

ET 250

Solar Module Measurements



Technical Description

Photovoltaic solar modules convert sunlight directly into electrical current and are therefore an ideal component for renewable energy supply. Typical solar modules from the field of photovoltaics are made of several silicon solar cells connected in series.

The ET 250 trainer contains two such solar modules. The tilt of the modules can be adjusted. Cables can be used to connect the two modules in series or in parallel. A slide resistor simulates varying loads. Thus the slide resistor makes it possible to record current-voltage curves.

The separate measuring unit provides displays for all relevant variables. Two power resistors in the measuring unit are used to expand the measuring range for measurements at low illuminance. Sensors on the solar module detect illuminance and temperature.

In order to ensure there is sufficient illuminance, the trainer should be operated with sunlight or the optionally available HL 313.01 Artificial Light Source.

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

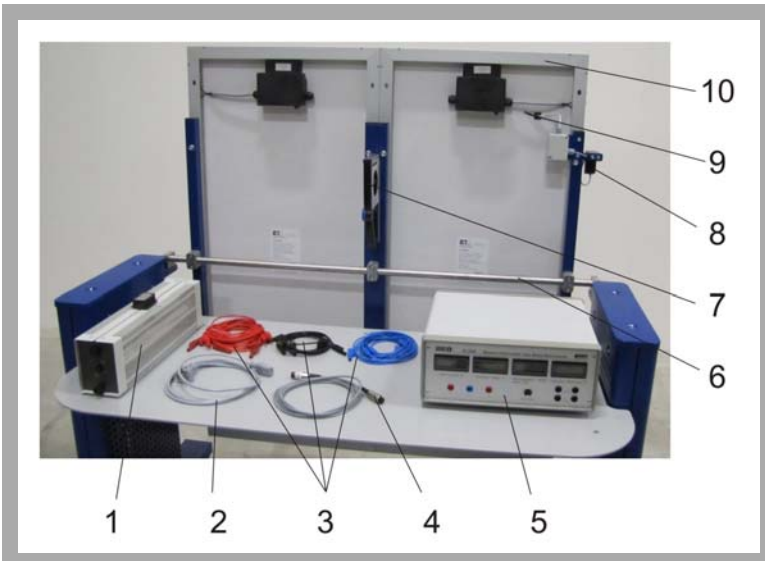
Learning Objectives / Experiments

- Physical behaviour of solar modules under a variety of effects
 - * illuminance
 - * temperature
 - * shading
- Familiarisation with key parameters
 - * short-circuit current
 - * open-circuit voltage
 - * current at maximum output
 - * voltage at maximum output
- Relationship between module tilt, illuminance, short-circuit current and electrical output
- Recording a module's current-voltage curve
- Determining the efficiency
- Connection types for the modules
 - * series connection
 - * parallel connection
- How cells covered by shadow affect the current-voltage curves

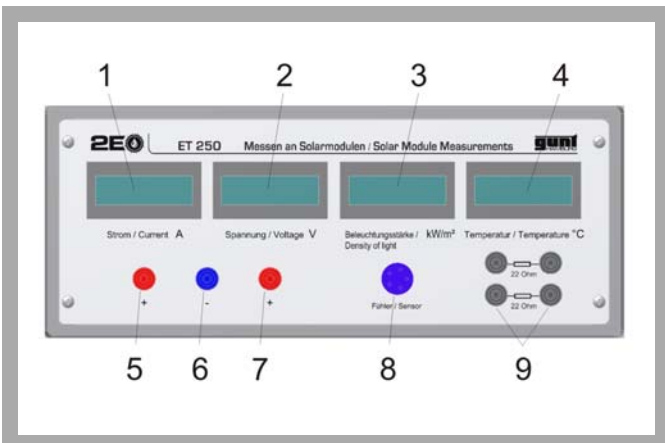
- * 2 solar modules on mobile frame
- * Two pivotable solar modules on mobile frame
- * Series and parallel connection
- * Adjustable electrical load
- * Measuring unit for current, voltage, illuminance and temperature
- * Suitable for sunlight and artificial light
- * Expandable with ET 255 Using Photovoltaics: Grid-Connected or Stand-Alone trainer

ET 250

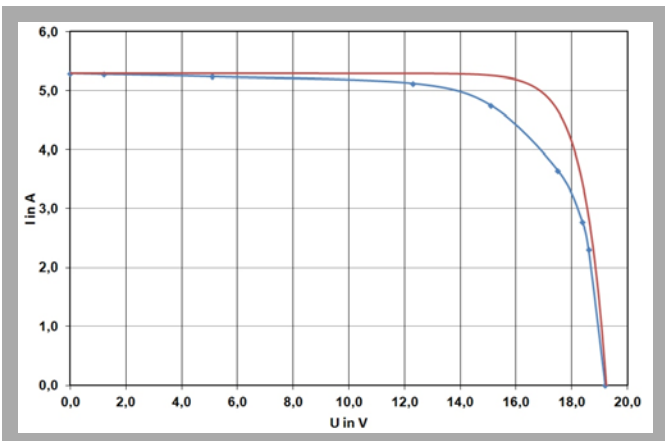
Solar Module Measurements



1 slide resistor, 2 power cable, 3 set of cables for parallel and series connection, 4 measuring cable, 5 measuring unit, 6 tilt axis, 7 inclinometer, 8 illuminance sensor, 9 temperature sensor, 10 solar modules



Displays: 1 current, 2 voltage, 3 irradiation intensity, 4 temperature; connections: 5 current and voltage, 6 sensors, 7 power resistors



Current-voltage curve of a solar module (module temperature 55°C): theoretical after single diode model (red), measured (blue)

Specification

- [1] Trainer for solar module measurements
- [2] Two pivoting solar modules on mobile frames
- [3] Series and parallel connection options
- [4] Slide resistor as variable load
- [5] Two power resistors for expanding the measuring range
- [6] Measuring unit with digital displays for current, voltage, illuminance and module temperature
- [7] Reference cell as illuminance sensor

Technical Data

- Module design:
- number of cells 36
 - cell material: monocrystalline silicon
 - module area: 0,64m²
- Typical module parameters under STC (Standard Test Conditions)
- max. output: 85W
 - short-circuit current: approx. 5,3A
 - open-circuit voltage: approx. 22V
- Slide resistor: 0...10 Ohm
- Two power resistors: 22 Ohm / 50W
- Measuring ranges
- temperature: 0...100°C
 - voltage: 0...200V
 - current: 0...20A
 - illuminance: 0...3kW/m²
 - tilt: 0...90°

Dimensions and Weight

LxWxH: 1410x795x1490mm
Weight: approx. 65kg

Connections

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

Scope of Delivery

- 1 trainer
- 1 slide resistor
- 1 measuring unit
- 1 set of cables
- 1 inclinometer
- 1 set of instructional material

Order Details

061.25000 ET 250 Solar Module Measurements



ET 250

Solar Module Measurements

Available Accessories and Options:

Product no. Order text

065.31301 HL 313.01 Artificial Light Source

061.25500 ET 255 Using Photovoltaics: Grid-Connected or Stand-Alone