Product datasheet   (en)

Version:	1607_23.02.2016

Photo:	Name:

leXsolar-SmartGrid Professional

Item number:

1607

Youtube link:

Area of application:	Dimensions (cm x cm x cm):

Electrical Engineering
Renewable Energies

64x37x16,5

Weight (kg):	User group:

8,5

Basic Training
Industrial Customers

Key facts:

Setup of a complete smart grid on laboratory scale
Investigating the influence of renewable energies on grid stability
Additional fundamental experiments on wind, photovoltaics, fuel cells and energy storages

List of components:

2 x 1400-13 leXsolar-base unit Professional
2 x 9100-04 SmartMeter

1 x 1118-03 leXsolar-Wind turbine module Pro
1 x 1100-04 Solar module 5.22 V, 380 mA
1 x 1400-19 Wind machine
1 x 1118-02 Motor module Pro
1 x 1118-17 Base for solar panel
2 x 9100-05 PowerModul
1 x 1400-12 leXsolar-Wind rotor set
2 x 1118-01 Light bulb module Pro
1 x 1118-11 Capacitor module Pro
1 x 9100-03 AV-Modul
1 x 1800-08 Battery module holder 1xAAA Pro
1 x 1801-06 LiFePo-battery AAA
1 x 1800-12 Fuel cell holder Pro
1 x 1118-13 MPP-Tracker Pro
1 x 1118-04 Potentiometer module Pro
2 x 1607-01 Grid module Pro
1 x 1118-05 Diode module Pro
1 x L2-04-116 Illuminant 120W, 12°
1 x L2-04-080 Lamp housing
6 x L2-05-068 Safety short-circuit plug, with mid socket
1 x L3-01-137 Koffer SmartGrid Pro 1607
1 x L3-01-138 Einlage SmartGrid Pro 1607
1 x L3-03-081 leXsolar-DVD Professional
5 x L2-04-066 Safety test lead, 25cm, red
4 x L2-04-067 Safety test lead, 25cm, black
4 x L2-04-059 Safety test lead, 50cm, red
4 x L2-04-060 Safety test lead, 50cm, black
1 x L2-02-017 Propeller
1 x L2-06-067 Reversible Fuel cell
1 x L3-03-176 Azimuth angle scale
1 x L3-03-171 Einräumplan 1607 SmartGrid Professional

Extras needed:

No extras needed, all included.

Extras available:

L2-04-044 electric grid adapter set

Description:

Understanding the complex interactions between renewable energies, energy stores and consumers in a smart grid is an important objective in vocational and technical education. leXsolar-SmartGrid Professional is the ideal basic training system to reach this goal. With setting-up smart grids on a laboratory scale and its measurement and control students will learn the electro-technical challenges of mains operations very demonstratively. Pre-set or user-created scenarios let the students gradually develop their knowledge with their own experiments. The influence of renewable energies on grid stability is one major issue of the product. The students at first experience the problem within an experiment to develop

approaches for increasing grid stability on their own. At the end they will verify them in practical experiments. Even such complex concepts as demand-side-management or conductor rope monitoring can be addressed in experiments. The basis for most of the experiments is the innovative leXsolar-Smartmeter 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 stores such as lithium-iron-phosphate batteries or fuel cells allow a large variety of fundamental experiments besides the smart grid experiments.

Experiments:

Smart Grid Experiments:
Daily power fluctuations of a photovoltaic (PV) power plant
Daily power fluctuations of a wind power plant
Energy supply of a building by conventional power plants
Energy supply of a building by conventional and PV power plants
Energy supply of a building by conventional and PV power plants with storage
Voltage behavior and grid stability in a radial distribution system
Grid stability with PV power plants
Grid stability with PV power plants depending on consumer load
Grid stability with PV power plants depending on wire length
Grid stability with PV power plants and smart transformer stations
Grid stability with PV power plants and storages
Grid integration of E-Mobility
Conductor rope management

Fundamental experiments:
- Photovoltaics
IV-Characteristics of solar panels
IV-Characteristics depending on illumination
IV-Characteristics depending on temperature
MPP-Tracking
- Wind energy
Turbine power dependent on blade shape and pitch angle
Turbine power dependent on number of blades
Turbine power dependent on wind direction

- Fuel Cell and Electrolyzer
Functionality of an electrolyzer
IV-characteristics of an electrolyzer
Functionality of a fuel cell
IV-characteristics of a fuel cell

Storage technologies
Charge and discharge characteristics of a capacitor
Functionality and charge procedure of a LiFePo battery
Operation of fuel cells and electrolyzers

Specifications of components:

1400-13 leXsolar-base unit Professional:
Main board for up to 4 plug-in modules
Grid-dimension of the plugs: 70 mm
Enables series and parallel connectsion of the modules
Changing between series and parallel connection by turning the Modules
Equipped with 12 additional 4mm security jacks for connecting security measuring lines
Each single plug-in module can be contacted externally
Enables current measurement between each module

9100-04 SmartMeter:
The SmartMeter is a power meter and energy meter. An
integrated relay function, which is controlled by a touch field,
can interrupt the electric flow through the SmartMeter.

Technical Data:
Power measurement: 0-12 W
Energy measurement: 0-200mWh
Relay function usable manually or via software

1118-03 leXsolar-Wind turbine module Pro:

1100-04 Solar module 5.22 V, 380 mA:
solar module with 9 high efficiency polycrystalline solar cells
4.5 V open circuit voltage
820 mA short circuit current
3.75 Wp peak power
Optimized low light behaviour
Solar cell size 3 pcs. 52mmx52mm
Contacting via 4mm jacks
Module size: 200 mm x 200 mm

1400-19 Wind machine:

1118-02 Motor module Pro:

1118-17 Base for solar panel:

9100-05 PowerModule:
The PowerModule is a compact, robust and easy-to-use power supply for experiments. The
voltage can be varied incrementally in 0.5V steps from 0 to 12V. It supplies up to 24W output
power!
With the acoustic feedback during operation and the voltage indicator by LEDs it is simple and
intuitive for the user. With only 70g it is the most lightweigt power supply of its power class. Due
to the design as leXsolar plug-in module it is fully compatible with all leXsolar experiments.
However, it can also be used in other setups with standard 4mm-connectors.

With software control* continuous variable voltages - even time-dependent - can be realized.

Technical data:

Output voltage 0-12V DC
Maximum current 2A
Maximum output power 24W
Automatic overcurrent detection
Voltage variation in 0.5V steps (manually) or continuous (with software* via USB-Connect* or Wireless-Connect**)
Accuracy: +-0.15V
Contacts: 4mm standard connectors and compatible to leXsolar main board
Input voltage 110-230V AC 50-60Hz
Adaptors for all common sockets included
Weight: 70g (+180g included wall power supply)
RiSU conform

*available from October 2015
** available from 2016

1400-12 leXsolar-Wind rotor set:
Set of rotor blades and hubs to set up different wind turbines
4 rotor blades with optimized profile
4 rotor blades with flat rectangular profile
5 hubs for setting up 3-blade rotors with pitches 20°, 25°, 30°, 50° and 90°
1 hub for setting up 4-blate rotor with pitch of 25°
1 Cap for 3-blade rotor and 1 cap for 4-blade rotor
Allows setting up 24 different wind turbines
Easy assembling and disassembling without tools

1118-01 Light bulb module Pro:

1118-11 Capacitor module Pro:
Capacitor module for simulating batteries in experiments
Extremely high capacity: 5 F
Voltage: 5,4 V
Equipped with automatic fuse protecting against short circuit
Layout: plug-in module with 4 mm jacks
3-terminal plug-in module for use in circuits with common ground
Grid-dimension of the jacks: 70 mm
Module size: 85 mm x 85 mm

9100-03 AV-Module:
The IV-Module is able to measure current and voltage and
therefore replaces conventional multimeters completely. With touch buttons three
measurement modes can be selected: current, voltage and combined current-/voltage-measurement.
leXsolar AV-Module is intuitive and easy to use but yet allows precice and professional
measurements. A high resolution graphics display shows the measurement values as well as
visualizes the measurement modes.

Technical specifications:

Voltage measurement:
- Range: 0...12 V
- Accuracy: 1mV
- Overvoltage protection >12V

Current measurement
- Range: 0...2 A
- Accuracy: 0.1mA (0...199mA) and 1mA (200mA...1A)
- Automatic fuse protection >2A (reactivation with touch button)
- Internal resistance <0.5 Ohm (0...200mA); <0.2 Ohm (200mA...2A)

Electrical connection:
- compatibel to leXsolar-basic unit
- 4mm-banana plugs

Display: Graphics display resolution192x192

Power supply: 2 x AA battery or rechargeable

Interfaces:
- Display to read the measurement values
- leXsolar USB-Connect* for direct PC-connection
- leXsolar Wireless-Connect* for wireless data acquisition

*available 2015

1800-08 Battery module holder 1xAAA Pro:

1801-06 LiFePo-battery AAA:

1800-12 Fuel cell holder Pro:

1118-13 MPP-Tracker Pro:
MPP-Tracker (DC/DC inverter) for experimental purposes
Input voltage: 2.5 ...5 V
Output voltage: 2.5 ... 5 V, regulated to maximum output power
Two modes: automatic mode for finding the MPP automatically, manual mode for setting output
voltage manually
Layout: plug-in module with 4mm jacks
3-terminal plug-in module for use in circuits with common ground
Grid-dimension of the jacks: 70mm
Module size: 85mmx85mm

1607-01 Grid module Pro:

1118-05 Diode module Pro:

1100-62 Potentiometer module 110 Ohm Pro:

L2-04-116 Illuminant 120W, 12°:

L2-04-080 Lamp housing:

L2-05-068 Safety short-circuit plug, with mid socket:

L3-01-137 Koffer SmartGrid Pro 1607:

L3-03-081 leXsolar-DVD Professional:

L2-04-066 Safety test lead, 25cm, red:

L2-04-067 Safety test lead, 25cm, black:

L2-04-059 Safety test lead, 50cm, red:

L2-04-060 Safety test lead, 50cm, black:

L2-02-017 Propeller:

L2-06-067 Reversible Fuel cell:

L3-03-176 Azimuth angle scale:

L3-03-220 Instruction for use of finger protector:

Specifications extras needed:

No extras needed, all inclusive.

Specifications extras available:

L2-04-044 electric grid adapter set: