# Hukseflux pyranometer selection guide

Next-level instruments for every application

*From the market leading pyranometer supplier: general guidelines for selection of the right pyranometer for your application. Main examples: use in PV system performance monitoring according to IEC 61724-1, use in meteorological networks and for diffuse radiation measurement. Customers prefer Hukseflux pyranometers for their unsurpassed measurement accuracy and their lowest total cost of ownership.*

**Figure 1** *SR300-D1 pyranometers, our most popular solution for PV system performance monitoring according to IEC 61724-1 class A.*

**Figure 2** *Example of a Hukseflux spectrally flat Class A pyranometer, model SR300-D1. This model is recommended for PV system performance monitoring as well as research-grade diffuse radiation measurement. Digital output via Modbus RTU over RS-485.*

## The right instrument for the application

Choosing the right instrument for your application might seem complex. We are here to help. First, consider these questions:

- are there standards for my application?
- what level of accuracy do I need?
- what maintenance will be available?
- what are the possibilities for mounting?
- how much electrical power is available?
- what sensor output does my measurement / data acquisition system require?

Your answers to the above questions will help us to provide our recommendation for the best-suited pyranometer, including:

- pyranometer class
- maintenance and calibration policy
- estimate of the measurement accuracy
- electrical interfacing, use of electrical power
- mechanical mounting

## Hukseflux pyranometer benefits

Hukseflux is a leading manufacturer—both in technology and market share—of pyranometers. You can rely on the best measurement accuracy in every class. In more detail, thanks to superior instrument design you can trust on:

- unparalleled accuracy in every class
- exceptional reliability, ensuring consistent performance over time
- lowest cost of ownership, minimising maintenance costs and extending the product life span

We offer the right pyranometer for every application and budget.

Table 1 on the next page gives an overview of pyranometers and the most common considerations for choosing a particular model. For some of these considerations, more information can be found in the rest of this document.

**Table 1** *The most common considerations when choosing a pyranometer for application in PV system performance monitoring, meteorological networks, and diffuse solar radiation measurement.*

| |  |  |  |  |
|---|---|---|---|---|
| | SR300-D1 | SR200-D1 | SR100-D1 | SR05-D1A3 |
| ISO 9060 classification | Spectrally flat<br>Class A | Spectrally flat<br>Class A | Spectrally flat<br>Class B | Spectrally flat<br>Class C |
| IEC 61724-1 suitability for PV monitoring system Class | Class A<br>for POA and GHI<br>for all locations and climatic conditions<br><br>Class A<br>for $POA^{REAR}$ and albedo | Class A<br>for POA and GHI<br>for locations where dew and frost are expected for less than 2 % of annual GHI hours<br><br>Class A<br>for $POA^{REAR}$ and albedo | Class B<br>for POA and GHI<br><br>Class A<br>for $POA^{REAR}$ and albedo | Class B<br>for POA and GHI<br><br>Class A<br>for $POA^{REAR}$ and albedo |
| Diagnostics in data stream: alerts | Alerts for:<br>instrument leakage<br>change of tilt<br>change of rotation<br>heating and ventilation malfunction<br>high internal humidity | Alerts for:<br>high internal humidity | Alerts for:<br>high internal humidity | No alerts |
| Heating to mitigate dew and frost / improve data availability | Heated | Not heated | Not heated | Not heated |
| Tilt sensor included | Yes | No | No | No |
| Surge immunity and EMC | IEC 61326-1 equipment classification: Industrial Equipment | IEC 61326-1 equipment classification: Industrial Equipment | IEC 61326-1 equipment classification: Industrial Equipment | |
| PV system performance monitoring | +++++ | + | – | – |
| High-accuracy meteorological networks | +++++ | ++++ | +++ | – |
| Agro-meteorological networks | + | + | ++ | ++++ |
| Diffuse radiation reference (low offset) | +++++ | +++ | ++ | – |
| Reflected radiation / albedo measurement (spectrally flat) | +++++ | ++++ | +++ | ++ |

## Highest accuracy in every class

Pyranometers are classified according to ISO 9060 in 3 accuracy classes: Class A, Class B, and Class C.

At Hukseflux we supply "spectrally flat" versions only because they measure accurately under all conditions and can easily be calibrated. From Class C to Class B and from Class B to Class A, the achievable accuracy improves by a factor of 2.

A general rule: the higher the required accuracy:

- the higher the cost of the instrument
- the higher the required level of maintenance (cleaning)
- the higher the required accuracy of calibration

## Uncertainty evaluation

The ASTM G213-17 provides guidance and recommended practices for evaluating uncertainties when performing outdoor measurements with pyranometers. The ASTM standard follows the ISO Guide 98.

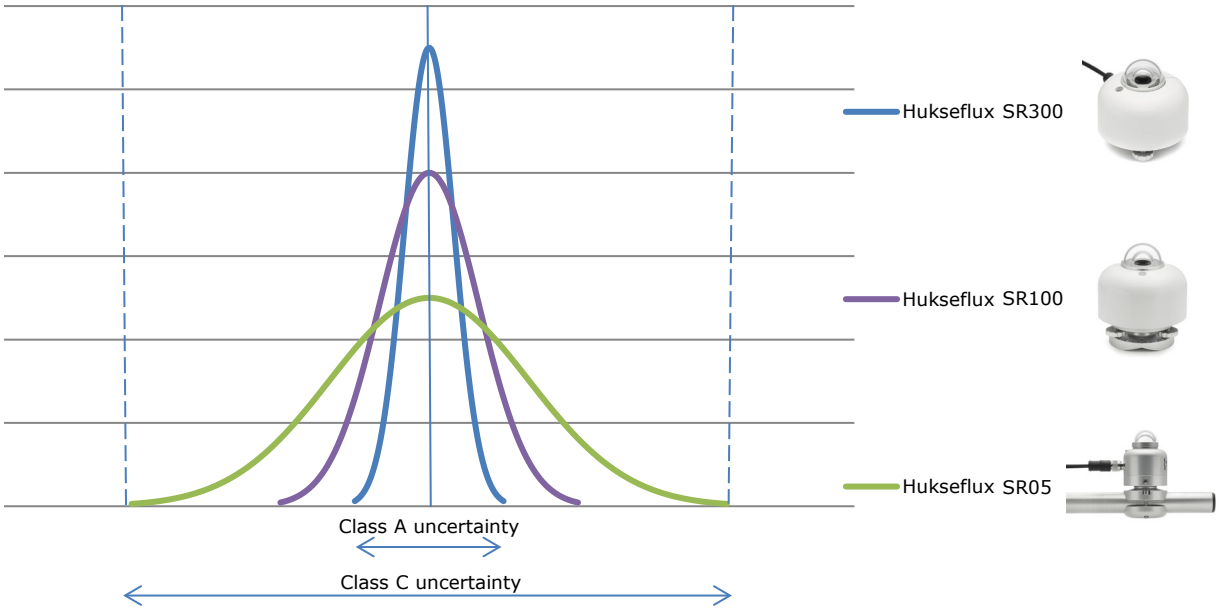


**Figure 3** *Impression of measurement uncertainty for well-maintained instruments of different ISO 9060:2018 pyranometer classes. From Class C to Class B and from Class B to Class A, the achievable accuracy improves by a factor of 2.*

## Highest reliability: immunity to high voltages and currents—surges

SR300-D1, SR200-D1 and SR100-D1 are classified for use in Industrial Environments according to IEC 61326-1 and IEC 61000-6-2. When designing a measuring system, pyranometer users may reach several levels of immunity. With the optional Surge Protection Device SPD01, this immunity can be increased to 4 kV. Up to 3 pyranometers can be protected with a single SPD01. A third-party SPD with similar specifications may also be used.
To attain the required level of immunity for a given installation, some general system components should be included, such as:

- lightning protection system
- earthing and grounding network
- external surge protection in addition to the native on-board sensor protection


**Figure 4** *The SPD01 Surge Protection Device.*

## Lowest total cost of ownership

Customers prefer Hukseflux pyranometers for their unsurpassed measurement accuracy and lowest cost of ownership. Total ownership costs are primarily determined by installation, on-site inspection, accidental damage, and calibration.

- fewer external components: Internal protection and isolation reduce the requirements and costs for added external protection devices.
- minimize risk of damage: Preventive measures, such as surge protection and dome protection, lower the risk of accidental damage
- worldwide calibration organization: Pyranometers must be calibrated every 2 years. Our worldwide calibration organization reduces calibration costs by simplifying return logistics and turnaround times. Learn more about pyranometer calibration services
- efficient O&M: Minimize inspection with built-in remote sensor diagnostics and quickly install using spring-loaded levelling and (for SR300-D1) on-site status-LED diagnostics


**Figure 5** *Lowest cost of ownership: make use of the worldwide Hukseflux calibration organisation.*

## Use in PV monitoring: IEC 61724-1

For high-accuracy PV system performance monitoring, the IEC 61724-1:2021 *Photovoltaic System Performance Monitoring – Guidelines for Measurement, Data Exchange and Analysis* – requires mitigation of dew and frost. SR300-D1 complies, for both Plane of Array (POA) and Global Horizontal Irradiance (GHI) without the need for additional accessories. For Reflected Horizontal Irradiance (RHI) and Rear-side Plane of Array irradiance ($POA^{REAR}$), lower class instruments may be used. Read more about PV monitoring according to IEC 61724-1 in our application note: The IEC 61724-1:2021 standard for PV monitoring systems: a quick explanation

## Use in meteorological networks

In WMO-No. 8, Guide to Meteorological Instruments and Methods of Observation, WMO recommends the use of spectrally flat Class B or "good quality" pyranometers such as the Hukseflux model SR100-D1 for network operation. Modern networks often use one level higher: spectrally flat Class A, such as our models SR300-D1 and SR200-D1.

Sensors made by Hukseflux passed validation and acceptance testing for many National Meteorological Networks. Here are our references* from 2013 to 2025.

- India: National Institute of Wind Energy (NIWE) solar resource assessment network
- USA: National Ecological Observatory Network (NEON), observation network
- UK: Centre for Ecology & Hydrology (CEH), measurement / monitoring network
- India: India Meteorological Department (IMD), national measurement network
- Japan: Japan Meteorological Agency (JMA), national measurement network
- China: China Meteorological Administration (CMA), national measurement network, through a technology transfer project.
- Ecuador: National Meteorological and Hydrological Institute (INAMHI), national measurement network
- USA: The Atmospheric Radiation Measurement (ARM) multi-laboratory network of the U.S. Department of Energy (DOE)
- India: Defence Geo-Informatics Research Establishment (DGRE) climate observation network in the Indian Himalayas

*NOTE: the fact that a sensor is tested or used in a network does not constitute a formal endorsement by the test institute or network owner.

## Use for diffuse radiation measurement

Diffuse solar radiation can be measured by diffusometers, such as our SRD100-D1 (Figure 6), or shaded pyranometers. For the latter, the dominant measurement error is the zero offset a. SR300-D1, equipped with internal ventilation, has very low offsets. It outperforms the quartz dome instruments, traditionally used for this purpose, at a much lower cost level.


**Figure 6** *SRD100 industrial diffusometer: sensor for the measurement of diffuse solar radiation. Designed for PV power plants, with other applications in meteorology and building physics.*

## Instrument cleaning and calibration

The performance of high-class instruments strongly depends on cleaning. At a low maintenance level, the achievable accuracy will not be reliably attained. Consider using 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. At low maintenance intervals, the use of multiple low-class instruments is a good alternative to using a single high-class instrument.

## Electrical interfacing

We can assist you in optimising the interfacing of the pyranometer to your data collection platform. Solutions vary from using a data logger as a local connection point for several different sensors to using transmitters incorporated in the pyranometer. The ideal solution for the solar PV industry and meteorological networks is the SR300-D1 pyranometer. Key features of this model: digital output and sensor communication using the industry-standard Modbus RTU protocol over 2-wire RS-485.

## Mounting accessories

Hukseflux offers a full range of practical brackets for mounting, levelling and electrically insulating pyranometers. They make installation and levelling easy. The most common ones are:

- spring-loaded or ball pyranometer levelling; time saver for the OEM crew
- a mounting fixture that electrically insulates the pyranometer body from the mounting structure
- mounting brackets for vertical masts, for horizontal crossarms and for flat walls
- mounting fixtures to construct albedometers from 2 pyranometers

## See also

Hukseflux offers a complete range of pyranometers. Take a look at all solar radiation sensors, accessories and related services.

## 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. We are market leaders in solar radiation- and heat flux measurement. Customers are served through our headquarters in the Netherlands, and locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia and Japan.

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