IEC 61724-1:2021

Selection of pyranometers for compliance with the new standard

The 61724-1 standard for PV system performance monitoring has been revised. The latest version, released July 2021, defines 2 "accuracy classes". In conformity declarations, providers must state the accuracy class of the measurement. The class is not only determined by the hardware that is used, but also by quality checks and measurement procedures. The standard contains detailed specifications at monitoring system component level. This memo offers comments on consequences of the standard concerning the selection of pyranometers. It shows requirements for solar radiation measurements and which pyranometers comply. A separate memo offers a general explanation of IEC 61724-1:2021.

Introduction

The first edition of IEC 61724-1: *Photovoltaic system performance monitoring – Guidelines for measurement, data exchange and analysis –*, dates from 2008. It has been updated twice. The latest 2021 version of the standard is fundamentally different from the 2008 version and has slightly changed relative to the 2017 version.

The new standard includes:

- 2 accuracy classes, A and B, for monitoring systems, to be used in conformity declarations. The 2017 Class C is now Class B
- accuracy requirements for monitoring equipment per class
- required quality checks (i.e. calibration and maintenance) per class
- recommended minimum number of instruments used as a function of the PV system scale
- new in 2021: requirements for reflected radiation and albedo measurement
- requirements for tilt sensors included

Consequences

The 2021 version of the standard recognises that the solar irradiance measurement is one of the weakest links in the measurement chain. For Class A systems, it specifies the Class of pyranometer that may be used, including requirements for dew and frost mitigation, azimuth and tilt angle accuracy. It also defines cleaning and calibration intervals for pyranometers. Furthermore, the standard defines requirements for measurement of module- and air temperature, wind speed and direction, soiling ratio, and (AC and DC) current and voltage.

Why heating?

IEC 61724-1:2021 requires pyranometer dew and frost mitigation for class A monitoring systems. Why? Pyranometer domes are made of glass. When facing the sky on a clear night, glass temperature tends to go below dewpoint, so that water condenses on the dome. Heating and ventilation of solar radiation sensors keep the glass temperature above dewpoint and free from dew and frost deposition. This significantly increases the reliability of the measured data. There is an exception for locations where dew and frost is expected for less than 2 % of annual GHI hours.

Figure 1 *Frost and dew deposition: clear difference between a non-heated pyranometer (back) and SR30 with heating.*

The following tables offer an overview of the main elements of the IEC 61724-1 monitoring classification system, its requirements for solar radiation measurement and which pyranometers comply in which accuracy class.

Table 1 *The main elements of the IEC 61724-1:2021 PV monitoring system classification system.*

	CLASS A	**CLASS B**	**CLASS C**
accuracy	high	medium	low
target application	utility scale PV systems and large commercial	rooftop or small to medium size commercial **New in 2021:** Old (2017) Class C is now Class B	**New in 2021:** No longer used

Table 2 *Requirements for solar radiation measurement in the IEC 61724-1 monitoring classification system.*

	CLASS A	CLASS B	CLASS C
irradiance measurement	for GHI and for POA: pyranometer Spectrally flat Class A (secondary standard) or for POA only: matched high-accuracy PV reference cell (same cell type and anti-reflection coating as the PV system) For reflected irradiance Class C pyranometers or PV reference cells may be employed	POA measurement and panel temperature measurement are required GHI and other parameters may be derived by other means than on-site measurement such as satellite observation	N/A
dew and frost mitigation	Required, except for locations where dew and frost is expected for less than 2 % of annual GHI hours. Whether an installation site requires mitigation is decided by analysis of typical meteorological year data for the site. Dew or frost is considered expected when ambient temperature is within 1.5 °C of dew point	not required	
cleaning	1 x / week (unless it can be proven that this is not needed)	not required	
alignment	tilt ± 1 ° azimuth ± 2 °	not required	
quality checks	calibration prior to use calibration 1 x / 2 yr	calibration prior to use calibration schedule as recommended by manufacturer	
number of systems per PV power plant	minimum recommended number depends on system size	minimum recommended number depends on system size	

Table 3 *Compliance of Hukseflux pyranometers with Class A, B and C monitoring system requirements.*

CLASS A	CLASS B	CLASS C
SR30 meets Class A PV monitoring system requirements for solar irradiance for all locations and climatic conditions and for tracker tilt angle measurements	*SR20-D2, SR15, SR05* meet Class B PV monitoring system requirements for solar irradiance for all locations and climatic conditions	N/A
SR20 all versions + VU01 ventilation unit *SR20-T1 and T2** meets Class A PV monitoring system requirements for solar irradiance for all locations and climatic conditions		
SR20-D1 meets Class A PV monitoring system requirements for locations where dew and frost is expected for less than 2 % of annual GHI hours.		

* the heater is not necessarily switched on; for operation within ISO 9060 Class A specifications: activate the heater when the sun is below the horizon

SR30: compliant with IEC, Class A

IEC 61724-1: *Photovoltaic System Performance Monitoring - Guidelines for Measurement, Data Exchange and Analysis* - requires dew and frost mitigation for Class A monitoring.
The SR30 pyranometer, released by Hukseflux in January 2017, was the first pyranometer compliant in its standard configuration with the requirements for Class A PV monitoring systems of the new IEC 61724-1:2017 standard.
SR30 offers heating without the need for additional accessories such as a traditional ventilation system.

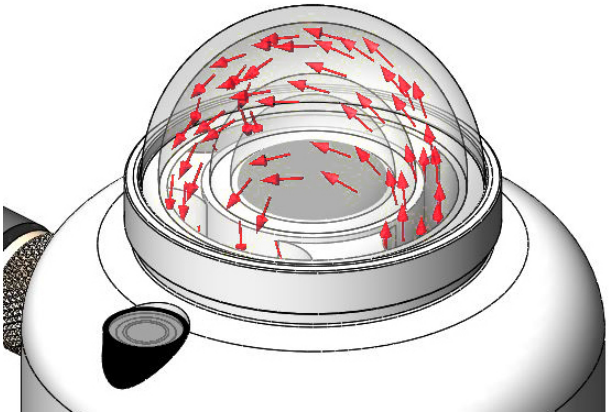

Figure 2 *Heating: how it's done: Recirculating Ventilation and Heating (RVH™) technology between the inner- and outer dome forming a closed circuit with the body is much more power-efficient than traditional ventilation systems.*

Heated for high data availability

High data availability is attained by heating of the outer dome by ventilating air between the inner and outer dome. This space forms a closed circuit together with the instrument body; ventilated air is not in contact with ambient air. Recirculating Ventilation and Heating (RVH™) technology, developed by Hukseflux, mitigates dew and frost and is as effective as traditional ventilation systems, without the maintenance hassle and large footprint. The instrument has 2 heating modes; normal at < 3 W, and medium at < 0.65 W power.

- low power consumption:
  SR30-M2-D1 requires less than 3 W, compared to 10 W for traditional ventilation systems
- low maintenance:
  SR30-M2-D1 does not require filter cleaning or replacement

The dome of the SR30 pyranometer is heated by ventilating the area between the inner and outer dome. RVH™ is much more efficient than traditional ventilation, where most of the heat is carried away with the ventilation air.
Recirculating ventilation is as effective in suppressing dew and frost deposition at less than 3 W as traditional ventilation is at 10 W. RVH™ technology keeps domes and sensor in perfect thermal equilibrium, which also leads to a reduction of zero offsets.

Figure 3 *Two SR30 Class A pyranometers with digital output for GHI (Global Horizontal Irradiance) and POA (Plane of Array) measurement applications.*

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 the main office in the Netherlands, and locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia and Japan.

Are you interested in this product?
E-mail us at: info@hukseflux.com