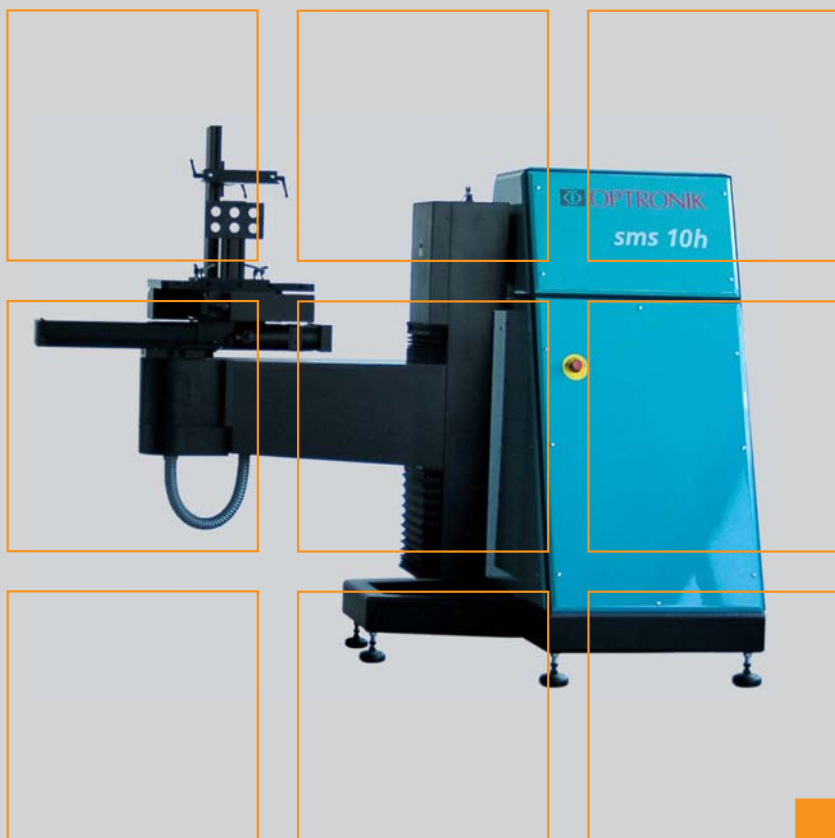


# GONIOPHOTOMETER SYSTEMS

*World Standard  
in Light Measurement since 1968*



**SMS10**



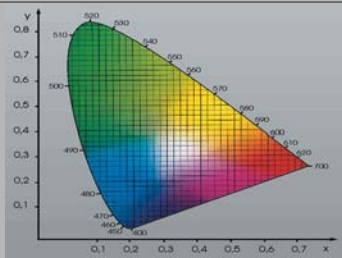
**X-Rite GmbH – Optronik**, a subsidiary of X-Rite Incorporated, is one of the most experienced suppliers of light measurement technology in the world. Product offerings include best-in-class light measurement systems, photopic detectors, goniophotometers, integrating spheres, system photometers, colorimeters, DC power supplies, reflectance and transmittance measuring systems and uniform light sources as well as various accessories for light measurement.

Since 1968, Optronik has specialized in the design and manufacture of goniophotometer systems and integrated laboratory solutions for a variety of electro-optical testing, measurement, and calibration.

Optronik is an acknowledged leader in the design and manufacture of precision photometric equipment, with one of the largest installed bases of goniophotometers in the world. Optronik's goniophotometers provide a photopically-corrected (eye response) measurement of the brightness (candle power), illuminance (in lux), and tristimulus color coordinates from optical radiation sources with directional light distributions.

Goniometers are used in the design, development, and production QA testing of lamps and in the certification of the final product according to relevant national and international standards & regulations, e.g. CIE, ECE & SAE.

## Light



CIE 1931 Chromaticity Diagram



Visible light is only a small section of electromagnetic radiation which produces a sensation of brightness and color in the human eye. Electromagnetic radiation is a form of energy. The spectrum of such radiation provides information on its energy composition. The entire spectrum of electromagnetic radiation ranges from X-ray radiation at the high-energy, short-wave end to radio waves at the low-energy, long-wave end. Photometry is the radiometric

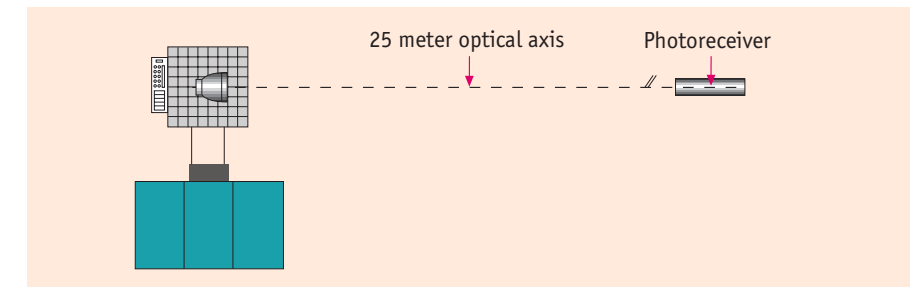
measurement of light as perceived by the human eye. A photopic filter passes the wavelengths of light in proportion to the eye's response. X-Rite – Optronik's proprietary photopic filters consist of several elements designed to match the CIE photopic response curve  $f_1$  to better than 1.5% at all wavelengths ( $f_1 < 1.5\%$  defines the highest accuracy class L according to DIN 5032 and CIE No. 69).

## Goniometer + Photometer = 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.**

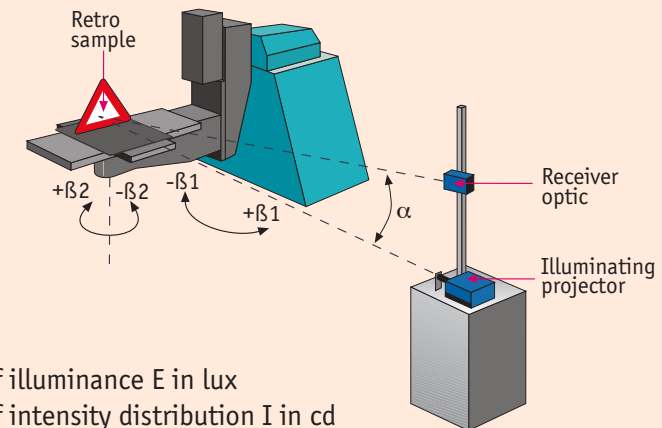
A goniophotometer therefore performs the measurement of the spatial distribution of a radiation source and displays the photometric properties of the light visible to the human eye in relation to a defined angular position. The automotive and general lighting industries use goniophotometers for lighting research and as a control measure in their manufacturing workflow.

Far field goniophotometer and detector with stray light tube positioned at a distance from which the light source can be regarded as point. (25 m for automotive headlamps, 3.162 m for signal lamps)



Whatever the requirement, X-Rite - Optronik has the solution with 5 standard goniophotometer systems designed for specific applications to be combined with various measurement devices. Our modular goniophotometer systems enable you to assemble a system tailored to your own unique requirement.

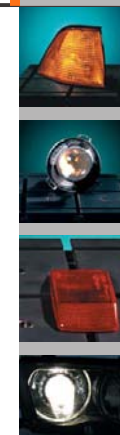
### Measurement Principle



- Measurement of illuminance E in lux
- Measurement of intensity distribution I in cd
- Measurement of luminous flux  $\Phi$  in lm
- Measurement of color coordinates and correlated color temperature
- Measurement of luminance L in  $\text{cd}/\text{m}^2$
- Measurement of retro-reflection R in  $\text{mcd}/\text{lx}$
- Test and calibration of sensors

## Typical Applications include the Testing of:

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



## Setting Standards in Goniophotometry



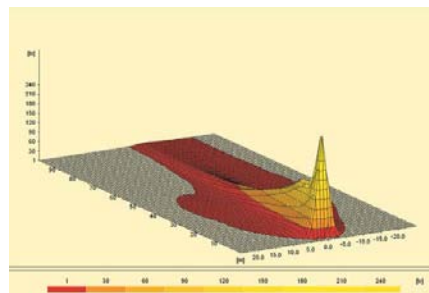
Upper section of control rack with convenient graphic crystal displays



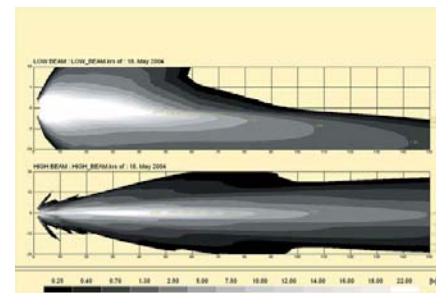
SMS 10 H performing

**Optronik's SMS-10 family of goniometers are characterized by:**

- The most modern designs on the market
- Faster measurement speeds; 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 v10dsp preamplifiers for convenient, high speed measurement of state-of-the-art light sources such as xenon, neon, and pulse width modulated LED sources. Optional pulse frequency detection
- Applications and post-sales support from the market leader: longest in the market with one of the largest customer bases and the global backup and financial stability that comes with being a member of the X-Rite family
- Unique processing speed; OptoCAN bus gives highest 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
- Five versions available, each with optimal configuration for intended application(s)
- All required accessories available from Optronik; no compatibility issues with third-party equipment
- Lamp power supply located at the goniometer test table to avoid disruption of electrical connections during scanning
- A 4- or 8-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 "down-stream"



3D-Isoline diagram on plane

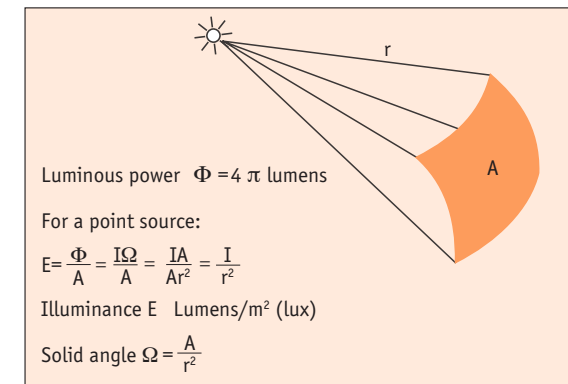


Double street isolux diagram

## Luminous Quantities

Type	Value	Symbol	Formula	Name	Unit
Radiation value	Luminous flux	$\Phi$	$\Phi = I \cdot \Omega$	Lumen	[lm]
Sender-side value	Luminous intensity	I	$I = \Phi / \Omega$	Candela	[cd]
	Luminance	L	$L = I / A$	Candela per square meter	[cd/m <sup>2</sup> ]
Recipient-side value	Illuminance	E	$E = \Phi / A$	Lux	[lux]

## Luminous Pointance | Candela



## Luminous Color

Value	Symbol	Unit
Standard color values	x, y	[1]
Trichromatic values	X, Y, Z	[1]
Color temperature	Tcp	[K]

## Goniophotometer SMS 10H Measurement Equipment for Automotive Lighting and Signal Lights and other Applications

### Applications



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

### Characteristics

Goniophotometer for measurement of headlamps and other lighting equipment  
Angular resolution 0.01°



## Goniometer GMS 10H

- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Three phase synchrony motor drives with sixteen speeds in both axes
- Incremental angle encoders with 0.01° accuracy in both axis
- Display of optical zero positions
- Horizontal mounting table for test samples with threads and mounting grooves
- Motor driven and PC controlled test table, adjustable in three directions, controlled manually at the main SMS10s, the recoCAN-L control unit at the test table or by computer with resolution of 0.1 mm
- Maximum sample dimensions 1600 mm x 600 mm
- Maximum sample weight 80 kg (rated weight 50 kg)
- Fast proceeding speed up to 50°/s
- Rapid scan measurements on the fly
- Built-in alignment laser
- 8-channel lamp multiplexer installed directly at test table
- Safe operation with emergency stop
- TÜV certificate available



RecoCAN-L



Assembly and test

## Photometer SMS 10s

- Accuracy class L (highest accuracy) acc. to DIN 5032 Section 7
- Display range: 0.1 mlx – 500 klx; 1 mcd – 5000 kcd (in 3.162 m)
- Highest precision system-photometer head, thermostabilized, with vv10dsp preamplifier
- Up to 5000 measurements per second in scan mode with highest repeatability of 99%
- Measurement of pulse width modulated light sources. Optional frequency detection
- Tube for stray light reduction
- Tripod or wall/ceiling mounting device



SMS10s

## Measurement and Control Unit

- Digital display of photometric values, angles, and rotation speeds with devices for manual control, remote control, safety controls, test circuits, computer coupling with RS232 and OptoCAN Bus Interface
- Display of retro-reflective and colorimetric properties (optional)

## Goniophotometer SMS 10C Measurement Equipment for Automotive Lighting and Signal Lights and other Applications

### Applications



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

### Characteristics

Goniophotometer for measurement of headlamps and other lighting equipment  
Angular resolution 0.01°

## Goniometer GMS 10C

- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Three phase synchrony 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
- Horizontal mounting table for test samples with threads and mounting grooves
- Motor driven and PC controlled test table, adjustable in three directions, controlled manually at the main control unit SMS10s, the recoCAN-s control unit at the test table or by computer with resolution of 0.1 mm
- Maximum sample dimensions 1200 mm x 500 mm
- Horizontal traversing range : +/- 200°
- Vertical traversing range : +/- 100°
- Traversing range X, Y, Z : +/- 75 mm, +/- 150 mm, -50 ... 450 mm
- (Optional : Y : +/- 200 mm, Z : -50 ... -850 mm)
- Maximum sample weight 50 kg (rated weight 20 kg)
- Fast proceeding speed up to 50°/s
- Rapid scan measurements on the fly
- 4-channel (option 2x4 channels) lamp multiplexer installed directly at test table
- Built-in alignment laser
- Safe operation with emergency stop
- TÜV certificate available



Test table with recoCAN-s remote control



Alignment laser



Control rack

## Photometer SMS 10s

- Accuracy class L (highest accuracy) acc. to DIN 5032 part 7
- Display range: 0.1 mlx – 500 klx; 1 mcd – 5000 kcd (in 3.162 m)
- Highest precision system-photometer head, thermostabilized, with vv10dsp preamplifier
- Up to 5000 measurements per second in scan mode with highest repeatability of 99%
- Measurement of pulse width modulated light sources. Optional frequency detection
- Tube for stray light reduction
- Tripod or wall/ceiling mounting device

## Measurement and Control Unit

- Digital display of photometric values, angles, and rotation speeds with devices for manual control, remote control, safety controls, test circuits, computer coupling with RS232 and OptoCAN Bus Interface
- Display of retro-reflective and colorimetric properties (optional)

## Goniophotometer SMS 10M Measurement Equipment for Automotive Lighting and Signal Lights and other Applications

## Applications

Test of lighting devices for development, quality control, and regulation fulfillment for certifying laboratories, automotive and automotive lighting industry, general lighting (directional sources), LED lamps and clusters

## Characteristics

Goniophotometer for measurement of headlamps and other lighting equipment  
Angular resolution 0.01°

## Goniometer GMS 10M

- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Three phase synchrony 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

- Horizontal mounting table for test samples with threads and mounting grooves
- Height adjustable test table
- Maximum sample dimensions 500 mm x 550 mm
- Horizontal traversing range : +/-160°
- Vertical traversing range : +/-90°
- Traversing range Z : 0 ...-250 mm (manual)
- Maximum sample weight 15 kg (rated weight 10 kg)
- Fast proceeding speed up to 20°/s
- Rapid scan measurements on the fly
- Built-in alignment laser
- Safe operation with emergency stop

## Photometer SMS 10s

- Accuracy class L (highest accuracy) acc. to DIN 5032 Section 7
- Display range: 0.1 mlx – 500 klx; 1 mcd – 5000 kcd (in 3.162 m)
- Highest precision system-photometer head, thermostabilized, with vv10dsp preamplifier
- Up to 5000 measurements per second in scan mode with highest repeatability of 99%
- Measurement of pulse width modulated light sources. Optional frequency detection
- Tube for stray light reduction
- Tripod or wall/ceiling mounting device

## Measurement and Control Unit

- Digital display of photometric values, angles, and rotation speeds with devices for manual control, remote control, safety controls, test circuits, computer coupling with RS232 and OptoCAN Bus Interface
- Display of retro-reflective and colorimetric properties (optional)

## Goniophotometer SMS 10μ Measurement Equipment for Automotive Lighting and Signal Lights and other Applications

## Applications

Test of lighting devices for development, quality control, and regulation fulfillment for certifying laboratories, automotive and automotive lighting industry, general lighting (directional sources), retro-reflectors, LED lamps and clusters





## Characteristics

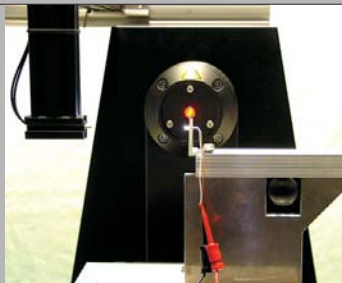
Goniophotometer for measurement of lighting equipment  
Angular resolution 0.01°

## Goniometer GMS 10μ



- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Stepper 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
- Horizontal mounting table for test samples with threads and mounting grooves
- Maximum sample dimensions 300 mm x 250 mm
- Horizontal traversing range : +/-160°
- Vertical traversing range : +/-130°
- Maximum sample weight 5 kg
- Fast proceeding speed up to 20°/s
- Rapid scan measurements on the fly
- Sample power connection at test table
- Built-in alignment laser
- Safe operation with emergency stop
- TÜV certificate available

## Photometer SMS 10s



Special application: LED measurement with detector with 1mm light sensitive surface

- Accuracy class L (highest accuracy) acc. to DIN 5032 Section 7
- Display range: 0.1 mlx – 500 klx; 1 mcd – 5000 kcd (in 3.162 m)
- Highest precision system-photometer head, thermostabilized, with vv10dsp preamplifier
- Up to 5000 measurements per second in scan mode with highest repeatability of 99%
- Measurement of pulse width modulated light sources. Optional frequency detection
- Tube for stray light reduction
- Tripod or wall/ceiling mounting device

## Measurement and Control Unit



Special application: Measurement of endoscope illuminators

- Digital display of photometric values, angles, and rotation speeds with devices for manual control, remote control, safety controls, test circuits, computer coupling with RS232 and OptoCAN Bus Interface
- Display of retro-reflective and colorimetric properties (optional)

## Goniophotometer SMS10S Measurement Equipment for Automotive Lighting and Signal Lights and other Applications

## Applications

Test of lighting devices for development, quality control, and regulation fulfillment for certifying laboratories, traffic signal, and traffic lighting test houses



## Characteristics

Goniophotometer for measurement of lighting equipment  
Angular resolution 0.01°

## Goniometer GMS 10S

- Stable high precision mechanical components
- Horizontal and vertical turning axes
- Three phase synchrony 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



## Photometer SMS 10s

- Accuracy class L (highest accuracy) acc. to DIN 5032 Section 7
- Display range: 0.1 mlx – 500 klx; 1 mcd – 5000 kcd (in 3.162 m)
- Highest precision system-photometer head, thermostabilized, with vv10dsp preamplifier
- Up to 5000 measurements per second in scan mode with highest repeatability of 99% (Scan measurements are not applicable for SMS10S goniometer)
- Measurement of pulse width modulated light sources. Optional frequency detection
- Tube for stray light reduction
- Tripod or wall/ceiling mounting device



## Measurement and Control Unit

- Digital display of photometric values, angles, and rotation speeds with devices for manual control, remote control, safety controls, test circuits, computer coupling with RS232 and OptoCAN Bus Interface
- Display of retro-reflective and colorimetric properties (optional)

## Accessories/ Service

## Options

- Additional photometer heads with stray light tubes and tripods for additional photometric distances
- SNT10 - Electrical power supply and indicating instruments for test lamps
- Remote control close to the goniometer with display of photometric values and angles for manual control during mounting and adjustment of test samples
- PPE 10 automatic photometer positioning unit
- LMUX 10 – additional 4 – channel lamp multiplexer (SMS10C)
- SAE aiming kit
- Universal sample holder set
- Sound card for acoustical warning signal
- Relays for laboratory illumination and warning lamp
- TÜV conformity certificate (certificate issued by independent test and certification institute stating the conformity with the recommendations of the GTB to perform tests according to ECE regulations)
- Integration of other equipment such as CCD array spectrophotometers, other power supplies, thermometers, multimeters, etc.

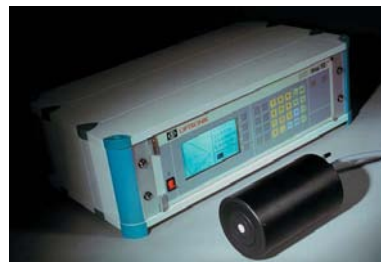


ppe10 photometer tube positioning unit



## Integration of further Test Equipment

- Retro-reflective material measurement with RMS10gse
- Licence plate lamp measurement with luminance meter SMS20
- Licence plate fixture / dummies, lamp holder device
- Color measurement with FMS10 colorimeter
- Other equipment purchased from competitors



FMS10 tristimulus colorimeter



Additional measurement distances with v10dsp preamplifiers



License plate fixture

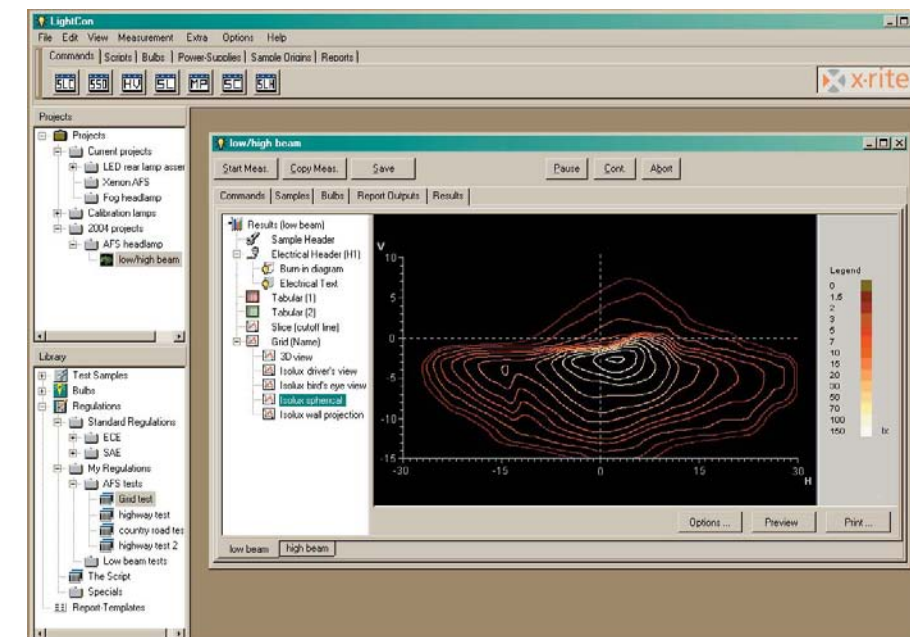


RMS10 retroreflectometer

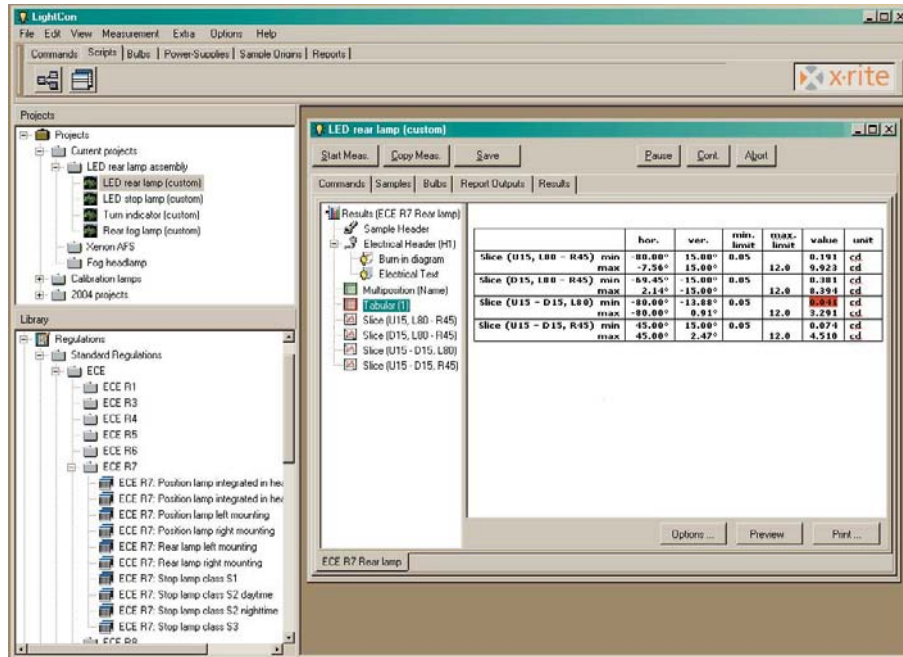


## Computer, Software and Services

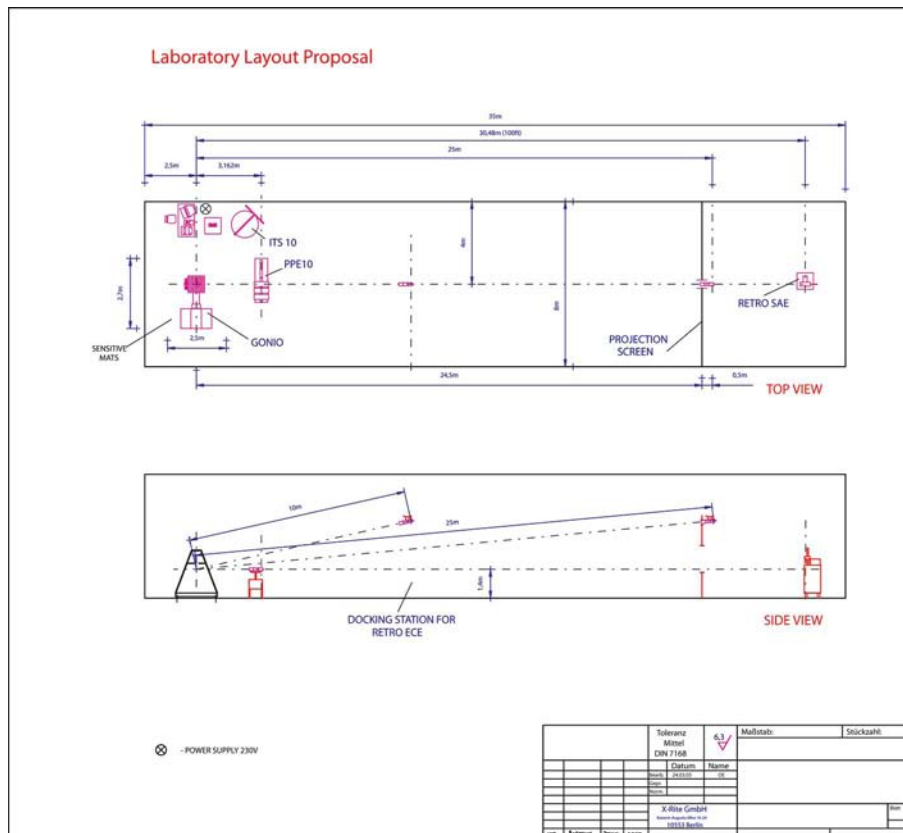
- Personal computer and OPTRONIK LightCon Software for automatic measurement and evaluation
- Program system for measurement, evaluation, test reports, graphical displays, and data management
- Numerous test routines acc. to ECE, SAE, and other regulations
- Evaluation routines for storage and display 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, French, Chinese, Dutch, and other languages available (extended software description available separately)
- Consulting, user training, installation, and service



Isolux diagram



Standard script acc. ECE R6



Laboratory Layout Proposal

## Goniometer Mechanics Overview

The Optronik SMS-10 range comprises 5 distinct models applicable to a wide range of sample sizes and weights.

Goniophotometer	SMS-10 $\mu$	SMS-10 m	SMS-10 c	SMS-10 h	SMS-10s
Typical applications & features	A compact goniometer designed for measuring small-sized test objects like LEDs, retro-reflecting materials, optical glass fiber cables or turn signal lamps.	The mid-sized model designed for objects up to 600mm. Two rotating axes and a height adjustable test table.	The universal model meeting the requirements of the automotive & aerospace industries for rapid, on-the-fly slice measurements. This system is equipped with a fully motorized table with 2 rotational axes and 3 linear axes. Samples are automatically positioned.	The top of the range model, for large sources such as brake lights, signal turn lamps, rear fog & rear signal lamps for rapid, on-the-fly slice measurements. This system is equipped with a fully motorized table with 2 rotational axes and 3 linear axes. Samples are automatically positioned.	For the largest sized sources such as traffic lights and lighted signs commonly used on highways and railways.
H-axis	$\pm 160^\circ$	$\pm 160^\circ$	$\pm 200^\circ$	$\pm 200^\circ$	$\pm 30^\circ$
V-axis	$\pm 130^\circ$	$\pm 90^\circ$	$\pm 100^\circ$	$\pm 100^\circ$	$\pm 20^\circ$
X-axis	-	-	$\pm 150\text{mm}$	$\pm 300\text{mm}$	-
Y-axis	-	-	$\pm 75\text{mm}$	$\pm 150\text{mm}$ or $\pm 200\text{mm}$	-
Z-axis	-	0...250mm	-50...450mm or -50...850mm	-50...450mm or -50...550mm	-
Nominal sample dimensions (L x W x H)	250 x 250 x 300mm	550 x 400 x 500mm	600 x 1200 x 800mm	800 x 1600 x 800mm	2000 x 2000 x 600mm
Rated sample load	5kg	10kg	20kg	50kg	100kg
Maximum sample load	5kg	15kg	50kg	80kg	150kg
Rotation speed H-axis	20°/s	20°/s	50°/s	50°/s	10°/s
Rotation speed V-axis	10°/s	10°/s	20°/s	20°/s	10°/s
Angle accuracy	0.01°	0.01°	0.01°	0.01°	0.01°
Typical accuracy at rated sample load	< 0.05°	< 0.05°	< 0.02°	< 0.02°	< 0.1°
Height of optical axis	400-1400mm	1400mm	1400mm	1400mm	1610mm
Photometer class	L - DIN5032	L - DIN5032	L - DIN5032	L - DIN5032	L - DIN5032
Display range	0.1 mlx-500 klx	0.1 mlx-500 klx	0.1 mlx-500 klx	0.1 mlx-500 klx	0.1 mlx-500 klx
Display in cd (3.162 m)	1 mcd-5000 kcd	1 mcd-5000 kcd	1 mcd-5000 kcd	1 mcd-5000 kcd	1 mcd-5000 kcd





### X-Rite – Optronik Services

X-Rite – Optronik is more than a manufacturer of photometer and goniophotometer systems and accessories. The company also offers a range of services to support customers who purchase Optronik products, as well as customers who outsource manufacturing, test, and calibration services. Customer service reflects a legacy of expertise in photometry technology and applications. No other manufacturer offers the knowledge base or the range of products developed by X-Rite – Optronik, and no other goniophotometer series can be compared with the performance in both accuracy and speed of the OPTRONIK SMS10 series.

Get assistance with all your test and measurement needs at: [info@optronik.de](mailto:info@optronik.de)

#### Custom Development

X-Rite – Optronik welcomes inquiries for the design and manufacture of custom optical radiation measurement and test systems. Experienced research and development engineers work closely with our customers to provide the highest level of product development, applications, and technical support. Customer focus, quality, innovation and excellence drive our culture.

You are welcome to visit our R&D and production plant in Berlin.

OPTRONIK. The World Standard in Light Measurement since 1968

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X-Rite has offices and representatives in every region of the world.  
For detailed information, please visit the corporate, Optronik or Labsphere websites:  
[xrite.com](http://xrite.com), [optronik.de](http://optronik.de), [labsphere.com](http://labsphere.com)