Hukseflux
Thermal Sensors

IEC 61724-1:2017

Selection of pyranometers for compliance with the new standard

The 61724-1 standard for PV system performance monitoring has been revised. The new version, released February 2017, defines "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 new 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 61724-1:2017.

Introduction

The first edition of IEC 61724-1: *Photovoltaic system performance monitoring – Guidelines for measurement, data exchange and analysis –*, dates from 2008. It now has been updated. The new 2017 version of the standard is fundamentally different from the 2008 version. The new scope not only defines the measuring system components and procedures (as in the 2008 version), but also aims to keep measurement errors within specified limits. It does so by establishing accuracy classes for monitoring systems.

The new standard includes:

- 3 accuracy classes, A, B and C, for monitoring systems, to be used in conformity declarations
- 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

Consequences

The 2017 version of the standard recognises that the solar irradiance measurement is one of the weakest links in the measurement chain. It specifies for each class of monitoring system the pyranometer class that must be used, including required instrument heating, azimuth and tilt angle accuracy. It also defines cleaning and calibration intervals for pyranometers. The standard also defines requirements for measurement of module- and air temperature, wind speed and direction, soiling ratio, and (AC and DC) current and voltage.

Why heating and ventilation?

IEC 61724-1:2017 requires pyranometer heating and ventilation for class A, and heating only for class B. 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 keeps the glass temperature above dewpoint and free from dew and frost deposition. This significantly increases the reliability of the measured data.

Figure 1 *frost and dew deposition: clear difference between a non-heated pyranometer (back) and SR30 with RVH™ - Recirculating Ventilation and Heating - technology (front)*

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 monitoring classification system*

	CLASS A	CLASS B	CLASS C
accuracy	high	medium	basic
purpose	utility scale PV systems	large commercial PV systems	small PV systems

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 GHI and for POA: pyranometer Spectrally flat Class B (first class) or for POA only: matched medium-accuracy PV reference cell, (same cell type and anti-reflection coating as the PV system)	any
heating	required	required	not required
ventilation	required for pyranometers	not required	not required
cleaning	1 x / week	optional	not required
alignment	tilt ± 1 ° azimuth ± 2 °	tilt ± 1 ° azimuth ± 2 °	not required
quality checks	calibration prior to use calibration 1 x / yr	calibration prior to use calibration 1 x / 2 yr	calibration prior to use calibration schedule as recommended by manufacturer
number of sensors	equal number of sensors in POA and GHI minimum recommended number depends on system size	equal number of sensors in POA and GHI minimum recommended number depends on system size	equal number of sensors in POA and GHI 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 (spectrally flat Class A - secondary standard-, digital output, includes heating, ventilation, tilt measurement)	*SR15-D1 and SR15-A1* (spectrally flat Class B - first class-, digital / analogue outputs, includes heating) activate the heater to comply with Class B	*SR05* (spectrally flat Class C -second class-)
SR20 all versions + VU01 ventilation unit (spectrally flat Class A - secondary standard-,, digital / analogue outputs, separate ventilation unit with heating) requires separate tilt verification	*SR20-T1 and T2* (spectrally flat Class B - secondary standard, analogue millivolt output version only, includes heating) activate the heater to comply with Class B	

Table 4 *Retrofitting Hukseflux pyranometers for Class A and B monitoring system compliance*

CLASS A	CLASS B	CLASS C
If you have SR20 all versions: add *VU01* ventilation unit to comply with Class A calibration 1 x / yr	*If you have SR20-T1 and T2:* activate the heater to comply with Class B calibration 1 x / 2 yr	*If you have any pyranometer:* it automatically complies with class C calibration according to manufacturer recommendation
	If you have SR15-D1 and SR15-A1: activate the heater to comply with Class B calibration 1 x / 2 yr	

Hukseflux SR30: compliant with IEC, Class A and B

IEC 61724-1: Photovoltaic System Performance Monitoring - Guidelines for Measurement, Data Exchange and Analysis - requires ventilation and heating for Class A monitoring.
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.
Only SR30 offers both (heating and ventilation), without the need for additional accessories such as a traditional ventilation system. Most competing pyranometers do not even comply with Class B, which requires heating.

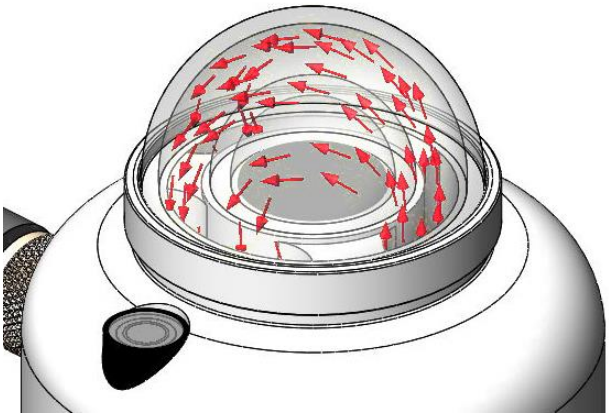

Figure 2 *how it's done: recirculating ventilation and heating between the inner- and outer dome is much more power efficient than traditional ventilation systems*

Heated for high data availability, featuring new RVH™ technology

High data availability is attained by heating of the outer dome using ventilation 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. RVH™ - Recirculating Ventilation and Heating - technology, developed by Hukseflux, suppresses dew and frost deposition and is as effective as traditional ventilation systems, without the maintenance hassle and large footprint.

- low power consumption: SR30 requires only 2 W, compared to 10 W for traditional ventilation systems
- low maintenance: SR30 does not require filter cleaning

RVH™ uses SR30's built-in heater and ventilator. The dome of 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 2 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 secondary standard pyranometers with digital output for GHI (global horizontal irradiance) and POA (plane of array) measurement applications*

About Hukseflux

Hukseflux Thermal Sensors makes sensors and measuring systems. Our aim is to let our customers work with the best possible data. Many of our products are used in support of energy transition and efficient use of energy. We also provide services: calibration and material characterisation. Our main area of expertise is measurement of heat transfer and thermal quantities such as solar radiation, heat flux and thermal conductivity. Hukseflux is ISO 9001 certified. Hukseflux products and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

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