



RENEWABLE ENERGIES

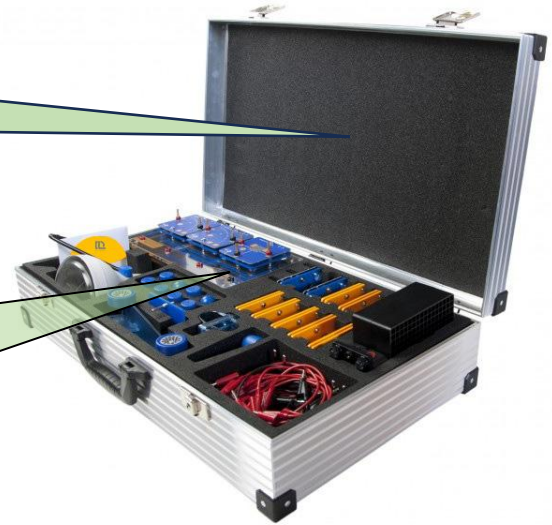


With this kit the students
can perform more than

25 experiments

Who is it for?

- Technicians in RE and Smart Grid systems.
- Electrical Technicians in Environmental Technology.



DL SGWD-L SMART GRID KIT

Understanding the complex interactions between renewable energies, energy storage and consumers in a smart grid is an important objective in vocational and technical education. **DL SGWD-L** is the ideal basic training system to reach this goal, and the influence of renewable energies on grid stability is one major issue of the product.

With setting-up smart grids on a laboratory scale and its measurement and control, the students will learn the electro-technical challenges of mains operations very demonstratively. They, at first, experience the problem within an experiment to develop approaches for increasing grid stability on their own. Pre-set or user-created scenarios let them gradually develop their knowledge with their own experiments and at the end they will verify them in practice.

The basis for most of the experiments is the innovative **SmartMeter** module allowing measurement and control of the energy fluxes in the experiments.

The experiment components for renewable energies such as wind and photovoltaics as well as energy storage such as lithium-iron-phosphate batteries or fuel cells allow a large variety of fundamental experiments besides the smart grid experiments.



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The kit is composed of the following components:

- 1x Solar module 5.33V, 380mA, 4mm plug,
- 1x Base unit Large,
- 1x Diode module,
- 2x Light bulb module,
- 1x Motor module without Gear,
- 1x Base for solar panel,
- 1x Wind rotor set,
- 1x Wind machine,
- 1x Wind turbine module,
- 2x Power grid module,
- 1x Capacitor module 5.0F/5.4V,
- 1x Electric model car with battery adapter,
- 1x AV-Module,
- 2x SmartMeter,
- 2x PowerModule,
- 1x Potentiometer module (110 Ω),
- 12x Bumpon transparent 5,0 mm height x 11,1mm diameter,
- 1x Propeller,
- 1x Lamp housing,
- 1x Illuminant 120W, 12°,
- 1x Reversible Fuel cell,
- 1x Insert SmartGrid,
- 1x Aluminium case SmartGrid,
- 1x Layout diagram SmartGrid,
- 1x Azimuth angle scale,
- 1x Info sheet initial startup,
- 4x Safety test lead, 25cm/black,
- 7x Safety test lead, 25cm/red,
- 3x Safety test lead, 50cm/black,
- 3x Safety test lead, 50cm/red.



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With this kit, the students can perform the following:

Fundamental Experiments

- *Photovoltaics:*
 - ◆ V-I Characteristics of a solar module,
 - ◆ V-I Characteristics of a solar module depending on illuminance,
 - ◆ V-I Characteristics of a solar module depending on temperature.
- *Wind power:*
 - ◆ Dependence of the power on blade shape and pitch angle,
 - ◆ Dependence of the power on number of blades,
 - ◆ Dependence of the power on wind direction.
- *Energy storage technologies:*
 - ◆ V-I characteristics of an electrolyser,
 - ◆ Behaviour of the voltage and the current during charging of an electrolyser,
 - ◆ Behaviour of the voltage and the current during discharging a fuel cell,
 - ◆ V-I characteristics of a fuel cell,
 - ◆ The t-V and t-I characteristics of a capacitor during charging and discharging,
 - ◆ The use of the electric car with capacitor and fuel cell.

Smart Grid Experiments

- The power fluctuations of a photovoltaic station,
- The power fluctuations of a wind turbine,
- Energy supply of a building by a power plant,
- Energy supply of a building by a power plant and a photovoltaic station,
- Energy supply of a building by a power plant, a photovoltaic station and an energy storage,
- The behaviour of the voltage in a conventional line grid,
- The behaviour of the voltage in a line grid with photovoltaic station,
- The behaviour of the voltage in a line grid with photovoltaic station depending on the consumption,
- The behaviour of the voltage in a line grid with photovoltaic station depending on the distance to the transformer,
- The behaviour of the voltage in a line grid with photovoltaic station and an intelligent transformer station,
- The behaviour of the voltage in a line grid with photovoltaic station and an energy storage (fuel cell/ EMobility),
- The behaviour of the voltage in a line grid with photovoltaic station and load management,
- Power line monitoring,
- Scenario experiment - Smart Grid.

Supplied complete with all the necessary accessories and a detailed manual.