

PV monitoring and meteorological industries prepare for revised pyranometer standard ISO 9060:2018

Do your instruments comply? Hukseflux models SR20 and SR30 do.

The ISO 9060 pyranometer classification standard's "final draft" has been submitted to ISO in April 2018. This note by Hukseflux Thermal Sensors reports positions on which there is confirmed consensus in the standard working group; it also reports an update of the state of development. For sources, see the last page of this note. Contents reflect the "personal opinion" at Hukseflux concerning this upcoming standard. The proposed revision will have stricter requirements than the prior 1990 version. There is consensus that performance verification reports for temperature dependence and directional response must now be included with every individual instrument of the highest accuracy class. The IEC 61724-1 PV system performance monitoring standard requires compliance with the latest ISO 9060 version, so that requirements for the highest accuracy, Class A, PV monitoring systems also change.

Good news for Hukseflux users:

- *installed base, present supply and future supply of Hukseflux SR20 and SR30, already comply with the new version of the ISO 9060 standard*
- *SR30 also complies with IEC 61724-1 Class A - PV system monitoring system requirements as is, while SR20 complies with Class A when used with the optional Hukseflux VU01 ventilation unit.*

Hukseflux' suggestion for all pyranometer users in PV monitoring and meteorological industries:

- *prepare to specify "Spectrally Flat Class A pyranometer" instead of "Secondary Standard"*



Figure 1 ISO 9060 secondary standard pyranometers

More about compliance of pyranometers with the new IEC classification

A separate memo offers comments on *consequences of the new IEC 61724-1 standard concerning the selection of pyranometers.*

Introduction

The 1990 edition of ISO 9060: *Solar energy – Specification and classification of instruments for measuring hemispherical solar and direct solar irradiance* –, is up for revision. The new 2018 version of the standard will be slightly different from the 1990 version. In fact, the standard is now in the FDIS "Final Draft" stage; only minor revisions are still permitted. Although a bit early, Hukseflux believes the time is right to inform the industry of the key changes to the standard on which there is confirmed consensus within the working group.

The new version of ISO 9060 includes:

- 3 instrument accuracy classes, A, B and C
- a special extension of every class "Spectrally Flat", which is recommended for Plane of Array (POA), albedo, and reflected solar measurements
- a new definition for spectral error (previously known as spectral selectivity)

New requirements are clarified for Class A (old name: Secondary Standard) pyranometers only:

- individual testing of temperature response
- individual testing of directional response

Many PV monitoring systems comply with IEC61724-1: *Photovoltaic system performance monitoring – Guidelines for measurement, data exchange and analysis*. This IEC standard is linked to ISO 9060. For details see the next paragraphs.

Getting prepared

Ask yourself:

- do I claim compliance with ISO 9060 “Secondary Standard”? If so, are/were the instruments supplied with temperature and directional response test reports on an individual sensor basis? Under ISO 9060:2018, “Class A” instruments must be supplied with said test reports.
- for PV monitoring: do I claim compliance with IEC 61724-1: Photovoltaic system performance monitoring? If claiming to offer IEC Class A monitoring, see explanation below.
- do I have old instruments on stock? You may consider an upgrade, see explanation below.

Additional preparations:

- change product specifications or requirements: refer to “Spectrally Flat Class A, B or C pyranometers” and ISO 9060:2018
- include “temperature and directional response test reports” to the specification of Class A instruments
- change the “spectral selectivity” specification to “spectral error”

Why you need a “Spectrally Flat” pyranometer in PV monitoring and in meteorology

For PV and Meteorological industries, working from the WMO manual and from IEC 61724-1, specifying “Spectrally Flat” instruments ensures continuity of performance. In more detail: the new ISO 9060:2018 specifies the spectral error using a clear sky spectrum and horizontally installed instruments. A special “Spectrally Flat” category is defined for instruments installed non-horizontal, potentially measuring a different spectrum, using the old (stricter) WMO, IEC and ISO definition of “spectral selectivity”. The standard specifically states use of “Spectrally Flat” instruments for:

- reflected solar radiation
- albedo

The same “Spectrally Flat” is essential for:

- Plane of Array (including reflected) irradiance
- diffuse irradiance (diffusometers)

What does IEC 61724-1 require?

This IEC 61724-1 standard, in chapter 2, requires compliance with **the latest available version** of the ISO 9060 standard.

This means users claiming compliance with IEC 61724-1 “Class A monitoring systems” must take special care. In case you are using a ventilated Hukseflux SR20, or the latest SR30 model, you already comply. In the event another ventilated pyranometer is used, consult Tables 1 and 2 in this document or contact the manufacturer.

Can I “upgrade” an older secondary standard pyranometer to comply with the new ISO 9060 Class A?

Yes, you can. To continue compliance with IEC 61724-1 Class A, pyranometers with directional response and temperature response test results according to ISO 9060 Spectrally Flat Class A are required.

If your pyranometers are lacking the required test reports, you can return your secondary standard pyranometer to the manufacturer, or to Hukseflux, for performance verification:

- temperature dependence test report
- directional response test report

NOTE: for any Hukseflux Secondary Standard model (i.e. SR20 and SR30), no additional testing is required as Hukseflux Secondary Standard pyranometers have always been supplied standard with the required test reports.

How much time do I have to comply?

The obligation to comply with a new standard does not follow from publication, but from reference to the new standard in specification documents. These may be tenders, other standards such as IEC 61724-1 or requests by the users of the pyranometer measurement data.*

- a new standard may immediately be used when published; if users ask for compliance with the ISO 9060:2018, the ISO 9060:1990 compliance is no longer sufficient.
- IEC 61724-1 requires immediate compliance. See also the next points.
- the ISO committee may specify a transition period from the 1990 to the 2018 version
- a typical transition period is 6 months to 1 year.

*source: NEN, the knowledge network for standardization in the Netherlands

Table 1 Requirements of ISO 9060:2018 and IEC 61724-1 PV system performance monitoring

ISO 9060:2018 COMPLIANCE	ISO 9060:2018 SPECTRALLY FLAT CLASS A	ISO 9060:2018 CLASS A	ISO 9060:2018 SPECTRALLY FLAT CLASS B
Accuracy	high	high	medium
Purpose/application	utility scale PV systems, Global (GHI), Plane of Array (POA) & albedo	utility scale PV systems, Global (GHI) only	large commercial PV systems
Individual test of temperature response	required	required	not required
Individual test of directional response	required	required	not required
Examples of ISO 9060:2018 complying instruments	SR30, SR20 all ISO 9060:1990 secondary standard pyranometers with directional- and temperature test reports	SR30, SR20 all ISO 9060:1990 secondary standard pyranometers with directional- and temperature test reports	SR15 all ISO 9060:1990 first class pyranometers
IEC 61724-1 COMPLIANCE	IEC 61724 CLASS A MONITORING SYSTEM	IEC 61724 CLASS A MONITORING SYSTEM	IEC 61724 CLASS B MONITORING SYSTEM
ISO 9060:2018 compliance required?	yes, chapter 2 demands compliance with the latest version of ISO 9060	yes, chapter 2 demands compliance with the latest version of ISO 9060	yes, chapter 2 demands compliance with the latest version of ISO 9060
Instrument requirements in ISO 9060:2018 vocabulary	ISO 9060 "Spectrally Flat Class A" with heater and ventilation	ISO 9060 "Class A" is insufficient: not suitable for Plane-of-Array (POA)	ISO 9060 "Spectrally Flat Class B" with heater
Examples of IEC 61724-1+ ISO 9060:2018 complying instruments	SR30 all ISO 9060:1990 secondary standard pyranometers with directional- and temperature test reports equipped with ventilation and heating		SR30, SR20-T1 and T2, SR15 all ISO 9060:1990 first class pyranometers equipped with heating

Table 2 Compliance of the leading pyranometer models used in PV monitoring

BRAND	MODEL	ISO 9060:2018 SPECTRALLY FLAT CLASS A (SECONDARY STANDARD)	IEC 61724-1 COMPLIANCE
Hukseflux	SR30	yes	class A
Hukseflux	SR20 with VU01 ventilation unit	yes	class A
Hukseflux	SR20-T1, SR20 –T2	yes	class B
All brands	ISO 9060: 1990 secondary standard pyranometers with directional- and temperature test reports equipped with ventilation and heating	yes	class A

Sources of information

The sources of information used for this note are the discussions in the ISO committee’s TC 180/SC1 working group, and the document ISO/DIS 9060: 2017(E) issued by ISO International Organization for Standardization, 2018. This note by Hukseflux reports positions, in this case technical requirements, on which there is confirmed consensus in the standardisation working group; it also reports an update of the state of development. The process of getting to a standard is open, transparent and aims to reach consensus. It takes place in committees and working groups. ** ISO allows reporting consensus positions.*** Contents of this note reflect the “personal opinion” at Hukseflux.



Figure 2 Two SR30 secondary standard pyranometers measuring GHI (global horizontal irradiance) and POA (Plane of Array) in a PV performance monitoring system

** source: NEN, the knowledge network for standardization in the Netherlands

*** source: ISO - Policy on communication and document retention, chapter D

About Hukseflux

Hukseflux Thermal Sensors offers measurement solutions for the most challenging applications. We design and supply sensors as well as test & measuring systems, and offer related services such as engineering and consultancy. With our laboratory facilities, we provide testing services including material characterisation and calibration. 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 sensors, systems and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

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