SR20-D2

Digital secondary standard pyranometer with Modbus RTU and 4-20 mA output

SR20-D2 is a solar radiation sensor of the highest category in the ISO 9060 classification system: secondary standard. SR20-D2 is designed for the solar PV industry, offering two types of commonly used irradiance outputs: digital via Modbus RTU over RS-485 and analogue 4-20 mA (current loop). Individually tested for temperature and directional response, SR20-D2 is the most accurate digital secondary standard pyranometer available.

Figure 1 SR20-D2 digital secondary standard pyranometer

Figure 2 state-of-the-art electronics inside the SR20-D2

Introduction

SR20-D2 measures the solar radiation received by a plane surface, in W/m^2, from a 180° field of view angle. It is employed where the highest measurement accuracy is required. SR20-D2 offers two types of outputs commonly used in the solar PV industry: 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 when using SR20-D2.

The best pyranometer for the PV industry

SR20-D2 is the most accurate digital secondary standard pyranometer available. Its benefits:

- Digital output: easy implementation & servicing
- Best-in-class temperature response $< \pm$ 0.4 % (-30 to +50 °C), best "zero offset a" and best calibration uncertainty
- Test certificates for temperature- and directional response included as required by ISO 9060
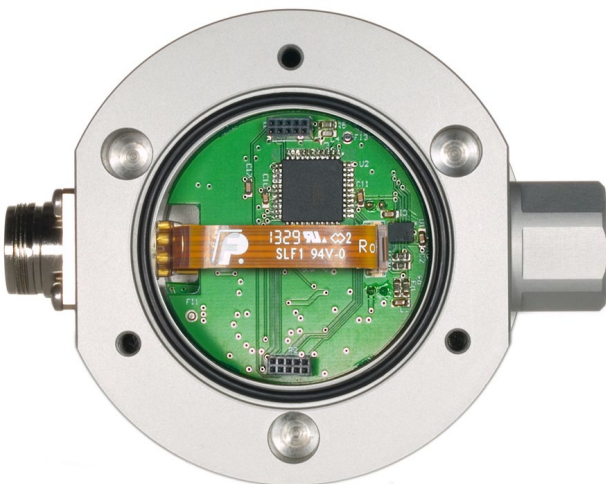- Re-calibration registers fully accessible to users

Best measurement accuracy

In order to improve overall measurement accuracy, Hukseflux effectively targeted two major sources of measurement uncertainty: calibration and "zero offset a".
In addition, SR20-D2 has a negligible temperature response. All are best in class. The temperature response of every individual instrument is tested and corrected onboard by the instrument electronics, using a second degree polynomial.

Demanding applications

SR20-D2's low temperature dependence makes it the ideal candidate for use under very cold and very hot conditions.

SR20-D2 design

SR20-D2 pyranometer employs a state-of-the-art thermopile sensor with black coated surface, two domes and an anodised aluminium body. The connector, desiccant holder and sun screen fixation are very robust and designed for long term industrial use. SR20-D2 uses a high-end 24-bit A/D converter. All parts are specified for use across SR20-D2's entire rated operating temperature range. SR20-D2 offers two types of outputs commonly used in the solar PV industry: digital output via Modbus RTU over 2-wire RS-485 and analogue 4-20 mA output (current loop).
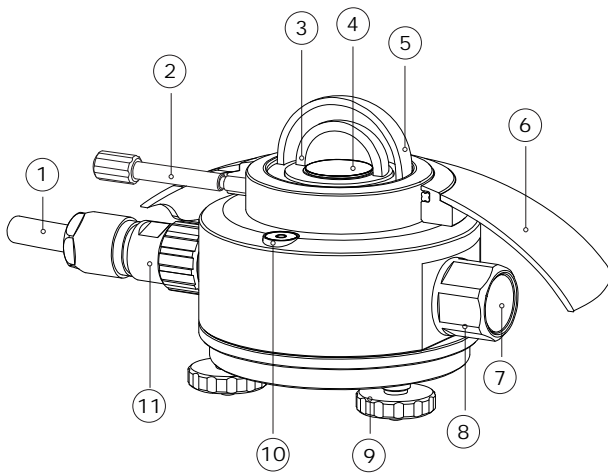
Figure 3 overview of SR20-D2:
(1) cable, (2) fixation of sun screen, (3) inner dome, (4) thermal sensor with black coating, (5) outer dome, (6) sun screen, (7) humidity indicator, (8) desiccant holder, (9) levelling feet, (10) bubble level, (11) connector

Standards

Applicable instrument classification standards are ISO 9060 and WMO-No. 8.

Re-calibration: accessible registers

The recommended calibration interval of pyranometers is 2 years. The registers containing the applied sensitivity and the calibration history of SR20-D2 are fully accessible for users. This allows the user to choose his own local calibration service. The same feature may be used for remotely controlled re-calibration of pyranometers in the field. Ask Hukseflux for information on this feature and on ISO and ASTM standardised procedures for field calibration.

Figure 4 SR20-D2 secondary standard pyranometers with digital output for GHI (global horizontal irradiance) and POA (plane of array) measurements

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.

Hukseflux Sensor Manager software

For communication between a PC and SR20-D2, the Hukseflux Sensor Manager software is included. It allows the user to plot and export data, and change the SR20-D2 Modbus address and its communication settings.

Figure 5 user interface of the Sensor Manager

Suggested use

- PV system performance monitoring
- all networks with regular instrument exchange
- scientific meteorological observations
- reference instrument for comparison
- extreme climates (tropical / polar)

Figure 6 SR20-D2 side view

See also

- SR20 secondary standard pyranometer with analogue millivolt output
- SR25 secondary standard pyranometer with sapphire outer dome
- alternative instruments: SR11 and LP02 for lower accuracy measurements
- SR12 first class pyranometer for solar energy testing applications
- the making of SR20 documented
- view our complete range of solar sensors

SR20-D2 specifications

Measurand	hemispherical solar radiation
ISO classification	secondary standard pyranometer
Calibration uncertainty	< 1.2 % (k = 2)
Zero offset a	5 W/m^2 unventilated 2.5 W/m^2 ventilated
Calibration traceability	to WRR
Calibration registers	accessible to users
Spectral range	285 to 3000 x 10^{-9} m
Rated operating temperature range	-40 to +80 ^{o}C
Temperature response	< ± 0.4 % (-30 to +50 °C)
Heater	no heating
Temperature response test of individual instrument	report included
Directional response test of individual instrument	report included
Standard cable length	5 m
Backwards compatibility	SR20-D1

Digital output

Output	-irradiance in W/m^2 -instrument body temperature in ^{o}C
Communication protocol	Modbus / over 2-wire RS-485
Transmission mode	RTU
Rated operating voltage range	5 to 30 VDC
Power consumption	< 75 x 10^{-3} W at 12 VDC

4-20 mA output

Output	irradiance in W/m^2
Transmitted range of 4-20 mA output	0 to 1600 W/m^2
Rated operating voltage range of 4-20 mA output	5.5 to 40 VDC
Power consumption	
- main supply	< 75 x 10^{-3} W at 12 VDC
- 4-20 mA current loop	< 40 x 10^{-3} W at 12 VDC, with recommended 100 Ω shunt resistor

Options

- longer cable, in multiples of 5 metres
- adapted transmitted range for 4-20 mA output
- ventilated with VU01 ventilation unit

# SR20-D2 digital secondary standard pyranometer

Nowadays, the best pyranometers are made by Hukseflux Thermal Sensors. This overview of features and benefits of SR20-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 paperwork
- only Hukseflux includes all ISO required reports with every individual sensor
- temperature response testing from -30 to 50 ^{0}C
- full directional response testing
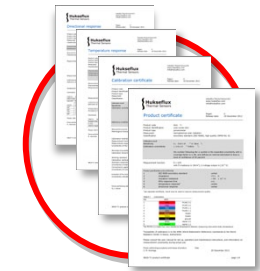
Best connector
- interchangeable cables
- IP67 grade
- for industrial use

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

Best digital interface
- industry standard output types
- Modbus RTU over 2-wire RS-485
- registers for re-calibration accessible to users

Best humidity protection
- wrench-operated
- o-ring compressed to spec
- desiccant service interval > 2 years