REV. 1.0
10 Jan. 2007

LP PYRA 05

GB

Our instruments' quality level is the results of the product continuous development. This can bring about differences between the information written in this manual and the instrument that you have purchased. We cannot entirely exclude errors in the manual, for which we apologize.
The data, figures and descriptions contained in this manual cannot be legally asserted. We reserve the right to make changes and corrections without prior notice.

LP PYRA 05

1 Introduction

The LP PYRA 05 albedometer measures the net global radiation, as well as the albedo of grounds (albedo is the ratio between diffuse radiation from a determined surface and the quantity of radiation that arrives on the surface).
The LP PYRA 05 is manufactured mounting two LP PYRA 02 pyranometers in one housing only. The two pyranometers, one measuring the incident radiation striking the ground [↓] and the other one measuring the reflected radiation [↑] are combined in such a way to have the same sensitivity.
The signals of the two pyranometers are obtained from the output cable. These signals can be processed to get the desired physical quantity.
The LP PYRA 05 can be used as a pyranometer for measuring global radiation.
As a pyranometer, the LP PYRA 05 falls into the First Class pyranometers meeting ISO 9060 specifications and the criteria of WMO "Guide to meteorological Instruments and Methods of Observation'", fifth edition (1983).

2 Working Principle:

The LP PYRA 05 albedometer is based on a pair of thermopile sensors, one of them measuring the incident radiation on the ground [↓] and the other one the reflected radiation [↑]. Each thermopile works as an independent pyranometer.
The thermopile sensitive surface is coated with a black matt paint, which allows the pyranometer not to be selective at different wave lengths.
The pyranometer spectral range is determined by the transmittance of the two glass domes type K5.
Radiant energy is absorbed by the thermopile black surface, creating a difference of temperature between the center of the thermopile (hot junction) and the pyranometer body (cold junction). The difference of temperature between hot and cold junction is converted in a Difference of Potential thanks to the Seebeck effect.
In order to grant the thermopile a proper thermal insulation from the wind and to reduce sensitivity to thermal irradiance, the LP PYRA 05 is equipped with two concentric domes on each side (figure 2), having a diameter of 50mm and 30mm, respectively.
The domes protect the thermopile from the dust, which, laying down on the black surface, might change the spectral sensitivity.

3 Installation and Mounting of the Albedometer:

Before installing the pyranometer, 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 drier as possibile:

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 pyranometer)
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 pyranometer 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 tighten it with the screws
10- The pyranometer is ready for use

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

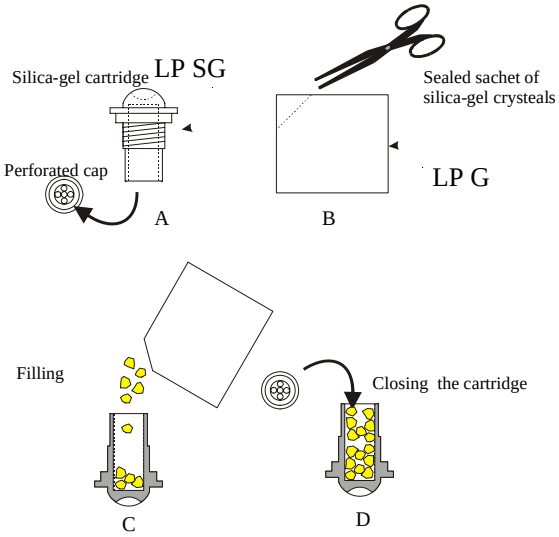

Fig. 1

- The PYRA 05 has to be mounted in a readily accessible location to clean the outer domes regularly and to carry out maintenance. Mount the albedometer 1-2m above the ground. Grass should be kept at the same height all the year long. In snowy regions, keep the instrument above the blanket of snow so that the distance from the albedometer to the snow be constant.
- Pursuant to ISO TR9901 standard and to WMO recommendations, the albedometer has to be positioned in such a way that the power line be pointed to the North Pole if the instrument is used in the Northern Hemisphere, and to the Southern pole if used in the Southern Hemisphere.
- The LP PYRA 05 pyranometer is provided with a spirit level for carrying out an accurate horizontal leveling. Mounting can be made using the rod provided with the instrument (see Fig. 2).
- Check that the electrical contact with the ground is done properly.

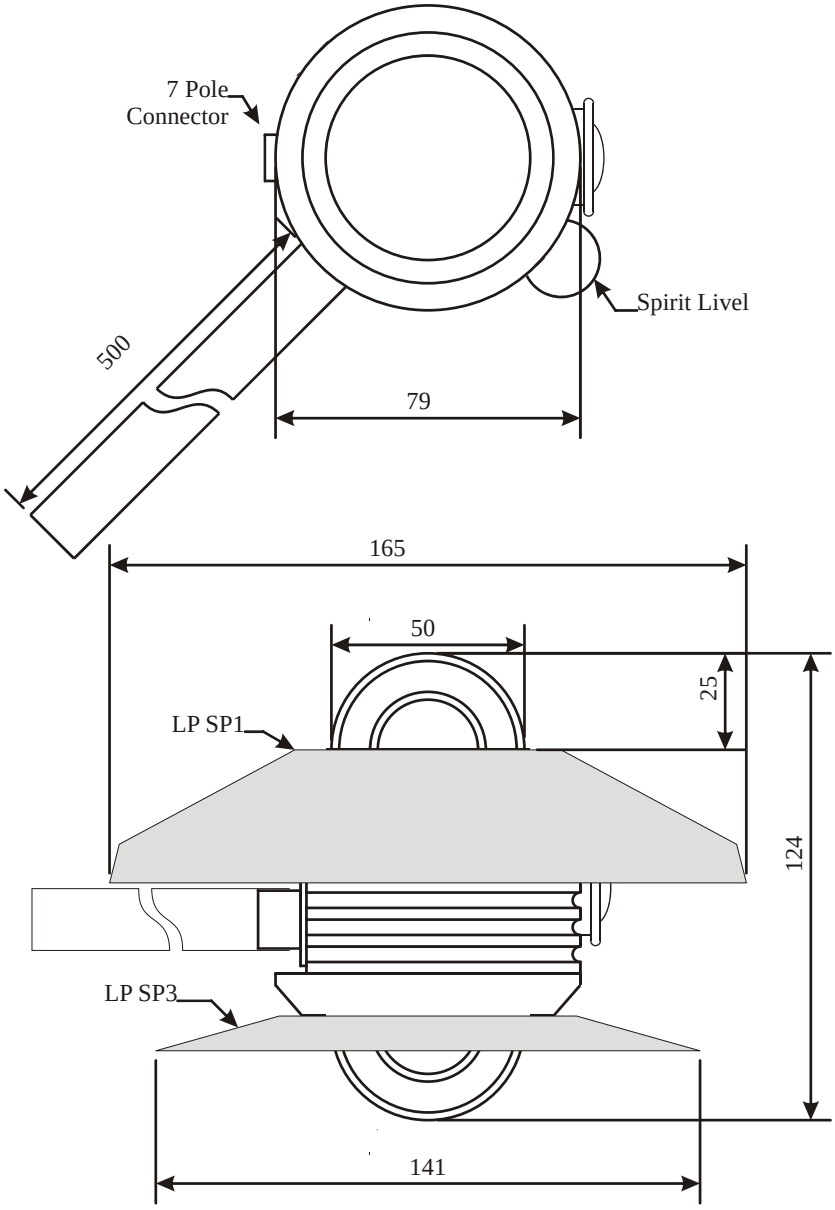
7 Pole
Connector
Spirit Livel
500
79
165
50
25
LP SP1
124
LP SP3
141

Fig 2

4 Electrical Connections and Requirements for Electronic Readout Instruments:

- The LP PYRA 05 pyranometer does not require any power supply.
- The optional cable is terminated with a connector at one end and it is made of PTFE UV-proof. It is provided with 5 wires and a braided wire (shield). Cable colors and connector poles are matched as follow (figure 3):

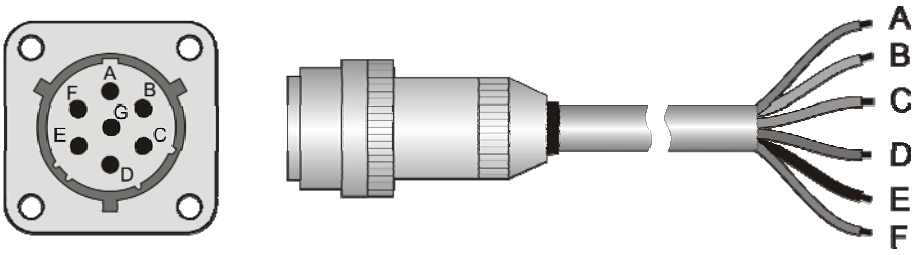

Figure 3

Connector	Function	Color
A	Vout (+)positive pole of the signal generated by the lower detector (↑)	Green
B	connected to the housing (⏚)	White
C	Vout (-) negative pole of the signal generated by the upper detector (↓)	Blu
D	Vout (+) positive pole of the signal generated by the upper detector (↓)	Red
E	shield	Black
F	Vout (-)negative pole of the signal generated by the lower detector (↑)	Brown

The braid (screen) is isolated from the housing by means of two surge arrestors. The braid and the white core have to be connected to the same ground as the readout instrument. The surge arrestor prevents lightning to damage data acquisition systems. Best safety is achieved through a perfect connection between housing and earth. The resistance inserted in parallel to the thermopile allows to obtain the same calibration factor for both sensors. See the electrical diagram (figure 3):

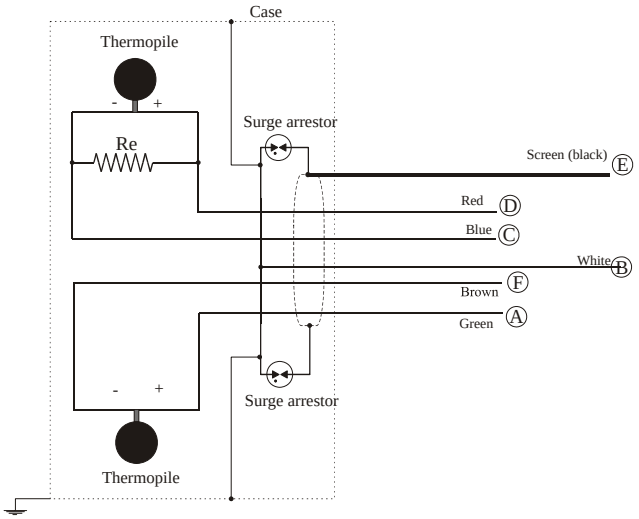

fig. 3

- The LP PYRA 05 has to be connected either to a millivoltmeter or to a data acquisition system capable to accept two inputs. Typically, the output signal does not exceed 20 mV. In order to better exploit the pyranometer features, the readout instrument should have a 1μV resolution.

5 Maintenance:

It is important to keep the outer domes 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 pyranometer dome. In this case the performed reading is highly over-estimated. To minimize the condensation growth, the albedometer is provided with a cartridge containing dessicant material: Silica gel. The efficiency of the Silica gel crystals decreases in the course of time while absorbing humidity. Silica gel crystals are active when their color is **yellow**, while they turn **blue** as soon as they loose their power. Read instructions at paragraph **"3"** about how to replace them. Silica gel typical lifetime goes from 2 to 6 months depending on the environment where the albedometer works.

6 Calibration and Measurements:

The albedometer **S** sensitivity (or calibration factor) allows to determine the irradiance by measuring a signal in Volts at the thermopile ends. The **S** factor is measured in $\mu V/(Wm^{-2})$ and it is the same for both sensors.

- 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:

$$E_e = DDP/S$$

Where:
E_e: is the Irradiance expressed in W/m^2,

DDP: is the difference of potential measured by the multimeter and expressed in μV,

S: is the calibration factor in μV/(W/m^2) shown on the albedometer label (and mentioned on the calibration report).

Albedometers are factory calibrated one by one and they are marked by their own calibration factor. To get best performances from your LP PYRA 05 it is strongly recommended that the calibration be checked annually

The instruments and the equipment of Delta Ohm Photo-Radiometry meteorological laboratory grant the calibration of pyranometers (that make up an albedometer) according to the WMO specifications and assure that measurements are traceable to the international standards

7 Technical Specifications:

Technical specifications listed hereunder are the same for both pyranometers that make up the albedometer. Thus here are the specifications related to a single sensor.

Typical sensitivity:	10 μV/(W/m^2)
Impedance:	30 Ω ÷ 60 Ω
Measuring range:	0-2000 W/m^2
Viewing angle:	2π sr
Spectral range: (dome transmission)	305 nm ÷ 2800 nm W/m^2 (50%) 335 nm ÷ 2200 nm W/m^2 (95%)
Operating temperature:	-40 °C ÷ 80 °C
Dimensions:	figure 2
Weight:	1.35 Kg

Technical specifications according to ISO 9060

1- Response time: (95%)	<28 sec
2- Zero Off-set:	
a) response to a 200W/m^2 thermal radiation:	<15 W/m^2
b) response to a 5K/h change in ambient temperature:	< |±4| W/m^2
3a- Long-term non-stability: (1 year)	< |±1.5| %

3b- Non-linearity:	$< \lvert \pm 1 \rvert$ %
3c- Cosine response:	$< \lvert \pm 18 \rvert$ W/m^2
3d- Spectral selectivity:	$< \lvert \pm 5 \rvert$ %
3e- Temperature response:	<4 %
3f- Tilt response:	$< \lvert \pm 2 \rvert$ %

8 Ordering Codes

LP PYRA 05-5	Albedometer made up by 2 first class pyranometers pursuant to ISO 9060 standard. Complete with: top and bottom shade disk, a cartdrige for silica gel crystals, 2 silica gel sachets, spirit level, rod for attachment to a mast, 7 pole plug and Calibration report.
CP AA 2.5	7 pole plug with UV proof cable, L=5m.
CP AA 2.10	7 pole plug with UV proof cable, L=10m.
LP SP1	Plastic, UV resistant top shade disk for the upward pyranometer (BASF LURAN S777 K)
LP SP3	Bottom shade disk as above, but for the downward pyranometer
LP SG	Desiccant sachet with silica gel crystals, complete with inner O-ring and cap
LP G	Pack of 5 cartridges of silica gel crystals

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GUARANTEE

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GUARANTEE CONDITIONS

All DELTA OHM instruments have been subjected to strict tests and are guaranteed for 24 months from date of purchase. DELTA OHM will repair or replace free of charge any parts which it considers to be inefficient within the guarantee period. Complete replacement is excluded and no request of damages are recognized. The guarantee does not include accidental breakages due to transport, neglect, incorrect use, incorrect connection to voltage different from the contemplated for the instrument. Furthermore the guarantee is not valid if the instrument has been repaired or tampered by unauthorized third parties. The instrument has to be sent to the retailer without transport charge. For all disputes the competent court is the Court of Padua.

This guarantee must be sent together with the instrument to our service centre.
N.B.: Guarantee is valid only if coupon has been correctly filled in all details.

Instrument type ❑ **LP PYRA 05**

Serial number _____

RENEWALS

Date	Date
Inspector	Inspector
Date	Date
Inspector	Inspector
Date	Date
Inspector	Inspector

RoHS 2002/95/EC

CE CONFORMITY	
Safety	EN61000-4-2, EN61010-1 LEVEL 3
Electrostatic discharge	EN61000-4-2 LEVEL 3
Electric fast transients	EN61000-4-4 LEVEL 3
Voltage variations	EN61000-4-11
Electromagnetic interference susceptibility	IEC1000-4-3
Electromagnetic interference emission	EN55020 class B