

## Software functions

Inside the **L<sup>3</sup>-standard**, there is a micro-controller which is able to transmit data to the PC via the USB connection. Thus, internal monitoring is possible (e.g. status of the **L<sup>3</sup>-standard**). Furthermore, also data can be read out such as operating hours, „running since“, the serial number and last calibration value.

With the **L<sup>3</sup>-standard** a small application and a ActiveX®-interface is delivered. With the application the user is able to read the status values transmitted via USB interface. The ActiveX®-interface allows the user to integrate the status values of the **L<sup>3</sup>-standard** into their own applications.

## Scope of delivery

The **L<sup>3</sup>-standard** is delivered together with a power supply unit. The LED standards should be used only with the power supply unit provided. The connector which is to be plugged to the **L<sup>3</sup>-standard** provides, in addition, a USB connector. The **L<sup>3</sup>-standard** can be connected to a computer via a USB extension cable.

- **L<sup>3</sup>-standard** of the desired type with plain end cover
- Factory calibration certificate for luminance and colour coordinates x,y (informative: relative spectral power distribution)
- Power supply unit
- USB-connection cable
- Software for displaying the internal data (Windows® Version XP and higher, 32Bit) ActiveX® Interface for including in own programs

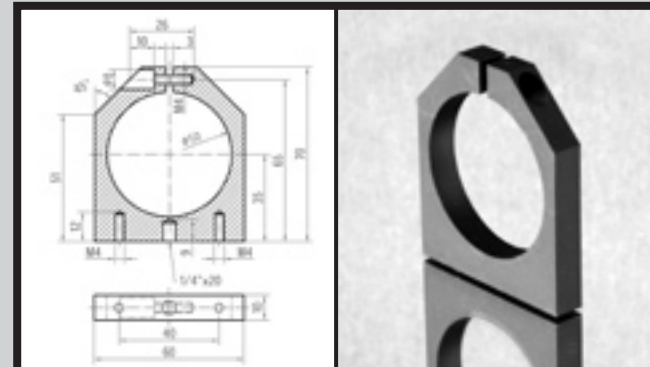
## Optional accessories

Upon request the following items can be offered, too:

- Cover for neutral density filters
- Neutral density filters for the adaption of the luminance
- Crown for forming the luminous intensity distribution
- Factory calibration certificate for luminous flux  $\Phi$ , luminous intensity  $I$  and luminous intensity distribution  $I(\theta, \varphi)$
- Calibration certificates issued by accredited calibration laboratories (e.g. PTB Germany, METAS Switzerland)



Top attachments for different tasks: end cover with filter adapter (left), Crown with three peaks (asymmetric) and plain end cover (right)



L<sup>3</sup>-standard mounting support for mounting on optical benches



L<sup>3</sup>-standard with associated power supply unit and cable, optional accessories in the image

**L<sup>3</sup>**  
standard

Presented by:

**HAWK** HAWK HOCHSCHULE  
FÜR ANGEWANDTE  
WISSENSCHAFT UND KUNST

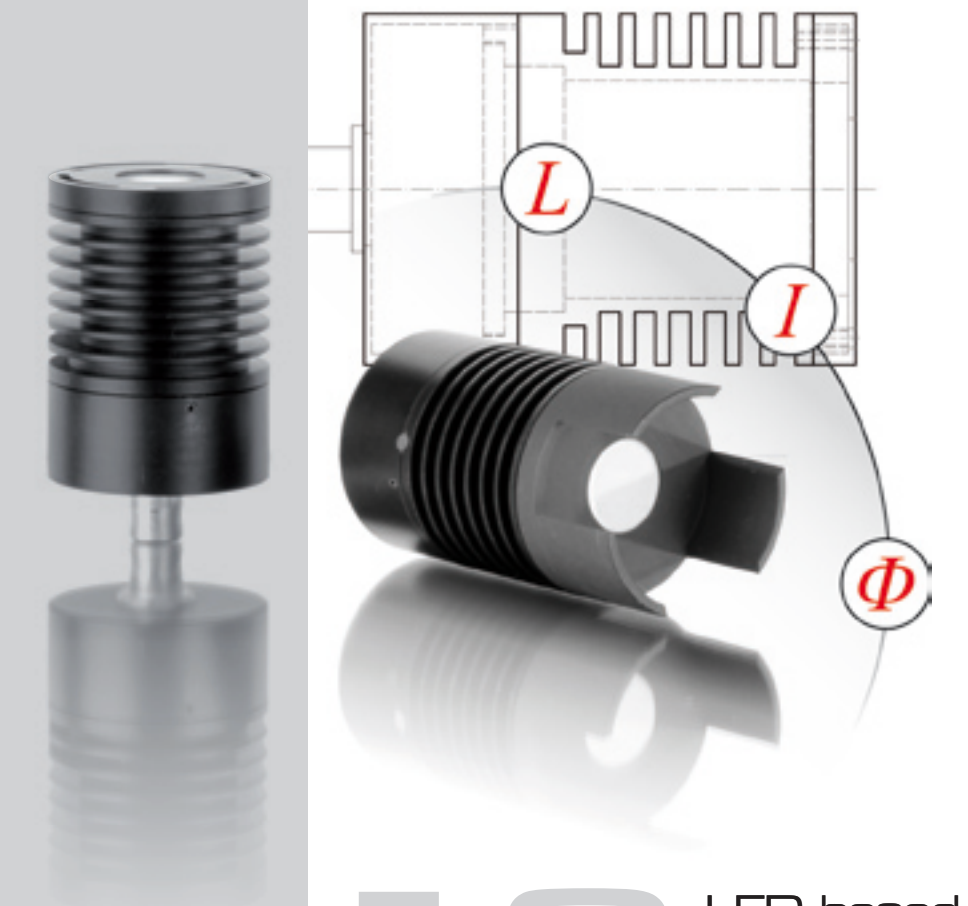
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**L<sup>3</sup>** LED-based  
standards for  
luminance,  
luminous intensity  
(distribution)  
and luminous flux

standard

## L<sup>3</sup>-standard

With the L<sup>3</sup>-standard the TechnoTeam Company offers stable coloured standards for Luminance, Luminous flux and Luminous intensity based on LEDs.

The stability of the photometric quantities is achieved through a temperature control containing a Peltier device, and an intensity control containing a spectrally matched photodiode. In the closed housing, which has an exchangeable end cover, a pre-aged and selected HighPower-LED is used for each L<sup>3</sup>-standard operated at about 2/3 of its rated current.

- high stability of the luminance (< 1%/100h)
- high stability of the dominant wavelength/colour (<1nm/100h)
- stable function independent of the room temperature (15°C bis 30°C)
- homogeneous luminance over the outlet opening (<2% inhomogeneity)
- standard equipment in (red, green, blue, yellow, orange, white)
- USB interface for reading the current operation status (serial number, working hours, temperature, ...)

In addition to the standard colours, also other colours can be supplied on customer's request. For this, the customer shall select, in cooperation with the TechnoTeam company, the type of LED.

## Calibration

For each L<sup>3</sup>-standard TechnoTeam provides a certification for the factory calibration. For the traceability of the photometric data of the LED luminance standards it is possible to calibrate the devices at a national metrology institute (e.g. PTB (D) or METAS (CH)).

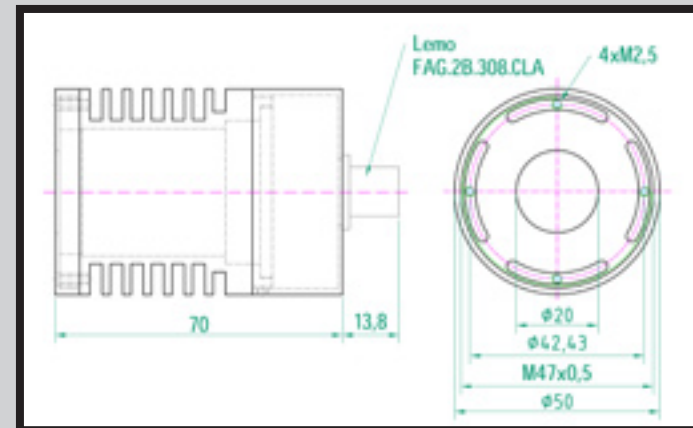
For each L<sup>3</sup>-standard the following data will be certified: luminance L and chromaticity coordinates x,y. Furthermore the luminous flux data, the luminous intensity (normal direction) and the luminous intensity distribution (for the crown end cover) can be delivered on request.

L<sup>3</sup>  
standard

## Description

The L<sup>3</sup>-standards consist of a LED which is operated at a pre-defined temperature. The decoupling of the light is effected at the outlet opening, which is covered with a diffusion screen and a diaphragm. In addition, a monitor diode provided inside the L<sup>3</sup>-standard ensures a constant luminance.

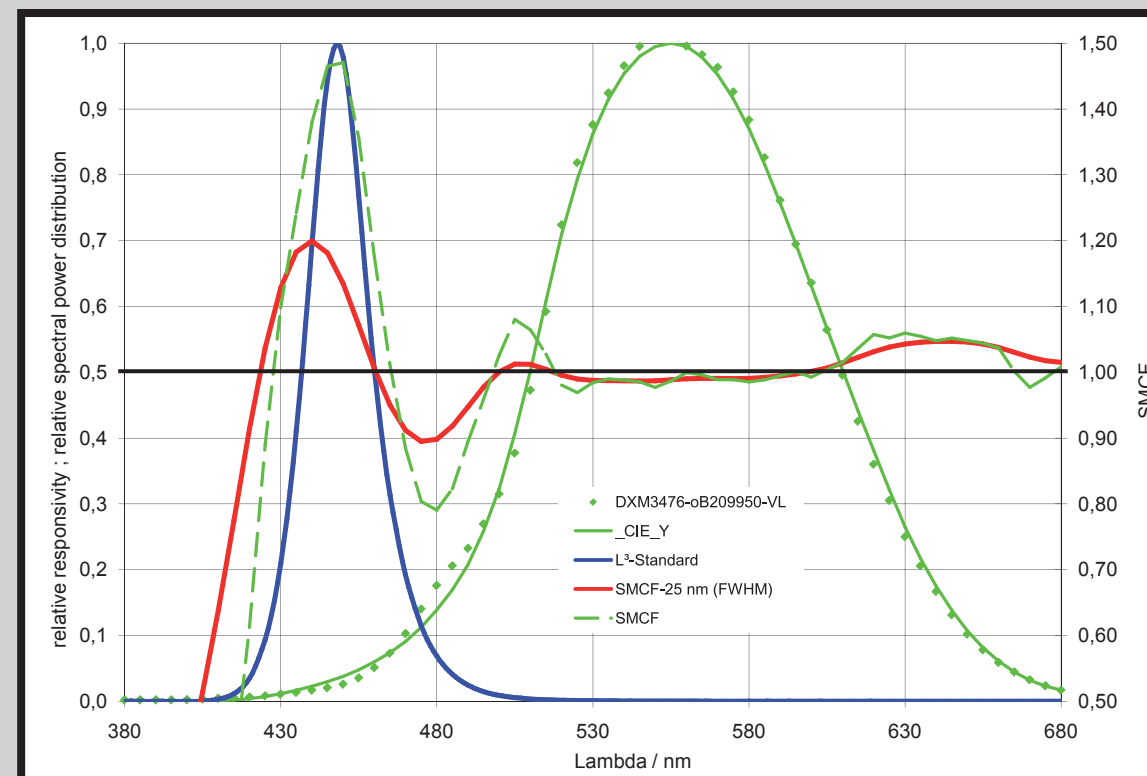
The luminance at the outlet opening stays constant, the variation of the colour coordinates remains within the measurement uncertainty stated in the calibration certificate.



L<sup>3</sup>-standard with optional accessories

## Available types<sup>1</sup>

Typ	L / cd / m <sup>2</sup>	x	y	λ <sub>Dom</sub> / nm	CCT / K
LA W5SM	4000	0.675	0.325	613	
LB W5SM	1900	0.114	0.093	475	
LCW W5SM	2400	0.441	0.427		3100
LD W5AM	1100	0.153	0.024	454	
LR W5SM	4200	0.692	0.308	620	
LT W5SM	6600	0.198	0.722	532	
LUW W5SM	7300	0.344	0.346		5000
LV W5AM	5800	0.089	0.581	506	
LW W5SM	8200	0.353	0.353		4700
LY W5SM	2100	0.603	0.396	595	
LH W5AM	1300	0.722	0.278	644	



SMCF for spectrally very narrowband spectral power distributions (green broken line, right-hand scale) and LEDs with 25 nm bandwidth FWHM (red solid line, right-hand scale) of an example camera (only V(λ)-filter)

<sup>1</sup> All values are approximated data and refer to measurements of systems implemented. The values of the concrete systems may deviate from them within the scope of the usual manufacturing tolerances for LEDs. | <sup>2</sup> For determining the spectral mismatch correction factors for LEDs, the SMCF shown must be convoluted with the spectral power distribution of the LED.

## Fields of application

### Spectral mismatch correction factor

For determining a spectral mismatch correction factor (SMCF), a measurement of a known parameter is carried out with the desired spectral power distribution. The quotient of the known parameter and the measured parameter is called spectral mismatch correction factor and can be used for further measurements with similar relative spectral distributions.

### System adjustment, system calibration

Monitoring of 10 to 15 different LED light sources by means of a colour camera. Determination of a matrixing for the colour camera by means of an equalization calculation (e.g. GLS) by using the measured data and also the calibration data of the LED light sources.

### Stability tests

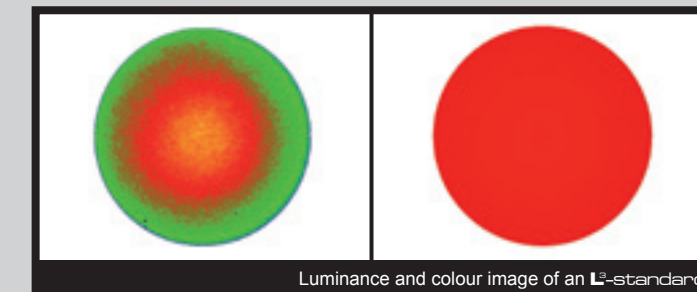
By means of a stable light source, the stability of measuring systems can be checked (e.g. measurements carried out at regular intervals for proving the good functioning of measuring devices).

### Luminous flux calibration

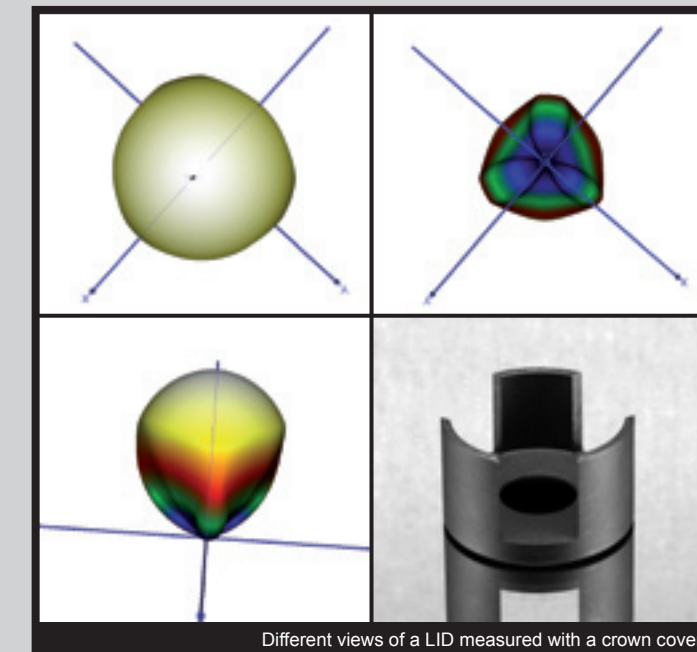
Luminous flux calibration of goniophotometers or integrating spheres with a stable light source providing a LED based spectral power distribution.

### LID comparison

Providing a stable luminance intensity distribution (LID) formed by the crown cover from the nearly Lambertian LID of the plain cover. Usable to check the LID measurement capabilities of goniophotometers.



Luminance and colour image of an L<sup>3</sup>-standard



Different views of a LID measured with a crown cover.

L<sup>3</sup>  
standard