Instrument Systems
KONICA MINOLTA Group

Optronik Line

AMS Screen Imaging System

Turnkey measurement solutions for automotive exterior lighting

01 \\ Turnkey measurement solutions for automotive exterior lighting

AMS screen imaging system

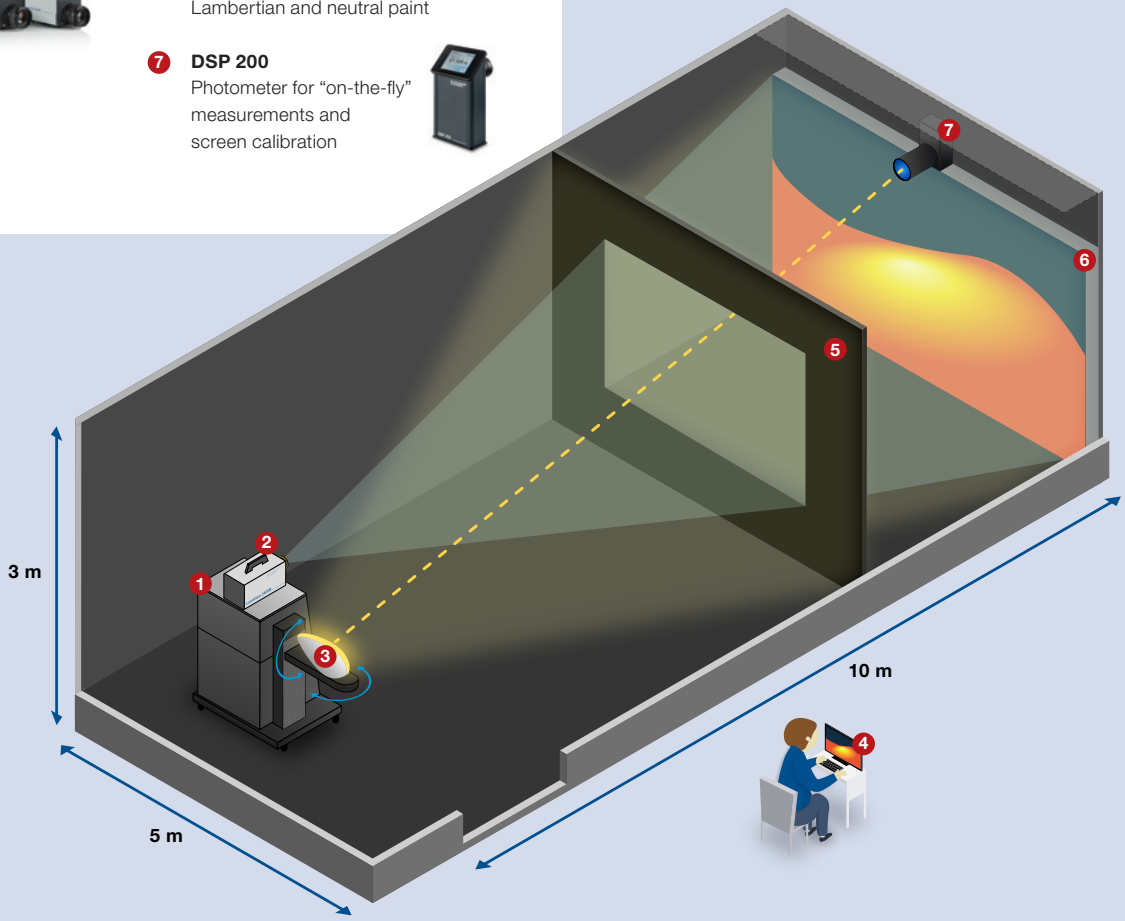
- Measurement of HD, ADB, matrix, pixel and all other headlamps
- Ultra rapid determination of light distribution using a LumiCam 2400B camera
- Goniometer integration and image stitching to measure complete distributions
- Geometrical and photometrical calibration source ACS 630 included
- Seamless integration into the proven LightCon user software environment
- Compliance check according to ECE / SAE / ICAO / FAA regulations
- Extensive graphical visualization for isocandela diagrams

Standard light laboratory set-up

1. **AMS 5000**
   High-performance CIE Type A goniophotometer

2. **LumiCam 2400B**
   2D imaging camera with motorized objective lenses

3. **Device under Test**
   HD, ADB, matrix, pixel and all kinds of headlamps
4. **LightCon Software**
   Regulation of compliance tests and extensive graphical analysis
5. **Baffles**
   One or more baffles can be inserted to reduce stray light
6. **Projection screen**
   Coated with white diffusive, nearly Lambertian and neutral paint
7. **DSP 200**
   Photometer for “on-the-fly” measurements and screen calibration



Growing variety of lighting scenarios

Exterior automotive lighting is presently characterized by a multitude of innovations, such as adaptive driving beam systems (ADB), pixel headlamps, adaptive driving beam headlamps and high definition headlamps.

The next revolution in automotive lighting lies in dazzle-free main beams in HD quality. This headlamp technology illuminates the road with maximum performance and facilitates communication as well as driver assistance. The vehicle receives detailed information about the environment from sensors that calculate in real time the brightness values for each of over two million pixels. Further functions such as symbol and video projection onto the road add to the complexity of the lighting devices.

Traditional methods of measuring light distribution with a far-field goniophotometer and illuminance meter have become inefficient and inadequate, as they are not fast enough for measuring every possible lighting scenario in an R&D environment.

The new AMS screen imaging system from Instrument Systems represents a fast method of combining camera-based luminance measurements on a projection screen (screen photometry) with goniometric far-field measurements in the light lab. The objective is to save time while maintaining a high level of accuracy.

The system setup includes a classic AMS 3000 or 5000 far-field goniophotometer with a DSP 200 fast illuminance meter positioned beyond the photometric limiting distance. The camera used for screen photometry is the recent LumiCam 2400B camera with 5 mega pixels, allowing an excellent resolution for the measurement of all common, but also state-of-the-art HD headlamps.

For quick and easy operation, the test results of both measurements can be simultaneously analyzed with the LightCon software.

02 \\ Benefits of the AMS screen imaging system

- **Speed:**
  Even very wide light distributions with a high angular resolution can be measured in a fraction of the time of the traditional far-field method using an illuminance meter and goniometer.

- **Precision:**
  The DSP 200 high-class L photometer is used as a reference photometer for correction.

- **For all typical measurement scenarios:**
  Assessment of various light distributions of HD and matrix beam headlamps, graphical output and compliance tests conforming to the relevant regulations (s. table “Typical test scenarios”).

- **Powerful software:**
  Seamless integration of the imaging screen into the LightCon software and simplified operations. The user can also apply all projects and regulations prepared in the LightCon database.

- **Preselection and automatic measurement procedure:**
  System automatically defines how many images must be taken to complete the measurement preselected in LightCon.

- **Calibration light source:**
  A geometrical and photometrical light source is included, enabling the user to autonomously calibrate the system.

- **Extensive support:**
  Our experts provide in-depth advice during the implementation phase to prepare the laboratory and screen, and to prevent stray light influence.

- **Flexibility:**
  System is also suitable for other applications such as taxiway lighting for airfields.

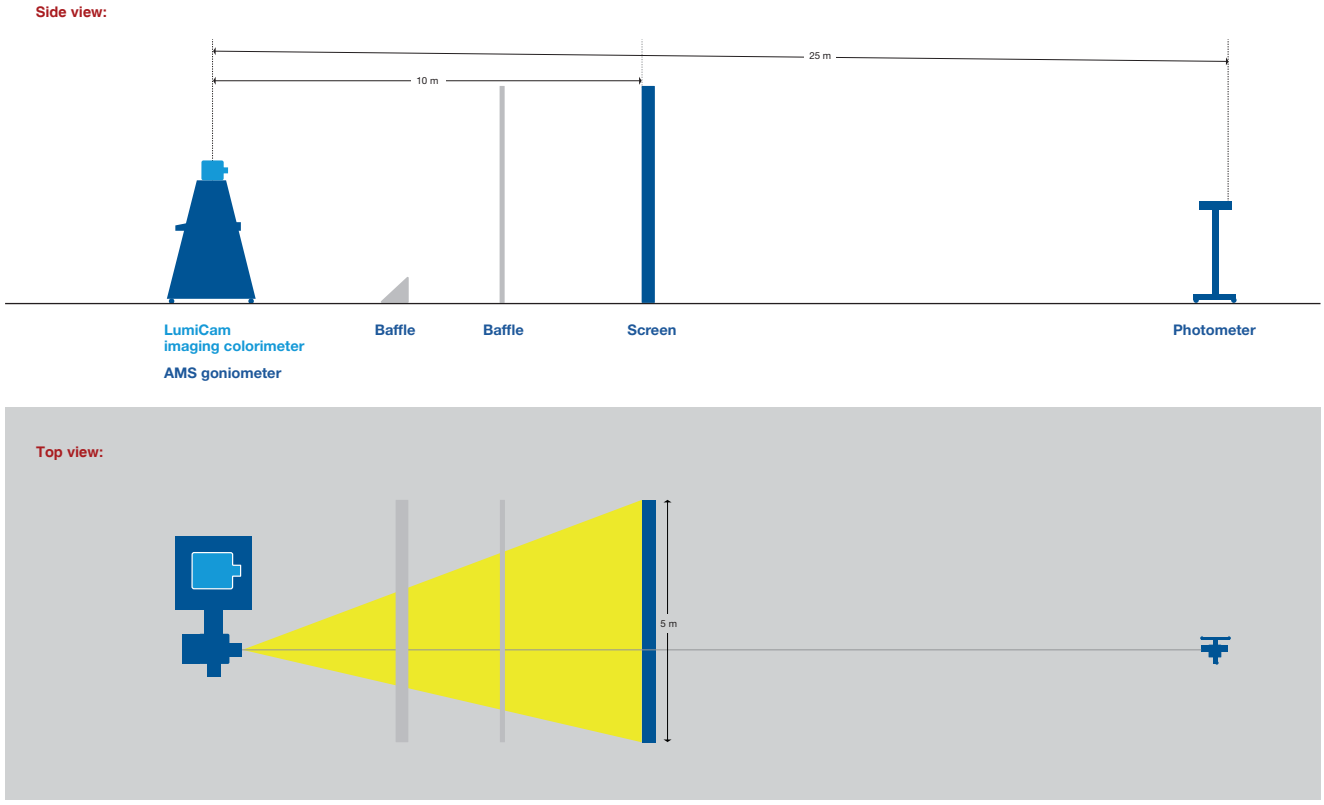
- **Upgrade for existing AMS systems:**
  Screen imaging solution can be combined with the AMS 3000 or 5000 goniophotometers already in place.

Typical test scenarios: Comparison of measurement results

Grid / Measuring device	AMS 5000 / DSP 200	AMS Screen Imaging System
DUT: LED Projection module		
H ± 8° @ 0.05° resolution V ± 5° @ 0.05° resolution	13:03 min	< 1 min
H ± 8° @ 0.1° resolution V ± 5° @ 0.1° resolution	06:33 min	< 1 min
DUT: Complete AFS / ADB / Matrix beam system		
H ± 50° @ 0.05° reolution V ± 15° @ 0.05° resolution	59:46 min	< 5 min
H ± 50° @ 0.1° resolution V ± 15° @ 0.1° resolution	29:56 min	< 5 min

03 \\ System configuration

The AMS screen imaging system must be set up in a light channel of at least 25 m length. In order to record the complete light distribution of the headlamp, the goniometer rotates the sample while the camera is taking a series of images that are later stitched in one image or test report.
The software corrects the distance shift resulting from the rotation, and takes the measurement at the central location in the screen as a reference for correction of the complete image, but also at the boundary area (distance greater than 10 m at the farthest points from the central HV point).



The LumiCam 2400B imaging photometer is located atop the goniometer housing in a special fixture with a tripod socket for repeatable positioning.

The ACS 630 calibration source consisting of a diffusive light source and alignment laser serves for convenient software-controlled user calibration of the set-up, both geometrically and photometrically.

The approximately 5 m wide projection screen is located at 10 m and coated with white diffusive, nearly Lambertian and spectrally neutral paint.

Further baffles can be placed between the screen and sample to reduce the stray light influence in the lab. The entire room must be painted black and matt.

The system also allows a rough alignment of the sample by finding the elbow point and sending the coordinates to the goniometer, enabling the latter to automatically align the headlamp.

Goniophotometric measurements at critical points and zones, as well as screen/camera measurements, can be combined and performed as one project and later displayed in one report.

The AMS screen imaging system is supported by an extension module of the advanced LightCon software that enables regulation compliance testing and extensive graphical analysis functions in the form of isocandela diagrams.

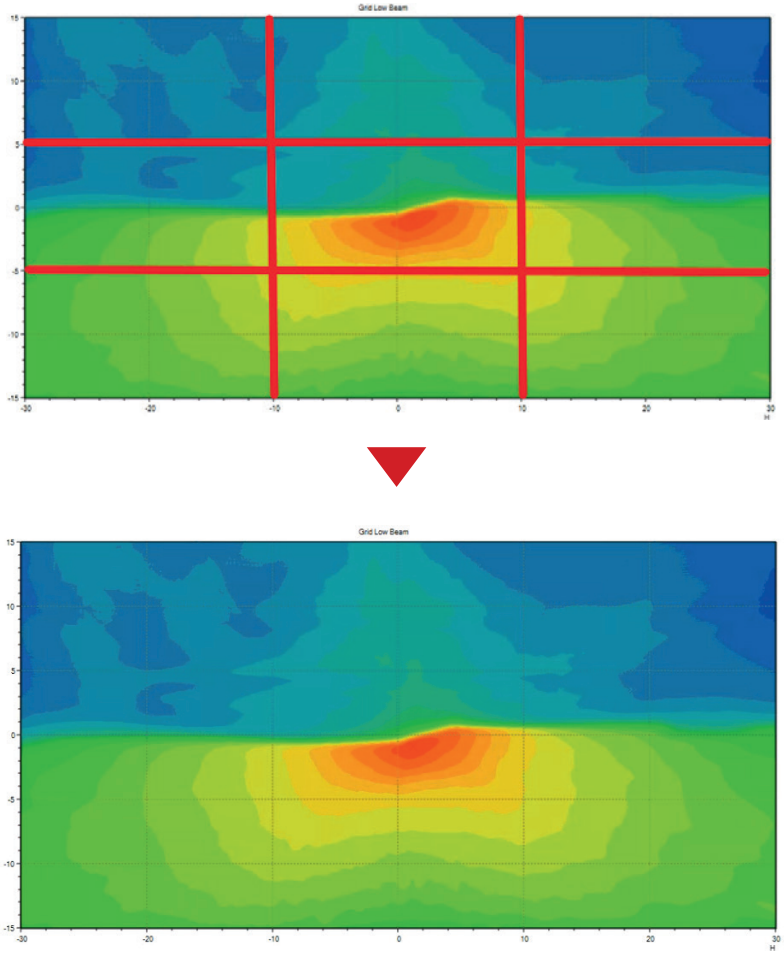
This includes spherical grid, screen projection, bird's eye view, driver's perspective, superimposition of a pair or more headlamp distribution and export functions for comparing the measured results with those achieved by simulation and raytracing programs.

Customer support and optional extensions

The installation of an AMS screen imaging system includes consultation from the planning stage to preparation of the laboratory, selection of the appropriate paint for the screen, location of baffles and final implementation, as well as initial operation.

After the system has been installed, customers receive an extensive operator training for efficient use of the system, trouble shooting and user calibration.

The AMS screen imaging system can optionally be extended by a line laser to project the typical lines of an ECE screen onto the projection screen. Together with further photometers for signal lighting, colorimeters, retroreflectometers and the Instrument Systems CAS140D series of superior spectroradiometers, the system is designed to be part of a complete turn-key solution for testing exterior automotive lamps suitable for legal type approval as well as R&D purposes.



LumiCam 2400B takes a series of images depending on the range of the grid selected in LightCon.

04 \\ Summary

With the Optronik line AMS screen imaging system, Instrument Systems offers a highly efficient solution for testing a wide range of lighting scenarios for advanced headlamps.

It is thus an excellent tool and useful extension to an AMS goniophotometer for all automotive front lighting applications.

05\\ Technical specifications (preliminary)

Marking	Optronik line AMS Screen Imaging System
Application field	Ultra-fast acquisition of luminous intensity distributions or automotive headlamps and similar test specimens
Camera sensor	Sony IMX264LLR CMOS Sensor Effective no. of pixels: 2428 x 2028 (5 MP) Pixel size: 3.45 µm x 3.45 µm
AD - converter	12 bit
Measuring range (cd)	1 cd – 1 Mcd (variation of exposure time) (higher with optional density filter)
Angular range	Depending on laboratory layout, typical: H ± 10°, V +5 to -5° for 4 x 2 m screen Larger range via image stitching / goniometer motion
Angular resolution	0.02°
Measurement time	See table page 4
Measurable contrast	1:100 (contrast enhancement via stray light correction available)
Spectral mismatch	Camera: f1'≤ 3.0%; photometer DSP 200: f1' 0.9 - 1.4 % (typical)
Calibration test of photmeter	ISO 17025 compliant against standard illuminant A, PTB traceable
Calibration test of camera	ISO 17025 compliant verification for luminance for LumiCam Mono
Calibration period	≤ 2 years
Test conditions	22°C ±5°C, humidity max. 70%
Screen calibration source	Integrated diffuse calibration source combined with laser based alignment tool.
Operating system	Windows 10
Operating software	LightCon module AMS Screen Imaging System

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