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English

Operating manual

Photometric/radiometric probes

LPPHOT01 – LPPAR01 – LPRAD01
LPUVA01 – LPUVB01 – LPUVC01

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Keep for future reference.

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1 INTRODUCTION

The probes of the series LP…01 allow measurement of photometric and radiometric quantities such as illuminance (lux), irradiance (W/m^2) across VIS-NIR, UVA, UVB, UVC spectral regions, the number of photons per time unit and area in the PAR region (400 nm…700 nm).

In probes LP….01 there is no need for external power supply. The output signal in mV is given through a resistor shunting the photodiode ends. The photocurrent generated by the photodiode when hit by light, is converted to a potential difference, which is read by a voltmeter. Once the DDP (Potential Difference) is known, the measured value can be calculated through the calibration factor.

Each probe is individually calibrated. The sensitivity factor is marked on the housing of the probe and is specific to that probe.

LPPHOT01 and LPPAR01 probes are equipped with cosine corrected diffuser.

LP…01 probes are **suitable for indoor applications** which requires the constant monitoring of the quantities specified.

The output signal can be amplified or converted into a 4…20 mA or 0…10 Vdc signal by using a converter of the series HD978TR3 (4…20 mA) or HD978TR4 (0…10 Vdc) for DIN rail attachment, or the wall mounting types HD978TR5 (4….20 mA) and HD978TR6 (0…10 Vdc).

2 PROBES TECHNICAL CHARACTERISTICS

All probes are composed of a photodiode, a filter, a diffuser, the case and a 5 meters cable allowing the connection of the probe to the reading instrument.

The typical variation of probe sensitivity with temperature variation is -0.1%/°C. The sensitivity factor shown on the probe was obtained in an air-conditioned environment at an ambient temperature of 23 °C and relative humidity 50 ±10 %.

2.1 LPPHOT01

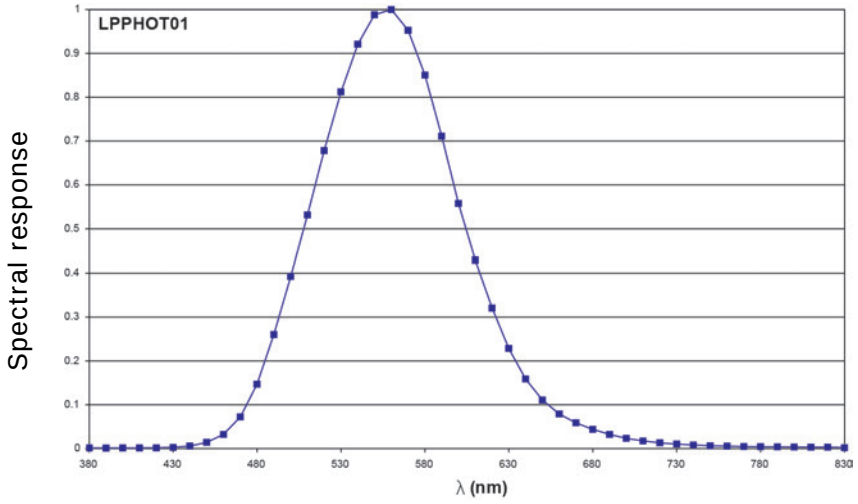
The LPPHOT01 probe (class B luxmeter) measures **illuminance** (lux) defined as the ratio between the luminous flux (lumen) passing through a surface and the surface area (m^2).

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

The difference in spectral response between LPPHOT01 and the standard photopic curve V(λ) is calculated by means of the error f_1'.

Photometric characteristics

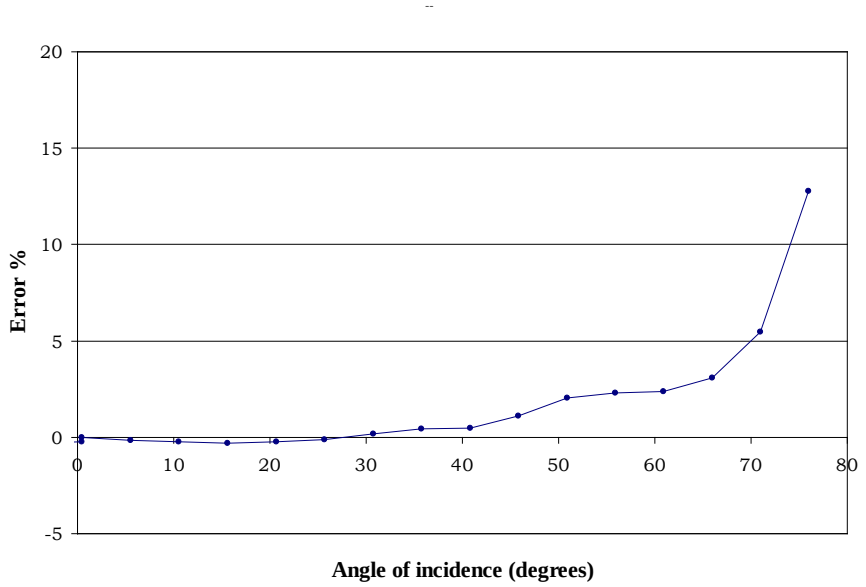
The spectral response curve of the LPPHOT01 probe is shown in the following graph together with the standard phototypical curve.



The calibration of the probe is performed by comparing it to a luxmeter calibrated by a Primary Metrological Institute. The calibration procedure follows the CIE publication No 69 (1987) "Method of Characterizing Illuminance Meters and Luminance Meters" and is carried out by illuminating the probe with a standard illuminant A.

The illuminant A is a reference incandescent lamp with a colour temperature of 2856K.

The following figure shows the trend of the deviation from the cosine law as the angle varies for the LPPHOT01 probe:



Technical specifications

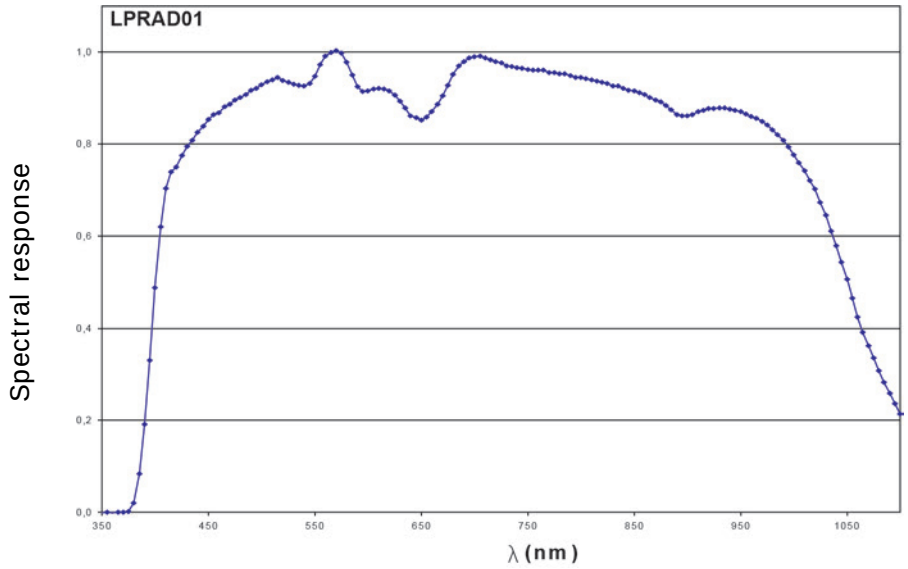
Typical sensitivity	0.5…1.5 mV/klux
Measuring range	0…200000
Spectral range	V(λ)
Calibration accuracy	<4%
f'_1 (V(λ) match error)	<6%
f_2 (cosine response / directional error)	<3%
f_3 (linearity)	<1%
F_5 (fatigue)	<0.5%
Operating temperature	0…50°C
Output impedance	0.5…1 kΩ
Dimensions	Ø 30 mm x 38 mm height

2.2 LPRAD01

The LPRAD01 probe measures **irradiance** (W/m^2) defined as the ratio between the flow of energy (W) crossing a surface and the area of the surface considered (m^2) in the spectral region of the VIS-NIR (400 nm…1050 nm).

Photometric characteristics

The spectral response curve of the LPPOHT01 probe is shown in the following graph together with the standard phototypical curve.



Probe calibration is carried out by using 577/579 nm lines of a Xe-Hg lamp, filtered through a special interferential filter. The temperature has a negligible influence on the spectral response of the probe.

Technical specifications

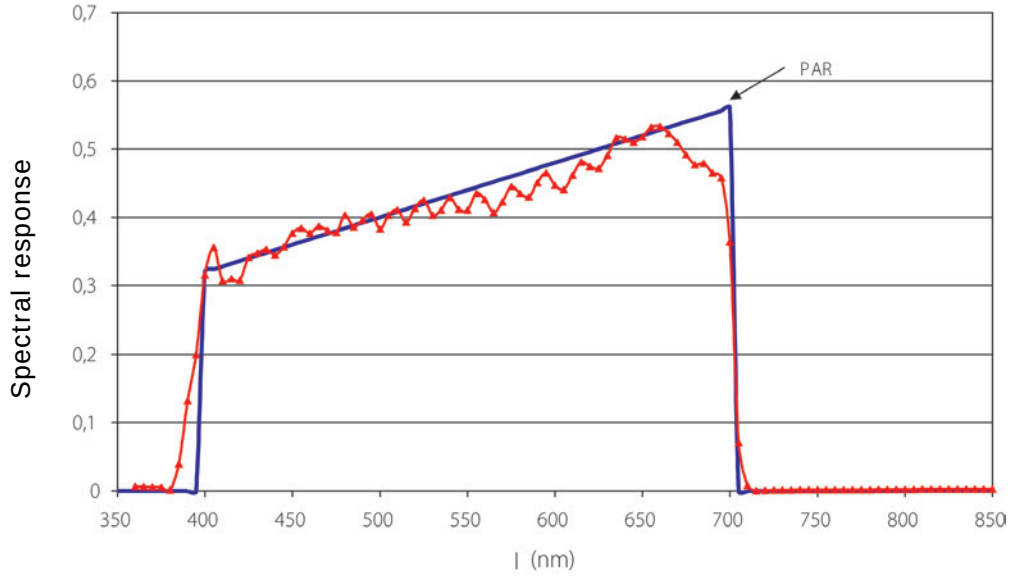
Typical sensitivity	2.6 µV/µW/cm^{-2}
Measuring range	0…200 mW/cm^2
Spectral range	≈400 nm…≈1050 nm
Calibration accuracy	<6%
f_2 (cosine response / directional error)	<6%
Operating temperature	0…50°C
Output impedance	1 kΩ
Dimensions	Ø 30 mm x 38 mm height

2.3 LPPAR01

The LPPAR01 probe measures the ratio between the number of photons that strike a surface in one second, in the 400 nm…700 nm spectral range and the surface area (m^2). This quantity is defined as PAR: **Photosynthetically Active Radiation.**

Radiometric characteristics

The spectral response curve of the LPPAR01 probe is shown in the following graph:

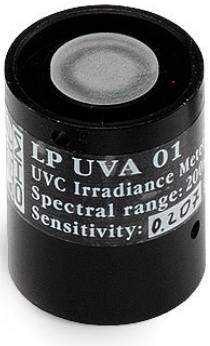


The probe calibration is carried out by using an halogen lamp, with a known spectral irradiance in a specific spectral range (400 nm…700 nm).

Technical specifications:

Typical sensitivity	30 µV/µmol·$m^{-2}s^{-1}$
Measuring range	0…5000 µmol·($m^{-2}s^{-1}$)
Spectral range	400 nm…660 nm
Calibration accuracy	<6%
f_2 (cosine response / directional error)	<6%
Operating temperature	0…50°C
Output impedance	1 kΩ
Dimensions	Ø 30 mm x 38 mm height

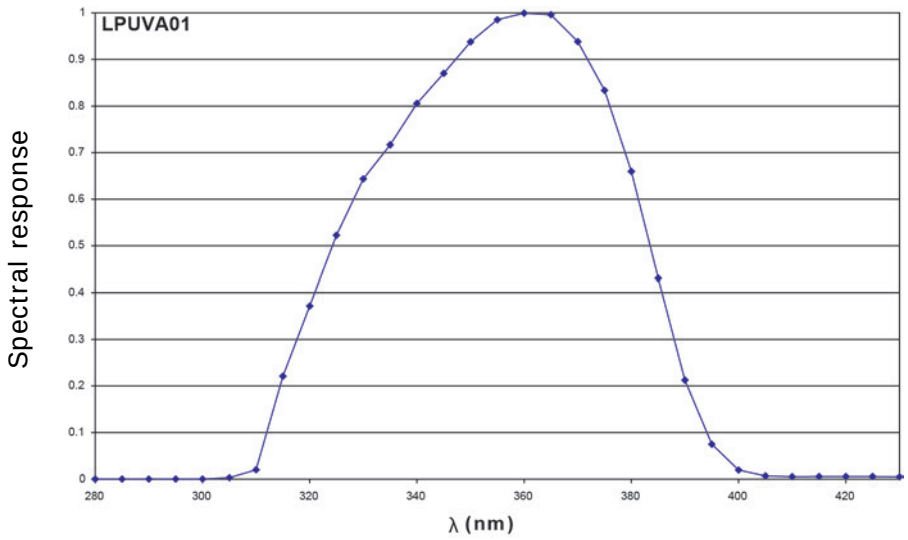
2.4 LPUVA01



The LPUVA01 probe measures **irradiance** (W/m^2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m^2) in the **UVA (315 nm…400 nm)** spectral range. Thanks to a new type of photodiode, LPUVA01 is blind to visible and infrared light.

Radiometric characteristics

The spectral response curve of the LPUVA01 probe is shown in the following graph:



The calibration is performed by reference to our primary standard with monochromatic light at 365 nm obtained separating the emission line of a Xe-Hg lamp with an interential filter. To get best performances from your LPUVA01 it is strongly recommended that the calibration be checked annually. The temperature has a negligible influence on the spectral response of the probe.

Technical specifications

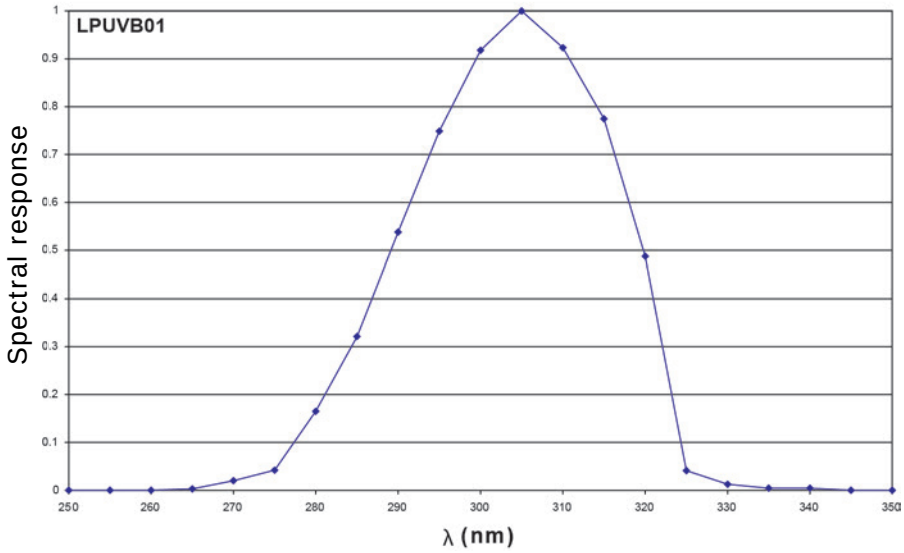
Typical sensitivity	2.6 µV/µW/cm^{-2}
Measuring range	0…200 mW/cm^2
Spectral range	peak at ≈360 nm and FWHM 60 nm
Calibration accuracy	<6%
Operating temperature	0…50°C
Output impedance	1 kΩ
Dimensions	Ø 30 mm x 38 mm height

2.5 LPUVB01

The LPUVB01 probe measures **irradiance** (W/m^2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m^2) in the **UVB (280 nm…315 nm) spectral range.** Thanks to the use of a new type of photodiode, the LPUVB01 probe is blind to visible and infrared light.

Radiometric characteristics

The spectral response curve of the LPUVB01 probe is shown in the following graph:



Probe calibration is carried out by using a 313 nm line of a Xe-Hg lamp, filtered through a special interferential filter. Measurement is carried out by comparison with the primary standards, assigned to Delta OHM Metrological Laboratory.

Technical specifications

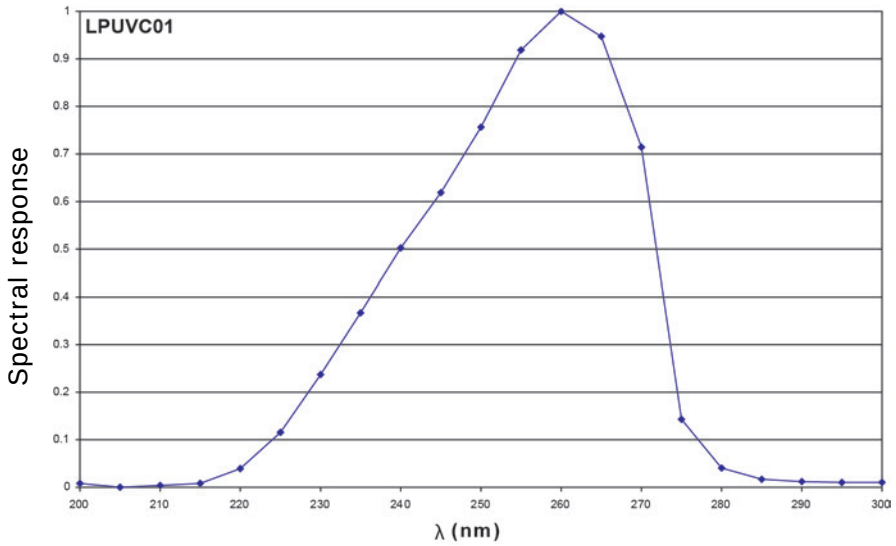
Typical sensitivity	0.19 µV/(µW/cm²)
Measuring range	0…200 mW/cm²
Spectral range	peak at ≈305 nm and FWHM 31 nm
Calibration accuracy	<8%
Operating temperature	0…50°C
Output impedance	2 kΩ
Dimensions	Ø 30 mm x 38 mm height

2.6 LPUVC01

The LPUVC01 probe measures **irradiance** (W/m^2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m^2) in the **UVC (200 nm…280 nm) spectral range**. Thanks to the use of a new type of photodiode, the LPUVC01 probe is blind to visible and infrared light.

Radiometric characteristics

The spectral response curve of the LPUVC01 probe is shown in the following graph:



The probe calibration is carried out by measuring irradiance coming from an Hg lamp at 254 nm.

Technical specifications

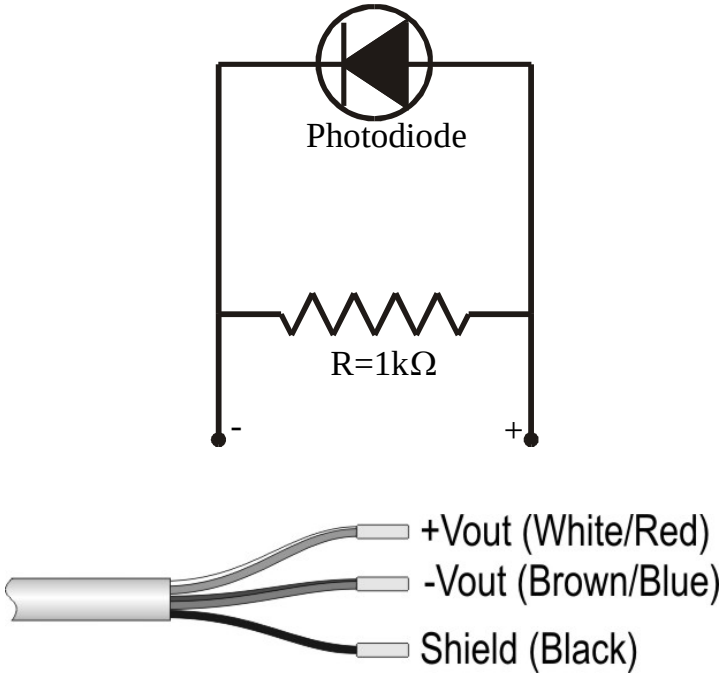
Typical sensitivity	0.25 µV/(µW/cm²)
Measuring range	0…200 mW/cm²
Spectral range	peak at 260 nm and FWHM 32 nm
Calibration accuracy	<10%
Operating temperature	0…50°C
Output impedance	2 kΩ
Dimensions	Ø 30 mm x 38 mm height

3 INSTALLATION

Once the installation place has been decided, the connections between the probe and the voltmeter should be provided; the voltmeter should have proper scales of measurement.

3.1 ELECTRICAL CONNECTIONS

The electric signal of the probes is measured at the ends of the resistance which short-circuits the terminals of the photodiode. The photocurrent generated by the photodiode struck by the light is converted into a difference in potential. The wiring diagram is shown in the following figure.



To obtain a reading precision of 1% of the difference in potential at the ends of the resistance, the probe must be connected to a digital multimeter with input resistance > 100 kΩ

4 MEASUREMENT

The probe output must be read with a digital multimeter with internal resistance >100kΩ. Connect the probe to the reading instrument as shown in the previous chapter.

Having measured the difference in potential (DDP) at the ends of the probe, the photo-radiometric measurement is given by the formula:

$$E = DDP/S$$

where:

E is the illuminance (Klux) or irradiance ($\mu W/cm^2$) or PAR $\mu mol/(m^2 s)$ according to the probe used

DDP is the difference in potential expressed in mV measured by the multimeter,

S is the calibration factor marked on the probe in mV/klux or $\mu V/(\mu W/cm^2)$ or $\mu V/(\mu mol/(m^2 s))$, according to the probe used.

Note for LPUVA01, LPUVB01 and LPUVC01

At the moment no international agreement exist for the calibration of this kind of radiometer, so the calibration coefficient is dependent from the calibration procedure like reported in the following article:

"*Source of Error in UV Radiation Measurements* ", T. C. Larason, C. L. Cromer on "*Journal of Reaserch of the National Institute of Standards and Technology"* Vol. 106, Num. 4, 2001. (The article is free on the NIST's WEB site at the following address : https://nvlpubs.nist.gov/nistpubs/jres/106/4/j64lar.pdf)

5 SAFETY INSTRUCTIONS

General safety instructions

The probes have been manufactured and tested in accordance with the safety standard EN61010-1:2010 “Safety requirements for electrical equipment for measurement, control and laboratory use” and has left the factory in perfect safety technical conditions.

The probes proper operation and operating safety can be ensured only if all standard safety measures as well as the specific measures described in this manual are followed.

The probes proper operation and operating safety can be ensured only in the climatic conditions specified in this manual.

Do not use the probes in places where there are:

- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

User obligations

The probe operator shall follow the directives and regulations below that refer to the treatment of dangerous materials:

- EEC directives on workplace safety.
- National law regulations on workplace safety.
- Accident prevention regulations.

6 ORDERING CODES

LPPHOT01	Photometric probe for measuring ILLUMINANCE, CIE photopic filter, diffuser for cosine correction. Output in mVdc per klux, cable L=5 m.
LPRAD01	Radiometric probe for measuring IRRADIANCE, diffuser for cosine correction. Output in µV / µWcm^{-2}, cable L=5 m.
LPPAR01	Radiometric probe for measuring PHOTONS FLOW (light flow in the field of photosynthesis of chlorophyll). Cosine correction. Output in µV/µmol m^{-2}s^{-1}, cable L=5 m.
LPUVA01	Radiometric probe for measuring IRRADIANCE in the UVA (315...400 nm). Output in µV/µWcm^{-2}, cable L=5 m.
LPUVB01	Radiometric probe for measuring IRRADIANCE in the UVB (280...315 nm). Output in µV/µWcm^{-2}, cable L=5 m.
LPUVC01	Radiometric probe for measuring IRRADIANCE in the UVC (220...280 nm). Output in µV/µWcm^{-2}, cable L=5 m.
LPBL	Base with levelling device.

DELTA OHM metrology laboratories LAT N° 124 are ISO/IEC 17025 accredited by ACCREDIA for Temperature, Humidity, Pressure, Photometry / Radiometry, Acoustics and Air Velocity. They can supply calibration certificates for the accredited quantities.

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DICHIARAZIONE DI CONFORMITÀ UE
EU DECLARATION OF CONFORMITY

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Documento Nr. / Mese.Anno:
Document-No. / Month.Year : **5172 / 07.2019**

Si dichiara con la presente, in qualità di produttore e sotto la propria responsabilità esclusiva, che i seguenti prodotti sono conformi ai requisiti di protezione definiti nelle direttive del Consiglio Europeo:
We declare as manufacturer herewith under our sole responsibility that the following products are in compliance with the protection requirements defined in the European Council directives:

Codice prodotto:
Product identifier : **LPPHOT01 – LPRAD01 – LPPAR01**
LPUVA01 – LPUVB01 – LPUVC01

Descrizione prodotto:
Product description : **Sonde foto-radiometriche**
Photo-radiometric probes

I prodotti sono conformi alle seguenti Direttive Europee:
The products conform to following European Directives:

Direttive / *Directives*	
2014/30/EU	Direttiva EMC / *EMC Directive*
2014/35/EU	Direttiva bassa tensione / *Low Voltage Directive*
2011/65/EU - 2015/863/EU	RoHS / *RoHS*

Norme armonizzate applicate o riferimento a specifiche tecniche:
Applied harmonized standards or mentioned technical specifications:

Norme armonizzate / *Harmonized standards*	
EN 61010-1:2010	Requisiti di sicurezza elettrica / *Electrical safety requirements*
EN 61326-1:2013	Requisiti EMC / *EMC requirements*
EN 50581:2012	RoHS / *RoHS*

Il produttore è responsabile per la dichiarazione rilasciata da:
The manufacturer is responsible for the declaration released by:

Johannes Overhues

Amministratore delegato
Chief Executive Officer

Caselle di Selvazzano, 19/07/2019

Questa dichiarazione certifica l'accordo con la legislazione armonizzata menzionata, non costituisce tuttavia garanzia delle caratteristiche.
This declaration certifies the agreement with the harmonization legislation mentioned, contained however no warranty of characteristics.

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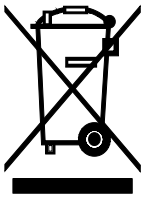
WARRANTY

Delta OHM is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.
Delta OHM repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the “Convention on Contracts for the International Sales of Goods” apply.

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased. In case of discrepancies and/or inconsistencies, please write to sales@deltaohm.com.
Delta OHM reserves the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.

CE RoHS

V2.0
28/05/2021