

Training Systems for Technical Education

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Training systems for entry level education can be found in the brochure *Science Education*.

For technical training purposes, Heliocentris offers innovative training systems for teaching engineering principles and application-oriented knowledge of fuel cell systems.

Fuel cell training systems

An important part of technical training

Prepare your students for tomorrow

Renewable energies are already considered a solution today for dealing with the expected energy shortage in the 21st century. The hydrogen-based fuel cell is part of this solution. As a complementary technology, it will be used in future energy systems to generate clean energy from regenerative hydrogen. Technical training today already has to familiarize the engineers of tomorrow with this technology. Heliocentris offers hands-on training products for this purpose.

Training systems for lectures and practica

Heliocentris provides effective support with systems for teaching fuel cell and hydrogen technology for use in lectures, practica and lab experiments. The subject is interdisciplinary and therefore suitable for many fields of study. You can also use our products to easily teach numerous other topics. Discover the possibilities.

Quality from Heliocentris

For more than 10 years Heliocentris has been developing innovative training systems of unequalled quality. Lecturers in more than 50 countries around the world trust this experience.

- » Integrated pedagogical concept with optimized instruction material
- » Excellent workmanship
- » Outstanding safety

Overview of the systems

Training systems from Heliocentris offer diverse capabilities for learning and experimenting. Find out which product suits your requirements best.



Instructor Training System

Teaches the basic functioning principles of a fuel cell system

Learning content

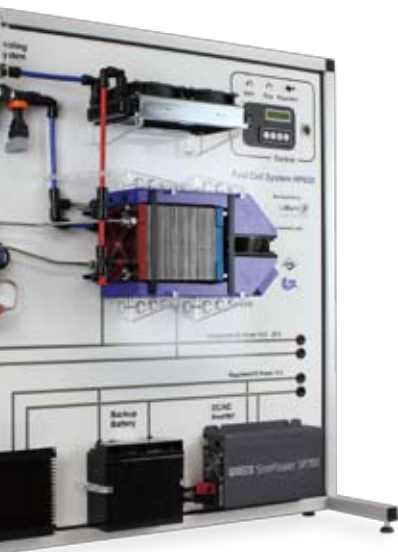
- » Structure and functioning principle
- » Parameters influencing the operating behavior of the stack
- » Efficiency analysis

Areas of application

- » Electrical engineering
- » Energy and process engineering
- » Mechanical engineering
- » Automotive engineering

Key features

- » 50 W PEM fuel cell with air cooling
- » Interface and software for automated characteristic curve recording



HP 600 Training System

Allows complete energy balance of electricity and heat

Learning content

- » Co-generation of electricity and heat
- » Effect of temperature on the performance of the fuel cell
- » Teaching of the hybrid concept

Areas of application

- » Energy and process engineering
- » Power supply engineering
- » Electrical engineering

Key features

- » 600 W PEM fuel cell with water cooling
- » Battery hybrid system with inverter

Nexa® Training System

Allows complex experiments on electrical design and hybridization

Learning content

- » System design and optimization of a hybrid system
- » Design of the energy storage system
- » Hands-on development, configuration and simulation of specific sample applications

Areas of application

- » Electrical engineering
- » Energy engineering
- » Power supply engineering

Key features

- » 1200 W PEM fuel cell module with air cooling
- » Energy management module
- » Integrated PC with TFT display

Instructor Training System



The Instructor is ideal for teaching basic engineering principles of fuel cell systems. Realistic, extensive experimenting capabilities and optimized instruction material make it a comprehensive instruction package.

*With
extensive
instruction
material*

Versatile system for interdisciplinary use

With the Instructor you teach the engineering principles of a fuel cell system, in addition to advanced knowledge of the overall relationships of the system:

- » Structure and functioning principle
- » Thermodynamics
- » Characteristic curves and efficiency ratings
- » System and power electronics

Suitable for basic and advanced courses

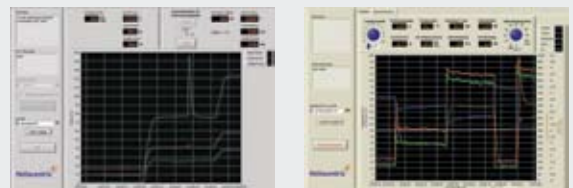
The Instructor has a modular design. This allows flexibility in the complexity of the test setup. From simple experiments for teaching the basic principles to complex experiments for experienced students. This makes the system suitable also for advanced courses.

Completely safe even under extreme loads

The Instructor is designed for maximum technical safety. Developed especially for educational purposes, the system is designed for safe and easy operation also by inexperienced persons. Integrated safety functions allow you to take the system to its limits without the risk of damage or safety hazards.

Full transparency – also in the lecture hall

With the Instructor you can examine exactly what affects the operating behavior of the fuel cell stack. Integrated data displays show the important parameters at a glance.



The software included with the system allows computer-supported measurements and display on a data projector – ideal for the lecture hall.

Applications

The Instructor is suitable for lectures and practica in diverse fields of study and occupations:

- » Electrical engineering
- » Energy engineering
- » Process engineering
- » Mechanical engineering
- » Automotive engineering

The product is also an excellent module for courses in *alternative energies*.



Teaching material

Facts

Instructor is one of the most popular fuel cell training systems worldwide.

- » 50 Watt PEM stack
- » Realistic test setups
- » Extensive instruction material
- » Suitable for basic and advanced courses
- » Quality from Heliocentris

Scope of experiments

Extensive experiment capabilities make the Instructor training system attractive for use in different fields of study.

Theory

- » Introduction to the operation of a fuel cell system
- » Characteristic curve and output curve of the fuel cell
- » Dependence of output on air supply and temperature
- » Hydrogen/current characteristic curve of the fuel cell
- » Efficiency analyses of the fuel cell stack

Practice

- » Set-up and operation of an autonomous power supply
- » Efficiency of the fuel cell system
- » Sample application of independent power supply:
How long can a fuel cell supply an autonomous consumer?
- » Sample application for fuel cell car:
Determination of the fuel consumption based on the load profile

600 W fuel cell training system with water cooling

HP600 Training System



The HP600 training system with a water cooled fuel cell teaches engineering principles at a high level. A complete energy balance of electricity and heat can be achieved to teach the principle of co-generation in a realistic setting.

Illustration of power and heat co-generation

The fuel cell stack in the HP600 is water cooled. A closed cooling circuit makes it possible to analyze the combined generation of electricity and heat. From the thermal economy of the fuel cell to the energy balance of the overall system, the principles of power and heat co-generation can be illustrated.

Hybrid system with extensive capabilities

The HP 600 can also teach the principle of hybridization in hands-on instruction. The inverter and battery make it possible to operate diverse consumers – independent of the power output of the fuel cell. This allows many interesting experiments with relevance to practical applications.

Extensive measuring capabilities

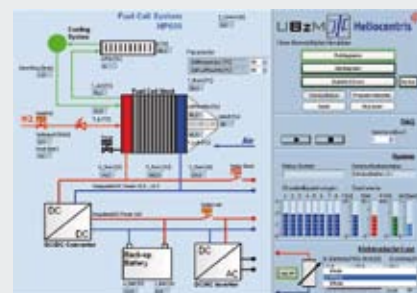
The IT interface of the system and special analysis software enable computer-supported measuring of the most important system parameters. Temperatures, volume flow rates, voltage, current and power output can be visualized transparently and presented to a larger audience using a data projector.

Diversity of application guaranteed

The HP600 training system can be used in many ways – from teaching engineering principles to the functioning principle of a fuel cell system and advanced experiments and practica dealing with energy and power supply engineering. The system concept allows you to adapt the level of the instruction to the level of the students' knowledge and the subject area.

Outstanding quality and safety

The HP 600 features excellent workmanship and can easily withstand the heavy duty of an instruction environment. The well-thought-out design of the system facilitates the experimenting process. Integrated safety functions ensure the safety of the system and users at all times.



Monitoring Software

Applications

The HP 600 training system is suitable for practica and lab experiments in the following fields:

- » Energy engineering
- » Process engineering
- » Power supply engineering
- » Electrical engineering

It helps students to develop application-related knowledge of hydrogen and fuel cell systems.

Facts

High-quality training system for teaching advanced principles:

- » 600 Watt fuel cell system
- » Closed cooling water circuit
- » Balancing of electricity and heat
- » Illustrates principle of co-generation
- » Illustrates principle of hybridization



Scope of experiments

Due to water cooling, the HP 600 is especially suitable for experiments in the field of power and heat generation:

- » Co-generation of electricity and heat
- » Complete energy balance of electricity and heat
- » Effect of temperature on the operating behavior of the fuel cell

1.2 kW fuel cell training system

Nexa[®] Training System

Also available as
a system solution
for constructing
prototypes



The Nexa[®] Training System supports you in preparing for the practical application of fuel cell technology. Lab experiments on electrical system design and hybridization can be conducted easily and effectively on the basis of an industrial fuel cell module.

The training solution for advanced instruction

The Nexa[®] Training System is the ideal solution for advanced instruction in the field of fuel cell and hydrogen technology. Students acquire practical knowledge for determining characteristic curves, efficiencies, load profiles and design criteria of a fuel cell system. Safe handling of hydrogen is also part of the concept.

A powerful hybrid system

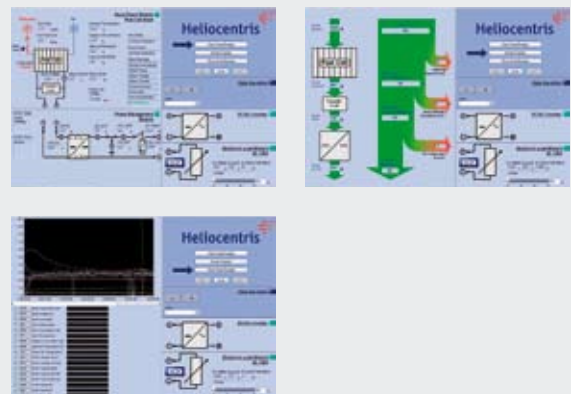
The Nexa[®] Training System is a powerful hybrid system. A battery makes it possible to operate consumers independent of the fuel cell. A central energy management module is used for convenient control of the DC/DC converter, battery load regulator and DC/AC converter. Gain experience in the design of hybrid systems – from the size of the hydrogen storage unit to the capacity of the batteries.

Optimal preparation for application projects

Practical applications can be designed, configured and simulated with the Nexa[®] Training System. Complete balancing of the entire energy conversion chain makes it possible to analyze system responses and optimize system design. Load step changes of up to 2 kW are possible.

Extensive visualization of system parameters

The LabView-based software of the Nexa[®] Training System allows visualization, checking and control of the entire energy management process. All data is visualized transparently at the system and component level.



Safe and easy operation

The modularity of the system facilitates its operation. All electrical and gas engineering connections can be established easily and safely on the front panels. The use of safe low-pressure metal hydride canisters for the hydrogen supply and extensive documentation ensure maximum application safety.



Practical implementation of theoretical concepts

The Nexa® Training System includes the fully integrated Nexa Power Module with a power output of 1.2 kW. The module is also available as a system solution for constructing prototypes. Therefore, the theoretical concepts can easily be implemented in practice.

More information can be found in the brochure *Fuel Cell System Programs*.

Applications

The Nexa® Training System is suitable for use in preparation for applications with a focus on electrical design in lab experiments and practica in the following fields of study:

- » Electrical engineering
- » Energy engineering
- » Power supply engineering

Facts

Advanced training system in preparation for applications:

- » 1.2 kW fuel cell system
- » Air cooled
- » Lab experiments on hybridization and system design
- » Preparation for the application
- » Also available as a system solution for constructing prototypes



Scope of experiments

The Nexa® Training System is suitable for lab experiments on system design and optimization of a hybrid system:

- » Current, voltage and output characteristic curves
- » System efficiency and efficiencies of individual components
- » Optimization of the power consumption of the fuel system
- » Design of a fuel cell system: Influence of battery capacity and type

Heliocentris supports instructors, developers and industrial partners worldwide in establishing hydrogen-based fuel cell technology as an integral part of modern energy systems. To do this, we provide them with solutions specifically tailored to their needs.

With a subsidiary in Vancouver, Canada, and customers in more than 60 countries, Heliocentris is a truly global player in the fuel cell industry.



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