SR15 SERIES
Spectrally flat Class B pyranometers (with heating when using SR15-D1)

SR15 pyranometer series is a range of high-accuracy solar radiation sensors. It is "spectrally flat Class B", according to the ISO 9060:2018 standard. Various outputs are available, both digital and analogue. Versions SR15-D1 and SR15-A1 are equipped with an on-board heater, mitigating dew and frost.

Figure 1 *SR15 spectrally flat Class B pyranometer series.*

Figure 2 *SR15 pyranometer mounted in POA (Plane of Array) on a mast for PV performance monitoring.*

Introduction

SR15 pyranometer series is a range of solar radiation sensors applied in general high-accuracy observations. The sensor measures the solar radiation received by a plane surface from a 180 ° field of view angle. This quantity, expressed in W/m^2, is called "hemispherical" solar radiation. SR15 pyranometer can be employed outdoors under the sun, as well as indoors with lamp-based solar simulators. Its orientation depends on the application and may be horizontal, tilted (for plane of array radiation) or inverted (for reflected radiation).

Your benefits

- best measurement accuracy in Class B
- improved response time
- with SR15-D1's and -A1's on-board heater: mitigates dew and frost in its standard configuration

SR15 series offers various versions with industry standard outputs, both digital and analogue:

Versions

- SR15-D1 digital spectrally flat Class B pyranometer, with Modbus RTU over RS-485 output and heater
- SR15-D2A2 digital spectrally flat Class B pyranometer, with Modbus RTU over TTL and 4-20 mA output
- SR15-A1 analogue spectrally flat Class B pyranometer with millivolt output and heater

SR15 series design

SR15 pyranometer employs a thermal sensor with black coating, two glass domes and an anodised aluminium body. Version SR15-A1 offers millivolt output. The digital sensors offer output via Modbus RTU over 2-wire RS-485 (version SR15-D1) and via Modbus TTL and 4-20 mA current loop (version SR15-D2A2).
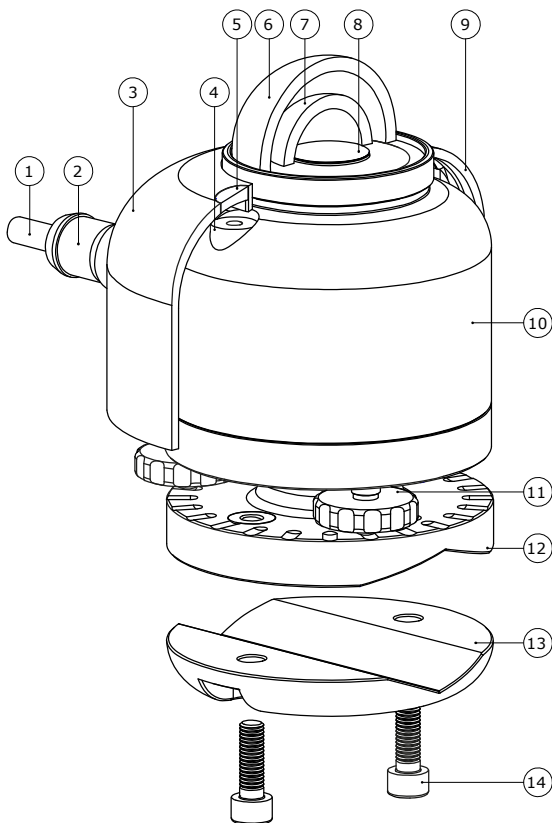

Figure 3 *Overview of SR15: (1) cable, (2) connector, (3) sun screen, (4) bubble level, (5) bubble level window, (6) outer dome, (7) inner dome, (8) thermal sensor with black coating, (9) quick release system of sun screen, (10) instrument body, (11) levelling feet, (12) optional spring-loaded levelling mount, (13) optional tube mount, (14) screws included with tube mount.*

SR15 series specifications

Measurand	hemispherical solar radiation
ISO classification	
ISO 9060:2018	spectrally flat Class B pyranometer
ISO 9060:1990	first class pyranometer
WMO performance level	good quality pyranometer
dew and frost mitigation	SR15-A1 and D1 have an on-board heater
Calibration uncertainty	< 1.8 % (k = 2)
Calibration traceability	to WRR
Spectral range	285 to 3000 x 10^{-9} m
Response time	< 10 s
Zero offset a	5 W/m^2 unventilated
Rated operating temperature range	-40 to +80 °C
Temperature response	< ± 2 % (-10 to +40 °C)
Heater	1.5 W at 12 VDC
Standard cable length	5 m
Levelling	optional spring-loaded levelling, with / without tube mount

Output

Version SR15-D1

Communication protocol	Modbus
Transmission mode	RTU
Hardware interface	2-wire (half duplex) RS-485
Digital output	- irradiance in W/m^2
	- instrument body temperature in °C
On-board heater	included

Version SR15-D2A2

Communication protocol	Modbus
Hardware interface	TTL
Digital output	same as SR15-D1
Analogue output:	4-20 mA current loop
On-board heater	not included

Version SR15-A1

Analogue output	millivolt
Sensitivity	10 x 10^{-6} V/(W/m^2)
On-board heater	included

Options

- spring-loaded levelling; practical for easy mounting, levelling and instrument exchange on flat surfaces
- tube levelling mount with set of bolts
- mounting brackets
- longer cable; 10 and 20 metres length
- 20 metres extension cable with 2 connectors

Suggested use

- PV system performance monitoring
- general solar resource monitoring
- indoor simulated solar testing
- meteorological networks

Improved measurement accuracy

Calibration of SR15 pyranometer has been improved; our latest calibration method results in an uncertainty of the sensitivity of 1.8 %, compared to typical uncertainties of higher than 2.8 % for this pyranometer class. SR15's response time is < 10 s, more than sufficient for PV system performance monitoring and meteorology.

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 61724-1.

Use as sunshine duration sensor

WMO has approved the "pyranometric method" to calculate sunshine duration from pyranometer measurements in WMO-No. 8, Guide to Meteorological Instruments and Methods of Observation. This implies that SR15 may be used, in combination with appropriate software, to estimate sunshine duration. This is much more cost-effective than using a dedicated sunshine duration sensor. Ask for our application note.

Use in National Networks

WMO, the World Meteorological Organization, recommends use of Class B (first class) pyranometers such as SR15 for network operation.

Figure 4 *PMF01 mounting fixture accessory: practical, small footprint, and allowing horizontal and Plane of Array installations on various platforms.*

Hukseflux Sensor Manager software

For communication between a PC and SR15 digital pyranometer series, the Hukseflux Sensor Manager software can be used. It allows the user to plot and export data, and change the SR15 Modbus address and communication settings. Also, the digital outputs may be viewed for sensor diagnostics.
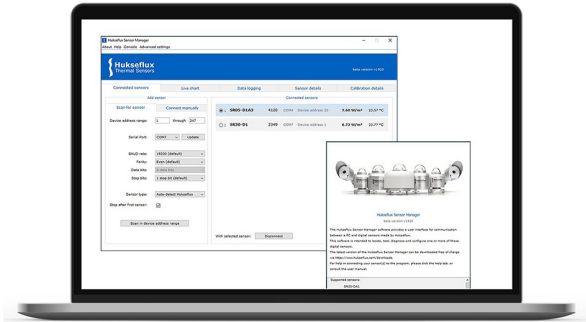

Figure 5 *User interface of the Hukseflux Sensor Manager software.*

Figure 6 *Several mounting options are offered, such as this spring-loaded levelling mount for easy mounting, levelling and instrument exchanges on flat surfaces.*

See also

- SR30 spectrally flat Class A (secondary standard) pyranometers for IEC 61724-1 class A PV monitoring systems
- SR05, an economical solution often used for monitoring small scale PV systems and large (agro-)meteorological networks
- PMF series brackets for tilted installations
- view our complete range of solar sensors

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.

For an overview of all SR15 versions and options, and how to order, please take a look at Table 1 on the next page.

VERSIONS OF SR15 (part numbers)

SR15-D1	digital spectrally flat Class B (first class) pyranometer, with heating and Modbus over RS-485 output
SR15-D1-LM01	digital spectrally flat Class B (first class) pyranometer, with heating and Modbus over RS-485 output, with levelling mount for spring-loaded levelling and mounting SR15 on a surface
SR15-D1-TLM01	digital spectrally flat Class B (first class) pyranometer, with heating and Modbus over RS-485 output, with tube levelling mount, for spring-loaded levelling and mounting SR15 on a tube
SR15-D2A2	digital spectrally flat Class B (first class) pyranometer, with Modbus over TTL and 4-20 mA output
SR15-D2A2-LM01	digital spectrally flat Class B (first class) pyranometer, with Modbus over TTL and 4-20 mA output, with levelling mount for spring-loaded levelling and mounting SR15 on a surface
SR15-D2A2-TLM01	digital spectrally flat Class B (first class) pyranometer, with Modbus over TTL and 4-20 mA output, with tube levelling mount for spring-loaded levelling and mounting SR15 on a tube
SR15-A1	analogue spectrally flat Class B (first class) pyranometer, with millivolt output and heating
SR15-A1- LM01	analogue spectrally flat Class B (first class) pyranometer, with millivolt output and heating, with levelling mount for spring-loaded levelling and mounting SR15 on a surface
SR15-A1- TLM01	analogue spectrally flat Class B (first class) pyranometer, with millivolt output and heating, with tube levelling mount for spring-loaded levelling and mounting SR15 on a tube

CABLE FOR SR15,
with female M12-A connector at sensor end, stripped over 0.15 m, and conductors with ferrules

'-05' after SR15 part number	standard cable length: 5 m
'-10' after SR15 part number	cable length: 10 m
'-20' after SR15 part number	cable length: 20 m

CABLE EXTENSION FOR SR15,
with male and female M12-A connectors

C07E-20	cable length: 20 m

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. Hukseflux products and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

Interested in this product?
E-mail us at: info@hukseflux.com

Figure 7 *SR15 with optional tube levelling mount.*