

DR20-A1 & DR15-A1

Analogue spectrally flat Class A & B pyrheliometers, with heating

DR20 and DR15 are high-accuracy direct (normal incidence) solar radiation sensors, or pyrheliometers. DR20 complies with the Class A, and DR15 with the Class B specifications of the ISO 9060:2018 standard. These instruments are used in tracker-mounted operation, and offer analogue millivolt outputs. Both pyrheliometers have superior window heating that leads to high data availability.



Figure 1 DR20 Class A / DR15 Class B pyrheliometer: the external housing of these instruments is identical.



Figure 2 the importance of heating: tracker-mounted operation of heated DR15-A1 and DR20-A1 pyrheliometers, here being installed with heated SR15-A1 pyranometers. The data availability of non-heated instruments suffers in almost all environments due to morning dew and frost.

Introduction

Hukseflux model DR15 pyrheliometer is an ISO 9060 spectrally flat Class B (old ISO classification “first class”) instrument. It replaces the models DR01, DR02 and DR03. DR20 is a new Class A instrument. It has a better temperature response than DR15. Both instruments offer the highest accuracy and highest data availability, featuring window heating at low offsets. At the same heating power, the heating has been improved with a factor 4, at a 4 times lower offset!

DR20 and DR15 are 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 DNI (direct normal irradiance). It is necessary to keep the instrument pointed at the sun by using a two-axis tracker.

Heated for high data availability

High data availability is attained by heating of the front window. This suppresses dew and frost deposition at a very low power consumption: DR20 / DR15 needs only 1 W to keep its window free from dew and frost.

Liabilities covered: test certificates

As required by ISO 9060 for Class A classification, each DR20 is supplied with test results for the individual instrument:

- sensitivity
- response time
- temperature response

DR15 certificates include sensitivity and response time only.

DR20 and DR15 use

A pyrheliometer is used in tracker-mounted operation. DR20-A1 and DR15-A1 can be connected directly to commonly used data logging systems. They offer analogue outputs in the millivolt range.

DR20 and DR15 design

The pyrheliometer features a precision ground and polished quartz window, a compact sized collimated tube and a thermopile sensor with black coated surface.

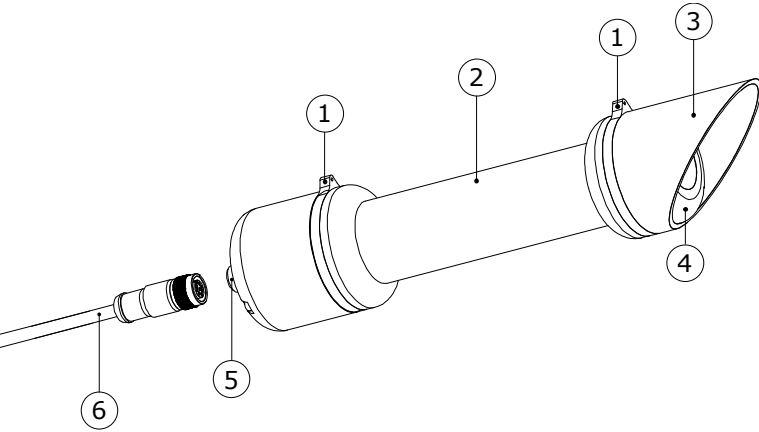


Figure 3 overview of DR20 / DR15:
 (1) sights, (2) aperture tube, (3) protection cap, (4) window assembly with heater, (5) connector, (6) cable

Suggested use

- solar energy surveys
- solar resource assessments
- meteorological networks
- sites with dew and frost problems

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.



Figure 4 DR20 / DR15 pyrheliometer side view

DR20 and DR15 specifications

Measurand	direct solar radiation
ISO classification	spectrally flat pyrheliometer DR20: Class A DR15: Class B
Calibration uncertainty	< 1.2 % (k = 2)
Heating	included
Heater	1 W at 12 VDC
Response time (95 %)	4 s
Full field of view angle	5 °
Slope angle	1 °
Zero offset	< ± 1 W/m ²
Calibration traceability	to WRR
Analogue output	millivolt
Spectral range	200 to 4000 x 10 ⁻⁹ m
Rated operating temperature range	-40 to +80 °C
Temperature response	DR20: < ± 0.5 % (-10 to +40 °C) with correction in data processing: < ± 0.4 % (-30 to +50 °C) DR15: < ± 1 % (-10 to +40 °C)
Calibration certificate	included
Temperature response test of individual instrument	DR20: report included DR15: no report
Cable length	5 m

See also

- [DR30-D1 digital pyrheliometer](#) with heating, internal tilt sensor and humidity measurement
- view our complete [product range of sensors](#)



Figure 5 DR20 / DR15 pyrheliometer front view

DR20 and DR15 user benefits

Using DR20 / DR15 pyrheliometers offer significant benefits over the use of competing models. The pyrheliometers offer the highest accuracy and highest data availability, featuring heating at low offsets. The advantages of having a heater are demonstrated in the following graphs:

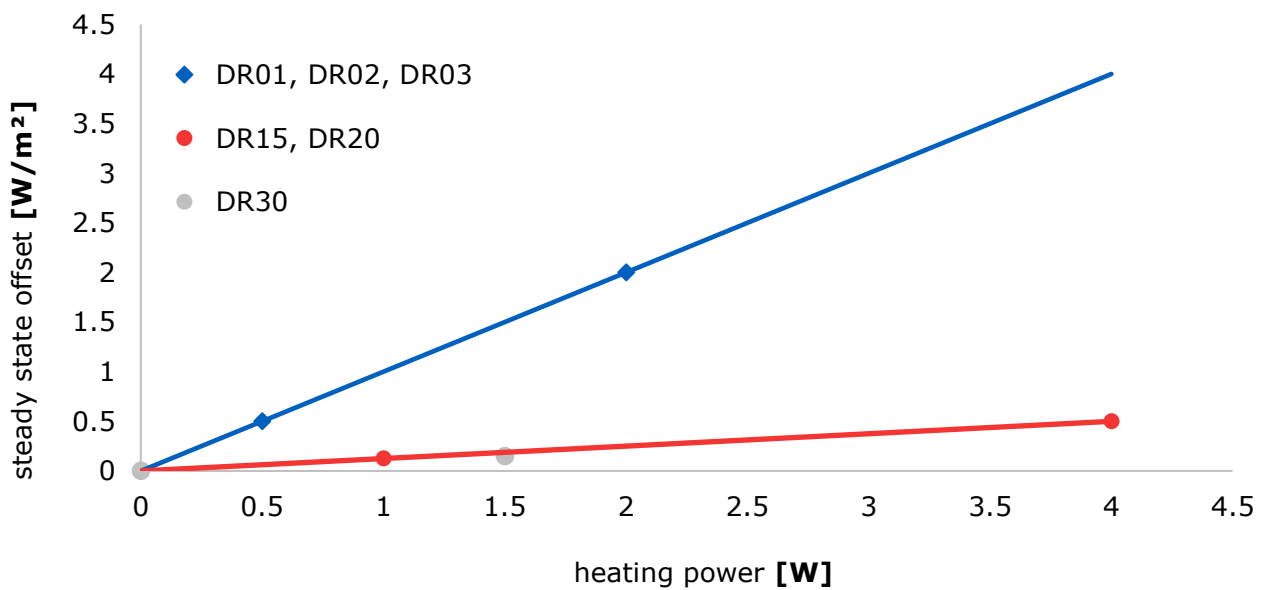


Figure 6 the offset of the latest models DR20, DR15 (and also the digital DR30) when heating, is much improved relative to the older DR01, DR02 and DR03 models. DR20 and DR15 have a 12 VDC, 1 W heater which produces a negligible offset. The older models had offsets of the order of 1 W/m² at the same heating level. In addition, the temperature of the front window of DR20 and DR15 is 4 times higher than that of the older models, at the same heating power.

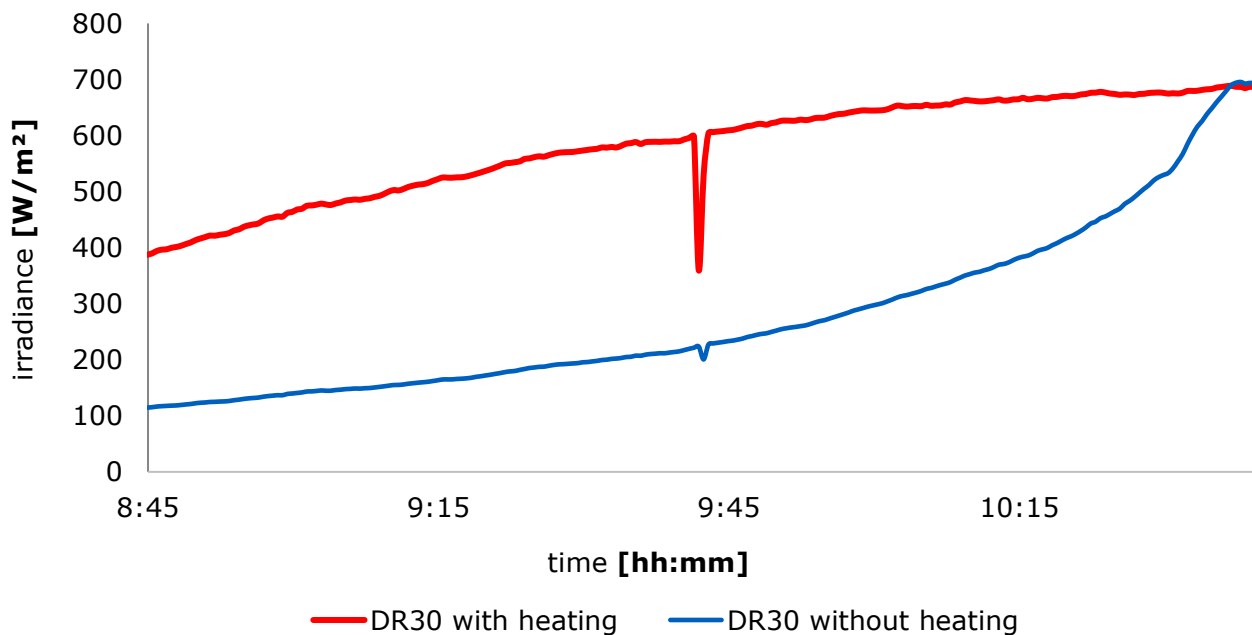


Figure 7 comparison of the measured data with and without heating on a typical winter morning, using model DR30 which has the same heating as DR20 and DR15. The unheated DR30 has dew on its front window and strongly underestimates the incoming irradiance. At around 10:30 the dew evaporates. Real measured data from Delft, the Netherlands.

About Hukseflux

Hukseflux Thermal Sensors offers measurement solutions for the most challenging applications. Hukseflux sensors, systems and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

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