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Luminoscope® PLA 5 - for German workshops

User manual

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Level: OPERATOR

Considerations

Copyright and disclaimer

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1 Regulations

Please read the following regulations before using the system and setting it on a powered status.

1.1 Safety regulations

This headlamp tester complies with the necessary safety regulations.

- Improper use or handling of the appliance can compromise the safety of the operator and the environment, as well as the reliability of the measurement.
- Repairs may only be done by the Service engineers of *LET Automotive*. Inexpert repairs can result in danger to the operator and environment.
- Repairs and/or spare parts exchange may only be done with units which are delivered by *LET Automotive*.

Besides the above mentioned safety regulations, the following must also be observed:

- Damaged steel wires on the vertical sliding table must immediately be replaced.
- Do not put or hang objects on the appliance (tools, clothes, …).
- Make sure the wheels of the base are always clean. Obstructions on the rails or wheels can bring the system off-balance during a movement.
- The appliance is not water-proof. Keep it safely out from water spills, soaking or submersion into water and any other liquid.
- The appliance is not shock-proof. Protect it against heavy shocks or impacts. Do not drop or let it fall.

1.2 Danger of localized heating

Warning:

- During the seasons of the year when the sun is very low in the sky, there is a risk of the sun shining directly into the collecting lens of the Luminoscope®, so that the focusing effect which is used to complete the headlights tests may cause focalized overheating inside the machine.
- The generated heating may in extreme cases severely damage the Luminoscope®!
- To avoid any possible damage, it is strongly recommended that the dust/sun cover is used whenever the Luminoscope® is not operational.

1.3 Danger laser beam

Green alignment line laser

The headlamp tester may be equipped with an optional green alignment laser with the following characteristics:

Warning:

- Laser class 2M, wavelength: 520nm, output power < 5mW

- Staring into the laser can lead to severe damage!
- Do not stare into the laser beam of the laser!

1.4 Environmental regulations

Notice:

- Be aware of the consequences of incorrect waste disposal.
- Incorrect disposal of recoverable materials may negatively impact the environment.
- When the service life of the Luminoscope® expires, the appliance should not be discarded with normal household waste. It should be offered for recycling according to the local currently valid regulations instead.

The following materials are used for the main parts of the Luminoscope® PLA 5:

Part	Material
Fresnel lens	Polymethyl methacrylate (PMMA)
Stand	Aluminium
Optical block	Polystyrene (PS) with high resistance
Base	Steel
Alignment mirror	Glass with a layer of aluminium
Alignment laser[1]	Steel sheet
Battery in alignment laser[1]	Nickel-metal-hydride (NiMH) technology based

[1] Part availability depends on the customer specific configuration of the Luminoscope® PLA 5.

2 Basic Principles

What follows is a general explanation of the principles involved in the design and use of Luminoscope® devices and their environment.

2.1 Headlamp criteria

During an international conference in Vienna in 1958 was agreed that the headlamps on vehicles should comply with the following criteria:

- A high beam should illuminate the road in front of the vehicle for at least 100m (300ft).
- A low beam should illuminate the road in front of the vehicle for at least 40m (120ft) without blinding the oncoming vehicles.

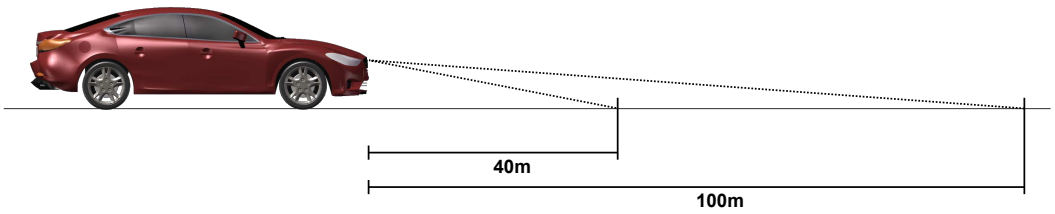

Figure 1: Headlamp criteria

These fundamental criteria don't describe the intensity values, any measuring procedure or how to prevent blinding the oncoming traffic. Therefore, different countries have developed their own standards and technical requirements.

The definition of a headlamp is determined by those standards. In Europe for instance the low beam is described by a “cut off” line which distributes the light beam in a sharp divided light and dark zone, while a low beam in America has to have minimal and maximal intensities in a number of predefined points.

2.2 Adjusting headlamps

The beam from a headlamp is normally directed towards the ground ahead of the vehicle for a low beam (approximately 40m), and straight ahead for a high beam (approximately 100m).

In order to better determine beam orientation, a perpendicular screen is placed in front of the vehicle at a somewhat shorter distance (a minimum of 10m). On this screen, at the same height, and relative to the vehicle axis, the position of the headlamps are indicated.

The lamps can thus be adjusted and checked, taking in account the required inclination settings.

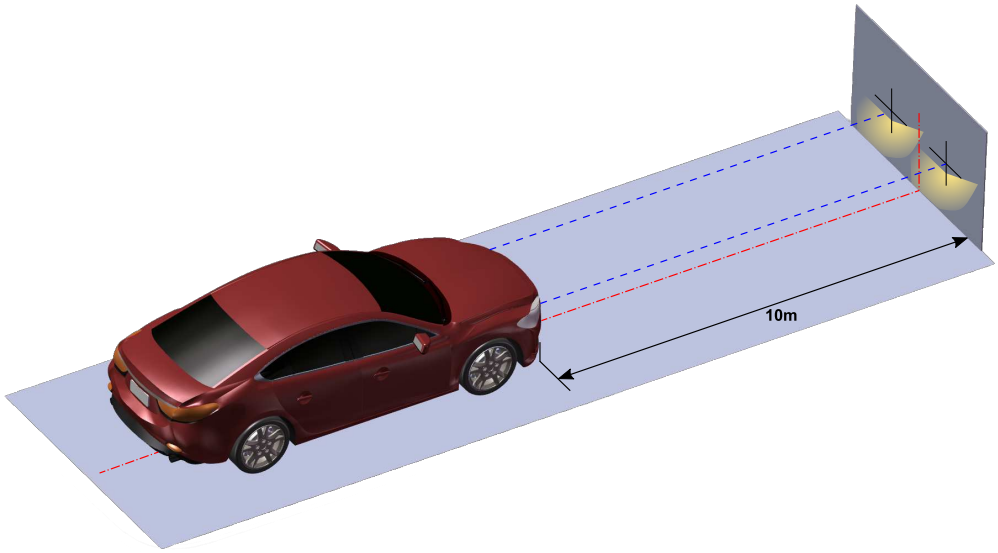

Figure 2: Basic principle of headlamp aiming on a 10m wall

If a white screen is placed at a distance of 10m in front of the headlamp, the inclination angle (slope) of the headlamp under test can be determined and expressed in *cm/10m* or *%*. This kind of projection screen is also called a *10m wall*.

L is the distance between the headlamp and the projection screen and is equal to 10m. The horizontal blue dotted line in the image below indicates the *mounting height* of the headlamp. This height should be marked on the 10m wall. The slopped dotted line represents the beam projection of the *cut-off line* of the low beam. The inclination angle (slope) of the headlamp is indicated as **α** and can be expressed in degrees.

H represents the distance between the *mounting height* of the headlamp and the beam projection of the *cutoff line*, measured on the 10m wall. If L=10m and H=10cm, the headlamp inclination is equal to 10cm/10m, or 1%.

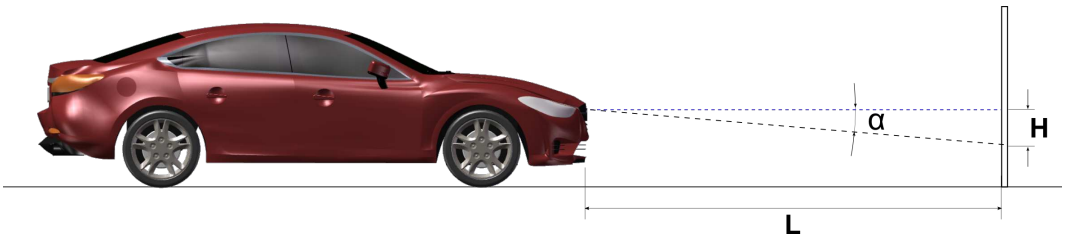

Figure 3: Beam slope

The following table provides the eventually needed conversion between the different units.

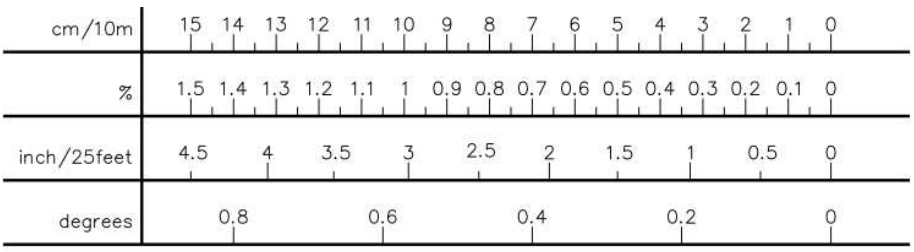

Figure 4: Unit conversion

This method has some disadvantages:

- It requires an indoor open area, over 10 meters long.
- The illumination level of that area has to be constant, mainly dimmed and independent from the varying conditions of natural light.
- The axes must be meticulously specified for each and every different vehicle and for any new vehicle alignment process.
- The method is purely visual and highly dependent on the operator skills and interpretation.

2.3 Lens Principle

The use of a converging lens placed at the focal length reduces the distance to the screen dramatically and eliminates the need of a dark room.

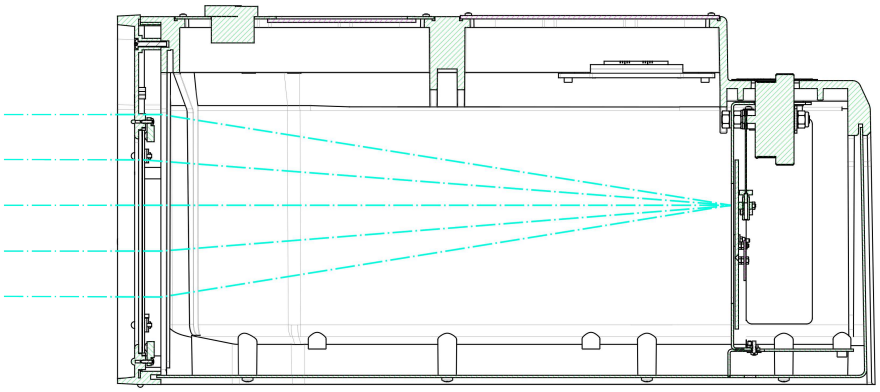

Figure 5: Parallel light rays entering the lens

All parallel rays from the same direction are concentrated in one point on the white projection screen inside the Luminoscope®.

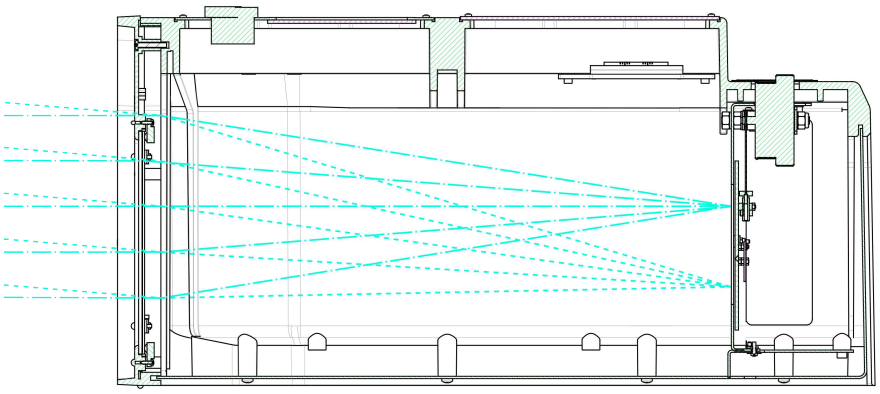

Figure 6: Parallel light rays from different angles entering the lens

Every point on the screen represents a collection of rays from the same direction.

2.4 Advantages of optical block with lens

The use of a collecting lens has advantages over the 10m wall projection method.

- The distance to the screen is dramatically reduced: from 10m to 0.5m.
- The beam intensity is much higher, dimming or cancelling the ambient light is no longer necessary.

- The white projection screen is positioned at the focal distance of the lens. All parallel rays from the same direction are concentrated in one point. Consequently, the relative position of the system in relationship to the lamp becomes less important as the beam projection of the screen remains identical, independent of the place where the rays enter the lens.

Care should be taken, nevertheless, to capture a maximum of the light from the beam, since any light from the beam not entering the Luminoscope® will not be available for visual headlamp assessment. To achieve it, the Luminoscope® has three markings indicating the center of the lens. This can help the operator to determine the ideal position of the optical block lens in front of the headlamp.

2.5 Image projection

The beam pattern is projected at the white projection screen inside the Luminoscope® and can be visually assessed by means of the markings on the screen.

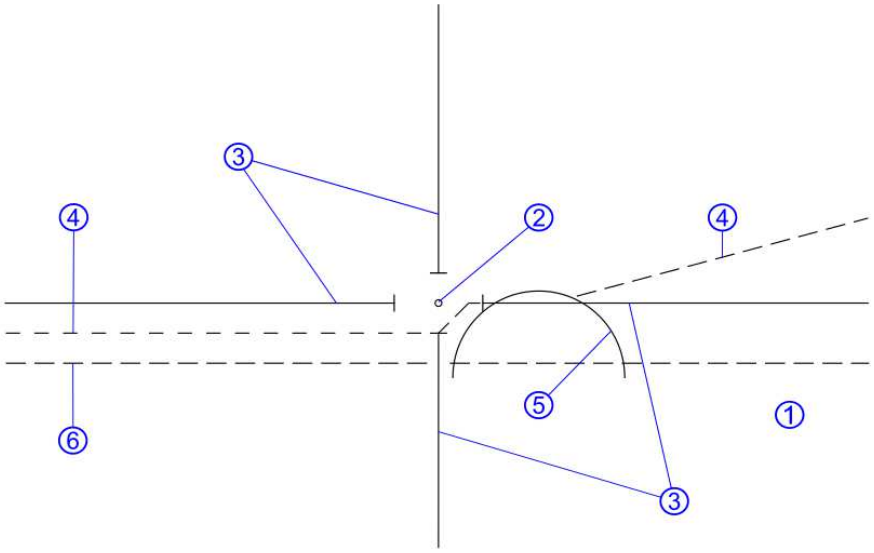

Figure 7: Projection screen with markings

#	Description
1	Projection screen area
2	Intensity measurement cell
3	Reference cross for high beam projection (high beam reference lines)
4	European LHD low beam cut-off line (low beam reference lines)
5	Hotspot area for American low beams
6	Fog beam cut-off line (fog beam reference line)

2.6 Alignment with the vehicle

In order to obtain a reliable measurement of the headlamp, it is necessary to achieve a good alignment of the Luminoscope® with the slope of the vehicle standing area and the longitudinal axis of the vehicle.

In the horizontal plane

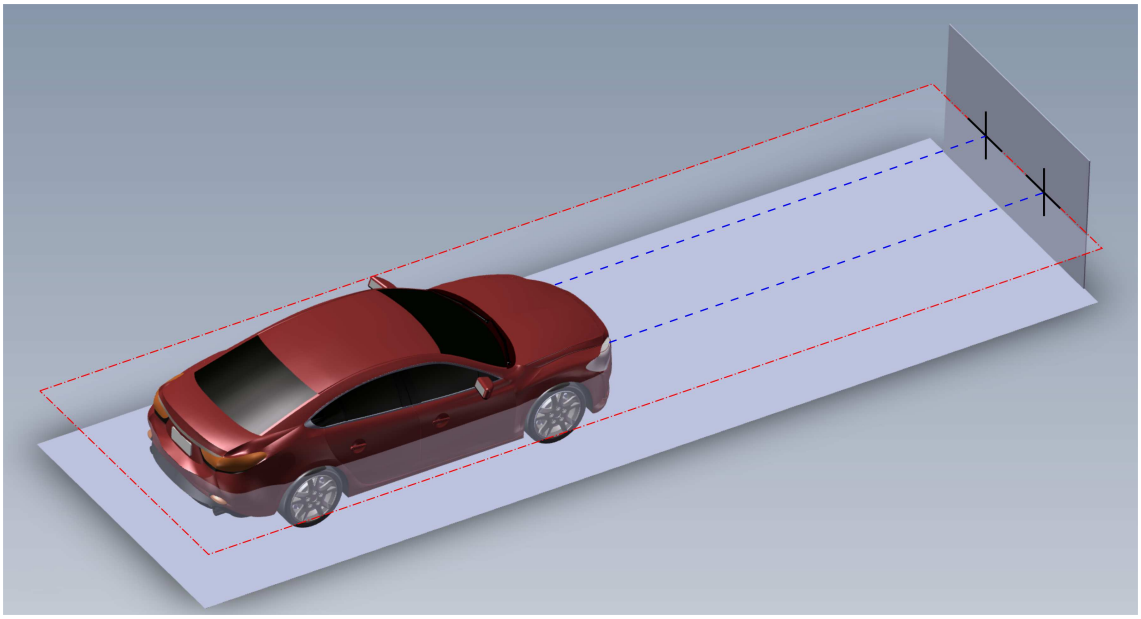

Figure 8: Horizontal plane alignment

The easiest way to achieve a good horizontal alignment with the vehicle is to place the vehicle on a horizontal floor and set the optical block also horizontal with the aid of the spirit level. In practice not so many floors are perfectly horizontal. There are two practical methods to achieve it:

- Measure the floor slope (check corresponding manual) and tilt the optical block in the same direction with the same slope.
- Measure the floor slope and add or subtract that value (depending on the direction of the floor slope) to the computed value of the beam position by the optical block.

In the vertical plane

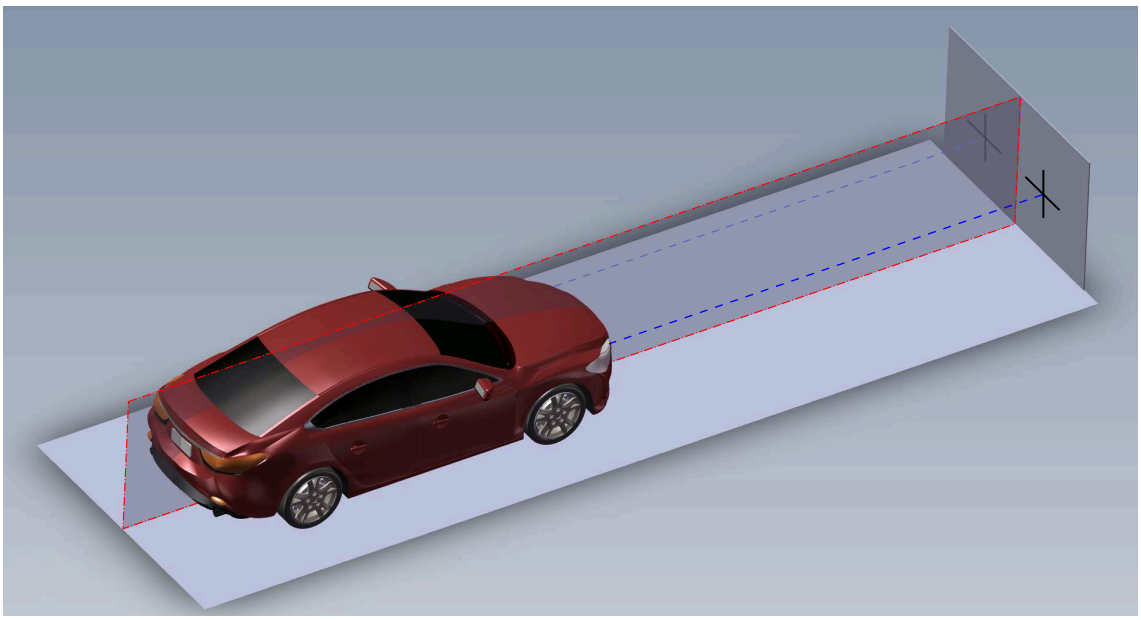

Figure 9: Vertical plane alignment

The precision of the measurement of the L/R position of the beam depends mainly on the vertical alignment of the vehicle towards the optical block. As an example, a simple misalignment of

5mm on a wheelbase of 2m will give an error of 5 x 5mm = 2.5cm/10m in the L/R measurement of the beam.

The vertical plane is also called the *longitudinal direction* of the vehicle.

In order to help the operator to correctly align the Luminoscope® with the longitudinal axis of the vehicle, the system is equipped with an alignment mirror, and optionally with an alignment laser. The reference lines on the mirror, as well as the optional laser line, should be calibrated perpendicular with the optical axis of the headlamp tester.

The operator rotates the stand, looking for the intersection point of the reference line(s), either those on the mirror or the laser projection, with two symmetrical points on the vehicle which are also considered as perpendicular with the longitudinal axis of the vehicle.

This procedure ensures the longitudinal alignment between the Luminoscope® and the vehicle longitudinal axis.

2.7 Positioning in front of the headlamp

It is of great importance that the lens of the Luminoscope® is correctly positioned in front of the headlamp to ensure that as many light rays as possible enter the lens.

This guarantees that the beam image is displayed realistically on the white projection screen inside the Luminoscope® to be able to perform a correct headlamp measurement.

With this purpose, the front of the Luminoscope® has three markings 1 indicating the centre of the lens. This can help the operator to correctly position the lens of the Luminoscope® in front of the headlamp.

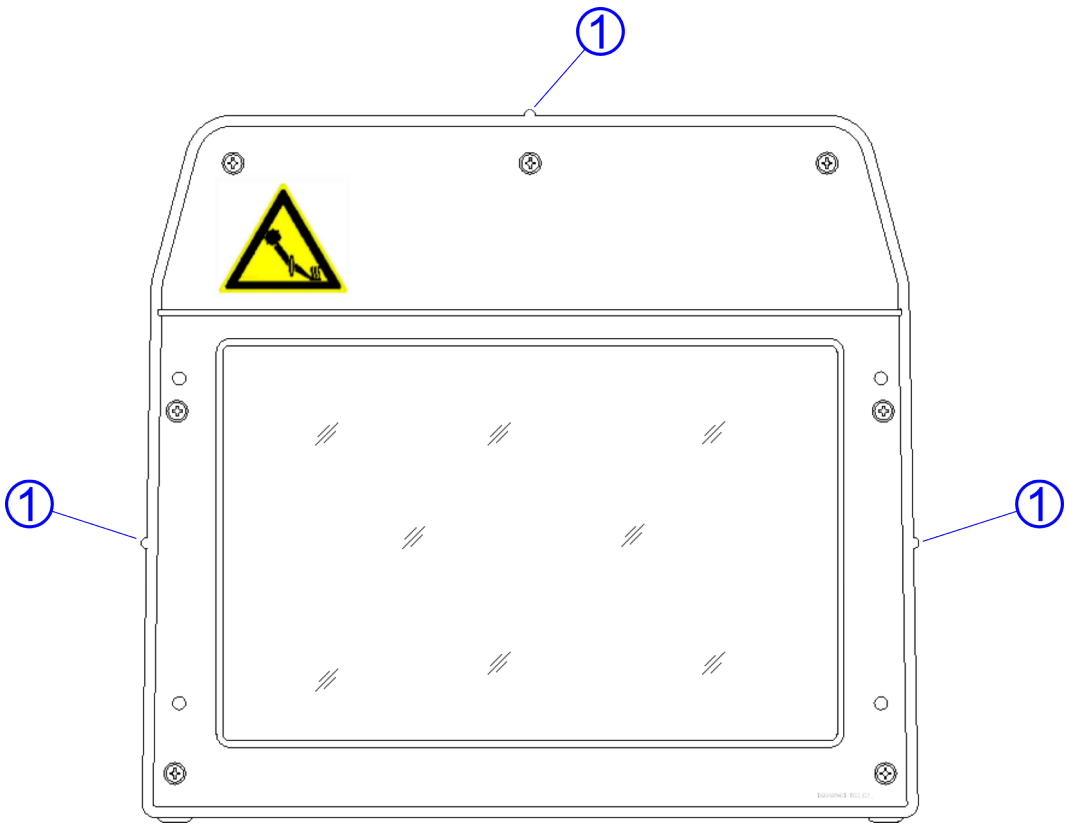

Figure 10: Central markings on the lens front

3 Headlamps

This is a review of the illumination patterns that different headlamps produce.

3.1 ECE or European low beam

Note: The terms *low beam* and *dipped beam* also refer to the same type of headlamp and are used interchangeably.

The purpose of the low beam is to illuminate the road ahead of the vehicle and traffic signs up to a distance of approximately 40m without blinding oncoming traffic. The asymmetrical low beam must be adjusted on a predefined inclination value. In Europe e.g. it's an inclination between -1% (or -10cm/10m) and -1.5% (or -15cm/10m). The reference point of the beam is the intersection of the horizontal part with the sloped part and is referred to as *V-point*. It is also called *kink point* and *elbow point*.

There exist two types of ECE low beams, depending on which side of the road the vehicle is driving:

LHD (Left Hand Drive)

The steering wheel is positioned on the left side of the vehicle and the driver uses the right side of the road. Some examples of countries on which this driving type is implemented include (but are not limited to) Belgium, France and Germany, among many others.

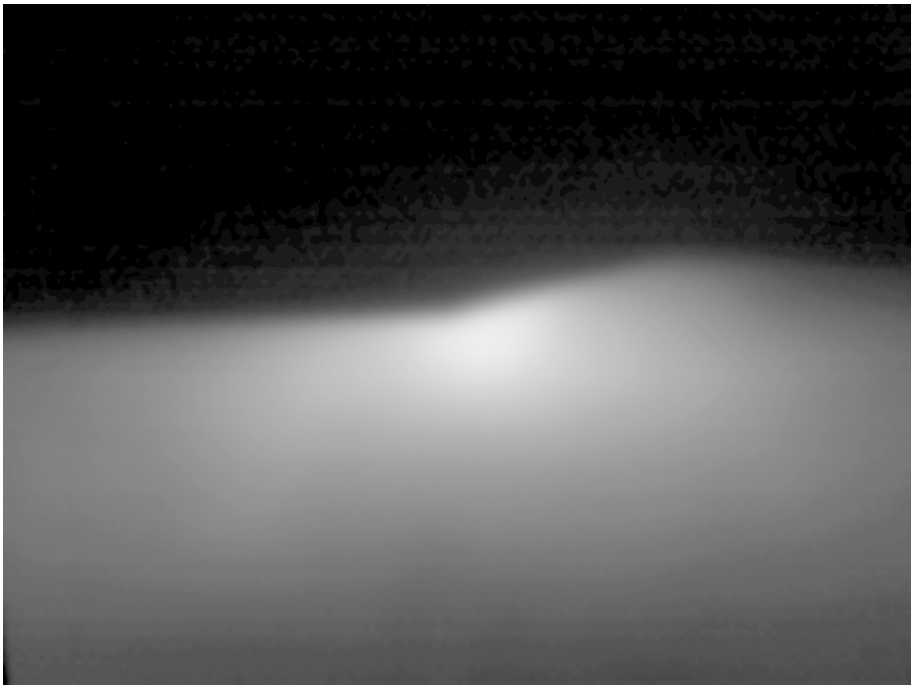

Figure 11: Low beam LHD

RHD (Right Hand Drive)

The steering wheel is positioned on the right side of the vehicle and the driver uses the left side of the road. Some examples of countries on which this driving type is implemented include Great Britain, Ireland, Japan, Thailand, Malaysia, Indonesia, New Zealand, Australia, India, South Africa, among many others.

Figure 12: Low beam RHD

The world map below shows the implemented driving types for each country.

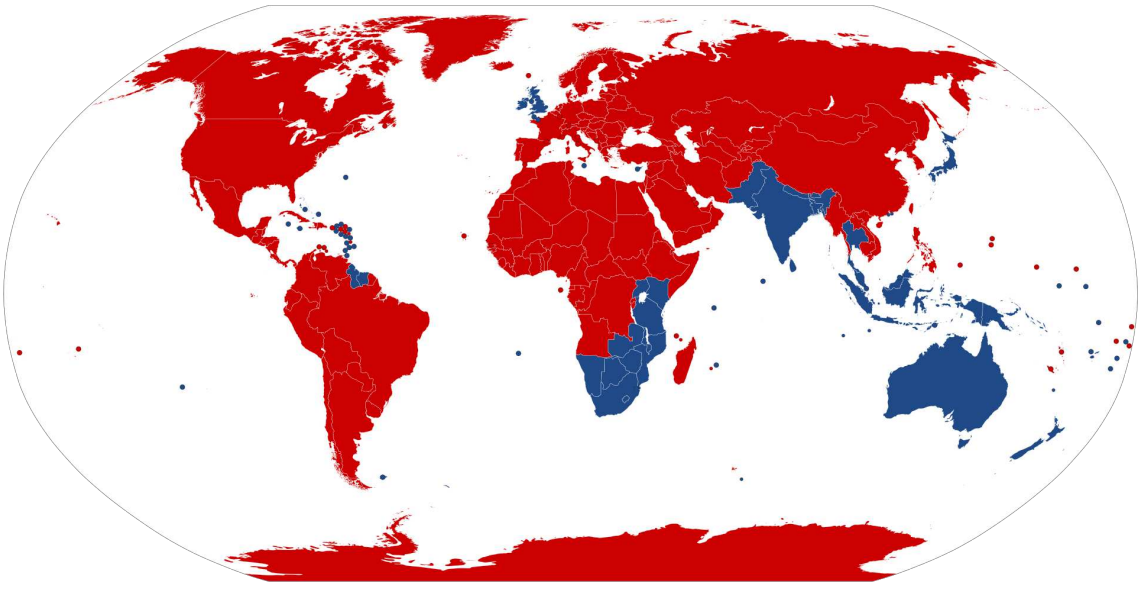

Figure 13: Implementation of LHD and RHD driving types across the world

3.2 High beam

Note: The terms *high beam* and *main beam* refer to the same type of headlamp and are used interchangeably.

The purpose of the high beam is to illuminate the road ahead of the vehicle at a further distance of approximately 100m. The form of the beam is rather oval. The reference point is the point with the highest intensity (hotspot).

There are two different ways of construction:

- The high beam is integrated in the same housing of the low beam. So it is not possible to separately adjust high and low beam. In most countries, the low beam is adjusted because this is the driving beam. Due to the construction of the headlamp, the high beam will be at an inclination value that is ±1% or 10cm/10m higher than the low beam value.
- The high beam is a standalone headlamp so both beams can be separately adjusted with their own adjusting screws. Adjustment of the high beam is done at a value of 1% or 10cm/10m higher than the low beam value.

Figure 14: High beam

3.3 Fog beam

Fog beams are mounted at the front bottom of the vehicle and illuminate the road as far as possible under fog, heavy rain or snow conditions.

The form of the beam is a broad band of light, where the reference is the flat horizontal top line (cut-off line) which is normally adjusted at 1% or 10cm/10m below the low beam value. A fog beam only has one adjusting screw controlling the inclination.

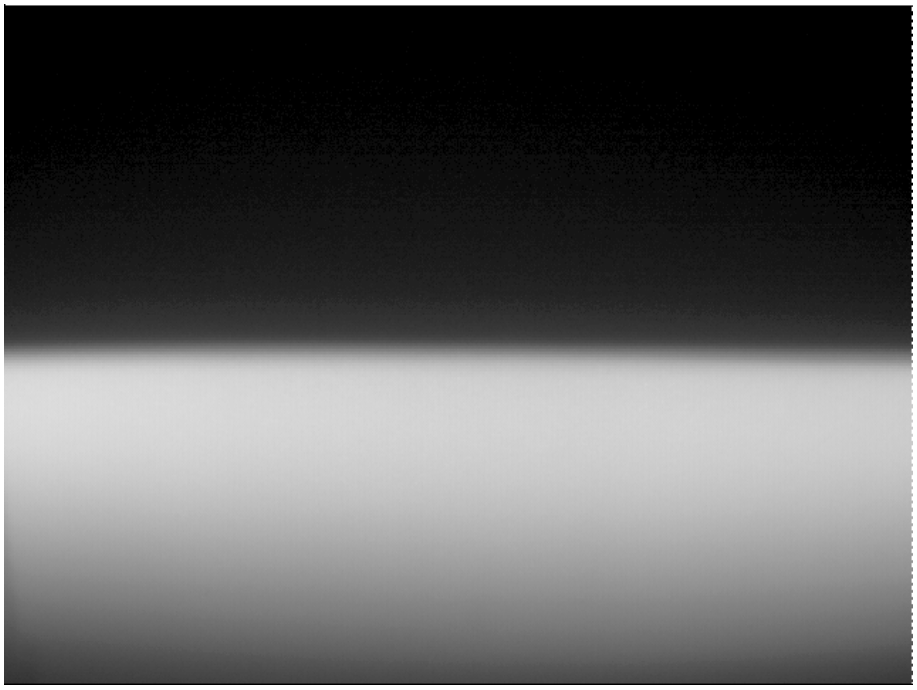

Figure 15: Fog beam

3.4 SAE or American low beam

Note: The terms *low beam* and *dipped beam* also refer to the same type of headlamp and are used interchangeably.

SAE (Society of Automotive Engineers)/ American low beams have an *LHD shaped cut-off line* with a small step and a zone of high intensity (*hotspot*) on the right side of the small step.

American low beams must be aimed – according to the marking on the glass – referring to the left or right side of the cut-off line.

There are two types of American low beams, requiring different adjustment methods:

VOL - Visually Optical Left	The left part of the cut-off line should be aimed at an inclination of -0,7%.
VOR - Visually Optical Right	The right part of the cut-off line should be aimed at an inclination of 0%.

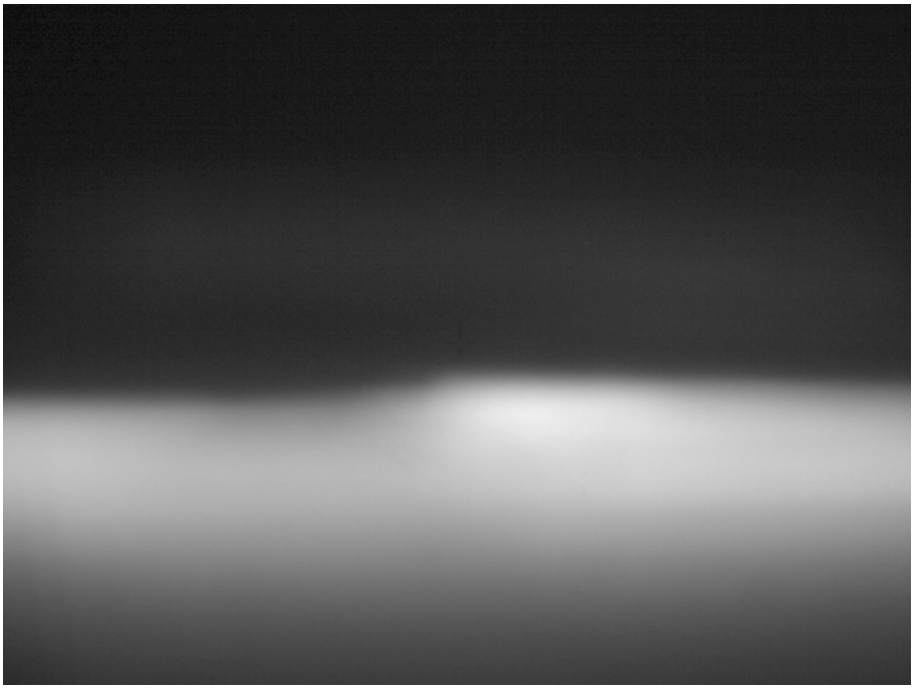

Figure 16: SAE low beam VOL or VOR

3.5 Japanese low beam

Note: The terms *low beam* and *dipped beam* also refer to the same type of headlamp and are used interchangeably.

The Japanese low beam has some similarities with a mirrored image of the SAE low beam, because the Japanese driver uses the left side of the road (RHD). However there are subtle details regarding the different heights of the zones at both sides of the step which make them different.

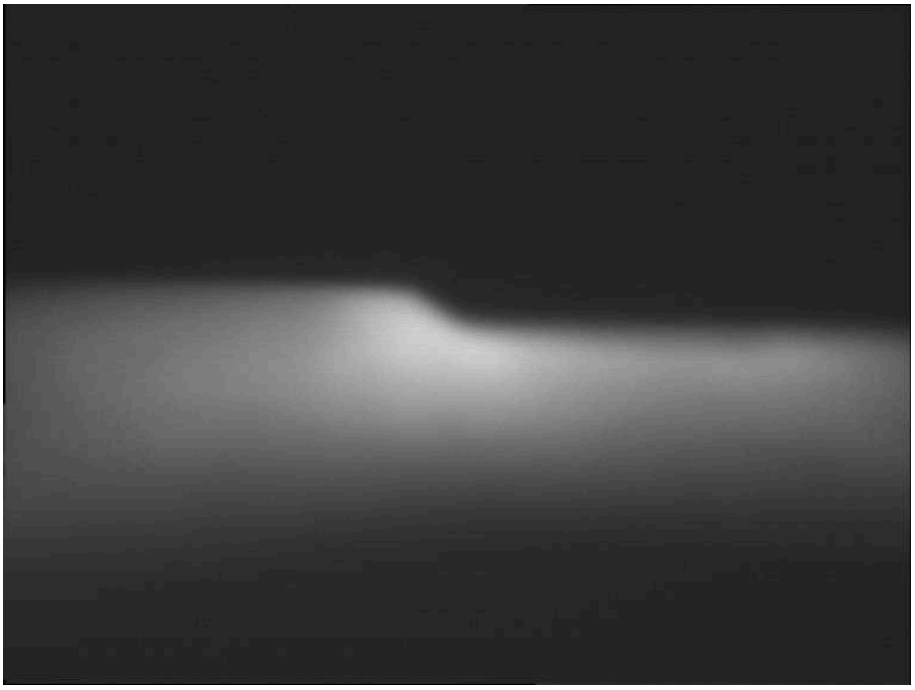

Figure 17: Japanese low beam

4 Prerequisites for checking or adjusting

In order to achieve an accurate and stable headlamp measurement or adjustment, a number of prerequisites must be taken care of.

4.1 Prerequisites for the vehicle

- The front wheels must be in the straight-line travel position.
- The tires should be inflated to manufacturer specified pressures.
- The vehicle should be empty, with the hand-brake released.
- The springs and the shock-absorbers should be in their equilibrium positions. For vehicles with hydro-pneumatic suspension, the motor should be running.
- Where the vehicle is equipped with a manual control to adjust the low beam, it should be checked that it is in its rest position.

4.2 Prerequisites for the headlamps

- Check that the headlamps are rigidly connected to the vehicle.
- Check whether the two lamp glasses are identical, whether they are in their correct angular position and that they are not cracked.
- Check that the lamp glasses are clean and whether the reflectors are in a satisfactory state.
- Check that the headlamp units neither contain any water, or are misted up.

4.3 Positioning the system

- Locate the vehicle approximately 20-60 cm from the lens of the headlamp tester.
- Check regularly that the air bubble in the spirit level is centered at the lamps' test place.

5 Technical characteristics

5.1 PLA 5 models

Depending on the provided guiding system, there are different Luminoscope® models available.

Model	Height range of the Luminoscope optical axis	Description
Luminoscope® PLA 5 DR	Between 225 mm and 1410 mm. Range might extend slightly further.	The two V-shaped front weels of the trolley base are guided on a hexagonal rail. The simple flat wheel runs on the square rail. The uniform levelling of the rails can be easily adjusted to obtain a perfect horizontal movement over the whole lenght of the rails.
Luminoscope® PLA 5 SR	Between 250 mm and 1425 mm. Range might extend slightly further.	The two rubber front wheels of the trolley are guided on a simple M-shaped steel rail, attached to the floor. The rubber rear wheel runs on the floor. There is no adjustment mechanism provided to adjust the uniform levelling of the rail. The inclination of the optical unit will subtle vary without any doubt while displacing the Luminoscope® and this has a direct consequence on the headlamp measurement. To solve this problem, the Luminoscope® PLA 5 SR has an AL (*Adaptative Levelling*) handle for correcting the slope of the optical block.
Luminoscope® PLA 5 NR	Between 250 mm and 1425 mm. Range might extend slightly further.	The three rubber wheels of the trolley base run on the floor. The Luminoscope® can be used on different locations which have identical floor slope for the vehicle standing area. The inclination of the optical unit will subtle vary without any doubt while displacing the Luminoscope® and this has a direct consequence on the headlamp measurement. To solve this problem, the Luminoscope® PLA 5 NR has an AL (*Adaptative Levelling*) handle for correcting the slope of the optical block.
Luminoscope® PLA 5 DR D	Between 235 mm and 1410 mm. Range might extend slightly further.	The "D" in the D-type refers to the trolley base of the Luminoscope® and stands for "Deutsch". The DR D trolley base is an universal base and has a different shape (L-shape) than the standard DR trolley base. The DR D trolley base can be equipped with different wheel types that can be guided on different guiding rail types. The three wheels of the trolley base are guided on two (adjustable) rails. In case of levelled guiding rails, the Luminoscope® can be moved perfectly horizontally over the whole length of the rails. In case there is no adjustment mechanism provided to adjust the uniform levelling of the rails, the inclination of the optical block will subtly vary without any doubt while displacing the Luminoscope®. This has a direct consequence on the headlamp measurement. To solve this problem, the Luminoscope® PLA 5 DR D has an AL (*Adaptative Levelling*) handle for correcting the slope of the optical block.

Model	Height range of the Luminoscope optical axis	Description
Luminoscope® PLA 5 SR D	Between 250 mm and 1425 mm. Range might extend slightly further.	The "D" in the D-type refers to the trolley base of the Luminoscope® and stands for "Deutsch". The SR D trolley base is an universal base and has a different shape (L-shape) than the standard SR trolley base. The SR D trolley base can be equipped with different wheel types. The two front wheels of the trolley base are guided on a simple rail, attached to the floor. The rear wheel runs on the floor. There is no adjustment mechanism provided to adjust the uniform levelling of the rail. The inclination of the optical block will subtly vary without any doubt while displacing the Luminoscope® and this has a direct consequence on the headlamp measurement. To solve this problem, the Luminoscope® PLA 5 SR D has an AL (*Adaptative Levelling*) handle for correcting the slope of the optical block.
Luminoscope® PLA 5 NR D	Between 250 mm and 1425 mm. Range might extend slightly further.	The "D" in the D-type refers to the trolley base of the Luminoscope® and stands for "Deutsch". The NR D trolley base is an universal base and has a different shape (L-shape) than the standard NR trolley base. The NR D trolley base can be equipped with different wheel types. The three wheels of the trolley base run on the floor. The inclination of the optical block will subtly vary without any doubt while displacing the Luminoscope® and this has a direct consequence on the headlamp measurement. To solve this problem, the Luminoscope® PLA 5 NR D has an AL (*Adaptative Levelling*) handle for correcting the slope of the optical block.

Luminoscope® PLA 5 DR

Figure 18: General view of Double Rail model (PLA 5 DR)

Luminoscope® PLA 5 DR D

Figure 19: General view of Double Rail model for the German market (PLA 5 DR D)

Luminoscope® PLA 5 SR

Figure 20: General view of Single Rail model (PLA 5 SR)

Luminoscope® PLA 5 SR D

Figure 21: General view of Single Rail model for the German market (PLA 5 SR D)

Luminoscope® PLA 5 NR

Figure 22: General view of No Rail model (PLA 5 NR)

Luminoscope® PLA 5 NR D

Figure 23: General view of No Rail model for the German market (PLA 5 NR D)

5.2 Guiding systems

The two front wheels of the trolley base of the Luminoscope® PLA 5 can be guided on one non-adjustable rail profile that is fixed to the floor. Other systems are guided on two robust adjustable rails which are fixed to the floor or recessed in the floor.

Guiding the Luminoscope® PLA 5 on rails ensures an easier alignment of the Luminoscope® with the vehicle. In case the rails are adjustable, the Luminoscope® remains horizontally along the whole range of the rails.

Luminoscope® PLA 5 systems without guiding rails are also available. In this case, the rubber wheels of the trolley base are just running on the floor. The equipment can be used on different locations which have the same floor slope for the vehicle standing area.

On systems with non-adjustable rails or without any rails, the inclination of the optical block will subtle vary without any doubt while displacing the system. This has a direct consequence on the measurement results of the Luminoscope®. To solve this problem, the Luminoscope® PLA 5 can be equipped with an *AL (Adaptive Levelling)* handle for correcting the slope of the optical block.

There are three different guiding systems available, depending on the use or type of rail:

- DR – Double Rail
- SR – Single Rail
- NR – No Rail

5.2.1 PLA 5 DR: double rail

The two V-shaped front wheels 1 of the trolley base are guided on a hexagonal rail 2. The simple flat rear wheel 3 runs on the square rail 4. The uniform levelling of the rails can be easily adjusted to obtain a perfect horizontal movement of the Luminoscope® over the whole length of the rails.

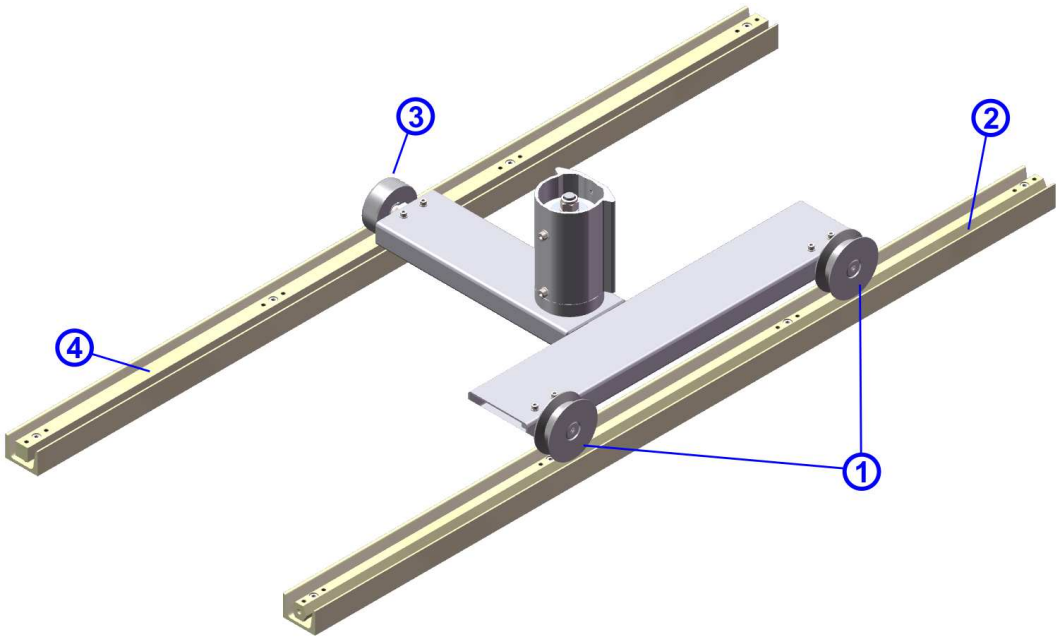

Figure 24: Double rail (DR)

5.2.2 PLA 5 SR: single rail

The two front rubber wheels 1 of the trolley base are guided on a simple M-shaped steel rail 2, fixated to the floor. The rear rubber wheel 3 runs on the floor.

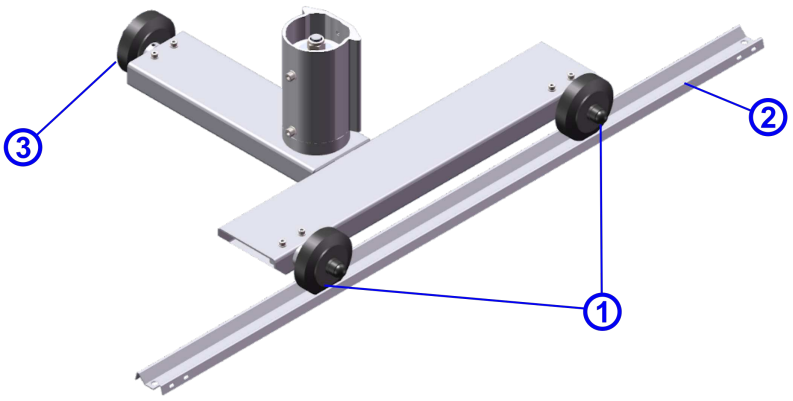

Figure 25: Single rail (SR)

There is no adjusting mechanism provided to adjust the uniform levelling of the rail.

5.2.3 PLA 5 NR: no rail

The three rubber wheels of the trolley base run on the floor.

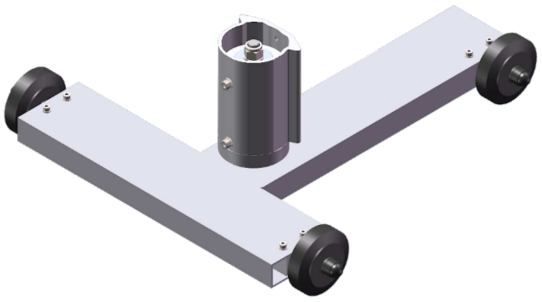

Figure 26: No rail (NR)

The system can be used on different locations which have an identical floor slope for the vehicle standing area.

The shape of the NR trolley differs from that for DR and SR models. The reason behind this is achieving an easier movement of the system between locations.

5.3 Layout

The following sections include detailed graphics and callouts of the Luminoscope® which lead to an easier identification of the different parts and models.

Remember: Depending on the ordered options, the supplied unit may look slightly different from the following drawings.

5.3.1 Front view

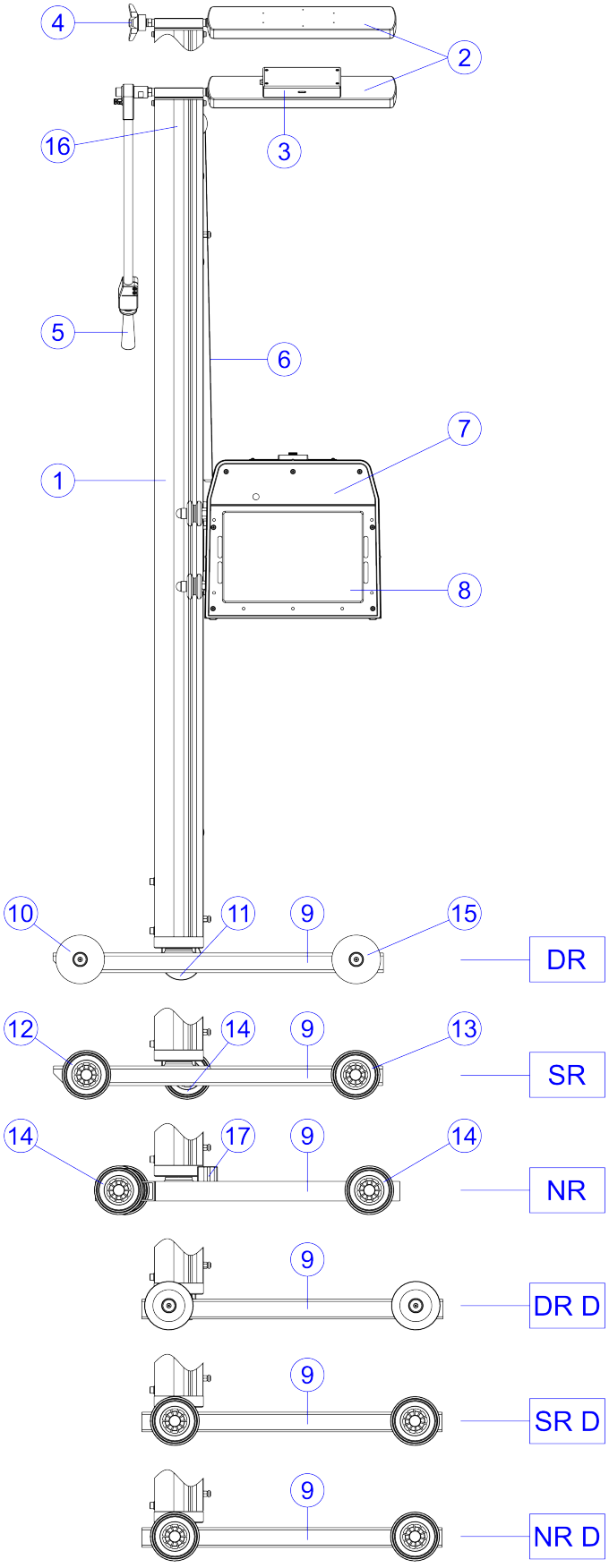

Figure 27: Front view of the Luminoscope®

1	Stand	The optical block is attached to the vertical sliding table of the stand.
2	Alignment mirror	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
3	Green alignment laser (optional)	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
4	Mirror / laser handle (standard type)	Used to tilt the alignment mirror / laser assembly.
5	Mirror / laser lever (optional)	Used to tilt the alignment mirror / laser assembly. The button on the lever extends the power-on button on the alignment laser.
6	Counterweight cable	Connects the vertical sliding table of the optical block with the counterweight inside the stand.
7	Optical block	The optical block includes a lens, a white projection screen with markings for visual headlamp assessment and a rotary knob for adjusting the vertical position of the projection screen.
8	Lens type label	Irremovable lens type label located at the bottom corner at the back of the lens. The label is visible by looking through the Perspex window on top of the optical block.
9	Trolley base	The trolley base on wheels ensures the stability and the perpendicularity of the system.
10	V-wheel with eccentric axle	Front wheel guides the system on the hexagonal rail. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
11	Flat wheel with eccentric axle	Flat wheel running on the square rail. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
12	Rubber wheel with eccentric axle	The rubber wheel runs on a non-adjustable rail profile. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
13	Rubber wheel	The rubber wheel runs on a non-adjustable rail profile.
14	Rubber wheel with eccentric axle	The rubber wheel runs on the floor. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
15	V-wheel	Front wheel of the system running on the hexagonal rail.
16	Luminoscope® type label	Irremovable type label of the Luminoscope® system at the side of the stand.
17	Brake mechanism	Brake mechanism for mast rotation.

5.3.2 Top view

PLA 5 DR

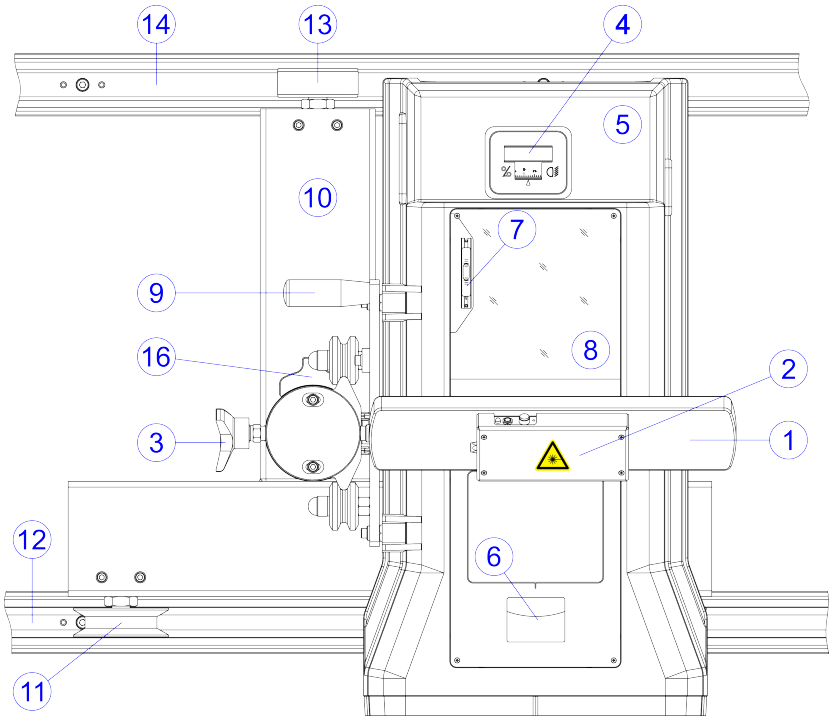

Figure 28: Top view Luminoscope® *PLA 5 DR*

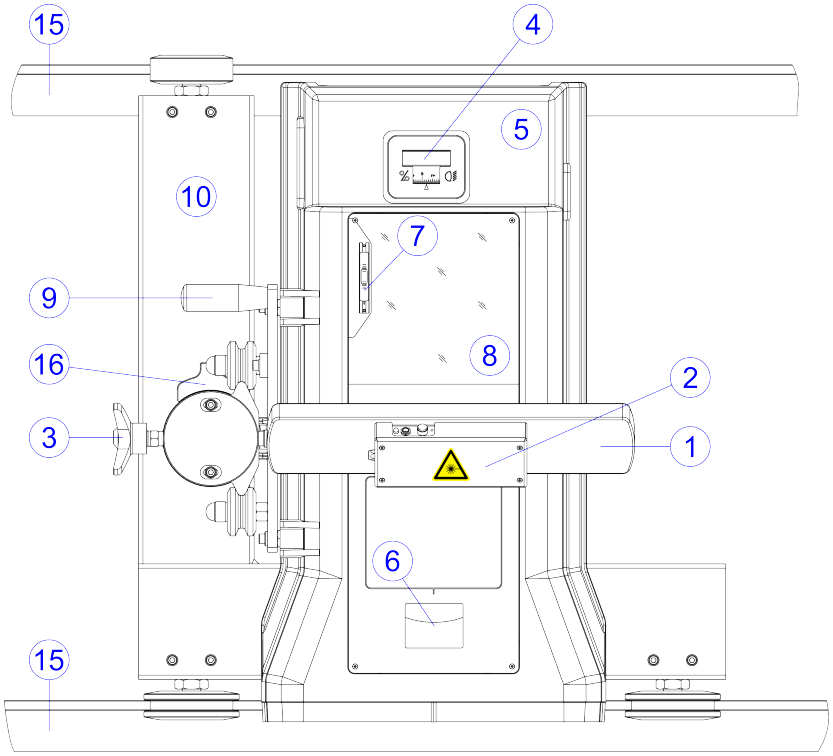

Figure 29: Top view Luminoscope® *PLA 5 DR D*

1	Alignment mirror	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.

2	Green alignment laser (optional)	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
3	Mirror / laser handle (standard type)	Used to tilt the alignment mirror / laser assembly.
4	Rotary inclination knob	To adjust the vertical position of the internal projection screen. The chosen value on the knob corresponds with the vertical position of the low beam cut-off line at the projection screen.
5	Optical block	The optical block includes a lens, a white projection screen with markings for visual headlamp assessment and a rotary knob for adjusting the vertical position of the projection screen.
6	Analog lux meter	Indicates the luminous intensity (in kCd) of the high beam.
7	Reference spirit level	The reference spirit level is used as a tool to verify the calibration status of the optical block. The Luminoscope® is initially calibrated at the factory to a point on which the optical axis of the optical block is horizontal.
8	Perspex window	The headlight image on the projection screen inside the optical block is visible through this window.
9	Handle	Handle on the vertical sliding table to move the system and vertically displace the optical block.
10	Trolley base	The trolley base on wheels ensures the stability and the perpendicularity of the system.
11	V-wheel with eccentric axle	Front wheel guides the system on the hexagonal rail. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
12	Adjustable hexagonal rail profile	Adjustable rail profile embedded in the floor, which guides the two front V-wheels of the trolley base.
13	Flat wheel with eccentric axle	Flat wheel running on the square rail. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
14	Adjustable square rail profile	Adjustable square rail profile embedded in the floor, over which the rear flat wheels of the trolley base runs.
15	Special guiding rail	Special rail profile mounted on the floor, not supplied by LET. May be adjusted to ensure a flat continuous surface. Requires matching wheels which are available in the LET catalog.
16	Brake mechanism	Brake mechanism for mast rotation.

PLA 5 SR

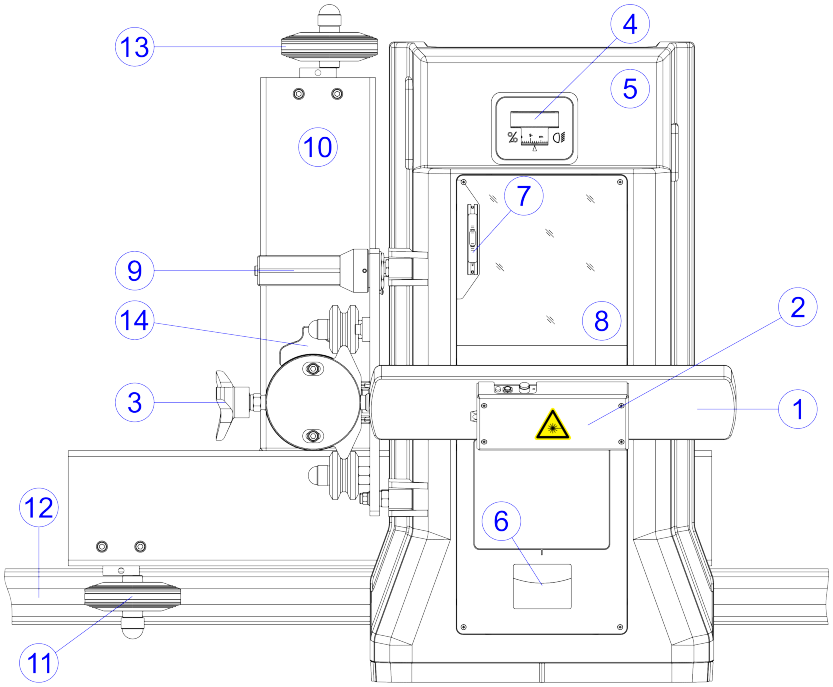

Figure 30: Top view Luminoscope® *PLA 5 SR*

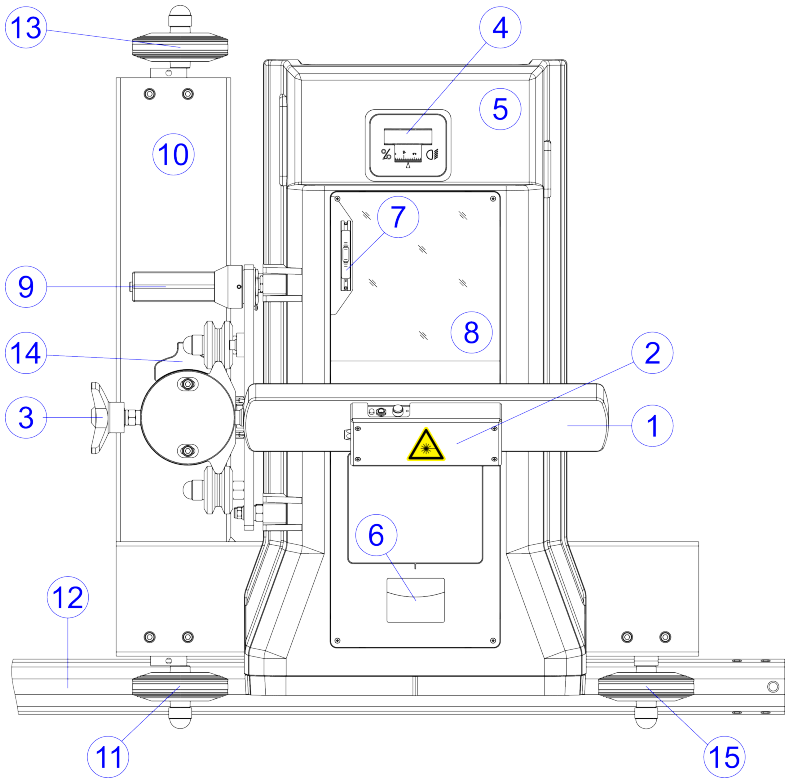

Figure 31: Top view Luminoscope® *PLA 5 SR D*

1	Alignment mirror	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
2	Green alignment laser (optional)	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.

3	Mirror / laser handle (standard type)	Used to tilt the alignment mirror / laser assembly.
4	Rotary inclination knob	To adjust the vertical position of the internal projection screen. The chosen value on the knob corresponds with the vertical position of the low beam cut-off line at the projection screen.
5	Optical block	The optical block includes a lens, a white projection screen with markings for visual headlamp assessment and a rotary knob for adjusting the vertical position of the projection screen.
6	Analog lux meter	Indicates the luminous intensity (in kCd) of the high beam.
7	Reference spirit level	The reference spirit level is used as a tool to verify the calibration status of the optical block. The Luminoscope® is initially calibrated at the factory to a point on which the optical axis of the optical block is horizontal.
8	Perspex window	The headlight image on the projection screen inside the optical block is visible through this window.
9	Adaptive levelling handle	Rotating the handle changes the inclination of the optical block.
10	Trolley base	The trolley base on wheels ensures the stability and the perpendicularity of the system.
11	Rubber wheel with eccentric axle	The rubber wheel runs on a non-adjustable rail profile. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
12	Non-adjustable rail profile	Non-adjustable rail profile mounted on the floor. The two front rubber wheels of the trolley base are guided on the rail.
13	Rubber wheel with eccentric axle	The rubber wheel runs on the floor. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
14	Brake mechanism	Brake mechanism for mast rotation.
15	Rubber wheel	The rubber wheel runs on a non-adjustable rail profile.

PLA 5 NR

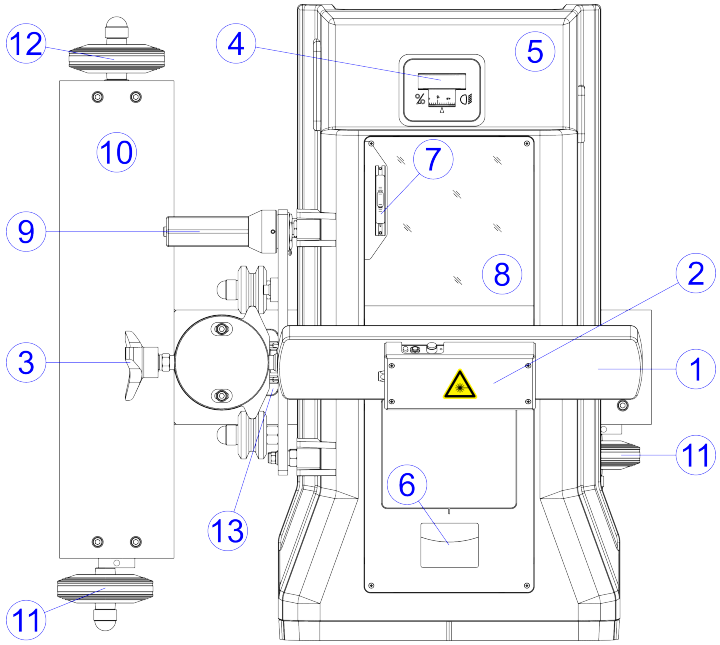

Figure 32: Top view Luminoscope® *PLA 5 NR*

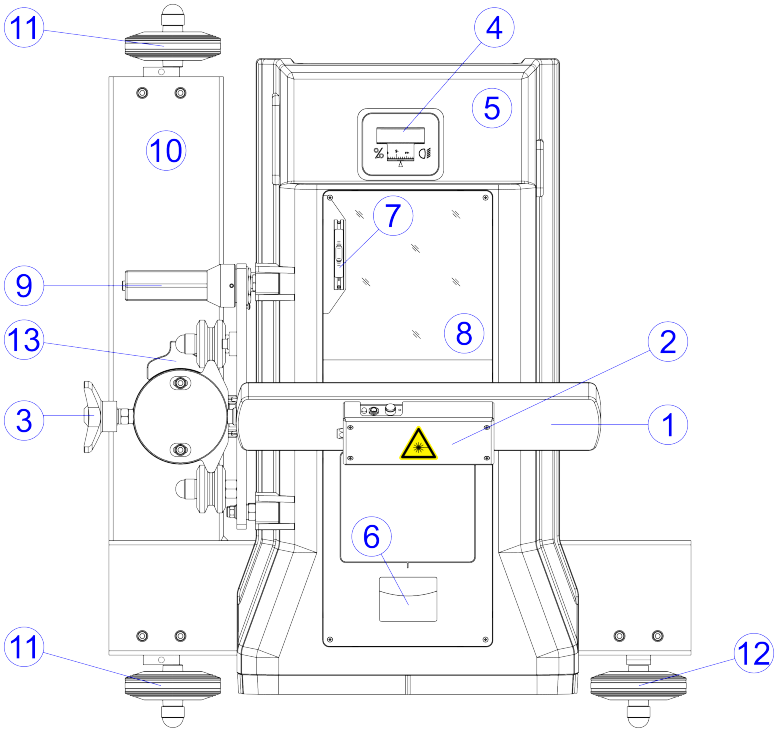

Figure 33: Top view Luminoscope® *PLA 5 NR D*

1	Alignment mirror	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
2	Green alignment laser (optional)	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
3	Mirror / laser handle (standard type)	Used to tilt the alignment mirror / laser assembly.

4	Rotary inclination knob	To adjust the vertical position of the internal projection screen. The chosen value on the knob corresponds with the vertical position of the low beam cut-off line at the projection screen.
5	Optical block	The optical block includes a lens, a white projection screen with markings for visual headlamp assessment and a rotary knob for adjusting the vertical position of the projection screen.
6	Analog lux meter	Indicates the luminous intensity (in kCd) of the high beam.
7	Reference spirit level	The reference spirit level is used as a tool to verify the calibration status of the optical block. The Luminoscope® is initially calibrated at the factory to a point on which the optical axis of the optical block is horizontal.
8	Perspex window	The headlight image on the projection screen inside the optical block is visible through this window.
9	Adaptive levelling handle	Rotating the handle changes the inclination of the optical block.
10	Trolley base	The trolley base on wheels ensures the stability and the perpendicularity of the system.
11	Rubber wheel with eccentric axle	The rubber wheel runs on the floor. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
12	Rubber wheel	The rubber wheel runs on the floor.
13	Brake mechanism	Brake mechanism for mast rotation.

5.3.3 Left side view

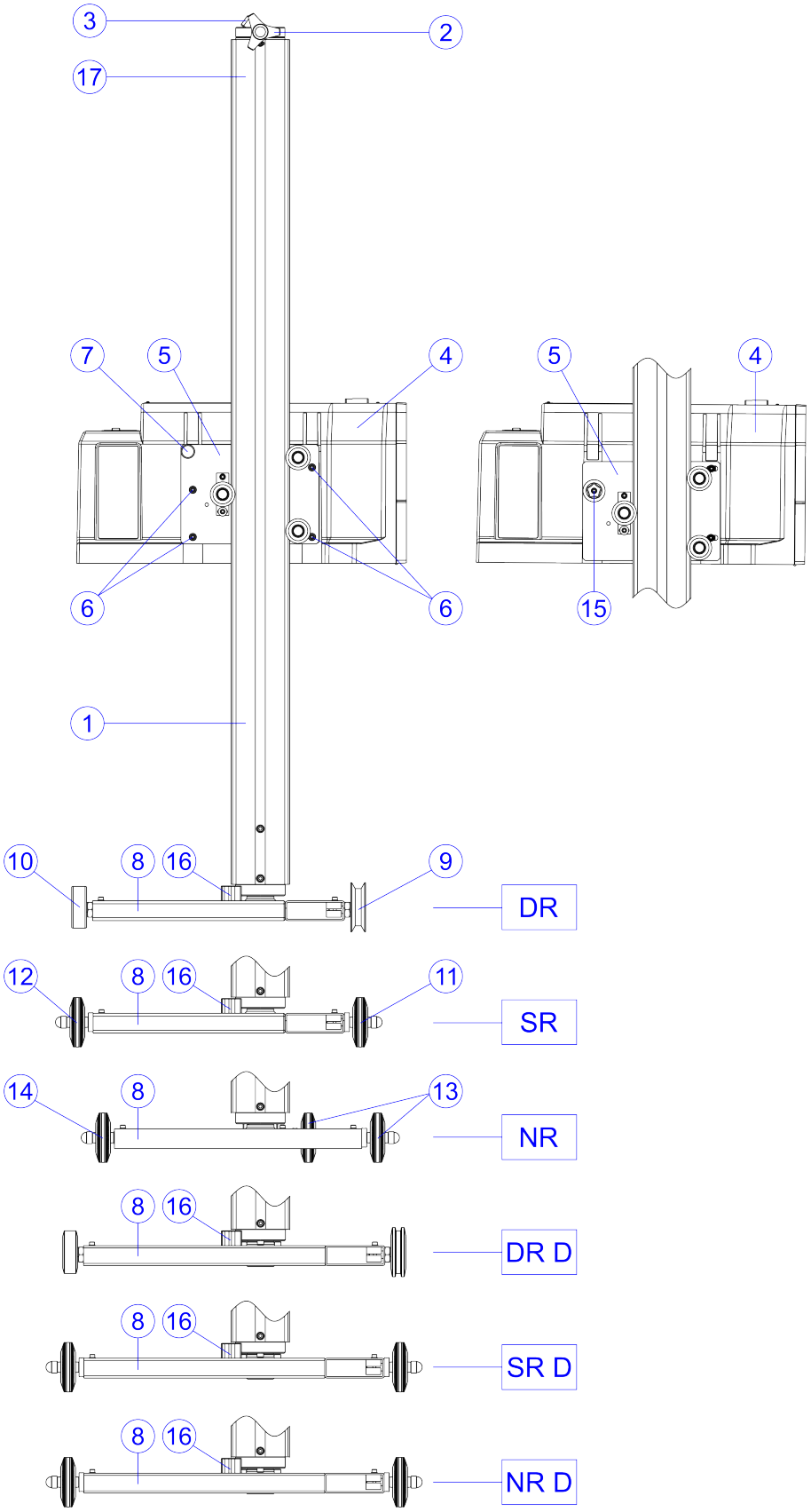

Figure 34: Left side view Luminoscope® *PLA 5*

1	Stand	The optical block is attached to the vertical sliding table of the stand.

2	Mirror / laser handle (standard type)	Used to tilt the alignment mirror / laser assembly.
3	Alignment mirror	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
4	Optical block	The optical block includes a lens, a white projection screen with markings for visual headlamp assessment and a rotary knob for adjusting the vertical position of the projection screen.
5	Vertical sliding table	The sliding table carries the optical block and can be displaced vertically by means of 3 small guiding wheels on the stand.
6	Fixation screws for optical block	The optical block is attached to the vertical sliding table by means of 4 screws DIN912 M6x20mm and 4 copper washers.
7	Handle	Handle on the vertical sliding table to move the system and vertically displace the optical block.
8	Trolley base	The trolley base on wheels ensures the stability and the perpendicularity of the system.
9	V-wheel with eccentric axle	Front wheel guides the system on the hexagonal rail. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
10	Flat wheel with eccentric axle	Flat wheel running on the square rail. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
11	Rubber wheel with eccentric axle	The rubber wheel runs on a non-adjustable rail profile. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
12	Rubber wheel with eccentric axle	The rubber wheel runs on the floor. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
13	Rubber wheel with eccentric axle	The rubber wheel runs on the floor. Provided with an eccentrical axis which allows for the vertical adjustment of the stand.
14	Rubber wheel	The rubber wheel runs on the floor.
15	Adaptive levelling handle	Rotating the handle changes the inclination of the optical block.
16	Brake mechanism	Brake mechanism for mast rotation.
17	Luminoscope® type label	Irremovable type label of the Luminoscope® system at the side of the stand.

5.3.4 Right side view

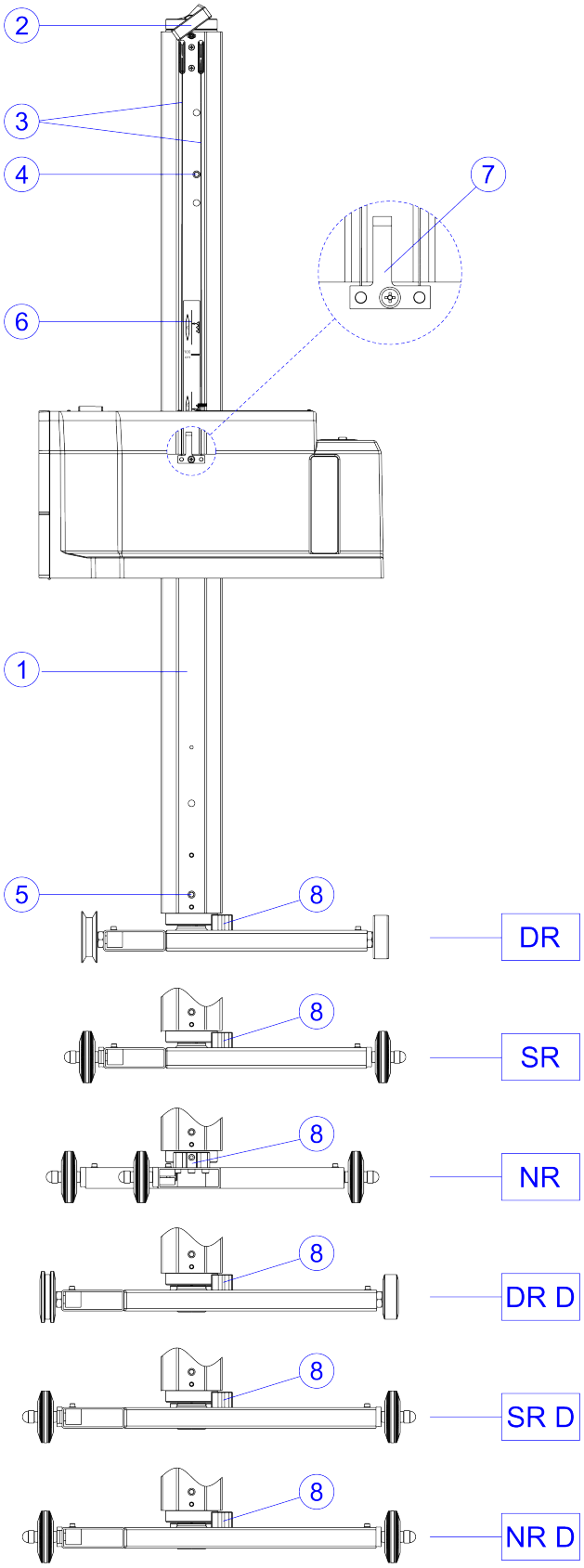

Figure 35: Right view Luminoscope® *PLA 5*

1	Stand	The optical block is attached to the vertical sliding table of the stand.

2	Alignment mirror	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
3	Counterweight cable	Connects the vertical sliding table of the optical block with the counterweight inside the stand.
4	Upper mechanical stop	Stops the vertical displacement of the sliding table in the highest position.
5	Lower mechanical stop	Stops the vertical displacement of the sliding table in the lowest position.
6	Headlamp mounting height indication sticker	Sticker with the different height zones. The specific sticker model, and even its requirement, depends on local authorities and norms. Please read the specific chapter on this topic if available.
7	Headlamp mounting height indicator	Indicates the headlamp mounting height after a correct positioning in front of the headlamp.
8	Brake mechanism	Brake mechanism for mast rotation.

5.3.5 Alignment laser

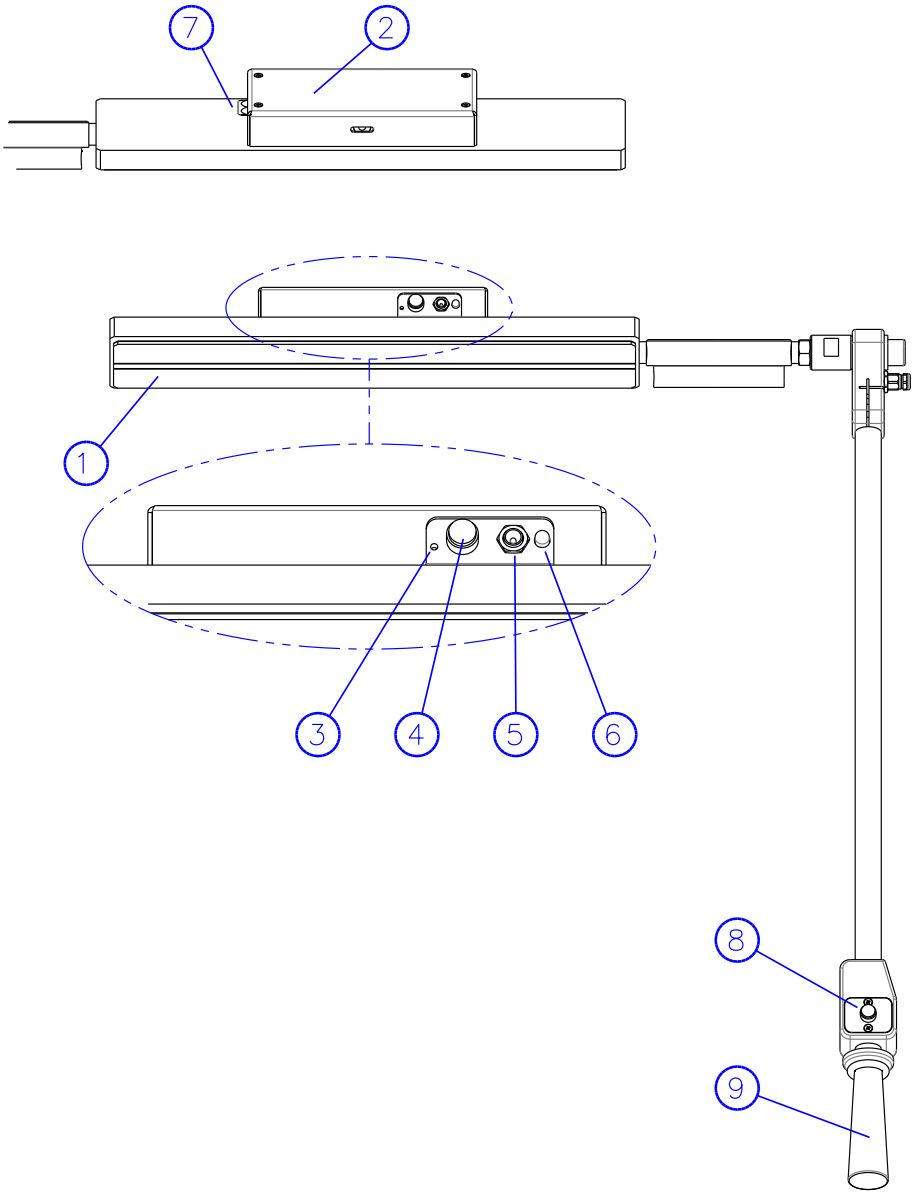

Figure 36: Alignment laser and mirror assembly

1	Alignment mirror	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
2	Green alignment laser (optional)	Used to align the optical axis of the optical block with the longitudinal axis of the vehicle.
3	Auto power-off time adjustment	Trimmer for adjusting the activation time for the alignment laser auto power-off function, between 6 sec and 2 minutes.
4	Power-on button	Push the button to turn on the alignment laser. The laser turns off automatically after a pre-set time.
5	12VDC charging connector	Battery charging connector. The internal battery pack provides power to the alignment laser. Use only the supplied 12VDC adaptor.

6	Status LED	This bicolor LED is connected to a voltage monitor that measures the battery voltage during charging and normal user. The color of the LED indicates the current status. Refer to the table below for a complete explanation.
7	Connector for external power-on button of alignment laser	Connected to the button of the optional lever, when this is supplied.
8	Power-on button on lever	Push the button to turn on the alignment laser. The laser turns off automatically after a pre-set time.
9	Mirror / laser lever (optional)	Used to tilt the alignment mirror / laser assembly. The button on the lever extends the power-on button on the alignment laser.

The color of the status LED 6 varies with the battery charge or usage cycle as follows:

While charging	RED	Charging voltage too low.
	ORANGE	Battery is being charged.
	GREEN	Battery fully charged.
While in use	RED	Battery voltage too low.
	ORANGE	Battery voltage is still enough.
	GREEN	Battery voltage OK.

5.4 Dimensions

5.4.1 PLA 5 DR

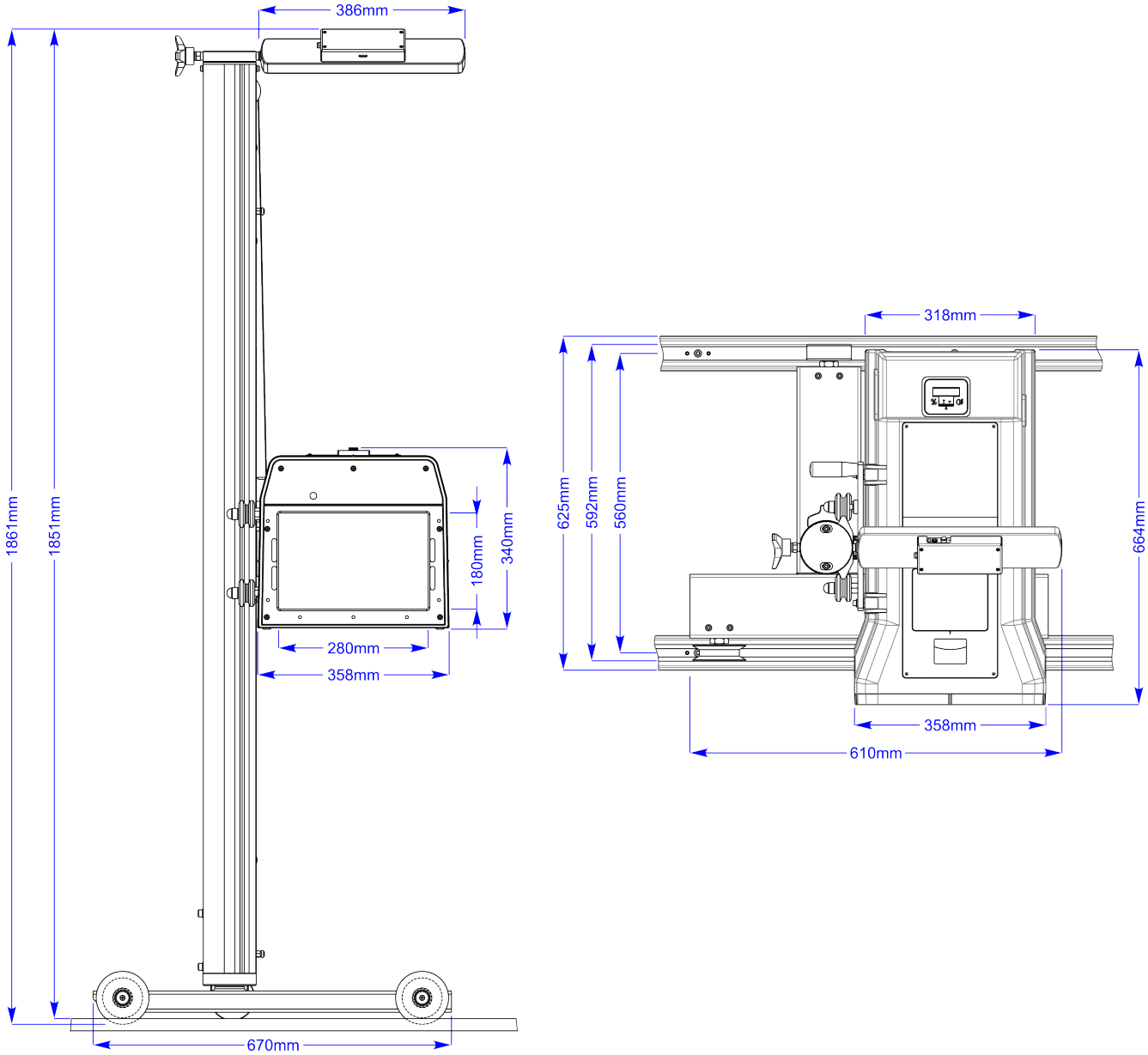

Figure 37: PLA 5 DR: front and top views

5.4.2 PLA 5 DR D

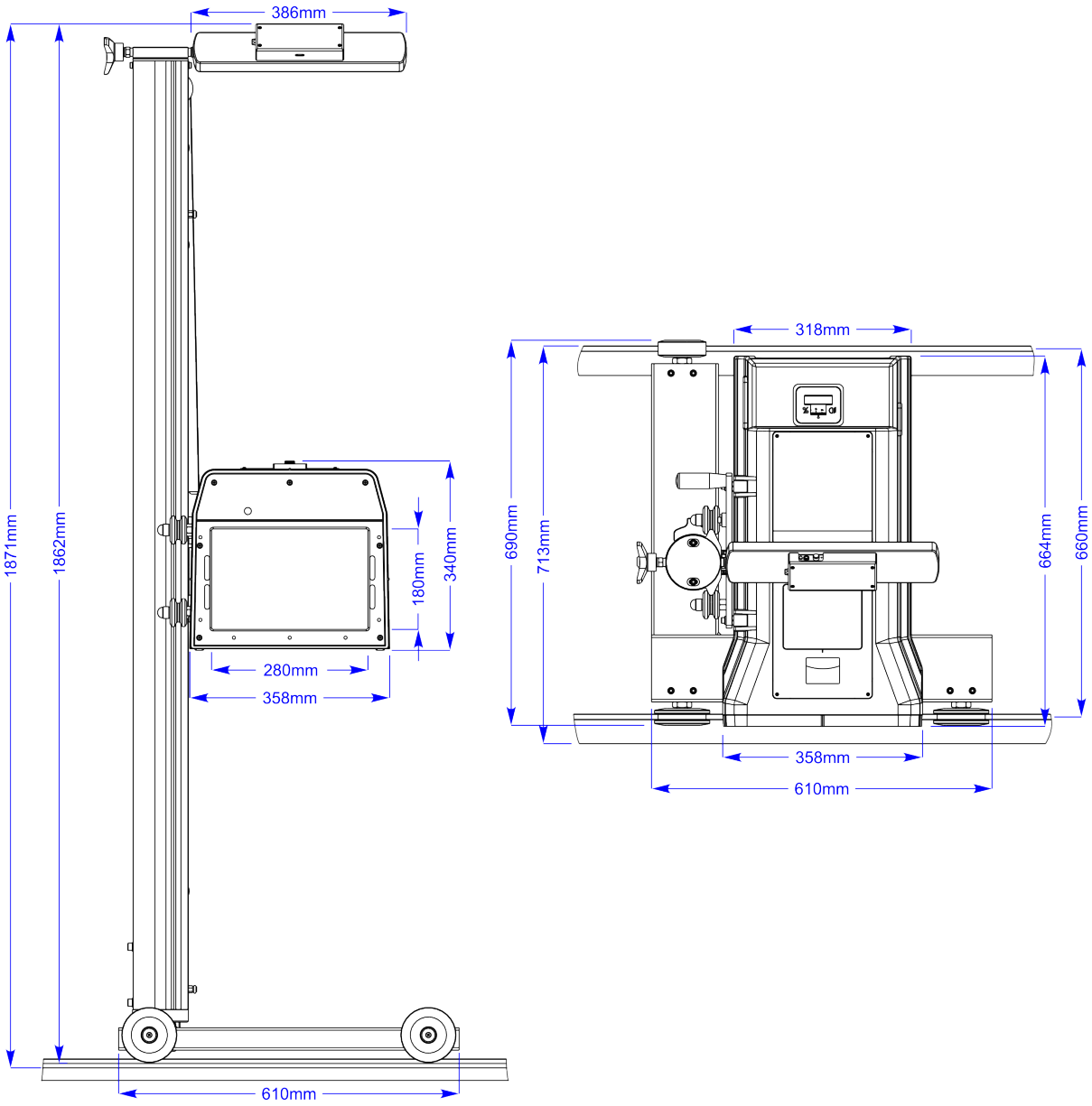

Figure 38: PLA 5 DR D: front and top views

5.4.3 PLA 5 SR

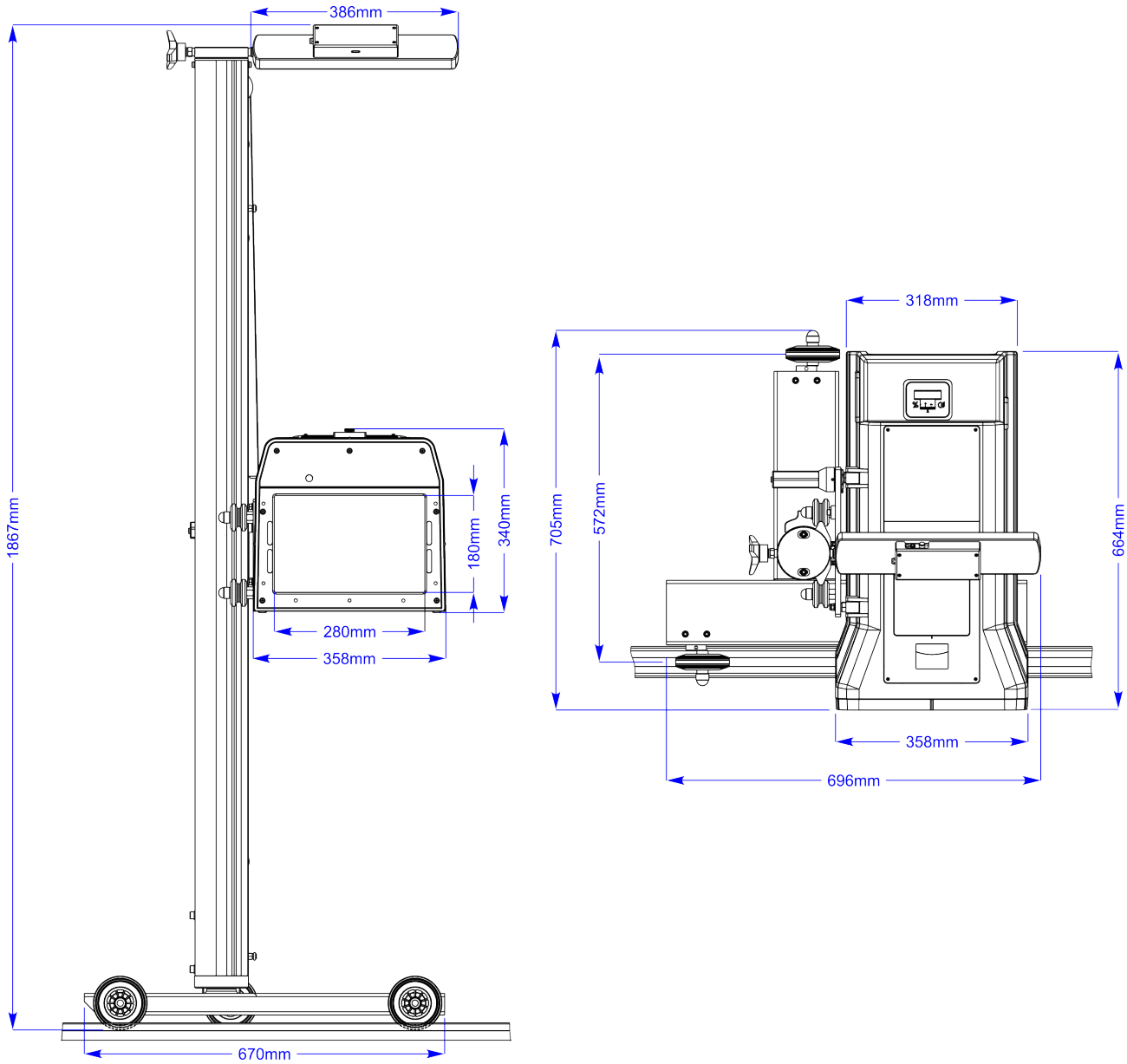

Figure 39: PLA 5 SR: front and top views

5.4.4 PLA 5 SR D

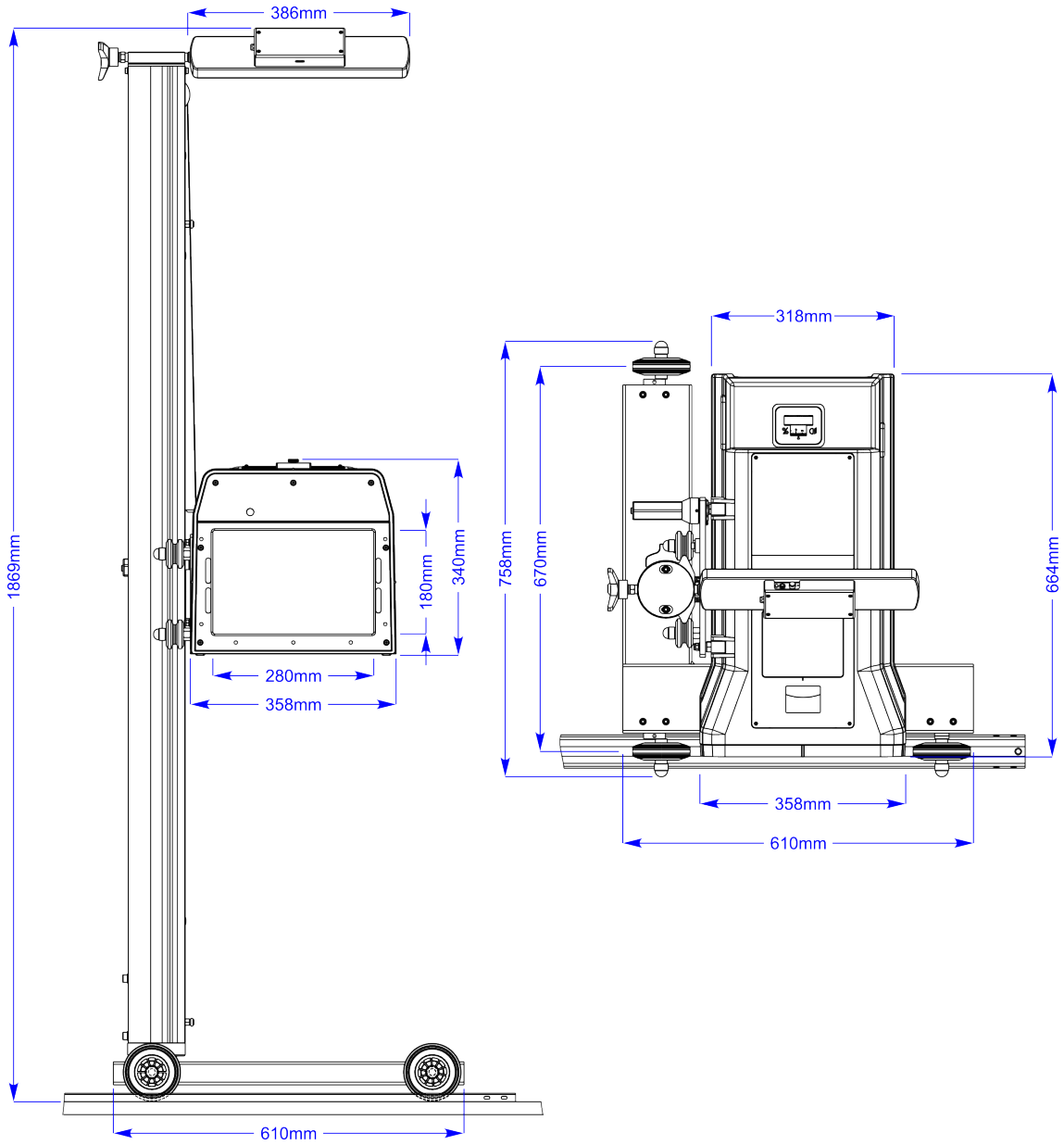

Figure 40: PLA 5 SR D: front and top views

5.4.5 PLA 5 NR

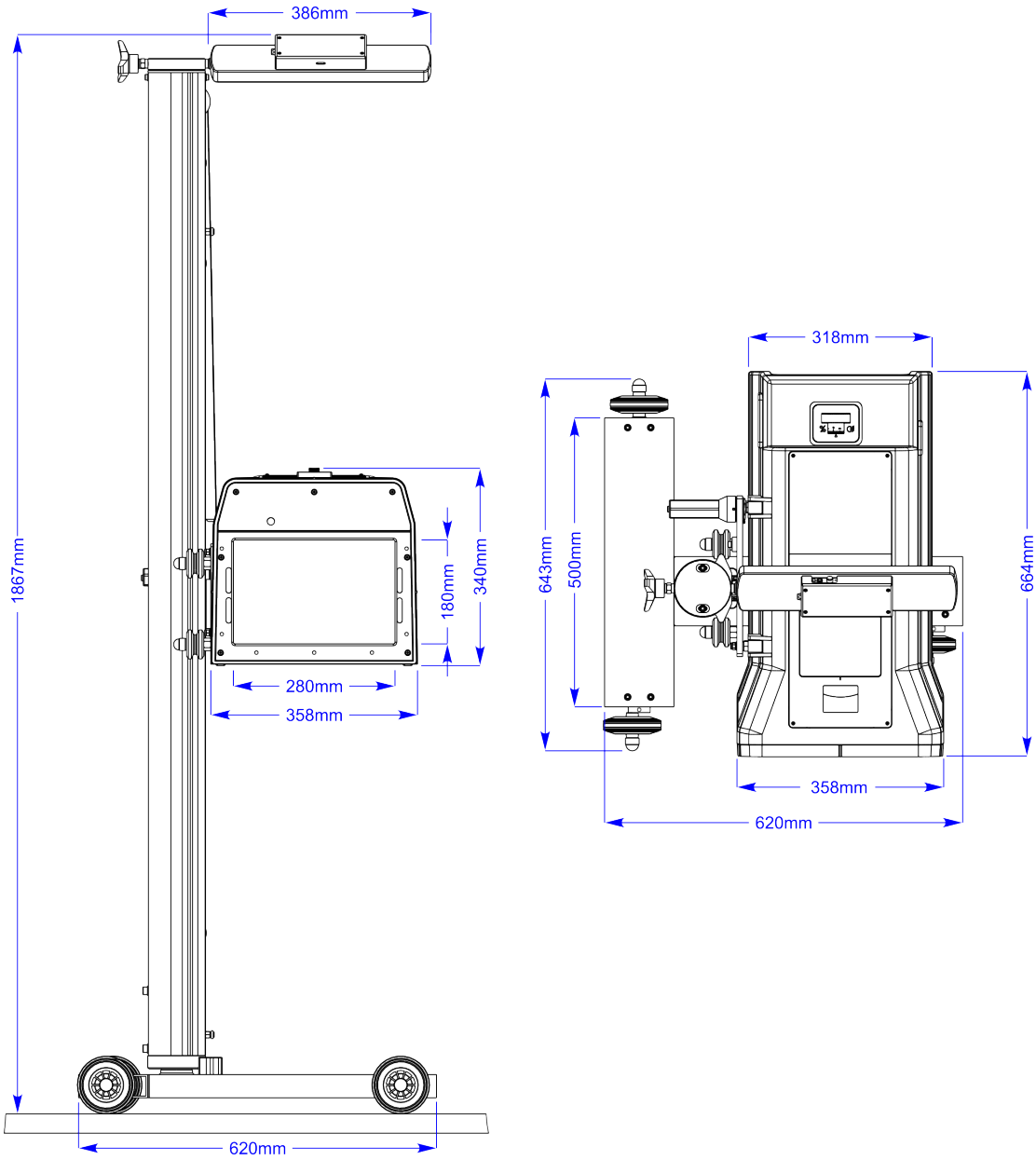

Figure 41: PLA 5 NR: front and top views

5.4.6 PLA 5 NR D

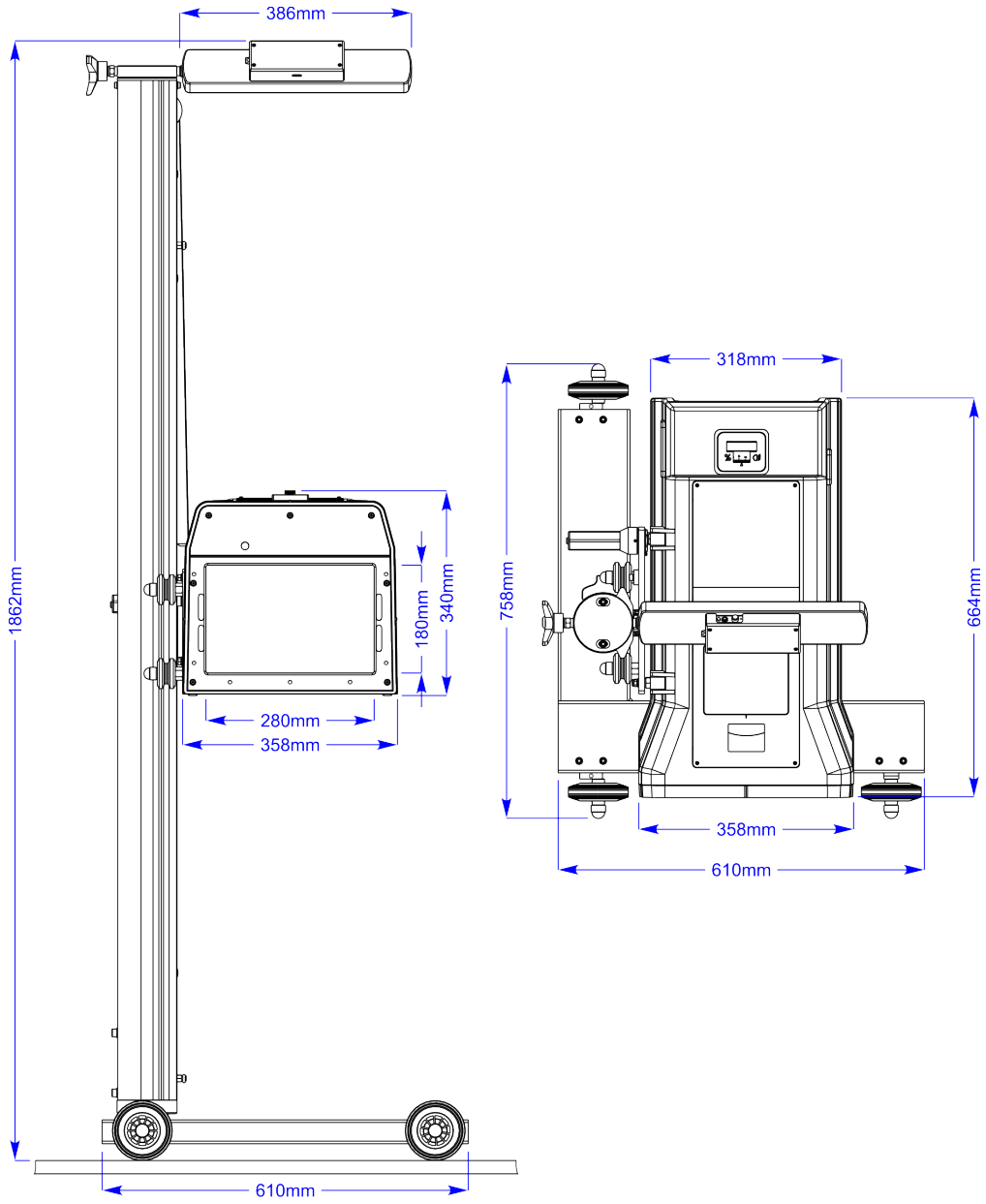

Figure 42: PLA 5 NR D: front and top views

5.5 Datasheet

Models	Luminoscope® PLA 5 DR	Double Rail
	Luminoscope® PLA 5 SR	Single Rail
	Luminoscope® PLA 5 NR	No Rail
	Luminoscope® PLA 5 DR D	Double Rail, german trolley base (L-shape)
	Luminoscope® PLA 5 SR D	Single Rail, german trolley base (L-shape)
	Luminoscope® PLA 5 NR D	No Rail, german trolley base (L-shape)
Headlamp assessment type		Visual

Testing range	Low beam up	0	%
	Low beam down	-6	%
	High beam up	+1	%
	High beam down	-5	%
	Fog beam up	-1	%
	Fog beam down	-7	%
	Left	12	%
	Right	12	%
	Luminous intensity (analog luxmeter)	0-125	kCd
Beam inclination setting			Rotary knob
Measurement tolerance	Horizontal	±0.5	%
	Vertical	±0.15	%
	Luminous intensity	±10	%
Measuring distance between headlamp and Luminoscope® lens		200 - 600	mm
Vertical positioning range, measured from lens center to ground. Range might extend slightly further.	PLA 5 DR	225 - 1410	mm
	PLA 5 SR	250 - 1425	mm
	PLA 5 NR	250 - 1425	mm
	PLA 5 DR D	235 - 1410	mm
	PLA 5 SR D	250 - 1425	mm
	PLA 5 NR D	250 - 1425	mm
Track distance	PLA 5 DR	560 - 585	mm
	PLA 5 DR D	660 - 685	mm
Device for horizontal alignment		Alignment mirror on top of the stand	
		Alignment laser on top of the stand (optional)	
Device for vertical alignment		*AL handle* (Adaptive Levelling) - only on certain models	
Dimensions (Height / Width / Depth)	PLA 5 DR	1843 / 696 / 674	mm
	PLA 5 SR	1849 / 696 / 705	mm
	PLA 5 NR	1848 / 620 / 665	mm
	PLA 5 DR-D	1846 / 610 / 690	mm
	PLA 5 SR-D	1853 / 610 / 758	mm
	PLA 5 NR-D	1853 / 610 / 758	mm
Weight		≈ 45	kg
Operating temperature range	Minimum	-10 to +35	°C
Relative humidity		< 80	%
Alignment laser battery (optional)	Technology	NiMH	
	Voltage	4,8	VDC
	Capacity	1,9	Ah
	Continuous operating time	6	h
	Charger voltage	12	VDC
	Charger power	10	W
	Charging cycle	10	h

6 Operation

The main purpose of the Luminoscope® is to measure specific headlamp beam characteristics such as horizontal beam position, vertical beam position, high beam intensity, etc.

6.1 Test cycle references

There is a number of topics related with the test sequence which apply to many of its steps. They are collected below and will be used as a reference along the explanation of the test cycle.

6.1.1 Beam icons

Each low beam, high beam and fog beam has its specific beam icon. Next table explains the meaning of the icons.

Icon	Beam
	Low beam
	High beam
	Fog beam

6.1.2 Left / right vehicle side definition

The left and right sides of the vehicle are always defined from the driver's point of view.

Headlamps which are located at the left side (as seen from the driver's point of view) are called the *left headlamps*, and those at the right side are called the *right headlamps*.

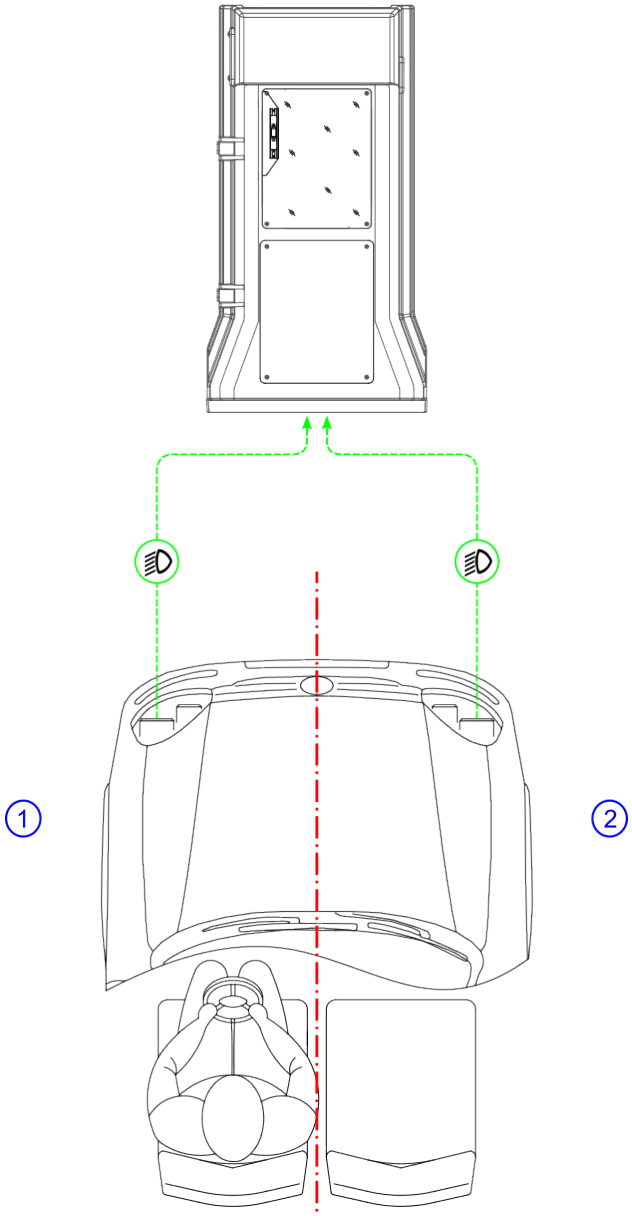

Figure 43: Left / right vehicle side definition

1	Left side of the vehicle	2	Right side of the vehicle

6.1.3 Alignment with the vehicle

Before each test cycle starts, it is necessary to align the optical axis of the headlamp tester with the longitudinal axis or driving direction of the vehicle, in order to minimize the measurement result error in the horizontal direction.

6.1.3.1 Alignment mirror

Use the alignment mirror on top of the stand to align the Luminoscope® with the longitudinal axis of the vehicle.

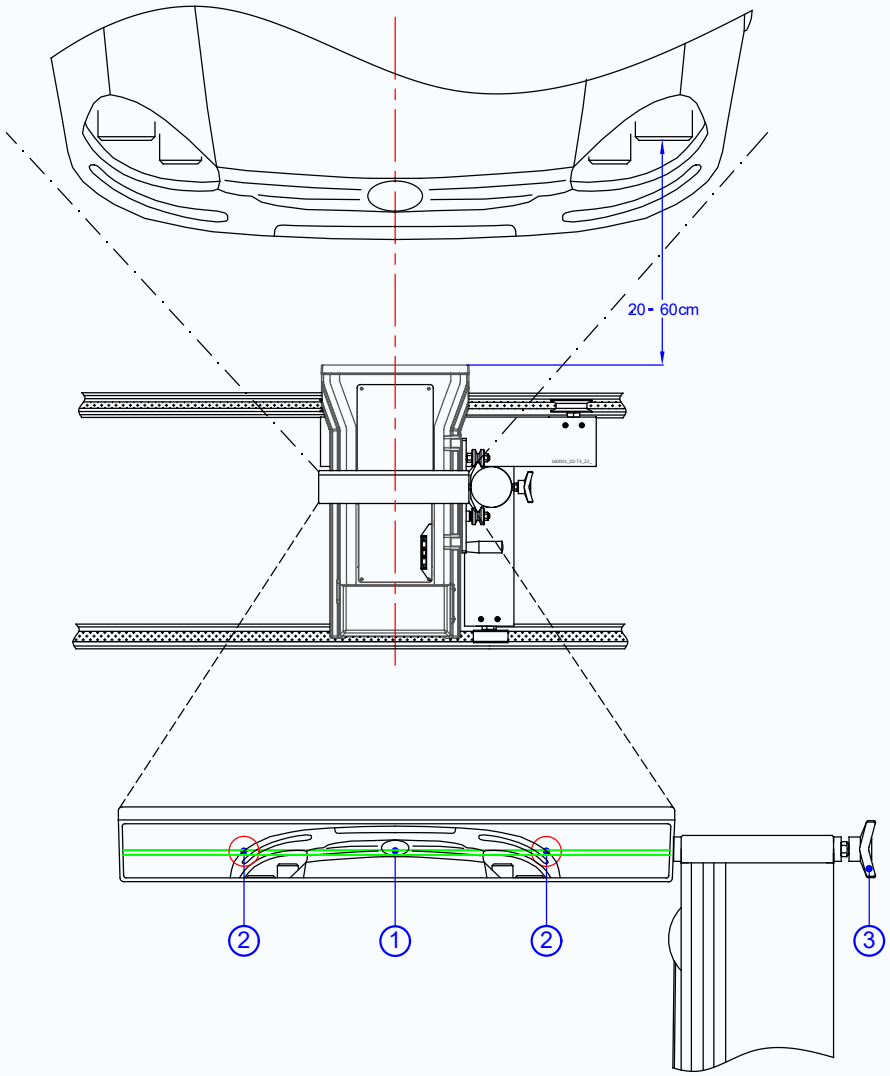

Figure 44: Use of alignment mirror to align the Luminoscope® *with vehicle longitudinal axis*

1. Move the Luminoscope® to the middle of the vehicle. Skip this step for the PLA 5 NR model.

Remember: In case of the PLA 5 NR model, the alignment should be performed for each vehicle side separately, i.e. once for the left headlamps and once for the right headlamps.

2. Rotate the mirror handle 3 until the lines 1 of the alignment mirror are visible at the front of the vehicle.

3. Release the brake mechanism for the mast rotation.

4. Rotate the stand slowly until one of the mirror lines 1 intersects two symmetrical points 2 of the vehicle.

   The two symmetrical points should be as far apart as possible, close to the vehicle sides, in order to maximize the precision of the alignment.

5. Tighten the brake mechanism for the mast rotation in case this is required.

6.1.3.2 Alignment laser

Use the optional green alignment laser on top of the stand to align the Luminoscope® with the longitudinal axis of the vehicle.

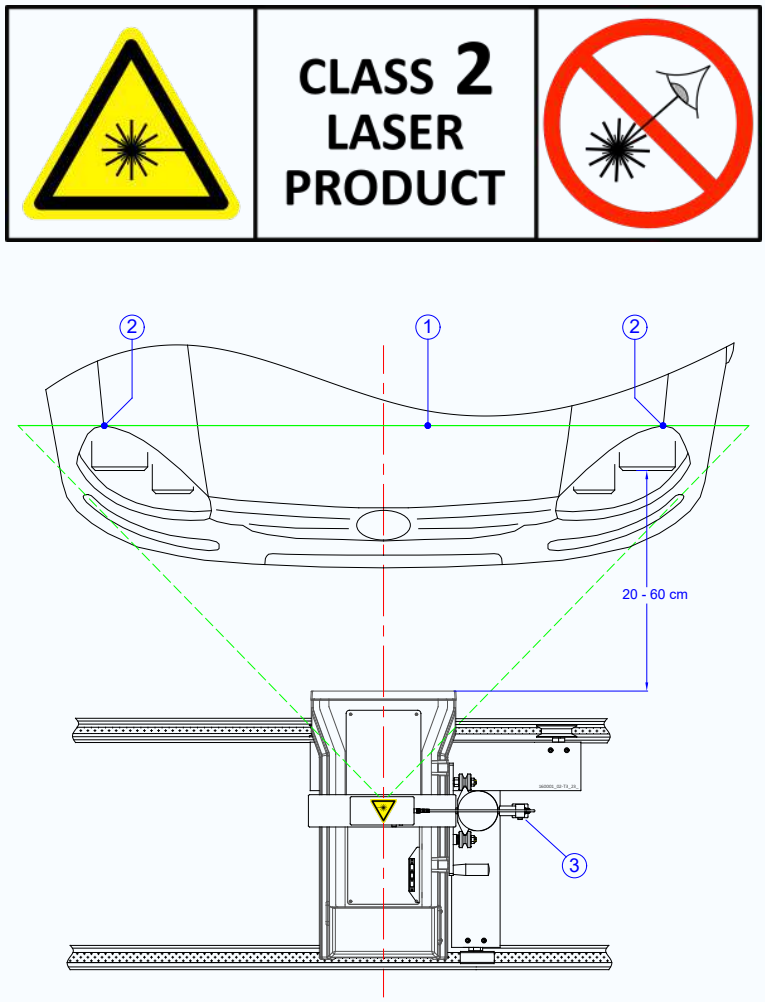

Figure 45: Use of alignment laser to align the Luminoscope® *with vehicle longitudinal axis*

1. Move the Luminoscope® to the middle of the vehicle. Skip this step for the PLA 5 NR model.

Remember: In case of the PLA 5 NR model, the alignment should be performed for each vehicle side separately, i.e. once for the left headlamps and once for the right headlamps.

2. Turn on the laser by pushing the **ON** button. The laser remains powered on for a preset timespan.

3. Rotate the laser handle 3 until the laser beam 1 is projected at the front of the vehicle.

4. Release the brake mechanism for the mast rotation.

5. Rotate the stand until the laser beam 1 intersects two symmetrical points 2 of the vehicle.

   The two symmetrical points should be as far apart as possible, close to the vehicle sides, in order to maximize the precision of the alignment.

   Some bodywork colours may cause too much color absorption. In this case, either use the alignment mirror or open the front hood and project the laser beam on two symmetrical points at the inside.

6. Tighten the brake mechanism for the mast rotation in case this is required.

6.1.4 Positioning in front of the headlamp

It is of great importance that the lens of the Luminoscope® is correctly positioned in front of the headlamp to ensure that as many light rays as possible enter the lens.

This guarantees that the beam image is displayed realistically on the white projection screen inside the Luminoscope® to be able to perform a correct headlamp measurement.

With this purpose, the front of the Luminoscope® has three markings indicating the centre of the lens. This can help the operator to correctly position the lens of the Luminoscope® in front of the headlamp.

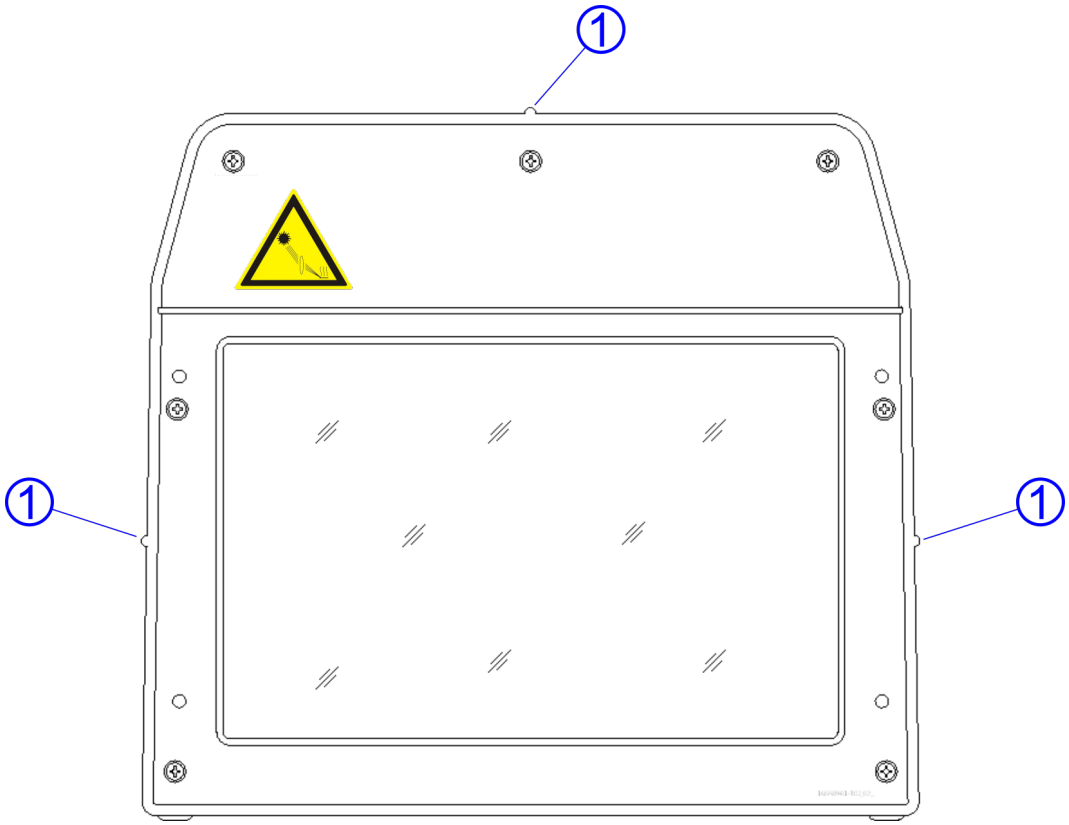

Figure 46: Central markings on the lens front

The operator positions the Luminoscope® in front of the headlamp by moving the optical block vertically and horizontally (without rotating the stand) and by simultaneously looking at the beam projection on the white projection screen inside the optical block. When the beam projection looks as expected, the visual assessment of the beam position can start.

6.1.5 Vertical beam target

The vertical target values and the audit tolerances for low, high and fog beams for different vehicle types are defined in the *Verkehrsblatt* that is published by the *Bundesministerium für Verkehr und digitale Infrastruktur - BMVI* that is applicable to the German market. The most current version of this document can be found in:

`https://www.verkehrsblatt.de/`

and its identification is *Richtlinie für die Überprüfung der Einstellung der Scheinwerfer von Kraftfahrzeugen bei der Hauptuntersuchung nach § 29 Straßenverkehrs-Zulassungs-Ordnung (StVZO) (HU-Scheinwerfer-Prüfrichtlinie), StV 22/7345.2/80-4*.

Depending on the vehicle category stated in the *Verkehrsblatt*, the corresponding vertical beam target value should be selected.

The vertical beam target for the low beams can be set by the rotary inclination knob on top of the optical block. The value on the knob corresponds with the vertical position of the low beam reference line at the projection screen.

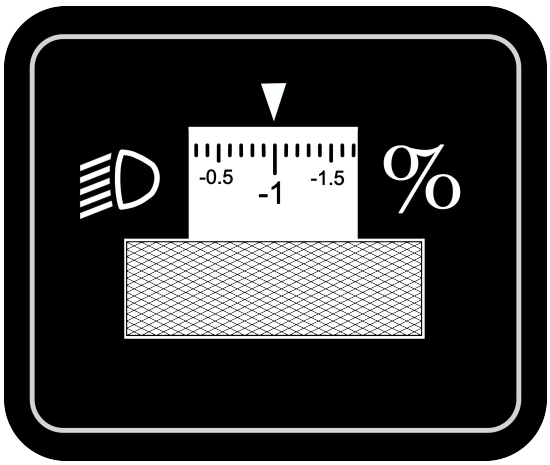

Figure 47: Rotary inclination knob for the low beam inclination

Remember: This feature only applies to the low beams.

6.1.6 AL (*Adaptive levelling*) handle

The vertical sliding table of the Luminoscope® may be provided with an AL (*Adaptive levelling*) handle.

Luminoscope® systems with a trolley base not running on adjustable guiding rails are equipped with an *Adaptive levelling* optional handle.

It’s unavoidable that the pitch angle of the optical block of systems with non-adjustable rails or without any rails will vary while displacing the system. This has a direct consequence on the headlamp measurement results. As a solution, the Luminoscope® PLA 5 may be equipped with an optional *Adaptive levelling* handle.

Before each visual headlamp assessment starts, the spirit level inside the optical block should have a zero readout. By rotating the *Adaptive levelling* handle 1, the slope of the optical block can be modified to have a zero readout of the spirit level. This operation should be done for each headlamp.

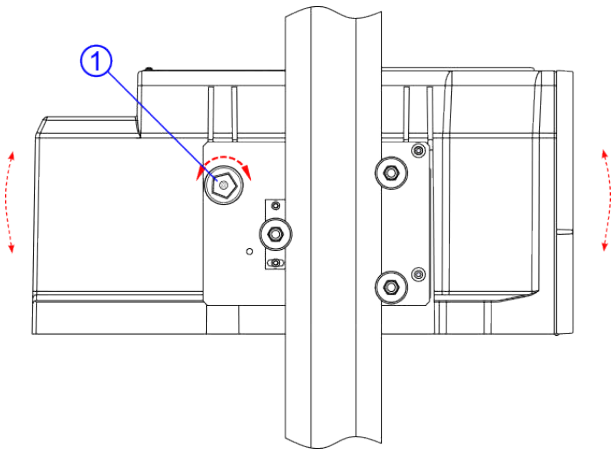

Figure 48: Adaptive levelling handle

6.2 Test cycle sequence

This chapter explains the different steps that should be followed in a test cycle.

Remember: The test cycle could look slightly different depending on the Luminoscope® configuration or step which could be based on different regulations.

Luminoscope® configurations with one or more guiding rails

Step number	Step description	Comments
1	Alignment with the vehicle	The Luminoscope® should be properly aligned with the longitudinal axis (driving direction) of the vehicle.
2	Positioning in front of the headlamp	Before the headlamp measurement can start, it is required to position the Luminoscope® correctly in front of the headlamp.
3	Setting the vertical beam target	Depending on the vehicle category as stated in the *Verkehrsblatt*, the corresponding vertical beam target value for the low beams should be set by means of the rotary knob.
4	Visual headlamp assessment	The beam pattern which is projected at the white projection screen inside the Luminoscope® should be visually assessed by means of the corresponding markings on the screen.

Luminoscope® configurations without guiding rails

Step number	Step description	Comments
1	Positioning in front of the headlamp	Before the headlamp measurement can start, it is required to position the Luminoscope® correctly in front of the headlamp.
2	Alignment with the vehicle	The Luminoscope® should be properly aligned with the longitudinal axis (driving direction) of the vehicle.

Step number	Step description	Comments
3	Adjusting the slope of the optical block	The *Adaptive Levelling* handle should be rotated to have a zero readout of the spirit level.
4	Setting the vertical beam target	Depending on the vehicle category as stated in the *Verkehrsblatt*, the corresponding vertical beam target value for the low beams should be set by means of the rotary knob.
5	Visual headlamp assessment	The beam pattern which is projected at the white projection screen inside the Luminoscope® should be visually assessed by means of the corresponding markings on the screen.

6.2.1 Alignment with the vehicle

The Luminoscope® should be properly aligned with the longitudinal axis (driving direction) of the vehicle.

1. Use the alignment mirror on top of the stand to align the Luminoscope® with the longitudinal axis of the vehicle, or
2. Use the optional green alignment laser on top of the stand to align the Luminoscope® with the longitudinal axis of the vehicle.

Remember: In case the Luminoscope® is used on a rail guiding system (e.g. PLA 5 SR – Single Rail or PLA 5 DR – Double Rail), the stand should not be rotated during the cycle, specially when moving the Luminoscope® from one side of the vehicle to the other side.

Remember: In case the Luminoscope® is NOT used on a rail guiding system (e.g. PLA 5 NR – No rail), the alignment procedure should be performed separately for each headlamp at the left and right sides of the vehicle.

Related information

Alignment with the vehicle (pg. 56)

6.2.2 Setting the vertical beam target

Depending on the vehicle category as stated in the *Verkehrsblatt*, the corresponding vertical beam target value should be selected, before the visual assessment of the beam position can start.

The vertical beam target value for the low beams should be set by the rotary inclination knob on top of the optical block. The value on the knob corresponds with the vertical position of the low beam reference line at the projection screen.

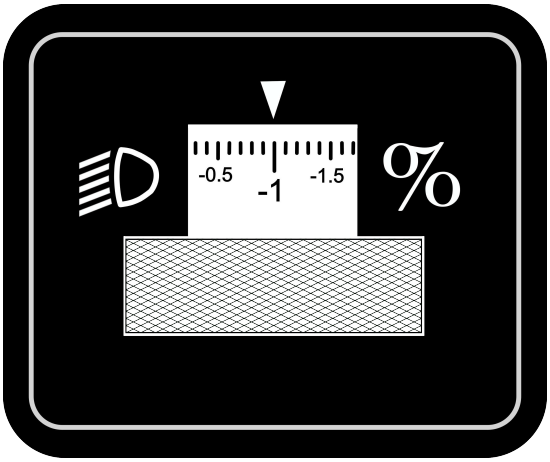

Figure 49: Rotary inclination knob for the low beam inclination

Remember: This feature only applies to the low beams. However, the vertical position of the high beam projection and the fog beam projection can also be visually assessed at the projection screen inside the optical block.

The high beam reference line at the projection screen is positioned 1% (10cm/10m) higher than the low beam reference line.

The fog beam reference line at the projection screen is positioned 1% (10cm/10m) lower than the low beam reference line.

e.g. in case of a rotary knob set at -1%:

- The low beam reference line is positioned at -1%
- The high beam reference line is positioned at 0%
- The fog beam reference line is positioned at -2%

Related information

Vertical beam target (pg. 60)

6.2.3 Positioning in front of the headlamp

Before the visual headlamp assessment can start, it is required to position the Luminoscope® correctly in front of the headlamp.

CAUTION: A correct positioning of the Luminoscope® in front of the headlamp is necessary for an accurate headlamp measurement.

1. Position the Luminoscope® in front of the headlamp under test.
2. Move the optical block vertically and / or horizontally (without rotating the stand) by simultaneously looking at the beam projection on the white projection screen inside the optical block.

3. Once the beam projection looks as expected (e.g. without beam deformation), the visual assessment can start.

Related tasks

Positioning in front of the headlamp (pg. 63)

6.2.4 *Adaptive Levelling* compensation

Before each visual headlamp assessment starts, the spirit level inside the optical block should have a zero readout. By rotating the *Adaptive Levelling* handle 1, the slope of the optical block can be modified to have a zero readout of the spirit level. This operation should be done for each headlamp.

Remember: Depending on the Luminoscope® configuration, it may be provided with an *Adaptive Levelling* handle.

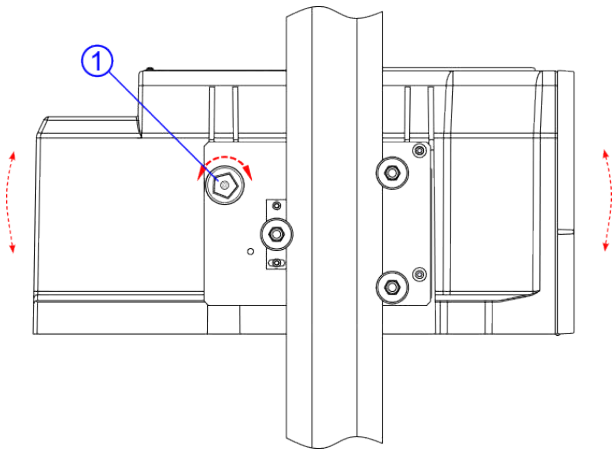

Figure 50: Adaptive Levelling handle

6.2.5 Beam measurement

The beam pattern is projected at the white projection screen inside the Luminoscope® and can be visually assessed.

The beam position should be compared to the corresponding reference line(s) on the screen. If needed the headlamp could be adjusted to match its beam projection with the reference line(s).

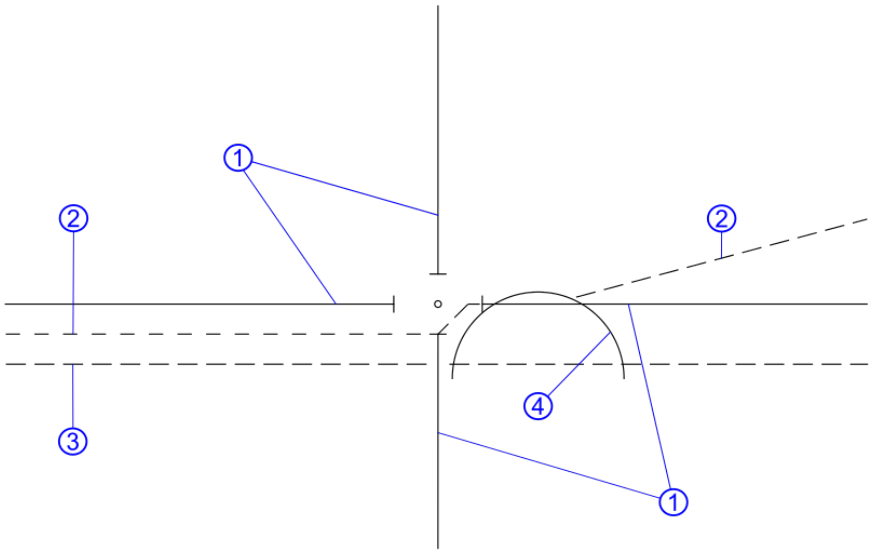

Figure 51: Projection screen with markings

#	Description
1	Reference cross for high beam projection.
2	European LHD low beam cut-off line.
3	Fog beam cut-off line.
4	Hotspot area for American low beams.

7 Personal notes