



# robogonio

Quick. Precise. Highly flexible.



opsira

[www.robogonio.com](http://www.robogonio.com)



# One system, six advantages

What the robogonio can do.

1. Highest flexibility

Goniophotometry in near and far field, various detector systems – combined in one instrument.

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2. Extremely quick scans

The class L photometer reduces measuring time. This means, for example: Hemisphere within approximately two minutes.

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3. Variable sizes

The robogonio is available in numerous versions (with a payload ranging from 6 to 1,000 kg), special models are always possible. Our official system partner: KUKA Roboter GmbH.

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4. Maximum precision

The robogonio offers the highest angle repeatabilities of up to 0.005° along with a photometer of the highest class (L).

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5. Intuitive operation

The robogonio is easy to use. Complicated and error-prone measurements with mirror goniophotometers are a thing of the past.

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6. All-round carefree package

We are pleased to support you - from the complete planning of your system and component calibration up to competent after-sales support.



## Optics design, light lab and measuring systems

The triad for perfect light.

For around 20 years, opsira has been a name synonymous with optical system technology - from the concept to the prototype ready for serial production. Whether competent development support, measurements in its light lab, or custom-made measuring systems for field work, opsira offers an all-round service package to its customers.

### Optics design

opsira engineers and technicians develop optical systems for their customers using state-of-the-art and highly efficient simulation and measuring technologies.

### Light lab

Customers wishing to use an external light lab can benefit from opsira's comprehensive services for light

measurement. opsira measures optical systems precisely, quickly and economically.

### Measuring systems

opsira offers customised optical measuring systems, high-tech products for photometry, spectrometry and goniophotometry for customers that have on-site measuring labs. Inspection and test systems for development and rapid production control are built according to customer specifications.

The highlight in the last few years: the goniophotometer robogonio. In these times of shorter product cycles, it is extremely important to have a quick and precise way of measuring light sources and luminaires. The development of luminaires requires high-quality measurement data at an early stage in order to design them as realistic and efficient as possible. This is where robogonio excels.

## Measurements with the robogonio at a glance

Everything is possible.

- With its six axes, the robogonio combines several goniophotometer types in a single instrument (DIN 5032-1, DIN EN 13032-1, CIE 121, CIE S 025). Especially types 1.1, 1.2, and 1.3 are dead easy for the robogonio. In these types, the detector stays stationary while the test piece (light source, luminaire, display...) rotates around its vertical and horizontal axes.
- In the far field, the robogonio measures the luminous intensity distributions of luminaires. Conventional far field data such as EULUMDAT or IES is generated directly.
- In the near field, the robogonio generates ray data of light sources with high precision, and even polychromatically, depending on the detector. Far field data can be calculated directly from the ray data.
- Angular dependent luminance measurements, for example, form the basis for glare ratings.
- When mounted on the robot arm, the detector can scan any geometry, including planes. This allows a quick evaluation of the light distribution of luminaires and headlights.
- If robogonio has the detector, so to say, in its hand, it bypasses the light source and functions as a luminous flux integrator for the determination of the total luminous flux.



## Safety & innovation under high deadline pressure

The robogonio for automotive.

In the automotive industry, two aspects of photometric measurement are of particular importance: Firstly, the demand for extremely quick and authoritative results. Secondly, the possibility to effect the measurements with the finest angular resolutions so that the tests comply with the applicable standards.

The robogonio meets both of these requirements perfectly. The high-speed photometer reduces the time required for classic goniometric measurements in the HV system (ECE, SAE) to a few minutes. Apart from this, the robogonio also permits angular resolutions of 0.01°. This enables precise observance of the cut-off line.

But this is not all: Due to its spatial flexibility, the robogonio can cover different headlight functions such as

high beam, low beam, or direction indicator light around different centres of rotation in a single measuring run. To achieve this, the robogonio uses optional mounting adapters to supply the headlight directly through the integrated power supplies, BUS signals or multiplexers. All measuring points according to ECE and SAE are scanned fully-automatically by the system.

*By the way*

For measuring elongated light guides, the robogonio can also be equipped with a high-resolution camera. Instead of taking complicated measurements in individual steps, the robogonio scans the light guide and conveniently provides high-precision results on the luminance distribution.

## Shorter R&D cycles, EULUMDAT & IES in view

The robogonio for luminaire manufacturers.

Constantly launching new variants of luminaires, easily providing light planners with far field data (IES, EULUMDAT), and quickly generating the required LED data. Robogonio stands for a measuring solution that fulfils all requirements.

First, the luminaire warms up in operating position; the run-up curve (DIN EN 13032-4) is provided by the robogonio. Then the luminous intensity distribution can be measured through any angle in the C-plane system since the robogonio can move the luminaire freely in space.

The optional spectrometer also enables colour-over-angle measurements to be taken. Optics designers can therefore determine how the colour changes at certain angles, and whether unwanted colour effects occur. Another important topic is the measurement of the total luminous flux in relation to the consumed electrical power. Luminous flux efficiency in lumen/watt and energy efficiency classes can be determined directly.

*By the way*

The robogonio also helps with a glare rating of luminaires.



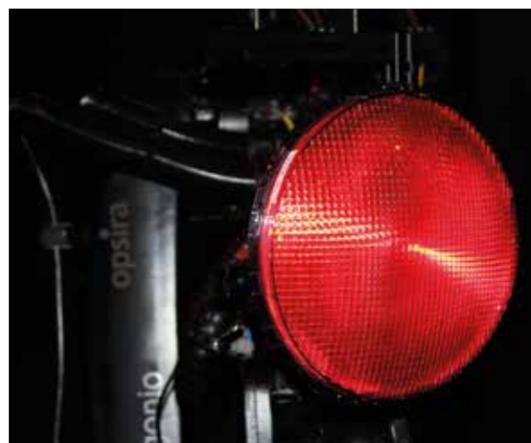
## Light on the spot, reliable and accurate

The robogonio for signal light manufacturers.

Luminous intensity distribution is an essential factor for measuring traffic lights, railway signals, beacons, or signal towers for production lines. Some applications present the additional challenge of the front and back light exit windows having to emit the exact required quantity of light. Here, the robogonio impresses with its flexibility since it can measure the luminous intensity distribution in both directions using arbitrary centres of rotation in space. Standard-relevant testing areas, for example according to ICAO, FAA, and DIN EN 12368, are covered automatically by the robogonio.

By the way

For fast and efficient work, the robogonio enables integrating user-defined measuring processes as well as the numerous updates of standards.



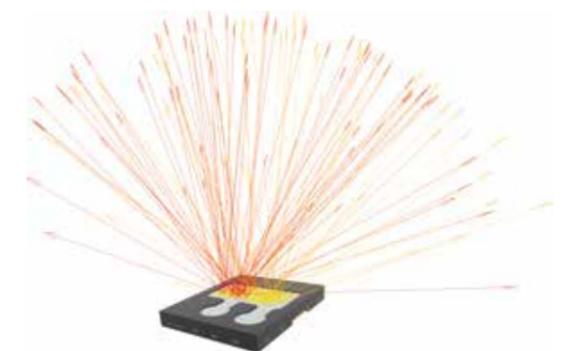
## Realistic simulation of optical systems

The robogonio for optics development.

All lights are different – a dilemma with which many optics designers are familiar with in the preliminary development. At the same time, the systems keep getting smaller and smaller - the key word here is LEDs. When reliable ray data for optical simulations is needed, conventional solutions are limited. The robogonio measures light sources with a high-resolution luminance camera from 10,000 different directions. This leads to reliable near field ray data that can be used in all standard optics simulation environments.

By the way

The robogonio is the only goniophotometer available that can take actual far field and near field measurements in one single instrument. Thus, the robogonio accompanies developers and producers from the first idea throughout the development and to the finished product.



# Evolutionary

The right size for every task.

The robogonio is available in many variants for different payloads, uses and space limitations.

The smaller models are designed for measuring the luminous intensity distribution of luminaires and LED PCBs as well as for scanning illuminance distributions.

The larger models are suitable for systems such as street lights, stage lights, and headlights.

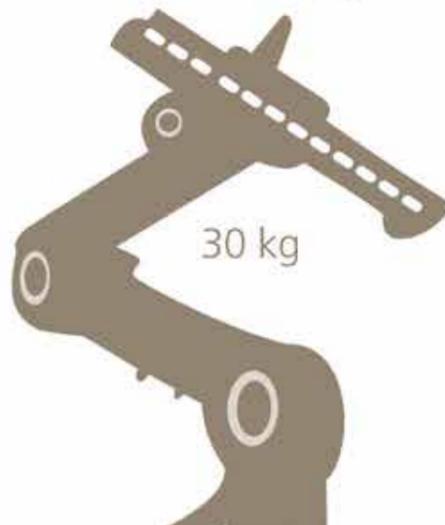
Further great advantages of the robogonio: It can be deployed almost anywhere. Its use is simple and intuitive. It doesn't require any specialised personnel.

By the way

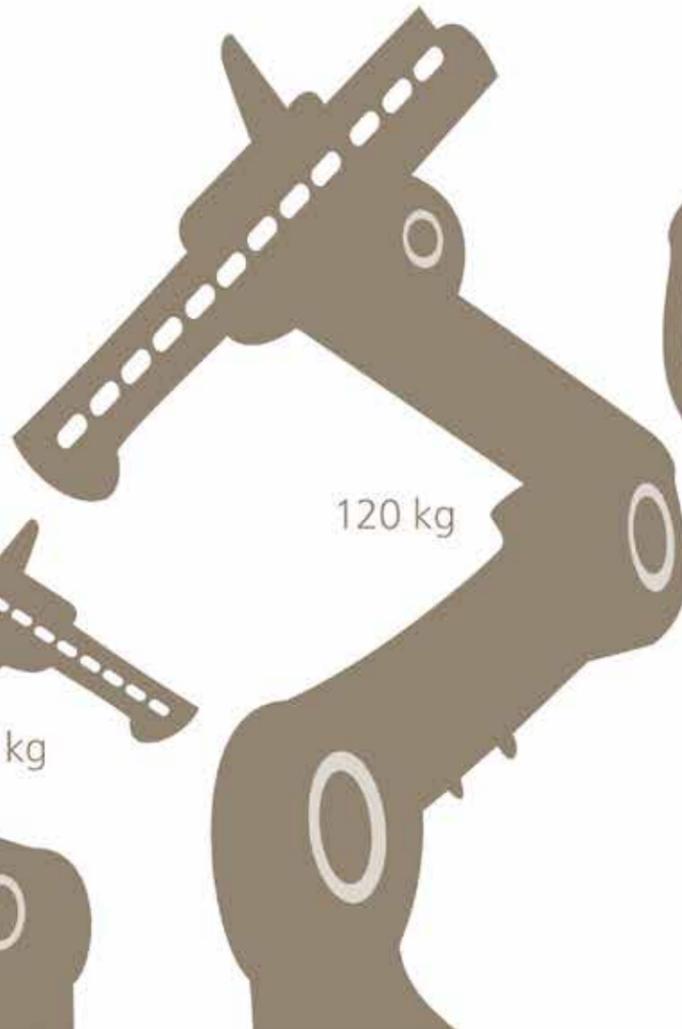
The sky's the limit - almost. Even payloads of up to 1,000 kg are possible. Our experienced partner for robotics: KUKA Roboter GmbH.



6 kg



30 kg



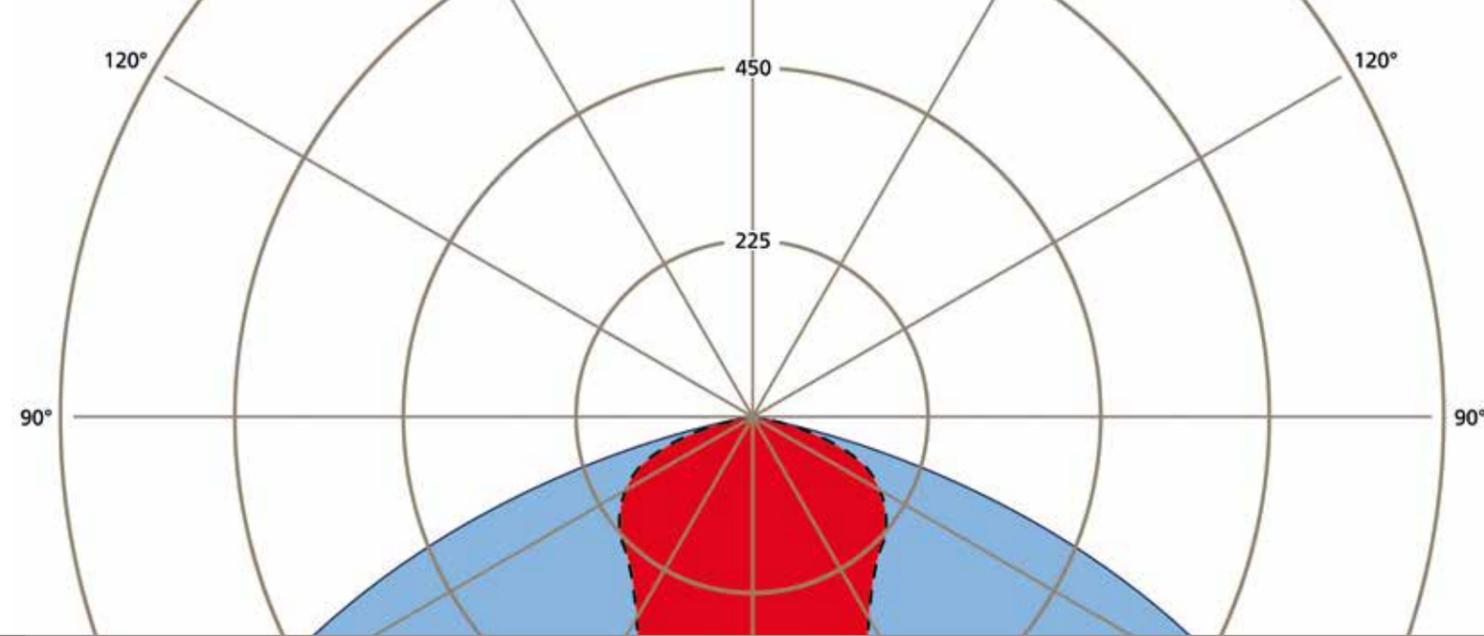
120 kg



500 kg



opsira



## The right model for every case

The robogonio - overview.

Type	mrg-6	mrg-10	mrg-12	mrg-16	mrg-22
Maximum payload* [kg]	6	10	12	16	22
Weight [kg]	52	54	270	260	260
Work envelope radius [mm] approx.	900	1,100	1,810	1,610	1,610
Position repeatability** [mm]	±0.03	±0.03	±0.04	±0.05	±0.05
Highest measurement resolution [°]	0.01	0.01	0.01	0.01	0.01
Angle repeatability [°] [of up to]	±0.005	±0.005	±0.005	±0.005	±0.005

Type	mrg-30	mrg-60	mrg-120	mrg-240	mrg-500
Maximum payload* [kg]	30	60	120	240	500
Weight [kg]	665	665	1,049	1,104	2,385
Work envelope radius [mm] approx.	2,030	2,030	2,500	2,500	2,826
Position repeatability [mm]	±0.06	±0.06	±0.06	±0.06	±0.08
Highest measurement resolution [°]	0.01	0.01	0.01	0.01	0.01
Angle repeatability [°] [of up to]	±0.005	±0.005	±0.006	±0.006	±0.03

Detector mountings	Wall, floor, ceiling or rail system mounting
Measurement data	Depending on the configuration: luminous intensity distribution (LID), luminous flux, colorimetric data (COA), luminance, glare rating, ray data, etc.
Power supplies	A number of high-quality DC and AC lab power supplies that can be controlled directly from the software are available with robogonio.

\*Test pieces with high mass moments of inertia (e.g. very long test pieces) can lead to a reduction of the payload.

\*\*The details for mrg-12 and mrg-22 were still provisional at the time the brochure was published.

## Configured as per your requirements

Detectors & more

opsira detectors offer established quality and a great number of measurement options. From the classic luminous intensity distribution to high-precision ray data –

configure the robogonio as per your requirements. The following configurations are available, can be combined or they are easily retrofitted.

Configuration and expansion packs

	Configuration	Detectors/systems
-f	Goniophotometer (far field)	Photometer frc'3
-l	Goniophotometer (far field)	High-end photometer (class L) frc'-f-l
-spr	Goniospectroradiometer	Spectroradiometer spr'3
-spc	Goniospectrometer	Spectrometer spec'3
-si	Near field goniophotometer (near field, far field, ray data)	Luminance measuring camera luca Photometer frc'3
-sic	Ray data goniophotometer (near field, far field, ray data, polychromatic)	Luminance and colorimetry camera luca'color and spectroradiometer spr'3
-rr	Goniophotometer system for measuring the retro-reflection	High-end photometer (class L) frc'-f-l Projector

Additional options

lmg	Power measuring devices
kl	Climate sensors
tes	Temperature sensors



## Switchboard and multiplexer

Excellent integration.

With the robogonio, you get an all-round carefree package. We plan and configure the integration of the robogonio in your measuring lab as per the respective requirements. The wide range of accessories includes integrated power supplies, power measuring devices, multiplexers, electrified mounting adapters and thermal sensors for luminaires. Once the robogonio is installed and tested on site by opsira, it is ready for use immediately.

### Switchboard

- Main operating switch module with emergency stop and release function
- Switch panel for easy connection of test pieces to supplies and electrical measuring technology (in connection with a mounting adapter)
- Drawer for storing measuring accessories
- Power supplies (AC & DC)
- robogonio control (only with mrg-6 and mrg-10)
- Control PC (19" industrial PC)

The multiplexer doesn't just enable you to control various channels. Even measurements of parameters with different current, voltage and power requirements are carried out with just one lab power supply and one power measuring device.

### Multiplexer

- 1-to-4 multiplexer for automated switching of supply and test channels via power electronics, cascable
- Integration in the robogonio mounting adapter
- Switching of supply and measuring lines
- Control via the Gonio software
- Option principally for automotive applications

## Mounting adapter and thermal sensors

Simplified connection and measuring.

For easy connection to the robogonio and direct testing of any kind of test piece, be it an elongated light guide, a signal light or an LED, it is possible to retrofit an optional mounting adapter as part of our system. It is intuitively operated and has an integrated power supply that almost eliminates the need for any further connections or cables.

### Mounting adapter

- Slot system for easy installation of test pieces
- 230 volt supply with ground contact
- Banana jacks with protective ground conductor
- SUB-D, 9-pin (D-SUB 9F or D-SUB 9S)
- RJ45 jack, UAE (universal connection unit) 8(8)

Temperature information is extremely important when measuring LED systems. Various questions need to be answered: How hot does the LED get during operation? How does the power change? Which maximum temperatures can be achieved? The thermal sensors determine these values and our software logs them.

### Thermal sensors

- Temperature sensors for measuring and recording the temperature at up to 10 measuring points (thermocouple input J, K, T, E, R, S, B, N, C, L, M, L DIN 43710)
- Integration in the robogonio mounting adapter (goniometer table)
- Reading out the temperature measuring points with the goniophotometer software



## Photometer and auxiliary photometer

Flexible and powerful. frc'3.

Depending on the configuration, the photometer/radiometer frc'3 can measure sources of light and radiation from ultraviolet to infrared quickly and efficiently.

When the frc'3 is equipped with an optional filter wheel, radiometric and photometric filtering is possible in one and the same device. Beside broadband radiometric fil-

ters or  $V(\lambda)$  filtering, other spectral adaptations can also be realised. The smaller auxiliary photometer frc'3-h is mounted on a test piece in such a way that it is stationary and rotates jointly with it. During the run-up period and the measuring process, it provides measuring values according to DIN EN 13032-4.

Typical bandwidth (photometer)	360 – 830	nm
Measuring ranges	4	
Dynamic	100 mLux < E < 1 MLux or 10 cd < I < 100 Mcd	
Sensor	integral sensor	
Filter wheel positions (optional)	4	
Measuring values per second	0.8	
Linearity	> 99.7	%
Spectral adaptation $f_1$	< 4	%
Diffuser option	opaque fused quartz	
Assessment true to $\cos f_2$ (with diffuser)	< 0.5	%
Instrument class (DIN 5032, T7)	A	
Dimensions (diameter, height)	Ø 68, height 60	mm
Weight	400	g



## The high-end photometer

Highest precision. Quick scans. frc-f-l.

As the top model among the opsira photometers, the frc-f-l scans luminous intensity distributions very quickly and with excellent accuracy. It meets the requirements for the highest photometer class L and picks up pho-

tometric measuring values in the kilohertz range. The measuring head is equipped with a thermostat to guarantee reproducible and reliable measuring results.

Typical bandwidth (photometer)	360 – 830	nm
Measuring ranges	13 (autorange function)	
Dynamic	10 $\mu$ Lux < E < 10 kLux or 1 mcd < I < 1 Mcd	
Sensor	integral sensor	
Measuring values per second	max. 125,000	
Linearity	> 99.9	%
Spectral adaptation $f_1$	< 1.5	%
Diffuser option	opaque fused quartz	
Assessment true to $\cos f_2$ (with diffuser)	< 0.5	%
Instrument class (DIN 5032, T7)	L	



## The spectrometer

Quick and extensive. spec'3.

The spectrometer spec'3 enables the measurement of spectral power distributions from UV to NIR. Colorimetric values in the visible spectral range according to CIE are provided directly. In combination with the robo-

gonio, the angular dependent colour behaviour (colour over angle) of light sources or luminaires can be measured quickly and easily.

Spectral distribution*	$S(\lambda)$
Colour coordinates*	$x, y / u', v' / L^*a^*b^*$
Colour temperature*	$T, T_n [K]$
Colour rendering indices*	$R_1-R_8, R_a, R_9-R_{14}, R_{15}$ (CIE 13.2, DIN 6169), $R_f$ and $R_g$ (IES-TM30-15)
Colour saturation*	$S [\%]$
Button angle*	$h [^\circ]$
Dominant wavelength*	$\lambda_d$
Transmittance	$T(\lambda) [\%]$ (specular, diffuse)
Reflectance	$R(\lambda) [\%]$ (specular, diffuse)
Wavelength bands	any bands between 180 nm and 2,500 nm possible
Pixel count of detector	approx. 2,048
A/D converter	16 bit/1 MHz
Wavelength resolution	0.03 nm to 10 nm FWHM
Measuring dynamics	$2 \times 10^8$ (system), 1,300:1 (individual measurement)
Linearity	> 99.8 %
Scatter light suppression	0.05 % @ 600 nm/0.10 % @ 435 nm
Integration times	1 ms to 65 s

\*These values also apply for the spectroradiometer spr'3 on the opposite side.

## The spectroradiometer

Complete solution for light and colour. spr'3.

Providing the luminous or radiant intensity and the absolute spectral distributions, the spectroradiometer spr'3 makes the robo-gonio a complete solution for light and colour.

By the way  
The spectroradiometer spr'3 can also be used as a stand-alone instrument for measuring illuminances, colour temperatures, or colour rendering indices.

Bandwidth	360 – 830 (other ranges possible)	nm
Wavelength resolution	0.03 nm – 10 nm FWHM	nm
Integration time	1 – 20,000	ms
Measuring dynamics (spectrometer)	$2 \cdot 10^8$ ; 1,300:1 (individual measurement)	
Linearity (spectrometer)	> 99.92	%
Scatter light (spectrometer)	0.05 % @ 600 nm, 0.1 % @ 435 nm	
Detector (spectrometer)	Si CCD array	
Measuring ranges (radiometer)	4	
Sensor (radiometer)	integral silicone sensor	
Linearity (radiometer)	> 99.7	%
Spectral adaptation	negligible due to spectral correction	
Diffuser option	opaque fused quartz	
Assessment true to $\cos^2$ (with diffuser)	< 0.5	%
Instrument class (DIN 5032, T7)	A	
Dimensions (WxDxH)	125 x 85 x 125	mm
Weight	1.3	kg



## The luminance camera

High dynamics and flexibility. luca.

The spatially resolving luminance camera luca measures the luminance distribution on small light sources or large luminaires. Thanks to the high dynamics of around six magnitudes, luca measures low-luminance objects (few  $\text{cd/m}^2$ ) as well as strong light sources such as high-pres-

sure discharge lamps quickly and easily. Depending on the requirements, the cameras are provided cooled and with LINOS/Rodenstock precision lenses. They work in 12-bit or 18-bit mode (software-supported).

Measuring range	200 $\text{mcd/m}^2$ – 1.2 $\text{Mcd/m}^2$
Integration time	0.1 ms – 2 s (cooled up to 10 s)
Binning mode	single to double
Digitalisation depth	12 bit
Measuring dynamics	63 dB (cooled up to 66 dB)
Photometric adaptation	$V(\lambda)$ , $f_1 < 4\%$
Linearity error	$f_3 < 0.6\%$
Luminance measurement inaccuracy	4 % @ 3,200 K
Luminance repeatability	< 0.6 %



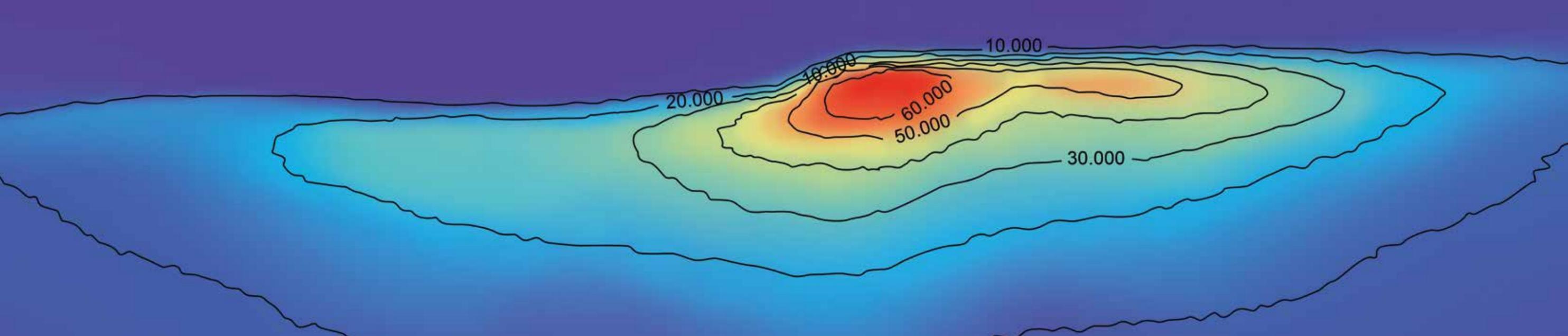
## The colorimetry camera

Luminance and colour distribution. luca'color.

Beside the luminance, the luminance and colorimetry camera luca'color measures the spatially resolved colour distribution – but not in a punctual manner as in a standard colorimeter, but areal and in a single shot.

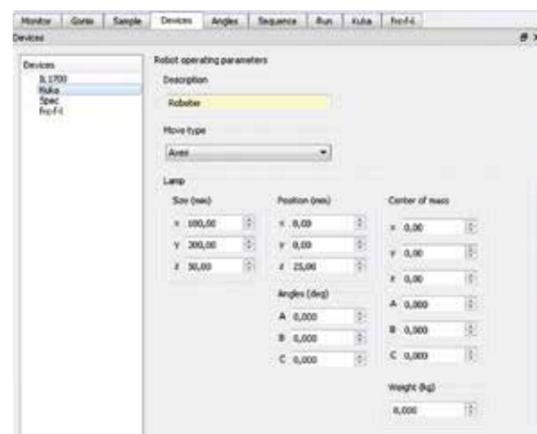
luca'color is equipped with an integrated filter wheel with ten positions and enables the direct measurement of tristimulus values according to CIE.

Measuring range	200 $\text{mcd/m}^2$ – 1.2 $\text{Mcd/m}^2$
Integration time	0.1 ms – 2 s (cooled up to 10s)
Binning mode	single to double
Digitalisation depth	12 bit
Measuring dynamics	63 dB (cooled up to 66 dB)
Number of filters	up to 10 filter positions are available
Photometric adaptation	$V(\lambda)$ , $f_1 < 4\%$
Colorimetry	tristimulus adaptation, $X(\lambda) f_1 < 7\%$ , $Z(\lambda) f_1 < 7\%$
Linearity error	$f_3 < 0.6\%$
Luminance measurement inaccuracy	4 % @ 3,200 K
Measurement inaccuracy x, y, CIE 1931	@ 3,200 K +/- 0.004
Luminance repeatability	< 0.6 %
Repeatability x, y, CIE 1931	+/- 0.0004



### Software and reporting functions.

- All opsira goniophotometer applications and all components can be operated directly using the gonio software.
- The software supports measurements in various coordinate systems. These include C-planes, B-planes, and cartesian coordinates (scanning).
- When configured in XML, it allows calling up pre-defined measurements and creating user-defined processes.
- If desired, these can be simulated and visualised before taking the actual measurement.
- The software provides the measuring results as raw data, for example in CSV format, or as reports in PDF files.
- The light distribution can be exported in IES and EULUMDAT file format.



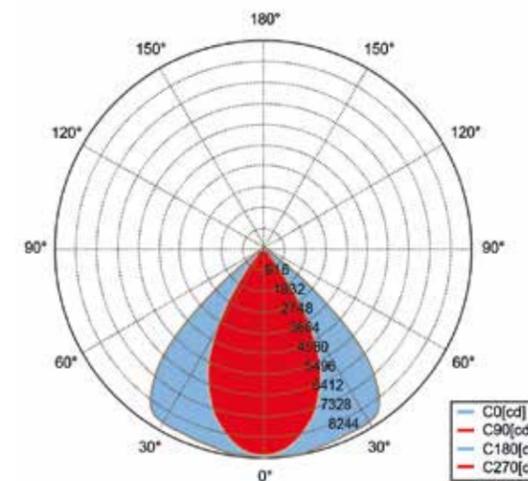
Every instrument, whether a goniophotometer, a detector system, or an auxiliary sensor system, is easily configured with separate setting menus.



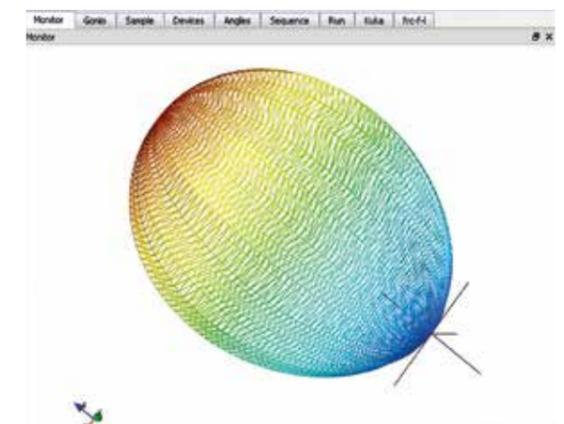
The software delivers freely configurable large displays for every measuring quantity.

### Polar LDC

The graphical plot of the luminous intensity distribution curve can be configured individually and customised with the most important data for light planning. Templates derived from this can be saved and retrieved at any time, which enables you to always work with the same graphics.



Our evaluation software provides data in the way our customers need it.



The luminous intensity or illuminance distributions can be visualised in various evaluation graphs. Depending on the application, specific test reports are generated directly in PDF format.

By the way  
Of course, the roboGonio software also provides for safety. The implemented collision control makes sure that the interaction between test piece, space, and the roboGonio functions smoothly.

# A wide range of accessories

Options for every requirement.

## Electrics and mechanics.

The main electric control cabinet is 600 mm wide, 1,800 mm high and 810 mm deep. Control boxes for robogonio  $\leq 10$  kg are integrated in the main cabinet. In this case, the control box has the following dimensions: W 483 mm x H 271 mm x D 460 mm. For robogonio  $> 10$  kg payload, our control box has the following dimensions: W 792 mm x H 960 mm x D 558 mm and is set up separately.

Safety components, such as safety laser scanners, are also available if required. We strongly recommend the cross-laser modules for easy set-up.

## Mechanics and options

A traversing rail for detectors and robogonio expands and simplifies the use of the devices. To achieve a camera-based (luca) measurement of illuminance distribution, a white wall (available in various sizes, fixed, pivotable or extendible) can be used as a projection

surface. A tripod, wall or ceiling mount can be used depending on how the detectors are used. Set-up stands are available in different sizes for ideal positioning of the robogonio and for an ergonomic adaptation of the workplace. Scatter light tubes are highly recommended for reducing the influence of scatter light.



## Lab power supplies.

DC – High resolution and accuracy	Voltage	Current	Power
OTS-LSV-DC-300	0 – 20 V	0 – 5 A	100 W
OTS-LSV-DC-301	0 – 32 V	0 – 3 A	96 W
OTS-LSV-DC-302	0 – 72 V	0 – 1.2 A	86 W
More models up to:	0 – 60 V	0 – 2.5 A	150 W

### DC – 3 channel

OTS-LSV-DC-310	0 – 30/30/5 V	0 – 3 A	195 W
OTS-LSV-DC-311	0 – 30/30/5 V	0 – 3 A	195 W
OTS-LSV-DC-312	0 – 30/30/5 V	0 – 6/3 A	375 W
OTS-LSV-DC-313	0 – 60/60/5 V	0 – 3 A	375 W

### DC – Constant voltage, current, and power supplies (autorange)

OTS-LSV-DC-320	0 – 80 V	0 – 60 A	1,200 W
OTS-LSV-DC-321	0 – 80 V	0 – 60 A	1,200 W
OTS-LSV-DC-322	0 – 150 V	0 – 30 A	1,200 W
More models up to:	0 – 160 V	0 – 120 A	6,000 W

### DC – High-performance constant voltage and current supplies (autorange)

OTS-LSV-DC-330	0 – 60 V	0 – 5 A	100 W
OTS-LSV-DC-331	0 – 60 V	0 – 10 A	200 W
OTS-LSV-DC-332	0 – 60 V	0 – 15 A	360 W
More models up to:	0 – 150 V	0 – 10 A	600 W

### AC – Linear voltage supplies

OTS-LSV-AC-040	0 – 150/300 V	3/1.5 A	300 W
OTS-LSV-AC-030	0 – 150/300 V	6/3 A	750 W
OTS-LSV-AC-020	0 – 150/300 V	12/6 A	1,500 W
OTS-LSV-AC-010	0 – 150/300 V	24/12 A	3,000 W

# Detailed planning & safety

We keep an eye on everything.

## Planning from A to Z.

opsira attaches great importance to counselling and accompanying its customers as a partner. Unlike mere product suppliers, we provide a custom-fitted and ready-to-use system. We look at the actual conditions on site, create a 3D-CAD plan, and deliver your robogonio once it is finished. Your system will be set up, installed, and calibrated by us.

### By the way

Cross-laser modules make the alignment of the luminaires during operation quick and intuitive. Thereafter, the robogonio maintains the centre of rotation in space with high precision.



## A safe working environment with robogonio.

Naturally, safety is a topic that is very important to us. The directives for operating a robogonio are exactly the same as for conventional goniophotometers. These are all defined by the standard EN ISO 12100 (Safety of Machinery) or the Product Safety Act.

The robogonio comes with a CE declaration of incorporation, otherwise opsira will help you implement this standard. On request, we issue an EC declaration of conformity for your installation.

## Specifications for an EC declaration of conformity (CE certificate)

Risk assessment according to machinery directive

Preparation of the safety concept

Verification of the performance level achieved

Verification of the user manual

Compilation of checklists

Safety inspection of the system

Final report

Issuing of the EC declaration of conformity

# Calibration, training, support

We are pleased to support you.

Calibration and after-sales support – everything you need.

We perform the initial set-up of the robogonio on site as part of the initial installation and commissioning of the system. After that, our service packages guarantee high and permanent reliability. If requested, the typical service takes place once a year and includes, among other things:

- checking the alignment of the entire system
- checking the angular accuracy of the goniophotometer
- calibrating the photometer and
- checking the safety of the system.

If your light-measuring section is equipped with a luminance camera or a spectral measuring system, they are to be sent to opsira before the service date. These components are then calibrated in the opsira calibration lab and reintegrated in your system as part of the service work. This way, we can limit your downtime to a few days.

If you wish for or require a TÜV calibration, this can be effected according to the latest requirements and according to the GTB.

By the way

The robogonio is based on a multifunctional and modular concept. Therefore, it is no problem at all to add more functions (such as near field goniophotometry for generating ray data later) at a later stage.



On site or in the opsira light lab – training courses for every requirement.

For quick and efficient work with the robogonio, we offer various training modules. Team training can be conducted on our in-house opsira demo system before your own robogonio is delivered. On the other hand, we also offer a basic training course on site, which takes place after your robogonio has been set up. Both options aim to familiarise all employees with basic topics such as goniophotometric measurements, the measurement of luminous intensity distributions and/or ray data, implementation of software and how to evaluate the results.

The advanced training takes place four to eight weeks after the basic module as a follow-up course. Here, we cover all questions that might have come up during the first measurements and deliver a deeper understanding to the users on what the robogonio has to offer.

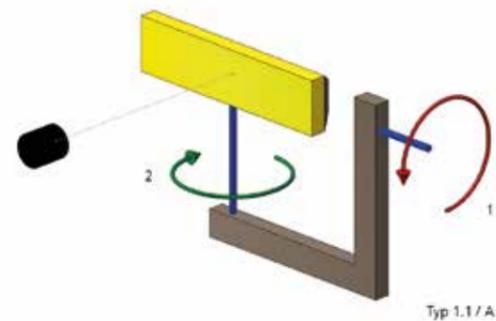
By the way

We also offer basic training courses on the topics of general photometry, colorimetry, and optical measurement technologies.



# Goniophotometry

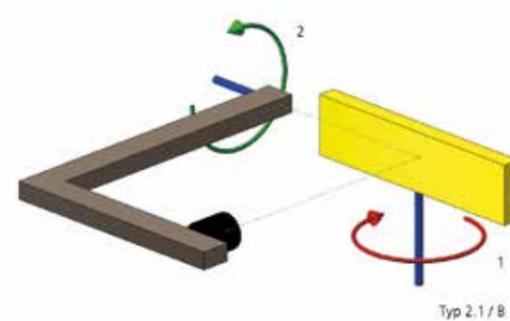
Old and new.



Conventional: Goniophotometer type 1.1, A planes



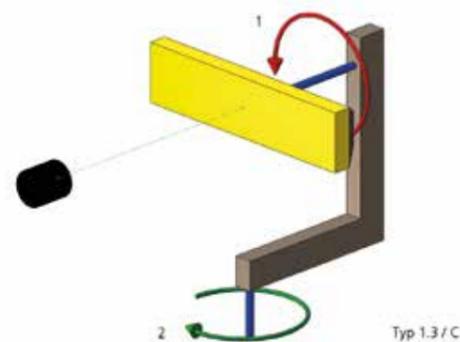
robogonio: Goniophotometer type 1.1, A planes



Conventional: Goniophotometer type 2.1, A or C planes



robogonio: Goniophotometer type 2.1



Conventional: Goniophotometer type 1.3, C planes



robogonio: Goniophotometer type 1.3, C planes

## More flexibility for your measurements

For all types of goniophotometer types, the robogonio moves the luminaire exactly like any conventional goniophotometer. However, due to its flexibility in space, it is possible to freely select the length and width of the test piece together with the centre of rotation in space. So the system presents new measuring possibilities, including the scanning of geometries or elongated light guides.



robogonio: scanning geometries in space



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