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DO-070.72E

PYRANOMETERS - ALBEDOMETERS - NET IRRADIANCE METER

LP PYRA 02 LP PYRA 03 LP PYRA 12 PYRANOMETERS
LP PYRA 05 LP PYRA 06 ALBEDOMETERS

PYRANOMETERS

Delta Ohm manufactures First Class LP PYRA 02 and LP PYRA 12 and Second Class LP PYRA 03 pyranometers which fully comply with ISO 9060 standards, and meet the requirements defi ned by the World Meteorological Organization (WMO). These are strong and reliable ground-based instruments, especially designed to be used under all weather conditions. They are suitable for installation on the fi eld.
Recommended use: atmospheric research, weather stations, climatology, energy saving research, productive effi ciency test of photovoltaic plants, etc…
Pyranometers LP PYRA 02 and LP PYRA 03 are well suited for the measurement of incoming global solar radiation (0.3µm ÷ 3µm spectral range). LP PYRA 12 shadow ring is designed to shield the instrument sensor from direct radiation; by that, an exact measurement of the diffuse sky radiation is possible.
No power supply is needed; pyranometers generate a voltage which is usually equal to:

$$10 \cdot mV / kW \cdot m^2$$

Every pyranometer is calibrated separately and is supplied standard with a WRR (World Radiometric Reference) Report of Calibration.

ALBEDOMETERS

Delta Ohm manufactures two different models of albedometers:
LP PYRA 05 is constructed starting from two 1st class* pyranometers and the LP PYRA 06 starting from two 2nd class* pyranometers (* according to ISO 9060 standards and to specifi cations published by the World Meteorological Organization). An albedometer basically consists of two pyranometers, mounted back-to-back, one looking upward (sky) and one downward (earth). The upward pyrameter measures the incident global radiation (direct radiation + diffuse radiation) striking the ground, while the downward one, measures the global radiation refl ected from the ground. The outputs of the two pyranometers electric signals (the two pyranometers which made up of the LP PYRA 05 are couppled in order to have the same sensitivity) can be directly sent to a data logger or to an automatic data processor. Albedo is the fraction of solar radiation that is refl ected from the ground, with respect to incident radiation:

ALBEDO = Reflected Global Radiation / Incident Global Radiation

By using albedometers, we can calculate the net radiation obtained through the difference between incident global radiation and refl ected global radiation.
Delta Ohm albedometers operate within 0.3 µm ÷3 µm spectral range. No power supply is needed, as the two pyranometers generate a voltage which is usually equal to:

$$10 \cdot mV / kW \cdot m^2$$

Every pyranometer composing the albedometer is calibrated separately as per the WRR (World Radiometric Reference) standard and is supplied with the relevant Report of Calibration.
These are strong and reliable ground-based instruments, especially designed to be used under all weather conditions. They are suitable for installation of the fi eld.
Recommended use: climatological research, weather stations, road weather stations, agriculture stations, etc…

TECHNICAL SPECIFICATION

	PYRANOMETERS		ALBEDOMETERS	
	LP PYRA 02 / LP PYRA 12*	**LP PYRA 03**	**LP PYRA 05****	**LP PYRA 06****
Typical sensitivity	10 µV (W/m²)			
Typical Impedance	33 Ω a 45 Ω			
Irradiace range	0 ... 2000 W/m²			
Viewing angle	2π sr			
Spectral range	305 nm a 2800nm W/m² (50%)			
Operating temperature	-40 ºC to 80 ºC			
Weight (pyranometer only)	0,90 Kg	0,45 Kg	1,35 Kg	1,1 Kg
Shadow ring for LP PYRA 12 Weight 5.90 Kg Diameter 570 mm Height 54 mm Basis diameter 300 mm			**All technical data, excluding weight, are referred to one of the two pyranometers composing the albedometer.	

LP NET 07 NET IRRADIANCE METER

LP NET 07 net radiometer is designed to measure the Net radiation passing through a surface, across the spectral range between the near ultraviolet and the far infrared. The Net radiation is defi ned as the difference between the radiation that strikes the top surface, and the radiation that strikes the bottom surface of the net radiometer. The upward facing surface measures direct and diffuse solar radiation plus long-wave irradiance from the sky (clouds), while the downward facing surface measures the refl ected solar radiation (Albedo) plus the terrestrial long-wave irradiance.
LP NET 07 is designed for continuous outdoor use, and is suitable for all weather conditions. Although net radiometers are generally used in meteorology to measure radiation balance, the LP NET 07 can also be used to measure indoor radiant temperature (ISO 7726).

Working Principle

LP NET 07 is based on a thermopile sensor with one set of hot junctions in contact with the upper surface and a set of cold junctions in contact with the lower surface. The difference in temperature between the two receivers is proportional to the net radiation. Through the Seebeck effect, the difference in temperature between hot and cold junctions is translated into a Potential Difference. A hemispheric Tefl on®-coated dome protects the two receivers, and their particular shape allows an optimal cosine corrected response. The Tefl on® coating allows both a continuous outdoor use and a constant spectral response, ranging from the near ultraviolet (200nm) to the far infrared (100µm) spectral regions.

Installing and mounting the net radiometer for total irradiance measurements:

- To allow cleaning the two receiving surfaces regularly, LP NET 07 should be mounted in easily reachable places. The surfaces can be washed with plain water or pure ETHIL alcohol.
- Mount the instrument so that no shadow will be cast on it at any time of day and of the seasons, from obstructions such as buildings, trees, or any other obstacle.
- In the NORTHERN hemisphere, the net radiometer is normally oriented towards the SOUTH, while it should be oriented NORTHWARD, in the SOUTHERN hemisphere.
- The instrument should be mounted at least 1.5 meters above the ground surface. The fl ux on the downward facing sensor is representative for a circular area having a radius of 10 times the height.
- While mounting the net radiometer, avoid touching both receiving surfaces.

Electrical Connections and requirements for electronic readout devices:

- LP NET 07 does not require any power supply.

Calibration and measurements:

Net radiometer sensitivity, indicated as S (or calibration factor), allows determining the net radiant fl ux passing through a surface. S factor is measured in µV/(Wm-2).

- Once the potential difference (DDP) has been measured at sensor ends, Ee fl ux is obtained through the following formula:

Ee= DDP/S

where; Ee: indicates the radiant fl ux expressed in W/m2,
DDP: indicates the potential difference expressed in µV and measured by the multimeter,
S: indicates the calibration factor expressed in µV/(W/m2) and shown on the net radiometer label (calibration factor is also mentioned in the calibration report).

N.B. If the difference of potential (DDP) is positive, the radiation on the upper surface is higher than the radiation on the lower surface (it happens normally in daily hours); if DDP is negative, the radiation on the lower surface is higher that the one on the upper surface (it happens in nightly hours).
Each net radiometer comes factory calibrated and has its own calibration factor.Calibration is performed inside Delta Ohm Metrological Laboratory, and is carried out by comparison with a reference net radiometer, using a solar simulator as a light source. Calibration is performed using a parallel light beam..

ORDER CODES

MODEL	
LP PYRA 02	First class pyranometer according to ISO 9060. Complete with: shade disk LP SP1, desiccant sachet with silica-gel crystals, 2 cartridges, spirit level, 4-pole fl ying connector and Report of Calibration. Typical sensitivity 10µV/(W/m2).Connection cable hasto be ordered separately.
LP PYRA 02 AC	First class pyranometer according to ISO 9060. Complete with shade disk LP SP 1, desiccant sachet with silica-gel crystals, 2 cartridges, spirit level, 4-pole fl ying connector and Report of Calibration. Connection cable has to be ordered separately. Current output 4…20mA. 4mA = 0W/m2, 20mA = 2000W/m2. Power supply: 10…30Vdc.
LP PYRA 02 AV	First class pyranometer according to ISO 9060. Complete with shade disk LP SP 1, desiccant sachet with silica-gel crystals, 2 cartridges, spirit level, 4-pole fl ying connector and Report of Calibration .Connection cable has to ordered separately. Voltage output 0…1Vdc, 0…5Vdc, 0…10Vdc. 0V = W/m2, 1/5/10Vdc = 2000W/m2. Power supply: 10…30Vdc (15…30Vdc for models with output 0…10Vdc).
LP PYRA 03	Second class pyranometer according to ISO 9060. Complete with spirit level, 4-pole fl ying connector and Report of Calibration. Typical sensitivity 10µV/(W/m2). Connection cable has to be ordered separately.
LP PYRA 03 AC	Second class pyranometer according to ISO 9060. Complete with spirit level, 4-pole fl ying connector and Report of Calibration. Typical sensitivity 10µV/(W/m2). Connection cable has to ordered separately. Current output 4…20mA. 4mA = 0W/m2,
LP PYRA 03 AV	Second class pyranometer according to ISO 9060. Complete with spirit level, 4-pole fl ying connector and Report of Calibration. Typical sensitivity 10µV/(W/m2).Connection cable has to ordered separately. Voltage output 0…1Vdc, 0…5Vdc, 0…10Vdc. 0V = W/m2, 1/5/10Vdc = 2000W/m2. Power supply: 10…30Vdc (15…30Vdc for models with output 0…10Vdc).
LP PYRA 05	Albedometer made up of two 1st Class pyranometers, according to ISO 9060. Complete with: top shade disk and bottom shade disc, drying cartridge with silicagel crystals, 2 silica gel cartridges, spirit level, rod for attachment to a mast, and Report of Calibration. Typical sensitivity 10µV/(W/m2). The connection cable has to be ordered separately.
LP PYRA 06	Albedometer made up of two 2nd Class pyranometers, according to ISO 9060. Complete with: top shade disk and bottom shade disc, spirit level, rod for attachment to a mast, connecting cable 5m and Report of Calibration. Typical sensitivity 10µW/(W/m2). The connection cable has to be ordered separately..
LP PYRA 12	First Class Pyranometer (LP PYRA 02) according to ISO 9060. Complete with shade disk, shadow ring for diffuse radiation, drying cartridge for silicagel crystals, 2 silicagel cartridges and Report of Calibration. Typical sensitivity 10µV/(W/m2). Connecting cable has to be ordered separately.

ORDER CODES

MODEL	
LP PYRA 12 AC	First Class Pyranometer (LP PYRA 02) according to ISO 9060. Complete with shade disk, shadow ring for diffuse radiation, drying cartridge for silicagel crystals, 2 silicagel cartridges and Report of Calibration. Typical sensitivity 10µV/(W/m2). Connection cable has to ordered separately. Current output 4…20mA. 4mA = 0W/m^2, 20mA = 2000W/m^2. Power supply: 10…30Vdc.
LP PYRA 12 AV	First Class Pyranometer (LP PYRA 02) according to ISO 9060. Complete with shade disk, shadow ring for diffuse radiation, drying cartridge for silicagel crystals, 2 silicagel cartridges and Report of Calibration. Typical sensitivity 10µV/(W/m2). Connection cable has to ordered separately. Voltage output 0…1Vdc, 0…5Vdc, 0…10Vdc. 0V = W/m2, 1/5/10Vdc = 2000W/m2. Power supply: 10…30Vdc (15…30Vdc for models with output 0…10Vdc
LP NET 07	Net radiometer. Connecting cable: 5 m standard length. Different cable lengths upon request
LP S1	Mounting kit for LP PYRA 02: bracket for attachment to a mast, including fasteners and leveling screws.
LP S2	Mounting kit: spirit level and stud for mounting LP PYRA 03 on a support which is also part of the kit. Fasteners, shade disk LP SP2 are included.
LP SP1	Shade disk for LP PYRA 02
LP SP2	Shade disk
LP SP3	Bottom shade disk for albedometer LP PYRA 05 (downward pyranometer
LP SG	Drying cartridge with silicagel crystals, complete with O-ring.
LP G	Pack of 5 cartridges of silicagel.
CP AA 1.5	Flying -pole connector, complete with UV-resistant cable L=5m. For the instruments LP PYRA 02- LP PYRA 03
CP AA 1.10	Flying -pole connector, complete with UV-resistant cable L=10m. For the instruments LP PYRA 02- LP PYRA 03
CP AA 2.5	Flying 7-pole connector, complete with UV-resistant cable L=5m. For the instruments LP PYRA 05- LP PYRA 06 - LP UVB 02.
CP AA 2.10	Flying 7-pole connector, complete with UV-resistant cable L=10m. For the instruments LP PYRA 05- LP PYRA 06 - LP UVB 02.