

CERTIFICATE NUMBER	009920140049
PYRHELIOMETER MODEL	CHP 1
SERIAL NUMBER	140049
SENSITIVITY	7.85 $\mu\text{V}/\text{W}/\text{m}^2$
IMPEDANCE	25 $\Omega$
TEMPERATURE	22 $\pm$ 2 $^{\circ}\text{C}$
REFERENCE PYRHELIOMETER	Kipp & Zonen CHP 1 sn REF2 active from 01 January 2014
CALIBRATION DATE	28 February 2014

**Calibration procedure**

Exact interchange of test pyrheliometer and reference pyrheliometer in a horizontal parallel beam of light from a Xenonlamp. Full collimation angle of beam is 1.0°. Irradiance  $500 \pm 50 \text{ W}/\text{m}^2$ . Roomtemperature 22  $\pm$  2  $^{\circ}\text{C}$ .

**Hierarchy of traceability**

This reference pyrheliometer was compared with the reference radiometer PMO2 of the World Radiation Center (WRC) using the sun as source. The reference radiometer is periodically calibrated against the World Standard Group (WSG), maintained at the WRC Davos. 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 measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588 m above sea level).

During the comparisons, the reference pyrheliometer received direct solar radiation with intensities ranging from 831 to 1001  $\text{W}/\text{m}^2$ , with a mean of 945  $\text{W}/\text{m}^2$ . The ambient air temperature ranged from +16 to +26.2  $^{\circ}\text{C}$  with a mean of +20.9  $^{\circ}\text{C}$ . The sensitivity calculation is based on 473 individual measurements. The sensitivity and its expanded uncertainty (95% level of confidence) are only valid for similar environmental conditions and amount:  $7.93 \pm 0.02 \mu\text{V}/\text{W}/\text{m}^2$ .

WRR- factor of PMO2: 0.998623 (from the last international Pyrheliometer Comparison, IPC-2010).

Dates of measurements: 7, 8, 13, 17, 18, 21 June 2013

**Correction applied 0.0%**

No correction to the Davos sensitivity figure has been applied.

**Justification of total instrument calibration uncertainty**

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CHP 1 as given by the World Radiation Center in Davos is  $\pm 0.02/7.93 = \pm 0.25\%$ . (See traceability text).

2. Based on experience the expanded uncertainty of the transfer procedure (calibration by non-simultaneous comparison) is estimated to be  $\pm 1.0\%$ .

The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.25^2 + 1.0^2)} = \pm 1.03\%$ .

**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.

Delft, The Netherlands, 28 February 2014



J. Mes  
(in charge of calibration facility)



W. Spronkers  
(in charge of test)

## MEASUREMENT REPORT

### PYRHELIOMETER

Routine measurement of temperature dependency during final inspection.

DATE OF MEASUREMENT : 03/03/2014

PERFORMED BY : F. de Wit

PYRHELIOMETER TYPE : CHP 1

SERIAL NUMBER : 140049

**PROCEDURE:**

The pyrliometer is mounted inside the climate chamber and illuminated with a white light source under normal incidence. A CMP22 pyranometer outside the chamber is used to monitor lamp stability.

The pyrliometer is tested in a temperature range over 50 °C down to -20 °C in steps of 10 °C. The relative temperature dependency is plotted below

