

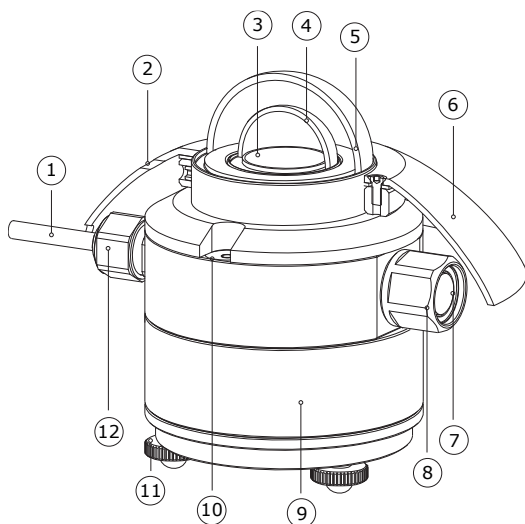
# SR11-TR

First class pyranometer with 4-20 mA transmitter

*SR11-TR is a high accuracy solar radiation sensor. SR11-TR pyranometer complies with the first class specifications of the ISO 9060 standard and the WMO Guide. It is the preferred instrument for outdoor PV system performance monitoring, according to the ASTM E2848 standard. SR11-TR houses a 4-20 mA transmitter for easy read-out by dataloggers commonly used in the industry.*



**Figure 1** SR11-TR first class pyranometer with 4-20 mA transmitter



**Figure 2** overview of SR11-TR:

(1) cable, (2) opening for fixation of sun screen, (3) thermal sensor with black coating, (4) inner dome, (5) outer dome, (6) sun screen, (7) humidity indicator, (8) desiccant holder, (9) transmitter housing, (10) bubble level, (11) levelling feet, (12) cable gland

## Introduction

SR11-TR is a solar radiation sensor that is applied in general high accuracy observations. It 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.

SR11-TR 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 (reflected radiation).

## Operation

Using SR11-TR is easy. The pyranometer can be connected directly to commonly used data logging systems. The irradiance in  $W/m^2$  is calculated by using the transmitter's output. In SR11-TR's standard configuration, the 4 to 20 mA output corresponds to a transmitted range of 0 to 1600  $W/m^2$ . This range can be adjusted at the factory upon request.

## PV system performance monitoring

The ASTM E2848 "Standard Test Method for Reporting Photovoltaic Non-Concentrator System Performance" (issued end 2011) confirms that a pyranometer is the preferred instrument for PV system performance monitoring. SR11-TR pyranometer complies with the requirements of this standard.

## Suggested use

- PV system performance monitoring
- general solar resource monitoring
- meteorological networks
- building physics

## SR11-TR design

SR11-TR pyranometer employs a thermal sensor with black coating, two glass domes and an anodised aluminium body, which also houses the transmitter.



**Figure 3** SR11-TR with its sun screen removed

## 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.

## 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.

## SR11-TR specifications

Measurand	hemispherical solar radiation
ISO classification	first class pyranometer
Calibration uncertainty	< 1.8 % (k = 2)
Calibration traceability	to WRR
Spectral range	285 to 3000 x 10 <sup>-9</sup> m
Transmitted range	0 to 1600 W/m <sup>2</sup>
Rated operating temperature range	-40 to +80 °C
Temperature response	< ± 2 % (-10 to +40 °C)
Standard cable length	5 m

## Options

- longer cable, in multiples of 5 metres
- internal temperature sensor
- adapted transmitted range

## See also

- sensor with linear millivolt output [SR11](#)
- [SR12](#) first class pyranometer for solar energy test applications
- alternative instrument: [SR20](#) pyranometer for higher accuracy measurements
- view our complete [product range of solar sensors](#)

## 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.

## 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, China and Japan.

Interested in this product?  
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