Балансомеры DELTA OHM LPNET07

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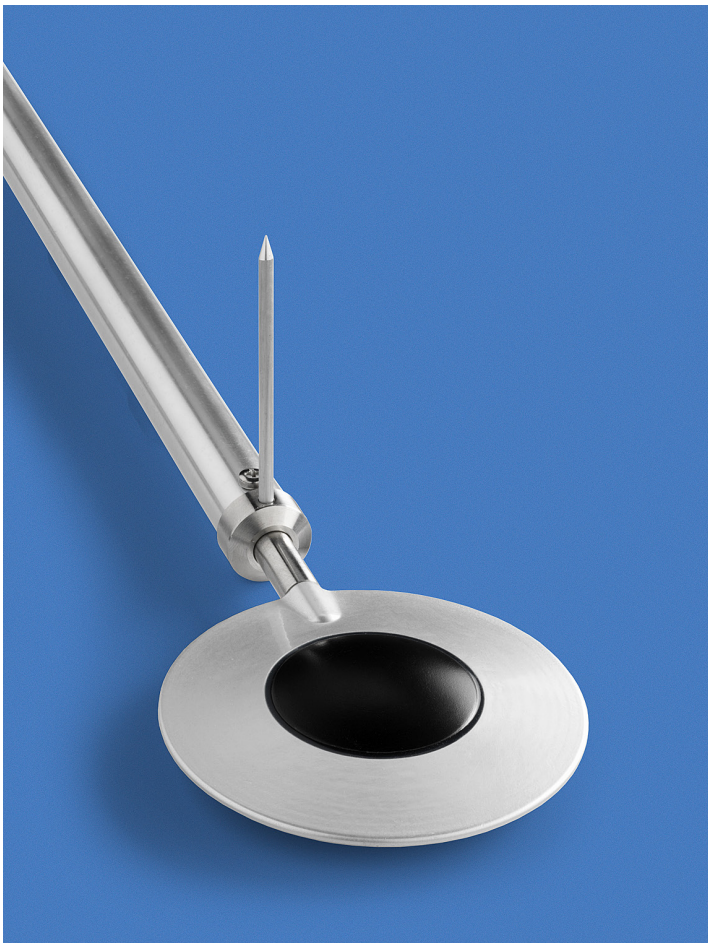
LPNET07



LPNET07
NET IRRADIANCE METER

LPNET07 measures the net radiation across a surface, from near ultraviolet to far infrared. The Net radiation is defined as the difference between the radiation that reaches the upper surface and the irradiation on the lower surface of the net radiometer. The surface of the upper receiver measures the direct solar radiation plus the diffuse one and the radiation at longer wavelengths emitted from the sky (clouds), while the lower receiving area measures the solar radiation reflected from the ground (albedo) and the radiation length wavelengths emitted from the earth.
The instrument is designed and constructed to be used outdoors in any weather conditions.
Besides its use in meteorology to measure energy balance, the LPNET07 can be used indoors for the measurement of radiant temperature (ISO 7726

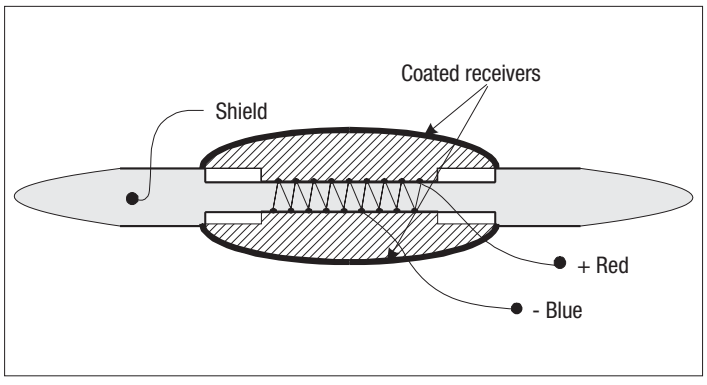


FIG. 1 - Wiring diagram.

Technical specifications	
Typical Sensitivity	10 µV/(W/m²)
Impedance	2 Ω ÷ 4 Ω
Measuring range	±2000 W/m²
Spectral range:	0.2 µm ÷ 100 µm
Working temperature	-40 °C ÷ 80 °C
Weight	0.35 kg
Response time (95%)	<60 s
Field of view	180° upper sensor 180° lower sensor

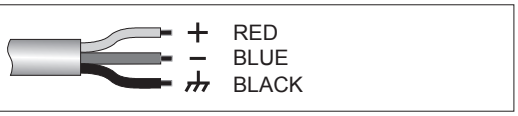
Working Principle

The net radiometer LPNET07 is based on a thermopile sensor whose warm joints are in thermal contact with the receiver while the upper cool joints are in thermal contact with the lower receiver. The temperature difference between the two receivers is proportional to the net irradiation. The temperature difference between hot and cold junction is converted into a voltage by Seebeck effect. The two receivers are made from a portion of spherical coated PTFE. The particular form of the two receivers provides a response in accordance with the cosine. The PTFE coating, as well as allowing outdoor installation for long periods without risk of damage, can have a constant spectral response from ultraviolet (200nm) up to far infrared (100 µm).

Installing and mounting the net radiometer for total irradiance measurements:

- To allow cleaning the two receiving surfaces regularly, LPNET07 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 SOUTH, while it should be oriented NORTHWARD, in the SOUTHERN hemisphere.
- The instrument should be mounted at a height of at least 1.5 m above the ground. Please note that the flow on the lower receiver is representative of a circular area with a radius of 10 times the height.
- When installing the net-radiometer avoid, wherever possible, to touch the surfaces of the receiving net-radiometer.

Connection Diagram LPNET07



Electrical Connections and requirements for electronic reading:

- LPNET07 does not require any power supply.
- It is available with a 5 m output cable
- It is supplied with a PTFE, UV resistant, braided shield and 2-wire cable. The colour code is as follows:
  black (shield) —> connected to the housing
  red —> (+) positive pole of the signal generated by the detector
  blue —> (-) negative pole of the signal generated by the detector
- It has to be connected to a millivoltmeter or to a data acquisition system with input impedance higher than 4000 Ω. Normally, the output signal from the net radiometer does not exceed ±20 mV. In order to grant the best performances in measurements, the instrument resolution should be of 1µV.

Maintenance:

In order to ensure a high measurement accuracy, it is necessary to keep the two receiving surfaces clean, the higher the frequency of cleaning, the best measurement accuracy will be.
Cleaning can be done with normal tissue for the cleaning of lens and water, if not enough, just use pure ethyl alcohol. After cleaning with alcohol it is necessary to clean the domes again with water only.
We strongly recommend to calibrate LPNET07 annually. The calibration can be carried out by comparison with another net-radiometer sample in the field. The field calibration is less precise than a calibration performed in the laboratory but has the advantage of not having to remove the instrument from its housing.

Calibration and measurements:

Net radiometer sensitivity, indicated as S (or calibration factor), allows determining the net radiant flow passing through a surface. **S factor is measured in μV/(Wm^{-2}).**
Measured the potential difference (DDP) at the ends of the flow probe is obtained by the following formula E_e

$$E_e = DDP/S$$

where;
E_e: indicates the radiant flux expressed in W/m^2,
DDP: indicates the potential difference expressed in μV and measured by the multimeter,
S: indicates the calibration factor expressed in μV/(W/m^2) 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 (typically during daylight hours); if DDP is negative, the radiation on the lower surface is higher that the one on the upper surface (typically at night).

Each net-radiometer is individually calibrated at the factory and is distinguished by its calibrator factor.
Calibration is performed inside Delta OHM Metrological Laboratory and performed with a net radiometer-reference with a solar simulator as the source of light. Calibration is performed with a beam of light in parallel.

Sensitivity to wind speed:

At the same radiant flux, by increasing the wind speed decreases the net radiometer output signal will (sensitivity decrease by increasing wind speed).
Measurements taken inside the wind tunnel, have shown that S_V sensitivity, related to the wind speed for LPNET07, can be corrected by using the following functions:

$S_v=S_0(1-0.011\times V)$ per V≤10m/s
$S_v=S_0(0.95-0.006\times V)$ per 10m/s<V<20m/s

Where: S_0 = sensitivity at zero wind speed
V = wind speed in m/s

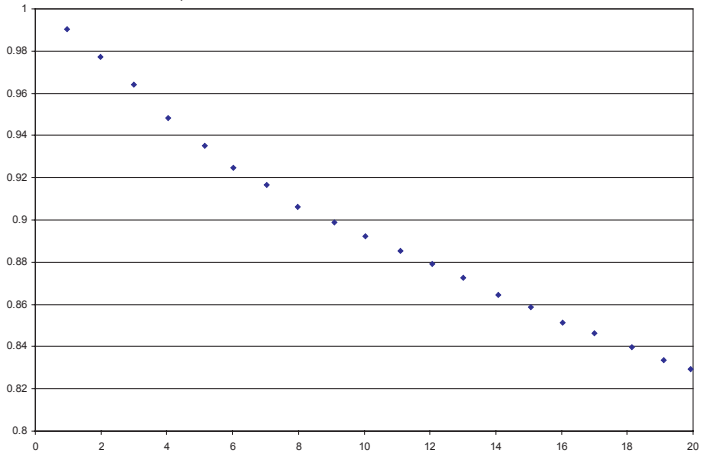


Fig. 2 - Calibration factor related with wind speed

Once we know both the net radiation - calculated through the sensitivity at zero wind speed (F_{net_0}) - and the wind speed in (V) in m/s, the correct data is obtained by using the following formula:

$F_{net}=F_{net\_0}/(1-0.011\times V)$ per V≤10m/s
$F_{net}=F_{net\_0}/(0.95-0.006\times V)$ per 10m/s<V<20m/s

Cosine response/Directional error:

The radiation falling on a surface should be measured with a sensor, whose response related to the light incidence angle, has to be a Lambertian Response. A receiver is known as Lambertian when its sensibility (S_ϑ), related to the incidence angle between the light and the detector surface, has the following behavior:

$$S_\vartheta = S_0 \cos(\vartheta)$$

Where: S_0 is the sensitivity when light strikes perpendicular to the surface, ϑ is the angle between the incident light beam and the line which is normal to the surface.

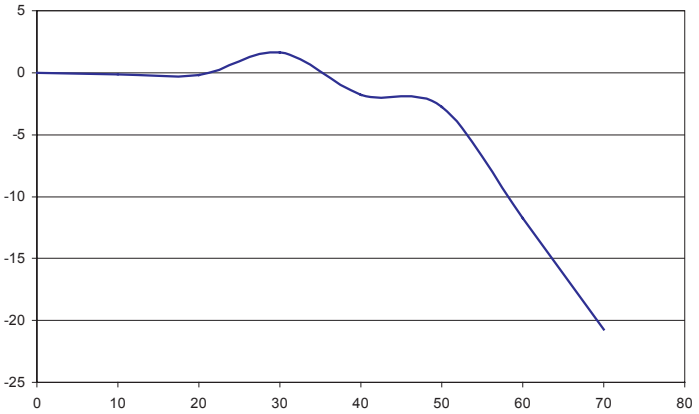


Fig. 3 - Typical behaviour of the error related to the angle of incidence.

ORDERING CODES:

LPNET07: Net radiometer. Connecting cable: 5 m standard length, complete with Ø 16x500 rod for attachment to a mast Different cable lengths upon request.

HD978TR3: Configurable signal converter amplifier with 4…20 mA (20…4 mA) output. Input measuring range -10…+60 mV. Default setting 0…20 mV. 2-module DIN housing. Minimum measuring range 2 mV.

HD978TR5: Wall configurable, signal converter amplifier with 4…20 mA (20…4 mA) output. Input measuring range –10…+60 mV. Default settings 0…20 mV. Minimum measuring range 2mV. Wall mouting.

HD978TR4:Configurable signal converter amplifier with 0…10 Vdc (10…0 Vdc) output. Input measuring range -10…+60 mV. Default setting 0…20 mV. Minimum measuring range 2 mV. 2-module DIN housing.

HD978TR6: Wall configurable, signal converter amplifier with 0…10 Vdc (10…0 Vdc) output. Input measuring range –10…+60 mV. Default settings 0…20 mV. Minimum measuring range 2 mV. Wall mouting.

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