Moshon DATA

"Imparting knowledge"

EuroNCAP 5 Lamp Lighting System

Models: MD-SLKZ, SLKS, SLZ, SLS

User Manual

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INTRODUCTION

Thank-you for choosing Moshon Data.

The Euro NCAP lighting system is a complete 5 x streetlamp system designed and tailored specifically to conduct the NCAP AEB VRU night testing procedure.

Moshon Data has worked very closely with both lighting and mast manufactures to create a solution that provides everything you need to start testing from the day of delivery. The system is able to provide the user with exacting degree alignment of the masts using a turnable, keyed mast.

This manual covers the installation, cabling, raising and lowering procedure of the full system.

SCOPE OF DELIVERY

All MD lighting system products are supplied complete with cables, manuals, adapter fittings etc. Everything you need to start night testing.

Qty	Description
5	Schuch or Zeta luminaire fitting and cable
5	Pneumatic mast (Keyed or standard)
5	Nylon head Adapter plate – allows fitting of luminaire to mast head
5	Q-Pod or MD-Base*
1	3 Way 16A splitter
2	2 Way 16A splitter
1	10 m high quality HO7RN-F rubber cable.
4	25 m high quality HO7RN-F rubber cable.
10	Q-Pod Weight bags* (Not applicable if MD-Base is supplied)
1	Bosch Professional GLM 30 laser measurement tool
1	Round alignment target with enhanced reflective material

*With the exception of sand and concrete for the weight bags and 4 wheeled bases.
Not included for logistical reasons - will drastically reduce shipping and handling costs.

Bases for the masts can be chosen to have either a mobile 4 wheeled base (MD-Base), or a Q-Pod tripod.

Where an MD-Base is supplied, it will be neccesary to fill the shell with concrete before use. Instructions on how to do this can be found in this manual.

PRODUCTS AND SPECIFICATIONS

	Premier		Standard		Cost-Effective
Parameter	**MD-SLKZ**	**MD-SLKS**	**MD-SLZ**	**MD-SLS**	**MD-SL-PU**
Luminaire type	**Zeta SmartScape Nano OD* (L02 lens)**	**Schuch 48 2403 ABX CL**	**Zeta SmartScape Nano OD* (L02 lens)**	**Schuch 48 2403 ABX CL**	**Zeta (L02 lens)**
Mast type	**Keyed Pneumatic** *Same as Standard, but all sections stay aligned when turning from the base, graticule allows degree marked adjustment)*		**Standard Pneumatic** *integral hand pump, clampable collars, quick release air outtake valve*		**Push-Up** *Each section raised by pushing up manually and locking*
Laser Alignment kit included?	**YES**		**NO**		**NO**
Maximum wind speed resistance	**56 mph**		**56 mph**		**-**
IP Water ingress rating	**IP66 (head), IP44 (Connectors)**				
Base type	**Choice of Wheeled MD-MastBase or Q-Pod tripod**				**Integrated tripod included.**

** OD refers to the Zeta Overdrive and dimming version*

LUMININAIRE SPECIFICATIONS

	Zeta SmartScape Nano (L02 lens) OD *	Schuch 48 2403 ABX CL
Luminaire power	**8-60 W**	**48 W**
Luminous Efficacy	**140 lm/W**	**138 lm/W**
Luminous flux	**6720 lm (@48 W)**	**6600 lm**
Ambient temperature	**-20 to +50 °C**	**-40 to +50 °C**
Input Voltage	**240 V or 12 V**	**240 V**

** OD refers to the Zeta Overdrive and dimming version*

- **Overdrive**: Zeta have enhanced the quality of a couple of internal components to push the internal drivers past their 40 W default output so they can be driven at higher levels up to 60 W.
- **Dimming**: This provides a means to tune the system to differing night-time luminance by using the recommended Konica Minolta light meter.

These enhancements are available on all Zeta systems by default. The standard version is available with this option and is used on the Low-Cost MD-SL-PU Push-up masts where light output is not critical.

Q-POD

The deployment of the Q-Pod ready for mast attachment is as follows.

- Undo the lower knob, pull out the lower central leg to release the other three legs from their achor point. Then straigten the Q-Pod feet so they will be approximately flat to the ground when it is up.


- Pull away the three Q-Pod feet slightly from the centre pole to allow the legs to move easier away from the centre pole when being extending at the next step.

- Under the middle knob, then pull down the centre collar section to open out the legs. Ease the legs out one at a time until they are all fully extended


- Once the centre collar is fully lowered and legs fully extended, secure the knob.


- Adjustments can now be made to each leg levelling up the frame to the ground.
    - Use a 90 deg angle measuring device such as a set square to adjust the tripod to the ground as required.

- To adjust the top of the Q-Pod to the mast, turn the top knob and extend the centre pole as required. This part my already be adjusted from a previous occasion, so only do this for the first time, or to suit a different mast.

- For full stability of the mast, the final step is to hang two weight bags full of sand from each carabiner found at the top of the Q-Pod

- Collapsing the Q-Pod is the reversal of above, the feet are pulled back, and tucked behind the curved edges of the central foot to hold in place during transportation.

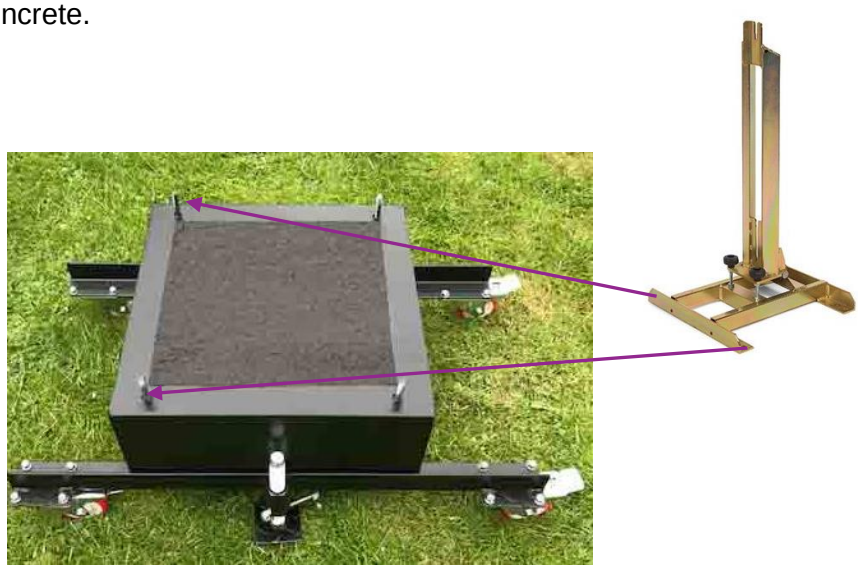
MD-BASE

The MD-Base comes to you as an empty shell – as shown lelow.

The shell must be filled with concrete before first use. The concrete is a mixture of cement, sand (aggregate) and water.

To do this, find a level area of ground (this is very important) then fill the structure with concrete to the very top lip.

Please be VERY careful not to get cement on the four studs.
We recommend using masking tape or similar to cover the
Studs before adding concrete.



Once the concrete has dried, attach the bolt down mast base to the top ond bolt down with the four nuts supplied.

MAST ATTACHMENT

Q-Pod

- With the Q-Pod deployed and adjusted level to the ground, the mast can be attached.


- Offer the thumbscrew at the lower end of the mast to the bottom Q-Pod slot, without lowering it fully into the slot…


- Locate the top slot and align the top thrumbscrew on the mast to the top slot on the Q-Pod and drop it into place. Tighten up both thumbscrews to secure. A large washer should be positioned behind each thumbscrew.

MD-Base

Attaching the mast to the MD-Base is much the same as with the Q-Pod.

Move to the desired position, the base should already be level to the ground by design, but just check that this is the case with a set square.

Then lock each of the wheels by pressing down the foot lever.

Lower the two support plates to the ground for extra stability.

LUMINAIRE FITTING AND USAGE

There are two types of luminaire offered by Moshon Data - Zeta and Schuch.

The luminaire consists of the following parts:

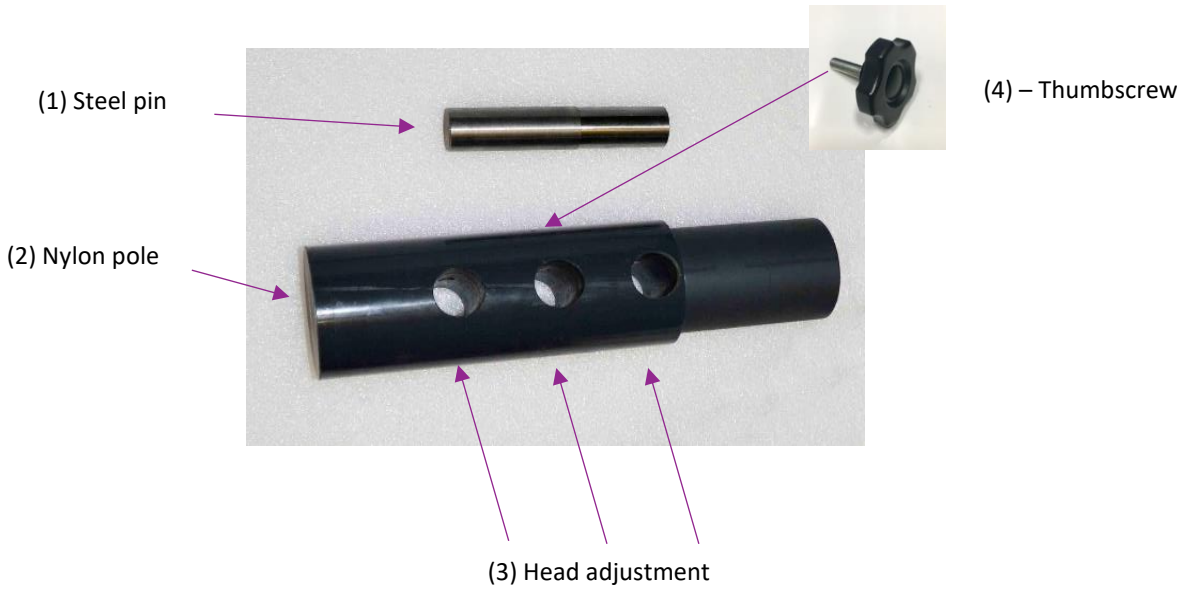
- The luminaire fitting (Zeta or Schuch)
- Nylon adapter pole – three adjustable positions
- Locating pin – long cylinder metal pin
- Black thumb screw

Attachment

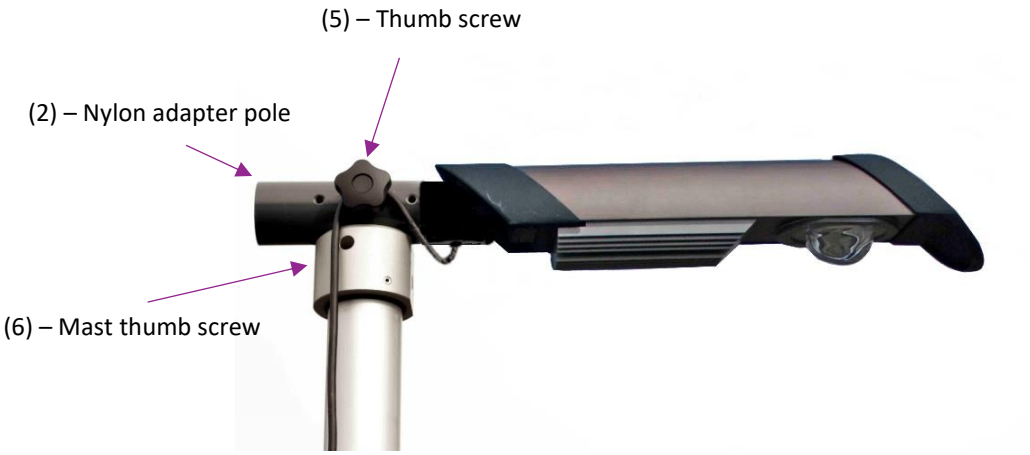
The luminaire head is attached to the top of the mast using the Nylon adapter plate as shown below.

There are three possible places the steel pin (1) can be located in the Nylon pole (2), allowing adjustment of the head (3) to be made further into the test area, or away as required.

Once the locating pin is in the preffered position, turn the thumb screw (4) clockwise to tighten onto the pin.



Once the locating pin is in place, drop the visible part of the pin of the luminaire into the top of the mast and tigiten the thumb screw (3) found at the very top of the mast, onto the steel pin (location of thumbscrew shown only, thumb screw not visible in the image).



Once tight, the cable can be routed nicely around the top thumb screw as shown.

Overdrive and Dimming - Zeta only

The Zeta system models are capable of being adjusted to suit the light envirionment. They use an overdrive option (included by default in MD-SLKZ Lighting Systems) to increase the light output sufficiently enough to ensure there will be full coverage over the test area to the specification in the lowest ambient light environment. Please check the latest NCAP protocol for the definition of what the current output requirement.

The dimming operation is managed through a digital control unit. The This is attached by means of straps and abungee cord around the mast as shown below.

- The cable out of the top of the control unit is 4 m
- By positioning the control box carefully on the mast base, you will be able to extend the head to exactly 5 m equally on all masts with the cable tight to the mast.
- 2 m out of the bottom to the ground.

Attach the flat bar with bungee cord around the mast pole

By factory default the output will be set to 85%. This output can be set accurately by using the three buttons on the digital display.

This produces a luminance average on the VUT path between 21-23 lux in a background environment of <1 lux. For first use, this should be udjusted using a lightmeter to suit your environment, the process for this is shown later in this manual.

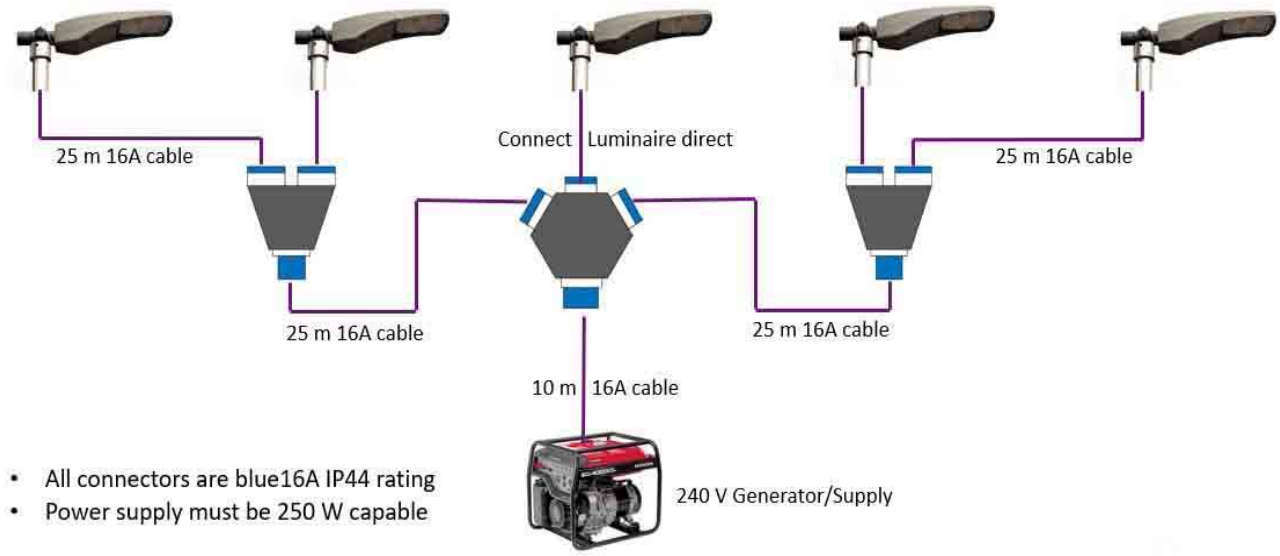
The power supply can either be 230 V or 12 V. This is defined by using the correct cable coming out of the bottom of the control unit and switching the main input switch.

CABLING DIAGRAM

All cables are supplied with the system to power up all five lights.

Connectors are 16A IP44 rated and will provide protection from intrusion of water, but not if submerged. Be aware of pools of water building up near them.

The diagram below shows how it all connects together.



***Note**: It may be neccesary to change the plug on the leading 10 m cable to a local variant.*

TAKING LIGHT READINGS

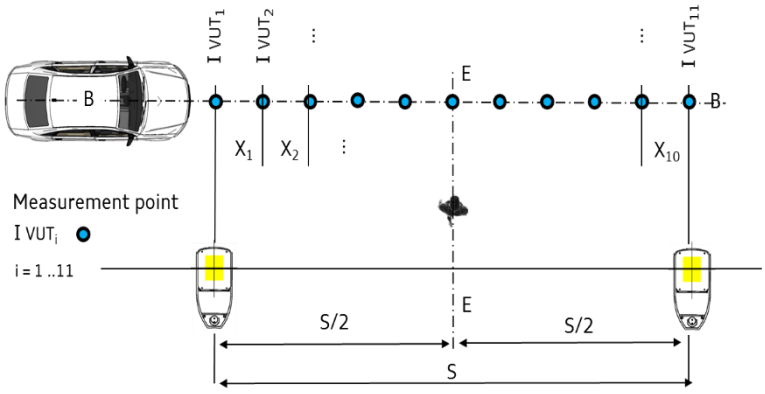
We recommend the use of a high quality lightmeter such as the Konica Minolta T-10A to take each measurement. This offers high accuracy and resolution of data, and is specified in the Euro NCAP protocol, also proved important from within our own tests at Moshon Data.

Please refer to the Euro NCAP AEB VRU protocol for EPT and VUT light paths to be tested using the lux meter, also for the current illuminance ranges allowable for each test path. An extract of the lighting Annex B from the AEB VRU test protocol is included in the rear of this manual.

An example of a typical EPT and VUT light measurment path is shown below.

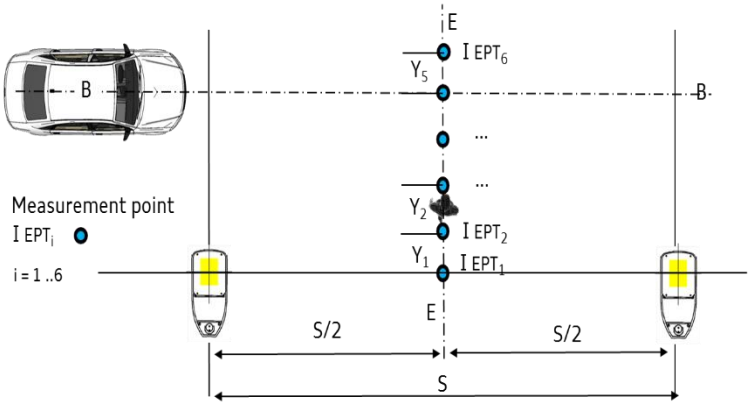
VUT Path

'S' is typically 25 m, the light points 'X' are divided equally across the test path.



EPT Path

Light measure points 'Y' are the divided equally between the lamp centre to VUT path distance, then one more the other side of the VUT path.



MAST OVERVIEW

Each mast is a very high quality tubular telescopic structure, made from stainless steel and other high quality materials. It is capable of handling wind speeds up to 56 mph provided it is used as intructed with the use of sandbags etc (Based on the 6 meter 80mm diameter mast and standard light fitting)

A drawing showing most of the masts components are shown below

Risks connected with the use of the mast

The telescopic mast has three main 'risk' conditions associated with its use. These instructions must be followed to assure operational safety and minimise these risks.

1. The first risk is the mast falling on its side, caused by the action of wind on the mast and/or bad fixing of attached items.

2. The second is related to the possibility of vertical descent of the mast, together with all appliances fixed to it.

   This may occur in exceptional conditions only when extending the mast, and in the case of a major air loss, caused by a sudden malfunction of a seal, damage to the mast or problems related to extreme temperatures. In this case it is possible for the mast to retract rapidly damaging itself and may cause harm or damage if within range. This can be avoided by using the locking system on each section as indicated in this manual. When extending the mast, it is necessary to maintain a safe distance in relation to the appliances fixed to the mast.

3. The third risk condition is related to the possibility of contact with overhead obstructions, particularly electric cables. This can only be avoided by the user who must consider the extended height of the mast and the existence of ovehead obstructions. Please note that for high tension lines, it is possible to cause a discharge just by proximity, even without contact with the line. Risk connected with atmospheric events such as lightning must also be considered, it may be necessary to adopt precautions such as grounding dispersal devices and maintaining an appropriate distance.

Attaching the mast to either the Q-Pod or MD-Base should be considered a two person job. This is especially true if the mast is attached to the base with the Lamp head in place as the whole system will be extremently heavy.

Attaching the mast with the lamp head in position may be neccesary with the Keyed masts becuase they are much heavier than a standard mast, plus they may also be physically too high for someone to reach the top even when the mast is in a retracted position. It is recommended to use a stool or step ladders to reach the top in this case.

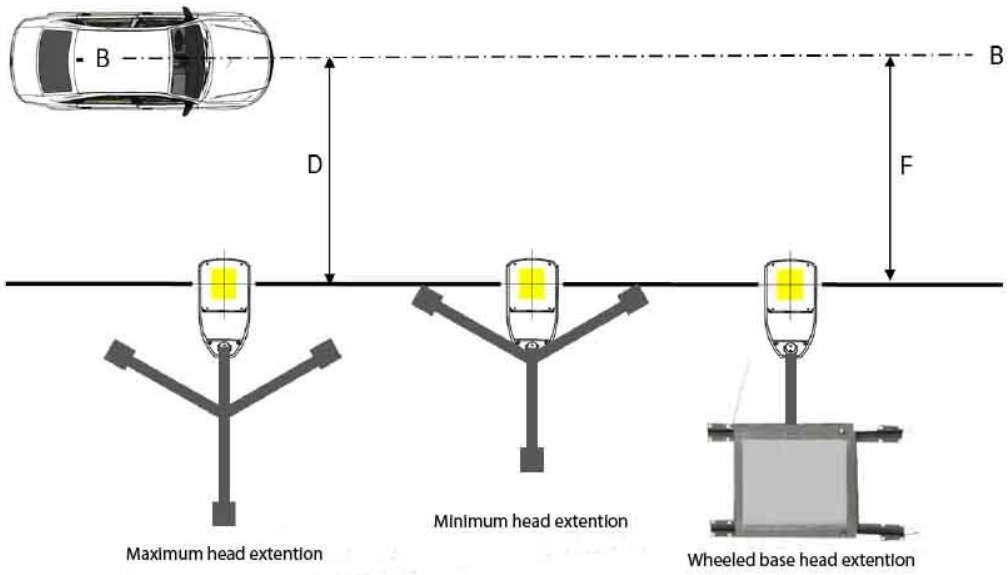
KEYED MAST ALIGNMENT PROCESS

The Keyed mast offers the following features:

- A keyed mast has a 'Keyway' or groove running the entire length of the mast that ensures the lamp head and all sections stay aligned the entire mast length right down to the base.
- Once fixed, lamp head will accurately maintain its position each time it is raised or lowered
- Has a laser alignment jig to ensure all 5 lamps in the kit are set to the same angle quickly

The following process should be used to set-up all 5 lamp heads in the kit.

1. Prepare the site, work out location and place either the Q-Pod or wheeled bases for all five streetlights as per the Q-Pod and MD-Base sections in this manual
    a. Each mast should not come into contact with electrical lines and other obstacles when raised.
    b. Ground should be level and flat so all masts are as upright to the ground as possible.
    c. Pay carefull attention to the intrusion of the base or tripod legs into the driving path of the test area from the geometric centre of the light field – see image below.



D = Lateral distance between the geometric centre of light field and the VUT path
F = Free space between driving path of VUT and equipment

2. Place each mast in turn onto the Q-Pod or wheeled base,
    a. At this stage ensure the mast remains fully retracted until all the alignments steps are completed.

    b. Attach mast into the slots in the lower and upper quick release mounting clamps
        i. It is easier to locate the lower stud into the lower mounting slot first, then locate the top.
        ii. Fully tighten both thumbscrews top and bottom to secure.

        ***Note**: It may be neccesary to rotate the hand pump if you intend to interchange masts between Q-Pod and MD-Base. Do this by loosening the hand pump clamp (tools supplied)*

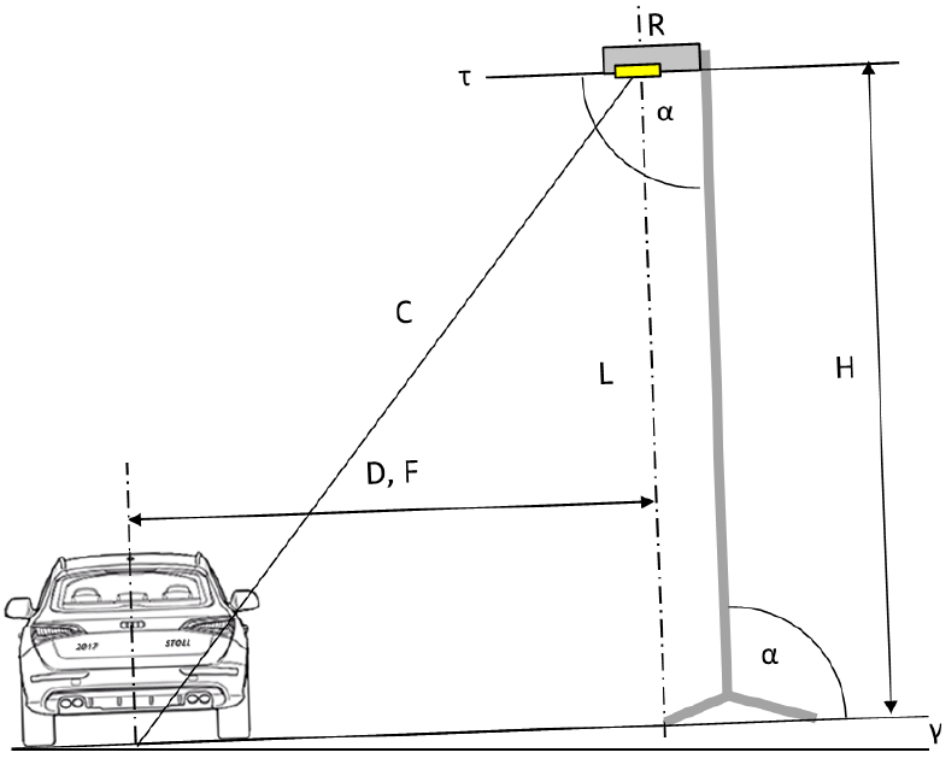
Loosen clamp nuts, and rotate hand pump on

    c. Once secured, rotate the base to align the red arrows at the base
        i. Turn both T-Bars anti-clockwise to loosen the quick release clamp to enable mast rotation

        ***Note**: This will ensure free rotaton away from the end-stops of the mast and allow maximum travel either direction.*

3. Each mast must be 90 deg vertical to the ground- even if the ground is on a camber.
    a. Ref: Latest Euro NCAP AEB VRU protocol.

    b. Use a large 90 deg set square to set/check angle 'a' – image below
        i. Q-Pods- Adjust mast angle using each of the three legs in turn
        ii. MD-Base – This should pre-level the mast to the ground so it is important to ensure the ground is level and check the angles

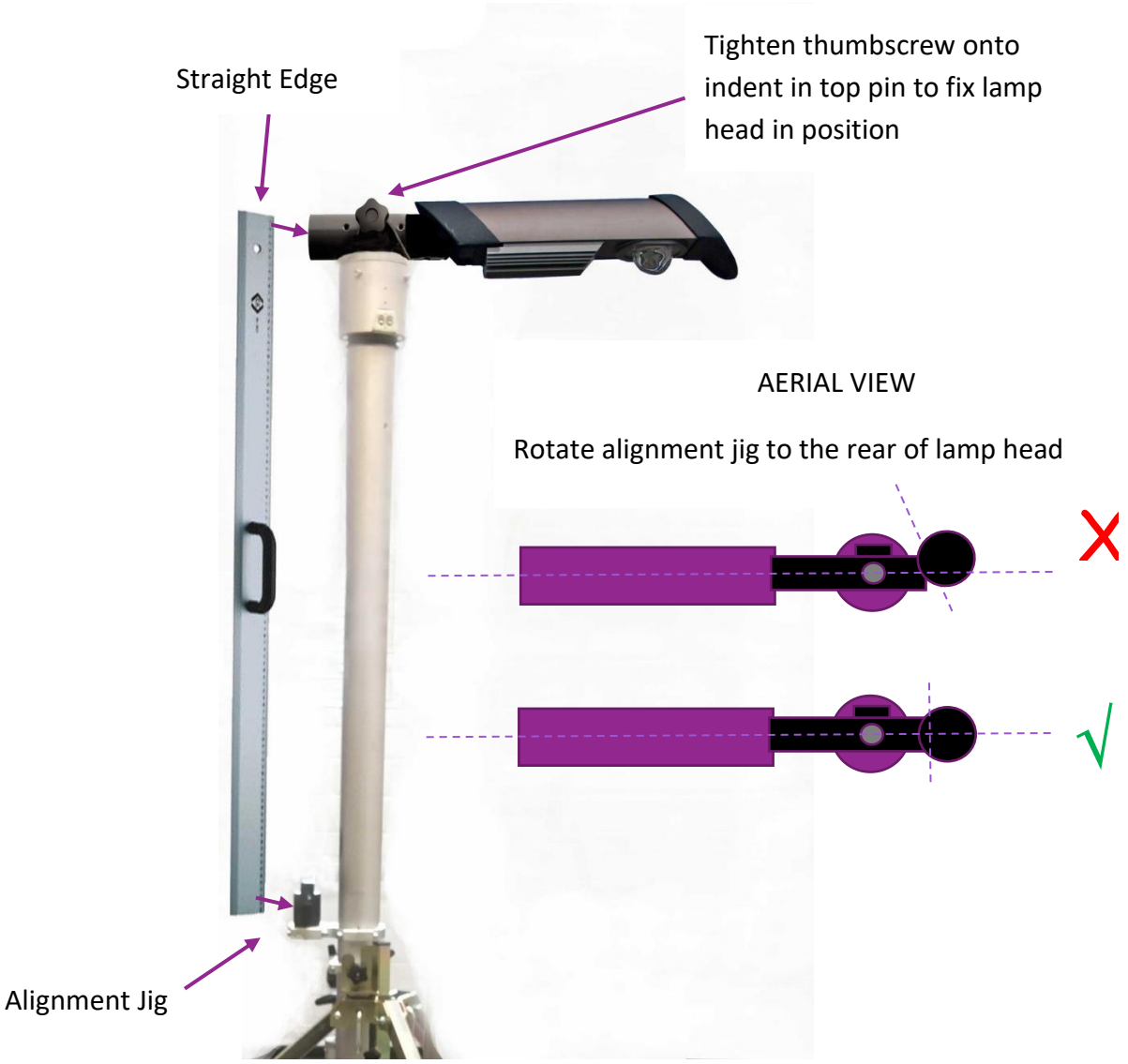


R:	Reference point geometric centre of the light field
L:	Centre line of the lamp (parallel to the pole)
D:	Lateral distance between the centre of the light field and the VUT path
F:	Free space between driving path of VUT and equipment
H:	Height of lamp
C:	Control line
τ:	Tilt of lamp
α:	Angle against ground and pole
γ:	Cross slope

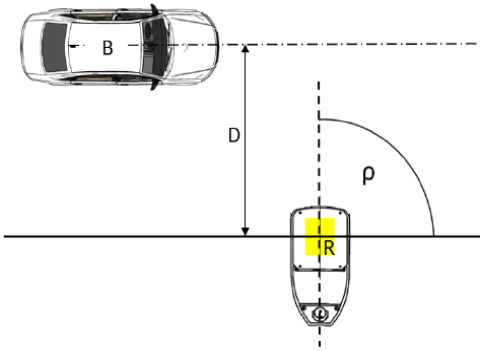
***Note**: NCAP specifies that the mast should be right angle to the ground – ie their advise is not to use a spirit level as the ground may not be level due to the road camber etc – please refer to the latest AEB VRU specification.*

4. Attach the lamp head to the top of the mast and check alignment to the Alignment jig

    a. Attach lamp head to the top pin.
        i. There is a small 'indent' in the pin in the top of the mast, make sure that the screw point of the thumscrew is located into this indent, then tighten down
        ii. Locate one end of a straight edge flat onto the rear of the lamp's nylon adapter pole, then drop other the end down to the alignment jig
        iii. It should already be factory aligned, but if not please adjust the alignment jig until it is square on to the nylon adapter pole of the lamp head.
        ***Note**: this move is critical for degree accuracy alignment of all the lamps to each other*
    b. Repeat this procedure for all five lamps



5. Proceed to align the first of the five lamp heads to be perpendicular (p) to the test track
    a. Undo quick release T-Bars
    b. Rotate the entire mast from its base as shown below making small degree turns until lamp head is perpendicular (p) to the test area and VUT vehicle path.
    c. Retighten quick release T-Bars
        i. Be careful not to knock or move the head to jig alignment during this process



Loosen the Upper quick release T-Bars to enable rotation.

Rotate, until lamp head is perpendicular then once in position tighten back up.

It may be necessary to once again loosen and turn the hand pump position to accommodate the new angle of the head

Before starting, ensure the red arrows are still aligned

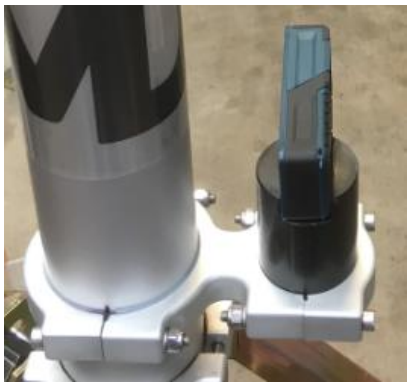
6. The remaining four lamps will be aligned to the first lamp using a laser alignment tool.
    d. The laser alignment tool consists of the following components
        i. Bosch Professional GLM 30 laser measurement tool
        ii. Round alignment target with enhanced reflective material
        iii. Round black nylon alignment jig pre-aligned to each lamp - step 4.

Bosch GLM 30


Round Alignment Target

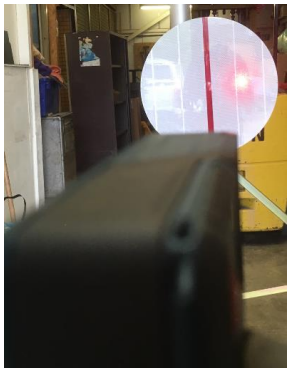
7. Proceed to accurately align the remaining four masts

    a. If not already done, position mast/base roughly in its final location
    b. Attach the laser measurement tool to the first mast in the line.
    c. Attach the round alignment target into the jig in the second adjacent mast

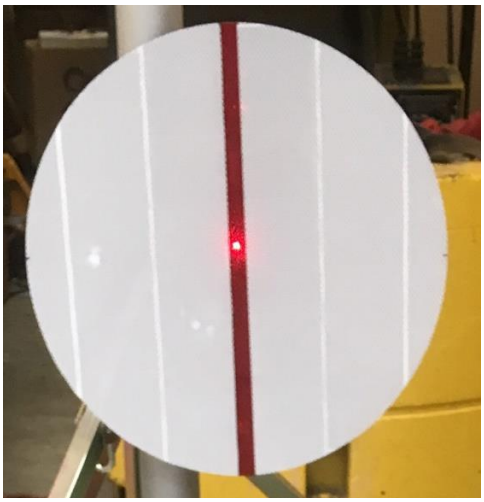

First mast holds laser tool


Second mast holds the target

d. Press red button to power up laser - Look at where the laser points (see below)

.  

e. If the second mast is close to its final positon, and the first mast is correctly set-up (as defined in steps 1-6) then the laser line should already be pointing to where the second mast should be positioned.
f. Press red button again to obtain measurement – Distance mast 1 to mast 2
    i. Move entire mast away/towards the first mast until at the correct distance
g. With a combination of moving the second mast into and away from the test area, plus rotating the mast on the base (as described in step 5) - move until the red point is located centrally to the red stripe – as shown below.

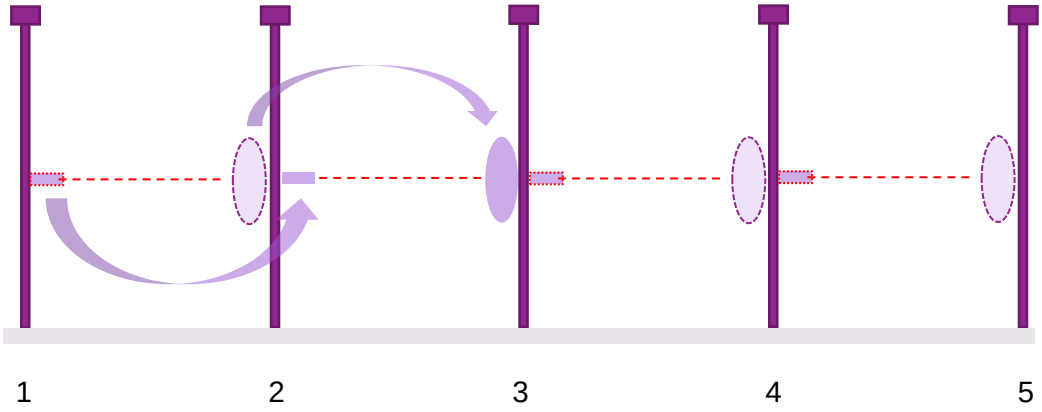
 

Correct Alignment

***Note**: Laser will not stay lit for safety reasons, so the task of alignment is best done with two people – one person to operate the laser tool in the first jig, the second person to rotate the second mast until the red dot appears central to the red stripe in target*

WARNING! Please be very careful when operating the laser not to aim it directly at anyone…

h. Once the second mast is aligned repeat for all masts
   i. Move the alignment target into the alignment jig of the third mast
   ii. Move the laser measuring tool into the alignment jig of the second mast
   iii. repeat steps 7.a – g
   iv. Repeat until all masts are aligned as shown below



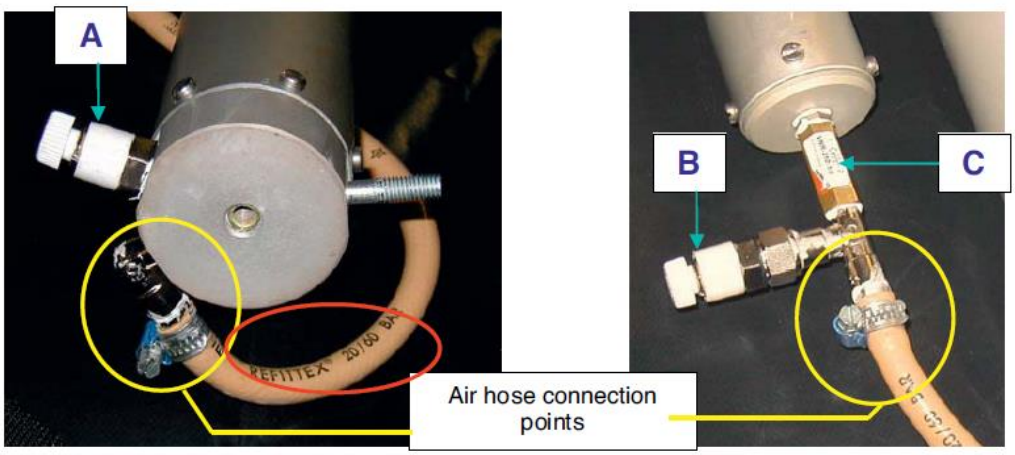
8. Setup is now complete

MAST RAISING PROCEDURE

To raise the mast:

1. Place the mast on the Q-Pod or base as required, checking the mast is vertical and not in the way of electrical lines and other obstacles. It will need to be level to the ground.

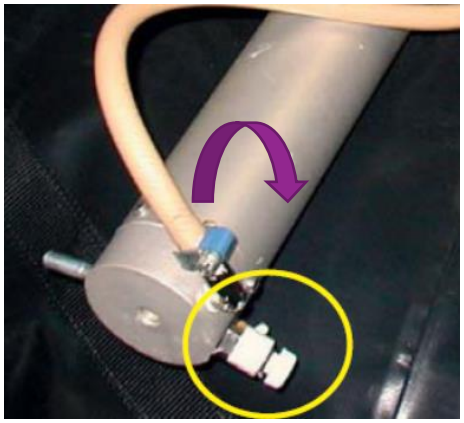
2. Note the positions of the air release valves –
    a. Locations may vary from mast to mast, but the pricnciple will remain the same



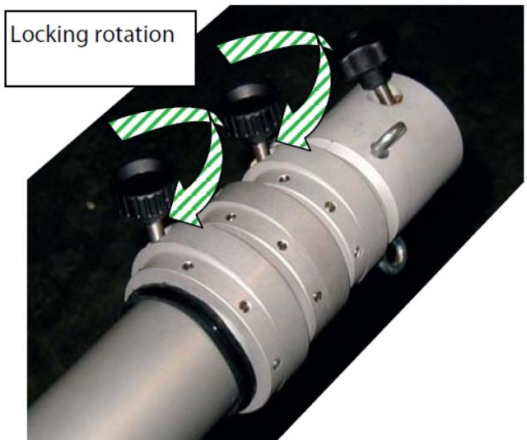
A – Mast air relase valve
B – Hand Pump air out-take valve
C – Non-return air valve

3. Close all air out-take valves – as shown in step 2

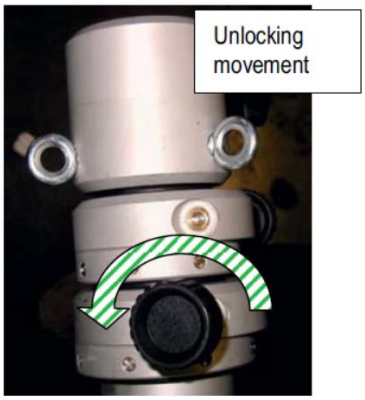
    Rotate Clock Wise to do this



4. Check and lock each mast section to avoid sudden extension.



5. Unlock the first, uppermost section by fully rotating the knob anti-clockwise



6. Extend fully the first section using the hand pump. When fully extended lock the section by turning knob clockwise and proceed with the second section (next one down from top)

7. by unlocking it, pumping, locking and so on until the desired height is reached or to complete extension of the mast

MAST LOWERING PROCEDURE

To lower the mast:

1. Lower the mast one section at the time, starting from the largest, lowest section.
2. Unlock the section and release the air valve.
3. Proceed in the same manner with all sections
4. When the mast is fully retracted, lock all sections in order to maintain stability.

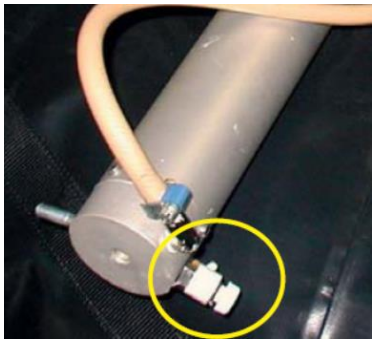
MAST MAINTENANCE NOTES

Ordinary Maintenance

At the end of each use, when retracting the mast, clean the outside using a damp cloth in order to remove dirt or dust. Check general conditions of the structure, eventual air leaks and wear due to corrosion or other.

Use in cold weather

With particularly low temperatures mast retraction may become difficult, caused by internal ice. In this case the user must wait for a temperature rise and purge all condensed water in the mast; this operation can be carried out when the mast is retracted by using the bleed valve at the bottom of the mast.

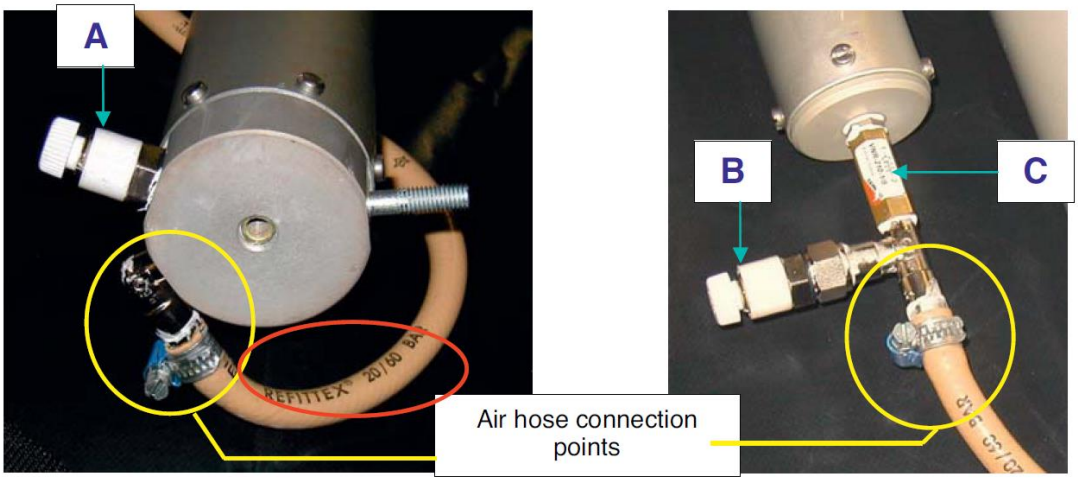


The presence of other residue (apart from water) might indicate internal damage to the mast.

The limit for low temperatures is – 25 °C . However special seals for lower temperatures are available on reque

Air Circuit Malfunction

The mast hand pump is supplied with a pneumatic circuit using a high resistance flexible tube which can withstand pressures of 20 [bar] (see red circle in below picture), excluding any failure due to pneumatic reasons. All connection points are fixed via metal band; it is advisable to perform a pre-use check and look for any damage to the system.



Parts Replacement

There are no user serviceable parts, but after prolonged usage, there may be areas that require some attention. These are listed as follows.

- Mast Seal Replacement - Each section of the mast has a seal that may eventually wear out
- Air Release Valve Replacement – In the event an air release valve should not functioning it is necessary to replace it
- Flexible Air Hose Replacement
- Locking Device Replacement

Please contact us for assistance if you suspect any of the areas above, we can arrange either a service or repair as appropriate.

REVISION HISTORY

Revision	Comments
181122	Initial version
190516	Updated to show laser alignment process for keyed masts
191016	Further mods and image additions
200121	Remove standard pneumatic model references
200813	Add 12 V 230 V Digital Control Unit information and updated specifications

APPENDIX A – EURO NCAP AEB VRU LIGHT TESTING EXTRACT

ANNEX B - TESTING AT LOW AMBIENT LIGHTING CONDITIONS

FOR SAFER CARS
EURO NCAP

EUROPEAN NEW CAR ASSESSMENT PROGRAMME
(Euro NCAP)

TEST PROTOCOL – AEB VRU systems

Version 3.0.2
July 2019

ANNEX B TESTING AT LOW AMBIENT LIGHTING CONDITIONS

B.1 Illumination Situation

Based on a GIDAS hotspot analysis, this appendix will describe a test condition for a night test scenario in urban situations.

B.2 Reference EN 13201

This European Standard defines performance requirements, which are specified as lighting classes for road lighting aiming at the visual needs of road users, and it considers environmental aspects of road lighting.

EN 13201, Road lighting is a series of documents that consists of the following parts:
— Part 1: Guidelines on selection of lighting classes [Technical Report];
— Part 2: Performance requirements [present document];
— Part 3: Calculation of performance;
— Part 4: Methods of measuring lighting performance;
— Part 5: Energy performance indicators.

B.3 Terms and definitions

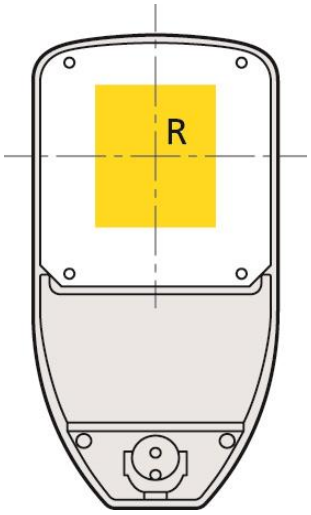
E - horizontal illuminance over a road area measured in lux (lx)

$\overline{Emin}$ - horizontal illuminance averaged over a road area measured in lux (lx).

Emin **-** lowest illuminance on a road area measured in lux (lx).

$\overline{Emax}$ - horizontal illuminance averaged over a road area measured in lux (lx).

Reference point R - The reference point of the lamp shall be the geometric centre of the light field



B.3.1 Derivation of parameter

The test condition in this appendix is based on accident analysis. The illumination values refer to DIN EN 13201.

The main illumination situations are main roads in urban situations with velocity 30...60 km/h, where main users are motorized vehicles and where bicycles and pedestrians are permitted.

The illuminance is based on class ME3. For ME3 comparative classes are available: C3 und S1. For Illuminance class S1 following values are defined in EN 13201:

Values for Class S1:

$$\overline{Emin} > 15lx \text{ AND } Emin > 5lx$$

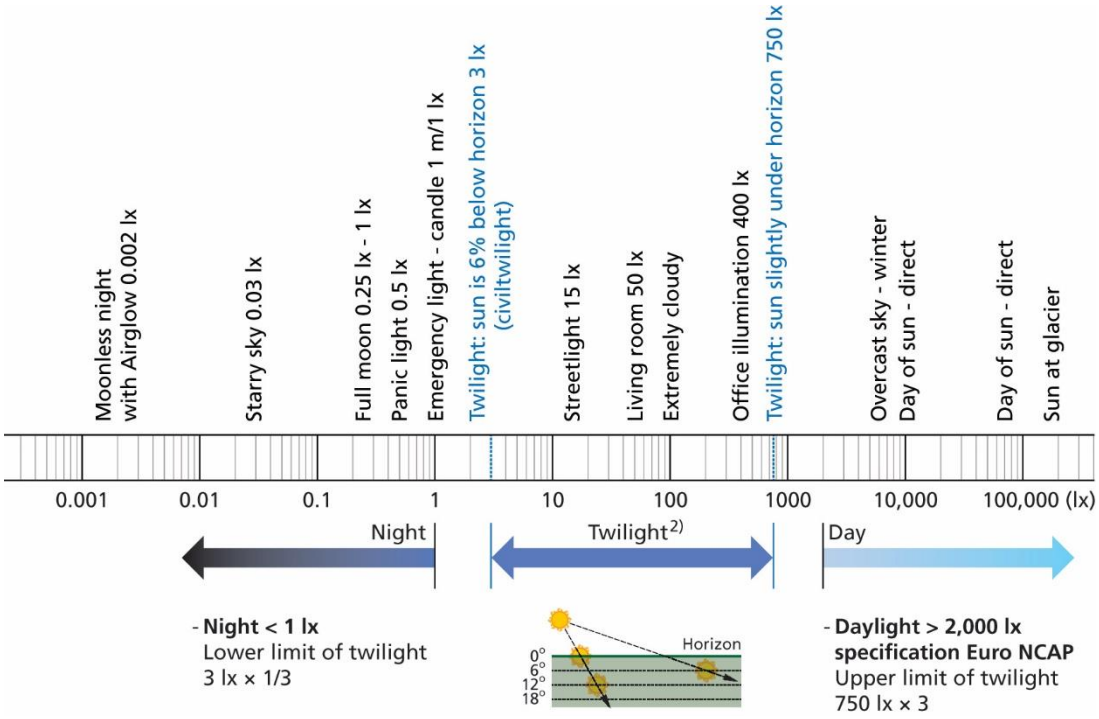
$$\overline{Emax} < 1,5 * \overline{Emin} \text{ AND } \overline{Emax} < 22,5lx$$

$\overline{Eref}$ - In order to reach a stable measurement setup, a reference value is defined as:

$$\overline{Eref} = \frac{\overline{Emin}+\overline{Emax}}{2} = \frac{15lx+22,5lx}{2} = 18,75lx$$

B.4 Light condition

There is a wide range of illuminance values in different situations. (see figure below).



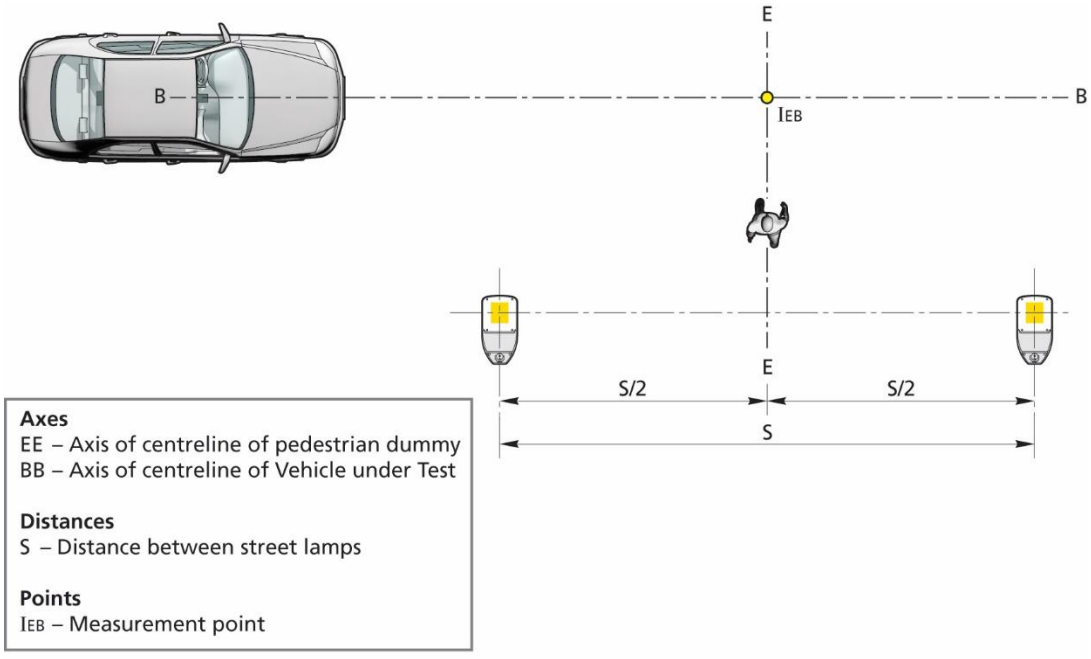
B.4.1 Background illuminance

The background illumination is an additive value to the streetlight illumination.

The position of the measurement of the background illumination shall be measured at the collision point. During measurement of background illumination all lamps and vehicle light shall be switched off.

Maximum of the background illumination on a test area during night shall be less than:

I_{EB} < 1lx



Axes
EE – Axis of centreline of pedestrian dummy
BB – Axis of centreline of Vehicle under Test

Distances
S – Distance between street lamps

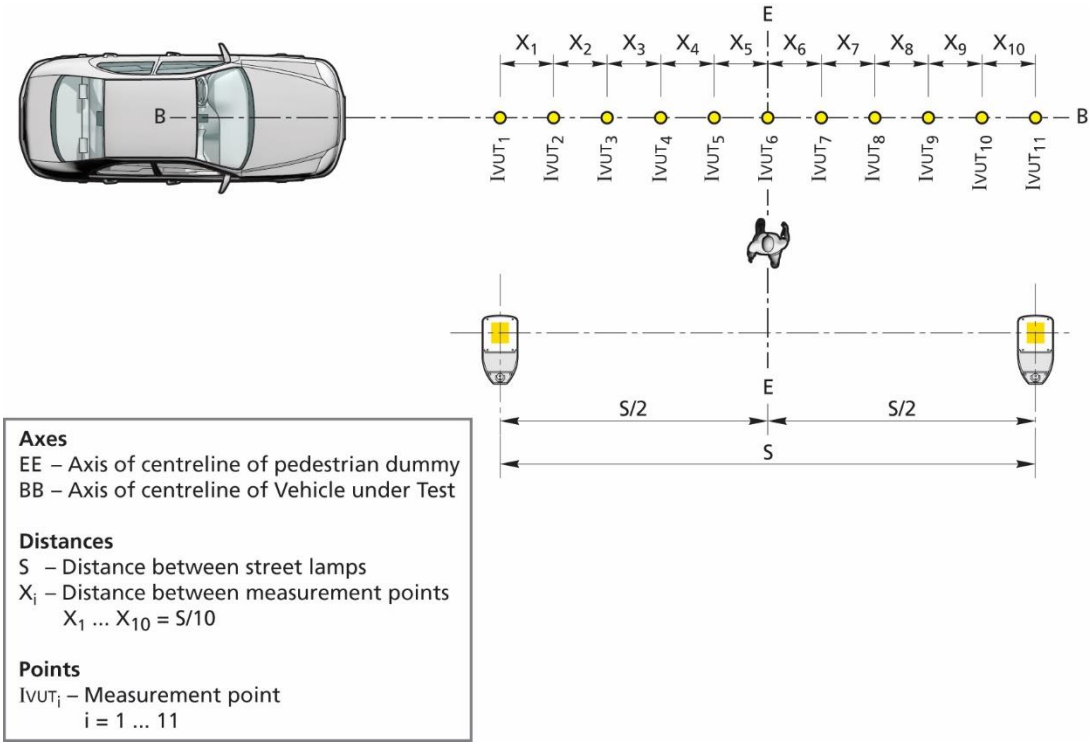
Points
IEB – Measurement point

B.4.2 Illuminance at VUT path

The illuminance of VUT path ($\overline{I\ VUT}$) is defined as an average of illuminance measurement points along the VUT path, trajectory BB. The average illuminance shall be in a range of:

$$\overline{\boldsymbol{I\ VUT}} = \overline{Eref} \pm Tolerance = \mathbf{19}\boldsymbol{lx} \pm \mathbf{3}\boldsymbol{lx}$$

$$\overline{I\ VUT} = \frac{1}{11}\sum_{i=1}^{11} I\ VUTi; \qquad 16lx < \overline{I\ VUT} < 22lx$$



Axes
EE – Axis of centreline of pedestrian dummy
BB – Axis of centreline of Vehicle under Test

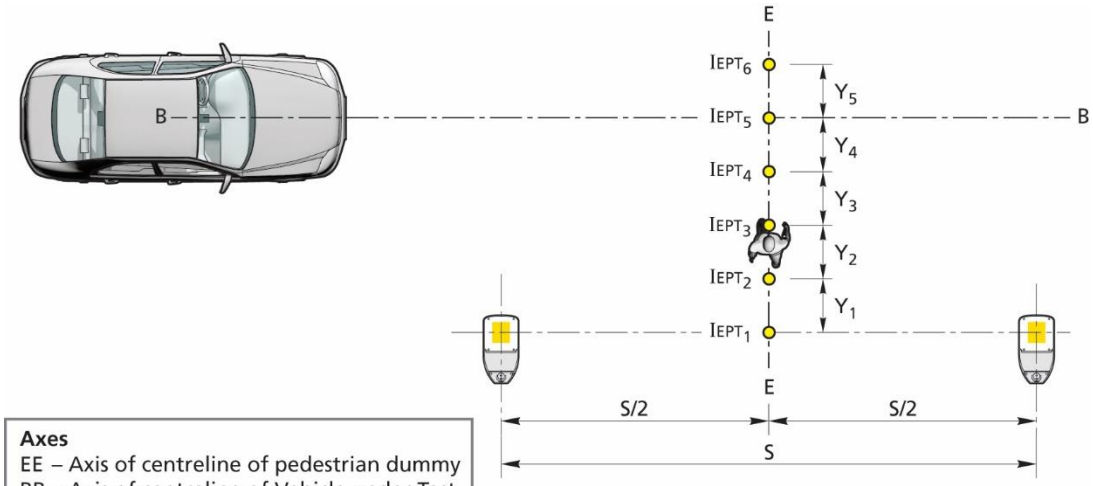
Distances
S – Distance between street lamps
X_i – Distance between measurement points
X_1 ... X_{10} = S/10

Points
$IVUT_i$ – Measurement point
i = 1 ... 11

B.4.3 Illuminance at EPT path

The illuminance along the EPT path, trajectory EE shall be at least $I\,EPT_i > Emin$

$I\,EPT_i$ > 5lx



Axes
EE – Axis of centreline of pedestrian dummy
BB – Axis of centreline of Vehicle under Test

Distances
S – Distance between street lamps
Y_i – Distance between measurement points
Y_1 ... X_5 = 1m

Points
$IEPT_i$ – Measurement point
i = 1 ... 6

B.4.4 Measurement tolerances

All measurement tolerances shall be

E : ± 1lx

B.5 Test Equipment

B.5.1 General requirement

The chosen lamp setup must reflect real world conditions. It is not allowed to install separate lamps to reach the required conditions. For the night test, a LED lamp shall be used due to its overall advantages like homogeneous illumination, long-term stability, power consumption etc.

B.5.2 Glaring

The lamps shall not be tilted towards the SV path to avoid any glaring which could affect the sensor performance. Glaring of the sensor system shall not occur everywhere on the test area and especially not along the section of the vehicle path.

B.5.3 Constant illumination function

To reach constant test conditions during test and lifetime, the lamp shall have a constant illumination function.

B.5.4 Colour temperature

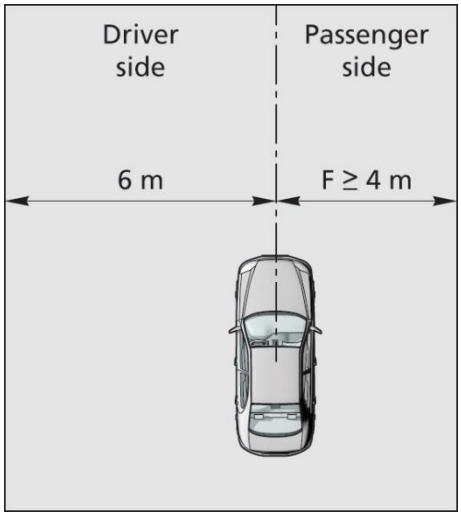
The colour temperature of the lamps shall be between 4500±1000K.

B.5.5 Mounting device

The lamps can be either installed stationary on a fixed pole, or on a mobile tripod. The mounting device must be designed to withstand wind speeds up to 20m/s.

B.5.6 Free Space (F)

In the passenger side of the VUT test path it is not allowed to install any mounting device from the lamp.

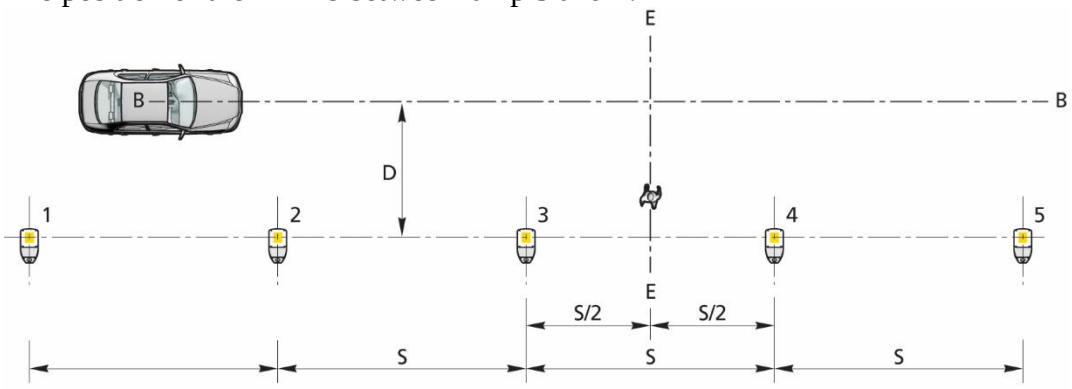


The free space F between the VUT path and the mounting facility shall be

F ≥ 4m.

B.5.7 Test setup

Three lamps in front of the pedestrian path and two lamps behind the pedestrian path are recommended (see figure below). That lamp configuration provides a homogeneous illumination of the test scenario according to real world situations. The position of the EPT is between lamp 3 and 4.

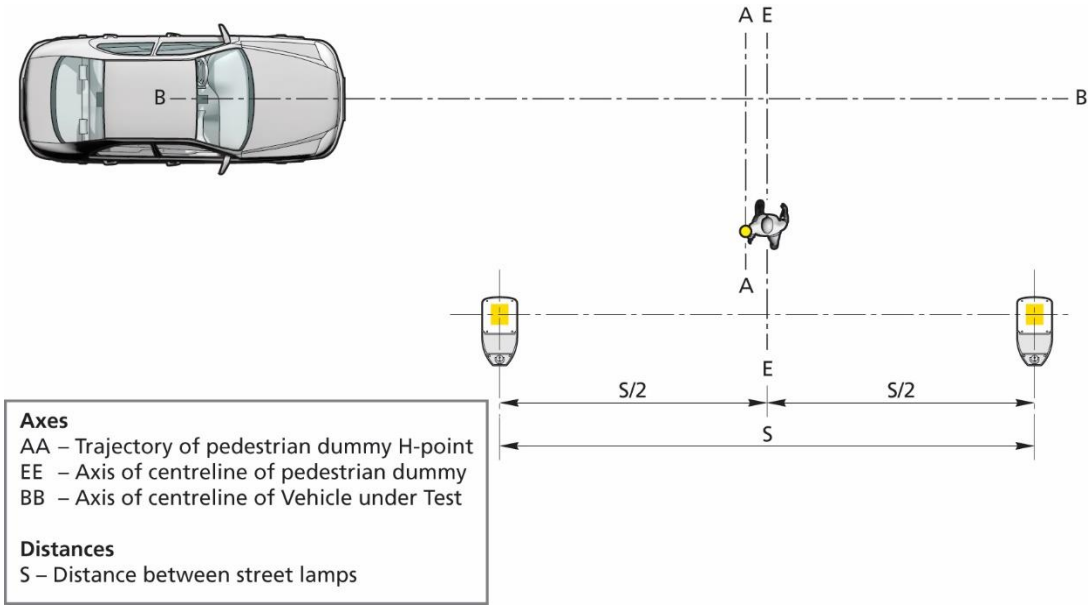


Axes
EE – Axis of centreline of pedestrian dummy
BB – Axis of centreline of Vehicle under Test

Distances
D – Lateral distance between the centre of the light field and the Vehicle under Test path
S – Distance between street lamps

B.5.8 EPT position

The EPT track EE shall be positioned between the street lamp 3 and 4 and passes the centreline of the EPT. Reference point for test setup is trajectory AA, which passes the pedestrian dummy H-point.

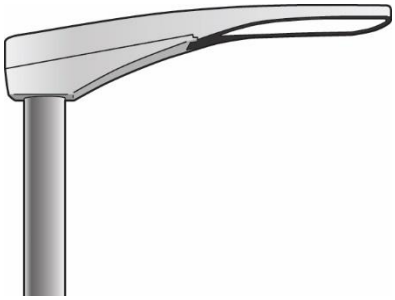


B.6 Example Test Equipment

As a reference and to demonstrate feasibility, the following sections provides example test equipment, test set-up and reference measurments that can be taken to ensure that the set-up will meet the requirements of this ANNEX.

B.6.1 Lamp type

Schuch, 48_LED (48 2403 ABX CL)



B.6.2 Requirement test setup adjustment

To be sure to reach requirement B4.2 and B4.3 the following parameters are allowed to be adjusted.

The distance of the lamp should be adjustable in order to reach the requested illumination values.

S: 25m ± 0,5m

The lateral distance between the centre of the LED-area and the vehicle path is adjustable in a range of

D: 4,0m ± 0,1m

The height of the lamp should be adjustable in order to reach the requested illumination values.

H: 5m ± 0,1m

Angle against ground and pole.

a : 90° ± 0,5°

The tilt of the lamp is adjustable in three different positions. (0° standard, 5°, 10°)

T: 0° standard position

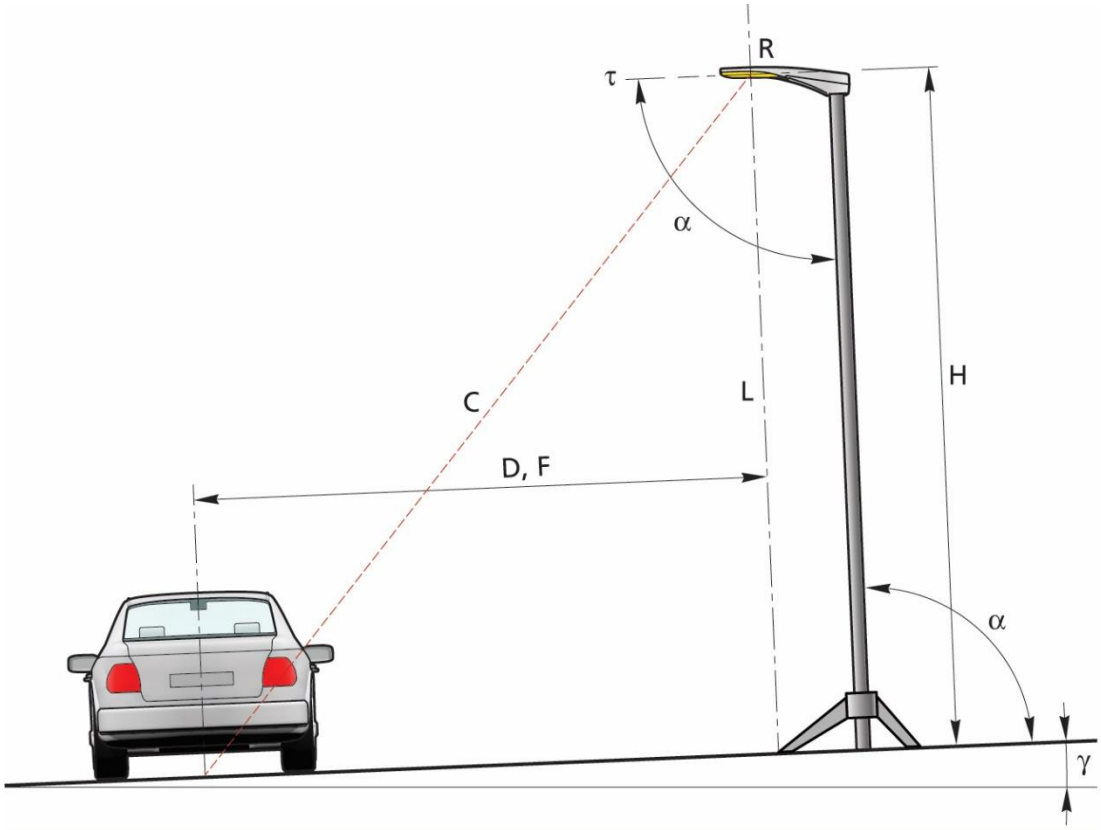
The inclination of road and test site surfaces is typically ~2.5%

c: < 1,5°

To ensure that the centre lines L of the lamps are oriented at right angles to the street even under the above conditions the length of the control line C shall be verified. Approval for the two lamps adjacent to the pedestrian path is sufficient.

$C = \sqrt{D^2 + H^2} = \sqrt{4m^2 + 5m^2}$

C: 6,4m ± 0,1m

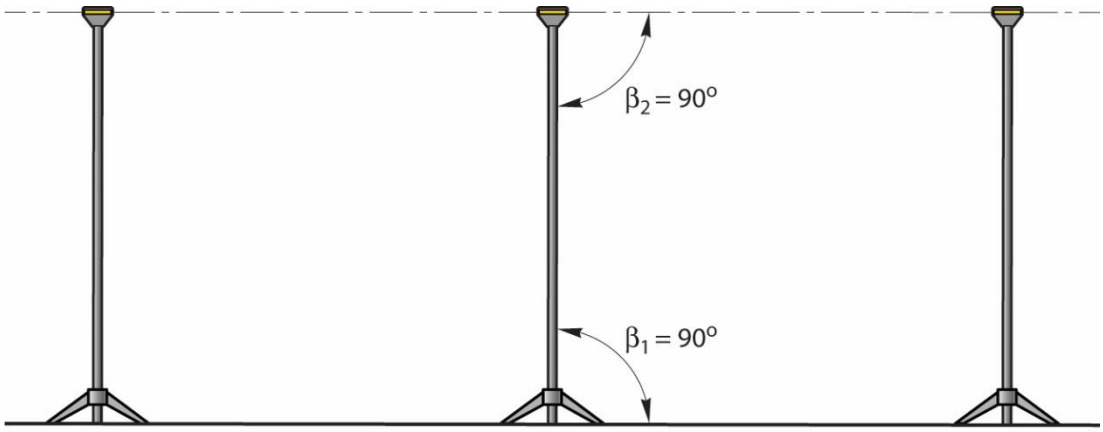


R – Reference point geometric centre of the light field
L – Centre line of the lamp (parallel to the pole)
D – Lateral distance between the centre of the light field and the VUT path
F – Free space between driving path of VUT and equipment
H – Height of lamp
C – Control line
τ – Tilt of lamp
α – Angle against ground and pole
γ – Cross slope

B.6.3 Longitudinal inclination of lamp

In order to get well balanced light distribution, it is necessary that the inclination of the lamp is in a range of:

β1,2: 90° ± 0.5°

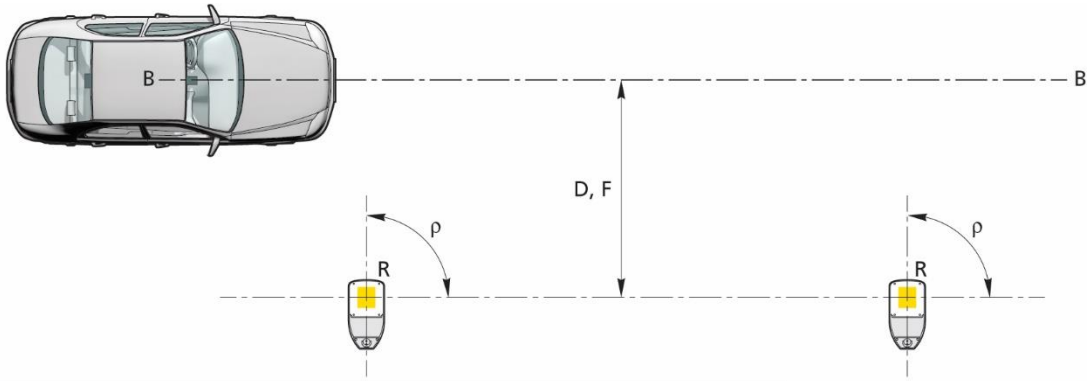


β_1 – Inclination of lamp to ground
β_2 – Inclination of lamp to pole

B.6.4 Orientation of lamp

In order to get well balanced light distribution, it is necessary that the rotation of the lamp in a range of:

ρ: 90° ± 0,1°



Axes
BB – Axis of centreline of Vehicle under Test

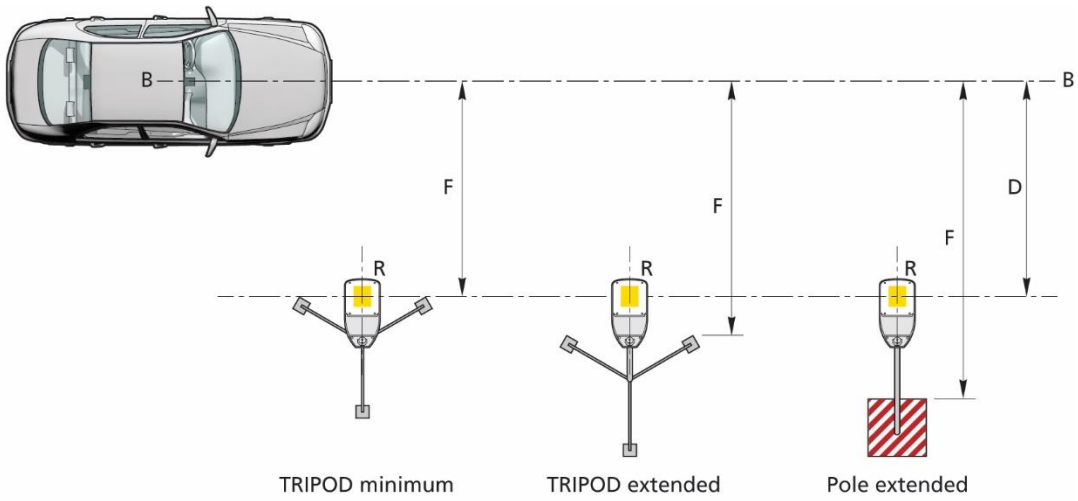
Angles
ρ – rotation of lamp

Distances
F – Free space between driving path of VUT and equipment
D – Lateral distance between the centre og the light field and the VUT path

Points
R – Reference point geometric centre of the light field

B.6.5 Example solutions

It is not allowed to install any mounting device within the free space. Different solutions are possible to reach the requirement as defined in B5.6.



Axes
BB – Axis of centreline of Vehicle under Test

Distances
F – Free space between driving path of VUT and equipment
D – Lateral distance between the centre og the light field and the VUT path

Points
R – Reference point geometric centre of the light field

B.6.6 Example mounting devices

It is not allowed to install any mounting device within the free space. Different solutions are possible to reach the requirement as defined in B5.6.

Towerlight TF5.5
http://www.towerlight.de/produkt/tf-5-5-7m/
(Date 2017-05-15)

configuration tripod

configuration cement pole

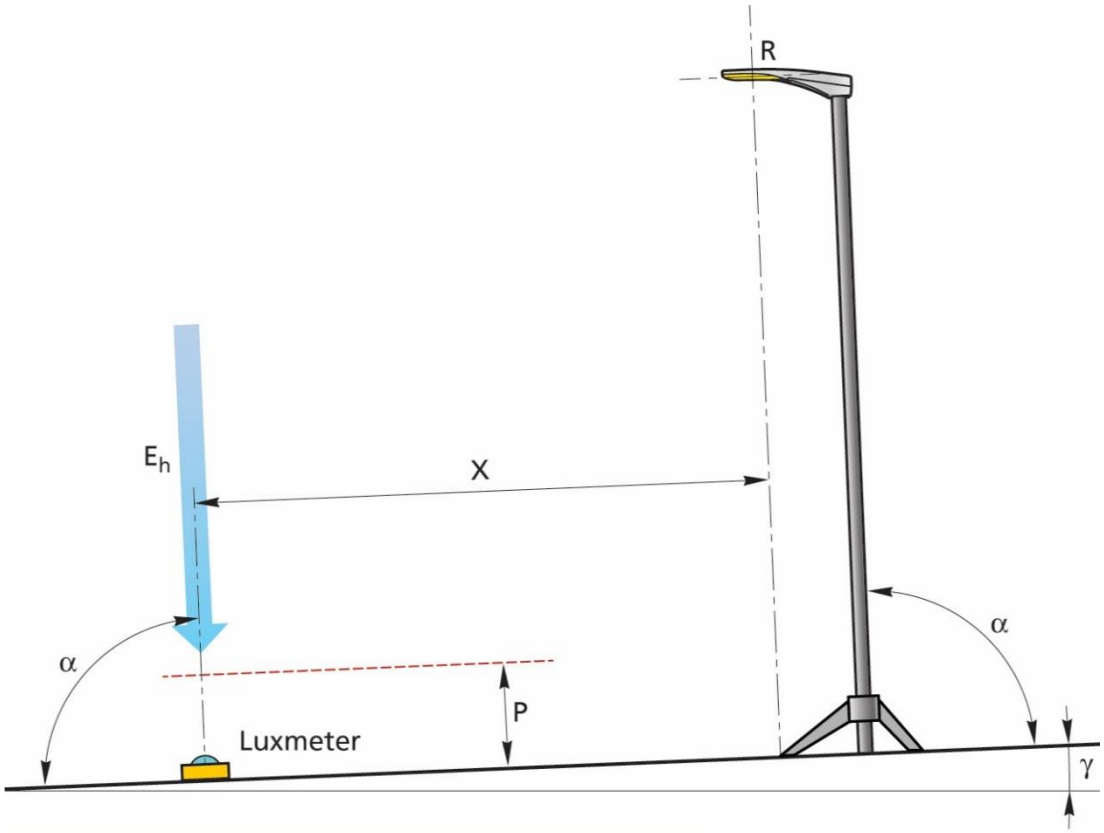
B.7 Measurement

To ensure, that the parameter defined in B4.1, B4.2 and B4.3 are in line with test setup, the parameter must be verified and documented.

B.7.1 Measurement setting

To measure the illumination, a calibrated luxmeter must be set on ground in a right angle to the street.

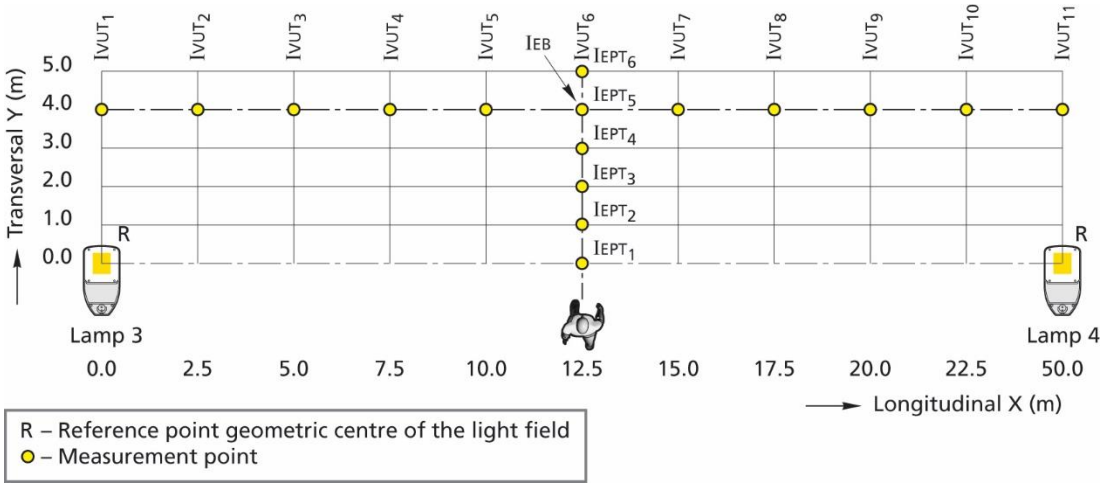
P: < 0,2m



E_h– Horizontal illumination
R – Reference point geometric centre of light field
P – Maximal height over ground
X – Position X
α – Angle against ground
γ – Cross slope

B.7.2 Example measurement grid

To ensure, that the parameter defined in B4.1, B4.2 and B4.3 are in line with test setup, the parameter must be verified and documented.
For I EPT5, I VUT6, I EB the position for measurement is:
X=12,5m, Y=4,0m.
The other values see figure below.



B.7.3 Example measurement tools

To measure the illuminance values, a calibrated luxmeter shall be used. The tolerance shall be:

Maximal error tolerance < 5%.

Luxmeter LMT B 360

http://www.lmt-berlin.de/de/b360.html

(Date 2017-05-15)

Luxmeter LMT B 360

Luxmeter Konika T-10A

https://www.konicaminolta.eu/de/messgeraete/produkte/licht-messtechnik/luxmeter/t-10a/einfuehrung.html

(Date 2017-05-15)

figure: Luxmeter Konika T-10A

B.7.4 Measurement documentation

The following values shall be measured and documented before and after a complete test series.

- **Background illuminance I_{EB} (B.4.1)**
  With all lamps and vehicle lights switched OFF, measure and record **I_{EB}** before and after a full test series.

- **Illuminance at VUT, EPT path (B.4.2 & B.4.3)**
  With all lamps ON and vehicle lights OFF, measure and record the illuminance at VUT and EPT path.