

T1+ Goniophotometer

The Goniophoto-spectrometer T1+ is a high precision and reliability photometer for measuring the distribution of the luminous intensity as well of the spectrum of conventional and LED light sources and luminaires.

The T1+ is manufactured in accordance with the following standards and recommendations:

- ▶ EN 13.032 Type 1.1, 1.2 and 1.3
- ▶ CIE Recommendation n.70 types 1 and 2 (Luminaire Revolving Goniophotometer)
- ▶ IESNA LM-79 Type C (for luminaires, light sources and LED modules of max dimensions 50x50x10 mm)

The T1+ allows measurements according to the following systems:

- ▶ C-Gamma
- ▶ V-H (B-Beta)
- ▶ for conical surfaces.

Mechanical Characteristics

Mechanical Part

The lower mechanical block houses the motors, encoders and reducers in addition to the machine control system assisted by computer.

It also holds any measurement instruments and the shaft that supports the upper part.

The upper mechanical part consists of an L-shaped arm that rotates around the vertical axis and supports the step-by-step motor for the movement of the luminaires along the C- or V- semi-planes.

The vertical part of the arm with flange for the device and motor is fixed.

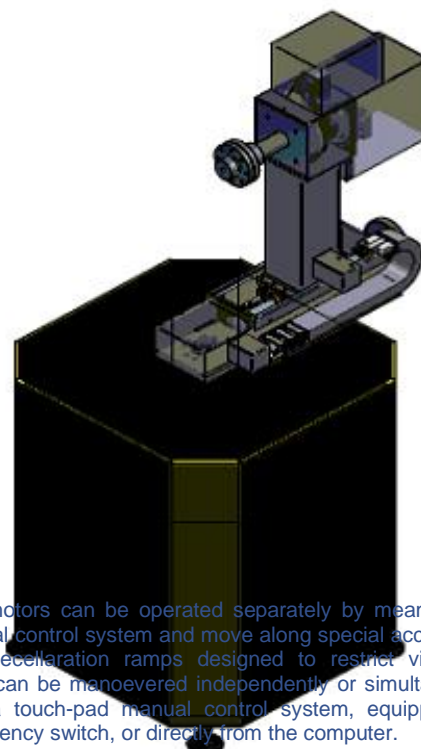
Synthesis of mechanical characteristics

Machine	
max. dimensions (AxBxH)	900x900x1900 mm
max. volume (AxBxH)	1100x1100x2500 mm
total max. weight	220kg approx.
max. rotation axis height	1800 mm +- 50 mm
max. axis rotation speed	1 turn/min
max. angle of horizontal axis rotation	+ 360°
max. angle of vertical axis rotation	+ 180°

Luminaires or light sources to be tested	
max. dimensions	700x300x300 mm
max. weight	30 kg

Electromechanical Actuators / Motors

The system is operated by 2 step-by-step motors with absolute encoders, controlled by a robotic system being its circuit boards situated on the side of the machine.



The motors can be operated separately by means of the manual control system and move along special acceleration and deceleration ramps designed to restrict vibrations. They can be maneuvered independently or simultaneously with a touch-pad manual control system, equipped with emergency switch, or directly from the computer.

The system can measure in continuous movement or by **T1+ Goniophoto-spectrometer** values whose difference must not exceed a pre-established range.

If this is not the case, further three values are taken and then compared until measurement stability is achieved.

Measurement with machine stop in each measurement position is generally more precise than continuous measurement but slower.

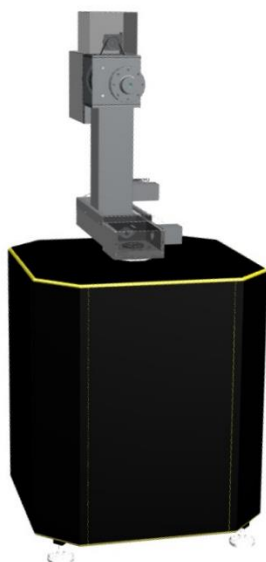
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The distribution board must be fed with 3 separate lines having the following characteristics:

- ▶ Machine Feed Line: Voltage 230 V - Frequency 50 Hz - Max. power 2000 W - Peak Current 7 A (other feeds on request)
- ▶ Light Sources Feed Line: Voltage 230 V or 380 V - Frequency 50 Hz - Max. power 5000 W - Peak Current: depends on feeder
- ▶ Computer and Devices Feed Line: Voltage 230 V - Frequency 50 Hz - Max. power 300 W (it is preferable to have a dedicated line).

Angle Measurement

Angle measurement is carried out directly on the horizontal and vertical axes by 2 13bit absolute encoders in order to determine the position corresponding to the C- and V- (B-) planes and the Gamma or H- (Beta) angle.



The angular resolution of the encoders is equal to $4/100^\circ$ (13 bit) and the angular positions are shown on screen during measurement along with indication of the state of progress of measurement and the polar diagram of the plane under examination.

Instruments

Luxmeter and Photocell

The photocell consists of a silicon photovoltaic cell whose response corresponds to the relative visibility curve CIE $V(\lambda)$ using the full-filtering method.



The photocell is thermostated at 35°C and is supplied along with a support to be fixed to the floor or ceiling.

The support is equipped with all fine regulating systems for the various alignments and lasers to verify the centering of the luminaire/lamp.

Photocell – Luxmeter System Characteristics (In accordance with EN 13032 - CIE 69 - DIN 5032/6)

▪ Acquisition Area Diameter	8 mm
▪ Calibration error ukal	< 1%
▪ Correspondence to $V(\lambda)$ f1 Curve	< 1.5%
▪ Directional Response Error f2	< 1%
▪ Linearity Error f3	< 0,1%
▪ Display Unit Error f4	< 0.1%
▪ Fatigue f5 (measured at 1 klx)	< 0.1%
▪ Modulated Light f7	< 0.1%
▪ Polarization f8	< 1%
▪ Scale Change Error f11	< 0.1%
▪ Temperature Coefficient α_{25}	0.1%/K (L)-0.2%/K (A)
▪ Sensitivity to UV (u)	< 0.01%
▪ Sensitivity to IR (r)	< 0.01%
▪ Overall Characteristic fges	< 3%
▪ Integration Period at 50 Hz	20-200 ms
▪ Calibration Period	2 years

The photocell is connected to the luxmeter by a shielded cable of a maximum length of 50 m: should it be necessary to increase this distance, a suitable signal amplifier will have to be taken into consideration.

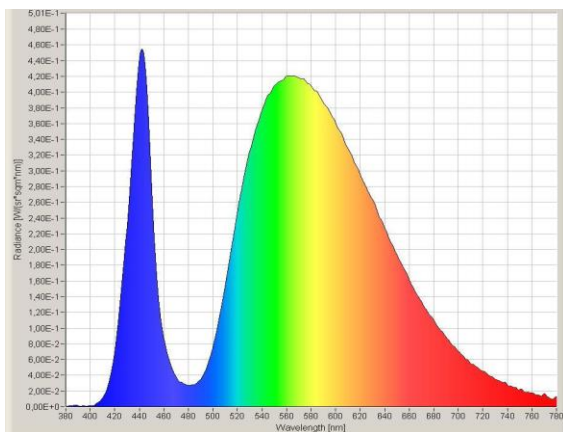
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Spectroradiometer (Optional)

The system can be equipped with a spectroradiometer fitted on an appropriate support.



It is therefore possible to make measurements as prescribed by the EN 13032-4 Standard by using the module **Gonwin SP** in Gonwin and defining a number n of C- semiplanes and Gamma angles in which to make the measurements.



Spectroradiometer Characteristics

▪ Spectral Range	380-780 nm
▪ Optical Bandwidth	4,5 nm FWHM
▪ Wavelengths Resolution	1 nm
▪ Digital Resolution	16 bit ADC
▪ Dispersive element	Imaging grating
▪ Sensor Type	CCD line array
▪ Measuring ranges	Luminance 0,2 ... 180.000 cd/m ² (Illuminant A) Luminance 0,2 ... 140.000 cd/m ² (typical warm white LED)
▪ Photometric Uncertainty	±4,4% (Illuminant A @ 100cd/m ² , k=2)
▪ Chromaticity Uncertainty	±0.002 x, y (Illuminant A, k=2)
▪ Color Repeatability	±0.0005 x, y (Illuminant A)
▪ CCT Repeatability	±20 K (Illuminant A)
▪ Wavelengths Accuracy	± 0.2 nm
▪ Calibration Traceability	NIST

Multimeter for Electrical Parameters (Optional)

T2+ can be equipped with a power analyser for measuring electrical parameters such as voltage, current, power, frequency and power factor on 1, 2 or 3 channels.



The electrical parameters of each measurement plan are saved in a CSV file for subsequent analysis and processing.

Environmental Parameters Measurement System (Optional)

The goniophotometer can be equipped with Environmental Parameters Measurement System for measuring temperature, air speed and humidity at 1 m from the luminaire or light source being tested.



The environmental parameters of each measurement plan are saved in a CSV file for subsequent analysis and processing, the same file used for the electrical parameters.

Control and Data Acquisition System

The control unit organizes and manages the measurement and is connected to the computer by means of a TCP/IP interface.

The system manages all the measurement procedures, from reading angular positions to acquiring the signal from the photocell; it allows the angles to be fixed for a defined position and to carry out the whole measurement according to the C-Gamma system and V-H system for conical surfaces.

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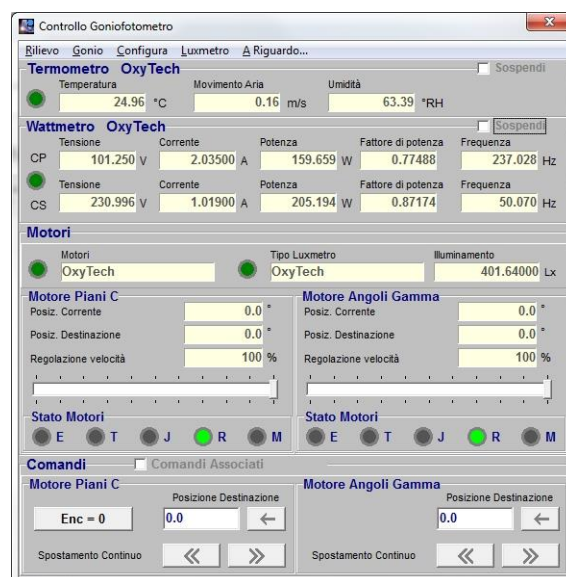
Software

T1+ Goniophotometer Management Software - Gonwin

The machine is supplied with management software **LITESTAR 4D Gonwin** in MS Windows® 11 environment that allows you to:



- ▶ carry out a complete measurement in accordance with:
 - standards (CIE Recommendations, EN 13032 Standard and IES LM-79 Standard)
 - matrices freely set by the user.
- ▶ save the measured values in matrices in GF format (goniophotometer format) convertible into formats Eulumdat, IES, Cibse TM14, LTLI and OXL OxyTech with **LITESTAR 4D Photoview**.
- ▶ perform point measurements defined by the operator
- ▶ define the type of measurement whether continuous or with stops in every measurement position
- ▶ regulate the automatic start of measurement by evaluating the light emission of the light source at full performance as well as the positive stability control
- ▶ regulate the length of the stops between one plane and the other
- ▶ regulate the speed of rotation around the axes during measurement
- ▶ measure and save in Excel file:
 - the electrical parameters before and after the feeders (optional module)
 - the parameters of temperature, humidity and speed of the air (optional module)
- ▶ manage all functions of control and acquisition of measured and calculated values
- ▶ assess the lamp flux stability during measurement with immediate stop to the latter should the differences be greater than a predefined delta
- ▶ assess the stability of the electrical parameters during measurement with immediate stop of the latter should the differences be greater than a predefined delta
- ▶ assess the flux decay for emergency lighting devices in accordance with EN 1838 (optional module)

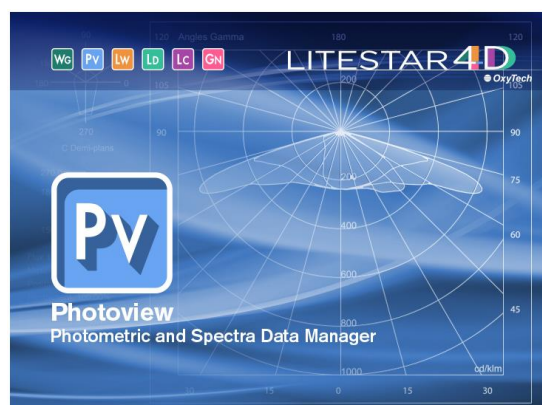


- ▶ visualize the stability graph of the electrical parameters throughout measurement
- ▶ visualize the polar diagram of the plane under examination throughout measurement
- ▶ automatically turn off lamp and machine at the end of measurement (useful function for long measurements that can also be performed during the night - optional module)
- ▶ measure the temperatures of luminaires and lamps using the thermocouple system (optional module).

The software works on PC in MS Windows® 10 environment and is available in more than 20 languages.

LITESTAR 4D Photoview Software

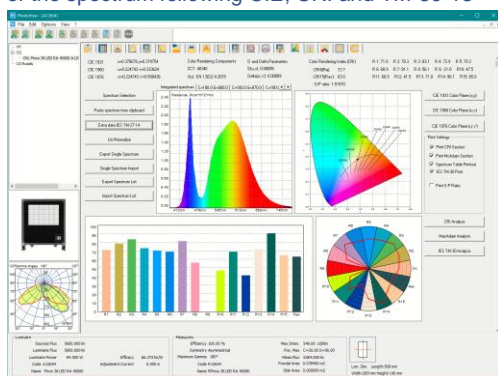
Processing and visualization of measurement results in tables and graphs are carried out with the **LITESTAR 4D Photoview Plus** module that allows you to:



- ▶ import the measurement data and save them in files defined by the operator
- ▶ convert a C- γ measurement into V-H and viceversa
- ▶ import and export the measurements in the standard formats Eulumdat, IES (86, 91 and 95), TM14, LTLI and OXL

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- ▶ process graphs:
 - polar, cartesian and beam aperture
 - of the glare
 - of the isolux and isocandela curves
 - of the yield for interior and road luminaires
 - of the photometric classification of road luminaires according to IES TM-15 standard
 - of the decay in emergency
 - of the spectrum following CIE, CRI and TM-30-18



- ▶ process tables:
 - of the utilances and utilization factors
 - of UGR and luminance values
 - of the international classifications.

The software works on PC in MS Windows® 11 environment and is available in more than 20 languages.

Computer

The computer supplied with the machine complies with the following minimum requirements:

- ▶ PC with 1 Gb RAM or greater and 2 Gb hard disk
- ▶ 2 USB and 2 LAN interfaces
- ▶ color monitor
- ▶ MS Windows® 11 or greater operating system

Optional Accessory Elements

The following optional accessory elements are available:

- ▶ Standard calibrated lamp for calibrating the goniophotometer inclusive of lampholder (4 wire technique), CC feeder and certificate
- ▶ Horizontal slide with vertical support for the fixture and motor is self-propelled and can be moved linearly forwards or backwards. The slide is equipped with a small wheel and worm screw for precise positioning of the fixture and to make the luminous center of the fixture coincide with the intersection of the 2 rotation axes
- ▶ Power supply (power source)
- ▶ Special brackets for fixing luminaires and lamps.

Room Dimensions and Characteristics

Dimensions

The dimensions of the room in which to install the goniophotometer depend on the type of luminaire to be measured.

The distance photocell/luminous center of luminaire is determined according to prescriptions given, for example, in Standard EN 13201-4:2015 paragraph 4.5.4.1

Example: **if we consider a linear LED luminaire with Lambertian light emission with a larger dimension of the luminous area of approximately 500 mm** therefore the distance must not be less than 2.5 m (in such case the rule of 5 times the greater dimension of the luminous area can be applied).

It is normally preferable to consider a distance of no less than 2,5 m even with luminaires of smaller dimensions.

It is also important to consider the type of beam emitted by the luminaire and the lamp power; in fact, when this is highly concentrated and the lamp exceeds the power of 400W, it is advisable to consider a distance photocell/luminous center of luminaire of approx. 5/8 m.

The room dimensions (Laboratory) are (consider that the length must be between 5 and 8 m + 1 m for arm movement):

- ▶ length > 6 m
- ▶ width 3 m
- ▶ height 2,7 m

Characteristics

Wall Colour - The laboratory walls should be painted in matt black and it's recommended to cover the laboratory wall, ceiling and floor surfaces with black velvet type DC-Fix

Air conditioning system - The room must be equipped with an air conditioning system capable of maintaining the temperature of the area around to the appliance to be measured at 25 °C +/- 1 °C

Further details may be provided in case of acquisition of the machine

Nota Bene

- ▶ Machine installation is carried out by OxyTech technicians.
- ▶ OxyTech reserves the right to make improvements to the machine at any time without obligation to inform.