TechnoTeam
Bildverarbeitung GmbH

Specification

RiGO801 – L (1400, 1500, 1800, 2000)

TechnoTeam Bildverarbeitung GmbH
https://www.technoteam.de
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1 RiGO801 - L

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. This specification is about the RIGO801 – L goniometer series for larger light sources (lamps and luminaires). There are four base sizes (max. size of luminous area) available: 1400 mm, 1500 mm, 1800 mm and 2000 mm.

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.

Figure 1: RiGO801 - L

1.1 Base specifications for RiGO801 – L - 1400 / 1500 / 1800 / 2000

Goniometer mechanic	
Movement:	Type C compliant configuration (LM79). Two coupled axes move the sensors on a sphere around the DUT.
Measuring position of the luminaire:	Normal position, no movement of the measuring object
Positioning accuracy:	φ < 0.02°, ϑ < 0.05°
Repetitive accuracy:	φ < 0.01°, ϑ < 0.02°
Material	Aluminium, coated with special black paint
Gears	High precision HarmonicDrive and Summitomo Cyclo gears

1.2 Fixing at the top

The goniophotometer models 1400 / 1500 / 1800 / 2000 need a fixed upper attachment. TechnoTeam support a fixing plate that can easily be attached to a suitable support construction to the ceiling or the side walls that is in the responsibility of the customer. The goniophotometer is attached to the fixing plate by using levelling bolts.

The upper support construction has to be stable enough to absorb any vibrations caused by the drives as best as possible to avoid vibrations of the test object support that is also fixed to this point. Although the goniometer is mounted to the fixing plate by using damping elements the topic vibration is important and has to be discussed individually. The upper support construction should be confirmed by TechnoTeam.

Please refer to the separate laboratory specification document for more details (https://www.technoteam.de/main/learn_more/downloads/rigo801/index_eng.html)!

1.3 Goniometer RiGO801 - 1400

1.3.1 *Specifications*

Size of measuring object:	≤ 1400 / 1200 mm (luminous area)[1]
Space required:	LxWxH = ≤ 2900 x 2900 x 2800 mm³
Travel path:	φ = 0° ... 360° ϑ = 10° ... 350° (hanging test object support) ϑ = -170° ... 170° (upstanding test object support)

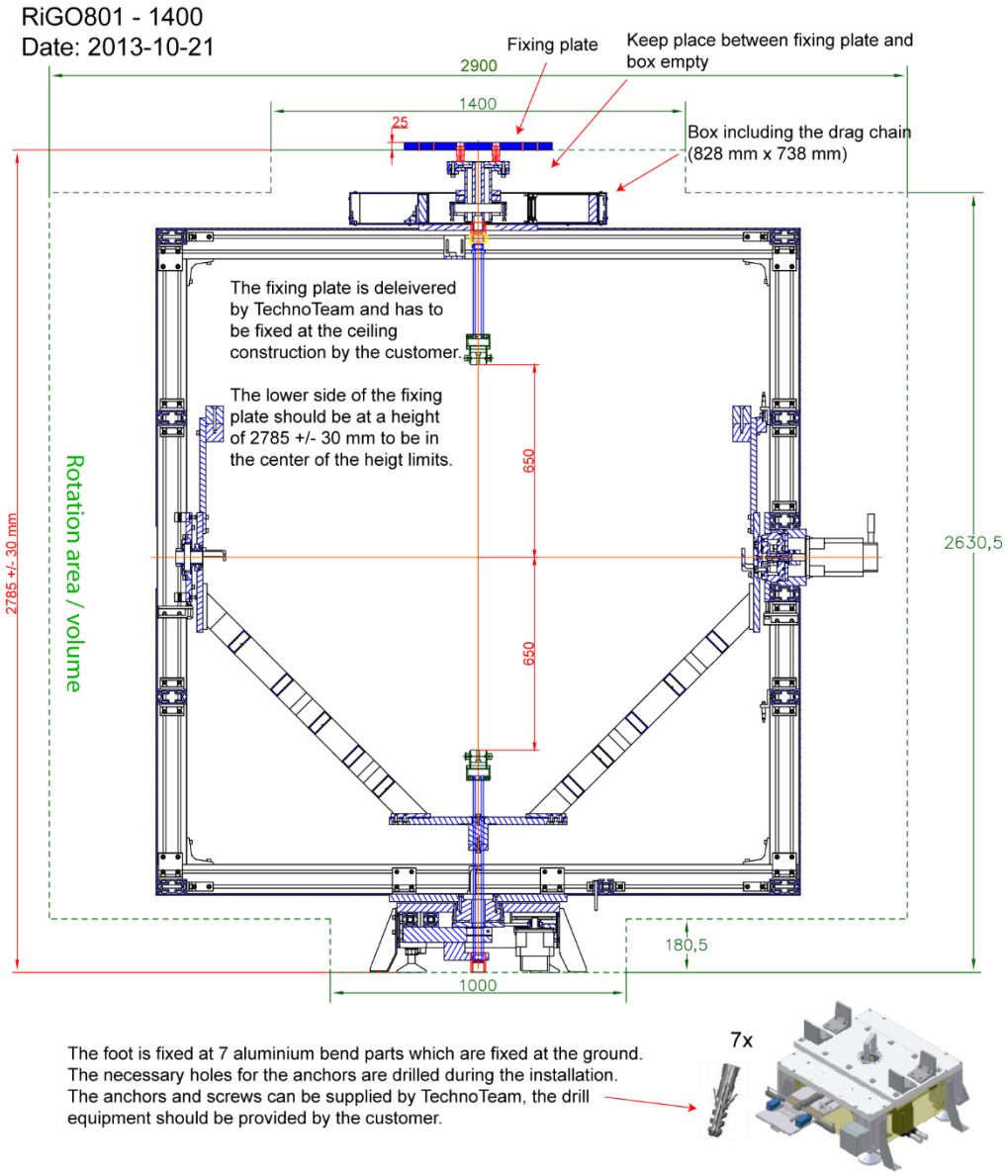

Figure 2: Schematic sectional drawing of RiGO801 - 1400

[1] Smaller field of view in case of option „Filter wheel color camera“

1.4 Goniometer RiGO801 - 1500

1.4.1 *Specifications*

Size of measuring object:	≤ 1500 mm (luminous area)
Space required:	LxWxH = ≤ 2900 x 2900 x 3300 mm^3
Travel path:	φ = 0° ... 360° ϑ = 8° ... 352° (hanging test object support) ϑ = -172° ... 172° (upstanding test object support)

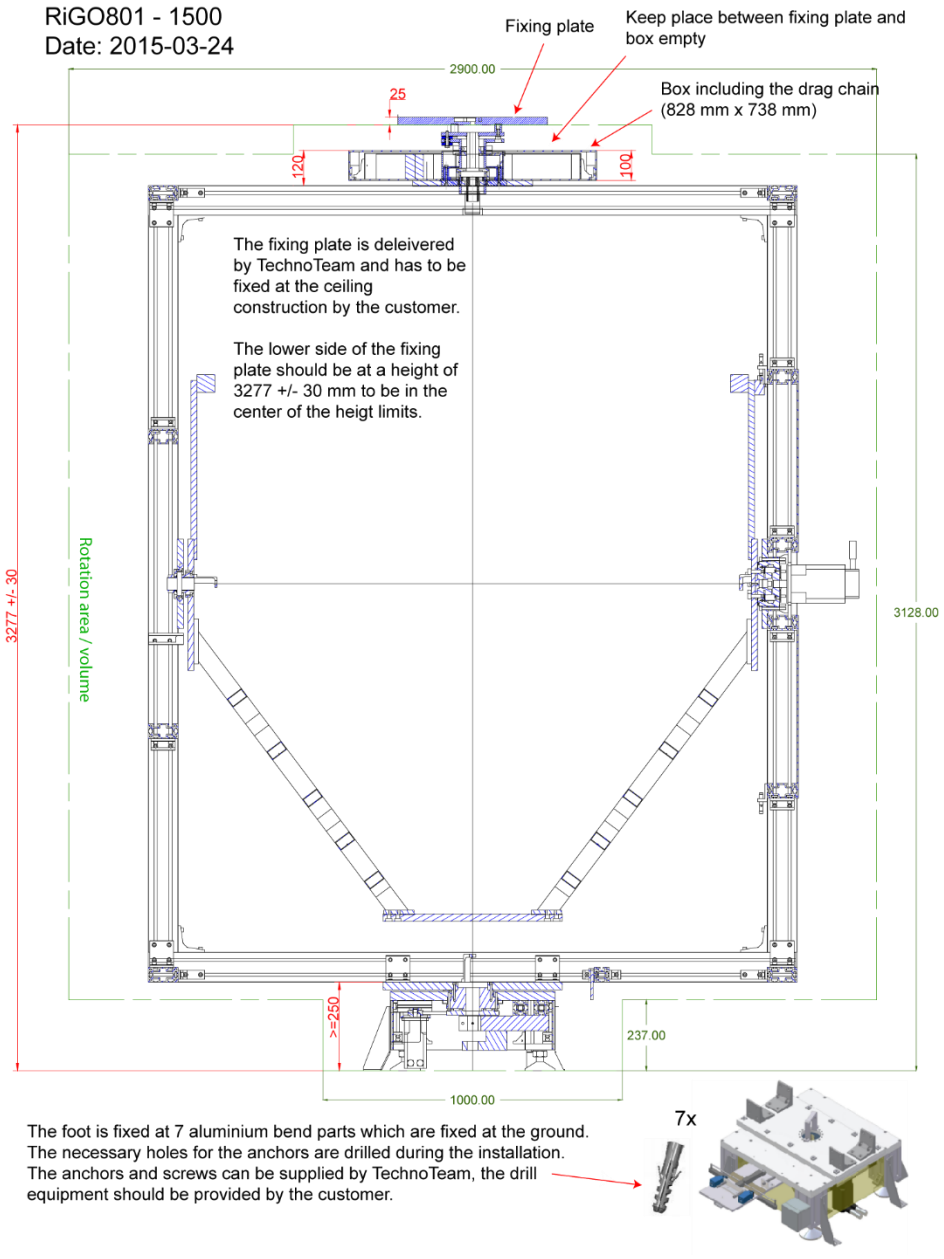

Figure 3: Schematic sectional drawing of RiGO801 - 1500

1.5 Goniometer RiGO801 - 1800

1.5.1 *Specifications*

Size of measuring object:	≤ 1800 mm (luminous area)
Space required:	LxWxH = ≤ 3400 x 3400 x 3870 mm^3
Travel path:	φ = 0° ... 360° ϑ = 6.5° ... 353.5° (hanging test object support) ϑ = -173.5° ... 173.5° (upstanding test object support)

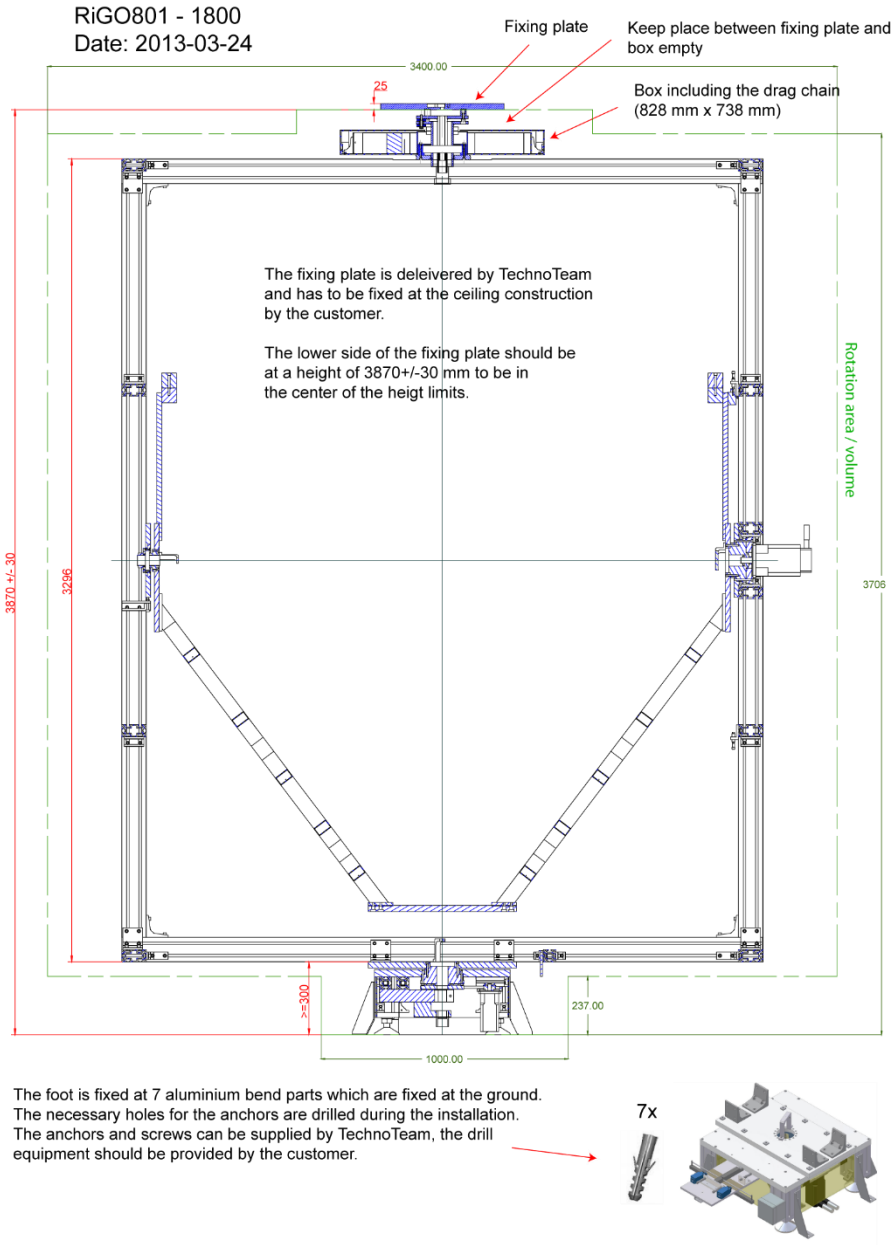

Figure 4: Schematic sectional drawing of RiGO801 - 1800

1.6 Goniometer RiGO801 - 2000

1.6.1 *Specifications*

Size of measuring object:	≤ 2000 mm (luminous area)
Space required:	LxWxH = ≤ 3600 x 3600 x 4100 mm^3
Travel path:	φ = 0° ... 360° ϑ = 6° ... 354° (hanging test object support) ϑ = -174° ... 174° (upstanding test object support)

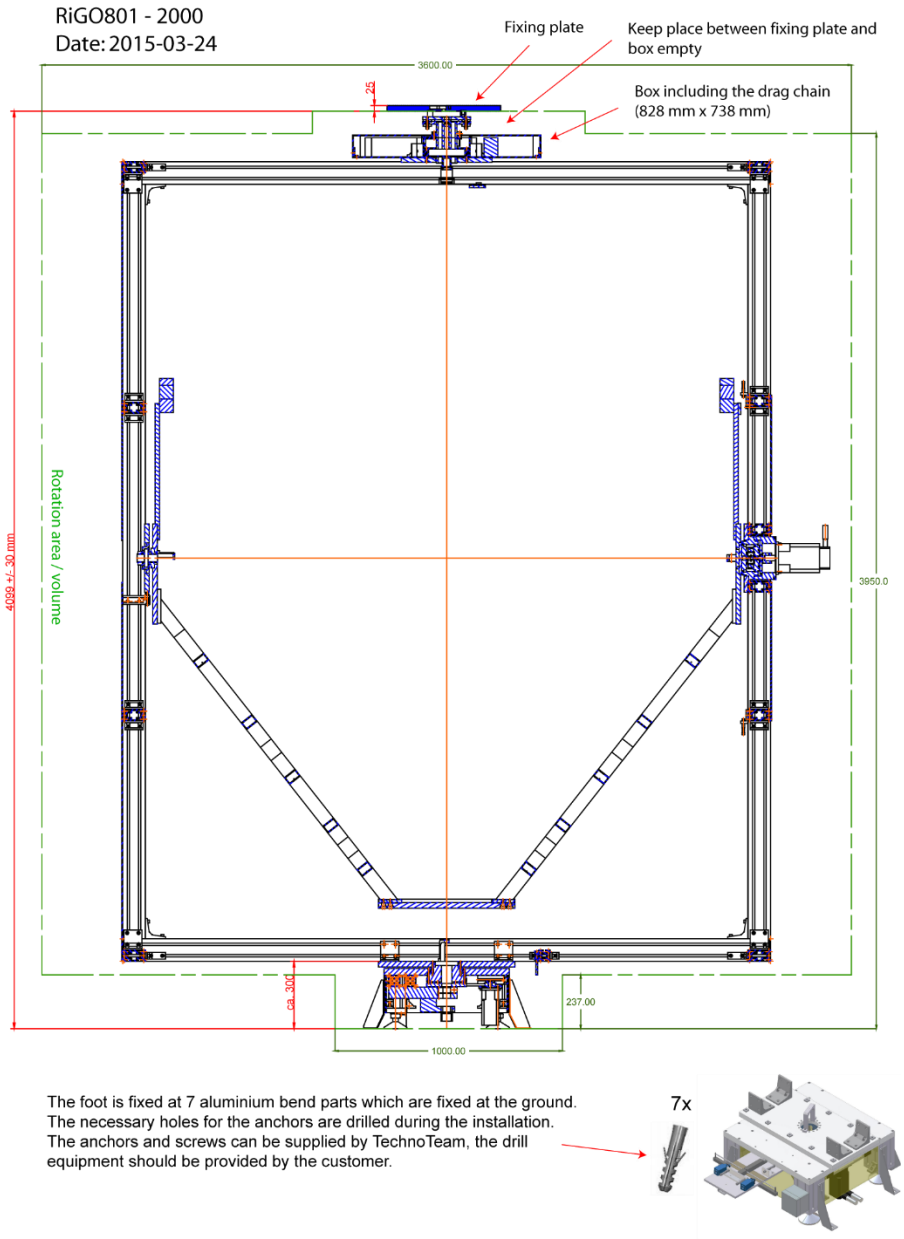

Figure 5: Schematic sectional drawing of RiGO801 - 2000

2 Goniometer components

2.1 DUT support posts

There are two support posts for attaching the devices under test to. One can be mounted at the top of the goniometer frame and is hanging. The other can be mounted at the goniometer socket and is upstanding. Both posts are not moved while the two goniometer axes are moving. Only one post at time can be used for operating the Goniophotometer. The free distance between mounting adapter and goniometer center is 650 mm by standard. Customer dependent modifications are possible.

The electrical connection to the DUT power supply panel is included in the posts in form of a multi-pole plug at the goniometer attachment side and safety banana plug sockets at the DUT attachment side.

2.1.1 *Upper hanging post*

The upper hanging post is mounted to an adapter part at the upper center of the goniometer frame (cf. Figure 6). This adapter is fixed to a flange that goes through the ball bearing flange the outer goniometer frame and is directly mounted to the ceiling attachment. Thus it is not moving with the rotation of the outer frame.

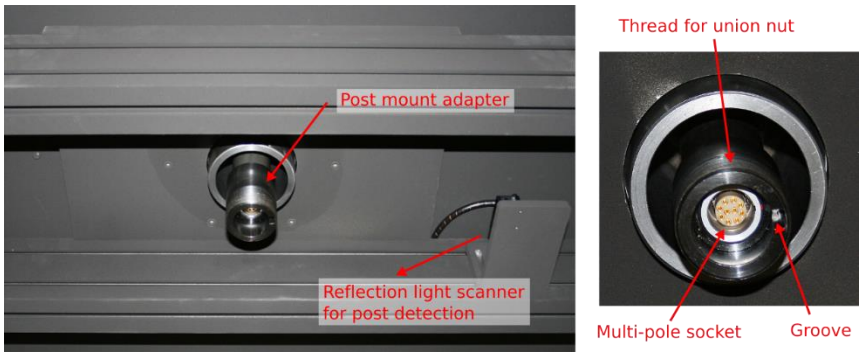

Figure 6: Upper post mount adapter

Figure 7: Upper post

Figure 8: Mounted upper post

2.1.2 *Lower upstanding post*

The lower upstanding post is mounted to an adapter part located below the hollow shaft of the gear in the goniometer base (cf. Figure 9).

Figure 9: Lower post mount adapter

Figure 10: Lower post

Figure 11: Mounted lower post

2.1.3 *DUT mounting*

The DUT is installed to the mount of the post (cf. Figure 12). A cylindrical mount adapter fits into the mount and is secured from falling down by a locking lever. Finally it can be fixed by a clamp. The mount adapter has a centred hole for M8 screws where the individual DUT support construction can be fixed. On top of the DUT mount there are 5 protected banana sockets for the electrical supply of the DUT.

Figure 12: DUT mount

2.1.4 *Technical Specification*

Maximum load:	50 kg
Connections	2x Power, 2x Sense, PE
Maximum Voltage:	230 V AC
Maximum Current:	20 A

3 Measuring components

3.1 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(λ)-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 13: LMK6 - 5

3.1.1 *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[2]	V(λ) [f1' typical < 4 %]
Calibration uncertainty[3]	ΔL [< 3% (for standard illuminant A)]
Repeatability[4]	ΔL [< 0.1%]
Uniformity	ΔL [< 2%]

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

[2] Measurements according to DIN 5032 Part 6/CIE Pub. 69
[3] Calibration according to DIN 5032 Part 6 using a luminance standard led back from the Physical-Technical Federal Institute
[4] 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

3.2 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'(λ), the circadian function of action C(λ), an IR-filter (measurements in the NIR range 780-1000 nm), a BLH (blue light hazard), or a clear glass filter .

Figure 14: LMK6–5 color camera

For RiGO801 measurements, the filter wheel position can be selected by software for each measurement (ray data or (luminous) intensity distribution).

3.2.1 *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, Lxy, Luv, Lu'v', L*u*v*, C*h*s*uv, L*a*b*, C*h*ab, HIS, HSV, HSL, WST[5]
Filter wheel	6 positions (x1, x2, y, z, glass, user defined)
Metrological specification[6]	V(λ) [f1' < 4 %], X(λ) [f1' < 4 %], Z(λ) [f1' < 6 %]

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

3.3 Optical Lenses

3.3.1 *Lens TT 4.2*

- Focal length: 4.2 mm
- Aperture angle: ~ 90 deg
- Photometrically corrected (shading / flat-field)
- Distortion-corrected

3.3.2 *Lens TT 8*

- Focal length: 8 mm
- Aperture angle: ~26 deg
- Photometrically corrected (shading / flat-field)
- Distortion-corrected

[5] Dominant wavelength, saturation, correlated color temperature
[6] Measurements according to DIN 5032 Part 6/CIE Pub. 69

3.3.3 *Lens TT 25*

- Focal length: 25 mm
- Aperture angle: ~14 deg
- Photometrically corrected (shading / flat-field)
- Distortion-corrected
- This optical lens is used for the adaption to smaller test objects

3.4 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

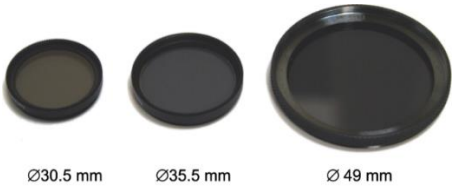

Figure 15: ND filter diameters

3.5 Photometer

3.5.1 *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 16: Photo current amplifier

3.5.2 *Photometer head VL-Th-M1*

- Manufacturer: Czibula & Grundmann GmbH (http://www.photo-meter.de)
- V(λ)-calibrated f1' < 1,5 %
- Cosine - adaptation f2 < 1,5 %
- thermostatic stabilized photometer head

Figure 17: Photometer head

3.6 Spectrometer JETI Specbos 1211E-2-LAN

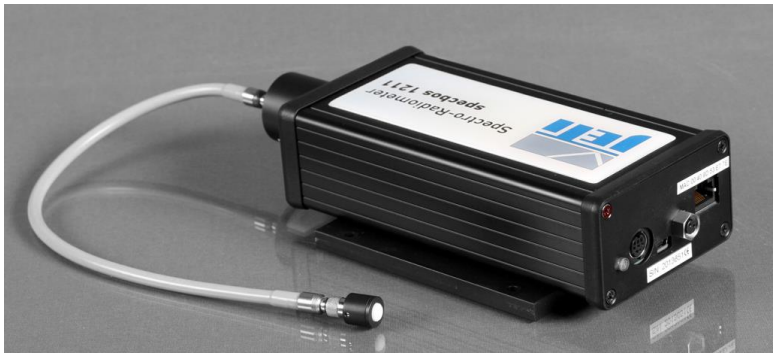

Figure 18: Spectrometer Specbos 1211E-2-LAN

3.6.1 *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:	• Spectral irradiance7 • 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	± 0.002 x, y (Illuminant A, k=2)
Color reproducibility	± 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
Dispersive element	Imaging grating (flat field)

For the detailed technical specification, please refer to the web site:
https://www.jeti.com/Products/Spectroradiometer/specbos1211-2

[7] For goniospectrometric application only spectral irradiance measuring head is used

3.6.2 *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 19: Irradiance Probe ACC 015

4 Switching cabinet components

4.1 Switching cabinet

The switching cabinet basically includes the measuring computer and the motor controller. It provides 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.

4.1.1 *Specification:*

Type	Rittal 19” switching cabinet
Height	1900 mm
Width / Depth	600 / 800 mm
Ventilation	Roof fan

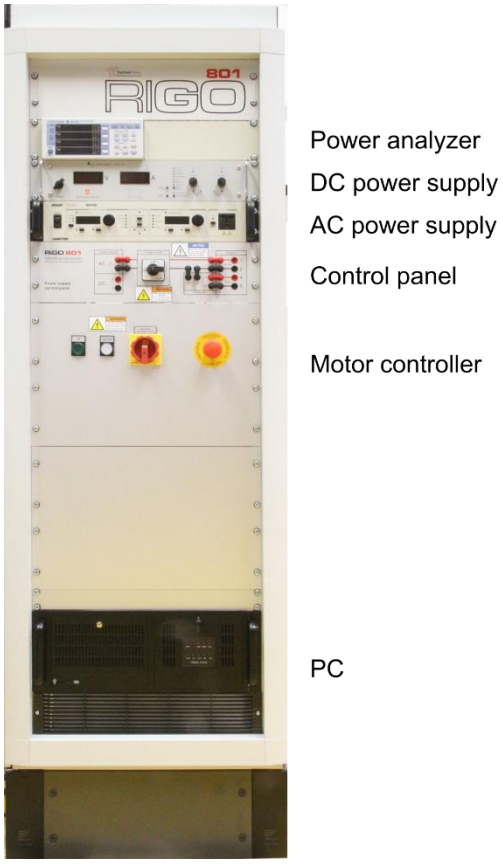

Figure 20: Example configuration of the switching cabinet

4.2 Control panel LSF 20

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.

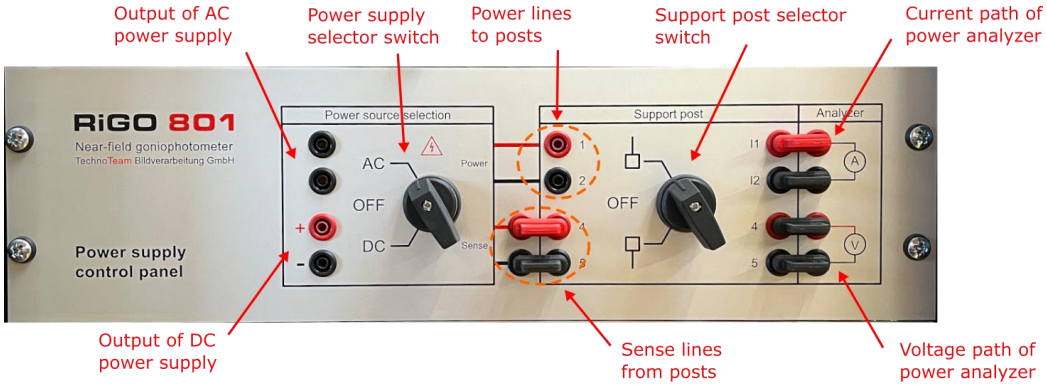

Figure 21: Control panel with standard configuration

4.2.1 *Specification*

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

4.3 AC Power Supply (Chroma 61600 Series)

4.3.1 *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

4.4 DC Power Supply (DELTA Electronica SM 70-22)

4.4.1 *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):	9.10^{-5}
CV (After 1hr warm-up during 8 hrs):	6.10^{-5}

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

4.5 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/

4.6 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

5 Additional components

5.1 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 22: 4-pole E27 test socket

5.2 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 23: Luminous flux standard lamp

6 Software

6.1 RiGO801 base software

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

6.1.1 *Feature list*

- Fast on-the-fly measurement
- Angular step sizes 0.1° ... 2.5° (camera), 0.1° ... 90° (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 LUMCat8.
- 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

[8] LUMCat is a software from the company Czibula&Grundmann (http://www.photo-meter.de/index.php/de/)

6.2 Goniospectrometer add-on for RiGO801 base software

Add-on for goniospectrometric measurements[9] according to IES-LM-79-19, CIE S 024 / EN 13032-4

6.2.1 *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, …)

6.3 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.

6.3.1 *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

[9] Option available in combination with spectroradiometer

6.4 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.

6.4.1 *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.

7 Contact

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