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Precautions

- Before installation and commissioning, read this Manual in detail, check the device list, and contact Launch or its Dealer immediately if there is any doubt.
- The operator must know the basic knowledge of four-wheel alignment.
- Operators must have safety knowledge in using device such as lifter, steering angle disk and in maintaining automobiles.
- After vehicle maintenance, all loosened bolts and parts should be checked and tightened as required to ensure safety.
- The X-613 portable 3D wheel aligner should not be installed on vibrating objects or inclined planes, and should be protected from direct sunlight and humidity.
- It is forbidden to disassemble the device without the manufacturer's authorization, so as not to cause damage to the parts, affect the diagnostic, and increase the difficulty and cost of maintenance. We do not warranty any damage caused by unauthorized disassembly.
- The camera of the X-613 portable 3D wheel aligner is the key optical component of the inspection, keep its surface clean.

Safety Information

Do not operate the four-wheel alignment system in a flammable or explosive environment.

Do not place any flammable or spontaneously combustible materials (e.g., cloths contaminated with motor oil and cloths contaminated with flammable solvents) next to the device.

Keep the device away from sources of ignition and place an appropriate fire extinguisher next to the device.

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1. Overview

1.1 Product Description

X-613 is a portable 3D four-wheel aligner with a new industrial design form, which is used to detect the mutual position and angle between the wheels of a car to determine the wheel alignment parameters of the car, so as to guide the automotive service technician to adjust the wheel alignment parameters to meet the design requirements of the car, to achieve the smoothness and safety of the car driving, and to reduce the fuel consumption of the car and the wear and tear of the tires.

The portable 3D Four-Wheel Aligner is easy to operate and is not affected by the level of the platform, and the tilting of the car body will not affect the accuracy. Dynamic measurement is realized by pushing the car or rolling the wheels, which improves the efficiency and accuracy of measurement.

1.2 Functions and Features

- Be ready to use out of the box, no assembly and wiring required; factory calibration free.
- Multi-platform compatibility, can be adapted to large shear lifters and four-post lifters.
- Match with PAD5/PAD7/PAD9 diagnostic tablet, measurement data can be transmitted wirelessly, and the measurement process and results can be observed at any time, which is convenient for undercarriage adjustment.
- Be equipped with high-capacity battery, no need to connect electricity during the measurement process, which is safer.
- Support two types of four-wheel alignment measurement: standard measurement and quick measurement, which can measure key parameters such as toe, camber, kingpin caster, kingpin inclination, thrust angle, etc., and additional measurements such as wheelbase, track width, axle offset, wheel offset, diagonal and center offset.
- Cover the four-wheel alignment data of a huge number of models worldwide, and support users to customize the data of new models.
- Generate professional inspection reports, support data comparison before and after alignment, and support report sharing.

1.3 Measurement Scope

Supported Vehicle Specifications	
Wheelbase	1940mm ~ 4600mm
Track Width	1290mm ~ 1900mm
Hub Diameter (with 4-point wheel clamp)	12 inch – 22 inch
Tire Diameter (with 3-point holder)	470mm ~ 1100mm

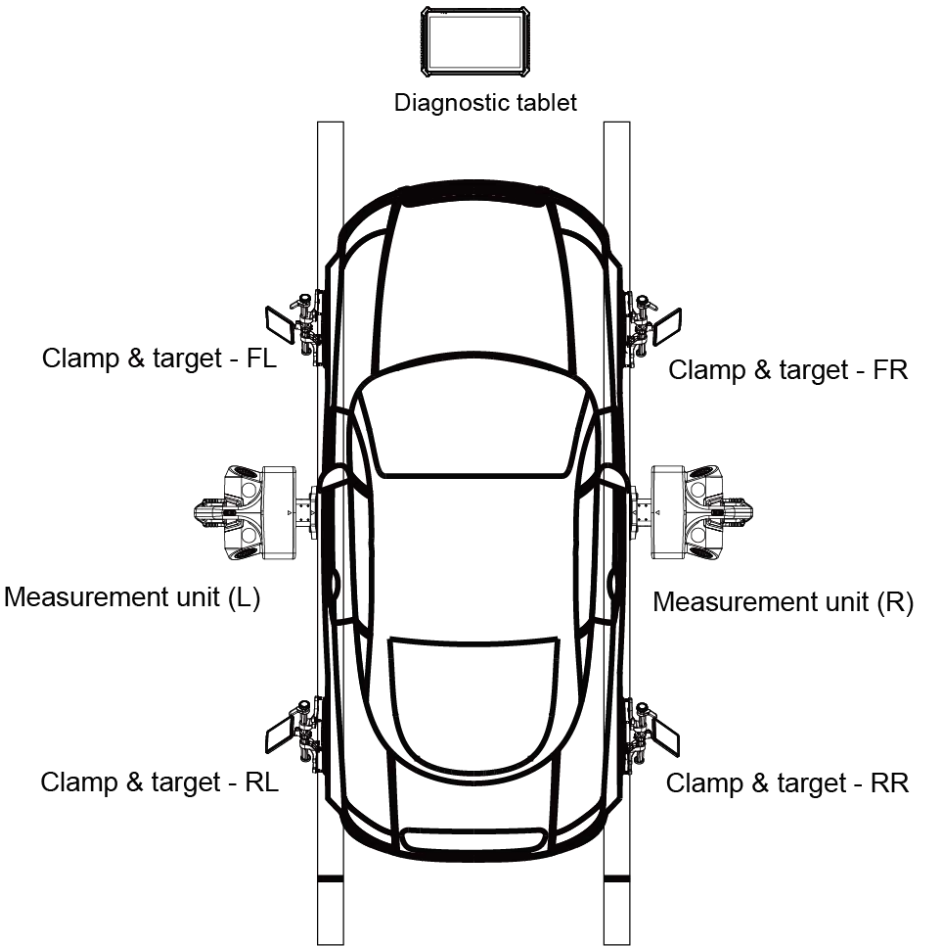
1.4 Environmental Requirements

Environmental Parameters	**Requirements**
Working Temperature	0℃~45℃
Working Humidity	20% ~ 90%
Storage Temperature	-20℃~70℃
Storage Humidity	10% ~ 90%
Working Atmospheric Pressure	86kpa~106kpa
Static Electricity Protection	Air Discharge 8kV, Contact Discharge 4kV
Light Requirement	Recommended for indoor use, avoid use in sunny environments
Height Difference of Lifter and Lane	Difference between front and rear < 2mm

1.5 Instructions for Use

The working group network diagram of X-613 portable 3D wheel aligner is shown below. The whole system mainly consists of data acquisition part with PAD5/PAD7/PAD9

diagnostic tablet. The data acquisition part consists of 2 measuring units and 4 targets.



2. Instrument Structure

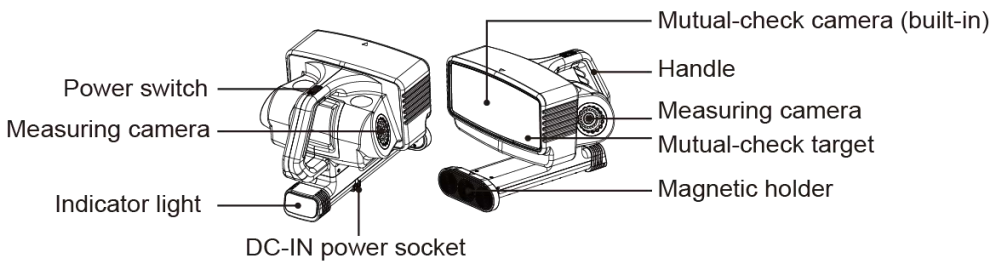
2.1 Overall Structure

X-613 portable 3D wheel aligner mainly consists of measuring unit (right/left), wheel clamp targets (right front/left front/right rear/left rear), steering angle disk, steering wheel mounting bracket, router and brake plate mounting bracket and other accessories, and is used with standard four-post lifter and PAD5/PAD7/PAD9 diagnostic tablet.

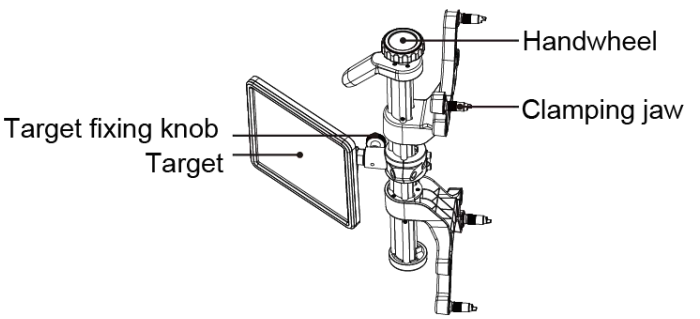
Note: The composition and accessories are different for different configurations, please consult your dealer or refer to the product packing list for details.

2.2 Measuring Unit Components

The X-613 portable 3D wheel aligner has 2 measuring unit components (right/left).



2.3 Wheel Clamps and Targets



Note: The hand wheel is used to adjust the height of the jaws.

3. Four-Wheel Alignment Procedure

3.1 Preparation

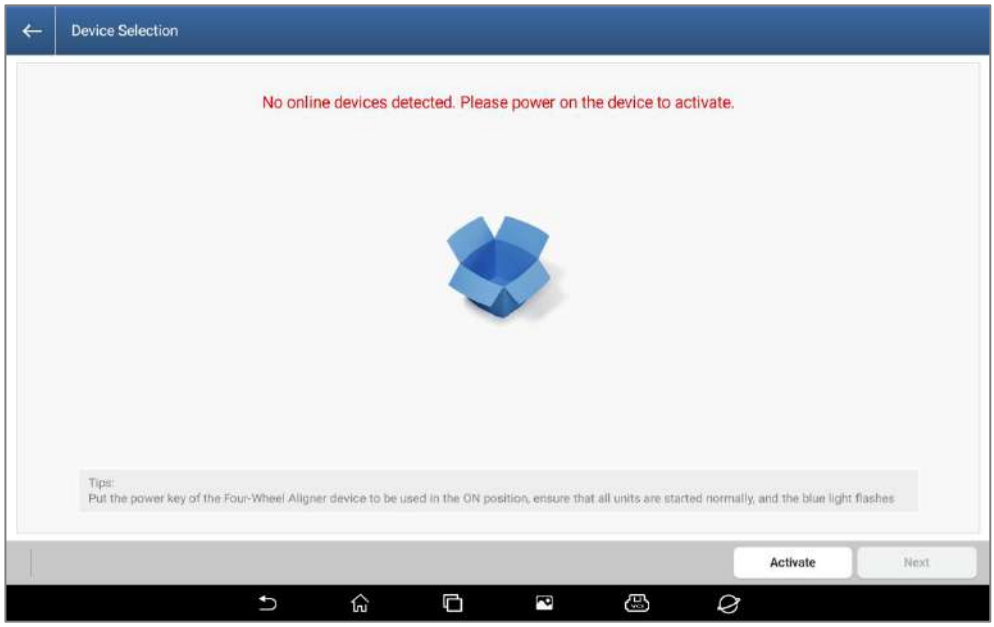
3.1.1 Device Activation

When using the X-613 for the first time, you need to activate the X-613 on the diagnostic tablet (PAD5/PAD7/PAD9).

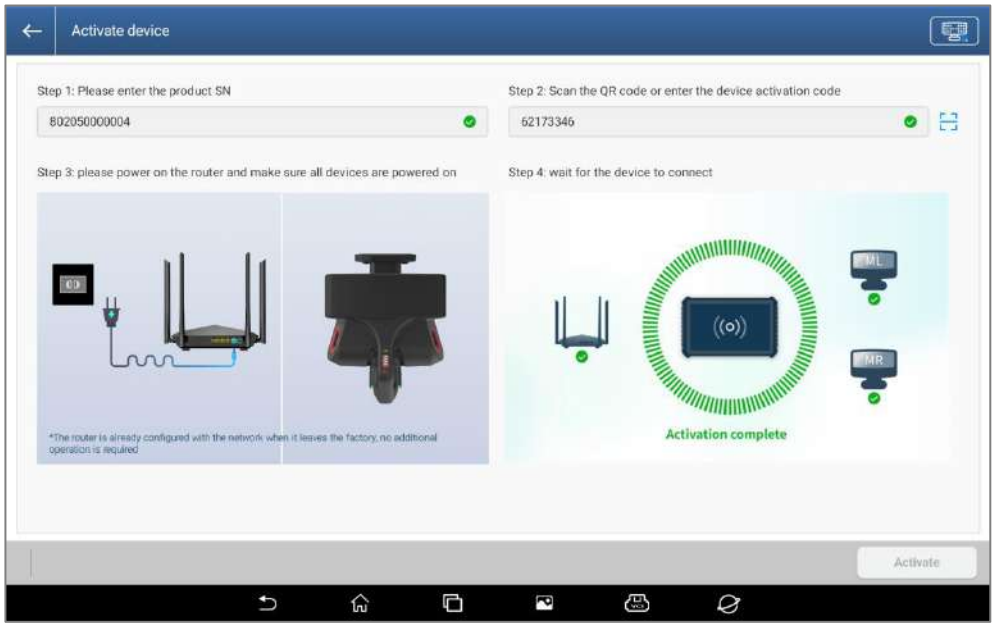
Description:

- Before activating the device, make sure the router network indicator is in the blue slow blinking state.
- Before activating the device, make sure that the X-613 device is in the normal startup state and is in the attempted connection state (i.e., the measuring unit is in the blue light blinking state) with the diagnostic tablet (PAD5/PAD7/PAD9).
- For details on how to install and connect the device, please refer to the *X-613 Quick Reference Guide*.

1) Click the [Four-Wheel Alignment] APP on the diagnostic tablet to enter the main interface of four-wheel alignment measurement program.
2) In the main interface, click [Four-wheel Alignment] icon to enter the device activation interface, select the device and click [Activate].

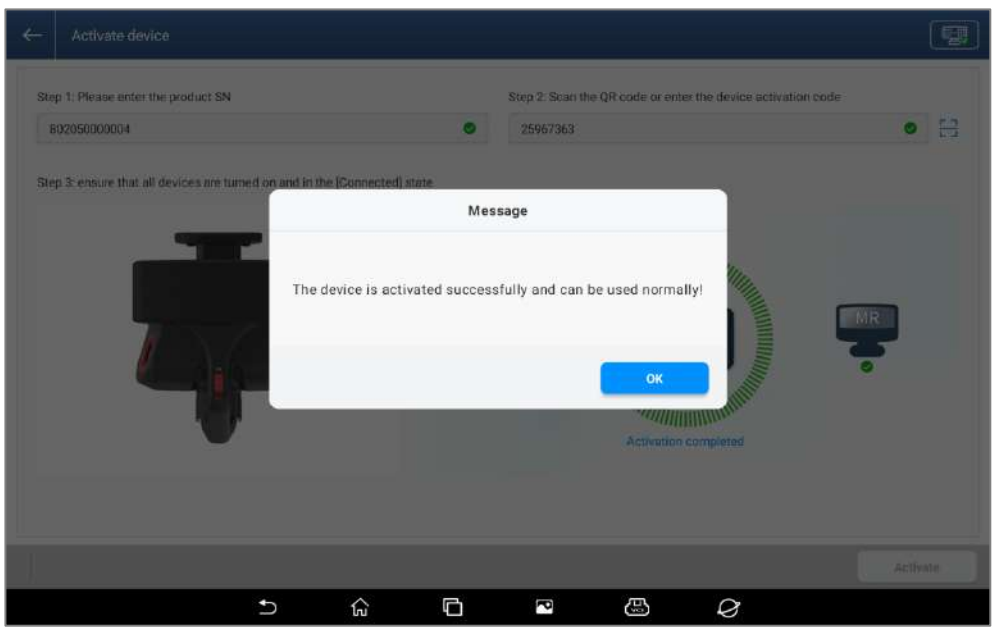


3) Enter the serial number and activation code of X-613 and click [Activate].

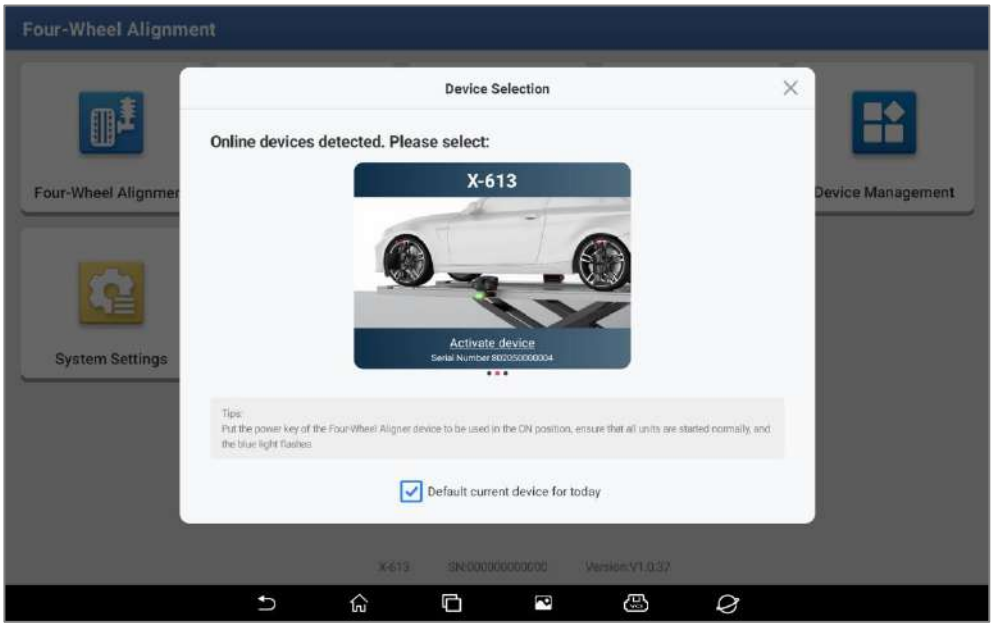


Note: You can click the icon to scan the activation code (QR code) of the device.

4) Activation succeeded.

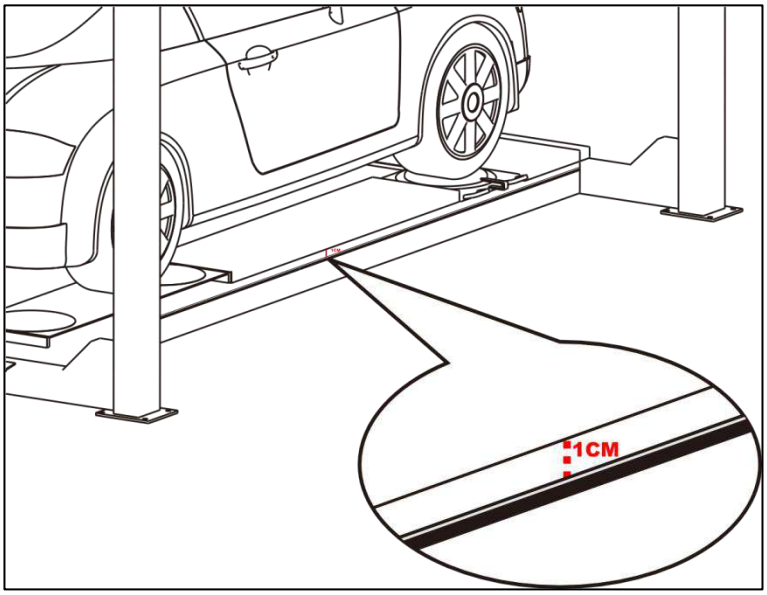


5) Select the device.



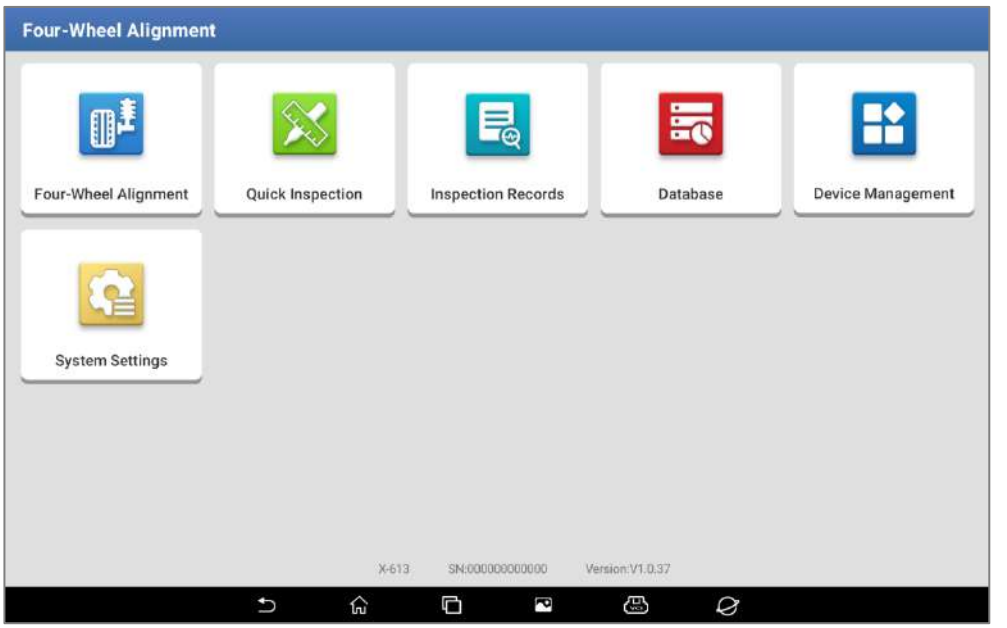
3.1.2 Usage of Positioning Stickers

The product comes with positioning stickers to assist in the installation of the device. Install the positioning sticker about 1cm from the lifter table and make sure that the stickers are parallel to the lifter table.



3.2 Routine Inspection

Click the [Four-Wheel Alignment] APP on the diagnostic tablet to enter the main interface of the four-wheel alignment measurement program. The main interface displays 6 functions: four-wheel alignment, quick inspection, inspection record, database, device management and system settings.



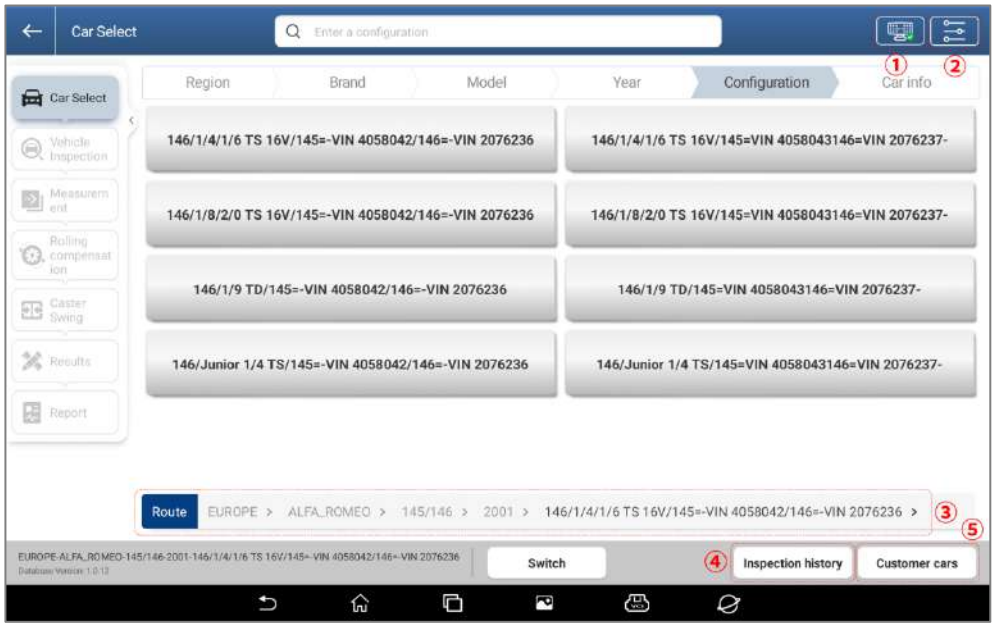
3.2.1 Vehicle Selection

In the main interface, click [Four-Wheel Alignment] icon to enter the 4-wheel alignment routine inspection interface. First of all, select the vehicle.

According to the information of the vehicle to be inspected, select [Region] -> [Brand] -> [Model] -> [Year] -> [Configuration], and then enter the [Vehicle Information] interface.

Note: Relevant information can be entered into the search box at the top of the screen

for quick search.

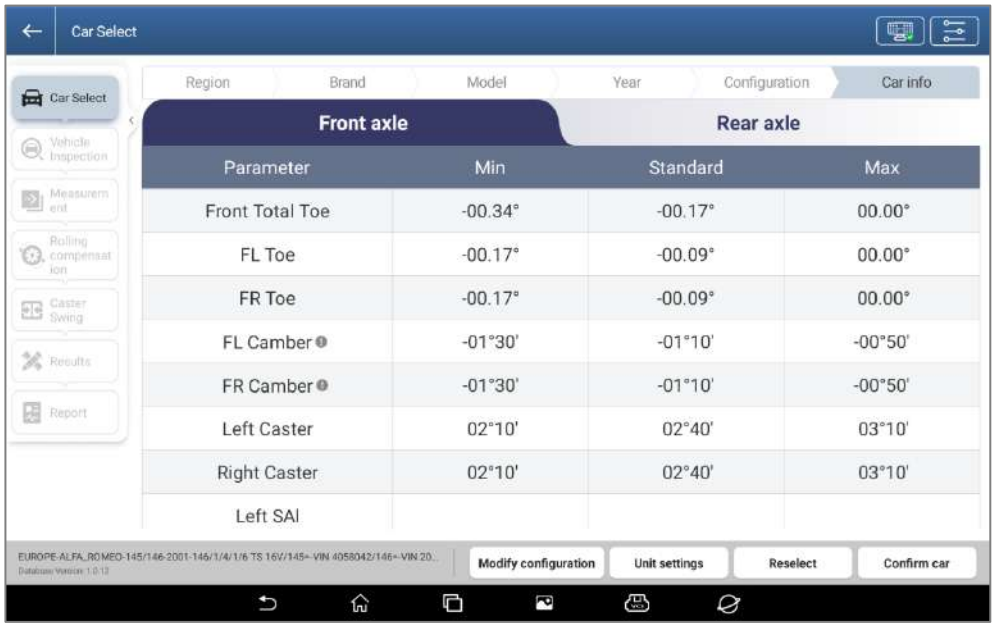


The screen buttons are described below:

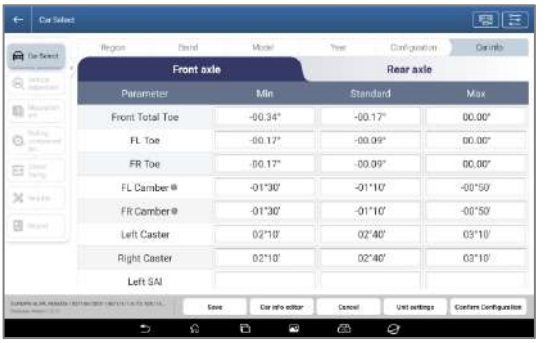
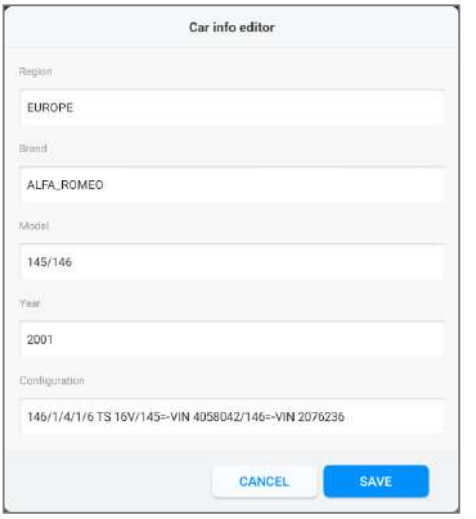
① **Device Status** ( )	Click this button to quickly check the device status, power, network connection signal and other information (green icon is displayed when all devices are online, red icon is displayed when there are devices with low power, orange icon is displayed when there are devices with abnormal status or faults, and blue icon is displayed when some of the devices are online or in connection).
② **Parameter**	Click this button to quickly enter the "Parameter Setting"

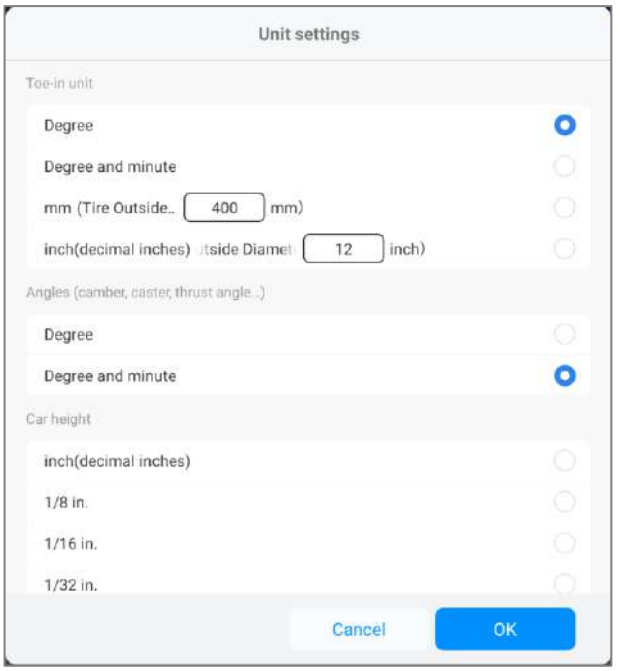
Setting(⚙)	interface.
③ **Path**	Reflect the selected vehicle region, brand, model, year and configuration information.
④ **History Inspection**	Be used to directly select previously inspected vehicles based on historical inspection records.
⑤ **Customer Vehicles**	Used to view saved customer vehicle information for direct selection of that vehicle.

The “Vehicle Information” screen allows you to view standard vehicle data as well as modify configurations and add custom data as needed.

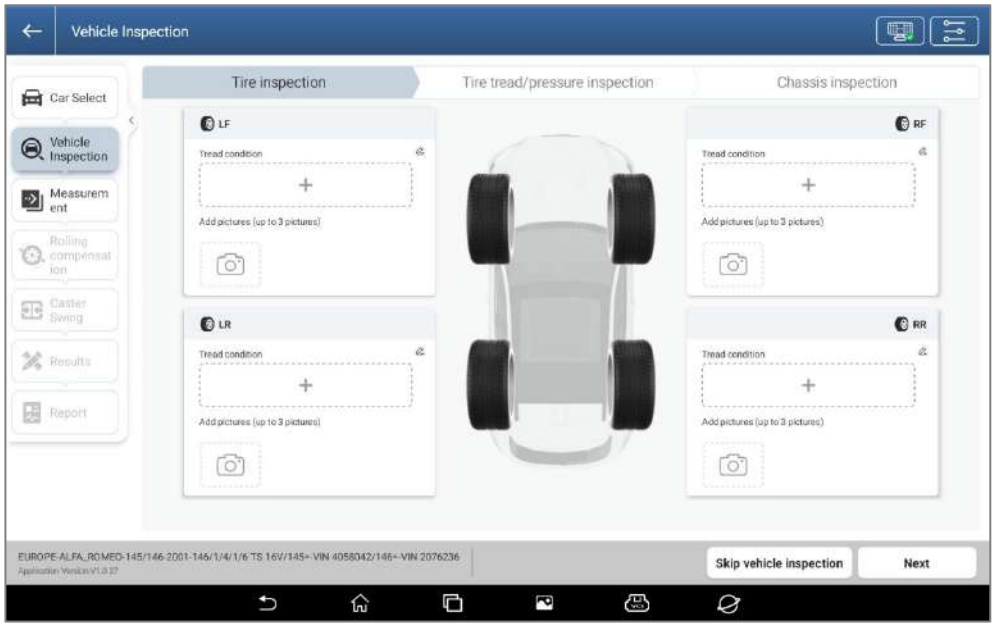


The screen buttons are described below:

[Modify Configuration]	This function is used to customize the configuration information. Click [Modify Configuration] to enter the following interface:  After modifying the parameter values, click [Save], enter the configuration name in the pop-up window and then click [OK] to store the modified configuration into the customized database. If you need to modify the model information of the customized data, you can click [Car info editor] and modify the corresponding information and then click [Save Current Configuration].  [Cancel]: Cancel the edit and return to the vehicle information

	confirmation interface. [Confirm Configuration]: Confirm that the configuration has been modified and return to the vehicle information confirmation interface.
[Unit Setting]	This function is used to modify the unit of toe, angle, vehicle height, track width and wheelbase. 
[Reselect]	Reselect the vehicle according to [Region] -> [Brand] -> [Model] -> [Year] -> [Configuration].
[Confirm car]	Confirm the vehicle information and enter the vehicle inspection screen.

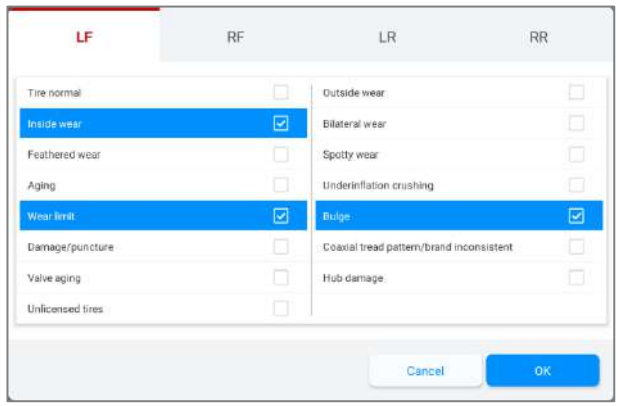
3.2.2 Vehicle Inspection



Complete vehicle tire inspection, tire tread and tire pressure inspection, body height measurement and other related inspections, and then click [Next] to enter the Measurement Preparation Interface. If you do not need to perform a vehicle inspection, click [Skip Vehicle Inspection] to enter the Measurement Preparation Interface.

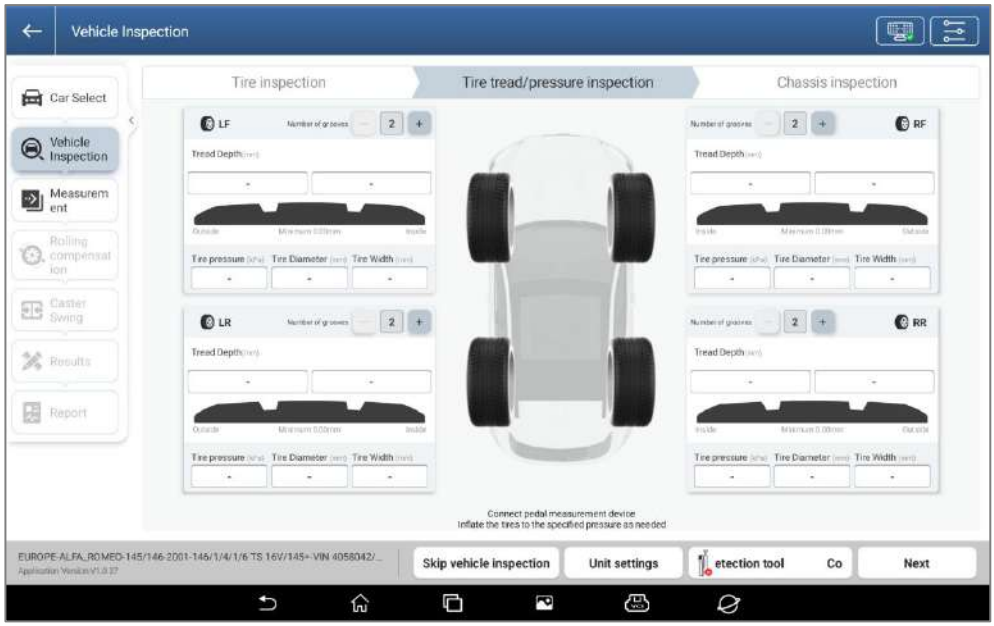
3.2.2.1 Tire Inspection

After checking the tread condition, click [+] and select the tread condition option for each tire in the pop-up window, and attach the corresponding reference photos (maximum 3 photos). After completing the tire inspection, click [Next] to enter the "Tire Tread and Tire Pressure Inspection" interface.



3.2.2.2 Tire Tread and Pressure Inspection

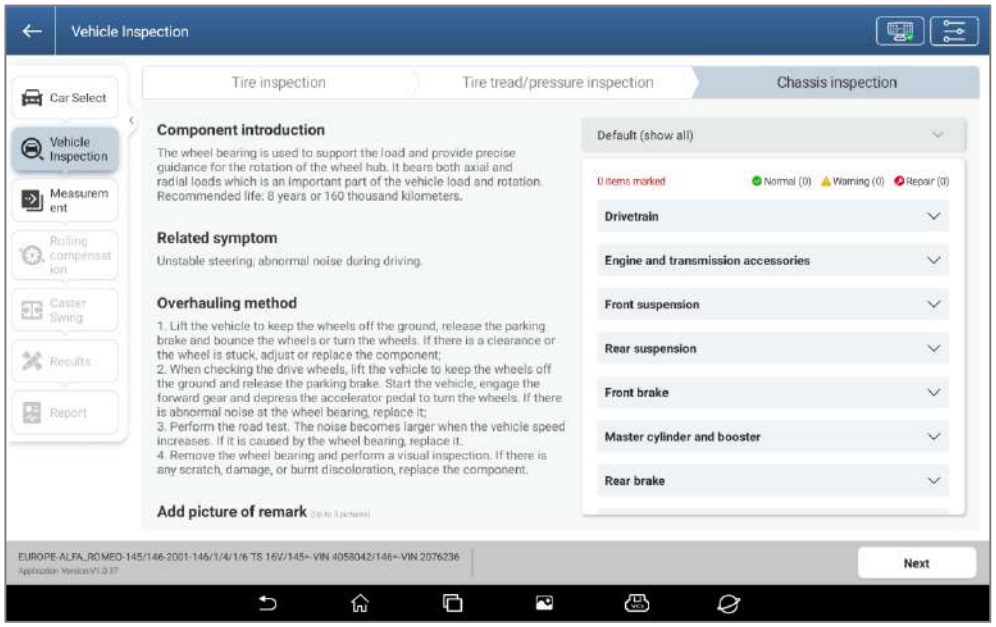
After completing the Tire Tread and Tire Pressure Inspection, click the corresponding input box to enter the inspection value. Under the "Tread Depth" option, you can click [+] or [-] to increase or decrease the input box to correspond to the number of grooves of different types of tires (2~5 grooves).
Here, you can click [Connect Tire Tread Inspection Tool] to connect the corresponding tire tread inspection device (purchased separately) for tire tread inspection.
Click [Next] to enter the "Body Height Measurement" interface after completing the Tire Tread and Tire Pressure Inspection.



3.2.2.3 Chassis Inspection

Follow the on-screen prompts to check the chassis of the vehicle and add relevant photos (up to 5) and notes, and click the corresponding options to mark the status of each component (normal/warning/repair). After completing the chassis inspection, click

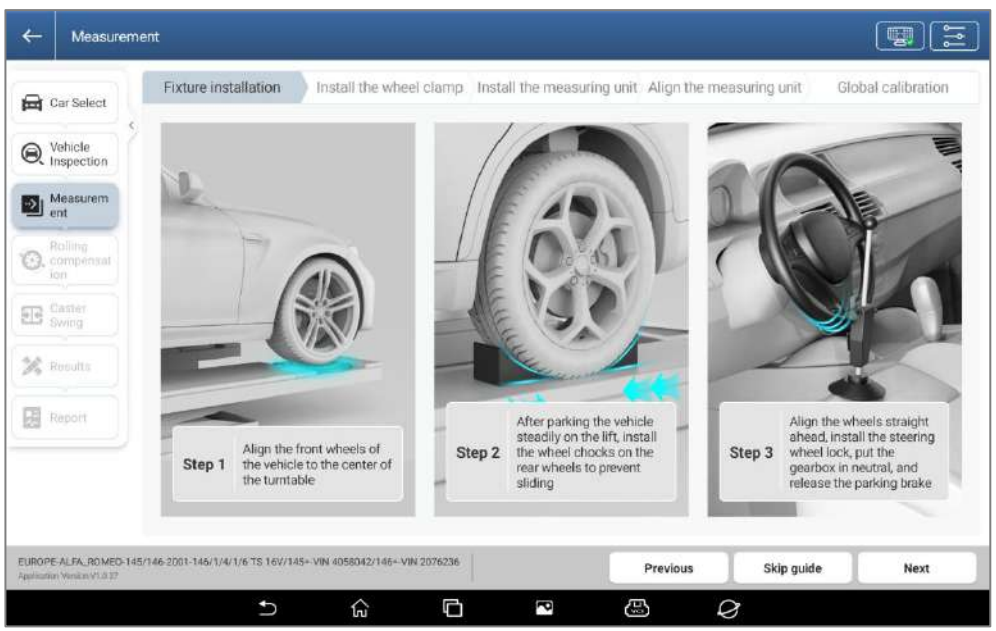
[Next] to enter the Measurement Preparation Interface.



3.2.3 Measurement Preparation

Follow the on-screen instructions to install the fixtures and device, and then proceed to the measurement scanning.

3.2.3.1 Fixtures Installation



Click [Fixtures Installation] and follow the on-screen instructions to install the relevant fixtures.

1) Park the front wheels of the vehicle to the center of the steering angle disk.
2) After parking the vehicle smoothly to the lifter, please install wheel wedges on the rear wheels to prevent skidding.
3) Position the wheels forward and install the steering wheel lock, put the transmission in neutral and release the parking brake.

3.2.3.2 Device Installation

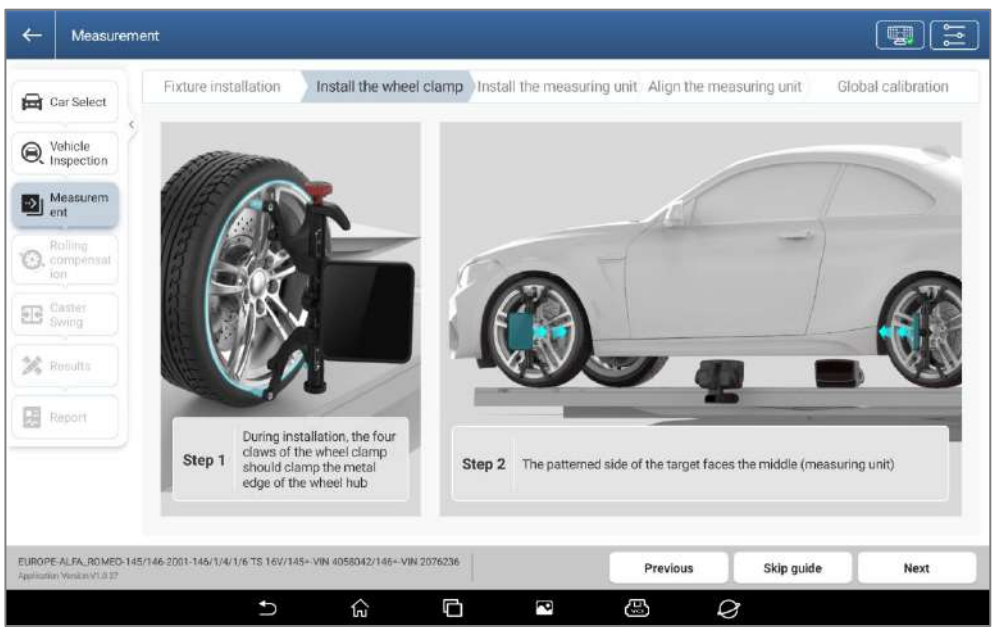
After the fixture installation is completed, click [Next] to enter the device installation guide interface, and follow the on-screen guidelines to install the relevant device.

Note: It is recommended to install the positioning stickers on the side of the lifter axle plate in advance in order to assist the installation of the device.

1) Wheel Clamp Installation

Please align the wheel clamps to the middle of the tires, and according to the schematic diagram, snap the 4 jaws of the wheel clamp to the metal side of the wheel hub, and point the patterned side of the target toward the middle (measuring unit).

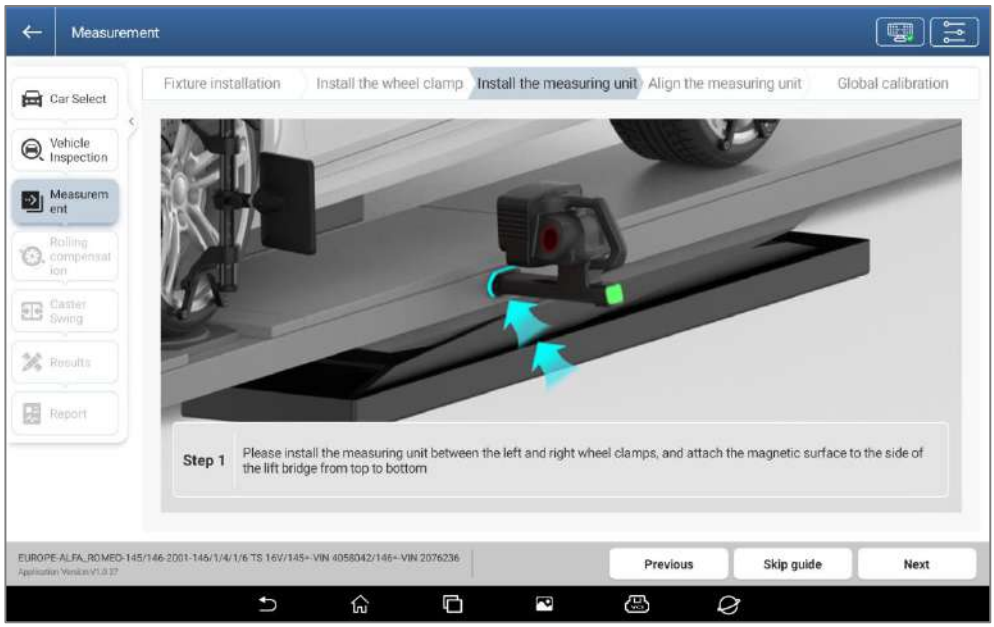
Note: The wheel clamps should be perpendicular to the ground, with an allowable error range of -15° to 15°.



2) Measuring Unit Installation

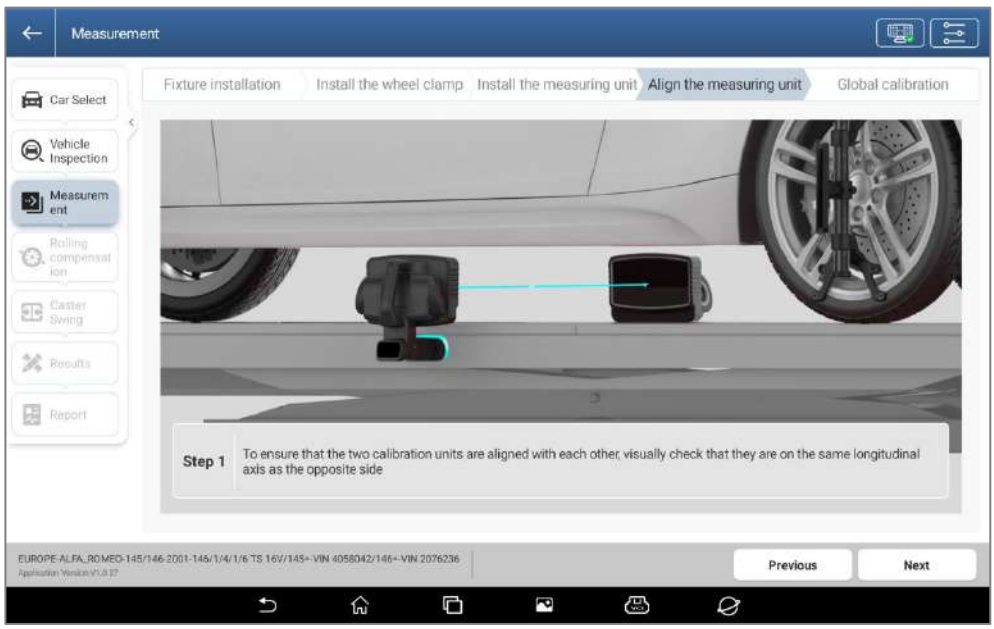
Please install the measuring unit in the middle of the front and rear wheel clamps and

attach the magnetic suction surface to the side of the lifter axle plate from top to bottom.



3) Measuring unit should be aligned.

To ensure that the two measuring units are aligned with each other, visually check that they are on the same longitudinal axis as the opposite measurement.

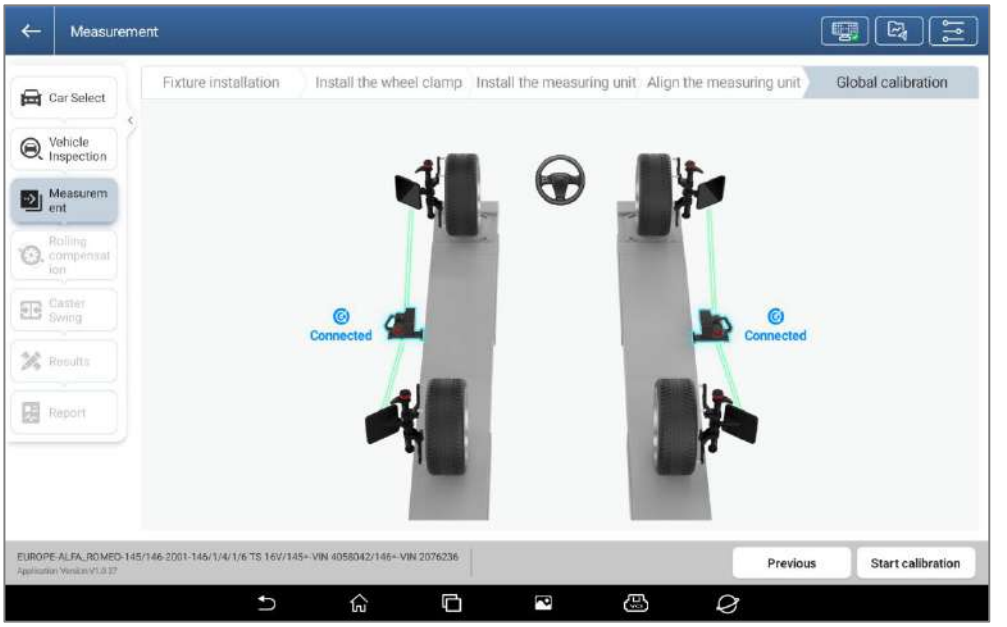


After both the wheel clamps and the measuring units have been installed, the indicator

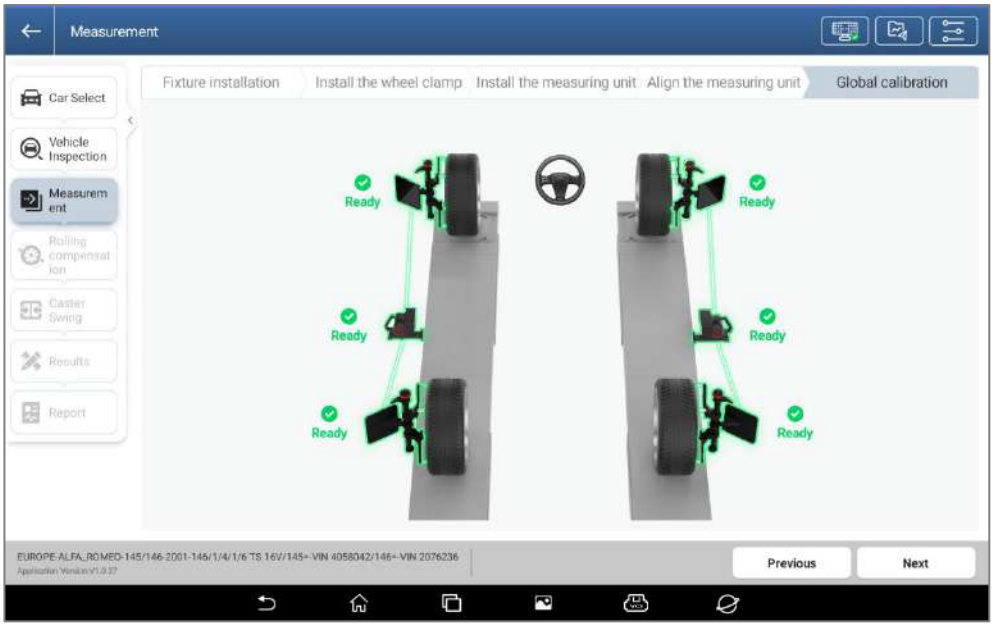
light of the measuring unit blinks rapidly in blue, which means that the measuring unit is searching for a diagnostic tablet. This is followed by a slow blinking blue light, which means that the device is internally networking. When both measuring units are successfully connected to the diagnostic tablet, the indicator light is green and always on.

3.2.3.3 Global Calibration

After the device is installed, click [Next] to enter the Global Calibration Interface.
After confirming that the icons of both measuring units show "Connected", click [Start Calibration].



After the calibration is completed, "Ready" is displayed on the measuring unit and target icons.

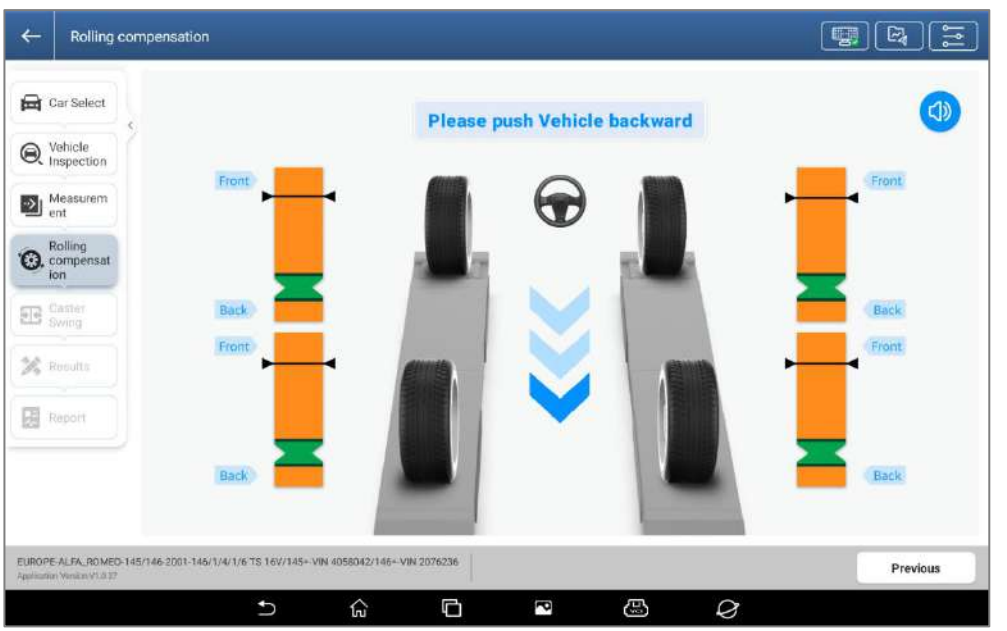


After the device installation is completed, click [Next] to enter the "Rolling Compensation" interface, and follow the prompts to push the car and complete the rolling compensation.

3.2.4 Rolling Compensation

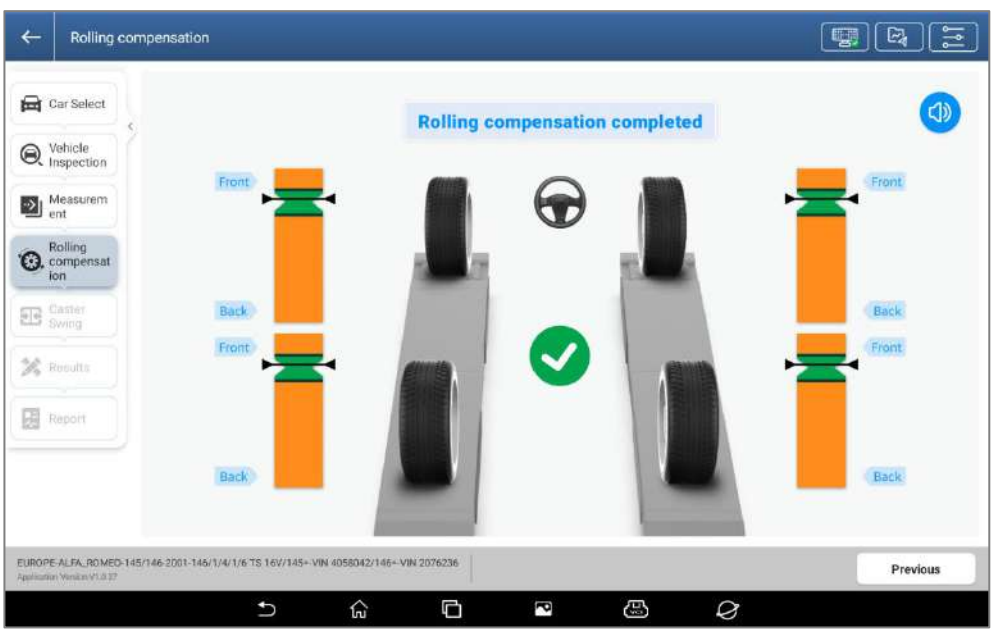
The rolling compensation operation is as follows:

1) According to the interface prompts, first push the vehicle backward slowly, so that all the pointers stay in the green zone, as shown in the following figure.



2) When the interface prompts "Please push the vehicle forward", then push the vehicle forward slowly, so that all the pointers stay in the green zone again.

When the interface prompts "Rolling Compensation Complete", the rolling compensation is completed, and automatically enter the "Kingpin Measurement" interface.



3.2.5 Kingpin Measurement

The kingpin measurement is for the front wheels, including the kingpin inclination and the kingpin caster. The kingpin inclination angle can make the weight of the car evenly distributed over the bearings, protect the bearings from damage, and make the steering force even and the steering light. The presence of kingpin caster angle allows the steering axis to meet the road surface in front of the tire's grounding point, allowing the car to keep straight by using the resistance of the road surface to the tires.

3.2.5.1 Preparation

Follow the screen prompts to make the following preparations:

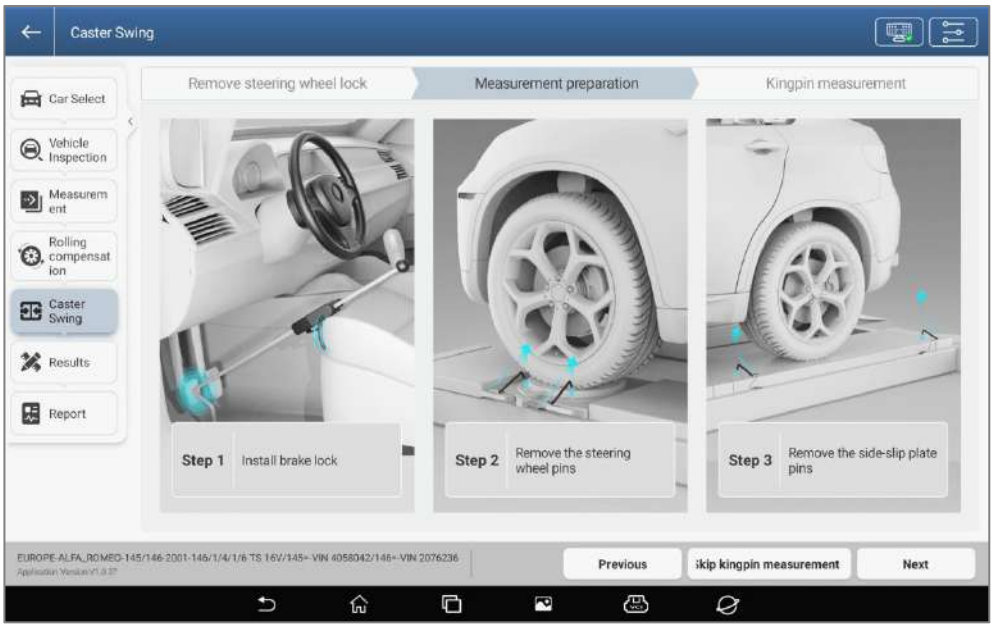
(I) Remove the steering wheel lock.

(II) Measurement Preparation

1) Install the brake lock.

2) Remove the pins of the steering angle disk.

3) Remove the pins of the side skid plate.

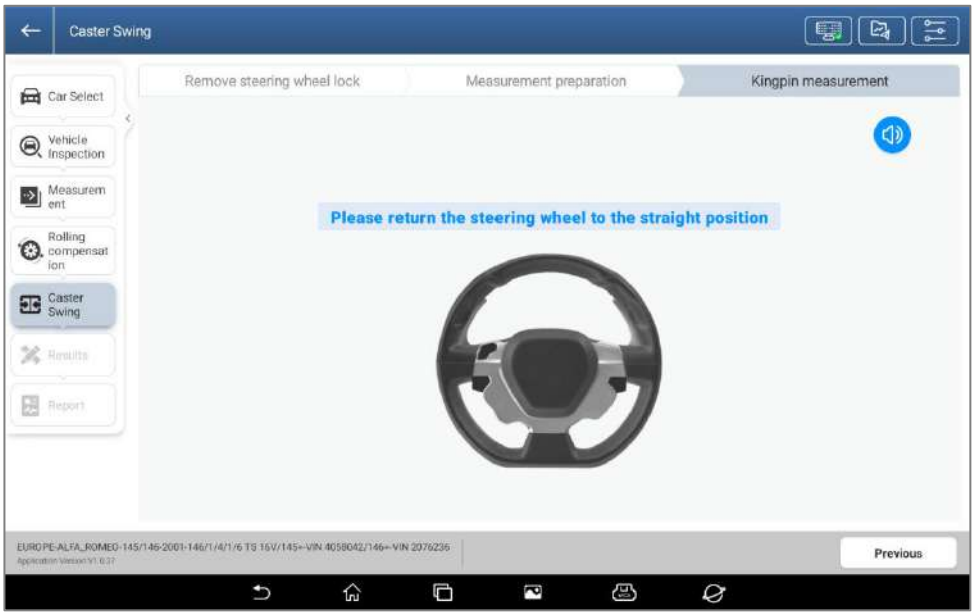


After the preparation is completed, click [Next] to enter the "Kingpin Measurement" interface.

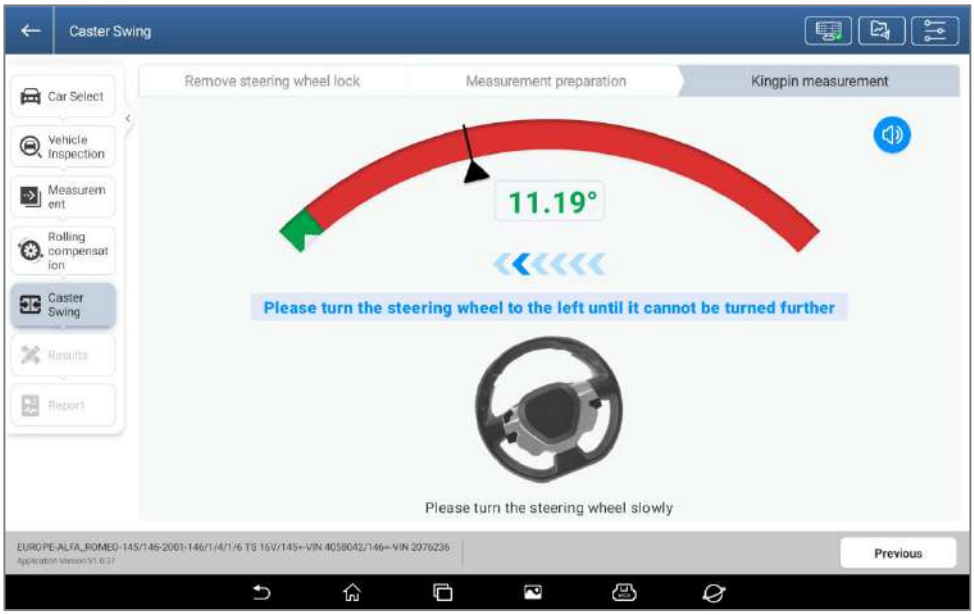
3.2.5.2 Kingpin Measurement

1) The steering wheel is adjusted to be straight ahead, that is, the toe of the two front

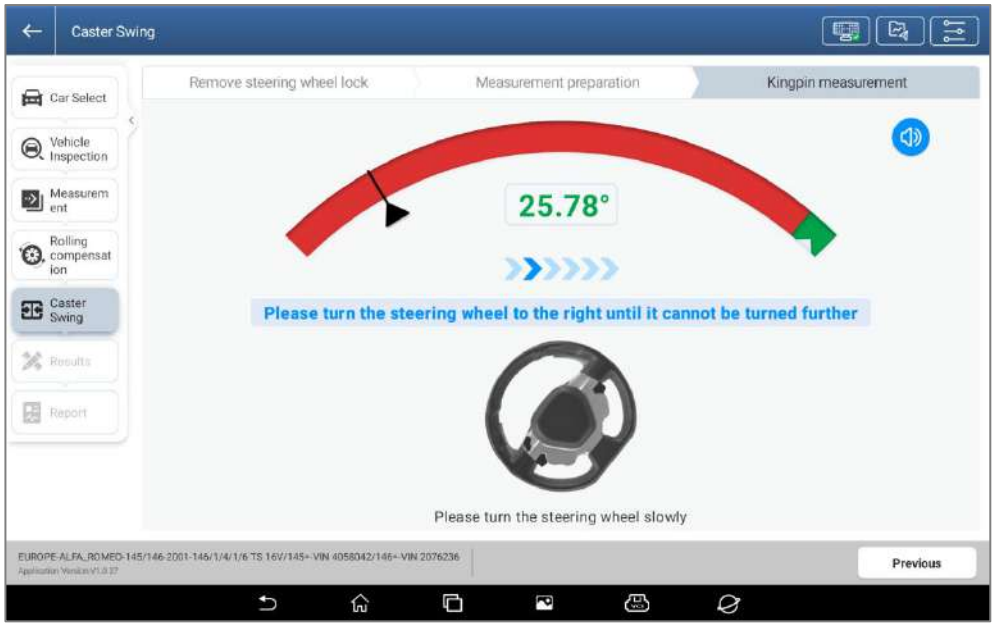
wheels is equal.



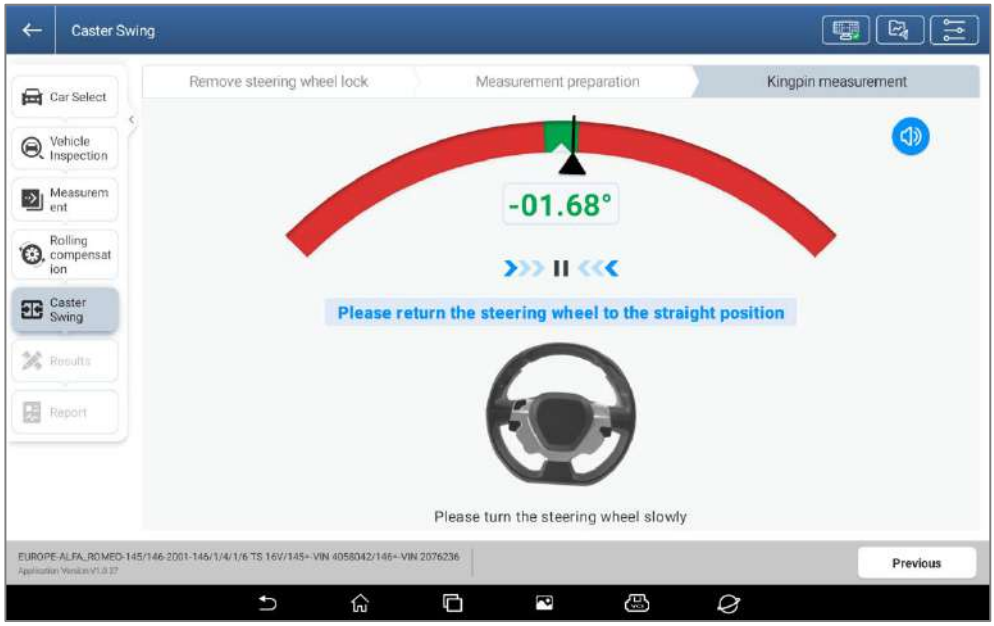
2) According to the interface prompts, turn the steering wheel to the left or right (turn the steering wheel slowly at a constant speed), when the wheel turning angle reaches or exceeds the set angle (12°), the interface prompts to turn the steering wheel in the opposite direction.



3) According to the interface prompts, turn the steering wheel slowly at a constant speed, when the wheel turning angle reaches or exceeds the set angle (12°), the interface prompts to return the steering wheel.



4) According to the interface prompts, turn the steering wheel to the initial position.



When the kingpin measurement is finished, turn to the "Measurement Result" interface.

Note: If you need to adjust the chassis, the lifter is shaking or lifting, please click the [ ] button to execute the "Global Calibration" to ensure that the height of the two lifter axle plates is the same.

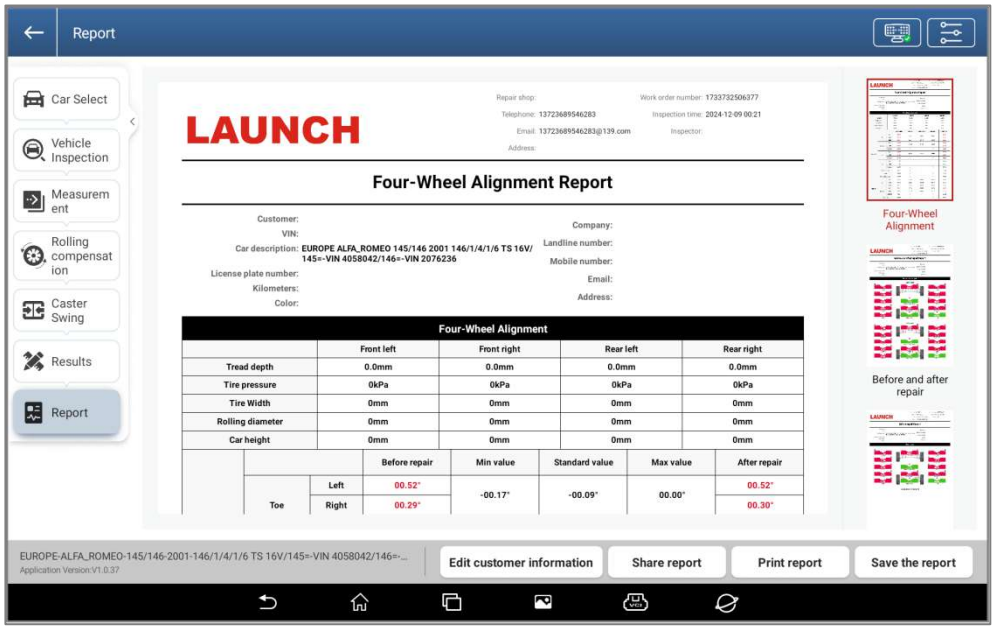
3.2.6 Measurement Result

This function is used to view and save the measurement results. The default display is the measurement result of "Kingpin", if you want to view the measurement results of "Rear Axis", "Front Axis", "All Measurements", “Symmetry”, etc., please click the corresponding buttons at the top of the screen to view them respectively.
Click [Unit settings] to modify the display unit of the measurement items.
Before maintenance, please click [Save current value before repair], the measurement results will be updated in real time after the completion of maintenance, click [Next] to save the current measurement results and enter the "Report" interface.

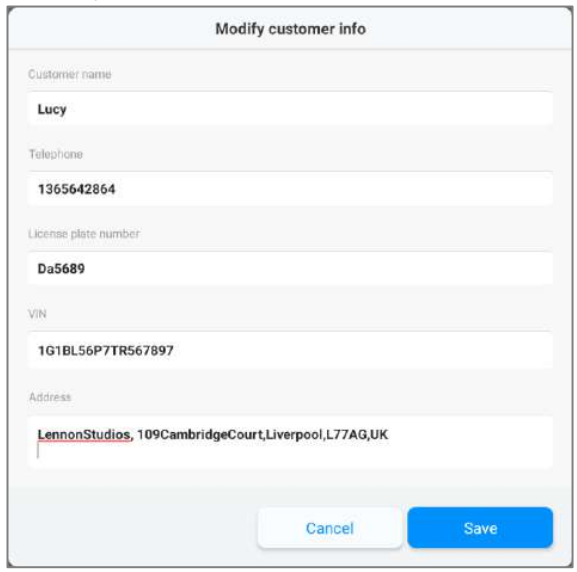
3.2.7 Inspection Report

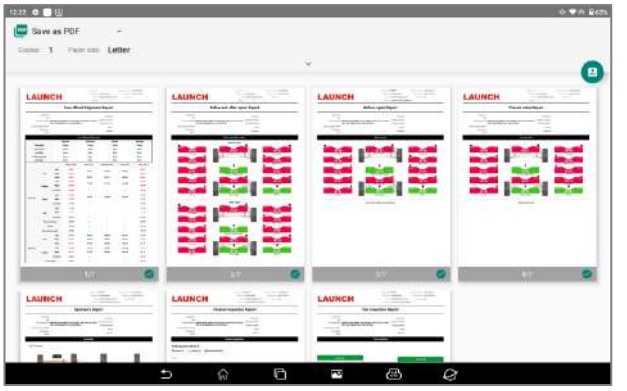
This function is used to view, save and share the inspection report. On the right side of the screen, you can click Four-Wheel Alignment, Before and After Repair, Before Repair, Current Value, Symmetrical Value, Tire Inspection, Body Height and other inspection

reports to view them separately.



The screen buttons are described below:

[Edit Customer Information]	You can modify or add customer information. 

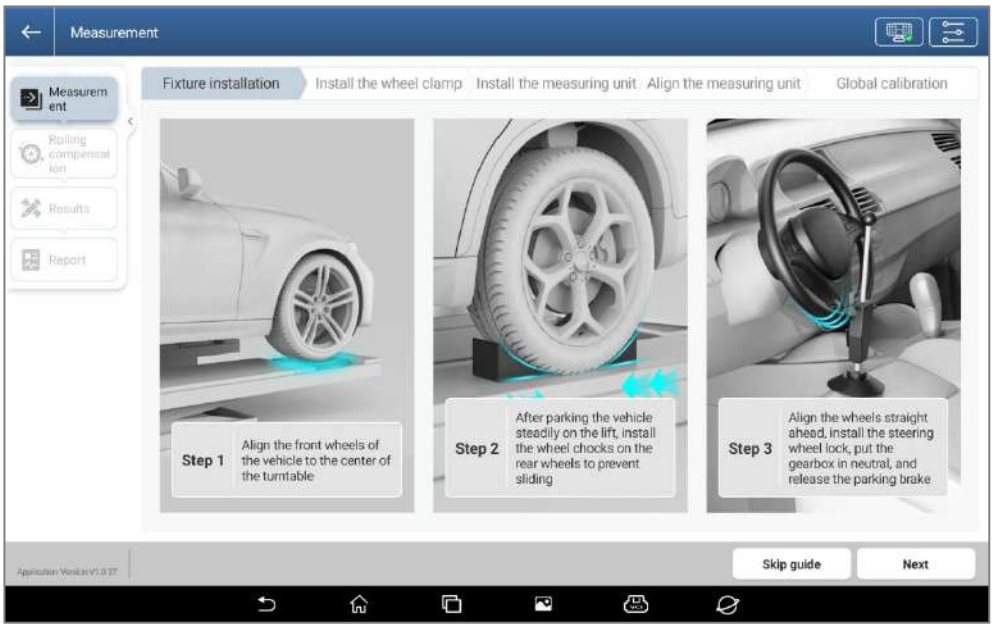
[Share Report]	The inspection report can be shared via QR code or e-mail.
[Print Report]	You can print the current inspection report, or select "Save as PDF" in the upper left corner of the pop-up interface to save the report as a PDF document. 
[Save Report]	Save the inspection report on the diagnostic tablet, you can click [Inspection Record] in the main interface to query and manage all the saved inspection reports.

3.3 Quick Inspection

Quick Inspection does not include vehicle selection and vehicle inspection steps, do not carry out the kingpin measurement, if you need to operate all the measurement functions please select [Four-Wheel Alignment] for routine inspection.

3.3.1 Measurement Preparation

Click [Quick Inspection] in the main interface to enter the following interface:



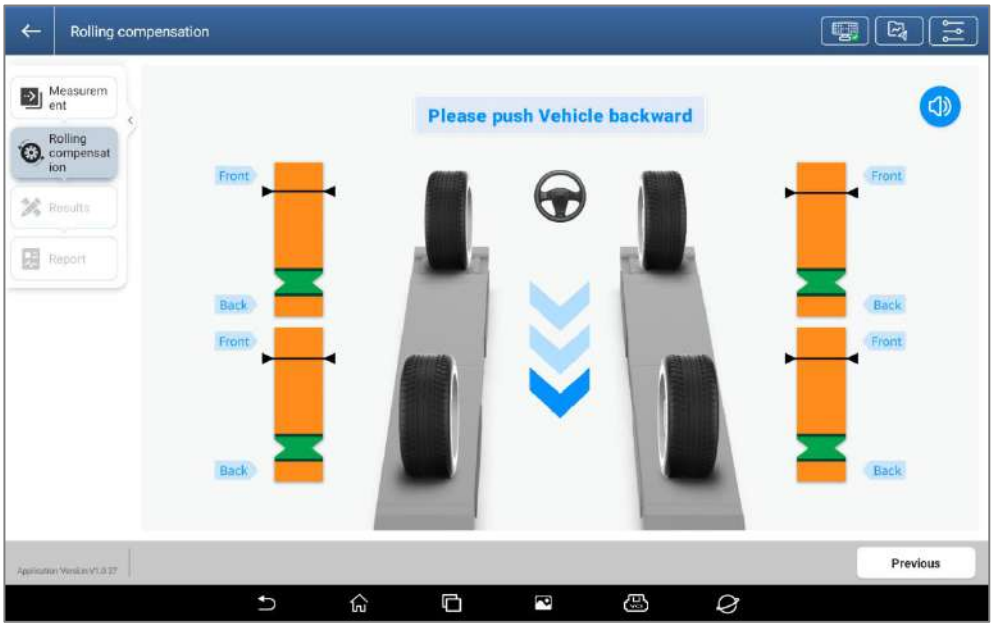
Follow the on-screen guidelines to complete the steps of fixture installation, wheel clamp installation, measuring unit installation, measuring unit alignment, global calibration, etc. After completing the measurement preparation, click [Next] to enter the "Rolling Compensation" interface.

3.3.2 Rolling Compensation

The rolling compensation operation is as follows:

1) According to the interface prompts, first slowly push the vehicle backward, so that all

the pointers stay in the green zone, as shown in the figure below.



2) When the interface prompts "Please push the vehicle forward", then push the vehicle forward slowly, so that all the pointers stay in the green zone again.

When the interface prompts "Rolling Compensation Completed", rolling compensation is completed, and automatically enter the "Measurement Result" interface.

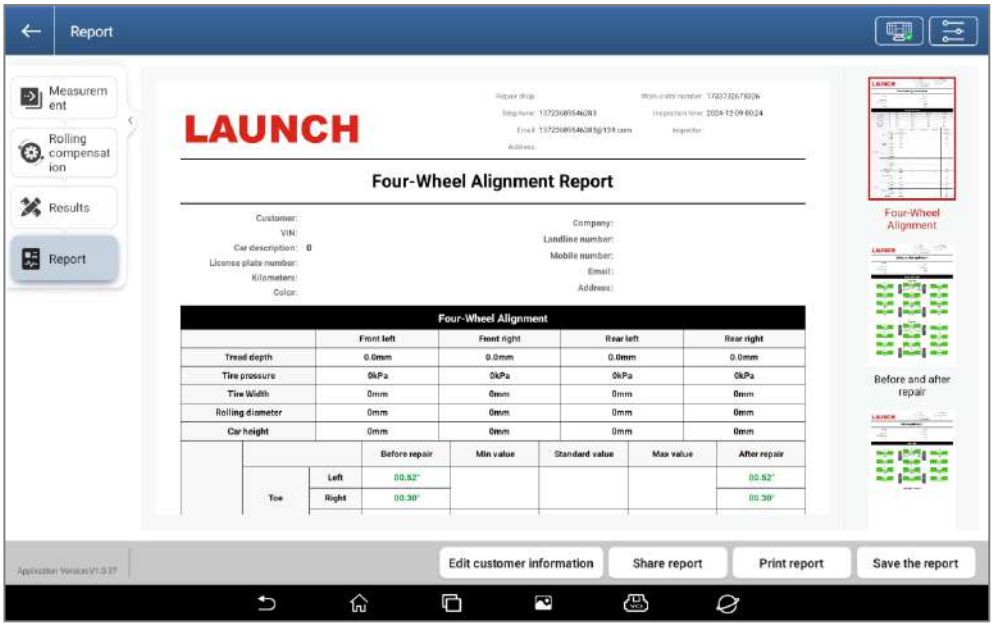
3.3.3 Measurement Result

This function is used to view and save the measurement results. The default display is "Rear Axis" measurement results, if you want to view the measurement results of "Front Axis", "All Measurements", "Symmetry" and other items, click the corresponding buttons at the top of the screen to view them respectively.

Save the measurement results before maintenance, after completing the maintenance, the measurement results will be updated in real time, click [Next] to save the current measurement results and enter the "Inspection Report" interface.

3.3.4 Inspection Report

This function is used to view, save and share the inspection report. On the right side of the screen, you can select Four-Wheel Alignment, Before and After Repair, Before Repair, Current Value, Symmetry and other inspection reports to view.



The screen buttons are described below:

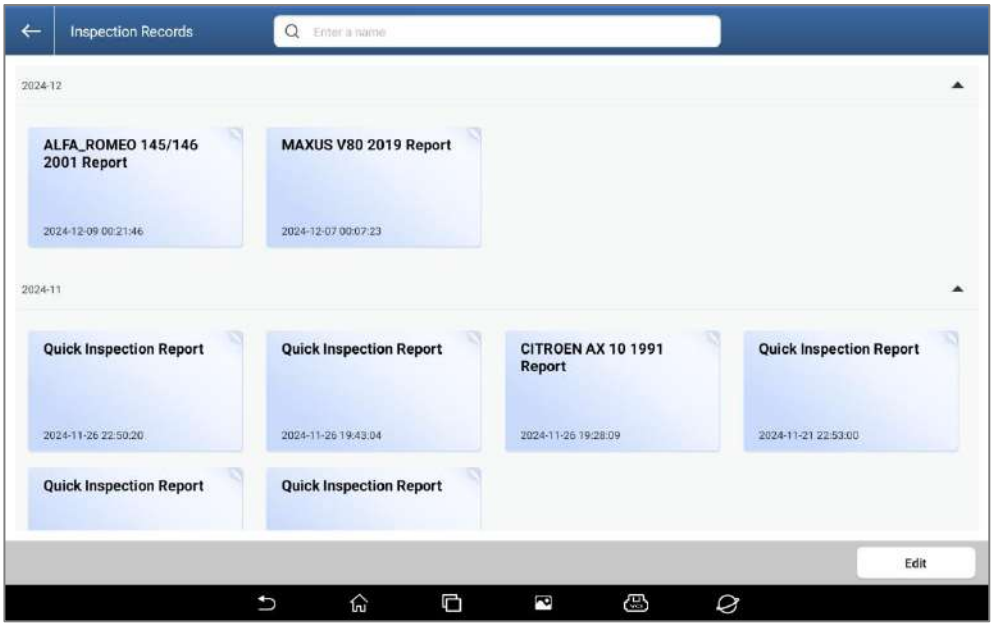
[Edit customer information]	You can modify or add customer information.
[Share report]	Inspection reports can be shared via QR code and e-mail.
[Print report]	You can print the current inspection report or save the report as a PDF document.
[Save the report]	Save the inspection report on the diagnostic tablet, you can click [Inspection Record] in the main interface to query and manage all the saved inspection reports.

3.4 Inspection Record

It is used to view and manage the saved inspection report.

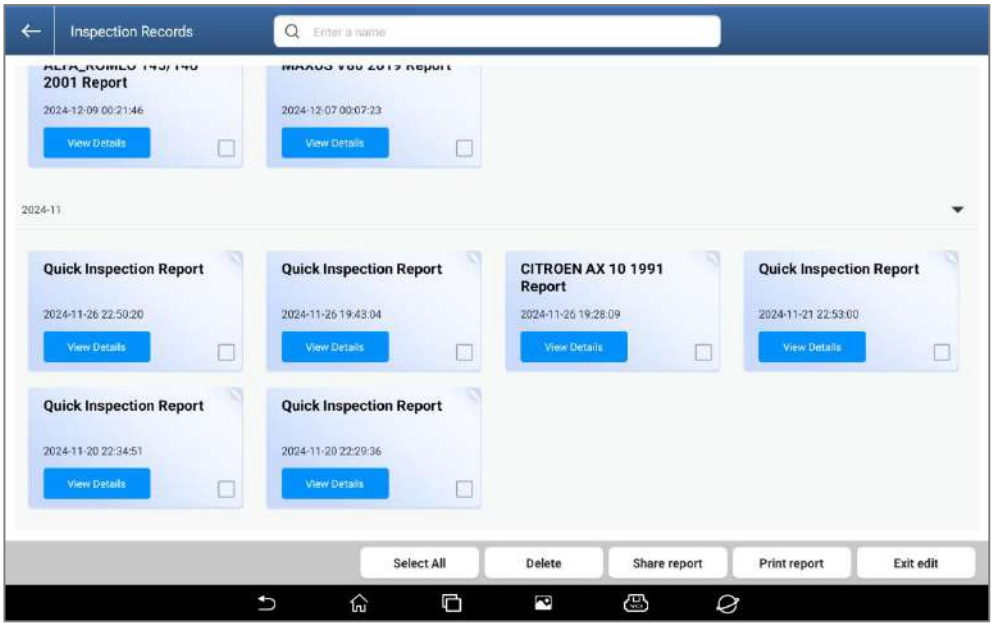
Click [Inspection Record] in the main interface to enter the "Inspection Record" interface, which are categorized according to the inspection time, click the down/up arrow on the right side of the corresponding time to unfold/fold the record list.

In the search box at the top of the screen, you can enter keywords in the report name to quickly search and find the corresponding inspection report.



Click on a single record to view the details of the inspection report, and you can share and print the inspection report.

Click [Edit] to manage the inspection report.



The screen buttons are described below:

[View Details]	View the details of the inspection report.
[Select All]	Check all the inspection reports that are unfolded.
[Delete]	Delete the selected inspection reports.
[Share Report]	Share the selected inspection reports, only one report can be shared at a time.
[Print Report]	Print the selected inspection report, only one report can be printed at a time.
[Exit Edit]	Exit the editing mode.

3.5 Database

This function includes a standard database and a customized database. The standard database includes information on all series of products produced by many domestic and foreign manufacturers during the production period, and the contents of the database can be updated in time through system upgrades.

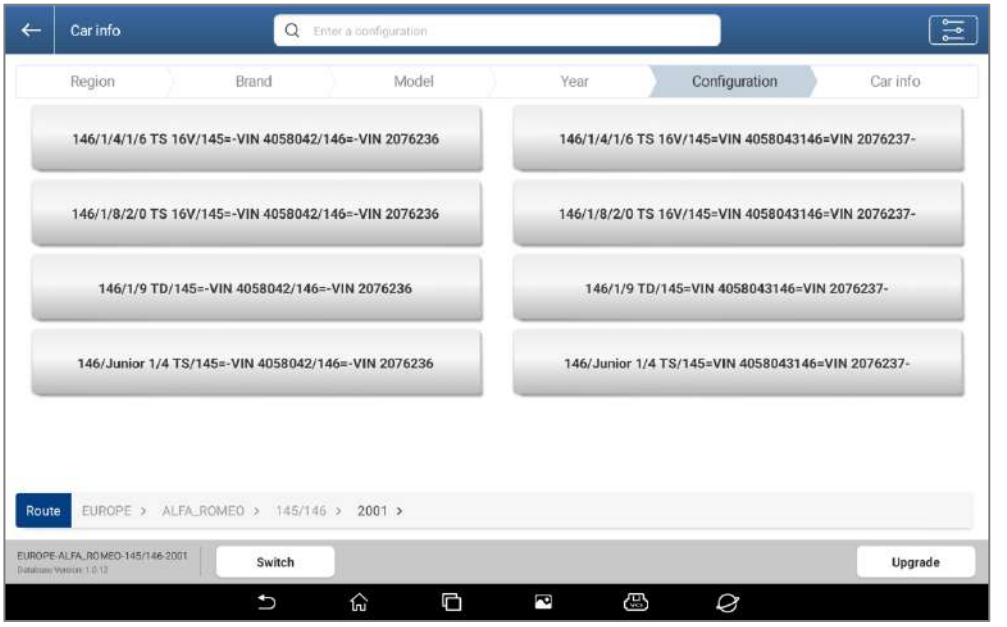
3.5.1 Standard Database

Click [Database] in the main interface, and then select [Standard Database].

In the standard database, select a vehicle by [Region] > [Brand] > [Model] > [Year] > [Configuration] (you can quickly find it by entering the corresponding keywords in the search box at the top of the screen) and enter the "Vehicle Information" interface to view the parameter information of the corresponding vehicle.

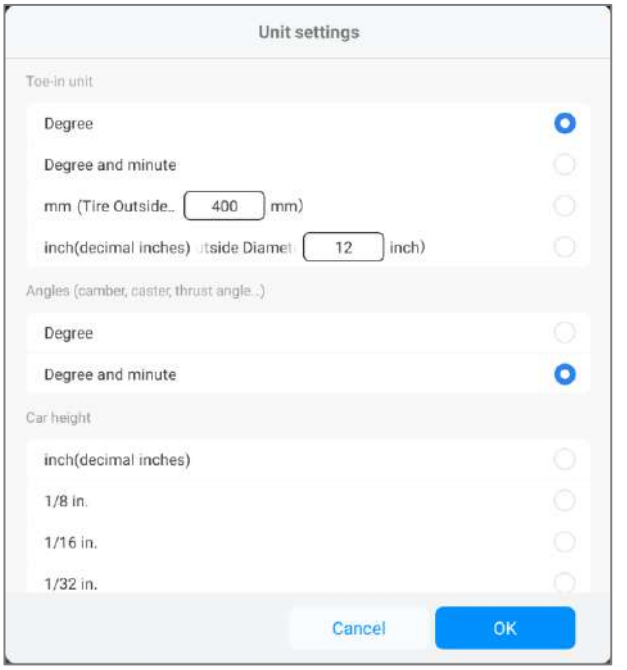
Click [Upgrade] at the bottom of the screen to upgrade the standard database to the latest version.

Note: After upgrading the database, the original customized data will not be lost.

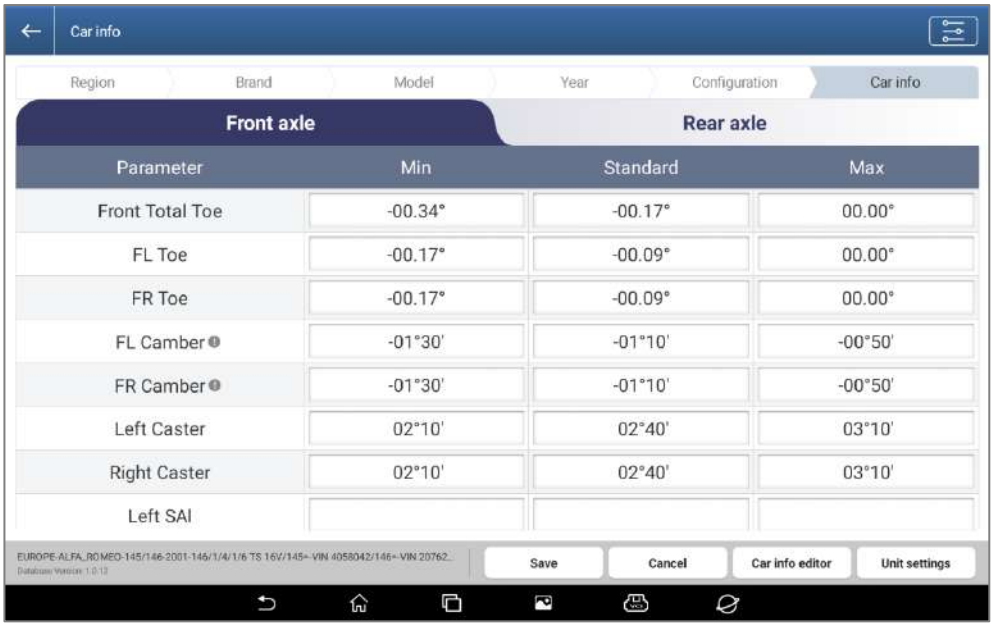


Enter the "Vehicle Information" interface.

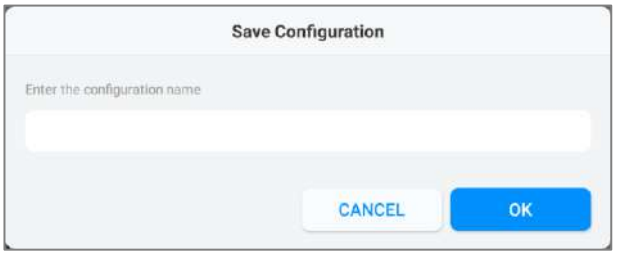
Click [Unit Setting] to modify the display unit of the corresponding parameter.



Click [Modify Configuration] to modify the value of the corresponding parameter as required, and then click [Save Current Configuration].



Enter the configuration name in the pop-up dialog box and click [OK] to save the modified configuration as a customized configuration.

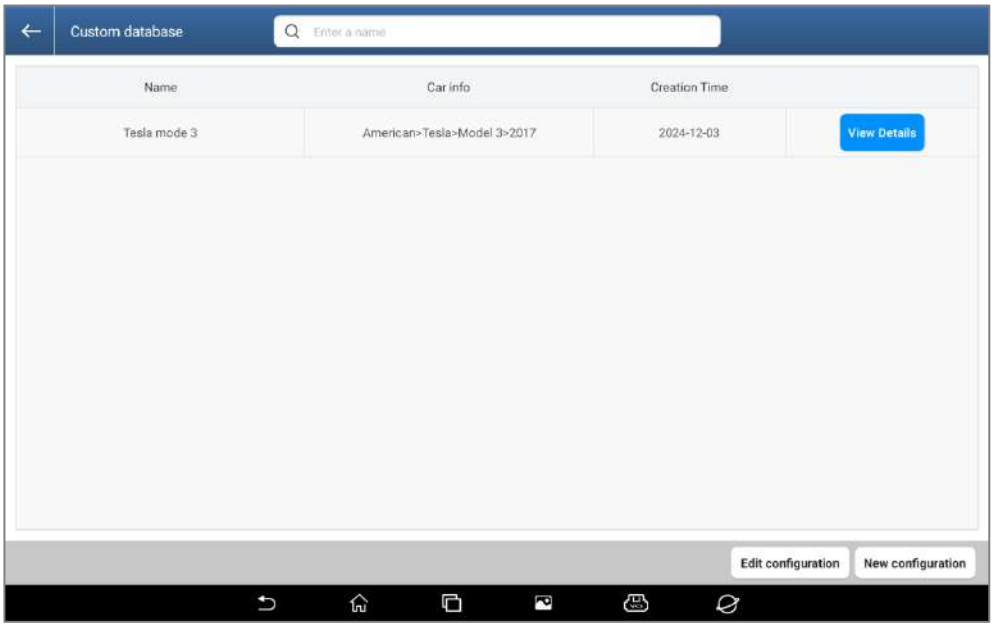


3.5.2 Customized Database

In addition to the standard database provided by the system, the user can also add customized data to add the model information that is not available in the standard data, so that the system is more suitable for the application of the repair station.

In the main interface, through [Database] -> [Customized Database] to enter the

"Customized Database" management interface.



The screen buttons are described below:

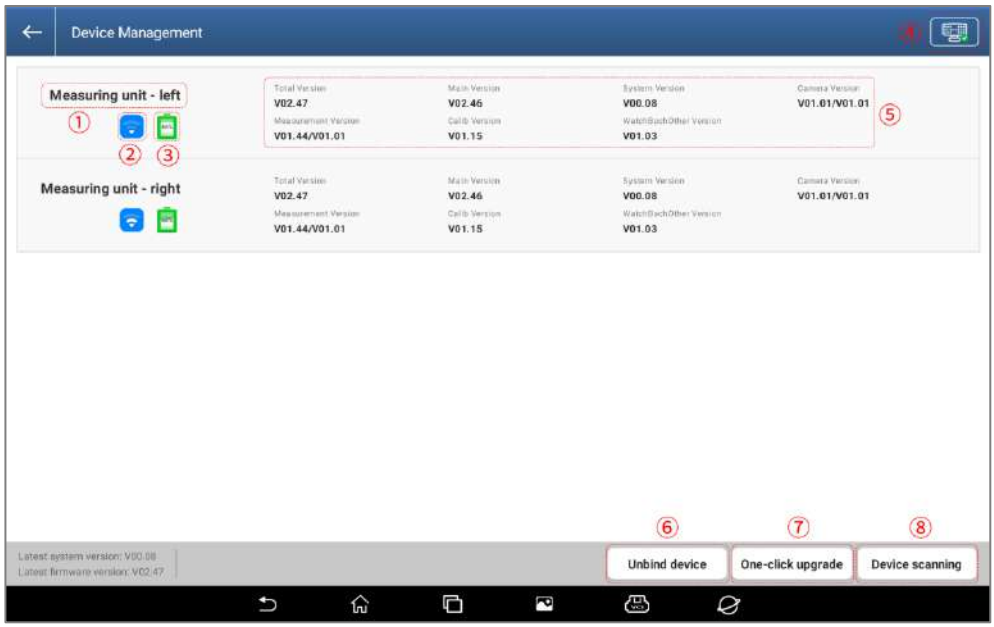
[View Details]	View the details of this customized data.
[Edit Configuration]	Be used to select and delete single or multiple customized data.
[Add New Configuration]	Used to add new customized data.

3.6 Device Management

This function is used to view device status and version information, manage device

system and firmware upgrade.

Click [Device Management] in the main interface to enter the following screen:



The screen buttons and display items are described as follows:

① Device Name and Identification	Be used to identify and distinguish different devices.
② Connection Status	The icon shows red when the device is not connected to the network, and the icon turns blue and shows the network signal strength when the device is connected to the network.
③ Battery Status	● The icon is displayed as when the device is not connected to the network. ● The icon turns to when the device is connected. ● The icon is displayed in red when the battery level is below 20%.
④ Device Status	Be used to view the device status. You can view the network connection status between the measuring unit and the diagnostic tablet, the power level of the measuring unit, and the network signal strength of the measuring unit.
⑤ Version	Be used to display version information such as system

Information	version, firmware version, etc. of the X-613 device.
⑥ **Unbundle Device**	Unbind X-613 device and diagnostic tablet.
⑦ **One-click Upgrade**	Be used to upgrade the device firmware and system to the latest version with one click. Note: When upgrading, please turn the power switch of the 2 measuring units to "ON". Make sure that the battery level of each unit is higher than 80% or place the device on the charging dock to charge.
⑧ **Device Scanning**	Be used to scan and connect devices for networking.

3.7 System Setting

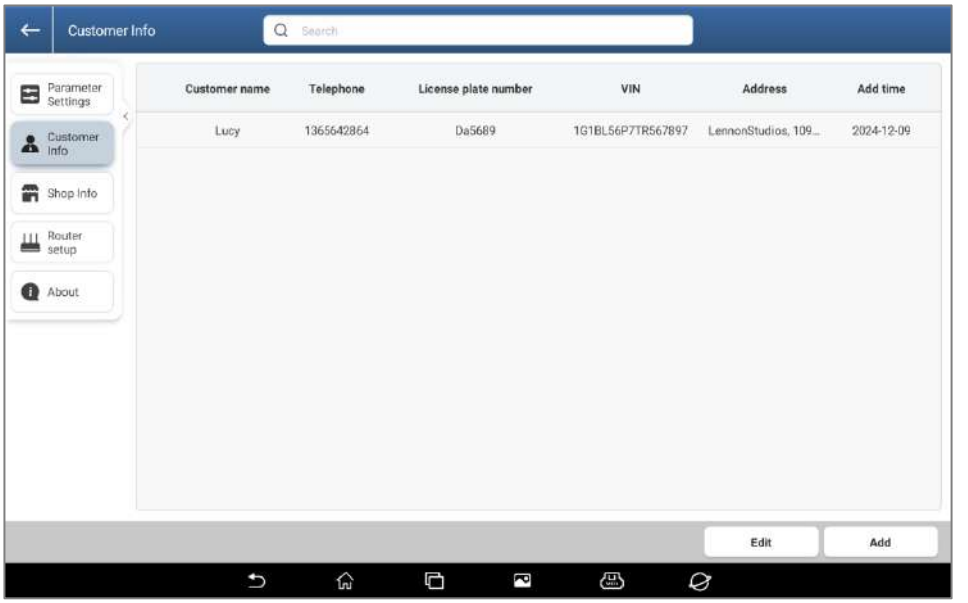
This function is used to set parameters, manage customer and store information, and view information such as application version and serial number.

3.7.1 Parameter Setting

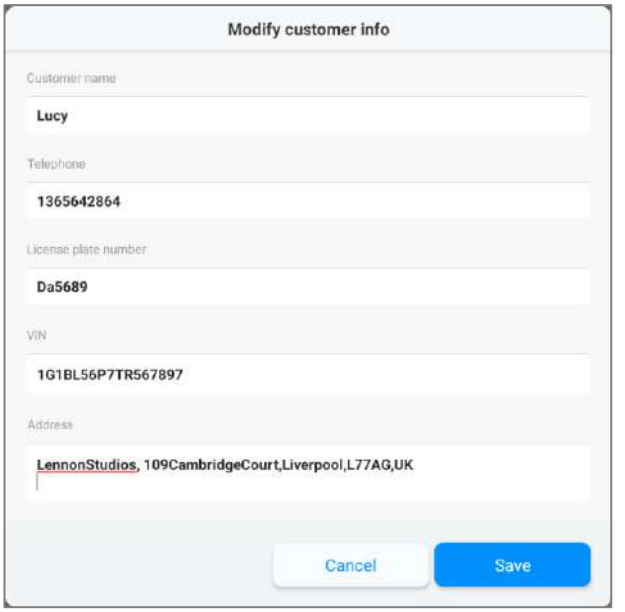
Click [System Setting] in the main interface to enter the "Parameter Setting" interface. Users can switch different display units for toe, angle, track width and wheelbase, tire pattern depth, tire pressure, vehicle height, etc. as needed.

3.7.2 Customer Information

Click [Customer Information] on the left side of the screen to enter the "Customer Information" management interface.

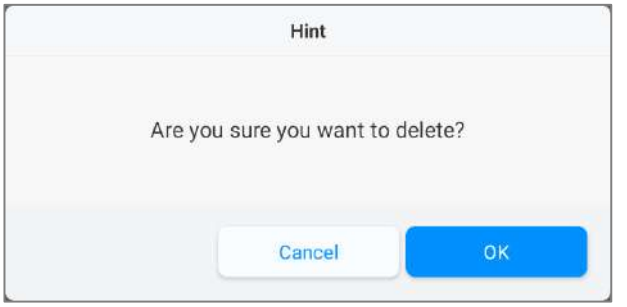


Click a single customer information, edit the corresponding information in the pop-up window and click [Save] to modify the customer information.

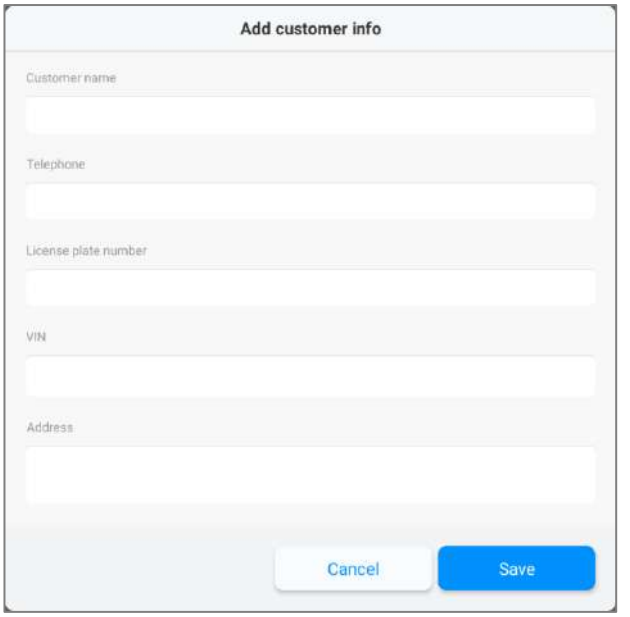


Click [Edit], then click the check box in front of the single customer information, and then click [Delete].

Click [OK] in the pop-up dialog box to delete the selected customer information.



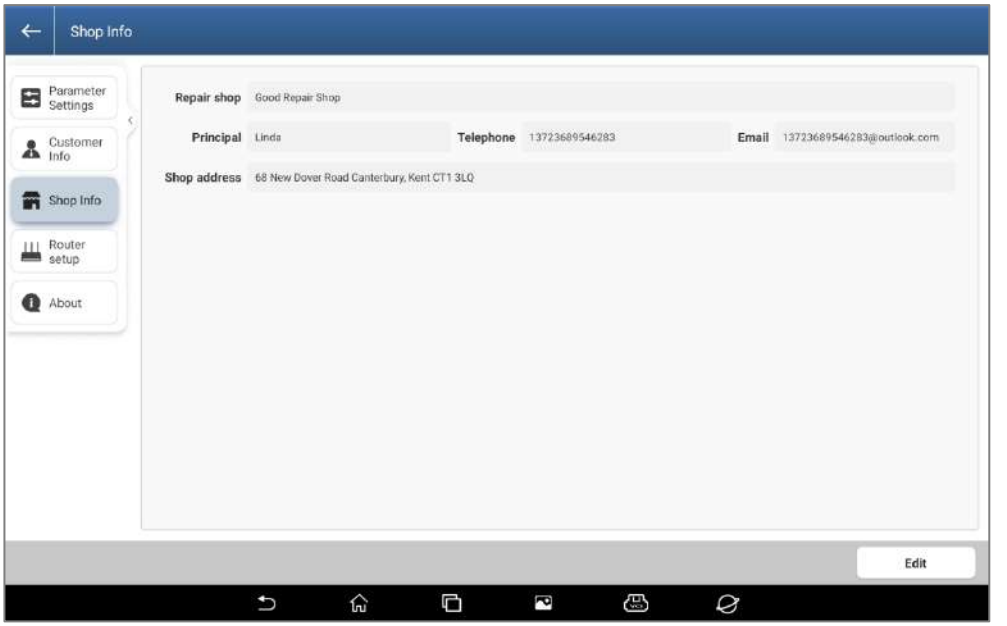
Click [Add] and enter the corresponding customer information in the pop-up window, then click [Save] to add the new customer information.



3.7.3 Store Information

Click [Store Information] on the left side of the screen to enter the "Store Information" management interface.

Click [Modify], then edit the corresponding store information, click [Save] to save the new store information.

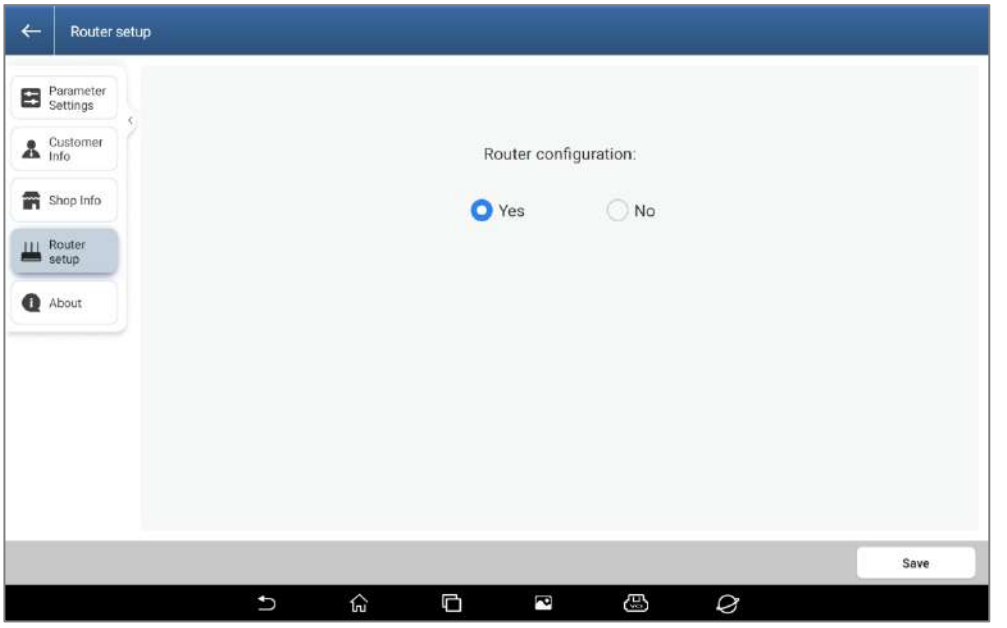


3.7.4 Router Setting

Click [Router Setting] on the left side of the screen to enter the "Router Setting" interface, select [Yes] to turn on the router.

Note:

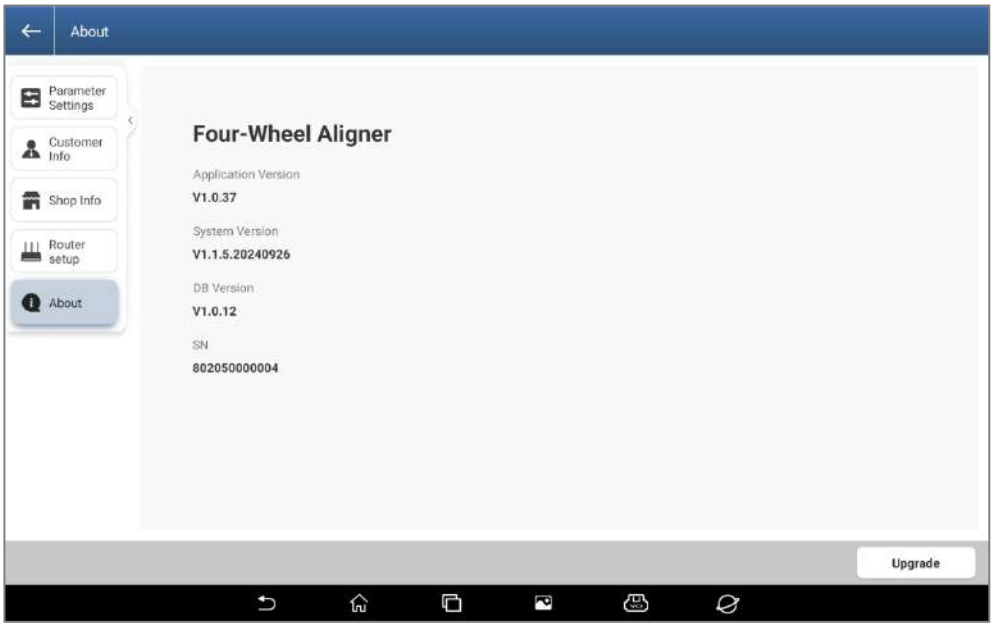
- Router configuration defaults to [Yes].
- It is forbidden to modify the router setting, otherwise it may cause the device to connect abnormally.



3.7.5 About

Click [About] on the left side of the screen to check the version number, serial number

and upgrade management.



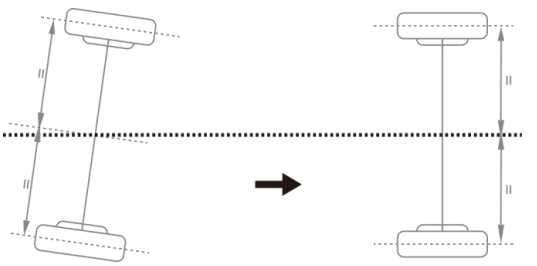
Click [Upgrade], the system will check if there is a new application version and upgrade the application to the latest version.

4. Terminology

The four-wheel alignment angle is the relative angle that exists between the suspension system and each moving part. Maintaining the correct four-wheel alignment angle ensures the vehicle's driving stability and reduces tire wear.
The main four-wheel alignment angles of a vehicle include: camber angle, toe angle, caster angle, and inclination angle.

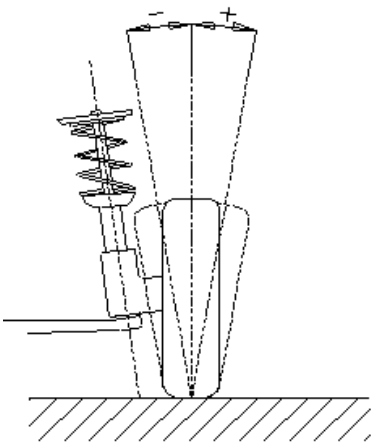
4.1 Geometric Centerline

It refers to the intersection line between the longitudinal center plane of the car body and the horizontal plane passing through the front and rear axles.



4.2 Camber Angle

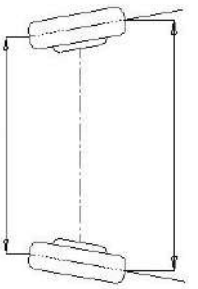
Camber angle is defined as the angle between the centerline of the tire and the vertical line when viewed from the front of the vehicle, **which is positive outward and negative inward**, as shown in the figure below. The difference in angle can change the point of contact between the tire and the ground and the point of application of force, which directly affects the adhesion and wear of the tire, and changes the distribution of force on the axle to avoid abnormal wear of the bearings. In addition, the existence of camber angle can be used to offset the angular change caused by the deformation of suspension system parts and the gap between movable surfaces after the car body is loaded. The presence of camber angle also affects the direction of travel of the vehicle, just as a motorcycle can utilize a leaning body to turn. Therefore, the camber angle of the left and right wheels must be equal, so that the balance of forces does not affect the straightness of the car, and then cooperate with the toe to improve the stability of the straightness and avoid uneven tire wear. Without this camber angle, the wheels will tilt too far to the inside when fully loaded, thus accelerating the eccentric wear of the tire and the wear of the wheel bearing.



4.3 Toe (Angle)

Toe angle is defined as the angle between the tire centerline and the longitudinal axis of the vehicle when viewed from the top of the vehicle looking downward, **inward being positive and outward being negative**, as shown in the figure below. The total toe value is equal to the sum of the toe values of the two wheels, i.e. the angle between the centerlines of the two tires. The function of the toe angle is to compensate for the tendency of the tires to roll inward or outward due to camber and road resistance, in order to ensure the straightness of the car.

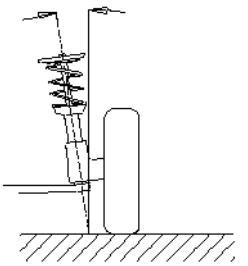
A related parameter to the toe angle is the toe-out on turns, which is also defined as the angle between the left and right tires when viewed from above the car, but with the opposite sign of the toe angle, **inward being negative and outward being positive**. Since some people are accustomed to the use of toe-out on turns, special attention should be paid to the difference between toe angle and toe-out on turns.



4.4 Kingpin Inclination Angle

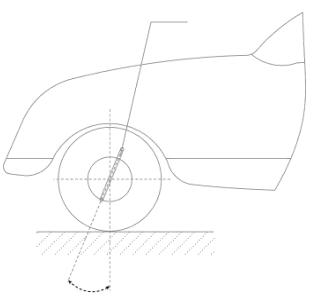
Kingpin inclination angle is defined as the angle between the centerline of the steering shaft and the vertical line as seen from the front of the vehicle, as shown in the figure

below. With kingpin inclination angle, the weight of the vehicle is evenly distributed over the bearings, which protects the bearings from damage, and equalizes the steering force, making the steering lighter. On the contrary, if the kingpin inclination angle is 0, the weight of the car and the ground reaction force will produce a large transverse shear stress in the axle, easy to make the axle damaged, the steering will also become heavy. In addition, the kingpin inclination angle is also the source of the return force after the front wheel steering. Kingpin inclination angle is set at the beginning of the vehicle suspension design and is usually not adjustable.



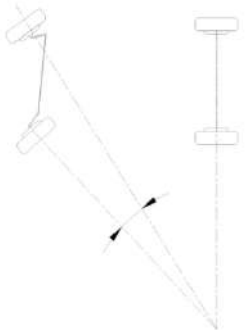
4.5 Kingpin Rear Caster Angle

Kingpin caster angle is defined as the angle between the centerline of the steering axis and a vertical line as viewed from the side of the vehicle, with forward being negative and backward being positive, as shown in the figure below. The existence of the kingpin caster angle can make the steering axis line and the road meeting point in front of the tire grounding point, and the car can keep straight by using the resistance of the road surface to the tire. The principle is just like the front wheel of a shopping cart will automatically turn to the direction where you apply force and keep straight. The greater the kingpin caster angle, the better the car's straightness and the better the steering wheel's recovery after steering, but it will make the steering heavy. In general, the kingpin caster angle of the car is about 1 degree to 4 degrees.



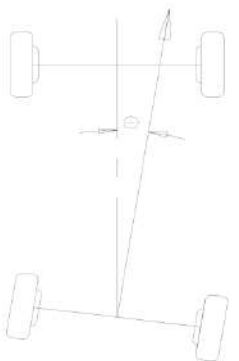
4.6 Toe-out on Turns at 20° Steering

The toe-out on turns in steering is defined as the difference between the steering angles of the two front wheels at 20° of steering, as shown in the figure below. The inner wheel usually turns more than the outer wheel, the difference is about 2 degrees, the purpose is to make the car can turn smoothly in a corner with the instantaneous center of the rear axle extension line as the center of the circle. In addition when the inner wheel angle is larger, the drag is also larger, and the difference in drag can cause the car to favor the side with more drag, making steering easier.



4.7 Thrust Angle

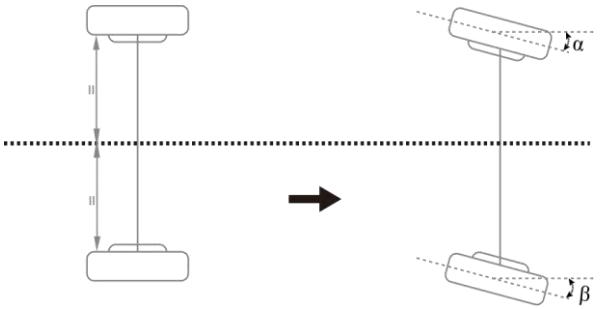
Thrust angle is defined as the angle made by the angle bisecting the total toe of the rear wheels of the car (trust line) and the geometric centerline, as shown in the figure below. It is generally specified that the thrust line is positive toward the left and negative toward the right. If the thrust angle is not zero, there is a tendency for the vehicle to move sideways. If this occurs, the rear wheel toe need to be adjusted.



4.8 Maximum Steering Angle

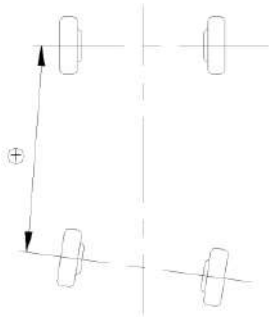
The maximum steering angle of a vehicle is the angle formed by turning the front wheels of the vehicle to the left or right to the limit position and the centerline of the front wheels

when no deflection occurs.



4.9 Wheelbase Difference

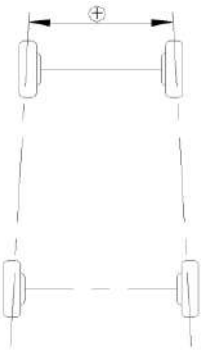
The angle between the line connecting the centers of the two front wheels and the line connecting the centers of the two rear wheels is known as the wheelbase difference (also known as wheelbase deviation) of the car. When the distance of the right wheel is greater than that of the left wheel, this state specifies that the wheelbase difference is positive, and conversely when the distance of the right wheel is smaller than that of the left wheel, this state specifies that the wheelbase difference is negative. If the front and rear track width of the car is already known in the specification values of the car, the wheelbase difference can be expressed in terms of the angular value, as shown in the figure below.



4.10 Track Width Difference

The included angle formed by the connecting line between the left front wheel and the left rear wheel and the ground contact point and the connecting line between the right front wheel and the right rear wheel and the ground contact point is called the track width difference of the automobile (also known as the wheel track width deviation). When the distance between the lines connecting the centers of the two rear wheels is greater than the distance between the lines connecting the centers of the two front wheels, this state specifies that the track width difference is positive, and vice versa specifies that the track

width difference is negative, and if the left and right wheelbase of the car are already known in the specification values of the car, the track width difference can be expressed in terms of angular value, as shown in the figure below.

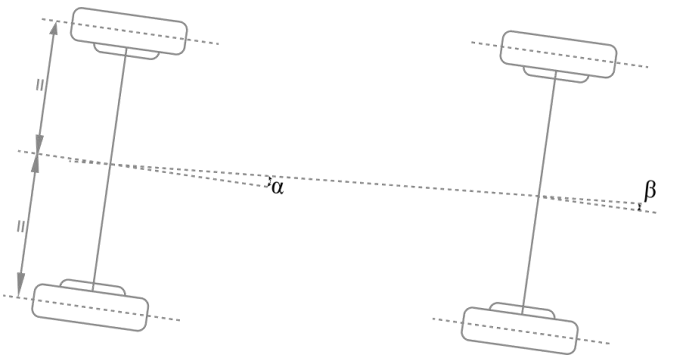


4.11 Left (Right) Lateral Offset (Angle)

The amount of relative offset between the left (right) rear wheel and the left (right) front wheel in the lateral direction of the car is the left (right) lateral offset. The left (right) lateral offset is positive when the left (right) rear wheel is offset outward compared to the left (right) front wheel, and negative vice versa. The angle between the line connecting the centers of the front and rear wheels on the left (right) side and the thrust line is the left (right) lateral offset angle.

4.12 Axle Offset (Angle)

The relative offset of the front and rear axles in the lateral direction of the car is called axle offset. When the rear axle is offset to the right compared to the front axle, the axle offset is positive and negative vice versa. The angle between the bisector of the track width difference angle and the thrust line is known as the axle offset angle.

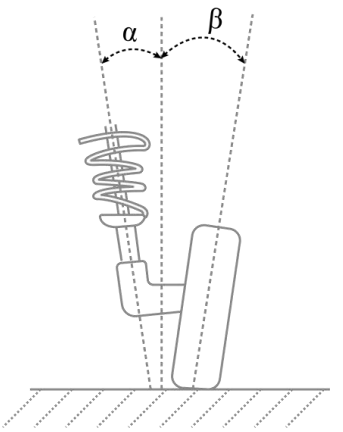


4.13 Delay (Angle)

The relative offset of the wheels on both sides of the same axle in the longitudinal direction of the car is called the delay. When the right wheel on the front (rear) axle is behind the left wheel, the front (rear) delay is positive and negative vice versa. The angle between the line connecting the centers of the two front (rear) wheels and the vertical line of the longitudinal geometric centerline of the car is called the front (rear) delay angle.

4.14 Included Angle

The angle Y between the axis of the kingpin and the axis of the wheel is called the included angle, the value of which is the sum of the kingpin inclination angle α and wheel camber angle β, as shown in the figure below.



4.15 Wheel Alignment

Half of the difference between the left toe and the right toe of the front wheels.

4.16 Symmetry Value

The geometry of the vehicle is usually symmetrical, used to initially determine whether the vehicle has been in an accident and to assist in four-wheel alignment.

FCC Warning

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with FCC radiation exposure limits set forth for an uncontrolled

environment. This device should be installed and operated with minimum distance 20cm between the radiator & your body.

Specific Absorption Rate (SAR) information:
This device meets the government's requirements for exposure to radio waves. The guidelines are based on standards that were developed by independent scientific organizations through periodic and thorough evaluation of scientific studies. The standards include a substantial safety margin designed to assure the safety of all persons regardless of age or health. FCC RF Exposure Information and Statement the SAR limit of USA (FCC) is 1.6 W/kg averaged over one gram of tissue. Device types: This device has also been tested against this SAR limit.
This device was tested for typical body-worn operations with the back of the This device kept 0mm from the body. To maintain compliance with FCC RF exposure requirements, use accessories that maintain an 0mm separation distance between the user's body and the back of This device. The use of belt clips, holsters and similar accessories should not contain metallic components in its assembly. The use of accessories that do not satisfy these requirements may not comply with FCC RF exposure requirements, and should be avoided.

Note: Indoor use only.

Warranty

This warranty applies only to customers and dealers who purchased Launch's products through normal procedures.

For a period of one (1) year from the date of delivery, Launch will warrant its electronic products against defects in material or workmanship. The damage of this device or parts caused by abuse, unauthorized change, use for purposes other than the design of this product, and failure to operate in the manner specified in the Manual is not covered by this Warranty.

Waiver

The above warranty is in lieu of any other form of warranty.

Order Notification

Replaceable parts and optional accessories may be ordered directly from Launch's authorized suppliers, please specify the following items when ordering:

- Order Quantity
- Part Number
- Part Name

Customer Service Center

If you encounter any problems during the operation of the device, please call: 4000666666.

When the device needs to be repaired, please send the device to Launch with the purchase invoice and a description of the problem. If the device is under warranty, Launch will repair the device free of charge; if the device is not under warranty, Launch will charge for the repair and return freight.

Address of Launch:

Customer Service Center of Launch Tech Co., Ltd., No.4012, Launch Industrial Park, North Wuhe Rd, Bantian Street, Longgang District, Shenzhen, China

Postal Code: 518129

Statement: LAUNCH reserves the rights to make any change to product designs and specifications without notice. The actual object may differ a little from the descriptions in the manual in physical appearance, color and configuration. We have tried our best to make the descriptions and illustrations in the manual as accurate as possible, and defects are inevitable, if you have any question, please contact local dealer or after-sale service center of LAUNCH, LAUNCH does not bear any responsibility arising from misunderstandings.