KIPP & ZONEN
SINCE 1830

CALIBRATION CERTIFICATE
PAR QUANTUM SENSOR

CERTIFICATE NUMBER	5755110340
SENSOR MODEL	PQS 1
SERIAL NUMBER	110340
SENSITIVITY	4.61 µV/µmol/s•m² at normal incidence and solar radiation at airmass 1.5
IMPEDANCE	240 Ohm
TEMPERATURE	22 ±2 °C
REFERENCE PYRANOMETER	Kipp & Zonen PQS 1 sn REF 2
CALIBRATION DATE	18/11/2011 (recalibration is recommended every two years)
IN CHARGE OF TEST	J.P. Vink

Calibration procedure

Exact interchange of test PQS 1 and reference PQS 1 in a horizontal parallel beam of filtered light (NIR reducing filter) from a Xenon lamp. The photosynthetic photon flux density was approx. 400 µmol/s.m2. The instrument temperature was approx. 25 °C.

Hierarchy of traceability

The reference PQS 1 has been calibrated on 7 July 2010 against a standard of known spectral irradiance, the 1000 W DXW tungsten halogen lamp OL 200A-H-S, S-961 supplied by Optronics Laboratories Inc. The standard lamp S-961 has been calibrated with a filter radiometer at the Metrology Research Institute of the Helsinki University of Technolgy (HUT) on 12 June 2009 for a vertical distance of 412.5 mm and a lamp current of 8.0000 A. The trapdetector (UVFR-8) of the filter radiometer is traceable to the cryogenic electrical substitution radiometer of SP,Sweden.

The calibration of the reference PQS 1 was done at Kipp & Zonen with a lamp current of 8.0000 ±0.0005 A. The instrument was placed at a vertical distance of 412±5 ±1 mm between lamp filament and PQS 1 diffuser surface. The theoretically calculated PAR irradiance at the diffuser surface should be 231.7 µmol/s.m2. A trend (growth) interpolation is done between the spectral irradiance values supplied at intervals of 50 nm. The instrument temperature was approx. 30 ±5 °C.

Correction applied

Correction for false NIR-response during calibration of the reference PQS 1 is necessary. With a RG780 cut-on filter, covering the PQS 1, the response to the abundant NIR radiation in the lamp spectrum was measured. The response on NIR is divided by 0.917 to correct for the reflection losses of the filter. (Fortunately the amount of NIR is negligible during calibration of production PQS 1's in the beam of a Xenon lamp, because of the NIR-absorbing heat filter).The three measured sensitivities were 4.415, 4.408 and 4.401 with a mean of: 4.408 µV/µmol/s.m².

A second correction factor of 0.993 is applied to this sensitivity figure to give proper µmol/s.m2 results under hemispherical sunlight at airmass 1.5. This is necessary because of the non-ideal quantum-response curve of the PQS 1. The correction is calculated by convoluting the spectral response of an ideal PAR sensor and of the PQS 1 sn REF 2 with resp. the DXW lamp spectrum and the airmass 1.5 spectrum. The airmass 1.5 spectrum is taken from the international standard ISO 9845-1 and also with this radiation spectrum the false NIR response is negligible.
The sensitivity of the reference PQS 1 for AM1.5 radiation is: 4.38 µV/µmol/s.m2

Notice

The calibration certificate supplied with the instrument is at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

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