The Solar Hydrogen Extension generates hydrogen from solar power. A software program helps users to learn about energy flux and system efficiency, making it possible to implement interesting projects dealing with autarkic energy supply.

**Product Features**
- PV systems for AC loads up to 700 W
- Electrolyzer and PV system can be used separately
- PC software for system control and data acquisition is included
- Extensive instruction and experimentation material
- Mobile system components with rollers
- Remote monitoring via LAN network is possible
System Design
Solar Hydrogen Extension

The Solar Hydrogen Extension is a modular system. Connecting cables and quick-release couplings allow easy set-up and take-down.

**Solar Module Unit**
- 2 x 200 Wp polycrystalline solar module
- Adjustable angle of inclination

**Optional: PV Sensor Kit**
- Temperature sensors
- Irradiation sensors
- Compass for module alignment

**System Technology Unit**
- Suitable for loads up to 700 W
- Ethernet port for PC control and network connection
- Includes power electronics, measuring technology and batteries
- Optimized for the supply of the electrolyzer

**Hydrogen Generator**
- Production capacity of 30 or 60 sl/h
- Suitable for continuous operation
- Interface for PC control

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**Functional Principle**

The direct current generated by the solar modules charges the system batteries by means of a load regulator. The power electronics, including an inverter and a DC converter, provide the user with 12 V DC and 230 V AC.

The system control provides for optimal operation of the hydrogen generator. It does not start operating until the battery has reached a minimum charge. This ensures uninterrupted operation of the system in case of inconsistent sunshine.

The hydrogen is stored in metal hydride canisters, which are also used in training and fuel cell systems from Heliocentris.

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**Possible Combinations**

The Solar Hydrogen Extension can be combined with the following products: Instructor Training and Integration System, Nexa® Training and Integration System and FC-42 Evaluation Kit.

*not included in the scope of delivery*
Software
Solar Hydrogen Extension

The software is used to visualize data and control the system. Measurements at the system and component level are displayed and can easily be retrieved and exported for further processing. Also, the limit values for the battery regulation can be defined.

Efficiency Analysis
» Overall system output balancing
» System efficiency chain (Sankey diagram)

System Overview
» Flow chart view
» Voltage and current display for individual components

Time Curve
» Graphic visualization of the measurements
» Freely configurable measurements

Supplementary Material

The supplementary material facilitates use of the system.

» Detailed operating manual
» Science book on hydrogen
» Experiment Guide with:
  ■ Graphic display of experiment set-ups
  ■ Worksheets with questions and tasks
  ■ Solutions

» CD-ROM with printable experiment sheets (PDF files)

Sample Experiments

» Optimal alignment of solar modules
» Determining the efficiency of the electrolyzer
» Behavior of solar modules
Product Overview
Solar Hydrogen Extension

Solar Hydrogen Extension

- System technology unit
- 2 mobile solar module units
- Hydrogen generator with interface (30 or 60 sl/h)
- Monitoring and control software
- Cable set

With 30 sl/h hydrogen generator  
Item No. 811

With 60 sl/h hydrogen generator  
Item No. 812

Technical Data

<table>
<thead>
<tr>
<th>System Technology Unit</th>
<th>Battery</th>
<th>Hydrogen Generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. input current, photovoltaics</td>
<td>30 A</td>
<td>2 solar lead-acid batteries (12 V), maintenance-free</td>
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<tr>
<td>System voltage, photovoltaics</td>
<td>24 V DC</td>
<td>System voltage</td>
</tr>
<tr>
<td>Max. output current 12 V DC</td>
<td>2 A</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Max. continuous output 230 V AC</td>
<td>700 W</td>
<td>Capacity</td>
</tr>
<tr>
<td>Momentary peak load</td>
<td>1050 W (for 10 sec)</td>
<td>55 Ah</td>
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<tr>
<td>Output voltage frequency</td>
<td>230 V, 50/60 Hz, True Sinus</td>
<td>Production capacity</td>
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<tr>
<td>Solar Module</td>
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<td>30</td>
</tr>
<tr>
<td>Type</td>
<td>Polycrystalline</td>
<td>Hydrogen purity</td>
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<tr>
<td>System voltage</td>
<td>24 V DC</td>
<td>&gt; 6.0 (99.9999 %)</td>
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<tr>
<td>MPP output</td>
<td>200 Wp</td>
<td>Outlet pressure</td>
</tr>
<tr>
<td>Efficiency</td>
<td>&gt;13 %</td>
<td>1.4 - 10.7 bar (selectable)</td>
</tr>
<tr>
<td>Short circuit current</td>
<td>8.5 A</td>
<td>Required water quality</td>
</tr>
<tr>
<td>MPP voltage</td>
<td>24.95 V</td>
<td>max. 2 µS/cm, deionized or distilled</td>
</tr>
</tbody>
</table>

PV Sensor Kit
- Irradiation sensor
- Temperature sensors
- Compass

Item No. 821

Hydrogen Storage Canister
- Low-pressure metal hydride canister
- Capacity 760 Nl
- Quick coupling

Item No. 647

Accessories

Accessories

- Solar Hydrogen Extension
  - System technology unit
  - 2 mobile solar module units
  - Hydrogen generator with interface (30 or 60 sl/h)

- Monitoring and control software
- Cable set

PV Sensor Kit
- Irradiation sensor
- Temperature sensors
- Compass

Item No. 821

Hydrogen Generator
- Production capacity 30 | 60 sl/h
- Hydrogen purity > 6.0 (99.9999 %)
- Outlet pressure 1.4 - 10.7 bar (selectable)
- Required water quality max. 2 µS/cm, deionized or distilled
- Operating temperature 15 °C to 40 °C
- Input voltage 120 or 240 V AC / 50-60 Hz
- Max consumption (selectable) 300 | 480 VA
- Dimensions (W x D x H) 230 x 35 mm
- Weight (unfilled) 20 kg

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