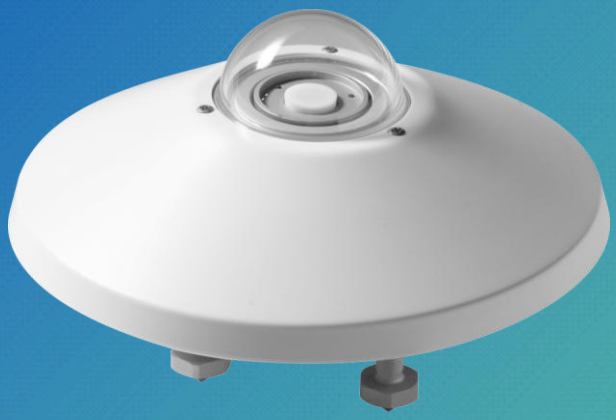
OPERATING MANUAL

LPPHOT02

Photometric probe



EN

V3.0

senseca

Contents

1 Introduction

The **LPPHOT02** probe measures illuminance (lux), defined as the ratio between the luminous flux (lumen) through a surface and the surface area itself (m^2).

The spectral response curve of a photometric probe matches that of the human eye, known as **standard photopic curve V(λ)**. The difference in spectral response between the LPPHOT02 and the standard photopic curve V(λ) is evaluated through the calculation of the error f'_1.

The probe is designed for long-term outdoor use, in particular for the measurement of daylight in climatological and meteorological applications.

Available in the following versions:

	Output				
Model	**mV**	**4…20 mA**	**0…1 V**	**0…5 V**	**0…10 V**
LPPHOT02	√				
LPPHOT02AC		√			
LPPHOT02AV					√
LPPHOT02AV1			√		
LPPHOT02AV5				√	

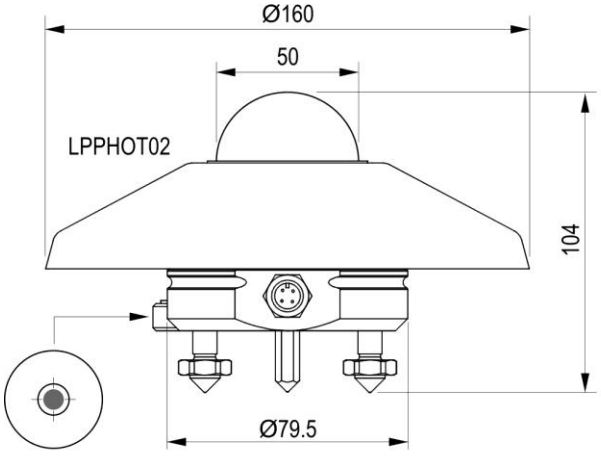
The illuminance range for the analog output is 0…150 klux.

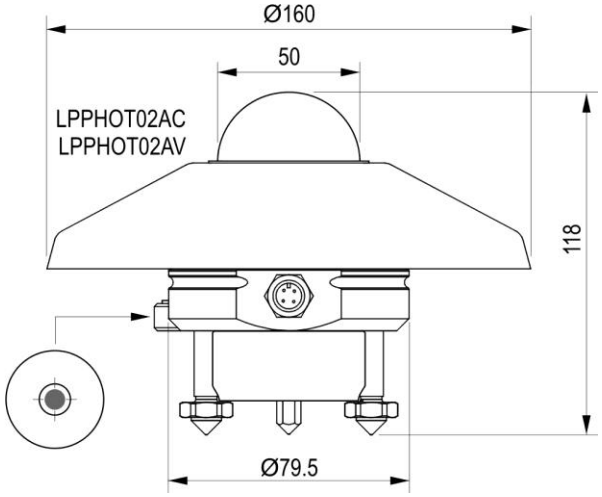
Each luxmeter is individually calibrated at the factory and is distinguished by its own calibration factor. The calibration is performed by comparison with the reference luxmeter of the Senseca metrology laboratory, using an illuminant "A" as a source, as required by CIE publication N°69 “Methods of characterizing illuminance meters and luminance meters: Performance, characteristics and specifications”.

2 Technical specifications

Measuring range	0…150 klux
Typical sensitivity	0.5...2 mV/klux
Viewing range	2π sr
Spectral range	Standard photopic curve
Response time	<0.5 s (95%)
Directional response (cosine law)	<8% (0…80°)
Long term instability (1 year)	<|±3|%
Error f'_1	<9%
Non linearity	<|±1|%
Temperature response	<0.1%/°C
Output LPPHOT02 LPPHOT02AC LPPHOT02AV LPPHOT02V1 LPPHOT02V5	Passive in mV 2-wire (current loop) 4…20 mA 0…10 V 0…1 V 0…5 V
Impedance (passive version)	0.5…1 KΩ
Power supply	10…30 Vdc (LPPHOT02AC / AV1 / AV5) 15…30 Vdc (LPPHOT02AV) LPPHOT02 does not require power supply
Operating temperature	-40…+80 °C
Weight	900 g approx.

Dimensions (mm)





3 Measuring principle

LPPHOT02 probe is based on a solid state sensor, whose spectral response has been adapted to that of the human eye using a special filter. The relative spectral response is reported on figure 3.1.

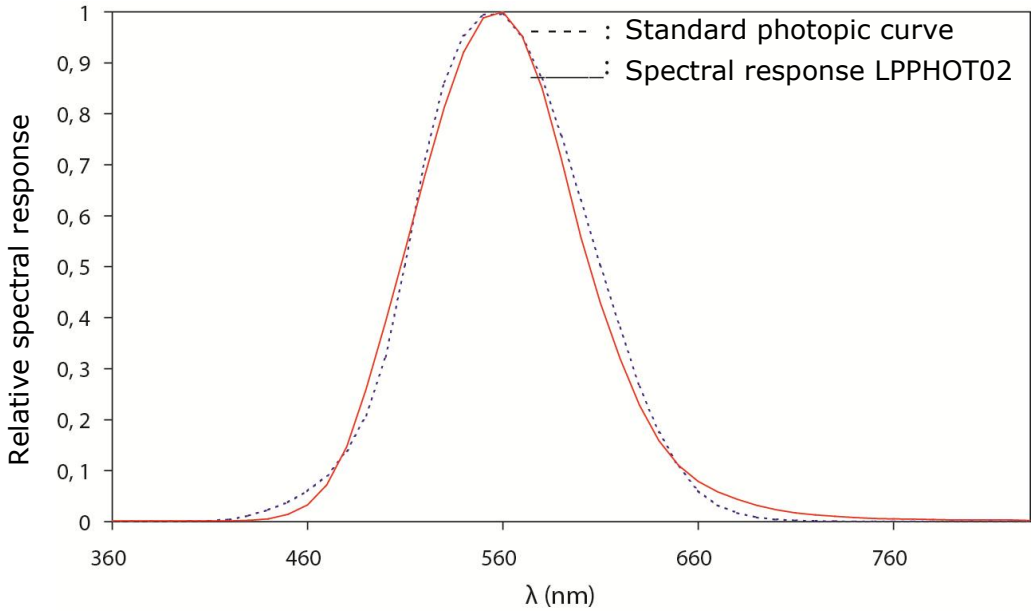


Fig. 3.1: spectral response

The probe 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 the Fig. 3.2.

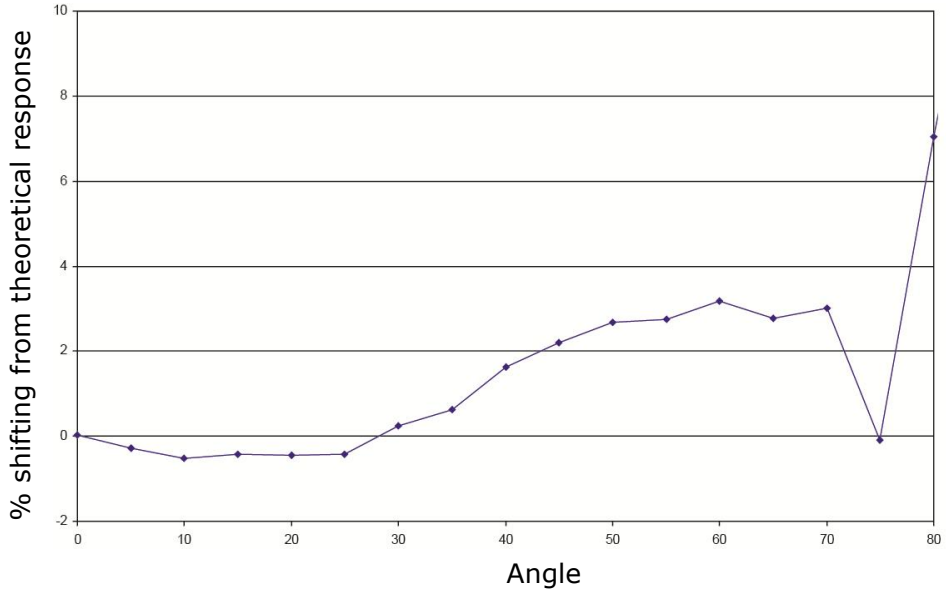


Fig. 3.2: directional error

The excellent relation between the response of the probe and the cosine law allows using the instrument also when the sun has a very low raising.

4 Installation

Before installing the probe, 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 probe).
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 probe 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 probe is ready for use.

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

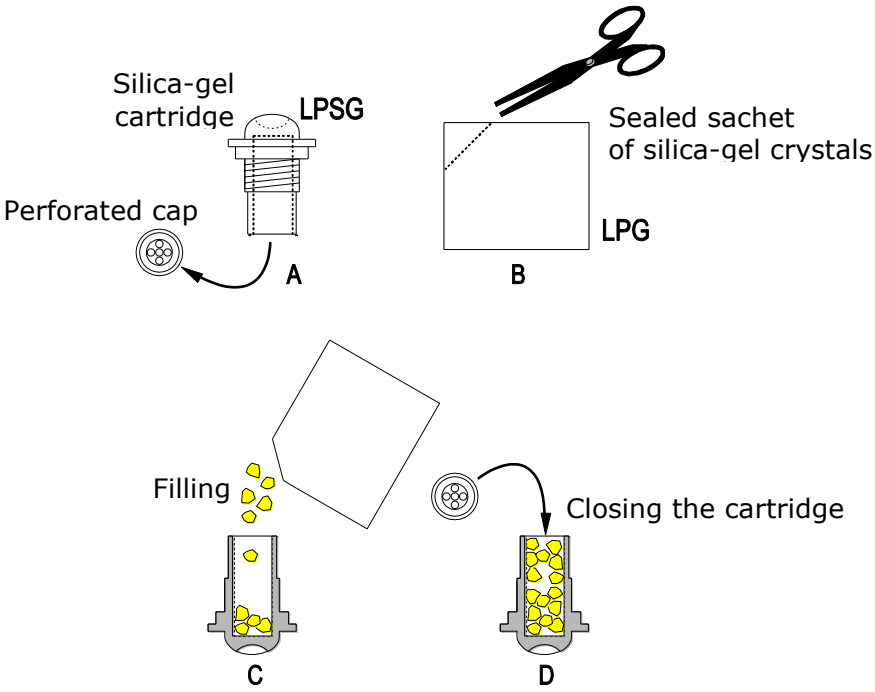


Fig. 4.1: filling the silica-gel cartridge

- The probe 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 sensor 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 mast height does not exceed the sensor plane to avoid measurement errors caused by any reflection or shadow of the mast itself.
- The sensor must be located far from any kind of obstruction, which might reflect sunlight (or sun shadow) onto the sensor itself.
- For fixing, use the M5 (32 mm interaxis) or M8 (65 mm interaxis) holes on the bottom of the probe The 65 mm interaxis holes can alternatively be used as thru-holes to fix the probe 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 probe.
- It is preferably to thermally insulate the probe from its mounting bracket ensuring, at the same time, a good electrical contact to ground.

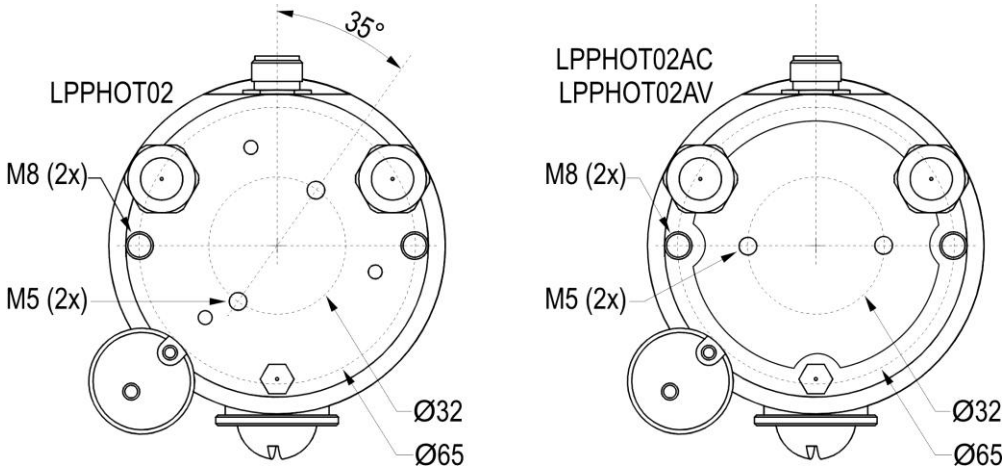


Fig. 4.2: fixing holes

4.1 Optional mounting bracket for installation on mast

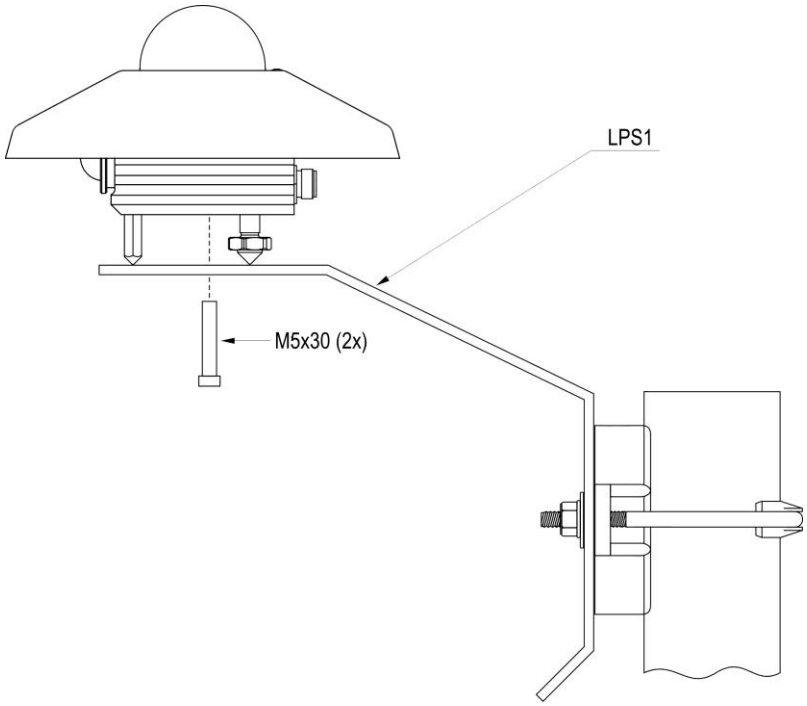


Fig. 4.3: LPS1 bracket for mast

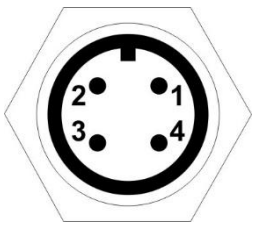
4.2 Electrical connections

Warning!

The metallic housing of the probe 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 probe 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:

Probe male connector (external view)		Function			CPM12AA4... wire color
		LPPHOT02	LPPHOT02AC	LPPHOT02AVx	
	1	+Vout	Iin (+)	+Vout	Red
	2	-Vout	Iout (-)	GND	Blue
	3	Housing	Housing	+Vdc	White
	4	Cable shield	Cable shield	Cable shield	Black

LPPHOT02 connections:

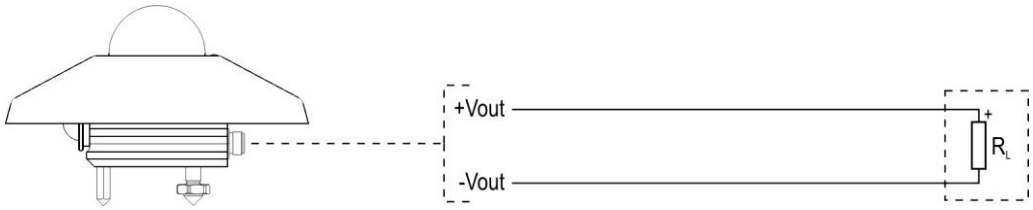


Fig. 4.4: LPPHOT02 connection diagram

The radiometer does not require power supply. The typical output impedance of the sensor is <1 kΩ.

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

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

LPPHOT02AC connections:

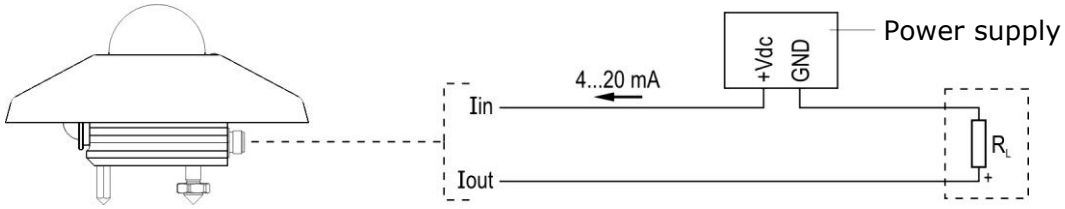


Fig. 4.5: LPPHOT02AC connection diagram

Radiometer power supply: 10…30 Vdc. Load resistance R_L ≤ 500 Ω.

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.

LPPHOT02AVx connections:

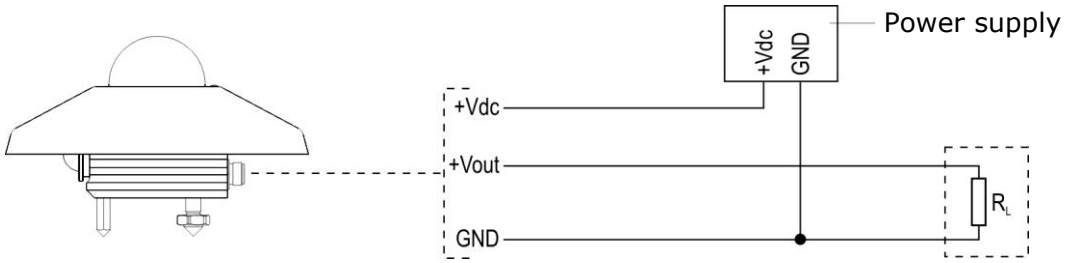


Fig. 4.6: LPPHOT02AVx connection diagram

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 ≥ 100 kΩ.

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

LPPHOT02:

Each probe is distinguished by its own sensitivity (or calibration factor) ***S*** expressed in mV/klux, shown in the label on the probe and in the calibration report.

The illuminance 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 illuminance expressed in klux;

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

S is the sensitivity of the probe expressed in mV/klux.

LPPHOT02AC:

The 4…20 mA output signal corresponds to the 0…150 klux illuminance range.

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

$$E_e = 9.375 \cdot (I_{out} - 4)$$

where:

E_e is the illuminance expressed in klux;

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

LPPHOT02AVx:

The output signal (0…1 V, 0…5 V or 0…10 V depending on the model) corresponds to the 0…150 klux illuminance range.

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

$E_e = 150 \cdot V_{out}$ for LPPHOT02AV1 (0…1 V output)

$E_e = 30 \cdot V_{out}$ for LPPHOT02AV5 (0…5 V output)

$E_e = 15 \cdot V_{out}$ for LPPHOT02AV (0…10 V output)

where:

E_e is the illuminance expressed in klux;

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 sensor dome. In this case the performed reading is highly over-estimated. To minimize the condensation, the sensor 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 sensor works.

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

7 Safety instructions

The probe 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 probe 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 probe 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

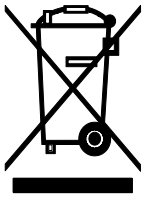
WARRANTY

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

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