

# SR30-M2-D1

Digital Class A pyranometer with heating and tilt sensor

*Introduced in 2017, SR30 is now the market leading Class A pyranometer for PV system performance monitoring. It is employed where the highest measurement accuracy is required.*

- the first pyranometer compliant in its standard configuration with the IEC 61724-1 Class A requirements
- heated for best data availability: RVH™ technology outperforms traditional pyranometer ventilation
- lowest total cost of ownership: supported by a worldwide calibration organisation
- calibrated tilt sensor complying with IEC 61724-1 requirements for single-axis tracker monitoring
- spectrally flat: WMO compliant, also suitable for Plane of Array, diffuse, and albedo measurement



**compliant with IEC 61724-1 Class A**

**with heating**

**calibrated tilt sensor**

**Figure 1** SR30: the market leading spectrally flat Class A pyranometer with heating and tilt sensor.



**Figure 2** To reduce total cost of ownership: make use of the worldwide Hukseflux calibration organisation.

## Introduction

Welcome to the next level in solar radiation monitoring! The all-digital heated SR30-M2-D1 offers the highest accuracy and highest data availability: it outperforms pyranometers equipped with traditional ventilation systems. After introduction in 2017, SR30 was rapidly recognised as the ideal instrument for use in PV system performance monitoring, and is increasingly used in meteorological networks as well.

SR30 is an ISO 9060 spectrally flat Class A pyranometer. It measures the solar radiation received by a plane surface, in W/m<sup>2</sup>, from a 180 ° field of view angle. SR30 offers many advantages over competing pyranometers.

### PV system performance monitoring: IEC 61724-1 Class A compliant

SR30 complies, without the need for additional accessories, with IEC requirements. It includes heating for dew and frost mitigation. The instrument has 2 heating modes; normal at < 3 W, and medium at < 0.65 W power.

### Lowest total cost of ownership

Customers prefer Hukseflux pyranometers for their unsurpassed measurement accuracy and their lowest total cost of ownership. Total costs are mainly determined by costs of installation, on-site inspections, servicing and calibration:

- pyranometers must be calibrated every 2 years. Such recalibration is considered good practice for any measuring instrument and is required by ISO, IEC and WMO standards covering PV system performance - and meteorological monitoring. Cost of recalibration, however, can be high. Hukseflux' worldwide calibration organisation will help you reduce these costs. Learn more about Hukseflux [pyranometer calibration services](#).
- low demand on infrastructure: for heating SR30's RVH™ requires less than 3 W power, compared to 10 W for traditional ventilation systems
- reduction of unnecessary on-site inspection by remote diagnostics
- reduction of unnecessary repair costs using a dome protector (see below)

### New (from April 2023): supplied with Dome Protector DP01

Damaged domes used to be a significant cause of pyranometer malfunction. The DP01 Dome Protector:

- mitigates the risk of damage to the pyranometer dome
- reduces unnecessary repair costs

We recommend to use DP01 during initial transport and installation at the measurement site. After that DP01 can be stored. It is used again, typically every 2 years, when the pyranometer is removed and sent to an external laboratory for calibration.

[More information about the DP01.](#)



**Figure 3** SR30 is supplied with a DP01 dome protector.

### Calibrated tilt angle measurement

SR30 includes a tilt sensor. This is very practical for remote checks of instrument installation. For PV systems with single-axis trackers, IEC 61724-1 Class A systems also require a tilt angle measurement.

The IEC suggested option to measure tilt by counting motor steps does not detect tracker faults, which is one of its purposes. Also counting steps will not lead to the required 1 ° accuracy (Clause 10.1). Every SR30 tilt sensor is individually calibrated and temperature compensated between -30 and +50 °C, resulting in a high accuracy measurement, in compliance with the required  $\pm 1^\circ$ .

### Spectrally flat as required for PV monitoring and albedo

The ISO 9060 defines pyranometer classes A, B and C. The standard also defines a subclass, called "spectrally flat".

The vast majority of users need to use instruments of the spectrally flat subclass; only spectrally flat instruments measure with high accuracy, even when a cloud obscures the sun, or when the irradiance includes reflected radiation. These situations occur for example when you measure Global Horizontal Irradiance (GHI) under partly or fully cloudy skies, when you measure Plane of Array (POA), albedo or net-radiation.

Instruments just of class A, B or C, and not spectrally flat, only measure accurately under clear sky conditions. Using "spectrally flat" instruments is essential because this ensures that:

- you can measure accurately not only horizontally under clear sky conditions, but also general GHI, POA, albedo and net radiation
- you comply with WMO requirements
- you can use the normal standardised ISO and WMO calibration procedures
- you can also separately measure the diffuse component only (creating a diffusometer) with a shadow ring or shading ball, using the same instrument model
- you can perform uncertainty evaluations with negligible (zero) spectral errors

### Heated for high data availability

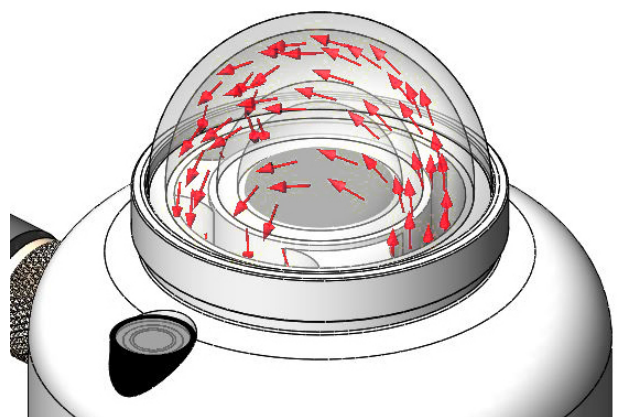
High data availability is attained by heating of the outer dome by ventilating air between the inner and outer dome. This space forms a closed circuit together with the instrument body; ventilated air is not in contact with ambient air. RVH™ - Recirculating Ventilation and Heating - technology, developed by Hukseflux, mitigates dew and frost and is as effective as traditional ventilation systems, without the maintenance hassle and large footprint. The instrument has 2 heating modes; normal at < 3 W, and medium at < 0.65 W power.

- low power consumption: SR30-M2-D1 requires less than 3 W, compared to 10 W for traditional ventilation systems
- low maintenance: SR30-M2-D1 does not require filter cleaning or replacement

The dome of the SR30 pyranometer is heated by ventilating the area between the inner and outer dome. RVH™ is much more efficient than traditional ventilation, where most of the heat is carried away with the ventilation air. Recirculating ventilation is as effective in suppressing dew and frost deposition at less than 3 W as traditional ventilation is at 10 W. RVH™ technology keeps domes and sensor in perfect thermal equilibrium, which also leads to a reduction of zero offsets.



**Figure 4** Heated to counter frost and dew deposition: clear difference between a non-heated pyranometer (back) and SR30 with RVH™ technology (front).



**Figure 5** Heating: how it's done: Recirculating Ventilation and Heating between the inner- and outer dome forming a closed circuit with the body is much more power-efficient than traditional ventilation systems.

### Environmental impact

We analysed the environmental impact of SR30 by comparison to externally ventilated pyranometers (SR20 + VU01). SR30's impact is lower due to:

- lower power consumption during use
- lower transport volume when first installed and when recalibrated every 2 years

Take a look at [our environmental impact analysis](#). As a user reduce environmental impact by:

- nearby calibration, minimising transport
- power heaters only if needed



**Figure 6** SR30 includes a digital tilt angle measurement, very practical for remote checks of instrument orientation. The image shows two SR30's in PV system monitoring, one measuring in Plane of Array (POA).

### Remote sensor diagnostics

Besides solar irradiance, SR30 outputs sensor diagnostics, including:

- instrument temperature
- tilt angle
- internal ventilator speed (RPM)
- internal humidity
- heater current

Remote diagnostics reduces the need for (un)scheduled field inspections.

### Liabilities covered: test certificates

As required by ISO 9060 for Class A classification, each SR30 is supplied with calibration and test results:

- sensitivity
- directional response
- temperature response
- tilt sensor response (0 to 90 °)

### Diffuse radiation measurement

With its outstanding zero offset specification and the fact that it is spectrally flat, SR30 is also the instrument of choice for high-accuracy diffuse radiation measurement.

### SR30-M2-D1 specifications

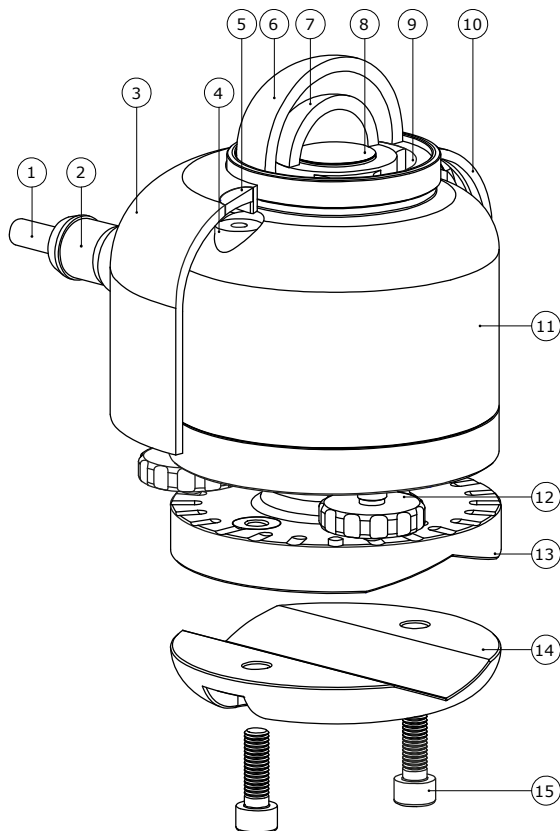
Measurand	hemispherical solar radiation
ISO classification	spectrally flat Class A pyranometer
ISO 9060:2018	secondary standard pyranometer
ISO 9060:1990	high quality pyranometer meets Class A PV monitoring system requirements for solar irradiance for all locations and climatic conditions and for tracker tilt angle measurements
WMO performance level IEC 61724-1 compliance	< 1.2 % (k = 2)
Calibration uncertainty	sensor tilt angle
Measurand	± 1 ° (0 to 90 ° tilt, -30 to + 50 °C)
Tilt measurement uncertainty	included (model DP01)
Dome protector	included
Heating	included
Ventilation	heated and ventilated
Standard operating mode	< 2 W/m <sup>2</sup>
Zero offset a	to WRR
Calibration traceability	included, content limited according to ISO/IEC 17025- 7.8.1.3.
Calibration certificate	(285 to 3000) x 10 <sup>-9</sup> m
Spectral range	-40 to +80 °C
Rated operating temperature range	<± 0.4 % (-30 to +50 °C)
Temperature response	report included
Temperature response test of individual instrument	report included to 95 °
Directional response test of individual instrument	report included (0 to 90 ° tilt, -30 to + 50 °C)
Tilt sensor calibration of individual instrument	5 m (see options)
Standard cable length	8 to 30 VDC
Rated operating voltage range	
<b>Operation in 3 power modes</b>	
Power consumption at 12 VDC	
Normal	< 3 W
Medium	< 0.65 W
Low	< 0.1 W
<b>Digital communication</b>	
Digital output	- irradiance in W/m <sup>2</sup> - instrument body temperature in °C - tilt angle in ° - internal humidity in % - ventilator speed in RPM
Communication protocol	Modbus
Hardware interface	2-wire (half duplex) RS-485

## Operation in 3 power modes

Heater and ventilation may be remotely switched on and off. The instrument has 2 heating modes; normal at < 3 W, and medium at < 0.65 W power. Operation without heating is also possible, in the low power mode at < 0.1 W. With decreasing power, the mitigation of dew and frost will become weaker. However, overall performance in all 3 modes will comply with the ISO 9060 Class A classification.

## SR30 design

The SR30 pyranometer employs a state-of-the-art thermopile sensor with black coated surface, two domes and an anodised aluminium body. It offers a digital output via Modbus RTU over 2-wire RS-485. The pyranometer outer dome is heated by ventilating the area between the inner and outer dome using RVH™ - Recirculating Ventilation and Heating - technology.



**Figure 7** Overview of SR30: (1) cable, (2) connector, (3) sun screen, (4) bubble level, (5) bubble level window, (6) outer dome, (7) inner dome, (8) thermal sensor with black coating, (9) internal ventilation vents, (10) quick release system of sun screen, (11) instrument body, (12) levelling feet, (13) optional spring-loaded levelling mount, (14) optional tube mount, (15) screws included with tube mount.

## Suggested use

- PV system performance monitoring
- scientific meteorological observations

## Hukseflux Sensor Manager software

For communication between a PC and SR30, the latest Sensor Manager software can be downloaded. It allows the user to plot and export data, and change the SR30 Modbus address and communication settings. Also, the digital outputs may be viewed for sensor diagnostics.

**Figure 8** The Sensor Manager software allows the user to change the Modbus address and communication settings.

## Optional accessories

- spring-loaded levelling; a practical mount for easy mounting, levelling and instrument exchange on flat surfaces (LM01), see the SR30 manual for details
- tube levelling mount with set of bolts (TLM01), see the SR30 manual for details
- longer cable; 10 and 20 metres
- calibration certificate including name and contact information of the customer
- DP01 dome protector set of 5 pieces
- AMF03 albedometer fixture
- PMF01 and PFM02 mounting fixtures



**Figure 9** *Optional spring-loaded levelling and tube mount for SR30. LM01 leveling mount (one part), TLM01 tube mounted (2 parts).*



**Figure 10** *PMF01 pyranometer mounting fixture can be used for easy installation of a pyranometer in Plane of Array (POA) for PV system performance monitoring.*

### See also

- [SRA30 albedometer](#) consisting of two SR30's and an AMF01
- [SR05](#), an economical solution often used for monitoring small scale PV systems
- [PMF01](#) and [PFM02](#) mounting fixtures
- consult our [pyranometer selection guide](#)
- introduction of SR30 on [our YouTube channel](#)
- [environmental impact analysis of SR30](#)
- [why ventilate and heat pyranometers](#)
- view our complete [range of solar sensors](#)

### About Hukseflux

Hukseflux is the leading expert in measurement of energy transfer. We design and manufacture sensors and measuring systems that support the energy transition. We are market leaders in solar radiation- and heat flux measurement.

Customers are served through the main office in the Netherlands, and locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia and Japan.

Are you interested in this product?  
E-mail us at: [info@hukseflux.com](mailto:info@hukseflux.com)

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### Best compliance with standards

- first pyranometer to comply with IEC 61724-1 Class A requirements for all locations and climatic conditions
- heated dome, Recirculating Ventilation and Heating (RVH™) technology
- calibrated tilt measurement, compliant with IEC 61724-1 requirements for pyranometer alignment with PV panels and measurement of single axis tracker tilt and tracker fault detection

### Best paperwork

- all ISO required reports with every individual sensor
  - temperature response testing -30 to 50 °C
    - full directional response testing to 95 °
- tilt sensor calibration (0 to 90 ° tilt, -30 to + 50 °C)



### Best accuracy and data availability

- ISO 9060 Class A
- spectrally flat
- mitigates dew and frost
- lowest zero offsets
- no external ventilator required
- 3 power modes



### Best diagnostics

- tilt angle
- humidity
- temperature
- ventilator speed (RPM)
- heater current



### Tilt sensor and levelling

- remote check using on-board tilt sensor
- window for visible bubble level
- with optional spring-loaded levelling mount
- easy mounting, levelling and instrument exchange

### Lowest total cost of ownership

- efficient worldwide calibration support
- dome protector reduces risk of damage
  - fast servicing organisation

