Guidance Note 7/17

Choosing the right photometer/illuminance meter

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Introduction

This Guidance Note explains the core parameters and requirements to consider when purchasing an illuminance meter. It does not advise on the use of the meter. The ILP recommends those undertaking any photometric measurements or assessments should be professionally qualified and competent in the discipline of illuminating engineering.

This includes a detailed understanding of the measurement instrumentation, the lighting installation being assessed including its measurement grids and design requirements, and Health and Safety.

This Guidance Notes supports and supplements the following ILP documentation:

- Guidance Note 3: Measurement of performance of LEDs
- Technical Report 28: Measuring road lighting performance on site

Whilst it focuses on the Minolta T-10 illuminance meter, other instruments from other suppliers are available.

Photometer requirements

A point to note is that you do not need a special meter for measuring the performance of LED installations, street lighting installations which have been designed using S/P ratios or other areas where mesopic vision is part of the design. This is explained in detail in ILP Guidance Note 3.

The requirements for the characterisation and performance of illuminance meters are defined under various standards. Instruments used for measurement of illuminance photometric parameters shall be Type F (for field use) as characterized according to BS 667:2005. There is a comprehensive range of photometers available covering a wide quality and price range but all are not equal and some are shown below which include a combined luminance and illuminance instrument.

General

The photometer must be fit for purpose, and for general lighting use it should:

- Be robust to withstand physical use including some degree of water resistance
- Have an auto zero facility
- Have a good battery life
- Have an appropriate sensor (see next bullet points)
- Be self-ranging and able to measure the range of lighting levels required
- Have short term reproducibility
- Be portable
- Hold function
- Have a provision for an internal back light under low lighting conditions

Range of alternative illuminance meters

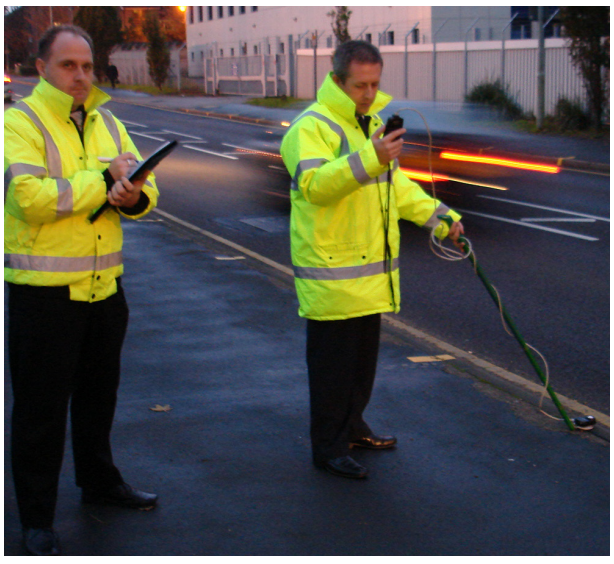
You may also find that an inbuilt colour correction factor (CFF) facility to adjust for different light sources is desirable, and depending upon the application it may be preferable to have a data logging facility.

Sensor requirements

The sensor is critical to the performance of the instrument as it turns the light energy into an electrical signal. It should have:

- A good linear response
- A response rate applicable to the application
- Good stability under varying temperatures and conditions
- Durability
- The ability to detect the light distribution to be measured
- A remote connection - not essential, but this will aid measurement and avoid user shadowing of the sensor.

Sensor remote connection



The lighting level at any one point on the measurement surface is formed not just from the light output of the immediately adjacent luminaire, but also those adjacent. As such the sensor must detect the light from all contributing luminaires.

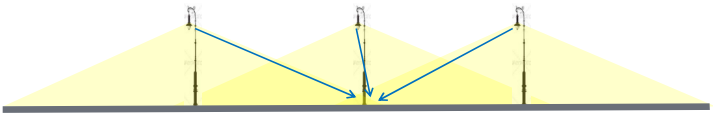
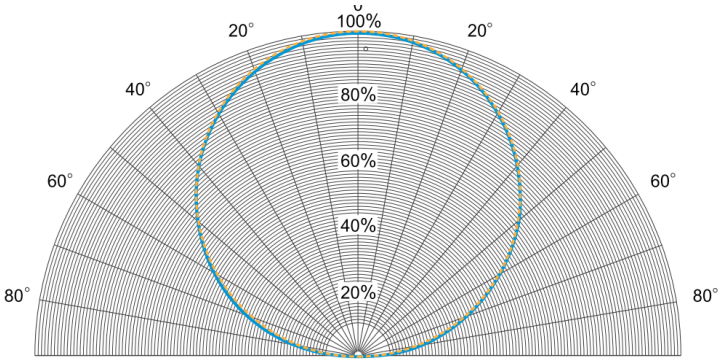


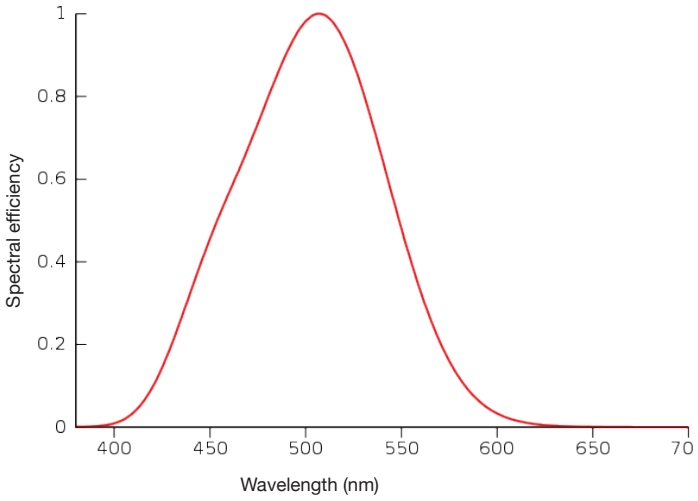
Diagram showing the contribution of light at one point

When measuring illuminance on this surface we must record all light falling in an arc of 180 degrees above the surface and 360 degrees around the sensor. The sensor must therefore be able to accurately capture light from all these directions.



above: sensor measurement arc diagram
below: T10 sensor head

As discussed in ILP Guidance Note 3, illuminance measurement is normally undertaken based upon photopic lighting levels. As can be seen from the standard CIE V(λ) response curve for the photopic eye shown below, the sensitivity of the eye varies depending upon the wavelength of light, with the eye response being very sensitive to 555nm (orange) and less sensitive to red and blue wavelengths.

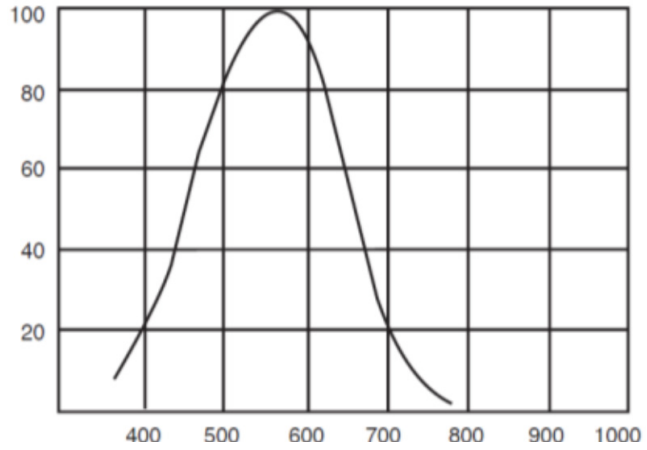


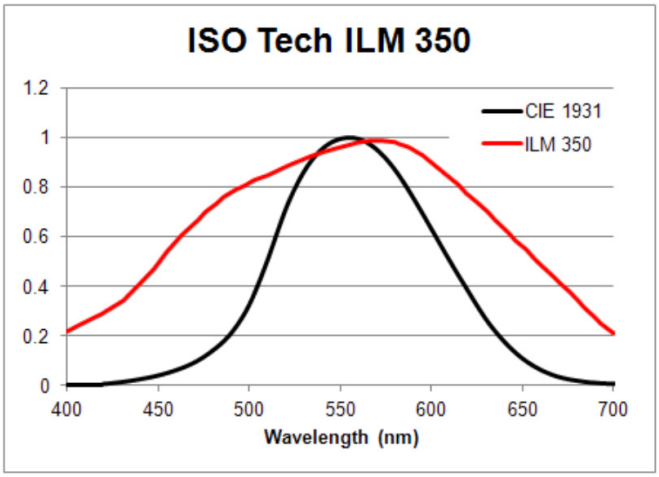
CIE photopic V (λ) response curve

It is important that any sensor used on a photometric instrument replicates as far as possible photopic response curve of the human eye. The measurement results will then record the lighting levels seen by a person with normal vision.

The stated performance data of a proposed instrument sensor should therefore be compared and mapped to the standard CIE V(λ) response curve; the closer the match the better the results. It should be noted that not all sensors are the same. A response curve may be shown and look suitable but when this is mapped onto the CIE response curve the actual response is far from satisfactory.

The following images show particularly poor representations following the mapping of various sensor response curves onto to the CIE Standard. Instruments with such response should not be used, especially if performances are being measured for contract performance assurance or in relation to obtrusive lighting evidence reports.

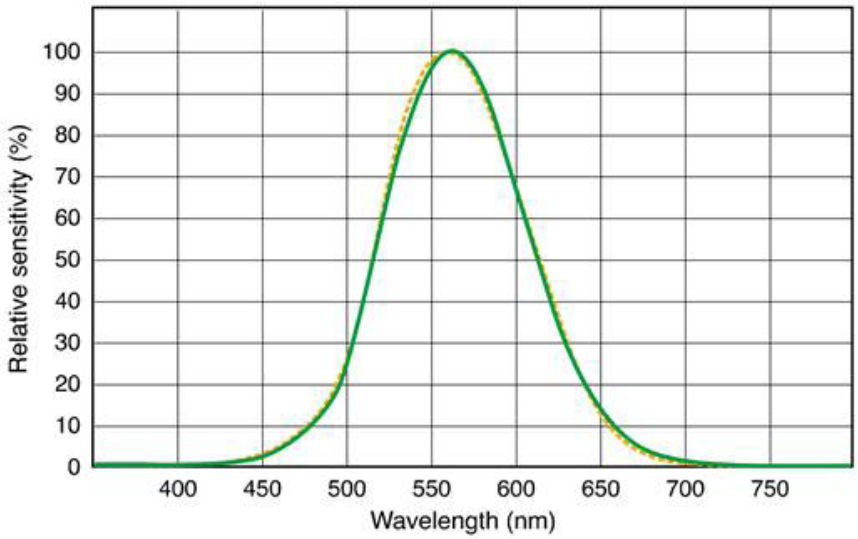




Supplied sensor performance and mapped (red line) onto the CIE V(λ) curves -Ivan Perre Transport for London, ILP Conference 2014

The closer the sensor response curve matches the CIE V(λ) curves, the more accurate the measured value. Even the closeness of the Minolta T10 sensor has a slight percentage error.

The following curve represents the response of the sensor used on the Minolta T-10 illuminance meter. As can be seen, it is a very close match to the CIE V(λ) photopic response curve. Where measurements are to be used for contractual or legal performance standards, the instrument(s) must be calibrated.



Minolta T-10 response curve mapping - Ivan Perre Transport for London, ILP Conference 2014

Calibration

Any calibration should be undertaken by an ISO 17025 accredited laboratory traceable to national standards such as those by National Institute of Standards and Technology (NIST) or North American Science Associates Limited (NAMS) and follow manufacturers' recommendations.

The light meter should be calibrated for the range of light levels to be measured, for street lighting applications this should be down to 1 lux.

Calibration frequency depends upon the regularity of use and how the instrument is treated. Generally, every 12 months is considered sufficient.

An operation log should be maintained; thus if an instrument is found to be out of calibration its use can be tracked and past results checked.

All photometers tend to be calibrated to a standard tungsten light source and therefore 'errors' will occur when the instrument is used to measure lighting levels under other light sources.

Conclusion/Summary

The choice of the right illuminance meter together with a competent user is important when undertaking any surveys, especially where these are related to such activities as contract performance surveys or obtrusive lighting assessments.

This Guidance Note provides advice on the key points to be considered when choosing an illuminance meter. Ability to perform the task must override the purchase price.

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