



Operating Instructions

Camera Adjustment System for ADAS

(Advanced Driver Assistance Systems)

SAD4000

Sensor Adjustment Device

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(Translation of the original manual)

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GEB 001 222

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1 General Safety Instructions

1.1 Operator's due diligence



Device safety can only be implemented during practical operation if all required applicable measures have been taken. The operator's due diligence includes planning such measures and checking their implementation.

In particular, the operator has to ensure that

- the camera adjustment system SAD4000 (referred to in the following only as SAD4000) is only used according to its intended use
- the SAD4000 is only used in a fully functioning state and free from defects
- the complete operating instructions are permanently available in a legible condition at the operating location of the device
- the device is only operated by accordingly qualified and authorised personnel
- all operating instructions and warning notices attached to the device have not been removed and are legible

The SAD4000 may only be structurally modified with prior written authorisation from the manufacturer!



Prior to each use of the SAD4000, it has to be checked for visible damage and it has to be ensured that the system is only operated when free from defects! Any defects that are identified have to be reported to a superior immediately!



Note

The user is independently responsible for proper operation and compliance with the safety regulations.

1.2 Basic safety measures for laser devices

The laser used in the camera housing is a Class 2 laser product. The laser radiation generated is not hazardous to the eyes for short periods of exposure (up to 0.25 s). When looking into the laser beam accidentally for a short period, the eye will be protected by the blink reflex.

NEVER INTENTIONALLY LOOK INTO THE LASER BEAM!

If you have reason to believe that your eyes have been damaged by the laser beam, seek the advice of an eye specialist immediately.

 Laser product CLASS 2 TYPE 1	Some basic instructions have to be followed for all lasers devices: - Never look directly into the beam! - Define beam paths precisely, avoiding drifting laser beams! - Hazardous reflections may be caused, particularly by shiny surfaces. Particular attention should therefore be paid to the position of the ACC camera on the crosshead before use. - The trajectory of the laser beam should not lie within the work area or where people are present. If this is unavoidable, ensure that the laser area is clearly recognisable and marked with the mandatory warning notices.
	Please refer to the accident prevention regulations (VGB 93 <i>Laser radiation</i>) for further safety instructions for working with lasers.

2 Product Description

Camera Adjustment System SAD4000

Item No. 924 000 016



Subject to technical modifications.

1.2 edition 01/2019

Images: HAWEKA AG / D-30938 Burgwedel

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2.1 Authorised intended use

- The SAD4000 was developed for testing and adjustment of an ACC* sensor on utility vehicles. It is also for testing the Multi-Function-Camera (MFC) of Advanced Driver Assistance Systems (ADAS) for trucks.
- The SAD4000 is an auxiliary module which is exclusively designed for measuring the ACC sensor on a truck in combination with the AXIS 4000 wheel alignment system.
- It cannot be used without the basic elements of the AXIS4000.
- Testing and alignment can be carried out quickly and reliably in “drive position” directly on the vehicle (with any required accessories).

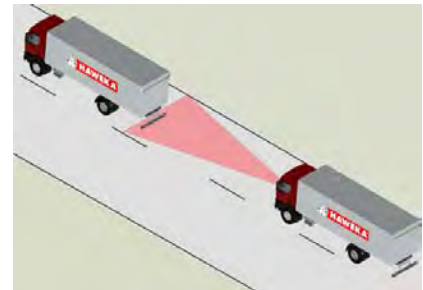


Note

The operator of the SAD4000, and not the manufacturer, shall be liable for all damage to persons and property caused by incorrect use!

* ACC = Adaptive Cruise Control

A radar distance sensor on the truck determines the relative speed and the distance to the vehicle in front, to provide data for the Advanced Driver Assistance Systems inside the vehicle.



2.2 Technical data

Measuring accuracy: The ACC sensor on the vehicle can be adjusted with an accuracy of up to 0.1 degrees

Laser:

Model:	DI650-1-3
Radiated power P_0	1 mW
Wavelength λ	650 nm
Operating range	10 m
Operating voltage:	3 V DC
Laser class	2 DIN EN 60825-1:1994-07

Camera:

Frequency range	2,4 GHz band (2405 – 2480 MHz) Automatic frequency correction
-----------------	--

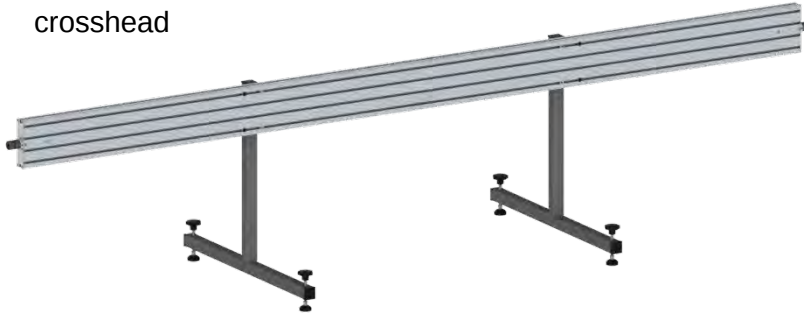
Power supply: Lithium Ion battery pack: 18650 CF 2S1P 7.4 V / 2250 mAh

Operating time with fully charged batteries: > 10 h

3 Equipment

3.1 Parts list for upgrade kit SAD4000

1 x crosshead



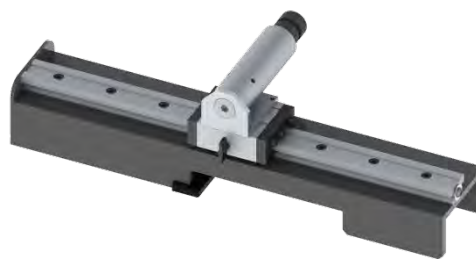
1 x item no. 924 001 148

1 x ACC camera



1 x item no. 924 001 187

1 x carriage



1 x item no. 913 052 132

1 x case

Item no. 900e008 383



USB-Stick / Software

1 x item no. 924 001 199



Operating instructions

1 x item no. GEB 001 222

3.2 Optional accessories for upgrade kit AXIS-ACC4000

1 x adapter mirror



1 x item no. 922 001 011

4 Preparatory measures

4.1 Design of the measuring crosshead



(Fig.1)

- The measuring crosshead consists of: 1 central part, 2 side parts, a carriage and an ACC camera.

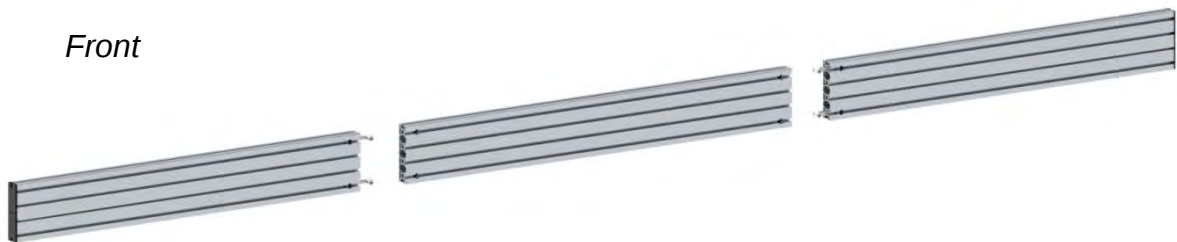
Step 1:

Assembly of the slide rails.

The two side parts must be connected to the left and right side of the central part.

Hereby, pay attention to the correct position of the side parts.

Front

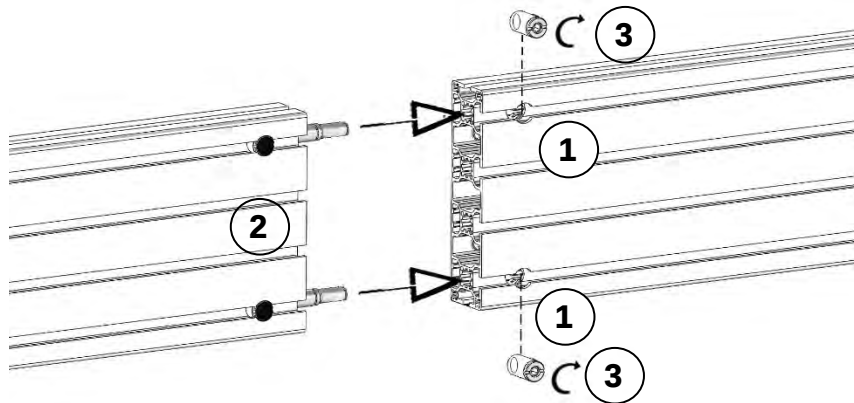


Rear



(Fig.2)

On the rear, all logos must be in the same direction.

Step 2:

(Fig. 3)

- 1.) Insert the fixing screws into the holes in the central part.
- 2.) Slide the side part with the centring pins into the central part until the pins are seated in the fixing screws.
- 3.) Use an Allen key to firmly lock the fixing screws on the pins.
 - Check the surfaces in the slide rails at the transition points. These must be aligned, otherwise the carriage could jam. As necessary, release the connection and realign the elements.
 - Repeat the process for the other side part.

Step 3:

- 1.) Slide the star grip screws through the holes in the support.
- 2.) Guide the device support to the side part and manually fasten to the side part by tightening the star grip screw.
- 3.) Repeat the process for the second device support.

Step 4:

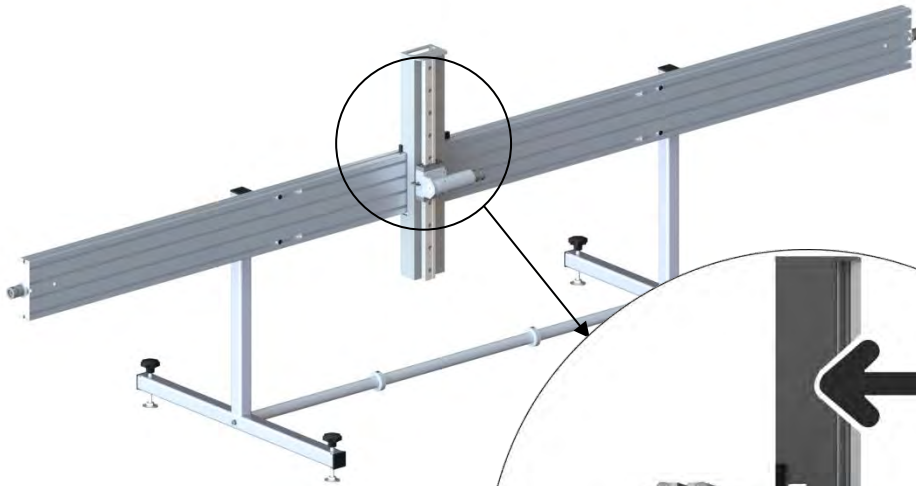
Using 2 bolts M8 x 50, connect the central rod between the device support.



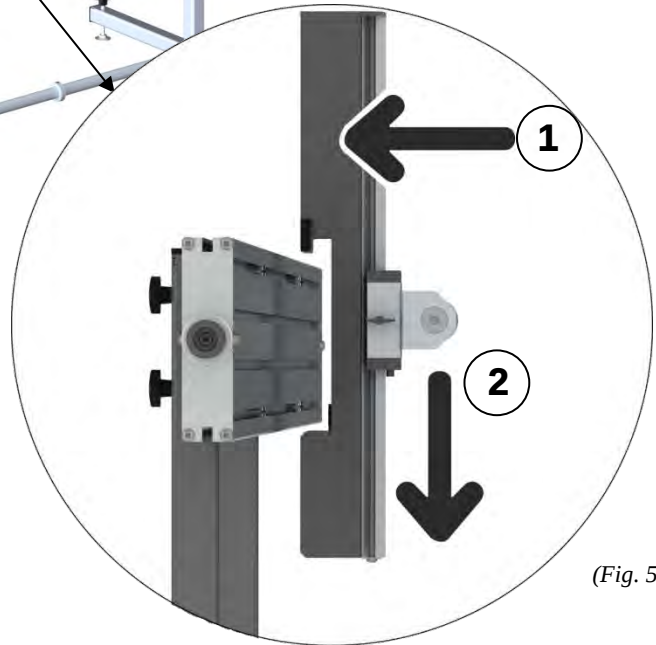
(Fig.4)



For the assembly of the calibration reflector, refer to Page 23.

**Step 5:**

Place the camera carriage on the slide rail of the crosshead from the front and set it into the guide groove (fig. 5)

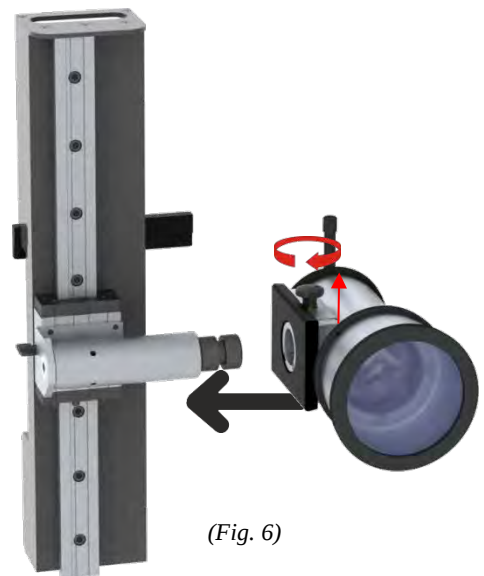


(Fig. 5)

Step 6:

Slightly release the fixing screw on the ACC camera and pull upwards.

Place the ACC camera on the log on the carriage and then carefully tighten the fixing screw so that the ACC camera can still be rotated on the pin.
(Fig. 6)



(Fig. 6)

4.2 Installing the software in Windows



Note

The **AXIS ACC** software is an independent program which is not started from within the AXIS400 application.

AXIS ACC is installed in addition to AXIS4000.

- Close all applications running on the computer
- Insert the USB-Stick into the PC



(Fig. 7)

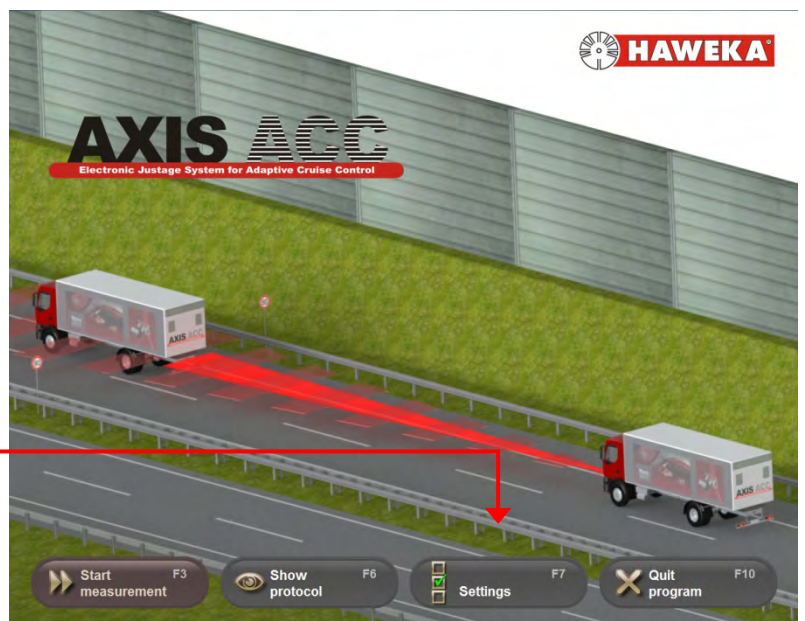
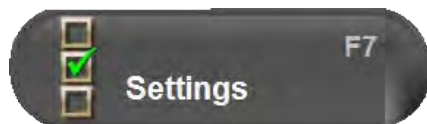
If the installation wizard does not start automatically, click Start on the Windows taskbar and select Run.

Enter `D:\axis_acc_setup_1.00.009` where "D" is the letter for the removable media.

- Read the licence agreement and follow the instructions of the installation wizard.
- When the installation is complete, the **AXIS ACC** software will have been installed on the computer.
- Remove the USB-Stick from the PC after installation.

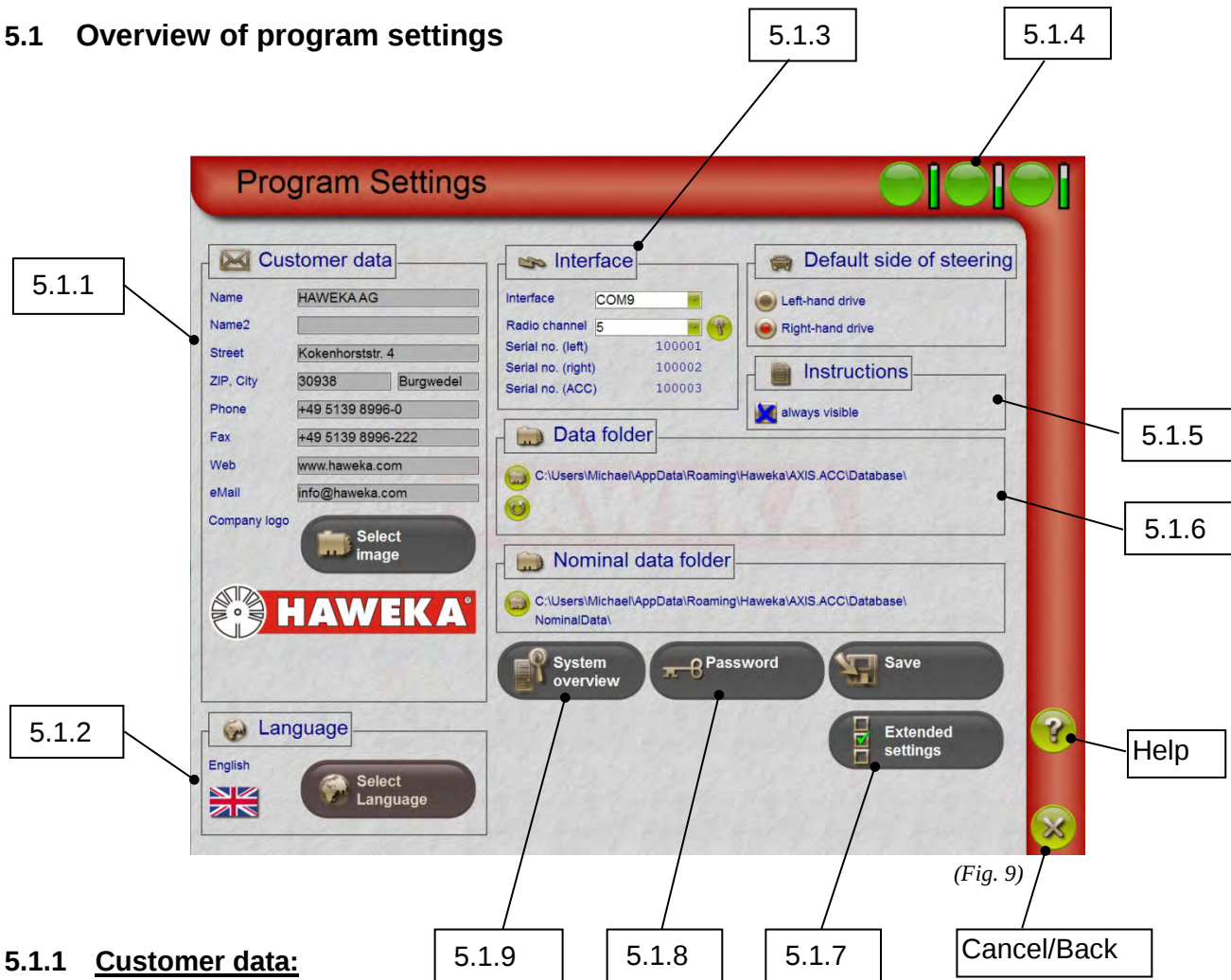
5 The AXIS ACC program

- Start the program.
- Click "**Settings**" on the start screen



(Fig. 8)

5.1 Overview of program settings



5.1.1 Customer data:

Enter your company name on the applicable lines so that the name can be included and printed on the measurement protocol. (Fig. 9)

“**Select image**” button:

A company logo can be saved to be displayed on the log.

Supported file types: BMP, JPG, GIF, PNG

The image size is scaled.



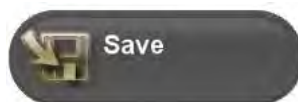
Note

Image files that are too small are enlarged, reducing their quality. The smallest format should be around 400 x 200 pixels at 72 dpi.

5.1.2 Language:

Click on the **Select Language** button to display menus and instructions in a different (approved) language. (Fig. 10)

All settings have to be confirmed by clicking “**Save**”.



(Fig. 10)

5.1.3 Interface:

The interface setting in the program should be set to “AUTO” for an automatic connection. The interface may be changed manually to a specific port if required (e.g. when using several systems).

Radio channel:

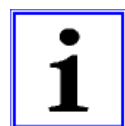
The radio channel set on the cameras for data transfer between the camera sensor and the program is displayed automatically.

The radio channel can be changed on the cameras if necessary and then has to be confirmed by clicking the **Magnify** button.



Magnify button

The dialogue window is divided into two columns. The left column displays the cameras that were found by the program but are not yet connected. The right column displays the camera(s) that are already connected to the program by radio. (Fig. 11)



Note

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

Serial number:

The serial numbers of the cameras are displayed as soon as the program has established a connection with the cameras.



(Fig. 11)

5.1.4 Information about camera symbols:

The connection to the cameras and the battery charge status are constantly checked and displayed during the entire program sequence.

Description of symbols:

The program has not yet made a connection query to the cameras; status unknown. (Fig. 12)



(Fig. 12)

The display is greyed out, the yellow circle is moving from left to right. The program is searching for additional cameras on all channels. (Fig. 13)



(Fig. 13)

The display flashes yellow and red alternately. The program is attempting to establish a connection with the cameras. (Fig. 14)



(Fig. 14)

Display is green: Connection to the camera has been established. (Fig. 15)



(Fig. 15)

Display is green, with a red centre: Connection has been established, but no reflector panel has been found.
(Fig. 16)



(Fig. 16)

Display is green with a yellow centre: Connection has been established and the reflector panel was found.
(Fig. 17)



(Fig. 17)

Charging state of the camera batteries
100 %, 75 %, 50 %, < 25 % capacity. (Fig. 18)



(Fig. 18)

The camera symbol flashes at a battery charge below 25 %. (Fig. 15)



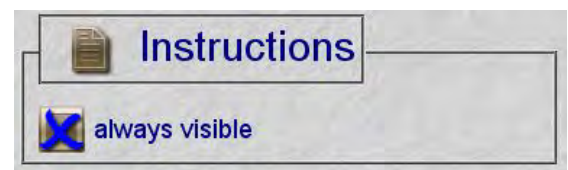
The camera has to be charged before carrying out any further measurements.



(Fig. 19)

5.1.5 Instructions

Specifying the default for displaying/hiding operating instructions during measurements.
(Fig. 20)



(Fig. 20)

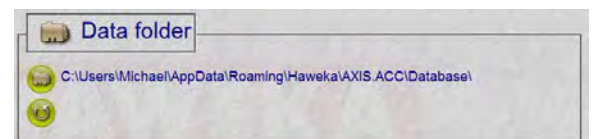


The instructions window can be displayed/hidden at any point in the program. Click on the **Instructions** button on the program page.



5.1.6 Data directory

All vehicle measurements are saved in a log file.
The preset file path is:
`C:\Users\BenutzerName\AppData\Roaming\Haweke\AXIS.ACC\Database\Results` (Fig. 21)



(Fig. 21)

To change the file location, click on "Folder":



To reset the default path, click on "Reset":

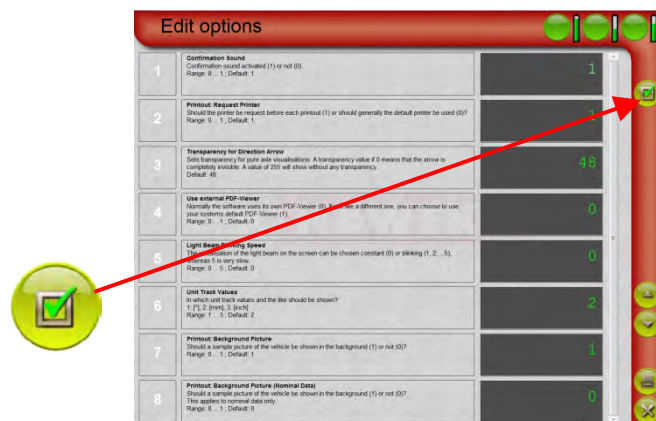


5.1.7 Advanced settings

Under advanced settings, the user can customise the program settings. (Fig. 22)

To customise settings, select the applicable parameter in the table and change the value.

The modified entries have to be confirmed by clicking on **“Accept values”**.



6 Preparing for measurement

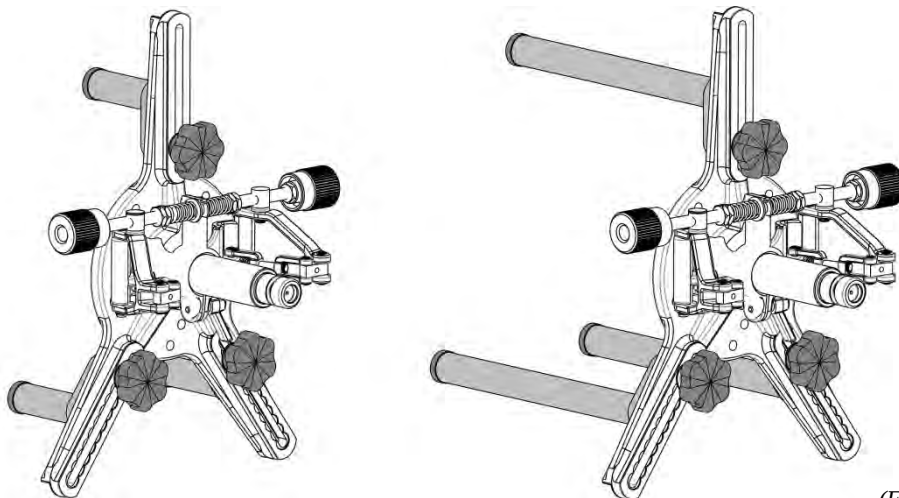
- The measurement has to be carried out on a level, horizontal floor
- Check that the vehicle has rims and tyres of the same size
- Check that the tyre pressure is correct
- Check the condition of suspension and shock absorbers
- Clean between the wheel nuts on the rims so the magnetic holders can ensure safe seating of the camera holder on the rim.

6.1 Mount the wheel alignment clamp



Note

The magnetic holders have to be converted for the rear wheels using the long magnetic feet (315 mm). (Fig. 25)



(Fig. 25)

- 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 holder.
- The wheel alignment clamp has to be placed on the **cleaned rim flange**. Two magnets should be located above the centre of the wheel and one magnet below. (Fig. 26)

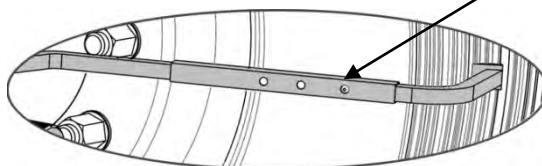


It has to be ensured that the camera mounting pins are aligned with the centre hole of the rim.

Note

For aluminium rims, the two clamping arms on the wheel alignment clamp have to be attached with screws.

- Hold the wheel alignment clamp at the centre of the wheel. Rest the magnetic feet on the rim flange and key the clamping arms into the tyre tread using the quick clamping test. (Fig. 27)
- Before tensioning, the clamping arms have to be adjusted on both sides so that they rest just in front of the tyre profile without tension.



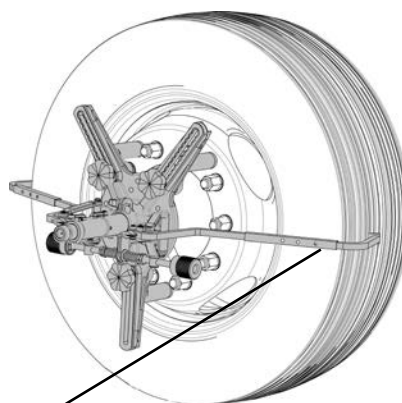
- Use the spindle on the tensioning head to tension the clamping arms until the wheel alignment clamp is seated firmly on the rim.

Attaching the camera

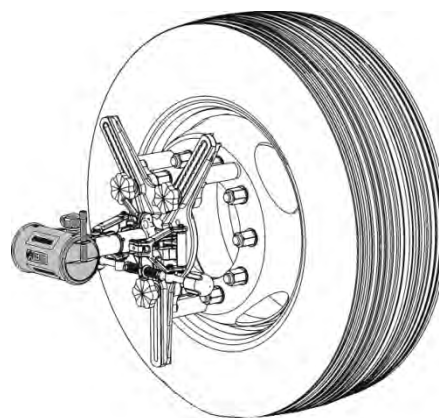
- Pull the camera mounting bolt gently upwards and slide the camera onto the camera mounting pin until the mounting bolt locks into the groove on the mounting pin.
- Then fix the camera to the pin by gently tightening the mounting bolt. (Fig. 28)
- Repeat the process for the second measuring head.



(Fig. 26)



(Fig. 27)



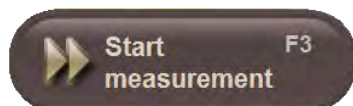
(Fig. 28)

7 Setting up the SAD4000 measuring unit

7.1 Defining vehicle data in the program

The sending/receiving unit is connected to the PC and the PC is switched on. The **AXIS ACC** program is started and on the start page. (Fig. 29)

- Click on **"Start measurement"**.



- Enter the specific vehicle data on the new screen page (fig 30)
- Entering the ACC data for the radar sensor. 7



Note

For all radar sensors with a reference mirror, the parameters for the deviation of the reference mirror to the radar axis have to be provided. (Fig. 30)



Note

The values for the deviations between reference mirror and radar axis were determined at the factory and are stored in the vehicle software.

These values are:

Azimuth Offset AZOF
Azimuth Offset ELOF

horizontal deviation of the radar axis
vertical deviation of the radar axis

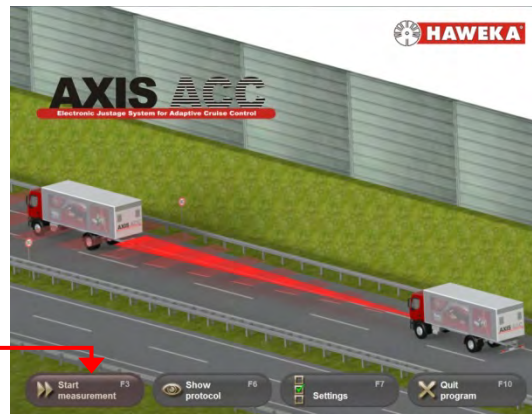
The values of these parameters are generally in the range between – 0.5 to + 0.5 degrees.



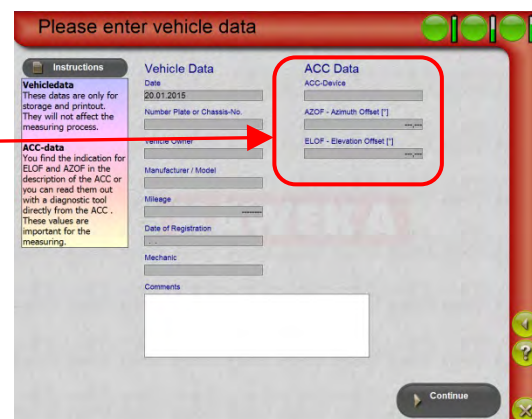
Attention

Failure to enter the AZOF and ELOF values for radar sensors with reference mirror will result in incorrect optical alignment of the radar sensor.

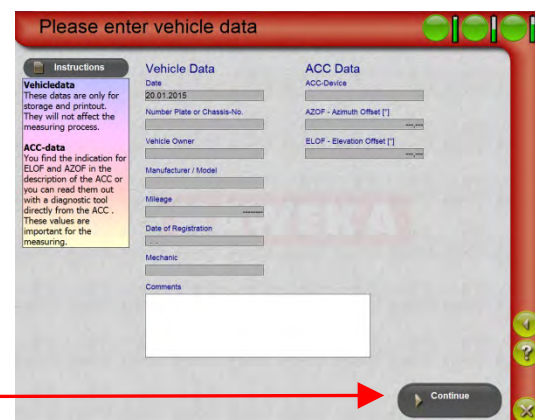
- When all relevant vehicle data have been entered in the program, complete this section by clicking **"Continue"**. (Fig. 31)



(Fig. 29)



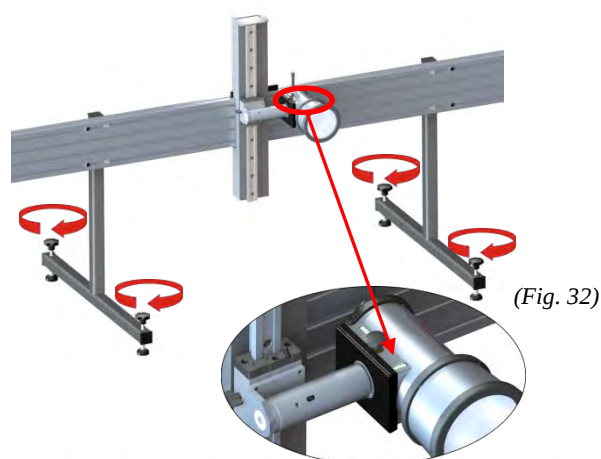
(Fig. 30)



(Fig. 31)

7.2 Aligning the measuring crosshead and the reflector support (AXIS4000) with the vehicle

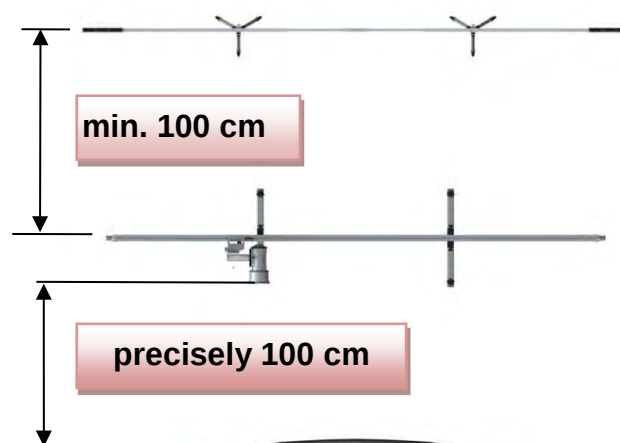
- Place the crosshead in front of the vehicle, parallel to the rear vehicle axle. (Fig. 33)
- Align the crosshead horizontally using the setting screws. Observe the spirit level on the ACC camera. (Fig. 32)
- Slide the camera carriage in the crosshead sideways until the ACC camera points towards the radar sensor of the vehicle.
- Position the camera at the same level as the ACC sensor on the vehicle.



Note

Place the crosshead in front of the vehicle so that the distance between the camera and the sensor on the vehicle is precisely 100 cm.

- Then place the reflector supports with the tripods (from AXIS4000) in front of and behind the vehicle and align them visually parallel to the vehicle axis.



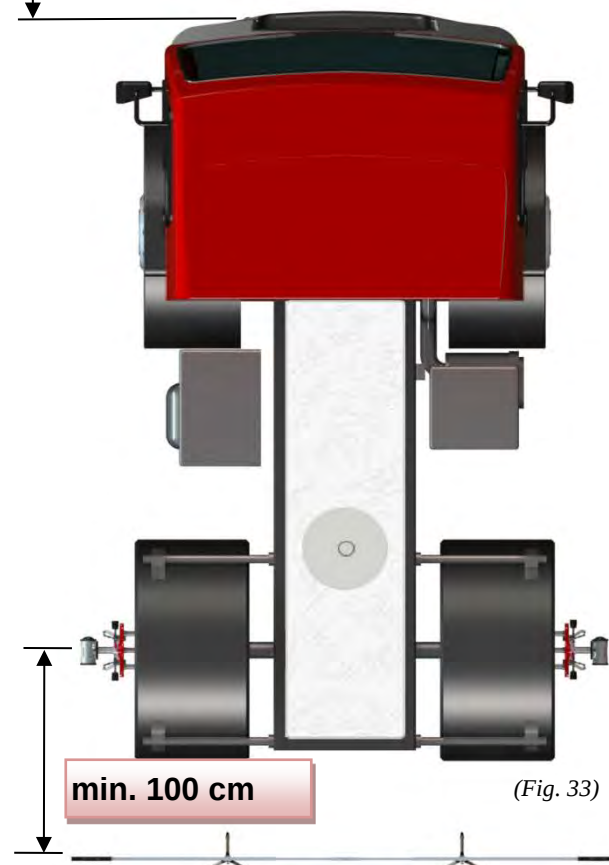
It has to be ensured that the reflector supports are placed close enough to the vehicle, but at least 1 metre from the camera and parallel to the vehicle rear.



Note

The reflector panels have to be aligned along a horizontal line with the cameras.

The height can be adapted using the adjustable tripods.



The program sequence of **AXIS ACC** will now guide the user through the individual processes step by step.

The relevant instructions on the left side of the screen support the user.

- Mount the cameras on the left and right of the vehicle and direct towards the rear reflectors. (Fig. 34)

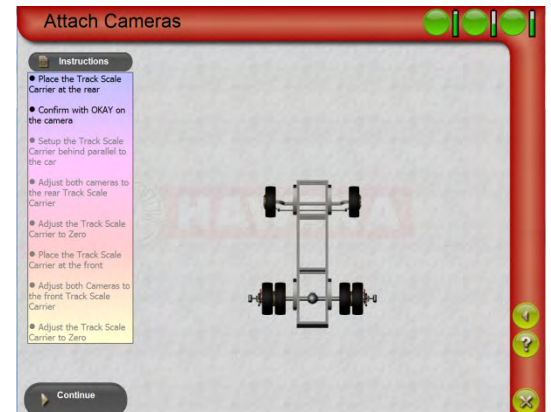
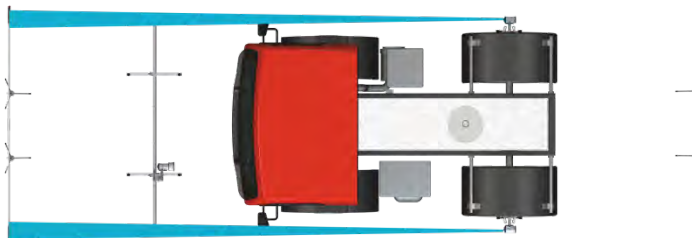
The next step describes how to align the reflector supports.

- Move the reflector supports sideways so that the bar on the screen moves from red to yellow and green and nearly reaches the value "0". (Fig. 35+36)

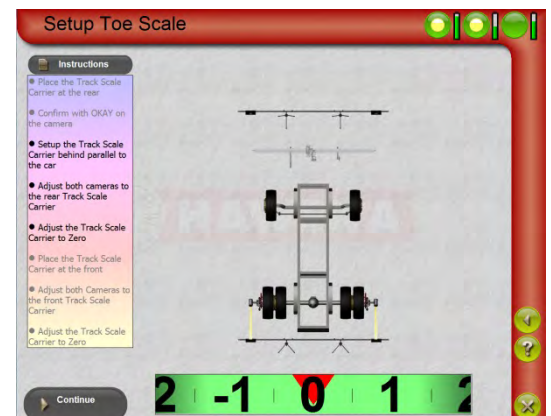


Note

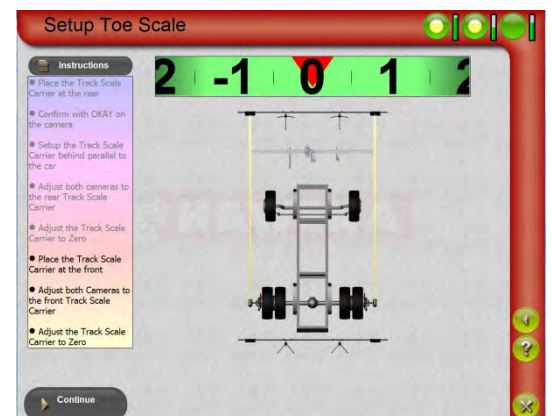
THE TRIPODS REMAIN IN PLACE! ONLY MOVE THE REFLECTOR SUPPORT.



(Fig. 34)



(Fig. 35)

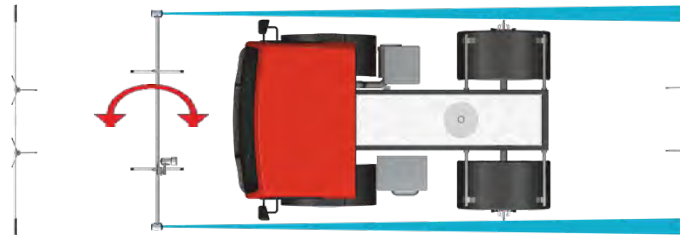


(Fig. 36)

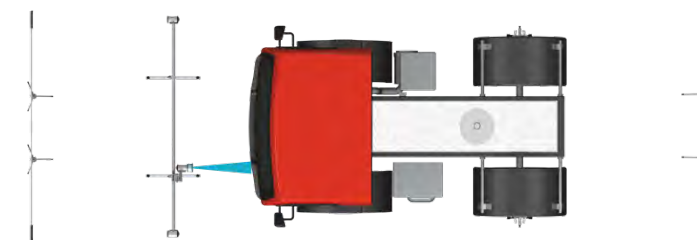
- Mount the cameras left and right on the crosshead and direct them towards the front reflector panels.
- Slide the crosshead parallel to the vehicle until the display shows “0”. (Fig. 37)



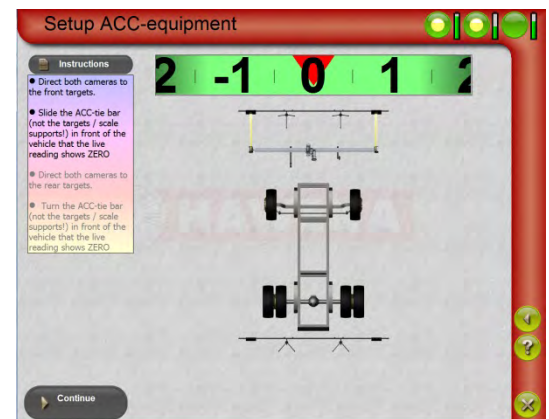
- Turn the cameras on the crosshead and direct towards the rear reflector panels.
- Now turn the crosshead until the display reaches “0”. (Fig. 38)



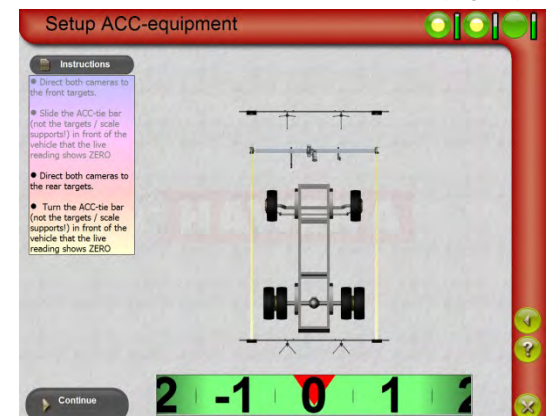
- Now the laser is activated. The adjustment of the ACC camera takes place towards the reference mirror of the radar sensor. The incline of the ACC camera will be aligned until the display reaches “0”. (Fig. 39)



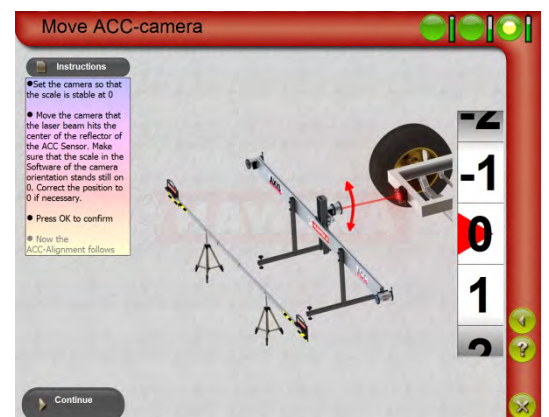
- Then confirm with **OK** on the camera. This completes the setup of the measuring unit. (Fig. 40)



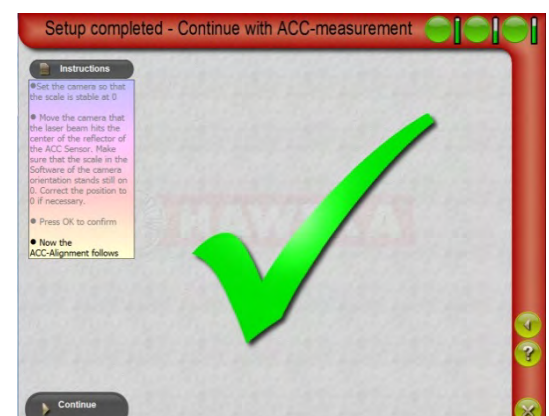
(Fig. 37)



(Fig. 38)



(Fig. 39)



(Fig. 40)

8 Measuring and adjusting the ACC sensor

8.1 Measuring the ACC sensor with reference mirror

The measurement starts immediately after confirming setup of the program with **"Continue"**.

The laser on the ACC camera is activated and emits its beam directly on the reference mirror of the ACC sensor. (Fig. 41)



(Fig. 41)

The reflecting laser beam is projected via the reference mirror of the sensor in the vehicle and back to the ACC camera. The measuring result is immediately displayed in the program digitally and graphically in degrees. (Fig. 42)

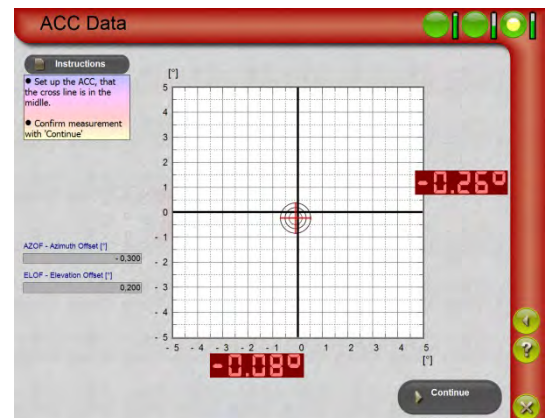
- The read value has to be compared to the manufacturer's SET values and adjusted using the adjustment screws on the ACC sensor if required.



Note

The settings are displayed in the program in real time.

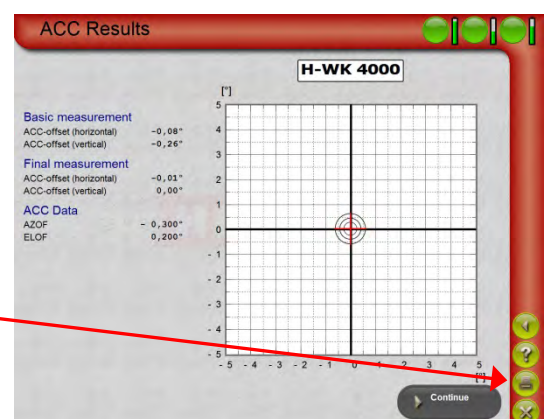
When the required settings have been made, click **"Continue"** to finish the measurement.



(Fig. 42)

The programme changes to the overview page and the individual measuring values before and after the adjustment are displayed. (Fig. 43)

- Use the **"Print"** button to print the measurement log. (See appendix 11.1 Printing the measurement log.)



(Fig. 43)

8.2 Measuring the ACC sensor without reference mirror

For an ACC sensor without a reference mirror (fig. 45), the optional adapter mirror 922 001 011 (fig. 44) has to be mounted on the ACC sensor of the vehicle.

- Attach the adapter mirror to the ACC sensor accordingly and secure with the knurled screws. (Fig. 46 & fig. 47)



Note

If the adapter mirror is mounted correctly it will sit parallel to the radar output area of the ACC sensor. (Fig. 44)

This will direct the laser beam of the ACC camera directly onto the adapter mirror of the ACC sensor.

The now reflecting laser beam is directed via the adapter mirror and back to the ACC camera on the measuring crosshead.

- The value determined for the ACC sensor is displayed in the diagram. (Fig. 49)
- The read value has to be compared to the manufacturer's SET values and adjusted using the adjustment screws on the ACC sensor if required.

When the required settings have been made, click "**Continue**" to finish the measurement.

- Use the "**Print**" button to print the measurement log. (See appendix 12.1 Printing out the measurement log.)



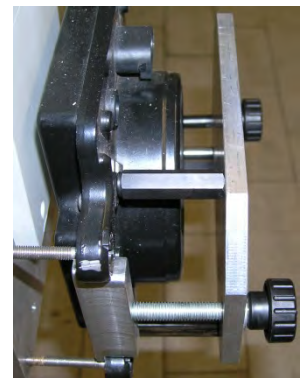
(Fig. 44)



(Fig. 45)



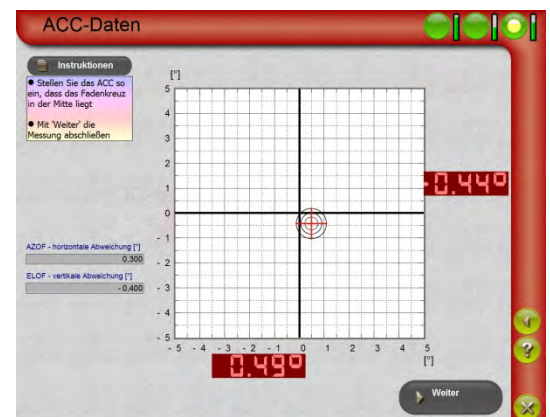
(Fig. 46)



(Fig. 47)



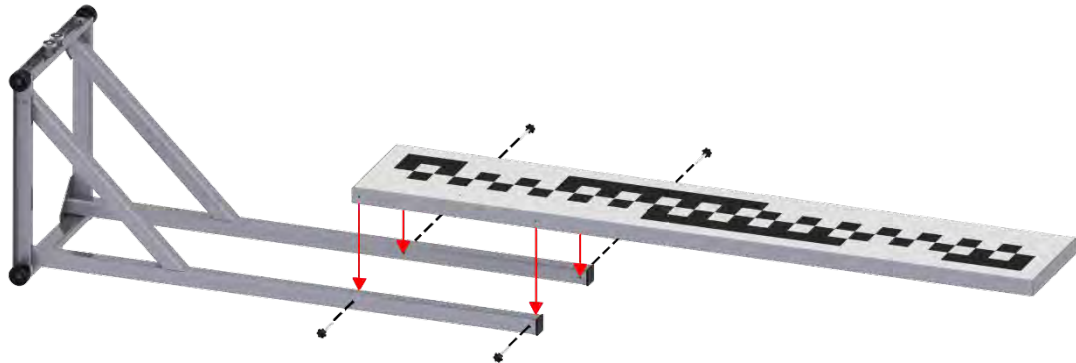
(Fig. 48)



(Fig.49)

9 Calibration Reflector for the Multi-Function-Camera (MFC)

9.1 Assembly of the calibration reflector



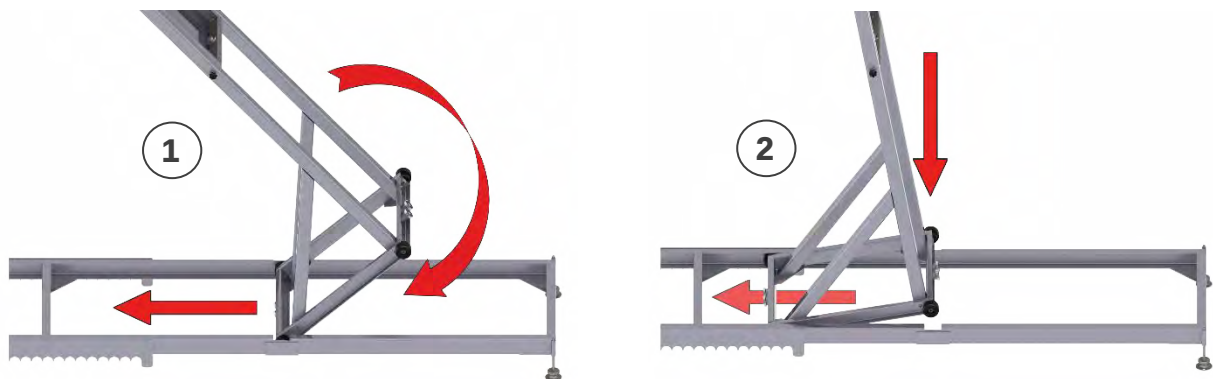
(Fig.50)

Step 1:

Using 4 star grip screws M6 x 60, attach the reflector panel to the stand. The reflector panel must be screwed together with the stand (using 4 pcs. of star grip screws M6 x 60).

Step 2:

Insert the stand, with the reflector panel, into the base frame.



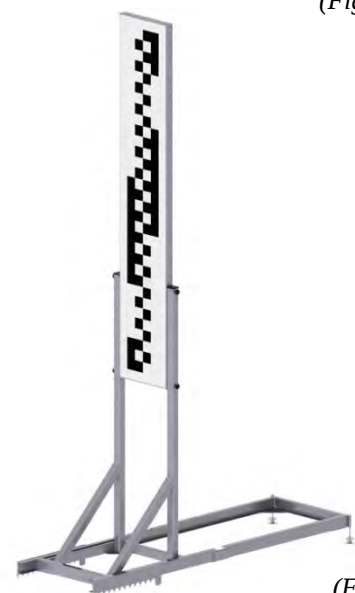
(Fig. 51)

- Tilt the reflector panel and first insert with the front rollers.
- Subsequently, push the reflector panel to the rear and insert the back rollers.
- Push the reflector stand and check for ease of movement.



Note

Make sure that the running surfaces of the base frame are always clean and free from grease and dust.



(Fig. 52)

9.2 Setting the calibration reflector

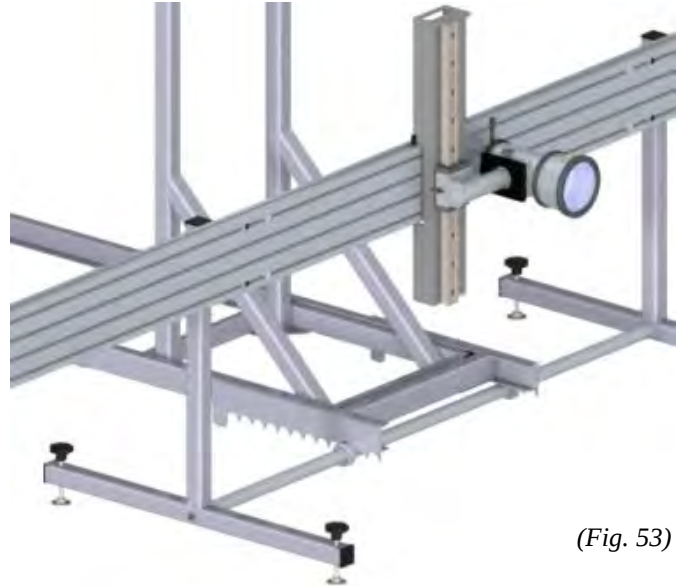
Aligning the position:

The calibration reflector must be positioned in front of the MFC. The distance between is specified by the vehicle manufacturers.

- For this, the base frame of the calibration reflector is hung into the central rod of the previously aligned crosshead.
(Fig. 53)

The base frame of the calibration reflector has different positions to engage.

- Depending on the type of vehicle, select a position to engage for the specified distance.



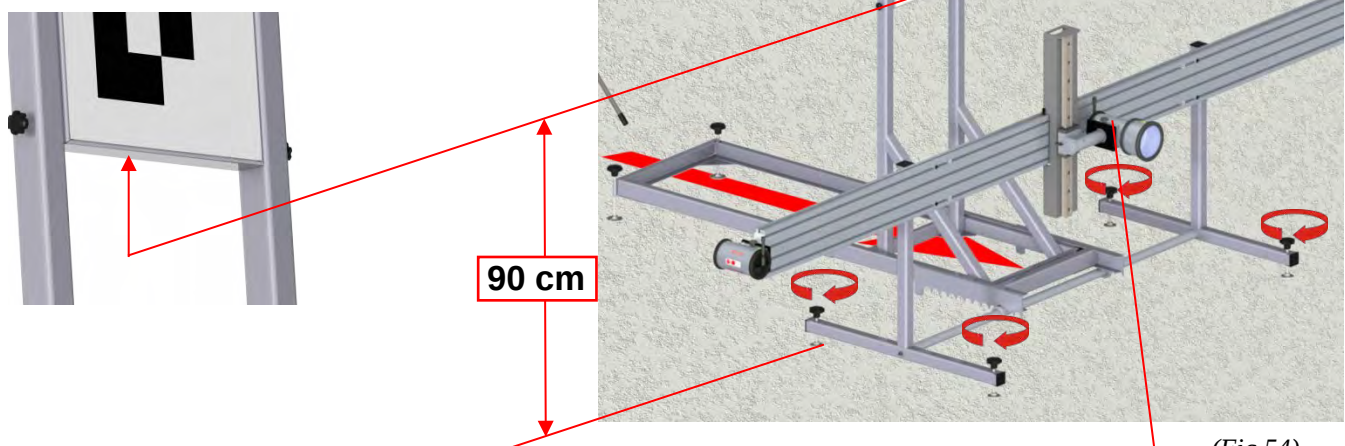
(Fig. 53)

Aligning the height:

- The reflector stand is pushed to the front position until the magnets rest on the base frame. (Fig. 54)

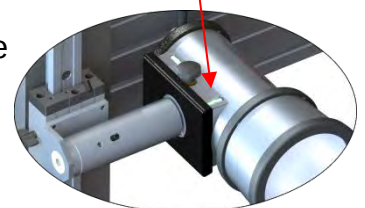
The lower edge of the reflector panel* must be a distance of exactly 90 cm from the floor (± 1 cm).

* Lower edge of the reflector panel



(Fig 54)

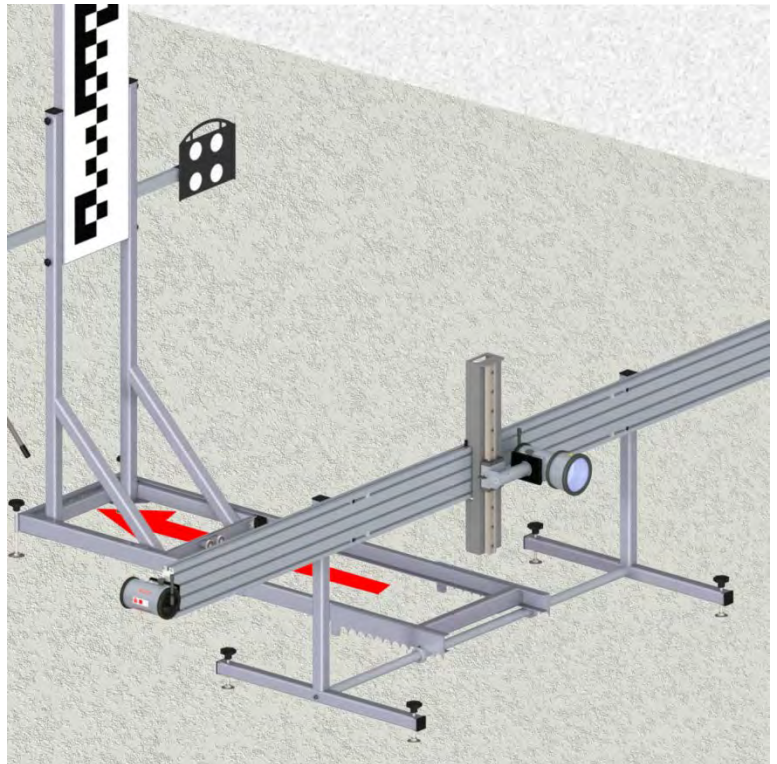
- Correction of the height is carried out using the setting screws of the crosshead.
- When the crosshead has been adapted in height, it must be checked using the level I and, as necessary, readjusted.
Also refer to Figure 32, Page 18.



Aligning horizontally:

Subsequently, the reflector panel must be aligned into a horizontal position.

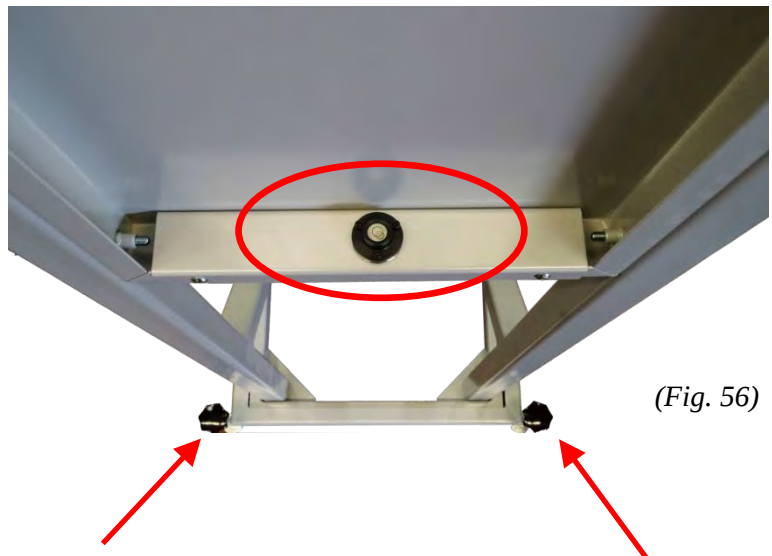
- For this, the reflector stand is put into the rear position until the magnets rest on the base frame. (Fig. 55)



(Fig. 55)

There is a spirit level located on the rear of the reflector.

- Using the spirit level, the reflector panel is aligned by the rear setting screws of the base frame. (Fig. 56)



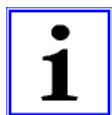
(Fig. 56)

Thus, setting the calibration reflector is completed and calibration of the MFC can be carried out in accordance with the specifications from the vehicle manufacturer.

10 Servicing

10.1 Maintenance and Care

The measuring crosshead with the sliding carriage, the ACC camera and the magnetic holder always have to be kept free from dirt.



Note

Please note that the components and their accessories are precision parts. These components have to be used and maintained with great care at all times.



Attention

Clean the protective screen in front of the camera lens with a dry, soft cloth, if necessary. Never use alcohol or other liquids!
Ensure not to scratch the detection side of the reflector panels.
Scratched reflectors may cause errors when measurements are recorded.



Only use the charger from AXIS4000 for charging the batteries in the camera measuring heads. This charger conforms to European safety standards and has been designed specifically for use with the batteries in the cameras.

11 Error description



Attention

Operators may only redress malfunctions that are clearly the result of operating or maintenance errors!

11.1 Description and causes of errors

Description	Possible causes	Troubleshooting
There is no connection to the cameras after program start	• There is insufficient battery power. • Incorrect interface connection specified in the program. • No or incorrect radio channel for the camera connection. • No USB driver installed for the receiver	• Charge the batteries in the camera measuring head • Click on "Settings", the interface should be set to AUTO (see 5.1.3) • Try to establish a new connection over a different radio channel • Install the USB driver from USB-Stick.
Wheel alignment clamp does not sit securely on the rim	• Dirty rim surface • Dirty magnetic holder • Magnets on the rim are not fully in contact • Vehicle with aluminium rims	• Clean the rim surface • Clean the magnet surface • Realign the magnetic feet • Use the clamping arms (AXIS4000)
The camera is not detecting any signals from the reflector panels	• The reflector panels are badly damaged or dirty. • The distance between camera and target detection is too small.	• Clean the reflector panels, or replace with new reflectors, if necessary. • Move the reflector support to at least 1 metre distance from the camera.

12 Appendix

12.1 Printing out the measurement log

HAWEKA AG
Kokenhorststr. 4
30938 Burgwedel
Phone +49 5139 8996-0 — Fax +49 5139 8996-222
Web www.haweke.com — eMail info@haweke.com



Mechanic:

20.01.2015, 15:39
Number plate: H-WK 4000
Vehicle owner: HAWEKA AG

Date of Registration: . . .
Mileage: 123123

Basic measurement

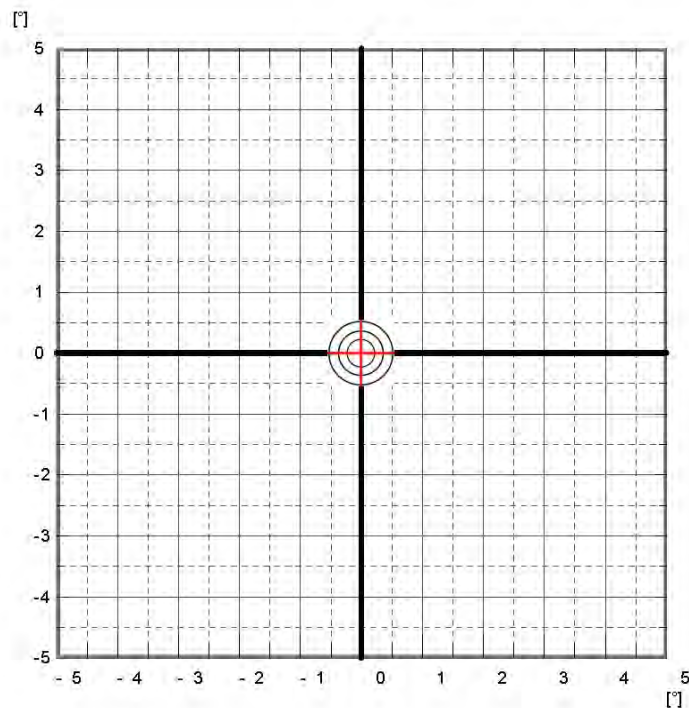
ACC-offset (horizontal) -0,08°
ACC-offset (vertical) -0,26°

Final measurement

ACC-offset (horizontal) -0,01°
ACC-offset (vertical) 0,00°

ACC Data

AZOF - 0,300°
ELOF 0,200°



13 EC Declaration of Conformity

The manufacturer:

HAWEKA AG
Kokenhorststraße 4
D-30938 Burgwedel

hereby declares that the system described
 in the following:

Camera Adjustment System
SAD4000

complies with the following directives and
 standards.

EMC directive	2014/30/EC
RED directive	2014/53/EC
RoHS directive	2011/65/EC

Applied European norms:

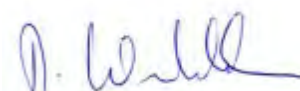
EMC for radio units with a short range device (SRD)	(ETSI) EN 301 489-03 (ETSI) EN 301 489-01 (ETSI) EN 300 220-1 (ETSI) EN 300 220-2
Broadband transmission systems 2,4 GHz ISM-band	ETSI EN 300 328 V2.1.1
Interference immunity and interference emissions	EN 61326-1
Photo biological safety of lamps and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

Burgwedel, 04/12/2017



Managing director:
 Dirk Warkotsch



(Signature)



HAWEKA AG

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