SR20-D1

Digital secondary standard pyranometer - Modbus protocol

SR20-D1 is a solar radiation sensor of the highest category in the ISO 9060 classification system: secondary standard. Irradiance is output digitally in W/m². SR20-D1 is designed for the solar PV industry, using the Modbus communication protocol over RS-485. Individually tested for temperature and directional response, SR20-D1 is the most accurate digital secondary standard pyranometer available.

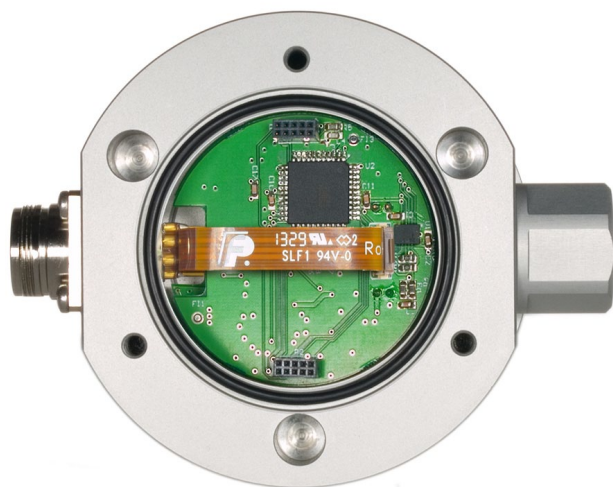**Figure 1** *SR20-D1 digital pyranometer - Modbus protocol*

Figure 2 *state-of-the-art electronics inside the SR20-D1*

Introduction

SR20-D1 measures the solar radiation received by a plane surface, in W/m², from a 180° field of view angle. It is employed where the highest measurement accuracy is required. SR20-D1's digital output, provided via the industry standard Modbus protocol, allows for easy data acquisition and error-free instrument exchange.

The best pyranometer for the PV industry

SR20-D1 is the most accurate digital secondary standard pyranometer available. Its benefits:

- Digital output: easy implementation & servicing
- Best-in-class temperature response < ± 0.4 % (-30 to +50 °C), best "zero offset a" and best calibration uncertainty
- Included in delivery as required by ISO 9060: test certificates for temperature response and directional response

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-D1 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-D1's low temperature dependence makes it the ideal candidate for use under very cold and very hot conditions.

SR20-D1 design

SR20-D1 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-D1 uses a high-end 24-bit A/D converter. All parts are specified for use across SR20-D1's entire rated operating temperature range. Communication protocol is the industry standard Modbus RTU over 2-wire RS-485.
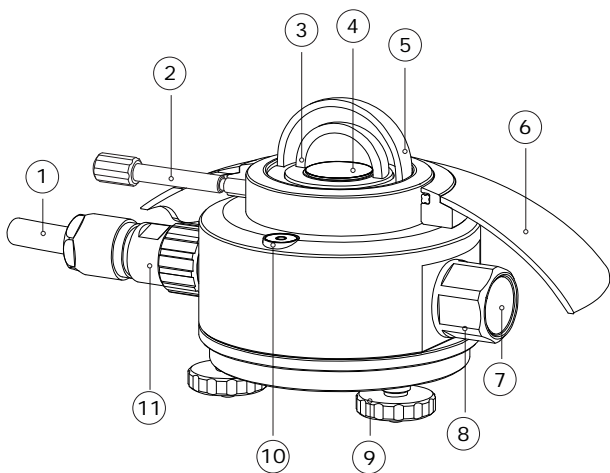
Figure 3 *overview of SR20-D1:*
(1) cable, (2) fixation of sun screen, (3) inner dome,
(4) thermal sensor with black coating, (5) outer dome,
(6) sun screen, (7) humidity indicator, (8) desiccant
holder, (9) levelling feet, (10) bubble level,
(11) connector

Standards

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

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.

Figure 4 *SR20-D1 secondary standard pyranometer 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.
Whatever your application is: Hukseflux offers the highest accuracy in every class at the most attractive price level.

Hukseflux Thermal Sensors

Hukseflux Sensor Manager software

For communication between a PC and SR20-D1, the Hukseflux Sensor Manager software is included. It allows the user to plot and export data, and change the SR20-D1 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-D1 side view*

See also

- SR20 secondary standard pyranometer with analogue output
- SR20-TR secondary standard pyranometer with 4-20 mA transmitter
- 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-D1 specifications

Measurand	hemispherical solar radiation
ISO classification	secondary standard pyranometer
Digital output	-irradiance in W/m^2 -instrument body temperature in ^{o}C
Calibration uncertainty	< 1.2 % (k = 2)
Zero offset a	5 W/m^2 unventilated 2.5 W/m^2 ventilated
Calibration traceability	to WRR
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
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
Standard cable length	5 m

Options

- longer cable, in multiples of 5 metres
- ventilated with VU01 ventilation unit

About Hukseflux

Hukseflux Thermal Sensors, founded in 1993, aims to advance thermal measurement. We offer a complete range of sensors and systems for measuring heat flux, solar radiation and thermal conductivity. We also provide consultancy and services such as performing measurements and designing instrumentation according to customer requirements. Customers are served through the main office in Delft in the Netherlands, and locally owned representations in the USA, India, China and Japan.

Are you interested in this product?
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