Measuring Wheel System

Wheel alignment system

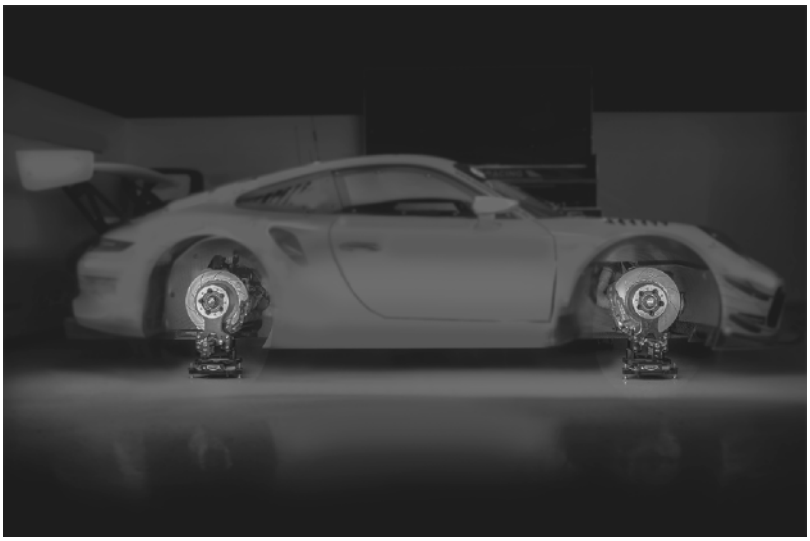

Figure 1

Foreword: This operating manual describes the functionality of the wheel alignment system and explains operation of the system and its components step by step. Please read these operating instructions carefully before starting the system and inform all operators of the steps described in this manual. The wheel alignment system is designed to simplify and optimize vehicle alignment. However, some safety instructions must be observed during use. Despite the precise manufacturing tolerances and quality features of the system, it is important to mention that all measuring systems can only provide accurate results if, in addition to correct operation, care is taken in the handling and storage of the components. It is expressly stated that some components (camber gauge, toe laser, etc.) must be inspected regularly to ensure that they are accurate. In most cases, these checks can be conducted by the operator. These checks are described insofar as possible in this manual. This manual describes the wheel alignment system, including all available options.

If you have questions or technical support enquiries, please contact Manthey-Racing GmbH

These instructions are not necessarily exhaustive.

WARNING

Risk of material damage if the tightening torque is too high.

- **Risk of damage to central lock nut.**
- **Risk of damage to vehicle parts.**

⇒ **The specified torque of 100 Nm (74 ftlb) must not be exceeded. The central lock nuts must NOT be installed using an impact bolter.**

NOTICE

- **Before starting alignment, please check the following points:**

⇒ **Fuel tank is completely full**

⇒ **The driver's weight was determined and an equivalent replacement weight is placed on the driver seat, or a weight of 75 kg / 165 lbs is assumed**

Model Year: **As of 2021**

Content

1. Overview of components

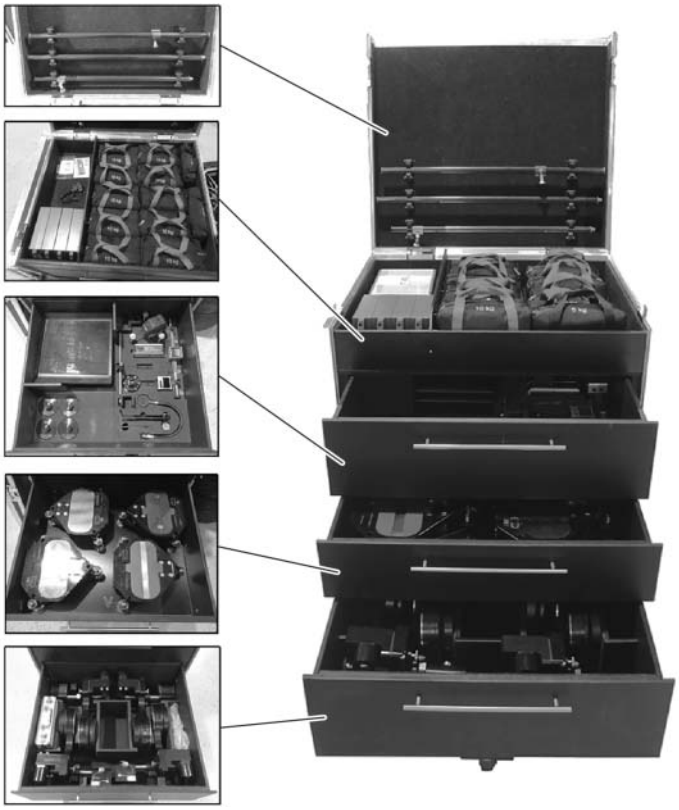

Figure 2

1.1 Lid contents

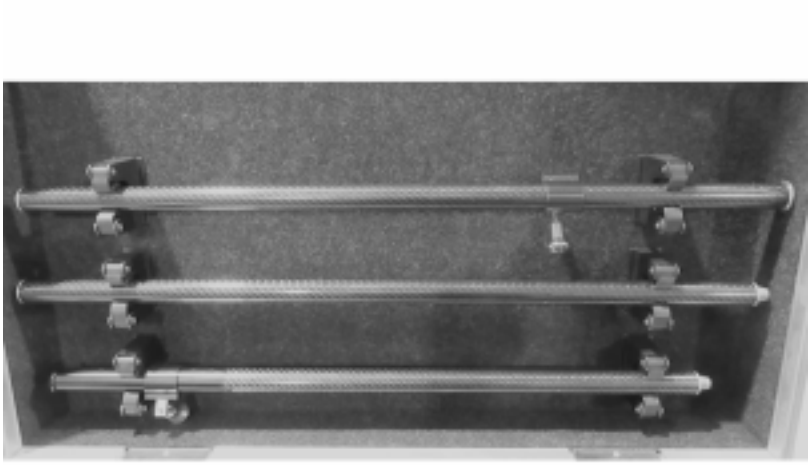

Figure 3

The three-piece toe width ruler is stored in the lid of the transport case. The toe width ruler is part of the basic system equipment.

To ensure easy and precise handling, the toe width ruler is made from rigid, light carbon fibre composite material.

1.2 Upper compartment contents

Figure 4

The upper compartment⇒ *Figure 4* is intended for optional components.

The weight bags (10 x 10 kg/ 22 lbs and 2 x 5 kg/ 11 lbs) can be stored safely here.

If the available electronic steering wheel scales with quick connector for racing vehicles is ordered with Krontec QR-30 quick connector, the charger with a mini-USB connection can be stored here.

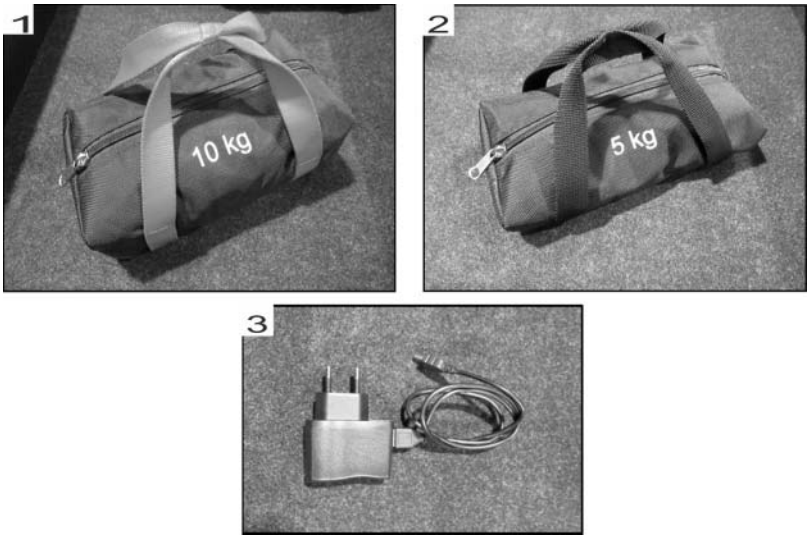

Figure 5

⇒***Figure 5* -1-** – Weight bag: 10 kg/ 22 lbs
⇒***Figure 5* -2-** – Weight bag: 5 kg/ 11 lbs
⇒***Figure 5* -3-** – Mini-USB charging cable for wheel scales (120V wall plug and adapter not included)

1.3 Contents of drawer 1

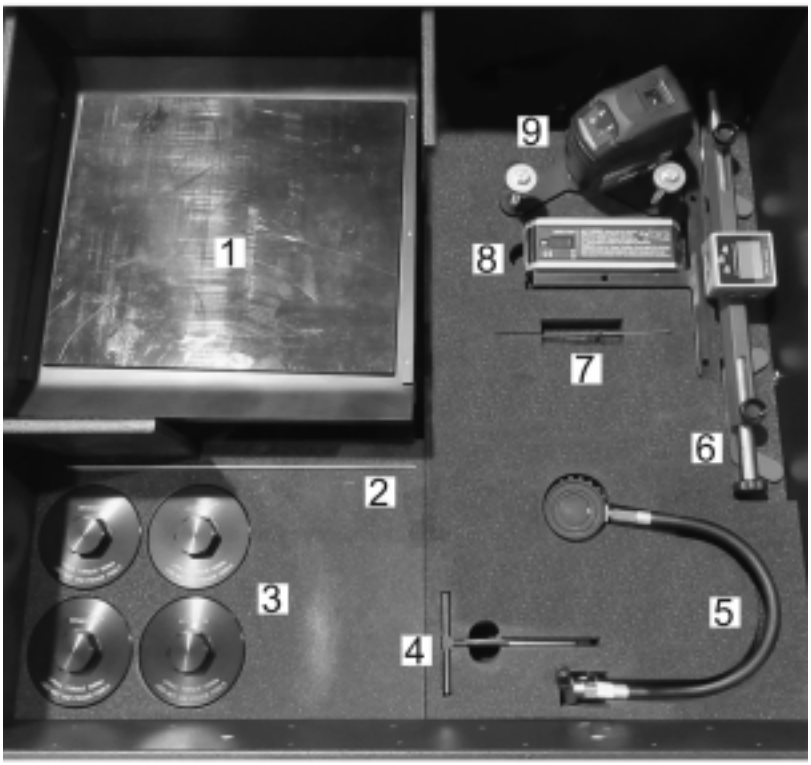

Figure 6

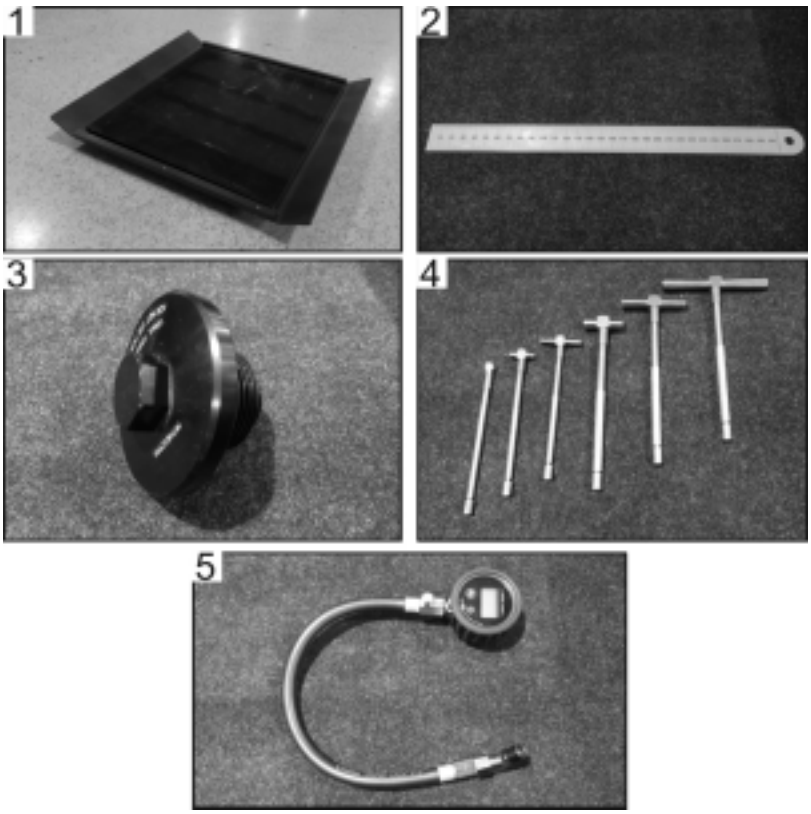

Figure 7

⇒***Figure 7* -1-** – Rotary plate
⇒***Figure 7* -2-** – Steel ruler, 300 mm
⇒***Figure 7* -3-** – Central lock for wheel nuts
⇒***Figure 7* -4-** – Various height gauges
⇒***Figure 7* -5-** – Air pressure tester

NOTICE

- **The standard central lock nuts on Porsche vehicles (model series 991) are not compatible with the measuring wheels. The central lock nuts shown here must be used for measuring.**

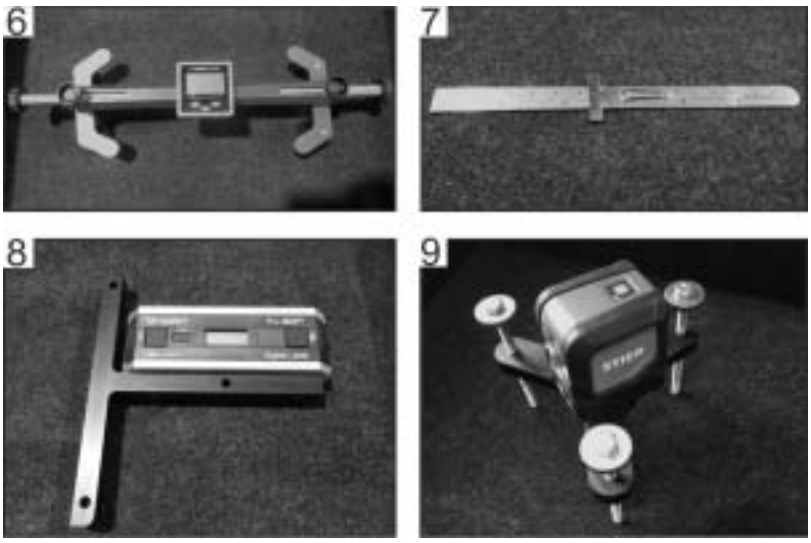

Figure 8

⇒***Figure 8* -6-** – "Universal" steering wheel scales
⇒***Figure 8* -7-** – Steel ruler: 150 mm
⇒***Figure 8* -8-** – Camber gauge
⇒***Figure 8* -9-** – Levelling laser with stand

1.4 Contents of drawer 2

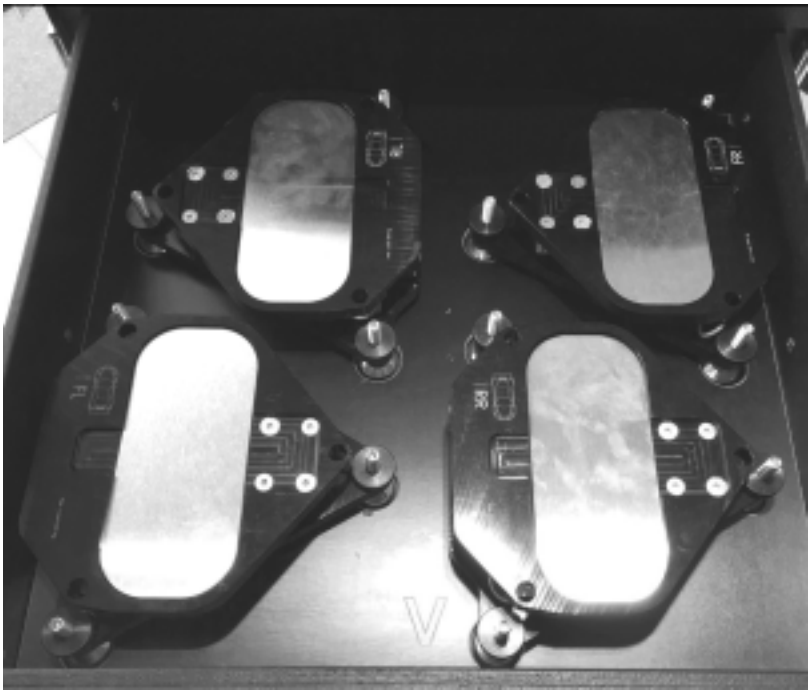

Figure 9

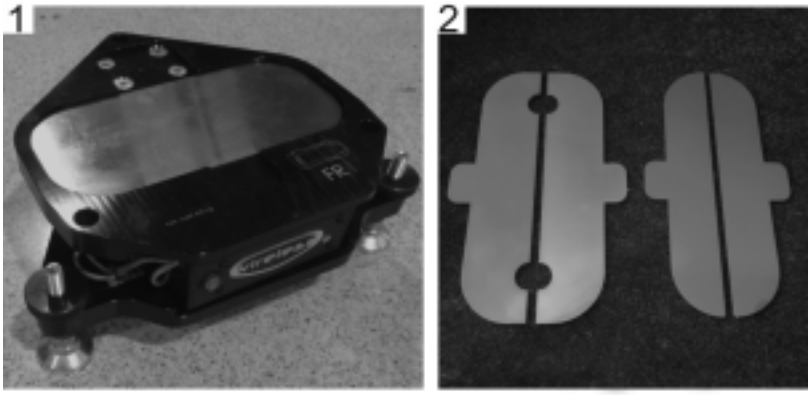

Figure 10

⇒***Figure 10*** **-1-** – Measuring table
⇒***Figure 10*** **-2-** – Insert, FA/RA

1.5 Contents of drawer 3

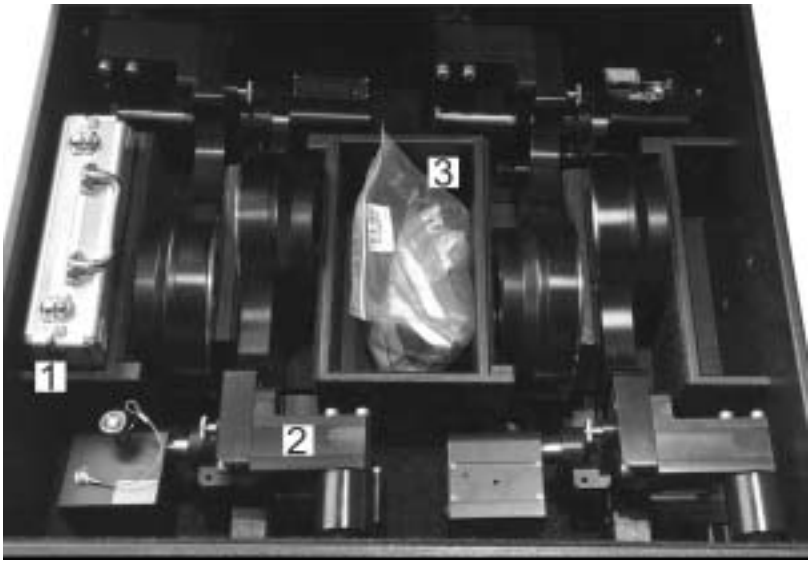

Figure 11

Figure 12

⇒***Figure 12* -1-** – Tablet with accessories
⇒***Figure 12* -2-** – Measuring wheel
⇒***Figure 12* -3-** – Pack of screws/washers

* The screws and adjusting shims supplied allow the measuring wheels to be adjusted according to the respective requirements (RO compensation and height adjustment).

2. Detailed information on the measuring wheel

2.1 The measuring table

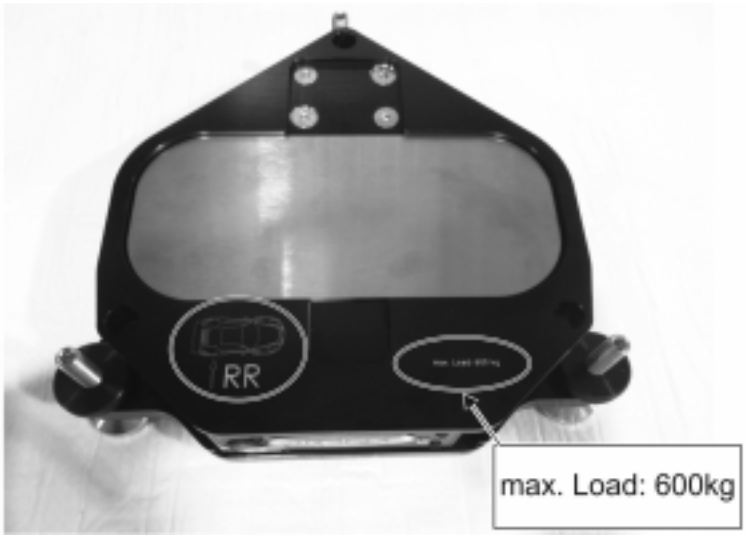

Figure 13

Four measuring tables are supplied. Each measuring table is allocated to a fixed position on the vehicle and identified accordingly.

The measuring tables perform two functions. On the one hand, once they have been aligned, the four measuring tables operate as an absolutely level contact surface for the measuring wheels. A wheel-load scale (load cell) for determining and transmitting the specific wheel load is integrated in each measuring platform.

RR —> Rear Right

RL —> Rear Left

FR —> Front Right

FL —> Front Left

NOTICE

- **Incorrect assignment of measuring tables will necessarily result in incorrect wheel load values!**

WARNING

Risk of material damage due to excessive load.

- **Risk of damage to the measuring table.**

⇒ **The maximum support load per measuring table must never be exceeded by 600 kg (1322 lbs). The vehicle must be carefully and evenly set down on the measuring tables. Failure to observe this will result in mechanical damage to the load cell.**

Figure 14

⇒***Figure 14*** **-1-** – Wheel load scale / This side must always face outwards towards the operator
⇒***Figure 14*** **-2-** – On/off switch on the wheel load scale
⇒***Figure 14*** **-3-** – The status LED indicates the state of the battery

Green LED charge state **OK**

Yellow LED, battery status **CRITICAL**

Red LED batteries empty - **REPLACE**

WARNING

Danger of material damage and injury

•

⇒ **The vehicle may only be measured using the wheel measuring wheel system on a solid substrate with sufficient load-bearing capacity. The measuring tables could topple over! Failure to take this point into consideration may result in serious injury and damage!**

Position the four measuring tables under the measuring wheels. The ball rollers of the measuring wheels may only come in contact with the measuring gauges in the hatched area.

⇒***Figure 15* -4-** – The ball rollers of the measuring wheels may only come in contact with the measuring gauges in the hatched area

⇒***Figure 15* -5-** – The height and level of the measuring table are adjusted using the three threaded pins.

⇒***Figure 15* -6-** – If the height and alignment of the measuring table are adjusted, the threaded pins must be secured with the knurled nuts to prevent them from being misaligned accidentally

Figure 15

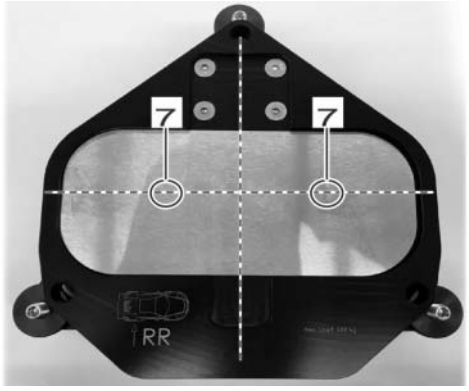

Figure 16

⇒***Figure 16* -7-** – The measuring tables must be positioned under the vehicle in such a way that the ball rollers of the measuring wheels are centered on the contact surface.

WARNING

Risk of material damage due to incorrect load distribution.

- **Risk of damage to the measuring table.**

⇒ **If the measuring wheels are set down outside of the hatched area, the vehicle may roll off the measuring table! Risk of personal injury and damage to property!**

⇒ **The height and level of the measuring table must not be adjusted under load (vehicle weight on table)!**

Figure 17

The three marked holes are used as a mounting for the levelling sleeves during the alignment of the measuring table.

Insert plates must be installed to limit the freedom of movement of the vehicle to a minimum on the measuring tables during measurement.

Figure 18

Figure 19

– Insert plate for the front axle

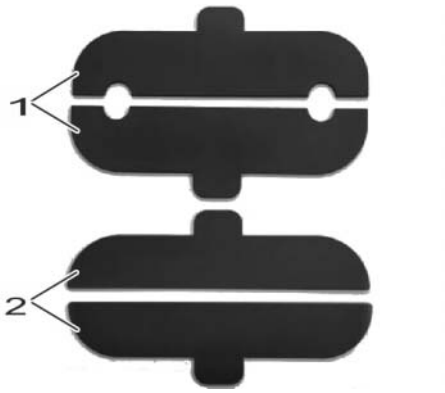

Figure 20

⇒***Figure 20* -1-** – Always place the insert with circular cut-out on the front-axle measuring table

⇒***Figure 20* -2-** – Always place the straight insert on the rear axle measuring table

Before the vehicle is set down onto the measuring tables with the measuring wheels installed, the inserts must be removed and inserted again after being set down.

NOTICE

- **The vehicle must not be measured without installing the inserts!**
- **The inserts are subject to certain wear and tear and must be replaced if they become excessively worn.**

If the vehicle height or weight including wheel load distribution is to be measured on a vehicle with installed wheels, this can be carried out using the optional turntables.

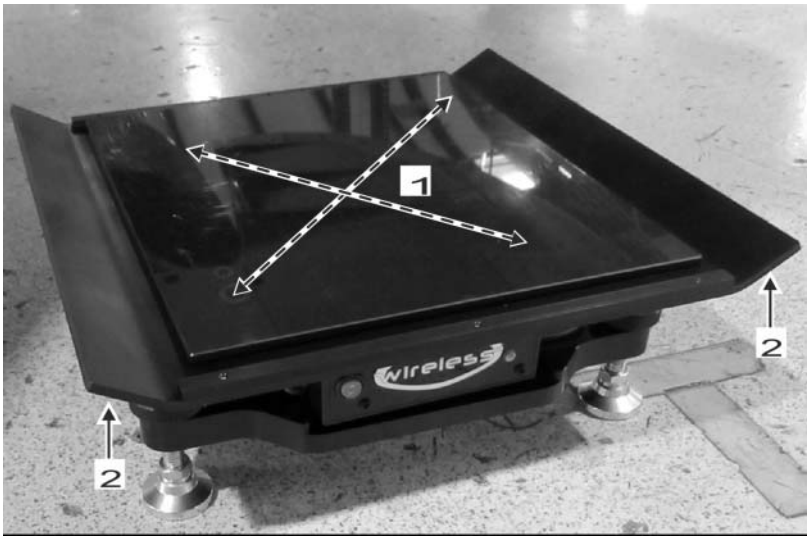

Figure 21

⇒***Figure 21* -1-** – The floating road contact plate allows the chassis to move within the wheel contact point

⇒***Figure 21* -2-** – The turntables are designed so that the vehicle is held securely and cannot roll off accidentally if the base plate is tilted upwards.

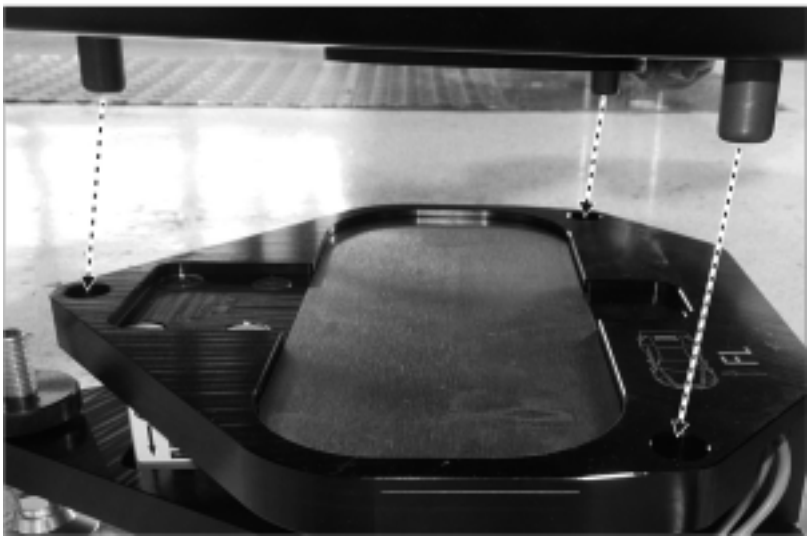

Figure 22

Once all four measuring tables have been aligned, the turntables are locked with the measuring table by means of the three retaining pins in the holes for the levelling sleeves.

Figure 23

Nine foot boosters are supplied for working on very uneven surfaces. These can be installed on up to three measuring tables and equate to a difference in height of approx. 40 mm.

The batteries on the measuring tables must be changed after approx. 50 - 60 operating hours. The status LED on the measuring table lights up red when the batteries are weak.

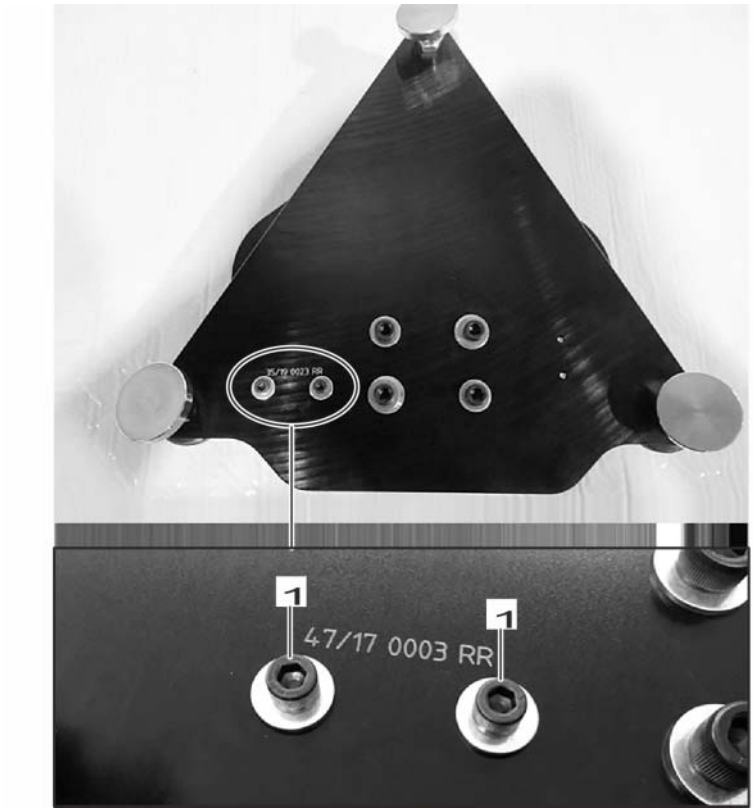

Figure 24

⇒***Figure 24*** **-1-** – To change the battery, turn the measuring table around and remove the two hexagon socket head bolts (**a/f: 4 mm**)

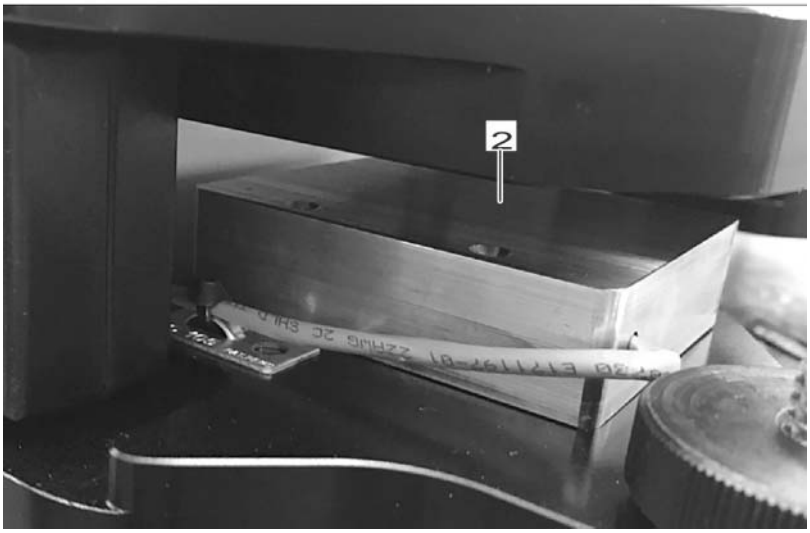

Figure 25

⇒***Figure 25*** **-2-** – Carefully remove the battery carrier without damaging the connecting cable.

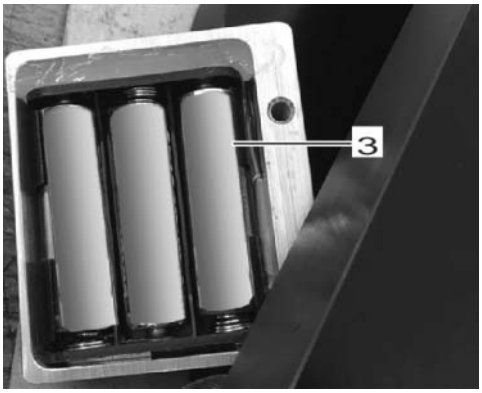

Figure 26

⇒***Figure 26*** **-3-** – Insert three new LR6-AA batteries.

NOTICE

- **Rechargeable batteries must not be used. Rechargeable batteries are operated on a low-voltage system (1.2 volts). The required batteries work with a voltage of 1.5 volts.**

Re-install the battery carrier and secure it with the two screws.

Tightening torque

Battery carrier screws: 3 Nm (2 ftlb.)

2.2 Tablet for determining the wheel load

The following pages offer a quick overview of how to use the system for measuring wheel load.

It is advisable to check and calibrate the measuring cells each year.

If the components are not handled properly (for example if they are dropped), we recommend that you should check them immediately.

The measured wheel loads are transmitted via Bluetooth to the attached tablet and are shown in real-time graphics in the installed "Computer hubs XLi" app.

Proceed as follows:

Figure 27 (shown as an example)

⇒***Figure 27 (shown as an example) -1-*** – Switch the tablet on. Hold down the ON/OFF button for 3 seconds.

⇒***Figure 27 (shown as an example) -2-*** – If the tablet does not switch on, charge it using the charger supplied. The USB charging connection is at the top of the device.

Figure 28 (shown as an example)

⇒***Figure 28 (shown as an example) -3-*** – Wait until the Bluetooth icon appears at the top right of the start screen.

Figure 29 (shown as an example)

⇒***Figure 29 (shown as an example) -4-*** – Launch the "Computer Scales XLi" app

Figure 30

⇒***Figure 30* -1-** – Switch on all four measuring plates. Start with the FL measuring table.

⇒***Figure 30* -2-** – The status LED lights up green permanently at the start. Once the connection is established between the measuring plates and tablet, the status LEDs of all measuring plates will start flashing green.

NOTICE

- **Only the front left (FL) measuring plate communicates with the tablet. The three other measuring plates transmit their values to the front left (FL) measuring plate. This in turn transmits all 4 measured values to the tablet.**

Main screen functions:

Figure 31 (shown as an example)

⇒***Figure 31 (shown as an example)* -1-** – ZERO resets the four wheel loads to zero. Press ZERO before placing the vehicle on the measuring plates.

⇒***Figure 31 (shown as an example)* -2-** – MEMORY stores up to 50 measurements. Navigate your way through the stored measurements using the arrow buttons.

⇒***Figure 31 (shown as an example)* -3-** – Press BACK to quit the app.

⇒***Figure 31 (shown as an example)* -4-** – Write-down information about the individual measurements under NOTES - ADD/VIEW.

⇒***Figure 31 (shown as an example)* -5-** – SAVE stores the current measurement.

⇒***Figure 31 (shown as an example)* -6-** – TAB BATT shows the tablet's battery level. Green =Full battery, Yellow = Charge battery as soon as possible, Red =Charge tablet immediately

⇒***Figure 31 (shown as an example)* -7-** – This area shows the current wheel load values.

For further information, read the enclosed original operating instructions.

2.3 The measuring wheel

2.3 The measuring wheel

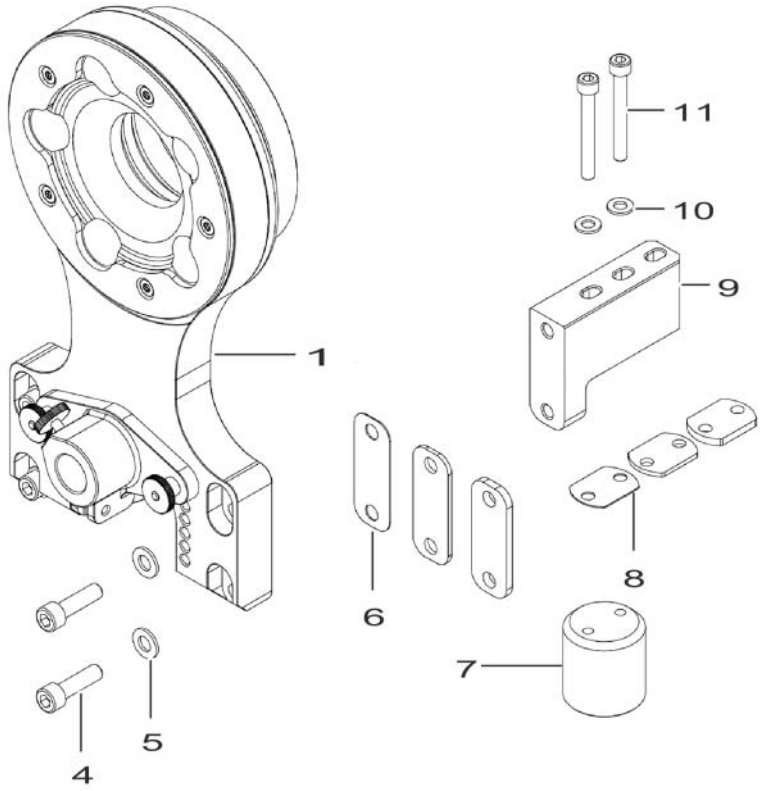

Figure 32

Item.	Designation	Quantity
1	MEASURING WHEEL INCL. CENTER HUB	4
Picture above	LASER SHAFT SCALED	4
Picture above	TRACKING LASER	4
4	HEXAGON SOCKET HEAD SCREW M10X35	16
5	WASHER FOR SCREW M10	16
6	RO ADJUSTING SHIM 1.0 MM / 3.0 MM / 5.0 MM	8 / 8 / 8
7	HEAVY-DUTY BALL ROLLER	8
8	ADJUSTING SHIM HEIGHT 1.0 MM / 3.0 MM / 5.0 MM	8 / 8 / 8
9	L-ANGLE DEFLECTOR	8
10	WASHER FOR SCREW M8	16
11	HEXAGON SOCKET HEAD SCREW M8X65	16

The individual components and possible configurations of the measuring wheels are described on the following pages.

The measuring wheels serve as a wheel replacement and their design ensures almost unrestricted accessibility to the suspension components during suspension alignment.

Center hubs for other hole circle diameters can be manufactured on request.

NOTICE

- **The perfect configuration - i.e. the adaptation of the measuring wheels to the specific wheel radius - is a key task and must be carried out with the greatest care.**
- **This measuring wheel system allows wheel radii from approx. 300 mm to approx. 360 mm to be covered. This corresponds to static tire diameters of approx. 600 mm to 720 mm.**

This means that a very wide range of road vehicles can be measured using this system.

Possible configurations and thus realisable wheel radii are described in more detail on the following pages.

The measuring wheels must be adjusted based on the RO data of the installed rims. This allows the reaction behavior of the measuring system to changes in camber on the vehicle to be aligned with the behavior of the vehicle wheels.

The offset (ball roller position) is adjusted roughly via the slotted position (adjustment range **A** or **B**). Fine adjustments are made using the supplied RO adjusting shims (1 mm, 3 mm and 5 mm).

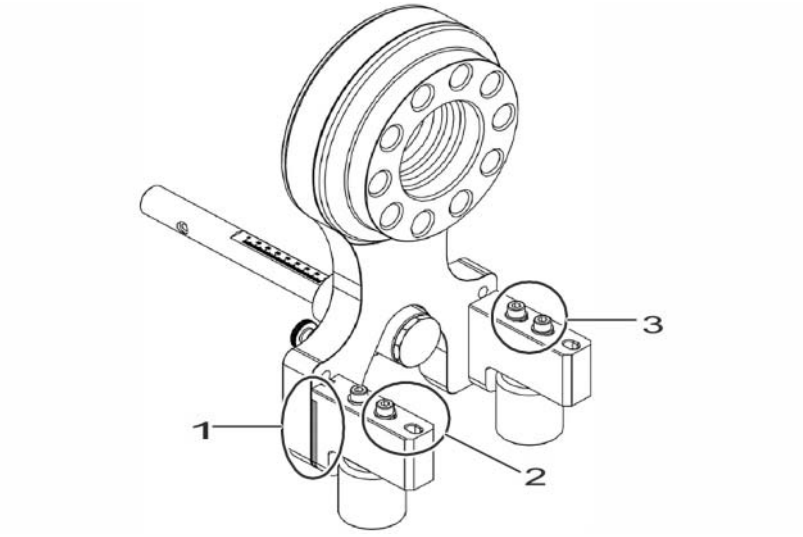

Figure 33

⇒***Figure 33* -1-** – Assembly position of the RO adjusting shims
⇒***Figure 33* -2-** – RO adjustment range B, rear fastening option
⇒***Figure 33* -3-** – RO adjustment range A, front fastening option

NOTICE

- **Achievable rim offsets (RO): 10 mm to 77.5 mm**

WARNING

⇒ **The minimum screw depth (thread length) in the L-bracket foot must always be at least 15 mm.**

⇒ **If RO adjusting shims are not used, the pre-installed M10 x 35 screws must be used.**

⇒ **The supplied M10 x 40 screws must be used for RO adjusting shim thicknesses up to 5 mm.**

⇒ **For RO adjusting shim thicknesses of more than 5.0 mm, fastening screws (M10 x 45) for the L bracket foot are mandatory. The minimum screw depth (thread length) in the L bracket foot of 15 mm must be observed.**

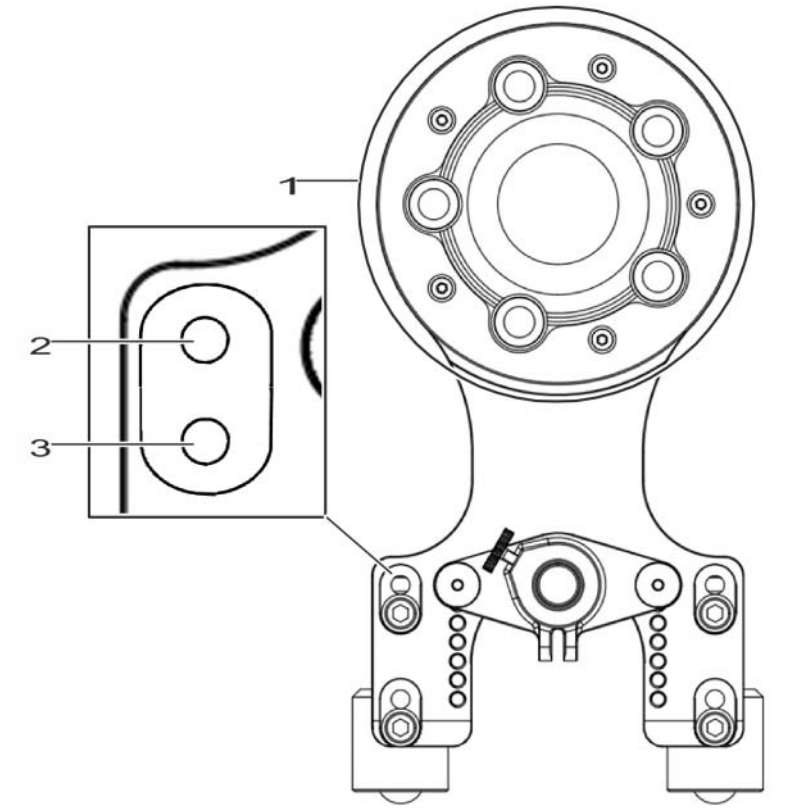

Figure 34

⇒***Figure 34* -1-** – Center hub
⇒***Figure 34* -2-** – Upper position for L-angle foot
⇒***Figure 34* -3-** – Lower position for L-angle foot

Tightening torque

M10 screws: 46 Nm (34 ftlb.)

The measuring wheels must be matched to the static wheel radius of the wheels. To do this, the vehicle on the tires is measured and the actual wheel radius is determined.

(Set specified air pressure!)

The measuring wheels for the front and rear axle can be adjusted based on the determined values.

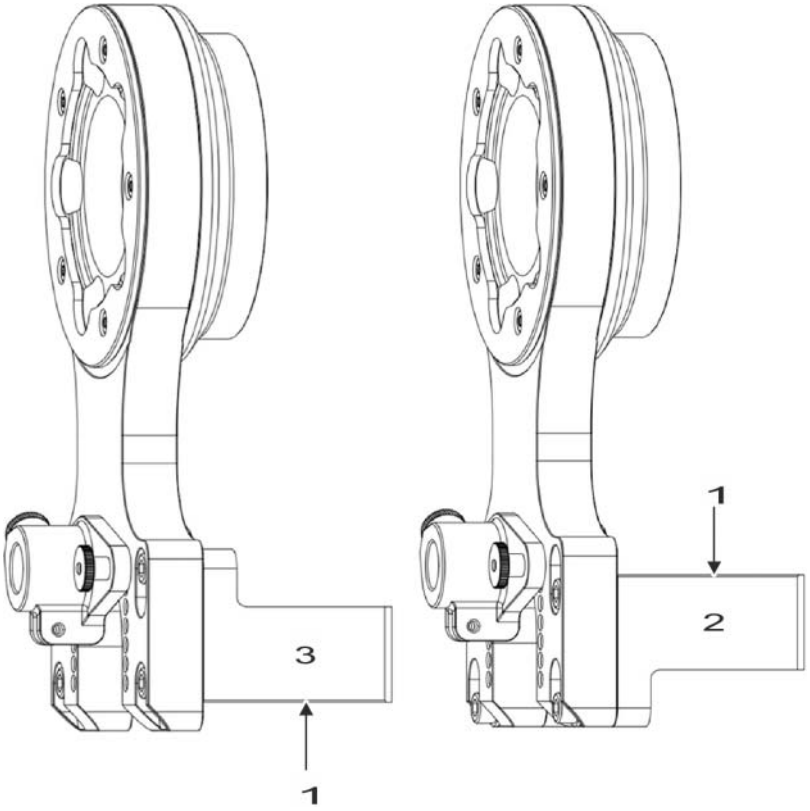

Figure 35

⇒***Figure 35* -1-** – The radius of the measuring wheels is roughly set using the L-angle foot position "**LOWER**" or "**UPPER**".

⇒***Figure 35* -2-** – Angle foot position "UPPER"

⇒***Figure 35* -3-** – Angle foot position "LOWER"

Fine adjustments are made using the enclosed shims with thicknesses of 1 mm, 3 mm and 5 mm.

NOTICE

- **To check this, the vehicle height can be determined in advance using the standard wheels and the height can be compared after the adjusted measuring wheels have been installed.**
- **The possible adjustment range (radius) of the measuring wheels is approximately: 300 mm – 360 mm**

WARNING

⇒ **If more than 3 mm height-adjusting washers have to be installed between the L bracket foot and ball roller, the pre-installed M8 x 65 screws must be replaced with the M8 x 80 screws supplied. The minimum screw depth (thread length) in the ball roller of at least 12 mm must be observed. Failure to comply with this can cause the screws to fail!**

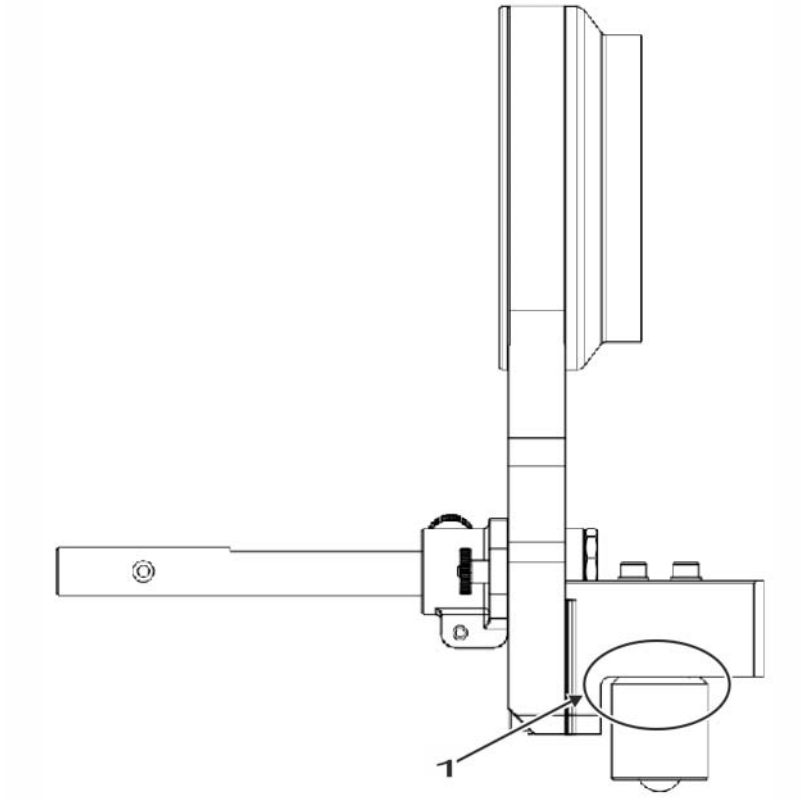

Figure 36

⇒***Figure 36*** **-1-** – Installation position for height adjusting shims

Tightening torque

M8 screws: 25 Nm (18.5 ftlb.)

Possible measuring wheel configurations

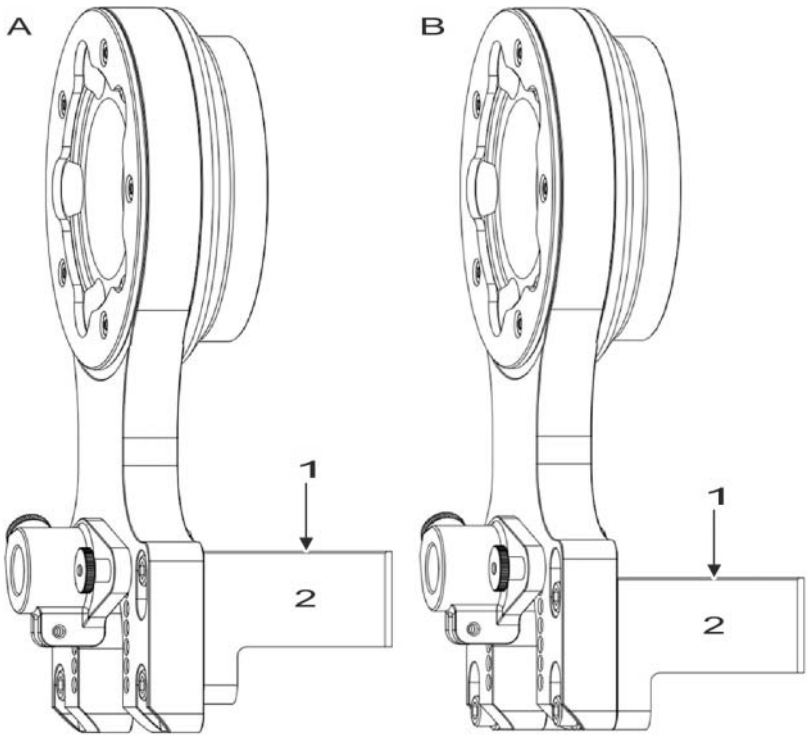

Figure 37

⇒***Figure 37* -1-** – Flat side
⇒***Figure 37* -2-** – Angle foot position “UPPER”

Measuring wheel configuration A- wheel radius 300 mm to 315 mm

This configuration (upper screw-on option for the L-angle foot with flat side facing upwards) results in a wheel radius of 300 mm **without adjusting shims**on the ball roller.

The radius can be increased in 1 mm increments up to 315 mm using height adjusting shims on the ball roller.

Measuring wheel configuration B- wheel radius 315 mm to 330 mm

This configuration (lower screw-on option for the L-angle foot with flat side upwards) results in a wheel radius of 315 mm **without adjusting shims** on the ball roller.

The radius can be increased in 1 mm increments up to 330 mm using height adjusting shims on the ball roller.

When using adjusting shims for the offset depth and the measuring wheel height, the aforementioned minimum thread-in depths (thread lengths) in the L-angle feet and ball rollers must be observed!

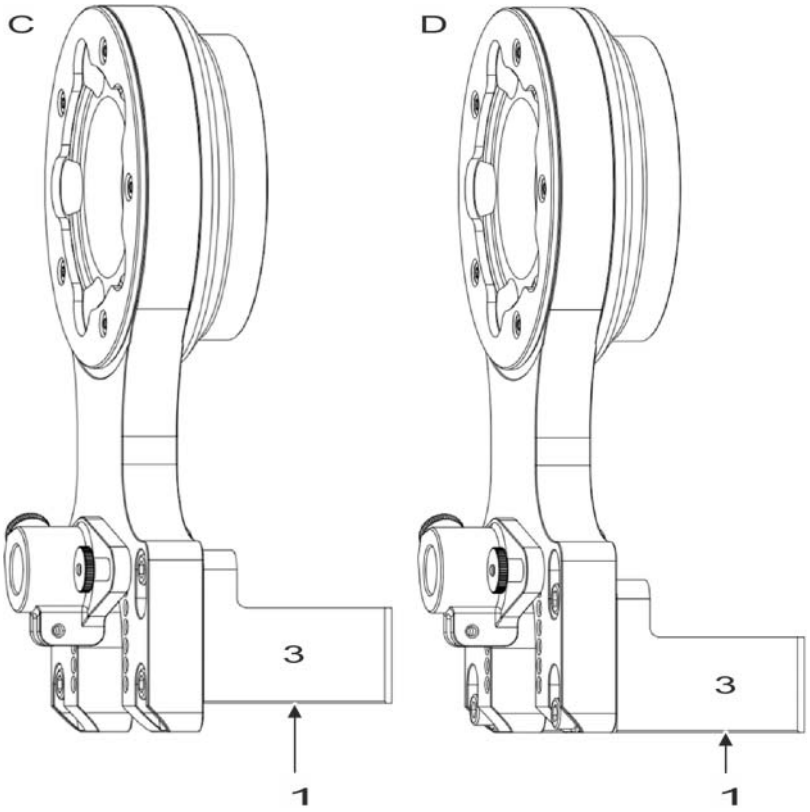

Figure 38

⇒***Figure 38* -1-** – Flat side
⇒***Figure 38* -2-** – Angle foot position “LOWER”

Measuring wheel configuration C- wheel radius 330 mm to 345 mm

This configuration (lower screw-on option for the L-angle foot with flat side facing upwards) results in a wheel radius of 330 mm **without adjusting shims** on the ball roller.

The radius can be increased in 1 mm increments up to 345 mm using height adjusting shims on the ball roller.

Measuring wheel configuration D- wheel radius 345 mm to 360 mm

This configuration (lower screw-on option for the L-angle foot with flat side upwards) results in a wheel radius of 345 mm **without adjusting shims** on the ball roller.

The radius can be increased in 1 mm increments up to 360 mm using height adjusting shims on the ball roller.

When using adjusting shims for the offset depth and the measuring wheel height, the aforementioned minimum thread-in depths (thread lengths) in the L-angle feet and ball rollers must be observed!

Ball roller in adjustment range A:

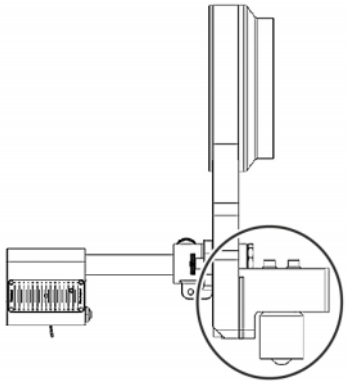

Figure 39

Ball roller in adjustment range B:

Below is an overview of the most important adjustment data.

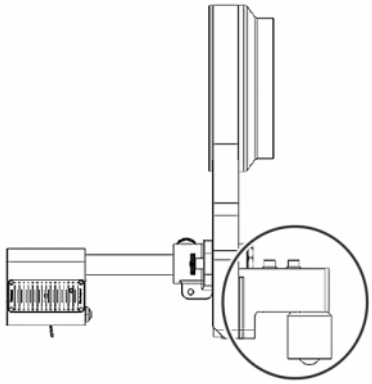

Figure 40

Position		**Possible adjustment range**	
L-angle foot	**Ball roller position**	**Height [mm]**	**Rim Offset [mm]**
Configuration 1		300 — 315	
Configuration 2		315 — 330	
Configuration 3		330 — 345	
Configuration 4		345 — 360	
	Adjustment range A		10.0 — 50.0
	Adjustment range B		37.5 — 77.5

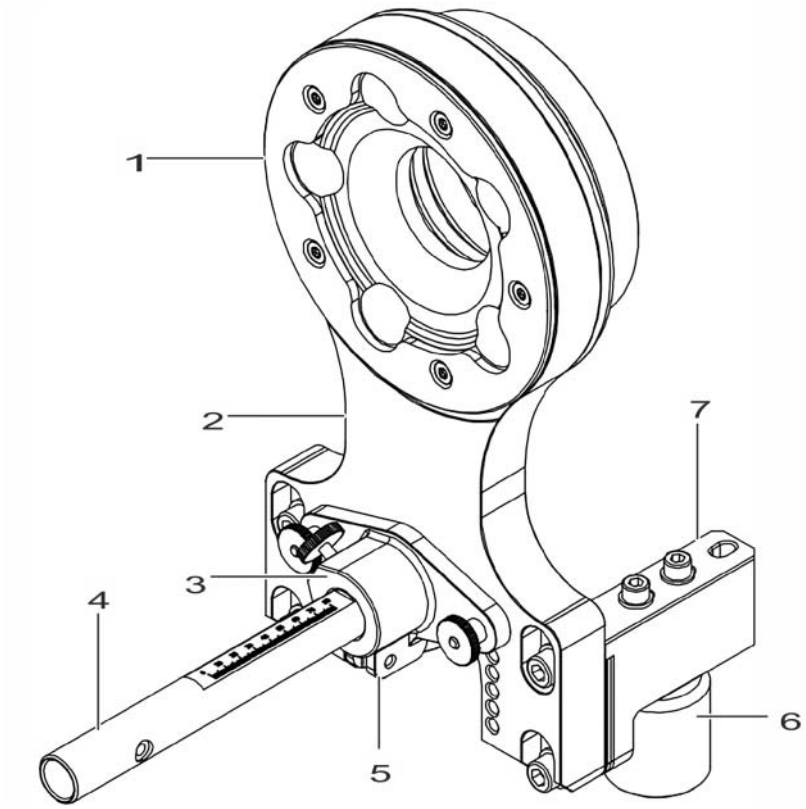

Figure 41

⇒***Figure 41* -1-** – Center hub
⇒***Figure 41* -2-** – Measuring wheel
⇒***Figure 41* -3-** – Laser shaft scaling mounting
⇒***Figure 41* -4-** – Laser shaft with scaling
⇒***Figure 41* -5-** – Track gauge fence mounting
⇒***Figure 41* -6-** – Heavy-duty ball roller
⇒***Figure 41* -7-** – L-angle foot

NOTICE

- **Never set the measuring wheel down in such a way that the laser shaft is exposed to mechanical pressure. This shaft is rectified and ground to very fine tolerances during production.**
- **Check the ball rollers for dirt and damage at regular intervals. Damage and/or dirt can impact the function of the very smooth steel rollers.**
- **The height of the laser shaft support can be adjusted in seven positions. The laser shafts from the front axle to the rear axle should always be horizontal.**

WARNING

⇒ **If individual components of the measuring gear are visibly damaged due to mechanical overload or impact, these components must be replaced.**

In some cases, the mounting positions must be changed for technical reasons (vehicle components obstructing the laser beams).

Options for fastening measuring wheel onto the vehicle

WARNING

⇒ **For 992 GT3: To install the Center hub, the front brake calliper must be removed in accordance with the instructions for ⇒*Workshop Manual 'Removing and installing the front brake calliper'*, or the Center hub and brake calliper will be damaged.**

Several options are available for fastening the measuring wheels onto the vehicle via the variable center hub.

Tightening torque

Wheel nut M14: 140 Nm (103 ftlb.)

Fastening the measuring wheel to a standard-production Porsche vehicle. Longer wheel bolts with ball collar must be used here.

Figure 42

Part No.: **56110276** (2 sets required)

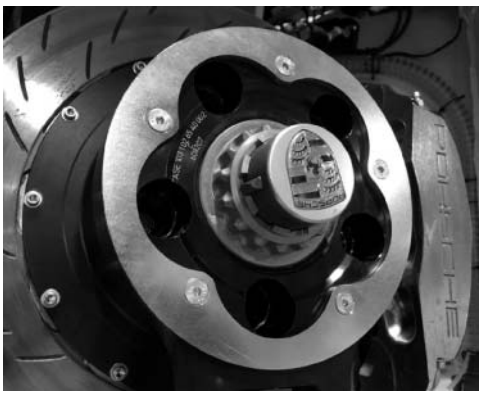

Figure 43

NOTICE

- **Ball seat nuts or screws must NOT be used.**

Tightening torque

Central lock nut: 520 Nm (383 ftlb.)

On GT road models with standard central locking, the measuring wheel is secured via the central locking nuts MTH012990A. MTMT000944A is also permitted for the FA.

Figure 44

Tightening torque

MTH012990A: 100 Nm (74 ftlb)

MT000944A: 100 Nm (74 ftlb)

Figure 45

2.4 Toe laser

The toe laser fulfils two functions:

Firstly, it projects the laser beam for the toe value display. Secondly, its scale can be used to display the toe value of the other axle.

NOTICE

- **The toe lasers are position-based and are identified accordingly (FL / FR / RL / RR).**

The laser is switched on using the button on the outside.

Figure 46

WARNING

Risk of personal injury

- **Risk of damage to the eyes!**

⇒ **Avoid class 2 laser beams. Avoid looking directly into the laser beam. Risk of damage to the eyes!**

NOTICE

- **The toe value of axle 1 is projected onto the scale plate of the toe laser of axle 2 and can be read directly there.**

The relevant toe laser is pushed into the relevant laser shaft and locked on the shaft using the ball lock pin.

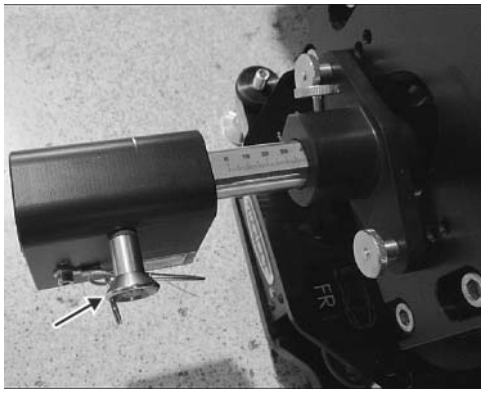

Figure 48

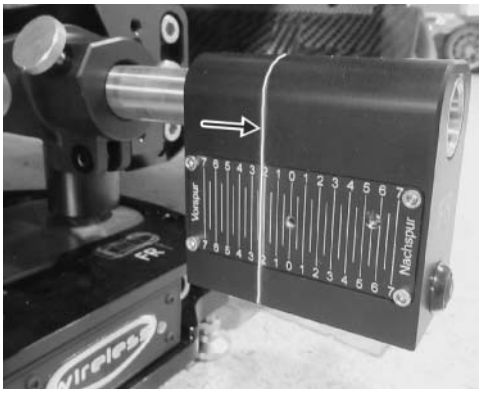

Figure 47

The measuring wheels on the vehicle must be adjusted to take account of the different axle geometries on the front and rear axles.

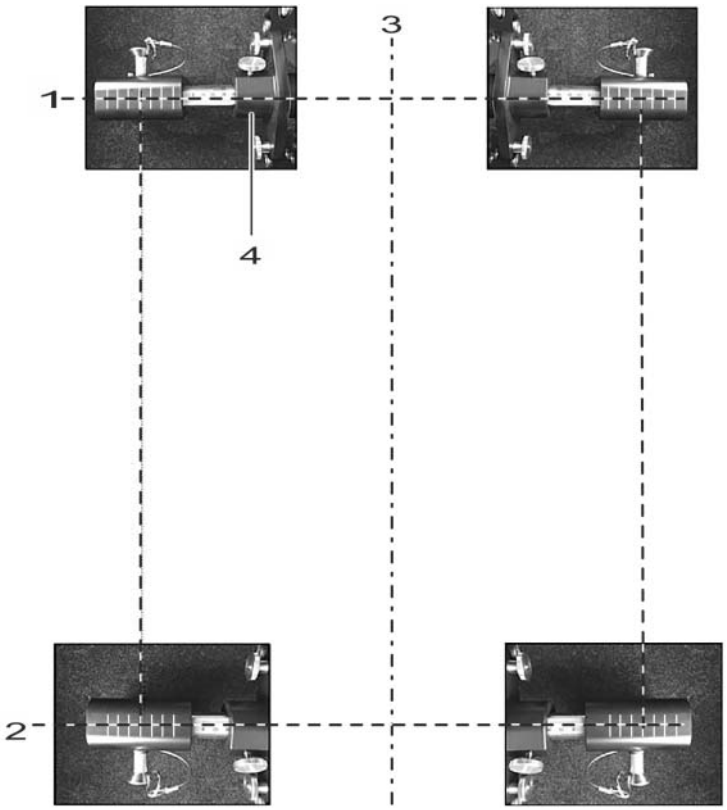

Figure 49

⇒***Figure 49* -1-** – Axle 1
⇒***Figure 49* -2-** – Axle 2
⇒***Figure 49* -3-** – Vehicle's central axis
⇒***Figure 49* -4-** – Measuring gear with laser shaft and toe laser

The toe lasers on the front and rear axles must be adjusted to form a rectangle when set correctly. This rectangular area must also be symmetrical. This means that the toe laser on one axle must be set to the identical value on the laser shaft.

To position the toe laser, the toe-width difference between the front and rear axles must first be determined. The toe width rule is used for this.

To measure and adjust the toe of the vehicle, the toe lasers must be aligned correctly and all four lasers must be activated.

The steering must be set to drive straight ahead and secured by suitable means.

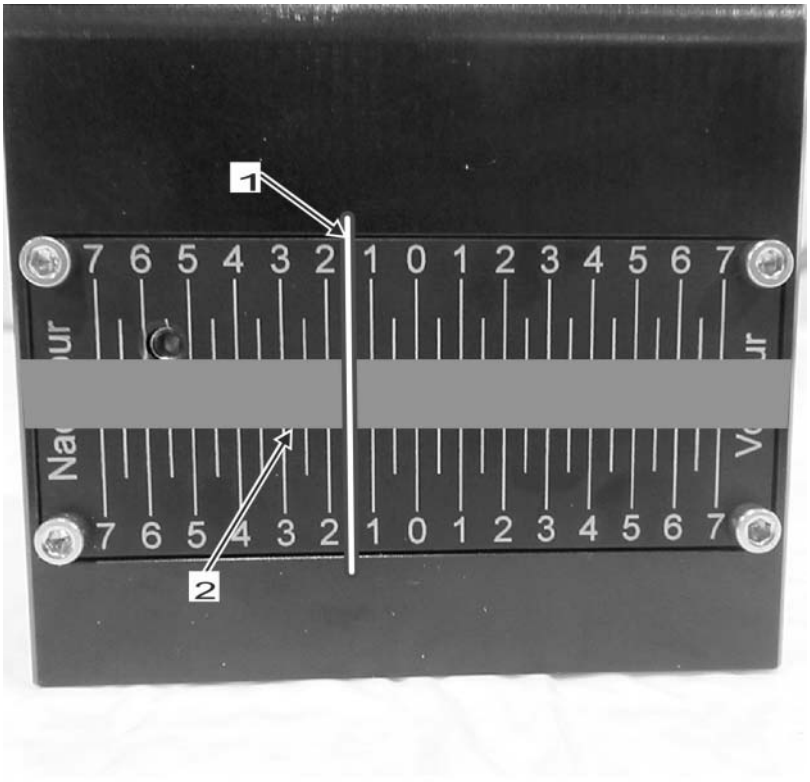

Figure 50

⇒***Figure 50* -1-** – The laser housings each project a laser beam onto the scale of the laser housing on the other axle on the same side of the vehicle.

⇒***Figure 50* -2-** – It is important to read the values in the middle area of the laser beam. If the beam is facing too far up or down, there may be slight deviations.

The toe values for the rear wheels are read on the scales on the front axle and the toe values for the front wheels on the scales on the rear axle.

If the values are to be compared with conventional measurements, they can be converted using the following formula:

Toe angle [minutes] = (measured value laser [mm] x 5.1) x (3438 / wheelbase [mm])

The scales used in this system indicate the toe value **in millimeters [mm]** and have a scale of 5.1:1. This allows more accurate adjustment and excellent readability.

Changing the battery on the toe laser:

The battery compartment is located on the underside of the toe laser housing.

Remove the**four** countersunk bolts with hexagonal head size SW 2.5.

Figure 51

Remove the cover and open the battery compartment.

Replace the two type AAA - Micro - LR03 1.5 V batteries.

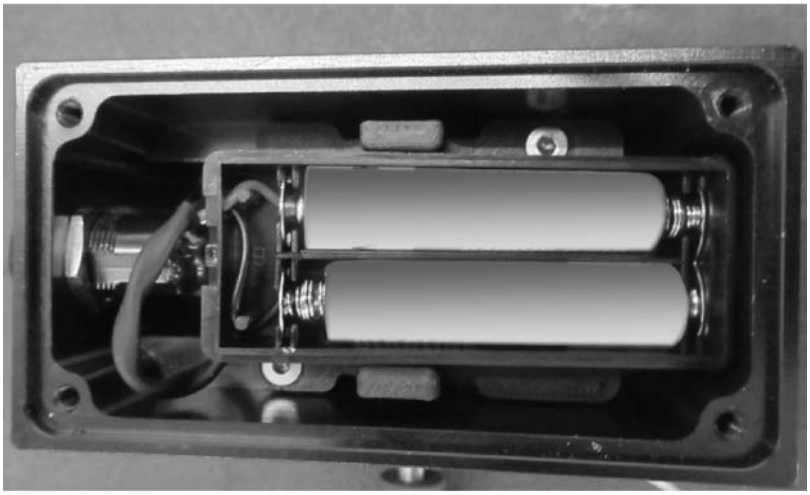

Figure 52

Close the battery box again and secure the cover with the four countersunk screws.

Tightening torque

Countersunk screw: 2.0 Nm (1.5 ftlb.)

2.5 The toe gauge ruler

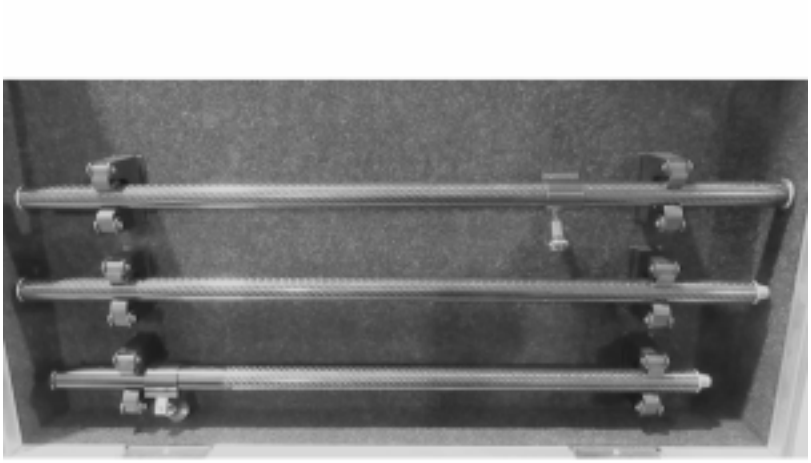

Figure 53

A clamping holder is attached to each of the outer parts.

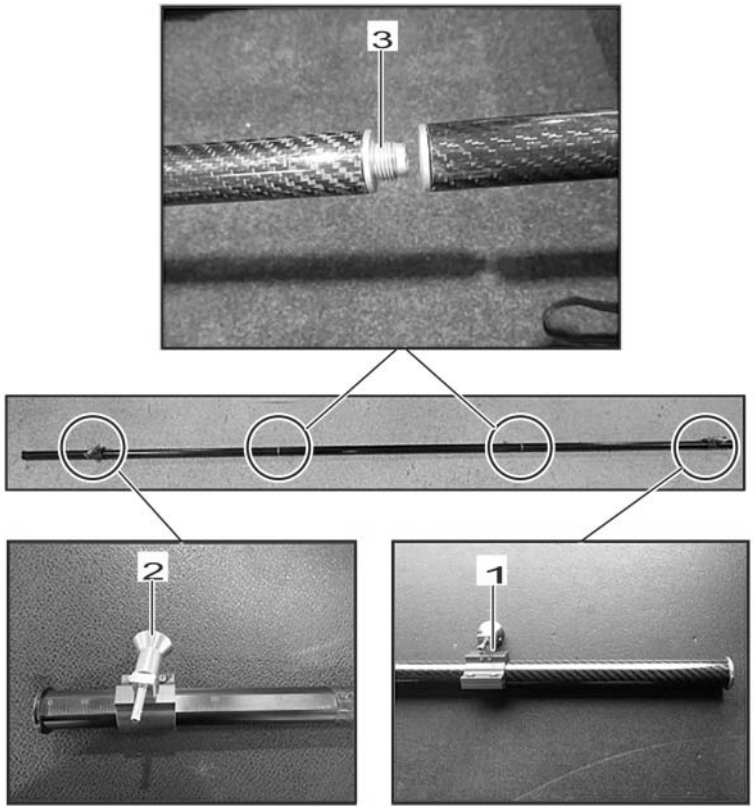

Figure 54

⇒***Figure 54* -1-** – The holder is screwed onto the outer rod without a scale (fixed bearing)

⇒***Figure 54* -2-** – The clamp holder serves as a reading aid for the toe width value on the ruler segment with the measuring scale in 2:1 scale.

⇒***Figure 54* -3-** – The screw connections of the toe width ruler may only be tightened hand-tight

Tightening torque

Fastening screw M4: 2.5 Nm (1.84 ftlb.)

The toe width ruler is fastened to the holder on the underside of the measuring wheel with the ball locking pins.

The toe width ruler is required to determine the toe width of the front and rear axles.

Measure the toe widths (initial measurement, toe widths unknown):

• Install the toe width ruler as described above. Do not yet secure the two clamping holders on the outer segments with the clamping screws.

• Insert the ruler between the ball rollers from the left side of the vehicle to the right side of the vehicle on axle 1.

Figure 55

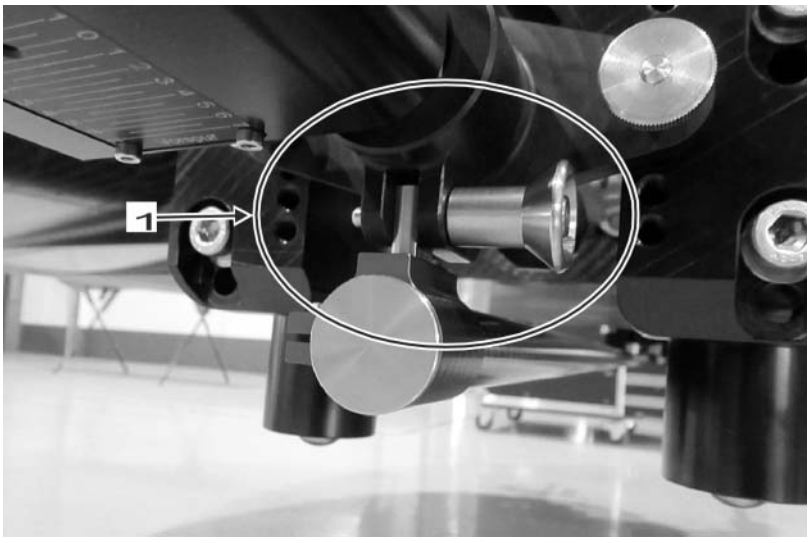

Figure 56

⇒***Figure 56* -1-** – Install the ruler on the measuring wheel using the ball locking pins. The vehicle must be on the measuring wheels.

• Align the ruler on the scale side approximately at scale value 40 (middle of the scale). Tighten the clamping screws just enough so that the clamp holder can still be moved on the scale.

Figure 57

⇒***Figure 57* -2-** – Secure the clamping piece on the **ruler segment without a scale** using the two clamping screws

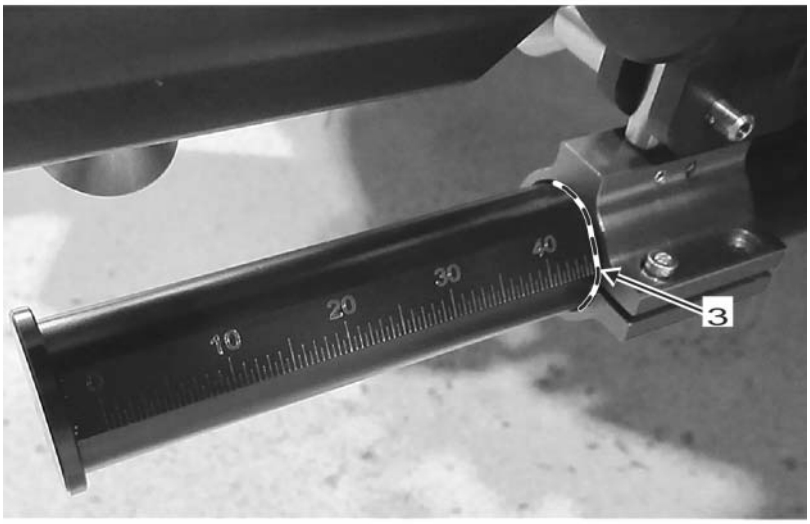

Figure 58

⇒***Figure 58* -3-** – Read the value on the scale segment. Always take readings on the front edge of the holder

In this figure: Read value **45**

• Set the **two** laser shafts of the measuring wheels from axle 1 **to** the value 45 that was read off.

If vehicles with similar toe widths are measured in the future, the clamping holder of the fixed side no longer needs to be loosened.

Tightening torque

Clamping screw M4: 2.5 Nm (1.84 ftlb.)

Figure 59

⇒***Figure 59*** **-1-** – If the toe width value is set on the two laser shafts of axis 1, the toe width ruler can be removed from axle 1

⇒***Figure 59*** **-2-** – **DO NOT release the clamp on the fixed side!**

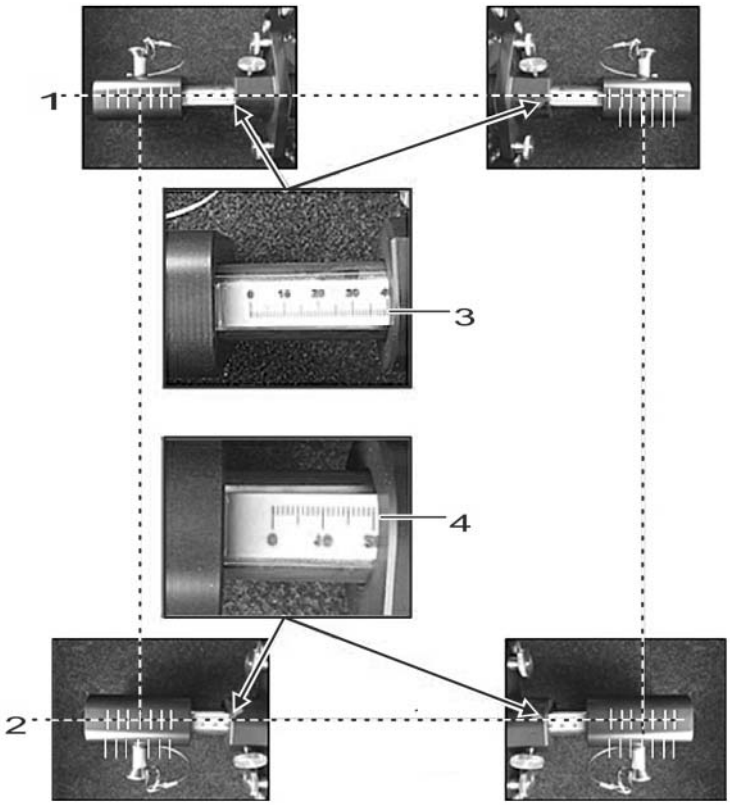

Figure 60

⇒***Figure 60* -1-** – Axle 1
⇒***Figure 60* -2-** – Axle 2
⇒***Figure 60* -3-** – Toe value, axle 1
⇒***Figure 60* -4-** – Toe value, axle 2, reference axle, because wider than axle 1 by toe value 20

• Attach the toe value ruler to the mounting points of the measuring wheels of axle 2, starting with the fixed side without scale.

• Lock the clamping holder on the scale side in the mounting point on the measuring wheel on the opposite side.

• Read the scale value reached and set the reading scale value on both laser shafts of axle 2.

Schematic representation of setting all four toe lasers using the example described here:

Assumption: Reading scale value is **25**.

This results in a toe width difference between axle 1 and axle 2 of:

45 (axle 1) - 25 (axle 2) = 20

Definition: Axle 2 with scale value 25 is wider than axle 1 by scale value 20.

Due to the 2:1 scaling of the ruler, the determined values can be set directly on the laser shafts. No conversions are required.

NOTICE

- **If the toe width changes during chassis setting, e.g. due to camber adjustment or height change, the toe lasers must be readjusted again before final toe measurement.**

2.6 "Universal" steering wheel scales

Figure 61

⇒***Figure 61* -1-** – Press the "On-Off-Level" button. "Level" appears on the display. The device is ready for measurement. The angle to the horizontal is displayed.

⇒***Figure 61* -2-** – Pressing the "HOLD" button, "freezes" the currently displayed value on the display. If "HOLD" is pressed again, the device returns to measurement mode. The current tilt angle is displayed again.

Press the "On/Off-Level" button to switch off. When the device is not in use, automatic shutdown takes place after 3 minutes.

In order to change the battery, the cover on the back must be removed. A 9V block battery is used.

Technical data:

Resolution: 0.05°

Accuracy: 0.1°

Battery type: 9V Block 6LR61

NOTICE

- **In order to minimize the negative influence of a non-straightened steering when measuring the vehicle, we advise clamping the inclinometer with retaining frame into the steering wheel as shown below and straightening the steering wheel (to zero) based on the displayed value.**

Figure 62

2.7 The camber gauge

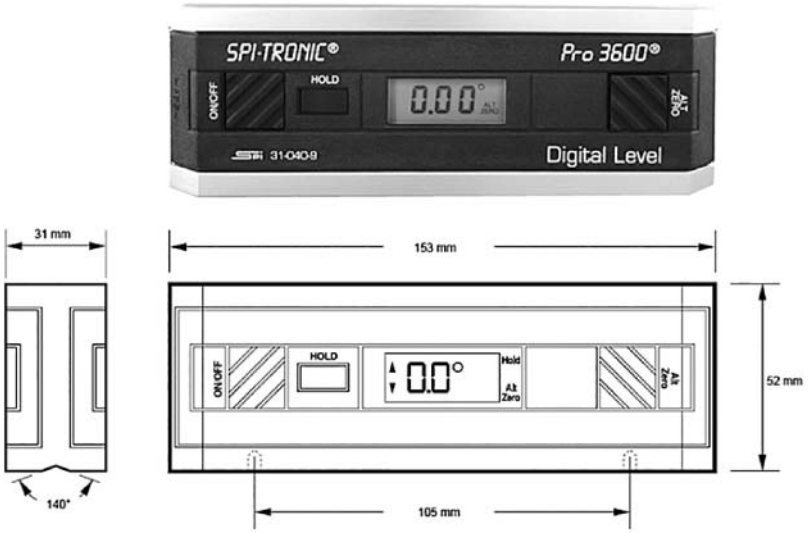

Figure 63

Quickstart

The digital camber gauge supplied was designed for precise measurements with an accuracy of 0.01° in the range from 0° to 90°.

ON/OFF button

The camber gauge is switched on and off by pressing the ON/OFF button. If the camber gauge is not moved for more than five minutes, it will switch off automatically by means of the AUTO OFF function.

Indicator arrows

The indicator arrows indicate the direction in which the camber gauge must be moved in order to go horizontal (0.00°) or vertical (90°).

HOLD button (Freeze)

To freeze a displayed value on the display, press the HOLD button. The value you want to freeze should be displayed on the display for approx. 5 seconds before pressing the HOLD button. HOLD mode is displayed by means of flashing indicator arrows, a flashing decimal point, and a flashing degrees symbol. To exit HOLD mode, press the HOLD button again.

ALT ZERO button (alt. reference)

To set a reference value that is different to 0.00°, set the camber gauge to the new reference surface, wait 5 seconds and then press the ALT ZERO button. "Alt" will be displayed briefly, followed by "-0-". The new reference surface has been adopted. Measurements can now be taken for the new reference surface (ALT Zero is displayed). To exit this mode again, press the ALT ZERO button again.

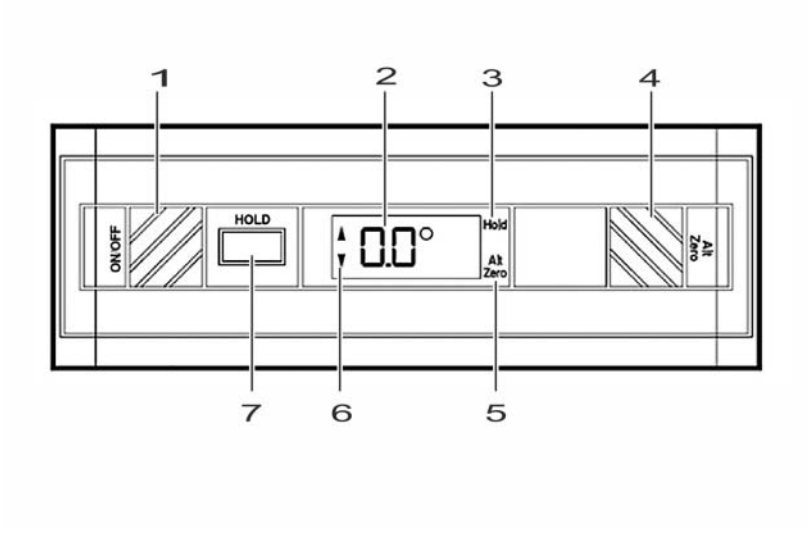

Figure 64

⇒***Figure 64* -1-** – ON/OFF button
⇒***Figure 64* -2-** – Display (LCD)
⇒***Figure 64* -3-** – HOLD indicator
⇒***Figure 64* -4-** – ALT ZERO button (alternative reference)
⇒***Figure 64* -5-** – ALT ZERO indicator
⇒***Figure 64* -6-** – Indicator arrows

⇒***Figure 64 -7-*** – HOLD button (Freeze)

The digital camber gauge (incl. retaining frame) supplied is used to determine the camber.

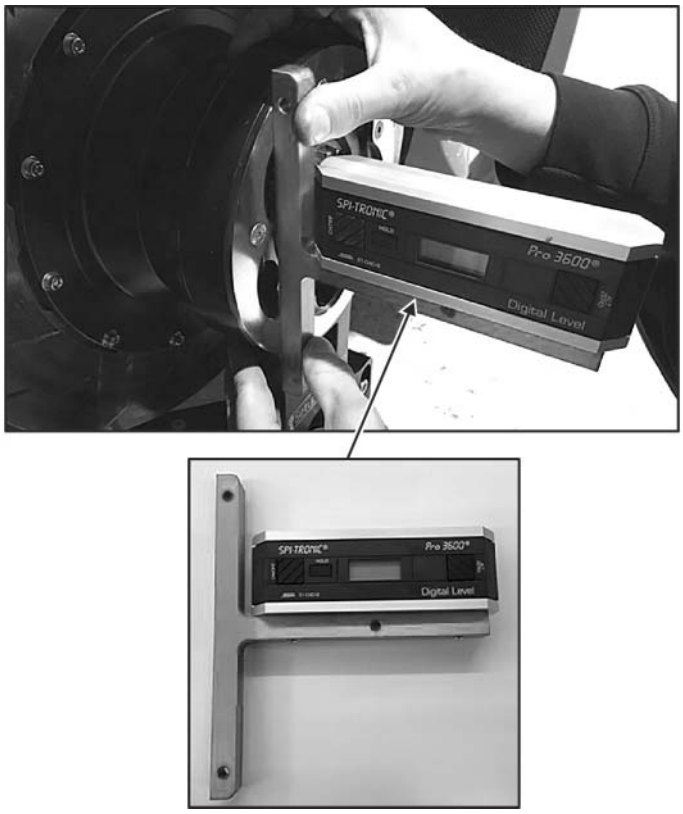

Figure 65

Carefully read the operating instructions included for the SPI-Tronic Pro3600 camber gauge. Before every use, check that the gauge is working correctly.

To determine the exact camber, proceed as follows:

- Switch the camber gauge on.
- Hold the camber gauge vertically as close as possible to the center of the wheel hub against the flat surface of the measuring wheel.
- Keep it as still as possible during measurement.
- Do not move the vehicle during measurement.
- Read out the measured value and note it down when it stops changing (duration: approx. 3 seconds).

For further information on camber gauge scale, read the enclosed operating instructions.

NOTICE

- **Before any measurement, the camber gauge should always be checked at a reference surface to ensure the display is correct.**

- **The camber gauge must not be stopped by the countersunk screws on the contact surface of the measuring wheel.**

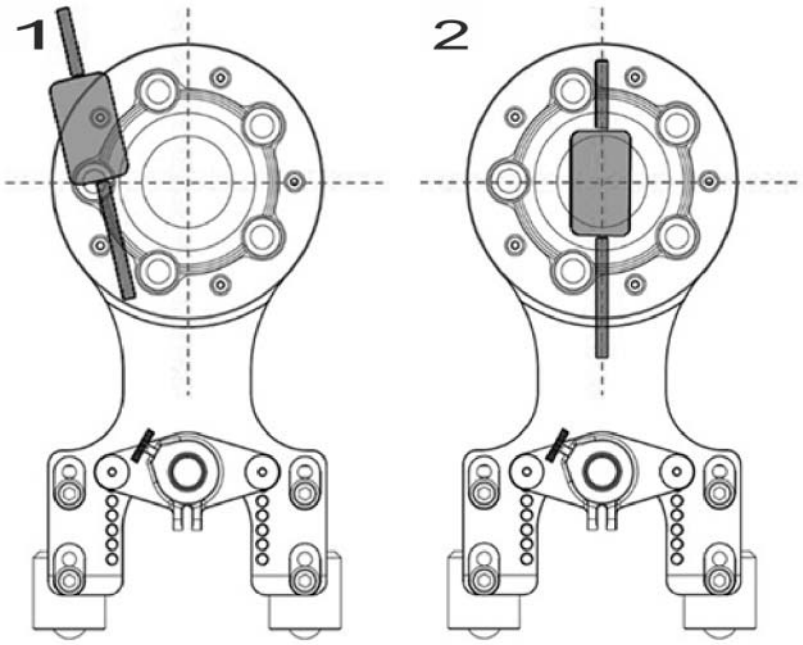

Figure 66

⇒***Figure 66* -1-** – Incorrect camber measurement
⇒***Figure 66* -2-** – Correct camber measurement

2.8 Levelling laser for aligning the measuring tables and measuring the vehicle height

The levelling laser supplied is used to align the measuring tables and to check the vehicle height. For further information, read the enclosed operating instructions.

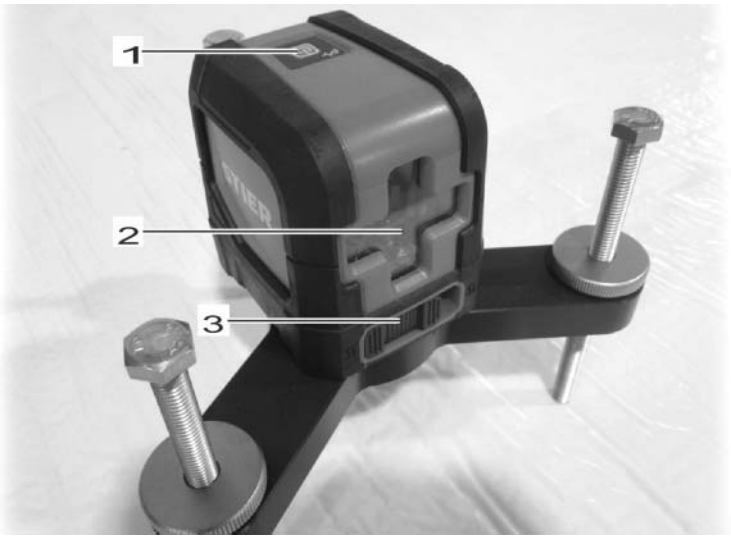

Figure 67

⇒***Figure 67 -1-*** – On/Off switch
⇒***Figure 67 -2-*** – Laser beam outlet opening
⇒***Figure 67 -3-*** – On/Off self-levelling

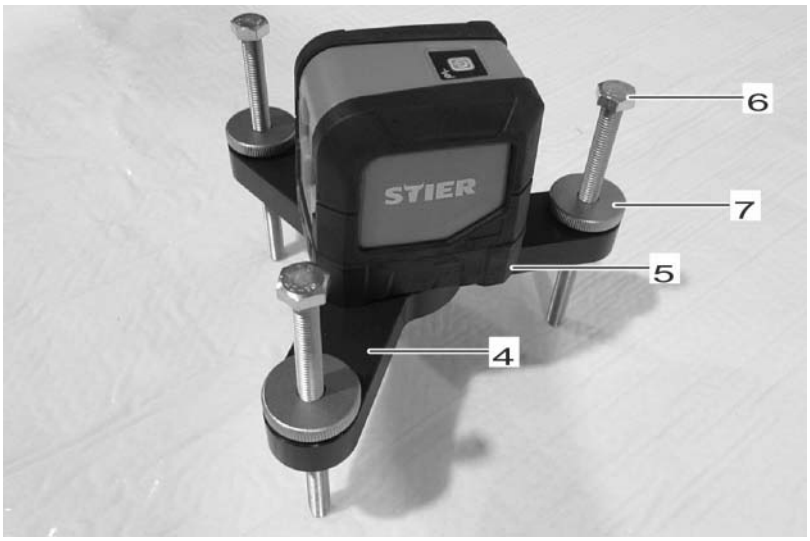

Figure 68

⇒***Figure 68 -4-*** – Stand
⇒***Figure 68 -5-*** – Battery compartment
⇒***Figure 68 -6-*** – Threaded rods for aligning the laser
⇒***Figure 68 -7-*** – Knurled nut

Align the laser height by adjusting the three threaded rods.

If the laser is aligned, the threaded rods are secured by the knurled nuts to prevent them from being accidentally misaligned.

NOTICE

- **The laser has a maximum inclination adjustment of ± 4 degrees. Align the laser as straight as possible during height adjustment.**
- **When transporting in the flight case, self-levelling must be blocked using the slider (3).**

Technical data:

Operating range: Up to 20 m

Deviation: 1.0 mm at 5 m

Dispersion: 2x 120°

Battery type: 2 x 1.5 V, Type AA

Laser class: 2

Laser Class 2

Do not look directly into the laser beam!

Aligning the measuring tables

• Position the four measuring tables under the vehicle with the measuring wheels set in such a way that they would be positioned at the middle of the measuring surfaces.

• **Do not yet** set the vehicle down on the measuring tables with the measuring wheels.

Figure 69

• Bring the four measuring tables to a similar level by adjusting the three feet. Make sure that the adjustment area (thread length) in both directions (higher and lower) is still sufficient.

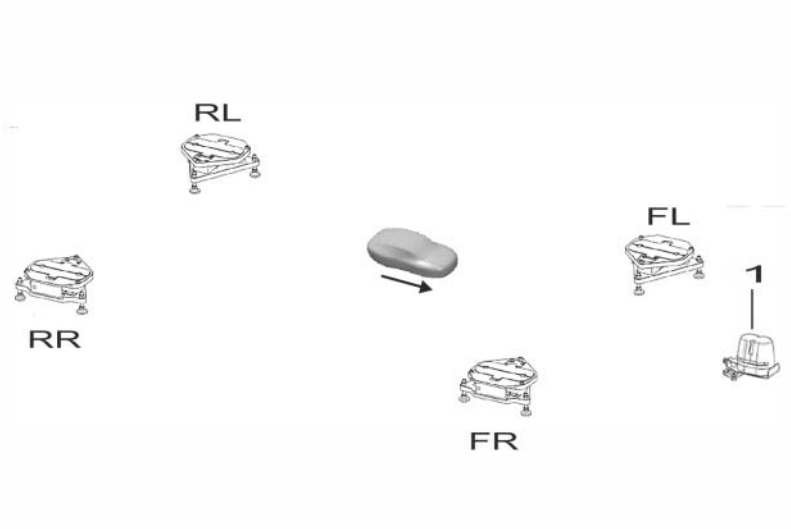

Figure 70

⇒***Figure 70* -1-** – Center the levelling laser approx. 0.5 m to 1.0 m **in front of** the vehicle and switch on the crossline laser. Make sure that the laser is roughly straight when aligned (less than ± 4°).
Activating the self-levelling function of the laser

• Insert the three levelling sleeves in the first measuring table. Start at the front left of the measuring table in direction of travel.

NOTICE

- **The levelling laser must not be moved while aligning the measuring tables.**
- **Arrange the first measuring table using the adjustable legs in such a way that the laser beam is in the center of the groove on all three levelling sleeves.**

⇒

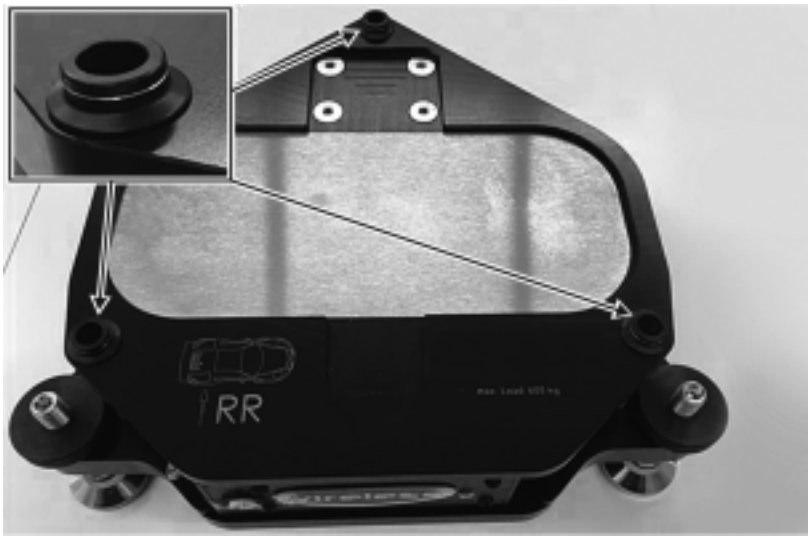

Figure 71

Aligning the measuring tables

• Set the other three measuring tables following the same procedure. Once all the measuring tables are set, the feet are secured with the knurled nuts to ensure that they cannot become misaligned.

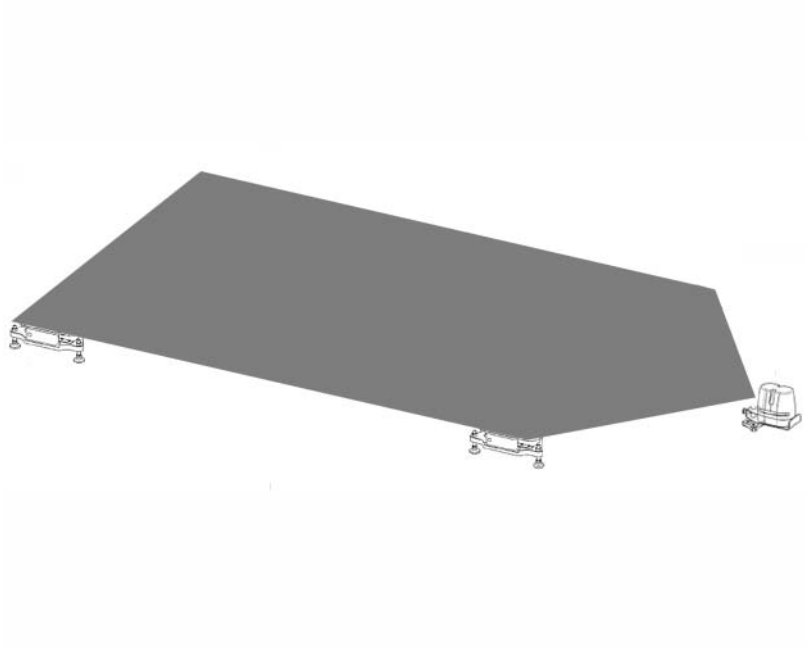

Figure 72

NOTICE

Aligning the measuring table

- **It is recommended that the exact alignment of the measuring tables should be rechecked after the feet have been secured**
- **If all measuring tables are adjusted correctly, they form one level**
- **Precise alignment of the measuring tables provides the basis for exact alignment**

Determining the vehicle height

The vehicle height can be determined at any points on the underbody using the steel ruler supplied (150 mm and 300 mm).

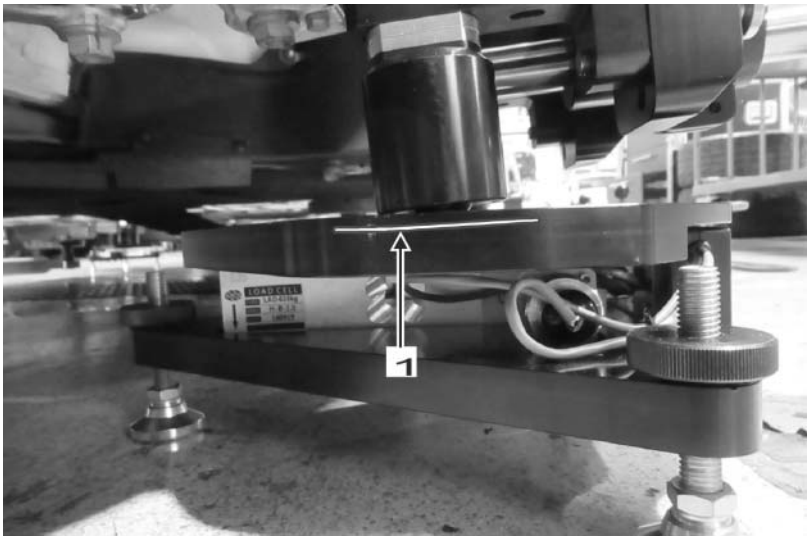

Figure 73

⇒***Figure 73*** **-1-** – To do this, the levelling laser, which was used to align the platforms, is positioned in front of the vehicle and aligned with the marking on the measuring tables. The marking is made at the same height as the contact surface of the measuring tables

If the steel ruler is stopped at a defined measuring point on the vehicle, the vehicle height can be read off directly from the ruler (laser beam).

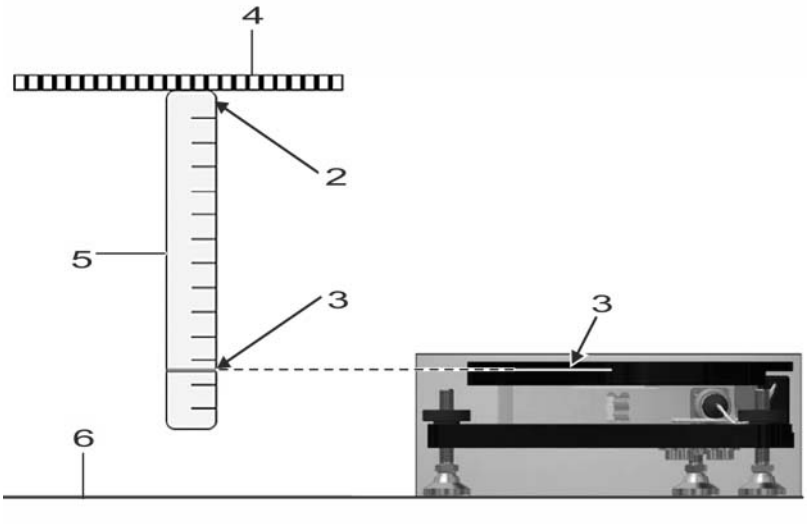

Figure 74

⇒***Figure 74* -2-** – Defined measuring point on the vehicle floor
⇒***Figure 74* -3-** – Laser beam
⇒***Figure 74* -4-** – Vehicle floor
⇒***Figure 74* -5-** – Steel ruler

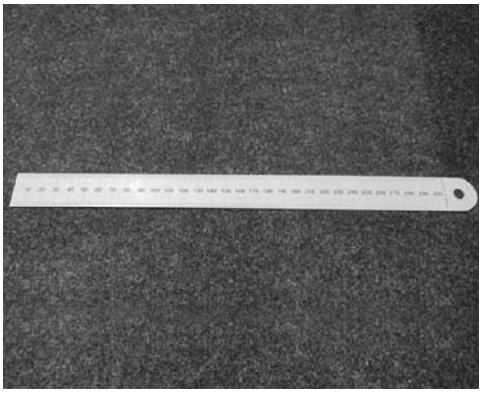

Figure 75

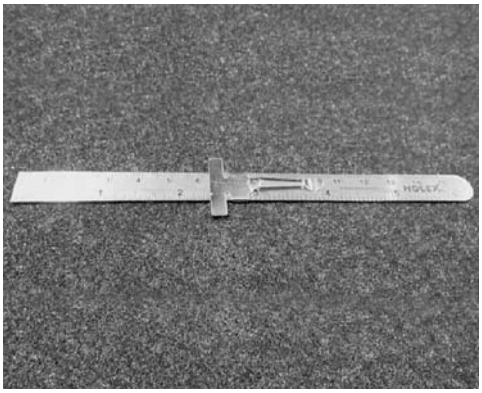

Figure 76

3. Determination of the required measuring wheel setting during the initial measurement of the vehicle

If no adjustment values are available for the vehicle to be configured, the vehicle height with the desired wheel/tire combination must be determined beforehand and the measuring wheels must be adapted according to this static diameter.

Proceed as follows:

- Align the measuring tables at the measuring station according to the specifications described.
- Insert the turntables into the measuring tables.

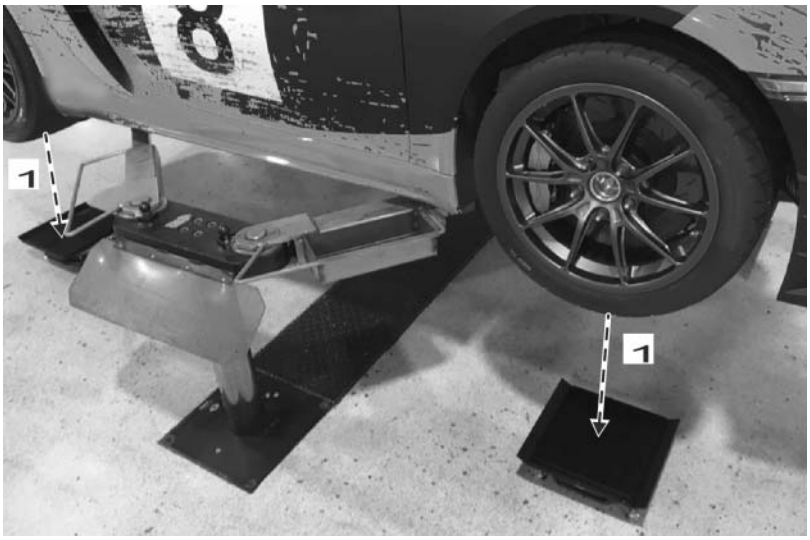

Figure 77

⇒***Figure 77*** **-1-** – Carefully place the vehicle on the turntables. Make sure that the tires only rest on the moving plates and not on the edge of the turntables!

- Set the chassis (compress).
- Check the measuring table alignment again using a levelling laser.

• Adjust the air pressure in the tires to the desired target air pressure.

• Insert the steering wheel scale and adjust the steering to zero (straight direction of travel).

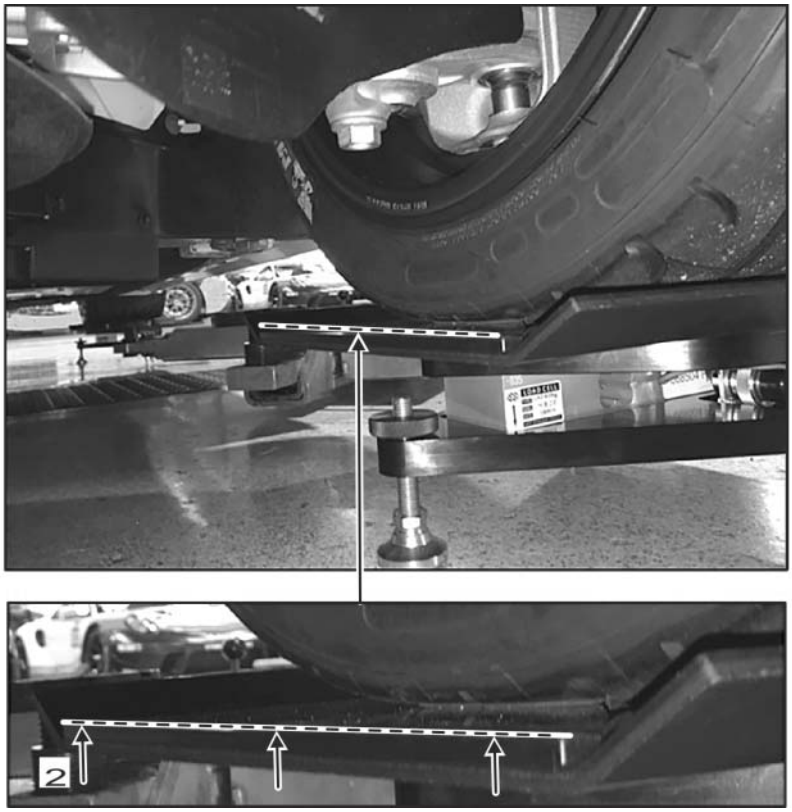

Figure 78

⇒***Figure 78* -2-** – Now align the levelling laser with the upper edge of the turntable. Check correct alignment on all four turntables.

The positions of the adjustment feet of all four measuring tables should be marked on the ground, as the measuring tables can shift when lifting the vehicle.

The levelling laser must not be moved / adjusted after alignment!

• Measure the driving height as shown in Fig. 80 at the measuring points specified by the repair guides or technical manuals. Note the values for the displayed driving heights on the front and rear axles.

• Remove the wheels from the vehicle.

• Adjust the measuring wheels using the RO adjusting shims in accordance with the instructions in **2.3 Set the measuring wheel** to the RO values of the front axle and rear axle rims.

• Install the measuring wheels on the vehicle in accordance with the instructions for securing them **2.3 Install the measuring wheel (fastening options for the measuring wheel on the vehicle)** on the vehicle.

• Before you set down the vehicle, check that the measuring tables are still in their original positions.

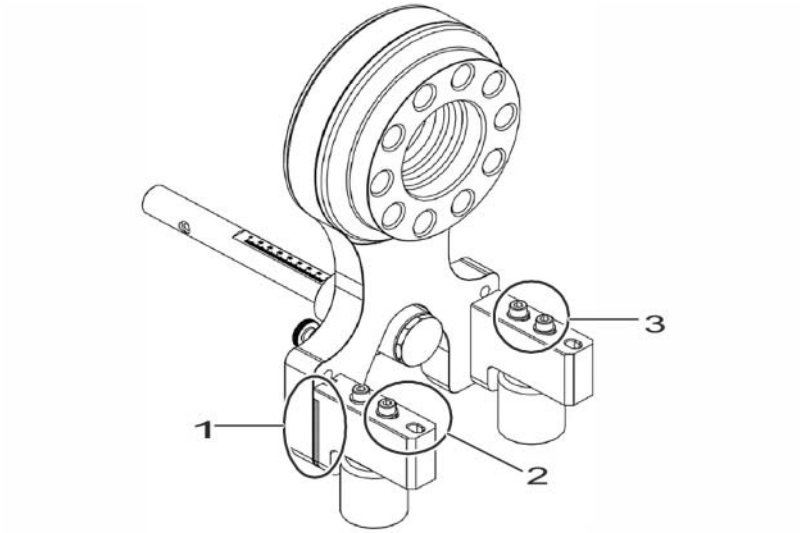

Figure 79

⇒***Figure 79* -1-** – Assembly point for RO adjusting shims
⇒***Figure 79* -2-** – RO adjusting range B, rear fastening option
⇒***Figure 79* -3-** – RO adjusting range A, front fastening option

• Carefully set the vehicle down on the measuring tables using the installed measuring wheels. Make sure that the measuring wheels are centerd on the contact surface.

• Mount the inserts on the front and rear axles.

• Set the chassis (compress).

• Check the zero position of the steering wheel scale and correct it if necessary.

Now align the levelling laser on the marking on the measuring table!

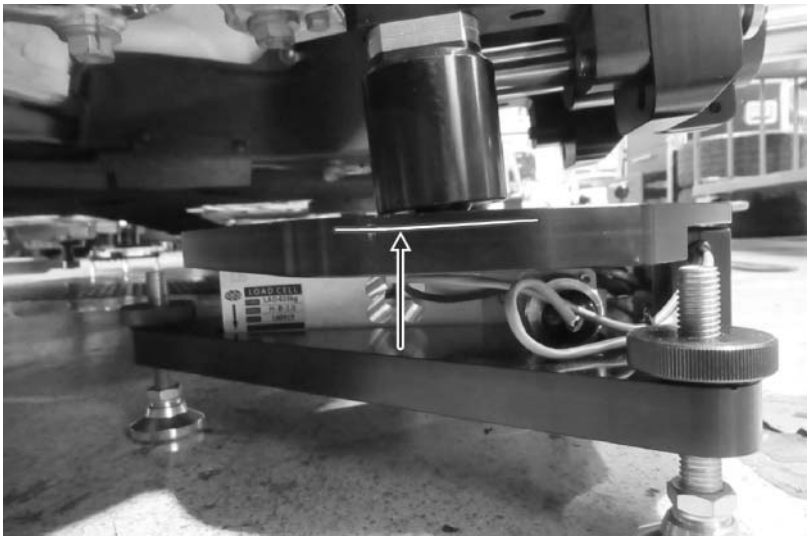

Figure 80

• Now measure the vehicle height on the identical measuring points on the vehicle. Write down the measured values.

• The difference between measuring the driving height with wheel/tire and measuring the height with the measuring wheels indicates the additional height adjustment required on the measuring wheel using adjusting shims and/or a guide for the bracket feet.

• If the measuring wheels are set, the vehicle height must be rechecked using installed measuring wheels.

Arrange the first measuring table using the adjustable legs in such a way that the laser beam is in the center of the groove on all three levelling sleeves.

4. Flow chart for measuring (initial measurement)

NOTICE

- **Before starting alignment, please check the following points:**

⇒ **Fuel tank is completely full**

⇒ **The driver's weight was determined and an equivalent replacement weight is placed on the driver seat, or a weight of 75 kg / 165 lbs is assumed**

The schematic procedure for vehicle measurement is shown below.

The complete procedure is described here. Steps that are required if there are no adjustment values available are marked as "optional".

Step 1

Align and level up the measuring tables.

Step 2 (Optional)

Carefully set the vehicle down with the wheels on the turntables

- Place determined driver's weight on driver seat
- Check that the fuel tank is completely full
- Adjust the tire air pressure to the target value

Step 3 (Optional)

Compress the vehicle / set the chassis

Step 4 (Optional)

Use the steering wheel scales and "straighten" the steering in the direction of travel

Step 5 (Optional)

Align the levelling laser precisely with the upper edge of the turntable

- The levelling laser must remain in this position

Step 6 (Optional)

Read off the driving height at the prescribed/defined measuring points using a steel ruler and note it down

Step 7 (Optional)

Raise the vehicle again and remove the wheels

- Make sure that the measuring tables are not allowed to slip (mark the position of the feet on the floor beforehand if necessary. Realign the tables with these markings again

Step 8

Install measuring wheels to the vehicle

- Observe the specified tightening torque.

Step 9

Carefully set the vehicle down on the measuring tables with the measuring wheels

- Check that the ball rollers are centrally aligned on the measuring tables!
- Install inserts on front axle/rear axle!

Step 10

Compress the vehicle / set the chassis

Step 11

Align the levelling laser with the marking on the measuring table

- The levelling laser must be in the same position as for alignment with the turntables.

Step 12

Readjust the direction of travel of the steering back to "straight" using the steering wheel scales

Step 13

Read off the driving height at the prescribed/defined measuring points using a steel ruler and note it down

Step 14 (Optional)

Raise the vehicle and balance the measuring wheels on the front and rear axle by adjusting the position of the L bracket feet and the height adjusting shims to the determined difference [in mm] between height measurement 1 and measurement 2. Use the RO adjusting shims to adjust the RO to the RO of the rims used. Switch on the tablet and wheel load scales and set wheel load values to "zero"

- Observe specified tightening torques.

Step 15 (Optional)

As a check, set the vehicle down on the measuring tables again, set/compress the chassis and straighten the steering. Compare the vehicle height with the values for the first measurement (with wheels)

- Install the inserts.

Measured values identical?

- No: Repeat, starting from Step 14
- Yes: Continue with Step 16

Step 16

Set the required driving height on the front and rear axle

Step 17

Measure and adjust the camber values

Step 18

Check/adjust the wheel load

Are the values for height, camber and wheel load correct?

- No: Repeat Step 16
- Yes: Continue with Step 19

Step 19

Measure toe width on front and rear axle. Adjust laser shafts to the measured values read off the toe width ruler. Switch on the toe laser, read off measured values and adjust the desired toe values

- Note the toe-in and toe-out!

Are all measured values set correctly?

- No: Repeat Step 16
- Yes: **Measurement completed!**

NOTICE

- **Any change in the camber and vehicle height will require a check and if necessary, the toe width can be adjusted using a toe alignment ruler and any other adjustments in the values for the laser shafts.**
- **Essentially, every change to a parameter means that the other values must be rechecked and may have to be adjusted!**
- **When measurement of the vehicle is complete, all values must be rechecked after the loosened screws have been tightened.**

5. Trouble shooting

5.1 Calibration of the wheel load scale

NOTICE

- **The wheel load scales should only be calibrated when wheel load values are obviously incorrectly displayed.**
- **The operator is responsible for obtaining the weights required for calibration.**
- **To achieve the most accurate calibration possible, calibration MUST be carried out with a weight of 800 lbs (363.0 kg).**
- **Conversion factor pounds [lbs] to kilograms [kg]: 1 lb = 0.4536 kg**

⇒

Step 1: **Turn on the tablet and wheel load scales**

(Follow the sequence and instructions on page 23/24)

Step 2: Launch the **"Computer Scales XLi" app**

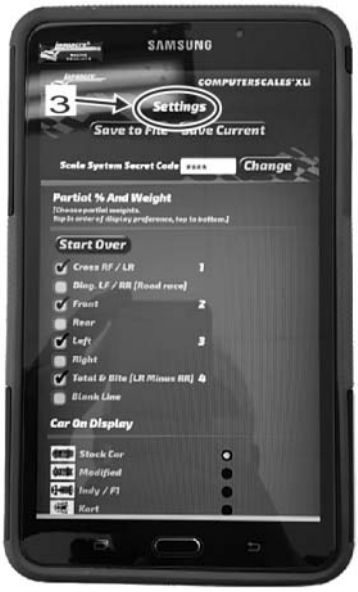

Figure 81 (shown as an example)

⇒***Figure 81 (shown as an example)*** **-Step 3-** – S-wipe right to left to go to the **"Settings"** page

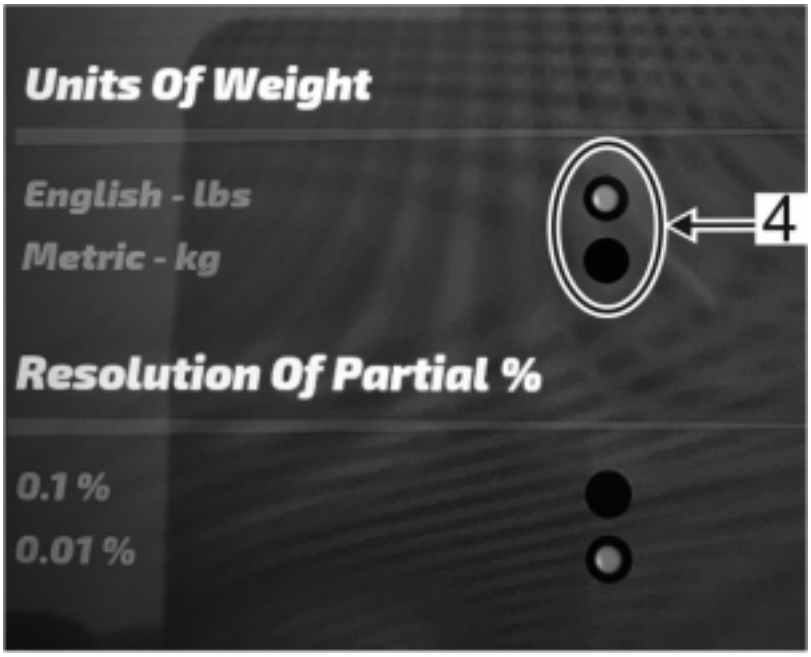

Figure 82 (shown as an example)

⇒***Figure 82 (shown as an example)*** **-Step 4-** – Scroll down and switch from **"Metric - kg"** to **"English - lbs"** under **"Units of Weight"**

Step 5 – **Rotate the tablet 90° (landscape)**

Figure 83 (shown as an example)

⇒***Figure 83 (shown as an example)*** **-Step 6-** – **Press the top and bottom of the screen at the same time**

Figure 84 (shown as an example)

⇒***Figure 84 (shown as an example)*** **-Step 7-** – Acknowledge the displayed warning with **"Yes"**

Figure 85 (shown as an example)

⇒***Figure 85 (shown as an example)*** **-Step 8-** – Under **"Enter Calibration Weight" enter** the value **800.0** and press **"Start Calibration"**

Step 9 – Select the wheel load scale to be calibrated **(LF / LR / RF / RR)**

Step 10 – Press **"Zero"**

Step 11 – Place the calibration weight of **363.0 kg (800 lbs)** on the appropriate wheel load scale

Step 12 – Press **"Calibrate"**. The corresponding wheel load scale is now calibrated. Remove the weight from the wheel load scale and acknowledge calibration with **"Done"**

Step 13 – Switch to the next wheel load scale and **repeat** steps **9 - 12**

Step 14 – If the desired wheel load scales are calibrated, complete calibration with **"Done"**

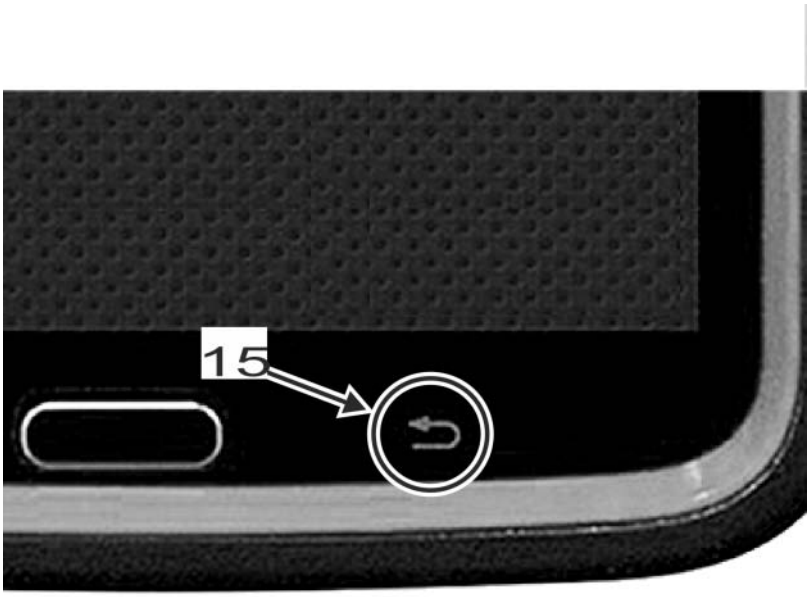

Figure 86 (shown as an example)

⇒***Figure 86 (shown as an example)*** **-Step 15-** – If all wheel load scales are calibrated, return to the "Settings" menu by pressing the **"Back" button** in the **"Settings"**menu.

Step 16 – Change the setting from **"English - lbs"** to **"Metric - kg"** again under **"Units of Weight"**

5.2 Functional test of track lasers and laser shafts

To ensure the correct functioning of the toe laser after improper use or storage, you can perform the following tests.

First of all, it is necessary to ensure that the measuring wheels are fixed. The laser beam position is read on the scale of the other axis and noted or marked. After that, the ball locking pin for positioning the laser housing on the laser shaft is removed and the laser housing is removed. The housing is rotated 180° around the axis of the ball locking bolts, plugged back into the shaft and fixed with the ball locking pin. The housing is now upside down above the shaft, but the laser beam continues to point in the same direction as before. If the laser beam continues to indicate the same value as before after rotation, this means that the laser housing is working properly.

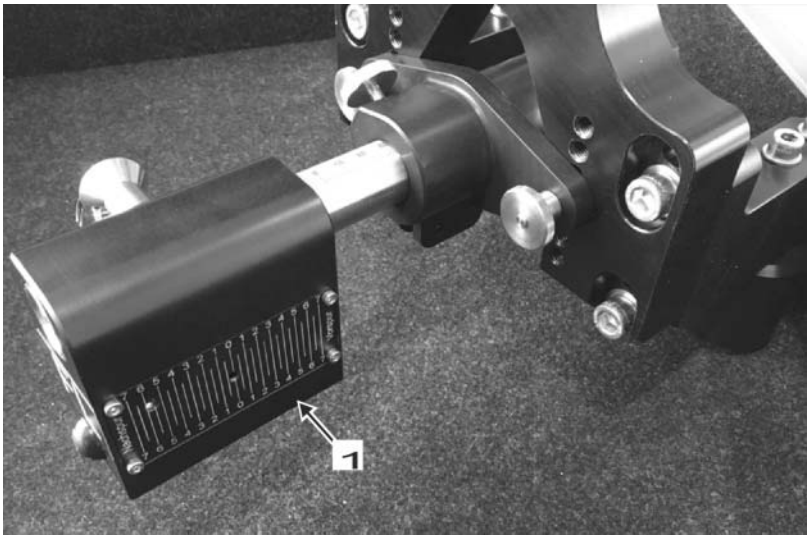

Figure 87

⇒***Figure 87* -1-** – First of all, it is necessary to ensure that the measuring wheels are fixed. The laser beam position is read on the scale of the other axis and noted or marked. After that, the ball locking pin for positioning the laser housing on the laser shaft is removed and the laser housing is removed

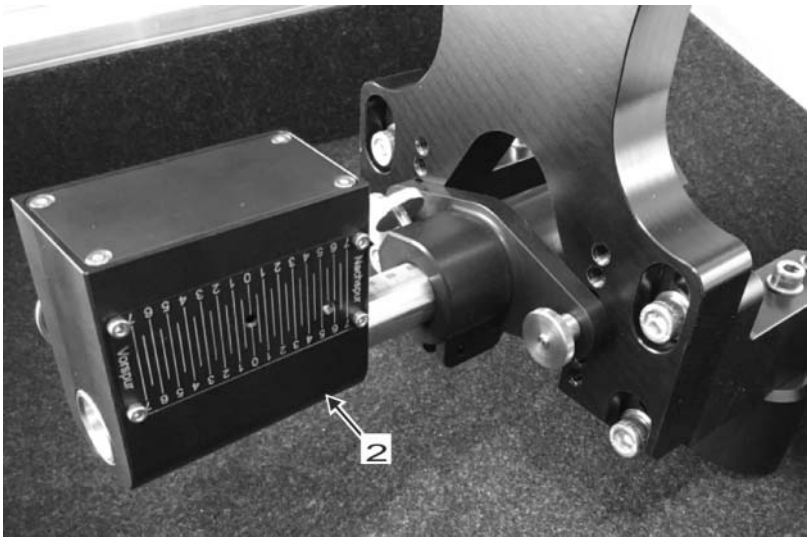

Figure 88

⇒***Figure 88* -2-** – The housing is rotated 180° around the axis of the ball locking bolts, plugged back into the shaft and fixed with the ball locking pin. The housing is now upside down above the shaft, but the laser beam continues to point in the same direction as before. If the laser beam continues to indicate the same value as before after rotation, this means that the laser housing is working properly.

Perform this check on all four toe lasers.

Laser Class 2

Do not look directly into the laser beam

It is now possible to check whether the laser shaft is straight or the screw-on flange is precisely perpendicular to the shaft. The laser shaft is set to any value with the toe laser and the laser beam is projected onto the scale plate of the other axis on the track laser. Read the displayed value.

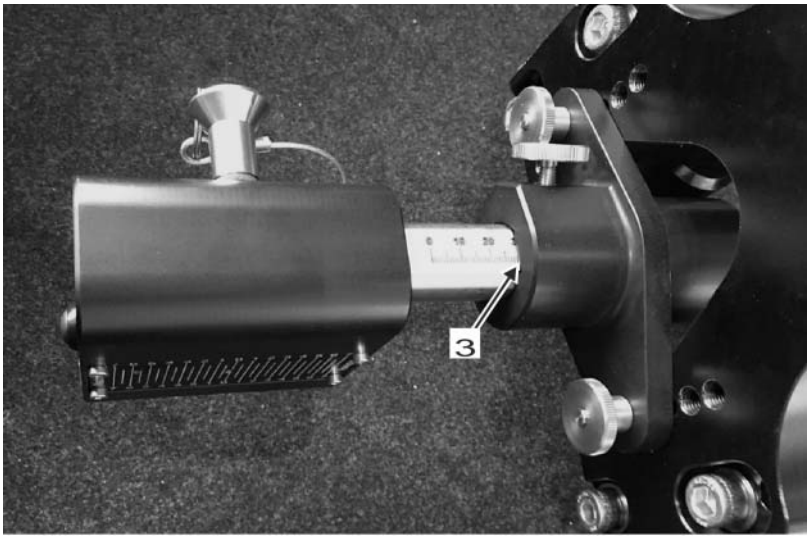

Figure 89

⇒***Figure 89*** **-3-** – Laser shaft with the scale set facing upwards. Setting value set to 30 mm for example purposes.

For test purposes, the shaft is rotated 180° around its central axis so that the scale on the shaft is at the bottom. The previously set value on the laser shaft must be reset. The position of all other parts is unchanged. If the laser beam continues to hit the same spot as before after rotation, this indicates that the laser shaft is straight. The screw-on flange can now also be rotated 180° around the shaft axis to check it is perpendicular.

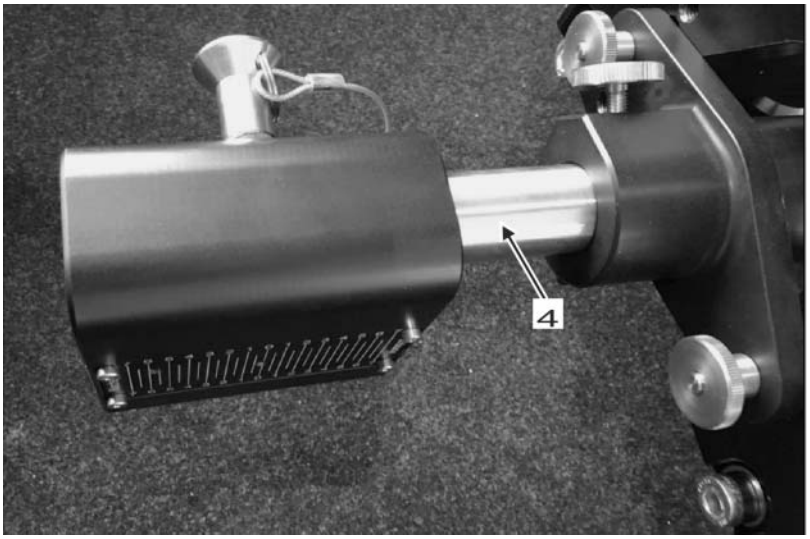

Figure 90

⇒***Figure 90* -4-** – Laser shaft and scale turned downward. The value of 30 mm must be retained.

Laser Class 2

Do not look directly into the laser beam

5.3 Checking the camber scales

Checking the camber scales

The accuracy of the camber scales should always be checked before use, especially after a fall or when used at ambient temperatures that differ from the last calibration by more than 5 °C. The camber scales are checked with the following simple steps.

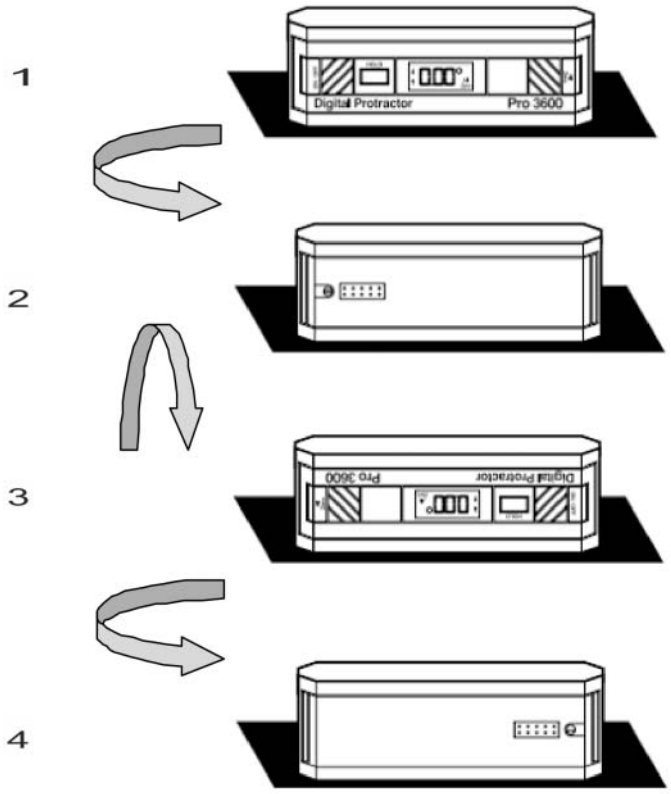

Figure 91

⇒***Figure 91*** **-Step 1-** – Position the camber scales on a level surface with the display facing in your direction. The surface does not need to be exactly horizontal. Switch on the camber scales and wait for 10 seconds. Note the value displayed.

⇒***Figure 91*** **-Step 2-** – Turn the camber scales horizontally by 180 degrees (display is pointing away from you). Wait 10 seconds and take note of the value displayed.

⇒***Figure 91*** **-Step 3-** – Now turn the vertical camber scale by 180 degrees (display points in your direction, balance is overhead). Wait 10 seconds and take note of the value displayed.

⇒***Figure 91*** **-Step 4-** – Finally, turn the camber scales once again horizontally by 180 degrees (display is pointing away from you, scale is still overhead). Wait 10 seconds and record this value.

If the individual values deviate by more than 0.1°, the camber scales MUST be re-calibrated using “Superset”.

The procedure for carrying out “Superset” is described in the enclosed original instructions.

The following applies when measuring **road vehicles**:

- Fuel tank is completely full
- Driver weight or, alternatively, 75 kg/ 165 lbs positioned on the driver’s seat

Vehicle	911 GT2 RS (991.2)	911 GT2 RS (991.2)	911 GT3 RS (991.2)	911 GT3 RS (991.2)
Axle	FA	RA	FA	RA
Spare shims [mm]	0	10	0	10
Height of adjusting shims [mm]	5	0	5	0
RO adjustment range [A/B]	A	B	A	B
L-angle foot connection	Bottom	Bottom	Bottom	Bottom
L-angle foot orientation	Top	Bottom	Top	Bottom

The measuring wheel must be set as shown in the table --> The result is the offset value. **All measuring wheel settings must be transferred analogously to 911 GT3 (992)! Same measuring wheel configuration**

NOTICE

The vehicle height displayed on the wheel alignment system does not correspond to the actual vehicle height. Offset between tire height and measuring wheel height:

- **FA: -23 mm**
- **RA: -12 mm**