



HD2102.1 AND HD2102.2 PHOTO-RADIOMETERS

The **HD2102.1** and **HD2102.2** are portable instruments with a large LCD display. They measure **illuminance, luminance, par and irradiance** (across VIS-NIR, UVA, UVB and UVC spectral regions or measurement of irradiance effective according to the UV action curve). The probes are equipped with the SICRAM automatic detection module: in addition to detection, this unit of measurement selection is also automatic. The factory calibration data are already stored inside the instruments. In addition to instantaneous measurement the instruments calculate the acquired measurements time integral $Q(t)$. Some thresholds can be associated with the integrated measurement and with the integration time, which can be set in the menu. When exceeded these thresholds cause the instrument to stop the integral calculation. The HD2102.2 instrument is a **logger**. It stores up to 38,000 samples with a one-channel probe and up to 14,000 samples with combined probes. These data can be transferred from the instrument to a PC via the connection of the multi-standard RS232C serial port and USB 2.0. Storing interval, printing and baud rate can be configured by using the menu. The HD2102.1 and HD2102.2 models are equipped with an RS232C serial port and can transfer the acquired measurements in real time to a PC or to a portable printer. The Max, Min and Avg functions calculate the maximum, minimum or average values. Other functions include: the relative measurement REL, the HOLD function, and the automatic turning off that can also be excluded. **The instruments have IP66 protection degree.**



HD40.1



SWD10

INSTRUMENT TECHNICAL CHARACTERISTICS

Instrument

| | |
|---|---|
| Dimensions (Length x Width x Height) | 185x90x40mm |
| Weight | 470g (complete with batteries) |
| Materials | ABS, rubber |
| Display | 2x4½ digits plus symbols - 52x42mm Visible area: 52x42mm |

Operating conditions

| | |
|---------------------------|--------------------------------|
| Operating temperature | -5...50°C |
| Storage temperature | -25...65°C |
| Working relative humidity | 0...90%RH without condensation |
| Protection degree | IP66 |

Power

| | |
|------------------------------------|---|
| Batteries | 4 1.5V type AA batteries |
| Autonomy | 200 hours with 1800mAh alkaline batteries |
| Power absorbed with instrument off | 20µA |
| Mains | Output mains adapter 12Vdc / 1000mA |

Measuring unit

lux - fcd - lux-s - fcd-s - W/m² - µW/cm²
J/m² - µJ/cm² - µmol/(m²·s) - µmol/m² - cd/m²
µW/lumen

Security of memorized data

Unlimited, independent of battery charge conditions

Time

| | |
|---------------|----------------------|
| Date and time | in real time |
| Accuracy | 1min/month max drift |

Measured values storage - model HD2102.2

| | |
|--------------------------------|---|
| Type (for single probes) | 2000 pages containing 19 samples each |
| Type (for combined probes) | 2000 pages containing 7 samples each |
| Quantity (for single probes) | total of 38000 samples |
| Quantity (for combined probes) | total of 14000 samples |
| Selectable storage interval | 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min, 1 hour |

Serial interface RS232C

| | |
|------------------------------|--|
| Type | RS232C electrically isolated |
| Baud rate | Can be set from 1200 to 38400 baud |
| Data bit | 8 |
| Parity | None |
| Stop bit | 1 |
| Flow Control | Xon/Xoff |
| Serial cable length | Max 15m |
| Selectable printing interval | Immediate or 1s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 20min, 30min, 1 hour |

USB interface - model HD2102.2

| | |
|------|---------------------------------|
| Type | 1.1 - 2.0 electrically isolated |
|------|---------------------------------|

Connections

| | |
|-----------------------------|---------------------------------------|
| Input module for the probes | 8-pole male DIN45326 connector |
| RS232 serial interface | 8-pole MiniDin connector |
| USB serial interface | B-type MiniUSB connector |
| Mains adapter | 2-pole connector (positive at centre) |

Technical characteristics of photometric and radiometric probes equipped with SICRAM module for the connection to the instrument

| LP 471 PHOT probe for the measure of ILLUMINANCE | | | | |
|--|--|-----------|----------|---------------------------|
| Measuring range (lux): | 0.10...199.99 | ...1999.9 | ...19999 | ...199.99·10 ³ |
| Resolution (lux): | 0.01 | 0.1 | 1 | 0.01·10 ³ |
| Spectral range: | in agreement with standard photopic curve V(λ) | | | |
| Class | B | | | |
| Calibration uncertainty: | <4% | | | |
| f ₁ (in agreement with photopic response V(λ)): | <6% | | | |
| f ₂ (response according to the cosine law): | <3% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | <0.5% | | | |
| f ₅ (fatigue): | <0.5% | | | |
| α (temp. coefficient) f ₆ (T) | <0.05%K | | | |
| Drift after 1 year: | <1% | | | |
| Working temperature: | 0...50°C | | | |
| Reference Standards | CIE n.69 - UNI 11142 | | | |

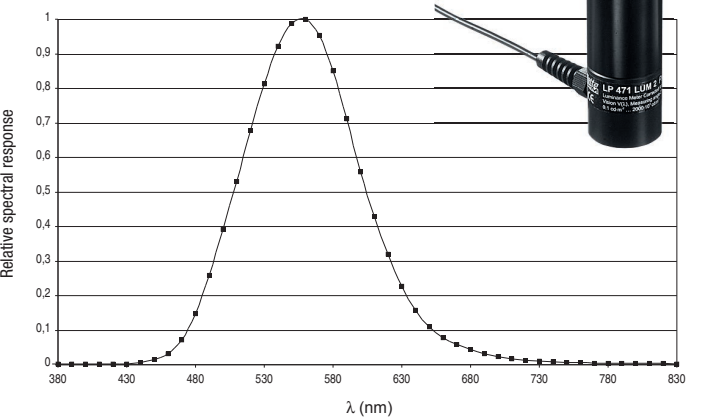
Photometric probe for **ILLUMINANCE** measurement, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.10 lux...200·10³ lux.



| LP 471 LUM 2 probe for the measure of LUMINANCE | | | | |
|--|--|----------|---------------|---------------|
| Measuring range (cd/m²): | 1.0...1999.9 | ...19999 | ...199.99·10³ | ...1999.9·10³ |
| Resolution (cd/m²): | 0.1 | 1 | 0.01·10³ | 0.1·10³ |
| Optical angle: | 2° | | | |
| Spectral range: | in agreement with standard photopic curve V(λ) | | | |
| Class | C | | | |
| Calibration uncertainty: | <5% | | | |
| f ₁ (in agreement with photopic response V(λ)): | <8% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | <0.5% | | | |
| f ₅ (fatigue): | <0.5% | | | |
| α (temp. coefficient) f ₆ (T) | <0.05%K | | | |
| Drift after 1 year: | <1% | | | |
| Working temperature: | 0...50°C | | | |
| Reference Standards | CIE n.69 - UNI 11142 | | | |

Photometric probe for **LUMINANCE** measurement, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 1.0 cd/m²...2000·10³ cd/m².

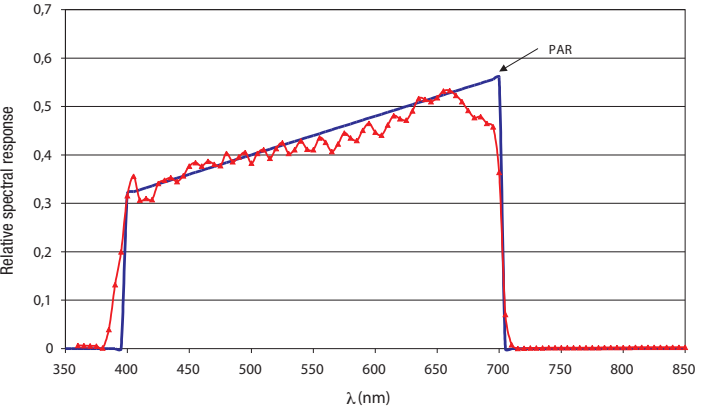
Typical response curve: LP 471 PHOT and LP 471 LUM2



| LP 471 PAR quantum radiometric probe for the measure of the photon flow across the chlorophyll range PAR | | | |
|--|---------------|----------------|--------------|
| Measuring range (μmol·m ⁻² ·s ⁻¹): | 0.10...199.99 | 200.0...1999.9 | 2000...10000 |
| Resolution (μmol·m ⁻² ·s ⁻¹): | 0.01 | 0.1 | 1 |
| Spectral range: | 400nm...700nm | | |
| Calibration uncertainty: | <5% | | |
| f ₂ (response according to the cosine law): | <6% | | |
| f ₃ (linearity): | <1% | | |
| f ₄ (instrument reading error): | ±1 digit | | |
| f ₅ (fatigue): | <0.5% | | |
| Drift after 1 year: | <1% | | |
| Working temperature: | 0...50°C | | |

Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm...700nm), measurement in μmol/m²·s. Measurement range: 0.10 μmol·m⁻²·s⁻¹...10·10⁻³ μmol·m⁻²·s⁻¹.

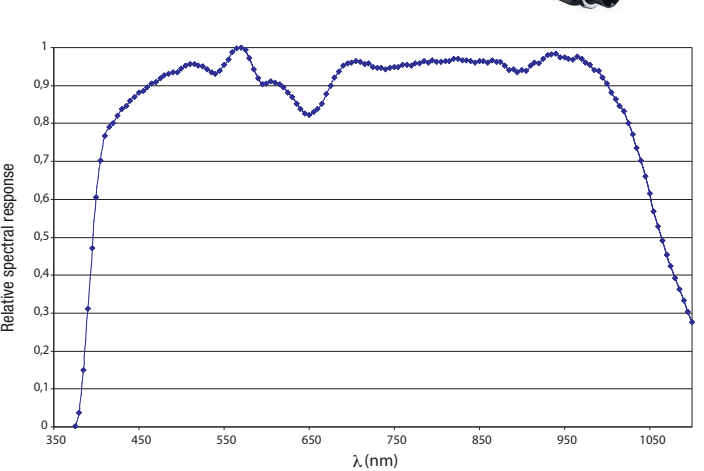
Typical response curve: LP 471 PAR



| LP 471 RAD probe for the measure of IRRADIANCE | | | | |
|--|--|----------------|----------------|----------------|
| Measuring range (W/m²): | 1.0·10 ⁻³ ...999.9·10 ⁻³ | 1.000...19.999 | 20.00...199.99 | 200.0...1999.9 |
| Resolution (W/m²): | 0.1·10 ⁻³ | 0.001 | 0.01 | 0.1 |
| Spectral range: | 400nm...1050nm | | | |
| Calibration uncertainty: | <5% | | | |
| f ₂ (response according to the cosine law): | <6% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | ±1 digit | | | |
| f ₅ (fatigue): | <0.5% | | | |
| Drift after 1 year: | <1% | | | |
| Working temperature: | 0...50°C | | | |

Radiometric probe for **IRRADIANCE** measurement in the spectral range 400nm...1050nm, diffuser for cosine correction. Measurement range: 1.0·10⁻³W/m²...2000W/m².

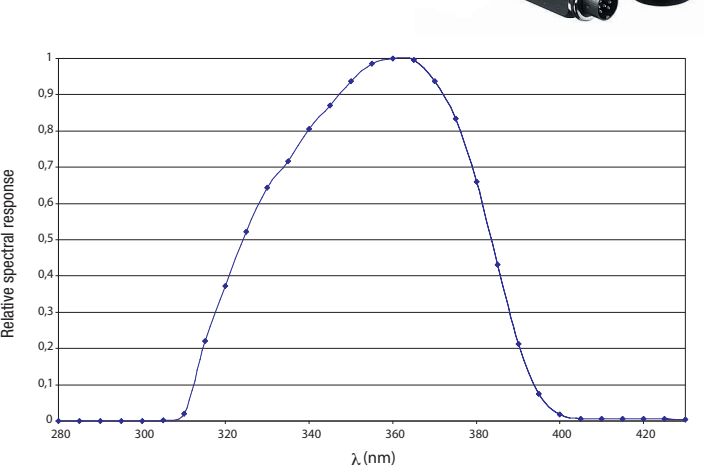
Typical response curve: LP 471 RAD



| LP 471 UVA probe for the measure of UVA IRRADIANCE | | | | |
|--|--|----------------|----------------|----------------|
| Measuring range (W/m²): | 1.0·10 ⁻³ ...999.9·10 ⁻³ | 1.000...19.999 | 20.00...199.99 | 200.0...1999.9 |
| Resolution (W/m²): | 0.1·10 ⁻³ | 0.001 | 0.01 | 0.1 |
| Spectral range: | 315nm...400nm (Peak 360nm) | | | |
| Calibration uncertainty: | <5% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | ±1 digit | | | |
| f ₅ (fatigue): | <0.5% | | | |
| Drift after 1 year: | <2% | | | |
| Working temperature: | 0...50°C | | | |

Radiometric probe for **IRRADIANCE** measurement, in the 315nm...400nm, peak 360nm, **UVA** spectral range. Measurement range: 1.0·10⁻³W/m²...2000W/m².

Typical response curve: LP 471 UVA

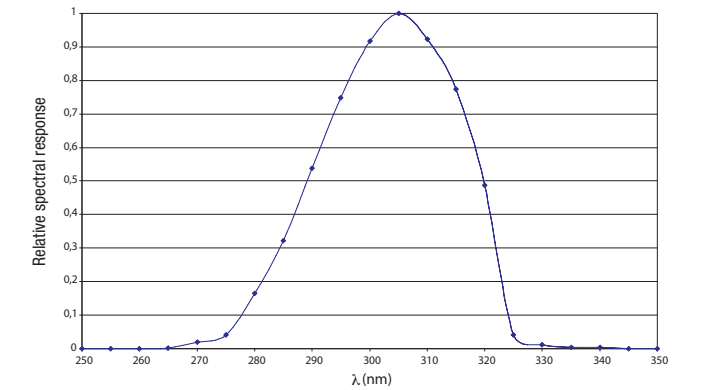


| LP 471 UVB probe for the measure of UVB IRRADIANCE | | | | |
|--|---|------------------|------------------|------------------|
| Measuring range (W/m²): | 1.0·10 ⁻³ ... 999.9·10 ⁻³ | 1.000 ... 19.999 | 20.00 ... 199.99 | 200.0 ... 1999.9 |
| Resolution (W/m²): | 0.1·10 ⁻³ | 0.001 | 0.01 | 0.1 |
| Spectral range: | 280nm...315nm (Peak 305nm...310nm) | | | |
| Calibration uncertainty: | <5% | | | |
| f ₃ (linearity): | <2% | | | |
| f ₄ (instrument reading error): | ±1 digit | | | |
| f ₅ (fatigue): | <0.5% | | | |
| Drift after 1 year: | <2% | | | |
| Working temperature: | 0...50°C | | | |

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 280nm...315nm, peak 305nm ... 310nm, Measurement range: 1.0·10⁻³W/m²...2000W/m².



Typical response curve: LP 471 UVB

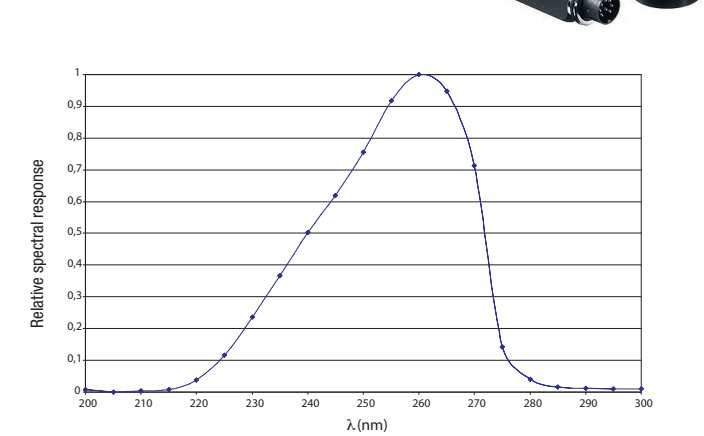


| LP 471 UVC probe for the measure of UVC IRRADIANCE | | | | |
|--|---|------------------|------------------|------------------|
| Measuring range (W/m²): | 1.0·10 ⁻³ ... 999.9·10 ⁻³ | 1.000 ... 19.999 | 20.00 ... 199.99 | 200.0 ... 1999.9 |
| Resolution (W/m²): | 0.1·10 ⁻³ | 0.001 | 0.01 | 0.1 |
| Spectral range: | 220nm...280nm (Peak 260nm) | | | |
| Calibration uncertainty: | <5% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | ±1 digit | | | |
| f ₅ (fatigue): | <0.5% | | | |
| Drift after 1 year: | <2% | | | |
| Working temperature: | 0...50°C | | | |

Radiometric probe for **IRRADIANCE** measurement, in the spectral range 220nm...280nm, peak 260nm, **UVC**. Measurement range: 1.0·10⁻³W/m²...2000W/m².



Typical response curve: LP 471 UVC



| Combined probe LP 471 P-A with two sensors for the measure of ILLUMINANCE and UVA IRRADIANCE | | | | |
|--|--|------------|-----------|----------------------------|
| <i>Illuminance</i> | | | | |
| Measuring range (lux): | 0.10 ... 199.9 | ... 1999.9 | ... 19999 | ... 199.99·10 ³ |
| Resolution (lux): | 0.01 | 0.1 | 1 | 0.01·10 ³ |
| Spectral range: | in agreement with standard photopic curve V(λ) | | | |
| α (temp. coefficient) f ₆ (T) | <0.05%K | | | |
| Calibration uncertainty: | <4% | | | |
| f ₁ (in agreement with photopic response V(λ)): | <6% | | | |
| f ₂ (response according to the cosine law): | <3% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | <0.5% | | | |
| f ₅ (fatigue): | <0.5% | | | |
| Class: | B | | | |
| Drift after 1 year: | <1% | | | |
| Working temperature: | 0...50°C | | | |
| Reference Standards | CIE n.69 - UNI 11142 | | | |

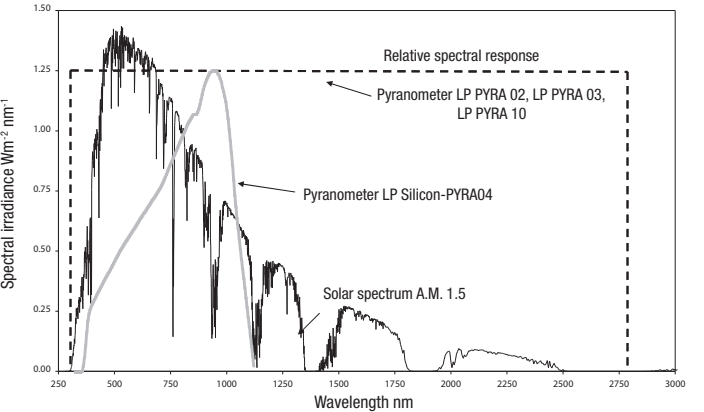
Please refer to the spectral response of the LP471PHOT probe

| | | | | |
|--|----------------------------|------------|-----------|----------------------------|
| <i>UVA Irradiance</i> | | | | |
| Measuring range (μW/cm²): | 0.10 ... 199.99 | ... 1999.9 | ... 19999 | ... 199.99·10 ³ |
| Resolution (μW/cm²): | 0.01 | 0.1 | 1 | 0.01·10 ³ |
| Spectral range: | 315nm...400nm (Peak 360nm) | | | |
| Calibration uncertainty: | <5% | | | |
| f ₂ (response according to the cosine law): | <6% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | ±1 digit | | | |
| f ₅ (fatigue): | <0.5% | | | |
| Drift after 1 year: | <2% | | | |
| Working temperature: | 0...50°C | | | |

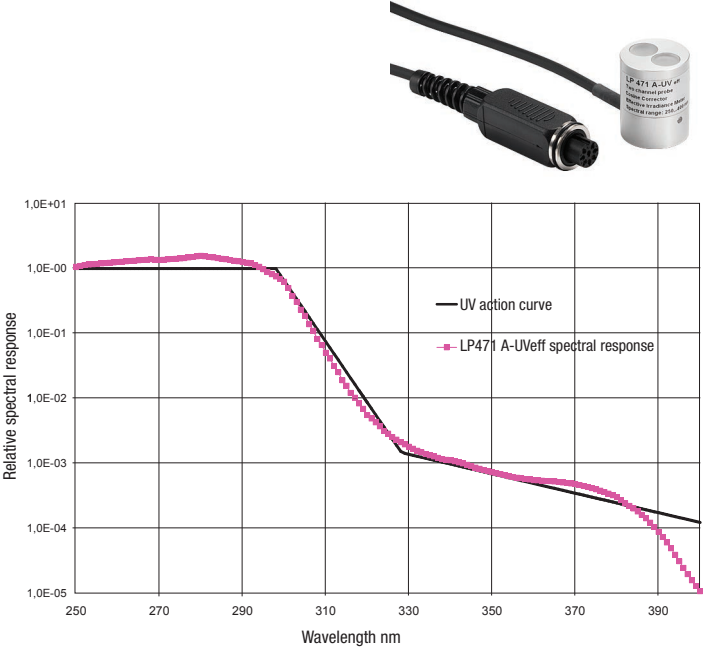
Please refer to the spectral response of the LP471UVA probe



| LP SILICON-PYRA probe for the measure of GLOBAL SOLAR RADIATION | | | | |
|---|---|------------------|------------------|------------------|
| Measurement range (W/m²): | 1.0·10 ⁻³ ... 999.9·10 ⁻³ | 1.000 ... 19.999 | 20.00 ... 199.99 | 200.0 ... 1999.9 |
| Resolution (W/m²): | 0.1·10 ⁻³ | 0.001 | .01 | 0.01 |
| Spectral range: | 400 nm ... 1100 nm | | | |
| Calibration uncertainty: | <3% | | | |
| f ₂ (response according to the cosine law): | <3% | | | |
| f ₃ (linearity): | <1% | | | |
| f ₄ (instrument reading error): | ±1 digit | | | |
| f ₅ (fatigue): | <0.5% | | | |
| Drift after 1 year: | <2% | | | |
| Working temperature: | 0...50°C | | | |

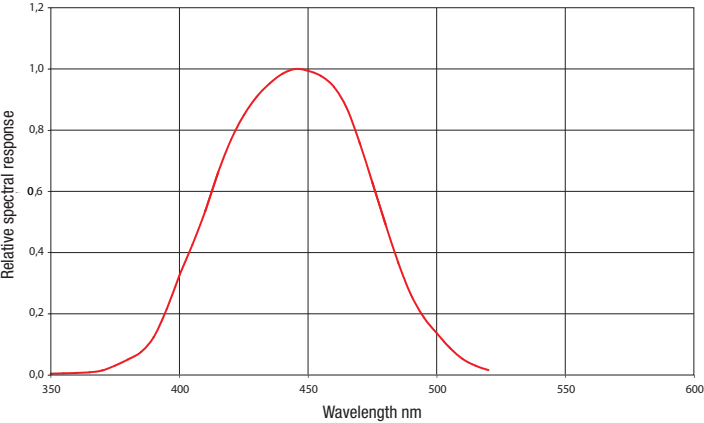


| LP 471 A-UVeff probe for the measure of TOTAL EFFECTIVE IRRADIANCE weighted according to the UV action curve (CEI EN 60335-2-27) | |
|--|--|
| <i>Total Effective Irradiance</i> | |
| Measuring range (W_{eff}/m^2): | 0.010 ... 19.999 |
| Resolution (W_{eff}/m^2): | 0.001 |
| Spectral range: | UV action curve for measuring erythema (250 nm...400 nm) |
| Calibration uncertainty: | <15% |
| f_3 (linearity): | <3% |
| f_4 (instrument reading error): | ± 1 digit |
| f_5 (fatigue): | <0.5% |
| Drift after 1 year: | <2% |
| Working temperature: | 0...50°C |
| <i>UV Irradiance</i> | |
| Measuring range (W_{eff}/m^2): | 0.1 ... 1999.9 |
| Resolution (W_{eff}/m^2): | 0.1 |
| Spectral range: | 315 nm ... 400 nm |
| <i>UV_BC Irradiance</i> | |
| Measuring range (W_{eff}/m^2): | 0.010 ... 19.999 |
| Resolution (W_{eff}/m^2): | 0.001 |
| Spectral range: | 250 nm ... 315 nm |



| LP 471 BLUE probe for the measure of IRRADIANCE in spectral band of BLUE LIGHT | | | | |
|--|--|------------------|------------------|------------------|
| Measurement range (W/m^2): | 1.0·10 ⁻³ ... 999.9·10 ⁻³ | 1.000 ... 19.999 | 20.00 ... 199.99 | 200.0 ... 1999.9 |
| Resolution (W/m^2): | 0.1·10 ⁻³ | 0.001 | .01 | 0.01 |
| Spectral range: | 380 nm ... 550 nm. Action curve for damages of Blue light B(λ) | | | |
| Calibration uncertainty: | <10% | | | |
| f_2 (response according to the cosine law): | <6% | | | |
| f_3 (linearity): | <3% | | | |
| f_4 (instrument reading error): | ± 1 digit | | | |
| f_5 (fatigue): | <0.5% | | | |
| Drift after 1 year: | <2% | | | |
| Working temperature: | 0...50°C | | | |

Relative spectral response



The radiometric probe LP 471-BLUE measures irradiance (W/m^2) in spectral band of blue light. The probe consists of a photodiode plus an appropriate filter and it is provided with diffuser for proper measure in accordance with the cosine law. The spectral response curve of the probe allows to measure the radiation effective for damages caused by blue light (curve B(λ)) according to the standards ACGIH / ICNIRP) in the spectral range from 380nm to 550nm. The radiation optics in this portion of the spectrum can produce photochemical damage to the retina. Another field of application is the monitoring of the probe irradiance from blue light used in the treatment of neonatal jaundice.



ORDERING CODES

- HD2102.1:** The kit consists of the instrument HD2102.1, 4 1.5V alkaline batteries, operating manual, case and **DeltaLog9** software downloadable from Delta OHM website. **Probes and cable must be ordered separately.**
- HD2102.2:** The kit consists of the HD2102.2 **datalogger**, 4 1.5V alkaline batteries, operating manual, case and **DeltaLog9** software downloadable from Delta OHM website, USB cable CP23. **Probes and cable must be ordered separately.**
- HD2110CSNM:** 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.
- C.206:** Cable for the connection of the instrument HD21...1 to the PC USB ports directly.
- SWD10:** Stabilized power supply at 230Vac/12Vdc-1000mA mains voltage.
- HD40.1:** Portable, serial input, 24 column thermal printer, 58mm paper width.

Probes complete with SICRAM module

- LP 471 PHOT:** Photometric probe for measuring **ILLUMINANCE** complete with SICRAM module, spectral response in agreement with standard photopic vision, Class B according to CIE n°69, diffuser for cosine correction. Measurement range: 0.10 lux...200-10³ lux.
- LP 471 LUM 2:** Photometric probe for measuring **LUMINANCE** complete with SICRAM module, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 1.0 cd/m²...2000-10³ cd/m².
- LP 471 PAR:** Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400nm...700nm) complete with SICRAM, measurement in $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$, diffuser for cosine correction. Measurement range: 0.10 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$...10-10³ $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$.
- LP 471 RAD:** Radiometric probe for measuring **IRRADIANCE** equipped with SICRAM module; in the 400nm...1050nm spectral range, diffuser for cosine correction. Measurement range: 1.0-10⁻³ W/m²...2000 W/m².
- LP 471 UVA:** Radiometric probe for measuring **IRRADIANCE** equipped with SICRAM module; in the 315nm...400nm, peak 360nm, **UVA** spectral range, quartz diffuser for cosine correction. Measurement range: 1.0-10⁻³ W/m²...2000 W/m².
- LP 471 UVB:** Radiometric probe for measuring **IRRADIANCE** equipped with SICRAM module, in the 280nm...315nm, peak 305nm...310nm, **UVB** spectral range, quartz diffuser for cosine correction. Measurement range: 1.0-10⁻³ W/m²...2000 W/m².
- LP 471 UVC:** Radiometric probe for measuring **IRRADIANCE** equipped with SICRAM module, in the 220nm...280nm, peak 260nm, **UVC** spectral range, quartz diffuser for cosine correction. Measurement range: 1.0-10⁻³ W/m²...2000 W/m².
- LP 471 BLUE:** Radiometric probe for measuring **IRRADIANCE** (W/m²) in spectral band of blue light equipped with SICRAM module. Spectral range: 380 nm...550 nm, quartz diffuser for cosine correction. Measurement range: 1.0-10⁻³ W/m²...2000 W/m².
- LP 471 P-A:** Combined probe for measuring **ILLUMINANCE** (lux), with standard photopic response, and **IRRADIANCE** ($\mu\text{W}/\text{cm}^2$) in the UVA spectral range (315...400 nm, with peak at 360 nm). Both the sensors are equipped with diffuser for the correction according to the cosine law.
Illuminance measuring range: 0.10 lux ... 200-10³ lux
Irradiance measuring range: 1.0 mW/m² ... 2000 W/m².
This probe provides the ratio between UVA irradiance and illuminance in $\mu\text{W}/\text{lumen}$ (quantity of interest in museums). The probe is equipped with SICRAM module and cable 2m long.
- LP 471 A-UVeff:** Combined probe for measuring the **TOTAL EFFECTIVE IRRADIANCE** (W/m²) weighted according to the UV action curve. The probe is made of two sensors for the correct measure of the Total Effective Irradiance in the range 250...400nm. Both these sensors are equipped with a diffuser for the correction according to the cosine law.
This probe supplies the Total effective irradiance (Eeff), the UV-CB effective irradiance and the UVA Irradiance.
Total effective irradiance measuring range: 0.010 W/m² ... 20 W/m².
B_C effective irradiance measuring range: 0.010 W/m² ... 20 W/m².
UVA irradiance measuring range: 0.1 W/m² ... 2000 W/m².
The probe is equipped with the SICRAM module and a cable 2m long.
- LP 471 PYRA 02..., LP PYRA 03..., LP PYRA 10..., LP 471 Silicon-PYRA...**
See page **LG-7**
- LP BL:** Base with levelling device for all the above-described probes except for the probes LP 471 LUM 2 and LP 471 PYRA.
- LP BL3:** Jointed support for all the above-described probes except for LP 471 LUM 2 and LP 471 PYRA.

- A** The models of portable data logger series HD21xx.2 has been implemented with a new serial port miniUSB type HID (Human Interface Device).
When making the connection to the PC by the USB cable type A - Mini USB B-type

coded CP23, **no USB driver installation is requested.**

- B** For the connection of the models **HD21xx.1** to the RS232 port of your PC, the USB/serial converter is available (code **C.206**). The converter is equipped with its own drivers that have to be installed before connecting the converter to the PC (please see the details in the CDRom supplied with the converter).
- C** The port with the MiniDIN connector which is present on every model is an RS232C type. By means of the cable coded HD2110CSNM, an RS232 port of a PC or the HD40.1 printer can be connected.

