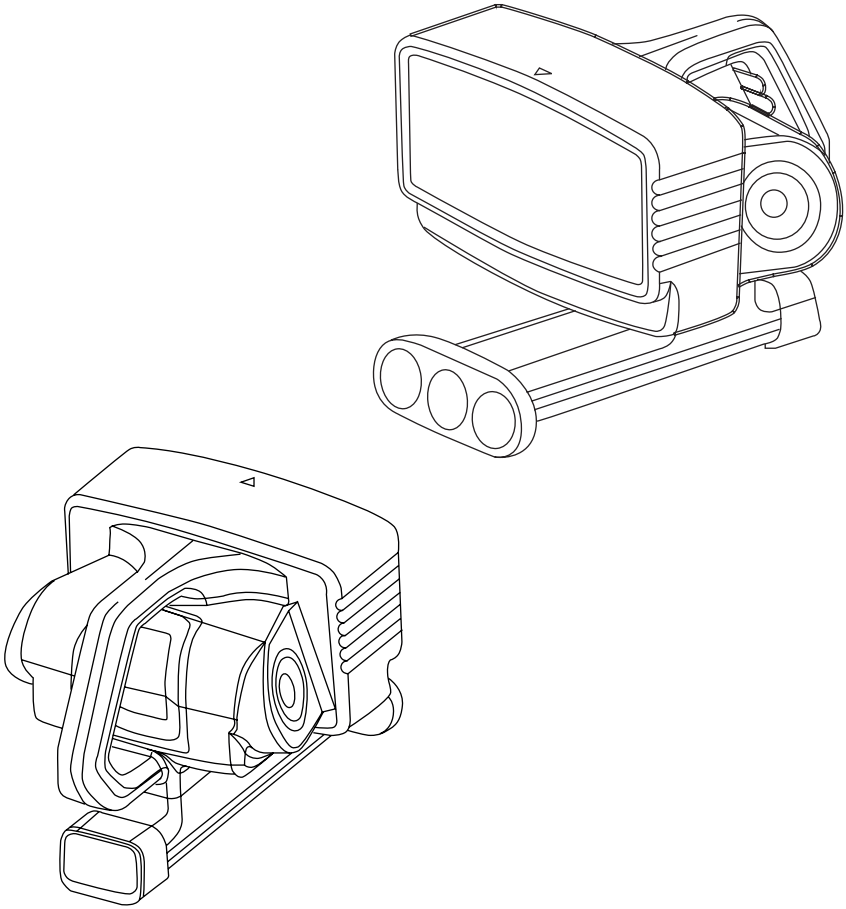
USER MANUAL

X-613

WIRELESS 3D WHEEL ALIGNMENT



LAUNCH

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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.

Contents

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

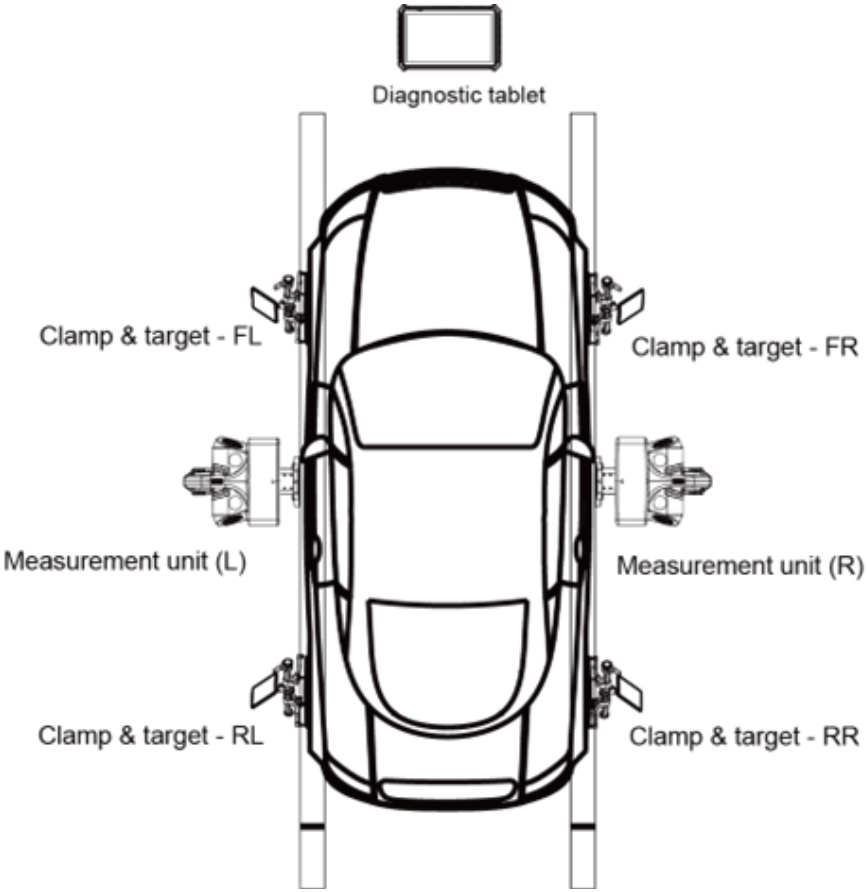
Supported Vehicle Specifications	
Wheelbase	1940mm ~ 4600mm
Track Width	275mm ~ 640mm
1290mm ~ 1900mm	470mm ~ 1100mm
Hub Diameter (with 3-point hub wheel clamp)	275mm ~ 640mm
Tire Diameter (with 4-point tire-hugging wheel clamp)	470mm ~ 1100mm

1.4 Environmental Requirements

Environmental Parameters	Requirements
Working Temperature	0ºC ~ 45ºC
Working Humidity	20% ~ 90%
Storage Temperature	-20ºC ~ 70ºC
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 Useh

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.



1. INSTRUMENT STRUCTURE

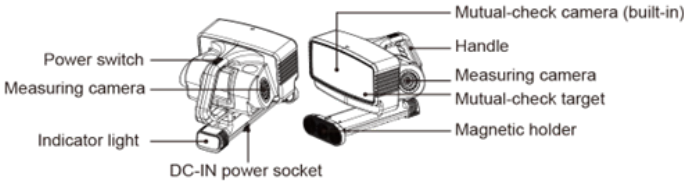
1.1 Overall Structure

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.

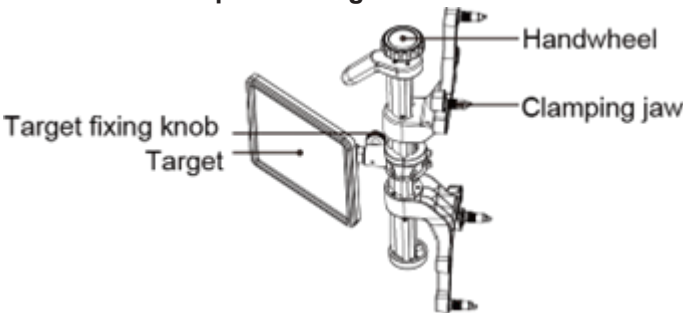
Note: The composition and accessories are different for different configurations, please consult your dealer or refer to the product packing list for details.

1.2 Measuring Unit Components

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



1.3 Wheel Clamps and Targets



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

2. FOUR-WHEEL ALIGNMENT PROCEDURE

2.1 Preparation

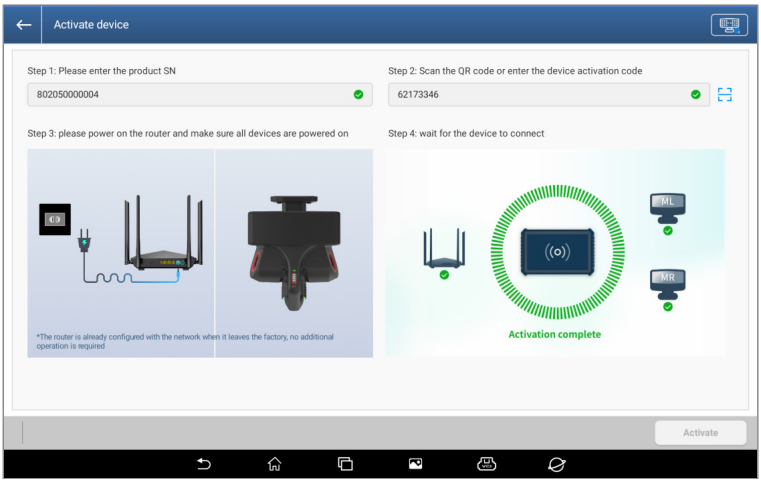
2.1.1. Device Activation

Wenn Sie den X-613 zum ersten Mal verwenden, müssen Sie den X-613 auf dem Diagnosetablett aktivieren.

Description:

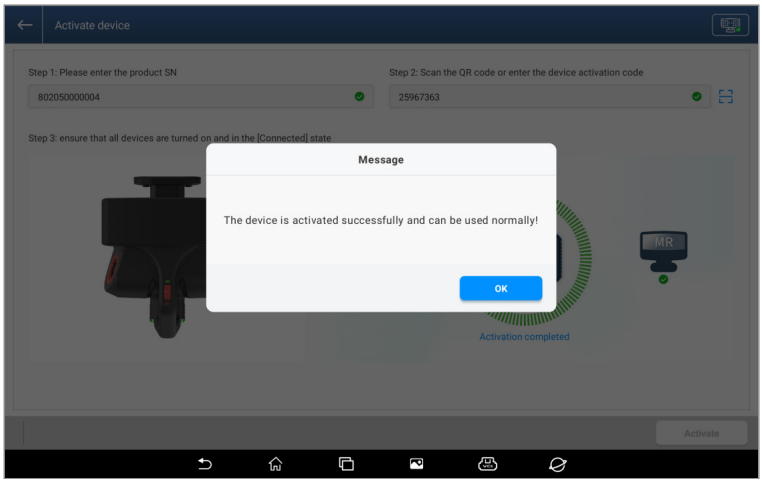
- Before activating the device, make sure the router network indicator is in the blue slow blinking state.
- Before activating the device, make sure that the X-613 device is in the normal startup state and is in the attempted connection state (i.e., the measuring unit is in the blue light blinking state) 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 APP [Wheel Alignment] on the diagnostic tablet to enter the main interface of the wheel alignment program.
2. Click the [Wheel Alignment] icon in the main interface to open the device activation interface, select the device and click [Activate].
3. Enter the serial number and the activation code of the X-613 and click on [Activate].



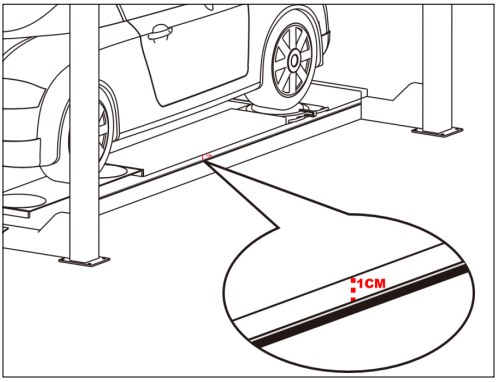
Note: You can click the icon to scan the activation code (QR code) of the device.

4. Activation succeeded.
5. Select the device.



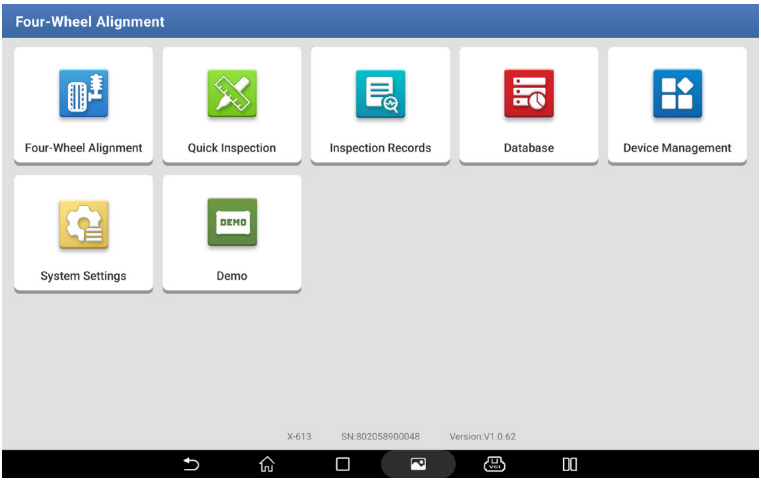
2.1.2. Use of positioning stickers

The product is supplied with positioning stickers to help with the installation of the device. Place the positioning sticker approximately 1 cm below the top edge of the lifting platform and ensure that it is parallel to the lifting platform.



2.2 Routine inspection

Click the [Wheel Alignment] APP on the diagnostic tablet to enter the main interface of the wheel alignment program. The main interface displays 6 functions: Wheel alignment, quick check, test report, database, Device management and system settings.

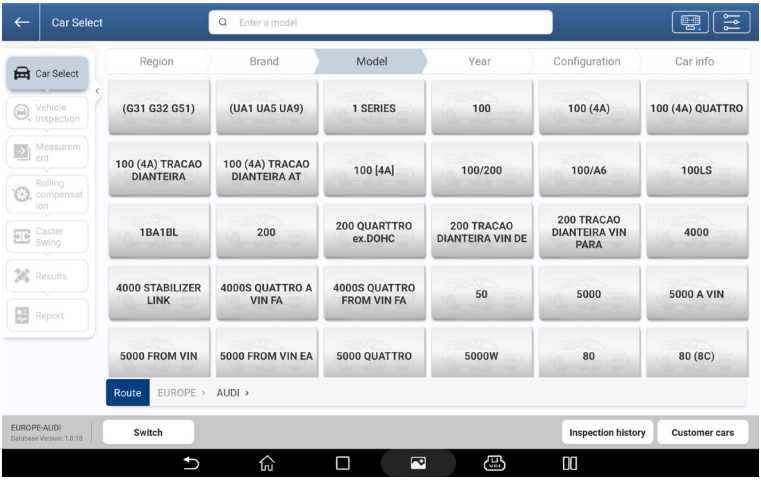


2.2.1. Vehicle selection

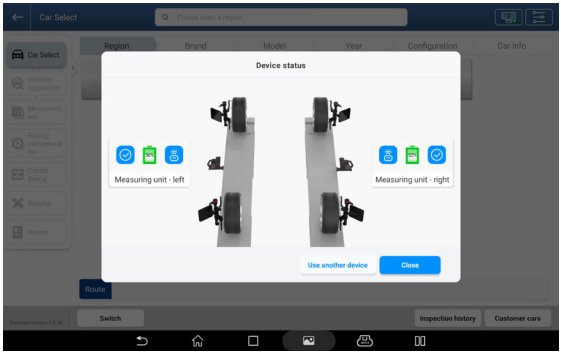
Click the [Wheel Alignment] icon in the main interface to open the four-wheel alignment routine inspection interface. First select the vehicle.

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

Note: Relevant information can be entered in the search field at the top of the screen for a quick search.

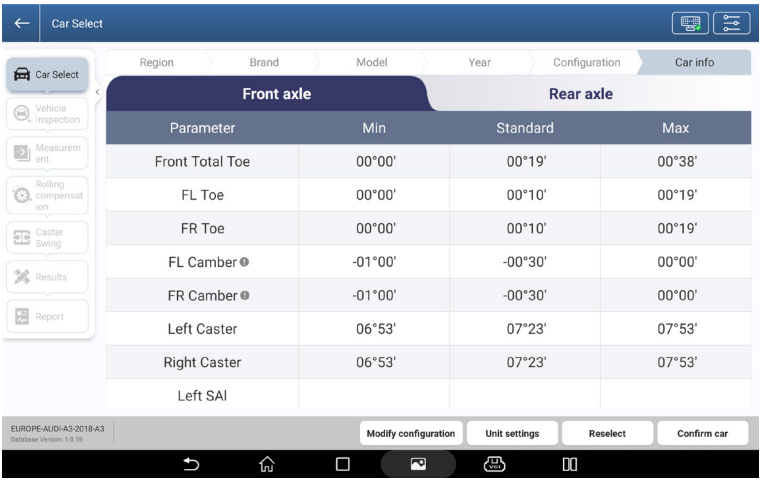


The screen buttons are described below:

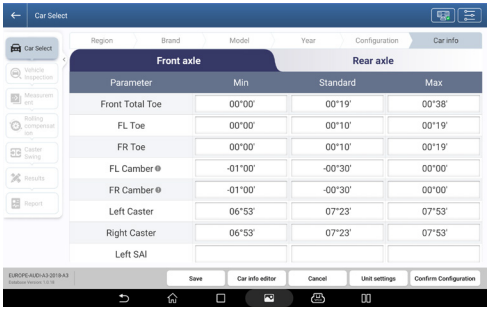
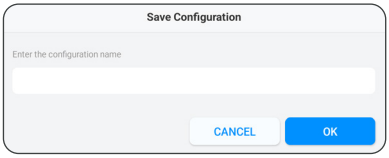
1) Device Status	Click this button to quickly check the device status, power, network connection signal and other information (green icon is displayed when all devices are online, red icon is displayed when there are devices with low power, orange icon is displayed when there are devices with abnormal status or faults, and blue icon is displayed when some of the devices are online or in connection). 
2) Parameter Setting	Click on this button to quickly return to the user interface. "Parameter setting" menu item.
3) Path	Enter the selected vehicle region, make and model,
4) History Inspection	For the direct selection of already tested vehicles on the basis of historical test protocols can be used.
5) Customer Vehicles	Used to display stored customer vehicle information for the direct selection of this vehicle.

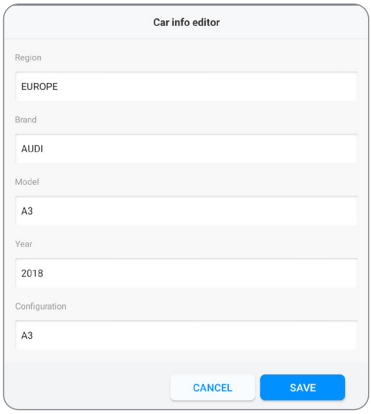
On the "Vehicle information" screen, you can enter the standard vehicle data view, change configurations and add user-defined data if required.

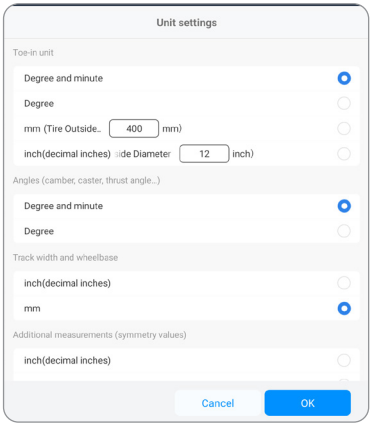
X-613 WIRELESS 3D WHEEL ALIGNMENT



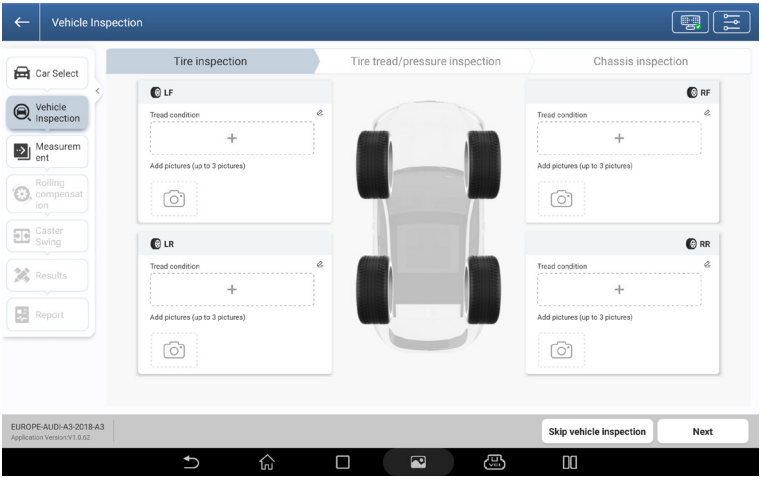
The screen buttons are described below:

[Configuration change]	You can use this function to adjust the configuration information. sen. Click on [Change configuration] to call up the following interface:  After you have changed the parameter values, click [Save], enter the configuration name in the pop-up window and then click [OK] to save the changed configuration in the user-defined database.  If you need to change the model information of the customized data, you can click [Edit vehicle information], change the corresponding information and then click [Save current configuration]..

[Configuration change]	 [Cancel]: Cancel the edit and return to the interface for confirming the vehicle information. [Confirm configuration]: Confirm that the configuration has been changed and return to the vehicle information confirmation interface.

[Unit setting]	You can use this function to set the unit of track, angle, vehicle height, track width and wheelbase. 
[Select new]	Select the vehicle again by [Region] -> [Make] -> [Model] -> [Year] -> [Configuration].
[Auto confirm]	Confirm the vehicle information and call up the screen for vehicle inspection.

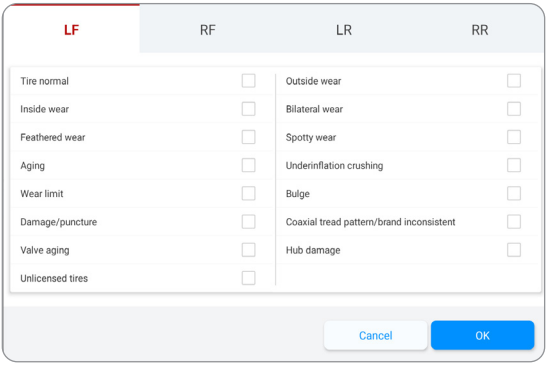
2.2.2. Vehicle inspection



Perform 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 on [Skip vehicle inspection] to call up the interface for measurement preparation.

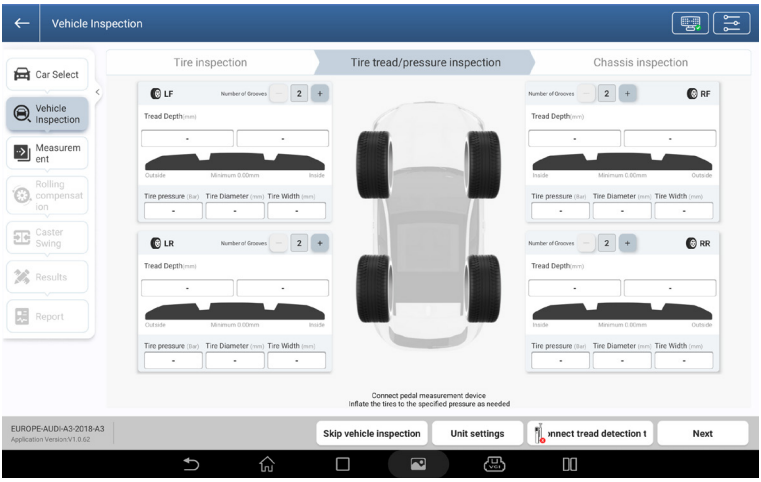
2.2.2.1. Tire inspection

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



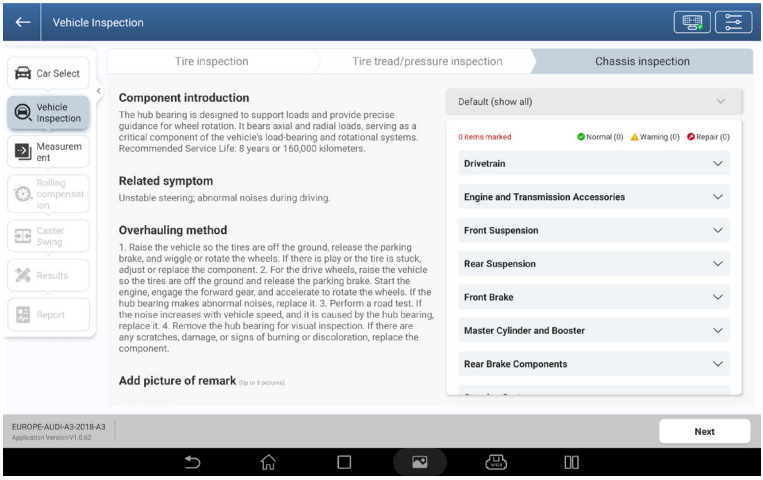
2.2.2.2. Inspection of tire tread and tire pressure

After completing the tire tread and pressure check, click the corresponding input field to enter the check value. Under the "Tread depth" option, you can click [+] or [-] to increase or decrease the input field according to the number of grooves of different tire types (2~5 grooves). Here you can click on [Connect tire tread gauge] to connect the corresponding tire tread gauge (sold separately) for the tire tread test.
Click on [Next] to continue after completing the tire profile and tire pressure check.
to call up the "Body height measurement" interface.



2.2.2.3. Chassis inspection

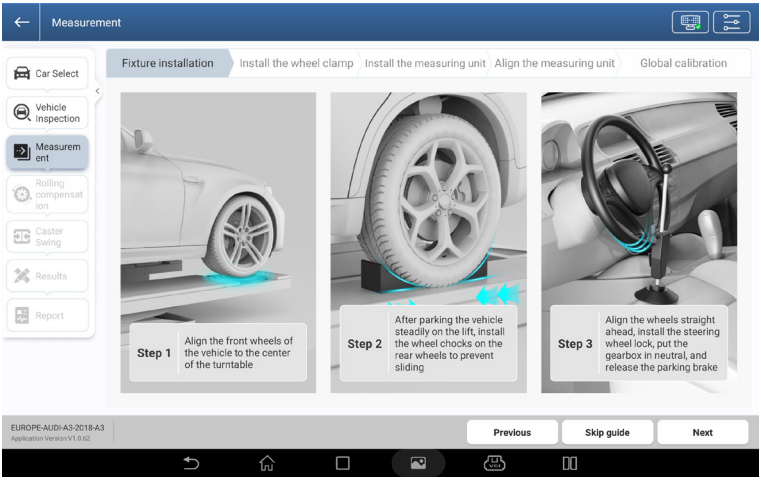
Follow the on-screen instructions to inspect the chassis of the vehicle and add relevant photos (up to 5) and notes, and click the corresponding options to mark the status of each component (normal/warning/repair). After completing the chassis inspection, click [Next] to enter the measurement preparation interface.



2.2.3. Preparation of the measurement

Follow the on-screen instructions to install the brackets and device, and then proceed to scan the measurement.

2.2.3.1. Installation of the devices



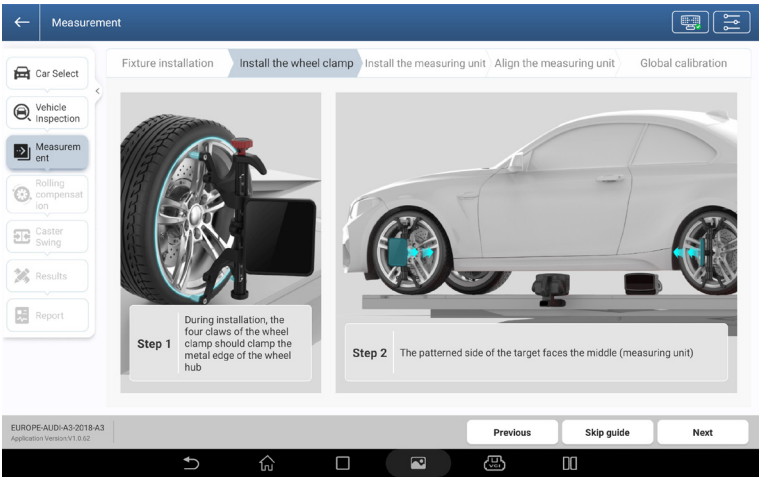
Click on [Fastener installation] and follow the instructions on the screen to install the appropriate fasteners.

1. Place the front wheels of the vehicle in the center of the turntable.
2. After parking the vehicle on the lift, you should attach wheel chocks to the rear wheels to prevent slipping.
3. Move the wheels forward, apply the steering wheel lock, shift the transmission into neutral and release the parking brake.

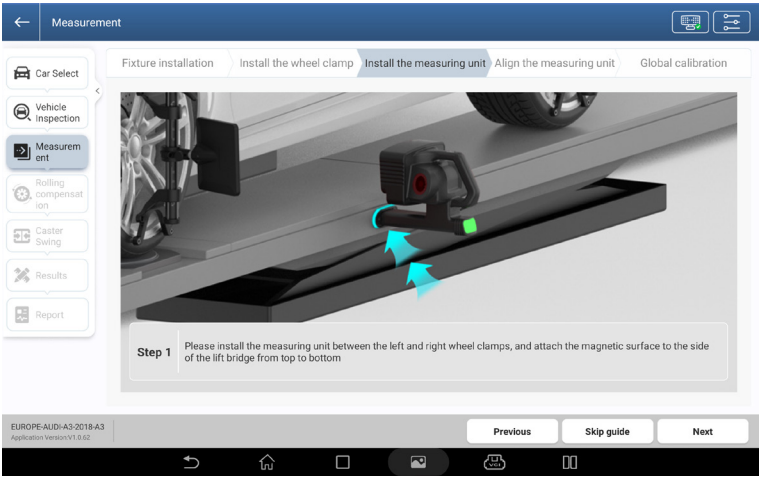
2.2.3.2. Installing the device

After the device installation is complete, click [Next] to access the device installation guide and follow the on-screen instructions to install the appropriate device.
Note: It is recommended to attach the positioning stickers to the side of the axle plate of the lifting device in advance to facilitate the installation of the device.

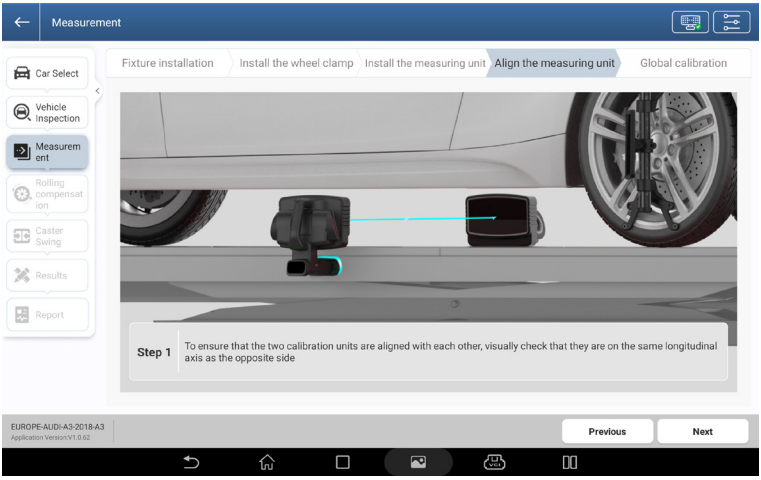
1. Fitting the wheel clamps Align the wheel clamps with the center of the tires and engage the 4 clamping jaws of the wheel clamp between the tire and the rim edge as shown in the schematic diagram.
Align the patterned side of the target with the center (measuring unit).
Note: The wheel clamps should be perpendicular to the ground, whereby an error range of -15° to 15° is permissible.



2. Installation of the measuring unit
Install the measuring unit in the center of the vehicle, between the front and rear wheel clamps, and attach the magnetic surface to the side of the lift from top to bottom.



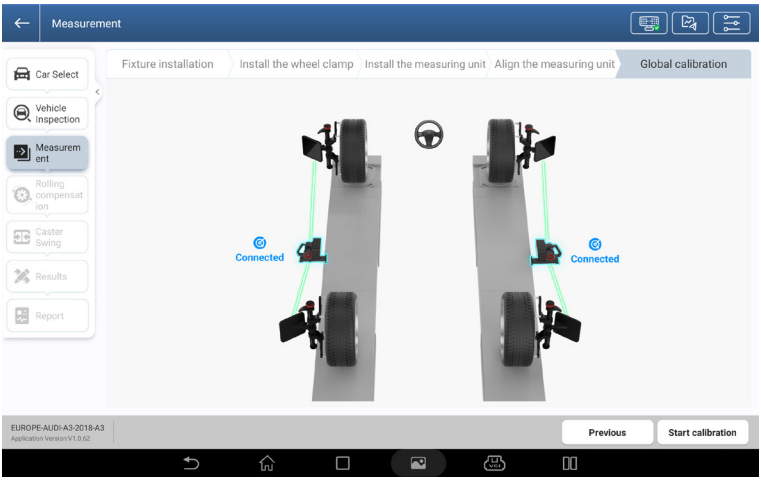
3. Align the measuring unit.
To ensure that the two measuring units are aligned with each other, visually check whether they are on the same longitudinal axis as the opposite measurement.



After both the wheel clamps and the measuring units have been installed, the indicator light of the measuring unit flashes blue quickly, which means that the measuring unit is searching for a diagnostic tablet. This is followed by a slow blue flash, which means that the device is internally networked. If both measuring units are successfully connected to the diagnostic tablet, the indicator light lights up green and is always on.

2.2.3.3. Global calibration

Once the device has been installed, click [Next] to access the global calibration interface. After you have confirmed that the symbols of both measuring units show "Connected", click on [Start calibration].



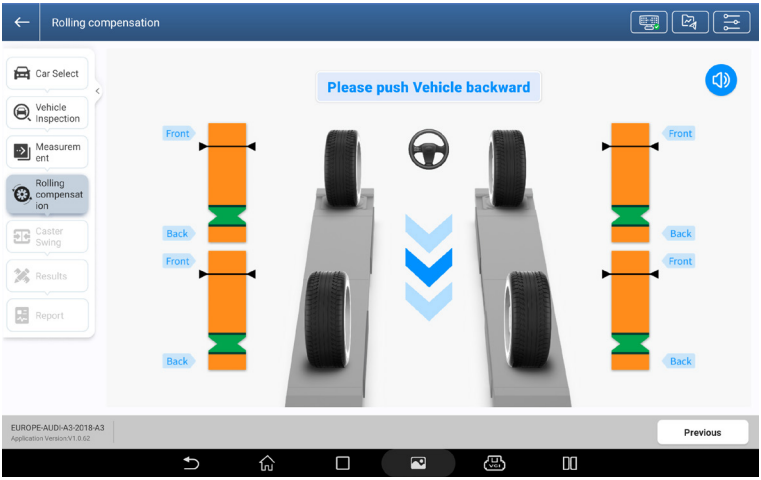
Once the calibration is complete, "Ready" is displayed on the symbols for the measuring unit and the target.

After the installation of the device is completed, click [Next] to enter the "Rim Impact Compensation" interface, and follow the instructions to push the vehicle and complete the compensation.

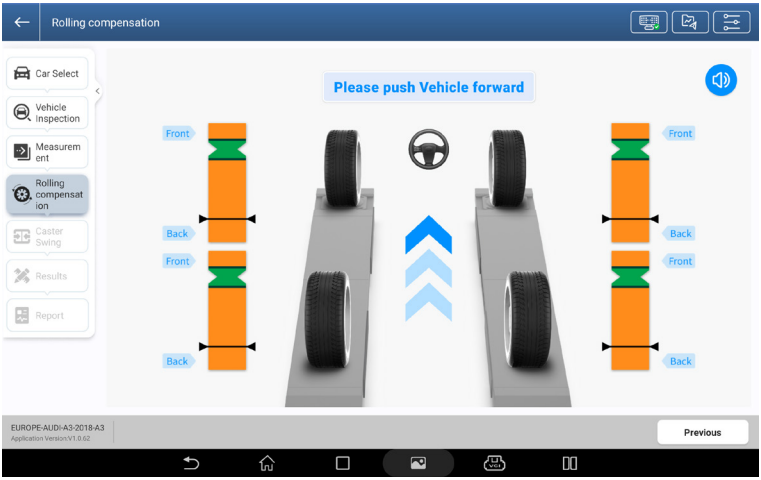
2.2.4. Rim runout compensation

The compensation process is as follows:

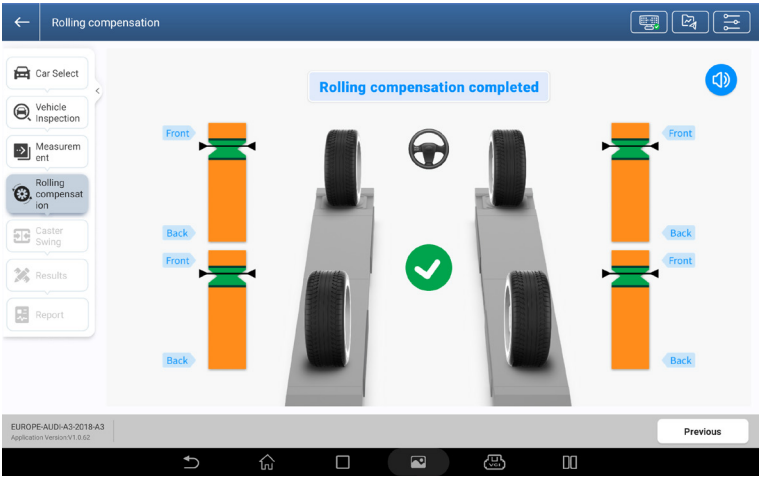
1. First push the vehicle slowly backwards according to the instructions on the user interface so that all pointers remain in the green area, as shown in the following illustration.



2. When the interface issues the prompt "Please push the vehicle forward", slowly push the vehicle forward so that all pointers remain in the green area again.



When the interface displays the message "Compensation completed", the roll compensation is complete and the "Caster angle measurement" interface is automatically called up.

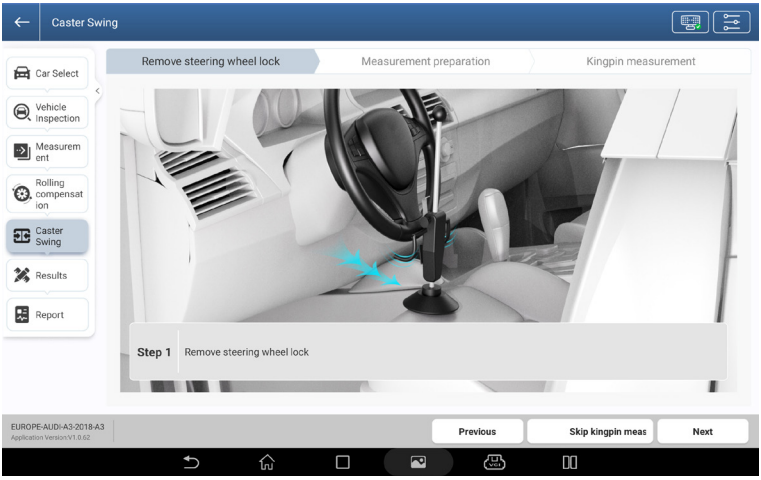


3.2.5. Steering lock measurement

The steering angle measurement relates to the front wheels and includes both the spread (steering knuckle inclination) and the caster angle.
The spread ensures that the vehicle weight is evenly distributed over the wheel bearings. This protects the bearings from damage, ensures an even distribution of steering forces and smooth steering behavior.
The caster angle causes the steering axle to hit the road ahead of the tire's contact point.
As a result, the vehicle uses the resistance of the road against the tires to drive straight ahead in a stable manner.

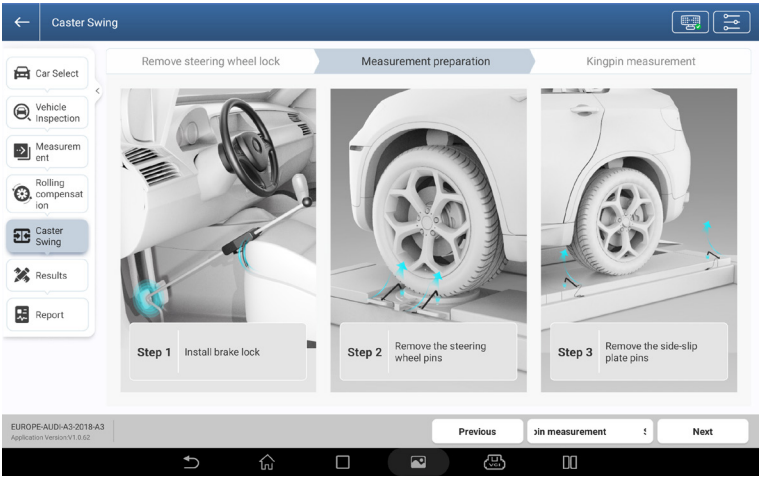
3.2.5.1. Preparation

Follow the instructions on the screen to complete the following preparations to meet:
(I) Remove the steering wheel lock.



(II) Preparation of the measurement

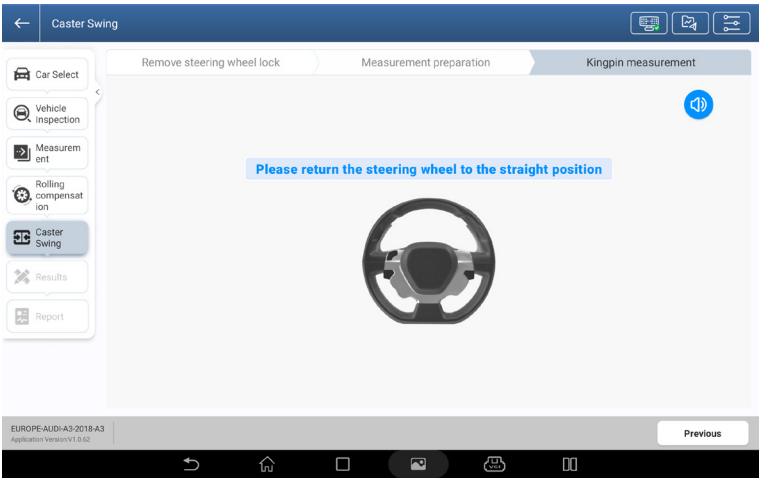
1. Fit the brake lock.
2. Remove the pins from the turntable.
3. Remove the pins from the side underride guard.



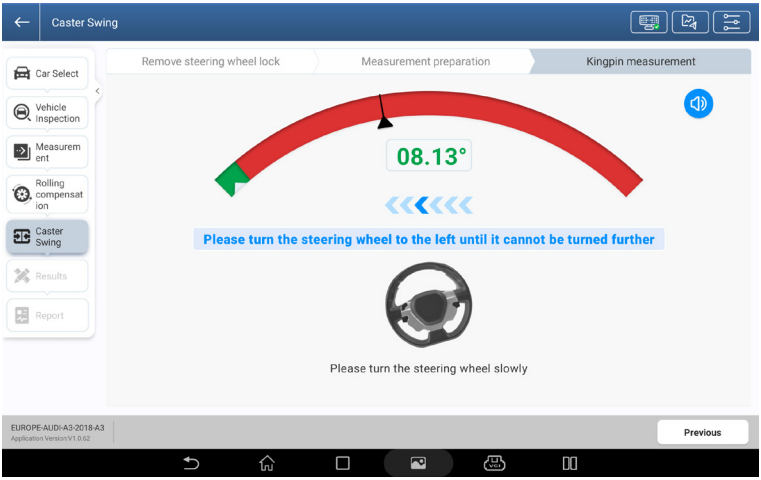
After completing the preparations, click [Next] to open the user interface. "Steering lock measurement" to open.

2.2.4.1. Steering lock measurement

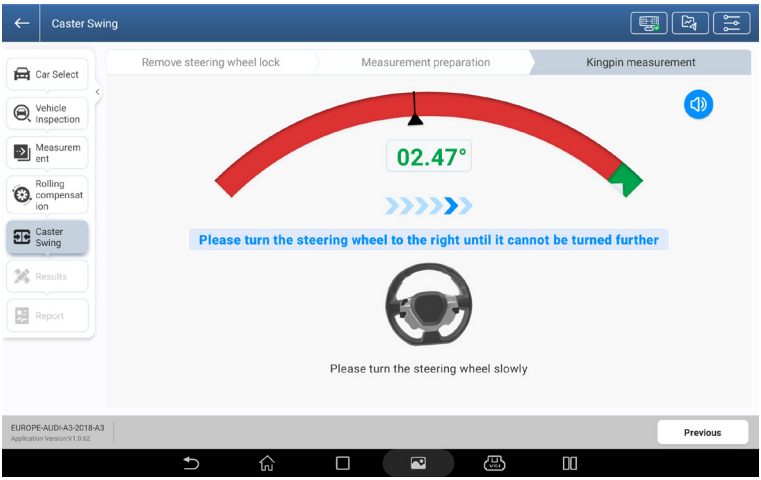
1. The steering wheel is set to drive straight ahead.



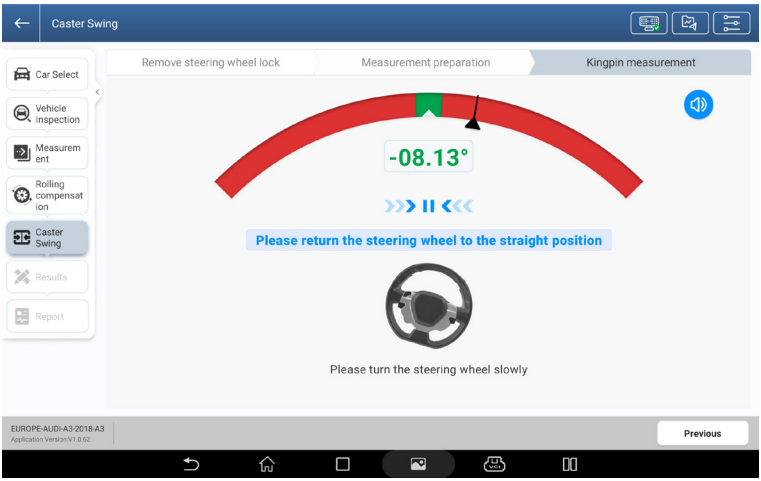
2. Turn the steering wheel to the left or right according to the instructions on the interface (turn the steering wheel slowly and at a constant speed).
speed). If the angle of rotation of the wheel reaches or exceeds the set angle (12°), the interface prompts you to turn the steering wheel in the opposite direction.



3. Turn the steering wheel according to the instructions on the interface. If the angle of rotation of the steering wheel reaches or exceeds the set angle (12°), the interface prompts you to reset the steering wheel.



4. Turn the steering wheel according to the instructions on the user interface to the starting position.



When the steering lock measurement is complete, call up the interface "Measurement result".

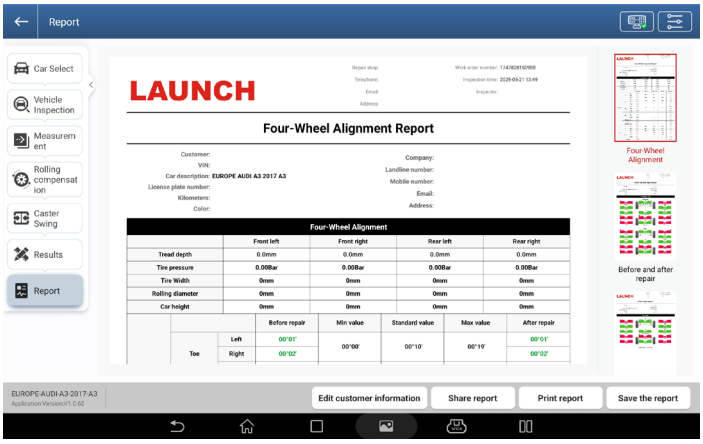
Note: If you need to adjust the chassis, the lifting device wobbles or lifts, please click on the [ ] button to perform the "Global calibration" to ensure that the height of the two axle plates of the lifting device is the same.

3.2.6. Result of the measurement

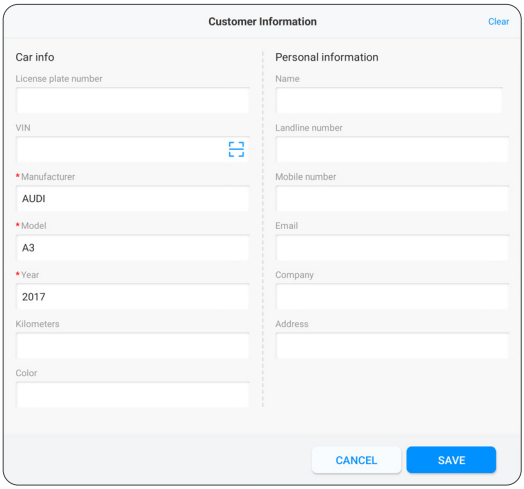
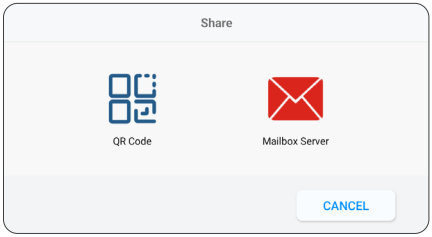
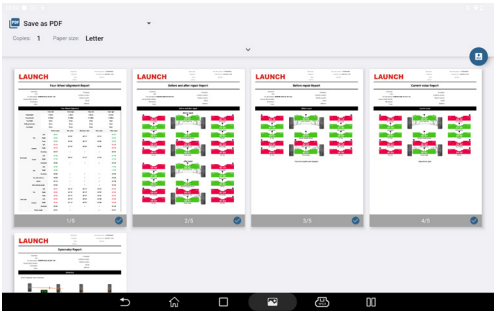
This function is used to display and save the measurement results. By default, the measurement result for "steering knuckle" is displayed. If you want to view the measurement results for "Rear axle", "Front axle", "All measurements", "Symmetry", etc., please click on the corresponding buttons at the top of the screen.
Click [Unit settings] to change the display unit for the measured values. Before maintenance, please click [Save current value before repair], the measurement results will be updated in real time after maintenance is completed, click [Next] to save the current measurement results and open the "Report" interface.

3.2.6.1. Inspection report

You can use this function to display, save and forward the inspection report. On the righthand side of the screen, you can click on "Wheel alignment", "Before and after repair", "Before repair", "Current value", "Symmetrical value", "Tire inspection", "Body height" and other inspection reports click to display them separately.



The on-screen buttons are described below:

[Edit customer information]	You can change or add customer information. 
[Share report]	The inspection report can be downloaded by QR code or e-mail. be passed on. 
[Print report]	You can print out the current inspection report or Select "Save as PDF" in the top left corner of the pop-up interface to save the report as a PDF document. 

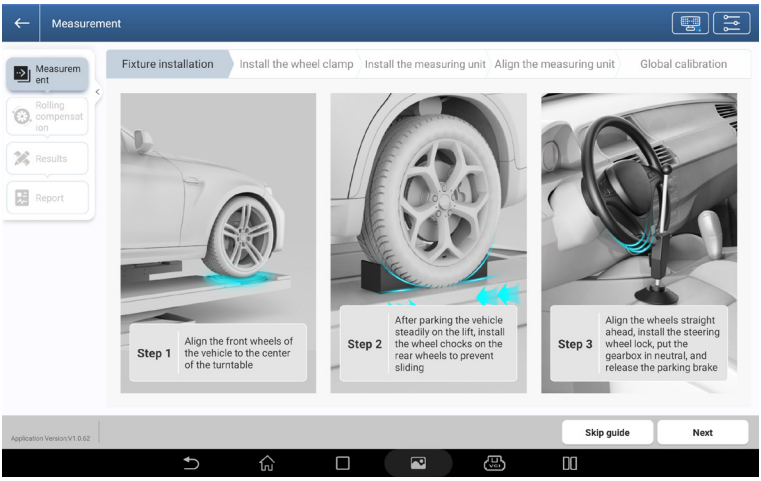
[Save report]	When you save the inspection report on the diagnostic tablet In the main interface, you can click on [Inspection log] to query and manage all saved inspection reports.

2.3 Fast inspection

The quick inspection does not include the vehicle selection and vehicle inspection steps, do not perform a steering lock measurement if you need to operate all measurement functions, please select [Wheel alignment] for routine inspection.

2.3.1. Preparation of the measurement

Click [Quick inspection] in the main interface to perform the following open the interface:



Follow the instructions on the screen to complete the steps for installing the bracket, wheel clamp, measuring unit, alignment of the measuring unit, global calibration, etc. After completing the measurement preparation, click [Next] to enter the "Rim Impact Compensation" interface.

2.3.2. Felgenschlagkompensation

Roll compensation is performed as follows:

1. First push the vehicle slowly backwards according to the instructions on the user interface so that all pointers remain in the green area.
2. When the interface issues the prompt "Please push the vehicle forward", slowly push the vehicle forward so that all pointers remain in the green area again.

When the interface displays the message "Compensation completed", compensation is complete and the "Measurement result" interface is automatically called up.

2.3.3. Result of the measurement

You can use this function to display and save the measurement results.
The measurement results of the "Rear axis" are displayed by default. If you want to display the measurement results of the "Front axis", "All measurements", "Symmetry" and other elements, click on the corresponding buttons at the top of the screen to display them.
Save the measurement results before maintenance, after maintenance is completed, the measurement results will be updated in real time. Click [Next] to save the current measurement results and open the "Inspection report" interface.

2.3.4. Inspection report

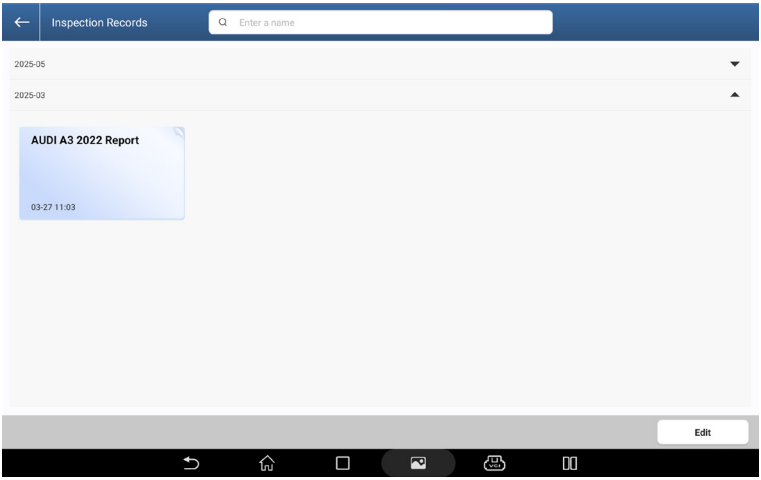
This function allows you to view, save and forward the inspection report. On the right-hand side of the screen, you can select Wheel alignment, Before and after repair, Before repair, Current value, Symmetry and other inspection reports for viewing.

The on-screen buttons are described below:

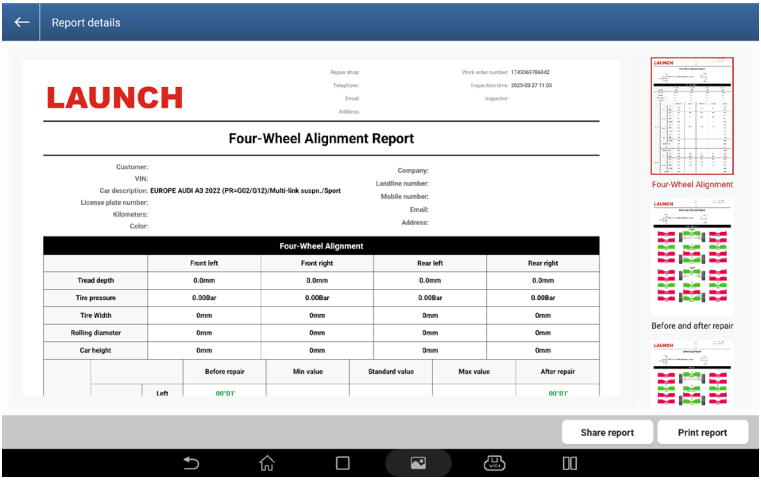
[Edit customer information]	You can change or add customer information.
[Share report]	Inspection reports can be forwarded via QR code and e-mail.
[Print report]	You can print out the current test report or save it as a PDF document.
[Save the report]	When you save the inspection report on the diagnostic tablet In the main interface, you can click on [Inspection log] to query and manage all saved inspection reports.

2.4 Inspection log

It is used to view and manage the saved inspection report. Click on [Inspection log] in the main interface to open the interface.
"Inspection log", which is categorized according to the inspection time. Click on the down/up arrow on the right-hand side of the relevant time to expand and collapse the log list.
In the search field at the top of the screen, you can enter keywords in the report name to quickly search for and find the relevant inspection report.



Click on an individual record to view the details of the inspection report and you can approve and print the inspection report.



Click on [Edit] to manage the inspection report.

Die Bildschirmtasten werden im Folgenden beschrieben:

[Show details]	View the details of the inspection report to.
[Select all]	Check all unfolded inspection reports.
[Delete]	Delete the selected test reports.
[Share report]	Release the selected inspection reports. It only one report can be released at a time.
[Print report]	Prints the selected inspection report. It can only one report can be printed at a time.
[Finish editing]	Exit the editing mode.

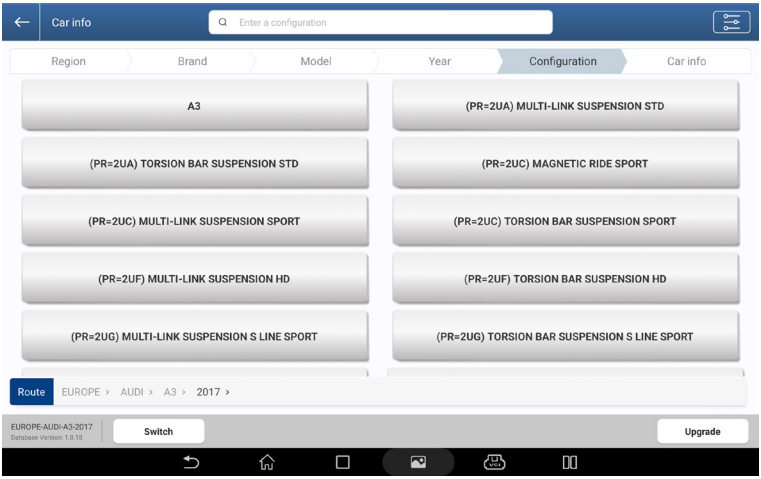
2.5 Database

This function includes a standard database and a customized database. The standard database contains information on all product series 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.

2.5.1. Standard database

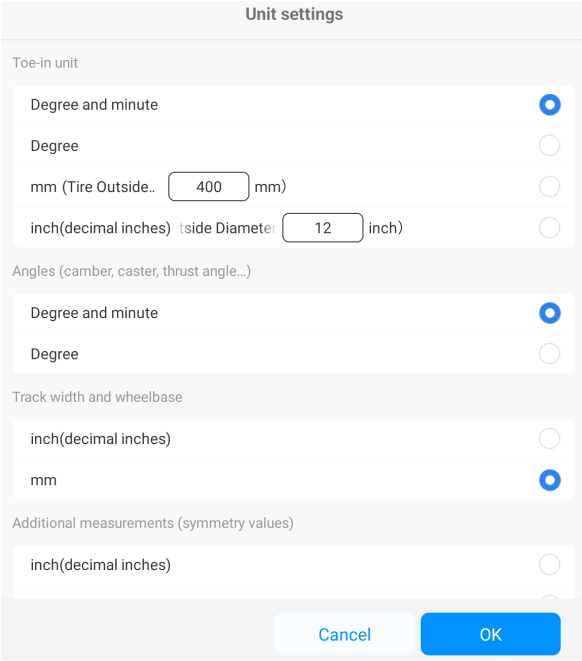
Click [Database] in the main interface and then select [Default database].

In the standard database, select a vehicle by [region]> [make]> [model] > Year of manufacture] > [Configuration] (you can quickly find it by entering the relevant keywords in the search field at the top of the screen) and access the "Vehicle information" interface to display the parameter information of the corresponding vehicle.
Click on [Upgrade] at the bottom of the screen to update the default database to the latest version.
Note: After updating the database, the original user data will be lost.

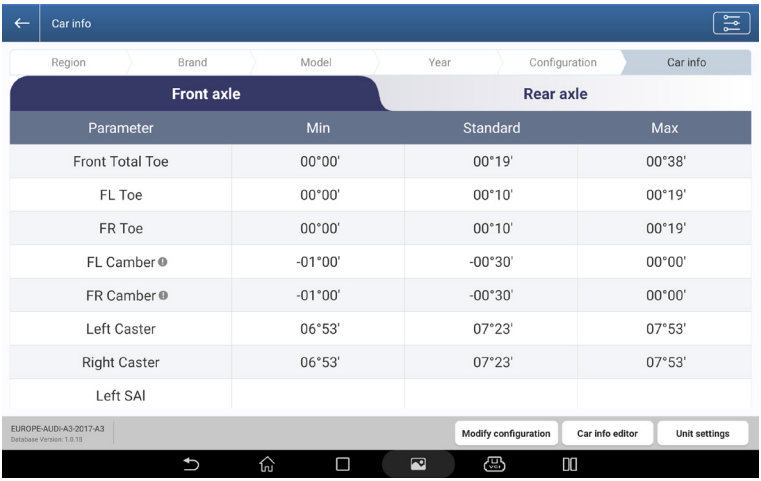


Call up the "Vehicle information" interface.

Click on [Unit settings] to change the display unit of the corresponding parameter.



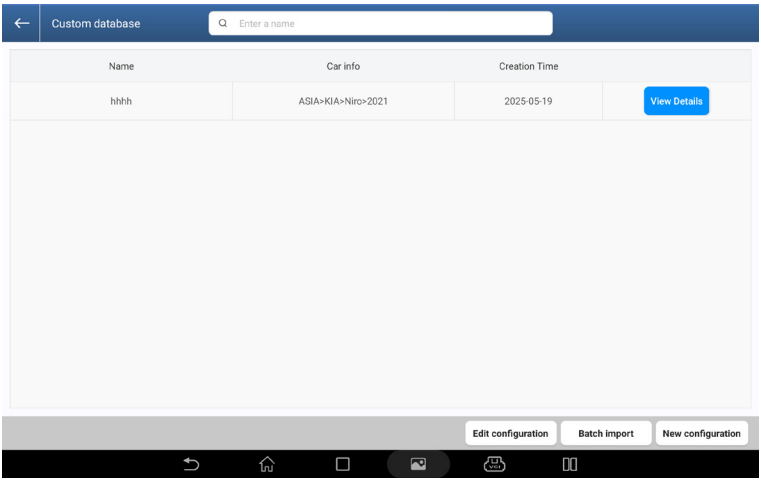
Click on [Change configuration] to change the value of the corresponding parameter as required and then click on [Save current configuration].



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

2.5.2. Customized database

In addition to the default database provided by the system, the user can also add customized data to add the model information that is not available in the default data, so that the system is more suitable for the application of the repair station.
In the main interface, you can access the "User-defined database" administration interface via [Database] -> [User-defined database].

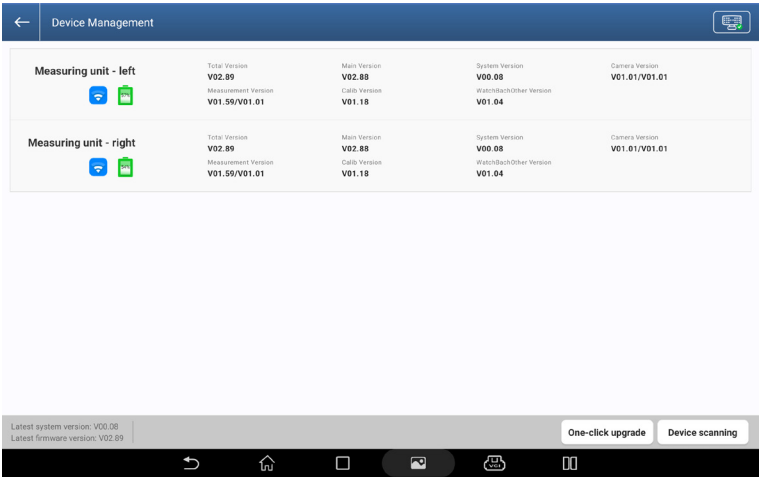


The on-screen buttons are described below:

[Show details]	Take a look at the details of this customized Data to.
[Edit configuration]	You can create single or multiple user-defined Select and delete data.
[New configuration add]	Used to add new user-defined Data.

2.6 Device management

You can use this function to display the device status and version information, manage the device system and update the firmware.
Click [Device management] in the main interface to open the following screen.
screen:



The on-screen buttons and display elements are described below:

1) Device name and Identification	They are used to identify the various 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) Information to the version	Be used to display version information such as system version, firmware version, etc. of the X-613 device.

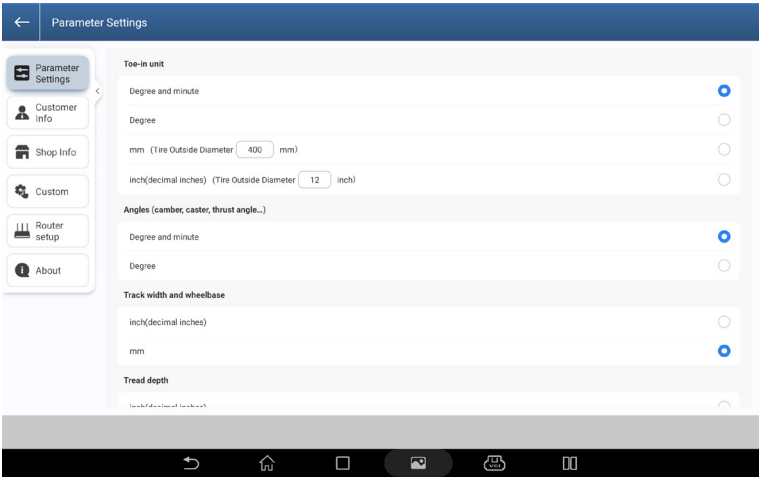
6) Upgrade with one click	With one click, you can change the device firmware and the Update the system to the latest version. **Note:** When upgrading, please switch the mains switch of the 2 measuring devices to "ON". Make sure that the battery level of each device is is higher than 80 %, or set the device to charge into the charging station.
7) Scan device	Used to scan and connect devices for the used for networking.

2.7 System setting

You can use this function to set parameters, manage customer and memory information and display information such as the application version and serial number.

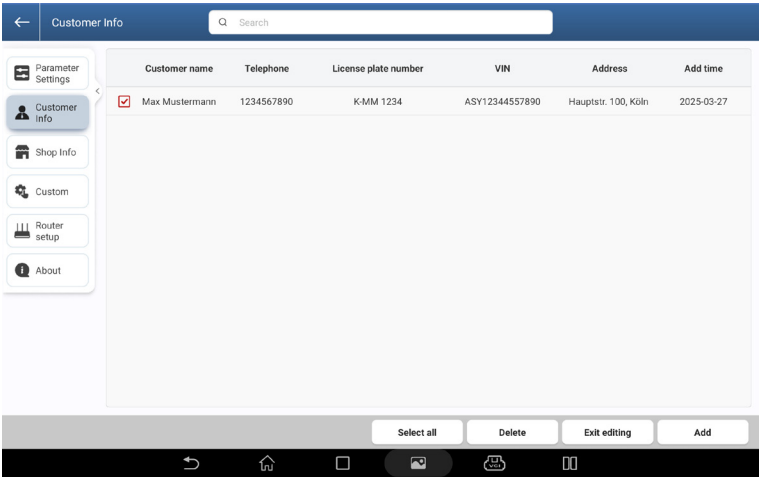
2.7.1. Setting the parameters

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

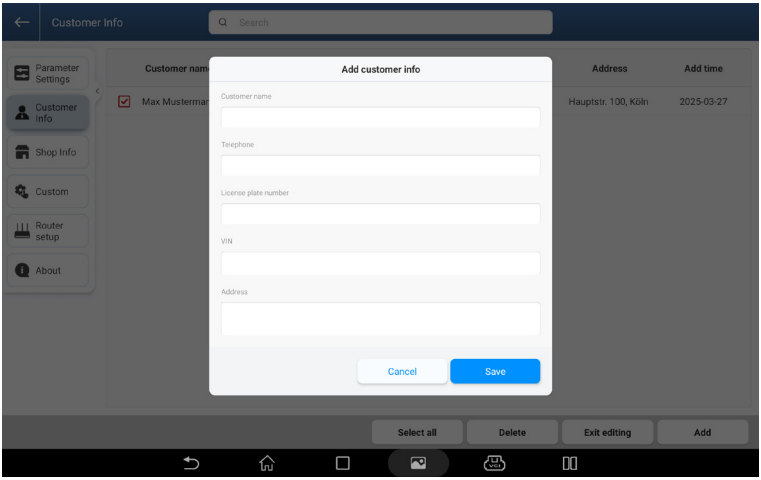


2.7.2. Information for customers

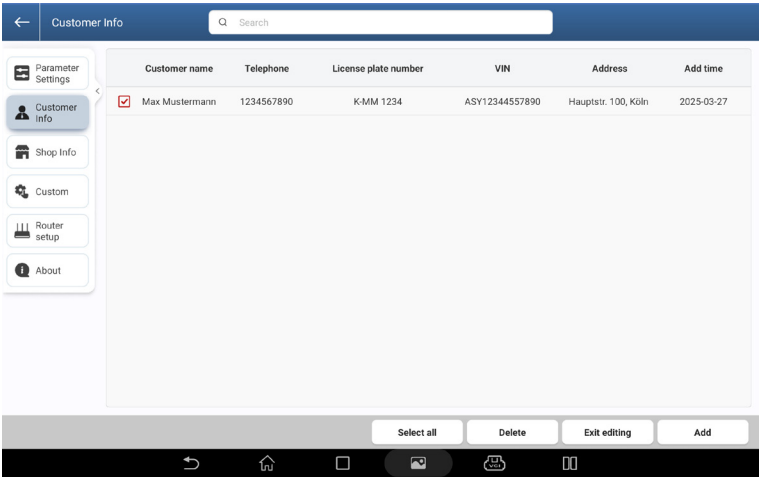
Click on [Customer information] on the left-hand side of the screen to display the Customer information" administration interface.



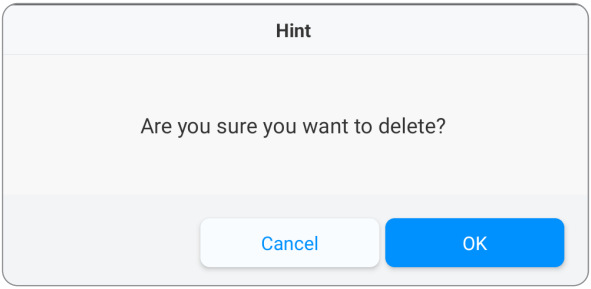
Click on an individual customer information, edit the corresponding information in the pop-up window and click on [Save] to change the customer information.

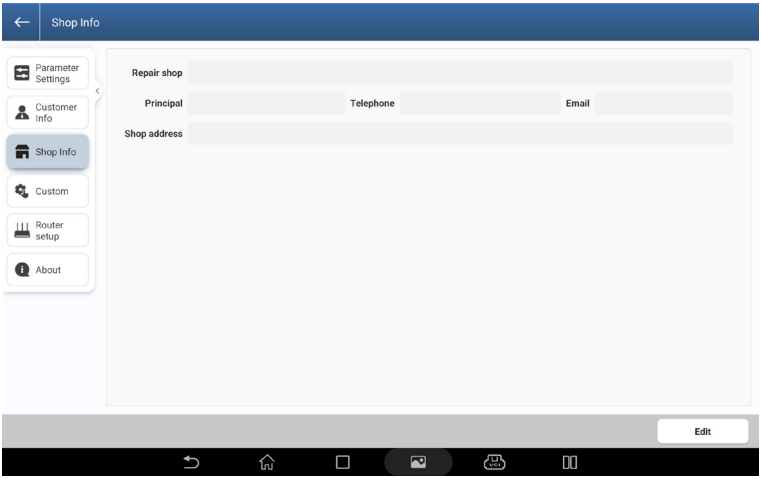


To delete the customer information, click on [Edit], then on the checkbox to the left of the individual customer information and then on [Delete].



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

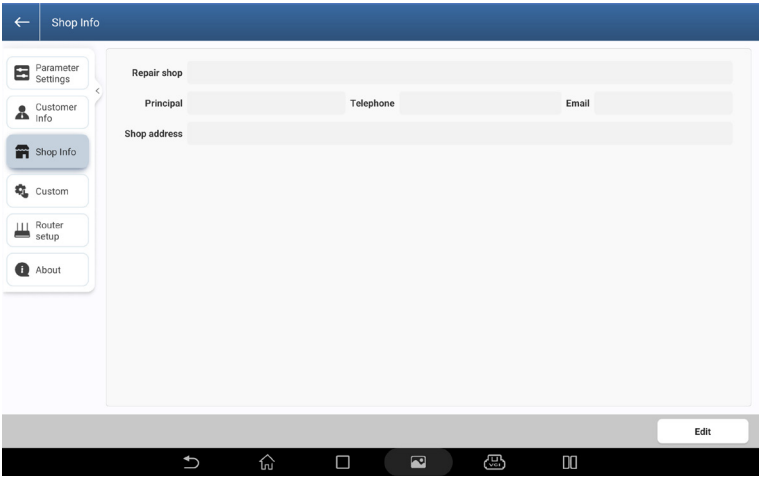




2.7.3. Save information

Click on [Workshop information] on the left-hand side of the screen to display the Open the "Workshop information" administration interface.

Click on [Edit], then edit the corresponding memory information and click on [Save] to save the new memory information.

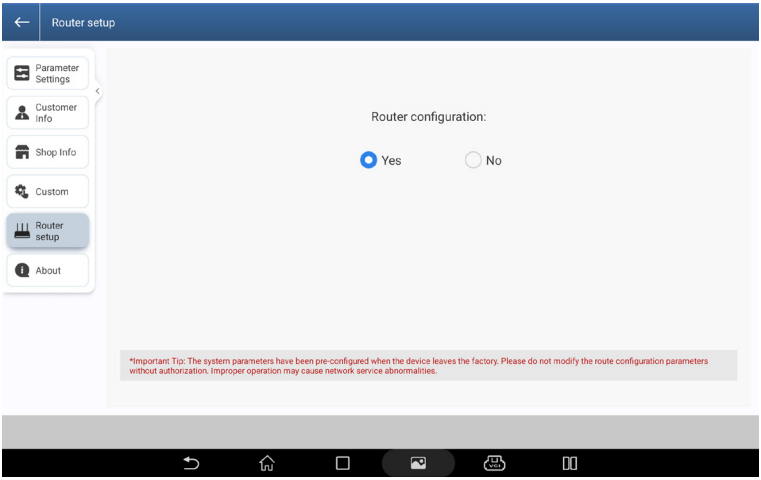


2.7.4. Router setting

Click [Router Setting] on the left side of the screen to open the "Router Setting" interface and select [Yes] to turn on the router. Note:

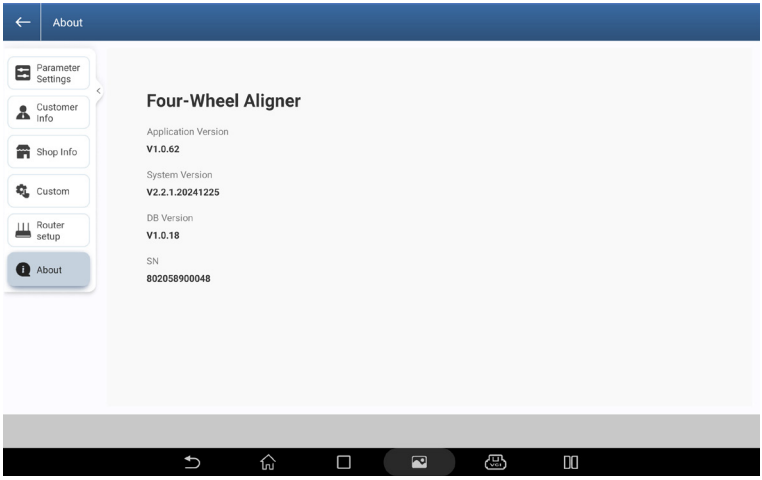
▪ The default setting of the router configuration is [Yes].

▪ It is forbidden to change the router settings, as this may result in connection interruptions.



2.7.5. About

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



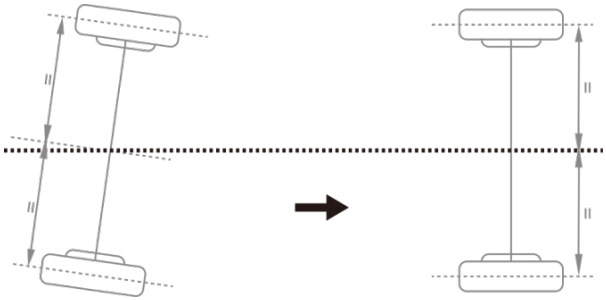
Click on [Upgrade]. The system checks whether there is a new application version and updates the application to the latest version.

3. TERMINOLOGY

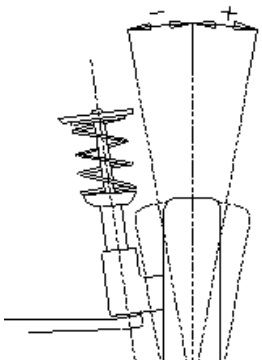
The wheel alignment angles are the relative angles that exist between the suspension system and each moving part. Maintaining the correct angles ensures the driving stability of the vehicle and reduces tire wear.
The most important angles for aligning the four wheels of a vehicle include: Camber, toe, caster and splay angles.

3.1 Geometric Centerline

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



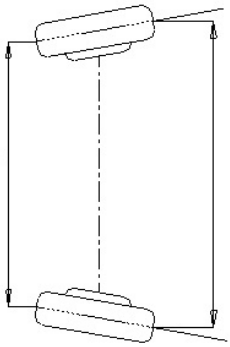
3.2 Camber angle



Camber is the angle between the centerline of the tire and the vertical, viewed from the front of the vehicle. A positive camber means that the wheel is inclined outwards, a negative camber means that it is inclined inwards (see illustration below). Differences in the camber angle change the contact point between the tire and the road surface as well as the force application point, which has a direct influence on grip and tire wear. The camber also influences the distribution of force on the axle, which can prevent uneven loading of the wheel bearings and the resulting wear. In addition, the camber helps to prevent angular changes caused by deformations of the chassis components and play in moving connections when the vehicle is loaded. The camber also influences the direction of travel - similar to a motorcycle leaning towards a bend. It is therefore important that the camber of the left and right wheels is the same in order to ensure a balanced application of force and not impair the straightness of the vehicle.

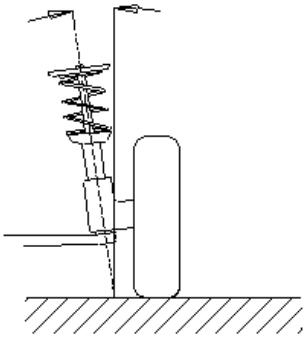
In combination with the correct toe setting, a correctly adjusted camber improves driving stability and prevents one-sided tire wear. If the correct camber is missing, the wheels can tilt inwards excessively when fully loaded, which can lead to severe one-sided tire wear and faster wear of the wheel bearings.

3.3 Track angle



The toe angle is defined as the angle between the centerline of the tire and the longitudinal axis of the vehicle, viewed from the top to the bottom of the vehicle. Inwards is described as positive, outwards as negative (see illustration below). The total toe value is the sum of the toe values of both wheels, i.e. the angle between the center lines of the two tires. The function of the toe angle is to compensate for the tendency of the tires to move inwards or outwards due to camber and road resistance in order to ensure that the vehicle drives straight ahead. A related parameter is the steering spread, which is also defined as the angle between the left and right tires, viewed from above - but with the opposite sign to the toe angle: inwards is negative, outwards is positive. As some people are more familiar with the representation of the curve track, particular attention should be paid to the difference between the track angle and the curve track.

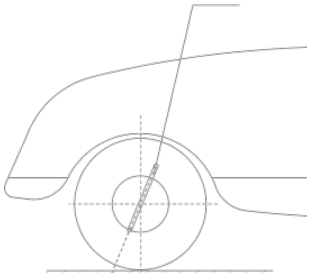
3.4 Spread angle



The splay angle is defined as the angle between the centerline of the steering axle and the vertical as viewed from the front of the vehicle (see illustration below). The splay angle distributes the vehicle weight evenly across the bearings, protecting them from damage and balancing the steering forces, making steering easier. If, on the other hand, the splay angle is 0, the vehicle weight and the counterforce from the ground generate a large lateral force in the axle, which can damage the axle and make steering heavier. In addition, the angle of spread is also the cause of theeinstellbar. Return force of the front wheels after steering. The spread angle is already determined during the design of the chassis and is generally not adjustable.

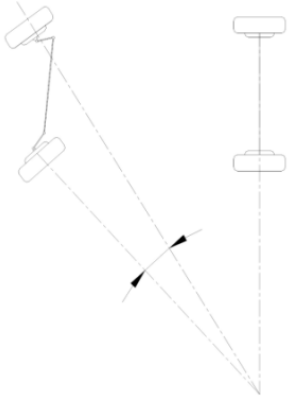
3.5 Caster angle

The caster angle is defined as the angle between the centerline of the steering axle and a vertical line, viewed from the side of the vehicle. An angle inclined forwards is negative, an angle inclined backwards is positive (see illustration below). The caster angle means that the extension of the steering axle the road in front of the tire's contact point. This allows the vehicle to drive straight ahead in a stable manner thanks to the resistance of the road against the tire. The principle is similar to the front wheel of a shopping cart, which automatically turns in the direction in which you are pushing and remains straight ahead. The greater the caster angle, the better the straight-line stability of the vehicle and the stronger the return force of the steering wheel after steering. However, this also makes the steering more sluggish. In general, the Caster angle of a vehicle between about 1 and 4 degrees.

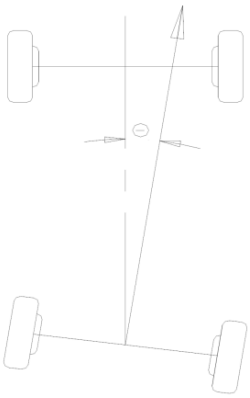


3.6 Track difference angle with 20° steering

The toe difference angle is defined as the difference between the steering angles of the two front wheels at a steering angle of 20 degrees, as shown in the illustration below. The inner wheel usually turns more than the outer wheel, the difference is about 2 degrees. The aim is to steer the vehicle cleanly through a bend with the current center of the bend on the extension line of the rear axle. In addition, the larger steering angle of the inner wheel also generates a higher rolling resistance.
This difference in rolling resistance can cause the vehicle to lean to the side with greater resistance, making it easier to turn.



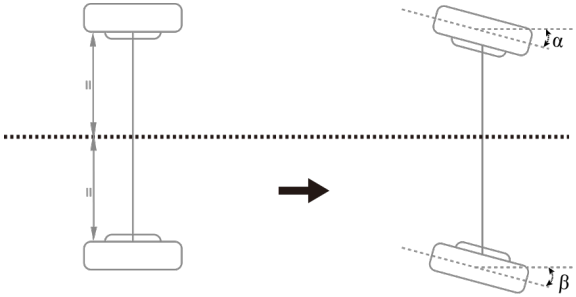
3.7 Shear angle



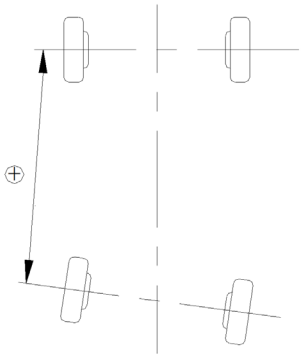
The thrust angle is defined as the angle between the bisector of the overall track of the rear wheels of the vehicle (thrust line) and the geometric centerline, as shown in the figure below. As a rule, if the thrust line is inclined to the left, the angle is positive; if it is inclined to the right, the angle is negative. If the thrust angle is not equal to zero, the vehicle tends to move sideways. In this case, the track of the rear wheels must be adjusted accordingly.

3.8 Maximum steering angle

The maximum steering angle of a vehicle is the angle that occurs w h e n the front wheels of the vehicle are turned to the left or right to the stop position, measured to the centerline of the front wheels, provided there is no lateral deviation (steering play or deformation).



3.9 Wheelbase difference

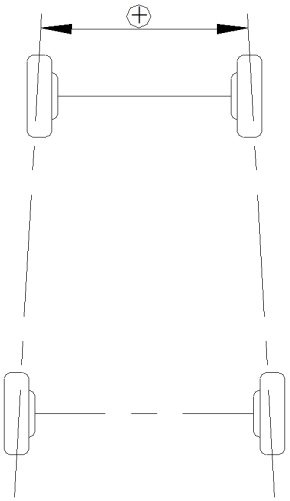


The angle between the line connecting the centers of the two front wheels and the line connecting the centers of the two rear wheels is referred to as the wheelbase difference (also wheelbase deviation) of the vehicle. If the distance of the right-hand wheel is greater than that of the left-hand wheel, the wheelbase difference is considered positive.
Conversely, if the distance of the right-hand wheel is smaller than that of the left-hand wheel, the wheelbase difference is specified as negative. If the track width at the front and rear axle of the vehicle is known from the technical data, the wheelbase difference can also be specified as an angular value, as shown in the figure below.

3.10 Difference in track width

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 vehicle (also known as track width deviation). If the distance between the connecting lines of the two rear wheels is greater than the distance between the connecting lines of the two front wheels, the track width difference is considered positive. If, on the other hand, the distance is smaller, it is described as negative. If the left and right wheelbases of the vehicle are already known in the technical data, the track width difference can also be expressed as an angular value, as shown in the figure below.

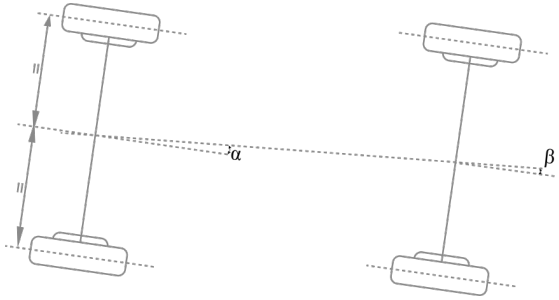
3.11 Left (Right) Lateral Offset



Der relative Versatz zwischen dem linken (rechten) Hinterrad und dem linken (rechten) Vorderrad in seitlicher Richtung des Fahrzeugs wird als linker (rechter) Seitenversatz bezeichnet. Ist das linke (rechte) Hinterrad im Vergleich zum linken (rechten) Vorderrad nach außen versetzt, ist der Seitenversatz positiv; ist es nach innen versetzt, ist der Wert negativ. Der Winkel zwischen der Verbindungslinie der Vorder- und Hinterräder auf der linken (rechten) Seite und der Schublinie wird als linker (rechter) Seitenversatzwinkel bezeichnet.

3.12 Axle offset

The relative offset of the front and rear axles in the lateral direction of the vehicle is referred to as axle offset. If the rear axle is offset to the right compared to the front axle, the axle offset is considered positive; if it is offset to the left, it is considered negative. The angle between the bisector of the track width difference angle and the thrust line is referred to as the axle offset angle.

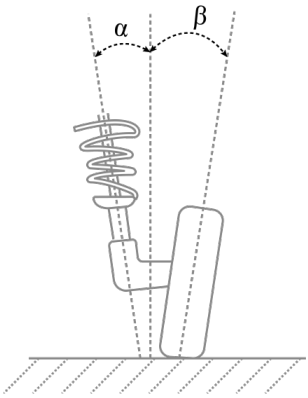


3.13 Delay

The relative offset of the wheels on both sides of the same axle in the longitudinal direction of the vehicle is referred to as deceleration. If the right wheel of the front (or rear) axle is behind the left wheel, the deceleration on the front (or rear) axle is positive, otherwise it is negative. The angle between the connecting line of the two front wheels (or rear wheels) and the perpendicular to the geometric longitudinal axis of the vehicle is referred to as the deceleration angle of the front (or rear) axle.

3.14 Included angle

The angle Y between the axis of the kingpin and the wheel axis is referred to as the inclusion angle. Its value results from the sum of the splay angle α and the camber angle β, as shown in the figure below.



3.15 Wheel alignment

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

3.16 Symmetry Value

The vehicle geometry is usually symmetrical and is used to initially determine whether the vehicle has been involved in an accident and to assist with 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.

Guarantee

This warranty applies only to customers and dealers who have purchased Launch's products in the normal way. Launch warrants its electronic products against defects in materials and workmanship for a period of one (1) year from the date of delivery. Damage to this device or parts caused by misuse, unauthorized modification, use for purposes other than those for which the product was designed, or failure to follow the operating instructions is not covered by this warranty.

Waiver

The above warranty replaces any other form of warranty.

Notification of the order

Replaceable parts and optional accessories can be ordered directly from Launch's authorized suppliers. Please specify the following items when ordering:
• Order quantity
• Part number
• Part Name

Kunden-Service-Center

If you have any questions while operating the device, please contact customer service at:
Tel: +49 (0) 2273 9875 55
Email: service@launch-europe.de

Explanation: LAUNCH reserves the right to change the product design and technical data without prior notice. The actual object may differ slightly in appearance, color and configuration from the descriptions in the manual. We have done our best to make the descriptions and illustrations in the manual as accurate as possible, and errors are inevitable, if you have any questions, please contact the local dealer or customer service of LAUNCH, LAUNCH bears no responsibility arising from misunderstandings.

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