

# SR25-D2

Digital secondary standard pyranometer with sapphire outer dome

*SR25-D2 takes solar radiation measurement to the next level. Using a sapphire outer dome, it has negligible zero offsets. SR25-D2 is heated in order to suppress dew and frost deposition, maintaining its high measurement accuracy. When heating SR25-D2, the data availability and accuracy are higher than when ventilating traditional pyranometers. It needs very low power. SR25-D2 offers two types of commonly used irradiance outputs in  $W/m^2$ : digital via Modbus RTU over RS-485 and analogue 4-20 mA (current loop).*



**Figure 1** SR25-D2 secondary standard pyranometer



**Figure 2** frost deposition: clear difference between SR25-D2 (left), versus a non-heated pyranometer without sapphire dome (right)

## Introduction

SR25-D2 represents the next level in solar radiation measurement. Using a sapphire outer dome, it has negligible zero offsets. SR25-D2 is heated in order to suppress dew and frost deposition, maintaining its high measurement accuracy. When heating SR25-D2, the data availability and accuracy are higher than when ventilating traditional pyranometers. In addition, SR25-D2 needs very low power; heating only consumes 1.5 W compared to the usual 10 W for ventilation. The low thermal offsets make SR25-D2 very suitable for measuring diffuse radiation. Patents on the SR25-D2 working principle are pending.

SR25-D2 offers two types of commonly used outputs: digital via Modbus RTU over RS-485 and analogue 4-20 mA (current loop). These industry standards allow for easy data acquisition, easy read-out and error-free instrument exchange. The instrument is also available with analogue millivolt output (as SR25).

### Best data availability

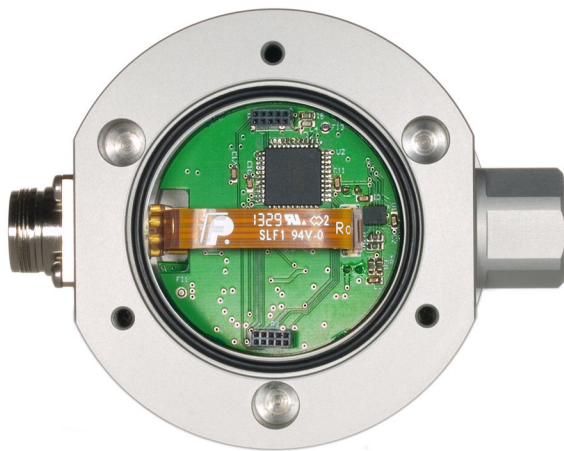
By keeping the SR25-D2 outer dome free of dew and frost with help of the internal heater, data availability is highly increased over traditional pyranometers, whether these are ventilated or not.

### Best measurement accuracy

SR25-D2 measures the solar radiation received by a plane surface, in  $W/m^2$ , from a  $180^\circ$  field of view angle. SR25-D2 offers the best measurement accuracy: the specification limits of two major sources of measurement uncertainty have been greatly improved over competing pyranometers: “zero offset a” and temperature response.

### SR25-D2 design

SR25-D2 has a sapphire outer dome, glass inner dome and an internal heater. It employs a state-of-the-art thermopile sensor with black coated surface and an anodised aluminium body. The connector, desiccant holder and sun screen fixation are very robust and designed for long term use.

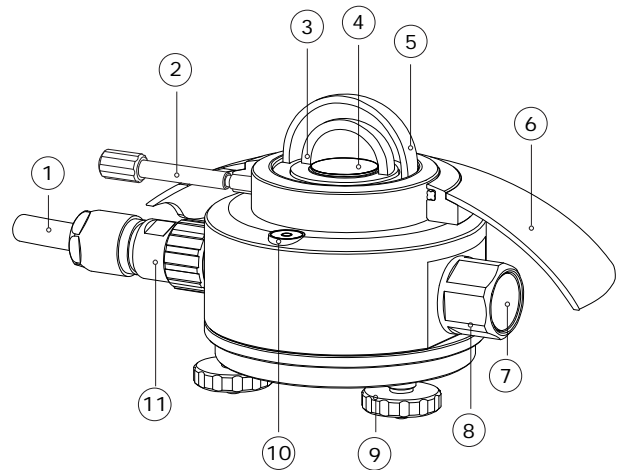


**Figure 3** state-of-the-art electronics inside the SR25-D2

SR25-D2 uses a high-end 24-bit A/D converter. All parts are specified for use across SR25-D2's entire rated operating temperature range. SR25-D2 offers two types of outputs: digital output via Modbus RTU over 2-wire RS-485 and analogue 4-20 mA output (current loop).

### Hukseflux Sensor Manager software

For communication between a PC and SR25-D2, the Hukseflux Sensor Manager software is included. It allows the user to plot and export data, and change the SR25-D2 Modbus address and its communication settings.



**Figure 4** overview of SR25-D2:

(1) cable, (2) fixation of sun screen, (3) glass inner dome, (4) thermal sensor with black coating, (5) sapphire outer dome, (6) sun screen, (7) humidity indicator, (8) desiccant holder, (9) levelling feet, (10) bubble level, (11) connector

### 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” (GUM) can be found in our manuals. We provide spreadsheets to assist in the process of uncertainty evaluation of your measurement.

### Standards

Applicable instrument classification standards are ISO 9060 and WMO-No. 8. Calibration is according to ISO 9847. PV related standards are ASTM E2848 and IEC 61724.

### Choosing the right instrument

Pyranometers are subject to classification in three classes according to ISO 9060.

From second class to first class and from first class to secondary standard, the achievable accuracy improves by a factor 2.

Measurement accuracy does not only depend on instrument properties, but also on measurement conditions. A very accurate instrument will quickly underperform without a regular schedule of maintenance.

Our pyranometer [selection guide](#) assists you in choosing the right instrument.

Whatever your application is: Hukseflux offers the highest accuracy in every class at the most attractive price level.

## Suggested use

- all situations where ventilated pyranometers are employed
- all networks with regular instrument exchange
- PV system performance monitoring
- indoor PV testing with solar simulators
- airborne measurements
- diffuse measurements
- environments with dew
- environments with frost

## SR25-D2 features and benefits

- sapphire outer dome: negligible zero offsets
- internal heater: because of dew and frost suppression by heating, better data availability and accuracy than ventilated instruments
- 1.5 W: very low power consumption
- digital output: easy implementation & servicing
- test certificates for temperature response and directional response included: all sensors tested individually for ISO 9060 compliance



**Figure 5** SR25-D2's sapphire outer dome takes solar radiation measurement to the next level

## See also

- [SR25](#) secondary standard pyranometer with sapphire outer dome and analogue millivolt output
- the making of SR25 [documented](#)
- [SR20](#) secondary standard pyranometer with analogue output, [SR20-D2](#) with digital output
- view our complete [range of solar sensors](#)

## SR25-D2 specifications

Measurand	hemispherical solar radiation
ISO classification	secondary standard pyranometer
Zero offset a	1 W/m <sup>2</sup> unventilated to WRR
Calibration traceability	accessible to users
Calibration registers	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
Directional response test of individual instrument	
Standard cable length	5 m
Backwards compatibility	SR25-D1
<b>Digital output</b>	
Output	-irradiance in W/m <sup>2</sup> -instrument body temperature in °C
Communication protocol	Modbus / over 2-wire RS-485
Transmission mode	RTU
Rated operating voltage range	5 to 30 VDC
Power consumption (sensor)	< 75 x 10 <sup>-3</sup> W at 12 VDC
Heater	1.5 W at 12 VDC
<b>4-20 mA output</b>	
Output	irradiance in W/m <sup>2</sup>
Transmitted range of 4-20 mA output	0 to 1600 W/m <sup>2</sup>
Rated operating voltage range of 4-20 mA output	5.5 to 40 VDC
Power consumption	
- main supply	< 75 x 10 <sup>-3</sup> W at 12 VDC
- 4-20 mA current loop	< 240 x 10 <sup>-3</sup> W at 12 VDC
Heater	1.5 W at 12 VDC

## Options

- longer cable, in multiples of 5 metres

## About Hukseflux

Hukseflux takes measurement to the next level. We design and supply sensors as well as test & measuring systems, and offer related services such as engineering and consultancy. Hukseflux sensors, systems and services are offered via our office in Delft, the Netherlands and local distributors worldwide.

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

# Digital secondary standard pyranometer with sapphire outer dome

Nowadays, the best pyranometers are made by Hukseflux Thermal Sensors. This overview of features and benefits of SR25-D2 gives you some of the reasons why! Whatever your application is, Hukseflux offers the highest accuracy in every class at the most attractive price level.



## Best measurement accuracy

- lowest zero offsets
- lowest calibration uncertainty
- best temperature dependence



## Best data availability

- sapphire dome combined with internal heating
  - suppresses dew and frost deposition
  - very low power consumption



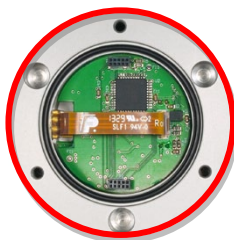
## Best connector

- interchangeable cables
- IP67 grade
- for industrial use



## Best desiccant cartridge

- visible indicator of instrument health
  - rugged aluminium design
  - serviceable by user



## Best digital interface

- Modbus RTU over 2-wire RS-485
- high-end 24-bit A/D converter
- easy implementation & servicing

## Best paperwork

- full directional response testing
  - temperature response testing from -30 to 50 °C
- all ISO required reports included with every individual sensor

