LP UVA 02 - LP UVA 02AC - LP UVA 02AV RADIOMETRIC PROBES

The radiometric LP UVA 02, LP UVA 02AC, and LP UVB02AV probes measure the global irradiance in the UVA on a flat surface (Watt/ m^2). The irradiance is the sum of direct solar irradiance and of diffuse irradiance from the sky.
The radiometer can also be used for monitoring UVA irradiance indoor.

Working Principle
LP UVA 02 radiometer is based on a solid state sensor, the spectral match with the desired curve is obtained using special filter. The relative spectral response is reported on figure 4.
In order to protect the diffuser from the dust, LP UVA 02 is equipped with a 50mm glass dome.
The cosine low response is obtained with a particular shaped PTFE diffuser. In figure 5 the cosine error versus angle of incident is reported.
The excellent cosine law response of LP UVA 02 allow to use the radiometer at any sun's zenith angle. (The diffused component of the UVA increases as the sun moves away from the zenith, so the error on direct component due to imperfect response according to the cosine becomes negligible on the measurement of global irradiance).

Installation and Mounting of the Radiometer for the Measurement of Global Radiation:
Before installation, refill the cartridge containing silica-gel crystals. Silica gel absorbs humidity in the dome chamber and prevents (in particular climatic conditions) internal condensation forming on the internal walls of the domes and measurement alteration.
Do not touch the silica gel crystals with your hands while refilling the cartridge. Carry out the following instructions in an environment as dry as possible:

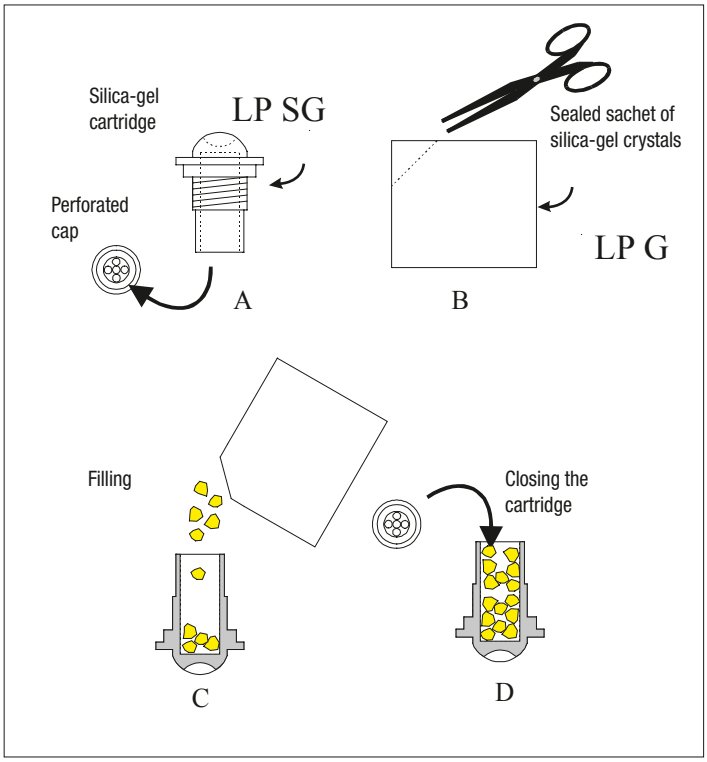
1- Loosen the three screws that fix the white shade disk
2- Unscrew the silica gel cartridge using a coin
3- Remove the cartridge perforated cap
4- Open the sachet containing silica gel (supplied with the radiometer)
5- Replace the silica gel crystals
6- Close the cartridge with its own cap, paying attention that the sealing O-ring be properly positioned.
7- Screw the cartridge to the radiometer body using a coin
8- Check that the cartridge is screwed tightly (if not, silica gel life will be reduced)
9- Position the shade disk and screw it with the screws
10- The radiometer is ready for use.

Figure N.1 shows the operations necessary to fill the cartridge with the silica gel crystals.

- The LP UVA 02 radiometer has to be mounted in a readily accessible location to clean the dome regularly and to carry out maintenance. At the same time, check that no building, construction, tree or obstruction exceeds the horizontal plane where the radiometer lays. If this is not possible, select a site where obstructions do not exceed 5 degrees of elevation, in the path followed by the sun, between earliest sunrise and latest sunset.
- The radiometer has to be located far from any kind of obstruction, which might reflect sunlight (or sun shadow) onto the radiometer itself.
- The LP UVA 02 radiometer is provided with a spirit level for carrying out an accurate horizontal leveling. The adjustment is made by means of two leveling screws that allow to adjust the radiometer inclination. Use the two 6mm-diameter holes and a 65mm interaxial distance to mount the instrument on a plane. Remove the shade disk to access the holes and reposition it after mounting (see fig. 2).
- The LP S1 mounting kit, supplied on demand as an accessory, allows an easy mounting of the radiometer on a mast. The mast maximum diameter shall not exceed 50 mm. The operator shall take care that the mast height does not exceed the radiometer plane to avoid measurement errors caused by any reflection or shadow of the mast itself. To fix the radiometer to the mounting bracket, remove the shade disk loosening the three screws, fix the radiometer, and mount the white shade disk again.
- It is suggested to thermally isolate the radiometer from its mounting brackets, and to check that the electrical contact with the ground be done properly

Electrical Connection and Requirements for Electronic Readout Devices:

- LP UVA 02 radiometer does not require any power supply.
- LP UVA 02 is supplied with a flying 4-pole M12 connector
- UV-proof PTFE cables are **available on request**, cable colors and connector poles of the screened 2-wire cable are matched as follows:
  Black → shield braid
  Red → (+) signal generated by the detector
  Blue → (-) negative signal generated by the detector (connected to the housing)
- LP UVA 02 is to be connected either to a millivoltmeter or data acquisition unit which input load resistance must be > 5MΩ. Typically, the radiometer output signal does not exceed 20mV. In order to better exploit the radiometer features, the readout instrument should have a 1μV resolution.



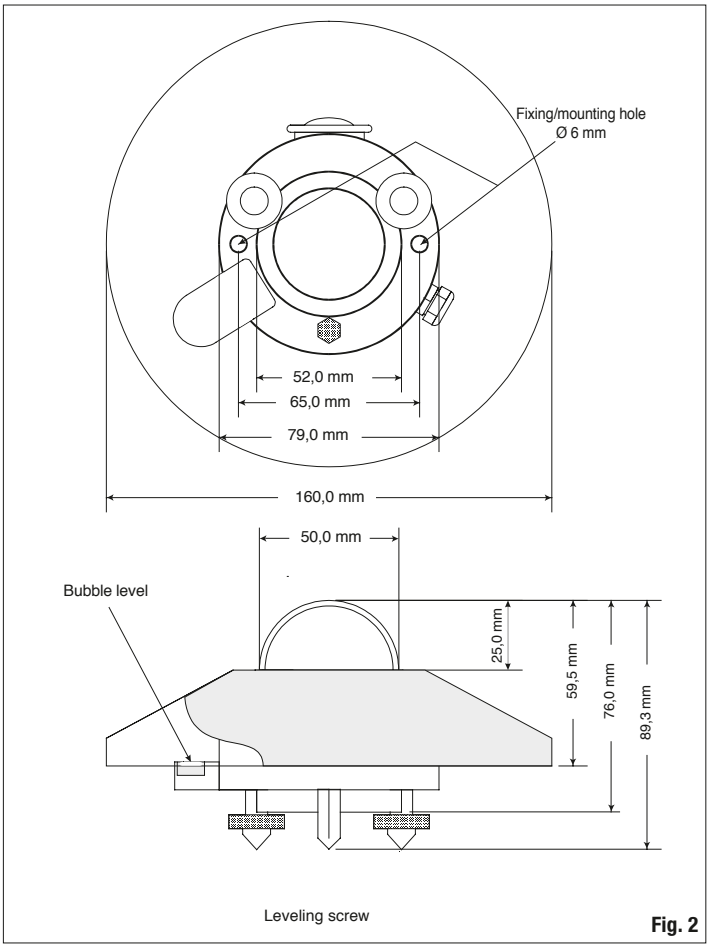
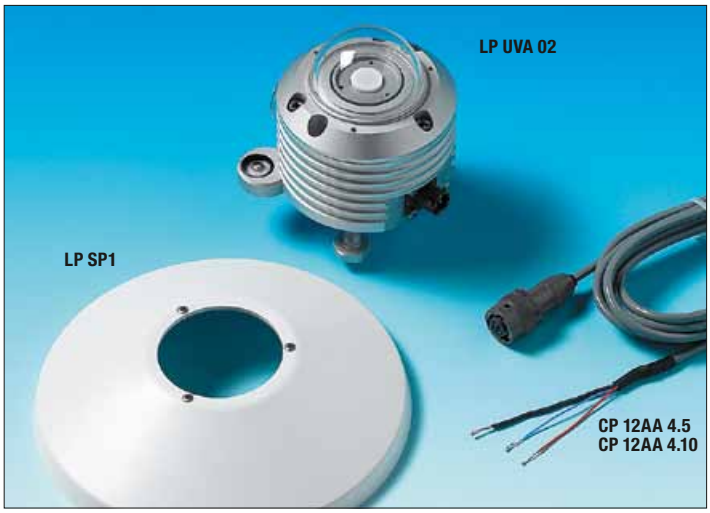


Fig. 2



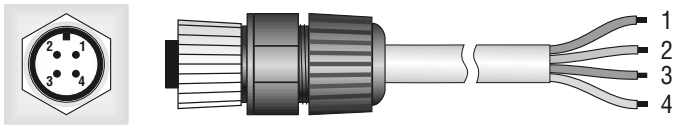
active when their color is **yellow**, while they turn **white** as soon as they loose their power. Read instructions on how to replace them. Silica gel typical lifetime goes from 2 to 6 months depending on the environment where the radiometer works.

Calibration and Measurements:
The radiometer **S** sensitivity (or calibration factor) allows to determine the irradiance by measuring a signal in Volts at the ends of the resistance which short-circuits the terminals of the photodiode ends. The **S** factor is measured in $\mu V/(Wm^{-2})$.

- Once the difference of potential (DDP) has been measured at the ends of the sensor, the E_e irradiance is obtained applying the following formula:

$$E_e = DDP/S$$

WIRING DIAGRAM LP PHOT 02



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP UVA 02

Connector	Function	Color
1	V out (+)	Red
2	V out (-)	Blue
3	Not connected	White
4	Shield (⏚)	Black

LP UVA 02 AC

Connector	Function	Color
1	Positivo (+), +Vdc	Red
2	Negativo (-), -Vdc	Blue
3	Not connected	White
4	Shield (⏚)	Black

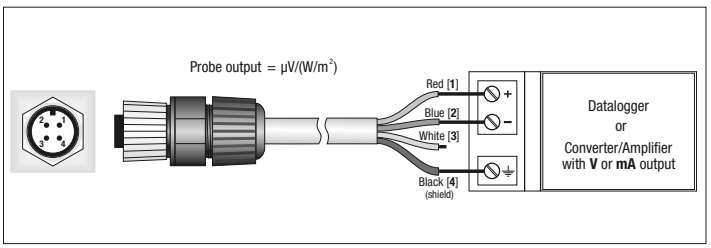
LP UVA 02 AV

Connector	Function	Color
1	(+) Vout	Red
2	(-) Vout e (-) Vdc	Blue
3	(+) Vdc	White
4	Shield (⏚)	Black

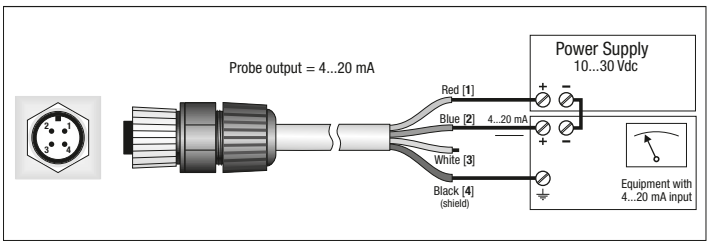
Maintenance:
It is important to keep the outer glass dome clean to grant measurement best accuracy. Consequently, the more the dome will be kept clean, the more measurements will be accurate. Washing can be made using water and standard papers for lens, or, in some cases, using pure ethyl alcohol. After using alcohol, clean again the dome with water only.
Because of the high rise/fall in temperature between day and night, some condensation might appear on the radiometer dome. To minimize the condensation growth, the radiometer is provided with a cartridge containing desiccant material: Silica gel. The efficiency of the Silica gel crystals decreases in the course of time while absorbing humidity. Silica gel crystals are

CONNECTION DIAGRAMS

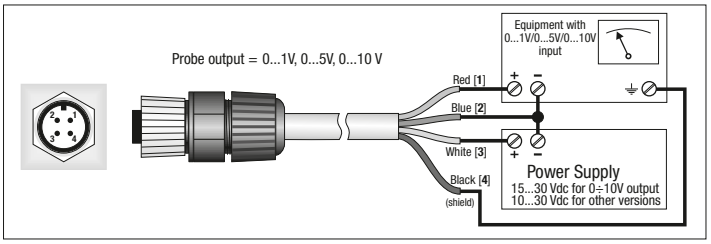
LP UVA 02



LP UVA 02 AC



LP UVA 02 AV



Where:
E_e: is the Irradiance expressed in W/m²,
DDP: is the difference of potential expressed in μV and measured by the multimeter,
S: is the calibration factor in μV/(W/m²) shown on the radiometer label (and mentioned in the calibration report) .

Each radiometer is individually calibrated at the factory and is distinguished by its calibrator factor.
The calibration is carried out following procedure N° DHLF-E-59. This procedure is used in the SIT calibration center N° 124 for the calibration of UVA radiometer.
The calibration was performed by reference to Delta Ohm srl primary standard with monochromatic light at 365 nm obtained separating the emission line of a Xe-Hg lamp with an inferential filter. To get best performances from your LP UVA 02 it is strongly recommended that the calibration be checked annually.
N.B. 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 Research 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 : http://www.nist.gov/jers)

Technical Specifications:

Typical sensitivity:	150 ÷ 350μV/(W/m²)
Response time:	<0.5 sec (95%)
Impedance:	5 ÷ 7.5 KΩ
Measuring range:	0-200 W/m²
Viewing angle:	2π sr
Spectral range:	327 nm ÷ 384 nm (1/2) 312 nm ÷ 393 nm (1/10) 305 nm ÷ 400 nm (1/100)
Operating temperature:	-40 °C ÷ 80 °C
Cosine response:	< 8 % (between 0° and 80°)
Long-term non-stability: (1 year)	<|±3| %
Non-linearity:	<1 %
Temperature response:	< 0.1%/°C
Dimensions:	figure 2
Weight:	0.90 Kg

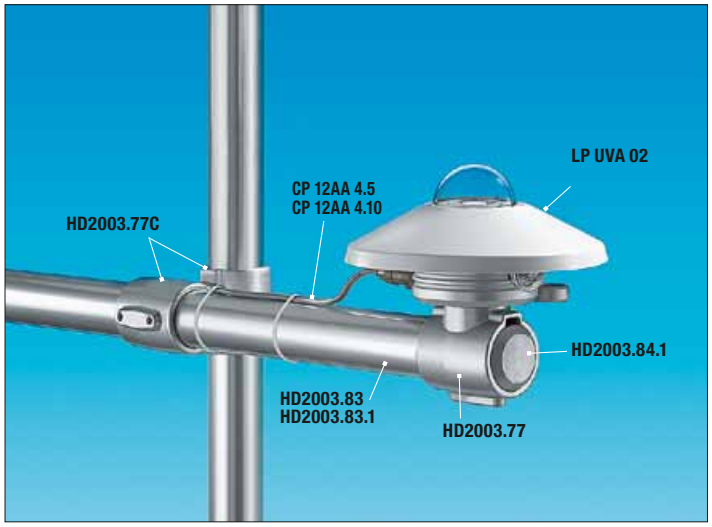
ORDERING CODES

LP UVA 02: Radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), complete with LP SP1 protection, silica gel cartridge, 2 spare sachets with silica gel crystals, bubble level, flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP UVA 02AC: Amplified radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), **4÷20mA output (0…150W/m²)**, integrated transmitter amplifier, **power supply 10…30Vdc**. Complete with flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP UVA 02AV: Amplified radiometric probe for the outdoor measurement of UVA irradiance (315…400nm), **0÷1Vdc, 0÷5Vdc, 0÷10Vdc output (0…150W/m²)**, integrated transmitter amplifier, **power supply 10…30Vdc**. **(15..30Vdc for 0…10Vdc output).** Complete with flying M12 4-pole connector and Calibration Report. **Cable has to be ordered separately.**

LP S1: Mounting kit for LP UVA 02: bracket for attachment to a mast, including fasteners and leveling screws.



LP UVA 02

LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).

LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.

LP G: Packet with 5 silica gel spare cartridge.

CPM12 AA4.5: 4-pole UV resistant cable L=5 m. For the instruments LP UVA 02, LP UVA 02AC, LP UVA 02AV.

CPM12 AA4.10: 4-pole UV resistant cable L=10 m. For the instruments LP UVA 02, LP UVA 02AC, LP UVA 02AV.

Configurable amplifiers and converters

HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD 778 TCAL: Power generator in the range –60mv…+60mV, **regulated by PC through RS232C serial port. DeltaLog-7** software to configure type K, J, T and N thermocouple transmitters and HD978TR3, HD978TR4, HD978TR5 and HD974TR6 converters.

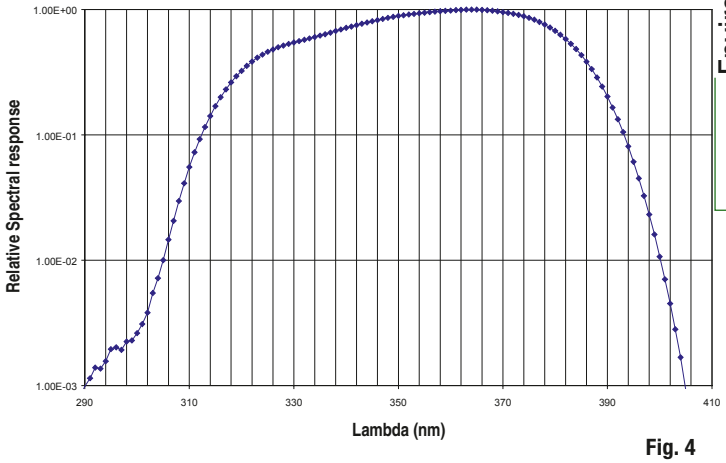


Fig. 4

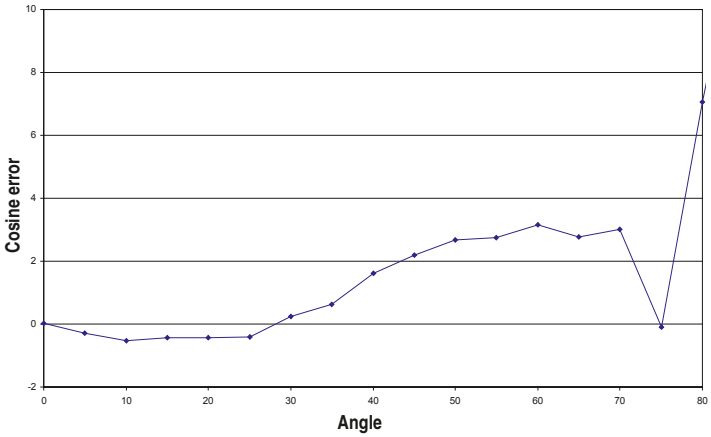


Fig. 5

LP UVB 02
RADIOMETRIC PROBE FOR ENVIRONMENTAL USE

The LP UVB 02 radiometer measures the global irradiance in the UVB spectral region on a flat surface (Watt/m^2). In particular, the instrument's spectral sensitivity is centered at 305nm with a 5nm band width (FWHM). The global irradiance is the sum of the direct solar irradiance and the sky diffuse irradiance on a surface parallel to the ground. In contrast to the visible spectrum where the direct component prevails over the diffuse component, in the UVB spectral region light is strongly diffused by atmosphere and thus the two components are equivalent. Therefore it is of primary importance for the instrument to be capable of measure both components accurately.

The LP UVB 02 probe is typically used in the following sectors:

- Monitoring the ozone layer. Indeed, the radiation around 295nm–315nm is strongly absorbed by ozone located in the stratosphere, therefore each small variation of the ozone layer corresponds to an increase or decrease of the radiation reaching the ground.
- Effects of UVB radiation (the most harmful to human health) on living beings.
- UVB radiation measurement in work spaces.

The LP UVB 02 radiometer needs power to function. Power is required to amplify the weak signal generated by the photodiode. Indeed, the radiometer is a current/voltage amplifier (transimpedance amplifier). This choice measures sun-produced UVB irradiance. Indeed, the need to use sophisticated filters (partially attenuating the signal concerned) and the relatively weak sun-produced irradiation in this spectral area, in the best case, make the photodiode-generated current in the order of hundreds of pAmpere. So it is not possible to use cable meters or tens of meters long as the noise might be greater than the signal itself. Therefore the signal must be amplified.

LP UVB 02 is robust and was manufactured to operate for long periods without maintenance (if powered correctly). This characteristic makes it suitable for location in meteorological stations.

A platinum-resistance thermometer (Pt100) is inserted inside the LP UVB 02 in order to control its temperature. Internal temperature must remain within its functioning range, otherwise measurements could be affected by higher systematic errors than those asserted in the manual. Exposure to temperature higher than +60°C can alter the interferential-filters spectral characteristics.

WORKING PRINCIPLE

The LP UVB 02 radiometer is based on an innovative solid state photodiode, the spectral response of which was adapted to that desired by using special interferential filters. In particular, the used photodiode and filters have exceptional stability characteristics, both for temperature and through time. This allowed manufacturing of an instrument that does not need heating, thus reducing energy consumption.

Particular attention has been given to filter design so as to make the instrument completely blind to wavelengths outside the concerned pass-band. The solar energy within the 302nm–308nm spectral band is only 0.01% of the total energy from the sun reaching Earth's surface. The relevant spectral response curve is shown in Fig. 1A (in linear scale) and Fig. 1B (in logarithmic scale).

The LP UVB 02 is provided with a 50mm-external-diameter dome in order to supply a suitable protection of the sensor to the atmospheric agents. Quartz was chosen due to its optimum transmission in the UV range.

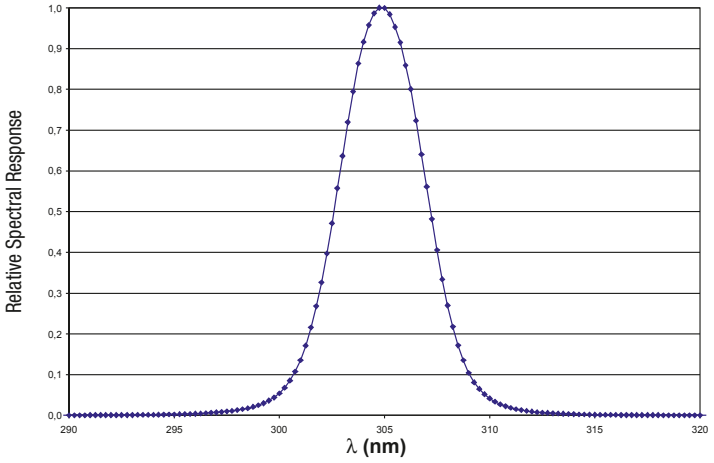


Fig. 1A

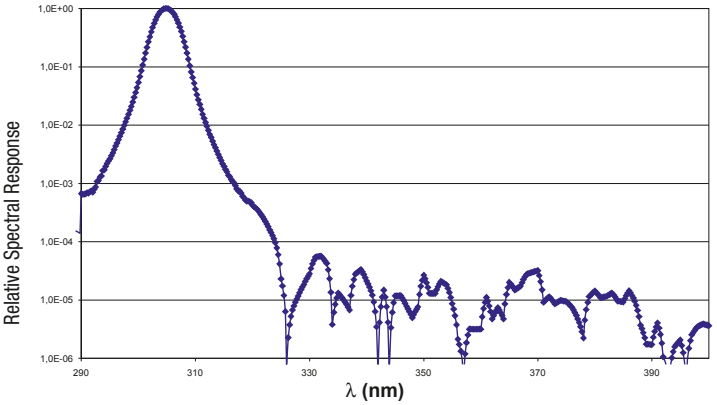


Fig. 1B

The response in accordance with the cosine law has been obtained thanks to the particular shape of the diffuser and of the housing. The departure between a theoretical response and the measured one is shown in the Fig. 2.

The excellent relation between the response of the LP-UVB-02 and the cosine law allows to use the instrument also when the sun has a very low raising (the UVB diffuse radiation increases as the sun is leaving the zenith, therefore the error on the direct radiation, owing to the imperfect response according to the cosine law, becomes negligible referred to the measurement of the global radiation).

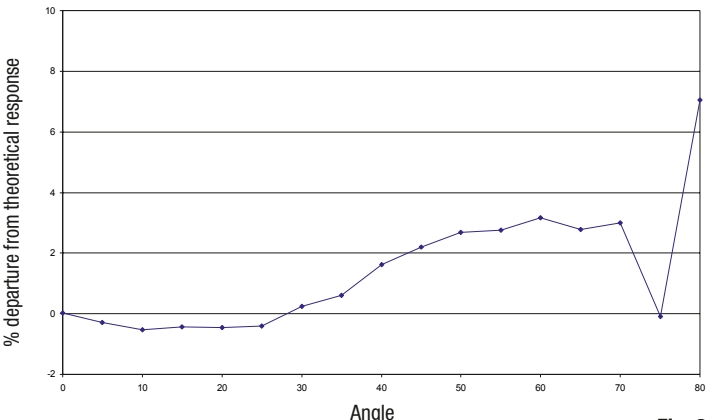


Fig. 2

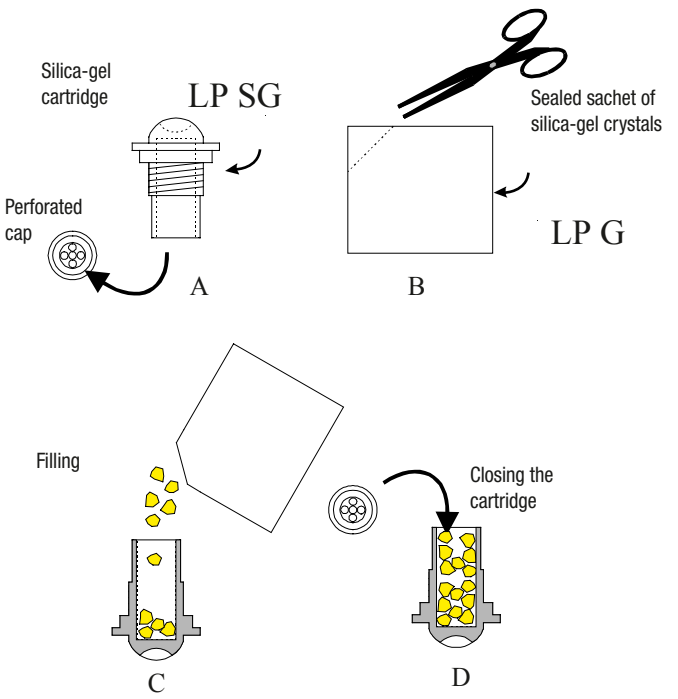


Fig. 3

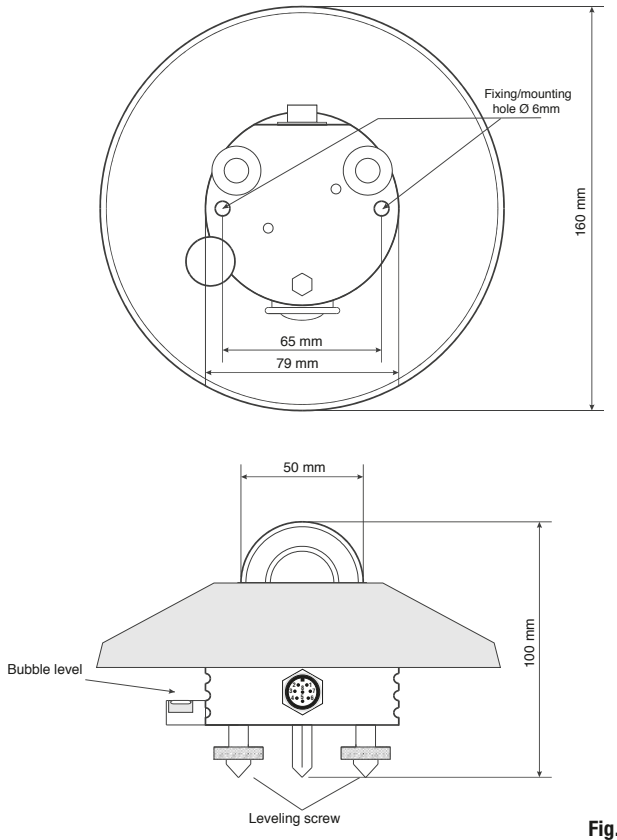


Fig. 4

Installation and Mounting of the Radiometer for the Measurement of the Global Radiation
Before installing the radiometer refill the cartridge containing the silica-gel crystals. Silica gel absorbs humidity in the dome chamber; in case of particular climatic conditions this humidity can cause condensation on the internal side of the dome and then modify the measurement. Do not touch the silica gel crystals with your hands and do not wet them while refilling the cartridge. Carry out the following instructions in an environment as dry as possible:

1- loosen the three screws that fix the white shade disk
2- unscrew the silica gel cartridge using a coin
3- remove the cartridge perforated cap
4- open the sachet containing the silica gel (supplied with the radiometer)
5- fill the cartridge with the silica-gel crystals
6- close the cartridge with its own cap, paying attention that the sealing O-ring be properly positioned and undamaged
7- screw the cartridge to the radiometer body using a coin
8- **check that the cartridge is screwed tightly** (if not, the silica-gel life will be reduced)
9- position the shade disk and tighten it with the screws
10- the radiometer is ready for use

Fig. 3 shows the operations necessary to fill the cartridge with the silica-gel crystals.

- The LP UVB 02 has to be mounted in a readily accessible location to be able to provide for a periodic cleaning of the external dome and for the maintenance. Check also that no building, construction, tree or obstruction exceeds horizontal plane where the radiometer lays. If this is not possible, select a site where obstructions do not exceed 5 degrees of elevation, in the path followed by the sun, between earliest sunrise and latest sunset.
- The radiometer has to be located far from any kind of obstruction, which might throw the solar radiation (or its shade) on the radiometer.
- The LP UVB 02 radiometer is provided with a spirit level for carrying an accurate horizontal leveling. The adjustment is made by means of two leveling screws that allow to adjust the radiometer inclination. Use the two 6mm-diameter and 65mm-interaxial-distance holes to mount the instrument on a plane. Remove the shade disk to access the holes and reposition it after mounting (see Fig. 4).
- The LP S1 mounting kit (Fig. 5), supplied on demand as an accessory, allows an easy mounting of the radiometer on a mast. The mast maximum diameter shall not exceed 50 mm. The operator shall take care that the mast height does not exceed the radiometer plane to avoid measurement errors caused by any reflection or shadow of the mast itself. To fix the radiometer to the mounting bracket, remove the shade disk loosening the three screws, fix the radiometer and mount the white shade disk again.
- It's suggested to thermally isolate the radiometer from its mounting brackets and to check that the electrical contact with the ground be done properly.

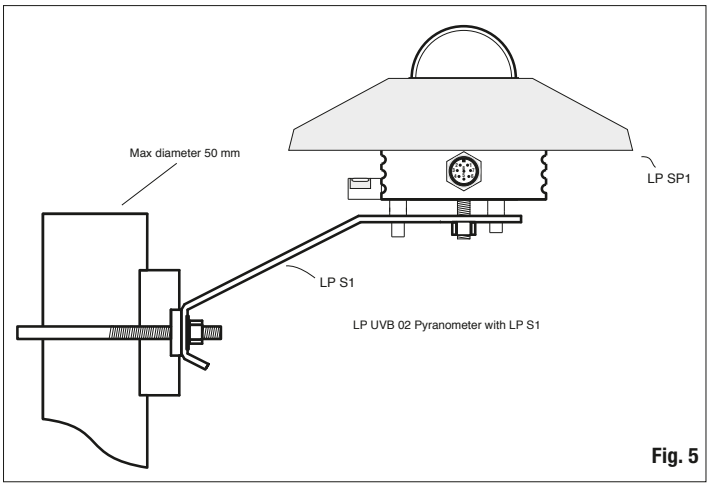


Fig. 5

Electrical Connections and Requirements for Electronic Readout Devices

The connections on the output connector are indicated below:

Pin8: V+, positive supply voltage for LP UVB 02 internal electronics. 7Vdc < V+ <30Vdc
Pin6: VoutTemp+, output signal for temperature measurement. 0V (-40°C) < Vout Temp+ < 1V (+60°C)
Pin2: Vout+, output signal for irradiance measurement in the UVB band. 0V < VoutUV+ < 4V.
Pin1: Ground of the two output signals, VoutTemp+, VoutUV+
Pin7: Housing.
Pin5: Power supply grounding.

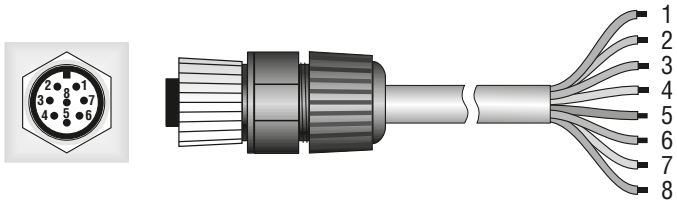
- The LP UVB 02 has to be connected either to a voltmeter or to a data acquisition system with input impedance greater than 10KΩ. Typically, the radiometer output signal, when exposed to the sun, does not exceed 1 volt. In order to better exploit the radiometer features, the readout instrument should have 0.1mV resolution.

N.B. The input load resistance of the data acquisition system must be greater than 10KΩ. The connection scheme is shown in figure 6.

The cable supplied with the UV-resistant output connector has 5 wires plus the braid (screen); the colour code is shown in fig. 6.

Maintenance
It is important to keep the outer domes clean to grant the best measurement accuracy. Consequently, cleaning the dome more often will give more accurate measurements. Cleaning can be carried out using water and standard papers for lens, or, if not sufficient, using pure ETHYL alcohol. After using alcohol, clean again the dome with water only. Because of the high rise/fall in temperature between day and night, some condensation might appear on the radiometer dome.

WIRING DIAGRAM LP UVB 02



Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

LP UVB 02

Connector	Function	Color
1	Signal GND	Red
2	V out UV (+)	Blue
3	Not connected	
4	Shield	Braid
5	Power GND	Brown
6	Vout Temp. (+)	White
7	Housing	Black
8	Power 7-30Vdc	Green

In this case the performed reading is highly overestimated. To minimize the condensation growth, the radiometer is provided with a cartridge containing desiccant material: Silica gel. The efficiency of the Silica gel crystals decreases in time with humidity absorption. Silica-gel crystals are active when their colour is **yellow**, and they turn **white** when they loose their power. Read the instructions of paragraph **3** on how to replace them. Silica gel typical duration goes from 2 to 6 months depending on the environment where the radiometer works.
We recommend to calibrate the instrument annually. Calibration can be performed by DeltaOhm Metrological Laboratories, or by connecting it to an identical instrument calibrated with reference to a Primary Metrological Institute having a known calibration factor.

Calibration and Measurements
The radiometer **S** sensitivity (or calibration factor) allows to determine the irradiance by measuring a signal in Volts generated by the internal amplification circuit. It is possible that an offset be present on the output signal of some fractions of millivolts (0.3-0.4mV), in which case it is also recommended that the data be acquired at night and subtract the night-measurement offset from the performed measurements. Once the difference of potential (VoutUV+) has been measured at the ends of the resistance, the E_e irradiance is obtained applying the following formula:

$$E_e = [VoutUV+] / S$$

where:

E_e: is the irradiance expressed in W/m^2,
VoutUV+: is the difference of potential measured by the multimeter and expressed in V,
S: is the calibration factor in V/(W/m^2), shown on the radiometer label (and mentioned on the calibration report).

In the presence of a possible offset of OF Volts, the previous calculations must be modified as follows:

$$E_e = ([VoutUV+] - OF)/S$$

Similarly, to know the instrument internal temperature once the "VoutTemp+" voltage in volts is known, we get:

$$T=100 \cdot [VoutTemp+] - 40 \ °C$$

Supposing a voltage VoutTemp+=0.532V is read, the previous formula gives the radiometer internal temperature:

$$T=(100 \bullet 0.532) - 40 \ °C = 13.2 \ °C$$

Radiometers are individually calibrated at factory. Calibration is carried out by measuring the radiometer-produced output signal when hit by a parallel and homogeneous light-beam of 304nm monochromatic light.
Note: currently no international calibration standards for this type of radiometer exist; therefore, the calibration coefficient only makes sense if the procedure followed to obtain it has been specified. Therefore the user has to consider that the same radiometer calibrated with different procedures can have different sensitivity factors, as explained in the article "*Source of Error in UV Radiation Measurements*", T. C. Larason, C. L. Cromer issued in the "*Journal of Research of the National Institute of Standards and Technology*" Vol. 106, Num. 4, 2001. (The article is available free of charge on the NIST web site at the following address: http://www.nist.gov/jers)

Technical characteristics
UV MEASUREMENT

Typical sensitivity:	≈5V/(W/m^2)
Response time:	<0.5 sec (95%)
Min. load impedance:	10 KΩ
Measurement range:	0-8 W/m^2
Viewing range:	2π sr
Spectral range:	305nm Peak
	302.5nm ÷ 307.5 nm (1/2)
	304nm ÷ 309 nm (1/10)
	297.5nm ÷ 311.75nm (1/100)
	292.5nm ÷ 316.255nm (1/1000)
Working temperature:	-40 °C ÷ +60 °C
Response according to the cosine law:	< 8 % (between 0° and 80°)
Long-term instability(1 year):	<|±3| %
Non linearity:	<1 %
Response according to temperature:	< 0.01%/°C

TEMPERATURE MEASUREMENT

Measurement range	-40°C +60°C
Accuracy	±0.2°C
Min. load impedance:	10 KΩ

POWER SUPPLY

Vdc+	7÷30 V DC
Typical consumption:	3 mA
Dimensions:	Fig. 4
Weight:	0.90 Kg.

ORDERING CODES:
LP UVB 02: Radiometer for outdoor measurements, complete with LP SP1 protection, 2 spare sachets with silica gel crystals, bubble level, flying M12 8-pole connector and Calibration Report. **Cable has to be ordered separately.**
LP S1: Mounting kit for LP UVB 02: bracket for attachment to a mast, including fasteners and leveling screws
LP SP1: UV resistant plastic shade disk (BASF LURAN S777K).
LP SG: Desiccant sachet with silica gel crystals, complete with inner O-ring and cap.
LP G: Packet with 5 silica gel spare cartridge.
CPM12 AA2.5: 8-pole UV resistant cable L=5 m.
CPM12 AA2.10: 8-pole UV resistant cable L=10 m.

LP 471 PYRA 02.5
LP 471 PYRA 02.10
LP 471 PYRA 03.5
LP 471 PYRA 03.10
LP 471 Silicon-PYRA

LP 471 PYRA 02.5 - LP 471 PYRA 02.10 - LP 471 PYRA 03.5 LP 471 PYRA 03.10 - LP 471 PYRA 10.5 - LP 471 PYRA 10.10 LP 471 SYLICON-PYRA PROBES WITH CABLE AND CONNECTOR WITH SICRAM MODULE

The probes LP 471 PYRA ... consist of a pyranometer LP PYRA 03, LP PYRA 02 or an LP PYRA 10 and a SICRAM module with a cable 5 or 10 meters long to connect the pyranometer to the instruments DO 9847, HD2102.2, HD2102.1 and HD2302.0 and have a direct reading in W/m^2 on the display of the indicator instrument.
The Pyranometer LP PYRA 03 is a Second Class, the LP PYRA 02 is a First Class and the LP PYRA 10 is Secondary Standard, according to ISO 9060. The instruments are supplied with the ISO9001 Report of calibration and the output 4-pole M12 connector. The specifications of the pyranometers LP PYRA 03 and LP PYRA 02 are available on page 13. The specifications of the pyranometer LP PYRA 10 02 are available on page 20.

The SICRAM module that makes the LP 471 PYRA... shows the same serial number of the pyranometer and is set by taking into account the sensitivity shown on the calibration report of the pyranometer, therefore it is not possible to use the same module to perform measurements with different pyranometer.

ORDERING CODES

LP 471 Pyra 02.5: The probe is made of a first class pyranometer LP PYRA 02 and a 5 meters cable equipped with SICRAM module.
The ISO9001 report of calibration of the pyranometer connected to the cable with SICRAM module, 2 silica gel cartridges and spirit level are supplied.
The probe so composed can be connected to the following instruments: HD2302.0, HD2102.1, HD2102.2 and DO9847.

LP 471 Pyra 02.10: The probe is made of a first class pyranometer LP PYRA 02 and a 10 meters cable equipped with SICRAM module.
The ISO9001 report of calibration of the pyranometer connected to the cable with SICRAM module is supplied.
The probe so composed can be connected to the following instruments: HD2302.0, HD2102.1, HD2102.2 and DO9847.

LP 471 Pyra 03.5: The probe is made of a second class pyranometer LP PYRA 03 and a 5 meters cable equipped with SICRAM module.
The ISO9001 report of calibration of the pyranometer connected to the cable with SICRAM module is supplied.
The probe so composed can be connected to the following instruments: HD2302.0, HD2102.1, HD2102.2 and DO9847.

LP 471 Pyra 03.10: The probe is made of a second class pyranometer LP PYRA 03 and a 10 meters cable equipped with SICRAM module.
The ISO9001 report of calibration of the pyranometer connected to the cable with SICRAM module, 2 silica gel cartridges and spirit level are supplied.
The probe so composed can be connected to the following instruments: HD2302.0, HD2102.1, HD2102.2 and DO9847.

LP 471 Pyra 10.5: The probe is made of a Secondary Standard pyranometer LP PYRA 10 and a 5 meters cable equipped with SICRAM module.
The ISO9001 report of calibration of the pyranometer connected to the cable with SICRAM module is supplied.
The probe so composed can be connected to the following instruments: HD2302.0, HD2102.1, HD2102.2 and DO9847.

LP 471 Pyra 10.10: The probe is made of a Secondary Standard pyranometer LP PYRA 10 and a 10 meters cable equipped with SICRAM module.
The ISO9001 report of calibration of the pyranometer connected to the cable with SICRAM module, 2 silica gel cartridges and spirit level are supplied.
The probe so composed can be connected to the following instruments: HD2302.0, HD2102.1, HD2102.2 and DO9847.

LP Silicon-PYRA 04: Pyranometer with silicon photodiode with 5m fixed cable and open wires on the cable end.
The probe can be connected the series of converters/amplifiers: HD978TR3 and 978TR5 for the 4-20 mA output.
HD978TR4 and HD978T6 for the 0-10 Vdc output.

LP 471 PYRA 03.5

LP PYRA 02.5
LP PYRA 10.5

LP PHOT 03
LP RAD 03
LP PAR 03
LP UVA 03
LP UVB 03

PHOTOMETRIC AND RADIOMETRIC PROBES WITH OUTPUT SIGNAL IN mV OR NORMALIZED 4÷20mA OR 0÷10Vdc OUTPUT

Photo-radiometric probes with output signal in mV or standard output 4÷20mA or 0÷10Vdc The probes of the series LP…03 **for outdoor use** allow to measure photometric and radiometric quantities such as: illuminance (lux), irradiance (W/m²) in the near ultraviolet spectral region VIS-NIR, UVA, UVB, and the photon flow across the PAR region (400nm...700nm). The probes with mV output do not require any power supply. The output signal is obtained from a resistance that short-circuits the terminal of the photodiode. The ratio of generated photocurrent to incident light power is converted into a Difference of Potential that can be read by a voltmeter. Once the DDP (Difference of Potential) is known, the measured value can be calculated through the calibration factor. All probes are individually calibrated and the calibration factor is also **shown on the probe housing**. The probes with normalized output current 4÷20mA or voltage 0÷10Vdc require external power supply. The probe LP UVB 03 is available only with standard output voltage 0÷5Vdc and requires external power supply.
All probes of the series LP…03 are equipped with diffuser for cosine correction and protection dome.

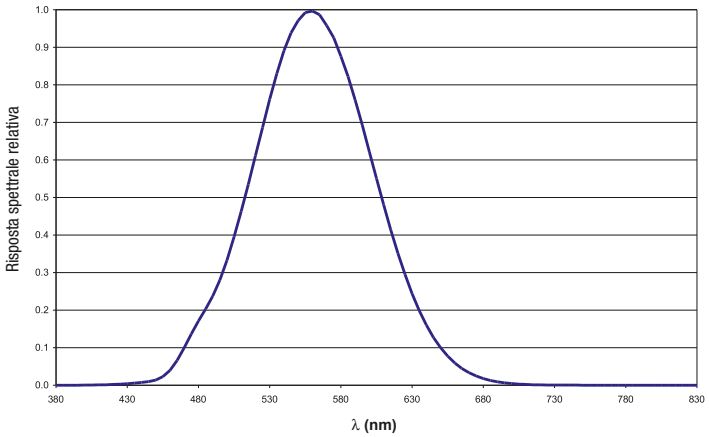
M12 male 4-pole connector.
Cables with female connectors and with 2, 5 or 10m length available on request.
On request female connector cable 2, 5 or 10 m long.

LP PHOT 03
The probe LP PHOT 03 measures illuminance (lux), defined as the ratio between the luminous flux (lumen) passing through a surface and the surface area (m²).
The spectral response curve of a photometric probe is similar to the human eye curve, known as standard photopic curve V(λ). The difference in spectral response between LP PHOT 03 and the standard photopic curve V(λ) is calculated by means of the error f1.
Calibration is carried out by comparison with a reference luxmeter, calibrated by a Primary Metrological Laboratory. The Calibration Procedure complies with the CEI publication No.69 "Methods of characterizing illuminance meters and luminance meters: Performance, characteristics and specifications, 1987".
The photometric measurement probe is designed for **outdoor** readings. CIE photopic filter. Cosine correction filter and K5 glass dome.
The heating option allows you to operate at low temperatures with good results.
Output, according to the chosen configuration, mV or normalized output 4÷20mA or 0÷10Vdc.

TECHNICAL SPECIFICATIONS:

Typical sensitivity:	0.5 ÷ 1.5 mV/(klux)
Spectral range:	V(λ) (see figure)
Calibration uncertainty:	< 4%
f'_1 (agreement with the standard curve V(λ)):	<6%
f_2 (Cosine response)	<3%
f_3 (linearity)	<1%
Measuring range:	0-200 klux
Viewing angle:	2π sr
Operating temperature:	-40°C ÷ +60°C heated version
	-20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version
Version with normalized output 4÷20mA:	4mA = 0 klux, 20mA = 150 klux
Version with normalized output 0÷10Vdc	0V = 0 klux, 10V = 150klux
Power supply:	10…30Vdc for version with normalized output 4÷20mA
	15…30Vdc for version with normalized output 0÷10Vdc

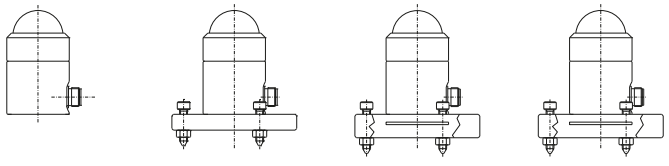
Typical spectral response curve of **LP PHOT 03:**



PURCHASING CODE
LP PHOT 03: Photometric probe for the measurement of illuminance, complete with K5 dome, flying female 4-pole connector, calibration report. **Cable with female connector has to be ordered separately.** Cables: **CPM12 AA 4**…with cable length 2, 5 or 10 meters.

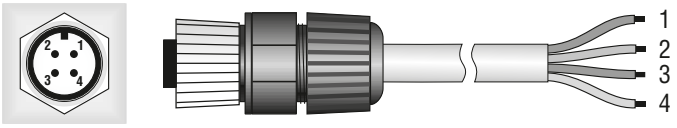
LP PHOT ☐
- **03** = mV per klux
- **03BL** = mV per klux, base with levelling device
- **03BLAC** = mV per klux, base with levelling device output 4÷20 mA
- **03BLAV** = mV per klux, base with levelling device output 0÷10 mA

CABLE:
CPM12 AA4 ☐
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m



LP PHOT 03 **LP PHOT 03BL** **LP PHOT 03BLAC** **LP PHOT 03BLAV**

WIRING DIAGRAM
4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LPPHOT 03, LP PHOT 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

LP PHOT 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) V out and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP PHOT 03BLAC

Connector	Function	Color
1	Positive (+), (+) Vdc	Red
2	Negative (-), (-) Vdc	Blue
3	Not connected	White
4	Shield	Black

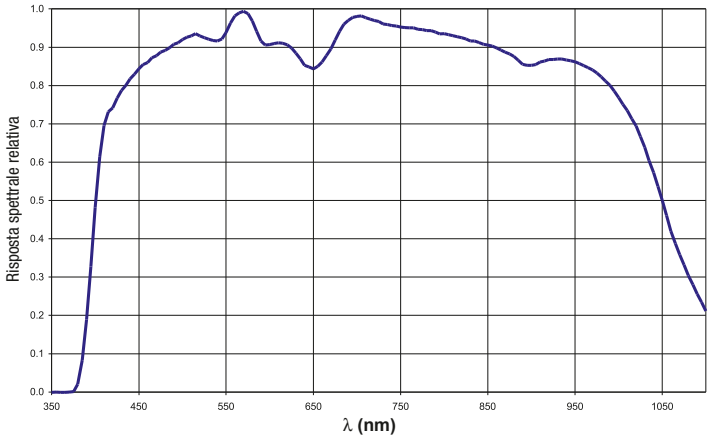
LP RAD 03

LP RAD 03 probe measures irradiance (W/m2) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m2) in the VIS-NIR (400nm-1050nm) spectral range. The probe is designed for **outdoor** readings.
Cosine correction filter and K5 glass dome.
Output, according to the chosen configuration, in µV per µW/cm² or 4÷20mA or 0÷10Vdc normalized output.

Technical specifications

Typical sensitivity:	1÷2.5 µV/(µW/cm2)
Spectral range:	400nm ÷1050nm
Calibration uncertainty:	<5%
f_2 (cosine response):	<3%
f_3 (linearity)	<1%
Operating temperature:	-40°C ÷ +60°C heated version
	-20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version
Version with normalized output 4÷20mA:	4mA = 0 W/m², 20mA = 2000 W/m²
Version with normalized output 0÷10Vdc	0V = 0 W/m², 10V = 2000 W/m²
Output impedance:	0.5 ÷ 1.0 KΩ non-normalized version
Power supply:	10…30Vdc for version with normalized output 4÷20mA
	15…30Vdc for version with normalized output 0÷10Vdc

Typical spectral response curve **LP RAD 03**

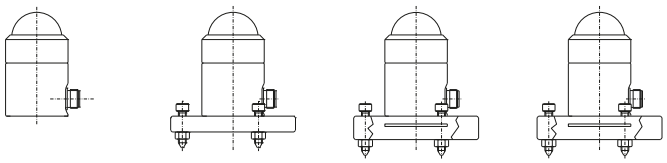


PURCHASING CODE

LP RAD 03: Radiometric probe for the measurement of irradiance, complete with K5 dome, flying 4-pole. Cable with female connector has to be ordered separately Cables: **CPM12 AA 4** with cable length 2, 5 or 10 meters.

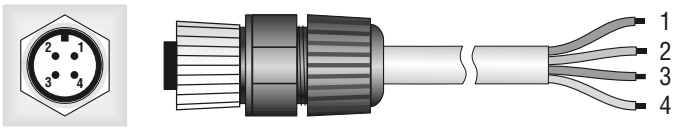
LP RAD ☐
- **03** = µV per µW/cm²
- **03BL** = µV/(µW/cm²), base with levelling device
- **03BLAC** = µV/(µW/cm²), base with levelling device output 4÷20 mA
- **03BLAV** = µV/(µW/cm²), base with levelling device output 0÷10 mA

CABLE:
CPM12 AA 4 ☐
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m



LP RAD 03 **LP RAD 03BL** **LP RAD 03BLAC** **LP RAD 03BLAV**

WIRING DIAGRAM
4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP RAD 03, LP RAD 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

LP RAD 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) V out and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP RAD 03BLAC

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

LP PAR 03

The probe LP PAR 03 measures the ratio between the number of photons that strike a surface in one second, in the 400nm-700nm spectral range and the surface area (m²). This quantity is defined as PAR: Photo-synthetically Active Radiation.
The probe calibration is carried out by using an halogen lamp, with a known spectral irradiance in a specific spectral range.
Temperature slightly affects the probe spectral response.
The probe is designed for **outdoor** readings.
Cosine correction filter and K5 glass dome.
Output, according to the chosen configuration, in µV per µmol $m^{-2}s^{-1}$ or normalized outputs 4÷20mA or 0÷10Vdc.

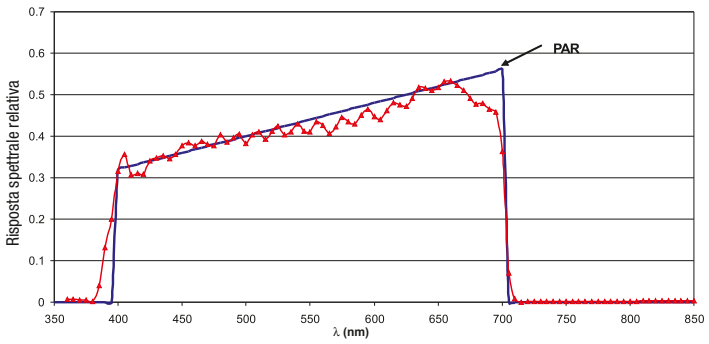
TECHNICAL SPECIFICATIONS

Typical sensitivity:	1÷2.5 µV/(µmol/(m^{-2}s^{-1})
Typical spectral range:	400 nm ÷ 700 nm
Calibration uncertainty:	<5%
f_2 (cosine response):	<3%
f_3 (linearity)	<1%
Operating temperature:	-40°C ÷ +60°C heated version
	-20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version

Version with normalized output 4÷20mA: 4mA = 0 µmol/(m^{-2}s^{-1}), 20mA = 5000 µmol/(m^{-2}s^{-1})
Version with normalized output 0÷10Vdc 0V = µmol/(m^{-2}s^{-1}), 10V = 5000 µmol/(m^{-2}s^{-1})

Power supply: 10…30Vdc for version with normalized output 4÷20mA
15…30Vdc for version with normalized output 0÷10Vdc

Typical spectral response curve **LP PAR 03:**

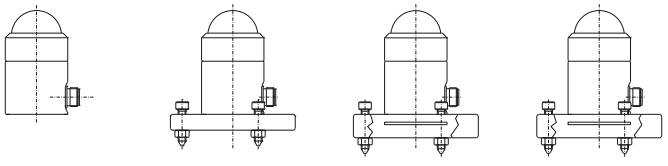


PURCHASING CODE

LP PAR 03 Radiometric probe for the measurement of the Photon flux in the PAR action spectra, complete with K5 dome, flying 4-pole connector. **Cable with female connector has to be ordered separately**. Cables: **CPM12 AA 4** …with cable length 2, 5 or 10 meters.

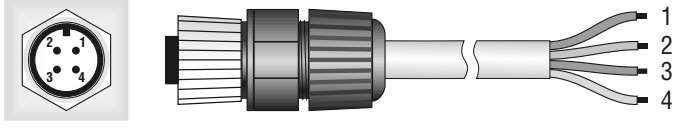
LP PAR ☐
- **03** = µV per µmol m^{-2}s^{-1}
- **03BL** = µV per µmol m^{-2}s^{-1}, base with levelling device
- **03BLAC** = µV per µmol m^{-2}s^{-1}, base with levelling device output 4÷20 mA
- **03BLAV** = µV per µmol m^{-2}s^{-1}, base with levelling device output 0÷10 mA

CABLE:
CPM12 AA4 ☐
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m



LP PAR 03 **LP PAR 03BL** **LP PAR 03BLAC** **LP PAR 03BLAV**

WIRING DIAGRAM
4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP PAR 03, LP PAR 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

LP PAR 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) Vout and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP PAR 03BLAC

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

LP UVA 03

The LP UVA 03 probe measures irradiance (W/m²) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m²) in the UVA (315 nm –400 nm) spectral range. Thanks to a new type of photodiode, LP UVA 03 is blind to visible and infrared light.

Probe calibration is carried out by using a 365 nm line of a Xe-Hg, filtered through a special interferential filter. Measurement is carried out by comparison with the primary standards, assigned to Delta Ohm Metrological Laboratory. The probe is designed for **outdoor** readings.

Cosine correction filter and K5 glass dome.

Output, according to the chosen configuration, in µV per µW/cm² or 4÷20mA or 0÷10Vdc normalized output.

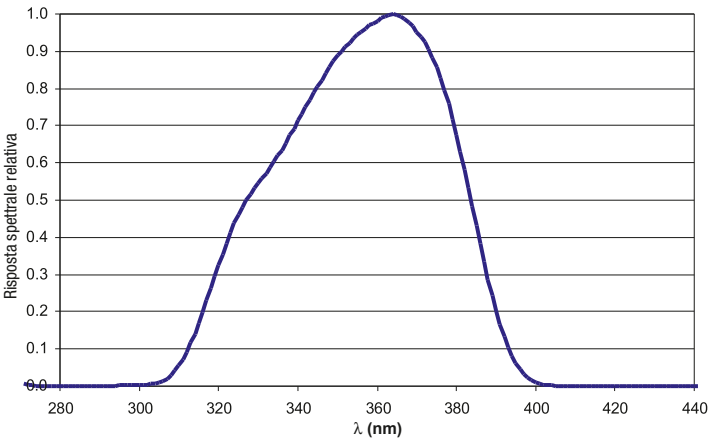
TECHNICAL SPECIFICATIONS

Typical sensitivity:	70÷200 µV/(W/cm^2)
Measuring range:	327÷384nm (1/2)
	312÷393nm (1/10)
	305÷400nm (1/100)
	Peak: 365nm
Calibration uncertainty:	<6%
f_2 (cosine response):	<6%
f_3 (linearity)	<1%
Operating temperature:	-40°C ÷ +60°C heated version
	-20°C ÷ +60°C standard version
Impedance:	0.5 ÷ 1.0 KΩ non-normalized version

Version with normalized output 4÷20mA: 4mA = 0 W/m² 20mA = 200W/m²
Version with standard output 0÷10Vdc : 0V = 0 W/m10V = 200W/m²

Power supply: 10…30Vdc for version with normalized output 4÷20mA
15…30Vdc for version with normalized output 0÷10Vdc

Typical spectral response curve **LP UVA 03:**



PURCHASING CODE

LP UVA 03: Radiometric probe for the measurement of the UVA irradiance, complete with with K5 dome, flying 4-pole connector. **Cable with female connector has to be ordered separately**. Cables: **CPM12 AA** …with cable length 2, 5 or 10 meters.

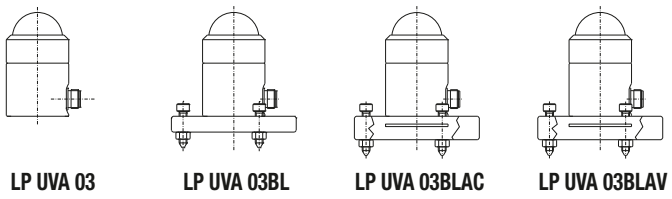
LP UVA ☐

- **03** = μV per μW/cm²
- **03BL** = μV per μW/cm², base with levelling device
- **03BLAC** = μV per μW/cm², base with levelling device output 4÷20 mA
- **03BLAV** = μV per μW/cm², base with levelling device output 0÷10 mA

CABLE:

CPM12 AA4 ☐

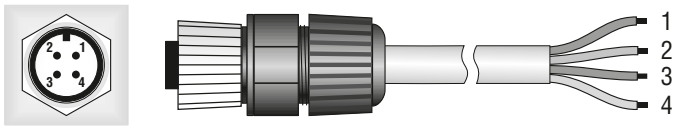
- **2** = length 2m
- **5** = length 5m
- **10** = length 10m



LP UVA 03 **LP UVA 03BL** **LP UVA 03BLAC** **LP UVA 03BLAV**

WIRING DIAGRAM

4-pole wire CPM12AA4…



Fixed 4-pole plug M12 **Flying 4-pole M12 socket**

LP UVA 03, LP UVA 03BL

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

LP UVA 03BLAV

Connector	Function	Color
1	(+) V out	Red
2	(-) Vout and (-) Vdc	Blue
3	(+) Vdc	White
4	Shield	Black

LP UVA 03BLAC

Connector	Function	Color
1	Positive (+)	Red
2	Negative (-)	Blue
3	Not connected	White
4	Shield	Black

LP UVB 03BLAVR:

The LP UVB 03BLAVR probe measures global irradiance (W/m²) defined as the ratio between the radiant flux (W) passing through a surface and the surface area (m²) in the UVB (280 nm ÷315 nm) spectral region. In particular, the spectral sensitivity is focused at 365nm, with a bandwidth (FWHM) of 5nm.

The global irradiance is the result of the sum of direct solar irradiance and of diffused irradiance

incident on a planar surface. In the UVB spectral region, unlike in the visible portion where the direct component prevails over the direct component, the light is strongly diffused by the atmosphere and thus the two components are equivalent, therefore is very important that the instrument is capable of measuring accurately both the components.

The probe is designed for **outdoor** readings.

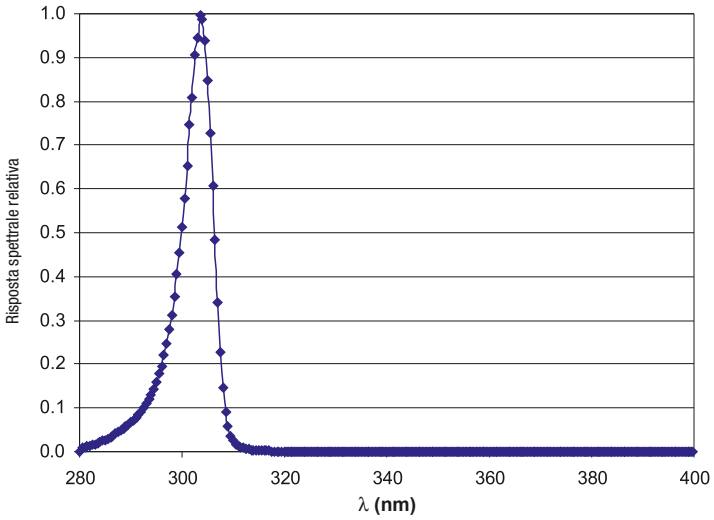
Cosine correction filter and Quartz dome.

Standard output 0÷5Vdc.

TECHNICAL SPECIFICATIONS

Typical sensitivity:	≈6V/(W/m²)
Typical spectral range:	301nm ÷ 306nm (1/2) 295 ÷ 308.5nm (1/10) 290 ÷ 311.5nm (1/100) Peak at 304nm
Calibration uncertainty:	<6%
f_2 (cosine response):	<6%
f_3 (linearity)	<1%

Typical spectral response curve **LP 03BLAV**



PURCHASING CODE

LP UVB 03BLAVR: Radiometric probe for the measurement of the UVB irradiance, complete with Quartz dome, flying 8-pole connector, calibration report. Cable with female connector has to be ordered separately. Cables: **CPM12 AA8** …, with cable lengths 2, 5 or 10 meters.

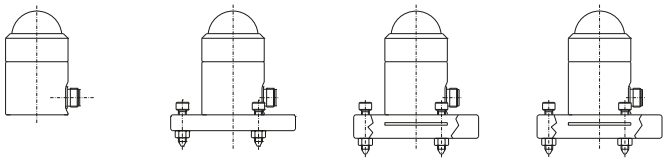
LP UVB ☐

- **03BLAVR** = 0÷5 V, complete with levelling device and heater

CABLE:

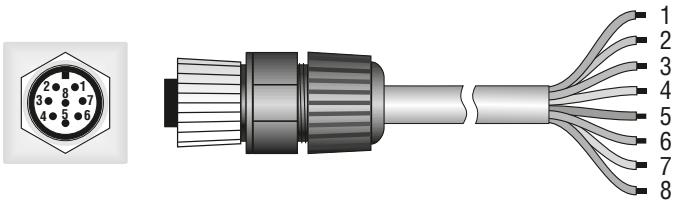
CPM12 AA8 ☐

- **2** = length 2m
- **5** = length 5m
- **10** = length 10m



LP UVB 03 **LP UVB 03BL** **LP UVB 03BLAC** **LP UVB 03BLAV**

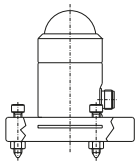
WIRING DIAGRAM
8-pole wire CPM12AA8…



Fixed 8-pole plug M12 **Flying 8-pole M12 socket**

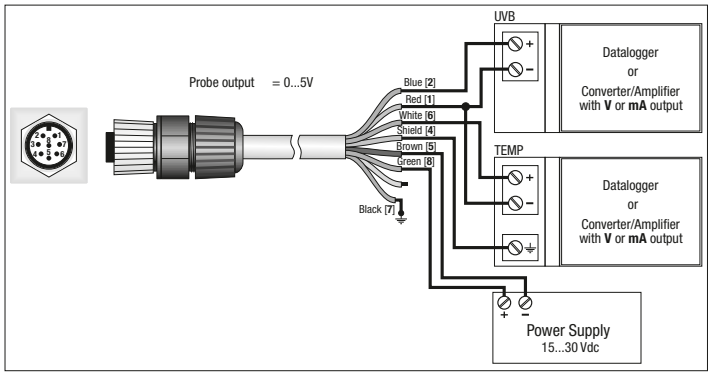
LP UVB 03BLAVR, LP UVB 03BLAVR

Connector	Function	Color
1	Signal GND	Red
2	V out UV (+)	Blue
3	Not connected	
4	Shield	Braid
5	Power GND	Brown
6	V out Temp. (+)	White
7	Housing	Black
8	Power 7-30Vdc	Green



LP UVB 03BLAV

LP UVB 03BLAV CONNECTION DIAGRAMS



ACCESSORIES

CPM12 AA8.2: 8-pole cable. Length 2m. 8-pole M12 connector on one end, open wires on the other side.

CPM12 AA8.5: 8-pole cable. Length 5m. 8-pole M12 connector on one end, open wires on the other side.

CPM12 AA8.10: 8-pole cable. Length 10m. 8-pole M12 connector on one end, open wires on the other side.

Configurable amplifiers and converters

HD978TR3: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR4: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Two DIN module (35mm) for rail attachment. Minimum measuring range 2mV. **Configurable with HD 778 TCAL.**

HD978TR5: Configurable signal converter amplifier with 4÷20mA (20÷4mA) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD978TR6: Configurable signal converter amplifier with 0÷10 (10÷0Vdc) output. Input measuring range –10..+60mV. **Default setting 0÷20mV.** Minimum measuring range 2mV. **Configurable with HD 778 TCAL. For wall mounting.**

HD 778 TCAL: Power generator in the range –60mv…+60mV, **regulated by PC through RS232C serial port. DeltaLog-7** software to configure type K, J, T and N thermocouple transmitters and HD978TR3, HD978TR4, HD978TR5 and HD974TR6 converters.

LP RAD 03 BLAC

LP RAD 03 BL

LP RAD 03