



## PHOTO-RADIOMETERS HD2102.1 AND HD2102.2

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 fitted with the SICRAM automatic detection module: in addition to detection, the unit of measurement selection is also automatic. The factory calibration settings are already memorized 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 **datalogger**. It stores up to 38,000 samples which can be transferred from the instrument connected to a PC via the multi-standard RS232C serial port and USB 2.0. The storing interval, printing, and baud rate can be configured using the menu.

The HD2102.1 and HD2102.2 models are fitted 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* function 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 disabled.

**The instruments have IP67 protection degree.**

### 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
Warehouse temperature	-25...65°C
Working relative humidity	0...90%RH without condensation

#### Protection degree

**IP67**

#### 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 9Vdc / 250mA

#### Measuring unit

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

#### Security of memorized data

Unlimited, independent of battery charge conditions

#### Time

Date and time	Schedule in real time
Accuracy	1min/month max departure

#### Measured values storage - model **HD2102.2**

Type	2000 pages containing 19 samples each
Quantity	Total of 38000 samples
Storage interval	1s...3600s (1hour)

#### 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
Immediate print interval	1s...3600s (1hour)

#### USB interface - model **HD2102.2**

Type	1.1 - 2.0 electrically isolated
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#### Connections

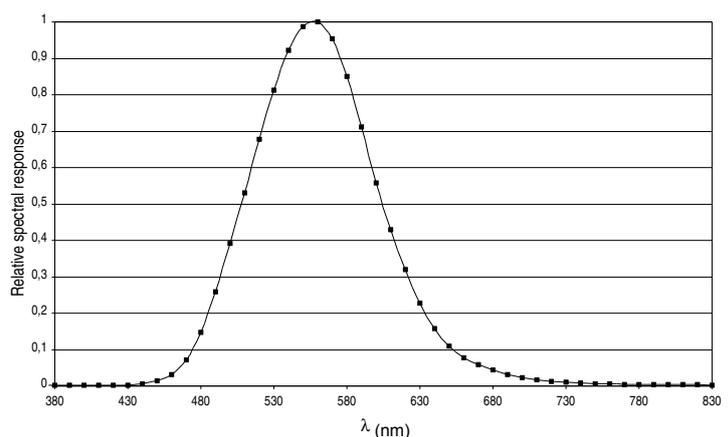
Input module for the probes	8-pole male DIN45326 connector
Serial interface and USB	8-pole MiniDin connector
Mains adapter	2-pole connector (positive at centre)

### Technical characteristics of photometric and radiometric probes complete with SICRAM module equipped with the instruments

ILLUMINANCE measurement probe LP 471 PHOT				
Measurement range (lux):	0.01...199.99	...1999.9	...19999	...199.99·10 <sup>3</sup>
Resolution (lux):	0.01	0.1	1	0.01·10 <sup>3</sup>
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C			
Calibration uncertainty:	<4%			
f <sub>1</sub> (in agreement with photopic response V(λ)):	<8%			
f <sub>2</sub> (response according to the cosine law):	<3%			
f <sub>3</sub> (linearity):	<1%			
f <sub>4</sub> (instrument reading error):	<0.5%			
f <sub>5</sub> (fatigue):	<0.5%			
α (temp. coefficient) f <sub>6</sub> (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0...50°C			
Reference Standards	CIE n.69 - UNI 11142			

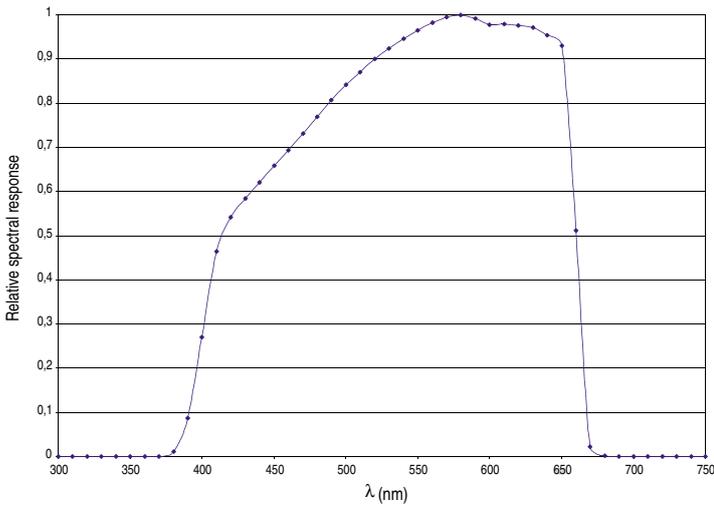
LUMINANCE measurement probe LP 471 LUM 2				
Measurement range (cd/m²):	0.1...1999.9	...19999	...199.99·10 <sup>3</sup>	...1999.9·10 <sup>3</sup>
Resolution (cd/m²):	0.1	1	0.01·10 <sup>3</sup>	0.1·10 <sup>3</sup>
Optical angle:	2°			
Spectral range:	in agreement with standard photopic curve V(λ)			
Class	C			
Calibration uncertainty:	<5%			
f <sub>1</sub> (in agreement with photopic response V(λ)):	<8%			
f <sub>3</sub> (linearity):	<1%			
f <sub>4</sub> (instrument reading error):	<0.5%			
f <sub>5</sub> (fatigue):	<0.5%			
α (temp. coefficient) f <sub>6</sub> (T)	<0.05%K			
Drift after 1 year:	<1%			
Functioning temperature:	0...50°C			
Reference Standards	CIE n.69 - UNI 11142			

#### Typical response curve: ILLUMINANCE



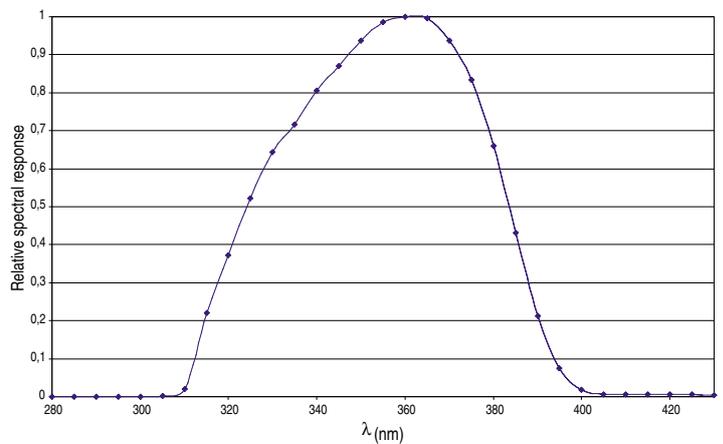
Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range PAR LP 471 PAR			
Measurement range ( $\mu\text{mol}/\text{m}^2\text{s}$ ):	0.01... 199.99	200.0...1999.9	2000...10000
Resolution ( $\mu\text{mol}/\text{m}^2\text{s}$ ):	0.01	0.1	1
Spectral range:	400nm...700nm		
Calibration uncertainty:	<5%		
$f'_1$ (response according to the cosine law):	<6%		
$f_3$ (linearity):	<1%		
$f_4$ (instrument reading error):	$\pm 1$ digit		
$f_5$ (fatigue):	<0.5%		
Drift after 1 year:	<1%		
Functioning temperature:	0...50°C		

Typical response curve: PAR



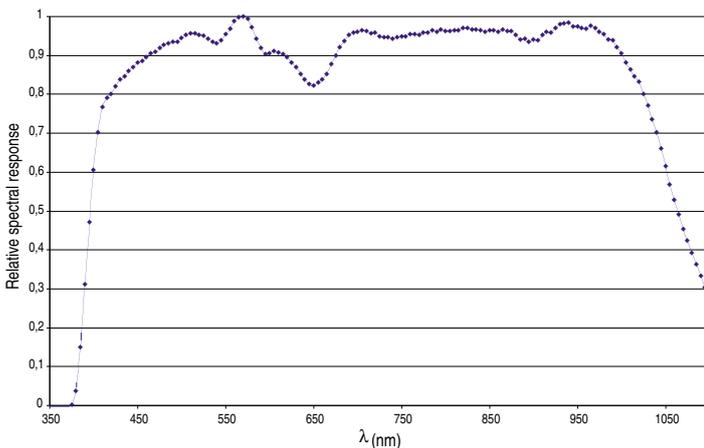
IRRADIANCE measurement probe LP 471 UVA				
Measurement range ( $\text{W}/\text{m}^2$ ):	$0.1 \cdot 10^{-3}$ ... $999.9 \cdot 10^{-3}$	1.000...19.999	20.00...199.99	200.0...1999.9
Resolution ( $\text{W}/\text{m}^2$ ):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1
Spectral range:	315nm...400nm (Peak 360nm)			
Calibration uncertainty:	<5%			
$f'_1$ (response according to the cosine law):	<6%			
$f_3$ (linearity):	<1%			
$f_4$ (instrument reading error):	$\pm 1$ digit			
$f_5$ (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Functioning temperature:	0...50°C			

Typical response curve: UVA



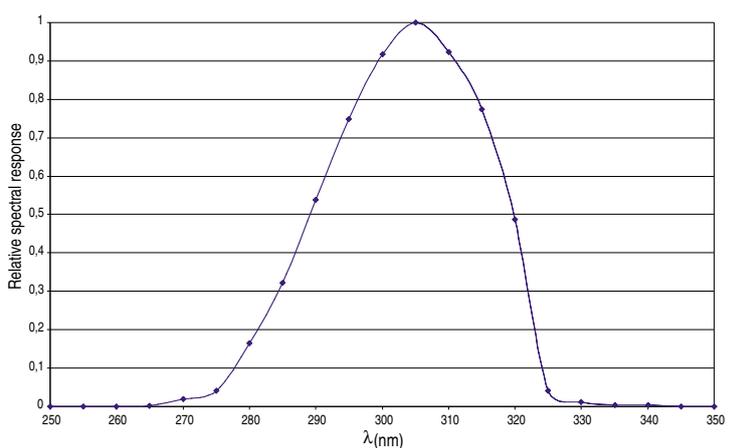
IRRADIANCE measurement probe LP 471 RAD				
Measurement range ( $\text{W}/\text{m}^2$ ):	$0.1 \cdot 10^{-3}$ ... $999.9 \cdot 10^{-3}$	1.000...19.999	20.00...199.99	200.0...1999.9
Resolution ( $\text{W}/\text{m}^2$ ):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1
Spectral range:	400nm...1050nm			
Calibration uncertainty:	<5%			
$f'_1$ (response according to the cosine law):	<6%			
$f_3$ (linearity):	<1%			
$f_4$ (instrument reading error):	$\pm 1$ digit			
$f_5$ (fatigue):	<0.5%			
Drift after 1 year:	<1%			
Functioning temperature:	0...50°C			

Typical response curve: RAD



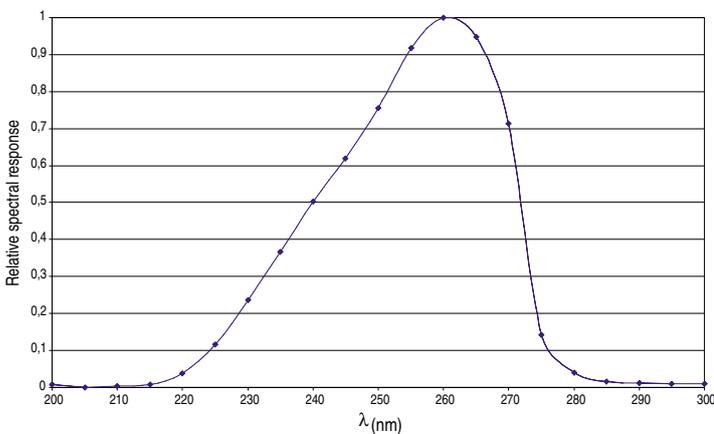
IRRADIANCE measurement probe LP 471 UVB				
Measurement range ( $\text{W}/\text{m}^2$ ):	$0.1 \cdot 10^{-3}$ ... $999.9 \cdot 10^{-3}$	1.000...19.999	20.00...199.99	200.0...1999.9
Resolution ( $\text{W}/\text{m}^2$ ):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1
Spectral range:	280nm...315nm (Peak 305nm)			
Calibration uncertainty:	<5%			
$f'_1$ (response according to the cosine law):	<6%			
$f_3$ (linearity):	<2%			
$f_4$ (instrument reading error):	$\pm 1$ digit			
$f_5$ (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Functioning temperature:	0...50°C			

Typical response curve: UVB



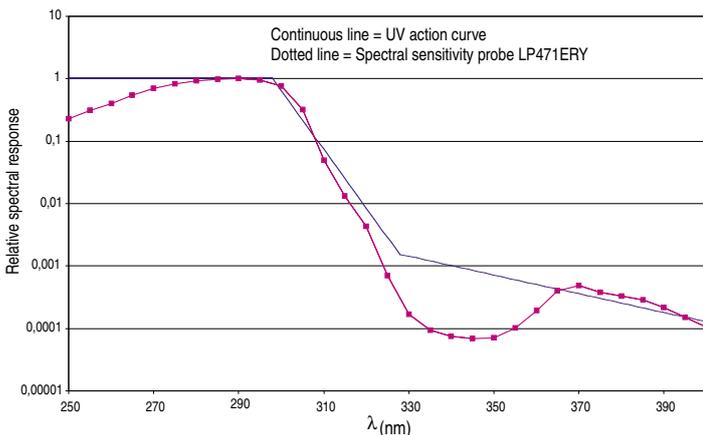
IRRADIANCE measurement probe LP 471 UVC				
Measurement range ( $W/m^2$ ):	0.1·10 <sup>-3</sup> ... 999.9·10 <sup>-3</sup>	1.000...19.999	20.00...199.99	200.0...1999.9
Resolution ( $W/m^2$ ):	0.1·10 <sup>-3</sup>	0.001	0.01	0.1
Spectral range:	220nm...280nm (Peak 260nm)			
Calibration uncertainty:	<5%			
f <sub>1</sub> (response according to the cosine law):	<6%			
f <sub>3</sub> (linearity):	<1%			
f <sub>4</sub> (instrument reading error):	±1 digit			
f <sub>5</sub> (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Functioning temperature:	0...50°C			

Typical response curve: UVC



Measurement probe LP 471ERY of EFFECTIVE TOTAL IRRADIANCE ( $W/m^2$ ) according to the UV action curve UV (CEI EN 60335-2-27)				
Measurement range ( $W_{eff}/m^2$ ):	0.1·10 <sup>-3</sup> ... 999.9·10 <sup>-3</sup>	1.000...19.999	20.00...199.99	200.0...1999.9
Resolution ( $W_{eff}/m^2$ ):	0.1·10 <sup>-3</sup>	0.001	0.01	0.1
Spectral range:	UV action curve for erythema measurement (250nm...400nm)			
Calibration uncertainty:	<15%			
f <sub>3</sub> (linearity):	<3%			
f <sub>4</sub> (instrument reading error):	±1 digit			
f <sub>5</sub> (fatigue):	<0.5%			
Drift after 1 year:	<2%			
Working temperature:	0...50°C			
Reference standard:	CEI EN 60335-2-27			

Typical response curve: EFFECTIVE TOTAL IRRADIANCE



The probe LP 9021 ERY measures the effective total irradiance ( $W_{eff}/m^2$ ) according to the UV action curve (CEI EN 60335-2-27). A particular type of photodiode and a combination of special filters bring the spectral response closer to the UV action curve.

CEI EN 60335-2-27 standards establish a maximum allowable dose of 100J/m<sup>2</sup> for first-time exposure and an annual dose of 15000J/m<sup>2</sup>.

The typical spectral response curve of LP 9021 ERY is shown in the Figure together with the UV action curve.

The good accordance between the two curves enables the instrument to take reliable measurements of different types of lamps (and filters) used at present for tanning machines.

Each probe is individually calibrated at DeltaOhm photo-radiometry laboratory by means of a double monochrome. **Calibration is performed at 290 nm through a SIT calibrated reference photodiode.**

#### ORDER CODES

**HD2102.1K:** The kit is composed of the instrument HD2102.1, connection cable for serial output HD2110CSNM, 4 1.5V alkaline batteries, operating manual, case and DeltaLog9 software. **The probes must be ordered separately.**

**HD2102.2K:** The kit is composed of the HD2102.2 datalogger, connection cable HD2101/USB, 4 1.5V alkaline batteries, operating manual, case and Delta-Log9 software. **The probes must be ordered separately.**

**HD2110CSNM:** 8-pole connection cable MiniDin - Sub D 9-pole female for RS232C.

**HD2101/USB:** Connection cable USB 2.0 connector type A - 8-pole MiniDin.

**DeltaLog9:** Software for download and management of the data on PC using Windows 98 to XP operating systems.

**AF209.60:** Stabilized power supply at 230Vac/9Vdc-300mA mains voltage.

**S'print-BT:** On request, portable, serial input, 24 column thermal printer, 58mm paper width.

#### Probes complete with SICRAM module

**LP 471 PHOT:** Photometric probe for **ILLUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measurement range: 0.01 lux...200·10<sup>3</sup> lux.

**LP 471 LUM 2:** Photometric probe for **LUMINANCE** measurement complete with SICRAM module, spectral response in agreement with standard photopic vision, vision angle 2°. Measurement range: 0.1 cd/m<sup>2</sup>...2000·10<sup>3</sup> cd/m<sup>2</sup>.

**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  $\mu\text{mol}/m^2\text{s}$ , diffuser for cosine correction. Measurement range: 0.01  $\mu\text{mol}/m^2\text{s}$ ...10·10<sup>3</sup>  $\mu\text{mol}/m^2\text{s}$ .

**LP 471 RAD:** Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 400nm...1050nm spectral range, diffuser for cosine correction. Measurement range: 0.1·10<sup>-3</sup>W/m<sup>2</sup>...2000 W/m<sup>2</sup>.

**LP 471 UVA:** Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 315nm...400nm, peak 360nm, **UVA** spectral range, quartz diffuser for cosine correction. Measurement range: 0.1·10<sup>-3</sup>W/m<sup>2</sup>...2000 W/m<sup>2</sup>.

**LP 471 UVB:** Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 280nm...315nm, peak 305nm, **UVB** spectral range, quartz diffuser for cosine correction. Measurement range: 0.1·10<sup>-3</sup>W/m<sup>2</sup>...2000 W/m<sup>2</sup>.

**LP 471 UVC:** Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 220nm...280nm, peak 260nm, **UVC** spectral range, quartz diffuser for cosine correction. Measurement range: 0.1·10<sup>-3</sup>W/m<sup>2</sup>...2000 W/m<sup>2</sup>.

**LP 471 ERY:** Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** ( $W_{eff}/m^2$ ) according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module. Spectral range: 250 nm...400 nm, quartz diffuser for cosine correction. Measurement range: 0.1·10<sup>-3</sup>W<sub>eff</sub>/m<sup>2</sup> ... 2000 W<sub>eff</sub>/m<sup>2</sup>

**LP BL:** Base with levelling device.