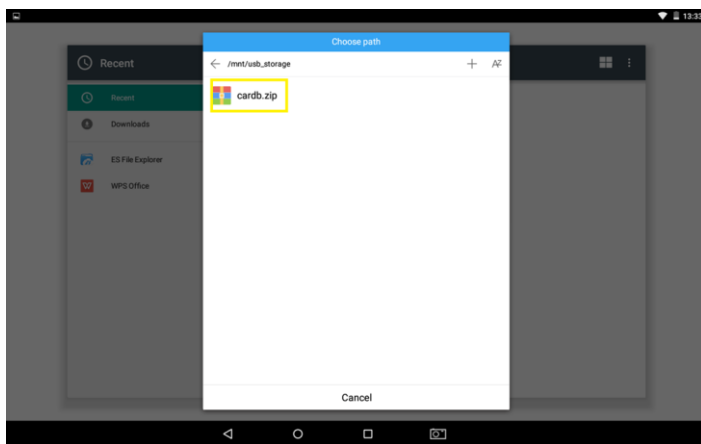
- d) Open [ES File Explorer], and the system will pop up [Choose path] dialog, then click the arrow to return to the homepage of folder



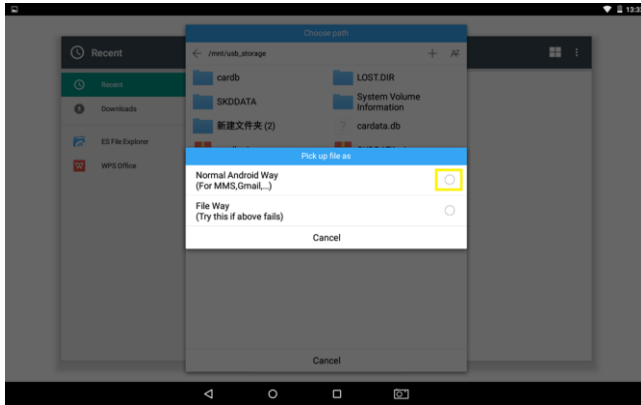
- e) Click **/mnt/usb_storage** to open the USB disk



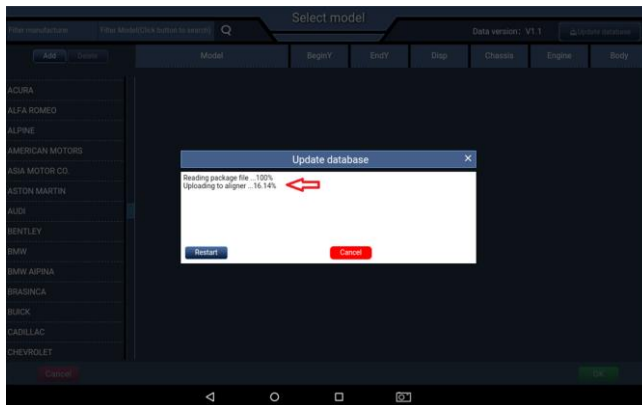
f) Open the data package **cardb.zip**



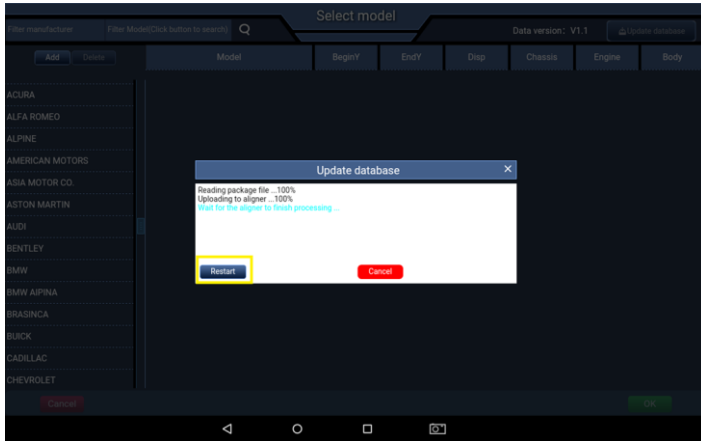
g) Select the first way



h) Wait for the system reading and updating the data



i) Click [**Restart**] to restart the host after completing the data updating



- j) Turn off the host and then turn on it to restart.

4.2.2 Vehicle pushing compensation

After finding the model to be tested, click **【OK】** to automatically enter the pushing compensation measurement interface. If the target positioning is not accurate, there will be corresponding adjustment prompts, as shown in figure 4.2.2-1, or other prompt information, Adjust the target respectively, until the prompt disappears.

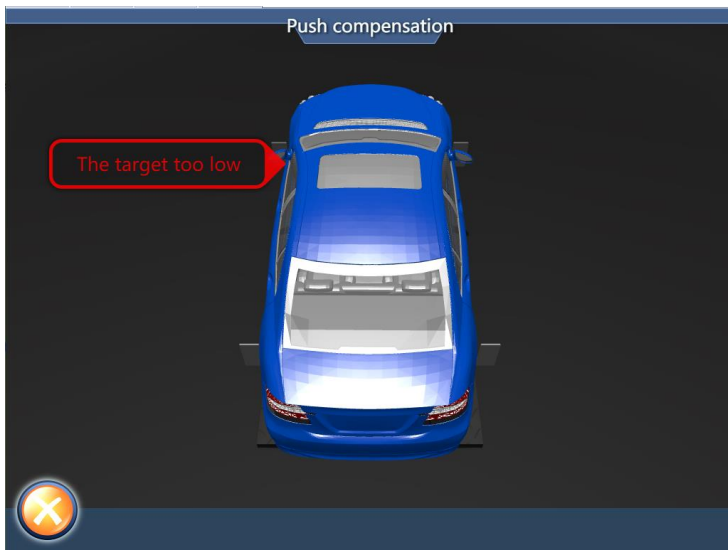


Figure 4.2.2-1 Target adjustment prompt

After the adjustment is completed, the program automatically enters the car pushing interface, as shown in figure 4.2.2-2.

➤ **How to perform vehicle pushing compensation**

- 1) According to the pushing prompt, drive the car slowly and evenly backwards about 15CM (the steering wheel is centered);

Note: Before pushing the car, you must ensure that the steering wheel is horizontal and lock it with the steering wheel mount.

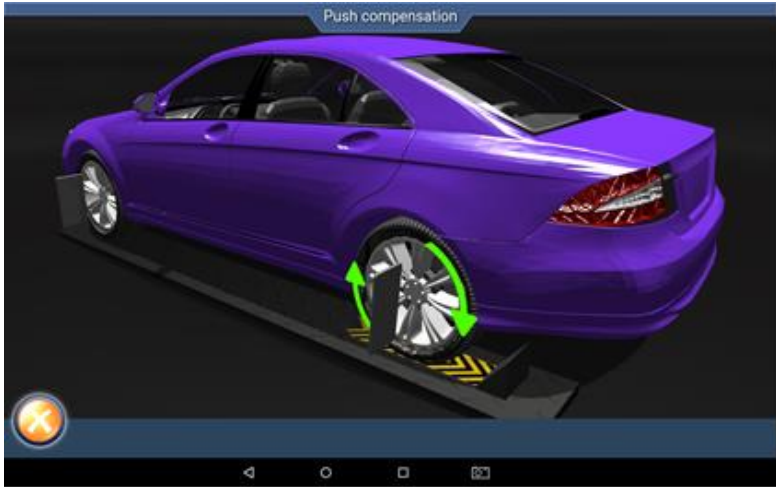


Figure 4.2.2-2 Backward pushing

- 2) When the following interface is prompted, please stop pushing backward and the rubber pad can be used to stuck the wheel;

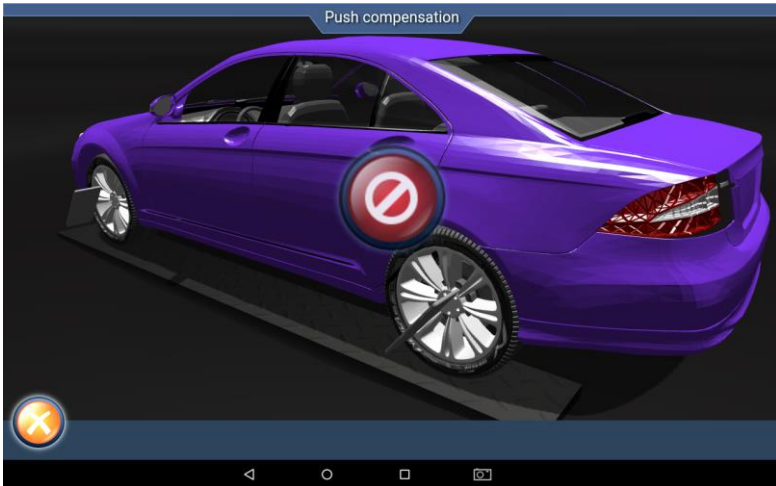


Figure 4.2.2-3 Stop pushing

- 3) When the following interface appears, move slowly and evenly forward according to the screen prompts;

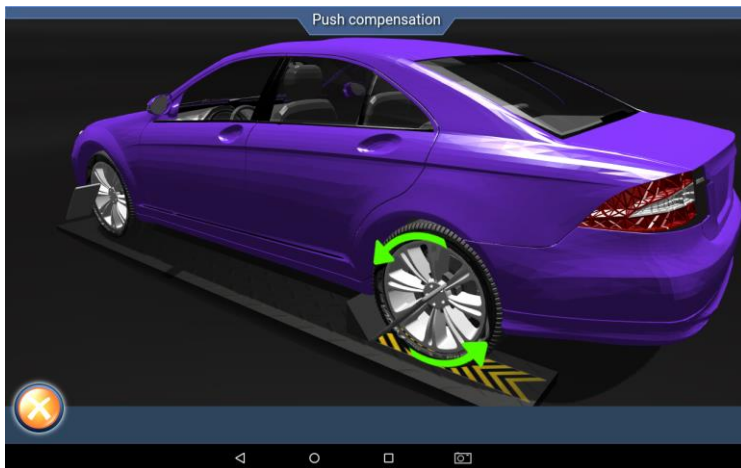


Figure 4.2.2-4 Forward pushing

- 4) When the following interface is prompted, stop pushing forward. At this time, the system may take a few seconds to calculate, please wait;



Figure 4.2.2-5 Stop pushing

- 5) If the measurement is successful, the system will automatically jump to the measurement result interface, as shown in figure 4.2.2-6 (The measurement data of

the figure is only for operation instructions, and does not have any reference value).



Figure 4.2.2-6 Measurement result

In order to make the user more directly understand the condition of the vehicle, the result display interface uses different color fonts to indicate whether the current measured value is within the standard range:

Red font: measured value beyond the standard range

Green font: measured value within the standard range

Precautions

1. During the measurement process, the object or person between the camera and the target should be removed to prevent the target from being blocked and affecting the measurement results.

2. Before measuring, be sure to center the steering wheel and fix it so that the steering wheel does not rotate during the pushing process, which will affect the test results.

4.2.3 Caster measurement

When measuring the caster, the pneumatic handbrake must be effective, and the

corner plate is installed at the center of the front wheel of the car. In order to make the wheel to rotate freely, the locking pin on both sides of the corner plate must be removed.


In the cart compensation measurement result interface, select the back tilt measurement in the lower left corner  back tilt measurement interface as shown in the figure 4.2.3-1:



Figure 4.2.3-1 Back tilt measurement interface

The caster measurement is for the front wheel, including the inclination angle and the caster angle. The inclination angle distributes the vehicle weight evenly over the bearing, protects the bearing from damage, and makes the steering force average and the steering light. The presence of the caster angle allows the intersection of the steering axis and the road surface to be in front of the grounding point of the tire, and the resistance of the road surface to the tire can be used to keep the car straight.

Operation interface instruction:

- Scroll bar: the red square will slide left and right as the steering wheel turns;
- Turning direction prompt: prompts the operator to turn the steering wheel;

- c. Target status: When there is an error in the target data acquisition, there will be a corresponding target position adjustment prompt.

Note: The handbrake must be pulled and the foot brake must be held before the caster measurement and shunting.

➤ **How to perform the caster measurement**

- 1) According to the interface prompt, first turn the steering wheel to the right (about 8°). When the scroll bar is close to the edge, stop turning the steering wheel.



Figure 4.2.3-2 Right turn steering wheel

- 2) According to the interface prompt, turn the steering wheel to the left (about -8°). When the scroll bar is close to the edge, stop the steering wheel

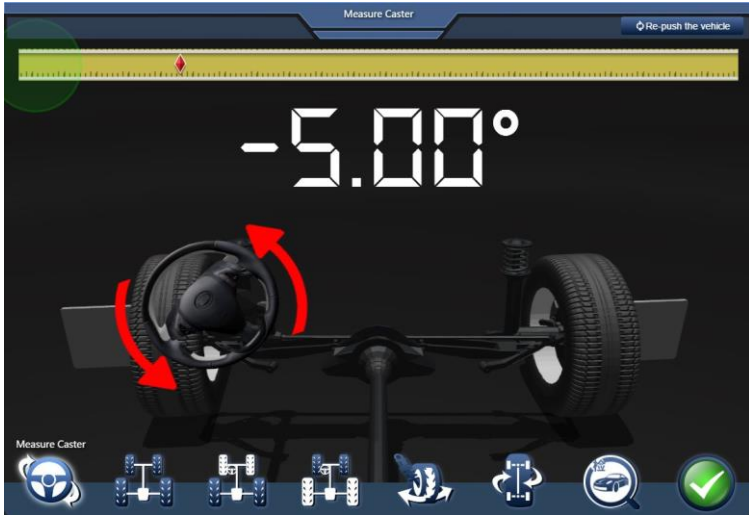


Figure 4.2.3-3 Left turn steering wheel

- 3) At this point, according to the prompt, slowly return to the right steering wheel (about 00 or so);



Figure 4.2.3-4 Back to the steering wheel

4) If the measurement is successful, the system will automatically pop up the measurement results, as shown in the figure:



Figure 4.2.3-5 Backward measurement results

In order to make the user more directly understand the condition of the vehicle, the result display interface uses different color fonts to indicate whether the current measured value is within the standard range:

Red font: measured value beyond the standard range

Green font: measured value within the standard range

Black font: current measured value without reference range

4.3 Lift mode

General measurement procedure for lift mode: Model selection ⇒ Lift the vehicle/push compensation ⇒ adjust ⇒ back tilt measurement ⇒ adjust ⇒ Test drive ⇒ Save measurement data ⇒ View/print results, The following describes the operation flow and method of the lift mode.

Note: Before the cart is measured, the steering wheel must be level and locked

with a steering wheel retainer.

- 1) In the four-wheel data interface, click [**Lift up the vehicle**] in the upper left corner, the software automatically switches to the lift measurement mode, and the target monitoring mode is also automatically switched.



Figure 4.3-1 four-wheel data interface

- 2) When the software pops up the following prompt, please operate the lift and Lift the body slowly;

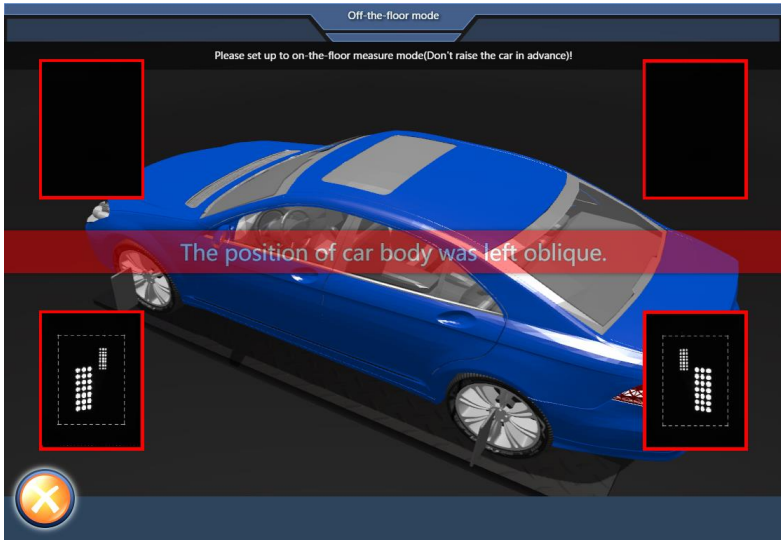


Figure 4.3-2 Off-the-floor interface1

- 3) If the frames of target graphics are red, the targets are not the correct position. Need to lift the body or adjust the elevation angle of targets. When the frames turn green, stop lifting the body and click **【✔】** to complete the lift mode setting ;

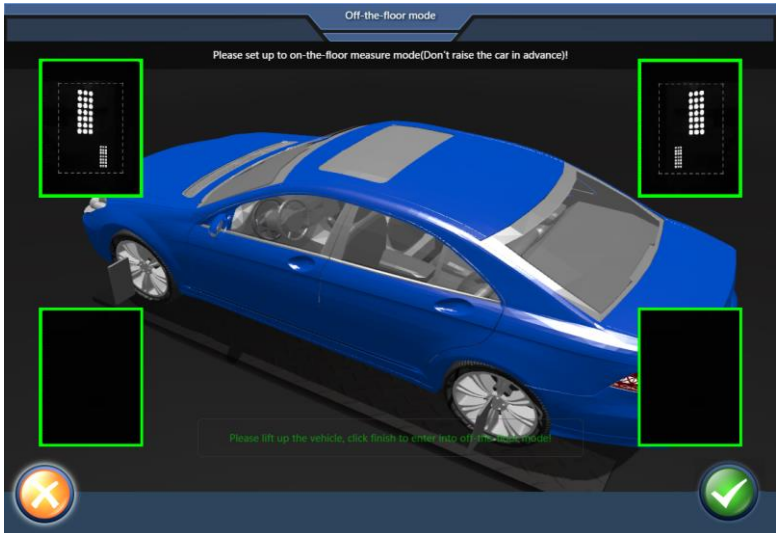


Figure 4.3-3 Off-the-floor interface2

- 4) After the lifting mode is set, the software automatically returns to the four-wheel data interface in the lifting mode. As shown in the figure below, click [**Re-push the vehicle**] in the upper right corner to start the cart compensation measurement;



Figure 4.3-4 four-wheel data interface in the lifting mode

- 5) The push compensation interface is shown in Figure 4.3-5. First, slowly turn the left rear wheel backwards according to the prompt until the yellow reference line reaches the green dot position, as shown in Figure 4.3-6, stop rotating;

Note: Do not touch the target when turning the wheel !



Figure 4.3-5 push compensation interface1



Figure 4.3-6 push compensation interface2

- 6) According to this method, the rotation is reversed: left rear wheel, right rear wheel, right front wheel, left front wheel;

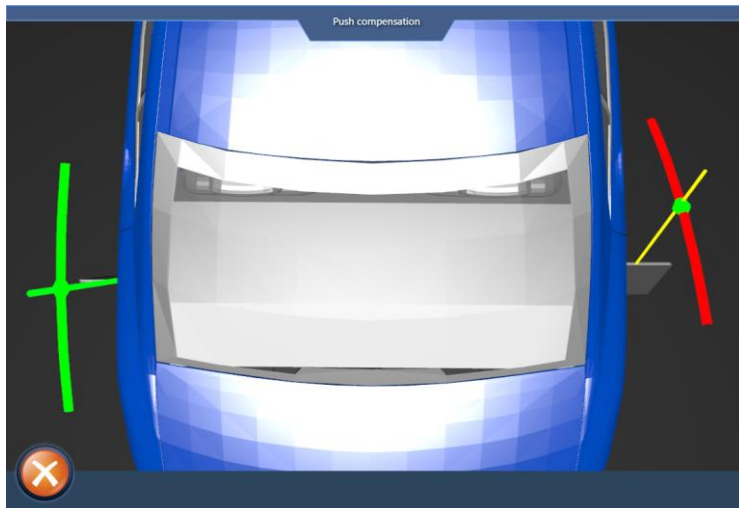


Figure 4.3-7 push compensation interface3

- 7) The measurement is completed, and the measurement result is as shown below (the measurement data of the legend is only for operation instructions and has no reference value).



Figure 4.3-8 four-wheel data interface

In order to make the user more intuitive to understand the condition of the vehicle, the result display interface uses different color fonts to indicate whether the current

measured value is within the standard range :

Red font: measured values are outside the standard range

Green font: measured values are within the standard range

Precautions :

1. During the measurement process, the object or person between the camera and the target should be removed to prevent the target from being blocked and affecting the measurement results.
2. Before measuring, be sure to center the steering wheel and fix it so that the steering wheel does not rotate during the cart, which will affect the test results.

4.4 Vehicle adjustment

In the measurement result interface, select [**Adjust the rear wheel**], [**Adjust the front wheel**] or [**Adjust the caster**] to enter the adjustment interface, as shown in figure below:

The general adjustment order of the wheels: First the rear wheel and then the front wheel.

Rear wheel adjustment order: camber angle → toe

Front wheel adjustment order: caster angle → inclination angle → camber angle → wheelbase → toe

Note: For more general overview of wheel aligners and analysis of measurement data, please see the appendix!




4.4 Adjustment interface

Attention!

If the new car or the car with good condition can be adjusted to the qualified range according to the standard data, the abnormal phenomenon can be eliminated; but the old car or the car with the aging condition can only be used as a reference.

4.5 Data saving

When you click the button  after completing the vehicle adjustment, the system will automatically pop up the following prompt, select [Save Data], fill in the vehicle related information on the maintenance record interface, click [OK] to save, all test records can be viewed or changed in the data maintenance interface.

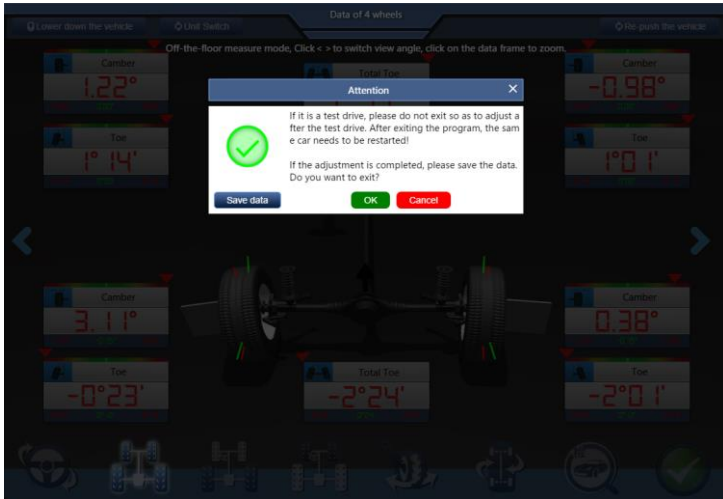



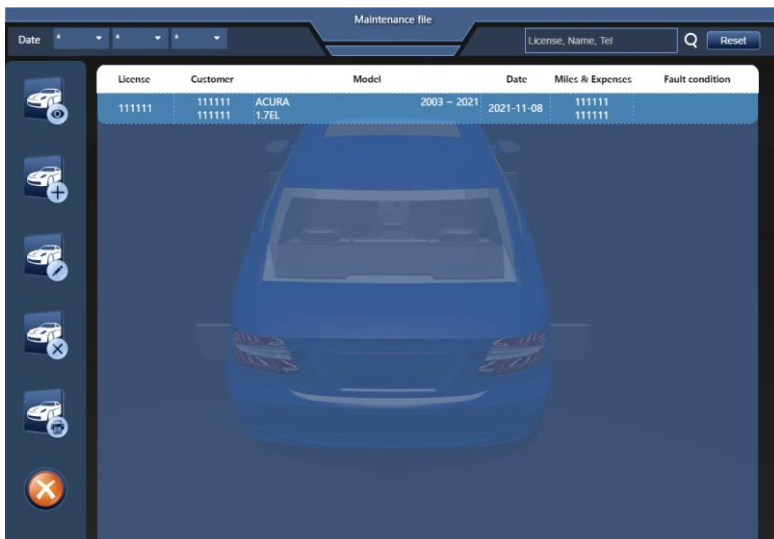
Figure 4.2.6-1 Data saving prompt



Figure 4.2.6-2 Save measurement data

5 Maintenance information

Select the maintenance data icon  on the main function interface to view, modify, delete, create, print, etc. the service records.



To print a four-wheel alignment test report, users need to install the printing device, keyboard, mouse, monitor and the printer driver on the host computer through the USB port or the corresponding port.

6 System setting


Select the system settings Icon[] on the main function interface to view store information, language settings, synchronization settings, model rendering settings, print settings, and more.



Figure 6-1 System Settings

6.1 Printing Information Setting

You can set the title, the workshop name, the address, etc. for the test report.

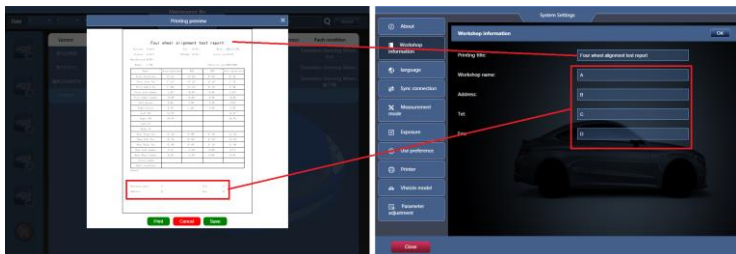


Figure 6.1-1 Printing information setting

6.2 Target type setting

Different installation schemes, as shown in Table 1, select the corresponding target

type.

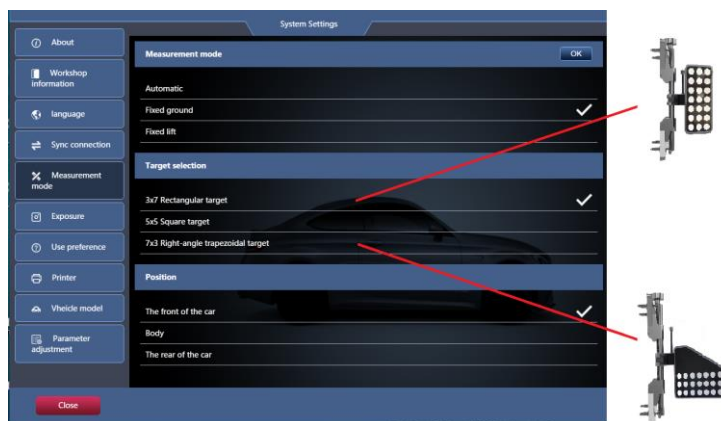




Figure 6.2-1 Target type setting

Table 1:

Target type	Physical map	Applicable platform
Small scissors target		Small scissor installation scheme, large scissor installation scheme
Double column target		Double-column installation, four-column installation
Big target 5*5	Not applicable	Not applicable
Small target 5*5	Not applicable	Not applicable

Tip: For the installation plan of each platform, please refer to the “2.3 5D Four-wheel alignment system installation method” section of this manual.

6.3 Data unit setting

The unit setting is for the display unit of the test report.

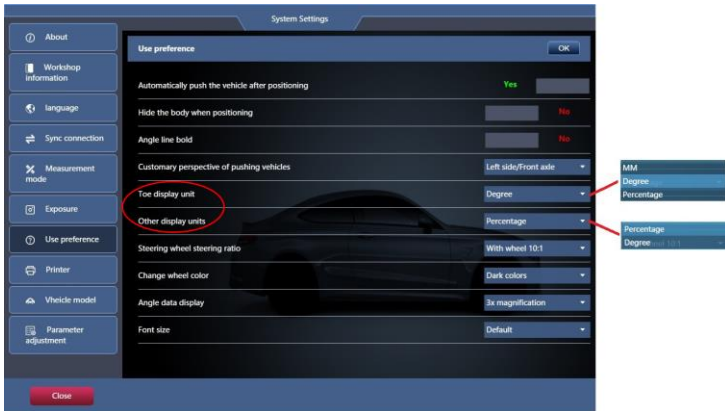


Figure 6.3-1 Data unit setting

6.4 Set the front position

The user can set the front position according to his own detection environment and detection habits. Once the front position is set, please do not change it at will.

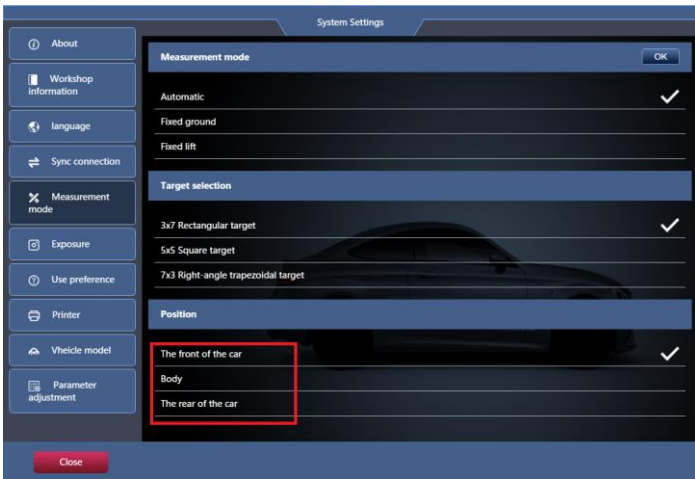


Figure 6.4-1 Car front position settings

Position mode	Description
The front of the car	In the ground measurement mode, the front of the vehicle is aligned with the four-wheel alignment host.
Body	In the lift measurement mode, the front of the vehicle is aligned with the four-wheel alignment host.
The rear of the car	In the ground measurement mode, the tail is aligned with the four-wheel alignment host



6.5 Set camera parameters

When the measuring environment is too dark or too bright, which is not conducive to the target to provide the target graphics reflection, the camera exposure can be adjusted. In general, if the targets graphics reflection is too dark, add the exposure value; if too bright, reduce the exposure value.

The actual application fields of five cameras are shown in figures 6.1.3-1 and 6.1.3-2. Please adjust the corresponding camera exposure according to the position of the camera.

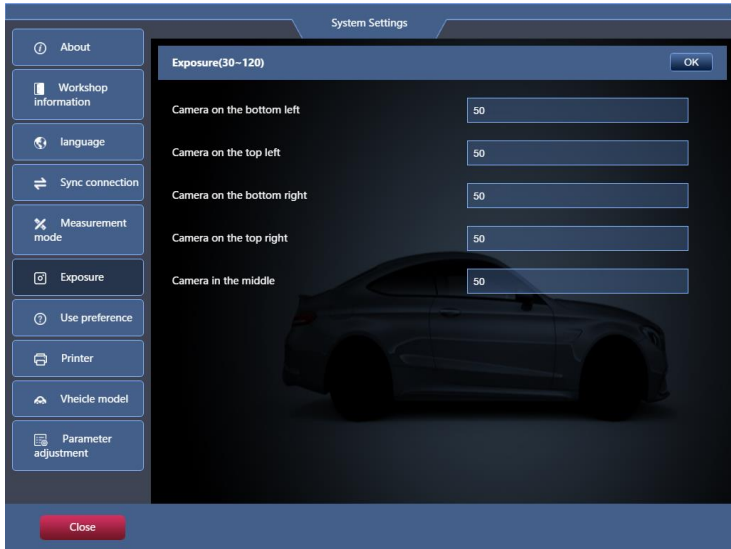


Figure 6.5-1 Camera exposure setting

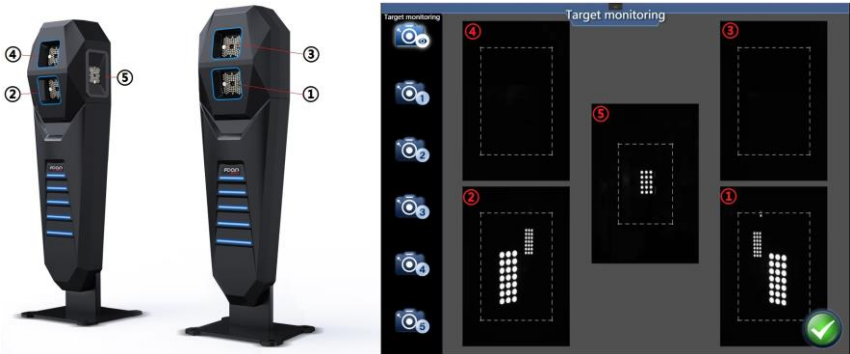


Figure 6.5-2 Camera corresponding position

Maintenance and maintenance storage environment

Environment requirement:

- a. The machine is suitable to work between 0°C and 40°C . If your working environment temperature is higher or lower than this temperature, the machine may not work properly. Please take measures to ensure the working environment

temperature;

- b. The main host and display should be placed on a flat workbench. Do not place the device near a heat source or under the direct sunlight;
- c. Pay attention to heat dissipation during the use of your equipment, keep the ventilation around the machine well; the working place of the aligner should be protected from moisture and corrosion, and working in a humid environment will cause adverse effects to the equipment;
- d. Some parts of the aligner, such as monitors are sensitive to magnets. Do not place the device near the magnet.

Precautions for using reflector:

- 1) The reflector should avoid glare or sunlight interference during use, otherwise it will not work properly;
- 2) It should be placed in a ventilated and dry place after use;
- 3) The surface of the reflector should be regularly cleaned with a soft cloth;
- 4) Do not vibrate, impact, or slip the reflector to avoid damage to the sensing element;
- 5) Do not open and change the original structural parts.

Equipment maintenance

- a. The surface of the screen will absorb dust due to static electricity. It is recommended to purchase a special wiper for LCD screen to clean the screen of the host.
- b. To avoid fingerprints, do not wipe the dust with your fingers. Do not use chemical cleaner to wipe the screen.
- c. Do not use a dissolved chemical such as banana oil, engine cleaner, or gasoline to wipe the host;
- d. When the equipment is dirty, please cut off the power first and use a non-woven

cloth or a mild neutral cleaning to wipe the surface of the equipment;

- e. Disconnect the power immediately if splashing in water or other liquids during use.
- f. Do a dust-proof treatment to ensure that the equipment is clean to extend the life of the machine.

Appendix

Appendix 1 Regular procedure for wheel alignment

First step: Symptom inquiry and vehicle test

Listen carefully and record the driver's description of the discomfort symptoms of the vehicle. Some of the symptoms caused by improper positioning angles can be visually inspected, such as tire abrasion. Some cannot be seen visually. If necessary, you should go to the test vehicle to make a rough judgment on the possible causes of the vehicle failure.

Second step: Inspection and maintenance of steering and suspension systems

After the inquiry or vehicle test is completed, the next step should be to check all steering and suspension components. Maintenance technicians should establish the notion that relying solely on the vehicle positioning system itself is not sufficient to eliminate steering faults and tire grinding problems, as well as other influencing factors. All steering and suspension components should be checked prior to wheel alignment.

Third step: Pre-positioning work for off-track fault

If the symptom described by the driver is that the vehicle is off-track, it should first be determined whether the deviation is caused by the side slip before positioning. The specific method is:

- (1) If it is a vacuum tire (radial tire), the two wheels on the left and right sides of the front wheel should be aligned and then test the vehicle.
- (2) After the left and right wheel alignment, if the off-track direction is opposite to the direction before the adjustment, it can be determined that the front wheel slip is one of the influencing factors (often the main factor). There are two solutions: ①four wheels are fully aligned until the combination of eliminating the deviation is found; ②the tires of any wheel in the front axle are removed, and then turned over (180°) and then installed. In most cases, after the tire is turned over, the off-track caused by the side slip can be greatly reduced. If the effect is not obvious, the driver is advised to replace the new tire.
- (3) If the left and right wheels of the front wheel are aligned and the direction of the off-track is unchanged, repeat the same process for the left and right wheels of the rear axle.
- (4) If the off-track direction remains the same after the rear wheel is aligned, it can be determined that the off-track is not caused by the side slip. Four-wheel positioning measurement must be performed to further find out the cause.

Fourth step: Four-wheel alignment measurement and result analysis

The measurement methods and operation steps of the aligners of different manufacturers are not the same, and there is no unified mode. But the basic operating process is basically the same:

- (1) Select the correct vehicle mode.
- (2) Wheel rim compensation (ROC), in the current practice, many four-wheel alignment service providers often omit this step in order to save trouble. It should be very careful when omitting this step. First, the vehicle rim must be in good condition, and secondly the sensor clamp must be carefully checked and confirmed to be fully seated. Otherwise, ignoring the wheel compensation may cause an error of 0.1° to 0.2°. This is a big error in some cases.

- (3) Measure: reading data.
- (4) Vehicle adjustment: The order rule for vehicle adjustment is : first the rear wheel, then the front wheel; the camber angle first then the toe; the front wheel caster angle first then the camber angle at last the toe.
- (5) Print result.

Our focus is on the analysis of measurement results.

In the foregoing "Basic Concept of Positioning Angle", some of the effects of deviations on the performance of the vehicle have been introduced. Below we summarize the symptoms:

1) Off-track

The reason caused off-track:

- ① The front wheel caster angle left and right is asymmetrical and the deviation exceeds 0.5° . The vehicle deviates to the side with the small caster angle.
- ② The front wheel camber angle left and right is asymmetrical and the deviation exceeds 0.5° . The vehicle deviates to the side where the camber angle of the front wheel is the largest.
- ③ The rear wheel camber angle is asymmetrical and the deviation exceeds 0.5° . The vehicle deviated to the side with the smallest camber of the rear wheel.
- ④ The change in the wheelbase of the vehicle can be observed based on the retraction angle of the front and rear axles. When the sum of the front and rear retraction angles exceeds 0.2° , a sensible deviation will occur, and the deviation will be toward the side with a small wheelbase.

In addition, the deviation factors that the four-wheel aligner cannot detect are:

- ⑤ Side slip, mostly caused by tires.
- ⑥ The tire pressure is not even.
- ⑦ The brakes are asymmetrical and slippery.
- ⑧ The steering assist is unbalanced.
- ⑨ Suspension parts are worn and out of tune.

Since the four-wheel aligner cannot detect all the deviation factors, it may seem everything is right from the aligner, but the vehicle is still off-track. At this time, it is necessary to check item by item.

Note:

In the practice of the actual four-wheel aligner service, it is often encountered that the vehicle does not have a deviation or a slight deviation, but after the front wheel toe is adjusted, the deviation is occurred or deviation is increased. It is easy to attribute this phenomenon to the toe adjustment when actually not. Because when the vehicle going straight, it is always in a position that the left and right toe is equal thus the front wheel toe itself does not cause a deviation. However, if the front wheel toe is not right, the friction between the tire and the ground will increase, instead it will cover the deviation. In fact, at this time, the vehicle has a tendency to deviate for other reasons, but it is covered up. When the tendency to deviation is covered, it often shows serious tire abrasion. At this time, if we do not comprehensively analyze the deviation factor and blindly adjust the toe, it will show the fault which is not serious before. Therefore, we must comprehensively analyze and handle the problem.

2) Tire abrasion

The reasons caused tire abrasion:

1. The front tire outside or inside is worn at the same time, and the front wheel toe is wrong.
2. The single front tire is worn and the camber angle is wrong.
3. The rear tire is worn, camber angle, toe

Besides, the tire wear factor which four-wheel aligner cannot detect is bad driving habit.

1. Tire pressure is too high, tire wear near the tread centerline
 2. The tire pressure is too low and both tires are worn at the same time.
 3. Chassis part problem
- 3) The vehicle is floating:** the caster angle is close to zero or the caster is negative.

(1) Steering wheel sinking

1. The caster is too large
2. The camber angle is wrong
3. The suspension parts after the violent bumps are slightly deformed or stiffened.

(2) Poor steering wheel alignment capacity

1. Caster angle too small
2. Steering machine problem
3. Other stiffening caused by incorrect angle.
4. Tire problem

- 4) Vehicle tail drop when it encounters a slight bump or acceleration, mainly caused by incorrect rear toe angle.**

Fifth step: Maintenance adjustment

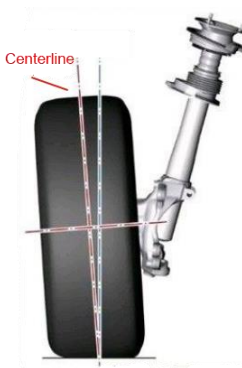
On the basis of comprehensive analysis and diagnosis, the vehicle positioning angle can be adjusted. The technician should have a clear expectation of the effect of the positioning angle adjustment. The order of adjustment is as follows:

1. First the rear axle two wheels: rear wheel camber angle→rear wheel toe
2. Then the front axle two wheels: If toe-out on turn is not right, replace the steering arm →caster angle (for vehicles with engine brackets, always adjust the engine bracket first)→camber angle→toe (the steering wheel horizontally positive lock at present).

Appendix 2 Basic overview of the aligner

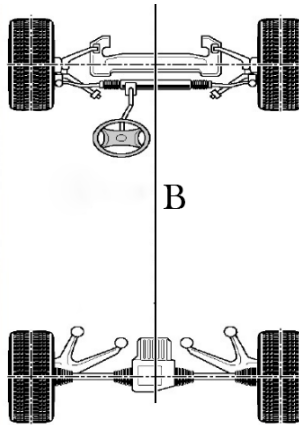
2.1 Wheel centerline

A straight line formed by the contact of the tire with the ground, and the straight line perpendicular to this line is called the centerline of the vehicle.



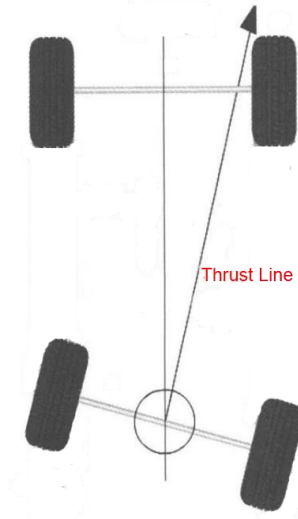
2.2 Vehicle centerline

Refers to the line that bisects the front and rear axles of the vehicle. B-vehicle centerline, also called the geometric centerline.



2.3 Thrust Line

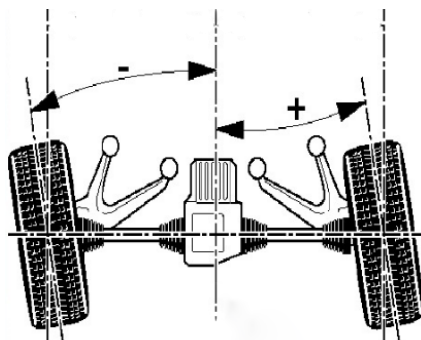
The bisector of the toe angle of the vehicle rear wheel is called the thrust line, and the angle between the thrust line and the center line of the vehicle is called the thrust angle.



2.4 Toe

The front toe angle refers to the angle between the vehicle thrust line and the wheel centerline. The rear toe angle refers to the angle between the centerline of the vehicle and the centerline of the wheel.

From the front of the car, if the wheel centerline deviates from the thrust or the vehicle centerline, the toe angle is defined as a negative value (Toe-Out), otherwise it is defined as a positive value (Toe-In).



2.4.1 Function

Reduce tire abrasion and rolling friction.

2.4.2 Symptom judgment:

- 1) Toe-In too large will cause
 - a. Rapid wear on the outside
 - ◇ For radial tire, there will be wear patterns similar to those formed by too large positive camber angle.
 - ◇ Wear forms are serrated or lumpy.
 - ◇ When the hand is stroked from the inside to the outside of the tire, the inner edge of the tread has a sharp feeling.

b. Steering unstable

- ✧ Poor straightness
- ✧ Wheel shaking

2) Toe-Out too large will cause

a. Rapid wear on the outside

- ✧ For the radial tire, there will be a wear pattern similar to that formed by too large negative camber angle.
- ✧ Wear forms are serrated or lumpy.
- ✧ When the hand is stroked from the outside to the inside of the tire, the inner edge of the tread has a sharp feeling.

b. Steering unstable

- ✧ Poor straightness
- ✧ Wheel shaking

2.4.3 Front wheel toe adjustment method

Adjust tie rod

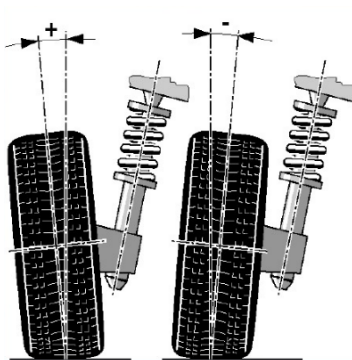
2.4.4 Rear wheel toe adjustment method

The original adjuster, eccentric concave wheel, eccentric bolt, eccentric bushing and long hole gaskets.

2.5 Camber Angle

Wheel camber angle is the angle between the centerline of the wheel and the vertical plane of the car. The angle is positive when the top of the wheel is tilted toward the

outside of the car, and vice versa. The main role of the wheel camber is to make the dynamic bearing center of the wheel and the ground properly distributed, so as to improve the service life of the mechanical parts and reduce the wear of the tires. If the wheel camber angle is wrong, the tire will wear abnormally, and the car will also occur off-track when driving.



2.5.1 Function

Adjust the vehicle load to act on the center of the tire to eliminate the deviation and reduce tire wear.

2.5.2 Symptom judgment

1) Positive camber angle too large

- a. Unilateral wear on the outside of the tire
- b. Suspension system parts wear accelerated;
- c. The vehicle will be deflected towards the side with a large camber angle.

2) Negative camber angle too large

- a. Unilateral wear on the inside of the tire;
- b. Suspension system parts wear accelerated;

c. The vehicle will be deflected towards the side with a small camber angle.

2.5.3 Example

The left front wheel camber angle is set to 1.0° , the right front wheel camber angle is set to 0.5° , and the vehicle is deflected to the left (the left and right wheel camber angle error is 0.5° , and the vehicle is deviated).

2.5.4 Camber adjustment method

Gaskets, eccentric cams, long holes, ball head rotation, post rotation, wedge gaskets, adjustment bearing housings, eccentric bolts, eccentric bushings and offset ball heads.

2.6 Set-back

Set-back refers to the angle between the line passing through the center of the two front wheels or the two rear wheels and the vertical line of the thrust. If the right wheel is in front of the left wheel, the angle is positive and vice versa. When the wheelbase is known, the set-back can be expressed in mm.

2.6.1 The cause of set-back

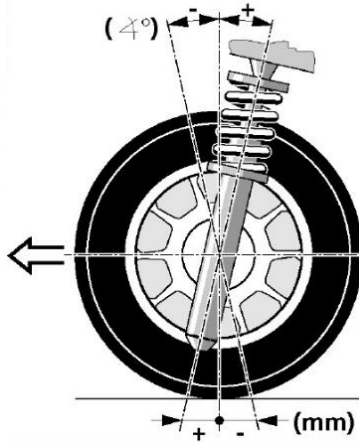
- ✧ Manufacturer (Specially designed to offset the effects of road arches.) ;
- ✧ Collision

2.6.2 Symptom judgment

In fact, that the set-back actually reflects the change in the wheelbase of the vehicle. When the set-back reaches a certain level, the vehicle will be deflected. The deviation direction is toward the smaller side of the wheelbase.

2.7 Caster

The caster angle refers to the line connecting the top of the ball or the top of the strut to the lower ball head (called the kingpin, the wheel rotates around when the car turns) and the plumb line as viewed from the side of the car. When the upper ball is idling behind the plumb line, it is positive and vice versa.



2.7.1 Function

Affects steering stability and steering wheel automatic alignment capability.

2.7.2 Symptom judgment

- Caster angle too small caused instability: lack of steering wheel automatic alignment ability after steering: when the vehicle speed is high, it will float (should pay full attention to this when driving on the highway)
- Caster angle asymmetry caused deviation: when the left and right caster angle is not equal and more than $30 (0.5^\circ)$, the vehicle will deviate, and the deviation direction will be toward the smaller side of the caster angle.

2.7.3 Example

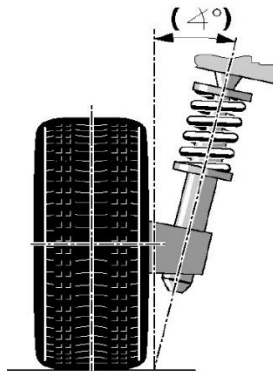
Left front wheel caster angle is set to $+0.5^\circ$, right front wheel caster angle is set to $+1.5^\circ$, then the vehicle deviates to the left.

2.7.4 Caster angle adjustment method

Gaskets, eccentric cams, long holes, strut rods, post rotation, engine bracket movement, and eccentric ball heads.

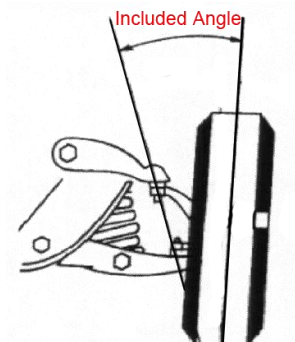
2.8 King pin or Steering Axis Inclination

The kingpin inclination angle refers to the connection and plumb line of the ball head or the ball head at the top of the pillar on the suspension as viewed from the front of the car. The upper ball is positive inward and vice versa. A reasonable kingpin inclination angle can make the car drive lightly, reduce the impact of the road through the steering wheel to conduct the steering wheel, and also have a certain automatic alignment function. The kingpin inclination refers to the angle at which the kingpin is slightly inward on the front axle, and its function is to automatically align the front wheel. The greater the angle, the stronger the effect of the front wheel automatic alignment, however, the more laborious the steering is, the more the tire wears; on the contrary, the smaller the angle, the weaker the effect of the front wheel automatically alignment.



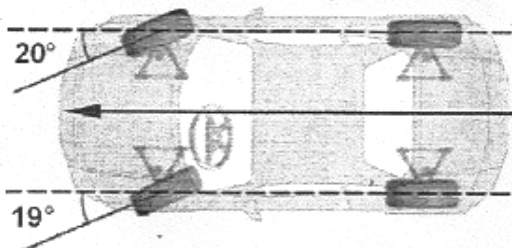
2.9 Included Angle

Included angle refers to the angle between the centerline of the wheel and the axis of the caster angle, that is, the included angle is equal to the geometric addition of the camber angle to the caster angle of the kingpin.



2.10 Top-Out On Turns

The 20° top-out on turn refers to the difference between the angles of rotation of the inner and outer wheels when the vehicle is turning.



2.11 Thrust angle

Thrust angle is the angle formed by the centerline of the vehicle and the thrust line. When the thrust line is located to the left of the vehicle centerline, it is positive, otherwise it is negative.

Thrust angle causes the tail of the vehicle to be biased to one side. In order to make the vehicle go straight, the front wheel has to turn to the direction of the thrust line. Therefore, if the toe angle of the front wheel is not compensated for the thrust angle, the steering wheel must turn to one side when the vehicle goes straight. If the toe angle of the rear wheel can be adjusted, the thrust angle should be adjusted as close as possible to zero.

The Thrust line direction is the actual running direction of the vehicle and is determined by the toe angle of the rear wheels. When the direction of the thrust line does not coincide with the geometric centerline of the vehicle, in order to go straight, the steering wheel must be turned to an angle, resulting in an imbalance of the steering wheel. At the same time, the driving route of the rear wheel does not coincide with the driving route of the front wheel. This phenomenon is called "rear wheel traverse". When the thrust line is not directly in front, the steering wheel must be turned to one side to ensure the straight line of the vehicle, which causes the steering wheel to be unbalanced.

If the thrust line is neglected, the accuracy of the positioning cannot be guaranteed, which is the main reason for the full deviation of the steering wheel.

Selecting the thrust line as a measurement can do the following:

☆ After adjusting the toe angle of the rear wheel to the specified value (factory specification value), the thrust line and the vehicle center line coincide. For vehicles with adjustable rear suspension, the toe angle of the rear wheel should be adjusted so that the thrust angle is as close as possible to zero.

☆ The steering wheel can be adjusted to balance by the thrust line reference, regardless of whether the thrust angle is zero or not.

When the rear wheel toe is not adjustable, the front and rear wheel toe angles can be adjusted to be the same by adjusting the front toe angle, and they are set to the angle at

which the steering wheel is balanced to match the rear wheel direction (thrust line) to ensure the balance of the steering wheel.

2.11.1 The cause of thrust angle

- ✧ It is generated with the generation of set-back.
- ✧ Rear toe asymmetry.

2.11.2 The effect of thrust angle

- ✧ Tire abrasion
- ✧ Steering wheel imbalance
- ✧ Off-track
- ✧ The vehicle body is skewed when go straight
- ✧ Steering wheel skew

2.11.3 The correction method of thrust angle

- ✧ Original car factory adjuster
- ✧ Install a wedge gasket between the axle and the tire
- ✧ Install adjuster behind concave wheel or other things

Four-wheel aligner common problems and solutions

1 The tablet cannot be synchronized with the computer program.

Check if the tablet port is connected to other networks instead of connecting to the aligner network (the tablet port is connected to the aligner host network to synchronize properly)

2. A few wheels prompt target find fewer circles than required

- 1) Target surface is dirty
- 2) Target installation angle is wrong
- 3) Target is blocked

- 4) The target is not in the camera monitor interface or near the edge of the camera monitor interface
- 5) The camera monitor interface sees the target too bright or too dark

3. Tablet display failed to login

- 1) Check if the WIFI signal of the host header exists
- 2) Check if the tablet is connected to the wireless router of the host header
- 3) Turn off the power of the host header and restart it to restart the computer.

4.Unable to boot or tablet no display

- 1) Check if the cable is normal, the battery is fully charged, and charge the host header or tablet.
- 2) Check if the HDMI cable connection between the TV and the host is normal.

5. Daily attention

Regularly clean the target, filter (use a soft cloth and avoid using rough cloth to wipe the surface of the filter), and the dust on the lamp board will affect the receiving effect.

Warranty

Respectful FCAR User:

Welcome to choose the FCAR series. In order to better use the product, we recommend that you take care of your product and follow the instructions in the user manual every time you use it. If your use meets this requirement, you will have a product that will provide you with a longer-term quality service.

1. This product is installed on-site by FCAR technicians or authorized technicians and confirmed on site.

2. Technicians conduct on-site training on the use of the equipment and deliver it after you are skilled.

3. The product must be purchased through a product distributor authorized by FCAR Technology. The product purchased through an abnormal channel, the purchaser must bear the cost of product repair service.

4. The following items: Tablet PC (display, touch screen), product manual, internal and external packaging, target, glass target, dongle, promotional gifts and other consumable items are not covered by the warranty.

5. Since the day that product have purchased (based on the valid purchase certificate and valid warranty card of this product), if the product has performance failure caused by non-human damage, the whole machine is guaranteed for three years. The first year is free of charge and the second and third years are paid for repair.

6. In any of the following cases, your product will not be covered by the free warranty:

1) Failures, defects or defects are not caused by FCAR technology product quality: Including that you have not used the product in accordance with the product manual and improper operation of the product, such as collision, drop, self-assembly and disassembly, resulting in pressure loss, etch and rust caused by liquid or food infiltration;

2) Natural wear and tear of the product: including but not limited to the chassis, mouse, keyboard, column, fixture, etc.

3) Disassembly, repair and modification without FCAR technology approval.

7. The following measures can be taken if quality problems or malfunctions occur during the warranty period.

1) You can contact the local purchased distributor or call the FCAR customer service hotline (0086-755-82904730) to get the correct service information.

2) After obtaining an effective reply from the distributor or company, you must send the product to the designated address of the company's factory for repair and maintenance, so as to get timely repair, maintenance and prevent further loss.

8. In the process of warranty service, you will bear the cost of product delivery or delivery related costs: including product packaging, transportation, insurance, etc.

9. The free warranty service you enjoy under this warranty is the only measure for the loss of the product due to defects in the product during the warranty period. FCAR Technology is not responsible for your direct or indirect losses.

10. All warranty information, product features and specifications of the product will be announced on the latest promotional materials and website of FCAR Technology without prior notice.



Shenzhen Fcar Technology Co., Ltd.



Shenzhen Fcar Technology Co., Ltd.



Certification

This product has been strictly inspected as qualified products and met the company standards.

Product name	5D Four-wheel alignment system
Product serial number	
Date of production	
Inspector	



Warranty card

Product name	5D Four-wheel alignment system
Product serial number	
Purchase date	

Company name: _____

User address: _____

Contact person: _____

Contact number: _____

