

We bring quality to light.

 Optronik Line



## Goniophotometer Systems

 **Instrument  
Systems**  
light measurement



Instrument Systems GmbH with its Optronik Division, is one of the leading European manufacturers and suppliers of light measurement equipment.

We play a leading role in the industry, furnishing entire light labs to the automotive and transportation engineering, but also general lighting sector. Our main products are large goniophotometer systems, retroreflectometers, integrating spheres and photometers. Prestigious testing and certification institutes as well as nearly all major suppliers of automotive lighting and many automobile manufacturers belong to our clientele.

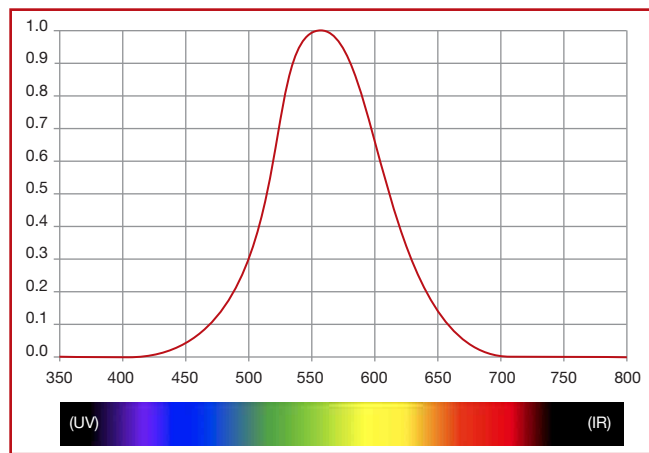
In cooperation with our headquarters in Munich, we can offer a unique product portfolio meeting our customers present and future requirements also for critical light sources such as LED.

Optronik Line equipment makes the difference with highest precision, reliability, operation speed and user-friendliness. Our service and customer focused developments create a solid foundation for the future – for superior technology Made in Germany.

## Introduction and applications

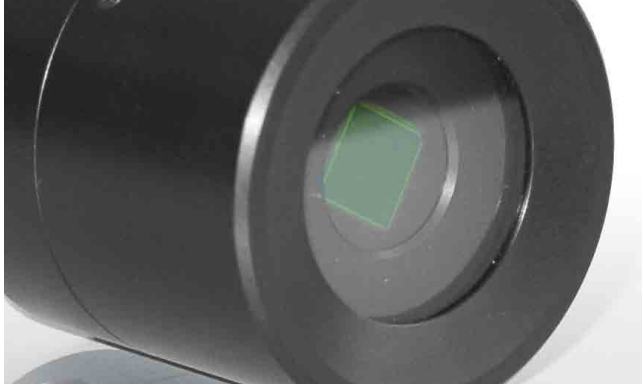
Goniometers from the Optronik Line – combined with a full range of state of the art photometers, colorimeters, retroreflectometers and other accessories – provide a photopically – corrected and automated measurement of the brightness (candle power) – luminous intensity (candela), illuminance (lux), luminous flux (lumen), retro-reflectivity (mcd/lx), color coordinates from optical radiation sources.

Our goniophotometers are used in the design, development, production QA testing of lamps and luminaires and in the certification of the final product according to relevant international and national regulations, standards and publications such as UN-ECE, SAE, FMVSS108, DIN-EN, CIE, ICAO, FAA, ASTM and others.



$V(\lambda)$  response – spectral sensitivity of the CIE standard observer

Our proprietary photopic filters are designed to match the CIE photopic standard luminosity function with an  $f_1'$  to better than 1.5% at all wavelengths ( $f_1' < 1.5\%$  is one of the most important figures defining the highest accuracy class L according to DIN 5032, DIN-EN 13032 and CIE No. 69). The use of full filtering technology makes sure that also the uncertainty resulting from non-uniform illumination of the detector will be reduced to a minimum ( $f_9$ ).

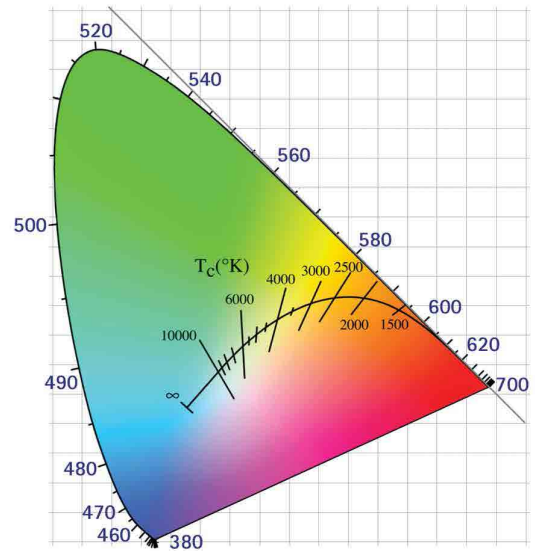


Optronik Line photopic detectors – leading edge in photometry

## Light

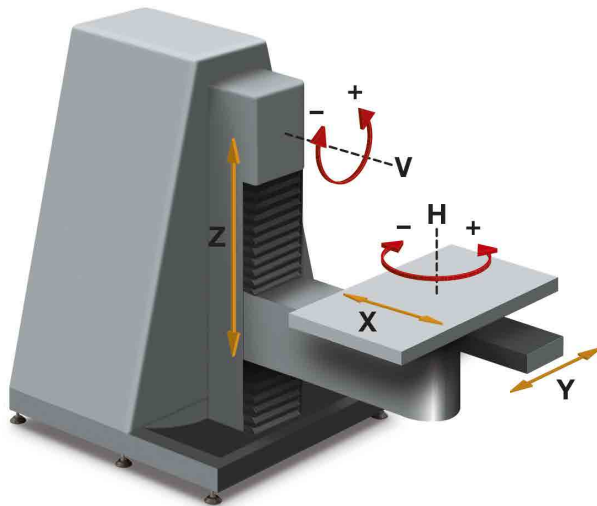
Light is the small section of electromagnetic radiation which produces a sensation of brightness and color in the human eye.

The measurement of light as perceived by the human eye is the task of photometry. Radiant power passes an optical filter reproducing the human sensitivity for brightness at day light conditions (photopic vision).



Planckian locus curve for white light in the CIE 1931 diagram

## Goniometer + Photometer = Goniophotometer

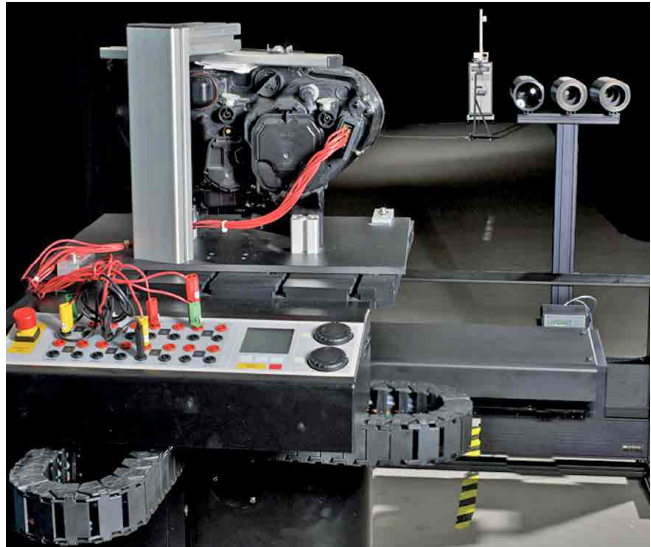


5-Axes Goniophotometer

The word gonio (γωνιο) derives from the Greek meaning angle. A goniometer is an instrument that measures angles most accurately. Photometer derives from the Greek photon (φωτον) = light and is an instrument that measures light.

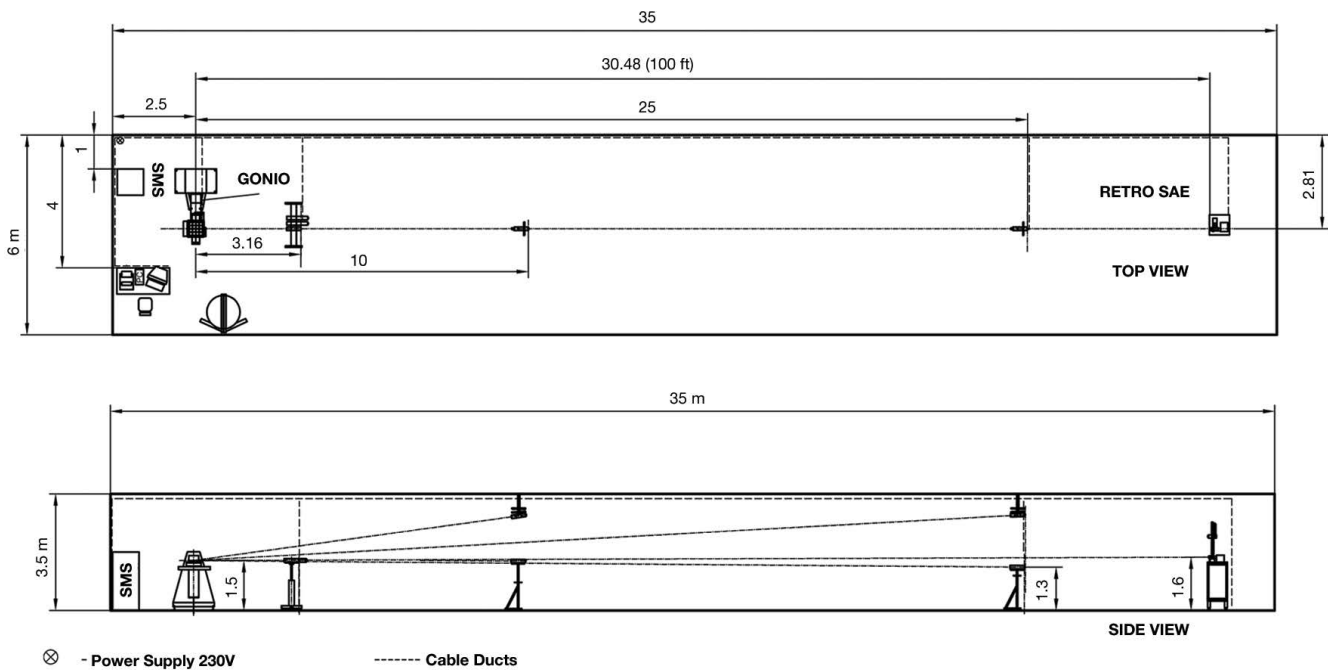
**Typical applications include the testing of:**

- Automobile headlamps, tail-lamps and direction indicators
- Luminance of license plates
- Road traffic signs
- Reflector lights
- Retro-reflecting materials
- LEDs, LED modules and LED luminaires
- Airport taxiway lighting
- Bicycle and motorbike lights
- Aerospace & marine lamps
- Endoscopic illuminators
- General lighting (directional radiation sources)



Our special expertise is the capability to provide turn-key solutions for photometric laboratories for type approval, homologation of automotive lamps according to international regulations such as UN-ECE, SAE, FMVSS108, JIS, GB.

The conformity of the Optronik Line systems to photometry accuracy guidelines issued by the GTB photometry group has been proven and acknowledged by independent and ISO 17025 accredited institutes.



Typical photometric lab layout for automatic applications; tripod or ceiling mounting of detectors alternatively

# AMS - Goniometer mechanics overview

The AMS series of goniophotometers comprises 6 distinct models applicable to a wide range of sample sizes and applications:

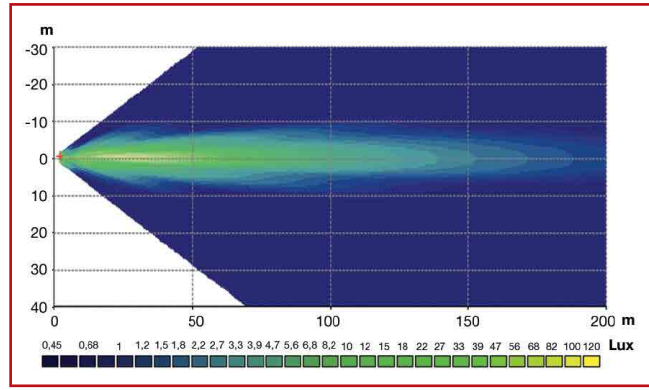
Goniophotometer	AMS 200	AMS 3000	AMS 5000 - 100	AMS 5000 - 110	AMS 9000
<b>Goniometer class</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>B</b>
H-axis	± 160°	± 200°	± 200°	± 200°	± 30°
V-axis	± 130°	± 100°	± 100°	± 100°	± 20°
Angular resolution	0.01°	0.01°	0.01°	0.01°	0.1°
Angular display	LCD	LCD	LCD	LCD	LCD
Display mode	optical zero	optical zero	optical zero	optical zero	optical zero
Typical accuracy under rated load	< 0.05°	< 0.02°	< 0.02°	< 0.02°	< 0.1°
Rotation speed H	Approx. 35°/s	Approx. 50°/s	Approx. 50°/s	Approx. 50°/s	Approx. 10°/s
Rated sample load	8 kg	20 kg	50 kg	50 kg	100 kg
Max. sample load	8 kg	40 kg	80 kg	80 kg	150 kg
Z-axis (height)	-	-50 to -450 mm motorized and PC controlled	-50 to -450 mm motorized and PC controlled	-50 to -650 mm motorized and PC controlled	-
Y-axis (back and forth)	-	± 75 mm	± 200 mm	± 200 mm	-
Y-axis (right-left)	-	± 150 mm	± 300 mm	± 300 mm	-
Height of optical axis	variable	1400 mm	1400 mm	1500 mm	1610 mm
Largest sample size (L x W x H)	< 250x450x450 mm	< 600x1200x800 mm	< 800x1800x800 mm	< 800x1800x1000 mm	< 2000x2000x600 mm
Photometer class	L (DIN 5032)	L (DIN 5032)	L (DIN 5032)	L (DIN 5032)	L (DIN 5032)
Display range E	0.1 mlx - 50 klx	0.1 mlx - 50 klx	0.1 mlx - 50 klx	0.1 mlx - 50 klx	0.1 mlx - 50 klx
Display resolution I (3.162 m)	1 mcd	1 mcd	1 mcd	1 mcd	1 mcd
Display modes	lx, cd, cd/m <sup>2</sup>	lx, cd, cd/m <sup>2</sup>	lx, cd, cd/m <sup>2</sup>	lx, cd, cd/m <sup>2</sup>	lx, cd, cd/m <sup>2</sup>
Capability to measure PWM LED	Yes	Yes	Yes	Yes	Yes
Connectivity	Up to 8 detectors	Up to 8 detectors	Up to 8 detectors	Up to 8 detectors	Up to 8 detectors
Interfaces	CAN Bus and RS232	CAN Bus and RS232	CAN Bus and RS232	CAN Bus and RS232	CAN Bus and RS232
Software	LightCon	LightCon	LightCon	LightCon	LightCon

# AMS Series of goniophotometers

## Setting standards in goniophotometry

Our special features:

- The most recent designs on the market
- Faster measurement speed: up to 5,000 measurements per second for fast grid and rapid slice measurements (typical grid only takes about 7-8 min.)
- Rotation speed up to 50°/s
- Highest photometer accuracy class L according to DIN5032, CIE69
- Higher angular resolution for equivalent speeds
- Greater photometric sensitivity – for example, to better define a low beam cut-off line
- New DSP 10 preamplifiers for convenient, high speed measurement of state-of-the-art light sources such as xenon, neon, and pulse width modulated LED sources
- OptoCAN bus gives high data processing speed and reduces the number of connecting cables
- Modular system design with convenient graphic liquid crystal displays
- Flexible LightCon software designed in partnership with leading auto lamp manufacturers to control the goniometer and share test data across a network
- All required accessories available; no compatibility issues with third-party equipment
- Lamp power supply located at the goniometer test table to avoid disruption of electrical connections during scanning

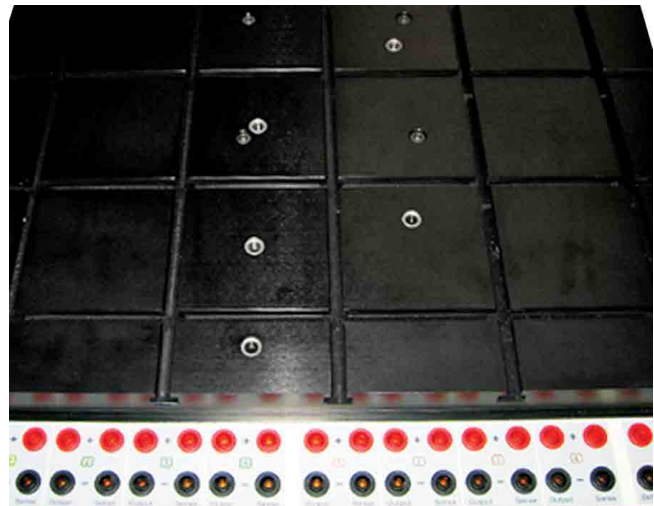


High beam – bird's eye view

- A 4, 9 or 10-channel power supply multiplexer located at the test table to allow for automatic testing of high and low beams and fog lamp in a test headlamp without user intervention
- Aiming laser integrated into the goniometer for simple alignment of samples
- Calibration traceable to PTB
- Satisfies SAE, ECE, GTB regulations for testing auto lamps, CIE 121 (goniophotometry of luminaires), and CIE 127 recommendations for LEDs
- Provides repeatable measures and objective, quantifiable data that can be used “downstream”



DSP 10 – capable to measure PWM LED



Test table of AMS 3000 with 9-channel multiplexer

# AMS 3000 Goniophotometer

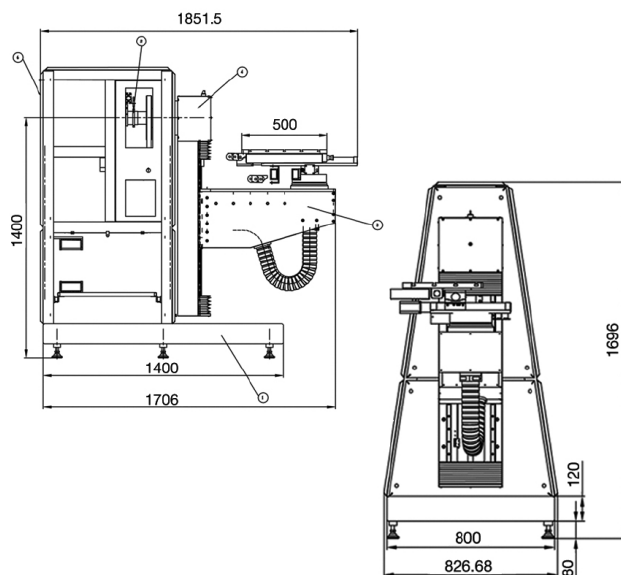
## Measurement equipment for automotive lighting, signal lights and other applications

The universal model meeting the requirements of the automotive and aerospace industries for rapid, on-the-fly slice measurements.

This system is equipped with a fully motorized and PC controlled table with 2 rotational axes and 3 linear axes. Samples are automatically positioned to the optical axis.

Test of lighting devices for development, quality control, and regulation fulfilment for certifying laboratories, automotive and automotive lighting industry, traffic signals, bus, train, ship, and aircraft lighting test houses.

- Angular resolution 0.01°
- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Three phase servo drives with sixteen speeds in both axes
- Incremental angle encoders with 0.01° accuracy in both axis
- Display of optical zero positions
- Maximum sample dimension <1200 mm x 600 mm
- Horizontal traversing range : +/-200°
- Vertical traversing range : +/-100°
- Fast proceeding speed up to 50°/s (H-axis)
- Rapid scan measurements on the fly
- Traversing range X, Y, Z : +/- 150 mm, +/- 75 mm, -50...450 mm



Sketch AMS 3000



AMS 3000 Goniophotometer for versatile applications



RecoCAN remote control serving for convenient manual fast and fine alignment of test table; displays active photometer channel and measured value

- Motor driven and PC controlled test table, adjustable in three directions, controlled manually at the AMS Controller, the recoCAN remote control unit or by computer with resolution of 0.1 mm
- Fast and fine adjustment of table
- Maximum sample weight 40 kg (rated weight 25 kg)
- Built-in alignment laser
- Horizontal mounting table 500 x 350 mm for test samples with threads and mounting grooves
- 9-channel lamp multiplexer installed directly at test table
- Switching between light sources connected also at test table
- Integration of up to three SNT 10 power supply/multimeter units
- Safe operation with emergency stop

# AMS 5000 Goniophotometer

## Measurement equipment for automotive lighting, signal lights and other applications

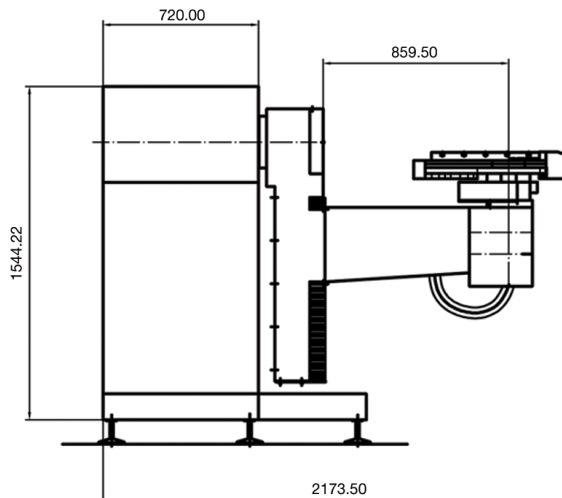
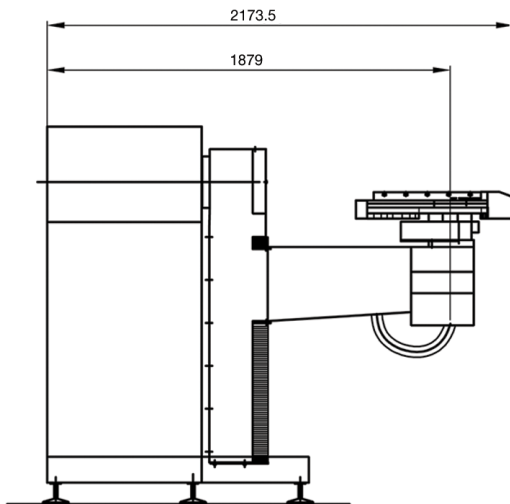
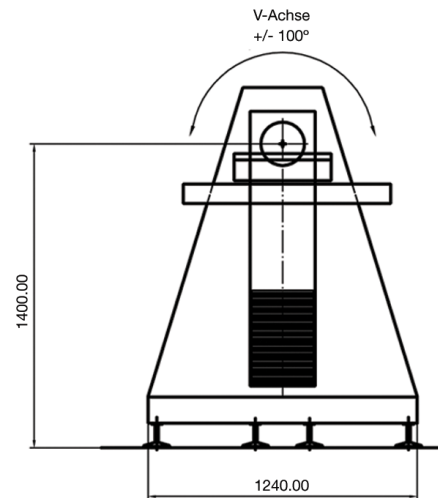
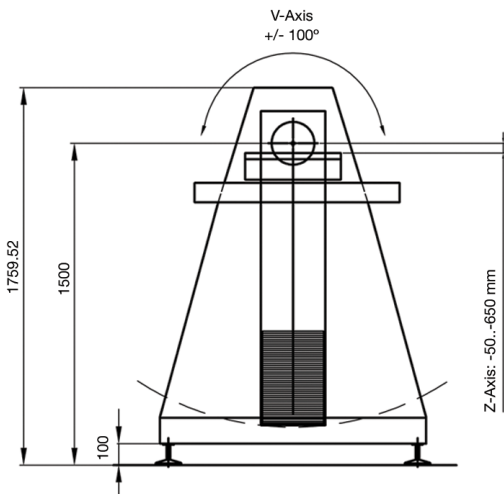
The top of the range model available today, for large sources such as headlamps, brake lights, signal turn lamps, rear fog and rear signal lamps for rapid, on-the-fly slice measurements.

This system is equipped with a fully motorized and PC controlled table with 2 rotational axes and 3 linear axes. Samples are automatically positioned to the optical axis.

Test of lighting devices for development, quality control, and regulation fulfilment for certifying laboratories, automotive and automotive lighting industry, traffic signals, bus, train, ship, and aircraft lighting test houses.



AMS 5000 Goniophotometer

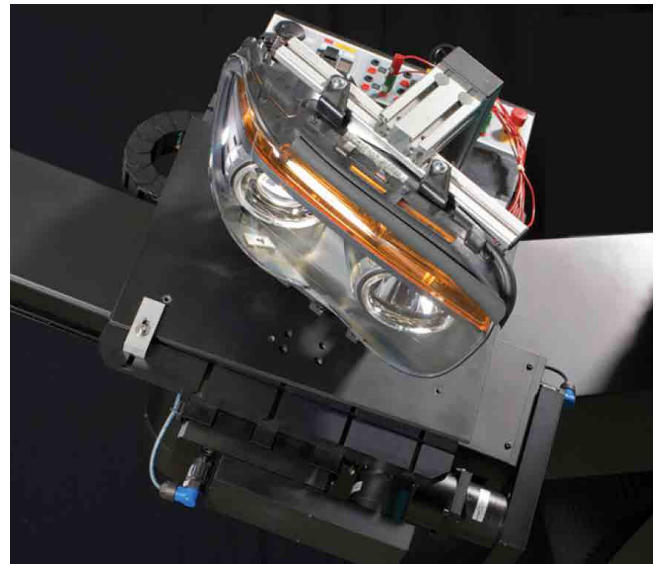


Sketch AMS 5000 - 100

Sketch AMS 5000 - 110



- Angular resolution 0.01°
- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Three phase servo drives with sixteen speeds in both axes
- Incremental angle encoders with 0.01° accuracy in both axis
- Display of optical zero positions
- Maximum sample dimensions < 1800 mm x 800 mm
- Horizontal traversing range : +/- 200°
- Vertical traversing range : +/- 100°
- Fast proceeding speed up to 50°/s (H-axis)
- Rapid scan measurements on the fly
- Traversing range X, Y, Z : +/- 300 mm, +/- 150 mm, -50...450 mm (AMS 5000 - 100)
- Traversing range X, Y, Z : +/- 300 mm, +/- 200 mm, -50...650 mm (AMS 5000 - 110)
- Motor driven and PC controlled test table, adjustable in three directions, controlled manually at the AMS Controller, the recoCAN-L control unit at the test table or by computer with resolution of 0.1 mm
- Fast and fine adjustment of table
- Maximum sample weight 80 kg (rated weight 50 kg)
- Built-in alignment laser
- Horizontal mounting table 500 x 500 mm for test samples with threads and mounting grooves
- 10-channel lamp multiplexer installed directly at test table
- Switching between light sources connected also at test table
- Manual control unit (recoCAN-L) equipped with touch screen unit at test table
- Integration of up to three SNT 10 power supply/multi-meter units
- Prepared to connect an AFS module at test table to control it via additional PC
- Prepared to implement temperature measurement of LED modules during photometric measurement (temperature time slice)
- Safe operation with emergency stop



Fast proceeding speed – one of the major features of the AMS Series

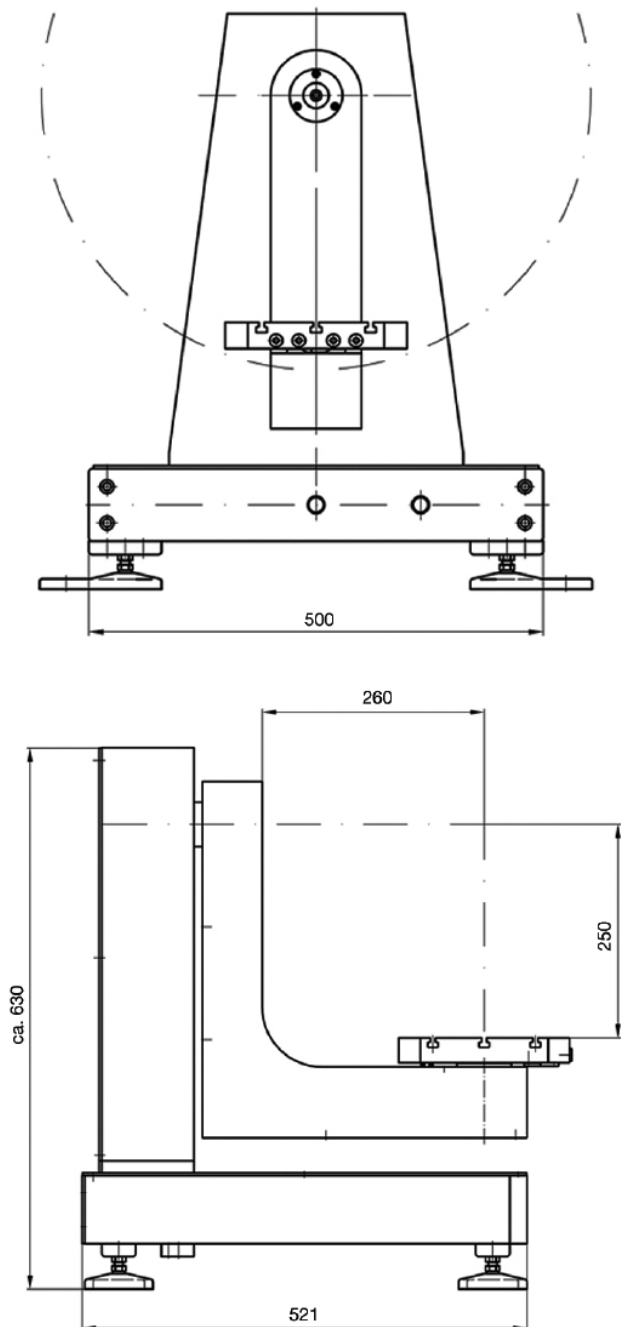


RecoCAN-L multiplexer and control unit with 10 channels for three power supplies simultaneously operated, touch screen with extended operating functions including a direct selection of power supply channel and manual positioning options in fast and fine adjustment mode. Optional connection of AFS data interface and temperature measurement of LED modules.

# AMS 200 Goniophotometer

## Goniophotometer for measurement of headlamps, headlamp modules, LED clusters and other lighting equipment

The mid-sized model designed for objects up to 480 mm. Two rotating axes and a manual height adjustable test table enable the unit to be used for various applications.



Sketch AMS 200



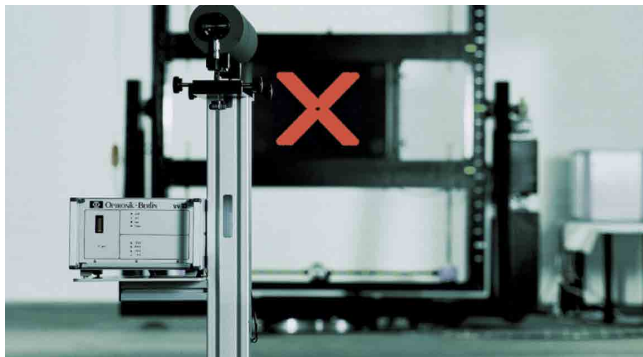
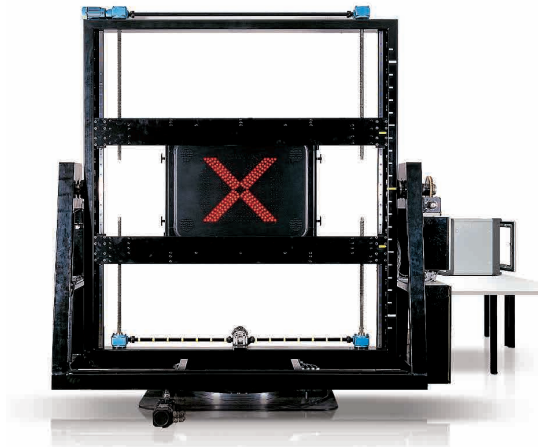
AMS 200 Goniophotometer with control unit

- Angular resolution  $0.01^\circ$
- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Three phase servo drives with sixteen speeds in both axes
- Incremental angle encoders with  $0.01^\circ$  accuracy in both axis
- Display of optical zero positions
- Maximum sample dimension AMS 200 <math>< 480 \text{ mm} \times 480 \text{ mm}</math>
- Horizontal traversing range :  $\pm 160^\circ$
- Vertical traversing range :  $\pm 130^\circ$
- Fast proceeding speed up to  $20^\circ/\text{s}$  (H-axis)
- Rapid scan measurements on the fly
- H and V axes controlled manually at the AMS Controller or by computer
- Maximum sample weight 8 kg
- Built-in alignment laser
- Horizontal mounting table  $20 \times 20 \text{ cm}$  for test samples with threads and mounting grooves
- Cable and sense wiring directly to the test table
- Integration of up to three SNT 10 power supply/multi-meter units
- Safe operation with emergency stop
- TÜV certificate available

# Customized design, e.g. special goniophotometer for traffic signs

## Measurement of traffic lights and guidance systems

For the largest sized sources such as traffic lights and lighted signs commonly used on highways and railways.



Client specific Goniophotometer design - one of our strengths. Goniophotometer for traffic signs and lights of large dimension and weight



Traffic management systems are measured with our goniophotometers

- Goniophotometer for measurement of lighting equipment
- Angular resolution 0.01°
- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Servo motor drives with sixteen speeds in both axes
- Smooth rotation
- Incremental angle encoders with 0.01° accuracy in both axes
- Display of optical zero positions
- Vertical mounting frame
- Maximum sample dimensions 2000 mm x 2000 mm
- Horizontal traversing range : +/- 30°
- Vertical traversing range : +/- 20°
- Maximum sample weight 150 kg (rated weight 100 kg)
- Proceeding speed up to 10°/s
- Built-in alignment laser
- Safe operation with emergency stop
- TÜV certificate available

# AMS Controller – Photometric acquisition system / goniometer control unit

The AMS Controller is the core component of an Optronik Line goniophotometer system. It serves both to indicate the angular position of the goniometer and to display the luminous values in lx, cd and cd/m<sup>2</sup>. Up to 8 DSP 10 preamplifiers can be connected, each disposing of an individual calibration available in lx, cd, or cd/m<sup>2</sup>.

The precision photometer head, with V( $\lambda$ ) filter, is thermo-stabilized. It can be delivered with our inhouse test report or optionally with PTB (Federal Institute for Physics and Technology) test and calibration report.



## Applications

- High performance precision photometer used for measurements in laboratory environments
- Goniometer control unit



Full LED headlamp; PWM LED sources are a challenge we found a solution for DSP 10



Full LED rear lamp with pulse width modulation and short duty cycles

The AMS System Rack contains:  
SNT 10 power supply (2 items), CM 10 Colorimeter and RMS 1200

## Characteristics

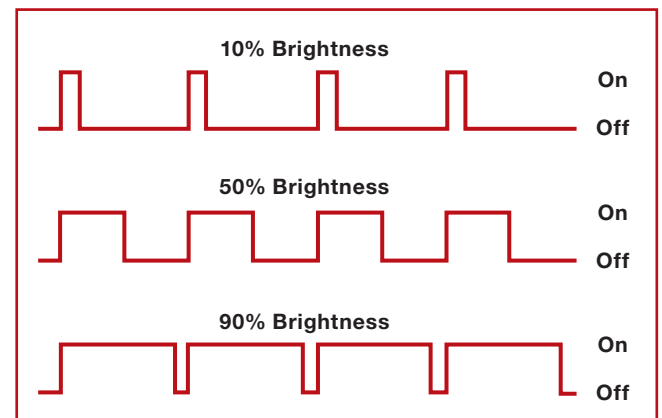
- 8 measurement ranges
- Display range 0.1 lx to 50,000 lx
- Display: 4 decimal digits
- Graphical LCD display: full textual display of value and measurement unit (lx, cd, cd/m<sup>2</sup> and other information (e.g. in conjunction with goniometer)
- V.23-(RS 232-) interface and CAN bus
- Adaptive auto-ranging
- Sampling rate (single points): 5 ms
- Sampling rate (scan mode): < 10  $\mu$ s (up to 5000 measurements/s in scan mode with goniometer)
- Display refresh time: < 0.8 s
- Rated voltage: 90-250 V
- Power consumption: < 50 VA
- Rated frequency: 45 Hz to 65 Hz
- Working temperature: 0 to 40°C
- Different photometer heads FE10 available 10 x 10, 30 mm diameter light sensitive surface
- Superb  $V(\lambda)$  approximation according to EN-DIN 13032, DIN 5032, CIE 69, class A and L
- Individual test report for  $V(\lambda)$  approximation class A and L acc. to DIN 5032 part 7
- Thermostatic stabilization 35°
- Calibration traceable to PTB standard, with calibration certificate
- 19" housing, three height units, prepared for integration into control racks
- Control of the manual measuring system independently from PC via front panel keys or directly via PC-program LightCon
- Normally, the measurement of test objects is supported by the LightCon software with PC operation, but most of the functions can be controlled manually by the AMS Controller (if manual mode is activated)
- Indication of error messages
- Measurement of pulse width modulated light (LED and others) sources
- Tube for stray light reduction
- Tripod or wall/ceiling mounting device



The AMS Controller

## Measurement and control functions of the AMS Controller

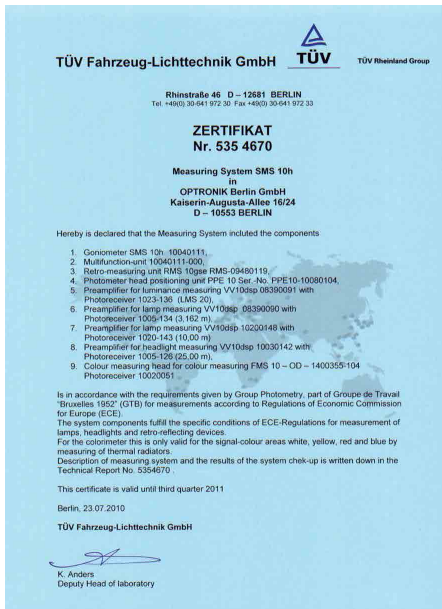
- Digital display of angular position of the main rotation axes H and V with 0.01° resolution
- Optical zero positions in relation to detector selected displayed
- Digital display of the position of linear axes (X, Y, Z) with 0.1 mm resolution
- Manual control of rotational and linear axes via front figure keypad and via alignment knob
- Display operation mode
- Display of the preamplifier/ measurement distance activated
- Computer coupling with RS232 and CAN Bus interface



The DSP 10 digital preamplifier: Capable to measure pulse width modulated LED sources of different frequency and duty cycle

# Goniophotometer options

SNT 10 DC power supply: CAN Bus controlled, high accuracy programming, read back and stabilization, supports 4+1 channel including sense wiring belong to the pic with the three displays.



Certificate issued by TÜV (ISO 17025 accredited) stating the conformity of our photometric equipment to perform type approval test according to UN-ECE regulations



Retroreflectometer RMS 1200

- Additional measurement distances / detectors / pre-amplifiers
- SNT 10 DC power supplies / multimeters.
- Conformity certificate available
- CAS 140CT Spectroradiometer
- CM 10 Colorimeter
- RMS 1200 Retroreflectometer
- LM 20 Luminance Meter (ECE R4)
- License plate holder and lamp holder (ECE R4)
- PPE 10 photometer tube positioning unit
- USH 30 universal lamp holder
- Etalon lamps for type approval available
- Measurement of the temperature of an LED module during photometric measurement
- IR sensitive measurement heads
- Additional safety device to shut down machine in case of emergencies
- Integration of photometer / colorimeters / retro-reflectometers already available



Automatic photometer tube positioning unit PPE10 with LM 20 and 3.162 m detector for luminous intensity measurement



SNT 10 - System power supply fully integrated by CAN-Bus supporting 4 channels power and sense each

# Lightcon Software, computer and services

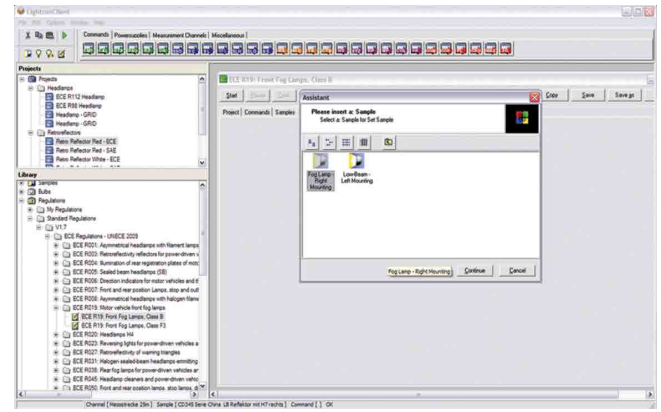
LightCon Software for automated measurement and evaluation.

- Program system for measurement, evaluation, test reports, graphical displays, and data management
- Numerous test routines acc. to ECE, SAE, and other regulations
- Evaluation routines for storage and display of spatial light distribution, isolux/isocandela lines, road isolux diagrams, illuminance intersections, perspective road displays, 3-dimensional plots, light output ratios
- Test and evaluation routines can be modified, enlarged, or completely created by the user
- Program versions in German, English and other languages available (extended software description available separately)
- Consulting, user training, installation, and service

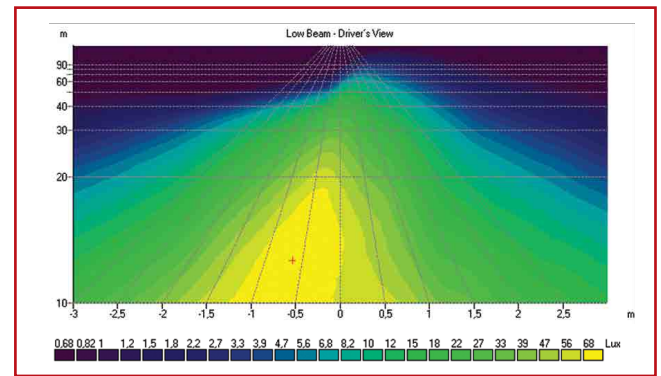
## LightCon – Short description

LightCon is a software package which has been developed especially for photometric equipment used in the field of automotive production and development. It offers a broad range of applications in the field of research, development and quality control of headlights or other automotive, but also non-automotive light sources and retro-reflecting materials.

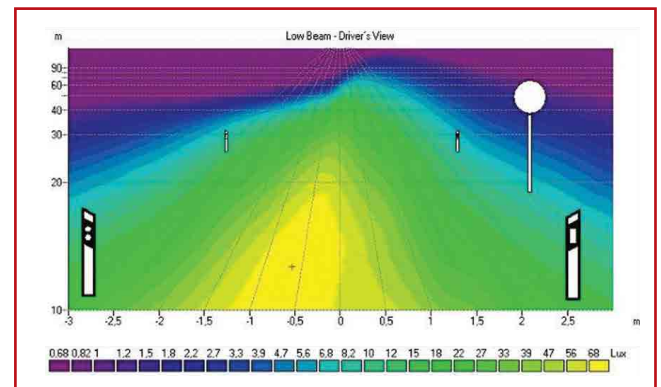
- Convenience: A state-of-the-art solution for light measurement
- Surface: Object windows are designed a way ensuring that the user is able to see commands already executed and those commands still in progress to be executed
- MS Explorer like functional trees help to get easier access to projects measured and objects in the library (such as bulbs, sample positions etc.)
- Routine measurement applications: Usual applications such as grid and slice are implemented as predefined routines and can be executed directly
- Assistant: An assistant is automatically launched to help the operator during application



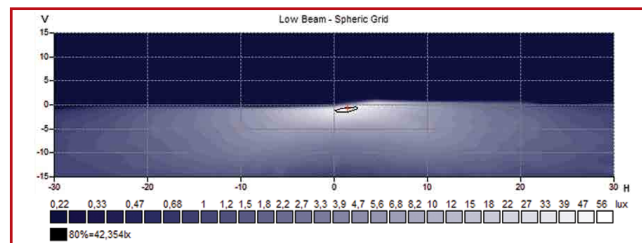
LightCon operator interface: Clear structure with assistant launched to help the applicator step by step. Explorer-like trees for data base (full regulation support), sample, bulb, project administration and saving



Driver's view low beam without obstacles



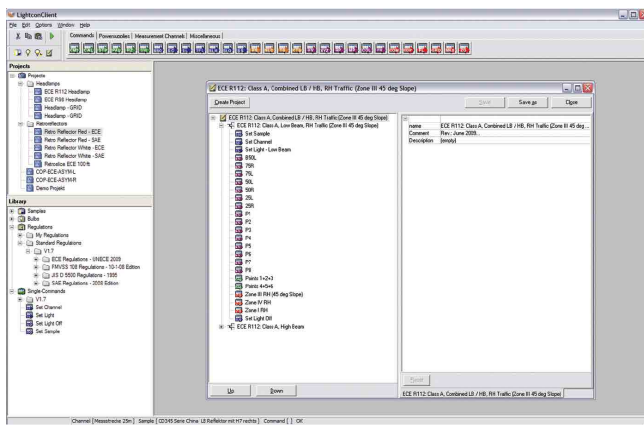
Driver's view low beam with obstacles



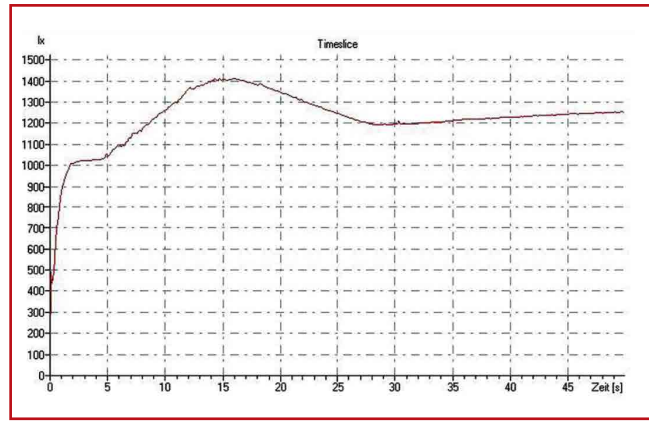
Spheric grid low beam - two colors, blue - white

## Function range structure

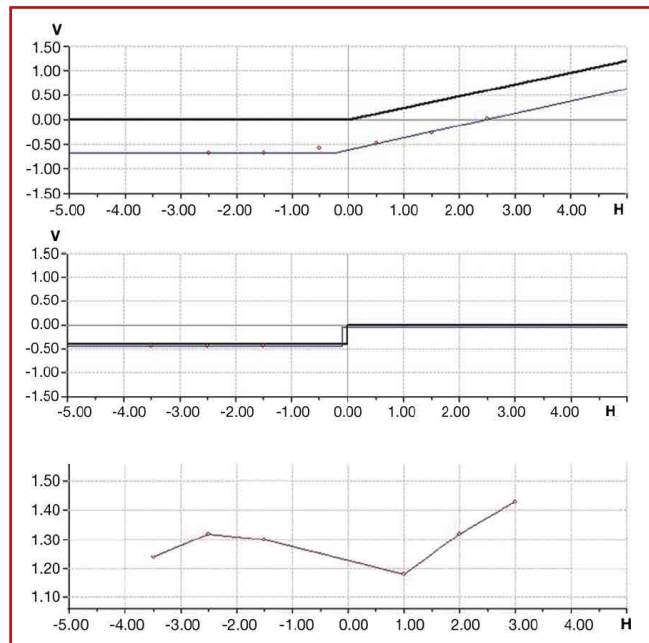
- Standard measurement according to international regulations such as ECE, SAE, JIS, KS
- Single point measurement, output of the measured results in Candela or Lux
- Min/Max calculation of vertical or horizontal cross sections, output of the maximum position
- Grid measurements in the form of vertical or horizontal cross-sections, subsequent storage and evaluation of the data measurement of the cut-off line, determination of gradient
- Measurements of time characteristics (switching on the lamp, burn-in time) of discharge lamps, graphic representation and output of the luminous intensity as function of time



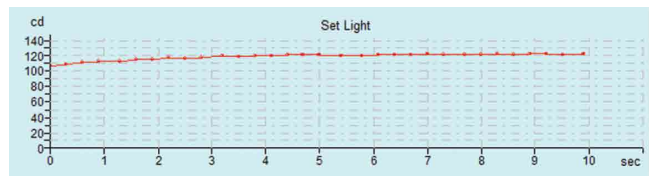
LightCon interface with ECE R112 regulation



Time slice: Burn-in behaviour of HID bulb vs. time



Measurement at the cut-off line of a low beam headlamp

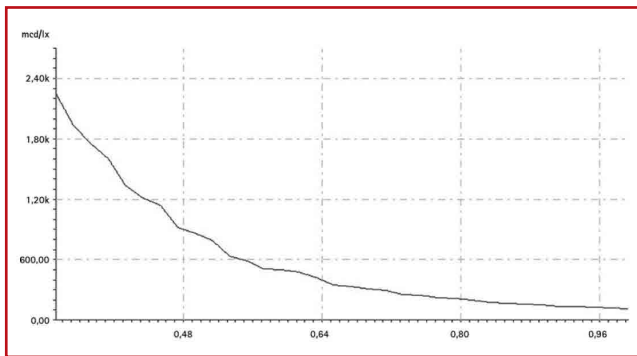


Real time display of the burn-in behaviour of the lamp

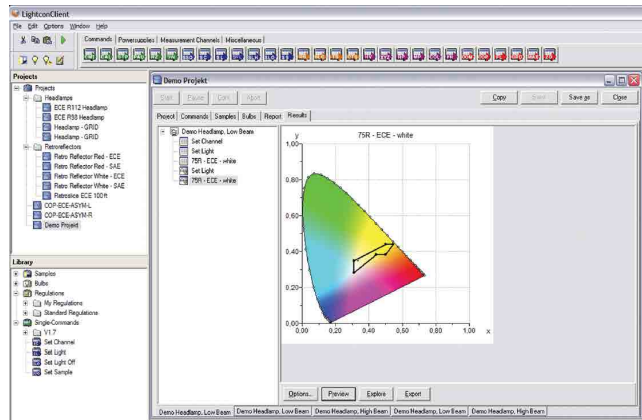


## Additional features

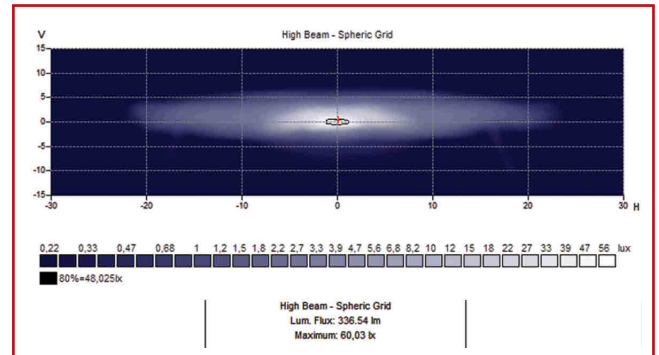
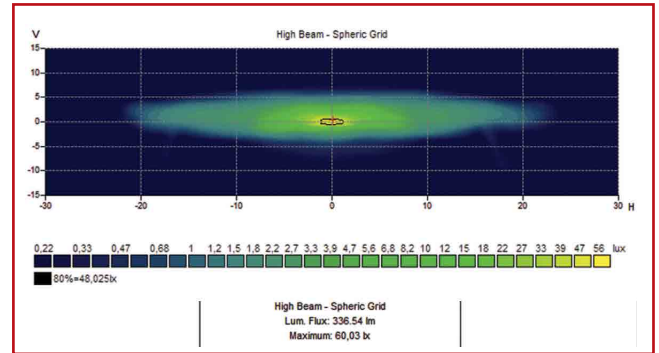
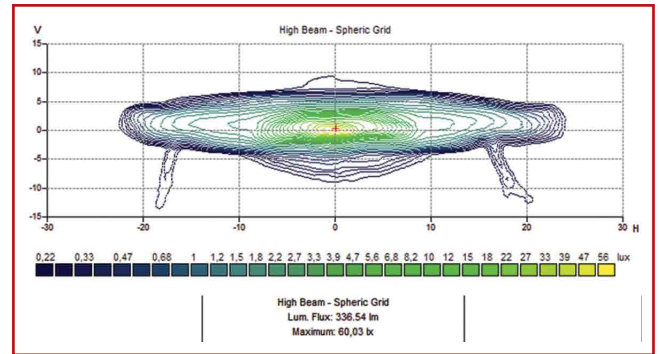
- Transformation of grid graphics into road or wall projections
- Addition (Superimposition) of measurement data obtained from several measurements
- Integration of the luminous flux in order to determine the efficiency
- Representation of the ISOLUX distribution in 2-D form, free choice of limit values
- Distribution of light in specific horizontal and vertical cross-sections
- Supports measurement of retro-reflection, luminous color, luminance
- Graphical 3-D-representation of light distributions
- Isocolor diagrams



Retroreflection slice: mcd/lx vs. observation angle



Measurement of color coordinates in pre-defined color polygons (e.g. ECE white, red, amber), multiple color measurement; color time slice

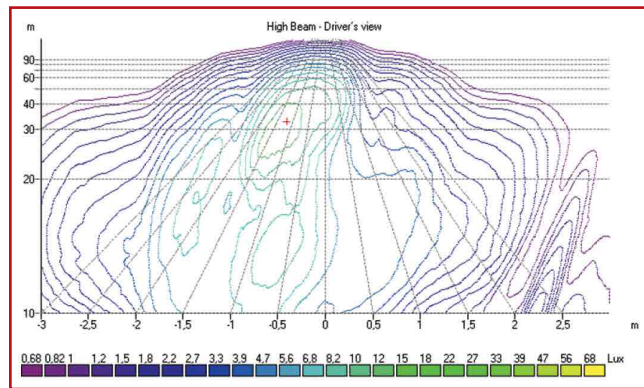
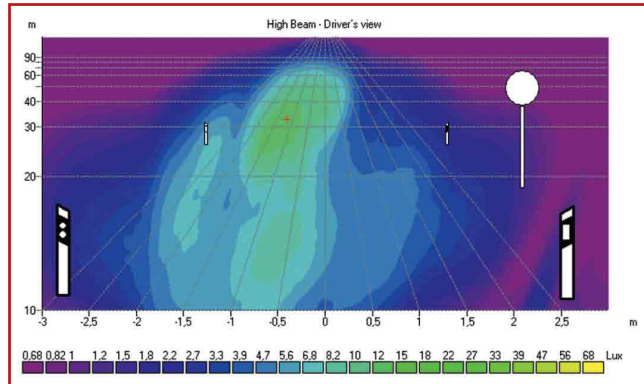


Examples for flexible design of spheric grid - isolux diagram high beam

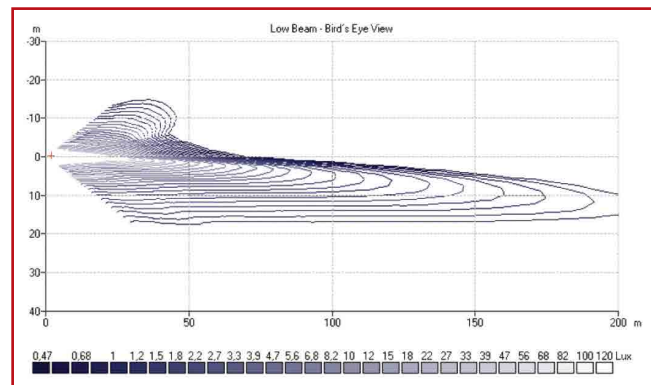
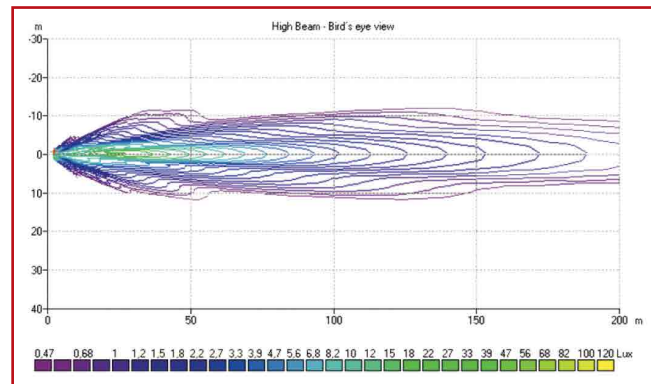
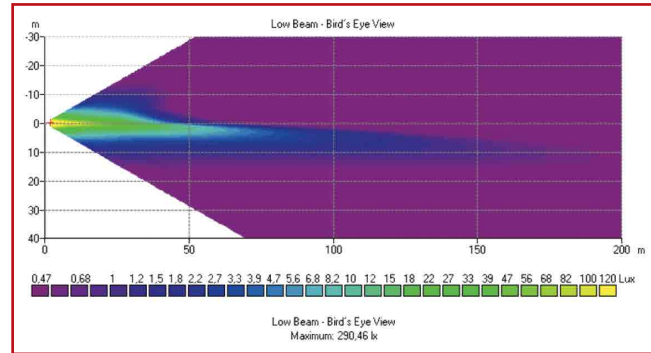
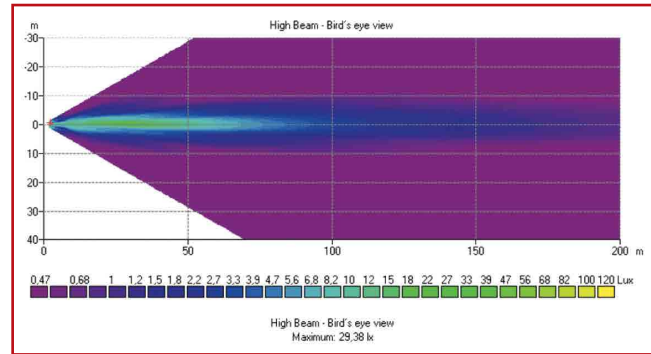
## System requirements

Windows 2000, Windows XP, Windows 7 (Windows 2000, XP are registered trademarks of the Microsoft Corp.). The software is able to control the following hardware components:

- AMS (all different models of the AMS Series)
- Power supply of the SNT 10 types
- Measuring channels directly connected with the AMS controller in order to measure luminous intensity
- Tristimulus colorimeter CM 10
- CAS 140CT (for color coordinates)
- SNT 10 DC power supplies
- Retro-reflectometer RMS 1200 gse (and other versions)
- Spectral analysis with the CAS 140 spectrometer (optional via IS software)
- HP multimeter and power supplies (option)
- Luminance meter LM 20
- Other photometric equipment (option)



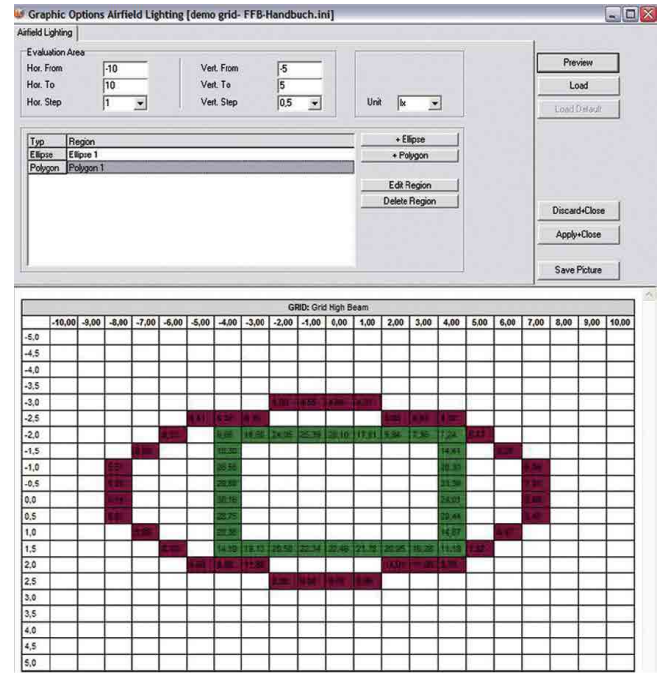
Isolux examples for driver's view high beam



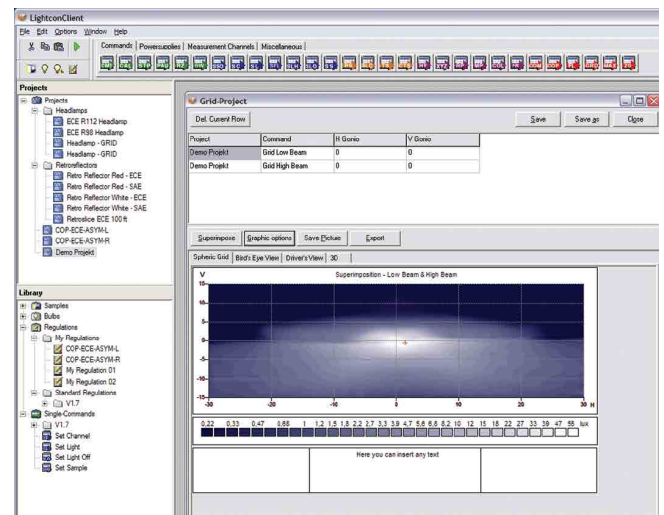
Different display modes of bird's eye view high beam/low beam

## Further features

- Online representation of results
- Hardware part of the entire system is represented on the user surface as adapted menu, function and input fields
- Online burn in diagram, online representation of values measured, online representation of grid diagrams
- System diagnosis assistant
- User administration: Access rights can be defined to limit access to certain high level user functions to be protected against unauthorized modification (user levels: user, regulation creator, administrator, service technician)
- Tool for professional, photo realistic presentation available (LucidDrive)
- Report generator allows free design of test reports
- Complete regulation support acc. to ECE and SAE
- Updates available as download from the corporate website
- Contains translator tool for multilingual functionality
- LightCon is multi user capable
- Training program available
- Graphical projections on any kind of surface available (bird's eye, driver's view, but also various inclinations of the surface illuminated)
- Library of obstacles, lines, polygons, ellipses, zones
- Customized approximation on user's demands
- Extensive application support directly from the system provider
- ASCII - excel export function (CSV format)
- IES export (for ray tracing and simulation programs such as ASAP and SPEOS)
- KRS export (for ray tracing and simulation programs such as LucidShape / Luciddrive)
- Further features available on request



Application taxiway and runway lighting for airports according to ICAO/FAA



Superimposition of various grids (one pair, two pair or more headlamps)

We bring quality to light.



**Instrument Systems GmbH**  
**– Optronik Division –**  
Kaiserin-Augusta-Allee 16-24  
10553 Berlin, Germany  
Tel.: +49 30 34 99 41-0  
Fax: +49 30 34 55 054  
Email: [info@optronik.de](mailto:info@optronik.de)  
[www.optronik.de](http://www.optronik.de)