

VISO SYSTEMS LightSpion

User Manual

Revision: 27 October 2022



Congratulations on purchasing your new Viso Systems LightSpion. Before using this product, please read the Safety Information.

This manual contains descriptions and troubleshooting necessary to install and operate your new Viso Systems product. Please review this manual thoroughly to ensure proper installation and operation.

For news, Q&A and support at Viso Systems, visit our website at www.visosystems.com

Other manuals in this series for which the latest version can be downloaded from www.visosystem.com, include:

- Light Inspector User Guide (Software)

Contents

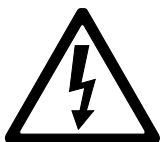
Safety Information	4
Preventing electric shocks	4
Disposing of this Product	4
Introduction	4
About this document	4
About the LightSpion	4
Product Dimensions	5
Shipping Packages.....	5
Installation	5
Software installation	5
Connecting power.....	6
AC power supply cable plug.....	6
Connecting USB.....	6
Room Considerations.....	7
Laboratory environment.....	7
Making Measurements	7
Preheating the sensor etc.	7
Bulbs and spots	8
Manual c-plane-option	9
Strips and Tubes.....	10
LightPort installation.....	10
Linear light holder installation	11
Checking for light overspill.....	12
Software extrapolation	13
Advanced Setup	16
Checking the calibration status.....	16
Custom calibration	16
Accuracy.....	19
Photo spectrometer accuracy	19
Optical sensor accuracy	19
Circular field accuracy	20
Specifications	23

Safety Information

Warning! This product is not for household use.

Read this manual before installing and operating the LightSpion, follow the safety warnings listed below, and study all the cautions in the manual.

Preventing electric shocks



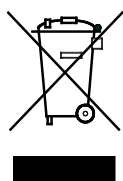
Make sure the power supply is always grounded.

Use a source of AC power that complies with the local building and electrical codes, that has both overload and ground-fault protection.

If the controller or the power supply are in any way damaged, defective, wet, or show signs of overheating, disconnect the power supply from the AC power and contact Viso Service for assistance.

Do not install or use the device outdoors. Do not spray with or immerse in water or any other liquid.

Do not remove any covers or attempt to repair the controller or the power supply. Refer any service to Viso.



Disposing of this Product

Viso Systems products are supplied in compliance with Directive 2012/19/EU on waste - electrical and electronic equipment (WEEE) together with the RoHS Directive 2011/65/EU with amendments 2015/863. Help preserve the environment! Ensure that this product is recycled at the end of its lifetime. Your supplier can give details of local arrangements for the disposal of Viso Systems products.

Introduction

About this document

These guidelines describe the installation process of the LightSpion followed by the typical measurements of various light sources.

About the LightSpion

The LightSpion is a portable far field goniometer system with a spectrometer sensor that makes it possible to get all photometric measurements quickly and efficiently. The Light Inspector software enables to quickly measure, save and export the newly obtained data.

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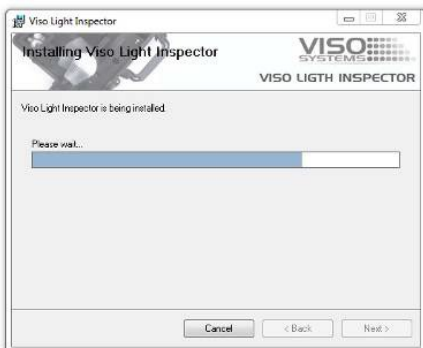
Product Dimensions



Shipping Packages

	Shipping Dimensions	Shipping Volume	Weight
1. LightSpion	450 x 350 x 160 mm	0.025 m ³	(net 6 kg) 7 kg

Installation



Software installation

Before you can start using the LightSpion, the VISO Light Inspector software must be installed. It is supported on all windows platforms.

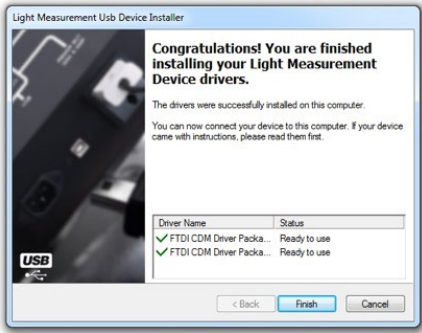
Use the following link to download the latest version:

<http://www.lightdataserver.com/software/VISO%20Systems/LightInspector.htm>

Please make sure the LightSpion is not connected to the computer during software installation.

Run the .msi file and follow the installation instruction.

USB drivers are automatically installed.



Your measurements are not lost when installing newer versions or uninstalling. All measurements will always remain in your document folder. If you want to remove all your measurements go to the 'Light Inspector' folder and delete them manually.

Typical folder location:

C:\Users\'Username'\Documents\Viso Systems\Light Inspector

Or if stored in dropbox:

C:\Users\'username'\Dropbox



Connecting power

The LightSpion comes with a standard IEC power-in connector and with a standard euro power cable, but any power cable can be used as the LightSpion supports any outlet voltage from 90-260VAC.

The power-in connector supplies power both to the goniometer motor and to the power analyzer and then subsequently to the measured light source. It means that the power is identical to the one of the measured light source (unless the latter is power with an external power supply).

AC power supply cable plug

Warning: Risk of an electric shock! Plug installation shall be performed by a qualified electrician.



A grounding-type (earthed) power plug that fits the local power outlet must be used. You can acquire an IEC power cable with a suitable grounding-type plug from most of consumer electronics stores.

When installing the plug connect pins as follows:

- Blue wire to **neutral**
- Yellow and green wire to **grounding** (earth)
- Brown wire to **live**



Neutral
Ground/Earth
Live



Connecting USB

The LightSpion is connected to the computer using a USB connector type B. A 2 m USB cable type A to B is included in the LightSpion case, however any USB cable supporting USB2.0 can be used.

The USB provides communication and power to the LightSpion's main board processor, power analyzer and photo spectrometer, meaning that the photo spectrometer can be used only with the connected USB.

Start the Viso Light Inspector software after having connected the USB; the connection to the LightSpion will be established automatically. A successful connection is shown with a green "Connected" icon in the upper right corner of the Viso Light Inspector software.

You can connect and disconnect the USB without restarting the Viso Light Inspector software, as the connection is always established automatically as soon as the USB connector is plugged in and vice versa.



Room Considerations

Laboratory environment

- The LightSpion can be used outside of the laboratory and compensates automatically for steady ambient light. However, for the most precise measurements, a dark room/laboratory is recommended. You can find guidance in https://data.visosystems.com/content/manuals/guidelines_building_a_lighting_laboratory.pdf
- Always keep your laboratory clean from dust and particles. Dust may interfere with measurement if it accumulates on and around the sensor by introducing straylight and disturbing translucence. Dust and particles in the mechanical parts of the goniometer may disturb functionality and may cause wear on motors, belts and bearings. Disconnect all USB cables and power supplies, and vacuum clean your goniometer regularly (normally every month) to remove dust. Mount a brush on the vacuum cleaner handle. Dry off all external surfaces with a clean, dry, cotton cloth (avoid statics).
- Avoiding air currents is necessary to minimize cooling of devices under test. Limit air flow (e.g., from air conditioning systems or draught) around the system (may alter light source intensity).
- Limit heat transmission from light source through mounting system. Should be mounted as realistically as possible

The standard test conditions and tolerance intervals of CIE DIS 025 (laboratory conditions)	Standard test condition	Tolerance interval
Ambient temperature	25.0 °C	±1.2 °C
Surface temperature for device under test	Nominal operating temperature t_p	±2.5 °C
Air movement	Stationary air	0 m/s to 0.25 m/s

Making Measurements

Preheating the sensor etc.

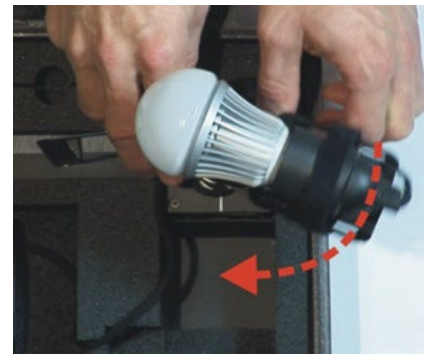
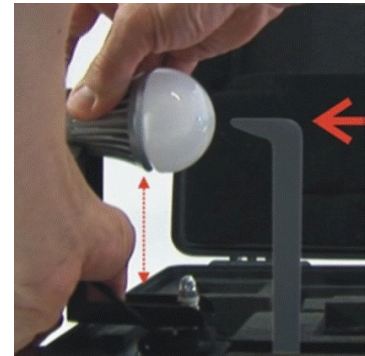
Many components including the sensor are temperature sensitive. In order to achieve correct measurements, make sure that the whole system has been turned on for 30 minutes or more.

Bulbs and spots

Before making any measurements, it is important to align the investigated light source. Use the alignment tool located in the front compartment of the LightSpion case and place it in front of the light source.

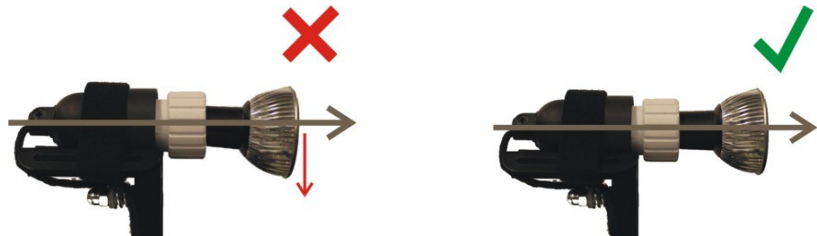
Then adjust the height by sliding the lamp holder bracket up and down.

Turn the lamp holder 90 degrees and set the center of rotation by sliding the lamp forward and backward, so that the center of the



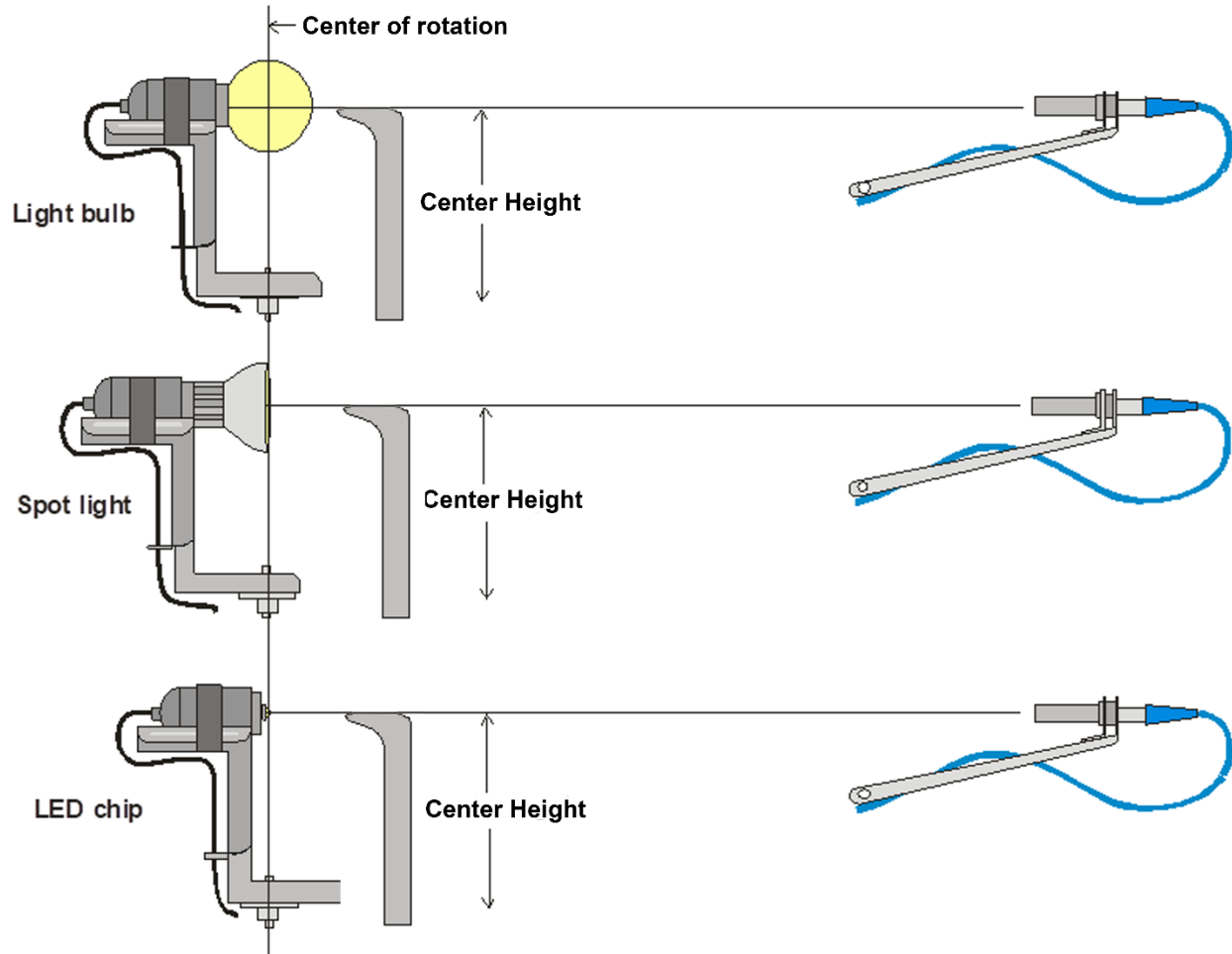
illumination part of the lamp is aligned with the alignment tool.

When measuring light sources with narrow beam angles it is important to ensure that the light is pointing straight horizontally to make certain that the centre of the beam is scanned at the correct point as shown below.



After alignment turn the light source back pointing straight towards the optical sensor. Also, remove the height alignment tool, and put in back into place in the foam slit.

Different alignment examples are shown below:

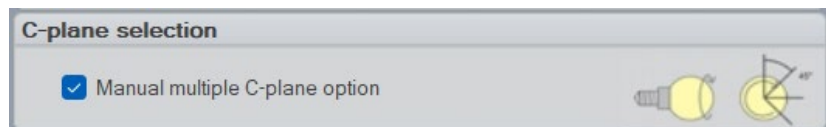


Manual c-plane-option

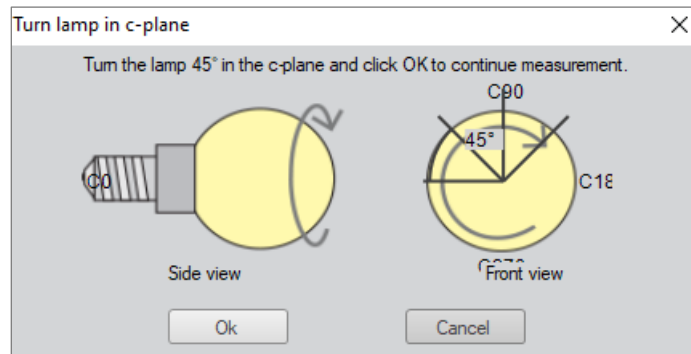
The LightSpion (with and without Extender) is set up to measure a single plane (= 2 c-planes). This is ok for rotational symmetrical light sources (read more in [page 19, Accuracy](#)), but some light source are more or less asymmetrical and more measurement planes are need to give an accurate characterization.

This can be done by manually turning the lampholder (on LightSpion) alternative the whole lamp holder bracket (on LightSpion Extender) every time a measurement plane is completed.

To perform a 4-plane measurement with manual c-plane rotation, go to Setup → Options → Basic → C-plane selection



Then start a new measurement as usual. Now, after the first measurement plane, this window opens:



The system will prompt you totally three times until all four planes have been measured.

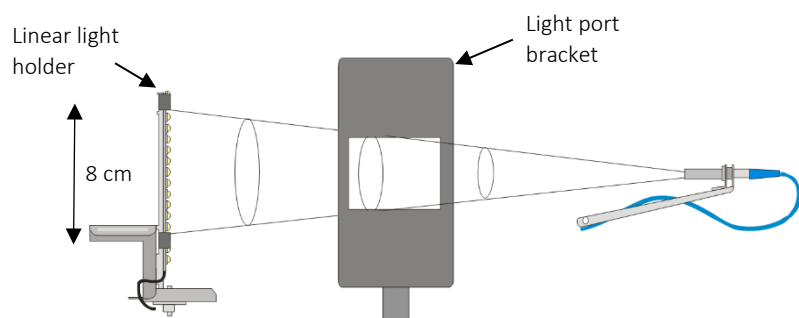
Strips and Tubes

The LightSpion can also measure linear light sources such as LED strips or tubes.

The Linear Lamp feature assumes that a measured portion of the light source is representative of the entire length. As this is not always the case, care should be taken that extrapolation of measurement results increases the inaccuracy of the results. Thus, it is recommended not to extrapolate more than 500%. This means that a LightSpion without Extender will be able to measure linear light sources with a length up to $8\text{ cm} * 5 = 40\text{ cm}$, and a LightSpion with Extender will be able to measure up to $22\text{ cm} * 5 = 110\text{ cm}$ with an acceptable accuracy.

The width of the linear tubes cannot exceed half of the maximal diameter, which is 8 cm. That means the maximum width of the linear tube is 4 cm.

To measure a linear light source a "light port bracket" can be used to ensure that only a specific portion of the linear light sources is being measured as shown below.



The "light port bracket" ensures that light from only 8 cm of the linear light source is captured. The full length of the light source is then typed into the software after the measuring process is finished. An alternative to the bracket is to mask off directly on the light source to ensure that only 8 cm contributes to the light output.

LightPort installation

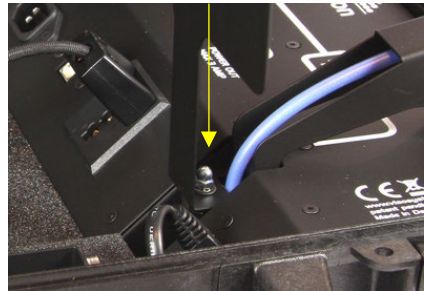
The "light port bracket" should be placed in the LightSpion case to ensure the correct measurement as shown below:



1) The LightPort is stored in the lid



2) Place the lid in the slot in front of the arm



3) A magnet keeps it in place



4) Push it in, to the end of the slot

NB: The bracket is not intended for use with "LightSpion Extender".

Linear light holder installation

The "linear light holder" is set and used as shown in the pictures below:



1) Take holder from the lid



2) Push to the end



3) Erect holder



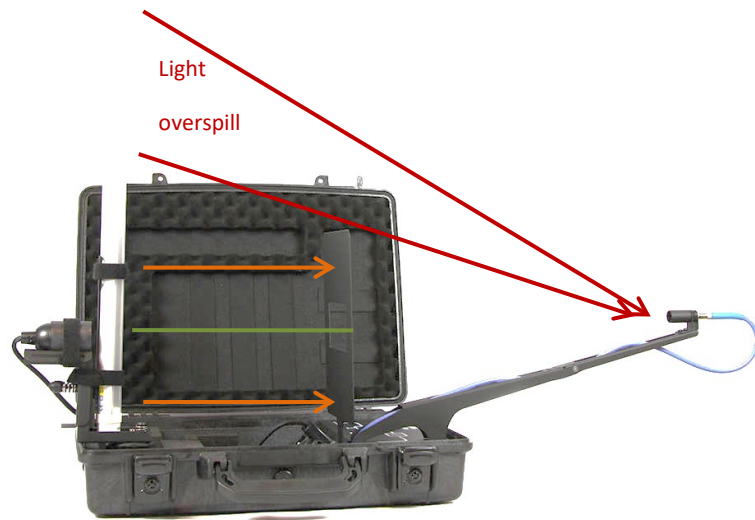
4) Use Velcro straps to hold fixture. Do not cover the middle 8+ cm. This section

contributes to the measurement as they are in the sensor field-of-view.



5) Center the light source. It is very important to center the light source over the rotational center of the goniometer.

Checking for light overspill



Light overspill, which is the light retrieved by the detector outside of the light port bracket area, can increase the measured value of the luminous flux.

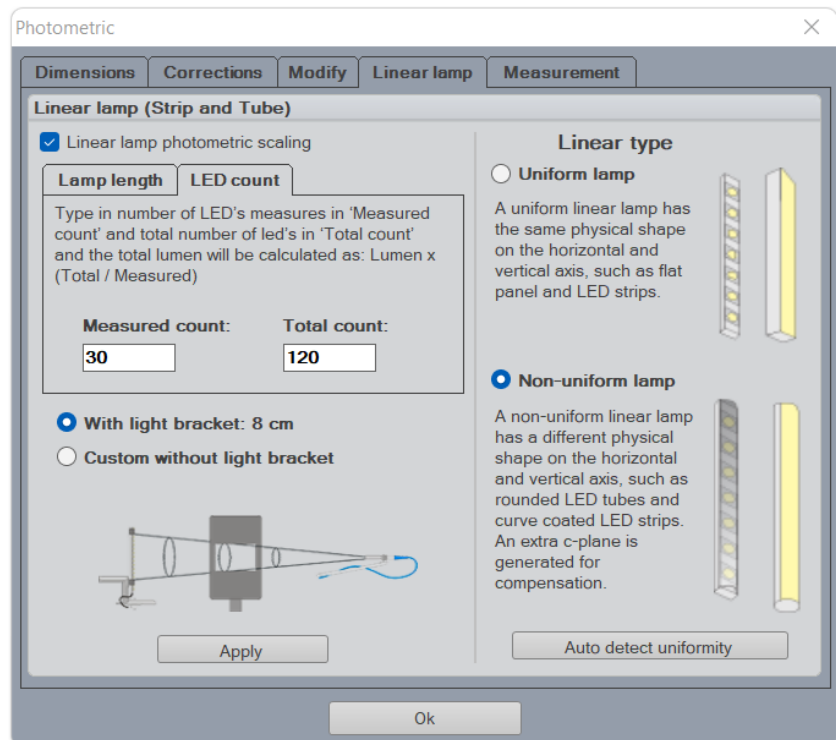
An extension plate for the light port bracket will prevent the light overspill. The extension is smoothly attached on top of the port bracket as shown in the pictures below.



Software extrapolation

Click *Edit* -> *Photometric* -> *Linear Lamp* to insert the real length of the source to the software. The complete light output of the linear light sources is then calculated.

For linear light sources of flexible lengths such as LED strips it is also possible to get the light output information specified in lumen per meter or foot.



Tick-off the box “Linear lamp photometric scaling”. Then choose one the two extrapolation modes (two different tabs, upper left-hand corner):

- By “Lamp Length” – this mode is used for light emission surfaces with a uniform luminance
- By “LED count” – this mode is used for light emission surfaces where you can count the single LEDs. If you can actually count the LEDs, this would be the most accurate extrapolation mode.

By lamp length

Upper field: Pick between options

Lamp length: Your custom length, measure and type

Show lumen per meter:

This option is for LED strips in rolls or the like where the lumen package is mostly expressed per meter

Show lumen per meter:

This option is for LED strips in rolls or the like where the lumen package is mostly expressed per foot

Lower field: Pick between options

With light bracket – this standard accessory ensures that only 8 cm is in the sensor field-of-view

If you physically masked off some of the light source, choose “Custom without a lamp bracket”. Use this option together LightSpion Extender.

Click the “Apply button” to see the result (“Calculated lumen:”) without closing the window.

Lamp length
LED count

Calculated lumen:

Lamp length: cm


Show as lumen per meter

Show as lumen per foot

With light bracket: 8 cm

Custom without light bracket

cm



Apply

By LED count

Count the LEDs that were visible for the sensor during measurement - either visible through the light bracket, or visible as not being physically masked. Type this quantity in the “Measured count” field.

Count the total amount of LEDs on your light source. Type this quantity in the “Total count” field.

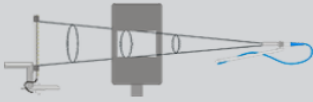
Lamp length
LED count

Type in number of LED's measures in 'Measured count' and total number of led's in 'Total count' and the total lumen will be calculated as: Lumen x (Total / Measured)

Measured count:	Total count:
<input type="text" value="20"/>	<input type="text" value="100"/>

With light bracket: 8 cm

Custom without light bracket



Apply

Determine whether the light distribution can be said to be uniform – crosswise = lengthwise.

A naked LED strip would typically have a Lambertian light distribution both crosswise and lengthwise.

Other light sources has some sort of optics in front of the light source, or the LEDs are recessed. In that case, the single, measured plane does not contain a simple, Lambertian distribution.

If it can be assumed that the light distribution lengthwise (in the orthogonal plane) is Lambertian, such a second plane can be added automatically with the “Non-uniform lamp” option. Choosing this option adds to the uncertainty of the measurement.



Linear type

Uniform lamp

A uniform linear lamp has the same physical shape on the horizontal and vertical axis, such as flat panel and LED strips.

Non-uniform lamp

A non-uniform linear lamp has a different physical shape on the horizontal and vertical axis, such as rounded LED tubes and curve coated LED strips. An extra c-plane is generated for compensation.

Auto detect uniformity

Example of a non-uniform lamp (two light distribution symmetry axes)

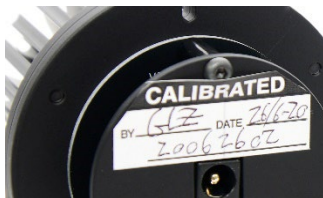
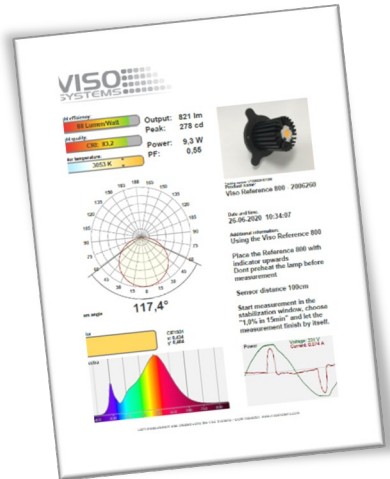
Check the power consumption

Make sure that the measured power consumption matches the final extrapolated length. If not, type the correct power details in Edit -> Power.

Advanced Setup

Checking the calibration status

A special Viso reference light source (Reference 800) is included in the package. The light source has its own power supply, and both parts are labelled with identical calibration date and numbers. Never measure without the original power supply.



Right after factory calibration of your system, the reference light source was measured and a certificate was issued. The certificate is part of the delivery. The certificate can also be downloaded from Viso's website using the calibration number on the labels.

With the reference lamp you can quickly check your calibration status:

- Check whether the total flux in lumen and peak candela is close to the original values
- Check whether the shape of the spectrum is close to the original shape.
- Check whether the spectrum looks spiky or jagged.

If you are not happy with the result, the system needs to be calibrated. Viso recommends calibration every year, or minimum every 2 years. Viso provides calibration service, or you may do your own calibrations following the 'Custom Calibration' procedure.

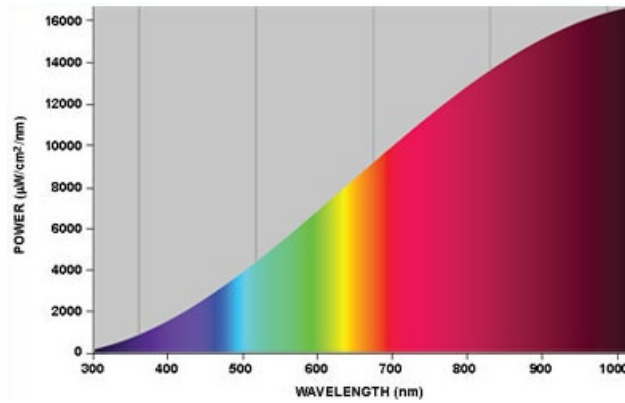
Check-up Procedure

- Place the Reference 800 with the indicator (the oblong hole in the base) upwards
- Do not preheat the light source before measurement
- Centre the light source in the gonio (measuring distance 66 cm)
- Start measurement normal measurement. In the stabilization window, choose "1,0% in 15 min." and let the measurement finish by itself.

Custom calibration

The LightSpion is delivered in a pre-calibrated condition. It is also possible to make a custom calibration of the photo spectrometer if desired. This could be necessary if the LightSpion is to be certified by an official agency, which will perform its own calibration and afterwards issue certification documents.

To make a custom calibration a calibration source must be used, the spectrum of which in a directional point at a certain distance is known. Such a spectrum is usually specified as power in $\mu\text{W}/\text{cm}^2/\text{nm}$, as shown below.



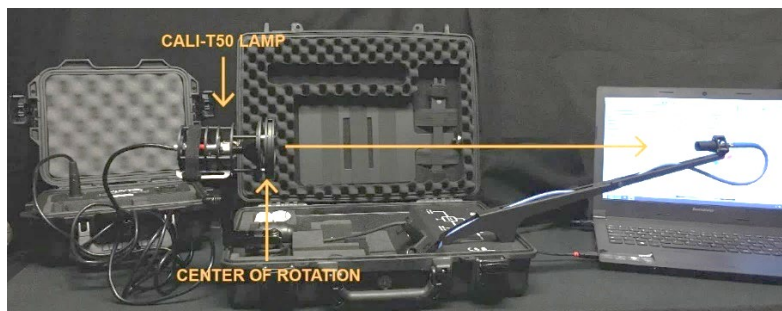
Calibration sources can be obtained from a number of suppliers, in this example will we use the CALI-T50 from Viso Systems which is a tungsten irradiance lamp. The spectrum of the calibration source is usually provided in a .Imp file (lamp file).

NOTE! Making a custom calibration does not delete the Viso factory calibration. You can always switch between factory and custom calibration at any time.

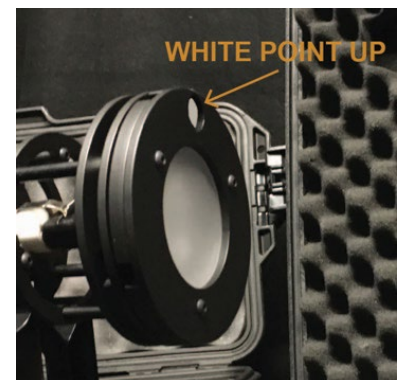
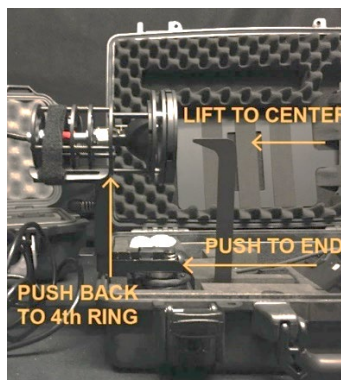
IMPORTANT: Calibration must be made in a dark environment, with non-reflective surfaces.

These steps show how to make a custom calibration.

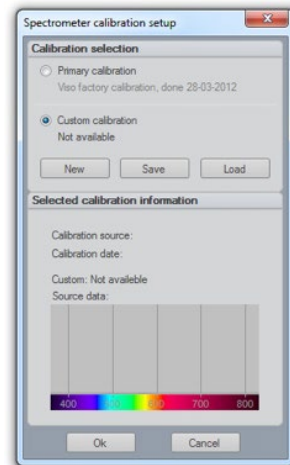
- 1 Place the calibration lamp at the center of the rotation motor and make sure it is lifted to the right height by using the alignment tool.



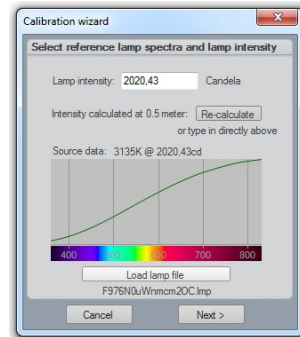
The lamp must be pointed directly towards the sensor. Sometime is might be necessary to unplug RJ45 cable to the motor to enabling precise alignment



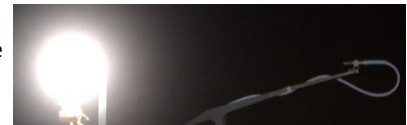
2 Open the Viso Light Inspector software connected to the LightSpion via USB and select *Setup - Spectrometer calibration*. Then select custom calibration and click on the new button. Note: The primary factory calibration will not be lost, and you can always return it.



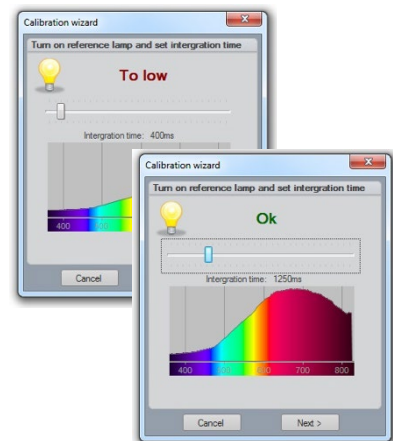
3 Select "Load lamp file" to load the calibration source spectrum. The system will automatically calculate the intensity of the source in candela based on the lamp file at a distance of 0.5 m. If the measurements are done at a different distance, then click on the re-calculate button. If you don't know the lamp distance but know the intensity value in candela, simply insert it directly into the candela box.



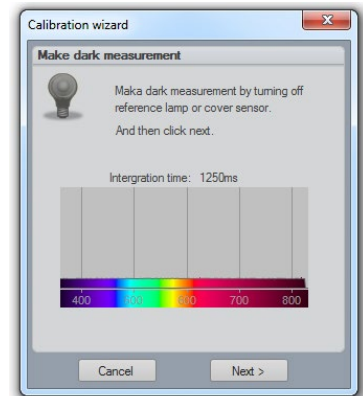
4 Make sure the calibration source has been turned on for at least 30 min, so the output is stable.



5 Click next and set the integration time to a maximum possible value to ensure the highest resolution, and therefore the best calibration quality.



6 Click next and cover the sensor or turn off the calibration source so the dark reference spectra can be measured



7 Click next – and the calibration is then finished.

When you close the calibration dialog will you be asked if you want to save the calibration to the device. When selecting yes, the custom calibration will be saved inside the device you can always switch back to the factory calibration at any time.

Accuracy

The accuracy of the LightSpion device consists of the sum of individual accuracies of the involving parts as follows:

- Photo spectrometer accuracy
- Optical sensor accuracy
- Circular field accuracy
- Absorption quality of your measuring space (unknown)

The accuracies of the devices are described below.

Photo spectrometer accuracy

The spectrometer used in the LightSpion is Ocean Optics STS-VIS.

The accuracy of the spectrometer has been previously tested in a wide temperature range from -10 to +50 degrees, therefore the device is adjusted for a temperature drift.

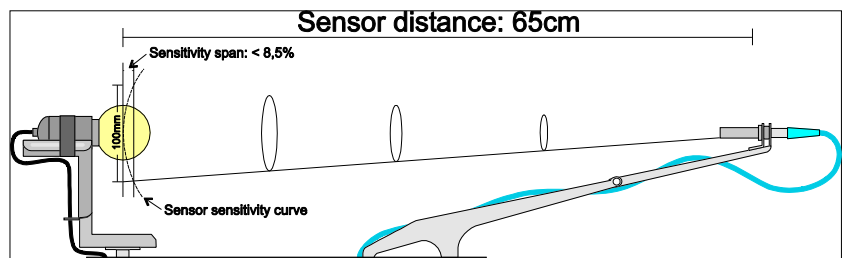
The linearity of the photo spectrometer is corrected to have an error $< +/- 0.5\%$ from 15-95% full scale (2,500 – 14,000 counts net).

The effect of the linearity error will also affect the color and CRI measurements so the complete series of measurement errors are as follows:

- Intensity error $< +/- 0.5\%$
- Color temperature error $< +/- 35$ Kelvin
- CRI error $< +/- 0.7\%$

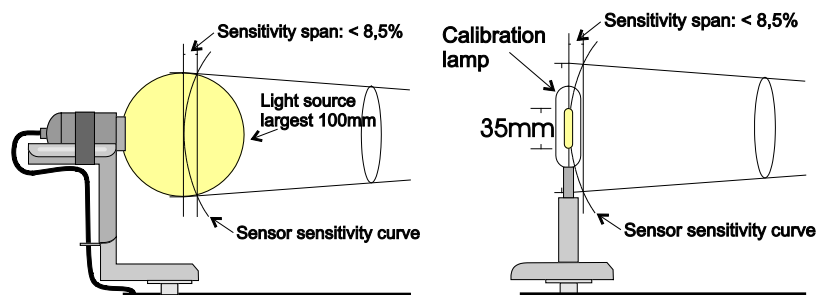
Optical sensor accuracy

The accuracy of the sensor depends on a change of a sensitivity field as a function of position (it is also called the sensitivity span). The measurement setup with an indicated sensitivity span of less than 8.5% is presented below.



The system is constructed for measuring light sources with a maximum diameter of 100 mm. It is calibrated with the help of a calibration source with an aperture diameter of 35 mm with constant field of light output. Thus, subsequently measured light sources with the same aperture and a constant field will have an error of 0%, whereas light sources smaller than 35 mm will have a positive error and vice versa.

The errors can occur due to differences in sizes of apertures of light fixtures. The largest error is then calculated according to the minimum and a maximum aperture sizes.



Max positive error +0.49%

Max negative error -2.55%

In most cases the maximum error would be smaller than 2.55%, as the light radiated from a large aperture would be highest in the center.

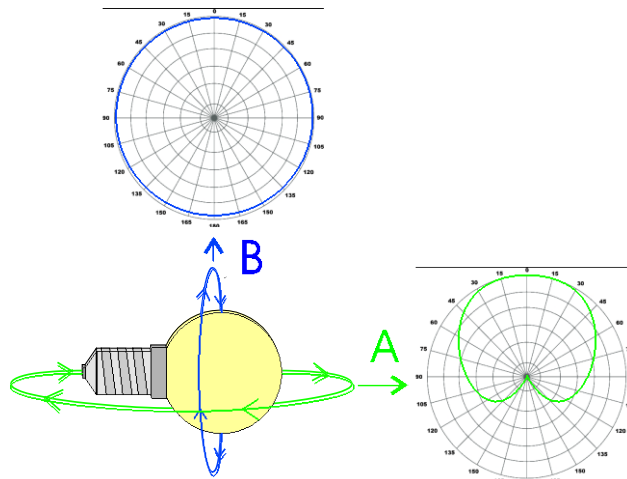
The inaccuracy of the sensor is rounded off to $\pm 2\%$.

Sensor intensity error $\pm 2\%$

Circular field accuracy

The LightSpion measures the luminous flux in lumen, which accounts for light radiated in all directions. Lumen measurement is generally done with the help of an integrating sphere, which allows to collect light radiated in all direction into one point.

The LightSpion uses goniometer technology to obtain this measurement. Unless applying the "Manual c-plane option", it captures light from one section of the light source (one measurement plane = 2 c-planes) and afterwards calculates the complete flux value based on this section, as shown below (section "A" is presented in green).



The principle behind it is based on a consideration that the opposite field “B” is circular (see in the picture above). Most of the light sources and fixtures have nonuniform circular “A” and “B” fields.

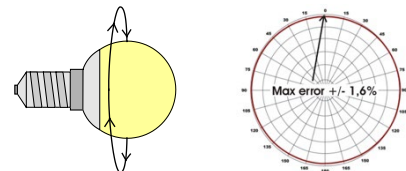
In some particular cases the deviation from a circular uniformity of the “B” field is caused by a physical geometry of the light source.

A series of test measurements of different types of light sources was made to account for such errors.

The total flux accuracy is calculated for each type of light sources by summation of the 3 kinds of errors: Spectrometer Intensity Error + Sensor Error + Circular Field Error = Total Lumen Accuracy

1. **A LED bulb with a frosted glass cone.**

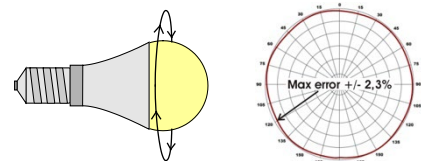
For this type of light source the “B” field is almost completely circular and therefore it has a small error when measured only using the “A” field.



Accuracy = 0.5% + 2% + 1.6% < +/- 4.1%

2. **A LED bulb with a frosted plastic cone.**

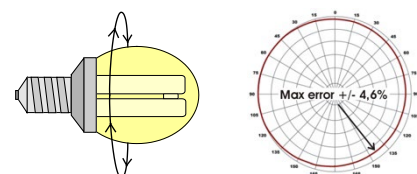
The plastic cone exposes the led. Thus it has a slightly deviated distribution of the “B” field, which results in a higher error value



Accuracy = 0.5% + 2% + 2.3% < +/- 4.8%

3. **Fluorescent bulb with a frosted cone.**

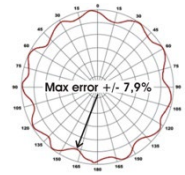
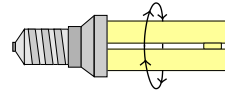
The large field of light from a fluorescent bulb and a nonuniform wearing of the glass tubes increase the error compared to LED.



Accuracy = 0.5% + 2% + 4.6% < +/- 7.1%

4. **Fluorescent open bulb.**

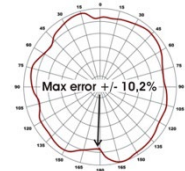
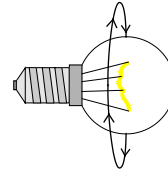
A non-frosted coned fluorescent bulb exposes the glass tube completely therefore producing an oscillating "B" field, which depends on the number of tubes.



$$\text{Accuracy} = 0.5\% + 2\% + 7.9\% < \pm 10.4\%$$

5. **Incandescent clear glass.**

Old-fashioned incandescent bulb gives the largest error due to a non-circular tungsten thread.



$$\text{Accuracy} = 0.5\% + 2\% + 10.2\% < \pm 12.7\%$$

Based on the above, the average accuracy is then calculated as follows:

$$\begin{aligned} \text{Total Average Lumen Error} &= \text{spectrometer intensity error} + \text{sensor error} + (\text{circular field error} \\ &\text{type1} + \text{type2} + \text{type3} + \text{type4} + \text{type5}) / 5 \\ &= 0.5\% + 2\% + (1.6\% + 2.3\% + 4.6\% + 7.9\% + 10.2\%) / 5 \\ &= \pm 7.82\% \end{aligned}$$

Specifications

Measurement method Far Field, Type C

Physical Dimensions

Shipping dimensions (L x W x H)	(L x W x H) 46 x 17.5 x 37.5 cm
Shipping weight	6 kg
Dimensions (L x W x H)	43 x 11.5 x 33.5 cm
Weight	5 kg
Sensor distance	66 cm
Lamp diameter range	0 – 80 mm
Lamp maximum weight (tower in upright position)	4 kg

Electrical

Power supply input	90 - 260 VAC, 50/60 Hz
Power consumption	15 W
USB current consumption	200 mA
Power analyzer voltage range	90 VAC - 260 VAC \pm 0.5V
Power analyzer current range	0 – 3 A (Avg: \pm 0.1 mA)
Power analyzer power range	0 – 300 W (Avg: \pm 0.1 W)
Power analyzer sample rate	70,000 samples/sec

Photometric

Flux, lumen @ 0.66 m	10 - 50,000 \pm 7.8% (see "Lumen Accuracy")
Intensity, candela	0.05 – 50,000 \pm 2.5%
Color temperature	1,000 K-10,000 K \pm 35 K
Color rendering index	0-100 \pm 0.7
Angular resolution BASIC MODE	5-degree step (About 20 sec measurement time per C-plane)
Angular resolution HIGH MODE	1-degree step (About 1 min measurement time per C-plane)
Angular resolution - highest resolution	0.1-degree step (About 5 min measurement time per C-plane)
Spectrometer type	STS Ocean Optics
Calibration	Fully calibrated with certificate
Re-calibration	Every 1 year (Maximum 2 years)

Control and interface

Control interface	USB 2.0
Control connector	USB-B

Connections

AC power in (power supply)	IEC 3-pin
Control connector	Universal socket
Light source adaptors	E27, E14, B22, GU10
PC	USB B

Approvals

Power supply	cUL/UL, CE, CCC, TUV, FCC
Power analyzer - photometer	CE

Warranty

Warranty period	2 years
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Ordering information

LightSpion	P/N LIGSP001
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At Viso Systems we design, develop and manufacture OEM- and customer-specific goniophotometer solutions. Our mission is to support customers with powerful, yet easy-to-use control and measurements solutions. Products are developed and manufactured in Copenhagen, Denmark.



Light measurement made easy
