



Operating instructions

Electronic wireless camera system for axle measurement on commercial vehicles

AXIS4000

Electronic Wheel Alignment

Camera Radio System

(Translation of the original manual)

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GEB 001 091

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Burgwedel 24.11.22
Version reference, see Page 10

1 General safety instructions

1.1 Duty of care of the operator



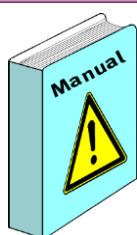
The AXIS4000 wheel alignment system has been designed and constructed according to pertinent, mandatory harmonised norms. It therefore conforms to the latest status of technology and offers the maximum degree of safety and reliability during operation.

Design modifications to the wheel alignment system may only be made with the written approval of the manufacturer!

The practical safety of the system can only be ensured if all necessary measures have been taken. It is the responsibility of the operator to plan such measures and ensure their proper implementation.

The operator must in particular ensure that

- the system is used properly in accordance with these instructions
- the system is only operated when in proper working order
- these operating instructions are always legible, complete, and available where the system is in use
- the system is operated only by qualified and authorised persons who are familiar with these operating instructions!
- personnel are trained regularly in all relevant aspects of health and safety at work, and are familiar with the operating instructions, and in particular the safety instructions contained therein.



Before using the wheel alignment system, always check for visible damage and only operate it when in proper working order! Any faults found must be reported to the person in charge immediately!



The user is responsible for proper operation of the system and observation of all the relevant safety regulations.

1.2 Warning and safety information for working with permanent magnets

Magnets can present a risk of injury if handled incorrectly. We therefore recommend observing the following instructions when working with magnets:



The strong forces of the magnets are a potential hazard source. Fingers or skin could be crushed (pinched)!
Please note that magnets can automatically attract one another even from large distances – this also presents a risk of injury.



Strong magnetic fields can influence or destroy electronic devices. This applies to pacemakers as well as to defibrillators. If you wear such a device, please observe the manufacturer's instructions on the safe distance.
If necessary, warn anyone wearing such a device.
A magnetic impulse could set the implants to a different mode.



Magnets are brittle, and can break under impact and splinter into sharp-edged pieces. Use the magnets carefully in the vicinity of components containing iron and subsequently ensure safe storage.



Magnets generate far-reaching, strong magnetic fields. They can damage electronic devices such as TVs, PCs, laptops, hard drives, credit and debit cards, data storage media, mechanical watches/clocks, hearing aids and speakers.

Keep the magnets away from all devices and objects which can be damaged by strong magnetic fields.



Wear protective gloves!



Wear safety goggles when handling strong magnets!
Ensure that the people in the vicinity are also protected or keep a sufficient distance.



Do not use the magnets in locations where they are exposed to high temperatures. The strength of magnets permanently decreases slightly at temperatures above 80 °C.



Damaged magnets are susceptible to corrosion and have to be replaced by a professional. Please contact the manufacturer or your sales representative.

2 Suspension terminology

The suspension forms the point of contact between the vehicle and the road surface. The full power of the engine is transferred to the road via the suspension, and forces generated from the road are transmitted back to the vehicle through the suspension. The suspension is therefore subjected to an enormous number of forces acting in different ways, and must therefore be maintained in perfect condition.

Even under normal conditions, general operation of the vehicle can cause changes to the suspension geometry. Normal wear to parts (wheel bearings, king pins. etc.) can also lead to changes in the suspension geometry. Incorrect steering and/or camber can not only damage the tyres, but also adversely affect the accuracy of the steering behaviour.

The complex geometry of the wheel suspension and the many different driving styles of drivers make it extremely difficult to establish the symptoms and probable causes. Tyre wear only indicates that the tyres may be exposed to unusual friction forces. Although this may help the technician in his diagnosis, it does not provide a direct route to the cause of the problem.

Assessment of the tyre profile only narrows down the cause of the problem. In all cases, a visual check must be followed by axle measurement.

All these circumstances necessitate a suspension measurement with the aid of a wheel alignment system. Special tools are not the only thing important to measuring procedures – the most important factors of suspension measurement still include the user's eyes, hearing and technical skill.

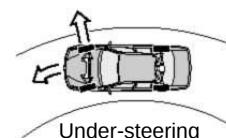
2.1 Suspension measurement terminology

Wheel alignment

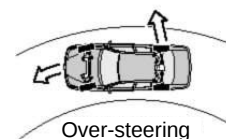
Wheel alignment is crucially important for straight run-out of the wheels, good grip by the tyres in bends and wear to the tyres. Wheel alignment crucially affects the driving characteristics in bends.

Here the distinction is made between

- Under-steering
- Over-steering
- Neutral steering



Under-steering



Over-steering

Wheelbase

The wheelbase is measured from the centre of the front axle to the centre of the rear axle. In the case of multi-axle vehicles, the individual wheelbases are given consecutively from front to rear. A long wheelbase gives greater cargo space, more driving comfort and a reduced tendency to pitching movements. A short wheelbase facilitates the handling of tight bends.

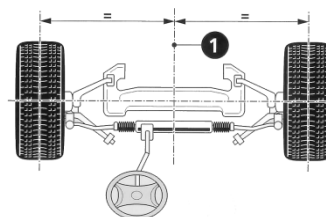
Total toe

The total toe is the dimension between the centre-line of the tyres. In the case of twin-wheel axles, the measurement is taken from centre-line to centre-line of the twin wheels. This has a crucial effect on the steering characteristics of the vehicle in bends. An uncorrected toe enables higher speeds in bends.

2.2 Measurement sizes for wheel alignment

Straight running

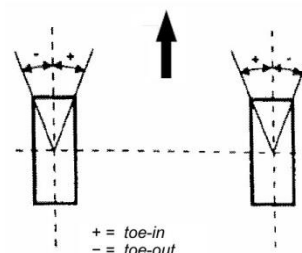
One of the reference sizes for recording measurement values is the chassis centre-line. Wheel alignment is an aid for aligning the front wheels with the same individual tracking from the chassis centre-line.



Total toe

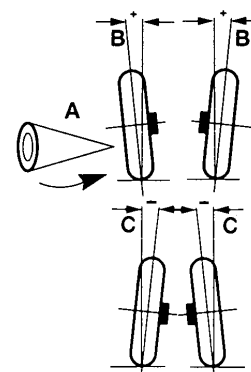
This is defined in terms of toe-in and toe-out. The toe-in is the value by which the front or rear wheel points inward toward each other at the front. The toe-in is expressed as a positive value.

If the wheels point outward, this is referred to as toe-out, which is expressed as a negative value. A correct toe-in or toe-out alignment ensures that the wheels run parallel when the vehicle is in motion.



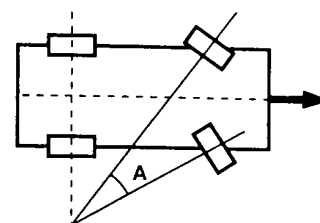
Camber

If the wheel is angled outward when the vehicle is viewed from the front or rear, this is referred to as positive camber (B); if it is angled inward, this is called negative camber (C). The effect of the camber can be compared to a cone, which always has a tendency to roll toward the narrowed end (A). Consequently, wheels which both have a positive camber have a tendency to roll away from each other, while wheels with negative camber roll towards each other.



Relative steering angle

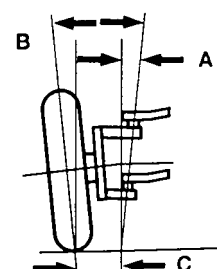
The relative steering angle is the difference in the angles between the front wheels and the vehicle centre-line when the steering wheel is turned. The angle (A) must be the same when steering to the right or left, taking the manufacturer's tolerances into account. The measurement is carried out at an angle of 20° of the wheel on the inside of the curve.



Inclination

Inclination is the angle of the king pin from the vertical to the centre-line of the vehicle (A). For vehicles with ball pins instead of king pins, the imaginary line through the steering rotation axis of the ball pins is used for measurement.

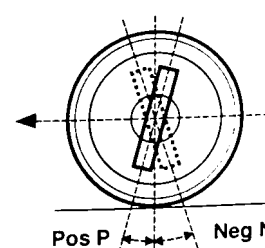
Inclination and camber together form the included angle (B). The axle stub must be checked for distortion or cracks if this deviates severely from the nominal value.



Castor

The castor designates the angle of the king pin to the vertical either to the front or rear. The castor angle affects the directional steering stability. Positive castor: high steering and holding forces

Negative castor: poor steering return.



3 Transporting the wheel alignment system

3.1 Dimensions and weight



Illustration: AXIS4000 Standard (#924 000 030)

		Length x Width x Height (cm)	Transport weight: (kg / gross)
AXIS4000 PRO	924 000 010	140 x 100 x 70	160
AXIS4000 PRO	924 000 013	120 x 80 x 90	160
AXIS4000 PRO	924 000 012	120 x 80 x 50	115
AXIS4000 STANDARD	924 000 030	120 x 80 x 105	220
AXIS4000 PREMIUM	924 000 050	120 x 80 x 125	280

3.2 Information on general handling and storage



Caution

Avoid severe shocks and vibrations during transport.



The system should be protected against damp and water.
This applies particularly during transport and storage of the complete wheel alignment system.
Ensure that the storage area is dry and free of dust.



Note

Always store the equipment and the rechargeable battery packs for cameras in a charged state.

4 Product description

AXIS4000 Wheel Alignment System

924 000 010 / 030 / 050



Date: 11 / 2022

Subject to technical amendment.

Version 6.3

Graphics: HAWEKA GmbH / D-30938 Burgwedel

Reproduction in any form is not allowed.

4.1 Proper use

- The AXIS4000 wheel alignment system has been developed to perform suspension measurements on motor vehicles, trailers, semi-trailers and agricultural towing vehicles.
- It is intended exclusively for rapid measurement of suspension geometry.

For the front axle and articulated axles:

- Camber
- Central positioning of the steering gear
- Total and single toe
- Castor
- King pin inclination
- Relative steering angle
- Max. steering angle

For the rear axle/s

- Camber
 - Toe
 - Axle mismatch
 - Axle inclination
- **The AXIS4000 wheel alignment system enables measurements to be performed in a "drive state", i.e. the vehicle does not need to be lifted.**
 - Other vehicle types can also be measured quickly and reliably (with the appropriate accessories).



Caution

If the AXIS4000 wheel alignment system is not used in accordance with these instructions, reliable operation of the system cannot be guaranteed!

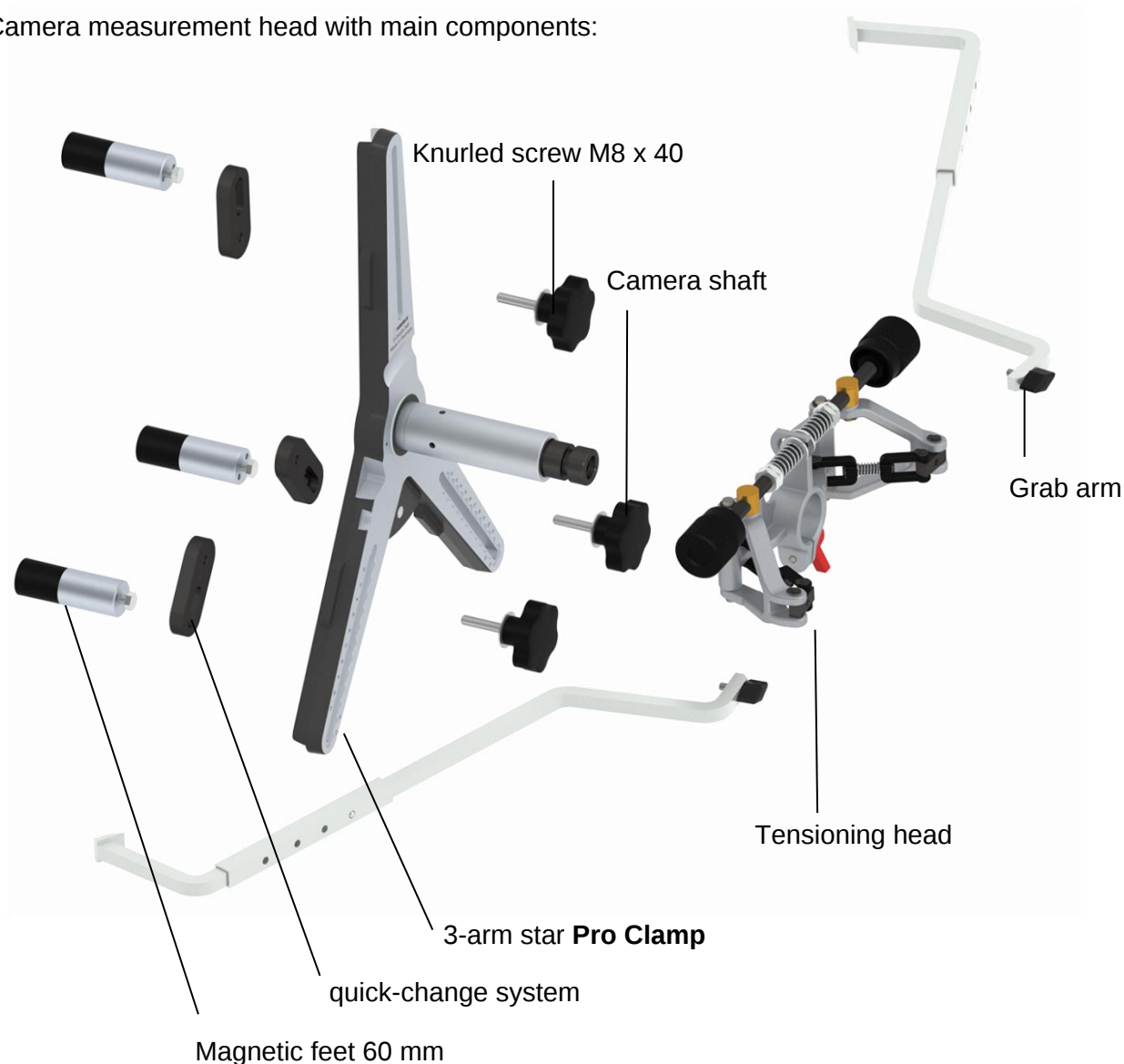


Note

The operator of the wheel alignment system, and not the manufacturer, is responsible for all personal and material damages resulting from improper use of the system!

4.2 Design of the camera measurement head

Camera measurement head with main components:



Caution

Never remove camera shaft from the 3-arm star!

The camera shaft is permanently mounted onto the 3-arm star. It was adjusted and calibrated after mounting.

If (e.g. after a fall) you suspect that the camera shaft is not vertical to the 3-arm star anymore, please contact your supplier!

4.3 Technical data

	Measuring range	Measuring accuracy:
Toe measurement	± 5 degrees	± 0°05'.
Camber measurement	-15 degrees to +15 degrees	± 0°05'.
Castor	- 5 degrees to +18 degrees	± 0°05'.
KPI	-10 degrees to +20 degrees	± 0°10'.
Max. steering angle	± 70 degrees	± 0°10'.
Axle offset	± 50 mm	± 0,5 mm
Out of square	± 15 degrees	± 0°05'
Parallelism	± 5 degrees	± 0°05'
Operating temperature	+5 to +40 degrees Celsius	
Shock resistance of the sensors	3500 g (inclination sensor) 2000 g (Gyro)	
Wireless module:		
Frequency range	2,4 GHz Band (2405 – 2480 MHz) Automatic frequency correction	
Number of channels	10	
Transmitting power	10 mW	
Camera:		
Power supply:	Lithium Ion battery pack: 18650 CF 2S1P 7,4 V / 2250 mAh	
Operating time with fully charged batteries	> 10 h	
Charging unit:		
Operating voltage	100 - 240 Volt	
Turning plates		
Load-bearing capacity	6 to. / each	

4.4 PC system requirements for the AXIS4000

Required operating system: Windows 7, 8.1, 10

Necessary minimum hardware requirements:

Processor: Pentium IV – AMD Athlon 1 GHz
 RAM: 2 GB
 Available hard disk space 100 MB
 Graphics: Resolution 1024 x 768 pixel / high colour
 Sound card
 Port: USB 1.1

Recommended:

Processor: Pentium or AMD with 1.6 GHz or bigger
 RAM: 4 GB
 Graphics card with AMD (ATI) or n-Vidia chip set from 16 MB
 Resolution 1280 x 1024 pixel / true colour
 WLAN (option for portable handheld)
 Printer, Sound card, USB 2.0

5 Equipment

5.1 Parts list - AXIS4000 basic version

2 pcs. Camera measurement heads
Item No. 924 001 000

6 pcs. Magnetic holder (60 mm)
Item No. 913 033 004

6 pcs. quick-change system
Item No. 913 027 006

2 pcs. Tensioning head
Item No. 912e008 140



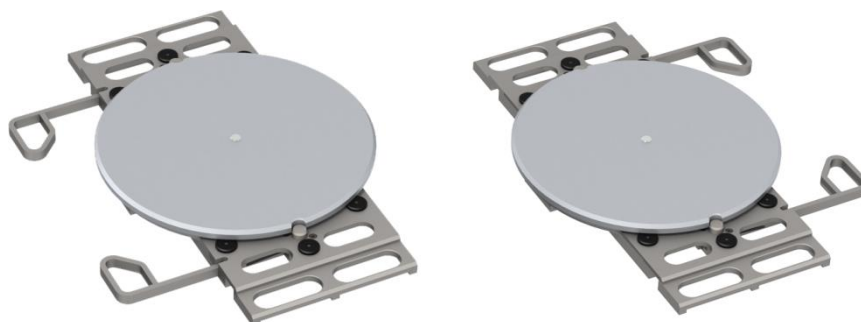
4 pcs. Grab arms for trucks / for aluminium rims
Item No. 912e008 303



6 pcs. Special magnet for rear axle measurement (315 mm)
Item No. 913 030 012



2 pcs. Turning plates
Item No. 913 011 050



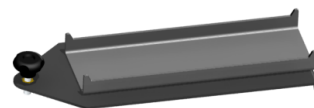
2 pcs. Electronic cameras with transmitter unit

Item No. 924 001 161 (left)

Item No. 924 001 162 (right)



1 pc. Floor plate for camera



Item No. 924 001 030

1 pc. Floor plate for reflector



Item No. 924 001 029

1 pc. Radio Server Unit
incl. USB cable

Item No. 924 001 160



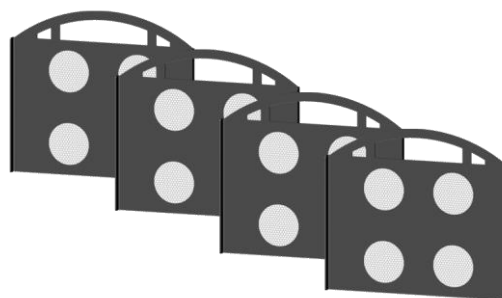
1 pc. Camera charging station

Item No. 924 001 034



4 pcs. Reflectors

Item No. 924 001 025



4 pcs. Tripod stands

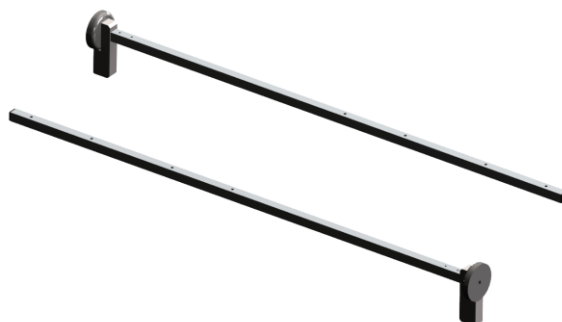
Item No. 913 052 024



2 pcs. Reflector stands
Item No. 913 052 081



2 pcs. Magnetic feet for reflectors
Item No. 913 052 077



1 pc. System stands (only for 924 000 010)
Item No. 900 008 211



1 pc. USB-Stick
Program AXIS4000



1 pc. Operating instructions
GEB 001 091



1 pc. Aluminium case
for cameras,
reflectors and transmitter
(only 924 000 010)



5.2 AXIS4000 optional accessories

- 1 pc. Equipment trolley for storage and transport

Item No. 924 001 035

- 1 pc. Handheld PC

Item No. 924 001 213



- 2 pcs. Additional turning plates for second articulated vehicle axle

Item No. 924 000 002



- 1 Set of accessories for small transporter:

Item No. 923 000 003



- 1 pc. Frame gauge for holding the reflector stand on an omnibus or vehicle chassis

Item No. 923 001 043



- 1 Set of accessories for semi-trailers and trailers

Item No. 923 000 001

- 1 pc King pin adapter --- 1 pc Coupling adapter
6 pc Magnetic holder (256 mm)



6 Initial commissioning

The following measures are required when using the wheel alignment system for the first time:



Assemble the AXIS4000 components



Install the software and FM transmitter under Windows



Setup the software.

(Abb. 1)

6.1 Assembling the reflector stand



(Abb. 2)

One reflector stand comprises the following components:

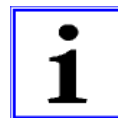
- a) 1 x **central section**
- b) 2 x **outside sections** with boreholes for the reflectors



(Abb. 3)

Pushing together of the two outer parts onto center part.

It should be ensured that the left and right parts have the same distance to the center part.



Note

The number on the pawl must be equal on both sides.



(Abb. 4)

The now assembled reflector stand is used for measurement in combination with the 2 tripod stands.

6.2 Installing software under Windows



(Fig. 5)



(Fig. 6)

- Close all applications that are currently open on the computer.
- Place the USB-Stick in the PC.
*If the installation wizard does not start automatically, click on **Start** in the Windows taskbar and then on **Run**. Enter **D:\axis4000setup_1.xxx.exe** (xxx = Version-no.), where **D** is the drive letter of the removable media.*
- If required, confirm the Windows safety warning and click the **Run** button.
- Read the licence agreement and follow the installation wizard instructions on the screen. (Fig. 6)
- Once installation is finished, the AXIS4000 software and FM transmitter driver will be installed on the computer.
- After installation, remove the USB-Stick from the PC.

The driver for the FM transmitter is usually added automatically to the system on your computer when the AXIS4000 program is installed. If the FM transmitter is connected to a free USB port on the PC after installation, the new hardware will be detected and integrated into the system.

If this function does not occur automatically or you deinstall and install the driver manually, then the driver can be integrated as follows into your system.

6.3 Installing the FM transmitter



(Fig. 7)

- Connect the Radio Server Unit (FM transmitter) using any USB connection cable (Fig. 7) to a free USB port on the computer.
- The new hardware will be detected by Windows and the installation wizard will start automatically.
- To select the destination of the driver, select: "*Install software from a specific source*" and select: "*Browse removable media*", with the AXIS4000 USB stick connected to the PC.

7 The AXIS4000 program

We have taken great care to ensure that every level of the entire program is quick to operate and easy to understand in terms of both its layout and use.

You will soon be able to determine the geometry of a vehicle using this program.

You will be easily guided through the individual program points in just a few work steps with the support of help texts and graphic images. You will always have enough information to feel confident with the program.

However, before you start the first vehicle measurement, you must carry out program settings for the most important parameters for individual use.

7.1 Setting up the software

- Start the program.

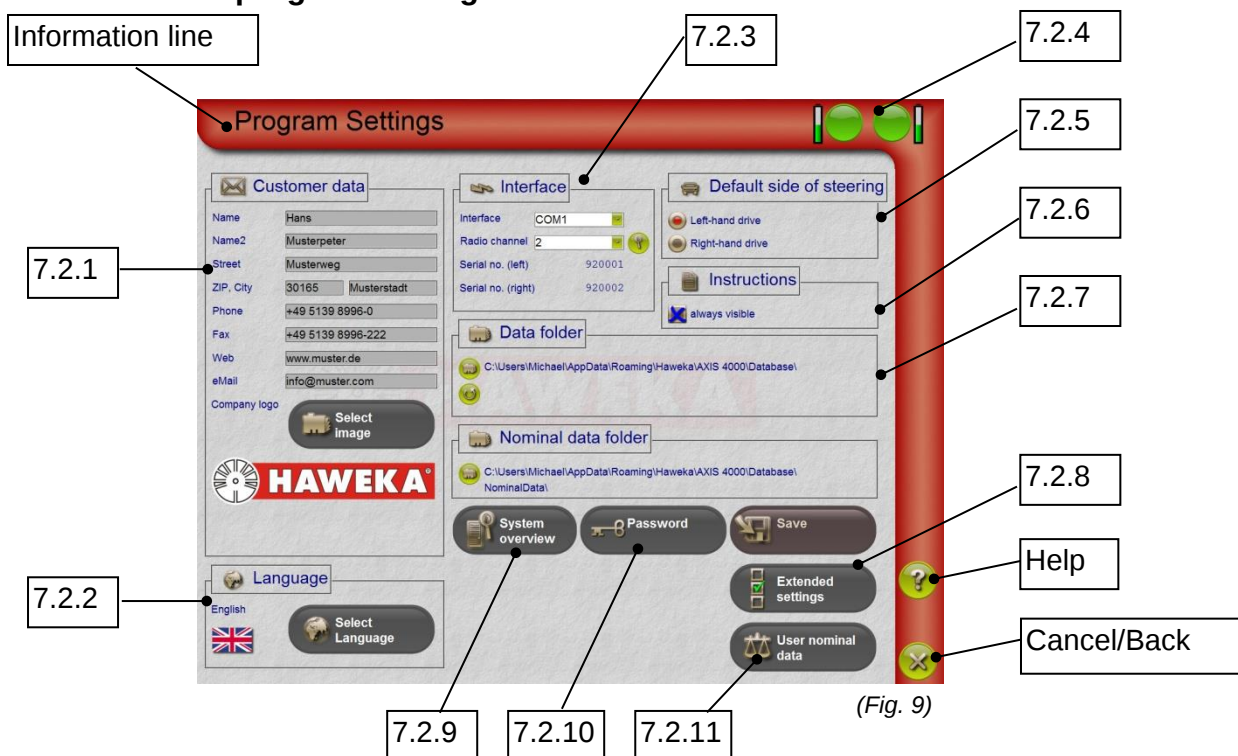
Under Windows select: *START –ALL PROGRAMS – HAWEKA – AXIS4000* and click on the program entry *AXIS4000*.



(Fig. 8)

After the program has started, select the "**Settings**" option for the first basic setting. (Fig. 8)

7.2 Overview of the program settings screen



7.2.1 Customer data:

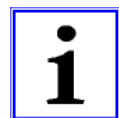
Enter your own company details in the corresponding lines so that these are included in the measurement report and subsequently printed with the report. (Fig. 9)

Select image button:

There is the option of inserting your company logo as a back image which will later appear on the report.

Prerequisites for the image file: Type: BMP, JPG, GIF, PNG

The image size will be scaled.

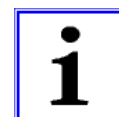


Note

Image files that are too small will be enlarged. This will lead to a loss of image quality. The smallest selected format should be within the range of 400 x 200 pixels at 72 dpi.

7.2.2 Language:

Pressing the **Select language** button will give you the option of having the menu and all instructions in a language of your choice. (Fig. 10)



Note

All settings must be confirmed by the **SAVE** button.



(Fig. 10)

7.2.3 Interface:

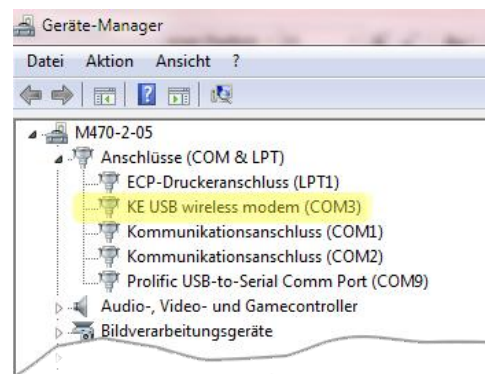
After successful installation, a new virtual COM interface for communicating with the FM transmitter is added to the computer.

The interface option in the program should be set to *AUTO* for automatic connection.

The interface can be manually changed to a selected port only when necessary (no connection to the cameras).



A new entry with the new COM interface for the FM transmitter is added in the device manager under Windows. (Fig. 11)



(Fig. 11)

Radio channel:

The radio channel set in the cameras is automatically shown for data transfer between camera sensors and program.

If required, the radio channel in the cameras can be changed and must then be accepted by the program using the **Magnifier** button.

Magnifier button

The dialogue window is split into two areas. The cameras found by the program but not yet connected are shown in the left area. The right area shows the camera(s) that is(/are) already connected wirelessly to the program.



The cameras and FM transmitter must be set to the same radio channel.

Serial numbers:

The camera serial numbers are displayed as soon as the program has established a connection to the camera.

7.2.4 Camera symbol information:

The camera connection and charge level of the batteries is continually monitored and displayed throughout the entire program run-time.

Symbol description:

The program has not yet polled a connection to the camera; status unknown. (Fig. 12)



(Fig. 12)

The display flashes between yellow and red. The program is attempting to connect with the cameras. (Fig. 13)



(Fig. 13)

Display is green: a connection is established to the camera. (Fig. 14)



(Fig. 14)

Display is green with a red dot: There is a connection but no reflector has been found. (Fig. 15)



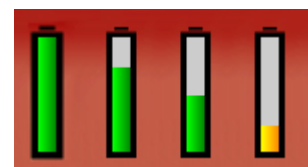
(Fig. 15)

Display is green with a yellow dot: There is a connection and the reflector has been detected. (Fig. 16)



(Fig. 16)

Charge level of the camera battery
100 %, 75 %, 50 %, < 25 % capacity. (Fig. 17)



(Fig. 17)

The camera symbol will flash when the charge level is less than 25 % for the corresponding battery. (Fig. 18)



Caution

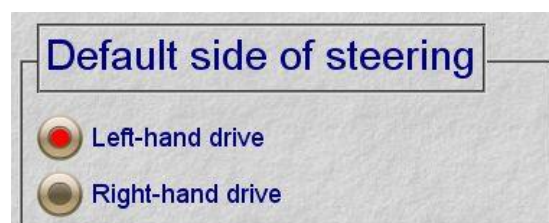
The cameras must be recharged to carry out further measurements.



(Fig. 18)

7.2.5 Default side of steering

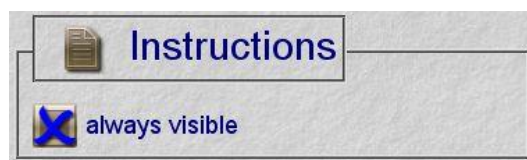
At this point, depending on which country it is used in, you can set a vehicle steering side as the default steering side for examining the middle position of the steering gear. (Fig. 19)



(Fig. 19)

7.2.6 Instructions

Establishing the standard setting for showing or hiding work instructions during measurements. (Fig. 20)



(Fig. 20)



Note

The instruction window can be shown or hidden at any point in the program. To do this, click the **Instructions** button on the program screen.



7.2.7 Data folder

All suspension measurements are saved in a protocol/report file. The preset directory path is:
My_Documents\User\Name\Applications\Haweke\AXIS4000\Database
(Fig. 21)



(Fig. 21)

To change the storage location, click the **"Folder"** button:



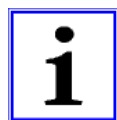
To restore the standard path, click the **"Back"** button:



7.2.8 Extended settings

This advanced setting gives the user the opportunity to set the program according to individual requirements. (Fig. 22)

For individual settings, select the corresponding parameters and change the value in the table.



Note

E.g. at Item 5 you can change the look of the printed report/protocol.



(Fig. 22)

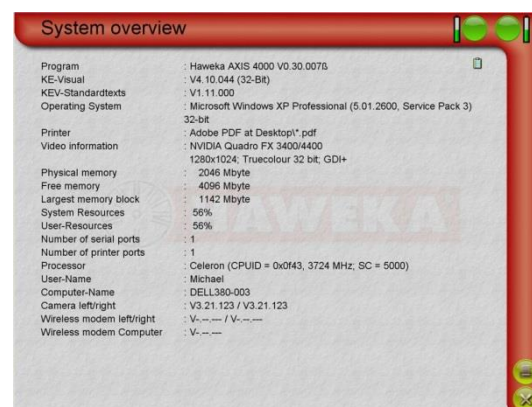


The altered entries must be confirmed with the **"Accept values"** button.

7.2.9 System overview

The system overview gives a list of components used by PC, cameras, FM transmitter and program versions.

This information is used by the service engineer as an overview of the system in the event of any faults. (Fig. 23)

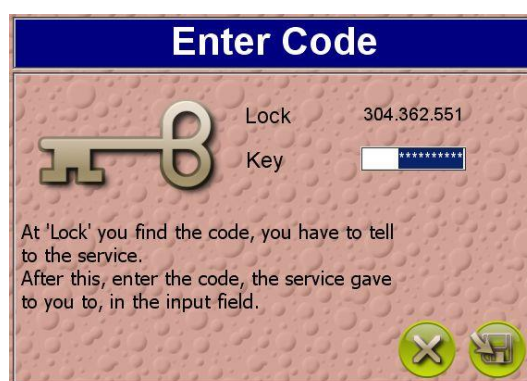


(Fig. 23)

7.2.10 Password/Enter code

This function is only used by our service personnel on-site for diagnostic work on the system.

This option enables you to carry out program-specific changes. (Fig. 24)

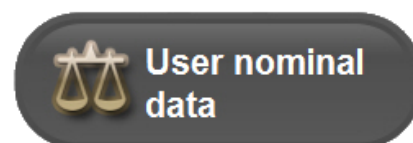


(Fig. 24)

7.2.11 User nominal data

With the help of the user database, own vehicles can be created for the comparison of the actual and the nominal data.

For the application of the user database see Page 43 Point 12.



8 Preparations for measurement



Note

Before the measurement can begin, some preparatory work must be carried out at the measuring site and on the vehicle. This work can vary and is in some cases stipulated by the vehicle manufacturer.

The following checklist is intended to help the user observe the various requirements:

- Check the vehicle to ensure that the rims and tyre sizes are all the same
- Check for adequate tyre tread
- Tyre wear!! Is there any noticeable, uneven tyre wear?
- Check the correct tyre inflation pressure
- Check for any play in the steering and wheel bearings
- Check the steering joints/king pins
- Check the condition of the springs and shock-absorbers
- Note the manufacturer's specifications for different loads in order to simulate driving conditions.
- Remove the wheel nut covers and/or hubcaps
- Clean the wheel rims between the wheel nuts so that the magnetic feet ensure correct positioning of the camera holder on the rim.

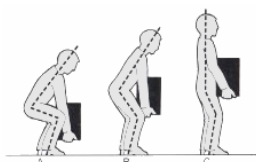
9 Front axle measurement

9.1 Preparatory measures on the vehicle

Driving the vehicle onto the turning plates



The turning plate is very heavy and weighs 20 kg.
Before raising the turning plate it must be secured with the safety catches to prevent it from turning. (Fig. 25)

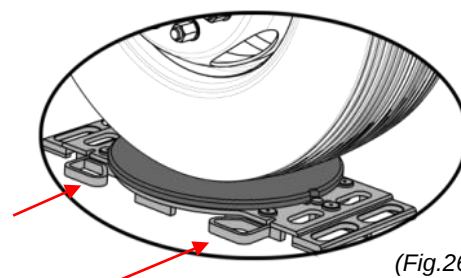


Observe the basic principles for the lifting of loads.

- Lay the turning plates on the left and on the right in front of the front wheels.
- Drive the vehicle onto the turning plates until the centre of the wheel is above the centre of the turning plate. (Fig. 25).
- Once the vehicle has reached this position on the turning plates, release the safety catches for the turning plates (Fig. 26).



(Fig. 25)



(Fig. 26)

Mount wheel alignment clamp

- The magnetic holders on the 3-arm clamping star have to be adjusted to the required rim flange.
- The magnetic holders have to be turned to ensure full contact with the rim flange between the wheel nuts and to ensure that all 3 magnetic feet have the same distance to the centre of the wheel alignment clamp.



Caution

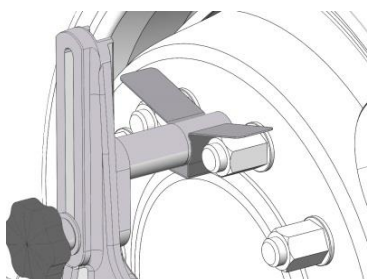
Check the contact surfaces of the magnets BEFORE you start! They have to be free from dirt and metal filings!

- Attach the wheel alignment clamps to the **cleaned rim flange** using the magnets.
- Two magnets should be located above the centre of the wheel and one magnet below. (Fig. 27)



IT HAS TO BE ENSURED THAT THE WHEEL ALIGNMENT CLAMPS AND/OR CAMERA HOLDING PINS ARE ALIGNED WITH THE CENTRE HOLE OF THE RIM.

In the case of aluminium rims, two gripper arms (912e008 303) shall be additionally screwed on to each wheel alignment clamp. Together with the mounting aid for aluminium rims (Fig. 29), the wheel alignment clamp is stopped in the middle of the wheel, whereby a magnet foot is above the middle of the wheel and two are below it. Rest the magnetic feet on the rim flange and key the gripper arms into the tyre tread using the quick clamping test. (Fig. 28)



(Fig. 29)

Before tensioning in their length, the clamping arms have to be adjusted on both sides so that they rest just in front of the tyre profile without tension.

Attaching the camera

- Pull the camera mounting bolt gently upwards and slide the camera onto the camera holding pin until the mounting bolt locks into the groove on the holding pin.
- Then, by slightly tightening, lock the camera to the pin using the camera locking bolts. (Fig. 30)

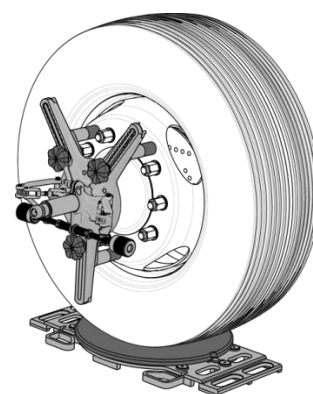
Switch on cameras

- The cameras are switched on with the OK button (green LEDs light up briefly once).

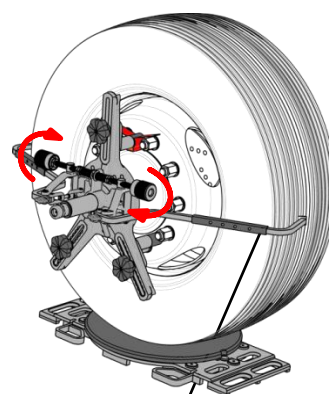


The cameras can only be switched off by exiting the program. See page 42, Quit the AXIS4000 and switch off the cameras.

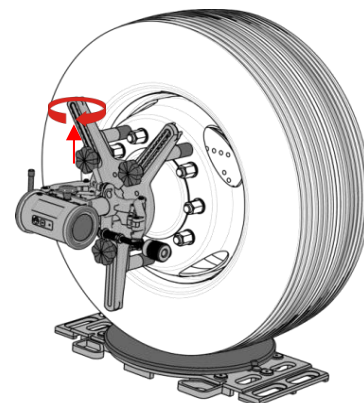
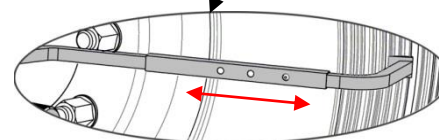
Note



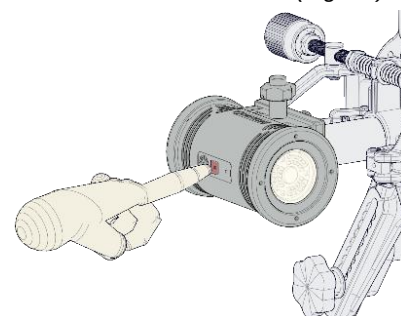
(Fig. 27)



(Fig. 28)



(Fig. 30)

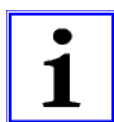


Front axle measurement

9.2 Specifying vehicle data in the AXIS4000 program

The Radio Server Unit is connected to the PC (see *Installation Point 6.4*) and the PC is switched on. The AXIS4000 program has been started and is showing the start screen.

- Select the **Start measurement** button.
- Enter vehicle data and select the vehicle type using the quick selection function. (Fig. 31)



Note

The quick selection function enables the user to directly accept preset vehicle values. However, specific changes can be made depending on the vehicle type.

- The **Special vehicle** option is used to set up an individual vehicle of up to 5 axles for measurement.
- Define the rim size on the following "Vehicle data" program screen and specify the type of axles depending on the vehicle. (Fig. 32)
- Now select the **Setup scales** button.

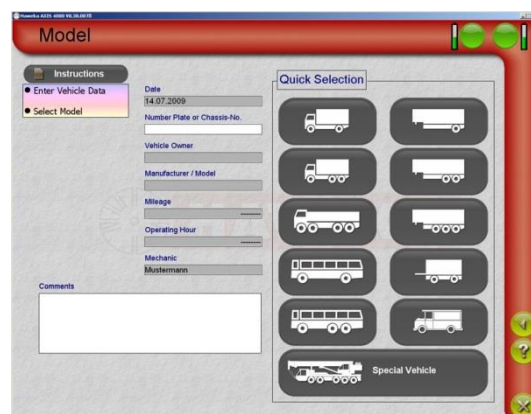


Note

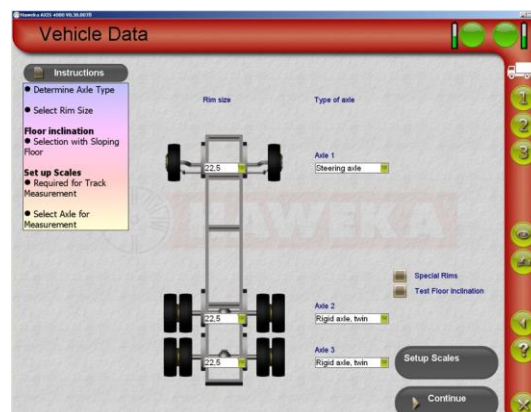
Using the **Continue** button, skip the scale setup and go straight to selecting the measurement types.

(See Page 30)

This option is only used for quick measurement of camber, castor, KPI, relative steering angle and max. steering angle. All other measurements can only be carried out when scale setup has been carried out beforehand!



(Fig. 31)



(Fig. 32)

- Select **Test floor inclination**
The vehicle must be measured on a level floor surface. If the user suspects that the selected work surface is not on a horizontal plane between left and right vehicle sides, the situation should be examined and taken into account for further measurements. **This step is not absolutely essential but is recommended in the event of any suspected floor surface inclination.** On this subject, please refer to Point 15 from Page 53
- Select **Special rims**
In some rare cases, you may not be able to position the wheel alignment clamp for the cameras correctly on the rim.



Caution

The camera measurement head must always be aligned parallel to the wheel hub.

In the case of Trilex rims, we cannot guarantee correcting positioning of the wheel alignment clamp due to the 3-part composition of the rim. Depending on the vehicle wheel, run-out compensation for the individual camera measurement heads must be carried out using the **Special rims** button. On this subject, please refer to Point 16 from Page 55.

Front axle measurement

9.3 Setting up the reflectors (scale setup)

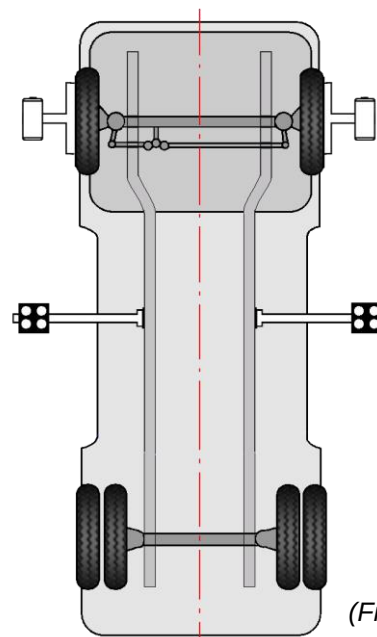
9.3.1 Fitting the magnetic feet onto the vehicle

- Secure the magnetic feet onto the vehicle chassis as centrally as possible.
- Make sure that the magnetic feet are fitted at the same point on both sides of the vehicle. (Fig. 33)
- Attach the reflectors onto the magnetic feet at the same position on both sides.



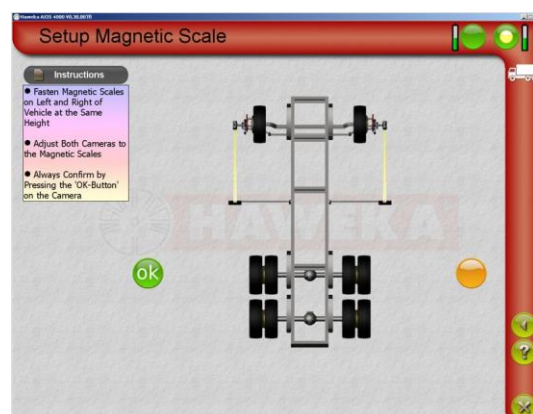
Note

The magnetic feet should be fitted to the vehicle chassis as far away from the cameras as possible. This creates a larger measurement rectangle.



(Fig. 33)

- When the magnetic feet with reflectors are secured to the vehicle, the left and right cameras must be aligned to the reflectors. When a camera detects a reflector, the symbol top right in the program changes and the process is confirmed by pressing the **OK button** on the corresponding camera.
- The program signals receipt of the measured values both visually with a green OK symbol and acoustically with a signal tone.
- It does not matter in which sequence (left/right) the reflectors are detected and confirmed by the OK button for the corresponding camera. (Fig. 34)
- Once both reflectors have been detected and calibrated, the program changes automatically to reflector stand setup.



(Fig. 34)

9.3.2 Assembling the reflector stands (toe scales) and aligning to the vehicle

There are 2 reflector stands each with 2 reflectors.



Note

THE REFLECTORS ON THE MAGNETIC FEET ARE REMOVED TO SETUP THE REFLECTOR STAND.



(Fig. 35)

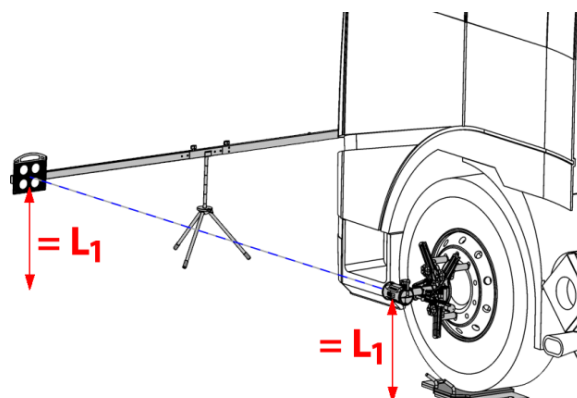
- Assembly is carried out by putting together the reflector stand, tripod stands and reflectors.

Front axle measurement

- A reflector stand is assembled and optically aligned in front of and behind the vehicle.
- Make sure that the reflector stands are close enough to the vehicle and stand parallel to the rear of the vehicle.
- Once the reflector stands are positioned, the left and right reflectors are fitted at the same position on the stand. (Note the positioning boreholes on the stand)

i **THE REFLECTORS MUST BE ALIGNED ON A HORIZONTAL LINE WITH THE CAMERAS!** (Fig. 36)

Note Height adjustment can be carried out using the adjustable tripod stands.



(Fig. 36)

Align the cameras to the rear reflectors.

- The rear reflector must be moved to the side until the bar on the screen changes from red to yellow to green and as closely as possible reaches the "0" value. (Fig. 37)

i **THE TRIPOD STANDS REMAIN STATIONARY! ONLY THE REFLECTOR STAND IS MOVED.**

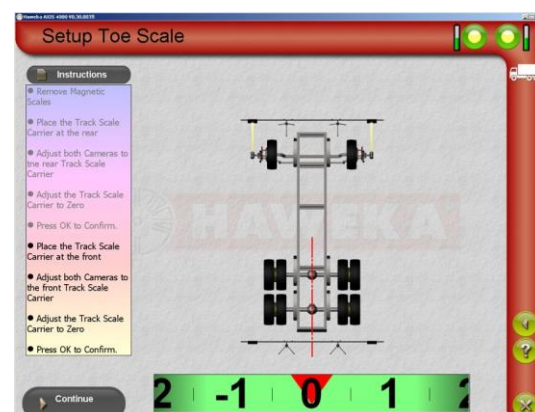
Note

- As soon as the reflector stand is setup, a centre-line is shown in this area of the vehicle. The program is now ready for the reflectors of the second reflector stand.
- Now turn both cameras towards the front reflectors.
- The bar on the screen displays a value again.
- The front reflector stand must be moved to the side until the bar on the screen changes from red to green and as closely as possible reaches the "0" value.
- Once this process is concluded, a centre-line will appear in this area as well. (A line is generated through the entire vehicle.)
- The vehicle centre-line is defined for the following measurements and the reflector stand setup is concluded with the **Continue** button. (Fig. 38)

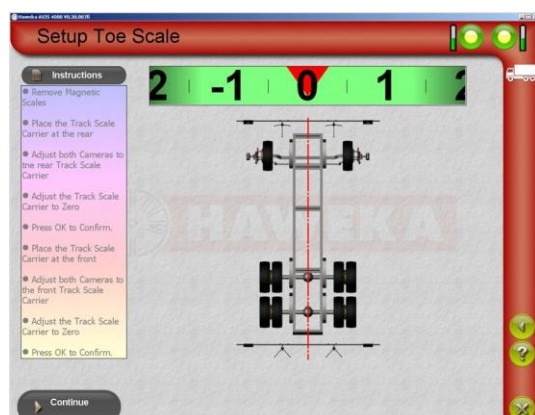
i **THE REFLECTOR STANDS SHOULD NOT BE MOVED AGAIN FROM THEIR POSITIONS FOR THE DURATION OF MEASUREMENT.**

Note

If the position of the reflector stands is altered during measurement, they must be re-aligned. Measurement can then be continued from the last measurement point.



(Fig. 37)



(Fig. 38)

Front axle measurement

9.4 Measuring the camber

- Before beginning measurement, align the cameras horizontally using a spirit level. (Fig. 39)
- Select the "**Camber**" button on the measurement selection screen for measuring the ACTUAL camber value. The camber value will then appear immediately in degrees and minutes. (Fig. 40)
- The measured ACTUAL values must now be compared to the required NOMINAL values.
- If the ACTUAL values lie outside the tolerance range of the NOMINAL values, then the camber must be adjusted on the vehicle when possible.



(Fig. 39)



Note

The following applies for adjustments:
IF THE CAMBER IS ADJUSTABLE ON THE VEHICLE, THEN THIS IS ALWAYS ADJUSTED FIRST.

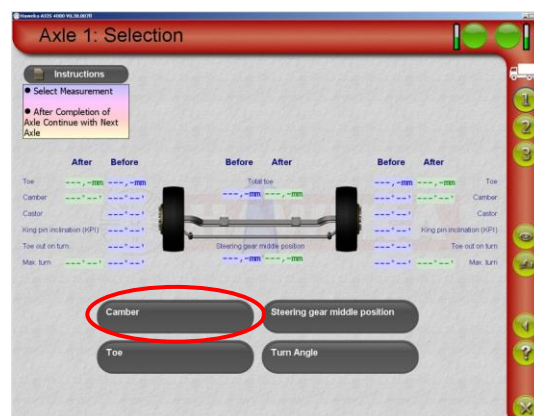
- Click on the settings symbol to adjust the camber.



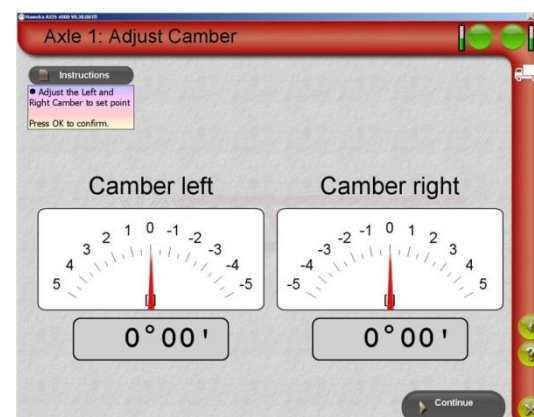
Note

THE SETTINGS SYMBOL ONLY APPEARS AFTER MEASURING THE ACTUAL VALUE.

- While carrying out settings, the current value for the left and right sides of the vehicle is displayed analogue and digital for setting the NOMINAL value. (Fig. 41)
- The **Continue** button changes the program back to the overview screen for the selected axle and displays the newly set value in the AFTER column. (Fig. 42)



(Fig. 40)



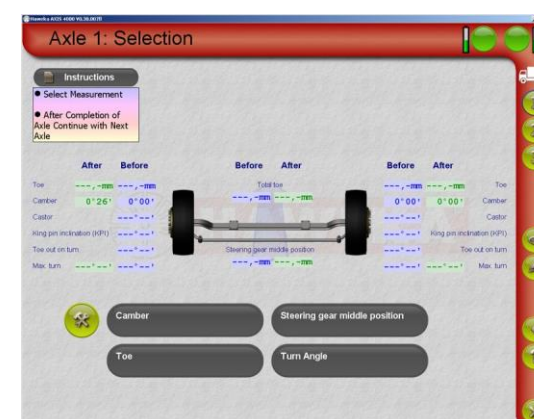
(Fig. 41)



Note

The BEFORE column means measured values before the setting.
The AFTER column means: measured values after the setting

	After	Before
Toe	--- , -mm	--- , -mm
Camber	0° 26'	0° 00'
Castor	---	---
King pin inclination (KPI)	---	---
Toe out on turn	---	---
Max. turn	---	---



(Fig. 42)

Front axle measurement

9.5 Steering gear middle position

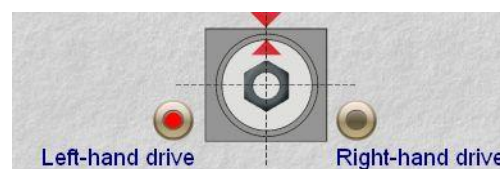
- Select the "**Steering gear middle position**" menu point on the overview screen for selection measurement types. (Fig. 43)

The middle position of the steering gear is measured on the one steering gear side of the vehicle.

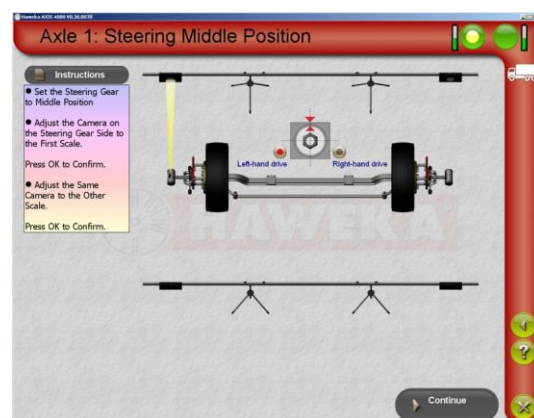
- If required, the specific steering side can be altered by clicking the **Left-hand drive** / **Right-hand drive** button. (Fig. 44)
- The steering gear must be brought into a central position before starting the measurement.
- The corresponding camera must now be aligned to the front reflector. (Fig. 45)
- Once the reflector has been detected, confirm the process with the **OK button** on the camera.
- The camera is now rotated by 180 degrees and aligned to the rear reflector. (Fig. 46)
- Once the second reflector has been detected, confirm the process again with the **OK button** on the camera.
- The measured value is displayed as soon as the work steps have all been completed.
- The **Continue** button changes the program back to the overview screen for the selected axle and displays the ACTUAL measured value.



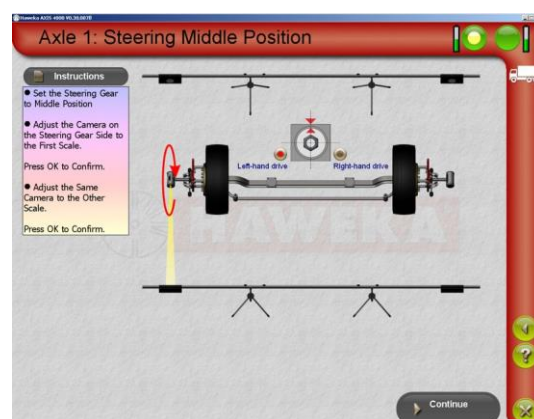
(Fig. 43)



(Fig. 44)



(Fig. 45)



(Fig. 46)

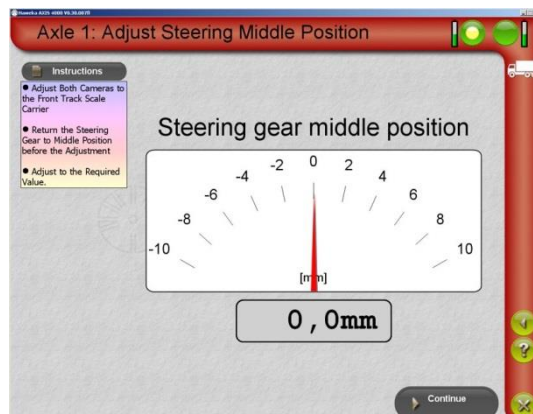
Front axle measurement

9.5.1 Adjusting the steering gear

If required, the steering gear middle position can be adjusted using the adjust button.

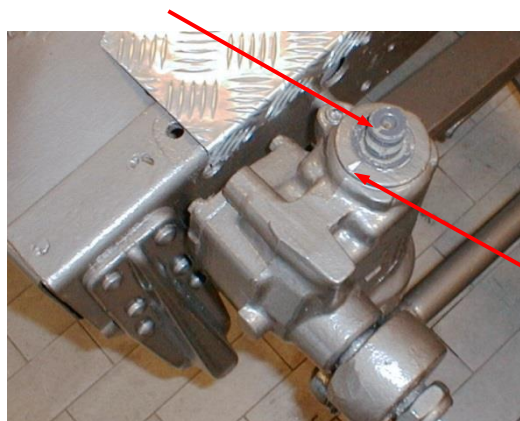


- The settings display appears when the adjust button for the steering gear is selected. (Fig. 47)
- Check the steering middle position on the steering gear. (Fig. 48)
- Carry out adjustments on the push-rod until the desired value is shown on the display.



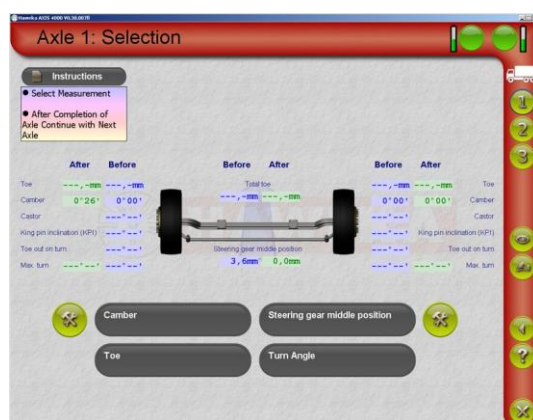
(Fig. 47)

During adjustments, the current value is display continuously both analogue and digital for setting the NOMINAL value.



(Fig. 48)

- After adjustments are complete, settings are concluded with the **Continue** button. The program changes back to the overview screen for the selected axle. The newly set value appears under the "After" column. (Fig. 49)



(Fig. 49)

Front axle measurement

9.6 Measuring the total toe and single toe

- Select the **Toe** menu point on the measurement report overview screen. (Fig. 50)
- For measuring the ACTUAL value, the cameras are turned to the front reflectors and then to the back reflectors and each is confirmed with the **OK** button.
- The individual work steps are described by the instruction windows in the program.

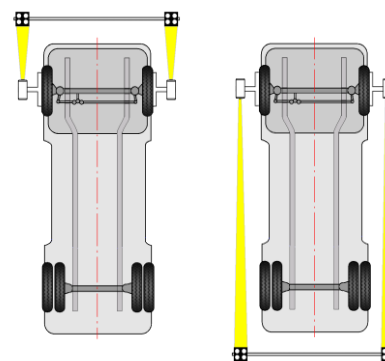


The procedure for recording measured values is displayed in the program by a yellow light beam. (Fig. 51) Values can be measured starting on the left or right side of the vehicle; this does not alter the measurement result.

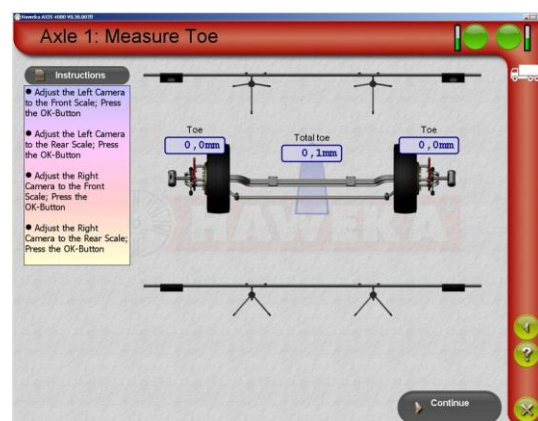
- After recording the measured values, the single toe values measured for each vehicle side and the total toe will be immediately displayed. (Fig. 52)
- The **Continue** button changes the program back to the overview screen for the selected axle and displays the ACTUAL toe value measured.
- The measured ACTUAL values must be compared to the required NOMINAL values.
- If the toe values measured lie outside the permitted tolerance for NOMINAL values, the vehicle geometry must be adjusted. This is done by selecting the adjust button for the toe.



(Fig. 50)



(Fig. 51)



(Fig. 52)



Front axle measurement

9.6.1 Adjusting the toe

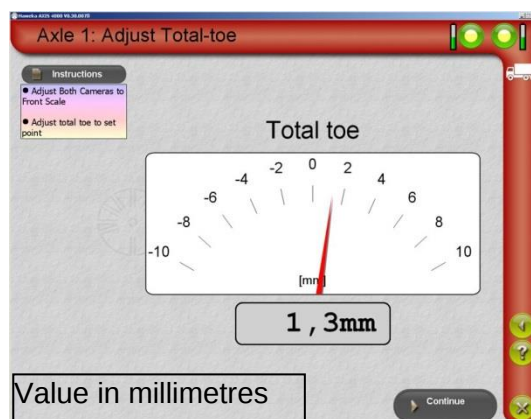
In the *Selection* dialogue window, you can choose the adjustment for single toe or total toe, depending on the axle type. (Fig. 53)



(Fig. 53)

Adjusting the total toe for front axles without the option of adjusting the single toe

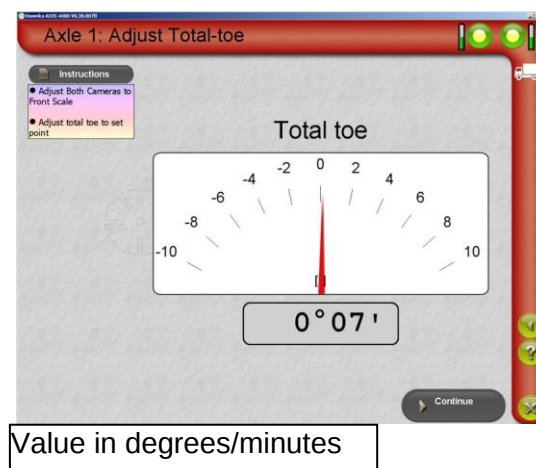
- On the selection screen for adjustments, select **Total toe**.
- A display appears for adjusting the NOMINAL value, which always shows the current value of the total toe, both analogue and digital, in mm for the entire duration of adjustment. (Fig. 54)



(Fig. 54)



If the toe value is needed in degrees, then the display can be changed from [mm] to [degrees]. (Fig. 55)
On this topic, please refer to Point 7.2.8 Extended settings.



(Fig. 55)

Front axle measurement

Once the desired NOMINAL value is adjusted, the procedure is completed with the "**Continue**" button.

- The program changes back to the overview screen for the selected axle and not only shows the measured values (BEFORE column) but also the newly adjusted values (AFTER column). (Fig. 56)



(Fig. 56)

Adjusting the single toe for front axles with independent wheel suspension

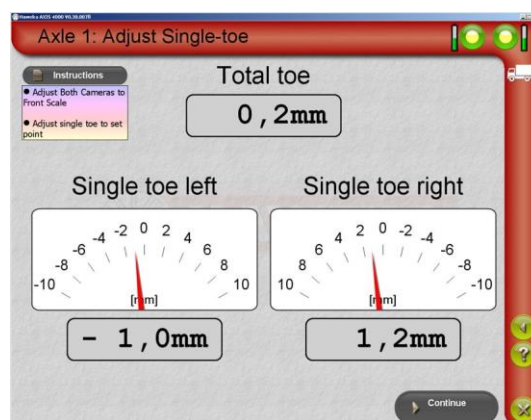
- On the selection screen for adjustments, select **Single toe**. (Fig. 57)
- The single toe values for the left and right sides are shown on two displays for adjusting the NOMINAL value. The current values and total toe are displayed analogue and digital in [mm] for the entire duration of adjustment. (Fig. 58)



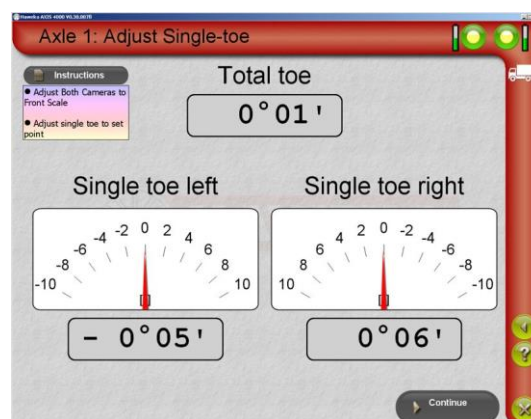
(Fig. 57)



If the toe value is needed in degrees, then the display can be changed from [mm] to [degrees]. (Fig. 59)
On this topic, please refer to Point 7.2.8 Extended settings.



(Fig. 58)



(Fig. 59)

Front axle measurement

Turn angle

9.7 Castor, KPI, relative steering angle and max. turn angle

Measurement of the castor, KPI, relative steering angle and max. turn angle is carried out in one work step. The cameras must be switched on and each one pointed at the front reflector. If this is not the case, a corresponding instruction window will remind you to position the camera appropriately before measurement.

- Before beginning measurement, each camera must be aligned horizontally using a spirit level. (Fig. 60)

LED for turn angle



(Fig. 60)

- Select the **Turn angle** menu point on the measurement report overview screen. (Fig. 61)

The work steps that now follow are described by instructions in the program window and are simultaneously shown on the monitor screen.

Two green LEDs also appear on the camera when measuring and when turning in whichever direction. (Fig. 60)



(Fig. 61)

Symbols in the program window will tell you when to carry out individual steering movements.



Note

WHILE EXECUTING A TURN ANGLE, MAKE SURE THAT THE STEERING MOVEMENT IS EVEN AND SMOOTH.



Left/right



Straight



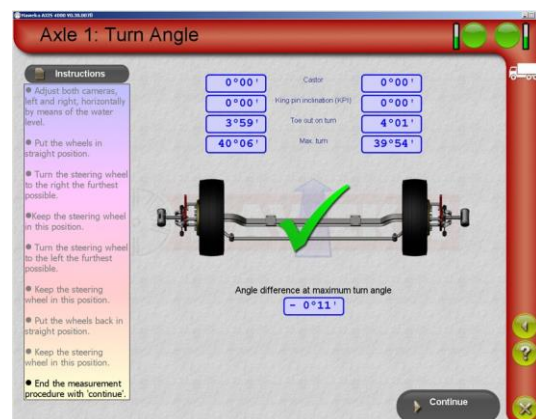
Stop



Finished

Once the procedure is completed, the measured values recorded will appear after a brief pause. (Fig. 62)

- The **Continue** button changes the program back to the overview screen for the selected axle and displays the ACTUAL value measured.



(Fig. 62)

Front axle measurement

9.7.1 Adjusting the maximum turn angle

If the measured angle difference between the maximum turn angle for left and right is outside the permitted tolerance, the maximum turn angle can be adjusted using the adjust button and with the aid of the analogue and digital display.

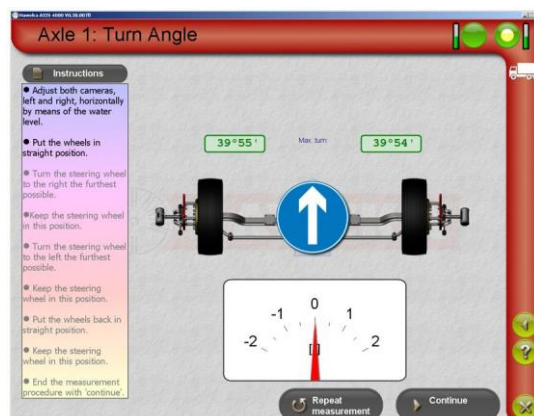
- To do this, select the adjust button next to the turn angle selection.
- Before beginning measurement, each camera must be aligned horizontally using a spirit level.
- The turning lock can now be adjusted on the vehicle. (Fig. 63)



Usually the left turn angle is adjusted on the left side of the vehicle and the right turn angle is adjusted on the right side of the vehicle.

Use the **Repeat measurement** button to repeat this stage in the program until the desired turn angle is adjusted.

The **Continue** button changes the program back to the overview screen for the selected axle and displays the newly measured values in the AFTER column. (Fig. 64)



(Fig. 63)



(Fig. 64)

10 Rear axle measurement

10.1 Measuring the camber

The front axle has been measured and adjusted!



THE CAMERA WHEEL ALIGNMENT CLAMPS MUST BE REPLACED ON THE REAR WHEELS WITH LONG MAGNETIC FEET (315 MM LONG).

Note

- To do this, loosen the knurled screws and replace the magnetic feet.
- Attach the camera measurement heads to the **cleaned rim flange** using the magnets and align the cameras with a spirit level. (Fig. 65)



(Fig. 65)

Now select one rear axle in the program on the measurement screen. (Fig. 66)

The example shows: Axle 2 selection

The program now shows the rear axle on the overview screen. (Fig. 67)

Axle 2 selection (rear axle)



(Fig. 66)

- Press the "**Camber**" button on the measurement selection screen to measure the **ACTUAL** camber value. The camber value will then appear immediately in degrees and minutes.
- The measured **ACTUAL** values must be compared to the required **NOMINAL** values.
- If the **ACTUAL** values lie outside the tolerance range of the **NOMINAL** values, then the camber must be adjusted on the vehicle when possible.

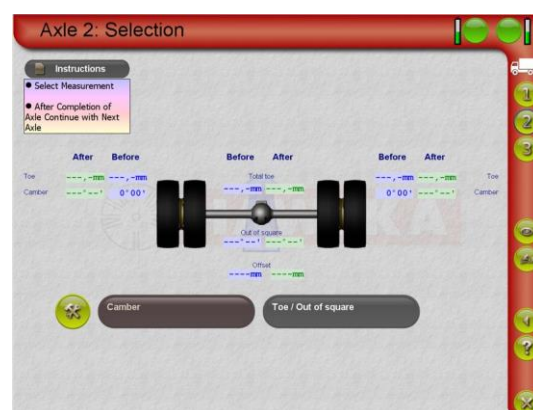
Click on the settings symbol to adjust the camber.



The following applies for adjustments:
IF THE CAMBER IS ADJUSTABLE ON THE VEHICLE, THEN THIS IS ALWAYS ADJUSTED FIRST.

Note

- The single camber values for the left and right sides are shown on two displays for adjusting the **NOMINAL** value. The current values are shown both analogue and digitally in degrees for the entire duration of adjustment.
- The **Continue** button changes the program back to the overview screen for the selected axle and displays the newly measured value in the **AFTER** column. (Fig. 67)



(Fig. 67)

Rear axle measurement

10.2 Toe / inclination

- To measure the **ACTUAL** value, the cameras are turned to the front reflectors and back reflectors and the measured values for each are recorded with the **OK button**. The individual work steps are described by instructions in the program window. (Fig. 68)
- The **Continue** button changes the program back to the overview screen for the selected axle and displays the measured values in the **BEFORE** column.

If axle inclination and/or axle mismatch are identified during measurement, the result will be shown graphically in the program.

(Fig. 69)



The axle inclination is shown graphically in the program only from a value of $> 0^{\circ}12'$ and axle mismatch is shown with a green arrow upwards of > 1 mm and a red arrow upwards of 10 mm.

To adjust the toe and inclination, click the adjust symbol next to the selection button.

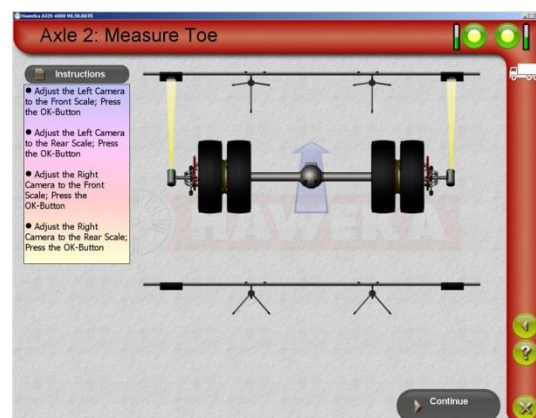
- Select the corresponding item for adjustment depending on the measurement result and vehicle axle. (Fig. 70)

10.2.1 Adjusting the toe/single toe

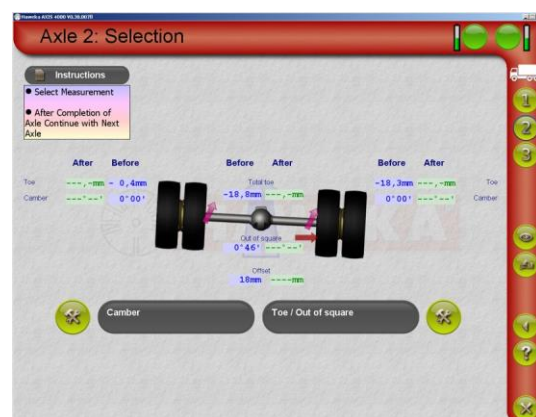
- One (total toe) or two displays for single toe values for the left and right sides are shown for adjusting the **NOMINAL** value. The current values and total toe are displayed analogue and digital in [mm] for the entire duration of adjustment. (Fig. 71)



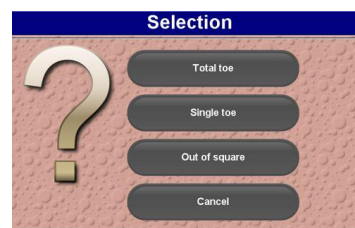
If the toe value is needed in degrees, then the display can be changed from [mm] to [degrees]. On this topic, please refer to Point 7.2.8 Extended settings.



(Fig. 68)



(Fig. 69)



(Fig. 70)



(Fig. 71)

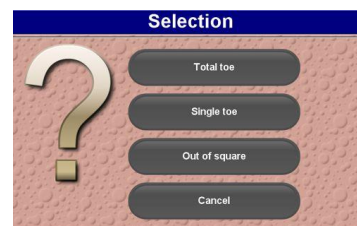
Rear axle measurement

10.2.2 Adjusting when out of square

To adjust the inclination when it is out of square, click the adjust symbol next to the selection button.

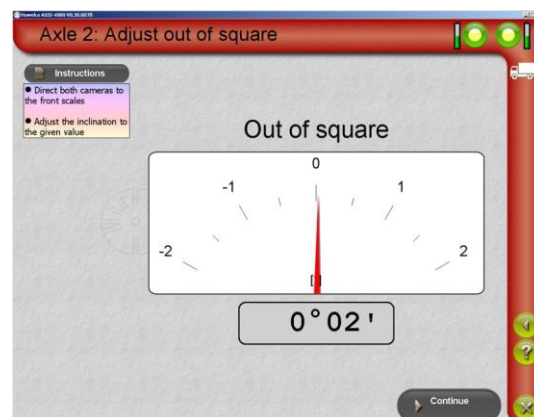


- Select the **Out of square** button in the selection window. (Fig. 72)



(Fig. 72)

- Both cameras are directed towards the front reflectors and aligned with the help of the spirit level.
- The inclination of the rear axle is displayed in degrees and minutes, both analogue and digital, for the entire duration of adjustment. (Fig. 73)
- The **Continue** button changes the program back to the overview screen for the selected axle and displays the adjusted value in the AFTER column.



(Fig. 73)

Now select another rear axle in the program on the measurement screen.

The example shows: Axle 3 selection. (Fig. 74)

The program changes to the overview screen for the new third axle.

The procedure for all further axles is dependent on the type of axle and is the same as described for axle 1 (steering axle) and axle 2 (rigid axle).



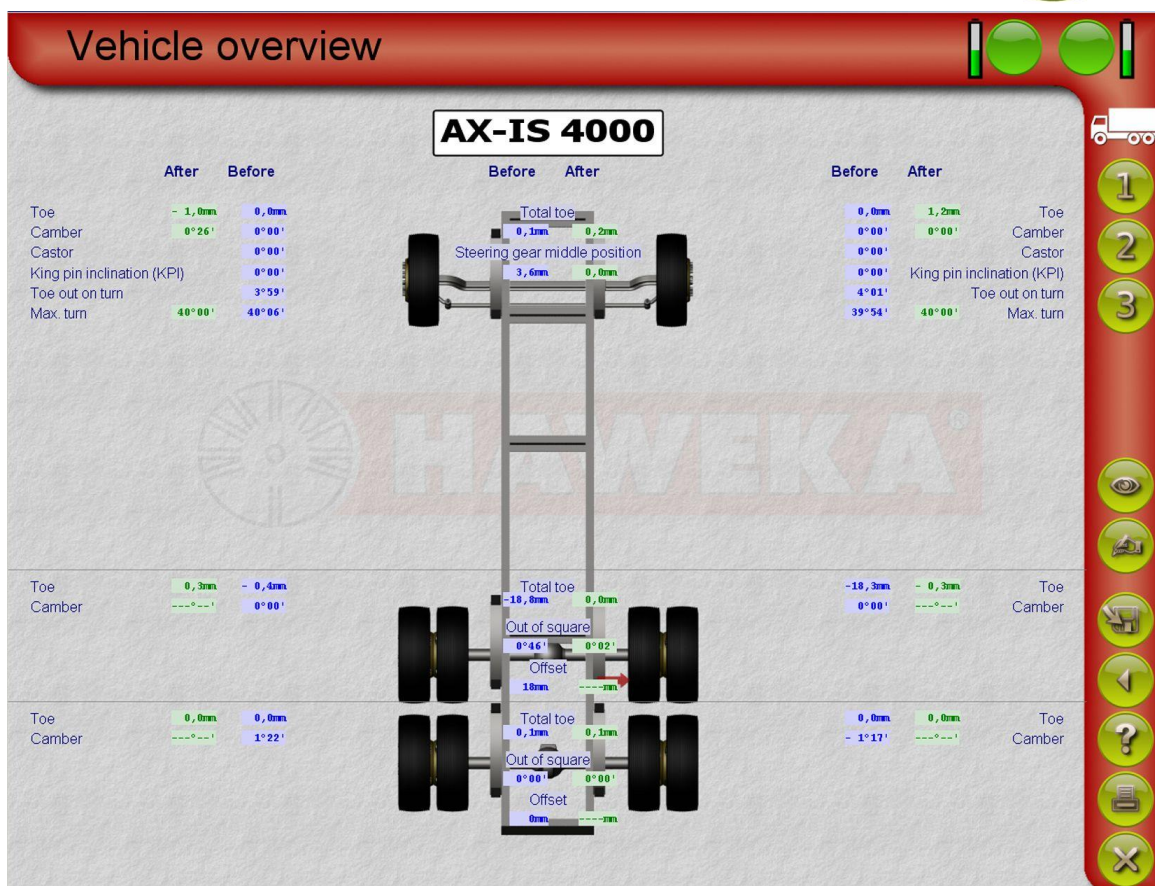
(Fig. 74)

11 Protocol, vehicle overview

On the selection screens for the corresponding vehicle axles, you can use the **Overview button** (Fig. 75) to directly access the overall protocol. This view enables a comparison of measured data for all vehicle axles. (Fig. 76)



(Fig. 75)



(Fig. 76)

By selecting the **Comment button** (Fig. 77) you can enter special comments about the vehicle that will appear later on the report printout.



(Fig. 77)

Use the **Save button** (Fig. 78) when work is finished to save the completed measurements.



(Fig. 78)

Use the **Print button** (Fig. 79) to print out the recorded data as a protocol/report on an installed printer.



(Fig. 79)

Protocol, vehicle overview

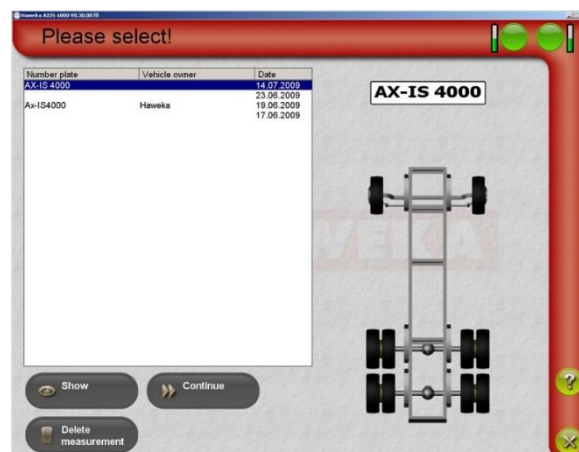
Use the **Show protocol** button on the start page of the program to open a saved measuring session again at any time. (Fig. 80)



(Fig. 80)

When you select **Show protocol**, an overview of all saved measuring sessions with a small preview will appear. (Fig. 81)

By pressing the **Show** button, the selected data record for a measuring session will appear on the vehicle overview screen with all axles.



(Fig. 81)



Note

If the data record for a measuring session has been saved, you will be able to carry out further measurements on this vehicle days later. To do this, select the **Continue** button.

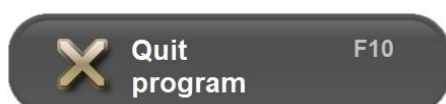
11.1 Quit the AXIS4000 and switch off the cameras

When the measurement is finished, the AXIS4000 program can be closed.



Note

You can only exit the AXIS4000 program and switch off the cameras at the same time by selecting **Exit program (F10)**. (Abb. 82)



(Fig. 82)

12 The AXIS4000 user reference database

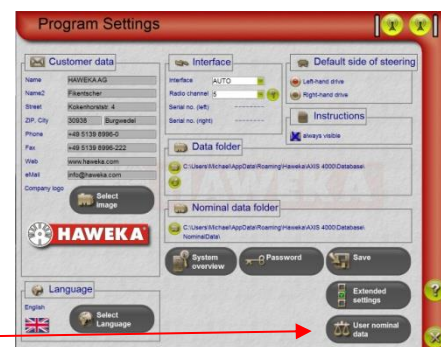
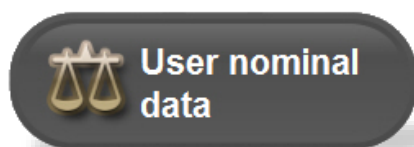
You can use this additional module for the AXIS4000 wheel alignment program to enter and save default target values for vehicle geometry data.

You can use this additional module to carry out a nominal/actual value comparison, during or after measurement.

12.1 Creating new vehicles in the database

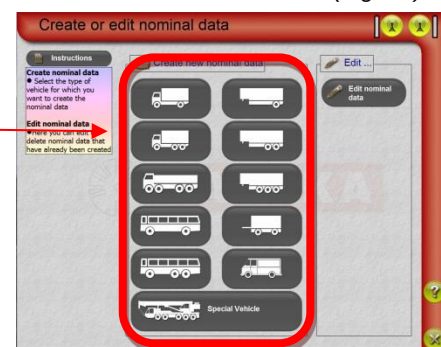
A new **User nominal data** selection button has been added under the *Settings* menu item after activation. (Fig. 83)

- Click on the *User nominal data* button



(Fig. 83)

- Select the type of vehicle for which you want to create nominal data. (Fig. 84)

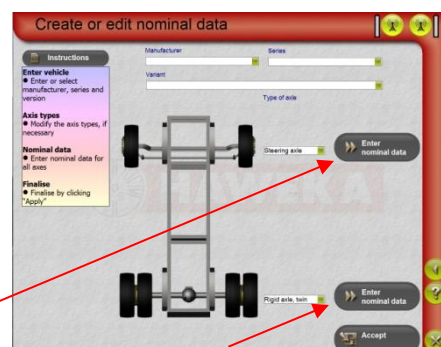


(Fig. 84)

- Enter the manufacturer, series and variant:

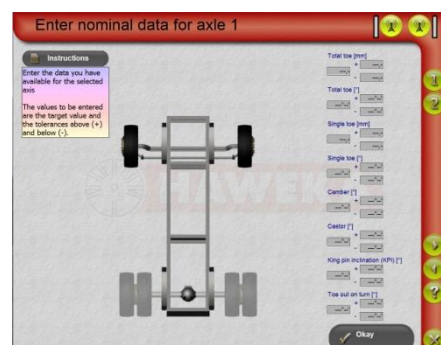
- Manufacturer:**
Add the vehicle manufacturer's name here.
E.g. Mercedes
- Series:**
Add the type here.
E.g. Actros
- Variant:**
Add special features here.
E.g. left- or right-hand drive or specific serial numbers

- After the axles types for the front and rear axles have been set via the drop-down selection menu, click on the first "Enter nominal data" button (for the front axle) (Fig. 85)



(Fig. 85)

- Enter the default values for the individual geometry data including the default tolerance values. (Fig. 85)
- After you have entered all values, click on the "Okay" button. (Fig. 86)
- Next, select the second "Enter nominal data" button for the rear axle.
- Enter the default values including the default tolerance values here as well. (Fig. 85)



(Fig. 86)

- Finally, go back by clicking “Okay”.
- Save your entered data by clicking the “Accept” button” (Fig. 87)

The new dataset has been created and can be used.

12.2 Using the user reference database

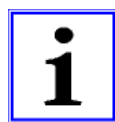
A new symbol with a set of scales has been added to the right side of the “Selection” section of the program.

- Start a vehicle alignment as usual.
- To use the database, click on the scales symbol after you have added the measured data. (Fig. 88)

An overview opens with the vehicle data you have created.

- Select the respective vehicle from the list and click on the “Load nominal data” button. (Fig. 89)

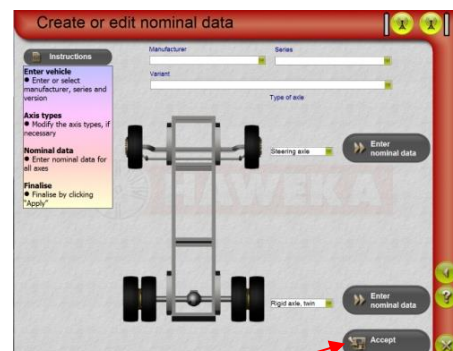
The NOMINAL data will be shown along with the ACTUAL data that has been recorded.



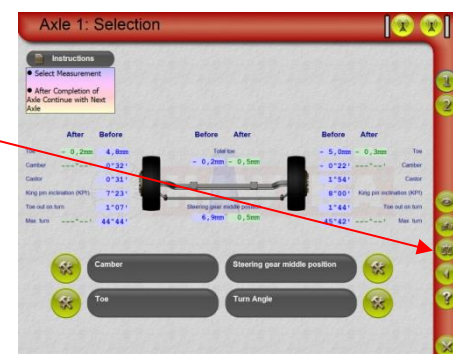
Note

Via the print button, the selected vehicle-data can be printed out separately

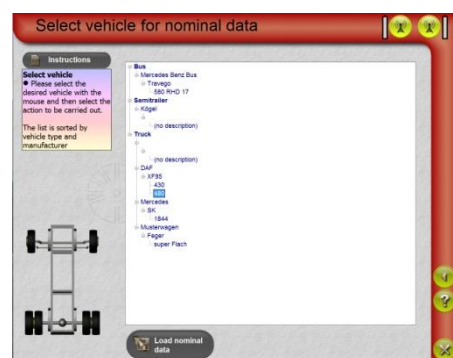
- To leave the nominal data screen and continue with measuring, click on the *Cancel* symbol on the bottom right side. (Fig. 90)



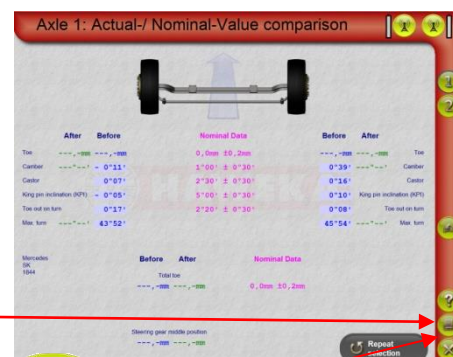
(Fig. 87)



(Fig. 88)



(Fig. 89)



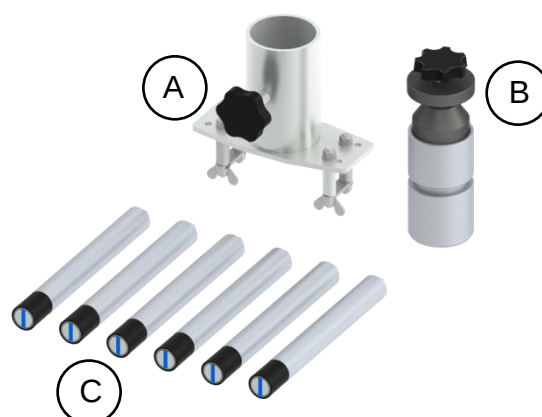
(Fig. 90)



13 Trailers and articulated trailers



If the AXIS4000 is only available in a basic version, then you will require an upgrade kit to measure truck trailers and semi-trailers.



The upgrade kit for measuring trailers and articulated trailers, Item No. 923 000 001 comprises:

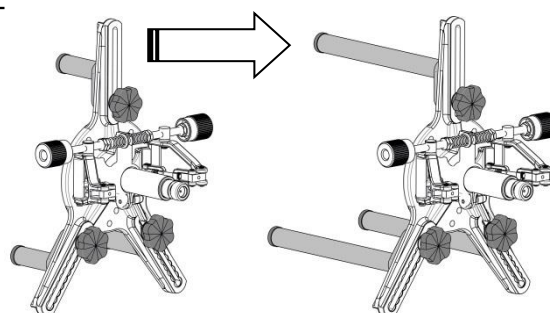
- | | |
|---|--------------------------------|
| A.) 1 x king pin adapter Ø 2" | Item No. 923 001 041 |
| B.) 1 x coupling ring/trailer drawbar adapter | Item No. 913 024 001 |
| C.) 6 x magnetic feet, 265 mm long | (1 piece) Item No. 913 029 012 |

The extension is used solely for measuring the total toe, single toe left/right, camber left/right and for determining the axle inclination and axle mismatch for articulated trailers and trailers in combination with the AXIS4000 basic version.

13.1 Preparatory measures for measuring articulated trailers

In order to be able to position the measuring heads against the vehicle wheels of the trailer, the magnetic feet on the 3-arm stars of the wheel alignment clamp may have to be changed.

- Loosen the knurled screws and replace the magnetic feet with the 265 mm long magnetic feet.
(Fig. 91)
- Fit the wheel alignment clamp as usual to the vehicle wheel of the trailer axle to be measured.



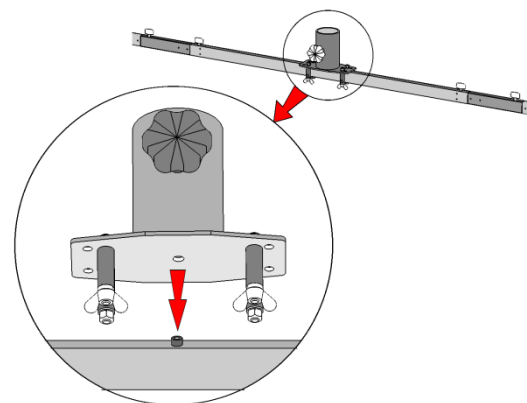
(Fig. 91)

Articulated trailers

13.2 Setting up the reflector stands for articulated trailers

Put together the reflector stands and then fit the king pin adapter centrally onto the reflector stand.

i Note There is a cylinder screw in the centre of the reflector stand. Place the king pin adapter with the borehole in the centre of the stand onto the screw head. (Fig. 92)



(Fig. 92)

The reflector stand is pushed onto the trailer's king pin using the king pin adapter and secured with the knurled screw. (Fig. 93)

Now fasten it as usual, i.e. both reflectors left and right onto the reflector stand.

The second reflector stand is set up behind the trailer on the two tripod stands and is optically aligned. (Fig. 94)
The procedure for this is as described under Point 9.3.2 Page 30.



(Fig. 93)

Both reflector stands must be optically aligned in such a way that they stand at rectangles to the long axle of the vehicle.



(Fig. 94)

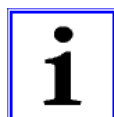
Articulated trailers

13.2.1 Setting up the reflector stands

- Use the quick selection option in the AXIS4000 program to select a trailer with the right number of axles.

The program changes to entry of vehicle data. (Fig. 95)

- This is where you select the corresponding axle type and appropriate rim size.
- Choose the "**Setup scales**" button.



Note

No magnetic feet are required for setup as the measurement rectangle is now defined by the reflectors on the king pin.

- Align the camera on the left and right to the reflectors on the king pin.
- Confirm positioning with the **OK button** on both camera casings. (Fig. 96)

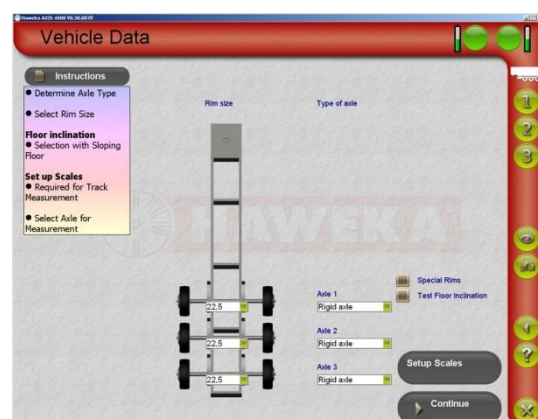
Once both reflectors have been detected, the program screen changes automatically and you will be asked to align both cameras to the rear reflectors.

- The reflector stand must now be moved to the side until the display nearly reaches "0". (Fig. 97)

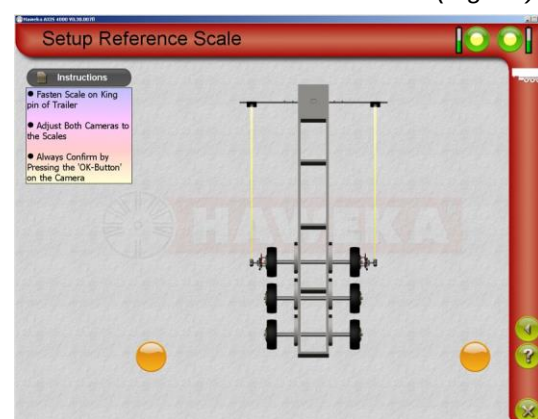
Start measurements

All subsequent measurements are carried out according to the working sequence for rear axle measurements. (Fig. 98)

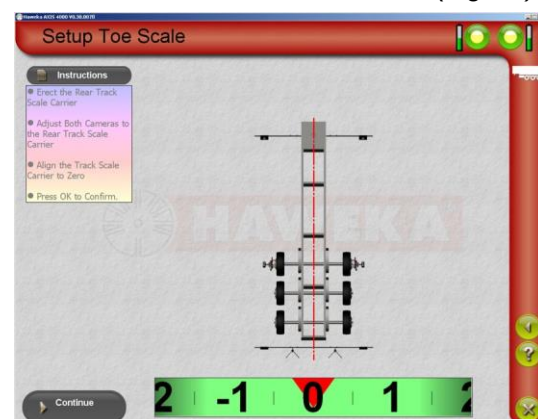
To measure the camber, toe, axle mismatch and inclination, please refer to Point 10 Page 40 *Rear axle measurement*.



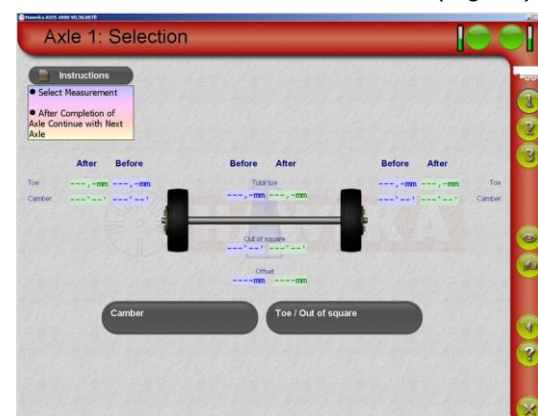
(Fig. 95)



(Fig. 96)



(Fig. 97)

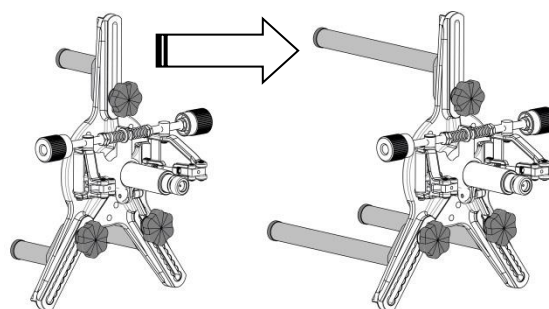


(Fig. 98)

Trailers

Preparations for measuring trailers

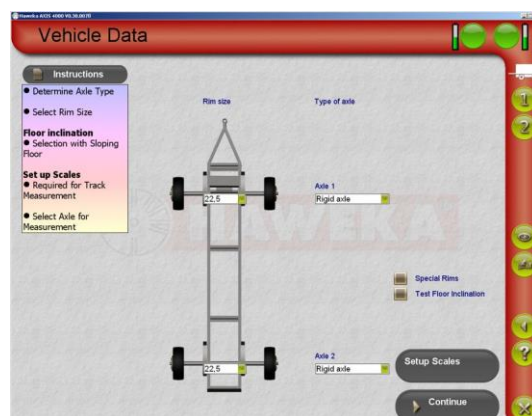
The camera measurement heads may have to be converted using the 265 mm long magnetic feet (similar to trailer measurements), depending on the rim type.
(Fig. 99)



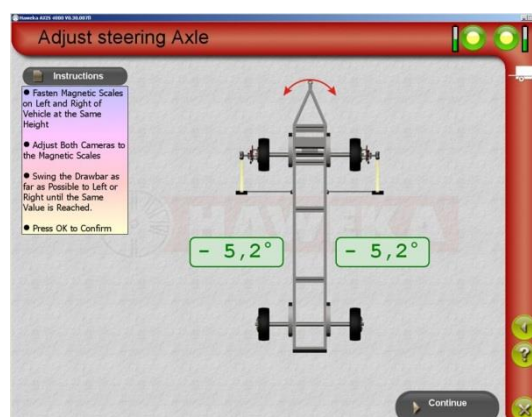
(Fig. 99)

13.3 Aligning the vehicle axle on the drawbar

- Check the drawbar for visible defects.
- The camera measurement heads are fitted to the vehicle wheels of the rotating axle.
- Place the magnetic feet on both vehicle sides at the same position on the chassis.
- Hang the reflectors on the right and left.
- Place the cameras onto the wheel alignment clamp on each side of the vehicle and align against the reflectors on the magnetic feet.
- Prepare the computer and select **Trailer** as vehicle type in the program.
- Enter the rim size. (Fig. 100)
- Select the **Setup scales** button.
- Now the vehicle axle is aligned against the drawbar until the values shown for both sides are the same. (Fig. 101)
- Use the parking brake to lock the vehicle wheels on the axle.
- End the procedure with the **Continue** button.



(Fig. 100)

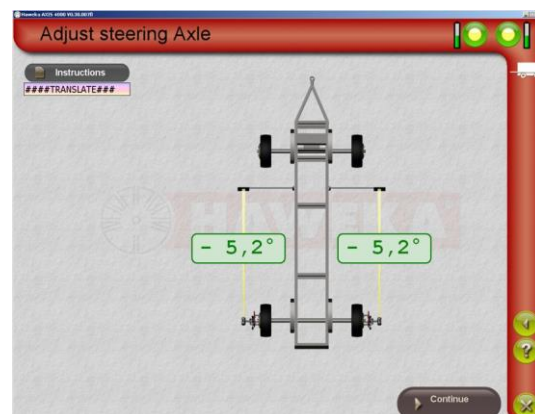


(Fig. 101)

Trailers

13.4 Examining the trailer coupling ring in relation to the vehicle centre-line

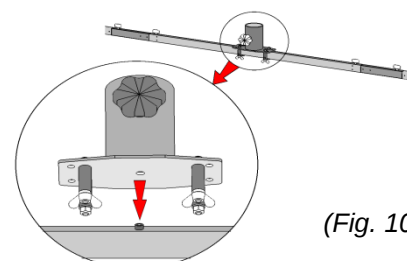
- Fit the camera measurement heads on the left and right of the rear vehicle axle.
- The magnetic feet remain on the vehicle chassis and the reflectors are turned by 180 degrees and attached again.
- Place the cameras onto the wheel alignment clamps on each side of the vehicle and align against the reflectors on the magnetic feet.
(Fig. 102)
- Once the reflectors have been detected, confirm the process with the **OK button** on the camera.
- The program then changes screen automatically. Now the reflector stand must be secured to the trailer coupling ring using the adapter.
- Remove the magnetic feet from the chassis.



(Fig. 102)

13.4.1 Attaching the reflector stand to the trailer coupling ring

- Put together the reflector stand using the king pin adapter as described for the articulated trailer under Point 12.2. (Fig. 103)
- The coupling adapter is unscrewed (Fig. 104) and pulled up from below into the trailer coupling of the drawbar.
- Now push the knurled screw with fitting plate from above through the trailer coupling and screw the coupling adapter securely to the drawbar. (Fig. 105)
- Now the king pin adapter with reflector stand is pushed onto the coupling adapter and screwed tight using the knurled screw. (Fig. 106)
- The reflectors are attached to the reflector stand on the right and left sides.



(Fig. 103)



(Fig. 104)



(Fig. 105)



(Fig. 106)

Trailers

Both cameras must now be aligned against the reflectors on the trailer coupling ring.

As soon as the cameras have detected the reflectors, the measured value is shown for the trailer coupling ring in relation to the vehicle centre-line in [mm]. (Fig. 107)



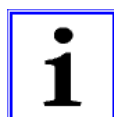
If the value is greater than **3 mm** to the left or right and therefore outside the tolerance range in relation to the vehicle centre-line, the next measurement should only be continued after correcting the drawbar.

If the suspension geometry on the drawbar is error-free, the value is displayed in green.

By pressing the "**Continue**" button, the program changes to setup toe scale and a red vehicle centre-line is shown in the upper area of the trailer.

13.4.2 Setting up the rear reflector stand

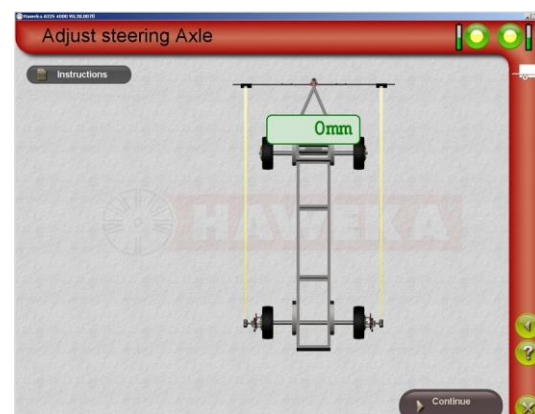
- The reflector stand with reflectors is set up behind the trailer and is optically aligned.
- Align both cameras against the rear reflectors.
- The rear reflector must be moved to the side until the bar on the screen changes from red to green and as closely as possible reaches the "0" value. (Fig. 108)



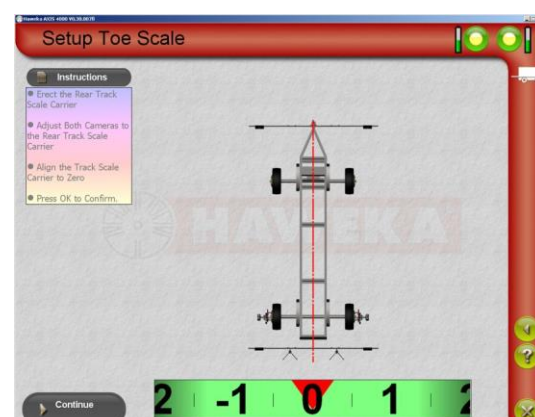
Note

THE TRIPOD STANDS REMAIN STATIONARY! ONLY THE REFLECTOR STAND IS MOVED.

- As soon as the reflector stand is set up with the reflectors, another centre-line will appear in the lower section of the trailer.
- The vehicle centre-line is now defined for the following measurements and the reflector setup is concluded with the **Continue** button.



(Fig.107)



(Fig.108)

Trailers

First measure the rear axle (second axle).

Start measurements

All subsequent measurements are carried out according to the working sequence for rear axle measurements. (Fig. 109)

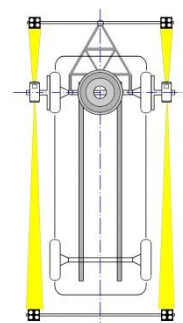
To measure the camber, toe, axle mismatch and inclination, please refer to Point 10 Page 40 *Rear axle measurement*.

Once all measurements are complete on the rear vehicle axle, the camera measurement heads are fitted to the front axle of the trailer.

Then the first axle (front axle) is selected in the program and measurements are carried out. (Fig. 110)



(Fig. 109)



(Fig. 110)

Special features in the case of a tandem trailer with rigid drawbar

Due to the special design of the tandem trailer with rigid drawbar, the measuring procedure is to be carried out as for an articulated trailer. (Fig. 111)

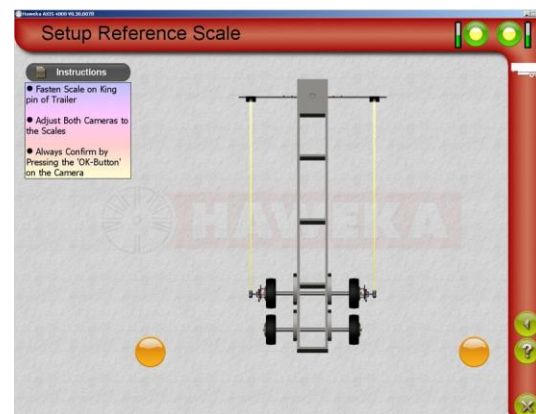
The rigid drawbar on the tandem trailer is treated like the king pin on the articulated trailer.

The reflector stand is fitted with the aid of the king pin adapter and the coupling adapter (as described for trailers) and a 2-axle articulated trailer is selected in the program. (Fig. 112)

All other work steps are described under Point 12.2.1.



(Fig. 111)



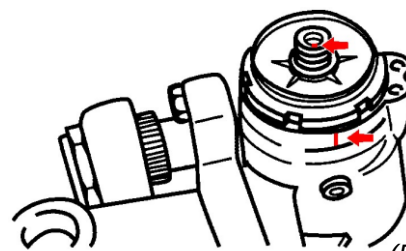
(Fig. 112)

14 Vehicles with two steerable front axles

To examine the parallelism of the two steerable front axles, the first and second steering axle must be measured fully beforehand and if necessary adjusted.



The parallelism of the steering axles can only be examined once the steering gear middle position on the first axle has been correctly adjusted. (Fig. 113)



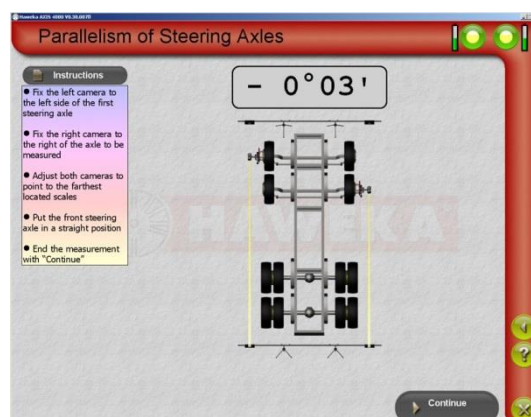
(Fig. 113)

- To prepare for the measurement, the camera measurement heads are secured to the first axle on the left vehicle side and to the second axle on the right vehicle side.
- Both cameras are aligned against the rear reflectors.
- The wheels on the first steering axle stand in "Forward direction"; this requires the steering gear to be brought into a central position.
- Then select the "**Parallelism of steering axles**" button. (Fig. 114)



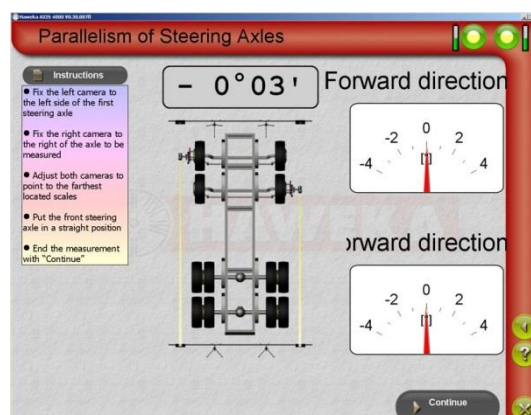
(Fig. 114)

The program immediately detects the angle of the axles in relation to each other and the measured value is displayed. (Fig. 115)



(Fig. 115)

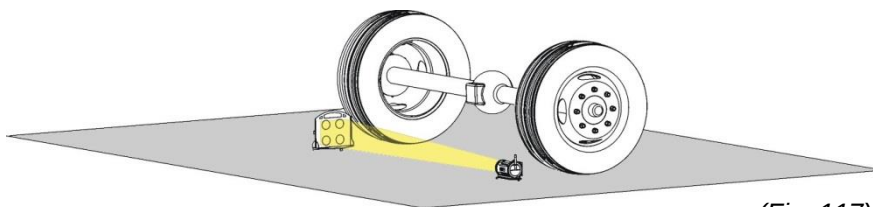
- Press the "**Continue**" button to return to the axle overview.
- If there is no parallelism ($0^{\circ} 00'$), an adjust button will appear; this is selected to correct the vehicle axles in relation to each other.
- The axles can be adjusted to the necessary value using the displays. (Fig. 116)
- Then press the "**Continue**" button to return to the second axle overview.



(Fig. 116)

15 Taking into account floor inclination

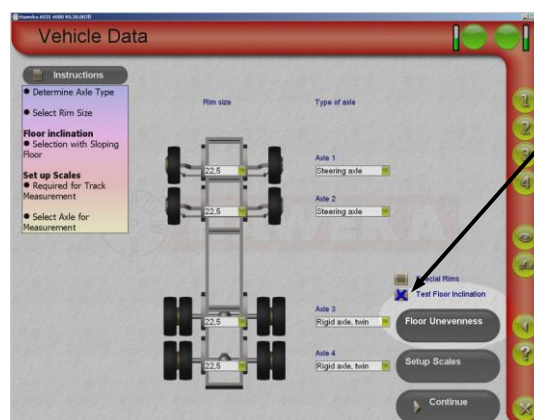
The AXIS4000 can take account of different floor inclinations for each axle during measurement.
(Fig. 117)



(Fig. 117)

Observe the following steps:

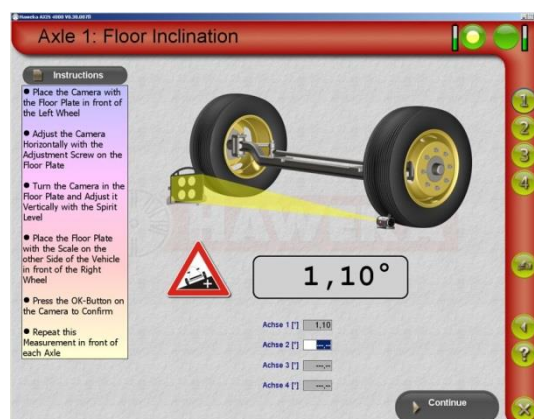
- After selecting the vehicle, tick the test floor inclination box on the vehicle data overview screen and select the new button "**Floor inclination**" (Fig. 118)
- Push a reflector into the holding plate (Fig. 119) and set it up in front of the right wheel of the axle being measured.
- In front of the left wheel of the same axle, fit the camera into the floor plate (Fig. 112) and align against the reflectors.
- Turn the camera in the plate until the camera is aligned vertically with the aid of a spirit level.
- Align the camera horizontally using the spirit level with the aid of the floor plate's setting screw.
- Select the axle to be measured in the program window on the right side. The program always starts with the first axle.
- Now press the **OK button** on the camera to record the value.
- The inclination is shown for the position of the axle. This value is now immediately and automatically taken into account for subsequent measurements on this axle. (Fig. 120)



(Fig. 118)



(Fig. 119)



(Fig. 120)

Floor inclination

A positive or negative amount can be shown for the floor inclination depending on the situation.
(Fig. 121)



(Fig. 121)

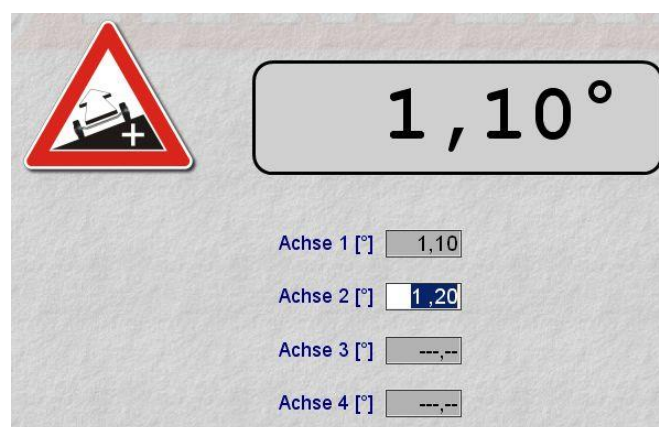
Positive value:

The right wheel is higher than the left when viewed in the direction of travel.

Negative value:

The left wheel is higher than the right when viewed in the direction of travel.

If you already know there is floor inclination (as measurements are often carried out at the same place), then the values can be entered manually and directly for each axle. (Fig. 122)



(Fig. 122)

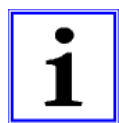
After measuring floor inclination for all axles, press the **"Continue"** button.

The program changes back to the vehicle data screen for the selected vehicle and the measurement can be conducted in the normal sequence.

16 Special rims

Run-out compensation must be carried out for the individual camera measurement heads for each vehicle axle by selecting **Special rims** if you cannot be sure that the wheel alignment clamp is correctly positioned in relation to the wheel hub.

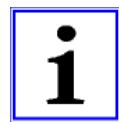
- Place the camera measurement heads on the rim flange of the first vehicle axle.



Note

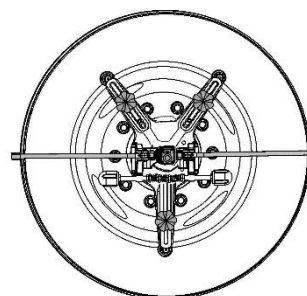
On vehicles with Trilex rims, the magnetic feet must be replaced with a special adapter and grab arms must be fitted to the wheel due to the 3-part design of the rim. (Fig. 123)
Item No. 924 000 004

- After selecting the vehicle, tick the special rims box on the vehicle data overview screen and select the **"Continue"** button. (Fig. 124)
- Run-out compensation will now be carried out for the first wheel on the first axle on the following program screen.
- Follow the instructions on the left-hand edge of the screen. Compensation is conducted in three stages and is shown graphically. (Fig. 125)
- Lower the vehicle back onto the turning plate.
- Then carry out run-out compensation on the same axle of the opposite wheel.
- After completing this process, measuring of this one vehicle axle can begin by pressing the **"Setup scales"** button. (Fig. 126)
- Run-out compensation must be carried out again for each wheel for every vehicle axle to be measured.

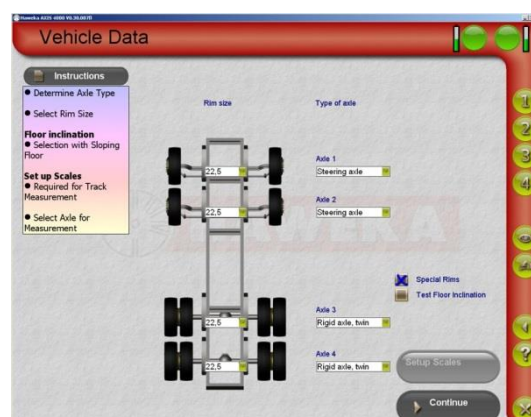


Note

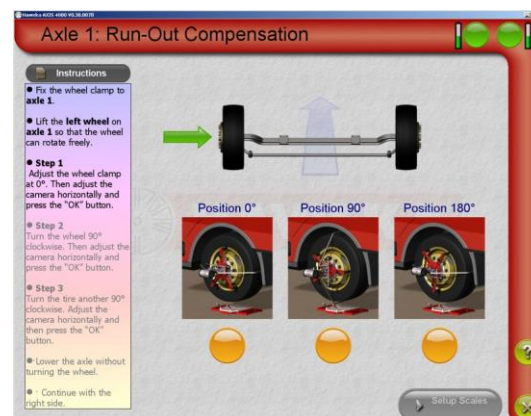
IF YOU SWAP VEHICLE AXLES DURING MEASUREMENT (BY CLICKING THE BUTTON 1 / 2 / 3 ETC.), YOU WILL HAVE TO CARRY OUT RUN-OUT COMPENSATION AGAIN.



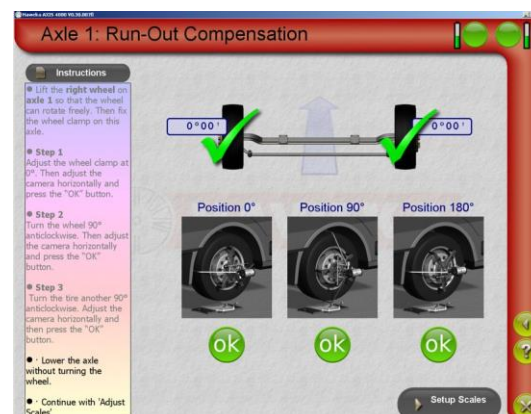
(Fig. 123)



(Fig. 124)



(Fig. 125)

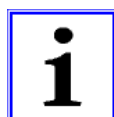


(Fig. 126)

17 Maintenance

17.1 Maintenance and care

The contact surfaces of the magnetic feet must always be kept clean and free from dirt. This is the only way to ensure full-surface contact and therefore secure positioning of the rim.



Note

Please note that the camera measurement heads, together with their accessories, are precision components. Always make sure that these components are used and maintained with the greatest of care.



Caution

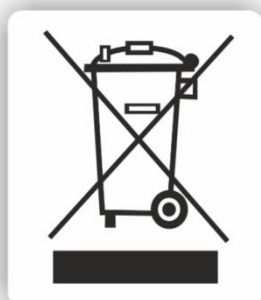
The protective cover in front of the camera lens must be cleaned with a dry, soft cloth when necessary. Never use alcohol or other liquids for cleaning!

Make sure that the reflectors are not scratched on the detecting side. **Scratched reflectors can lead to measurement errors.**



Only use the charging unit supplied to recharge the batteries in the camera measurement heads. This unit conforms with European safety standards and is especially designed for the batteries used in the AXIS4000 wheel alignment system.

18 Notice regarding disposal



The cameras and batteries must not be disposed off as regular waste. You can return the cameras to us within the scope of implementation of the Electrical and Electronic Equipment Act (law on putting into circulation, return and environmentally-friendly disposal of electrical and electronic equipment).

Send these to us directly (sufficiently stamped). We will dispose of the electronic components correctly and in an environmentally-friendly manner.

19 Fault-finding and correction



Caution

Operators may only themselves attempt to rectify such faults that are clearly due to operating or maintenance errors!

19.1 Description and causes of faults

Description	Possible causes	Fault correction
There is no connection established to the cameras after program start	• Not enough battery power left. • Incorrect interface connection specified in the program. • No or incorrect radio channel for camera connection No USB driver for the receiver installed on the operating system	• Recharge the batteries in the camera measurement heads using the charging unit supplied • After program start, select the "Settings" button; interface should be set to <i>AUTO</i> (see Pnt. 7.2.3) • Try to establish a new connection with another radio channel Install the USB driver which is on the USB-Stick (Pnt.6.3, Page 19)
The camera does not detect any signal from the reflectors	The reflectors are severely damaged or dirty	Clean reflectors or replace with new ones, if necessary
Camera measurement head is not seated securely on the rim	• Dirty rim surface • Dirty magnetic feet • No full-surface contact by the magnets with the rim	• Clean rim surface • Clean magnet surface • Re-align magnetic feet
Measurement results are unrealistic	• Front reflector distance from left to right differs from the rear distance from left to right • Measurement head alignment incorrect	• Check distances! Same reflector distances at front and back. • Check by carrying out a run-out test of the wheel alignment clamp and re-measuring the toe, if necessary contact the Service department

20 Appendix

20.1 Measurement report for vehicle measurement

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 Kokenhorststraße 4
 30938 Burgwedel
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 Fax: +49(0)5139/8996-222
 Web: www.haweke.com
 eMail: info@haweke.com

Mechanic:

 **HAWEKA®**

20.03.2009

Number plate: H-WK 1968
 Vehicle owner: HAWEKA

After Before		Before After		Before After	
Toe	0,0mm - 3,9mm	Total toe		- 0,1mm 0,0mm	Toe
Camber	---°---' 0°40'	- 3,9mm 0,0mm		1°00' ---°---'	Camber
Castor	0°39'	Steering gear middle position		0°37'	Castor
King pin inclination (KPI)	4°50'	2,7mm 0,0mm		4°45'	King pin inclination (KPI)
Toe out on turn	3°36'			5°27'	Toe out on turn
Max. turn	---°---' 32°09'			47°02' ---°---'	Max. turn
Toe	0,0mm - 0,5mm	Total toe		0,4mm 0,0mm	Toe
Camber	---°---' 0°40'	- 0,1mm - 0,1mm		1°01' ---°---'	Camber
Castor	0°44'	Parallelism of Steering Axles		0°37'	Castor
King pin inclination (KPI)	5°09'	- 0°13' 0°00'		4°51'	King pin inclination (KPI)
Toe out on turn	3°11'			4°28'	Toe out on turn
Max. turn	---°---' 29°09'			40°17' ---°---'	Max. turn
Toe	---,---mm -13,4mm	Total toe		13,3mm ---,---mm	Toe
Camber	---°---' 0°40'	- 0,2mm ---,---mm		1°01' ---°---'	Camber
Out of square					
- 1°34' ---°---'					
Offset					
- 1mm ---mm					
Toe	---,---mm 5,2mm	Total toe		- 5,1mm ---,---mm	Toe
Camber	---°---' 0°40'	0,1mm ---mm		1°02' ---°---'	Camber
Out of square					
0°36' ---°---'					
Offset					
- 1mm ---mm					

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<http://www.haweke.com>

E-Mail: info@haweke.com

21 EC Conformity Declaration

The manufacturer:

HAWEKA GmbH
Kokenhorststraße 4
D-30938 Burgwedel

hereby declares that the system described in the following:

Electronic wireless camera system for axle measurement on commercial vehicles
Type: AXIS4000

complies with the following directives and norms.

EMC directive	2014/30/EU
Low voltage directive	2014/35/EU
RED directive	2014/53/EU
RoHS 3 directive	2015/863/EU

Applied European norms:

EMC for radio units with a short range device (SRD)	(ETSI) EN 301 489-03 (ETSI) EN 301 489-01 (ETSI) EN 300 220-1 (ETSI) EN 300 220-2
Broadband transmission systems 2,4 GHz ISM-band	ETSI EN 300 328 V2.1.1
Interference immunity and interference emissions	EN 61326-1
Photobiological safety of lamps and lamp systems	EN 62471
Exposure limits for artificial optical radiation	BGI 5006
Protection: IP54	DIN EN 529
Shock test: Free fall	DIN EN 60068-2-31, EC

Design changes that affect the technical data specified in the operating instructions as well as the proper, intended use of the system render this conformity declaration invalid!

Burgwedel, 16.11.2022



CEO
 Dirk Warkotsch



(Signature)



HAWEKA GmbH

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