

DR02

Fast response first class pyrheliometer

DR02 is a high accuracy direct (normal incidence) solar radiation sensor with a short response time. The scientific name of this instrument is pyrheliometer. DR02 complies with the first class specifications of the ISO 9060 standard and the WMO Guide. Its fast response makes it very suitable for PV (photovoltaics)-related applications. DR02 pyrheliometer has a heated window and is used in tracker-mounted operation.



Figure 1 DR02 fast response first class pyrheliometer showing its polished quartz window assembly with heater



Figure 2 pyrheliometers and pyranometers on a tracker

Introduction

DR02 is a solar radiation sensor that is applied in high accuracy measurement of the solar radiation received by a plane surface from a 5 ° full field of view angle. This quantity, expressed in W/m^2 , is called "direct" solar radiation or direct normal irradiance (DNI). Pyrheliometers like DR02 are generally employed outdoors under the sun. It is necessary to keep the instrument pointed at the sun by using a two-axis tracker.

Due to its short response time, DR02 is ideally suited for concentrated PV or concentrated thermal applications, where it will match the response time of the panel or receiver. Typical DR02 applications are solar energy resource assessment and system performance monitoring (in particular for concentrated solar energy), scientific solar climate observations and outdoor material testing.

Benefits and operation

Besides its short response time, DR02 offers more advantages over competing models: DR02 window assembly is equipped with a heater which increases data availability, for instance by reducing measurement errors caused by (early-morning) dew deposition. DR02 can be connected directly to commonly used data logging systems. The irradiance in W/m^2 is calculated by dividing the instrument output, a small voltage, by the sensitivity. This sensitivity is provided with DR02 on its product certificate. DR02 pyrheliometer is optionally equipped with a temperature sensor and is optionally characterised for its temperature dependence. This can be used to increase the accuracy of the measurement.

Standards

Applicable instrument classification standards are ISO 9060 and WMO-No. 8. Calibration is traceable to WRR (World Radiometric Reference)

Uncertainty evaluation

The uncertainty of a measurement under outdoor conditions depends on many factors. Guidelines for uncertainty evaluation (according to the "Guide to Expression of Uncertainty in Measurement" or GUM) can be found in our manuals. We provide spreadsheets to assist in the process of uncertainty evaluation of your measurement.

DR02 design

The pyrheliometer features a precision ground and polished quartz window, a collimated tube and a thermopile sensor with black coated surface. DR02 also features a thermally isolated low power heater in the window assembly.



Figure 3 DR02 fast response pyrheliometer side view

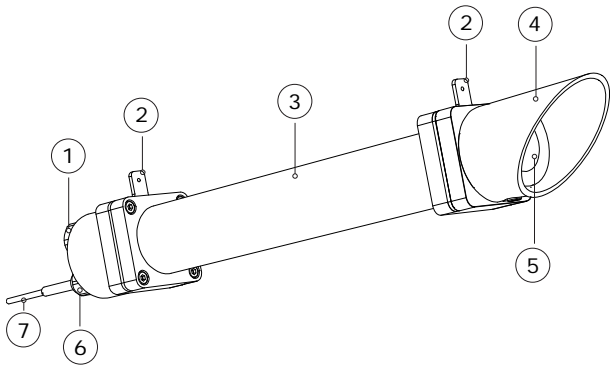


Figure 4 overview of DR02:
(1) humidity indicator, (2) sights, (3) aperture tube, (4) protection cap, (5) window assembly with heater, (6) cable gland, (7) cable

Suggested use

- outdoor PV / CPV and CSP system performance monitoring
- solar energy surveys
- solar resource assessments
- meteorological networks

See also

- **DR01** first class pyrheliometer
- **DR03** compact fast response pyrheliometer
- view our complete [product range of solar sensors](#)

DR02 specifications

Measurand	direct solar radiation
ISO classification	first class pyrheliometer
Response time (95 %)	2 s (nominal)
Total sensor length including cap	380×10^{-3} m
Full field of view angle	5 °
Slope angle	1 °
Calibration uncertainty	< 1.2 % (k = 2)
Measurement range	0 to 4000 W/m ²
Spectral range (50 % transmission points)	200 to 4000 $\times 10^{-9}$ m
Sensitivity (nominal)	10×10^{-6} V/(W/m ²)
Rated operating temperature range	-40 to +80 °C
Temperature response	< ± 1 % (-10 to +40 °C)
Temperature response *	< ± 0.4 % (-30 to +50 °C) with correction in data processing
Window assembly with heater	12 VDC, 0.5 W
Standard cable length	5 m (see options)

* if opted for internal temperature sensor + temperature dependence characterisation (see options)

Options

- longer cable, in multiples of 5 m, cable lengths above 20 m in multiples of 10 m
- internal temperature sensor
- temperature dependence characterisation

About Hukseflux

Hukseflux Thermal Sensors offers measurement solutions for the most challenging applications. We design and supply sensors as well as test & measuring systems, and offer related services such as engineering and consultancy. With our laboratory facilities, we provide testing services including material characterisation and calibration. Our main area of expertise is measurement of heat transfer and thermal quantities such as solar radiation, heat flux and thermal conductivity. Hukseflux is ISO 9001:2008 certified. Hukseflux sensors, systems and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

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