

# LS-DAL

## Multi channel broadband VIS-NIR light source

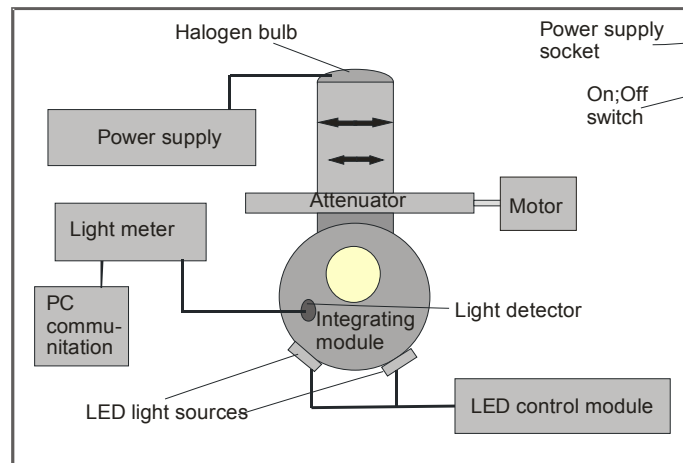


Fig. 1. Block diagram of LS-DAL calibrated light source



Fig. 2. Photos of LS-DAL calibrated light source front view and back view

### BASIC INFORMATION:

The LS-DAL light source is a multi-channel calibrated light source developed for realistic simulation of light conditions from dark, moonless nights to ultra bright days at different geographical regions. Design of this light source is optimized for use in systems for testing VIS-SWIR cameras (color/monochrome CCD/CMOS/ICCD/EBCCD cameras, SWIR cameras) used for long/medium range surveillance applications.

LS-DAL light source offers extremely high dynamic range, continuous regulation of light intensity (ability to simulate both ultra bright days and ultra nights), fully computerized design. User can regulate spectrum of emitted light in order to simulate conditions at different surveillance scenarios caused by different spectrum of light that illuminate scenery of interest and different spectral reflectance of such scenery. Resistibility of tested VIS-NIR camera against UV light reflected from the scenery of interest can be checked, too.

The LS-DAL source can work in four different modes: 1) halogen bulb of 2856K color temperature spectrum, 2) white broadband LED of color temperature over 5000K spectrum in visible range, 3) mixed mode when both halogen and white broadband LED are active at regulated ratio of halogen/LED light intensity, 4) high intensity UV LED light mixed with halogen light or white LED light. Switching of modes or work in mixed mode enables significant variations of spectrum of emitted light.

Intensity of the halogen bulb is regulated using an opto-mechanical attenuator that changes light intensity but does not change light color temperature. Intensity of the white LED source is regulated electronically using advanced electronic regulation/stabilization system. Intensity of UV LED is not regulated. Regulation of spectrum of emitted light is additionally supported by a set of external spectral filters.

These advanced simulation capabilities make LS-DAL light source an unique solution on international market.

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### FEATURES:

- Extremely wide dynamic range ( $10^9$ ) and continuous regulation of light intensity enables simulation of both ultra bright day conditions and ultra night conditions). *There is on the market no light source that could simulate light conditions in so wide range. Some competitors claim that their light sources offer regulation from 0 lx but this level is achieved by switching off the light source not by true precision regulation.*
- Ability to regulate spectrum of emitted light in order to simulate conditions at different regions caused by different spectrum of light that illuminate scenery of interest and different spectral reflectance of such scenery. *There is on the market no light source that could enables similar spectrum regulation.*
- Ability to check resistibility of tested VIS-NIR camera against UV light reflected from scenery of interested (simulation of conditions met at coastal areas or high altitude mountains that are potentially damaging for some imaging sensors due to presence of UV light).
- Fully computerized design. Light intensity and mode of work can be controlled from PC.
- Compact design optimized for use in systems for testing VIS-NIR cameras.
- Open policy of Inframet on recalibration. Inframet delivers information that enables users of LS-DAL light sources to recalibrate these light sources.
- LS-DAL source is optimized for use in image projectors in systems for testing VIS-NIR cameras. These image projectors (collimators) require from the light source Lambertian emission of light only in narrow angle (typically below  $10^\circ$ ). Therefore LS-DAL light source behave like a fully Lambertian source at emission angles up to  $15^\circ$ .

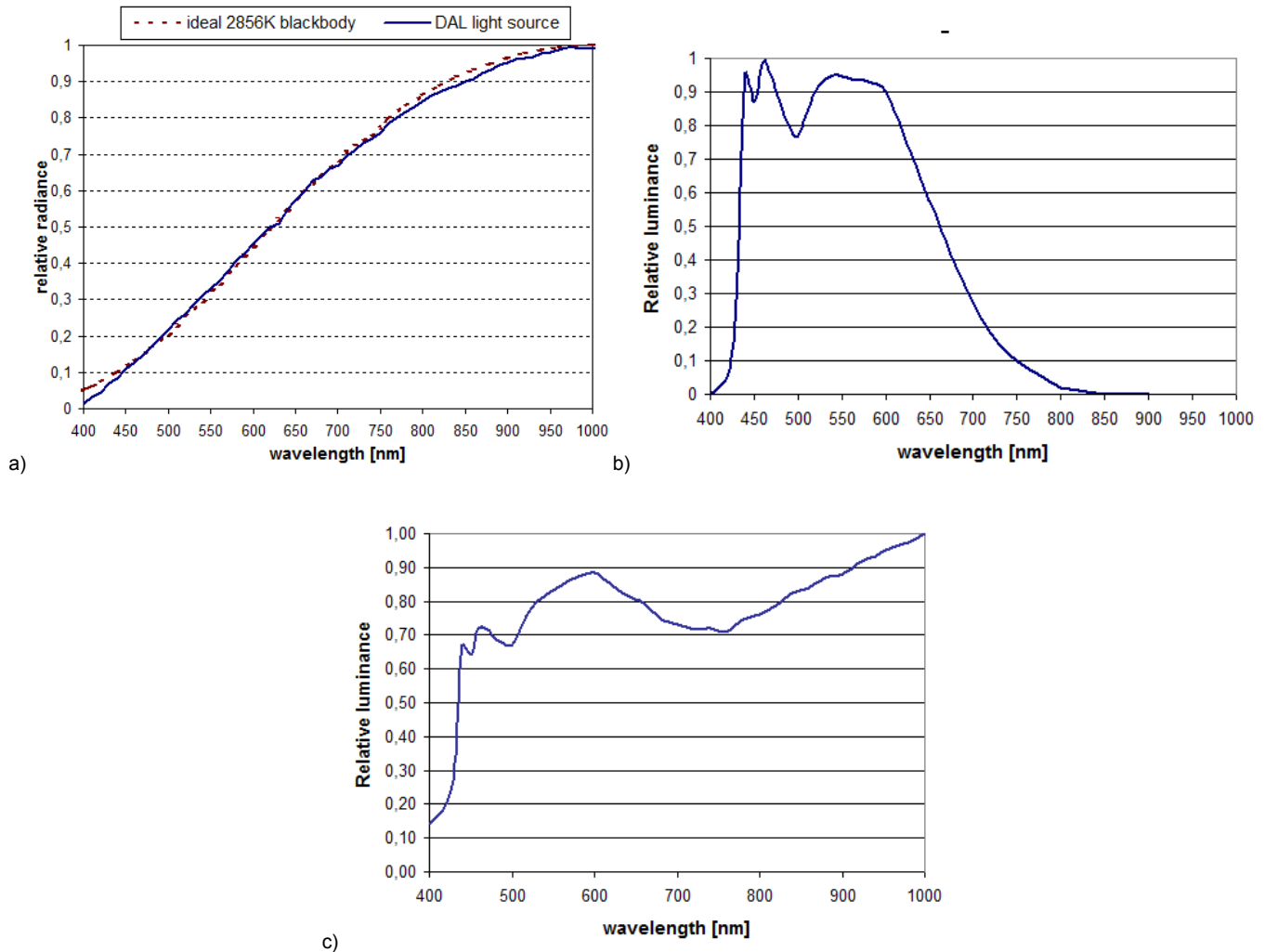


Fig.3. Spectrum of light emitted by LS-DAL source working in three different modes: a)Halogen, b)White broadband LED, c)Mixed mode (example spectrum)

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### TECHNICAL PARAMETERS

Parameter	Value
<i>Performance parameters</i>	
Light source diameter	40 mm
Modes of work:	1) halogen bulb of 2856K color temperature for night and typical day simulation 2) white LED of color temperature over 5000K for simulation of ultra bright days 3) mixed mode for simulation of variable spectrum of light reflected by scenery of interest 4) high intensity UV LED for checking resistibility against UV light.
Total luminance range	10 mcd/m <sup>2</sup> - 10 kcd/m <sup>2</sup> – D (day version) 10 $\mu$ cd/m <sup>2</sup> - 10 kcd/m <sup>2</sup> – DN (day/night version) (option: luminance range can be expanded)
Simulated illuminance ranges (approximate values for targets of 100% reflectance)	D version: 30 mlx - 30 klx (0.003 fc-3000 fc) DN version: 30 $\mu$ lx - 30 klx (0.000003 fc-3000 fc)
Total dynamic of light source	10 <sup>6</sup> - D version 10 <sup>9</sup> – DN version
Spectral band	Calibrated for testing VIS or VIS/NIR imaging sensors of spectral band not wider than 400-1100nm
Emission angle	Lambertian source at angles up to 15°
<i>Halogen mode</i>	
Light source	halogen bulb as a polychromatic source of light in 400 nm to 1000nm spectral band
Spectrum of emitted light	Greybody of color temperature 2856K (see Fig.3a)
Uncertainty of color temperature	50K
Regulation type	Continuous
Regulation method	Opto-mechanical attenuator
Luminance range	10 $\mu$ cd/m <sup>2</sup> - 1500 cd/m <sup>2</sup>
Regulation resolution	10 $\mu$ cd/m <sup>2</sup> (at low intensity range)
Stabilization time	<90 sec
Temporal stability	<1%
External filters	a)VIS only, b)NIR only
<i>LED mode</i>	
Light source	white LED as a source of polychromatic light at spectral range 0.4-0.8 $\mu$ m.
Spectrum of emitted light	Resemble greybody of color temperature over 5000K in visible band (see Fig.3b)
Regulation method	Electronic regulation
Luminance range	1cd/m <sup>2</sup> - 10 000 cd/m <sup>2</sup>
Regulation resolution	1 cd/m <sup>2</sup>
Stabilization time	<60 sec
Temporal stability	<1%
<i>Mixed mode</i>	
Light source	halogen bulb and white LED
Spectrum of emitted light	depends on proportion of regulated halogen intensity to LED intensity (example spectrum in Fig.3c)
Regulation method	Electronic regulation mixed with opto-mechanical regulation
Luminance range	20 $\mu$ cd/m <sup>2</sup> - 11 kcd/m <sup>2</sup>

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Regulation resolution	10 $\mu\text{cd}/\text{m}^2$ (at low luminance range)
Stabilization time	<100 sec
Temporal stability	<1%
<i>UV mode</i>	
Light source	High power UV LED
Spectrum of emitted light	UV-A light in spectral band from 340nm to 410nm
Regulation method	Non regulated
<i>Other parameters</i>	
Work temperature	+5°C to +35°C
Storage temperature	-5°C to +55°C
Humidity	Up to 90% (non condensing)
Dimensions	380x260x250
Mass	12 kg

\*specifications are subject to change without prior notice

### SUMMARY

LS-DAL multichannel light source due to extremely wide range of regulated luminance, ultra high maximal luminance, ability to vary light spectrum of simulated scenery, PC control, and compact design significantly exceeds simpler, single channel halogen light sources offered at international market. The latter sources can be considered as good solution for applications that require constant 2850K spectrum of emitted light but should not be accepted in applications that require realistic simulation of lighting conditions like systems for testing VIS-NIR cameras.

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