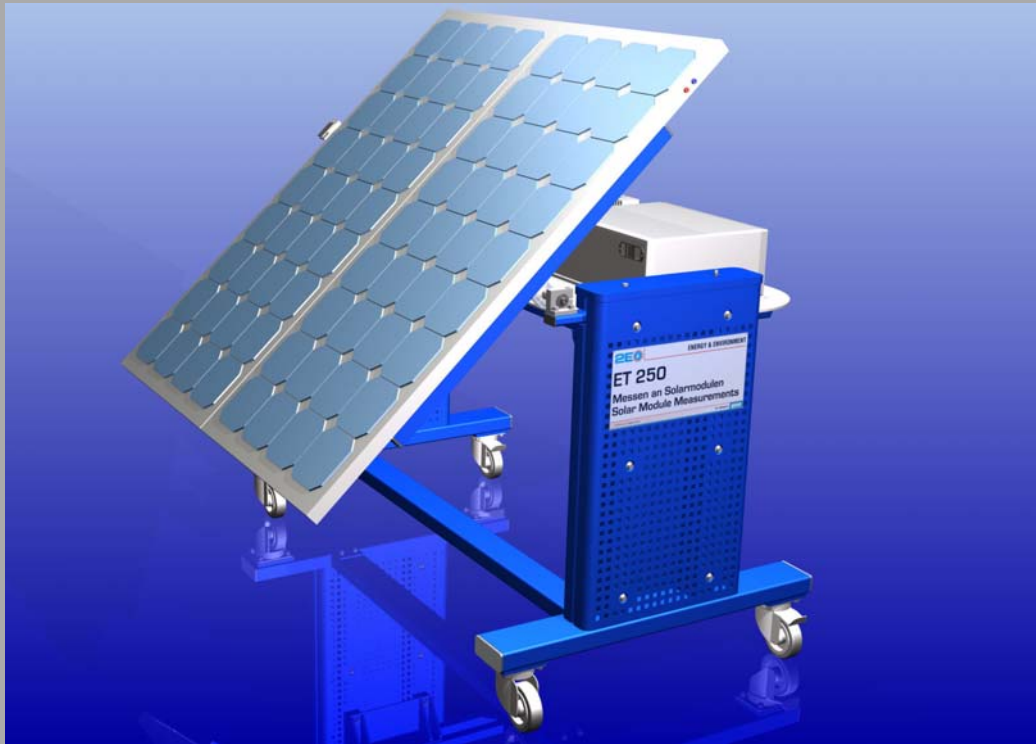


ET 250

Solar Module Measurements



- * 2 solar modules on mobile frame
- * Inclinal solar modules
- * Measurement with commercially available measuring instruments for field operation
- * Suitable for sunlight and artificial light

Technical Description

Photovoltaic solar modules are a very important part of the renewable energy sector. They are used in small-scale systems generating a few kilowatts up to commercial solar power plants that generate megawatts of power.

The most common type of solar modules use an array of silicon solar cells, which is the type used in the trainer.

The measuring unit has displays for irradiation intensity, module temperature, voltage and current. The supplied rheostat enables plotting of voltage versus current characteristics. Two power resistors can be used to extend the measuring range to lower irradiation levels.

The system should be operated with sufficient irradiation intensity using direct sunlight or the optionally available artificial light source HL 313.01.

For extending the learning objectives measuring instruments for field operation or a multimeter can be optionally used.

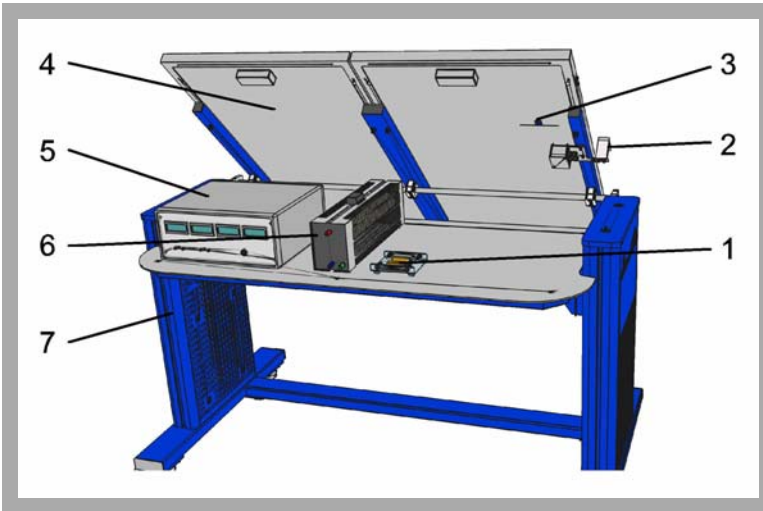
The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

Learning Objectives / Experiments

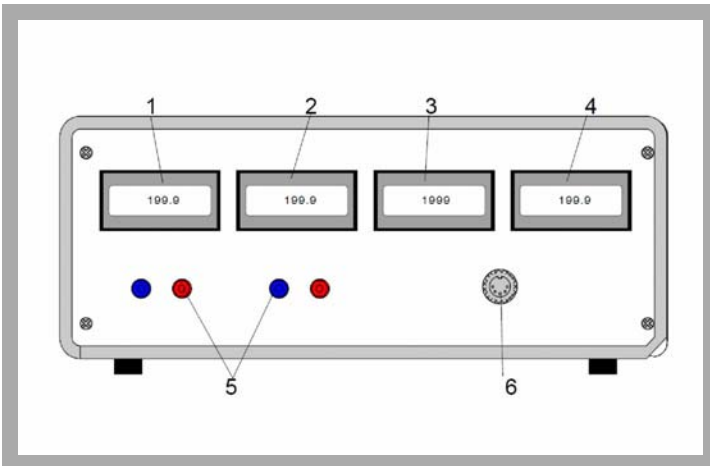
- Physical behaviour of solar modules under various conditions
 - * irradiation
 - * shadowing
- Familiarisation with the most important characteristic variables
 - * short circuit current
 - * open circuit voltage
 - * current at maximum power point (MPP)
 - * voltage at maximum power point (MPP)
 - * irradiation intensity
- Correlation of angle of inclination, irradiation intensity, short circuit current and electrical power
- Plotting of voltage vs. current characteristics for a module
- Temperature behaviour and its relevance for comparison with standard test conditions (STC)
- Connection modes of modules
 - * serial connection
 - * parallel connection
- Shadowing behaviour based on voltage vs. current characteristic
- Professional usage of measuring instruments for field operation (instruments not supplied)

ET 250

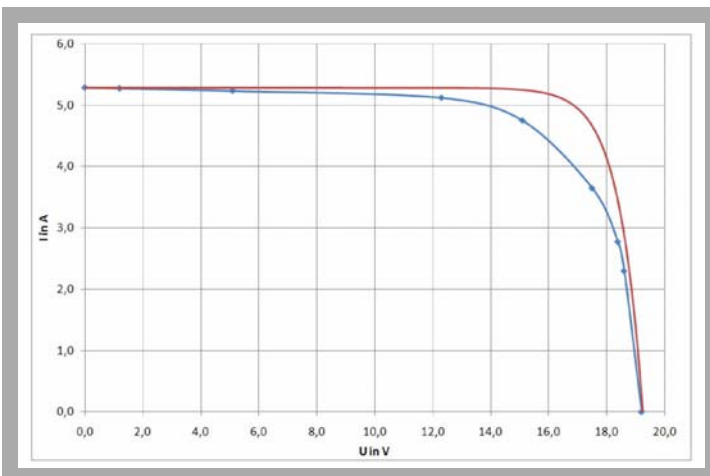
Solar Module Measurements



1 power resistors, 2 irradiation sensor, 3 temperature sensor, 4 solar module, 5 measuring unit, 6 rheostat, 7 frame



Displays: 1 current, 2 voltage, 3 irradiation intensity, 4 temperature;
connections: 5 current and voltage, 6 sensors



Current vs. voltage characteristic of a solar module: theoretical according to 1-diode model (red), measured (blue)

Specification

- [1] Trainer for solar module measurement
- [2] 2 inclinable solar modules on mobile frame
- [3] Series and parallel configuration possible
- [4] Rheostat as variable load
- [5] 2 power resistors for extending the measuring range
- [6] Measuring unit with digital displays for current, voltage, irradiation intensity and temperature
- [7] Reference cell as irradiation sensor

Technical Data

Characteristic variables of 1 module (measured at standard test conditions, STC)

- peak power (P_{max}): $85W_p$
- module area: $0.646m^2$
- current at max. power (I_{MPP}): approx. 4.7A
- voltage at max. power (V_{MPP}): approx. 18V
- short circuit current (I_{SC}): approx. 5.3A
- open circuit voltage (V_{OC}): approx. 22V
- 36 cells, 125x125mm each (monocrystalline silicon)
- rheostat: 0...11 Ohm
- 2 power resistors: 22 Ohm / 50W

Measuring ranges

- temperature: 0...100°C
- voltage: 0...200VDC
- current: 0...20A
- irradiation intensity: 0...1500W/m²
- angle of inclination: 0...90°

Dimensions and Weight

l x w x h: 1270 x 600 x 1450 mm (trainer)

l x w x h: 360 x 310 x 160 mm (measuring unit)

Weight: approx. 46 kg

Connections

230V, 50/60Hz, 1 phase or 120V, 60Hz, 1 phase

Scope of Delivery

- 1 trainer
- 1 rheostat
- 1 measuring unit
- 2 power resistors
- 1 set of cables
- 1 clinometer
- 1 set of instructional material

Order Details

061.25000 ET 250 Solar Module Measurements

ET 250

Solar Module Measurements

Available accessories:

Product no. Order text

065.31301 HL 313.01 Artificial Light Source