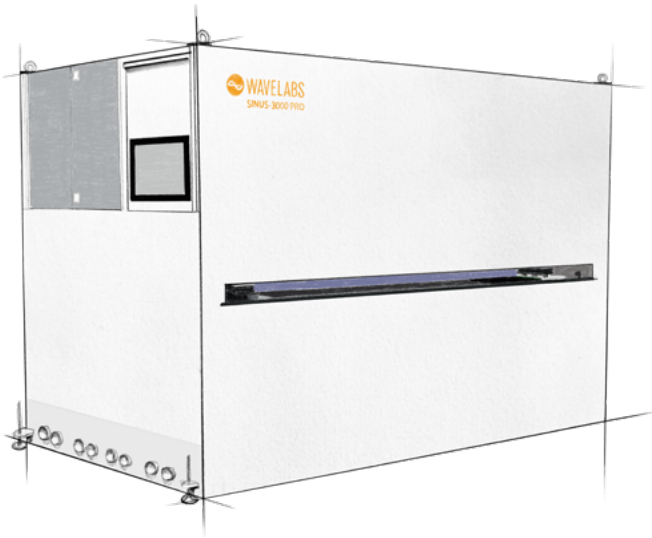


# LED's MEASURE SOLAR MODULES

## LED SOLAR SIMULATOR SINUS-3000 PRO



The tabletop **SINUS-3000 PRO** is the ideal flasher for solar module production lines and R&D. Its nearly perfect simulation of the sun's spectrum enables highly accurate solar module efficiency measurement at minimum operating costs due to the long lifetime of LEDs. An exposure time of up to 500 ms makes it the perfect fit for various research and development applications.


**LED's** present the innovative all-in-one tool!





### HIGHLIGHTS


 **Multicolor LED-based light source**  
for a perfect copy of the sun


 **All LEDs can be tuned**  
for customised spectra


 **Fully integrated electro-luminescence camera**  
(optional)

 **Second LED light source**  
for bifacial testing  
(optional)

 **Meets class A+A+A+ criteria**  
(IEC 60904-9 ed.3) for spectral match, non-uniformity and temporal stability

 **Flash time of up to 500 ms**  
for high performance cells

 **Ideal for easy integration**  
into production line testing

 **Stand-alone system**  
provides flexibility for R&D

 **Small footprint**



# LED SOLAR SIMULATOR

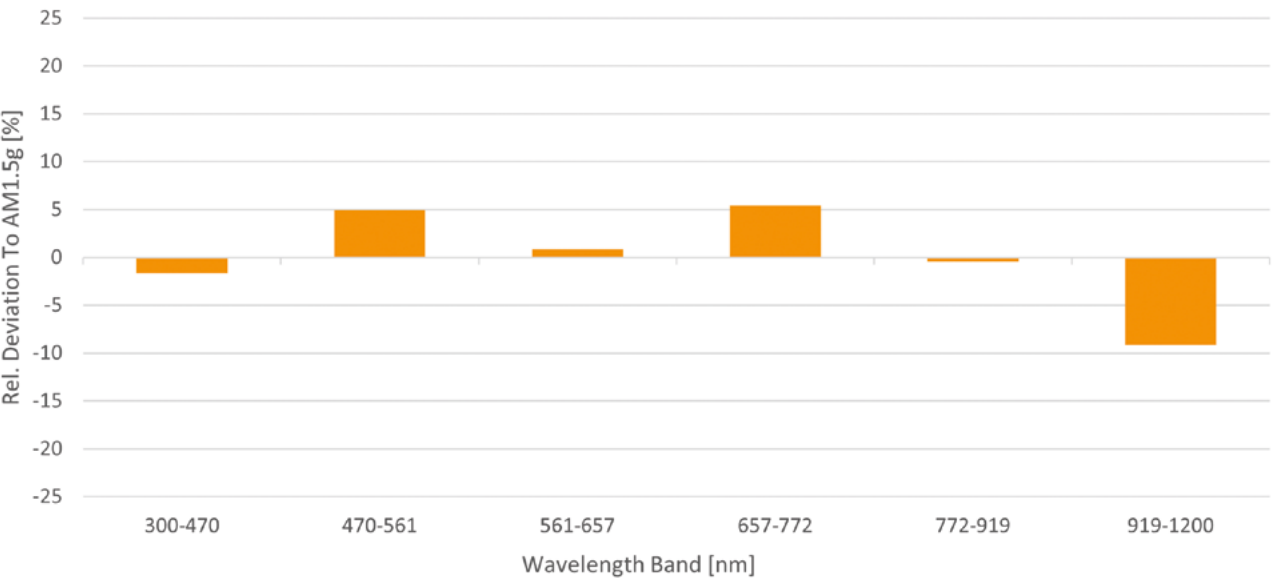
## SINUS-3000 PRO

### CLASSIFICATION

	SINUS-3000 PRO		Class A+A+A+ requirements (IEC 60904-9 Ed. 3)
Spectral match	Class A+	0.875 - 1.125	0.875 - 1.125
Nonuniformity of irradiance	Class A+	< 1%	< 1%
Short-term instability (STI)	Class A+	Synchronized	Synchronized
Long-term instability (LTI)	Class A+	< 1%	< 1%

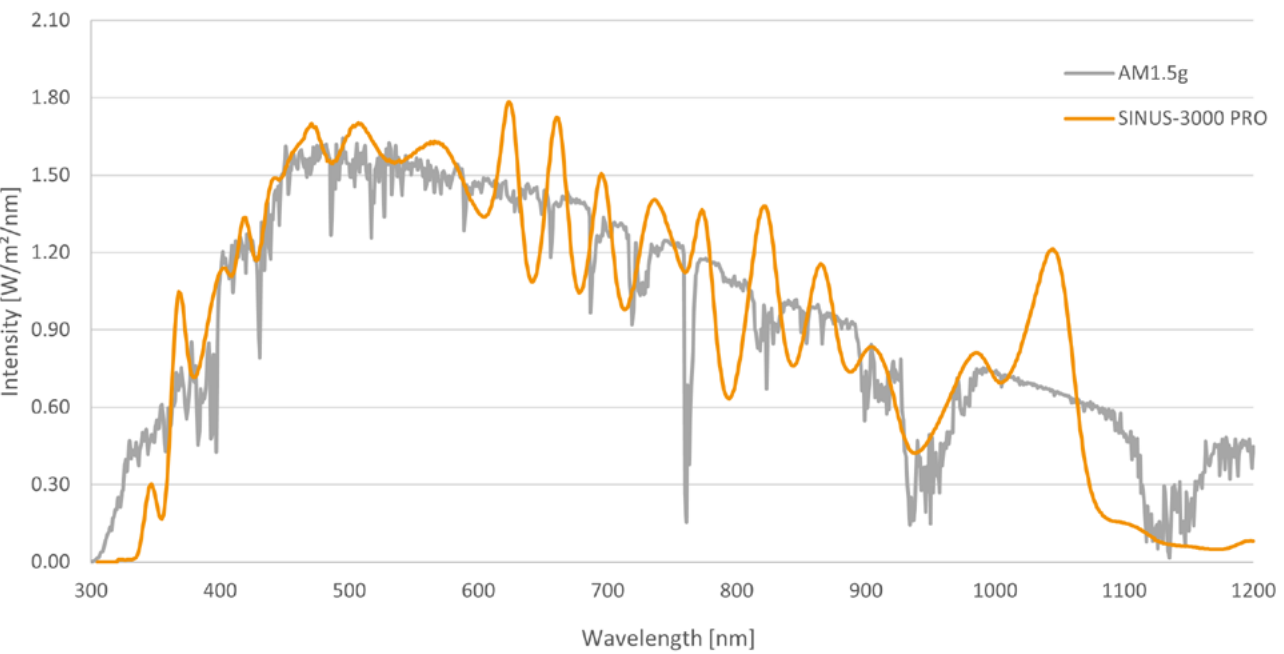
Classification conditions: 150 ms irradiance time, 1 sun, AM1.5g, 760 mm working distance between light engine and solar module

### Typical spectral deviation



### SPECTRAL QUALITY

#### Typical spectrum of LED solar simulator for SINUS-3000 PRO



### FUNCTIONALITY

I-V curve measurement	Under illumination and dark I-V
Solar cell parameter analytics	Voc, Isc, FF, PMPP and conversion efficiency
Temperature correction	Solar cell parameters are adjusted according to IEC 60891
Bypass diodes testing	Reverse voltage

# LED SOLAR SIMULATOR

## SINUS-3000 PRO

### PRODUCT FEATURES

Spectrum	AM1.5g, AM0 or any customer-defined spectrum possible with light engine including illumination by single colors
SPD	≤ 22%
SPC	≥ 95%
Irradiance time	Adjustable: From 70 ms up to 500 ms depending on duty cycle, longer flash times at reduced stability
Cycle time	< 20 s (incl. optional features)
Intensity	Qualified intensities: 0.2, 0.5, 1.0 and 1.2 suns Intermediate intensities can be set individually
Voltage/Current resolution	0.025%
Number of measurement points	As required: Up to 4,000 per recipe (depends on flash duration)
Test area	For modules with two configurations: up to 2,700 x 1,400 mm² and up to 2,230 x 1,400 mm²
Module orientation	Sunny side down or up according requirements, long-edge lead
I-V measurement up to	80 V, 24 A, 750 W or customized
User-defined analytics	Open software interface allows for export of all measured data for analysis and import of classification criteria

### OPTIONAL: CAMERA SYSTEM FOR ELECTROLUMINESCENCE (EL)

Resolution	< 200 µm/px – adjustable
Current range	0 - 20 A depending on IV configuration
Automatic defect recognition	On request

### OPTIONAL END-OF-LINE TESTS

The SINUS-3000 PRO is designed as an **all-in-one tool** for end-of-line testing according to IEC 61730 and UL 61730. Measuring the module output power and bypass diode testing are already included in the basic configuration. The following tests can be added optionally while maintaining the cycle time of less than 20 seconds.

Insulation test (Hipot)	DC output voltage range 0.1 kV - 7 kV Resistance measurement range 0.5 MOhm - 1,000 MOhm
Visual Inspection (VIS)	Camera system with resolution of <200 µm/px. Automatic defect recognition software can be included on request
Continuity test of equipotential bonding	Test performed by 4-wire measurement: AC output current range 0.5 A – 32 A Resistance measurement range 1 mOhm - 500 mOhm

### OPTIONAL: REAR SIDE FLASHER

Spectral match	Class A+
Non-uniformity of irradiance	Class A+
Short-term instability (STI)	Class A+
Intensity	Qualified intensities: 0.1 and 0.3 suns Intermediate intensities can be set individually

### SCOPE OF DELIVERY

- Light engine
    - › Automation
    - › Pyrometer
    - › Intensity sensor
  - I-V electronics and amplifier
  - Industrial PC and touchscreen
- Barcode reader
  - User manuals
  - Hardware options
    - › Fully integrated EL system
    - › Fully integrated VIS-System
    - › Fully integrated HiPot System