

RiGO 801

LED



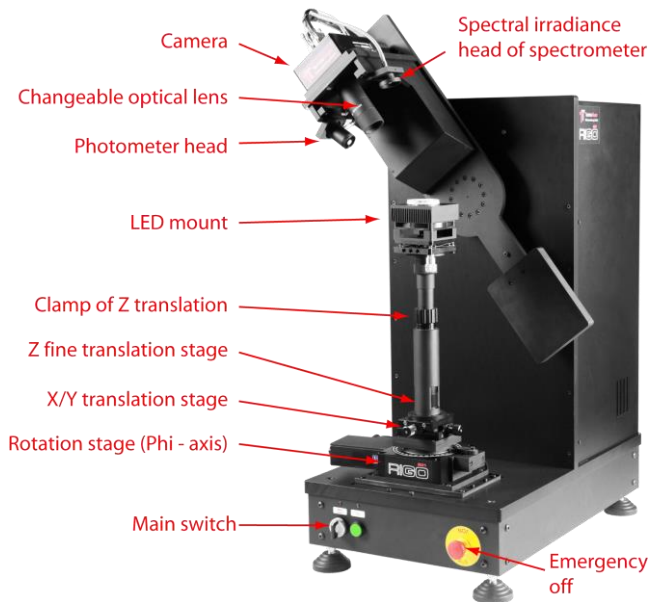
Specification 2019-03-28

Table of contents

TABLE OF CONTENTS	2
RIGO801 - LED	3
SPECIFICATIONS.....	3
LED MOUNT	4
HEAT SINK AND FAN	4
THREAD GRID.....	4
TEMPERATURE SENSOR	5
PLUG.....	5
1-WIRE USB ADAPTER	5
CONNECTOR PIN ASSIGNMENT	6
MEASURING COMPONENTS	7
LMK98 – 4 FILTER WHEEL EXTENSION.....	7
LMK98 – 4 IMAGE-RESOLVING LUMINANCE MEASURING CAMERA	7
LMK98 – 4 COLOR.....	9
OPTICAL LENS TT 6.5	10
OPTICAL LENS TT MACRO	10
ND FILTER SET	10
PHOTO CURRENT AMPLIFIER (CZIBULA & GRUNDMANN GMBH).....	11
PHOTOMETER HEAD (CZIBULA & GRUNDMANN GMBH).....	11
SPECTROMETER JETI SPECBOS 1211-LAN.....	11
EVALUATION COMPUTER	13
SOFTWARE	13
RiGO801 BASE SOFTWARE	13
CONVERTER801 RAY DATA GENERATION SOFTWARE.....	14
LMK LABSOFT LUMINANCE MEASURING SOFTWARE (FULL VERSION)	14
LMK LABSOFT COLOR EXTENSION.....	15
LMK LABSOFT ACTIVE X EXTENSION	15
ADDITIONAL COMPONENTS	16
STANDARD LAMP FOR LUMINOUS FLUX FOR RIGO 801 – LED	16
SPECIFICATION.....	16
INSTALLATION OF THE GONIOPHOTOMETER AND USER TRAINING	16

RiGO801 - LED

The Goniophotometer series type RiGO801 utilizes a new image-resolving CCD measuring technique for determining ray data and luminous intensity distributions. The correct determination of the luminous intensity distributions (LID) of LEDs, lamps and luminaires is performed far within their photometric limiting distance on the basis of image-resolved measurements of luminous intensity distributions.



Our LED goniophotometer is especially designed to measure high precision ray data but also the far-field LID. The DUT is mounted on top of the vertical Phi – Axis that rotates 360 degree. The camera and photometer move on an arc bow.

The DUT position can be adjusted by precise x/y/z stages. The electrical interface between DUT mount socket and Phi-Axis is a 12-pin socket that offers also customer specific DUT mount sockets.

The goniophotometer is a compact self-standing device that can operate in a small room or a small black cabin.

Figure 1: Near-field goniophotometer RiGO801 for LEDs/OLEDs and modules, equipped with spectrometer (option)

Specifications

Goniometer mechanic	
Maximum size of test object:	≤ 200 mm (diameter of luminous area)
Space required:	LxWxH = approx. 700 x 700 x 1000 mm ³
Movement:	The measuring camera and the illuminance meter are moved on a circular path around the lamp (horizontal θ-axis). The lamp/LED itself is turned around a vertical φ-axis.
Measuring position of the test object:	Test object upstanding, rotated around vertical axis.
Measuring distance:	~160 mm
Travel path:	φ = 0° ... 360°, δ = -143° ... 143°
Positioning accuracy:	φ < 0.02°, δ < 0.05°
Repetitive accuracy:	φ < 0.01°, δ < 0.02°
Ray data accuracy:	< 0.01 mm
Material	Aluminium, black anodised
Drives and Gears	High precision HarmonicDrive and Newport units

LED mount

The LED mount consists of a fan cooled heat sink, a leveling element and a fixable plug connection. The heat sink has a grid of threads for the fixing of the DUT, e.g. a LED-board. A 1-wire temperature sensor is situated in the center of the heat sink. The plug provides contacts for the DUT power, the sense lines, the fan supply, the 1-wire signal and USB interface for future purpose. All signals can be contacted at the back panel of the goniophotometer.

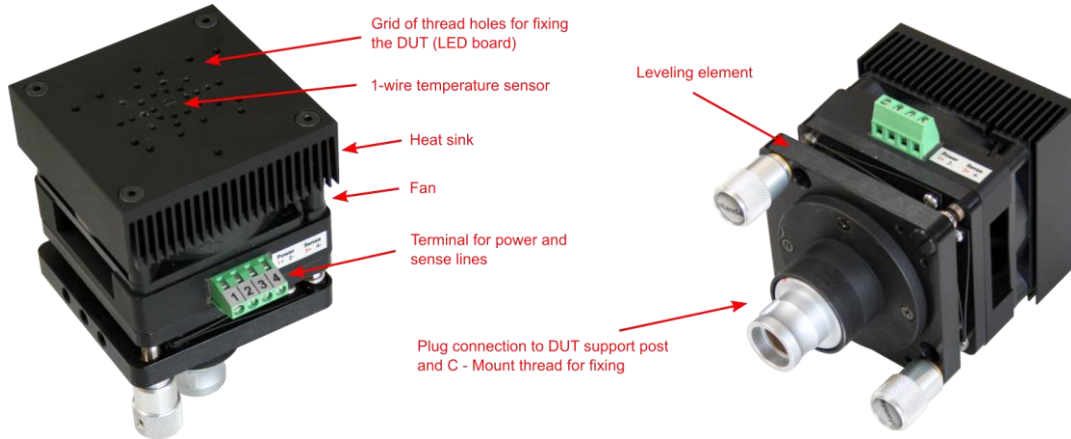


Figure 2: LED mount

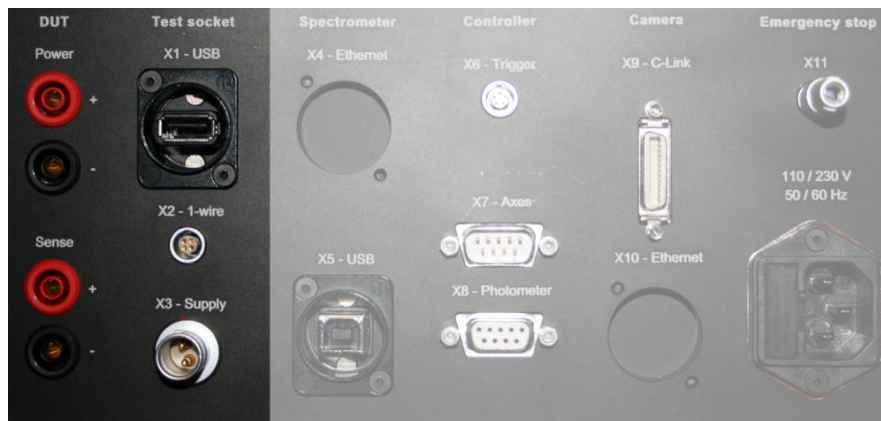


Figure 3: Back panel connections to LED mount plug
Heat sink and fan

Dimension	75 x 75 x 25 mm
Fan	ebm-papst 712F, 12V DC, air flow 44 m ³ /h
Temperature max.	60 °C

Thread grid

The inner thread pattern (M2 and M2.5 threads) has been designed to fit for all common LED boards. They are arranged as opposing pairs so that at least two screws can be used for fixing the board. Please refer to Figure 4 for details of the thread positions.

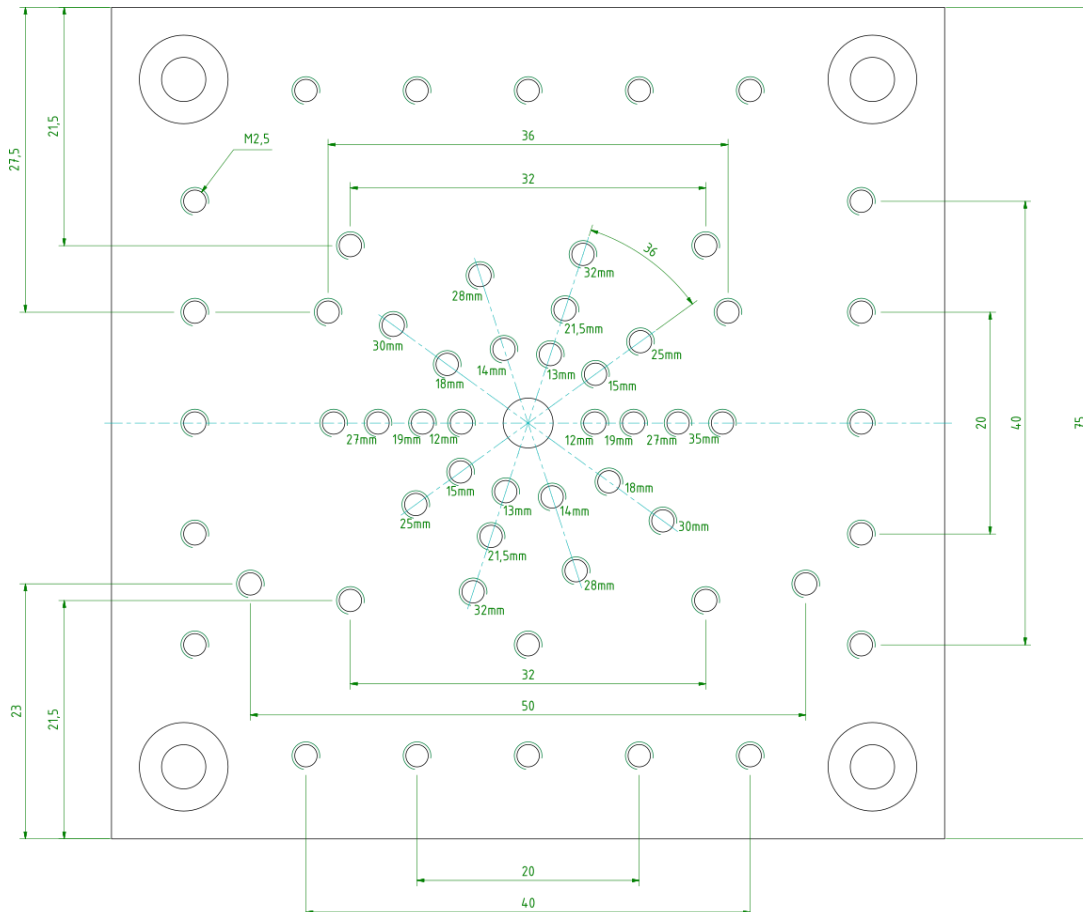


Figure 4: Grid of thread holes for fixing the LED board
Temperature sensor

Article description	18B20 (Dallas Semiconductor)	
Description	Digital thermometer sensor in TO92 housing, communication via 1-wire Bus	
Temperature range:	-55°C to +125°C	
Resolution:	9 to 12 Bit	
Accuracy:	+/- 0,5°C (-10°C to 85°C)	

Plug

Type	12 pins, Lemo FAG.4B.312.CLA
Power lines	Maximum 60 V AC/DC / 12 A

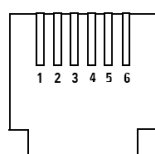
1-wire USB adapter

Manufacturer: Eclo (<http://www.eclo.pt>)

Type: PN10000500011




FIGURE 2
RJ-11 socket pin-out
(looking into socket)



pin	signal
1	NC
2	NC
3	1-Wire data
4	1-Wire GND
5	NC
6	NC

Figure 5: 1-wire USB adapter

Connector Pin assignment

	Socket (Goniometer): Lemo EGG.4B.312.CLL	Plug: Lemo FAG.4B.312.CLA
-----------------------------------------------------------------------------------	------------------------------------------------	---------------------------------

Pin	Funktion	
1	Power +	Max. 60V / 12A
2	Power -	
3	Sense +	
4	Sense -	
5	Power Messfassung (+)	
6	Power Messfassung (-)	
7	1-wire Data	1-wire
8	1-wire GND	
9	USB VCC	USB
10	USB Data +	
11	USB Data -	
12	USB GND	
Earthing at plug housing		

Measuring components

LMK98 – 4 Filter wheel extension

The LMK 98-4 with filter wheel extension is equipped with a filter wheel with 6 positions. Beside our pre defined color set in case of our LMK98-4 color measuring camera the filter types can be defined individually (e.g. special spectral filters, ND filter).

For RiGO801 measurements the camera is used in a special digital 2x2 binning mode. The filter wheel position can be selected by software for each measurement (ray data or luminous intensity distribution). Measured images are used internally in the software for ray data calculation. The evaluation of images in full resolution is available in combination with the software package LMK LabSoft.



Figure 6: LMK98 with filter wheel

Specifications:

Please refer also to the specifications of the base camera LMK98-4.

Filter wheel:	6 positions
Control	By software

More information available on <http://www.technoteam.de>

LMK98 – 4 Image-resolving luminance measuring camera

The LMK 98-4 is a high-tech digital CCD camera system equipped with a precise analogue electronic system for signal generation. Each camera is provided with a especially calculated and manufactured full filter in order to achieve a high-quality $V(\lambda)$ -adaptation for determining the luminance.

For RiGO801 measurements the camera is used in a special digital 2x2 binning mode and the measured luminance images are used internally in the software for ray data calculation. The full resolution and the evaluation of luminance images is available in combination with the software package LMK LabSoft.



Figure 7: LMK98 - 4

Specifications:

Type	Kappa DX 4
Sensor	CCD Sony ICX 285 AL (2/3")
Full Resolution (effective pixel)	1390 (H) x 1040 (V)
Binning resolution in RiGO801 mode (effective pixel)	695 (H) x 519 (V)
Video signal	12 bit digital, progressive scan, data transfer with CameraLink interface (max. 20m PC-cable)
Video signal in RiGO801 mode (digital binning)	13 bit digital, progressive scan, data transfer with CameraLink interface (max. 20m PC-cable)
Dynamic (luminance-measurement)	Single picture measurement: 1:1100 (~ 61 dB) Multi picture measurement: 1:3600 (~71 dB) High Dynamic measurement: 1:10000000 (~ 140 dB)
Measurement values	Luminance: L (cd/m ²) Further measuring quantities can optionally be defined via scaling factors
V(λ) adaption	V(λ) – full filter-adapted, f1' typical < 3.5 %
Measuring range	Setting the luminance measuring ranges by choosing the integration time from 100 μ s...15 s Accuracy rating depending on lens (aperture number = k), e.g.: 1ms ~ 1800 cd/m ² & 3s ~ 0.6 cd/m ² (k = min.) 1ms ~ 60000 cd/m ² & 3s ~ appr. 20 cd/m ² (k = max.) Higher luminances can be achieved using optional neutral density filters.
Calibration uncertainty ¹	fix focused lenses ΔL [< 2%]
Repeatability ²	ΔL [< 0.1%]
Measuring accuracy	ΔL [< 3% (for standard illuminant A)]
Uniformity	ΔL [< 2%]

More information available on <http://www.technoteam.de>

¹ Calibration according to DIN 5032 Part 6 using a luminance standard traced back from the Physical-Technical Federal Institute

² Measurement performed on a stabilized white LED light source L=100cd/m². Mean value over 100 Pixel; repeatability as variability of the mean value

LMK98 – 4 color

The LMK 98-4 color is equipped with a filter wheel for colour measurement, adapted to the CIE colour matching functions of the 2° standard observer (CIE 1931). Thus, luminances and colour coordinates can be measured in a spatially resolved way. The filter wheel permits a total of 6 filters to be incorporated, with 4 filters being necessary for colour measurement. In addition, the measuring system can also be equipped with filters for the scotopic luminance $V'(\lambda)$, the circadian function of action $C(\lambda)$, an IR-filter (measurements in the NIR range 780-1000 nm), a BLH (blue light hazard), or a clear glass filter .

For RiGO801 measurements the camera is used in a special digital 2x2 binning mode. The filter wheel position can be selected by software for each measurement (ray data or luminous intensity distribution). Measured images are used internally in the software for ray data calculation. The full resolution and the evaluation of luminance and color images is available in combination with the software package LMK LabSoft.

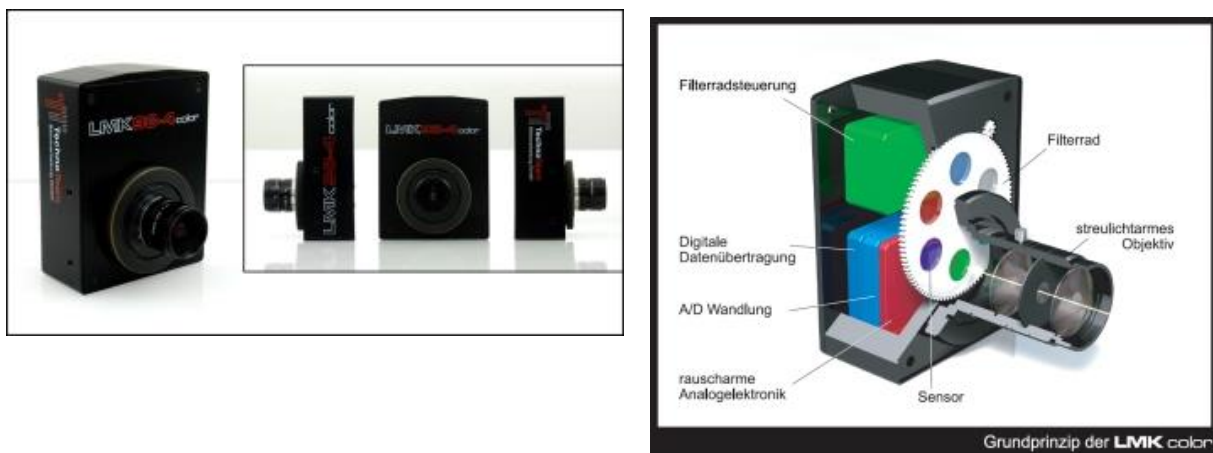


Figure 8: LMK98 – 4 color camera

Specifications

Type	Kappa DX4
Sensor:	CCD Sony ICX 285 AL (2/3")
Full Resolution (effective pixel)	1390 (H) x 1040 (V)
Binning resolution in RiGO801 mode (effective pixel)	695 (H) x 519 (V)
Video signal	12 bit digital, progressive scan, data transfer with CameraLink interface (max. 20m PC-cable)
Video signal in RiGO801 mode (digital binning)	13 bit digital, progressive scan, data transfer with CameraLink interface (max. 20m PC-cable)
Dynamic (luminance-measurement)	Single picture measurement: 1:1100 (~ 61 dB) Multi picture measurement: 1:3600 (~71 dB) High Dynamic measurement: 1:10000000 (~ 140 dB)
Measuring quantities	Luminance: L (cd/m ²), chromaticity coordinates: x,y, Supported colour spaces: RGB, XYZ, sRGB, EBU-RGB, User, Lxy, Luv, Lu'v', L*u*v*, C*h*s*uv, L*a*b*, C*h*ab, HIS, HSV, HSL, WST ³

³ Dominant wavelength, saturation, correlated color temperature

	Further measuring quantities can optionally be defined via scaling factors.
Filter wheel	6 positions (x1, x2, y, z, glass, user defined)
V(λ) adaption	V(λ) – full filter-adapted, f1' typical < 3.5 %
Measuring range	Setting the luminance measuring ranges by choosing the integration time from 100 μ s...15 s Accuracy rating depending on lens (aperture number = k), e.g.: 1ms ~ 1800 cd/m ² & 3s ~ 0.6 cd/m ² (k = min.) 1ms ~ 60000 cd/m ² & 3s ~ appr. 20 cd/m ² (k = max.) Higher luminances can be achieved using optional neutral density filters.
Calibration uncertainty ⁴	fix focused lenses ΔL [< 2%]
Repeatability ⁵	ΔL [< 0.1%] $\Delta x,y$ [< 0,0001]
Measuring accuracy	ΔL [< 3% (for standard illuminant A)] $\Delta x,y$ [< 0.0020 (for standard illuminant A)] $\Delta x,y$ [< 0.0100 (set of test colours)] ⁶
Uniformity	ΔL [< 2%]

More information available on <http://www.technoteam.de>

Optical Lens TT 6.5

- Focal length: 6.5 mm
- Aperture angle: ~54 deg
- Photometrically corrected (shading / flat-field)
- Distortion-corrected

Optical Lens TT Macro

- Focal length: Macro
- Aperture angle: ~2.6 deg
- Photometrically corrected (shading / flat-field)
- Distortion-corrected

ND Filter set

- 6 ND Filters with transmissions from ~25 % ... ~0.02 %
- Filter thread 30.5 x 0.5 mm (RiGO – LED), 35.5 x 0.5 mm (RiGO – Lamps)
- For RiGO – Luminaires: Special mount, Filter thread 49 x 0.75 mm

⁴ Calibration according to DIN 5032 Part 6 using a luminance standard traced back from the Physical-Technical Federal Institute

⁵ Measurement performed on a stabilized white LED light source L=100cd/m². Mean value over 100 Pixel; repeatability as variability of the mean value

⁶ Measured value based on 30 test colors with different spectral distributions based on ROSCO color filters

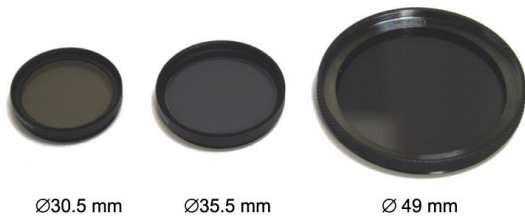


Figure 9: Three ND filter diameters

Photo current amplifier (CZIBULA & GRUNDMANN GMBH)



- Current range: 0.1 pA to 1 mA
- Illuminance range (RiGO801 configuration): 0.7 ... 690000 lx
- Integration time: 10ms to 400ms
- Number of ranges: 13
- Linearity: < 0.1 %

Photometer head (CZIBULA & GRUNDMANN GMBH)

- $V(\lambda)$ -calibrated $f1' < 1,5 \%$
- Cosine - adaptation $f2 < 1,5 \%$

Spectrometer JETI Specbos 1211-LAN



Figure 10: Spectrometer Specbos 1211-LAN

Short specifications

Optical Parameters	
Spectral range:	350 nm - 1000 nm
Optical bandwidth:	4.5 nm
Wavelength resolution:	1 nm
Digital electronic resolution:	16 Bit ADC (15 Bit used)

Measuring values:	<ul style="list-style-type: none"> • Spectral radiance • Total luminance/ total radiance • Total illuminance/ total irradiance • Chromaticity coordinates x , y ; u', v' • Correlated Color Temperature, color purity • Color Rendering Index, RGB • Circadian metrics, Photosynthetically Active Radiation
Measuring ranges and accuracy	
Measuring range luminance:	0.1 - 2500 cd/m ² (higher values with optional filter)
Measuring range illuminance	2 - 10 000 lx
Luminance accuracy	± 2 % @ 1000 cd/m ² and 2856 K
Luminance reproducibility	± 1 %
Chromaticity accuracy	± 0.002 x , y @ 2856 K
Color reproducibility	± 0.0005 x , y
CCT reproducibility	± 20 K @ 2856 K
Wavelength accuracy	± 0.5 nm
Other technical data	
Interface:	Ethernet
Dimensions	180 mm * 82 mm * 53 mm
Dispersive element	Imaging grating (flat field)

For the detailed technical specification please refer to the web site:

<http://www.jeti.com/cms/index.php/instruments/radiometer/specbos-1211>

Cosine-corrected Irradiance Probe ACC 015

The cosine-corrected irradiance probe ACC 015 is adapted to the spectrometer through a 300 mm optical fibre.



Wavelength range:	350 ... 1000 nm
Diffusor diameter	7 mm
Barrel diameter:	12 mm

Evaluation computer

- Advantech SYS-4U400-4S03, Rackmount
- Intel® Core™ i7-4770S Processor
- 4GB DDR3-1333
- DVD-RW drive
- 500 GB SATA HDD
- Expansion Slots 3x PCI 32-bit/33 MHz, 2x PCIe x 1 (Gen2), 2x PCIe x16 (Gen3)
- 2x GbE LAN, 2x DVI, 1x VGA, 2 USB 3.0; 7 USB 2.0 (1 x USB Type-A)
- Windows10 Professional / 32 Bit
- Two RS232 ports

Software

RiGO801 base software



The measuring program RiGO801 offers the operator a comfortable setup and execution of the measurement.

Feature list

- Easy alignment of the objects to be measured by means of the measuring camera. Image grid which can be activated, and metric coordinate system
- Fast on-the-fly measurement
- Measurement of luminous intensity distributions with the camera in the case of large measurement objects in relation to the sensor distance (near-field mode) or with the photometer in the case of small objects to be measured (far-field mode)
- Saving in the TechnoTeam – format (.TTL), conversion into various standard formats (LDT, IES). The measurements will be evaluated using LumCAT.
- Angular step sizes 0.1° ... 2.5° (camera), 0.1° ... 90° (photometer)
- Capturing ray data, saving in the TechnoTeam – format (.TTR). Conversion into various standard formats using the Converter801 program.
- Spectrometer measurement according to IES-LM-79-08, CIE S 024 / EN 13032-4 (option)
- Protocolling the pole illuminances for stability monitoring (pole monitoring)
- Protocolling the stabilizing process and automatic start of the measurement
- Controlling the filter wheel of a color measuring camera (option)
- Data acquisition of external devices (e.g. power analyzer or data logger)
- Synchronisation of external data acquisition software to the measurement by triggering
- Batch processing of several measurements
- Available languages: German, English

Converter801 ray data generation software



The program Converter801 is used to process the TechnoTeam ray data files (.TTR). The conversion into various file formats with ray tracing on different target geometries is possible. Embedded additional information as the luminous intensity distribution, luminance images, DUT alignment, the burn-in protocol and acquired measuring values of external measuring devices (e.g. Power Analyzer) can be visualized and exported. An additional integration of spectral information is possible (spectrum → wavelength per

ray).

Feature list

- Visualization of all data (ray data, luminous intensity distribution, luminance images, alignment of the object to be measured, burn-in protocol as well as the logged measurement data of external devices such as power analyzer) contained in TechnoTeam ray files (.TTR).
- Generation of various ray data formats (TM25, ASAP, Optis, LightTools, LucidShape, Zemax, TracePro, SimuLux, Photopia)
- Raytracing to basic geometries (sphere, cylinder, cuboid)
- Rotation and displacement of the ray data
- Integration of spectral information possible (spectrum → wavelength per ray)
- Recalculation of the luminous intensity distribution in other angular resolutions
- Output of the luminous intensity distribution in various formats (EULUMDAT, IES)
- Provision of customized formats possible
- Batch processing of conversion processes
- API for accessing the TechnoTeam ray data format
- Available languages: German, English

This software is free of license fees and can be used without any restrictions and transferred to any ray data users.

LMK LabSoft luminance measuring software (full version)

The LMK LabSoft is a laboratory software package that offers a variety of functions for capturing and evaluating luminance and for instance color images. LabSoft is bundled with the measuring camera LMK98-4 and the calibration data set.

Specification

Image capture

- Live image
- Exposure adjustment
- 'SinglePic'-image
- 'MultiPic'-image
- 'HighDyn'-image
- Capturing modulated light
- Live Luminance and Live HighDyn
- Capturing measurement series (manual, time controlled, mechanical controlled)
- Representation of images (Pseudo-colours, ISO colours, scaling)
- Working with images (load, save, delete, copy, print)
- Displaying measuring values by means of cursors (standard, rectangle, circle, line, circular ring, cross, zoom)

<ul style="list-style-type: none"> • Measurement regions (load, save, copy, paste, group, print)
Measuring value indication using inspectors
<ul style="list-style-type: none"> • Standard statistics (standard evaluation, histogram, sectional view, time statistics, luminance object, integral object, symbol object, arc object, filament object) • Report function (create, load, save, print)
Evaluation images and image processing
<ul style="list-style-type: none"> • Unlimited evaluation images • Physical parameters and units • Assigning list of regions • Assigning image tab windows • Image arithmetics • Coordinate transformation • Projective rectification - orthophotographs • ISO lines in luminance images
Automation via TCL-Macro
<ul style="list-style-type: none"> • Recording of TCL - Macros • Running of TCL - Macros

Further information is also available on <http://www.technoteam.de>.

LMK LabSoft color extension

Specification

The color specific functions are only available in combination with a LMK98 – 4 color camera.

Image capture
<ul style="list-style-type: none"> • Color 'HighDyn'-image
Colour images and colour metrics
<ul style="list-style-type: none"> • Colour space and measuring values • Calculation of colour differences • Decomposition of colour images into colour extract images • Composition of colour extract images into colour images • Test colour images • Measurement protocols (create, load, save, comments)

Further information is also available on <http://www.technoteam.de>.

LMK LabSoft ActiveX extension

Using the LMK LabSoft as ActiveX control allows the development of own software to command each function from a suitable programming software (e.g. LabView).

Specification

Active X
<ul style="list-style-type: none"> • Active X programming interface

Further information is also available on <http://www.technoteam.de>.

Additional components

Standard lamp for luminous flux for RIGO 801 – LED

This luminous flux standard lamp is designed for the usage inside the RiGO 801 – LED goniophotometer. The halogen incandescent lamp is situated inside a cylindrical aluminium housing that is capped with a diffuser glass plate. Thus the light distribution is limited to one hemisphere. The housing includes the standard plug connection to the LED goniophotometer.



Figure 11: Standard lamp suitable for the RiGO 801 LED goniophotometer

Specification

Lamp type	Halogen incandescent lamp, Osram 12 V / 5 W
Housing	Black anodized aluminium, capped with diffuser glass plate
Luminous flux	~ 3.6 lm (individual exact value in calibration certificate)
Uncertainty of luminous flux	3.4 %
Standard alignment	Upstanding
Warm-up time	10 minutes

Installation of the goniophotometer and user training

- Installation of the goniophotometer in the laboratory
- Testing of the complete equipment
- Test measurements
- User training