Fraunhofer ISE

# List of accredited test procedures (D-K-11140-02-00)

CalLab PV Modules TestLab PV Modules

Revision date: 18.12.2024

## Monofacial PV modules

| Standard | Title | Edition | Release | Status |
|---|---|---|---|---|
| IEC 60904-1 | Photovoltaic devices - Part 1: Measurement of photovoltaic current-voltage characteristics | 2,0 | 2006-09 | Revised |
| | | 3,0 | 2020-09 | Valid |

| Measurement quantity / Calibration item | Range | | | Measurement conditions / procedure | Expanded uncertainty of measurement[1)] |
|---|---|---|---|---|---|
| Short-circuit current Solar modules | 16 mA | to | 50 A | IEC 60904-1:2020 | 0,9 % |
| Open-circuit voltage Solar modules | 10 mV | to | 420 V | IEC 60904-1:2020 | 0,6 % |
| Current at maximum power Solar modules | 16 mA | to | 50 A | IEC 60904-1:2020 | 1,3 % |
| Voltage at maximum power Solar modules | 10 mV | to | 420 V | IEC 60904-1:2020 | 1,0 % |
| Maximum power Solar modules | 0,2 W | to | 5 kW | IEC 60904-1:2020 | 1,1 % |
| Fill factor of IV-curve Solar modules | 0% | to | 100% | IEC 60904-1:2020 | 1,0 % |
| Efficiency Solar modules | 0% | to | 100% | IEC 60904-1:2020 | 1,3 % |

## Bifacial PV modules

| Standard | Title | Edition | Release | Status |
|---|---|---|---|---|
| IEC TS 60904-1-2 | Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices | 1,0 | 2019-01 | Valid |

| Measurement quantity / Calibration item | Range | | | Measurement conditions / procedure | Expanded uncertainty of measurement[1)] |
|---|---|---|---|---|---|
| Short-circuit current Solar modules | 16 mA | to | 50 A | IEC TS 60904-1-2:2019 | 1,2 % |
| Open-circuit voltage Solar modules | 10 mV | to | 420 V | IEC TS 60904-1-2:2019 | 0,6 % |
| Current at maximum power Solar modules | 16 mA | to | 50 A | IEC TS 60904-1-2:2019 | 1,6 % |
| Voltage at maximum power Solar modules | 10 mV | to | 420 V | IEC TS 60904-1-2:2019 | 1,0 % |
| Maximum power Solar modules | 0,2 W | to | 5 kW | IEC TS 60904-1-2:2019 | 1,4 % |
| Fill factor of IV-curve Solar modules | 0% | to | 100% | IEC TS 60904-1-2:2019 | 1,1 % |
| Efficiency Solar modules | 0% | to | 100% | IEC TS 60904-1-2:2019 | 1,6 % |
| Short-circuit current bifaciality Solar modules | 0% | to | 100% | IEC TS 60904-1-2:2019 | 0,7 % |
| Open-circuit voltage bifaciality Solar modules | 0% | to | 100% | IEC TS 60904-1-2:2019 | 0,9 % |
| Maximum power bifaciality Solar modules | 0% | to | 100% | IEC TS 60904-1-2:2019 | 1,3 % |
| Rear irradiance driven power gain yield (BiFi) Solar modules | 0 W/(W/m$^2$) | to | 5 W/(W/m$^2$) | IEC TS 60904-1-2:2019 | 11,7 % |

**Abbreviations used:**
IEC International Electrotechnical Commission
TS Technical Specification
CMC Calibration and measurement capabilities

[1)] The expanded uncertainties according to EA-4/02 M:2022 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.