

The most important characteristics of solar cells and modules are the current(I)-voltage(V) characteristics measured under illumination and in the dark. The experimental data determined from this measurement include the open-circuit voltage  $V_{OC}$ , the short-circuit current  $I_{SC}$ , the maximum power  $P_{MAX}$  at the maximum power point (MPP), and the fill factor FF. The latter is defined as the ratio between  $P_{MAX}$  and the product of  $V_{OC}$  and  $I_{SC}$ , i. e.:

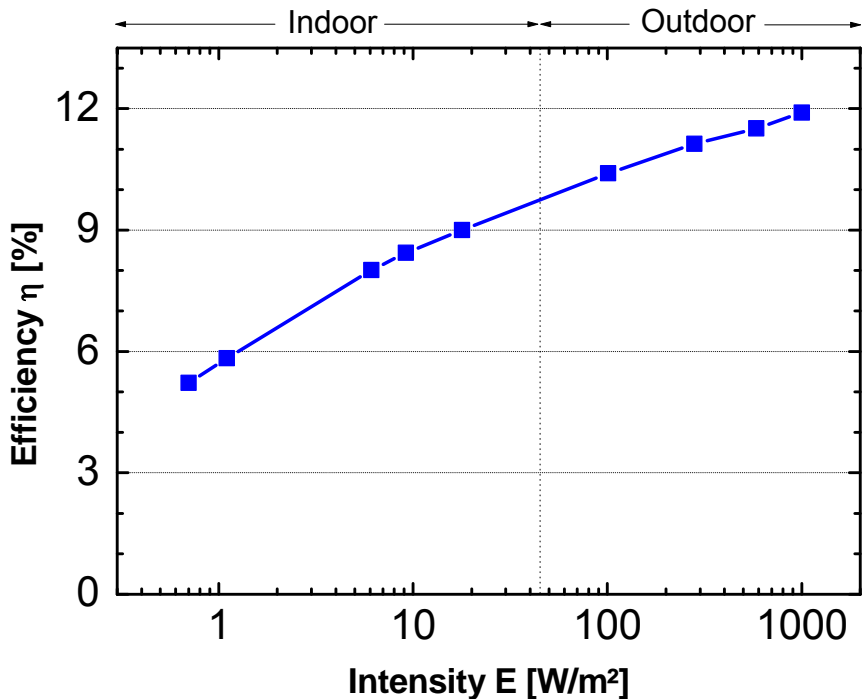
$$P_{MAX} = FF \cdot V_{OC} \cdot I_{SC}$$

The ratio of the usable electrical power at the MPP to the irradiated light power  $P_E$  finally yields the efficiency  $\eta$  of a solar cell or module. The reference area for  $\eta$  is either the total area of the module including the frame, or the aperture area, which only includes the active regions and the internal contact surfaces of the module. The standard testing conditions (STC) are 25 °C and AM 1.5 Global irradiance at 1000 W/m<sup>2</sup>.

<b>Solar Simulators</b>	10 cm x 10 cm:	0,5 kW xenon lamp
	10 cm x 10 cm:	2 lamp simulator 0,5 kW xenon and halogen lamp
	30 cm x 30 cm:	2,5 kW metal halide lamp
<b>Specifications</b>	Temperature control: Spectrum: Homogeneity: Illumination intensity:	Temperature-controlled copper plate Filter for 1000 W/m <sup>2</sup> AM 1.5 Global Typically +/- 2 % by optical integrators Variable
	Other features:	<ul style="list-style-type: none"><li>• Four-point probe measurement</li><li>• Spring-loaded contact manifolds</li><li>• Calibration with a Si reference cell</li><li>• Software for measuring I(V) characteristics</li><li>• Spectroradiometer</li></ul>
<b>Options</b>	Measurements of solar cells and modules up to 30 cm x 30 cm Measurements of non-contacted or encapsulated thin-film solar modules Temperature variations from 10 °C to 60 °C Illumination intensity from indoor values up to 1000 W/m <sup>2</sup> (AM 1.5 Global) Additional filters for AM0 und AM1 spectra	
<b>Requirements</b>	Sample sizes up to 30 cm x 30 cm Contact on illumination side	

# Application Examples for Solar Simulators

## Efficiency of a 5 cm x 5 cm CIS Solar Module Depending on the Illumination Intensity



## I/V Characteristic of a 30 cm x 30 cm CIS Solar Module

