

RiGO801 – 600



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1 RiGO801 – 600

The RiGO801 goniophotometer devices use the near-field measuring technique for measuring luminous intensity distributions (LID) and ray data far within the photometric limiting distance of the light source.

Due to the close measuring distance, the RiGO801 – L goniophotometer devices are very compact in relation to conventional far-field systems. This also enables installation in small laboratory rooms.

This specification is about the RiGO801 – 600 goniophotometer system which designed for precise ray file measurements as well as for LID measurements of small luminaires up to 600 mm diameter.



Figure 1: RiGO801 - 600

1.1 Specifications

Goniometer mechanic	
Size of measuring object:	<= 550 mm diameter of luminous area <= 600 mm mechanical diameter
Space required:	$L \times W \times H = 2000 \times 1600 \times 2200 \text{ mm}^3$
Movement:	Type C compliant configuration (LM79). Two coupled axes move the sensors on a sphere around the DUT.
Measuring position of the test object:	Stationary, burning position hanging
Measuring distance:	~370 mm
Travel path:	$\varphi = 0^\circ \dots 360^\circ$, $\vartheta = 18.5^\circ \dots 341.5^\circ$
Positioning accuracy:	$\varphi < 0.02^\circ$, $\vartheta < 0.05^\circ$
Repetitive accuracy:	$\varphi < 0.01^\circ$, $\vartheta < 0.02^\circ$
Material	Aluminium, coated with special black paint
Gears	High precision HarmonicDrive

1.2 Goniometer setting and dimensions

The rotating parts of the goniometer are integrated into a free-standing rack. The rack needs to be placed on a stable and non-vibrating ground. No other supporting constructions are necessary.

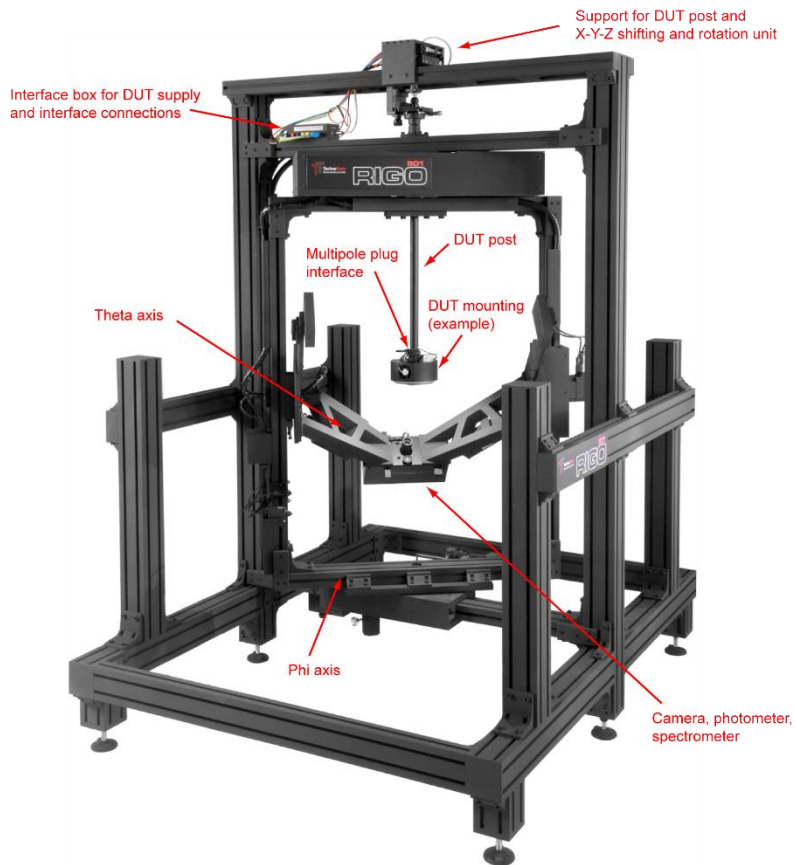


Figure 2: RiGO801 - 600

1.3 X-Y-Z shifting and rotation unit for test object holder

Using the X-Y-Z shifting and rotation unit the DUT post can be positioned and rotated precisely. The multi-pole plug at the end of the post includes all power supply lines as well as additional power lines for the DUT mount adapter (e.g. fan) and contacts for interfaces (USB, 1-wire).

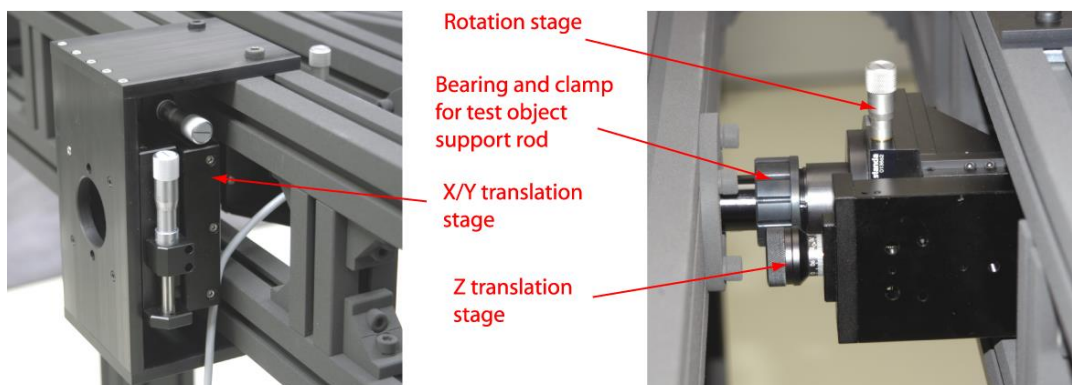


Figure 3: X-Y-Z shifting and rotation unit

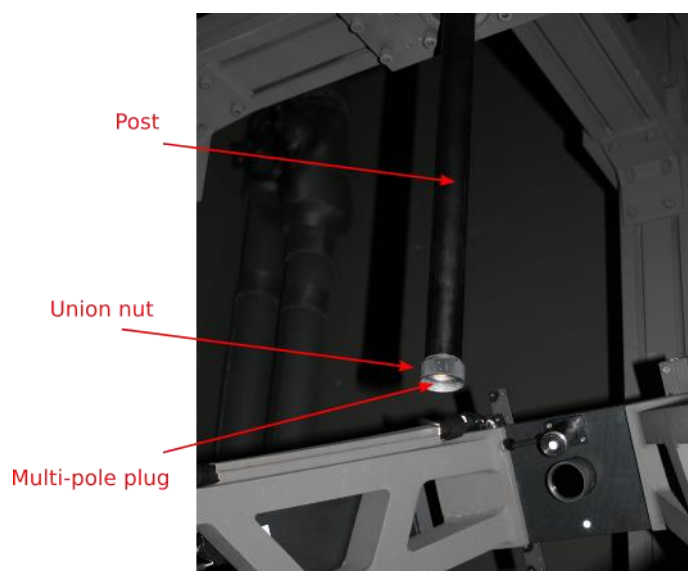


Figure 4: DUT support post

1.3.1 Technical Specification

Maximum load:	10 kg
Connections	2x Power, 2x Sense, PE, 1-wire, USB
Maximum Voltage:	230 V AC
Maximum Current:	12 A

2 Measuring components

2.1 LMK6 – 5 Image-resolving luminance measuring camera

The LMK 6-5 is a high quality luminance measuring camera with a 5 Megapixel CMOS image sensor. Each camera has a unique filter glass made for it, which ensures a high-quality $V(\lambda)$ -adaptation. The LMK 6-5 is robust in construction, lightweight and has compact dimensions. So, it can be used in almost every process for a wide range of lighting measurement tasks.

For RiGO801 measurements, the camera is used in different resolution modes for a flexible adaption of the field of view and pixel resolution. Real-time triggering enables precise positioning of the image recording.



Figure 5: LMK6 - 5

2.1.1 Base specifications:

Type	TechnoTeam LMK6-5
Sensor	Sony-CMOS [IMX 250 (2/3"); 12 Bit digital]
Resolution	2464 x 2056 Pixel
Interface	Gigabit Ethernet Interface(GigE ®)
Measurement quantities	Luminance: L (cd/m ²)
Metrological specification ¹	$V(\lambda)$ [f1' typical < 4 %]
Calibration uncertainty ²	ΔL [< 3% (for standard illuminant A)]
Repeatability ³	ΔL [< 0.1%]
Uniformity	ΔL [< 2%]

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

¹ Measurements according to DIN 5032 Part 6/CIE Pub. 69

² Calibration according to DIN 5032 Part 6 using a luminance standard led back from the Physical-Technical Federal Institute

³ Measurement performed on a stabilized white LED light source L=100 cd/m². Mean value over 100 Pixel; repeatability as variability of the mean value

2.2 LMK6 – 5 color

The LMK6-5 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 filter wheel position can be selected by software for each measurement (ray data or (luminous) intensity distribution).



Figure 6: LMK6-5 color camera

2.2.1 Specifications

Basic specifications	Please refer to the base specification of the LMK6-5 above.
Measuring quantities	Luminance: L (cd/m^2), chromaticity coordinates: x, y , Supported colour spaces: RGB, XYZ, sRGB, EBU-RGB, User, L_{xy} , L_{uv} , $L_{u'v'}$, $L^*u^*v^*$, $C^*h^*s^*uv$, $L^*a^*b^*$, C^*h^*ab , HIS, HSV, HSL, WST ⁴
Filter wheel	6 positions (x1, x2, y, z, glass, user defined)
Metrological specification ⁵	$V(\lambda)$ [$f1' < 4 \%$], $X(\lambda)$ [$f1' < 4 \%$], $Z(\lambda)$ [$f1' < 6 \%$]

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

2.3 Optical Lenses

2.3.1 Lens TT 6.5

- Focal length: 6.5 mm
- Aperture angle: $\sim 54^\circ$
- Photometrically corrected (shading / flat-field)
- Distortion-corrected

2.3.2 Lens TT 25

- Focal length: 25 mm
- Aperture angle: $\sim 14^\circ$
- Photometrically corrected (shading / flat-field)

⁴ Dominant wavelength, saturation, correlated color temperature

⁵ Measurements according to DIN 5032 Part 6/CIE Pub. 69

- Distortion-corrected
- This optical lens is used for the adaption to smaller test objects

2.3.3 *Lens TT 50*

- Focal length: 50mm
- Aperture angle: ~5.6 deg
- Photometrically corrected (shading / flat-field)
- Distortion-corrected
- This optical lens is used for the adaption to smaller test objects

2.3.4 *Lens TT Macro*

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

2.4 ND Filter set

- 6 ND Filters with transmissions from ~25 % ... ~0.02 %
- Filter thread 35.5 x 0.5 mm (RiGO – 300/600 and RiGO – LED)
- For RiGO – L: Special mount, Filter thread 49 x 0.75 mm

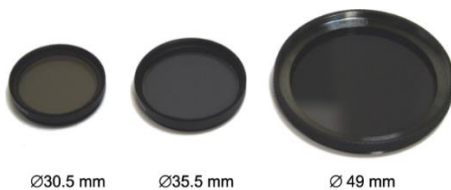


Figure 7: ND filter diameters

2.5 Photometer

2.5.1 *Photo current amplifier MB13*

- Manufacturer: Czibula & Grundmann GmbH (<http://www.photo-meter.de>)
- 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 %



Figure 8: Photo current amplifier

2.5.2 Photometer head VL-M2

- Manufacturer: Czibula & Grundmann GmbH
(<http://www.photo-meter.de>)
- $V(\lambda)$ -calibrated $f1' < 1,5 \%$
- Cosine - adaptation $f2 < 1,5 \%$



Figure 9: Photometer head

2.6 Spectrometer JETI Specbos 1211E-2-LAN



Figure 10: Spectrometer Specbos 1211E-2-LAN

2.6.1 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 irradiance⁶ • Chromaticity coordinates $x, y; u', v'$ • Correlated Color Temperature, color purity • CRI, TM30 • Circadian metrics, Photosynthetically Active Radiation
Measuring uncertainties (according to CIE TN 009:2019)	
Chromaticity accuracy	$\pm 0.002 x, y$ (Illuminant A, $k=2$)
Color reproducibility	$\pm 0.0005 x, y$ (Illuminant A)
CCT reproducibility	± 20 K (Illuminant A)
Wavelength accuracy	± 0.5 nm (HgAr line source)
Other technical data	
Interface:	Ethernet / USB
Dimensions	180 mm * 82 mm * 53 mm

⁶ For goniospectrometric application only spectral irradiance measuring head is used

Dispersive element	Imaging grating (flat field)
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For the detailed technical specification, please refer to the web site:
<https://www.jeti.com/Products/Spectroradiometer/specbos1211-2>

2.6.2 Cosine-corrected Irradiance Probe ACC 015

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

Diffusor diameter	7 mm
Barrel diameter:	12 mm



Figure 11: Irradiance Probe ACC 015

3 Switching cabinet components

3.1 Switching cabinet

The switching cabinet basically includes the measuring computer and the motor controller. It provides some space for additional devices like power analyzer and power supplies. If those optional components are included in the order, they are mounted and wired to the switching cabinet by TechnoTeam. If this lower switching cabinet with a height of 1100 mm should be extended with additional components that wouldn't fit into it, a higher switching cabinet would be possible.

3.1.1 Specification:

Type	19" switching cabinet
Height	1100 mm
Width / Depth	600 mm
Ventilation	Fan in back door
Mobility	Possible, socket is equipped with rolls

3.1.2 Example configuration:



Figure 12: Switching cabinet front and back view

3.2 Control panel LSF 95

Control panel to be mounted as front panel of the switching cabinet for a comfortable setup of the connections between the power supplies, the power analyzer and the DUT. The output lines of the control panel are directly connected to the plugs of the test object support inside the goniophotometer.

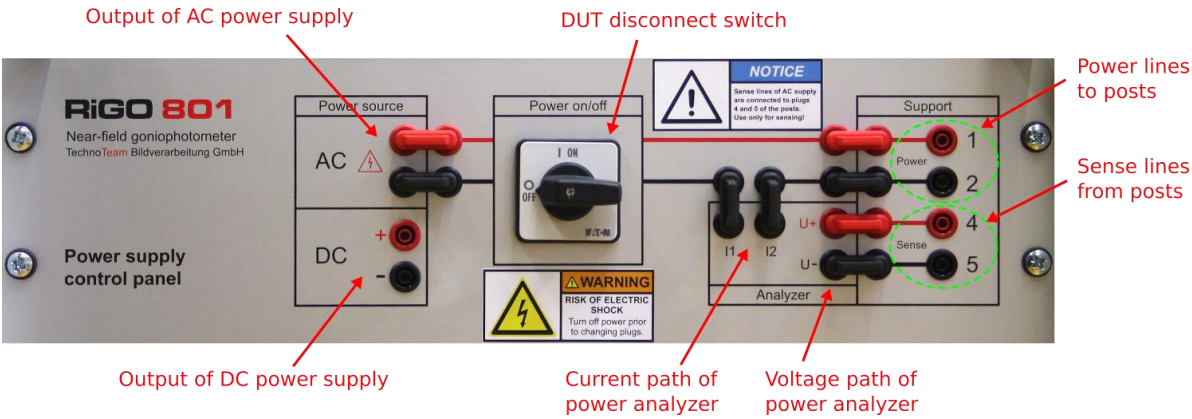


Figure 13: Control panel with standard configuration

3.2.1 Specification

Material:	Aluminium
Dimension:	482.6 mm x 132 mm
Maximum current:	20A
Maximum Voltage:	230 V
Sockets:	Ø 4 mm Safety sockets

3.3 AC Power Supply (Chroma 61600 Series)



3.3.1 Short specification

Model	61601	61602	61604
Output Rating - AC			
Power:	500 VA	1000 VA	2000 VA
Voltage range:	150V/300V		
Current (rms):	4A/2A (150V/300V)	8A/4A (150V/300V)	16A/8A (150V/300V)
Frequency:	DC, 15~1kHz		
Output Rating - DC			
Power:	250 W	500 W	1000 W
Voltage range:	212V/424V		
Current (rms):	2A/1A (212V/424V)	4A/2A (212V/424V)	8A/4A (212V/424V)
Input Rating			

Voltage and Frequency:	90 to 250 VAC, 47 to 63 Hz, single phase		
Current (rms):	10A Max. @ 90V	18A Max. @ 90V	28A Max. @ 90V

Detailed specification:

https://www.chromaate.com/en/product/programmable_ac_power_source_61600_series_177

3.4 DC Power Supply (DELTA Electronics SM 70-22)



3.4.1 Short specification

Output	
Voltage:	0 to 70 V
Current:	0 to 22 A
Autoranging (2 ranges) max. output current/voltage:	60 A / 0 to 26 V 30 A / 26 to 52 V
Input	
Voltage and Frequency:	90 to 265 VAC, 48 to 62 Hz, single phase
Current:	0 to 22 A
Autoranging (2 ranges) max. output current/voltage:	60 A / 0 to 26 V 30 A / 26 to 52 V
Stability	
CC (After 1hr warm-up during 8 hrs):	$9 \cdot 10^{-5}$
CV (After 1hr warm-up during 8 hrs):	$6 \cdot 10^{-5}$

Detailed specification: <https://www.delta-elektronika.nl/products/sm1500-series>

3.5 Power analyzer (Yokogawa Digital Power Meter WT310E)

- Maximum input with assured accuracy: 26 A
- Basic accuracy: 0.1%
- DC measurement: 0.5 Hz to 100 kHz frequency range
- 5 mA range for very low current measurements
- USB and GPIB interface



Detailed specification:

<https://tmi.yokogawa.com/solutions/products/power-analyzers/digital-power-meter-wt300e/>

3.6 Evaluation computer

- Advantech ASMB-787 ATX Motherboard, Rackmount 19"
- Intel® Core™ i7-10700E Processor
- 16 GB DDR4 2666MHz
- DVD-RW drive
- HDD WD RED 1TB
- SSD 512GB 3D NAND TLC
- Windows 11 Pro

4 Additional components

4.1 E27 Test socket

This test socket is suitable for mounting inside all goniometer types except RiGO801 – LED.

- 4-pole E27 socket with hard gold plated contacts
- separate contacts for power supply and sensing



Figure 14: 4-pole E27 test socket

4.2 Calibrated luminous flux standard lamp, E27 socket

- Incandescent lamp Riva B6000 E27 24V 100W „F“, impact resistant, TechnoTeam version
- Socket basis black (15 mm above socket)
- Traced back to national luminous flux standard by accredited laboratory



Figure 15: Luminous flux standard lamp

4.3 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.

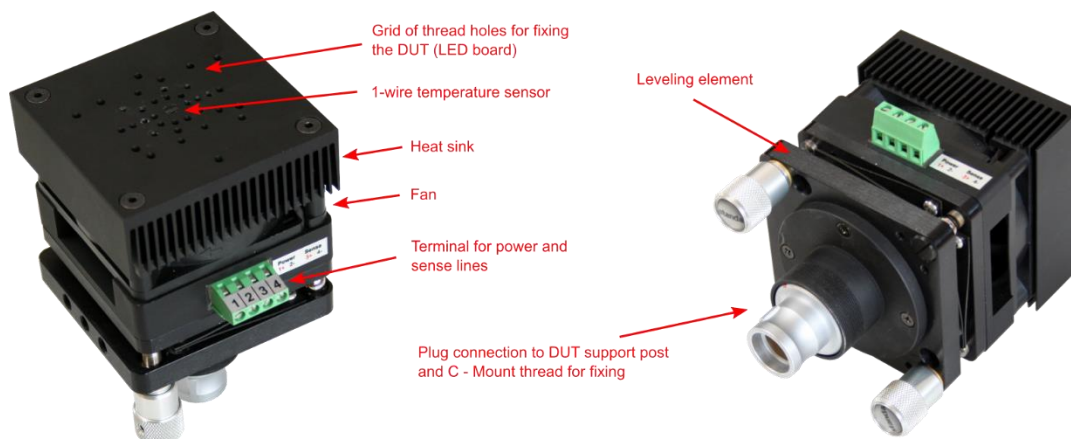


Figure 16: LED mount

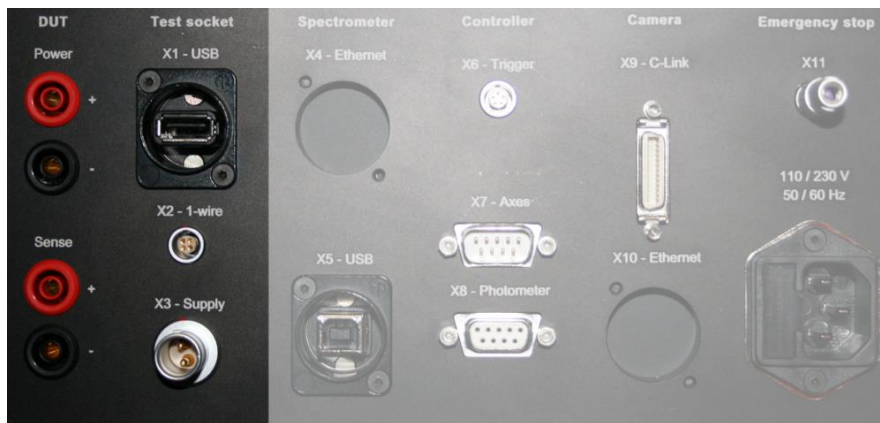


Figure 17: Back panel connections to LED mount plug

4.3.1 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

4.3.2 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 18 for details of the thread positions.

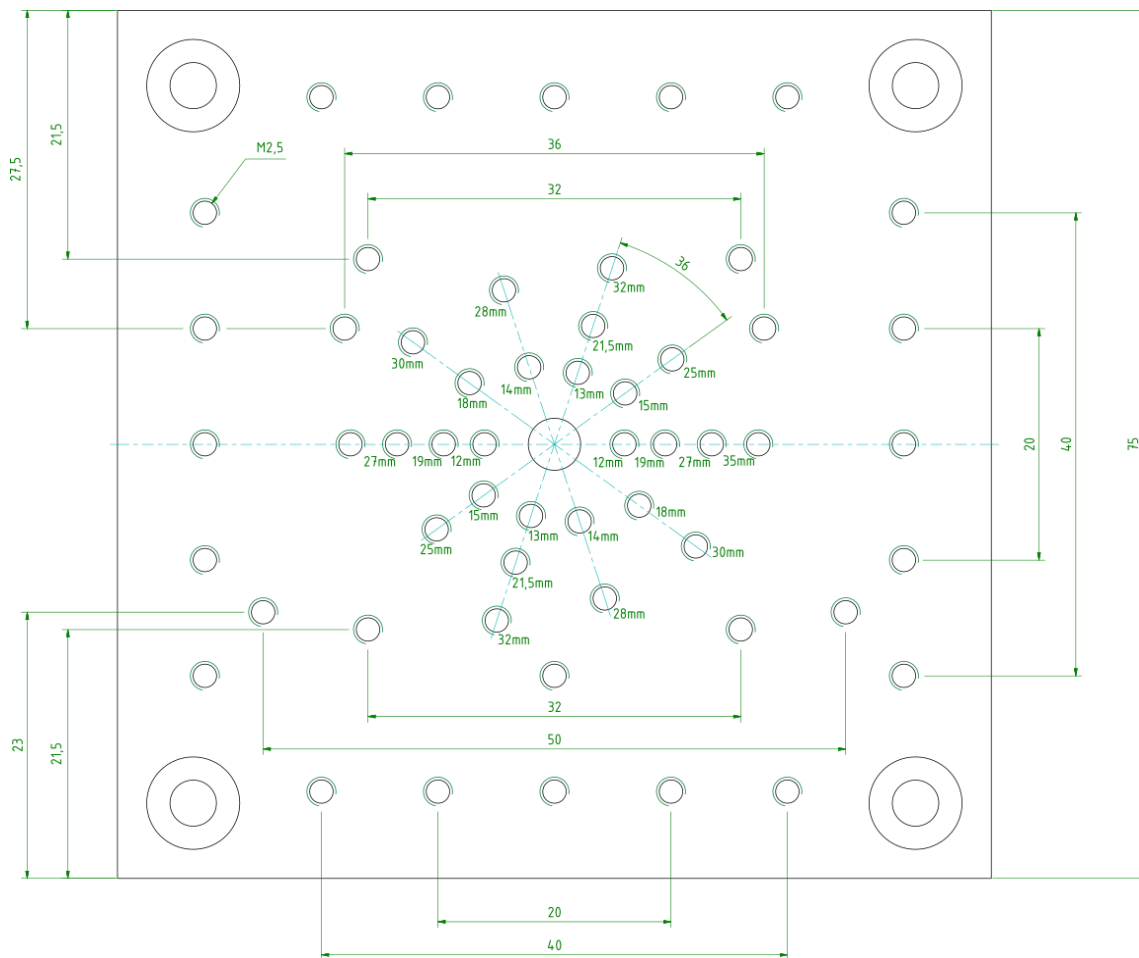


Figure 18: Grid of thread holes for fixing the LED board

4.3.3 Temperature sensor

Article description	18B20 (Dallas Semiconductor)	
Description	Digital thermometer sensor in T092 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)	

4.3.4 Plug

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

4.3.5 1-wire USB adapter

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

Type: PN10000500011

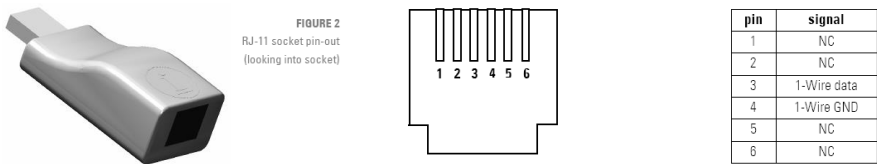



Figure 19: 1-wire USB adapter

4.3.6 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		

5 Software

5.1 RiGO801 base software



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

5.1.1 Feature list

- Fast on-the-fly measurement
- Angular step sizes $0.1^\circ \dots 2.5^\circ$ (camera), $0.1^\circ \dots 90^\circ$ (photometer)
- 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)
- Easy alignment of the objects to be measured by means of the measuring camera. Image grid which can be activated, and metric coordinate system
- Saving in the TechnoTeam – format (.TTL), conversion into various standard formats (LDT, IES). Further processing of LID data by using LUMCat⁷.
- Capturing ray data, saving in the TechnoTeam – format (.TTR). Conversion into various standard formats using the Converter801 program.
- 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)
- multi-channel measurements for colorimetric evaluations
- spectral ray file generation
- Data acquisition of external devices (e.g. power analyser, temperature sensors or data loggers)
- Synchronisation of external data acquisition software to the measurement by triggering
- Batch processing of several measurements
- Available languages: German, English

⁷ LUMCat is a software from the company Czibula&Grundmann (<http://www.photo-meter.de/index.php/de/>)

5.2 Goniospectrometer add-on for RiGO801 base software



Add-on for goniospectrometric measurements⁸ according to IES-LM-79-19, CIE S 024 / EN 13032-4

5.2.1 Feature list

- Measurements
- spectral flux (relative)
- xy and u'v' coordinates, Dominate wavelength, CCT, CRI, TM30
- color uniformity delta u'v'
- Export to various file formats (.csv, ASCII, .spectrum, ...)

5.3 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 supported.

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

5.3.1 Feature list

- Generation of various ray data formats (TM25, ASAP, Optis, LightTools, LucidShape, Zemax, TracePro, Photopia)
- Generation of spectral ray files
- Visualization of all data contained in TechnoTeam ray files (ray data, luminous intensity distribution, luminance images, alignment of the object to be measured, stabilization protocol as well as the logged measurement data of external devices such as power analyser and temperature logger)
- Preparation of a universal TTR exchange files (Specification of conversion parameters, delete and edit internal information, integrating data sheets, reports or other data)
- Raytracing to basic geometries (sphere, cylinder, cuboid)
- Rotation and displacement of the ray data
- Integration of spectral information possible (spectral ray files)
- Recalculation of the luminous intensity distribution in other angular resolutions
- Calculation of near-field distributions
- Calculation of the virtual focus point of a ray file
- 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

⁸ Option available in combination with spectroradiometer

5.4 LumCAT



LumCAT is a photometric database software by Czibula & Grundmann GbR. It allows the management of photometric data together with all product properties like texts, images etc due to a relational database-table system. Also it includes editors for the intensity distribution which allows modification in many different ways.

5.4.1 Feature list

- Support for TechnoTeam measurement data files (*.TTL), EULUM-DAT, TM14, IES, Calculux
- System for managing and processing luminaire data
- Integrated relational database, realized as standard ACCES-DB version
- Modification of all product information
- Tabular processing of the luminous intensity distribution
- Function for turning, inclining and swivelling the luminous intensity distributions
- Modification of the operating efficiency ratio (scaling)
- Multiple processing function for loading information, dimensions, manufacturer and article names
- Photometric product valuation in the form of a print-out or as WMF-file
- Output of the luminous intensity distribution (polar, cartesian, cone diagram)
- Output of the illumination efficiency ratios
- Glare evaluation according to Söllner and UGR
- Isolux diagrams
- Illumination efficiency ratios according to LiTG Publ. 3.5

Available languages: German, English

For more information, please refer to the manufacturers Website <http://www.lumcat.com>.

6 Contact

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