

Product datasheet (en)

Version: 1605_24.05.2017

Photo:



Name:

leXsolar-SmartGrid Ready-to-go

Item number:

1605

Youtube link:

Area of application:

**Physics
Technology Training**

Dimensions (cm x cm x cm)

64x37x16,5

Weight (kg):

7,5

User group:

**Middle School / Junior High School
Highschool / Secondary School
Industrial Customers**

Key facts:

Fully equipped experiment system for a variety of renewable energy technologies (solar, wind, fuel cell, storage technology, e-mobility)
Setup of a complete smart grid in the lab
Generation of different energy source and load profiles
All additional equipment already included

List of components:

- 1 x 1100-53 SM 5.22V, 380mA, 4mm plug
- 1 x 1100-19 leXsolar-Base unit Large
- 1 x 1100-21 Diode module
- 2 x 1100-26 Light bulb module
- 1 x 1100-27 Motor module without gear
- 1 x 1118-17 Base for solar panel
- 1 x 1400-12 leXsolar-Wind rotor set
- 1 x 1400-19 Wind machine
- 1 x 1400-22 Wind turbine module
- 2 x 1600-01 power grid module
- 1 x 1600-02 Capacitor module 5.0F/5.4V
- 1 x 1801-02 Electric model car
- 1 x 9100-03 AV-Module
- 2 x 9100-04 SmartMeter
- 2 x 9100-05 PowerModule
- 1 x 1100-61 Potentiometer module 110 Ohm
- 12 x L2-02-016 Bumpon transparent 5,0 mm height X 11,1mm diameter
- 1 x L2-02-017 Propeller
- 1 x L2-04-080 Lamp housing
- 1 x L2-04-116 Illuminant 120W, 12°
- 4 x L2-06-012 Test lead black 25 cm
- 7 x L2-06-013 Test lead red 25 cm
- 3 x L2-06-014 Test lead black 50 cm
- 1 x L2-06-067 Reversible Fuel cell
- 1 x L3-01-139 Insert SmartGrid RtG 1605
- 1 x L3-01-140 Aluminium case SmartGrid RtG 1605
- 1 x L3-03-169 Layout diagram 1605 SmartGrid Ready-to-go
- 1 x L3-03-176 Azimuth angle scale
- 3 x L2-06-015 Test lead red 50 cm
- 1 x L3-03-258 Info sheet initial startup

Extras needed:

No extras needed, all included.

Extras available:

- L3-03-177 Anleitungsheft leXsolar-SmartGrid Ready-to-go
- L3-03-178 Lehrerheft leXsolar-SmartGrid Ready-to-go
- L3-03-187 Teacher`s manual leXsolar-SmartGrid Ready-to-go
- L3-03-188 manual leXsolar-Instructions manual SmartGrid Ready-to-go
- L2-04-044 electric grid adapter set

Description:

Ready-to-go stands for a fully equipped product of the leXsolar-SmartGrid line in a durable aluminum suitcase that is ready to use anytime and anywhere.

leXsolar-SmartGrid Ready-to-go allows the construction of a smart grid with a variety of renewable energy sources on a laboratory scale. It's possible to choose different energy generation profiles and observe their effect on the system. The various available storage units and consumers make for a complex smart grid and a multitude of possible scenarios to analyze.

The energy flows within the smart grid can be read directly from the displays of the smartmeters. This enables the students to control the system manually.

All necessary SmartControl components for measuring and control are already included. The package includes wind and solar power as well as fuel cell, storage technology and e-mobility components and, thus, also the foundation for a variety of basic experiments.

Experiments:

1. Basic experiments on photovoltaic
 - 1.1 The I-V-characteristic of a solar module
 - 1.2 The I-V-characteristic of a solar module depending on the illuminance
 - 1.3 The I-V-characteristic of a solar module depending on the temperature
2. Basic experiments on wind power
 - 2.1 The dependence of the power on the pitch angle and the blade design
 - 2.2 The dependence of the power on the number of blades
 - 2.3 The dependence of the power on the wind direction
3. Basic experiments on energy storage technologies
 - 3.1 The I-V-characteristic of an electrolyzer
 - 3.2 Behavior of the voltage and the current during charging of an electrolyzer
 - 3.3 The I-V-characteristic of a fuel cell
 - 3.4 Behavior of the voltage and the current during discharging a fuel cell
 - 3.5 The t-V- and t-I-characteristic of a capacitor during charging
 - 3.6 The t-V- and t-I-characteristic of a capacitor during discharging
 - 3.7 The use of the electric car with capacitor and fuel cell
- 4.1 The power fluctuations of a photovoltaic station
- 4.2 The power fluctuations of a wind turbine
- 4.3 Energy supply of a building by a power plant
- 4.4 Energy supply of a building by a power plant and a photovoltaic station
- 4.5 Energy supply of a building by a power plant, a photovoltaic station and an energy storage
- 4.6 The behavior of the voltage in a conventional line grid
- 4.7 The behavior of the voltage in a line grid with photovoltaic station
- 4.8 The behavior of the voltage in a line grid with photovoltaic station depending on the consumption
- 4.9 The behavior of the voltage in a line grid with photovoltaic station depending on the distance to the transformer
- 4.10 The behavior of the voltage in a line grid with photovoltaic station and an intelligent transformer station
- 4.11 The behavior of the voltage in a line grid with photovoltaic station and an energy storage (fuel cell / E-Mobility)
- 4.12 The behavior of the voltage in a line grid with photovoltaic station and load management
- 4.13 Power line monitoring
- 4.14 Scenario experiment: Smart Grid

Specifications of components

1100-19 leXsolar-Base unit Large:

Main board for the leXsolar plug-in system with 3 slots
Grid-dimension of the plugs: 70 mm
Enables series and parallel connection of the modules
Changing between series and parallel connection by turning the modules
Equipped with 4 additional 4 mm jacks for connecting measuring lines

1100-21 Diode module:

Plug-in Module with Schottky-diode
Flux voltage ca. 0.3 V
Forward continuous current: 200 mA
Qualified as bypass-diode for single solar cells
Layout: plug-in module with 4 mm jacks
Grid-dimension of the jacks: 70 mm
Module size: 85 mm x 85 mm

1100-26 Light bulb module:

Plug-in module with micro bulb
Initial voltage: 0.9 V
Initial current: 25 mA
Maximum voltage: 6 V
Equipped with automatic fuse protecting from overvoltage
Layout: plug-in module with 4 mm jacks
Grid-dimension of the jacks: 70 mm
Module size: 85 mm x 85 mm

1100-27 Motor module without gear:

Plug-in module with DC-motor
Initial current: 20 mA
Initial voltage: 0.35 V
Equipped with automatic fuse protecting from overvoltage
Layout: plug-in module with 4 mm jacks
Grid-dimension of the jacks: 70 mm
Module size: 85 mm x 85 mm

1118-17 Base for solar panel:

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-blade 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

1400-19 Wind machine:

1400-22 Wind turbine module:

Wind turbine module for attaching different types of rotors

Generator: maximum 6 V DC

Layout: plug-in module with 4 mm jacks

Grid-dimension of the jacks: 70 mm

Module size: 85 mm x 85 mm

including safeguard to prevent touching running blades

1600-01 power grid module:**1600-02 Capacitor module 5.0F/5.4V:****1801-02 Electric model car:****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 precise 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:

- compatible to leXsolar-basic unit
- 4mm-banana plugs

Display: Graphics display resolution 192x192

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

*Please ask for availability

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

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 lightweight 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: $\pm 0.15V$

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

*Please ask for availability

1100-61 Potentiometer module 110 Ohm:

L2-02-016 Bump on transparent 5,0 mm height X 11,1mm diameter:

L2-02-017 Propeller:

L2-04-080 Lamp housing:

L2-04-116 Illuminant 120W, 12°:

L2-06-012 Test lead black 25 cm:

The black test lead is used for the electrical connection of the modules. The cable is directly plugged into the base plate or alternatively directly into the plug connection of the modules. The cables have two different colors to distinguish between the positive and the negative pole. The black cables are plugged into the negative pole.

L2-06-013 Test lead red 25 cm:

The red test lead is used for the electrical connection of the modules. The cable is directly plugged into the base plate or alternatively directly into the plug connection of the modules. The cables have two different colors to distinguish between the positive and the negative pole. The red cables are plugged into the positive pole.

L2-06-014 Test lead black 50 cm:

The black test lead is used for the electrical connection of the modules. The cable is directly plugged into the base plate or alternatively directly into the plug connection of the modules. The cables have two different colors to distinguish between the positive and the negative pole. The black cables are plugged into the negative pole.

L2-06-067 Reversible Fuel cell:**L3-01-139 Insert SmartGrid RtG 1605:****L3-01-140 Aluminium case SmartGrid RtG 1605:****L3-03-169 Layout diagram 1605 SmartGrid Ready-to-go:****L3-03-176 Azimuth angle scale:****L2-06-015 Test lead red 50 cm:**

The red test lead is used for the electrical connection of the modules. The cable is directly plugged into the base plate or alternatively directly into the plug connection of the modules. The cables have two different colors to distinguish between the positive and the negative pole. The red cables are plugged into the positive pole.

L3-03-258 Info sheet initial startup:

Specifications extras needed:

No extras needed, all inclusive.

Specifications extras available:

L3-03-177 Anleitungsheft leXsolar-SmartGrid Ready-to-go:

L3-03-178 Lehrerheft leXsolar-SmartGrid Ready-to-go:

L3-03-187 Teacher`s manual leXsolar-SmartGrid Ready-to-go:

The experiment handbooks are available as PDF and Word versions in the online portal. A description of how to download the booklets is attached to every experiment set.

L3-03-188 manual leXsolar-Instructions manual SmartGrid Ready-to-go:

The instruction manuals are available as PDF and Word versions in the online portal. A description of how to download the booklets is attached to every experiment set.

L2-04-044 electric grid adapter set: