



IDEAL

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3D HD MULTI-AXLE IMAGE WHEEL ALIGNER

Manual

IWA-60-8500-HD-K

By  Techno Vector



User Manual

Wheel Aligners

Techno Vector 7 Truck

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Techno Vector Wheel Aligners. General Information

Thank you for purchasing the TechnoVector wheel aligner. This is the latest 3D wheel aligner developed by Techno Vector Group.

Techno Vector 6 and 7 wheel aligners are based on machine vision system. Both types of the wheel aligners include cameras and high-precision image targets.

The wheel aligner software processes images received from cameras, and by using the received data, determines the target position in 3D space to high precision. All parameters that can be measured with the wheel aligner are calculated using the target positions. 3D technologies provide convenience, high-speed operation and accuracy of measurements.

See the contents of this manual to study the Techno Vector wheel aligners in detail. To get a short description of the wheel aligner operation please see the next page **Quick Start**.

Refer to the wheel aligner help section that includes video training and a detailed description of each operation mode.

The software has a user-friendly interface; 3D models and prompt messages on the screen will give you a clear idea about a current operation.

Quick Start. Wheel Aligner for trucks.

Step 1. Turn on your computer and cameras.

Step 2. Start the TechnoVector software on your desktop.

Controlling Your Wheel Aligner

Control your wheel aligner with **F1, F2, F3, F4, Enter and arrow keys** (←↑↓→).

Create an Order

Step 3. Press **F2-Create Order**.

Step 4. Enter information about the vehicle and its owner.

Step 5. Select the vehicle's model from the TechnoVector database.

Step 6. Select axles that should be measured.

Step 7. Review the illustrations.

Step 8. Review the specifications and check tire pressure.

Step 9. Select a measurement mode (relative to the frame or any rear axle).

Installation of Targets, Compensation and Measurement

Step 10. Select axles for measurement.

Step 11. Mount the targets onto the vehicle one by one. Rotate the targets in the clamps so that the indicator is in the green zone.

Step 12. Press **F2-Next** to begin.

Step 13. Roll the vehicle backwards until the STOP sign appears on the screen.

Stop.

Step 14. Roll the vehicle to the original position until the STOP sign appears on the screen. Stop.

Step 15. If you have selected the measurement mode using the frame, measure the frame. Follow the instructions displayed on the screen.

Step 16. Unlock the turn tables.

Step 17. Turn the steering wheel so that the wheels are in the straight ahead position. Use the indications on the screen as a guide.

Step 18. Press **F2-Next**.

Step 19. Attach the brake lock.

Step 20. Turn the steering wheel to the left so that the indicator can be in the green zone. Use the indications on the screen as a guide. Wait until the measurements are automatically taken.

Step 21. Turn the steering wheel to the right so that the indicator can be in the green zone. Wait until the measurements are automatically taken.

Step 22. Set the steering wheel straight ahead. Use the indications on the screen as a guide. Wait until the measurement is automatically finished.

Report and Adjustment

Step 23. See the report. If the vehicle should be adjusted, push **F2-Adjustment**.

Step 24. Select a convenient display mode by pressing **F2, F1** and **left/right** keys.

Step 25. Make adjustments using the data displayed on the screen.

Step 26. Repeat the measurement. In order to do that, return to the report mode (**F4-Back**). Then press the button (**F3-Repeat Measurement**).

Step 27. If other axles should be measured, press **F3 - Repeat Measurement** and select Axle Selection. Repeat all the steps beginning from the target installation for each set of axles.










Step 28. Print out the report, if necessary. In order to do that, press **F1 - Print** in the report mode.

Step 29. The report ready for printing out will be displayed on the screen. If necessary, you can set how it is displayed (**F3 - Customize Report**).

Step 30. Print out the report.

Step 31. Finish your work with the client by pressing **F4**.

Safety Precautions

	When working with the device follow general safety rules applied to electrical equipment that uses alternating current.
	Working without grounding is forbidden!
	You must not use the device if the power supply cable has visual damage.
	When installing the device at its workplace or when using or calibrating it, you must use a special grounding socket. Neutral point in any alternating current systems must be grounded.
	You must not use the device when disassembled, with protective covers and housings removed.
	The device must not be operated in damp locations and if there is water on the floor.
	Safety devices must not be replaced, electric circuits must not be disconnected and connected when power cable is connected.
	The power button must be off when transporting and storing the device.
	Read this manual carefully before operating the device.

1. Description and Operation

1.1. Product Designation

The diagnostic device based on a computer-aided system of measurement processing and displaying is designed to check wheel alignment parameters in vehicles with 12 to 27" rims.

The device allows checking the following wheel alignment parameters shown in the table below.

Front axle	Camber; Total toe; Caster; SAI/KPI; Front wheel turning angles; Lock angle.
Rear axle	Camber; Total toe; Individual toe;
Symmetry angles	Front set back; Rear set back; Thrust angle; Geometrical driving axis.

1.2. Specifications

The measurement parameters of the device are shown in the table below.

Parameter	Measurement Range	Maximum Error in Measurement	Average Error in Measurement
Front Wheel Alignment			
Camber	±8°	±3'	±2'
Front total toe	±5°	±3'	±2'
Caster	±19°	±8'	±5'
SAI/KPI	±19°	±8'	±5'
Lock angle	±45°	±10'	±5'
Rear Wheel Alignment			
Camber	±8°	±3'	±2'
Rear total toe	±5°	±3'	±2'
Rear individual toe	±2,5°	±3'	±2'
Symmetry Angles			
Front set back	±2,5°	±3'	±2'
Rear set back	±2,5°	±3'	±2'
Thrust angle	±2,5°	±3'	±2'
Geometrical driving axis	±2,5°	±3'	±2'

The device can be operated 48 hours continuously, complying with its specifications is guaranteed.

1.3. Operating Principles

Techno Vector 7 wheel aligners are based on machine vision system with cameras and high-precision image targets. The wheel aligner’s software processes images received from cameras and recognizes the targets in the frame.

The special software uses the received images and allows high-precision determination of the target in space. All parameters that can be measured with the wheel aligner are calculated using the target positions. 3D technologies provide convenience, high-speed operation and accuracy of measurements.

High-speed software operation is provided by a method of shooting in the region, when only that part of the image is transferred from the camera which contains the target. If the target is not found, the software requests the camera to give it an enlarged part of the image, where the target was found last. If the target is not found again, the full frame is requested. This method allows a quick restoration of automatic shooting right after a person passed in front of the camera.

Calibration of wheel aligners and checking of accuracy are carried out with a calibration device. The calibration device is a shaft that rotates around its axis and has fastening for targets at its ends.

1.4. Software’s Structure

The aligner’s software is using Microsoft Windows as an operating system. The workflow can be broken down into the following sections:


Order Management	Register an order, search and select vehicle model, check the specifications and illustrations for a selected model;
Measurement	Perform the necessary measurements;
Report	Review the measurement results. Print them out;
Adjustment	Adjust the vehicle’s parameters, monitoring actual values on the screen

1.5. Wheel Aligner Supply Package

Serial number plate

Serial (factory) number of the product is stamped on the table on the rear of the system unit. It is also stated in the product certificate.



 Provide this number when you call the service department. This will considerably reduce request processing time.

1.6. List of items that can be included with the Techno Vector aligner

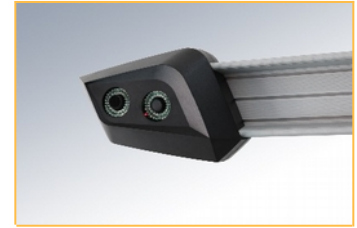
Equipment configuration and appearance is subject to change by the manufacturer, and the items included vary depending on the wheel aligner model. The information given below is general and can be used to identify parts of the aligner or its model.

Video cameras for Techno Vector 7 aligner series

The main element of the machine vision system is video cameras equipped with LEDs and IR light filters.

There is a separate key on the power supply unit that is used to turn on and off cameras.

Depending on the configuration the Techno Vector wheel aligners can be equipped with 2 or 4 cameras. Techno Vector Truck aligners are always equipped with 4 cameras.



Computer cabinet

In computer cabinet computer system and power supply unit are placed and all portable parts of the wheel aligner are stored.

There can be different versions of computer cabinet depending on the wheel aligner model.



Measurement targets

Measurement targets are used:

- in Techno Vector 7 wheel aligners (4 targets)
- in Techno Vector 7 Truck wheel aligners (8 targets)

Measurement targets are flat boards with high-precision pattern. The targets should be mounted onto the wheels. The target housing includes a pivot pin that is used to fasten the targets to a clamp or calibration device.



Measurement targets can be different in size and can have different pattern, that depends on the wheel aligner configuration.

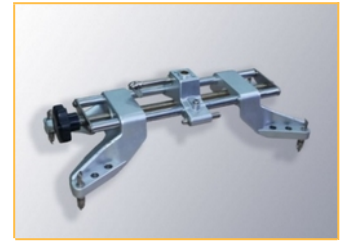
Laser Probe Target

Probe targets are usually used with Techno Vector Truck aligners. A probe target can be used to point onto the truck's frame, so that the alignment is performed relative to the frame and not relative to the vehicle's central line, calculated by wheel's positions. For long wheelbase trucks this is essential.



Clamps (wheel adapters)

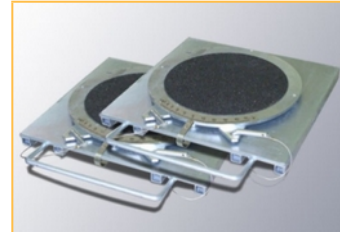
Clamps are special tools that allow fastening targets or PCUs to wheel disks. Clamps are mounted onto all four wheels of a vehicle. It is required to mount each target or portable camera unit onto the wheel that corresponds to the mark on the target or CPU.



Clamp models can be different depending on the wheel aligner version.

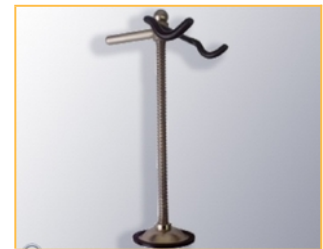
Front turn tables

Front turn tables are used to unload the front (steerable) wheels of a vehicle while measurements are taken and to measure the lock angle, if the turn table is equipped with a corresponding turning scale.



Steering wheel holder

Steering wheel holder is used to fix the steering wheel position while making adjustments.



Brake lock

Brake lock is used to keep the brake pedal in the depressed position while measuring caster and SAI/KPI and also while making adjustments.



2. Using the Wheel Aligner

2.1. Preparation

Connect the power supply cord to the socket.

Check the front surface of the targets and camera lenses visually. If there is dirt, clean them (see the section Maintenance for details).

2.2. Switching On

Press the buttons on the rear of the computer cabinet in order to turn on the computer and cameras. Press the power button on the computer. Wait until Windows is loaded.

Start the Techno Vector software clicking on the desktop shortcut.

The loading screen is displayed while the software is being loaded. After the Vector software is loaded, the main menu is displayed on the screen.

2.3. Techno Vector Software Basics

2.3.1. Interface Basics



At the bottom of the screen there are **control buttons**. By pressing them you can perform all basic operations with the aligner. You can use your mouse, keyboard or the Techno Vector remote control to press these buttons (**F1, F2, F3, F4**).

At the top of the screen there is a title bar that includes the current **Screen name**, a **Menu button**, and a **Icon/Widget area**.

By clicking on a **Menu button**, you can access additional actions. The list of actions depends on a current active screen.

The contents of a **Icon/Widget** area depend on an aligner's model, current screen and/or additional selections made by the user.



If the wheel aligner's calibration was not performed or was performed incompletely, there will be a disclaimer displayed on the screen in the main menu.

The software will not allow to proceed to make any measurements or adjustments unless the full calibration is performed (or restored from back up).



Widget list

Basic widgets that are always shown in the software include:



Target status icon

Clock

Help button

Situational widgets for all aligners include:



Suspended wheels icon

Widgets specific for 7204 truck aligners:



Truck icon

Laser probe battery status

2.3.3. Target status icon

The target status indicator looks like a vehicle chassis icon and is located in the upper right-hand corner of the screen, near the clock. Depending on an amount of targets the wheel aligner has to track, it can contain 4 or more indicators of a target status.



Truck target tracking

When a camera is shooting frames, the wheel that corresponds to the target it is tracking will change its color.

Indicator state	Description
Red, not blinking;	The camera does not respond to requests or is not connected;
Red, blinking;	The target is not recognized in the frame;
Yellow, blinking;	The target is found but is not stable, i.e. there are fluctuations in the target position in space;
Green, blinking;	The target is found and is stable
Gray, not blinking.	The camera is connected but is not currently in use;

2.3.4. Navigation basics.

You can navigate through various screens of the software using **F1**, **F2**, **F3**, **F4** buttons.

All the basic actions necessary to perform a measurement are streamlined in a linear sequence.

As a rule, in order to go "forward" press **F2**, to go "backward" press **F4**.

The buttons can become disabled, if the progression is currently impossible (e.g. the button is inaccessible in the measurement until the steering wheel is in the required position).

2.3.5. Workflow when using Techno Vector Truck wheel aligners



Below you can check a short description of actions performed in each part of the flowchart.

Order & Setup

- Create an order, fill in the data necessary;
- Select a truck model from the database;
- Select an axle configuration;
- Make yourself acquainted with the vehicle specifications and supplementary information provided in the images section;
- Check vehicle's tire pressure;
- Prepare the vehicle;
- Select axles to measure if needed¹;
- Set up clamps with targets onto the vehicle's wheels;

Measurement

- Perform compensation;
- Perform frame measurement if necessary;
- Perform the initial measurement;
- Perform caster measurement if necessary;
- Center the steering wheel if necessary;
- Perform steering wheel straight position measurement if necessary²;

Initial Report

- Review the measurement results;
- If necessary, proceed to adjustment, or just print the report and finish the order;

Adjustment

- Perform the vehicle's selected axles adjustment;
- Return to the report;
- Repeat the measurement to fill the second column of the report³;
- If more axles have to be measured, select the next set of axles to measure and perform a 'Measurement' again;

¹ You can measure up to 4 axles simultaneously, the software will request what axles you are going to measure;

² If selected in software's settings

³ The second column can be populated automatically with data from the adjustment screen if enabled in the software's settings. When adjusting **Caster** we specifically recommend to repeat the measurement, as the data displayed during the adjustment is preliminary;

Final Report

- Review the final results;
- Print the report if necessary;
- Finish the order;

2.4. Creating an Order

To place an order, press **F2 Create Order** in the **Main Menu**. The software will proceed to the **Order Registration** screen. Fill in all the information you need to identify the order¹.

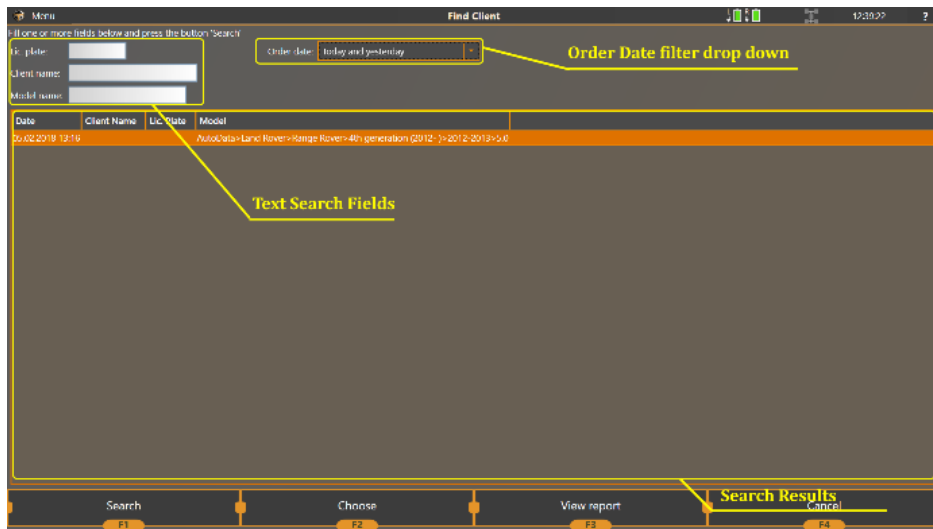
The software allows to fill the following data on the order:

License Plate No	Vehicle's license plate. Upon filling this you can use the Fast Search button (see below)
Mileage	Total mileage of the vehicle at the time of the adjustment
Client Name	Vehicle owner's name
Address	Vehicle owner's address
Phone Number	Vehicle owner's phone number
VIN	VIN code of the vehicle
e-mail	Vehicle owner's e-mail address. This address is required if you intend the software to send your client an e-mail with the adjustment report.
Chosen model	The model name in the Techno Vector database. To select a model, press F3 Select model
Year of manufacture	Vehicle's year of manufacture
Color	Vehicle's color

Instead of filling in the information for the returning client you can make a fast search by clicking the **Fast Search** button, which will automatically select the latest order with the License Plate that is entered, or press **F1 Find Client** button to enter the **Find Client** screen, where you can find a previous order and use all the information from it.

In the **Find Client** screen, you can narrow the search by filling the text search fields (**Lic Plate, Client Name, Model Name**) and restrict the search to orders made a given date, by selecting an appropriate option in the **Order Date** drop down box.

¹ After performing a measurement you can also add text comments to the report (to indicate some issues with the vehicle for example).



Press the **F1 Search** button to perform a search. Select an appropriate line in the **'Search Results'** lists and press **F2 Choose** to return to the **Order Registration** screen, or check the report for the selected order by pressing **F3 View Report** button. You can return to the **Order Registration** without finding the order by pressing **F4 Cancel** button.

In the **Order Registration** screen, press **F2 Continue** or **F3 Select model** to select the car model that is being measured¹.

An additional menu option is also available throughout the entire order's lifetime: **Car Photo**. This allows to attach a photo from the webcam feed (if you have one) of the vehicle. This photo can be accessed at any time, even after the order has been finished, and also printed out in the report.

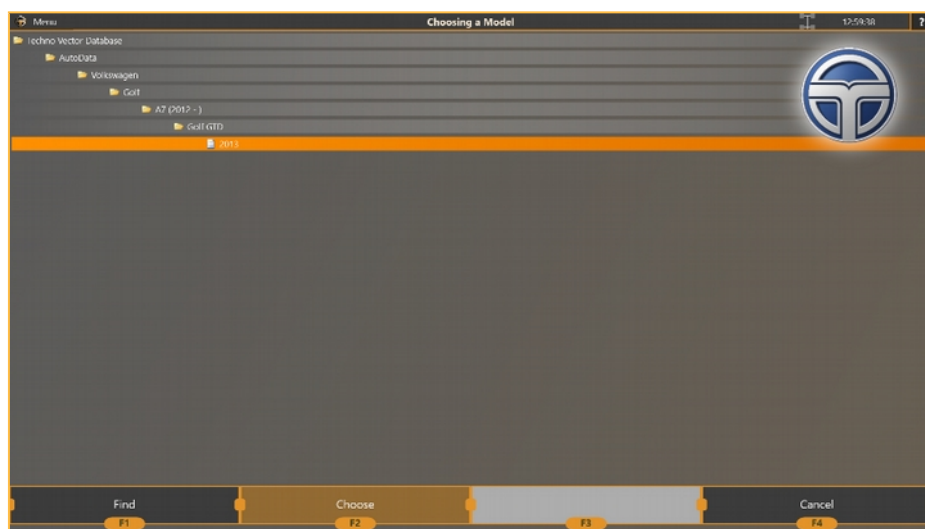


2.5. Selecting a vehicle model

Selecting a model from the database determines the specifications: value ranges for each parameter that is measured by the aligner. Selecting a correct model is **essential** in wheel aligner's operation. To select a model, the user navigates a tree-view that consists of several root folders:

Techno Vector Database	Contains most of the modern vehicle's models (more than 42000 model entries in the database). This is the most commonly used folder.
Recently Used Models	A list of 20 recently used vehicle's models. This is useful when the aligner is situated at a workshop with a limited amount of vehicle models (such as a single-brand dealer's workshop).
Custom Models	Allows the user to create and use previously created custom entries with custom specification values. This is useful, when adjusting a vehicle that is not present in the database.

¹ If the model is already selected, **F2 Continue** proceeds to the **Vehicle Configuration** screen



To select a model, navigate the folders in the tree, narrowing down the selection and reaching the leaf of a tree (marked with a 'document' icon). You can navigate the tree using arrows and the enter key on the keyboard, remote control or using a mouse by double clicking the folder to open or close it. You can also iterate through all the subfolders with names starting with a certain letter. To do that press a corresponding letter key on the keyboard.

All the folders and models listed in the database are sorted alphabetically¹.

When the desired model is selected, press **Enter**, double-click, or press **F2 Choose** to return to the **Order Registration** screen.

You can search models in the Techno Vector database by text. To do that, press **F1 Find** button. The software will proceed to the **Find Model** screen, where you can type in the vehicle's model name and the software will display all matching entries in the database. The software looks for inclusion of all the words listed in the search field, so you can narrow down the search by typing more words into the text field.

For example, when looking for a certain model, you can limit the search to the Autodata folder by typing Autodata:

Or you can narrow down the search to a specific text:

When the folder or model you wanted to find is selected, press **F2** to return to the **Model Selection** screen.

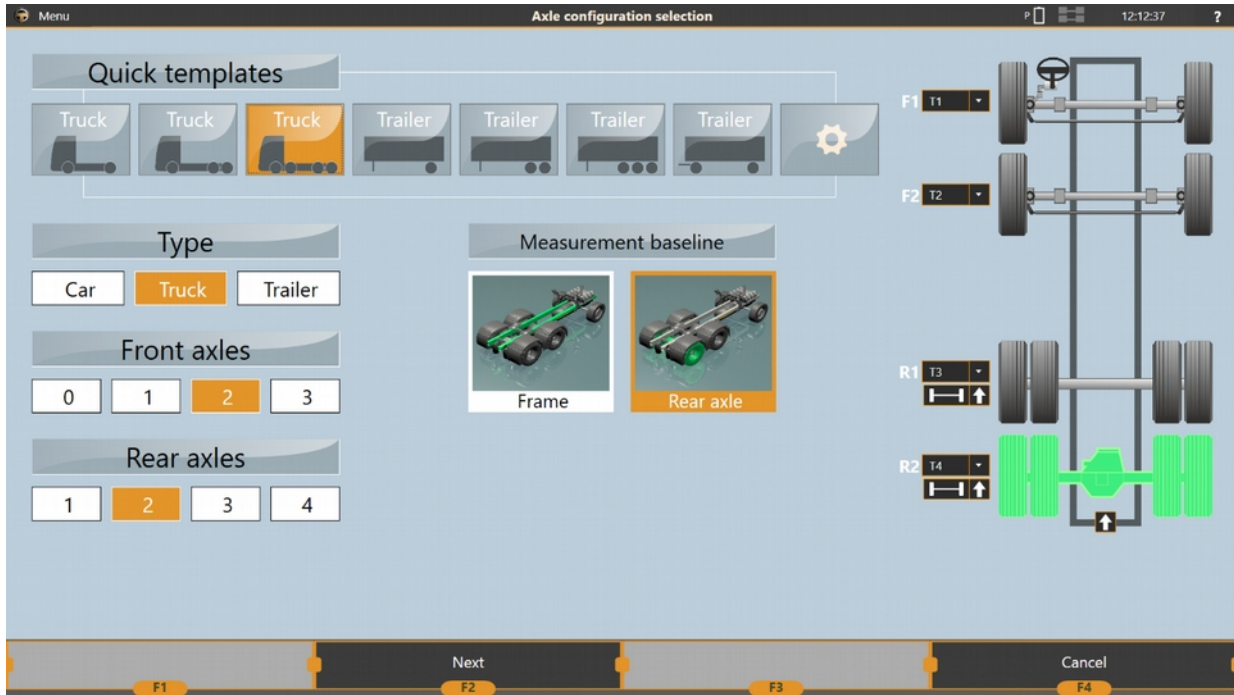
If you have selected a folder, the tree will automatically navigate to this folder and after that you'll need to navigate further and select the appropriate model entry.

If you have selected a model, the model entry will be selected and you need to confirm the selection when returning to the **Model Selection** screen.

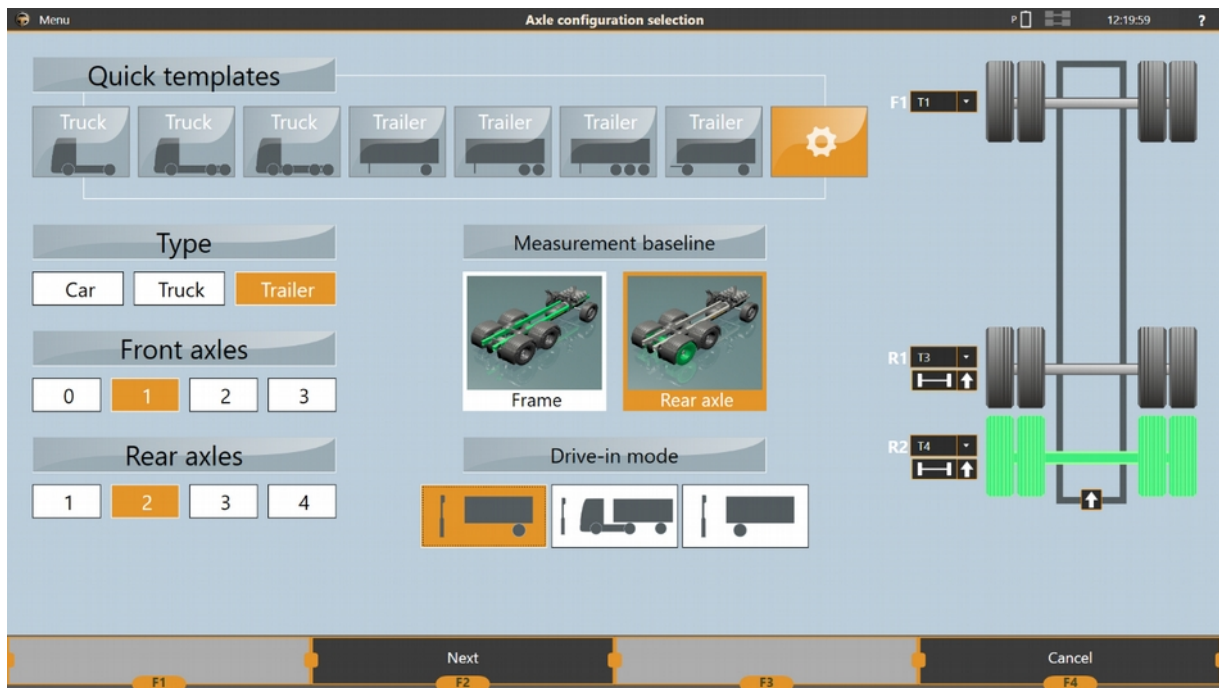
¹ A very common reason of not finding a model during the model selection is model naming. In different countries same vehicles models can be sold using different brand names. Different model names are listed one after the other, and the model's position in the list is determined by the first model's name. If the model is not found where you think it should be - try searching using the **Find Model** screen.

2.6. Selecting the Vehicle's Configuration

After selecting a model the software requires to select a set of axles to measure. You can select one of the **Quick templates**, or customise the vehicle's setup by selecting whether it's a Car, a Truck or a Trailer, setting the number of **Front axles** and **Rear axles**. You can also change the measurement baseline to be either the vehicle's **Frame**, or its **Rear axle**.



When the **Trailer** vehicle type is selected, you can also select a Drive-In mode. You can either put the trailer in front of the aligner alone (useful for drive-through setups), along with the truck or drive it in reverse.



Pick the appropriate setup of the vehicle you intend to adjust and press **F2 Next**.

Note, that you should select the amount of axles you intend to measure and/or adjust, not necessarily the total amount of axles of the vehicle.

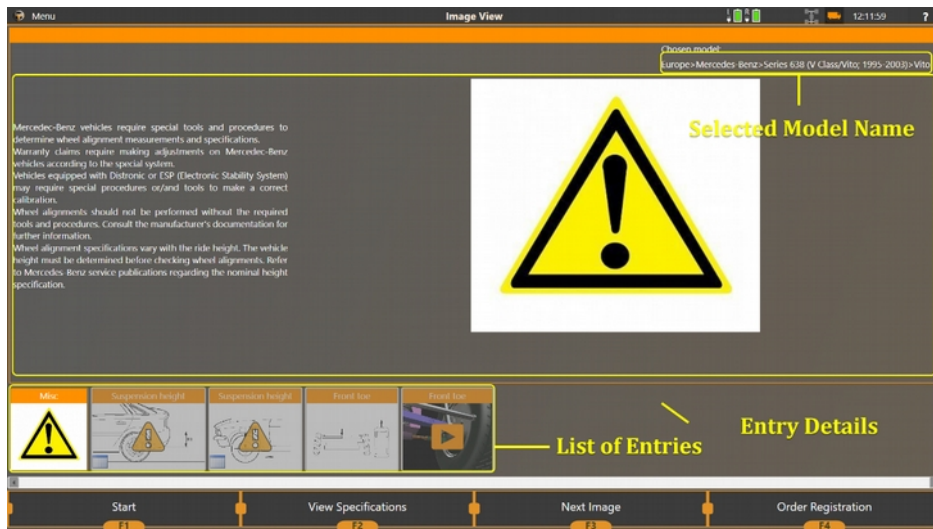
2.7. Reviewing and checking the vehicle's documentation and specifications

After creating an order and selecting the vehicle's model, the software proceeds to model information mode. It consists of three screens:

- Image view;
- Specification view;
- Tire Pressure view;

2.7.1. Image View

In the image view, the software displays all the available data entries in the Techno Vector Database about the selected model: methods of toe/camber adjustments, loading schemes, or any other additional information related to wheel alignment it has about the model.

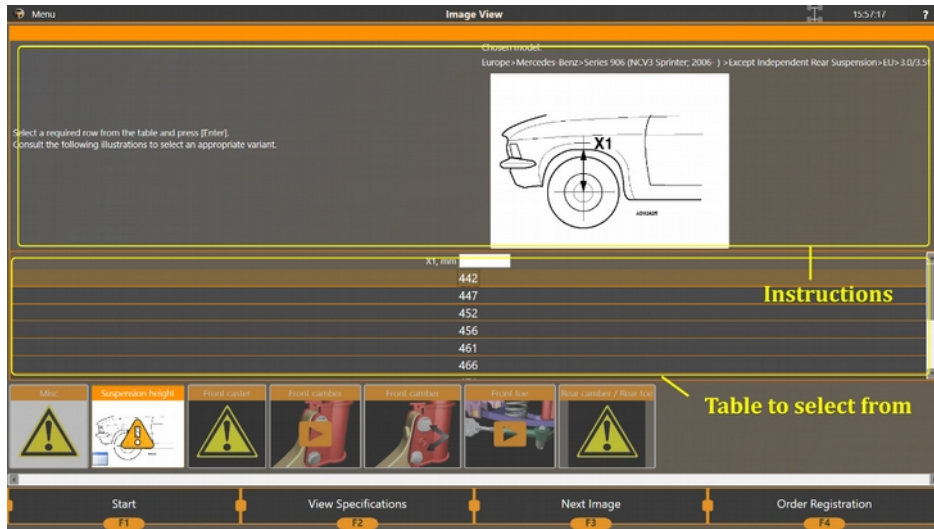



You can select any entry in the list at the bottom of the screen and view it in details.

For several car models (mainly Mercedes, Audi and other German manufacturers), in the Image view there can be special entries that contain tables.

Some tables require you to select a line from the list. This helps to determine the final values of the specifications you need to select a line from each table.

You can select the line using arrow keys on the keyboard or the remote control and then press **ENTER** to confirm it.



 You can always return to reexamine any image in the Image View screen using the Menu command at both 'Report View' and 'Adjustment Mode'

2.7.2. Specification View

After you've finished reviewing all the images, the software proceeds to the Specifications View. These are the ranges of values specified by the vehicle manufacturer that are required to be set on the vehicle for it to function correctly.



Front axle	Min value	Best value	Max value
Left camber	-0°06'	+0°29'	+1°04'
Right camber	-0°06'	+0°29'	+1°04'
Cross camber	-1°00'	+0°00'	+1°00'
Left caster	+4°33'	+5°03'	+5°33'
Right caster	+4°33'	+5°03'	+5°33'
Cross caster	-0°30'	+0°00'	+0°30'
Total toe	+0°10'	+0°20'	+0°30'
Left SAI	+13°01'	+13°31'	+14°01'
Right SAI	+13°01'	+13°31'	+14°01'
Cross SAI			
Rear axle	Min value	Best value	Max value
Left camber	-1°00'	+0°00'	+1°00'
Right camber	-1°00'	+0°00'	+1°00'
Total toe	+0°00'	+0°15'	+0°30'
Thrust Angle			

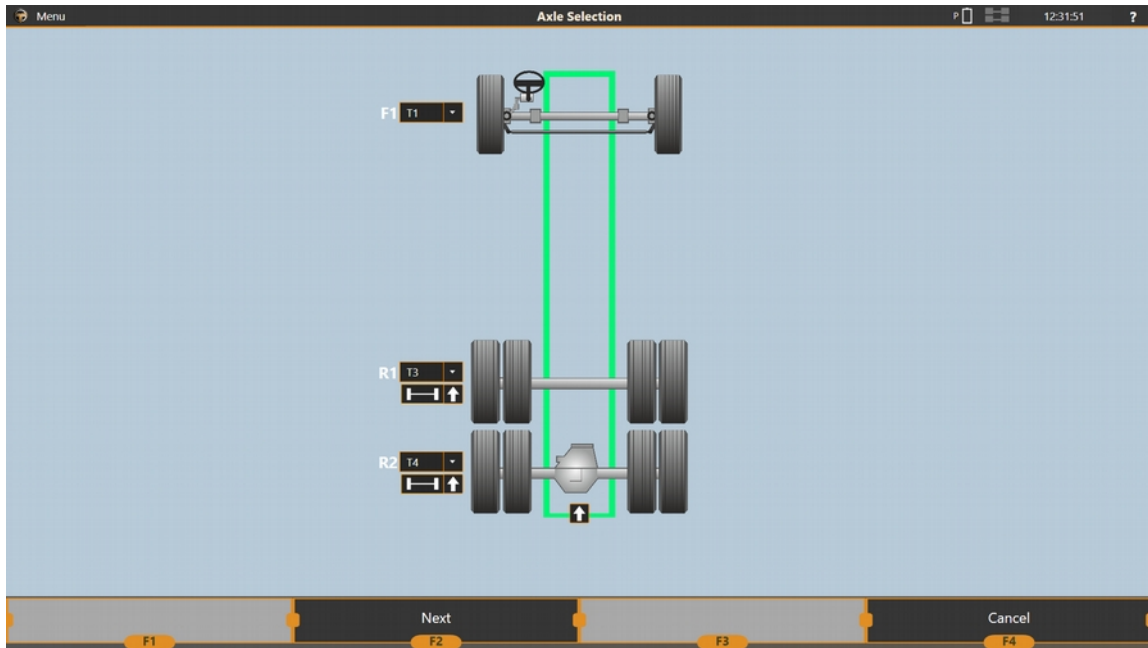
2.7.3. Tire Pressure

Model	Production Year	Discs	Wheel Size	Modification	Front tires	Rear tires	
Sprinter(906)	2006-13		205/75 R 16 C 110/108R	209 Van	3.1	3.1	
			235/65 R 16 C 115/113R	209 Van	3	3	
				311/315 Van/313 Droppide PU	3	3	
				311 Chassis cab	3	3	
				235/60 R 17 C 117/115R	209 Van	3	3
					311/315 Van	3	3

For many models, pressure values can vary depending on modifications and tire sizes. Make sure the tire pressure in each wheel is set to correct values before you proceed.

2.8. Axle Selection

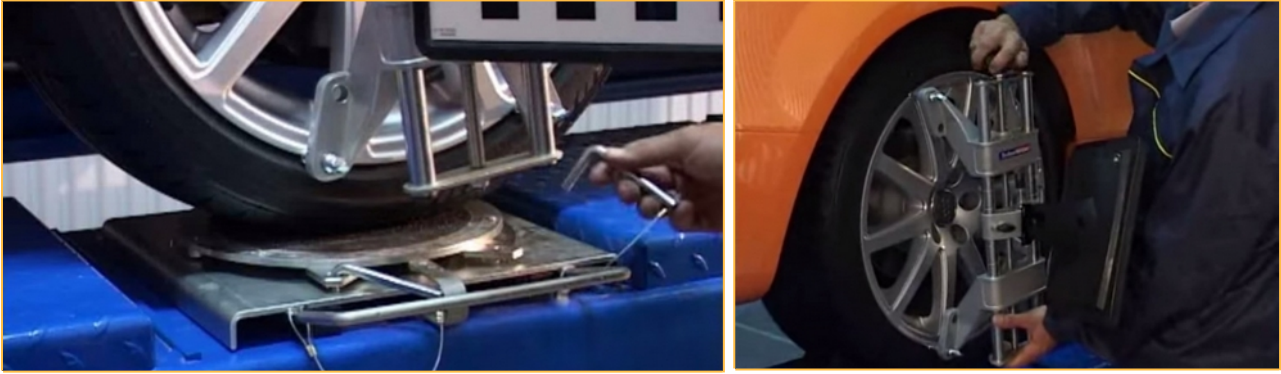
In most cases the software selects targets you place onto targets automatically. However in Custom Modes and when measuring a vehicle with more than **four** axles, an **Axle Selection** screen is displayed.



For each dropdown list, select a target you intend to place to the corresponding axle. If you do not intend put targets on to that axle's wheels, leave the dropdown blank. For example, on the screen above, you can see that you need to put T1 targets onto the front axle, T4 targets onto the rearmost axle, T3 targets onto the middle axle.

If you perform adjustment on a vehicle with more than 4 axles, to measure all of them at some point during the adjustment you will need to return to this screen and select a different target setup.

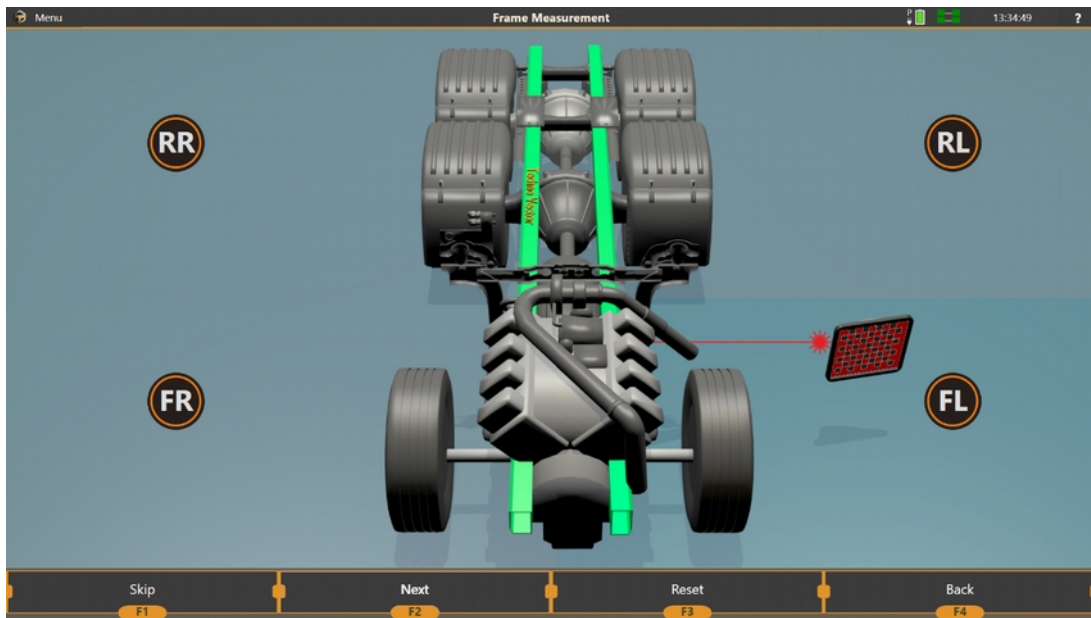
2.9. Preparing the Vehicle



- Block the front turn tables with locking pins;
- Roll or drive the vehicle onto the workplace. Try to avoid big turns of the steering wheel as this may leave residual tension in the suspension of the vehicle;
- The vehicle's front wheels must reside at the centre of the turn tables;
- Set wheel blockers to prevent the vehicle from rolling backwards if needed;
- Check all the vehicle's suspension elements meticulously. The suspension should be in a good working order before making a measurement;
- Make sure the tire pressure is within the vehicle's recommended specifications;
- Mount wheel adapters with targets onto wheel rims. To increase/decrease the adapter's designated wheel size, rotate the tension screw of the clamp to move apart two-shoulder consoles;
- To fasten the clamp to the inner side of the rim, attach the clamp to the wheel with two claws (upper or lower). Rotate the tension screw to bring the other pair of claws to the attaching point and lock the clamp to the wheel;
- Make sure that all the clamps are securely attached;
- Make sure that the targets are inserted into the clamp completely (as far as it can go);

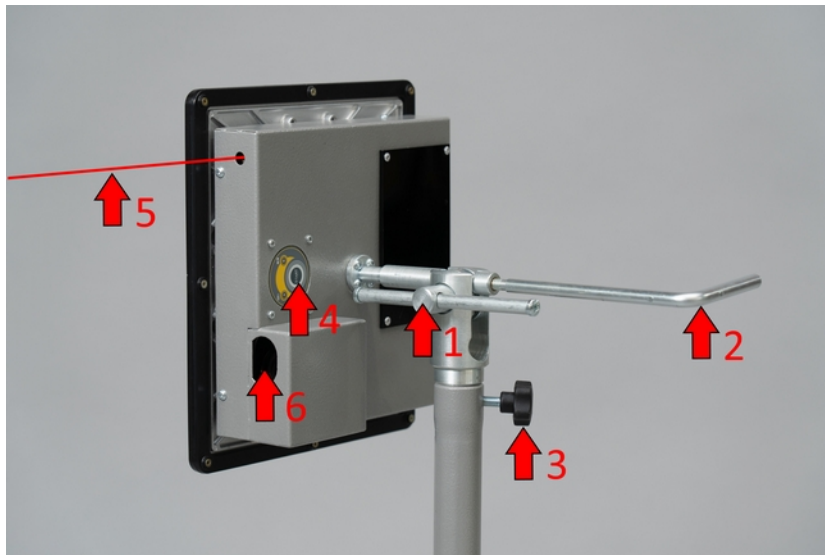
2.10. Frame Measurement

Frame measurement has to be performed if you are measuring the truck relative to the frame. If you are measuring the vehicle relative to one of its axles, this step is skipped.



Frame measurement is done with the laser probe.

Laser probe is a device with wireless connectivity that consists of a target, a laser pointer, a camera, a battery and a processing unit.



To **turn on** or **turn off** the laser probe press the on/off button (4). The laser probe turns itself off automatically after a frame measurement has been performed. To force the turn-off, you can hold the (4) button. If held for longer than 3 seconds, the laser probe will turn itself off.

You can **adjust the height** of the laser probe using the (3) handle to loosen up the telescopic mechanism and move it up and down. After you had the height adjusted, tighten the (3) handle.

To **rotate** the laser probe (altering the direction of the laser beam (5)), loosen up the position lock (1) while holding the direction handle (2). Adjust the rotation and tighten the position lock (1) back.

To perform a measurement, point a laser pointer onto the position you want to measure on the vehicle's frame, while having the target facing the aligner's cameras. When ready press **F2**. Repeat the procedure for all the four points required by the software.



The **WiFi** indicator on the laser probe is flashing blue when the data is being transmitted.

The battery indicator is flashing green under normal operation. The green flashes are becoming more and more intermittent with the battery charge going down. When the battery is low and requires charging, the indicator start flashing red.

While charging, the battery indicator is flashing red and green. When fully charged the battery indicator is always green.

For every step you need to point at four points on the vehicle's frame.

The order of measurement: **FL - RL - RR - FR**.

Try to perform the point symmetrical: measure the points on the left and on the right approximately at the same places.

To perform a step, point the laser pointer where you intend to measure the frame and press **F2 Next** (it's best to use a remote).



If during the subsequent stages you have moved vehicle to the side, we advise to repeat the frame measurement.

2.11. Compensation

To perform a reliable measurement, you need to determine the position of each target relative to the wheel's centre. To do that, a procedure called 'Compensation' is performed. There are two modes of compensation:

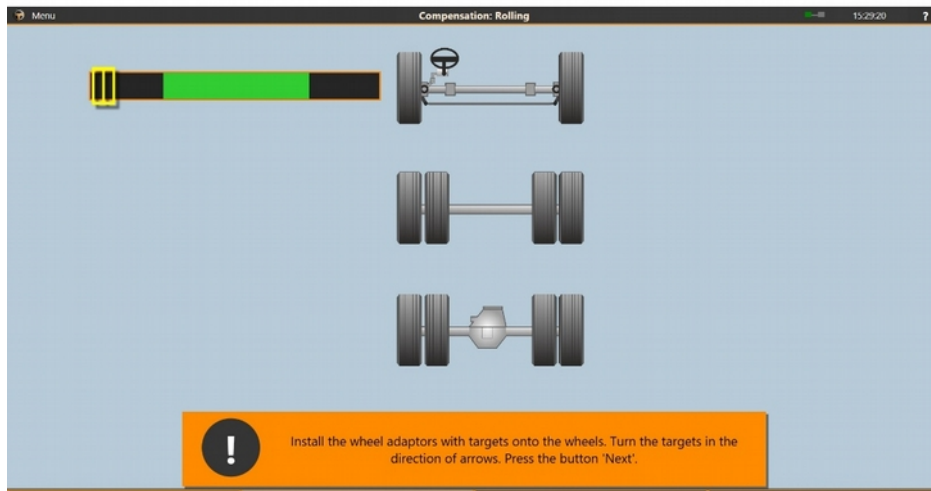
- Jacking, where you lift the vehicle's wheels (one by one, one axle at a time, or all four simultaneously) and then rotate each wheel backwards and forwards.
- Rolling, where you roll the entire vehicle backwards and forwards
- Forward, where you roll the entire vehicle forwards only.

Forward compensation is most commonly used.

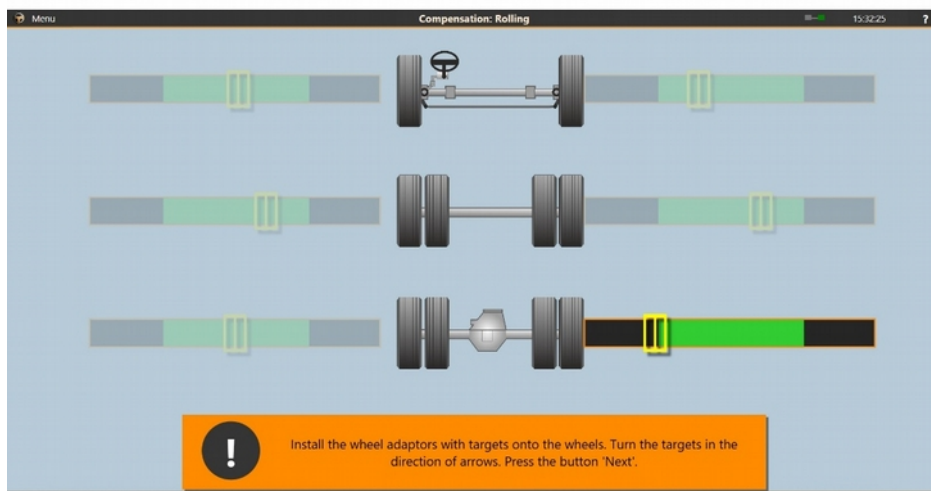


Compensation is a special procedure in the measurement part of the software that determines position of axis of wheel rotation. Compensation is compulsory because it allows for errors that can appear if a clamp is mounted incorrectly or if wheel disks are uneven. The software allows you to skip this procedure, but nevertheless we strongly recommend performing compensation every time when a clamp is mounted onto a wheel. Otherwise the precision may be heavily compromised.

2.11.1. Rolling and Forward Compensation



When starting the compensation, you need to ensure the targets in the clamps are installed at the correct angle towards the cameras. Their position must allow the cameras to see targets when you roll the vehicle. Set up the clamps on the vehicle's wheels and then rotate the targets one by one starting with FL so that the cameras are able to see them. Targets should be detected by the software. Rotate the targets so that the yellow indicator is within the green zone. When the STOP signal shows up, you are in the green zone and the software will proceed to an installation of the next target.



If you always attach the clamps in the same way and don't move the targets in them, you won't need to alter target positions in them often. The targets would always face cameras and have a correct angle to perform compensation.



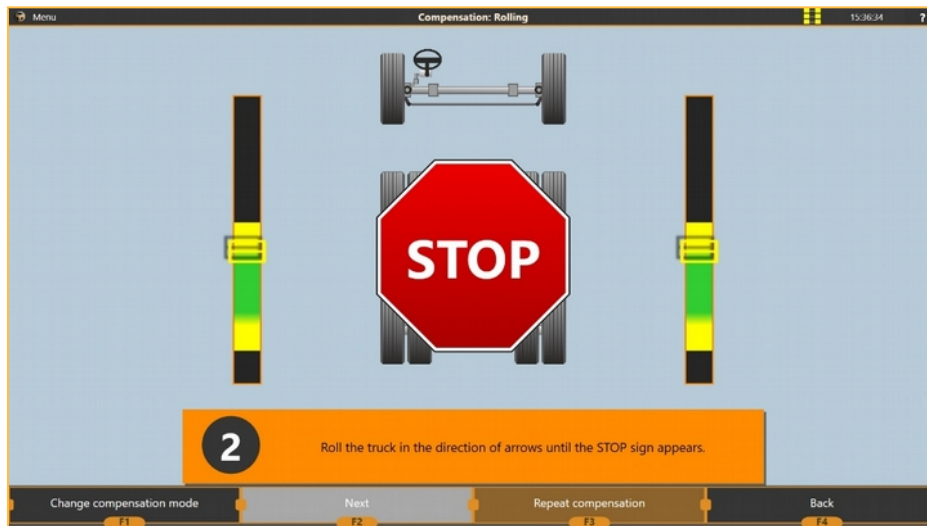
After the targets are positioned, make sure they are firmly fixed in the clamp's socket.

When all the targets are set into the correct positions, you can proceed to Step 2. This will be indicated by button **F2** becoming available. To continue you can either press the **F2** button or start rolling the vehicle and the software will automatically proceed to step 2.

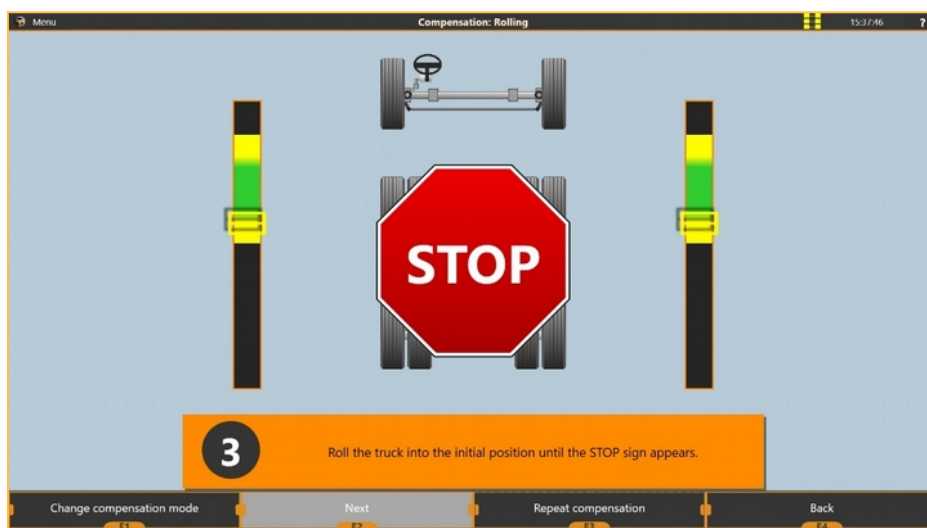


For the Forward compensation the software immediately moves to the step 3.

Step 2. Roll the vehicle backwards until the STOP sign appears.



Step 3. Hold the vehicle steady and wait until the software proceeds to the next step. Roll the vehicle forwards.



Depending on the results of the compensation and the settings selected, the software can proceed either directly to the 'Measurement' screen, or display the compensation results.



If **compensation errors**, displayed after the compensation **exceed 3'**, it would be best to repeat the compensation. If even after repeateds, the errors are still high, check the vehicle's suspension for any damage. Alternatively, you can choose to switch to **jacking compensation**.



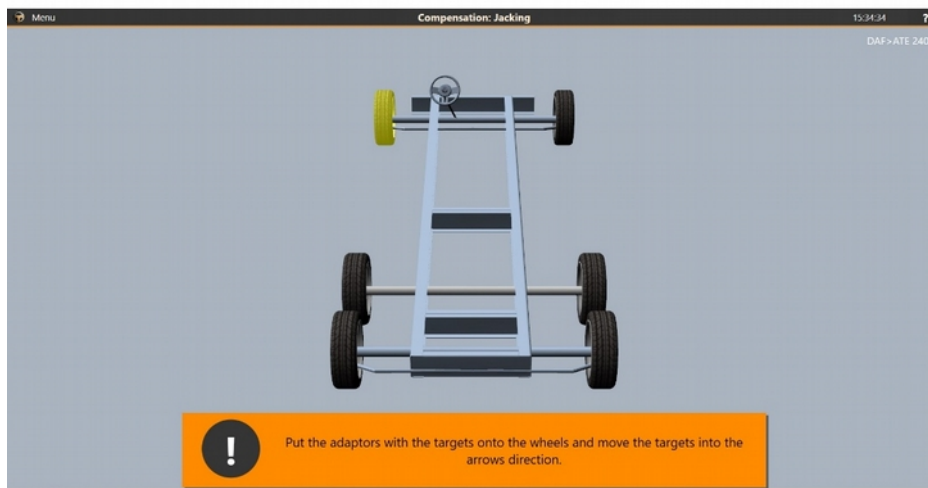
A compensation mode called '**Extended rolling compensation**' is designed for vehicles where the rear wheel's sizes differ from the front wheel's. This allows the aligner to perform each axle's compensation steps at different times, allowing you to stop 2 times at the rear instead of the one (a separate stop for each axle).



Rolling compensation should be performed on a **flat surface only**. You must not perform rolling compensation for a vehicle with large deviations in wheel alignment angles (e.g. after body repair and after replacing some suspension parts). When rolling a wheel with an oval tire, or if the tire is very low-profile, the lower edge of the clamp can bump into the floor. In this case you can set the initial position of the clamp so that during the roll it wouldn't happen.

2.11.2. Jacking compensation

Jacking compensation is usually performed when there is no space to roll the vehicle, when the vehicle's suspension is damaged, or when its toe is greater than 2 degrees. Jacking is heavily recommended in case with a very big toe or suspension damage because rolling the vehicle might cause it to swerve to the side unpredictably (including the steering wheel moving by itself) which would cause a very big calculation error with the rolling compensation.



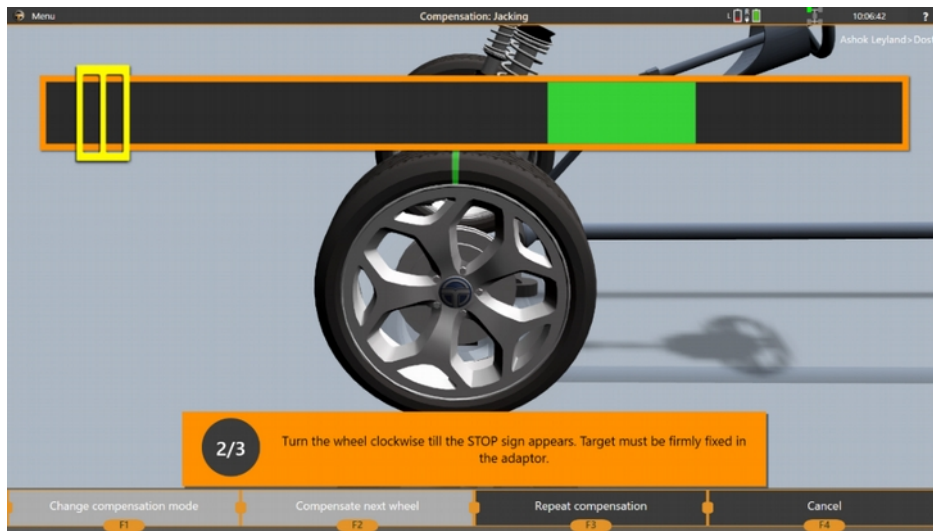
While **jacking compensation** is done one wheel at a time, you can raise vehicle entirely, axle by axle or wheel by wheel.

After the target setup is completed, you can now select a wheel to perform compensation. You can always override a predefined order of wheels and select a different wheel during compensation.

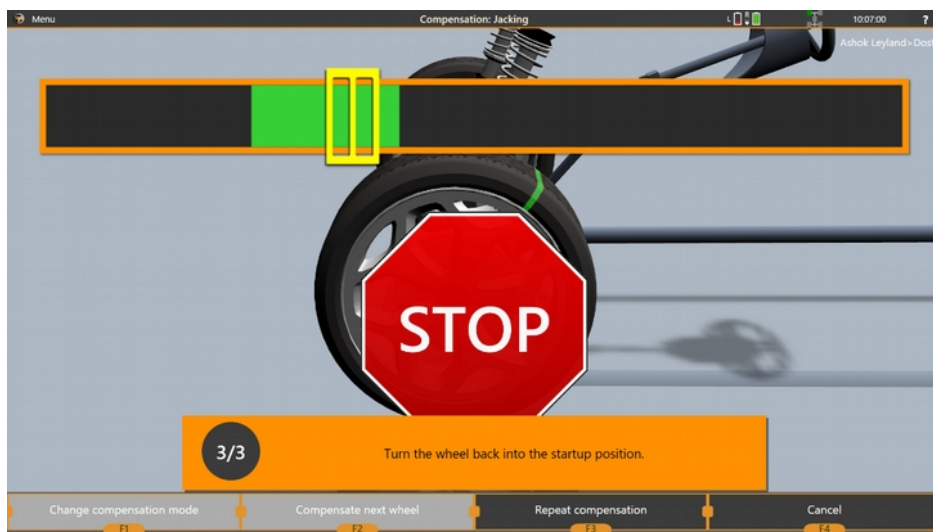
The wheels that already have been compensated are tinted green. The selected wheel is displayed either with yellow colour or with green flashing colour if the compensation for this wheel has already been performed.

When the wheel is selected, press **F2 Compensation** to start this wheel's compensation.

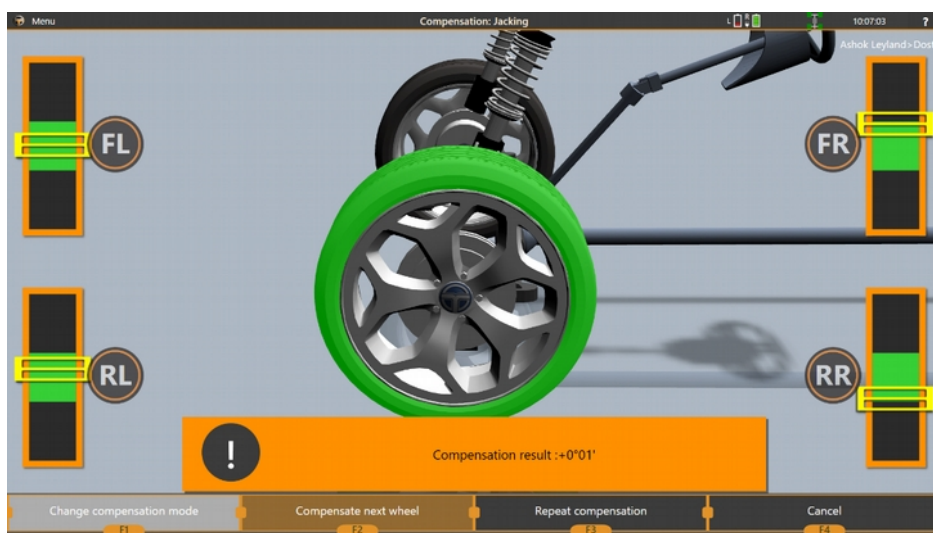
Wait for the first step to be taken automatically and then proceed to the second step: rotate the wheel clockwise (according to the instructions on the screen).



When the wheel will be turned the needed amount, a **STOP** sign will appear. Stop rotating the wheel, wait until the software moves to the next step.



On the third step, you need to return the wheel that is being compensated to its initial position. Wait for the **STOP** sign appear.



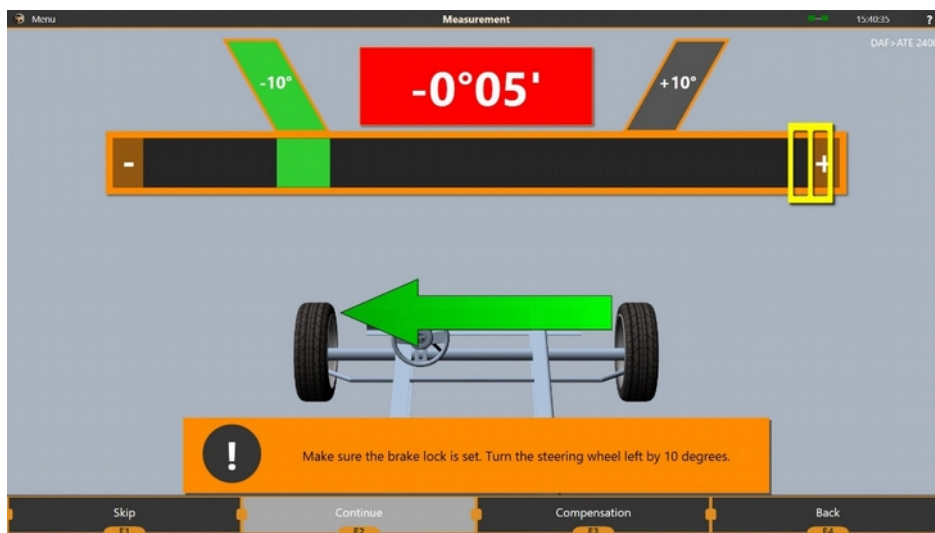
If there are still wheels to be compensated, press **F2 Compensate next wheel**. If all the wheels are compensated, the **F2** button will proceed to the next screen.



If you are repeating the compensation, all the wheels will be green already, and to repeat the compensation you have to select the wheel and press **F3 Repeat compensation**.

2.12. Measurement

Measurement is performed after all the preparatory steps, including compensation are completed. During this step, the vehicle's wheel alignment parameters are all measured and attached to the order.



Before proceeding to the measurement. Remove the locking pins of the turn tables. The wheels must rotate freely during measurement.



If you're doing caster or toe-out-on-turns measurement, apply the handbrake (or electronic handbrake).



On the measurement screen you can see the gauge with an indicator, that shows the steering wheel position, an arrow, that indicates the direction, where the steering wheel has to be returned to perform current step.

Current active step is coloured bright green, finished steps dark green, unfinished steps are gray. The amount of steps that are performed during the measurement can vary and depend on the software's settings.

Measurement can have the following steps:

Initial measurement	The steering wheel's position is not relevant, the software acquires the location of the wheels and measures the toe so that it would correctly perform measurements of Caster. Performed automatically when all the targets are stable.
Caster measurement at 10 degrees	If 10 degrees stop is selected, the caster is automatically measured at 10 degrees.
Final measurement	Measures toe and camber. Note that zero on the screen indicates the central line position, not the steering wheel position. Performed automatically when the steering wheel is set to zero.
Steering wheel position measurement	Measures steering wheel position relative to the central line. This mode requires the user to press the F2 button to trigger the measurement.

All the steps except for the **Final measurement** can be skipped by pressing the **F1 Skip** button.

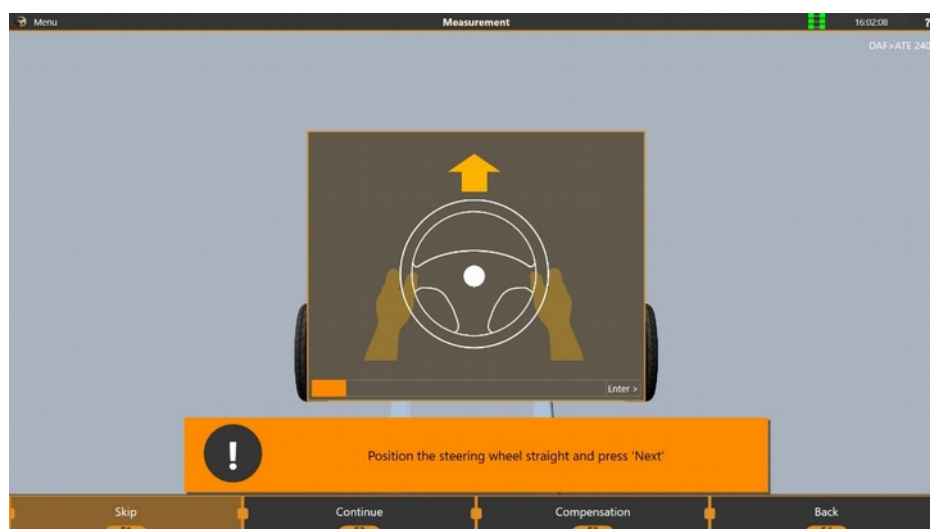


Note that in the customisation screen there is an additional option available: **F1 Repeat compensation**. You can always return to compensation using this button, or using the menu on top of the screen.



F4 Back in the measurement works differently - it returns to the previous screen. During the first measurement that would still be compensation, but if the measurement is repeated - the return will be performed to the Report View mode.

If measurement of the steering wheel position is enabled, the following screen is displayed after all the measurement steps are done:



When the steering wheel is set straight, press **F2 Continue**. If you do not wish to perform this step, you can press **F1 Skip**.

2.13. Report View

In the report you can see the results of the measurement, adjustment. From here you can head forward to make adjustments, print the report, repeat measurements among other things.

Parameter name:	Specifications		Measurement	
	Min	Max	Before	After
Front axle				
Left camber	-1°28'	-0°28'	-1°58'	- - -
Right camber	-1°28'	-0°28'	-2°22'	- - -
Cross camber	-0°30'	+0°30'	-0°24'	- - -
Left toe	+0°00'	+0°07'	+0°11'	- - -
Right toe	+0°00'	+0°07'	+0°11'	- - -
Total toe	+0°01'	+0°15'	+0°22'	- - -
Left caster	+7°45'	+8°45'	+7°58'	- - -
Right caster	+7°45'	+8°45'	+7°15'	- - -
Cross caster	-0°30'	+0°30'	-0°43'	- - -
Left SAI	- - -	- - -	+9°30'	- - -
Right SAI	- - -	- - -	+9°33'	- - -
Cross SAI	- - -	- - -	+0°03'	- - -
Left IA	- - -	- - -	+7°32'	- - -
Right IA	- - -	- - -	+7°11'	- - -
Setback	- - -	- - -	+0°00'	- - -
Centering	-0°03'	+0°03'	+0°01'	- - -

The report screen is a table of vehicle's wheel alignment parameters and its values.

The first column of the table is the parameter name, such as Toe, Camber, Caster, etc.

The **Specifications** column of the table is filled out of the vehicle model you selected during 'Select Model' step. If the manufacturer does not have any specifications for the parameter, the values are left empty (- - -).

The **Before** column is what will be printed out as a 'Before adjustment' column. This is the first measurement you performed for this order.

The **After** column is what will be printed out as a 'After adjustment' column. This is the last measurement you performed for this order.

On the screenshot above the **After** column is empty. To fill this column, you have to perform another measurement.

This can be achieved either by repeating the measurement by pressing the **F3** button or by exiting the adjustment mode with a feature 'Use alignment data from adjustment in the report' enabled in software's settings.

To proceed to adjustment, press **F2 Adjustment**.

To print out the report, press **F1 Print**.

To repeat the measurement or compensation, press **F3 Repeat Measurement**.

To finish the order and return to the main menu, press **F4 Finish the order**.



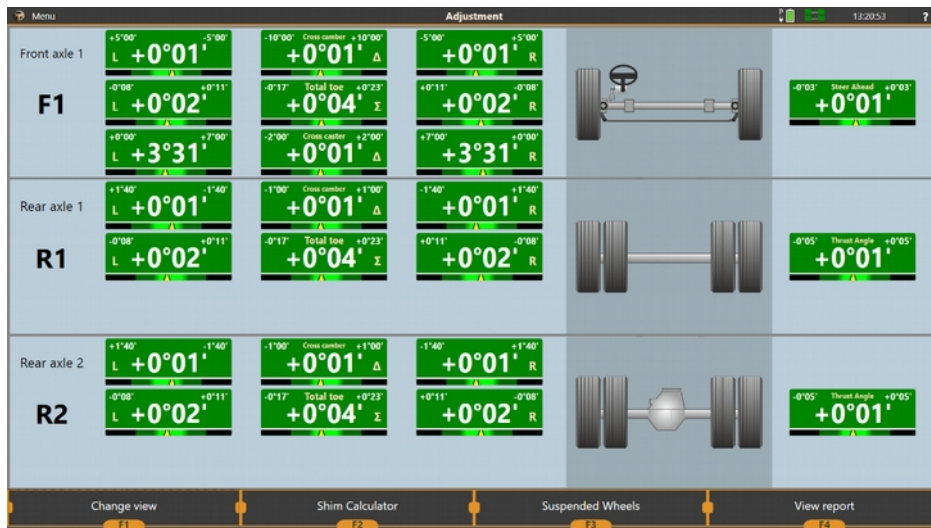
Remember that the caster values that are copied over from adjustment mode may not be precise, because Caster can only be measured when the steering wheel is turned! If you have had the caster adjusted, it is advised to redo the measurement step (with turning the steering wheel 10 or 20 degrees).



You can use **Show History** button to select any measurement as the **Before** and the **After** column if you've performed several. This can be useful if one of the measurements was performed with some kind of an error.

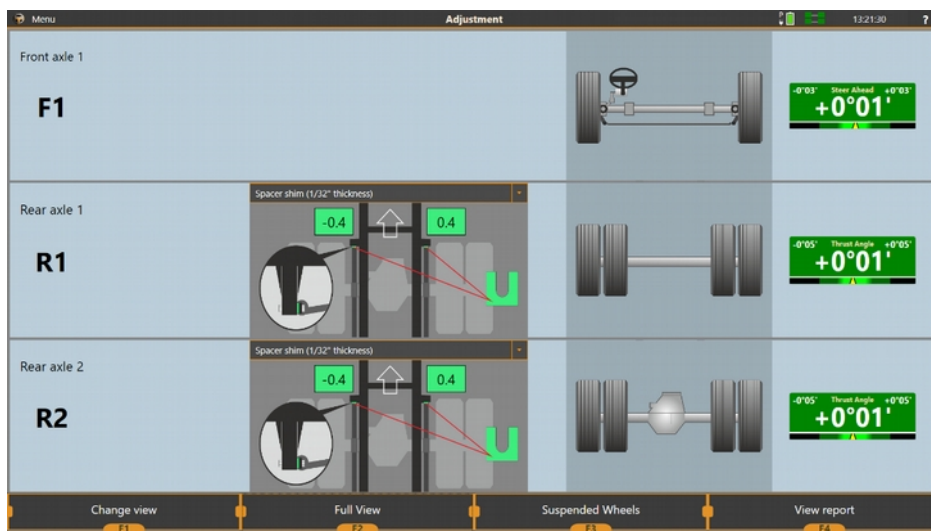
2.14. Adjustment

The adjustment screen is the main screen you're going to work with when performing an alignment. It is used to dynamically track the parameters you are adjusting.



In the adjustment mode you have several options of how to represent the data on the screen available. The general view provides the overview of all the active axles (the ones that are measured live by the aligner).

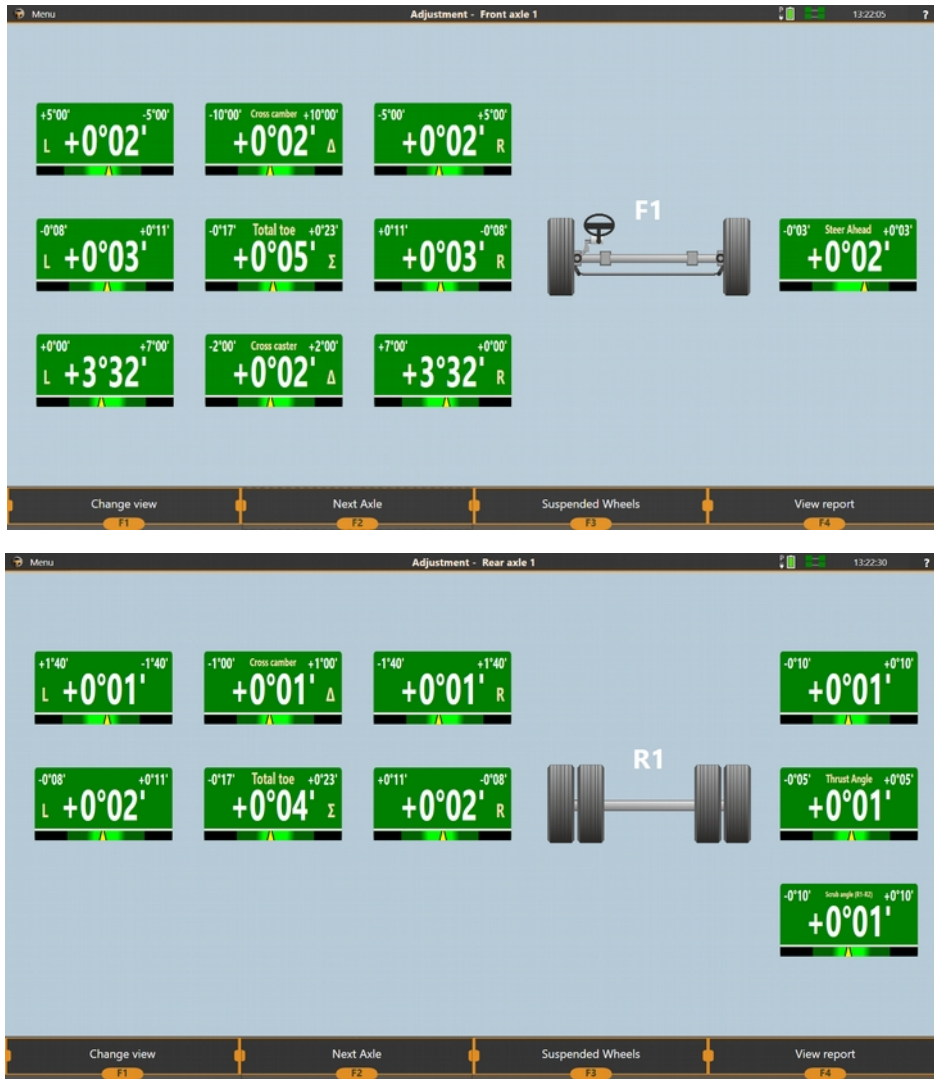
A Shim Calculator (activated by pressing **F2 Shim Calculator** button) screen allows to automatically calculate the amount of shims to be placed to correct the thrust angle of the axle to 0.



In a dropdown box you can select a spacer shim's size.

To display a single axle only, you can press **F1 Change view**

To switch between axles press **F2 Next Axle**



2.14.1. Extended measurement modes

In some cases, to perform an adjustment, it is required to raise the axle. If the software is not notified of such an action, the values will change drastically and will require the technician to estimate changes, and then to check the values back in the standard position.

The Techno Vector software contains a Suspended Wheels mode that allows to lift the vehicle entirely, to lift its one axle or even one wheel, while still maintaining the displayed values 'as if' the vehicle was not lifted.

You can access the **Suspended Wheels** mode by pressing **F3** in the adjustment screen. Turned steering and removed wheel mode can be accessed using the menu.



Suspended wheels mode

All three of these modes are very similar and allow to 'offset' the displayed values so that any movement before activating the mode is discarded.

When any of these modes are active, the additional icon is displayed on top of the screen in the title bar:



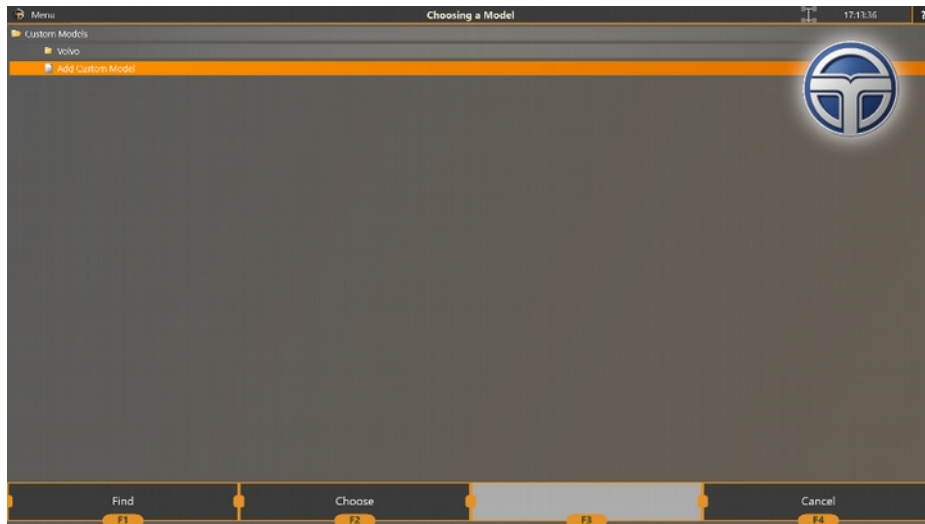
To exit the Suspended Wheels press **F3**.

2.15. Additional Operation Modes

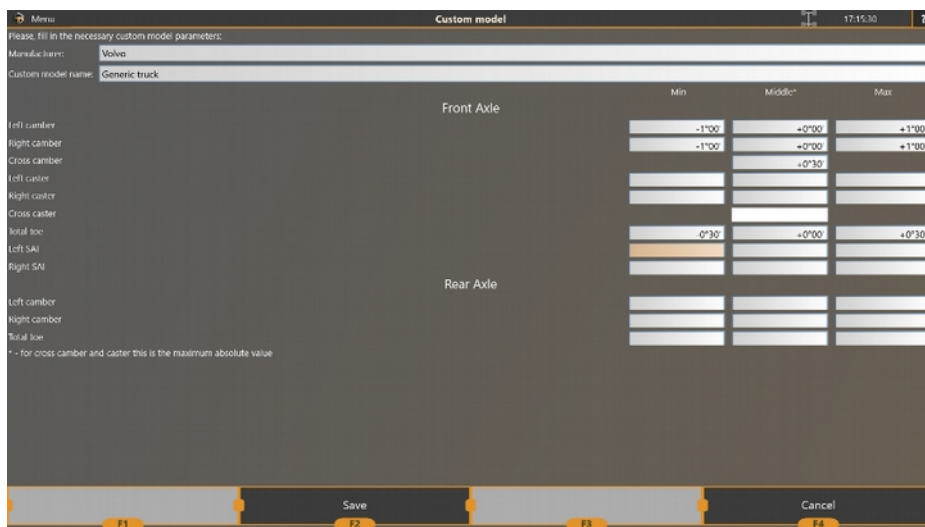
2.15.1. Custom Models

The software allows you to create custom car models, so that you might enter your own specifications for vehicles that are not present in the Techno Vector database.

To create a custom model entry, select the section **Custom Models - Add Custom Model** in the **Model Selection** screen.

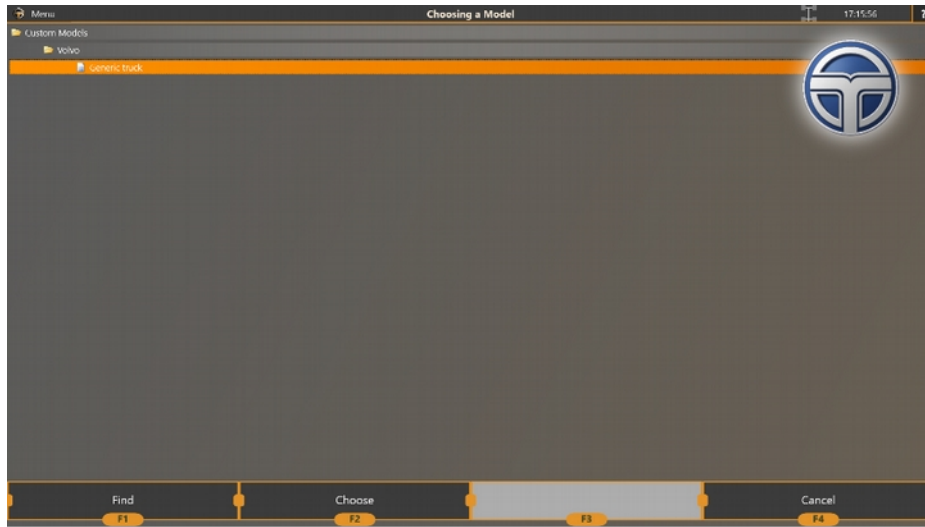


The software will proceed to the specifications input screen.



When all the necessary values are entered, you can press **F2 Save** and the custom model will be added to the Custom Model list in the **Model Selection** screen.

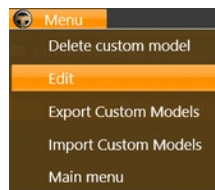
If you leave the Manufacturer field blank, the custom model will be placed at the root of the Custom Model folder. If you specify a Manufacturer name, it will be placed in a folder with the manufacturer's name.



You can select a custom car model for the model in the same way you select a car from the Techno Vector database: press **F2 Choose**. The model's specifications will be displayed in the subsequent order screens.

The menu contains additional operations for a selected custom car.

You can edit or delete a custom car.



2.15.2. Importing and Exporting Custom Cars

The Export mode is used to save data on certain cars in a separate file.

To enter the Export mode, select Export Custom Cars from the menu.



Select all cars that you want to export and press Export. In the pop-up window that appeared enter a required file name, if necessary, and press Save.

To cancel exporting, press Cancel.

The Import mode is used to remove cars from a separate file and save them to the custom cars database.

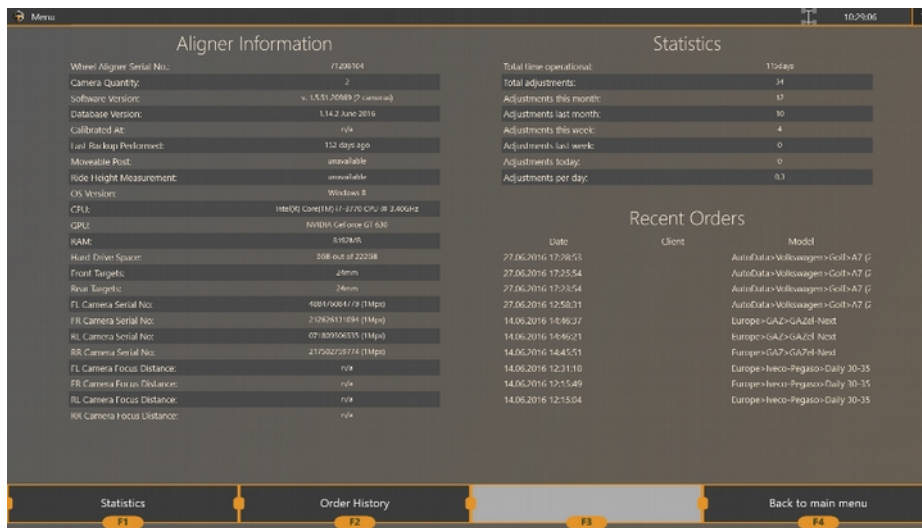
Select a file name from which you want to import the data. The software analyzes the import file contents and, if there are copies, it gives a warning on the screen.



Import and Export option is used to transfer your own custom model data between multiple aligners. This is especially useful for the markets, where the Techno Vector's database is outdated or insufficient.

2.15.3. Information about Wheel Aligner

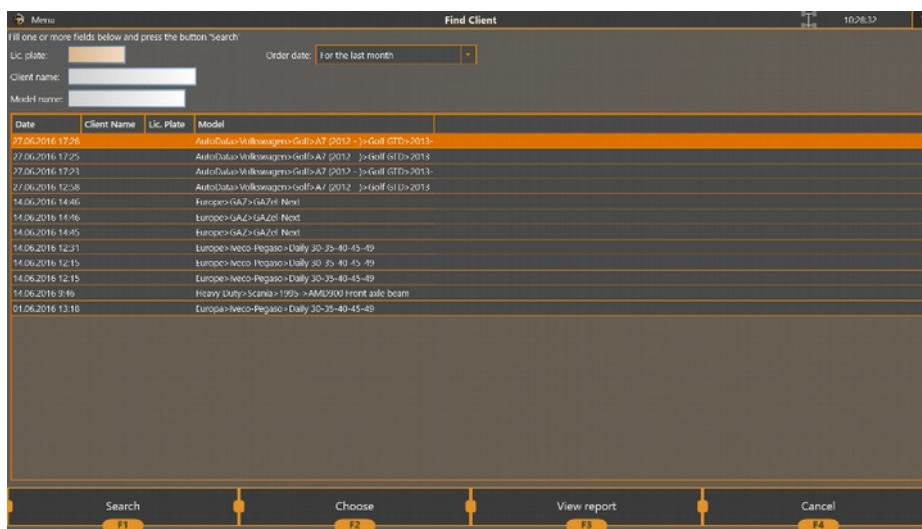
Press **F1 Information** in the startup screen to see detailed information about the wheel aligner.



Information about wheel aligner includes: serial number of the machine, information about the computer and equipment configuration and summary statistics for days, weeks, months.

2.15.4. Order History

Press **F2 Order History** to see information about all adjustments that were performed.



Select a time interval you need in the field Order Date and press **F1 Search**.

If you need to find a certain order, fill in any of the search fields: Vehicle's Licence Plate, Client's Name, Vehicle Model and press **F1 Search**.

For each order you found you can see a report on adjustment by pressing **F3 View Report**.

2.11.5. Statistics




To see statistics, press **F1 Statistics** in the Wheel Aligner Information screen.



Select a required type of diagram (adjustments per week, adjustments per day, measurements since placed in service), user and time interval to see all the necessary data in detail.

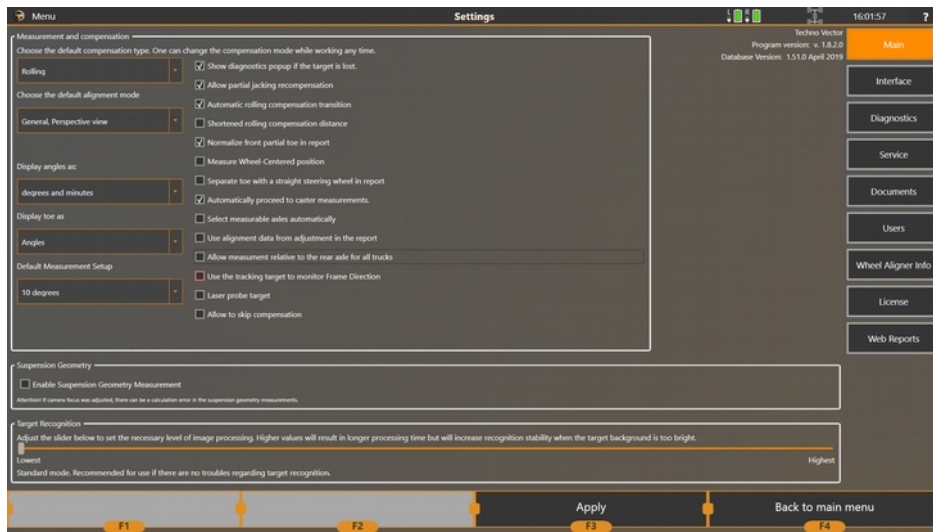
2.16. Software's Settings

Settings screen allows you to control the software, calibrate, check calibration, back up and restore data from the backup copy. To enter the settings mode, press **F3 Settings** in the main menu. After that the software will proceed to the settings screen where the Main tab is selected by default.

	Only a skilled professional should edit the settings in Service menu.
	You can see the detailed description of lower-level settings in Installation and Maintenance Manual for Techno Vector™ wheel aligners. This information is for dealer and service centers only.
	You must not change lower-level software settings by yourself because it can result in the impossibility to use the wheel aligner or incorrect measurements.

2.16.1. Main

This screen includes the main software settings. In the upper right-hand corner of the screen you can see the software version and the vehicle database version that is used by the Techno Vector software.



Settings-Main

Option	Description
Default compensation type	<p>Sets the default compensation type. The list includes Rolling compensation, Jacking compensation, Rolling compensation (extended) and Forward compensations.</p> <p>Rolling is a standard backwards-forwards compensation</p> <p>Rolling (extended) is a standard backwards-forwards compensation with an ability to accommodate differently sized rims (i.e. when front wheels are smaller or bigger than the rear ones)</p> <p>Jacking is a compensation where the technician raises one or more wheels at the same time and rotates one at a time</p> <p>Forward is a compensation where instead of rolling backwards and forwards, the technician places the vehicle before the turntables and rolls the vehicle onto them just once: forward.</p>
Display angles as	Sets a format in which angle values are displayed. The possible options are: degrees and minutes (0°00’), degrees and decimals (0.0°).
Display toe as	You can select a format in which toe is displayed (angular values, mm or inches ¹).
Default measurement	Sets the default set up for the measurement. Available

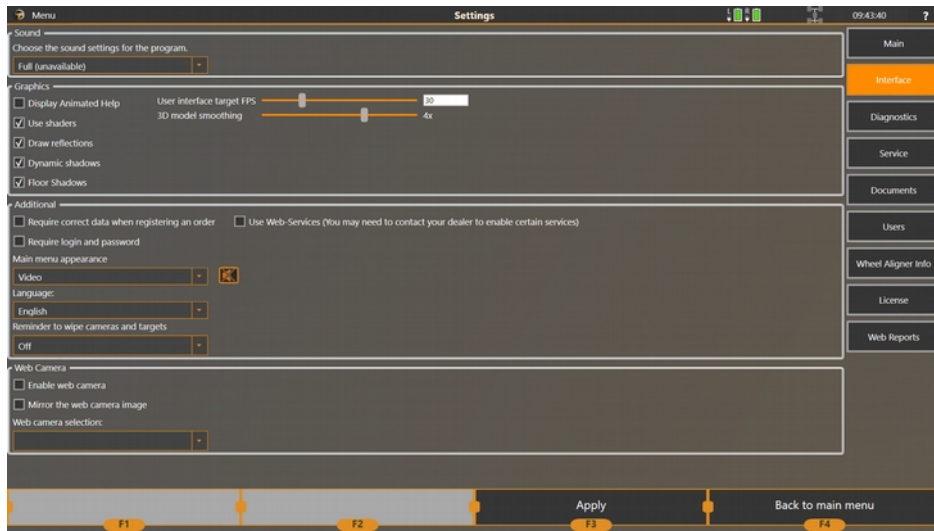
¹ To display toe in mm or inches, you can select alter the wheel’s diameter for each vehicle during order creation. You can also leave it unchanged to use the European standard of conversion

setup	options are: 10 degrees caster only, 10 degrees caster + 20 degrees measurement for toe-out-on-turns, 20 degrees measurement only (with caster at 20).
Allow partial jacking recompensation	If enabled, when performing the jacking compensation once again, the old results will be saved and all the wheels will be considered compensated. This way you can repeat compensation only for one wheel without repeating the compensation for the rest of the wheels.
Automatic rolling compensation transition	If enabled, the software recognises the start of the rolling compensation (all wheels move backwards simultaneously) and starts it automatically without requiring you to press F2.
Normalize front individual toes in the report	If enabled, the front left toe and front right toe in the report will be set equal to half the total toe. This is useful to get rid of "red" values in parameters if there is a very narrow tolerance range for toe in the vehicle specifications and the steering wheel was not positioned exactly at 0.
Measure Wheel-Centered position	If enabled, adds a steering wheel position step to the Measurement.
Separate toe with a straight steering wheel in report	If enabled and the steering wheel position is measured, creates an additional individual toe entries called 'Left Toe with steering straight' and 'Right Toe with steering straight'. If not enabled, the normal Left and Right Toe values are set to toes, when the steering wheel is set straight.
Automatically proceed to caster measurements	If enabled, the software doesn't require you to press the F2 Next button before starting the measurement.
Select measurable axles automatically	Automatically picks the axles to measure. If you are unsure in what order it's better to do truck alignment, enable this option
Use alignment data from adjustment in the report	If enabled, the software automatically fills the 'After' column with the current adjustment data when you return to the report. Note , that the Caster value is preliminary and it is advised to repeat its measurement procedure to be certain in its value. Other values, that are calculated during measurement, will not be filled either.
Allow measurement relative to the rear axle for all trucks	If enabled, the software allows to perform measurements relative to the rear-most axle for trucks with any amount of axles. The rear-most axle should be measured first when this mode is selected.
Laser Probe Target	If enabled, a laser probe is used to perform frame measurement.
Allow to skip compensation	Enables an option in the menu while doing the compensation to skip it altogether. Caution! Skipping compensation can cause incorrect measurements. The

	manufacturer does not guarantee accuracy of measurements when using this function.
CPU cost for target recognition	It allows you to solve problems connected with target lost at the bright white background (sunshine, sky, well-lit street).

2.12.2. Interface

The **Settings - Interface** screen allows you to set program interface parameters and make graphic settings of the 3D model displayed in the adjustment, measurement and compensation modes.



Picture 1. Settings - Interface.

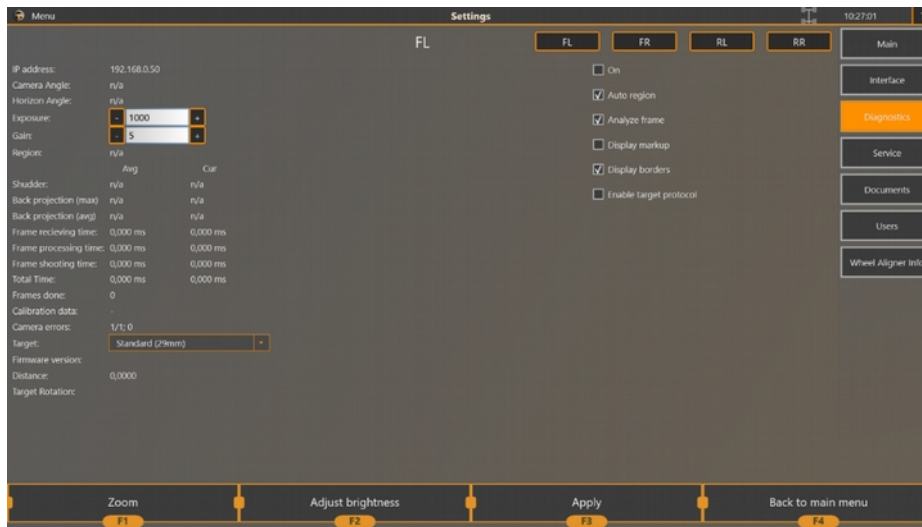
Parameter	Description
Sound settings	The following options are available: <ul style="list-style-type: none"> • Full - sound effects and voice-over tips are enabled (available for select languages); • Sound and no voice - only sound effects are included; • No sound - no sounds are included;
Display animated help	Displays animations that remind the technician to perform certain actions, such as putting the steering wheel lock, releasing the pins of the turntables, etc. Every animation lasts for about 20 seconds and closed earlier by pressing the ENTER key on the keyboard or the remote.
Use shaders	Use shader special effects when starting software. If you are using an embedded graphics card, turning off this function is recommended.
Draw reflections	Turns on and off reflection displaying on 3D screens of the software. If you are using an embedded graphics card, turning off this function is recommended.
Dynamic shadows	Turns on and off displaying of dynamic shadows from wheels on 3D

	screens of the software. If you are using an embedded graphics card, turning off this function is recommended.
Floor shadows	Turns on and off displaying of static floor shadows from the chassis on 3D screens of the software. If you use an embedded graphics card, turning off this function is recommended;
User interface target FPS	Target amount of 'Frames-per-Second' of the user interface. Default value is 60.
3D model smoothing	Reduces 'aliasing' of the 3D image. Available values: 1x (no smoothing), 2x, 4x, 8x. Default value: 4x. If you are using an embedded graphics card, turning off this function is recommended.
Require correct data when registering an order	Requires entering a client's name and a vehicle registration plate number when registering an order.
Require login and password	Switches the software to the multi-user mode. The software will require a user name and password on the next program launch. You can add, delete and change users in the Settings - Users mode;
Main menu appearance	Allows you to change the main menu appearance to one of the following: <ul style="list-style-type: none"> - video clip; - chassis; - or video clip and chassis simultaneously.
Language	Changes the language of the software. The database language will remain unchanged ¹ ;
Reminder to wipe cameras and targets	Makes the software to display a reminder to wipe cameras and targets. It is possible to set up the reminder to appear every N hours or N adjustments;
Use web-camera	Enables the web-camera for drive-in in the main menu;
Mirror the image from web-camera	Mirrors the image received from the web-camera. It's convenient if you use a web-camera as a camera for a drive-in.
Select web-camera	If several web-cameras installed in the system are available, it allows you to select the web-camera to be displayed in the main menu.

¹ The database always includes only one language. To have the database data in another language, a corresponding distribution package is required (if present).

2.12.3. Camera Diagnostics




The diagnostics mode is used to check camera operation.



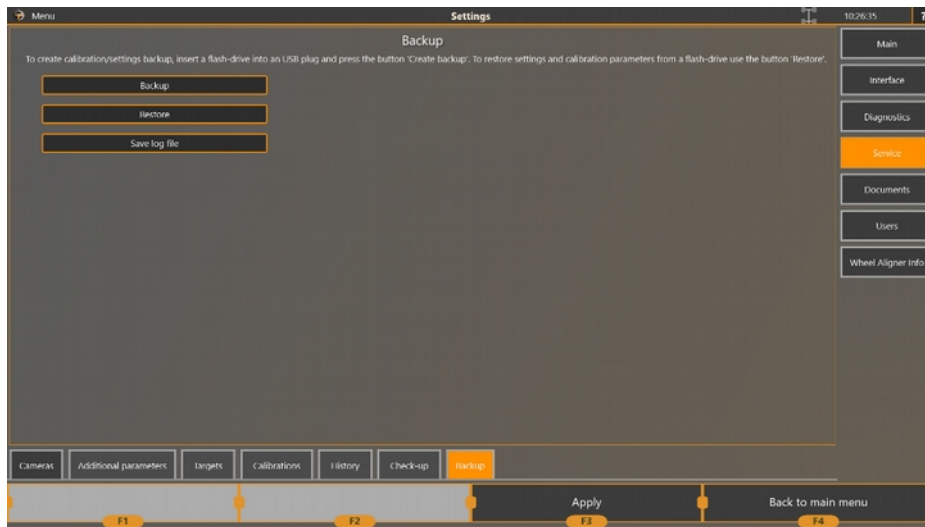
Select a camera by pressing **FL**, **FR**, **RL**, **RR** and check Enabled to start working with the camera. You can find the detailed description of lower-level settings in Installation and Maintenance Manual for Techno Vector™ wheel aligners. This information is for dealer and service centers only.

2.12.4. Service

This mode is used for the initial setup of the wheel aligner, its calibration and testing and creating backup of the software data.

	Only a skilled professional should edit the settings in Service menu.
	You can find the detailed description of lower-level settings in Installation and Maintenance Manual for Techno Vector™ wheel aligners. This information is for dealer and service centers only.
	You must not change lower-level software settings by yourself because it can result in the impossibility to use the wheel aligner or in incorrect measurements.

2.12.4.1. Service - Backup



This mode is designed to create and restore a backup of the software settings and database. You can also save the software's log file.

To back up data, press **Backup**. Select where to save data to. Saving can be made to a computer hard drive or to any external data storage device (a flash drive, external hard drive, etc.). We recommend saving data to an external device to be sure they are safe.

To restore data from the backup copy, press **Restore** and select the path where the backup copy is.

2.12.5. Documents

This tab allows to customise the print-out produced by the wheel aligner.



Parameter	Description
Service center name	The workshop's name
Service center address	The workshop's address
Report message	Message at the bottom of the print-out
Logo	Logo image shown in the upper right-hand corner of the document in the printed report.
Report warning title	Title of the warning line in the print-out
Report Warning text	Warning shown in the print-out
Printed report default mode	Standard or Extended. Standard - one page, all angular parameters. Extended - 2-page print-out with geometry data.
Printed report default view	Table or 3D. Table printout is a 2-dimensional table with parameters and its values. Best to use for ink economy or with black and white printer. 3D is a printout with 3D suspension graphics. Requires colour ink.
Do not print icons	Disables printing coloured icons near the parameters in the report.
Do not show total order timespan in the report	Disables printint the total amount of time it took to finish the order
Print out information about aligner in the report	Prints out general data about the aligner in the report

2.12.6. Users

This mode allows you to add, edit or delete users from the Vector software in the multi-user mode (“Require login and password” in the Settings-Main mode).

By default, there is one user with the Administrator login in the software. This user's default password is **1234**. Note, this user cannot be deleted, it is also impossible to remove administrator rights from this user.

The users who do not have administrator rights cannot perform calibrations on the wheel aligner or change any non-interface settings.



To add a user, click **Add**, type in **Login, Password, User name** for the printout and enable the checkbox if you want this user to have administrator rights. The press **F2 Add**.

To edit a user, select the user in the list and click **Edit**.

To delete a user, select the user in the list and click **Delete**.

2.12.7. Information about Wheel Aligner

This section is used to display and edit information about the wheel aligner.

The screenshot shows the 'Settings' interface for a wheel aligner. It is organized into three main sections:

- Necessary Information:** Includes fields for 'Wheel Aligner Model', 'Wheel Aligner Serial', and four 'Target Serial' fields (FL, FR, RL, RRL). Each field has an 'Edit' button. A note states: "If the targets has serial numbers on the front side, it is absolutely necessary to type these numbers in the following fields. If no serial numbers are found leave these fields blank." The 'Calibration shaft length (mm)' is set to 1950, with a note: "This parameter can be changed only while calibrating targets." The 'Wheel Adapter height (mm)' is set to 190.
- Software Information:** Displays 'Software Version: v. 1.8.2.0', 'Database Version: 1.51.0 April 2019', and 'OS Version: Windows 10 Enterprise'.
- Hardware Information:** Lists serial numbers for 'FL Camera', 'FR Camera', 'RL Camera', 'RRL Camera', 'SC Camera', and 'HASP Serial No.' (907571512).

A sidebar on the right contains navigation options: Main, Interface, Diagnostics, Service, Documents, Users, **Wheel Aligner Info** (highlighted), License, and Web Reports. The bottom of the screen features function keys: F1, F2, F3 (Apply), and F4 (Back to main menu).

Field	Description
Wheel aligner serial number	The wheel aligner serial number is specified in the certificate for the product and embossed on the metal nameplate on the PC system unit. To fill in this field, press Edit .
Target serial numbers	These fields are obsolete and are left in the software for backwards compatibility.
Calibration shaft length (mm)	This value is filled in only while doing target calibration. In this mode it is impossible to change this field, the value is provided for reference
Clamp height	Clamp height is required to calculate vehicle suspension geometry, it also slightly affects wheel alignment angles. Clamp height is measured from the plane of mounting seats for clamp claws to the outer bushing edge for target mounting. The value for standard clamps is 190mm.
Software version	Displays the current software version.
Database version	Displays version of the vehicle database.
Operating system version	Displays the operating system version.
Camera serial numbers	If cameras are connected, these fields show serial numbers of each camera.
HASP serial number	Displays the HASP key serial number.

3. Maintenance

The maintenance operation assumes following the storage and operation precautions specified in this User Manual and documentation for PC components and doing minor repairs and periodic calibrations.

Calibration

Periodicity of calibrations is specified in section 2.

Cleaning

Before calibrating check the device components visually and clean them with a soft cloth.

Use petrol and a soft cloth to wipe pivot pins of targets, portable camera units and elements of clamps.

Use alcohol to clean the connectors of the cables and device.

Remove dust and dirt from the device as and when necessary.

Caution! Damage or dirt on pivot pins of targets and clamps can cause intolerable errors in measurement.

We recommend greasing guideways of tension screws and bushings of clamps periodically.

4. Minor Repair

Minor repairs and after-sales service should be performed by the manufacturer's service department at the request of a client.

The following services are available:

starting-up and adjustment works (at the request of a client, special contract is required), including assembling the device after its transportation, calibrating the device, checking if the work place complies with the requirements specified in the installation manual, and doing demo work for training customers;

24-month warranty;

After-sales and out-of-warranty service at the request of a customer or according to an additional contract.

5. Storage

After receiving the device verify that the set includes all the components.

The device can be stored in heated or unheated premises.

When storing the device in heated premises, the following requirements must be complied with: temperature from +41°F (+5°C) to +104°F (+40°C), relative humidity up to 70% at a temperature of +77°F (+25°C). A short increase of relative humidity up to 80% is allowed.

When storing the device in unheated premises, the following requirements must be complied with:

temperature from -22°F (-30°C) to +86°F (+30°C),

relative humidity up to 80% at a temperature of +59°F (+15°C).

A short increase of relative humidity up to 98% is allowed.

An average shelf-life of the device on heated premises is 5 years, on unheated premises - 0.5 year.

6. Transportation

Transportation of the device should be carried out in special package in enclosed means of transportation (enclosed freight cars, enclosed car bodies, holds, hermetically sealed compartments of aircraft).

When transported, crates with the devices should be rigidly fastened to the means of transportation.

Rules of cargo handling should be followed according to the signs on the box: Caution, Fragile, This Side Up, Do Not Turn Over, Keep Away From Water.

NOTE. When the device is transported short distances, it is allowed to transport it without special package in enclosed means of transportation, but it is required to take measures not to damage it.

The device should be transported under the following conditions: the ambient temperature range of -40°F (-40°C) to $+104^{\circ}\text{F}$ ($+45^{\circ}\text{C}$) and the relative humidity is up to 95% at a temperature of $+95^{\circ}\text{F}$ ($+35^{\circ}\text{C}$).

7. Installation

For 7202, 7204, 7206, 7208, 7212, 7214, 7216, 7218 and 7204T modifications:

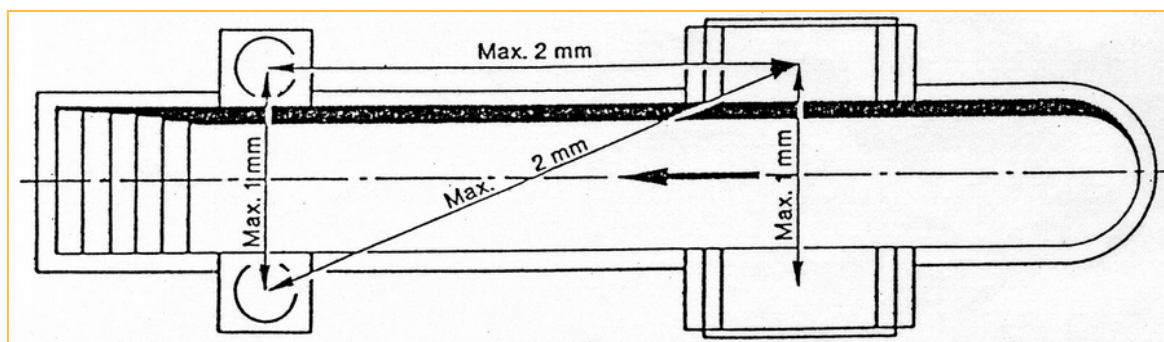
The primary installation of the device is made under a separate contract by the manufacturer service center or by a consumer; following the manufacturer's requirements is strongly recommended.

The installation is carried out according to the document Installation and Maintenance Manual for Techno Vector 7 Wheel Aligners.

The device works with a 4-post lift or repair pit, compliance with the horizontality requirements is needed.

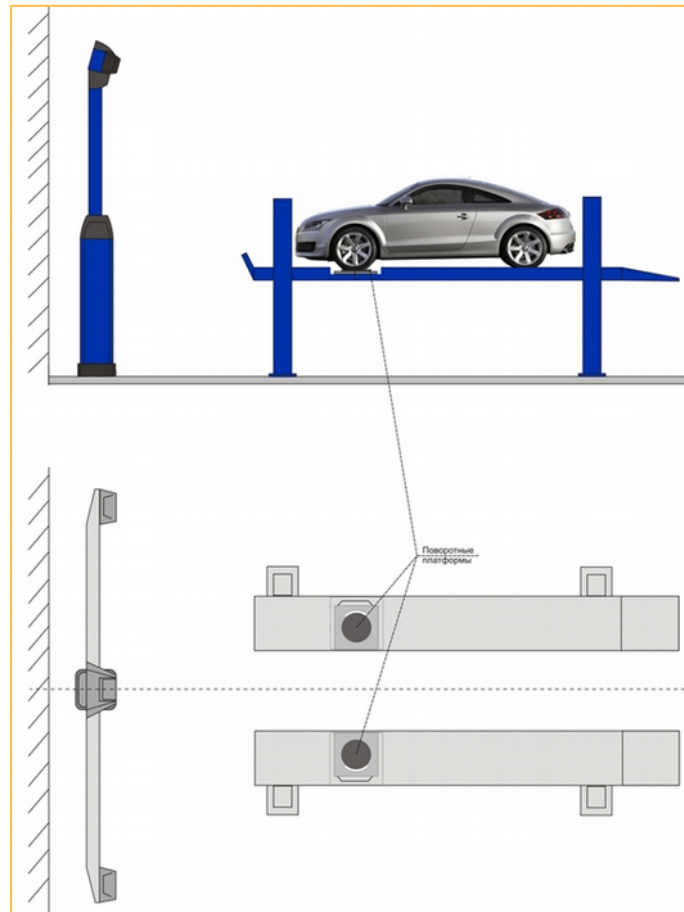
Posts of the lift, other equipment, columns in the shop and other objects should not prevent you from having access to the wheels and other adjustable elements of the vehicle.

The difference in level of front turntables and rear platforms must not exceed the sizes indicated in the picture.



If it is impossible to level the lift or pit according to the requirements specified above, we recommend switching on the program option Measure relative to the Vehicle Plane, this will minimize errors.

The device should be installed so that the PC monitor can be seen by the technician who can be near any wheel or under the vehicle while performing wheel alignment. The recommended device location is shown below:



Checking and setting level difference of the wheel platforms should be made before operating the device at a new workplace and also at time-from-time rechecking of the platforms; the periodicity of this procedure should be determined by a consumer due to constructive instability of the used platforms.

Checking level difference of the platforms can be made by the manufacturer's service department.

Computer cabinet is supplied assembled. Recommended positions for the power supply unit, printer, monitor and other necessary elements are specified in the attachments.

We recommend connecting the monitor, printer and electronic unit with a multiple socket and a voltage stabilizer.

8. Theoretical knowledge on Wheel Alignment

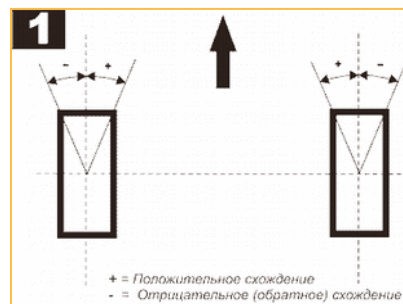
Here you will find descriptions of the parameters that can be measured by the wheel aligner.

Toe

Toe is the difference of measurements taken at the front and rear wheel rim points in a horizontal plane. If the measurement taken at the front points is less than the measurement taken at the rear points (that is the wheels point towards the vehicle centerline), then the wheels are said to have toe-in, conversely – the wheels are said to have toe-out.

Before taking measurements it is necessary to make sure there is no wheel rim run-out. An incorrect toe setting affects the directional stability and controllability in a negative way.

Toe can be measured in linear and angular measures depending on the type of the equipment used.

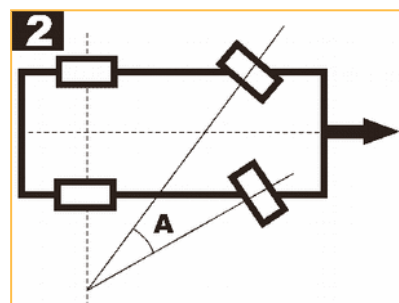


Toe-Out-On-Turns

Toe-Out-On-Turns is the difference of outer and inner wheel turn angles measured from the vehicle centerline.

The steering linkage is designed so that the inner wheel can turn through a smaller radius (a bigger turning angle), to reduce wheel slip.

There must be zero difference in angles when the steering is turned to the left and to the right or the difference must be within the tolerance range specified by the manufacturer (angle A).

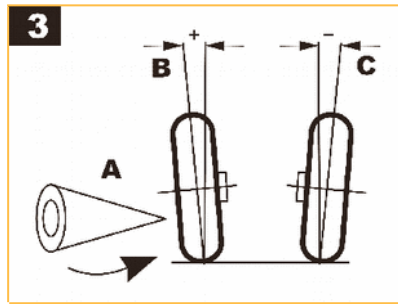


Camber

If a wheel leans away from the vehicle, camber is positive (B), if wheels lean towards the vehicle camber is negative (C), when viewed from the front to the rear of the vehicle.

Camber effect can be examined by the example of a rolling cone (A) (rolling stabilization). The wheels which have a positive camber tend to roll from the vehicle centerline; the wheels which have a negative camber tend to roll towards the centerline.

Camber is measured in degrees with the wheels in the straight-ahead position.



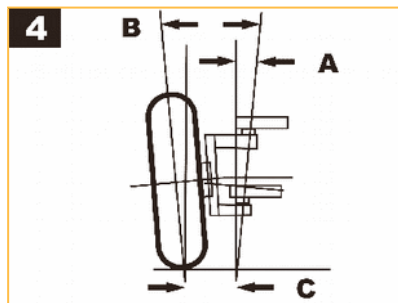
SAI/KPI and Included Angle

SAI/KPI is measured from the vertical towards the vehicle centerline (A).

Many suspension systems do not have a kingpin, and in this case we can speak about an imaginary KPI, replaced by the axis which passes through the ball joint centers.

Adding together the camber angle and SAI/KPI angle gives the included angle. Camber angle and SAI/KPI angle axes intersect at some point. If the lines intersect below the road surface, the dimension C is a positive scrub radius, if the lines intersect above the road surface, the scrub radius is negative.

Small scrub radius stabilizes the steering. On vehicles with diagonal split brake circuits negative scrub radius stabilizes the steering when the braking forces are unbalanced on the steerable wheels.



Caster

The caster angle is measured from the vertical as viewed from the side of the vehicle.

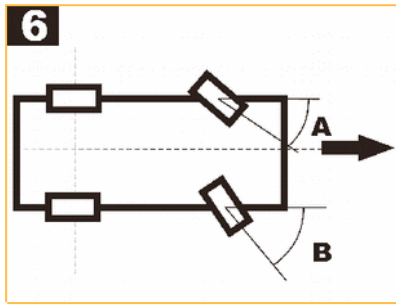
It affects the directional stability of the steering.

The caster angle is usually set up positive to provide self-centering of the steering wheel.

Lock Angle

Lock angle is the angle of the inner and outer wheels on left-hand or right-hand lock relative to the straight-ahead position.

The inner wheel swing angle is much bigger than the outer wheel swing angle (A).

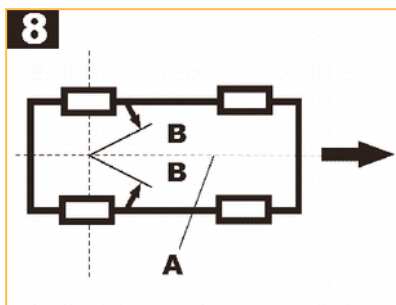


Axis of Symmetry and Thrust Axis Deviation

Axis of symmetry is the line connecting the centers of the front and rear axles (A).

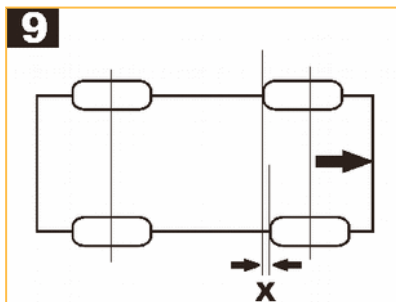
Incorrect toe setting of the rear and front wheels may cause the deviation of the vehicle travel from the centerline.

Symmetry breakdown is known as the thrust axis deviation.



Wheel Setback

Wheel set-back (X) is measured at the wheels of one axle. It can be measured in linear and angular measures.



Thrust Line and Thrust Angle

Thrust Line for motor car is determined by the position of rear wheels of a car. Thrust Line is formed by the bisector of toe of the rear left and rear right wheel. The angle between the thrust line and the vehicle centerline is Thrust Angle.

The Thrust Angle is positive if the Thrust Line is deflected to the right from the vehicle centerline.

Axle Setback

Axle Setback is the angle between the perpendicular to the line that connects the centers of the left and right wheels and the longitudinal line of the vehicle.

Axle Setback is positive if the left wheel is shifted forwards relative to the right wheel.

Parallelism and Scrub Angle

Mutual alignment of axles is a very important parameter for trucks.

Adjacent axles form a Tandem.

For each axle there is a line called Thrust Line. This line is formed by the bisector of toe of the left and right wheels. The angle between the Thrust Line and the vehicle centerline is Thrust Angle.

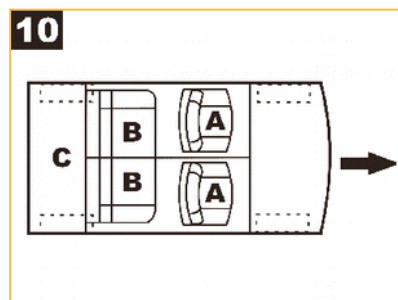
For the tandem, the angle between the thrust line of axle 1 and thrust line of axle 2 is Tandem Scrub Angle. This is the basic parameter for tandem. The best value for this parameter is $0^{\circ}0'$.

Another parameter called Parallelism has a different geometrical origin. If we draw a line through the centers of the wheels for each axle in the tandem, the angle that is formed by these two lines will mean Axle Parallelism. However, as the important travel direction for the axle is the Thrust Line and because of accuracy, you should choose Scrub Angle when performing alignment.

Ride Height and Load Positioning

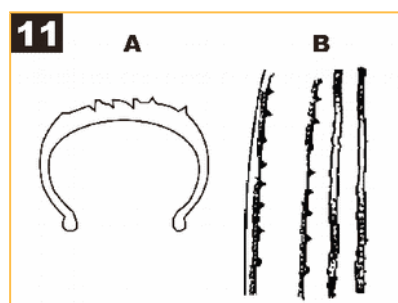
Some vehicle manufacturers require to perform alignments with the vehicle laden in a certain way.

The load must be positioned on the front (A) and rear (B) seats and in the trunk (C), depending on the vehicle model.



Tire Wear

Incorrect wheel alignment causes quick tire wear. Tire wear peculiarities caused by incorrect toe setting are shown in picture 11: excessive toe-out causes feathering (A) and wear on the inside shoulder of the tire (B).



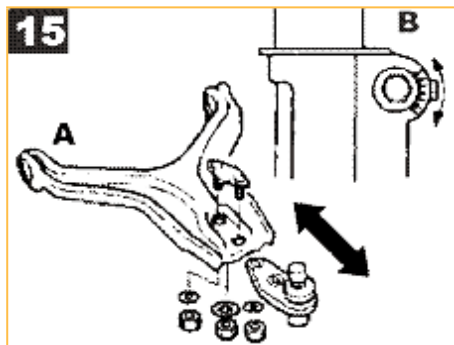
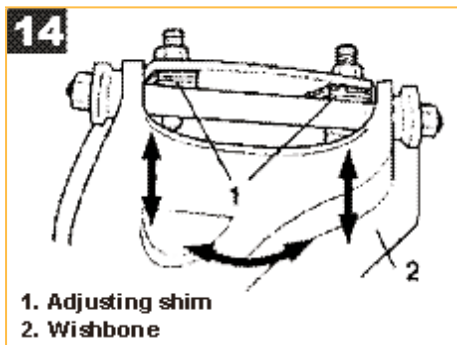
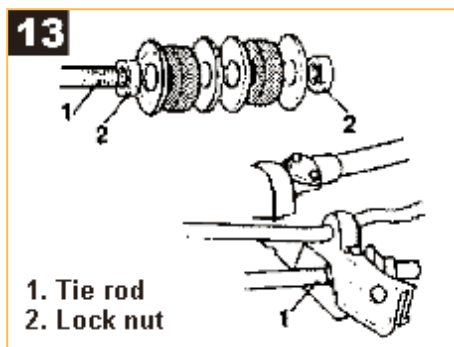
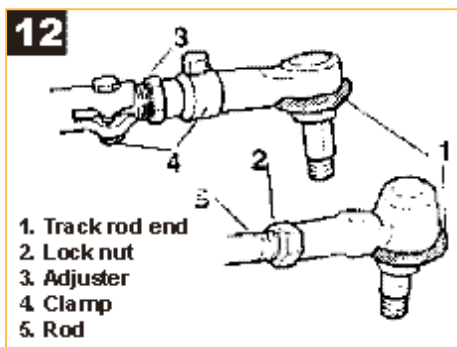
Adjustment

Check:

1. Tire size and tire pressure.
2. Suspension spring condition (vehicle visibly level).
3. The steering mechanism and linkage for excessive free play.
4. Wheel bearing adjustment.
5. Wheel run-out (buckled rims must be replaced).
6. Position load in the vehicle as recommended.
7. Bounce the vehicle on suspension with the handbrake off.
8. Set the steering mechanism in the center position.

Adjustment types:

1. Toe - toe adjustment can be usually performed by changing the length of the track rod after loosening the lock-nut and the clamp (picture 12). The track rod end rotation must be equal on both sides of the vehicle.
2. Caster is adjustable by changing the length of the tie rod (picture 13) or changing the thickness of shims under the wishbone mounting (picture 14).
3. Camber - in most cases camber is adjustable by:
 - a) changing the position of the top of the McPherson strut
 - b) changing the thickness of shims under the wishbone mounting (picture 14)
 - c) changing the ball joint position on the wishbone (picture 15, A)
 - d) adjusting the cam at the bottom of the strut (picture 15, B).



9. Frequently Asked Questions

Here are answers to frequently asked questions.

9.1. FAQ about the Vector Software

Question	Answer
How should I fill in the AFTER column in the report?	The AFTER column can be filled in after the second measurement only (F3 - Repeat measurement in the Report mode). This is due to the fact that some vehicle parameters are calculated approximately during adjustment and cannot be considered reliable.
Can I see the list of illustrations to the vehicle after the adjustment has started?	The list of images is available by pressing the Menu button in the upper left-hand corner of the screen in the adjustment mode. In this case you can return from the View Images mode to Adjustment by pressing F4.
There is no required model in the database.	Check the vehicle database installed on your computer (see clause 2.16.7). Try to update the database by downloading the update from www.technovector.com . If in the latest database there is still no model you need, but you have data on wheel alignment, you can create a Custom Car .
How can I create a custom car?	In the Model Selection mode in the tree chart of cars select Custom Cars . Then select Add Custom Car . In the window that appeared enter manufacturer name, model name and all wheel alignment data you have. Press F2 - Save . In the Model Selection mode in the Custom Cars section find and select the model you created.
How do I search a vehicle by name?	The request is split up into words during the search, after that the same words can be found in the text of the full name of the model. So, searching by the phrase Nissan Note and Note Nissan will produce the same results.
Can I use different compensation methods for different vehicles without changing settings?	Yes, you can. To change the current compensation mode, press F1 - Change Compensation Type in any compensation mode.
Can I perform rolling compensation for all wheels and then perform jacking compensation for one or several wheels?	To use results of the previous compensation in jacking compensation, switch on Allow Partial Jacking Compensation in Settings - Main .

<p>How can I display geometry suspension measurements on the screen?</p>	<p>To measure geometry suspension, turn on Display Geometry Suspension Report in Settings - Main.</p>
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9.2. Questions about wheel alignment.

Question	Answer
<p>What are the main criteria which indicate that wheel alignment checking is necessary?</p>	<p>Wheel alignment checking is necessary when you observe any of the following criteria:</p> <p>After chassis repair:</p> <ul style="list-style-type: none"> -track rod replacement -ball joint replacement -idler arm replacement -steering reduction gearbox replacement -suspension arm replacement -silent block and spring replacement (re-checking is required after 2000 – 3000 km traveled) <p>After changing the clearance of a vehicle (settling).</p> <p>The vehicle pulls to one side or the steering wheel changed its position when traveling straight ahead.</p> <p>Erratic steering.</p> <p>Dull steering. Reaction to the steering wheel movement is slow. Hard steering.</p> <p>The vehicle pulls to one side when braking or is going to make a U-turn on a slippery road (if the braking system works properly).</p> <p>After hitting obstructions followed by rim deformation, suspension breakdown even if the signs mentioned above are not observed.</p> <p>Excessive tire wear.</p> <p>If the left and the right turning radii are different and you want to align them (sometimes it is accompanied by the fender guards catching on the wheels on the left- and right-hand lock).</p> <p>The steering wheel returns to the center position slowly after making a turn.</p>

	After running-in a new car or after buying a used car.
Why is the steering wheel not centered when moving straight ahead?	<p>There can be several reasons:</p> <ol style="list-style-type: none"> 1. Excessive play in the steering wheel. When traveling, there is left or right free play and this causes a minor steering wheel deviation. 2. The vehicle has the rear axle turned. Wheel alignment was performed on the front axle without taking into account the rear axle shift. 3. Rear cross camber is too high, especially when one wheel has a positive camber and another has a negative camber. 4. Difference in tire pressure of rear/front wheels is too big. 5. There are hidden chassis faults, which could not be detected before performing wheel alignment for one reason or another. <p>Note: if besides steering wheel free play the vehicle also pulls to one side, first remove the cause of pulling to one side and then check for the proper steering wheel position.</p>
Why does the vehicle pull to one side after a proper wheel alignment?	<ol style="list-style-type: none"> 1. Check the tires to find out if they cause the vehicle pull. To do this exchange left and right front tires. If after that the vehicle starts pulling to another side, the cause is the tires. Rotate the tires to find a pair on which the vehicle travels straight. Then adjust the rotational direction (if there is an arrow on the tire which points the rotational direction), i.e. turn the tires over on the rims, if necessary. This reason for pulling to one side is very common now (and strangely enough, even when tires are new). Specialists say that is the so called tire nonuniformity. 2. Excessive tire imbalance. Wheel rim distortion. 3. Only the front axle of the vehicle was diagnosed and adjusted. Make a diagnosis of the rear axle. It may be the reason for pulling to one side (distortion, deformation, incorrect alignment). 4. There are hidden chassis faults, which could not be detected before performing wheel alignment for one reason or another.
Before wheel alignment the vehicle did not pull to one side but there was excessive tire wear. After wheel alignment the	Most probably the cause is tires (consult the previous item). Earlier the vehicle traveled straight because pulling to one side made by the tires was balanced by pulling to another side made by the incorrect wheel alignment. When one cause was removed, pulling to one side appeared.

<p>vehicle pulls to one side.</p>	
<p>The car does not pull to one side, there is no excessive tire wear, but the steering is hard.</p>	<ol style="list-style-type: none"> 1. Tight ball joints and track rods were installed while repairing, the idler arm or steering reduction gearbox (steering rack) are overtightened. It may stabilize on its own in the course of time, except for over tightening which should be brought to standard. 2. Incorrect wheel alignment. 3 .Rim offset (parameter ET is indicated in the rim marking) does not correspond to the recommended one by the manufacturer. 4. Tire pressure is low.
<p>Why do wheel alignment settings change in the course of time even if there were no car accidents and chassis repair?</p>	<ol style="list-style-type: none"> 1. As it is known, wheel alignment directly depends on the vehicle clearance, (i.e settling) and the clearance can change according to the car age. This is caused by sagging of springs and silent blocks. 2. Occurrence and accumulation of microscopic gaps in suspension pivot connections which cause tangible wheel alignment changes. 3. Natural body aging (unitized body vehicles). Permanent car body deformation in the operational process results in gradual changing of geometry and wheel alignment.

LIMITED WARRANTY

Structural Warranty:

The following parts and structural components carry a five year warranty:

Columns	Arms	Uprights	Swivel Pins
Legs	Carriages	Overhead Beam	
Tracks	Cross Rails	Top Rail Beam	

Limited One-Year Warranty:

Tuxedo Distributors, LLC (iDEAL) offers a limited one-year warranty to the original purchaser of Lifts and Wheel Service equipment in the United States and Canada. Tuxedo will replace, without charge, any part found defective in materials or workmanship under normal use, for a period of one year after purchase. The purchaser is responsible for all shipping charges. This warranty does not apply to equipment that has been improperly installed or altered or that has not been operated or maintained according to specifications.

Other Limitations:

This warranty does not cover:

1. Parts needed for normal maintenance
2. Wear parts, including but not limited to cables, slider blocks, chains, rubber pads and pulleys
3. Replacement of lift and tire changer cylinders after the first 30 days. A seal kit and installation instructions will be sent for repairs thereafter.
4. On-site labor

Upon receipt, the customer must visually inspect the equipment for any potential freight damage before signing clear on the shipping receipt. Freight damage is not considered a warranty issue and therefore must be noted for any potential recovery with the shipping company.

The customer is required to notify Tuxedo of any missing parts within 72 hours. Timely notification must be received to be covered under warranty.

Tuxedo will replace any defective part under warranty at no charge as soon as such parts become available from the manufacturer. No guarantee is given as to the immediate availability of replacement parts.

Tuxedo reserves the right to make improvements and/or design changes to its lifts without any obligation to previously sold, assembled or fabricated equipment.

There is no other express warranty on the Tuxedo lifts and this warranty is exclusive of and in lieu of all other warranties, expressed or implied, including all warranties of merchantability and fitness for a particular purpose.

To the fullest extent allowed by law, Tuxedo shall not be liable for loss of use, cost of cover, lost profits, inconvenience, lost time, commercial loss or other incidental or consequential damages.

This Limited Warranty is granted to the original purchaser only and is not transferable or assignable.

Some states do not allow exclusion or limitation of consequential damages or how long an implied warranty lasts, so the above limitations and exclusions may not apply. This warranty gives you specific legal rights and you may have other rights, which may vary from state to state.

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