

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-18657-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: 06.12.2019

Date of issue: 06.12.2019

Holder of certificate:

**Institut für Solarenergieforschung GmbH
ISFH Calibration and Test Center (CalTeC)
Am Ohrberg 1. 31860 Emmerthal**

Calibration in the fields:

High Frequency – and radiation quantities
optical quantities
– photovoltaics
– radiometry

Within the measurands/calibration items marked with with *), the calibration laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, to use calibration standards or equivalent calibration procedures listed here with different issue dates. The calibration laboratory maintains a current list of all calibration standards / equivalent calibration procedures within the flexible scope of accreditation.

Abbreviations used: see last page

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Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
photovoltaics		DIN EN 60904-1:2007		
short circuit current solar cells*	0.5 mA to 12 A		0.93 %	
open circuit voltage solar cells*	0.1 V to 20 V		0.24 %	
Fill factor solar cells*	25 % to 95 %		0.66 %	
Maximum power solar cells*	0.01 mW to 40 W		1.1 %	
Efficiency solar cells*	0.1 % to 95 %		1.2 %	
spectral responsivity*	0.2·10 ⁻³ mA/(W/m ²) to 20 mA/(W/m ²)	DIN EN 60904-8: 2015 wavelength		
		280 nm to < 300 nm	14 %	
		300 nm to < 350 nm	1.4 %	
		350 nm to < 400 nm	1.1 %	
		400 nm to < 600 nm	0.90 %	
		600 nm to < 800 nm	0.90 %	
		800 nm to < 1000 nm	0.90 %	
		1000 nm to < 1100 nm	0.90 %	
	1100 nm to < 1150 nm	2.4 %		
	1150 nm to 1200 nm	5.2 %		
Temperature coefficient of short circuit current of solar cells*	0 ppm/K to 2000 ppm/K	DIN EN 60891:2010 DIN EN 60904-1:2007	100 ppm/K	
Temperature coefficient of open circuit voltage of solar cells*	-10000 ppm/K to 0 ppm/K		80 ppm/K	
Temperature coefficient of maximum power of solar cells*	-10000 ppm/K to 0 ppm/K		210 ppm/K	

¹⁾ The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of $k = 2$ unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
responsivity irradiance detectors	0.001 mV/(W/m ²) to 100 mV/(W/m ²)	100 W/m ² to 1050W/m ² 20°C to 100°C	1.2 %	Measurement of output voltage and temperature signal of sensor unit
	0.001 mA/(W/m ²) to 10 mA/(W/m ²)			Measurement of output current and temperature signal of sensor unit
area	0.25 cm ² to 250 cm ²	SOP: BA_AREA_Bedienungsanleitung_QM16a 2019	0.40 %	Area standard: glass-chrome-mask
Radiometry spectral irradiance (lamps)	1.0·10 ⁻⁵ W/(m ² ·nm) to 0.5 W/(m ² ·nm)	Wellenlänge		Lamp power:
		250 nm to < 265 nm	17 %	200 W <= 300 W
		265 nm to < 300 nm	6.8 %	
		300 nm to < 350 nm	2.0 %	
		350 nm to < 400 nm	1.5 %	
		400 nm to < 840 nm	1.3 %	
		840 nm to < 950 nm	1.4 %	
		950 nm to < 1300 nm	1.7 %	
		1300 nm to < 1600 nm	2.3 %	
1600 nm to 1700 nm	2.7 %			

Abbreviations used:

CMC	Calibration and measurement capabilities (Kalibrier- und Messmöglichkeiten)
DIN	Deutsches Institut für Normung e.V.
BA	standard operations procedure of CAB

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