LPS – Thermopile pyranometers

(Rev.0 110324)

Description

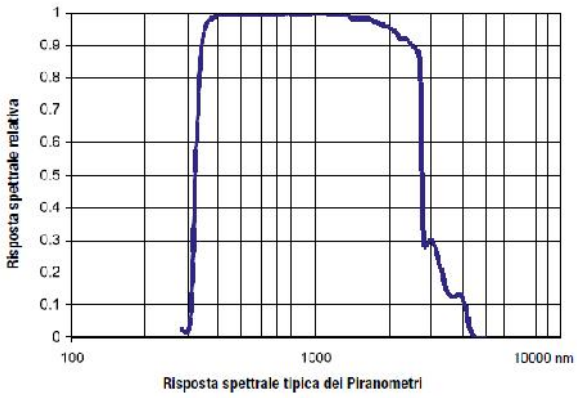
LPS are thermopile pyranometers employed for measuring of the global solar radiation (direct+diffuse) in compliance with **ISO9060:2018** and **IEC61724-1** norms and with the guidelines of **WMO** Annex8 (World Meteorological Organization). All pyranometers are calibrated singolarly with reference to **WRR** (World Radiometric Reference) in conformity to **ISO9847:2023** norm. The pyranometers are characterised by the following accuracy classes:

1. LPS100C0: Spectrally flat **A** Class (*ex Secondary Standard Class)* with average accuracy [1] ±1%
2. LPS020C0: Spectrally flat Class B (*ex First Class)* with average accuracy ±2%
3. LPS030C0: Spectrally flat **C** Class (ex *Second Class)* with average accuracy ±4%

The pyranometers are available in versions with 4-20mA or, on request, RS485 Modbus output. Besides all LPS pyranometers can be supplied in albedometer version with double pyranometer for global (from the sky) and reflected (from the soil) solar radiation measurement.

Working principle

The pyranometer is based on a thermopile sensor. The sensitive surface of the thermopile is covered with matt black paint which allows the pyranometer not to be selective at various wavelengths. The pyranometer spectral range is determined by the transmission of the glass domes type K5. Radiant energy is absorbed by the thermopile black surface, creating in this way a temperature difference between the center of the thermopile (hot junction) and the pyranometer body (cold junction). The temperature difference between hot and cold junction is converted into a voltage signal by Seebeck effect. The spectral range of the pyranometer is determined by the transmission of the two concentric glass domes, with an external diameter of 50 and 30 mm, which also ensure adequate thermal insulation of the thermopile from the wind and reduce sensitivity to thermal radiation. In addition, the domes protect the thermopile from dust, which, by settling on the blackened part, could alter its spectral sensitivity. The special material used to make the domes allows the spectral range to be extended to short wavelengths from 283 nm.



Advantages

- ✓ Excellent quality / price ratio
- ✓ Several ranges of accuracy
- ✓ Good robustness and reliability
- ✓ Operation in extreme weather conditions

Main applications

- ✓ Meteorology and climatology
- ✓ Photovoltaic plants yield and Energy savings
- ✓ Atmospheric research
- ✓ Agriculture

[1] The **average accuracy** ha sto be intended as **<u>expected daily uncertainty</u>** (level of reliability 95%) – Source **W.M.O., Measurement of radiation, Chapter 7 Annex 8.** The sensor accuracy is determined by its belonging class, in other terms: 1) Secondary standard (*or High Quality),* 2) *First Class (or Good Quality)* and 3) *Second Class* (or *Moderate Quality)*

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Technical Data

Models	LPS100C0 (A class /High quality)	LPS020C0 (B class / Good quality)	LPS030C0 (C class/Moderate quality)
Typical measurement range	0…2000 W/m^2 (or other range in the field -200…4000 W/m^2 on request)		
Spectral range (50%) / Field of view	283…2800nm / 2πsr (180°)		300…2800nm / 2πsr (180°)
Transducer	Thermopile (Senseca made), Geoves customized		
Typical Sensitivity	6…12 µV/(W/m^2)		5…15 µV/(W/m^2)
Resolution	0,1W/m^2		
Outputs/power/consumption Versions:	4…20mA / 10…30Vdc (typ.12Vdc) / 22mA RS485 (modbus)/ 7…30Vdc (typ.12Vdc) / 22mA		
Working temperature	-40…+80°C		
Materials	Anodized aluminum, ASA and optical glass (double dome)	Anodized aluminum, ASA and optical glass (double dome)	Anodized aluminum, ASA and optical glass (single dome)
Dimensions / weight	Ø160xh101mm / 0,7kg	Ø160xh101mm / 0,7kg	Ø110xh60mm / 0,4kg
ISO9060:2018 features **Response Time (95 %)**	< 6 s	< 28 s	< 30 s
Zero Off-set a) Response to a thermal radiation of 200 W/m^2	<±7 W/m^2	<±10 W/m^2	<±15 W/m^2
b) Response to a change of 5K/h in the room temperature	<±2 W/m^2	<±4 W/m^2	<±4 W/m^2
c) Total zero offset including a) and b) effects and other sources	<±10 W/m^2	<±15 W/m^2	<±20 W/m^2
Long-term instability (1 year)	<±0,5%	<±1%	<±1%
Non-linearity	<±0,2%	<±1%	<±1%
Directional Response (up to 80° with 1000 W/m^2 beam)	<±10 W/m^2	<±18 W/m^2	<±20 W/m^2
Spectral Selectivity	<±0,2%	<±0,5%	<±1%
Temperature response	<±0,5%	<±1,5%	<±2%
Tilt Response	<±0,2%	<±1%	<±1,5%

Electrical Connection

Pyranometer Vers.	**(current)**	**(serial)**
Output	4…20mA (0…2000 W/m^2)	RS485 (Modbus)
Resistive shunt load	25…500Ω (tip.100Ω)	
IP68 Connector on the sensor	Pin1: Iin (+ 10…30Vdc) Pin2: Iout (– signal) Pin3: Pin4: 	Pin1: Gnd (- Negative of power) Pin2: +Vdc (+ Positive of power) Pin3: DGnd (Digitale Ground) Pin4: DATA – (RS485) Pin5: DATA + (RS485) Pin6: AGnd (Analog Ground) Pin7: AOut (Positive of analog output) Pin8: N.C. (not connected) Connector housing / Shield of the cable – pyranometer container 

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Mounting

Load the cartridge containing silica-gel. Install pyranometer away from obstacles that could project the reflection of the sun (or their shadows) on the sensor. When the pyranometer is used without the white screen should be positioned so that the cable comes out of toward the NORTH when used in the northern hemisphere (on the opposite side when installed in the southern hemisphere), according to ISO TR9901 and the WMO recommendations. In any case it is preferable to follow this suggestion even when the screen is used. For an accurate horizontal positioning, the pyranometer is provided with level spirit; the adjustment is made using the two screws with adjusting nut for adjusting the angle of the pyranometer. The fixing of a plan can be performed by using the two holes of 6mm diameter and spacing of 65 mm. To access the holes, remove the screen and reposition it after mounting. In order to facilitate the installation of the pyranometer, Geoves provides a universal bracket (cod. STF-UNI) that allows mounting on poles (ø25 ... 43mm) vertical, horizontal and oblique position (the latter eg. To allow the installation at the same tilt of photovoltaic panels for the production of electricity).

The installer must take care that the height of the mast does not exceed the pyranometer plane to avoid measurement errors caused by any reflection or shadow of the mast. It is recommended to thermally isolate the pyranometer from its mounting, at the same time make sure there is a good electrical contact to earth.

Installation

Application	Installation height	Orienting and Localization
Meteorology (ref. WMO Annex 8)	1,5…2 m from the ground or on the top of main pole	Oriented toward South without any obstacle over standing that can throw shadow above the sensor. It's advisable an height installation of 1,5-2m to ensure an easy maintenance and check of glass dome cleaning.

Pyranometers in ALBEDOMETER configuration, models: ALBA, ALBB and ALBC

The albedometers are sensors that measure the albedo or the ratio between the global radiation reflected from the ground and the global radiation; the albedometer consist of two opposite pyranometers and are available in the following models: **ALBA-I** with A Class (ex Secondary Standard), **ALBB-I** with B Class (ex First Class) and **ALBC-I** with C Class (ex Second Class) pyranometers. The albedometer features are the same of pyranometers (for more details see the above table "Technical Data"). Eachone of the two pyranometers have distinct electrical output so you can measure separately the reflected and the incident radiation.

Ventilation and heating unit for LPS pyranometers

The RISC-LPS ventilation and heating unit can be applied to A and B Class pyranometers and can be used outdoor in any weather condition. Ventilation of instruments increases the measurements accuracy making uniform the temperature of the pyranometer, in particular avoids the deposition of dew and frost on the optical parts of the sensors; besides this solution reduces the offset type A (found in pyranometers and pyrgeometers) due to the cooling of the dome respect to the instrument body. It's possible to use the heating in extreme environmental conditions to prevent ice forming on the dome of the pyranometer (when the heating is switched on, it must be considered that the type A offset could therefore increase is recommended to use the heating for the necessary time to ice or snow removal formed on instruments).

Power supplies requested are:
- For heating are required 12Vdc (6W)
- For the fan are required 12Vdc (5W)

The ventilator uses a fan with IP 54 protection and capacity of 170m3 / h, is provided with a filter that must be periodically checked and replaced if dirty or clogged.
Technical features:
- Power supply: 12Vdc Ventilation (5W)
- Heating 12Vdc (6W)
- Working temperature: -30 ... 70 ° C

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