REV. 1.6
Aug. 28th 2012

HD2302.0

ENGLISH

Our instruments' quality level is the results of the product continuous development. This can bring about differences between the information written in this manual and the instrument that you have purchased. We cannot entirely exclude errors in the manual, for which we apologize.
The data, figures and descriptions contained in this manual cannot be legally asserted. We reserve the right to make changes and corrections without prior notice.

Photo-Radiometer
HD2302.0

HD2302.0

1. Input for probes, 8-pole DIN45326 connector.
2. Battery symbol: displays the battery charge level.
3. Function indicators.
4. Secondary display line.
5. **DATA** key: displays the maximum (MAX), the minimum (MIN) and the average (AVG) of current measurements.
6. **CLR** key: resets the maximum, average, and minimum value of the captured measurements.
7. **HOLD** key: freezes the measurement.
8. **UNIT** key: allows selection of the unit of measurement.
9. **REL** key: enables the relative measurement (displays the difference between the current value and the logged value when the key is pressed).
10. **ON-OFF/AUTO-OFF** key: turns the instrument on and off; when pressed together with the HOLD key, disables the *AutoPowerOff* function.
11. MAX (maximum value), MIN (minimum value) and AVG (average value) symbols.
12. Main display line.
13. Line for symbols and comments.

CERTIFICATO DI CONFORMITÀ DEL COSTRUTTORE

MANUFACTURER'S CERTIFICATE OF CONFORMITY

rilasciato da
issued by

DELTA OHM SRL STRUMENTI DI MISURA

DATA
DATE 2012/08/28

Si certifica che gli strumenti sotto riportati hanno superato positivamente tutti i test di produzione e sono conformi alle specifiche, valide alla data del test, riportate nella documentazione tecnica.

We certify that below mentioned instruments have been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

Le misure effettuate presso un Laboratorio di Taratura Accredia sono garantite da una catena di riferibilità ininterrotta, che ha origine dalla taratura dei campioni di prima linea del Laboratorio presso l'istituto metrologico nazionale.

Measurements performed in an Accredia Calibration Laboratory are guaranteed by a uninterrupted reference chain which source is the calibration of the Laboratory first line standards at the national metrological institute.

Tipo Prodotto: **Fotoradiometro**
Product Type: *Photo-Radio meter*

Nome Prodotto: **HD2302.0**
Product Name:

Responsabile Qualità
Head of Quality

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1. GENERAL CHARACTERISTICS

The Photo-Radiometer Model **HD2302.0** is a portable instrument, fitted with a large LCD display for visualization of the measured data. It measures:

- **illuminance**;
- **luminance;**
- **PAR**;
- **irradiance** (across VIS-NIR, UVA, UVB and UVC spectral regions or in the measured effective irradiance according to the UV action curve).

The probes are fitted with the SICRAM *automatic detection* module, with the factory calibration settings already being memorized inside. In addition to detection, the unit of measurement selection is also automatic.

The Photo-Radiometer measures the following instantaneous quantities:

Type of measurement	**Unit of Measurement**
Illuminance (PHOT)	lux - fcd
Irradiance (RAD - UVA - UVB - UVC- PYRA)	W/m^2 - $\mu W/cm^2$
PAR	$\mu mol/(m^2 \cdot s)$
Luminance (LUM 2)	cd/m^2

Using the Max, Min and Avg function of this instrument respectively obtains the maximum, minimum or average values.
Other available functions are:

- the relative measurement REL;
- the HOLD function;
- the automatic turning off which can also be disabled.

See chapter 2 for further details.

2. DESCRIPTION OF THE FUNCTIONS

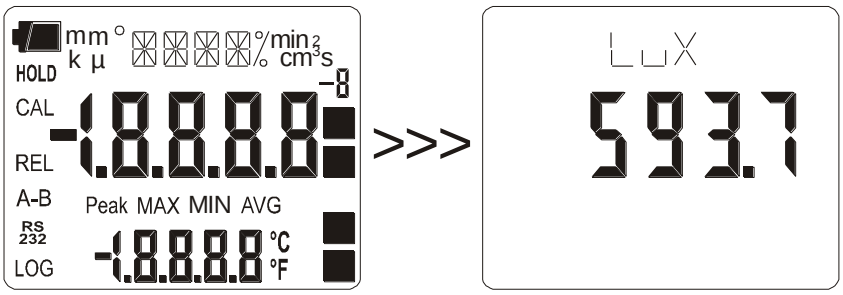
The Photo-Radiometer Model **HD2302.0** keyboard is composed of single-function keys, except the ON-OFF/Auto-OFF key that has two functions (see the description of the key below).
The pressing of a key is accompanied by a short confirmation "beep": a longer "beep" sounds if the wrong key is pressed.
Each key specific function is described in detail below.

ON-OFF and AUTO-OFF key

This key has two functions:

- **ON/OFF:** to turn the instrument on press **ON**, to turn it off press **OFF**.

The turning on enables all display segments for a few seconds, starts an **Auto-test** including the detection of the probe connected to the input, and sets the instrument ready for normal measurement.
The following is displayed:



- **AUTO/OFF:** the ***AutoPowerOff*** function can be disabled by simultaneously pressing this key and the "**HOLD**" key when turning the instrument on.

During turning on, should no probes be connected, the **"PROB"** message is displayed in the line for symbols for a few seconds, while the **"ERR"** message is shown in the central part of the display.
When the probe is inserted into a functioning instrument, it is not detected: as the data are captured upon turning the instrument on, it is necessary to turn it off and on again.

Caution! Replace the probes when the instrument is off.

+ HOLD **Disabling of the automatic turning off**

The instrument has an *AutoPowerOff* function that automatically turns the instrument off after about 8 minutes if no key is pressed during the intervening time.
Press simultaneously the **ON/OFF** key and the **HOLD** key to disable this function.
In this case, remember to turn the instrument off using the **ON/OFF** key: disabling of the automatic turning off is shown by the blinking battery symbol.

CLR **CLR/ESC key**

It resets the maximum, average, and minimum value of the captured measurements.

DATA key

By pressing this key once the maximum (MAX) value of the measurements captured by the probe connected to the instrument is displayed, updating it with the acquisition of new samples;
- by pressing this key again the minimum (MIN) value is displayed;
- by pressing this key a third time the average (AVG) value is displayed.

The acquisition frequency is once a second.

The MAX, MIN and AVG values remain in the memory until the instrument is on, even after exiting the DATA calculation function. When the instrument is off, the previously memorized data are cleared. Upon turning on, the instrument automatically starts memorizing the MAX, MIN and AVG values.

To reset the previous values and start with a new measurement session, press until the **FUNC_CLRD** message appears.

HOLD key

By pressing this key the current measurement update is frozen and the "HOLD" message will appear in the upper left-hand corner of the display. To return to the current measurement, press the key again.

It is also used to disable the *AutoPowerOff* function (see the description of the key on page 7).

UNIT key

By pressing this key the **unit of measurement of the main input quantity is selected**: the unit of measurement will appear in the upper part of the display; the measured value will be displayed in the central line. By repeatedly pressing the UNIT key, the desired unit of measurement can be selected. In the combined probes, **UNIT** key allows to select one of the available measures (in these probes, unit of measurement cannot be changed).

NOTE: The **units of measurement** available are determined according to the probe connected to the input, as reported in the following table:

Type of measurement	**Unit of Measurement**
Illuminance (PHOT)	lux - fcd
Irradiance (RAD - UVA - UVB - UVC - PYRA)	W/m^2 - $\mu W/cm^2$
PAR	$\mu mol/(m^2 \cdot s)$
Luminance (LUM 2)	cd/m^2

REL key

It displays the difference between the current value and that measured on pressing the key. The "REL" message is displayed on the left.

To return to the normal measurement, press the key again.

3. PROBES AND MEASUREMENTS

The instrument works with probes of the LP471… series: these are photometric and radiometric probes that measure:

- **illuminance** (LP471 PHOT),
- **irradiance** (LP471 RAD, LP471 UVA, LP471 UVB and LP471 UVC),
- **PAR** (LP471 PAR),
- **luminance** (LP471 LUM 2),
- **effective irradiance** according to the UV action curve (LP471 ERY),
- **effective irradiance** in the spectral range of blue light (*LP 471 BLUE*),
- **illuminance, UVA irradiance** and **UVA irradiance - illuminance ratio** (Combined probe *LP 471 P-A - please see note 1*),
- **total effective irradiance UVA + UV-CB** according to the UV weighting curve (combined probe *LP 471 A-UVeff* for measuring total effective irradiance in the range 250...400 nm - *please see note 1*),
- **global solar irradiance** in the spectral range 400…1100 nm with silicon photodiode (*LP 471 SILICON PYRA*),
- **global solar irradiance** in the spectral range 300…3000 nm. Probe consisting of a second class pyranometer LP PYRA 03 and a 5 m long cable with SICRAM module (*LP 471 PYRA 03*),
- **global solar irradiance** in the spectral range 300…3000 nm. Probe consisting of a first class pyranometer LP PYRA 02 and a 5 m long cable with SICRAM module (*LP 471 PYRA 02*).

Note 1: probes *LP 471 P-A* and *LP 471 A-UVeff* work with instruments HD2302.0 having firmware version "HD2302.01" and following. On the back of these instruments a label shows version and date of the firmware. To update previous instruments, contact your dealer Delta Ohm.

All probes, except LUM 2, are provided with a diffuser for cosine correction.
Upon turning on the instrument automatically detects the probe connected to the input: it is sufficient to **connect it before turning the instrument on**.
The **unit of measurement** is determined according to the probe connected to the input: use the UNIT key to change the unit of measurement.
In the combined probes, **UNIT** key allows to select one of the available measures (in these probes, unit of measurement cannot be changed).
All probes are calibrated in the factory; no calibration is required by the user.

The probe is detected during turn on: if a probe is connected and the instrument is on, it is necessary to turn it off and on.

3.1 COMBINED PROBE LP 471 P-A

LP 471 P-A is a two sensors combined probe with SICRAM module for measuring **illuminance** (lux) with standard photopic spectral response and **irradiance** ($\mu W/cm^2$) in **UVA** spectral range (315...400 nm, with peak at 365 nm). Moreover probe provides the ratio of UVA irradiance and illuminance in µW/lumen (quantity of interest in the museums field).
Both sensors are equipped with diffuser for the correction according to the cosine law.
At switching on, the instrument displays alternatively the measures of the two sensors. Pressing any key (excluded ON/OFF key), automatic commutation is turned off. To reactivate it, press HOLD and REL keys together.
To select the measure to display, press UNIT key.

3.2 COMBINED PROBE LP 471 A-UVEFF

LP 471 A-UVeff is a two sensors combined probe with SICRAM module for measuring **total effective irradiance** according to the UV weighting curve. Two sensors are used to correctly measure the total effective irradiance in the range 250...400 nm.
Both sensors are equipped with diffuser for the correction according to the cosine law. The probe provides the total effective irradiance ("Er" at display), the effective irradiance in the range UV-CB ("BC" at display) and the UVA irradiance ("A" at display).
At switching on, the instrument displays alternatively the measures of the two sensors. Pressing any key (excluded ON/OFF key), automatic commutation is turned off. To reactivate it, press HOLD and REL keys together.
To select the measure to display, press UNIT key.

3.3 PROBES LP 471 PYRA 02 AND LP 471 PYRA 03

LP 471 PYRA 02 and ***LP 471 PYRA 03*** probes measure the **global solar radiation** in the spectral range 300…3000 nm. They are composed of a first class (LP PYRA 02) or a second class (LP PYRA 03) pyranometer and a cable with SICRAM module.
Since calibration data of pyranometer are saved in SICRAM module, the cable cannot be used together with other pyranometers.
The **global solar radiation** is expressed in W/m^2 or in $\mu W/cm^2$. Measuring range is 0…2000 W/m^2.
The module is equipped with a 5 m or 10 m long cable ending with a 4 poles male connector to be inserted in the female connector of the pyranometer.
No user calibration is required.
The SICRAM module is recognized at the instrument switching on, then it's absolutely necessary to **connect the module before turning the instrument on**.

3.4 PROBE LP 471 SILICON-PYRA

LP 471 Silicon-PYRA measures the **global solar radiation** using a silicon photodiode in the spectral range 400…1100 nm.
The diffuser allows a correction according to the cosine law.
The probe is suitable for the measurement of natural sunlight. Under overcast skies, or for reflected light measurements the use of a thermopile pyranometer is recommended (LP 471 PYRA 03 or LP 471 PYRA 02).

The measurement of global solar radiation is expressed in W/m^2 or in $\mu W/cm^2$. Measuring range is 0…2000 W/m^2.
No user calibration is required.
The SICRAM module is recognized at the instrument switching on, then it's absolutely necessary to **connect the module before turning the instrument on**.

4. WARNINGS

1. Do not bend the probe connectors or force them upward or downward.
2. Do not bend or force the contacts when inserting the probe connector into the instrument.
3. The sensors and filters should not exceed the temperature limits established with consequent irreparable degradation of their characteristics.
4. Do not drop the probes: as this could cause irreparable damage.
5. Avoid taking measurements in presence of high frequency sources, microwave ovens or large magnetic fields; results may not be very reliable.
6. The instrument is water resistant and IP67, but should not be immersed in water. The probe connectors must be fitted with sealing gaskets. Should the instrument fall into the water, check for any water infiltration. Gently handle the instrument in such a way as to prevent any water infiltration from the connectors' side.

5. INSTRUMENT SIGNALS AND FAULTS

The following table lists all of the indications displayed by the instrument in different operating and error situations:

Display indications	Explanation
BATT TOO LOW CHNG NOW	Indication of insufficient battery charge: it appears when you turn the instrument on. The instrument issues a long beep and turns off. Replace the batteries.
CAL LOST	Program error: it appears after turning on for a few seconds. Contact the instrument's supplier.
PROB COMM LOST ERR	This appears if the probe has already been detected by the instrument, but is disconnected. At the same time an intermittent beep is issued.
FUNC CLRD	Maximum (MAX), minimum (MIN) and average (AVG) values cleared.
NEW_PROB_DET	New probe detected
NO_PRBE_ SER_NUM	The connected probe's serial number is absent
OVER or - - - -	Measurement overflow: indicates that the probe is measuring a value exceeding the measuring range.
PLS_EXIT >>> FUNC RES_FOR_FACT ONLY	Please exit using ESC >>> function reserved to factory calibration
PRBE_SER #### ####	Serial number #### #### of the connected probe
PROB ERR	A probe with SICRAM module has been inserted when not admissible for that instrument.
PROB COMM LOST	This appears if the probe has already been detected by the instrument, but is disconnected. At the same time an intermittent beep is issued.
SYS ERR #	Instrument management program error. Contact the instrument's supplier and communicate the numeric code # reported by the display.

6. LOW BATTERY WARNING AND BATTERY REPLACEMENT

The battery symbol 
on the display constantly shows the battery charge status. To the extent that batteries have discharged, the symbol "empties". When the charge decreases still further it starts blinking.

In this case, batteries should be replaced.
If you continue to use it, the instrument can no longer ensure correct measurement. However, the memory data are maintained.
If the battery charge level is insufficient, the following message appears when you turn the instrument on:

BATT TOO LOW
CHNG NOW

The instrument issues a long beep and turns off. In this case, replace the batteries in order to turn the instrument back on.

To replace the batteries, proceed as follows:
1. switch the instrument off;
2. unscrew the battery cover counter clockwise;
3. replace the batteries (3 1.5V alkaline batteries - type AA);
4. screw the cover on clockwise.

Malfunctioning upon turning on after battery replacement
After replacing the batteries, the instrument may not restart correctly; in this case, repeat the operation.
After disconnecting the batteries, wait a few minutes in order to allow circuit condensers to discharge completely; then reinsert the batteries.

6.1 WARNING ABOUT BATTERY USE

- Batteries should be removed when the instrument is not used for an extended time.
- Flat batteries must be replaced immediately.
- Avoid batteries leaking.
- Always use good quality leakproof alkaline batteries. Sometimes on the market, it is possible to find new batteries with an insufficient charge capacity.

7. INSTRUMENT STORAGE

Instrument storage conditions:

- Temperature: -25…+65°C.
- Humidity: less than 90%RH without condensation.
- Do not store the instrument in places where:
  - humidity is high;
  - the instrument may be exposed to direct sunlight;
  - the instrument may be exposed to a source of high temperature;
  - the instrument may be exposed to strong vibrations;
  - the instrument may be exposed to steam, salt or any corrosive gas.

The instrument case is made of ABS plastic: do not use any incompatible solvent for cleaning.

8. NOTES ABOUT WORKING AND OPERATIVE SAFETY

Authorized use

The technical specifications as given in chapter TECHNICAL CHARACTERISTICS must be observed. Only the operation and running of the measuring instrument according to the instructions given in this operating manual is authorized. Any other use is considered unauthorized.

General safety instructions

This measuring system is constructed and tested in compliance with the EN 61010-1 safety regulations for electronic measuring instruments. It left the factory in a safe and secure technical condition.
The smooth functioning and operational safety of the measuring system can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.
The smooth functioning and operational safety of the instrument can only be guaranteed under the environmental and electrical operating conditions that are in specified in chapter TECHNICAL CHARACTERISTICS.

Do not use or store the product in places such as listed below:

- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the instrument.
- Excessive induction noise, static electricity, magnetic fields or noise.

If the measuring system was transported from a cold environment to a warm environment, the formation of condensate can impair the functioning of the measuring system. In this event, wait until the temperature of the measuring system reaches room temperature before putting the measuring system back into operation.

Obligations of the purchaser

The purchaser of this measuring system must ensure that the following laws and guidelines are observed when using dangerous substances:

- EEC directives for protective labour legislation
- National protective labour legislation
- Safety regulations

9. TECHNICAL CHARACTERISTICS

9.1 TECHNICAL CHARACTERISTICS OF THE PHOTO-RADIOMETER

Instrument	
Dimensions (Length x Width x Height)	140 x 88 x 38 mm
Weight	160 g (complete with batteries)
Material	ABS
Display	2x4½ digits plus symbols 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 of the case	**IP67**
Power	
Batteries	3 1.5V type AA batteries
Autonomy	200 hours with 1800mAh alkaline batteries
Power absorbed with instrument off	< 20 μA
Connections	
Input for probes	8-pole male DIN45326 connector
Unit of Measurement	lux - fcd - W/m² - μW/cm² - μmol/(m²·s) - cd/m² μW/lumen in the *LP471P-A* probe
EMC standard regulations	
Safety requirements for electrical equipment.	EN61010-1
EMC Generic standards. Immunity.	EN61000-6-2:2005
EMC Generic standards. Emission standards.	EN61000-6-3:2007
Electrostatic discharge immunity test.	EN61000-4-2 level 3
Radiated RF electromagnetic field immunity test.	EN61000-4-3 level 3
Electrical fast transient/burst immunity test.	EN61000-4-4 level 3
Immunity to conducted disturbances.	EN61000-4-6
El. Interference - Line-conducted disturbances.	EN55022:2007 class B
El. Interference - Radiated emissions.	IEC/CISPR 22 class B

9.2 TECHNICAL CHARACTERISTICS OF PHOTOMETRIC AND RADIOMETRIC PROBES COMPLETE WITH SICRAM MODULE EQUIPPED WITH THE INSTRUMENT

ILLUMINANCE measurement probe LP 471 PHOT complete with SICRAM module and equipped with the instrument

Measurement range (lux):	0.01…199.99	…1999.9	…19999	…199.99·10^3
Resolution (lux):	0.01	0.1	1	0.01·10^3

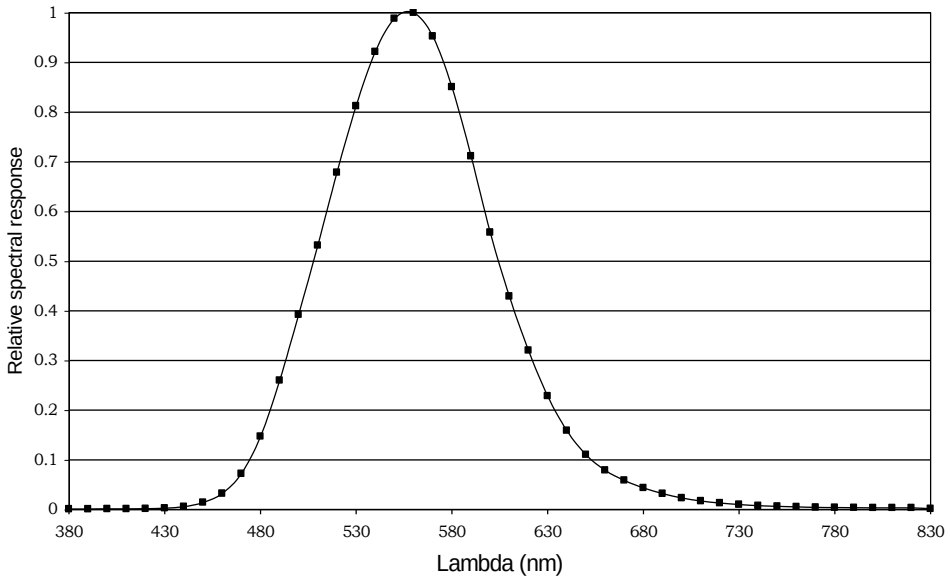
Spectral range:	in agreement with standard photopic curve V(λ)
α (temperature coefficient) f_6(T):	<0.05% K
Calibration uncertainty:	<4%
f'1 (in agreement with photopic response V(λ)):	<6%
f_2 (response according to the cosine law):	<3%
f_3 (linearity):	<1%
f_4 (instrument reading error):	<0.5%
f_5 (fatigue):	<0.5%
Class:	B
Drift after 1 year:	<1%
Functioning temperature:	0…50 °C
Reference Standard	CIE No. 69 – UNI 11142

LUMINANCE measurement probe LP 471 LUM 2 complete with SICRAM module and equipped with the instrument

Measurement range (cd/m^2):	0.1…1999.9	…19999	…199.99·10^3	…1999.9·10^3
Resolution (cd/m^2):	0.1	1	0.01·10^3	0.1·10^3

Optical angle:	2°
Spectral range:	in agreement with standard photopic curve V(λ)
α (temperature coefficient) f_6(T):	<0.05% K
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%
Class:	C
Drift after 1 year:	<1%
Functioning temperature:	0…50 °C
Reference Standard	CIE No. 69 – UNI 11142

Typical response curve

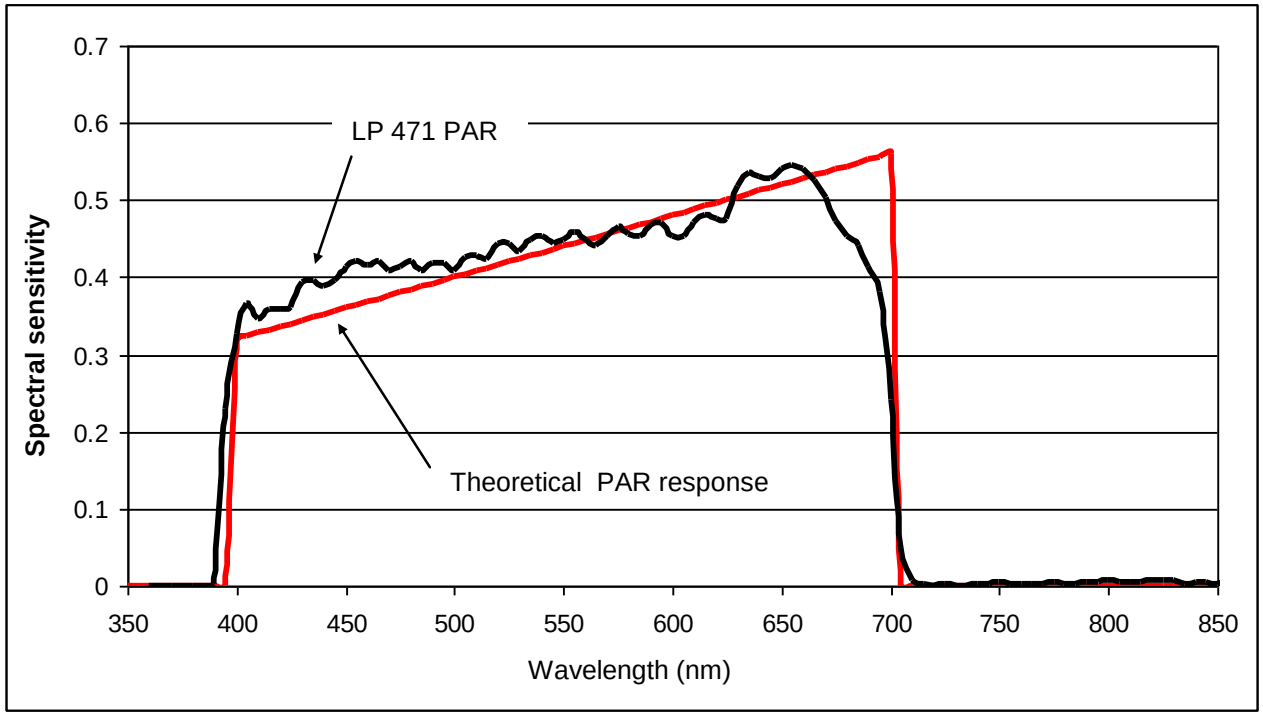


Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range PAR LP 471 PAR complete with SICRAM module and equipped with the instrument

Measurement range (µmol/m^{2}s):	0.01… 199.99	200.0…1999.9	2000…10000
Resolution (µmol/m^{2}s):	0.01	0.1	1

Spectral range: 400 nm…700 nm
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%
Functioning temperature: 0…50 °C

Typical response curve

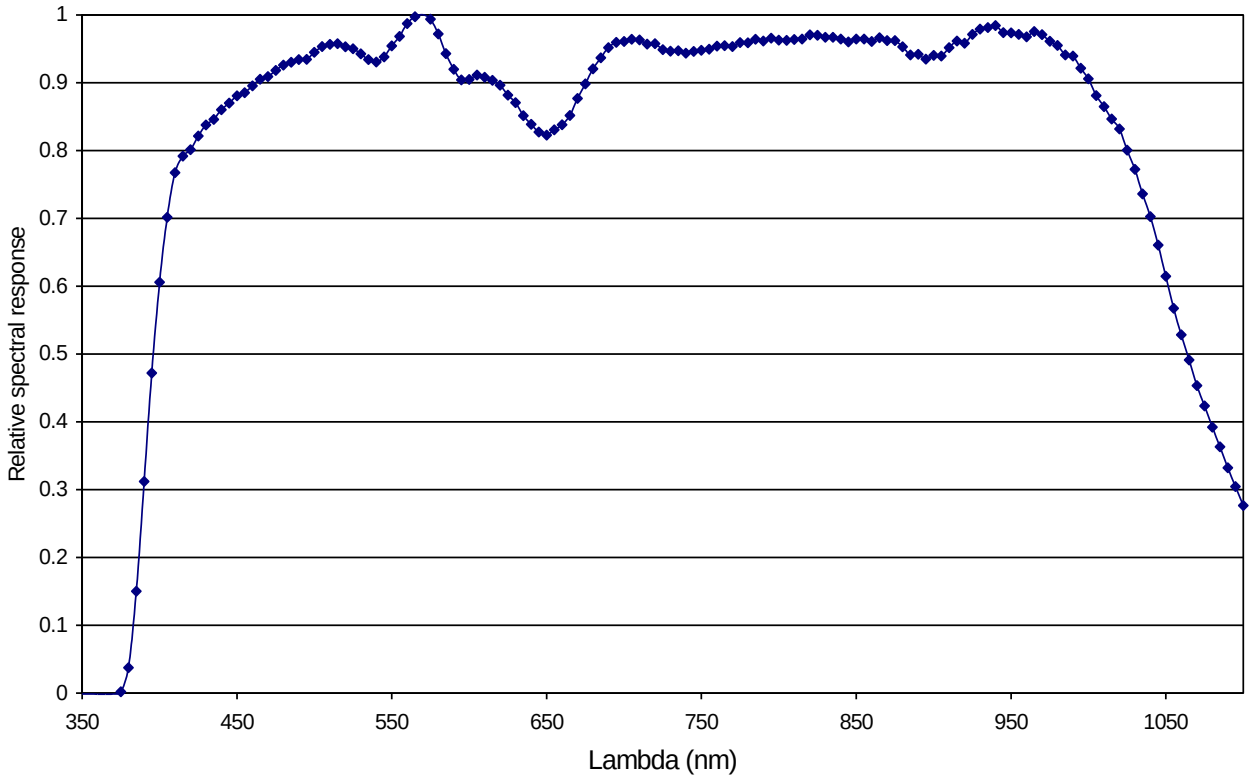


IRRADIANCE measurement probe LP 471 RAD complete with SICRAM module and equipped with the instrument

Measurement range (W/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 (W/m^2):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1

Spectral range:	400 nm…1050 nm
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%
Functioning temperature:	0…50 °C

Typical response curve

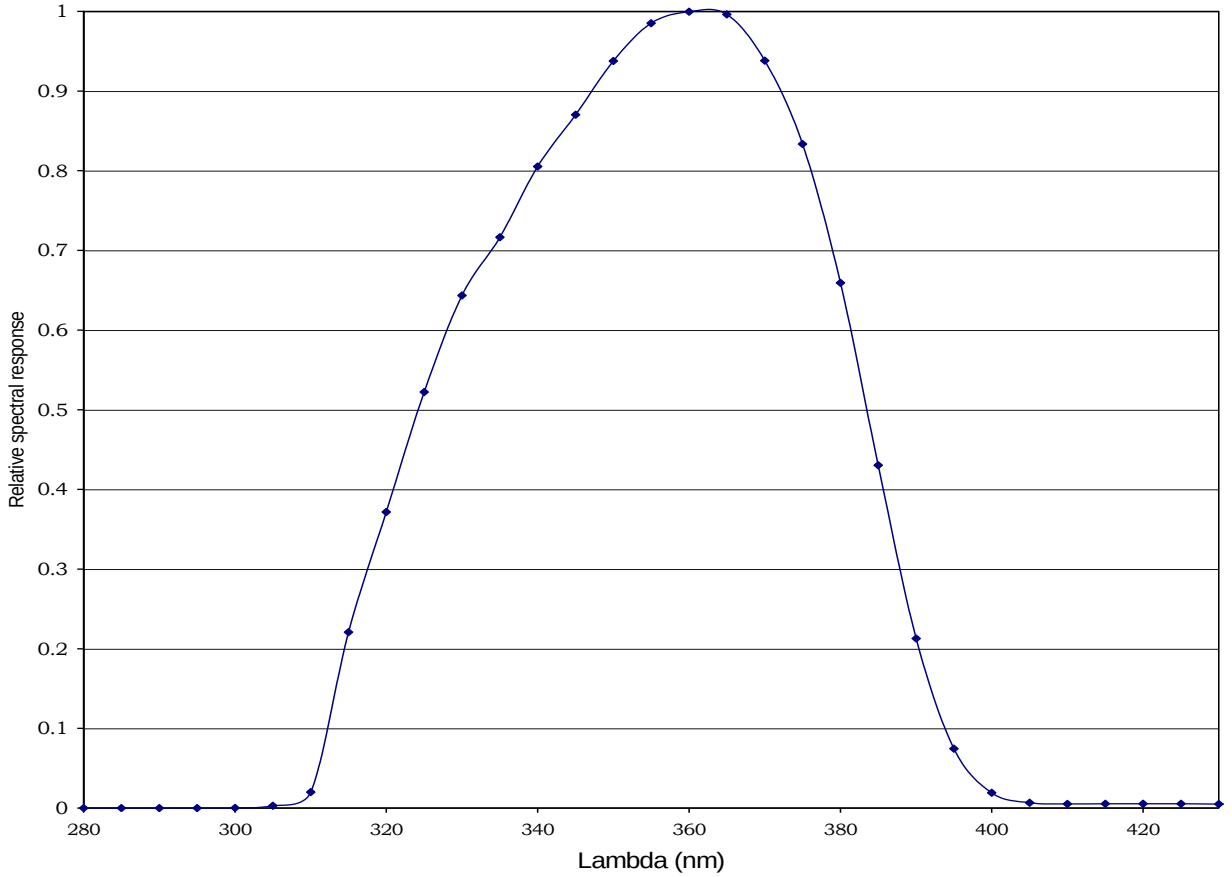


IRRADIANCE measurement probe LP 471 UVA complete with SICRAM module and equipped with the instrument

Measurement range (W/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 (W/m^2):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1

Spectral range: 315 nm…400 nm (Peak 360 nm)
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%
Functioning temperature: 0…50 °C

Typical response curve

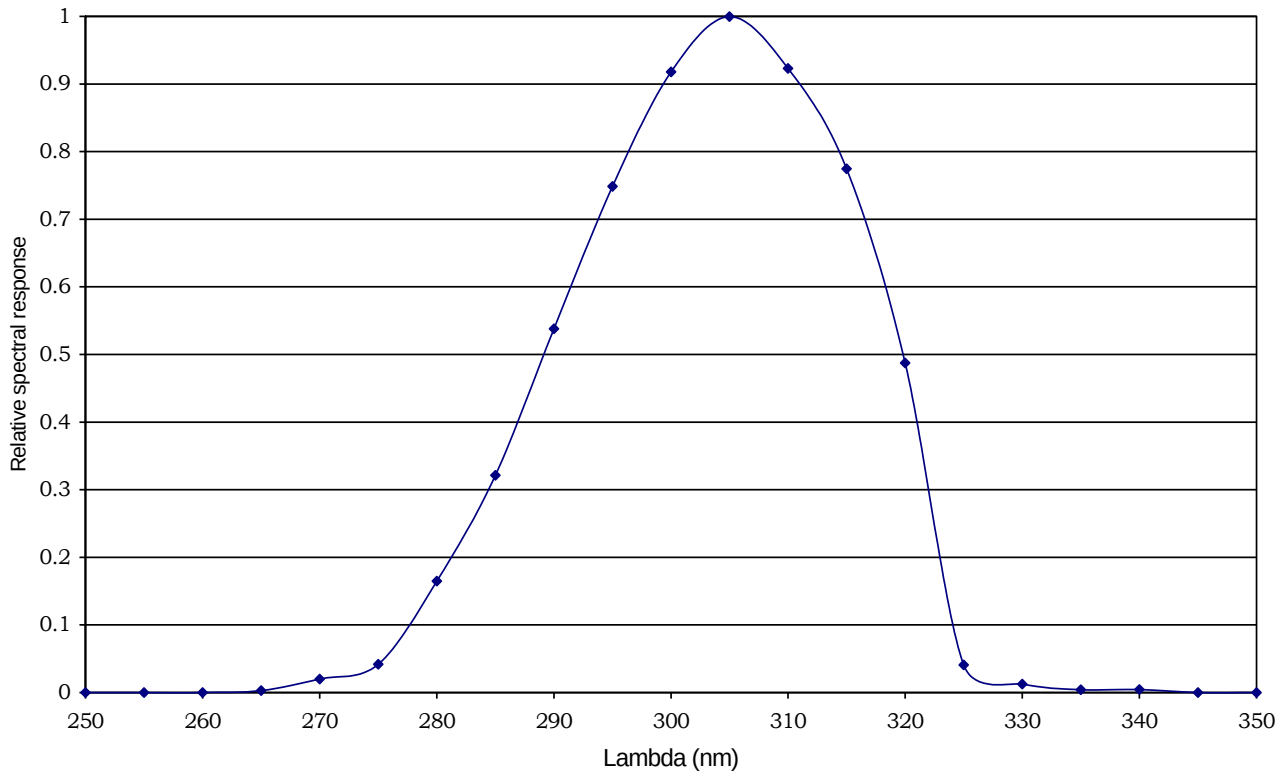


IRRADIANCE measurement probe LP 471 UVB complete with SICRAM module and equipped with the instrument

Measurement range (W/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 (W/m^2):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1

Spectral range: 280 nm…315 nm (Peak 305 - 310 nm)
Calibration uncertainty: <5%
f_2 (response according to the cosine law): <6%
f_3 (linearity): <2%
f_4 (instrument reading error): ±1digit
f_5 (fatigue): <0.5%
Drift after 1 year: <2%
Functioning temperature: 0…50 °C

Typical response curve

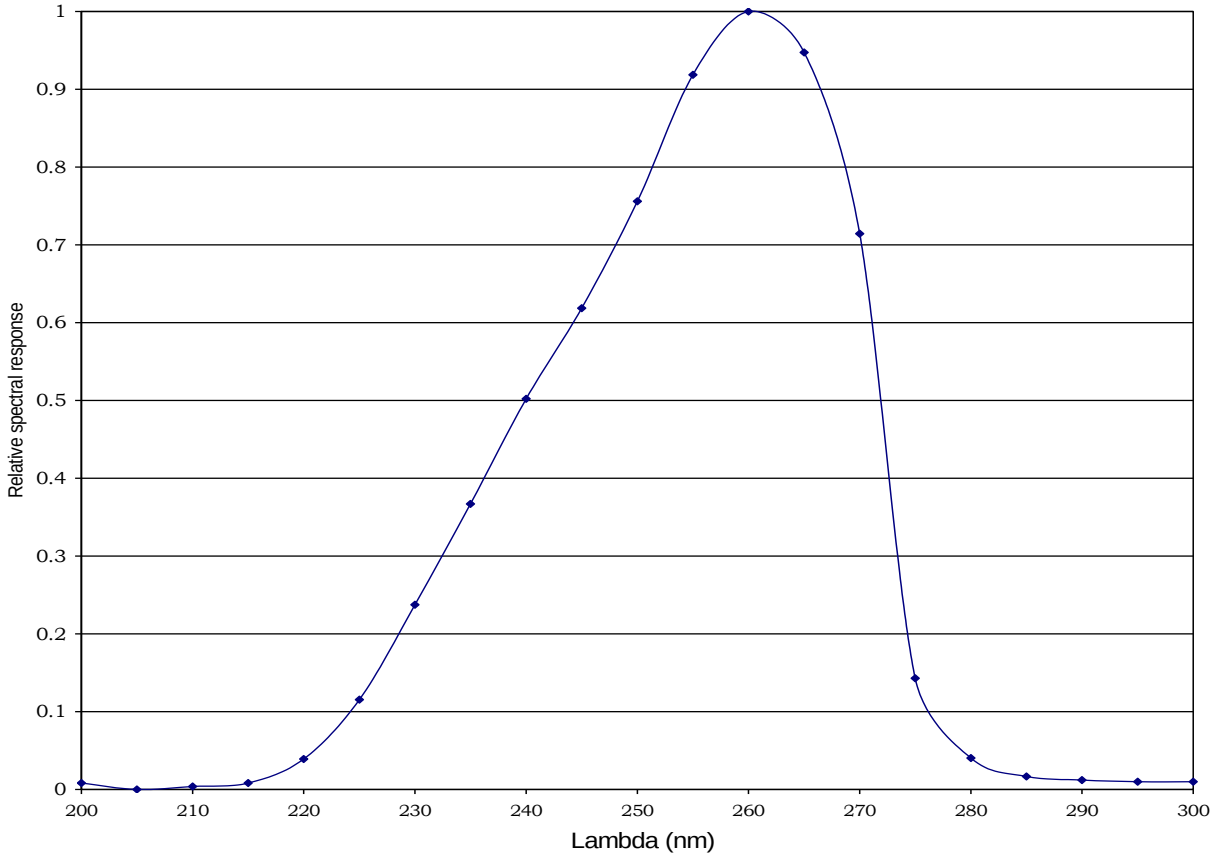


IRRADIANCE measurement probe LP 471 UVC complete with SICRAM module and equipped with the instrument

Measurement range (W/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 (W/m^2):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1

Spectral range: 220 nm…280 nm (Peak 260 nm)
Calibration uncertainty: <5%
f_2 (response according to the cosine law): <6%
f_3 (linearity): <1%
f_4 (instrument reading error): ±1digit
f_5 (fatigue): <0.5%
Drift after 1 year: <2%
Functioning temperature: 0…50 °C

Typical response curve



Measurement probe LP 471 ERY of TOTAL EFFECTIVE IRRADIANCE (W_{eff}/m^2) weighted according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module and equipped with the instrument

Measurement range (W_{eff}/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 (W_{eff}/m^2):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1

Spectral range: UV action curve for erythema measurement (250 nm…400 nm)

Calibration uncertainty: <15%

f_3 (linearity): <3%

f_4 (instrument reading error): ±1digit

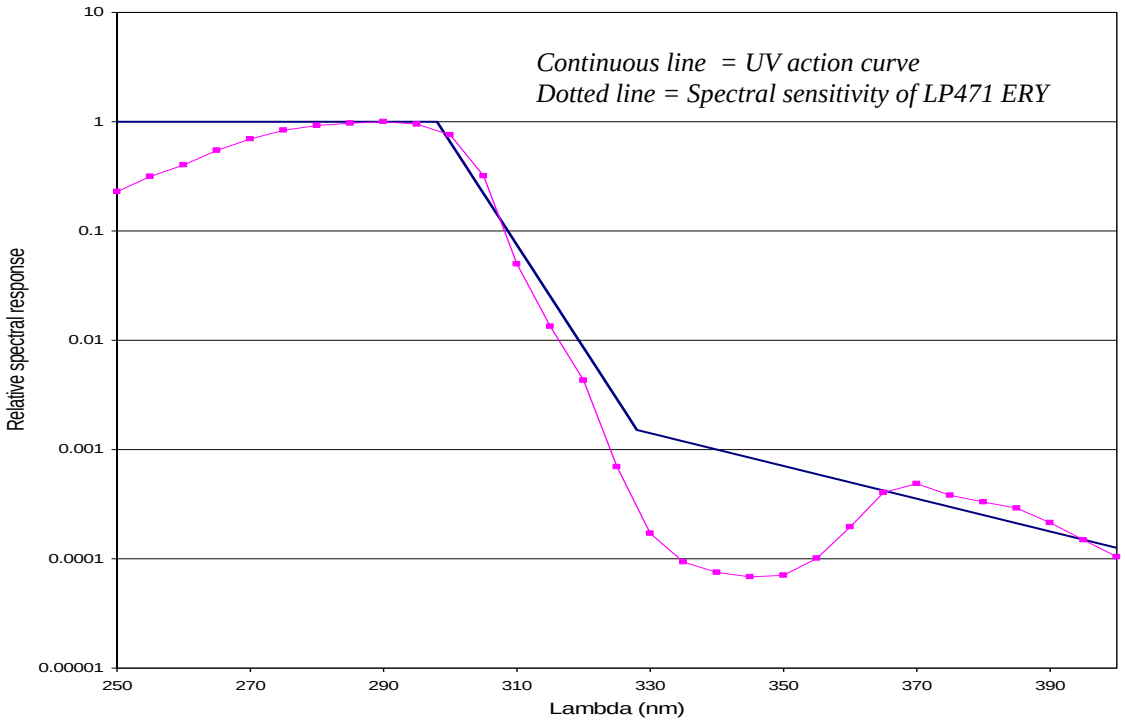
f_5 (fatigue): <0.5%

Drift after 1 year: <2%

Working temperature: 0…50 °C

Reference Standard CEI EN 60335-2-27

Typical response curve



The LP 471 ERY probe measures the total effective irradiance (W_{eff}/m^2) weighted according to the UV action curve (CEI EN 60335-2-27). The particular photodiode and a proper combination of filters, brings the probe's spectral curve close to the UV action curve.

The CEI EN 60335-2-27 norm prescribes that, during the first tanning treatment, the dosage of 100 J/m^2 cannot be exceeded, and that the maximum yearly dosage must not exceed 15000 J/m^2.

The typical spectral curve of the LP 471 ERY probe is illustrated in the figure together with the UV action curve: the agreement between the two curves mean reliable measurements are obtained using the different types of lamps (and filters) used by the tanning machines currently on the market.

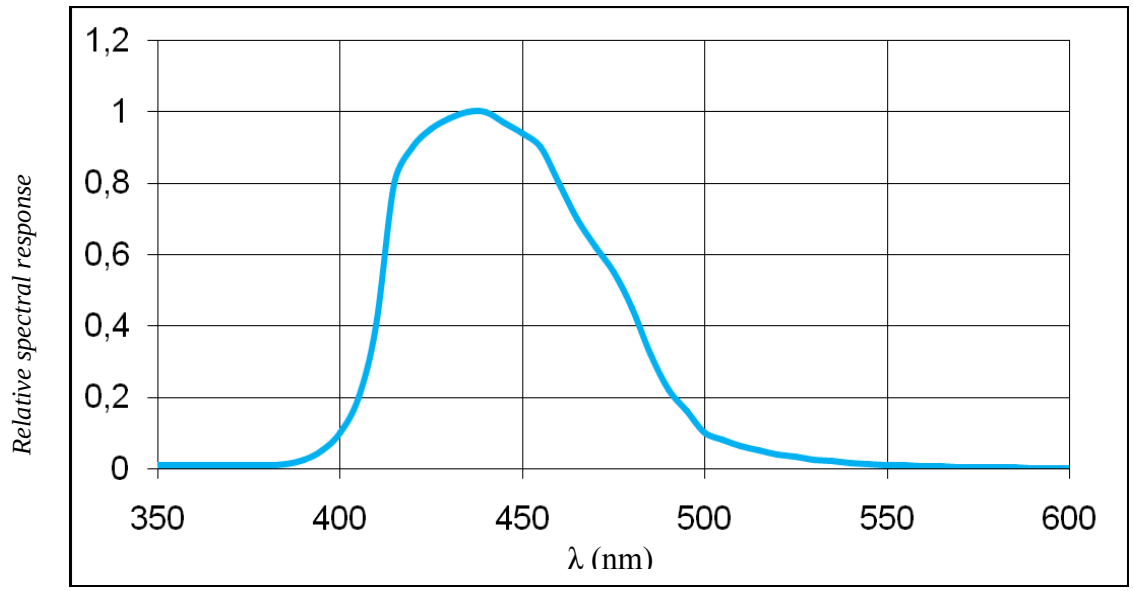
All probes are individually calibrated in the DeltaOhm photo-radiometry laboratory, using a dual-beam monochromator. **The calibration is performed at 295nm, using a calibrated photodiode as reference.**

EFFECTIVE IRRADIANCE measurement probe in the spectral range of Blue light LP 471 BLUE complete with SICRAM module and equipped with the instrument

Measurement range (W/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 (W/m^2):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1

Spectral range: 380 nm…550 nm. Blue hazard action curve 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%
Functioning temperature: 0…50 °C

Typical response curve



The radiometric probe LP 471 BLUE measures the irradiance (W/m^2) in the spectral range of Blue light. The probe consists of a photodiode with an appropriate filter and is provided with a diffuser for correct measurement according to the cosine law.
The spectral response curve of the probe allows to measure the effective irradiance for blue light hazard (curve B (λ) according to the standards ACGIH / ICNIRP) in the spectral range 380nm ... 550nm. Optical radiations in this range can produce photochemical retinal injury. Another field of application is the monitoring of the blue light irradiance in the treatment of neonatal jaundice.

Two sensors combined probe LP 471 P-A for ILLUMINANCE and UVA IRRADIANCE measurement complete with SICRAM module and equipped with the instrument

Illuminance

Measurement range (lux):	0.01…199.99	…1999.9	…19999	…199.99·10^3
Resolution (lux):	0.01	0.1	1	0.01·10^3

Spectral range:	according to photopic curve V(λ)
α (temperature coefficient) f_6(T):	<0.05% K
Calibration uncertainty:	<4%
f'1 (according to photopic curve 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%
Functioning temperature:	0…50 °C
Reference Standard	CIE n°69 – UNI 11142

Please see spectral response at pag.18.

UVA Irradiance

Measurement range (μW/cm^2):	0.01…199.99	…1999.9	…19999	…199.99·10^3
Resolution (μW/cm^2):	0.01	0.1	1	0.01·10^3

Spectral range:	315 nm…400 nm (Picco 360 nm)
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%
Functioning temperature:	0…50 °C

Please see spectral response at pag.21.

Combined probe LP 471 A-UVeff for measuring TOTAL EFFECTIVE IRRADIANCE (W_{eff}/m^2) according to UV weighting curve (CEI EN 60335-2-27), complete with SICRAM module and equipped with the instrument

Total effective irradiance

Measurement range (W_{eff}/m^2):	0.001… 19.999
Resolution (W_{eff}/m^2):	0.001
Spectral range:	UV action curve for erythema measurement (250 nm…400 nm) See fig.1.
Calibration uncertainty:	<15%
f_3 (linearity):	<3%
f_4 (instrument reading error):	±1digit
f_5 (fatigue):	<0.5%
Drift after 1 year:	<2%
Functioning temperature:	0…50°C
Reference Norm	CEI EN 60335-2-27

UVA Irradiance

Measurement range (W_{eff}/m^2):	0.1… 1999.9
Resolution (W_{eff}/m^2):	0.1
Spectral range:	315 nm … 400 nm

UV-BC Irradiance

Measurement range (W_{eff}/m^2):	0.001… 19.999
Resolution (W_{eff}/m^2):	0.001
Spectral range:	250 nm…315 nm

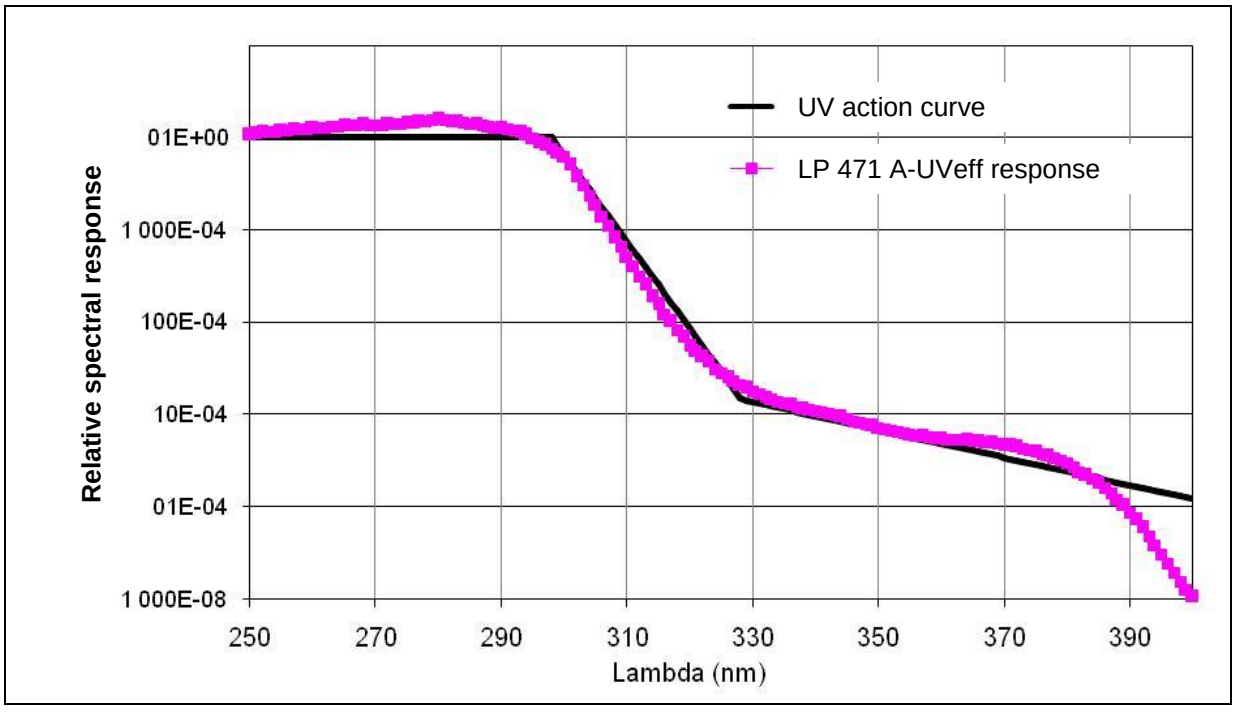
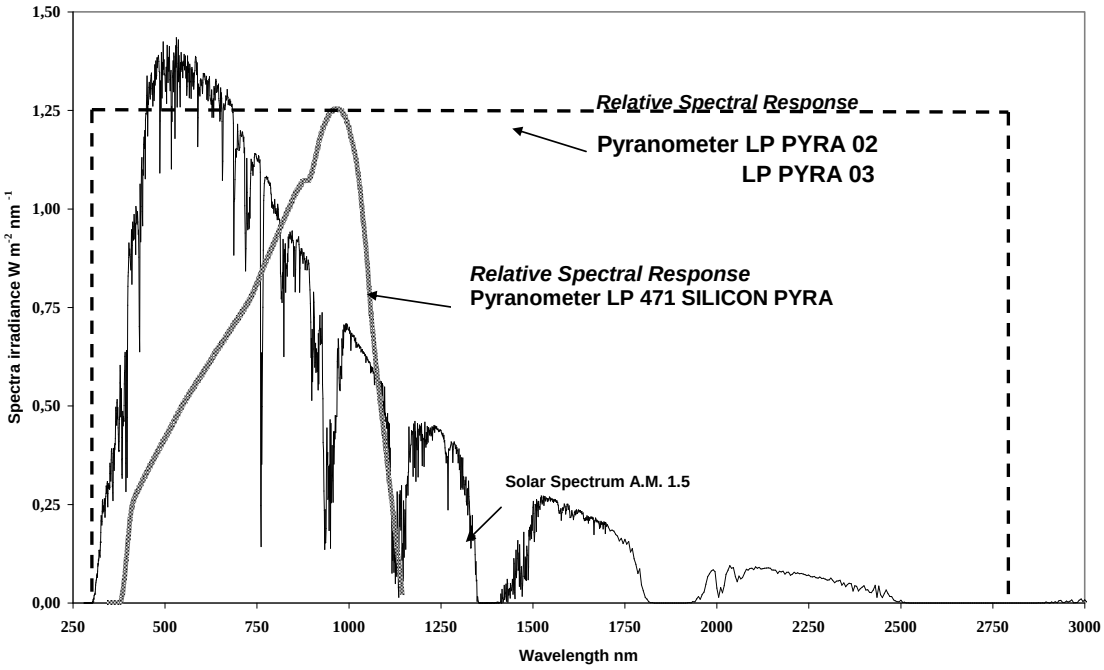


Fig.1

Measuring probe LP 471 SILICON-PYRA of GLOBAL SOLAR IRRADIANCE complete with SICRAM module and equipped with the instrument

Measurement range (W/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 (W/m^2):	$0.1 \cdot 10^{-3}$	0.001	0.01	0.1

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%
Functioning temperature:	0…50 °C



10. ORDER CODES

HD2302.0 The kit is composed of the instrument HD2302.0, 3 1.5V alkaline batteries, operating manual, and case. **The probes must be ordered separately.**

10.1 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, class B according to CIE n°69. Measurement range: 0.01 lux…$200 \cdot 10^3$ 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^2…$2000 \cdot 10^3$ cd/m^2.

LP 471 PAR Quantum radiometric probe for the measurement of the photon flow across the chlorophyll range **PAR** (Photosynthetically Active Radiation 400 nm…700 nm) complete with SICRAM, measurement in μmol/m^2s, diffuser for cosine correction. Measurement range: 0.01μmol/m^2s…$10\mu 10^3$μmol/m^2s

LP 471 RAD Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 400 nm…1050 nm spectral range, diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m^2 …2000 W/m^2.

LP 471 UVA Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module; in the 315 nm…400 nm, peak 360 nm, **UVA** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m^2…2000 W/m^2.

LP 471 UVB Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 280 nm…315 nm, peak 305 - 310 nm, **UVB** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m^2…2000 W/m^2.

LP 471 UVC Radiometric probe for **IRRADIANCE** measurement complete with SICRAM module, in the 220 nm…280 nm, peak 260 nm, **UVC** spectral range, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m^2…2000 W/m^2.

LP 471 ERY Radiometric probe for **EFFECTIVE TOTAL IRRADIANCE** measurement (W_{eff}/m^2) weighted 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: $0.1 \cdot 10^{-3}W_{eff}/m^2$…2000 W_{eff}/m^2.

LP 471 BLUE Radiometric probe for **EFFECTIVE IRRADIANCE** measurement in the spectral range of Blue light complete with SICRAM module.
Spectral range 380nm…550nm, diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3}$W/m^2 …2000 W/m^2.

LP 471 P-A Combined probe for measuring the **ILLUMINANCE** (lux), with standard photopic spectral response, and for measuring the **IRRADIANCE** (μW/cm^2) in the **UVA** spectral range (315-400 nm, with peak at 360 nm). Both sensors are equipped with diffuser for the correction according to the cosine law.

Illuminance measuring range: 0.3 lux … $200 \cdot 10^3$ lux.
Irradiance measuring range: 0.1 mW/m^2…2000 W/m^2. The probe provides the ratio of the UVA irradiance and the illuminance in µW/lumen (quantity of interest in the museums field). Supplied with SICRAM module and 2 m cable (Please see note 1).

LP 471 A-UVeff Combined probe for measuring the **TOTAL EFFECTIVE IRRADIANCE** according to the weighting curve UV. The two sensors are used to correctly measure the total effective irradiance in the range 250-400 nm. Both sensors are equipped with diffuser for the correction according to the cosine law. The probe provides the total effective irradiance (E_{eff}), the effective irradiance in the range UV-CB and the UVA irradiance.
Total effective irradiance measuring range: 0.001 W/m^2…20 W/m^2.
B_C effective irradiance measuring range: 0.001 W/m^2…20 W/m^2.
UVA irradiance measuring range: 0.1 W/m^2…2000 W/m^2. Supplied with SICRAM module and 2 m cable. (Please see note 1).

LP 471 Silicon-Pyra Pyranometer with silicon photodiode to measure the **GLOBAL SOLAR IRRADIANCE**, diffuser for cosine correction. Spectral range: 400…1100 nm. Measuring range: 0…2000 W/m^2. Fixed cable 5m long, with SICRAM module.

LP 471 PYRA 02.5 Probe consisting of a first class pyranometer LP PYRA 02 and a 5 m long cable complete with SICRAM module.

LP 471 PYRA 02.10 Probe consisting of a first class pyranometer LP PYRA 02 and a 10 m long cable complete with SICRAM module.

LP 471 PYRA 03.5 Probe consisting of a second class pyranometer LP PYRA 03 and a 5 m long cable complete with SICRAM module.

LP 471 PYRA 03.10 Probe consisting of a second class pyranometer LP PYRA 03 and a 10 m long cable complete with SICRAM module.

LP BL Base with levelling device. **To be assembled with the probes at order time**. Not available for LUM and PYRA probes.

Note 1: probes *LP 471 P-A* and *LP 471 A-UVeff* work with instruments HD2302.0 having firmware version "HD2302.01" and following. On the back of these instruments a label shows version and date of the firmware. To update previous instruments, contact your dealer Delta Ohm.

GUARANTEE

TERMS OF GUARANTEE

All DELTA OHM instruments are subject to accurate testing, and are guaranteed for 24 months from the date of purchase. DELTA OHM will repair or replace free of charge the parts that, within the warranty period, shall be deemed non efficient according to its own judgement. Complete replacement is excluded and no damage claims are accepted. The DELTA OHM guarantee only covers instrument repair. The guarantee is void in case of incidental breakage during transport, negligence, misuse, connection to a different voltage than that required for the appliance by the operator. Finally, a product repaired or tampered by unauthorized third parties is excluded from the guarantee. The instrument shall be returned FREE OF SHIPMENT CHARGES to your dealer. The jurisdiction of Padua applies in any dispute.

The electrical and electronic equipment marked with this symbol cannot be disposed of in public landfills. According to the UE Directive 2002/96/EC, the European users of electrical and electronic equipment can return it to the dealer or manufacturer upon purchase of a new one. The illegal disposal of electrical and electronic equipment is punished with an administrative fine.

This guarantee must be sent together with the instrument to our service centre.

IMPORTANT: Guarantee is valid only if coupon has been correctly filled in all details.

Instrument Code: ❑ **HD2302.0**

Serial number _____

RENEWALS

Date _____	Date _____
Inspector _____	Inspector _____
Date _____	Date _____
Inspector _____	Inspector _____
Date _____	Date _____
Inspector _____	Inspector _____

CE

RoHS 2002/95/EC

CE CONFORMITY	
Safety requirements for electrical equipment.	EN61010-1
EMC Generic standards. Immunity for industrial environments.	EN61000-6-2:2005
EMC Generic standards. Emission standards.	EN61000-6-3:2007
Electrostatic discharge immunity test.	EN61000-4-2 level 3
Radiated, radio-frequency, electromagnetic field immunity test.	EN61000-4-3 level 3
Electrical fast transient/burst immunity test.	EN61000-4-4 level 3
Immunity to conducted disturbances, induced by RF fields.	EN61000-4-6
Electromagnetic Interference - Line-conducted disturbances.	EN55022:2007 class B
Electromagnetic Interference - Radiated emissions.	IEC/CISPR 22 class B