# ACS-530

## Calibration LED

### Product-Highlights

- Less than 0.1 % variation in light output within 60 hours of operation
- Suitable for averaged LED intensity, luminous flux, color coordinates, dominant wavelength, and color temperature
- Compatible with all Instrument Systems accessories
- Calibration is traceable to national standards
- Complete solution including software

ACS-530 series calibration LEDs are convenient, reliable tools that let you check Instrument Systems measuring equipment and, if necessary, calibrate their absolute photometric readings. Instrument Systems calibrates these LEDs for measuring luminous flux and averaged LED intensity. All standards used for calibrating purposes are directly traceable to national labs' reference standards, enabling calibration using the substitution method recommended by CIE.

A calibration LED's radiant power must be reproducible and remain stable, which requires excellent thermal management. To this end, the LED and components necessary to stabilize temperature are assembled in a small housing with very low thermal conductivity. This immunizes the LED against external temperature fluctuations and achieves excellent long-term stability and reproducibility, both of which are indispensable to taking reliable measurements. The LED's light passes through a diffuser, producing a Lambertian radiation pattern. The calibration LED may be used with every Instrument Systems accessory, including the LEDGON goniophotometer.

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ACS-530 heads

## LED Control software

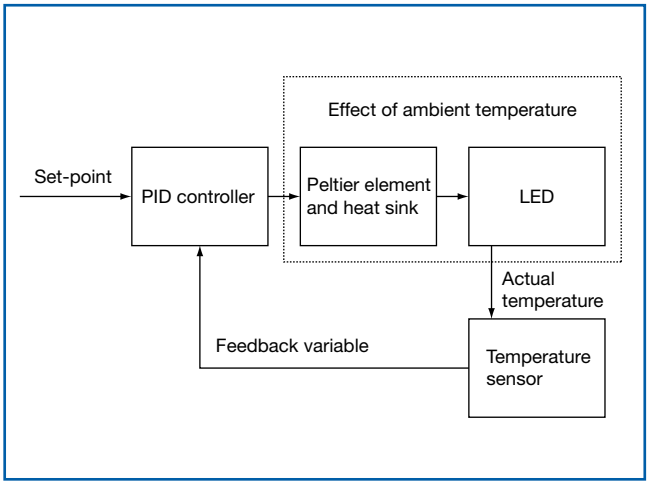
Instrument Systems developed LED Control software to program and read-out the TEC controller and the current source. For every calibration LED, this software generates a dedicated file that logs key operating parameters, for example, forward voltage, current, temperature, and operating time. This solution supports Keithley series 2400 and 2600 SourceMeter current sources, which also allow the LED's forward voltage to be measured and monitored with great accuracy.

Every calibration LED is equipped with a ribbon cable that provides an electrical connection and contains all the necessary power and test wires. A plug-in connector and an adapter cable branch these circuits out to the SourceMeter and the TEC controller.

## A new concept

The conventional approach to stabilizing standard LEDs is to keep the LED chip's temperature above the ambient temperature using a heating element controlled by the forward voltage of the LED. Unvarying forward voltage ensures the emitted light intensity remains constant.

ACS-530 series calibration LEDs, however, feature high-power LEDs that generate considerable heat. To prevent temperatures from rising, a Peltier element transports heat away from the LED. This cooling process has the added advantage that it effectively reduces degradation of the LED. An electronic circuit comprising a TEC controller and a temperature sensor sited near the LED chip is used to stabilize the temperature.




Concept of intensity stabilization

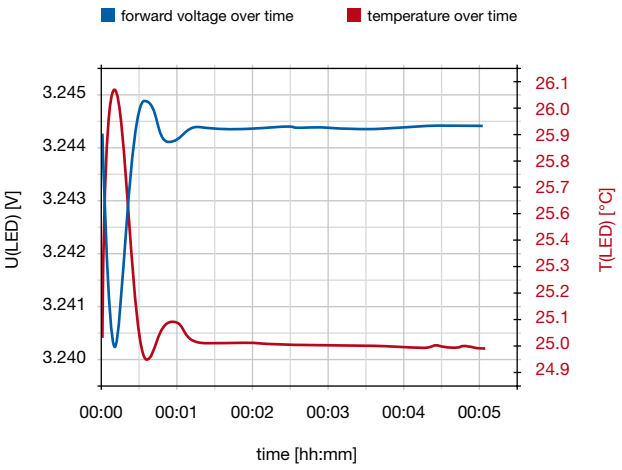
## Calibration according to ISO 17025

Instrument Systems' ISO 17025-certified test laboratory can measure calibration LEDs' averaged LED intensity ($I_{LED-A}$ and $I_{LED-B}$) and luminous flux according to CIE127:2007. A test certificate documents traceability to standard LEDs of the German national laboratory PTB (Physikalisch-Technischen Bundesanstalt), as well as associated measurement uncertainties.

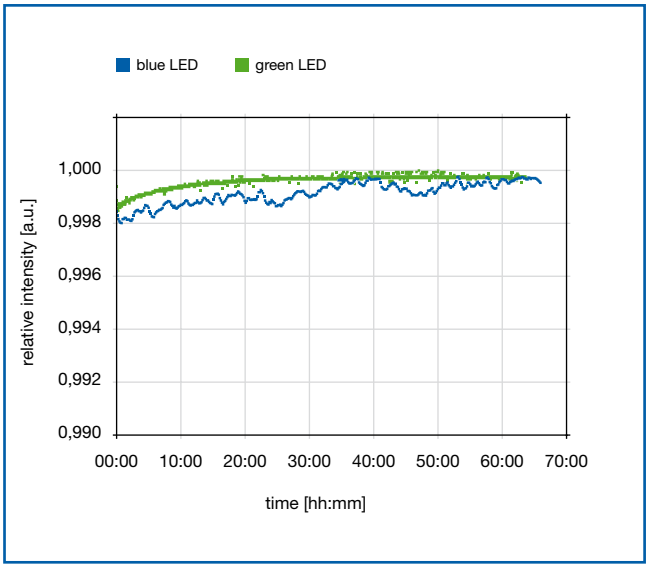
Instrument Systems calibration lab

## Fast stabilization

An LED's stabilization time matters – it is a key criterion for convenience and efficiency in the lab. For every LED type, the software sends a discrete set of PID control parameters to the TEC controller. This reduces initial transient time to less than two minutes, after which the forward voltage ($V_f$) and temperature remain constant. This means that the calibration LED is ready for use after just a few minutes, saving valuable time in the lab.



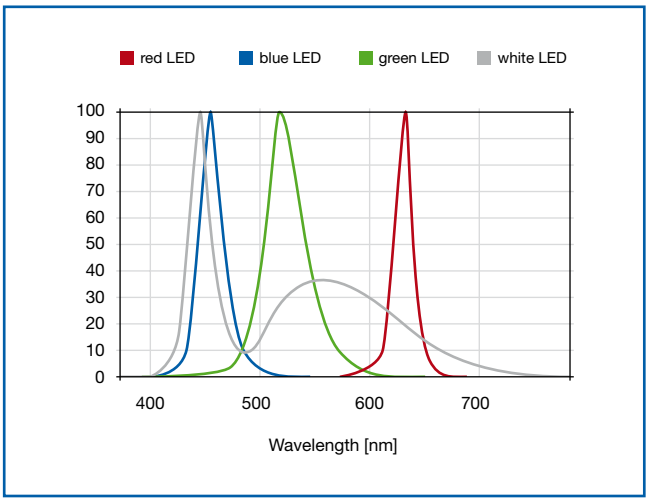

The calibration LED's initial transient time




Stability test conducted on calibration LEDs over 60h

## In all colors

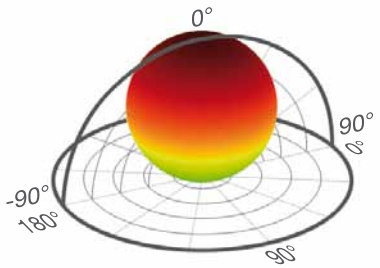
Calibration LEDs come in the four key colors blue, green, red, and white to cover the entire visible spectrum. Averaged LED intensity typically ranges from 0.5 to 2 candelas, and luminous flux ranges from 1 to 3 lumens depending on color.




Typical spectral power distributions of the various calibration LEDs

## Lambertian radiation pattern

A diffuser located in front of the LED generates a nearly perfect Lambertian radiation pattern that is desired for calibration purposes. The diffuser's narrow diameter of just 7 mm ensures the unit's light emission is ideal for calibrating averaged LED intensity. What's more, the white LED achieves constant color temperature regardless of emission angle.




The calibration LED's Lambertian radiation pattern

## Typical photometric values and specifications

| LED | Dominant wavelength [nm] or correlated color temperature $T_n$ [K] | Averaged LED Intensity | Luminous flux |
|---|---|---|---|
| White | 6400 – 7000 K | 1.3 cd | 2.8 lm |
| Blue | 465 nm | 0.5 cd | 1 lm |
| Green | 530 nm | 1 cd | 2.2 lm |
| Red | 630 nm | 0.7 cd | 1.5 lm |

Note: All indicated values are typical.

| Technical specifications | |
|---|---|
| Operating current | 350 mA +/- 0.05 mA |
| Temperature at the control point | +/- 0.05 °C |
| Photometric stability | 0.1% at 25 °C +/-2 °C ambient temperature<br>0.5% at 25 °C +/-5 °C ambient temperature |
| Length | 145 mm |
| Weight | 750 g |
| Compatibility | All Instrument Systems measurement adapters with 25 mm diameter |
| Electrical connections | 2 banana plugs for power supply; Sub-D connector for temperature controller |

## Ordering information

| Item no. | Description |
|---|---|
| ACS-530-1 | White Calibration LED in socket with 25 mm Ø; 350 mA |
| ACS-530-3 | Blue Calibration LED in socket with 25 mm Ø; 350 mA |
| ACS-530-5 | Green Calibration LED in socket with 25 mm Ø; 350 mA |
| ACS-530-7 | Red Calibration LED in socket with 25 mm Ø; 350 mA |
| ACS-530-9 | Adapter cable for connecting ACS-530-x series of high-power calibration LEDs to a current source and TEC control unit |
| **Temperature controller and current sources** | |
| W-210 | Arroyo 5305 TEC Controller |
| W-110 | Keithley 2400 SourceMeter |
| W-121 | Keithley 2600 SourceMeter |
| **Calibrations** | |
| CAL-511 | Averaged LED Intensity $I_{LED-B}$ (luminous intensity) according to CIE127:2007 and ISO 17025 test certificate |
| CAL-512 | Averaged LED Intensity $I_{LED-A}$ (luminous intensity) according to CIE127:2007 and ISO 17025 test certificate |
| CAL-513 | Luminous flux of LEDs according to CIE127:2007 and ISO 17025 test certificate |
| CAL-515 | Luminous flux and averaged LED intensity $I_{LED-A}$ and $I_{LED-B}$ (luminous intensity) according to CIE127:2007 and ISO 17025 test certificate |

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