Hukseflux
Thermal Sensors

Hukseflux pyranometer selection guide

Highest accuracy in every class at the most attractive price level

Hukseflux offers a wide range of solutions for measurement of solar radiation. This brochure offers you general guidelines for selection of the right instrument. The application of pyranometers in PV system performance monitoring is highlighted as an example. Please contact us for further assistance.

Figure 1 *SR20 secondary standard pyranometers in PV system performance monitoring, measuring global and plane of array irradiance*

Figure 2 *Example of a Hukseflux pyranometer: Hukseflux SR20-TR secondary standard pyranometer with integrated 4-20 mA transmitter*

The right instrument for the application

Choosing the right instrument for your application is not an easy task. We can offer assistance. But first, you should ask yourself the following questions:

- are there standards for my application?
- what level of accuracy do I need?
- what will be the instrument maintenance level?
- what are the interfacing possibilities?

When discussing with Hukseflux we will not only select the most suitable pyranometer.
Our recommendation will include:

- recommended pyranometer class
- recommended maintenance level
- estimate of the measurement accuracy
- recommended calibration policy
- recommended interface

Accuracy improvement by a factor 2

Pyranometers are subject to classification according to ISO 9060. The 3 classes are:

- secondary standard
- first class
- second class

From second class to first class and from first class to secondary standard, the achievable accuracy improves by a factor 2. (see Figure 3)

Hukseflux pyranometers

Measurand	hemispherical solar radiation
ISO 9060 classification	secondary standard, first class, second class
Options	4-20 mA transmitter, cable length, internal temperature sensors. Heating and temperature sensors are standard on higher class models

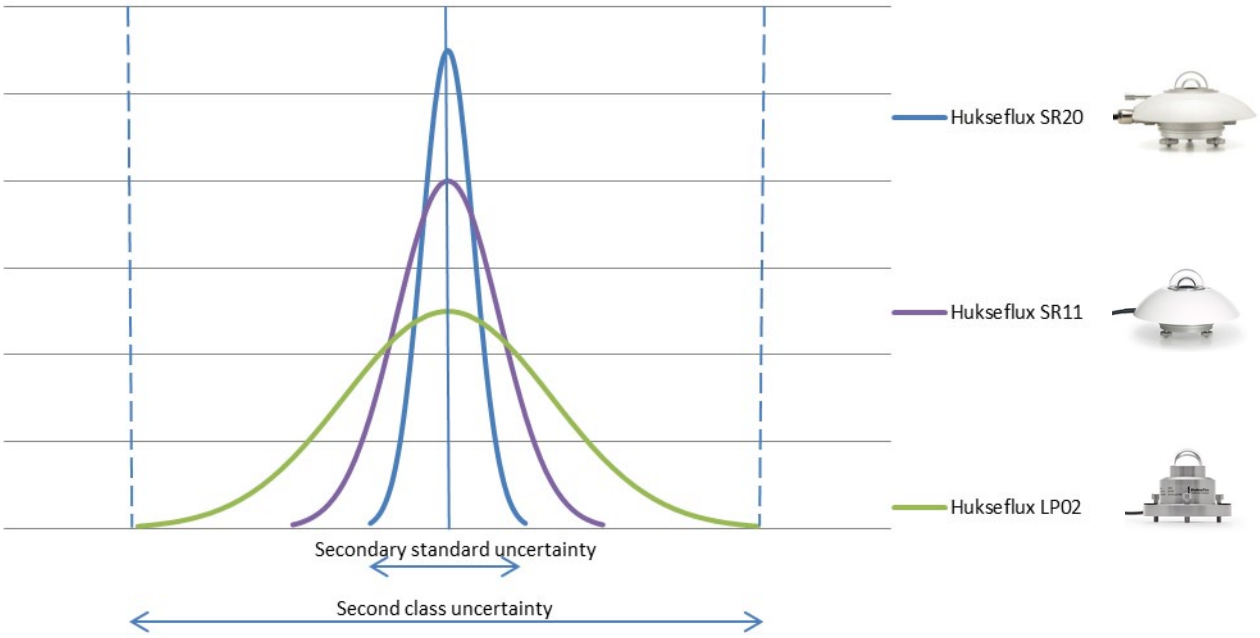

Figure 3 *A visual impression of measurement uncertainty for well maintained instruments of different ISO 9060 pyranometer classes. From second to first class and from first class to secondary standard, the achievable accuracy improves by a factor 2.*

Hukseflux pyranometer benefits

Hukseflux offers you the best measurement accuracy in every class. In more detail, superior instrument design allows us to claim:

- the best calibration uncertainty
- lowest "zero offset a"
- reduction of measurement errors caused by early morning dew deposition; the top models include a heater

PV system performance monitoring

In PV system performance monitoring, the recommended starting point is a first class pyranometer. This is explicitly stated in ASTM E2848 "Standard Test Method for Reporting Photovoltaic Non-Concentrator System Performance" (issued end 2011). Hukseflux model SR11 pyranometer is a good choice. Recommended recalibration interval is 2 years. ASTM E2848 suggests instruments to be "characterised to the extent practicable". You may prefer the SR12 first class pyranometer or SR20 secondary standard pyranometer because of their higher level of characterisation.

Not only the right instrument should be chosen, but also the system configuration should be optimised. For PV system performance monitoring, irradiance needs to be measured in the plane of array of the PV panel. In addition horizontally placed instruments are used for the measurement of global radiation (see Figure 1). Global irradiance data enable the user to compare the local climate and system efficiency between different sites. These data can also be compared to measurements by local meteorological stations.

Need for recalibration

In case you require a first class pyranometer, but wish to avoid a 2-yearly recalibration, use a higher class instrument: secondary standard. Our SR20 secondary standard pyranometer offers better stability and therefore can work within first class limits at a lower recalibration interval.

Influence of instrument cleaning

The performance of high class instruments strongly depends on cleaning. At a low maintenance level, the achievable accuracy will not be reliably attained. You may then consider to employ multiple instruments. The use of redundant instruments allows remote checks of one instrument using the other as a reference, which leads to a higher measurement reliability. For lower class instruments the relative loss of accuracy at a low maintenance level is less significant. Under such conditions use of multiple low class instruments is a good alternative to using a single high class instrument.

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Table 1 *The most common considerations when choosing a pyranometer*

					
	SR20	SR12	SR11	SR03	LP02
ISO 9060 classification	Secondary standard	First class	First class	Second class	Second class
PV industry standards ASTM E2848, IEC 61427	++++	+++	++	-	-
Achievable measurement accuracy	++++	+++	++	+	+
Low need for recalibration at first class performance	++++	++	++	-	-
Response time	+++	++	++	++++	+
Incorporated heater and temperature sensor	++	++	-	-	-
Low relative loss of accuracy at a low cleaning interval	+	++	++	+++	+++

Interfacing

We can assist you in optimising the interfacing of the pyranometer to the data collection platform at the measurement site. Solutions vary from using a datalogger as a local collection point for several different sensors to the use of transmitters incorporated in the pyranometer (our –TR versions).

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 user manuals. We provide spreadsheets to assist in the process of uncertainty evaluation of your measurement.

See also

View our complete range of sensors on our website or see the overview on the next page.

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.

Need for support in your selection process?
E-mail us at: info@hukseflux.com

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SR20 PYRANOMETER
Secondary standard pyranometer with heater

SR20-TR PYRANOMETER
Secondary standard pyranometer with heater and 4-20 mA transmitter

SR12 PYRANOMETER
First class pyranometer for solar energy test applications

SR11 PYRANOMETER
First class pyranometer

SR11-TR PYRANOMETER
First class pyranometer with 4-20 mA transmitter

SR03 PYRANOMETER
Fast response second class pyranometer

LP02 PYRANOMETER
Second class pyranometer

LP02-TR PYRANOMETER
Second class pyranometer with 4-20 mA transmitter

LP02 / LI19 PYRANOMETER
Second class pyranometer with LI19 handheld read-out unit

DR02 PYRHELIOMETER
Fast response first class pyrheliometer with heater

DR01 PYRHELIOMETER
First class pyrheliometer with heater

NR01 NET RADIOMETER
4-component net radiometer

RA01 RADIOMETER
2-component radiation sensor

SRA01 ALBEDOMETER
Second class albedometer