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HD 2021T

TRANSMITTERS FOR ILLUMINANCE AND IRRADIANCE MEASUREMENTS

LP PHOT 01 – LP RAD 01 – LP PAR 01 – LP UVA 01 – LP UVB 01 – LP UVC 01

PHOTOMETRIC AND RADIOMETRIC PROBES

SERIE HD 2021T TRANSMITTERS FOR ILLUMINANCE AND IRRADIANCE MEASUREMENTS.

The HD 2021T series allows conversion of photometric and radiometric quantities as illuminance (Lux) and irradiance (W/m²) - across, UVA, UVB, UVC spectral regions and 400 ÷ 1000nm band - into a 0 ÷ 10 voltage signal.

The voltage output 0 ÷ 10 V (0 ÷ 1 V, 0 ÷ 5V, 4 ÷ 20mA on request for substantial orders) comes factory set calibrated to the full scale range specified at the time of order.

HD 2021T transmitters wide range of applications include:

- Measurement of illuminance (HD 2021T) in offices and laboratories, manufacturing plants and production areas, commercial sites, theatres, museums, sports lighting, roadway lighting, tunnels and nursery-gardening systems.
- Measurement of solar irradiance, within 400nm ÷ 1000nm spectral band (HD 2021T.1).
- Monitoring tanning lamps irradiance within UVA (HD 2021T.2) and UVB (HD2021T.3) spectral regions, as well as efficiency control in filters for high pressure UV lamps.
- Efficiency control in UV lamps used in water purification plants, where UVC (HD2021T.4) band irradiance needs to be constantly monitored.

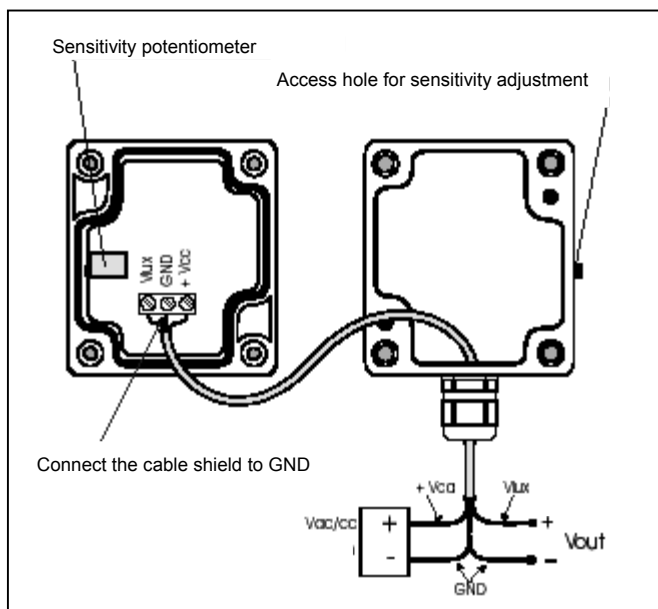
HD2021T transmitters can be installed either for indoor or outdoor applications (Protection: IP66). In case of extremely intense light sources measuring, the transmitter sensitivity can be reduced upon request. The HD 2021T series employs filters and photodiodes especially studied to adjust spectral response to a specific region of interest.

**TECHNICAL SPECIFICATIONS**

	HD 2021T	HD 2021 T.1	HD 2021 T.2	HD 2021 T.3	HD 2021 T.4	HD 2021 T.5	HD 2021 T.6
Sensor	Photodiode Si	Photodiode Si	Photodiode GaP	Photodiode SiC	Photodiode SiC	Photodiode GaP	Photodiode Si
Spectral range	Curve V(λ)	450..950 nm	UVA	UVB	UVC	UV	Curve V(λ)
Viewing angle	Corrected in accordance with the Cosine law						20 ° in accordance CIE 88/90
Sensitivity	5 – 500 mV/lux	1 – 100 mV/(mV/m²)	1 – 100 mV/(mV/m²)	0,1 – 10 mV/(mV/m²)		1 – 100 mV/(mV/m²)	0,5 – 50 mV/(cd/m²)
Output signal	0 .. 10 V (0 .. 1 V, 0 .. 5 V, 4 .. 20 mA on request)						
Power supply	16 .. 40 Vcc ó 24 Vca 0 .. 10V output 10 ÷ 40 Vdc or 24 Vac for 0 ÷ 1 V, 0 ÷ 5 V output - 10 ÷ 40 Vdc for 4 ÷ 20 mA output						
Power consumption	10 mA						
Working temperature	-20 a 60 °C						
Electrical protection	Protected against polarity inversions						
Dimensions	58 x 65 x 52 mm.						58 x 65 x 145 mm
Degree of protection	IP67						
Maximum cable length	150 m						

ORDER CODES

* The full scale value has to be selected in the fields A, B, C				
MODELO	A	B	C	X
HD 2021T	0,02÷2 klux	0,2÷20 klux		Other ranges on request for at least 5 pcs per order
HD 2021T1	0,2÷20 W/m ²	2÷200 W/m ²	20÷2000 W/m ²	
HD 2021T2	0,2÷20 W/m ²	2÷200 W/m ²	20÷2000 W/m ²	
HD 2021T3	2÷200 W/m ²	20÷2000 W/m ²		
HD 2021T4	2÷200 W/m ²	20÷2000 W/m ²		
HD 2021T5	0,2÷20 W/m ²	2÷200 W/m ²	20÷2000 W/m ²	
HD 2021T6	20÷2000 cd/m ²	0,2÷20kcd/m ²	2÷200 klux	
** For voltage output 0÷10V please indicate: V For current output 4÷20mA please indicate: A i.e. HD2021TBA: Transmitter for illuminance range 0.2÷20klux, Output 4÷20mA				



Installation of transmitters

After choosing the right position where to install HD2021T, we need to provide the electric connections inside the transmitter. Loosen the four screws on the lid in order to lift it; the inside of the transmitter will look as in figure n.1.

On the terminal board we will locate three terminals with the following tags:

GND = meaning the ground referred to power supply an output signal

+Vcc = where the positive pole of the power supply has to be connected (in case of continuous power being employed)

Vlux (output) = system output to be connected to the positive pole of a Multimeter or Data Logger

Fig. 1

The sample below shows the installation of HD2021T illuminance transmitter monitoring lamps intensity. For this kind of application, HD2021T transmitters are generally installed on ceilings, close to the area where illuminance needs to be monitored (figure 2).

Through a reference Luxmeter (ex. HD2102.1(2) with probe LP471 PHOT) previously placed in the operating area, we work on HD2021T potentiometer until we get to the desired reference value. HD2021T output is able to control several adjustable feeders at the same time..

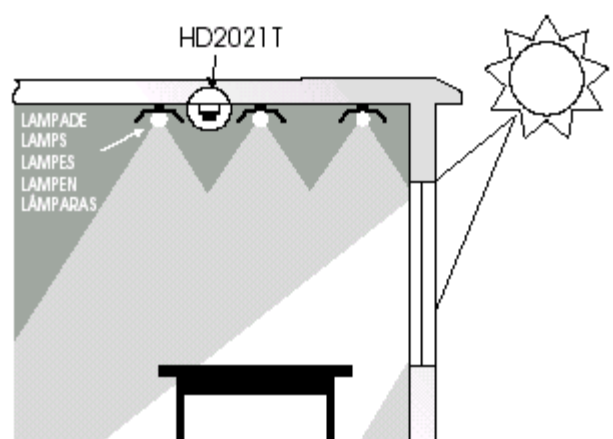
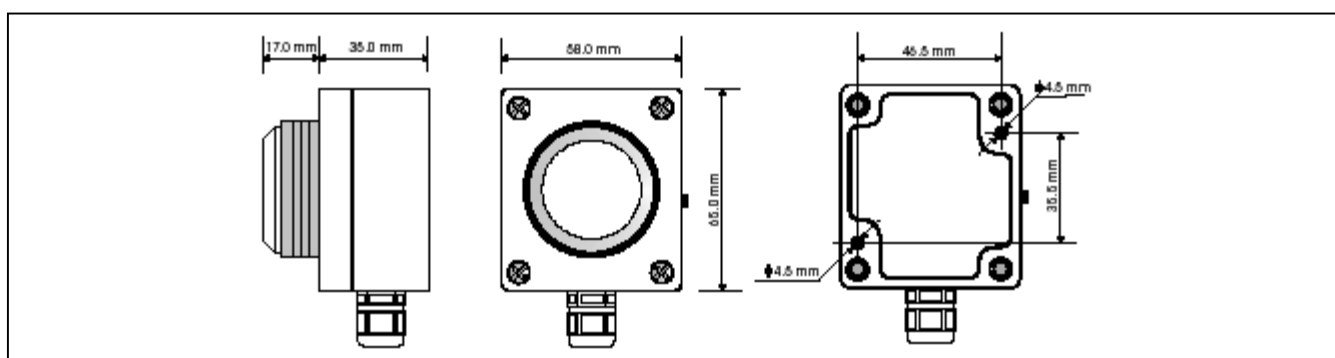
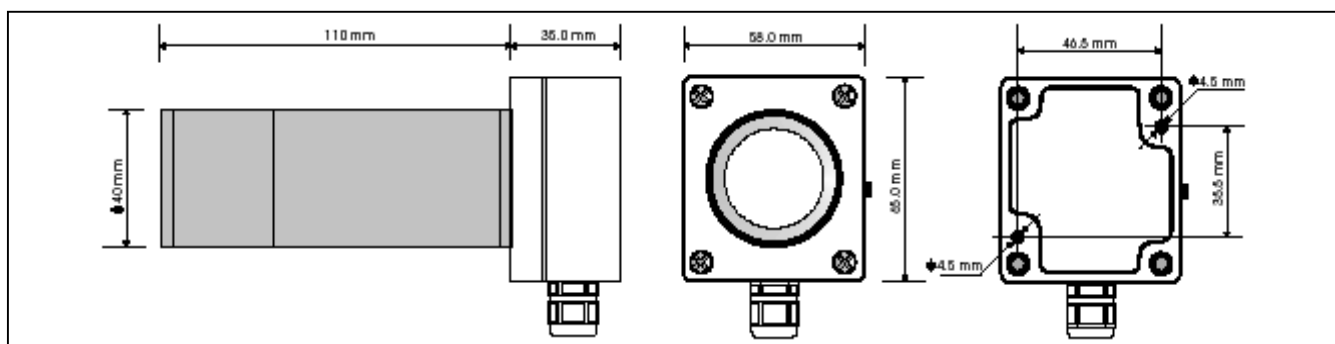


Fig. 2



DIMENSIONS : HD2021T, HD2021T.1, HD2021T.2, HD2021T.3, HD2021T.4, HD2021T.5



DIMENSIONS : HD2021T.6

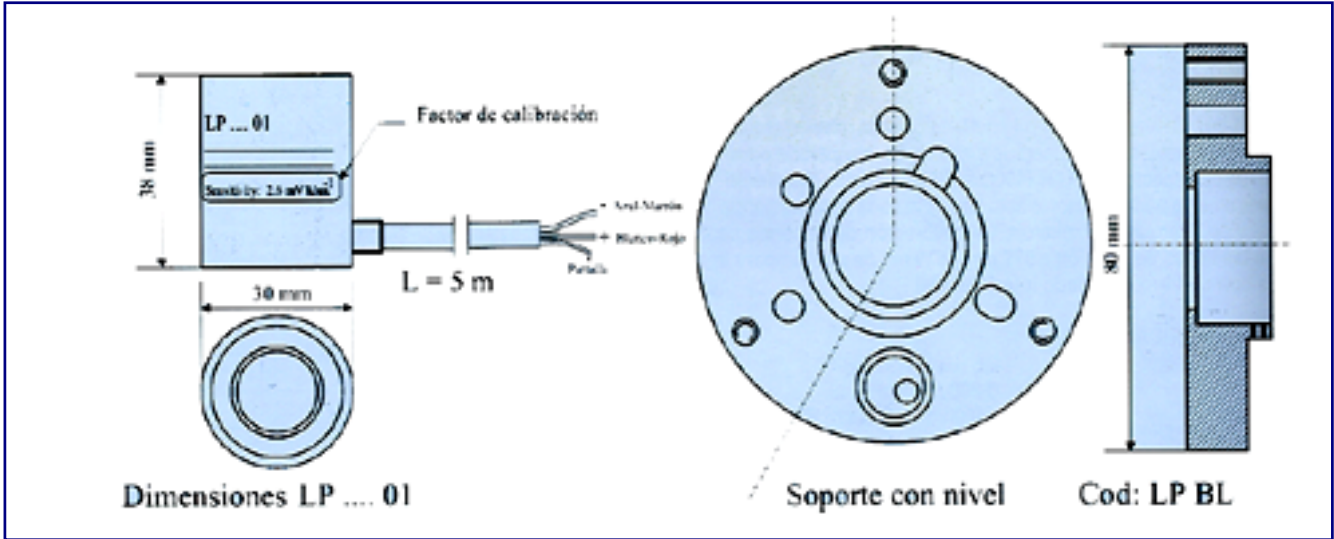
LP PHOT 01, LP RAD 01. LP PAR 01, LP UVA 01, LP UVB 01, LP UBC 01
PROBES FOR EXTERNAL ENVIRONMENT AND WEATHER STATIONS
PHOTOMETRIC / RADIOMETERPROBES (OUT MV) DELTA OHM



his series of probes, to measure photometric and radiometric quantities, luminance (lux) and irradiance (W/cm²) in the VIS-NIR spectral regions, UVA, UVB, UVC and the number of photons per unit time and surface PAR region, measuring the flow of photons in the field of photosynthesis of chlorophyll (400 nm ÷ 700 nm)
No power needed, the output signal in mV is obtained from a resistor that shorts the terminals of the photodiode. Thus the current generated by the photodiode, to receive the light, becomes a potential difference that can be read by a voltmeter. Using the calibration factor, it is possible to calculate the measured value.
All probes are calibrated individually and the calibration factor is shown in the probe and in the manual and is specific to each of them.
All probes incorporate a diffuser for cosine correction. This diffuser is made of quartz measuring probes in the UV spectral range, and acrylic or Teflon in the rest.
This family of probes is suitable for applications both indoors and outdoors, where needed constant monitoring of any of the specified quantities.

Installation

After fixing the probe in its working position, is connected to the voltmeter reading to be made (check that the scale is adequate) following the connection instructions manual that came with the probe. For applications which require positioning of the probe parallel to the ground, LP support can be provided with level indicator BL.

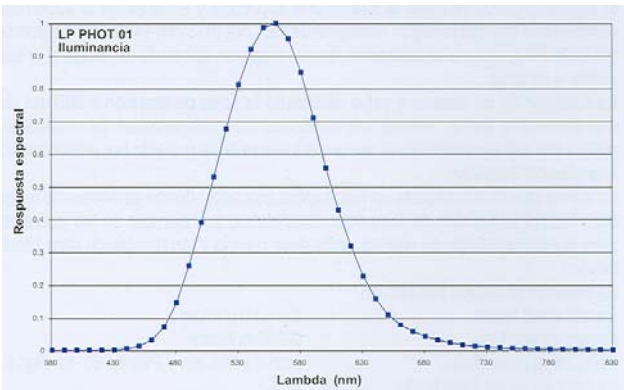


DESCRIPTION OF THE PROBES

LP PHOT 01 (Illuminance)

Measure illuminance (lx) defined as the ratio of luminous flux (lumen) and the crossing area (m²).
The spectral response curve of a photometric probe is similar to the human eye, known as standard photopic curve V (λ). The difference in spectral response between the probe and this curve is evaluated by calculating error f1 '
The calibration of the probe is compared to a standard luxmeter. The calibration procedure is as specified in the CIE Publication No. 69 (1987) "Put ye of Characterizing Illuminance Meters and Luminance Meters
Caibración Enlighten The probe is performed with a standard font called illuminant A

Technical features	
Typical sensitivity	0,5 a 1,5 mV/ klux
Spectral range	V(λ)
Calibrtion accuracy	< 4 %
f ₁ ' (according to the photopic response V(λ)	< 8 %
f ₂ (cosine response as)	< 3 %
f ₃ (linearity)	< 1 %
f ₅ (wear)	< 0,5 %
Working temperature	0 to 50 °C
Output impedance	0,5 to 1 kΩ

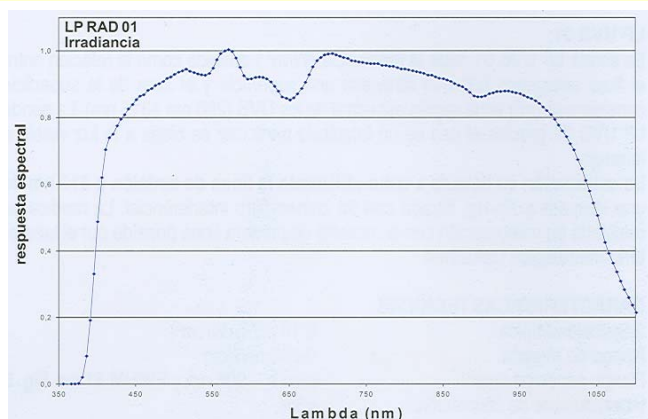


RAD LP 01 (irradiance)

Measure the irradiance (W/m²) defined as the ratio between the energy flow (W) passing through a surface and its area (m²) in the VIS-NIR spectral region (400nm to 1050nm). These characteristics make it particularly suitable for measurements in the range laproximada visual and infrared.

The probe calibration is performed using the lines at 577nm and 579nm emission of a Xe.Hg lamp filtered through a suitable interference filter.

Technical features	
Typical sensitivity	2,6 $\mu\text{V}/(\mu\text{W}/\text{cm}^2)$
Operating range	0 to 200 mW/cm^2
Spectral range	400 to 1050nm
Calibration accuracy	< 6 %
f ₂ (cosine response as)	< 7 %
Working temperature	0 to 50 °C
Output impedance	1 k Ω



LP UVA 01 (radiation in the UVA area)

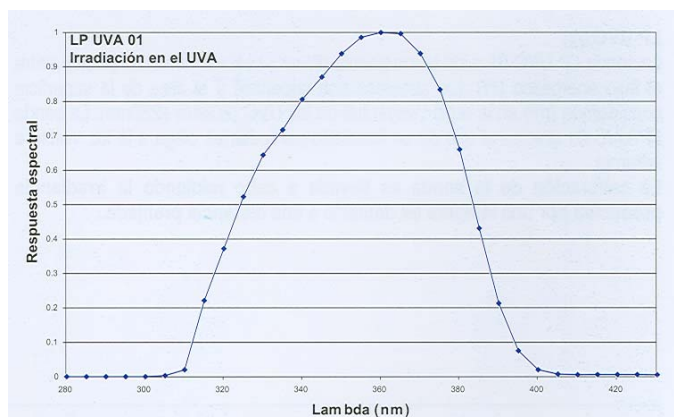
Measures irradiance (W/m²) defined as the ratio between the energy flow (W) passing through a surface and its area (m²) in the UVA spectral region (315nm to 400nm). The probe LP UVA 01 through the use of a particular photodiode is blind to visible light and infrared.

The probe calibration is performed using emission lines of 365 nm Xe.Hg lamp filtered through a suitable interference filter

The measure is by comparison with a laboratory in the Delta Ohm.

The probe can be used in any process that requires a control ultraviolet emission

Technical features	
Typical sensitivity	2,6 $\mu\text{V}/(\mu\text{W}/\text{cm}^2)$
Operating range	0 to 200 mW/m^2
Spectral range	Peak 360nm FWHM 60nm
Calibration accuracy	< 6 %
Working temperature	0 to 50 °C
Output impedance	1 k Ω



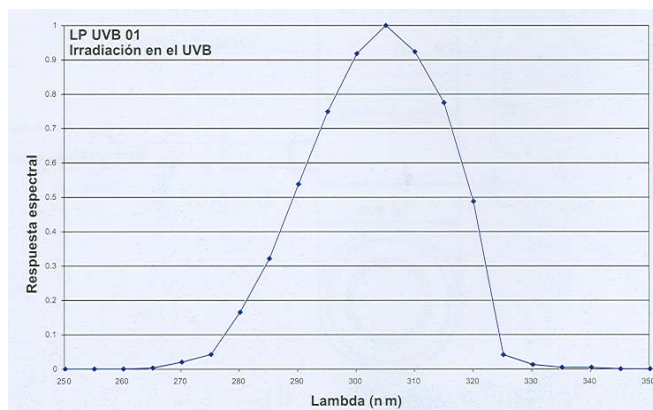
LP UVB 01 (radiation in the UVA area)

Measures irradiance (W/m²) defined as the ratio between the energy flow (W) passing through a surface and its area (m²) in the UVB spectral region (280nm to 315nm). The probe LP UVB 01 through the use of a particular photodiode is blind to visible light and infrared.

The probe calibration is performed using emission lines of 313 nm Xe.Hg lamp filtered through a suitable interference filter

The measurement is compared to a pattern in the laboratory Delta Ohm.

Technical features	
Typical sensitivity	2,6 $\mu\text{V}/(\mu\text{W}/\text{cm}^2)$
Operating range	0 to 200 mW/m^2
Spectral range	Peak 305nm FWHM 31nm
Calibration accuracy	< 8 %
Working temperature	0 to 50 °C
Output impedance	2 k Ω

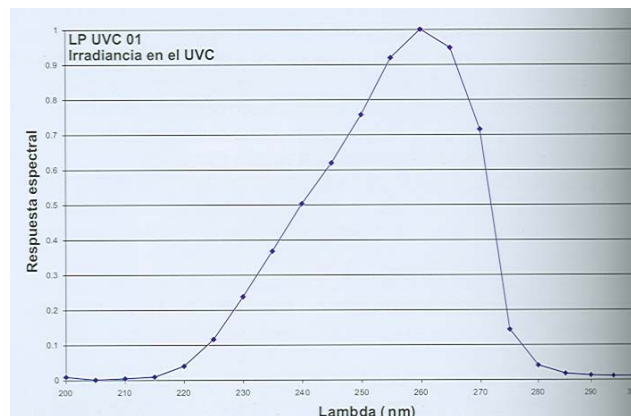


UVC LP 01 (radiation in the UVA area)

Measures irradiance (W/m²) defined as the ratio between the energy flow (W) passing through a surface and its area (m²) in the UVC spectral region (200nm to 280nm). UVC LP probe 01 through the use of a particular photodiode is blind to visible light and infrared.

The probe calibration is performed by measuring the irradiación a deuterium lamp to a preset distance.

Technical features	
Typical sensitivity	0,19 $\mu\text{V}/(\mu\text{W}/\text{cm}^2)$
Operating range	0 to 200 mW/m^2
Spectral range	Peak 260nm FWHM 32nm
Calibration accuracy	<10 %
Working temperature	0 to 50 °C
Output impedance	2 k Ω

**LP PAR 01 (photon flux measurement in the field of chlorophyll)**

It measures the relationship between the number of photons arriving at a surface and its area (m²) in the spectral region (400nm to 700nm).

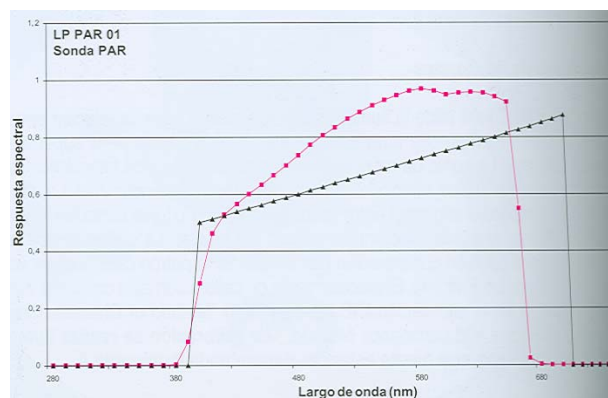
The measured quantity is called PAR

The probe calibration is performed with a halogen lamp from which irradiance known spectral spectral region of interest.

The influence of temperature on the spectral response is irrelevant.

The diffuser, and the particular structure of the correct probe response to vary the angle of incidence of light on the diffuser according to the cosine law

Technical features	
Typical sensitivity	30 $\mu\text{V}/(\mu\text{mol}/(\text{m}^2\text{s}))$
Operating range	0 a 5000 $\mu\text{mol}/(\text{m}^2\text{s})$
Spectral range	400 to 600 nm
Calibration accuracy	<6 %
f_2 (cosine response as)	<7%
Working temperature	0 to 50 °C
Output impedance	1 k Ω

**ORDER CODES**

MODEL	FEATURES
LP PHOT 01	Photometric probe for measuring ILLUMINANCE, CIE photopic filter, diffuser for cosine correction. Output in mV / klux, cable L=5m.
LP RAD 01	Radiometric probe for measuring IRRADIANCE, diffuser for cosine correction. Output in mV per W/cm^2 , cable L=5m.
LP PAR 01	Radiometric probe for measuring PHOTONS FLOW (light flow in the field of photosynthesis of chlorophyll). Cosine correction. Output in $\text{mV}/\mu\text{mol m}^{-2}\text{s}^{-1}$, cable L=5m.
LP UVA 01	Radiometric probe for measuring IRRADIANCE in the UVA (315...400nm). Output in $\mu\text{V}/\mu\text{Wcm}^{-2}$, 5m cable
LP UVB 01	Radiometric probe for measuring IRRADIANCE in the UVB (280...315nm). Output in $\mu\text{V}/\mu\text{Wcm}^{-2}$, 5m cable
LP UVC 01	Radiometric probe for measuring IRRADIANCE in the UVC (220...280nm). Output in $\mu\text{V}/\mu\text{Wcm}^{-2}$, 5m cable
LP BL	Base with levelling device. On request for assembly with the probes at the time of order. Working temperature-40...+80°C.

LP PHOT 02, LP PHOT 02 AC, LP PHOT 02 AV PHOTOMETRIC PROBES

LP PHOT 02 The probe measures the luminance (lux) defined as the ratio between the luminous flux (lumen) passing through a surface, this surface area (m²).

The spectral response curve of a photometric probe is similar to the human eye known as standard photopic curve V (λ).

The difference between the spectral response of the probe, and the curve is evaluated by calculating the error f1.

The probe is designed and built for outdoor use, and is used to measure the daylight in the meteorological field.

Working principle

It is based on a solid state sensor whose spectral response was corrected by using filters to fit the human eye response.

The sensor element is protected by a transparent glass dome, with an outer diameter of 50 mm, to ensure their impervious to the elements.

The answer according to the law of cosines is obtained thanks to the special shape of the PTFE diffuser and housing.

Calibration and implementation of measures

The sensitivity of the probe S, measured in mV / klux (or calibration factor), to determine the luminance measuring the voltage drop V on a short-circuits the photodiode resistance.

Ee luminance is obtained from the following formula

$$E_e = DDP / DDP S$$

Each probe is individually calibrated at the factory, according to the guide CIE No. 69 "Methods of characterizing illuminance meters: Performance, Characteristics and specifications 1987"

3 models are manufactured:

LP PHOT 02

with mV output signal. No power needed.

LP PHOT 02 AC

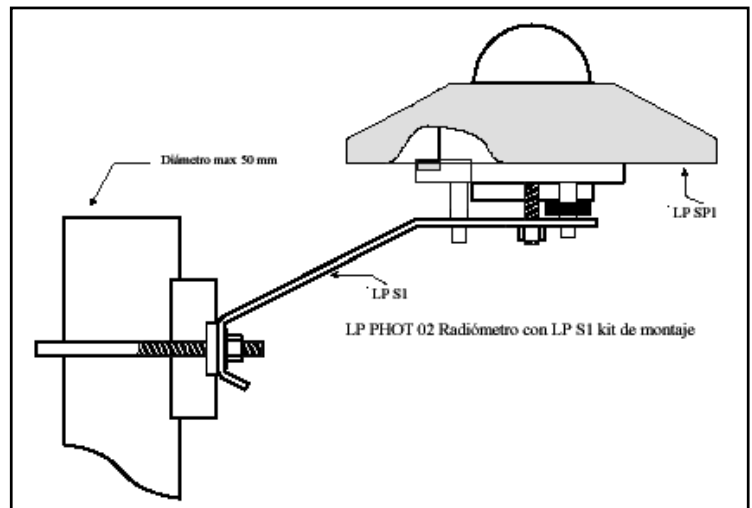
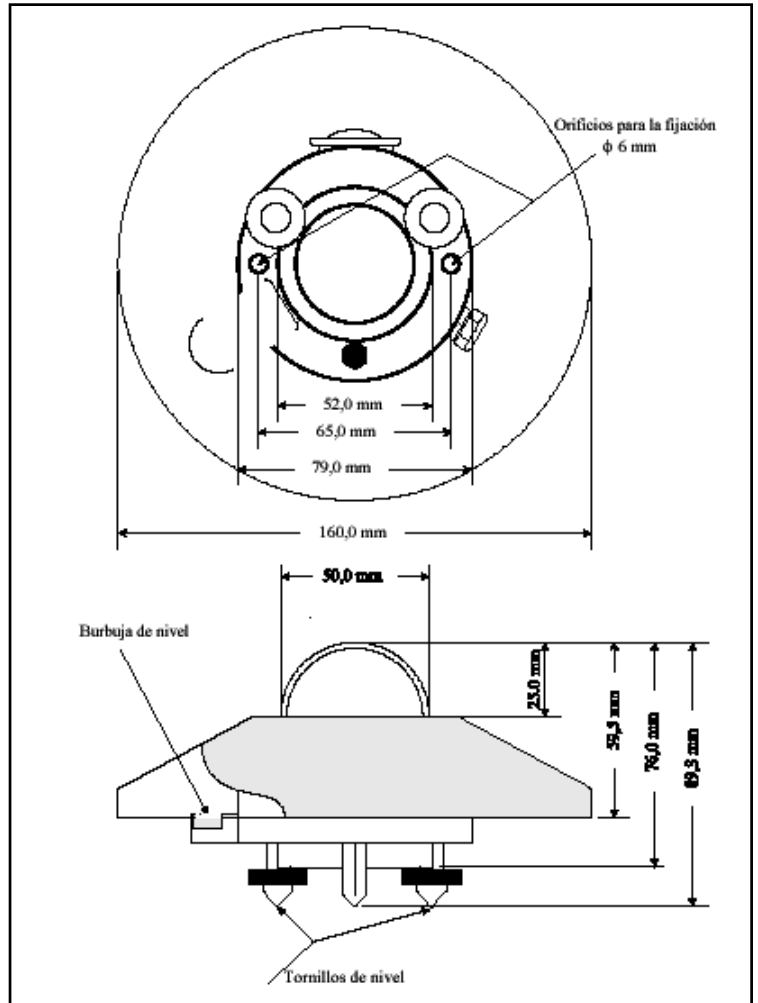
Output 4 ... 20 mA. 10-30 VDC Power

LP PHOT 02 AV

0 ... 10 Vdc output (upon request 0 ... 1 Vdc, 0 ... 5 Vdc)

Power Supply 14-30 Vdc

The three models are available in two versions: With cable 5 meters and 10 meter cable





LP UVA 02, LP UVB 02 RADIOMETERS

The LP UVA 02 radiometer measures the global radiation in the UVA spectral range on a flat surface (W/m²). Radiation is the sum of directly produced by the sun and diffuse sky. The instrument can also be used in the monitoring of UVA emissions indoors.

The UVB measured in the UVB spectral range . Working principle It is based on a solid state sensor, whose spectral response has been adapted to the desired one by using appropriate filters.

The LP UVA 02 radiometer clear glass dome, with an outer diameter of 50 mm, to ensure the immutability of the sensor face to atmospheric agents.

The answer according to cosine law is obtained through the special shape of the diffuser and the housing PTFE

4 models are manufactured:

LP UVA 02 with mV output signal. No power needed.

LP UVB 02 with mV output signal. No power needed

LP UVA 02 AC Output 4 ... 20 mA, 10-30 VDC Power

LP UVA 02 AV Output 0 .. 10 VDC (on request 0 ... 1 Vdc, 0 ... 5 Vdc) Power Supply 14-30 Vdc

Calibration and implementation of measures

S radiometer sensitivity, measured in $\mu\text{V}/\text{Wm}^2$ (or calibration factor), to determine the luminance measuring the voltage drop V on a short-circuits the photodiode resistance.

Ee luminance is obtained from the following formula

$E_0 = DDP / S$ E_0 being expressed in W/m^2 radiation

DDP The voltage drop expressed in microvolts

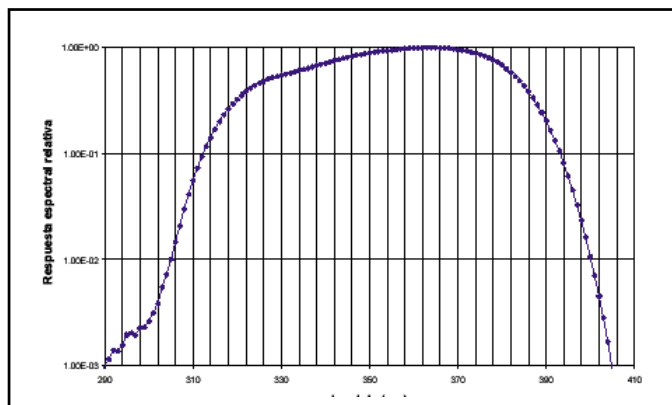
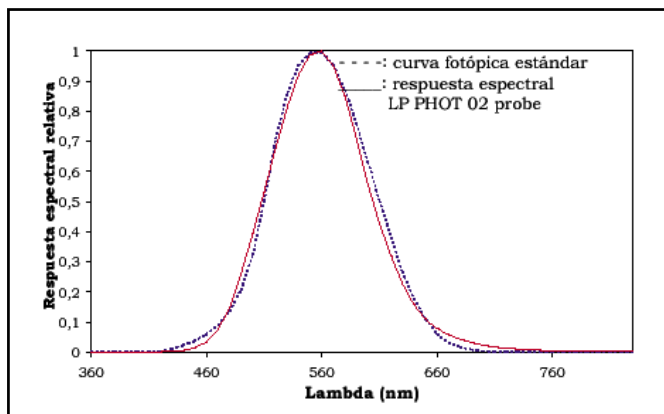
S The calibration factor (see labeling of radiometer and calibration report)

Each radiometer is individually calibrated at the factory and has its own calibration factor. Procedure is used DHLF-E-59 for the calibration of UV radiometers.

The calibration is performed using the emission line at 365 nm from a Xe-Hg lamp, the measure is suitably filtered by comparison with the first line shows the power of laboratory Delta Ohm weather.

It's advisable to check the calibration on an annual basis

	LP PHOT 02	LP PHOT 02 AC	LP PHOT 02 AV	LP UVA 02	LP UVA 02 AC	LP UVA 02 AV	LP UVB 02
Power supply		10..30 Vcc (14..30 Vcc 0..10V output)			10..30 Vcc (14..30 Vcc 0..10V output)		7..30 Vcc
Consumo típico							3 mA
Typical sensitivity:	0,52...2,0 mV/klux			150..250 μV/(W/m ²)			
Impedance	0,5 .. 1kΩ			5 .. 7,5kΩ			Mínima impedancia de carga 10 kΩ
Measurement range:	0 .. 200 klux			0 ... 1000 W/m ²			0 ... 8 W/m ²
Viewing range	2 π sr						
Spectral range	Standard photopic curve CIE N° 69			327..384 nm (1/2) 312..393 nm (1/10) 305..400 nm (1/100)			305 nm Pico 302,5..307,5 nm (1/2) 301..309 nm (1/10) 297,5..311,75 nm (1/100) 292,5..316,255 nm (1/1000)
Output signal		4..20mA	0..1 Vcc, 0..5 Vcc 0..10 Vcc		4..20mA	0..1 Vcc, 0..5 Vcc 0..10 Vcc	
Range		4 mA = 0 lux 20 mA = 150 klux	0 Vcc = 0 lux 1Vcc,5Vcc,10Vcc = 150 lux		4 mA = 0 W/m ² 20 mA = 150 W/m ²	0 Vcc = 0 W/m ² Vcc,5Vcc,10Vcc = 150 W/m ²	
Working temperature	-40 a 80 °C						-40 to 60 °C
Response time:95%	< 0,5 seg						
Error	< 9%						
Response according to the cosine law:	<8% (between 0 and 80 ° C) typical						
Long-term instability (1 year):	< ± 3%						
Non linearity:	< 1%						
Response according to temperature:	< 0,01% / °C						< 0,01% / °C
Temperature measurement							
Measurement range							-40 to 60 °C
Accuracy							± 0,2 °C
Min. load impedance:							10 kΩ



MODEL	FEATURES
LP PHOT 02	Photometric probe complete with shade disk, dessicant sachet with silicagel crystals, 2 silica-gel cartridges, bubble level, 4-pole fl ying connector and Report of Calibration. Connecting cable has to be ordered separately.
LP PHOT 02 AC	Photometric probe complete with shade disk, dessicant sachet with silicagel crystals, 2 silica-gel cartridges, bubble level, 4-pole fl ying connector and Report of Calibration. Output signal 4..20mA . Connecting cable has to be ordered separately.
LP PHOT 02 AV	Photometric probe complete with shade disk, dessicant sachet with silicagel crystals, 2 silica-gel cartridges, bubble level, 4-pole fl ying connector and Report of Calibration. Output signal 0..1 V, 0..5 V, 0..10V. Connecting cable has to be ordered separately
LP UVA 02	Radiometer complete with shade disk, desiccant sachet with silica gel crystals, 2 silicagel cartridges, spirit level, 4-pole fl ying connector and Calibration Report. Connection cable has to be ordered separately.
LP UVA 02 AC	Radiometer complete with shade disk, desiccant sachet with silica gel crystals, 2 silicagel cartridges, spirit level, 4-pole fl ying connector and Calibration Report...Output signal 4..20mA Connection cable has to be ordered separately
LP UVA 02 AV	Radiometer complete with shade disk, desiccant sachet with silica gel crystals, 2 silicagel cartridges, spirit level, 4-pole fl ying connector and Calibration Report...Output signal 0..1 V, 0..5 V, 0..10V Connection cable has to be ordered separately
LP UVB 02	Radiometer complete with: protection, cartridge for silica-gel crystals,2 refi lls, spirit level 7-pole fl ying connector, and Report of Calibration. Connection cable has to be ordered separately.
LP S1	Kit composed of bracket for attachment of the LP UVB 02 radiometer to a mast, complete with leveling screws and fasteners.
LP SP1	UV resistant plastic shade disk. BASF LURAN S777K.
LP SG	Desiccant sachet with silica gel crystals complete with O-ring and cap.
LP G	Pack of 5 silica-gel crystals refi lls.