SUNdidactics
SolarEnergyDidactics
SolarEducation
SolarEngineering
Photovoltaics + Solarthermal
innovative Solarsysteme für Schule und Ausbildung
innovative solar- systems for school, college, technical education

NILS ISFH
Kooperationspartner
cooperation partner
Lernwerkstatt NILS-ISFH
am Institut für Solarenergieforschung ISFH
An- Institut der Leibniz Universität Hannover
Solartechnik
Solardidaktik
Solare Wissenschaft
Solar technology Solar didactics
Solar science

Photovoltaik-System
SUSE
Solartechnik
Experimentiergeräte
Solare Experimente von der Grundschule bis zum Abitur
Solar technology
Experimentation devices
Solar experiments

BNE
Bildung für nachhaltige Entwicklung
Education for Sustainable Development

Solardidactic – Solarzellen - Solarmodule – PV- Experimentiergeräte – PV –Experimentieranleitungen - Solarthermie- Experimentiergeräte
didaktische Konzepte – Solarberatung – Fortbildung - solare Aus- und Weiterbildung - Solarspielzeug
Solardidactics + solar cells + solar modules + photovoltaic experiment devices + solar toys + solar education and training

SUNdidactics Solar Systems **Hildesheim, Germany**
Phone: +49(0)5121 860730 Fax: +49(0)3222 3706689 Mail: info@sundidactics.de Mobile: +49(0)1757660607 Web: www.sundidactics.de skype: wolfschanz

The solar load module SUSE 4.55 Technical manual and experiments

The solar load module **SUSE 4.55**
Top: General view from the top
Bottom: Front side with the 3 socket pairs, on the top side the turning knob of the potentiometer is visible.

1. Technical manual:

The **solar load module SUSE 4.55** is necessary for the exact measurement of the power output of a solar cell or solar module. From measurements of the open circuit voltage and short-circuit current, the electrical power of the solar cell or solar module cannot be determined exactly, for that, the connection to a variable ohm resistive load is necessary.

With the connected load module SUSE 4.55, the power, MPP (maximum power point), and efficiency factor can be determined exactly.

Optimal for these measurements is the usage of a PC measuring interface like CassyLab, Vernier, or similar systems. The measurements can also be conducted with multimeters, that method is time-consuming though.

The load module SUSE 4.55 is available in 3 versions:

SUSE 4.55-1: For experiments with **1 solar cell**
SUSE 4.55-6: For experiments with **2-6 solar cells** in series connection
SUSE 4.44-18: For experiments with **7-18 solar cells** in series connection

The **load module SUSE 4.55** consists of a plexiglass angle (155mm x 80mm, bent to 75°), on one side there are 3 color-coded socket pairs to connect a solar cell/solar module, voltage measurement device, current measurement device. On the other side there is an appropriate high performance potentiometer with a turning knob.

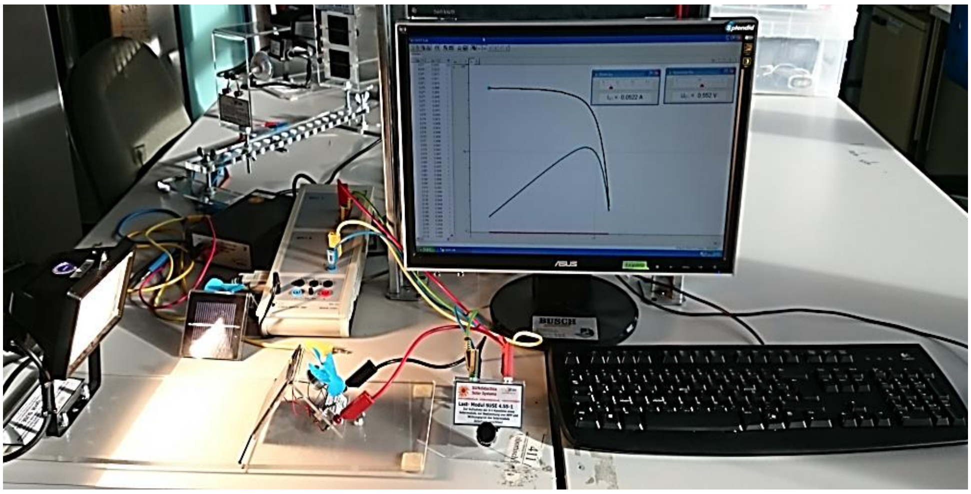
The measurements can be conducted under irradiation of the solar cell/solar module outdoors in the natural sunlight or indoors in a lab with artificial light sources (Basic device SUSE 4.0, halogen spot lamp SUSE 5.16, or illuminated plate of an overhead projector).

2. Theory of operation:

The device is connected to the solar module and the measurement inputs for V and I, the potentiometer can be rotated from 0 Ω up to a maximum value, thereby changing the ohm load from very high to minimal. The electrical energy produced by the solar cell/solar module is converted to heat energy in the potentiometer, it serves as a load resistance. The electrical power output of a solar cell or solar module is maximal at a distinct pair of voltage and current values, so at a distinct ohm load, this is the **maximum power point, it must be determined precisely**.

3. Experiment with PC data logging, here as an example with CassyLab and a notebook:

The following photo shows the measuring setup. The solar cell is connected to SUSE 4.55 with a red-black wire pair, the Cassy input VOLTAGE with a blue-yellow wire pair, the Cassy input CURRENT with a greenwhite wire pair. The solar module is illuminated by a light source, in the photo the halogen spot of the basic device SUSE 4.0 is used.



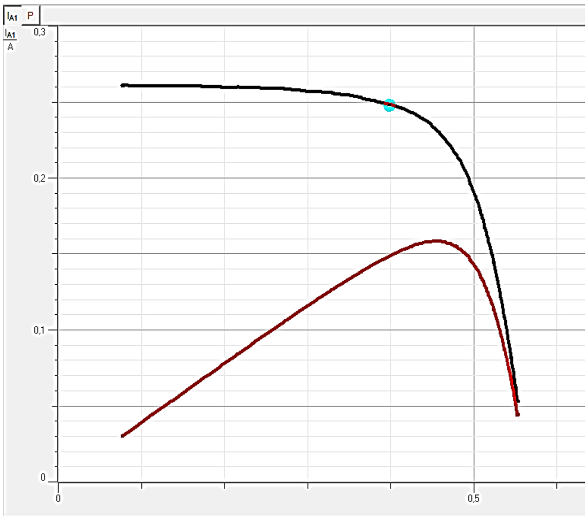
Basic device SUSE 4.0 Cassylab Interface Solar module SUSE CM6MS SUSE 4.55

Measurement setup with SUSE 4.55 at the NILS lab of the ISFH

At the bottom left the basic device SUSE 4.0 with the 120W halogen spot lamp. On the basic device, the solar module SUSE CM6MS is located, next to it the load module SUSE 4.55. To the left of the display, there is the data logging system CassyLab.
On the display the recorded characteristic curves are clearly visible.

The Cassy settings are loaded, the display shows the I-V and P-V characteristic curves of the used solar cell or solar module (see photo).
From the intersection point of the I-V curve with the I axis, the short-circuit current and from that the light intensity = irradiance S can be determined, from the maximum of the P-V curve the location of the MPP.

Scale gradations: 0,3 = 0,3 A
Scale gradations: 1 unit = 0,1 V



Original recording with CassyLab, solar module SUSE CM6MS and load module SUSE 4.55

Black curve: The I(V) curve, the intersection with the y-axis (linear extension of the curve) is the short-circuit current I_{SC}. From I_{SC} the light intensity = irradiance S can be calculated.

Red curve: The power curve P(V). The maximum is the maximum power point MPP.

The exact method of analysis with measuring examples for ISCED levels 2 and 3 and the procedure with multimeters instead of PC data logging is described in detail in the manual for SUSE 5.15.

For ISCED 3 SUSE 4.55 is used in the learning stations G22 and D14.