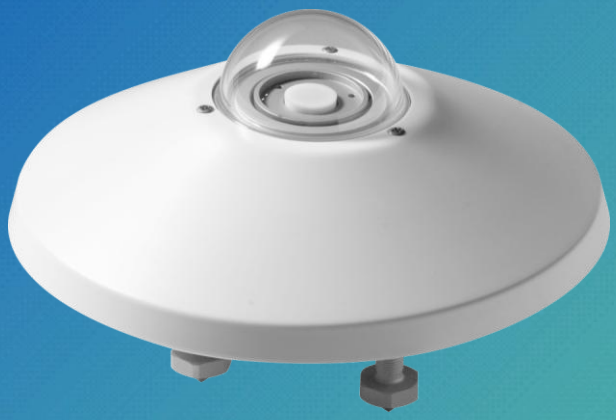
OPERATING MANUAL

LPUVA02

UVA radiometer



EN

V3.0

senseca

Contents

1 Introduction

The **LPUVA02** radiometer measures the global irradiance in the UVA spectral range on a flat surface. The global irradiance is the sum of direct sun irradiance and diffuse irradiance.

The radiometer can also be used for monitoring indoor UVA emissions.

Available in the following versions:

	Output				
Model	**mV**	**4…20 mA**	**0…1 V**	**0…5 V**	**0…10 V**
LPUVA02	√				
LPUVA02AC		√			
LPUVA02AV					√
LPUVA02AV1			√		
LPUVA02AV5				√	

The irradiance range for the analog output is 0…200 W/m^2.

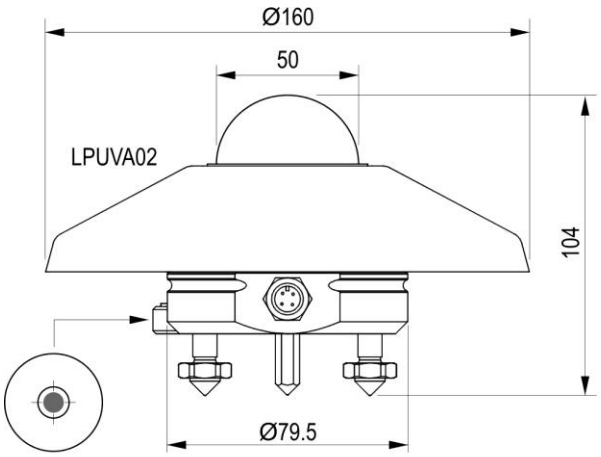
Each radiometer is individually calibrated at the factory and is distinguished by its own calibration factor. The calibration is performed by comparison with the primary standard of the Senseca metrology laboratory, using the emission line at 365 nm of a suitably filtered Xe-Hg lamp.

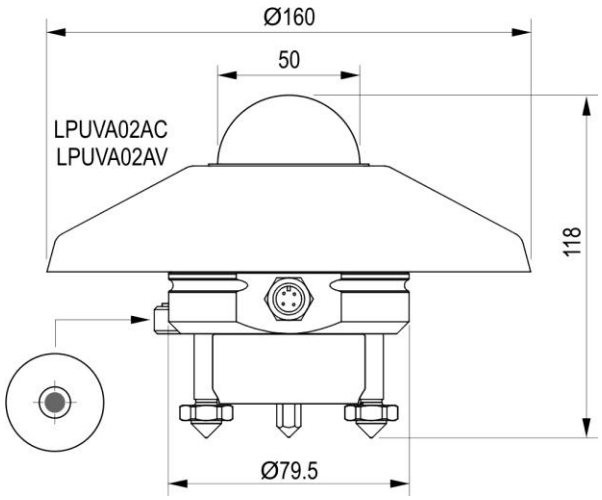
Note: there is no international standard for the calibration of UVA radiometers; therefore, when considering the value of the calibration coefficient, the method by which it was obtained must be taken into account; the same radiometer calibrated with different procedures can have different calibration factors.

2 Technical specifications

Measuring range	0…200 W/m^2
Typical sensitivity	70...200 µV/Wm^{-2}
Viewing range	2π sr
Spectral range	342 nm...384 nm (1/2) 330 nm...393 nm (1/10) 320 nm...400 nm (1/100) Peak: 365 nm
Response time	<0.5 s (95%)
Directional response (cosine law)	<8% (0…80°)
Long term instability (1 year)	<|±3|%
Non linearity	<|±1|%
Temperature response	<0.1%/°C
Output LPUVA02 LPUVA02AC LPUVA02AV LPUVA02AV1 LPUVA02AV5	Passive in mV 2-wire (current loop) 4…20 mA 0…10 V 0…1 V 0…5 V
Impedance (passive version)	3 kΩ
Power supply	10…30 Vdc (LPUVA02AC / AV1 / AV5) 15…30 Vdc (LPUVA02AV) LPUVA02 does not require power supply
Connection	4-pole M12
Operating temperature	-40…+80 °C
Weight	900 g approx.

Dimensions (mm)





3 Measuring principle

LPUVA02 radiometer is based on a solid state sensor, whose spectral response has been adapted using appropriate filters. The relative spectral response is reported in figure 3.1.

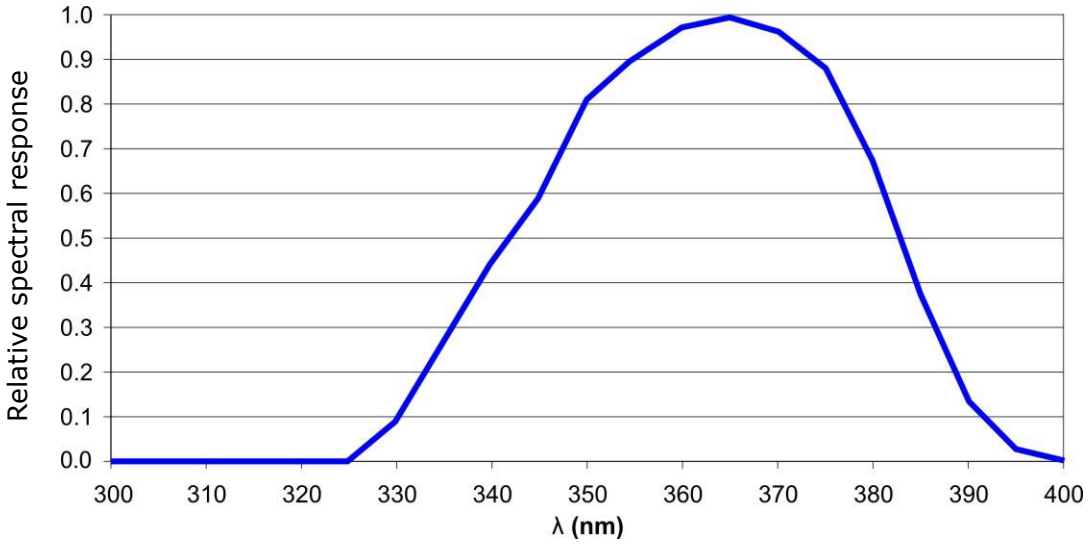


Fig. 3.1: spectral response

The radiometer is equipped with a 50 mm outer diameter dome to ensure a suitable protection of the sensor from the weather elements.

The response in accordance with the cosine law has been obtained thanks to the particular shape of the diffuser and of the housing. The deviation between the theoretical response and the measured one is shown in figure 3.2.

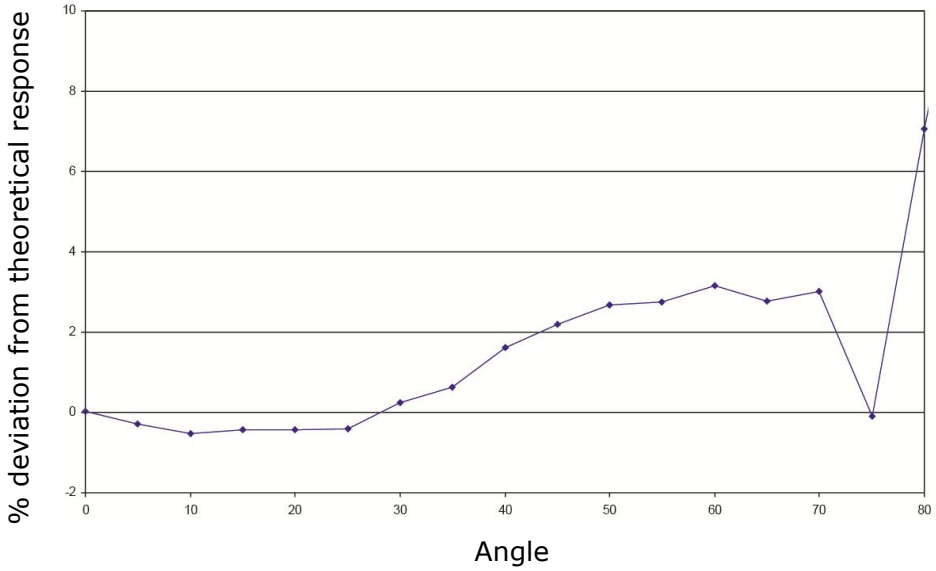


Fig. 3.2: directional error

The excellent relation between the response of the radiometer and the cosine law allows using the instrument also when the elevation of the sun is very low (the UVA diffuse radiation increases as the sun moves away from the zenith, therefore the error on the direct radiation, due to the imperfect response according to the cosine law, becomes negligible on the measurement of the 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.

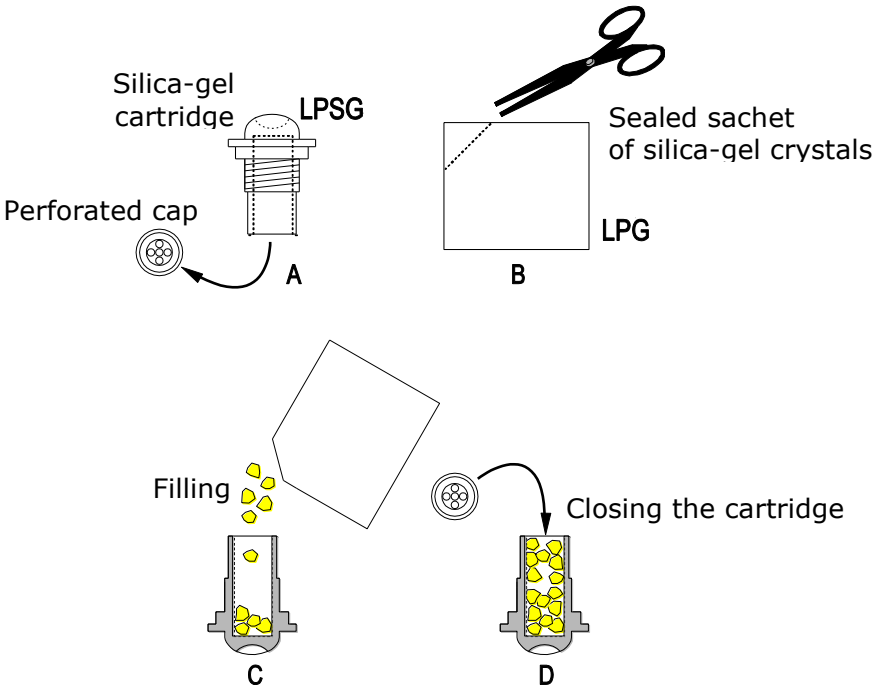


Fig. 4.1: filling the silica-gel cartridge

- 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° of elevation. The mast height does not exceed the radiometer plane to avoid measurement errors caused by any reflection or shadow of the mast itself.
- 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 M5 (32 mm interaxis) or M8 (65 mm interaxis) holes on the bottom of the radiometer The 65 mm interaxis holes can alternatively be used as thru-holes to fix the radiometer from above with M5 screws (in this case, remove the shade disk to access the holes and reposition it after mounting). For an accurate horizontal positioning, adjust the height of the two lower feet with hex ring nut, using the bubble level integrated in the radiometer.
- It is preferably to thermally insulate the radiometer from its mounting bracket ensuring, at the same time, a good electrical contact to ground.

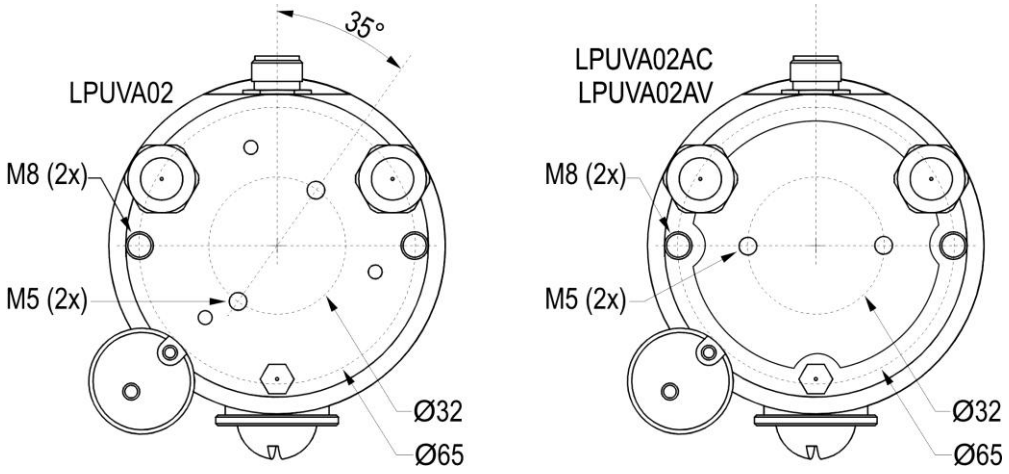


Fig. 4.2: fixing holes

4.1 Optional mounting bracket for installation on mast

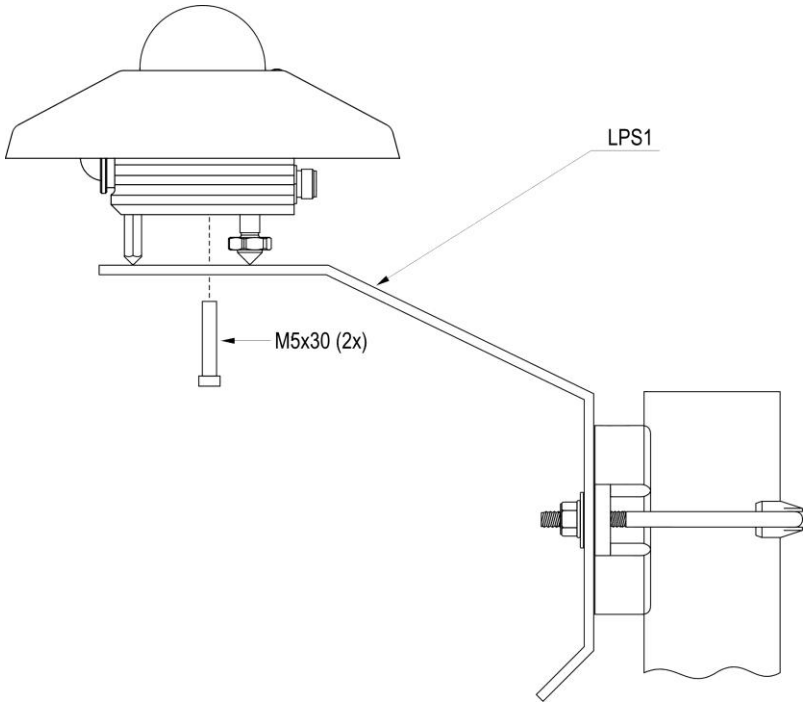


Fig. 4.3: LPS1 bracket for mast

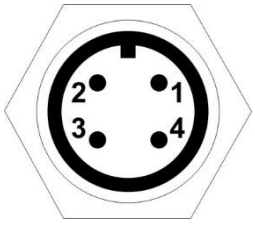
4.2 Electrical connections

Warning!

> The metallic housing of the radiometer should preferably be grounded (earthed) locally. Do not connect the wire corresponding to the housing to ground, unless it is not possible to ground the radiometer metallic housing locally via the support mast.

Internally there are surge protection devices connected to the housing. Grounding the housing allows the correct protection functionality of the devices.

Connector pinout:

Radiometer male connector (external view)		Function			CPM12AA4... wire color
		LPUVA02	LPUVA02AC	LPUVA02AVx	
	1	+Vout	Iin (+)	+Vout	Red
	2	-Vout	Iout (-)	GND	Blue
	3	Housing	Housing	+Vdc	White
	4	Cable shield	Cable shield	Cable shield	Black

LPUVA02 connections:

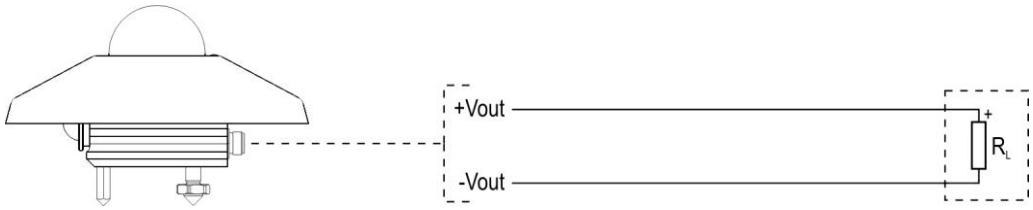


Fig. 4.4: LPUVA02 connection diagram

The radiometer does not require power supply. The typical output impedance of the sensor is ~3 kΩ.

The output signal typically does not exceed 50 mV. The recommended resolution of the reading instrument is 1 μV.

Connect the cable shield to the ground of the reading instrument.

LPUVA02AC connections:

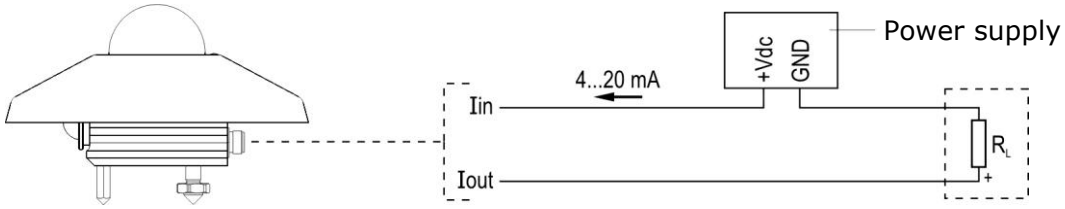


Fig. 4.5: LPUVA02AC connection diagram

Radiometer power supply: 10…30 Vdc. Load resistance $R_L \leq 500\ \Omega$.

Connect the cable shield to the ground of the reading instrument.

In the event of an anomaly in the measurement (detected measurement outside the measuring range), the output goes to 22 mA.

LPUVA02AVx connections:

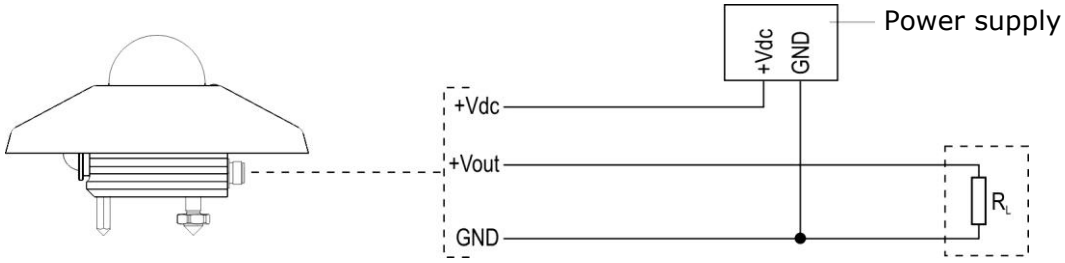


Fig. 4.6: LPUVA02AVx connection diagram

Pyrheliometer power supply: 10…30 Vdc for 0…1 V and 0…5 V outputs, 15…30 Vdc for 0…10 V output. Load resistance $R_L \geq 100\ k\Omega$.

Connect the cable shield to the ground of the reading instrument.

In the event of an anomaly in the measurement (detected measurement outside the measuring range), the output goes to a value 10% higher than the full scale (e.g., 11 V if the output is 0...10 V).

5 Measurement

LPUVA02:

Each radiometer is distinguished by its own sensitivity (or calibration factor) ***S*** expressed in μV/(Wm^{-2}), shown in the label on the radiometer and in the calibration report.

The irradiance E_e is obtained by measuring with a multimeter the difference of potential ***DDP*** at the ends of the sensor and applying the following formula:

$$E_e = DDP / S$$

where:

E_e is the irradiance expressed in W/m^2;

DDP is the difference of potential expressed in μV measured by the multimeter;

S is the sensitivity of the radiometer expressed in μV/(Wm^{-2}).

LPUVA02AC:

The 4…20 mA output signal corresponds to the 0…200 W/m^2 irradiance range.

The irradiance E_e is obtained by measuring with a multimeter the current I_{out} absorbed by the sensor and applying the following formula:

$$E_e = 12.5 \cdot (I_{out} - 4)$$

where:

E_e is the irradiance expressed in W/m^2;

I_{out} is the current expressed in mA absorbed by the radiometer.

LPUVA02AVx:

The output signal (0…1 V, 0…5 V or 0…10 V depending on the model) corresponds to the 0…200 W/m^2 irradiance range.

The irradiance E_e is obtained by measuring with a multimeter the output voltage V_{out} of the sensor and applying the following formula:

$E_e = 200 \cdot V_{out}$ for LPUVA02AV1 (0…1 V output)

$E_e = 40 \cdot V_{out}$ for LPUVA02AV5 (0…5 V output)

$E_e = 20 \cdot V_{out}$ for LPUVA02AV (0…10 V output)

where:

E_e is the irradiance expressed in W/m^2;

V_{out} is the output voltage expressed in V measured by the multimeter.

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, silica-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.

NOTES

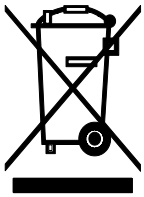
WARRANTY

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.

CE RoHS

senseca.com

Senseca Italy S.r.l.
Via Marconi, 5
35030 Selvazzano Dentro (PD)
ITALY
info@senseca.com

senseca