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

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Photovoltaik-System
SUSE
Solartechnik
Experimentiergeräte
Solare Experimente
von der Grundschule
bis zum Abitur
Solar technology
Experimentation devices
Solar experiments from primary school to college

BNE
Bildung für nachhaltige Entwicklung
Education for Sustainable Development

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

SUNdidactics Solar Systems

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Short guide to experiments
with the solar module SUSE CM315

Follow the QR codes for the **extensive experimentation manual** in German and English

QR English

QR German

After you completed and tested the solar module, you can now conduct **4 experiments on photovoltaics** with the short manual. You can download the short manual and the extensive 14 page experimentation manual to your smartphone via the QR codes.

1. Determine voltage, current, power with measurements

For this you need a multimeter with 2 lab wires (red + black) and the basic device SUSE 4.0 (halogen spot lamp 120W).
Settings of the multimeter for measuring the voltage: 20V DC, black negative wire into com socket, red positive wire into V socket, for measuring the current: 10A DC, black negative wire into com socket, red positive wire into 10A socket (indoors use measurement range 20mA DC).

Measurement site	**Voltage V in V** Motor on	**Voltage V in V** Motor off	**Short-circuit current I in A**	**Power P in W** P = V*I*0,8
On glass plate (center) of an overhead projector				
40 cm in front of halogen lamp 120W				
Outdoors with bright sunshine				
Outdoors with clouded sky				
Indoors in a conventionally lit room				

Compare the voltage of the solar cell to the measured voltage of a battery: V_{batt} = ...V

What do you notice? Note your observations on the measurements and the rotational speed of the motor as well as other evaluation ideas here. What do you notice in comparison to the battery?

2. Determining the irradiance (light intensity) of the light

For this you need a multimeter in the **measurement range 10A DC** with 2 lab wires (red + black), switch the motor off for measurements! Black negative wire into com socket, red positive wire into 10A DC socket.

The intensity of the light (= irradiance S in W/m²) can be determined by measuring the short-circuit current, because that value is directly proportional to the irradiance. With this equation S can be calculated from the short-circuit current:

Measurement site	**Short-circuit current I in A**	**Irradiance S in W/m²**
On glass plate (center) of an overhead projector		
Outdoors with bright sunshine adjusted towards the sun		
Outdoors with clouded sky adjusted southward		
Outdoors in the shade		

$$S = \frac{\mathbf{I} \text{ in A} * \mathbf{1000}}{\mathbf{0{,}45} \text{ A}} \text{ W/m}^2$$

0,45 A is the short-circuit current of the solar cell with S = 1000W/m²

3. Series connection of solar cells

For this you need a multimeter in the measurement range 20V DC with 2 lab wires (red + black), switch the motor on and off for measurements! Additional lab wires are required to connect several modules.

Because solar cells only have a low voltage of approximately 0,6 V, in big solar modules they are connected electrically in series, often 36 or 60 or even 72 cells. This increases the voltage.
Experiment: Arrange 2 solar modules SUSE CM315 in the light of a halogen lamp and connect the negative pole of module 1 to the positive pole of module 2. You can now measure the total voltage between the positive pole of module 1 and the negative pole of module 2. Note the values in the table and extend the circuit to 3 or 4 modules in series connection.

Number of modules	**Total voltage in V**
2	
3	
4	

Explain your observations/measurements here:

Additionally you can also connect a solar motor SUSE 4.16, an LED module SUSE 4.15, or the radio SUSE 4.36 to the total voltage. You may require more than 4 solar cells in series connection! If you are interested in the detailed **technical data of the solar cell**, you can find those via this QR code:

Note your observations and evaluations here:

QR technical data solar cell SUSEmod5

4. SUSE CM315 as a wind power plant

Connect a multimeter in the measurement range 20V DC to the red-black socket pair with 2 lab wires and switch on the motor! Now blow strongly into the fan, so that it rotates fast, and observe the multimeter display! What do you notice? Note the values of the measured voltages in the table!

Explain this effect in the orange box:

Fan rotation	**Voltage in V**
Slow	
Medium	
Fast	
Very fast	