

Calibration Certificate

No. 2009-C-33

Calibration Item

Pyranometer

Manufacturer	Eppley
Type	PSP
Serial Number	26953F3

Customer

Optimare Sensorsystem AG
Am Luneort 15 a
27572 Bremerhaven
Germany

Calibration Mark

Label 2009-C-33

Period of Calibration

2009 July 2, 13, 16, 20, 27 - 30, August 5, 6

Davos Dorf, 7 August 2009



C. Thomann
In charge of calibration



Dr. W. Finsterle
Head WRC section solar radiometry



PMOD/WRC follows the requirements for the competence of testing and calibration laboratories according to ISO/IEC 17025. PMOD/WRC is a designated institute of the Swiss Federal Office of Metrology, the Swiss signatory of the CIPM MRA (International Committee for Weights and Measures - Mutual Recognition Arrangement).

Calibration certificates without signature are not valid. This calibration certificate shall not be reproduced except in full, without the written approval of the Physikalisch-Meteorologisches Observatorium Davos and World Radiation Center.

Certificate No. 2009-C-33

Calibration procedure

This pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The direct solar radiation is determined using the PMO2, member of the World Standard Group (WSG) and the diffuse radiation is measured using the shaded standard pyranometer of the World Radiation Center (WRC). The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588m). The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is $\pm 0.3\%$.

The inclination of the receiver surfaces versus their horizontal position were set to 0.0 degrees, the instrument signal wire to the north. During the comparisons, the instrument received global radiation intensities ranging from 636 W/m² to 957 W/m², with a mean of 832 W/m². The angle between the solar beam and the normal of the receiver surface varied from 27.7 degrees to 50.0 degrees, with a mean of 37.5 degrees. The ambient temperature ranged from 13.8 °C to 24.0 °C, with a mean of 21.0°C. The sensitivity calculation and the single measurements deviation (σ) are based on 786 individual measurements. The obtained sensitivity value is valid for similar conditions.

Calibration results

Sensitivity: $S = 8.98 \mu\text{V} / (\text{Wm}^{-2})$

Uncertainty: $u = \pm 0.12 \mu\text{V} / (\text{Wm}^{-2})$

The reported expanded uncertainty of measurements is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Calibrations Remarks

Reference: WRR represented by the absolute pyrliometer: PMO2
WRR-Factor of PMO2: 0.998618
(from the last International Pyrliometer Comparison, IPC-2005
Diffuse radiation: Pyranometer CM22 S.N. 020059 with calibration factor: 8.91
(Ventilated with heated air, automatic shading disk, instrument-wire to the north)

Comments

Instrument Condition: The calibration item was received fully functional and did not show any erratic behavior or irregularities during calibration.