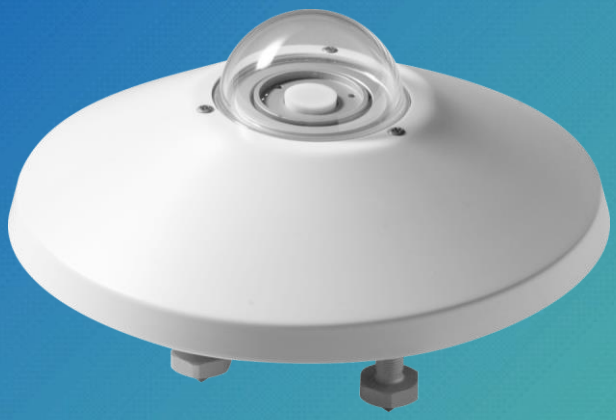
OPERATING MANUAL

LPUVI02

UV Index radiometer



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V2.0

senseca

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1 Introduction

The **LPUVI02** radiometer measures the global effective irradiance on a flat surface according to the requirements of the WMO for the measurement of UV index. The global irradiance is the sum of direct sun irradiance and diffuse irradiance. In the ultraviolet spectral region, unlike what occurs in the portion of visible light, where the direct component is prevalent on the diffuse component, the light is strongly scattered by the atmosphere, and therefore the two components are equivalent; it is therefore of primary importance that the radiometer is able to accurately measure both components.

The radiometer is available in the following versions:

	Measuring range		**Output**		
Model	**0…16 UV Index**	**0…20 UV Index**	**0…1 V**	**0…5 V**	**0…10 V**
LPUVI02AV	√				√
LPUVI02AV1	√		√		
LPUVI02AV5	√			√	
LPUVI02.1AV		√			√
LPUVI02.1AV1		√	√		
LPUVI02.1AV5		√		√	

The LPUVI02**.1**… versions are suitable for the measurement of UV in equatorial areas and high mountains, where the UV index can exceeds 11 for a significant time.

The radiometer is manufactured to operate for long periods without maintenance (if powered correctly). This characteristic makes it suitable for use in remote meteorological stations.

UV INDEX EXPOSURE LIMITS

The UV index is a dimensionless value calculated from the total effective irradiance E_{eff} (expressed in W/m^2) in accordance with WMO requirement:

$$UV\_index = E_{eff} \times 40$$

The following table shows the potential damage that the solar ultraviolet radiation can cause to skin and eyes.

UV index	**Exposure**	**Prescriptions**
1, 2	Low	No protection needed
3…5	Moderate	Some protection required
6, 7	High	Full protection required
8…10	Very high	Extra protection required
> 10	Extreme	Stay inside

2 Technical specifications

Measuring range	0…16 UV Index (**LPUVI02AV…**) 0…20 UV Index (**LPUVI02.1AV…**)
Viewing angle	2π sr
Spectral range	According to UV weighting curve ISO/CIE 17166:2019
Spectral error	<|±20| %
Response time	<0.5 s (95%)
Zero offset (in darkness)	<|±1| mV
Output type	0…1 V, 0…5 V or 0…10 V depending on model
Output impedance	< 1kΩ
Power supply	8…30 Vdc (models with 0…1 V and 0…5 V output) 15…30 Vdc (models with 0…10 V output)
Operating temperature	-40…+80 °C
Directional response (cosine law)	< 5 % (up to 70°) < 8 % (70…80°)
Long term instability (1 year)	<|±3| %
Non linearity	<|±1| %
Temperature response	< 0.1%/°C
Weight	900 g approx.
Protection degree	IP 67

3 Measuring principle

LPUVI02 is based on a solid state sensor, whose spectral response has been adapted to the UV weighting curve (CIE, Erythema action curve). The following figure shows the comparison between the spectral response of LPUVI02 and the UV action curve.

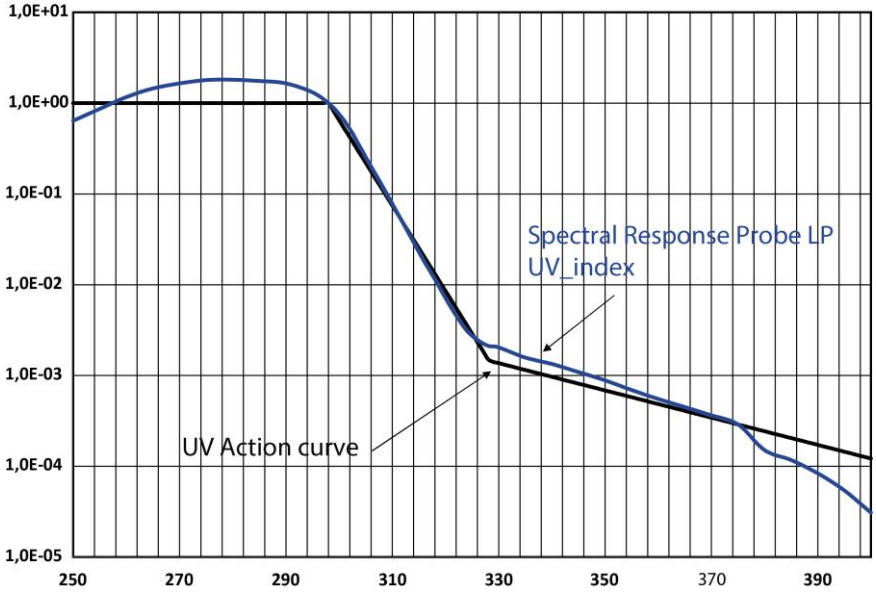


Fig. 3.1: spectral response

The radiometer is equipped with a quartz dome in order to ensure adequate sensor protection against weather agents.

The response according to the cosine law has been obtained by using a material with excellent ultraviolet diffusion and transmission properties. The deviation between the theoretical and the measured response is shown in the following figure.

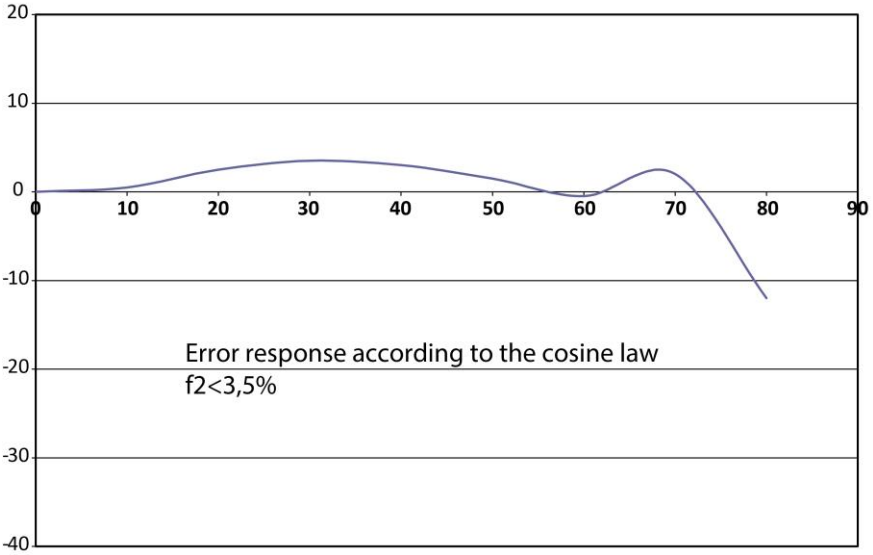


Fig. 3.2: directional error

The excellent accordance between the LPUVI02 response and cosine response (error f_2<3.5%) allows using the sensor even when the sun elevation is low (the diffuse component of solar ultraviolet light increases as the sun moves away from the zenith, so the error on direct component due to imperfect response according to the cosine law, becomes negligible on the measurement of global radiation).

4 Installation

Before installing the radiometer, refill the cartridge containing silica-gel crystals. Silica gel absorbs humidity in the dome chamber and prevents, in particular climatic conditions, condensation 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 drier 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. 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.
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.

The figure below shows the operations necessary to fill the cartridge with the silica gel crystals.

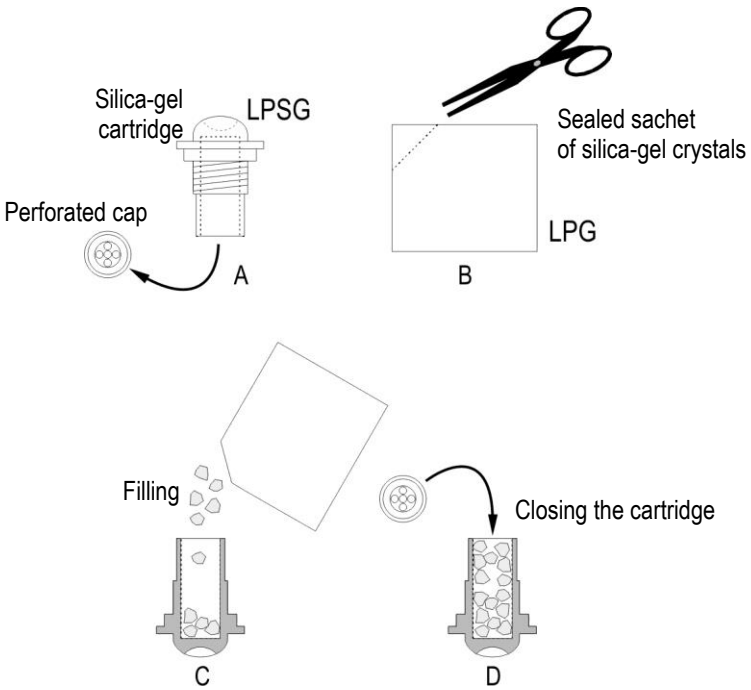


Fig. 4.1: filling the silica-gel cartridge

- The radiometer must be mounted in an easy-to-reach location in order to clean the dome regularly and carry out maintenance. At the same time, make sure that no buildings, constructions, trees or obstructions exceed the horizontal plane where the radiometer lies. If this is not possible, select a site where obstructions in the path of the sun from sunrise to sunset do not exceed 5 degrees of elevation.
- The radiometer must be located far from any kind of obstruction, which might reflect sunlight (or sun shadow) onto the radiometer itself.
- For fixing, use the holes on the radiometer body (remove the shade disk to access the holes and reposition it after mounting) or the suitable accessories (see the figures below). In order to allow an accurate horizontal positioning, the radiometer is equipped with a levelling device: the adjustment is made by means of the two levelling screws that allow adjusting the radiometer inclination. The mast height does not exceed the radiometer plane to avoid measurement errors caused by any reflection or shadow of the mast itself.
- It is preferably to thermally insulate the radiometer from its mounting bracket ensuring, at the same time, a good electrical contact to ground.

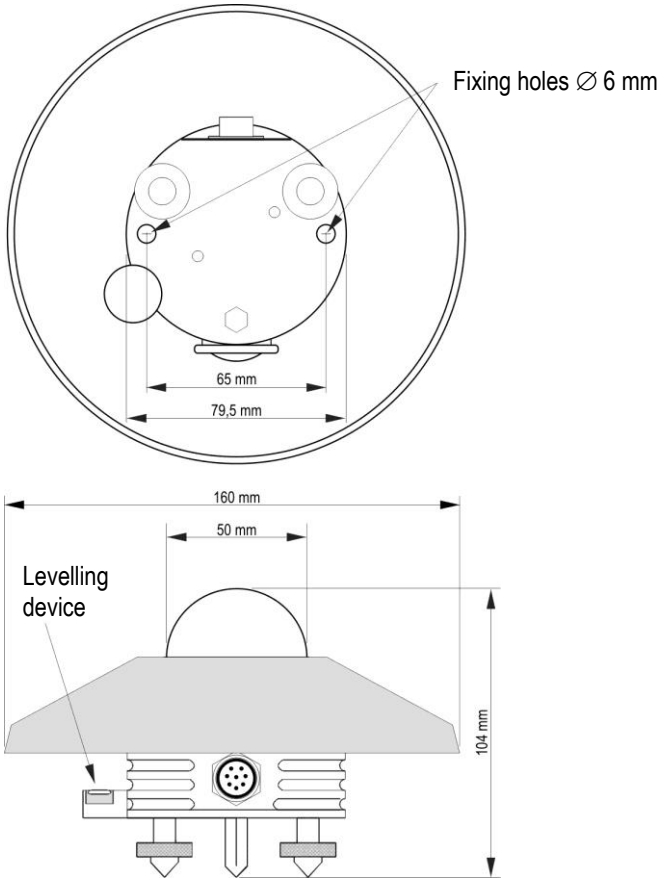


Fig. 4.2: fixing holes and levelling device

4.1 Optional mounting bracket for installation on mast

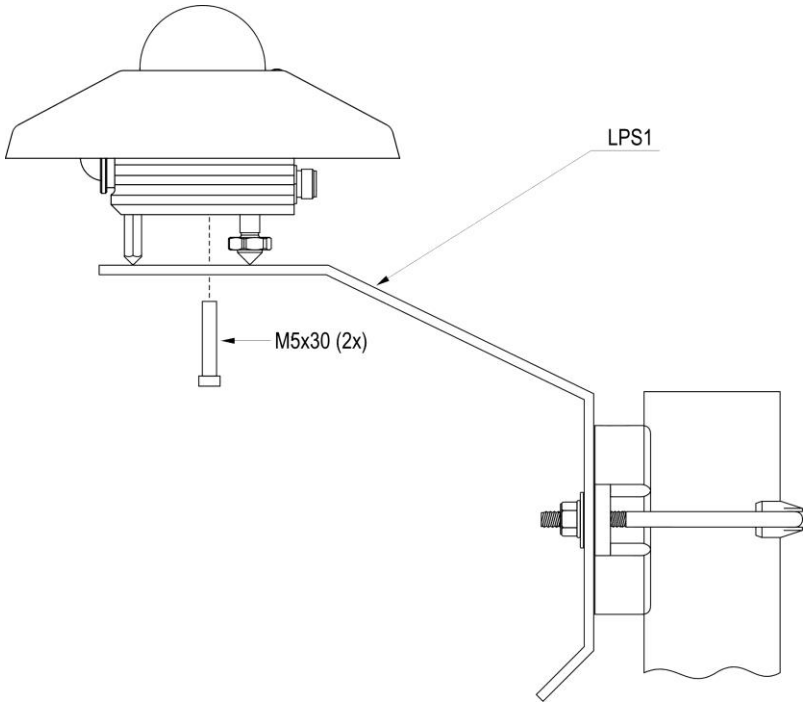


Fig. 4.3: LPS1 bracket for mast

4.2 Electrical connections

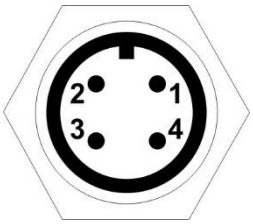
Warning!

The metallic housing of the radiometer should be grounded locally. The shield of the CPM12AA4… cable is not connected to the housing.

Connector pinout:

Pin	Function	CPM12AA4… wire color
1	+Vout (output positive)	Red
2	GND	Blue
3	+Vdc (power supply positive)	White
4	Cable shield	Black

Radiometer male connector



Connect the radiometer to a power supply and an instrument with voltage input as shown below. The load resistance (R_L) of the reading instrument must be **≥ 100 kΩ**. Connect the cable shield to the ground (PE) of the reading instrument.

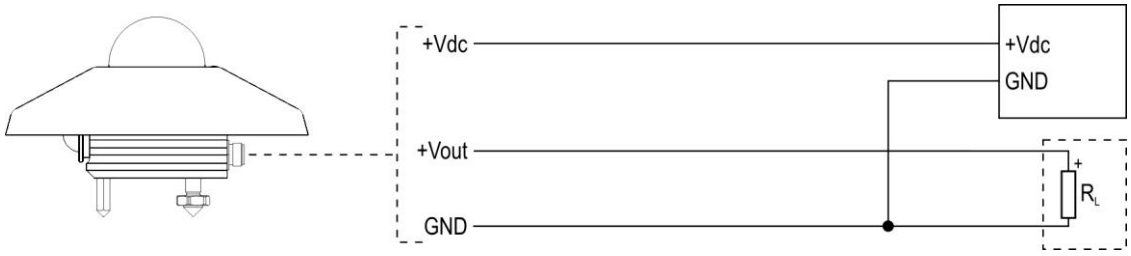


Fig. 4.4: LPUVI02…AV… connections

5 Measurement

LPUVI02AV…

The output signal (0…1 V, 0…5 V or 0…10 V depending on the version) corresponds to 0…16 UV Index range.

The UV Index is obtained by measuring with a multimeter the output voltage V_{out} of the sensor, expressed in V, and applying the following formula:

$UV\ Index = 16 \times V_{out}$ for the version 0…1 V

$UV\ Index = 3.2 \times V_{out}$ for the version 0…5 V

$UV\ Index = 1.6 \times V_{out}$ for the version 0…10 V

LPUVI02.1AV…

The output signal (0…1 V, 0…5 V or 0…10 V depending on the version) corresponds to 0…20 UV Index range.

The UV Index is obtained by measuring with a multimeter the output voltage V_{out} of the sensor, expressed in V, and applying the following formula:

$UV\ Index = 20 \times V_{out}$ for the version 0…1 V

$UV\ Index = 4 \times V_{out}$ for the version 0…5 V

$UV\ Index = 2 \times V_{out}$ for the version 0…10 V

6 Maintenance

In order to grant measurements high accuracy, it is important to keep the glass dome clean. Consequently, the more the dome will be kept clean, the more measurements will be accurate.

You can wash it using water and standard papers for lens. If necessary, use pure ETHYL alcohol. After using alcohol, clean again the dome with water only.

Because of the high temperature changes between day and night, some condensation might appear on the radiometer dome. In this case the performed reading is highly over-estimated. To minimize the condensation, the radiometer is provided with a cartridge containing dessicant material (silica-gel). The efficiency of the silica-gel crystals decreases over time while absorbing humidity. Silica-gel crystals are efficient when their colour is **yellow**, while they turn **white/translucent** as soon as they lose their efficiency. Read instructions at chapter 3 about how to replace the silica-gel crystals. Silica-gel typical lifetime goes from 2 to 6 months depending on the environment where the radiometer works.

To exploit all the radiometer features, it is highly recommended that the calibration be checked annually.

7 Safety instructions

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

Do not use the radiometer in places where there are:

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

User obligations

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

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

8 Accessories ordering codes

The radiometer is supplied with shade disk, sylica-gel cartridge, 2 spare sachets, levelling device, M12 female free connector (only if the optional cable is not ordered) and Calibration Report.

Cables and fixing accessories must be ordered separately.

Fixing accessories

LPS1	Fixing bracket for Ø 30…50 mm mast. Installation on horizontal or vertical mast.

Installation cables

CPM12AA4…	Cable with 4-pole M12 connector on one end, open wires on the other end. Length 5 m (CPM12AA4.5) or 10 m (CPM12AA4.10).

Spare parts

LPSP1	UV-resistant solar radiation protection screen.
LPG	Silica-gel (5 sachets).
LPSG	Cartridge to contain desiccant silica-gel crystals, complete with O-ring and cap. Spare part.

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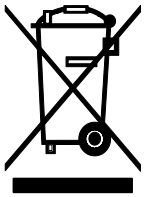
WARRANTY

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

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.
We reserve the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



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

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

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