HUKX

Sensor
Technology

Brochure

Digital Class A
pyrheliometer

DR30-D1

DR30-D1
Digital Class A pyrheliometer

with heating and tilt sensor

DR30-D1 is Hukx's most advanced digital sensor for direct (normal incidence) solar radiation. This high-accuracy pyrheliometer complies with Class A specifications set by ISO 9060 and the WMO Guide. It features superior window heating that leads to high data availability and an internal tilt sensor to verify tracker performance.

Welcome to the next level in solar radiation monitoring! The all-digital DR30-D1 pyrheliometer offers the highest accuracy and data availability, featuring window heating at low offsets. At the same heating power, the heating has been improved by a factor of 4, at just a quarter of the offset! With on-board tilt and humidity sensors, the DR30-D1 is purpose-built for high-accuracy measurement of direct solar radiation—also known as Direct Normal Irradiance (DNI)—received by a plane surface from a 5 ° full field of view angle. DNI is expressed in W/m^2. For optimal results, the instrument must be mounted on a two-axis tracker to stay pointed at the sun.

Figure 1 DR30-D1 digital Class A pyrheliometer, with built-in heating and a tilt sensor.

Heated for high data availability

High data availability is attained by heating the front window, which suppresses dew and frost deposition.

– low power consumption: DR30-D1 only needs 2 W to keep its window free from dew and frost.

Remote sensor diagnostics

In addition to solar irradiance, DR30-D1 outputs sensor diagnostics such as:

– tilt angle
– internal humidity
– heater current

Remote diagnostics permit real-time status monitoring, reducing the need for (un)scheduled field inspections.

Liabilities covered: test certificates

Each DR30-D1 digital pyrheliometer is supplied with test results for the individual instrument:

– sensitivity
– response time
– temperature response
– tilt angle measurement

Instrument use

The DR30-D1 pyrheliometer is designed for tracker-mounted operation. It connects directly to commonly used data logging systems and offers a digital output via Modbus RTU over 2-wire RS-485.

DR30-D1 design

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

Suggested use

– solar energy surveys
– solar resource assessments
– meteorological networks
– sites with dew and frost issues

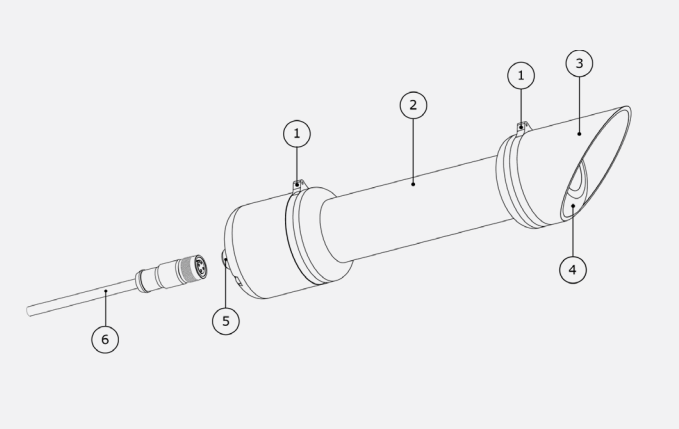

Figure 3 Overview of DR30:
1. sights
2. aperture tube
3. protection cap
4. window assembly with heater
5. connector
6. cable

Figure 2 The importance of heating: tracker-mounted operation of DR30-D1 pyrheliometer (on the right) compared to a non-heated instrument (on the left). The data availability of the non-heated instrument suffers in almost all environments due to morning dew, rime, and frost.

Options

– longer cable; 10 and 20 meters
– 20 meters extension cable with 2 connectors

Hukseflux Sensor Manager software

For communication between a PC and DR30-D1, Hukseflux Sensor Manager software can be used. It allows you to plot and export data, change the DR30-D1's Modbus address and communication settings, and view digital outputs for sensor diagnostics.

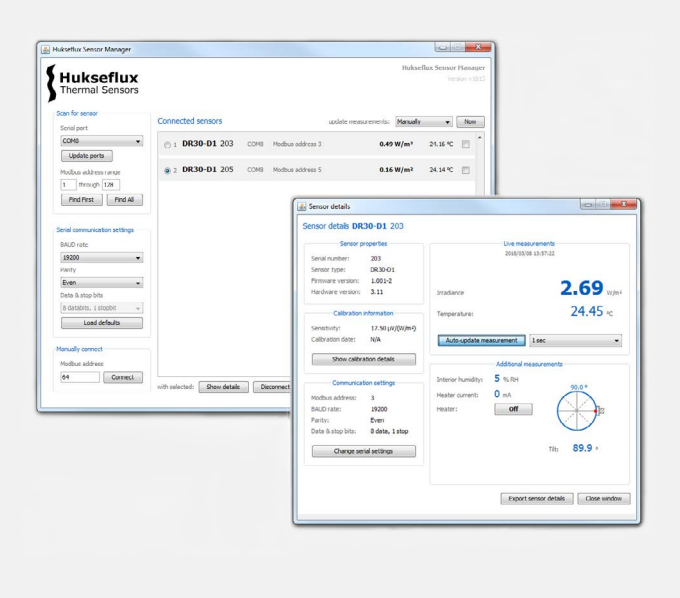

Figure 4 User interface of the Hukseflux Sensor Manager, showing sensor diagnostics.

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 you in evaluating the uncertainty of your measurements

See also

– DR20-A1 and DR15-A1 analog, spectrally flat Class A & B pyrheliometers, with heating
– View our complete product range of sensors.

Figure 5 DR30-D1 digital pyrheliometer front view.

DR30-D1 user benefits

Using the DR30-D1 digital pyrheliometer offers significant benefits over competing models. The all-digital DR30-D1 pyrheliometer offers the highest accuracy and highest data availability, featuring heating at low offsets and on-board tilt and humidity sensors. The advantages of having a heater and tilt sensor are demonstrated in the following graphs:

Figure 6 DR30-D1 digital pyrheliometer side view.

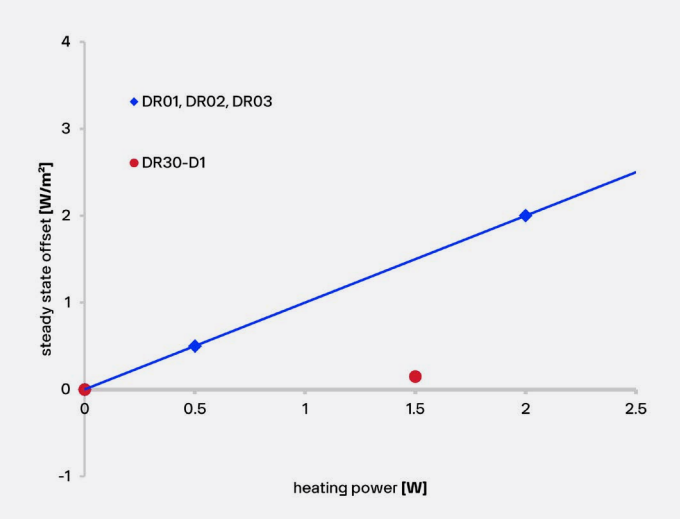

Figure 7 The offset of DR30-D1 when heating is significantly improved compared to the older DR01, DR02, and DR03 models. DR30-D1 has a 1.5 W heater and produces a negligible offset. The older models had offsets of the order of 2 W/m² at the same heating levels. In addition, the temperature of DR30-D1's front window is 4 times higher than that of the older models at the same heating power.

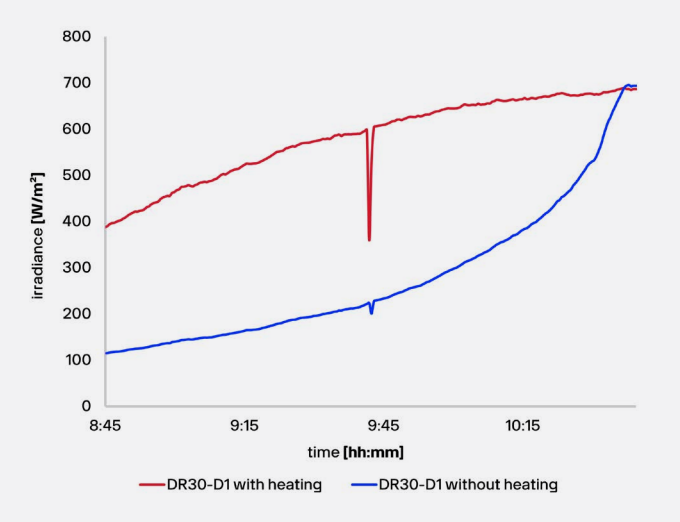

Figure 8 Comparison of measured data with and without heating on a typical winter morning. The unheated DR30-D1 has dew on its front window, which causes a significant underestimation of incoming irradiance. At around 10:30, the dew evaporates. Real measured data from Delft, the Netherlands.

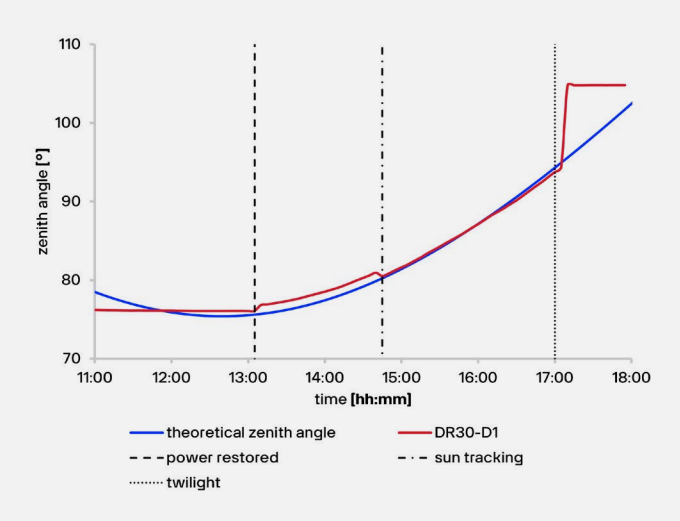

Figure 9 Example of the DR30-D1 tilt sensor being used for tracker performance monitoring: the red line is the output of the DR30-D1 tilt sensor, and the blue line is the theoretical zenith angle. There is a power failure before 13:00; at that time power is restored. Tracking between 13:00 and 15:00 is under cloudy conditions, based on GPS information only and slightly off. Tracking from 15:00 onwards is under sunny conditions and based on the tracker's sun sensor. The tracker moves to its rest position shortly after 17:00. Real measured data from Delft, the Netherlands.

DR30-D1 specifications

General specifications

measurand	direct solar radiation
ISO classification	spectrally flat Class A pyrheliometer
calibration uncertainty	< 1.2 % (k = 2)
measurand	sensor tilt angle
tilt measurement uncertainty	± 1 ° (0 to 180 °)
heating	included
response time (95 %)	4 s
full field of view angle	5 °
slope angle	1 °
power consumption – standard operating mode – low power operating mode	 2 W 0.1 W
zero offset a (5 K/hr)	< ± 1 W/m²
calibration traceability	to WRR
spectral range	200 to 4000 x 10^{-9} m
rated operating temperature range	-40 to +80 °C
temperature response	< ± 0.4 % (-30 to +50 °C)
temperature response test of individual instrument	report included
tilt sensor test of individual instrument	report included
rated operating voltage	7 to 30 VDC
standard cable length	5 m

Digital communication

digital output	– irradiance in W/m² – instrument body temperature in °C – tilt angle in ° – internal humidity in %
communication protocol	Modbus
transmission mode	RTU
hardware interface	2-wire (half duplex) RS-485

About Hukx

Hukx is the leading innovator in solar radiation and heat flux sensor technology. We are proud to set the standard in high-accuracy measurement, and to be working at the heart of the energy transition.

Customers worldwide rely on our bestselling pyranometers, pyrheliometers, and heat flux sensors. From sensor design and selection to supply and recalibration, we support you across the entire lifecycle.

Hukx is headquartered in the Netherlands, with locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia, and Japan.

Let us help you select the best sensor for your application.
Get in touch with our experts today via: info@hukx.com

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